Identifying Cost-Effective, High-Return, and Quickly Implementable Improvements to Address Freight Congestion and Mobility Constraints in Tennessee

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16. Abstract

This study compares four multidimensional resource allocation models to prioritize freight improvement projects for regional, state, and local transportation agencies to maximize return on investment. The proposed models are based on economic competitiveness with and without mutual exclusiveness in location, and equity in opportunity and outcome. Multiple dimensions of the models include the transportation mode, performance measures, improvement type, geographic regions, policy criteria, and time. Results from a case study in the State of Tennessee show that project selection based on equity in outcome provides the optimal balance between benefits and their distribution among counties, while project selection based on equity in opportunity results in the lowest total return on investment.

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EXECUTIVE SUMMARY

Freight traffic demand is receiving ever-increasing attention as the expected growth will overburden existing infrastructure, causing increased congestion, higher delays, air emissions, and operational costs, among others. Furthermore, evolving technologies, growing demand, changing business practices, shifting patterns of e-commerce, are creating safety, security, environmental, and other adverse effects of transportation system performance. Improvements to the freight transportation system are often complicated and expensive. Both public and private-sector agencies often try to find operational improvements, or other low-cost and quickly implementable ways to address congestion and mobility constraints. The constraints can be categorized as three types: Physical, Operational, and Regulatory. Physical constraints related to geometry and infrastructure conditions limit the freight systems' operational and free-flow characteristics (example: interchange, railroad crossing, rail sidings, and highway geometry). Operational constraints refer to practices, processes, events, or occurrences that constrain optimal throughput and efficient operating conditions (example: inefficient signal time and terminal gate operations, inappropriate speed limit etc.). Regulatory constraints refer to federal, state or local regulations that pose restrictions on freight movement (hour of service rule, truck lane restriction, HAZMAT routes etc.). The FAST Act clearly recommends preservation and improvement of the infrastructure by adopting state of good repair techniques and implementing cost effective transportation projects.

In a constrained and scarce budget era, the key question that remains to be addressed is how to design low cost, high return, and quickly implementable improvement options to address freight congestion and mobility constraints. Tennessee has heavy freight traffic, and identifying projects that are low in cost, have a higher rate of return, and that are quickly implementable would provide significant value to both public and private sector stakeholders.

Goals and Objectives: (1) Define low cost, high rate of return, and quickly implementable project alternatives, (2) Develop criteria for assessing low-cost and quickly implementable improvement by freight mode through the identification of constraints, (3) Develop a methodology that both the public and private sectors can use to identify, categorize, and prioritize these alternatives, (4) Demonstrate the rate of return of suggested project improvements by using case studies in TN.

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CHAPTER 1: INTRODUCTION

The economy of a region highly depends on the freight activities. According to the Federal Highway Administration (FHWA), freight volume is expected to grow over 60% over next 25 years. The new transportation bill in the United States, referred as *FAST Act*, recommends separate stream of funding to be dedicated to state Departments of Transportation (DOTs) to invest in freight specific projects to alleviate congestion, improve operational efficiency, and enhance safety (FAST Act, 2015). In the last few years, state DOTs have started the planning process to develop ways to utilize scarce resources in prioritizing freight improvement projects. The freight planning prioritization process consists of three steps: (i) identification of problematic sections (or project) of multimodal freight network; (ii) development of alternatives for each project; and (iii) allocation of the resources in the multimodal freight network consisting of numerous projects and limited funds. While the first two steps are based on engineering design, the third step is a resource allocation problem.

To the best of authors' knowledge resource allocation for freight improvement is missing from literature. The contribution of this report is twofold. First, development of a resource allocation model that considers various policies state DOTs encounter in decision making. Second, application of the model in a real-world case study and insights for public agencies to consider unique model features in various policy settings to augment prioritization of multimodal freight projects. Development of such models poses some new challenges as it includes *multiple dimensions*. The first dimension is multiple performance measures. State DOTs are typically dealt with multiple performance measures such as congestion, air quality, safety, and others. The second dimension is multimodality as a freight network consists of truck, rail, air, water, and pipeline working together. The third dimension pertains to the projects generated from problematic sections of the freight network, and the benefits and costs associated with each. The fourth dimension revolves around time. Typically, agencies do not plan on a year-by-year basis but rather consider a short-term planning horizon of five to ten years. Time is a critical element as the question of *when* to invest, i.e. to invest now or to wait is important. The fifth dimension is multiple regions. A state consists of multiple counties, and each county identifies multiple projects belonging to each mode and performance measure. The sixth dimension is policy considerations. Each state has some policies such as maximum benefits, carryover of surplus to next fiscal year, equitable funds allocation, duration of planning periods, etc.

The rest of the report is organized as follows. The next chapter presents the rich literature review on the freight constraints and the efforts developed to resolve these constraints along with the similarities and uniqueness of the freight resource allocation problem. The third chapter is the methodology section presenting different resource allocation models for the prioritization of the freight projects. The fourth chapter contains the analysis of data for the identification of the constraints and projects in the freight corridor of Tennessee. The result section is presented in the fifth chapter. Chapter six concludes the report with summary and the directions for the future research.

CHAPTER 2: LITERATURE REVIEW

Freight traffic demand has constantly increased over the last decades, and this trend is expected to continue over the coming decades. Figure 2-1 illustrates four forecasts of freight transportation demand. According to the 2009 estimates, total freight demand is expected to grow from about 13.5 billion tons to about 18.5 billion tons in 2030, i.e., 37% increase. The study conducted in 2004 calls for about 53% increase in freight transportation demand in the same time period. Several reasons contribute to demand freight increase including growing population, evolving technologies, changing business practices, shifting patterns of e-commerce.

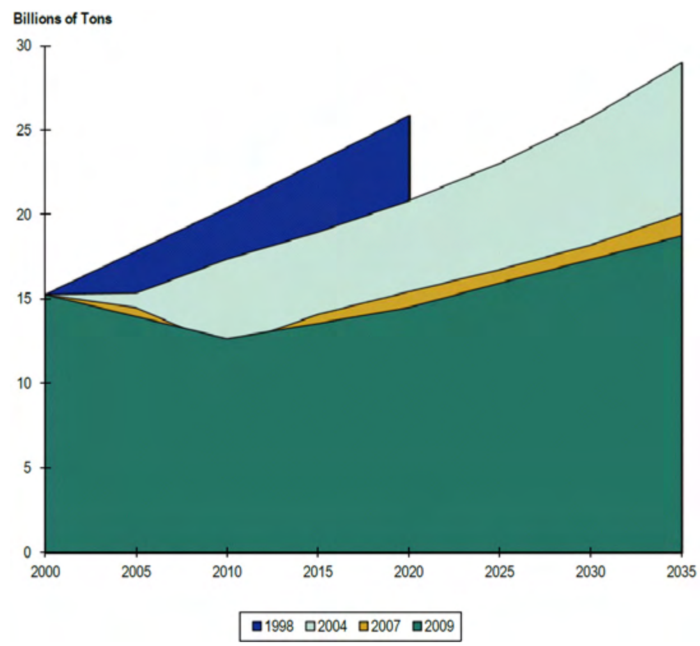


Figure 2-1: Four forecast for freight transportation demand (source: (Grenzeback et al., 2013))

Considering adverse effects of freight demand increase, such as congestion, delays, air emissions, and operational costs, it is important to develop effective strategies for improving the state of the freight transportation system. Improvements to the freight transportation system are complicated and expensive. Both public and private-sector agencies often try to find operational solutions addressing congestion and mobility constraints that are low-cost, high-return, and quickly implementable (LHQ solutions). In the subsequent four subtasks, the literature is reviewed to

1. Define and categorize various constraints associated with freight transportation system;
2. Identify state of the practice of low cost and high return investments for freight movement;
3. Recognize the methodologies used to prioritize investments subjected to budget and other constraints;
4. Identify recommended practices and lessons learned from the literature.

2.1 Definitions of constraints

In general, constraints to the freight transportation system can be categorized into three types, according to (Short, 2010):

i. Physical constraints: any geometric or infrastructure-related condition preventing the freight transportation system from operating at free-flow speed, and within legally-required parameters is considered as a physical constraint.
ii. Operational constraints: any practice, event, process, or occurrence resulting in suboptimal throughput and inefficient operation of the freight transportation system falls in the category of operational constraints.
iii. Regulatory constraints: any regulatory requirement, including local, state, or federal requirements that restrict operational performance of the freight transportation system is defined as a regulatory constraint.

Consistent with the above definitions, the improvements addressing freight mobility can be categorized into three groups: (1) physical, geometric, or engineering improvements; (2) operation and technology improvements; and (3) regulatory or policy-based improvements. Examples of physical, operational, and regulatory constraints are presented in Table 2-1.

Table 2-1: Examples of physical, operational, and regulatory constraints

Constraint\Mode	Highway	Rail	Marine
Physical	Inadequate number of lanes	Inadequate number of sidings	Inadequate capacity at port terminals
Operational	Poor signal phasing	Inefficient train scheduling	Inefficient port terminal gate processes
Regulatory	Truck restrictions	Limits on operating hours	Labor contractual limitations

2.2 LHQ solutions: State of the practices

Considering substantial freight demand increase in the coming decades, freight mobility constraints will impose more adverse financial and environmental effects to the transportation service providers and community. Our constrained and scarce budget era has motivated researchers and practitioners to develop low cost, high return and quickly implementable improvement solutions (LHQ solutions) to address freight congestion and mobility constraints. The America's Surface Transportation Act, known as FAST Act (FAST Act, 2015), also emphasizes on preservation and improvement of the infrastructure by adopting state of good repair techniques and implementing cost effective transportation projects. The first step to identify the state of the art and state of the practice of investments on the freight transportation system is to characterize LHQ solutions. There is no consensus on the definition of LHQ solutions but (Short, 2010) defines a low cost and quickly implementable solution as “an action that modifies existing geometry and/or operational features of the freight transportation infrastructure system and that can be implemented within a short period without extended disruption to traffic flow. Such an improvement may be physical, operational, or regulatory, as long as it enables greater and more efficient throughput from existing facilities. These actions may be spot (or location-specific) improvements or may be limited to short sections of the physical infrastructure. Likewise, they may be specific to a given supply chain process point, regulation, or mode; they may also affect multiple modes of freight movement. Furthermore, low-cost improvements do not involve massive reconstruction of infrastructure that usually takes many years to complete."

The literature suggests different criteria for characterizing LHQ solutions. For example, (Latham & Trombly, 2003) states that the improvements requiring an investment of $10,000 to $50,000 can be considered as low-cost improvements (Short, 2010), as illustrated in Table 2-1, defines mode-specific features for LHQ solutions. Based on the above discussions, it can be concluded that a LHQ solution is the one that 1) costs no more than $10 million; 2) can be implemented in less than 2 years; and 3) results in a high profit after implementation (i.e., has a high rate of return).

Focusing on the highway system, physical improvements are implemented to address four constraint types: (1) Interchange constraints; (2) Highway capacity constraints; (3) Geometry constraints; and (4) Intersection related constraints (Systematics, 2005). The literature further categorizes operational improvements into 15 groups: (1) Using a short section of the shoulder as an additional lane; (2) Re-striping the merge/diverge areas to improve traffic flow; (3) Reducing lane widths to add a(n) (auxiliary) lane; (4) Modifying weaving; (5) Metering or closing entrance ramps; (6) Adjusting speed limits when congested; (7) Zippering, self-metering to promote fair and smooth merges; (8) Improving traffic signal timing on arterials; (9) Improving arterial corridors using access management principles; (10) High Occupancy Vehicle (HOV) lanes; (11) Providing traffic diverging information; (12) Implementing road pricing to bring supply and demand into alignment; (13) Integrating private towing and recovering companies into training programs; (14) Training programs to improve communication among various stakeholders; (15) Information sharing systems (e.g., weather information) (Dunn & Latoski, 2003; Margiotta, Spiller, & Halkias, 2007; Systematics & others, 2005). Lastly, regulatory improvements include (1) Developing policies that aim at lowering vehicular traffic demand which in turn improve freight traffic flow (e.g., carpooling, teleworking, use of mass transit); policies facilitating freight traffic movements. Many US cities and states have successfully implemented abovementioned low-cost, quickly implementable improvements to address (freight) mobility constraints on the highway systems. Some examples of physical, operational, and regulatory improvements for the highway system are presented in Table 2-3.

Table 2-2: Mode-specific characteristics of low-cost, quickly-implementable solutions (source: (Short, 2010))

Mode	Action characteristics	
Highway	Less than $1 million Spot or location-specific improvements No environmental clearances necessary No right-of-way acquisition No special programming required Implementation at district or lowest operation level	Less than 1 year
Rail	Class I railroad – $1 million to $10 million	Less than 2 years
	Regional railroad – less than $2 million	Less than 1 year
	Short-line railroad – less than $500,000	Less than 6 months
Marine	Less than $1 million Essentially incentive-based programs to demand and changes in operational practices, technology deployments Physical improvements coordinated with rail projects within and outside the port terminals links serving ports – location-specific actions Uniqueness of each port acknowledged	Less than 2 years

Turning to the railway system, improvements are usually implemented to increase the system capacity. Rail capacity is constrained by several factors including the number of tracks, number and length of sidings, number of crossovers and other constraints, type of signaling, speed limits, grade and curvature, suboptimal fleet structure (excess of shortage of numbers of locomotives and rail cars), traffic mix, and length of trains (Systematics, 2003). Categorization of LHQ solutions for railway mobility problems is as follows:

- Physical improvements: track improvements (adding sidings), upgrading branch lines, expansion of carload terminals, developing strategic overhead grade crossings;
- Operational improvements: track maintenance, upgrades of communication system, joint use of facilities (pairing mainlines to provide directional running), use of larger cars (does not apply to Class I railroads), developing remote switching from the cab, installing radar in locomotives to avoid rear-end collisions;
- Regulatory improvements: revising trackage rights to improve efficiency of operation.

Examples of low-cost improvements applied to the rail industry are presented in Table 2-4. Comparted to highway projects, rail improvement projects, especially physical improvement projects, are budget intensive. Examples of multi-billion rail capacity improvement projects are presented in (Bryan, Weisbrod, & Martland, 2007).

Table 2-3: Examples of successful implementing LHQ solution for highway systems

	Location	Improvement	Cost	Reference
Physical improvements	Dallas, TX	Modifying ramps to remove a weaving problem	$660,000	Walters et al. (2005)
	Fort Worth, TX	Adding an auxiliary lane to remove a weaving section	$150,000	
	Dallas, TX	Capacity expansion through adding a lane to the inside shoulder	$130,000	
	Puget Sound, WA	Capacity expansion through adding a new lane for slower traffic	NA	Margiotta et al. (2007)
	Tampa, FL	Adding a right-turn lane and a signalized right-turn lane to address weaving and queuing at an interchange	NA	
	Baltimore, MD	Widening a ramp to increase the capacity	NA	
	Chicago, IL	Updating and synchronizing the signal system at an intersection near a major intermodal facility to reduce delays	NA	NCHRP Report 497 (2003)
Operational improvements	Atlanta, GA	Restriping and extension of a divider wall on a 4-mile section of downtown freeway in Atlanta to reduce weaving and delay	NA	Margiotta et al. (2007)
	New York City, NY	Upgrading traffic signals at 145 locations to reduce delay	$500 to 3000$ per intersection	NCFRP Report 7 (2010)
	Stuart, FL	Lowering the number of median openings to reduce slow downs	NA	Latham and Trombly (2003)
	Detroit, MI	Signal upgrades to decease traffic signal queuing	NA	
	Knoxville, TN	Providing detector actuated flashers for sight distance problems at locations in which corrective earthwork is very expensive	NA	
	Springfield, MO	Installing mast arm (for mounting signal head in order to better visibility) and lane use signs and realigning signals	$150 to $5000 each	

	Detroit and Grand Rapids, MI	Implementing all-red phase, changing signal heads, relocation of signal heads for better visibility, installing back plates on signals, and removing on-street parking at 112 intersections	NA	
	New Hampshire	Installing and placing driver speed feedback signs at various locations to improve traffic flow	NA	
Regulatory improvements	Orange County, CA	Establishing incentive programs to promote carpooling and use of electric vehicles	NA	Orange County (2016)
	Downtown Chicago, IL	Designating areas with on-street parking as loading zones before 9 AM Initiating an enforcement program that prevents non-commercial vehicles from parking in dock areas Distributing promotional materials among buildings with “where to call” information	NA	O'Laughlin et al. (2008)

Table 2-4: Examples of implementing LHQ solution in rail industry

Location	Improvement	Imp. type	Reference
Chicago, IL	Updating the signaling system for two railway companies in the Chicago region (EW-4 project). The project has increased the capacity from 23 trains to 46 trains	Operational	(CREATE, 2015)
West Durban, NC	Spent $3.6 million to:		(Short, 2010)
	Extend and upgrade the siding track from 6,500 ft to 9,000 ft	Physical	
	Realign the track to straighten the curve to allow higher speeds	Physical	
	Construct 12,500 ft of new track	Physical	
	Change railroad switches to allow higher speeds at sidings	Operational	
North Carolina	A new centralized train traffic control system is installed between Greensboro and Cary at a cost of $8 million. The system has increased maximum train speed from 59 mph to 79 mph	Operational	(Short, 2010)
Winterport, ME	A new siding is constructed at a cost of $215,000. The new siding keeps an annual 2,000+ truck trips off the highways	Physical	(Bryan et al., 2007)
Stockton Springs, ME	$210,000 is spent to construct a new siding. The new siding keeps 4,000 truck trips/yr off the highways	Physical	
South Portland, ME	$570,000 is spent to build a new rail access to gravel pits. The access reduces 100,000 to 150,000 truck trips, annually	Physical	
Easton, ME	Sidings are rehabilitated/constructed to improve freight traffic. 50,000-75,000 tons (annual) demand for French fries will shift to rail as a result of these improvements	Physical/ operational	
Muskingum County, OH	To promote rail use in an industrial park, a new 2,878 ft track is constructed at a cost of $200,000	Physical	

Lastly, marine transportation system (MTS) is composed of waterways, ports, and intermodal connections (i.e., connections to rail and highway transportation systems). MTS capacity has two dimensions: (1) short-term capacity to respond to interruptions; (2) long-term capacity to respond to the growing demand. The following low-cost, quickly implementable improvements can be employed to address MTS capacity constraints:

- Physical improvements: modernizing docks and dams, increasing terminal capacity; improving access to rail, road, and pipeline, using advanced navigation and communication systems
- Operational improvements: more efficient port utilization, improved signage, improved communication systems
- Regulatory improvements: increasing the number of hours and shifts that terminal gates are open to work, reducing container dwell times, congestion pricing programs.

Examples of implementing LHQ solutions to the marine transportation system are presented in Table 2-5. Physical improvements to the marine transportation system are usually very expensive. For example, modernization of the Port of Anchorage, Alaska is projected to cost $550 million. This modernization includes improving safety and shipping operation efficacy, and improving resiliency against extreme events (e.g., seismic events) (Port of Alaska, 2016).

Table 2-5: Examples of implementation of LHQ solution for marine transportation

Location	Improvement	Imp. type	Reference
Los Angeles, CA	A congestion pricing program is implemented in the Ports of Los Angeles and Long Beach to give an incentive to operators to shift movements of international containers from peak weekday hours to evenings and weekends. As a result of this program, all 12 international container terminals established evening shifts and 38% of total demand has shifted to evening shifts.	Regulatory	(PIERPASS, 2016)
Multiple locations	Several terminals across the US use internet based systems to provide tracking companies with gate processing real-time information. These systems improve operations planning and resource management and thus reduce the cost to shippers, consignees, brokers, and others.	Operational	(Short, 2010)

2.3 State of the art of the methodologies for prioritizing freight investments

The problem of finding optimal LHQ solutions is essentially a resource allocation problem which is investigated by researchers in various fields including transportation, safety, production, energy. In this section, the relevant literature is reviewed to learn different approaches employed by researchers to address the resource allocation problem. Prioritization of highway safety projects was considered by keeping the objective as to maximize benefits resulted in reduction of crashes (Miller, Whiting, Kragh, & Zegeer, 1987). The resulted resource allocation demonstrated the benefits of not using intuition rather than optimization for prioritization of safety projects. Sheu (Sheu, 2006) proposed a dynamic customer group-based logistics resource allocation methodology for the use of demand-based responsive distribution. The uniqueness of the model was introduction of time value of money. Fiedrich et al. (Fiedrich, Gehbauer, & Rickers, 2000) introduced a dynamic optimization model that uses detailed descriptions of the operation areas and the available resources to calculate the resource performance and efficiency for different tasks, immediately after a strong earthquake. Rauch and Casella (Rauch & Casella, 2003) developed a model that is applied to the trade and wages debate to address whether ties can reduce the world welfare through trade diversion, and to compare the effect of ties on trade in differentiated versus homogeneous products.

For selection of resource allocation projects in a transportation infrastructure, Wey and Wu (Wey & Wu, 2007) proposed an analytic network process approach considering interdependencies among evaluation criteria and candidate projects. Melkote and Daskin (Melkote & Daskin, 2001) investigated a resource allocation model that simultaneously optimizes facility locations and design of the underlying transportation network using budgeting and planning decisions. The resource allocation model has been widely used in safety projects to find the optimal policy scenarios. Kar and Dutta (Kar & Datta, 2004) developed a model to implement safety projects in high-priority areas in Michigan. Based on a set of safety performance index values, the authors develop an optimal resource-allocation model using linear programming to achieve the overall safety benefits. Vidal and Goetschalckx (Vidal & Goetschalckx, 2001) presented a model for the optimization of after tax profits for multinational corporation. This model includes the transfer prices and the allocation of transportation costs as explicit decision variables.

Various sectors in the transportation arena employ mathematical techniques to effectively and efficiently allocate scarce resources among agents/units. For example, (Churchill & Lovell, 2012) presents a stochastic programming model to coordinate matching flights to the slots at congested airports. The proposed problem differs from previous models in that it explicitly takes into consideration uncertainty in capacity of air transportation resources (i.e., airports and air space regions). (Kim & Hansen, 2013) develop a framework to evaluate different strategies employed to allocate ground delays to flights in order to limit flow through the constrained capacity of airspace regions. Four allocation strategies are evaluated: full information system-optimal, parametric system-optimal, first-submitted first-assigned, and ration-by-schedule. (Zargayouna, Balbo, & Ndiaye, 2016) develop an optimization model for efficient allocation of parking spaces to drivers. The objective of this problem is reducing search time for drivers with dynamic geographical positions. Difficulty of this problem arises from nondeterministic appearance of the agents, i.e., drivers. (Su et al., 2014) suggest a planning tool for land use allocation based on transportation condition. The tool includes a three-stage model with feedback loops controlling the convergence of allocation. By coupling optimization and simulation techniques, (Sánchez-Martínez, Koutsopoulos, & Wilson, 2016) proposes a framework to allocate a fixed number of buses to a group of routs. The model maximizes service frequency but maintains the existing service frequencies and operating strategies. (Mathew, Khasnabis, & Mishra, 2010) develop a resource allocation model which includes the choice of a fleet improvement program, agencies that may receive them, and the timing of investments. (Wang, 2016) considers a containerized cargo transportation problem in which the freight operator allocates uncertain capacities to products to maximize its profit. The problem is formulated as a constrained stochastic programming model. (Wang, Wang, & Zhang, 2016) propose stochastic programming models to allocate seats to each cabin class for each train service. Stochasticity of the problem arises from random demand and passenger choice behavior. (Vasco & Morabito, 2016) study the problem of movement of a fleet of vehicles transporting goods between terminals. The problem is formulated as an integer programming model and emphasis is given to problem solving in real-world situations using heuristic methods including greedy randomized adaptive search and simulated annealing.

Resource allocation models are also used to improve transportation safety. (Konur, Golias, & Darks, 2013) develop a 0-1 binary programming model to select projects that improve railroad-highway crossing safety. The authors compare the optimization method against the sorting method suggested by the US Department of Transportation and find that the optimization method is more efficient in increasing the safety at crossings. However, the difference in the efficiencies of the sorting method and the mathematical modeling approach is relatively small. (Mishra, 2013) develops a similar model to maximize total benefits, measured in terms of dollars from savings in fatal, injury and property damage only (PDO) crashes, subject to budget and other constraints. (Lambert, Baker, & Peterson, 2003) develop a model to allocate transportation funds to guardrails. Multiple objective functions are evaluated including cost minimization, maximization of kilometers of road protected, maximization of severity protected, maximization of vehicle kilometers protected, and maximization of severity kilometers protected. (Mishra, Golias, Sharma, & Boyles, 2015) put forward 0-1 binary programming models for funding allocation to improve safety on urban intersections.

Resource allocation models are extensively employed by industrial engineering researchers to solve different problems. Among all, (Fang & Li, 2015) present a model for reallocation of resources based on revenue efficiency across a set of decision making agents in a centralized decision-making environment. (Li, Chen, & Tao, 2016) couple queuing and optimization models to study demand allocation and pricing in an energy market consisting of two providers that are renewable and fossil-based energy providers. When the queue length for renewable energy increases, new customers who originally were interested in renewable energy service may select fossil-fired energy service. By allocating server capacity and pricing each service, the service provider maximizes its profit. (Arora, Raghu, & Vinze, 2010) develop a quadratic optimization model for allocating regional aid during public health emergencies. The objective function, which is square of the lost benefits due to a non-availability of resources, is minimized subject to a set of constraints ensuring equitability of allocation across regions. (Luscombe & Kozan, 2016) integrates the theory of parallel machine and flexible job shop environments to assign patients to beds and tasks to resources. This problem has a dynamic nature as assignments are performed in a real-time fashion. Heuristic methods are employed to develop fast solutions that respond to unscheduled arrivals and heterogeneous patient care needs. (Notte, Pedemonte, Cancela, & Chilibroste, 2016) study allocation of food resources to a heterogeneous dairy herd.

The problem is maximization of milk production or the margin over feeding cost for the entire dairy herd subject to food budget; a constraint ensuring the total number cows in milking is equal to the total number of cows; and a restriction enforcing the food consumed by each cow is no more than its potential consumption.

In conclusion, our literature review reveals that mathematical optimization is the prevailing approach in modeling effective allocation of a set of resources to agent/users. Mathematical models use both continuous or integer decision variables, depending on the nature of the problem. The optimization problem becomes stochastic when demand, capacity of the system, or both are uncertain. In real-time applications and for large-scale problems, heuristic and metaheuristic methods are employed to provide fast solutions responding to special requirements of the problem.

2.4 Recommended Practices and Lessons Learned

In this task, the relevant literature is reviewed to 1) define constraints facing freight transportation system; 2) recognize the state of the practice of low cost and high return investments for freight movement; and 3) identify the methodologies for prioritizing freight investments subject to budget and other constraints.

It is found that improvement to the freight transportation system can be categorized into three groups: physical, operational, and regulatory improvements. Physical improvements are those activities that involve construction to add capacity or modify geometry. Operational improvements aim at reducing occurrence of conflicts and delays using decision aids and technological innovations. Regulatory improvements involve changes to institutional policies and actions and regulations that constrain freight movements. In general, low-cost, high return solutions for freight constraints have four main features: 1) they do not require massive construction activities; 2) their implementation do not result in substantial disruptions to the existing traffic flow; 3) they can be implemented in a short period of time (less than one year for highways and less than two years for railroads and marine transportation); and 4) they can be accomplished with limited budget (less than $1 million for highways and maritime transportation and up to $10 million for Class I railroads).

Review of the literature indicates that several US states and cities have successfully implemented low-cost, high-return solutions to address limitations facing passenger/freight transportation systems. To our knowledge, however, no systematic approach is employed for optimal selection of improvement projects when the budget is constrained. LHQ solution for highway, railway, and marine transportation systems are documented in

Table 2-6 (some of the improvements may not apply to freight transportation).

The problem of finding optimal LHQ solutions is essentially a resource allocation problem. While resource allocation modeling is not employed to address freight constraints, it has been widely investigated in other fields such as safety, production, and energy. Our review indicates that optimization is the dominant approach in optimal allocation of scarce resources to agents/users. Both continuous and integer programming may be employed, certainly depending on the features of the problem. When demand or system capacity (resource) is uncertain, stochastic programming may be considered. Metaheuristic and heuristic algorithms may be utilized when developing fast solutions is of interest.

Table 2-6: LHQ solutions for highway, railway, and marine transportation systems (source: (Short, 2010))

	Physical	Operational	Regulatory
Highway	Add lane; Add auxiliary lane; Add turning lane; Add traffic signal; Add warning signs; Add a passing lane; Add warning signs; Add dedicated turning; Channelization; Extend existing lane; Modify median bull; Extend ramp length; Extend acceleration and deceleration lanes; Extend turning lane; Interchange realignment; Improve road signage; Provide parking facilities even with no facilities; Pave shoulders; Proper roundabout near freight facilities; Redirection of traffic; Restriping; Ramp metering; Revise merging/diverging; Speed reduction; Signal upgrade; Signal phasing; Widen lane; Widen shoulders on mainline and ramps	Alter ramp metering operation; Better advance navigational signing; Improve road signage at interchange entrances and exits; Signal installation; Signal phasing; Synchronize signal phasing; Traffic signal upgrade; Remove ramp meter; Relocate ramp meter; More flexible use of drivers	Modify restrictions; Revise parking restrictions; Provide additional parking; Allow parking on paved shoulders and ramps
Railway	Advanced electronic inspection techniques; Branch line upgrades; Curve superelevation; Connection tracks; Centralized traffic control system; Extended siding track; Expansion of carload terminals; Expansion of intermodal terminals; Improve crossing warning systems and make current passive crossings active; Internal gateway facilities; New track (siding) turnout; New siding track; Provide crossover; Realign tracks; Turnout; Track surfacing; Tie replacement	Coordinate operations of Class I and shortline/regional railroads; Centralized traffic control system; Hire temporary workers; Negotiate contracts to accommodate "limbo time"; On-board and wayside defect detection and other advanced sensors; Remote switching; Signal improvements (advanced technologies); Trunked digital communications systems; Upgrade/reconfigure interlocking, low-emission switch engines	Modify routing restrictions for hazardous materials; Upgrade card readers; Modify town-level regulations that avoid hosting freight handling facilities; Improve agreements between short-line operators and the large (Class I) railroads

Table 2-6 (Cont'd)

	Physical	Operational	Regulatory
Marine	Expanded rail connections; Widen local roads; Restriping to add lanes; Auxiliary gate lanes; Locate secured inspection areas outside major traffic areas; Terminal reconfiguration to add capacity	Automated yard marshalling and inventory control; Congestion pricing; Establish flexible labor shifts; Expanded gate hours; Fast rail shuttles; Incentive-based program to shift freight from trucks to rail; Integrated maritime and rail movements; Joint inspection facilities; Hire temporary labor; High-speed gates/fast lane using reportless checking; Multi-pick cranes; Off-dock container yards; Partnership to accommodate uneven demand cycles; Partnership to reduce passenger/freight rail use conflicts; Support labor union and training programs; Synchronizing traffic lights; Trucking appointment system; Traffic management; Utilize wireless communications to facilitate proper storage, ship operations, gate operations	Smooth out mismatched labor structures; Negotiate training terms and conditions to increase skills and trained labor supply; Negotiate contract to accommodate "limbo time"; Upgrade card readers; Use existing software packages for card readers

CHAPTER 3: METHODOLOGY

In this chapter, the methodology for identifying the constraints in the freight corridor and the development of the various resource allocation models for the prioritization of projects in order to resolve those constraints, is presented. Figure 3-1 illustrates the simple framework of the resource allocation model comprising of three major steps: (1) Identification of problematic sections, (2) Proposal of the projects, and (3) Formulation of the model for the prioritization of the projects based on different policies.

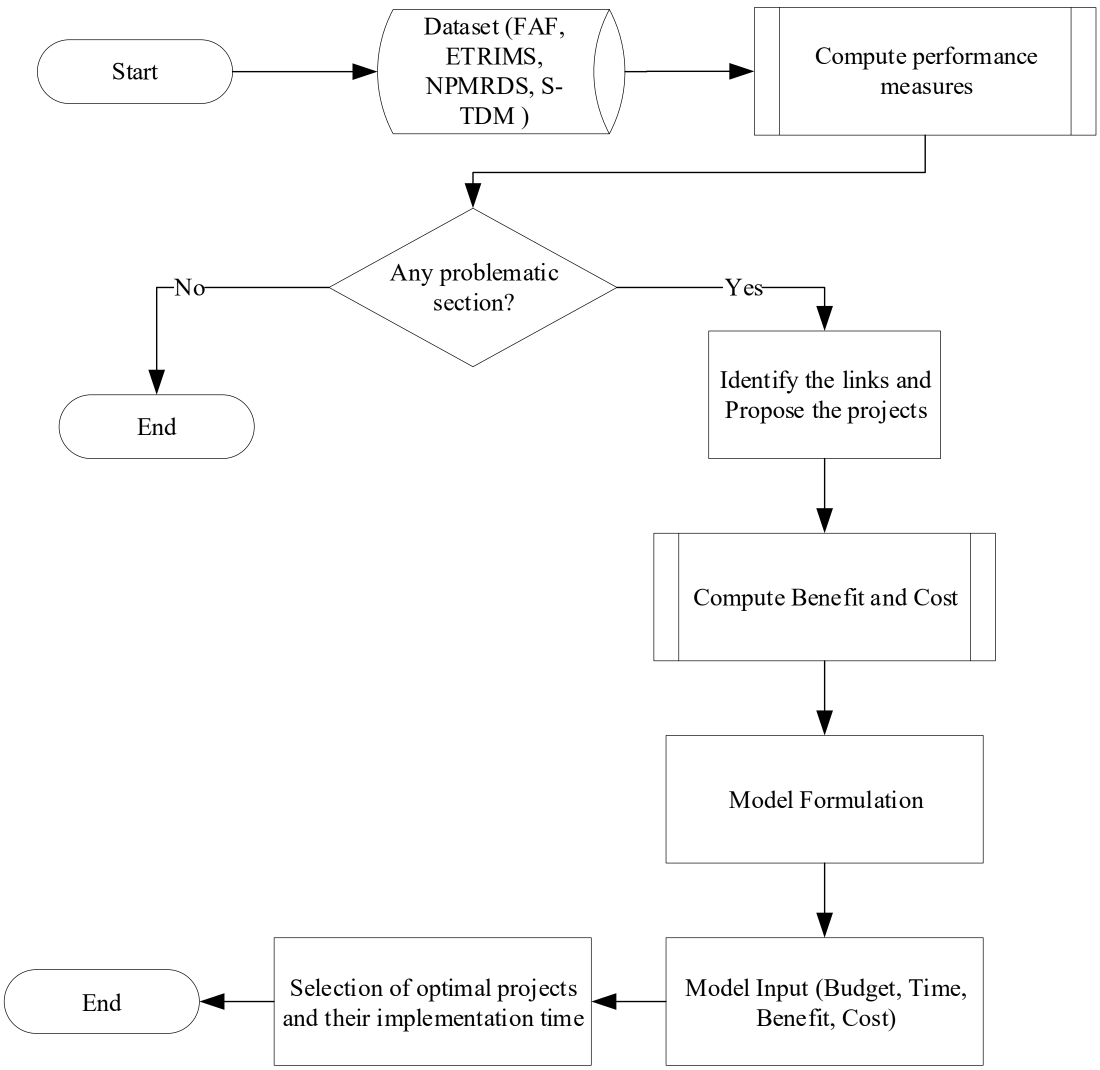


Figure 3-1: Methodological Framework for identification and addressal of the problematic section

The above first two steps come with the analysis of different freight movement related datasets in a region. For that, various standard conditions have been established with regard to existing literature and engineering design based on performance measures such as volume to capacity ratio (VCR), truck percentage (TP), freight tonnage movement, number of crash per mile, etc. These conditions are described in detail in next chapter (Data). These conditions help to identify the problematic sections in the region and hence different alternatives to overcome the problem are the proposed projects. Once there are a set of proposed projects, the resource allocation model comes into play to prioritize those projects meeting the specific goal of the freight agency.

Four resource allocation models using four different policies are developed to prioritize freight improvement projects based on specific features of the freight transportation system discussed in the chapter 1. These models are based on different policies, the first two being basically the economic competitiveness (maximum benefits) models and the remaining two are the equity based models. The main nomenclature used in the models are presented in

Table 3-1. Other notation will be presented as needed. It is assumed that there exists a pre-specified set of projects **I**, in which each project relates to a specific mode, location, improvement type, and time of implementation. The benefits and costs of implementation of each project are assumed to be known. The total benefits is calculated as the present worth (PW) of all the annual benefits over the service life (n) of the project adjusted with annual interest rate, α and expected annual growth of benefits with increasing infrastructure users, β in cash flow. The budget remaining at the end of each year (i.e., surplus budget), is carried over to the successive year. All these models and policies are discussed in detail, further in this chapter.

Before delving into the optimization models, it is worth establishing a baseline scenario to facilitate model comparison. The base scenario in this report is an intuitive sorting model, ***M0*** based on a heuristic sorting algorithm in which projects in ***I*** are first sorted in descending order based on the benefits at the beginning of the first year. The project with the highest benefits is then selected conditional on (i) the project is not previously implemented in that location (i.e., mutually exclusiveness constraint); and (ii) the cost of the project is within the available budget. The project is added to the list of selected projects and the available budget is recalculated. This process is repeated for the second to the last projects in ***I*** until no further project can be added. The remainder of the budget, if there is any, is added to the budget of the next year, and the entire process is repeated for the second to the last years in the planning horizon.

Table 3-1: Notations used in the models

Type	Component	Description
Sets	*I*, i	Set and index of projects
	J, j	Set and index of counties
	T, t	Set and index of time periods in planning horizon
	L, *l*	Set and index of locations
Parameters	$B_{it=0}$	Annual benefits from project i at time t =0
	$B_{Ti=0} = B_{it=0}\frac{(1+\beta)^t}{(\alpha-\beta)}\left[1-\left(\frac{1+\beta}{1+\alpha}\right)^n\right]\frac{1}{(1+\alpha)^{t-1}}$	Total benefits from project i at time t =0
	$K_{it=0}$	Construction cost of project i calculated at time t =0
	γ	Cost annual growth rate (expected)
	$K_{it} = K_{it=0} * (1+\gamma)^{t-1}$	Construction cost of project i at time t
	g_{ij}	Binary parameter indicating if project i lies in county j
	h_{il}	Binary parameter indicating if project i lies on location l
	$d_{j\hat{j}} = \left\lvert\sum_i (g_{ij} - g_{i\hat{j}})\right\rvert, j \neq \hat{j} \in J$	Number of candidate projects difference between two counties
	$\mathcal{E}$	Equity in opportunity parameter
	P_t	Budget for all improvement projects at time t
	e	Equity in outcome parameter
Variables	$X_{it} \in \{0,1\}$	=1 if project i is chosen at time t and zero otherwise
	$SP_{t-1} \in \mathbb{R}$	Carry over budget from year *t-1* to year t
	$R \in \mathbb{R}^+$	Maximum benefits that can be allocated to any county
	$S \in \mathbb{R}^+$	Minimum benefits that can be allocated to any county

3.1 Model Formulation

M1: Economic Competitiveness

The first model (***M1*** shown in 1.1-1.4) maximizes economic competitiveness which is one of the major goals of USDOT's strategic plan (USDOT, 2012). In ***M1,*** total benefits are maximized subject to budgetary constraints. Constraint set (1.2) ensures that the project selection does not exceed the available budget of each year. Constraint set (1.3) ensures that each project is selected only once while constraint set (1.4) carries over any unspent portion of the budget from time period *t* to *t+1*. In this report, $SP_0 = 0$ is assumed.

$$\boldsymbol{M1}: max \sum_{i,t} B_{Ti=0} X_{it} \tag{1.1}$$

Subject to

$$\sum_i K_{it} X_{it} \leq P_t + SP_{t-1} \qquad \forall t \in T \tag{1.2}$$

$$\sum_t X_{it} \leq 1 \qquad \forall i \in I \tag{1.3}$$

$$P_t - \sum_i K_{it} X_{it} + SP_{t-1} = SP_t \qquad \forall t \in T \tag{1.4}$$

M2: Economic Competitiveness with Mutual Exclusiveness

Model ***M2*** ((2.1)-(2.2)) extends ***M1*** by adding a mutual exclusiveness constraint (constraint set 2.2) to ensure that a location cannot be assigned more than one project over the planning horizon. The rational for introducing this constraint is to (indirectly) maximize the total number of locations that receive funding as compared to ***M1***. In theory, it may be possible that there are very few unique locations with multiple projects overlapped in same location. In that scenario, the model might end up selecting very few projects with huge leftover budget.

$$\boldsymbol{M2}: max \sum_{i,t} B_{Ti=0} X_{it} \tag{2.1}$$

Subject to

(1.2)-(1.4)

$$\sum_{i,t} X_{it} h_{il} \leq 1 \qquad \forall l \in L \tag{2.2}$$

M3: Economic Competitiveness with Equity in Opportunity

Model ***M3*** is introduced to distribute the available funds in a fair manner among the sub-regions in the area under study (e.g., counties within the state). Fairness (i.e., equity) is introduced via constraint sets (3.2) and (3.3) that bound the difference of projects selected between any two counties to a fixed number. Constraint set (3.2) ensures that at least one project is selected in each county while constraint set (3.3) bounds the difference in the number of projects selected between any two counties to an upper limit. This bound is calculated as a percentage (i.e., an equity in opportunity parameter $\mathcal{E}_{j\hat{j}}$) of the difference of candidate projects for each county pair ($d_{j\hat{j}}$). For example, if two counties have three and ten candidate projects respectively, then the difference between the number of selected projects between these counties cannot exceed (10-3)×$\mathcal{E}_{j\hat{j}}$ *or* 7$\mathcal{E}_{j\hat{j}}$). Note that, in this report, the equity in opportunity parameter for any county pair is assumed to be same (i.e., $\mathcal{E}_{j\hat{j}} = \mathcal{E}_{k\hat{k}} \forall\, j, \hat{j}, k, \hat{k} \in J | j \neq \hat{j}, k \neq \hat{k}$). Values of $\mathcal{E}_{j\hat{j}}$ can be estimated as (weighted) ratios of population, income, or other socioeconomic characteristics (Lee & Wong, 2004; Talen, 1998; Talen & Anselin, 1998; Welch & Mishra, 2013).

$$\boldsymbol{M3}: max \sum_{i,t} B_{Ti=0} X_{it} \tag{3.1}$$

Subject to

(1.2)-(1.4), (2.2)

$$\textstyle\sum_{i,t} X_{it}\, g_{ij} \geq 1 \qquad \forall\, j \in J \tag{3.2}$$

$$\left|\textstyle\sum_{i,t} X_{it}\, g_{ij} - \sum_{i,t} X_{it}\, g_{i\hat{j}}\right| \leq \mathcal{E}_{j\hat{j}} d_{j\hat{j}} \qquad \forall\, j, \hat{j} \in J | j \neq \hat{j} \tag{3.3}$$

***M4*: Economic Competitiveness with Equity in Outcome**

M3 distributes the available resources across counties in a fair manner with regards to the total portion of the available funding allocated but does not ensure an equitable distribution of benefits (i.e., outcomes). For example, two counties may receive the same amount of funding but the benefits from these projects may vary significantly. To account for the equity in outcome, constraints (4.2)-(4.4) are added to ***M2*** and the resulting model is termed model ***M4***. Constraint set (4.2) bounds the benefits of each county between the upper (*R*) and lower bounds (*S*) where *R* and *S* are determined within constraints set (4.3). Constraint set (4.3) ensures that the difference between *R* and *S* is less than a pre-specified percentage (i.e., equity in opportunity parameter e) of the total benefits. Constraints (4.2) and (4.3), try to minimize the difference in benefits between any two counties in an effort to obtain an equitable benefits allocation.

$$\boldsymbol{M4}: max \sum_{i,t} B_{Ti=0} X_{it} \tag{4.1}$$

Subject to

(1.2)-(1.4), (2.2)

$$R \geq \textstyle\sum_{i,t} B_{Ti=0} X_{it} g_{ij} \geq S \qquad \forall\; j \in J \tag{4.2}$$

$$R - S \leq e \textstyle\sum_{i,t} B_{Ti=0} X_{it} \tag{4.3}$$

3.2 Chapter Summary

In this chapter, four resource allocation based on different policies are formulated in addition to the manual allocation model. Based on specific goals and objectives of the implementing agencies, these models can be used to prioritize the freight related projects. These models are general in the sense that they can be used for any kind of freight resource allocation in any area. Although county is discussed as the geographical region for this specific project, the region can be in any size. These models will be used to prioritize the projects in chapter five once the possible projects are identified in the next chapter.

CHAPTER 4: DATA COLLECTION AND PROCESSING

4.1 Study Area

The model formulated in chapter 3 is applied in the freight corridor for the state of Tennessee. The multimodal freight network consists of over 28,413 miles of functionally classified roadway, over 1,200 miles of railway, 949 miles of navigable waterway, and 3,360 miles of pipeline (TDOT, 2016; USDOE, 2016). Because of unavailability of data, only roadway and railways modes are considered in the model application. 2,238 projects are proposed in 51 counties, considering 10 years of planning horizon.

In this section, the data collection, analysis, and identification of projects are presented. Potential locations to be improved are identified based on three performance measures including congestion reduction, operational improvement, and safety enhancement. For rail mode because of unavailability of data, only safety performance measure is used for identification of potential locations.

4.2 Analysis of freight congestion and mobility constraints in TN

The objective of this task is to analyze various constraints affecting freight congestion and mobility in the State of Tennessee. These constraints include, but are not limited to, safety, recurring and non-recurring congestion, reliability, and parking. Databases to be analyzed to identify barriers to freight movement include Freight Analysis Framework (FAF), Enhanced Tennessee Roadway Information Management System (ETRIMS), National Performance Management Research Data Set (NPMRDS), Statewide Travel Demand Model (STDM), and Metropolitan Planning Organization Travel Demand Model (MPOTDM). All modes of freight transportation is analyzed. Previously identified freight projects in the long-range plan will also be studied.

4.3 Freight Analysis Framework (FAF) dataset

The Freight Analysis Framework Version 4 (FAF4) is a dataset produced through a partnership between Bureau of Transportation Statistics (BTS) and Federal Highway Administration (FHWA). The goal of this dataset is to develop a comprehensive picture of freight movement among states and major metropolitan areas by all modes of transportation.

The State of Tennessee comprises of four FAF regions: Memphis, Nashville, Knoxville, and Rest of TN. A preliminary analysis of the FAF dataset suggests six patterns of freight movement for TN (Figure 4-1) as:

Pattern 1: TN (Origin) → Domestic destination
Pattern 2: Foreign origin → TN (Origin) → Domestic destination
Pattern 3: Domestic origin → TN (Destination)
Pattern 4: Foreign origin → Domestic origin → TN (Destination)
Pattern 5: TN (Origin) → Domestic destination → Foreign destination
Pattern 6: Domestic origin → TN (Destination) → Foreign destination

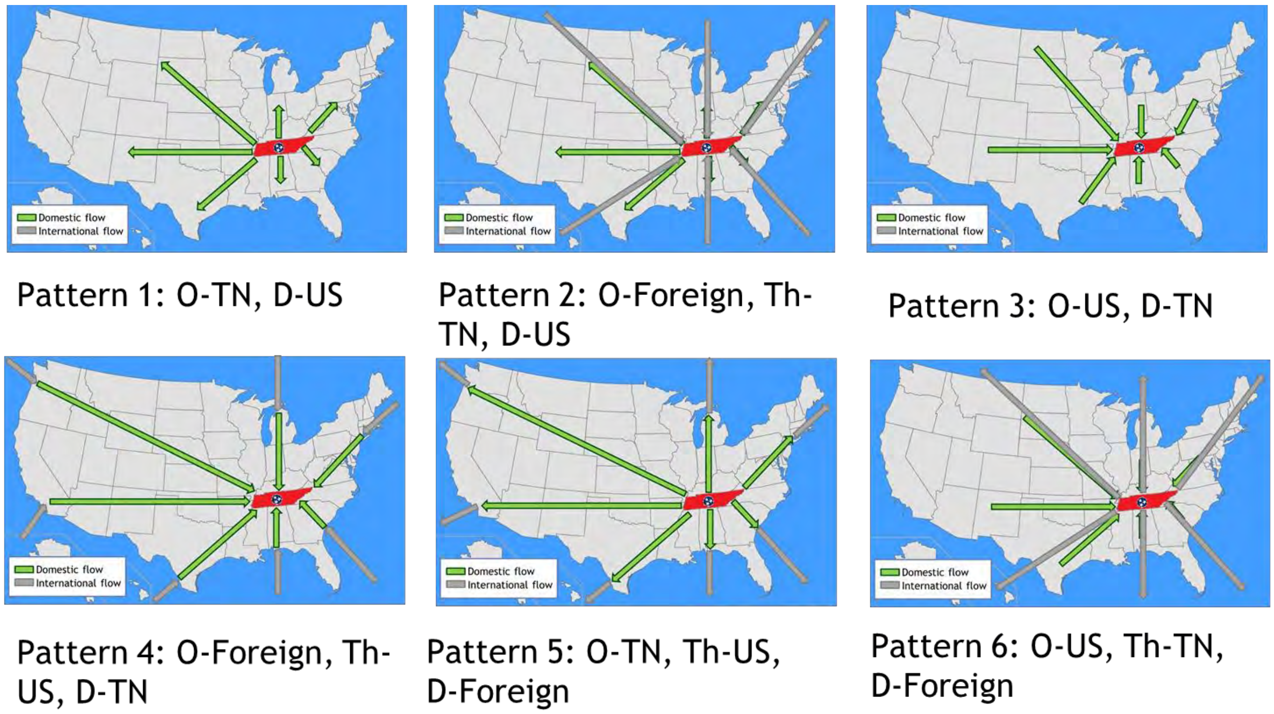


Figure 4-1: Patterns of freight movement for TN (source: FAF4)

Total tonnage and value of transported goods through the six recognized patterns are visualized in Figure 4-2**Error! Reference source not found.**. The vast majority of freight tonnage is transported in patterns 1 and 3 indicating that domestic FAF zones are the main trade partners of the State of Tennessee. However, values of freight in patterns 4 and 6, are comparable to those in patterns 1 and 3; therefore, it can be speculated that products transported in patterns 4 and 6 are more valuable. This is not surprising considering that patterns 4 and 6 involve import and export. In the remainder of this subtask, each of the above freight movement patterns is analyzed separately.

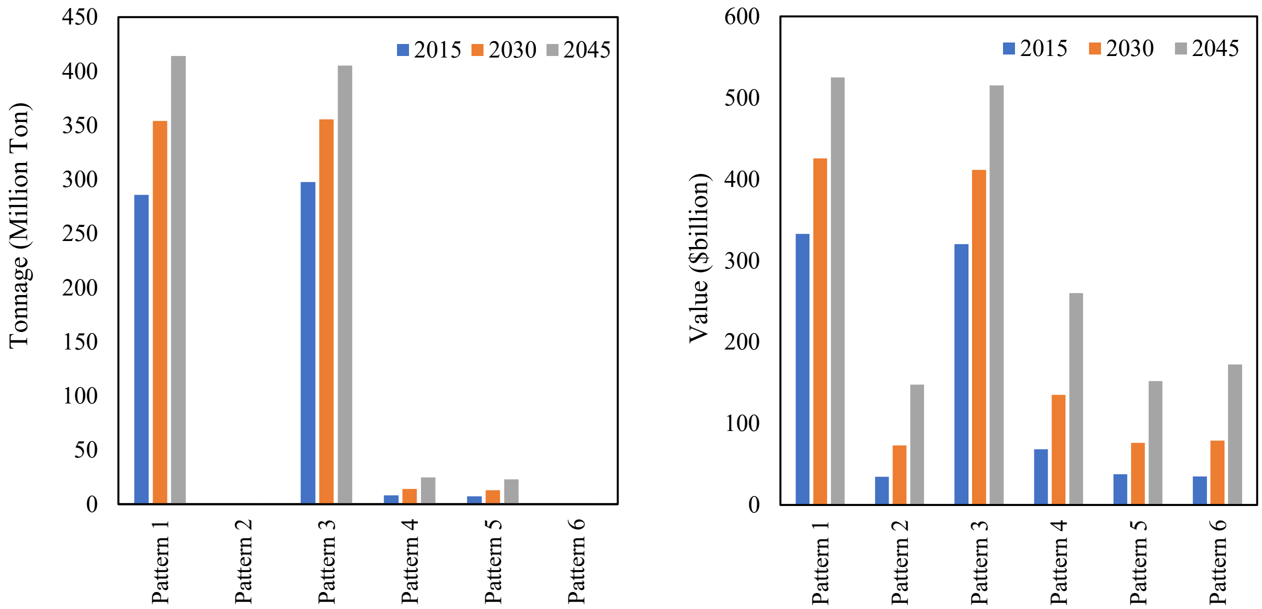


Figure 4-2: Total freight weight and value for the six FAF demand patterns

4.3.1 Pattern 1: TN (Origin) → Domestic destination

Figure 4-3**Error! Reference source not found.** shows total weight and value of freight movements in Pattern 1 for the four FAF regions in TN. In terms of freight tonnage departing Tennessee to a domestic destination, Rest of TN has the highest share, followed by Nashville, Memphis, and Knoxville. Demand for all four FAF regions are expected to growth through 2045, but at lower rates for Knoxville and Memphis. Freight value follows a similar trend and continues to grow though the next decades. Unlike the freight tonnages, the value of freight departing Nashville is higher than other three regions. While freight tonnage for Memphis region grows at a small rate, increase rate for the value of freight for this region is comparable to those for Nashville and Rest of TN. Considering freight tonnage growth in the four regions, it can be concluded that Nashville and Rest of TN FAF regions will face more severe mobility constraints in the next decades, compared to Memphis and Knoxville FAF regions.

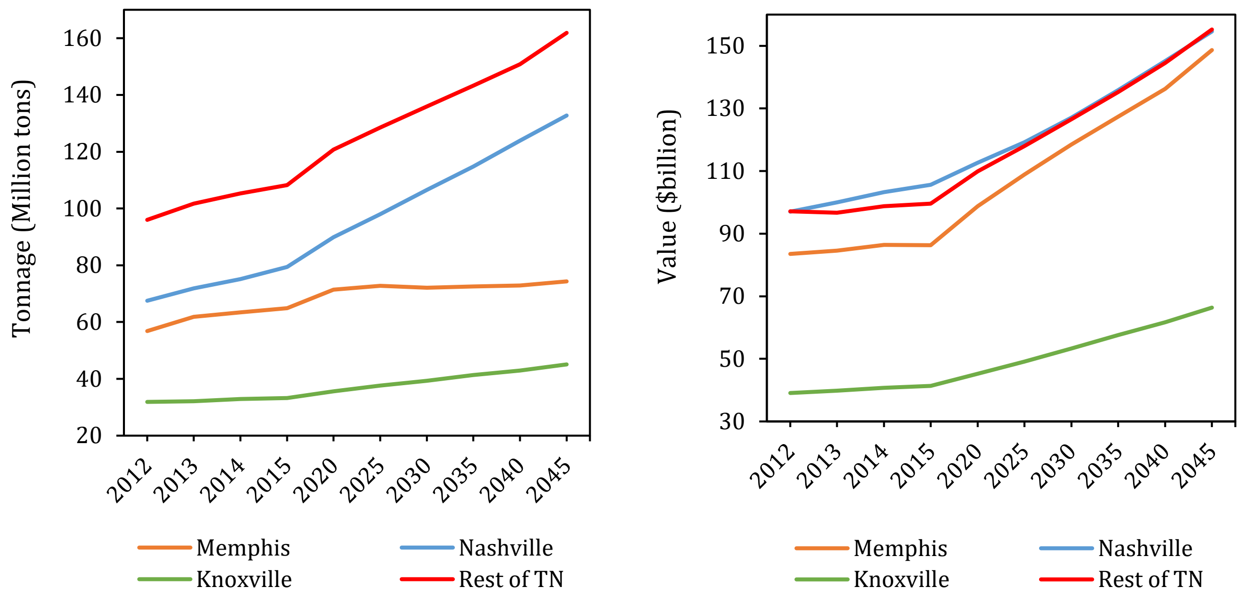


Figure 4-3: Total weight and value of Pattern 1 freight demand by FAF region

Figure 4-4**Error! Reference source not found.** illustrates the shares of the six modes in total tonnage departing the State of TN to domestic regions. Truck and pipeline are the two major modes that move Pattern 1 freight demand. In total, more than 93% of total demand is always transported by truck and pipeline modes. Rail is the third important mode with about 3% to 4% share. Demand for all four modes will grow over the next decades considering the total freight demand growth. Therefore, all modes not only will continue to face the existing mobility constraints but also encounter new constraints caused by demand increase. Considering that truck mode share will decrease substantially, and the corresponding demand will be absorbed by pipeline, special attention should be given to constraints facing pipeline.

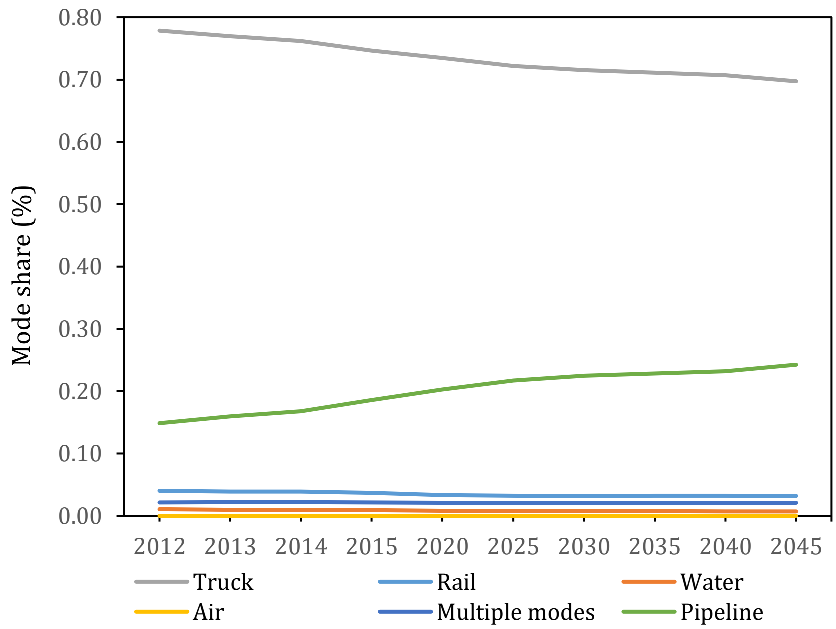


Figure 4-4: Mode shares in Pattern 1 freight demand

Figure 4-5 shows the share of top six commodities in total tonnage departing Tennessee to domestic destinations. Coal, gravel, non-metal mineral products, other food stuff, gasoline, waste/scrap are main commodities that are transported. The highest increase of demand share pertains to coal, where the demand share is expected to increase from 19.6% in 2015 to 25.3% in 2045. Special consideration, therefore, should be given to mobility constraints associated with coal transportation. Other commodities will experience minor changes in demand share, mostly less than 2%.

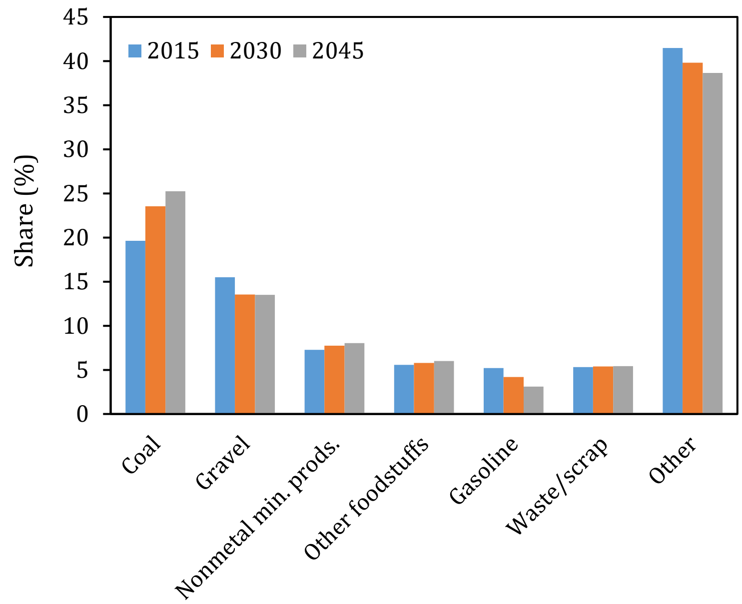


Figure 4-5: Commodity shares in Pattern 1 demand for major commodity types

Figure 4-6 illustrates top five trade partner of Tennessee. Interestingly, Tennessee itself has the highest share (nearly 50% share in 2015). This share, however, is expected to decrease over the next decades. The other four states make into the top five are Kentucky, Mississippi, Georgia, Alabama. The results seem to be reasonable considering the geographical locations of the mentioned states. It is observed that some demand will shift from TN→TN to TN→KY. Improvements may therefore target constraints facing transportation between Tennessee and Kentucky.

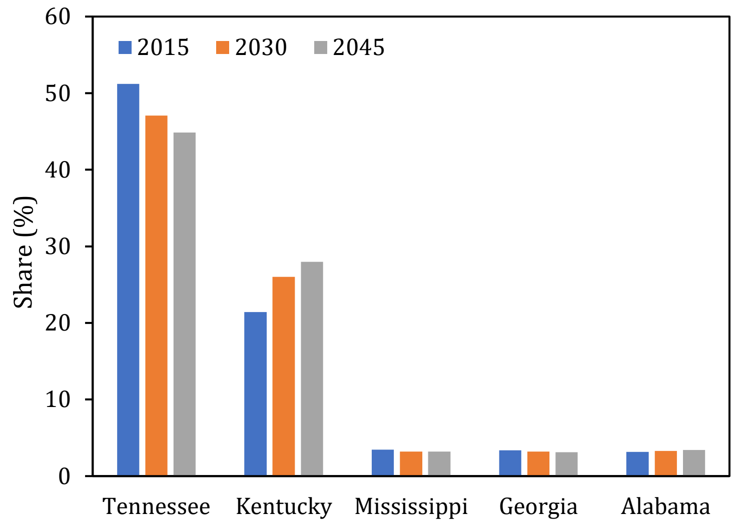


Figure 4-6: Top trade partner of TN in Pattern 1

4.3.2 Pattern 2: Foreign origin → TN (Origin) → Domestic destination

Figure 4-7 illustrates total weight and value for freight movements in Pattern 2. In this pattern, shipments from outside the US are first carried to TN, and then transferred to a domestic destination. In both terms, tonnage and value, Memphis is the most important port of entry, thanks to FedEx Express super hub located in Memphis International Airport. In the 2012-2015 period, Memphis' tonnage and value experienced a slight drop. However, a sustainable rate is forecasted for the 2015-2045 period. The other three FAF regions, i.e., Nashville, Knoxville and Rest of TN, experience insignificant increase rates compared to Memphis. This figure informs us of presence of capacity constraint at Memphis International Airport in the future.

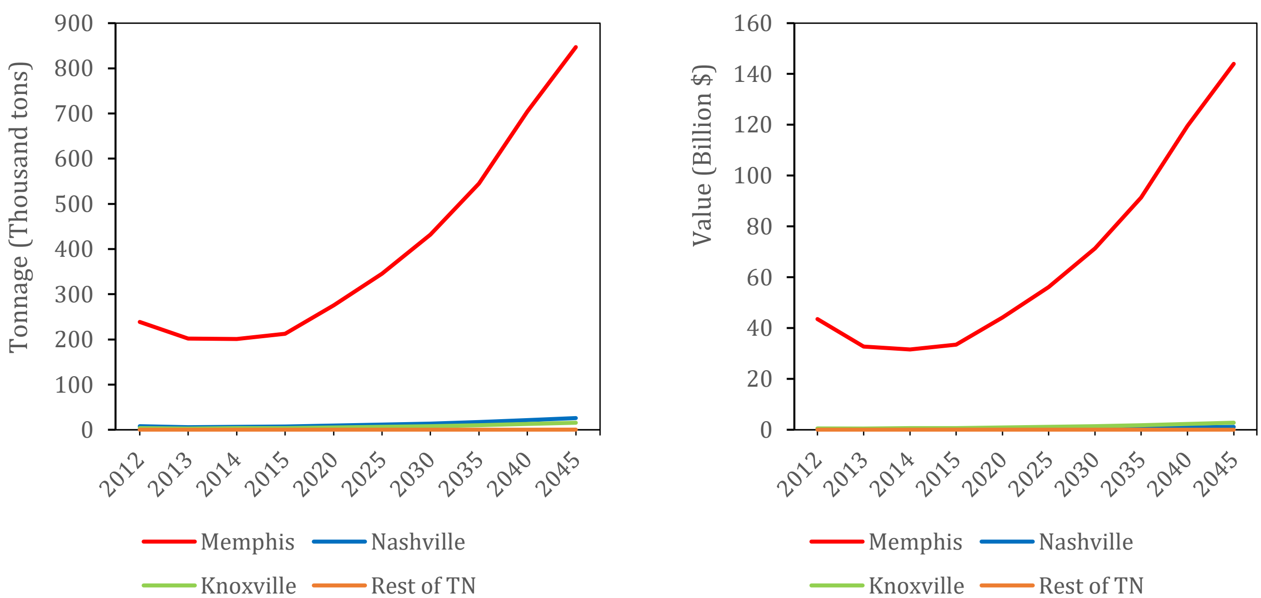


Figure 4-7: Total weight and value of Pattern 2 freight demand by FAF region

Figure 4-8 displays the origin of the freight entering the US in Pattern 2. The highest tonnage and value pertain to Europe and Eastern Asia. Unlike Europe, which has experienced constant increase, some fluctuations can be identified for value of freight imported from Eastern Asia. Overall, Europe and Eastern Asia will continue to remain the top partners of TN over the next years, with much higher shares compared to Mexico, Rest of Americas, Canada, and SE Asia & Oceania. Considering that air transport is the only mode of carrying freight directly from Eastern Asia and Europe to Tennessee, this observation further supports existence of capacity constraint at FedEx super hub in the next days.

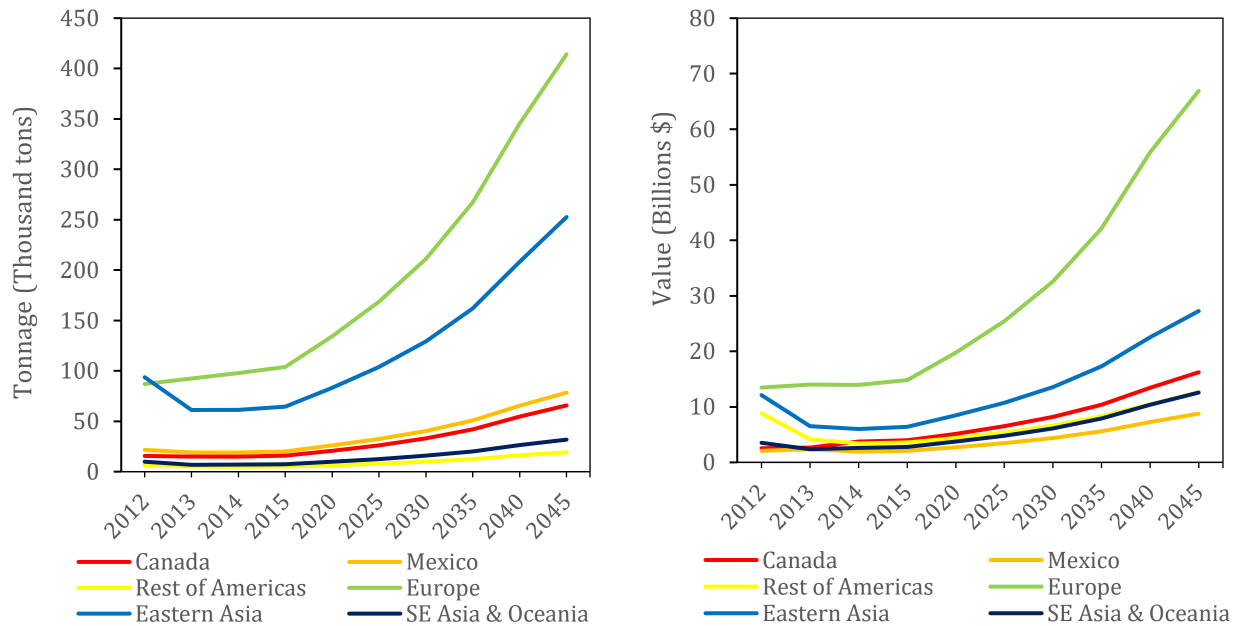


Figure 4-8: Total weight and value of Pattern 2 freight demand by origin

Share of each mode in the freight tonnage arrived in TN in Pattern 1 is shown in Figure 4-9. Focusing on the left-hand-side panel, air is and remains to be the major in-bound mode of transportation with a share over 90%. Out-bound mode shares are illustrated in the right-hand-side panel of Figure 4-9, where it is observed that air is still the predominant mode but with a lower share compared to the its share in in-bound movements. Truck mode share in the out-bound movements is expected to remain stable over the next decades. However, overall demand – and thus truck demand – will increase giving rise to additional highway mobility constraints in the future.

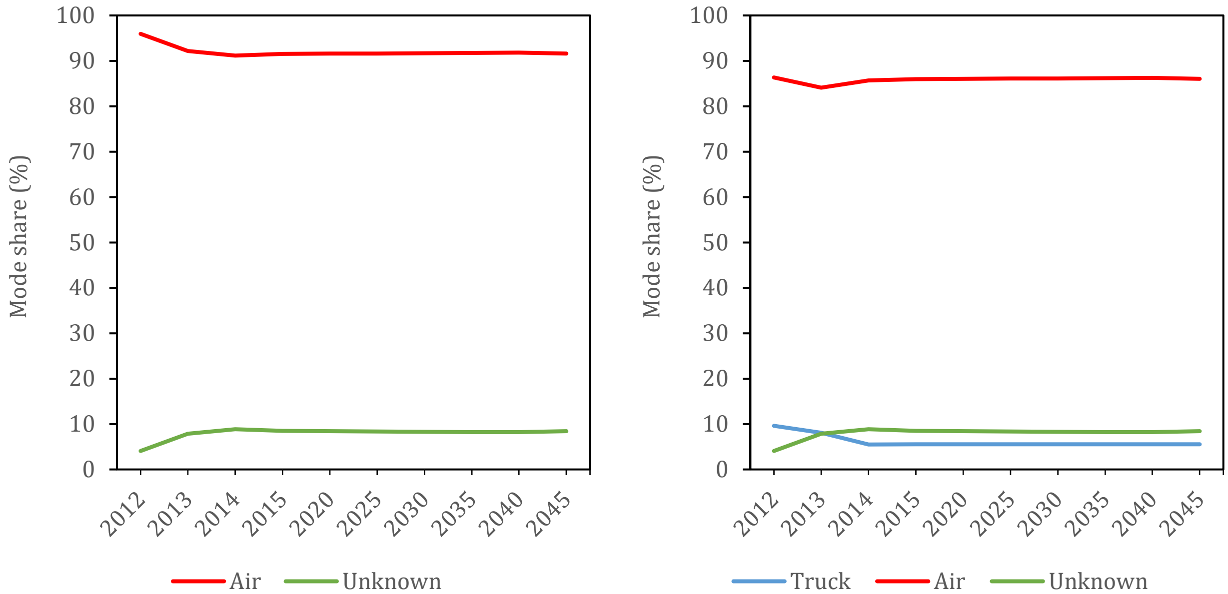


Figure 4-9: Mode shares for Pattern 2 freight movements (Left-hand-side panel: in-bound mode; Right-hand-side panel: out-bound mode)

Figure 4-10 provides the shares of six major commodities in total tonnage in Pattern 2 freight movements. Electronics, machinery, precision instruments, textiles/leathers, plastics/rubber, and articles-base metal high the highest share among 44 commodity types considered in the FAF dataset. Shares of electronics and precision materials will grow in the next years while other commodity types will experience insignificant share reduction. Special consideration is required to tackle mobility constraints affecting transportation of these commodity types.

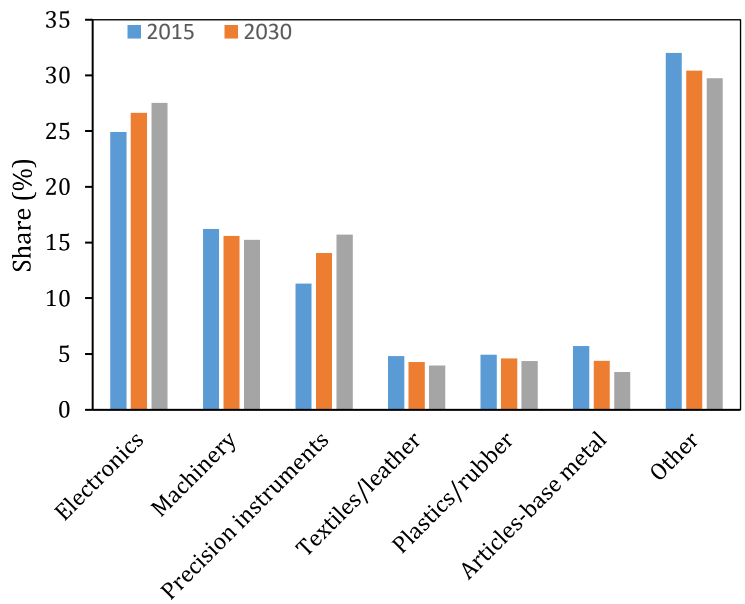


Figure 4-10: Shares for major commodity types in Pattern 2

4.3.3 Pattern 3: Domestic (Origin) → TN destination

Figure 4-11 shows total tonnage and value for freight shipments arriving in Tennessee from other Domestic origins. Both the value of tonnage of freight in Pattern 2 steadily increase in 2012-2045 period. Similar to what it is observed in Pattern 1, Rest of TN ranks first, followed by Memphis and Nashville, and Knoxville in the last place. In terms of value, however, the curves representing Memphis, Nashville, and Rest of TN are very similar.

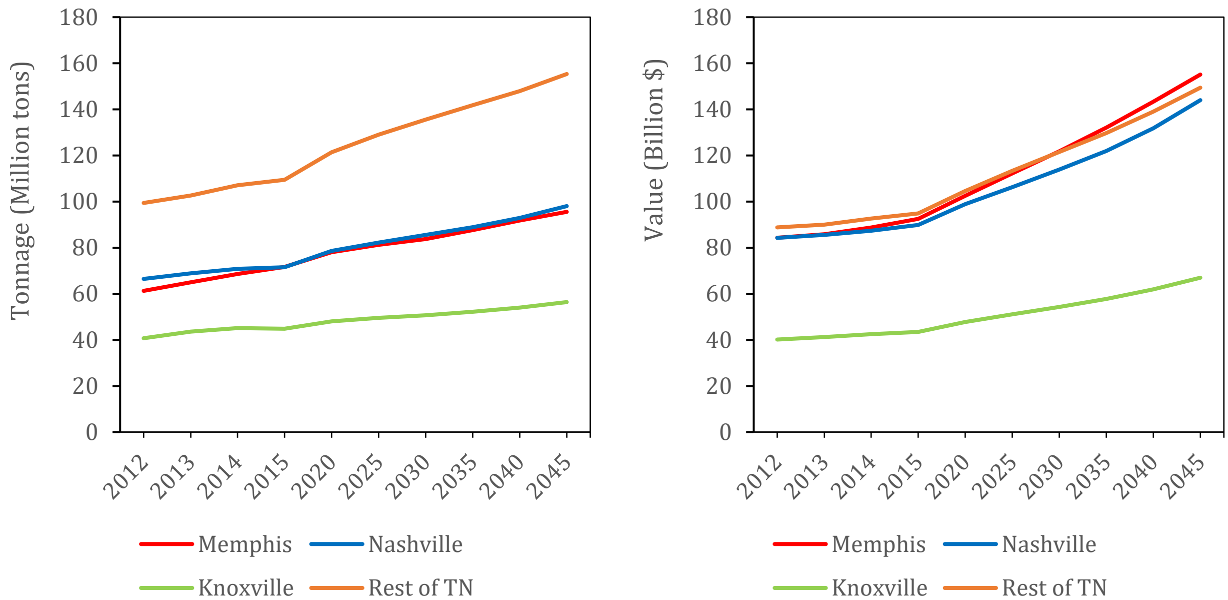


Figure 4-11: Total freight tonnage and value in Pattern 3

Figure 4-12 displays mode shares for Pattern 3 freight demand. Truck strongly dominates other modes, with a steady share about 67%. Similar to mode shares under Pattern 1, pipeline is the second most important mode of transportation with nearly 17% mode share. No significant modal shift over the next decades is found.

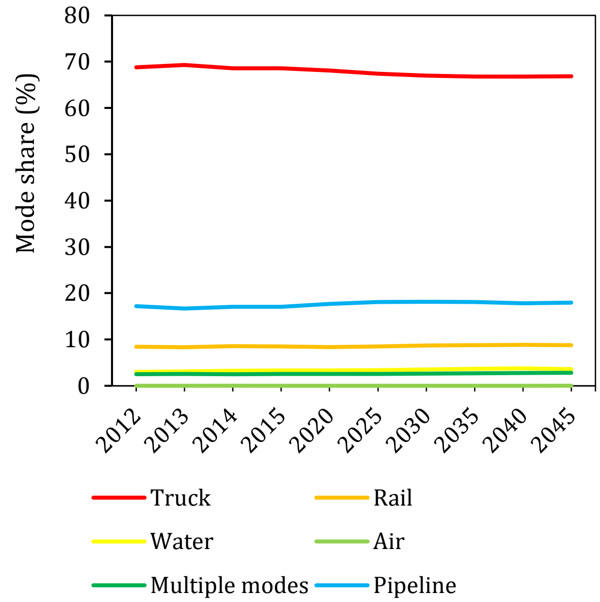


Figure 4-12: Mode shares in Pattern 3 freight demand

Commodity shares for freight tonnage arriving in Tennessee from domestic origins are presented in Figure 4-13. Similar to our observation for Pattern 1, coal, gravel, nonmetal mineral products, other food stuff, gasoline, and waste/scrap are main commodities transported to the State of Tennessee. Unlike Pattern 1, share of each commodity type remains relatively stable over the next years.

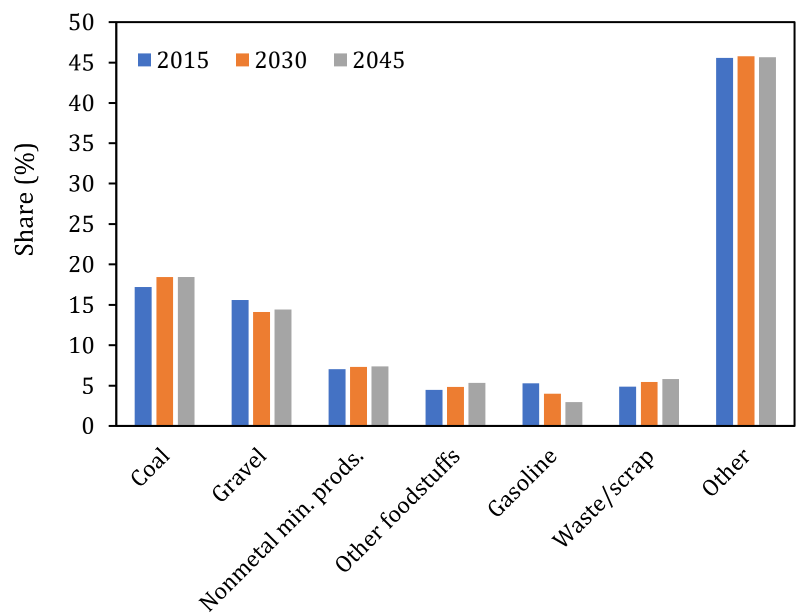


Figure 4-13: Commodity shares in Pattern 3 demand for major commodity types

Figure 4-14 shows the top five trade partners of Tennessee under Pattern 3 demand. Tennessee's most important partner is itself, which is consistent with our observation in Pattern

1. Total tonnage imported to TN from itself, however, is expected to decrease over time. Minor changes in the shares of other trade partners of TN over the next decades is observed.

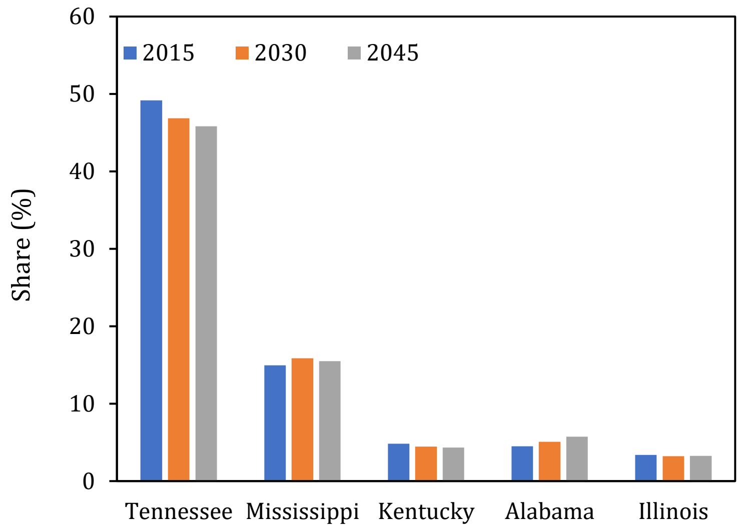


Figure 4-14: Top trade partners of Tennessee in Pattern 3

4.3.4 Pattern 4: Foreign origin → Domestic (Origin) → TN destination

Figure 4-15 depicts total freight weight and value in Pattern 4, where foreign shipments enter the US through a domestic region and then arrive at the State Tennessee as the final destination. In terms of tonnage, Nashville FAF region is leading, followed by Memphis, Rest of TN, and Knoxville. Demand values for the three regions receiving higher tonnages seem also seems to grow at higher rates. However, in terms of value, freight imported to the Memphis region has the highest value, although the difference between Memphis and Nashville is not significant in the 2013-2025 period.

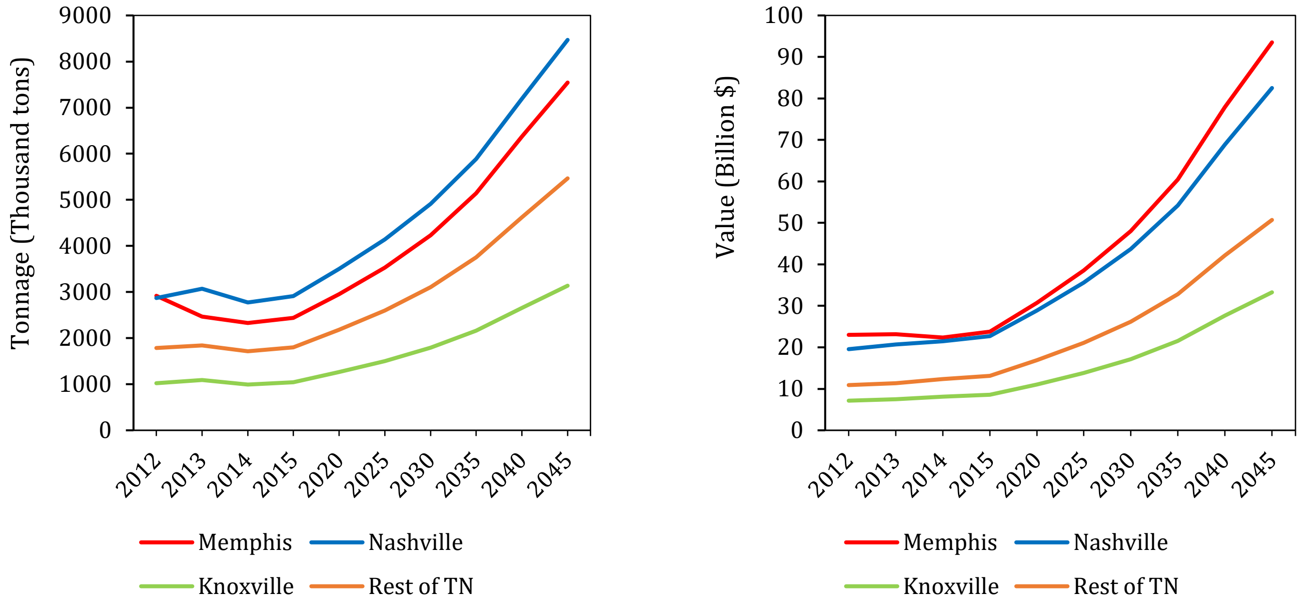


Figure 4-15: Total weight and value of Pattern 4 freight demand by FAF region

Figure 4-16 illustrate the tonnage and value of freight demand in Pattern 4 as a function of the origin country/region. In terms of tonnage, Eastern Asia is the most has the highest value of exports to the State of Tennessee. Canada and Mexico ranked rank second and third, respectively. Eastern Asia also has the highest value of exports to TN, with much higher freight value compared to all other regions. Interestingly, Canada only ranks four in terms of value while it ranks second in terms of tonnage. Same is true for Mexico. This implies that the freight exported by the two countries have low value/tonnage ratio.

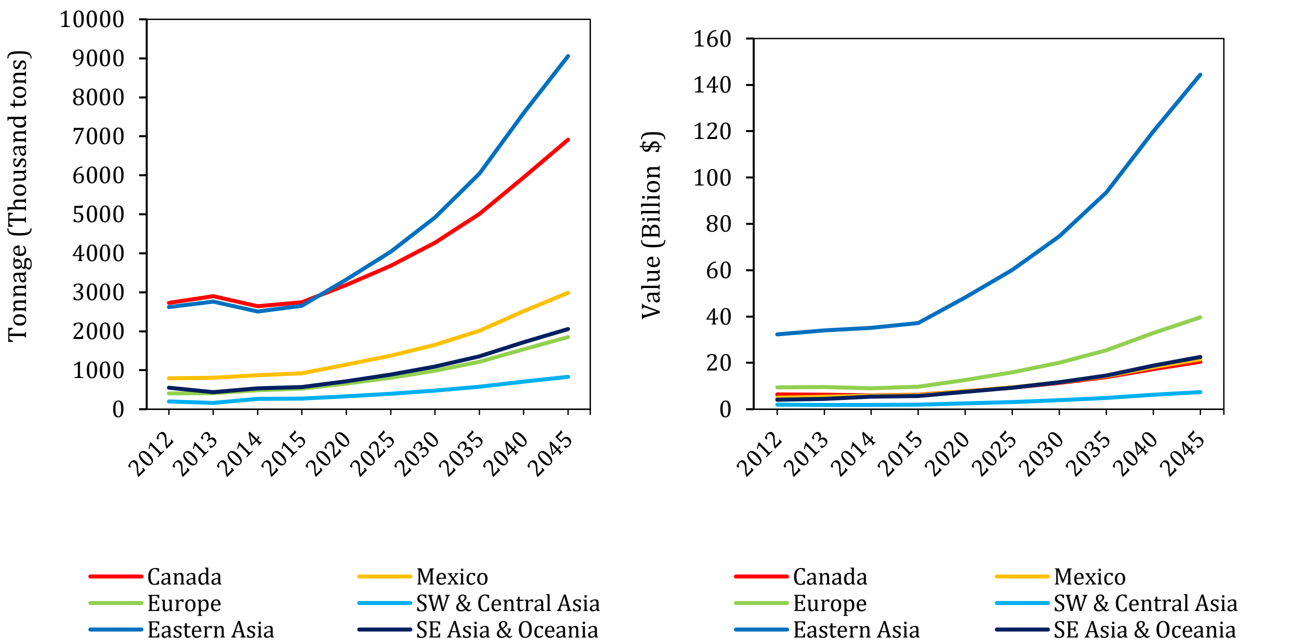


Figure 4-16: Total weight and value of Pattern 4 freight demand by origin country/region

Figure 4-17 presents in-bound mode and domestic mode for freight demand in Pattern 4. It is observed that the majority of shipments are imported to the US via a port, and then transported to TN via rail, truck, or multiple modes (intermodal). Rail and truck have the highest import mode shares after water transportation. Air is rarely used in this pattern of freight demand. It is further observed that mode share of truck, as a domestic mode of transportation, constantly increases over the 2012-2045 period.

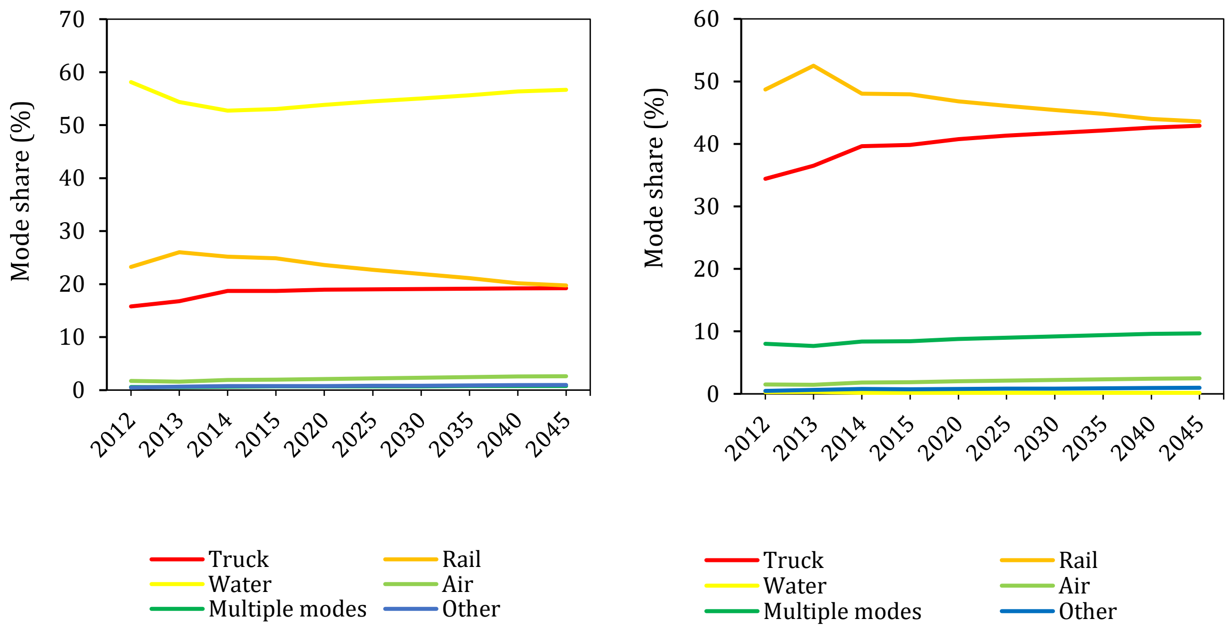


Figure 4-17: Mode shares in Pattern 4
(Left-hand-side panel: import mode; Right-hand-side panel: domestic mode)

Figure 4-18 illustrate the shares of top seven commodities under Pattern 4 freight demand. Machinery, motorized vehicles, base metals, plastics/rubber, electronics, basic chemicals, nonmetallic minerals are main commodities that are imported to Tennessee. The top five commodity types have relatively equal shares and commodity has more than 15% of share. This implies that a diverse set of commodities is being imported to Tennessee under this pattern of demand.

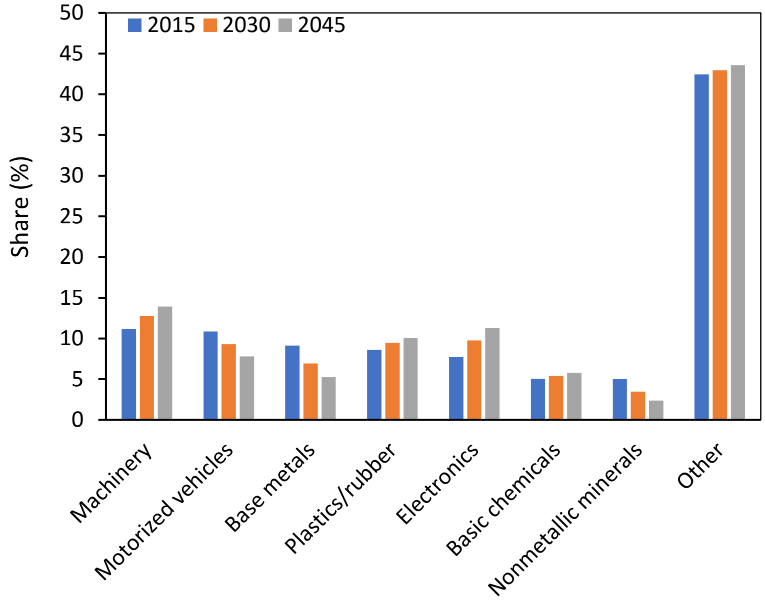


Figure 4-18: Commodity shares in Pattern 4 demand for major commodity types

4.3.5 Pattern 5: TN (Origin) → Domestic destination → Foreign destination

Figure 4-19 illustrates the tonnage and the value of freight in Pattern 5. Tonnage exported from the Memphis region is higher than the other three FAF regions. This region, however, has experienced a slight drop in export tonnage in the 2012-2015 period. The curves representing Nashville and rest of TN follow a very close pattern. Knoxville, however, is expected to experience a much lower demand increase rate. Insights obtained for freight value are similar to those for tonnage except in that Nashville and Rest of TN follow distinct patterns.

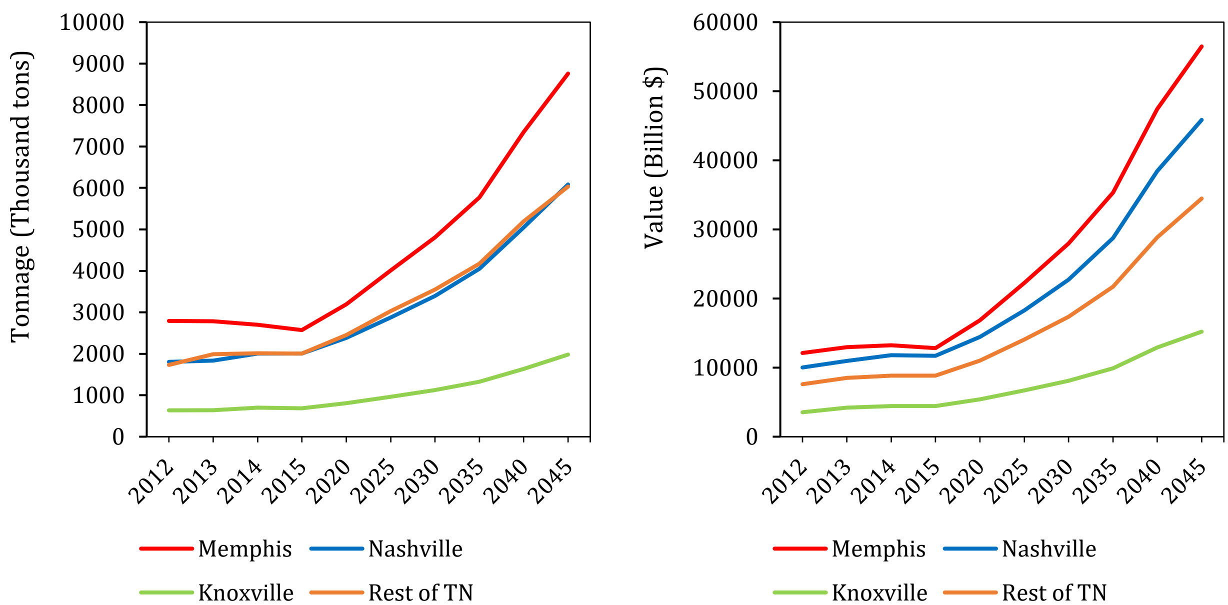


Figure 4-19: Total weight and value of Pattern 5 freight demand by FAF region

Information regarding the final destination of freight demand in Pattern 5 is presented in Figure 4-20. Mexico receives the greatest portion of freight exported from TN, followed by Canada, Eastern Asia, and Europe. A different pattern for freight value (right-hand-side panel) is observed, where freight received by Canada has the highest value. Freight sent to Europe also has higher value than Eastern Asia and Mexico. This implies that the freight exported to Mexico has a low value/ton ratio, compared to the freight exported to Europe and Canada.

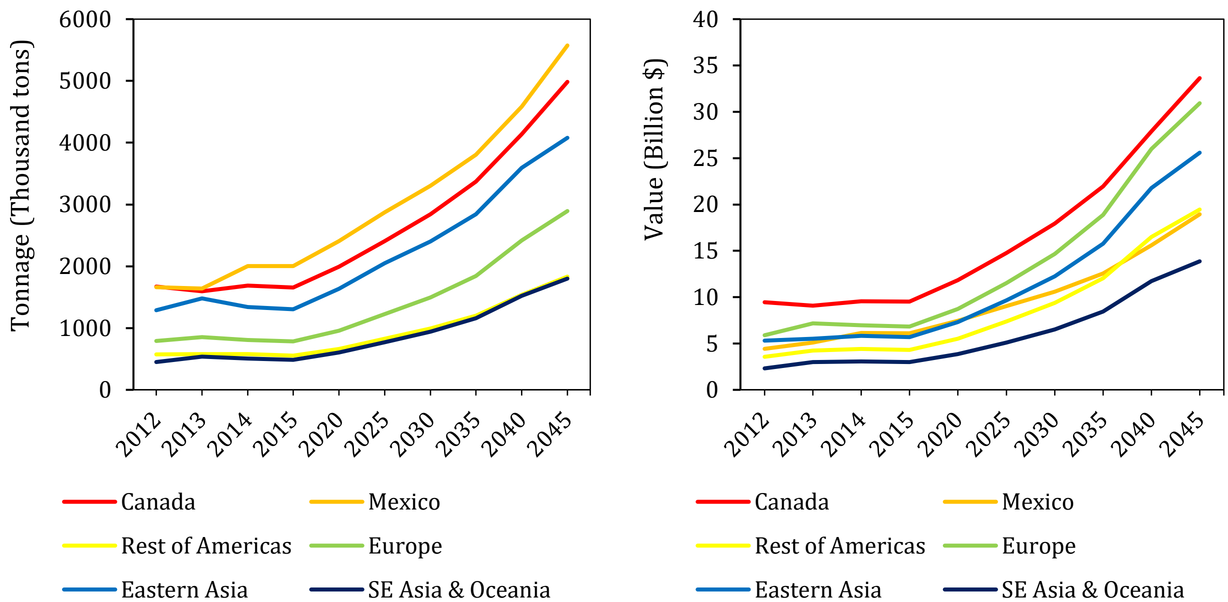


Figure 4-20: Total weight and value of Pattern 5 freight demand by destination

Figure 4-21 illustrates export and domestic mode shares in Pattern 5 freight demand. Similar to Pattern 4, water is the dominant export mode, mainly due to economies of scale of maritime shipping. Unlike Patter 4, rail has a lower export mode share than truck. Truck also strongly dominates other modes in the domestic market. Insights obtained from this figure coupled with continuous growth of freight demand Pattern 5 inform us of existence of more truck-related mobility constraints in the next decades.

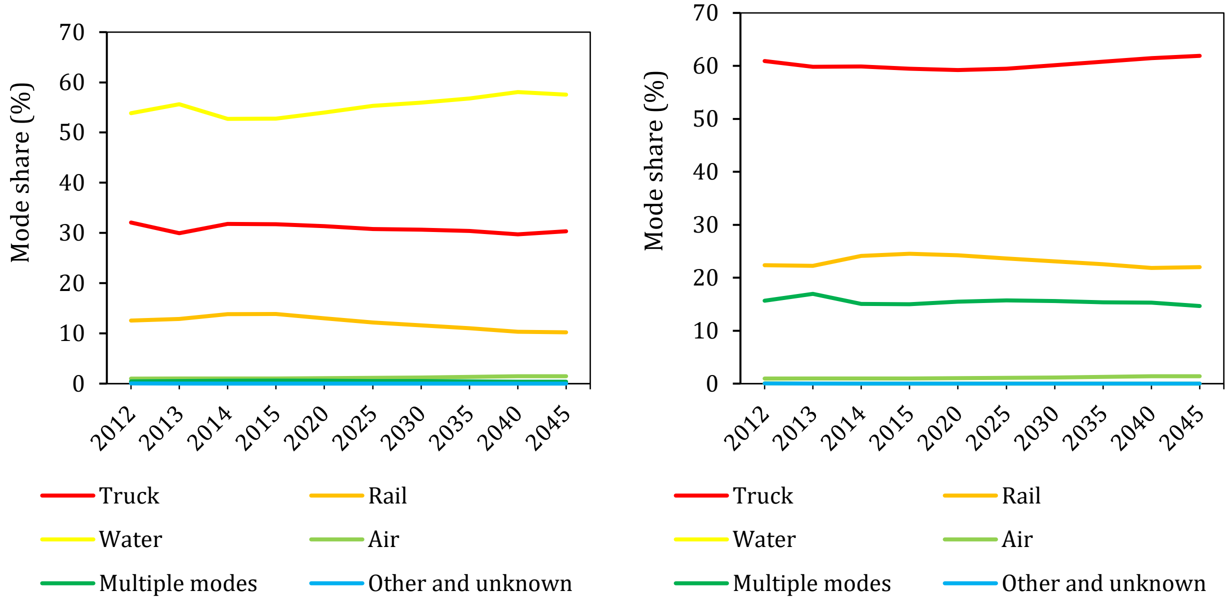


Figure 4-21: Mode shares in Pattern 5
(Left-hand-side panel: export mode; Right-hand-side panel: domestic mode)

Shares of main commodities exported under Pattern 5 are illustrated in Figure 4-22. Plastics/rubber, newsprint/report, basic chemicals, metallic ores, machinery, motorized vehicles, other agricultural products, are the main commodities that are exported from TN. The highest share pertains to plastics/rubber with about 14% share. Other commodity types have relatively equals shares of 7-8% in total tonnage transported from Tennessee under Pattern 4.

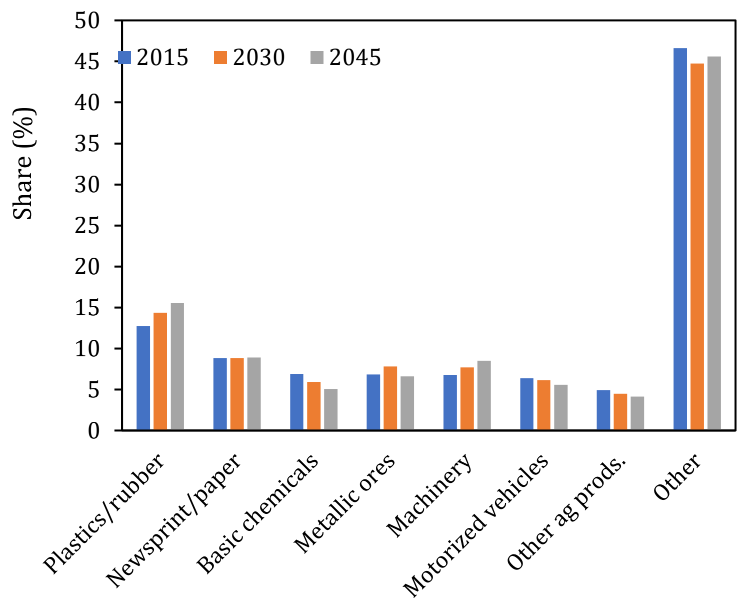


Figure 4-22: Commodity shares in Pattern 5 demand for major commodity types

4.3.6 Pattern 6: Domestic (Origin) → TN destination → Foreign destination

Figure 4-23 shows the tonnage and value of freight departing the State of Tennessee in Pattern 6. Thanks to FedEx superhub located in Memphis, both tonnage and value of departing the Memphis FAF region are substantially greater than those departing other three FAF regions in TN. Although total tonnage departing Memphis region has been relatively constant in the 2012-2015 period, a large increase of demand is forecasted for 2015-2045.

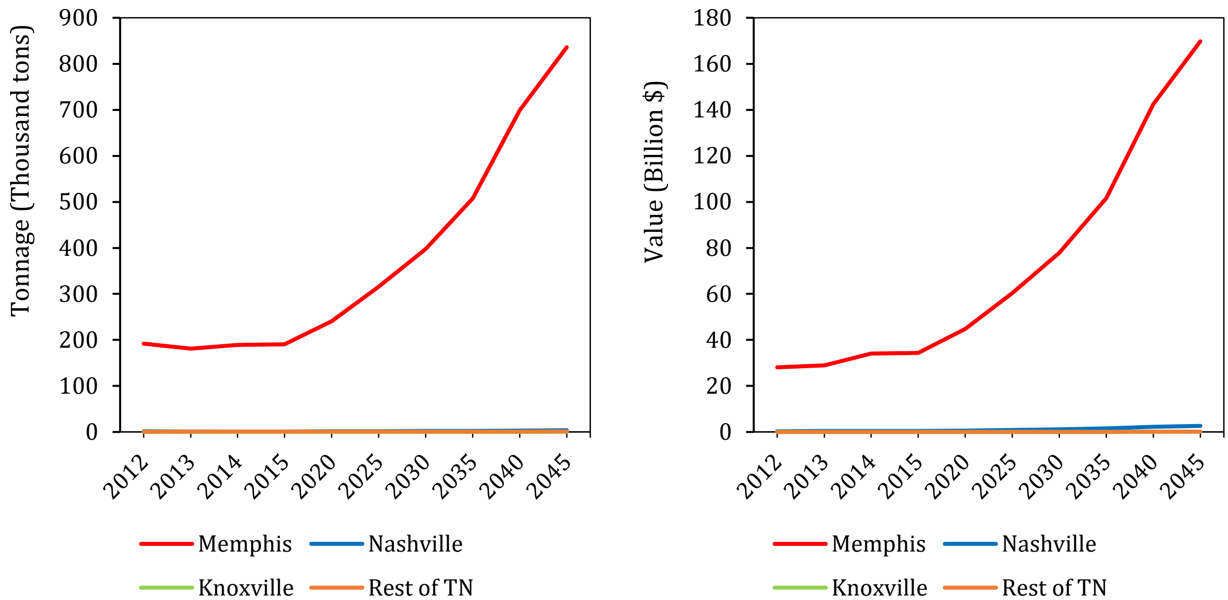


Figure 4-23: Total weight and value of Pattern 6 freight demand by FAF region

Figure 4-24 shows the foreign country in which freight is transported to through pattern 6. In general, the amounts of freight tonnage and value will continue to increase over the next decades. Both tonnage and value freight exported to Europe and Cana are higher than the freight exported to other regions/countries. Demand for Cana and Europe also increases at a higher rate, compared to the other four regions.

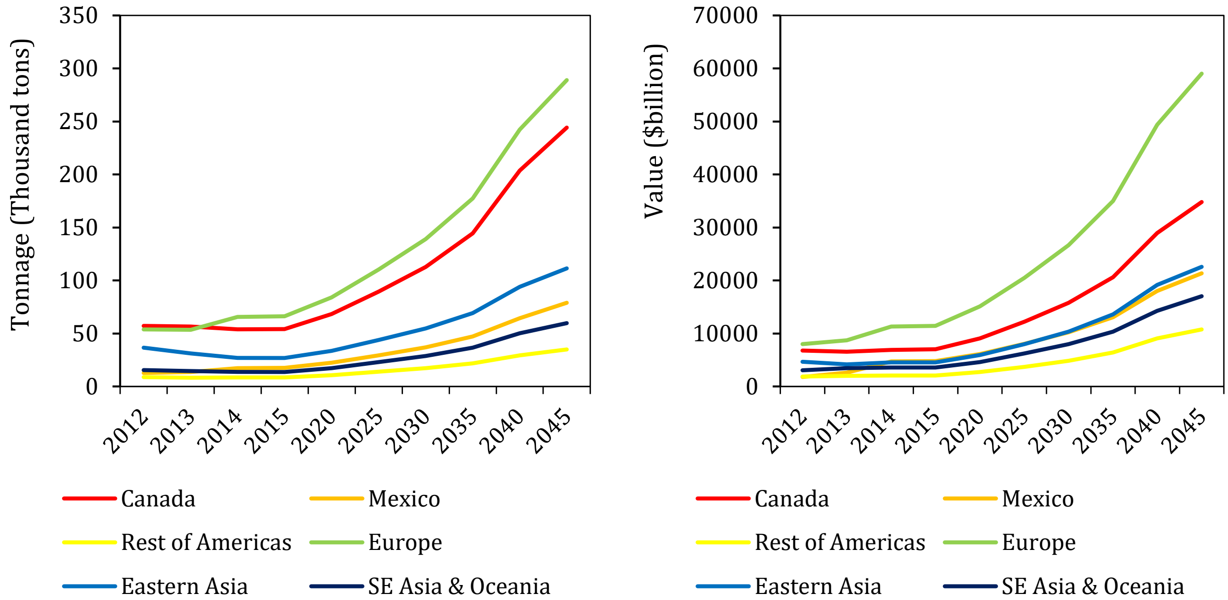


Figure 4-24: Total weight and value of Pattern 6 freight demand by final foreign destination

Figure 4-25 illustrate the mode shares in Pattern 6. Not surprisingly, it is observed that almost entire freight coming from domestic origins to Tennessee in order to be exported to foreign destinations are hauled by air mode. Significant demand increase forecasted in this pattern suggests presence of strong mobility constraints at Memphis International Airport.

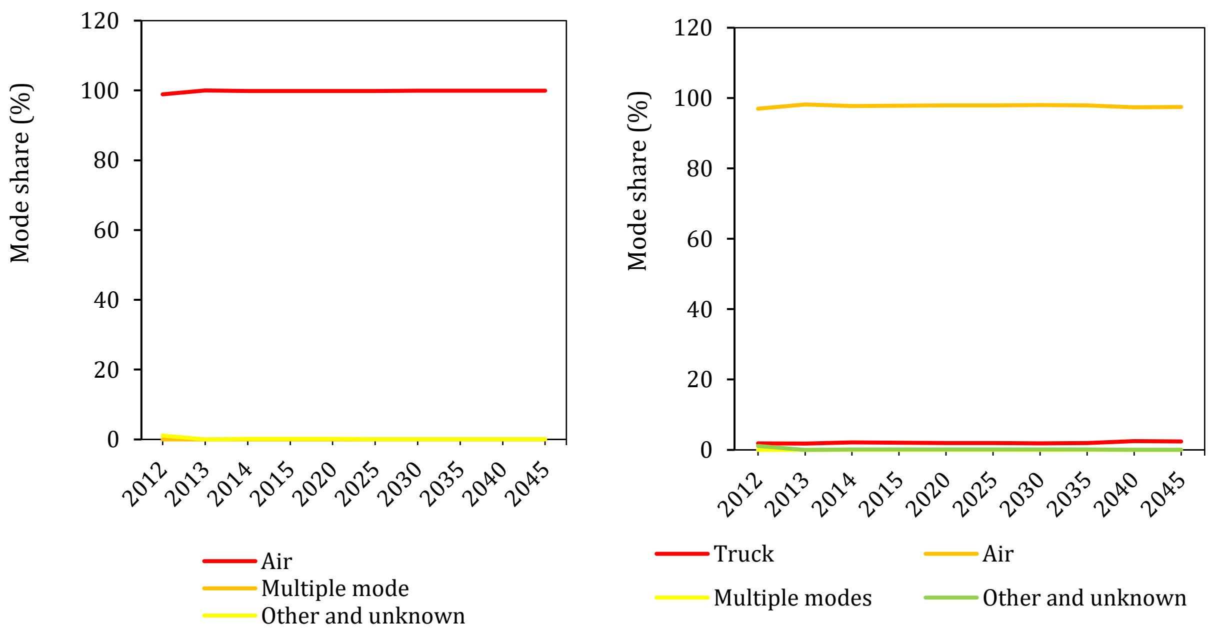


Figure 4-25: Mode shares in Pattern 6 foreign (left-hand-side panel: domestic mode; right-hand-side panel: export mode)

The share of main commodities exported to foreign destinations through pattern 6 are shown in Figure 4-26. Electronics, machinery, article-base metal, and precision instruments have the highest shares. As expected, most commodity types are sensitive materials/items. Changes in commodity shares are insignificant for all commodity types.

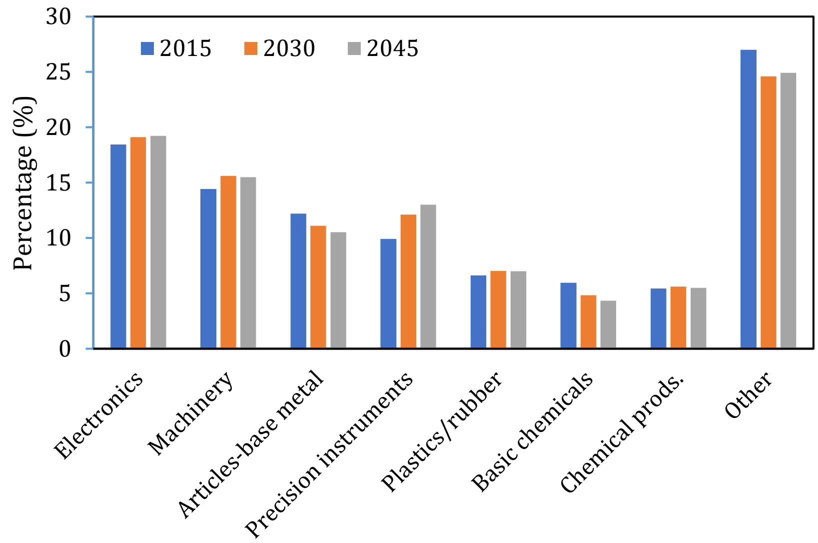


Figure 4-26: Commodity shares in Pattern 6 demand for major commodity types

4.4 Enhanced Tennessee Roadway Information Management System (ETRIMS) dataset

ETRIMS is a map-centric, web based, single integrated system that includes state and local roadways, structures, pavement, traffic, photo logs, and crash data. Roadway inventory and crash data for all the public roads are provided in this application. The roadway safety data is combined with crash data to better identify and understand the problems, prioritize locations for treatment, apply effective countermeasures, and evaluate the effectiveness of those countermeasures (Scopatz et al., 2014). The crash data is of the period 2002 to 2016, from which several types of crashes along the interstates and expressways of Tennessee are identified. The types of crashes are fatal, injury, property damage only (PDO), and total crash per mile. This information is provided in the attribute table of downloaded shape file. The problematic sections are selected based on the upper boundary condition for number of crashes per mile. This measure indicates the safety on the links of freight corridor and the identification of the location for safety related projects. The maps in this dataset are presented for four regions of Tennessee, from east to west.

The severe type of crash is fatal as it causes the loss of life. For most of the links, the fatal crash per mile is less than 0.4 in region 1. Some of the links on I-75 and I-40 have this number in between 0.4 and 1 while some are in between 1 and 1.6 with very few critical links on I-40, having fatal crash greater than 2.2 (**Error! Reference source not found.**). The links are more severe in region 2, compared to region 1. Many links on I-75, northeast of Chattanooga have fatal crash greater than 2.2 while very few links on I-40 have this number. I-24 on other side, have most links with fatal crash less than 1. I-40 is safer than I-75 and I-24 in this region, as indicated in Figure **Error! No text of specified style in document.**-1. Most of the links in region 3 have fatal crash number less than 0.4 with very few, greater than 2.2 (Figure **Error! No text of specified style in document.**-2). I-65 is critical among three major interstates, in this region.

In region 4, while most of the links have fatal crash number less than 0.4, some links have this number in between 0.4 and 1 (Figure **Error! No text of specified style in document.**-3). With I-40 being the major interstate in this region, some of the links are critical around Memphis on I-40 and I-55 indicating the less secure condition. As region 2 is the major freight activity region in Tennessee and Nashville with heavy traffic, I-65 is the main freight corridor and seems critical in terms of safety. Therefore, safety projects must be implemented very soon in this region.

Injury crash is any type of crash other than fatal that involves capacitating and incapacitating injury. Links on I-40 East from very beginning in this region up to diverging point of I-40 and I-75 and in remaining I-75 beyond this point have injury crash in between 5 and 15, as shown in Figure **Error! No text of specified style in document.**-4. This indicates the higher volume of traffic in that section due to combination of traffic from two major interstates and city traffic near Knoxville. In region 2, while most of the links have injury crash less than 15 on I-24, major links of I-75 passing through Chattanooga have this number greater than 25 indicating again the city traffic and congestion (Figure **Error! No text of specified style in document.**-5). I-24 road is critical inside Nashville in region 2, with injury crash greater than 35 indicating again the higher traffic in Nashville, as shown in Figure **Error! No text of specified style in document.**-6. While most of the links on I-40 have crashes less than 5, few links looping around the Memphis on I-40 and I-55 have the number greater than 35 as shown in Figure **Error! No text of specified style in document.**-7. Based on this crash type, I-65 is the critical interstate.

PDO crash is the type of crash involving property damage only. Beside some links of I-40 and I-75 around Knoxville, almost all other links have PDO crash less than 10, in region 1. The links around Knoxville have this number in between 10 and 50. This result may be the higher traffic flowing in and out of the city, Knoxville (Figure **Error! No text of specified style in document.**-8). The interstates in region 2 are almost similar in this crash type. Most of the links have PDO in between 10 and 30, with very few links in between 30-50 passing through Chattanooga (Figure **Error! No text of specified style in document.**-9). The interstates in region 3 have most of their links with PDO crash under 10 while some links passing through Nashville, have this number greater than 50 (Figure **Error! No text of specified style in document.**-10). As Nashville is one of the major freight center of Tennessee and higher traffic inside the city, this type of crash is commonly observed. I-40 in region 4 seems safer in this crash category with almost all the links having this number less than 10. However, many links on I-55 bypassing Memphis International Airport to the west have PDO crash greater than 10 with few links greater than 50, as shown in Figure **Error! No text of specified style in document.**-11. Looking at this result, some safety project need to be prioritized on I-55 passing through Memphis.

The last type is the combination of all three major crash types, explained above. As PDO crash is significantly greater than other crashes, the total crash represents PDO most and almost reflects the scenario of PDO crash. Almost all the links in region 1 and 2 except Knoxville and Chattanooga have total number of crashes under 20. The links passing through these two cities have this number in between 20 and 80, as shown in Figure **Error! No text of specified style in document.**-12 and Figure **Error! No text of specified style in document.**-13. This scenario is critical in Nashville area as most of the links passing through this city have total crash in between 20 and 80, some in between 80 and 200 with few links greater than 200 (Figure **Error! No text of specified style in document.**-14). As the traffic in Nashville is very higher, the total crash is also very high, especially in the core interstates passing through Nashville. Except Memphis and Jackson, all the links have total number of crash less than 20, in region 4. While most of the links on I-40 passing through Memphis and Jackson have this number in between 20 and 80, few links on I-55 have greater than 200 crashes, as shown in Figure **Error! No text of specified style in document.**-15. Based on this crash dataset, I-55 around Memphis and I-24 passing through Nashville look critical and hence, safety related projects (102) are essential on this links to ensure the safety.

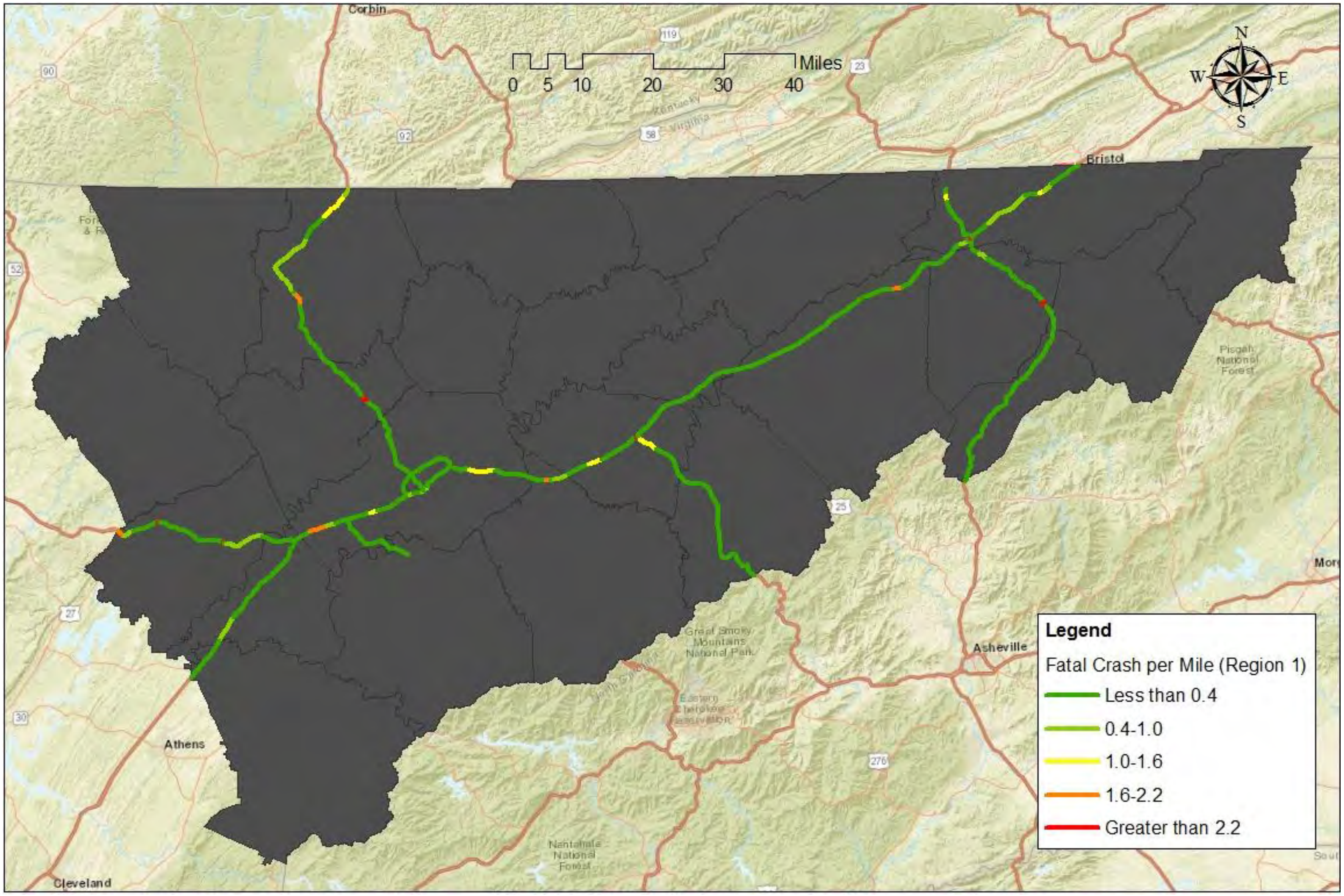


Figure 4-27: Region 1 of Tennessee showing Fatal Crash per mile for interstates and expressway

4.5 National Performance Management Research Data Set (NPMRDS) dataset

This is the latest and the largest dataset of all. This dataset is developed by FHWA while collected and supplied by HERE company. This product specification covers the delivery of initial archive and ongoing monthly datasets for National Highway System (NHS). The dataset is provided in three separate file. The first is a Traffic Message Channel (TMC) static file that contains the TMC information which is unique for each section and does not change frequently. The second is the database of average travel time of passenger, freight and combined for identified roadways geo-referenced to TMC location codes, updated monthly. This database is of October 2016. The third and the last file is the shape file that contains the spatial information of each section of NHS in US and boarder regions, given by unique ID and is updated quarterly.

To depict the variation in speed for different time period throughout the day, the four groups were identified. First is the am peak period (6-9 am), second is the mid-day period (9 am -2 pm), third is pm peak period (2-6 pm), and the last is the off-peak period (6 pm – 6 am). The average travel time for each link (TMC) for freight, is computed in statistical software, R. It is then joined with the static file based on the TMC code to obtain the distance of each link. The file is then joined with LUT file to obtain the corresponding link id before joining finally to the shape file. The average speed of freight vehicle for each link is computed using average travel time and distance for each link, for different time periods. The ratio of average speed to posted speed limit is computed for the performance measurement of freight links of Tennessee.

Speed/Speed Limit:

One of the major performance measures that gives the picture of the performance of freight links is the ratio of average speed to posted speed limit. The average speed can be computed from this dataset but the speed limit for freight truck is not provided in dataset. And it is difficult to obtain that measure efficiently and accurately. Hence, an approximate method for the computation of speed limit is described here.

<u>Computation of speed limit</u>

The 85th percentile speed is the free flow speed which when rounded to nearest lower multiple of 5 gives the approximate measurement of speed limit. For this, the average speed for the morning hours of weekend is computed for each link and then rounded off.

Error! Reference source not found., **Error! Reference source not found.**, **Error! Reference source not found.**, and **Error! Reference source not found.** are the maps of region 1 of Tennessee (eastern part) with Knoxville as main city, corresponding to the am peak, mid-day, pm peak, and off peak periods respectively, showing four major interstates I-40, I-75, I-81, and I-26. The performance of freight corridor of region 1 are relatively better than region 3 and 4, as the speed on all the links are greater than 50% of posted speed limit, except few at pm peak hours. With most of the links speed greater than 75% of speed limit, I-26 is slightly congested at am peak, shown by yellow color. However, almost all the corridor has speed near to speed limit at mid-day and off peak hours, which indicates the lesser volume of freight vehicles during this period. The pm peak hour is congested with major influence on I-40, between the point of convergence and divergence of I-75 on I-40, near Knoxville city. The congested links are shown by red color in **Error! Reference source not found.**, where speed is lesser than 50% of speed limit. Hence, either some projects in order to overcome the congestion need to be implemented on these links or identification of bypass of Knoxville city is essential.

Error! Reference source not found., Figure **Error! No text of specified style in document.**-16, Figure **Error! No text of specified style in document.**-17, and Figure **Error! No text of specified style in document.**-18 show the region 2 of Tennessee corresponding to the am peak, mid-day, pm peak, and off peak periods respectively, with Chattanooga as major city and lies west of region 1. This region is the least congested with three major interstates I-40, I-75, and I-24. Like the other regions, volume of vehicles at pm peak is higher than other periods and influence of higher traffic can be seen around the Chattanooga city. I-40 is the busiest highway and speed is lesser than 75% of speed limit in major parts of I-40 and I-75, at pm peak hours.

Figure **Error! No text of specified style in document.**-19, Figure **Error! No text of specified style in document.**-20, Figure **Error! No text of specified style in document.**-21, and Figure **Error! No text of specified style in document.**-22 show region 3 for am, mid-day, pm, and off peak periods respectively. With Nashville as the capital of Tennessee, the performance is worst of all regions. Nashville is the main freight hub in this region. Many links shown by yellow and red colors depict the congested part in peak periods of the day while congestion is observed inside Nashville in all periods. This region contains three major and longest interstates of the state I-40, I-24, and I-75. The am and pm peak periods are the worst of all and almost all links passing through Nashville city need to be either upgraded or bypass of Nashville is must. The volume of vehicle at off peak is higher than mid-day. Based on this performance measure, this region is critical of all and hence, quickly implementable solution is necessary.

The last region (region 4) is shown by Figure **Error! No text of specified style in document.**-23, Figure **Error! No text of specified style in document.**-24, Figure **Error! No text of specified style in document.**-25, and Figure **Error! No text of specified style in document.**-26 for four periods of a day, am peak, mid-day, pm peak and off peak period respectively. I-40 is the major interstate and Memphis is the main city and freight hub, in this region. High volume of vehicles can be observed in I-40 inside Memphis city in all periods except off peak with pm peak, the critical of all. Some of the links (northeast) of Memphis have average speed lesser than 50% of speed limit, shown by red color in Figure **Error! No text of specified style in document.**-25. Hence the links of I-40 passing through and immediately exiting/entering Memphis must be upgraded soon. Any link or section with speed/speed limit lesser than 0.75, is termed as problematic section and the total number of problematic sections is 1254 (operational projects).

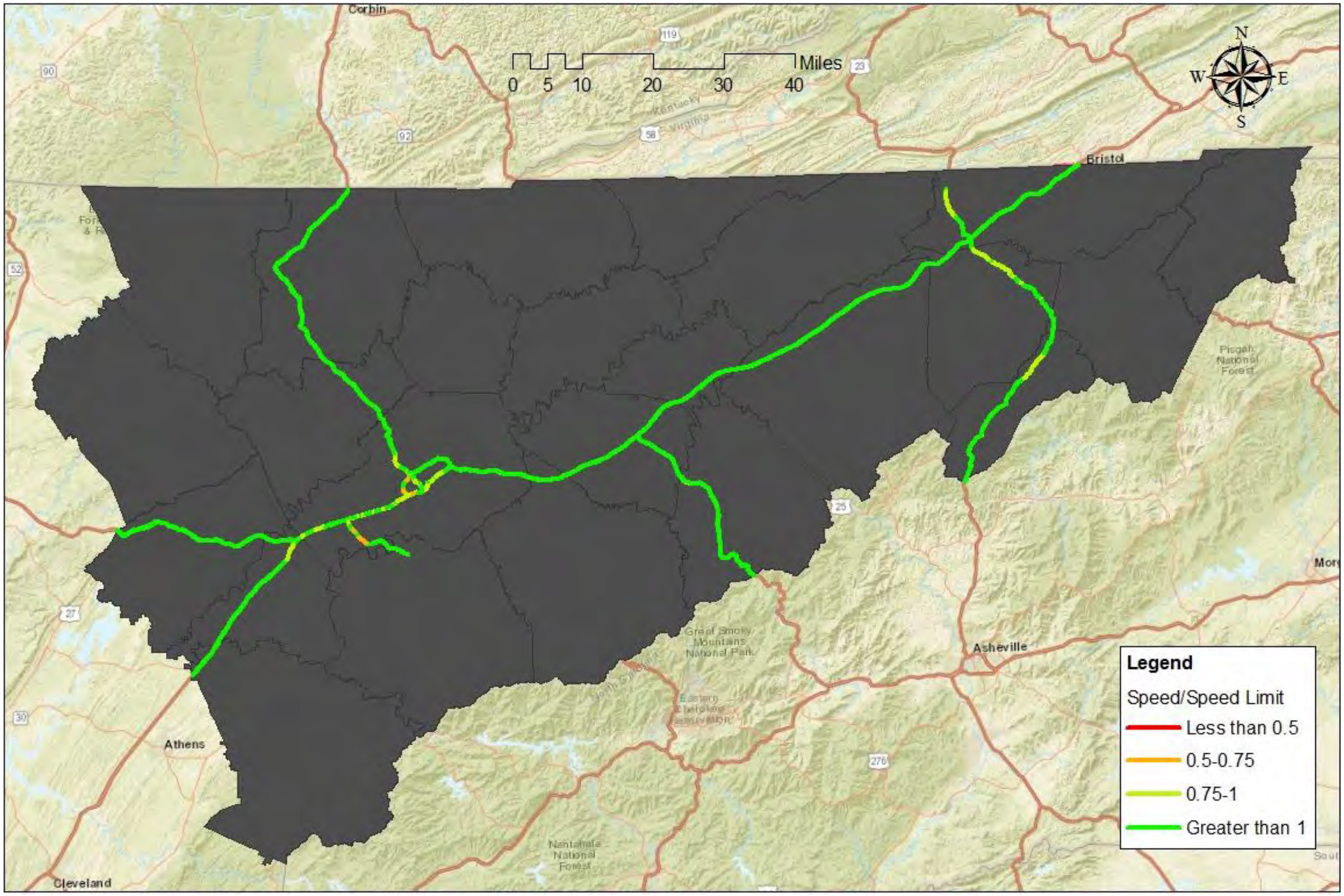


Figure 4-28: Region 1 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for am peak hours (6-9 am)

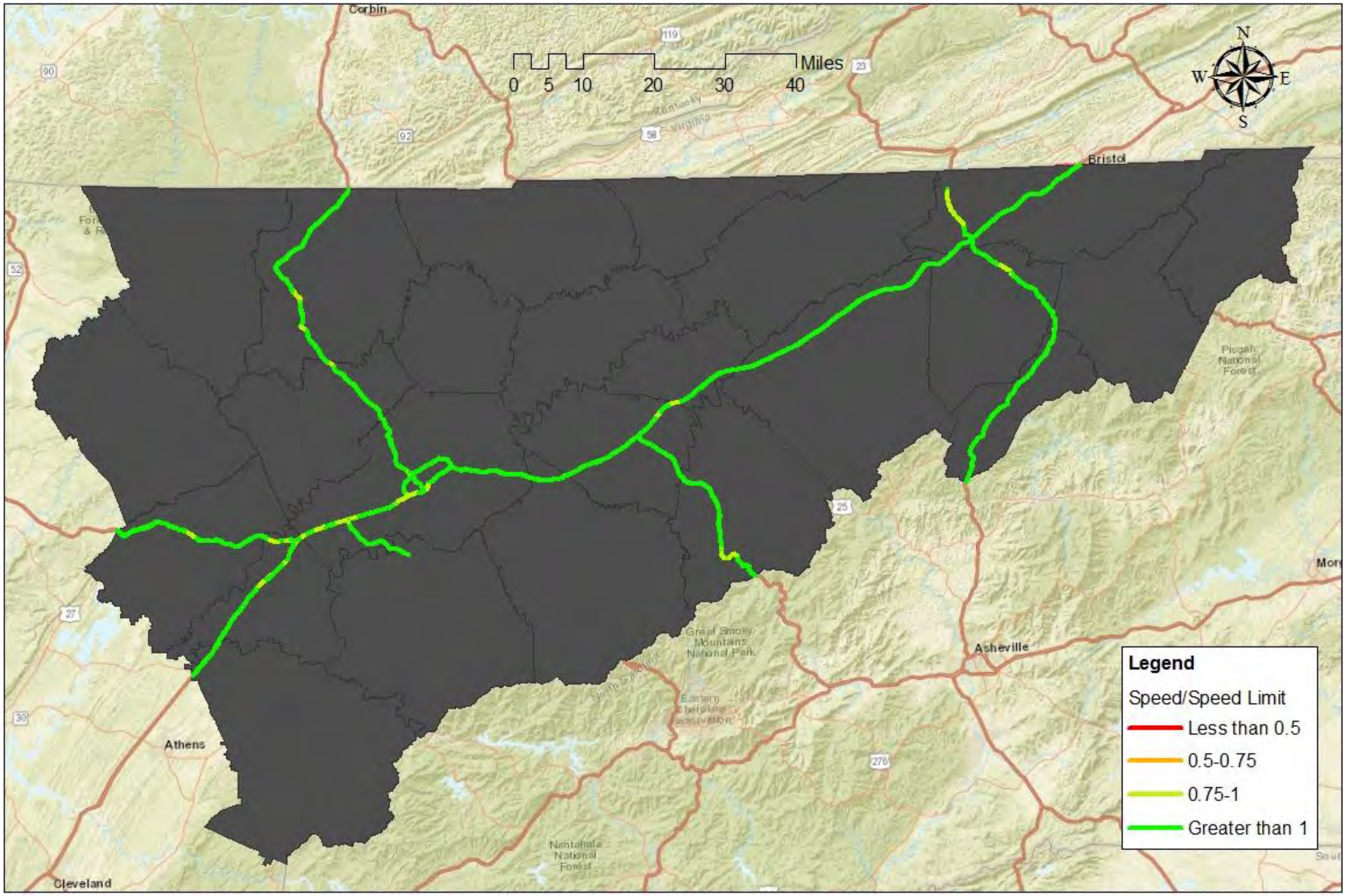


Figure 4-29: Region 1 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for mid-day hours (9 am-2 pm)

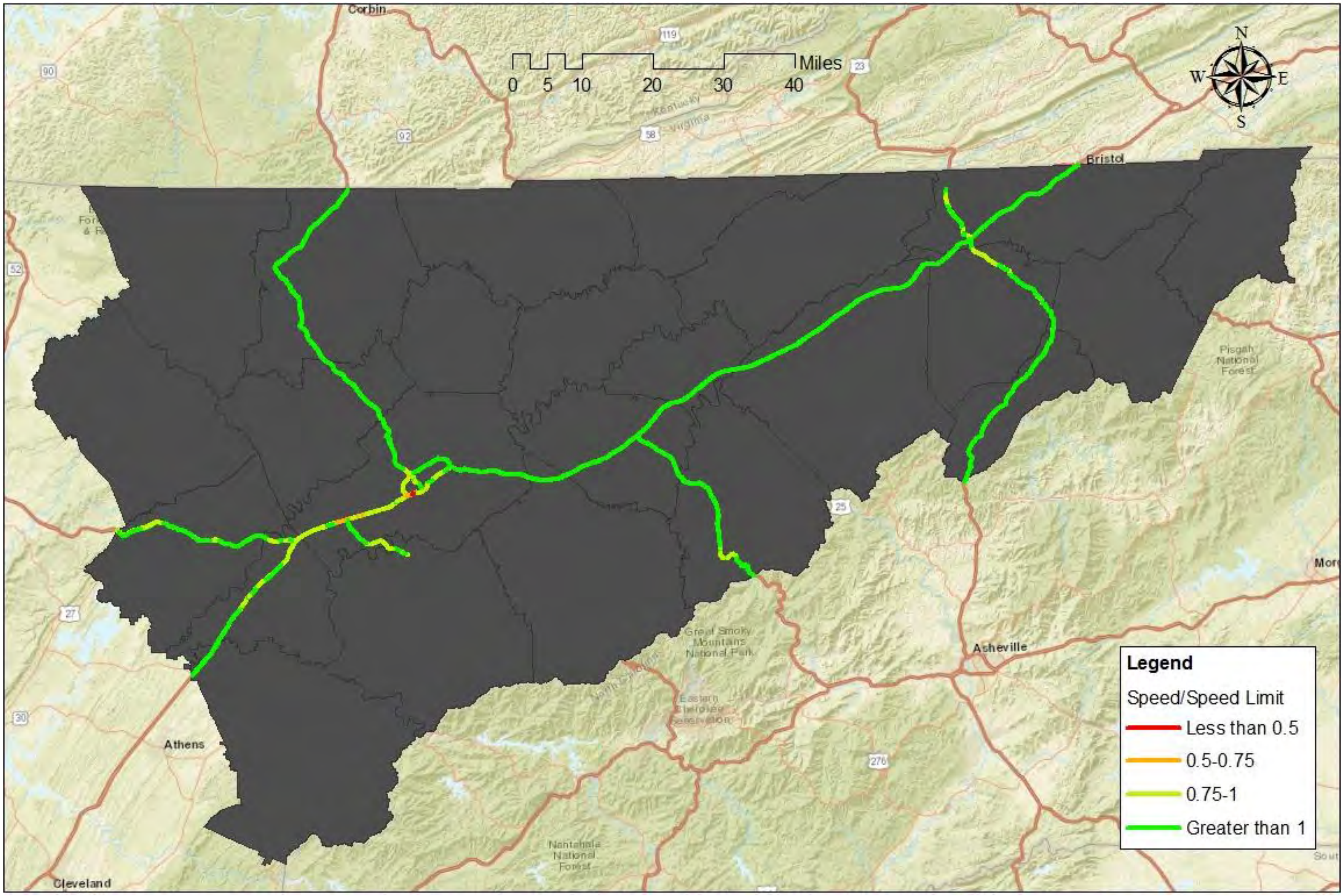


Figure 4-30: Region 1 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for pm peak hours (2-6 pm)

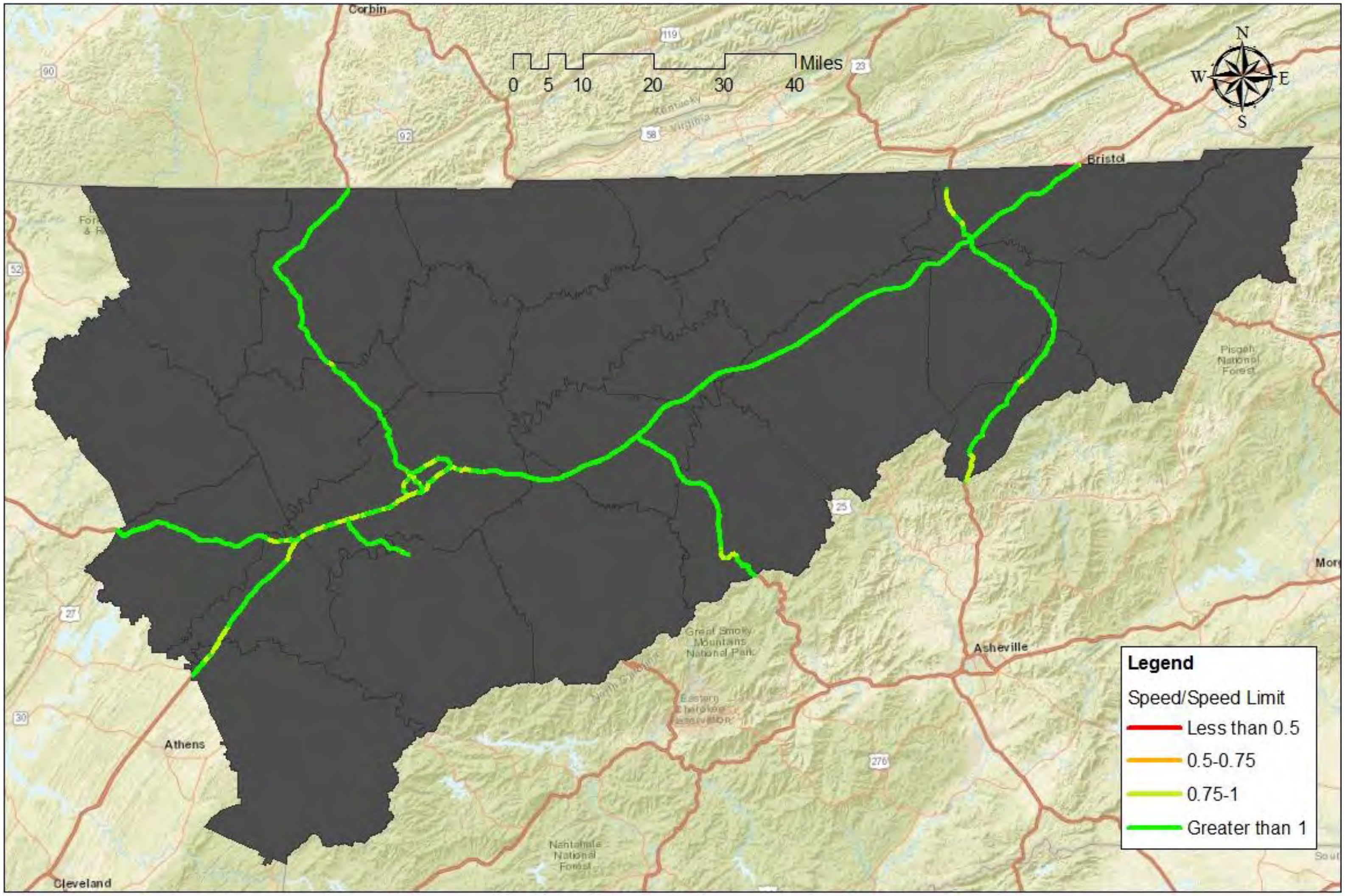


Figure 4-31: Region 1 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for off-peak hours (6 pm-6 am)

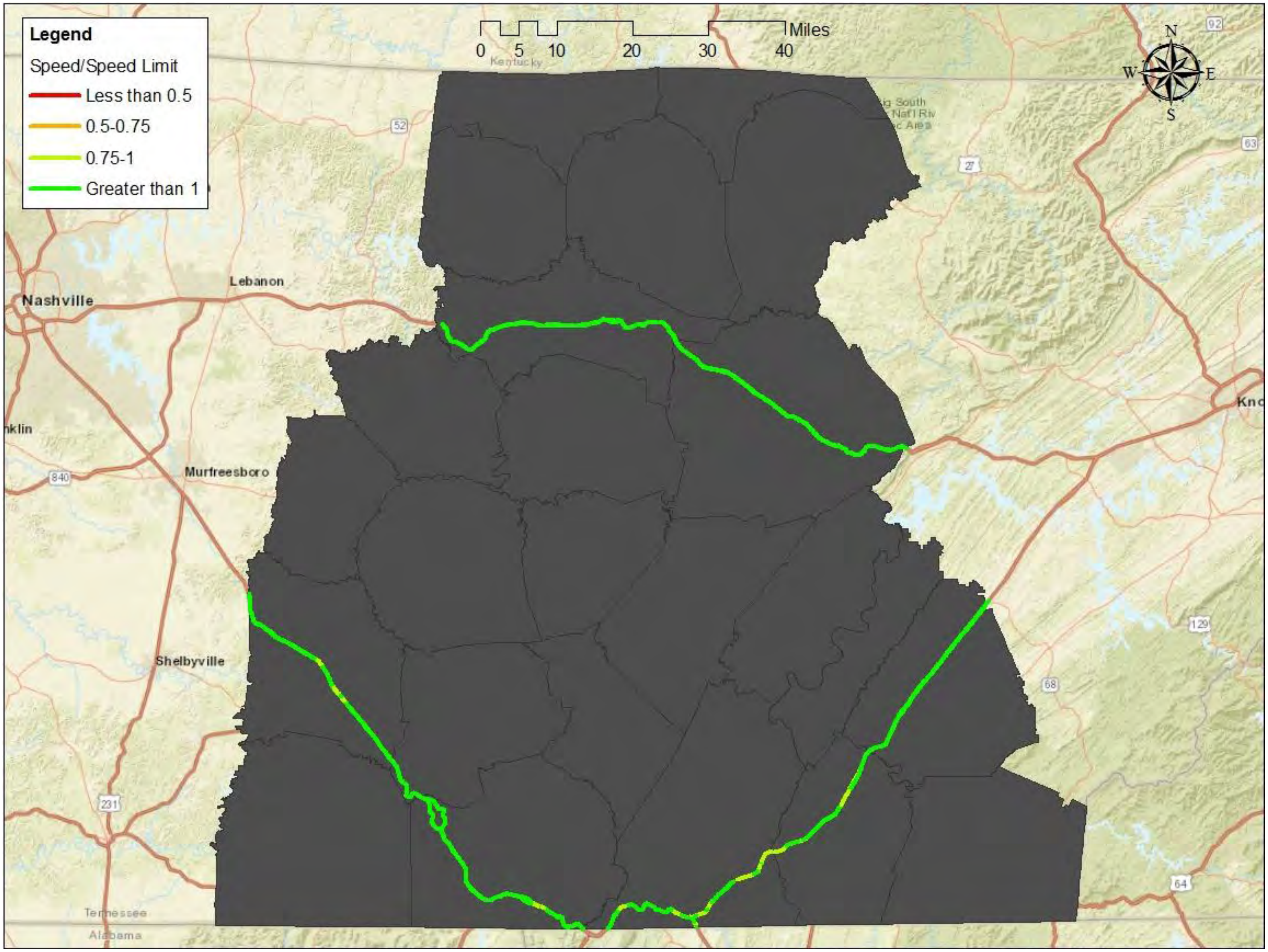


Figure 4-32: Region 2 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for am peak hours (6-9 am)

4.6 Statewide Travel Demand Model Travel Demand Model (S-TDM) dataset

This dataset comprises the data of four decades 2010, 2020, 2030, and 2040. The Statewide Travel Demand Model (S-TDM) of Tennessee contains the overall roadway sections of Tennessee along with major freight connectors inside US. The dataset is trimmed to obtain the roadway networks of Tennessee only. Each section is provided with unique ID with different attributes. Some of the major attributes are length, functional class, number of lanes, volume of truck and passenger cars, Average Annual Daily Traffic (AADT), and capacity of section in each direction. The principal arterials belonging to interstates and expressways and other urban principal arterials, based on functional class, have been selected for the analysis.

Three performance measures, Volume to Capacity ratio (V/C), Truck Percentage (TP), and V/C greater than 0.8 and TP greater than 20% have been computed and shown in maps for principal arterials including interstate, expressways, and other principal arterials. For simplicity, Tennessee State is divided into four regions with Knoxville as a major station for region 1, Chattanooga for region 2, Nashville for region 3, and Memphis for region 4.

Volume to Capacity Ratio (V/C):

Figure **Error! No text of specified style in document.**-27, Figure **Error! No text of specified style in document.**-28, Figure **Error! No text of specified style in document.**-29, and Figure **Error! No text of specified style in document.**-30 show the volume to capacity ratio for regions 1, 2, 3 and 4 respectively, for year 2010. Almost all the links passing through the major cities Knoxville, Chattanooga, Nashville and Memphis has V/C ratio in the range 0.8-0.9, shown by yellow color and corresponds to Level of service (LOS) D. Most of the other links in all regions have V/C ratio less than 0.7, with some critical links of V/C greater than 1.

The scenario is more critical in 2020.Figure **Error! No text of specified style in document.**-31, Figure **Error! No text of specified style in document.**-32, Figure **Error! No text of specified style in document.**-33, and Figure **Error! No text of specified style in document.**-34 show the similar trend of V/C ratio over the links but with higher intensity. The V/C jumps from under 0.7 to greater than 0.8 in more links of major cities with similar but sparse observation in some links, not passing through these cities. This scenario gets more intense in 2030 and many links of the major interstates (I-40, I-75, I-65, and I-24) jumps to V/C greater than 0.8 while few links of other arterials passing through these cities get critical with V/C greater than 1, shown in Figure **Error! No text of specified style in document.**-35, Figure **Error! No text of specified style in document.**-36, Figure **Error! No text of specified style in document.**-37 and Figure **Error! No text of specified style in document.**-38. Finally, I-40 becomes very critical at the end of 2040 highlighting the fact the truck volume is going to increase in I-40 between 2030 and 2040 (Figure **Error! No text of specified style in document.**-39, Figure **Error! No text of specified style in document.**-40, Figure **Error! No text of specified style in document.**-41, and Figure **Error! No text of specified style in document.**-42). The increment in volume of trucks in the arterials except interstates, in region 2, is very noticeable in this period.

Comparing the model of 2010 to 2040, the V/C ratio of many arterials inside and along the major cities jump from under 0.7 to greater than 1, which is very critical. Hence, capacity expansion projects on the interstates like I-40, I-65, and I-24 along with some expressways and major arterials inside the cities with possible bypasses to Nashville, are essential in order to avoid the freight congestion in near future in Tennessee.

Truck Percentage (TP):

Error! Reference source not found., Figure **Error! No text of specified style in document.**-43, Figure **Error! No text of specified style in document.**-44, and Figure **Error! No text of specified style in document.**-45 show the maps of Truck Percentage (TP) for region 1, 2, 3, and 4 respectively, for year 2010. The dense road network in each map represent the major city of each region. The major interstates like I-40, I-75, and I-81 have many links with TP greater than 20%, especially on the links leading to major cities of Tennessee. TP is observed more than 40% on the links of I-40 between Memphis and Nashville, indicating the most freight activities between these cities. Although truck observation is higher in major interstates and expressways, especially around Nashville, truck flow is lesser than 10% in other principal arterials.

Increment in TP is noticeable on the links of I-81, the north-east region of Tennessee, in 2020. Figure **Error! No text of specified style in document.**-46 shows the major freight activities on this interstate with the TP above 30%. Some of the new links on I-75 and I-24 (near Chattanooga) and I-40 in region 2 have turned into red indicating critical condition, shown by Figure **Error! No text of specified style in document.**-47. The truck flow in region 3 and 4 remains almost same by 2020, shown by Figure **Error! No text of specified style in document.**-48 and Figure **Error! No text of specified style in document.**-49. Figure **Error! No text of specified style in document.**-50 shows the V/C for region 1 in 2030. By 2030, region 2 is expected to carry higher volume of trucks by its two major interstates, I-24 and I-40. While less than a half links in those interstates have TP between 30 and 40%, remaining links have TP greater than 40% as indicated by red color in Figure **Error! No text of specified style in document.**-51. Major attention towards the freight congestion solution must be given in this region in near future (especially on I-24). Although some increment in truck flow on the links of I-65 can be observed around Nashville, increment in TP is almost insignificant in region 3 while the links on I-40 between Memphis and Jackson of region 4 will be critical by 2030 shown by Figure **Error! No text of specified style in document.**-52 and Figure **Error! No text of specified style in document.**-53 respectively.

By 2040, some links of I-40 on east of Knoxville become critical with TP greater than 40% as shown by Figure **Error! No text of specified style in document.**-54. While all the links of I-24 in region 2 also become critical with TP greater than 40% shown in Figure **Error! No text of specified style in document.**-55, the truck flow in region 3 and 4 is almost the same as in 2030 as displayed in Figure **Error! No text of specified style in document.**-56 and Figure **Error! No text of specified style in document.**-57 respectively. Considering these results, TP on interstates I-40, I-81, and I-24 seem to increase significantly in near future. Hence, to avoid the freight congestion and the economic losses due to this congestion, immediate actions need to be undertaken. Further, the interstates and the expressways are the major freight corridor for trucks with very less movement on other principal arterials.

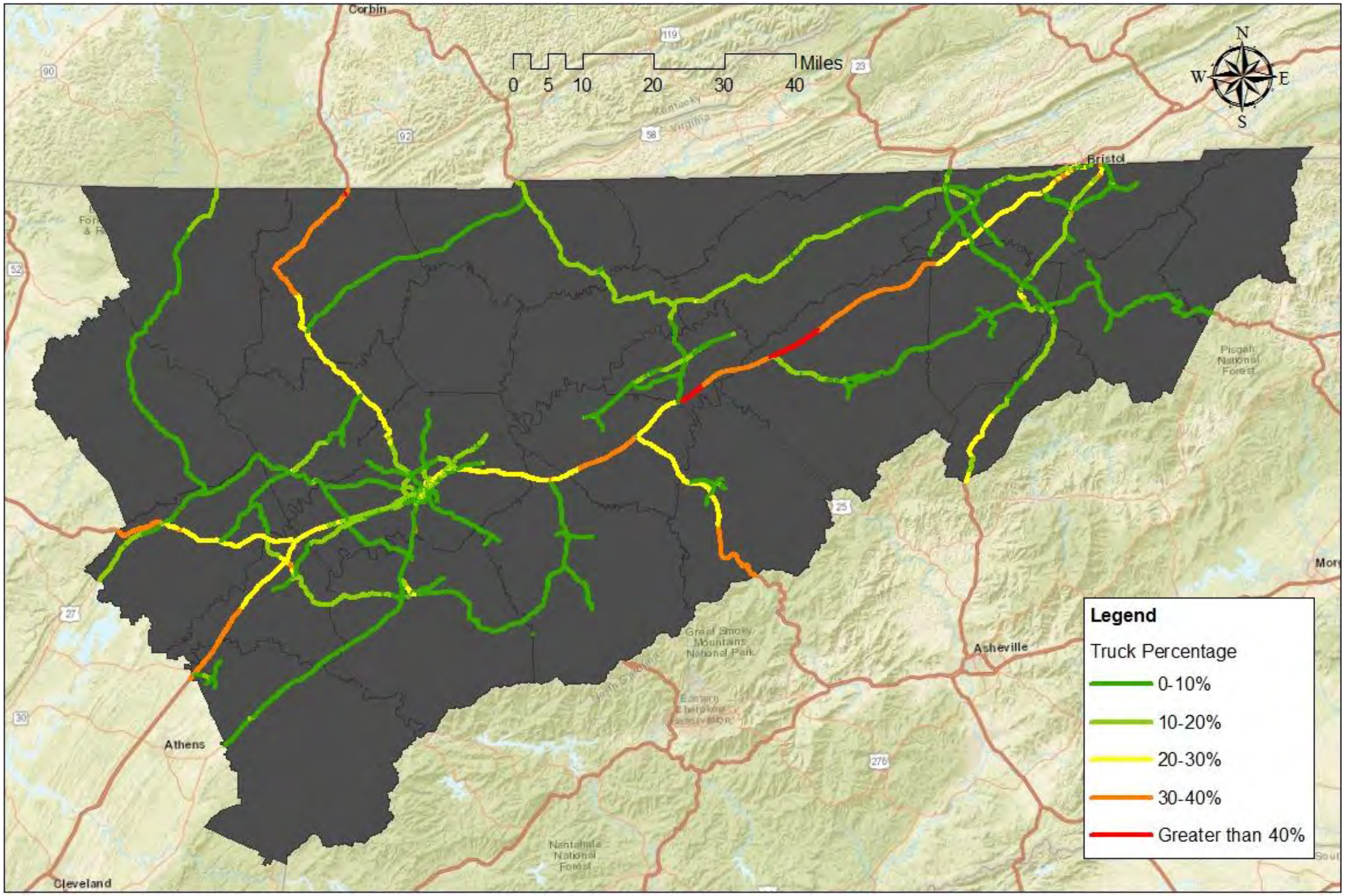


Figure 4-33: Region 1 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2010

V/C Greater Than 0.8 and TP Greater Than 20%:

This is the joint measure of V/C and TP which is more reliable than the individual measures, V/C and TP. If a corridor has V/C of 0.9 and with less than 5% of trucks, that corridor cannot be counted for a freight improvement. Similarly, any corridor having truck percentage 40% but V/C 0.5 would also be infeasible for the improvement. Hence, any link with V/C greater than 0.8 and TP greater than 20% is identified as a problematic section and an improvement in a form of project, to overcome the freight congestion, is proposed.

As of 2010, the problematic sections are located near four major cities of Tennessee. While most of the links are on major interstates I-40, I-75, I-24, and I-65 represented by red color in **Error! Reference source not found.**, Figure **Error! No text of specified style in document.**-58, Figure **Error! No text of specified style in document.**-59, and Figure **Error! No text of specified style in document.**-60, few are on other principal arterials. Nashville, capital of Tennessee, and a region of major freight activities is also a hub of three major interstates and hence many critical sections are in this area. The number of problematic section in 2010 is 379. More problematic links are identified in 2020 with almost all of them on I-40 in region 1. The links are between the point of convergence of I-75 with I-40 and Knoxville, indicated by Figure **Error! No text of specified style in document.**-61. While the scenario is very similar to 2010 in region 2 and 3 represented by Figure **Error! No text of specified style in document.**-62 and Figure **Error! No text of specified style in document.**-63, more problematic links are added on I-55 in region 4, as shown in Figure **Error! No text of specified style in document.**-64. The total number of problematic section reach 656 by 2020.

With time, the demand increases and so is the congestion, for same capacity. More problematic links are added on I-40 in region 1 by 2030 (Figure **Error! No text of specified style in document.**-65) and some new are added on I-75, north-east of Chattanooga (Figure **Error! No text of specified style in document.**-66). Scenario is more critical in region 2 as many new problematic links are added on the interstates around Nashville as shown by Figure **Error! No text of specified style in document.**-67. Similar is the case in region 4 but with lesser intensity, the new problematic links can be seen on I-40 (Figure **Error! No text of specified style in document.**-68). With Nashville leading the major freight activities, the total number of problematic section reach 1114 by 2030. By 2040, almost all the sections between the convergence point of I-40 with I-75 and Knoxville, turns into problematic sections as shown by red color in Figure **Error! No text of specified style in document.**-69 and I-75 around Chattanooga (Figure **Error! No text of specified style in document.**-70). Again, Nashville as leading freight activities center, many problematic sections are added on I-40 and there is an addition on both I-55 and I-40 in region 4, indicated by Figure **Error! No text of specified style in document.**-71 and Figure **Error! No text of specified style in document.**-72 respectively. The number of problematic sections reach 719 by 2040 and these will be the proposed projects in our case because mitigation of the congestion for a long range is wanted. This measure indicates that the special focus on improvement of capacity on freight corridor of Tennessee must be given on region 3 with Nashville as a center of the region.

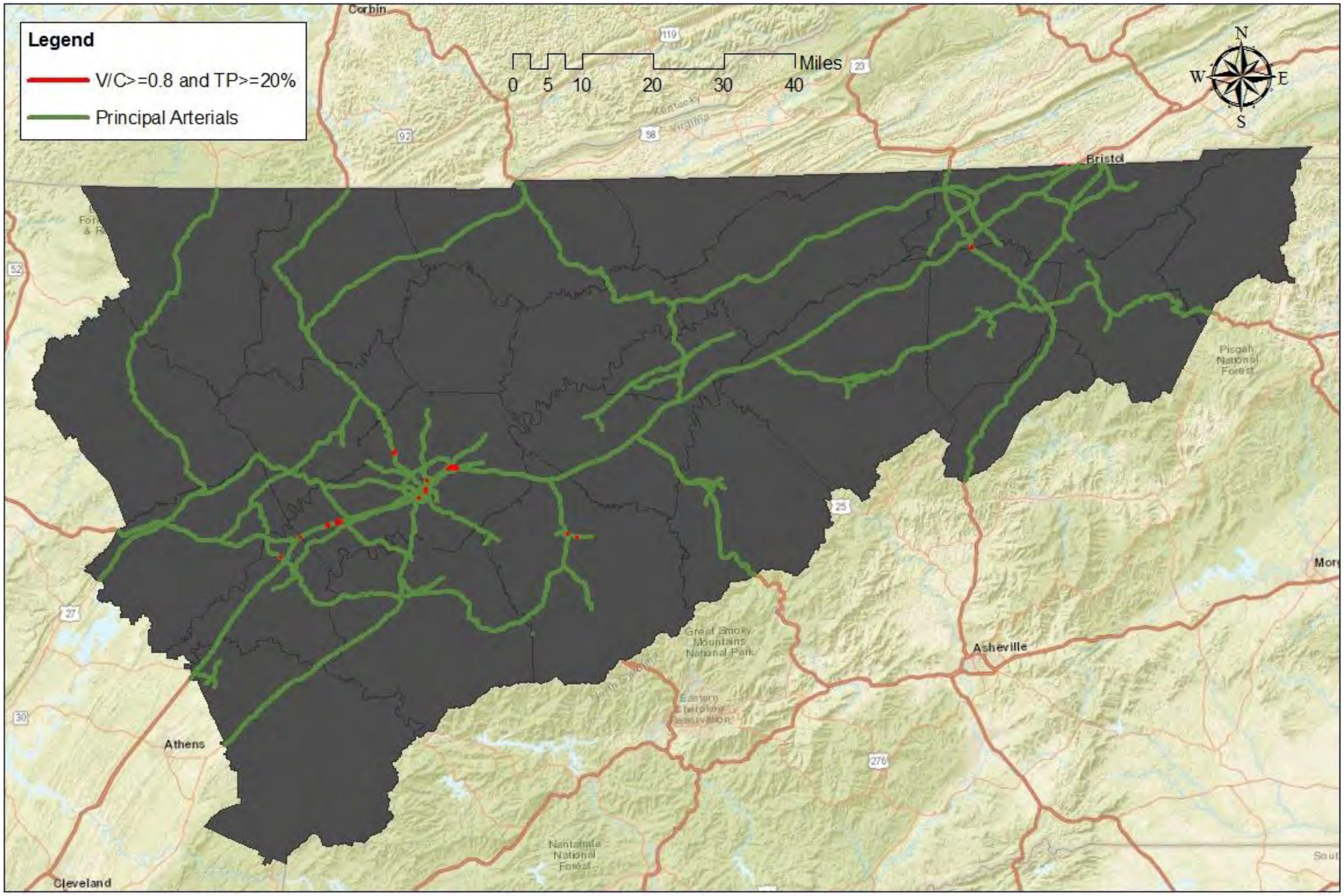


Figure 4-34: Region 1 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2010

4.7 Identification of Problematic Links and Projects

For congestion mitigation, capacity expansion projects (one and two-lane addition) are proposed on the sections identified from S-TDM. For operational improvement, increase in speed is proposed with projects such as patching, rehabilitation, and overlays on the sections identified from NPMRDS. For safety projects of roadway identified from ETRIMS, two alternatives (advance warning signs and pavement friction) are proposed based on the countermeasures recommended in highway safety manual. Three types of countermeasures, flashing lights, median, and gates are used as safety countermeasures on railroad-highway crossing (TRIS, 2014). A total of 2,238 projects for three performance measure were identified from two major freight modes. Geographical representations of the projects for four regions of TN are shown in Figure 4-35.

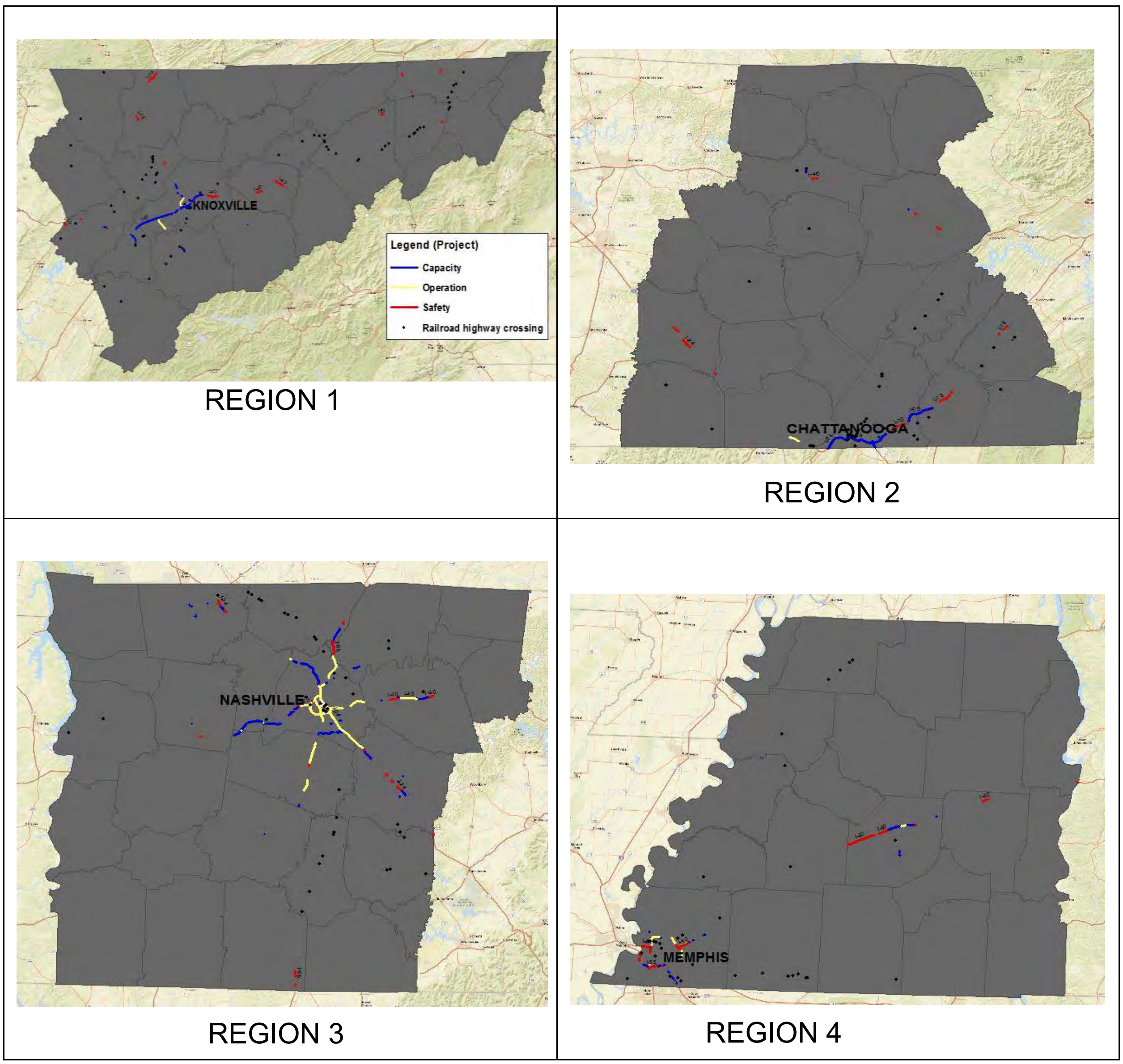


Figure 4-35: Illustration of capacity expansion, operational, and safety projects in the four regions within the State of Tennessee (same legend across all maps

4.8 Projects from Tennessee Freight Plan

In addition to this research, 201 projects in the state of Tennessee have already been identified by the Tennessee freight plan (TDOT, 2014). Out of them, 123 are fully funded and 78 are partially funded projects. Only the fully funded projects have been spatially located and four out of those projects (E-27, E-37, M-8, and M-28) are missing in the shape file provided by TDOT. Now, out of remaining 119 projects, 96 projects (almost 81%) have already been addressed through this research. Since the benefits information of the remaining 23 projects are lacking, these projects have not been included in the dataset.

4.9 Computation of Benefits of the Projects

The benefits of the capacity expansion project can be computed by the saving in travel time using Bureau of Public Roads (BPR) function. The difference in travel time before and after the project is converted into monetary value using value of time, $33.8/hour. The monetary value related to travel time savings in freight is obtained from the reports (Belenky, 2011) which is adjusted to present year using annual interest rate. The benefits of the operational projects is found by computing the difference in travel time before and after the project and converted to a monetary value. The benefits of the safety project is, saving in the cost associated with the crash. The average cost of fatal and nonfatal injuries has been estimated in Highway Safety Manual (HSM). According to HSM, these costs were developed based on the KABCO scale. The average economic cost of crashes along with crash reduction factors for different types of safety projects are shown in **Error! Reference source not found.**.

Table 4-1: Parameter values used in case study

Parameters	Value	Unit	Reference
Fatal	4,008,900	$ per crash	(Herbel, Laing, & McGovern, 2010)
Injury	113,300	$ per crash	
PDO	7,400	$ per crash	
Crash reduction factor (signs)	0.35	Per crash	(Bahar, Masliah, Wolff, & Park, 2008; Scopatz et al., 2014)
Crash reduction factor (pavement friction)	0.75	Per crash	
Crash reduction factor (Flashing Lights)	single track-0.9, multiple track-0.65	Per crash	
Crash reduction factor (Gates)	single track-0.7, multiple track-0.65	Per crash	
Crash reduction factor (Median)	0.8	Per crash	

4.10 Projects Detail

For congestion mitigation, capacity expansion projects (one and two-lane addition) are proposed on the sections identified from S-TDM. For operational improvement, increase in speed is proposed with projects such as patching, rehabilitation, and overlays on the sections identified from NPMRDS. For safety projects of roadway identified from ETRIMS, several alternatives are proposed based on the countermeasures recommended in highway safety manual. Three types of countermeasures, flashing lights, median, and gates are used as safety countermeasures on railroad-highway crossing (Volmer et al., 2006). A total of 2,238 projects for three performance measure were identified from two major freight modes. The sample projects and their details are shown in spreadsheet form in Table 4-2, ready to feed into the allocation models.

Expected annual benefits, capital cost, and project life of each project are computed based on engineering design and are presented in the Appendix B:. The cost of all the projects is about $2.5 billion and it is assumed that at least 5% of that cost will be available. Hence the budget starting with 10 million dollars in the first year increases by 3% every successive year, resulting $95.78 million of present worth in 10 years planning period. Four different budget scenarios of $86.20, $95.78, $105.36, and $115.896 million are assumed over the planning horizon respectively. These budgets reflect PW and have been abbreviated as B1, B2, B3, and B4 respectively. B2 is estimated using the assumption that $10 million are available in year 1 and an annual increase of 3% over the ten years planning horizon. The remaining three budgets are estimated by assuming a 10% decrease/increase for B1 and B3 respectively and a 20% increase for B4 with respect to the budget available for B2. Also, five values (0, 0.25, 0.5, 0.75, and 1) is considered for the equity in opportunity and outcome parameters ($\mathcal{E}$ and e respectively). These values were estimated from a sensitivity analysis that is presented in subsection 5.5.2. The annual interest rate (α), expected annual growth of benefits corresponding to increase in number of infrastructure users by time (β), and expected annual growth of costs (γ) in cash flow are assumed to be 4%, 2% and 3% respectively. The composition of the projects in terms of cost and benefits across all modes and improvement types are summarized in Table 4-3**Error! Reference source not found.**, assuming that all the projects get selected in the first year.

4.11 Chapter Summary

Basically, four important datasets are analyzed to find out the constraints in various models related to three different performance measures (capacity improvement, operational efficiency, and safety). Although the datasets in rail are not easily available, the highway railroad crossing is incorporated. Hence, two major modes of Tennessee are included in the case study. More than 2,000 problematic sections (links) are found over the freight corridor of Tennessee. Various kind of policy related assumptions and standard market values (interest and growth rate) are made for the model computations. The datasets are prepared in such a way that it can be fed reliably into the model. The results of the manual and four resource allocation models will be discussed in the next chapter.

Table 4-2: Sample data showing details of the proposed projects

Project ID	Annual Benefits ($ million)	Cost ($ million)	Improvement Type	County	Location	Mode	Project Life
1	1.390	1.602	Capacity expansion	Knox	I-275 between I-75 & I-40	Road	20
2	1.41	0.49	Capacity expansion	Knox	I-40 between Western Ave & 17th street	Road	20
3	2.683	3.381	Capacity expansion	Bradley	I-75 between US 64 & TN 317	Road	20
4	0.742	1.391	Capacity expansion	Hamilton	I-24 at S Seminole Dr.	Road	20
5	1.570	1.923	Capacity expansion	Hamilton	I-24 between Germantown Rd & Belvoir Ave	Road	20
…	…	…	…	…	…	…	…
2238	0.029	0.125	Safety	Shelby	Patterson at Southern Ave	Rail	25

Table 4-3: Benefits, Cost and Number of all proposed projects by mode and improvement type

Improvement Type	Benefits ($ billion)		Cost ($ million)		Number of Projects	
	Road	Rail	Road	Rail	Road	Rail
Capacity	2.944 (11.3%)	-	420.413 (15.4%)	-	719	-
Operational	18.076 (69.7%)	-	2,254.299 (82.7%)	-	1,254	-
Safety	4.821 (18.6%)	0.075 (0.3%)	22.479 (0.8%)	29.072 (1.1%)	102	163
Total	25.841	0.075	2,697.191	29.072	2,075	163
Grand Total	25.916		2,726.263		2,238	

CHAPTER 5: RESULT

The resource allocation models are modeled in GAMS and solved using IBM ILOG CPLEX Optimizer V12.7 on a computer with Intel Core i7-3770 3.4 GHz CPU and 16 GB of RAM. To guarantee an optimal solution, the optimality gap value is set to 1.0 x10^{-10} in OPTION file of GAMS. Optimal solution for each model is found within maximum of 17 minutes which is reasonable considering the planning nature of this report. For brevity, only the results of the models are presented in this chapter. It first presents the overall benefits resulted from each model in the planning period followed by the benefits coming from each year. It then discusses benefits received by each mode and improvement type followed by distribution of benefits across counties in Tennessee. The sensitivity analysis is presented at the end.

5.1 Total Benefits

Figure 5-1 shows the total benefits and the total number of projects selected for the four different budgets and different values of the equity parameters. Figure 5-2 shows the same information as but as a percentage of the values for ***M1***. From these figures, following points are observed:

i) As expected, the total benefits (but not the number of selected projects) from ***M1*** are higher than all other models for all four budgets;

ii) The addition of mutual exclusiveness constraint in ***M2*** decreases the objective function value (i.e., total benefits) but increases the total number of projects for all budgets. This is a tradeoff that a decision maker should consider;

iii) As expected, the higher the total budget the higher the total benefits excluding model ***M0***. The unpredictable behavior of ***M0*** (with respect to the total benefits and number of project selected when the budget increases) is not surprising due to the heuristic nature of project selection (discussed more in section 5.5.1);

iv) When the equity parameter value is set to zero, the most equitable distribution among the various modes, improvement types, and counties with the lowest total benefits for both ***M3*** and ***M4*** is observed;

v) By increasing the equity parameter value, equity constraint sets 3-3 and 4-3 start to relax; As a result, the benefits distribution becomes less equitable, and the total benefits increase. This pattern is observed across all four budgets for both ***M3*** and ***M4***.

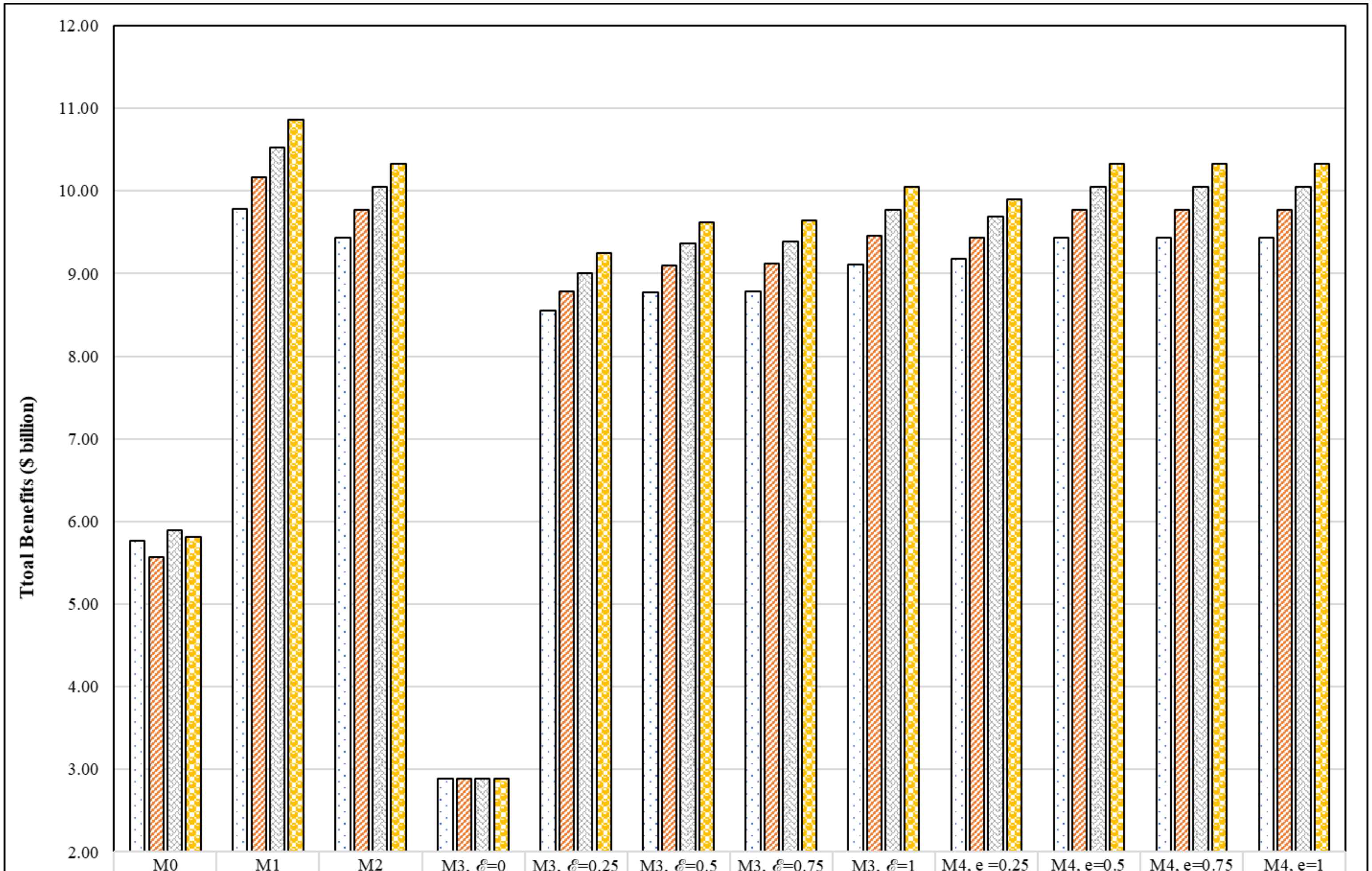
vi) For values of e greater than 0.5, ***M4*** produces the same total benefits as ***M2*** which means that constraint set 3.3 becomes inactive when $e \geq 0.5$.[1] The effects of the equity parameters values to the total benefits will be discussed in detail in subsection 5.5.2.

vii) Model ***M3*** results in the least total benefits, compared to the other models, suggesting that equity in opportunity policy should be very carefully analyzed before implementation;

viii) As the budget increases the percentage of total benefits for models ***M0***, and ***M2*** through ***M4*** as compared to ***M1*** decrease. A similar (but not consistent) pattern is observed for the number of projects.

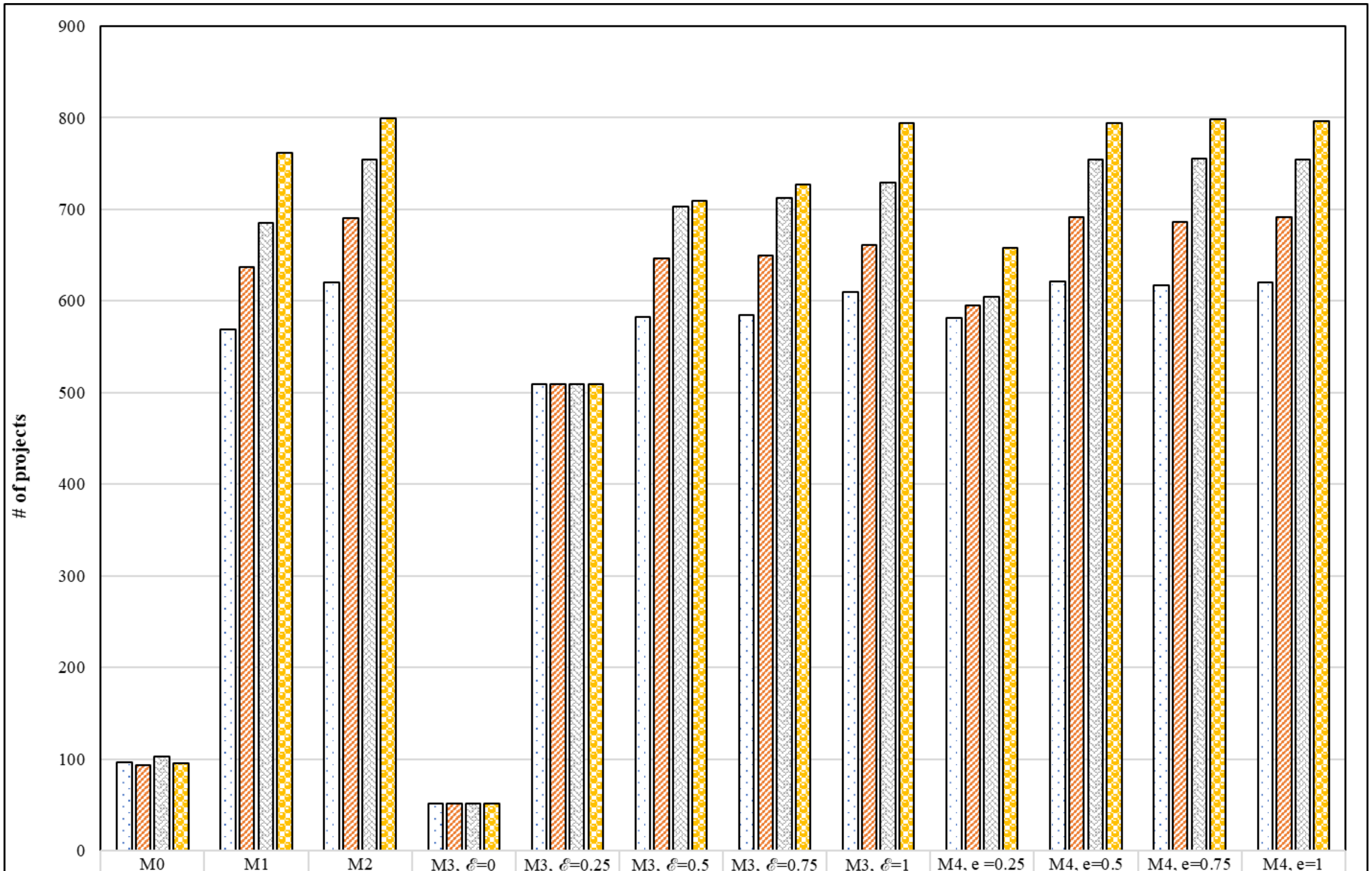
It should be noted that for $e = 0$, the only feasible solution to the problem is $X_{it} = 0, \forall i \in I, t \in T$. Even though generalization of this result cannot be made it is highly unlikely that any other solution to ***M4*** (when $e = 0$) will exist (for real world input data) such that the minimum and maximum benefits received by all counties is equal to the same value.

[1] The value of e after which constraint set 3.3 becomes inactive cannot be generalized as it depends on the data used.



	M0	M1	M2	M3, ℰ=0	M3, ℰ=0.25	M3, ℰ=0.5	M3, ℰ=0.75	M3, ℰ=1	M4, e =0.25	M4, e=0.5	M4, e=0.75	M4, e=1
B1	5.76	9.78	9.43	2.89	8.55	8.77	8.79	9.11	9.17	9.43	9.43	9.43
B2	5.57	10.17	9.77	2.89	8.78	9.10	9.12	9.46	9.43	9.77	9.77	9.77
B3	5.90	10.52	10.05	2.89	9.01	9.37	9.39	9.77	9.69	10.05	10.05	10.05
B4	5.82	10.87	10.32	2.89	9.25	9.62	9.65	10.05	9.90	10.32	10.32	10.32

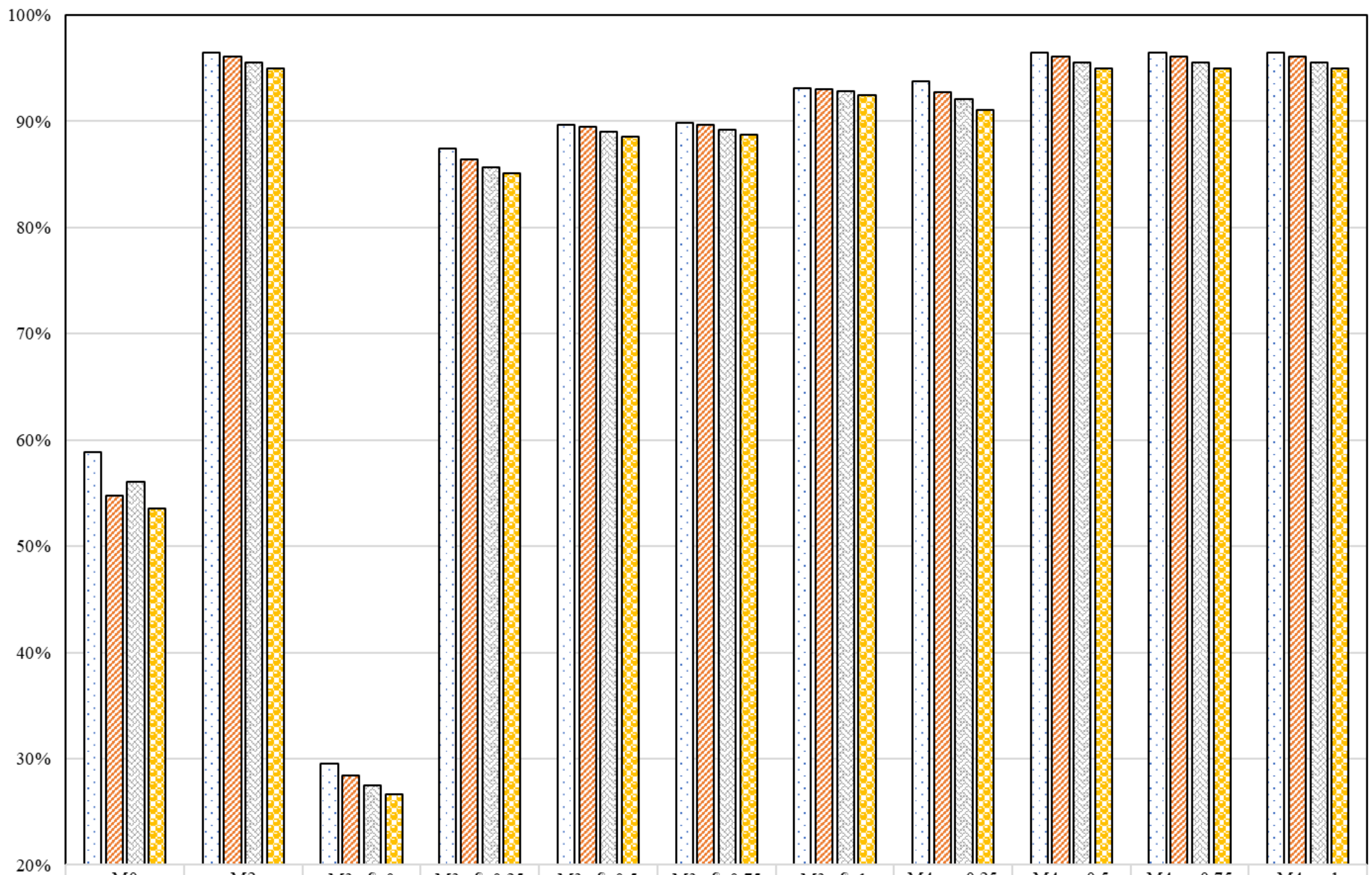
5-1(a): Total benefits by budget, model, and equity



	M0	M1	M2	M3, ℰ=0	M3, ℰ=0.25	M3, ℰ=0.5	M3, ℰ=0.75	M3, ℰ=1	M4, e =0.25	M4, e=0.5	M4, e=0.75	M4, e=1
B1	97	569	620	51	509	583	585	610	582	621	617	620
B2	93	637	690	51	509	646	650	661	595	691	686	691
B3	103	685	754	51	509	703	712	729	605	754	755	754
B4	95	762	799	51	509	709	727	794	658	794	798	796

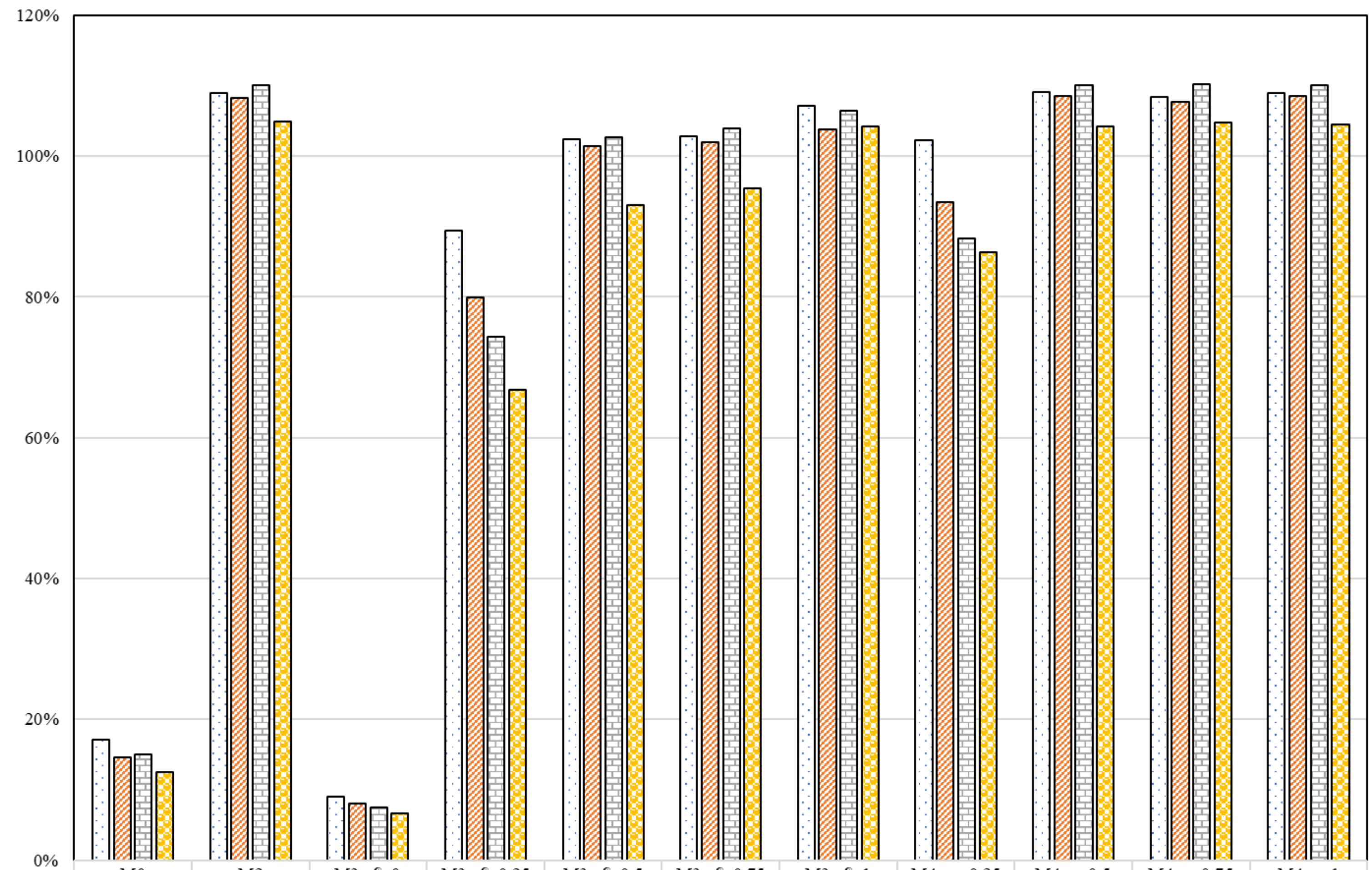
5-1(b): Total number of selected projects by budget, model, and equity

Figure 5-1: Total benefits and number of selected projects by budget, by model, and by equity



	M0	M2	M3, $\mathcal{E}$=0	M3, $\mathcal{E}$=0.25	M3, $\mathcal{E}$=0.5	M3, $\mathcal{E}$=0.75	M3, $\mathcal{E}$=1	M4, e =0.25	M4, e=0.5	M4, e=0.75	M4, e=1
B1	59%	96%	30%	87%	90%	90%	93%	94%	96%	96%	96%
B2	55%	96%	28%	86%	89%	90%	93%	93%	96%	96%	96%
B3	56%	96%	27%	86%	89%	89%	93%	92%	96%	96%	96%
B4	54%	95%	27%	85%	89%	89%	92%	91%	95%	95%	95%

5-2(a): Percentage of total benefits of *M0*, *M2-M4* to *M1*



	M0	M2	M3, ℰ=0	M3, ℰ=0.25	M3, ℰ=0.5	M3, ℰ=0.75	M3, ℰ=1	M4, e =0.25	M4, e=0.5	M4, e=0.75	M4, e=1
B1	17%	109%	9%	89%	102%	103%	107%	102%	109%	108%	109%
B2	15%	108%	8%	80%	101%	102%	104%	93%	108%	108%	108%
B3	15%	110%	7%	74%	103%	104%	106%	88%	110%	110%	110%
B4	12%	105%	7%	67%	93%	95%	104%	86%	104%	105%	104%

5-2(b): Percentage of number of selected projects of *M0*, *M2-M4* to *M1*

Figure 5-2: Comparison of *M0*, *M2-M4* to *M1* in terms of total benefits and number of selected projects

5.2 Benefits Distribution

Figure 5-3 and Figure 5-4 show the benefits distribution by year and budget obtained by each model/budget/equity parameter value. Figure 5-4 adds the dimension of the equity parameters for models ***M3*** and ***M4***. For all models, annual benefits after 20 years are lumped together (x-axis label "*>20*") as they represent a small percentage of the total benefits. From these figures, following points are observed:

i) The benefits distributions, for all models (excluding ***M0*** which is based on a heuristic), budgets, and equity parameter values, follow a bell-shaped curve with a long right-side tail and a maximum value at year five. The bell-shaped curve is attributed to the decrease of the present worth due to the interest rate. In other words, there is a trade-off between the interest rate and the number of projects selected every year;
ii) Most of the benefits are received within the first 15 years (or five years after the end of planning horizon);
iii) Model ***M1*** is the only model with over 1% of the total benefits distributed after year 20;
iv) For models ***M3*** and ***M4***, as expected, relaxation of the equity constraints results in higher yearly benefits;
v) Higher budgets do not necessarily translate into consistently higher yearly benefits (for example, for model ***M2*** and years 9 through 15, budget B1 provides higher yearly benefits than budget B4).

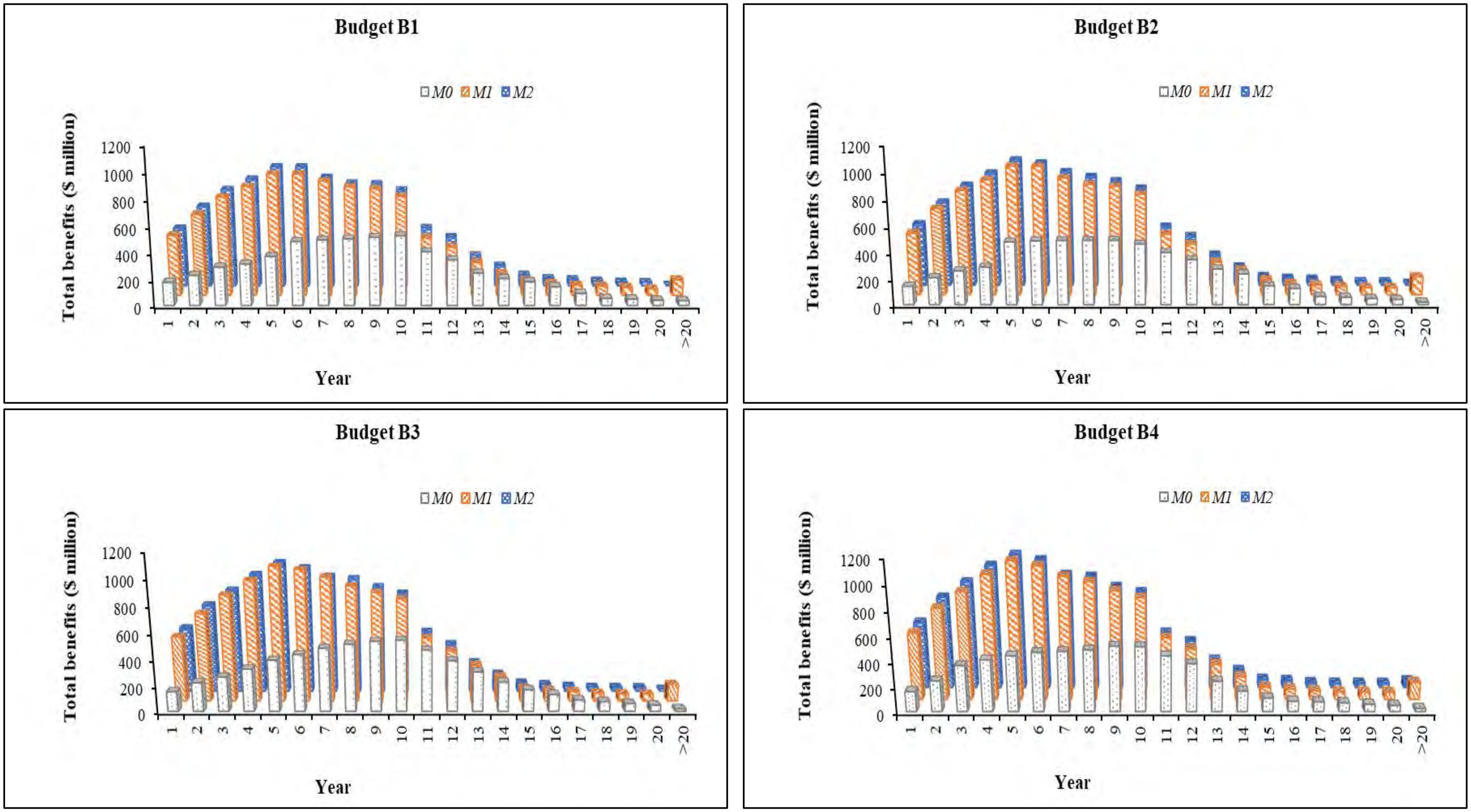
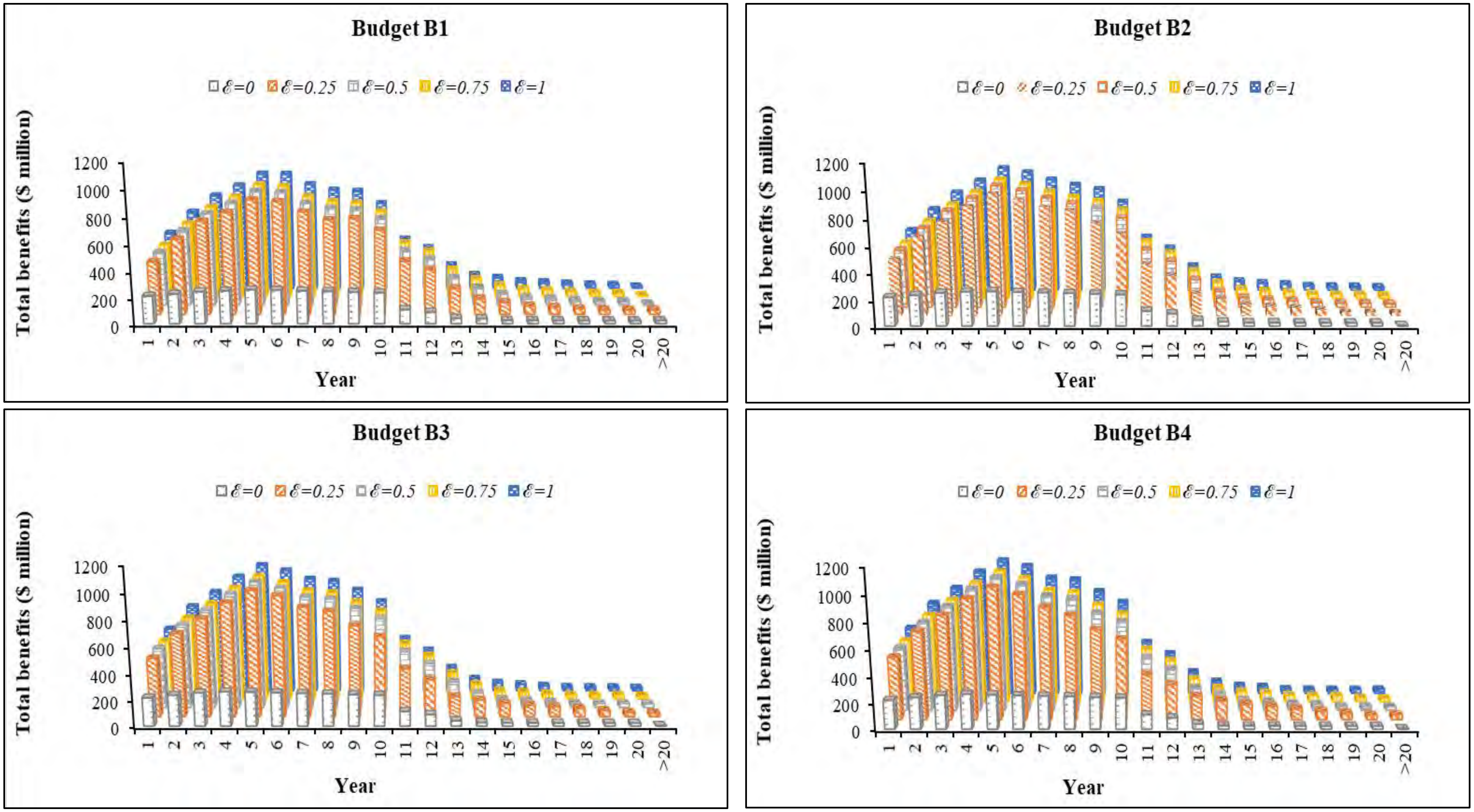
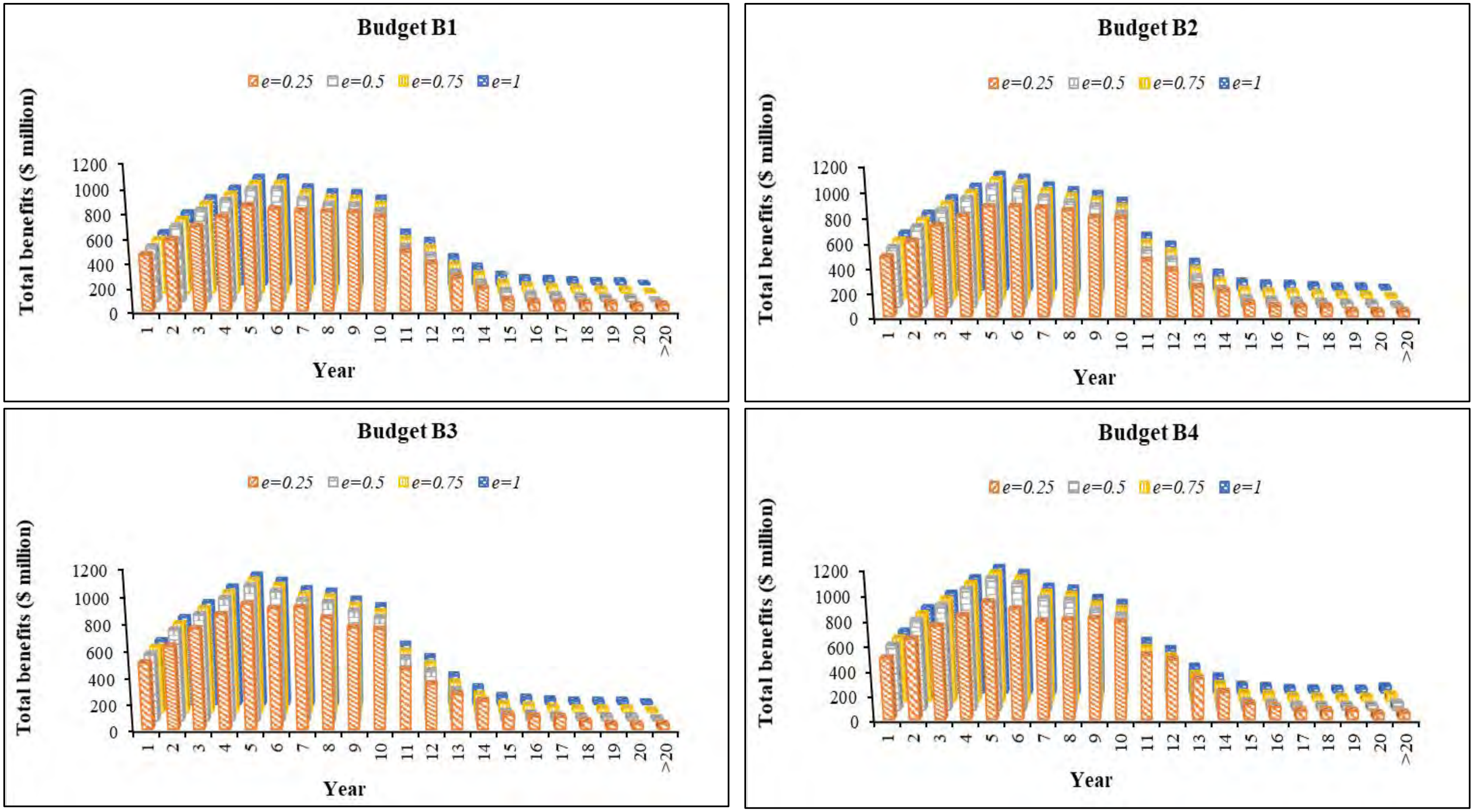


Figure 5-3: Benefits distribution by year, by model, and by budget



5-4(a): Benefits distribution of *M3* (Economic Competitiveness with Equity in Opportunity)



5-4(b): Benefits distribution of *M4 (*Economic Competitiveness with Equity in Outcome)

Figure 5-4: Benefits distribution by year, equity parameters ($\mathcal{E}$ and e), and budget

5.3 Benefits by Mode and Improvement Type

Table 5-1 shows the total benefits by mode and improvement type for the four different budgets. All models allocate almost all the benefits to the roadway which is intuitive as only one type of improvement (i.e., safety) is considered for rail. In addition, rail safety projects are less beneficial than roadway safety projects as fatal crashes in railroad-highway crossing are less common (at least in our dataset). Considering that the benefits of reducing PDO crashes is much lower than savings in freight travel time and fatal crashes, all models, excluding ***M3***, never selected any railroad safety projects. Railroad safety projects are selected by ***M3*** in those counties where there is no other type of candidate improvement projects. The other interesting result to note is that roadway safety projects contribute the maximum portion of total benefits almost in all models as the economic costs from crashes is higher than the freight travel time savings. In addition, highway operational projects are more beneficial than capacity expansion projects mainly because the cost of operational projects are lower and have added benefits (reduction in fatal crashes and emissions) compared to capacity expansion projects (FHWA, 2017).

Table 5-1: Total benefits in billion dollars by mode, by improvement type, by budget, by model, and by equity parameter

Model & equity parameter	Truck												Rail			
	Capacity expansion				Operational				Safety				Safety			
	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4
M0	0.94	0.92	0.95	0.98	1.26	1.04	1.27	1.23	3.56	3.61	3.68	3.60	0	0	0	0
M1	1.20	1.28	1.28	1.33	3.95	4.24	4.58	4.86	4.64	4.65	4.66	4.67	0	0	0	0
M2	0.71	0.74	0.75	0.91	4.22	4.53	4.79	4.98	4.49	4.50	4.51	4.43	0	0	0	0
M3, $\mathcal{E}$=0	0.55	0.56	0.56	0.56	0.59	0.59	0.59	0.59	1.73	1.73	1.73	1.73	0.01	0.01	0.01	0.01
M3, $\mathcal{E}$=0.25	0.77	0.77	0.78	0.82	3.88	4.11	4.32	4.54	1.73	3.90	3.90	3.88	0.01	0.01	0.01	0.01
M3, $\mathcal{E}$=0.5	0.72	0.75	0.77	0.77	4.05	4.33	4.57	4.82	3.99	4.00	4.01	4.02	0.01	0.01	0.01	0.01
M3, $\mathcal{E}$=0.75	0.72	0.75	0.77	0.77	4.07	4.36	4.60	4.85	3.99	4.00	4.01	4.01	0.01	0.01	0.01	0.01
M3, $\mathcal{E}$=1	0.72	0.74	0.75	0.78	3.93	4.25	4.52	4.76	4.44	4.45	4.47	4.50	0.02	0.02	0.02	0.02
M4, e=0.25	0.92	0.93	0.93	1.01	3.88	4.12	4.37	4.52	4.38	4.38	4.39	4.38	0	0	0	0
M4, e=0.5	0.71	0.74	0.75	0.92	4.22	4.53	4.79	4.98	4.49	4.50	4.51	4.43	0	0	0	0
M4, e=0.75	0.71	0.74	0.75	0.91	4.22	4.53	4.79	4.98	4.49	4.50	4.51	4.43	0	0	0	0
M4, e=1	0.71	0.74	0.75	0.92	4.22	4.53	4.79	4.98	4.49	4.50	4.51	4.43	0	0	0	0

5.4 Benefits by County

In this subsection, the results on distribution of benefits across counties are presented. Recall that 51 out of the 95 counties in Tennessee had candidate improvement projects. A summary of the total benefits by county, budget, model, and equity parameter are presented in Table 5-2. ***M0*** distributes the budget to only 27 out of the 51 counties and, despite having the lowest coefficient of variation (CV) and highest minimum benefits received by a county among the five models, it exhibits the lowest number of counties receiving the benefits. This reinforces the observations from the results presented in the previous subsections, that this model may not be used. ***M1*** distributes projects in 31 counties and ***M2*** across 32 counties as mutual exclusiveness omits the possibility of selecting projects in the same location thereby increasing the possibility of projects belonging to different counties being selected.

M3 allocates benefits across all 51 counties with a very less benefits distributed all over the possible counties (see minimum county benefits in Table 5-2). This is because of the equity constraints in place making sure that each county receives at least one project in 10 years planning horizon. The pattern of benefits distribution across the counties in ***M3*** is similar for all values of equity with significantly lower benefits in case of 0. Then, only 32 counties are benefitted in ***M4*** where the maximum difference within maximum and minimum benefits between the counties is less than 25%, 50%, 75%, and 100% of total benefits for equity parameter 0.25, 0.5, 0.75, and 1 respectively. When the equity parameter is set 0, the model ends up with selecting no projects at all to satisfy the constraints. In this model, rather than the selection of more counties, the difference between the benefits received by any two counties is minimized. However, four counties (Knox, Hamilton, Davidson, and Shelby) are the top four benefitted counties regardless the model and the equity parameter thereby highlighting the beneficial and important projects in these counties which need to be prioritized in the freight resource allocation.

Table 5-2: Summary statistics of county benefits by budget, by model, and by equity parameter

Model & equity parameter	Number of benefitted county				Min benefits in a county ($ billion)				Max benefits in a county ($ billion)				Coefficient of variation (CV) of benefits in a county ($ billion)			
	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4
M0	27	27	27	27	0.02	0.02	0.02	0.02	1.15	1.04	1.20	1.07	1.35	1.25	1.34	1.29
M1	31	31	31	32	Y	Y	Y	Y	2.81	3.05	3.32	3.54	1.89	1.94	2.00	2.08
M2	31	32	32	32	Y	Y	Y	Y	3.02	3.24	3.39	3.51	2.00	2.09	2.12	2.11
M3, $\mathcal{E}$=0	51	51	51	51	Y	Y	Y	Y	0.38	0.38	0.38	0.38	1.41	1.39	1.39	1.39
M3, $\mathcal{E}$=0.25	51	51	51	51	Y	Y	Y	Y	2.93	3.14	3.18	3.21	2.90	2.97	2.97	2.93
M3, $\mathcal{E}$=0.5	51	51	51	51	Y	Y	Y	Y	3.08	3.28	3.41	3.64	2.90	2.95	2.97	3.04
M3 $\mathcal{E}$=0.75	51	51	51	51	Y	Y	Y	Y	3.08	3.28	3.42	3.49	2.90	2.94	2.98	2.94
M3, $\mathcal{E}$=1	51	51	51	51	Y	Y	Y	Y	2.90	3.18	3.34	3.48	2.67	2.75	2.78	2.82
M4, e=0.25	32	32	32	33	Y	Y	Y	Y	2.29	2.36	2.42	2.48	1.82	1.80	1.83	1.87
M4, e=0.5	31	32	32	32	Y	Y	Y	Y	3.02	3.24	3.40	3.50	2.00	2.09	2.12	2.11
M4, e=0.75	31	31	32	32	Y	Y	Y	Y	3.02	3.25	3.41	3.50	2.00	2.05	2.12	2.11
M4, e=1	31	32	32	32	Y	Y	Y	Y	3.02	3.25	3.39	3.50	2.00	2.09	2.12	2.11

Note: Y<=0.005

5.5 Sensitivity Analysis

5.5.1 Benefits vs Budget

In this subsection, 18 new budget scenarios are developed by increasing/decreasing budget B2.Further, $\pm 10\%$ increment is used with a maximum/minimum budget of $\pm 90\%$ of B2. For this analysis, the equity in opportunity and outcome parameters values were set to 0.5 and 0.3 respectively as they provide the best tradeoff between equity and total benefits (see subsection 5.5.2 for a detailed discussion on the selection of these values). Results from this analysis are shown in Figure 5-5 where it is observed that ***M0*** behaves in an unpredictable manner with cases where the total benefits decrease with the increase of the total budget (e.g., while the total budget moves from 50% to 60% increment, the total benefits decrease by ~20%). As expected the remaining four models exhibit reasonable trends (i.e., an increase/decrease in the total budget results in an increase/decrease in the total benefits) with model ***M1*** exhibiting the largest and model ***M4*** the smallest slopes.

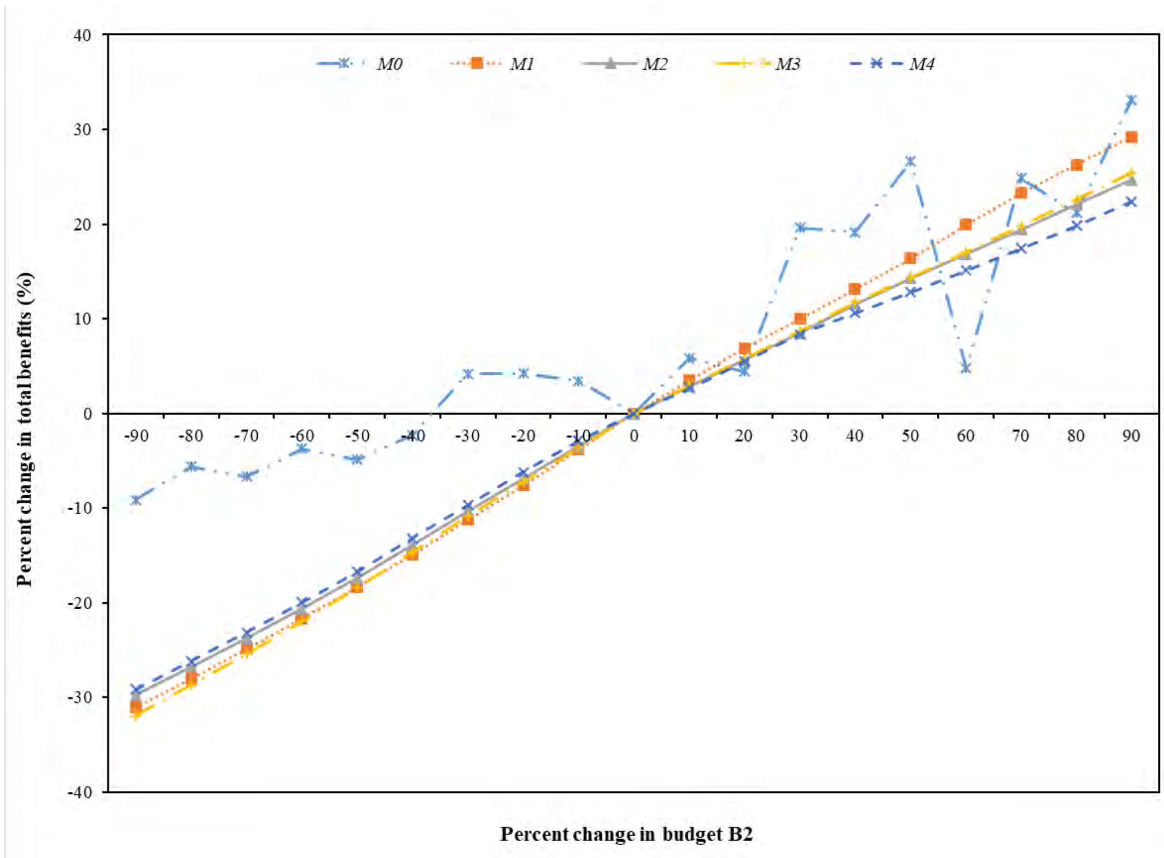


Figure 5-5: Variation of total benefits by budget and model (Note: B2 is 95.78 million dollars)

5.5.2 Benefits vs Equity

This subsection shows the trade-off between the total benefits and the equity parameter values i.e., the lower the value of equity parameter ($\mathcal{E}$ and e), lower is the total benefits and vice versa. When the value of equity parameter is lower, the distribution is more equitable and vice versa

(Mishra et al., 2015). Next, results from an analysis to quantify the effects of the equity parameters to the total benefits for the equity models ***M3*** and ***M4*** are presented.

5.5.2.1 Equity in Opportunity (*M3*)

Recall that the equity constraint (3-3) in ***M3***, restricts the difference of the number of selected projects between any two counties below a predefined value ($\mathcal{E}*d_{j\hat{j}}$) and acts as an equity measure (the lower its value the higher the equity). In this subsection, results from an analysis aimed at quantifying the change of the total benefits with respect to the value of the equity in opportunity parameter ($\mathcal{E}$) are presented. For this analysis, $\mathcal{E}$ value varied from 0 to 1 with an increment of 0.05 and the percent change of the total benefits with respect to the maximum total benefits (i.e., when $\mathcal{E}$=1) are shown in Figure 5-6. It is observed that the curve patterns are very similar irrespective of the budget used (which is one of the reasons why the analysis for the nineteen different budgets used in subsection 5.5.1 is not done). Furthermore, it is observed that once ($\mathcal{E} \geq \sim 0.3$), the total benefits increase remains rather small (until a big jump is observed when the value of $\mathcal{E}$ increases from 0.95 to 1 because of significant increase in number of projects at $\mathcal{E}$=1, for this particular dataset). This would indicate a break point (or knee[2]) and suggest that a value of $0.3<\mathcal{E}\leq 0.5$ would results in the optimal split between total benefits and equitable (in opportunity) distribution of projects.

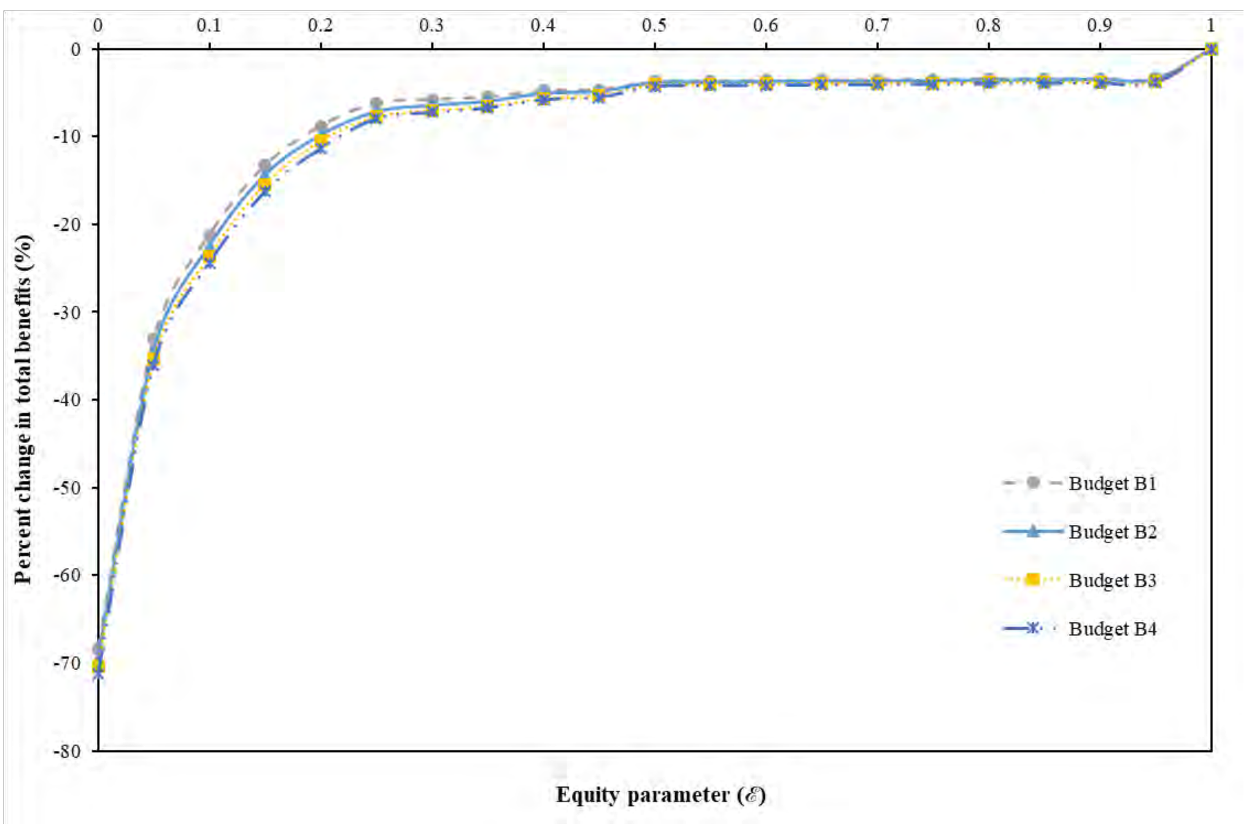


Figure 5-6: Total benefits vs. equity in opportunity parameter ($\mathcal{E}$) for different budgets (*M3*)

[2] The data points in Figure 5-6 form a Pareto Front. The "knee" is formed by those solutions of the Pareto front, where a small improvement in one objective would lead to a large deterioration in at least one other objective (Das, 1999).

5.5.2.2 Equity in Outcome (*M4*)

Recall that the equity constraint (4-3) in ***M4***, restricts the difference between the maximum and minimum benefits received by the counties below a predefined value ($e\sum_{i,t} B_{Ti=0} X_{it}$) and, similar to $\mathcal{E}$, acts as an euqity measure (the lower its value the higher the equity. In this subsection, results from an analysis aimed at quantifying the change of the total benefits with respect to the value of the equity in outcome parameter (e) are presented for four different budgets (B1, B2, B3, and B4). For this analysis, e values varied from 0 to 1 with an increment of 0.05 and the percent change of the total benefits with respect to the maximum total benefits (i.e., when $e = 1$) are shown in Figure 5-7. Similar to model ***M3***, it is observed that the curve patterns are very similar irrespective of the budget used. Furthermore, it is observed that once ($e \geq \sim 0.3$), the change of the total benefits becomes insignificant. This is a slightly different pattern from the one observed with model ***M3***, and indicates that a value of 0.2≤ e ≤~0.3 would result in the optimal split between the total benefits and equitable (in outcome) distribution of benefits. It is noted that the equity parameters values where the knee is observed (for both ***M3*** and ***M4***) are significantly affected by the data. In such instances, these values should be re-estimated for any new dataset. Note, that the form of the graphs will remain the same (i.e., a concave form with reducing marginal total benefits as the values of $\mathcal{E}$ and e increase).

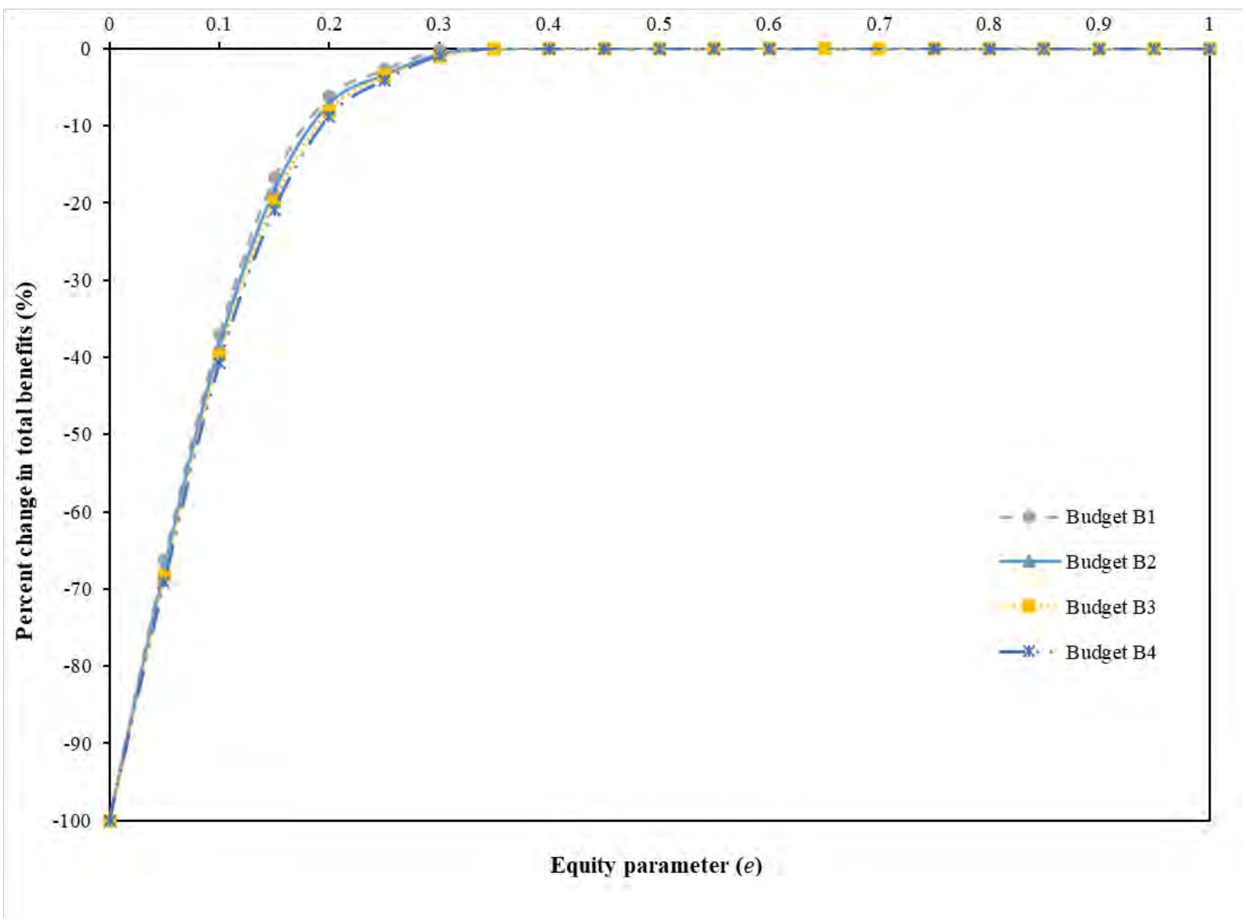


Figure 5-7: Total benefits vs. equity in outcome parameter (e) for different budgets (*M4*)

5.6 Chapter Summary

While ***M1*** appears to be most beneficial model, it is most unequitable. Adding mutually exclusiveness to ***M1*** takes model towards the equitable zone by constraining the allocation of multiple projects in the same location (in case of ***M2***). Although ***M3*** and ***M4*** are equity based models, the area of equity is different. While the former tries to allocate the resources equitably to the counties, the later focuses on the equitable allocation of benefits among the counties rather than the resources. The trend of benefits distribution over the years of the planning period is similar in all models except ***M0*** indicating the importance of beneficial projects due to their selection at the early period, resulting in the higher overall benefits. This is because all the benefits are converted to present worth and the model tries to maximize it by implementing the projects as soon as possible during the planning period. Moving to the improvement type of the projects, safety projects in road tends to be beneficial than other as they contribute the major portion of benefits in almost all models. But the safety projects in rail are way less beneficial than other projects basically because of lesser fatal crashes in the railroad crossing. As mentioned earlier, ***M3*** allocates the benefits equitably to all possible counties (51 out of 95) although lesser in the value. The important take away from this analysis is that the four counties (Knox, Hamilton, Davidson, and Shelby) are the maximum benefitted counties in all optimization models indicating that these counties have higher number of beneficial projects and they are to be prioritized during the planning.

Sensitivity analysis was carried out basically to assist the planners on the allocation of the budget in the real case scenario. The knowledge about the difference in the expected output with variation of budget for different models can definitely make think on the possibility of different budgets. Further, the performance of the equity parameters of ***M3*** and ***M4*** give the outline on setting these parameters to achieve the maximum benefits along with the equitable allocation.

CHAPTER 6: CONCLUSION

This report developed a six-dimensional (modes, performance measures, improvement types, time periods, regions, and policies) freight resource allocation methodology that can be used for the allocation of funds to alleviate congestion and enhance safety. To the authors' best knowledge, this is the first report that addresses freight resource allocation considering this combination of dimensions. The contribution of this report in viewpoint of research and practice is twofold. First, the development of a set of multidimensional freight resource allocation models that public agencies can utilize considering policy, budget, and other constraints. Second, the application of the model to a real-world case study and offering insights to public agencies to consider unique model features in various policy settings to augment prioritization of multimodal freight projects.

State DOTs are responsible to maintain multimodal freight transportation, however policies between states vary. Hence, this report proposes four models each consisting of a unique policy and compares the results with a base model (***M0***) where selection of projects is conducted using an intuitive sorting model. In all four models, maximization of planning period benefits is considered as the objective. Each model differs from other by specific nature of constraints. ***M1*** is referred as economic competitiveness where projects are not mutual exclusive to the locations. In ***M2***, mutual exclusiveness constraint is added. ***M3*** adds equity in opportunity constraint where counties receive equitable resources (projects). ***M4*** introduces equity in outcome constraint where the sub-regions (counties) receive equitable benefits. The state of Tennessee is used as the case study for the proposed resource allocation model. For each model, a planning period of ten years is considered with pre-specified annual budget, growth in cost, and benefits of projects over time. The multi-year feature allows the user to effectively utilize the year-end savings in subsequent years, thereby, deriving the most benefits from the available resources. Incorporation of policy constraints allows the analyst flexibility of selectively adding required constraints to the resource allocation problem. The results show that ***M1*** provides highest benefits followed by ***M2*** but allocation is highly unequitable. ***M3*** provides the least benefits; however, resources were provided equitably to the sub-regions benefitting all possible counties. ***M4*** provides third best benefits with most equitable allocation of benefits. At the end, sensitivity analysis is carried out to see the performances of the models developed. The variation of overall maximum benefits is observed corresponding to the variation in allocated budget and equity parameters used in equity models. This can be a valuable asset to freight agencies in setting the model parameters in different scenarios (input data, budget, and desired equity) to maximize the benefits, during planning phase. From the spectrum of models presented, depending on the goal of the public agency, appropriate models can be used for freight resource allocation

Four resource allocation models, each consisting of a unique policy are developed and the results are compared within these four models together with a model based on heuristic project selection. Results showed that introduction of equity in outcome does not reduce benefits significantly when compared to models without equity while introduction of equity in opportunity results in significant benefits reduction. It also revealed the existence of an equity value breakpoint beyond which reduction of equity does not result in a significant increase of benefits. Future research could focus on the following: i) inclusion of additional modes, ii) inclusion of maintenance and operations costs, iii) generation of benefits after a pre-specified time period of project completion, iv) consideration of a diverse and conflicting set of objectives in a multi-objective resource allocation modeling framework, and v) investing a loan i.e. borrowing money for a freight investment. The former three future research items can be easily included in the models and solved using the same solution algorithms presented in this research. The fourth research item would require significant effort (e.g., introduction of new decision variables and constraints) and, most likely, a metaheuristic solution algorithm to be developed. And, the last research item will be a complete economic analysis.

REFERENCES

Arora, H., Raghu, T. S., & Vinze, A. (2010). Resource allocation for demand surge mitigation during disaster response. *Decision Support Systems*, *50*(1), 304–315.

Bahar, G., Masliah, M., Wolff, R., & Park, P. (2008). FHWA Desktop Reference for Crash Reduction Factors. Retrieved January 29, 2018, from https://safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011/

Belenky, P. (2011). The Value of Travel Time Savings: Departmental Guidance for Conducting Economic Evaluations, Revision 2. *Washington DC: United States Department of Transportation*.

Bryan, J., Weisbrod, G. E., & Martland, C. D. (2007). *Rail freight solutions to roadway congestion: Final report and guidebook* (Vol. 586). Transportation Research Board.

Churchill, A. M., & Lovell, D. J. (2012). Coordinated aviation network resource allocation under uncertainty. *Transportation Research Part E: Logistics and Transportation Review*, *48*(1), 19–33.

CREATE. (2015). Chicago- BRC and NS Signalization, EW4. Retrieved January 29, 2018, from http://www.createprogram.org/factsheets/EW4.pdf

Das, I. (1999). On characterizing the “knee” of the Pareto curve based on normal-boundary intersection. *Structural Optimization*, *18*(2–3), 107–115.

Dunn, W. M., & Latoski, S. P. (2003). *Safe and Quick Clearance of Traffic Incidents: A Synthesis of Highway Practice* (Vol. 318). Transportation Research Board.

Fang, L., & Li, H. (2015). Centralized resource allocation based on the cost–revenue analysis. *Computers & Industrial Engineering*, *85*, 395–401.

FAST Act. (2015). FAST Act Legislation - FHWA | Federal Highway Administration. Retrieved January 28, 2018, from https://www.fhwa.dot.gov/fastact/legislation.cfm

FHWA. (2017). Operations Benefit/Cost Analysis Desk Reference - Chapter 2 Overview of B/C Analysis for Operations. Retrieved from https://ops.fhwa.dot.gov/publications/fhwahop12028/sec2.htm

Fiedrich, F., Gehbauer, F., & Rickers, U. (2000). Optimized resource allocation for emergency response after earthquake disasters. *Safety Science*, *35*(1–3), 41–57.

Grenzeback, L. R., Brown, A., Fischer, M. J., Hutson, N., Lamm, C. R., Pei, Y. L., … others. (2013). *Transportation Energy Futures Series: Freight Transportation Demand: Energy-Efficient Scenarios for a Low-Carbon Future*. Cambridge Systematics Inc./National Renewable Energy Laboratory. Retrieved from http://www.osti.gov/scitech/biblio/1338437

Herbel, S., Laing, L., & McGovern, C. (2010). *Highway Safety Improvement Program Manual*. US Department of Transportation, Federal Highway Administration, Office of Safety.

Kar, K., & Datta, T. (2004). Development of a safety resource-allocation model in Michigan. *Transportation Research Record: Journal of the Transportation Research Board*, (1865), 64–71.

Kim, A., & Hansen, M. (2013). A framework for the assessment of collaborative en route resource allocation strategies. *Transportation Research Part C: Emerging Technologies*, *33*, 324–339.

Konur, D., Golias, M. M., & Darks, B. (2013). A mathematical modeling approach to resource allocation for railroad-highway crossing safety upgrades. *Accident Analysis & Prevention*, *51*, 192–201.

Lambert, J. H., Baker, J. A., & Peterson, K. D. (2003). Decision aid for allocation of transportation funds to guardrails. *Accident Analysis & Prevention*, *35*(1), 47–57.

Latham, F. E., & Trombly, J. W. (2003). *Low cost traffic engineering improvements: A primer*. Retrieved from https://trid.trb.org/view.aspx?id=755037

Lee, J., & Wong, K. K. (2004). The impact of accountability on racial and socioeconomic equity: Considering both school resources and achievement outcomes. *American Educational Research Journal*, *41*(4), 797–832.

Li, X., Chen, H. H., & Tao, X. (2016). Pricing and capacity allocation in renewable energy. *Applied Energy*, *179*, 1097–1105.

Luscombe, R., & Kozan, E. (2016). Dynamic resource allocation to improve emergency department efficiency in real time. *European Journal of Operational Research*, *255*(2), 593–603.

Margiotta, R. A., Spiller, N. C., & Halkias, J. A. (2007). *Traffic Bottlenecks: A Primer–Focus on Low-Cost Operational Improvements*. Retrieved from https://trid.trb.org/view.aspx?id=839771

Mathew, T. V., Khasnabis, S., & Mishra, S. (2010). Optimal resource allocation among transit agencies for fleet management. *Transportation Research Part A: Policy and Practice*, *44*(6), 418–432.

Melkote, S., & Daskin, M. S. (2001). An integrated model of facility location and transportation network design. *Transportation Research Part A: Policy and Practice*, *35*(6), 515–538.

Miller, T. R., Whiting, B., Kragh, B., & Zegeer, C. (1987). Sensitivity of a highway safety resource allocation model to variations in benefit computation parameters. *Transportation Research Record*, *1124*, 58–65.

Mishra, S. (2013). A synchronized model for crash prediction and resource allocation to prioritize highway safety improvement projects. *Procedia-Social and Behavioral Sciences*, *104*, 992–1001.

Mishra, S., Golias, M. M., Sharma, S., & Boyles, S. D. (2015). Optimal funding allocation strategies for safety improvements on urban intersections. *Transportation Research Part A: Policy and Practice*, *75*, 113–133.

Notte, G., Pedemonte, M., Cancela, H., & Chilibroste, P. (2016). Resource allocation in pastoral dairy production systems: Evaluating exact and genetic algorithms approaches. *Agricultural Systems*, *148*, 114–123.

PIERPASS. (2016). Overview of the OffPeak Program and PierPass. Retrieved January 29, 2018, from www.pierpass.org

Port of Alaska. (2016). Port Modernization Project Port project funding - Port of Anchorage. Retrieved January 29, 2018, from https://www.portofalaska.com

Rauch, J. E., & Casella, A. (2003). Overcoming informational barriers to international resource allocation: prices and ties. *The Economic Journal*, *113*(484), 21–42.

Sánchez-Martínez, G. E., Koutsopoulos, H. N., & Wilson, N. H. (2016). Optimal allocation of vehicles to bus routes using automatically collected data and simulation modelling. *Research in Transportation Economics*, *59*, 268–276.

Scopatz, R., Zhou, Y., Wojtowicz, A., Carter, D., Smith, S., & Harrison, P. (2014). *Tennessee Roadway Information System: State and Local Data Integration*. Retrieved from https://trid.trb.org/view.aspx?id=1371762

Sheu, J.-B. (2006). A novel dynamic resource allocation model for demand-responsive city logistics distribution operations. *Transportation Research Part E: Logistics and Transportation Review*, *42*(6), 445–472.

Short, J. (2010). *Identifying and using low-cost and quickly implementable ways to address freight-system mobility constraints* (Vol. 7). Transportation Research Board National Research.

Su, H., Wu, J. H., Tan, Y., Bao, Y., Song, B., & He, X. (2014). A land use and transportation integration method for land use allocation and transportation strategies in China. *Transportation Research Part A: Policy and Practice*, *69*, 329–353.

Systematics, C. (2003). The Tioga Group: Goods Movement Truck and Rail Study Executive Summary. Retrieved January 29, 2018, from http://www.freightworks.org/Documents/Forms/AllItems.aspx

Systematics, C. (2005). *An initial assessment of freight bottlenecks on highways*. Cambridge Systematics, Incorporated.

Systematics, C., & others. (2005). Traffic congestion and reliability: Trends and advanced strategies for congestion mitigation. *Final Report, Texas Transportation Institute. Http://Ops. Fhwa. Dot. Gov/Congestion_report_04/Index. Htm*.

Talen, E. (1998). Visualizing fairness: Equity maps for planners. *Journal of the American Planning Association*, *64*(1), 22–38.

Talen, E., & Anselin, L. (1998). Assessing spatial equity: an evaluation of measures of accessibility to public playgrounds. *Environment and Planning A*, *30*(4), 595–613.

TDOT. (2014). Tennessee Statewide Multimodal Freight Plan. Retrieved February 1, 2018, from https://www.tn.gov/content/tn/tdot/long-range-planning-home/longrange-policy/freight-planning.html

TDOT. (2016). TDOT 25-YEAR LONG-RANGE TRANSPORTATION POLICY PLAN-TRAVEL TRENDS & SYSTEM PERFORMANCE POLICY PAPER. Retrieved January 28, 2018, from https://www.tn.gov/content/dam/tn/tdot/documents/Travel_Trends_022316.pdf

TRIS. (2014). Roadway Safety Data Program Tennessee casestudy. Retrieved January 30, 2018, from https://safety.fhwa.dot.gov/rsdp/downloads/tncasestudy.pdf.

USDOE. (2016). USDOE TN Energy Sector Risk Profile. Retrieved January 28, 2018, from https://energy.gov/sites/prod/files/2016/09/f33/TN_Energy%20Sector%20Risk%20Profile_2.pdf

USDOT. (2012). Moving Ahead for Progress in 21st Century (MAP-21) (Report to Congress No. HR.4348). U.S. Department of Transportation, Federal Highway Administration, Washington DC. Retrieved from https://www.fhwa.dot.gov/map21/legislation.cfm

Vasco, R. A., & Morabito, R. (2016). The dynamic vehicle allocation problem with application in trucking companies in Brazil. *Computers & Operations Research*, *76*, 118–133.

Vidal, C. J., & Goetschalckx, M. (2001). A global supply chain model with transfer pricing and transportation cost allocation. *European Journal of Operational Research*, *129*(1), 134–158.

Volmer, N., Baer, P., Gibson, J., Hey, J., Lutz, W., O'Riley, C., & McCauley, D. (2006). Use of a Benefit-Cost Ratio to Prioritize Projects for Funding.

Wang, X. (2016). Stochastic resource allocation for containerized cargo transportation networks when capacities are uncertain. *Transportation Research Part E: Logistics and Transportation Review*, *93*, 334–357.

Wang, X., Wang, H., & Zhang, X. (2016). Stochastic seat allocation models for passenger rail transportation under customer choice. *Transportation Research Part E: Logistics and Transportation Review*, *96*, 95–112.

Welch, T. F., & Mishra, S. (2013). A measure of equity for public transit connectivity. *Journal of Transport Geography*, *33*, 29–41.

Wey, W.-M., & Wu, K.-Y. (2007). Using ANP priorities with goal programming in resource allocation in transportation. *Mathematical and Computer Modelling*, *46*(7–8), 985–1000.

Zargayouna, M., Balbo, F., & Ndiaye, K. (2016). Generic model for resource allocation in transportation. Application to urban parking management. *Transportation Research Part C: Emerging Technologies*, *71*, 538–554.

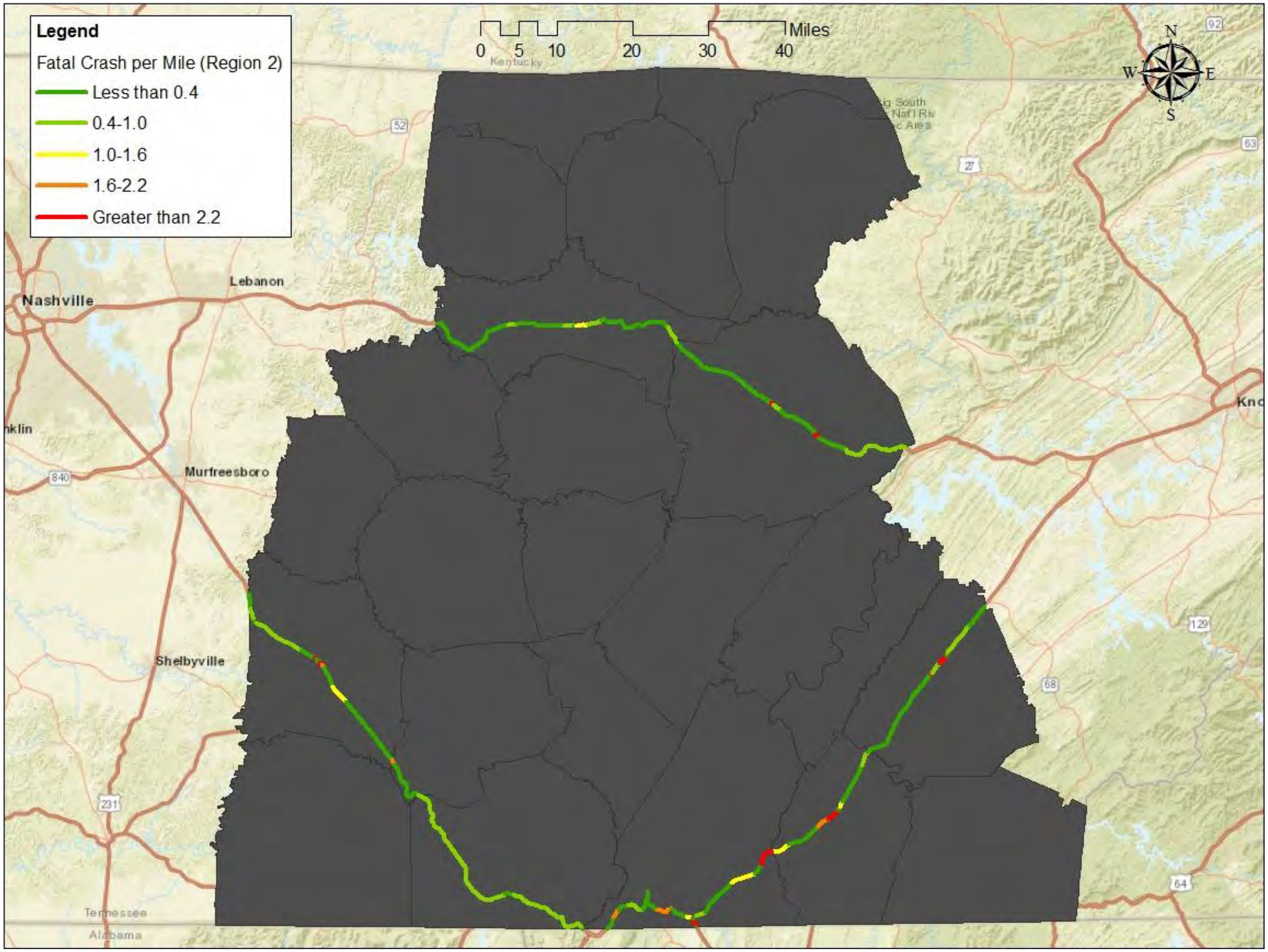


Figure Error! No text of specified style in document.**-1: Region 2 of Tennessee showing Fatal Crash per mile for interstates and expressways**

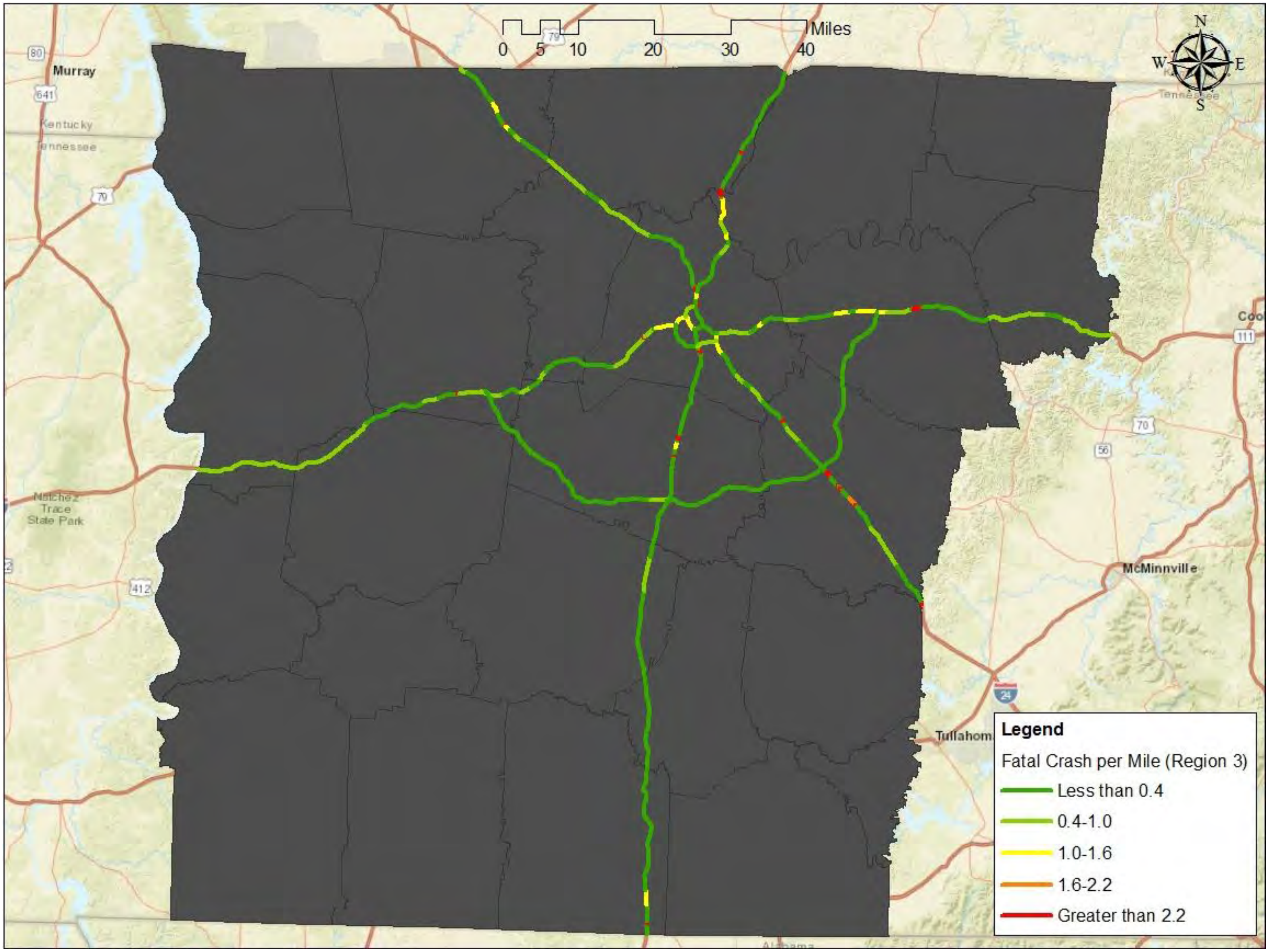


Figure Error! No text of specified style in document.**-2: Region 3 of Tennessee showing Fatal Crash per mile for interstates and expressways**

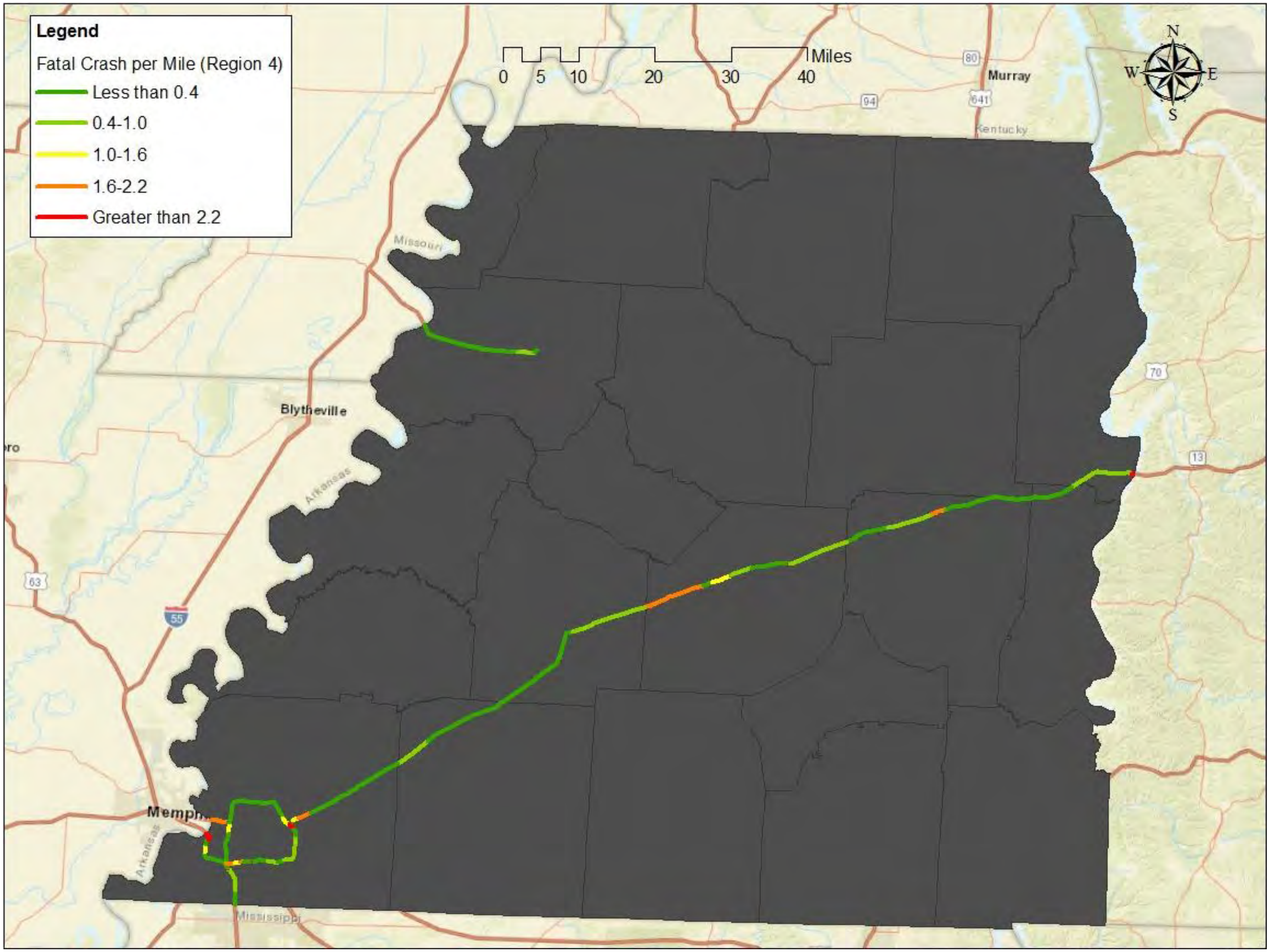


Figure Error! No text of specified style in document.**-3: Region 4 of Tennessee showing Fatal Crash per mile for interstates and expressways**

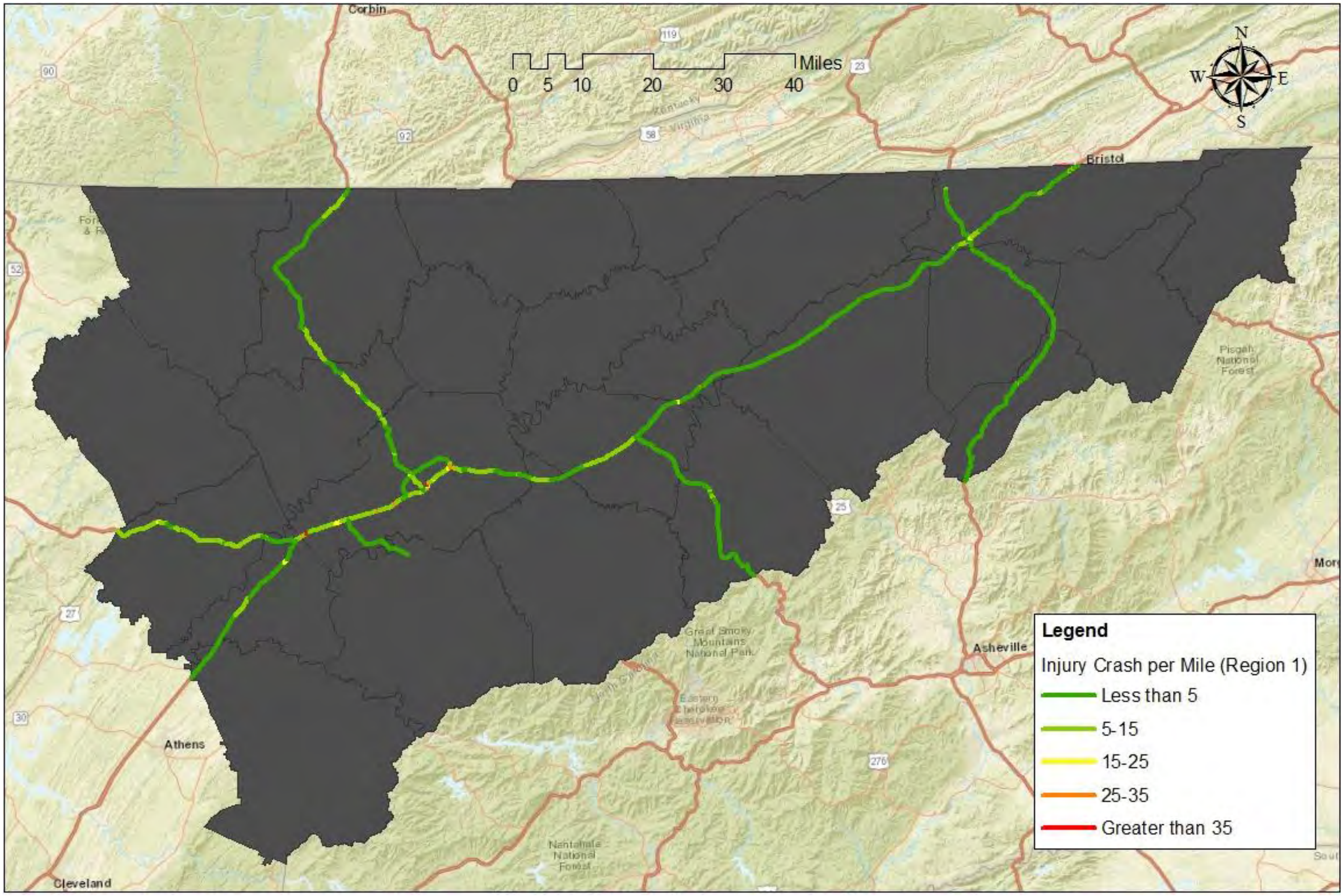


Figure Error! No text of specified style in document.**-4: Region 1 of Tennessee showing Injury Crash per mile for interstates and expressways**

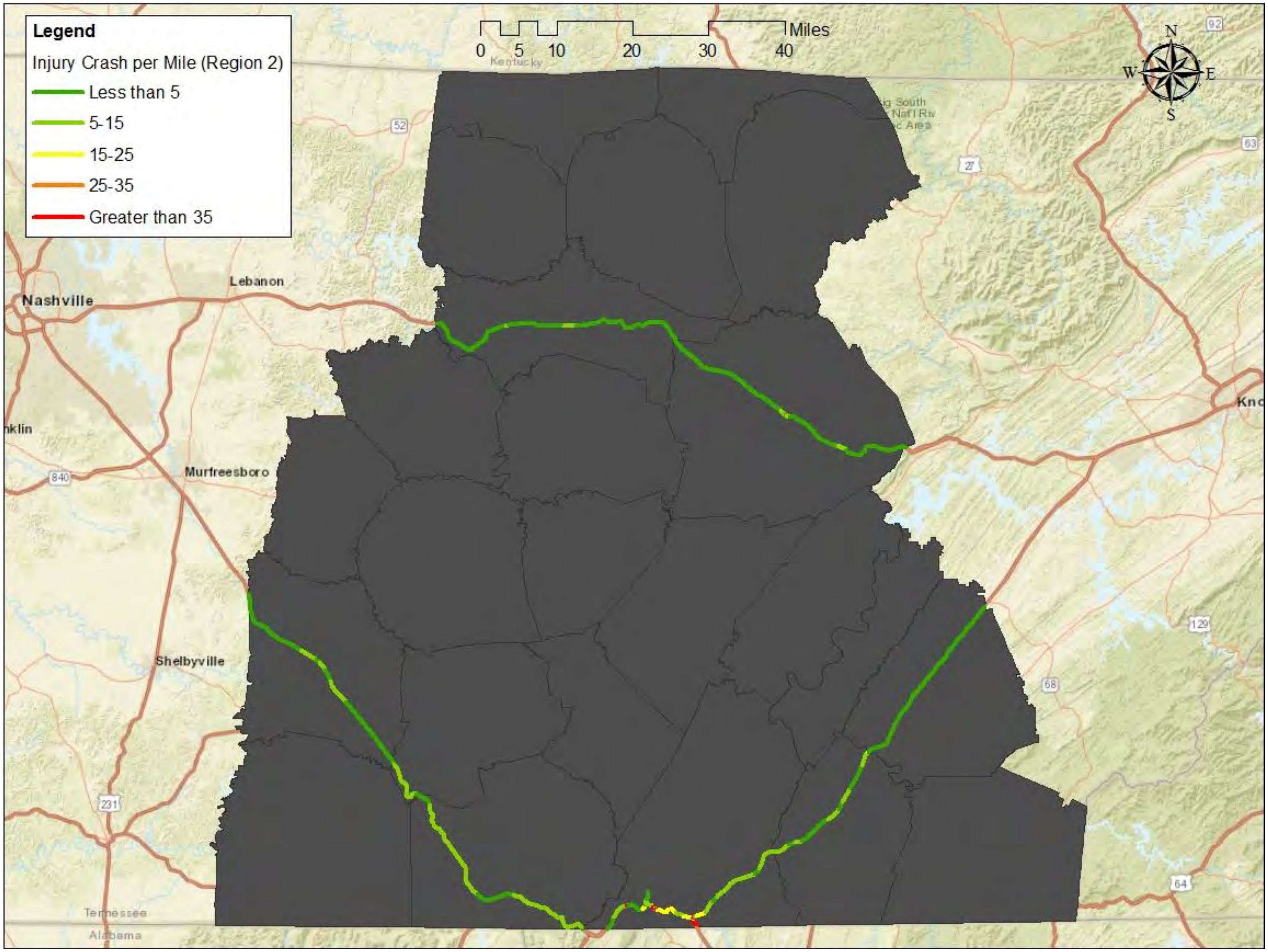


Figure Error! No text of specified style in document.**-5: Region 2 of Tennessee showing Injury Crash per mile for interstates and expressways**

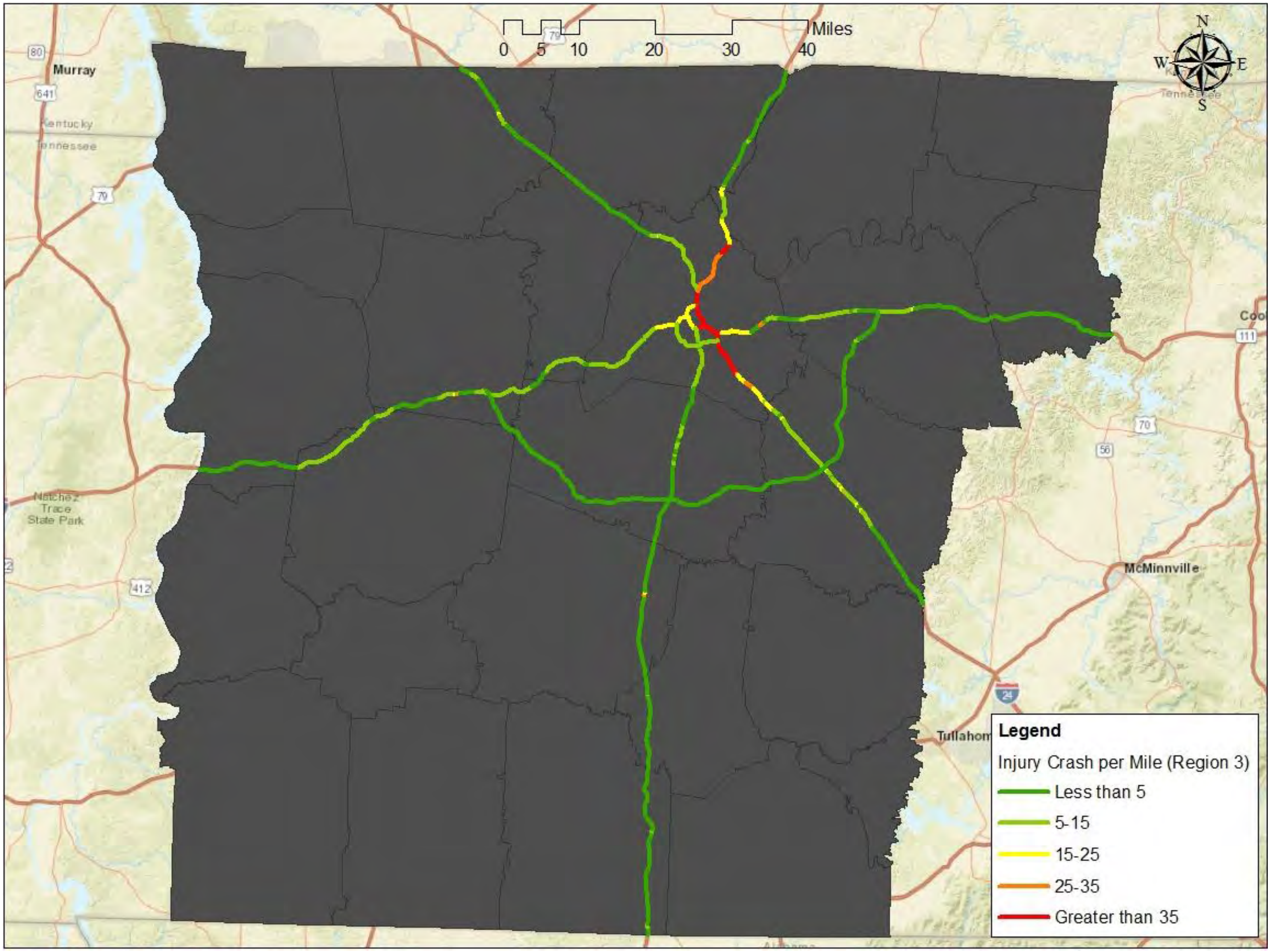


Figure Error! No text of specified style in document.**-6: Region 3 of Tennessee showing Fatal Crash per mile for interstates and expressways**

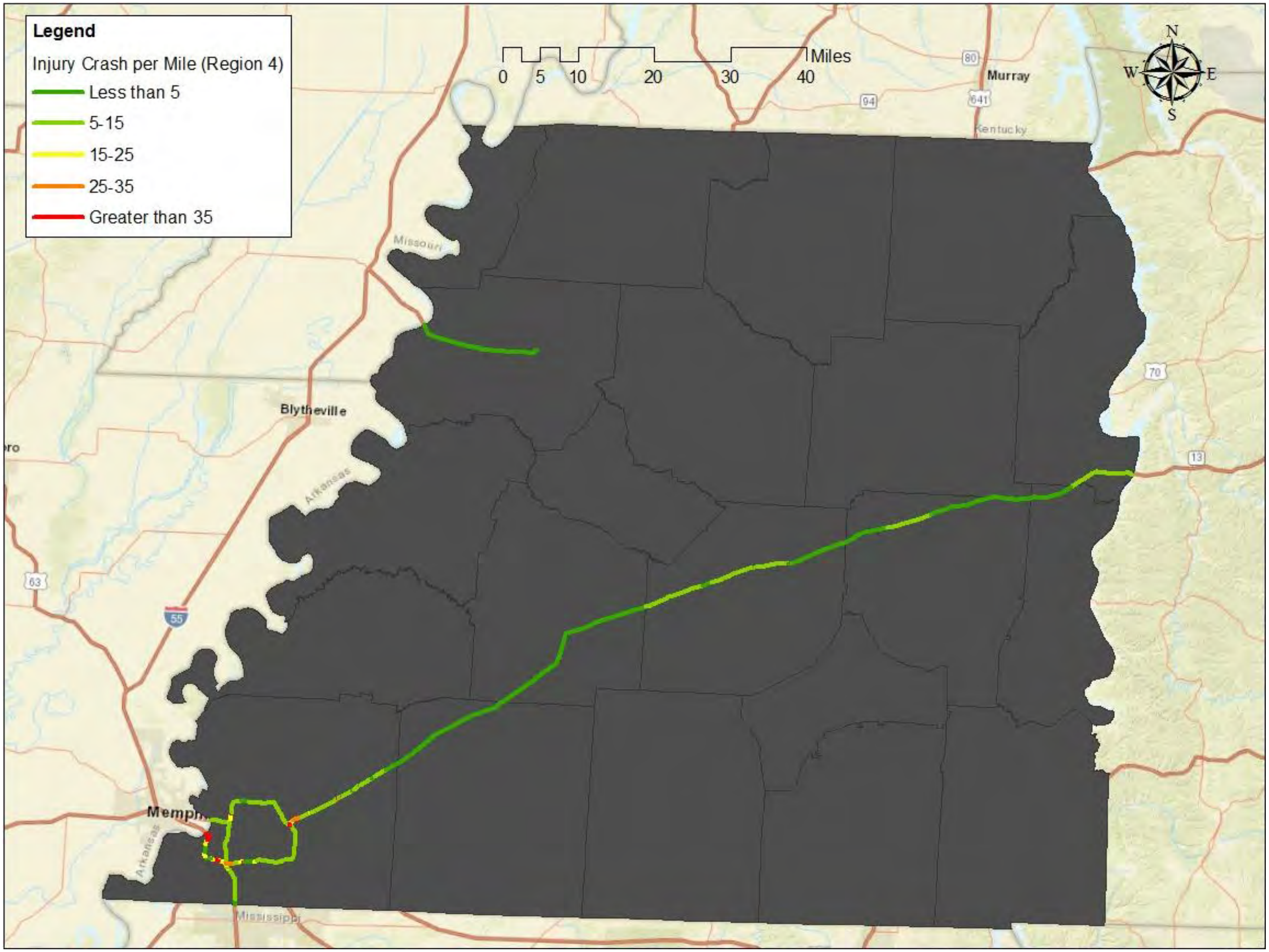


Figure Error! No text of specified style in document.**-7: Region 4 of Tennessee showing Injury Crash per mile for interstates and expressways**

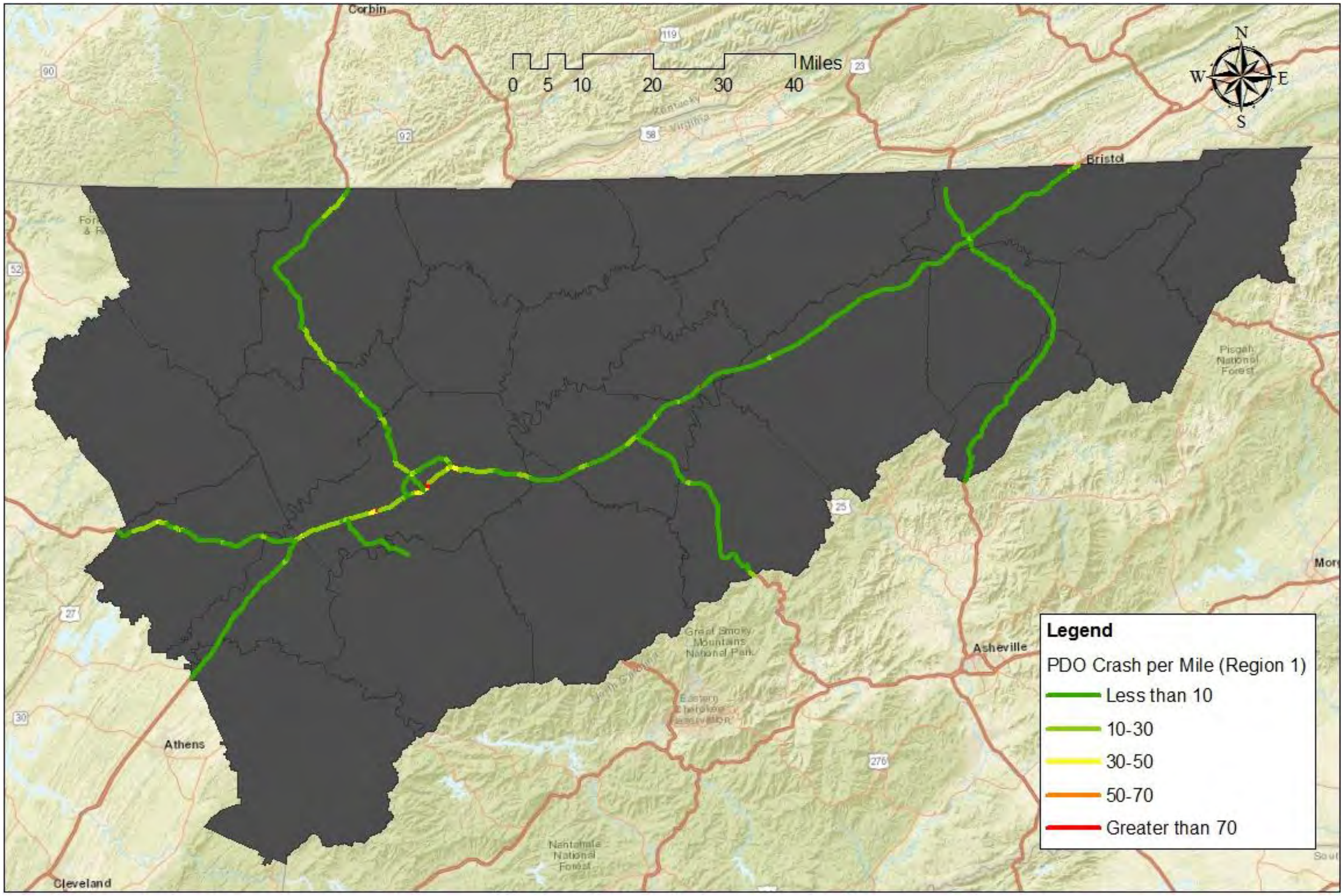


Figure Error! No text of specified style in document.**-8: Region 1 of Tennessee showing Property Damage Only (PDO) Crash per mile for interstates and expressways**

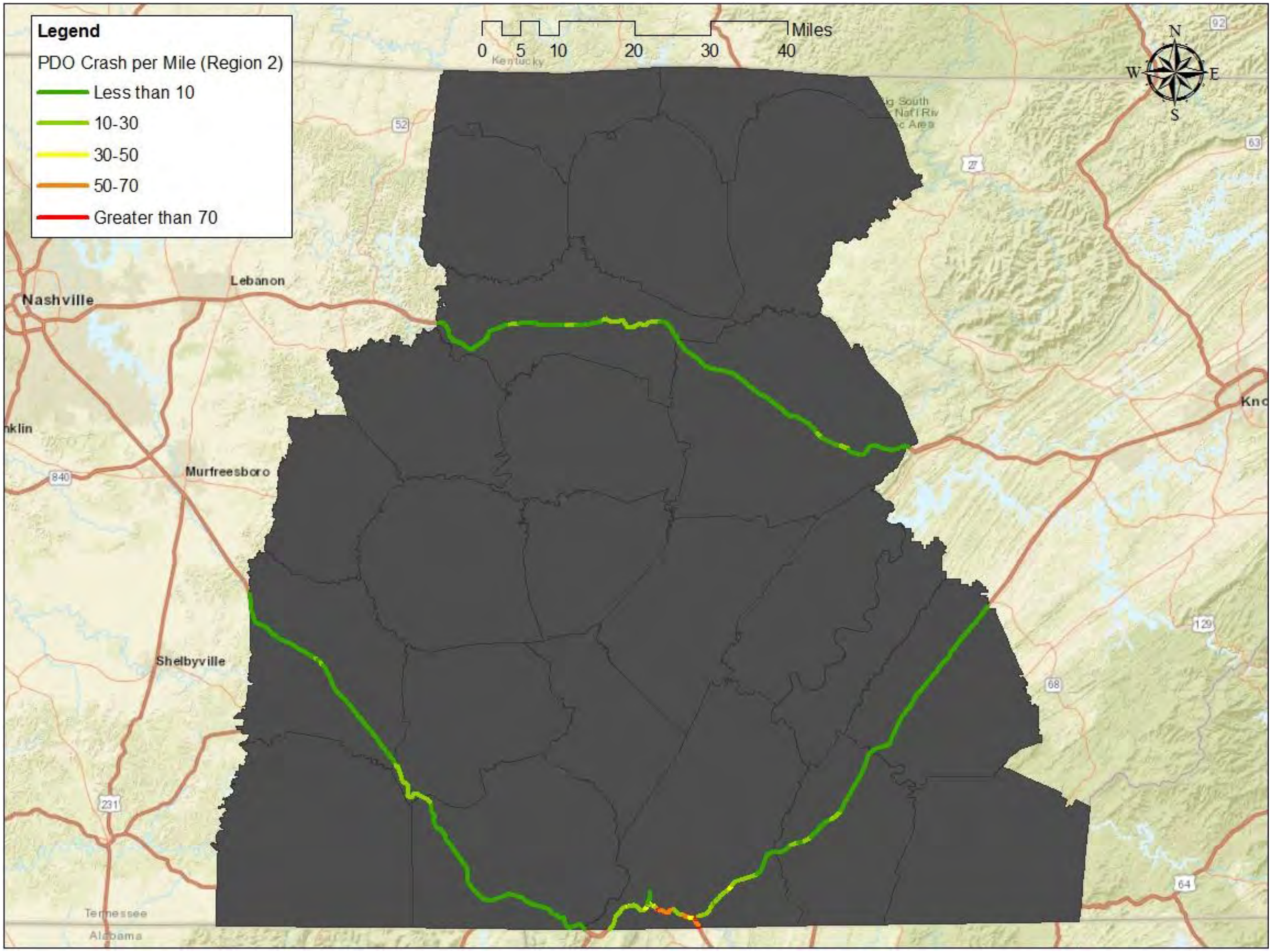


Figure Error! No text of specified style in document.**-9: Region 2 of Tennessee showing Property Damage Only (PDO) Crash per mile for interstates and expressways**

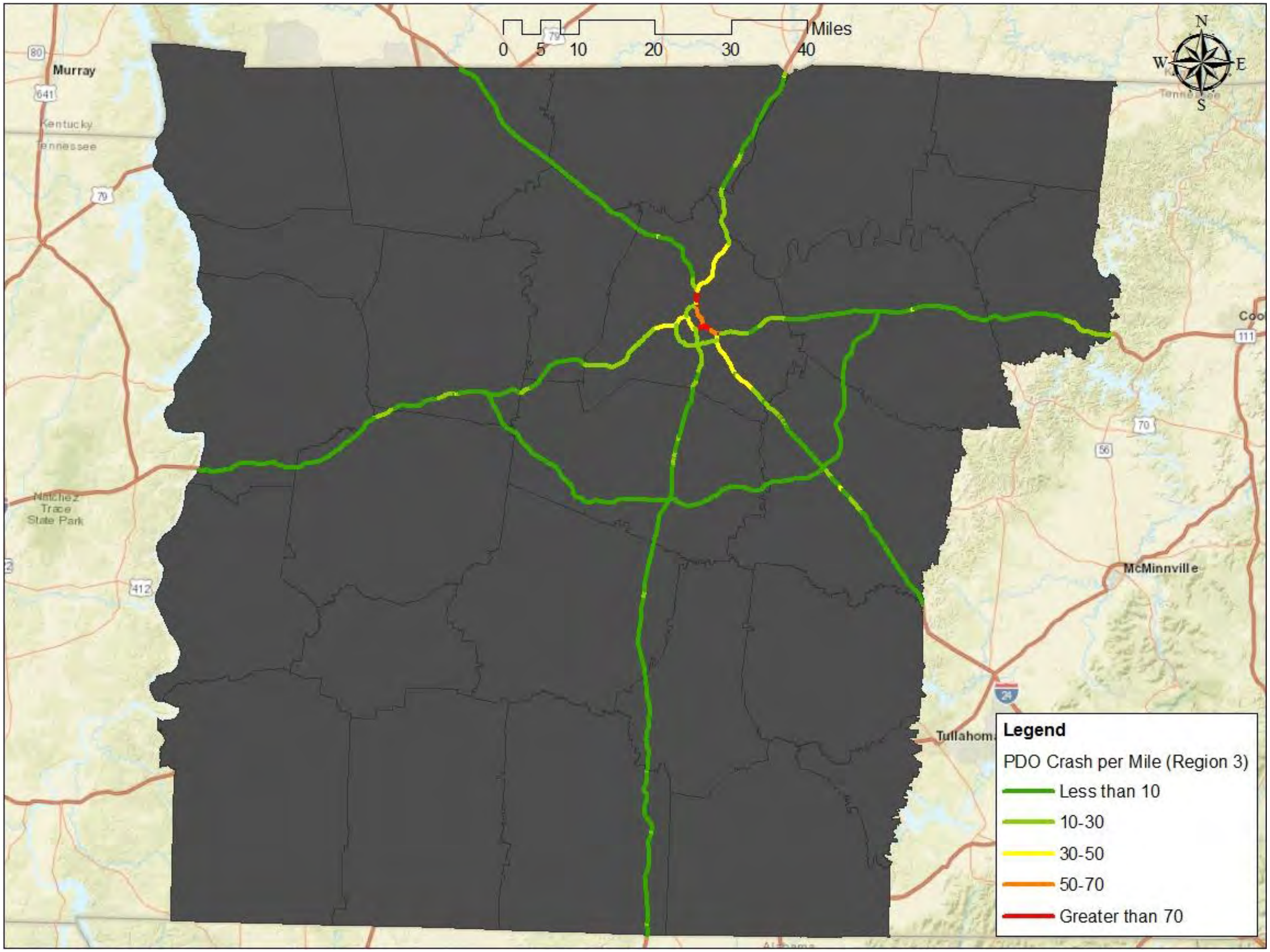


Figure Error! No text of specified style in document.**-10: Region 3 of Tennessee showing Property Damage Only (PDO) Crash per mile for interstates and expressways**

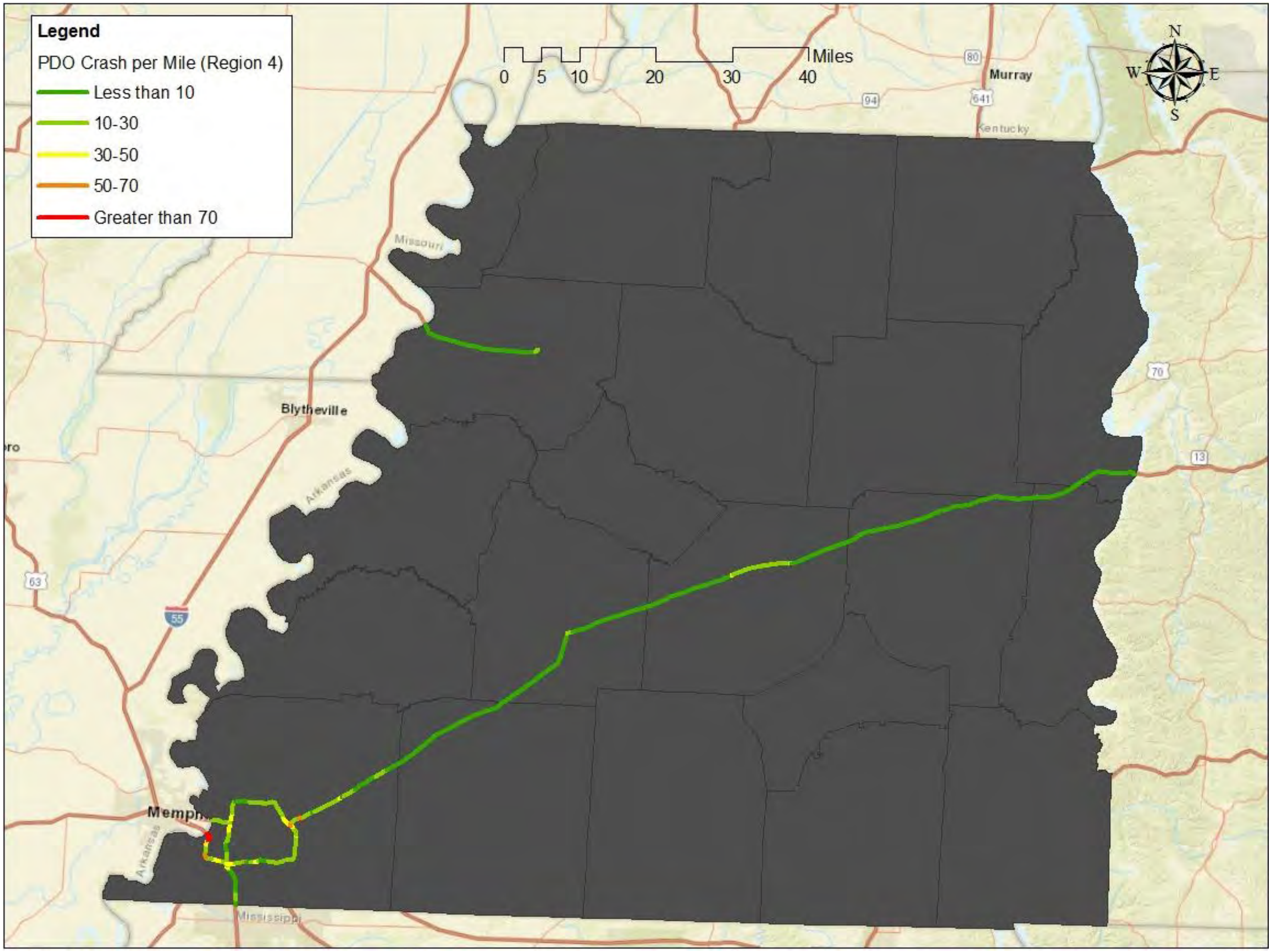


Figure Error! No text of specified style in document.**-11: Region 4 of Tennessee showing Property Damage Only (PDO) Crash per mile for interstates and expressways**

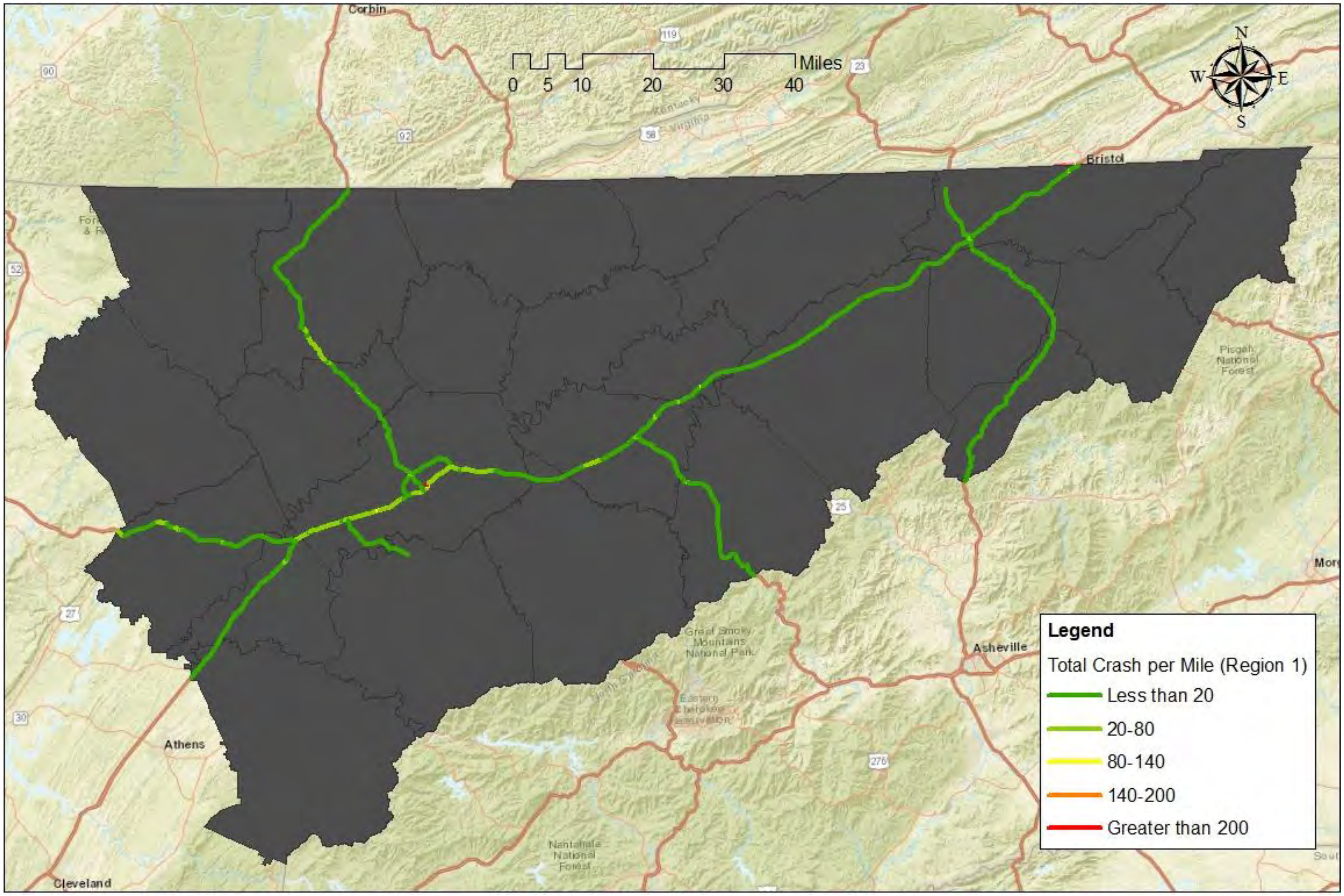


Figure Error! No text of specified style in document.**-12: Region 1 of Tennessee showing Total Crash per mile for interstates and expressways**

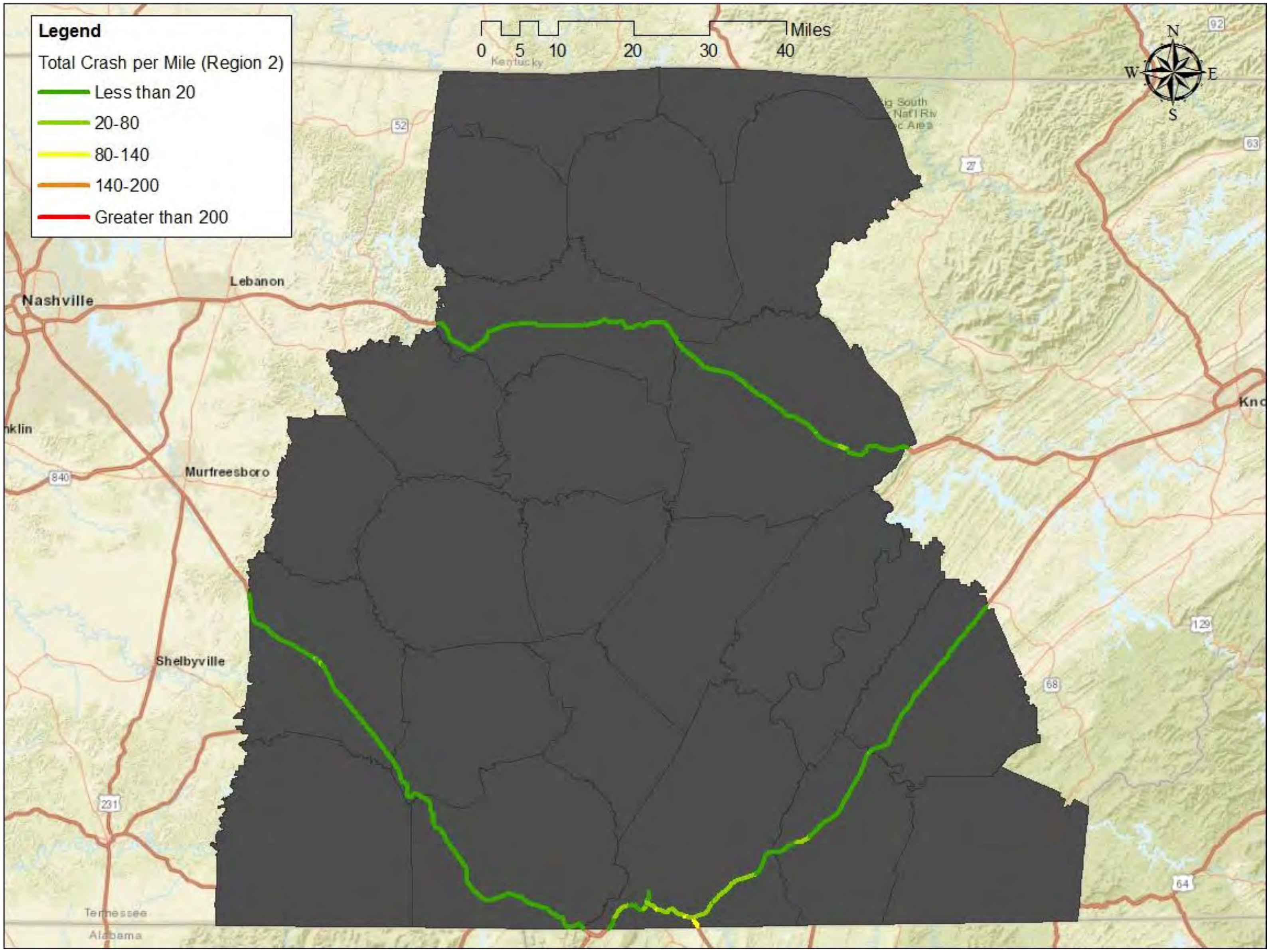


Figure Error! No text of specified style in document.**-13: Region 2 of Tennessee showing Total Crash per mile for interstates and expressways**

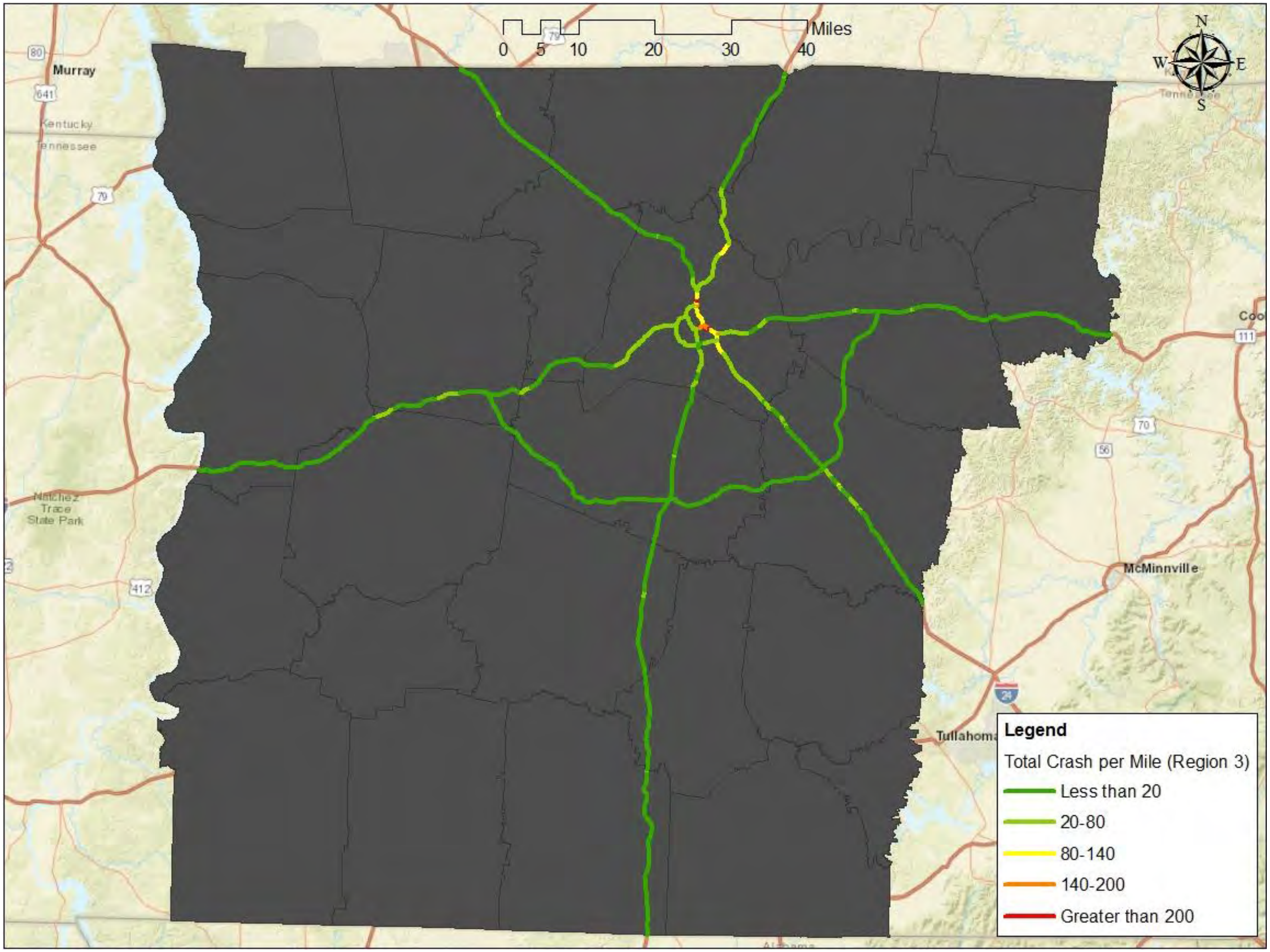


Figure Error! No text of specified style in document.**-14: Region 3 of Tennessee showing Total Crash per mile for interstates and expressways**

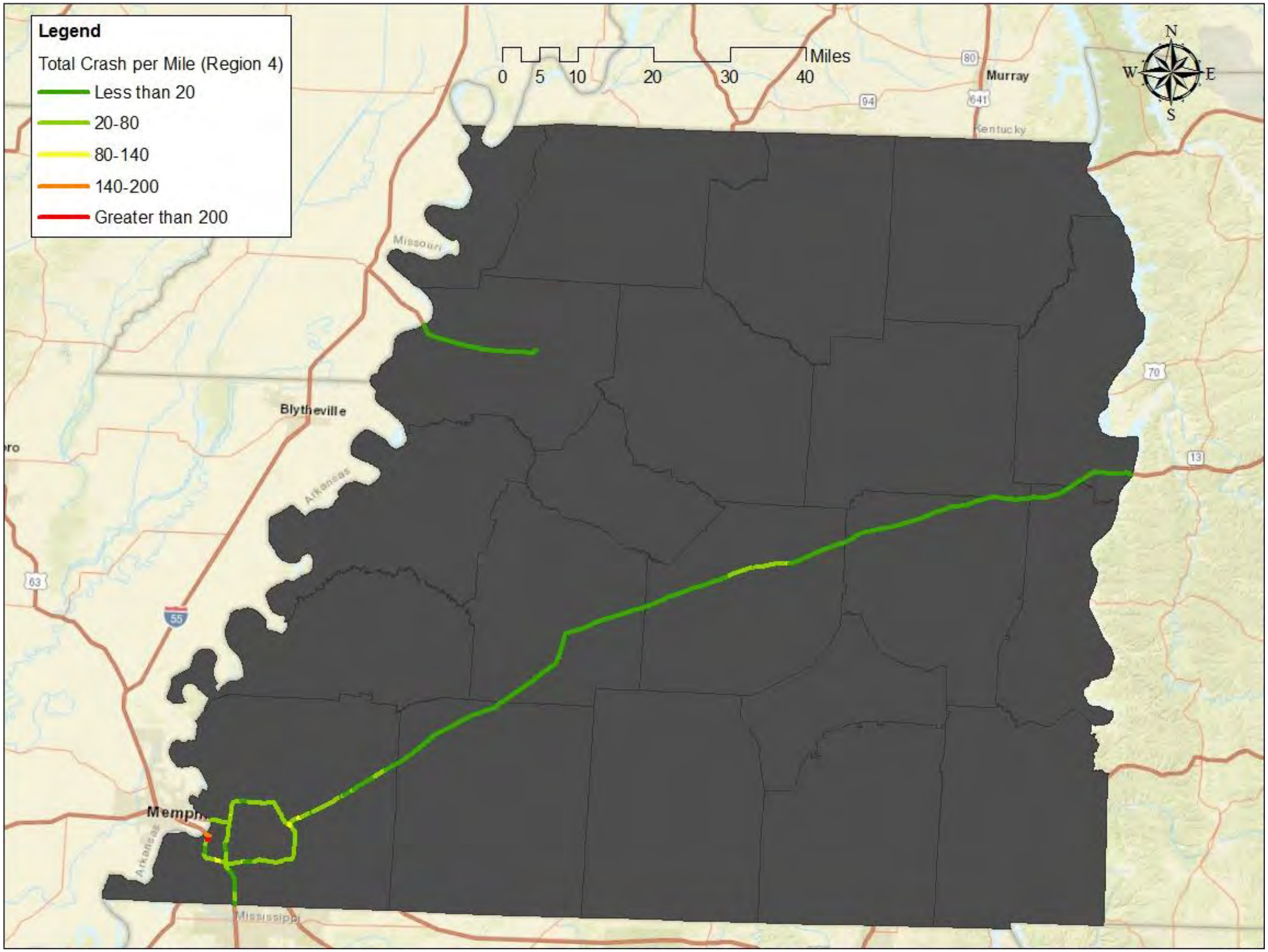


Figure Error! No text of specified style in document.**-15: Region 4 of Tennessee showing Total Crash per mile for interstates and expressways**

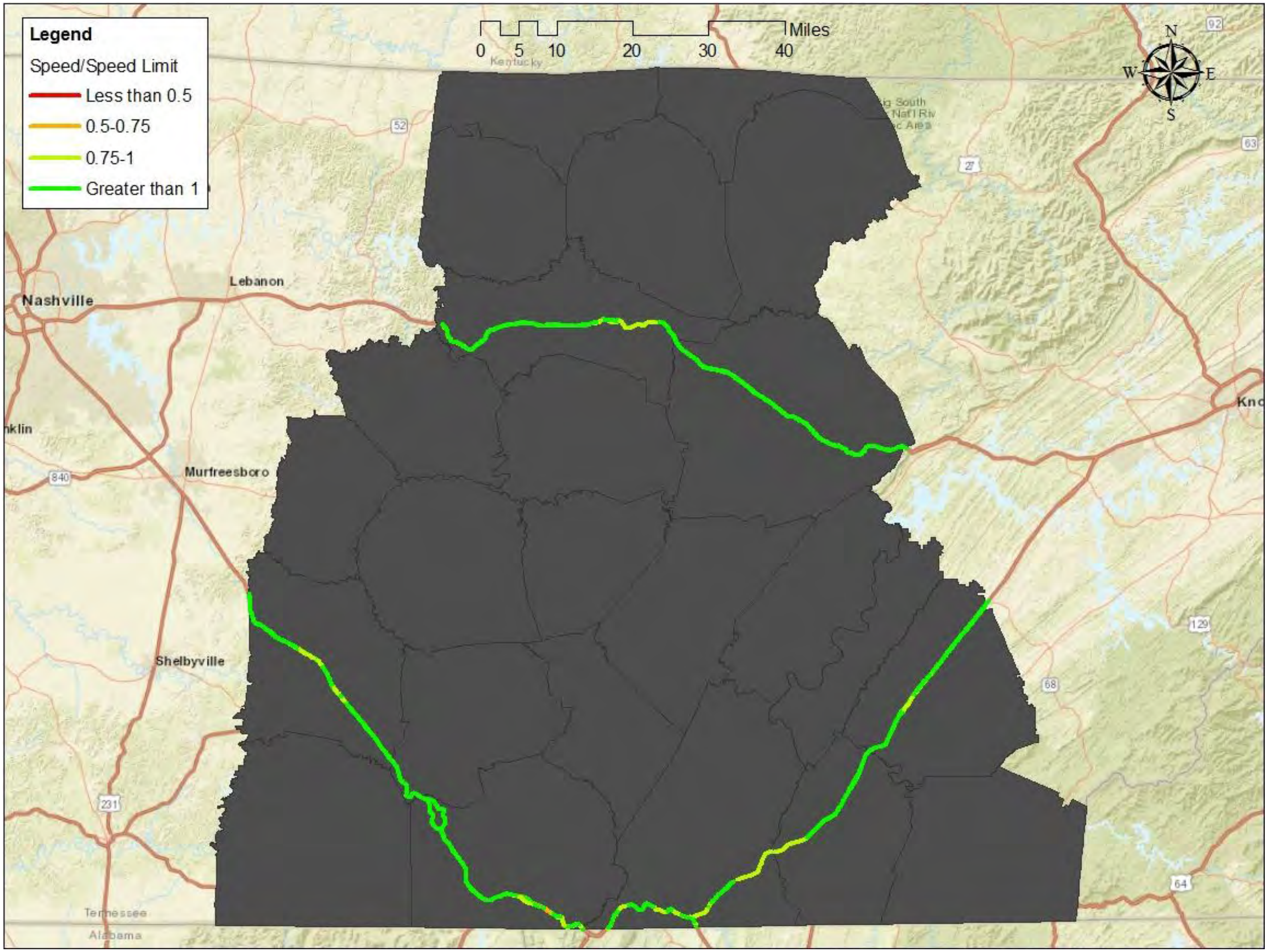


Figure Error! No text of specified style in document.**-16: Region 2 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for mid-day hours (9 am-2 pm)**

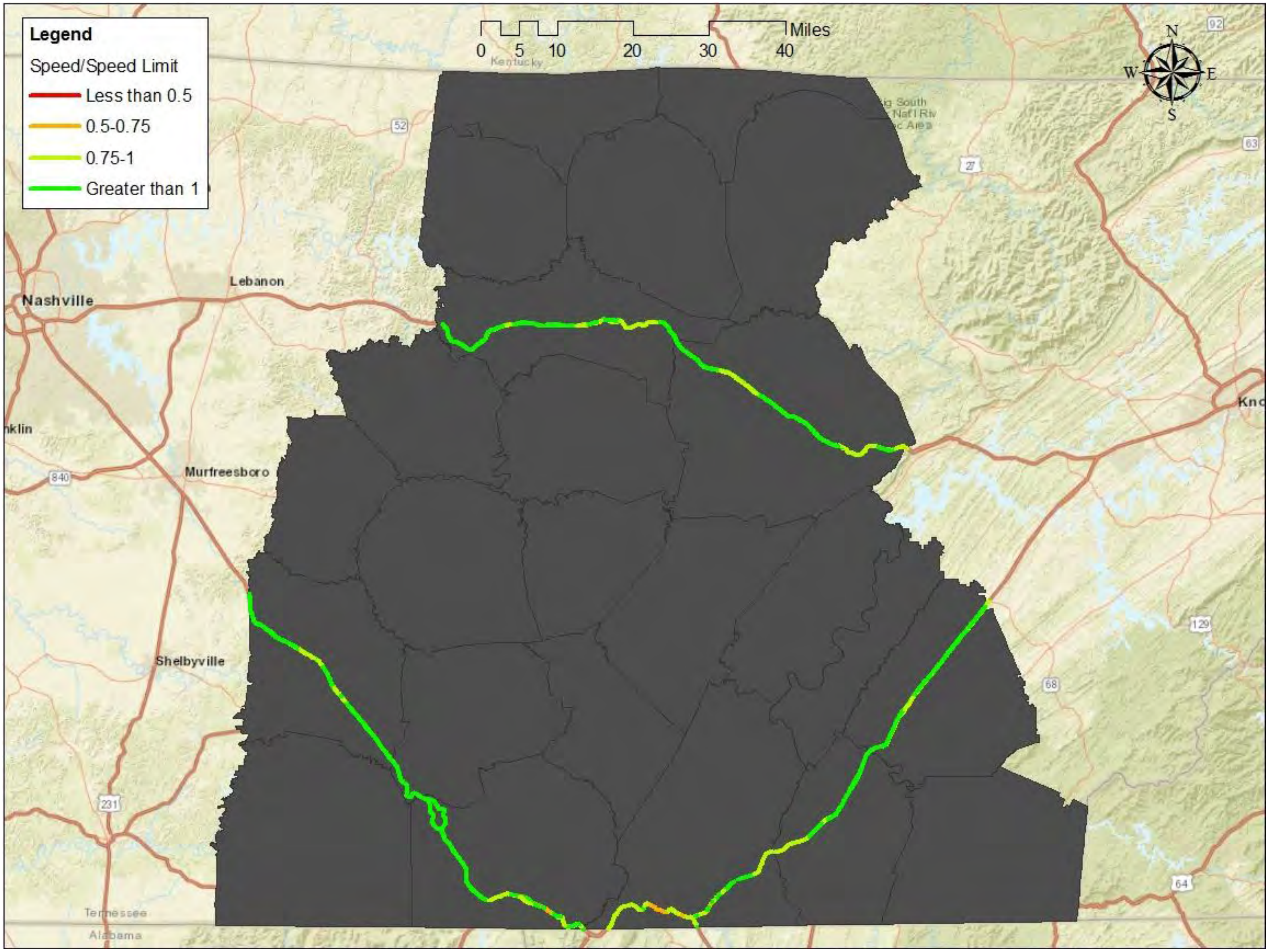


Figure Error! No text of specified style in document.**-17: Region 2 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for pm peak hours (2-6 pm)**

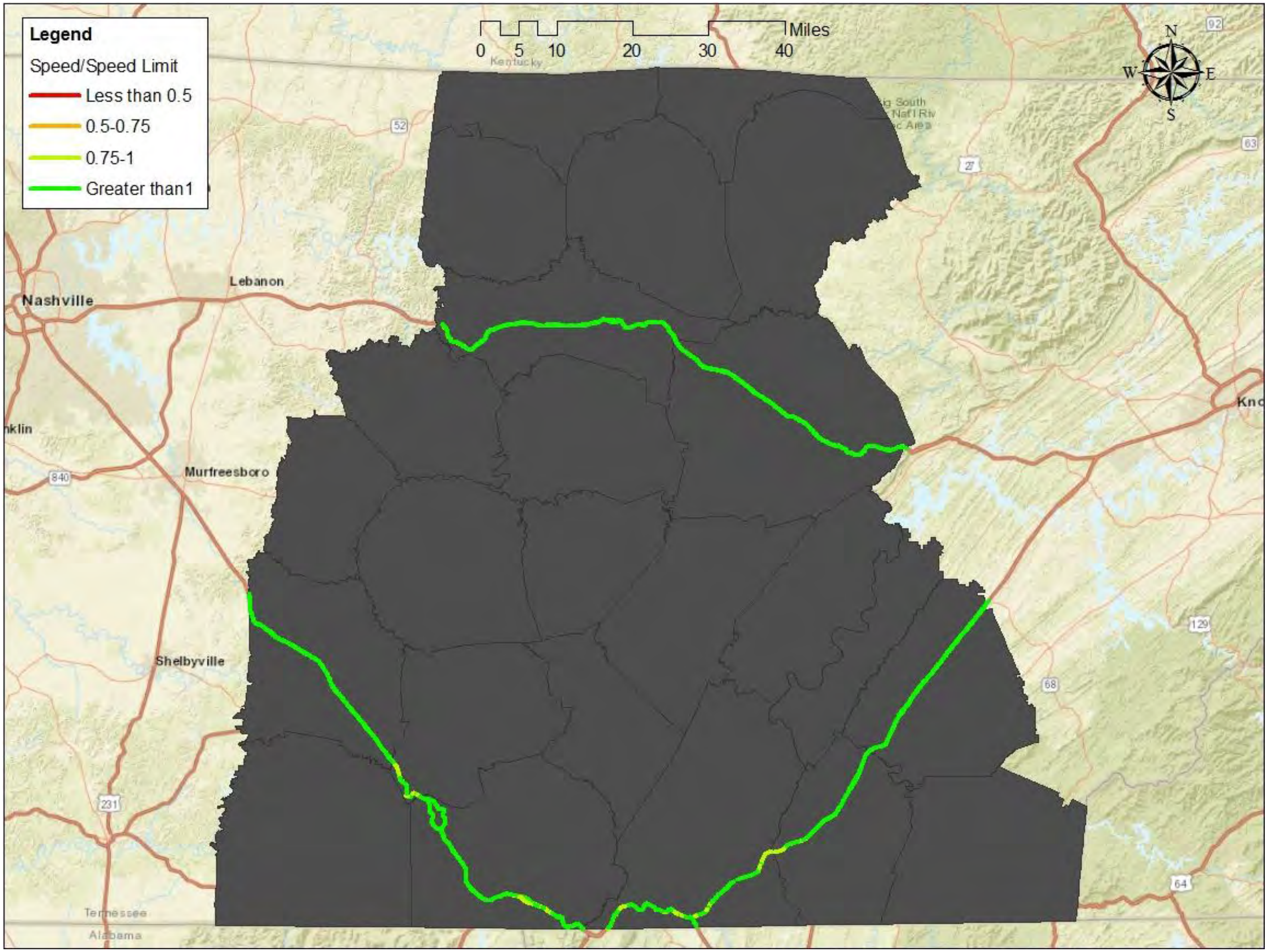


Figure Error! No text of specified style in document.**-18: Region 2 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for off-peak hours (6 pm-6 am)**

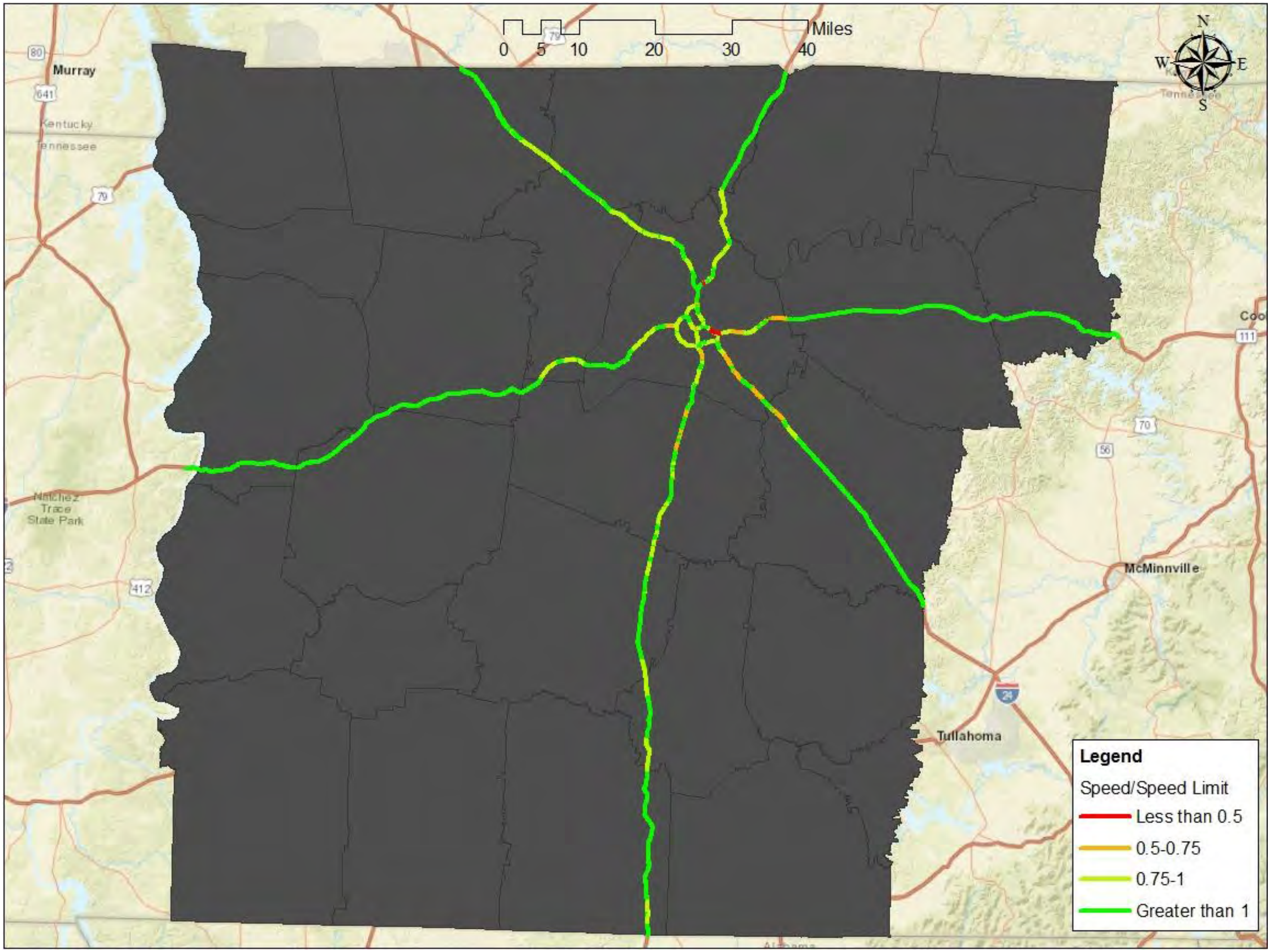


Figure Error! No text of specified style in document.**-19: Region 3 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for am peak hours (6-9 am)**

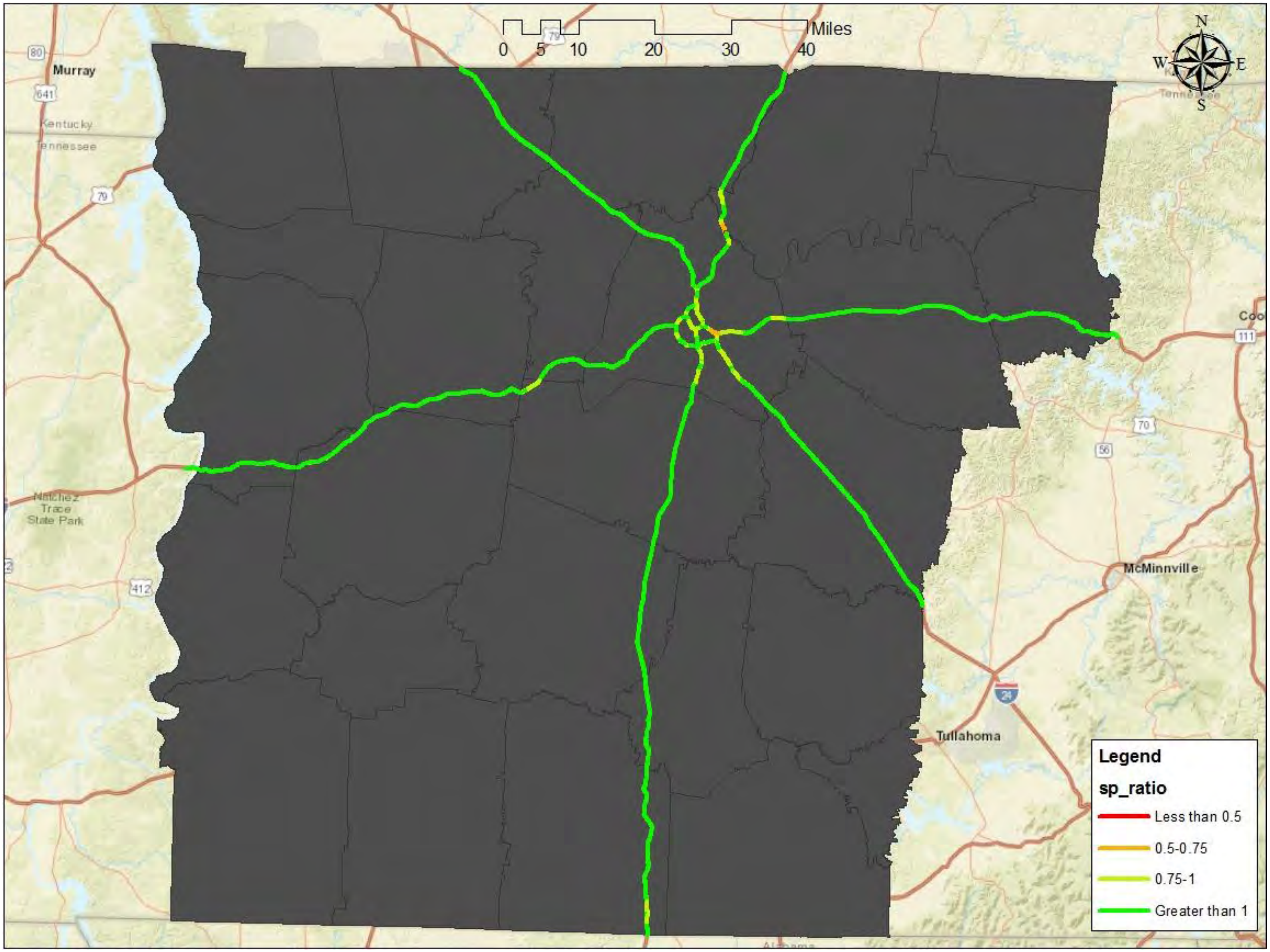


Figure Error! No text of specified style in document.**-20: Region 3 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for mid-day hours (9 am-2 pm)**

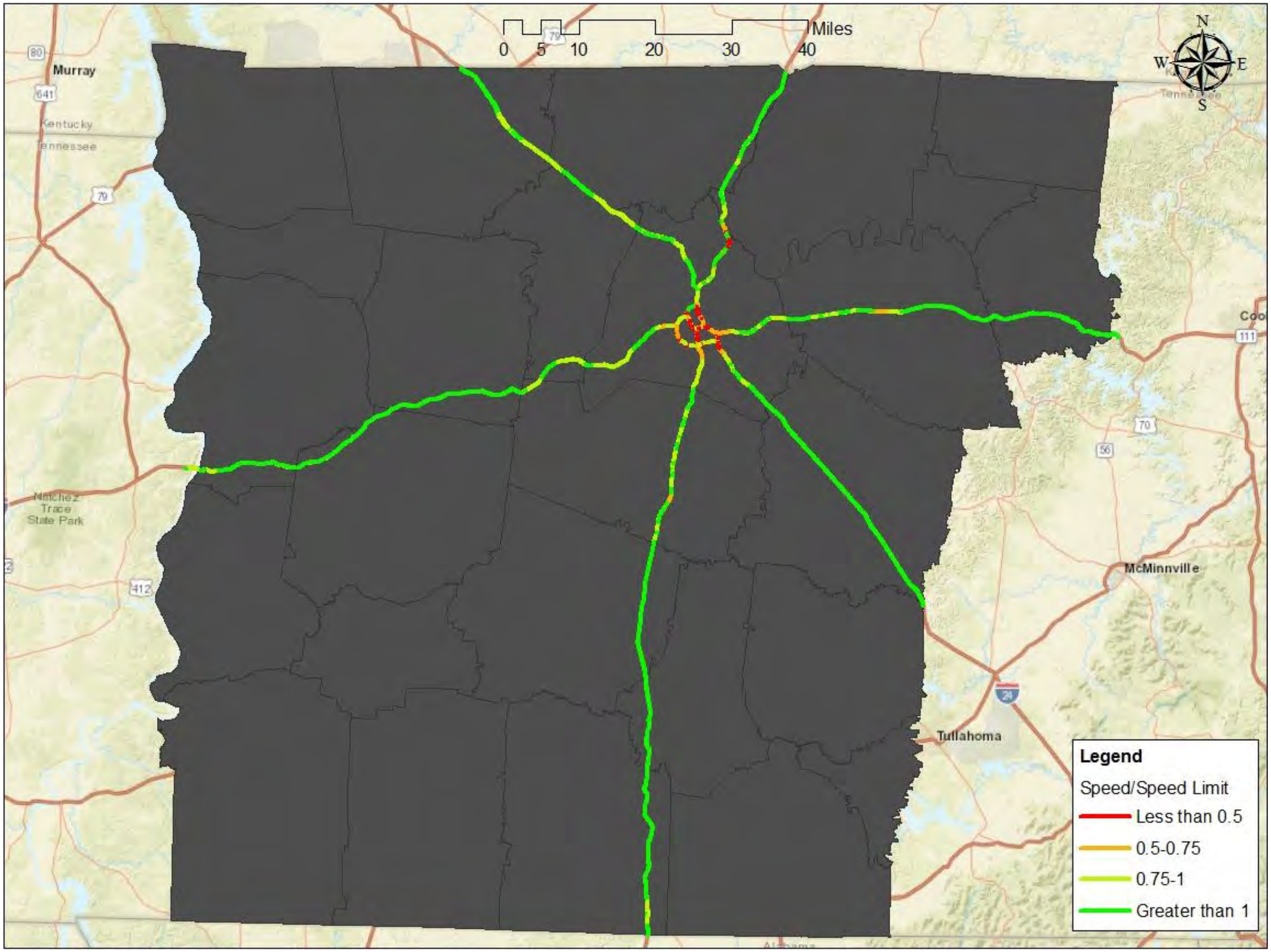


Figure Error! No text of specified style in document.**-21: Region 3 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for pm peak hours (2-6 pm)**

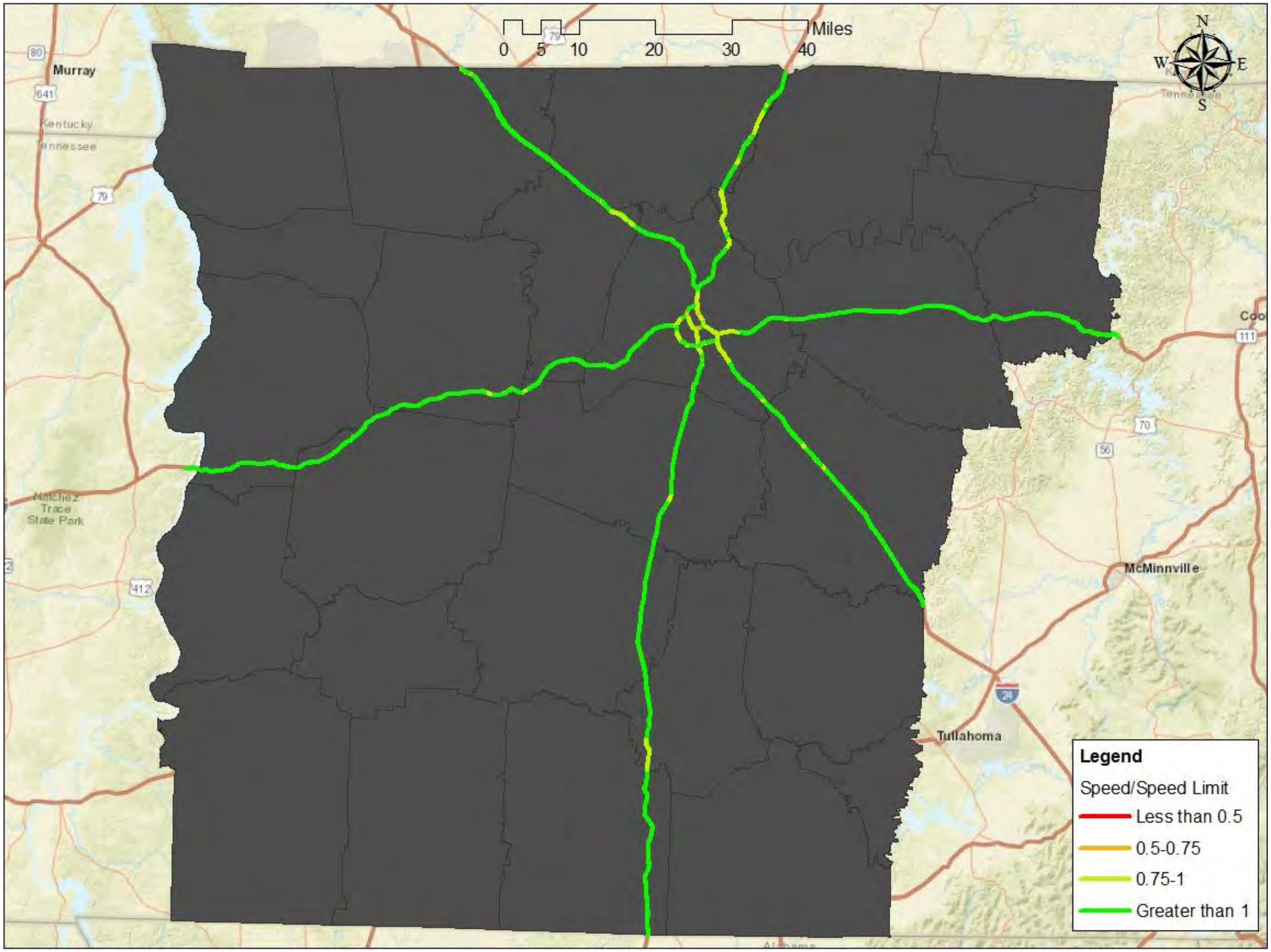


Figure Error! No text of specified style in document.**-22: Region 3 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for off-peak hours (6 pm-6 am)**

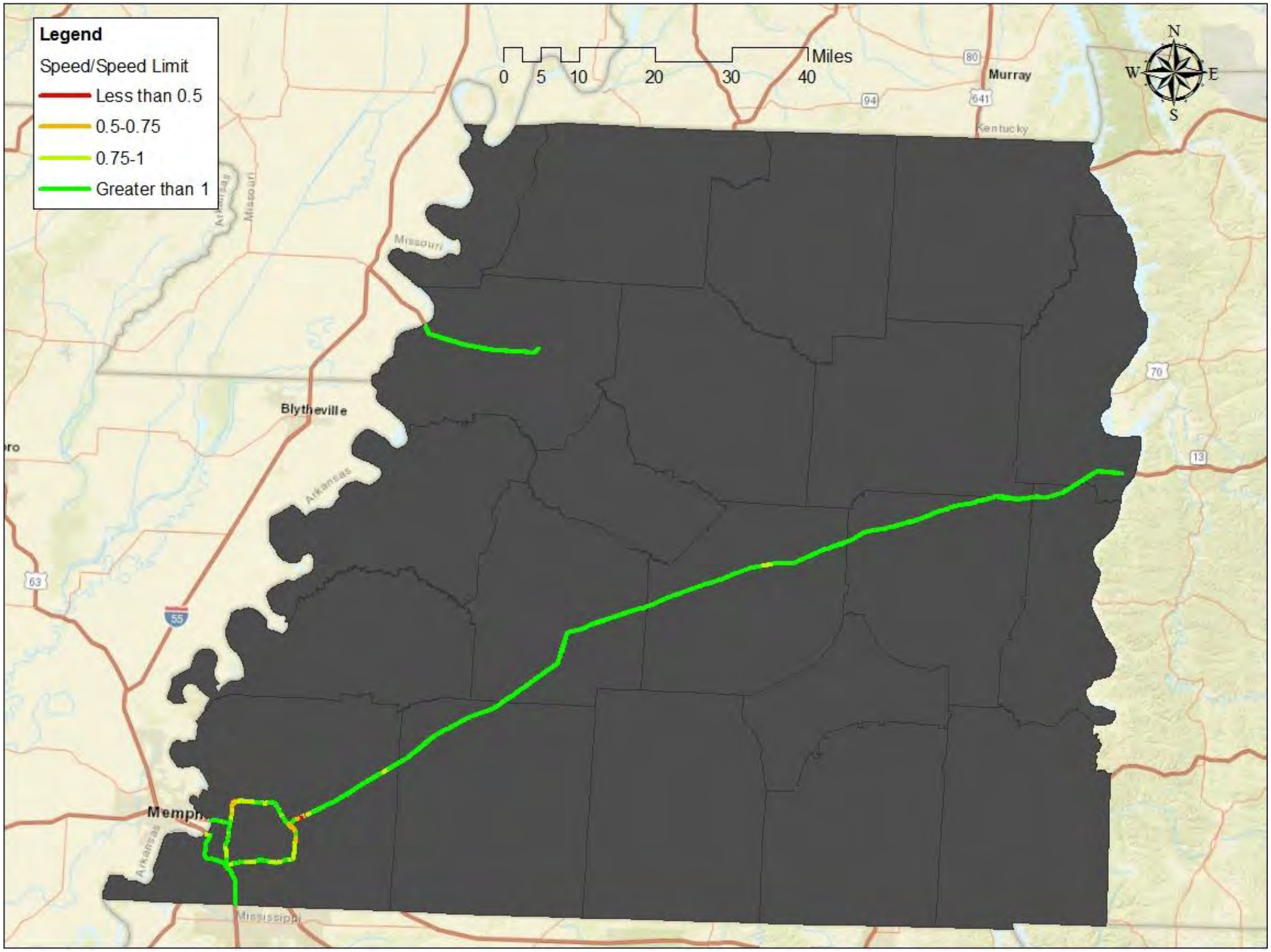


Figure Error! No text of specified style in document.**-23: Region 4 of Tennessee showing Speed to Speed Limit ratio in Interstates, for am peak hours (6-9 am)**

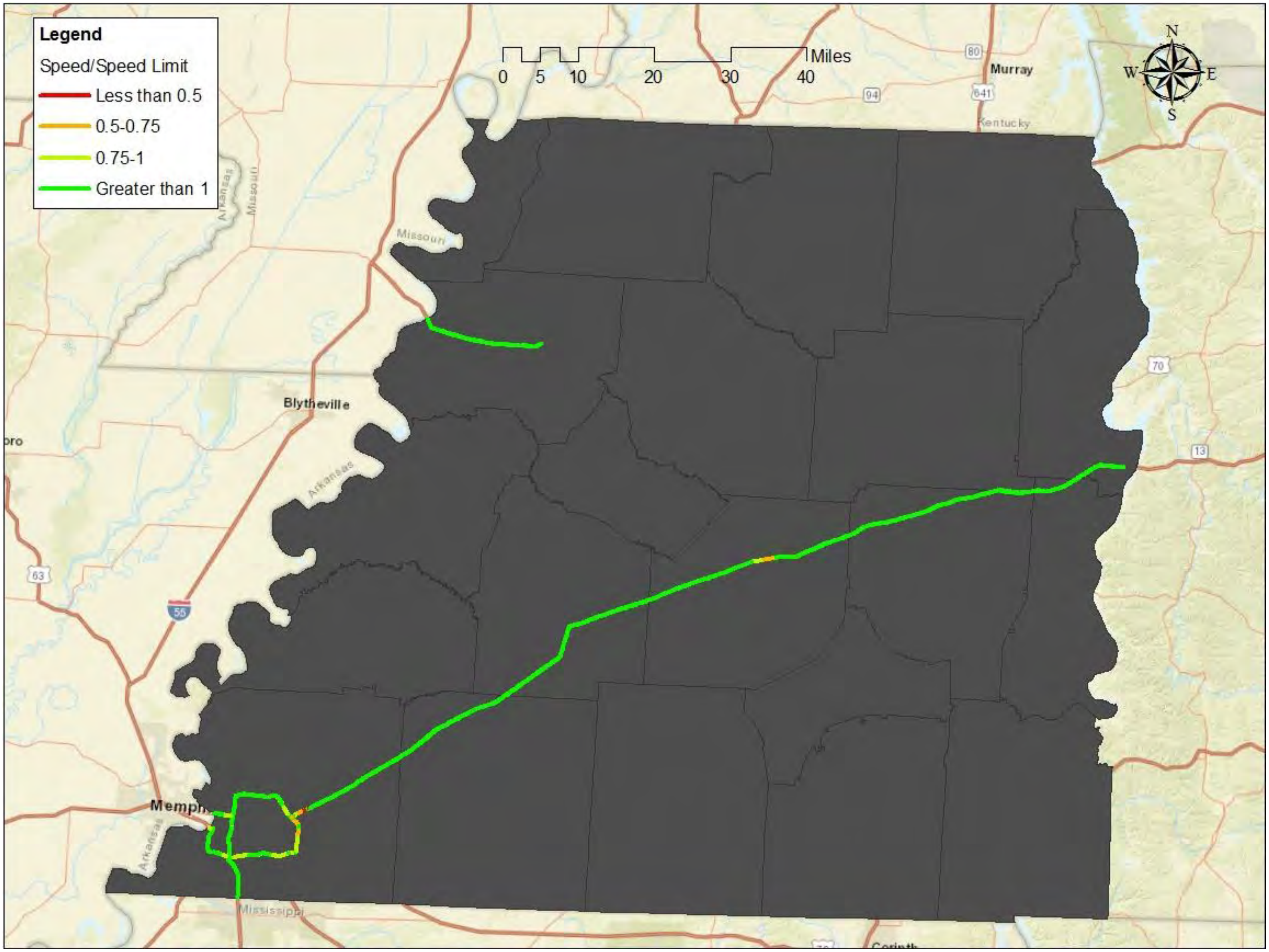


Figure Error! No text of specified style in document.**-24: Region 4 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for mid-day hours (9 am-2 pm)**

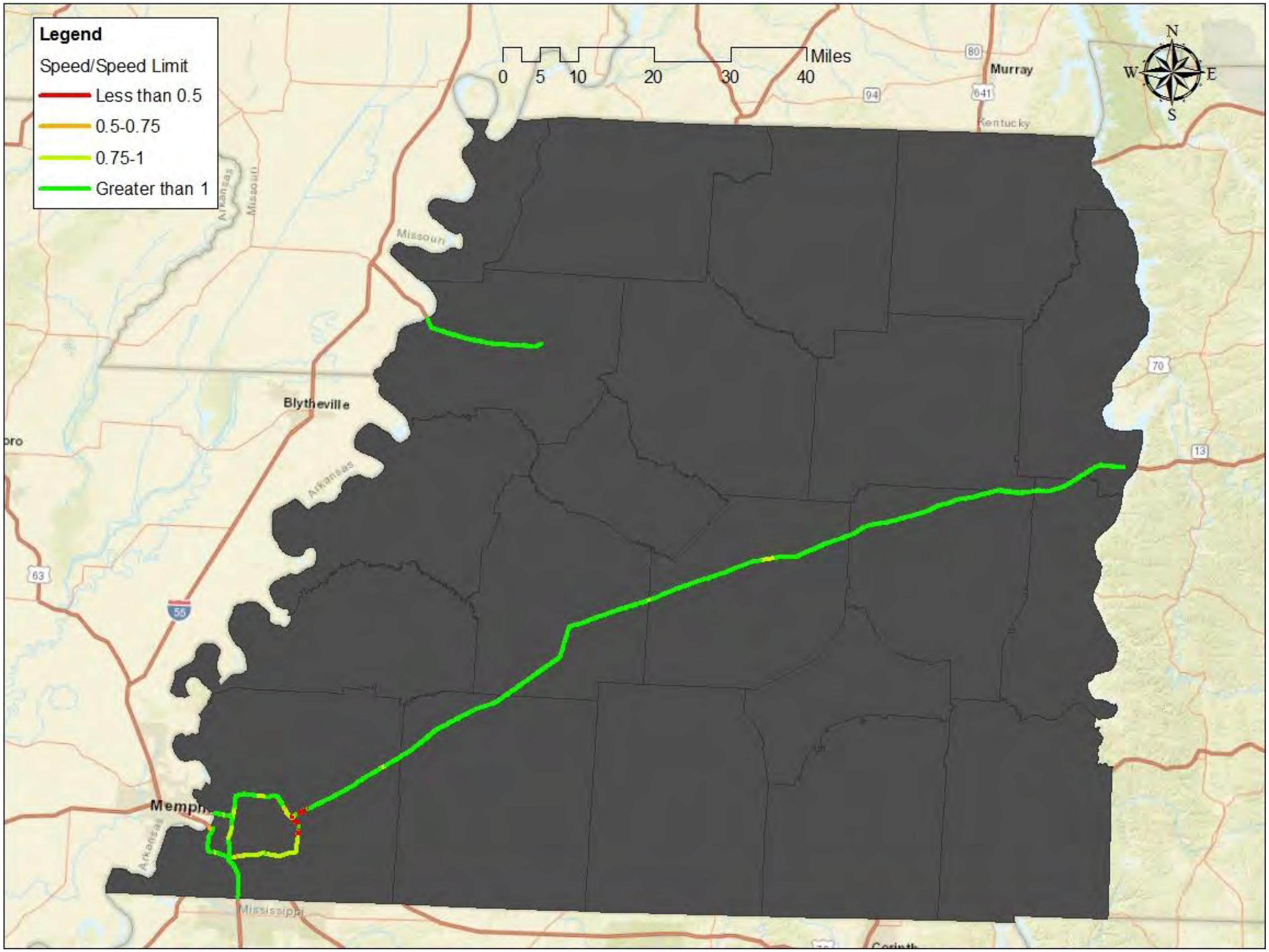


Figure Error! No text of specified style in document.**-25: Region 4 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for pm peak hours (2-6 pm)**

Figure Error! No text of specified style in document.**-26: Region 4 of Tennessee showing Speed to Speed-Limit ratio in Interstates, for off-peak hours (6 pm-6 am)**

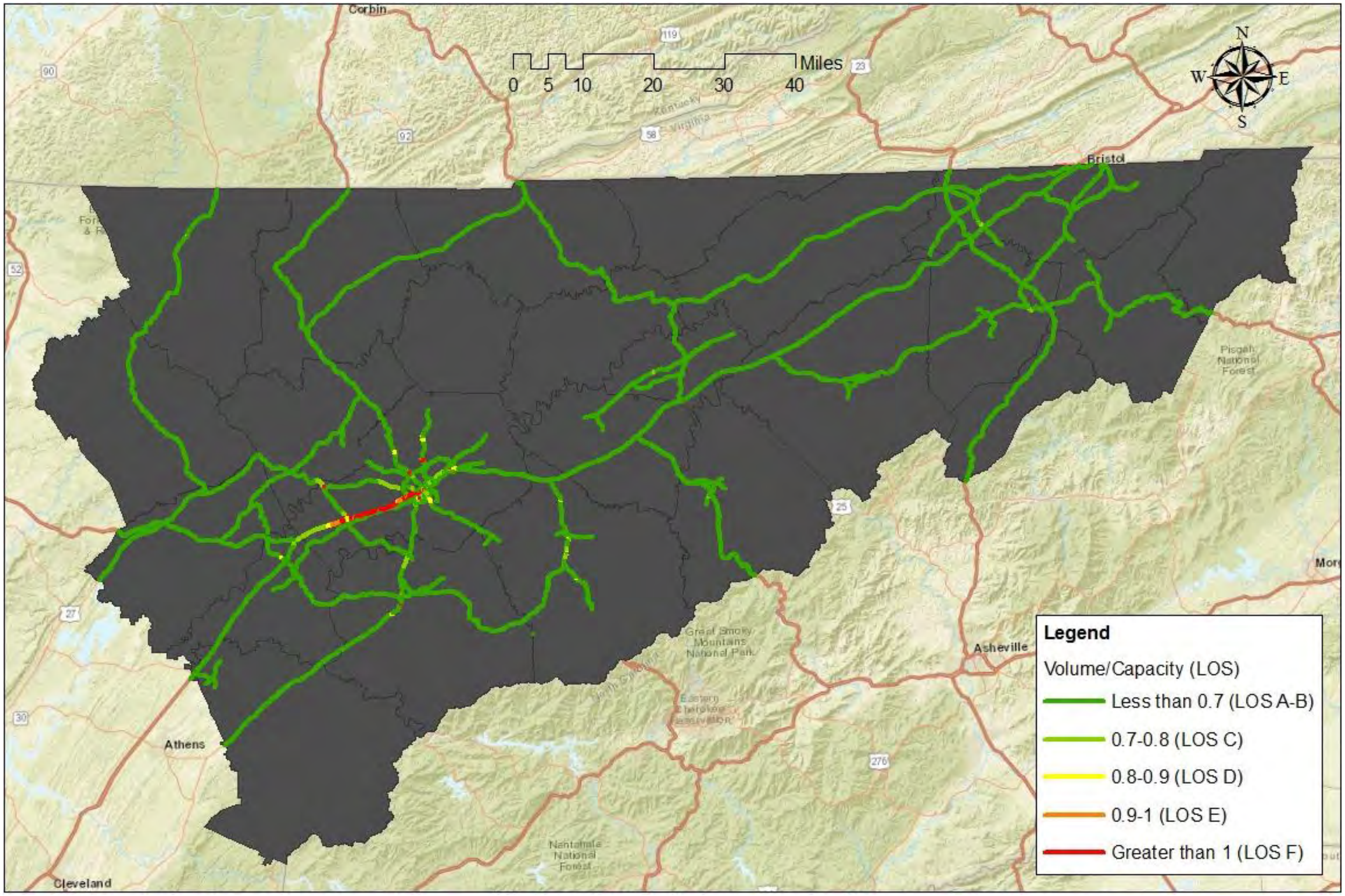


Figure Error! No text of specified style in document.**-27: Region 1 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2010**

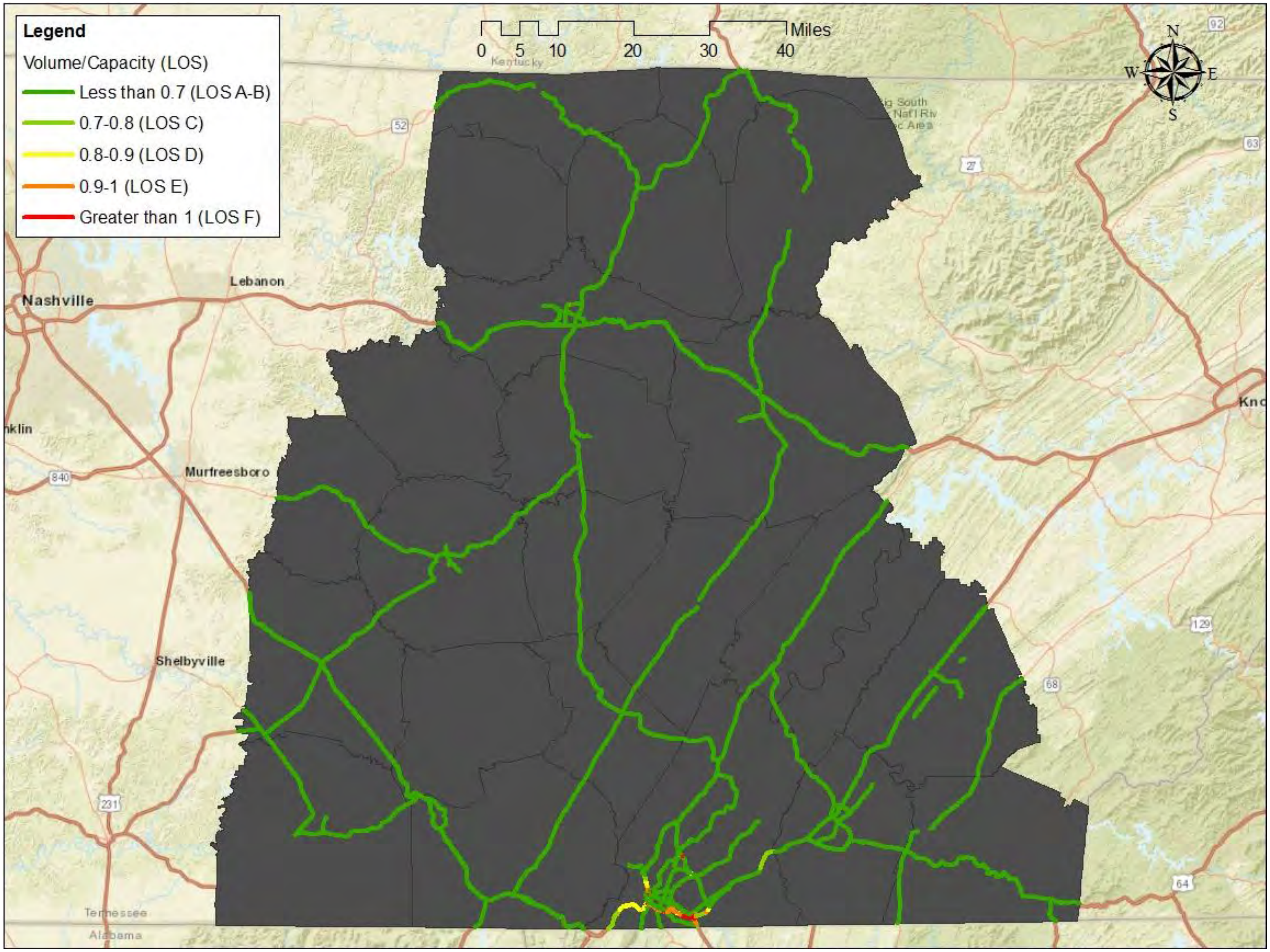


Figure Error! No text of specified style in document.**-28: Region 2 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2010**

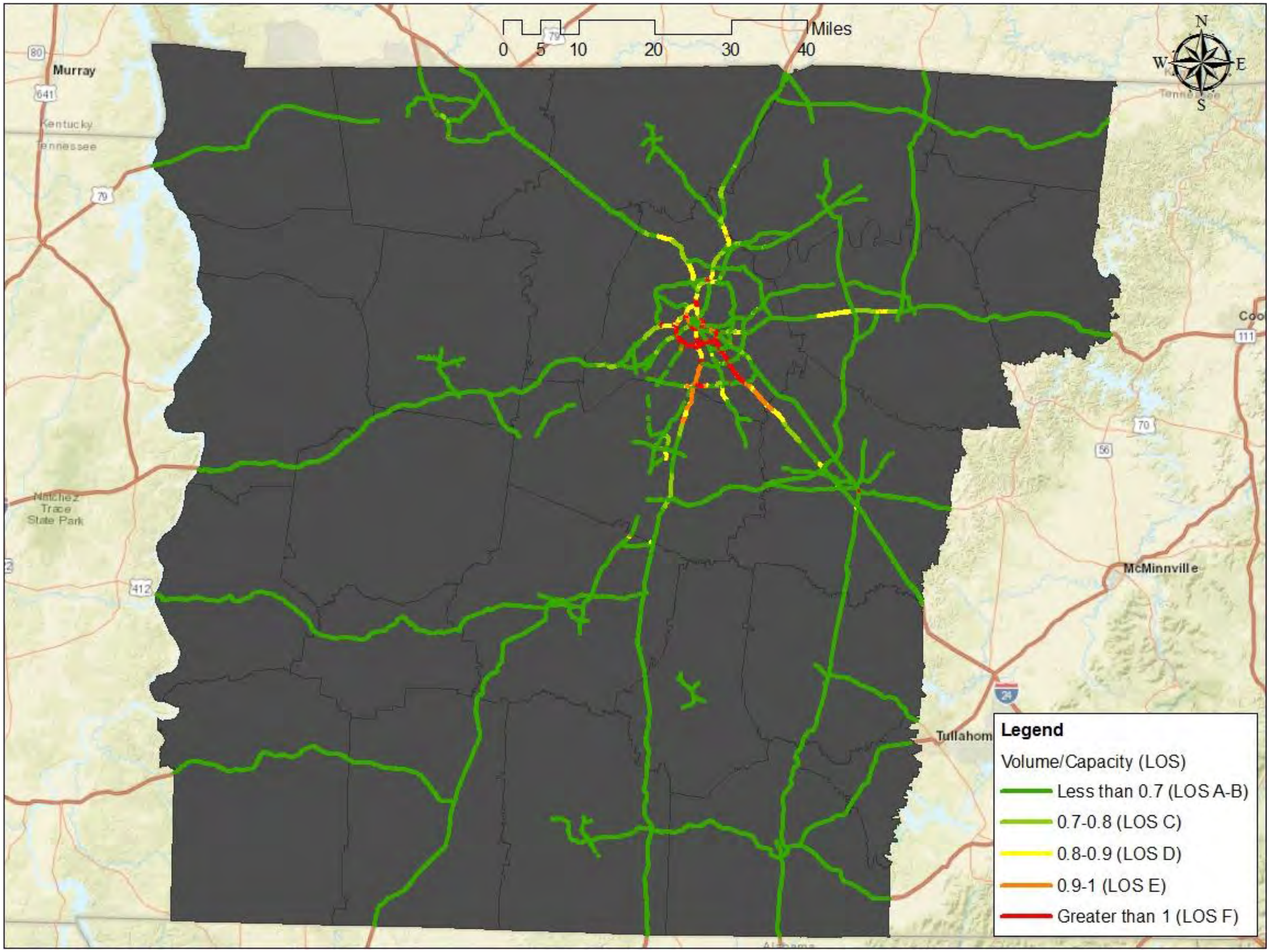


Figure Error! No text of specified style in document.**-29: Region 3 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2010**

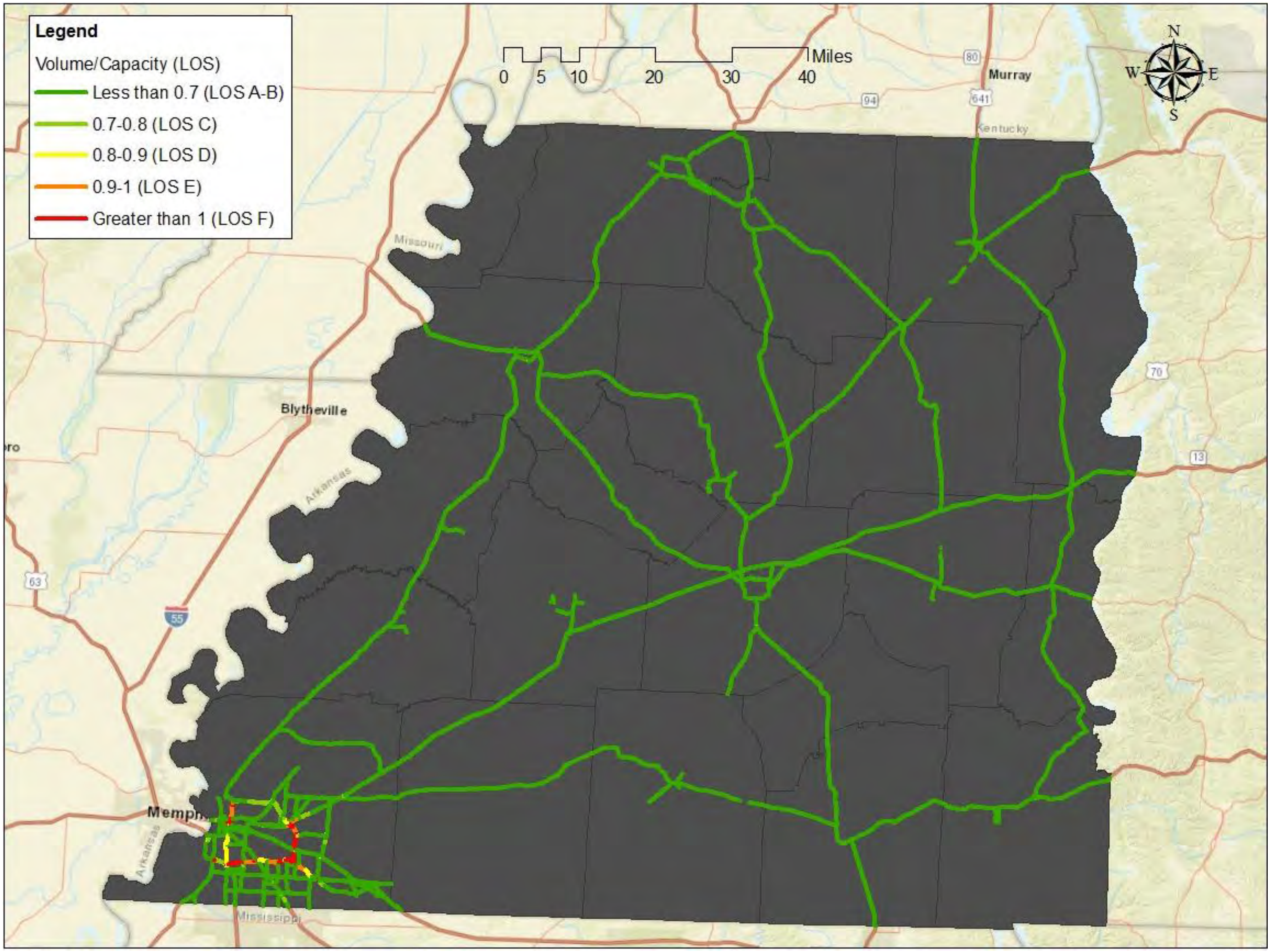


Figure Error! No text of specified style in document.**-30: Region 4 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2010**

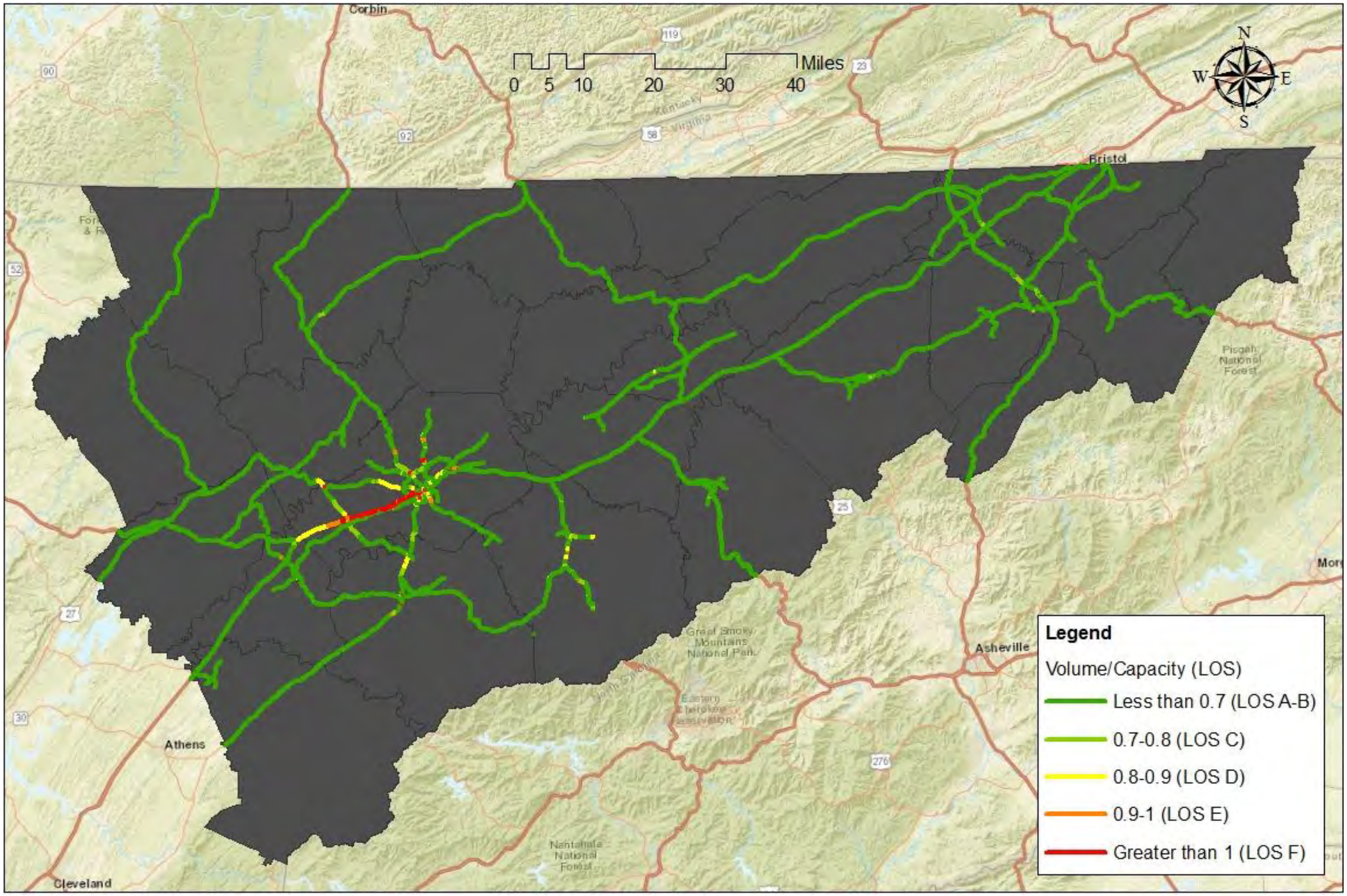


Figure Error! No text of specified style in document.**-31: Region 1 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2020**

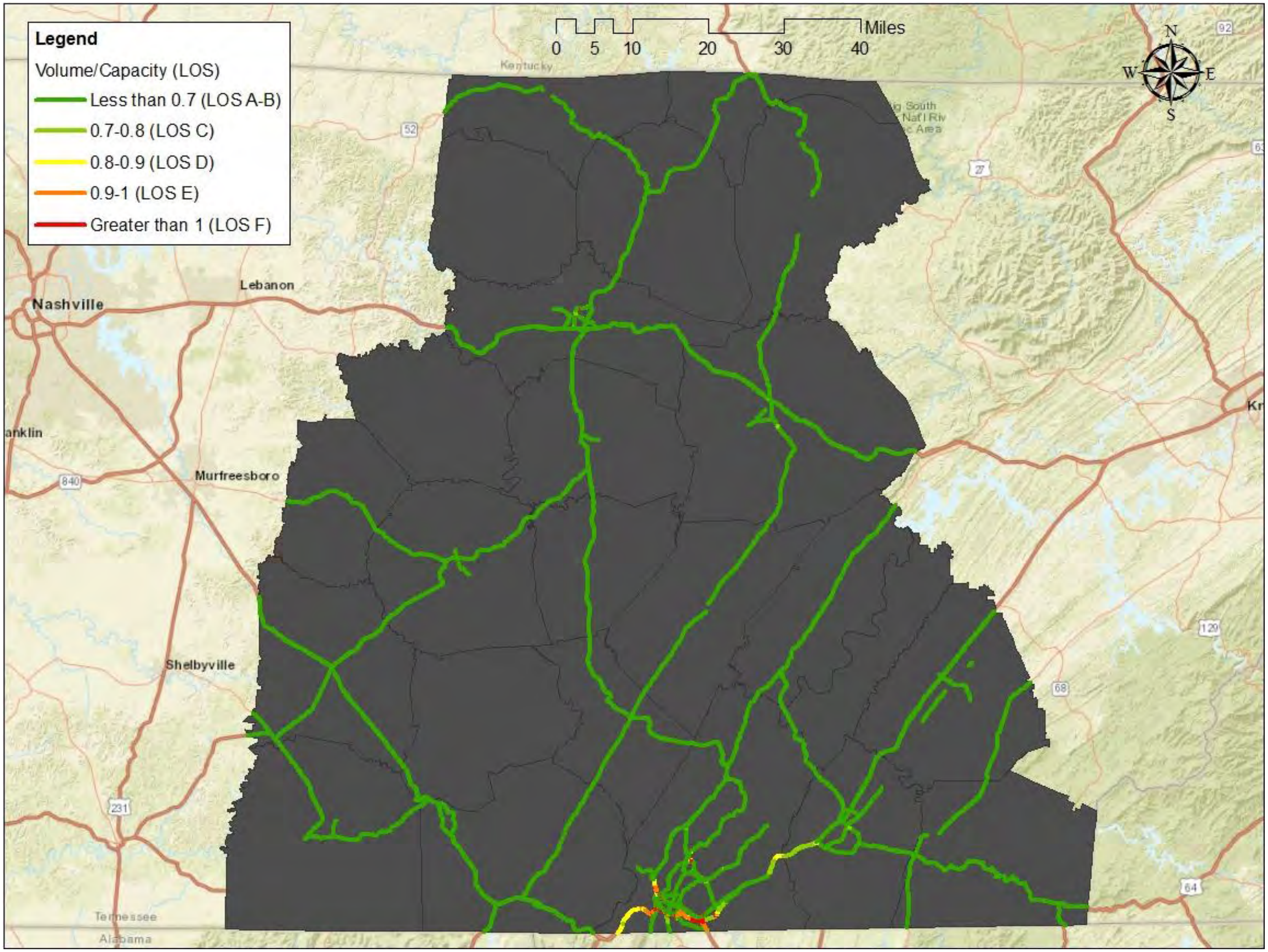


Figure Error! No text of specified style in document.**-32: Region 2 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2020**

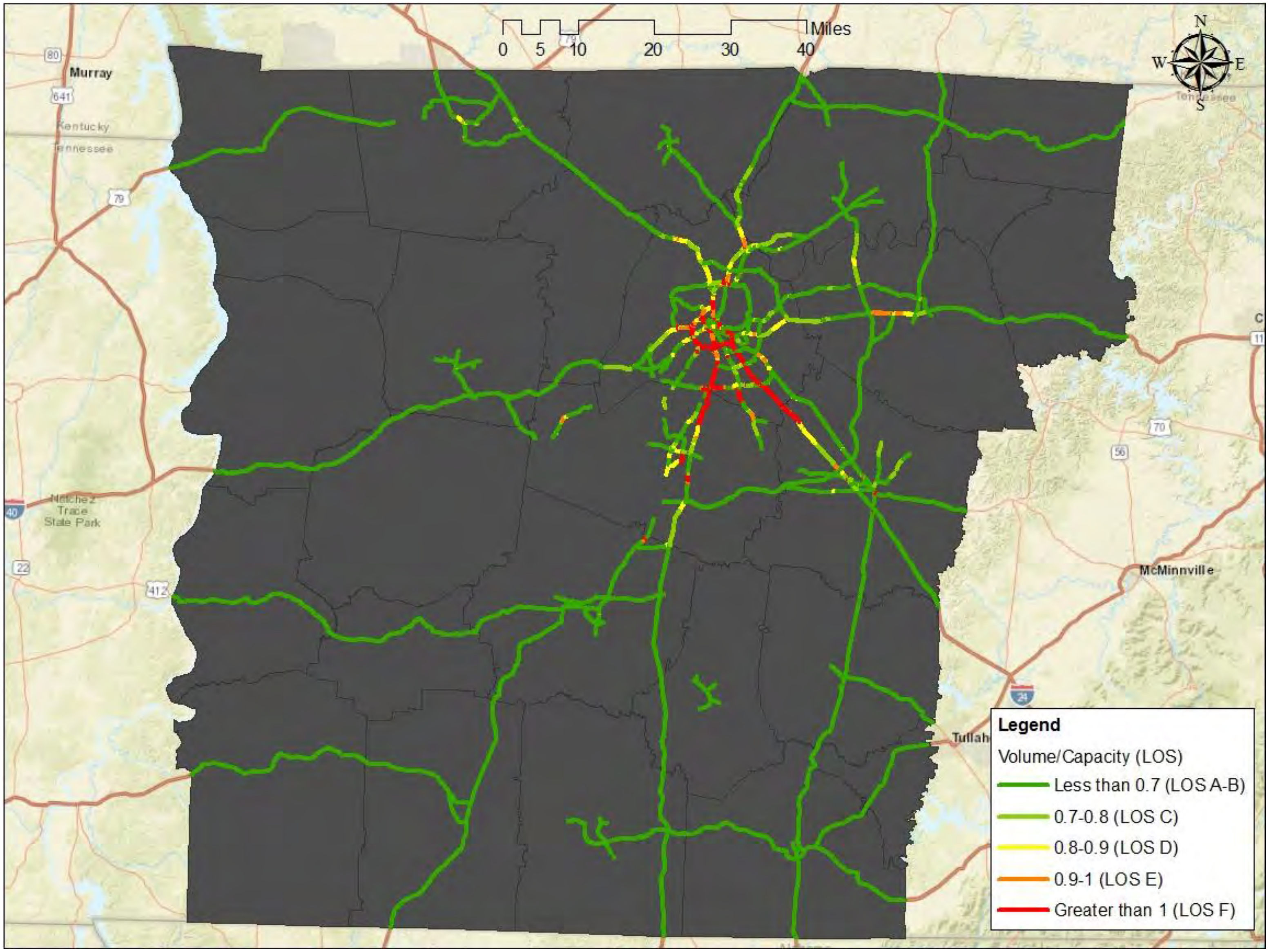


Figure Error! No text of specified style in document.**-33: Region 3 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2020**

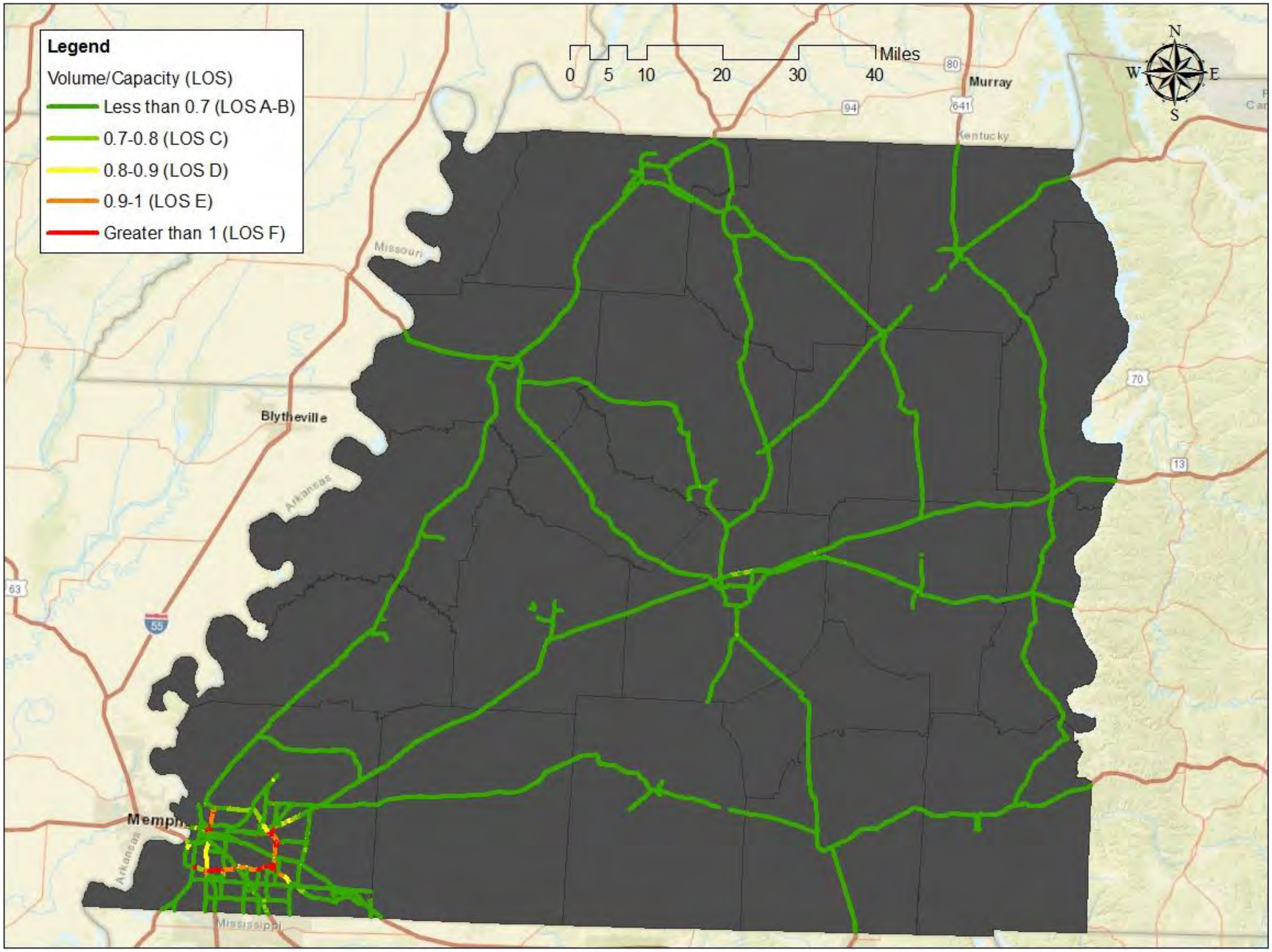


Figure Error! No text of specified style in document.**-34: Region 4 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2020**

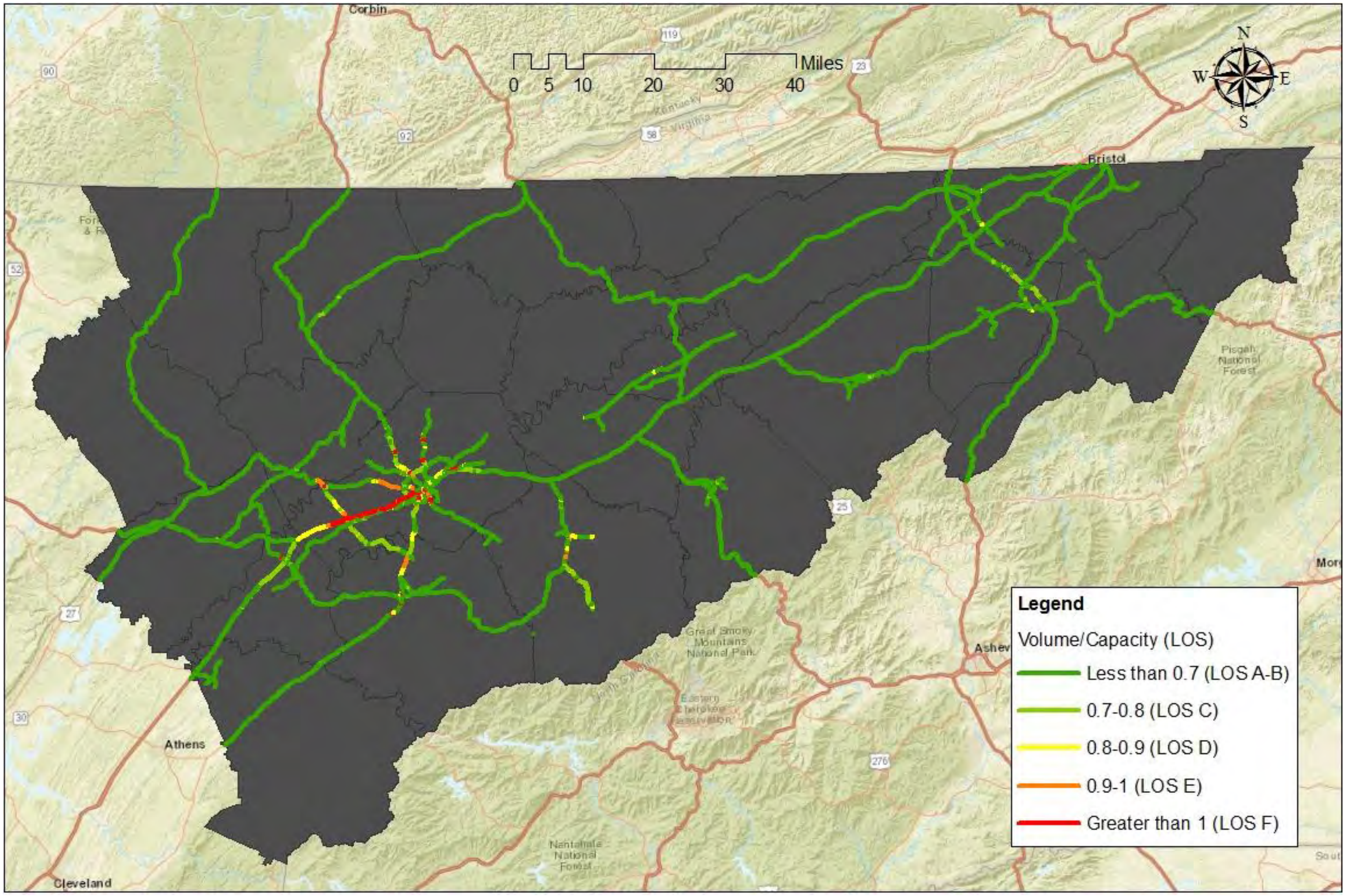


Figure Error! No text of specified style in document.**-35: Region 1 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2030**

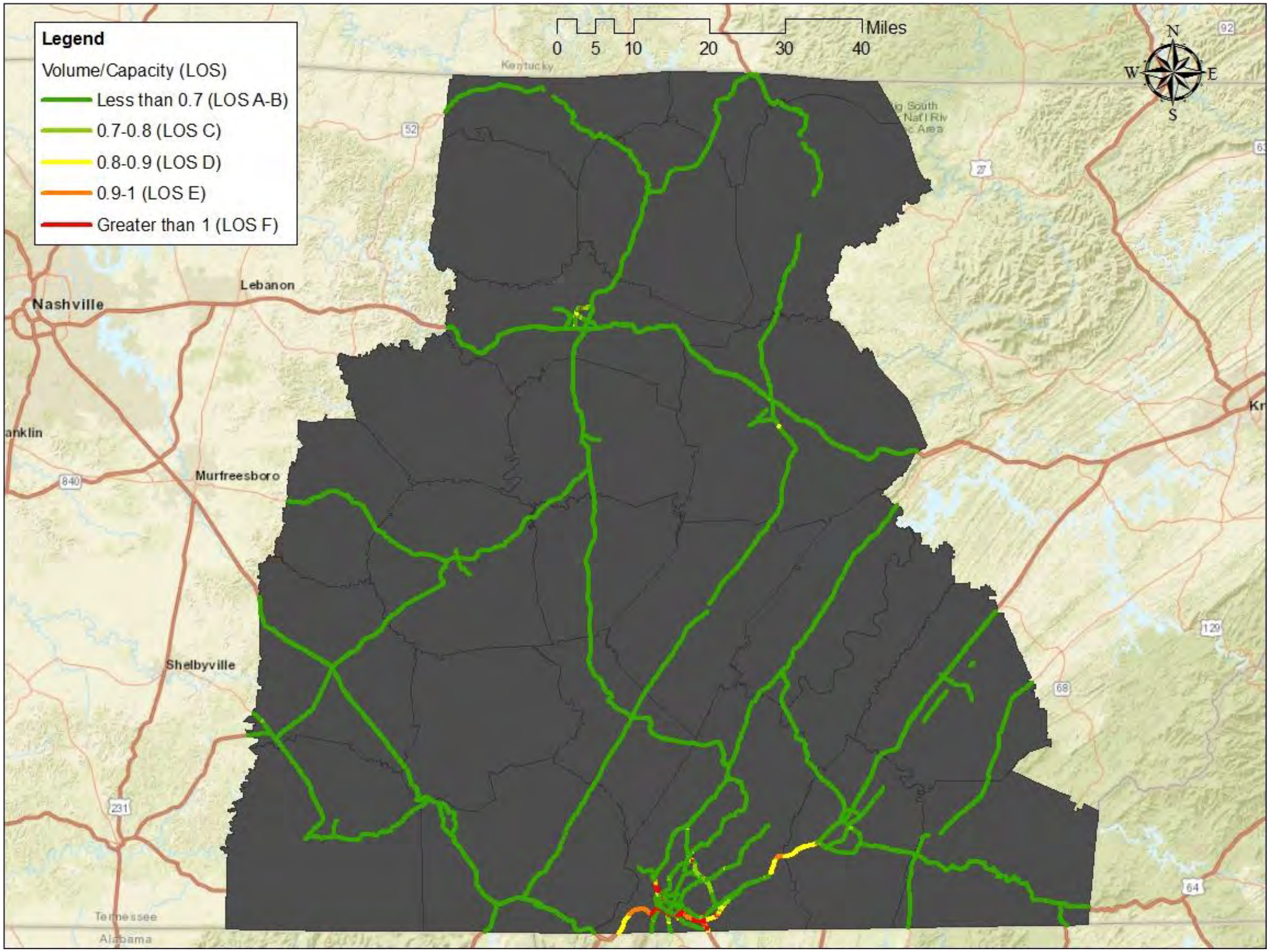


Figure Error! No text of specified style in document.**-36: Region 2 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2030**

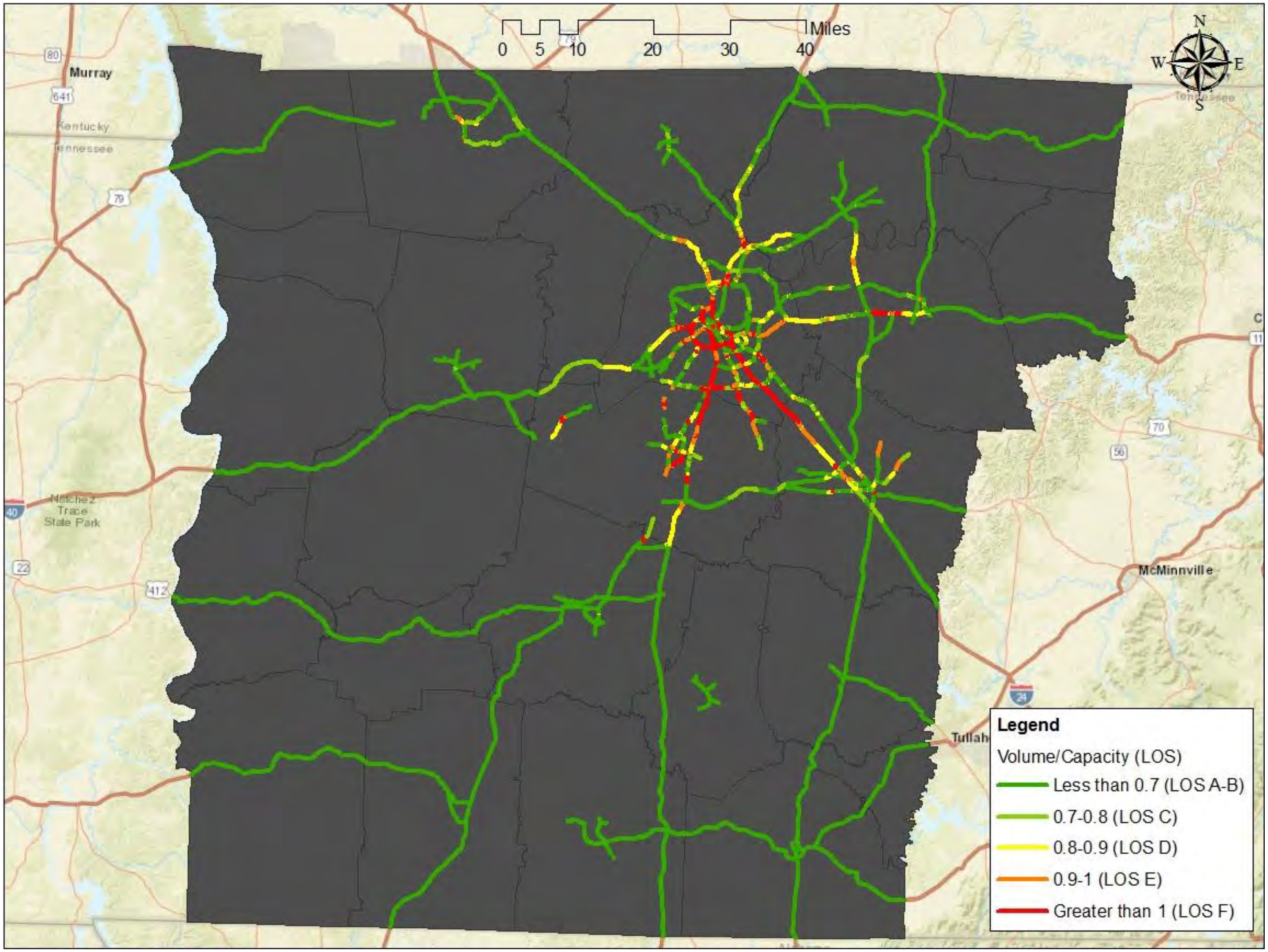


Figure Error! No text of specified style in document.**-37: Region 3 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2030**

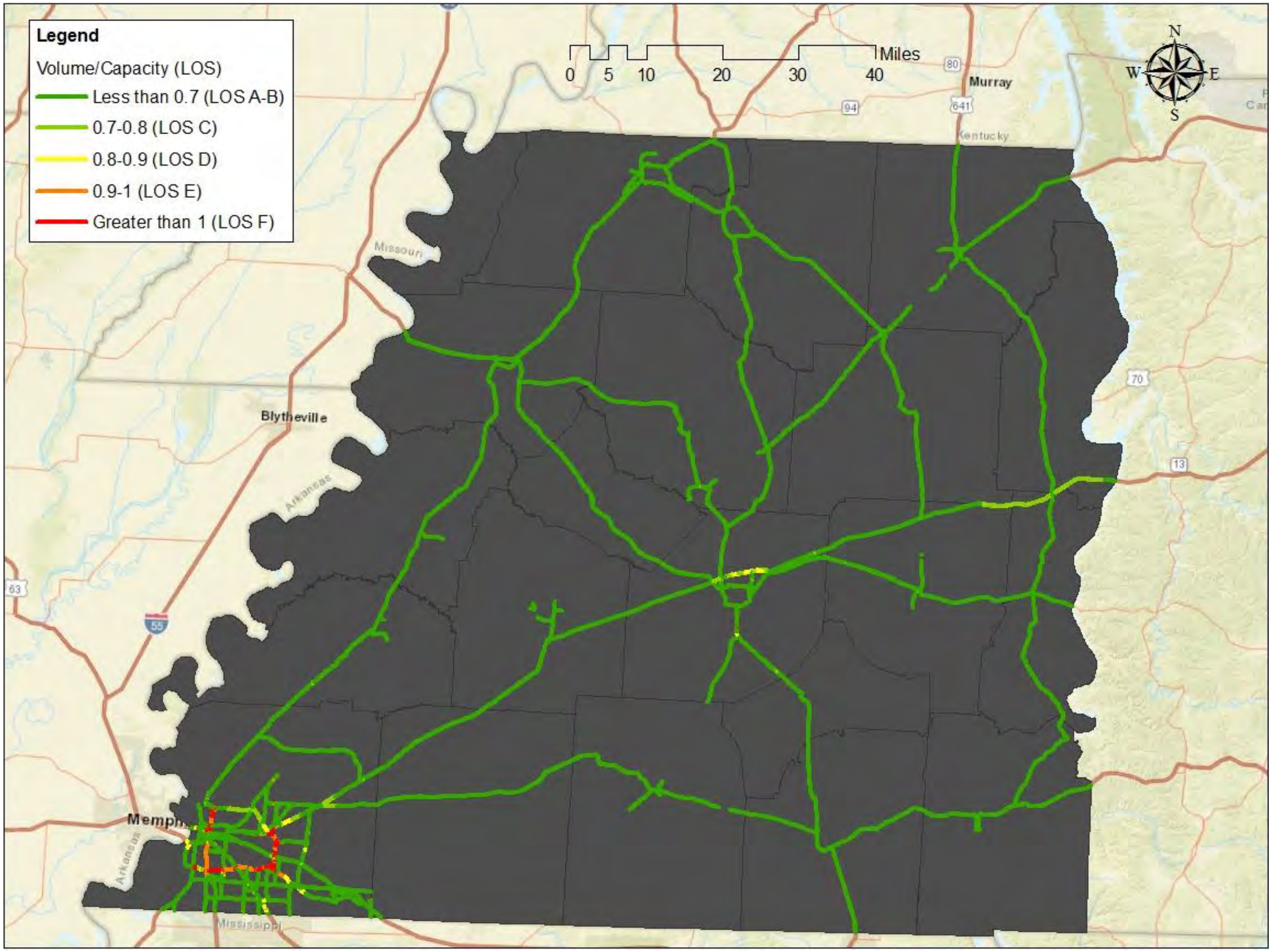


Figure Error! No text of specified style in document.**-38: Region 4 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2030**

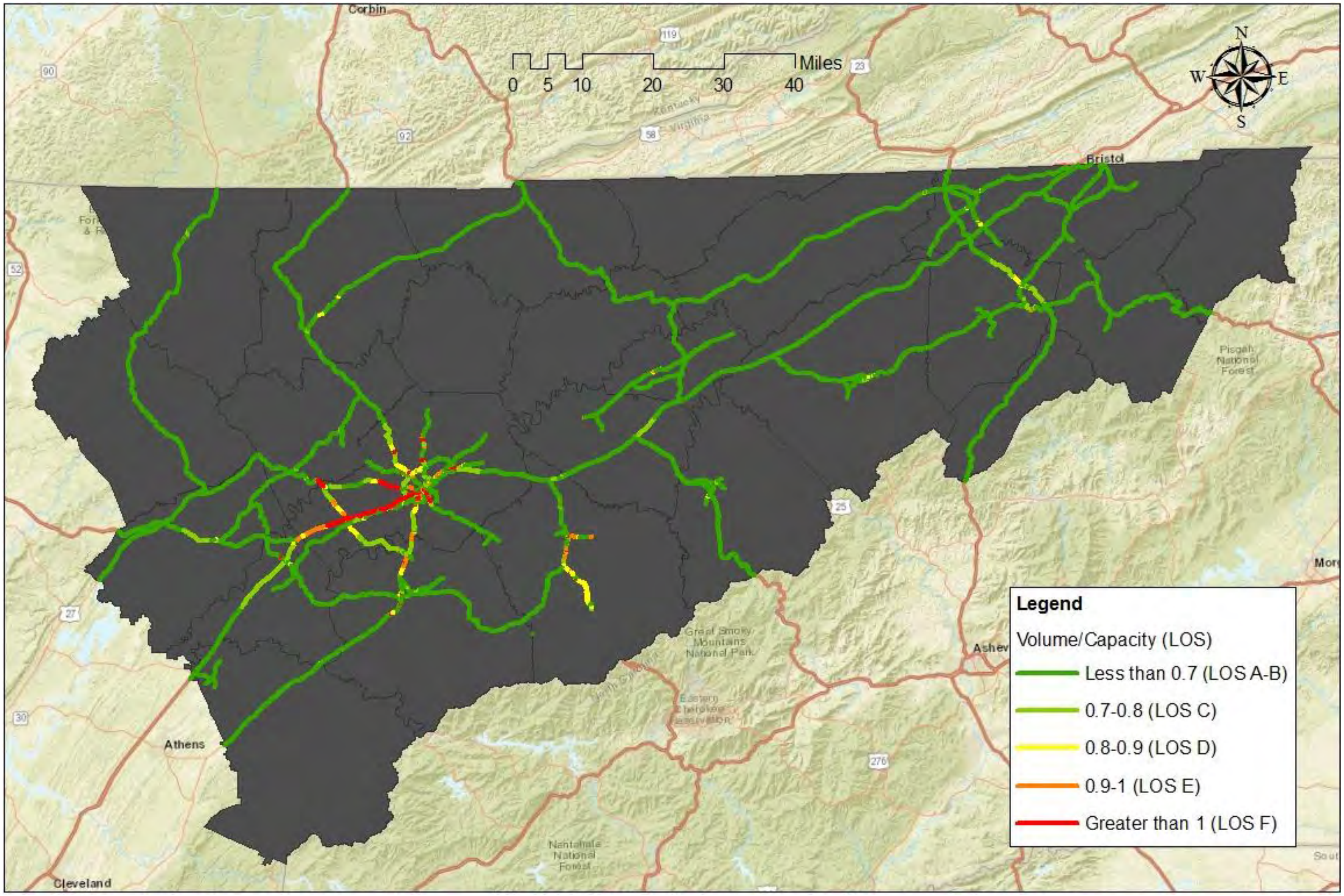


Figure Error! No text of specified style in document.**-39: Region 1 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2040**

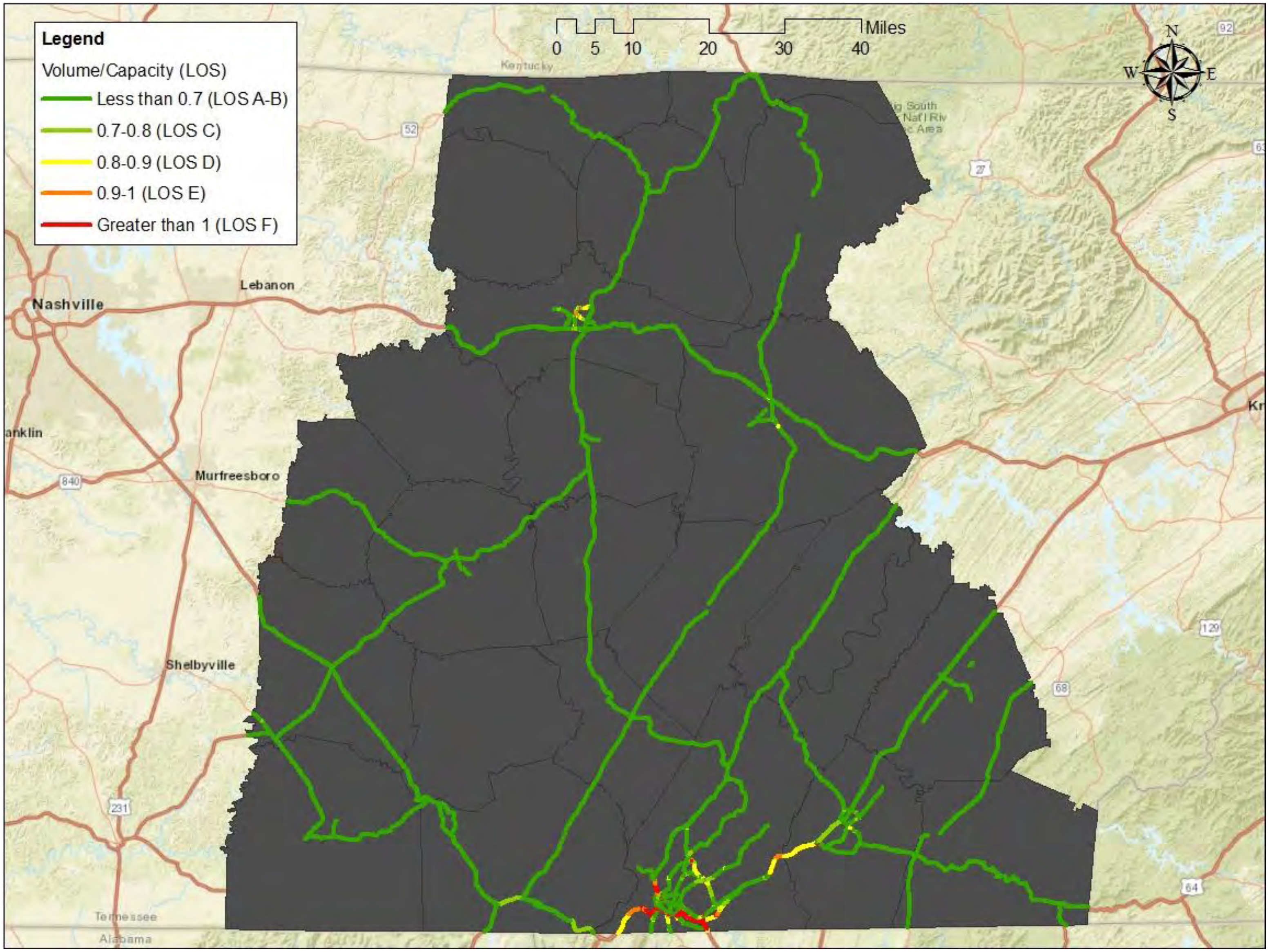


Figure Error! No text of specified style in document.**-40: Region 2 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2040**

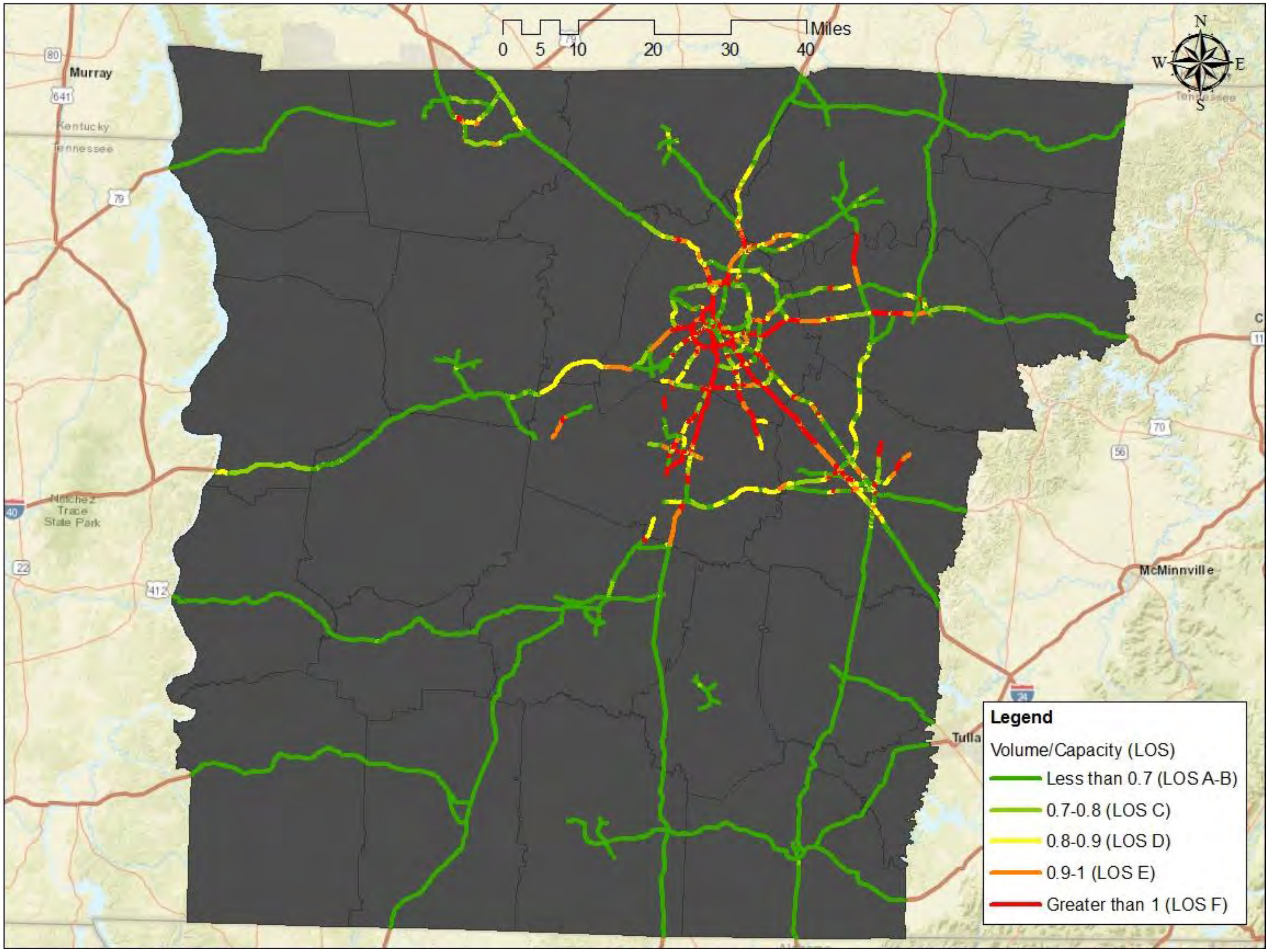


Figure Error! No text of specified style in document.**-41: Region 3 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2040**

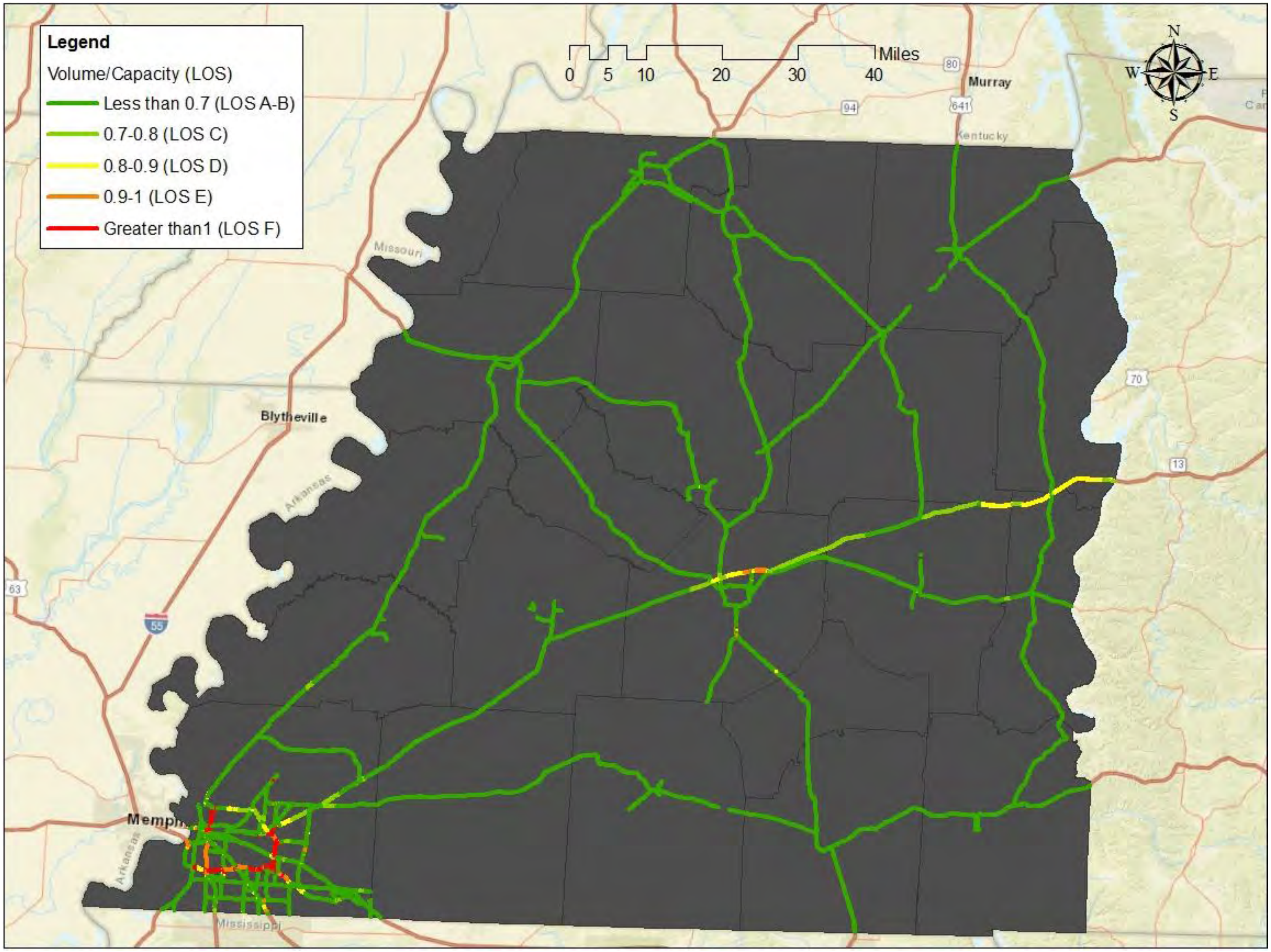


Figure Error! No text of specified style in document.**-42: Region 4 of Tennessee showing Volume to Capacity Ratio (V/C) for major arterials, including interstates, expressways, and principal arterials, in 2040**

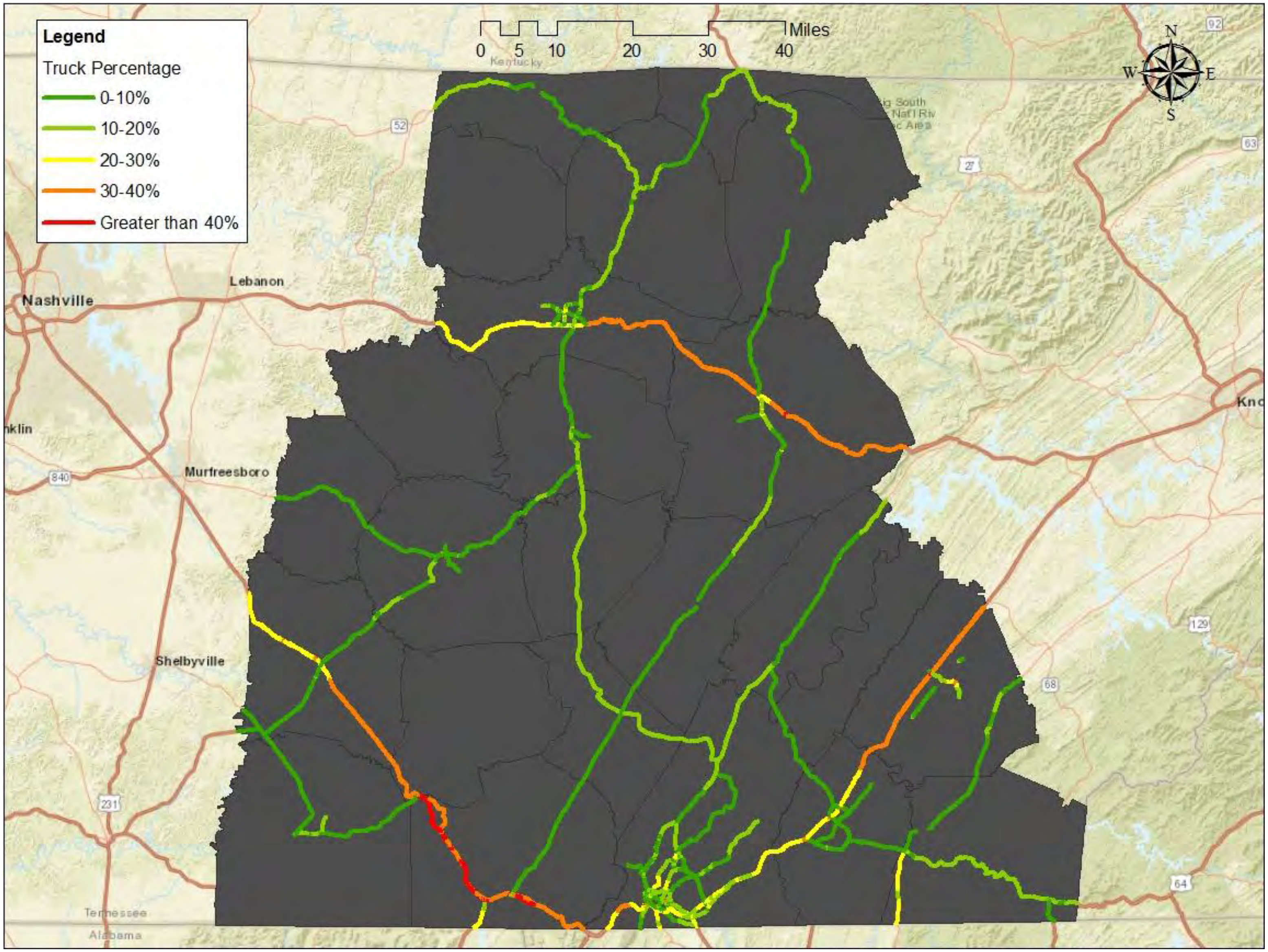


Figure Error! No text of specified style in document.**-43: Region 2 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2010**

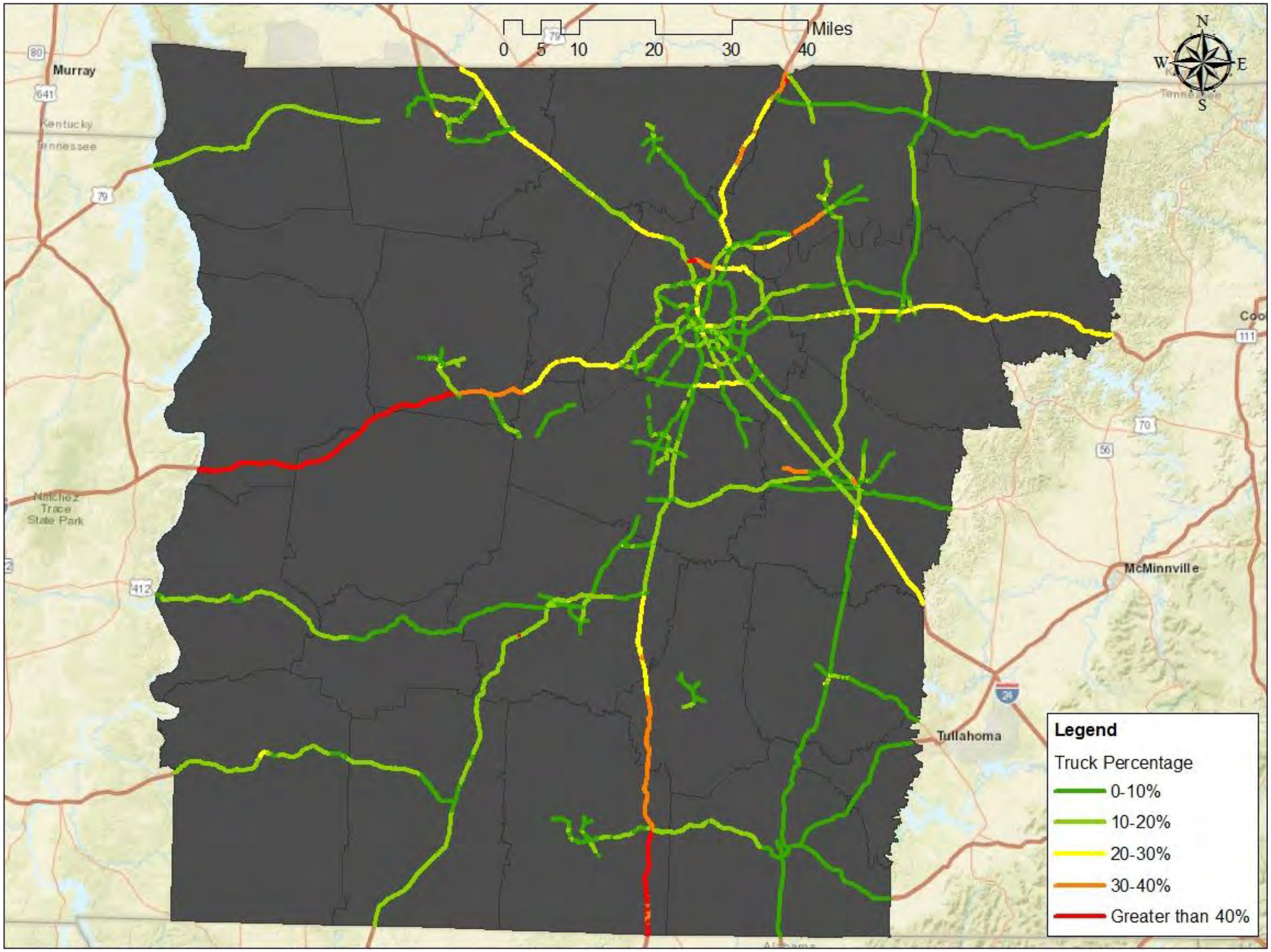


Figure Error! No text of specified style in document.**-44: Region 3 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2010**

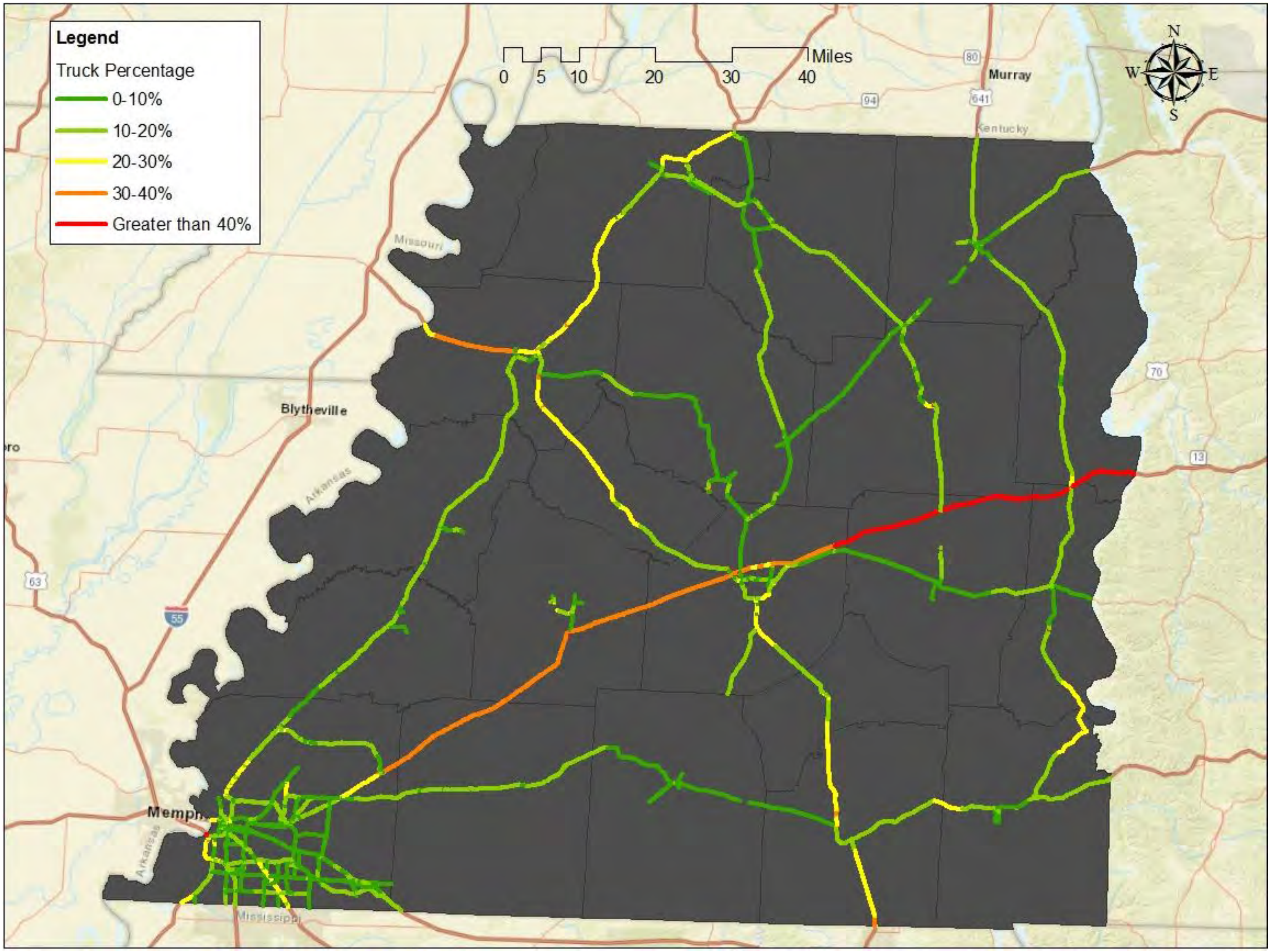


Figure Error! No text of specified style in document.**-45: Region 4 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2010**

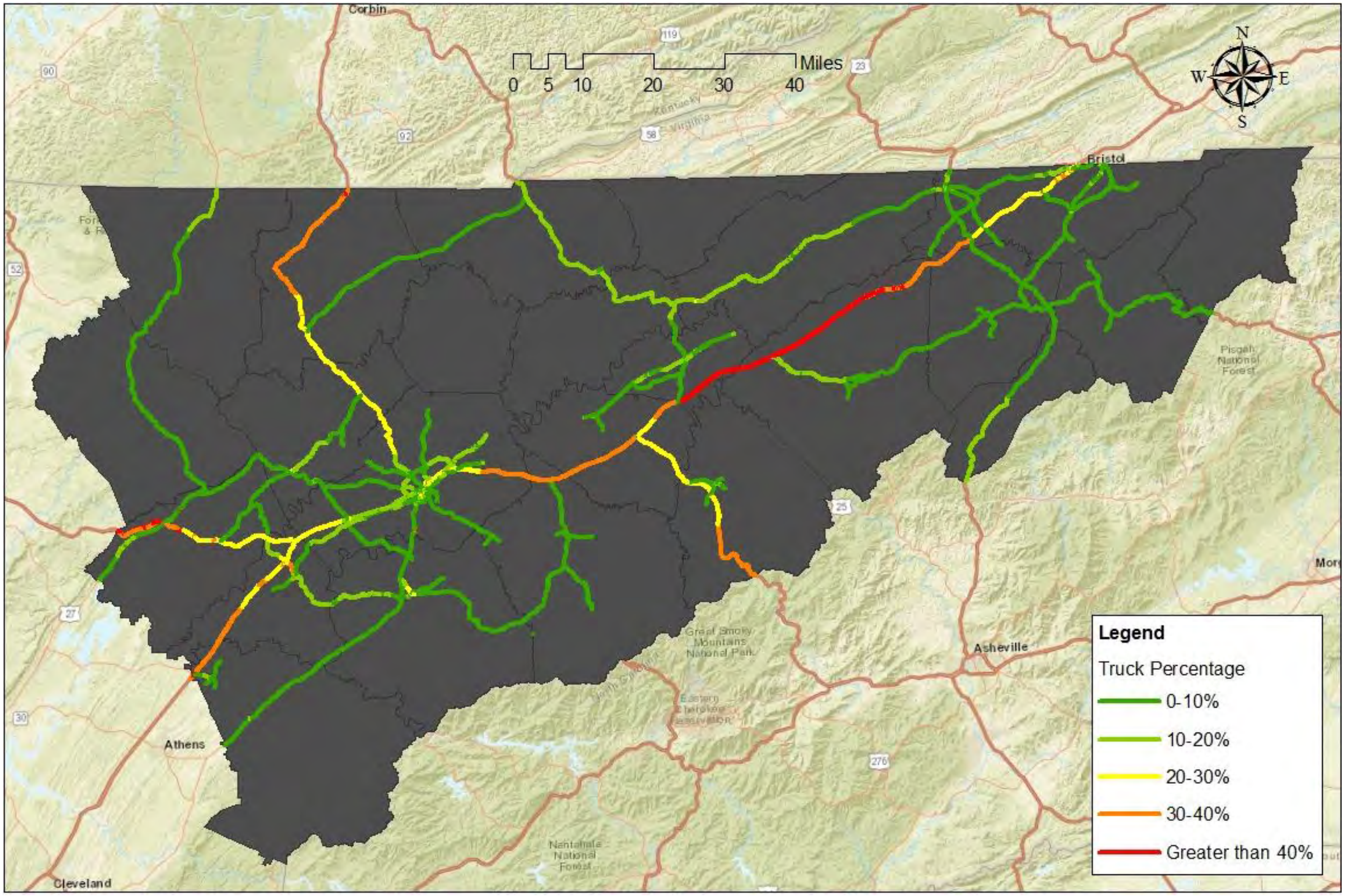


Figure Error! No text of specified style in document.**-46: Region 2 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2020**

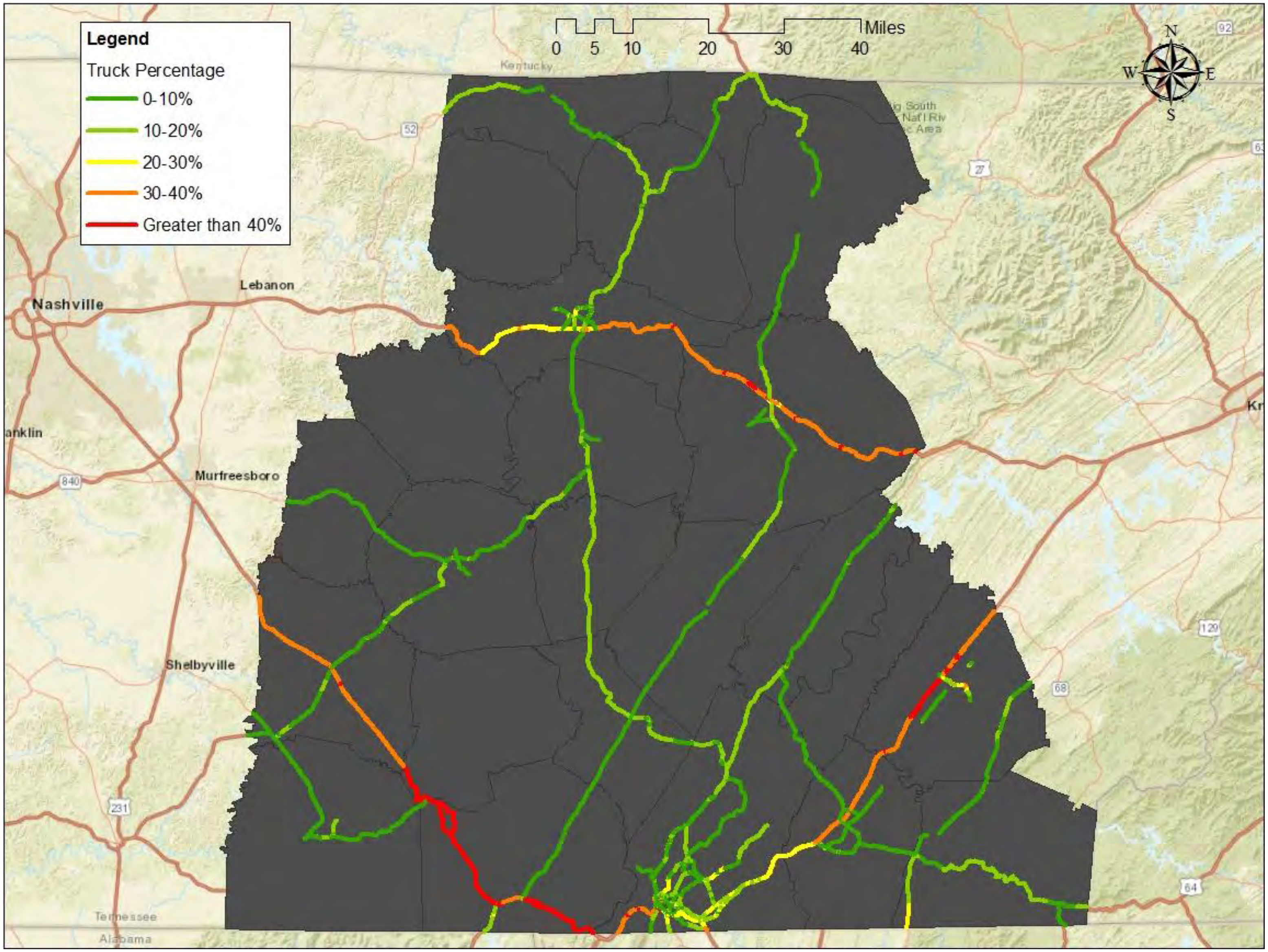


Figure Error! No text of specified style in document.**-47: Region 2 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2020**

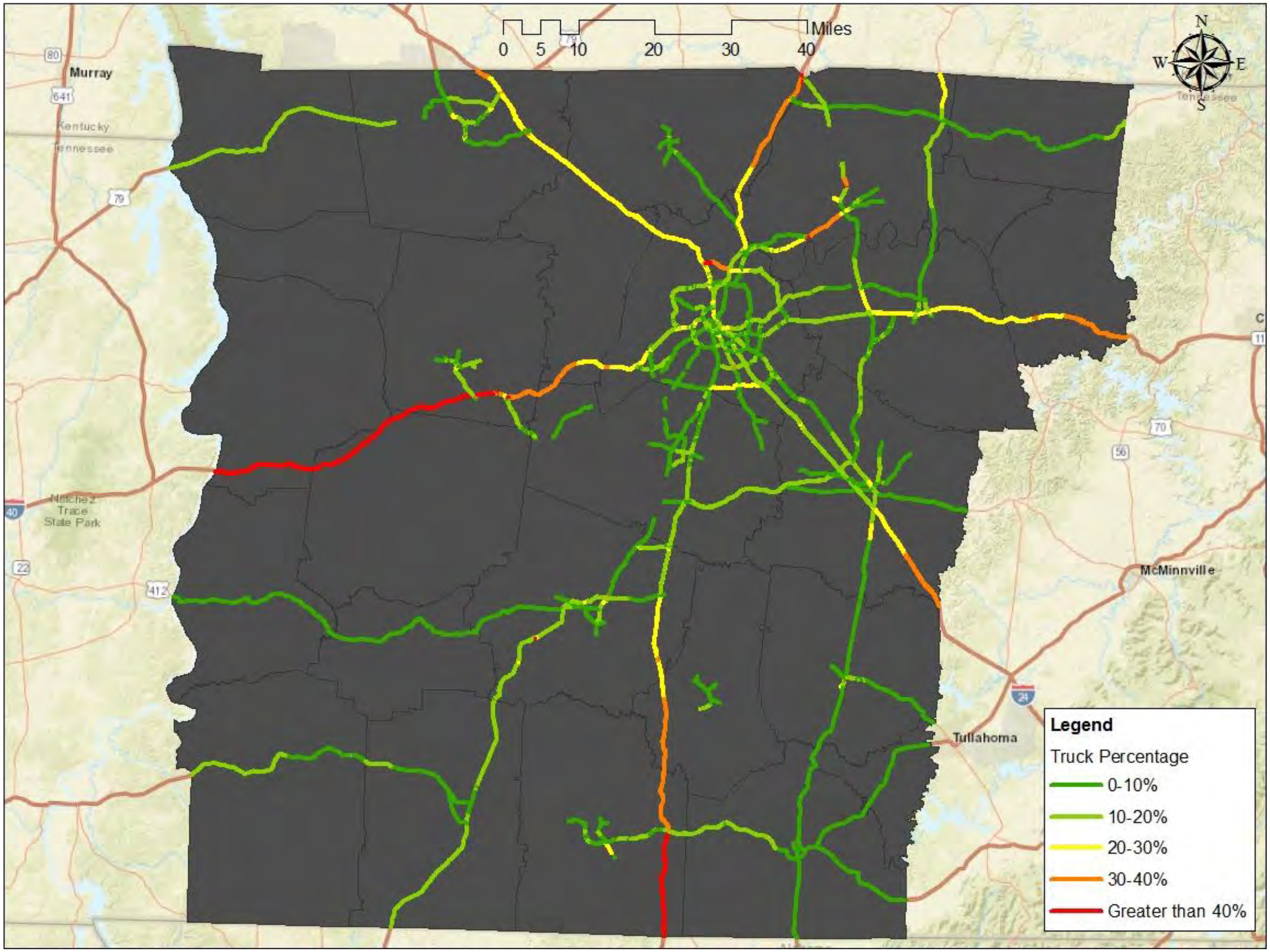


Figure Error! No text of specified style in document.**-48: Region 3 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2020**

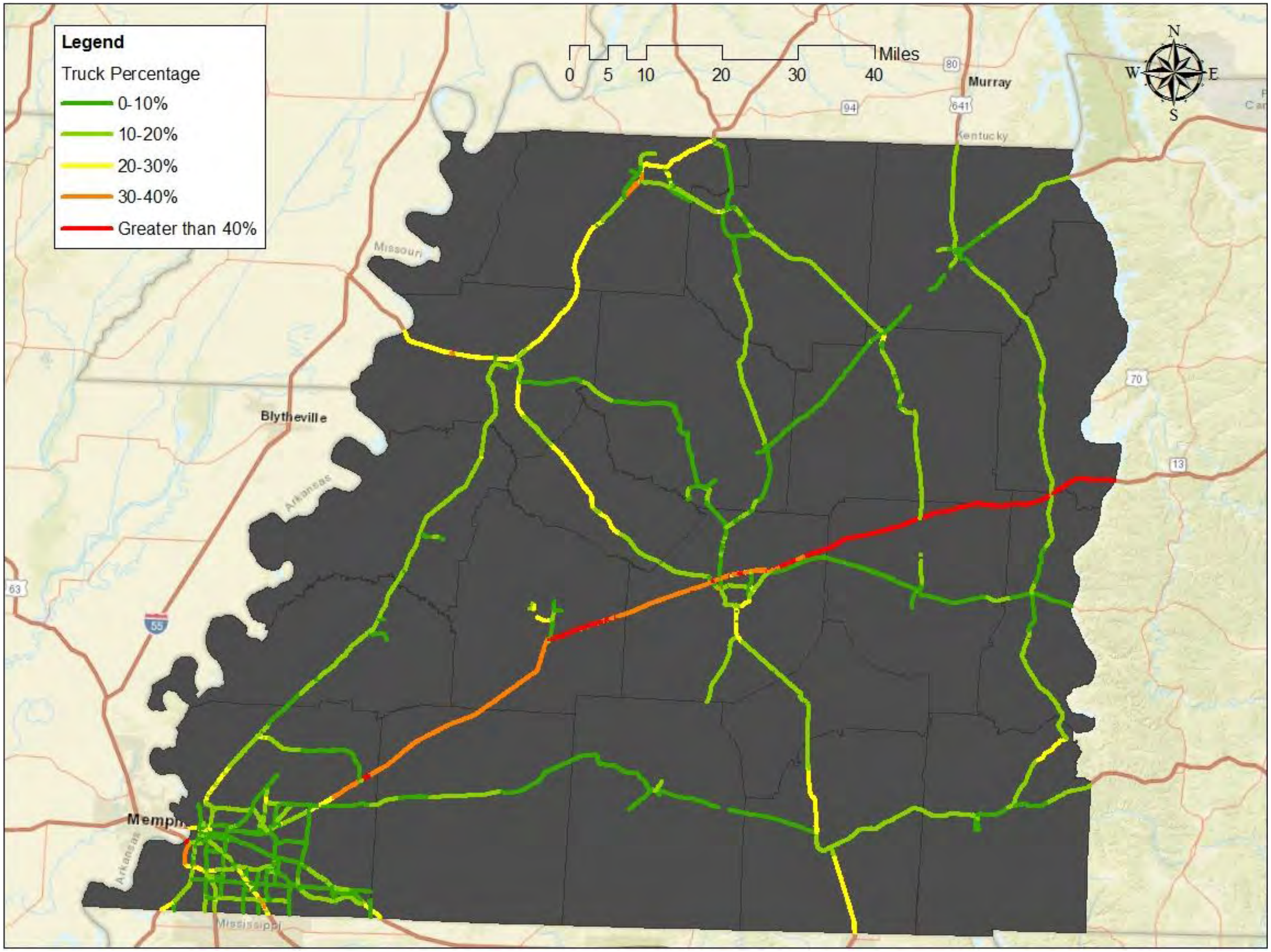


Figure Error! No text of specified style in document.**-49: Region 4 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2020**

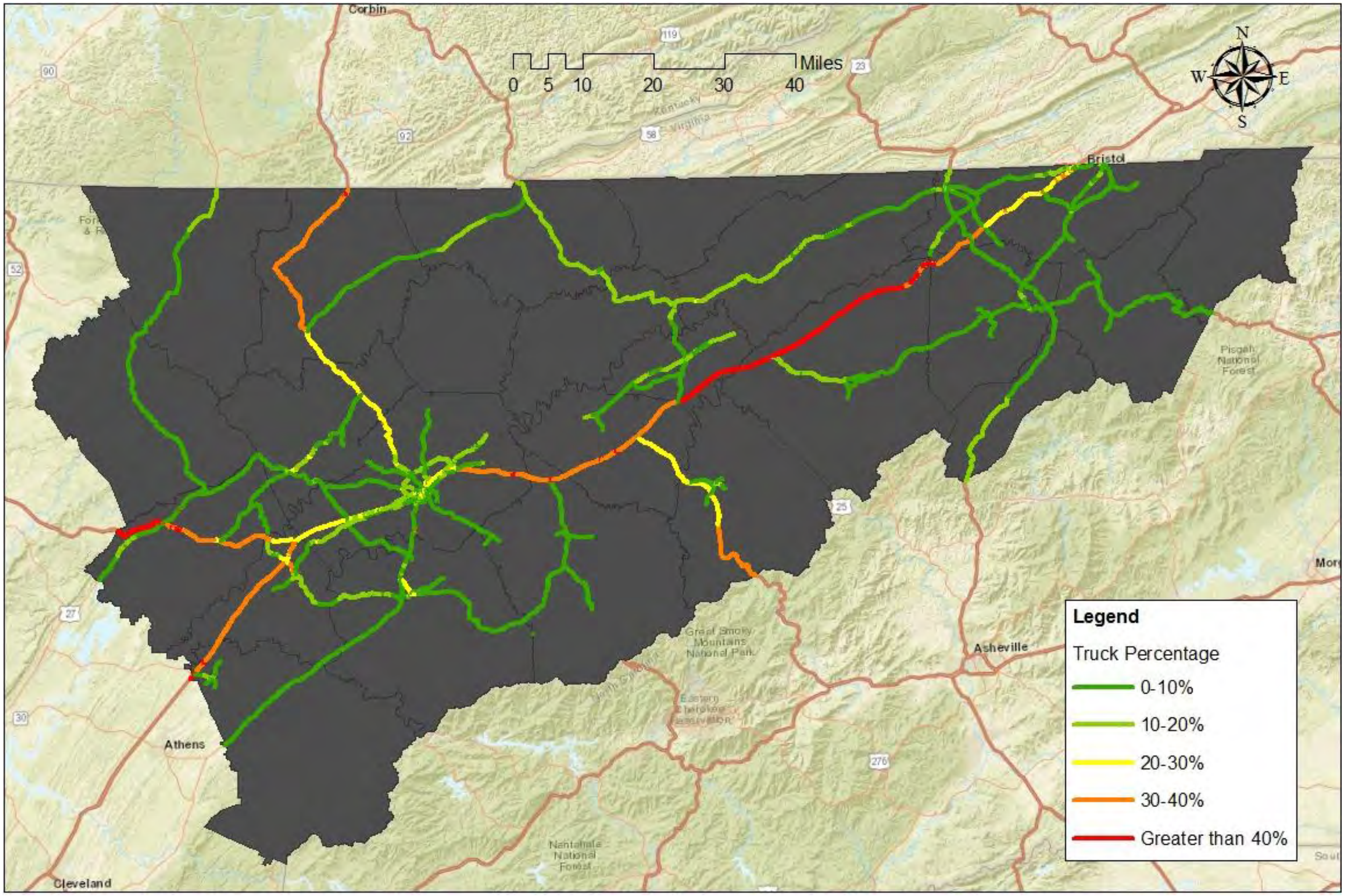


Figure Error! No text of specified style in document.**-50: Region 1 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2030**

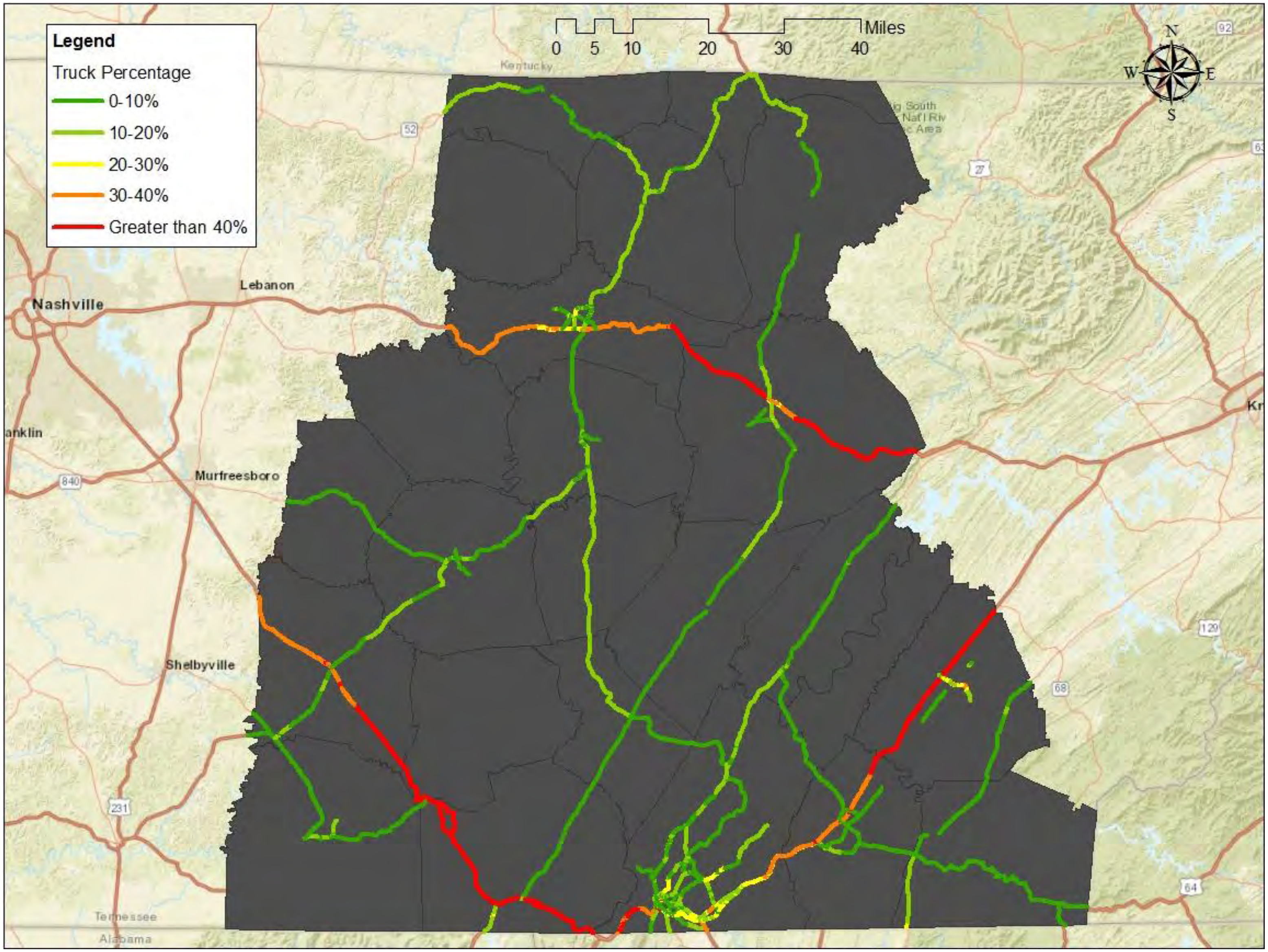


Figure Error! No text of specified style in document.**-51: Region 2 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2030**

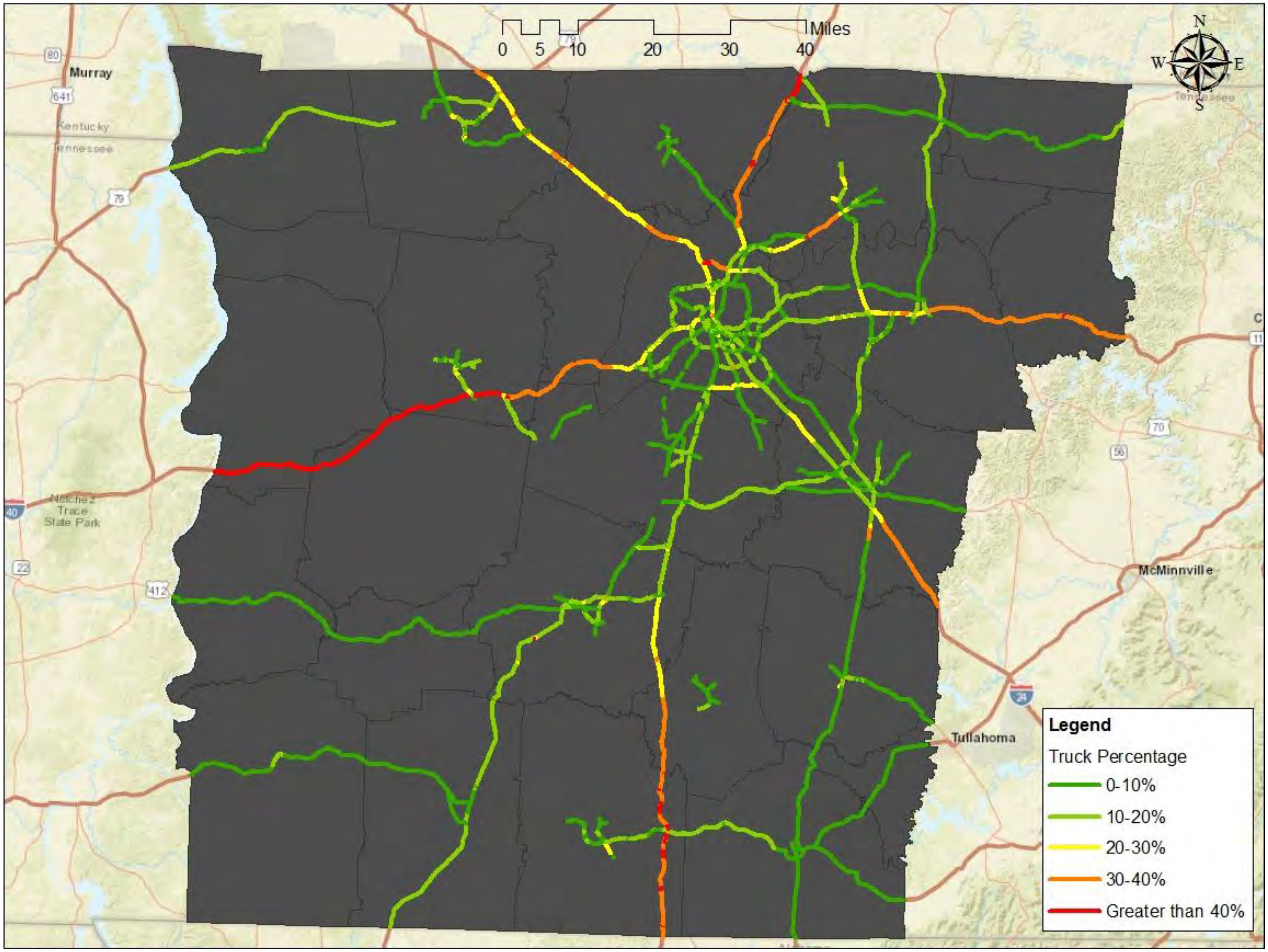


Figure Error! No text of specified style in document.**-52: Region 3 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2030**

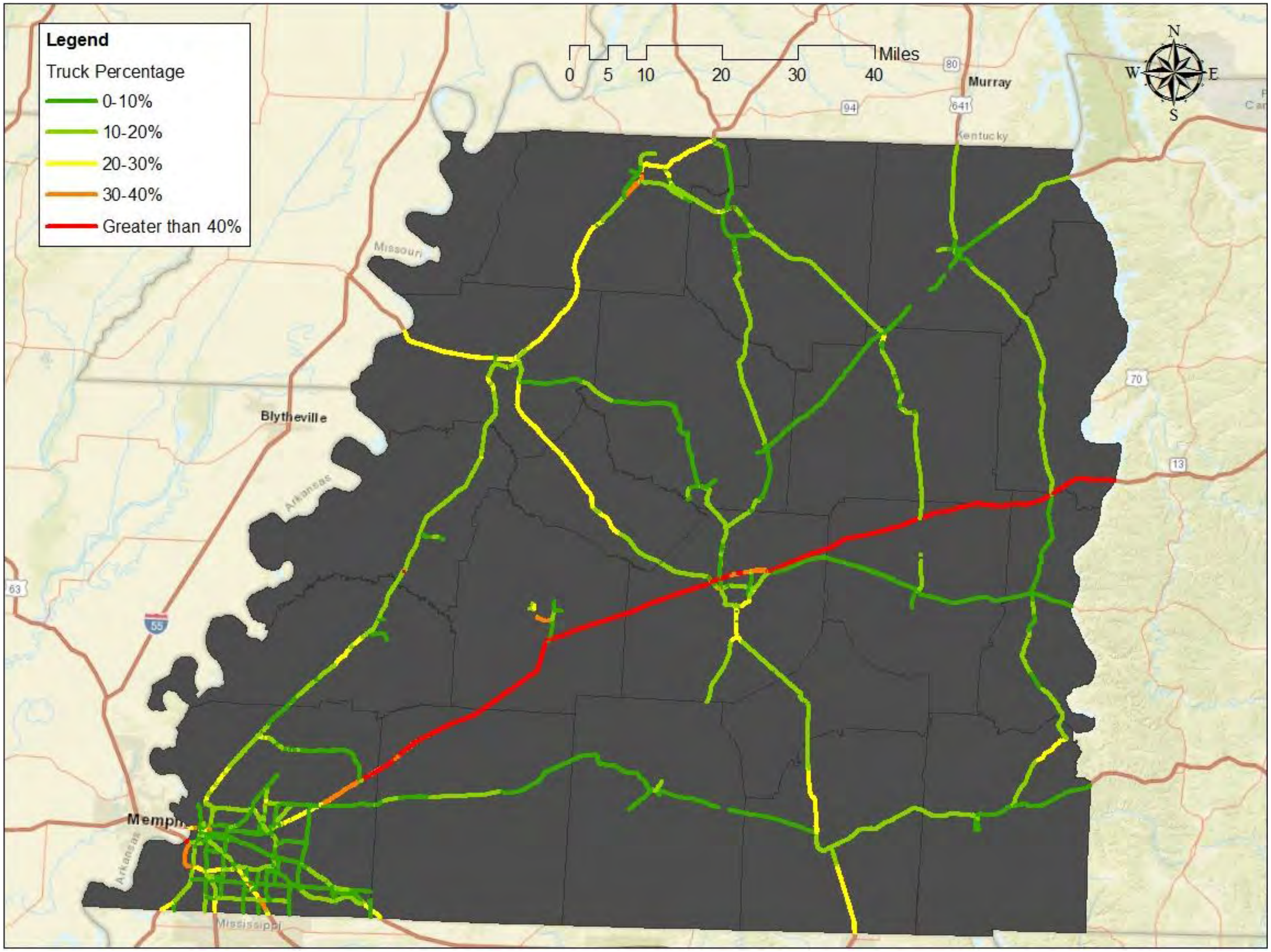


Figure Error! No text of specified style in document.**-53: Region 4 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2030**

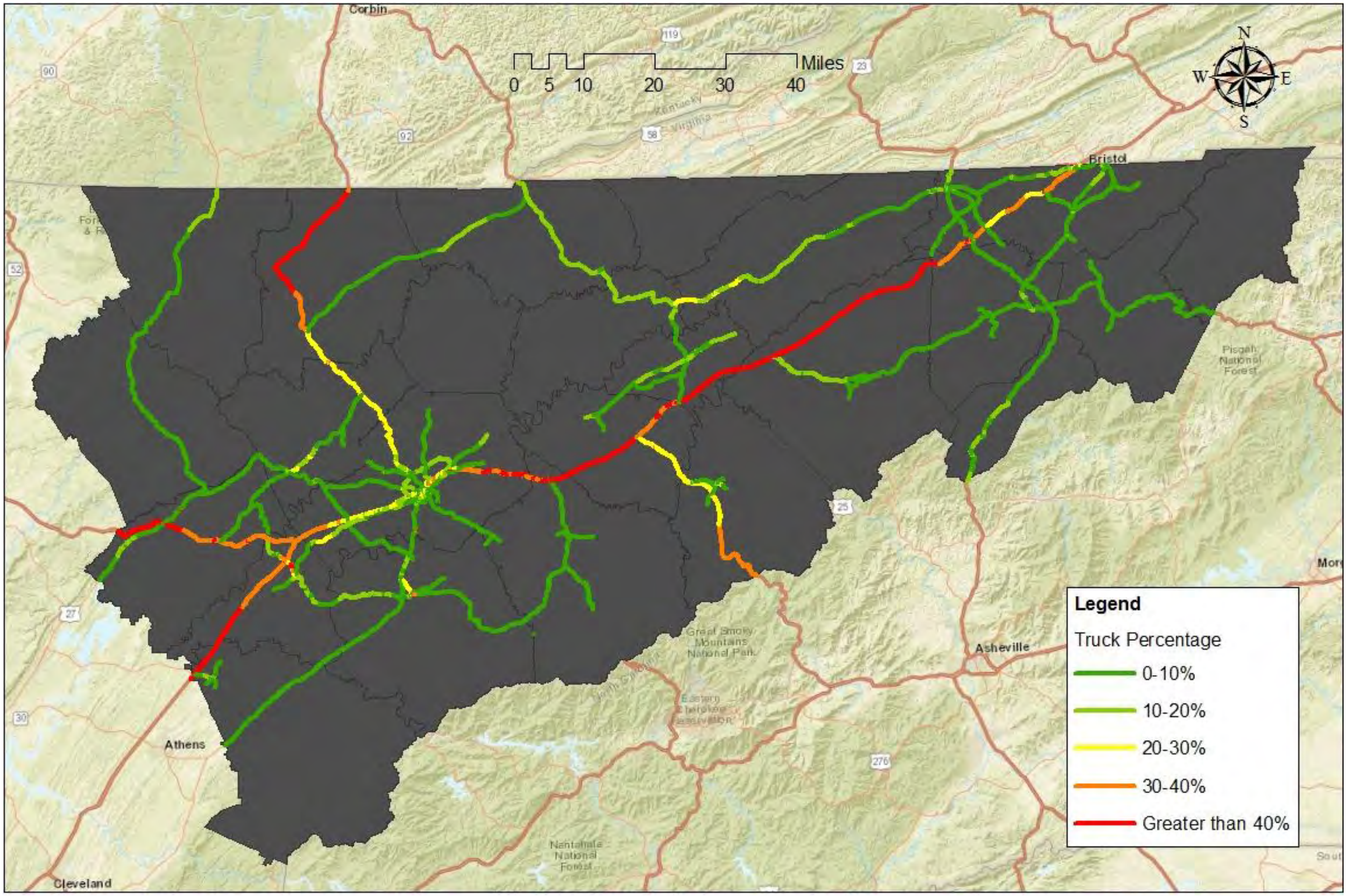


Figure Error! No text of specified style in document.**-54: Region 1 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2040**

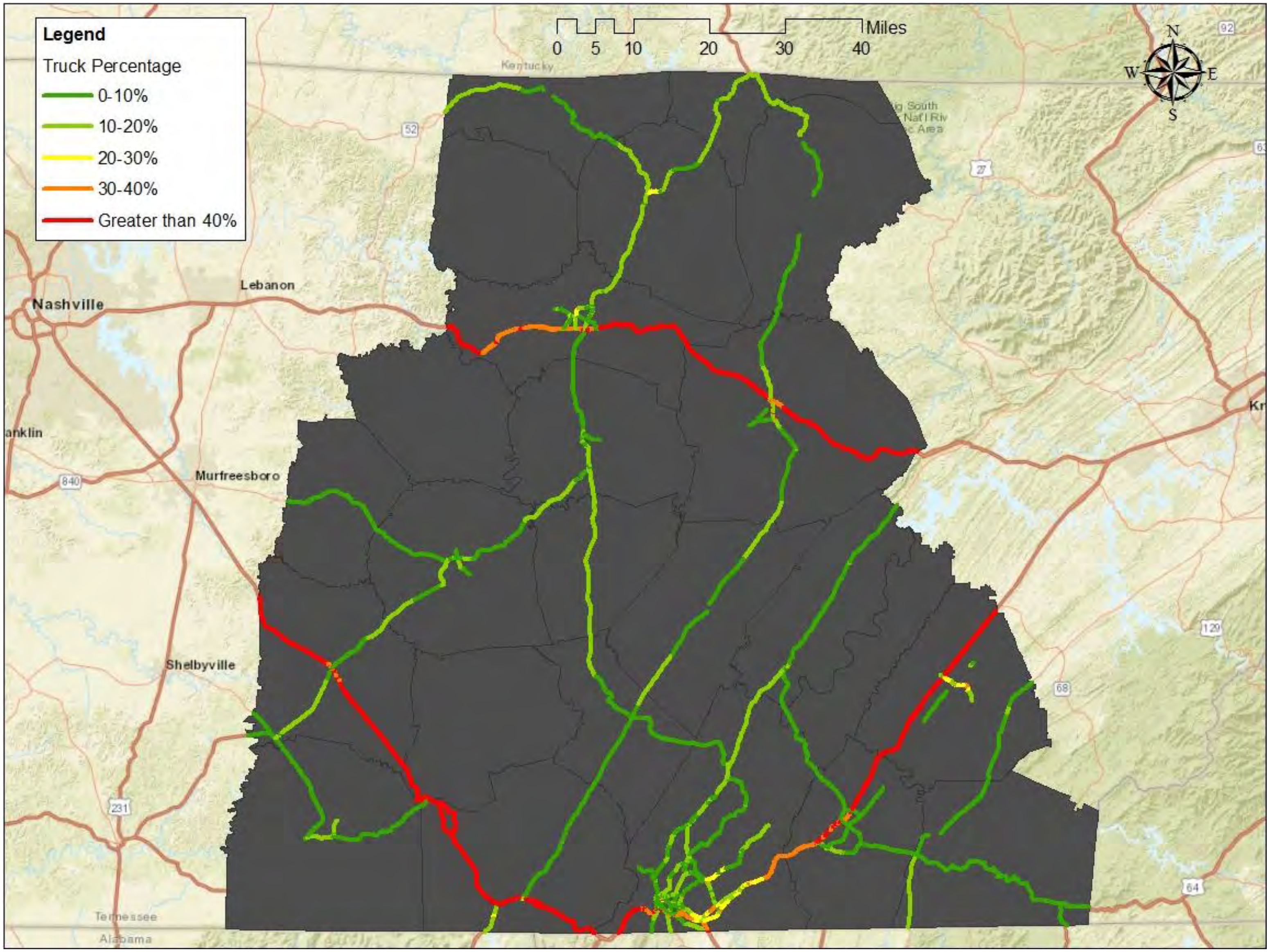


Figure Error! No text of specified style in document.**-55: Region 2 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2040**

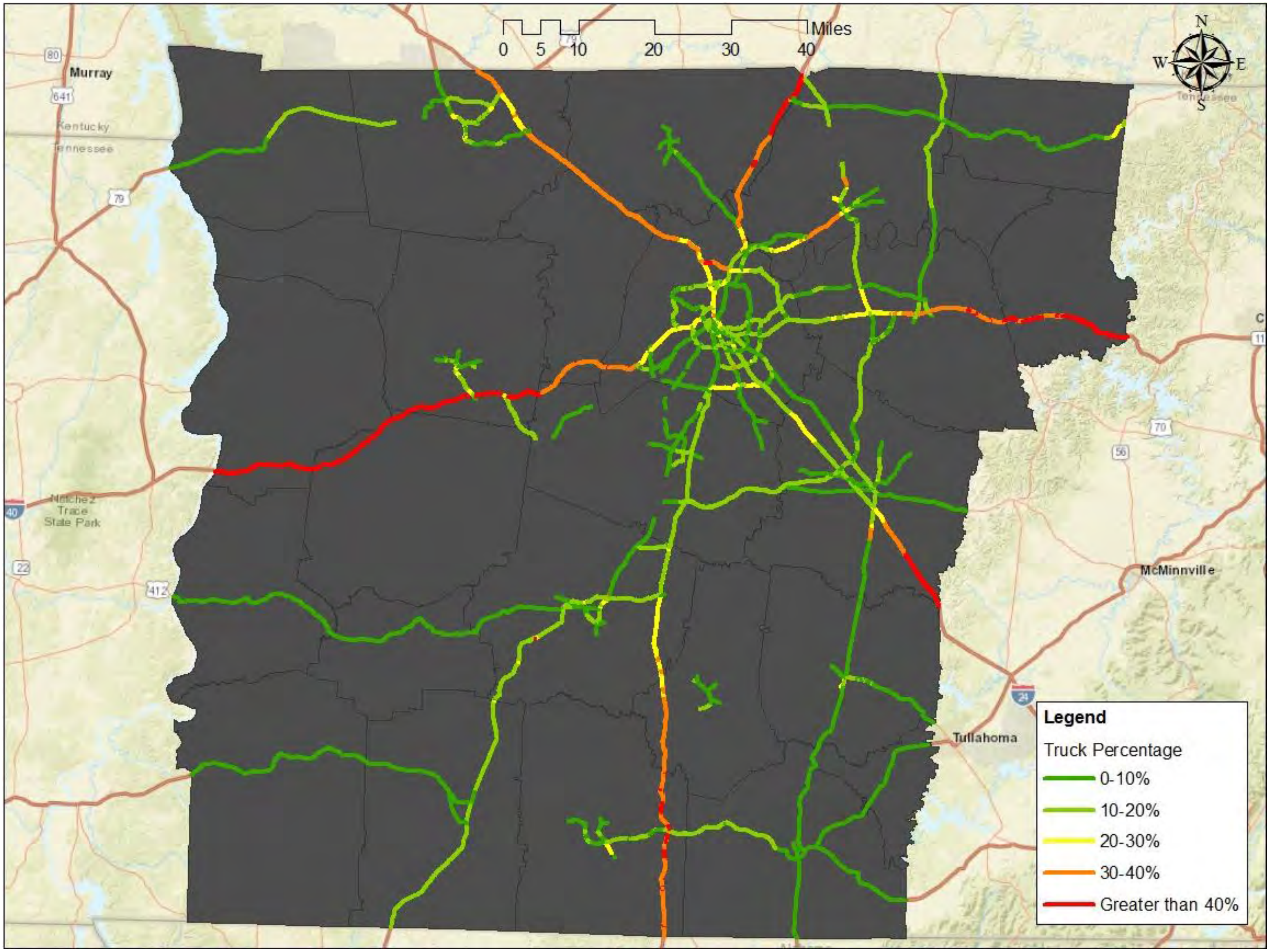


Figure Error! No text of specified style in document.**-56: Region 3 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2040**

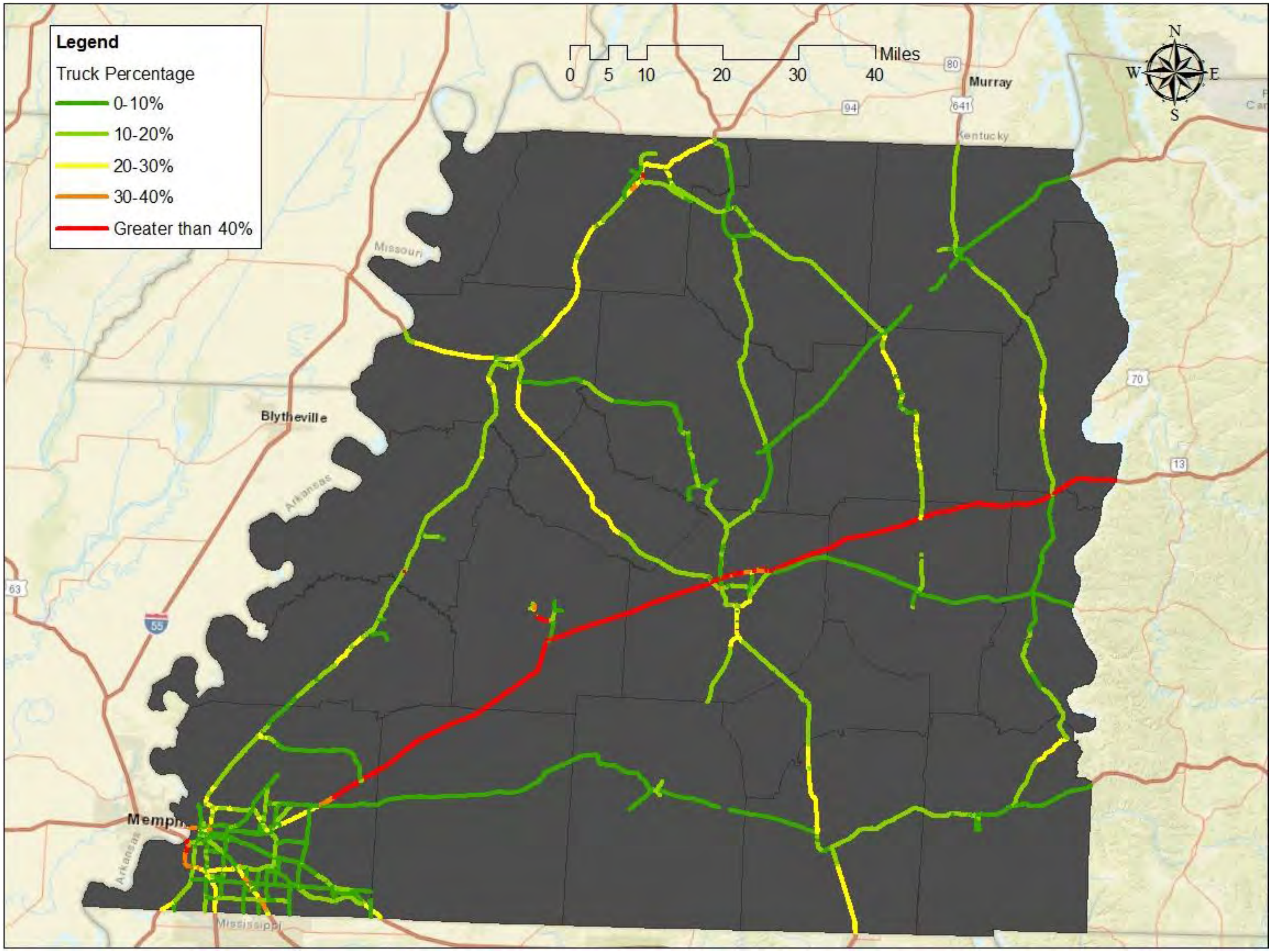


Figure Error! No text of specified style in document.**-57: Region 4 of Tennessee showing Truck Percentage (TP) for major arterials, including interstates, expressways, and principal arterials, in 2040**

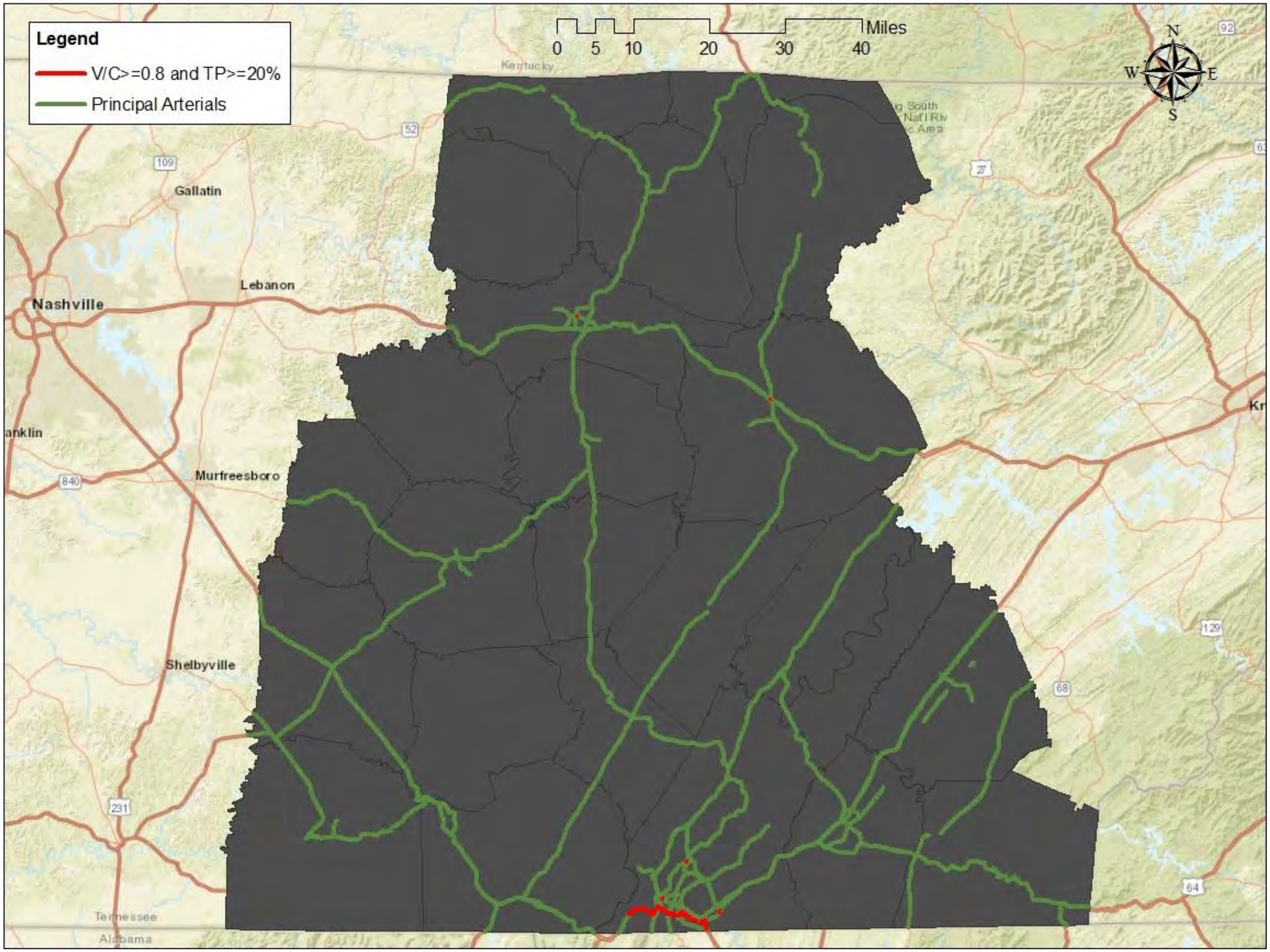


Figure Error! No text of specified style in document.**-58: Region 2 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2010**

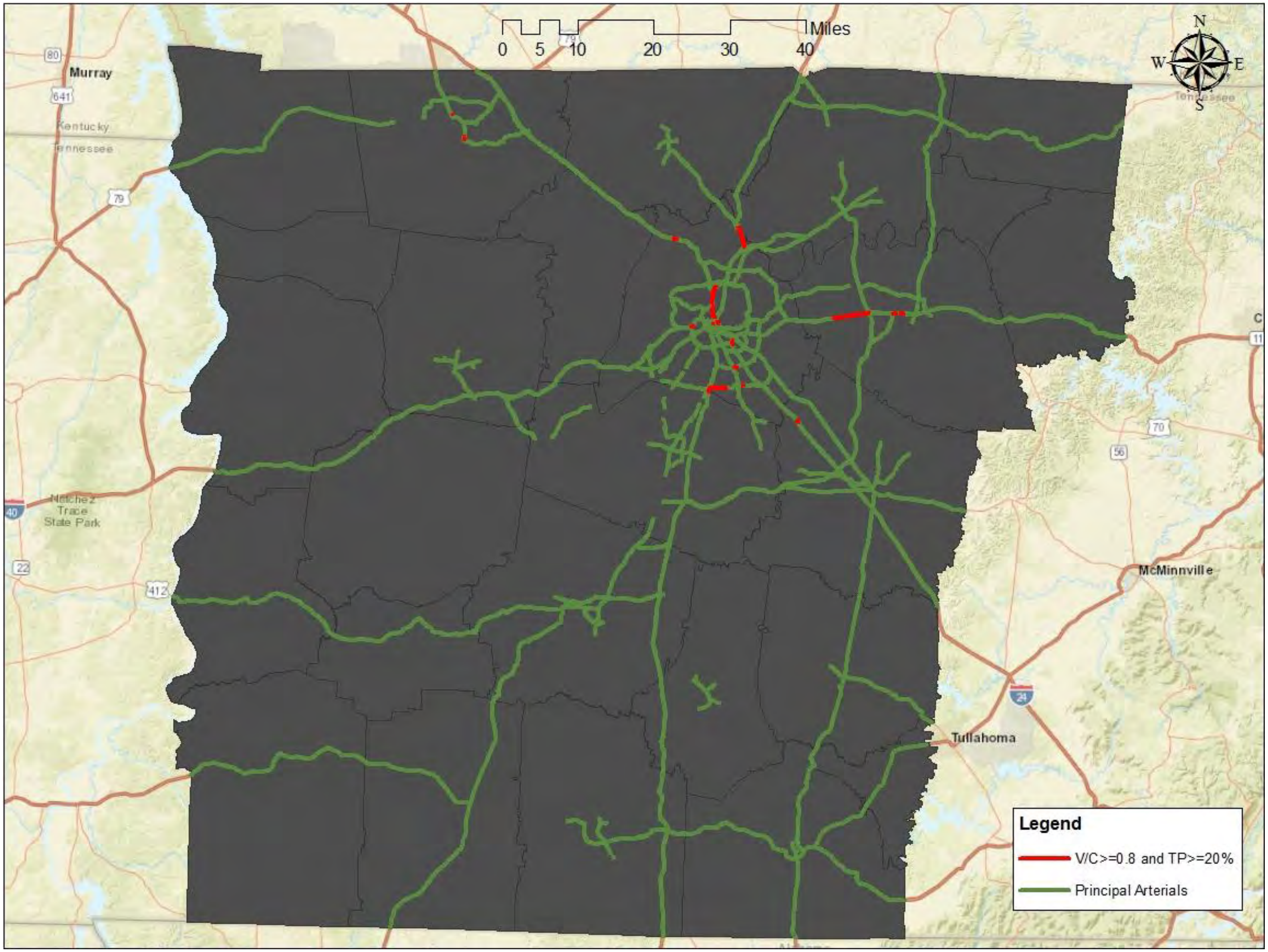


Figure Error! No text of specified style in document.**-59: Region 3 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2010**

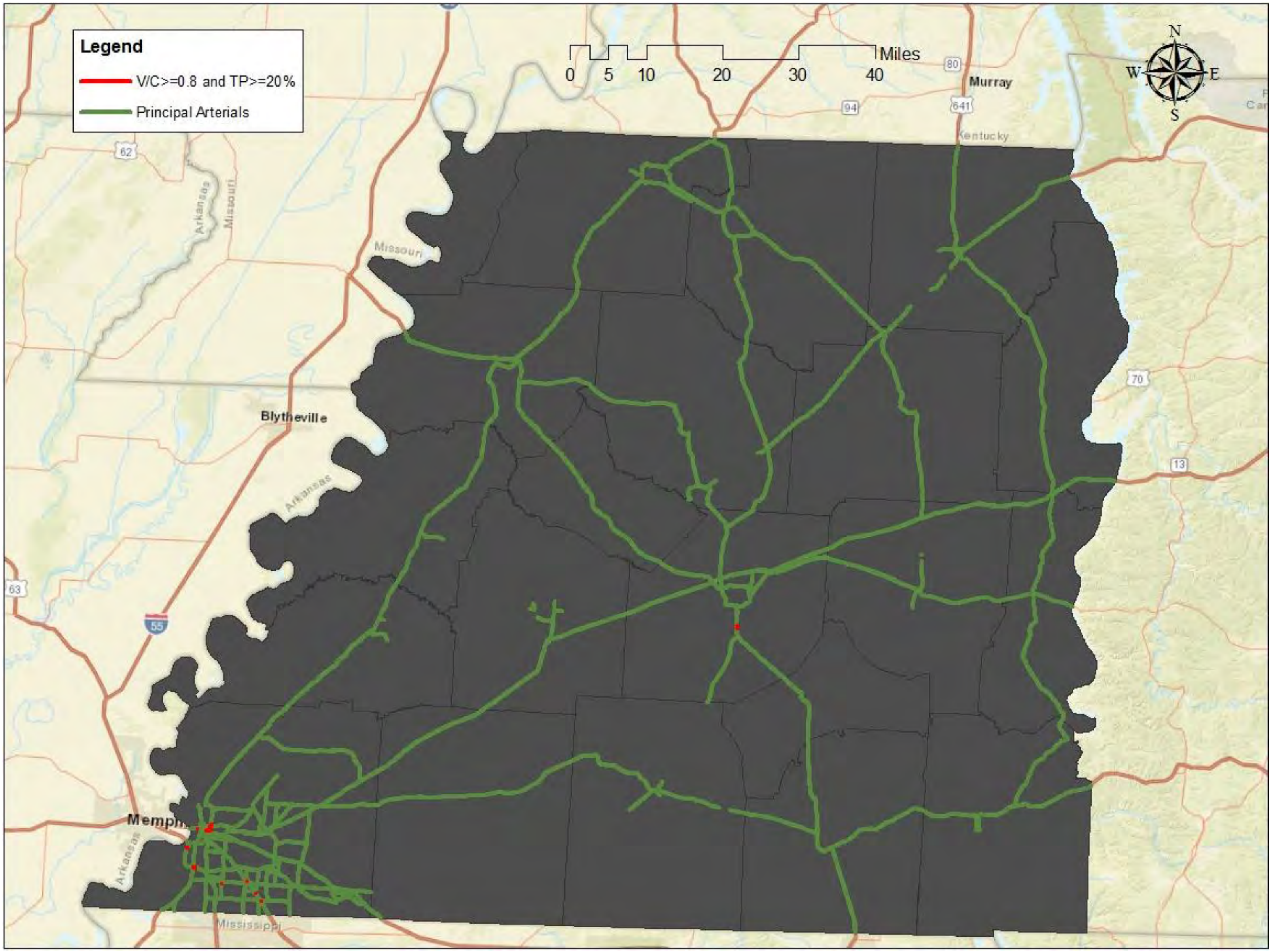


Figure Error! No text of specified style in document.**-60: Region 4 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2010**

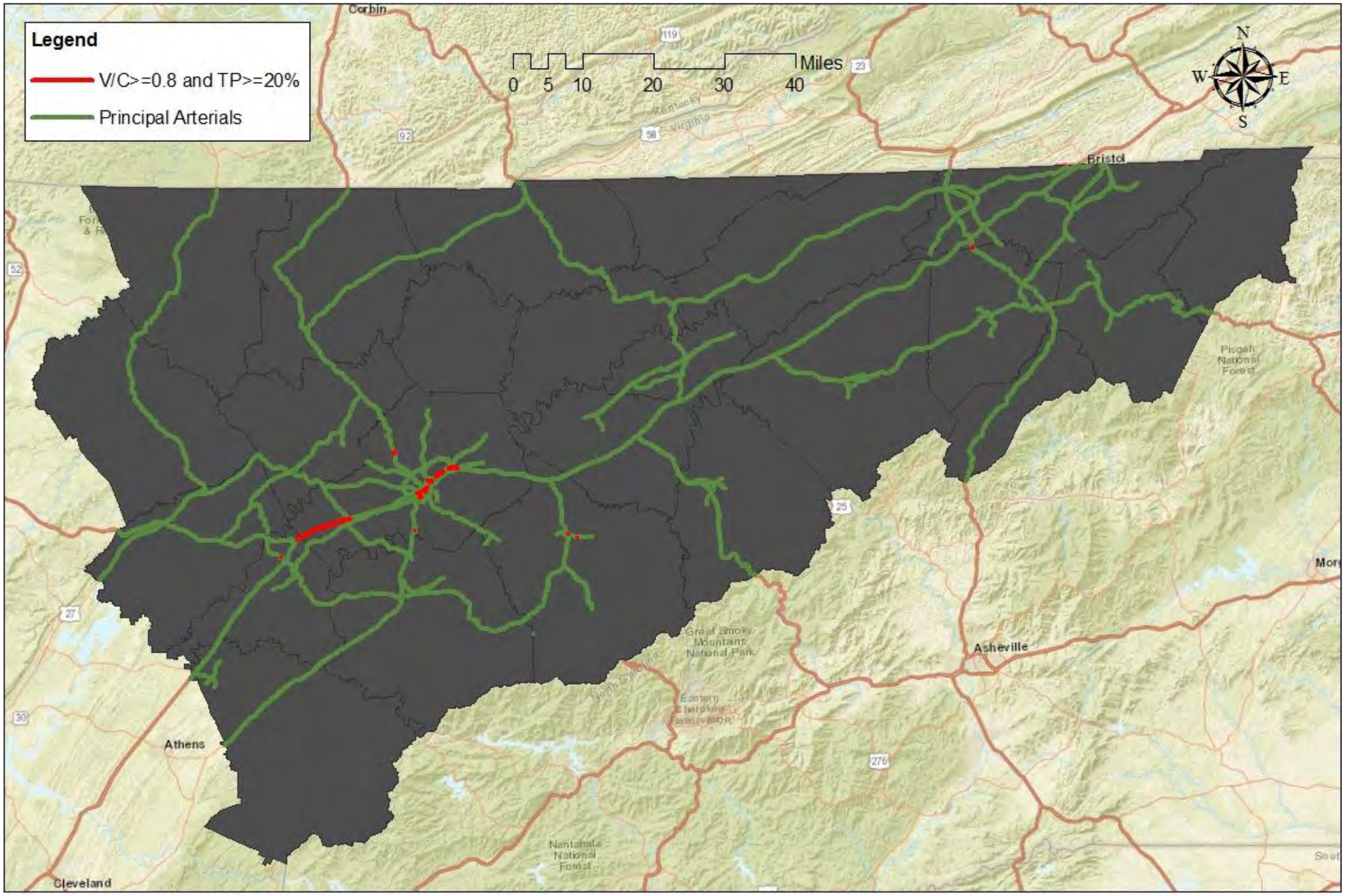


Figure Error! No text of specified style in document.**-61: Region 1 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2020**

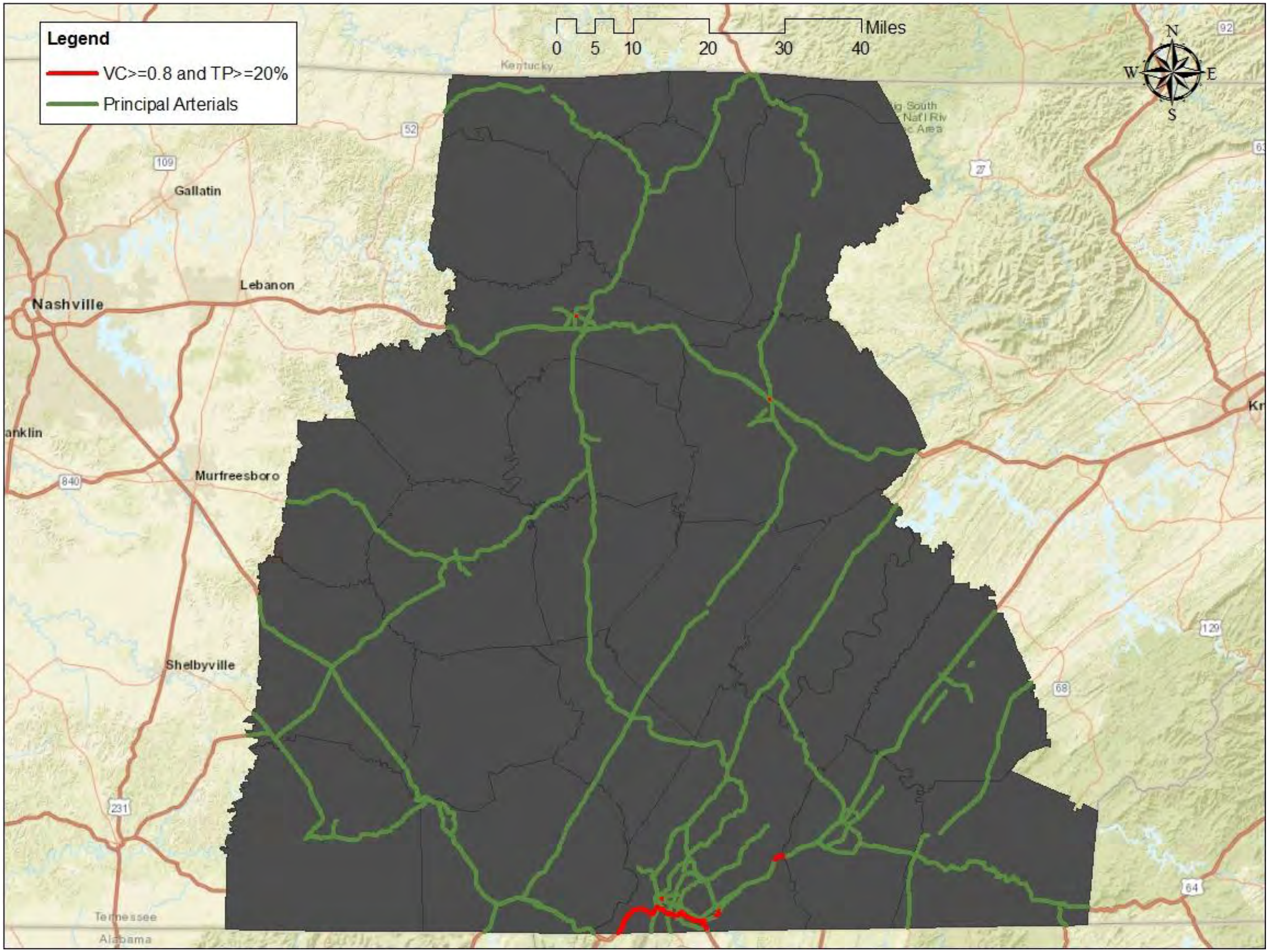

Legend
VC>=0.8 and TP>=20%
Principal Arterials
0 5 10 20 30 40 Miles
N
S
W
E
Kentucky
Gallatin
Nashville
Lebanon
Murfreesboro
Shelbyville
Tennessee
Alabama

Figure Error! No text of specified style in document.**-62: Region 2 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2020**

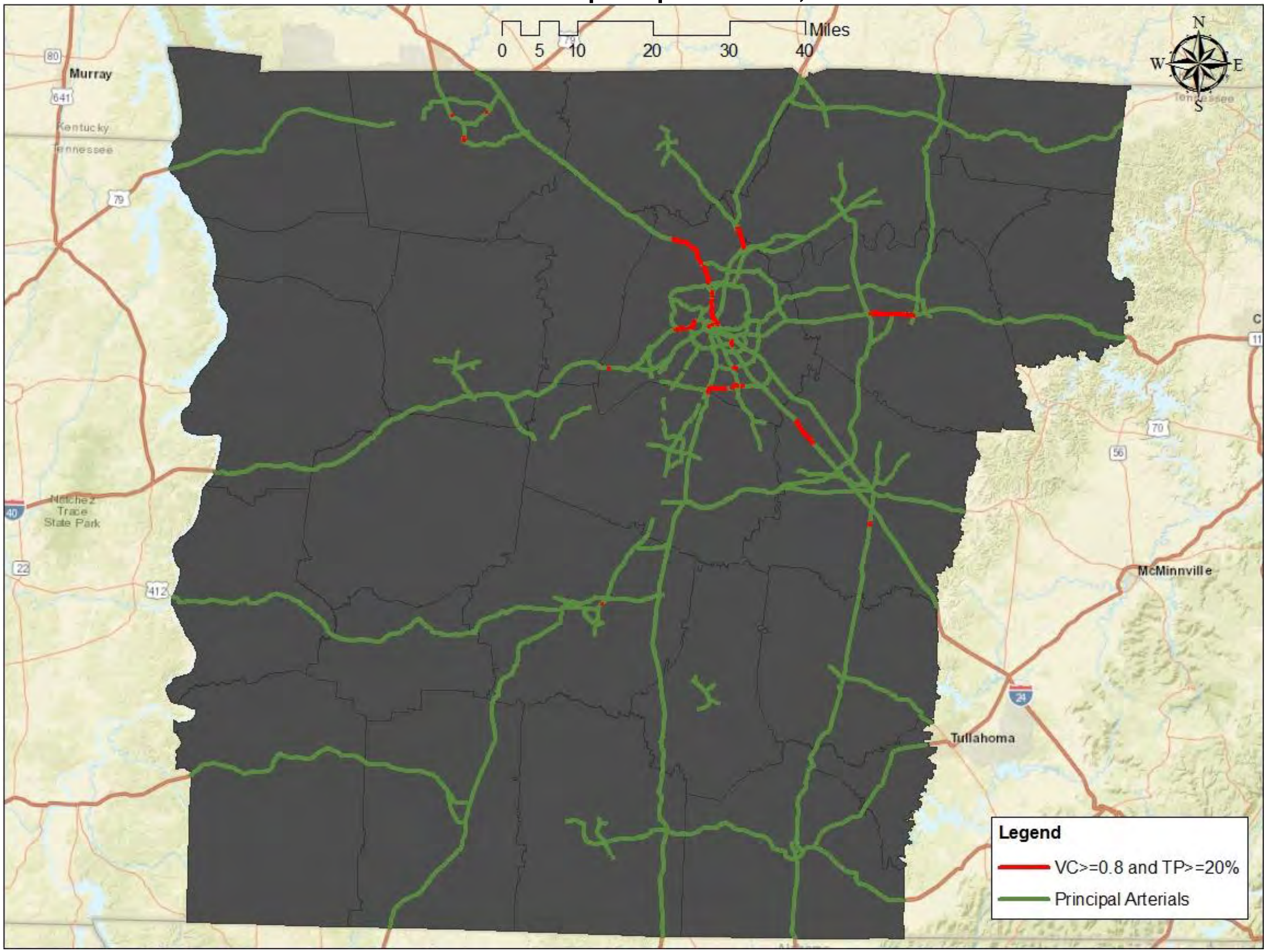


Figure Error! No text of specified style in document.**-63: Region 3 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2020**

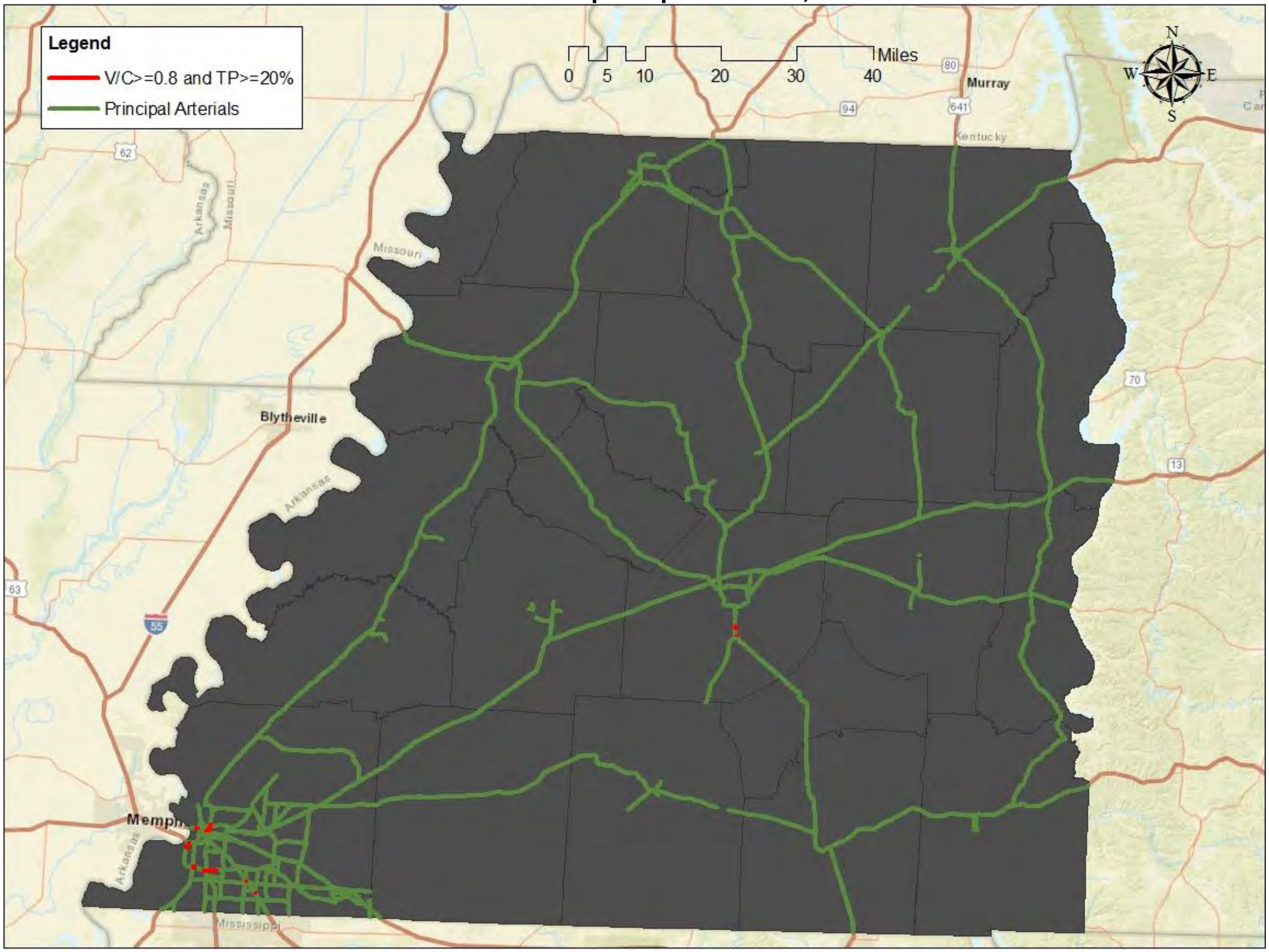


Figure Error! No text of specified style in document.**-64: Region 4 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2020**

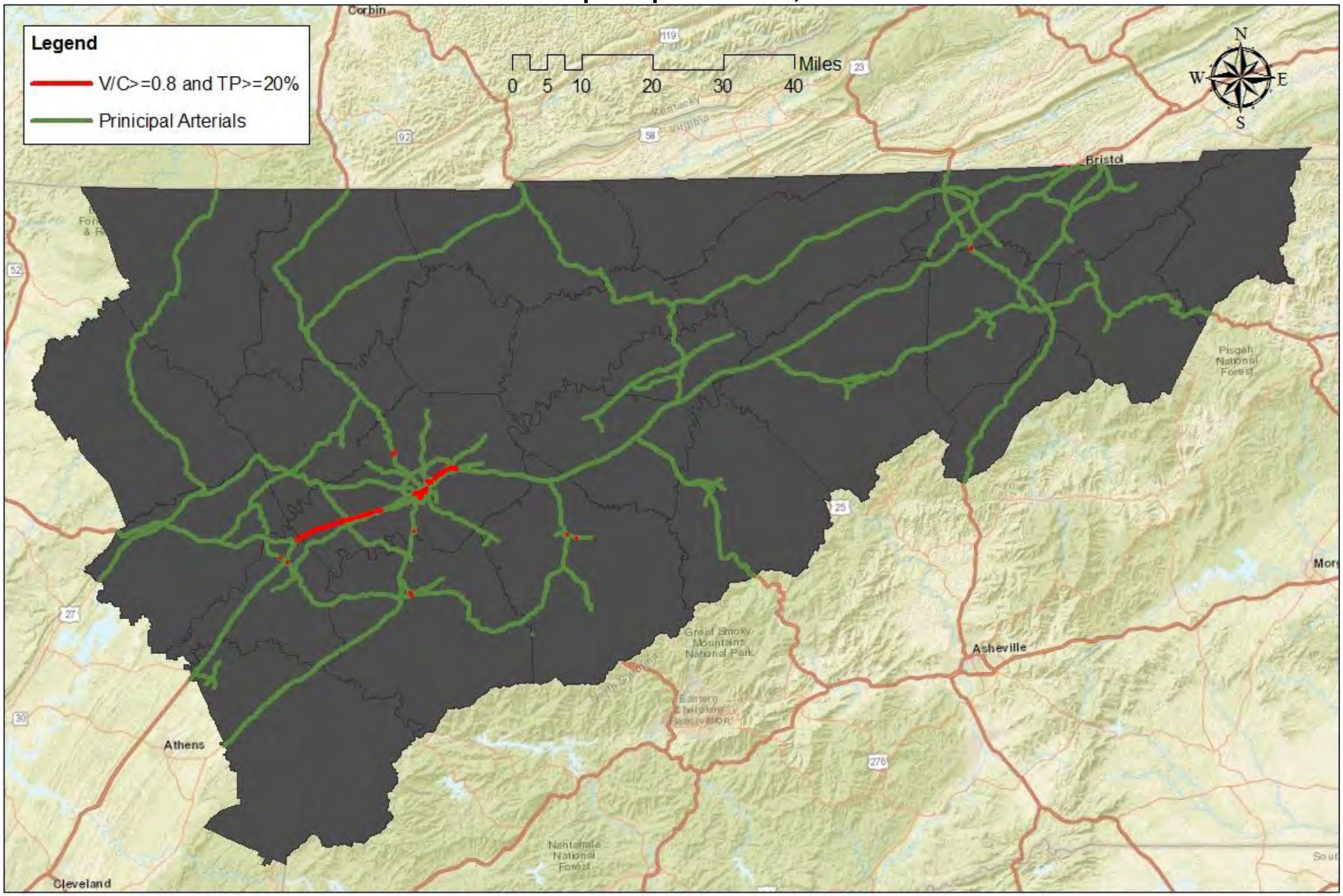


Figure Error! No text of specified style in document.**-65: Region 1 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2030**

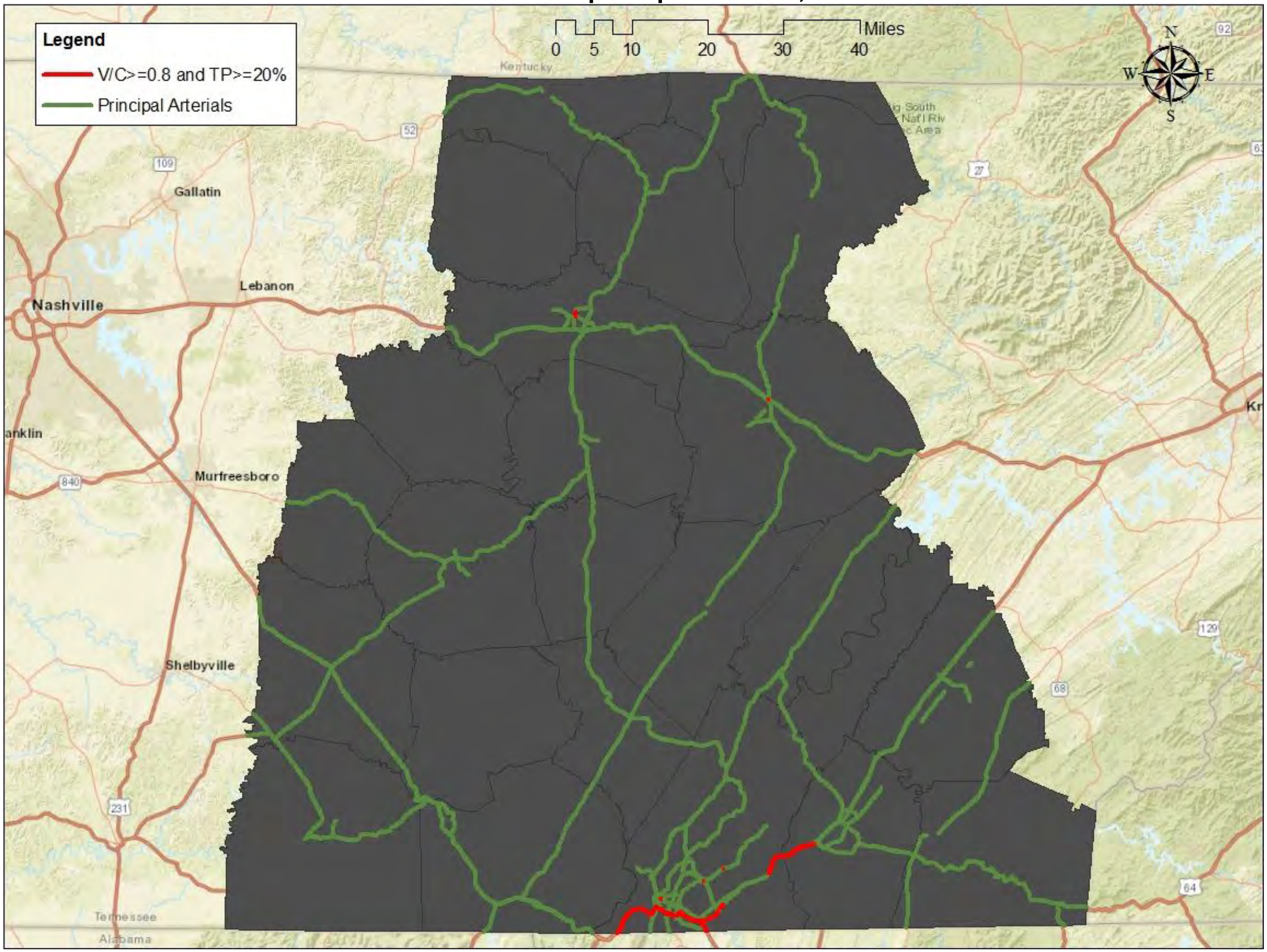


Figure Error! No text of specified style in document.**-66: Region 2 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2030**

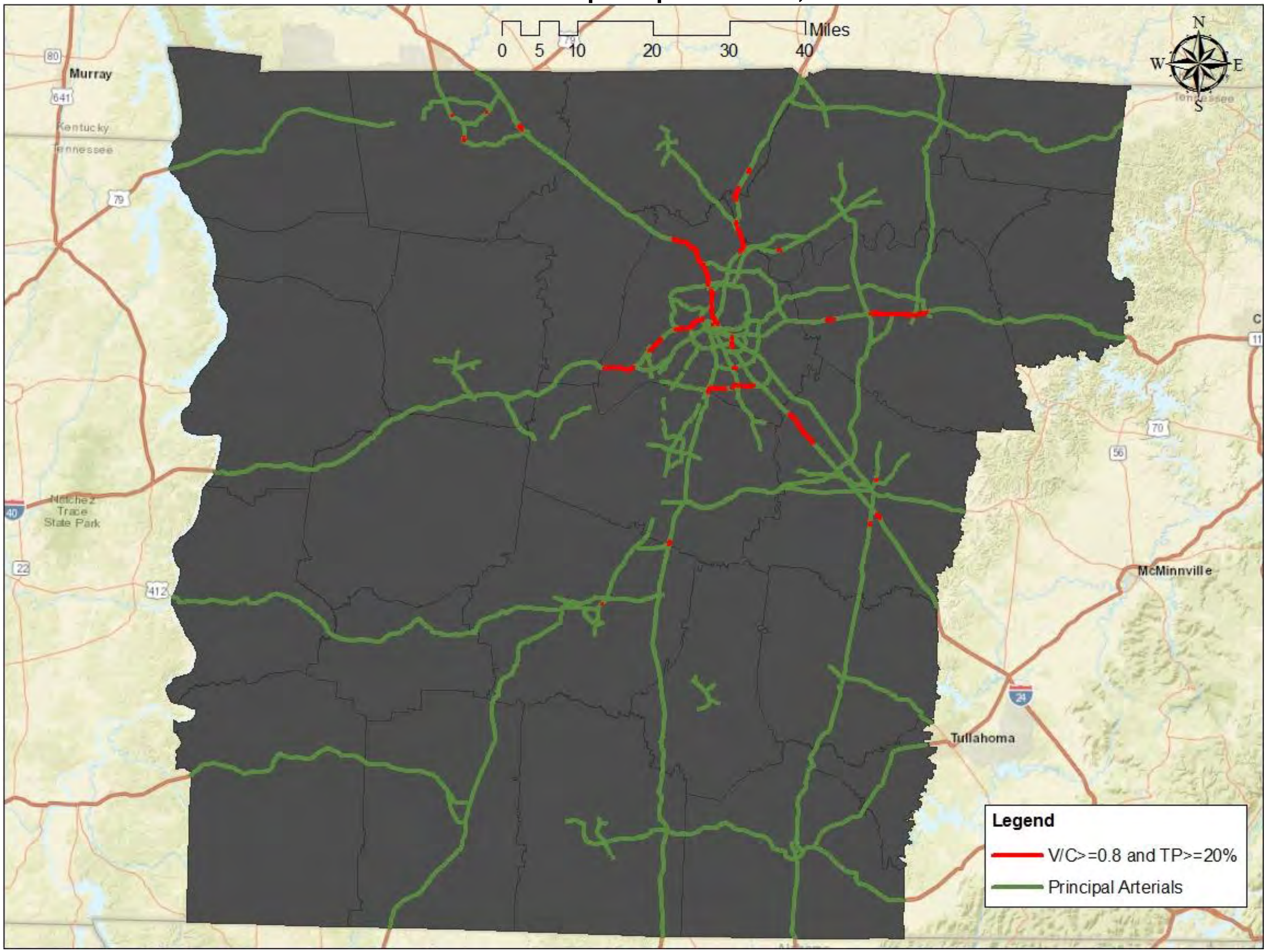


Figure Error! No text of specified style in document.**-67: Region 3 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2030**

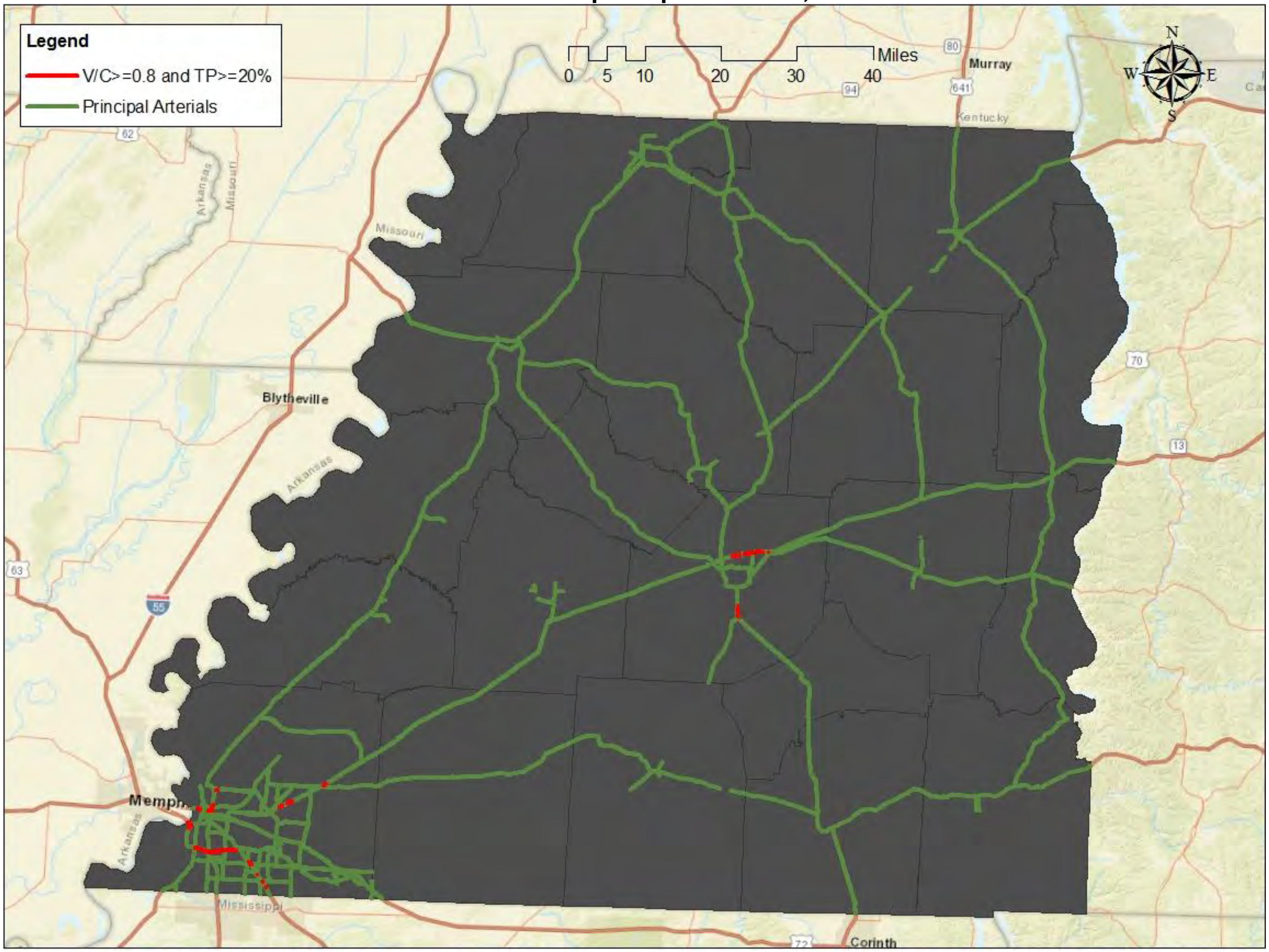


Figure Error! No text of specified style in document.**-68: Region 4 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2030**

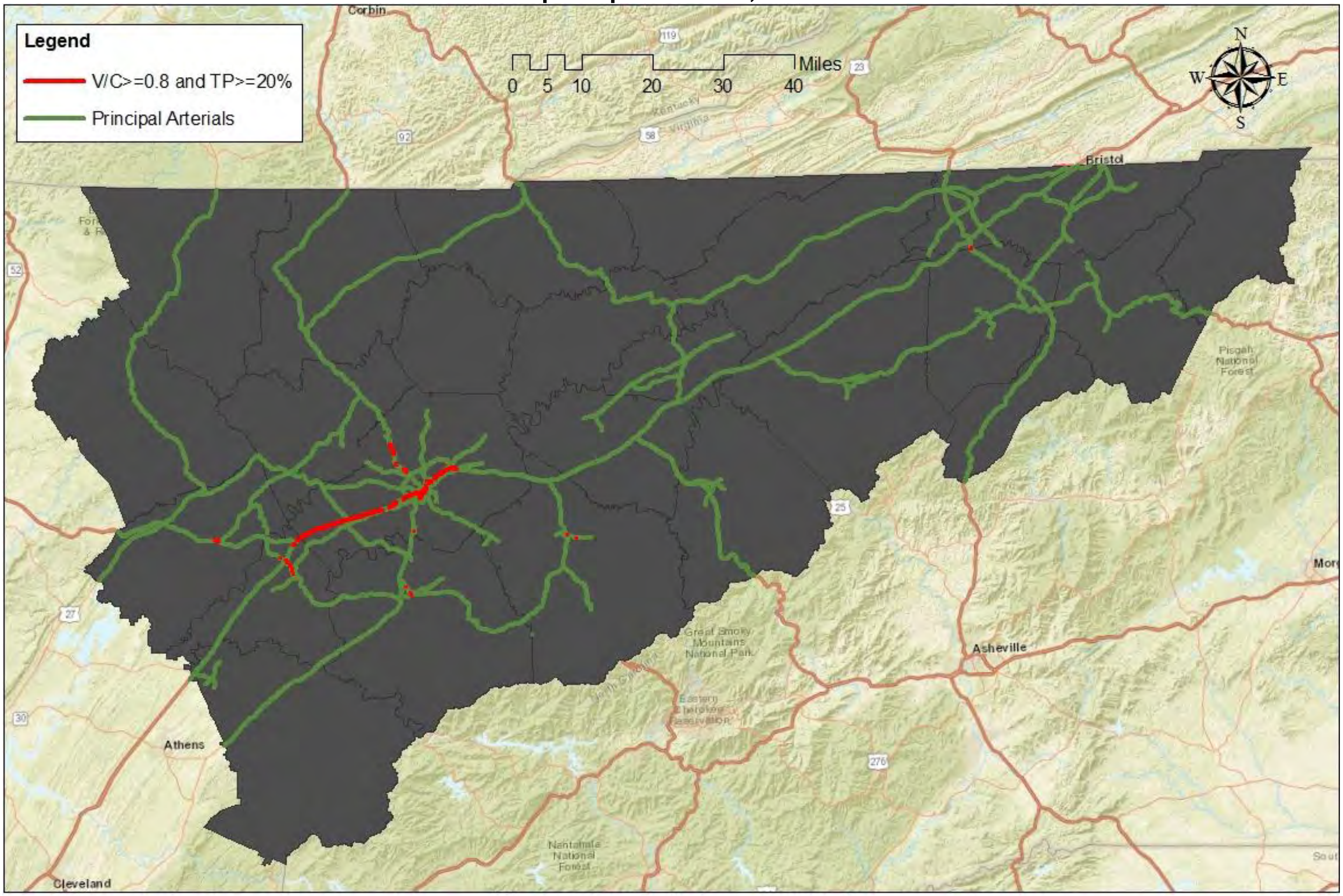


Figure Error! No text of specified style in document.**-69: Region 1 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2040**

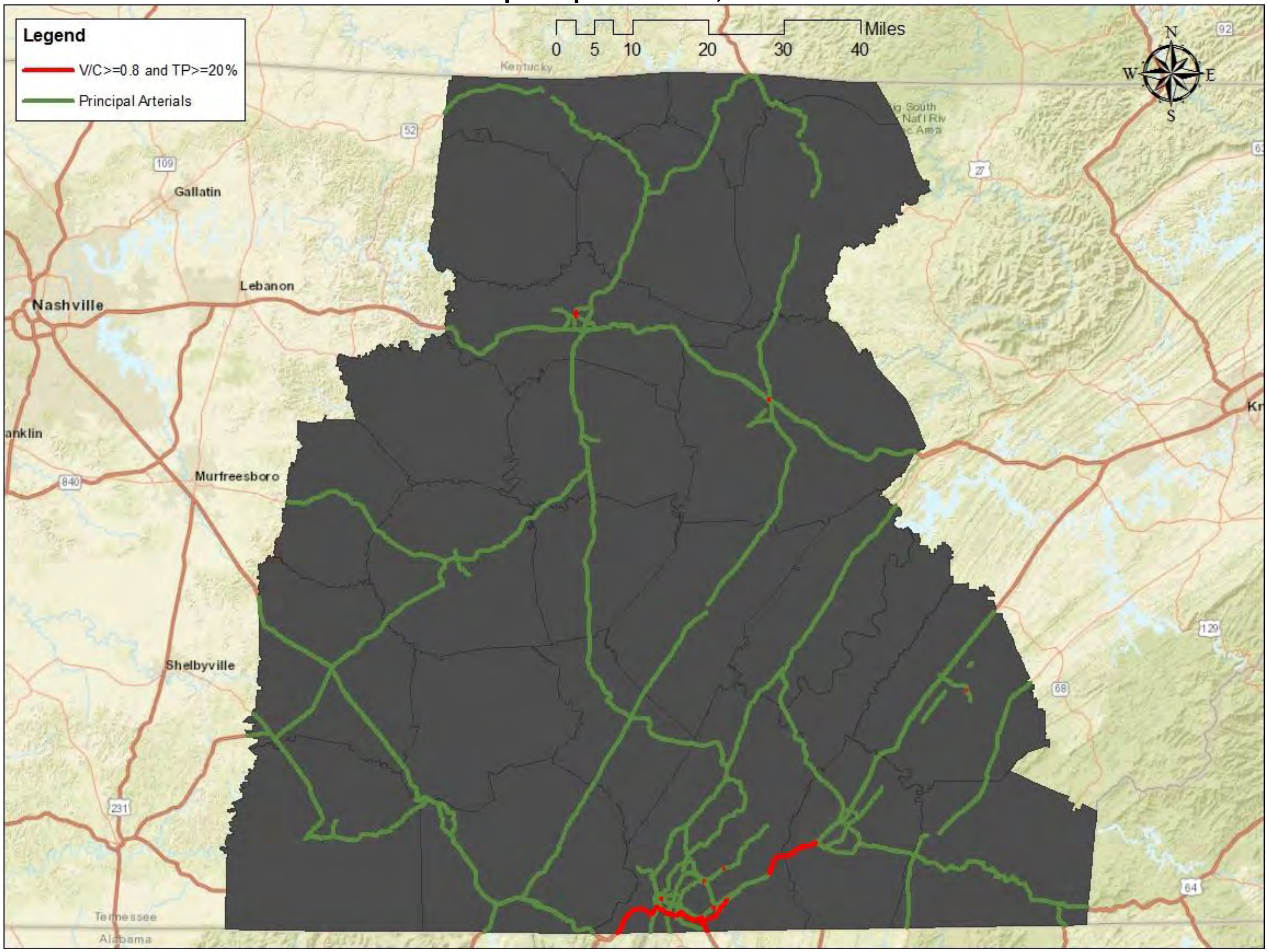


Figure Error! No text of specified style in document.**-70: Region 2 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2040**

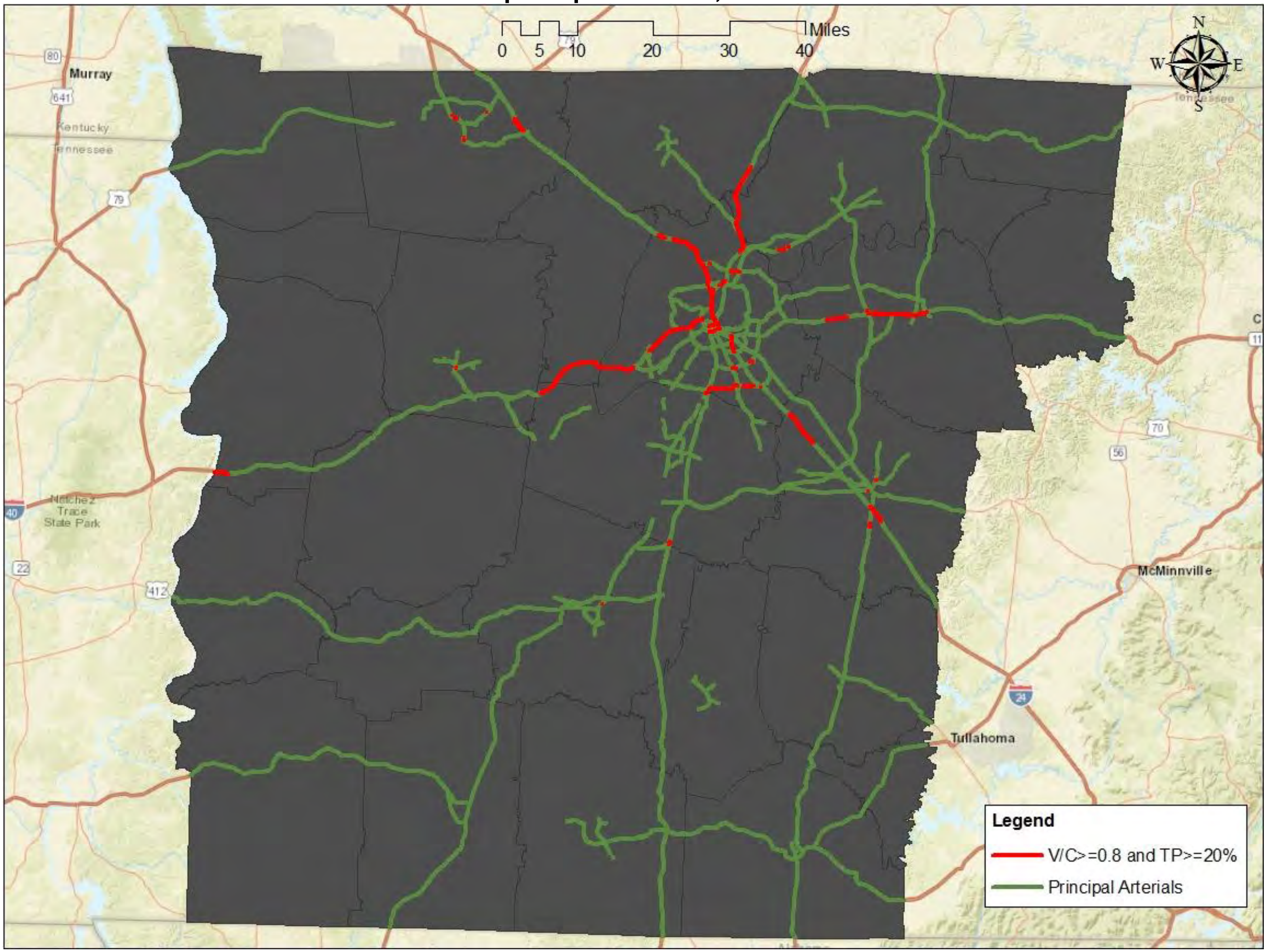


Figure Error! No text of specified style in document.**-71: Region 3 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2040**

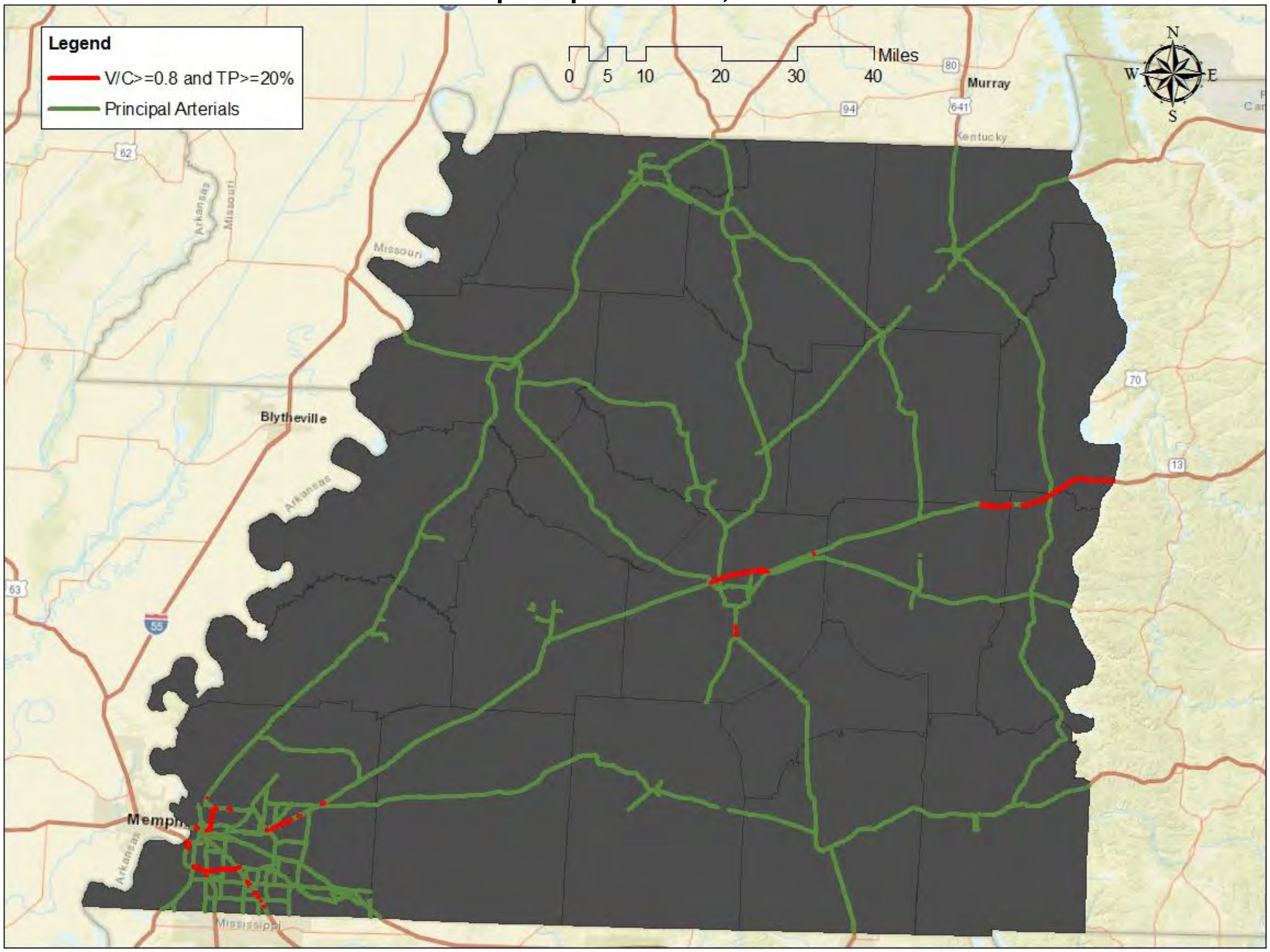


Figure Error! No text of specified style in document.**-72: Region 4 of Tennessee showing Volume to Capacity Ratio (V/C) greater than 0.8 and Truck Percentage (TP) greater than 20% for major arterials, including interstates, expressways, and principal arterials, in 2040**

APPENDIX B: PROJECT DETAILS

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1	673	Hamilton	1	1	482246.9784	30044.32	20	Road
2	878	Davidson	1	2	255935.0759	16048.03	20	Road
3	591	Hamilton	1	2	544440.0819	34138.43	20	Road
4	462	Hamilton	1	1	787853.8723	49401.66	20	Road
5	636	Hamilton	1	2	549594.4752	34579.41	20	Road
6	1457	Shelby	1	1	41580.39317	2653.46	20	Road
7	396	Knox	1	1	1125948.032	71995.5	20	Road
8	596	Hamilton	1	2	525368.8269	33766.8	20	Road
9	1027	Davidson	1	2	170367.2851	10978.94	20	Road
10	1123	Davidson	1	2	289990.6231	18739.99	20	Road
11	1239	Sumner	1	1	94014.18799	6099.12	20	Road
12	1385	Wilson	1	1	53960.66226	3549.03	20	Road
13	479	Hamilton	1	2	791870.4089	52791.28	20	Road
14	602	Hamilton	1	2	556689.0599	37474.37	20	Road
15	546	Hamilton	1	2	654413.4385	44053.04	20	Road
16	118	Loudon	1	1	5541366.627	374476.32	20	Road
17	825	Davidson	1	1	307410.9315	20774.33	20	Road
18	1022	Davidson	1	2	188013.7881	12808.8	20	Road
19	818	Davidson	1	1	358878.8103	24449.35	20	Road
20	560	Hamilton	1	2	714277.3398	48812.89	20	Road
21	977	Davidson	1	2	217743.9394	14880.51	20	Road
22	592	Hamilton	1	1	558488.2349	38433.98	20	Road
23	1287	Sumner	1	1	72312.24732	4976.4	20	Road
24	1236	Davidson	1	1	96776.16476	6663.2	20	Road
25	1057	Davidson	1	2	136834.5531	9432.61	20	Road
26	627	Hamilton	1	2	478201.2659	32964.61	20	Road
27	1079	Rutherford	1	2	310195.9649	21597.63	20	Road
28	600	Hamilton	1	2	538682.7219	37588.69	20	Road
29	692	Bradley	1	1	405762.5901	28712.1	20	Road
30	635	Hamilton	1	2	489920.2166	34667.45	20	Road
31	509	Hamilton	1	2	682305.5137	48405.21	20	Road
32	749	Cheatham	1	1	353153.7404	25054.03	20	Road
33	521	Hamilton	1	2	663195.3576	47049.6	20	Road
34	363	Knox	1	1	1211389.394	85940.79	20	Road
35	855	Davidson	1	1	266876.0049	18933.34	20	Road
36	431	Hamilton	1	1	869687.1592	61761.8	20	Road
37	1040	Davidson	1	2	137393.7562	9861.14	20	Road
38	598	Hamilton	1	2	492429.3364	35343.98	20	Road
39	333	Knox	1	1	1234399.383	88686.75	20	Road
40	1021	Davidson	1	2	154296.2759	11085.66	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
41	862	Davidson	1	1	260510.8155	18717.02	20	Road
42	1463	Shelby	1	1	35774.4068	2570.31	20	Road
43	901	Davidson	1	2	229652.5329	16500.09	20	Road
44	760	Montgomery	1	2	338468.5823	24342.67	20	Road
45	568	Hamilton	1	2	570382.2405	41022.25	20	Road
46	123	Knox	1	1	4752807.673	341825.53	20	Road
47	343	Knox	1	2	1265272.254	91000.08	20	Road
48	145	Knox	1	2	3802473.709	273851.69	20	Road
49	242	Knox	1	2	1632211.565	118312.01	20	Road
50	199	Knox	1	2	2230004.48	161643.53	20	Road
51	775	Montgomery	1	1	286754.4574	20785.67	20	Road
52	535	Hamilton	1	2	547202.0587	39664.62	20	Road
53	436	Hamilton	1	1	979519.4993	71025.04	20	Road
54	955	Davidson	1	2	215949.5177	15685.95	20	Road
55	1126	Davidson	1	2	129815.5305	9429.53	20	Road
56	984	Davidson	1	2	172570.0588	12552.07	20	Road
57	566	Hamilton	1	2	566214.9621	41198.39	20	Road
58	455	Hamilton	1	1	905437.2528	66522.42	20	Road
59	700	Bradley	1	1	341498.0039	25114.23	20	Road
60	347	Knox	1	2	1084931.704	79787.49	20	Road
61	255	Knox	1	2	1482456.99	109022.15	20	Road
62	595	Hamilton	1	2	460851.3837	33891.81	20	Road
63	1509	Shelby	1	1	24347.2142	1792.77	20	Road
64	1183	Davidson	1	1	92336.57886	6799.28	20	Road
65	965	Davidson	1	2	180792.7749	13312.94	20	Road
66	833	Davidson	1	1	276358.1435	20350.12	20	Road
67	908	Davidson	1	2	219757.0703	16182.3	20	Road
68	988	Davidson	1	2	167002.3416	12297.61	20	Road
69	699	Bradley	1	1	385767.4344	28406.91	20	Road
70	676	Hamilton	1	1	402426.8224	29806.35	20	Road
71	283	Knox	1	2	1535323.56	113716.13	20	Road
72	534	Hamilton	1	2	607727.2784	45012.4	20	Road
73	1041	Davidson	1	2	141191.4742	10502.44	20	Road
74	408	Knox	1	2	925680.403	68856.2	20	Road
75	1035	Davidson	1	2	144376.5002	10739.51	20	Road
76	1390	Wilson	1	1	46199.89656	3436.66	20	Road
77	317	Knox	1	2	1200730.498	89796.57	20	Road
78	578	Hamilton	1	2	474525.1137	35487.43	20	Road
79	522	Hamilton	1	2	627090.2916	46924.5	20	Road
80	604	Hamilton	1	2	499003.6191	37470.55	20	Road
81	865	Davidson	1	1	247658.8708	18596.91	20	Road
82	1384	Wilson	1	1	47250.22575	3555.32	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
83	1036	Davidson	1	2	141580.485	10671.08	20	Road
84	417	Washington	1	2	881109.4892	66411.2	20	Road
85	883	Davidson	1	2	236397.0078	17817.94	20	Road
86	485	Hamilton	1	2	687323.7532	52232.89	20	Road
87	531	Hamilton	1	2	597301.7887	45391.98	20	Road
88	1009	Davidson	1	2	153158.4193	11649.84	20	Road
89	437	Hamilton	1	1	805087.0512	61238.89	20	Road
90	1216	Davidson	1	2	79027.54646	6011.43	20	Road
91	967	Davidson	1	2	202334.2486	15396.59	20	Road
92	577	Hamilton	1	2	609842.5247	46406.18	20	Road
93	490	Hamilton	1	1	773236.791	58840.19	20	Road
94	1151	Davidson	1	1	114981.8708	8749.74	20	Road
95	276	Knox	1	2	1531589.056	116792.52	20	Road
96	444	Hamilton	1	1	772711.6264	59489.27	20	Road
97	614	Hamilton	1	2	475497.6408	36635.43	20	Road
98	1301	Robertson	1	1	61877.03228	4770.69	20	Road
99	1103	Davidson	1	1	111373.7955	8613.52	20	Road
100	1078	Rutherford	1	2	122766.9496	9494.77	20	Road
101	763	Montgomery	1	2	311826.2043	24116.57	20	Road
102	1034	Davidson	1	2	139042.1895	10753.8	20	Road
103	828	Davidson	1	1	265499.8792	20534.34	20	Road
104	571	Hamilton	1	2	464906.8214	36200.46	20	Road
105	361	Knox	1	1	1107552.683	86324.13	20	Road
106	731	Cheatham	1	1	393056.5244	30743.2	20	Road
107	341	Knox	1	2	1164917.19	91252.51	20	Road
108	759	Montgomery	1	2	308636.3156	24348.17	20	Road
109	328	Knox	1	2	1218804.912	96151.55	20	Road
110	1218	Davidson	1	1	75803.61935	5980.21	20	Road
111	448	Hamilton	1	1	749113.258	59176.19	20	Road
112	1537	Shelby	1	2	17184.55262	1357.7	20	Road
113	312	Knox	1	2	1388554.643	110510.09	20	Road
114	1380	Wilson	1	2	45353.79804	3616.19	20	Road
115	1226	Davidson	1	2	73134.03266	5831.72	20	Road
116	934	Davidson	1	1	185465.7673	14789.1	20	Road
117	1412	Wilson	1	1	40116.73999	3198.92	20	Road
118	915	Davidson	1	2	199552.8213	15935.64	20	Road
119	679	Hamilton	1	1	428559.3886	34292.31	20	Road
120	1359	Wilson	1	1	58071.66514	4646.79	20	Road
121	1157	Davidson	1	2	106134.2241	8492.82	20	Road
122	822	Davidson	1	1	301692.4726	24179.6	20	Road
123	308	Knox	1	2	1512089.889	121189.86	20	Road
124	501	Hamilton	1	2	663739.9727	53471.39	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
125	1037	Davidson	1	2	130085.2155	10541.36	20	Road
126	511	Hamilton	1	2	594437.6965	48178.22	20	Road
127	1052	Davidson	1	2	124838.4322	10118.01	20	Road
128	1167	Davidson	1	1	88091.49838	7139.79	20	Road
129	867	Davidson	1	1	262431.5564	21356.8	20	Road
130	228	Knox	1	2	2074832.93	168852.6	20	Road
131	314	Knox	1	2	1104917.135	90490.36	20	Road
132	349	Knox	1	2	1085670.825	89034.89	20	Road
133	625	Hamilton	1	2	429784.0077	35255.52	20	Road
134	368	Knox	1	1	1018692.888	83565.09	20	Road
135	1503	Shelby	1	1	26408.9715	2170.77	20	Road
136	1077	Rutherford	1	2	134092.0269	11023.21	20	Road
137	853	Davidson	1	1	268908.5864	22106.07	20	Road
138	398	Knox	1	1	1007713.058	82840.7	20	Road
139	897	Davidson	1	2	237442.4744	19519.43	20	Road
140	798	Davidson	1	1	310323.65	25510.91	20	Road
141	502	Hamilton	1	2	603141.8135	49651.8	20	Road
142	360	Knox	1	1	1050027.709	86440.96	20	Road
143	507	Hamilton	1	2	589949.4843	48691.63	20	Road
144	860	Davidson	1	1	227911.7095	18832.01	20	Road
145	402	Knox	1	1	799621.4493	66171.23	20	Road
146	488	Hamilton	1	2	619684.4982	51305.21	20	Road
147	304	Knox	1	1	1271462.388	105267.56	20	Road
148	237	Knox	1	2	1646867.547	136616.04	20	Road
149	364	Knox	1	1	1184460.12	99421.88	20	Road
150	1019	Davidson	1	2	155322.292	13037.58	20	Road
151	769	Montgomery	1	2	326681.5546	27421.29	20	Road
152	1068	Davidson	1	1	135628.6196	11384.54	20	Road
153	370	Knox	1	2	920774.0041	77848.49	20	Road
154	1080	Rutherford	1	2	97768.14233	8316.99	20	Road
155	1025	Davidson	1	2	114573.4094	9746.7	20	Road
156	573	Hamilton	1	2	423015.2196	35985.87	20	Road
157	698	Bradley	1	1	332074.217	28433.29	20	Road
158	393	Knox	1	1	862646.0635	73863.1	20	Road
159	471	Hamilton	1	2	631087.3777	54036.16	20	Road
160	916	Davidson	1	2	185898.5418	15917.37	20	Road
161	1053	Davidson	1	2	117884.8639	10093.81	20	Road
162	1117	Davidson	1	2	98225.23003	8410.48	20	Road
163	190	Knox	1	2	2572489.599	220498.13	20	Road
164	907	Davidson	1	2	187250.3544	16182.6	20	Road
165	1129	Davidson	1	2	92997.89724	8054.28	20	Road
166	428	Hamilton	1	1	722514.6438	62575.37	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
167	525	Hamilton	1	2	532035.4997	46169.74	20	Road
168	257	Knox	1	2	1319514.949	114877.73	20	Road
169	801	Davidson	1	1	235584.9477	20510.36	20	Road
170	836	Davidson	1	2	215832.9238	18790.78	20	Road
171	336	Knox	1	2	1053003.642	92174.86	20	Road
172	373	Knox	1	2	939149.9023	82229.58	20	Road
173	192	Knox	1	2	2508847.43	220012.53	20	Road
174	863	Davidson	1	1	212078.9694	18606.52	20	Road
175	1331	Rutherford	1	1	49248.7688	4321.9	20	Road
176	299	Knox	1	2	1211481.784	106316.38	20	Road
177	457	Hamilton	1	1	652575.3624	57268.31	20	Road
178	1143	Davidson	1	2	88553.44872	7771.62	20	Road
179	1055	Davidson	1	2	114378.904	10084.65	20	Road
180	621	Hamilton	1	1	407736.82	35951.07	20	Road
181	697	Bradley	1	1	323340.9243	28509.86	20	Road
182	911	Davidson	1	2	182708.6531	16137.11	20	Road
183	499	Hamilton	1	2	569482.653	50298.08	20	Road
184	1133	Davidson	1	2	90250.50838	7971.16	20	Road
185	301	Knox	1	2	1280229.72	113519.84	20	Road
186	854	Davidson	1	1	214033.7488	19017.48	20	Road
187	816	Davidson	1	1	238123.2433	21157.95	20	Road
188	796	Davidson	1	1	249482.359	22167.37	20	Road
189	927	Davidson	1	2	170756.2959	15172.3	20	Road
190	622	Hamilton	1	1	401337.5921	35660.31	20	Road
191	757	Davidson	1	1	276187.9513	24540.31	20	Road
192	750	Cheatham	1	1	281429.8719	25006.13	20	Road
193	1100	Rutherford	1	2	98079.35098	8714.83	20	Road
194	982	Davidson	1	2	142397.4077	12652.83	20	Road
195	506	Hamilton	1	2	634082.7609	56529.53	20	Road
196	885	Davidson	1	2	230712.5873	20568.42	20	Road
197	503	Hamilton	1	2	643978.2235	57412.13	20	Road
198	1048	Davidson	1	2	134670.6805	12006.3	20	Road
199	711	Cumberland	1	1	305461.0149	27284.76	20	Road
200	300	Knox	1	2	1189668.003	106273.19	20	Road
201	146	Knox	1	1	2985200.894	267687.7	20	Road
202	204	Knox	1	2	1984417.092	178698.51	20	Road
203	623	Hamilton	1	2	394680.6446	35584.12	20	Road
204	714	Davidson	1	1	300997.1158	27178.73	20	Road
205	492	Hamilton	1	1	496538.2631	44923.1	20	Road
206	394	Knox	1	1	813134.7124	73588.09	20	Road
207	1247	Davidson	1	1	55030.44199	4982.01	20	Road
208	722	Williamson	1	1	296752.0353	26887.82	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
209	1304	Davidson	1	2	51913.49286	4704.13	20	Road
210	944	Davidson	1	1	157894.626	14367.62	20	Road
211	616	Hamilton	1	2	398259.5441	36361.66	20	Road
212	318	Knox	1	2	1105101.915	101247.58	20	Road
213	248	Knox	1	2	1644674.499	150809.9	20	Road
214	1056	Davidson	1	2	97340.23043	8934.99	20	Road
215	315	Knox	1	2	1284698.481	117955.37	20	Road
216	605	Hamilton	1	2	471977.0929	43335.3	20	Road
217	247	Knox	1	2	1416295.976	130254.89	20	Road
218	819	Davidson	1	1	228130.5281	21046.68	20	Road
219	469	Hamilton	1	1	525675.1729	48529.17	20	Road
220	869	Davidson	1	1	230425.6919	21299.85	20	Road
221	378	Knox	1	2	859957.0263	79570.26	20	Road
222	163	Knox	1	2	2260561.279	211184.36	20	Road
223	1072	Rutherford	1	2	103788.0846	9698.06	20	Road
224	372	Knox	1	1	881532.5384	82371.59	20	Road
225	792	Davidson	1	1	244250.1636	22823.43	20	Road
226	1114	Davidson	1	2	80393.94694	7518.82	20	Road
227	904	Davidson	1	2	174096.9263	16357.89	20	Road
228	628	Hamilton	1	2	372862.0007	35033.73	20	Road
229	405	Knox	1	2	791729.3925	74527.27	20	Road
230	150	Knox	1	1	3222084.166	303741.58	20	Road
231	797	Davidson	1	1	270678.5856	25516.53	20	Road
232	177	Knox	1	2	2687529.821	253350.24	20	Road
233	1361	Wilson	1	2	48850.03272	4605.17	20	Road
234	268	Knox	1	1	1474195.373	138974.94	20	Road
235	151	Knox	1	1	3212412.384	302839.75	20	Road
236	443	Hamilton	1	1	736640.5989	69444.61	20	Road
237	762	Montgomery	1	2	298575.5235	28147.41	20	Road
238	894	Davidson	1	2	179922.3632	16974.37	20	Road
239	468	Hamilton	1	1	672774.7488	63512.31	20	Road
240	432	Hamilton	1	1	649944.6768	61631.38	20	Road
241	703	Bradley	1	1	295677.3929	28084.12	20	Road
242	567	Hamilton	1	2	433596.3137	41184.47	20	Road
243	924	Davidson	1	2	161614.5418	15350.81	20	Road
244	1269	Sumner	1	1	49404.37312	4700.76	20	Road
245	1084	Rutherford	1	1	85538.61492	8139.15	20	Road
246	1116	Davidson	1	2	78551.00821	7474.3	20	Road
247	674	Hamilton	1	1	364269.7244	34682.51	20	Road
248	906	Davidson	1	1	197695.2947	18822.83	20	Road
249	467	Hamilton	1	1	668592.8826	63657.89	20	Road
250	375	Knox	1	2	857229.088	82051.11	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
251	1074	Rutherford	1	2	115720.9913	11132	20	Road
252	543	Hamilton	1	2	531982.0107	51175.61	20	Road
253	332	Knox	1	1	1139393.218	109608.13	20	Road
254	306	Knox	1	2	1081698.052	104825.66	20	Road
255	374	Knox	1	2	980419.0868	95108.62	20	Road
256	132	Knox	1	1	3145162.14	305136.31	20	Road
257	518	Hamilton	1	2	566881.1432	55179	20	Road
258	843	Davidson	1	1	235662.7499	22939.11	20	Road
259	1060	Davidson	1	2	101697.1515	9936.62	20	Road
260	755	Davidson	1	1	291821.3233	28530.9	20	Road
261	222	Knox	1	2	1423978.94	140725.28	20	Road
262	794	Davidson	1	1	214733.9682	21221.54	20	Road
263	270	Knox	1	1	1209201.208	119844.01	20	Road
264	303	Knox	1	2	1062301	105339.4	20	Road
265	294	Knox	1	2	1088000.027	107908.25	20	Road
266	441	Hamilton	1	1	706584.651	70244.81	20	Road
267	803	Davidson	1	1	217870.3679	21757.66	20	Road
268	178	Knox	1	2	2505988.2	251521.12	20	Road
269	799	Davidson	1	1	253664.2252	25459.86	20	Road
270	379	Knox	1	2	784678.5715	79089.44	20	Road
271	205	Knox	1	2	1761509.034	178467.95	20	Road
272	350	Knox	1	2	936543.5299	95323.94	20	Road
273	184	Knox	1	2	2160186.764	219870.03	20	Road
274	615	Hamilton	1	2	385427.0499	39230.16	20	Road
275	941	Davidson	1	1	163948.6067	16803.01	20	Road
276	435	Hamilton	1	1	695201.2221	71251.82	20	Road
277	783	Williamson	1	1	259868.9477	26634.3	20	Road
278	141	Knox	1	1	2810554.49	289431.04	20	Road
279	481	Hamilton	1	2	511432.5145	52667.7	20	Road
280	672	Hamilton	1	1	313002.962	32248.79	20	Road
281	120	Loudon	1	1	3700017.987	381215.25	20	Road
282	260	Knox	1	2	1802870.608	186058.04	20	Road
283	168	Knox	1	1	2565925.041	269057.92	20	Road
284	1458	Shelby	1	1	25198.17535	2646.72	20	Road
285	1013	Davidson	1	2	108723.6593	11420.51	20	Road
286	835	Williamson	1	2	192322.0828	20243.56	20	Road
287	316	Knox	1	2	966521.6756	101735.02	20	Road
288	359	Knox	1	1	820715.5606	86663.69	20	Road
289	811	Davidson	1	1	202645.4572	21398.45	20	Road
290	748	Cheatham	1	1	237398.7107	25068.27	20	Road
291	450	Hamilton	1	1	552662.798	58840.57	20	Road
292	767	Montgomery	1	1	257602.9597	27447.84	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
293	415	Sullivan	1	2	629006.1698	67703.97	20	Road
294	391	Knox	1	1	806565.2923	87110.61	20	Road
295	634	Hamilton	1	2	372560.5173	40237.44	20	Road
296	970	Davidson	1	2	142037.5727	15340.41	20	Road
297	896	Davidson	1	2	139115.129	15043.88	20	Road
298	893	Davidson	1	2	124789.8059	13798.2	20	Road
299	1071	Rutherford	1	2	87143.28452	9753.74	20	Road
300	926	Davidson	1	2	135779.3613	15197.93	20	Road
301	1358	Wilson	1	2	36109.92862	4042.13	20	Road
302	1066	Davidson	1	1	87950.48196	9851.98	20	Road
303	330	Knox	1	2	854209.3915	95688.58	20	Road
304	351	Knox	1	2	792522.002	88778.38	20	Road
305	381	Knox	1	1	698206.3306	78394.1	20	Road
306	631	Hamilton	1	1	310897.441	34907.47	20	Road
307	401	Knox	1	2	628602.5711	70579.5	20	Road
308	1249	Davidson	1	1	49992.75198	5613.19	20	Road
309	1152	Davidson	1	2	66924.44757	7514.3	20	Road
310	544	Hamilton	1	2	393426.0847	44174.09	20	Road
311	935	Davidson	1	1	115939.8099	13094.02	20	Road
312	512	Hamilton	1	2	422062.1431	48079.11	20	Road
313	339	Knox	1	2	807357.9019	91970.6	20	Road
314	1577	Shelby	1	2	11682.94536	1349.55	20	Road
315	200	Knox	1	2	1567951.841	182026.85	20	Road
316	319	Knox	1	1	866891.144	100958.83	20	Road
317	458	Hamilton	1	1	490980.2711	57226.54	20	Road
318	985	Davidson	1	1	106486.8472	12463.31	20	Road
319	213	Knox	1	2	1396704.419	163472.73	20	Road
320	564	Hamilton	1	2	352818.2186	41294.56	20	Road
321	742	Cheatham	1	1	252545.8192	29698.66	20	Road
322	701	Bradley	1	1	278361.5492	32734.62	20	Road
323	371	Knox	1	1	816553.1449	96025.57	20	Road
324	745	Cheatham	1	1	213921.9082	25377.35	20	Road
325	1184	Davidson	1	1	57160.27619	6780.95	20	Road
326	1332	Rutherford	1	1	36328.74721	4309.88	20	Road
327	1467	Shelby	1	2	18487.73884	2210.98	20	Road
328	418	Sullivan	1	2	633479.7942	75947.32	20	Road
329	461	Hamilton	1	1	539402.3919	64668.55	20	Road
330	644	Hamilton	1	1	284707.288	34242.9	20	Road
331	1067	Davidson	1	1	81682.54525	9843.06	20	Road
332	565	Hamilton	1	2	342256.575	41244.2	20	Road
333	1501	Shelby	1	1	15895.95431	1915.69	20	Road
334	1016	Davidson	1	2	108203.3574	13176.49	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
335	688	Bradley	1	1	276129.5996	33625.88	20	Road
336	1334	Rutherford	1	1	40802.37154	4968.94	20	Road
337	1083	Rutherford	1	2	81517.21565	9959.82	20	Road
338	620	Hamilton	1	2	315939.9936	38602.52	20	Road
339	648	Hamilton	1	1	278205.9448	34058.13	20	Road
340	539	Hamilton	1	2	361561.2366	44373.64	20	Road
341	693	Bradley	1	1	233819.8112	28708.05	20	Road
342	235	Knox	1	2	1131690.804	138949.54	20	Road
343	889	Davidson	1	2	162742.6732	20192.23	20	Road
344	290	Knox	1	2	1030504.229	127859.72	20	Road
345	249	Knox	1	2	1203750.194	149355.29	20	Road
346	234	Knox	1	2	1118435.26	139321.32	20	Road
347	652	Hamilton	1	1	262684.4134	33013.46	20	Road
348	202	Knox	1	2	1434472.507	180280.89	20	Road
349	380	Knox	1	2	610644.8595	78496.94	20	Road
350	996	Davidson	1	1	93498.74866	12038.79	20	Road
351	999	Davidson	1	2	92579.71062	11920.47	20	Road
352	1273	Sumner	1	1	40345.28384	5194.89	20	Road
353	1043	Davidson	1	2	81468.5893	10490.04	20	Road
354	1223	Davidson	1	2	45548.30345	5864.96	20	Road
355	1011	Davidson	1	2	90177.56886	11611.6	20	Road
356	1324	Rutherford	1	2	34140.56139	4396.54	20	Road
357	706	Putnam	1	1	214359.5453	27894.95	20	Road
358	891	Davidson	1	2	181925.7689	23700.75	20	Road
359	765	Montgomery	1	1	184673.1577	24068.76	20	Road
360	227	Knox	1	2	1121892.594	146220.37	20	Road
361	925	Davidson	1	2	117593.1058	15333.97	20	Road
362	254	Knox	1	2	948768.1947	123720.56	20	Road
363	820	Davidson	1	1	160948.3608	20987.88	20	Road
364	1086	Rutherford	1	2	70289.39109	9166.07	20	Road
365	498	Hamilton	1	2	385076.9402	50305.32	20	Road
366	663	Hamilton	1	1	239363.2153	31269.77	20	Road
367	140	Knox	1	1	2562817.817	335746.4	20	Road
368	459	Hamilton	1	1	502135.1561	65783.26	20	Road
369	321	Knox	1	1	881352.6209	115463.79	20	Road
370	746	Cheatham	1	1	223739.5685	29311.84	20	Road
371	487	Hamilton	1	2	392827.9806	51746.63	20	Road
372	207	Knox	1	2	1330314.862	175278.64	20	Road
373	251	Knox	1	2	1124562.181	148178.84	20	Road
374	241	Knox	1	2	1181591.166	155693.44	20	Road
375	1285	Sumner	1	1	33702.92422	4448.48	20	Road
376	208	Knox	1	2	1509075.055	199737.36	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
377	186	Knox	1	2	1765282.439	233648.58	20	Road
378	206	Knox	1	2	1333922.937	176945.47	20	Road
379	1365	Wilson	1	2	28786.80009	3867.04	20	Road
380	1299	Robertson	1	1	35677.1541	4792.87	20	Road
381	1522	Shelby	1	1	12472.65916	1675.59	20	Road
382	1169	Davidson	1	1	52900.6078	7107.3	20	Road
383	1029	Davidson	1	2	81556.11674	10957.25	20	Road
384	239	Knox	1	2	1014676.351	136325.97	20	Road
385	411	Knox	1	2	509915.3724	68509.64	20	Road
386	1366	Wilson	1	1	28728.44847	3859.89	20	Road
387	1302	Robertson	1	1	35224.92903	4733	20	Road
388	407	Knox	1	2	549657.6895	73878.49	20	Road
389	195	Knox	1	2	1573962.059	214756.62	20	Road
390	403	Knox	1	2	780404.3152	107181.71	20	Road
391	491	Hamilton	1	1	367367.2229	50729.35	20	Road
392	526	Hamilton	1	2	385318.5421	53370.24	20	Road
393	1338	Rutherford	1	2	42134.73357	5891.14	20	Road
394	761	Montgomery	1	2	240467.0334	33621.81	20	Road
395	504	Hamilton	1	2	349268.4949	48924.05	20	Road
396	309	Knox	1	2	738537.0266	104559.29	20	Road
397	253	Knox	1	2	878804.6001	125068.58	20	Road
398	236	Knox	1	2	967231.6203	137653.28	20	Road
399	143	Knox	1	2	1991720.77	283455.92	20	Road
400	218	Knox	1	2	929672.6264	133868.94	20	Road
401	214	Knox	1	2	1002830.972	144411.16	20	Road
402	172	Blount	1	1	1585009.966	228382.68	20	Road
403	219	Knox	1	2	1044566.97	150723.87	20	Road
404	176	Knox	1	2	1531520.979	221040.58	20	Road
405	733	Cheatham	1	1	182446.0708	26419.68	20	Road
406	1111	Davidson	1	2	58789.25896	8519.35	20	Road
407	1433	Shelby	1	1	20393.89182	2955.42	20	Road
408	1278	Sumner	1	1	35312.45646	5117.5	20	Road
409	1235	Davidson	1	1	39703.416	5753.85	20	Road
410	1382	Wilson	1	1	24561.17014	3559.54	20	Road
411	1372	Wilson	1	2	25733.06521	3743.26	20	Road
412	983	Davidson	1	2	86603.53202	12599.74	20	Road
413	829	Davidson	1	1	140486.3921	20523.89	20	Road
414	861	Davidson	1	1	128850.1062	18823.93	20	Road
415	489	Hamilton	1	1	349438.6871	51050.42	20	Road
416	355	Knox	1	1	600083.216	88324.33	20	Road
417	452	Hamilton	1	1	397355.0939	58687.27	20	Road
418	244	Knox	1	2	945894.3773	142255.82	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
419	1018	Davidson	1	2	86671.60891	13062.24	20	Road
420	203	Knox	1	2	1382938.299	208422.25	20	Road
421	225	Knox	1	2	1044401.64	158247.67	20	Road
422	331	Knox	1	1	629492.4333	95536.87	20	Road
423	139	Knox	1	1	2193471.502	335922.46	20	Road
424	1042	Davidson	1	2	78161.9974	12149.71	20	Road
425	817	Davidson	1	1	157583.4173	24495.63	20	Road
426	991	Davidson	1	2	91368.91447	14203.6	20	Road
427	142	Knox	1	1	2148093.391	334374.05	20	Road
428	128	Loudon	1	1	2192236.393	343185.4	20	Road
429	921	Davidson	1	2	115832.8319	18301.77	20	Road
430	966	Davidson	1	2	97539.59847	15411.69	20	Road
431	832	Davidson	1	1	150153.3108	23725.05	20	Road
432	173	Blount	1	2	1662739.188	262722.42	20	Road
433	744	Cheatham	1	1	186691.1513	29498.32	20	Road
434	638	Hamilton	1	2	216056.605	34432.62	20	Road
435	782	Williamson	1	1	144323.0113	23000.55	20	Road
436	220	Knox	1	2	944897.5371	150590	20	Road
437	1240	Davidson	1	2	35609.0772	5675.18	20	Road
438	1388	Wilson	1	1	21838.09446	3480.8	20	Road
439	148	Knox	1	2	1650704.166	264554.46	20	Road
440	813	Davidson	1	1	117738.9849	18897.46	20	Road
441	389	Knox	1	1	538857.7768	87276.51	20	Road
442	162	Knox	1	2	1709940.788	276952.26	20	Road
443	1406	Wilson	1	1	20116.72162	3262.02	20	Road
444	486	Hamilton	1	2	320812.354	52027.61	20	Road
445	1002	Davidson	1	1	73109.71948	11856.69	20	Road
446	1165	Davidson	1	1	44473.66108	7212.68	20	Road
447	164	Knox	1	2	1696690.107	275179.27	20	Road
448	298	Knox	1	2	656421.7068	106492.78	20	Road
449	157	Knox	1	2	1580876.726	256470.21	20	Road
450	216	Knox	1	2	1002228.006	162594.75	20	Road
451	1250	Davidson	1	1	34442.04477	5587.99	20	Road
452	830	Davidson	1	1	145723.4502	23757.2	20	Road
453	726	Cheatham	1	1	175580.03	28720.06	20	Road
454	155	Knox	1	2	1689639.286	276381.54	20	Road
455	649	Hamilton	1	1	239912.693	39262.04	20	Road
456	302	Knox	1	2	745636.4739	122025.28	20	Road
457	449	Hamilton	1	1	615471.4347	101793.74	20	Road
458	451	Hamilton	1	1	354427.7508	58744.18	20	Road
459	305	Knox	1	2	630712.9548	104946.07	20	Road
460	1314	Sumner	1	1	27444.71279	4572.35	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
461	1261	Davidson	1	1	32307.34794	5383.03	20	Road
462	271	Knox	1	1	711602.8905	119630.45	20	Road
463	212	Knox	1	2	986769.6884	165890.02	20	Road
464	310	Knox	1	2	620588.9484	104330.39	20	Road
465	584	Hamilton	1	2	233868.4375	39316.89	20	Road
466	426	Hamilton	1	1	382708.8368	64446.03	20	Road
467	209	Knox	1	2	1014428.357	170824.49	20	Road
468	420	Hamilton	1	1	388422.4331	65408.67	20	Road
469	942	Davidson	1	2	85713.66979	14433.82	20	Road
470	752	Cheatham	1	1	147172.5155	24973.24	20	Road
471	777	Davidson	1	2	146272.9279	24890.51	20	Road
472	274	Knox	1	1	959057.5306	163223.1	20	Road
473	325	Knox	1	2	776300.2512	133653.72	20	Road
474	322	Knox	1	2	619169.0589	106675.06	20	Road
475	240	Knox	1	2	901235.9361	156254.35	20	Road
476	453	Hamilton	1	1	390474.4652	67903.9	20	Road
477	313	Knox	1	2	584799.9537	102636.66	20	Road
478	252	Knox	1	2	674039.034	119256.43	20	Road
479	586	Hamilton	1	1	217709.9009	38931.18	20	Road
480	286	Knox	1	2	625359.1935	112482.18	20	Road
481	1137	Davidson	1	2	51067.39435	9206.34	20	Road
482	613	Hamilton	1	1	236440.7715	42625.22	20	Road
483	446	Hamilton	1	1	381493.1781	68775.98	20	Road
484	790	Davidson	1	1	144551.5551	26477.46	20	Road
485	158	Knox	1	2	1191131.656	219229.45	20	Road
486	258	Knox	1	2	662110.9899	122305.32	20	Road
487	880	Davidson	1	2	97364.54361	17985.37	20	Road
488	474	Hamilton	1	1	289283.0277	53437.05	20	Road
489	939	Davidson	1	1	79348.48038	14657.56	20	Road
490	175	Knox	1	1	1260550.635	237634.8	20	Road
491	1459	Shelby	1	1	16139.08606	3050.61	20	Road
492	246	Knox	1	2	809550.9503	153024.01	20	Road
493	232	Knox	1	2	871632.2133	166248.74	20	Road
494	806	Davidson	1	1	131412.7149	25064.7	20	Road
495	538	Hamilton	1	1	269954.053	51489.09	20	Road
496	425	Hamilton	1	2	391378.9153	74648.94	20	Road
497	940	Davidson	1	1	67648.98021	12984.18	20	Road
498	311	Knox	1	2	480690.9351	92265.02	20	Road
499	422	Hamilton	1	1	300447.638	57669	20	Road
500	484	Hamilton	1	2	270197.1847	52372.38	20	Road
501	472	Hamilton	1	2	278731.1094	54026.95	20	Road
502	1181	Davidson	1	1	35365.94545	6865.88	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
503	849	Davidson	1	1	99401.98774	19299.96	20	Road
504	1288	Sumner	1	1	25621.22461	4974.76	20	Road
505	738	Cheatham	1	1	184104.2294	35787.96	20	Road
506	289	Knox	1	2	533212.2574	103849.87	20	Road
507	412	Knox	1	2	341245.1469	68378.14	20	Road
508	959	Davidson	1	2	115272.4815	23194.91	20	Road
509	495	Hamilton	1	2	268072.2132	54210.93	20	Road
510	930	Davidson	1	2	73664.05989	14905.13	20	Road
511	256	Knox	1	2	606341.4274	122690.61	20	Road
512	1339	Rutherford	1	1	20987.13331	4247.14	20	Road
513	913	Davidson	1	2	109127.258	22129.44	20	Road
514	958	Davidson	1	2	92108.03501	18678.21	20	Road
515	329	Knox	1	1	468967.1218	95718.55	20	Road
516	581	Hamilton	1	2	193411.3131	39477.1	20	Road
517	617	Hamilton	1	2	176411.5406	36279.34	20	Road
518	881	Davidson	1	1	86856.38905	17862.18	20	Road
519	589	Hamilton	1	2	188154.8045	38695.25	20	Road
520	433	Hamilton	1	1	507109.1948	106162.03	20	Road
521	1291	Robertson	1	1	32360.83692	6777.74	20	Road
522	1045	Davidson	1	2	69205.02345	14494.5	20	Road
523	129	Loudon	1	1	2058800.821	431214.63	20	Road
524	588	Hamilton	1	2	213795.4796	44941.14	20	Road
525	167	Knox	1	2	987358.0672	209294.63	20	Road
526	357	Knox	1	1	560219.333	120684.73	20	Road
527	1023	Davidson	1	2	69705.87488	15281.1	20	Road
528	1190	Davidson	1	1	41439.37675	9085.12	20	Road
529	185	Knox	1	2	954676.2964	217197.62	20	Road
530	516	Hamilton	1	2	225013.5789	51192.96	20	Road
531	1054	Davidson	1	2	47537.12123	10816.03	20	Road
532	395	Knox	1	1	433907.5223	100129.6	20	Road
533	382	Knox	1	1	337262.6487	78372.64	20	Road
534	377	Knox	1	2	344255.1181	79997.75	20	Road
535	197	Knox	1	2	791330.6564	183888.84	20	Road
536	447	Hamilton	1	1	254724.2797	59192.78	20	Road
537	548	Hamilton	1	2	187619.9146	43599.17	20	Road
538	116	Loudon	1	1	1624125.003	379076.05	20	Road
539	272	Knox	1	1	491174.7765	118301.4	20	Road
540	161	Knox	1	2	1000740.039	241032.74	20	Road
541	366	Knox	1	1	347887.5065	83790.27	20	Road
542	262	Knox	1	2	579849.5726	140252.43	20	Road
543	1153	Davidson	1	2	42110.4204	10377.62	20	Road
544	764	Montgomery	1	1	135249.3341	33330.67	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
545	221	Knox	1	2	843584.5337	207894.5	20	Road
546	866	Davidson	1	2	104084.7054	25651.45	20	Road
547	476	Hamilton	1	1	213085.5349	53042.75	20	Road
548	287	Knox	1	2	515784.573	129351.09	20	Road
549	111	Loudon	1	1	1947373.537	488372.88	20	Road
550	179	Knox	1	2	926084.0017	232493.81	20	Road
551	170	Knox	1	2	979631.34	246828.61	20	Road
552	514	Hamilton	1	2	204488.396	51523.31	20	Road
553	1047	Davidson	1	2	44449.34791	11199.82	20	Road
554	477	Hamilton	1	1	242280.6871	61278.91	20	Road
555	482	Hamilton	1	2	207444.8781	52650.3	20	Road
556	342	Knox	1	2	358439.4248	91155.65	20	Road
557	809	Davidson	1	1	116858.8479	29720.89	20	Road
558	691	Bradley	1	1	156591.4397	39827.12	20	Road
559	938	Davidson	1	1	79742.35382	20282.58	20	Road
560	464	Hamilton	1	1	215497.4019	55507.62	20	Road
561	527	Hamilton	1	2	231612.1748	63670.98	20	Road
562	392	Knox	1	1	228062.4512	62809.42	20	Road
563	291	Knox	1	2	460765.7139	127186.21	20	Road
564	445	Hamilton	1	1	249390.7338	68840.41	20	Road
565	413	Sevier	1	2	286543.1787	79096	20	Road
566	1276	Sumner	1	1	16372.49255	4554.04	20	Road
567	1298	Robertson	1	1	15288.12491	4252.68	20	Road
568	758	Montgomery	1	2	78030.70625	21706	20	Road
569	191	Knox	1	2	606219.8615	168636.55	20	Road
570	280	Knox	1	2	366010.5477	101816.67	20	Road
571	653	Hamilton	1	2	103442.8375	28775.86	20	Road
572	419	Hamilton	1	1	235045.1952	65424.63	20	Road
573	137	Knox	1	1	1045627.024	291049.42	20	Road
574	169	Knox	1	2	820671.7969	230171.71	20	Road
575	618	Hamilton	1	1	129156.4522	36224.68	20	Road
576	226	Knox	1	2	715381.158	202340.46	20	Road
577	181	Knox	1	2	801289.3332	228286.4	20	Road
578	1404	Wilson	1	1	13484.96145	3853.03	20	Road
579	201	Knox	1	2	664197.0604	193507.63	20	Road
580	267	Knox	1	1	365081.6752	106447.17	20	Road
581	238	Knox	1	2	535319.4175	158167.74	20	Road
582	187	Knox	1	2	641153.0324	201389.54	20	Road
583	532	Hamilton	1	2	163655.4827	52381.58	20	Road
584	344	Knox	1	2	326519.2847	104925.27	20	Road
585	320	Knox	1	1	359046.0522	115764.01	20	Road
586	667	Hamilton	1	2	109308.4868	35243.41	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
587	273	Knox	1	1	424725.392	136941.13	20	Road
588	1030	Davidson	1	2	39301.29246	12672.12	20	Road
589	166	Knox	1	2	709964.1824	237420.4	20	Road
590	1277	Sumner	1	1	20640.24712	7090.6	20	Road
591	147	Knox	1	1	774146.1038	267114.55	20	Road
592	76	Wilson	1	2	2308360.983	813671.28	20	Road
593	583	Hamilton	1	2	129423.8972	45620.77	20	Road
594	152	Knox	1	2	648262.205	231194.74	20	Road
595	734	Cheatham	1	1	85365.80015	30522.2	20	Road
596	563	Hamilton	1	2	134585.721	48122.07	20	Road
597	97	Shelby	1	2	1397385.188	503573.53	20	Road
598	732	Cheatham	1	1	84084.03138	30632.56	20	Road
599	345	Knox	1	2	285483.8345	104843.64	20	Road
600	189	Knox	1	2	629182.5906	231067.06	20	Road
601	193	Knox	1	2	455799.1058	167948.51	20	Road
602	654	Hamilton	1	2	77850.78875	28687.3	20	Road
603	1006	Davidson	1	2	28076.85536	10393.44	20	Road
604	149	Knox	1	2	632876.8274	234293.79	20	Road
605	493	Hamilton	1	1	187940.8485	69987.8	20	Road
606	159	Knox	1	2	917224.2804	341569.66	20	Road
607	131	Loudon	1	1	695852.8152	271993.04	20	Road
608	99	Shelby	1	2	1191403.963	465989.02	20	Road
609	165	Knox	1	2	674591.1343	274981.89	20	Road
610	198	Knox	1	2	515738.5146	211534.8	20	Road
611	517	Hamilton	1	2	134593.2608	55205	20	Road
612	46	Davidson	1	2	2162608.357	887582.13	20	Road
613	1127	Davidson	1	2	17442.27228	7179.05	20	Road
614	397	Knox	1	1	199277.3448	82876.53	20	Road
615	156	Knox	1	2	512784.3271	217118.19	20	Road
616	292	Knox	1	2	215580.0667	92300.14	20	Road
617	134	Knox	1	1	656518.9595	283913.58	20	Road
618	174	Blount	1	1	485480.6307	209948.02	20	Road
619	264	Knox	1	1	318851.2915	139415.56	20	Road
620	108	Knox	1	2	1107146.625	501900.01	20	Road
621	183	Knox	1	2	524997.409	237995.89	20	Road
622	70	Robertson	1	1	1858723.054	842611.01	20	Road
623	119	Loudon	1	1	764216.6028	346598.04	20	Road
624	135	Knox	1	1	555050.3518	259950.39	20	Road
625	456	Hamilton	1	1	108723.6593	50920.08	20	Road
626	121	Loudon	1	1	646180.9972	307876.41	20	Road
627	138	Knox	1	1	571972.3222	272814.45	20	Road
628	54	Davidson	1	2	1430640.75	689831.29	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
629	144	Knox	1	2	770497.5976	383375.53	20	Road
630	154	Knox	1	2	488315.547	243405.13	20	Road
631	48	Davidson	1	2	2547301.149	1301819.98	20	Road
632	126	Loudon	1	1	558600.0755	291366.44	20	Road
633	97	Shelby	1	2	951005.0068	497475.95	20	Road
634	54	Davidson	1	1	1588486.75	852244.98	20	Road
635	110	Knox	1	2	695055.3431	375037.71	20	Road
636	354	Knox	1	1	145387.9284	78449.59	20	Road
637	846	Davidson	1	1	33736.96267	18308.44	20	Road
638	153	Knox	1	2	472871.8178	259389.23	20	Road
639	48	Davidson	1	2	2469338.519	1354533.09	20	Road
640	103	Knox	1	1	811855.8394	448853.9	20	Road
641	196	Knox	1	2	358653.3808	198846.28	20	Road
642	160	Knox	1	2	383958.5341	214282.28	20	Road
643	130	Loudon	1	1	484493.5158	273800	20	Road
644	52	Davidson	1	2	1296879.382	732901.09	20	Road
645	230	Knox	1	2	283693.1281	167302.66	20	Road
646	549	Hamilton	1	2	58881.64903	35294.57	20	Road
647	346	Knox	1	2	149851.8274	90399.26	20	Road
648	434	Hamilton	1	1	102047.2613	61561.59	20	Road
649	90	Shelby	1	1	846458.3511	510643.2	20	Road
650	406	Knox	1	2	99042.15274	61068.19	20	Road
651	48	Davidson	1	2	1897161.966	1234864.29	20	Road
652	117	Loudon	1	1	501877.4365	333841.36	20	Road
653	46	Davidson	1	2	1148267.527	780030.1	20	Road
654	113	Knox	1	1	810748.9069	552044.71	20	Road
655	223	Knox	1	2	251622.5195	172918.99	20	Road
656	390	Knox	1	1	126947.887	87241.38	20	Road
657	107	Knox	1	2	585918.3598	409643.02	20	Road
658	217	Knox	1	2	202071.6663	142638.42	20	Road
659	791	Davidson	1	1	27702.43245	20243.84	20	Road
660	233	Knox	1	2	158794.2135	117614.05	20	Road
661	95	Shelby	1	1	878697.7314	682266.28	20	Road
662	34	Hamilton	1	2	3667932.135	2847980.55	20	Road
663	93	Shelby	1	1	864737.7615	671431.28	20	Road
664	105	Roane	1	1	437437.7955	421743.27	20	Road
665	115	Loudon	1	1	350479.2911	337905.66	20	Road
666	106	Roane	1	1	426278.0478	410986.13	20	Road
667	352	Knox	1	1	81410.23768	78494.01	20	Road
668	480	Hamilton	1	2	48529.0988	46791.46	20	Road
669	210	Knox	1	2	153309.161	151006.8	20	Road
670	109	Knox	1	2	389142.1031	383302.6	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
671	127	Loudon	1	1	290381.9833	286026.38	20	Road
672	136	Knox	1	1	263019.9353	259077.73	20	Road
673	358	Knox	1	1	78303.01382	77130.23	20	Road
674	510	Hamilton	1	2	43369.8429	42721.51	20	Road
675	77	Wilson	1	2	546083.6526	567060.17	20	Road
676	46	Davidson	1	2	895955.1143	948790.01	20	Road
677	35	Hamilton	1	2	1755250.822	1976278.44	20	Road
678	39	Hamilton	1	1	1453563.212	1888124.68	20	Road
679	93	Shelby	1	1	403681.3822	540696.28	20	Road
680	35	Hamilton	1	2	1672206.739	2287906.89	20	Road
681	34	Hamilton	1	2	1478853.778	2169678.7	20	Road
682	211	Knox	1	2	104984.2929	156796.43	20	Road
683	48	Davidson	1	2	1129390.777	1727564.29	20	Road
684	266	Knox	1	1	69676.69906	106580.59	20	Road
685	34	Hamilton	1	2	1783006.744	2852173.88	20	Road
686	104	Knox	1	1	285334.568	460600.15	20	Road
687	278	Knox	1	2	63335.82283	102617.02	20	Road
688	48	Davidson	1	2	894073.2745	1448682.74	20	Road
689	84	Shelby	1	1	291894.2628	472962.98	20	Road
690	243	Knox	1	2	76630.26733	124506.01	20	Road
691	133	Knox	1	1	174189.3163	285647.56	20	Road
692	34	Hamilton	1	2	1830033.288	3001091.78	20	Road
693	21	Hamilton	1	1	1083973.765	1830629.19	20	Road
694	39	Hamilton	1	1	1091471.948	1850945.13	20	Road
695	84	Shelby	1	1	249900.5456	451082.14	20	Road
696	171	Knox	1	2	101458.8824	202507.39	20	Road
697	48	Davidson	1	2	750489.3838	1497978.86	20	Road
698	48	Davidson	1	2	545509.8617	1126881.25	20	Road
699	114	Knox	1	1	165071.8754	340996.68	20	Road
700	215	Knox	1	2	61697.11478	152813.95	20	Road
701	338	Knox	1	2	34869.95666	86367.38	20	Road
702	48	Davidson	1	2	710445.5833	1759666.4	20	Road
703	261	Knox	1	2	45932.45163	113774.94	20	Road
704	33	Hamilton	1	2	1220759.692	3071427.09	20	Road
705	84	Shelby	1	2	175964.1782	446465.93	20	Road
706	46	Davidson	1	2	361254.8906	998923.52	20	Road
707	46	Davidson	1	2	318000	891000	20	Road
708	21	Bradley	1	1	3814693.511	10859535.46	20	Road
709	32	Hamilton	1	1	1233577.598	3652461.3	20	Road
710	32	Hamilton	1	1	1067985.421	3208286.79	20	Road
711	122	Knox	1	1	95662.62131	344115.7	20	Road
712	53	Davidson	1	1	163476.9311	731279.27	20	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
713	32	Hamilton	1	1	1553115.942	7999512.03	20	Road
714	32	Hamilton	1	1	842344.5618	6262193.04	20	Road
715	44	Davidson	1	2	63831.81161	675642.57	20	Road
716	32	Hamilton	1	1	276139.3249	3020522.38	20	Road
717	34	Hamilton	1	2	162820.4754	2342680.8	20	Road
718	10	Knox	1	2	857258.2638	14779382.93	20	Road
719	8	Knox	1	1	1271617.993	23778830.98	20	Road
720	2983	Shelby	2	2	15926.64901	3482.01081	5	Road
721	2405	Davidson	2	2	129939.7353	28559.58683	5	Road
722	2470	Davidson	2	2	129939.7353	28559.58683	5	Road
723	2550	Davidson	2	2	1314243.415	155668.2076	10	Road
724	2529	Davidson	2	2	15354267.62	1870742.304	10	Road
725	2147	Davidson	2	2	8133439.806	1000528.019	10	Road
726	1746	Knox	2	2	51670.59058	12157.97221	5	Road
727	2311	Davidson	2	1	1836764.268	229059.57	10	Road
728	2534	Williamson	2	2	16723151.38	2287324.38	10	Road
729	1752	Knox	2	2	2551235.348	349530.0242	10	Road
730	2636	Davidson	2	2	2551235.348	353603.2073	10	Road
731	2160	Williamson	2	2	161523.5177	42834.74434	5	Road
732	2430	Davidson	2	2	161523.5177	42834.74434	5	Road
733	2279	Davidson	2	1	164852.1171	44262.82128	5	Road
734	2670	Davidson	2	2	303134.7411	83341.5189	5	Road
735	2386	Davidson	2	2	1314243.415	197259.8677	10	Road
736	2525	Davidson	2	2	1673772.344	254740.376	10	Road
737	2746	Davidson	2	2	197961.2371	58283.14214	5	Road
738	2931	Shelby	2	1	145371.1659	42834.74434	5	Road
739	2469	Davidson	2	2	145371.1659	42834.74434	5	Road
740	1975	Davidson	2	2	20967.04899	6345.655997	5	Road
741	2779	Davidson	2	2	71493.78387	21889.07481	5	Road
742	3021	Madison	2	2	71493.78387	21889.07481	5	Road
743	2918	Shelby	2	2	175965.5441	58283.14214	5	Road
744	1844	Knox	2	2	265911.045	88666.18268	5	Road
745	1980	Davidson	2	1	93508.80175	31242.75953	5	Road
746	1866	Marion	2	2	93508.80175	31242.75953	5	Road
747	1744	Knox	2	2	119297.1863	41500.05596	5	Road
748	2737	Davidson	2	2	119297.1863	41500.05596	5	Road
749	2151	Davidson	2	1	157903.4224	55138.35792	5	Road
750	86	Shelby	2	1	6345594.631	1168801.924	10	Road
751	2183	Davidson	2	2	337837.0953	63009.90002	10	Road
752	1780	Knox	2	2	73738.86251	26341.10469	5	Road
753	2493	Davidson	2	1	118995.5117	43042.69411	5	Road
754	2304	Davidson	2	2	12150556.02	2311766.272	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
755	2506	Davidson	2	2	236365.3734	88666.18268	5	Road
756	2001	Davidson	2	1	4080568.251	831834.3307	10	Road
757	2780	Davidson	2	2	6111512.565	1245903.153	10	Road
758	1789	Knox	2	2	7032496.154	1443529.518	10	Road
759	2253	Davidson	2	1	147546.1734	58905.60263	5	Road
760	1876	Hamilton	2	1	20772.32503	8323.473203	5	Road
761	2061	Davidson	2	1	20772.32503	8323.473203	5	Road
762	2048	Davidson	2	1	2700075.748	574156.5389	10	Road
763	2404	Davidson	2	2	52828.16546	21437.01061	5	Road
764	1781	Knox	2	2	244011.5339	100189.5088	5	Road
765	2408	Davidson	2	2	197961.2371	81785.83811	5	Road
766	2911	Shelby	2	2	197961.2371	81785.83811	5	Road
767	2961	Shelby	2	2	78544.56112	33155.67516	5	Road
768	1978	Wilson	2	2	1595718.909	355058.3869	10	Road
769	2672	Davidson	2	2	132615.5342	29653.05489	10	Road
770	1913	Hamilton	2	2	8952829.725	2012084.784	10	Road
771	2608	Davidson	2	1	86576.92412	38083.99408	5	Road
772	2497	Davidson	2	1	176633.8013	78396.08367	5	Road
773	2602	Davidson	2	2	56890.07758	25658.64089	5	Road
774	2784	Davidson	2	2	47662.52258	21889.07481	5	Road
775	2656	Davidson	2	2	242912.8187	111668.3182	5	Road
776	1891	Hamilton	2	2	176633.8013	81274.92169	5	Road
777	2863	Shelby	2	1	5860413.462	1443529.518	10	Road
778	1794	Knox	2	2	8138936.113	2012084.784	10	Road
779	1938	Davidson	2	2	8138936.113	2012084.784	10	Road
780	1932	Davidson	2	2	8138936.113	2012084.784	10	Road
781	2343	Davidson	2	2	8138936.113	2012084.784	10	Road
782	2904	Shelby	2	2	8138936.113	2012084.784	10	Road
783	2769	Davidson	2	2	4889210.052	1245903.153	10	Road
784	2419	Davidson	2	2	94775.54006	46417.55061	5	Road
785	2085	Davidson	2	1	7926017.766	2078488.128	10	Road
786	2597	Davidson	2	1	144377.4837	73357.06585	5	Road
787	2081	Davidson	2	2	2094503.928	563768.3187	10	Road
788	2802	Shelby	2	1	2094503.928	563768.3187	10	Road
789	2749	Davidson	2	2	105197.402	54123.97318	5	Road
790	2262	Davidson	2	2	7325042.502	2012084.784	10	Road
791	2372	Davidson	2	2	15202864.89	4358774.569	10	Road
792	2218	Davidson	2	2	15202864.89	4358774.569	10	Road
793	2436	Davidson	2	2	15202864.89	4358774.569	10	Road
794	2605	Davidson	2	2	4037438.862	1177547.262	10	Road
795	2971	Shelby	2	2	16723151.38	4934426.282	10	Road
796	2821	Shelby	2	1	2637190.948	778382.7139	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
797	1894	Hamilton	2	2	2637190.948	778382.7139	10	Road
798	1948	Davidson	2	2	129939.7353	73357.06585	5	Road
799	1823	Unicoi	2	2	176633.8013	99978.06436	5	Road
800	1762	Knox	2	2	176633.8013	99978.06436	5	Road
801	2716	Davidson	2	2	93508.80175	54123.97318	5	Road
802	1883	Hamilton	2	1	144245.6025	84125.24513	5	Road
803	2502	Davidson	2	2	144245.6025	84125.24513	5	Road
804	2809	Shelby	2	1	6793729.513	2078488.128	10	Road
805	2674	Davidson	2	1	21656.84383	12664.64277	5	Road
806	2009	Davidson	2	2	176633.8013	103649.4295	5	Road
807	2491	Rutherford	2	2	176633.8013	103649.4295	5	Road
808	2849	Shelby	2	1	4688330.77	1443529.518	10	Road
809	1881	Hamilton	2	2	4688330.77	1443529.518	10	Road
810	2234	Davidson	2	2	6511148.891	2012084.784	10	Road
811	2421	Davidson	2	1	4409525.191	1372939.939	10	Road
812	2051	Davidson	2	2	5879366.921	1836825.553	10	Road
813	2153	Davidson	2	2	5879366.921	1836825.553	10	Road
814	2857	Shelby	2	2	190789.3474	114115.895	5	Road
815	2777	Davidson	2	2	13682578.4	4303334.52	10	Road
816	2396	Davidson	2	1	22223.31351	13359.61324	5	Road
817	2087	Davidson	2	1	134520.0262	81850.25999	5	Road
818	2750	Davidson	2	2	145371.1659	89151.98823	5	Road
819	2288	Davidson	2	2	29727.26651	18292.42031	5	Road
820	2619	Davidson	2	2	189979.3253	117076.1447	5	Road
821	1776	Knox	2	2	3633694.976	1177547.262	10	Road
822	2270	Davidson	2	2	42136.49287	26341.10469	5	Road
823	1878	Hamilton	2	2	42136.49287	26341.10469	5	Road
824	2211	Davidson	2	1	13889.57094	8710.960818	5	Road
825	1877	Hamilton	2	2	2259021.517	750474.5035	10	Road
826	1845	Knox	2	1	12936938.76	4359655.552	10	Road
827	2373	Davidson	2	1	12936938.76	4359655.552	10	Road
828	2938	Shelby	2	2	12936938.76	4359655.552	10	Road
829	2281	Davidson	2	1	12936938.76	4359655.552	10	Road
830	1747	Knox	2	2	12936938.76	4359655.552	10	Road
831	1770	Knox	2	2	12936938.76	4359655.552	10	Road
832	1910	Hamilton	2	2	2260449.384	778382.7139	10	Road
833	2694	Davidson	2	2	54849.6066	36058.71309	5	Road
834	2623	Davidson	2	2	8050750.695	2804052.635	10	Road
835	2300	Davidson	2	1	8050750.695	2814711.314	10	Road
836	1818	Knox	2	2	8050750.695	2814711.314	10	Road
837	2973	Shelby	2	1	78863.20032	52925.54226	5	Road
838	2210	Davidson	2	2	78863.20032	52925.54226	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
839	2389	Davidson	2	1	4080568.251	1453507.469	10	Road
840	2441	Davidson	2	2	4080568.251	1453507.469	10	Road
841	2416	Davidson	2	1	4080568.251	1453507.469	10	Road
842	2013	Davidson	2	1	1595718.909	569472.5979	10	Road
843	2111	Davidson	2	1	5144446.056	1836825.553	10	Road
844	2141	Davidson	2	2	5144446.056	1836825.553	10	Road
845	2786	Davidson	2	2	5144446.056	1836825.553	10	Road
846	2787	Davidson	2	2	5144446.056	1836825.553	10	Road
847	1819	Knox	2	2	5144446.056	1836825.553	10	Road
848	3004	Shelby	2	2	9367791.164	3348017.847	10	Road
849	2217	Davidson	2	2	12162291.91	4358774.569	10	Road
850	2763	Davidson	2	2	12162291.91	4358774.569	10	Road
851	2047	Davidson	2	2	12162291.91	4358774.569	10	Road
852	2462	Davidson	2	1	63769.14372	43824.29956	5	Road
853	2317	Davidson	2	2	13682578.4	4934426.282	10	Road
854	1859	Knox	2	1	7333815.078	2665413.345	10	Road
855	1739	Knox	2	2	168870.5114	117076.1447	5	Road
856	1872	Hamilton	2	2	3229951.09	1177547.262	10	Road
857	2004	Davidson	2	1	4032920.545	1477423.419	10	Road
858	2084	Davidson	2	1	5661441.261	2078488.128	10	Road
859	2145	Williamson	2	2	1952734.401	718093.8225	10	Road
860	1842	Knox	2	2	1952734.401	718093.8225	10	Road
861	2096	Davidson	2	2	1952734.401	718093.8225	10	Road
862	2244	Williamson	2	2	77609.29608	54475.19689	5	Road
863	1765	Knox	2	2	273276.9211	192421.7497	5	Road
864	2213	Davidson	2	1	141307.041	99978.06436	5	Road
865	2474	Davidson	2	2	141307.041	99978.06436	5	Road
866	2669	Davidson	2	2	12866767.93	4789215.946	10	Road
867	2005	Davidson	2	2	77609.29608	55149.28688	5	Road
868	2557	Davidson	2	1	98491.96469	70037.41758	5	Road
869	2287	Davidson	2	1	55339.66188	39429.31456	5	Road
870	86	Shelby	2	1	2259021.517	864455.4433	10	Road
871	2509	Davidson	2	1	2259021.517	864455.4433	10	Road
872	1798	Knox	2	2	2259021.517	864455.4433	10	Road
873	2021	Davidson	2	1	2259021.517	864455.4433	10	Road
874	2291	Davidson	2	1	2309700.994	884410.9327	10	Road
875	1943	Davidson	2	2	2309700.994	884410.9327	10	Road
876	1812	Knox	2	2	5596844.978	2148501.11	10	Road
877	2233	Davidson	2	1	5596844.978	2148501.11	10	Road
878	2043	Davidson	2	1	5596844.978	2148501.11	10	Road
879	2427	Davidson	2	2	5596844.978	2148501.11	10	Road
880	2428	Davidson	2	2	5596844.978	2148501.11	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
881	2788	Shelby	2	2	5596844.978	2148501.11	10	Road
882	2792	Shelby	2	2	5596844.978	2148501.11	10	Road
883	1977	Sumner	2	2	141307.041	103649.4295	5	Road
884	2721	Davidson	2	2	141307.041	103649.4295	5	Road
885	2114	Davidson	2	2	384076.494	147826.3805	10	Road
886	2460	Davidson	2	1	153353.9628	113092.7779	5	Road
887	2705	Davidson	2	1	28445.03879	20987.07604	5	Road
888	2531	Davidson	2	2	84817.03265	62682.97884	5	Road
889	2649	Davidson	2	1	1936304.158	750474.5035	10	Road
890	1885	Hamilton	2	2	1936304.158	750474.5035	10	Road
891	2968	Shelby	2	2	12200159.71	4738752.64	10	Road
892	2591	Davidson	2	2	6060705.95	2369700.379	10	Road
893	2824	Shelby	2	2	9153.795934	6929.011089	5	Road
894	2055	Davidson	2	1	8326925.479	3348017.847	10	Road
895	2680	Davidson	2	2	8326925.479	3348017.847	10	Road
896	2568	Davidson	2	1	8326925.479	3348017.847	10	Road
897	2634	Davidson	2	2	8326925.479	3348017.847	10	Road
898	1785	Knox	2	2	189979.3253	146138.5332	5	Road
899	2069	Williamson	2	1	6900643.453	2804052.635	10	Road
900	2874	Shelby	2	1	6900643.453	2804052.635	10	Road
901	2450	Davidson	2	2	6900643.453	2804052.635	10	Road
902	2717	Davidson	2	2	6900643.453	2804052.635	10	Road
903	3009	Shelby	2	2	23541.24062	18287.62123	5	Road
904	1873	Hamilton	2	2	6060705.95	2473968.395	10	Road
905	2836	Shelby	2	2	11697061.75	4789215.946	10	Road
906	2837	Shelby	2	2	11697061.75	4789215.946	10	Road
907	2838	Shelby	2	2	11697061.75	4789215.946	10	Road
908	2185	Davidson	2	1	3528805.477	1447795.613	10	Road
909	2734	Davidson	2	1	3993517.302	1639032.447	10	Road
910	2206	Davidson	2	1	3993517.302	1639032.447	10	Road
911	2846	Shelby	2	1	3993517.302	1639032.447	10	Road
912	2813	Shelby	2	1	3993517.302	1639032.447	10	Road
913	2519	Davidson	2	2	3993517.302	1639032.447	10	Road
914	2687	Davidson	2	2	3993517.302	1639032.447	10	Road
915	2745	Sumner	2	2	3993517.302	1639032.447	10	Road
916	2564	Davidson	2	2	3993517.302	1639032.447	10	Road
917	86	Shelby	2	1	4409525.191	1836825.553	10	Road
918	1820	Knox	2	2	4409525.191	1836825.553	10	Road
919	1834	Knox	2	2	4409525.191	1836825.553	10	Road
920	2342	Davidson	2	2	201204.4235	160416.6335	5	Road
921	2170	Davidson	2	2	201204.4235	160416.6335	5	Road
922	2741	Davidson	2	2	1643317.714	689866.4761	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
923	2030	Davidson	2	1	77777.46677	62315.85544	5	Road
924	2032	Davidson	2	1	77777.46677	62315.85544	5	Road
925	2224	Davidson	2	1	10575991.05	4474074.926	10	Road
926	2806	Shelby	2	2	11183479.73	4738752.64	10	Road
927	2964	Shelby	2	2	11183479.73	4738752.64	10	Road
928	2235	Davidson	2	2	11183479.73	4738752.64	10	Road
929	2236	Davidson	2	2	11183479.73	4738752.64	10	Road
930	2345	Davidson	2	1	12150556.02	5149999.05	10	Road
931	76	Wilson	2	2	12150556.02	5149999.05	10	Road
932	51	Davidson	2	2	12150556.02	5149999.05	10	Road
933	2094	Davidson	2	2	12150556.02	5149999.05	10	Road
934	2158	Davidson	2	2	12150556.02	5149999.05	10	Road
935	1981	Davidson	2	1	83409.41451	67667.53154	5	Road
936	2285	Davidson	2	2	3389520.047	1445638.796	10	Road
937	2250	Davidson	2	2	3389520.047	1445638.796	10	Road
938	2143	Williamson	2	2	3389520.047	1445638.796	10	Road
939	2683	Davidson	2	2	1673772.344	718093.8225	10	Road
940	1835	Knox	2	2	1673772.344	718093.8225	10	Road
941	1892	Hamilton	2	2	77777.46677	63899.08347	5	Road
942	1840	Knox	2	2	6111512.565	2665413.345	10	Road
943	2936	Shelby	2	2	31602.36965	26341.10469	5	Road
944	2960	Shelby	2	2	31602.36965	26341.10469	5	Road
945	51	Davidson	2	2	70717.83842	59011.92344	5	Road
946	2016	Davidson	2	2	70717.83842	59011.92344	5	Road
947	2710	Davidson	2	1	10575991.05	4699651.838	10	Road
948	48	Davidson	2	1	3264454.601	1453507.469	10	Road
949	2600	Davidson	2	1	1936304.158	864455.4433	10	Road
950	2115	Davidson	2	2	3983854.754	1794601.131	10	Road
951	2479	Wilson	2	2	168870.5114	146138.5332	5	Road
952	2169	Davidson	2	1	1879385.101	853905.2047	10	Road
953	2310	Davidson	2	1	1879385.101	853905.2047	10	Road
954	2414	Davidson	2	2	55534.68087	48271.83632	5	Road
955	44	Davidson	2	2	969443.0266	441883.9823	10	Road
956	48	Davidson	2	1	969443.0266	441883.9823	10	Road
957	2451	Davidson	2	1	4529153.009	2078488.128	10	Road
958	2150	Davidson	2	1	157903.4224	138544.529	5	Road
959	1806	Knox	2	2	39437.79592	35083.07501	5	Road
960	2110	Davidson	2	2	39437.79592	35083.07501	5	Road
961	2574	Davidson	2	2	219473.0706	195390.8004	5	Road
962	2214	Davidson	2	2	176436.127	157374.3755	5	Road
963	46	Davidson	2	1	9518391.946	4474074.926	10	Road
964	2326	Davidson	2	1	854842.0805	402378.0097	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
965	2267	Davidson	2	2	854842.0805	402378.0097	10	Road
966	2851	Shelby	2	1	25044.30299	22554.66084	5	Road
967	1961	Davidson	2	2	28445.03879	25658.64089	5	Road
968	1988	Davidson	2	2	29206.82249	26378.43596	5	Road
969	2447	Davidson	2	1	132615.5342	62914.73057	10	Road
970	2563	Davidson	2	1	118320.0261	107471.7264	5	Road
971	1993	Davidson	2	2	211723.3524	194329.6089	5	Road
972	2894	Shelby	2	1	62070.17724	57275.80762	5	Road
973	2406	Davidson	2	2	62070.17724	57275.80762	5	Road
974	2221	Davidson	2	2	62070.17724	57275.80762	5	Road
975	1954	Davidson	2	2	67853.62612	62682.97884	5	Road
976	2227	Davidson	2	1	10631736.52	5149999.05	10	Road
977	2400	Davidson	2	1	10631736.52	5149999.05	10	Road
978	2937	Shelby	2	2	10631736.52	5149999.05	10	Road
979	2530	Davidson	2	2	10631736.52	5149999.05	10	Road
980	1950	Davidson	2	2	219473.0706	203206.4324	5	Road
981	2927	Shelby	2	2	6558640.117	3187447.326	10	Road
982	2654	Davidson	2	2	4848564.76	2369700.379	10	Road
983	2186	Davidson	2	1	72051.40245	67299.70464	5	Road
984	2077	Davidson	2	1	178159.1389	166735.461	5	Road
985	2719	Davidson	2	2	134726.5516	126576.7096	5	Road
986	2241	Williamson	2	2	3797713.791	1889021.667	10	Road
987	1839	Knox	2	2	3797713.791	1889021.667	10	Road
988	2949	Shelby	2	2	13669375.52	6810163.312	10	Road
989	2678	Davidson	2	2	13669375.52	6810163.312	10	Road
990	2679	Davidson	2	2	13669375.52	6810163.312	10	Road
991	2265	Davidson	2	2	1369431.429	689866.4761	10	Road
992	2354	Davidson	2	2	1369431.429	689866.4761	10	Road
993	2507	Davidson	2	2	8624625.837	4359655.552	10	Road
994	2518	Davidson	2	2	11665863.85	5944887.938	10	Road
995	2134	Davidson	2	2	11665863.85	5944887.938	10	Road
996	2776	Davidson	2	2	11665863.85	5944887.938	10	Road
997	2955	Shelby	2	2	11665863.85	5944887.938	10	Road
998	2677	Davidson	2	2	9357649.4	4789215.946	10	Road
999	2778	Davidson	2	2	9357649.4	4789215.946	10	Road
1000	2622	Williamson	2	2	106076.7576	104070.2886	5	Road
1001	1927	Marion	2	2	2948592.955	1522398.73	10	Road
1002	1760	Knox	2	2	3414732.646	1794601.131	10	Road
1003	2420	Davidson	2	1	8460792.841	4474074.926	10	Road
1004	2059	Davidson	2	1	8460792.841	4474074.926	10	Road
1005	2019	Davidson	2	2	9781764.832	5210372.831	10	Road
1006	1856	Knox	2	2	9781764.832	5210372.831	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1007	2008	Davidson	2	2	9781764.832	5210372.831	10	Road
1008	2635	Davidson	2	2	9781764.832	5210372.831	10	Road
1009	2739	Davidson	2	2	9781764.832	5210372.831	10	Road
1010	46	Davidson	2	2	9781764.832	5210372.831	10	Road
1011	46	Davidson	2	2	9781764.832	5210372.831	10	Road
1012	1972	Davidson	2	2	9781764.832	5210372.831	10	Road
1013	1973	Davidson	2	2	9781764.832	5210372.831	10	Road
1014	2333	Davidson	2	2	9781764.832	5210372.831	10	Road
1015	2334	Davidson	2	2	9781764.832	5210372.831	10	Road
1016	2505	Davidson	2	2	6245194.109	3348017.847	10	Road
1017	2216	Davidson	2	2	6245194.109	3348017.847	10	Road
1018	2541	Davidson	2	2	6245194.109	3348017.847	10	Road
1019	2795	Shelby	2	2	6245194.109	3348017.847	10	Road
1020	2796	Shelby	2	2	6245194.109	3348017.847	10	Road
1021	2367	Davidson	2	2	6245194.109	3348017.847	10	Road
1022	2242	Williamson	2	2	1677400.689	906149.0463	10	Road
1023	2278	Davidson	2	1	153353.9628	159891.7842	5	Road
1024	2411	Davidson	2	1	61352.20643	64639.17826	5	Road
1025	46	Davidson	2	1	5657245.681	3136734.861	10	Road
1026	1799	Knox	2	2	5657245.681	3136734.861	10	Road
1027	1875	Hamilton	2	2	98793.49178	105246.9058	5	Road
1028	1935	Davidson	2	2	98793.49178	105246.9058	5	Road
1029	2466	Davidson	2	1	9112917.016	5149999.05	10	Road
1030	2616	Davidson	2	2	15202864.89	8636171.52	10	Road
1031	34	Hamilton	2	2	15202864.89	8636171.52	10	Road
1032	2653	Williamson	2	2	33974.01887	36834.28271	5	Road
1033	46	Davidson	2	1	2700075.748	1535282.689	10	Road
1034	2997	Shelby	2	2	2700075.748	1535282.689	10	Road
1035	2202	Davidson	2	2	1423152.456	820806.9378	10	Road
1036	2500	Davidson	2	1	3255183.249	1889021.667	10	Road
1037	2165	Williamson	2	2	3255183.249	1889021.667	10	Road
1038	1803	Knox	2	2	3255183.249	1889021.667	10	Road
1039	2274	Davidson	2	2	8133439.806	4738752.64	10	Road
1040	2516	Davidson	2	2	8133439.806	4738752.64	10	Road
1041	1848	Knox	2	2	16723151.38	9776727.62	10	Road
1042	1933	Davidson	2	2	8187943.225	4789215.946	10	Road
1043	1944	Davidson	2	2	8187943.225	4789215.946	10	Road
1044	2207	Davidson	2	1	8417.975426	9410.879889	5	Road
1045	2385	Davidson	2	2	1533283.985	899389.5977	10	Road
1046	1963	Davidson	2	2	384076.494	227436.0543	10	Road
1047	1939	Davidson	2	2	3571729.488	2131165.767	10	Road
1048	2452	Davidson	2	1	103967.1006	121434.7627	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1049	2553	Davidson	2	2	98929.20847	116279.9675	5	Road
1050	2112	Davidson	2	2	88397.29803	104070.2886	5	Road
1051	2817	Shelby	2	2	88397.29803	104070.2886	5	Road
1052	2549	Davidson	2	2	111295.3595	131523.3918	5	Road
1053	2369	Davidson	2	2	2845610.538	1794601.131	10	Road
1054	2991	Shelby	2	1	115435.8988	139208.539	5	Road
1055	1905	Hamilton	2	2	115435.8988	139208.539	5	Road
1056	1911	Hamilton	2	2	115435.8988	139208.539	5	Road
1057	2772	Davidson	2	2	4950089.971	3136734.861	10	Road
1058	2682	Davidson	2	2	4950089.971	3136734.861	10	Road
1059	2755	Williamson	2	1	131466.6956	159663.4556	5	Road
1060	2727	Williamson	2	2	1914358.047	1229451.154	10	Road
1061	1738	Knox	2	2	1914358.047	1229451.154	10	Road
1062	2453	Davidson	2	2	1914358.047	1229451.154	10	Road
1063	1847	Knox	2	2	15202864.89	9776727.62	10	Road
1064	2588	Davidson	2	2	38482.3209	47334.83113	5	Road
1065	1928	Marion	2	2	2358874.364	1522398.73	10	Road
1066	2665	Williamson	2	2	29727.26651	36834.28271	5	Road
1067	2913	Shelby	2	2	151921.8567	188485.9661	5	Road
1068	2942	Shelby	2	1	84680.13581	105246.9058	5	Road
1069	2189	Davidson	2	2	3061482.418	1997387.16	10	Road
1070	44	Davidson	2	1	39235.40103	49870.55329	5	Road
1071	2584	Davidson	2	2	122683.1703	159891.7842	5	Road
1072	1936	Davidson	2	2	283805.2911	370282.1856	5	Road
1073	2703	Davidson	2	2	3061482.418	2131165.767	10	Road
1074	1940	Davidson	2	2	3061482.418	2131165.767	10	Road
1075	1751	Knox	2	2	62493.99688	83176.37725	5	Road
1076	2257	Davidson	2	1	239625.6719	321389.4662	5	Road
1077	1821	Knox	2	2	12162291.91	8636171.52	10	Road
1078	1964	Davidson	2	2	12162291.91	8636171.52	10	Road
1079	2617	Davidson	2	2	12162291.91	8636171.52	10	Road
1080	34	Hamilton	2	2	12162291.91	8636171.52	10	Road
1081	2664	Davidson	2	1	3879102.174	2776122.839	10	Road
1082	2611	Davidson	2	2	101006.4115	139208.539	5	Road
1083	2161	Davidson	2	1	101006.4115	139208.539	5	Road
1084	2876	Shelby	2	2	52256.09009	72315.5875	5	Road
1085	2245	Williamson	2	2	38804.64804	54475.19689	5	Road
1086	1946	Davidson	2	2	1515689.933	1122807.355	10	Road
1087	2582	Davidson	2	2	72731.16607	103243.8948	5	Road
1088	2222	Davidson	2	2	72731.16607	103243.8948	5	Road
1089	1753	Knox	2	2	70593.92318	100614.6263	5	Road
1090	2736	Davidson	2	1	2358874.364	1770909.662	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1091	2366	Williamson	2	2	31961.2813	46125.90885	5	Road
1092	1787	Knox	2	2	153353.9628	224628.9888	5	Road
1093	2188	Davidson	2	2	153353.9628	224628.9888	5	Road
1094	2693	Davidson	2	2	25044.30299	37356.15701	5	Road
1095	2378	Davidson	2	2	252248.652	377069.519	5	Road
1096	2730	Davidson	2	2	98929.20847	151411.3532	5	Road
1097	2230	Davidson	2	2	107866.4478	166993.7252	5	Road
1098	2238	Davidson	2	2	607958.117	495051.549	10	Road
1099	2028	Davidson	2	1	3394214.402	2776122.839	10	Road
1100	2540	Davidson	2	2	5848530.875	4789215.946	10	Road
1101	2856	Shelby	2	1	4521886.538	3707447.02	10	Road
1102	86	Shelby	2	1	2443587.916	2006152.813	10	Road
1103	2663	Davidson	2	1	2443587.916	2006152.813	10	Road
1104	2743	Williamson	2	2	2443587.916	2006152.813	10	Road
1105	2434	Davidson	2	1	3150088.372	2617817.931	10	Road
1106	2178	Davidson	2	2	3150088.372	2617817.931	10	Road
1107	2847	Shelby	2	1	5182577.912	4312261.944	10	Road
1108	46	Davidson	2	2	121673.4086	194671.7889	5	Road
1109	2203	Davidson	2	1	5287995.526	4474074.926	10	Road
1110	2162	Davidson	2	1	6075278.011	5149999.05	10	Road
1111	2478	Wilson	2	2	6075278.011	5149999.05	10	Road
1112	2383	Davidson	2	2	202089.8274	327961.6768	5	Road
1113	76	Wilson	2	2	17547734.43	15240353.31	10	Road
1114	2041	Davidson	2	2	17547734.43	15240353.31	10	Road
1115	2993	Shelby	2	2	17547734.43	15240353.31	10	Road
1116	2501	Davidson	2	2	17547734.43	15240353.31	10	Road
1117	3011	Shelby	2	2	264686.4969	443186.2818	5	Road
1118	2744	Sumner	2	2	357349.4296	605933.7262	5	Road
1119	2327	Davidson	2	2	357349.4296	605933.7262	5	Road
1120	2579	Davidson	2	1	2909326.63	2586431.823	10	Road
1121	1748	Knox	2	2	2425103.892	2161178.187	10	Road
1122	2330	Davidson	2	1	44197.61639	76625.11862	5	Road
1123	2696	Davidson	2	2	627.8372251	1096.614757	5	Road
1124	2176	Davidson	2	2	417064.1191	391734.8131	10	Road
1125	1801	Knox	2	2	134726.5516	244051.2738	5	Road
1126	2022	Davidson	2	1	2094503.928	2006152.813	10	Road
1127	2580	Davidson	2	2	122683.1703	224628.9888	5	Road
1128	2646	Davidson	2	1	2700075.748	2617817.931	10	Road
1129	2307	Davidson	2	1	2700075.748	2617817.931	10	Road
1130	2331	Davidson	2	1	4442209.639	4312261.944	10	Road
1131	2888	Shelby	2	1	4442209.639	4312261.944	10	Road
1132	1771	Knox	2	2	101281.2378	188485.9661	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1133	2397	Davidson	2	2	56453.42387	105246.9058	5	Road
1134	2790	Shelby	2	2	56453.42387	105246.9058	5	Road
1135	2351	Davidson	2	2	15354267.62	15240353.31	10	Road
1136	1757	Knox	2	2	152489.0639	289162.7425	5	Road
1137	2410	Davidson	2	2	231600.6848	443186.2818	5	Road
1138	2118	Davidson	2	1	1595718.909	1605300.114	10	Road
1139	2762	Davidson	2	2	1595718.909	1605300.114	10	Road
1140	2121	Davidson	2	1	1212551.946	1223346.362	10	Road
1141	2630	Davidson	2	1	19741201.23	20153264.88	10	Road
1142	2825	Shelby	2	2	19741201.23	20153264.88	10	Road
1143	2765	Davidson	2	2	19741201.23	20153264.88	10	Road
1144	2007	Davidson	2	2	19741201.23	20153264.88	10	Road
1145	2006	Davidson	2	2	4678824.7	4789215.946	10	Road
1146	2844	Shelby	2	1	3617509.231	3707447.02	10	Road
1147	2859	Shelby	2	1	2402991.523	2471526.659	10	Road
1148	2878	Shelby	2	1	151921.8567	298255.7854	5	Road
1149	2102	Davidson	2	1	1796852.469	1862600.857	10	Road
1150	2922	Shelby	2	2	1796852.469	1862600.857	10	Road
1151	2842	Shelby	2	1	1796852.469	1862600.857	10	Road
1152	2394	Davidson	2	2	15202864.89	16247951.25	10	Road
1153	48	Davidson	2	2	15202864.89	16247951.25	10	Road
1154	2552	Davidson	2	2	15202864.89	16247951.25	10	Road
1155	2190	Davidson	2	2	16723151.38	18393774.76	10	Road
1156	2728	Williamson	2	2	2094503.928	2310844.287	10	Road
1157	2929	Shelby	2	2	285879.5437	605933.7262	5	Road
1158	2433	Davidson	2	2	285879.5437	605933.7262	5	Road
1159	2417	Davidson	2	1	627.8372251	1336.225756	5	Road
1160	34	Hamilton	2	2	1908715.041	2163231.065	10	Road
1161	1822	Knox	2	2	1908715.041	2163231.065	10	Road
1162	2801	Shelby	2	2	1908715.041	2163231.065	10	Road
1163	2042	Davidson	2	2	17547734.43	20153264.88	10	Road
1164	2829	Shelby	2	2	17547734.43	20153264.88	10	Road
1165	2504	Davidson	2	2	17547734.43	20153264.88	10	Road
1166	2350	Davidson	2	2	17547734.43	20153264.88	10	Road
1167	2930	Shelby	2	2	17547734.43	20153264.88	10	Road
1168	2935	Shelby	2	2	17547734.43	20153264.88	10	Road
1169	2246	Davidson	2	1	1377128.215	1584564.503	10	Road
1170	86	Shelby	2	1	130704.9119	289162.7425	5	Road
1171	2226	Davidson	2	1	3701841.366	4312261.944	10	Road
1172	101	Shelby	2	1	3701841.366	4312261.944	10	Road
1173	1918	Hamilton	2	2	236545.9356	528689.2683	5	Road
1174	2835	Shelby	2	1	1496873.392	1793284.846	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1175	2402	Davidson	2	1	2059707.02	2471526.659	10	Road
1176	2805	Shelby	2	1	2059707.02	2471526.659	10	Road
1177	2380	Davidson	2	1	2059707.02	2471526.659	10	Road
1178	3019	Madison	2	2	2059707.02	2471526.659	10	Road
1179	1807	Knox	2	2	2059707.02	2471526.659	10	Road
1180	2277	Davidson	2	1	62070.17724	142408.4853	5	Road
1181	2443	Davidson	2	1	1540159.259	1862600.857	10	Road
1182	2332	Davidson	2	1	2675606.421	3309201.314	10	Road
1183	2706	Davidson	2	1	1455484.827	1816655.844	10	Road
1184	2895	Shelby	2	1	423743.7953	532283.3401	10	Road
1185	2740	Davidson	2	2	882382.2976	1136689.495	10	Road
1186	2561	Davidson	2	2	882382.2976	1136689.495	10	Road
1187	2673	Davidson	2	2	882382.2976	1136689.495	10	Road
1188	2319	Davidson	2	1	274512.9756	674598.1525	5	Road
1189	44	Davidson	2	2	1526604.308	1981970.793	10	Road
1190	2445	Davidson	2	2	1515689.933	1983564.785	10	Road
1191	2407	Davidson	2	2	264686.4969	661886.8161	5	Road
1192	2545	Davidson	2	2	1636041.464	2163231.065	10	Road
1193	2002	Davidson	2	1	1939551.087	2586431.823	10	Road
1194	2175	Wilson	2	2	12162291.91	16247951.25	10	Road
1195	3002	Shelby	2	2	12162291.91	16247951.25	10	Road
1196	2512	Davidson	2	2	12162291.91	16247951.25	10	Road
1197	2575	Davidson	2	1	1180395.613	1584564.503	10	Road
1198	2803	Shelby	2	1	1574369.373	2149546.717	10	Road
1199	2108	Davidson	2	1	72909.66302	195022.353	5	Road
1200	2966	Shelby	2	1	72909.66302	195022.353	5	Road
1201	2058	Davidson	2	2	34074.62624	92631.93271	5	Road
1202	1923	Marion	2	2	1939551.087	2776122.839	10	Road
1203	2065	Davidson	2	1	244011.5339	674598.1525	5	Road
1204	2449	Davidson	2	1	2229672.018	3309201.314	10	Road
1205	2119	Davidson	2	1	2229672.018	3309201.314	10	Road
1206	48	Davidson	2	1	2229672.018	3309201.314	10	Road
1207	1849	Knox	2	2	2229672.018	3309201.314	10	Road
1208	1852	Knox	2	2	2229672.018	3309201.314	10	Road
1209	2908	Shelby	2	2	231600.6848	661886.8161	5	Road
1210	2718	Davidson	2	2	12162291.91	18393774.76	10	Road
1211	1991	Davidson	2	2	13160800.82	20153264.88	10	Road
1212	2666	Williamson	2	2	165468.1529	485342.3236	5	Road
1213	2889	Shelby	2	1	101281.2378	298255.7854	5	Road
1214	2793	Shelby	2	2	81236.1772	248132.511	5	Road
1215	2794	Shelby	2	2	81236.1772	248132.511	5	Road
1216	1985	Davidson	2	2	31961.2813	97707.57035	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1217	2603	Davidson	2	2	2058083.555	3354366.247	10	Road
1218	2079	Davidson	2	1	29206.82249	92631.93271	5	Road
1219	1998	Davidson	2	1	2700075.748	4685271.306	10	Road
1220	2129	Davidson	2	1	2700075.748	4685271.306	10	Road
1221	2684	Davidson	2	2	2700075.748	4685271.306	10	Road
1222	2068	Cheatham	2	2	2700075.748	4685271.306	10	Road
1223	2348	Davidson	2	1	13160800.82	23219039.73	10	Road
1224	1880	Hamilton	2	2	182184.614	649587.3478	5	Road
1225	2884	Shelby	2	1	88397.29803	320786.4902	5	Road
1226	2340	Davidson	2	2	88397.29803	320786.4902	5	Road
1227	2290	Davidson	2	1	954127.6928	1819085.3	10	Road
1228	2839	Shelby	2	2	11625.0199	43665.2816	5	Road
1229	2840	Shelby	2	2	11625.0199	43665.2816	5	Road
1230	77	Wilson	2	2	276824.88	1046586.261	5	Road
1231	2418	Davidson	2	2	160963.5388	610277.5265	5	Road
1232	2581	Davidson	2	2	38482.3209	152560.383	5	Road
1233	2947	Shelby	2	2	185605.8549	743575.6643	5	Road
1234	2720	Davidson	2	2	38482.3209	154338.217	5	Road
1235	2810	Shelby	2	1	187669.6337	762852.9077	5	Road
1236	46	Davidson	2	1	184024.7554	757287.7521	5	Road
1237	2667	Williamson	2	2	184024.7554	757287.7521	5	Road
1238	2751	Davidson	2	2	46178.78507	202055.9237	5	Road
1239	2240	Davidson	2	1	144245.6025	631931.585	5	Road
1240	2140	Davidson	2	2	196589.3183	866860.1831	5	Road
1241	2159	Davidson	2	2	103967.1006	461977.6952	5	Road
1242	2791	Shelby	2	2	415237.3199	1861350.572	5	Road
1243	1912	Hamilton	2	2	168689.3591	757287.7521	5	Road
1244	2848	Shelby	2	2	168689.3591	757287.7521	5	Road
1245	2891	Shelby	2	2	168689.3591	757287.7521	5	Road
1246	86	Shelby	2	2	110991.1771	498762.6752	5	Road
1247	2879	Shelby	2	1	61550.47082	276760.4585	5	Road
1248	2699	Davidson	2	1	184220.6595	830837.2451	5	Road
1249	2000	Davidson	2	1	164852.1171	746945.8945	5	Road
1250	2344	Davidson	2	1	70717.83842	320786.4902	5	Road
1251	2494	Davidson	2	1	748436.6961	1793284.846	10	Road
1252	2974	Shelby	2	2	110991.1771	507333.4847	5	Road
1253	2268	Davidson	2	2	90122.96529	416576.1811	5	Road
1254	1956	Davidson	2	2	90122.96529	416576.1811	5	Road
1255	2105	Davidson	2	1	90122.96529	416576.1811	5	Road
1256	1778	Knox	2	2	236365.3734	1102349.123	5	Road
1257	2382	Davidson	2	2	236365.3734	1102349.123	5	Road
1258	2092	Davidson	2	1	196589.3183	966123.9837	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1259	2225	Davidson	2	1	196589.3183	966123.9837	5	Road
1260	2503	Davidson	2	2	303134.7411	1503276.203	5	Road
1261	2951	Shelby	2	2	369099.84	1861350.572	5	Road
1262	2811	Shelby	2	1	369099.84	1861350.572	5	Road
1263	48	Davidson	2	1	369099.84	1861350.572	5	Road
1264	2893	Shelby	2	1	369099.84	1861350.572	5	Road
1265	2910	Shelby	2	1	369099.84	1861350.572	5	Road
1266	2941	Shelby	2	1	369099.84	1861350.572	5	Road
1267	2781	Davidson	2	2	369099.84	1861350.572	5	Road
1268	2036	Davidson	2	1	8773867.213	23219039.73	10	Road
1269	2536	Williamson	2	2	8773867.213	23219039.73	10	Road
1270	2812	Shelby	2	2	8773867.213	23219039.73	10	Road
1271	46	Davidson	2	2	8773867.213	23219039.73	10	Road
1272	2887	Shelby	2	1	53203.00907	274663.532	5	Road
1273	2457	Davidson	2	1	144245.6025	746945.8945	5	Road
1274	2965	Shelby	2	1	144245.6025	746945.8945	5	Road
1275	2977	Shelby	2	1	144245.6025	746945.8945	5	Road
1276	2314	Davidson	2	2	144245.6025	746945.8945	5	Road
1277	2392	Davidson	2	1	164852.1171	865238.9315	5	Road
1278	3000	Shelby	2	1	164852.1171	865238.9315	5	Road
1279	2873	Shelby	2	1	38482.3209	202055.9237	5	Road
1280	2308	Davidson	2	1	157903.4224	831697.1025	5	Road
1281	2424	Davidson	2	2	157903.4224	831697.1025	5	Road
1282	2881	Shelby	2	1	38482.3209	204410.5448	5	Road
1283	2135	Davidson	2	2	121456.4094	649587.3478	5	Road
1284	2487	Williamson	2	2	241420.3776	1300130.386	5	Road
1285	2650	Williamson	2	2	241420.3776	1300130.386	5	Road
1286	2651	Williamson	2	2	241420.3776	1300130.386	5	Road
1287	2359	Davidson	2	1	119297.1863	648708.557	5	Road
1288	2357	Davidson	2	1	119297.1863	648708.557	5	Road
1289	1745	Knox	2	2	119297.1863	648708.557	5	Road
1290	2685	Davidson	2	2	157271.4547	866860.1831	5	Road
1291	2906	Shelby	2	1	157271.4547	866860.1831	5	Road
1292	2271	Davidson	2	2	157271.4547	866860.1831	5	Road
1293	1759	Knox	2	2	157271.4547	866860.1831	5	Road
1294	2527	Davidson	2	2	157271.4547	866860.1831	5	Road
1295	2413	Davidson	2	2	157271.4547	866860.1831	5	Road
1296	2520	Davidson	2	1	157271.4547	866860.1831	5	Road
1297	2555	Davidson	2	2	269453.1032	1503276.203	5	Road
1298	1945	Davidson	2	2	269453.1032	1503276.203	5	Road
1299	1955	Davidson	2	2	269453.1032	1503276.203	5	Road
1300	102	Shelby	2	2	88792.94169	498762.6752	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1301	2752	Davidson	2	2	88792.94169	498762.6752	5	Road
1302	2074	Davidson	2	2	88792.94169	498762.6752	5	Road
1303	2959	Shelby	2	2	88792.94169	498762.6752	5	Road
1304	3013	Shelby	2	2	88792.94169	498762.6752	5	Road
1305	1777	Knox	2	2	214638.0159	1207962.962	5	Road
1306	1893	Hamilton	2	2	214638.0159	1207962.962	5	Road
1307	2858	Shelby	2	2	214638.0159	1207962.962	5	Road
1308	2589	Davidson	2	2	214638.0159	1207962.962	5	Road
1309	2573	Williamson	2	2	214638.0159	1207962.962	5	Road
1310	1951	Davidson	2	2	214638.0159	1207962.962	5	Road
1311	1953	Davidson	2	2	214638.0159	1207962.962	5	Road
1312	1965	Davidson	2	2	214638.0159	1207962.962	5	Road
1313	1966	Davidson	2	2	214638.0159	1207962.962	5	Road
1314	2346	Davidson	2	2	214638.0159	1209244.135	5	Road
1315	2980	Shelby	2	2	88792.94169	507333.4847	5	Road
1316	2595	Davidson	2	2	184024.7554	1063899.455	5	Road
1317	2132	Davidson	2	2	119297.1863	694585.572	5	Road
1318	2353	Davidson	2	2	57295.30993	338114.368	5	Road
1319	2799	Shelby	2	1	57295.30993	338114.368	5	Road
1320	2149	Davidson	2	2	74651.55728	441913.9009	5	Road
1321	1769	Knox	2	2	219473.0706	1300130.386	5	Road
1322	1815	Knox	2	2	219473.0706	1300130.386	5	Road
1323	2807	Shelby	2	2	219473.0706	1300130.386	5	Road
1324	1931	Davidson	2	2	219473.0706	1300130.386	5	Road
1325	2855	Shelby	2	1	201780.0393	1209606.96	5	Road
1326	2049	Davidson	2	2	469174.0843	2840437.876	5	Road
1327	1986	Davidson	2	1	157271.4547	966123.9837	5	Road
1328	2156	Davidson	2	1	157271.4547	966123.9837	5	Road
1329	2157	Davidson	2	1	157271.4547	966123.9837	5	Road
1330	2293	Davidson	2	1	157271.4547	966123.9837	5	Road
1331	2294	Davidson	2	1	157271.4547	966123.9837	5	Road
1332	2455	Davidson	2	1	157271.4547	966123.9837	5	Road
1333	1957	Davidson	2	2	67592.22397	416576.1811	5	Road
1334	2258	Davidson	2	1	122683.1703	757287.7521	5	Road
1335	2565	Rutherford	2	2	122683.1703	757287.7521	5	Road
1336	2099	Davidson	2	2	229316.9564	1423688.336	5	Road
1337	2398	Davidson	2	2	229316.9564	1423688.336	5	Road
1338	1782	Knox	2	2	229316.9564	1423688.336	5	Road
1339	2060	Davidson	2	2	229316.9564	1423688.336	5	Road
1340	2490	Rutherford	2	2	168689.3591	1063899.455	5	Road
1341	2659	Davidson	2	2	168689.3591	1063899.455	5	Road
1342	2228	Davidson	2	2	168689.3591	1063899.455	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1343	2295	Davidson	2	2	168689.3591	1063899.455	5	Road
1344	1841	Knox	2	2	190789.3474	1207962.962	5	Road
1345	2488	Williamson	2	2	190789.3474	1207962.962	5	Road
1346	2841	Shelby	2	2	190789.3474	1209244.135	5	Road
1347	2388	Davidson	2	1	2104.19882	13438.34039	5	Road
1348	2377	Davidson	2	2	252248.652	1611711.051	5	Road
1349	2620	Davidson	2	2	89888.70647	575864.9775	5	Road
1350	2495	Davidson	2	1	61926.19954	401171.5409	5	Road
1351	2375	Davidson	2	2	106041.9434	694585.572	5	Road
1352	1887	Hamilton	2	2	106041.9434	694585.572	5	Road
1353	2521	Davidson	2	2	83409.41451	552827.7302	5	Road
1354	2709	Davidson	2	1	50929.16438	338114.368	5	Road
1355	2898	Shelby	2	2	276824.88	1861350.572	5	Road
1356	2742	Davidson	2	2	276824.88	1861350.572	5	Road
1357	2076	Davidson	2	1	25218.37441	171931.1533	5	Road
1358	46	Davidson	2	1	107240.6758	734627.0696	5	Road
1359	1802	Knox	2	2	116886.0022	808738.2295	5	Road
1360	2984	Shelby	2	2	235771.4653	1633977.322	5	Road
1361	1774	Knox	2	2	129939.7353	903686.4583	5	Road
1362	2528	Davidson	2	2	83983.85017	596670.2377	5	Road
1363	1914	Hamilton	2	2	64176.2938	460229.5238	5	Road
1364	2946	Shelby	2	2	64176.2938	460229.5238	5	Road
1365	2647	Davidson	2	1	168150.0328	1209606.96	5	Road
1366	2067	Davidson	2	1	168150.0328	1209606.96	5	Road
1367	2232	Davidson	2	1	147546.1734	1062444.126	5	Road
1368	2252	Davidson	2	1	147546.1734	1062444.126	5	Road
1369	2318	Davidson	2	1	147546.1734	1062444.126	5	Road
1370	2866	Shelby	2	1	147546.1734	1062444.126	5	Road
1371	2254	Davidson	2	1	147546.1734	1062444.126	5	Road
1372	2070	Cheatham	2	2	147546.1734	1062444.126	5	Road
1373	2890	Shelby	2	2	147546.1734	1062444.126	5	Road
1374	1968	Davidson	2	2	147546.1734	1062444.126	5	Road
1375	1969	Davidson	2	2	147546.1734	1062444.126	5	Road
1376	2148	Davidson	2	2	147546.1734	1062444.126	5	Road
1377	2174	Wilson	2	2	147546.1734	1062444.126	5	Road
1378	2832	Shelby	2	2	19501.3087	141527.6891	5	Road
1379	2286	Davidson	2	2	19501.3087	141527.6891	5	Road
1380	2312	Davidson	2	1	7041.92617	51678.66757	5	Road
1381	2538	Williamson	2	2	19501.3087	143661.0443	5	Road
1382	2944	Shelby	2	2	130895.0628	967802.3174	5	Road
1383	48	Davidson	2	2	130895.0628	967802.3174	5	Road
1384	48	Davidson	2	2	130895.0628	967802.3174	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1385	2914	Shelby	2	2	175578.4565	1300130.386	5	Road
1386	2686	Davidson	2	2	554307.6909	4153463.385	5	Road
1387	1775	Knox	2	2	30788.80708	230926.8637	5	Road
1388	2011	Davidson	2	2	30788.80708	230926.8637	5	Road
1389	2979	Shelby	2	2	30788.80708	230926.8637	5	Road
1390	1888	Hamilton	2	2	30788.80708	230926.8637	5	Road
1391	2759	Davidson	2	2	84495.44309	637292.6366	5	Road
1392	2215	Davidson	2	2	112906.8477	853053.8684	5	Road
1393	2688	Davidson	2	2	44563.01883	338114.368	5	Road
1394	2990	Shelby	2	1	44563.01883	338114.368	5	Road
1395	2347	Davidson	2	2	92944.9874	708816.0603	5	Road
1396	2748	Davidson	2	2	92944.9874	708816.0603	5	Road
1397	1930	Davidson	2	2	92944.9874	708816.0603	5	Road
1398	1790	Knox	2	2	105197.402	808738.2295	5	Road
1399	1783	Knox	2	2	134520.0262	1041369.705	5	Road
1400	2023	Davidson	2	1	134520.0262	1041369.705	5	Road
1401	1882	Hamilton	2	1	134520.0262	1041369.705	5	Road
1402	2086	Davidson	2	1	134520.0262	1041369.705	5	Road
1403	2283	Davidson	2	1	134520.0262	1041369.705	5	Road
1404	2548	Davidson	2	1	134520.0262	1041369.705	5	Road
1405	2297	Davidson	2	2	134520.0262	1041369.705	5	Road
1406	2438	Davidson	2	2	183453.5651	1423688.336	5	Road
1407	2480	Davidson	2	2	183453.5651	1423688.336	5	Road
1408	1828	Knox	2	2	197954.5988	1538327.015	5	Road
1409	2146	Davidson	2	2	197954.5988	1538327.015	5	Road
1410	2266	Davidson	2	2	197954.5988	1538327.015	5	Road
1411	2124	Davidson	2	1	197954.5988	1538327.015	5	Road
1412	2637	Davidson	2	1	197954.5988	1538327.015	5	Road
1413	2050	Davidson	2	2	554307.6909	4309780.818	5	Road
1414	2193	Davidson	2	2	206385.2608	1611711.051	5	Road
1415	2648	Davidson	2	1	302349.6496	2363402.42	5	Road
1416	1773	Knox	2	2	115501.987	903686.4583	5	Road
1417	2425	Davidson	2	2	61550.47082	483597.9699	5	Road
1418	1854	Knox	2	2	61550.47082	483597.9699	5	Road
1419	2868	Shelby	2	1	61550.47082	483597.9699	5	Road
1420	2604	Davidson	2	2	28875.79177	228411.5708	5	Road
1421	2606	Davidson	2	2	28875.79177	228411.5708	5	Road
1422	2609	Davidson	2	1	28875.79177	228411.5708	5	Road
1423	2362	Davidson	2	2	15926.64901	126747.5383	5	Road
1424	2853	Shelby	2	1	118995.5117	951547.3706	5	Road
1425	1984	Davidson	2	1	71910.96518	575864.9775	5	Road
1426	1895	Hamilton	2	2	71910.96518	575864.9775	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1427	1897	Hamilton	2	2	71910.96518	575864.9775	5	Road
1428	2379	Davidson	2	1	124760.5208	999181.4338	5	Road
1429	2554	Davidson	2	2	175965.5441	1416632.957	5	Road
1430	2360	Davidson	2	2	230687.4	1861350.572	5	Road
1431	48	Davidson	2	1	207934.2013	1682676.284	5	Road
1432	2612	Davidson	2	2	207934.2013	1682676.284	5	Road
1433	2173	Davidson	2	2	207934.2013	1682676.284	5	Road
1434	1974	Davidson	2	2	207934.2013	1682676.284	5	Road
1435	2897	Shelby	2	2	207934.2013	1682676.284	5	Road
1436	2322	Wilson	2	2	207934.2013	1682676.284	5	Road
1437	2323	Wilson	2	2	207934.2013	1682676.284	5	Road
1438	2182	Davidson	2	2	98793.49178	802603.5297	5	Road
1439	2024	Davidson	2	1	20772.32503	168878.2268	5	Road
1440	2168	Davidson	2	1	20772.32503	168878.2268	5	Road
1441	2992	Shelby	2	2	118995.5117	967802.3174	5	Road
1442	1952	Davidson	2	2	63769.14372	525078.3603	5	Road
1443	2120	Davidson	2	1	503916.0826	4153463.385	5	Road
1444	2251	Davidson	2	1	503916.0826	4153463.385	5	Road
1445	48	Davidson	2	1	503916.0826	4153463.385	5	Road
1446	2867	Shelby	2	1	503916.0826	4153463.385	5	Road
1447	2179	Davidson	2	2	503916.0826	4153463.385	5	Road
1448	2275	Davidson	2	1	503916.0826	4153463.385	5	Road
1449	2128	Davidson	2	2	503916.0826	4153463.385	5	Road
1450	2639	Davidson	2	2	503916.0826	4153463.385	5	Road
1451	2498	Davidson	2	1	78863.20032	651456.1174	5	Road
1452	2499	Davidson	2	1	78863.20032	651456.1174	5	Road
1453	2089	Davidson	2	1	78863.20032	651456.1174	5	Road
1454	2437	Davidson	2	2	78863.20032	651456.1174	5	Road
1455	2361	Davidson	2	2	175965.5441	1458737.86	5	Road
1456	2104	Davidson	2	2	175965.5441	1458737.86	5	Road
1457	2917	Shelby	2	2	175965.5441	1458737.86	5	Road
1458	1947	Davidson	2	2	104979.8127	881133.0128	5	Road
1459	2056	Davidson	2	1	185682.2693	1562161.225	5	Road
1460	2187	Davidson	2	1	185682.2693	1562161.225	5	Road
1461	1994	Davidson	2	2	185682.2693	1562161.225	5	Road
1462	2195	Davidson	2	2	185682.2693	1562161.225	5	Road
1463	2592	Davidson	2	2	185682.2693	1562161.225	5	Road
1464	2200	Davidson	2	2	90122.96529	760022.8265	5	Road
1465	2097	Davidson	2	2	90122.96529	760022.8265	5	Road
1466	1999	Davidson	2	2	63769.14372	538451.5487	5	Road
1467	2774	Davidson	2	2	63769.14372	538451.5487	5	Road
1468	2715	Davidson	2	2	37990.34788	324362.1471	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1469	2299	Davidson	2	1	503916.0826	4309780.818	5	Road
1470	2599	Davidson	2	1	61926.19954	529723.0967	5	Road
1471	2819	Shelby	2	1	178159.1389	1538327.015	5	Road
1472	2551	Davidson	2	1	178159.1389	1538327.015	5	Road
1473	3001	Shelby	2	1	178159.1389	1538327.015	5	Road
1474	2899	Shelby	2	2	98793.49178	853053.8684	5	Road
1475	2923	Shelby	2	2	98793.49178	853053.8684	5	Road
1476	2155	Davidson	2	2	98793.49178	853053.8684	5	Road
1477	2933	Shelby	2	2	93508.80175	808738.2295	5	Road
1478	1896	Hamilton	2	2	93508.80175	808738.2295	5	Road
1479	2303	Davidson	2	2	8154.508019	70708.53412	5	Road
1480	2901	Shelby	2	2	122683.1703	1063899.455	5	Road
1481	2492	Rutherford	2	2	122683.1703	1063899.455	5	Road
1482	2305	Davidson	2	1	85332.75608	741763.6198	5	Road
1483	2401	Davidson	2	1	85332.75608	741763.6198	5	Road
1484	2125	Davidson	2	1	52828.16546	462306.9419	5	Road
1485	2747	Davidson	2	2	83409.41451	734627.0696	5	Road
1486	2535	Williamson	2	2	138431.0273	1228254.038	5	Road
1487	1962	Davidson	2	2	138431.0273	1228254.038	5	Road
1488	1743	Knox	2	2	138431.0273	1228254.038	5	Road
1489	2875	Shelby	2	2	59721.24582	531724.4843	5	Road
1490	1740	Knox	2	2	101064.2386	903686.4583	5	Road
1491	1741	Knox	2	2	101064.2386	903686.4583	5	Road
1492	2180	Davidson	2	2	187140.7812	1682676.284	5	Road
1493	2753	Davidson	2	2	187140.7812	1682676.284	5	Road
1494	2629	Davidson	2	1	134520.0262	1209606.96	5	Road
1495	2025	Davidson	2	1	134520.0262	1209606.96	5	Road
1496	1826	Knox	2	2	134520.0262	1209606.96	5	Road
1497	2034	Davidson	2	1	178159.1389	1608013.887	5	Road
1498	1995	Davidson	2	1	107095.9605	967802.3174	5	Road
1499	2205	Davidson	2	1	194297.1814	1762712.884	5	Road
1500	2886	Shelby	2	1	211088.1392	1919615.58	5	Road
1501	2358	Davidson	2	2	46010.76191	419496.4019	5	Road
1502	2814	Shelby	2	1	129576.9882	1190307.235	5	Road
1503	2902	Shelby	2	2	129576.9882	1190307.235	5	Road
1504	2958	Shelby	2	2	71597.93168	662272.2459	5	Road
1505	2556	Davidson	2	2	71597.93168	662272.2459	5	Road
1506	2967	Shelby	2	1	156437.2396	1462991.243	5	Road
1507	2090	Davidson	2	1	156437.2396	1462991.243	5	Road
1508	2031	Davidson	2	1	64562.93886	606654.7951	5	Road
1509	2381	Davidson	2	2	194297.1814	1827442.71	5	Road
1510	2415	Davidson	2	2	283805.2911	2674583.288	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1511	1949	Davidson	2	2	283805.2911	2674583.288	5	Road
1512	2012	Davidson	2	1	77777.46677	736011.0487	5	Road
1513	2638	Davidson	2	1	77777.46677	736011.0487	5	Road
1514	2426	Davidson	2	2	77777.46677	736011.0487	5	Road
1515	2864	Shelby	2	1	77777.46677	736011.0487	5	Road
1516	2027	Davidson	2	1	77777.46677	736011.0487	5	Road
1517	2681	Davidson	2	2	174273.2159	1651086.657	5	Road
1518	2854	Shelby	2	1	174273.2159	1651086.657	5	Road
1519	2578	Davidson	2	2	174273.2159	1651086.657	5	Road
1520	2306	Davidson	2	1	74666.16157	711974.2222	5	Road
1521	2247	Davidson	2	1	55534.68087	531391.7213	5	Road
1522	1929	Marion	2	2	84817.03265	812162.4625	5	Road
1523	2702	Davidson	2	1	83983.85017	804673.8816	5	Road
1524	2163	Davidson	2	2	145371.1659	1393580.233	5	Road
1525	1990	Davidson	2	1	145371.1659	1393580.233	5	Road
1526	2515	Davidson	2	1	15196.13915	145714.2548	5	Road
1527	2289	Davidson	2	2	37990.34788	364698.1914	5	Road
1528	2123	Davidson	2	1	34074.62624	329627.9805	5	Road
1529	2585	Davidson	2	2	25218.37441	246482.6012	5	Road
1530	2948	Shelby	2	2	176633.8013	1733106.833	5	Road
1531	1772	Knox	2	2	176633.8013	1733106.833	5	Road
1532	2237	Davidson	2	2	7449.666323	73123.55836	5	Road
1533	2282	Davidson	2	1	49240.37666	483597.9699	5	Road
1534	3014	Shelby	2	2	91635.32131	900533.2197	5	Road
1535	1983	Davidson	2	2	91635.32131	900533.2197	5	Road
1536	2248	Davidson	2	2	58443.0011	574774.8849	5	Road
1537	34	Hamilton	2	1	124587.9245	1228254.038	5	Road
1538	2181	Davidson	2	2	124587.9245	1228254.038	5	Road
1539	1800	Knox	2	2	74666.16157	741763.6198	5	Road
1540	1919	Hamilton	2	2	74666.16157	741763.6198	5	Road
1541	2711	Williamson	2	2	176633.8013	1762712.884	5	Road
1542	2773	Davidson	2	2	82042.51138	820807.5806	5	Road
1543	1850	Knox	2	2	82042.51138	820807.5806	5	Road
1544	2477	Wilson	2	2	82042.51138	820807.5806	5	Road
1545	1922	Marion	2	2	82042.51138	820807.5806	5	Road
1546	2431	Davidson	2	2	82042.51138	820807.5806	5	Road
1547	2201	Davidson	2	2	221324.8659	2220519.154	5	Road
1548	2321	Davidson	2	2	221324.8659	2220519.154	5	Road
1549	2614	Davidson	2	2	221324.8659	2220519.154	5	Road
1550	2657	Davidson	2	2	221324.8659	2220519.154	5	Road
1551	2341	Davidson	2	2	221324.8659	2220519.154	5	Road
1552	2403	Davidson	2	2	221324.8659	2220519.154	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1553	2932	Shelby	2	1	84680.13581	853053.8684	5	Road
1554	2260	Davidson	2	2	84680.13581	853053.8684	5	Road
1555	1865	Marion	2	2	189979.3253	1919615.58	5	Road
1556	2192	Davidson	2	1	166347.361	1682676.284	5	Road
1557	1879	Hamilton	2	2	81236.1772	823762.9608	5	Road
1558	2633	Davidson	2	2	81236.1772	823762.9608	5	Road
1559	2697	Davidson	2	2	22223.31351	225488.6295	5	Road
1560	2249	Davidson	2	2	91583.68996	930735.5315	5	Road
1561	1915	Hamilton	2	2	176633.8013	1796749.475	5	Road
1562	2566	Rutherford	2	2	176633.8013	1796749.475	5	Road
1563	2325	Davidson	2	1	52256.09009	531724.4843	5	Road
1564	2570	Davidson	2	2	45281.28468	462306.9419	5	Road
1565	2577	Davidson	2	1	45281.28468	462306.9419	5	Road
1566	2033	Davidson	2	1	145371.1659	1492134.97	5	Road
1567	2475	Davidson	2	2	145371.1659	1492134.97	5	Road
1568	1855	Knox	2	2	176633.8013	1827442.71	5	Road
1569	2700	Davidson	2	1	39235.40103	406479.1672	5	Road
1570	2316	Davidson	2	2	39437.79592	410457.6871	5	Road
1571	2091	Davidson	2	1	129576.9882	1357078.344	5	Road
1572	2045	Davidson	2	2	83983.85017	881133.0128	5	Road
1573	2963	Shelby	2	2	83983.85017	881133.0128	5	Road
1574	1900	Hamilton	2	2	252271.3698	2674583.288	5	Road
1575	74	Williamson	2	2	321614.4867	3423328.619	5	Road
1576	2444	Davidson	2	2	321614.4867	3423328.619	5	Road
1577	2970	Shelby	2	2	321614.4867	3423328.619	5	Road
1578	2797	Shelby	2	2	321614.4867	3423328.619	5	Road
1579	1886	Hamilton	2	2	321614.4867	3423328.619	5	Road
1580	2861	Shelby	2	1	274512.9756	2973409.45	5	Road
1581	2523	Davidson	2	2	274512.9756	2973409.45	5	Road
1582	3020	Madison	2	2	274512.9756	2973409.45	5	Road
1583	1921	Hamilton	2	2	34839.06527	377609.5952	5	Road
1584	2950	Shelby	2	2	34839.06527	377609.5952	5	Road
1585	2456	Davidson	2	1	22578.5372	244962.6716	5	Road
1586	1827	Knox	2	2	303641.0234	3314075.86	5	Road
1587	1796	Knox	2	2	303641.0234	3314075.86	5	Road
1588	2220	Davidson	2	2	120722.6541	1319929.469	5	Road
1589	1959	Davidson	2	2	55339.66188	606654.7951	5	Road
1590	2391	Davidson	2	1	55339.66188	606654.7951	5	Road
1591	3006	Shelby	2	2	28790.67381	315690.9918	5	Road
1592	2975	Shelby	2	2	28790.67381	315690.9918	5	Road
1593	2976	Shelby	2	2	28790.67381	315690.9918	5	Road
1594	1832	Knox	2	1	72909.66302	806824.676	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1595	2912	Shelby	2	2	110744.8218	1228254.038	5	Road
1596	2952	Shelby	2	2	110744.8218	1228254.038	5	Road
1597	2292	Davidson	2	1	84817.03265	944736.9628	5	Road
1598	2122	Davidson	2	1	34074.62624	379691.3828	5	Road
1599	2675	Davidson	2	1	34074.62624	379691.3828	5	Road
1600	2508	Davidson	2	1	34074.62624	379691.3828	5	Road
1601	48	Davidson	2	1	47601.15503	531391.7213	5	Road
1602	2461	Davidson	2	1	47826.85779	538451.5487	5	Road
1603	2184	Davidson	2	1	29206.82249	329627.9805	5	Road
1604	1909	Hamilton	2	2	72909.66302	823335.6013	5	Road
1605	2044	Davidson	2	1	101064.2386	1146681.739	5	Road
1606	2103	Davidson	2	2	211088.1392	2396131.217	5	Road
1607	2107	Davidson	2	2	211088.1392	2396131.217	5	Road
1608	2625	Davidson	2	2	105173.3565	1195468.542	5	Road
1609	1817	Knox	2	2	168870.5114	1919615.58	5	Road
1610	2315	Davidson	2	2	168870.5114	1919615.58	5	Road
1611	1867	Marion	2	2	168870.5114	1919615.58	5	Road
1612	2053	Davidson	2	2	78544.56112	900533.2197	5	Road
1613	2594	Davidson	2	2	78544.56112	900533.2197	5	Road
1614	2083	Davidson	2	2	78544.56112	900533.2197	5	Road
1615	2481	Davidson	2	2	78544.56112	900533.2197	5	Road
1616	101	Shelby	2	2	78544.56112	900533.2197	5	Road
1617	1797	Knox	2	2	103661.5906	1190307.235	5	Road
1618	2139	Davidson	2	2	103661.5906	1190307.235	5	Road
1619	2953	Shelby	2	2	35311.86092	406479.1672	5	Road
1620	2064	Davidson	2	1	13889.57094	160256.0586	5	Road
1621	2063	Davidson	2	1	129218.8141	1492134.97	5	Road
1622	2037	Davidson	2	1	129218.8141	1492134.97	5	Road
1623	2472	Davidson	2	2	129218.8141	1492134.97	5	Road
1624	2459	Davidson	2	1	63999.56706	741763.6198	5	Road
1625	1982	Davidson	2	2	175965.5441	2046974.375	5	Road
1626	2987	Shelby	2	2	175965.5441	2046974.375	5	Road
1627	2940	Shelby	2	2	175965.5441	2046974.375	5	Road
1628	2907	Shelby	2	2	175965.5441	2046974.375	5	Road
1629	1861	Unicoi	2	2	64001.33728	745457.6098	5	Road
1630	2337	Davidson	2	2	64001.33728	745457.6098	5	Road
1631	2338	Davidson	2	2	64001.33728	745457.6098	5	Road
1632	1899	Hamilton	2	2	201566.433	2363402.42	5	Road
1633	2513	Davidson	2	2	78500.30568	930735.5315	5	Road
1634	2558	Davidson	2	2	78500.30568	930735.5315	5	Road
1635	2559	Davidson	2	2	78500.30568	930735.5315	5	Road
1636	2831	Shelby	2	2	78500.30568	930735.5315	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1637	1979	Davidson	2	2	78500.30568	930735.5315	5	Road
1638	1809	Knox	2	2	67853.62612	812162.4625	5	Road
1639	2957	Shelby	2	2	285879.5437	3423328.619	5	Road
1640	1874	Hamilton	2	2	285879.5437	3423328.619	5	Road
1641	1967	Davidson	2	2	116886.0022	1401032.652	5	Road
1642	3018	Madison	2	2	68368.75948	820807.5806	5	Road
1643	2471	Davidson	2	2	68368.75948	820807.5806	5	Road
1644	2954	Shelby	2	2	121673.4086	1462991.243	5	Road
1645	2144	Williamson	2	2	234587.0421	2840437.876	5	Road
1646	1824	Knox	2	2	273276.9211	3314075.86	5	Road
1647	2658	Davidson	2	2	273276.9211	3314075.86	5	Road
1648	2624	Davidson	2	2	273276.9211	3314075.86	5	Road
1649	2981	Shelby	2	2	134726.5516	1633977.322	5	Road
1650	1793	Knox	2	2	134726.5516	1633977.322	5	Road
1651	1989	Davidson	2	1	244011.5339	2973409.45	5	Road
1652	2626	Davidson	2	1	244011.5339	2973409.45	5	Road
1653	2313	Davidson	2	1	244011.5339	2973409.45	5	Road
1654	2628	Davidson	2	1	244011.5339	2973409.45	5	Road
1655	2689	Davidson	2	1	244011.5339	2973409.45	5	Road
1656	2690	Davidson	2	1	244011.5339	2973409.45	5	Road
1657	1864	Marion	2	2	244011.5339	2973409.45	5	Road
1658	1838	Knox	2	2	244011.5339	2973409.45	5	Road
1659	2537	Williamson	2	2	53203.00907	649299.3828	5	Road
1660	2164	Davidson	2	2	53203.00907	649299.3828	5	Road
1661	2843	Shelby	2	1	36636.57387	448244.7616	5	Road
1662	2197	Davidson	2	2	181083.9812	2222833.551	5	Road
1663	1971	Davidson	2	2	181083.9812	2222833.551	5	Road
1664	1833	Knox	2	1	104291.493	1280989.764	5	Road
1665	48	Davidson	2	2	266114.1775	3283114.115	5	Road
1666	1916	Hamilton	2	2	266114.1775	3283114.115	5	Road
1667	2167	Davidson	2	2	266114.1775	3283114.115	5	Road
1668	2698	Davidson	2	1	52575.46688	651456.1174	5	Road
1669	2088	Davidson	2	1	52575.46688	651456.1174	5	Road
1670	2818	Shelby	2	1	56890.07758	706481.6115	5	Road
1671	2212	Davidson	2	1	23026.99236	287230.6185	5	Road
1672	2587	Davidson	2	2	29727.26651	371142.1218	5	Road
1673	1942	Davidson	2	2	206835.1911	2587381.261	5	Road
1674	2196	Davidson	2	2	206835.1911	2587381.261	5	Road
1675	1890	Hamilton	2	2	206835.1911	2587381.261	5	Road
1676	1908	Hamilton	2	2	206835.1911	2587381.261	5	Road
1677	2324	Wilson	2	2	78500.30568	986469.4833	5	Road
1678	2572	Davidson	2	2	84421.68402	1065960.37	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1679	2336	Davidson	2	1	84421.68402	1065960.37	5	Road
1680	1814	Knox	2	2	84421.68402	1065960.37	5	Road
1681	2850	Shelby	2	1	84421.68402	1065960.37	5	Road
1682	2320	Davidson	2	1	84421.68402	1065960.37	5	Road
1683	2458	Davidson	2	1	84421.68402	1065960.37	5	Road
1684	1920	Hamilton	2	2	84421.68402	1065960.37	5	Road
1685	46	Davidson	2	1	84421.68402	1065960.37	5	Road
1686	2586	Williamson	2	2	130704.9119	1651086.657	5	Road
1687	2724	Williamson	2	2	130704.9119	1651086.657	5	Road
1688	2524	Davidson	2	2	130704.9119	1651086.657	5	Road
1689	2994	Shelby	2	2	24677.7204	315690.9918	5	Road
1690	2062	Davidson	2	2	5436.33868	69658.51797	5	Road
1691	1766	Knox	2	2	62493.99688	806824.676	5	Road
1692	1831	Knox	2	1	62493.99688	806824.676	5	Road
1693	1871	Hamilton	2	2	147761.6975	1908671.753	5	Road
1694	2015	Davidson	2	2	29206.82249	379691.3828	5	Road
1695	2017	Davidson	2	1	29206.82249	379691.3828	5	Road
1696	2798	Shelby	2	2	23250.0398	305178.3851	5	Road
1697	3015	Madison	2	2	113066.4624	1492134.97	5	Road
1698	2191	Davidson	2	2	118161.4441	1562161.225	5	Road
1699	2075	Davidson	2	2	118161.4441	1562161.225	5	Road
1700	2039	Davidson	2	1	2640.427277	35005.55115	5	Road
1701	2423	Davidson	2	2	19290.65279	256797.7253	5	Road
1702	2117	Davidson	2	1	185682.2693	2471927.394	5	Road
1703	1997	Davidson	2	1	185682.2693	2471927.394	5	Road
1704	1862	Marion	2	2	185682.2693	2471927.394	5	Road
1705	1863	Marion	2	2	185682.2693	2471927.394	5	Road
1706	2484	Davidson	2	2	105197.402	1401032.652	5	Road
1707	2883	Shelby	2	1	90239.79966	1208982.516	5	Road
1708	2645	Davidson	2	2	90239.79966	1208982.516	5	Road
1709	2982	Shelby	2	2	264686.4969	3610500.229	5	Road
1710	2986	Shelby	2	2	264686.4969	3610500.229	5	Road
1711	1813	Knox	2	2	264686.4969	3610500.229	5	Road
1712	2468	Davidson	2	2	242912.8187	3314075.86	5	Road
1713	2496	Davidson	2	2	242912.8187	3314075.86	5	Road
1714	2198	Davidson	2	2	242912.8187	3314075.86	5	Road
1715	2199	Davidson	2	2	242912.8187	3314075.86	5	Road
1716	2613	Davidson	2	2	242912.8187	3314075.86	5	Road
1717	1960	Davidson	2	2	242912.8187	3314075.86	5	Road
1718	2440	Davidson	2	2	160963.5388	2220519.154	5	Road
1719	1941	Davidson	2	2	160963.5388	2222833.551	5	Road
1720	2010	Davidson	2	2	236545.9356	3283114.115	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1721	2152	Davidson	2	2	236545.9356	3283114.115	5	Road
1722	2756	Sumner	2	2	186151.672	2587381.261	5	Road
1723	2760	Sumner	2	2	186151.672	2587381.261	5	Road
1724	1934	Davidson	2	2	67853.62612	944736.9628	5	Road
1725	54	Davidson	2	1	4132.573314	57620.14941	5	Road
1726	2701	Davidson	2	1	83983.85017	1188302.477	5	Road
1727	1987	Davidson	2	2	83983.85017	1188302.477	5	Road
1728	2263	Davidson	2	1	83983.85017	1188302.477	5	Road
1729	1754	Knox	2	2	168870.5114	2396131.217	5	Road
1730	1791	Knox	2	2	168870.5114	2396131.217	5	Road
1731	2133	Davidson	2	2	168870.5114	2396131.217	5	Road
1732	2482	Davidson	2	2	64001.33728	911390.8517	5	Road
1733	46	Davidson	2	2	64001.33728	911390.8517	5	Road
1734	2261	Davidson	2	2	64001.33728	911390.8517	5	Road
1735	2768	Davidson	2	2	31402.7776	448244.7616	5	Road
1736	1902	Hamilton	2	2	215736.436	3131406.736	5	Road
1737	2302	Davidson	2	1	90239.79966	1312265.477	5	Road
1738	3022	Madison	2	2	90239.79966	1312265.477	5	Road
1739	2642	Davidson	2	2	90239.79966	1312265.477	5	Road
1740	2885	Shelby	2	1	67671.88376	984602.7063	5	Road
1741	1924	Marion	2	2	67671.88376	984602.7063	5	Road
1742	1925	Marion	2	2	67671.88376	984602.7063	5	Road
1743	2154	Davidson	2	2	67671.88376	984602.7063	5	Road
1744	2785	Davidson	2	2	56453.42387	829703.5427	5	Road
1745	2137	Wilson	2	2	56453.42387	829703.5427	5	Road
1746	2926	Shelby	2	2	27464.78072	406479.1672	5	Road
1747	2733	Davidson	2	1	62806.44031	934306.7785	5	Road
1748	2735	Davidson	2	1	62806.44031	934306.7785	5	Road
1749	1808	Knox	2	2	62806.44031	934306.7785	5	Road
1750	1810	Knox	2	2	62806.44031	934306.7785	5	Road
1751	2003	Davidson	2	2	93508.80175	1401032.652	5	Road
1752	2364	Davidson	2	2	93508.80175	1401032.652	5	Road
1753	2596	Davidson	2	2	129865.3862	1951516.182	5	Road
1754	2171	Davidson	2	2	129865.3862	1951516.182	5	Road
1755	2467	Davidson	2	2	129865.3862	1951516.182	5	Road
1756	2142	Davidson	2	1	126652.8835	1908671.753	5	Road
1757	1901	Hamilton	2	2	56453.42387	853053.8684	5	Road
1758	2335	Davidson	2	1	187669.6337	2840437.876	5	Road
1759	2229	Davidson	2	2	187669.6337	2840437.876	5	Road
1760	1898	Hamilton	2	2	187669.6337	2840437.876	5	Road
1761	2892	Shelby	2	2	187669.6337	2840437.876	5	Road
1762	1755	Knox	2	2	15394.40354	233278.6385	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1763	2925	Shelby	2	2	54157.45146	823762.9608	5	Road
1764	2800	Shelby	2	1	78959.8247	1208982.516	5	Road
1765	2259	Davidson	2	2	22223.31351	345821.884	5	Road
1766	2409	Davidson	2	2	231600.6848	3610500.229	5	Road
1767	2996	Shelby	2	2	231600.6848	3610500.229	5	Road
1768	2880	Shelby	2	1	33148.21229	518274.7234	5	Road
1769	1996	Davidson	2	1	33148.21229	518274.7234	5	Road
1770	2100	Davidson	2	2	165468.1529	2587381.261	5	Road
1771	2569	Williamson	2	2	165468.1529	2587381.261	5	Road
1772	2757	Sumner	2	1	51126.83869	807738.6327	5	Road
1773	2239	Davidson	2	1	51126.83869	807738.6327	5	Road
1774	2412	Davidson	2	1	51126.83869	807738.6327	5	Road
1775	2422	Davidson	2	2	22794.20873	364698.1914	5	Road
1776	2255	Davidson	2	1	297772.309	4774388.493	5	Road
1777	2510	Davidson	2	2	297772.309	4774388.493	5	Road
1778	2136	Davidson	2	2	297772.309	4774388.493	5	Road
1779	2999	Shelby	2	2	297772.309	4774388.493	5	Road
1780	1970	Davidson	2	2	62806.44031	1009107.478	5	Road
1781	1836	Knox	2	2	62806.44031	1009107.478	5	Road
1782	2972	Shelby	2	2	62806.44031	1009107.478	5	Road
1783	2978	Shelby	2	2	62806.44031	1009107.478	5	Road
1784	2533	Davidson	2	2	42136.49287	681271.4787	5	Road
1785	1784	Knox	2	1	151921.8567	2471927.394	5	Road
1786	2072	Sumner	2	1	251958.0413	4153463.385	5	Road
1787	2871	Shelby	2	1	78959.8247	1312265.477	5	Road
1788	1763	Knox	2	2	78959.8247	1312265.477	5	Road
1789	2476	Davidson	2	2	222077.3559	3712634.816	5	Road
1790	1786	Knox	2	2	222077.3559	3712634.816	5	Road
1791	2571	Davidson	2	2	222077.3559	3712634.816	5	Road
1792	2539	Williamson	2	2	222077.3559	3712634.816	5	Road
1793	2208	Davidson	2	2	222077.3559	3712634.816	5	Road
1794	2432	Davidson	2	2	222077.3559	3712634.816	5	Road
1795	2808	Shelby	2	1	101281.2378	1703006.907	5	Road
1796	2098	Davidson	2	2	115435.8988	1951516.182	5	Road
1797	2631	Davidson	2	2	184916.9451	3131406.736	5	Road
1798	2309	Davidson	2	2	184916.9451	3131406.736	5	Road
1799	2641	Davidson	2	2	184916.9451	3131406.736	5	Road
1800	2830	Shelby	2	2	184916.9451	3131406.736	5	Road
1801	2046	Davidson	2	2	184916.9451	3131406.736	5	Road
1802	2296	Davidson	2	2	184916.9451	3131406.736	5	Road
1803	2486	Davidson	2	2	184916.9451	3131406.736	5	Road
1804	2448	Davidson	2	2	58443.0011	995721.9184	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1805	2920	Shelby	2	2	42136.49287	718752.4338	5	Road
1806	101	Shelby	2	2	42136.49287	718752.4338	5	Road
1807	2532	Davidson	2	2	42136.49287	718752.4338	5	Road
1808	2640	Davidson	2	2	42136.49287	718752.4338	5	Road
1809	2834	Shelby	2	1	11251.50396	192132.246	5	Road
1810	2071	Sumner	2	2	53875.24925	930196.1006	5	Road
1811	2896	Shelby	2	2	185605.8549	3235934.563	5	Road
1812	2485	Davidson	2	2	185605.8549	3235934.563	5	Road
1813	2517	Davidson	2	2	185605.8549	3235934.563	5	Road
1814	1858	Knox	2	2	185605.8549	3235934.563	5	Road
1815	1958	Davidson	2	2	185605.8549	3235934.563	5	Road
1816	2695	Davidson	2	2	62087.43687	1083761.162	5	Road
1817	3016	Madison	2	2	56393.23647	984602.7063	5	Road
1818	3017	Madison	2	2	56393.23647	984602.7063	5	Road
1819	2758	Davidson	2	2	29226.44241	516449.4761	5	Road
1820	2770	Davidson	2	2	29226.44241	516449.4761	5	Road
1821	2988	Shelby	2	2	29226.44241	516449.4761	5	Road
1822	3008	Shelby	2	2	29226.44241	516449.4761	5	Road
1823	2544	Davidson	2	2	98929.20847	1749280.654	5	Road
1824	2109	Davidson	2	1	75861.94366	1341930.547	5	Road
1825	2435	Davidson	2	1	75861.94366	1341930.547	5	Road
1826	2395	Davidson	2	1	13889.57094	245777.5907	5	Road
1827	2329	Davidson	2	1	72051.40245	1275573.242	5	Road
1828	2166	Davidson	2	1	67679.84974	1208982.516	5	Road
1829	1795	Knox	2	2	194079.7397	3473713.774	5	Road
1830	2767	Davidson	2	2	264686.4969	4774388.493	5	Road
1831	2560	Davidson	2	2	264686.4969	4774388.493	5	Road
1832	2393	Davidson	2	2	264686.4969	4774388.493	5	Road
1833	2934	Shelby	2	2	264686.4969	4774388.493	5	Road
1834	2915	Shelby	2	2	264686.4969	4774388.493	5	Road
1835	2916	Shelby	2	2	264686.4969	4774388.493	5	Road
1836	1749	Knox	2	2	105544.0696	1908671.753	5	Road
1837	2945	Shelby	2	2	105544.0696	1908671.753	5	Road
1838	2826	Shelby	2	2	7515.164379	136902.2798	5	Road
1839	2231	Davidson	2	1	14391.87023	263624.9725	5	Road
1840	1756	Knox	2	2	2755.048876	50607.78711	5	Road
1841	1870	Hamilton	2	2	186151.672	3475175.484	5	Road
1842	2370	Davidson	2	2	62070.17724	1162091.424	5	Road
1843	1792	Knox	2	2	126652.8835	2382470.75	5	Road
1844	2761	Davidson	2	2	187669.6337	3563210.175	5	Road
1845	1764	Knox	2	2	296518.9949	5697199.746	5	Road
1846	2865	Shelby	2	1	72731.16607	1404635.235	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1847	2731	Davidson	2	2	72731.16607	1404635.235	5	Road
1848	2732	Davidson	2	2	72731.16607	1404635.235	5	Road
1849	2082	Davidson	2	2	72731.16607	1404635.235	5	Road
1850	1843	Knox	2	2	296518.9949	5733081.34	5	Road
1851	1811	Knox	2	2	176436.127	3473713.774	5	Road
1852	2057	Davidson	2	2	176436.127	3473713.774	5	Road
1853	2463	Davidson	2	2	176436.127	3473713.774	5	Road
1854	2464	Davidson	2	2	176436.127	3473713.774	5	Road
1855	2526	Davidson	2	1	9644.146248	192132.246	5	Road
1856	2607	Davidson	2	2	46178.78507	930196.1006	5	Road
1857	2093	Sumner	2	2	46178.78507	930196.1006	5	Road
1858	2284	Davidson	2	1	118320.0261	2388775.297	5	Road
1859	2583	Williamson	2	2	16987.00943	345782.1754	5	Road
1860	2989	Shelby	2	2	264686.4969	5392185.182	5	Road
1861	3012	Shelby	2	2	264686.4969	5392185.182	5	Road
1862	2985	Shelby	2	2	264686.4969	5392185.182	5	Road
1863	3010	Shelby	2	2	264686.4969	5392185.182	5	Road
1864	2194	Davidson	2	2	111295.3595	2277786.592	5	Road
1865	2376	Davidson	2	2	25051.23635	516449.4761	5	Road
1866	1804	Knox	2	2	25051.23635	516449.4761	5	Road
1867	2489	Rutherford	2	2	25051.23635	516449.4761	5	Road
1868	2018	Davidson	2	1	65024.52313	1341930.547	5	Road
1869	1860	Knox	2	1	65024.52313	1341930.547	5	Road
1870	2823	Shelby	2	1	118161.4441	2471927.394	5	Road
1871	2655	Davidson	2	2	263572.4399	5697199.746	5	Road
1872	2652	Williamson	2	2	263572.4399	5697199.746	5	Road
1873	2209	Davidson	2	2	263572.4399	5697199.746	5	Road
1874	2446	Davidson	2	1	21466.54542	466806.85	5	Road
1875	2852	Shelby	2	1	21466.54542	466806.85	5	Road
1876	1767	Knox	2	2	148484.6839	3235934.563	5	Road
1877	2138	Davidson	2	2	148484.6839	3235934.563	5	Road
1878	2116	Davidson	2	1	45114.58918	984602.7063	5	Road
1879	2273	Davidson	2	2	45114.58918	984602.7063	5	Road
1880	1851	Knox	2	2	53203.00907	1162091.424	5	Road
1881	2522	Davidson	2	2	53203.00907	1162091.424	5	Road
1882	2722	Davidson	2	2	53203.00907	1162091.424	5	Road
1883	2601	Davidson	2	1	11289.2686	247457.388	5	Road
1884	2754	Davidson	2	2	23546.99382	519031.2206	5	Road
1885	2668	Williamson	2	2	23546.99382	519031.2206	5	Road
1886	2371	Davidson	2	2	194079.7397	4289424.102	5	Road
1887	2384	Davidson	2	2	28445.03879	630653.3069	5	Road
1888	2903	Shelby	2	2	28445.03879	630653.3069	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1889	2454	Davidson	2	2	28445.03879	630653.3069	5	Road
1890	102	Shelby	2	1	23291.93495	524634.8492	5	Road
1891	51	Davidson	2	2	105544.0696	2382470.75	5	Road
1892	51	Davidson	2	2	105544.0696	2382470.75	5	Road
1893	1768	Knox	2	2	105544.0696	2382470.75	5	Road
1894	2223	Davidson	2	2	92026.68695	2088904.475	5	Road
1895	2172	Davidson	2	2	92026.68695	2088904.475	5	Road
1896	2514	Davidson	2	1	92026.68695	2088904.475	5	Road
1897	2365	Williamson	2	2	53875.24925	1231981.912	5	Road
1898	2723	Davidson	2	2	98929.20847	2277786.592	5	Road
1899	2465	Davidson	2	1	60609.30505	1404635.235	5	Road
1900	102	Shelby	2	2	231600.6848	5392185.182	5	Road
1901	2256	Davidson	2	1	297772.309	7130421.063	5	Road
1902	2909	Shelby	2	2	297772.309	7130421.063	5	Road
1903	86	Shelby	2	2	297772.309	7130421.063	5	Road
1904	2771	Davidson	2	2	198514.8727	4774388.493	5	Road
1905	2349	Davidson	2	2	10065.45807	244463.0137	5	Road
1906	2713	Davidson	2	2	176436.127	4289424.102	5	Road
1907	2714	Davidson	2	2	176436.127	4289424.102	5	Road
1908	1884	Hamilton	2	2	176436.127	4289424.102	5	Road
1909	1889	Hamilton	2	2	176436.127	4289424.102	5	Road
1910	2782	Davidson	2	2	141148.9016	3473713.774	5	Road
1911	1992	Davidson	2	2	141148.9016	3473713.774	5	Road
1912	2621	Williamson	2	2	23291.93495	589218.7429	5	Road
1913	1976	Sumner	2	2	38804.64804	994693.7694	5	Road
1914	3005	Shelby	2	2	92026.68695	2388775.297	5	Road
1915	86	Shelby	2	1	10065.45807	262411.1614	5	Road
1916	2882	Shelby	2	1	46178.78507	1231981.912	5	Road
1917	2820	Shelby	2	1	46178.78507	1231981.912	5	Road
1918	2995	Shelby	2	2	264686.4969	7130421.063	5	Road
1919	2939	Shelby	2	2	264686.4969	7130421.063	5	Road
1920	2073	Davidson	2	2	264686.4969	7130421.063	5	Road
1921	1829	Knox	2	2	264686.4969	7130421.063	5	Road
1922	1830	Knox	2	2	264686.4969	7130421.063	5	Road
1923	2764	Davidson	2	2	264686.4969	7130421.063	5	Road
1924	2298	Davidson	2	2	264686.4969	7130421.063	5	Road
1925	1904	Hamilton	2	2	28445.03879	771031.9768	5	Road
1926	2352	Davidson	2	2	28445.03879	771031.9768	5	Road
1927	2483	Davidson	2	2	28445.03879	771031.9768	5	Road
1928	2615	Davidson	2	2	30785.85672	853749.2371	5	Road
1929	2691	Davidson	2	2	123505.2889	3473713.774	5	Road
1930	2692	Davidson	2	2	123505.2889	3473713.774	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1931	1853	Knox	2	2	19290.65279	546783.7173	5	Road
1932	1779	Knox	2	2	19290.65279	546783.7173	5	Road
1933	2627	Davidson	2	1	31961.2813	939239.7046	5	Road
1934	2789	Shelby	2	2	31961.2813	939239.7046	5	Road
1935	2095	Davidson	2	2	31961.2813	939239.7046	5	Road
1936	2390	Davidson	2	1	78880.01739	2388775.297	5	Road
1937	2969	Shelby	2	2	141148.9016	4289424.102	5	Road
1938	2272	Davidson	2	2	141148.9016	4289424.102	5	Road
1939	2511	Davidson	2	2	141148.9016	4289424.102	5	Road
1940	2276	Davidson	2	1	16819.2813	519031.2206	5	Road
1941	2726	Williamson	2	2	16819.2813	519031.2206	5	Road
1942	48	Davidson	2	1	38482.3209	1231981.912	5	Road
1943	2860	Shelby	2	1	31043.71843	1003315.481	5	Road
1944	2543	Davidson	2	2	86576.92412	2833362.605	5	Road
1945	2660	Davidson	2	1	86576.92412	2833362.605	5	Road
1946	2661	Davidson	2	1	86576.92412	2833362.605	5	Road
1947	2439	Davidson	2	2	165429.0606	5500682.731	5	Road
1948	2644	Davidson	2	2	123505.2889	4289424.102	5	Road
1949	2707	Davidson	2	2	16637.09639	589218.7429	5	Road
1950	2827	Shelby	2	2	59052.10352	2116465.393	5	Road
1951	2872	Shelby	2	1	59052.10352	2116465.393	5	Road
1952	2546	Davidson	2	2	59052.10352	2116465.393	5	Road
1953	2783	Davidson	2	2	198514.8727	7130421.063	5	Road
1954	1805	Knox	2	2	88218.06348	3473713.774	5	Road
1955	2052	Davidson	2	2	13309.67711	524634.8492	5	Road
1956	2368	Davidson	2	2	13309.67711	524634.8492	5	Road
1957	2671	Davidson	2	2	22862.36211	927325.4961	5	Road
1958	1906	Hamilton	2	2	51670.59058	2116465.393	5	Road
1959	48	Davidson	2	1	132343.2485	5500682.731	5	Road
1960	1816	Knox	2	2	132343.2485	5500682.731	5	Road
1961	3003	Shelby	2	2	132343.2485	5500682.731	5	Road
1962	2775	Davidson	2	2	132343.2485	5500682.731	5	Road
1963	2708	Davidson	2	2	13309.67711	589218.7429	5	Road
1964	2126	Davidson	2	2	88218.06348	4289424.102	5	Road
1965	2962	Shelby	2	2	70574.45079	3473713.774	5	Road
1966	2870	Shelby	2	1	165429.0606	8215122.012	5	Road
1967	2339	Davidson	2	2	18289.88969	1010360.564	5	Road
1968	2399	Davidson	2	1	8812.14391	490361.8538	5	Road
1969	2998	Shelby	2	2	70574.45079	4289424.102	5	Road
1970	1825	Knox	2	2	132343.2485	8215122.012	5	Road
1971	2562	Davidson	2	2	132343.2485	8215122.012	5	Road
1972	1788	Knox	2	2	132343.2485	8215122.012	5	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
1973	2919	Shelby	2	2	132343.2485	8215122.012	5	Road
1974	92	Shelby	3	2	405441.501	2179877.312	12	Road
1975	38	Hamilton	3	2	1798951.077	9729383.193	12	Road
1976	9	Knox	3	2	515409.303	2706201.597	12	Road
1977	11	Knox	3	2	1570151.067	9283482.868	12	Road
1978	51	Davidson	3	2	345213.3463	2230603.324	12	Road
1979	90	Shelby	3	2	653999.7099	4363299.218	12	Road
1980	88	Shelby	3	2	490499.7824	2960933.355	12	Road
1981	89	Shelby	3	2	484812.8284	2930373.208	12	Road
1982	98	Shelby	3	2	322731.6355	2519679.322	12	Road
1983	96	Shelby	3	2	354561.828	2688478.628	12	Road
1984	8	Knox	3	2	1057348.909	9165409.573	12	Road
1985	97	Shelby	3	2	716464.2308	5610421.451	12	Road
1986	35	Hamilton	3	2	408932.4614	3119098.88	12	Road
1987	50	Davidson	3	2	363536.9016	3048207.003	12	Road
1988	53	Davidson	3	2	614331.7551	4452393.063	12	Road
1989	48	Davidson	3	2	2968146.242	23703944.41	12	Road
1990	84	Shelby	3	2	949438.8787	9308295.025	12	Road
1991	101	Shelby	3	2	208597.1876	2183421.906	12	Road
1992	34	Hamilton	3	2	1035863.998	10078956.79	12	Road
1993	21	Hamilton	3	2	730311.5496	8667442.039	12	Road
1994	99	Shelby	3	2	219457.5121	2407593.516	12	Road
1995	86	Shelby	3	2	397379.5419	4838897.491	12	Road
1996	32	Hamilton	3	2	302052.2651	4277127.268	12	Road
1997	54	Davidson	3	2	205100.4695	2743850.932	12	Road
1998	45	Davidson	3	2	125343.3977	2118517.519	12	Road
1999	39	Hamilton	3	2	825963.7599	14638214.56	12	Road
2000	47	Davidson	3	2	109107.4278	2042979.35	12	Road
2001	100	Shelby	3	2	97536.67206	1927348.951	12	Road
2002	91	Shelby	3	2	102180.3488	2093705.362	12	Road
2003	46	Davidson	3	2	1020590.574	15841173.07	12	Road
2004	10	Knox	3	2	106942.3936	2458319.528	12	Road
2005	94	Shelby	3	2	124290.6509	2851290.445	12	Road
2006	36	Hamilton	3	2	381159.6272	10011370	12	Road
2007	44	Davidson	3	2	208363.0507	6432192.423	12	Road
2008	58	Giles	3	1	21477.87025	1923804.357	10	Road
2009	85	Shelby	3	2	73704.25314	2281329.336	12	Road
2010	17	Sullivan	3	1	20261.30304	1923804.357	10	Road
2011	57	Giles	3	1	21477.87025	2039434.756	10	Road
2012	75	Wilson	3	1	45100.64912	4592117.12	10	Road
2013	95	Shelby	3	2	96651.51834	3198181.643	12	Road
2014	42	Putnam	3	1	34376.51318	3963239.113	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
2015	33	Hamilton	3	2	60021.09117	2363956.692	12	Road
2016	72	Williamson	3	1	20546.60961	2209335.761	10	Road
2017	24	Bradley	3	1	16139.70292	1937982.732	10	Road
2018	59	Montgomery	3	1	34564.48567	4103681.669	10	Road
2019	19	Sullivan	3	1	18439.71303	2151520.561	10	Road
2020	3	Campbell	3	1	98005.35286	11273293.31	10	Road
2021	93	Shelby	3	2	237226.4102	9060029.756	12	Road
2022	6	Jefferson	3	1	61954.57295	8183652.879	10	Road
2023	28	Coffee	3	1	63387.97452	8493996.44	10	Road
2024	87	Shelby	3	2	35543.46249	1992253.338	12	Road
2025	4	Greene	3	1	27877.41947	4038777.282	10	Road
2026	61	Montgomery	3	1	14972.40312	2104339.143	10	Road
2027	69	Sumner	3	1	67609.91379	8983773.089	10	Road
2028	76	Wilson	3	1	58796.85852	8378366.041	10	Road
2029	82	Madison	3	1	59758.60394	8446815.022	10	Road
2030	2	Campbell	3	1	41231.36727	6092390.413	10	Road
2031	77	Wilson	3	1	33202.93187	4537846.515	10	Road
2032	102	Shelby	3	2	77258.21764	4378579.291	12	Road
2033	31	Coffee	3	1	12902.17136	1992253.338	10	Road
2034	37	Hamilton	3	2	38306.62091	2274240.148	12	Road
2035	81	Haywood	3	1	184341.254	28668195.98	10	Road
2036	49	Davidson	3	2	76701.97242	4606295.496	12	Road
2037	16	Sevier	3	1	14050.49584	2209335.761	10	Road
2038	27	Coffee	3	1	12926.00452	2137342.186	10	Road
2039	22	Bradley	3	1	36462.10087	6176119.468	10	Road
2040	5	Jefferson	3	1	45390.1267	7076350.503	10	Road
2041	80	Henderson	3	1	45200.57219	8056287.001	10	Road
2042	41	McMinn	3	1	31038.69097	5846951.24	10	Road
2043	67	Rutherford	3	1	25362.89272	4480031.315	10	Road
2044	29	Cumberland	3	1	9588.205943	1927348.951	10	Road
2045	52	Davidson	3	2	48378.18106	2997480.991	12	Road
2046	23	Bradley	3	1	40764.27823	8236821.787	10	Road
2047	1	Anderson	3	1	19245.40153	4021054.313	10	Road
2048	12	Roane	3	1	23994.88921	4567304.963	10	Road
2049	30	Cumberland	3	1	17753.8306	3868876.277	10	Road
2050	20	Washington	3	1	15908.45571	3847608.714	10	Road
2051	73	Williamson	3	1	7849.266594	1937982.732	10	Road
2052	63	Rutherford	3	1	8973.906158	2205791.167	10	Road
2053	26	Coffee	3	1	7617.109808	2042979.35	10	Road
2054	78	Wilson	3	1	28098.79811	7908755.257	10	Road
2055	79	Humphreys	3	1	7350.637144	2035890.162	10	Road
2056	62	Robertson	3	1	12918.3868	3901879.32	10	Road

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
2057	66	Rutherford	3	1	9684.013583	2512590.134	10	Road
2058	40	McMinn	3	1	6223.464726	1978074.963	10	Road
2059	56	Giles	3	1	6226.249111	1985164.15	10	Road
2060	68	Rutherford	3	1	8300.583071	2382781.359	10	Road
2061	74	Williamson	3	1	6233.241118	2035890.162	10	Road
2062	71	Williamson	3	1	6694.962683	2158609.749	10	Road
2063	14	Roane	3	1	7954.662832	2400504.329	10	Road
2064	43	Coffee	3	1	10344.59683	3840519.526	10	Road
2065	15	Roane	3	1	5812.551453	2042979.35	10	Road
2066	25	Coffee	3	1	5843.884492	2053613.131	10	Road
2067	70	Robertson	3	1	18441.16298	6526555.259	10	Road
2068	60	Montgomery	3	1	4146.203941	1978074.963	10	Road
2069	65	Rutherford	3	1	4471.762498	2140886.78	10	Road
2070	7	Jefferson	3	1	6665.622827	3908968.507	10	Road
2071	64	Rutherford	3	1	21037.15737	13976333.51	10	Road
2072	18	Sullivan	3	1	5997.593756	4180321.536	10	Road
2073	83	Madison	3	1	3451.703665	2263606.367	10	Road
2074	13	Roane	3	1	2471.637778	2093705.362	10	Road
2075	55	Dickson	3	1	8090.884568	7930022.82	10	Road
2076	3198	Blount	3	3	124581.0484	36428.54153	25	Rail
2077	3216	Rhea	3	3	124581.0484	28627.49502	25	Rail
2078	3100	Hamilton	3	3	196907.2681	24799.15485	25	Rail
2079	3110	Hawkins	3	3	196907.2681	7541.791214	25	Rail
2080	3109	Knox	3	3	196907.2681	6901.329079	25	Rail
2081	3108	Hamilton	3	3	196907.2681	24541.18387	25	Rail
2082	3212	Morgan	3	3	124581.0484	28659.62645	25	Rail
2083	3213	Scott	3	3	124581.0484	28868.37015	25	Rail
2084	3211	Morgan	3	3	124581.0484	26720.87878	25	Rail
2085	3103	Blount	3	3	196907.2681	24799.15485	25	Rail
2086	3165	Knox	3	3	124581.0484	36729.3324	25	Rail
2087	3158	Greene	3	3	145344.5564	26236.56689	25	Rail
2088	3168	McMinn	3	3	124581.0484	26307.81714	25	Rail
2089	3154	Greene	3	3	145344.5564	36439.01377	25	Rail
2090	3173	Sullivan	3	3	124581.0484	36497.49478	25	Rail
2091	3116	Loudon	3	3	196907.2681	7396.169606	25	Rail
2092	3218	Rhea	3	3	124581.0484	28829.71973	25	Rail
2093	3206	Davidson	3	3	124581.0484	26685.62713	25	Rail
2094	3117	Anderson	3	3	196907.2681	7326.443984	25	Rail
2095	3178	Washington	3	3	124581.0484	36522.93793	25	Rail
2096	3166	Loudon	3	3	124581.0484	36561.28872	25	Rail
2097	3147	Hamblen	3	3	145344.5564	36570.90417	25	Rail
2098	3205	Marion	3	3	124581.0484	36481.2112	25	Rail

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
2099	3184	Hamilton	3	3	124581.0484	36439.01377	25	Rail
2100	3170	Monroe	3	3	124581.0484	36492.05376	25	Rail
2101	3125	Washington	3	3	196907.2681	7038.000411	25	Rail
2102	3155	Greene	3	3	145344.5564	36434.33034	25	Rail
2103	3183	Williamson	3	3	124581.0484	36491.75057	25	Rail
2104	3133	Franklin	3	3	196907.2681	6870.928763	25	Rail
2105	3134	Fayette	3	3	196907.2681	6547.561304	25	Rail
2106	3208	Blount	3	3	124581.0484	28647.31407	25	Rail
2107	3121	Carter	3	3	196907.2681	6638.513649	25	Rail
2108	3219	Rhea	3	3	124581.0484	28753.16293	25	Rail
2109	3123	Washington	3	3	196907.2681	6471.494341	25	Rail
2110	3138	Fayette	3	3	196907.2681	7451.165729	25	Rail
2111	3153	Greene	3	3	145344.5564	36630.81971	25	Rail
2112	3180	Washington	3	3	124581.0484	36431.71389	25	Rail
2113	3169	McMinn	3	3	124581.0484	26333.67059	25	Rail
2114	3136	Haywood	3	3	196907.2681	6672.254134	25	Rail
2115	3209	Hamilton	3	3	124581.0484	26498.27697	25	Rail
2116	3210	Hamilton	3	3	124581.0484	26470.86385	25	Rail
2117	3127	Bedford	3	3	196907.2681	6164.694615	25	Rail
2118	3130	Rutherford	3	3	196907.2681	6632.97623	25	Rail
2119	3137	Loudon	3	3	196907.2681	7451.165729	25	Rail
2120	3142	Marshall	3	3	196907.2681	7097.207397	25	Rail
2121	3143	Marshall	3	3	196907.2681	7451.165729	25	Rail
2122	3144	Marshall	3	3	196907.2681	7451.165729	25	Rail
2123	3145	Marshall	3	3	196907.2681	7400.483645	25	Rail
2124	3156	Greene	3	3	145344.5564	26298.157	25	Rail
2125	3160	Greene	3	3	145344.5564	26290.59371	25	Rail
2126	3199	Lauderdale	3	3	124581.0484	36486.09836	25	Rail
2127	3115	Blount	3	3	196907.2681	7502.684351	25	Rail
2128	3135	Davidson	3	3	196907.2681	7053.385725	25	Rail
2129	3207	Blount	3	3	124581.0484	28868.1692	25	Rail
2130	3122	Carter	3	3	196907.2681	7128.784072	25	Rail
2131	3140	Fayette	3	3	196907.2681	7451.165729	25	Rail
2132	3118	Anderson	3	3	196907.2681	7266.920501	25	Rail
2133	3119	Anderson	3	3	196907.2681	7211.949376	25	Rail
2134	3120	Anderson	3	3	196907.2681	7266.920501	25	Rail
2135	3190	Giles	3	3	124581.0484	26290.59371	25	Rail
2136	3132	Anderson	3	3	196907.2681	6870.928763	25	Rail
2137	3124	Sumner	3	3	196907.2681	7038.000411	25	Rail
2138	3186	Washington	3	3	124581.0484	36549.17856	25	Rail
2139	3175	Sullivan	3	3	124581.0484	36573.21127	25	Rail
2140	3141	Fayette	3	3	196907.2681	7097.207397	25	Rail

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
2141	3128	Franklin	3	3	196907.2681	6164.694615	25	Rail
2142	3131	Bedford	3	3	196907.2681	6580.075438	25	Rail
2143	3139	Fayette	3	3	196907.2681	6802.347428	25	Rail
2144	3176	Sullivan	3	3	124581.0484	36724.00731	25	Rail
2145	3181	Washington	3	3	124581.0484	36431.71389	25	Rail
2146	3201	Fayette	3	3	124581.0484	36605.12368	25	Rail
2147	3177	Sullivan	3	3	124581.0484	36643.28446	25	Rail
2148	3179	Washington	3	3	124581.0484	36992.58894	25	Rail
2149	3202	Hardeman	3	3	124581.0484	36636.58452	25	Rail
2150	3114	Monroe	3	3	196907.2681	7502.684351	25	Rail
2151	3182	Marshall	3	3	124581.0484	36431.71389	25	Rail
2152	3185	Greene	3	3	124581.0484	37042.4378	25	Rail
2153	3204	Marion	3	3	124581.0484	26335.93416	25	Rail
2154	3129	Rutherford	3	3	196907.2681	6996.860037	25	Rail
2155	3167	Loudon	3	3	124581.0484	26417.80444	25	Rail
2156	3174	Sullivan	3	3	124581.0484	36569.44511	25	Rail
2157	3152	Bradley	3	3	145344.5564	36443.79841	25	Rail
2158	3146	Marshall	3	3	65000	32854.0138	25	Rail
2159	3162	Hamblen	3	3	145344.5564	36573.9981	25	Rail
2160	3200	Fayette	3	3	124581.0484	36442.6562	25	Rail
2161	3203	Marion	3	3	124581.0484	37005.82189	25	Rail
2162	3085	Davidson	3	1	196907.2681	22771.5092	25	Rail
2163	3086	Knox	3	1	196907.2681	24866.73289	25	Rail
2164	3097	Hamilton	3	1	196907.2681	22709.56266	25	Rail
2165	3091	Shelby	3	1	196907.2681	24783.81916	25	Rail
2166	3026	Hamblen	3	1	216286.5423	26793.69515	25	Rail
2167	3039	Warren	3	1	216286.5423	24735.14156	25	Rail
2168	3095	Robertson	3	1	196907.2681	24849.02265	25	Rail
2169	3093	Robertson	3	1	196907.2681	22732.0839	25	Rail
2170	3054	Davidson	3	1	196907.2681	24813.22432	25	Rail
2171	3053	Dyer	3	1	196907.2681	24826.69529	25	Rail
2172	3088	Shelby	3	1	196907.2681	24833.07371	25	Rail
2173	3051	Montgomery	3	1	196907.2681	24813.22432	25	Rail
2174	3023	Anderson	3	1	216286.5423	26791.28525	25	Rail
2175	3079	Davidson	3	1	196907.2681	24814.43339	25	Rail
2176	3047	Hamilton	3	1	196907.2681	24654.98552	25	Rail
2177	3038	Madison	3	1	216286.5423	24569.85606	25	Rail
2178	3061	Shelby	3	1	196907.2681	24832.57765	25	Rail
2179	3052	Putnam	3	1	196907.2681	22735.88966	25	Rail
2180	3050	Davidson	3	1	196907.2681	24813.22432	25	Rail
2181	3078	Hamilton	3	1	196907.2681	24842.7279	25	Rail
2182	3077	Putnam	3	1	196907.2681	24799.15485	25	Rail

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
2183	3063	Shelby	3	1	196907.2681	24793.66839	25	Rail
2184	3041	Davidson	3	1	216286.5423	24734.01954	25	Rail
2185	3048	Hamilton	3	1	196907.2681	24526.32492	25	Rail
2186	3042	Davidson	3	1	216286.5423	24734.01954	25	Rail
2187	3029	Anderson	3	1	216286.5423	30856.16074	25	Rail
2188	3055	Bedford	3	1	196907.2681	24579.28868	25	Rail
2189	3071	Shelby	3	1	196907.2681	24944.51603	25	Rail
2190	3034	Hamilton	3	1	216286.5423	30880.33646	25	Rail
2191	3043	Hamilton	3	1	216286.5423	24727.40475	25	Rail
2192	3082	Polk	3	1	196907.2681	24849.02265	25	Rail
2193	3080	Shelby	3	1	196907.2681	24849.02265	25	Rail
2194	3045	Hamilton	3	1	216286.5423	24797.37278	25	Rail
2195	3032	Davidson	3	1	216286.5423	26782.22997	25	Rail
2196	3036	Hamilton	3	1	216286.5423	30909.25594	25	Rail
2197	3066	Hamilton	3	1	196907.2681	24825.56934	25	Rail
2198	3035	Hamilton	3	1	216286.5423	30798.48773	25	Rail
2199	3087	Hamblen	3	1	196907.2681	24849.02265	25	Rail
2200	3044	Hamilton	3	1	216286.5423	24629.01583	25	Rail
2201	3027	Hamilton	3	1	216286.5423	30919.33461	25	Rail
2202	3028	Humphreys	3	1	216286.5423	30851.71477	25	Rail
2203	3030	Blount	3	1	216286.5423	30812.05702	25	Rail
2204	3064	Anderson	3	1	196907.2681	24793.66839	25	Rail
2205	3075	Shelby	3	1	196907.2681	22717.80418	25	Rail
2206	3076	Davidson	3	1	196907.2681	24799.15485	25	Rail
2207	3081	Shelby	3	1	196907.2681	24814.43339	25	Rail
2208	3067	Hamilton	3	1	196907.2681	24825.56934	25	Rail
2209	3068	Knox	3	1	196907.2681	24825.56934	25	Rail
2210	3069	Knox	3	1	196907.2681	22734.85753	25	Rail
2211	3058	Knox	3	1	196907.2681	24614.14119	25	Rail
2212	3098	McMinn	3	1	196907.2681	24799.15485	25	Rail
2213	3046	Hamilton	3	1	216286.5423	24656.51097	25	Rail
2214	3062	Shelby	3	1	196907.2681	24793.66839	25	Rail
2215	3059	Madison	3	1	196907.2681	24685.28088	25	Rail
2216	3031	Blount	3	1	216286.5423	26218.32933	25	Rail
2217	3033	Hamilton	3	1	216286.5423	26810.7451	25	Rail
2218	3094	Robertson	3	1	196907.2681	24849.02265	25	Rail
2219	3096	Shelby	3	1	196907.2681	24799.15485	25	Rail
2220	3060	Sumner	3	1	196907.2681	24792.21633	25	Rail
2221	3092	Davidson	3	1	196907.2681	24663.49534	25	Rail
2222	3072	Shelby	3	1	196907.2681	24900.27645	25	Rail
2223	3056	Davidson	3	1	196907.2681	24655.96928	25	Rail
2224	3083	Anderson	3	1	196907.2681	24789.36355	25	Rail

Project ID	Location ID	County	Type	Subtype	Cost($)	Annual Benefits ($)	Life (years)	Mode
2225	3090	Robertson	3	1	196907.2681	22718.18438	25	Rail
2226	3025	White	3	1	216286.5423	31032.77232	25	Rail
2227	3024	Shelby	3	1	216286.5423	30357.11794	25	Rail
2228	3049	Bedford	3	1	196907.2681	25021.10028	25	Rail
2229	3065	Wilson	3	1	196907.2681	24825.56934	25	Rail
2230	3073	Shelby	3	1	196907.2681	24877.5219	25	Rail
2231	3074	Shelby	3	1	196907.2681	24864.13542	25	Rail
2232	3084	Humphreys	3	1	196907.2681	24866.73289	25	Rail
2233	3089	Robertson	3	1	196907.2681	22718.18438	25	Rail
2234	3037	Hamilton	3	1	216286.5423	24764.28155	25	Rail
2235	3070	Knox	3	1	196907.2681	22731.89469	25	Rail
2236	3040	White	3	1	216286.5423	24578.1801	25	Rail
2237	3057	Knox	3	1	196907.2681	24832.57765	25	Rail
2238	3099	Anderson	3	2	196907.2681	24799.15485	25	Rail

Note:

- Type 1- capacity expansion project, sub type 1- one lane expansion, sub type 2- two lane expansion
- Type 2- operational project, sub type 1- patching and rehabilitation, subtype 2- asphalt surface overlays
- Type 3- safety project (road), sub type 1- advance warning signs, subtype 2- pavement friction
- Type 3- safety project (rail), subtype 1- flashing lights to gates, subtype 2- gates to adding median, subtype 3- passive to flashing lights
- Cost is assumed as the one-time cost invested at the beginning of the project