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TDOT 25-YEAR LONG-RANGE TRANSPORTATION POLICY PLAN



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1.0 INTRODUCTION

The most fundamental purpose of transportation networks is mobility and connectivity. Tennessee's transportation system must link people to jobs and services, businesses to other businesses and communities to each other across the state. A strong and connected transportation system is important to retain Tennessee's competitiveness in today's economy, while at the same time, improving the quality of life throughout the state by connecting residents to jobs, schools, services, and attractions. This system should provide Tennessee residents, visitors, and businesses with mobility options and choices among the transportation modes. All modes must function together as an integrated system to provide the transportation system needed for Tennessee's future.

A central element of TDOT's vision of an efficient and effective multimodal transportation system is the provision of viable alternatives to the single occupant vehicle (SOV). The purpose of this policy paper is to describe current policies and programs of the State related to mobility through public transit, transportation demand management, and non-motorized transportation and to provide recommendations for programs and policies consistent with the Guiding Principles of TDOT's 25-Year Policy Plan. A brief description of each of these topics related to mobility and their relevance to the Guiding Principles is provided below.

1.1 PUBLIC TRANSIT

Public transit plays an important role in maintaining and enhancing the quality of life for Tennessee residents. Transit services not only help increase the total throughput of persons on our roadways, but also provides critical mobility options and helps meet the accessibility needs of residents and visitors, who because of age, disability, or economic disadvantage, cannot or chose not to own or drive an automobile. The demographic data and trends of our state point to a potential increased need and desire for public transit services in our cities and our rural communities. TDOT's role in providing these mobility and accessibility options to Tennessee's residents and visitors is critical for the future quality of life and economic competitiveness of Tennessee's communities.

1.2 TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) programs seek to increase travel by alternative modes and at alternative times to reduce total trips, reduce congestion and decrease the use of single-occupant modes. TDM efforts can help TDOT to expand and enhance goals for mobility, transportation system efficiency, and environmental protection by reducing SOV congestion and improving air quality as a result. TDM efforts tend to be relatively low-cost alternatives, especially in comparison to building additional roadway capacity. Additionally, TDM programs can support economic growth across the state by helping workers save money getting to and from their jobs and aiding employers who have reduced parking capacity or other transportation needs. Under the larger umbrella of TDM, Active Transportation Demand Management (ATDM) strategies can make use of emerging technologies to improve personal mobility and promote efficient travel choices. While ATDM builds upon traditional TDM, it includes many aspects that affect demand, including active traffic and parking management, which can have an impact on transportation demand strategies.

1.3 NON-MOTORIZED TRANSPORTATION

Alternatives to SOV travel include non-motorized transportation, which typically consist of the walking and bicycling modes. Investments in the infrastructure and policies that support travel

by these modes can have many positive benefits ranging from modal shifts during peak hours to healthier residents. Trends in demographics as well as generational attitudes point to nominal increases in walking and biking levels, particularly in urban areas. In order to adequately plan for and encourage these alternative means of transportation, states will need to shift part of their focus from unmet highway demands to alternative transportation options.

1.4 RELEVANCY TO GUIDING PRINCIPLES

Multimodal alternatives and programs have specific applicability and relevancy to the Guiding Principles for TDOT's 25-Year Policy Plan, including:

- **Preserve and Manage the Existing System** – Effective public transportation systems, a robust TDM program, and the provision of non-motorized options reduce single occupancy vehicles and helps to preserve roadway capacity. The assets that provide these services are equally important and must be effectively managed and maintained.
- **Provide for the Efficient Movement of People and Freight** – The promotion of mobility options, reliable public transportation systems, and TDM programs has the potential to optimize the movement of people and goods by providing greater access to transportation services for all people and by building better connections among different modes of transportation, thereby increasing the total throughput of persons and goods on the state roadway system.
- **Build Partnerships for Sustainable and Livable Communities** – Broad public input and community involvement from public, private, and non-profit entities are required for the successful development and implementation of mobility options, TDM programs, and non-motorized accommodations, which in turn help communities be more sustainable and livable.
- **Protect Natural, Cultural and Environmental Resources** – Reducing overall VMT (or the rate at which it is increasing) by reducing the reliance on single occupant vehicles reduces congestion and gas consumption, enhances air quality, and reduces the potential need for additional roadway widening and/or extensions.
- **Emphasize Financial Responsibility** – Effective public transportation services, TDM programs, and the provision of non-motorized accommodations represent low-cost measures that increase transportation system efficiency and reduce potential capital outlays.

2.0 SUMMARY OF FINDINGS

The following is a brief summary of findings of existing plans, policies, and programs, future growth, trends, and technology, and recommendations related to public transportation, travel demand management, and non-motorized transportation.

Summary of Findings

- TDOT's recent planning efforts reflect an increased focus on public transit as a key piece of the state's transportation network due to the impacts of increasing congestion levels on state highways, forecasted population and employment growth across the state, and the concentration of growth and congestion in urban areas.
- Tennessee's funding level for transit is "in the middle of the pack" when compared to state funding levels of large urban transit agencies in peer states on a per capita basis. Additionally, Tennessee's five largest transit operations are comparatively cost-efficient.
- TDOT acts primarily as a conduit for FTA funds as a grant administrator for agencies that meet federal requirements. This is a common practice among peer and surrounding states although some states take a more active role in providing public transportation statewide.
- Mobility challenges and desires continue to change in Tennessee. Increased percentages of household income spent on transportation and increased commuting distances are factors that will likely contribute to increased transit demand in the future.
- TDOT's decentralized approach to the provision of TDM programs across the state (i.e. TDM programs and initiatives authored or promulgated primarily by regional or urban transit agencies and/or city planning departments) is addressing current TDOT policy directives related to TDM.
- TDM efforts in Tennessee primarily include the management of Intelligent Transportation System (ITS) infrastructures, maintenance of park-and-ride lots, and the provision of information for ridesharing opportunities in the state.
- Mobility challenges arising from generational attitudes, growth in urban centers, and an aging population will increase the need for non-motorized transportation alternatives.
- TDOT has limited resources, human or monetary, dedicated strictly to bicycle and pedestrian projects. The entire Department plays a role in accommodating users of these modes as TDOT looks to incorporate non-motorized provisions in all projects where feasible and practical.
- Similar to most of the surrounding and peer states, Tennessee has a statewide bicycle and pedestrian plan that identifies changing demands for provision of non-motorized alternatives.

Recommendations

- TDOT should take a greater role in the planning of regional transit as a means of improving mobility and managing demand. Examples of state DOTs that have embraced enhanced activities in the coordination and provision of transit services can be seen in Florida, Virginia, Washington, and Minnesota.
- TDOT should require that agencies applying for state or federal funding maintain and

submit a Transit Development Plan, which would help define and guide future public transit needs for that agency. These plans could help ensure that the transit systems and networks across the state are coordinated, effective, and provide the proper linkages within their service area. Florida, Washington, and North Carolina programs are prime examples of this program requirement.

- TDOT should continue to increase RPO responsibilities to encompass more multimodal considerations (e.g., transit planning, non-motorized, etc.).
- TDOT should develop a new Statewide Strategic Transit Plan for Tennessee.
- As TDOT establishes a program for congestion reduction investments in the 3-Year Plan, ATDM strategies should be considered.
- TDOT should develop a Multimodal Access Policy and Program, which would include internal guidelines and training.
- To expand on the Multimodal Access Policy, TDOT should work to provide technical resources for local municipalities on this topic.

3.0 EXISTING TDOT POLICY, PLANS, AND DATA ANALYSIS

3.1 PUBLIC TRANSIT

TDOT's Division of Multimodal Transportation Resources serves as the recipient and administrator of federal transit assistance funds for all small urban and rural transit systems, and of federal planning and technical assistance funds for urbanized areas and statewide projects. To receive federal funds, the Division submits applications to the Federal Transit Administration (FTA), administers contracts with state providers, and monitors their compliance with federal regulations.

The transit providers of Tennessee form a comprehensive and linked transit system. Urban transit systems are funded under Section 5307 of the Federal Transit Act of 1964 which covers Small Urban areas (population between 50,000 and 200,000) and Large Urban areas (population exceeding 200,000 persons.) Section 5311 of the Federal Transit Act of 1964 was passed to provide a formula grant program for transportation services in the non-urban areas. Funds are provided for capital assistance, operating assistance, and project administration. Eligible recipients include public bodies and private, non-profit organizations. Participation by private, for-profit enterprises under contract to an eligible recipient is also encouraged.

TDOT has worked in recent years to expand its focus from highways and roadways to include the supporting elements of the state's transportation network, including public transit. This section provides a background on the current programs, policies, and plans as well as demographic and mobility trends that are impacting TDOT's provision and support of public transit services across the state. Currently Tennessee's budget for mass transit is 2.5% (\$45,997,000) of the total TDOT budget (\$1,839,880,000). Tennessee's 2013 population was 6,495,970. This level of spending equates to \$7.46 per capita per year on mass transit, a level that may need to increase as the state population continues to grow and mobility challenges arise.

3.1.1 Current Policies, Plans, and Programs

TDOT's stated vision of "serving the public by providing the best multimodal transportation system in the nation" underscores the Department's recognition that alternative travel modes and choices to the private vehicle should be an integral part of their future transportation programs and policies. This vision statement has led TDOT to develop new programs to facilitate and enhance their support of multimodal efforts. However, a comprehensive set of multimodal policies have not yet emerged from this vision statement. The 25-Year Policy Plan provides a potential opportunity to develop a framework for these policies.

TDOT does not directly operate any transit service in Tennessee. Transit services are operated by six agencies in large urban agencies, eight agencies in small urban areas, two agencies in tourist destinations, and nine regional rural agencies. These agencies have multiple funding sources (local, state, and federal funds) and their goals, policies, and programs are locally- and regionally-driven, developed, and approved. Outlined below are the three primary activities of the programs that TDOT administers to assist these providers in the generating mobility options for Tennesseans:

Grant Administrator for Federal Transit Funds

FTA provides formula funding for operations and maintenance of public transit agencies across Tennessee, and TDOT administers these funds to the agencies and helps to ensure that these agencies meet the reporting requirements of FTA. This program serves to underscore that other agencies are responsible to plan and deliver public transit services, and TDOT's role is to support and facilitate these programs through their administering of formula funds to each

agency. TDOT administers these funds according to their State Management Plan for Federal Transit Administration Programs which details the role of each participating agency, eligibility requirements for funding programs, their applications and contractual agreements, and TDOT's administration of these grants, among other things¹.

Funding Partner for Urban and Rural Transit Agencies

In addition to their role as a grant administrator for federal formula funding, TDOT also supports the provision of public transportation programs and projects through the matching funds they provide to transit agencies, both urban and rural, across the state. These matching funds can support transit capital investments.

TDOT's Multimodal Access Grant Funds

In 2013, TDOT set aside state funds in the Three-Year Work Program to create a Multimodal Access Grant Fund. This program supports the transportation needs of transit users, pedestrians, and bicyclists through infrastructure projects that address existing gaps along state routes and access at transit hubs. These projects are funded at 95% by the state with a 5% local match. The total project costs must not exceed \$1 million. The funds are available for scoping and design, acquisition of right-of-way, and construction of projects that support multimodal connectivity. In order to qualify for the Multimodal Access Grant Fund, projects must be located:

- Along a state route, or
- Within ¼ mile of a state route and provide a direct connect to a state route, or
- Provide direct access to a transit hub ("hub" defined as a municipality's primary or secondary transit facility).

In addition to these ongoing programs, TDOT's emerging expanded focus on all modes of travel is demonstrated by several recent TDOT plans and reports (summarized below) that include discussions of public transportation and its overall importance to state transportation policy.

Multimodal Transportation Resource Division Long Range Transit Plan, 2003

The objective of the TDOT Division of Multimodal Transportation Resources is to lead the state in the establishment and maintenance of public, private, and non-profit passenger transportation systems. As Tennessee's population grows and changes, the role of transit will become increasingly more important. Recognizing that transit is critical to Tennessee's future, the Multimodal Transportation Resources Division initiated TDOT's first 25-Year Transit Plan in 2003. The goal of *Transit for Tennessee 2025* was to triple the number of transit users in the state over the next 25 years. This plan recognizes the importance of transit to Tennessee's transportation system and that investments should be made strategically to encourage the use and growth of the transit system.

Coordinated Public Transit-Human Services Transportation Plan (CPTHSTP) with Regional and Metropolitan Planning Organizations and Transit Providers

TDOT assists in the development of numerous CPTHSTPs across the state. The purpose of these plans is to improve transportation services for persons with disabilities, older adults, and individuals with lower incomes by ensuring that communities coordinate transportation resources provided through multiple federal programs. Coordination enhances transportation access, minimizes duplication of services, and facilitates the most appropriate and cost-effective

1 <http://www.tdot.state.tn.us/publictrans/docs/DraftTennesseeStateManagementPlan-2014.pdf>

transportation possible with available resources. Federal funding requires the development of CPTHSTPs, and TDOT assists in the development of these plans in order to work closely with other transportation providers, consumers, advocates, human service agencies/providers, and others to assess available transportation services, identify transportation gaps, and look for innovative strategies and solutions to enhance transportation and accessibility for these groups.

Tennessee Department of Transportation, Sustainable Transportation in Tennessee, January 2009

This report makes a number of recommendations to promote sustainable transportation in Tennessee, including the expansion of the role of public transportation, transportation demand management, and non-motorized options as they play a vital role in the overall future of transportation in Tennessee. The report also recommends that TDOT establish a sustainable transportation initiative and build a comprehensive program that focuses on promoting energy efficiency, identifying planning policies and potential legislation that supports Smart Growth, research opportunities for innovative transportation financing, promote internal and external environmental awareness, and encourage the continuation of successful strategies at TDOT.

Tennessee Department of Transportation, Tennessee's 25-year Transportation Plan, PlanGo, 2005

This plan was the first formal recognition of the demographic and development trends that are beginning to impact Tennessee's population now and in the future. The trends highlighted in this plan illustrate the transportation needs in Tennessee. Trends such as an aging population, population growth in metropolitan areas, and increased congestion have continued in the nine years since this plan was published and will likely continue into the future. The guiding principles of the plan indicate that investing in transit should be strongly considered as an option to achieve the state's transportation goals and principles.

The recommendations included in these previous planning documents (and since implemented by the Department) have formed the foundation for a compelling argument that public transit should be an important mode for TDOT to invest in over the long-term.

3.1.2 Data Analysis and Trends

Transit systems are used to connect people with destinations, so it is important to understand:

- Where people are traveling from and where do they want to go?
- Where are people living?
- Where are they working?
- How do they commute to work, and how long does that trip last?
- Do they have access to a car?

Demographics are a useful tool to help describe existing conditions and forecast future trends, and to support the design of transit service that is responsive to and anticipates customer demand. In addition to demographic data, transit-related data is also helpful in understanding the demand and usage of services. This section presents the summary data for the state's demographic profile and the public transit systems. Understanding this data and the trends they indicate for the future will assist in developing sound policies for TDOT's multimodal program going forward.

Population and Employment Growth

Tennessee’s population has steadily grown over the past several decades, and is forecasted to continue growing through 2040. Data shows that Tennessee residents will continue to live in urban areas, and population growth rates will be strongest in these areas. After briefly plateauing in the early 2000s, employment growth in the State is resuming its historical growth curve and is forecasted to continue steady growth through 2040. A greater number of jobs are found in urban areas, and the forecasted rate of growth in employment is comparatively higher in urban areas.

There are a number of implications on mobility that arise as a result of population and employment growth, especially in urban areas of Tennessee. Table 1 below shows the forecasted balance between employment and population growth statewide and for urban counties within each TDOT region. Interestingly, urban areas in Regions 1, 2, and 4 are expected to see more employment growth than population increase; this imbalance is often indicative of increased numbers of in-commuters from suburban counties to urban counties creating mobility challenges for TDOT. The lower ratio in Region 3 is likely due to the growth of employment centers in the suburban counties surrounding Nashville.

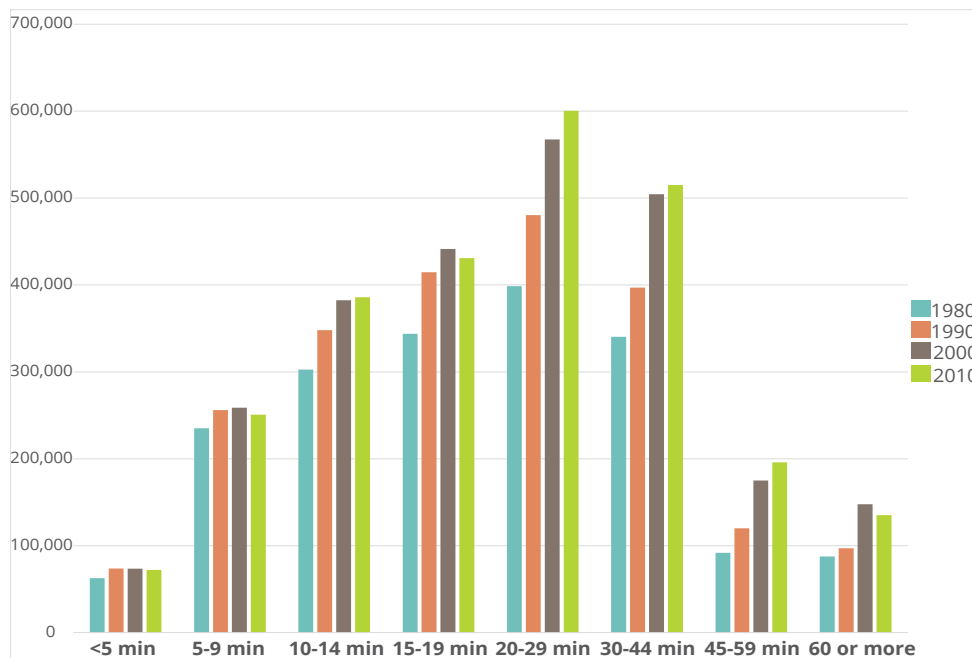
Table 1 Population – Employment Balance

Geography	2010		2040		Change in Population	Change in Employment	Jobs per Person
	Population	Employment	Population	Employment			
Statewide	6,357,436	3,541,416	8,528,963	5,470,861	2,171,527	1,929,445	0.89
Region 1 Urban Counties	956,454	536,799	1,243,157	861,590	286,703	324,791	1.13
Region 2 Urban Counties	436,438	281,603	507,782	372,486	71,344	90,883	1.27
Region 3 Urban Counties	1,525,081	957,595	2,574,316	1,694,587	1,049,235	736,992	0.70
Region 4 Urban Counties	1,027,250	680,239	1,168,274	1,010,218	141,024	329,979	2.34

Source: Woods & Poole

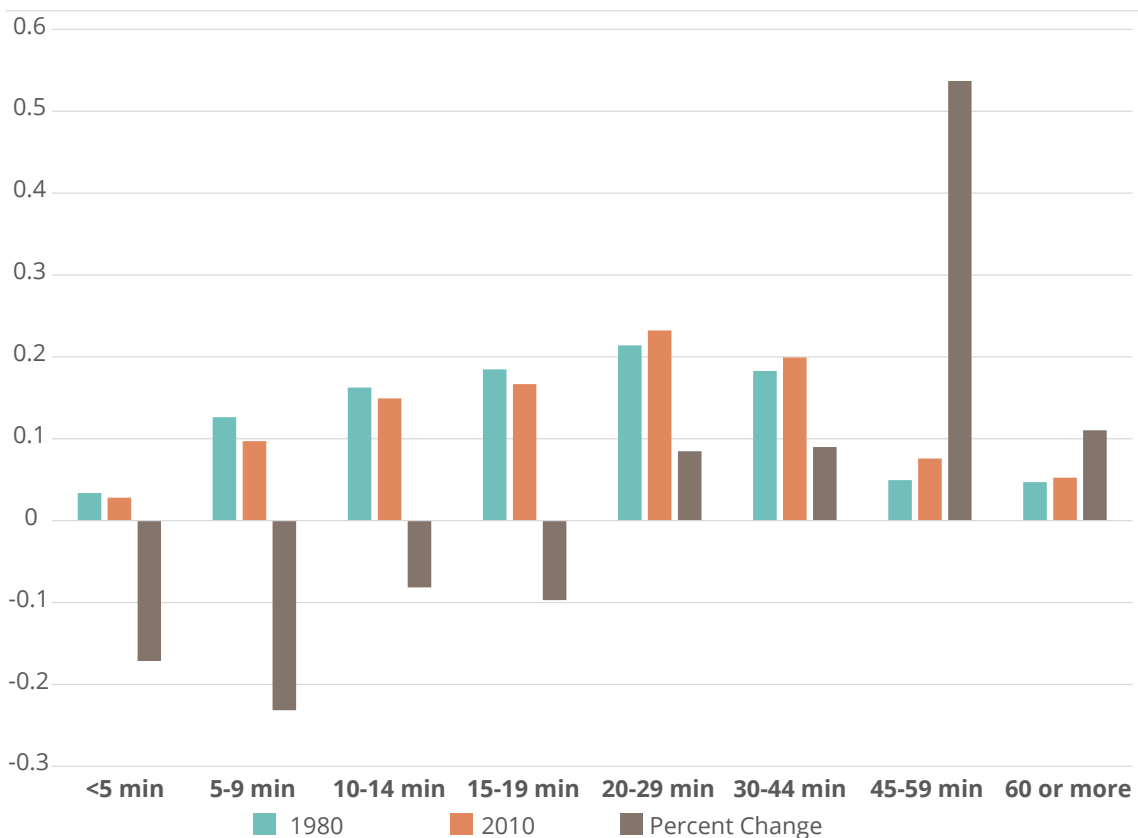
Average Commute Travel Time

Noting the commuting patterns implied by the data in Table 1, Figure 1 shows how the average commute times of Tennessee workers have changed from 1980 to 2010. As shown in Figure 2, the greatest increase in average travel time between 1980 and 2010 occurred in commutes over 20 minutes; compared to 1980, significantly more Tennesseans were commuting 45 to 59 minutes in 2010. The percentage of Tennessee workers commuting 19 minutes or less declined in those same 30 years. The data shows that overall a larger percentage of workers are experiencing longer commutes than their peers did in 1980.



Source: U.S. Census, 2010

Figure 1 Average Commute Time in Tennessee (1980 - 2010)



Source: U.S. Census, 2010

Figure 2 Change in Distribution of Tennessee Commuters' Average Commute Time (1980 - 2010)

Levels of Urban Congestion

Congestion levels in three of Tennessee's largest cities were documented in the Texas Transportation Institute's (TTI) 2012 Urban Mobility Report.² As shown in Table 2, Nashville and Memphis fall into the Large Urban Area category of the rankings (over one million and less than three million in population); the congestion metrics for both cities indicate levels of delay and fuel consumption that exceed the average for that category. The congestion metrics for Knoxville, which falls into TTI's Medium Urban Area category (over 500,000 and less than one million in population), also exceed the average congestion levels of that category. Tennessee's three largest cities experience higher levels of congestion than the average of their peers.

Table 2 Levels of Roadway Congestion in 2012

City	Category	Yearly Delay per Auto Commuter		Excess Fuel per Auto Consumer	
		Hours	Rank	Gallons	Rank
Nashville	Large Urban Area	47	11	24	8
Memphis	Large Urban Area	38	30	19	24
U.S. Large Urban Area Average		37	--	17	--
Knoxville	Medium Urban Area	37	37	18	30
U.S. Medium Urban Area Average		29	--	14	--

Source: Texas Transportation Institute, 2012 Urban Mobility Report

As shown in Table 3, congestion levels, as measured by the TTI metrics, have increased between 104 and 375% between 1982 and 2012 in Tennessee's three largest cities. These facts are echoed in the results from TDOT's 2013 Customer Survey, where residents, partners, and elected officials all considered relieving congestion a top priority for the Department.

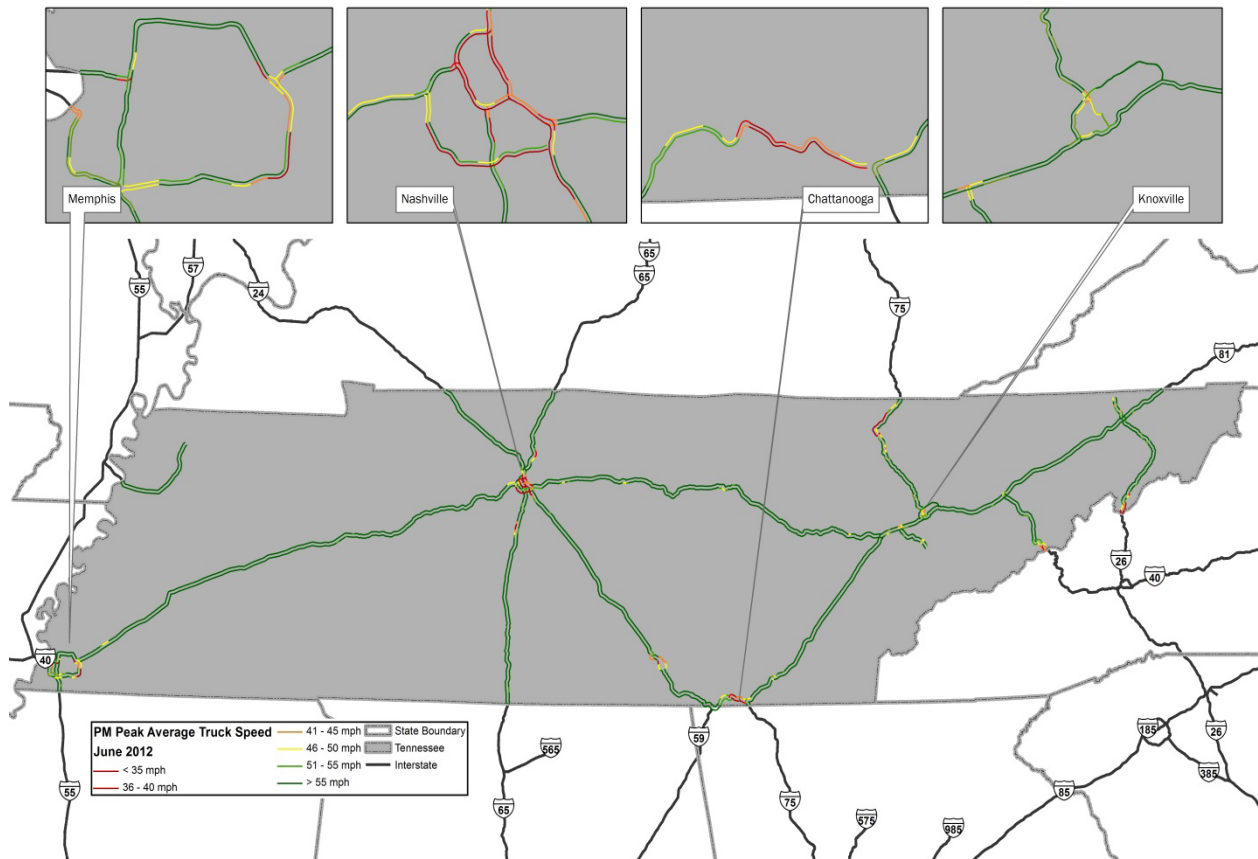
Table 3 Change in Levels of Roadway Congestion (1982 - 2012)

City	Yearly Delay per Auto Commuter (Hours)			Excess Fuel per Auto Consumer (Gallons)		
	1982	2012	Percent Change	1982	2012	Percent Change
Nashville-Davidson	23	47	104%	12	24	100%
Memphis	8	38	375%	5	19	280%
Knoxville	10	37	270%	7	18	157%

Source: Texas Transportation Institute

In addition to the TTI report, TDOT obtained data from the American Transportation Research Institute (ATRI), which collects speed data for trucks on the interstate system and help to make inferences on the speed of passenger cars as well since trucks generally travel in mixed traffic. Figure 3 below shows the average speed of large trucks during the evening peak period, with the urban areas of the state highlighted in the figure insets. The urban congestion shown in these insets is caused by a variety of recurring and non-recurring incidents. Recurring congestion happens during those times of the day when there are simply more vehicles on the roadway than it has capacity to hold. Non-recurring congestion occurs due to events that temporarily disrupt traffic flow; unlike peak hour congestion, these events are unexpected and can be caused by issues such as safety incidents, weather, work zones, or special events.

² <http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/mobility-report-2012.pdf>



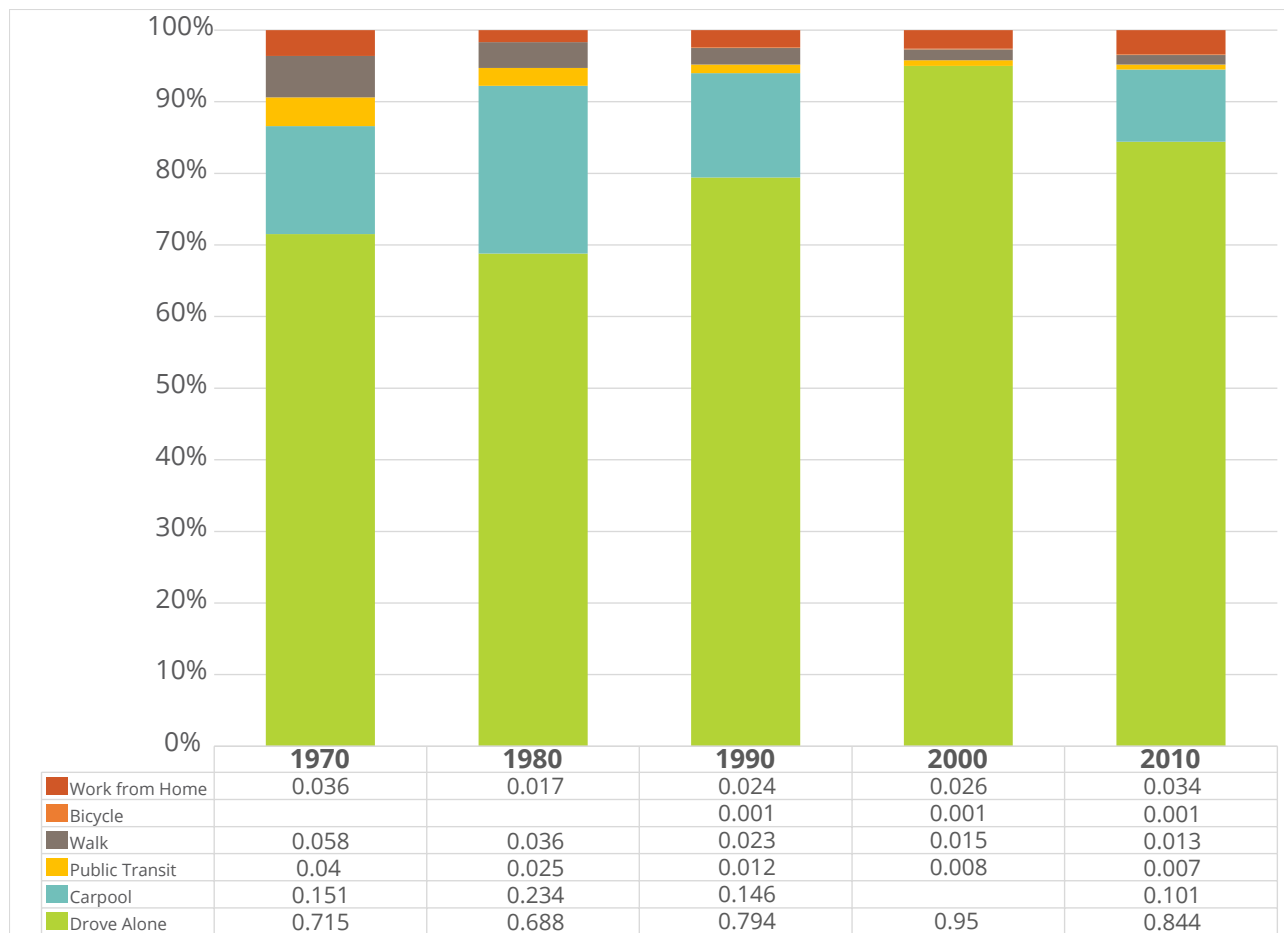
Source: ATRI

Figure 3 Average PM Peak Hour Truck Speed - June 2012

As one means of addressing the increases in urban congestion, federal law mandates that each urban area over 200,000 in population, known as Transportation Management Areas (TMAs), prepare a Congestion Management Process (CMP). In Tennessee, this requirement falls on the four largest urban areas of Nashville, Memphis, Knoxville, and Chattanooga and is normally carried out through the long-range planning process. Simply put, these CMPs outline a systematic approach to managing congestion. These processes include continuous performance monitoring, which directly feeds into the development and assessment of a variety of congestion mitigation strategies. It should be noted that CMPs typically identify a wide range of mitigation strategies beyond just public transit and can include the promotion and provision of other alternative modes of transportation, linking land use and transportation investments, TDM and ITS investments as well as many others.”

Commute Mode Share

As shown in Figure 4, the percentage of Tennessee commuters who drove alone to work was higher in 2010 than in 1970, while the percentage of commuters who commuted by transit has shrunk. The corresponding increase in average commute times and congestion levels may be reflective of this shift towards commuting by car.



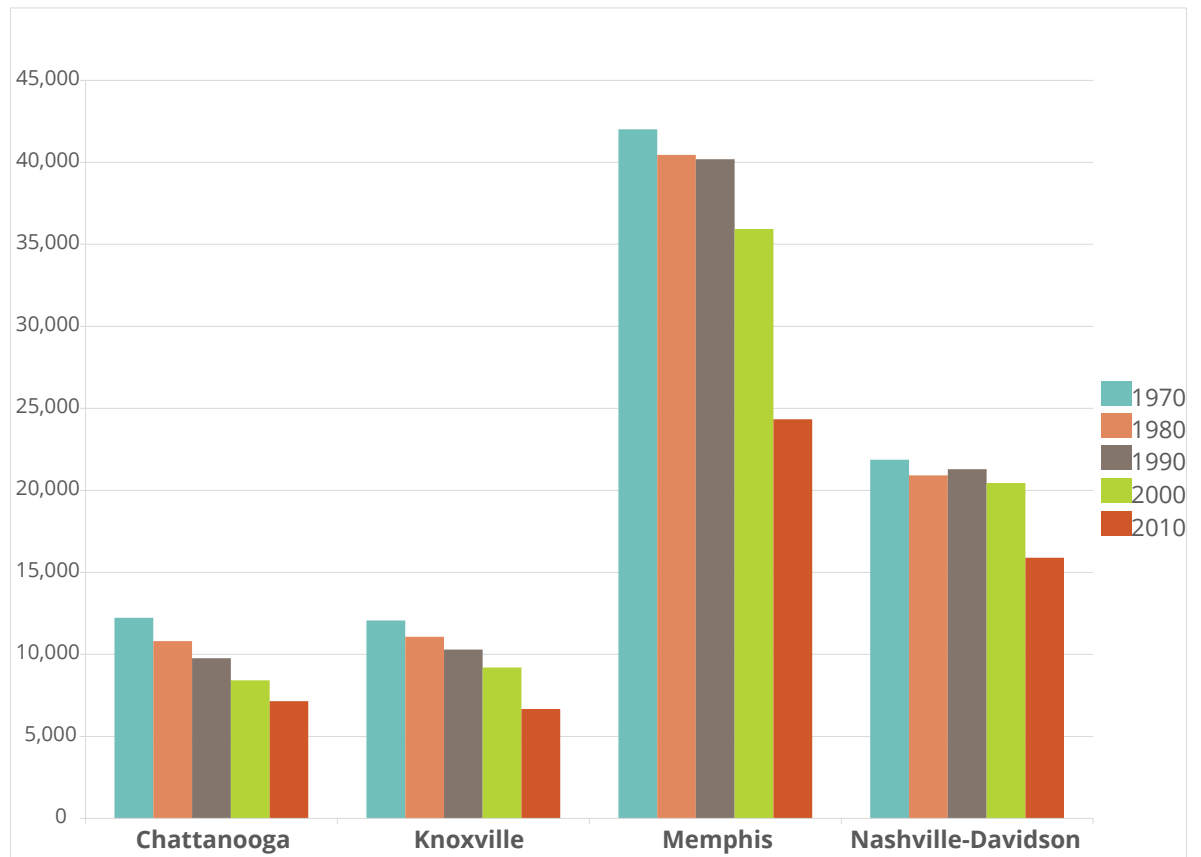
* Bicycle commute data not available for 1970 and 1980; carpool information not available for 2000

Source: U.S. Census, 2010

Figure 4 State of Tennessee Commute Mode Share (1970 to 2010)

Zero Car Households

As shown in Figure 5, the number of zero car households in Tennessee's four largest cities has decreased between 1970 and 2010, even as population has increased. This trend towards higher rates of car ownership may be driving the commute mode shift towards cars, which may be driving growth in commute times and the comparatively high levels of congestion in Tennessee's largest cities.

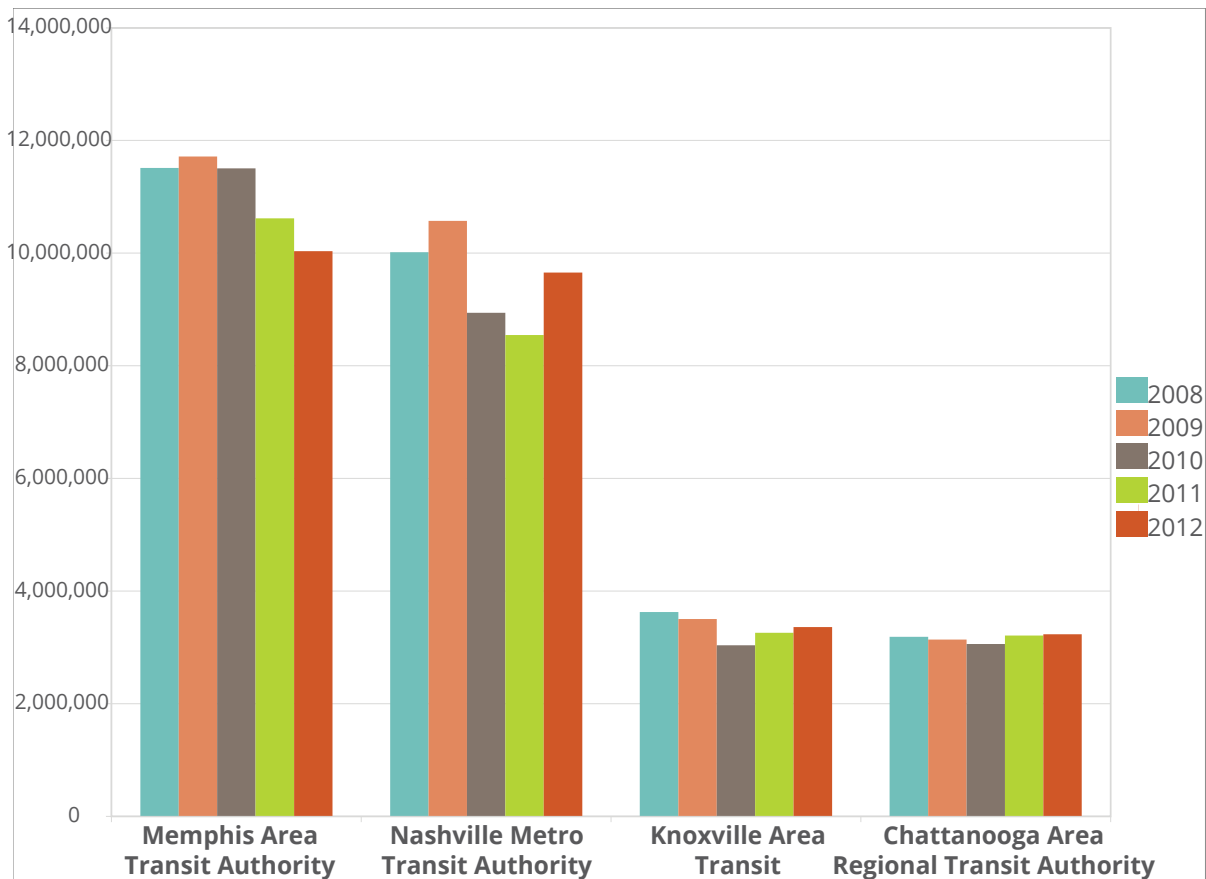


Source: U.S. Census, 2010

Figure 5 Number of Zero Car Households in Tennessee's Largest Cities (1970 - 2010)

Transit Ridership

In 2012, just under 1.7 million Tennessee residents lived within the service area of one of the four largest transit agencies in the state, and hundreds of thousands more live within the service area of smaller urban transit agencies. Rural transit service operates in all 95 Tennessee counties, thus every Tennessee resident has access to at least some level of transit service. As shown in Figure 5, Memphis and Nashville make up a substantially larger portion of the state's metropolitan ridership. While the two remaining larger cities, Chattanooga and Knoxville, exhibit lower numbers of transit users, all agencies have experienced small, gradual increases in their ridership since 2010. The ridership totals shown in Figure 5 include both fixed route service and demand response riders for each agency as reported in FTA's National Transit Database. This ridership equates to the annual unlinked trips per NTD's figures.



Source: National Transit Database

Figure 6 Transit Ridership for Tennessee's Four Largest Transit Agencies (2008 - 2012)

The combined number of annual transit rides (i.e. NTD's unlinked trips) provided by these four agencies far exceeds both the population of each agency's service area and the population of the urban area in which each agency is based. While the transit mode share may be small compared to auto mode share, it is still a critical element of the transportation network because it provides millions of rides a year to Tennessee residents. These rides represent access to jobs, education, services, and recreation; shifting these transit rides to car trips would result in even higher levels of roadway congestion and cause even more significant travel delays.

While transit service is often associated with urban areas, rural transit service provides critical links to jobs, health care, and other services for Tennessee residents who choose to live outside of the city. As shown in Table 4, 12 rural transit providers operate in Tennessee and provide service coverage to all 95 counties. The majority of rural transit providers operate on a demand response basis, meaning they respond to individual requests for transit service rather than providing a number of fixed routes within the service area. It is important to note that ridership within these rural areas has grown by over 16% between 2010 and 2012.

Table 4 Rural Transit Provider Statistics

Category	2010	2011	2012
Number of reporting providers	12	12	12
Number of counties served	95	95	95
Total trips	2,910,241	3,114,890	3,387,804
Total capital expenditures	\$16,779,004	\$7,630,948	\$4,214,223
State capital contribution	\$1,037,656	\$329,936	\$424,575
Percent of capital expenditures funded by state	6.2%	4.3%	10.1%
Total operating expenditures	\$42,015,839	\$47,066,373	\$49,025,264
State operating contribution	\$9,084,501	\$8,770,265	\$9,020,555
Percent of operating expenditures funded by state	21.6%	18.6%	18.4%

Source: National Transit Database

Household Transportation Costs

The Center for Neighborhood Technology, a non-profit organization located in Chicago, calculates and maintains annual statistics regarding average transportation costs for households across the nation. The 2012 edition of this calculation found that households in Nashville, Knoxville, and Memphis spend a significantly higher percent of household income on transportation than the national average of 19%, as shown in Table 5.³

Table 5 Household Transportation Costs

Metropolitan Statistical Area	Annual Transportation Cost	Median Household Income	Transportation Costs as a Percent of Household Income
Nashville-Davidson-Murfreesboro-Franklin	\$14,854	\$51,352	29%
Knoxville	\$14,973	\$45,727	33%
Memphis	\$14,182	\$44,831	32%
National Average	-	-	19%

Source: Center for Neighborhood Technology; American Community Survey 2009 Five-Year Estimates

The share of discretionary household budget declines as transportation costs increase. Increasing the number and type of transportation and mobility options (including increased investment in transit, bicycle, and pedestrian facilities) may alleviate some pressure on household incomes by offering cost-effective alternatives to car ownership.

³ Center for Neighborhood Technology, "H+T Affordability Index, 2012 Fact Sheet," htaindex.org

3.2 TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) programs seek to increase travel by transit, carpools, vanpools, bicycling, and walking, and at alternative times, in order to reduce total trips, reduce congestion and decrease use of single-occupant vehicles (SOVs). TDM efforts can help TDOT expand and enhance goals for mobility, transportation system efficiency, and environmental protection by reducing SOV congestion while simultaneously improving air quality. TDM efforts also tend to be relatively low-cost, especially in comparison to building additional roadway capacity, and can support economic growth as they help workers save money getting to and from their jobs, while also aiding employers who have reduced parking capacity or other transportation needs. Because transit and bicycle/pedestrian issues are covered in depth in other sections of this paper, this section will focus primarily on ridesharing services (i.e., carpooling and vanpooling) and tertiary services associated with ridesharing such as park-and-ride lots and the use of High Occupancy Vehicle (HOV) lanes.

3.2.1 Current Policies, Plans, and Programs

Ridesharing

TDOT sponsors and promotes a wide variety of TDM programs and services across the State, generally in coordination with local transit providers or planning organizations and primarily servicing the major urban areas. Some of the most commonly used and effective TDM services in Tennessee are carpooling and vanpooling, both of which can be categorized as ridesharing.

Ridesharing is generally defined as the agreement between two or more parties to share a ride to work or another location; carpools tend to be more informal in structure while vanpools typically carry nine to 15 passengers and are arranged around a formal agreement. It is important to note that while commuters can achieve some of the same benefits by using either form of ridesharing (e.g. saving money on gasoline, parking and other costs, reducing wear and tear on their personal vehicle, utilizing “preferential parking” spots in some cases, etc.), they can only achieve income tax savings when they commute by vanpool.

In both scenarios, the participants determine rules and guidelines for their carpool or vanpool in order to keep the arrangement running smoothly, including pick up and drop off points and times, and details for riders such as whether or not they will eat or drink in the vehicle, whether talking is permitted or if it will be a “quiet ride,” and similar parameters of conduct. In some carpooling arrangements, one person typically drives while passengers will contribute money toward gas and other vehicle expenses. Some carpools alternate drivers and do not exchange money. Depending on their origin(s) and destination(s), they may meet at a central location, such as a park-and-ride lot, or they may be picked up at their home. Often times, carpoolers work at the same or very close destinations. They may share a ride several days a week or only periodically, depending on the frequency of their needs.

Vanpooling can be an economical option for individuals commuting longer distances, typically at least 25 miles or more each way. The number of passengers, length of the trip, insurance, maintenance, gas, and any other fees (e.g., parking) determine the actual cost per month per passenger. Qualified vanpools under Section 132(f) of the Internal Revenue Code can use tax-free benefits for the purposes of vanpooling, just like commuters who take transit or use this benefit to pay for parking. The federal tax code allows employers to offer this benefit to employees. These “Qualified Transportation Fringe Benefits” are deducted from corporate gross income for taxes paid by the employer. Both employers and their employees can save on taxes, depending on whether the employee shares in paying some of the cost or if the employer covers the full cost

for them because neither pays federal income or payroll taxes on these benefits.

There are currently three kinds of vanpools currently operating in the state of Tennessee:

- Owner-operated vans – where an individual leases or purchases a van and operates the van independently. Riders usually meet at a central location and pay the owner a set monthly fee.
- Third-party vans – where a vanpool “vendor” leases the vehicle for a monthly fee that includes the vehicle operating cost, insurance, and maintenance. The vendor can contract directly with one or more employees. The monthly lease fee is paid by the group of users.
- Employer-provided vans – where the employer (or a group of employers) buys or leases vans for employees’ commute use. The employer organizes the vanpool riders and insures and maintains the vehicles. The employer may charge a fee to ride in the van or subsidize the service.

In addition to vanpools, there are examples of ridesharing companies that exist in urban areas that are not run by TDOT. For instance, Chattanooga utilized Congestion Mitigation and Air Quality Improvement program (CMAQ) funds to jump start the GrenTrips pilot program, which helps to connect commuters interested in ridesharing. This program also works to provide educational resources and incentives to encourage alternative modes of transportation and thereby reduce single-occupant trips.

As mentioned previously, park-and-ride lots not only serve transit users, but oftentimes can be used as a meeting place for carpools and vanpools. One of the challenges of using a mode of travel other than a SOV, when commuters have the choice of using other options, is finding a secure place to park their vehicle. The features, benefits and amenities that commuters seek out in park-and-ride lots prompt them to ask questions, including:

- Are there ample spaces available? Is the lot paved, stone or another surface? Are spaces clearly marked?
- Can I save money by parking here versus parking in another location? (Perhaps by paying less to park or in gas by not driving as far when ridesharing or using transit.)
- Will my car be safe here? Is the lot well-lit? Is the area patrolled by police or security? Are there fences or other barriers around the perimeter? Can potential vandals or burglars be seen from the road or nearby businesses? Are there security cameras?
- How close is the lot to my home and work location? Is it easy to see from the road? Is it easily accessible (easy entry and exit) by car, bicycle and/or on foot (i.e. are there sidewalks nearby if I’m walking)?
- Does public transit service this location? If so, are there covered shelters where I can wait for the bus or train in case of inclement weather?
- Are there other amenities that make this location attractive, such as bike racks or lockers, newspaper or other vending, and/or places to take care of errands before or after work like grocery stores, dry cleaning, retail, daycare, fast food or other similar establishments?
- Who owns the lot and will I be at risk of being towed for any reason? Who do I contact if there is a problem and how?

In searching for public information on park-and-ride lots, links provided by the Regional Transportation Authority (RTA) of Middle Tennessee and the Nashville Metropolitan Transit Authority (MTA) are easily found, but there is no central location where commuters can find this information, along with non-transit park-and-ride lots. Being able to locate those lots is particularly important to ridesharing commuters. Table 6 below lists the statewide park-and-ride lots.

Table 6 Park-and-Ride Locations in Tennessee

Location	Exit	County	City	Capacity	Paved	Lighted
I-40 & SR-109	232	Wilson	Lebanon	40	Yes	No
I-24 & Almadale Road	70	Rutherford	Smyrna	25	Yes	No
I-24 & New Hope Road	32	Cheatham	Ashland City	32	Yes	No
I-24 & SR-76	11	Montgomery	Clarksville	100	Yes	No
I-24 & SR-96	78	Rutherford	Murfreesboro	78	Yes	No
I-40 & SR-56 N.	280	Putnam	Cookeville	40	Yes	No
I-65 & Concord Road*	71	Williamson	Brentwood	50	Yes	No
Rossvie Road	8	Montgomery	Clarksville	100 +	Yes	No
SR-41A & SR-49	24	Cheatham	Pleaseant View	30	Yes	No
SR-79 & SR-105*		Carroll	Trenewant	52	Yes	No
W. Franklin & Foster*		Sumner	Gallatin	35	Yes	Yes
I-40 & SR-96	182	Williamson	Fairview	75	Yes	No
SR-28 & College Station Road*		Bledsoe	Pikeville	14	Yes	No
I-75 & SR-60	25	Bradley	Cleveland	29	Yes	No
I-40 W. Highway 70 (MTA)	196	Davidson	Nashville	68	Yes	Yes
Old Hickory Blvd (MTA)		Davidson	Lakewood City Hall	20	Yes	Yes
US 441 & Wiley Oakley Drive		Sevier	Gatlinburg	150	Yes	Yes
Wesmoreland*		Sumner	Westmoreland	50	Yes	Yes
I-181 & Oakland Avenue	36	Washington	Johnson City	50	Yes	Yes

*Note: Indicates park-and-ride lot that is not currently active

Source: Tennessee Department of Transportation, Division of Multimodal Transportation

To facilitate TDM efforts, the Department provides a user-friendly website called Tennessee Smart Commute⁴, which serves as a central online resource to direct the public to the commuter programs and services available to them. This website provides the following options: walking, biking, rail, public transit, ridesharing, and HOV lanes.

There is also a location on the website specifically for State employees, which directs these individuals to programs tailored to their commuting needs including parking information only available to State employees, a free transit pass program for State employees in the greater Nashville and Memphis areas called “Swipe N Ride,” the State’s own carpool application, and information on the State’s bike locker program. The State also provides priority parking for carpoolers, vanpoolers, and motorcycles. Along with options explicitly for State employees, the Tennessee Smart Commute website lists a variety of carpooling and vanpooling programs, as detailed below:

- Tennessee Carpool Center: Connects with other carpoolers in your area – This is an online “bulletin board” for carpool matching provided by eRidshare.com; it is a free site where commuters can list their desired route, days of travel, and other pertinent details, and try to find travel companions. There may be some privacy risk involved for individuals in using

4 <http://www.tdot.state.tn.us/smartcommute/>

this type of site, as you must post your contact information in an all-access public forum. At the time this paper was written, there were 59 listings on this site for Tennessee.

- RTA Carpool RideMatch: Find a friend to share a ride – This ridematching service is provided by the Regional Transportation Authority (RTA) of Middle Tennessee, the transit system that provides bus routes and regional rail. The RTA promotes carpooling and vanpooling, and also provides an Emergency Ride Home program to those who carpool or vanpool, and maintains a database of over 3,000 potential ridesharers in Middle Tennessee.
- Memphis Rideshare: Connect with carpoolers in the Memphis area – The Memphis Area RideShare Program’s (MAR) mission is to encourage commuters to consider alternatives to driving single occupancy vehicles to work every day. To promote carpooling, MAR provides a web-based matching service through the Shelby County website and incentives to those who participate in the program when they register their carpool on the site.
- Knoxville Smart Trips: Connect with carpoolers in the Knoxville area – Smart Trips, which is housed within the Knoxville - Knox County Metropolitan Planning Commission, is a free, online program that encourages people to take alternative commutes such as walking, riding a bicycle, or carpooling, instead of driving alone to work. Smart Trips helps commuters find carpool partners or learn to navigate the area by bike, bus or on foot while saving money on gas and helping the environment. Smart Trips was founded in 2003 with part-time staff and hired a full-time coordinator in 2005. In 2007, they began an incentive program. More information on Smart Trips and their incentive program can be found at <http://smarttrips.knoxtrans.org>.
- Carpool World: Worldwide match for commuters based on proximity to home – this is another online “bulletin board” for carpool matching similar to eRidshare.com (see above); however, it shows those seeking rides for the entire country and beyond. At the time this paper was written, there were no listings on this site for Tennessee.
- RTA Vanpool RideMatch: Find a friend to share a ride – see the information listed above under Carpool Programs for Middle Tennessee; the same is applicable except with the vanpool program, commuters are eligible for Qualified Transportation Fringe Benefits, as vanpoolers enter a formal agreement and do not use their personal vehicles per the established guidelines. More information on this follows in the Current Trends and Impacts section.
- TMA: Vanpool fleet serving nine Middle Tennessee counties – The website lists this as a vanpool resource for nine counties, but the Transportation Management Association (TMA) Group’s website says that the service provides this and other commuter services in 16 middle Tennessee counties, including: Williamson, Wilson, Sumner, Rutherford, Robertson, Putnam, Montgomery, Maury, Marshall, Lawrence, Humphreys, Hickman, Dickson, Davidson, Coffee, and Cheatham. The TMA Group is a 501(c)(3) nonprofit corporation established in 1988 as a public-private partnership of business, governmental, and community leaders, who support a regional transportation system that provides a variety of accessible, affordable, reliable, and interconnected transportation choices that are both healthy for the environment and for people. The TMA provides their “Vanstar” vanpools on behalf of Williamson County, Tennessee, and the Regional Transportation Authority; they raise public awareness and promote TDM and mobility management solutions to transportation challenges throughout the region. They also provide additional transit-related services under contract with the Franklin Transit Authority, as well as other services in various areas.
- Vride: Memphis Area Rideshare – Memphis Area Rideshare (MAR) as listed above under

Carpool Programs, offered through the Shelby County Air Quality Improvement Branch, has partnered with vRide (formerly known as VPSI, Inc.), a national vanpool vendor, to provide this program. vRide offers ridematching services and is the nation's largest private provider of commuter vanpools with more than 6,500 vans on the road today.

- **Statewide: Tennessee Vans – Tennessee Vans (TN Vans)** is a social business enterprise whose mission is to meet the mobility needs of the transportation disadvantaged in a financially sustainable manner. Founded in 1990, TN Vans works in partnership with community agencies that provide services to persons with disabilities, workforce participants, the youth, seniors, recovery program participants, and community outreach programs. Through these partnerships, TN Vans is able to maintain program sustainability and produce positive financial, social, and environmental outcomes and benefits to its program participants, investors, and communities in Tennessee. With a staff of five full-time employees, TN Vans is currently providing approximately 1.2 million trips per year for more than 2,500 people using a fleet of 200 vehicles. (Note: Also listed under this link is The Knoxville Commuter Pool (KCP), a regional commuter van service. KCP's mission is to provide vehicles and support services to community groups and employee groups who desire to use vans to meet transportation needs.)

In addition to carpool and vanpool programs, there are a number of transit pass programs across the state, used to incentivize making trips by transit. For State employees, the Swipe N Ride program offers free transit bus passes in Nashville and Memphis as a means to improve air quality through reduced congestion with the added benefit for state employees. Many other employers across the state offer incentives for employees who use transit for their commutes. Additionally, many schools across the state offer reduced or free bus passes for students; examples include the University of Tennessee (Knoxville and Chattanooga), East Tennessee State University, and Tennessee Technological University. For younger students, Nashville's transit service (MTA) has implemented the StrIDe program which allows Metro Nashville Public School students in grades 9 – 12 to ride the bus year-round for free as a means of improving their mobility.

High Occupancy Vehicle (HOV) Lanes

Tennessee has used high occupancy vehicle (HOV) lanes as a tool to promote ridesharing to reduce congestion on urban interstates since 1993. The central concept for HOV lanes is to move more people rather than more cars. Each vehicle that travels in an HOV lane must carry the minimum number of people posted on the entrance signs; in Tennessee, this is at least two people. There are two exceptions: motorcycles and hybrid vehicles bearing the state's approved and issued "Smart Pass" sticker. A comprehensive list of the vehicles that are eligible on the Environmental Protection Agency's list can be found on the Tennessee Smart Commute website. The Department of Revenue began accepting applications for the Smart Pass program on January 1, 2009, which allows hybrid vehicles to drive in HOV lanes without satisfying the two-passenger minimum.

The benefits of HOV lanes include:

- Moving more people in fewer vehicles, thereby reducing the demand for new highways
- Increasing the efficiency of existing highways
- Reducing the use of personal resources such as time and fuel
- Benefiting drivers of single-occupant vehicles by taking carpoolers out of general use lanes
- Reduced traffic congestion, yielding air quality benefits

There are currently HOV lanes located along various sections of the following highways near Nashville: I-24 (in Davidson and Rutherford Counties), I-40 (in Davidson and Wilson Counties), and I-65 (in Davidson and Williamson Counties), as well as I-40 and I-55 (both in Shelby County) near Memphis.

High Occupancy/Toll (HOT) lanes have been proposed in some states, where an SOV driver can pay a toll to use the HOV lane when regular lanes are congested, and the price of using the HOT lane typically fluctuates dependent on the level of traffic congestion on the corridor (also known as congestion pricing). This practice defeats the central concept of moving more people rather than more cars; however, it can be used to minimize traffic congestion within the normal travel lanes and as a revenue generator, and therefore, is appealing to some DOTs.

Funding

Methods for funding TDM programs also vary by state and by individual program. Many programs are funded heavily using Congestion Mitigation and Air Quality Improvement program (CMAQ) allocations, while others use a mix of funding sources. An overview of the various types of funding sources typically used for TDM programs follows below Table 7.

Table 7 Funding Sources for TDM Programs

Funding Type/Name	Source or Agency	Match Required?	Description
CMAQ Funds (Congestion Mitigation and Air Quality)	Federal Highway Administration (FHWA)	Varies	Funding specifically designed to underwrite congestion mitigation efforts, which can be used to fund commuter service programs; states can elect to allocate their CMAQ funds to TDM programs
Federal Surface Transportation Program (STP) funding	FHWA	Yes	Federal STP funding can also be used to fund congestion mitigation efforts (travel demand management strategies and programs)
Section 5307	Federal Transit Administration (FTA)	Yes	Urban Transit funding that can support or fund commuter services; in many cases, a good source for vans to be used for vanpooling
Section 5311	FTA	Yes	Rural Transit funding that can support or fund commuter services
Local funding	County or City Governments	Varies	Counties and cities can make periodic and/or on-going contributions toward commuter service programs that demonstrate benefits to the local area
Local agencies	Policy Boards	Varies	Some local boards, such as Workforce Development Boards, administer funding for programs that assist low-income workers with access to training and employment opportunities
State agencies	Department of Transportation and others	Varies	Funding can be provided by these agencies for special initiatives, such as demonstration projects
Federal agencies	Environmental Protection Agency (EPA) or other agencies	Varies	Federal agencies may provide grants or targeted funding for commuter programs
Federal and/or state legislative appropriations	Federal and/or state legislators	No	Federal and state legislative delegation can make appropriations for projects that benefit their constituency.

3.3 NON-MOTORIZED TRANSPORTATION

As generational, national, and local attitudes towards non-motorized travel have shifted in the previous decades, the programs and policies of TDOT with regard to non-motorized travel have grown to reflect those as well. Despite the relatively small percent of mode share for walking and biking, TDOT has continually adapted in their efforts to fulfill the non-motorized needs and desires of both urban and rural communities across the state. The Department does this through instituted programs and policies as well as planning efforts that help guide and prioritize investment decisions.

3.3.1 Current Policies, Plans, and Programs

TDOT, as well as its many external planning partners, have continually aimed to improve the state of non-motorized travel in Tennessee through a variety of planning efforts. For the Department, a key part of this effort rests in its current Bicycle and Pedestrian Plan, which results from the previous long-range transportation plan, PlanGo, completed in 2005. This element of the plan documented the various trends, amenities, connectivity, and safety issues related to both pedestrians and bicyclists and also recommended improvements to the non-motorized systems across the state. The overall purpose of this plan element was to provide directives through new policies, procedures, and programs that would emphasize the consideration of bicycle and pedestrian accommodations and encourage greater opportunities for walking and biking within Tennessee.

As a means of building on PlanGo, the Department undertook a more technical look at bicycle conditions on the state route system by utilizing a Bicycle Level of Service (BLOS) analysis in 2010. This analysis provided a means of examining the conditions of various transportation facilities across the state to determine how suitable they were for bicycle travel. This, in turn, aided in the development of recommendations that would allow for the Department to accomplish an increase in bicycling trips across the state.

Not only does the Department have a variety of internal efforts to plan for the provision of non-motorized accommodations, but it also is involved with similar efforts conducted by its external planning partners. Many of the larger MPOs have developed their own Bicycle and Pedestrian Plans, which serve as a guide to policy implementation and investments in the urban areas of the state. TDOT takes part in the development of these plans through their review and comment periods. Additionally, members of TDOT's Division of Multimodal Transportation Resources are routinely engaged in Bicycle and Pedestrian Advisory Committees (BPACs) in urban areas. These groups generally consist of a variety of stakeholders who represent local governments, transit agencies, law enforcement, and private non-profits with the purpose of advising the MPOs regarding issues related to non-motorized travel.

TDOT also has many programs instituted to promote the use of non-motorized modes of transportation such as walking and biking. The Transportation Alternatives program and the recently created Multimodal Access and Community Transportation Planning Grants are in place to aid the Department in creating greater opportunities for these modes of transportation. Programs such as the following have helped Tennessee to become 22nd in the country in terms of per capita spending on bicycle and pedestrian projects.

Transportation Alternatives Program - TDOT's Transportation Alternatives Program (TAP) is operated by the Local Programs Development Office and has distributed more than \$287 million to nearly 250 communities across the state to build sidewalks, bike and pedestrian trails, and to renovate historic train depots and other transportation-related structures. As mentioned

previously, the TAP now includes the SRTS funding as well as the Recreational Trails Program (RTP) and Transportation Enhancement (TE) activities. Between the years of 2009 and 2012, Tennessee used approximately 56% of its Transportation Enhancement funds for bicycle and pedestrian related projects.

Safe Routes to School Program – Funds from TAP are used for Tennessee’s Safe Routes to School (SRTS) program to invest in pedestrian and bicycle safety, both for students and the community, and create opportunities for increased physical activity among student populations. SRTS funding was awarded through congressional legislation, administered through the Federal Highway Administration, and allotted to state Departments of Transportation to guide the spending of gas-tax revenues. Previously communities were not required to provide a local match for these funds, meaning that all projects were 100% federally funded and required no monetary commitment from participating organizations and communities. However, under the MAP-21 legislation the SRTS program was combined with other programs under the Transportation Alternatives Program meaning that projects had to compete for funding and applicants must provide a 20% match. To date, Tennessee’s SRTS Program has awarded 88 projects totaling over \$16 million. As of January 2014, since the program’s start, TDOT received 231 applications requesting over \$44 million that represented a diverse mix of educational activities, major projects such as sidewalk segments and shared-use paths, and minor improvements such as sign packages, crosswalks, and pedestrian signals.

TDOT’s Multimodal Access Grant Funds - The Department has recently created a program called the Multimodal Access Grant that allocates state dollars to support the transportation needs of pedestrians and bicyclists as well as transit users through infrastructure projects that address existing gaps along state routes. These projects are 95% state-funded and require only a 5% local match. For the 2014 award year, nearly \$10 million has been allocated to 13 different communities to fund a variety of multimodal projects ranging from park-and-ride lots to intersection improvements.

TDOT’s Community Transportation Planning Grant Funds - In 2014, the Department instituted a new grant program that provides planning and technical resources to assist rural communities in developing transportation plans. The primary goal of this grant program is to help communities plan for future transportation system needs, land use, and growth management issues; however, this goal has a strong tie to the Department’s emphasis on multimodal accommodations as seen through the types of plans exemplified on the website. The program website provides examples of a variety of planning efforts eligible for the funds including, but not limited to, Bicycle and Pedestrian plans, Complete Streets plans, and Road Diet analysis among many others. The only requirements for using these funds are that the local community must be located outside an MPO planning boundary, the project must be along a state route or within 1/4 mile and provide a direct connection to a state route, and they must hire TDOT pre-qualified consultants to develop planning documents. Additionally, the local communities are required to match 10% of the project costs.

Not only does the Department allocate funding for the design of new and improved facilities, but it also provides opportunities through various other programs to help increase the safety of non-motorized users. Between 2003 and 2009, 8,000 pedestrians and 2,600 bicyclists were involved in crashes on Tennessee’s roadways. As walking and biking become more prevalent forms of travel for commuting as well as recreational purposes, the vulnerability of those users also increases, creating a need for increased safety precautions to protect bicyclists and pedestrians.

Highway Safety Improvement Program - The Highway Safety Improvement Program (HSIP) provides funding to states to improve the safety of their public roadways. Federal transportation

legislation allows funds to be used to decrease the high risk for fatalities and severe injuries among bicyclists and pedestrians. Through their Road Safety Audit Review (RSAR) process, the Department uses HISP funds that are set aside through the High Risk Rural Roads Program (HRRRP) to evaluate these facilities for safety issues primarily for automobile drivers, but occasionally for pedestrians and bicyclists. In areas where there have been severe crashes involving pedestrians and bicyclists, the Department evaluates the risk to non-motorists to determine potential low-cost, quickly-implementable improvements to the area.

Congestion Mitigation and Air Quality Improvement Program - In addition to these traditional funding programs, the Department has begun to allocate dollars from the Congestion Mitigation and Air Quality Improvement (CMAQ) program for the improvement of bicycle and pedestrian facilities in urban areas across the state. One of the qualifications is that the non-motorized accommodations must be able to show a decrease in emissions, usually accomplished through a modal shift. Approximately 0.5% of CMAQ funds went to the provision of bicycle and pedestrian accommodations between the years 2009 and 2012 compared to a national average of 8.7%. It is important to note that even though the amount of CMAQ funds dedicated to biking and walking is low relative to other states, Tennessee still ranks highly regarding its policies for non-motorized travel. The reason for this high ranking is due to the numerous policies and plans that have been put in place at a state level by the Department. Tennessee is one of only 11 states in the country to have published goals for increasing non-motorized travel and one of only 20 states to have published goals for reducing safety risks for these system users.

Multimodal Access Policy - As a means to better accommodate all users of the transportation system, TDOT has adopted a bicycle and pedestrian accommodation policy throughout the state. The policy of the Department is to routinely integrate bicycling and walking options into the transportation system where appropriate as a means to improve mobility and safety of non-motorized traffic. With regard to bicycling and walking, TDOT is committed to the ongoing development of the transportation infrastructure as a means of improving conditions for users of these modes. Where opportunities arise in new construction or reconstruction of roadways, the Department tries to integrate design features appropriate for the context and function of the facility while anticipating future bicycle and pedestrian demands. Noting that bicyclists and pedestrians need to not only travel along the roadways, but also cross them, the design of intersections and interchanges is important to the Department when planning for non-motorized travel. While TDOT ambitiously tries to accommodate non-motorized travel in many ways, shapes, and forms, there are exceptions that make implementation infeasible or at the very least, impractical. For example, such conditions can occur where local plans conflict with state plans, where non-motorized travel is prohibited on facilities (e.g., interstates), or where the cost of bicycle and pedestrian facilities is disproportionate to the need or expected use of the facility. Overall, TDOT has taken the approach that, where feasible and desirable, the implementation of facilities to promote non-motorized travel should be evaluated for incorporation into the transportation system.

Current Funding Sources - There are a variety of funding sources that are used to implement solutions for non-motorized travel options. Some of these are federal, some come from the State, and some are local.

- Safe Routes to School (SRTS) (now included in the Transportation Alternatives Program)
- Congestion Mitigation and Air Quality Improvement (CMAQ)
- Surface Transportation Program (STP) (Transportation Enhancement Activities, Safety, HSIP)
- National Highway Performance Program (NHPP) funds

- Recreational Trails Program (RTP)
- National Scenic Byways Program
- Job Access and Reverse Commute Grants
- TIGER Discretionary Grants
- High Priority Projects (HPP) and Designated Transportation Enhancement Activities
- TDOT's Multimodal Access Grant Program
- TDOT's Community Transportation Planning Grant Program

3.3.2 Data Analysis and Trends

A resurgence in non-motorized travel is not only a national phenomenon but is also a phenomenon occurring within Tennessee. This is evident in walking and biking activity seen in many urban areas across the State, the number of requests and investments by communities large and small for sidewalk, bikeway, and greenway facilities, as well as the number of plans and policies being enacted to promote, protect, and enhance walking and bicycling within the State.

There is likely no one definitive factor or set of factors that can explain this resurgence of walking and biking. However, it appears that the personal cost of motorized transportation, worsening congestion in urban areas, personal preference, environmental and health consciousness, as well as a variety of other factors all contribute to the increasing use of non-motorized modes of travel. There are demands for non-motorized accommodations in both urban and rural areas of Tennessee, although they may not be the same. Urban areas, defined as the counties that were within the MPO boundaries as of 2013, offer more opportunities for walking and biking trips versus rural areas defined as counties outside the MPO limits, where land use is less dense and trips tend to be longer in distance. The following highlight key factors that relate to TDOT's 25-Year Policy Plan:

Demographic Changes

Population characteristics vary across urban and rural areas in any state. As such, many of these demographic characteristics can have a tremendous impact on the demand for and provision of non-motorized transportation facilities. Tennessee is continually described as a great place to live as well as an opportune Southeastern location for employers. The benefit of these characteristics typically results in statewide growth in population and employment; however, this growth doesn't occur equally across rural and urban areas of the state. Studies show that from 2000-2010, the population of rural counties in the U.S. only grew by 2.2 million, which is half of the growth seen in the previous decade⁵. As can be seen in the Policy Paper on Demographic Changes, much of this growth was seen in the rural areas located just on the fringe of urban areas. Similarly for Tennessee, the rural county populations grew by approximately 198,000 between those same years while urban populations grew by 455,000. Furthermore, Woods & Poole projections anticipate that rural populations in the state will grow by only 26% while the urban counties will grow by 39% over the next 25 years. This will ultimately result in only 29% of Tennessee's population residing in rural counties by 2040. Beyond simply population growth, the demographics of the population also relate to the likelihood of people to use biking and walking as a means of travel. One of the primary changes in the population that affects this likelihood is the percent of aging population within an area. While aging transcends urban and rural boundaries, projections show that rural

⁵ <http://www.carseyinstitute.unh.edu/publications/IB-Johnson-Rural-Demographic-Trends.pdf>

areas of the state will be home to a larger percentage of the State's aging population while the urban areas will contain a smaller percentage of those age brackets comparatively. Based solely on age and implied physical abilities, it would appear that these demographic changes make urban areas more 'ripe' for improved non-motorized transportation alternatives.

The population is also changing their desires when searching for a place to live. Oftentimes, when choosing a home location, the biggest house isn't always the top priority; instead, many people are now looking at the quality of life in an area. This frequently translates into accessibility to greenways, bike trails, sidewalks, and other non-motorized travel accommodations. Whether it means walking children to school through the pedestrian network or riding bikes on a greenway for recreational purposes, it is becoming more and more apparent that biking and walking are increasing in popularity within residential community selection.

Employment Changes

Employees are changing their attitudes when it comes to their needs and desires for a workplace. No longer do people look for a traditional 'brick and mortar' work location. Many employees are now looking for workplaces that allow them flexibility in traveling options, whether to alleviate headaches with morning and afternoon peak hour commutes, or just alternative transportation options for mid-day lunch breaks. Employers are starting to look at workplace locations, not just for a convenient place to conduct business, but also central to a variety of activities to allow their employees to make use of alternative modes of transportation in order to promote healthy lifestyles, stewardship of the surrounding environment, and convenience. Additionally, technology now makes it feasible for many employers to offer alternative workplace options. For instance, some industries allow their employees to work at a remote office location. These may be closer to the employee's home, which ultimately helps reduce their commutes. In turn, shorter commuting distances provide more opportunities to walk and bike to work.

Employers are growing more concerned with providing amenities and accommodations for their employees who are users of non-motorized transportation. In addition, they are also examining the financial benefits of providing those amenities for their own businesses. Particularly for service-related industries, biking and walking facilities nearby create increased opportunity for traffic into their businesses, which, in turn, has the potential to increase revenues.

Non-Motorized Travel Needs

There are numerous types of bicycle and pedestrian facilities throughout the state. When thinking of pedestrian facilities, sidewalks generally come to mind, but greenway facilities also contribute to pedestrian networks in many cities across the state. Bicycle facilities come with more variation though. For example, bicycle facilities can either completely separate the bicyclist from motorized traffic (as is the case with a greenway), separate bicyclists from motorized traffic on the roadway via bollards or pavement markings, or allow the bicyclists to ride in mixed traffic (as is the case on some bike routes). These different facility types are typically implemented based on available pavement width, anticipated usage by bicyclists, and the types of bicyclists that will likely use the bike connections. Various organizations help to provide these amenities such as TDOT, MPOs, cities and municipalities, governments, as well as private and non-profit organizations. Particularly for cycling, there are many examples of private industries and non-profit organizations that seek to increase walking and bicycling through the accessibility to different amenities. For example, Nashville has recently implemented a B-Cycle program, which provides a new level of convenience to riders who may not have a bike of their own or who want to simply rent a bike for a short trip. Similarly, Chattanooga has implemented their bicycle transit system to accommodate the temporary bicycling needs for commuters, tourists, as well as the recreational bicyclist.

There are many different uses for bicycle and pedestrian facilities that can accomplish different purposes. Some are utilized more for commuting purposes while others are used recreationally, and oftentimes those purposes differ based on geographic location. There are also outside factors that affect the need for bicycle and pedestrian accommodations. For these reasons, the needs vary in urban and rural areas as well as across different regions of the state.

Existing demographic characteristics as well as the changes occurring in both rural and urban areas will inevitably have an impact on the non-motorized needs across the state. People are living longer lives due to advances in medical technology. There are certain physical capabilities that diminish with age, which often limit mobility options. Some of these inabilities can be related to vision and hearing impairments, way finding difficulties, epilepsy, deterioration in reflex abilities, dementia, and other physical impairments. Inabilities such as these may provide opportunities for Tennessee to respond to the growing aging population. This could be accomplished through the institution of policies that attempt to keep people who suffer from such ailments from driving. As the aging population becomes less and less able to drive, and consequently less and less dependent on automobiles, non-motorized options become increasingly important. While these older portions of the population are not likely to walk or bike for traditional commuting or recreational purposes, bicycle and pedestrian facilities can still play a part in helping them access transit options, where they can ultimately reach their destinations.

The need for non-motorized facilities in Tennessee also arises from generational, cultural, or even financial perspectives. There are segments of the state's population that are driving less for some of the above reasons. For instance, many studies show that the millennial generation is more prone to walking and biking than some previous generations. Research cites growing access to technology and social interaction via the internet, increased costs of owning and maintaining a vehicle, and environmental and health consciousness as some of the root causes for modal shifts to non-motorized travel. There are many portions of the population that make the choice not to drive. However, others are not so fortunate and may not be able to drive for financial reasons. Constrained by the increasing costs of owning and operating vehicles such as registration and insurance costs, there will always be portions of the population that depend on sidewalks and bicycle facilities for transportation. Oftentimes, these portions of the population rely on transit as transportation as it is oftentimes a more affordable option compared to owning an automobile. As such, there is an increasing need for adequate sidewalk and bicycle facilities, particularly associated with transit stops and the surrounding land uses served by transit.

Particularly for urban areas, development patterns can greatly impact the need for non-motorized accommodations. For instance, as urban areas continue to change with the infill of new developments, studies have shown that number of trips made by automobile is reduced and that the new land uses generally tend to spur increased levels of non-motorized travel. Additionally, vehicular trips in urban areas are limited by the amount of parking available. The cost of providing unlimited parking for businesses and the land it would take to do so is often expensive, particularly in urban areas. As such, providing walking and biking accommodations is oftentimes a more cost-feasible means of providing access to urban areas and/or in locations where real estate is limited or costly. Studies have shown that proximity to bicycle and pedestrian facilities has the potential to increase business patronage, particularly in urban areas. Therefore, non-motorized travel warrants some level of priority in terms of economic opportunities. Biking and walking may also be prevalent forms of travel in suburban areas, where an economy may be tied directly to tourism. Overall, the need for bicycle and pedestrian facilities can be seen in both rural and urban areas. While the needs and accommodations may be different, they still can have an impact on local economies, residential selection, and quality of life for Tennessee residents.

It is important to point out that with the anticipated increase in usage of non-motorized facilities,

the management of these facilities will most likely need to increase as well. The Alliance for Walking and Biking Benchmark Report, published in 2014, conducted a survey across the country to capture various attributes of non-motorized travel, its infrastructure, as well as the staffing levels used to support the various programs. On a statewide level, Tennessee had approximately 5.5 state employees working on bicycle and pedestrian related responsibilities (e.g. Transportation Alternatives Program, Safe Routes to Schools Program, etc.) as of 2012. This may be inadequate if non-motorized travel is anticipated to increase significantly.

4.0 FUTURE GROWTH, TRENDS, AND TECHNOLOGY

Throughout Tennessee, the mobility needs of the state's residents, workers, and visitors are growing and changing. Public transit services, TDM programs, and non-motorized transportation options provide residents with enhanced personal mobility and improved access to destinations. All of the 95 counties in Tennessee are served with public transit and have the opportunity to access TDM programs and non-motorized alternatives, but the diversity of service needs, the uncertainties involved with future funding, and the variety of services present unique challenges for the future. This section provides an overview of future demographic trends that are impacting these alternative modes of transportation across the state and identifies key programs, policies, and performance measures in peer states that may be instructive for TDOT's multimodal approach to future transportation issues and challenges.

Figure 7 below shows the states examined relating to each of these topics. The peer states shown in Figure 7 were chosen to align with those identified as peers in TDOT's 2013 Customer Survey, as they were similar to Tennessee in the areas of geographic size, demographics, growth trends, and/or DOT practices. Table 8 summarizes the components of this review with regard to state DOT policies, plans, and programs for public transportation, TDM, and non-motorized transportation.

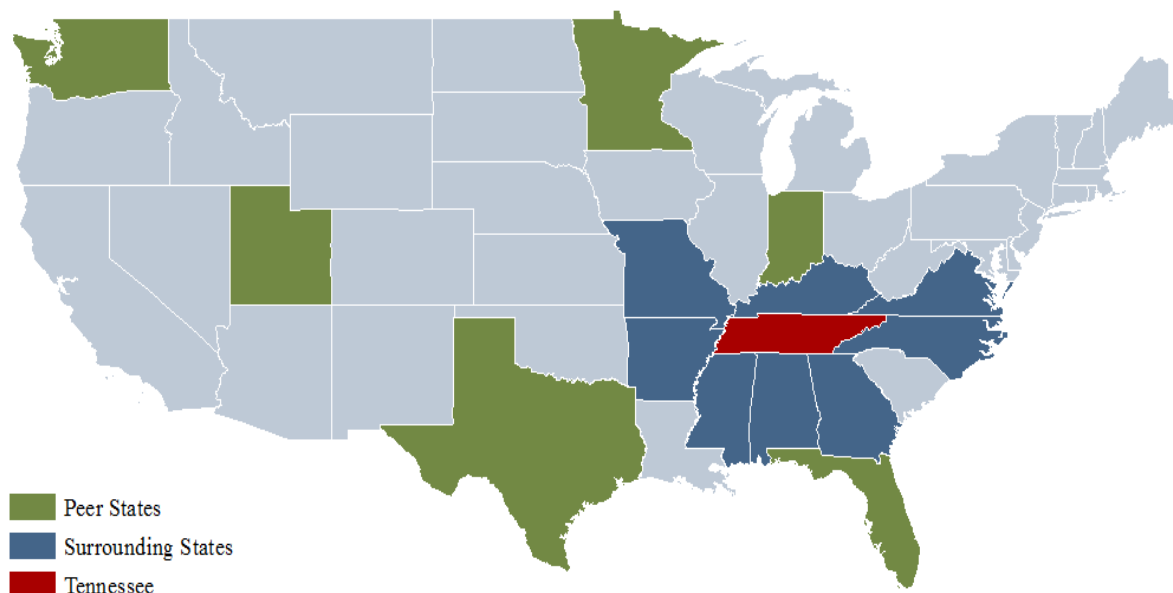


Figure 7 Surrounding, Peer, and Other Noteworthy States

Table 8 Surrounding and Peer State Comparison

Plans, Policies, and Programs	Tennessee	Alabama	Arkansas	Florida	Georgia	Indiana	Kentucky	Minnesota	Mississippi	Missouri	North Carolina	Texas	Utah	Virginia	Washington
Public Transit															
Statewide Transit Plan	✓				✓			✓						✓	✓
Transit Development Plan - Requirements				✓							✓			✓	✓
Coordinated Statewide Transit Services (Rural Transit Services)	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
DOT Role in Transit (beyond grant management)				✓				✓						✓	✓
Transportation Demand Management (TDM)															
Statewide TDM Programs -Centralized/ -Decentralized -Ridesharing Initiatives -Park and Ride Lots	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Transportation System Management & Operations (TSM&O) Initiatives -HOV/HOT Lanes -ITS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Non-Motorized Modes															
<u>Complete Streets/ Multimodal Access</u> -Established Policy -Accommodation Policy -Technical Assistance/ Resources	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<u>Bicycle and Pedestrian</u> -Design Guidelines -Non-Motorized Plans (Statewide) -Non-Motorized Plans (Local) -Technical Assistance/ Resources	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓

4.1 PUBLIC TRANSIT

Personal mobility needs in Tennessee are changing in response to a growing population with evolving characteristics. Public transit is a means by which trips are made by those who choose not to or cannot drive. This paper highlighted the background information on demographic conditions and trends that are currently influencing public transportation service in Tennessee. This subsection provides a summary of the future growth trends, with specific emphasis placed on consumer groups that have traditionally had mobility limitations including seniors, minorities, and low-income persons. As these populations change and grow, the challenge is implementing transit services to meet their mobility needs.

In terms of population growth, Tennessee counties are expected to grow more rapidly than the nation as a whole, with projections indicating an increase in statewide population of more than two million persons by 2040. Much of this new statewide growth will be focused in the large urban areas, with nearly 50% of this overall population growth occurring in the Nashville MSA and the counties constituting the Nashville Area Metropolitan Planning Organization (MPO). Equally impactful, however, is the projection that the rural areas of Tennessee are also forecasted to grow substantially, thus generating additional demands for public transit services in these areas.

Furthermore, the nature of this population growth will create issues for public transit providers across the state. Significant population increases in the urban areas will likely be located in dense pockets of urban development along critical, congested highways and urban arterials. These dense corridors are and will continue to be logical transit corridors for these cities. Also, the substantial population growth projected for those suburban commuter communities surrounding Nashville, Memphis, and the state's other large cities could lead to a demand for additional transit services along interstates and other major transportation corridors (i.e. Class I rail lines) as these commuters seek to access jobs and entertainment in the urban cores. Finally, the continued growth and aging of the rural population base create significant issues for public transit providers who respond to unique demands with limited resources. Over the next 25 years, the overall transit consumer base will expand across the state, and more importantly, the submarkets within that consumer base (i.e. young urban professionals, transit-dependent persons, and the elderly) will likely become a larger percentage of the overall population and demand for public transit services will likely grow accordingly.

For older Americans (and Tennesseans), affordable, reliable transportation options are essential. Current trends are indicating that more and more seniors are choosing to live their retirement years in their current location; and as people age, isolation from social and health services and caregivers can become a growing problem. Physical disabilities and personal income constraints are contributors to this age group's increasing reliance on public transportation into the future. In 2010, approximately 14% of Tennesseans were 65 years of age or older. By 2040, the proportion of seniors is expected to increase to 19% of the state's residents. An elderly population base, both in rural and urban areas, will likely demand additional and expanded public transit services and capacity.

The following pages highlight the practices and programs that Tennessee's surrounding, peer, and other noteworthy states' utilize in the area of public transit. This evaluation may provide valuable lessons learned for TDOT in regards to future plans, programs, and policies related to public transit, as well as the Department's role in providing these services. Because the role of state DOTs in the provision of public transit is shaped by the number and type of transit providers operating within their state, we have performed a high-level and generalized comparison and evaluation of these peer states to determine if there are major statewide initiatives or policy directions that TDOT may want to consider researching in more detail.

Alabama

Alabama's transit services are described in the state's long-range document, the *Alabama Statewide Transportation Plan* (2008). In this plan, the State of Alabama notes that transit buses are expected to increase in importance as the state's population ages and the cost of fuel increases over time. Alabama's 13 urban area transit systems and the numerous rural systems provide access and help with congestion mitigation.

Though it works with local governments to operate and organize public transportation, ALDOT primarily acts as a conduit for all FTA funding for rural transit systems. ALDOT coordinates statewide transit services through Coordinated Public Transit-Human Services Transportation Plans (CPTHSTPs)⁶; in fact, each transit project that applies for funding through the Department must be checked to make sure it was derived from one of these locally developed plans. Alabama requires these plans to be developed at a regional planning council level. This approach essentially provides a statewide assessment of transit needs via regional plans.

Arkansas

According to the *Arkansas Statewide Long-Range Intermodal Transportation Plan* (2007) there are eight urbanized area and seven rural area public transportation systems. The Public Transportation Programs Section of the Arkansas State Highway and Transportation Department (AHTD) provides day-to-day oversight, technical assistance, and fiscal management of FTA programs. In 2001, Act 949 established the Arkansas Public Transit Fund, which is funded from a 5% tax on car rental rates. This tax generates approximately \$3.5 million annually for transit activities. The funds generated by the tax on rental cars are used to match federal funds for the purchase of public transportation vehicles, public transit equipment or facilities, and for the operation of federal programs⁷. Additionally, public transportation in rural areas of the state is covered by CPTHSTPs.

Florida

Florida has an extensive public transportation system and many plans to accompany them. FDOT's *A Vision of Future Transit Ridership* (2013) examined demographic and mobility trends in order to determine the transit vision that Florida needed to have to address increasing transit demands. Additionally, Florida recently developed their Long-Range Transportation Plan, *Horizon 2060*, which calls for more integration of rural and urban transit systems, extensions of passenger rail services, and consolidation of regional transit agencies. The DOT requires Transit Development Plans (TDPs); with a 10-year horizon, these plans serve as the basis for defining future public transit needs, a prerequisite to receipt of state funds. Additionally, the federal ruling requires that the TDP be the provider's planning, development, and operational guidance document. FDOT is one of few states to take an active role in public transportation. The Public Transit Division has three offices with the following responsibilities:

- The Grant Administration Office administers Federal and State transit grants, monitors compliance with transit regulations, and provides planning and technical assistance to Florida's transit agencies and communities.
- The Transit Operations Office reviews and implements safety programs, provides technical assistance in the design and procurement of buses for non-profit and governmental entities, and training programs for mechanics, fleet supervisors and operational transit staff.
- The Transit Planning Office provides guidelines, handbooks, documents, planning software, and networking information for transit professionals.

6 <http://www.dot.state.al.us/moweb/hsctp2012.htm>

7 Arkansas State Highway and Transportation Department, *2013 Facts*, 2013.

Florida coordinates statewide transit services through their Commission for the Transportation Disadvantaged, established in 1989 by their legislature and housed within the DOT. This type of coordination system is intended to balance local flexibility with comprehensive state planning, policy and oversight.

Georgia

The *Georgia DOT Fact Book* states that public transit programs are a key part of Georgia's ability to mitigate congestion, improve air quality, and facilitate economic development. The *State Management Plan (SMP)* includes policies and procedures common to all FTA programs administered by Georgia DOT (GDOT). The SMP provides:

- An overview of FTA programs administered by GDOT
- Responsibilities of sub-recipients as GDOT grantees
- Checklist and forms to help adhere to FTA requirements
- General programmatic and regulatory information common to all programs

Similar to many other DOTs, GDOT acts primarily as a grant administrator for and overseer of FTA funding. Rural transit services are also provided via the Department of Human Resources (DHR) Coordinated Transportation System in partnership with GDOT. The *Rural and Human Services Transportation Study – Phase I Implementation Plan* outlines strategies for Georgia to consider with the intent of advancing the coordination of transit service provisions across the state; this plan also identified transit needs by region.

Indiana

Indiana DOT's (INDOT's) role in public transportation is mainly financial; however, the Department does offer some technical assistance with regard to aspects of transit planning across the state. The *Indiana Mass Transit Study*, published in 2008, provided several conclusions about the current state of transit in Indiana. The state currently supports transit through a set of programs; an increase in state participation is intended to serve as a catalyst for more local participation. This additional funding could be used to target three areas: 1) Expanded rural transit program; 2) Expanded urban transit program; 3) Capital infrastructure fund. In addition to this public transportation plan, INDOT's Long-Range Plan, *2013-2035 Future Transportation Needs Report "Keeping Indiana Moving"*, outlines several public transit trends and needs. Some of these needs include how transit agencies will need to coordinate with organizations in their communities that work with older people and that plan and provide for their needs. Furthermore, Indiana transit service is covered by regional CPTHSTPs that incorporate MPOs as well as rural planning areas⁸.

Kentucky

Based on information gathered from *Kentucky's Long-Range Statewide Transportation Plan (2006)*, Kentucky's public transportation system consists of 21 rural public transportation services and eight urban bus systems that service 21 million passengers annually. Since 1999, Kentucky has implemented a regional coordinated human service delivery program in an effort to coordinate the funding and the services for the various human service transportation systems throughout the state. The coordinated transportation delivery program consists of 15 service regions, providing transportation services for all 120 counties.

⁸ <http://www.in.gov/indot/2825.htm>

Minnesota

The Minnesota Department of Transportation's (MnDOT's) *2013 Transit Report: A Guide to Minnesota's Public Transit System* documents transit trends in the state annually as well as accomplishments in terms of financial and ridership changes. In this report, it documents that the statutory purposes of MnDOT's Public Transit Participation Program are to provide access to transit for persons who have no alternative mode of transportation available, increase the efficiency and productivity of public transit systems, alleviate problems of automobile congestion and energy consumption, provide desirable land use where such activities are cost-effective, maintain a state commitment to public transportation, and meet the needs of individual transit systems to the extent they are consistent with the other objectives stated previously. MnDOT is also currently coordinating with several cities in the state on planning transit investments, including Minneapolis (streetcar, bus rapid transit, and light rail) and St. Paul (mode to be determined).

MnDOT primarily acts as a grant administrator for FTA funds, but does offer some technical assistance for transit planning; additionally, the Department monitors performance and offers recommendations for improvement to agencies. They also have a coordinated rural transit system statewide⁹; MnDOT partners with local planning organizations (Regional Development Commissions or RDCs) for developing CPTHSTPs in the economic development regions. Where no RDC existed, MnDOT staff assists with the development of these plans. In an effort to consolidate regional efforts in developing CPTHSTPs, MnDOT produces a synthesis report that summarizes all of the individual regional plans.

The *Greater Minnesota Transit Plan 2010-2030* is the Department's statewide, 20-year policy plan for the public transportation system; while it primarily focuses on policies necessary to expand public transportation in the state, it includes documentation and estimates of future levels of funding to accompany MnDOT's vision for transit. Additionally, the *Greater Minnesota Public Transit Investment Plan*, completed in January 2011, outlines MnDOT's investment priorities for preserving, expanding, or contracting public transit services depending on projected transit need and future state and federal funding levels.

Mississippi

Mississippi's *2013 Community Transportation Statistical Analysis Report* outlines how community transportation plays an important role in supporting economic growth and other measures that improve the quality of life for Mississippi residents. The Mississippi DOT (MDOT) recognizes that investing in community transportation generates several benefits, such as:

- Riders have better access to job training and jobs.
- Riders get better access to healthcare.
- Riders save on their travel costs when using transit.
- Local businesses increase their level of activity and more money is spent locally.

While the state does not have a separate transit plan, Mississippi's *Unified Long-Range Transportation Infrastructure Plan 2035, Appendix F: Transit Needs Assessment* (2011) states that the mission of the Public Transit Division is to plan, develop, implement, and administer sustainable transportation programs, projects, and plans that promote the most effective and efficient allocation of resources throughout the state. MDOT has been working with local communities across the state in recent years to implement regional coordination though it hasn't come to complete fruition yet.

⁹ <http://www.coordinatemntransit.org/regionalplans/2011/index.html>

Similar to other DOTs, Mississippi is not involved with transit planning on any level beyond grant administration.

Missouri

The Missouri Department of Transportation (MoDOT) acts as a conduit for federal transit funding, administering state and federal programs related to general public transportation and specific transit programs for agencies serving senior citizens and/or persons with disabilities. The state's rural public transportation is discussed in regional coordinated transit service plans.

The State of Missouri's *Long-Range Transportation Plan* (2007) discusses Missouri DOT's *Missouri Statewide Passenger Transportation Study*, which identifies significant unmet public transit mobility needs in both rural and urban areas of the state. On average, Missouri's urban areas are approximately 50% underserved, while the rural areas of the state meet about one-third of the demand. The report estimates that \$200 million is needed annually for 20 years to close the gap in this demand. To meet the demand for transit services, transit needs include additional buses, light rail vehicles, and infrastructure to support the increase in trips.

North Carolina

The North Carolina Department of Transportation (NCDOT) *Statewide Regionalization Study* (2012) was created in response to legislation, which required the NCDOT, Public Transportation Division (PTD) to study the feasibility and appropriateness of developing regional transit systems examining both consolidation on the basis of regional travel patterns and the consolidation of single-county transit systems.

The NCDOT has three functions with respect to transit: (1) administering federal and state transportation grant programs, (2) providing safety and training opportunities for transit professionals, and (3) making planning and technical assistance available. The North Carolina Human Service Transportation Council (HSTC), which was authorized by a Governor's Executive Order in 1991, serves in an advisory capacity to the NCDOT in addressing needs, barriers, policies, and opportunities for the provision of human service transportation.

NCDOT requires that every five years, each county in the state complete a Community Transit Services Plan (CTSP) as a prerequisite for federal and state funding for capital, administrative, and operating assistance. Each plan must 1) evaluate the system's current approach in all facets of management and operations; 2) evaluate the results of the system's current direction; and 3) identify organization strengths and target opportunities for improvement¹⁰.

Texas

Texas's *Statewide Long-Range Transportation Plan* found that public transportation is an integral part of the Texas transportation system. It not only provides an alternative means of travel in both urban and rural areas, but also provides vital services for the elderly and persons with disabilities. The anticipated public transportation capital investment needed between 2006 and 2035 is \$40.2 billion, with 95% estimated for metropolitan areas and 5% for small urban and rural transit operators. Due to financial constraints, TxDOT only acts as a grant administrator for FTA funding.

The large variety of metropolitan, suburban, and rural services provided in Texas are coordinated through the Regional Service Planning group that coordinates rural transit services on behalf of TxDOT. This organization helps organize a single online location where a variety of information

¹⁰ <http://www.ncdot.gov/nctransit/download/Plans/LocallyCoordinatedPlan.pdf>

regarding the public transportation infrastructure and services can be found; this website is also home to the regionally coordinated transportation plans¹¹.

Utah

Utah's *Unified Transportation Plan 2011-2040* outlines the state's planned multimodal transportation system. While not specific to only public transportation, this plan acknowledges parts of this system that include many transit elements such as an expanded road system, expanded bus system, expanded light rail system, commuter rail, intercity rail and interstate passenger rail, bus rapid transit, bicycle and pedestrian networks, carpool travel, and passenger and freight intermodal connections. The Unified Plan outlines several new transit capital needs that will increase mode choice options. Transit capital needs in rural areas include infrastructure to provide mode choice, new equipment, transit vehicles and funding for feasibility studies for fixed route service.

Utah considers its CPTHSTPs to be its acting statewide plan; the current plan is the first one established by the state and was developed soon after the passing of SAFETEA-LU in 2005. This along with the accompanying plans for each Utah region can be found on the UDOT website¹². It does not appear that UDOT takes an active role in public transportation beyond that of a grant administrator.

Virginia

Transit is not looked upon as a minor responsibility for the Virginia DOT Department of Rail and Public Transportation. With three of the 75 largest transit agencies in the country, management and planning for this state is key. The state accomplishes a great deal by being actively involved in a variety of elements in planning for and delivering public transportation services.

Unlike many DOTs, Virginia not only administers Federal and State funding to transit agencies, but delves deeper into the process of delivering public transportation by offering technical assistance. They have created multimodal design guidelines to help plan for the uses of all users, including transit, along key corridors. With the same emphasis on corridors, VDOT routinely conducts corridor studies specifically focused on transit applications as well as Transportation Demand Management opportunities. The Department also employs transit-specific initiatives aimed at decreasing SOV trips in favor of a mode shift to transit.

The Virginia Department of Rail and Public Transportation recently completed their 25-year look at statewide transit services, called the *Statewide Public Transportation and Transportation Demand Management Plan* (2014). In this plan, the state identifies trends affecting public transit demands, financial shortcomings, and the areas of focus for transit investment. These areas are:

- Bringing public transportation assets into a state of good repair.
- Meeting future travel demand through expanded transit capacity.
- Addressing significant growth with rapid transit capital projects.
- Reducing auto reliance and increasing transit system efficiency and effectiveness through expanded TDM efforts.

In addition to the statewide plan, VDOT uses its rural Planning District Commissions (PDCs) as a means of coordinating rural transit provisions across the state¹³. VDOT also requires each of the

11 http://www.regionalserviceplanning.org/texas_regions/plans_presentations/

12 <http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:3214>

13 <http://www.drpt.virginia.gov/planning-and-commuter-programs/Transit-reference-material/>

rural areas to prepare Transit Development Plans as they provide a solid foundation for funding requests and feed directly into the programming process. To capture the benefit of this planning tool, VDOT requires that any public transit operator receiving state funding prepare, adopt, and submit a TDP¹⁴.

Washington

The Washington DOT (WSDOT) Public Transportation Division developed their Statewide Human Services Transportation Plan, which serves as a strategic framework for addressing the state's existing and future human services transportation needs; it primarily identifies planning-level recommendations. As a foundation for this plan, Washington has 15 CPTHSTPs, one for each of its RTPOs (14) and one for San Juan County, which does not affiliate with any RTPO.

The *Washington Transportation Plan 2030* (2010) states that in order to meet their goal of to “strengthen connectivity of people and communities”, the state should support strategies and investments to better link people and commerce, such as transit-oriented development, bicycle and pedestrian networks, park-and-ride lots and broadband access. Support should also be given for the location of transportation facilities such as transit only lanes, where transit operation in the corridor is critical to maintaining and improving mobility, particularly in urban centers.

WSDOT is the recipient for FTA funds and as such, is a grant administrator for those public transportation programs. However, WSDOT also administers a Consolidated Grant Program using state funds to support transportation services throughout the state. It is a state practice that any project seeking funding through this program come from a region's coordinated plan. Transit Development Plans are also required of agencies by state legislation in order to receive funding; these are updated every six years.

The state administers funding in the form of Rural Mobility Grants and Specialized Paratransit Needs Grants that target those underserved populations in rural areas not appropriately served by transit and those with specialized transportation needs, respectively. With a combination of federal and state funds, WSDOT partners with the Washington State Health Care Authority (HCA) to provide medical non-emergency transportation. The DOT's Regional Mobility Grant program supports local efforts to improve transit mobility and reduce congestion on the most heavily traveled roadways. In addition to funding transit programs, the Department also carries out other initiatives such as guidelines for Transit Asset Management Plans and Vehicle Maintenance Plans, cost analysis tools for calculating life-cycle costs for equipment, training sessions for helping regional authorities plan for more efficient systems through the Washington State Transportation Training Coalition (WSTTC), and an optional peer review program to encourage agencies to learn from one another.

Budgetary Review of Peer, Surrounding, and Noteworthy States

In addition to the review of policies, plans, and programs of the surrounding, peer, and noteworthy states, a review of their public transportation budgets and overall effectiveness of their large urban systems was conducted to determine if additional guidance could be provided to future TDOT policy and program frameworks. Transit funding for Tennessee and these states was assessed to compare the level of investment each state makes in public transportation. The budget for public transportation was calculated as a percent of the total budget for the state DOT. Additionally, the public transportation budget was calculated per capita using 2013 Census data.

As shown in Table 9, Tennessee falls in the middle of its surrounding states in terms of funding for public transit as a percent of DOT budget and per capita spending. This ranking is based on the assumption that the level of public transit funding in the states of Alabama, Mississippi, and

14 <http://www.drpt.virginia.gov/planning-and-commuter-programs/planning-commuter-programs-overview/>

Arkansas are likely lower than that of Tennessee based on the limited nature of their public transit programs. When compared to its peer states' budgets, however, Tennessee compares favorably to Texas, but is far behind Virginia and Washington. Budget figures for AR, MS, AL and UT were unavailable based on a review of public sources.

Table 9 Surrounding and Peer State Funding Summary

State	Percent of DOT Budget Spent on Transit	Per Capita Transit Spending
Texas	0.8%	\$3.35
Kentucky	1.5%	\$8.75
Georgia	1.7%	\$3.46
Indiana	2.1%	\$6.48
Tennessee	2.5%	\$7.46
Missouri	3.3%	\$11.88
North Carolina	4.4%	\$8.59
Florida	4.8%	\$20.51
Virginia	8.4%	\$46.50
Washington	9.6%	\$56.84
Alabama	NA	NA
Arkansas	NA	NA
Mississippi	NA	NA
Utah	NA	NA

Source: Respective state DOT budgets, US Census Bureau, Woods and Poole

Data from the National Transit Database (NTD) was collected to analyze the efficiency of the five largest transit agencies in Tennessee and the largest transit agencies in the surrounding and peer states. As shown in Table 10, the Tennessee agencies perform better than their peer agencies in two out of three categories, despite the fact that Tennessee spends less per capita on transit than some of the peer states. A few things to note:

- Tennessee agencies have comparatively lower operating expenses per vehicle revenue mile than peer state agencies
- Tennessee agencies have comparatively lower operating expenses per passenger mile than peer state agencies
- Peer state agencies provide comparatively more trips per vehicle revenue mile

While Tennessee's largest agencies cost less to operate per vehicle revenue and passenger mile, there may still be opportunities to improve service effectiveness through improved route structures that more effectively connect major activity generators. Improvements in connectivity would support expanded mobility within the state's cities and more closely align the service effectiveness of Tennessee's largest transit agencies with those in peer states. This improved connectivity will be particularly important as more and more Tennessee residents choose to live in cities, and corresponding congestion levels continue to grow. While this type of analysis is a transit agency-level task, TDOT could support agency efforts through dedicated planning funding.

Table 10 NTD Efficiency Metrics for Tennessee Agencies and Peer State Agencies

	Service Efficiency: Operating Expense per Vehicle Revenue Mile	Service Effectiveness: Operating Expense per Passenger Mile	Service Effectiveness: Unlinked Passenger Trips per Vehicle Revenue Mile
Chattanooga (CARTA)	\$7.16	\$1.49	1.44
Clarksville (CTS)	\$3.78	\$0.85	0.79
Knoxville (KAT)	\$7.69	\$1.93	1.29
Memphis (MATA)	\$7.73	\$0.94	1.48
Nashville (MTA/RTA)	\$8.13	\$0.81	1.99
TN Agency Average	\$6.90	\$1.20	1.4
Atlanta, GA (MARTA)	\$9.28	\$0.93	2.7
Birmingham, MS (MAX)	\$8.20	\$1.44	1.01
Charlotte, NC (CATS)	\$6.71	\$2.48	2.7
Columbus, OH (COTA)	\$8.75	\$1.20	1.9
Dallas, TX (DART)	\$8.94	\$1.50	1.41
Gulfport, MS (Coast)	\$3.85	\$0.66	0.81
Houston, TX (METRO)	\$8.71	\$1.01	1.75
Indianapolis, IN (IndyGo)	\$6.83	\$1.05	1.53
Little Rock, AR (CATA)	\$5.44	\$0.80	1.22
Louisville, KY (TARC)	\$8.35	\$0.87	2.43
Richmond, VA (GRTC)	\$8.06	\$1.02	1.96
Seattle, WA (King County Metro)	\$12.91	\$0.94	2.87
Salt Lake City, UT (UTA)	\$7.68	\$1.98	1.45
St. Louis, MO (Metro)	\$7.49	\$0.92	1.56
Peer Agency Average	\$7.94	\$1.20	1.81

Source: National Transit Database, 2012

FTA has historically required both rural and urban transit agencies to report transit-related data that demonstrates the overall efficiency and cost effectiveness of their programs. As part of MAP-21, the establishment of a performance- and outcome-based program became a key focus, accompanied by performance measures beyond annual ridership, operating costs per mile, and other indicators. Performance management will transform Federal highway and transit programs for both FHWA and FTA and provide a means to more efficient investment of Federal transportation funds by focusing on national transportation goals, increasing the accountability and transparency of the Federal highway and transit programs, and improving transportation investment decision-making through performance-based planning and programming. The State, MPOs, transit agencies, and other stakeholders are tasked to establish performance measures and targets.

FTA has established new performance measures for State of Good Repair and Safety. These measures are to be based on the transit agencies' Asset Management and Safety Plans, and the data and metrics used to report this information are still being identified by FTA.

Furthermore, federal transportation legislation requires a new system for reporting the performance measures for the rural transit agencies to be developed at the state level. These regulations will require TDOT to develop these guidelines and implement those measures for applicable rural providers. TDOT should investigate the current practices of the urban transit agencies across the state in terms of their State of Good Repair and Safety measures and determine if similar measures could be applied to rural agencies.

4.2 TRAVEL DEMAND MANAGEMENT

TDM remains a relatively new and uncharted discipline for TDOT just like many other DOTs across the country. Transportation professionals are only now beginning to understand and effectively evaluate the real effectiveness of these strategies in road and highway planning. In many of the most successful programs, the effectiveness is found only in congested urban corridors where a mixture of strategies for both public and private sector participation yields tangible results. Identified in this section are examinations and findings from research of best practices in TDM programs for surrounding and peer states. Additionally, Section 4.4 provides an in-depth review of ATDM practices and other emerging technologies as they relate to personal mobility and efficient travel.

Alabama

Alabama has few TDM strategies. The state's CommuteSmart website offers ride matching for carpool and vanpools, while also providing a calculator for measuring and tracking commute costs. To assist in this program, ALDOT provides several park-and-ride lots. Transportation System Management and Operations (TSM&O) initiatives carried out by ALDOT include a small system of HOV lanes in the large municipalities and several Intelligent Transportation Systems (ITS). These ITS include fiber optic communication networks, traffic surveillance Closed Circuit Television, and machine vision vehicle tracking.

Arkansas

Like Alabama, Arkansas has few TDM strategies in place. AHTD provides numerous park-and-rides statewide. One ridesharing initiative, arkRide, exists within the state and is managed through a partnership between AHTD, the Central Arkansas Transit Authority, and MetroPlan (Little Rock's MPO). The website offers ride matching for carpooling and vanpooling, as well as walk buddy matching. ITS employed by AHTD is limited to electronic message boards. The Department has also assisted each MPO in developing Regional ITS Architectures.

Florida

State legislation requires FDOT to consider TDM strategies in all studies, plans, programs, functional areas, and in employee benefit programs. FDOT provides oversight and funding for District Offices to implement their own TDM programs. These District Offices fund six regional commuter assistance programs across the state to carry out implementation of strategies including carpooling, vanpooling, public transit, telework, and flexible work scheduling. Rideshare programs, funded by FDOT and implemented by Districts, exist in several regions in the state. Park-and-ride facilities are offered through a variety of venues, including VDOT, local transit agencies, and agreements with shopping centers, churches, etc.

In 2010, FDOT endorsed a TSM&O program, adopted a business plan, and outlined a strategic plan. FDOT's program is based upon performance management, active management of the multi-modal transportation network, and positive safety and mobility outcome delivery to the traveling public. Stated program strategies include ramp signals, managed lanes, Rapid Incident Scene Clearance, variable speed limits, microwave vehicle detection, traveler information through changeable signs, and use of Advanced Traffic Management Systems (ATMS). FDOT also provides HOV/HOT lanes in three counties within the Miami area as part of this TSM&O program. A formal program, development of a TSM&O policy, and the creation of guidance documents is to be completed between 2013 and 2015.

Georgia

GDOT's TDM program recently expanded statewide building off of Atlanta's efforts. The Department oversees the entire TDM approach from the state level, while all major contracts and initiatives ultimately link back to the DOT. Other major partners include the Department of Environmental Protection (DEP), the Atlanta Regional Commission (ARC), Georgia Regional Transit Authority (GRTA), and nine TMAs. Much of the current TDM programs and structure is based on a strategic plan, A Framework for Cooperation to Reduce Traffic Congestion and Improve Air Quality. GDOT's role includes local, technical assistance to employers in the nine TMAs, the Clean Air Campaign (CAC), RideSmart matching services, commuter financial incentives, marketing and promotional materials, the Telework Leadership Initiative, HOV/HOT/Express lanes, construction mitigation, and integration of 511 with CAC. GDOT also provides 87 park-and-ride lots across the state.

GDOT's Transportation Management Centers is at the heart of Georgia's ITS. Headquartered in Atlanta, it serves as the information clearinghouse for GA-NaviGator 511, the 24/7 real-time transportation, management system and Georgia 511, a phone service providing travel assistance. This TMC coordinates with the Macon TMC and satellite Transportation Control Centers (TCC) across the state. Other ITS strategies include ramp meters, changeable message signs, video detection systems, and Closed-Circuit Television.

Indiana

Indiana TDM efforts largely fall upon the responsibility of regional and local authorities. Ridesharing Initiatives and park-and-ride lots are implemented and operated by these agencies. The only TDM Program INDOT carries out is TrafficWise, a strategy that employs Intelligent Transportation System technologies. Use of Dynamic Message Signs are used on Indiana's metropolitan interstates, while traffic alerts are additionally communicated through the Highway Advisory Radio system and notices sent over the Internet or smart phone.

Kentucky

TDM efforts in Kentucky are largely left up to regional and local agencies. The Kentucky Transportation Cabinet's (KYTC's) website offers a Congestion Tool Box for implementation strategies these agencies may explore. KYTC does offer limited park-and-ride lots to complement local (or privately operated) rideshare programs and has a website (CarpoolKY) for matching state worker carpools. In addition, HOV lanes and limited Intelligent Transportation Solutions are used by the Department. For ITS solutions, KYTC partners with regional and local agencies and are largely centered on providing up-to-date traffic information.

Minnesota

While MnDOT employs TDM strategies and programs, general TDM programs are largely carried out by local and regional agencies. MnDOT provides these programs with administration, planning, policy, and funding assistance. Particularly relating to the Metropolitan Council of the Twin Cities program, MnDOT provides program evaluation, performance measurement, and aids in the development of the multimodal system. These regional programs generally consist of rideshare matching, vanpools, and trip reduction strategies including parking cash-outs (employer gives employee an option to take a cash payment and give up their parking space, effectively subsidizing their transit or carpool commute) and transit pass subsidies. The Department additionally provides park-and-ride lots across the state to assist these regional efforts.

In addition to partnering with regional and local agencies, MnDOT provides a broad range of TSM&O Initiatives. MnDOT's HOV/HOT program (MnPASS) allows solo drivers to pay an electronic fee, while transit buses, carpoolers, and motorcycles may use the lane for free. As these express

lanes become increasingly congested, the fee to enter the lane increases. MnDOT's Guidestar Program, established in 1991, performs many ITS activities and is guided by a Strategic Plan. MnDOT uniquely provides real-time traveler information for arterials, cell traffic data to reduce need for traffic monitoring systems, deer detection systems to reduce deer/vehicle crashes, and a Vehicle as Sensors (VAS) project that sends traffic data to traffic management centers via MnDOT's freeway service providers and State Patrol vehicles retrofitted with transponders. A MnDOT ITS Design Manual resource assists agency and consultant personnel in the design of ITS elements.

Mississippi

A limited number of TDM strategies in Mississippi are largely employed by regional and local agencies. MSDOT recently carried out a study to analyze the feasibility of a ridesharing program. The study concluded that the state has all necessary elements to develop such a program. Recommendations include acquisition of ridesharing software, a prioritized list of possible ridesharing pilots, and discusses potential park-and-ride locations. HOV/HOT lanes and limited use of ITS technologies are currently used by MSDOT. The Department also analyzes the best ways to integrate TDM for rural traffic to reduce SOV travel.

Missouri

TDM strategy responsibilities are shared between MoDOT and regional/local entities. For example, while MoDOT offers 6,700 free parking spaces for commuters in 115 lots across the state, regional agencies (such as Kansas City Area Transit Authority) and local agreements with retail centers, churches, or other organizations additionally provide park-and-ride lots. While MoDOT encourages ridesharing for state employees through the option to use state vehicles, general rideshare programs are carried out by regional agencies. The Department also offers HOV and HOT lanes, while employing ITS applications and technologies including traffic management centers and other standardly-employed methods.

North Carolina

NCDOT offers a statewide TDM Program that provides the overall policy framework, state funding, and fiscal oversight for regional TDMs. NCDOT's involvement is governed by the 2004 Statewide Transportation Demand Management Plan. NCDOT also provides funding for the statewide ridematching program software and other TDM studies. A statewide website, ShareTheRide NC, offers assistance in carpooling and vanpooling. Funding for the site is provided by NCDOT and several regional transportation planning entities. Also found on the website is information regarding the GoPoints and GoPerks Incentive Programs designed to encourage ridematching.

The Department also uses Intelligent Transportation Systems divided into eight categories: signal systems, traveler information, incident management assistance, transportation management centers, commercial vehicle operations, transit management, and traffic management and information devices. While NCDOT designates HOV lanes on the State Highway System, HOV lanes on Municipal Street Systems are designated by the corresponding municipality.

Texas

TDM Programs in the state of Texas are largely implemented at a regional (MTAs) or local level. Typically these services include ridesharing, vanpooling, and employer outreach and assistance. TxDOT maintains seven HOV lane systems across the state. Unlike Virginia, hybrid vehicles with only one occupant are not allowed on these express lanes. All other HOV systems in the state are owned and operated by local, regional, or private entities. While MPOs are involved in the planning, programming and implementation of ITS programs and projects, TxDOT District Offices operate and manage the transportation management centers. ITS components typically include closed

circuit television, ramp meters, Mobility Assistance Patrol, lane control signals, dynamic message signs, and traffic flow detectors.

Utah

TravelWise, UDOT's TDM Program, began in 2008 and is a comprehensive TDM marketing outreach program. This program outlines a set of strategies that encourages alternatives to driving alone. With UDOT acting as lead, the \$1.5 million Program relies on partnerships between community organizations, private businesses, and the Utah Transit Authority (UTA). TravelWise strategies include carpool and vanpool programs, telecommuting, flexible work hours, car/bike sharing, and shifting work times. It is worth noting UTA is charged with implementing both the ridesharing database and vanpool services.

In addition to the TDM Program, UDOT also employees use of Express Lanes (HOV) and Intelligent Transportation Systems (ITS). ITS projects are funded primarily through federal, state, and local participation. Several of the ITS technologies include closed-circuit TV, variable message signs, traffic signal coordination, pavement sensors, and weather sensors to provide real-time information.

Virginia

Statewide TDM is accomplished through a partnership between VDOT, the Department of Rail and Public Transportation (DRPT), Transportation Management Areas (TMAs), and 15 commuter assistance programs administered by local and regional planning entities. DRPT is responsible for the Statewide Transit and Transportation Demand Management Plan, while also heading a Transit/TDM Advisory Committee (of which includes VDOT representation). VDOT's role in this partnership complements DRPT programs through demand-side strategies such as the recently implemented Demand Management Program, implementing park-and-ride policies, using Intelligent Transportation Systems (ITS), using Integrated Corridor Management to create an interconnected network in parallel facilities, conducting outreach and education, promoting telework, and accommodating pedestrians and bicyclists.

HOV and HOT lanes are additionally implemented by VDOT. Virginia is one of few states that allows hybrids (with only one occupant) to use these lanes if they have the "clean special fuel" license plate. Furthermore, HOV-3 lanes are provided for in-bound and out-bound lanes into Washington DC due to level of HOV usage. Rideshares are regionally supported by planning district commissions, while the existing park-and-ride program is sponsored out by VDOT.

VDOT's ITS Program, Smart Travel, is dependent upon a strong partnership between the Central Office, Regional/Corridor Committees, and VDOT District Offices, as well as cooperation with other agencies and private sector investment. All parties play a critical role in accomplishing Smart Travel's vision. The Central Office in particular archives statewide data, centralizes the electronic payment systems, provides traveler information (pre-trip and en route), and traveler services information. The VDOT District Offices are the operators of ITS and therefore, provide the foundation for the Smart Travel program.

Washington

In 1991, Washington passed the Commute Trip Reduction (CTR) Law followed by CTR Efficiency Act in 2006. This Act established the state's CTR program using partnerships among employers, local jurisdictions, planning organizations, transit systems, and the state to encourage employees to carpool, ride the bus, telework, bike, or walk. Most often larger companies in congested areas, employers develop and manage their own programs based on locally adopted goals for reducing vehicle trips and miles traveled. The CTR Performance Grant Program awards one-year grants to entities who offer financial incentives as part of their program. Regional/local governments and

transit agencies are responsible for the implementation, while WSDOT provides technical assistance, develops implementation contracts, and allocates funding for CTR planning.

Several additional TDM strategies contribute to the success of the CTR Program including the Trips Reduction Performance Program, Rideshare Tax Credits, Vanpool Grant Program, Regional Mobility Grant Program, and park-and-ride lots. WSDOT's Rideshare Program is especially effective. A website provides an interactive ridematch tool, various commuting options (carpool, vanpool, SchoolPool, etc.), ability to track one's trips and money saved, and incentives for participation.

WSDOT also provides TSM&O initiatives including smart highways and HOV/HOT lanes. Toll rates adjust based on congestion to ensure traffic in the HOT lanes are free-flowing, but may be used as a HOV lane if taking a bus, vanpool, or carpool. Smart highways in Washington are those consisting of high-tech overhead signs that provide immediate information on variable speed limits, lane status and real-time traffic information.

Performance measures for TDM programs are generally very elusive and difficult to gauge. Federal transportation legislation offers no real guidance on metrics for TDM programs, but one best practice recognized across the country is the use of an independent evaluation method to measure the success of the TDM program(s) in a given state. The goal of TDM programs should be to provide alternatives so that SOV commuters may be able to commute using another mode, whether that is joining a carpool or vanpool, taking the bus or train, bicycling or walking, or teleworking. The change does not have to be an "all or nothing" proposition – many successful programs show statistics of individuals who use an alternative commuting method several days per week, but not every day that they commute. But by doing so even on some days, we can track these program participants' measurable VMT reduction and show their associated mode shift from SOV to another mode.

3.3 NON-MOTORIZED TRANSPORTATION

As population and employment continues to grow, it's unlikely that congestion on the transportation system will improve. As commute times get longer, residents may look to non-motorized means of getting to and from their destinations. Additionally, other factors such as preference, transportation costs, and/or the inability to own or operate a vehicle can impact one's choice to use non-motorized modes. Many aspects of bicycling and walking can be undertaken by DOTs; this review of surrounding and peer states examines the policies, programs, and plans regarding statewide non-motorized transportation plans, design guidelines for non-motorized facilities, provisions of technical resources and assistance by the DOT, and Complete Streets policies. The latter is covered to a brief extent as the policy paper on *Accessibility: Land Use, Access Management, Multimodal Access, and Health and Environment* covers the surrounding and peer state review on this topic in greater detail.

Alabama

While no statewide Complete Streets policy exists, ALDOT and the state's MPOs have recognized the need to look at Complete Streets concepts to meet the demands for bicycling and walking. In 2010, ALDOT developed a Bicycle and Pedestrian Plan to guide decisions as to where facilities should be provided, identifies the planning and design resources needed to meet future demand, and identifies potential statewide linkages that would connect communities. ALDOT division offices do work with MPOs to improve the status of bicycle and pedestrian facilities; however, ALDOT uses these relationships and knowledge of local/regional plans to inform their own planning and design process versus assisting these entities with the development of their own.

Arkansas

While Arkansas has a stated accommodation policy for bicycle and pedestrian facilities, it has

no state-level Complete Streets policy. AHTD does, however, maintain a Bicycle and Pedestrian Transportation Plan. The Department is currently engaged in an 18-month planning process with the Department of Parks and Tourism, Department Of Health, and the State Police to update their Plan (to be completed by 2015). Design guidelines will be added as part of this update. While several local and regional entities have created bicycle and pedestrian plans, they are not required.

Florida

While FDOT has no Complete Streets policy per se, Complete Streets concepts and bicycle/pedestrian accommodations underlie their Context Sensitive Solutions (CSS) and Transportation Design for Livable Communities policies. In response to safety issues, Florida's Transportation Secretary launched a Bicycle/Pedestrian Focused Initiative in 2011. A Pedestrian and Bicycle Strategic Safety Plan was developed in 2013 to help guide the Department's Bicycle/Pedestrian Safety Program. Design guidelines for these facilities are found within Chapter 8 of FDOT's Plans Preparation Manual. Each of FDOT's seven districts are assigned a District Pedestrian and Bike Coordinator to provide assistance in FDOT projects and activities.

FDOT also employs the use of performance measures to track progress in meeting their mobility goals. These include monitoring the number of students receiving bicycle and pedestrian safety education or skill training and the number of local municipalities with bicycle and pedestrians plans.

Georgia

GDOT implements a Complete Streets Design Policy to ensure that bicycle, pedestrian, and transit needs are met. The Department has produced numerous resources, starting with the Bicycle and Pedestrian Safety Action Plan (GBPSAP), to assist interdepartmental, local government, and regional planning agency decisions on the Policy's implementation. GDOT developed a Bicycle and Pedestrian Task Team to advise the Department on matters including policies, plans, maps, publications, and accessibility issues. Design is guided by Chapter 9 in the state's Design Policy Manual.

In addition to providing design guidelines, GDOT coordinates with local governments and regional planning agencies to ensure that bicycle, pedestrian, and transit needs are met at all stages of project development. GDOT provides two resources focused upon pedestrian planning in particular, the Guidebook for Pedestrian Planning and the Pedestrian and Streetscape Guide. The Guidebook outlines methods for evaluating, funding, and prioritizing pedestrian facilities, while the latter details proper design, construction, and maintenance of pedestrian facilities. GDOT also tracks the number of local bicycle and pedestrian plans as well as the increase in 'end-of-trip' bicycle facilities such as showers and bike lockers as a means to measure performance.

Indiana

INDOT has added a Complete Streets statement to its CSS Planning Guidelines. Indianapolis, like other local/regional planning organizations, has developed a Bicycle Master Plan seeking to expand its mobility options. INDOT partnered with the Department of Natural Resources to develop the state-wide plan, Hoosiers on the Move: The Indiana State Trails, Greenways, and Bikeways Plan, in 2006. This document's vision is to build a statewide system that provides access to a trail opportunity within 15 minutes of all Indiana citizens.

Kentucky

The Kentucky Transportation Cabinet (KYTC) adopted an accommodation policy, Pedestrian and Bicycle Travel Policy, in 2002. A Bicycle and Bikeway Commission (KBBC) has been established since 1992 to advise the KYTC's Secretary on all matters pertaining to bicycle facilities and promoting bicycling interests to governing officials and the public at large. While some municipalities and

MPOs have bicycle and pedestrian plans, KYTC does not. They do, however, offer an education grant (Paula Nye Memorial Bicyclist and Pedestrian Education Grant) funded by the “Share the Road” license plate option. Grant money is awarded to non-profits and state and local government agencies to improve safety through funding safety brochures and DVDs, limited staff salaries, and public awareness campaigns to name a few. Design guidelines relating to bicycle and pedestrian facilities are provided within the Highway Design Manual.

Minnesota

As discussed in the Land Use section, MnDOT adopted a Complete Streets policy in 2010. While MnDOT provides a design guideline document for the installation of pedestrian crosswalks on state highways and a Bikeway Facility Design Manual, guidelines can also be found within the state’s document Minnesota’s Best Practices for Pedestrian/Bicycle Safety. A Statewide Bicycle Planning Study was carried out in 2012 to inform MnDOT’s Statewide Bicycle System Plan and the future Statewide Bicycle Policy Plan Project. While local and regional entities do produce their own pedestrian and bicycle plans, the Policy Plan Project will provide a framework for guidance in developing District Bicycle Master Plans. Currently, MnDOT has a State Aid for Local Transportation Department that offers funding and technical assistance to local levels of government; however, the Bicycle Planning Study noted the disconnect between MnDOT district staff and local/regional bicycle planning initiatives.

MnDOT tracks numerous performance measures related to non-motorized transportation. These include the following among many others:

- Reduction in bicycle and pedestrian-related crashes
- Percent growth in miles of pedestrian and bicycle facilities per year
- Overall mode split and/or split by trip purpose or area
- Percent of funding going towards non-motorized modes

Mississippi

In 2010, MDOT adopted a pedestrian and bicycle accommodation policy. While seven municipalities have passed complete streets policies, only a few have produced bicycle and pedestrian plans.

Missouri

The Missouri General Assembly adopted HR 23 in 2011 that declares support for Complete Streets policies and urges adoption at all levels of government. While MoDOT has not officially adopted a Complete Streets policy, the Department has committed to providing accommodation for pedestrians and bicyclists (1999 policy) and improving their policies internally. The Department has produced a General Pedestrian and Bicycle Guide, but provides departmental policies only. A few of the larger municipalities have prepared their own bicycle and pedestrian plans.

North Carolina

The Department’s Division of Bicycle and Pedestrian Transportation is one of the oldest and largest in the country. WalkBikeNC is NCDOT’s Statewide Pedestrian and Bicycle Plan with many local/regional planning agencies forming their own. NCDOT provides technical expertise, Complete Streets training, sample plans on their website (including a full template for Bicycle and Pedestrian Plans), and a Complete Streets Planning and Design Guidelines which includes facility design. NCDOT adopted a formal Complete Streets policy in 2009 in order to provide an efficient multi-modal transportation network.

NCDOT also tracks performance of non-motorized accommodations in terms of safety, mobility options, and health and environment. Some of these performance measures are listed below:

- Physical inactivity rates and/or obesity rates
- Miles of greenways and shared use paths
- Measure of connectivity between non-motorized assets
- Percent of existing facilities brought into compliance with Americans with Disabilities Act (ADA) standards
- Percent growth in miles of pedestrian and bicycle facilities per year
- Cities, businesses, and universities designated as Bicycle and Walk Friendly by the League of American Bicyclists and the Pedestrian and Bicycle Information Center
- State rank in country for bicyclist and pedestrian fatalities
- Number of (or reduction in) annual bicycle or pedestrian involved crashes

Texas

TxDOT considers bicycle and pedestrian accommodation within all projects. Guidelines are provided within TxDOT's Roadway Design Manual. The Department also provides technical expertise to local and regional planning agencies including information about facility design, policies, and regulations. The state's Bicycle and Pedestrian Coordinator in particular offers training for TxDOT staff and serves as a subject matter expert on research projects relating to non-motorized transportation.

Utah

While Utah does not have a Complete Streets policy, Utah seeks to accommodate pedestrians and bicyclists as part of UDOT's commitment to Context Sensitive Solutions. Design guidelines for these accommodations are provided in UDOT's Roadway Design Manual of Instruction and the Pedestrian and Bicycle Guide (PBG), while UDOT's Utah Traffic Controls for School Zones contains roadway design specific to school zones. An official statewide UDOT plan does not exist; however, the PBG contains components similar to a master plan. In addition to this resource, UDOT provides a Bicycle and Pedestrian Master Plan Design Guide to walk local and regional planning agencies step-by-step through the Master Plan development process.

Virginia

In 2004, VDOT adopted the "Policy for Integrating Bicycle and Pedestrian Accommodations". In the past several years, VDOT has worked to develop an expanded-upon bicycle and pedestrian policy for the state. The documents, Bicycle Policy Plan and Pedestrian Policy Plan, represent phases towards accomplishing this task. With similar components to a master plan, the third phase (future) is to combine these documents into a State Bicycle and Pedestrian Implementation Plan. Municipalities and regional planning agencies have already begun to adopt their own bicycle and pedestrian master plans. VDOT's Bicycle Facility Planning document acts a guidance tool for such entities looking to develop a bicycle-specific plan.

Washington

In 2011, WSDOT adopted a Complete Streets policy. The State Bicycle Facilities and Pedestrian Walkways Plan acts as a guide to implementing this policy. WSDOT's Design Manual contains chapters detailing design guidelines for bicycle and pedestrian facilities. Additional guidelines,

including wayfinding procedures, are found within the State Plan and the Shared-Use Path Design Guidance documents. WSDOT provides a Pedestrian Facilities Guidebook to assist planners, developers, engineers, designers, and WSDOT personnel in planning for and designing pedestrian facilities. While many local and regional entities do participate in bicycle and pedestrian planning, only the larger entities have developed separate dedicated plans. Many performance measures regarding non-motorized mobility are tracked throughout Washington; some of them are listed below:

- Number of (or reduction in) annual bicycle or pedestrian involved crashes
- Number of annual bicycle or pedestrian fatal crashes and/or fatality rates per capita
- Percent reduction in pedestrian fatalities at crosswalks
- Portion of agencies with adopted ADA transition plans
- Number of schools/students participating in the SRTS program
- Percentage of people living within a walkable or bikable distance to goods and services
- Reduction in greenhouse gas emissions attributed to installation of bicycle and pedestrian facilities

Funding and Staffing

In addition to these policies, plans, and programs, the staffing levels of these surrounding and peer state DOTs are presented below in Table 11. This is provided to make a comparison between the human and monetary resources allocated to providing non-motorized transportation and how well each DOT ranks in terms of the bicycle¹⁵ and pedestrian¹⁶ friendly communities they have in their state.

Table 11 Staffing and Funding Levels for Non-Motorized Transportation

State	2012 Staffing Levels	Average Annual Funds Allocated (in millions)	2012 State Population	Number of Bicycle Friendly Communities	Number of Pedestrian Friendly Communities
Alabama	13	\$48	4,841,933	1	-
Arkansas	5	\$7	2,969,994	4	-
Florida	11	\$81	19,358,310	10	3
Georgia	10	\$43	9,931,894	6	2
Indiana	2.2	\$35	6,550,608	8	1
Kentucky	3.2	\$27	4,399,612	2	1
Minnesota	17.5	\$27	5,399,808	9	4
Mississippi	6	\$9	2,998,225	2	1
Missouri	8	\$31	6,047,070	6	1
North Carolina	3	\$28	9,799,026	10	4
Tennessee	5.5	\$20	6,472,066	3	1
Texas	25	\$55	26,174,540	4	1
Utah	12	\$10	2,869,917	5	-
Virginia	7	\$15	8,217,041	4	4
Washington	15	\$29	6,927,449	7	1

¹⁵ American Bicyclist, The League of American Bicyclists, March-April 2014

¹⁶ Walk Friendly Communities Organization

With regard to funding levels, Tennessee ranks in the 'middle of the pack' as far as allocated dollars are concerned within the country; specifically, Tennessee spent 2% of all Federal funding on non-motorized projects, just 0.1% below the state average. Table 12 below shows the funding for bicycle and pedestrian projects that are allocated from some of the aforementioned federal sources for surrounding and peer states for the years 2009-2012.

Table 12 Funding Sources for Non-Motorized Transportation (2009-2012)

Funding Source/ State	Tennessee	Washington	Minnesota	North Carolina	Georgia	Florida
CMAQ	\$272,667	\$22,947,412	\$8,633,460	\$5,096,811	\$9,091,350	-\$531,147
STP/TE	\$22,539,778	\$29,601,677	\$44,882,709	\$17,476,846	\$53,804,324	\$149,946,932
STP/Other	\$6,017,277	\$17,062,249	\$6,388,532	\$27,887,833	\$31,227,161	\$39,254,077
SRTS	\$8,326,354	\$11,701,532	\$7,163,635	\$6,142,396	\$14,012,991	\$41,956,245
HSIP	\$0	\$1,336,177	\$138,600	\$1,603,800	\$0	\$15,754,715
NTPP	\$0	\$0	\$20,732,284	\$0	\$0	\$0
HPP	\$18,990,938	\$9,220,436	\$5,681,783	\$14,094,653	\$18,748,294	\$11,628,337
RTP	\$2,066,516	\$0	-\$2,043	\$5,780,292	\$0	\$5,159,186
Other	\$5,417,294	\$4,546,516	\$2,327,398	\$6,901,304	\$1,915,680	\$11,173,143
Total	\$63,630,824	\$96,415,999	\$95,946,358	\$84,983,935	\$128,799,800	\$274,341,488
Funding Source/ State	Mississippi	Alabama	Kentucky	Arkansas	Missouri	Virginia
CMAQ	\$0	\$1,249,493	\$7,423,606	\$0	\$1,658,667	\$4,737,287
STP/TE	\$23,296,143	\$21,194,719	\$7,387,330	\$1,556,023	\$61,841,667	\$34,489,285
STP/Other	\$871,005	\$1,089,003	\$4,044,144	\$5,180,513	\$9,496,410	\$1,519,490
SRTS	\$3,997,750	\$12,226,916	\$3,305,848	\$5,057,914	\$8,563,878	\$9,939,418
HSIP	\$0	\$4,500	\$0	\$0	\$0	\$1,132,135
NTPP	\$0	\$0	\$0	\$0	\$1,274,610	\$0
HPP	\$107,987	\$221,180	\$24,056,349	\$239,748	\$4,424,390	\$1,652,420
RTP	\$5,467,724	\$0	\$3,643,367	\$3,599,040	\$7,362,042	\$0
Other	\$0	\$655,381	\$35,550,275	\$12,721,778	\$4,131,578	\$6,488,424
Total	\$33,740,609	\$36,641,192	\$85,410,919	\$28,355,016	\$98,753,242	\$59,958,459

4.4 IMPACTS OF EMERGING TECHNOLOGIES

The aforementioned tactics of improving personal mobility through the provision of non-motorized accommodations, transit service, and traditional transportation demand management are typically thought of as more traditional ways of aiding people in their travel from origin to destination. However, the use of technology in transportation is an emerging topic, primarily due to the increased prevalence of technology in all parts of life. As such, there appears to be a trend in the use of emerging technologies to ensure that people are traveling in the most efficient way. One way of facilitating this efficient travel is to create a dynamic and connected transportation system. A dynamic transportation system is one that can detect conditions of the system in real time and one that uses flexible methods to adapt to those changing conditions. The connectivity of a transportation system speaks to how it uses technology to communicate with people or entities that may need real-time traffic information. In many ways, dynamic and connected transportation systems utilize principles of Active Transportation Demand Management (ATDM) to help monitor and manage the system.

There are oftentimes many unrealized benefits that technology can bring to a transportation system. Especially with the requirement for performance measures, utilizing ATDM principles can help to achieve performance objectives, such as preventing or postponing a breakdown in traffic flow, reducing emissions, maximizing efficiency and person-throughput, improving safety, or promoting alternative modes of travel. As ATDM strategies are implemented, continuous monitoring helps to determine their effects on system performance. Another benefit of ATDM is that its principles can be implemented for various operational time frames; different issues may benefit more from a long-term strategic approach versus short-term tactical decisions. In both the long- and short-term, proactively planning for traffic congestion and incidents using ATDM can help to alleviate their negative impacts.

4.4.1 ATDM Practices

There are a variety of approaches and methods used to achieve a dynamic and connected transportation system through ATDM principles and strategies. These can generally be broken down into three categories: active demand management, active traffic management, and active parking management.

Active Demand Management

As defined by the Federal Highway Administration (FHWA), Active Demand Management (ADM) “works to influence travel behavior in real time and goes beyond traditional travel demand management (TDM) to use information and technology to dynamically manage demand including redistributing travel to less congested times of day or routes, or reducing overall vehicle trips by influencing a mode choice.”¹⁷ While ADM builds upon traditional TDM, there is one primary difference; ADM strategies seek to utilize new technologies and modern connectivity to help travelers make informed decisions in the short-term while traditional TDM strategies seek to influence long-term behavior changes. A few key ADM strategies are outlined in the following paragraphs.

- **Dynamic Ridesharing** – Dynamic ridesharing is based on the principle of linking people in order to maximize the existing capacity of the transportation system. It relies on the connectivity offered through social networking and smart phones to match travelers that are both providing and seizing the opportunity to decrease transportation costs. The ‘dynamic’ aspect of this concept refers to changing the choices made by an individual en-route; that is, a traveler’s mode choice may be changed throughout a trip as a result of information provided

17 <http://www.ops.fhwa.dot.gov/publications/fhwahop13018/>

such as congestion levels or transit availability. Additionally, the term ‘dynamic’ has been used to describe the short notice that is often given when scheduling a trip. Currently, these types of services are offered by for-profit companies, typically in urban areas.

- On-Demand Transit and Dynamic Transit Capacity Assignment- The concept of on-demand transit is similar to demand-responsive transit service, often found in rural areas of the state. As such, it involves giving travelers the ability to request transit trips in real time from services with flexible routes and schedules, but utilizing new technologies. Another aspect of incorporating transit service into an ADM approach is by using dynamic transit capacity assignment strategies. These involve reorganizing schedules and the assignment of assets such as buses based on both real-time and predicted patterns of demand. This allows transit service to cover the most congested parts of the network when needed, which has the potential to reduce traffic demand and consequent delays on the roadways. Another transit-related ADM strategy includes dynamic fare reduction, which involves reducing the fare along a specific corridor as transit becomes more desirable due to congestion and delays; this can aid in shifting travelers from their vehicles to transit services to help relieve some of the congestion.
- Dynamic Lane Management and Pricing – Dynamic lane management is an ADM concept that primarily applies to High Occupancy Vehicle (HOV) lanes and High Occupancy Toll (HOT) lanes. It refers to the change in qualifications for using these lanes based on real-time congestion levels. The number of required occupants, hours of operation, or vehicle exemptions are all examples of qualifications that could change. Additionally, the concept of dynamic pricing can be used to achieve a variety of goals and objectives such as increasing HOT lane usage. In this approach, toll fares would change in response to current congestion levels as opposed to following a fixed fare schedule.
- Predictive Traveler Information – This strategy involves combining real-time information as well as historical data to predict future traffic conditions within a relatively short time frame. Once these conditions are determined, the goal is to relay this information to the public before travelers begin their trips or en-route in order to influence their behavior. Desired impacts could include changing a person’s mode, route, or travel time given the traffic information they received.

Active Traffic Management

Active Traffic Management (ATM) is defined by FHWA as “the ability to dynamically manage recurrent and non-recurrent congestion based on prevailing and predicted traffic conditions.”¹⁸ At its core, the idea of ATM is to take a more proactive approach to anticipating changes in facility conditions and actively managing the system prior to those occurrences, as opposed to simply reacting to system failures after the fact. Utilization of new technologies is a key part of ATM that ultimately helps maximize person-throughput and improve safety. These goals can oftentimes be achieved by automating the implementation of traffic management tactics in order to maximize the effectiveness and efficiency of the system as quickly as possible. The two fundamental notions of ATM are the management of the capacity on a facility and the direct interaction with drivers to encourage them to make informed driving decisions; the tactics discussed below are all meant to fall in line with those ideas.

- Dynamic Lane/Shoulder Use and Control – This ATM strategy is particularly useful for managing congestion and lane flows after an incident. Dynamic lane use refers to the ability, through dynamic signage, to give advance warning to motorists before a point where lanes are closed so that they can safely merge into adjoining lanes. Dynamic shoulder use refers to the utilization of ‘hard shoulders’ as travel lanes during congested periods or as a result

18 <http://www.ops.fhwa.dot.gov/publications/fhwahop13018/>

of incidents based on real-time data; these can either be used for regular or special purpose travel (i.e. transit).

- **Dynamic Speed Limits** – Utilizing dynamic speed limits entails adjusting speed limits based on real-time traffic and/or weather conditions. Speed limits can be regulatory or advisory and they can be applied to individual lanes or entire facilities. This ATM approach can be employed to help an agency meet goals for safety, mobility, or environmental impacts.
- **Queue Warning** – In this ATM approach, traffic congestion is monitored continuously to identify queues or significant reductions in speed along a facility. After these locations are identified, dynamic message signs, sometimes accommodated with flashing lights, are used to alert motorists in order to prevent rear-end crashes.
- **Adaptive Ramp Metering** – This strategy employs the use of traffic signals on merge ramps to dynamically control the rate at which vehicles can enter a controlled-access facility. Controlling this rate based on real-time traffic volumes allows for smoothing of the traffic flow onto the facility, making more efficient use of capacity. Since the rate is based on real-time information, the rate at which vehicles enter the facility can be dynamically altered based on traffic flows.
- **Adaptive Signal Control** – With the continuous monitoring of arterial traffic volumes, adaptive signal control can be used as an ATM strategy to help reach operational goals such as reducing queue lengths or delays at intersections. Technology is used to relay information on upstream traffic volumes to downstream signal controllers, which then begin adjusting timing parameters (e.g., cycle length, offsets, phases, etc.) during each cycle to optimize traffic operations.

Active Parking Management

Active Parking Management (APM) is defined by FHWA as “the dynamic management of parking facilities in a region to optimize performance and utilization of those facilities while influencing travel behavior at various stages along the trip-making process.”¹⁹ Some studies have shown that in major downtown areas, approximately 30% of congestion is due to vehicles circulating to find a parking space. While that statistic may not be valid in all or any of Tennessee’s major cities, the population and employment growth expected in the urban areas could bring this issue to the forefront of an ATDM discussion. With the key component being timely information, APM strategies seek to use modern technology to relay information so that system users can make informed decisions regarding trip timing, mode choice, parking facility choice, etc. In addition to conveying information, APM tools can be used to accept reservations and parking payments, monitor use, and conduct enforcement.

- **Dynamically Priced Parking** – This APM strategy involves the changing of parking fees based on the availability and demand for parking. Its goal is to influence a person’s timing of trips as well as their parking location choice in an effort to balance the supply and demand of parking spaces. If successfully implemented, this strategy has the potential to reduce traffic congestion by managing demand specifically in downtown areas.
- **Dynamic Parking Reservation** – Dynamic parking reservation strategies aim to provide travelers with information on parking availability in advance of their trip in an effort to decrease the traffic created by vehicles. It allows people to reserve a parking space at their destination so as to ensure its availability. This strategy requires that parking is continuously monitored so that system users have an accurate depiction of availability when making a reservation.
- **Dynamic Wayfinding** – Dynamic wayfinding involves continuous monitoring of parking availability in conjunction with its location as a means of helping travelers. This information is

19 <http://www.ops.fhwa.dot.gov/publications/fhwahop13018/>

provided to travelers to help them efficiently find a parking space, thereby reducing the time spent searching for parking.

- **Dynamic Parking Capacity** – Not only is parking difficult to find at times, but it is also oftentimes simply unavailable. In circumstances where parking demand greatly exceeds the supply, dynamic parking capacity strategies can be used to make efficient use of under-utilized facilities, such as retail parking lots, to meet the excess demand. Dynamic routing can also be used to help guide travelers to the additional parking capacity in addition to simply relaying information about additional parking availability.

Many of these ATDM strategies can be categorized as falling under the larger umbrella of Transportation System Management and Operations (TSM&O). FHWA defines TSM&O as “an integrated program to optimize the performance of existing multimodal infrastructure through implementation of systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system.”²⁰ It includes a wide variety of approaches and strategies used to maximize the efficiency of the transportation system and improve mobility for its users. Many of the goals and objectives of TSM&O such as managing incidents on the transportation system, efficiently timing traffic signals, and others can be accomplished through strategies and technologies utilized by an ATDM approach. In addition to ATDM, TSM&O also uses Intelligent Transportation Systems (ITS) to effectively manage the transportation system. ITS can be defined as the use of technological applications to better manage the transportation system by communicating information to system users. ITS includes many different elements that aid in collecting and disseminating information. Such technologies are utilized in order to achieve objectives such as communicating data wirelessly to a variety of entities and the public, collecting cellular probe data to understand trip-making behavior, and improving response time for automobile accidents, among others. Additional information on TDOT’s TSM&O and ITS activities can be found in the policy paper on Coordination, Cooperation, and Consultation.

4.4.2 Other Technological Advancements

In addition to the ATDM strategies and approaches outlined above, there are a variety of other technological advancements that currently, or potentially could, play a significant role in the management and operation of the transportation system.

- **Autonomous Vehicles** – An autonomous vehicle (AV) is a car that utilizes a combination of technologies and sensors to operate through steering, accelerating, and/or braking with limited or no driver input. Some vehicles on the road today have automated features (e.g., adaptive cruise control, parking assist, traffic jam assist). However, these features still require constant monitoring by a driver. As automated technologies advance, it is envisioned that these vehicles will eventually control the driving task completely. In fact, on-road vehicle testing is currently underway and legal in several states already.
- **Connected Vehicles** – Connected vehicle technologies are also gaining traction in the transportation industry as a means of potentially maximizing the efficiency of the system. This is done by embedding technology into both vehicles as well as the transportation infrastructure so that they are able to communicate with each other. There are three main types of connected vehicle platforms: Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), and Vehicle-to-Other (V2X). A vehicle with V2V technology uses on-board dedicated short-range radio communication devices to transmit messages about a vehicle’s speed, heading, brake status, and other information to other vehicles and receive the same information from the messages; such communication has the potential to decrease accident rates. Similarly, V2I technologies enable communication between vehicles and the transportation infrastructure.

20 <http://ops.fhwa.dot.gov/publications/fhwahop12003/background.htm>

V2I applications could eventually allow infrastructure elements such as traffic signals and signs to alert motorists to safety hazards such as red light violations or decreased curve speeds in inclement weather. V2X technologies enable communication between vehicles and other parts of the transportation system such as pedestrians, bicyclists, trains, etc.

- **Wearable Technology** – Due to the decreasing size of computers coupled with their increasing abilities, there are many technologies that are becoming wearable, meaning that they are able to be worn by people in a variety of ways for a variety of reasons. Many of these wearable technologies have the potential to impact the way we see, use, and interact with the transportation system. For example, Google Glass is an optical head-mounted display worn like eyeglasses that can be used to make navigation and driving easier and potentially safer by utilizing hands-free technology. Subway navigation bracelets are marketed as an accessory that can tell you train arrival times, approaching stops, and the color of a subway line, as well as show available transfers. Assistive scarves can be worn by pedestrians with visual impairments that make them aware of objects within their pathways so that they can be avoided. One start-up company has used 3-D printers to create RFID-enabled rings to replace public transportation cards in order to make payment on buses more efficient and convenient; this technology has already been approved for use by the Massachusetts Bay Transportation Authority. Other wearables such as smart watches and fitness trackers could one day be integrated into the connected vehicles technology, which could potentially have positive impacts on pedestrian and bicyclist safety.
- **Virtual Activities** – The increased activity taking place through the internet has the potential to greatly influence personal mobility and the transportation system. Individuals are now able to order virtually anything online and have it delivered to their doorstep, a service and convenience that offers the potential for reducing trips along the transportation network, at least in personal vehicles; however, those trips are now being shifted from a personal automobiles to semi-trucks and local delivery vehicles. In an effort to combat increased freight traffic as well as improve supply chain efficiency, companies such as Amazon and Germany-based delivery firm DHL are looking to drone technology as a modern means of delivering parcels. Though there are air traffic regulations to comply with and navigational issues with autonomous drones, this technology may be able to at least aid in the local parcel delivery process.

4.4.3 State Practices

Active Demand Management

There are a variety of cities that have begun to employ some of the ADM strategies mentioned above. It appears that in most of the areas where they are implemented, strategies tend to focus on dynamic lane management and pricing. For example, Minneapolis, MN, Atlanta, GA, and Houston, TX have coupled dynamic pricing of HOT lanes along certain corridors with incentives for transit and HOV usage. The Washington State Smarter Highways program also uses high-tech overhead signs to display variable speed limits, lane statuses, and real-time traffic information so drivers know what's happening ahead of them along key corridors.

In addition to the dynamic HOT lanes and shoulder usage, there are other ADM applications in use such as the 511 system in San Francisco. This system collects and disseminates both real-time and predictive travel information relative to traffic congestion, transit, rideshares, and bicycling around the clock. San Francisco also established their Messaging Infrastructure for Travel Time Estimates to a Network of Signs (MITTENS) that provides real-time highway and scheduled transit travel times, displayed to induce en-route mode shifts. This system relies on the 511 infrastructure, but goes beyond the online interface of 511 to broadcast that information on changeable message signs

along the network with updates every minute.

Active Traffic Management

Similar to ADM approaches, ATM strategies are primarily used in larger cities and along specific congested corridors. It seems that the most common utilization of ATM comes in the form of dynamic speed limits. Cities in Colorado, Missouri, Washington, California, Texas, Oregon, Alabama, and Arizona as well as others utilize dynamic speed limits to improve safety in inclement weather and/or congested conditions.

In addition to variable speed limits, many cities are also implementing the use of paved shoulders to improve person-throughput on congested facilities by allowing buses or HOV users to travel in the shoulder, bypassing cars that may be stuck in congestion. Modeled after a historically successful approach in the Twin Cities, Chicago now utilizes ‘hard shoulder running’, allowing buses to temporary use the shoulder during congested periods along I-55. Virginia’s I-66 ATM system utilizes dynamic message signs to control the use of both shoulders and travel lanes during peak periods; additionally they are used to relay information about lane closures and merges due to incidents, construction, etc.

Many cities utilize ramp metering as a means of controlling the flow of vehicles merging onto a facility. However, most of those are programmed with static entry rates, allowing a fixed number of vehicles into the traffic stream per minute. Cities such as Los Angeles, CA, Minneapolis, MN, Houston, TX, and Portland, OR have implemented adaptive ramp metering so that the vehicles entering the traffic stream is dependent on traffic volumes upstream of the merge point. Research was conducted in Portland to compare pre-timed and adaptive ramp metering results; it was concluded that the adaptive metering consistently allowed higher flows of vehicles onto the freeway, thus reducing the delay of users sitting on the ramps.

Parts of New York have enabled adaptive traffic signal control in order to respond to congestion in real time through the manipulation of traffic signal timings. Initial results showed a 10% improvement in travel times as a result of the ATM strategy. Other cities such as Atlanta, GA and Houston, TX have also implemented adaptive traffic signal control along specific corridors.

Active Parking Management

Unlike many of the ADM and ATM strategies, which focus on corridors or travel behavior, APM strategies tend to focus in a specific and typically small geographic area such as a central business district. For instance, San Francisco, CA has a program entitled *SFpark* which periodically adjusts meter and garage pricing to match the demand for parking. This demand-responsive parking encourages drivers to make use of typically under-utilized areas and garages thereby helping to distribute parking throughout the city.

New York City also has enabled dynamically priced parking that is responsive to demand to parking spaces as part of their PARK Smart program. The goal of the program is not necessarily to keep people from driving and thereby parking, but rather to encourage motorists to only park as long as was absolutely necessary. This helps to increase parking turnover, freeing up spaces sooner so that motorists spend less time searching for a spot. Some neighborhoods saw as much as 23% drop in the average time a car occupied a specific space.

There are APM strategies that work to address parking issues for other motorists in addition to personal vehicle users. For instance, the Federal Motor Carrier Safety Administration (FMCSA) has undertaken a recent initiative to address truck parking issues. They are developing an ITS technology called “Smart Park” that will provide real-time truck parking availability information to truckers on the road. The goal of this strategy is to reduce driver fatigue and thereby make commercial vehicle

operation safer through the use of ITS to improve the awareness and utilization of truck parking facilities.

One of the unique characteristics of ATDM initiatives that bears mentioning is that they are often multi-jurisdictional in nature. For example, the Virginia Department of Transportation (VDOT) coordinated with various municipalities as well as software developers in the implementation of the I-66 ATM system. The dynamically-priced HOT lanes throughout the major urban areas in Texas required cooperation between the Strategic Projects Division and the Toll Operations Division within the Texas Department of Transportation (TxDOT) as well as county and regional toll authorities, private developers, transit authorities, and multiple MPOs. The New York City Department of Transportation (NYCDOT) has worked with community boards, Business Improvement Districts (BIDs), and other community stakeholder groups to implement the PARK Smart program across six neighborhoods. Overall, there is a variety of stakeholders to consider when implementing ATDM strategies and programs; such stakeholders include cities, counties, state DOTs, transit providers, emergency responders, elected officials, and others as they can all benefit from successful ATDM efforts.

5.0 CONCLUSIONS AND RECOMMENDATIONS

As a fundamental purpose of transportation networks, mobility and connectivity are key components to Tennessee’s transportation system, which links people to jobs and services, businesses to other businesses and communities to each other across the state. This system should provide Tennessee residents, visitors, and businesses with mobility options and choices among the transportation modes. All modes must function together as an integrated system to provide the transportation system needed for Tennessee’s future.

The purpose of this policy paper is to describe current policies and programs of the State for mobility through provision of public transportation services, TDM, and non-motorized accommodations and to provide recommendations for plans, policies, and programs consistent with the Guiding Principles of TDOT’s 25-Year Policy Plan.

5.1 SUMMARY OF FINDINGS

Public transit serves to meet the mobility needs of those who cannot or choose not to drive whether it be due to financial constraints, environmental consciousness, inability to operate a vehicle, or any other reasons. As Tennessee’s population grows and changes, demand for these services is likely to increase in both urban and rural areas of the state. Not only does public transit serve to meet the mobility needs of Tennessee residents, but it also has the potential to play a significant role in the reduction of traffic on the roadways.

Managing the growth of and periodic shifts in traffic demand are necessary elements of effectively managing a transportation system. TDM is the application of strategies, initiatives, and policies in order to redistribute demand on the system’s capacity to a different time, location, or mode. This is traditionally accomplished through the promulgation of ridesharing services, alternative working arrangements, ITS applications, provision of multimodal infrastructure, congestion pricing, and other means of discouraging single-occupant vehicle trips, particularly during peak hours.

The transportation system not only is meant to transport people in vehicles, but also people who may choose or are required to use other modes such as walking, bicycling, or transit. Non-motorized forms of transportation offer many benefits, both for the transportation system and for personal gain. Provision of accommodations to support these modes can offer some degree of peak hour congestion relief, environmental benefits from reduced emissions, physical fitness benefits, and others.

In conclusion, the following is a summary of findings of existing plans, policies, and programs, future growth, trends, and technology related to public transit, travel demand management, and non-motorized transportation.

- TDOT’s recent planning efforts reflect an increased focus on public transit as a key piece of the state’s transportation network due to the impacts of increasing congestion levels on state highways, forecasted population and employment growth across the state, and the concentration of growth and congestion in urban areas.
- Tennessee’s funding level for transit is “in the middle of the pack” when compared to state funding levels of large urban transit agencies in peer states on a per capita basis. Additionally, Tennessee’s five largest transit operations are comparatively cost-efficient.
- TDOT acts primarily as a conduit for FTA funds and as a grant administrator for agencies that meet federal requirements. This is a common practice among peer and surrounding states although some states take a more active role in providing public transportation statewide.

- Mobility challenges and desires continue to change in Tennessee. Increased percentages of household income spent on transportation and increased commuting distances are factors that will likely contribute to increased transit demand in the future.
- TDOT's decentralized approach to the provision of TDM programs across the state (i.e. TDM programs and initiatives authored or promulgated primarily by regional or urban transit agencies and/or city planning departments) leads to varied interpretation and effectiveness in addressing TDOT's policy directives related to TDM.
- TDM efforts in Tennessee primarily include the management of ITS infrastructures, maintenance of park-and-ride lots, and the provision of information for ridesharing opportunities in the state.
- Mobility challenges arising from generational attitudes, growth in urban centers, and an aging population will increase the need for non-motorized transportation alternatives.
- TDOT has limited resources, human or monetary, dedicated strictly to bicycle and pedestrian projects; however, the entire Department plays a role in accommodating users of these modes as TDOT looks to incorporate non-motorized provisions in all projects where feasible and practical.
- Similar to most of the surrounding and peer states, Tennessee has a statewide bicycle and pedestrian plan that identifies changing demands for non-motorized provisions.

5.2 RECOMMENDATIONS

In conclusion, the following recommendations are proposed as they relate to public transit, travel demand management, and non-motorized transportation.

- TDOT should take a greater role in the planning of regional transit as a means of improving mobility and managing demand. Examples of state DOTs that have embraced enhanced activities in the coordination and provision of transit services can be seen in Florida, Virginia, Washington, and Minnesota.
- TDOT should require that agencies applying for state or federal funding maintain and submit a Transit Development Plan, which would help define and guide future public transit needs for that agency. These plans could help ensure that the transit systems and networks across the state are coordinated, effective, and provide the proper linkages within their service area. Florida, Washington, and North Carolina programs are prime examples of this program requirement.
- TDOT should continue to increase RPO responsibilities to encompass more multimodal considerations (e.g., transit planning, non-motorized, etc.).
- TDOT should develop a new Statewide Strategic Transit Plan for Tennessee.
- As TDOT establishes a program for congestion reduction investments in the 3-Year Plan, ATDM strategies should be considered.
- TDOT should develop a Multimodal Access Policy and Program, which would include internal guidelines and training.
- To expand on the Multimodal Access Policy, TDOT should work to provide technical resources for local municipalities on this topic.

