FINAL REPORT

TENNESSEE LONG-RANGE TRANSPORTATION PLAN

MODAL NEEDS

DECEMBER 2005

TDOT

PLAN Go.

A Long-Range Multimodal Strategy

Prepared by
The PBS&J Consultant Team

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Tennessee Long-Range Transportation Plan

Modal Needs
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Executive Summary

ES.1 Introduction

The Tennessee Department of Transportation (TDOT) is developing a Long-Range Transportation Plan (LRTP) to provide a basis for making informed transportation decisions. The LRTP will identify Tennessee's transportation system needs to meet user expectations for the movement of both people and goods for the next 25 years. It will establish vision and policy structures, set forth strategies, provide a framework for directing investments, and identify the financial resources needed to sustain the plan's vision.

This *Modal Needs* report documents one of several major steps in the long-range planning process. This report examines each component of the state's transportation network to identify the long-term needs of the transportation modes to 2030. The determination of need is based on modal assessments presented in the *Challenges and Opportunities* report, various mode plans where available, from needs assessment tools used within TDOT, by additional research, and from public feedback gleaned from a series of statewide meetings.

Based on the analysis of modal needs documented in this report, it was determined that over the next 25 years, Tennessee's transportation needs are estimated to be nearly $130 billion. This includes the cost of building and maintaining the infrastructure, including the roads and bridges, railroads, locks and dams, airports, buses and vans, and the cost of operating those systems that typically are the responsibility of public agencies (highways and public transportation). The figures do not reflect the cost of operating privately operated systems such as railroads, water carriers, or airports, in the same way that we have not estimated the cost to individuals to operate their personal automobiles. The estimates also do not include costs of the local and county roadway systems that historically are managed and maintained by those agencies.

This modal needs estimate does not take into account which entity would make the investment to address the identified needs. That need might be met by TDOT using state or federal funds, by local governments, or by the private sector. The estimates are allocated to show how these modal needs are divided among the expense to preserve the systems, to modernize them to meet current standards, and to expand them to meet the need for greater system capacity.

That $130 billion transportation need is daunting, and unfortunately is not only a challenge for the future. Today, there is a $40 billion backlog of accumulated or deferred highway and other transportation needs. While the highway system is generally well-maintained, funding resources have not permitted the state to keep pace with the rapid increase in highway travel, resulting in significant mileage of the 14,150-mile state highway system that is over-capacity, and an accumulated backlog of bridge repair/replacement projects and roadway geometric and safety projects. There are lesser backlog needs across the other modes.

ES.2 Modal Analysis Framework

The statewide transportation system comprises six principal modes of travel. An inventory and description of these modes is presented in the *Challenges and Opportunities* report. The six modes are:

- Highways
- Railroads
- Aviation
- Waterways
- Public Transportation
- Bicycle/Pedestrian

In addition, there are two "support elements," which were also examined. The two specific support elements considered are Intelligent Transportation Systems (ITS) and Transportation Demand Management (TDM). These elements can be considered as spanning the modes in terms of their potential impact and influence, and both provide strategies, programs, and actions that enable more efficient and productive use of the built infrastructure developed through the individual modes.

The Tennessee transportation system consists of all the transportation modes–their facilities and services–and the nodes that link them together. TDOT is not fully responsible for all facilities spanning all modes–from ownership, management, and financial support perspectives– from a statewide planning view. It is useful, however, to consider the larger picture when assessing trends, needs, and funding of transportation infrastructure projects across the state and across a multitude of governmental jurisdictions.

To support the assessment of modal needs to 2030, a needs framework was established for the study. The framework recognizes that transportation investments should include both capital investments for physical improvements and various costs involved with the operations and management of the infrastructure and the services that may be operated on the infrastructure. The framework also recognized that the investment needs can be allocated to three basic investment categories:

- Maintenance/Preservation. Actions that address the operations of existing infrastructure and services, or which maintain or preserve the condition of existing built facilities.
- Safety/Modernization. Actions that improve existing infrastructure without increasing capacity, including reconstruction, replacement, widening without capacity addition (e.g., roadway shoulder widening, bridge widening for shoulder, safety improvement, or eliminating deficiencies from standards).
- Expansion/Enhancement. Actions that add capacity or are a significant betterment to the functionality of a facility (e.g., additional travel lanes, interchange reconstruction or additional ramps, transit service coverage or frequency expansion, new road or transit corridor, or shortline railroad load capacity upgrade).

The development of a systematic transportation plan should be based on the identification and evaluation of transportation investment needs by mode, with integrated consideration of the interplay between modes in terms of multimodal corridors and intermodal linkages. Such an approach addresses the technical needs of each mode while coordinating opportunities to provide multimodal choices in certain corridors and regions as well as to interconnect the modes to enhance efficient utilization of transportation investments. The study process was sensitive to the importance of multimodal and intermodal opportunities, and the several modal plans recognized this in their plan recommendations.

Information to develop the estimates of transportation modal needs to 2030 was derived from several basic sources:

- Modal Plans. Prepared by TDOT specifically to identify improvement needs for a specific mode.
- Metropolitan Planning Organization (MPO) Plans. The state's 11 MPOs are charged with developing LRTPs for their respective planning areas, and those plans constitute an accurate assessment of the highway and public transportation needs within those communities.
- *Challenges and Opportunities* report. Prepared as part of this study process, it contains salient summaries of travel and demographic trends that will help shape the character of the state's future transportation needs.
- Public Involvement Process. The LRTP process included a public involvement and study outreach process that was an integral part of the needs assessment and plan evaluation steps.

In response to identified social and economic trends and the resultant transportation challenges, TDOT has proposed a series of goals and objectives that, if realized, should create a transportation system that will more efficiently move people and freight, provide more mobility options, and preserve critical infrastructure. These Guiding Principles are viewed as the basic building blocks for the LRTP. The corresponding goals and objectives will serve to drive the definition of long-term investment strategies, develop performance measures by which the extent of goals achievement can be measured, and identify project evaluation criteria by which short-term project programming decisions will be made. The Guiding Principles are also helping to shape performance measures and the alternative investment scenarios that will shape the 25-Year Vision Plan. The seven Guiding Principles of the Tennessee LRTP are:

- Preserve and Manage the Existing Transportation System
- Move a Growing, Diverse, and Active Population
- Support the State's Economy
- Maximize Safety and Security
- Build Partnerships for Livable Communities
- Promote Stewardship of the Environment
- Emphasize Financial Responsibility

A derivative set of goals and objectives relating back to the Guiding Principles and objectives was used to steer the development of investment plans through the LRTP process.

The identification of modal needs for the LRTP process was structured to be comprehensive and systematic across the modes, and consistent with technical requirements about how the transportation systems components should perform in terms of capacity, quality of service, and other features.

The traditional role of TDOT in the various management functions of transportation modes has evolved based on changes in funding sources and levels, functional responsibilities, the roles of local governments and the private sector, and other factors. Table ES-1 summarizes the traditional role of TDOT in the oversight of statewide modal systems, and indicates how each mode has been reflected in the modal needs estimates.

Table ES-1. TDOT Role in Statewide Transportation System

Mode or Support Element	Traditional TDOT Responsibility		Modal Partners	Inclusion in Modal Needs Estimate
	Ownership	Finance		
Highway	State system only	Full responsibility for state system; minor support to local systems	Local governments MPOs	All state system costs and state-sponsored programs
Public Transportation	No role	State program for capital and operating support	Local governments Regional Transportation Authorities MPOs	All capital and operating costs
Railroad	No role	Grants for shortline rail upgrades	Local governments Private sector	All capital costs
Waterways	No role	Minimal	USCOE Waterway authorities Local governments Private sector	All capital costs
Bicycle/ Pedestrian	State system facilities only	Funding for state system; minimal support to local systems	Local governments	All state system costs and state-sponsored programs
Aviation	No role (except for ownership of one public use airport)	State funding and federal funding conduit for regional and community airports; minor funding for commercial airports	Local governments	All capital costs
ITS	State system only	State system capital and operating; partner to local agencies	Local governments MPOs	All capital and operating costs
Travel Demand Management	N/A	Small-scale program to date	Local governments Regional Transportation Authorities MPOs	All program costs

TDOT understands that it cannot independently determine the future of the state's entire transportation system; further, it recognizes the importance of working with other state, local, and federal agencies, MPOs, regional planning commissions, and other local organizations, businesses, cities, and counties. Systems are in place to foster this collaborative approach to transportation decision making. TDOT maintains relationships with local governments, MPOs,

Economic Development Districts, and human resource agencies through its general administration and planning programs, project-specific planning procedures, state-funding programs, state administered grant programs, interagency coordination efforts, and public outreach programs.

ES.3 Statewide Transportation System Performance and Outlook

A variety of considerations fold into the process of defining modal needs, ranging from factors that influence projections of demand into the future, to situational factors of the modal systems and how their capacity is consumed by individuals, businesses, and tourists, both from within the state and from outside, to the characterization of the general programs and investments theoretically needed to address these collective needs and what their associated costs. These factors and considerations collectively point to several underlying strategies:

- "Silver bullet" solutions–a major capital project within a single mode–will become less common as project costs spiral due to materials and land costs. Projects will need to be conceived in many cases as multifaceted, involving several kinds of physical investment and operational management. Particularly in urban areas, it is being recognized that a collection of multimodal capacity and demand management actions are becoming a more pragmatic, cost-effective approach to coping with mounting transportation needs, whether across a region or in particular corridors or sectors.
- Scarcity of funds may push agencies to consider partial, scaled down, deferred, or phased solutions; although efforts to optimize network utilization through changing the location, timing, and mode of trips are becoming a more important in developing an overall solution.
- Funding shortfalls for capacity expansion will likely translate into an outright or de facto reduction in quality of service standards (longer peak periods of freeway congestion or more delayed flights at the airport). This is a common accommodation to chronically inadequate infrastructure funds. More innovative and far-reaching strategies to accomplish strategic and demonstrated investments will become more common.

It is recognized that the definition of modal needs sets the stage for the formulation of an LRTP that captures the priorities of Tennesseans within a funding program that is affordable and supportable. The modal needs estimates capture a level of investment that will enable a response to identified needs in general terms. Transportation system usage trends and patterns are monitored regularly, modal needs estimates updated periodically, and the LRTP updated at intervals. Thus, there will be ample opportunities to refine outlooks as these trends collectively manifest themselves over time, and more importantly, better articulate the definition of the most appropriate and cost-effective investments at the program and project levels.

Significant trends and challenges will influence Tennessee's future transportation system, as discussed in the *Challenges and Opportunities* report, and are recapped below.

Tennessee's Economy

Tennessee has enjoyed positive economic growth at or above the national trend over the last decade, and the outlook is for continued economic expansion. This outlook is based on the state's diverse regional economies drawing from sectors as diverse as manufacturing, distribution, agriculture, tourism, education, and retirement communities. The state's location, close to the bulk of the eastern U.S. markets and a reliable labor pool, has over the years attracted economic anchors such as Federal Express, General Motors' Saturn division, Nissan Corporation, and Dell Computer Corporation. With this economic growth will come increased demands for reliable goods transportation across the freight modes.

Demographic Trends

With a population increase of more than 30 percent and an employment increase of more than 40 percent by 2030, the state will see a geographic expansion of its large urban areas and other urban centers. Population growth is projected to be greatest in the metropolitan Nashville area, with other higher growth pockets in eastern Tennessee along the I-75 and I-40 corridors, though the majority of counties are expected to see growth between 25 and 50 percent. Forecasts show disproportionate growth in the numbers of the elderly, which raises questions about long-term mobility. Transportation mobility for the rural population and minority population segments is also a long-term consideration. Employment growth echoes population growth for the most part, with most areas seeing increases of 15 percent or more.

Travel Trends

Recent trends at both the state and national levels have shown increasing rates of auto ownership per capita and vehicle miles of travel (VMT) per capita. Coupled with lower-density suburban development patterns, it is becoming increasingly difficult to cost effectively provide the conventional mix of mobility choices. When linked to rapidly increasing infrastructure costs in recent years, the ability to extract the same transportation benefit and system performance from each transportation dollar becomes even more difficult.

Trade and Freight

Tennessee has an interesting mix of highway, railroad, aviation, and waterways access (three river navigation systems with access to the Midwest and the Gulf Coast), extending the state's reach to both domestic and international markets. Interestingly, given the state's location and regional geography, more than 60 percent of the freight volume in the state is passing through Tennessee. While many states experience this phenomenon, the situation does put significant added burden on the transportation system, though it may bode well for the state's role in regional distribution.

Transportation System Investment

Tennessee is beginning to experience the pressures of larger, rapidly growing states such as Florida. For years, a basic transportation system was able to meet modest growth trends by robust infrastructure maintenance programs to preserve built investments and add selected capacity projects that were relatively inexpensive lane at-grade additions within existing right-of-way if traffic demands were not met through unused system capacity. Many agencies have entered an era where such simpler, lower-cost projects have been replaced by more expensive

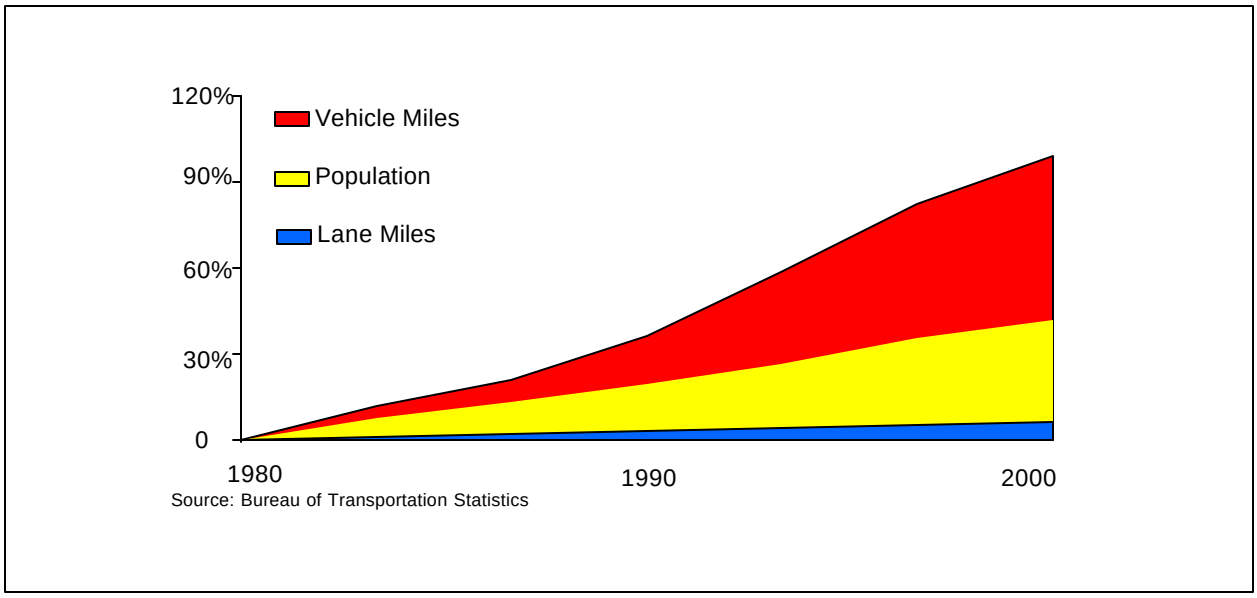
projects requiring structures, additional right-of-way, and complex solutions. Relying only on increases in gas tax revenues is becoming problematic, and options such as inflation-indexing and innovative partnering, special assessments and other strategies merit stronger consideration due to increasing project backlogs and improvement needs mounting faster than revenues.

A summary of travel demand forecasts was developed from the synthetic travel demand model, which is focused on the highway network, upon which the vast majority of passenger trips and freight movements occur today and are also expected to occur in 2030.

- VMT has increased more than 100 percent over the past 20 years and continues to increase. This dynamic change in system usage versus supply has led to sharply higher travel demands in many corridors, creating chronic congestion in some corridors and a rising rate of auto crashes.
- More than 71 percent of this travel occurred on the state highway system, 10 percent was on county roads, and 19 percent was on city streets.
- The interstate system comprising, 1.2 percent of total centerline mileage, carries 27 percent of the total VMT.

The extent of the challenge confronting TDOT is shown below. From 1980 to 2000, the population increased approximately 40 percent and the VMT doubled (100 percent increase). Over the same period, the number of lane miles on the state highway system has increased only 8 percent. While there was considerable reserve unused capacity in the system, the trends are troubling, as at some point, capacity deficiencies will become more prevalent as the reserve capacity is consumed, and costs to add capacity will become the norm.

Comparison of Population, Travel, and Miles of Highway



Source: State of Tennessee historical data

Truck traffic is also growing significantly, as highlighted below:

- Of total freight shipments to, from and within the state, 74 percent moved on the highway system.
- The Federal Highway Administration forecasts that freight shipments by will grow in 20 years from 501 million tons in 1998 to 866 million tons in 2020 (73 percent increase), with highways continuing to carry the same share of freight as today.
- Truck traffic is a significant component of traffic volumes, especially on interstate routes. The interstate system, comprising 1.2 percent of total mileage, carries about 80 percent of the state's truck VMT.
- The truck percentage on some interstate rural segments is in the range of 30 to 40 percent of total daily traffic on those segments.
- With modern logistics calling for just-in-time delivery of both commercial and industrial process inputs and outputs, the interstate system has evolved into a moving warehouse of supplies, parts, and finished products.
- More than 60 percent of total freight movements involve freight passing through the state.
- About 56 percent of trucking movements pass through the state, while approximately three quarters of rail and barge movements pass through.
- Of the freight movements occurring completely within Tennessee, trucks have a dominating 97 percent mode share.

The synthetic travel model developed for the study focused on the portion of the state highway system serving the rural and small areas. Analysis of model output provided these observations:

- Rural population is projected to increase by 42 percent over the planning period.
- Total VMT in the rural areas is forecast to increase by more than 60 percent and by 122 percent for truck VMT. Most truck travel will occur on the interstate and trunk state highways.
- There is a significant projected increase in the intercity travel times between various in-state city pairs, ranging from 15 to 33 percent, again demonstrating the need for additional investments in rural traffic capacity.
- Indications predict significant degradation in rural and small area traffic conditions that will need to be factored into the modal needs analysis.

As part of the synthetic network modeling activities and coordination with other network traffic service analysis using TDOT's roadway inventory database and analysis software, the traffic network performance was evaluated to assess the extent of network capacity needs. The synthetic model assessed rural and small urban areas of the TDOT state highway system, while TRIMS assessed the state highway system within the urbanized areas under the planning auspices of the 11 MPOs.

The traffic service analyses were performed for the base year 2003 for the existing roadway network and for the future year 2030 for the existing plus committed (E+C) network. The E+C network refers to the existing roadway system in the base year 2003 plus those projects currently under construction and those ready to go to construction for which the intent is to fund and construct them in the near future. This E+C network provides a reference for what additional improvements might be needed to maintain traffic service standards. The level of service results for the urbanized areas within the MPOs was derived from TDOT analyses using the agency's highway system database and software. Key observations derived from these analyses are described below:

- In rural and small urban areas for 2003, the overall traffic service conditions are good to excellent, depending upon the road type, with an overall rating of good for the state roads in the rural and small urban areas, with 6 percent of the system in the poor category and 13 percent in the fair category. Using the rule that unsatisfactory level of service (LOS) includes all segments with LOS E or F and rural and small urban area freeways with LOS D, then 8.2 percent of the rural and small urban area network has unsatisfactory LOS in 2003.
- In rural and small urban areas for 2030, the overall traffic service conditions are still good to excellent, depending upon road type, and an overall rating of good is retained for the state roads in rural and small urban areas, but with 27.1 percent of the system in the poor category and 16.7 percent in the fair category. However, there is a significant degradation in the level of service, particularly for the interstate segments where 67 percent are rated poor and another 17 percent are rated fair. Using the rule that unsatisfactory LOS includes all segments with LOS E or F and rural and small urban area freeways with LOS D, then 28.7 percent of the rural and small urban area network has unsatisfactory LOS in 2030.
- In the urban areas for 2003, the overall traffic service conditions range from excellent to poor, depending upon the location and type, with an overall rating of fair for the state roads in the urban areas, with 42 percent of the system in the poor category, and 16 percent in the fair category.
- In the urban areas for 2030, overall traffic service conditions are skewed toward the congested end of the scale; an overall rating of poor results for state roads in urban areas, with 69 percent of the system in the poor category, and 10 percent in the fair category. However, there is a significant degradation in the LOS, particularly for the interstate segments, where 95 percent are rated poor and another 5 percent are rated fair.

These summaries demonstrate that much of the reserve capacity of the Tennessee road system has been consumed over the last two decades and that physical capacity expansion will be required in the future, particularly for interstate highway segments, the workhorse of the state highway system, in both rural and urban areas.

Three additional technical analyses were conducted as they relate to technical planning considerations for statewide travel demand planning, the loads consequently placed onto the highway system from a capacity standpoint, the potential interplay between the highway and railroad modes to shift longer distance travel demand for passenger and freight movements from highways, and planning and project activities in the states surrounding Tennessee. The three additional analyses are described below:

Market Analysis of Intercity Passenger Rail Trips

This analysis compared potential intercity rail passenger travel demand as estimated in the Tennessee Rail System Plan to the interstate highway passenger trip volumes in the parallel highway corridors for the four most promising intercity rail passenger service corridors. The overall capture rates were relatively low, which affects the role of mode diversion in terms of deferring highway improvement needs.

Freight Rail Corridor Analysis

One of the leading issues confronting TDOT is diminishing highway capacity, resulting in part because of the proliferation of large trucks using its major highway system, particularly the interstate system in recent years. A freight diversion study was performed to evaluate strategies that could be used to assess the potential for diversion of truck trips to the railroad mode. The scope of the analysis included the study of two interstate highway corridors to determine how much future year commodity flow would divert to rail, assuming rail service was improved in each. The premise underscoring rail system investments was that they would lead to cargo movement diversions from truck to rail and consequently reduce congestion on the interstate highway system.

The overall conclusion of the study was that because most freight currently shipped by truck, which is divertible to rail, either begins or has a destination outside Tennessee, no foreseeable rail improvements could be implemented on facilities inside Tennessee that could produce enough commodity diversion to significantly improve operating conditions on the interstate system. If comprehensive national, regional, or multi-state rail system initiatives became available in the future, rail network improvements inside Tennessee may become more effective for diverting goods from truck to rail inside Tennessee. Even if this occurred, the Freight Diversion Study indicates that resulting freight diversions would likely preserve interstate system capacity for somewhere between 1 to 5 years.

Surrounding States Initiatives

Tennessee, centrally positioned in the eastern United States, is bordered by eight states. While the common borders vary in length, there are transportation planning and transportation system use interests that span from Tennessee to each of its neighbors. Recognizing this significant condition, a surrounding states survey was conducted to assess the status of projects and planning that were noteworthy in relation to the state's transportation network. This survey was distributed to state planning officials in each state as well as to border MPOs and to the Fort Campbell military installation. It addressed topics including current, pending, and planned projects relating to highways, transit, ITS and 511 services, public transportation, bicycle facilities, railroads, and waterways. The survey also asked about toll road and public/private partnership projects.

ES.4 Summary of Modal and Support Element Needs

The modal needs estimation process requires the formulation of costs representing investments needed in mode infrastructure for both initial capital costs of building the facilities, specific maintenance costs, and in some cases, the operational costs of providing services. Also, the costs

of providing certain technical planning and mode development activities are required as are the costs of TDOT funding participation to financially support selected mode activities at the local level. The basic steps shown below were undertaken to develop estimates of future modal needs– to incorporate the preceding range of cost components–as appropriate.

1. Identify investment categories.
2. Define investment needs by investment category.
3. Estimate basic investment costs (2005).
4. Adjust basic investment costs.

This modal needs estimate does not take into account which entity would make the investment to address the identified needs. That need might be met by TDOT using state or federal funds, by local governments, or by the private sector. The estimates are allocated to show how these modal needs are divided among the expense to preserve the systems, to modernize them to meet current standards, and to expand them to meet the need for greater system capacity. Table ES-2 summarizes the overall 25-year modal needs in year of expenditure (YOE) terms.

Table ES-2. Summary of Modal Needs

Investment Areas		Modal Needs by Summary Category ($M YOE)	(% of Total)
Maintenance/ Preservation	Highway: Bridge and Roadway Maintenance, and ITS	22,770	17.55
	Public Transportation, Bicycle/Pedestrian, and Transportation Options (TDM): Urban and Rural System Capital and Operating Support	5,220	4.02
	Aviation and Waterways: Regional System Support	2,020	1.56
	Maintenance/Preservation Subtotal	30,010	23.13
Safety/ Modernization	Highway: Bridge Replacement, Widening of Narrow Lanes, Local System Support	21,510	16.58
	Public Transportation and Bicycle/Pedestrian: Support Systems	200	0.15
	Aviation, Railroad and Waterway: Improved communication systems, rail grade crossing protection, shortline track capacity, and rehabilitation programs	2,710	2.09
	Safety/Modernization Subtotal	24,420	18.82
Expansion/ Enhancement	Highway: Congestion Relief, Local System Expansion, ITS Expansion	51,230	39.49
	Public Transportation and Bicycle/Pedestrian: Urban and Rural System Expansion Support	9,190	7.08
	Aviation, Rail, and Waterways: Partnered Support of Airport Expansion, Rail bypass and intermodal yards, expanded port facilities, Intercity Passenger Rail	14,890	11.48
	Expansion/Enhancement Subtotal	75,310	58.05
	Total	129,740	100.00
	Summary by Investment Areas		
	Maintenance/Preservation	30,010	23.13
	Safety/Modernization	24,420	18.82
	Expansion/Enhancement	75,310	58.05
	Total	129,740	100.00
	Summary By Mode		
	Highway and ITS	95,510	73.62
	Public Transportation, TDM, and Bicycle/Pedestrian	14,610	11.26
	Aviation, Rail, and Waterways	19,620	15.12
	Total	129,740	100.00

As documented in the *Financial Plan* report and elsewhere, financial revenue forecasts were developed based on TDOT's existing funding sources, recognizing changes in the state population and employment, changes in motor vehicle registration and usage, and the outlook for federal funds, and extrapolated to 2030. This trend line forecast indicates that TDOT would have approximately $69 billion in revenues available, based on future estimates of state revenues and federal revenues that flow through the TDOT budget.

This figure is far short of satisfying the projected modal needs of $130 billion that have been identified, but it is important to recall that the modal needs are a composite of future system requirements, not all of which have traditionally fallen under TDOT funding responsibility. In addition to the projected trend line revenue, TDOT has historically partnered with federal, state, regional and local agencies as well as the private sector in the financial support of infrastructure projects, and not all those partnering funds flow through the TDOT budget. While the level of these partnering funds varies significantly by mode, program, and project, the analysis of the proposed vision plan discussed in Chapter 6 suggests that such funds might amount to an additional 12 to 15 percent over the funds flowing through the TDOT budget. Thus, the trend line budget of TDOT, coupled with other partnering funds, could yield as much as $79 billion to address modal needs. However, this combined funding figure would still fall considerably short of more robust satisfaction of modal needs, meeting only about 61 percent of estimated total modal needs.

Of interest in this discussion is the topic of backlogged modal needs. Backlog refers to those improvement needs that should be implemented immediately based on facility capacity or condition requirements, but which have not been implemented due to funding shortfalls. The accumulation of backlog suggests that the existing budget does not have the capacity to keep pace with the accumulation of improvements needs. Those projects for which funding is not available are essentially deferred and become backlogged. Often, once this condition is initiated, the backlog continues to grow annually as the budget shortfall is a chronic condition.

Based on the analysis of modal needs, it was estimated that of the state's modal needs that total $129.74 billion YOE, $39.5 billion (30 percent) are in the backlog category. Nearly 90 percent ($37.3 billion) of this backlog is in the highway mode. Backlogged urban and rural widening projects are $8.0 and $9.9 billion, respectively. Backlog in structurally deficient bridges is $2.0 billion, and for functionally obsolete bridges it is $5.4 billion. Backlog in geometric deficiencies (narrow lanes and narrow or missing shoulders) is another $12.0 billion. While it could be said that some of these backlog needs are more critical than others, they all represent system deficiencies of one type or another that have not been remediated. Addressing accumulated backlog is an important consideration in developing alternative investment scenarios and in formulating a suitable vision plan for the state's transportation system.

ES.5 Scenarios for Long-Range Plan Formulation

To investigate the extent to which transportation investment should be expanded toward addressing estimated modal needs, three potential investment scenarios were constructed. Each scenario addressed specific investments to be dedicated to the individual transportation investment categories. The three scenarios represent three different levels of investment to help discriminate what varying levels of investment could accomplish overall and by category.

The status quo investment scenario is designed to maintain the current level of performance across the transportation system for Tennessee's growing population. It continues the excellent level of maintenance for Tennessee's highway and aviation infrastructure and includes a more limited investment in public transportation and bicycle/pedestrian facilities. Because the status quo investment scenario is the least expensive, it does not offer a change in backlogged needs

and meets only the highest priority needs for safety. Additionally, there is limited or no state participation in major rail or new public transportation projects. The 25-year total expenditures included in the status quo investment scenario are summarized in Table ES-3 by investment category.

Table ES-3. Status Quo Investment Scenario Expenditures

Investment Category	Status Quo 25-year Total ($B YOE)
Maintenance	25
Modernization	15
Expansion	35
Total	75

Source: PBS&J

The balanced investment scenario attempts to balance desired system performance with financial responsibility. It maintains the high standards for highways and bridges and improves the investment in bicycle/pedestrian facilities and public transportation facilities. The balanced investment scenario also provides some reduction in backlogged needs and more funding for safety and modernization than the status quo investment scenario. Additionally, it looks to expand multimodal programs and transportation options within Tennessee. The 25-year total expenditures included in the balanced investment scenario are summarized in Table ES-4 by investment category.

Table ES-4. Balanced Investment Scenario Expenditures

Investment Category	Balanced 25-year Total ($B YOE)
Maintenance	24
Modernization	20
Expansion	41
Total	85

Source: PBS&J

The optimistic investment scenario reflects public input for desired system performance and addresses all feasible modal needs. It increases maintenance efforts for all modes and eliminates all backlogged modal needs. The optimistic investment scenario also expands transportation options in Tennessee and increases the focus on multimodal options. Additionally, the scenario builds expanded partnerships with local government and the private sector. The 25-year total expenditures included in the optimistic investment scenario are summarized in Table ES-5 by investment category.

Table ES-5. Optimistic Investment Scenario Expenditures

Investment Category	Optimistic 25-year Total ($B YOE)
Maintenance	24
Modernization	25
Expansion	56
Total	105

Source: PBS&J

The summary of the expenditures associated with the three investment scenarios range from $75 to $105 billion in YOE dollars for the 25-year Tennessee LRTP. All three investment scenarios include total expenditures that are less than the 25-year modal needs but greater than the $69.4 billion baseline forecast of TDOT revenues, resulting in funding shortfalls for all three investment scenarios. These funding gaps are summarized in Table ES-6 for each investment scenario.

Table ES-6. 25-Year Revenue Requirements and Funding Shortfalls

Investment Category	Status Quo ($B YOE)	Balanced ($B YOE)	Optimistic ($B YOE)
Total	75.00	85.00	105.00
Revenue Forecast	69.00	69.00	69.00
Funding Shortfalls	6.00	16.00	36.00

Source: PBS&J

To have a reasonable financial plan, additional measures must be taken to eliminate the funding gaps shown in Table ES-7. These measures may include alternative financing approaches such as the introduction of new revenue sources, increasing tax rates for existing revenue sources, and debt financing. A portion of the gaps will be covered by funding historically provided by TDOT's transportation partners and not accounted for in TDOT's budget; however, these complementary sources generally address only a small share of the funding gaps.

ES.6 25-Year Vision Plan

The intent of the 25-year Vision Plan is to serve as a blueprint to guide finance, policy, operational, and project-related decision making by TDOT as the agency moves into implementation of the proposed program of investments that will advance Tennessee toward addressing the wide range of modal needs in the dynamic and changing environment of the future.

The 25-year Vision Plan is further described in the Long-Range Plan document developed under this study, and it is also the starting point for the 10-Year Strategic Investments Program, which is also documented as a separate report. The proposed Vision Plan calls for the identification of additional revenues sources, through a range of potential options including expansion of existing revenue sources, introduction of new revenue sources, public-private partnerships, bonding of committed revenue streams, and other innovative strategies.

Table ES-7. Modal Needs Addressed by the Vision Plan

Investment Category	25-Year Modal Needs								
	25-Year Modal Need (regardless of funding source) in $M YOE	Highway	Public Transp.	Aviation	Railroad	Water	Bicycle/ Pedestrian	ITS	TDM
I. Maintenance/Preservation									
25-Year Modal Need (regardless of funding source) in $M	30,010	20,110	5,010	1,320	0	700	60	2,660	150
Proposed 25-Year TDOT Budget in $M	25,690	20,110	2,100	670	0	20	30	2,660	100
Estimated Partnering Funds Outside TDOT Budget in $M	4,265	0	2,910	650	0	640	15	0	50
Total TDOT and Other Modal Investment in $M	29,955	20,110	5,010	1,320	0	660	45	2,660	150
% of Modal Needs Met By Total Proposed Investment	99.8	100.0	100.0	100.0	N/A	94.3	75.0	100.0	100.0
II. Safety/Modernization									
25-Year Modal Need (regardless of funding source) in $M	24,420	21,510	100	1,320	1,310	80	100	0	0
Proposed 25-Year TDOT Budget in $M	17,120	15,770	70	670	580	10	20	0	0
Estimated Partnering Funds Outside TDOT Budget in $M	1,250	0	30	650	510	40	20	0	0
Total TDOT and Other Modal Investment in $M	18,370	15,770	100	1,320	1,090	50	40	0	0
% of Modal Needs Met By Total Proposed Investment	75.20	73.3	100.0	100.0	83.2	62.5	40.0	N/A	N/A
III. Expansion/Enhancement									
25-Year Modal Need (regardless of funding source) in $M	75,310	47,590	9,010	1,990	12,650	250	180	3,640	0
Proposed 25-Year TDOT Budget in $M	42,450	38,620	1,770	340	620	20	80	1,000	0
Estimated Partnering Funds Outside TDOT Budget in $M	10,290	0	5,790	1,650	1,690	80	80	1,000	0
Total TDOT and Other Modal Investment in $M	52,740	38,620	7,560	1,990	2,310	100	160	2,000	0
% of Modal Needs Met By Total Proposed Investment	70.0	81.2	83.9	100.0	18.3	40.0	88.9	54.9	N/A
Totals									
25-Year Modal Need (regardless of funding source) in $M	129,740	89,210	14,120	4,630	13,960	1,030	340	6,300	150
Proposed 25-Year TDOT Budget in $M	85,260	74,500	3,940	1,680	1,200	50	130	3,660	100
Estimated Partnering Funds Outside TDOT Budget in $M	15,805	0	8,730	2,950	2,200	760	115	1,000	50
Total TDOT and Other Modal Investment in $M	101,065	74,500	12,670	4,630	3,400	810	245	4,660	150
% of Modal Needs Met By Total Proposed Investment	77.9	83.5	89.7	100.0	24.4	78.6	72.1	74.0	100.0

The proposed Vision Plan as defined would address two thirds of the total modal needs as defined, and along with anticipated funds from TDOT's various transportation partners that do not flow through TDOT's budget would collectively address three quarters of the total estimated needs.

As with all steps in the LRTP process, the structured public involvement process already described was integral into the final definition of the 25-Year Vision Plan. Feedback from the Regional Working Group sessions on the three alternative transportation investment scenarios was carefully considered in gauging the level of financial investment in each investment program, and the Statewide Steering Committee was also a subsequent sounding board.

The proposed Vision Plan represents a robust pursuit of the estimated modal needs, and as proposed, is truly a reflection of the feedback from Tennessee's citizens on transportation investment needs and priorities.

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Acronyms and Abbreviations

ADA	Americans with Disabilities Act of 1990
E+C	Existing plus committed
FHWA	Federal Highway Administration
GARVEE	Grant Anticipation Revenue Vehicle
ITS	Intelligent Transportation System
LOS	Level of service
LRTP	Long-Range Transportation Plan
MPO	Metropolitan Planning Organization
PCE	Passenger car equivalent
PT	Public transportation
TDM	Transportation Demand Management
TDOT	Tennessee Department of Transportation
TVA	Tennessee Valley Authority
USCOE	U.S. Army Corps of Engineers
v/c	Volume-to-capacity (ratio)
VMT	Vehicles miles of travel
YOE	Year of expenditure

Glossary of Terms

Corps of Engineers (USCOE)
Refers to the U.S. Army Corps of Engineers, in the context of their federal responsibilities for the management and maintenance of the inland waterways system.

Economic Development District (EDD)
An agency responsible for furthering economic development opportunities in both urbanized and non-urbanized areas of the state. Tennessee has nine EDDs.

Federal Aviation Administration (FAA)
The federal agency responsible for aviation safety and other rules and regulations relating to aviation. The FAA provides funding to states and local governments for rehabilitation of airport facilities, pavement, maintenance, upgrades, and new construction. It also provides guidance on maximizing safety and adequate traffic control.

Federal Highway Administration (FHWA)
The federal agency responsible for administering roadway programs and funds. The FHWA implements transportation legislation approved at the congressional level that appropriates all federal funds to states and local governments. The FHWA works closely with state departments of transportation.

Federal Railroad Administration (FRA)
The federal agency responsible for administering railroad programs and funds. The FRA works with state governments and other governmental entities to oversee rail safety, operations, policy issues and other elements in the public interest under prevailing laws.

Federal Transit Administration (FTA)
The federal agency responsible for administering transit programs and funds. The FTA works with state and local governments to select new transit systems for implementation and guides capital, operating, and transit methodology decisions.

Goal
A long-term end toward which all programs and activities are aimed.

Guiding Principle
Overarching focus area that represents Tennessee Department of Transportation values.

Highway Incident Management Plan
A plan that outlines strategies for clearing incidents quickly to prevent highway congestion. An incident can be a vehicle crash or stall on a highway or interstate.

Intelligent Transportation System (ITS)
Activities that enable the transportation system to operate more efficiently, such as the use of variable message signs, cameras, and transportation control centers that are used to manage

traffic congestion. ITS is also implemented to maximize the use of transit via "smart" cards and signal prioritization for buses along arterials and high-occupancy vehicle lanes on highways.

Intermodal
Providing connectivity between modes. Often referred to for connections between freight modes, but applicable as well to passenger movements, such as the transfer from a vehicle at a park-and-ride lot to a public transportation vehicle.

Long Range Transportation Plan (LRTP)
The end product of a process of assessing existing and future transportation needs for every mode of transportation by technical, system-wide evaluation and public input.

Metropolitan Planning Organization (MPO)
A government agency responsible for transportation planning in urban areas with populations over 200,000. MPOs are mandated by federal legislation. Tennessee has 11 MPOs.

Modal Plan
A mode is a specific transportation service such as aviation, highway, or rail. Modal plans specify needs within each transportation service.

Multimodal
Providing more than one type of transportation service, usually within a given travel corridor, such as major urban corridor that might provide a highway, public transportation service, and a bicycle path.

Objective
A specific end that marks progress toward meeting a goal.

Performance Measures
Indicators of transportation system performance that are related to important issues or concerns of those making investment decisions. These measures can be used as a means of providing accountability on transportation spending and often are used as part of the criteria to select projects or strategies.

Policy
The principles, plans, or procedures established by an agency, institution, or government, generally with the intent of reaching a long-term goal.

Statewide Transportation Improvement Program
A short-range (3- to 5-year) list of funded transportation projects scheduled for implementation.

Chapter 1
Introduction

The purpose of this report is to define goals, objectives, and policies that reflect the values of the State of Tennessee and the challenges facing the state in providing a transportation infrastructure and transportation services for current and future residents. These goals are the basic building blocks for developing Tennessee's Long-Range Transportation Plan (LRTP).

The LRTP must be responsive to both federal guidelines and state regulations; both of these serve to form a framework for the plan and to define the basic plan content.

1.1 Purpose of Report

The Tennessee Department of Transportation (TDOT) is developing an LRTP to provide a basis for making informed transportation decisions. The LRTP will identify Tennessee's transportation system needs to meet user expectations for the movement of both people and goods for the next 25 years. It will establish vision and policy structures, set forth strategies, provide a framework for directing investments, and identify the financial resources needed to sustain the plan's vision.

This report documents one of several major steps in the long-range planning process. It examines each component of the state's transportation network to identify the long-term needs of the transportation modes to 2030. The determination of need is based on modal assessments presented in the *Challenges and Opportunities* report, various mode plans where available, from needs assessment tools used within TDOT, by additional research, and from public feedback gleaned from a series of statewide meetings.

1.2 Report Overview

This report includes the following chapters:

- Chapter 2: Modal Analysis Framework
- Chapter 3: Statewide Transportation System Needs Overview (Performance and Outlook)
- Chapter 4: Summary of Modal and Support Element Needs
- Chapter 5: Scenarios for Long-Range Plan Formulation
- Chapter 6: 25-Year Vision Plan

Chapter 2 defines the analysis framework used to develop the modal needs estimates. Chapter 3 summarizes various transportation planning assessments that form the basis for the estimation of modal needs. Chapter 4 presents the development of the modal needs estimates, including the assumptions and basis for those estimates. Chapter 5 presents analysis scenarios used in long-range plan formulation, with each scenario addressing the modal needs in varying degrees. Chapter 6 presents the resulting vision plan that resulted from an interactive review of the investment scenarios through a structured public involvement process involving Regional Working Groups, the Statewide Steering Committee for the plan, and other public feedback opportunities.

Based on the analysis of modal needs documented in this report, it was determined that over the next 25 years, Tennessee's transportation needs are estimated to be nearly $130 billion. This includes the cost of building and maintaining the infrastructure, the roads and bridges, railroads, locks and dams, airports, buses and vans, and the cost of operating those systems that typically are the responsibility of public agencies (highways and public transportation). The figures do not reflect the cost of operating privately operated systems such as railroads, water carriers, or airports, in the same way that we have not estimated the cost to individuals to operate their personal automobiles. The estimates also do not include costs of the local and county roadway systems that historically are managed and maintained by those agencies.

This modal needs estimate does not take into account which entity would make the investment to address the identified needs; that need might be met by TDOT using state or federal funds, by local governments, or by the private sector. The estimates are allocated to show how these modal needs are divided among the expense to preserve the systems, to modernize them to meet current standards, and to expand them to meet the need for greater system capacity.

That $130 billion transportation need is daunting, and unfortunately is not only a challenge for the future. Today, there is a $40 billion backlog of accumulated or deferred highway and other transportation needs. While the highway system is generally well-maintained, funding resources have not permitted the state to keep pace with the rapid increase in highway travel, resulting in significant mileage of the 14,150-mile state highway system that is over-capacity, and an accumulated backlog of bridge repair/replacement projects and roadway geometric and safety projects. There are lesser backlog needs across the other modes.

Based on the definition of the modal needs, including backlog needs, three investment scenarios were developed and reviewed through the structured public involvement process. Based on review of public input and analysis of funding resources and options, a 25-year Vision Plan emerged as a blueprint for developing Tennessee's future transportation system.

Chapter 2

Modal Analysis Framework

2.1 Summary of Modal Systems and Supporting Elements

The statewide transportation system is comprised of several distinct modes which support the movement of people and goods across the state. These modal resources are first defined as part of the modal analysis framework.

2.1.1 Overview

The statewide transportation system comprises six principal modes of travel. An inventory and description of these modes are in the *Challenges and Opportunities* report. The six modes are:

- Highways
- Railroads
- Aviation
- Waterways
- Public Transportation
- Bicycle/Pedestrian

Two "support elements" were also examined: intelligent transportation systems (ITS) and transportation demand management (TDM). These elements can be considered as spanning the modes in terms of their potential impact and influence, and both provide strategies, programs, and actions that enable more efficient and productive use of the built infrastructure developed through the individual modes. The role of these support elements is discussed in Chapter 4.

The Tennessee transportation system consists of all the transportation modes–their facilities and services–and the nodes that link them together. TDOT is not fully responsible for all facilities spanning all modes–from ownership, management, and financial support perspectives– from a statewide planning view. It is useful, however, to consider the larger picture when assessing trends, needs and funding of transportation infrastructure projects across the state and across a multitude of governmental jurisdictions.

2.1.2 Needs Framework

To support the assessment of modal needs to 2030, a needs framework was established. The framework recognizes that transportation investments should include both capital investments for physical improvements as well as various costs involved with the operations and management of the infrastructure and the services that may be operated on the infrastructure. The framework also recognized that the investment needs can be allocated to three basic investment categories:

- Maintenance/Preservation. Actions that address the operations of existing infrastructure and services, or which maintain or preserve the condition of existing built facilities.

- Safety/Modernization. Actions that improve existing infrastructure without increasing capacity, including reconstruction, replacement, widening without capacity addition (e.g., roadway shoulder widening, bridge widening for shoulder, safety improvement, or eliminating deficiencies from standards).
- Expansion/Enhancement. Actions that add capacity or are a significant betterment to the functionality of a facility (e.g., additional travel lanes, interchange reconstruction or additional ramps, transit service coverage or frequency expansion, new road or transit corridor, or shortline railroad load capacity upgrade).

2.1.3 Multimodal and Intermodal Opportunities

The development of a systematic transportation plan should be based on the identification and evaluation of transportation investment needs by mode, with integrated consideration of the interplay between modes in terms of multimodal corridors and intermodal linkages. Such an approach addresses the technical needs of each mode while coordinating opportunities to provide multimodal choices in certain corridors and regions as well as to interconnect the modes to enhance efficient utilization of transportation investments. The study process was sensitive to the importance of multimodal and intermodal opportunities, and the several modal plans recognized this in their plan recommendations.

Many of the more significant opportunities for coordinated planning of both corridors and nodes, for both passenger and freight movements, lie within the urbanized areas and certainly TDOT is a partner to the Metropolitan Planning Organizations (MPO) in planning for and capitalizing on these opportunities where appropriate. The fact was recognized through this LRTP planning process that the objective of developing multimodal corridors and intermodal hubs must begin early in the planning phases to screen real prospects, perform the appropriate studies for worthwhile opportunities, and pursue their development on a collaborative interagency basis.

Once a need has been characterized as strictly a highway capacity issue or a transit service corridor issue, the tendency is to develop narrowly defined mode-specific solutions. Increasing pressures on the collective transportation system in the face of scarce revenues are together compelling forces toward the philosophy of looking at congestion issues in the concept stage for multimodal corridor solutions incorporating intermodal connections. While many needs will continue to fall towards single-mode solutions, much of the longstanding latent capacity of the transportation system has been consumed in recent years, and single-mode capacity solutions are becoming more expensive, forcing agencies to consider more creative solutions. Most of the execution of this philosophy must occur following adoption of this LRTP during the conceptual analysis phase of project development.

2.2 Basis for Modal Needs

As noted, information to develop the estimates of transportation modal needs to 2030 were derived from several basic sources listed below and as shown in Figure 2-1:

- Modal Plans. Prepared by TDOT specifically to identify improvement needs for a specific mode.

- MPO Plans. The state's 11 MPOs are charged with developing LRTPs for their respective planning areas, and those plans constitute an accurate assessment of the highway and public transportation needs within those communities.
- *Challenges and Opportunities* report. Prepared as part of this study process, it contains salient summaries of travel and demographic trends that will help shape the character of the state's future transportation needs.
- Public Involvement Process. The LRTP process included a public involvement and study outreach process that was an integral part of the needs assessment and plan evaluation steps.

Figure 2-1. Input to Development of Modal Needs

2.2.1 Modal Plans

Primary sources for the estimation of modal needs were technical mode plans prepared by TDOT. TDOT has completed five modal plans in the last 5 years:

- Tennessee Airport System Plan (completed in 2001 and updated in 2005)
- Intelligent Transportation System Strategic Plan (completed in 1998; updated in 2002)
- Tennessee Rail System Plan (completed in 2003)
- Strategic Plan for Highway Incident Management in Tennessee (completed in 2003)
- Tennessee Transit Tomorrow Plan (completed in 2004)

Also, the Bicycle and Pedestrian Plan and an update of the Aviation System Plan were developed as part of the current LRTP process.

Other specific needs assessments were also prepared by the study team in cooperation with TDOT for highway needs, and some additional assessments and updates were developed for the rail and waterways modes and for ITS. For the highway mode, the study team worked closely with TDOT in using its in-house analytical tools to evaluate features of the highway and bridge system for condition and for conformance to various standards, and to estimate resulting system deficiencies and the costs of remediating those deficiencies.

2.2.2 Metropolitan Planning Organization Plans

The state's MPOs are primary transportation partners with TDOT, given their role to perform technical planning and to administer the prioritization and programming of improvements and funding for urban area transportation projects. In this capacity, there is considerable coordination between the MPOs and TDOT. As part of their regular LRTP updates, the MPOs formulate their own transportation needs statements, calibrating those needs against reasonably expected funding streams to finance the adopted lists of projects for 20-year planning periods. The improvement programs in the currently adopted LRTPs for the MPOs were reviewed to coordinate those improvement needs located on the state highway system with the separate estimates through TDOT of urban area highway improvement needs. The recently completed Tennessee Transit Tomorrow Plan was used as the primary tool to project statewide public transportation needs as it compiled a systematic tabulation of capital and operating costs for anticipated transit needs across all of the state's urban and rural public transportation systems.

2.2.3 Challenges and Opportunities Report Findings

The purpose of the *Challenges and Opportunities* report prepared as part of this study was to define baseline conditions of Tennessee's transportation system, including the many uses and demands placed on it. Further, it examined how these demands influence travel and system usage, and identified a set of trends and issues to be considered as part of the planning process. Those and related findings are summarized in Chapter 3, and they provided a useful foundation for better understanding the future transportation system needs of the citizens and businesses in Tennessee. The identified forces and influences on future travel demand, along with various technical analyses that quantified these needs from a system capacity standpoint, were important considerations in formulating the estimates of modal needs.

2.2.4 Public Input

To ensure broad involvement from a range of stakeholders, TDOT created nine Regional Working Groups and a 60-member Statewide Steering Committee. The Regional Working Groups were configured along the geographic boundaries of Tennessee's Economic Development Districts.

The nine Regional Working Groups and the Statewide Steering Committee established for the LRTP process met in September and November of 2004 to discuss and refine the LRTP statewide Guiding Principles, goals, and objectives. The Guiding Principles were generally supported by all groups as a set of overarching guidelines for future transportation investments. Additional cycles of meetings were conducted in April and June of 2005 to review potential transportation investment scenarios and the proposed vision plan resulting from the study process.

In addition, TDOT received public input at trade fairs, conventions, annual meetings, and other venues where citizens were asked their opinions on issues or concerns about transportation in Tennessee. The TDOT Web site also received a broad range of comments from the public.

Feedback from all workshops and other interfaces with the public were tabulated and reviewed by TDOT staff and the consultant team, and considered along each step of the study process in tailoring specific transportation system improvement categories and in refining investment scenarios.

2.3 Statewide Modal Needs Planning Structure

This section summarizes how modal needs planning, from a statewide perspective, is accomplished in Tennessee.

2.3.1 Modal Needs Development Framework

The identification of modal needs for the LRTP process was structured to be comprehensive and systematic across the modes, and consistent with technical requirements about how the transportation systems components should perform in terms of capacity, quality of service, and other features.

In addition to creating a consistent statewide approach, establishing goals, objectives, and policies during the LRTP process is important because they should relate to the state's long-term transportation challenges and opportunities. As such, they form the road map to achieve the state's vision, given the anticipated growth over the next 25 years. This report describes how each of the goals, objectives, and policies responds to identified challenges or opportunities.

Before this multimodal LRTP was developed, modal needs plans specific to transportation services (such as aviation, rail, transit, and bicycle and pedestrian) were created for TDOT. During the needs identification process, goals and objectives specific to each transportation mode were identified.

To refine the statewide goals, objectives, and policies, and to include innovative opportunities in the planning process, several peer state plans were reviewed to assure that the LRTP conformed to "state-of-the-practice" long-range planning methods. The peer state review summary highlights TDOT's standing among peer state plans and identifies future opportunities for the continued development of plans and programs that are consistent with the LRTP goals.

Many key common phrases found in the modal plans have been translated into the statewide goals and objectives. Collaboration, cooperation, and partnerships were all encouraged in the plans. Strategies included working with local governments and the different regions to effectuate desired modal changes statewide. Other common themes included reducing congestion and increasing capacity. These issues are also addressed in the statewide goals relating to improving mobility and providing modal capacity to serve sustained economic growth. Finally, many of the modal plans addressed efficiency and effectiveness in the delivery of transportation services. These issues were also incorporated in the draft statewide goals, as were goals for financial responsibility and existing system preservation.

2.3.2 Tennessee's Long-Range Transportation Plan Guiding Principles

The first steps in the LRTP process brought TDOT and its stakeholders to an agreement on an overall vision and core principles that will help guide TDOT's actions over the long term, provided specific intermediate objectives that mark progress in meeting the long-term vision, and established policies that define how programs and activities are conducted to achieve identified goals. Ultimately, these policies will guide the state's future transportation investments in the long-range (25-year), intermediate-range (10-year), and short-range programs (3-year State Transportation Program).

The LRTP vision will emphasize linkages among transportation choices and other economic and social goals of Tennessee, such as fostering a robust state economy linked to global markets, revitalizing Tennessee's urban and rural areas, promoting a sense of community, and preserving natural areas and open space.

In response to identified social and economic trends and the resultant transportation challenges, TDOT has proposed a series of goals and objectives that, if realized, should create a transportation system that will more efficiently move people and freight, provide more mobility options, and preserve critical infrastructure. These Guiding Principles are viewed as the basic building blocks for the LRTP. The corresponding goals and objectives will serve to drive the definition of long-term investment strategies, develop performance measures by which the extent of goals achievement can be measured, and identify project evaluation criteria by which short-term project programming decisions will be made. The Guiding Principles are also helping to shape performance measures and the alternative investment scenarios that will shape the 25-Year Vision Plan. The seven Guiding Principles of the Tennessee LRTP are:

- Preserve and Manage the Existing Transportation System
- Move a Growing, Diverse, and Active Population
- Support the State's Economy
- Maximize Safety and Security
- Build Partnerships for Livable Communities
- Promote Stewardship of the Environment
- Emphasize Financial Responsibility

The relationship of the Guiding Principles to the goals and objectives is shown in Table 2-1.

Table 2-1. Guiding Principles, Goals, and Objectives

Guiding Principle	Goal	Objectives
Preserve and Manage the Existing Transportation System	Maintain the efficiency, integrity, and effectiveness of the existing transportation system.	Develop cost-effective management and operation strategies to extend life of existing roads, bridges, railroad crossings, public transportation facilities, and other transportation equipment and assets. Use new technologies and other strategies to move people and freight faster and more safely throughout existing transportation network.
Move a Growing, Diverse, and Active Population	Provide the transportation resources and services necessary to optimize the movement of people and goods by providing greater access to transportation services and better connections between different transportation modes.	Increase mobility for all people, including traditionally underserved populations, by supporting different modes of transportation appropriate to the density, employment, and land use patterns. Implement affordable strategies that reduce bottlenecks, congestion, and travel times for all modes. Provide the appropriate facilities to improve connections between airports, bicycles, highways, pedestrians, public transportation, railways, and waterways.
Support the State's Economy	Make transportation investments to support economic growth, economic competitiveness, and tourism in Tennessee.	Provide aviation, highway, public transportation, rail, and waterway capacity to meet interstate and intrastate passenger and freight traffic needs. Ensure infrastructure and transportation services are available to increase access to employment opportunities. Through partnerships of communities and regions, make transportation investments that support economic development by linking commercial/retail areas, tourist destinations, and other activity centers.
Maximize Safety and Security	Provide a safe and secure transportation system for residents, visitors, and commerce.	Reduce injuries, fatalities, and property damage in all modes of transportation. Minimize security risks at airports, water ports, rail stations, rest areas, roadways, bikeways, and public transportation facilities throughout the state. Improve disaster, emergency, and incident response preparedness and recovery. Minimize construction-related safety impacts. Assess security vulnerabilities and create redundancies where applicable in all modes.

Table 2-1. Guiding Principles, Goals, and Objectives (Continued)

Guiding Principle	Goal	Objectives
Build Partnerships for Livable Communities	Establish strong, ongoing collaborative partnerships with other state and federal agencies, city and county governments, and regional organizations.	Provide timely and early opportunities for comprehensive public input into the development of plans and programs. Establish regular collaborative decision making opportunities with Metropolitan Planning Organizations, Economic Development Districts, cities, and counties to develop plans and programs and increase coordination of land use and transportation. Collaborate with other state and local agency efforts and/or private sector efforts to enhance the transportation system.
Promote Stewardship of the Environment	Protect, preserve, and enhance the natural, social, and historic environment of the state.	Implement transportation strategies that minimize impacts to natural resources and that conserve energy. Develop transportation infrastructure and services that minimize adverse impacts to people, communities, and cultural and historical resources. Develop a transportation network that minimizes land consumption, including the reuse or redevelopment of areas.
Emphasize Financial Responsibility	Provide responsibility, accountability, and sustainability in the expenditure of transportation funds to produce tangible transportation benefits with minimal waste, and maximize the use of available transportation resources.	Increase Tennessee's share of federal transportation funding. Select and program projects, including alternative modes of transportation, based on identified regional needs and effectiveness. Develop alternative funding strategies for transportation investments. Monitor and report to the public transportation system investment and performance. Allow flexibility in local management of projects where feasible.

2.3.3 TDOT Role in the Statewide Transportation System

TDOT has developed into a multimodal agency with an involvement in every transportation mode–involving the functions of ownership, management, planning, policy oversight, regulatory oversight, operations, conduit for federal funds, and state funding–with its role ranging from significant to minor across the modes and the various dimensions of infrastructure management and administration. As the roles of state transportation agencies continue to evolve, so too will the roles of the agencies across the functional responsibilities and the modes, as a result of changing funding strategies, emergence of stronger agency-to-agency and public-private

partnerships, and policy decisions sensitive to specific needs and conditions in each state. Examples of these roles would be partnering between the state and local agencies on new categories of projects, providing state-based policy incentives and funding to local governments for certain initiatives, or increasing state funding participation under selected existing programs.

The traditional role of TDOT in the various management functions of transportation modes has evolved based on changes in funding sources and levels, functional responsibilities, the roles of local governments and the private sector, and other factors. Table 2-2 summarizes the traditional role of TDOT in the oversight of statewide modal systems, and indicates how each mode has been reflected in the modal needs estimates.

Table 2-2. Tennessee Department of Transportation Role in Statewide Transportation System

Mode or Support Element	Traditional TDOT Responsibility		Modal Partners	Inclusion in Modal Needs Estimate
	Ownership	Finance		
Highway	State system only	Full responsibility for state system; minor support to local systems	Local governments MPOs	All state system costs and state-sponsored programs
Public Transportation	No role	State program for capital and operating support	Local governments Regional Transportation Authorities MPOs	All capital and operating costs
Railroad	No role	Grants for shortline rail upgrades	Local governments Private sector	All capital costs
Waterways	No role	Minimal	USCOE Waterway authorities Local governments Private sector	All capital costs
Bicycle/ Pedestrian	State system facilities only	Funding for state system; minimal support to local systems	Local governments	All state system costs and state-sponsored programs
Aviation	No role (except for ownership of one public use airport)	State funding and federal funding conduit for regional and community airports; minor funding for commercial airports	Local governments	All capital costs
ITS	State system only	State system capital and operating; partner to local agencies	Local governments MPOs	All capital and operating costs
Travel Demand Management	N/A	Small-scale program to date	Local governments Regional Transportation Authorities MPOs	All program costs

2.3.4 Planning Coordination and Collaboration

TDOT is also required to work closely with local city and county road departments, public transportation agencies, airport authorities, and other public and private organizations to coordinate transportation facilities and services in Tennessee (TCA 4-3-2303 [12]). This working

relationship is extended to the state's 11 MPOs: Bristol, Chattanooga, Clarksville, Cleveland, Jackson, Johnson City, Kingsport, Knoxville, Lakeway, Memphis, and Nashville. The four largest MPOs are required to complete a Congestion Management System plan; this necessarily calls for TDOT involvement as many of the congested urban corridors and segments lie on the TDOT roadway network.

Part of the LRTP effort has been to identify ways to strengthen and enhance TDOT's partnership with these other public and private entities so that Tennessee's overall transportation enterprise advances as rapidly as possible. Without such strong partnerships, TDOT cannot meet the spirit or the letter of the regulations cited above.

TDOT understands that it cannot independently determine the future of the state's entire transportation system; further, it recognizes the importance of working with other state, local, and federal agencies, MPO, regional planning commissions, and other local organizations, businesses, cities, and counties. Systems are in place to foster this collaborative approach to transportation decision making. TDOT maintains relationships with local governments, MPOs, Economic Development Districts, and human resource agencies through its general administration and planning programs, project specific planning procedures, state funding programs, state-administered grant programs, interagency coordination efforts, and public outreach programs.

Chapter 3

Statewide Transportation System Performance and Outlook

3.1 Tennessee Transportation Trends and Challenges

This chapter profiles each mode in terms of the system elements, conditions, and usage. Following the profiles are summaries of strategic observations and trends noted in the *Challenges and Opportunities* report that characterize the demands confronting transportation and shape the definition of the resulting modal needs.

3.1.1 Summary of Demographic, Social, Environmental, and Financial Trends

As part of the *Challenges and Opportunities* report, trends likely to influence the extent and magnitude of transportation services required to drive the state's economy and to meet social mobility needs were examined.

Demographic factors are among the most important considerations in any projection of future transportation demand and yield considerable insight into travel behavior and transportation system use. By 2030, Tennessee's population is expected to grow by more than 2.2 million, resulting in a population of nearly 8 million. Statewide employment is also expected to grow from 3.5 million in 2000 to more than 5 million by 2030. With population growth comes the expansion of many urban areas. Expanding urban and suburban development as well as growth of consumer demand and expansion of the state's economy will place increased strain on transportation systems. The sections below summarize the key implications of these forces.

Population and Employment Trends and Implications

- The state's population for 2000 was 5,689,283, an increase of 17 percent from 1990. From 2005 to 2030, the population is expected to increase at a rate within a range of 1 to 3 percent annually, and is forecasted to reach nearly 8 million by 2030. Population growth will continue to place increasing demands on Tennessee's transportation system, particularly in suburban and rural areas.
- The baby boom generation (those born from 1946 to 1964) comprises the largest population segment (35 percent) in Tennessee. Those 62 years and older account for approximately 15 percent of Tennessee's current population. In addition, the University of Tennessee's Center for Business and Economic Research report states that the most rapidly growing population segment through 2025 is the 65 to 69 age group for both males and females. The baby boom generation's work-related travel and economic activity will continue to place significant demands on the state's transportation system. An aging population will place increased demands on special transit services for medical and personal travel.
- Growth in the state's suburban areas, along with rural development, will result in longer peak periods of travel, as people take longer to get to their destinations from suburban or rural communities.

- Suburban job expansion will increase reverse commute trips, generating bi-directional peak-hour freeway congestion and accentuating the need for suburban job access for workers residing in center cities.

Land Use Trends and Implications

- Because much of Tennessee's recent growth has occurred in suburban areas, commuting patterns are not only from suburb-to-city commutes, but are beginning to be suburb-to-suburb and city-to-suburb commutes, resulting in new demands on Tennessee's transportation system.
- Because much of the newer development has been lower-density, many new subdivisions tend to be designed mainly for automobile access with little regard for other modes, including transit, pedestrians, and bicycles. These developments often do not recognize the special needs of the young, elderly, or disabled, or those without automobiles.

Environmental Trends and Implications

- TDOT and its service partners must find a way to support local development goals and transportation demands and still meet the air quality standards established by the Environmental Protection Agency. One of the major trends in air quality is the promulgation of a new 8-hour standard for ozone established by the agency. Based on the new standards, 18 counties in Tennessee are in nonattainment with national ambient air quality standards for ozone. In addition, 7 of these 18 counties (located in Knoxville, Memphis and Nashville) are maintenance areas for the 1-hour standard for ozone. A greater burden will be placed on these 18 counties to show how they can support local development goals and transportation demands and still meet U.S. Environmental Protection Agency fair quality standards.
- Major environmental constraints can impact the implementation of transportation improvements if not properly considered as part of the long-range planning and design process.

Energy Use and Fuel Consumption Trends and Implications

- Fifty percent of the state's petroleum consumption is used for gasoline. The Tennessee transportation system consumes 29 percent of the state's energy, and petroleum fuels 96 percent of the state's transportation sector. This dependency on petroleum products is sustainable only as long as these products are readily available and affordable.
- The transportation sector could improve the energy efficiency of the system by using more efficient vehicles, cleaner alternative energy sources, reformulated fuels, and by increasing system efficiency. According to the Victoria Transportation Policy Institute, if such efficiencies were put in place, up to a 20 percent personal transportation energy savings could be realized. Fuel price increases will exert some effect on the marketplace in terms of higher-mileage vehicles and changes in travel behavior to reduce vehicle miles of travel (VMT).

Tourism Trends and Implications

- Tourism continues to be an important economic contributor to Tennessee's overall economy. In 2002, 38.9 million tourism-related person-trips were taken to and from the state. The primary mode of transportation was the automobile, which accounted for 87 percent of the tourism-related travel. Air travelers made up 8 percent of tourist travel, while other modes contributed the remaining 5 percent. Tourism has an impact on Tennessee's transportation infrastructure, but is an economic stimulus as well.

Technology Trends and Implications

- Tennessee's ability to accommodate communications system conduits in transportation rights-of-way or on other properties and facilities is essential now and will be imperative in the future. It is important for the state's communications providers and TDOT to establish the institutional arrangements needed to enable shared right-of-way agreements.
- Technology brings increased flexibility to work or shop from home, thus reducing the necessity of some automobile trips.
- With economic globalization and information technology development, businesses will continue to lose their links to the specific communities in which they are located. This may result in a continued trend in employment and residential decentralization, further increasing travel on the state's highway and local road systems.

Financial Implications

The section below outlines major financial implications identified for the transportation system.

- Even if there were no change in travel behavior, projections show a substantial increase in population and employment, meaning ever-increasing travel demands placed on system capacity. These demands alone translate into substantial new capital and operating costs for the transport network, and they will be exacerbated if trends such as increased VMT per capita persist.
- Continued diversion of transportation revenue to support the state's general fund obligations will exacerbate the challenge of meeting transportation needs.
- Increasing demand for transportation services and for transportation system operation and maintenance will require more flexibility in using available funding and accessing new sources of capital funding.
- Changes in technology and energy supply will likely impact Tennessee's transportation revenues, as gasoline consumption per unit of transportation begins to drop. This will create the need to investigate new sources of transportation revenue.
- By using unissued bond authorizations, TDOT is limited in its ability to expand the program. The requirement for debt service payments constrains TDOT's cash flow. Because TDOT is managing as much bond authorization as it is, expanding the program requires identifying a new revenue source. Without a new revenue source, TDOT would have to reduce the current highway program to permanently cancel the rolling window of bond authorization.

3.1.2 Modal Profiles

Each transportation mode is summarized below as to its key components, the condition of the modal assets, and the demands on the existing system facilities and services. Much of this information is distilled from the *Challenges and Opportunities* report.

3.1.2.1 Highways

Components

The highway system is by far the most extensive modal system, providing links to virtually every developed area in the state. The highway network has historically been the foundation of mobility and will continue to serve in this capacity into the future. Increasing attention is being given to its importance in providing linkages to other modes.

- 14,150 miles of state highways (16 percent of all road centerline miles)
- 1,073 miles of interstate
- 13,077 miles of state roads
- 8,043 state-owned or maintained bridges
- 11,607 locally owned bridges
- 11 interstate welcome centers
- 9 truck weigh stations
- 80 percent of the total centerline mileage is rural; 20 percent is urban.
- The state highway system, under TDOT jurisdiction, mirrors this rural/urban split.
- 56,000 miles are under county control (64 percent), 17,000 miles under municipal control (19 percent), and 800 miles under the control of various federal and state agencies (1 percent).

Utilization

Use of the highway system has been growing significantly. Aspects of this growth and patterns of usage are described below.

- There were 68.2 billion VMT on Tennessee highways and streets in 2002.
- The VMT has increased more than 100 percent over the past 20 years and continues to increase. Concurrently, lane miles in the system have grown only by 6.5 percent.
- This dynamic change in system usage versus supply has led to sharply higher travel demands in many corridors, creating chronic congestion in some corridors and a rising rate of auto crashes.
- More than 71 percent of this travel occurred on the state highway system, 10 percent was on county roads, and 19 percent on city streets.
- The interstate system, comprising 1.2 percent of total centerline mileage, carries 27 percent of total VMT.

- County roads comprise 64 percent of highway mileage while carrying only 10 percent of total VMT.
- City streets are 19 percent of total mileage while carrying 19 percent of VMT.
- Of total freight shipments to/from and within the state, 74 percent moved on the highway system.
- According to FHWA data, trucking movements within, into or out of, and through Tennessee can be summarized as follows:
  - 56 percent: passing through the state
  - 20 percent: origin *or* destination within the state
  - 5 percent: origin *and* destination within the state
  - 18 percent: pattern could not be identified
- Shipments by truck are forecast by FHWA to grow in 20 years from 501 million tons in 1998 to 866 million tons in 2020 (73 percent increase), with highways continuing to carry the same share of freight as today.
- Truck traffic is a significant component of traffic volumes, especially on interstate routes. The interstate system, comprising 1.2 percent of total mileage, carries about 80 percent of the truck VMT in the state.
- The truck percentage on some interstate rural segments is in the range of 30 to 40 percent of total daily traffic on those segments.
- With modern logistics calling for "just in time" delivery of both commercial and industrial process inputs and outputs, the interstate system has evolved into a moving warehouse of supplies, parts, and finished products.

Mode Implications

- Both nationally and within Tennessee, the average annual number of miles that vehicles travel continues to grow. People drive longer distances and make more trips. Travel is growing at a much faster rate than capacity improvements to the transportation system. This differential is contributing to increased traffic congestion and increasing backlog in projects.
- The increased travel in emerging suburban areas has resulted in traffic congestion in these locations.
- Higher speed limits and the desire to improve the safety of travel has led the FHWA to require more stringent design standards in the construction of future highway projects. While this is a desirable action, it will lead to higher project costs and possibly less flexibility where projects are located.
- The good condition of Tennessee's highways and bridges is the result of a commitment to protecting the investment in infrastructure. This means most needs are already being addressed and can be continued. However, there is a backlog in structurally deficient and functionally obsolete bridges. The number of structurally deficient bridges will grow more rapidly, requiring attention to keep pace with them.

- The amount of freight moved by truck continues to increase. Higher levels of truck traffic have implications on traffic congestion and on the durability of highways and bridges. If more freight could be shifted to other travel modes, there could be a positive impact on traffic congestion and required highway maintenance.
- Between 1980 and 2002, annual VMT on the state's roads and bridges doubled, growing from 34 billion to 68 billion. Conversely, while the amount of travel doubled between 1980 and 2002, lane miles in the highway system increased by only 8 percent, from 172,000 to 185,000. This differential is contributing to increased traffic congestion.
- Preliminary assessment of the transportation system shows that for current traffic conditions, capacity is reasonably sufficient in most intercity travel corridors. However, within the metropolitan areas and several corridors extending from the metropolitan areas, congestion is a growing concern. Urban areas have fewer highway lane miles than rural areas, but handle more vehicle travel than rural areas. The increased travel in emerging suburban areas has resulted in traffic congestion in larger metropolitan locations.
- TDOT maintains 14,150 miles of highways and 8,043 bridges on the state system. The state's interstate system is in excellent condition. Of the interstate system measured for performance quality index, 97.1 percent was determined to be in excellent condition, with the remaining 2.9 percent rated in good condition. Pavement surface condition for nearly all of U.S. and state highways is in excellent or good condition. For bridges, 1,451 of the 8,043 state-maintained bridges are either structurally deficient or functionally obsolete. The good condition of Tennessee's highways and bridges allows flexibility to respond to future transportation needs rather than having to allocate a disproportionate amount of funds to maintain the existing system. However, the existing transportation infrastructure is aging and is, in some cases, not designed to meet current levels of traffic or current safety and design standards.
- On a tonnage basis, approximately 75 percent of freight transported to, from, or though Tennessee is by truck. Additionally, trucks are the only means of supply to 85 percent of the state's communities and carry approximately 80 percent of the manufactured freight transported in Tennessee. The amount of freight moved by truck continues to increase. Higher levels of truck traffic have implications on traffic congestion, safety, the structural integrity and smooth riding surface of highways and bridges, and can result in increased maintenance requirements. If some growth in freight movement could be shifted to other travel modes, there could be a positive impact on traffic congestion and required highway maintenance.

3.1.2.2 Aviation

Components

The state's aviation system plays a key role in the commerce and economy of Tennessee, providing commercial airline passenger and freight services, as well as charter and general aviation activities at dozens of sites across the state. The aviation industry generates an economic impact of approximately $3 billion and provides about 49,000 jobs. Adequate infrastructure will be needed to support continued growth in commercial passenger trips, aviation cargo, and general aviation.

- The six commercial service airports provide service in Memphis, Nashville, Knoxville, Chattanooga, Jackson, and the Tri-Cities.
- The 14 regional service airports and 64 community service airports provide general aviation services across the state.

Utilization

- Statewide commercial service boarding passengers are just over 10 million per year, and are expected to double by 2030.
- Memphis and Nashville handle 90 percent of commercial passenger traffic. This share is forecast to continue through 2030.
- Enplaned and deplaned cargo is expected to more than triple by 2030, from today's 7.6 billion pounds to 26 billion pounds. These figures are dominated by Federal Express activity through the Memphis airport, which accounts for about 97 percent of statewide air freight and is forecast to more than triple. Air freight through regional airports is forecast to double, from 87 million pounds to 209 million pounds over the same period.
- Both statewide general aviation operations and aircraft based at airports are forecast to increase about 37 percent by 2030 at the commercial and regional airports.
- The number of annual operations statewide by commercial and charter flight operators at the commercial and regional airports is expected to approximately double by 2030.

Mode Implications

- Demand and usage measures as noted are projected to increase at much greater rate than population and employment growth, demonstrating a more intensive use per capita of the state's aviation resources.
- The Aviation System Plan provides Tennessee with an effective airport system. Each commercial and regional airport was evaluated to determine future improvement needs. The system and its managing partners will be challenged to maintain the infrastructure and systems in the face of increasing demand.
- TDOT is working to develop an adequate airport system to meet the state's current and future aviation needs. Other challenges include maintaining a safe and reliable airport system, and, when considering system expansion, minimizing environmental impacts and non-compatible land uses to the extent feasible.

3.1.2.3 Waterways

Components

Key components of the waterways system across Tennessee are shown below.

- Tennessee has 887 main channel miles of navigable rivers:
  - Cumberland River: 310 miles
  - Mississippi River: 176 miles
  - Tennessee River: 401 miles
- Tennessee has six ports along the Mississippi River.
- Of the 95 counties in Tennessee, 35 have navigable waterways that border or flow through their areas.
- All counties, except for five in the northeast corner of the state, have direct access to or are within 50 miles of an access point to a navigable river.
- Tennessee has the fifth largest navigable inland waterway system in the United States.
- Navigation on the Tennessee River relies on 9 multipurpose dams and 12 lock chambers, 5 within the state and the rest nearby in adjacent states. Navigation on the Cumberland River uses 4 multipurpose dams and locks, 3 in the state. The Mississippi River is free of locks and dams south of St. Louis.
- All of Tennessee's major cities (Memphis, Nashville, Knoxville, and Chattanooga) are located on navigable rivers.
- Due to its location, Tennessee can use its waterways to easily transport commodities north into major metropolitan markets or south to deep water ports.
- Tennessee has two direct links to seaports on the Gulf of Mexico via the Mississippi River and the Tennessee-Tombigbee Waterway. These direct links offer significant international opportunities.
- Tennessee has 172 port terminals, with 23 classified as inactive.
- The largest and busiest port is the International Port of Memphis, second largest inland port on the Mississippi River and fourth largest inland port in the country.

Utilization

The tonnage and type of freight moved on the waterway systems in Tennessee are indicators of its usefulness. Below are highlights of the system's usage.

- Using barges to transport freight is the most cost efficient, environmentally friendly, and safest mode compared to air, rail, or truck modes.
- While water transportation probably has the slowest ship phasing times, 95 percent of all goods imported into the country already arrive by ship or barge.
- Tennessee rivers carry a variety of commodities including coal, petroleum (fuel and asphalt), chemicals and fertilizers, crude materials (sand and gravel), manufactured goods (processed

steel) and farm products (corn and wheat). This is a small sampling of everyday products shipped by water transportation.

- The International Port of Memphis on the Mississippi River, including Memphis Harbor and Wolf River Harbor, shipped and received almost 17 million short tons of freight in 2001. This is down from a high of 18.2 million tons in 2000, but is an upward growing trend since the early 1990s.
- The Cumberland River shipped and received 23.1 million tons of freight in 2001, down from a high of 24.2 million tons in 1999.
- The Tennessee River shipped and received 47.9 million tons of commodities in 2001, down from a high of 52 million tons in 1998.
- A significant trend in increased containerized freight is being forecast for the next 20 years and will help shape new and improved ways that the waterway system can be used.

Mode Implications

- Tennessee has the nation's fifth largest navigable inland waterway system. There are 1,062 miles of navigable waterways and 172 ports along or inside the state's borders. Tennessee also has two direct links to seaports on the Gulf of Mexico via the Mississippi River and the Tennessee-Tombigbee waterway. These direct links offer significant domestic and international opportunities.
- The waterways system in Tennessee can potentially help reduce traffic congestion on highways and railroads. Preserving and promoting the waterways ensures competitive shipping prices across all modes of transportation.
- The functions of Tennessee's waterway system include transporting commercial and special freight as well as bulk commodities, recreation usage, and water supply. For Tennessee's waterways to provide a greater contribution to freight movement, the waterway system must be upgraded. Upgrades include replacing aging infrastructure at a number of major locks and dredging rivers in key locations to allow use by deeper barges.
- While TDOT has an interest in ensuring that the waterway system functions effectively, the Tennessee Valley Authority (TVA) and the U.S. Army Corps of Engineers (USCOE) have primary responsibility for capital improvements to and operations of these waterways. TDOT is exploring ways to support these agencies and private operators to increase movement of freight via waterway.

3.1.2.4 Railroads

Components

The rail system in Tennessee consists of a network of 3,081 miles of rail lines across the state. The rail system is entirely used for freight movement, except for Amtrak service along the western border. Railroads provide an alternative to goods movement by truck for those longer distance movements served by rail corridors. Given the amount of through truck traffic, it is clear that the role of rail in Tennessee is critical in addressing long-term movement of goods and materials.

- Six Class I railroads operate on more than 2,335 miles of track in the state, accounting for 76 percent of the total mileage. CSX and Norfolk Southern are the dominant carriers, with 85 percent of the Class I miles.
- Nineteen shortline railroads provide service over branch lines and connect local shippers to the Class I railroads. The shortline railroads operate more than 746 miles of track, or 24 percent of the statewide system.
- TDOT provides financial support for the shortline operators by assisting in infrastructure renewal projects.
- Intercity passenger rail service within the state is limited, spanning service over just 132 miles to two stations in Memphis and Newbern-Dyersburg. This service is part of Amtrak's City of New Orleans route between Chicago and New Orleans, and provides one train per day in each direction.
- Commuter rail service is being planned along a corridor in Nashville, and other corridors in the area are being contemplated. There are short passenger-only rail services in the state: a downtown rail trolley in Memphis and an incline rail system in Chattanooga.

Utilization

Usage of the Tennessee rail system can be characterized by the points described below.

- Based on the shape of the state and the locations of rail corridors, most rail movements occur in several north-south corridors running across the state. There is relatively limited east-west freight movement by rail.
- In 1999 Class I railroads moved 57 million tons of freight (more than 1.9 million carloads).
- In 2001 shortline railroads shipped 4 million tons of freight (48,000 carloads).
- Rail freight volumes are projected to increase by about 50 percent over current levels, with some shifts in the shares of specific commodities. The forecasts may be conservative as they assume no constraints in the competing highway network.

Mode Implications

- Tennessee is served by six Class I (major freight railroad) and 19 shortline railroads, which comprise a network of 3,081 miles of track. In 1998, 80 million tons of freight valued at $33 billion was moved by rail. Freight moved by rail is expected to increase to 137 million tons by 2020. While shipment of freight over rail is a viable and growing alternative to shipment by truck, the projected growth in rail traffic raises the possibility of increased rail/vehicle conflicts, traffic delays, and noise impacts.
- As a private enterprise operating under regulations of the Federal Railroad Administration, railroads are generally responsible for maintaining and operating their systems to minimum condition and safety standards, and as such primary corridors are in good condition. However, increases in rail traffic are creating pressure points where transitory and recurring delays arise, whether on running segments with single tracks or intermodal yards where shipments are transferred. These issues also are the primary responsibility of the railroads; however, there are instances where public sector partnership can provide a catalyst for an

improvement with measurable public benefit, and such opportunities should be considered where studies show they are worthy.

- While increased use of freight rail could decrease demands on Tennessee highways, it could also require increased public investment in rail-related infrastructure to add sufficient capacity. Intermodal connectors/access would also require additional investment.
- While shipment of freight over rail is a viable and growing alternative to shipment by truck, the projected growth in rail traffic raises the possibility of increased rail/vehicle conflicts, traffic delays, and noise impacts.

3.1.2.5 Public Transportation

Components

Public transportation services across the state comprise an increasingly important resource for travel in Tennessee. In urban areas, it provides the only travel option for many, and for others a low-cost commuting choice in a time of increasing congestion and gasoline costs. For visitors to the state, it provides convenient mobility around crowded tourist attractions. Around major activity centers, transit connects resident, workers, shoppers, and diners. In rural areas, it provides lifeline service, connecting the elderly, the disabled, and low-income citizens to essential medical, social service, and shopping needs. The role of public transportation in Tennessee is critical to ensure basic mobility and transportation choices in the future.

Key components of public transportation services across Tennessee are described below.

- Public transportation systems serving all 95 counties
  - Five large metropolitan systems (metropolitan areas with populations over 200,000)
  - Six urban systems (in metropolitan area with populations between 50,000 and 200,000)
  - Four trolley-replica tram systems (Knoxville, Gatlinburg, Pigeon Forge, and Franklin) and trams in Chattanooga
  - 11 rural transportation systems in each Human Resource Agency area, focused on providing a degree of mobility to elderly, disabled, and low-income customers living in these rural areas
  - In addition to 25 public agency providers, approximately 80 private not-for-profit and other public organizations received assistance to purchase vehicles and provide transportation services to people with mental or physical disabilities.
- Memphis has initiated a light rail system from downtown to the medical center; another corridor to the airport is planned.
- The Regional Transportation Authority in Nashville is advancing commuter rail service extending eastward from downtown into Wilson County, and, in concert with the Metropolitan Transit Authority and the Nashville Area MPO, is studying four other corridors for potential service.
- In the Sevierville-Pigeon Forge-Gatlinburg corridor, the feasibility of Bus Rapid Transit service is being explored.

Utilization

Ridership on public transportation is a barometer of the extent of services provided and the usage of those services. Highlights regarding use of transit services are shown below.

- Existing transit ridership in Tennessee has surpassed 30 million annual trips. Ridership occurs on transit buses, vans, and trolleys operated by metropolitan, urban, and rural providers.
- In 2001, approximately 1.36 million trips were delivered by agencies serving the state's 11 rural public transportation districts.
- Total transit ridership declined over the 1990s, largely because fixed route bus patronage was down by 15 percent. However, there was a noticeable flattening and some recovery of ridership in the latter part of the 1990s, a trend that has persisted, echoing transit ridership gains nationally over the last several years. This trend is being experienced on both urban fixed route and demand responsive services. Rural trips have remained fairly level, although this reflects limitations in the amount of service available rather than actual demand or need.
- A significant trend has been the growing proportion of medical trips, which have tended to be longer, affecting the average trip length and total miles of service provided.
- Factors such as the aging population, the relationship between wages and transportation costs, escalating costs of auto ownership and gasoline, transit service improvements, and land use patterns will collectively help shape the levels of future ridership.

Mode Implications

- For many persons, the role of public transportation as a part of the overall transportation system may not be significant. It is anticipated, however, that over the next 10 to 20 years, increased fixed-route services and newer premium transit services could provide cost-effective mobility as our transportation system capacity needs become more challenging to implement.
- Developing alternative modes of travel to automobile, including public transportation, could potentially offset increases in traffic congestion. Public transportation accounts for about 3 percent of the total trips taken in urban areas. Past funding constraints have limited the opportunity for enhancing public transportation to meet additional public transportation needs and services. However, for public transportation use to increase, it must be more competitive with other modes of transportation. Service must be more frequent, more comfortable, provide convenient access to destinations, and be competitive in terms of total travel time.
- Public transportation needs in the established urban service areas will expand as the geographic size and population and employment of these areas continue to grow.
- By 2025, five urban areas are anticipated to be large enough to warrant new public transportation systems: Murfreesboro, Morristown, Cleveland, Columbia, and Cookeville. In addition, demographic forecasts project growth in rural and elderly populations; this will create a growing need for public transportation services to serve these market segments.

3.1.2.6 Bicycles/Pedestrians

Components

Many Tennesseans are interested in walking and bicycling as a means of transportation and recreation. As modes of travel, walking and bicycling are healthy, efficient, low-cost, and available to nearly everyone. These modes can help communities achieve the larger goals of developing and maintaining livable communities, making neighborhoods safer and friendlier, and reducing transportation-related air pollution and noise. They can provide transportation system flexibility by providing choices, particularly in combination with transit systems, to people of all ages and abilities. There is also growing interest in encouraging walking and bicycling as a way to improve public health, with effort to create more walkable and bikeable communities that encourage healthier lifestyles.

System Description

The state's key bicycle and pedestrian facilities and programs for state-owned roadways include:

- Five official state bicycle routes for recreational touring totaling 690 miles
- 8,500 roadway miles with 4-foot-wide shoulders that accommodate bicycles
- 150 miles of greenways, sidewalks, and trails
- Some bicycle lanes in urban areas
- Sidewalks in urban areas
- Shared-use paths and greenways in Nashville, Chattanooga, Knoxville, Johnson City, Memphis, and in various state parks
- Signed bicycle routes
- State-sponsored Bicycle Ride Across Tennessee event.

Utilization

- It is challenging to get an accurate picture of how many people are currently walking and bicycling in Tennessee, particularly at the state level.
- The most consistent data are available through the U.S. Census, but there are some significant drawbacks. For one, the data include only people who travel to work, missing students, those who work at home, and those who do not work. It also misses trips that are not work trips, including trips to grocery store, parks, schools, friends' house, coffee shops, and recreational outings. Potentially hundreds of thousands of walking and bicycling trips are not being recorded.
- Additionally, it is important to note that everyone is a pedestrian at some point in the day and will likely need accessible facilities during their life. Walking to cars in parking lots, walking between buildings at work, walking into grocery stores…all are considered pedestrian trips.
- Trends that have emerged from analyzing the Census data are described below.

- Nationwide, the number of workers riding bicycles to work has been increasing. In all, 466,800 workers commuted by bicycle in 1990, while 488,500 workers commuted by bicycle in 2000.
- Bicycle use has decreased (from 0.41 percent to 0.39 percent) due to the increase in the number of workers driving or working from at home during this same period. The situation is similar in Tennessee. Bicycle use increased between 1990 and 2000; from 1,818 bike commuters in 1990 (0.10 percent), to 2,330 in 2000 (0.09 percent). However, the working population of Tennessee has increased 40 percent in the same period. While this is a positive gain in the number of people riding their bicycle to work, the percentage of bicyclists as part of the working population has gone down.
- Only Alabama has a lower bicycle commute rate of the states adjacent to Tennessee.
- People are not walking as much. In Tennessee 50,773 people walked to work in 1990 (2.8 percent), while 39,689 people walked to work in 2000 (1.6 percent).

Mode Implications

- The lack of bicycle and pedestrian facilities limits their utility as travel modes. Walking and bicycling made up about 1.6 percent of work-related trips in Tennessee in 2000, making them the second most popular forms of travel after driving. Improving bicycle and pedestrian facilities will require identifying fundable, feasible, bicycle or pedestrian projects that connect destinations. In addition, if bicycle or pedestrian use is to increase, new highway and land use development projects must consider how safe bicycle or pedestrian movement can be accommodated.
- Coordination with local and regional jurisdictions, as well as private developers, is particularly important if bicycle and pedestrian conditions are to improve.

3.1.2.7 Support Systems

Intelligent Transportation Systems

ITS operations in Tennessee focus primarily on travel and traffic management, commercial vehicle operations, information management, and maintenance and construction management. TDOT also provides a supporting role to public transportation and emergency management. Additional coordination is still needed to fully realize the benefits of this technology. Each strategic priority will require different combinations of legislative involvement, partnerships, funding levels, and internal agency staffing.

Both ITS (and companion highway incident management) strategic plans note that the majority of improvements will have moderate to significant capital costs. The ongoing costs of operation and maintenance will require increased attention at policy and legislative levels. Given this level of expense, implementing many ITS or incident management strategies will likely require new and innovative financial sources.

Additional coordination is still needed to fully realize the benefits of ITS. Each strategic priority will require different combinations of legislative involvement, partnerships, funding levels, and internal agency staffing.

Transportation Demand Management

Widespread application of TDM strategies is an emerging rather than mainstream phenomenon in Tennessee, although the larger MPOs have been immersed in its application to address urban transportation congestion and capacity issues; this is appropriate and to be expected as TDM needs and applications are less urgent in the rural segments of the state highway system and appropriate in the urbanized areas where traffic congestion is a daily condition. TDOT roles in urbanized areas has historically been that of an involved agency, partnering in project- or corridor-level TDM initiatives.

As part of the LRTP process, it is being recognized that TDOT has an important role in mobility management across the state. TDM is an enabling strategy; that is, one from which other significant benefits can be leveraged from a relatively small catalyst investment or program support. This philosophy is to be recognized in the development of transportation system needs by identification of a TDM implementation investment category.

3.1.3 Summary of Strategic Modal Needs Planning Considerations

A variety of considerations fold into the process of defining modal needs, ranging from factors that influence projections of demand into the future, to situational factors of the modal systems and how their capacity is consumed by individuals, businesses, and tourists, both from within the state and from outside, to the characterization of the general programs and investments theoretically needed to address these collective needs and what their associated costs. Some of the noted considerations in defining modal needs include, but are not limited to, those described below.

- Projected changes in demographics and their influence on the transportation network
- Projections of future system demands and markets, both passenger and freight movements
- Influence of geography and topography on travel demand patterns
- User response to system dynamics: fuel costs, service costs, time, congestion, reliability, tolerance, redundancy, incremental decision making, and cumulative effects
- Consumption of available remaining unused modal capacity and frequency of need for steps in capacity versus rate of growth in demand
- Developing new corridors versus expanding or upgrading existing corridors versus changing how efficiently corridors are used
- Scarcity of simpler, less expensive solutions and the emergence of more complicated and expensive solutions
- Accelerating costs of infrastructure development and operations
- Management of transportation service costs: shifting activities to travelers, designing facilities to require less maintenance, management and labor to operate
- Extracting latent capacity and more efficient utilization from built facilities through ITS and TDM

These factors and considerations collectively point to several underlying strategies, as described below.

- "Silver bullet" solutions–a major capital project within a single mode–will become less common as project costs spiral due to materials and land costs. Projects will need to be conceived in many cases as multifaceted, involving several kinds of physical investment and operational management. Particularly in urban areas, it is being recognized that a collection of multimodal capacity and demand management actions are becoming a more pragmatic, cost-effective approach to coping with mounting transportation needs, whether across a region or in particular corridors or sectors.
- Scarcity of funds may push agencies to consider partial, scaled down, deferred, or phased solutions; although efforts to optimize network utilization through changing the location, timing, and mode of trips are becoming a more important in developing an overall solution.
- Funding shortfalls for capacity expansion will likely translate into an outright or de facto reduction in quality of service standards (longer peak periods of freeway congestion or more delayed flights at the airport). This is a common accommodation to chronically inadequate infrastructure funds. More innovative and far-reaching strategies to accomplish strategic and demonstrated investments will become more common.

It is recognized that the definition of modal needs sets the stage for the formulation of an LRTP that captures the priorities of Tennesseans within a funding program that is affordable and supportable. The modal needs estimates capture a level of investment that will enable a response to identified needs in general terms. Transportation system usage trends and patterns are monitored regularly, modal needs estimates updated periodically, and the LRTP updated at intervals Thus, there will be ample opportunities to refine outlooks as these trends collectively manifest themselves over time, and more importantly, better articulate the definition of the most appropriate and cost-effective investments at the program and project levels.

Significant trends and challenges will influence Tennessee's future transportation system, as discussed in the *Challenges and Opportunities* report, and as summarized in this chapter. These challenges are recapped below.

Tennessee's Economy

Tennessee has enjoyed positive economic growth at or above the national trend over the last decade, and the outlook is for continued economic expansion. This outlook is based on the state's diverse regional economies drawing from sectors as diverse as manufacturing, distribution, agriculture, tourism, education, and retirement communities. The state's location, close to the bulk of the eastern U.S. markets and a reliable labor pool, has over the years attracted economic anchors such as Federal Express, General Motors' Saturn division, Nissan Corporation, and Dell Computer Corporation. With this economic growth will come increased demands for reliable goods transportation across the freight modes.

Demographic Trends

With a population increase of more than 30 percent and an employment increase of more than 40 percent by 2030, the state will see a geographic expansion of its large urban areas and other urban centers. Population growth is projected to be greatest in the metropolitan Nashville area, with other higher growth pockets in eastern Tennessee along the I-75 and I-40 corridors, though the majority of counties are expected to see growth between 25 and 50 percent. Forecasts show disproportionate growth in the numbers of the elderly, which raises questions about long-term mobility. Transportation mobility for the rural population and minority population segments is also a long-term consideration. Employment growth echoes population growth for the most part, with most areas seeing increases of 15 percent or more.

Travel Trends

Recent trends at both the state and national levels have shown increasing rates of auto ownership per capita and VMT per capita. Coupled with lower-density suburban development patterns, it is becoming increasingly difficult to cost effectively provide the conventional mix of mobility choices. When linked to rapidly increasing infrastructure costs in recent years, the ability to extract the same transportation benefit and system performance from each transportation dollar becomes even more difficult.

Trade and Freight

Tennessee has an interesting mix of highway, railroad, aviation, and waterways access (three river navigation systems with access to the Midwest and the Gulf Coast), extending the state's reach to both domestic and international markets. Interestingly, given the state's location and regional geography, more than 60 percent of the freight volume in the state is passing through Tennessee. While many states experience this phenomenon, the situation does put significant added burden on the transportation system, though it may bode well for the state's role in regional distribution.

Transportation System Investment

Tennessee is beginning to experience the pressures of larger, rapidly growing states such as Florida. For years, a basic transportation system was able to meet modest growth trends by robust infrastructure maintenance programs to preserve built investments and add selected capacity projects that were relatively inexpensive lane at-grade additions within existing right-of-way if traffic demands were not met through unused system capacity. Many agencies have entered an era where such simpler, lower-cost projects have been replaced by more expensive projects requiring structures, additional right-of-way, and complex solutions. Relying only on increases in gas tax revenues is becoming problematic, and options such as inflation-indexing and innovative partnering, special assessments and other strategies merit stronger consideration due to increasing project backlogs and improvement needs mounting faster than revenues.

3.2 Travel Demand Forecasts

This section summarizes travel demand forecasts developed from the synthetic travel demand model that is focused on the highway network, upon which the vast majority of passenger trips and freight movements occur today and are expected to occur in 2030.

3.2.1. Growth in Travel Demand

Travel demand drives the need for the range of improvements needed for the transportation network to continue to satisfy the mobility and goods movement requirements of the state's residents, visitors, institutions and businesses. Recent and projected travel trends are discussed here.

3.2.1.1 Vehicular Travel

Usage of Tennessee's highway system has been growing significantly. Some aspects of this growth and patterns of usage are described below.

- In 2002 there were 68.2 billion VMT on Tennessee highways and streets.
- VMT has increased more than 100 percent over the past 20 years and continues to increase. Concurrently, lane miles in the system have grown only by 8.1 percent.
- This dynamic change in system usage versus supply has led to sharply higher travel demands in many corridors, creating chronic congestion in some corridors and a rising rate of auto crashes.
- More than 71 percent of this travel occurred on the state highway system, 10 percent was on county roads, and 19 percent was on city streets.
- The interstate system, comprising 1.2 percent of total centerline mileage, carries 27 percent of the total VMT.
- County roads comprise 64 percent of highway mileage while carrying only 10 percent of total VMT.
- City streets are 19 percent of total mileage while carrying 19 percent of VMT.

Table 3-1 provides current travel measures that indicate the level of traffic on the state highway system. Annual VMT is the sum of the miles traveled by vehicles over a calendar year. Annual VMT for rural areas was approximately 32 billion miles. Urban areas have fewer highway lane miles, but handle more vehicle travel than do rural areas, with over 36 billion miles of VMT. While total volumes tend to be lower in rural areas, these highways tend to have a higher percentage of truck traffic than those in urban areas (16.8 percent versus 8.0 percent). The VMT per capita is 11,838 miles per year.

Table 3-1. Travel Measures for 2002

Annual Vehicle Miles of Travel (Billions)		
Area	Annual VMT	% Trucks*
Rural	32.068	16.8
Urban	36.161	8.0
Total	68.229	

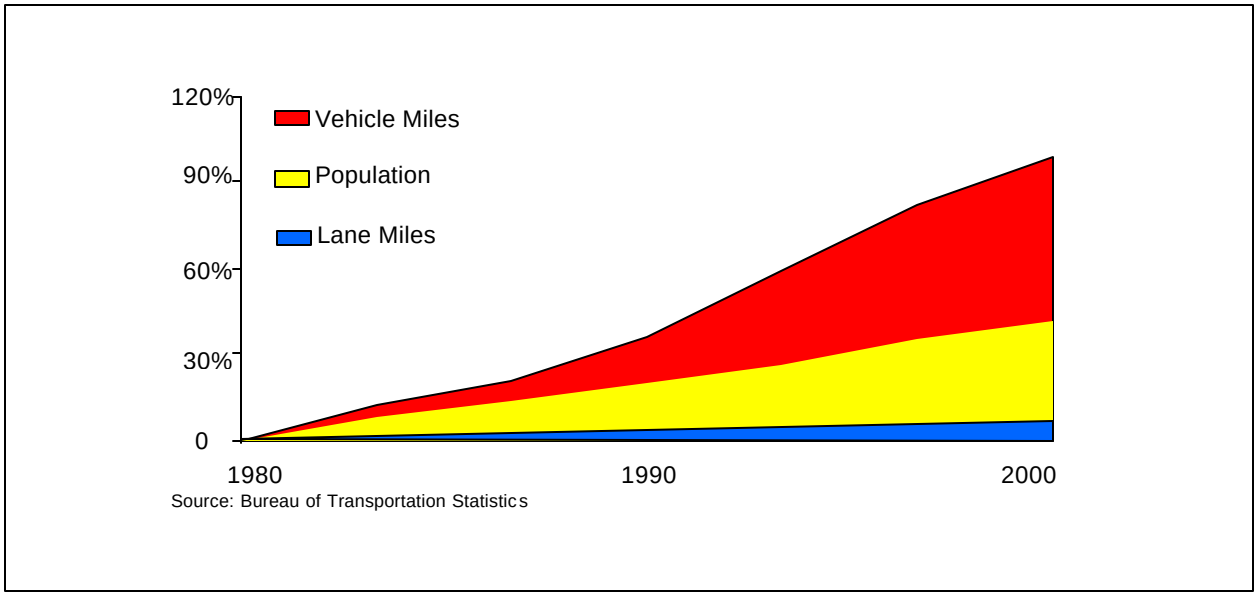
Source: "Highway Statistics," 2002. United States Department of Transportation, FHWA.

* "% trucks" includes buses, single-unit trucks with at least two axles and six tires, plus combination trucks. Data are based on Highway Performance Monitoring System sample data reported by each state. National average is weighted on VMT.

Traffic conditions for rural and small urban areas were analyzed with the synthetic travel demand model. The model results for these areas outside the MPO planning areas show a 60 percent increase in VMT between 2003 and 2030 for total traffic. For trucks, the projected increase in vehicle miles of travel in the same area is estimated to increase 122 percent, more than doubling. These magnitudes of increase will consume much of the unused rural system capacity and necessitate the need for highway widenings.

The challenge confronting TDOT is shown in Figure 3-1. From 1980 to 2000, the state's population increased approximately 40 percent, and VMT doubled (100 percent increase). Over the same period, the number of lane miles on the state highway system has increased only 8 percent. While there was considerable reserve unused capacity in the system, the trends are troubling because at some point, capacity deficiencies will become more prevalent as the reserve capacity is consumed, and costs to add capacity will become the norm.

Figure 3-1. Comparison of Population, Travel, and Miles of Highway



Source: State of Tennessee historical data

3.2.1.2 Truck and Freight Travel

Freight is transported by trucks, air carriers, waterways, and rail carriers, with the trucking industry claiming the largest share of freight movement. Demand is driven by businesses and by the availability of facilities and equipment. Even when freight arrives by other modes, distribution to its final destination is usually by trucks using the highway system. The statistics below (obtained from TNTrucking.org) describe the state's trucking industry:

- Tennessee ranks sixth in the nation and first in the Southeast for cargo ton-miles and the value of commodities carried by truck.
- The trucking industry employs 4 percent of the state's population.
- Tennessee is home to more than 10,600 for-hire and private interstate trucking businesses.
- Trucks are the only means of supply to 85 percent of the state's communities.
- Trucks carry approximately 80 percent of the manufactured freight transported in Tennessee.

Additional highlights of trucking movements are shown below.

- Of total freight shipments to, from and within the state, 74 percent moved on the highway system.
- The FHWA forecasts that freight shipments by truck will grow in 20 years from 370 million tons in 1998 to 655 million tons in 2020 (73 percent increase), with highways continuing to carry the same share of freight as today.
- Truck traffic is a significant component of traffic volumes, especially on interstate routes. The interstate system, comprising 1.2 percent of total mileage, carries about 80 percent of the truck VMT in the state.
- The truck percentage on some interstate rural segments is in the range of 30 to 40 percent of total daily traffic on those segments.
- With modern logistics calling for just-in-time delivery of both commercial and industrial process inputs and outputs, the interstate system has evolved into a moving warehouse of supplies and parts as well as finished products.

Table 3-2 summarizes overall freight movements in Tennessee.

Table 3-2. Freight Shipments To, From, and Within Tennessee: 1998, 2010, and 2020

Tennessee	Tons (Millions)			Value (Billions $)		
	1998	2010	2020	1998	2010	2020
State Total	501	712	866	384	745	1,189
By Mode						
Air	<1	2	3	52	125	221
Highway	370	535	655	294	555	868
Other*	<1	<1	<1	<1	<1	<1
Rail	80	112	137	33	57	87
Water	49	64	72	5	8	12
By Destination/Market						
Domestic	484	682	821	354	676	1,058
International	17	30	45	31	68	131

Source: FHWA Freight News : Tennessee Freight Transportation Profile
[http://www.ops.fhwa.dot.gov/freight/freight_analysis/state_info/tennessee/tn2.pdf]
Note: Modal numbers may not add to totals due to rounding , and shipments through Tennessee are not included.

* The "Other" category includes international shipments that moved via pipeline or an unspecified mode.

- The majority of freight movement involves trucks, with railroads and waterways having considerably smaller shares. Other key points relating to freight movements include these: total freight shipments to, from and within Tennessee are projected to increase 73 percent from 1998 to 2020, a compound rate of increase of 2.5 percent per year. At this rate, by 2030 total freight shipments would increase to 1.1 billion tons annually
- More than 60 percent of total freight movements involve freight passing through the state.
- About 56 percent of trucking movements pass through the state, while approximately three quarters of rail and barge movements pass through the state.
- Of the domestic freight with an origin, destination, or both within the state, nearly half of the movements begin and end in the state, and the balance has an origin or destination outside the state.
- More goods enter the state than leave the state, regardless of the freight mode.
- Of the freight movements occurring completely within Tennessee, trucks have a dominating 97 percent mode share.

Trucking dominates the regional and state freight movements both in terms of total volume and total movements because trucking loads per unit are much smaller than for rail or waterborne movements. Trucks tend to handle smaller and more dispersed shipping markets, and goods with higher value, perishable time limits. With the expectation of business customers for overnight delivery and of manufacturers for just-in-time delivery, the trucking industry is sometimes collectively referred to as a warehouse on wheels.

Opportunities to moderate future truck trip volumes by diversion to other modes is worth investigating, but there are inherent limits due to the issues noted above and due to shipping costs, reliability of delivery timelines, safety and security, and other issues. To a large extent in

today's logistics environment, each mode is exhibiting its natural market share within the freight marketplace for the mix of customer base, commodity characteristics, origin/destination and volume structure, and the competitive pricing environment. Influencing these market shares, given the extent of freight movements through Tennessee and the nature of freight market patterns, will require careful consideration, extensive dialogue with the modes, and interstate coordination and cooperation.

3.2.1.3 Other Existing Highway Network Baseline Measures

As part of the long-range planning process, a statewide synthetic travel model was developed to project future travel demand on the state highway system. The model reflected the trunk network and tripmaking in the 11 MPO areas, but was not structured to provide detailed modeling in those areas, as there are travel demand models in the urban areas. In rural and small urban areas, the model included interstate highways, major state highways, and selected elements of minor state highways, such that the coverage is approximately 60 percent of the state highway network carrying approximately 87 percent of the VMT. The synthetic model provides additional useful measures on the performance of the state highway system in rural and small urban areas (those population centers without MPO status). As part of the model output, several system performance statistics were captured and provide a snapshot of the existing and future conditions, for the "existing and committed" network on the rural/small urban component of the state highway system. Obviously, congestion and delay will be alleviated by projects to be implemented as part of the final LRTP vision. These statistics are summarized in Table 3-3.

Table 3-3. Existing and Future Synthetic Model Statistics

Parameter	2003 Existing Network	2030 E+C Network	% Change
Rural/Small Urban Population[1]	3,142,600	4,464,500	42.1
Statewide Employment[2]	3,508,300	5,057,600	44.2
Centerline Miles[3]			
Small Urban Freeways	69	69	
Small Urban Non-Freeways	611	624	
Rural Freeways	650	650	
Rural Non-Freeways	5,366	5,434	
Lane Miles[3]			
Freeways	2,923	2,923	
Non-Freeways	14,192	15,014	
Persons (Rural/Small Urban) Per Lane Mile			
Freeways+Non-Freeways	183.6	249.1	35.6
Total Daily VMT			
Freeways	23,530,500	37,014,300	57.3
Non-Freeways	41,476,700	67,493,300	62.7
Subtotal	65,007,200	104,507,600	60.8
Daily VMT Per Capita (Rural/Small Urban)			
Freeways+Non-Freeways	20.7	23.4	13.0

Table 3-3. Existing and Future Synthetic Model Statistics (Continued)

Parameter	2003 Existing Network	2030 E+C Network	% Change
Avg. Equilibrium Speed			
Freeways	66.4	56.5	-14.9
Non-Freeways	51.9	50.5	-2.7
Total Delay (Hours)			
Freeways	15,086	130,763	766.8
Non-Freeways	51,201	204,595	299.6
Subtotal	66,287	335,358	406.9
Delay Per Capita (Minutes)			
Freeways + Non-Freeways	1.3	4.5	246.2
Truck Daily VMT			
Freeways	5,789,700	13,250,600	128.9
Non-Freeways	1,654,000	3,460,900	109.2
Subtotal	7,443,700	16,711,500	124.5
Truck Volume Per Lane Mile			
Freeways	1,980	4,560	130.3
Non-Freeways	120	230	91.8
Truck Daily VMT Per Statewide Employee			
Freeways+Non-Freeways	2.1	3.3	
Congested Centerline Miles			
Small Urban Areas:			
Freeways with high V/C ratio	1.4	37.6	2,640
% Freeways with high V/C ratio	2.0	54.8	
Non-Freeways with high V/C ratio	78.6	215.5	174.2
% Non-Freeways with high V/C ratio	12.9	34.5	
Rural Areas:			
Freeways with high V/C ratio	121.8	532.0	336.8
% Freeways with high V/C ratio	18.7	82.2	
Non-Freeways with high V/C ratio	50.3	273.8	450.3
% Non-Freeways with high V/C ratio	0.9	5.0	
	(Hrs:Mins)	(Hrs:Mins)	
Memphis–Nashville	3:39	4:53	33.8
Nashville–Clarksville	1:12	1:35	31.9
Nashville–Chattanooga	2:37	3:15	24.2
Nashville–Knoxville	3:13	4:01	24.9
Knoxville–Chattanooga	2:12	2:41	22.0
Knoxville–Bristol	2:02	2:21	15.6

Significant implications of the changes in most of these statistics are described below.

- Rural population is projected to increase by 42 percent over the planning period.
- Total VMT is forecast to increase by more than 60 percent, and by 124 percent for truck VMT. Most truck travel will occur on the interstate and trunk state highways.
- A significant increase is projected in the intercity travel times between in-state city pairs, ranging from 15 to 33 percent, again demonstrating the need for additional investments in rural traffic capacity.

- Total delay and delay per capita are projected to increase dramatically. While some of this delay may occur within the range of acceptable traffic levels of service (LOS), much of it will occur at unacceptable levels, prompting the need for improvement projects. The degree of change suggests the need for a more pronounced level of rural capacity projects as remaining unused capacity is absorbed by traffic growth.
- Roadway miles with a high V/C ratio, as an indicator of service quality, have increased. While the high percentage change is due to the small existing levels, there is nevertheless a large change in the number of affected miles.
- Indications predict a significant degradation in rural and small area traffic conditions that must be factored into the modal needs analysis.

3.2.2 Highway Network Analysis

As part of the synthetic network modeling activities and coordination with other network traffic service analysis using TDOT's roadway inventory and analysis software, the traffic network performance was evaluated to assess network capacity needs. The synthetic model assessed rural and small urban areas of the TDOT state highway system, while TRIMS assessed the state highway system within the urbanized areas under the planning auspices of the 11 MPOs.

Traffic service analyses were performed for the base year 2003 for the existing roadway network and for the future year 2030 for the existing plus committed (E+C) network. The E+C network refers to the existing roadway system in the base year 2003 plus those projects currently under construction and those ready to go to construction for which the intent is to fund and construct them in the near future. The E+C network provides a frame of reference for what additional improvements might be needed over time to maintain traffic service standards.

The analyses using the model and TDOT roadway inventory and analysis software were coordinated for consistency in the traffic service analysis, and used the same traffic LOS volume-to-capacity (v/c) ratios for the deficiency calculations. To recognize the impact of trucks on roadway capacity, given the state's more rugged topography from east to west, truck volumes were converted to passenger car equivalents (PCE). The conversion factors used were 1.0 PCE per truck for flat terrain, 1.5 PCE for rolling terrain, and 3.5 PCE for mountainous terrain. Consequently, traffic service results reflect the number of trucks on a segment and the effect of the terrain for that segment. On some routes with high truck traffic volumes in rolling to mountainous terrain, the truck traffic has a pronounced affect on overall traffic service. The following traffic service descriptions were used in the analysis:

- Excellent: LOS A/B
- Good: LOS C
- Fair: LOS D
- Poor: LOS E/F

Traffic results from the synthetic model are shown in Figures 3-2 and 3-3 for 2003 and 2030, respectively. Appendix B provides the same results for each TDOT region. It is shown over the planning period, there is a dramatic increase in the segments with fair and poor LOS. The interstate highways experience this phenomenon as well. Table 3-4 summarizes the extent of fair and poor traffic service on rural segments of interstate highways.

Table 3-4. Summary of 2030 Interstate Traffic Service

		2030 Traffic Service for the E+C Network			
		LOS D		LOS E/F	
Interstate Segment	Approx. Length (miles)	Miles	% of Total	Miles	% of Total
I-40 Memphis to Nashville	149	38	26	95	64
I-40 Nashville to Knoxville	116	0	0	116	100
I-40/I-81 to North Carolina	32	8	25	24	75
I-24 Chattanooga to Nashville	88	29	33	22	25
I-24 Nashville to Clarksville	16	0	0	16	100
I-75 Chattanooga to Knoxville	65	0	0	65	100
I-75 Knoxville to Kentucky	40	0	0	40	100
I-81/I-40 Bristol to Knoxville	62	11	18	32	52
I-65 Nashville to Kentucky	20	0	0	20	100
I-65 Nashville to Alabama	51	25	49	9	18
I-26 North Carolina to I-81	26	0	0	0	0
Total	665	111	17	439	66

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

Figure 3-2. 2003 Level of Service on the State Highway System Outside Metropolitan Planning Organizations for the Existing Network.

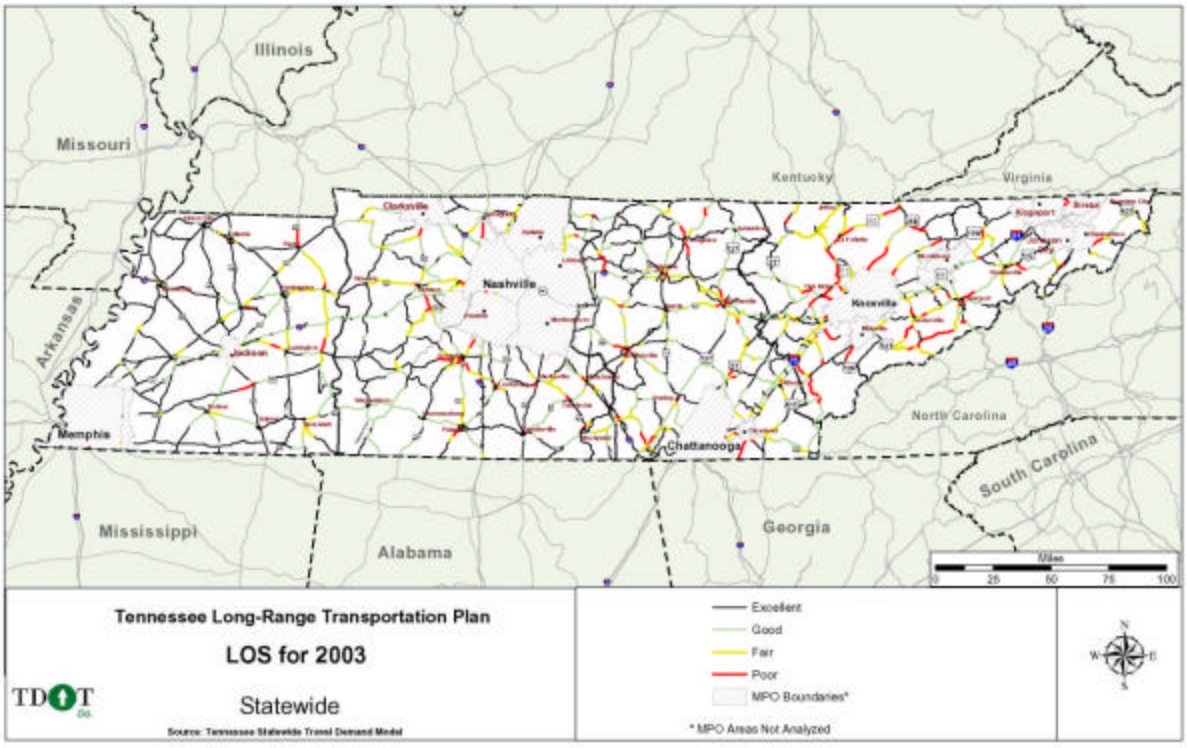
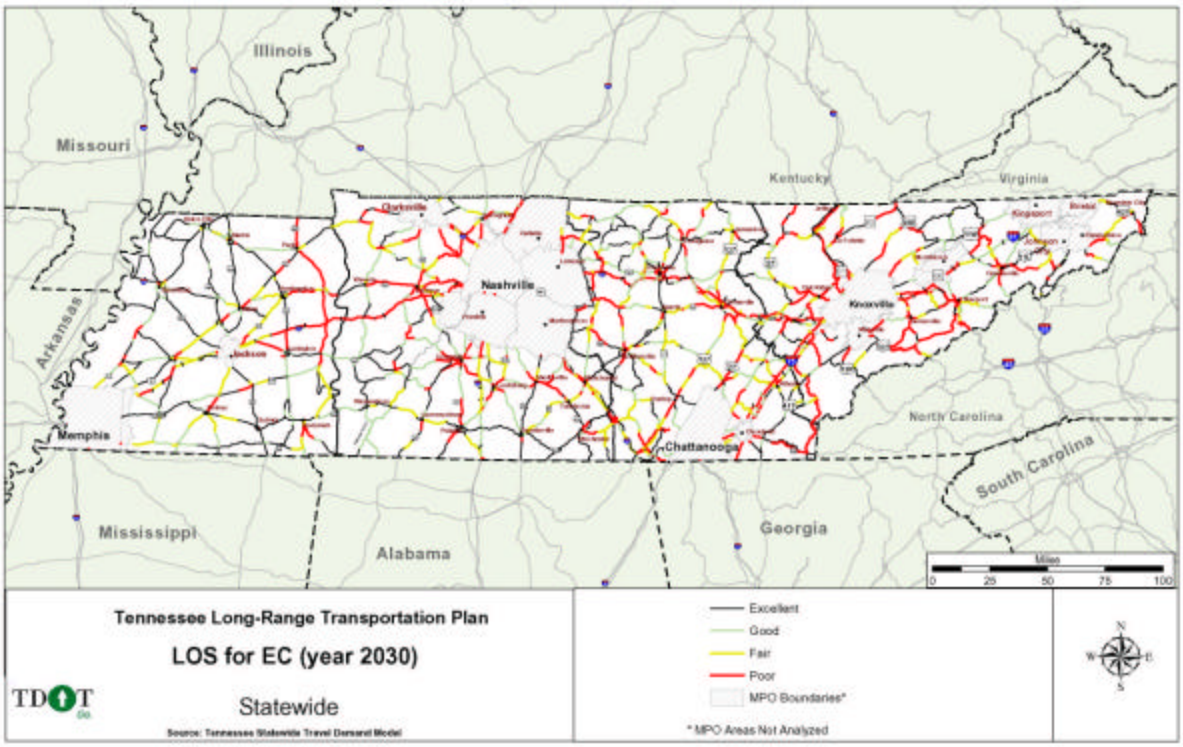


Figure 3-3. 2030 Level of Service on the State Highway System Outside Metropolitan Planning Organizations for the Existing Network



These LOS results can also be presented in terms of a detailed statistical summary. Table 3-5 compares traffic service results from the synthetic model for the rural and small urban areas of the state.

Table 3-5. Rural/Small Urban Area State Highway System Traffic Service

	Centerline Mileage by LOS					% Centerline Mileage by LOS				Weighted
LOS >	A/B	C	D	E/F		A/B	C	D	E/F	Average
	Excellent	Good	Fair	Poor	TOTAL	Excellent	Good	Fair	Poor	Rating
Traffic Capacity (2003)										
Rural Interstates	183	306	104	7	600	30.5%	51.0%	17.3%	1.2%	**Good**
Small Urban Interstates	18	18	15	4	55	32.7%	32.7%	27.3%	7.3%	**Good**
Interstate Total	**201**	**324**	**119**	**11**	**655**	30.7%	49.5%	18.2%	1.7%	**Good**
Small Urban Highways	317	154	74	104	649	48.8%	23.7%	11.4%	16.0%	**Good**
Rural (Multilane or Flat)	842	4	0	0	846	99.5%	0.5%	0.0%	0.0%	**Exc.**
Rural (Rolling or Mountainous)	2,127	1,444	687	315	4,573	46.5%	31.6%	15.0%	6.9%	**Good**
Rural Subtotal	*2,969*	*1,448*	*687*	*315*	*5,419*	54.8%	26.7%	12.7%	5.8%	**Exc.**
Non-Interstate Total	**3,286**	**1,602**	**761**	**419**	**6,068**	54.2%	26.4%	12.5%	6.9%	**Exc.**
TOTAL	***3,487***	***1,926***	***880***	***430***	***6,723***	***51.9%***	***28.6%***	***13.1%***	***6.4%***	**Good**
Traffic Capacity (2030 E+C)										
Rural Interstates	35	56	108	401	600	5.8%	9.3%	18.0%	66.8%	**Poor**
Small Urban Interstates	14	0	3	38	55	25.5%	0.0%	5.5%	69.1%	**Fair**
Interstate Total	**49**	**56**	**111**	**439**	**655**	7.5%	8.5%	16.9%	67.0%	**Poor**
Small Urban Highways	186	109	73	285	653	28.5%	16.7%	11.2%	43.6%	**Fair**
Rural (Multilane or Flat)	1,042	83	12	0	1,137	91.6%	7.3%	1.1%	0.0%	**Exc.**
Rural (Rolling or Mountainous)	1,118	1,175	939	1,113	4,345	25.7%	27.0%	21.6%	25.6%	**Good**
Rural Subtotal	*2,160*	*1,258*	*951*	*1,113*	*5,482*	39.4%	22.9%	17.3%	20.3%	**Good**
Non-Interstate Total	**2,346**	**1,367**	**1,024**	**1,398**	**6,135**	38.2%	22.3%	16.7%	22.8%	**Good**
Total	**2,395**	**1,423**	**1,135**	**1,837**	**6,790**	**35.3%**	**21.0%**	**16.7%**	**27.1%**	**Good**

Notes: All data are for rural and small urban areas outside of MPO planning areas.

2030 E+C refers to the condition of 2030 traffic assigned to the existing network with the addition of committed projects.

Non-interstate mileage includes a limited number of freeway miles on the state system.

Weighted average rating is a weighted combination of the midpoint v/c ratio for each category, expressed as LOS category.

Color shadings in cells reflect dominant percentages (more than 30 percent).

Table mileages include all interstate highways, all major state highways, a small portion of minor state highways, and a small number of county and local roads to provide network connectivity to interstate interchanges.

The LOS results for the urbanized areas within the MPOs was derived from TDOT analyses using the agency's highway system database and software. Tables 3-6 and 3-7 present the level of service results for the urbanized areas for 2003 and 2030, respectively.

Table 3-6. Traffic Service Summary for Urbanized Areas (2003)

INTERSTATE ROUTES ONLY									STATE ROUTES ONLY									TOTAL (Both Interstate and State Routes)								
	Centerline Mileage by LOS				% Centerline Mileage by LOS			Weighted		Centerline Mileage by LOS				% Centerline Mileage by LOS			Weighted		Centerline Mileage by LOS				% Centerline Mileage by LOS			Weighted
	A,B & C	D	E & F	Total	A,B & C	D	E & F	Average		A,B & C	D	E & F	Total	A,B & C	D	E & F	Average		A,B & C	D	E & F	Total	A,B & C	D	E & F	Average
MPO	Exc./Good	Fair	Poor		Exc./Good	Fair	Poor	Rating	MPO	Exc./Good	Fair	Poor		Exc./Good	Fair	Poor	Rating	MPO	Exc./Good	Fair	Poor		Exc./Good	Fair	Poor	Rating
Bristol	7	0	0	7	100%	0%	0%	Exc./Good	Bristol	46	8	19	73	63%	11%	26%	Exc./Good	Bristol	53	8	19	80	66%	10%	24%	Exc./Good
Chattanooga	7	0	24	31	23%	0%	77%	Poor	Chattanooga	71	46	57	174	41%	26%	33%	Fair	Chattanooga	78	46	81	205	38%	22%	40%	Fair
Clarksville	10	0	1	11	91%	0%	9%	Exc./Good	Clarksville	26	20	33	79	33%	25%	42%	Fair	Clarksville	36	20	34	90	40%	22%	38%	Fair
Cleveland	4	0	4	8	50%	0%	50%	Fair	Cleveland	12	16	18	46	26%	35%	39%	Fair	Cleveland	16	16	22	54	30%	30%	41%	Fair
Jackson	10	0	1	11	91%	0%	9%	Exc./Good	Jackson	30	5	17	52	58%	10%	33%	Exc./Good	Jackson	40	5	18	63	63%	8%	29%	Exc./Good
Johnson City	15	0	0	15	100%	0%	0%	Exc./Good	Johnson City	64	24	28	116	55%	21%	24%	Exc./Good	Johnson City	79	24	28	131	60%	18%	21%	Exc./Good
Kingsport	21	0	4	25	84%	0%	16%	Exc./Good	Kingsport	53	25	29	107	50%	23%	27%	Exc./Good	Kingsport	74	25	33	132	56%	19%	25%	Exc./Good
Knoxville	18	0	33	51	35%	0%	65%	Fair	Knoxville	28	66	107	201	14%	33%	53%	Poor	Knoxville	46	66	140	252	18%	26%	56%	Fair
Lakeway	2	0	0	2	100%	0%	0%	Exc./Good	Lakeway	43	9	19	71	61%	13%	27%	Exc./Good	Lakeway	45	9	19	73	62%	12%	26%	Exc./Good
Memphis	25	0	32	57	44%	0%	56%	Fair	Memphis	101	71	60	232	44%	31%	26%	Fair	Memphis	126	71	92	289	44%	25%	32%	Fair
Nashville	18	33	129	180	10%	18%	72%	Poor	Nashville	506	106	493	1105	46%	10%	45%	Fair	Nashville	524	139	622	1285	41%	11%	48%	Fair
Davidson	*11*	*5*	*74*	*90*	*12%*	*6%*	*82%*	Poor	*Davidson*	*58*	*39*	*178*	*275*	*21%*	*14%*	*65%*	Poor	*Davidson*	69	44	252	365	*19%*	*12%*	*69%*	Poor
Rutherford	*5*	*19*	*9*	*33*	*15%*	*58%*	*27%*	Fair	*Rutherford*	*113*	*32*	*80*	*225*	*50%*	*14%*	*36%*	Fair	*Rutherford*	118	51	89	258	*46%*	*20%*	*34%*	Fair
Sumner	*0*	*5*	*1*	*6*	*0%*	*83%*	*17%*	Fair	*Sumner*	*118*	*13*	*90*	*221*	*53%*	*6%*	*41%*	Fair	*Sumner*	118	18	91	227	*52%*	*8%*	*40%*	Fair
Williamson	*1*	*2*	*21*	*24*	*4%*	*8%*	*88%*	Poor	*Williamson*	*103*	*11*	*96*	*210*	*49%*	*5%*	*46%*	Fair	*Williamson*	104	13	117	234	*44%*	*6%*	*50%*	Fair
Wilson	*1*	*2*	*24*	*27*	*4%*	*7%*	*89%*	Poor	*Wilson*	*97*	*3*	*49*	*149*	*65%*	*2%*	*33%*	Exc./Good	*Wilson*	98	5	73	176	*56%*	*3%*	*41%*	Fair
Springfield	*0*	*0*	*0*	*0*	*0%*	*0%*	*0%*	*N/A*	*Springfield*	*17*	*8*	*0*	*25*	*68%*	*32%*	*0%*	Exc./Good	*Springfield*	17	8	0	25	*68%*	*32%*	*0%*	Exc./Good
Total	***137***	***33***	***228***	***398***	**34%**	**8%**	**57%**	Fair	**Total**	***980***	***396***	***880***	***2256***	**43%**	**18%**	**39%**	Fair	**Total**	***1117***	***429***	***1108***	***2654***	**42%**	**16%**	**42%**	Fair

Notes: Source: TDOT TRIMS 2003 data within MPO urbanized areas (2003 traffic on existing network).
Weighted average rating is a weighted combination of the midpoint v/c ratio for each category, expressed as LOS category.
Color shadings in cells reflect dominant percentages (30% or more).
Mileages are rounded for simplicity in presentation.

Table 3-7. Traffic Service Summary for Urbanized Areas (2030)

INTERSTATE ROUTES ONLY									STATE ROUTES ONLY									TOTAL (Both Interstate and State Routes)								
	Centerline Mileage by LOS				% Centerline Mileage by LOS			Weighted		Centerline Mileage by LOS				% Centerline Mileage by LOS			Weighted		Centerline Mileage by LOS				% Centerline Mileage by LOS			Weighted
	A,B & C	D	E & F	Total	A,B & C	D	E & F	Average		A,B & C	D	E & F	Total	A,B & C	D	E & F	Average		A,B & C	D	E & F	Total	A,B & C	D	E & F	Average
MPO	Exc./Good	Fair	Poor		Exc./Good	Fair	Poor	Rating	MPO	Exc./Good	Fair	Poor		Exc./Good	Fair	Poor	Rating	MPO	Exc./Good	Fair	Poor		Exc./Good	Fair	Poor	Rating
Bristol	0	1	6	7	0%	14%	86%	Poor	Bristol	27	15	31	73	37%	21%	42%	Fair	Bristol	27	16	37	80	34%	20%	46%	Fair
Chattanooga	0	0	31	31	0%	0%	100%	Poor	Chattanooga	37	27	110	174	21%	16%	63%	Poor	Chattanooga	37	27	141	205	18%	13%	69%	Poor
Clarksville	0	0	11	11	0%	0%	100%	Poor	Clarksville	12	3	64	79	15%	4%	81%	Poor	Clarksville	12	3	75	90	13%	3%	83%	Poor
Cleveland	0	0	8	8	0%	0%	100%	Poor	Cleveland	15	2	29	46	33%	4%	63%	Fair	Cleveland	15	2	37	54	28%	4%	69%	Fair
Jackson	0	2	9	11	0%	18%	82%	Poor	Jackson	21	6	25	52	40%	12%	48%	Fair	Jackson	21	8	34	63	33%	13%	54%	Fair
Johnson City	1	3	11	15	7%	20%	73%	Poor	Johnson City	33	22	61	116	28%	19%	53%	Fair	Johnson City	34	25	72	131	26%	19%	55%	Fair
Kingsport	0	0	25	25	0%	0%	100%	Poor	Kingsport	35	16	56	107	33%	15%	52%	Fair	Kingsport	35	16	81	132	27%	12%	61%	Fair
Knoxville	0	2	49	51	0%	4%	96%	Poor	Knoxville	17	7	177	201	8%	3%	88%	Poor	Knoxville	17	9	226	252	7%	4%	90%	Poor
Lakeway	0	2	0	2	0%	100%	0%	Fair	Lakeway	29	12	30	71	41%	17%	42%	Fair	Lakeway	29	14	30	73	40%	19%	41%	Fair
Memphis	0	8	49	57	0%	14%	86%	Poor	Memphis	73	31	128	232	31%	13%	55%	Fair	Memphis	73	39	177	289	25%	13%	61%	Fair
Nashville	1	0	179	180	1%	0%	99%	Poor	Nashville	263	107	735	1105	24%	10%	67%	Poor	Nashville	264	107	914	1285	21%	8%	71%	Poor
Davidson	*0*	*0*	*90*	*90*	*0%*	*0%*	*100%*	Poor	*Davidson*	*19*	*8*	*248*	*275*	*7%*	*3%*	*90%*	Poor	*Davidson*	19	8	338	365	*5%*	*2%*	*93%*	Poor
Rutherford	*0*	*0*	*33*	*33*	*0%*	*0%*	*100%*	Poor	*Rutherford*	*84*	*18*	*123*	*225*	*37%*	*8%*	*55%*	Fair	*Rutherford*	84	18	156	258	*33%*	*7%*	*60%*	Fair
Sumner	*0*	*0*	*6*	*6*	*0%*	*0%*	*100%*	Poor	*Sumner*	*51*	*32*	*138*	*221*	*23%*	*14%*	*62%*	Fair	*Sumner*	51	32	144	227	*22%*	*14%*	*63%*	Poor
Williamson	*0*	*0*	*24*	*24*	*0%*	*0%*	*100%*	Poor	*Williamson*	*49*	*33*	*128*	*210*	*23%*	*16%*	*61%*	Fair	*Williamson*	49	33	152	234	*21%*	*14%*	*65%*	Poor
Wilson	*1*	*0*	*26*	*27*	*4%*	*0%*	*96%*	Poor	*Wilson*	*46*	*14*	*89*	*149*	*31%*	*9%*	*60%*	Fair	*Wilson*	47	14	115	176	*27%*	*8%*	*65%*	Fair
Springfield	*0*	*0*	*0*	*0*	*0%*	*0%*	*0%*	*N/A*	*Springfield*	*14*	*2*	*9*	*25*	*56%*	*8%*	*36%*	Exc./Good	*Springfield*	14	2	9	25	*56%*	*8%*	*36%*	Exc./Good
Total	***2***	***18***	***378***	***398***	**1%**	**5%**	**95%**	Poor	**Total**	***562***	***248***	***1446***	***2256***	**25%**	**11%**	**64%**	Fair	**Total**	***564***	***266***	***1824***	***2654***	**21%**	**10%**	**69%**	Poor

Notes: Source: TDOT TRIMS 2030 data within MPO urbanized areas (2030 traffic on existing network).
Weighted average rating is a weighted combination of the midpoint v/c ratio for each category, expressed as LOS category.
Color shadings in cells reflect dominant percentages (30% or more).
Mileages are rounded for simplicity in presentation.

Tables 3-6 and 3-7 help to quantify the extent of network deficiencies without further network improvements. Key observations from these summaries are described below.

- In rural and small urban areas for 2003, the overall traffic service conditions are good to excellent, depending upon the road type, with an overall rating of good for the state roads in the rural and small urban areas, with 6 percent of the system in the poor category, and 13 percent in the fair category. Using the rule that unsatisfactory LOS includes all segments with LOS E or F and rural and small urban area freeways with LOS D, then 8.2 percent of the rural and small urban area network has unsatisfactory LOS in 2003.
- In rural and small urban areas for 2030, overall traffic service conditions are still good to excellent, depending upon the road type; an overall rating of good is retained for state roads in rural and small urban areas, but with 27.1 percent of the system in the poor category, and 16.7 percent in the fair category. However, there is a significant degradation in the LOS, particularly for the interstate segments, where 67 percent are rated poor and another 17 percent are rated fair. Using the rule that unsatisfactory LOS includes all segments with LOS E or F and rural and small urban area freeways with LOS D, then 28.7 percent of the rural and small urban area network has unsatisfactory LOS in 2030.
- In the urban areas for 2003, the overall traffic service conditions range from excellent to poor, depending upon the location and type, with an overall rating of fair for the state roads in the urban areas, with 42 percent of the system in the poor category, and 16 percent in the fair category.
- In the urban areas for 2030, overall traffic service conditions are skewed toward the congested end of the scale; an overall rating of poor results for state roads in urban areas, with 69 percent of the system in the poor category, and 10 percent in the fair category. However, there is a significant degradation in the LOS, particularly for the interstate segments, where 95 percent are rated poor and another 5 percent are rated fair.

These summaries demonstrate that much of the reserve capacity of the Tennessee road system has been consumed over the last two decades and that physical capacity expansion will be required in the years to come, particularly for interstate highway segments, the workhorse of the state highway system, in both rural and urban areas.

3.3 Other Supporting Analyses

Three additional technical analyses were conducted as part of the study scope; they are reported here as they relate to some technical planning considerations for statewide travel demand planning, the loads consequently placed onto the highway system (capacity), the potential interplay between highway and railroad modes to shift longer-distance travel demand for passenger and freight movements from highways, and planning and project activities in the states surrounding Tennessee. The three additional analyses are summarized below.

3.3.1 Market Analysis of Intercity Passenger Rail Trips

Preparation of the LRTP included developing a statewide synthetic model that provides a sophisticated tool for planners in assessing future travel demands on the state network outside of urban areas. One application of the resulting traffic assignments as derived from the model trip table is an assessment of intercity passenger vehicle trips as related to the potential for intercity

passenger rail service. The topic is of interest from the standpoint of developing multimodal corridors that would offer travel choices, increase redundancy in travel options, and extend the capacity of existing highways.

Diversion from highway travel to passenger rail is a higher-order travel planning exercise given usually limited rail itineraries, out-of-pocket fare cost, the number of travelers in a group, fixed beginning and end points for the rail service, ultimate traveler origins and destinations, competing modes, and other factors. Intercity passenger rail is not a dynamic market in today's environment, given the funding issues related to Amtrak, the national rail service. There are a few state-supported intercity passenger rail services, such as those offered in North Carolina and in the northeast. Often, long-distance commuter rail services focused on large metropolitan area downtowns take on an intercity flavor when the service corridors become longer, connecting to smaller cities and often crossing state lines.

Passenger rail service in Tennessee currently exists only in the form of Amtrak service through the state in the corridor paralleling the Mississippi River, although commuter rail service is a long-range urban mobility strategy in Nashville, and the first corridor is in the deployment phase. The Tennessee Rail System Plan developed a few years ago did consider the potential for intercity rail passenger service, and provided a preliminary assessment of several corridors, including a review of the capital investments and operating costs (stations, trackage and control improvements, rolling stock) that would be needed to implement service. This analysis recognized that track infrastructure upgrades would be needed, and presumed that many of these would first occur to the benefit of freight rail movements. It is noted that railroads are basically freight-oriented facilities and passenger service itineraries are often subject to the scheduling requirements of freight train operations.

The Tennessee Rail System Plan screened potential corridors lying entirely or partially within the state. The screening process yielded four promising corridors: Chattanooga-Louisville, Memphis-Nashville, Nashville-Bristol, and Chattanooga-Bristol. For these corridors, the plan estimated potential ridership on the service corridor, using the comparable corridor methodology wherein ridership levels on other passenger rail corridors around the country with reasonably similar characteristics are reviewed, compared, and adjusted based on factors such as population centers served, service frequency, service speed, and connectivity to other rail services to yield estimates for the subject four promising corridors. For each corridor, estimates were developed for intrastate ridership (passengers using the service within the state, and interstate ridership (passengers using the service for extended trips beyond the intrastate service).

As part of the LRTP process, a limited assessment of the intercity passenger vehicle traffic assignments was performed to help gauge the potential for ridership, at least on a longer-term basis. To accomplish this, synthetic model traffic assignments for 2003 and 2030 for the interstate highway corridors connecting the state's major urban areas were reviewed. The roadway segments between the city pairs were reviewed for a representative number of average daily passenger vehicles in each intercity corridor, focusing on the lower-volume segments as an indicator of the true intercity movements unaffected by urban commuter traffic, as this provides a ceiling for the potential market. Based on the length of the corridors considered, diversion of traffic on parallel lower class state highways was not considered necessary. Applying a representative vehicle occupancy rate of 1.5 persons per vehicle provides an estimate of the maximum number of longer-distance daily person movements in a given corridor.

The next step in the review was to calculate an approximate market capture percentage based on the ratio of the projected rail passenger corridor ridership per the rail plan to the estimated longer-distance person-trips by passenger car. This is a somewhat simplistic approach that does not explicitly consider the range of travel decision factors in a mode choice model, or that trips might travel the entire length of the service corridor; it is what was contemplated in this exercise and does provide a relative indication of the ridership potential in corridors based on the travel demand in that corridor. Even under the more optimal conditions of an urban commuter rail corridor with its more frequent service and more compact traveler origin-destination patterns, capture rates are most often in the single-digit percentages. For intercity rail service, representative capture rates are estimated to range from 3 percent to lower fractional percentages in the range of 0.5 percent. Table 3-8 summarizes the results of this calculation to the four most promising intercity passenger corridors per the rail plan. Table 3-8 shows that the existing capture rates using this procedure yield total corridor person-trip capture rates (both intrastate and interstate trips) in the vicinity of 1 percent of total person trips.

Table 3-8. Rail Passenger Capture Analysis

Analysis Component	Most Promising Passenger Rail Diversion Corridors			
Most Promising Passenger Rail Corridor	Chattanooga-Louisville	Memphis-Nashville	Nashville-Bristol	Chattanooga-Bristol
Annual Rail Passengers - Intrastate Component	53,200	39,300	37,500	22,900
Annual Rail Passengers - Interstate Component	102,200	75,500	97,200	59,300
Annual Rail Passengers - Total	155,400	114,800	134,700	82,200
Corresponding Interstate Highway Corridor	I-24 and I-65	I-40	I-40 and I-81	I-75, I-40 and I-81
Representative Daily Non-truck Traffic Volume (2003)	24,000	20,000	20,000	20,000
Representative Daily Non-truck Traffic Volume (2030)	32,000	25,000	24,000	24,000
Representative Annual Non-truck Traffic Volume (2003)	8,640,000	7,200,000	7,200,000	7,200,000
Representative Annual Non-truck Traffic Volume (2030)	11,520,000	9,000,000	8,640,000	8,640,000
Annual Highway Person-Trips (2003) *]	12,960,000	10,800,000	10,800,000	10,800,000
Annual Highway Person-Trips (2030)*	17,280,000	13,500,000	12,960,000	12,960,000
Intrastate Rail Passenger Ridership as % of 2003 Highway Person Trips	0.41	0.36	0.35	0.21
Interstate Rail Passenger Ridership as % of 2003 Highway Person Trips	0.79	0.70	0.90	0.55
Total Rail Passenger Ridership as % of 2003 Highway Person Trips	1.20	1.06	1.25	0.76

Sources: Tennessee Rail System Plan (2002), Task 4 Report (STV, Inc.); Synthetic Model Output (PBS&J)
* Vehicle occupancy assumed at 1.5 persons per vehicle.

In addition to providing mobility choices and some redundancy in travel options, rail passenger service could potentially help reduce the need for roadway capacity. To defer construction of a roadway lane addition project, it would be necessary to divert a number of person-trips from passenger vehicles to passenger rail service sufficient to drop the remaining number of vehicular trips below the lane addition threshold; this would obviously vary by individual corridor. Alternatively, diversion of a significant number of person-trips could delay the need to widen by a certain number of years, depending on the diversion and the traffic growth rate.

3.3.2 Freight Rail Corridor Analysis

One of the leading issues confronting TDOT is diminishing highway capacity, resulting in part because of the proliferation of large trucks using its major highway system, particularly the interstate system, in recent years. The model development team conducted a Freight Diversion Study using the synthetic network model and Transearch 2001 Commodity Flow database provided by Reebie Associates to assist in evaluating strategies that could be used to assess the potential for diversion of truck trips to the railroad mode. The model was designed to investigate operational impacts on the highway system that could be expected as a result of cargo diversions from truck to rail if significant investments were made to improve the state's rail system. The study methodology, findings, and a map showing TransCAD's transportation planning capabilities are presented below.

The scope of the analysis included the study of two interstate highway corridors to determine how much future year commodity flow would divert to rail, assuming rail service was improved in each. The premise underscoring rail system investments was that they would lead to cargo movement diversions from truck to rail and consequently reduce congestion on the interstate highway system.

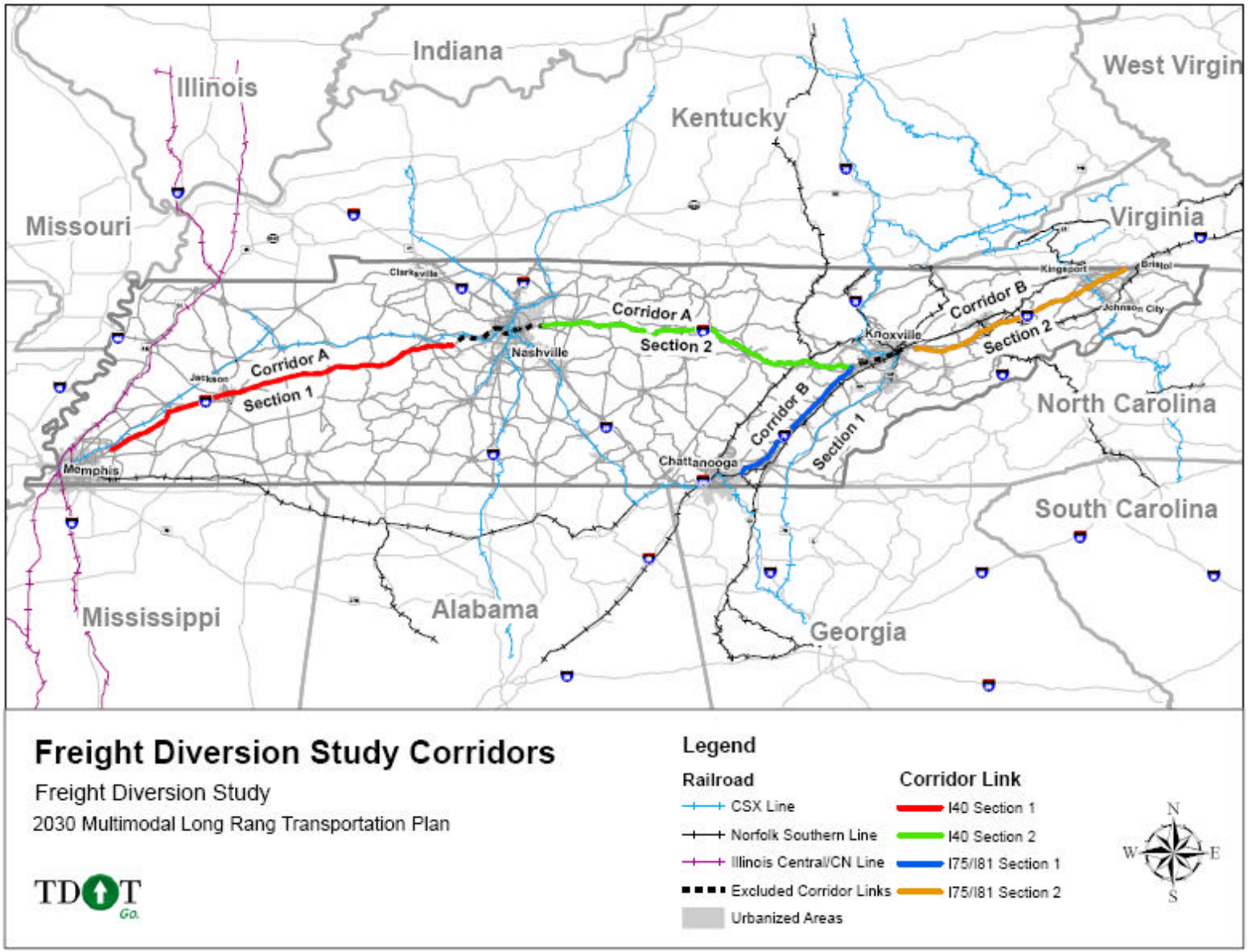
The two interstate corridors that were designated for the study and the methodology employed to conduct the analyses are described below.

3.3.2.1 Corridor Selection

I-40 between Memphis and Knoxville, the first corridor selected, is labeled Corridor A on Figure 3-4. It was chosen because it includes the proposed East-West Rail Line improvement project, which would resurrect service on an abandoned rail line between Algood and Oliver Springs, through the Cumberland Mountains. Also, there is a perception by some individuals that operating conditions are rapidly deteriorating on I-40, especially between Memphis and Nashville, because of an influx of large trucks.

I-75/I-40/I-81 between Chattanooga and Bristol, the second corridor selected, is labeled Corridor B on Figure 3-4. This corridor was selected based on: (a) linkage to transportation improvements that the State of Virginia has proposed for the entire length of I-81 within its borders; (b) a relatively high volume of trucks and freight in the corridor; and (c) existing congestion or near-congested congestions on rural sections of I-75 between Chattanooga and Knoxville.

Figure 3-4. Freight Diversion Study Corridors



3.3.2.2 Future Interstate System Service Levels

The objective of this task is to identify the future year that each study corridor becomes capacity deficient and how severe or widespread those deficiencies will be by 2030, assuming the perpetuation of existing truck and rail mode splits. A follow-up step in this task was to obtain estimates for the level of truck reduction that would be needed to measurably improve operating conditions in each corridor. The synthetic model was used to estimate the relative contribution of trucks in computing section-level v/c ratios in each of the corridors. Conduct of this step consisted of the following activities/assumptions:

- Establishing appropriate beginning and endpoints for operational analyses (v/c ratios) in each corridor
- Defining segmentation in each corridor
- Defining v/c thresholds indicating an unsatisfactory LOS in an interstate corridor
- Estimating the daily volume of trucks that would need to be removed from the interstate to delay the need to widen the entire facility by 1 year, 5 years, and until 2030
- Performing an order of magnitude cost estimate associated with adding one additional through lane to each Interstate corridor in both directions of travel.

The results of this task are discussed below in the Findings section.

3.3.2.3 Truck-to-Rail Diversion

This task consisted of analyzing commodity flows from the Statewide Freight Model, in origin-destination format, based on the 2001-level freight flows by commodity type provided by Reebie Associates and the 2030 forecast of freight movements by commodity type that were prepared by the freight model development team. The findings of this task included a feasibility assessment of the likelihood of diverting enough freight from truck to rail so that the need to add additional through travel lanes on the interstate would be delayed for 1 year, 5 years, and until 2030. The findings would also included illustrative rail system improvements, based on a qualitative assessment and projects in the Tennessee Rail Systems Plan that would reasonably result in the three levels of freight diversion specified above. Conduct of this portion of the analysis consisted of the following activities/assumptions:

- Performing a select link(s) analysis of commodity flows by commodity type (shipments via truck) on the most congested link in both designated corridors.
- Identifying significant commodity flows by type on the interstate that are likely candidates for diversion to the rail system based on the 2001-level truck versus rail mode splits observed in the I-75 Corridor between Chattanooga and Jellico (on the Kentucky border). Existing mode split percentages were computed for each commodity group subdivided by trip orientation (Table 3-9).
- Converting annual tons of potentially divertible commodity flows into annual and daily truckloads.

- Comparing the amount of potentially divertible truckloads with the reduction sizes needed to postpone adding an additional through-lane on the interstate system for 1 year, 5 years, and until 2030.
- Assimilating the two separate analyses to assess the relative feasibility of diverting a significant amount of freight from truck to rail in each of the designated interstate corridors.

Table 3-9. Freight Model Commodity Groups/Mode Split Trip Orientations

No.	Model Commodity Group	No.	Trip Orientation
1	Petroleum and minerals	1	External-External northbound
2	Food products	2	External-External southbound
3	Chemicals	3	External-Internal northbound
4	Timber and lumber	4	External-Internal southbound
5	Agriculture	5	Internal-External northbound
6	Machinery	6	Internal-External southbound
7	Paper products	7	Internal-Internal
8	Primary metal		
9	Waste products		
10	Manufactured household and other		
11	Miscellaneous and container		

3.3.2.4 Findings

The most pertinent information obtained from the Freight Diversion Study is shown in Table 3-10, by corridor and section. The table contains two columns of estimated daily truck volumes that represent different measurements. In the left column, the "Required Number of Divertible Trucks" is the daily volume needed to preserve available capacity in the corridor for 1-year, 5-year and 10-year periods beginning in future year 2020. Truck volumes displayed in the right column labeled "Maximum Daily Divertible Truck Trips" are the number of daily trucks that could possibly be diverted to rail from the interstate system. Maximum divertible truck volumes are also reported for 1-year, 5-year and 10-year increments, to facilitate comparison with the volume of trucks required to divert in order to preserve capacity.

For Corridor A, Section 1 (I-40 from Memphis to Nashville) the values in Table 3-10 indicate that the maximum divertible volume of commodities from truck to rail could possibly preserve capacity on I-40 in future year 2020 up to 5 years and maybe longer. However, there would clearly not be enough commodity diversion so that interstate capacity would be preserved over a 10-year period. By future year 2030, the required number of truck diversions needed to preserve capacity for 10 years is 7,200 per day, which is far above the 4,700 maximum divertible per day. Divertible truck volume estimates for the other two corridors lead to similar conclusions.

The 5,200 maximum divertible daily trips on the section of I-40/I-81 from Knoxville to Bristol is equivalent to the required volume necessary to preserve capacity for up to 10 years. In a sense, however, this is misleading because the actual amount of freight that could reasonably be diverted from this section in future year 2030 would be less than 5,200 trucks per day.

To interpret these findings in the proper context, other background material in addition to that provided in the methodology description is beneficial. This information is listed below.

- One of the four interstate corridor sections highlighted in Figure 3-4 was dismissed from the diversion analysis. Corridor B, Section 1 (I-75/I-40/I-81 from Chattanooga to Knoxville) is already the recipient of a high level of rail service. CSX and Norfolk Southern operate mainlines, spurs, and switching yards through and within the corridor. As such, it was considered pointless to apply existing I-75 Corridor mode splits to estimate the amount of freight that could be diverted from truck to rail, assuming rail service were significantly improved in the corridor.
- A section of the interstate system was considered capacity deficient when more than 50 percent of its total centerline miles became capacity deficient. Capacity deficient network links, for this application, were defined by area type as follows: (1) v/c ratio > 0.90 in rural areas, and (2) v/c ratio > 1.0 in small urban areas. Based on this definition, the three sections of interstate were not considered capacity deficient until future year 2020. In practice, TDOT attempts to alleviate capacity deficiencies well in advance of what could be implied by this analysis.

Table 3-10. Estimated Reduction of Trucks Required to Preserve Available Capacity and Estimated Maximum Freight Diversion from Truck to Rail

Corridor A (I-40)					
	Duration of Capacity Preservation				
Section	No. of Years	Model Forecast Year	Required No. of Divertible Trucks	Maximum Daily Divertible Truck Trips	Maximum Divertible >= Required Reduction ?
1. Memphis to Nashville	1	2020 to 2021	100	3,800	Yes
	5	2020 to 2025	1,500	4,200	Yes
	10	2020 to 2030	7,200	4,700	No
2. Nashville to Knoxville	1	2020 to 2021	200	3,200	Yes
	5	2020 to 2025	1,200	3,600	Yes
	10	2020 to 2030	6,000	4,700	No
Corridor B (I-75/I-40/I-81)					
	Duration of Capacity Preservation				
Section	No. of Years	Model Forecast Year	Required No. of Divertible Trucks	Maximum Daily Divertible Truck Trips	Maximum Divertible >= Required Reduction ?
2. Knoxville to Bristol	1	2020 to 2021	100	4,400	Yes
	5	2020 to 2025	1,100	4,800	Yes
	10	2020 to 2030	5,200	5,200	Yes

- The commodity groups responsible for producing the largest mode shifts in each corridor were construction and mining, chemicals, machinery, and agriculture. Of these, commodity flows of construction and mining materials produced the highest volume of diversions by far.
- An order of magnitude estimate to add one through-lane to Corridor A in both directions of travel was $2.5 billion. For an additional through-lane in both directions of travel on Sections 1 and 2 of Corridor B, the cost estimate was $1.6 billion.
- The cost for rail improvements necessary to trigger the diversions shown in Table 3-10 was not done as part of this investigation. However, some cost estimation was done in the 2003 Rail System Plan for the East-West Rail Line Improvement. The proposed connection between Oliver Springs and Algood was estimated to have a current capital cost of approximately $118 million.

Because most freight currently shipped by truck, which is divertible to rail, either begins or has a destination outside Tennessee, no foreseeable rail improvements could be implemented on facilities inside Tennessee to produce enough commodity diversion to significantly improve operating conditions on the interstate system. If comprehensive national, regional, or multi-state rail system initiatives became available in the future, rail network improvements inside Tennessee may become more effective in terms of diverting goods from truck to rail. Even if this occurred, the Freight Diversion Study indicates that resulting freight diversions would likely preserve interstate system capacity for somewhere between 1 to 5 years.

3.3.3 Surrounding States Initiatives

Tennessee, centrally positioned in the eastern United States, is bordered by eight states. While the common borders vary in length, transportation planning and transportation system utilization interests span from Tennessee to each of its surrounding neighbors. Recognizing this significant condition, a surrounding states survey was conducted to assess the status of projects and planning that were noteworthy in relation to the transportation network in Tennessee. This survey was distributed to state planning officials in each state as well as to border MPOs and to the Fort Campbell military installation. The survey addressed topics including current, pending, and planned projects relating to highways, transit, ITS and 511 services, public transportation, bicycle facilities, railroads, and waterways. The survey also asked about toll road and public/private partnership projects. There was a complete response from all those contacted.

The surrounding states survey responses are in Appendix A. Highlights of the responses are shown below.

- Kentucky: The state is doing planning for the I-69 corridor and is currently preparing to use Grant Anticipation Revenue Vehicle (GARVEE) bonds to complete the widening of I-65 and I-75 to six lanes from border to border. A private party is looking into a private port with shortline connector that would service both Tennessee and Kentucky. The state has several designated bicycle routes interfacing with Tennessee.
- Virginia: The state is widening I-81 from Bristol to six lanes. Virginia is studying dedicated truck lanes and ways to divert some freight to rail. The TransDominion Corridor Study is being conducted to study passenger rail that runs from Bristol to Lynchburg to Richmond.
- North Carolina: The state has projects on I-26 from Asheville to the Tennessee border, on I-40 from Asheville to Knoxville, and on US 64/US 321 connects Bristol, Tennessee, to Hickory, North Carolina.
- Georgia: The state is studying a high-speed rail ground transportation corridor from Atlanta to Chattanooga. A Memorandum of Understanding of all stakeholders is being developed. TDOT will be included in the memorandum and the planning of this corridor. Public-private partnerships will be explored.
- Alabama: The state is doing advance planning for I-22, which would run from Memphis to Birmingham.
- Mississippi: The state is planning for the I-69 corridor, which involves a new Mississippi River crossing at Benoit, and widening I-55 south of Memphis.

- Arkansas: The state is investigating a third river crossing in the Memphis area (south of the existing crossings) to connect to either Mississippi or Tennessee off of I-55 and potentially connect to I-69, and is considering multimodal corridor features. A toll bridge from Osceola to Millington, Tennessee, is being considered.
- Missouri: The state is completing widening of two roads connecting to I-55 west of the Mississippi, and is a participant in the Midwest Regional Rail Initiative.
- Fort Campbell: Fort Campbell recently added a 13-acre rail spur and rail yard and is considering doubling the size of the rail yard. The base houses the 101st Airborne Division, the only U.S. air assault force.
- All states are exploring ITS improvements which may require varying degrees of coordination between Tennessee and the other states.
- There are several fronts where coordination on bicycle, railroad, and water facilities would assist in integrating various "hub and spoke" facilities into the affected states networks.

These surrounding state projects and initiatives have been considered in various aspects of this study, and the inventory provides a database for ongoing coordination by TDOT on the priority projects and corridors.

Chapter 4

Summary of Modal and Support Element Needs

This chapter recaps the process through which estimates of future transportation needs of the state were formulated. As noted, six basic transportation modes and two support elements were examined.

A modal need is a project, program, or funding commitment for a given mode that is needed to provide for an expected transportation function, performance level, or quality of service. Modal needs are interpretations by planners and engineers of those investments in transportation facilities and services that are appropriate in addressing the goals and objectives established for Tennessee's transportation system. While these needs are developed mode by mode, the development of multimodal corridors providing for improved mobility choices and "intermodal nodes" (or hubs) providing for convenient interconnection or transfers between modes, for both passenger and freight movements, are recognized as integral parts of the process to define the best transportation solution for a given transportation need.

Modal needs were estimated regardless of what entity owns, manages, and finances the modal facilities and services across the state. Needs estimates were developed for the six basic modes (highways, public transportation, bicycle/pedestrian, railroads, waterways, and aviation) and for two important support elements that can enhance efficiency and flexibility in the use of the other modes: ITS and TDM. The needs estimates included costs for new or improved facilities for all the modes and support elements (except for the county and municipal road systems, which are traditionally overseen by local governments), and the operating costs for highways, public transportation, and ITS. Operating costs for railroads, aviation, and waterways have traditionally been the responsibility of the operators–local government, federal government, and the private sector.

Modal needs were also assigned to one of three basic investment categories:

- Maintenance/Preservation. Actions that address operations of existing infrastructure and services, or that maintain or preserve the condition of existing built facilities.
- Safety/Modernization. Actions that improve existing infrastructure without increasing capacity, including reconstruction, replacement, widening without capacity addition (e.g., roadway shoulder widening, bridge widening for shoulder, safety improvement, or eliminating deficiencies from standards).
- Expansion/Enhancement. Actions that add capacity or are a significant betterment to the functionality of a facility (e.g., additional travel lanes, interchange reconstruction or additional ramps, transit service coverage or frequency expansion, new road or transit corridor, or shortline railroad load capacity upgrade).

4.1 Modal Needs Estimation Procedures

The modal needs estimation process requires formulating costs representing investments needed in mode infrastructure for both initial capital costs of building the facilities, specific maintenance

costs, and, in some cases, the operational costs of providing services. Also, the costs of providing certain technical planning and mode development activities may be required along with the costs of TDOT funding participation to financially support selected mode activities at the local level. The basic steps described below were undertaken to develop estimates of future modal needs (to incorporate the preceding range of cost components) as appropriate.

1. Identify Investment Categories
   Based on a review of existing TDOT budget categories and the formulation of the investment framework into three main investment categories: maintenance/preservation, safety/ modernization, and expansion/enhancement, the appropriate modal investment categories were defined.

2. Define Investment Needs by Investment Category
   Modal needs were developed for each investment category identified in Step 1 from a variety of sources. For many of the categories, modal plans provided a foundation of the needs. In these instances, the modal investment needs from the mode plan were distributed to the various investment categories and summarized if necessary. In a few instances, modal needs from plans were augmented or some mode specific needs assessments were performed to develop the needs basis.

3. Estimate Basic Investment Costs (2005)
   Basic investment costs are defined as the capital costs in 2005 dollars to implement a project in terms of its construction costs or operating costs.

   The basic investment costs were extracted from updates to modal plans and from other specific needs assessments and calculations. There were a few investment categories for which estimates were not available or for which more conventional cost estimating procedures were not applicable; these categories were small in magnitude. In these cases, existing TDOT investment levels were reviewed and adjusted by category-specific adjustments to generate a reasonable estimate of the financial commitment involved. A basic example would be grant programs administered by TDOT for several local highway improvement programs.

   For any basic costs derived from information sourced prior to 2005, the basic cost was escalated to 2005 by an inflation rate of 4 percent per year. All future year costs that were taken from modal plans, internal TDOT technical needs assessments or other estimates were all in base year (2005) dollars or were adjusted to that base; no inflated future year costs were encountered.

4. Adjust Basic Investment Costs
   Basic investment costs were further adjusted for several factors. For those costs that did not include engineering/construction inspection costs, an allowance of 12 percent was made for these design/construction oversight costs. Another adjustment was the allocation of TDOT administrative costs across all of the investment costs, rather than carrying these costs as an individual line item. These costs were allocated on a percentage basis at a rate of 9 percent, based on current TDOT administrative costs.

Finally, all adjusted basic investment costs as noted were developed for the base year 2005. For consistency with the financial analysis component of the study that examined future TDOT revenue streams, the future year costs of the modal needs were adjusted for the time value of money; that is, the reduced buying power of today's dollar on a future year basis. Because the change in revenue over time reflected a 3 percent escalation factor that yielded a relatively flat growth curve, it was assumed that project implementation would occur on an approximately linear basis over time of the base year cost. With this assumption, a composite investment cost adjustment factor for the continuum of transportation spending over the next 25 years could be derived, based on standard economic analysis reference tables. The conversion of the base year investment costs to reflect the spending of funds over the next 25 years with a change in the future year cost is referred to in this study as YOE cost. The YOE adjustment factor that was applied to the base year modal needs investment costs was 1.50. Consequently, the cost of modal needs and the investment levels considered in the various transportation investment scenarios were all expressed in YOE dollars.

4.2 Highways

The highways mode includes the state highway system, both the roadways and bridges. TDOT also oversees other roadways in state-owned parks and other properties. Also under the highway mode are grant programs to local governments for county and municipal roadway projects.

4.2.1 Issues and Considerations

Highway system needs include these basic categories: regular maintenance and preservation (e.g., patching, painting, and resurfacing), safety and modernization (e.g., intersection improvement), and expansion (e.g., new routes or added lane miles).

Given the size of the system, a basic financial commitment is needed for maintenance and preservation of built facilities. The aging of the system, safety issues, and changing design policies and standards also require replacement of road segments and bridges. Finally, new demands on the system give rise to consideration of new road links or added lanes to existing facilities.

Principal needs for the highway mode are summarized below.

- For system expansion, the need for future roads is dependent on traffic growth and congestion patterns, funding availability, and public policy on the application of multimodal transportation solutions and trip reduction strategies in certain corridors, particularly in urbanized areas.
- Regular maintenance includes routine management of the right-of-way, such as mowing, winter road conditioning and snow removal, sign replacement and other regular expenses. Projections of these basic costs are $13.3 billion over the 25-year planning period.
- The aging of structures will require replacing older bridges that have reached their useful service life. Additional structures will deteriorate during the planning period. Bridge needs total $6.8 billion, of which $2.0 billion are current or backlog needs. In addition, there is another $5.37 billion in needs that are functionally obsolete; that is, deficient not because of

the structural condition but because the lane width, shoulder width, vertical clearance, or some other key feature that is substandard geometrically under current design standards.

- Segments of certain main highway corridors, especially interstate highways, will require capacity improvements due to increases in urban area traffic or through traffic including significant truck volumes on some segments. Potential priorities include interstate segments near Memphis, Nashville, Chattanooga, and Knoxville as well as intercity segments such as Chattanooga to Knoxville, Memphis to Nashville, and Knoxville to the Virginia state line. Other key state highways will experience similar effects.
- For the "county seat/four-lane road" program, connectors are in place to 54 counties, while activities are in various stages on another 41. Some roadway segments would be justified based on future capacity deficiencies, while others would not. The estimated total remaining cost for the segments that are not capacity-deficient is $3.4 billion YOE.

4.2.2 2030 Modal Needs

State highway system needs were determined using the TDOT roadway inventory and analysis software to evaluate deficiencies (both capacity and geometrics) and apply unit costs for each selected improvement to address the deficiency. The EVE program compares the existing conditions of each homogeneous section of the state highway system to minimum standards for the route's functional classification and traffic volume range to determine where capacity deficiencies currently exist or will occur in the future. The program computes a cost for each improvement type to arrive at an overall cost to correct the system deficiencies. The program also compares existing geometrics with minimum standards to identify where geometric deficiencies occur.

The EVE program was used to assess modal needs because it is capable of addressing needs for both capacity and geometric deficiencies and translating those into estimated improvements costs; it is also the historical tool that has been used to evaluate highways systems needs. Based on the approach defined for this project, the synthetic travel demand model focused on the rural and small urban coverage of the TDOT highway network, and did not specifically include the low-volume portion of the rural network accounting for about 25 percent of total system mileage, but less than 10 percent of vehicle miles of travel. In the future the capacity-deficient link table output from the synthetic travel demand model output could be interfaced with the EVE program capacity deficiency module to generate the cost of corresponding remedial road capacity improvements.

Roadway capacity needs were based on those roadway segments, both rural and urban, on the state highway system that would fall below an acceptable traffic LOS before 2025. For this study, the minimum acceptable LOS is D for rural interstate segments and E for all other state highway segments.

Bridge needs were determined using the FHWA Structural Inventory and Appraisal Analysis procedures. Bridges with a sufficiency rating of 80 or below were assumed to need replacing or major rehabilitation work.

System preservation needs were determined based on statewide data from the Pavement Management System and historical data for the pavement life expectancy for each highway type. The interstate highway system has an average pavement life expectancy of 10 years, while the remainder of the state highway system has an average pavement life expectancy of 12 years. Using this data, it was determined that approximately 485 lane miles of interstate highways will need to be resurfaced annually, and approximately 2,537 lane miles of the remaining system will require resurfacing annually.

Roadway maintenance needs include such items as drainage, traffic signs and other traffic control devices/features, pavement patching, mowing, and litter pick up to keep the highways aesthetically pleasing and safe for the motoring public. Maintenance needs were determined based on a per lane-mile cost from maintenance records and historical data and projected through the 25-year planning horizon.

The estimate of highway needs includes the costs for a list of currently committed projects with adequate needs justification and whose development and implementation are sufficiently advanced such that they will be completed. Because the 25-year revenue forecast for TDOT includes revenues accruing beginning next fiscal year, and a share of the near-term highway funds will be used to complete implementation of this set of committed projects, the modal needs estimate for highways includes these projects.

Table 4-1 summarizes the 25-year estimate of highway modal needs.

Table 4-1. Modal Needs Estimate, Highways

Major Investment Category	Investment Category	Modal Needs Estimate ($M YOE)
Maintenance/ Preservation	Highway - State/Local System Bridge Repair/ Replacement (Structurally Deficient)	6,720.0
	Highway - State System Resurfacing/ Routine Maintenance	13,390.0
	Subtotal	20,110.0
Safety/ Modernization	Highway - State System Bridge Repair/ Replacement (Functionally Obsolete)	5,370.0
	Highway State System - Safety and Geometric Improvements	11,990.0
	Highway - Local System Modernization	4,150.0
	Subtotal	21,510.0
Expansion/Enhancement	Highway - Rural Widening (Interstate, state)	14,550.0
	Highway - Urban Widening (Interstate, state)	27,020.0
	Highway - Local System Expansion	2,620.0
	Highway - County Seat Connectors (Non-capacity deficient segments)	3,400.0
	Subtotal	47,590.0
	Total	89,210.0

4.3 Public Transportation

The public transportation mode consists of the networks of public transportation services operated across the state in urban and rural services areas, relying of a variety of vehicle and facilities, spanning service types such as light rail, conventional bus transit on fixed routes, and demand-responsive service using small tram vehicles. TDOT does not have an ownership role in these services which are managed by a variety of county, municipal, regional and social service agencies, but does have a significant role in providing capital and operating financial assistance as well as channeling Federal Transit Administration grant monies to various service providers.

4.3.1 Issues and Considerations

The recently completed Tennessee Transit 2025 Plan proposed goals to triple urban transit ridership and to more than double rural ridership. Highlights of the public transportation needs to support and achieve this goal are described below.

- The plan would require a gradual increase in the state transit investment to a level 50 percent greater than existing.
- Forecasts for capital costs include allowances for proposed rail systems in Memphis and Nashville, bus rapid transit in the Sevierville corridor, new transit systems in emerging transit markets, and general expansion of conventional transit services in all urban and rural service areas.
- The Memphis Area Transit Authority's long-range plan includes light rail in three regional corridors, and an Alternatives Analysis study is underway for the top priority corridor (Downtown-Airport line). A 7-mile downtown rail trolley system is in operation.
- The Regional Transit Authority in Nashville is developing commuter rail service extending eastward from downtown into Wilson County, and, in concert with the Metropolitan Transit Authority and the Nashville Area MPO, is studying four other corridors for potential commuter rail service.
- In the Sevierville-Pigeon Forge-Gatlinburg corridor, the feasibility of bus rapid transit service is being explored.
- By 2025, five urban areas in the state are anticipated to be large enough to warrant new transit systems: Murfreesboro, Morristown, Cleveland, Columbia, and Cookeville; service is expected to be implemented before 2025.
- Continued expansion of existing fixed route urban bus systems is expected in Memphis, Nashville, Knoxville, Chattanooga, Clarksville, Jackson, Johnson City, Oak Ridge, Bristol, Kingsport, Pigeon Forge, and Gatlinburg.
- Dial-a-ride services in urban areas as well as rural transit services will experience growth in customer demand.

4.3.2 2030 Modal Needs

The Tennessee Transit 2025 Plan developed estimates of the capital and operating costs needed to attain the proposed ridership levels defined in the plan. For the capital costs, estimates were made for both urban and rural services, existing and proposed, for the fixed route and demand-responsive public transportation services to 2025. The capital costs included periodic replacement of rolling stock, new vehicles for service expansion, and other incidental capital costs. Using information in the report, these capital costs were extrapolated 5 years to 2030 to provide a 25-year estimate. Based on the capital costs for the current level of public transportation services, the capital cost forecasts were apportioned between existing services and service expansion.

For the capital costs of new premium transit services involving light rail guideway transit, commuter rail transit, or bus rapid transit service, capital costs from the study were extracted. These types of services involving major capital investments were referred to as New Starts projects, as they fall under a Federal Transit Administration funding program of that name.

The study also projected operational costs for rural, urban, and New Starts public transportation services for a 10-year period. Using information in the report, these operating costs were extrapolated to 2030 to provide a 25-year estimate. Based on the operating costs for the current level of public transportation services, the operating cost forecasts were apportioned between existing services and service expansion.

Capital and operating costs for a given investment category (for example, existing urban transit service) were grouped together from an investment cost standpoint because both are needed to provide the actual service.

Table 4-2 summarizes the 25-year estimate of Public Transportation modal needs.

Table 4-2. Modal Needs Estimate, Public Transportation

Major Investment Category	Investment Category	Modal Needs Estimate ($M YOE)
Maintenance/Preservation	Public Transportation - Existing Services (Capital and Operations including Bus/Van Replacement)	5,010.0
	Subtotal	5,010.0
Safety/Modernization	Public Transportation - Modernization	100.0
	Subtotal	100.0
Expansion/Enhancement	Public Transportation - Urban Bus System Expansion (Capital and Operations)	4,570.0
	Public Transportation - Rural Service Expansion (Capital and Operations)	650.0
	Public Transportation - New Starts: Rail, Bus Rapid Transit (Capital and Operations)	3,790.0
	Subtotal	9,010.0
	Total	14,120.0

4.4 Bicycle/Pedestrian Facilities

Modal needs for bicycle and pedestrian facilities across the state were derived principally from the modal plan prepared as part of the LRTP study. This modal plan considered the role of bicycle and pedestrian facilities in relation to the TDOT statewide highway network, and also considered actions on the part of TDOT to support bicycle and pedestrian facilities on the local and county roadway networks through various planning initiatives and through grant programs under which TDOT would provide some financial support of projects that complement the state system bicycle and pedestrian facilities or which are otherwise worthy of state support.

4.4.1 Issues and Considerations

Facilities supporting bicycle and pedestrian movements are somewhat unrecognized in their role of supporting statewide transportation, especially mobility in populated areas. These facilities provide the network for shorter non-motorized trips, and are a regular part of other trips; for example, bicycling to a bus stop for the next leg of a work commute trip or walking from a parking lot or transit stop to a place of employment. These facilities can also provide for a significant recreational role. While the state role has historically been focused on statewide bicycle routes and accommodating bicycles safely within the shoulders of state highways, much can be done to enhance the scale and scope of bicycle and pedestrian facilities in the state, especially when they can complement other modes of travel to and from travel mode terminal points or hubs.

While the state and many of the urban metropolitan areas have put considerable effort toward improving the number and quality of bicycle and pedestrian facilities, many challenges still make bicycling and walking difficult in Tennessee. These challenges evolve from national and statewide trends in metropolitan growth and land use, increased reliance on motor vehicles and miles traveled, and the slow pace of institutional change. These challenges can be overcome in Tennessee with time and effort as political, financial, and citizen support for bicycling and walking increases and the current transportation system is redeveloped to adequately accommodate these modes.

Bicycle and pedestrian modal needs facing the state of Tennessee are described below.

- Ensuring that all bicycle, pedestrian, and roadway projects are built to the highest standard and accommodate all Tennessee residents.
- Providing suitable and safe facilities for bicycling and walking along state roadways. Nearly half of the shoulders in Tennessee are comprised of dirt or gravel, requiring bicyclists (and pedestrians in many cases) to ride and walk in the roadway.
- Better data collection processes are needed to provide more detail in analyses of bicycle and pedestrian crashes. Without better data collection techniques, the real causes of bicycle and pedestrian crashes will be largely unknown.
- Coordinating with local and regional agencies to improve bicycle and pedestrian facilities in metropolitan areas and improve connections to existing and planned local facilities.

- Providing safety information and funding for local programs that teach residents how to be safe bicyclists and pedestrians. Educating motorists about the rights and responsibilities of bicyclists and pedestrians. Safety education should also include enforcement.
- Limited existing facilities: Public comments and a review of facilities and plans in Tennessee points to the demand for an integrated and consistent network of pedestrian and bicycle facilities, especially in cities and towns.
- The greatest barriers and gaps are often also the most expensive, and the need to address the gaps is typically not apparent, since existing conditions dissuade people from walking or riding in these locations.
- Adequately maintaining bicycle and pedestrian facilities. Like all states, TDOT's challenges lie with developing an identification and response system to make spot maintenance as needed, and in identifying sufficient funds to perform routine maintenance repairs along roadway shoulders.
- Finding strategies for intermodal linkages and synergies between modes, especially in urban and suburban settings.

4.4.2 2030 Modal Needs

The Bicycle and Pedestrian Plan provided a framework for a systematic review of these issues and needs, and formulated a multifaceted statement of potential improvements, programs, and actions, which, taken together, constitute the statement of modal needs from the state perspective.

Key recommendations in the plan included improved bicycle facility maintenance, particularly periodic sweeping of bicycle routes, as well as a group of programs to improve the planning and development of bicycle and pedestrian facilities. These programs are relatively small but collectively would elevate the planning and oversight of the system, and include design standards, Web-based resource center, supporting technical research, training materials, a local facilities handbook, state coordination with local agencies, periodic updates of the state bicycle system map, crash reporting system improvements, system usage monitoring, safety program, system website to promote usage, support of an annual conference, and a facility and right-of-way inventory. These collective actions have a cost of $60.0 million YOE.

Key modernization activities would be retrofitting state facilities for compliance with ADA requirements and introducing state grant programs for bicycle system, pedestrian system and safe-route-to-school projects elsewhere along state routes in urban areas at a combined cost of $100.0 million YOE.

From a system expansion and enhancement perspective, completion of an eight-route statewide bicycle route system and elimination of strategic gaps in the bicycle route system to enhance safety and usage has a cost of $180.0 million YOE.

Table 4-3 summarizes the 25-year estimate of bicycle/pedestrian modal needs.

Table 4-3. Modal Needs Estimate, Bicycle/Pedestrian

Major Investment Category	Investment Category	Modal Needs Estimate ($M YOE)
Maintenance/Preservation	Bicycle/Pedestrian–Preservation	60.0
	Subtotal	60.0
Safety/Modernization	Bicycle/Pedestrian–Safety; Facility Modernization	100.0
	Subtotal	100.0
Expansion/Enhancement	Bicycle/Pedestrian–New Facilities	180.0
	Subtotal	180.0
Total		340.0

4.5 Railroads

The rail system is an important component of freight movements within the state. The railroad system is owned and managed by private enterprise.

4.5.1 Issues and Considerations

As freight movements and volume moving on railroads grow, rail system usage will increase and its relationship to the highway mode will become more important. The role of shortline railroads in the industry will be a public policy issue as well. Anticipated key system needs are described below.

- An increase in train length (number of cars) and in larger capacity rail cars will increase delays at railroad crossings, resulting in an adverse effect on the highway network, and add to the need for maintaining tracks in quality condition.
- An increase in rail traffic will also create more potential conflicts at rail-highway grade crossings. Increased investment in crossing controls or grade separations will become necessary to maintain safety.
- As the size and weight of freight cars increase, shortlines will need to upgrade their rail or accordingly forego movement of these cars, diminishing their market opportunities. An investment in this area may be warranted.
- Restoring abandoned track between Nashville and Knoxville would permit east-west intrastate and interstate rail movements and enhance the attractiveness of rail movements.
- The potential use of rail corridors for urban commuter rail services, or for intercity passenger service, will need to consider the role of freight movements in those corridors.
- There is a potential role for rail in the diversion of new freight from highways to reduce highway widening needs and the associated effects of heavy truck traffic on safety, air quality, and noise.
- Potential projects identified in the state rail plan include intermodal rail yard projects, shortline extensions and upgrades, Class I railroad system connections, and a major urban bypass.

- The feasibility of intercity passenger rail service has also been explored. Some preliminary feasibility studies and implementation/operational costs have been developed for some of these elements. The costs are significant and the role of the railroads, the federal government, TDOT, and others in their funding will need further study and definition.
- High-speed rail has been examined for feasibility in an initial study, with the first segment from Atlanta to Chattanooga potentially to move forward into the study phase. Funds for potential Tennessee participation in this initiative for the segment from Chattanooga to Nashville have been recognized in the modal needs as well. However, the cost of this initiative will require careful scrutiny as to the public benefits and the role of the state in its funding.

4.5.2 2030 Modal Needs

TDOT has traditionally had a minimal role in the railroad mode because it is principally a private sector enterprise operating on privately held right-of-way. However, the state has promoted economic development through an improvement grant program that improves the condition and capacity of the shortline rail corridors feeding into the mainline Class I rail corridors. This program is referred to as the "286k" program, which upgrades Tennessee's shortline railroads to allow them to accommodate the heavier rail cars favored by Class I rail operators and major shippers. The terms "286k" refers to a 286,000-pound load rating for the rail. The state has also been active with the railroads in improving railroad-highway crossing safety. Increasing consideration is given to the use of railroads for urban commuter rail and intercity passenger service, and railroads may have a role in the future in terms of the diversion of truck freight from the highway system. As a result, and as is reflective of a national trend, there is an emerging role for public funding of rail system improvements as a catalyst to implementing improvements that demonstrate a real public benefit in terms of public safety, economic betterment, or avoidance of other capital costs.

Safety and modernization needs include continuing the shortline rail improvement program for upgrading the trackbed ballast and ties and now, where appropriate, heavier rail so that the shortline can match the load capacity of the mainline. This program needs $520 million YOE. Also in this category are a set of potential upgrades to the Class I rail mainlines around the state to improve safety and reduce rail congestion, including crossing safety, short sections of double-tracking or bypass tracks, and selected grade separations, at a cost of $720 million YOE.

Another set of Class I railroad mainline projects would enhance operating speed and capacity in these corridors. Key projects include improvements to the east-west rail corridor within Tennessee including reconstructing the gap in the corridor between Nashville and Knoxville; alternatively, the value of these improvements could be directed to other corridors to enhance east-west rail movements. Other projects include several intermodal rail yard improvements, additional rail feeder corridors, rail bypasses, and rail system interconnections to enhance interline movement flexibility. As noted, the intent is that to merit state funding participation based on further study, these projects would demonstrate specific public benefits. The cost of the identified improvements is $3.45 billion YOE.

Rail system expansion needs include the costs of the four most promising passenger rail corridors from the previous railroad system plan: Chattanooga-Bristol, Memphis-Nashville,

Nashville-Bristol, and Chattanooga-Louisville. Assuming these corridors would take 10 years to implement, the cost of rolling stock, stations, line improvements, and operations for the four corridors is $1.18 billion YOE. These costs are somewhat incremental as they assume that the appropriate freight rail improvements have been previously made.

Another rail initiative is high-speed rail service extending from Atlanta to Chattanooga and potential northward to Nashville. Based on the results of a prior study, the preliminary cost of implementing the Tennessee section of the corridor is $8.02 billion YOE. The entire concept would require considerable further study and the scrutiny of the value of state funding investment; Tennessee is continuing to monitor the concept with the state of Georgia.

Table 4-4 summarizes the 25-year estimate of railroad modal needs.

Table 4-4. Modal Needs Estimate, Railroads

Major Investment Category	Investment Category	Modal Needs Estimate ($M YOE)
Safety/ Modernization	Railroad–Class I Freight Rail Safety and Modernization	720.0
	Railroad–Shortline/"286k" Program	590.0
	Subtotal	1,310.0
Expansion/Enhancement	Railroad–Freight Capacity	3,450.0
	Railroad–Intercity Passenger Service	1,180.0
	Railroad–Nashville/Chattanooga High-Speed Rail	8,020.0
	Subtotal	12,650.0
	Total	13,960.0

4.6 Waterways

Waterways have historically provided for the cost-efficient transport of large volumes of bulk materials such as grains, fertilizers, aggregate, and cement. The state has a substantial waterways system, whose facilities are overseen for the most part by federal agencies. TDOT has historically had a relatively small role in the oversight and development of the waterways system.

4.6.1 Issues and Considerations

There is emerging interest for the movement of containerized goods for those product lines of lower value with less time sensitivity as to the time in transit and the reliability of the delivery date. There is also interest in the role of waterborne shipping to provide some relief to trucking movements on interstate highways; however, the promise of this is highly dependent on the volumes and shipping patterns of trucked commodities that are amenable to diversion, as well as cost economies. Modal needs issues for the waterways system are described below.

- Freight shipments are expected to double in the next twenty years, with Latin American trade nearly tripling during the same period. Waterways must be represented in TDOT's planning process to make the entire transportation system as efficient and effective as possible.

- New locks are needed at the Kentucky and Chickamauga dams on the Tennessee River. The new Kentucky lock is under construction, and the new Chickamauga lock is currently being designed. The USCOE and TVA need full funding for these projects to complete them as soon as possible. Although the Kentucky lock is not within Tennessee's borders, this lock is critical to the entire Tennessee River system. Benefits from this new lock will be realized more in Tennessee than any other state.
- To accommodate heavier barge tows, navigation channels must be deepened to a minimum 12-foot draft depth. Dredging portions of the Tennessee River and upgrading the last three locks on the Tennessee River would allow this 12-foot draft depth.
- With the extensive rail and truck network, both Nashville, along the Cumberland River, and Chattanooga, on the Tennessee River, are ideal candidates for large multimodal ports. Dyersburg, located in northwest Tennessee, is currently planning a multimodal port facility on the Mississippi River.
- Identify bridges over navigable waters that do not meet required height and width requirements or do not have the correct signage and lighting. These bridges should be inventoried and ranked in order of priority for upgrades that will allow for safer navigation, or removed and replaced where applicable. TDOT should coordinate with the U.S. Coast Guard and the USCOE.
- Additional and safer mooring cells are needed throughout the waterway system for temporary mooring and fleeting. Mooring cells are constructed using flat sheet piles interlocked in a circular pattern and filled with stone or concrete. They are used for barge tie-offs or unloading at shoreline facilities.
- Although not strictly a TDOT issue, it is recognized that the USCOE needs full funding of its operations and a maintenance budget for inland navigation.

4.6.2 2030 Modal Needs

Waterways preservation and maintenance needs include preparing and periodically updating a state waterways plan, providing a technical assistance program, an annual traffic/volume monitoring program, enhanced TDOT coordination with federal and local agencies, and a waterways safety program. More significantly, a group of waterways system projects overseen by the USCOE are included in this category because they are needed replacements of key navigation facilities, most noticeably the Chickamauga Lock in Chattanooga. The combined cost of these elements is $700.0 million YOE.

The basic safety and modernization investment has to do with the inventory of bridge clearance and related navigation safety conditions. Navigation improvements, and in some cases bridge demolition, are estimated to cost $80 million YOE.

Expansion and enhancement needs include other operational improvements including ports serving the waterways, intermodal connector rail and highway links to the ports, a waterways transportation fund to support waterways projects determined to be in the public interest, funds for new port development, and port security improvements. The collective cost of these needs is $250 million YOE.

Table 4-5 summarizes the 25-year estimate of waterways modal needs.

Table 4-5. Modal Needs Estimate, Waterways

Major Investment Category	Investment Category	Modal Needs Estimate ($M YOE)
Maintenance/Preservation	Waterway Preservation	700.0
	Subtotal	700.0
Safety/Modernization	Waterways – Modernization	80.0
	Subtotal	80.0
Expansion/Enhancement	Waterways – Facility Improvements	250.0
	Subtotal	250.0
Total		1,030.0

4.7 Aviation

The aviation system like other modes faces significant needs based on the anticipated growth rates in passenger enplanements and freight movements.

4.7.1 Issues and Considerations

In the recently completed Aviation System Plan Update, the projected airport usage variables were used along with available capital improvement plans for the 20 commercial and regional airports to identify potential capital needs through 2030. A subsequent estimate of project costs was developed to quantify the costs of these needed projects. For the other community airports, an annual improvement cost allowance was included based on historical needs to account for those modal needs.

Aviation projects include a wide range of airside projects (such as runways, taxiways, aprons, and utilities) and landside projects (terminals, hangars, parking facilities, and other needs) property acquisition, security, fueling systems, airport access, and specific plans. More than 450 specific actions were identified for the 20 commercial and regional airports.

Because aviation projects are usually multipurpose, it is difficult to assign them specifically to one basic infrastructure investment category. Therefore, as part of the project cost estimation process, the project costs were allocated to the three major investment categories on a percentage basis. It is also noted that while state funds and federal funds flowing through the TDOT budget account for the majority of monies for the regional and community airports, the commercial airports are direct grantees of federal funds, and those and the matching local funds are not reflected in the TDOT budget. The needs of all aviation facilities in the state are included, however, in the modal needs estimate.

Significant capital projects identified at the commercial airports are described below.

- Memphis: A possible relocation of the Tennessee Air National Guard to allow Federal Express expansion, the first phase of a new transportation center and employee parking area, terminal expansion, a new Aircraft Rescue and Fire Fighting facility, taxiway expansion, a new service road bridge, a new air cargo area on the east side of the airport, several connecting taxiways, a new glycol collection system and several departure staging pads, belly cargo facilities, and long-term plans for a new terminal building. There are also airport access issues.
- Nashville: Land acquisition, aircraft maintenance facility, expanded taxiway and apron areas, centralized airport support facility, police building expansion, partially consolidated rental car facility, and general aviation buildings and apron expansion, terminal area roadway improvements, expansion of parking facilities, new centralized airport support facility, general aviation apron and buildings, new Aircraft Rescue and Fire Fighting facility, runway and taxiway extension for Runway 2L, taxiway extension at the approach end of Runway 13, and several cargo apron areas.
- Tri-Cities: Parking and ramp expansions, multimodal center, expansion of cargo area and new cargo buildings, widening of the airport perimeter road, widening of state route west of the airport, further expansion of cargo area, additional corporate hangar development, multiple runway extensions and parallel taxiways, a new runway with parallel taxiway, and taxiway extension.
- Chattanooga: Several taxiway extensions, updated lighting systems, additional development of corporate and T-hangars, and a new Aircraft Rescue and Fire Fighting facility, associated ramp space, and an air cargo area.
- Knoxville: Runway extension to Runway 5L, taxiway connectors and runway exits, and terminal and ramp expansion project; new parallel runway and taxiway system, a new terminal building, and taxiway connectors.
- Jackson: Perimeter road, runway and taxiway extension; possibly need a new terminal building.
- Similar menus for capital improvements at the regional airports have also been developed.
- Needs at community airports are more basic and consist of periodic runway, apron, and taxiway resurfacing as well as other miscellaneous projects relating to navigation aids, hangars, and site improvements.

4.7.2 2030 Modal Needs

The types of modal needs for Tennessee's airports were recapped in the previous section. As noted, the tabulation of needs was allocated to the principal investment categories on a percentage basis. The allocation was tailored to three classes of airports: commercial, regional, and community.

Table 4-6 summarizes the 25-year estimate of aviation modal needs.

Table 4-6. Modal Needs Estimate, Aviation

Major Investment Category	Investment Category	Modal Needs Estimate ($M YOE)
Maintenance/Preservation	Aviation–Maintenance/Preservation Projects	1,320.0
	Subtotal	1,320.0
Safety/Modernization	Aviation–Modernization Projects	1,320.0
	Subtotal	1,320.0
Expansion/Enhancement	Aviation–Expansion Projects	1,990.0
	Subtotal	1,990.0
Total		4,630.0

4.8 Intelligent Transportation Systems

ITS can be considered as transportation system support "hardware" that involves more technical and physical components that extract better efficiencies from transportation systems. ITS projects are most often associated with the highway system, which is not inappropriate because highways are the backbone of the state transportation infrastructure. However, ITS applications span the modes and can enhance other transportation processes such as safety and security or intermodal connectivity, for example. Examples of such applications are surveillance cameras, which can enhance response to vehicular accidents and reduce the impacts of the resulting congestion, and electronic payment systems, which can automate, consolidate, and expedite payment for transportation services such as parking fees, tolls, and transit services. As a point of reference in this study, ITS also includes a family of programs referred to as highway incident management, which includes the freeway patrol service and other activities to improve highway capacity by managing the impacts of disruptions to highway travel.

4.8.1 Issues and Considerations

The basic strategy for developing ITS in Tennessee was laid out in the Intelligent Transportation System Strategic Plan updated in 2002. Implementation actions were refined and cost estimates prepared as part of the LRTP modal needs analysis. It is the intent that other agencies will bear significant funding responsibility for those programs and system components off the state highway system. Specific initiatives accounted for in the modal needs analysis are described below.

- Freeway, major arterial, and rural surveillance. This element is defined to provide coverage of roadway segments with a projected 50,000 or more daily vehicles. Recognizes operational traffic management centers in the four major population centers (Nashville, Memphis, Knoxville, and Chattanooga) by 2010, and accounts for facilities, operations, and periodic equipment replacement and upgrades.
- Urban traffic centers. For population centers over 25,000, development of urban traffic operations centers and surveillance to be interfaced with the TDOT statewide network.
- Roadside Weather Information System. Assumes a statewide network with up to 25 monitoring sites.

- Traffic management centers. Assumes ultimate development of operations interfaces for integrated statewide operations network, including pre-trip and en route information systems development.
- Incident management. Assumes expansion and improvement of the existing highway incident management program proportional to transportation network ITS coverage.
- Wireless communications backbone network. Accounts for system expansion and includes operations and maintenance costs.
- Transit ITS. Provides for support of initial ITS development and interface to regional operations networks for the largest urbanized areas.
- General ITS elements. Includes significant development of an archived data function for a virtual data warehouse supporting statewide and regional archiving and development support for initial interfaces to other operations centers such as the smaller urban areas, transit, and emergency management services.
- TDM support. Provides an allowance for support of multimodal TDM programs.
- Rail-highway interface. Provides for grade crossing monitoring systems and operations centers interface upgrades for 25 to 30 locations statewide.

4.8.2 2030 Modal Needs

Implementation and ongoing costs for the ITS modal needs programs summarized above were developed, tabulated, reviewed, and refined. The capital, maintenance, and operations costs for the various programs were grouped into two investment programs for planning purposes. Those activities related to the completion of the initial phase of ITS facility and systems development, including ongoing maintenance and operations costs, account for a modal needs cost of $2.66 billion YOE. Those activities related to the further expansion and development of ITS infrastructure and operations as presented, also including ongoing maintenance and operations cost, account for a modal needs cost of $3.63 billion YOE.

Table 4-7 summarizes the 25-year estimate of ITS support element needs.

Table 4-7. Modal Needs Estimate, Intelligent Transportation Systems

Major Investment Category	Investment Category	Modal Needs Estimate ($M YOE)
Maintenance/Preservation	ITS–Existing Operations (all modes)	2,660.0
	Subtotal	2,660.0
Expansion/Enhancement	ITS–Coverage Expansion and Operations (all modes)	3,640.0
	Subtotal	3,640.0
Total		6,300.0

4.9 Transportation Demand Management

Modal needs for TDM programs were developed as a programmatic component of the overall modal needs analysis because the existing TDOT programs in this area have been limited historically and are only now beginning to emerge and be recognized as an integral component of robust multimodal transportation management. TDOT has in the past cooperated with MPO initiatives involving TDM, especially when the focus involves TDOT-managed transportation corridors. An example is the cooperative effort with the Knoxville MPO for the reconstruction of I-40 through the central city. A Transportation Demand Management Plan is being developed as part of this LRTP study; however, its recommendations were not available for development of the TDM modal needs.

4.9.1 Issues and Considerations

TDM can be considered as transportation system support "software," as a parallel strategy to ITS as "hardware," because it focuses on managing travel demand to make better and more cost-effective use of transportation capacity through strategies oriented to influencing and incentivizing travel decisions on making trips: the need to travel, when to travel, where to travel in fulfilling the trip purpose, what mode to take, whether to travel with others, what path to follow, and so on. The goal of TDM is to influence trip planning need, path, time, and space to reduce the load on the transportation system capacity, peaking, number of vehicular trips, and length of travel required.

Many strategies under TDM increase mobility choices and provide incentives and disincentives to affect trip choices. While TDM is more often associated with reducing peak highway system demand, and as a result is tied to public transportation, carpooling, and bicycle/pedestrian travel as an alternative travel mode, its impact can span other modes; and it is considered by some to more broadly relate to changes in how goods and freight are moved. TDM is becoming recognized within TDOT as a tool to enhance the efficiency and cost effectiveness of other capital and operational transportation initiatives.

4.9.2 2030 Modal Needs

Existing TDOT budgetary commitments to TDM activities have not been significant; recent activities have been limited; and the efforts have basically been layered within other planning and project funding.

To account for TDM programs more explicitly and recognize TDM as a valuable long-term investment strategy, a specific transportation investment category was identified. The investment was recognized in the maintenance/preservation investment component as TDM is construed as a strategy to extract additional efficiency from existing investments and better management demand reducing load on existing system capacity. It was determined that an annual investment beginning at $3.0 million and increasing to $5.0 million, for an average of $4.0 million annually, over the 25 years would be appropriate in this support element, amounting to $150 million YOE.

Table 4-8 summarizes the 25-year estimate of TDM support element needs.

Table 4-8. Modal Needs Estimate, Transportation Demand Management

Major Investment Category	Investment Category	Modal Needs Estimate ($M YOE)
Maintenance/ Preservation	Transportation Options – TDM	150.0
	Subtotal	150.0
	Total	150.0

4.10 Summary Tabulation of Modal Needs

This section compiles the needs of each individual mode and mode support area into a single table and discusses implications of the overall modal needs.

Based on the analysis of modal needs documented in this report, it was determined that over the next 25 years, Tennessee's transportation needs are estimated to be nearly $130 billion. This includes the cost of building and maintaining the infrastructure, the roads and bridges, railroads, locks and dams, airports, buses and vans, and the cost of operating those systems that typically fall to public agencies (highways and public transportation). The figures do not reflect the cost of operating privately operated systems such as railroads, water carriers, or airports, in the same way that we have not estimated the cost to individuals to operate their personal automobiles. The estimates also do not include costs of the local city and county roadway systems that historically are managed and maintained by those agencies.

Modal needs highlights for each mode and support area are summarized below.

- Highways. Maintain the existing highway system in quality condition as the backbone for basic statewide mobility; address backlog needs in highway capacity and bridges; address future needs in highway capacity and bridges.
- Public Transportation. Maintain existing urban and rural public transportation services; provide for expansion of conventional urban and rural systems with population growth and to expand usage; support premium transit projects in large urban areas (light rail, commuter rail, bus rapid transit)
- Aviation. Sustain ongoing program of partnership with regional and community airports for preservation, modernization, and capacity improvements; support similar needs at the state's six commercial airports.
- Railroads. Continue to support shortline rail improvements; participate in railroad freight mainline improvements (bypass tracks, intermodal yards, grade crossings, other upgrades) with public benefit; develop promising intercity passenger rail corridors; and investigate high-speed rail corridor.
- Waterways. Enhance planning and management of waterways system; provide support for safety, security, dredging, and navigation improvements; improve ports access; support the USCOE replacement of strategic locks and dams.
- Bicycle/Pedestrian. Improve planning and development of statewide bicycle routes and support bicycle and pedestrian networks in populated areas as alternative modes of travel.

- ITS. Complete and maintain the initial phase of ITS traffic management and surveillance, including highway incident management program; provide for expansion of ITS facilities and services as the state grows and usage of the transportation network intensifies
- TDM. Provide funds to support programs that encourage changes in travel choices and behavior that improve the more efficient use of existing facilities and positive interaction between land uses and alternative modes to highway travel.

This modal needs estimate does not take into account which entity would make the investment to address the identified need. That need might be met by TDOT using state or federal funds, by local governments, or by the private sector. The estimates are allocated to show how these modal needs are divided among the expense to preserve the systems, to modernize them to meet current standards, and to expand them to meet the need for greater system capacity. Table 4-9 summarizes the overall 25-year modal needs in YOE terms.

4.11 Modal Needs in Relation to Trend Financial Resources

As documented in the *Financial Plan* report and elsewhere, financial revenue forecasts were developed based on TDOT's existing funding sources, recognizing changes in the state population and employment, changes in motor vehicle registration and usage, and the outlook for federal funds, and extrapolated to 2030. This trend line forecast indicates that TDOT would have approximately $69 billion in revenues available, based on future estimates of state revenues and federal revenues that flow through the TDOT budget.

This figure is far short of satisfying the projected modal needs of $130 billion that have been identified, but it is important to recall that the modal needs are a composite of future system requirements, not all of which have traditionally fallen under TDOT funding responsibility. In addition to the projected trend line revenue, TDOT has historically partnered with federal, state, regional, and local agencies as well as the private sector in the financial support of infrastructure projects, and not all those partnering funds flow through the TDOT budget. While the level of these partnering funds varies significantly by mode, program, and project, the analysis of the proposed Vision Plan discussed in Chapter 6 suggests that such funds might amount to an additional 12 to 15 percent over the funds flowing through the TDOT budget. Thus, the trend line budget of TDOT coupled with other partnering funds could yield as much as $79 billion to address modal needs. However, this combined funding figure would still fall short of the more robust satisfaction of modal needs, meeting only about 61 percent of estimated total modal needs.

Of interest in this discussion is backlogged modal needs. Backlog refers to those improvement needs that should be implemented immediately based on facility capacity or condition requirements, but which have not been implemented due to funding shortfalls. The accumulation of backlog suggests that the existing budget does not have the capacity to keep pace with the accumulation of improvement needs. Projects for which funding is not available are essentially deferred and become backlogged. Often, once this condition is initiated, the backlog continues to grow year by year, as the budget shortfall is a chronic condition.

Table 4-9. Summary of Modal Needs

Investment Areas		Modal Needs by Summary Category (%M YOE)	(% of Total)
Maintenance/ Preservation	Highway: Bridge and Roadway Maintenance and ITS	22,770	17.55
	Public Transportation, Bicycle/Pedestrian, and Transportation Options (TDM): Urban and Rural System Capital and Operating Support	5,220	4.02
	Aviation and Waterways: Regional System Support	2,020	1.56
	Maintenance/Preservation Subtotal	30,010	23.13
Safety/ Modernization	Highway: Bridge Replacement, Widening of Narrow Lanes, Local System Support	21,510	16.58
	Public Transportation and Bicycle/Pedestrian: Support Systems	200	0.15
	Aviation, Rail, and Waterways: Improved communication systems, rail grade crossing protection, shortline track capacity and rehabilitation programs	2,710	2.09
	Safety/Modernization Subtotal	24,420	18.82
Expansion/ Enhancement	Highway: Congestion Relief, Local System Expansion, ITS Expansion	51,230	39.49
	Public Transportation and Bicycle/Pedestrian: Urban and Rural System Expansion Support	9,190	7.087
	Aviation, Railroad and Waterway: Partnered Support of Airport Expansion, Rail bypass and intermodal yards, expanded port facilities , Intercity Passenger Rail	14,890	11.48
	Expansion/Enhancement Subtotal	75,310	58.05
	Total	129,740	100.00
	Summary by Investment Areas		
	Maintenance/Preservation	30,010	23.13
	Safety/Modernization	24,420	18.82
	Expansion/Enhancement	75,310	58.05
	Total	129,740	100.00
	Summary By Mode		
	Highway and ITS	95,510	73.62
	Public Transportation, TDM, and Bicycle/Pedestrian	14,610	11.26
	Aviation, Rail, and Waterways	19,620	15.12
	Total	129,740	100.00

Based on the analysis of modal needs, it was estimated that of the state's modal needs, which total $129.74 billion YOE, $39.5 billion (30 percent) are in the backlog category. Nearly 90 percent ($37.3 billion) of this backlog is in the highway mode. Backlogged urban and rural widening projects are $8.0 and $9.9 billion, respectively. Backlog in structurally deficient bridges is $2.0 billion and for functionally obsolete bridges, is $5.4 billion. Backlog in geometric deficiencies (narrow lanes and narrow or missing shoulders) is another $12.0 billion. While it could be stated that some of these backlog needs are more critical than others, they all represent

system deficiencies of one type or another that have not been remediated. Addressing accumulated backlog is an important consideration in developing alternative investment scenarios and in formulating a suitable vision plan for the state's transportation system.

The study process recognized that this shortfall of funds versus needs would materialize. Consequently, the study anticipated the formulation and evaluation of three transportation investment scenarios that would represent differing steps toward addressing transportation modal needs. These scenarios would rely in differing degrees upon the development of expanded or new funding sources to address the identified shortfall between modal needs and projected funding resources. These three investment scenarios were developed and reviewed from a technical standpoint by TDOT and the study team and underwent a coordinated review with the Regional Working Groups and the Statewide Steering Committee. Based on this review process, a proposed Vision Plan for Tennessee's transportation future was identified and presented. The alternative investment scenarios and the resulting Vision Plan for 2030 are discussed in Chapters 5 and 6.

Chapter 5

Scenarios for Long-Range Plan Formulation

5.1 Development of Scenarios

These principles led to the development of investment policies for each of TDOT's modes that focused on preserving the existing system and expanding transportation options in both rural and urban areas: identifying multimodal options to relieve congestion and to improve movement of people and freight, and targeting high-risk and strategic locations to improve safety. To meet these investment policies, the modes focused on three types of investments:

- Maintenance and Preservation
- Safety and Modernization
- Expansion and Enhancement

Maintenance and preservation investments include projects that repair, replace, or operate existing infrastructure and services, such as road resurfacing, existing public transportation operations and bus/van replacement, and bridge repair and replacement. Safety and modernization investments include projects such as pedestrian sidewalk ramp retrofitting, railroad crossing upgrades, turn lanes and lane widenings. Expansion and enhancement investments include projects that add capacity to Tennessee's transportation system, such as adding lanes, increasing freight capacity, adding new airport runways and hangars, and expanding public transportation services.

To investigate the extent to which transportation investment should be expanded toward addressing estimated modal needs, three potential investment scenarios were constructed. Each addressed specific investments to be dedicated to the individual transportation investment categories. The three scenarios represent three levels of investment to help discriminate what varying levels of investment could accomplish overall and by category. Detailed profiles for each investment scenario were developed and are presented in Table 5-1.

Table 5-1. Summary of Alternative Transportation Investment Scenarios

Tennessee Long Range Transportation Plan - Investment Scenarios Worksheet								
		Status Quo	**(Millions)**	***Balanced***	**(Millions)**	***Optimistic***	**(Millions)**	**Modal Needs (Millions)**
Maintenance/Preservation	Aviation - Maintenance/Preservation Projects (taxiway/runway/apron resurfacing, building and hangar repair)	Continue matching 50% of aviation maintenance projects.	$620	Continue matching 50% of aviation maintenance projects.	$620	Continue matching 50% of aviation maintenance projects.	$620	$1,320
	Bicycle/Pedestrian -system planning, marketing, road sweeping	Continue limited maintenance of existing facilities as part of highway maintenance.	$0	Maintain existing bike/ped facilities on heavily traveled state highways.	$30	Maintain existing bike/ped facilities on all state highways.	$60	$60
	Highway - State & Local System Bridge Repair/Replacement (Structurally Deficient Bridges)	Small number of structurally deficient bridges.	$7,000	Small number of structurally deficient bridges.	$7,000	Small number of structurally deficient bridges.	$7,000	$7,000
	Highway - State System Road Resurfacing & Routine Maintenance	Maintain/preserve highways at current level.	$13,390	Repave less often, but maintain high standards.	$12,040	Repave less often, but maintain high standards.	$12,040	$13,390
	Intelligent Transportation Systems (ITS) - Existing Operations (all modes)	Continue current (ITS) programs such as HELP trucks and traffic centers in four major cities.	$2,660	Continue current (ITS) programs such as HELP trucks and traffic centers in four major cities.	$2,660	Continue current (ITS) programs such as HELP trucks and traffic centers in four major cities.	$2,660	$2,660
	Public Transportation - Existing Services (Capital and Operations - includes Bus/Van Replacement)	Continue current level of state funding to public transportation. (10% capital costs, 15% operating costs)	$540	Increase state funding for operating existing public transportation. (10% capital costs, 25% operating costs)	$630	Increase state funding to 1/3 of operating cost for existing public transportation. (10% capital costs, 33% operating costs)	$700	$5,010
	Railroad - Short line Preservation Projects (ballast, track and bridge repair)	Continue current level of assistance for short line rail preservation projects.	$440	Continue current level of assistance for short line rail preservation projects.	$440	Continue current level of assistance for short line rail preservation projects.	$440	$440
	Transportation Options - Transportation Demand Management (TDM) (van pooling, park and ride lots)	TDM strategies remain largely local responsibility.	$50	Increase funding and leadership to local agencies for TDM strategies.	$100	Become equal partners with local agencies for broader range of TDM strategies.	$150	$150
	Waterways Preservation (system planning, safety/security, dredging)	No participation in waterway maintenance.	$0	No participation in waterway maintenance.	$0	Provide 20% of funding for waterway maintenance projects.	$140	$700
	Maintenance/Preservation Subtotal		$31,700		$32,520		$33,610	$36,730
Safety/Modernization	Aviation - Modernization Projects (update instruments/systems/facilities to current standards)	Continue matching 50% of airport upgrade projects.	$620	Continue matching 50% of airport upgrade projects.	$620	Continue matching 50% of airport upgrade projects.	$620	$1,320
	Bicycle/Pedestrian - (ADA retrofitting, local grant programs, school safety)	Continue limited funding for bike/ped safety and ADA retrofit programs.	$0	Increase funding for bike/ped safety and ADA retrofit programs.	$70	Provide significant funding for bike/ped safety and ADA retrofit programs.	$50	$100
	Highway - State System Bridge Repair/Replacement (Functionally Obsolete)	Funding for about 50% of identified highway and bridge safety and modernization needs, focusing on heavily traveled roads.	$2,690	Increase funding to address about 75% of identified highway and bridge safety and modernization needs.	$4,030	Address all highway and bridge safety and modernization needs.	$5,370	$5,370
	Highway State System - Safety and Geometric Improvements (lane width, shoulder width, safety projects)		$7,430		$11,140		$14,860	$14,860
	Highway - Local System Modernization (turn lanes, safety projects)	Continue current "State Aid" to local programs.	$4,150	Continue current "State Aid" to local programs.	$4,150	Continue current "State Aid" to local programs.	$4,150	$4,150
	Public Transportation - Modernization (bus shelters, ADA access)	Provide 50% of matching funds required for federal funding.	$50	Provide 75% of matching funds required for federal funding.	$80	Provide all matching funds required for federal funding.	$100	$100
	Railroad - Class I Freight Rail Safety and Modernization (railroad crossings, track condition upgrades, signal controls)	No participation.	$0	Provide 20% of funding for Class I improvements that support intermodal facilities.	$140	Provide 20% of funding for Class I improvements that support intermodal facilities.	$140	$720
	Railroad - Short Line "286K" Program (upgrade trackbed and bridges for heavier rail cars to match mainline rail)	No participation in upgrading short line rail.	$0	Provide approximately 25% of funding for short line rail upgrades that demonstrate economic benefit	$40	Provide approximately 50% of funding for short line rail upgrades that demonstrate economic benefit.	$70	$150
	Waterways -Modernization (port/dock facilities, bridge clearances, safety and security)	No participation in waterway facilities modernization.	$0	Provide 20% of funding for waterway safety and modernization projects.	$20	Provide 20% of funding for waterway safety and modernization projects.	$20	$60
	Modernization Subtotal		$14,930		$20,240		$25,330	$26,840
Expansion/Enhancement	Aviation - Expansion Projects (widen/lengthen/add taxiways, runways, terminals, hangars and other infrastructure)	Continue current funding match for airport expansion.	$340	Continue current funding match for airport expansion.	$340	Continue current funding match for airport expansion.	$340	$1,990
	Bicycle/Pedestrian - New Facilities (Eight Statewide routes, bridges/crossings, bicycle/pedestrian safety programs)	No targeted funding for new bike/ped facilities. Include bike/ped facilities in new state projects where appropriate.	$0	Make "Status Quo" investments plus develop eight new state bike routes.	$70	Make "Status Quo" investments, develop eight new state bike routes and add funding for safe routes to schools.	$140	$180
	Highway - Rural widening, Interstate, State	Limit congestion to current levels by adding lanes and multimodal solutions where practical. Size of backlog remains the same.	$10,910	Address highway congestion, adding multimodal solutions where practical. Size of backlog reduced by 50%.	$12,370	Address highway congestion, adding multimodal solutions where practical. Address major backlog needs.	$14,550	$14,550
	Highway - Urban widening, Interstate, State		$20,270		$22,970		$27,020	$27,020
	Highway - Local System Expansion	Continue state programs for industrial access and local "State Aid".	$2,220	Continue state programs for industrial access and local "State Aid".	$2,220	Expand state programs for industrial access and local "State Aid".	$2,820	$2,820
	Highway - County Seat Connectors	No funding for county seat connectors except those with capacity or safety problems (which are addressed under other investment categories).	$0	Partial funding (10%) for county seat connectors that do not have current capacity or safety problems (based on projected benefits).	$240	Funding approximately 50% of the county seat connectors that do not have current capacity or safety problems (based on projected benefits).	$1,180	$2,360
	ITS - Coverage Expansion and Operations (all modes)	Continue current ITS expansion program.	$310	Assist local governments in expanding ITS coverage to areas of need.	$880	State expands ITS coverage to areas of need.	$1,770	$1,770
	Public Transportation - Urban Bus System Expansion (Capital and Operations)	Continue current level of state funding.	$650	Increase funding match for new and expanded public transportation, primary responsibility remains with local government.	$1,030	Become equal partner with local government in matching federal funds for new public transportation operations.	$1,330	$4,570
	Public Transportation - Rural Service Expansion (Capital and Operations)	Continue current level of state funding.	$90		$140		$190	$650
	Public Transportation - New Starts: Rail, Bus Rapid Transit (Capital & Operations)	Minimal funding.	$30		$520		$1,020	$3,790
	Railroad - Freight Capacity (rail yards, bypasses, second tracks, interconnections, intermodal facilities)	No participation.	$0	Partner on projects where significant federal or private partnerships are available.	$350	Partner on projects where significant federal or private partnerships are available.	$680	$3,450
	Railroad - Intercity Passenger Service	No participation.	$0		$120		$590	$1,180
	Railroad - Nashville / Chattanooga High Speed Rail	No participation.	$0	No participation.	$0		$4,010	$8,020
	Waterways - Facility Improvements (intermodal connections, waterway and port improvements and new facilities)	No participation in new ports and waterways projects.	$0	Provide 10% of funding for new or expanded ports and intermodal facilities.	$30	Provide 20% of funding for new or expanded ports and intermodal facilities.	$50	$250
	Expansion Subtotal		$34,820		$41,230		$55,510	$72,400
	TOTAL		$74,450		$85,040		$104,700	$129,970

5.2 Status Quo Scenario

The status quo investment scenario is designed to maintain the current level of performance across the transportation system for Tennessee's growing population. It continues the excellent level of maintenance for Tennessee's highway and aviation infrastructure and includes a more limited investment in public transportation and bike/pedestrian facilities. Because the status quo investment scenario is the least expensive, it does not offer a change in backlogged needs and meets only the highest priority needs for safety. Additionally, there is limited or no state participation in major rail or new public transportation projects. The 25-year total expenditures included in the status quo investment scenario are summarized in Table 5-2 by investment category.

Table 5-2. Status Quo Investment Scenario Expenditures

Investment Category	Status Quo 25-year Total ($B YOE)
Maintenance	25
Modernization	15
Expansion	35
Total	75

Source: PBS&J

5.3 Balanced Scenario

The balanced investment scenario attempts to balance desired system performance with financial responsibility. It maintains the high standards for highways and bridges and improves the investment in bicycle/pedestrian facilities and public transportation facilities. The balanced investment scenario also provides some reduction in backlogged needs and more funding for safety and modernization than the status quo investment scenario. Additionally, it looks to expand multimodal programs and transportation options within Tennessee. The 25-year total expenditures included in the balanced investment scenario are summarized in Table 5-3 by investment category.

Table 5-3. Balanced Investment Scenario Expenditures

Investment Category	Balanced 25-year Total ($B YOE)
Maintenance	24
Modernization	20
Expansion	41
Total	85

Source: PBS&J

5.4 Optimistic Scenario

The optimistic investment scenario reflects public input for desired system performance and addresses all feasible modal needs. It increases maintenance efforts for all modes and eliminates all backlogged modal needs. The optimistic investment scenario also expands transportation options in Tennessee and increases the focus on multimodal options. Additionally, the scenario builds expanded partnerships with local government and the private sector. The 25-year total expenditures included in the optimistic investment scenario are summarized in Table 5-4 by investment category.

Table 5-4. Optimistic Investment Scenario Expenditures

Investment Category	Optimistic 25-year Total ($B YOE)
Maintenance	24
Modernization	25
Expansion	56
Total	105

Source: PBS&J

5.5 Conclusions

The summary of the expenditures associated with the three investment scenarios range from $75 to $105 billion in YOE dollars for the 25-year Tennessee LRTP. All three investment scenarios include total expenditures that are less than the 25-year modal needs but greater than the $69.4 billion baseline forecast of TDOT revenues, resulting in funding shortfalls for all three investment scenarios. These funding gaps are summarized in Table 5-5 for each investment scenario.

Table 5-5. 25-Year Revenue Requirements and Funding Shortfalls

	Status Quo ($B YOE)	Balanced ($B YOE)	Optimistic ($B YOE)
Total	75.00	85.00	105.00
Revenue Forecast	69.00	69.00	69.00
Funding Shortfalls	6.00	16.00	36.00

Source: PBS&J

To have a reasonable financial plan, additional measures must be taken to eliminate the funding gaps shown in Table 5-5. These measures may include alternative financing approaches such as the introduction of new revenue sources, increasing tax rates for existing revenue sources, and debt financing. A portion of the gaps will be covered by funding historically provided by TDOT's transportation partners and not accounted for in TDOT's budget; however, these complementary sources generally address only a small share of the funding gaps.

Chapter 6

25-Year Vision Plan

6.1 Overview

This chapter presents the 25-Year Vision Plan which, emerged from the technical and public review of the three original transportation investment scenarios. The intent of the 25-year Vision Plan is to serve as a blueprint to guide finance, policy, operational and project-related decision making by TDOT as the agency moves into implementation of the proposed program of investments that will advance Tennessee toward addressing the wide range of modal needs in the dynamic and changing environment of the future.

The 25-year Vision Plan is further described in the Long-Range Multimodal Plan document developed under this study and is also the starting point for the 10-Year Strategic Investments Program, also documented as a separate report. The proposed Vision Plan calls for the identification of additional revenues sources through a range of potential options including expanding existing revenue sources, introducing new revenue sources, forming public-private partnerships, bonding of committed revenue streams, and other innovative strategies.

The proposed Vision Plan as defined would address two thirds of the total modal needs as defined, and along with anticipated funds from TDOT's various transportation partners that do not flow through TDOT's budget would collectively address three quarters of the total estimated needs. Table 6-1 summarizes the proposed investments and anticipated partner investments by mode and support element.

6.2 Public Involvement and Feedback

As with all steps in the LRTP process, the structured public involvement process already described was integral into the final definition of the 25-Year Vision Plan. Feedback from the Regional Working Group sessions regarding the three alternative transportation investment scenarios described in the prior chapter was carefully considered in gauging the level of financial investment in each of the individual investment programs, and the Statewide Steering Committee served as a subsequent sounding board for this determination as well.

6.3 Plan Description

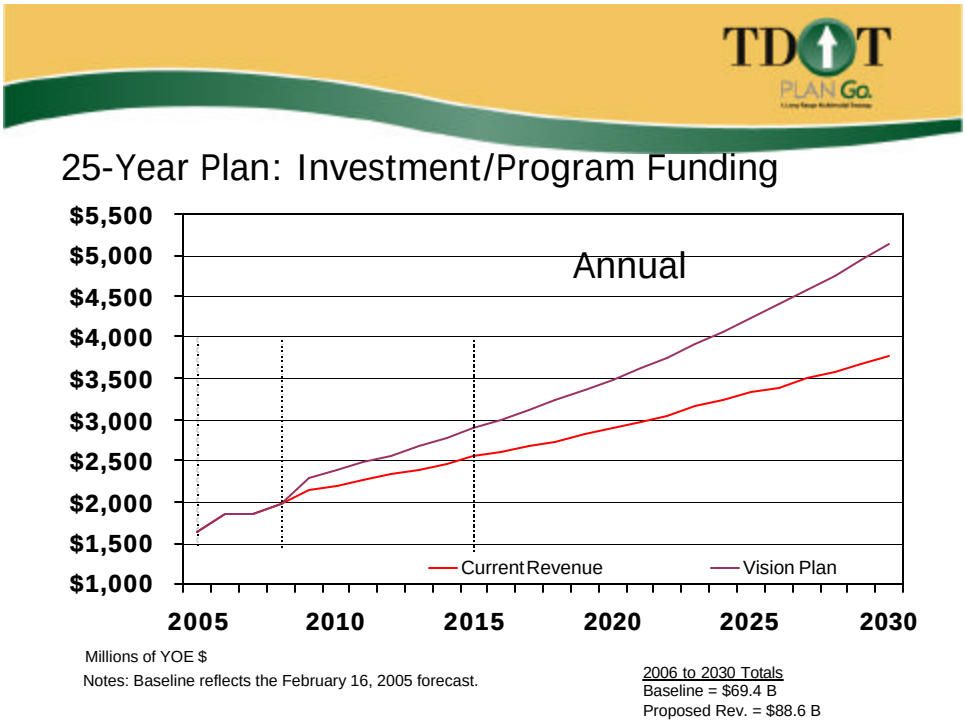
The proposed Vision Plan represents a robust pursuit of the estimated modal needs. Table 6-2 summarizes the impact of the Vision Plan investments by each investment category in relation to the modal needs for that investment category. Each cell provides a characterization of what can be accomplished with the proposed investment through the TDOT budget. The table shows that the extent to which modal needs are addressed varies by investment category, based on a variety of factors, but with an emphasis on the feedback gleaned from the public involvement process as to the appropriate level of the overall transportation investment and its distribution across the various investment categories. The Vision Plan as proposed reflects the feedback from Tennessee's citizens as to investment needs and priorities.

Table 6-1. Modal Needs Addressed by the Vision Plan

Investment Category	25-Year Modal Needs								
	25-Year Modal Need (regardless of funding source) In $ Millions YOE	Highway	Public Transp.	Aviation	Railroad	Water	Bicycle/ Pedes-trian	ITS	TDM
I. Maintenance/Preservation									
25-Year Modal Need (regardless of funding source) in $M	30,010	20,110	5,010	1,320	0	700	60	2,660	150
Proposed 25-Year TDOT Budget in $M	25,690	20,110	2,100	670	0	20	30	2,660	100
Estimated Partnering Funds Outside TDOT Budget in $M	4,265	0	2,910	650	0	640	15	0	50
Total TDOT and Other Modal Investment in $M	29,955	20,110	5,010	1,320	0	660	45	2,660	150
% of Modal Needs Met By Total Proposed Investment	99.8	100.0	100.0	100.0	N/A	94.3	75.0	100.0	100.0
II. Safety/Modernization									
25-Year Modal Need (regardless of funding source) in $M	24,420	21,510	100	1,320	1,310	80	100	0	0
Proposed 25-Year TDOT Budget in $M	17,120	15,770	70	670	580	10	20	0	0
Estimated Partnering Funds Outside TDOT Budget in $M	1,250	0	30	650	510	40	20	0	0
Total TDOT and Other Modal Investment in $M	18,370	15,770	100	1,320	1,090	50	40	0	0
% of Modal Needs Met By Total Proposed Investment	75.20	73.3	100.0	100.0	83.2	62.5	40.0	N/A	N/A
III. Expansion/Enhancement									
25-Year Modal Need (regardless of funding source) in $M	75,310	47,590	9,010	1,990	12,650	250	180	3,640	0
Proposed 25-Year TDOT Budget in $M	42,450	38,620	1,770	340	620	20	80	1,000	0
Estimated Partnering Funds Outside TDOT Budget in $M	10,290	0	5,790	1,650	1,690	80	80	1,000	0
Total TDOT and Other Modal Investment in $M	52,740	38,620	7,560	1,990	2,310	100	160	2,000	0
% of Modal Needs Met By Total Proposed Investment	70.0	81.2	83.9	100.0	18.3	40.0	88.9	54.9	N/A
Totals									
25-Year Modal Need (regardless of funding source) in $M	129,740	89,210	14,120	4,630	13,960	1,030	340	6,300	150
Proposed 25-Year TDOT Budget in $M	85,260	74,500	3,940	1,680	1,200	50	130	3,660	100
Estimated Partnering Funds Outside TDOT Budget in $M	15,805	0	8,730	2,950	2,200	760	115	1,000	50
Total TDOT and Other Modal Investment in $M	101,065	74,500	12,670	4,630	3,400	810	245	4,660	150
% of Modal Needs Met By Total Proposed Investment	77.9	83.5	89.7	100.0	24.4	78.6	72.1	74.0	100.0

Table 6-3 summarizes the proposed Vision Plan investments in comparison to the historical TDOT budget distribution applied to the trend line revenue forecast of $69 billion. Because the Vision Plan has an estimated investment of $85 billion, there is clearly a funding shortfall that would need to be addressed by modifications to the types and levels of existing revenue streams, along with innovative and newer funding strategies that have had limited application in Tennessee thus far. Figure 6-1 shows the funding shortfall.

Figure 6-1. Comparison of Tennessee Department of Transportation Trend Line Forecast to Revenue Stream Needed to Support the Proposed Vision Plan



6.4 Summary

The proposed 25-Year Vision Plan provides a foundation to guide transportation decision making in Tennessee in the near term and for the long-term future. The process undertaken to formulate the Vision Plan was as important as the technical development of the plan document because the two working in tandem have helped to define a future for transportation, one that should preserve past investments and guide prudent future investments for the betterment and improved mobility of the state's citizens, businesses, and institutions.

Table 6-2. Modal Needs and Proposed Investment Summary

Investment Category	25-Year Modal Needs		25-Year Proposed Investment	
	25-Year Modal Need (regardless of funding source) in $M YOE	Modal Need Coverage	Proposed 25-Year TDOT Budget in $M YOE	Policy and Program Impact
I. Maintenance/Preservation	30,010		25,690	
Aviation–Maintenance/Preservation Projects	1,320	Addresses anticipated projects at regional and community airports, as well as the significant needs at the six major commercial airports. Source: Aviation Plan Update.	670	Provides for historical TDOT share of aviation financing, which with local funding addresses the modal need.
Bicycle/Pedestrian–Preservation	60	Introduces dedicated funding for maintaining primary bicycle routes in safe condition, as well as for activities to support development of bicycle/pedestrian facilities as alternate travel modes. Source: Statewide Bicycle/Pedestrian Plan.	30	Provides first significant TDOT committed funding for bicycle facility maintenance, and assuming a 2:1 match ratio with other funds, would address 75% of modal needs.
Highway–State/Local System Bridge Repair/ Replacement (Structurally Deficient)	6,720	Accounts for existing backlog in bridges needing repair as well as the additional bridges that will need repair over time; includes the existing local system program with a 25% increase.	6,720	Provides funding to address all of existing and future bridge repair needs on the state system, and continues the existing local system program with a 25% increase.
Highway–State System Resurfacing/ Routine Maintenance	13,390	Assumes maintaining state system at present high levels, protecting the historical investments in the network.	13,390	Proposed funding allows continued high-level maintenance of the road system.
ITS–Existing Operations (all modes)	2,660	Enhances system optimization through maintenance of current/committed urban area traffic centers (4) and urban freeway ITS; continues incident management/ freeway patrol program; extends multimodal ITS programs.	2,660	Fully funds existing and committed ITS urban freeway programs and extends funding to applications for transit and travel demand management. Recognizes value of programs to reduce peak period demand.
Public Transportation (PT)–Existing Services (Capital and Operations, including. Bus/Van Replacement)	5,010	Includes capital and operating costs to maintain existing level of both rural and urban public transportation services. Source: Statewide Transit Plan	2,100	Increases state support for PT operating assistance to 33% state funding, and maintains PT capital match at 10%; strengthens local partnerships. If matched with local and federal dollars, would fund 100% of needs.
Transportation Options–Transportation Demand Management (TDM)	150	Provides dedicated funding for TDM initiatives, in partnership with local and regional agencies, to implement strategies to promote travel choices and decisions that help to maximize system efficiency. Source: LRTP Consultant Team	100	Provides significant seed monies that can be leveraged with other local/regional funds to initiate and develop multimodal strategies, travel choices, and agency partnerships to foster more efficient use of built facilities; assuming a 2:1 match ratio with other funds, would address 100% of modal needs.
Waterway Preservation	700	Includes several high cost lock and dam projects overseen by the USCOE; funds to preserve waterway operations such as dredging, navigations aids, security enhancements, and waterways planning.	20	TDOT match provides small but significant boost in waterways preservation to support efficient operations and promotion of waterways as alternative freight mode, consistent with traditional agency role and responsibilities. Major capital investment role remains with USCOE.

Table 6-2. Modal Needs and Proposed Investment Summary (Continued)

Investment Category	25-Year Modal Needs		25-Year Proposed Investment	
	25-Year Modal Need (regardless of funding source) in $M YOE	Modal Need Coverage	Proposed 25-Year TDOT Budget in $M YOE	Policy and Program Impact
II. Safety/Modernization	24,420		17,120	
Aviation–Modernization Projects	1,320	Addresses anticipated projects at regional and community airports, as well as the significant needs at the six major commercial airports. Source: Aviation Plan Update.	670	Provides for historical TDOT share of aviation financing, which with local funding addresses the modal need.
Bicycle/Pedestrian–Safety; Facility Modernization	100	Addresses needs for bicycle/pedestrian safety and facility modernization, including ADA retrofitting.	20	Provides for a portion of state needs and provides a state match to local programs; with equal match would address 40% of modal need.
Highway–State System Bridge Repair/Replacement (Functionally Obsolete)	5,370	Accounts for existing backlog in bridges needing repair as well as the additional bridges that will need repair over time.	4,120	Provides funding to address 77% of existing backlogged bridge repair needs for functionally obsolete bridges.
Highway State System–Safety and Geometric Improvements	11,990	Provides for widening shoulders and narrow lanes on roadways with over 1,000 vehicles per day and allowance for other safety enhancement projects.	7,500	Funds 70% of roadway geometric deficiencies, allowing significant improvement with focus on higher volume roadways and those with lower cost per mile to implement.
Highway–Local System Modernization	4,150	Recognizes the existing funding in the TDOT budget for local systems and provides for a 25% increase.	4,150	Fully funds this local system program as defined.
Public Transportation–Modernization	100	Accounts for improvements in accessibility for ADA and for additional shelters and patron amenities.	70	Funds 70% of identified modal needs, and with partner funds would cover all of the modal needs.
Railroad–Class I Freight Rail Safety and Modernization	720	Accounts for a variety of improvements to improve rail operations and safety, including bypass tracks, yard modifications, track upgrade, and signal system modifications. Source: State Rail Plan	100	Provides limited state share as seed money to support projects of strategic interest and state benefit, promoting rail as alternative freight mode and reducing urban impacts. Assuming 20% state match to other funds, would address 70% of needs.
Railroad–Shortline/"286K" Program	590	Accounts for total needs in upgrading shortline rail segments to proper condition and upgrading them to accommodate heavier rail cars as viable extensions of mainline rail corridors.	480	Provides sufficient state funding with a local/private match to implement all identified improvement needs. Assumes 20% private and/or local match.
Waterways–Modernization	80	Accounts for addressing safety hazards involving removal of bridges and/or piers for clearance. Source: LRTP Consultant	10	Provides 20%TDOT matching funds for the highest priority waterway safety projects, addressing 60% of needs.
III. Expansion/ Enhancement	75,310		42,450	
Aviation–Expansion Projects	1,990	Addresses anticipated projects at regional and community airports, and continuation of present TDOT funding at the six major commercial airports. Source: Aviation System Plan	340	Based on traditional TDOT funding participation, funding would address the community and regional airport needs, and provide historical support (2-3%) to commercial airport projects; would address the modal needs.
Bicycle/Pedestrian–New Facilities	180	Includes costs of completing a statewide bicycle route network and eliminating strategic gaps in the network; supporting other projects to expand bicycle and pedestrian facilities. Source: Statewide Bicycle/Pedestrian Plan	80	Provides for significant further development of statewide bicycle routes and gap closures on a priority basis, and state match to expand other facilities. With equal match, would address almost 90% of needs.

Table 6-2. Modal Needs and Proposed Investment Summary (Continued)

Investment Category	25-Year Modal Needs		25-Year Proposed Investment	
	25-Year Modal Need (regardless of funding source) in $M YOE	Modal Need Coverage	Proposed 25-Year TDOT Budget in $M YOE	Policy and Program Impact
Highway–Rural Widening (Interstate, state)	14,550	Includes road widening needs on the rural segments of the state system based on capacity deficiencies. Includes County Seat Connectors projected to be capacity deficient. LOS standards: Interstate - C or better, other rural highway - D or better.	12,700	Addresses 87% of existing backlogged and future roadway capacity deficiencies.
Highway–Urban Widening (Interstate, state)	27,020	Addresses road widening needs on the urban segments of the state system based on capacity deficiencies.	23,300	Addresses 87% of existing backlogged and future roadway capacity deficiencies.
Highway–Local System Expansion	2,620	Recognizes the existing funding in the TDOT budget for local systems and provides for a 25% increase.	2,320	Fully funds this local system program as defined.
Highway–County Seat Connectors (Non-deficient segments)	3,400	Accounts for the remaining segments which are not capacity deficient. Segments projected to be capacity deficient are included under Highway - Rural Widening.	300	Proposes funding for approximately 10% of identified needs, to be implemented in part on basis of economic impact, and to be coordinated with strategic corridors initiative.
ITS–Coverage Expansion and Operations (all modes)	3,640	Includes costs for expansion of ITS to rural and additional urban freeways, introduction of urban street system ITS applications, expanded incident management/road patrols, ITS communications system, and other ITS support programs.	1,000	Provides funds for strategic ITS implementation on state routes and support for off-system applications where matched by other funding sources. Assumes 100% funding for state system and 15% match for off-system improvements, addressing 55% of modal needs.
Public Transportation–Urban Bus System Expansion (Capital and Operations)	4,570	Includes capital and operating costs to expand urban public transportation services as defined in the state Public Transportation Plan. Source: Statewide Transit Plan	1,000	Increases state support for PT operating assistance to 25% state funding, and maintains PT capital match at 10%. If matched with local and federal dollars, would fund 97% of needs.
Public Transportation–Rural Service Expansion (Capital and Operations)	650	Includes capital and operating costs to expand rural public transportation services as defined in the state Public Transportation Plan.	150	Maintains state support for PT operating assistance at 25% state funding, and PT capital match at 10%. If matched with local and federal dollars, would fund 97% of needs.
Public Transportation–New Starts: Rail, Bus Rapid Transit (Capital and Operations)	3,790	Includes capital and operating costs for currently proposed New Start light rail projects in Nashville and Memphis, and bus rapid transit in Sevierville.	620	Provides enhanced level of capital and operating funding for proposed New Starts projects (25% capital and 25% operating), promoting travel choices in major urban and tourism areas. If matched with local and federal dollars, would fund 65% of needs.
Railroad–Freight Capacity	3,450	Recognizes costs for a variety of Class I railroad improvements including upgrades for east-west rail connectivity, intermodal rail facility improvements, rail interconnections, rail bypasses, double-tracking, and intermodal yards.	360	Provides 20% TDOT seed money for strategic improvements on a priority, public/private partnership basis for projects with a demonstrated public benefit, to enhance viability of rail as an alternate freight mode to trucks and to reduce conflicts with the highway network; covers 52% of needs.

Table 6-2. Modal Needs and Proposed Investment Summary (Continued)

Investment Category	25-Year Modal Needs		25-Year Proposed Investment	
	25-Year Modal Need (regardless of funding source) in $M YOE	Modal Need Coverage	Proposed 25-Year TDOT Budget in $M YOE	Policy and Program Impact
Railroad–Intercity Passenger Service	1,180	Accounts for capital and operating costs for the four most promising intercity rail passenger corridors.	250	Provides seed money to initiate services; fund two corridors at a 50% match ratio, which would address 40% of needs.
Railroad–Nashville / Chattanooga High-Speed Rail	8,020	Addresses potential cost of actual implementation of the corridor, in conjunction with other states.	10	Provides allocation for further planning, environmental and conceptual engineering studies, in partnership with border state initiatives.
Waterways–Facility Improvements	250	Recognizes costs for new or expanded port facilities, and a program for improvements on port intermodal connectors.	20	Provides funding on a 20% TDOT match basis for priority and strategic projects which can enhance attractiveness of waterways as alternative freight mode. Would address 40% of needs.
Total	**129,740**		**85,260**	

Table 6-3. Proposed Vision Plan Investment with Comparison to Historical Budget

	Investment Areas	Actual 2005 Spending ($M)	Actual 2005 Spending (% of Total)	Historical Approach (YOE)* ($M)	Historical Approach (YOE)* (% of Total)	Recommended 25-Year Funding (YOE)* ($M)	Recommended 25-Year Funding (YOE)* (% of Total)	% Change vs. Historic Spending	Policy and Program Impacts
Maintenance/ Preservation	Highway: bridge and roadway maintenance, and ITS	514.7	31.97	22,048	31.77	22,770	26.71	3.28	Continues high-level maintenance of expanding system and of aging, structurally deficient bridges, including backlog. Enhances system optimization through maintenance of current/committed urban area traffic centers; extends multimodal ITS programs.
	Public Transportation, Bicycle/Pedestrian, and Transportation Options (TDM): urban and rural system capital and operating support	54.5	3.39	2,048	2.95	2,230	2.62	8.91	Increases state support for public transportation operating assistance to 33%; provides committed funding for bicycle facility maintenance; strengthens local partnerships; recognizes value of programs to reduce peak period demand.
	Aviation and Waterway: regional system support	15.6	0.97	666	0.96	690	0.81	3.59	Maintains airport support; strengthens private partnerships in interest of promoting multimodal freight options.
	Maintenance/Preservation Subtotal	584.7	36.32	24,761	35.68	$ 25,690	30.13	3.75	
Safety/ Modernization	Highway: bridge replacement, widen narrow lanes, local system support	290.3	18.03	12,437	17.92	15,770	18.50	26.79	Addresses 75% of functionally obsolete bridge replacement and highway lane widening needs, enhancing operations by eliminating restrictions on busier street elements.
	Public Transportation and Bicycle/Pedestrian: support systems	1.1	0.07	48	0.07	90	0.11	89.08	Funds system upgrades focusing on needed ADA improvements, improving system access.
	Aviation, Railroad, and Waterways: Improved communication systems, rail grade crossing protection, shortline track capacity, and rehabilitation programs	26.7	1.66	1,143	1.65	1,260	1.48	10.25	Funds needed regional airport upgrades; establishes grant programs to promote railroad and waterway safety through private partnerships.

Table 6-3. Proposed Vision Plan Investment with Comparison to Historical Budget (Continued)

	Investment Areas	Actual 2005 Spending ($M)	Actual 2005 Spending (% of Total)	Historical Approach (YOE)* ($M)	Historical Approach (YOE)* (% of Total)	Recommended 25-Year Funding (YOE)* ($M)	Recommended 25-Year Funding (YOE)* (% of Total)	% Change vs. Historic Spending	Policy and Program Impacts
	Safety/Modernization Subtotal	318.1	19.76	13,628	19.64	17,120	20.08	25.62	
Expansion/ Enhancement	Highway: congestion relief, , local system expansion, ITS expansion	690.0	42.86	29,989	43.21	39,620	46.47	32.12	Funds 85% of need, including 50% of backlog; enhances economic development through continued industrial access, state aid, and county seat connector programs; extends ITS systems into critical rural corridors and into smaller cities.
	Public Transportation and Bicycle/Pedestrian: urban and rural system expansion support, bicycle and pedestrian system coverage expansion	9.5	0.59	694	1.00	1,850	2.17	166.57	Promotes service expansion through increased funds for state match for urban and rural system expansion; supports expansion of bicycle and pedestrian facilities.
	Aviation, Railroad, and Waterway: partnered support of airport expansion, rail bypass and intermodal yards, expanded port facilities , intercity passenger rail options	7.7	0.48	328	0.47	980	1.15	198.78	Funds needed regional airport expansion; establishes grant programs to promote railroad and waterway system enhancements that promote multimodal freight opportunities, through private partnerships. Intercity travel options promoted through funding for extension of existing services into new markets.
	Expansion/Enhancement Subtotal	707.2	43.92	31,011	44.68	42,450	49.79	36.89	
	Total	1,610.0	100	69,400	100.00	85,260	100	22.85	

Table 6-3. Proposed Vision Plan Investment with Comparison to Historical Budget (Continued)

Investment Areas	Actual 2005 Spending		Historical Approach (YOE)*		Recommended 25-Year Funding (YOE)*		
	($M)	(% of Total)	($M)	(% of Total)	($M)	(% of Total)	% Change vs. Historic Spending
Highway and ITS	1,495	92.86	64,473	92.90	78,160	91.70	21.23
Public Transportation, TDM, and Bike/Pedestrian	65	4.04	2,789	4.02	4,170	4.89	49.52
Aviation, Rail, and Waterways	50	3.10	2,137	3.08	2,930	3.44	37.11
Total	1,610	100.00	69,400	100.00	85,260	100.00	22.85

Appendix A
Surrounding States Survey

Appendix A

Surrounding States Survey

As part of the Tennessee Long-Range Transportation Plan, a survey form was distributed to representatives of the surrounding state transportation departments, Metropolitan Planning Organizations situated on the Tennessee border, and Fort Campbell, a major military installation situated in both Tennessee and Kentucky. The participants in the survey and a summary tabulation of the responses are presented in this appendix.

Participants

State Departments of Transportation

Alabama
Bill Couch, Assistant Transportation Planning Engineer
Stan Biddick, ITS
Wes Elrod, Multimodal Bureau
Frank Farmer, Aviation
Jenny Williams, Rail

Arkansas
Scott Bennett, Assistant Chief Engineer for Planning

Georgia
Joe Palladi, Georgia Department of Transportation

Kentucky
Annette Coffey, Director of Planning

Missouri
Marcie K. Meystrik, Long-Range Transportation Planning Coordinator

Mississippi
Ray Ballentine, Director of Planning, 601-359-7025

North Carolina
Alpesh Patel, Systems Planning Unit, Transportation Planning Branch

Virginia
Ben Mannell, Statewide Planning Manager

Metropolitan Planning Organizations/Other

Tennessee MPOs
Rex Montgomery, Bristol, Tennessee (borders Virginia)
Stan Williams, Clarksville, Tennessee (borders Kentucky)
Eugene Bryan, Memphis, Tennessee (borders Mississippi and Arkansas)
Karen Rhodes, Chattanooga, Tennessee (borders Georgia) – captured in GDOT response
Bill Albright, Kingsport, Tennessee (borders Virginia and near Kentucky) – no response

Surrounding State MPOs
Eddie Brawley, West Memphis, Arkansas
Connie Graham, Huntsville, Alabama

Other
Wally Crow, Fort Campbell Military Base (Kentucky and Tennessee)

Major corridor initiatives

Alabama

- Huntsville Southern Bypass
- Huntsville Eastern Bypass
- Huntsville Northern Bypass Phase 2
- Proposed I-22 would run along the current Hwy 78 between Memphis and Birmingham
- Memphis to Atlanta Highway
- Improvements along ARC Corridor V, also known as US 72 East in Madison County

Arkansas

- Third river crossing in the West Memphis/Memphis area (south of the existing crossings) to connect to either Mississippi or Tennessee off of I-55 and potentially connect to I-69. The study is looking at making this a multimodal corridor.

Georgia

- New roadway corridor from Dade County, Georgia to Franklin County, Georgia, which would run parallel to Tennessee near South Pittsburg.
- Recently completed a study about traffic impacts from the Chickamauga and Chattanooga Military Park
- Capacity improvements planned on Tennessee State Routes 151, 146, and US 41, which connect into Georgia
- Third Tennessee River Bridge crossing that would connect US 27 north of Soddy Daisy
- The Chattanooga MPOs 2030 Plan is proposing several roadway projects near or at the Tennessee-Georgia State line
- The Chattanooga LRTP recommended a High-Occupancy Vehicle Feasibility Study along a section of I-75 and I-24 and a Chattanooga Bypass Feasibility; Location and Freight study to be done
- Four projects in Fannin County are related to construction and widening on SR 60, which is near Polk County, Tennessee
- A planning study is underway to determine the need for widening US 411 from the Tennessee state line through Murray and Gordon counties to I-75 in Bartow County

Kentucky

- Expansion of Cole Road off of Hwy 41A, which would service Fort Campbell
- Expansion of Hwy 41A to I-24
- Expansion of KY 9-11 and 115 near Fort Campbell
- I-69
- Improvements to US 641
- Improvements to US 127 just north of Livingston, Tennessee; improvements run from border to Jamestown, Kentucky
- Currently preparing to use GARVEE bonds to complete widening of I-65 and I-75 to six lanes from border to border.
- A planning study on how to modify the existing parkway system between Henderson and Fulton to accommodate a future I-69 is near completion; however, major improvements to those routes are unlikely

- There is also a project to extend the Breathitt (Pennyrile) Parkway in Hopkinsville to connect with I-24 near Ft. Campbell.

Missouri

- MoDOT has plans to complete the US Route 60 Corridor. This project will complete the four-lane corridor from Springfield to Sikeston
- MoDOT is also widening US Route 412 from two to four lanes from I-55 to Kennett, Missouri

Mississippi

- Improvements to I-55 south of Memphis, including additional lanes to increase capacity
- I-69, which includes a new Mississippi River crossing at Benoit
- A new Mississippi River crossing is being built on Route 82 at Greenville
- Proposed I-22 would run along the current Hwy 78 between Memphis and Birmingham

North Carolina

- US 64/US 321 connects Bristol, Tennessee, to Hickory, North Carolina
- I-26 from Asheville to Tennessee border
- I-40 from Asheville to Knoxville
- US 19E in Mitchell and Yancy counties in North Carolina, near Erwin, Tennessee
- Completion of the I-73/74 interstate projects
- US 74

Virginia

- Widening I-81 from Bristol to six lanes. Virginia is studying dedicated truck lanes and ways to divert some freight to rail
- Various improvements to State Route 58 near Bristol
- I-81
- I-73
- Coalfields Expressway

511 programs

Arkansas

- The Arkansas Highway Commission will consider in June a Minute Order authorizing staff to begin planning for 511

Georgia

- Implementation of GDOT's 511 program is underway. GDOT is in the process of hiring a consultant firm to assist in program development. Specific information unknown at this time.

Kentucky

- In 2002 Kentucky implemented 511 statewide for both landline and wireless phones.
- In the southern and eastern parts of the state, the 511 system has expanded to include tourism information.
- Future goals are to work with neighboring states to share information automatically, to enable transfers between states for interested callers, and to work out state line issues relating to wireless towers near state lines.

- Other goals include continuing to gather accurate information into the system through better coordination with state and local law enforcement agencies and highway district offices.

Missouri

- MoDOT has delayed the implementation of 511 to focus on collecting quality data to populate the 511 system.

Mississippi

- Study completed; not anticipated in near future because of funding.

North Carolina

- NCDOT started a 511 traveler information program in August 2004.
- 12 kiosks are located throughout the state at rest areas and major tourist centers.
- A dedicated funding source has been established for maintenance and operation of such infrastructure.
- Future plans include adding more kiosks, dynamic message signs, pavement detection devices, etc.

Virginia

- VDOT has had 511 along I-81 since 2002 and has recently expanded the system to cover the entire state.

ITS programs

Alabama

- The City of Huntsville has identified ITS strategies and is currently developing a Strategic Regional ITS Plan. Future plans include installing fiber-optic cable, dynamic message signs, and video cameras along Hwy 53.

Arkansas

- Message boards, cameras, and speed detectors on I-40 between West Memphis and Canada Road (Memphis).
- Message boards, cameras, and speed detectors on I-55 from West Memphis through Memphis to Mississippi line.
- Development of a regional architecture for the West Memphis area will begin soon.

Georgia

- Dalton-Whitfield County is the only area near the Tennessee border that has plans for new ITS programs.
- A project has been identified for a Transportation Control Center, but plans are long range.

Kentucky

- Preliminary stages of improving access and congestion on Hwy 41 A with message boards; needs funding.
- Overhead dynamic message signs on I-75 near the Cumberland Gap tunnel and near Lexington
- A system of dynamic message signs on I-65 in the vicinity of Elizabethtown

Mississippi

- Web cameras in DeSoto County
- Message boards, cameras, and speed detectors on I-55 from West Memphis through Memphis to Mississippi line

Virginia

- Virginia uses message boards along the Tennessee border; also has one in Tennessee
- VDOT currently installing additional message sign boards along I-81.

Future use of tolling

Alabama

- Alabama conducting toll feasibility studies on new roadways
  - I-10 to Dothan
  - Outer loop in Montgomery

Arkansas

- Considering a toll bridge from Osceola to Millington, Tennessee
- Tolling is being considered for construction of the Bella Vista Bypass (Highway 71/Future Interstate 49) in northwest Arkansas.

Georgia

- GDOT has no plans at this time to use tolling to build any new roads or bridges in Dade, Walker, Catoosa, Whitfield, Murray, and Fannin Counties bordering Tennessee.
- Currently uses tolling on GA 400.
- State Road and Tolling Authority are considering tolling other roadways.

Kentucky

- The proposed new bridges over the Ohio River at Louisville may use tolling as a financing method.
- The Brent Spence Bridge may use tolling as a possible financing method.

Missouri

- Conducting a toll study to determine the feasibility of tolls on certain facilities.

North Carolina

- Future tolling will be on new roads/bridges, authority and oversight is granted to the North Carolina Turnpike Authority.

Virginia

- VDOT is considering tolls for trucks along I-81 as part of its National Environmental Policy Act (NEPA) study for this corridor.

Major bicycle routes near the Tennessee border

Alabama

- State bicycle plan currently in development

Arkansas

- None at the state level

Georgia

- Three major bike routes come close or head into Tennessee:
  - Chattahoochee Trail
  - March to the Sea
  - Mountain Crossing

- Several bike routes/bicycle improvements are being proposed near the Georgia-Tennessee border and within the planning boundaries of the Chattanooga MPO (Dade, Walker, and Catoosa counties) and are included in the Chattanooga LRTP.

Kentucky

- Nine designated bicycle routes and the TransAmerica Tour crisscrossing Kentucky.
- Designated bicycle routes that lead from Kentucky to Tennessee:
  - Fulton County KY 94 south to TN 78 near Reelfoot Lake National Wildlife Refuge
  - Logan County KY 102 and KY 96 at Keysburg KY south to Adams, Tennessee
  - Simpson County KY 2593 south to near Mitchellville, Tennessee
  - Cumberland County, Dale Hollow Lake area, Peytonsburg, KY 61 South to TN 53 to Celina
  - US 25W South Jellico, Tennessee, in Whitley County

Missouri

- MoDOT in process of updating LRTP, which will include development of a statewide bicycle map

Mississippi

- Memphis MPO Bike Plan has proposed routes to connect with Mississippi routes.
- The state has identified no major state routes.

Virginia

- The Commonwealth Transportation Board recently directed VDOT to give non-motorized transportation the same consideration as motorized transportation in the planning, design, construction, and operation of Virginia's transportation network.

Additional intercity passenger rail

Alabama

- None planned at this time, but a private group in Birmingham is working on a rail line to Atlanta.

Georgia

- A study is underway for a high-speed rail ground transportation corridor from Atlanta to Chattanooga. A Memorandum of Understanding of all stakeholders is being developed. TDOT will be included in the MOU and corridor planning.

Missouri

- No immediate plans, but Missouri, along with eight other states, is a participant in the Midwest Regional Rail Initiative.

Mississippi

- Memphis is currently studying a line that would run close to I-55 and end in either Horn Lake or Southaven.

North Carolina

- A phased plan to extend passenger rail service to Asheville and western North Carolina is currently on hold for funding.
- Detailed studies are underway to determine feasibility of route to and from Wilmington.

- North Carolina and Virginia are studying a high-speed rail corridor connecting the two states.
- The NCDOT has partnered with the North Carolina Railroad and Norfolk Southern to improve the busy Raleigh to Charlotte rail corridor.

Virginia

- TransDominion Corridor Study is being conducted to study passenger rail that runs from Bristol to Lynchburg to Richmond.
- Studying a high-speed rail corridor between Washington D.C., Richmond, Virginia, and Charlotte, North Carolina

New freight rail lines or facilities and significant upgrades to existing lines

Kentucky

- Fort Campbell recently added a 13-acre rail spur and rail yard. Fort Campbell is considering doubling the size of the rail yard.
- Kentucky is interested in the Midwest Regional Rail Initiative. No funding.

Mississippi

- Study to relocate the East-West CSX corridor that runs along I-10. No additional capacity.
- State is undertaking statewide Rail Needs Assessment that could impact Tennessee.

North Carolina

- Evergreen has located at Wilmington ports and expects to expand TEUs significantly in the next 5 years.
- By 2009 a new Federal Express hub will be operational at Piedmont Triad International Airport.
- NCDOT in preliminary phase of starting urban freight study in the Wilmington area.

Virginia

- Possible line in conjunction with I-81

New multimodal or intermodal terminals or facilities

Alabama

- Expansion of facilities at the International Intermodal Center (IIC) in Huntsville was necessary in 2003.
- New initiatives for IIC have been identified to increase the capacity for intermodal transportation. The "Stack-Train" concept is addressed in the LRTP and has resulted in substantial increases in volumes at major intermodal hubs, such as Memphis and Atlanta.

Arkansas

- Intermodal facilities are being planned for:
  - Russellville
  - Van Buren
  - Near Monticello

Kentucky

- RJ Corman is looking into a private port with shortline connector that would service Tennessee and Kentucky.
- SKDEC has received several earmarks of federal transportation funds to build a rail-highway intermodal facility in Pulaski County, Kentucky.

- R J Corman has received funds to rehabilitate an existing line in central Kentucky between Louisville and Lexington.

Missouri

- St. Louis is in early construction phase of a multimodal facility that will bring together light rail, city bus, intercity bus, and Amtrak service into one facility.

Mississippi

- Discussions about developing an intermodal terminal near Hattiesburg.
- Burlington Northern is also expanding near Hwy 78 and Shelby Drive in Memphis which is near the Mississippi border. In conjunction with that expansion, Mississippi is looking to expand Route 305, which will parallel the facility. This expansion would at least double Burlington Northern's current capacity.

North Carolina

- A new multimodal center opened in Greensboro (Douglas Galyon Depot) in August 2003. It is a transfer center that houses the Trailways Bus Station and taxicab stand and will eventually include Amtrak service.
- The Triangle Transit Authority oversees the ongoing planning for a regional rail system in the Triangle. Service is expected to be operational by 2008 and includes the construction of a multimodal center/station in downtown Raleigh.
- A downtown multimodal center/station is part of Charlotte's transit system. The 93,200 square-foot facility serves as the main terminal and transfer facility for Charlotte's public transportation system. This will soon service new commuter rail/bus rapid transit service in the next 2 years.
- Charlotte-Douglas International airport is the potential location for a new Norfolk-Southern Intermodal yard.
- The Global Transpark in Kinston continues to seek an intermodal role for eastern North Carolina. The Transpark was built with the concept of seamless connections between air-truck-freight rail movement.

Virginia

- There were plans to install an intermodal (train/truck) terminal in an industrial park just northeast of Wytheville and north up to I-77/I-81.
- The Heartland Corridor initiative proposes the expansion of a major rail freight corridor stretching from Norfolk to Chicago. Components of the initiative call for removing a residential rail corridor to a safe and secure highway median rail corridor and constructing an intermodal transfer facility adjacent to I-81 to alleviate congestion.

Major waterway improvements, dams, locks, or ports

Alabama

- The Huntsville MPO conducted a River Port Development Study in 2000 to identify sites for port facilities adjacent to the Tennessee River. The feasibility of the new river port development is dependent upon a common desire and concerted effort by community leaders to recruit businesses using barge transportation.

Arkansas

- A slack water harbor is being considered for the Blytheville area in northeast Arkansas.

Kentucky

- RJ Corman is considering a port off Hwy 374.

- The 1999 Needs Assessment conducted on the Hickman-Fulton County Riverport indicated improvements were needed to increase capacity.
- The Henderson Riverport Authority has received several earmarks of federal transportation funds to build a dock expansion.

Missouri

- The U.S. Army Corps of Engineers (USCOE) is planning to expand lock and dam system on Mississippi River North of St. Louis.

North Carolina

- The USCOE recently finished a river deepening channel project for the Wilmington Port.
- Port Authority is looking to improve Radio Island facilities at the Morehead City ports.
-

Virginia

- Norfolk International Terminals and Virginia Port Authority are planning expansion and significant growth in the amount of freight that their facilities will be able to accommodate. This will have a statewide impact on truck and rail freight growth in the next 10 to 20 years.

New commercial or regional airports or new major hubs at existing airports

Alabama

- New regional airport being built in Cherokee County.
- Madison County Airport expansion recently completed.
- Huntsville International Airport plans expansion.

Arkansas

- West Memphis airport plans additional runway.

Kentucky

- Currently building/improving three new community airports:
  - Williamsburg
  - Morehead
  - Marion-Crittenden County
- Two new community airports will be under construction within 12 months:
  - Tri-County
  - Hancock County
- Somerset and Bowling Green will likely soon provide passenger service.
- UPS is expanding Louisville hub.
- CHL is closing hub at Northern Kentucky/Cincinnati airport.

Mississippi

- Tunica has a 7,000-foot-long runway, with plans to expand to at least 10,000 feet and build a tower.
- Additional air freight capacity might be part of a project in Olive Branch.

North Carolina

- Expansion plans at state's two largest airports:
  - Charlotte Douglas Airport is adding a fourth runway of 9,000 feet.

  - Raleigh-Durham Airport is expanding Terminal C. Building will more than double in size and number of gates will increase. Apron area will also be expanded.
- Federal Express hub at Triad International Airport is major new hub facility
- Major hub possibility also exists for Global Transpark

Virginia

- Lee County Airport near Jonesville, Virginia
- Grundy, Virginia- Proposed General Aviation Replacement Airport
- Franklin County/Rocky Mount, Virginia
- Tappahannock-Essex County Airport

Additional Projects

Virginia

- Improvements planned in Moccasin Gap area along Routes 23, 58, 224, and 72 as well as Route 58 in Lee and Wise Counties.

Public/private partnerships to build or expand major transportation facilities

Alabama

- No plans, but open to private partners for toll roads (private entity would build, operate, and maintain)

Georgia

- Public/private partnerships will be involved in developing high-speed rail ground transportation corridor from Atlanta to Chattanooga. TDOT and GDOT will be involved in implementation of roadway projects/studies proposed in Chattanooga MPO 2030 Transportation Plan.

Kentucky

- Potential RJ Corman port

Missouri

- Missouri has no public/private partnerships.
- Two major projects are being funded through cooperation between MoDOT and local transportation development districts:
  - MO Route 100 in Franklin County
  - US Route 67 in Madison, Wayne, and Butler counties

Mississippi

- Bonding partnerships occurring with local governments, but no private entities.

North Carolina

- Not at this time unless the Turnpike Authority mentioned earlier chooses to study such a possibility.

Virginia

- I-81 likely to involve a PPTA.
- Heartland Corridor likely to involve both public and private investment as the railroads are owned by private entities.

Plan documents

Alabama

- State Aviation System Plan
- State Bicycle Plan
- State Rail Plan
- Huntsville MPOs Year 2030 LRTP

Arkansas

- West Memphis MPO LRTP

Georgia

- Chattanooga LRTP
- Once complete, TDOT may also want to review GDOT Statewide Transportation Plan and Dalton MPO 2030 Plan.

Kentucky

- Fort Campbell Transportation Plan
- Statewide Transportation Plan
- Statewide Rail Plan
- Statewide Riverport Plan

Missouri

- MoDOT Statewide Transportation Improvement Program
- MoDOT Planning Framework
- MoDOT in beginning phase of updating LRTP

Mississippi

- Vision21 map
- Statewide Rail Needs Assessment when complete in 2006

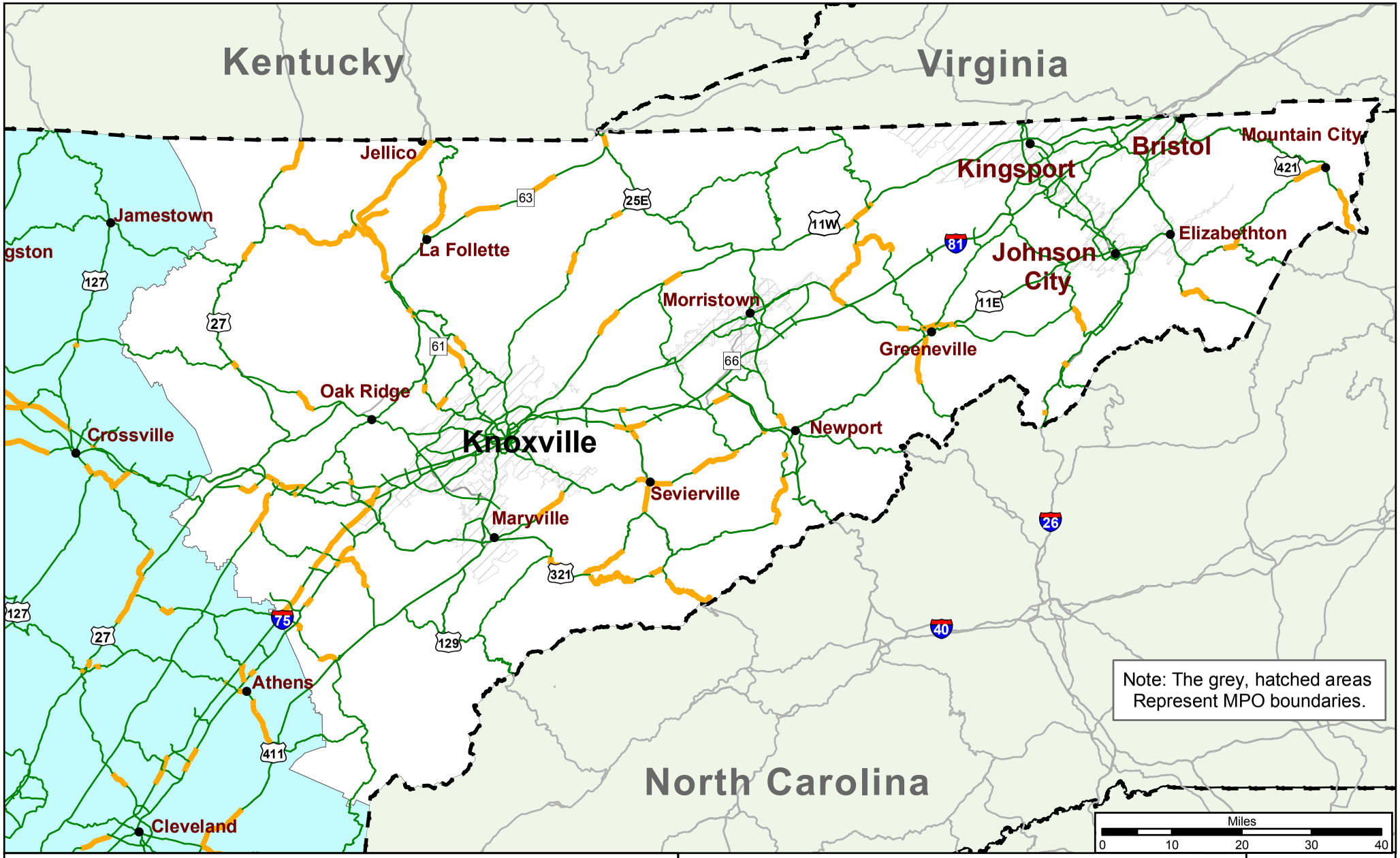
North Carolina

- Statewide Multimodal Transportation Plan

Virginia

- VTrans2025
- State Highway Plan
- State Rail Plan
- Virginia Air Transportation System Plan
- 2040 Port Master Plan

Appendix B
Highway System Level of Service Maps



Tennessee Long-Range Transportation Plan

LOS D Year 2003

Region 1

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS D

* Urban Areas were not analyzed

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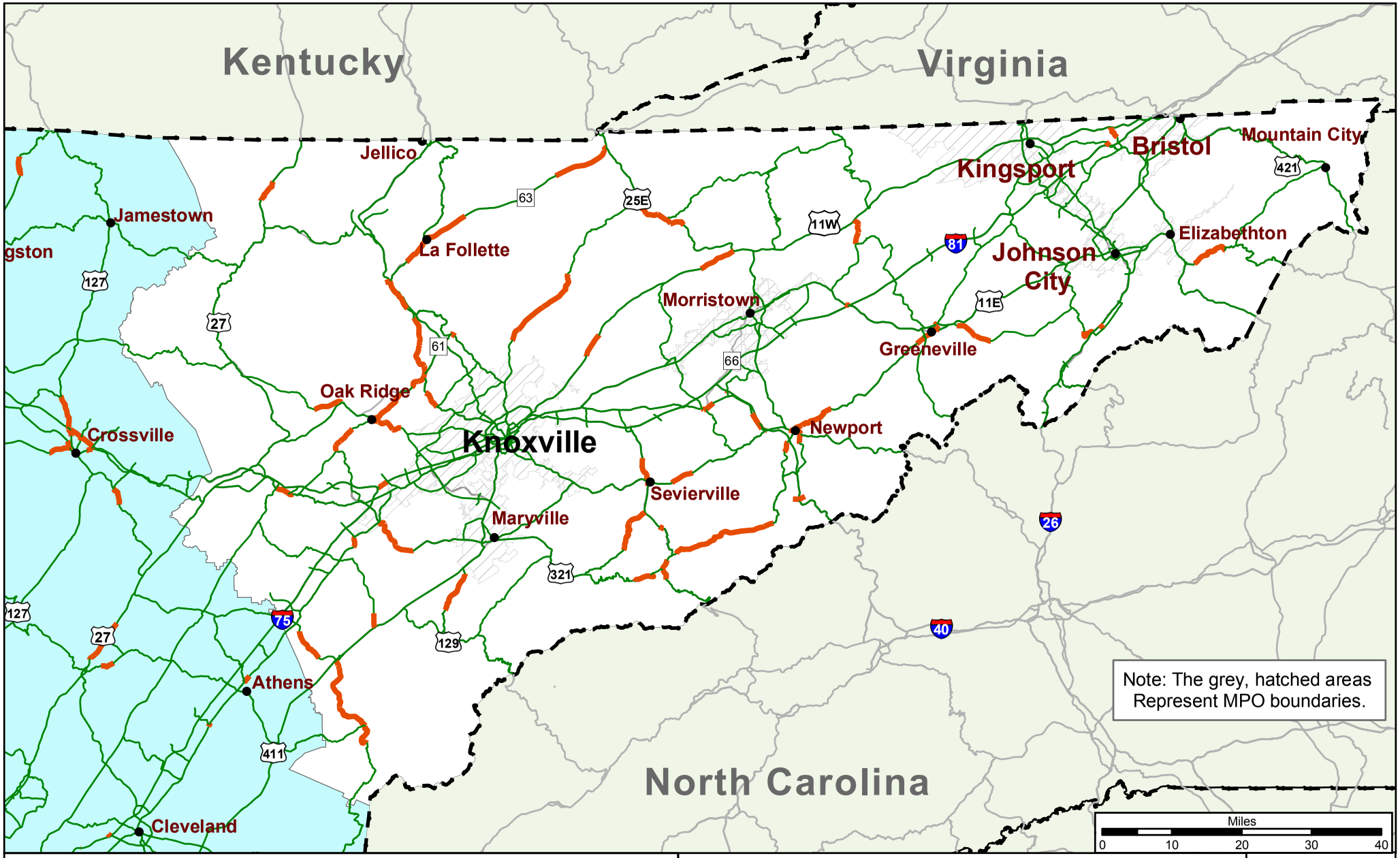

Tennessee Long-Range Transportation Plan

LOS E&F Year 2003

Region 1

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS E&F

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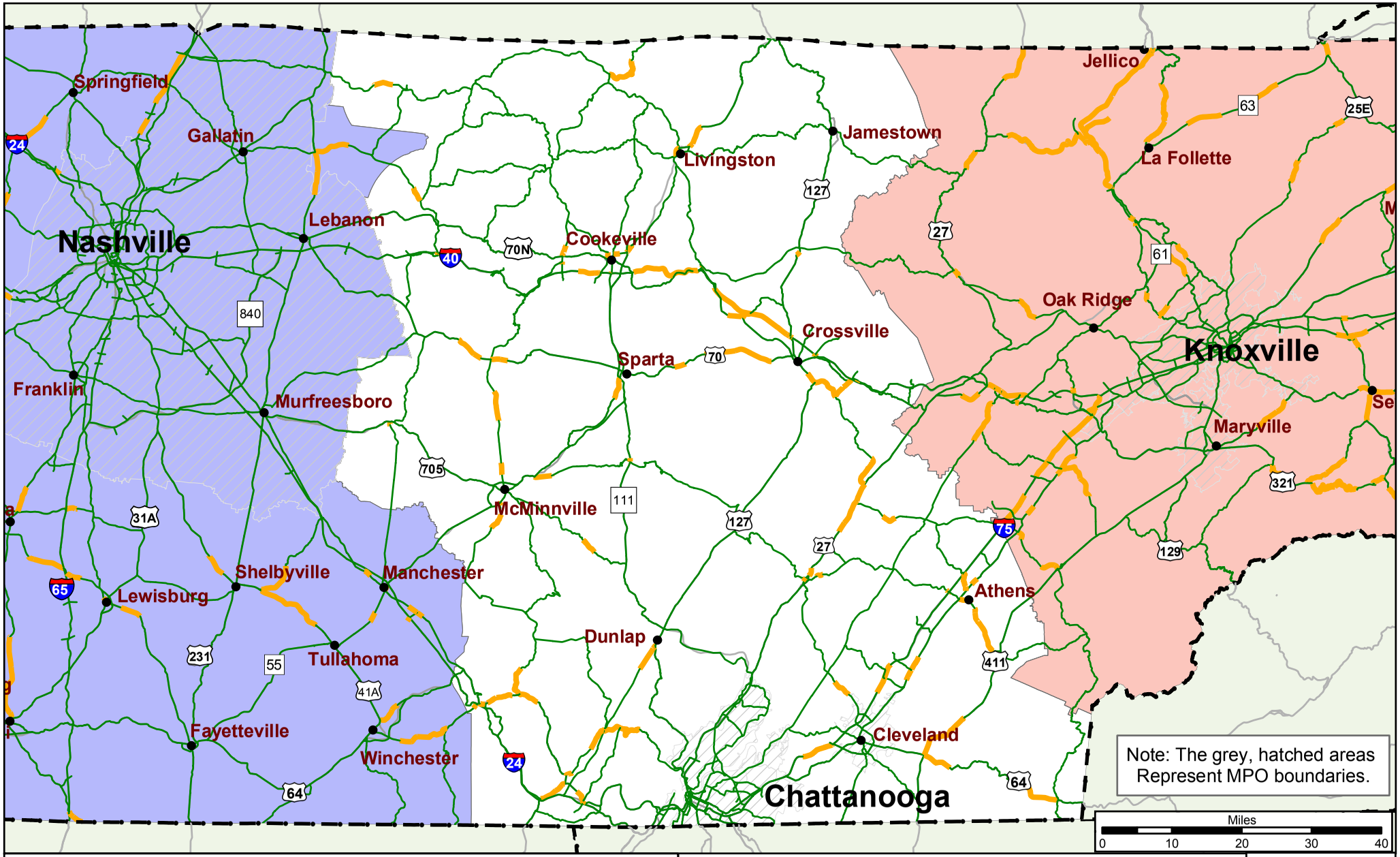

Tennessee Long-Range Transportation Plan

LOS D Year 2003

Region 2

TDOT Go.

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS D

*** Urban Areas were not analyzed**

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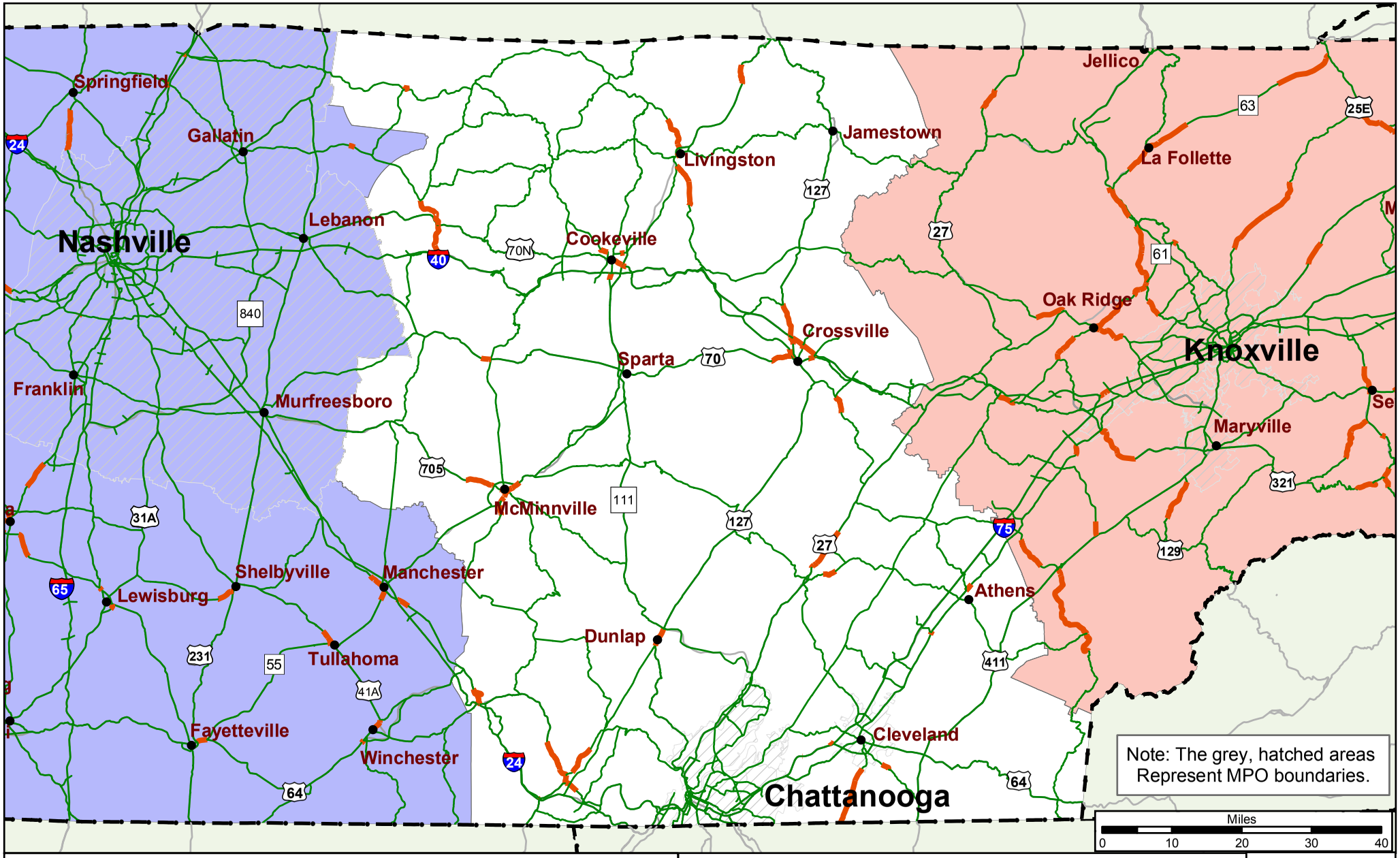

Tennessee Long-Range Transportation Plan

LOS E&F Year 2003

Region 2

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS E&F

* Urban Areas were not analyzed

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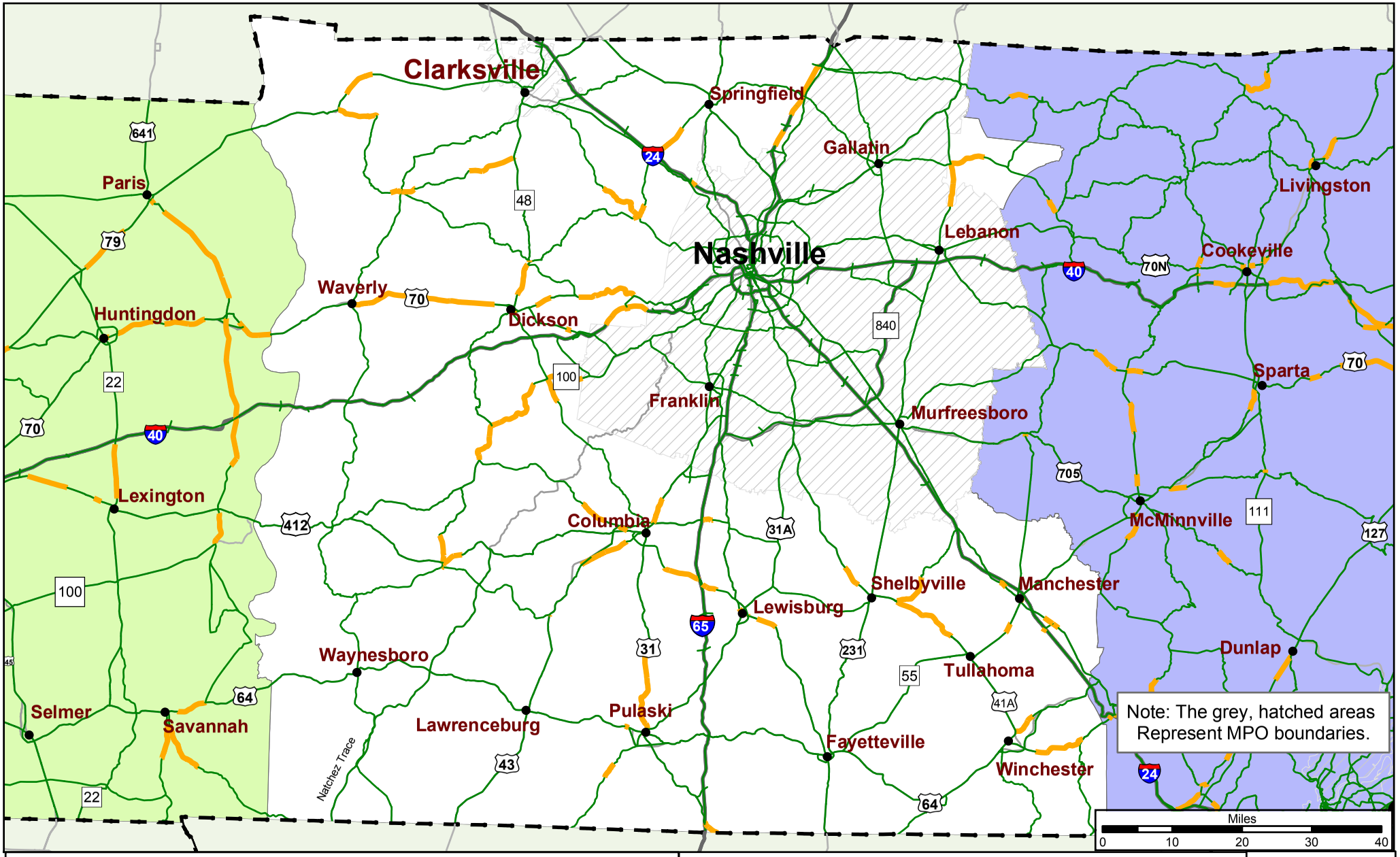

Tennessee Long-Range Transportation Plan

LOS D Year 2003

Region 3

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS D

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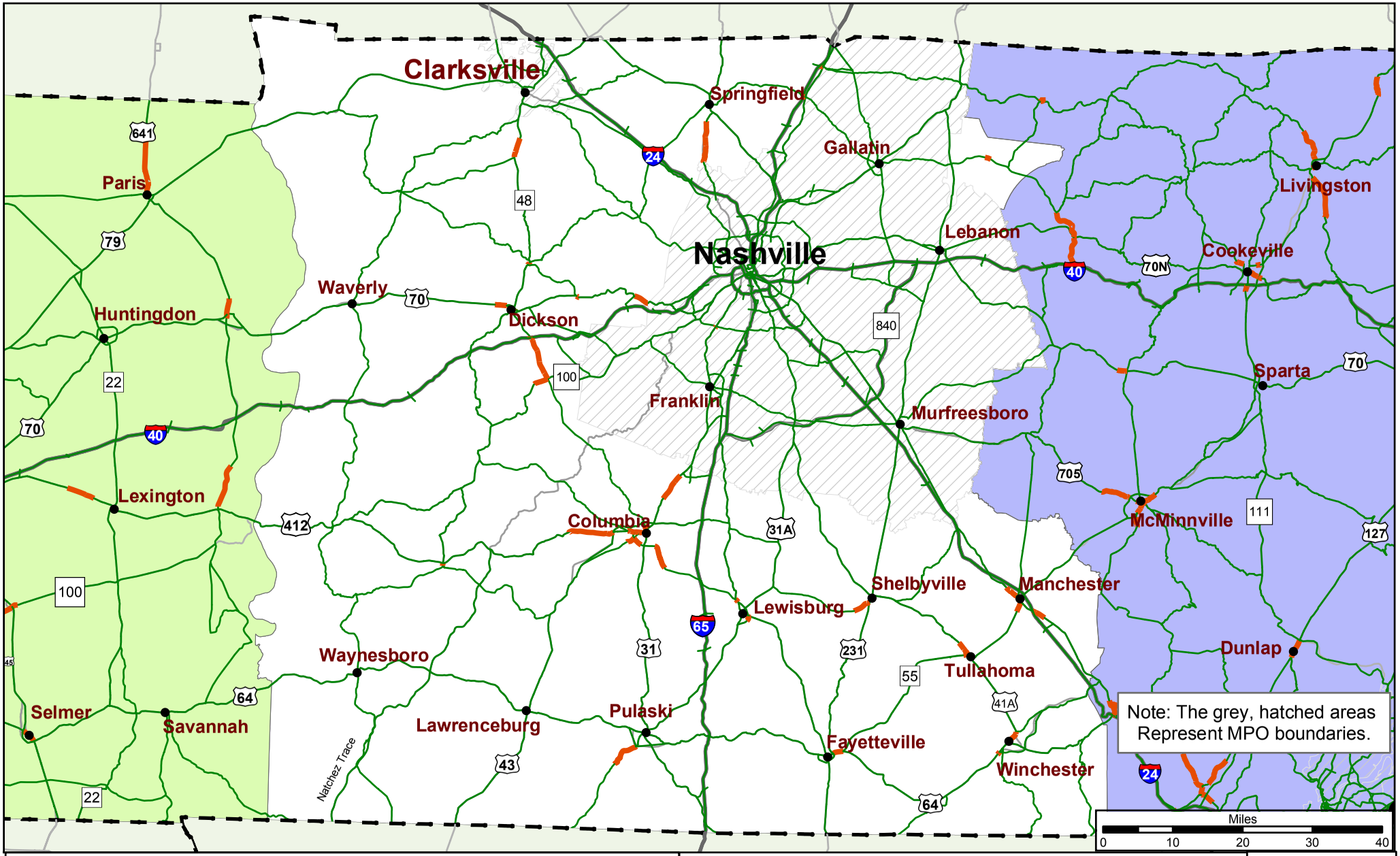

Tennessee Long-Range Transportation Plan

LOS E&F Year 2003

Region 3

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS E&F

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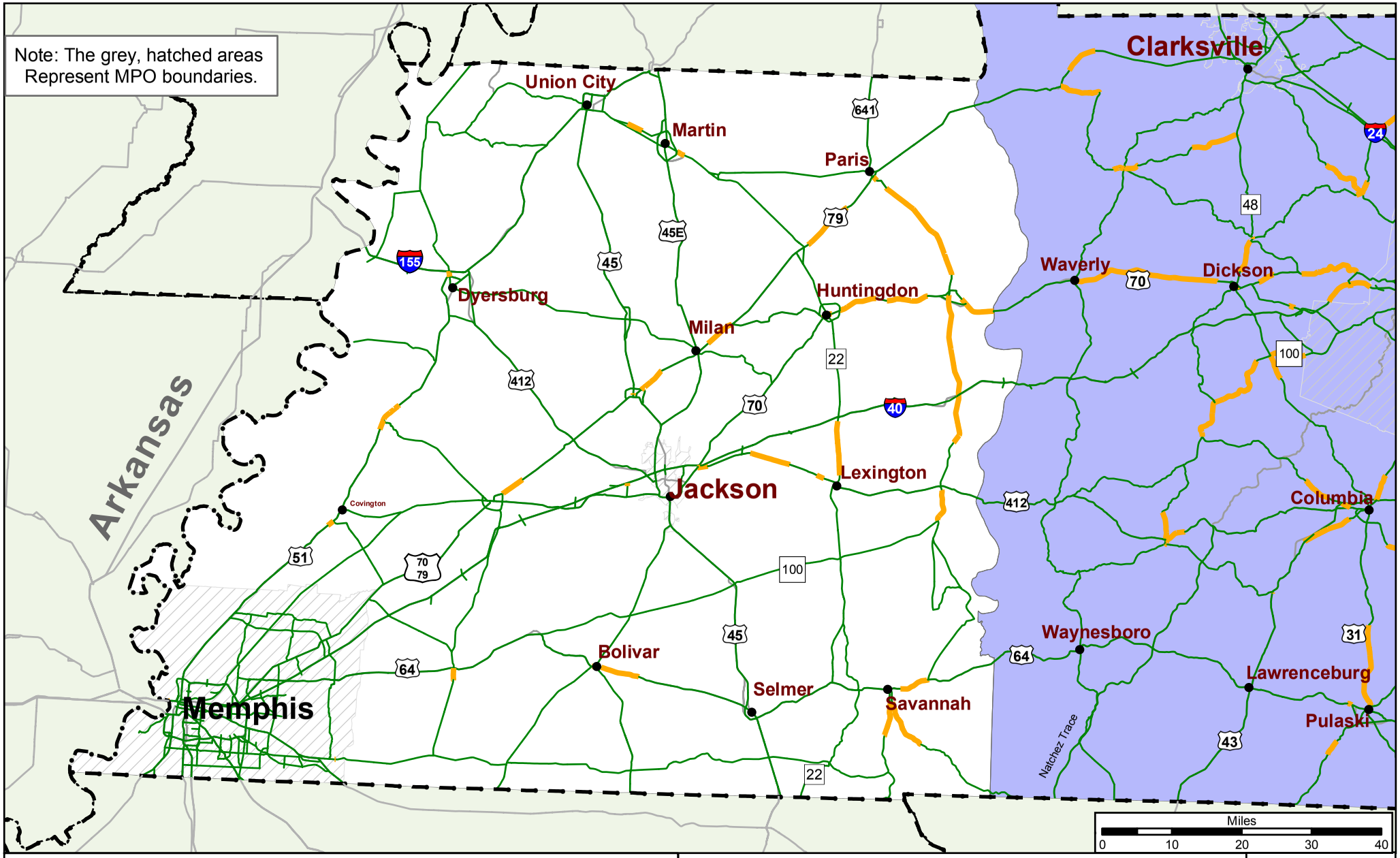

Tennessee Long-Range Transportation Plan

LOS D year 2003

Region 4

TDOT Go.

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS D

* Urban Areas were not analyzed

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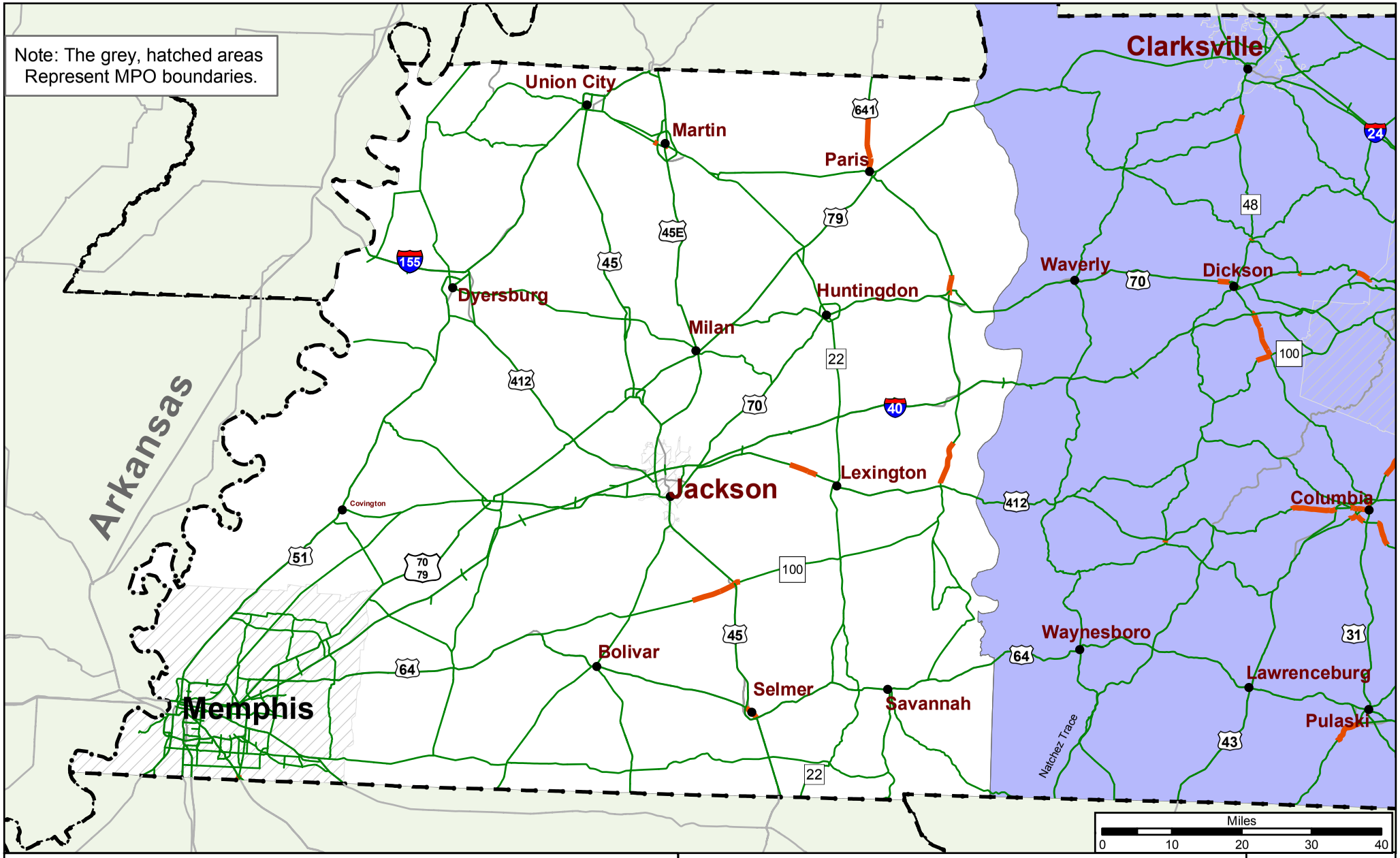

Tennessee Long-Range Transportation Plan

LOS E&F year 2003

Region 4

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS E&F

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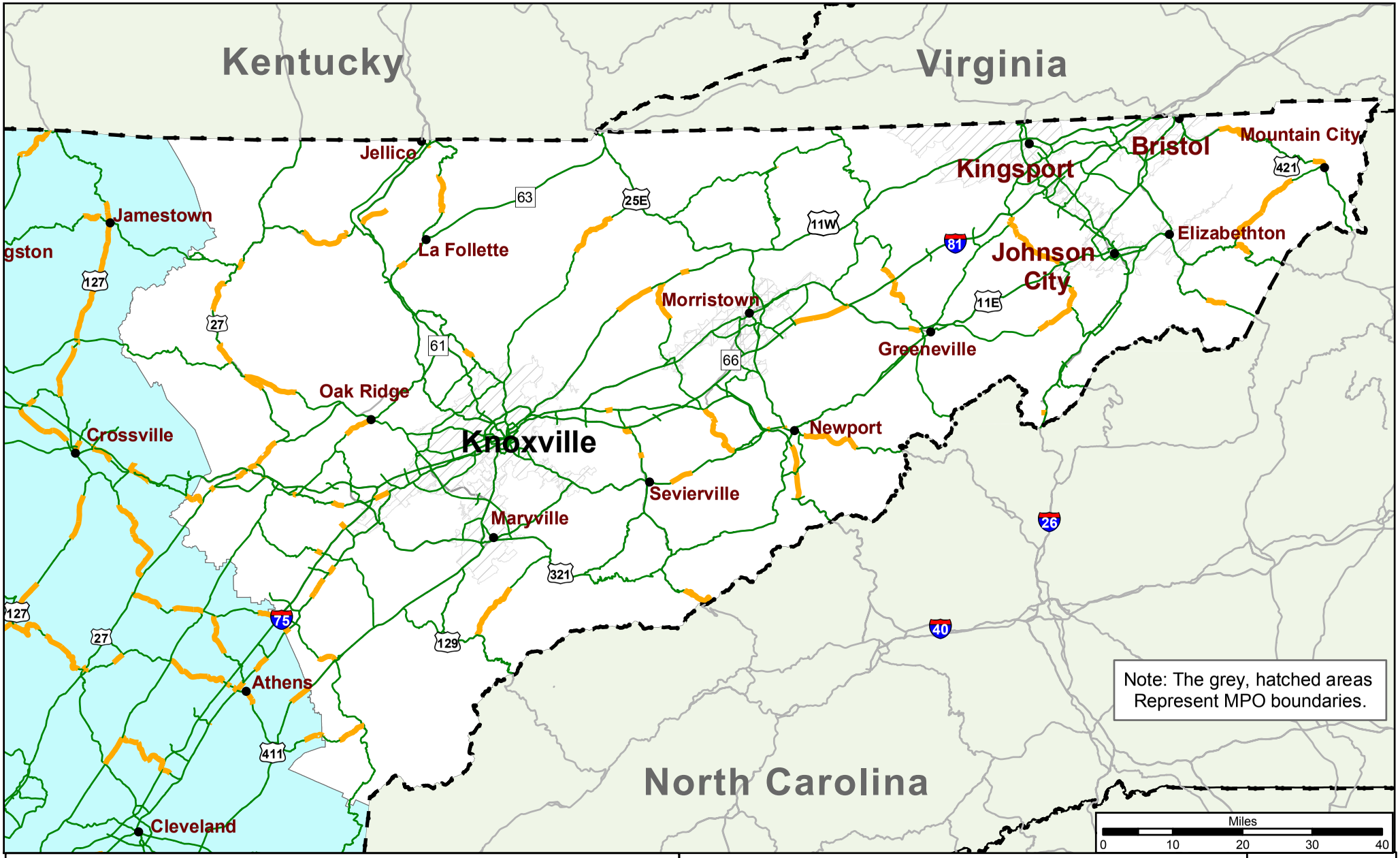

Tennessee Long-Range Transportation Plan

LOS D Year 2030

Region 1

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS D

*** Urban Areas were not analyzed**

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Tennessee Long-Range Transportation Plan

LOS E&F Year 2030

Region 1

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS E&F

*** Urban Areas were not analyzed**

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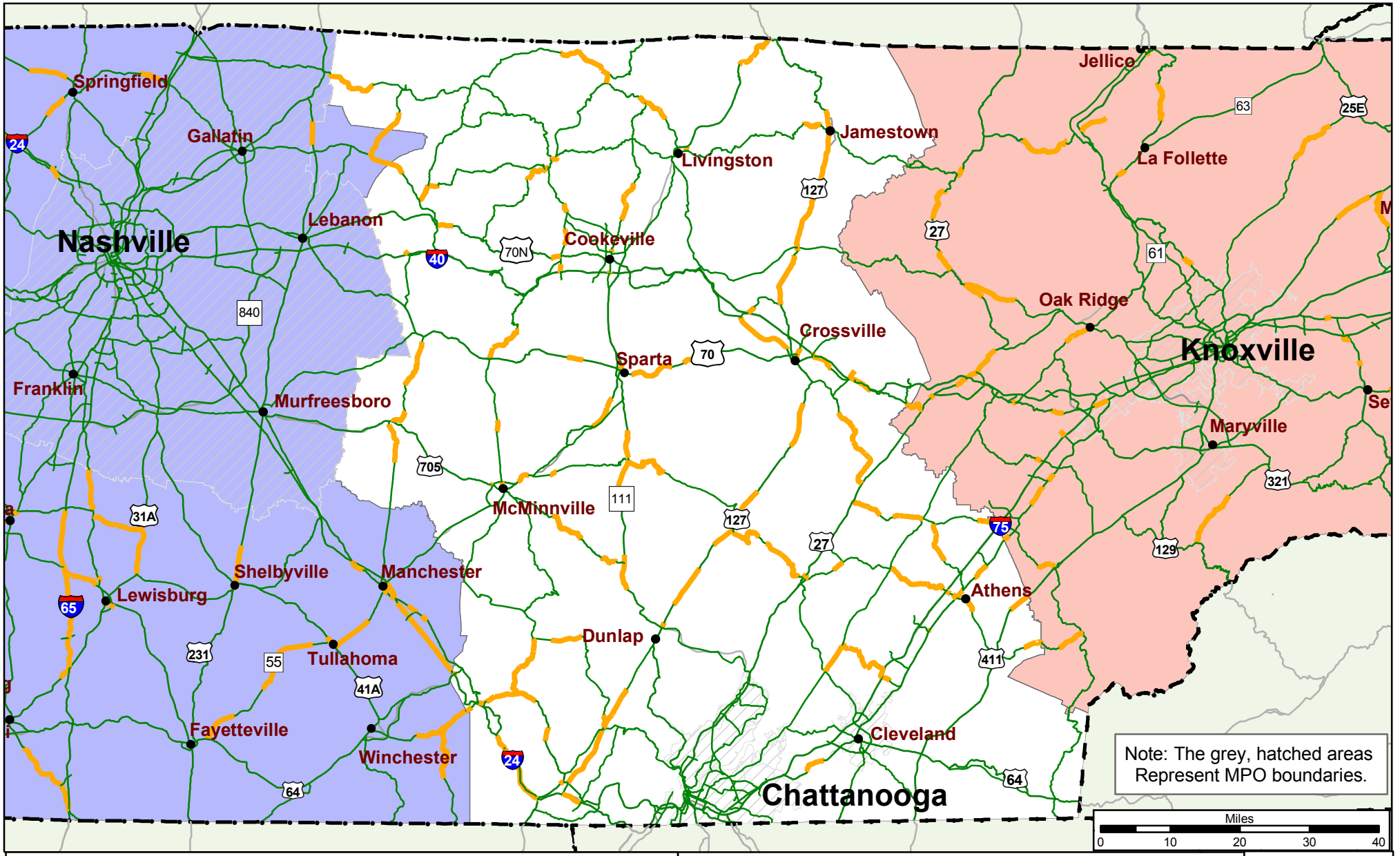

Tennessee Long-Range Transportation Plan

LOS D Year 2030

Region 2

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio

All other values

LOS D

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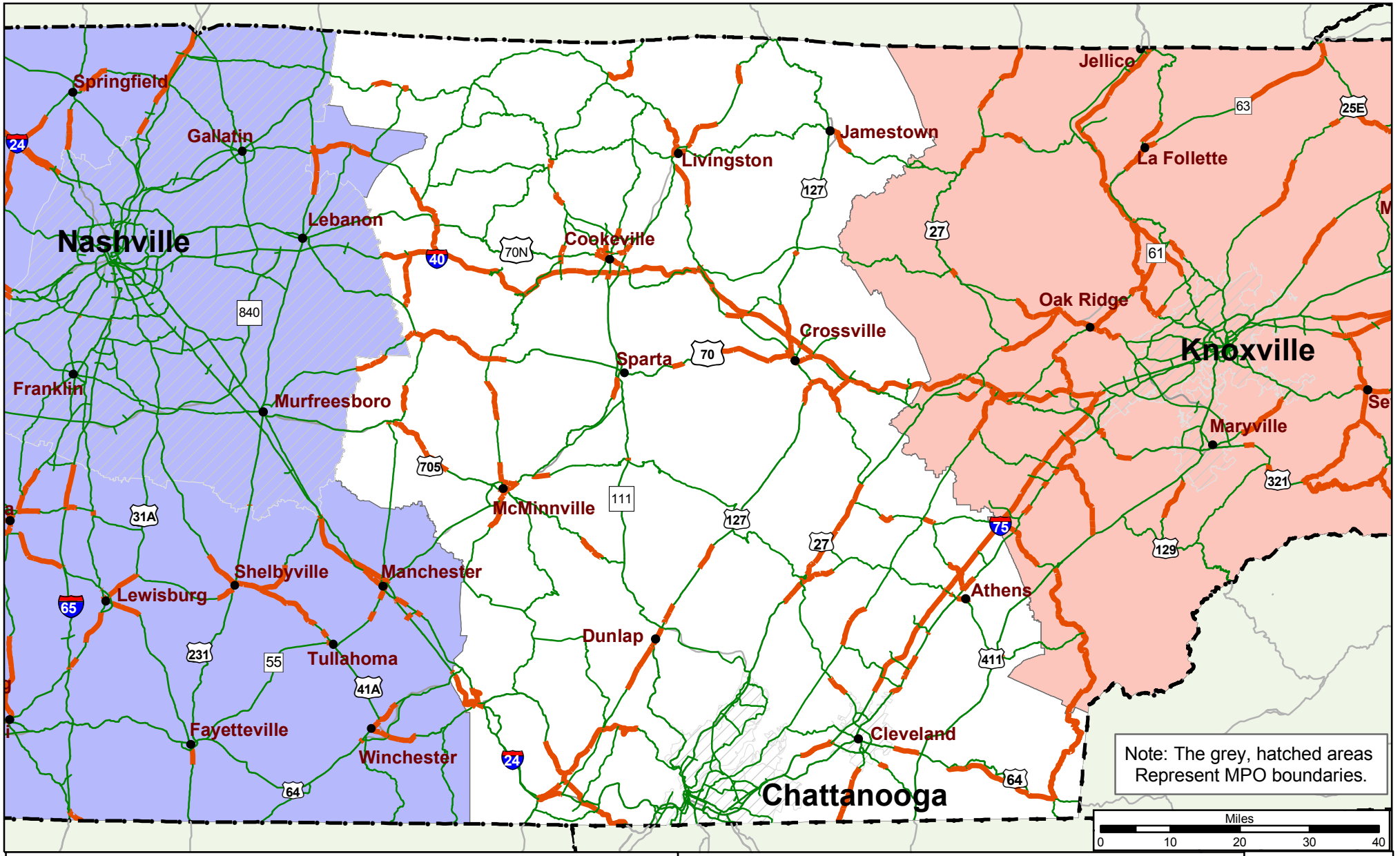

Tennessee Long-Range Transportation Plan

LOS E&F Year 2030

Region 2

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio

All other values

LOS E&F

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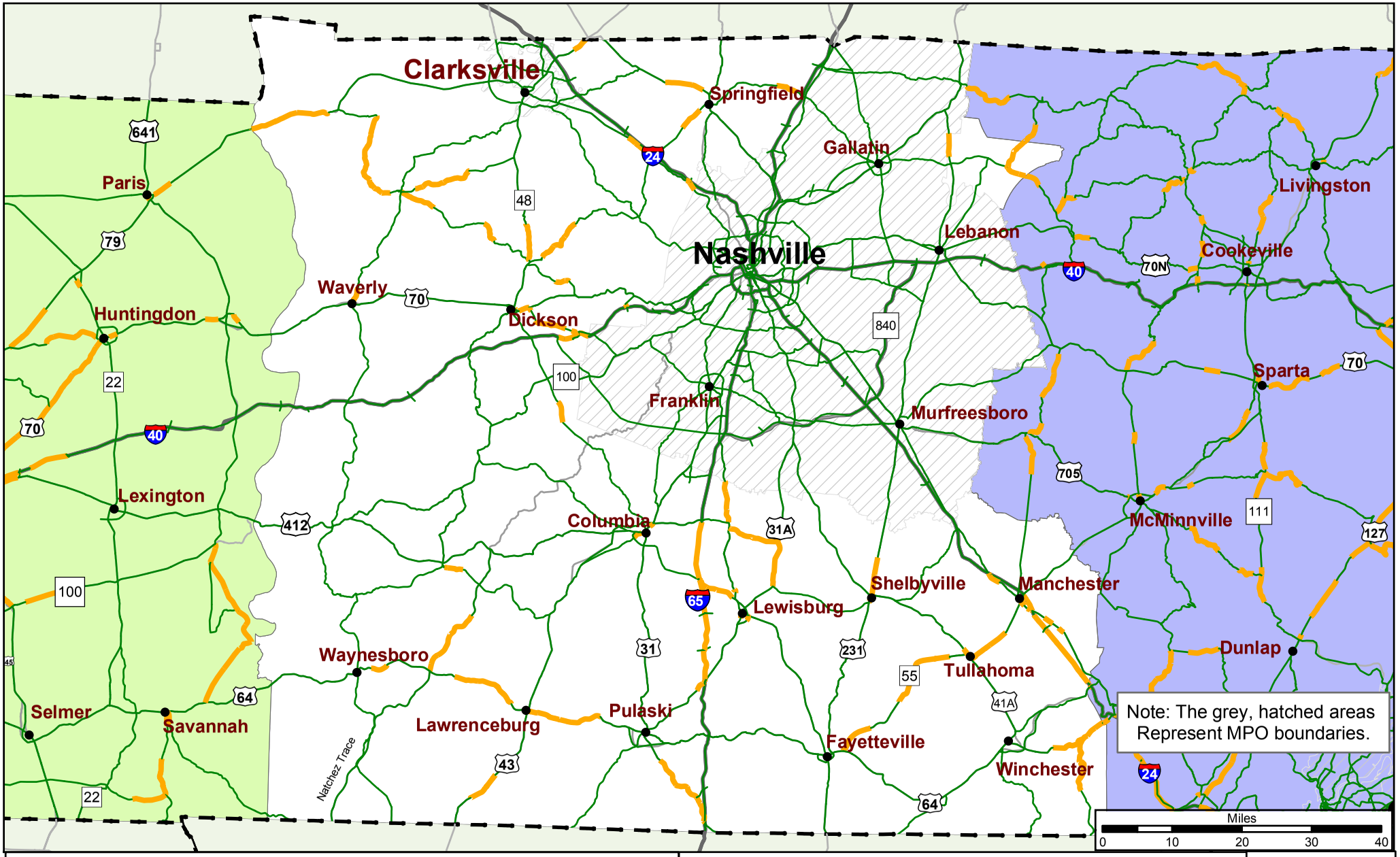

Tennessee Long-Range Transportation Plan

LOS D Year 2030

Region 3

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS D

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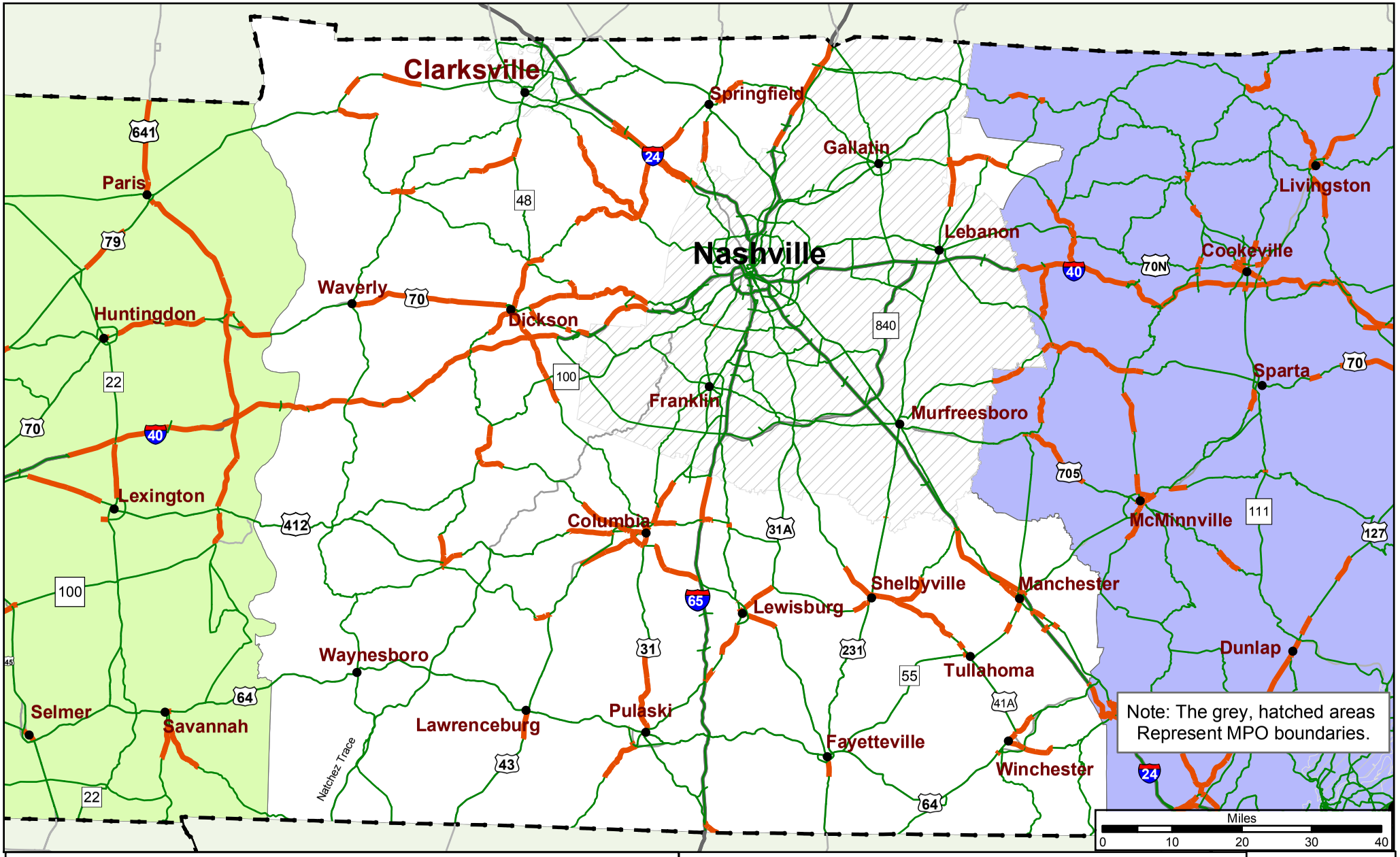


Tennessee Long-Range Transportation Plan

LOS E&F Year 2030

Region 3

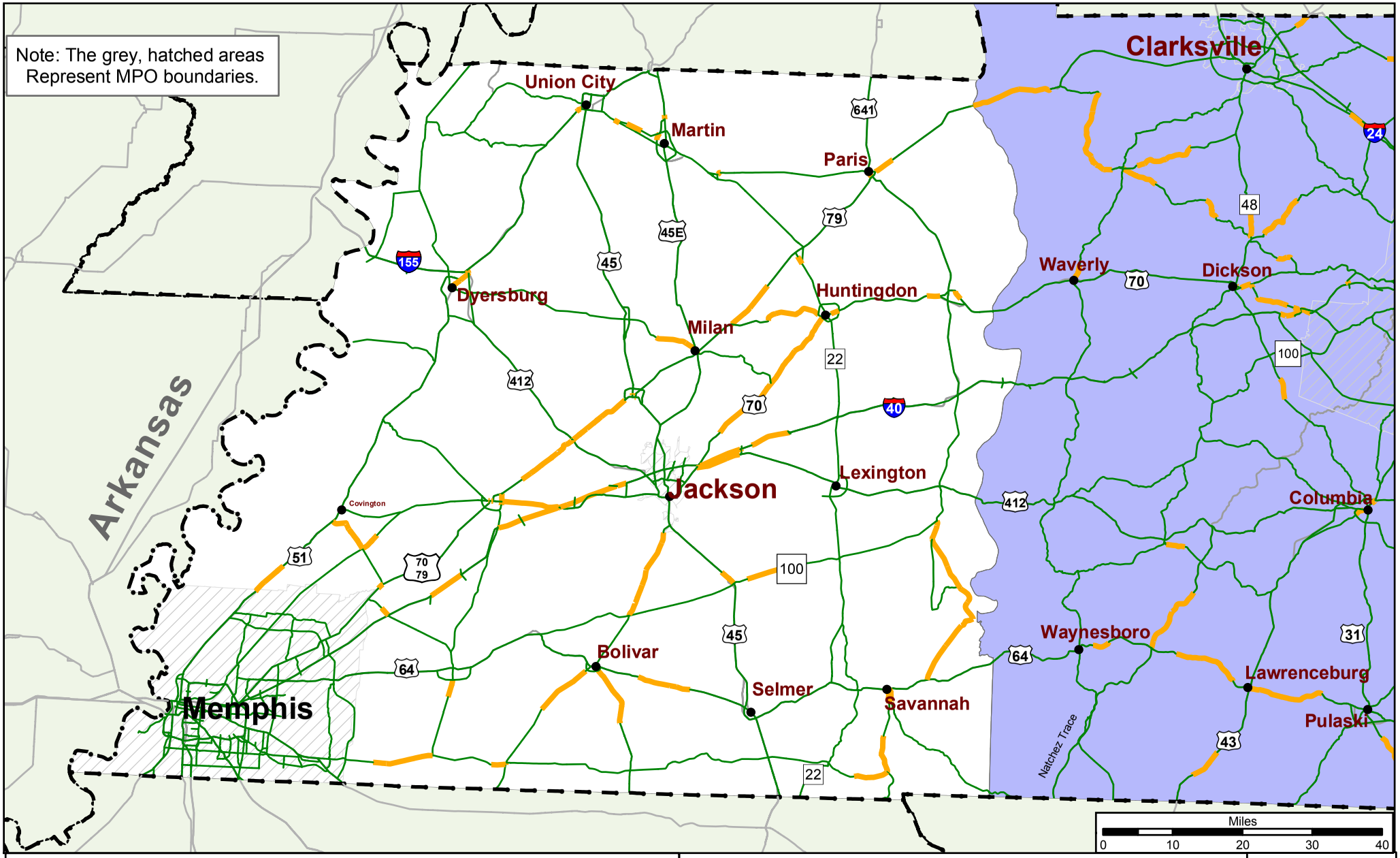
Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS E&F

*** Urban Areas were not analyzed**



Tennessee Long-Range Transportation Plan

LOS D year 2030

Region 4

TDOT Go.

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS D

*** Urban Areas were not analyzed**

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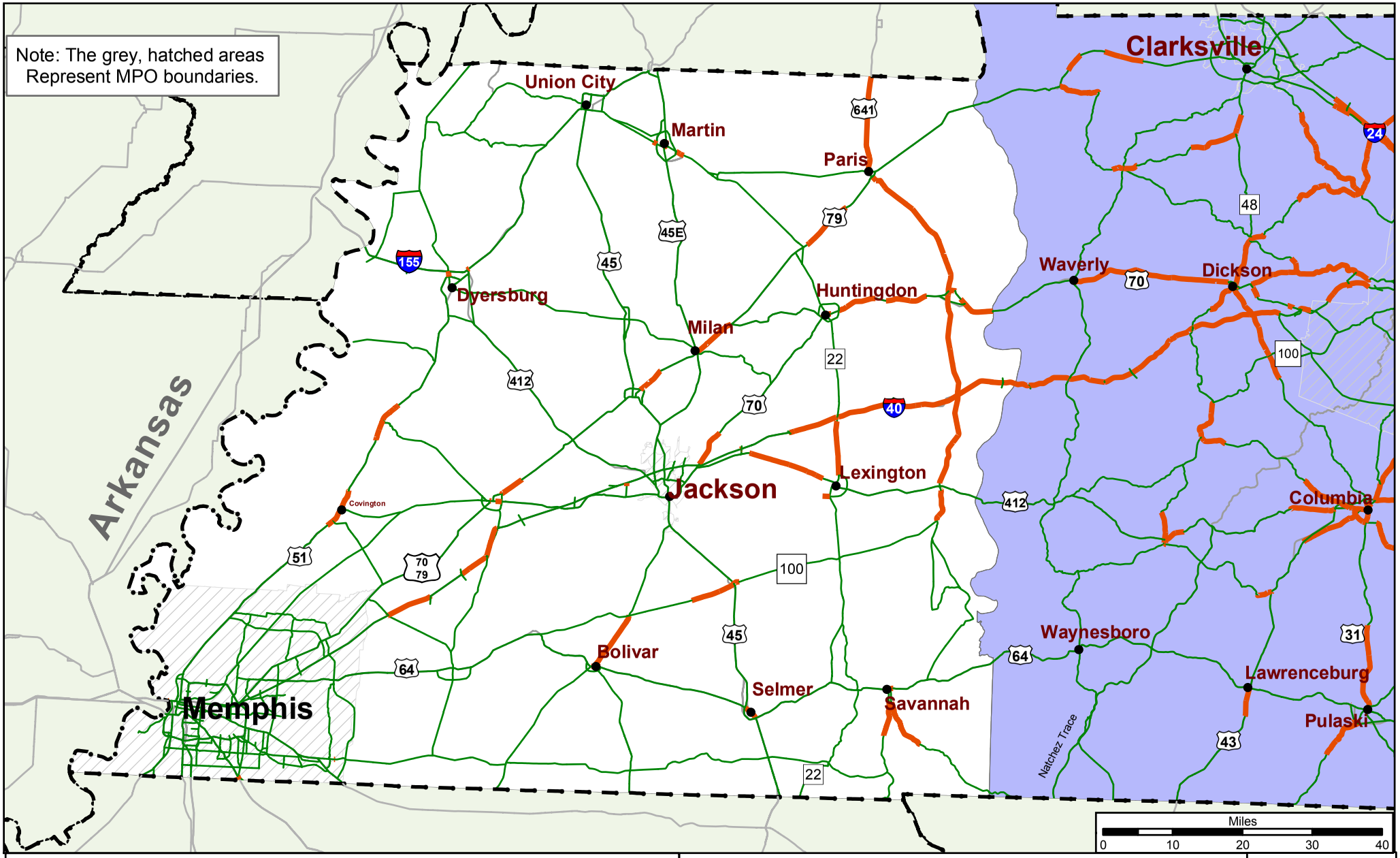

Tennessee Long-Range Transportation Plan

LOS E&F Year 2030

Region 4

TDOT Go.

Source: Tennessee Statewide Travel Demand Model

Volume to Capacity Ratio*

All other values

LOS E&F

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