Tennessee Long-Range Transportation Plan

Bicycle and Pedestrian Element

December 2005

Contents

Figures

Tables

Maps

Appendices

Acronyms and Abbreviations

AASHTO	American Association of Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
APBP	Association of Pedestrian and Bicycle Professionals
BRAT	Bicycle Ride Across Tennessee
BTF	Bicycle Transportation Fund
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning Systems
ISTEA	Intermodal Surface Transportation Efficiency Act
ITE	Institute of Transportation Engineers
LRTP	Long-Range Transportation Plan
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
NHTSA	National Highway Traffic Safety Administration
NPS	National Park Service
PBCAT	Pedestrian-Bicycle Crash Analysis Tool
PTA	Pedestrian Transportation Account
RSTP	Regional Surface Transportation Program
RTPA	Regional Transportation Planning Agency
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
TEA-21	Transportation Equity Act for the Twenty-first Century
TRB	Transportation Research Board
TRIMS	Tennessee Roadway Information Management System
US DOT	United States Department of Transportation

Executive Summary

The Bicycle and Pedestrian Element of the Long-Range Transportation Plan aims to position Tennessee as one of the most progressive states for bicycling and walking for the next 25 years. This Plan provides a clear directive that emphasizes the continual development of transportation facilities that accommodate bicyclists and pedestrians, new policies, procedures and programs, and the development of eight new state bicycle routes. The plan includes eight components:

Guiding Principles, Goals, and Objectives This component outlines a vision for bicycling and walking in Tennessee. Seven broad "guiding principles" are shared by other elements of the Long-Range Transportation Plan while specific goals and objectives address engineering, education, enforcement, and encouragement. This section helps establish direction for TDOT and provides tangible objectives for the state to meet these goals.

This component of the plan also summarizes the benefits of bicycling and walking and how investing in bicycle and pedestrian facilities can improve the entire transportation system, as well as other things that are challenging to quantify, like community livability, the environment, and public health.

Existing Policies and Plans TDOT has made a strong effort in the past to integrate bicycle and pedestrian friendly policies into its larger transportation planning and implementation projects. Much of the work occurred in the 1970's and most recently with the adoption of the Bicycle and Pedestrian Policy (TCA 4-3-2303) in 2003. Some local efforts have been strong as well. This chapter of the document provides a summary of existing state policies, plans, and programs. It also discusses local plans and programs and advocacy organizations.

Existing Conditions Over half of Tennessee's highways have paved shoulders greater than four feet in width, generally enough room to safely ride a bicycle with most traffic volumes. Nine state bicycle routes offer residents and visitors excellent recreational touring opportunities. Still, there are many barriers to safe bicycling and walking throughout the state. This component discusses these challenges with relation to existing bicycling and walking rates in Tennessee and select urban areas, existing bicycle facilities on state highways, major gaps in the bicycle and pedestrian network, and an analysis of collected data on motor vehicle crashes involving bicyclists and pedestrians. The Plan also presents a modified Bicycle Compatibility Index (BCI) methodology called a Suitability Index that should be used to facilitate easier annual assessment updates of roadway conditions for bicyclists.

Needs Analysis This chapter of the plan discusses the needs of various non-motorized users, including commuter and recreational bicyclists, pedestrians, the disabled, and children. It provides guiding principles for planning and building facilities that are appropriate for the users, focusing on making the transportation system as accessible as possible. The chapter also catalogues statewide attractors and generators in tabular and graphical format, including parks, universities and colleges, tourist attractions, and annual events.

Proposed State Bicycle System This component proposes eight new state bicycle routes that were developed using the suitability index, attractor and generator analysis, and local input. The proposed state bicycle routes connect to existing state bicycle routes and bicycle routes in

adjoining states, parks, cities and scenic areas. In addition, nine bicycle connector routes are proposed to supplement the existing and proposed state bicycle routes by providing linkages to major cities and transportation networks, like bus and train routes. The new proposed state bicycle routes offer low-volume, rural riding opportunities for recreational bicyclists who live in or visit Tennessee. This section also makes recommendations for signing, maintenance, and jurisdictional responsibility of the bicycle routes.

Recommended Policies, Practices and Procedures This component establishes bicycle and pedestrian planning, design, and implementation guidelines and recommends accommodating actions. It also provides recommendations to enhance existing TDOT bicycle and pedestrian-related policies. Additionally, this section provides recommendations for local bicycle plans and other modal plans, public/private initiatives, strategies for increasing walking and bicycling rates in Tennessee, education and safety programs, and training and resource delivery programs.

Policy Guidance By Environment This component contains policy guidance on the applications of bicycle and pedestrian facilities based on different highway environments and conditions. This section of the document will help TDOT staff and others identify types of environments and choose appropriate bicycle and pedestrian facilities from various toolboxes. The toolboxes contain information about bicycle and pedestrian facilities, including the purpose of the facility, where it should be used, and guidelines for its use.

Implementation The final plan component discusses gaps in the bicycle and pedestrian network, the costs to bridge these gaps, as well as the costs to implement recommended programs and policies. Funding sources are described for transportation projects as well as trail and greenway projects. This plan recommends about $200 million worth of improvements for bicycle and pedestrian facilities over the next 25 years, including developing and implementing eight new state bicycle routes, eliminating gaps for bicyclists and pedestrians, funding maintenance programs to improve existing bicycle and pedestrian facilities, and funding to bring pedestrian facilities into ADA compliance. The proposed package also includes funding for research, map production, trainings, counting/forecasting programs, developing design standards, inventories, data development, bicycle and pedestrian program administration, and grant programs administered through TDOT, like Safe Routes to School, the Bicycle Transportation Fund and the Pedestrian Transportation Fund, among others.

Chapter 1
Introduction

The state of Tennessee recognizes that safe and effective bikeway and pedestrian networks enhance the quality of life for residents and visitors to the State. This Bicycle and Pedestrian component of the Long-Range Transportation Plan serves as an information and policy document to guide the development and maintenance of a statewide bicycle network on the nearly 14,150 miles of state highways under the jurisdiction of the Tennessee Department of Transportation, support facilities and other programs for pedestrians and bicyclists in Tennessee over the next 25 years. These policies address important issues related to Tennessee's bikeways and walkways such as planning, community involvement, utilization of existing resources, facility design, multi-modal integration, safety and education, support facilities, as well as specific programs, implementation, maintenance and funding.

1.1 Reasons for the Plan

The population of Tennessee is increasing. Projections indicate that by the year 2030, the number of people living in the state will grow by nearly 33 percent. A recent press release from the U.S. Census Bureau ranked Tennessee among the fastest growing 15 states. Many residents are interested in walking and bicycling as means of transportation and recreation. Considered two of the 'minor modes' of transportation, walking and bicycling make up about 1.7% of the work-related trips in Tennessee as of 2000[1]--making them the second most popular forms of travel after driving. Mass transit trips make up 0.8% of the work-related trips in Tennessee as of 2000.

As modes of travel, walking and bicycling are healthy, efficient, low cost, and available to nearly everyone. Walking is the most basic form of transportation. Almost everyone is a pedestrian at some point in the day, as walking is often the quickest way to accomplish short trips in urban areas. Pedestrians also include persons using wheelchairs and other forms of mobility devices. Bicycling is the most energy efficient form of transportation today. A car will only travel 280 feet on the number of calories that a bicyclist needs to travel three miles.

Walking and bicycling help communities achieve the larger goals of developing and maintaining "livable communities;" making neighborhoods safer and friendlier; and reducing transportation-related environmental impacts, mobile emissions, and noise. They provide transportation system flexibility by providing alternative mobility options, particularly in combination with transit systems, to people of all ages and abilities. There is also growing interest in encouraging walking and bicycling as a means for improving public health. Increasingly, public health organizations are looking to metropolitan and state transportation planners to create more walkable and bikeable communities that encourage healthier lifestyles.

[1] Travel to Work Characteristics for the United States, 2000, U.S. Census

1.2 Organization of the Plan

The Tennessee Bicycle and Pedestrian Plan consists of the following components:

- **Existing Policies and Plans** This section analyzes current TDOT and local plans, policies and programs related to bicycle and pedestrian issues. A comparison of other statewide bicycle and pedestrian plans is included. Additionally, this section outlines the Goals and Policies of the Bicycle and Pedestrian Plan.
- **Existing Bicycle and Pedestrian Conditions** This section summarizes bicycling and walking conditions in Tennessee today. It examines the existing facilities and conditions for bicyclists and pedestrians, the challenges and opportunities, major gaps in the bicycle and pedestrian system, and presents an analysis of bicycle and pedestrian collisions on state routes. Additionally, this section introduces a modified BCI methodology for Tennessee called a Suitability Index.
- **Needs Analysis** This component outlines the benefits of bicycling and walking, characteristics and needs of bicyclists and pedestrians, and a discussion of statewide attractors and generators.
- **Recommended Practices, Procedures, and Programs** This section includes a summary of existing TDOT practices and procedures, as well as recommended enhancements to those practices and policies. Furthermore, the section discusses coordination with local bicycle plans and other modal plans, public/private initiatives, strategies for increasing walking and bicycling in Tennessee, education and safety programs, and training and resource delivery programs.
- **Recommended Statewide Bicycle System** This component includes the recommended statewide bicycle routes in graphical form, as well as a description of the bicycle routes and facilities. The section also covers recommendations on signing and maintenance of the statewide bicycle routes.
- **Policy Guidance by Environment** This section contains policy guidance on the application of bicycle and pedestrian facilities based on different highway environments and conditions. This section of the document will aid TDOT staff and others to identify types of environments and choose appropriate bicycle and pedestrian facilities from various toolboxes.
- **Implementation Strategies** The final plan component discusses the development of bicycle and pedestrian projects, including the role of various Tennessee state departments, as well as an overview of cost and funding opportunities.

Chapter 2

Principles, Goals, and Objectives

The Long-Range Transportation Plan (LRTP) is intended to guide TDOT for the next 25 years as the state continues to grow. As part of the LRTP, TDOT is committed to providing a transportation system that serves all of its residents, including bicyclists and pedestrians. This Bicycle and Pedestrian Plan is one part of the larger Tennessee LRTP. The Plan shares the same overriding 'Guiding Principles' as the other transportation modes in the LRTP. Each principle has an associated bicycle and pedestrian set of goals and objectives.

2.1 Principles, Goals, and Objectives

2.1.1 Guiding Principle: Preserve and Manage the Existing Transportation System

Goal: Maintain the efficiency, integrity, and effectiveness of the existing transportation system.

Objectives:
- Develop cost-effective maintenance strategies.
- Develop new technologies for greater efficiencies in movement.

2.1.2 Guiding Principle: Move a Growing, Diverse, and Active Population

Goal: Provide the resources and services needed to optimize the movement of goods and people.

Objectives:
- Increase the mobility of all citizens.
- Identify the needs for all modes that reduce congestion and travel times.
- Provide facilities that improve connections between modes.

2.1.3 Guiding Principle: Support the State's Economy

Goal: Provide resources and services to support economic growth, competitiveness, and tourism.

Objectives:
- Provide modal capacity to meet passenger and freight traffic needs.
- Increase access to employment opportunities.
- Provide needed support to tourist, business and other activity centers.

2.1.4 Guiding Principle: Maximize Safety and Security

Goal: Improve safety and security for all users.

Objectives:
- Reduce injuries and fatalities in all modes.
- Ensure security and minimize risk across the transportation system.

2.1.5 Guiding Principle: Build Partnerships for Livable Communities

Goal: Establish strong, on-going collaborative partnerships.

Objectives:

- Provide for proactive public input into land use and transportation planning.
- Establish regular collaborative coordination with Metropolitan Planning Organizations (MPOs).
- Working with State agencies, identify actions to benefit the multimodal network.

2.1.6 Guiding Principle: Promote Stewardship of the Environment

Goal: Protect, preserve, and enhance the environment.

Objectives:

- Implement strategies to improve air quality and conserve energy.
- Minimize impacts to human and natural environments and cultural and historic resources.
- Capitalize on land use and development patterns.

2.1.7 Guiding Principle: Emphasize Financial Responsibility

Goal: Provide responsibility and accountability in spending funds.

Objectives:

- Increase the state share of federal funding.
- Select and program projects based on needs and effectiveness.
- Develop alternative funding sources.
- Monitor and report system investment and performance to the public.

2.2 Benefits of Bicycling and Walking

Establishing and implementing a Bicycle and Pedestrian Plan will help TDOT meet many of the above goals and objectives. Improvements to bicycle and pedestrian facilities result in expanded mobility options for Tennessee residents, especially those who are car-less (the elderly, young, disabled, low income persons) and those who seek to integrate a healthy lifestyle into their daily travels. With over 40% of all trips in the United States being two miles or less (FHWA, National Personal Transportation Survey, 1995), walking or bicycling can serve as an important mobility option especially in our towns and cities.

Walking and bicycling are important to the health of all Tennesseans, not just to those doing the walking or cycling. People choosing to ride or walk rather than drive are typically replacing short automobile trips, which contribute disproportionately high amounts of pollutant emissions. Since bicycling and walking contribute no pollution, require no external energy source, and use land efficiently, they effectively move people from one place to another without adverse environmental impacts.

Bicycling and walking can also help alleviate congestion and stressed transportation systems. Nationally, the number of vehicle miles traveled (VMT), rates of car ownership, and trips have continued to grow, which has increasingly stressed transportation systems (primarily roadways) and contributed to congestion (NPTS, 2003). Bicycling and walking require less space and infrastructure when compared to automobile facilities. Improvements made for bicyclists often result in better conditions for other transportation users as well. For instance, paved shoulders, wide curb lanes, and bicycle lanes not only provide improved conditions for bicyclists, but often contribute to safer conditions for motorists and a reduction in roadway maintenance costs as well.

Walking and bicycling are also good choices for families. A bicycle enables a young person to explore her neighborhood, visit places without being driven by her parents, and experience the freedom of personal decision-making. More trips by bicycle and on foot mean fewer trips by car. In turn, this means less traffic congestion around schools and in the community, and less time spent by parents driving kids around. There are also more opportunities to speak to neighbors and more "eyes on the street" to discourage crime and violence. It is no accident that communities with low crime rates and high levels of walking and bicycling are generally attractive and friendly places to live.

Bicycling and walking provide numerous benefits.

The extent of bicycling and walking in a community has been described as a barometer of how well that community is advancing its citizens' quality of life. Streets that are busy with bicyclists and walkers are considered to be environments that work at a human scale, and foster a heightened sense of neighborhood and community. These benefits are impossible to quantify, but when asked to identify civic places that they are most proud of, residents will most often name places where walking and bicycling are common, such as a popular greenway, river front project, neighborhood market, Main Street, or downtown.

An integrated and consistent bicycle and pedestrian system can result in significant economic benefits to Tennessee communities. This includes improvements in real estate values for homes near quality facilities and 'pedestrian-friendly' areas, retention and attraction of quality employees for business, and direct expenditures from visitors touring on local routes.

Chapter 3
Existing Plans and Policies

3.1 State Plans, Policies, and Programs

Transportation planning has changed significantly in the last 10 years as cities, counties, and states have adopted policies to encourage planning and design for all transportation modes. TDOT has made impressive progress towards making bicycling and walking safer and more convenient. This is most clear in the Bicycle and Pedestrian Policy (January, 2003) which commits TDOT to "routinely integrate bicycling and pedestrian facilities into the transportation system as a means to improve the mobility and safety of non-motorized traffic." This includes complying with the American Disabilities Act (ADA), providing adequate bicycling space on roadways, and designing facilities with context sensitivity.

Bicycling in the Great Smoky Mountains

With such a large and diverse population of rural and urban citizens, much of the bicycle and pedestrian leadership in Tennessee has come from local and regional agencies and advocacy groups. With the approval of the *Bicycle and Pedestrian Policy* and the development of the Tennessee LRTP, the state is taking a more active role in the development and oversight of pedestrian and bicycle-related issues.

Table 3-1 summarizes the contents of other state DOT bicycle and/or pedestrian plans, relative to the contents of the TDOT bicycle and pedestrian plan. Most state bicycle and pedestrian plans serve as policy documents that establish the role of the state in bicycle and pedestrian planning. Some include design guidelines, but many simply set up the policy structure and related goals and objectives for local project funding and implementation. The TDOT Bicycle and Pedestrian Plan is unique in its comprehensiveness and analysis of existing conditions. While it offers policy and implementation recommendations, it also provides an in-depth look at the conditions of the state's highway system for bicycling and walking.

Table 3-1. Bicycle and Pedestrian Plan Comparison Matrix

Topic	Alaska	Arizona	Connecticut	Idaho	Maryland	Nevada	New York	North Carolina	Oregon	Vermont	Washington	Wisconsin
General												
Benefits of bicycling						✓			✓			✓
History/Context			✓	✓		✓	✓				✓	✓
Goals and Objectives	✓	✓	✓	✓		✓	✓		✓		✓	✓
Existing Conditions												
Facility Inventory and Evaluation		✓			✓	✓		✓				
Safety Analysis			✓			✓		✓			✓	✓
Collision Analysis			✓			✓		✓				✓
Needs Analysis												
Attractors and Generators												
Challenges and Opportunities	✓				✓							✓
Practices and Policies												
Previous State and Regional Planning Efforts		✓	✓	✓	✓		✓	✓		✓		✓
Existing State Policies and Laws		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Existing Federal Policies and Laws	✓		✓			✓	✓	✓	✓			✓
Goals and Policies	✓	✓	✓	✓	✓		✓	✓	✓	✓		
Benchmark/Performance Standards	✓					✓						
Proposed Bicycle and Pedestrian System												
Bicycle System		✓					✓					
Pedestrian System		✓										
Bicycle Suitability Model												
Design and Standards												
Restriping roads with bike lanes		✓					✓		✓			✓
Shoulder path design		✓	✓				✓		✓			✓
Shared-use path designs		✓	✓				✓		✓			✓
Wide curb lane designs			✓						✓			✓
Intersection designs		✓	✓				✓		✓			
Signing and marking			✓			✓	✓					
ADA, AASHTO, MUTCD	✓	✓	✓	✓		✓	✓	✓	✓			✓

Implementation												
Roles and Responsibilities						✓						✓
Strategies						✓						✓
Cost Estimates												
Funding Sources												
Federal Revenue	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
State revenue	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Local Revenue	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Private Revenue	✓	✓			✓					✓		✓
Amenities												
Bicycle maps									✓			
Bicycle parking									✓			

3.1.1 State Policies

Many of Tennessee's laws and policies originate from Federal laws that require planning for non-motorized transportation. The Transportation Equity Act for the 21st Century (TEA-21), like its predecessor the Intermodal Surface Transportation Efficiency Act (ISTEA), has contained influential laws and policies for non-motorized transportation. Congress recognized that bicyclists and pedestrians have the same origins and destinations as other transportation system users and that it is important for them to have safe and convenient access to airports, ports, transit terminals, and other intermodal facilities as well as to jobs, services, recreation facilities, and neighborhoods. TEA-21 placed a strong emphasis on creating a seamless transportation system that all users can enjoy and use efficiently and safely.

Federal transportation policy is to increase non-motorized transportation to at least 15% of all trips and to simultaneously reduce the number of non-motorized users killed or injured in traffic crashes by at least 10% (TEA-21, 1998). This policy, which was adopted in 1994 as part of the National Bicycling and Walking Study, remains a high priority for the U.S. Department of Transportation (US DOT). TEA-21 provides the funding opportunities, planning processes, and policy language by which states and metropolitan areas can achieve this ambitious national goal.

The US DOT encourages states, local governments, professional associations, other government agencies, and community organizations to adopt its Policy Statement (*A US DOT Policy Statement: Integrating Bicycling and Walking into Transportation Infrastructure*, 2000) as an indication of their commitment to accommodating bicyclists and pedestrians as an integral element of the transportation system. One of the key principles of the Policy Statement is that "bicycling and walking facilities will be incorporated into all transportation projects unless exceptional circumstances exist." The US DOT calls on each organization or agency to explicitly adopt one, all, or a combination of the various TEA-21 implementation criteria **and** to be committed to taking some or all of the actions listed here as appropriate for their situation:

- Define the exceptional circumstances in which facilities for bicyclists and pedestrians will NOT be required in all transportation projects.
- Adopt new manuals, or amend existing manuals, covering the geometric design of streets, the development of roadside safety facilities, and design of bridges and their approaches so that they comprehensively address the development of bicycle and pedestrian facilities as an integral element of the design of all new and reconstructed roadways.
- Adopt stand-alone bicycle and pedestrian facility design manuals as an interim step towards the adoption of new typical sections or manuals covering the design of streets and highways.
- Initiate an intensive re-tooling and re-education of transportation planners and engineers to make them conversant with the new information required to accommodate bicyclists and pedestrians. Training should be made available for, if not required of, agency traffic engineers and consultants who perform work in this field.

3.1.1.1 TDOT Bicycle and Pedestrian Policy

TDOT adopted elements of the US DOT Policy Statement by adopting its own Bicycle and Pedestrian Policy through TCA 4-3-2303 (12) in January 2003. The TDOT Policy Statement text is as follows:

Purpose

It is the intent of the Tennessee Department of Transportation (TDOT) to promote and facilitate the increased use of non-motorized modes of transportation. This includes developing facilities for the use of pedestrians and bicyclists and promoting public education and safety programs for using such facilities. It is also the intent of TDOT to outline a policy accommodating bicycle and pedestrian travel in the development and implementation of TDOT transportation programs.

Policy

The policy of TDOT is to routinely integrate bicycling and pedestrian facilities into the transportation system as a means to improve mobility and safety of non-motorized traffic. Below are specific aspects of the policy as it relates to each non-motorized element.

Bicycle

TDOT is committed to the development of a transportation infrastructure that improves conditions for bicycling through the following actions:

- Provisions for bicycles will be integrated into new construction and reconstruction of roadway projects through design features appropriate for the context and function of the transportation facility.
- The design and construction of new facilities should anticipate likely future demand for bicycling facilities and not preclude the provision of future improvements.

These bike lanes in Nashville provide dedicated room for cyclists.

- By addressing the need of bicyclists to cross corridors as well as travel along them, and designing intersections and interchanges to accommodate bicyclists in a manner that is accessible and convenient.
- The design of facilities for bicyclists will follow design guidelines and standards as developed by TDOT.
- The measurement of usable shoulder width does not include the width of a gutter pan.
- Where shoulders with rumble strips are installed, a minimum clear path of 4 feet of smooth shoulder is to be provided.
- In cases where a minimum shoulder width of 4 feet cannot be obtained, such as in restrictive urban areas, an increased curb lane width will better accommodate bicycles and motor vehicles within the shared roadway. The recommended width for shared use in a wide curb lane is 14 feet.

Pedestrian

TDOT is committed to the development of a transportation infrastructure that improves conditions for pedestrians through the following actions:

Pedestrian amenities like this signal help improve pedestrian safety.

- In urbanized areas, sidewalks or other types of pedestrian travel ways should be incorporated in new construction or reconstruction projects, unless one or more of the conditions for exception are met as described in this policy.
- The design and construction of new facilities should anticipate likely future demand for pedestrian facilities and not preclude the provision of future improvements.
- By addressing the need of pedestrians to cross corridors as well as travel along them and designing intersections and interchanges to accommodate pedestrians in a manner that is accessible and convenient.
- The design of facilities for pedestrians will follow design guidelines and standards as adopted by TDOT.
- Provisions for pedestrians will be integrated into new construction and reconstruction projects through design features appropriate for the context and function of the transportation facility.

- Pedestrian facilities must be designed to accommodate persons with disabilities in accordance with the access standards required by the Americans with Disabilities Act (ADA). All sidewalks, shared use paths, street crossings and other pedestrian facilities must be constructed so that all pedestrians, including people with disabilities, can travel independently.

Exceptions

There are conditions where it is generally inappropriate to provide bicycle and pedestrian facilities. These conditions include:

- Facilities, such as interstates, where bicyclists and pedestrians are prohibited by law from using the roadway. In this instance, a greater effort may be necessary to accommodate bicyclists elsewhere in the same transportation corridor.
- The cost of providing bicycle and pedestrian facilities would be excessively disproportionate to the need or probable use. Excessively disproportionate is defined as exceeding twenty percent of the projects total right-of-way costs.
- Bridge Replacement Rehabilitation projects funded with HBRRP funds on routes where no pedestrian or bicycle facilities have advanced to the stage of having engineering drawings nor are there any funded state bridge maintenance projects.
- Other prudent factors where there is a demonstrated absence of need. Exceptions for not accommodating bicyclists and pedestrians in accordance with this policy will be documented describing the basis for the exception. For exceptions on federal aid highway projects, concurrence from the Federal Highway Administration (FHWA) must be obtained.
- Facilities for bicyclists and pedestrians which conflict with local municipality plans or as requested by the Commissioner of TDOT.

The TDOT Bicycle and Pedestrian Policy was predicated by **Senate Joint Resolution #42** (1973). This resolution indicated that bicycling "is a major sport, is a mode of transportation for both children and adults, and is effective in protecting the environment and conserving fuel", but it further indicated that "bicycling is sometimes hazardous in combination with high volume motor vehicle traffic" and that "actions taken to promote bicycling should be uniform and coordinated."

3.1.2 State Plans and Publications

TDOT was at the forefront of the bicycling and walking revolution in the 1970s when world events caused many organizations to view bicycling and walking as legitimate forms of transportation. The state published several plans and policies throughout the early 1970s that inventoried existing conditions, established design guidelines, and set forth progressive roadway policies for inclusion of bicyclists and pedestrians in Tennessee. Unfortunately, without Federal funding sources, the vision for the state was never realized as bicycle and pedestrian projects were passed over for roadway expansion projects. Similar goals, objectives, and policies were revived in the early part of the century upon adoption of the Tennessee State Recreation Plan and the Greenway and Trails Plan. Today, the Long-Range

Transportation Plan continues to establish goals and policies for the state in the hope that the vision for the state set forth in the 1970s will emerge over time.

The following section summarizes the bicycle and pedestrian planning efforts of the state since 1974.

Bicycling in Tennessee: Inventory of Users, Facilities, and Programs (1974). The report's primary purpose was "the gathering and synthesizing of information regarding (1) existing use of the bicycle, (2) existing special bicycle facility development, and (3) existing governmental programs relating to bicycling within the State." The document was also intended to inform the policy-making decisions on both the local and State levels of Government within Tennessee. The document reports the results of a comprehensive user survey incorporating crash data from Shelby County for 1973, provides an inventory of local government activities related to bikeway development, highlights state and federal activities, and identifies potential bikeway opportunities and constraints.

Bicycling in Tennessee: A Framework for Establishing State Policies (1975). The report's primary purpose was to "suggest the type and magnitude of governmental activity needed in response to bicycling demand." The report identifies bicycle facility options and priorities, program options and priorities, governmental jurisdictional responsibilities, and funding sources and plans. It also outlines specific recommendations for immediate legislative action.

Bicycling in Tennessee: A State Plan for Bicycle Facilities and Programs (1975)

Bicycling in Tennessee: Planning and Design Manual (1975). The report's primary purpose was to assist local units of government in planning and designing bicycle facilities. Furthermore, it was hoped that the manual would be used to provide guidelines for evaluating local bikeway projects which may become eligible for State funding assistance. The Manual reiterates the need for governmental action, outlines bikeway planning principles, bicycle facility design principles and standards, and discusses how to evaluate bicycle facility investments and implementation techniques.

Tennesseans Outdoors: A Quality of Life for the Future (1986). The Governor's Commission on Tennesseans Outdoors issued this report to identify and address the challenges of keeping Tennessee a beautiful and livable state. In "Setting Aside Special Places", the Commission recommended that, "The Governor should establish a State Bicycling Program, which will include formation of a Tennessee Bicycle Advisory Commission, the creation of an office of Bicycle Coordinator within the Department of Transportation, and adoption of safe bicycling standards for all highway construction and renovation."

Bicycling in Tennessee (1986). This report was forwarded to the Governor by the Governor's Commission on Tennesseans Outdoors. The proposal makes a number of suggestions about how to integrate the need for bicycling and walking spaces along the highway system with a major emphasis on new construction or major reconstruction. Considerations mentioned include: providing sufficient state transportation funds to support a comprehensive statewide bicycle program, develop current roadway and bikeway design

standards and criteria to maximize the safety and convenience of the bicycle, direct the DOT to include the bicycle as a serious mode of transportation in urban area transportation studies, and to consider bicycle-related businesses in plans for economic development, including bicycle touring, especially for the economic development of rural areas.

Tennessee Bicycling Plan (1986). Prepared by the Transportation Planning Division of TDOT, the sections of the Plan address previous bicycle planning, an inventory of existing conditions, bicycling opportunities in various parts of Tennessee, TDOT policies as they relate to bikeways, design criteria, and federal, state, and local funding opportunities for bicycle facilities. The plan was never officially adopted by TDOT.

Tennessee State Recreation Plan (1995 and 2003). The plan and its subsequent update were developed under the direction of the Tennessee Department of Environment and Conservation (TDEC) to help fulfill the department's mission. Two issues that came into focus for TDEC after beginning the planning process were: (1) trails and trail users (including bicyclists and pedestrians) are requiring information, management, and development of resources necessary for their enjoyment; and (2) access to recreation opportunities for people with disabilities. Chapter 7 of the Plan directly addresses trail specific issues. Access to existing trails and development of new opportunities, for both motorized and non-motorized trail users, were consistently rated as high needs at public workshops. The latest edition of the plan is designed to "assess the current supply of and public demand for the whole range of recreation activities in Tennessee, to identify critical issues relating to recreation opportunities and to conservation of recreation resources, and to develop a set of policy proposals (the Action Program) aimed at addressing those issues." In addressing these challenges, the plan identifies greenways as an important attribute to promote as they provide opportunities for several of the activities with the highest rate of participation among Tennesseans, including bicycling and walking.

Tennessee Greenways and Trails Plan (2001). The stated vision is, by the year 2020, to be able to "safely travel to parks, schools, offices, and shopping areas without stepping into an automobile….(where) you can get on your bike and safely ride for hundreds of miles in any direction…" The plan identifies: urban trails, walking trails, mountain bike trails, road cycling routes, rail-trails, and multi-use trails. A mission of the Plan is to make Tennessee's roadways bicycle and pedestrian friendly while promoting bicycling and walking.

Tennessee Roadway Design Guidelines and Instructional Bulletins establish uniform policies and procedures for roadway design activities within TDOT. They provide standard roadway design files from the TDOT Chief Engineer regarding construction on the State Highway System for use in preparing contract plans and specifications for State highway construction projects as well as for use by local agencies in preparing project plans and specifications for construction of local streets and roads.

TDOT Traffic Design Manual is a supplement to the *Tennessee Roadway Design Guidelines* and "aids in the development of signal, minor intersection improvement, lighting and signing and marking plans." The Design Manual specifically addresses the needs of pedestrians in Section 4.4.

3.1.3 State Code

Tennessee Code 55-8-17x (amended July 1, 1985). The Code recognized the bicycle as a vehicle with the rights and responsibilities of other vehicles on the road. The amended code also allowed bicycles to pedal on the roadway rather than a designated bike path.

3.1.4 State Bicycle and Pedestrian Programs

Bicycle Ride Across Tennessee (BRAT) is a ride sponsored by the Tennessee Department of Environment and Conservation (TDEC), the governors council on Health and Fitness, TDOT, and the Department of Tourist Development. The BRAT is a multi-day bicycle tour with over 500 riders annually that highlights the natural beauty of Tennessee.

State Bicycle Routes are the five designated and signed bicycle routes for which TDOT produces free maps. In addition, there are four bicycle routes that are not mapped or comprehensively signed (sections may be signed). The bicycle routes all use regular roads of the State, County, and City highway systems with no special lanes or other provisions provided for bicyclists.

Tennessee Driver Handbook addresses the need to be aware of other roadway users in Chapter 14, "Sharing the Road Safely." The chapter acknowledges that the streets and highways are becoming more crowded every day, and that drivers are not the only people using the roadways. The chapter addresses an individual's role whether they are a driver, pedestrian, or bicyclist.

Coordinated School Health Program administered by the Department of Education is concerned with addressing the variety of health-related concerns and problems faced by Tennessee's youth. In addressing the problems at hand, the program utilizes *Twenty for Tennessee: Good Health and Safety Principles for Learning and Practices*, one principle of which is training in pedestrian and vehicle/bicycle safety.

Other programs related to bicycle and pedestrian safety and use include *Booze It and Lose It*, *Click it or Ticket*, and school zone enforcement actions. Sixty percent of the budget for the Governor's Highway Safety Office currently goes to programs related to reducing drunk driving and campaigns to increase the use of safety belts. In 2003, there were about 500 fatalities in Tennessee caused by drivers under the influence of alcohol and/or drugs. While these programs are designed to educate motorists, they have a secondary effect for bicyclists and pedestrians by making the roadway safer for all users.

3.1.5 Local Plans and Programs

Metropolitan regions in the state have also committed to making bicycling and walking more accessible. Nashville-Davidson County recently published (March, 2003) the *Strategic Plan for Sidewalks & Bikeways* for implementing bikeways and walkways in the metropolitan area. Chattanooga-Hamilton County published the *Urban Area Facilities Master Plan* (2002), and the Knoxville Transportation Planning Organization (TPO) published the *Knoxville Regional Bicycle Plan* (2002) and maintains the Regional Bicycle Program. Memphis-Shelby County is in the process of updating their 1997 regional bicycle plan. Other counties and

cities have also completed bicycle or, less frequently, pedestrian plans. Table 3-2 shows local plans and programs that were reviewed for the state bicycle and pedestrian plan.

TDOT should assist counties, with guidance or technical assistance, in preparing county or regional bicycle plans. Federal and/or state funds should be made available for such planning efforts.

Table 3-2. Local Bicycle and Pedestrian Plans and Programs in Tennessee

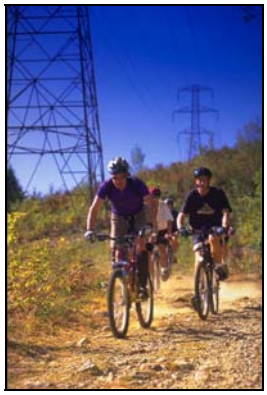
Local Bicycle and Pedestrian Plans and Programs
Nashville-Davidson County Strategic Plan for Sidewalks and Bikeways (2003)
Wilson County Bicycle and Pedestrian Master Plan
Knoxville Regional Bicycle Plan (2002)
Knoxville Regional Bicycle Program
Chattanooga Urban Area Bicycle Facilities Master Plan (2002)
Chattanooga Urban Area Sidewalk-Streetscape Policy Guide (2003)
Jackson MPO Bicycle and Pedestrian Plan (2004)
Transportation Management Association Group (TMA) - Williamson County.
Memphis Demonstration Bicycle Route Study (1977)
City of Memphis Bike Route Tours
Johnson City MTPO Area Bicycle Routes
Clarksville-Montgomery County Greenway Master Plan
Clarksville Bicycle and Pedestrian Plan
Murfreesboro Bicycle Plan
Hendersonville Bicycle and Pedestrian Plan

3.2 Advocacy Organizations and Clubs

The state has a very active bicycle and pedestrian advocacy network, with groups such as Walk/Bike Nashville, Chattanooga Bicycling Club, Memphis Hightailers Bicycle Club, the Bicycle Federation of Tennessee, and many others, such as:

Appalachian Mountain Bike Club	Smoky Mountain Wheelmen - Knoxville
Blood Sweat and Gears Bicycle Club	Sumner County Cycle Club
Columbia Cycling Club	Tennessee Cycle Club
Harpeth Bicycling Club	Tennessee Bicycle Racing Association
Highland Rimmers Bicycle Club	Tennessee Valley Bicycle Club
Kingsport Bicycle Association	The Third Ring Road Club
Morristown Bicycle Association	Tri-Cities Road Club
MTBC: Mountain Trails Bicycle Club	Upper Cumberland Wheelmen Bicycle Club
Murfreesboro Bicycle Club	Veloteers Bicycle Club
Nashville Bicycle Club	Tennessee Walking Connection
North Chattanooga Cycle Club	Foothill Striders Recreation Club
Northeast Tennessee Mountain Bike Assoc.	Knoxville Track Club
Potbelly Bicycle Association	Chattanooga Track Club
R.A.T.T. Mountain Bike Club	Tennessee Trails Association (14 chapters)
Southern Cycling Operations	KnoxVelo

In addition, Tennessee has equestrian organizations, such as the Blue Ridge Trailriders and the Tennessee Horse Council. These groups represent a potent constituency for improvements.



Tennessee cycling clubs often organize group rides and races.

Chapter 4
Existing Conditions

4.1 Bicycling and Walking Trends

Changes in lifestyle, culture, and public policy in the past 50 years have affected how Americans move around. Perhaps the biggest changes that impact mobility have been changes in family structure, increases in private vehicle use, subdivision development and suburban growth, increases in commute time, and growth in non-work travel. This results in more vehicles and, thus, more vehicle miles traveled. For example, in 1999 the FHWA reported that Nashville residents had the highest rate of motor vehicle travel in the United States—an average of 37.7 miles per person per day. In addition, more women have entered the workforce, which means more commuters, and children are involved in more organized activities, often requiring parent-based transportation.

Another nationwide trend that has occurred over the past 50 years is that commuting as a proportion of all travel has been decreasing, meaning travel for shopping, errands, and recreation has increased. Additionally, roadway congestion has shifted the peak travel periods, in essence spreading out the time range when people travel. Gone are the days of the morning and evening commute. Often, highways (principal arterials) are congested throughout the day. Similar trends are occurring in Tennessee, as metropolitan areas continue to grow in population and area.

A good pedestrian environment contributes to a vibrant community.

As modes of travel, walking and bicycling are healthy, efficient, low cost, and available to nearly everyone. However, it is challenging to present an accurate picture of bicycling and walking trends at any level, particularly at the state level. This is primarily due to the cost of collecting data and the lack of good data sources. Currently, the most reliable data source for trend analysis is the U.S. Decennial Census. The U.S. Census has collected journey to work data that include bicycling and walking categories since 1980. However, the U.S. Census is very limited and does not account for 73% of all trips that are not commute trips (National Household Transportation Survey, 2001). Additionally, the U.S. Census only surveys people over the age of 16, eliminating most school-based trips which are often done on foot or by bicycle.

Tennessee has many of the elements to attract people to walk and bicycle for work and non-work trips:

- Small towns and neighborhoods
- An interest in health and the environment
- Quiet rural roads perfect for bicycle touring and recreational riding
- Beautiful and well developed state parks and natural areas

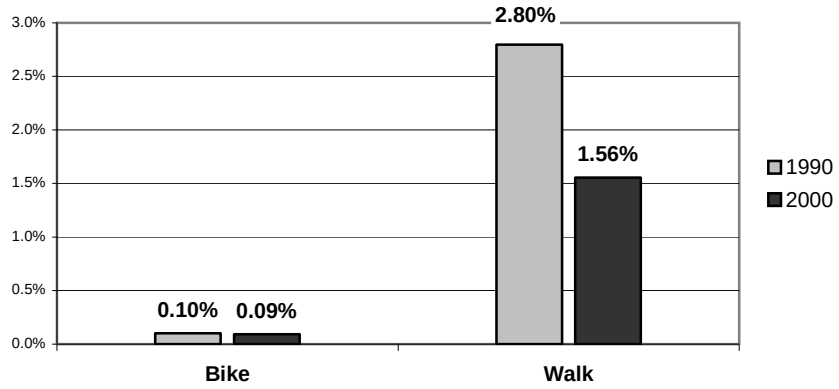
- Historic trails and trade routes
- Numerous natural corridors that can provide off-road opportunities

Despite these draws, the data indicate that there is not much bicycling or walking throughout the state.

4.1.1 Bicycling

Nationwide, the number of workers riding their bicycle to work has been increasing. In all, 466,800 workers commuted by bicycle in 1990, while 488,500 workers commuted by bicycle in 2000. However, there has been a decrease in the rate of bicycle use (from 0.41% to 0.39%) due to the increase in the number of workers who chose to drive or work from home during this same time period. The situation is similar in Tennessee (Figure 4-1). Bicycle use increased between 1990 and 2000; from 1,818 bike commuters in 1990 (0.10%), to 2,330 bike commuters in 2000 (0.09%). However, the working population of Tennessee has increased 40% in the same time period. While this is a positive gain in the number of people riding their bicycle to work, the percentage of bicyclists as part of the working population has decreased.

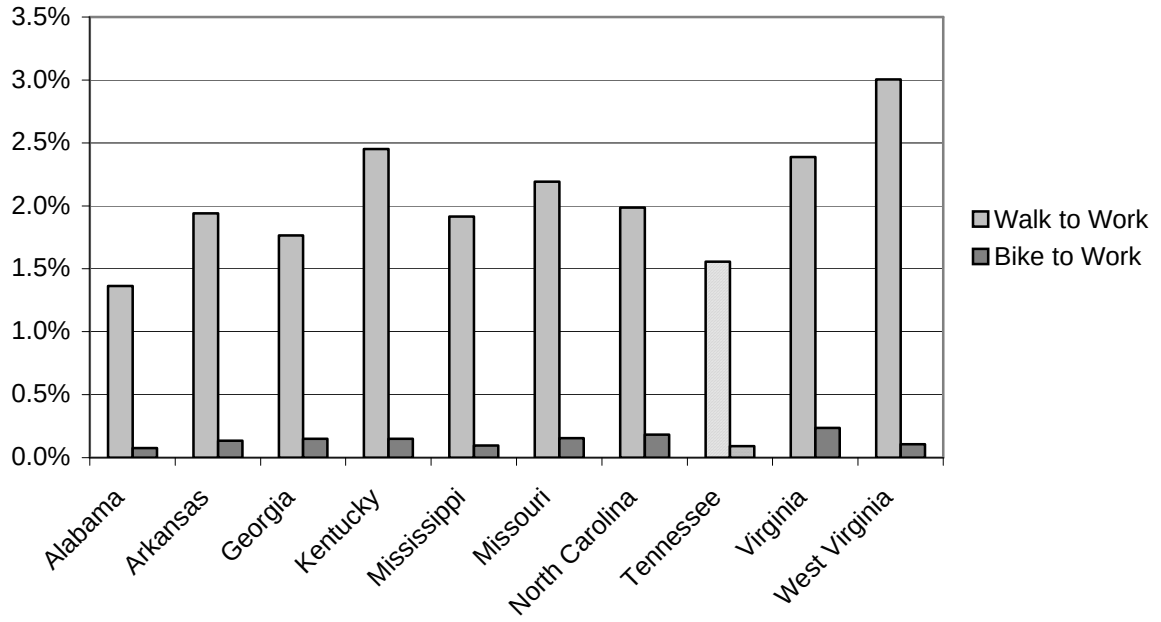
Figure 4-1. Tennessee Rates of Biking and Walking to Work: 1990 and 2000



4.1.2 Walking

Unfortunately, walking commute trips have been decreasing both nationwide and throughout Tennessee. About 4.5 million Americans walked to work in 1990 (3.9%), but in 2000, the number of walk-commuters dropped to 3.8 million (3.0%). In Tennessee, 50,773 people reportedly walked to work in 1990 (2.8%), while 39,689 people walked to work in 2000 (1.6%). Again, the overall population of workers in Tennessee and the United States increased during this time period. Tennessee has one of the lower percentages of workers commuting by bicycle and walking when compared to other states in the region. Only Alabama has a lower percentage of people bicycling and walking to work (Figure 4-2).

Figure 4-2. Percentage of Workers Who Commuted to Work by Walking and Bicycling, 2000 – A Comparison of States Adjacent to Tennessee



A closer look at select Tennessee cities shows how this change is taking place in different parts of the state. Nashville and Knoxville had gains in bicycle commuters between 1990 and 2000; a 6% increase in Nashville and a 46% increase in Knoxville. However, walking to work decreased in Knoxville (-5%) and gained a marginal number of walking commuters in Nashville (.37%). Memphis (Shelby County) had a 33% drop and Chattanooga (Hamilton County) had 33% drop in walking and bicycling in the same time period.

Possible explanations for these changes in Tennessee and the United States include rapid expansion of very low density suburbs, dispersal of jobs from center cities to the outer suburbs, higher vehicle ownership per household, and higher traffic volumes on local roadways, making walking and bicycling difficult.

4.2 Existing Bicycle Facilities

Some bicyclists in the midwest once jokingly commented that if it weren't for the auto traffic, they would have a great bikeway system. This statement hints at a truth in Tennessee, as well. Many of the state's roads are considered fine for adult bicycling the way they are because of their low traffic volumes, existing shoulders, or a combination of low speeds and moderate levels of traffic.

Accordingly, some portions of Tennessee's county and town road systems are reputed to offer some of the best bicycling roads in the United States because of their low volumes, good surface conditions, and picturesque appeal. Many of the state highways now have wider

travel surfaces that give bicyclists access to at least a narrow (three foot) paved shoulder, making it easier for bicyclists and motorists to share the roadway. Most of these highways are near the outskirts of urban areas and on rural bypasses, where roads have not yet been converted to curb and gutter.

Around urban areas, many county and town roads that may have been acceptable for bicycling just 10 years ago have seen a tremendous increase in traffic volumes due to new development. This is true for many state highways. Since most of these roadways have neither lanes wide enough to provide adequate lane-sharing for bicyclists and motorists nor paved shoulders, bicyclists often feel that they are being squeezed off the roadway by the sheer number of motorists or by drivers who decide to pass without adequate safe clearance. Unfortunately, motorists often grow impatient when encountering bicyclists, especially in situations when they are unable to easily move into the oncoming lane for safe passage due to the heavy amount of oncoming traffic.

Public comments and a review of facilities and plans in Tennessee point to the need for an integrated and consistent network of pedestrian and bicycle facilities, especially within cities and towns. There are still a number of gaps in the system, especially upon entering metropolitan areas and crossing physical features, such as rivers and mountains. Many existing bridges and tunnels do not accommodate bicyclists and pedestrians and create very hazardous bicycling and walking conditions. The lack of adequate facilities in urban areas have likely contributed to the decline in walking and bicycling.

The American Association of Highway and Transportation Officials (AASHTO) has developed national design standards for bikeways. These standards have existed since 1971, and were most recently modified in 1999. They include:

Bicycle Lane: A portion of roadway which as been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists.

Bikeway: A generic term for any road, street, path or way which in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles, or are to be shared with other transportation modes.

Designated Bicycle Route: A shared roadway which has been designated by signing as a preferred route for bicycle use.

Shared Use Path: A bikeway physically separated from any street or highway. Shared use paths may also be used by pedestrians, skaters, wheelchair users, joggers, and other non-motorized users. Also referred to as *trail* or *multi-use path*.

4.2.1 Bicycle Lanes

Tennessee has very few miles of bike lanes, most of which are found on local roads in larger urban areas. No city in Tennessee can claim to have a fully developed system of bicycle facilities, though cities like Chattanooga, Nashville, and Knoxville are making concerted efforts to improve the number and quality of bicycle facilities in these areas.

Bike lanes on 18th Ave. South in Nashville

4.2.2 Shoulders

Approximately 66% of all state highways have shoulders that are paved and 4 feet or wider, shown on the regional maps on pages 4-7 through 4-10. Four feet of roadway space provides sufficient space for many bicyclists to coexist with motor vehicles. However, the wider the shoulder, the more comfortable the riding experience, particularly for less skilled riders and children. Many of these state roadways are signed with the standard MUTCD "Bike Route" sign, as it was once TDOT policy to sign all roadways with shoulders 4 feet in width or greater. This practice has since stopped; it is unknown how many miles of signed bicycle routes exist on state highways.

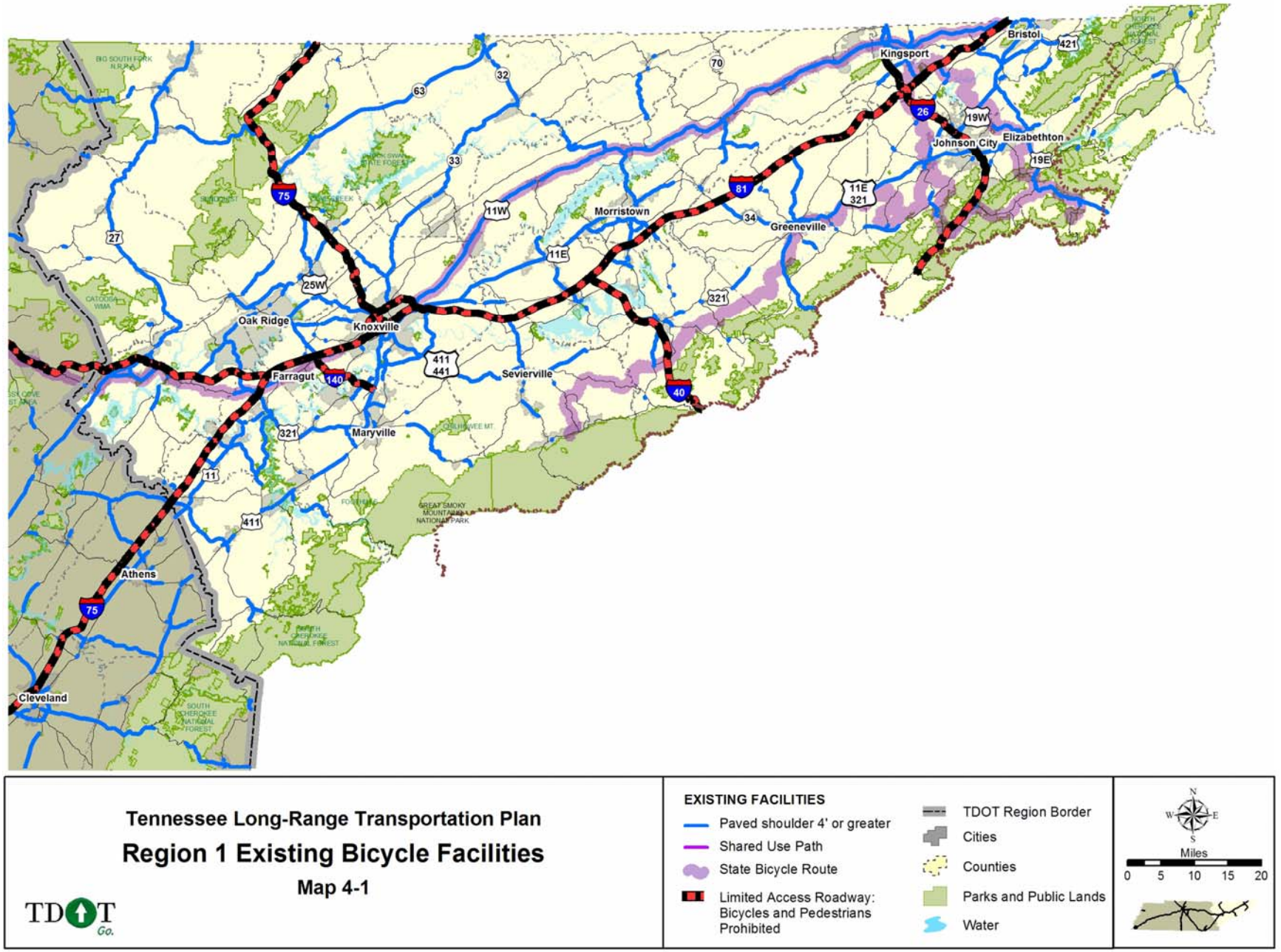
The width of a new or retrofitted shoulder is, in some cases, different for motor vehicle safety than for bicycle safety. For example, while a 10-foot shoulder is often preferable for vehicle safety, 4-foot-wide shoulders are often sufficient for bicycle use. Shoulders constructed for motor vehicle purposes obviously will also benefit bicyclists. Shoulders (a) should be on those segments of the State Bicycle System offering the greatest benefit to bicyclists, and (b) will also benefit motorists and are therefore not necessarily funded strictly with bicycle funds. In other words, shoulders will always benefit bicyclists and motor vehicles, and should be considered joint projects. Bicycle funds should be used on shoulders where they provide the greatest benefits to bicyclists: in urban areas and on state bicycle routes.

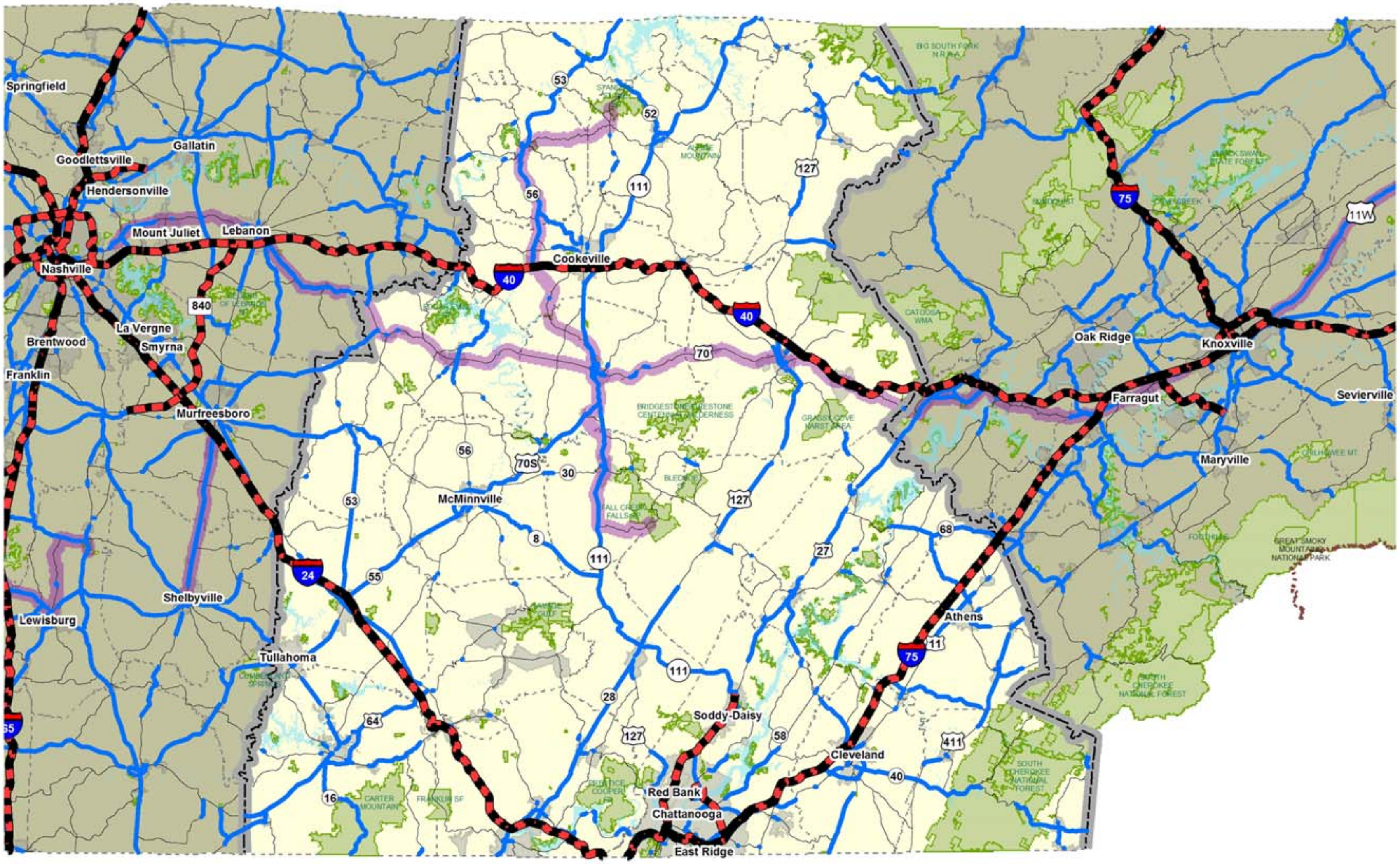
Several other issues are important to address in relationship to shoulder improvements. First, while shoulders can frequently be widened, narrow bridges represent a potentially worse hazard because there is no escape zone for bicyclists or vehicles. Second, while shoulders always benefit bicyclists, they are especially critical in areas where there is limited motorist visibility, such as around sharp curves, where a vehicle will be surprised to find a bicycle in the roadway. Third, shoulders are always the repository of gravel and debris swept naturally by vehicle traffic, and need to be maintained on a routine basis to be usable by bicyclists. Fourth, in some cases shoulders can be 'created' simply by re-striping the existing pavement, narrowing travel lanes, or shifting lane striping. Finally, in some special circumstances, parallel pathways may supplement (but not replace) shoulders for bicycle traffic.

A shoulder bikeway provides adequate room for cyclists.

Wherever possible, new roadway shoulders should be constructed to AASHTO standards. AASHTO identifies a shoulder width of 3 meters (9.8 feet) for roadways with higher traffic volumes. "In difficult terrain and on low-volume highways, (…) the minimum shoulder width of .6 meters (about 2 feet) should be considered and a 1.8 to 2.4 meter width (5.9 feet to 7.8 feet) would be preferable." (p. 338). However, the cost to retrofit many of the State highways in Tennessee, particularly in the more mountainous regions, means that narrower shoulders or a shoulder on the uphill travel side are a more practical solution. A shoulder on the uphill side allows bicyclists, who are moving considerably slower than motor vehicles while climbing, to be separated from the travel way. In areas of rugged topography or other constraints, wide shoulders are simply not practical except where there are appreciable traffic volumes. The final decision on shoulder width rests with the reasonable judgment of a licensed engineer.

Additional shoulder width will benefit bicyclists and pedestrians in rural areas. In addition to providing room for bicycles, striping a shoulder can help channelize motor vehicles and provide a traffic calming effect. In some very constrained areas, or where motor vehicle and bicycle traffic is expected to be low, minimal shoulders (between 2 and 4 feet) are preferable to no shoulders.


Bristol
Kingsport
421
26
19W
Johnson City
Elizabethton
19E
70
32
63
33
75
81
11E
321
Morristown
34
Greeneville
11W
11E
27
25W
321
Oak Ridge
Knoxville
411
441
Sevierville
Farragut
140
40
Maryville
321
11
411
Athens
75
Cleveland
Tennessee Long-Range Transportation Plan
Region 1 Existing Bicycle Facilities
Map 4-1
TDOT Go.
EXISTING FACILITIES
Paved shoulder 4' or greater
Shared Use Path
State Bicycle Route
Limited Access Roadway: Bicycles and Pedestrians Prohibited
TDOT Region Border
Cities
Counties
Parks and Public Lands
Water
N
W
E
S
Miles
0 5 10 15 20



Tennessee Long-Range Transportation Plan

Region 2 Existing Bicycle Facilities

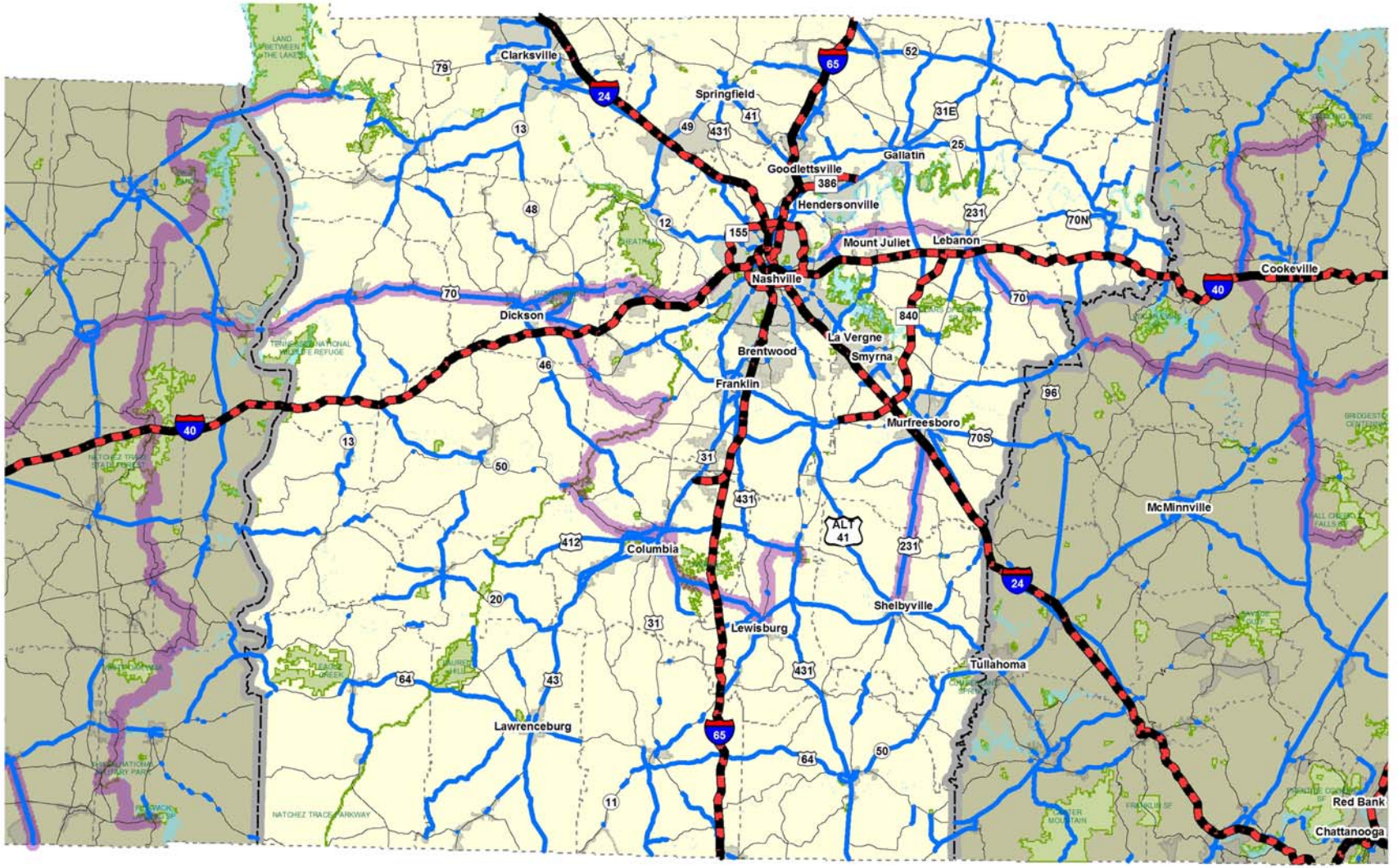
Map 4-2

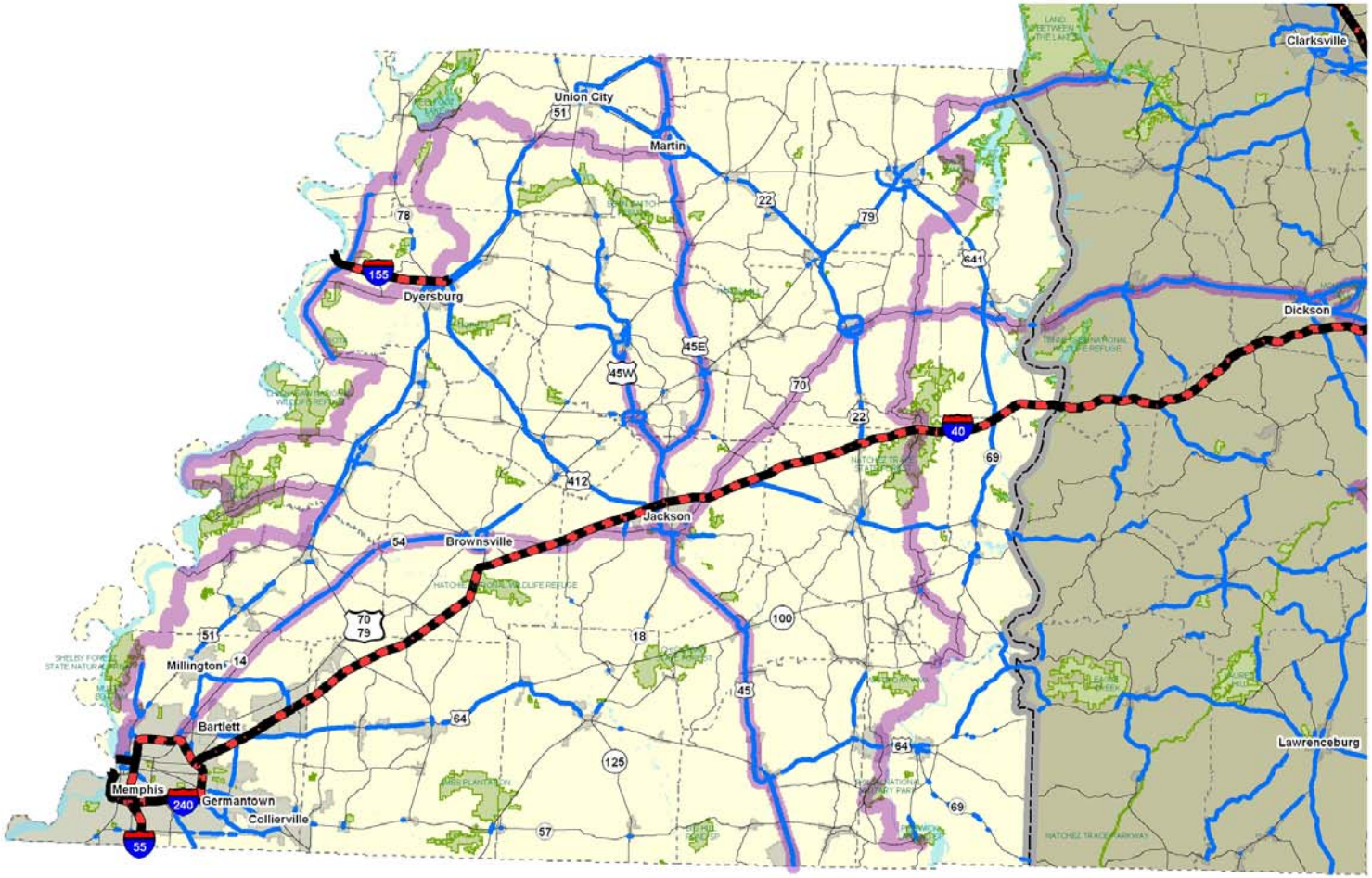
EXISTING FACILITIES

- Paved shoulder 4' or greater
- Shared Use Path
- State Bicycle Route
- Limited Access Roadway: Bicycles and Pedestrians Prohibited
- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water

Miles
0 5 10 15 20

TDOT Go.


Clarksville
Springfield
Goodlettsville
Gallatin
Hendersonville
Mount Juliet
Lebanon
Cookeville
Nashville
Dickson
Brentwood
Franklin
La Vergne
Smyrna
Murfreesboro
McMinnville
Columbia
Shelbyville
Lewisburg
Tullahoma
Lawrenceburg
Red Bank
Chattanooga
NATCHEZ TRACE PARKWAY
TENNESSEE NATIONAL WILDLIFE REFUGE
ALT 41
Tennessee Long-Range Transportation Plan
Region 3 Existing Bicycle Facilities
Map 4-3
TDOT Go.
EXISTING FACILITIES
Paved shoulder 4' or greater
Shared Use Path
State Bicycle Route
Limited Access Roadway: Bicycles and Pedestrians Prohibited
TDOT Region Border
Cities
Counties
Parks and Public Lands
Water
N
W
E
S
Miles
0 5 10 15 20



Tennessee Long-Range Transportation Plan

Region 4 Existing Bicycle Facilities

Map 4-4

TDOT Go.

EXISTING FACILITIES

- Paved shoulder 4' or greater
- Shared Use Path
- State Bicycle Route
- Limited Access Roadway: Bicycles and Pedestrians Prohibited
- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water

Miles

0 5 10 15 20

4.2.3 State Bicycle Routes

There are nine existing state bicycle routes in Tennessee. Five of these routes are mapped and signed with route specific signage. They include the *Reelfoot*, *River*, *Heartland*, *Highland Rim*, and *Mountain* routes. These routes vary in length and difficulty, typically starting and ending at a state park. Other routes recognized as state bicycle routes, though not mapped and sporadically signed with the standard MUTCD "Bike Route" sign, include the Memphis to Bristol route (U.S. 70), U.S. 45 between Mississippi and Martin, and U.S. 231 from Shelbyville to Murfreesboro. Additionally, the Mississippi River Trail, which travels from Mississippi to Kentucky along the Mississippi River on mostly local roads, can be considered an existing state bicycle route.

Free bicycle route maps (*Cycling Tennessee's Highways*) are distributed by TDOT for the five named and signed bicycle routes. They consist of a packet of cue sheets with a map, safety information, and a briefing on bicycle laws. Each cue sheet has a list of mileposts, which is coordinated with milepost numbers on standard MUTCD "Bike Route" signs along the route.

The five named, mapped, and signed bicycle routes typically follow low volume, rural roads, many of which are not state highways and have no special provisions for bicycles. Many of the roads that comprise these routes are two lane rural roads with little or no shoulders. While the bicycling conditions are generally good, this detail has led to some problems with maintenance and facility provision along the routes.

According to AASHTO, signing of shared roadways indicates to bicyclists that there are particular advantages to using these routes compared to alternate routes. This means that the local jurisdiction has taken action to ensure these routes are suitable as shared routes and is responsible for maintaining them. While the roadway pavement condition of the state bicycle routes appears to be in good condition, there is no evidence of any additional actions by the local jurisdiction to ensure that these routes are maintained. This is problematic if the local jurisdiction does not have the funding or does not want to maintain the roadway.

AASHTO also recommends that bike route signs include destination information regardless of the type of facility or roadway where they are used. The existing *Highland Rim* route signs, for example, do not include any destination information unless the bicyclist has the accompanying tour map cards. There is no destination or route information to indicate to a bicyclist that this is a mapped touring route with points of interest other than the milepost numbers in the upper left corner of the bike route signs. Furthermore, some of the signage along the route is missing directional arrows and mileage information, making navigation without the tour map cards challenging.

It is recommended that all new state bicycle routes utilize roadways within TDOT jurisdiction. This will simplify maintenance, signing, and mapping procedures and keep the onus of responsibility on TDOT for providing and maintaining appropriate bicycle facilities on the routes. This recommendation is further discussed in Chapter 7.

4.2.4 Greenways and Trails (Shared Use Paths)

Interest in developing longer greenways and trails is growing in all of Tennessee's cities and towns. There are many existing greenways under the jurisdiction of local and regional agencies throughout the state. The Tennessee Department of Environment and Conservation (TDEC) oversees approximately 1.9 miles of greenway (Pinson Mounds State Park, Henry Horton State Park, and the Bicentennial Mall State Park), and over 800 miles of trail, primarily consisting of hiking trails or footpaths in state parks. TDOT's role is to coordinate with other departments such as TDEC and the National Park Service (NPS) to ensure that these facilities are built to established standards, provide good regional connectivity, and, when appropriate, are included along State highways.

Shared use paths provide benefits for many types of users.

4.2.5 Other Roadway Elements

4.2.5.1 Rumble Strips

Rumble strips are provided to alert motorists that they are wandering off the travel lanes onto the shoulder. They are most common on long sections of straight freeways in rural settings, but are also used on sections of two-lane undivided highways. Tennessee has been installing rumble strips on all of its interstate and major route resurfacing projects since 1996. Tennessee standard drawings dictate that, on a 10-foot shoulder, rumble strips should be 3 feet wide and located approximately one foot from the edge of the traveled way (Standard Drawing RP-CS-1 and RP-CS-2).

Rumble strips are uncomfortable and sometimes hazardous for bicyclists and are not recommended on designated bicycle routes. Rumble strips should not be used in an urban setting where bicycle facilities are planned or needed. If rumbles strips are necessary, they should follow bicycle-friendly guidelines and leave an unobstructed travel way and clear zone of at least 4 feet. Gaps should be provided every 25 feet to allow ease of access through the line of strips.

4.2.5.2 Drainage Grates

Some older drainage grates on state highways in urban areas are hazardous for bicyclists, since they can catch a bicycle wheel, causing the cyclist to fall. Safety issues can also arise if road repaving changes the elevation between the drainage grate and the adjacent pavement. Current TDOT standards are bicycle-friendly (Standard Drawing D-CBB-12A). Replacing existing grates or welding thin metal straps across the grate perpendicular to the direction of travel is a retrofit opportunity that greatly improves the bicycling environment. Drainage grates should be checked periodically to ensure that the straps remain in place.

4.3 Pedestrian Facilities

4.3.1 Sidewalks

Pedestrian facilities along state highways vary dramatically. Some highways have wide, continuous sidewalks with street furniture, lighting, pedestrian signal heads, and marked crosswalks. Other highways have cracked or heaving sidewalks that are discontinuous, forcing pedestrians to walk in the roadway, through private frontages, or on the shoulder. Most state highways have no pedestrian facilities due to the rural nature of the state.

Sidewalks, shared use paths, street crossings (including over- and undercrossings), pedestrian signals, signs, street furniture, transit stops and facilities, and all connecting pathways should be designed, constructed, operated, and maintained so that all pedestrians, including people with disabilities, can travel safely and independently. TDOT should focus its pedestrian facility provision efforts along state highways in urban areas, on highways that also serve as Main Street in small communities, and along highways in areas where tourists are likely to walk from one attraction to another. Chapter 8 provides an audit system and treatment toolboxes that help TDOT identify and improve pedestrian facilities throughout the state.

4.4 Maintenance

Poor walking or riding conditions on roadways, shoulders, paths, and sidewalks are one of the most common comments received from Tennessee residents. Roadway shoulders collect debris, sidewalks and paths are cracked by tree roots, and all of these facilities require continual care in order to function properly. Many existing shoulders are ostensibly useless due to the amount of debris in the shoulder, forcing bicyclists to ride in the roadway travel lane.

Like all states, TDOT's challenges lie with developing an identification and response system to make spot maintenance as needed, and in identifying sufficient funds to perform routine maintenance repairs along roadway shoulders. Sidewalks and pathways along State highways represent a distinct problem, one that may be resolved through coordination with local agencies. It is recommended that TDOT headquarters work closely with the TDOT region offices to develop an identification and response system, sweeping schedule, and funding strategies for state highways that have shoulders.

4.5 Bicycle Suitability Model

A suitability model or index is used in bicycle transportation planning to assess the suitability of existing roadway characteristics for bicycling. It is also used to identify existing gaps and potential bikeways, and recommend improvement projects that would enhance or complete the bicycle network.

There are two generally-accepted tools available for estimating the suitability of roads for bicycling. The first, developed by Alex Sorton and others at the Northwestern University's Traffic Institute in the 1980's, is called the "Bicycle Stress Level" analysis (hereafter referred to as "Sorton"). The second, called the "Bicycle Compatibility Index" (BCI), was developed for the FHWA by David Harkey and others at the University of North Carolina's Highway Safety Research Center, and became available in late 1998 (North Carolina Department of Transportation, 2003).

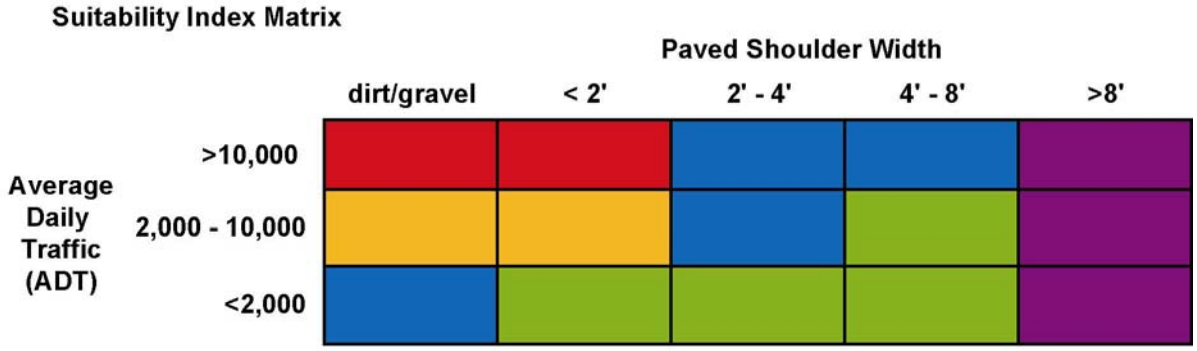
Both models are based on many years of careful research and surveying of bicyclists under simulated bicycling conditions, and can produce worthwhile results. More often, unfortunately, transportation planners are presented with at least two significant barriers to implementation. First, both the Sorton and the BCI are expressly intended for urban and suburban application, and are therefore of very limited utility for use in rural areas such as in Tennessee. Second, many agencies – such as TDOT – that wish to estimate bicycle compatibility on their roads do not possess the rather extensive data required for employing the BCI model, which requires 13 pieces of information ranging from 85th percentile speed to adjacent land uses. Even if data is available, organizing it in such a manner is prohibitively time consuming and expensive. Many agencies, then, choose to isolate a few of these variables and develop their own compatibility index, such has been done in this plan.

4.5.1 TDOT Suitability Index Methodology

The model developed for this plan seeks to address and overcome these limitations – and is tailored to fit TDOT's needs – by applying the following methodology:

- The parameters that are analyzed and used to determine suitability are limited to three. These are: shoulder width, shoulder type (paved or unpaved), and volume (all motor vehicles). This is due to the availability of existing data in a modifiable format.
- The revised model uses numeric input. Shoulder width was categorized into five groups, and ADT was categorized into three groups. These parameters were chosen based on industry standards for the needs of Type A (Advanced) and B (Basic) bicyclists (see page 5-1) with a focus on recreational touring due to the rural nature of the majority of state highways.
- The number of suitability output scores or categories is reduced from the BCI's six to five. The five categories are color coded: red and orange depict very unfavorable or unfavorable bicycle suitability, and blue and green depict somewhat favorable or favorable bicycle suitability. Purple is indicative of a wide shoulder and is independent of ADT (Figure 4-3).

Figure 4-3. TDOT Suitability Index Matrix



The results of using this simplified version of the BCI and Sorton models are as follows:

- Data requirements are both greatly reduced and tailored to match TDOT's data currently available.
- The model is more tailored to the fact that Tennessee's roads are predominantly rural.
- The model will produce comprehensive suitability ratings, at what might be called a "corridor" level of analysis, which is most appropriate for state planning.
- The results are sufficiently detailed and consistent to allow for mapping at a state-wide level.

Suitability of highways for bicycling is most affected by traffic volume and shoulder width. Therefore, the following four actions should be considered, especially when roadways are reconstructed:

1. On all higher-volume rural roadways (generally with motor vehicle volumes exceeding 2,000 per day), paved shoulders should be provided per TDOT policy and the AASHTO Green Book.
2. On all roadways of less than 2,000 ADT with a suitability rating of blue, the Suitability Index analysis will be conducted to determine if the addition of a shoulder will improve bicycling conditions to green.
3. On higher-volume roadways (exceeding 2,000 vehicles per day) with bicyclists currently using or anticipated to use the roadway, wider paved shoulders should be provided. A suitability valuation of blue will be considered a threshold for evaluating the need for addition of shoulders or widened outside lanes.
4. On lower-volume roadways (under 2,000 vehicles per day) with wide shoulders, no special improvements are necessary to accommodate bicyclists. These lower-volume roadways are identified and mapped to provide bicyclists with appropriate information to help them make connections between communities and rural recreation and commercial areas/sites.

It should be noted that the TDOT suitability index should be used for planning purposes only. Routes that show favorable bicycling conditions do not imply any guarantee of safety, quality

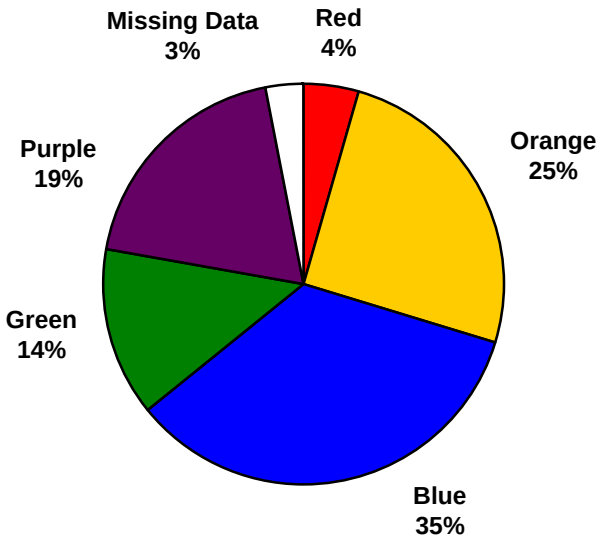
of facility, or type of condition. The suitability index and maps reflect existing shoulder width and average daily traffic data on state-owned roadways queried from the Tennessee Roadway Information Management System (TRIMS) database in spring 2004. The data provided on the suitability maps may be inaccurate or out of date. A field check of the data in spring and summer 2004 revealed inconsistencies with the data, and shoulder width data recorded in TRIMS was significantly higher than with measured widths recorded in the field. These inconsistencies could be an anomaly or prevalent throughout the system. It is recommended that TDOT update the TRIMS database to accurately reflect on-the-ground conditions and integrate it with a Geographic Information System (GIS) for future analyses.

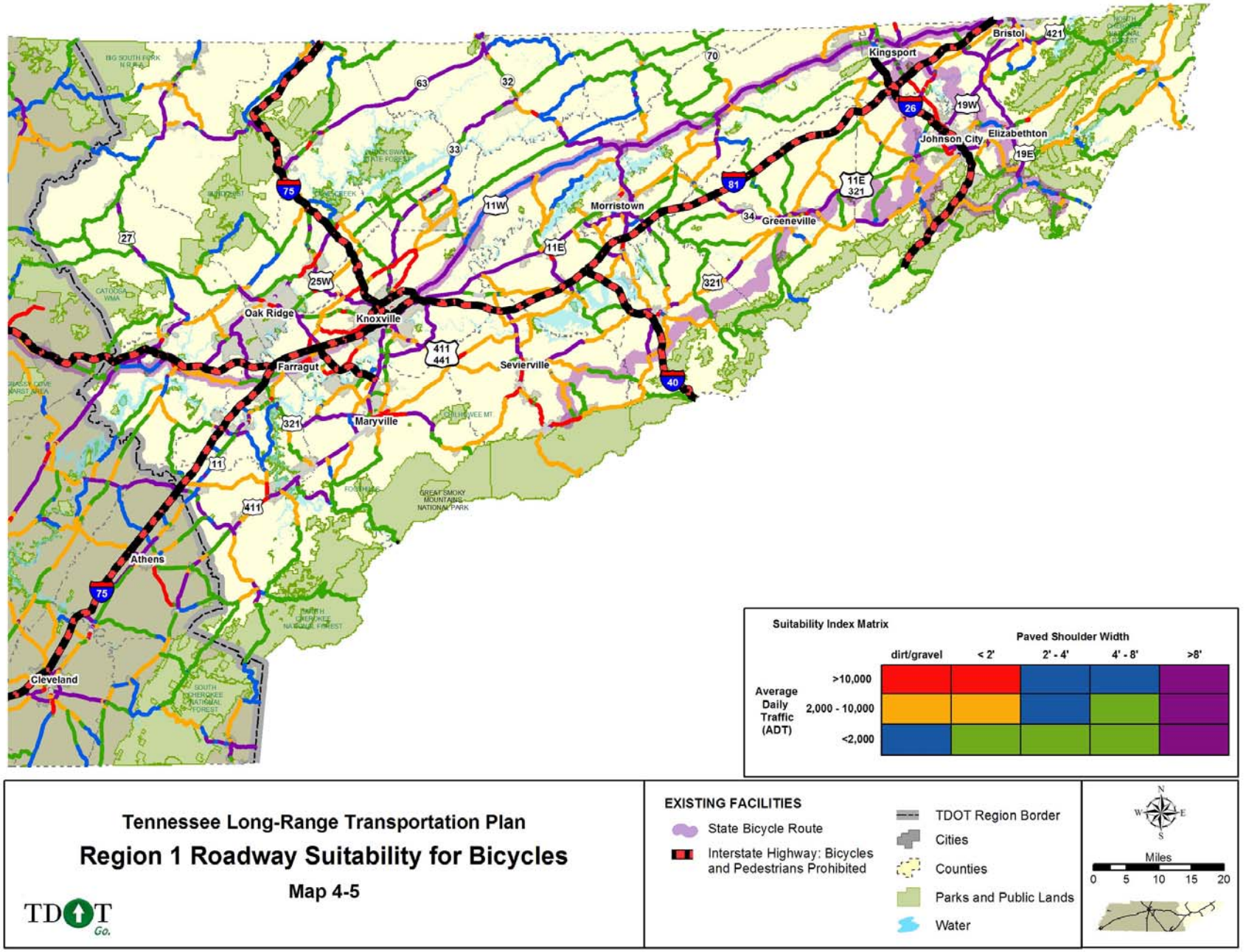
4.5.2 Suitability of Tennessee Highways

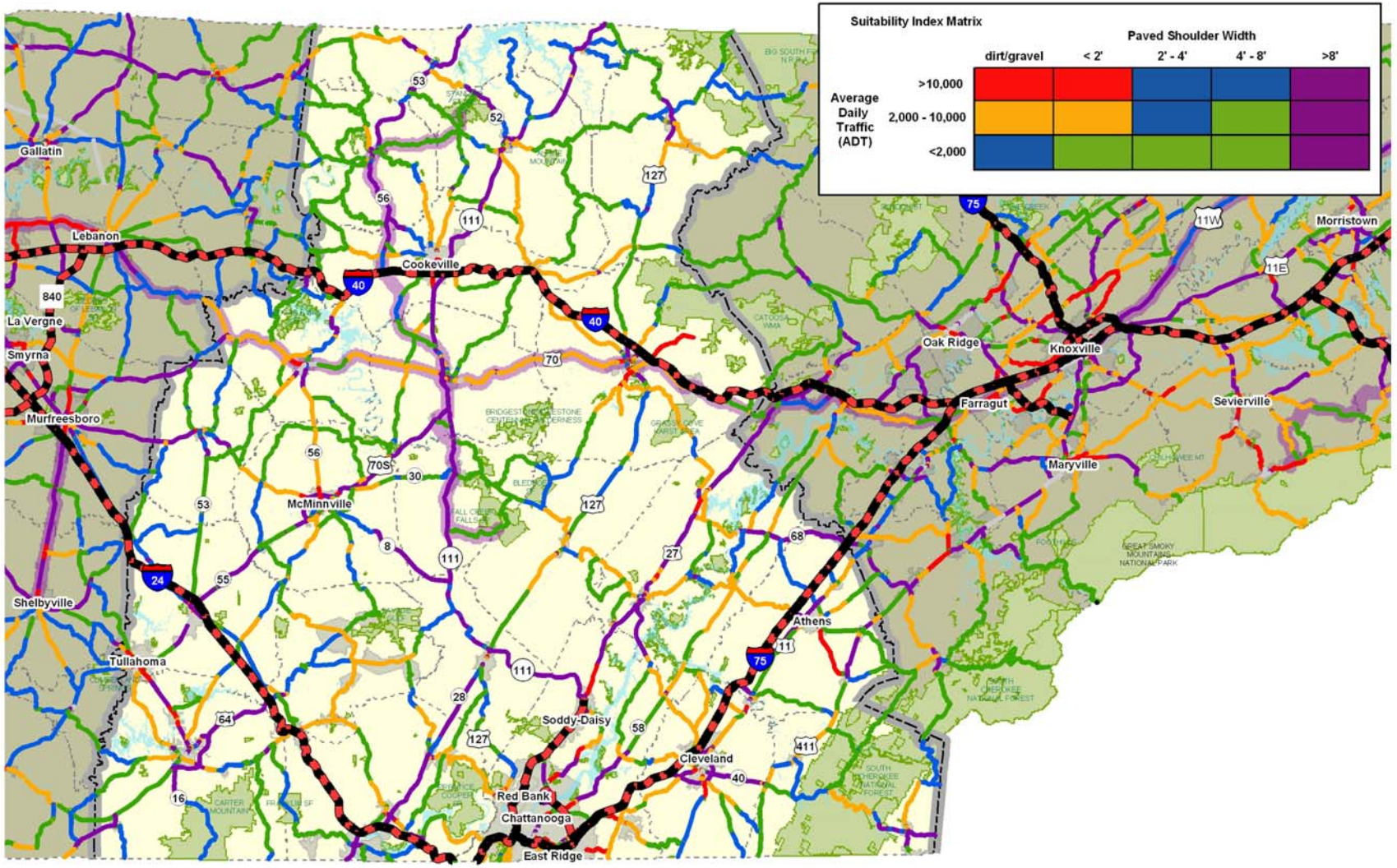
The following maps on pages 4-17 through 4-20 display all state highways and their level of suitability.

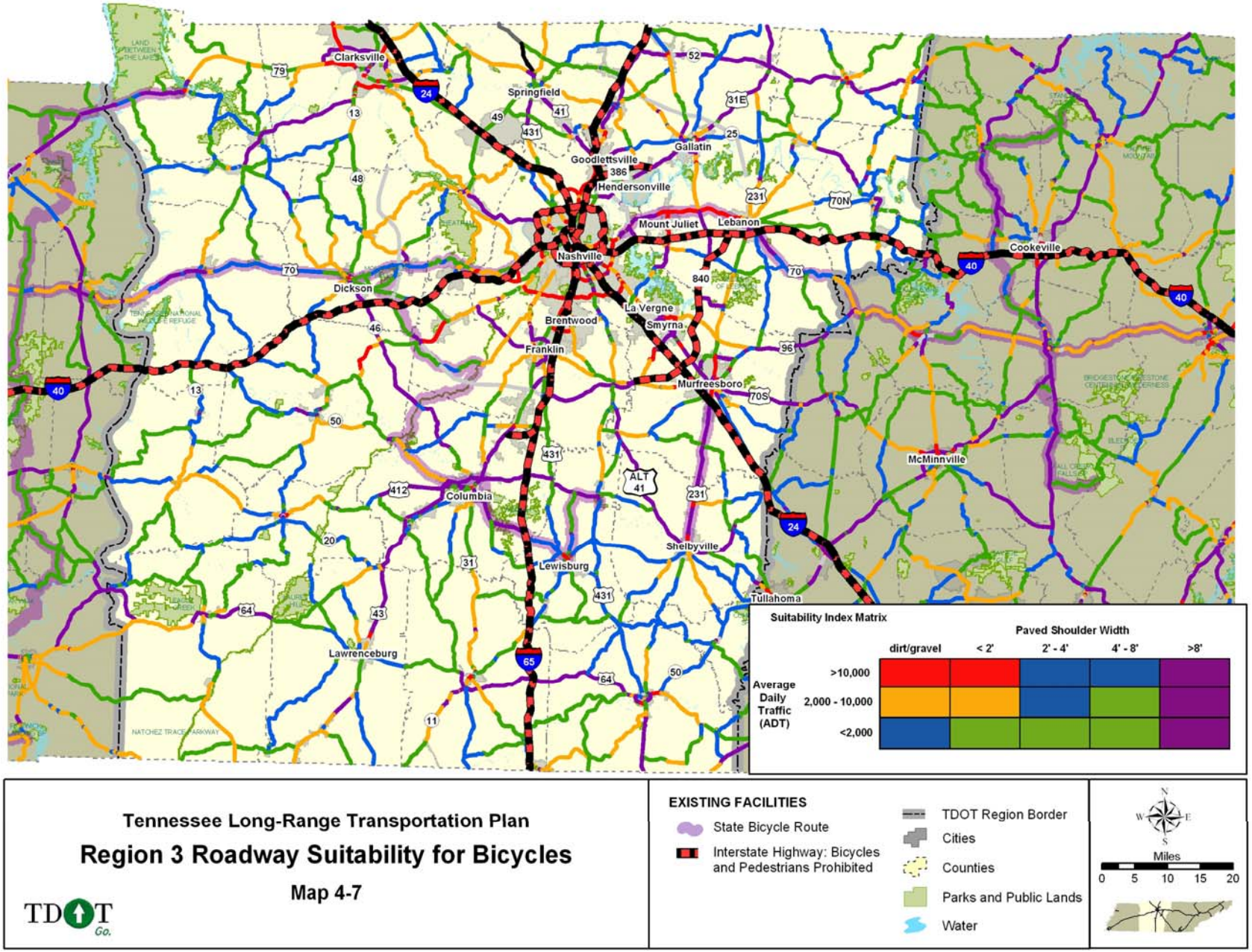
Of the over 14,150 miles of state highways, nearly 10,000 miles of state highway have roadway conditions that are favorable or somewhat favorable for Type A and recreational touring bicyclists. Almost all of these roads are located in rural parts of the state or have wide shoulders in urban areas. Over 7,700 miles (49%) of state highways are coded green or blue, indicating that the existing conditions are suitable for bicycling. Approximately 4,470 miles of state highway are not favorable for bicycling. These highways are characterized by high traffic volumes and narrow or non-existent shoulders. These roads are generally located in and around urban areas. These locations are where TDOT should focus improvements, including shoulder construction or widening, re-striping the roadway, or striping a bicycle lane, particularly if they are roadways that have been identified by a local bicycle plan as a bicycle route or bikeway.

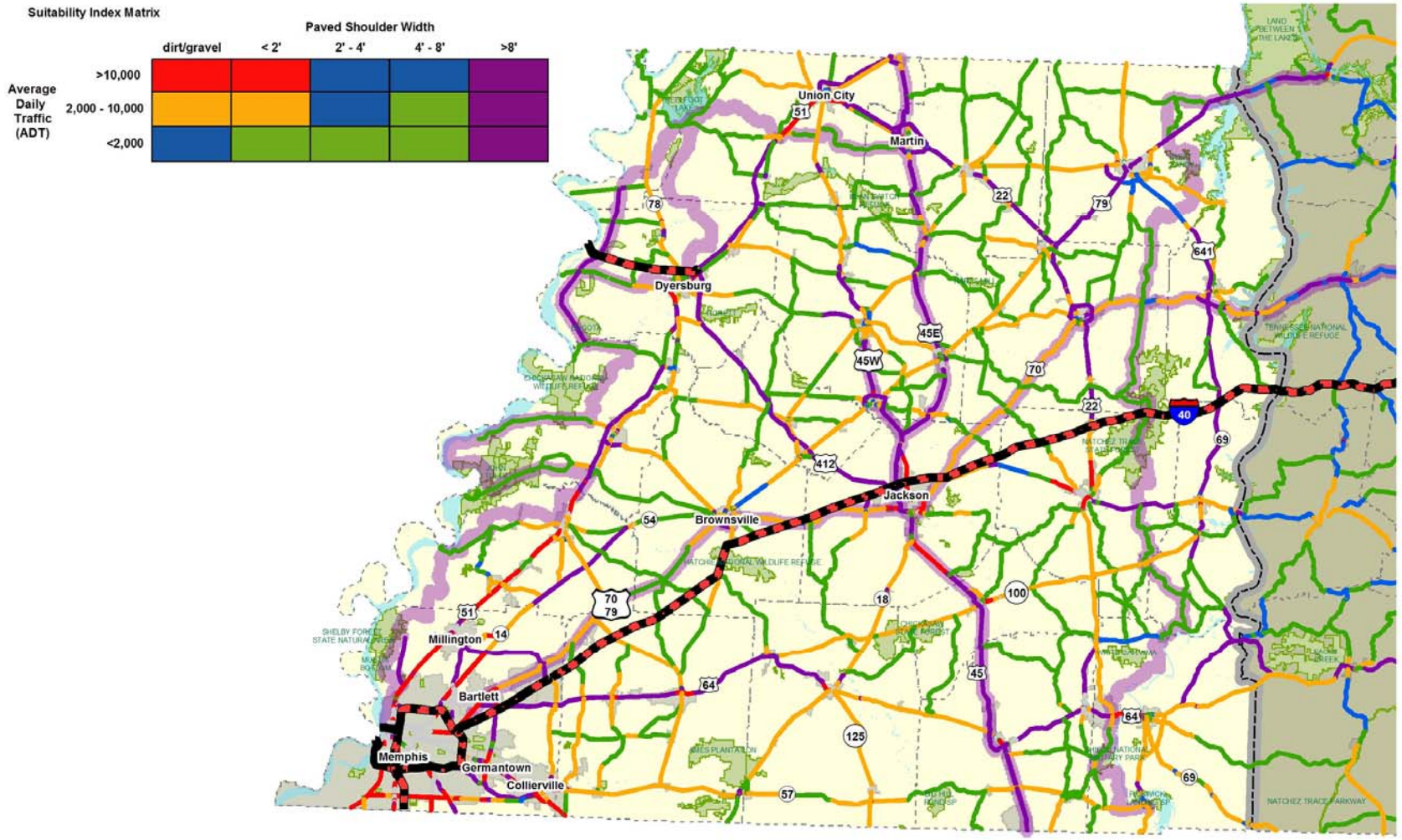
Figure 4-4. Bicycle Suitability of Tennessee Highways




Bristol
421
Kingsport
70
63
32
26
19W
Elizabethton
Johnson City
19E
33
75
81
11E
321
11W
Morristown
34
Greeneville
27
11E
25W
321
Oak Ridge
Knoxville
411
441
Farragut
Sevierville
40
321
Maryville
11
411
Athens
75
Cleveland
Suitability Index Matrix
Paved Shoulder Width
dirt/gravel
< 2'
2' - 4'
4' - 8'
>8'
Average Daily Traffic (ADT)
>10,000
2,000 - 10,000
<2,000
Tennessee Long-Range Transportation Plan
Region 1 Roadway Suitability for Bicycles
Map 4-5
TDOT
Go.
EXISTING FACILITIES
State Bicycle Route
Interstate Highway: Bicycles and Pedestrians Prohibited
TDOT Region Border
Cities
Counties
Parks and Public Lands
Water
N
W
E
S
Miles
0
5
10
15
20


Suitability Index Matrix
Paved Shoulder Width
dirt/gravel
< 2'
2' - 4'
4' - 8'
>8'
Average Daily Traffic (ADT)
>10,000
2,000 - 10,000
<2,000
Gallatin
Lebanon
Cookeville
La Vergne
Smyrna
Murfreesboro
McMinnville
Shelbyville
Tullahoma
Soddy-Daisy
Red Bank
Chattanooga
East Ridge
Cleveland
Athens
Oak Ridge
Knoxville
Farragut
Maryville
Sevierville
Morristown
Tennessee Long-Range Transportation Plan
Region 2 Roadway Suitability for Bicycles
Map 4-6
EXISTING FACILITIES
State Bicycle Route
Interstate Highway: Bicycles and Pedestrians Prohibited
TDOT Region Border
Cities
Counties
Parks and Public Lands
Water
N
W
E
S
Miles
0 5 10 15 20


Clarksville
Springfield
Goodlettsville
Hendersonville
Gallatin
Mount Juliet
Lebanon
Nashville
Cookeville
Dickson
Brentwood
La Vergne
Smyrna
Franklin
Murfreesboro
McMinnville
Columbia
Shelbyville
Lewisburg
Tullahoma
Lawrenceburg
Suitability Index Matrix
Paved Shoulder Width
dirt/gravel
< 2'
2' - 4'
4' - 8'
>8'
Average Daily Traffic (ADT)
>10,000
2,000 - 10,000
<2,000
Tennessee Long-Range Transportation Plan
Region 3 Roadway Suitability for Bicycles
Map 4-7
TDOT Go.
EXISTING FACILITIES
State Bicycle Route
Interstate Highway: Bicycles and Pedestrians Prohibited
TDOT Region Border
Cities
Counties
Parks and Public Lands
Water
N
W
E
S
Miles
0 5 10 15 20


Suitability Index Matrix
Paved Shoulder Width
dirt/gravel
< 2'
2' - 4'
4' - 8'
>8'
Average Daily Traffic (ADT)
>10,000
2,000 - 10,000
<2,000
Union City
Martin
Dyersburg
Jackson
Brownsville
Millington
Bartlett
Memphis
Germantown
Collierville
Tennessee Long-Range Transportation Plan
Region 4 Roadway Suitability for Bicycles
Map 4-8
TDOT Go.
EXISTING FACILITIES
State Bicycle Route
Interstate Highway: Bicycles and Pedestrians Prohibited
TDOT Region Border
Cities
Counties
Parks and Public Lands
Water
N
W
E
S
Miles
0 5 10 15 20

4.6 Major Gaps in the Tennessee Bicycle and Pedestrian Network

Gaps in the bicycle and pedestrian network create additional barriers that discourage people from walking and bicycling for transportation and recreational purposes. This is particularly true for newer pedestrians and bicyclists, who are not as confident or knowledgeable about existing routes. Identifying and filling in the gaps provides greater connectivity and reliability for bicyclists and pedestrians of all ages and abilities.

Major statewide gaps include topographic features like the Tennessee and Mississippi Rivers, the Appalachian Mountains, the Cumberland Plateau and Highland Rim, and the Cumberland Gap, as well as through urban areas where bicycle and pedestrian facilities are limited or not adequately maintained. Tunnels, narrow mountain roads, and narrow bridges do not provide sufficient access and restrict connectivity for bicyclists and pedestrians. Additionally, interstate freeways and limited access highways are gaps when bicycle and pedestrian facilities are not provided on, under, or over them. Gaps in the proposed state bicycle route system are addressed in Chapter 6.

Many roadways lack adequate room for cyclists and pedestrians.

In conjunction with an analysis of the suitability model developed for the Tennessee Bicycle Plan, various MPOs have identified a number of key gaps in their bicycle and pedestrian system. These gaps in the present bicycle and pedestrian network could exist due to lack of facilities on a major bike route, or due to topographic constraints such as a river crossing or tunnel. It is recommended that TDOT work closely with the local MPO to eliminate or mitigate these gaps on state roadways.

Information on critical facility gaps on state routes was provided by some of the MPOs, while additional information was obtained from bicycle facilities master plans or long-range transportation plans. The gaps were identified based on the information received by the MPOs from their own studies and outreach within the bicycling and pedestrian communities in their region.

Table 4-1 summarizes significant gaps on state highways, as identified by the local planning organization.

Table 4-1. Significant Gaps on Tennessee State Highways

Memphis – Shelby County	
Mississippi River – I-55 Crossing	Bicyclist and pedestrian access across the Mississippi River. Currently, there is a sidewalk path across the I-55 Mississippi River bridge, however it is difficult to access and in need of repair and clean up.
Meeman-Shelby Forest	Direct access to Meeman-Shelby Forest. One of the attractive destinations in the area, particularly for bicyclists, is not easily accessed.
North-South access in Shelby County	There are few opportunities for direct north-south access in Shelby County, severely limiting the transportation options for bicyclists in southwest Tennessee.
Direct access to Shelby Farms	There are few on-street bicycle lanes and/or routes that connect greater Memphis with Shelby Farms. Many bicyclists and pedestrians have to drive to the site.
Nashville	
US 70S / SR 100	Percy Werner Park is a major destination for bicyclists in the region and currently lacks any bicycle facilities. However, this lack of dedicated bicycle facilities does not deter bicyclists from currently using the road.
US Hwy 31 (Gallatin Rd.)	New facilities on Gallatin Road would connect into existing bike lanes on Riverside Drive and tie into projects that are already on the ground. Facilities on this route would provide primary connections between Nashville, Hendersonville, and Gallatin.
US 70 (Lebanon Rd.)	Lebanon Road would provide a major east-west connection from Lebanon through Mt. Juliet and into downtown Nashville. This facility could be a "trunk" line with eventual connections to several rail stations.
Knoxville	
I-140/Pellissippi Parkway between Topside Road and Northshore Road	Some clarification regarding TDOT policy for this section is necessary, however, there is no nearby alternative for bicyclists to cross the river. The closest detour is over 25 miles out of a bicyclist's way. The TPO requested a policy change from TDOT to allow bicyclists on the Pellissippi Bridge over Lake Loudoun. This request was denied and the TPO has appealed the decision. (October 2004)
SR 1 (Kingston Pike and Cumberland)	There is an overall lack of facilities along this route, as well as a lack of alternative east-west routes. Kingston Pike and Cumberland serve a number of destinations in the Knoxville regional area, including the University of Tennessee, downtown Knoxville, and neighborhoods to the west.
SR 33 (Broadway)	This route lacks adequate facilities for both bicyclists and pedestrians with no viable north-south alternative for users. SR 33 has sidewalks, but they are not always separated from traffic and not complete for the whole corridor. Curb ramps are missing in places. Connects to downtown Knoxville.
SR 71 (Chapman Highway)	This route lacks adequate facilities for both bicyclists and pedestrians. There is no viable north-south alternative for users. Connects to downtown Knoxville.
Chattanooga	
Highway 153	Adding bike lanes on the highway from Highway 41 to the state line provides important connections between North Georgia and Hamilton County. It also connects the Ooltewah-Collegedale area with Ringgold.
Highway 58	Adding signage and pavement markings improves regional connections to the south of Chattanooga.

Highway 193	Adding signage and pavement markings improves regional connections near Chattanooga.
US 27	TDOT restricts access to roadway, which is one of the fastest and easiest ways to travel north and to US 127 over Signal Mountain, a popular bicycle route.
Missionary Ridge (US 41/76 and US 11/64)	Tunnels along these routes have narrow sidewalks and no shoulders. Adding flashing warning lights and signs would improve bicyclist safety on these roadways.
Franklin	
SR 96 (Murfreesboro Rd.)	Adding bike lanes to connect downtown Franklin with downtown Murfreesboro.
SR 31 (Columbia Ave.)	Adding bike lanes to connect Thompsons Station, Spring Hill, and downtown Franklin.
SR 431 (Lewisburg Ave.)	Adding bike lanes to create additional north-south routes into downtown Franklin
Jackson	
US 45 Bypass	Including bike lanes along the bypass between Airways Blvd. and Hollywood Drive would provide a north-south link between the CBD and south Jackson area to the residential and commercial areas to the north.
Southern Bypass	Including bike lanes on the Southern Bypass between South Highland Avenue and the US 45 Bypass would provide an additional north-south link in Jackson.
Lebanon	
US 231 (Hunters Point Pike-Canoe Branch)	This route extends from within the Lebanon planning area and connects to Old Hickory Lake, providing a scenic and relatively safe route for bicyclists.
US Highway 70N (Carthage Highway)	This roadway connects Lebanon and Wilson County with Smith County, providing a link for bicyclists.
US Highway 70 (Sparta Pike, SR 26)	Sparta Pike extends from Lebanon through Watertown and into Smith County, with a proposed mix of bike lanes and bike routes providing a link from Lebanon to Watertown and beyond into Smith County.
US 231 (Murfreesboro Road)	Murfreesboro Rd extends south from Lebanon to the Rutherford County line, providing a relatively safe route for bicyclists.
US 70N (Carthage Highway)	This route also connects with a similar Wilson County project to provide bicycle connections from Baddour Parkway east and continuing to the Wilson/Smith county lines.
Blount County	
SR 411	This route, between Wildwood Road and River Ford Road is an existing 2-lane road with no shoulders but which is regularly used by bicyclists in the region.
Hendersonville	
US 31E	This is Main Street through Hendersonville and lacks improvements for bicyclists, which would provide an east-west route through town.

4.7 Crash Analysis

4.7.1 Types of Crashes

Concerns about safety are among the top reasons people do not walk or bicycle more often. Contrary to popular belief, most bicycling crashes do not involve collisions with motor vehicles. They usually involve falls or collisions with stationary objects, other cyclists, and pedestrians. Many of these crashes are not reported to the police and are not included in the analysis.

Most auto-ped and auto-bicyclist crashes are due to bicyclists or motorists disobeying the rules of the road. In a review of bicycle-motorist crash causes, the fault lies equally with motorists and bicyclists. Most collisions occur where two roadways or a roadway and a driveway intersect, and one user fails to yield the right of way to the other.

Child errors account for more than 90% of all child bicycle crashes. In contrast, 60% of adult bicycle crashes are the result of motorist, not bicyclist, error. The most common crash is a left turn across the path of an oncoming bicycle. A frequent and unexpected error among both adult and child bicyclists is riding the wrong way in traffic. Wrong-way bicycle riding is involved in 30% of all bicycle-motor vehicle collisions.

4.7.2 Spending on Safety

A major goal of the State of Tennessee is to improve safety for pedestrians and bicyclists. Tennessee spent nearly 3.5 billion dollars on federal surface transportation projects from 1998 to 2003 (Surface Transportation Policy Project, *Mean Streets*, 2004). About 1.1% of those funds – approximately $37 million – were spent on pedestrian and bicycle projects, averaging $1.06 per person on pedestrian and bicycle facilities and safety. Figure 4-5 on page 4-37 shows crash and spending data from 2002-2003 for all states. Tennessee ranks 29th with an average annual pedestrian deaths per capita rate of 1.45 per 100,000 people.

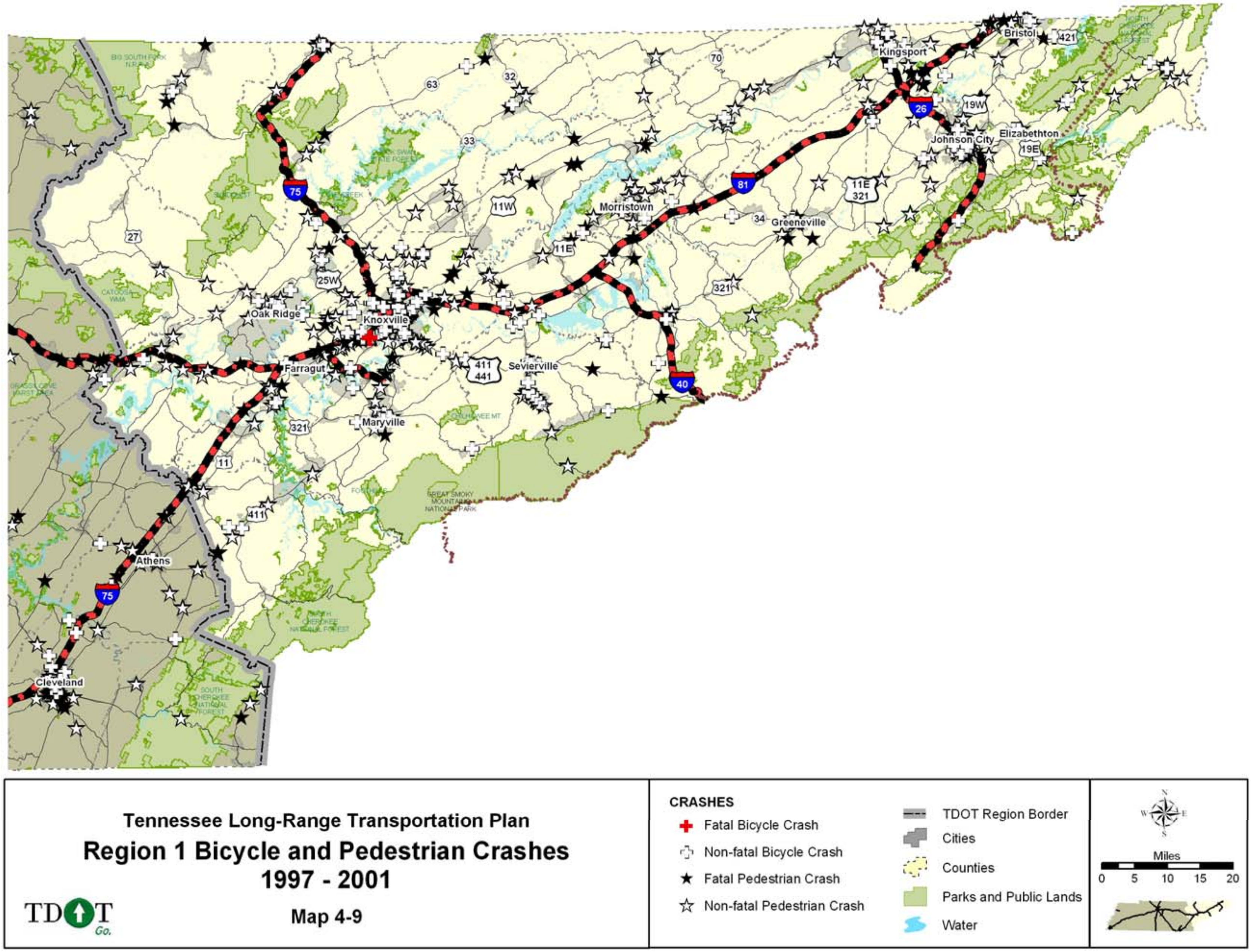
The National Highway Traffic Safety Administration (NHTSA) and the Tennessee Department of Safety provide statewide fatality data. In a comparison of statewide bicycle and pedestrian deaths for 2001 for selected states, Tennessee had the lowest fatality rate for pedestrians and bicyclists (Table 4-2). However, without comparable bicycle and pedestrian use data, statewide injury or fatality trends may be misleading because the level of bicycling and walking activity is not fully known.

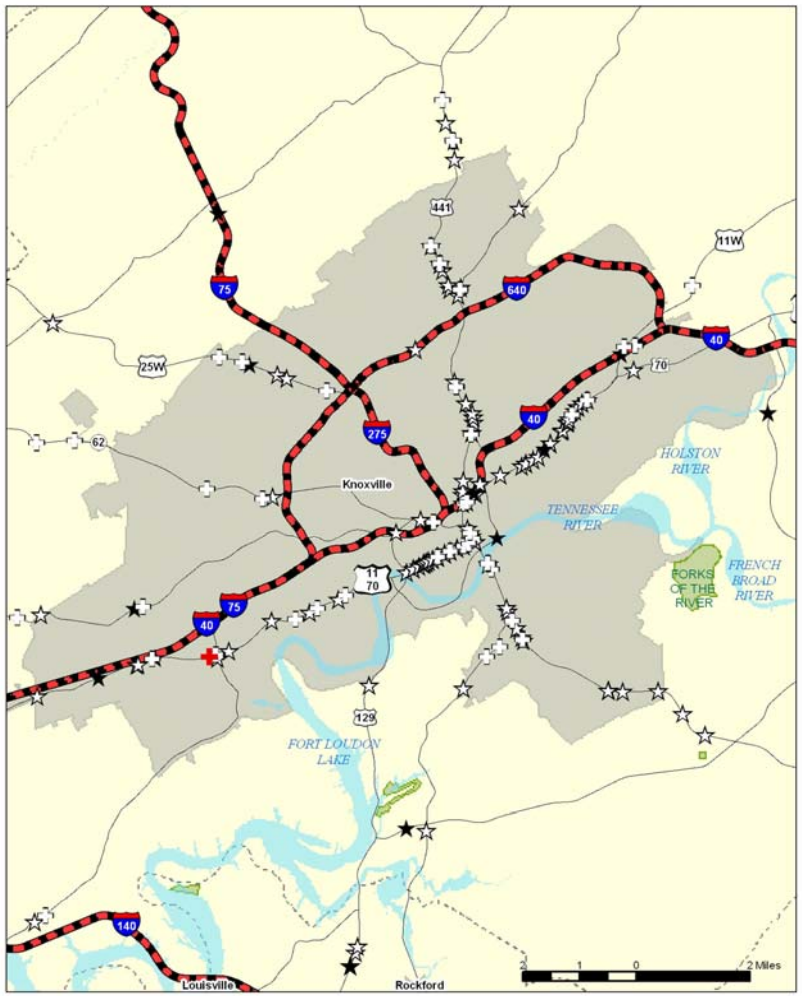
Table 4-2. Comparison of Statewide Bicycle and Pedestrian Deaths, 2001

State	Total Traffic Deaths	Resident Population (thousands)	Bicyclist Deaths	Bicyclist Deaths per Million Population	Pedestrian Deaths	Pedestrian Deaths per Million Population
Tennessee	1,251	5,745	5	0.87	78	13.58
Florida	3,011	16,355	127	7.77	489	29.90
North Carolina	1,530	8,195	24	2.93	149	18.18
Texas	3,724	21,340	46	2.16	449	21.04
Mississippi	784	2,857	8	2.80	59	20.65
Georgia	1,615	8,394	20	2.38	146	17.39
US Total	42,116	285,093	728	2.55	4,882	17.12

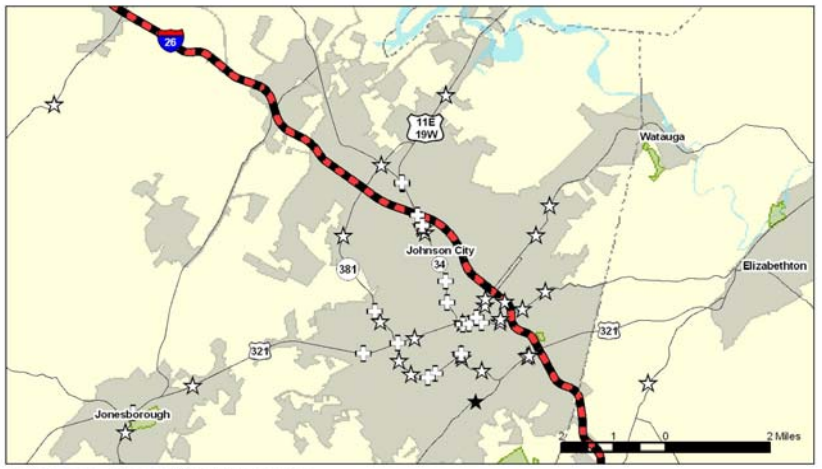
Over the past 10 years, bicyclists' injury and fatality rates have been decreasing. This is good news, but it does not tell the whole story. The available data indicates that fewer people are bicycling and walking while personal vehicle miles traveled has increased. Because fewer people are riding, fewer people are involved in crashes. However, several positive trends emerged from an analysis of pedestrian and bicycle crash data from the TRIMS database.

The crash analysis was conducted using TRIMS data for the years 1997-2001. These years were chosen for the crash analysis, since 2001 was the last year that complete information was provided. Overall, only a few state routes showed a significant number of crashes from 1997-2001, with only seven state routes having 10 or more crashes each year during this time period. This may indicate that most state highways are relatively safe, experiencing only a few, if any, crashes during any one year. The findings could also indicate that fewer bicyclists and pedestrians are using the state highways and, thus, the crash numbers are lower. The majority of crashes on state routes occurred at intersections, resulting primarily in non-fatal injuries to the bicyclist or pedestrian.

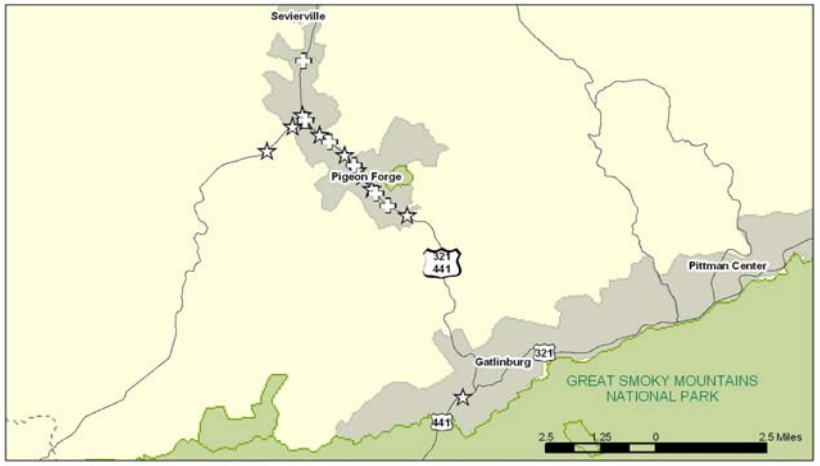

Kingsport
Bristol
Johnson City
Elizabethton
Morristown
Greeneville
Knoxville
Oak Ridge
Farragut
Sevierville
Maryville
Athens
Cleveland
75
81
26
40
11W
11E
25W
27
321
411
441
11
19W
19E
421
63
32
33
70
34
Tennessee Long-Range Transportation Plan
Region 1 Bicycle and Pedestrian Crashes
1997 - 2001
Map 4-9
TDOT
CRASHES
Fatal Bicycle Crash
Non-fatal Bicycle Crash
Fatal Pedestrian Crash
Non-fatal Pedestrian Crash
TDOT Region Border
Cities
Counties
Parks and Public Lands
Water
Miles
0 5 10 15 20



Knoxville Metropolitan Area



Jonesboro / Johnson City / Elizabethton



Sevierville / Pigeon Forge / Gatlinburg

Tennessee Long-Range Transportation Plan

Region 1: Selected Cities

Bicycle and Pedestrian Crashes 1997 - 2001

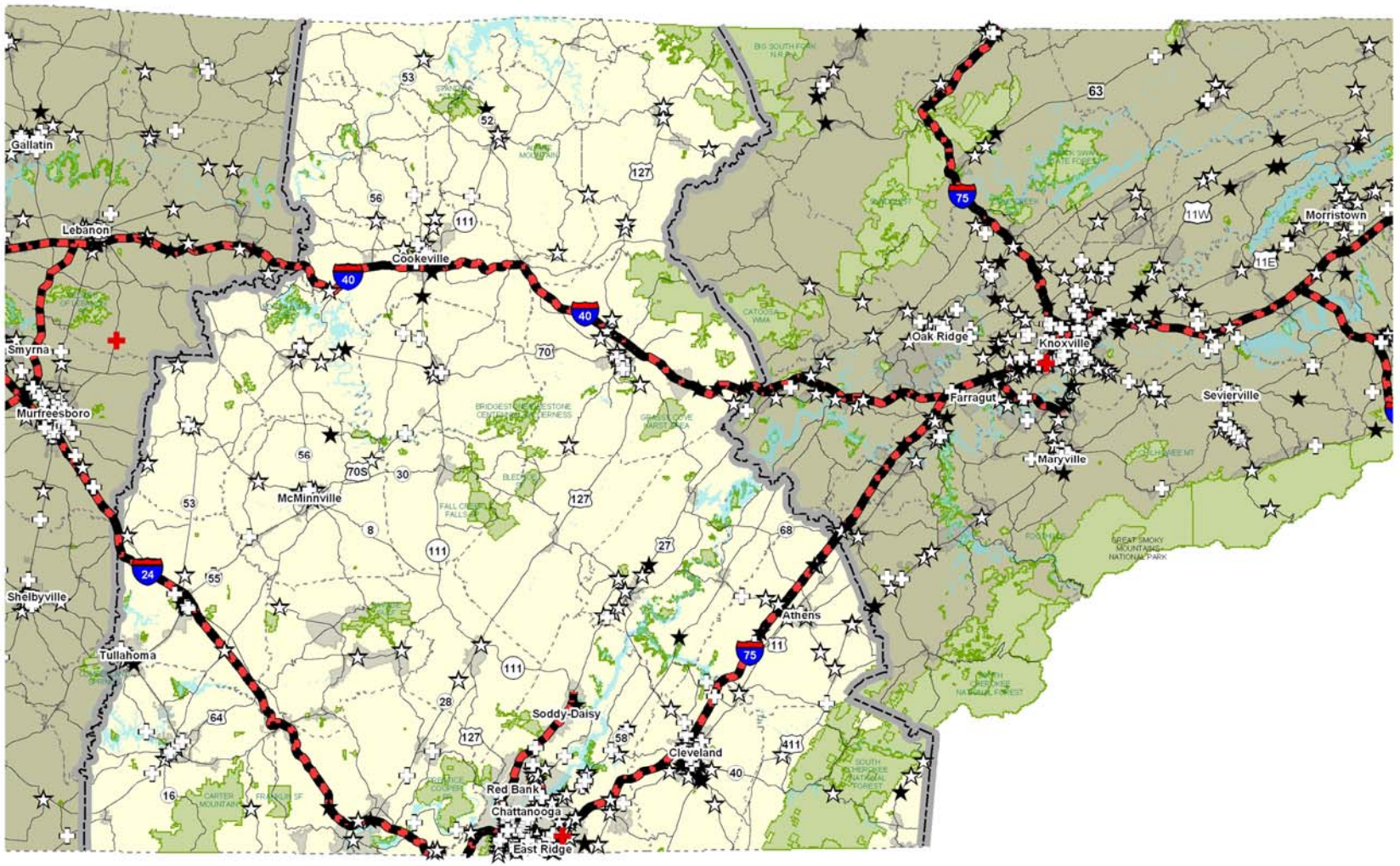
Map 4-10

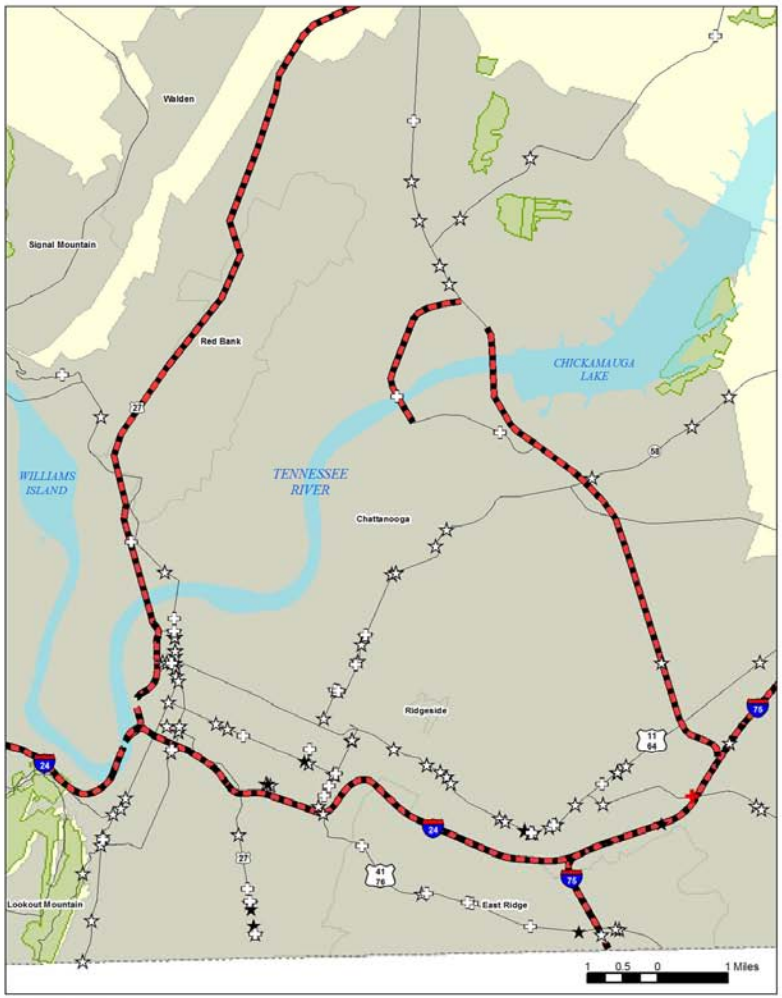
TDOT Go.

CRASHES

- Fatal Bicycle Crash
- Non-fatal Bicycle Crash
- Fatal Pedestrian Crash
- Non-fatal Pedestrian Crash

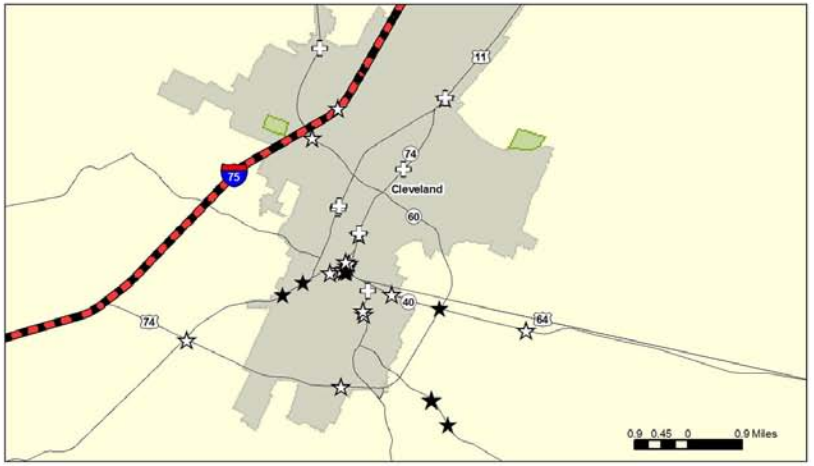
- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water


Gallatin
Lebanon
Cookeville
Smyrna
Murfreesboro
McMinnville
Shelbyville
Tullahoma
Soddy-Daisy
Red Bank
Chattanooga
East Ridge
Cleveland
Athens
Oak Ridge
Knoxville
Farragut
Maryville
Sevierville
Morristown
Tennessee Long-Range Transportation Plan
Region 2 Bicycle and Pedestrian Crashes
1997 - 2001
Map 4-11
TDOT Go.
CRASHES
Fatal Bicycle Crash
Non-fatal Bicycle Crash
Fatal Pedestrian Crash
Non-fatal Pedestrian Crash
TDOT Region Border
Cities
Counties
Parks and Public Lands
Water
N
W
E
S
Miles
0 5 10 15 20



Chattanooga

Cookeville



Cleveland

Tennessee Long-Range Transportation Plan

Region 2: Selected Cities

Bicycle and Pedestrian Crashes 1997 - 2001

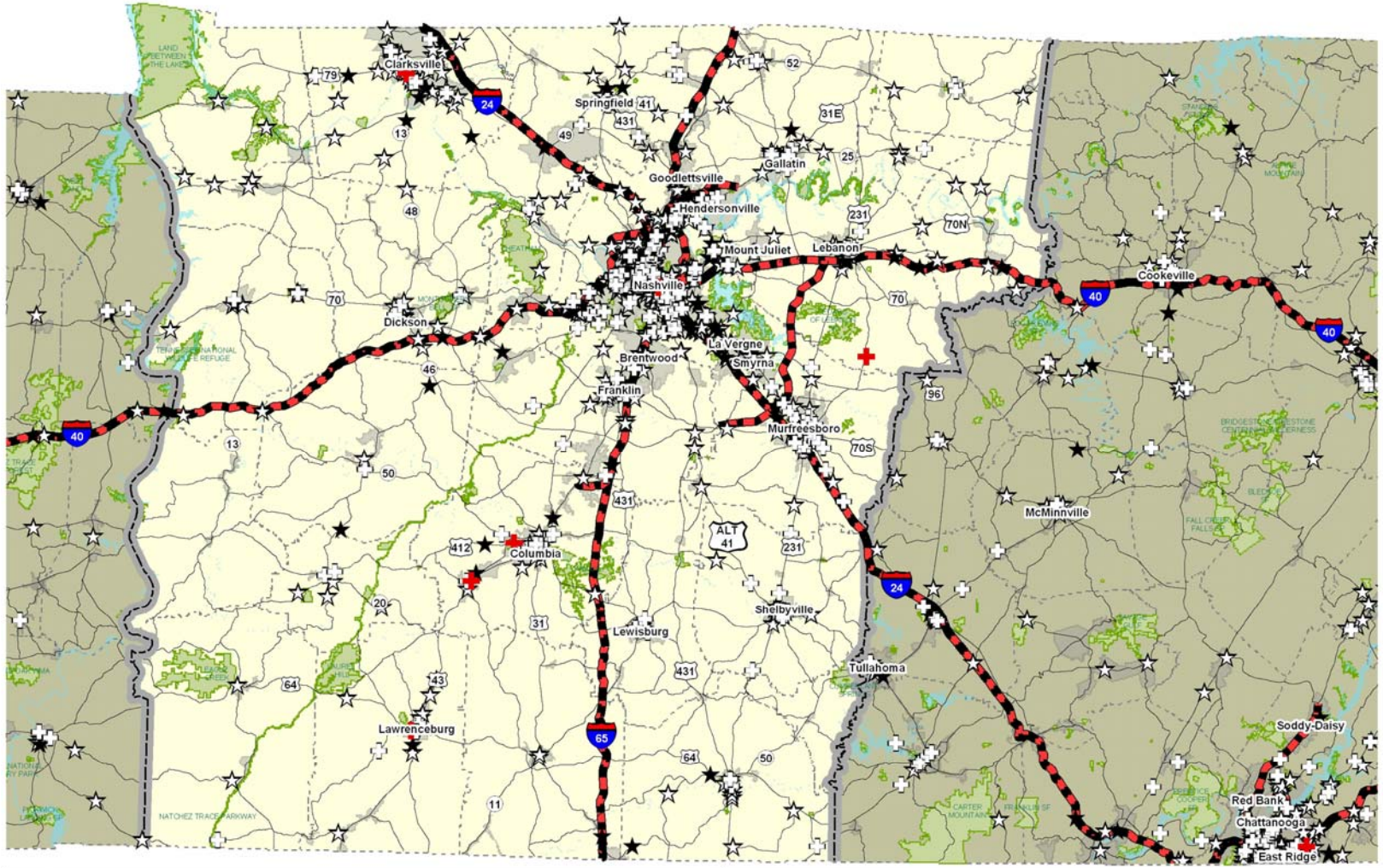
Map 4-12

TDOT Go.

CRASHES

- Fatal Bicycle Crash
- Non-fatal Bicycle Crash
- Fatal Pedestrian Crash
- Non-fatal Pedestrian Crash

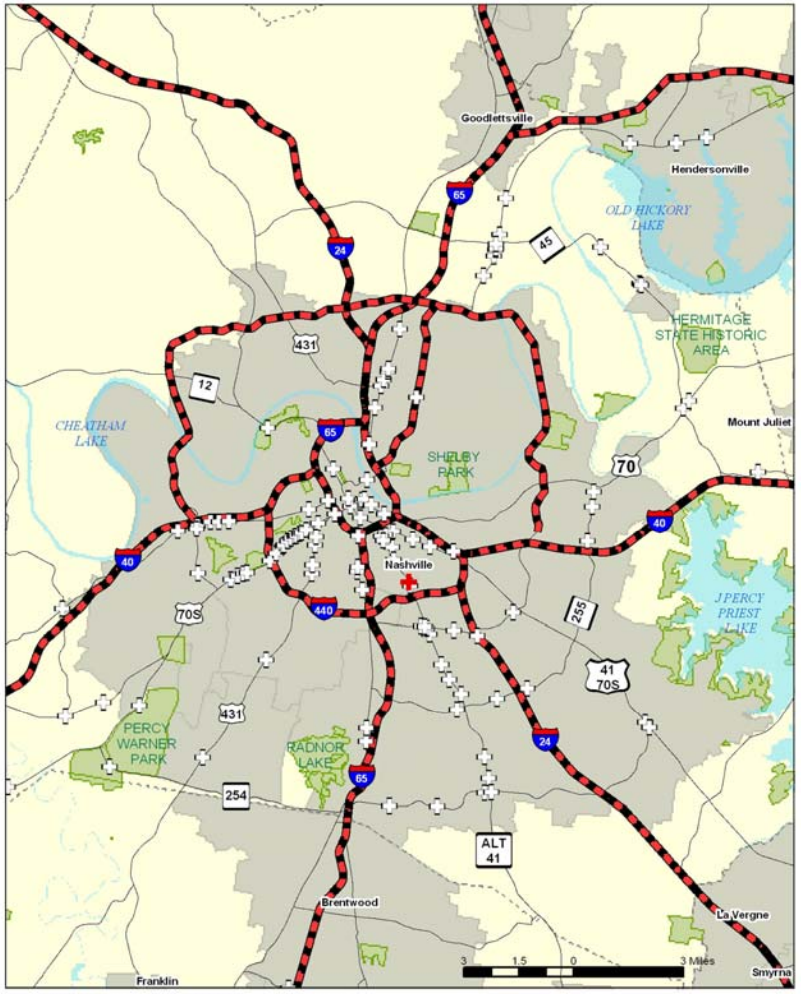
- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water



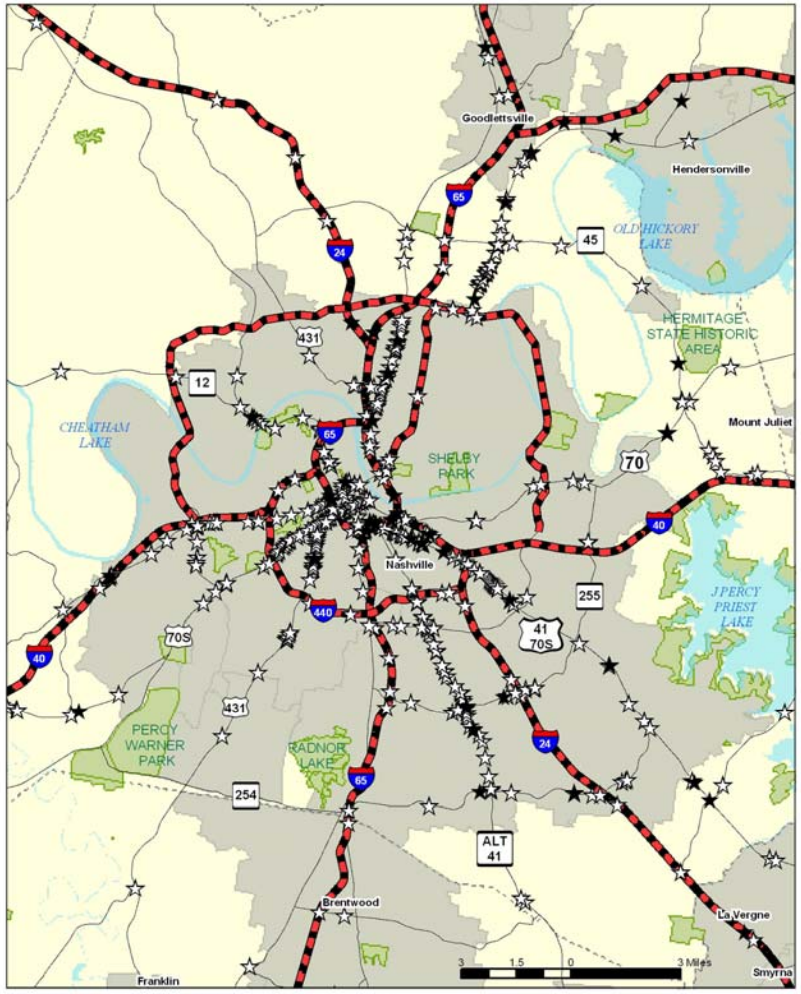
Tennessee Long-Range Transportation Plan

Region 3 Bicycle and Pedestrian Crashes
1997 - 2001

Map 4-13



Nashville Metropolitan Area: Bicycle Crashes



Nashville Metropolitan Area: Pedestrian Crashes

Tennessee Long-Range Transportation Plan

Region 3: Nashville

Bicycle and Pedestrian Crashes 1997 - 2001

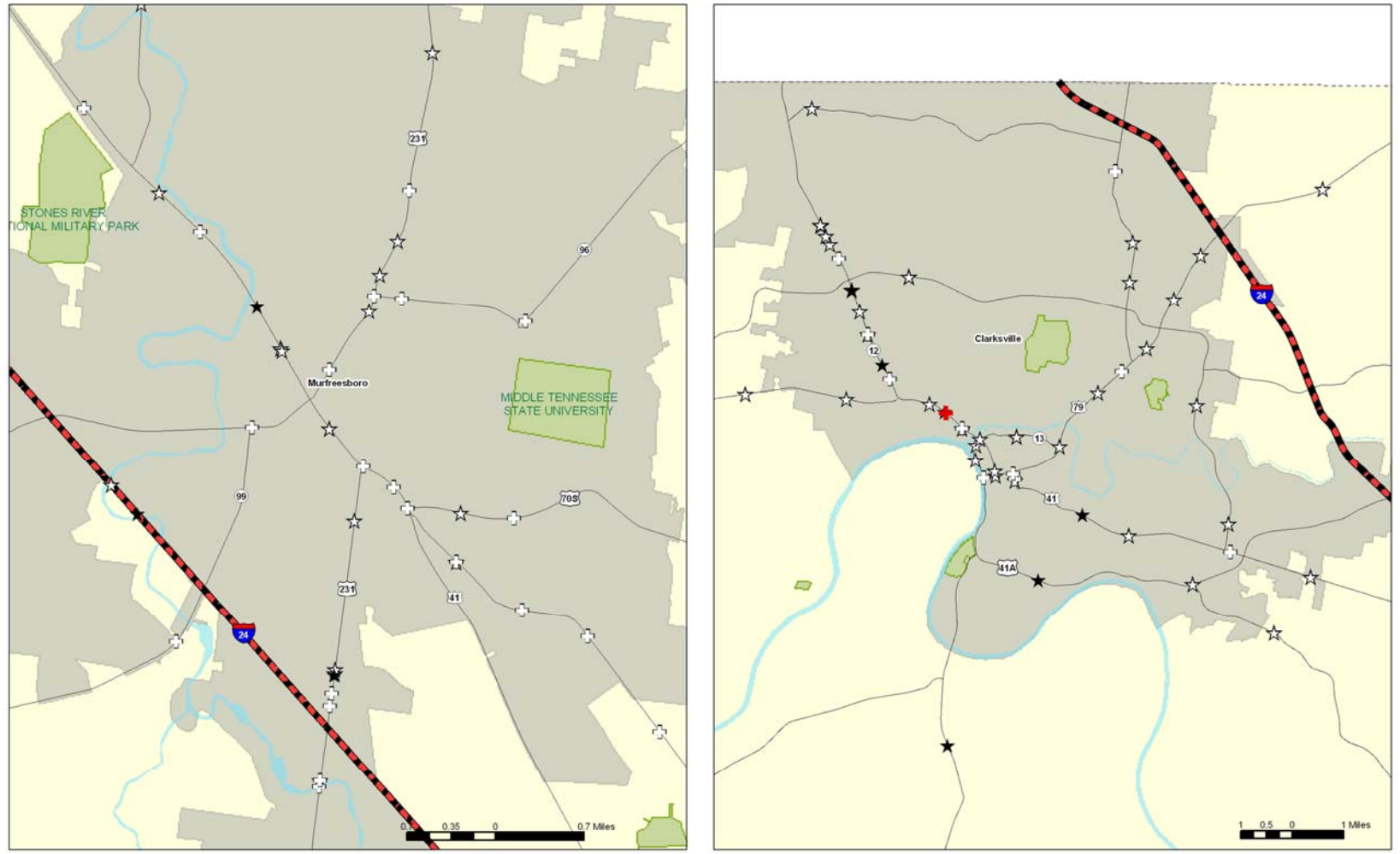
Map 4-14

TDOT Go.

CRASHES

- Fatal Bicycle Crash
- Non-fatal Bicycle Crash
- Fatal Pedestrian Crash
- Non-fatal Pedestrian Crash

- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water



Murfreesboro

Clarksville

Tennessee Long-Range Transportation Plan

Region 3: Selected Cities

Bicycle and Pedestrian Crashes 1997 - 2001

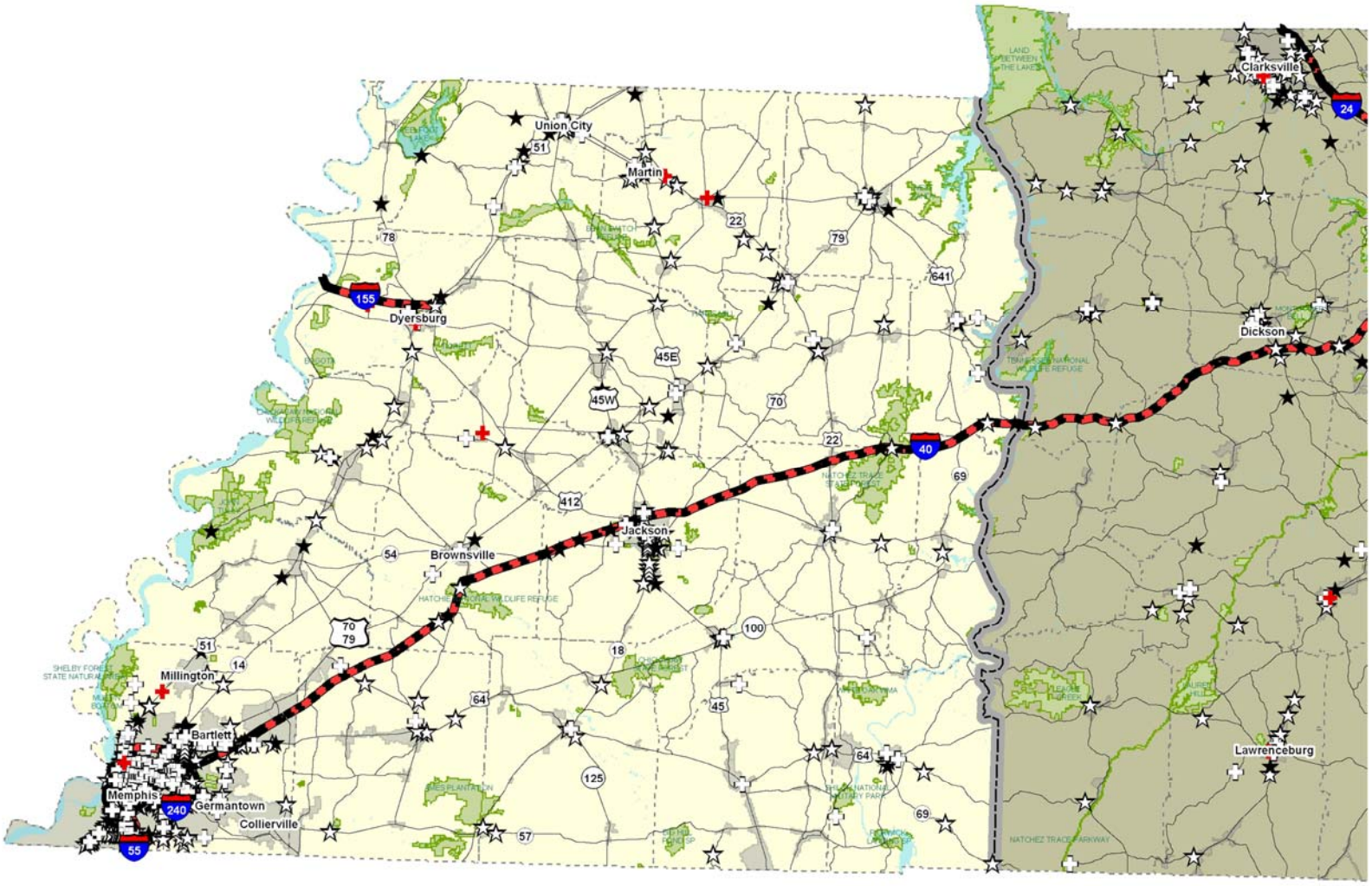
Map 4-15

TDOT Go.

CRASHES

- Fatal Bicycle Crash
- Non-fatal Bicycle Crash
- Fatal Pedestrian Crash
- Non-fatal Pedestrian Crash

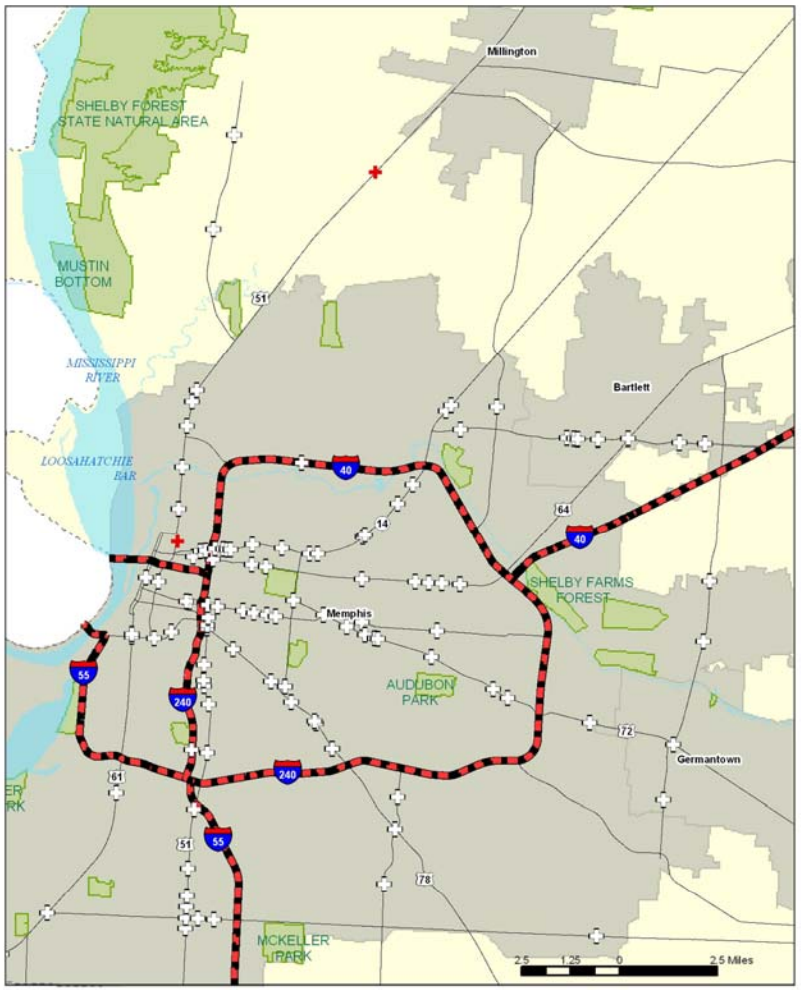
- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water



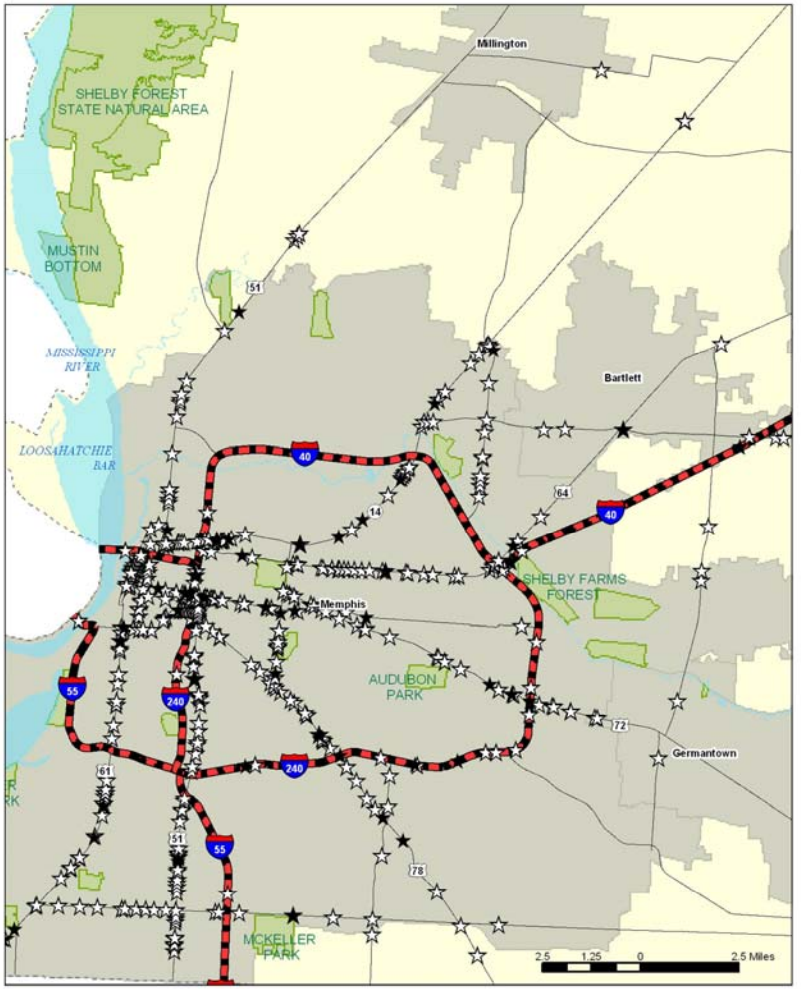
Tennessee Long-Range Transportation Plan

Region 4 Bicycle and Pedestrian Crashes
1997 - 2001

Map 4-16



Memphis Metropolitan Area: Bicycle Crashes



Memphis Metropolitan Area: Pedestrian Crashes

Tennessee Long-Range Transportation Plan

Region 4: Memphis

Bicycle and Pedestrian Crashes 1997 - 2001

Map 4-17

TDOT Go.

CRASHES

- Fatal Bicycle Crash
- Non-fatal Bicycle Crash
- Fatal Pedestrian Crash
- Non-fatal Pedestrian Crash

- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water

Jackson Area Bicycle and Pedestrian Crashes

Tennessee Long-Range Transportation Plan

Region 4: Jackson

Bicycle and Pedestrian Crashes 1997 - 2001

Map 4-18

TDOT Go.

CRASHES

- Fatal Bicycle Crash
- Non-fatal Bicycle Crash
- Fatal Pedestrian Crash
- Non-fatal Pedestrian Crash

- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water

N W E S

Miles

0 0.4 0.8 1.2 1.6

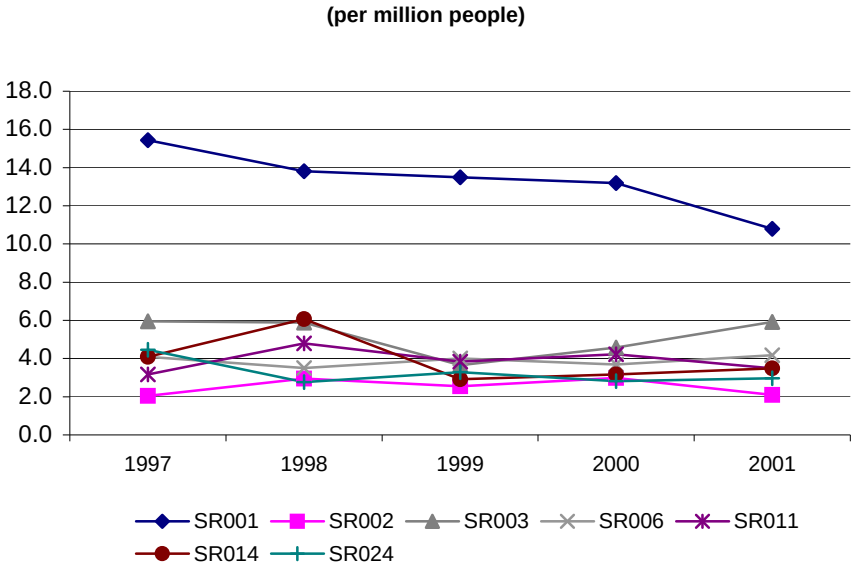
Figure 4-5. Pedestrian Fatalities and Spending on Walking and Bicycling by State

State	Average Annual Pedestrian Deaths (2002-2003)	Average Annual Pedestrian Deaths per 100,000 Capita (2002-2003)	Portion of All Traffic Deaths that were Pedestrians (2002-2003)	Percent of All Federal Transportation Funds Spent on Bicycle/ Pedestrian Projects (FY1998-FY2003)
Alabama	63	1.40	6.2%	0.8%
Alaska	13	1.94	13.6%	2.5%
Arizona	141	2.55	12.5%	0.6%
Arkansas	37	1.36	5.8%	1.3%
California	719	2.04	17.3%	0.9%
Colorado	67	1.47	9.7%	0.9%
Connecticut	42	1.21	13.6%	1.0%
Delaware	18	2.15	13.2%	2.0%
Florida	503	2.98	16.0%	1.6%
Georgia	162	1.88	10.3%	1.2%
Hawaii	29	2.28	22.4%	0.9%
Idaho	14	1.03	5.0%	0.9%
Illinois	193	1.53	13.4%	1.0%
Indiana	58	0.93	7.1%	1.1%
Iowa	19	0.63	4.4%	1.0%
Kansas	25	0.90	5.0%	1.2%
Kentucky	59	1.43	6.3%	1.0%
Louisiana	96	2.14	10.7%	1.0%
Maine	14	1.04	6.4%	0.8%
Maryland	110	2.01	16.8%	0.6%
Massachusetts	73	1.13	15.7%	1.3%
Michigan	173	1.71	13.5%	0.9%
Minnesota	52	1.02	7.8%	1.8%
Mississippi	48	1.65	5.4%	0.5%
Missouri	84	1.48	6.9%	1.4%
Montana	12	1.31	4.5%	1.0%
Nebraska	12	0.69	4.0%	1.6%
Nevada	61	2.76	16.3%	0.8%
New Hampshire	13	1.01	10.2%	1.6%
New Jersey	162	1.88	21.3%	0.4%
New Mexico	56	3.01	12.6%	0.8%
New York	341	1.78	22.5%	0.7%
North Carolina	164	1.96	10.6%	0.6%
North Dakota	5	0.71	4.5%	0.8%
Ohio	95	0.83	7.0%	0.8%
Oklahoma	46	1.30	6.5%	0.9%
Oregon	49	1.38	10.3%	1.1%
Pennsylvania	165	1.33	10.3%	0.4%
Rhode Island	12	1.07	12.2%	1.5%
South Carolina	89	2.16	8.8%	0.2%
South Dakota	9	1.18	4.7%	0.2%
Tennessee	85	1.45	7.1%	1.1%
Texas	408	1.86	10.9%	0.4%
Utah	27	1.13	8.3%	1.1%
Vermont	6	0.89	7.5%	2.4%
Virginia	87	1.19	9.4%	0.5%
Washington	74	1.20	11.7%	1.6%
West Virginia	25	1.38	6.0%	0.1%
Wisconsin	53	0.97	6.4%	1.1%
Wyoming	6	1.10	3.2%	0.9%
U.S. Total (excl. DC)	4,861	1.68	11.4%	0.9%

Source: Surface Transportation Policy Project, Mean Streets, 2004

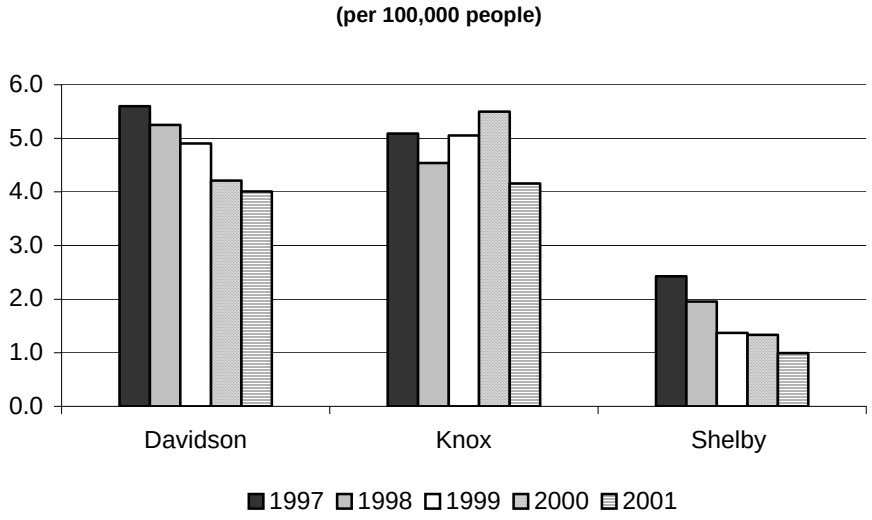
An initial analysis revealed that seven state routes had 10 or more crashes per year each year since 1997. Overall, the majority of these seven state routes recorded fewer crashes each year from 1997 to 2001, while accounting for around 40% of total crashes for each of those years. Many of the state routes saw a significant decrease in the crash rate, most noticeably US 70 / ALT 70. US 51, traveling north-south through the western most counties, might require further investigation, since the crash rate increased steadily from 1999 – 2001 (Figure 4-6).

Figure 4-6. Crash Rates for State Routes with 10 or More Pedestrian and Bicycle Crashes per Year: 1997 - 2001



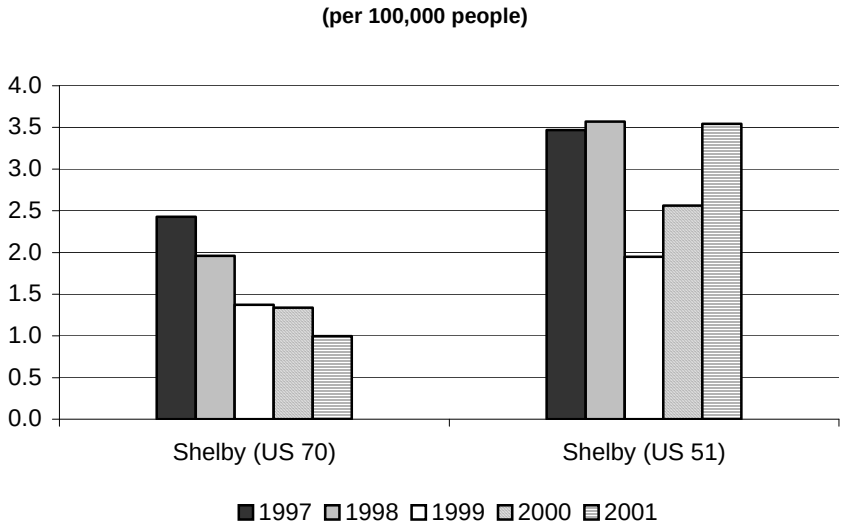
The significantly higher crash rate for US 70 can be attributed to two major factors. US 70 is a primary east-west route, extending almost the entire length of Tennessee. As such, the route travels through many of the more densely populated counties in Tennessee. Looking at three of these counties shows that the reduction in the US 70 crash rate can be directly tied to the crash rate reductions in Davidson and Shelby Counties (Figure 4-7).

Figure 4-7. US 70 Bicycle and Pedestrian Crash Rates, 1997-2001



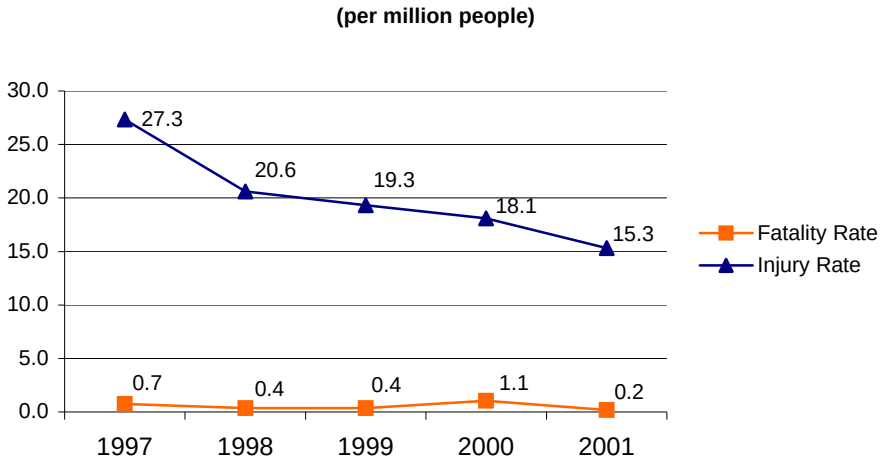
Additional analysis of the crashes on US 70 and US 51 showed that while Shelby County experienced the greatest decrease in crash rates on US 70, the overwhelming majority of the crashes on US 51 took place within Shelby County, indicating that bicyclists and pedestrians may be utilizing different routes than in the past in Shelby County (Figure 4-8).

Figure 4-8. Shelby County Bicycle and Pedestrian Crash Rates, 1997-2001



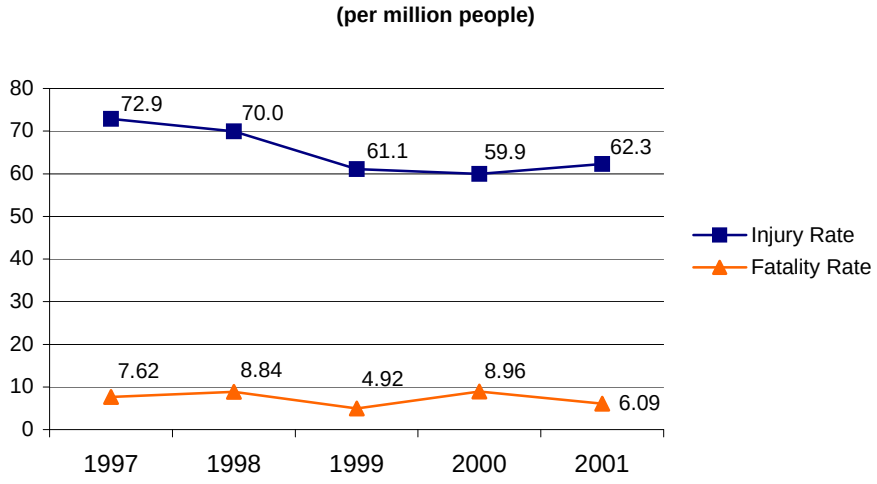
The trends for bicyclists are similar to trends demonstrated by the state routes over the five-year period. The crash rate resulting in bicyclist injuries has decreased each year from 1997 to 2001, while crashes resulting in fatalities have generally been declining, with 2000 being an exception to that trend. One possible reason is that, overall, there is a smaller percentage of bicyclists on the road now than in past years. However, another reason may be that motorists and bicyclists have learned to share the road better, resulting in fewer crashes.

Figure 4-9. Bicycle Crash Rate in Tennessee, 1997-2001



The trends for pedestrians are similar to trends demonstrated earlier over the five year period, as crash rates resulting in pedestrian injuries decreased each year from 1997 to 2000, although they slowly started rising again after 2000. A possible reason for the slow increase could be the larger number of people walking and driving, increasing the chances of a crash occurring. Crashes resulting in pedestrian fatalities have fluctuated over the five-year period, with no clear trends (Figure 4-10).

Figure 4-10. Pedestrian Crash Rate in Tennessee, 1997-2001



Logically, the majority of bicycle and pedestrian collisions on State Routes have occurred in counties that house the state's largest metropolitan areas: Shelby County (Memphis), Davidson County (Nashville), Hamilton County (Chattanooga), Knox (Knoxville), and Montgomery (Clarksville). Shelby County has the largest population and generally the largest number of fatalities and injuries for both bicyclists and pedestrians; however, the pedestrian injury and fatality rate for Shelby County matches up well when compared with other populous Tennessee counties. More noticeable is the dramatic decrease in the pedestrian

injury rate for Shelby County from 1998 to 1999. Shelby County was able to cut the injury rate from 14 people per 100,000 to only 8 people per 100,000; a 42% drop in the injury rate. (See Figure 4-11 and Figure 4-12) .

Figure 4-11. Pedestrian Injury Rate by Major Metropolitan County

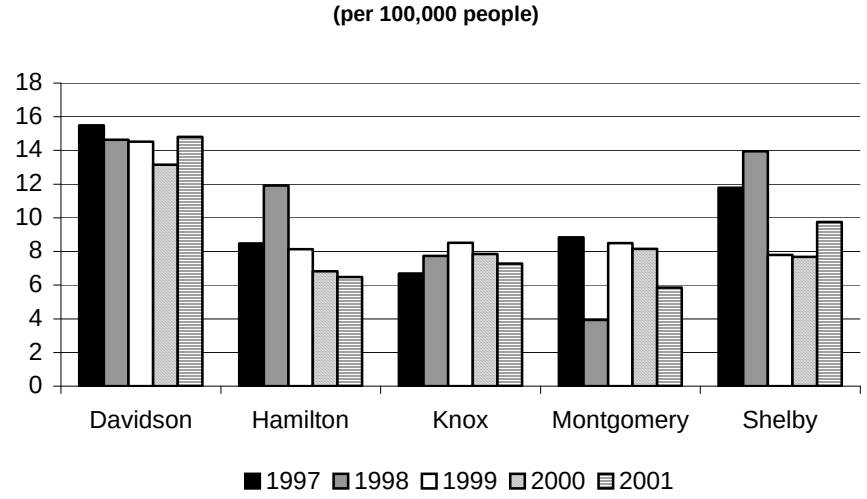
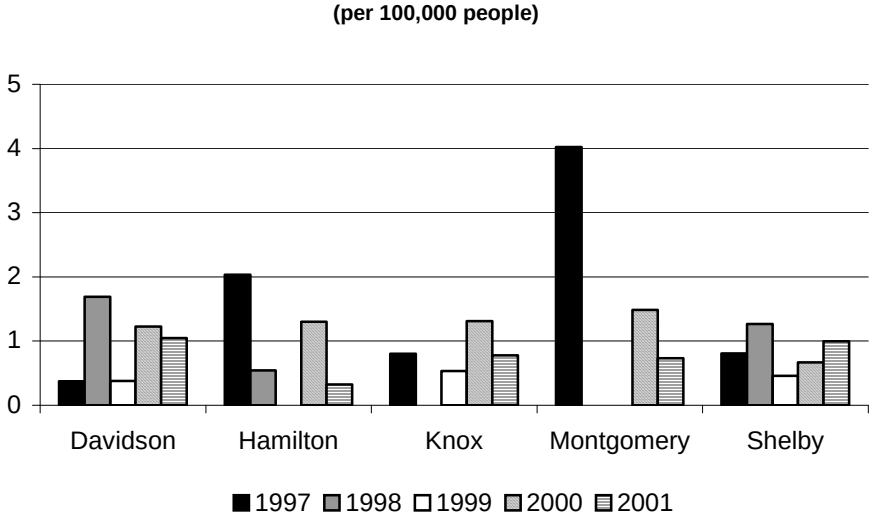
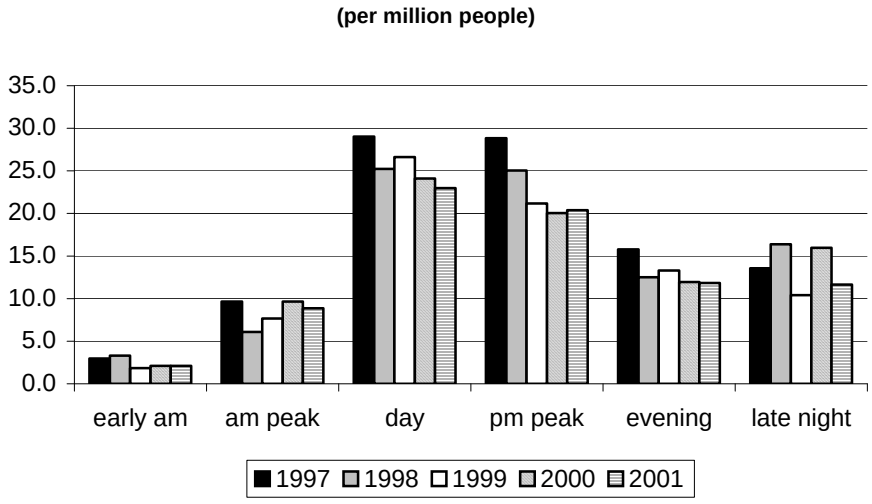


Figure 4-12. Pedestrian Fatality Rate by Major Metropolitan County



Additionally, an analysis was undertaken of other variables available in the TRIMS database, such as weather and time of day, that might correlate with the crash data to better explain the trends illustrated above. Looking at the time of day segments for the years 1997-2001 shows overall that as the day went on, the pedestrian and bicyclist crash rate increased. This is particularly noticeable in the pm peak hours, where the three-hour period accounts for only 12.5% of the day, yet the time segment sees between 20% and 30% of crashes. This makes intuitive sense, as a large number of people are getting out of school or off work at that time and traveling to other locations (Figure 4-13).

Figure 4-13. Bicycle and Pedestrian Crash Trends by Time Segment, 1997-2001



These rates are supported by an analysis of the weather and lighting conditions from the TRIMS database. From 1997-2001, over 60% of the crashes occurred under clear weather conditions, while over 55% of the crashes occurred during daylight hours.

State crash data can be used as an indicator for problem locations on state highways but, ultimately, bicycle and pedestrian safety is a personal and local commitment. State plans and state staff provide data, resources, tools, standards, and advice. Program choice and implementation are the responsibility of the town, county, and city in their efforts to make safe and welcoming places for bicyclists and pedestrians. Detailed recommendations for improving data quality and collection techniques for TDOT are found in Chapter 7 of this document.

Necessary decisions fall into four areas:

1. **Safe bicycling and walking facilities.** While state and local programs may emphasize different aspects of bicycling (e.g., touring, commuting, child cycling, etc.), it is important that the facilities provided are safe for the users.
2. **Effective outreach.** Bicyclists, pedestrians, and motorists must be educated on the need to safely share the roadway where necessary and to respect non-shared spaces such as bike lanes and pedestrian walkways.
3. **Improved crash prevention.** Communities must develop ways to expand bicycle-related crash prevention knowledge, and to improve the skills and judgment of children, parents, adult cyclists, and motorists.
4. **Selective enforcement.** Effective selective enforcement campaigns are necessary to communicate that bicycle safety is an important part of a safe community and that reduction of violations can eliminate 90% of bicycle/motor vehicle crashes.

Chapter 5
Needs Analysis

5.1 Survey and Workshop Results

The following needs have also been identified by the general public in the LRTP public comments collected via an on-line and paper survey. Comments from 2,572 respondents included:

- Cities/counties/state should provide wider shoulders or bike lanes especially on scenic routes and in cities.
- Cities/counties/state should provide additional greenways and pathways.
- Urban bikeway systems need better connectivity, especially at major freeways.
- Better maintenance on shoulders is needed.
- Lack of courtesy from motorists (better education and enforcement is needed).
- Adequate pedestrian walkways are needed.
- Crossing some intersections can be very challenging.
- Sidewalk conditions are often poor.

Bicycling and walking issues together accounted for a significant share of all comments collected in the survey process. In addition to these surveys, meetings were held with local agencies and organizations to gain direct input, including Knoxville (April 2, 2004), Townsend (April 3, 2004), and Chattanooga (April 5, 2004). Regional governments in Tennessee, such as Knox County, have conducted their own surveys as part of their planning efforts as well.[2]

5.2 User Characteristics and Needs

The purpose of reviewing the needs of bicyclists and pedestrians is twofold: (1) it is instrumental when planning a system that must serve all user groups, and (2) it is useful when pursuing competitive funding and attempting to quantify future usage and benefits to justify future expenditures of limited resources.

5.3 Bicyclists

When discussing the needs of the current and future user of planned bicycle facilities, it is important to keep in mind two considerations: (1) the ability and comfort level of the bicyclist, and (2) the purpose of the bicycle trip.

Due to the nature of most state highways, this plan primarily addresses the needs of Type A and B users. User types are defined below:

- Type A: Advanced
- Type B: Basic

[2] Knoxville Regional Bicycle Plan, 2002, p. 1/12.

- Type C: New riders and Children

Type A riders are advanced or expert riders who are generally using their bicycles as they would a motor vehicle and are typically comfortable riding with motor vehicle traffic. Expert riders are generally riding for convenience and speed, and desire direct access to destinations with a minimum of detour or delay. Sufficient operating space on the traveled way or shoulder needs to be provided to eliminate the need for either the bicyclist or a passing motor vehicle to shift position.

Type B riders are basic or less confident adult riders, or casual riders who prefer to avoid roads with fast and busy motor vehicle traffic, unless there is ample roadway width to allow easy overtaking by faster motor vehicles. Type B riders may be using their bicycles for transportation purposes, e.g., to get to the store or to visit friends, but may also be riding for recreational purposes. Casual riders are more comfortable riding on neighborhood streets and shared use paths. Designated facilities such as bike lanes or wide shoulder lanes should be provided on busier streets to accommodate the Type B rider.

Type C riders are inexperienced riders, often children who may not travel as fast as their adult counterparts. These riders require access to key destinations in their community, such as schools, convenience stores, and recreational facilities while generally avoiding major traffic streets. Routes along residential streets with low motor vehicle speeds, linked with shared use paths, and busier streets with well-defined pavement markings between bicycles and motor vehicles, can accommodate Type C riders.

5.3.1 Commuter Bicyclists

Commuter bicyclists in Tennessee range from employees who ride to work to children who ride to school. Millions of dollars nationwide have been spent attempting to increase the number of people who ride to work or school, with some success. The type of commuter bicyclists and the characteristics of their bicycling are summarized below.

- Commuter bicyclists typically fall into one of three categories: (1) adult employees, (2) students, and (3) shoppers.
- Commuter trips usually range from several blocks to ten miles.
- Commuters typically seek the most direct and fastest route available, with regular adult commuters often preferring to ride on arterials rather than side streets.
- Commute periods typically coincide with peak traffic volumes and congestion, increasing the exposure to potential conflicts with vehicles.
- Places to safely store bicycles are of paramount importance to all bicycle commuters.
- Major commuter concerns include changes in weather (rain), riding in darkness, personal safety, and security.
- Rather than be directed to side streets, most commuting adult cyclists would prefer to be given bike lanes or wider curb lanes on direct routes, which are often arterial streets (state highways).
- Intersections are a primary concern for bicyclists.

- Commuters generally prefer routes where they are required to stop as few times as possible, minimizing delay and conserving energy.
- Many younger students (ages 7-11) use sidewalks for riding to schools or parks, which is acceptable in areas where pedestrian volumes are low and driveway visibility is high. Older students (ages 12-14) who consistently ride at speeds over 10 mph should be directed to riding on streets wherever possible.
- Signal controls that function for bicyclists are of significant concern for bicyclists. For example, being able to trigger traffic signals.
- Facilities maintenance has also been identified numerous times as a significant concern for bicyclists. Keep roadway edges, shoulders, and bicycle lanes in good condition by sweeping, striping, and repairing damage to the roadway surface.

5.3.2 Recreational Bicyclists

The needs of recreational bicyclists in Tennessee must be considered, as they are often different from commuter bicycling. Though it is not quantitatively known, the impression is that Tennessee currently has a moderate level of recreational bicycling, but strong potential exists for increasing this activity in the State. A large number of school-aged people, adults, and retired people enjoy cycling. Additionally, many tourists in the state enjoy taking a bicycle to exercise in the pleasant weather or may travel specifically to the State to tour on one of the five existing State bicycle routes or the existing federally designated Natchez Trace bicycle route. Specific needs and patterns for recreational bicyclists are:

Safe bicycling facilities attract touring cyclists.

- Recreational bicycling typically falls into one of four categories: (1) exercise, (2) non-work destinations such as parks, (3) touring, long distance treks, or events, or (4) sight-seeing.
- Recreational users range from healthy adults to children to senior citizens. Each group has their own abilities, interests, and needs.
- Directness of the route is typically less important than routes with less traffic conflicts. Visual interest, shade, protection from weather, moderate gradients, or other “comfort” features are also very important.
- People exercising or touring often prefer a loop route rather than having to retrace their route.

5.4 Pedestrians

According to the 2000 U.S. Census, 49.7 million (19%) of non-institutionalized Americans over five years old have at least one long-term disability. The 2000 Census data shows that 792,723 (15.2%) of non-institutionalized Tennessee residents over five years old have long-term disabilities. Some people have more than one disability. With advances in health care, people are living longer. As our population ages, the proportion of people with disabilities is likely to grow. Moreover, most people endure temporary disabilities from injuries or illness at one or more points in their lives. By planning for people with disabilities, we can allow them to live independently and lead full, enriched lives. Most importantly, walking environments that accommodate people with disabilities also improve walking conditions for everyone else. People with strollers, carts, skateboards, and skates can use the same curb ramps and other improvements.

The following design principles represent a set of ideals which should be incorporated, to some degree, into every pedestrian improvement.

The pedestrian environment should be safe. Sidewalks, walkways, and crossings should be designed and built to be free of hazards and to minimize conflicts with external factors such as noise, vehicular traffic, and protruding architectural elements.

The pedestrian network should be accessible to all. Sidewalks, walkways, and crosswalks should ensure the mobility of all users by accommodating the needs of people regardless of age or ability.

Marked pedestrian crosswalks clearly delineate appropriate crossing locations.

The pedestrian network should connect to places people want to go. The pedestrian network should provide continuous direct routes and convenient connections between destinations, including homes, schools, shopping areas, public services, recreational opportunities, and transit.

The pedestrian environment should be easy to use. Sidewalks, walkways, and crossings should be designed so people can easily find a direct route to a destination and delays are minimized.

The pedestrian environment should provide good places. Good design should enhance the look and feel of the pedestrian environment. The pedestrian environment includes open spaces such as plazas, courtyards, and squares, as well as the building facades that give shape to the space of the street. Amenities such as street furniture, banners, art, plantings, and special paving, along with historical elements and cultural references, should promote a sense of place.

The pedestrian environment should be used for many things. The pedestrian environment should be a place where public activities are encouraged. Commercial activities such as

dining, vending, and advertising may be permitted when they do not interfere with safety and accessibility. Areas with higher pedestrian activity are generally safer than those that do not have pedestrians present.

Pedestrian improvements should be economical. Pedestrian improvements should be designed to achieve the maximum benefit for their cost, including initial and maintenance costs, as well as reduced reliance on more expensive modes of transportation. Where possible, improvements in the right-of-way should stimulate, reinforce, and connect with adjacent private improvements.

The single best indicator for pedestrian activity is land use zoning. Higher density land uses and retail/office zoning generally indicates a higher level of pedestrian activity. Land use zoning also indicates where future development will likely occur. Land uses that are of highest priority in serving pedestrian needs include:

- Schools and Universities
- Employment, retail, office and restaurant centers and corridors
- Downtowns, Main Streets
- Transit centers and stops
- Tourist attractions
- Higher-density residential areas
- Parks
- Annual festival sites

5.4.1 Children and Safe Routes to School

Children must be taken into account in pedestrian planning, particularly near schools and parks. Children are less mentally and physically developed than adults. They typically have less peripheral vision, less ability to judge speed and distance, difficulty locating sounds, read less than adults or not at all, sometimes act impulsively or unpredictably, and lack familiarity with traffic.

New programs are promoting walking and bicycling to school.

Thirty years ago, 66% of all children walked or bicycled to school. Now, 87% of all trips to and from school are by car or bus, and in some areas over 20% of morning traffic is a result of parents driving their children to school. The explanation for this change includes expanding low-density school districts, concerns about safety and security by parents, siting of new schools to the periphery of communities, and increases in traffic on local roadways.

Safe Routes to Schools programs are likely to be a major component of new Federal transportation legislation. This is partially a result of concerns about the health and inactivity of our children, and partially an attempt to lessen local traffic congestion in communities. Identifying and improving routes for children to safely walk and bicycle to school is one of the most cost effective means of reducing weekday morning traffic congestion and can help

reduce auto-related pollution. While the focus is on school areas, Safe Routes to School programs address issues that can improve quality of life for entire neighborhoods and communities – improving safety for pedestrians and bicyclists; reducing traffic speed and congestion; and increasing physical activity and health. Senior citizens and others will also benefit from improvements made for school children.

5.4.2 Transit Access

Integrated and consistent bicycling and walking facilities that complement a comprehensive transit system create a transportation synergy that can provide people with easy, quick, and inexpensive access to work, school, shopping, and other desirable destinations. People are able to take longer trips, pass over or through barriers, and increase a transit systems service area, ultimately making the transportation system more efficient without adding more capacity.

Bike racks on buses allow cyclists to commute longer distances.

The benefits of pedestrian-transit or bicyclist-transit travel in comparison with automobile travel are readily recognized: lower air pollutant emissions, reduced highway congestion, lower capital costs for park and ride facilities, reduction in the reliance on foreign oil, improved neighborhoods, and increased mobility. There are many benefits of realizing the full potential of integrating bicycle and transit methods of travel. Transit enables the bicyclist to take longer trips, allows bicyclists to pass over or through topographical barriers, and bicyclists can increase transit catchment areas without expanding the route system.

Pedestrian and bicycle facilities need to be designed to provide safe and direct access to transit stations and stops. These include continuous sidewalks and bicycle lanes, crosswalks, illumination, covered shelters, bicycle racks, and street treatments that improve safety across wide roadways including medians, pedestrian signals, and/or over- and under-crossings.

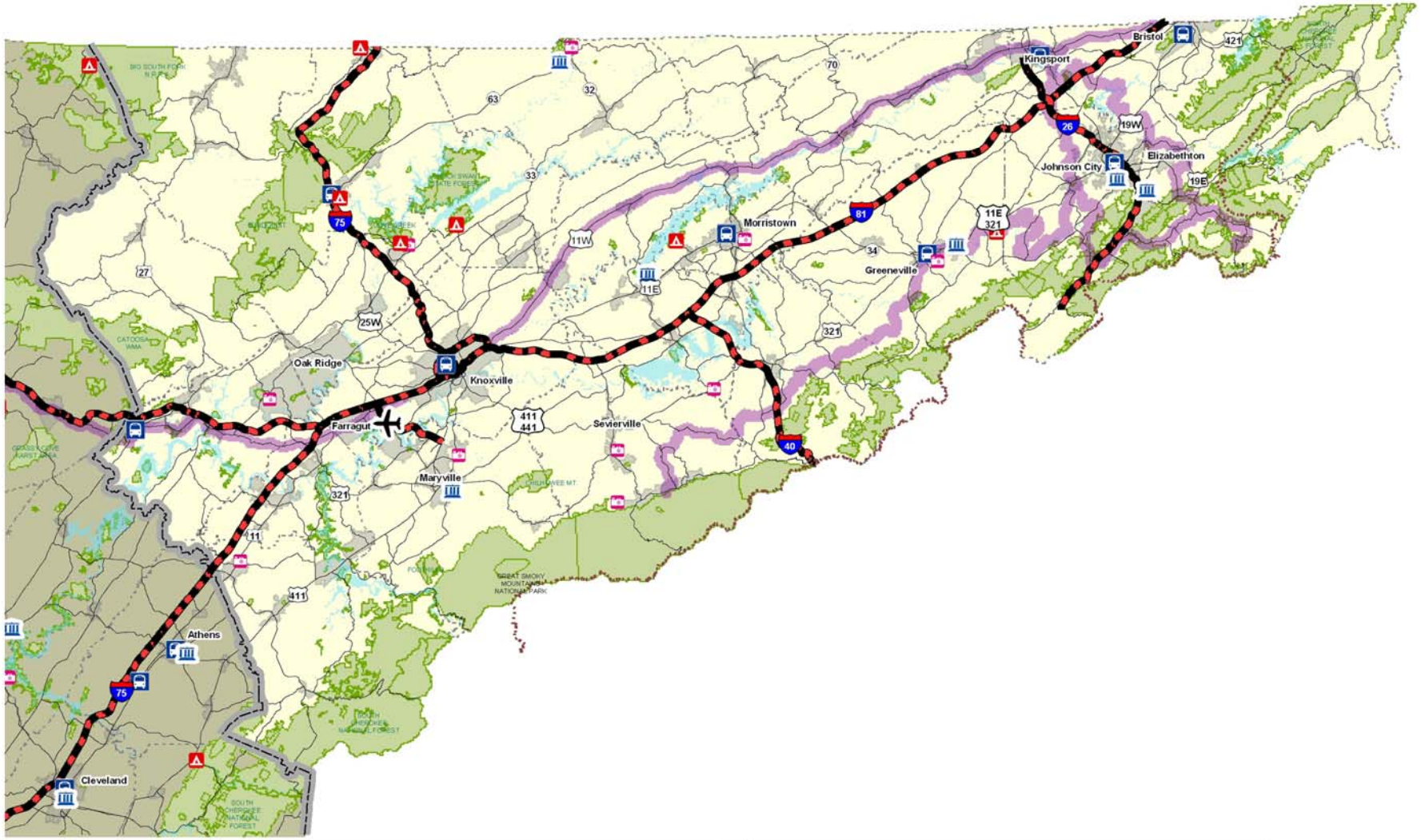
5.5 Attractors and Generators

An important component of developing bicycle and pedestrian networks is to provide connectivity between popular origins and destinations. At a statewide level, this means creating bicycle network connections between the larger origins and destinations across the state. These more prominent origins and destinations include cities and towns, national, state, and regional parks, universities and colleges, tourist attractions, and statewide transit facilities. The most prominent statewide attractors and generators have been organized in the four regions identified by TDOT (see Map 5¬1 through Map 5¬4) and are listed in Table 5-1 through Table 5-4.

Table 5-1. Region 1 Attractors and Generators

Region 1	
Tourist Attractions	
American Museum of Science and Energy	Oak Ridge
Andrew Johnson National Historic Site and Cemetery	Greeneville
Bristol Caverns	Bristol
Crockett Tavern and Museum	Morristown
Dollywood	Pigeon Forge
Exchange Place	Kingsport
Knoxville Zoo	Knoxville
Museum of Appalachia	Norris
Ober Gatlinburg Ski Resort and Amusement Park	Gatlinburg
Overmountain Victory National Historic Trail	
Rocky Mount Museum	Piney Flats
Sam Houston School House	Rockford
The Lost Sea	Sweetwater
Colleges and Universities	
Carson-Newman College	Jefferson City
East Tennessee State University	Johnson City
Johnson Bible College	Knoxville
King College	Bristol
Knoxville College	Knoxville
Lincoln Memorial University	Harrogate
Maryville College	Maryville
Milligan College	Johnson City
South College	Knoxville
The University of Tennessee	Knoxville
Tusculum College	Greeneville
Parks	
Appalachian National Scenic Trail	
Big Ridge State Park	
Big South Fork National River and Recreation Area	
Cove Lake State Park	
Cumberland Gap National Historic Park	
Davy Crockett Birthplace State Park	
Fort Loudon State Park	
Frozen Head State Park	

Great Smoky Mountains National Park	
Indian Mountain State Park	
Norris Dam State Park	
Panther Creek State Park	
Roan Mountain State Park	
Sycamore Shoals State Park	
Warrior's Path State Park	
Annual Events	
Dogwood Arts Festival, mid-April	Knoxville
Historic Rugby Pilgrimage of Homes, 1st weekend in October	Historic Rugby
NASCAR at Bristol Motor Speedway	Bristol
National Storytelling Festival, 1st weekend in October	Jonesborough
Rhododendron Festival, late June	Roan Mountain
Smoky Mountain Winterfest, mid-November	Gatlinburg, Pigeon Forge, Sevierville



Tennessee Long-Range Transportation Plan

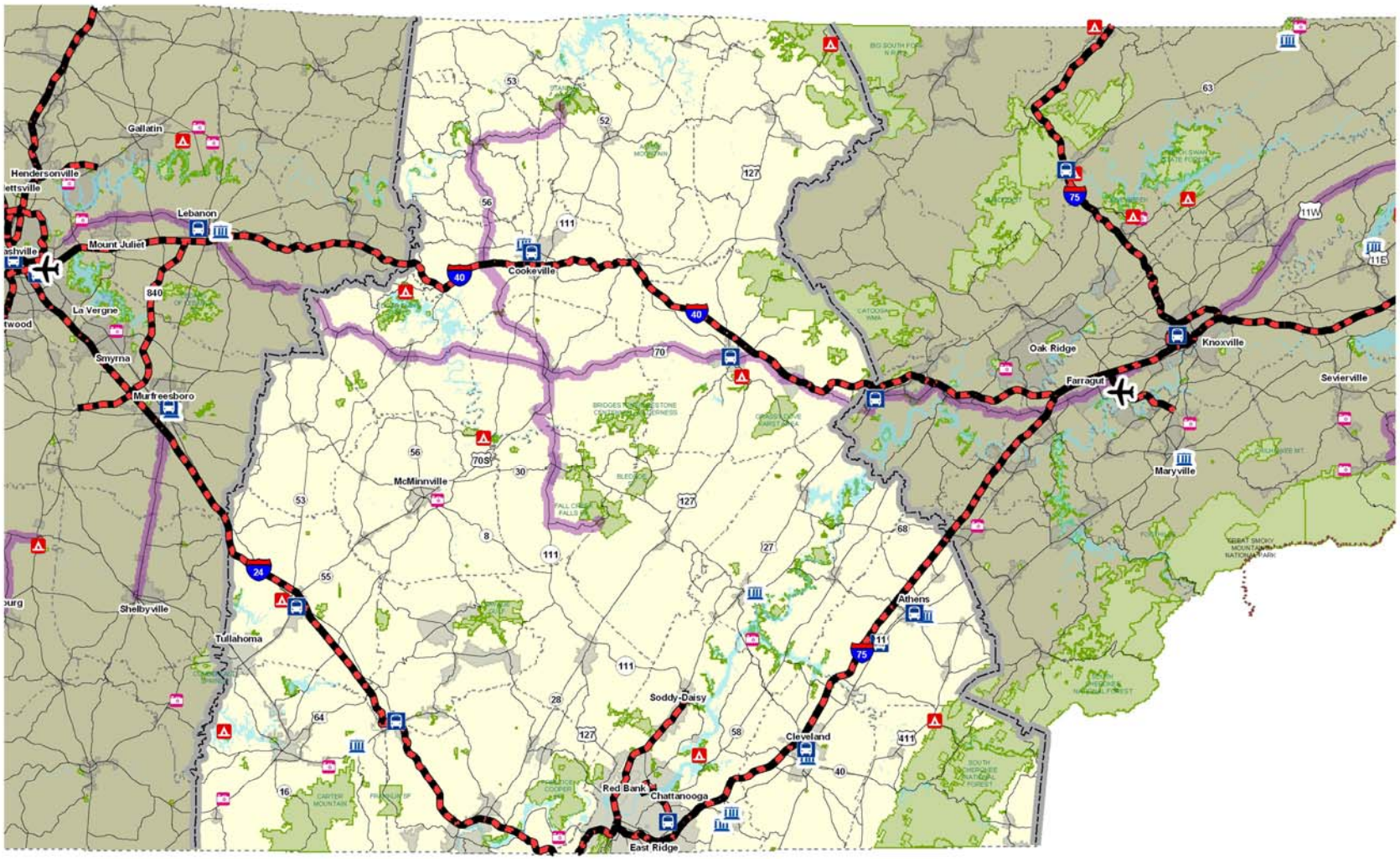
Region 1 Attractors and Generators

Map 5-1

Table 5-2. Region 2 Attractors and Generators

Region 2	
Tourist Attractions	
Cherokee Memorial Park	Birchwood
Cumberland Caverns Park	McMinnville
Falls Mill	Belvidere
Obed Wild & Scenic River	Wartburg
Raccoon Mountain Caverns	Chattanooga
Railroad Museum	Cowan
The Tennessee Aquarium	Chattanooga
Colleges and Universities	
Bryan College	Dayton
Lee University	Cleveland
Southern Adventist University	Collegedale
Tennessee Tech University	Cookeville
Tennessee Temple University	Chattanooga
Tennessee Wesleyan College	Athens
The University of the South	Sewanee
University of Tennessee	Chattanooga
Parks	
Booker T. Washington State Park	
Burgess Falls State Park	
Cordell Hull State Park	
Cumberland Mountain State Park	
Edgar Evins State Park	
Fall Creek Falls State Park	
Harrison Bay State Park	
Hiwassee/Ocoee Scenic River State Park	
Justin P. Wilson Cumberland Trail State Park	
Old Stone Fort State Park	
Pickett State Park	
Red Clay State Park	
Rock Island State Park	
Sgt. Alvin C. York Historic Park	
South Cumberland State Park	
Standing Stone State Park	
Tims Ford State Park	
Trail of Tears National Historic Trail	

Annual Events	
Fall Color Cruise and Folk Festival, last two weekends in October	Chattanooga
Old Time Fiddlers Jamboree, 1st weekend in July	Smithville



Tennessee Long-Range Transportation Plan

Region 2 Attractors and Generators

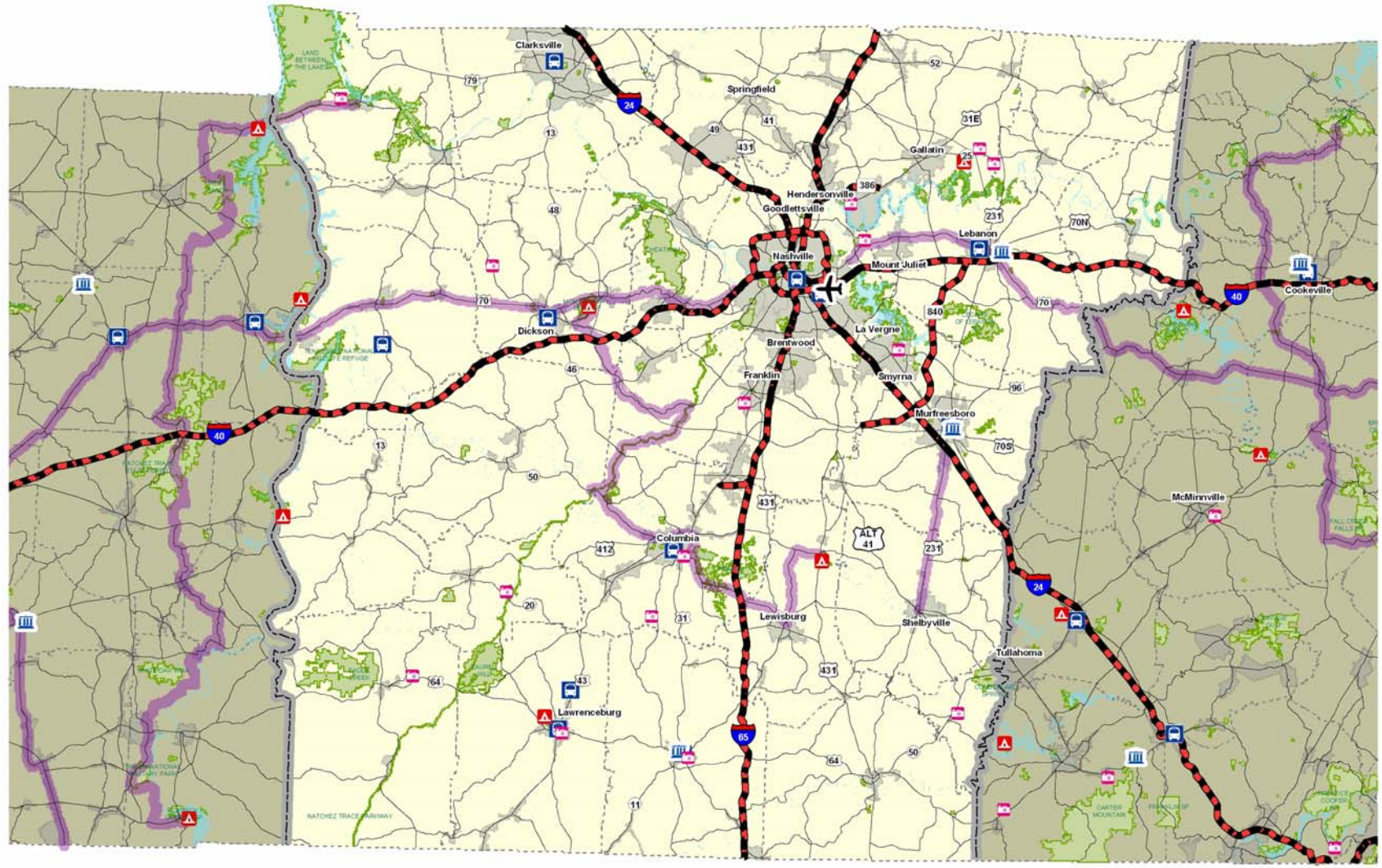
Map 5-2

TDOT Go.

Table 5-3. Region 3 Attractors and Generators

Region 3	
Tourist Attractions	
Carter House	Franklin
Cragfont	Gallatin
Davy Crockett cabin and Museum	Lawrenceburg
Home of James K. Polk	Columbia
Jack Daniels Distillery	Lynchburg
Jewel Cave	Dickson
Meriweather Lewis Monument	Columbia
Nashville Zoo	Nashville
Natchez Trace Parkway	
Natural Bridge	Waynesboro
Rock Castle	Hendersonville
Sam Davis Home	Smyrna
Sam Davis Memorial Museum	Pulaski
Southport Saltpeter Cave	Columbia
The Hermitage	Nashville
Wildlife Park	Nashville
Colleges and Universities	
Aquinas College	Nashville
Austin Peay State University	Clarksville
Belmont University	Nashville
Cumberland University	Lebanon
Fisk University	Nashville
Lipscomb University	Nashville
Martin Methodist College	Pulaski
Middle Tennessee State University	Murfreesboro
Meharry Medical College	Nashville
Tennessee State University	Nashville
Trevecca Nazarene University	Nashville
Vanderbilt University	Nashville
Parks	
Bicentennial Mall State Park	Nashville
Bledsoe Creek State Park	
Cedars of Lebanon State Park	
David Crockett State Park	
Dunbar Cave State Park	

Fort Donelson National Battlefield and Cemetery	Dover
Henry Horton State Park	
Johnsonville State Historic Park	
Long Hunter State Park	
Mousetail Landing State Park	
Narrows of the Harpeth	
Port Royal State Park	
Radnor Lake State Park	Nashville
Ross Creek Landing State Park	
Stones River National Battlefield and Cemetery	Murfreesboro
Trail of Tears National Historic Trail	
Annual Events	
Fan Fair, mid-June	Nashville
Mule Day, 1st weekend in April	Columbia
Tennessee Old-Time Fiddlers Championship, late March	Clarksville
Tennessee State Fair, mid-September	Nashville
Tennessee Walking Horse National Celebration	Shelbyville



Tennessee Long-Range Transportation Plan

Region 3 Attractors and Generators

Map 5-3

TDOT Go.

ATTRACTORS AND GENERATORS

- Railroad and Bus Service
- Major Airport
- Camping
- Tourist Attraction
- University / College
- State Bicycle Route
- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water

N W E S

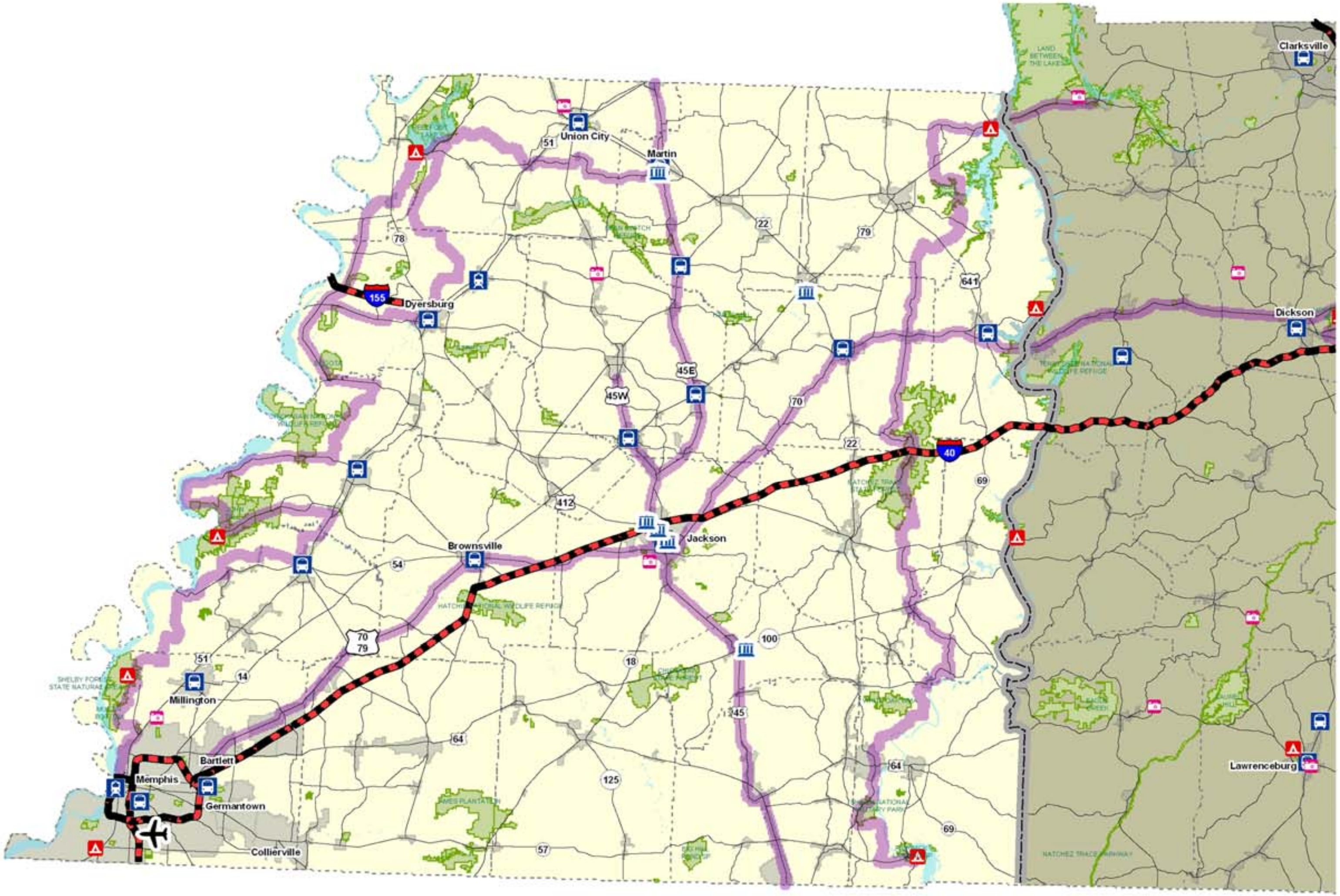
Miles

0 4 8 12 16

Table 5-4. Region 4 Attractors and Generators

Region 4	
Tourist Attractions	
Beale Street	Memphis
Casey Jones Home and Railroad Museum	Jackson
Crockett Cabin	Rutherford
Dixie Gun Works Museum	Union City
Graceland	Memphis
Memphis Motorsports Park	Memphis
Memphis Pink Palace Museum	Memphis
Memphis Zoo	Memphis
Mud Island	Memphis
National Civil Rights Museum	Memphis
Peabody Hotel	Memphis
Colleges and Universities	
Baptist Memorial College of Health Sciences	Memphis
Bethel College	McKenzie
Crichton College	Memphis
Christian Brothers University	Memphis
Freed-Hardeman University	Henderson
Lambuth University	Jackson
Lane College	Jackson
LeMoyne-Owen College	Memphis
Memphis College of Art	Memphis
Rhodes College	Memphis
Union University	Jackson
University of Memphis	Memphis
University of Tennessee-Martin	Martin
University of Tennessee-Memphis	Memphis
Parks	
Big Cypress Tree State Park	
Big Hill Pond State Park	
Chickasaw State Park	
Fort Pillow State Historic Park	
Meeman-Shelby Forest State Park	
Nathan Bedford Forest State Park	
Natchez Trace State Park	
Paris Landing State Park	

Pickwick Landing State Park	
Pinson Mounds State Park	
Reelfoot Lake State Park	
Ross Creek Landing State Park	
Shiloh National Cemetery and Military Park	
T.O. Fuller State Park	
Trail of Tears National Historic Trail	
Annual Events	
Elvis International Tribute Week, mid-August	Memphis
Memphis in May	Memphis
World's Largest Fish Fry, late April	Paris



Tennessee Long-Range Transportation Plan

Region 4 Attractors and Generators

Map 5-4

TDOT Go.

ATTRACTORS AND GENERATORS

- Railroad and Bus Service
- Major Airport
- Camping
- Tourist Attraction
- University / College
- State Bicycle Route
- TDOT Region Border
- Cities
- Counties
- Parks and Public Lands
- Water

N W E S

Miles
0 4 8 12 16

Chapter 6

Proposed State Bicycle System

6.1 State Bicycle Routes

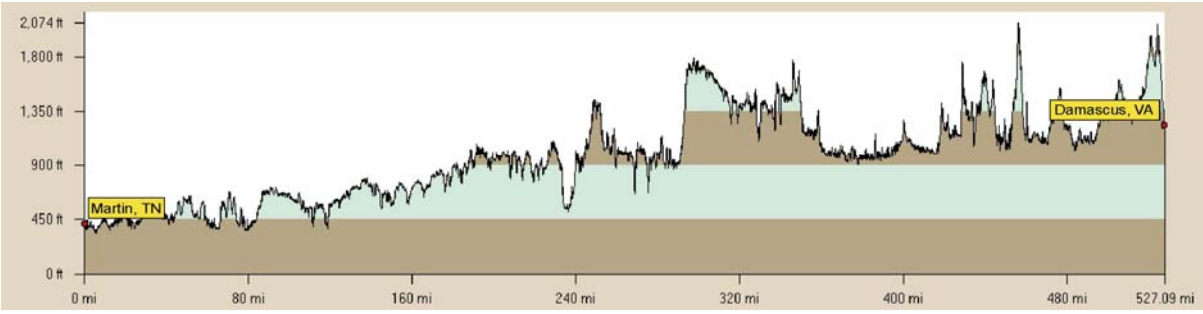
Building on the existing state bicycle routes, this plan proposes eight new state bicycle routes that connect to various state parks and natural areas, cities and towns, scenic areas, tourist attractions, and other destinations throughout the state (Map 6¬1 on page 6-2). Most of the routes connect to existing or planned bicycle routes in adjoining states, including Kentucky, North Carolina, Virginia, Missouri, Arkansas, Georgia, and Mississippi.

The proposed state bicycle routes were developed utilizing input from the suitability index, attractor and generator analysis, identifying scenic corridors, proximity to existing or planned bicycle routes in adjoining states, and regional knowledge. The proposed routes were developed with the recreational touring bicyclist in mind and highlight low-volume rural highways that have some paved shoulders. This Plan provides a jumping off point for the State to engage local communities, field check the routes, and develop fully comprehensive maps, a signing system, and web-based information about the tours. They also provide an opportunity to work with the Tennessee Department of Tourism to produce a web-based accommodation guide for cities and towns along the proposed routes.

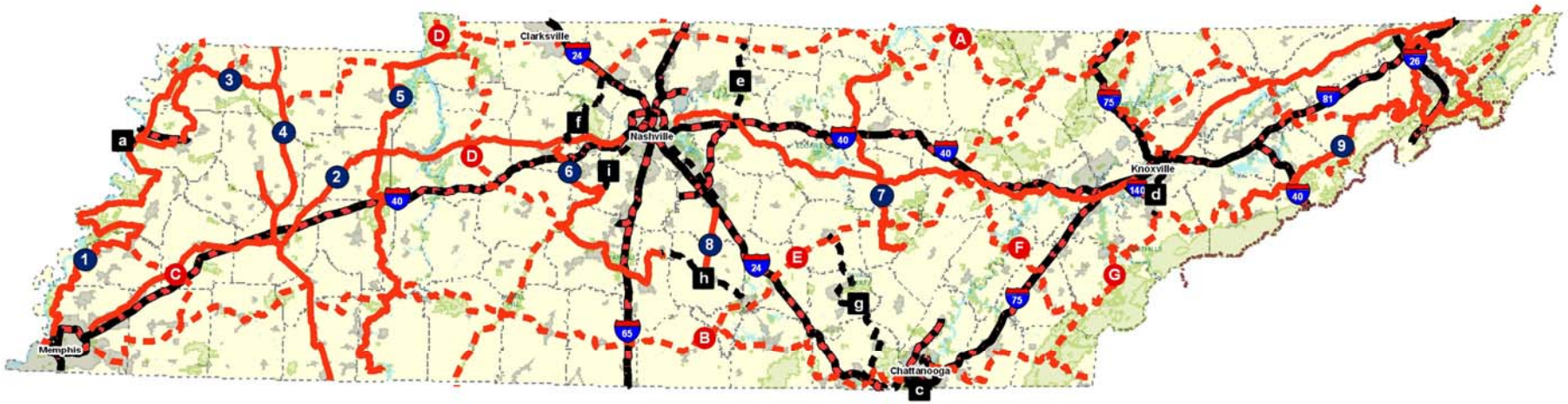
6.1.1 Stateline Tour

The Stateline Tour travels the length of Tennessee in its northern reaches, linking the existing Reelfoot and Mountain state bicycle routes. It also connects to the existing State Route 45, and the River and Highland Rim state bicycle routes. This varied tour travels through beautiful and very challenging parts of Tennessee, visiting lakes, battlefields, mountains, small towns, and natural areas. Notable landmarks on this tour include Reelfoot Lake, Land Between the Lakes (Kentucky Lake and Lake Barkley), the upper reaches of the Natchez Trace, Cumberland Gap, and historic towns like Bean Station and Greeneville. The Stateline Tour connects to the Mississippi River Trail, Kentucky's Midland Kentucky Tour, Southern Lakes Tour, Mammoth Cave Tour, Central Heartlands Tour, and Bluegrass Tour bicycle routes, and Adventure Cycling's Great Rivers Tour.

Stateline Tour Statistics



Total mileage: 528 miles	**Climbing elevation: 46,068 feet**
	Descending elevation: 45,250 feet



Existing State Bicycle Routes

1. Mississippi River Trail
2. Memphis to Bristol
3. Reelfoot
4. State Route 45 Bicycle Route
5. River
6. Heartland
7. Highland Rim
8. Route 231 - Shelbyville to Murfreesboro
9. Mountain

Proposed State Bicycle Routes

A. Stateline
B. Southern Rambler
C. Memphis Loop
D. Land Between the Lakes
E. Cumberland Traverse
F. Mountain Valley - Watts Bar Dam
G. Foothills
H. Cumberland Loop

Proposed State Bicycle Connector Routes

a. Arkansas Connector
b. Georgia Connector 1
c. Georgia Connector 2
d. Knoxville Connector
e. Lebanon Connector
f. Heartland Connector
g. Chattanooga Connector
h. Tullahoma Connector
i. Natchez Connector

Tennessee Long-Range Transportation Plan

Existing and Proposed State Bicycle Routes

Map 6-1

TDOT Go.

LEGEND

- Limited Access Highway: Bikes and Peds Prohibited
- Cities
- Counties
- Parks and Public Lands
- Water
- Existing State Route
- Proposed State Route
- Proposed Connector

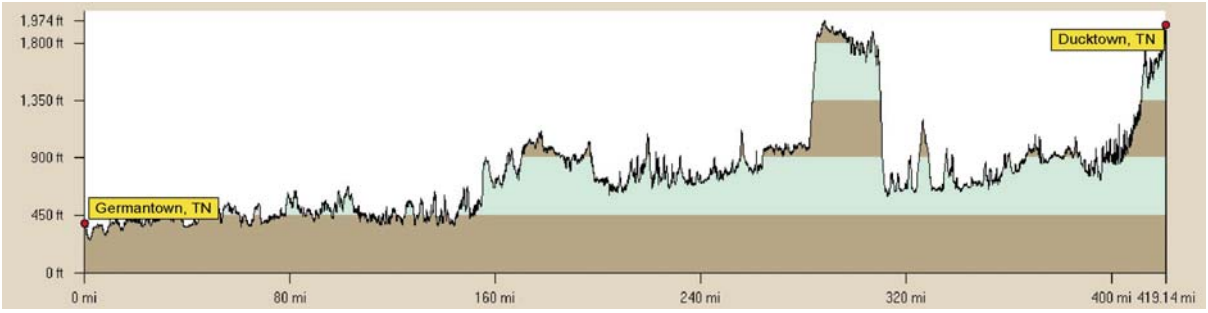
N W E S

Miles
0 10 20 30 40

6.1.2 Southern Rambler

The southern counterpart of the Stateline Tour, the Southern Rambler, meanders across the southern portion of the state connecting Memphis to the mountains. The route roughly follows one of the Trail of Tears historic routes and links state parks, historic sites, towns and cities, and the existing River state bicycle route with connections to the Mississippi River Trail and State Route 45 as well. Other attractions include the Natchez Trace, scenic country back roads, the Davy Crockett Cabin and Museum, the Jack Daniels Distillery, Chattanooga, and the Appalachian Mountains. The Southern Rambler connects to Mississippi's Natchez Trace bicycle route, Georgia's Chattachoochee Trace and March to the Sea bicycle routes, and North Carolina's Mountains to the Sea bicycle route.

Southern Rambler Statistics

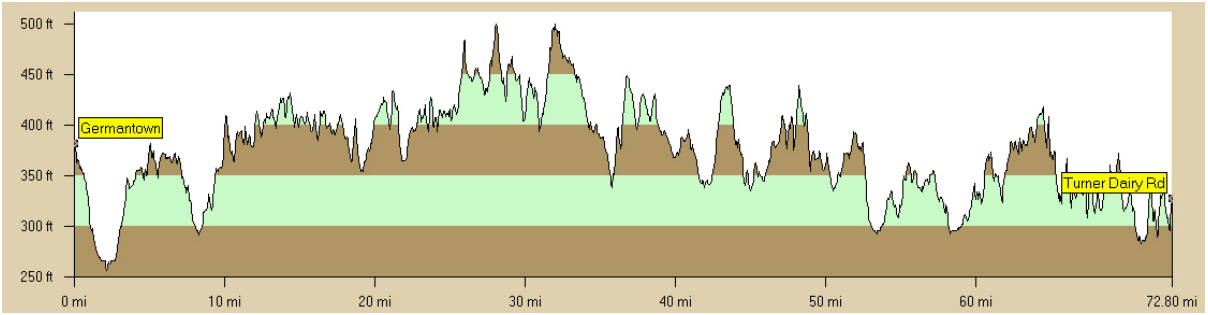


Total mileage: 420 miles	**Climbing elevation: 36,168 feet**
	Descending elevation: 34,620 feet

6.1.3 Memphis Loop

The Memphis Loop uses portions of the Mississippi River Trail and the proposed Southern Rambler state bicycle route to encircle Memphis on low-volume, rural highways. Attractions include the Mississippi River Trail, downtown Memphis, and gentle, rolling topography.

Memphis Loop Statistics

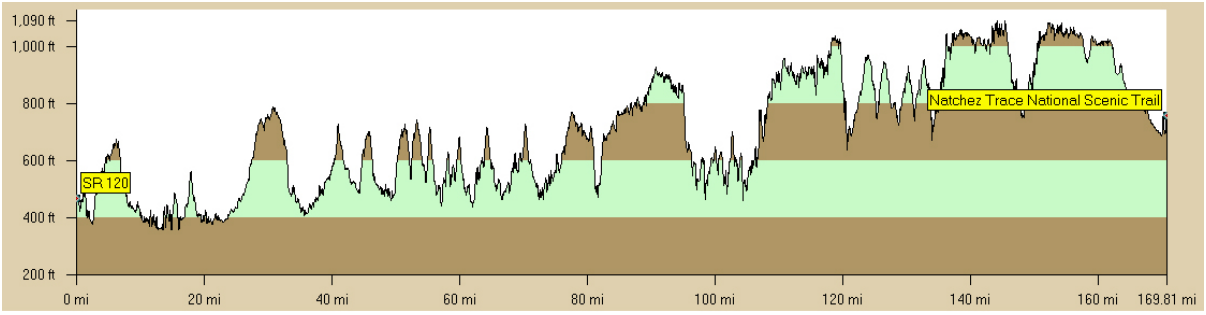


Total mileage: 73 miles	**Climbing elevation: 3,149 feet**
	Descending elevation: 3,203 feet

6.1.4 Land Between the Lakes

The Land Between the Lakes state bicycle route roughly follows the Great Rivers touring route established by Adventure Cycling. Beginning at the Land Between the Lakes, this proposed route travels roughly parallel to the Tennessee River and connects to the Natchez Trace Parkway and Mississippi. Bicyclists will encounter many other touring bicyclists and enjoy many hiking trails, boardwalks, waterfalls, and historical sites along the Trace. Attractions include the Land Between the Lakes, the Natchez Trace, and the existing Heartland state bicycle route.

Land Between the Lakes Statistics

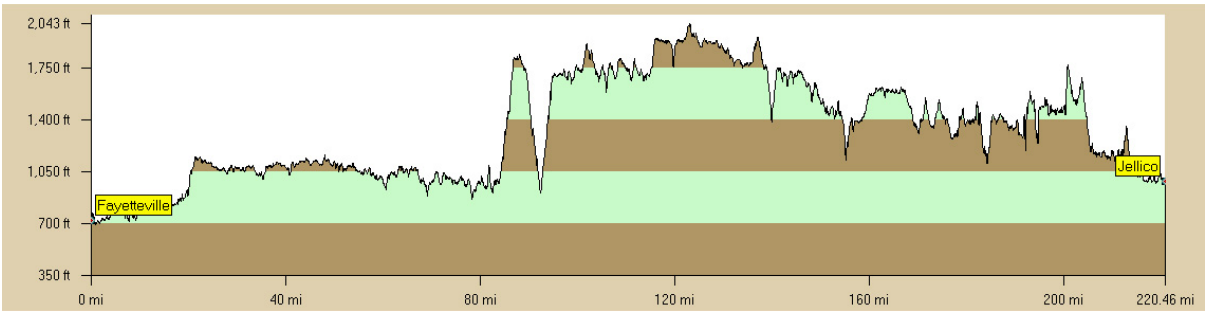


Total mileage: 170 miles	**Climbing elevation: 14,780 feet**
	Descending elevation: 14,487 feet

6.1.5 Cumberland Traverse

The Cumberland Traverse connects the proposed Southern Rambler and Stateline Tour bicycle routes, roughly traveling along the Cumberland Plateau, through small towns, up and down steep hills, and through beautiful natural areas. The Cumberland Traverse connects to the Highland Rim state bicycle route and the Cumberland Gap. Other attractions include Fall Creek Falls State Park, Crossville, and McMinnville.

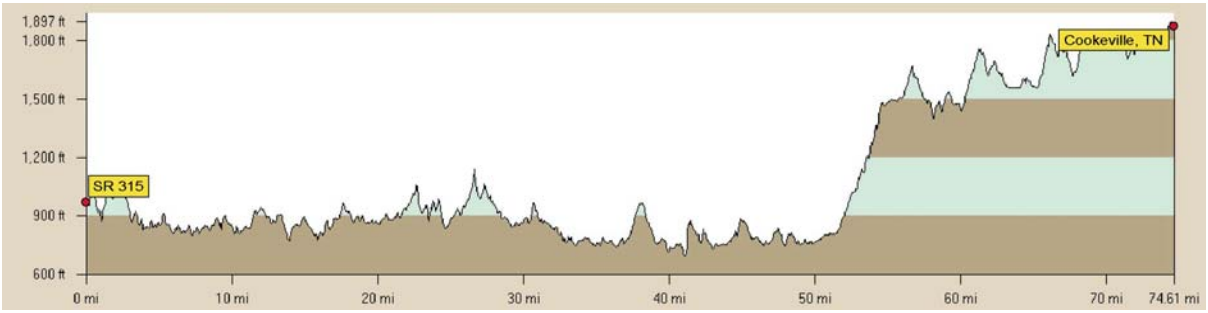
Cumberland Traverse Statistics



Total mileage: 219 miles	**Climbing elevation: 17,194 feet**
	Descending elevation: 16,928 feet

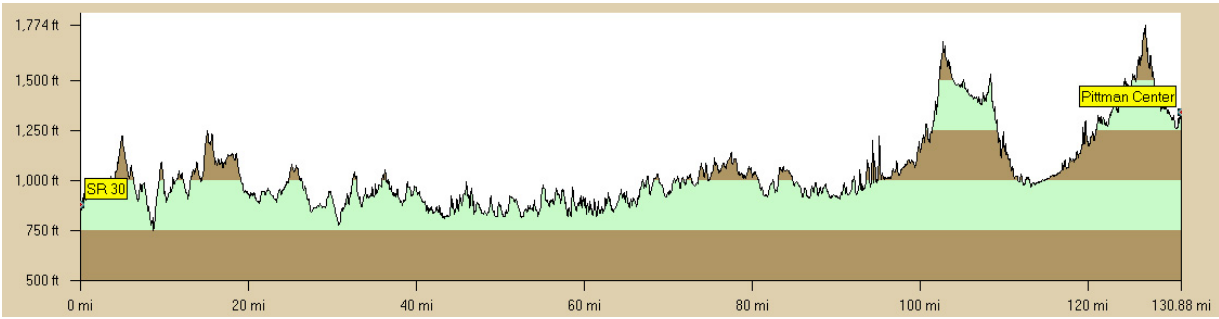
6.1.6 Mountain Valley – Watts Bar Dam

The portion of this proposed state bicycle route from Etowah to Watts Bar Dam was developed by bicyclists who live in the area. The extension of the route to Cookeville was developed to highlight the beautiful Cumberland Plateau and the natural areas around Crossville. The Mountain Valley–Watts Bar Dam route connects the proposed Foothills and Cumberland Traverse state bicycle routes.

Mountain Valley – Watts Bar Dam Statistics	
	
Total mileage: 75 miles	**Climbing elevation: 6,840 feet**
	Descending elevation: 5,933 feet

6.1.7 Foothills Tour

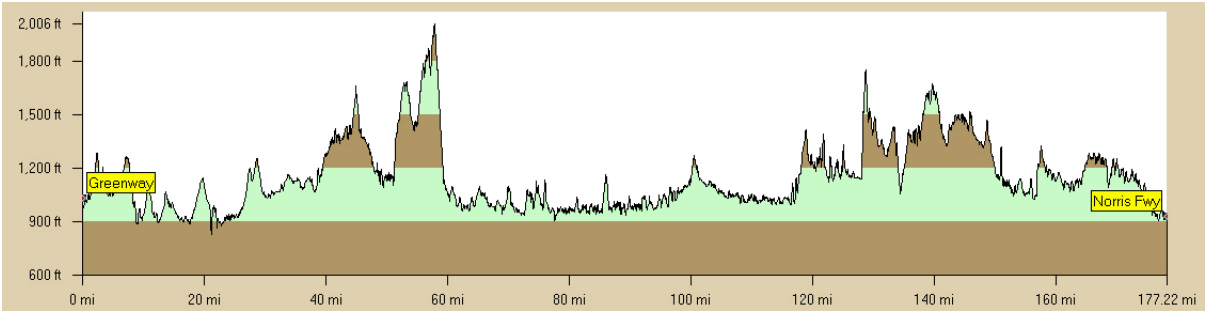
This challenging and beautiful proposed state bicycle route extends the existing Mountain state bicycle route to the north and south to connect small towns, the Overmountain Victory National Historic Trail, the Great Smoky Mountains National Park, tourist attractions, North Carolina's Mountain Connector bicycle route, and Virginia's Interstate 76 bicycle route. The Foothills Tour consists of low-volume, challenging mountain highways; panoramic vistas, rivers, and streams; and a glimpse of geologic history as the tour follows one of the oldest mountain ranges in the world.

Foothills Tour Statistics	
	
Total mileage: 131 miles	**Climbing elevation: 14,149 feet**
	Descending elevation: 13,692 feet

6.1.8 Cumberland Gap Loop

The Cumberland Gap Loop creates a mountain and valley loop out of Knoxville that extends into Kentucky on old Highway 25E, which has been blocked off to motor vehicle traffic since opening the Cumberland Gap Tunnel. The intention of the NPS is to let the road revert to its original state - dirt. The proposed route connects through Kentucky on the Bluegrass and Southern Lakes bicycle routes. To shorten the route, riding overland on low-volume, but very steep roads, Highway 74/90 is an option. Attractions include Cumberland Gap National Historic Park, Norris Lake, Chuck Swan State Forest, and Knoxville.

Cumberland Gap Loop Statistics



Total mileage: 177 miles	**Climbing elevation: 18,650 feet**
	Descending elevation: 18,753 feet

6.2 State Connector Routes

State connector routes are proposed bicycle routes that make connections between major cities, existing and proposed state bicycle routes, and adjacent states. These routes tend to be more direct and are intended for bicyclists who visit from other places or live in Tennessee urban areas and want to gain access to existing state bicycle routes without having to drive.

- **Heartland Route Connector**: connects the existing Heartland state bicycle route with the proposed Stateline Tour state bicycle route.
- **Georgia Connector I**: connects downtown Chattanooga to the Georgia state line along Broad Street and Ochs Highway (Highway 58).
- **Georgia Connector II**: connects downtown Chattanooga to the Georgia state line along Ringgold Road (Highway 41/76).
- **Lebanon Stateline Connector**: connects Lebanon to the proposed Stateline state bicycle route on Highway 231.
- **Nashville Connector**: connects south Nashville to the Natchez Trace Parkway on Highway 100.
- **Knoxville Connector**: connects east Knoxville to the proposed Foothills state bicycle route on the Maryville Pike (Highway 33).
- **Chattanooga Connector**: connects Chattanooga to the proposed Cumberland Traverse state bicycle route and the existing Highland Rim state bicycle route.

- **Arkansas Connector**: connects Memphis over the Mississippi River to Arkansas.
- **Tullahoma Connector**: connects Tullahoma and the proposed Cumberland Traverse state bicycle route to the existing River state bicycle route.

6.3 Proposed Route Recommendations

6.3.1 Signing State Bicycle Routes

Bike Route ends, but the wide shoulder continues.

A topic receiving increasing attention by State staff and Tennessee bicycle advocates alike has been the adoption of consistent policies for signing bicycle routes adopted or designated by the State. Policies for this activity have varied in the past. At one point, TDOT policy was to sign all roadways with shoulders greater than four feet, which was followed somewhat inconsistently. The close similarities in signage between the five touring routes and other state routes with wide shoulders can cause confusion. Furthermore, signage that indicates "End Bicycle Route" has a negative connotation to cyclists and provides misleading information to motorists. Maintaining consistency amongst these facilities and incorporating these routes into a coherent, logical and connective system is important.

Traditionally, "Class III" (shared signed bicycle route) facilities have involved little more than a "Bike Route" sign and occasionally a directional arrow to indicate where an authority thought bicyclists should ride. The current edition of the AASHTO Guidelines for the Development of Bicycle Facilities makes designation of bike routes more meaningful. Under current guidelines, these routes must have physical improvements or other characteristics which make that particular route more useful or safe than a more obvious alternative.

Specifically, AASHTO delineates four purposes for signed routes:

1. Providing continuity to other bicycle facilities such as bike lanes or shared use paths.
2. The route is a common route for bicyclists through a high demand corridor.
3. In rural areas, the facility is preferred for bicycling due to low motor vehicle traffic volume or paved shoulder availability.
4. The route extends along local neighborhood streets and collectors that lead to an internal neighborhood destination such as a park, school or commercial district.

Further, AASHTO elaborates that "Signing of shared roadways indicates to cyclists that there are particular advantages to using these routes compared to alternate routes. This means the

responsible agencies have taken action to ensure these routes are suitable as second routes and will be maintained."

AASHTO identifies eight criteria to be met for signing shared roadways:

1. The route provides through and direct travel in bicycle-demand corridors.
2. The route connects discontinuous segments of shared use paths, bike lanes, and/or other bike routes.
3. An effort has been made to adjust traffic control devices to give greater priority to bicyclists on the route, as opposed to alternative streets, including the use of bicycle-sensitive detectors where bikes are expected to stop.
4. Street parking has been removed or restricted in areas of critical width to provide improved safety.
5. A smooth surface has been provided (provide bicycle safe drainage grates).
6. Maintenance of the route will be sufficient to prevent accumulation of debris.
7. Wider curb lanes or shoulders are provided.
8. The widths of these shoulders or curb lanes meet or exceed width standards included in the Shared Roadways section of the 1999 AASHTO Guidelines (page 17).

At the state level, there are three types of signing that might be contemplated. First is the potential designation of any and all routes on the State-owned system that meet criteria for bike routes, which might be signed with a numbering system unique to the bicycle program. Second is the need to sign (as described above) alternate routes to freeway corridors, or high-hazard areas. The third type of sign would designate the existing and proposed state touring routes adopted in this plan. These signs should be identifiably unique and reflect a characteristic of the route.

Bicycle route signage

6.3.2 Maintenance

TDOT should ensure that a mechanism exists to evaluate and make spot improvements to alleviate potential hazards and improve conditions for bicyclists at specific locations along the state bicycle route network. Hazards may include improperly designed or placed drainage grates, cracks or seams in the pavement, or overhanging tree limbs or other obstacles located along bikeways. Intersection problems may include areas where lane changes are difficult (e.g., bike lane to left-turn pocket), signal timing problems (e.g., green phase is too short), or locations where vehicular traffic congestion blocks bike facilities on a regular basis. Hazards such as obstacles in a bikeway should be eliminated as quickly as possible.

This program is considered ongoing, as hazards may emerge over time (e.g., as bikeway facilities age) and future changes in traffic patterns may affect intersection conditions. The

state should ensure that a mechanism is in place for collecting input on problem locations along the bikeway network, such as a form available on the TDOT website.

It is recommended that TDOT headquarters work closely with the TDOT region offices to develop an identification and response system, sweeping schedule, and funding strategies for state highways that have shoulders or are designated as a local bicycle route. Special attention should be given to state bicycle routes and should include monthly sweeping inspections or after events that would add debris to the roadway, such as floods and ice storms where gravel or sand is put down. A sample maintenance table is provided below.

Table 6-1. Bicycle Route Maintenance

Item	Frequency
Sign replacement/repair	1-3 years
Trail pavement marking replacement	1-3 years
On-Street pavement marking replacement	1-3 years
Planted tree, shrub, & grass trimming/fertilization	5 months-1 year
Pavement sealing/potholes	5-15 years/30-40 years for concrete
Clean drainage system	Annual
Pavement sweeping	Monthly
Shoulder mowing and weed removal	Bi-Annual – Fall/Spring
Trash disposal	As needed, twice a week
Inspect bridge abutments and structures	After each storm
Graffiti removal	Weekly
Maintain furniture	1 year
Restroom cleaning/repair	Weekly
Pruning to maintain vertical clearance	1-4 years
Remove fallen trees	As needed (on trail only)
Weed control	Monthly
Maintain emergency telephones	1 year
Maintain irrigation lines/replace sprinklers	1 year
Irrigate/water plants	Weekly - as required during establishment growth period
Fencing	Monthly

6.3.3 Utilizing a GIS and Improving Data Quality

Coordinating with local agencies for the LRTP was challenging due to the different terminology, programs, and plan formats between the agencies. In addition to the standardization of local and regional bicycle and pedestrian plans (outlined in Chapter 7 of this document), it is recommended that TDOT develop a standard geo-referenced database that would allow local agencies to seamlessly transfer spatial information and update TDOT's GIS databases. Standards and templates should be developed by TDOT so that local agencies can coordinate future bicycle and pedestrian planning efforts. Standard elements would

include standard facility terms, length of facility, sign locations, standard roadway names/route numbers, and other information.

It is very important that the TDOT database be as accurate and up-to-date as possible in order for future roadway-bikeway analyses to be successful. It is recommended that TDOT conduct a thorough "ground truthing" exercise throughout the state to compare and systematically update the TRIMS database information with actual roadway conditions.

6.3.4 Mapping

TDOT should continue developing and producing free state bicycle route maps. These maps should include state route information, as well as information about route attractions, camping opportunities, and other local accommodation information. The maps should be highly graphical and user friendly, partitioned into day-length (35 – 60 miles) sections, and be able to fit when folded into a map holder.

TDOT should utilize its technological capability to publish the state bicycle route maps on its website. At minimum, the maps should be available in a portable document format (PDF) so residents and visitors can download and print the maps locally. The mapping could also be more sophisticated by utilizing the suitability index and allowing the computer user to zoom in on a particular part of the state to develop their own tour.

6.3.5 Priority Projects

Priority projects are those bicycle and pedestrian projects that serve the most users or have the most need. A project prioritization methodology is outlined in Chapter 7. It is recommended that TDOT use this methodology to focus its funding efforts on projects in urban areas, as defined by the local bicycle and pedestrian plan, and on proposed state bicycle routes. Priority projects on the proposed state bicycle routes are highlighted in Chapter 9 of this document with an associated cost.

Chapter 7

Recommended Policies, Procedures, and Practices

This chapter covers existing and proposed TDOT policies, practices, and procedures related to bicycle and pedestrian modes of travel. The recommendations in this chapter will serve as the basis for TDOT efforts over the life of the plan, along with recommendations in other chapters. The definitions of each of these terms are presented below.

Policies: TDOT goals and objectives in the form of specific policies, requirements, regulations, guidelines, laws, and other tools.

Procedures: TDOT organization processes used to analyze and make decisions on projects, funding, approvals, and other efforts.

Practices: TDOT organization practices or activities that may include research, planning, design, construction, and maintenance.

Concepts and recommendations identified in this Plan would typically start with a policy, followed by a procedure by which TDOT approves or adopts a concept, and a practice or implementation in the form of research, construction, and operations.

Recommendations in this chapter fall into one of four basic categories:

1. Recommended **research** to be conducted by TDOT on the effectiveness and cost of a proposed practice, policy, or procedure.
2. A new **program** that could be instituted by TDOT through one of its existing divisions, after being studied for financial implications and with the approval of the required agencies and officials.
3. An informational or technical **resource** that could be developed by TDOT for the benefit and use by its own staff, local agencies, and in some cases, the general public.
4. A **refinement or expansion** of an existing practice, policy, or procedure that might improve its effectiveness.

7.1 Principles, Goals, and Objectives

7.1.1 Long-Range Transportation Plan

This Bicycle and Pedestrian Plan is one part of the larger Tennessee LRTP. The Plan shares the same overriding 'Guiding Principles' as the other transportation modes in the LRTP. Section 2.1 Principles, Goals, and Objectives beginning on page 2-1 lists and summarizes these principles, goals, and objectives. Each principle has an associated bicycle and pedestrian set of proposed Objectives and Actions, which are detailed in this chapter.

7.1.2 State Bicycle and Pedestrian Plan

The Objectives and Actions for the Bicycle and Pedestrian Plan reflect the special needs of these modes, framed in the traditional four-E's format (Engineering, Education, Enforcement, and Encouragement).

7.1.2.1 Engineering

Objective: Plan and design new and upgraded transportation facilities to accommodate bicyclists and pedestrians.

Actions:

- Encourage local agencies to develop bicycle and pedestrian plans.
- Accommodate bicycle and pedestrians as appropriate when designing or retrofitting roadway projects.
- Adhere to nationally-accepted design standards and guidelines.
- Provide reasonable access and routes for bicyclists and pedestrians when developing new roadway projects.
- Maximize opportunities to enhance bicycle and pedestrian facilities when existing roadways are improved and upgraded.

Objective: Expand and improve a statewide network of safe and convenient routes for bicycle transportation and touring.

Actions:

- Develop a statewide network of bikeways connecting major urban areas, recreational areas, and visitor destinations.
- Provide user maps showing the bicycling conditions and locations in the state.

7.1.2.2 Education

Objective: Expand the range of educational efforts ranging from safety education, licensing requirements, and public service information.

Actions:

- Publish bicycle and motor vehicle safety information materials.
- Provide demonstration grants to communities.
- Update motor vehicle training materials.
- Expand and improve efforts to monitor and analyze bicycle and pedestrian crash data.
- Promote the use of wearing helmets through the use of incentives and public awareness of the benefits.
- Develop public service announcements that increase awareness of bicyclists and pedestrians.

Objective: Assist local communities in preparing Safe Routes to School plans and implementing needed measures and programs.

Actions:

- Provide funding and technical resources to communities to initiate Safe Routes to School programs.
- Work with local police and educational groups to teach young people how to ride and walk in their communities.

7.1.2.3 Enforcement

Objective: Improve enforcement of laws to address areas of conflict between bicyclists, pedestrians, and motorists.

Actions:

- Develop enforcement strategies directed at high incidence locations.
- Develop specific training programs for police officers.
- Expand or modify the Vehicle Code as it relates to bicycle and pedestrian laws.

Many states use signage to educate motorists about driver responsibilities.

7.1.2.4 Encouragement

Objective: Encourage more work and discretionary trips be made by walking or bicycling by promoting the benefits of these modes.

Actions:

- Publicize the benefits of a healthy and active lifestyle.
- Facilitate access to technical information to assist local agencies and groups promoting walking and bicycling.
- Publish bicycle maps and other materials.
- Assist employers in promoting bicycle/pedestrian commuting programs.

7.1.2.5 Principles, Goals, and Objectives Recommendation

Use these principles, goals, objectives, and actions to develop and implement TDOT practices, policies, and procedures identified in this Plan.

7.2 Preserve and Manage the Existing Transportation System

Recommended strategies and actions under this principle address issues such as design standards, innovative design treatments, efficient use of right-of-way, agency-wide training, and maintenance practices.

7.2.1 Design Standards

TDOT has adopted AASHTO's Guide for the Planning, Design, and Operation of Pedestrian Facilities (2004), Guide for the Development of Bicycle Facilities (1999—currently being updated) as the official sources of bicycle and pedestrian design standards and guidelines for the State. These documents cover a wide variety of topics and provide both general and specific recommendations on everything from policies to design details. These documents are widely adopted by state DOTs and help ensure state-to-state consistency in bikeway and pedestrian facility design.

AASHTO and ADA have established national standards for sidewalk designs.

Other documents that serve as formal or informal standards for Tennessee include the Manual on Uniform Traffic Control Devices, the Uniform Building Code (UBC), and FHWA-documents covering Americans with Disabilities issues such as *Designing Sidewalks and Trails for Access, Volumes I and II*. Publications by organizations such as AASHTO, the Institute of Transportation Engineers (ITE), Transportation Research Board (TRB), and the National Cooperative Highway Research Program (NCHRP) serve as standards or guidelines for many areas that directly or indirectly impact bikeway and pedestrian facilities. Finally, AASHTO's *Green Book (A Policy on Geometric Design of Highways and Streets)* along with TDOT's own roadway design standards indirectly impact bikeway and pedestrian facilities by allocation of roadway and right-of-way to motor vehicles.

7.2.1.1 Expand and/or Clarify Standards

The AASHTO bicycle and pedestrian publications cover most, but not all, of the situations and conditions that may confront TDOT or local agency engineers as they plan or design facilities. TDOT may wish to identify topics and designs not covered in these documents or, in some cases, customize or clarify some of the recommendations in those publications. In other cases, discrepancies or inconsistencies may exist between different sources. For example, the current Guide does not differentiate between urban and rural roadway treatments, nor does it provide guidance on retrofitting existing roadways with bike lanes. Once the updated version of the AASHTO *Guide for the Development of Bicycle Facilities* becomes available, TDOT should identify issues, conflicts, and new or customized design treatments and produce a Design Supplement.

7.2.1.2 Standards, Guidelines, and Design Exceptions

Most of the planning and design practices identified in bicycle and pedestrian documents, including the AASHTO Guides, are not based on extensive research but are, rather, the result of practices that were tried over time and accepted into general practice based on their historic performance. It is not known, for example, if and how much the provision of bike lanes improves safety, or whether a five-foot-wide bike lane is significantly better than a four-foot-wide bike lane. In-depth research has simply never been completed on most of the subjects in either Guide.

Research is further complicated by the fact that bicycles and pedestrians are far less predictable and fewer in numbers, generally, than automobiles. As such, design guidelines and standards being considered for inclusion in the State Bicycle and Pedestrian Plan could be classified into the following general categories:

Standard

This design or operational element has either been the subject of in-depth research with clear findings, has been in common practice for at least 10 years with no significant problems being published, has obvious benefits, and/or is generally consistent with recognized sources such as the AASHTO Guide. Further research could help refine these standards, but they are unlikely to be completely changed.

Best Practice

Also known as a "guideline" or advisory standard, this is a design or operational element where no conclusive in-depth research has been conducted yet, it has been in practice in select locations around the country for at least 10 years with no significant safety problems being published, the benefits have been identified but not quantified, it is generally consistent with recognized sources such as the AASHTO Guide, and/or is *not* a safety issue where prudence dictates a conservative approach until research proves otherwise. Further research could help refine these "best practices," but they are unlikely to be completely changed. These practices can be followed with reasonable confidence but should be subject to sound local engineering judgment.

Innovative Treatment

This is a design or operational element where no conclusive in-depth research has been conducted yet, it has been in practice in select locations around the country with no significant safety problems being published, the benefits have been identified but not quantified, is generally consistent with recognized sources such as the AASHTO Guide, and/or is *not* a safety issue where prudence dictates a conservative approach until research proves otherwise. Further research could help refine these "innovative treatments," and there is a possibility they may change or be eliminated over time. These practices should be followed with caution, subject to solid analytical review of their application, subjected to sound local engineering judgment, and possibly installed on a test or interim basis first.

7.2.1.3 Use of Standards and Guidelines

It is recommended that TDOT continue to encourage the use of 'sound engineering judgment' in the application of any design or treatment, that the application of 'best practices' or 'innovative treatments' be done cautiously, and that TDOT initiate appropriate research or publicize available research into the latter two categories as appropriate. TDOT should also identify gaps, duplication, and inconsistencies between the accepted design resources and resolve these issues through a design bulletin or update. The existing design standards do not cover many topics that are of direct interest to TDOT and local agencies.

7.2.1.4 Design Exceptions

TDOT should require all proposed pedestrian and bicycle designs not included in the AASHTO Guides, MUTCD, or other accepted sources, to provide a design exception report documenting the reasons for the design, an engineering analysis into the impacts on safety, and information on research or 'best practices' of the proposed design.

7.2.1.5 Mandatory versus Advisory Standards

AASHTO pedestrian and bicycle design publications do not always differentiate between mandatory (will, must) and advisory (should, may, could) standards. They also present numerous 'optional' treatments, along with 'recommended' versus 'minimal' standards. TDOT may wish to address these issues in a Design Supplement that provides guidance on what TDOT considers to be mandatory minimum standards and recommended options.

7.2.1.6 Web-Based Access to Design Standards and Guidelines

TDOT and local agency staff must currently refer to numerous different sources for design standards, guidelines, and best practices for bikeways and pedestrian facilities. In some cases, there is overlap and duplication between these sources. The most cost-effective means of resolving these issues and maximizing access to these resources is to put them on the TDOT website and include a detailed and easy-to-use subject index. This would be similar to the other design standards and drawings already located on the TDOT website.

7.2.1.7 Americans with Disabilities Act (ADA)

No other topic has greater repercussions for bicycle and pedestrian accessibility and project feasibility than the application of the ADA. National and Federal interpretation of the ADA has evolved through a combination of court cases (and the U.S. Department of Justice), findings of the U.S. Access Board, and the publication of FHWA documents such as *Designing Sidewalks and Trails for Access, Parts I and II*.

ADA Transition Plans require inventories of facilities such as curb ramps.

From the perspective of a local agency trying to meet the latest ADA policies and laws, there are so many local and national sources that it may be difficult to ensure the proper approach is being used. Because of this uncertainty and the need for conformance, some ADA design requirements may be misapplied. A unified source, or at least a unified index that covers both the pedestrian and bicycle standards and guidelines, would be helpful.

7.2.1.8 Routine Accommodation of Non-Motorized Users

TDOT has an excellent policy regarding routine accommodation of bicycling and pedestrian facilities into the transportation system. The policy includes detailed explanations of the

application of this policy, along with clarifications and exceptions. Some of these clarifications and exceptions may have unintended impacts on the application of the policy. Examples of this language are shown below in italics, with potential impacts and recommended changes shown in bullets.

7.2.1.9 Bicycle Accommodation

TDOT is committed to the development of a transportation infrastructure that improves conditions for bicycling through the following actions:

- Provisions for bicycles will be integrated into new construction and reconstruction of roadway projects through design features appropriate for the context and function of the transportation facility.
  - *The references to 'context and function' are subject to wide interpretation. To simplify this, the language could read: 'appropriate for the existing and future needs of bicyclists and pedestrians.' For example, an airport runway project would not need to provide bicycle or pedestrian facilities because there is no existing or future need for access.*
- The design and construction of new facilities should anticipate likely future demand for bicycling facilities *and not preclude the provision of future improvements*.
  - *Tools for identifying likely future demand are included in this Plan. Since transportation improvement plans will always anticipate future long-term needs, and provide designs to accommodate those needs, the need for this last statement is unclear.*
- By addressing the need of bicyclists to cross corridors as well as travel along them and designing intersections and interchanges to accommodate bicyclists in a manner that is accessible and convenient.
  - *This is an example where a specific standard or requirement for this type of facility would be helpful, since AASHTO and other sources do not address this issue directly. In some states, the DOT is responsible for addressing bicycle and pedestrian connectivity across all new or existing state highways in the form of new over or under crossings.*
- The measurement of usable shoulder width does not include the width of a gutter pan.
  - *On new roadway projects this statement makes perfect sense. AASHTO allows use of the gutter pan in some cases, and eliminating this may reduce the number of bike lane projects in the state.*

7.2.1.10 Pedestrian

TDOT is committed to the development of a transportation infrastructure that improves conditions for pedestrians through the following actions:

- The design and construction of new facilities should anticipate likely future demand for pedestrian facilities and not preclude the provision of future improvements.
  - *Same comments as for bicycles*

- By addressing the need of pedestrians to cross corridors as well as travel along them and designing intersections and interchanges to accommodate pedestrians in a manner that is accessible and convenient.
  - *Same comments as for bicycles*
- Provisions for pedestrians will be integrated into new construction and reconstruction projects through design features appropriate for the context and function of the transportation facility.
  - *Same comments as for bicycles*

7.2.1.11 Accommodation Exceptions

There are conditions where it is generally inappropriate to provide bicycle and pedestrian facilities. These conditions include:

- Facilities where bicyclists and pedestrians are prohibited by law, such as urban-area interstate highways, from using the roadway. In this instance, a greater effort may be necessary to accommodate bicyclists elsewhere in the same transportation corridor.
  - *Refer to section 7.3.1 Access to TDOT Facilities.*
- The cost of providing bicycle and pedestrian facilities would be excessively disproportionate to the need or probable use. Excessively disproportionate is defined as exceeding twenty percent of the project's total right-of-way costs.
  - *This statement may be unnecessarily rigid and difficult to quantify. For example, shoulders are both a motor vehicle safety feature and a bikeway in some cases. It is also highly unlikely that a bicycle or pedestrian facility would ever account for more than 20% of the right-of-way costs on a major transportation project, and in the cases that it did, it could be for acceptable reasons. Finally, AASHTO states that all new highways (except limited access) should be designed and constructed under the assumption that bicyclists will use them.*
- Bridge Replacement Rehabilitation projects funded with HBRRP funds on routes where no pedestrian or bicycle facilities have advanced to the stage of having engineering drawings nor any funded state bridge maintenance projects.
  - *US DOT policy requires the accommodation of bicycles on all replaced bridges provided it can be done at a 'reasonable' cost. The normal clear zone or shoulder required by AASHTO on bridges should suffice for bicyclists. The provision of a sidewalk on one or both sides should be contingent on the local agency either having (a) existing sidewalks or plans for sidewalks connecting to the project, or (b) providing TDOT with either documentation (counts) or other information showing the demand for a sidewalk.*

These policies may also be expanded to cover new rail, transit, and other transportation projects, where routine accommodation of bicycles and pedestrians is a priority.

7.2.2 Retrofitting Existing State Highways

Identifying priority locations for shoulder or other improvements to existing state highways to accommodate bicycles or pedestrians is important in order to allocate resources effectively.

Retrofits of highways include re-striping travel lanes to provide bike lanes, shoulders, or wider curb lanes, expanding shoulders, changing intersection striping, modifying curb radius, and other changes. The methodology to determine where to target resources for the retrofitting of existing highways is addressed in various sections of this plan, including:

- 7.2.4, Maintenance and Repair of Facilities
- 7.3.2, Local Coordination on Bicycle and Pedestrian Facilities
- 7.3.5, Local Agency Support and Bicycle/Pedestrian Plans
- 7.5.3, Pedestrian and Bicycle Safety Programs
- 7.8.3, Project Development, Ranking, and Funding

Project Development, Ranking, and Funding presents a methodology for prioritizing projects including retrofits for highways. Chapter 6, Proposed State Routes, identifies the recommended statewide bicycle routes along with priority gaps for improvements. Chapter 8, Policy Guidance by Environment, presents specific techniques for effectively retrofitting highways in a variety of settings.

7.2.2.1 Recommendations

Follow the recommended project ranking methodology presented in this Plan. This will allow for an orderly and effective phasing of improvements over time. Other events may trigger the need for a highway retrofit that may not be included in this methodology. This includes:

- A major bicycle or pedestrian-related safety incident triggers an investigation by authorities that reveal that an existing highway design or operation that requires immediate retrofitting.
- A major natural or environmental disaster impacts pedestrian or bicycle safety.
- A funding, right-of-way acquisition, or other opportunity makes a highway retrofit an immediate priority.

7.2.2.2 Urban Bikeway Roadway Design

State highways in urban and suburban areas often require trade-offs between standard TDOT practice and local needs. Good examples of this are trade-offs between rumble strips and bike lanes or shoulders, between maintaining a level of service standard for an intersection versus providing capacity for bicyclists and pedestrians in a downtown area, and between designing and posting roadways for the 85^{th} percentile or lower speeds to reflect local conditions. While these issues need to be addressed on a case-by-case basis using a standardized review and approval process, clarifying policies may make this process more consistent.

7.2.3 Education and Training

Training TDOT staff on bikeway and pedestrian facility planning, design, operations, maintenance, and other topics helps meet the goal of maximizing efficiency and quality in the department. This same training program could be made accessible to local agency staff who could also benefit from the same materials. While some universities offer courses on these topics, the level of detail and practical application of these subjects is typically not available. Some agencies and organizations offer these types of courses as well. However, a TDOT training

program offers the advantage of ensuring the materials are consistent with TDOT policies, practices, and procedures, and that the effectiveness of the training can be measured and adjusted as needed.

7.2.3.1 Education and Training Recommendations

Develop Training Materials

TDOT should consider developing a comprehensive training program for its staff, along with a state-of-the-art delivery system that maximizes efficiency and effectiveness. TDOT could develop a series of training modules that divide the different curriculum topics into logical groups, allowing for user flexibility. TDOT should integrate parts of the separate pedestrian and bicycle tracks since many facilities are used by both groups or developed at the same time. The curriculum and support material should be organized in a manner so that attendees who have questions or an interest in sub-areas can be referred to a Technical Appendices on CD or a website so that valuable class time is not wasted.

7.2.4 Maintenance and Repair of Facilities

An appropriately funded and responsive maintenance program is necessary to ensure continued and safe use of pedestrian and bicycle facilities. Foremost, a consistent sweeping program to remove debris from roadways, paved shoulders, bike lanes, and shared-use paths is necessary. Responsive attention to pedestrian and bikeway maintenance requests by residents and visitors is also highly desirable to quickly address problems and to maintain a strong rapport and good public image with citizens.

7.2.4.1 Maintenance and Repair Recommendations

Review Current Maintenance and Repair Practices

Pavement should be maintained to a safe standard on all on-street bikeways and shoulders. Dense, graded asphalt concrete surfaces are preferable to open graded or seal-coated surfaces. All manhole covers, utility covers, drop inlet and other drainage grates, and construction joints should be located outside of paved shoulders or bike lanes, if possible. If covers or drainage grates are located within the paved shoulders or bike lanes, they must be kept level with the surrounding pavement and free of bicycle wheel-trapping gaps.

Implement a monthly sweeping schedule of major roadways, bi-monthly for local streets except posted bike routes. Implement bi-weekly sweeping of bike lane facilities and local street bike routes. Conduct inspection for pavement repair needs as part of the sweeping program (or on a separate bi-monthly inspection program) and respond appropriately to repair needs. Implement monthly inspection of shared-use paths for potholes, cracking, landscape maintenance, and sweeping needs.

Construction Zones and Utilities

If utility work is necessary within the paved shoulder or bike lane, the full width of the area should be repaved smoothly to grade after work is complete. Considerations for bicyclists and pedestrians should be made when bicycle facilities and walkways are closed for utility work, such as by providing wider curb lanes or temporary bike lanes and walkways through the construction areas. In some cases, appropriate and convenient detour routes may be provided for bicyclists and pedestrians.

Alternative routes should be designated during disruptive construction.

Construction and barricade workers should be trained and construction zones should be monitored to ensure safe pedestrian and bicycle passage through construction zones, per standards and guidance set forth in the current MUTCD edition.

Pavement edges, including where the asphaltic concrete roadway meets the Portland cement concrete gutter pan, should be flush to reduce the potential for bicycle crashes.

Provided below are sample guidelines for appropriate maintenance and construction zone treatments:

- Conduct periodic review of drainage grates and cattle guards (if applicable) to ensure that no parallel cracks develop which can trap a bicycle wheel and cause crashes. Respond immediately to citizen requests to repair or replace drainage grates that are considered hazardous.
- Consider bicycle and pedestrian safety needs through or around construction zones and develop barricade plans to provide improved safety specifically for bicyclists and pedestrians. Train staff construction crews and contractors to provide wide curb lanes (15 feet) through construction zones and separate walkways, where feasible. Provide signs for suggested detour routes for bicyclists if detour routes do not deviate from the route under construction by more than one-quarter mile. Provide Share the Road signs through construction zones at inception of zones and at one-quarter mile intervals.

Maintenance Response Mechanisms

TDOT divisions should have a specific telephone number for people to call to report maintenance problems. All calls should be logged and classified for level of required response. Provide timely response to citizen maintenance requests. Consider a 48-hour "Pothole Patrol," which sets forth goals to address routine maintenance requests within 48 hours after notification and/or inspects within 48 hours and schedule repairs within a reasonable time frame. Respond immediately to requests of a more serious nature, where citizens may indicate an emergency condition.

Research into Maintenance and Repair Costs

The extent, cost, current operations, and responsibilities of maintenance and repair costs for bicycle and pedestrian facilities, including shoulders, will require input from TDOT divisions and departments. Once this information is collected, possibly as part of a larger roadway maintenance analysis, potential changes to financial allocations, practices, and procedures could be made. For example, TDOT may decide to use available Federal dollars for the purchase of maintenance equipment such as sweepers that could help accelerate activities. Roadway repair procedures for activities such as new pipelines could be modified to ensure acceptable pavement smoothness standards were met.

Priorities for Maintenance/Repair (see also 7.8.3 Project Development, Ranking, and Funding)

Roadway repair and long-term maintenance projects that would benefit bicyclists and pedestrians, especially along statewide bicycle routes and in developed areas, could receive priority status through a revised Project Ranking process. Analysis into the cost and programming impacts of this recommendation need to be developed and reviewed by the appropriate TDOT departments.

7.3 Move a Growing, Diverse, and Active Population

This section of recommendations addresses bicycles and limited access highways, development of projects in local communities, technical assistance to local agencies, promotion, and innovative technologies.

7.3.1 Access to TDOT Facilities

Bicycles are prohibited from some sections of limited access highways in Tennessee. In some of these locations, particularly TDOT bridges, highways offer the only reasonable connection for bicyclists. Studies of bicycle safety on highway shoulders has shown that safety conditions are acceptable as long as the shoulders meet AASHTO standards, and bicycles are directed to exit the highway at all ramps. Other states allow bicycles on limited access highways where reasonable alternative routes do not exist, under the assumption that the highways themselves displaced local roads that were previously accessible to bicyclists. In all cases, bicycles are forced to exit the highway at all interchanges. Additional information can be found in the "White Paper: Bicycling and Limited Access Highways in Tennessee" prepared in June 2005.

7.3.1.1 Access Recommendations

Adopt a New Access Policy

TDOT should consider adopting a new policy that would allow consideration of bicycle access on highways where no reasonable alternative route existed. This process would allow for input from local agencies, the public, and bicycle organizations. The definition of 'reasonable alternative' would be defined in terms of a route that more than doubled the length of the connection, and/or included gradients, surfaces, or other features that do not meet AASHTO recommendations.

TDOT should be playing an active role in developing bikeways parallel to State highways, especially when there is a safety or capacity benefit. In comparison, the State of Oregon requires bikeways to be considered as part of all highway projects, and, in fact, new highways in Oregon are often constructed with parallel bike facilities. Consideration should be given to expand this section for the inclusion of bikeways parallel to State highways when "existing bikeway routes are unreasonably circuitous and they can be provided within TDOT right-of-way with reasonable costs and with local support."

As part of this adoption process, guidelines could also be developed for:

- Providing bike paths as part of new freeway projects
- Installing bike paths on existing freeway right-of-ways
- Bicycles on existing bridges
- Placement of rumble strips on highways
- Pedestrian overcrossings or undercrossings along highways
- Improving all state highways for bicycle travel
- Accommodating bicycles at freeway interchanges

Conduct a research study on the potential wording and financial, operational, and legal implications of adopting this new policy. If acceptable, adopt a new policy that allows bicycle to use to limited access highways where reasonable alternatives do not exist and adequate shoulders exist.

7.3.2 Local Coordination on Bicycle and Pedestrian Facilities

Pedestrian and bicycle facilities, which include sidewalks, bike lanes, crosswalks, warning and advisory signs, refuges, and other treatments, are most often found or needed in developed areas. Developed areas range from low-density rural areas to small villages, towns, and cities. State highways (except for limited access highways) are part of the local roadway system, are part of the local community, and are used by bicycles and pedestrians. In many cities, state highways serve as a community's Main Street or commercial center, and may require improvements to enhance bicycle and pedestrian circulation and safety.

7.3.2.1 Local Coordination Recommendations

Local Streets: Flexibility in Design and Operations Handbook

Different states have various documents that address these issues, which may include related topics such as traffic calming, context sensitive design, and pedestrian safety. We recommend that TDOT develop a document to be used by local agencies to understand the range of possible treatments that TDOT would accept on state highways that also serve as local roadways.

In order to develop any new management and improvement arrangements on State right-of-way, an analysis of potential impacts and benefits would need to be accomplished. A Handbook would need to be created that identified acceptable options for pedestrian facilities, the TDOT review and approval process, and management and maintenance agreements responsibilities. Research would need to be conducted to determine how the proposal would be utilized, how it might impact State Highway operations, safety, and liabilities, cost impacts, and other items. Research

for this project would include a review of current encroachment methods used by local agencies and TDOT, and a comparison with methods from other states.

The Handbook could include the following elements:

- Definition of local roads covered in the document
- The need for community involvement and local plan consistency (especially level of service and related methods)
- The process for TDOT approvals and permits
- Methods of obtaining approvals for non-standard designs and treatments
- Funding, construction, maintenance options
- Finding standards and guidelines

Potential treatments:

- Banners and decorations
- Crosswalks
- Curb extensions
- Furnishings
- Gateway treatments
- In-pavement flashers
- Landscaping
- Lowered speed limits
- Medians
- Narrowing travel lanes
- On-street parking
- Pedestrian refuges
- Public art
- Reducing travel lanes
- Roundabouts and traffic circles
- Signage
- Street lighting
- Textured pavement
- Transverse rumble strips
- Widened sidewalks
- Bike lanes

Local Agency Coordination

Other methods of coordinating with local agencies include (a) regularly scheduled TDOT Bicycle/Pedestrian Committee meetings around the state devoted to non-motorized topics, during which local agencies could bring up issues of interest; and (b) the designation of non-motorized coordinators for each TDOT division. Both of these efforts are already being done to some extent by TDOT. The need for and cost of these efforts would need to be examined.

7.3.3 Technical Assistance

Local agency staff may struggle to keep up with the latest technical methods and 'best practices,' especially for the bicycle and pedestrian transportation modes. Web-based materials identified in 7.2.1 Design Standards will be useful. The Education and Training Program recommended in 7.2.3 Education and Training addresses this in part by offering training and resource materials to local agencies in classrooms and on the web. However, neither of these resources may be sufficient for a local agency trying to find the appropriate solution for a complex study area. For example, a city may have the need for a mid-block pedestrian crossing near a school and is unsure of the best combination of measures that will be most appropriate for their situation. The agency could contract with a consulting firm for these services; however, in many cases there is a need for an independent, subjective analysis to analyze a problem prior to bringing in a firm or professional to implement a design.

7.3.3.1 Technical Assistance Recommendations

TDOT Technical Assistance Program

Some state and regional governments have addressed the need described above by funding or directly offering technical assistance to local agencies on a competitive and need basis, in the form of public and private experts. These technical experts, working on an annual retainer for TDOT or a regional agency, are brought in to conduct an intensive evaluation and analysis of local conditions, and offer preliminary recommendations. The agency can then pursue funding for further design of the project. This has proved popular for issues such as pedestrian safety at complex intersections, where specialized expertise in GIS-based collision software and other tools can be used to identify patterns and develop solutions.

Types of technical assistance include:

- Pedestrian and bicycle safety audits
- Safety analysis of school zones
- Problem intersection diagnosis
- Calming traffic in residential areas
- Overcoming barriers created at interchanges

This type of program may be managed by TDOT, a Tennessee university under contract to TDOT, or a regional transportation agency. TDOT should conduct an internal study to determine the cost and effectiveness of this type of program. If it is determined that this would be an effective program, TDOT could take the lead in initiating this program either directly as a new program administered by a local TDOT division, or indirectly by allocating funding for regional agencies and rural counties to implement this program. Either approach could utilize internal experts or provide funding to hire experts from local universities and/or consulting firms.

7.3.4 Multimodal Transportation

By far the most cost-effective means of providing bicycle and pedestrian facilities is to integrate them into other transportation projects, whether they are roadway rehabilitation projects, new

multimodal terminals, or other facilities. This plan has already identified specific proposals for including bicycle and pedestrian elements on State-funded projects.

7.3.4.1 Multimodal Transportation Recommendations

Safe Routes to Transit

TDOT should consider a new program entitled 'Safe Routes to Transit' that is similar to the Safe Routes to School program, but focused on non-motorized connections to transit hubs. Extending the range of local transit systems by enhancing bicycle/pedestrian access is one of the most cost-effective means of increasing ridership. This could be in the form of a new grant program, or it could be a required element in local plans wishing to compete for grant funds. The program would focus on a one- to five-mile radius around multimodal hubs, and evaluate accessibility, corridor improvements, crossing improvements, on-site bike parking, and other elements.

7.3.5 Local Agency Support and Bicycle/Pedestrian Plans

One of the most effective things a local agency can do to enhance pedestrian and bicycle conditions is to complete a bicycle and pedestrian plan. TDOT would benefit directly from these plans by receiving funding applications for projects that have undergone a thorough local review and adoption process. State DOT's can play a key role in encouraging local agencies to complete high quality, consistent local bicycle and pedestrian plans. Some state DOTs have established requirements or incentives to encourage local agencies to develop plans with specific elements.

7.3.5.1 Local Agency Support Recommendations

Local Plan Incentives or Requirements

TDOT could require local agencies to have a local bicycle or pedestrian plan that meets specific requirements in order to qualify for some funding sources, or provide incentives in the form of receiving priority for competitive grants. This is a similar requirement already applied to other transportation modes including transit (short range transit plans), rail (rail service plans), and roadways (circulation elements, master plans, traffic studies). Local and regional bicycle and pedestrian plans help ensure that a coordinated, efficient, and effective network of improvements is made in Tennessee. Local plans provide the opportunity to assess current conditions, develop long-term goals and visions, evaluate needs, gather public input, develop effective projects, rank those projects, and develop an implementation plan.

Bicycle Transportation Plan

A city, county, region, or agency could complete a bicycle transportation plan in order to meet proposed TDOT funding requirements, or to receive priority points on competitive grant programs. Potential minimum standards for local bicycle plans include:

- The number of existing bicycle commuters in the plan area
- The potential increase in the number of bicycle commuters resulting from the implementation of the plan

- A map and description of existing and proposed land use and settlement patterns, bikeways, bicycle transportation and parking facilities, and facilities for changing and storing clothing and equipment
- A description of bicycle safety and educational programs
- A description of the extent of citizen and community involvement in the development of the plan
- A description of how the plan has been coordinated and is consistent with other local or regional plans
- A description of the proposed projects and their relative priority
- A description of past expenditures for bicycle facilities
- A description of future financial needs for bicycle projects

Pedestrian Plan

A local pedestrian plan should cover the entire scope of pedestrian topics. This will facilitate the application of appropriate standards and guidelines. Potential topics are listed below.

- The application of standards, guidelines, and best practices in the development of pedestrian facilities
- A complete bibliography of relevant documents on pedestrian standards, guidelines, and best practices.
- A description of pedestrian abilities, needs, interests, safety considerations, levels of use, demand, activity areas, and trip characteristics.
- Information on how to assess existing pedestrian conditions in a variety of settings, from urban to rural communities. This should include inventory, mapping, public workshop, and agency input techniques.
- Information on the basic types of pedestrian facilities and elements of a successful pedestrian system, including continuity, consistency, accessibility, pedestrian-friendly streets and street networks, establishing pedestrian zones, and model pedestrian communities.
- Information on the ADA and barrier-free design, including the latest interpretations from the U.S. Access Board, designing for older and younger people, and eliminating obstacles and barriers.
- Information on basic design parameters including minimum and recommended widths and clearances, passing and rest areas, grades, slopes, curb ramps, ramps, handrails, driveways, surfacing, textural and visual cues, site connections, signing and other communication aids, and lighting.
- Information on trails and pathways, including accessibility, boardwalks and trestles, surfacing, and other topics, to the extent it is not duplicated in State or AASHTO documents.
- A chapter on the design of sidewalks and walkways, including minimum and recommended provisions by land use type and physical settings, sidewalks versus walkways, design and construction specifications, dimensions, street separation and edge treatment, street furnishings, utilities, and related clearances, landscaping and street trees, bicycles and other devices on sidewalks, and maintenance.

- Information on pedestrians and intersections, including crosswalk types, effects on traffic capacity, recommended design practices, intersection design, traffic signals, and innovative treatments.
- Information on crossings including mid-block crossings, uncontrolled and controlled crossings, grade separation, selection of crossing type, railroad crossings, and medians and refuges.
- A section on traffic calming and how techniques such as neighborhood traffic management can benefit pedestrians and pedestrian movement.
- A section on pedestrian access to transit, including transit compatible design, transit centers, park-and-ride facilities, safe routes to transit, transit malls, and related topics.
- A chapter on site design for pedestrians geared towards new or redeveloping areas, focusing on pedestrian-friendly designs; elements of a walkable community; on-site circulation and parking; building location and design; land use, density, and pedestrian use; and integrated pedestrian systems in new developments.
- A section on pedestrian safety, including analyzing collision data, reconstructing incidents, identifying improvements to address safety problems, and safety in work zones.
- Strategies for implementation including funding, assessment districts, requirements, ordinances, and financial plans.

7.3.6 Innovative Treatments

The bicycle and pedestrian field is rapidly evolving, with new practices, standards, and procedures appearing almost daily. Many of these innovations are aimed at helping overcome major gaps and barriers in the transportation system for bicyclists and pedestrians. It is in the interest of TDOT and Tennessee to identify, evaluate, and apply as appropriate these innovative treatments. Unfortunately, while Tennessee has many excellent success stories, it is not currently the leader in research on the bicycle and pedestrian fields. The Florida DOT and University of North Carolina have led major technical research in this field, and many other states have completed bike and pedestrian plans. Tennessee has an important role to play in this field from a transportation, safety, and economic perspective, and should take active steps to become a leader. This can be accomplished through the following methods.

7.3.6.1 Innovative Treatment Recommendations

Form Research Partnerships

TDOT should identify a university or universities in the State to act as a research partner on non-motorized projects. Most research grants from the NCHRP and other sources are awarded to research groups that are also supported by state DOTs. As a short-term step, TDOT should identify needed research topics in the field that would be of statewide interest. Some of those potential topics include:

- **Retrofitting Bridges to Accommodate Bicycles and Pedestrians**. Tennessee has numerous major bridges that are not slated to be re-constructed for many years. In the interim, methods of attaching new light-weight structures for bicyclists and pedestrians should be explored.

- **Warning Lights in Tunnels**. Bicycles must share the roadway with motor vehicles in tunnels, especially in eastern Tennessee. Warning systems that can be activated by bicyclists to help warn motorists of the presence of a bicyclist would have immediate safety benefits.
- **On-Demand Shuttles**. Major gaps created by Tennessee's rivers and mountains may pose insurmountable costs to provide reasonable bicycle access. One solution to be studied may include on-demand shuttles that can ferry people across major barriers and gaps on small vehicles, perhaps during peak seasons. These types of systems already exist in other parts of the country.
- **Accommodation on Public Transit**. Some public transit agencies in Tennessee already provide bike racks on their buses. For those that do not, research might be presented showing the benefit of these systems, along with funding opportunities. For agencies that already have racks, exploring new technologies that provide room for three and four bicycles are potential research topics.

7.4 Support the State's Economy

Recommendations in this section address resources and services to support economic growth, competitiveness, and tourism. Specific recommendations look at developing maps, signs, and other products, along with improvements focused on tourist and employment areas.

7.4.1 Statewide Information Systems

TDOT already produces and distributes one of the most comprehensive recreational bicycle route maps in the country (*Cycling Tennessee's Highways*). Recommendations in Chapter 6 include new routes designed to link cities and major destinations, plus enhancements to the existing five routes identified in the *Cycling Tennessee's Highways*. These types of products and improvements help to attract visitors to Tennessee, help retain high quality employees, and generally enhance the livability of Tennessee's towns and cities.

7.4.1.1 Recommendations

Statewide Bicycle System

It is recommended that TDOT build on the success of *Cycling Tennessee's Highways* and develop a comprehensive package of services and improvements to attract visitors to the state and help retain quality employees. Key elements of this will be:

- A statewide bicycle route map that will show recommended routes on state highways between Tennessee's major cities and towns along with connections to major activity centers (such as universities), local businesses, and tourist destinations.
- A web-based version of this map that will provide interactive information to people planning their trips, providing information on local services, parks, and businesses.
- A comprehensive signage system that will identify the statewide system with a distinctive logo, and be placed at least every five miles and where there is a change in roadways.

7.4.2 Activity Center Access and Safety

One of the criteria for allocating funding to bikeway and pedestrian improvements recommended in this Plan is how well the project improves access and safety conditions on routes linking to major tourist, business, and other activity centers. These areas represent one of the best opportunities to have a positive economic, health, and transportation impact, since the focus of activity also means more potential users. For example, a new greenway linking a residential area to a major employment center will be heavily used by employees and residents, since it serves a natural market. People visiting tourist areas are already looking for recreational activities to pursue. With walking and bicycling the #1 and #2 most popular recreational activities of Americans, providing these facilities where people recreate is only natural.

7.4.2.1 Activity Center Access Recommendations

Focus Improvements on Major Activity Centers

Available funding and TDOT resources for non-motorized facilities should be prioritized for areas serving major business, recreational, or other activity centers.

7.5 Maximize Safety and Security

This section focuses on methods of improving safety and security for all users through enhancements to the TDOT data collection system, crash reporting system, and safety and education programs.

7.5.1 Enhance the Data Collection System

One of the greatest challenges facing the bicycle and pedestrian field is the lack of documentation on usage and demand. Without accurate and consistent demand and usage figures, it is difficult to measure the positive benefits of investments in these modes, especially when compared to the other transportation modes such as the private automobile. *The Guidebook on Methods to Estimate Non-Motorized Travel* (U.S. Department of Transportation, Federal Highway Administration, Publication N. FHWA-RD-165, July 1999) states that "further development of modeling techniques and data sources are needed to better integrate bicycle and pedestrian travel into mainstream transportation models and planning activities (Vol. 1, Section 4)."

Modes such as the private automobile have established documentation sources such as ITE's *Trip Generation Manual*, which is used nationally to establish roadway demand and distribution and justify expenditures on roadway improvements. Existing sources such as the U.S. Census Journey-to-Work and the National Household Travel Survey either cover a limited population sample or do not provide the needed information, with the results that transportation professionals have a hard time justifying new bicycle/pedestrian investments, undercount bicycling and walking in regional modeling efforts, and the transportation, economic, safety, health, and other benefits are either ignored or undervalued.

Meanwhile, hundreds of agencies and organizations around the state are counting and surveying bicycles and pedestrians every year. Unfortunately, with no consistent counting or surveying

methodology, this data is of limited value and cannot be used to establish any national standard or help establish linkages between land use, density, type of facility, demographic, or other factors and usage levels.

7.5.1.1 Bicycle and Pedestrian Count Recommendations

Annual Count Program

Local agencies around Tennessee are already conducting bicycle and pedestrian counts and surveys for a variety of purposes, such as testing whether new facilities are being used, establishing base data to determine collision rates, and identifying needs of local residents for new networks and facilities. Unfortunately, the number of agencies conducting these counts is small, and these efforts are not being done on a consistent basis so that a useful database of information can be developed for research purposes. TDOT could play a leadership role by sponsoring and coordinating a statewide bicycle and pedestrian count and survey effort, establishing count and survey methodologies, helping to collect the data, and making the data available to local agencies and research groups as needed.

Specific steps that need to be taken for this program include:

1. Establish a consistent bicycle and pedestrian count and survey methodology, building on the "best practices" from around the country, and publicize the availability of this free material for use by agencies and organizations on-line.
2. Establish a database of bicycle and pedestrian count information generated by these consistent methods and practices, to be made available for free via the Internet upon request.
3. Use the count and survey information to begin analysis on the correlations between various factors and bicycle and pedestrian activity. These factors may range from land use to demographics to type of new facility.

7.5.1.2 Potential Methods

A consistent bicycle and pedestrian count methodology needs to be developed, reviewed, and approved by peer groups such as the TRB, AASHTO, the Association of Pedestrian and Bicycle Professionals (APBP), and other groups. Types of data collection techniques and information to be analyzed include:

Hose counts are typically used to gauge levels of bicycle activity.

- Locations with high pedestrian and bicycle volumes
- Representative locations in urban, suburban, and rural locations
- Key corridors that can be used to gauge the impacts of future improvements
- Locations where counts have been conducted historically

- Locations where bicycle and pedestrian collision numbers are high
- Locations where there are ongoing counts being conducted by local agencies through a variety of means, including videotaping

Count Variables

- Type and quality of existing pedestrian or bicycle facility
- Duration of count, time of day, day of week, season
- Count type (manual, hose, video, other)
- Weather
- Season

Background Data to be Collected

- Surrounding land use(s) and densities
- Population within 1 mile, 5 miles, and 30 miles (using GIS)
- Local area bicycle and pedestrian commute mode percentages (from US Census, NPTS, NHTS)
- Demographic data of surrounding area (average age, income, auto ownership, education)
- Existing collision data on or near count location
- Number of annual visitors to the area
- Completeness and quality of the connecting bikeway or walking system

Survey or Questionnaire Questions

- Trip method: walking, bicycling, other
- Why user does not walk or bicycle more often
- Trip and user origin and destination
- Length of trip
- Trip purpose (recreation, transportation, exercise)
- Age range
- Auto ownership
- Changes that might make user consider walking or bicycling more often
- How familiar user is with the benefits of walking or bicycling

Once a consistent methodology has been approved, TDOT should publicize this free service, begin gathering data, and sort it so that it can be analyzed and distributed to agencies and organizations upon request. This material should be available for free through a website.

The main questions this research will help answer are:

- **Demand Projections.** What is the projected demand for a specific type of bikeway or pedestrian facility in a variety of settings? This will help planners and designers select

appropriate facility types, evaluate alternate alignments, size facilities, and justify the facilities in grant applications.

- **Trip Generation and Distribution.** What is the existing and projected mode split of non-motorized users for a variety of land uses? This can help modelers and planners develop more accurate traffic models, estimate the impact/benefit of bikeways/pedestrian facilities, estimate vehicle miles and vehicle trips, and develop more comprehensive ordinances and requirements for developers.
- **Overall Trends.** What is the overall trend in walking and bicycling in Tennessee, by demographic group, land use, density, geography, climate, and a multitude of other factors?

The main benefits of the data collection program would be:

- Planners, agency staff, and others will be able to quickly access the latest figures and trends in usage and demand for a variety of types of facilities in a variety of settings. This will be useful for developing estimates of usage for proposed improvements.
- Researchers and others will be able to use the data to establish correlations between usage and a variety of land use and demographic data available in the State. Modelers will be able to base their projections on actual empirical data.
- Statewide trends in bicycle and pedestrian activity could be a major annual benchmark in evaluating the success of investments in facilities and programs, and in national trends overall in terms of modal selection and activity.

Adopt a Bicycle and Pedestrian Forecasting Tool

The count methodology previously identified will allow the State and local agencies to understand current levels of walking and bicycling throughout the state. It is recommended that TDOT adopt a consistent projection methodology for forecasting bicycle and pedestrian usage to allow local agencies to incorporate this information into their transportation models, and also to quantify the benefits of proposed projects. It is recommended that TDOT adopt the methodology being studied currently by ITE that will be similar to their Trip Generation Tables and other tools.

7.5.2 Improving the Accuracy of Crash Data

The Tennessee Department of Safety is responsible for the collection and analysis of all crash data. The Tennessee Highway Patrol utilizes a crash analysis and reporting system that collects and analyzes data from state and local police departments. All police departments in Tennessee use a standardized crash reporting system, and this data is available to local agencies that wish to analyze safety in their communities. Tennessee does an excellent job at collecting, analyzing, and responding to crash statistics and trends.

The Tennessee Driver's License Handbook contains sections for bicycle and pedestrian laws, rules of the road, and related material, along with information addressing motorists' responsibilities related to bicycles and pedestrians.

7.5.2.1 Crash Data Recommendations

Crash Analysis and Reporting System

The current system used by the Highway Patrol could be enhanced for the bicycle and pedestrian modes in several ways. First, the accuracy of the crash reports could be enhanced if officers were equipped with Global Positioning Systems (GPS) so that the exact location of crashes could be reported and mapped. This is especially important in rural and low-density areas where adjacent street addresses are not available, and the nearest cross-street may be miles away.

Another potential enhancement is the use of specialized GIS-based crash analysis software that can help TDOT, THP, and local agencies and departments in understanding the causes of pedestrian and bicycle-related crashes. One of these software programs, Pedestrian-Bicycle Crash Analysis Tool (PBCAT), is available from FHWA.

The Vehicle Crash Report itself may be modified to help officers identify causal information related to bicycle and pedestrian incidents as well. Identifying fault, code violations, and obtaining accurate diagrams of crashes are critical to identifying the best type of engineering, enforcement, or education measures.

7.5.3 Pedestrian and Bicycle Safety Programs

Tennessee has a long history of proactively addressing pedestrian and bicycle safety. This includes the three 'E's' of education, enforcement, and engineering, implemented by TDOT, the Tennessee Department of Safety, and other state and local agencies. At the same time, this field is constantly evolving with different state and local agencies trying new techniques.

7.5.3.1 Safety Programs Recommendations

Enhanced Safety Programs

Specific means of enhancing current programs, policies, and procedures in Tennessee related to bicycle and pedestrian safety include:

- Convene a statewide conference of TDOT engineers to address this topic.
- Identify a number of statewide 'control locations' to collect more detailed information on pedestrian-involved collisions, using advanced technology such as video cameras. This would allow the State to collect base data on the number of pedestrians in the area and a base 'rate' of collisions to be developed.
- Continue to meet ADA requirements on all TDOT facilities, and add buffers between pedestrians and motor vehicles along higher speed, non-freeway state routes as feasible.
- Maintain the TDOT policy of not allowing pedestrians on high-speed freeway shoulders.
- Continue pursuing a pedestrian safety publicity campaign.
- Consider adopting the latest MUTCD standards for minimum green clearance time for pedestrians using passive pedestrian detection equipment.
- Continue research into pedestrian safety at roundabouts.

- Recommend methods to estimate pedestrian demand for state routes that lack access control in urban areas.
- Continue integrating provisions for bicycle facilities into all new and reconstructed roadway projects with appropriate design for features for the context and function of the roadway.
- Continue finding new partnerships and expanding old partnerships with federal and local agencies responsible for bicycle network and pedestrian facilities
- Continue working on funding Safe Routes to School program to increase education and awareness about proper bicycling technique and the following the rules of the road.
- Continue to provide bicycle facilities that encourage all users to obey the rules of the road to reduce dangerous behaviors such as wrong way riding and disregarding stop signs.
- Consider the use of pedestrian capacity and level of service for state routes that lack access control in urban areas.
- Develop a rating and management system for sidewalk maintenance.
- Review the US DOT policy statement in regards to funding for sidewalk construction.
- Develop a program for the removal of pedestrian obstacles in 'high' pedestrian demand areas, and remove these obstacles as part of re-construction efforts.
- Develop separate paths or sidewalks for pedestrians on routes that have 'medium' or 'high' pedestrian demand.
- Conduct research and develop policies on alternate types of crosswalk markings, in-pavement crosswalk lighting techniques, internally illuminated crosswalk warning signs, passive pedestrian detection devices, minimum green time for pedestrian crossings for speeds as low as three feet per second, and countdown timers.
- Study and provide policies and guidance on pedestrian collisions at intersections and devices such as auditory messages and pedestrian scramble systems.
- Install pedestrian signal heads and activation at signalized intersections in all urban and suburban locations.
- Develop warrants for bus stop bulbouts (curb extensions) based on vehicular and pedestrian demand.
- Support research on the use of ultraviolet headlights on a national level.
- Continue working with the Department of Motor Vehicles to ensure that drivers test cover all sections of the Driver's Handbook, including questions related to the bike section.
- Expand public service announcement (PSAs) program to address sharing the road with bicyclists and pedestrians.

Improving safety in any area requires **changing individual behavior**, the environment, and the equipment or materials being used. Safety in transportation focuses on three key elements: engineering, education, and enforcement. Other factors are often added, including encouragement and emergency response. The engineering and maintenance of roadways affect both the environment and the equipment, as do individual and group choices and behavior.

Education can be addressed to bicyclists, pedestrians, motorists, parents, peers, teachers, law enforcement officers, engineers, designers, and many others. Accurate information and research

must be used to set policies and recommend the appropriate tools. A community's maintenance decisions can improve or decrease safety for users. For example, overgrown shrubbery can obstruct the view of a driveway, intersection, traffic sign, or other important traveler information. Debris along the curb or lampposts too close to a sidewalk can create a hazard.

Engineering decisions can be improved through education, clear standards, training, and by understanding users' requests or complaints. It is sometimes difficult to identify which decision makers need, and will take advantage of, training. The education challenge is to offer training and related information that will be used at the appropriate engineering decision points.

Law enforcement is an exceptionally good way to educate the public about the importance of bicycle safety to a community. Enforcement works as education when the laws identified for selective enforcement can be clearly tied to local crash and injury causes and when the enforcement agency works with local media to alert the public of the dangers of certain behaviors and the importance of stopping violators of the most critical laws. At the same time, officers must recognize and acknowledge that the majority of people will do the right thing as long as they know what is expected.

Enforcement stops of bicyclists should focus on wrong-way riding, nighttime riding without a headlight and rear red reflector, driveway and mid-block ride-outs (failures to yield), and red light violations. Officers should stop motorists because of speed, operating while intoxicated, ignoring traffic controls, failure to yield (especially on left turns), not sharing a lane or keeping at least three feet from a bicyclist when passing, and any behavior that is aggressive toward a bicyclist or pedestrian. This includes such behavior as: yelling and throwing objects; touching the bicyclist while passing; unwarranted braking after passing; and tailgating with or without blowing the horn.

State and local police should increase enforcement of laws in areas with concentrations of bicycle and pedestrian collisions, in downtown areas where there are a high number of pedestrians, and at the beginning of each school year on school commute routes. If the crash reporting system indicates any specific pattern, such as time of day, age of people involved, location, fault, or code violation, enforcement should be targeted to address these conditions. If physical roadway conditions (such as visibility, signage, etc.) are determined to be the problem, police should contact TDOT or local engineering departments and provide a summary of their analysis and conclusions.

Safety-oriented activities can be grouped into three general categories:

1. Prevention of crashes and therefore injuries
2. Prevention of certain types of life-threatening injuries
3. Prevention of situations that have been shown to result in injuries

A state bicycle and pedestrian plan, state and national policy, and data or research cannot make safety happen. Ultimately, the local community decides which, if any, of these activities to implement. Individual and collective commitment to correcting what is wrong, teaching what is right, and rewarding good behavior, is fundamentally a local task to make a safe community.

However, TDOT and the Department of Safety may be able to address these issues by promoting safety and funding training and crash analysis programs.

When all Tennessee communities share this commitment, this State will be a safe place where bicycling and walking are an easy and frequent transportation choice.

7.5.3.2 Safety Action Strategies

There are three key strategies to prevent serious injuries and deaths involving bicycles and pedestrians:

1. Prevent the crashes (education).
2. Intervene in the crash so that injury is minimized (helmet use, slowing traffic).
3. Provide quality emergency response and follow-up medical care when there is a crash to reduce long-term costs to the individual and to society.

Tennessee communities need to use the best resources and tools available and focus on all three areas to improve the safety of all bicyclists and pedestrians. Children and novice adult bicyclists are involved in crashes that most often result from bicyclist error, while more experienced bicyclists are most frequently involved in crashes where the motor vehicle operator or other person is in error. Time of day is another factor in crashes, especially for children. The large majority of their crashes occur in the three to four hours right after school.

Location is also a factor. For children, crashes generally take place on neighborhood streets and often are at mid-block or stop sign locations. Most motorists, pedestrians, and bicyclists do not respond safely or quickly to the unexpected. Strategies that a community can follow to prevent crashes, reduce injury, or intervene once a crash occurs are offered below.

However, communities should examine their choices every few years to make sure they still work, are the best approach for the identified local bicycle and pedestrian crash concerns, and have not been superseded by better approaches. Community leaders concerned about bicycle and pedestrian safety should remain open to innovative approaches in the fields of engineering, education, enforcement, emergency medical services, and encouragement. Developing new strategies or trying other communities' strategies can help result in better ways to make bicycling and walking both fun and safe.

7.5.3.3 Crash Prevention: Engineering

Eliminating competing uses of the bicycling and walking space, or denying bicyclists or pedestrians use of certain spaces reserved for others can help prevent crashes. Limiting bicyclist use can include designating slow speed user areas in locations such as pathways, pedestrian-only sidewalks, and child play areas. However, care must be taken not to limit bicycle access to necessary and desired destinations. The following are engineering and traffic-calming strategies that a community can use to protect exclusive and shared space for bicyclists:

- Establishing lanes for use only by bicycles, buses, and right turning motor vehicles

- Developing exclusive bicycle lanes that cannot be intruded on by a motor vehicle, except when it is turning
- Restricting whole streets or neighborhoods to use only by bicycles and local residents' motor vehicles
- Incorporating measures to reduce speed of vehicles on neighborhood streets

Additional strategies a community should pursue include:

- A road hazard and sidewalk identification system and reporting mechanisms
- Complete investigation of bicycle and pedestrian crashes that occur so the community can understand how similar crashes can be avoided in the future
- Taking advantage of educational opportunities that involve the training of planners and engineers in the planning and design of bicycle and pedestrian accommodations

7.5.3.4 Crash Prevention: Education

Other ways to prevent crashes are to provide bicyclists with current information about the causes of bicycle and pedestrian crashes, and how those causes differ by age, gender, and rural or urban setting. Instructors must understand what knowledge and skills are needed to prevent crashes, especially with motor vehicles, which cause 90% of the serious injuries and deaths for bicyclists and pedestrians. Instructional programs for both children and adults can provide a multi-faceted approach, including:

- In-school informational and hands-on programs
- Community single-day biking or walking events
- Parental rule-setting, supervision, instruction, and reinforcement
- Instruction in the proper sizing and adjustment of a bicycle
- Bicycle maintenance by the owner and professional
- Citizen reporting and prompt repair of road hazards
- Law enforcement which stresses the community's commitment to legal, respectful, and safe interactions between bicyclists and pedestrians, motor vehicle operators, and other bicyclists

It is recommended that the Tennessee Department of Safety consider establishing a Bicycle and Pedestrian Safety and Education Officer position. Two major responsibilities for this position would be:

1. To plan and administer a program of safety education which includes safety information concerning interaction among motor vehicles, bicycle(ist)s, and pedestrians
2. Provide grants to local governmental entities, including school districts, for assistance in carrying out the program of safety education

The Pedestrian Safety and Education Officer would aid bicyclists in their riding skills, inform bicyclists and pedestrians of applicable traffic laws, and encourage observance of those laws while generally promoting bicycle safety. TDOT, NHTSA, and other safety or bicycling

organizations offer up-to-date informational brochures, posters, bumper stickers, book covers, videotapes, training guides, and full curriculum materials free or at low cost.

Education should also be directed to motorists so they have a better understanding of appropriate bicycling techniques, learn how to share the streets and roads safely, and understand the importance of communication and obeying laws. Driver's education instruction should focus more on how to avoid crashes with bicyclists and pedestrians, and on understanding how driving violations lead to serious crashes. Parents and new drivers should be the targets of messages focused on driving in school areas and neighborhoods, as well as on how to prevent crashes with bicyclists and pedestrians.

7.5.3.5 Crash Prevention: Enforcement

Law enforcement agencies can project the community's commitment to making bicycling a safe, enjoyable activity for community members and visitors through a clear policy that bicycle safety law enforcement is part of their traffic enforcement and community policing activities.

Parents and schools also play a role in enforcement:

- Parents are responsible for disciplining their children for any violation of bicycle laws. This discipline must be accompanied by further efforts to educate children on expected safe bicycling.
- School authorities must educate students regarding bicycling and walking to school policies and rules. Schools should ensure that the rules and policies exist to protect the child bicyclist and pedestrian, and are fair to all students. The school should provide accurate information about specific bicycle and pedestrian crash causes in the community.

A balanced enforcement effort targeted at bicyclists, pedestrians, and motorists, and combined with good public information, is essential for bicycle and pedestrian safety enforcement to be effective.

7.5.3.6 Crash Intervention: Helmet Ownership and Use

According to the NHTSA, head injury causes 75% of the 900 bicyclist deaths in the United States each year. About 50% of bicycle injuries are from falls. Falls with resulting head injury can occur anytime. The most effective way to prevent head injury (the single largest killer and permanent disabler of bicyclists) is to wear a correctly sized and fitted helmet. According to studies by the Harborview Injury Prevention and Research Center in Seattle, correctly worn helmets can prevent up to 88% of bicyclists' brain injuries.

Community programs can help prevent deaths and incapacitation caused by head and brain injury. Promotion of the correct use of an approved helmet and the prompt replacement of a helmet struck in a crash are fundamental to bicycle safety. TDOT currently distributes free helmets to school children when funding is available. It is recommended that TDOT expand and continue funding this and similar programs around the state.

Helmet Safety Programs and Requirements

Programs to encourage bicyclists, especially children, to wear helmets have proven effective at reducing injuries and fatalities around the country. TDOT, in conjunction with the Highway Patrol and other agencies, may institute a helmet subsidy program that provides low-cost or free helmets to children. Helmet manufacturers and others may also be involved in this program.

TDOT and other agencies may also wish to evaluate the possibility of requiring all bicyclists under 18 years of age to wear a helmet. In states where this has been put into effect, compliance has been very high with resulting tangible reductions in severe injuries and fatalities.

7.5.3.7 Level of Service/Suitability Models

A hybrid Suitability Model and Map was created as part of this planning process to analyze safety conditions on TDOT roadways. The two factors used in the analysis, shoulder width and Average Daily Traffic (ADT), are the best indicators for basic bicycle conditions in the state. The tool also indicates basic pedestrian conditions in undeveloped areas where there are none or very few sidewalks, and people need to walk along roadways. It is recommended that the Suitability Model and Map created for this plan be used to focus safety education, enforcement, and engineering funds and programs. This tool could be enhanced by the addition of crash statistics and other information in the future, and used to identify specific locations that need improvement.

7.5.3.8 Sidewalk Safety

TDOT has limited control over sidewalks in the state; however, it can provide recommendations and model regulations to help local agencies. In some cases, it directly controls sidewalk operations and should implement the following recommendations:

- Make it illegal for bicycles to use sidewalks in downtowns and busy commercial areas.
- Discourage bicyclists over the age of 15 from using sidewalks.
- Regulate the use of personal mobility devices, such as scooters and Segways, on sidewalks to areas where pedestrian volumes are low to moderate, and there is adequate sidewalk width.

7.6 Build Partnerships for Livable Communities

This section addresses the TDOT principle of establishing strong, ongoing collaborative partnerships with local agencies and the private sector, and specifically, incentives for compatible land use policies, research into the land use-transportation relationship, and goals of the 'Livable Tennessee' program that promote tourism and economic development.

7.6.1 Land Use Development Policies

Land use and urban design are the two most important elements that impact the viability of the bicycle and pedestrian modes. Sprawling low density development separated by wide, high-speed and high-volume arterials will rarely become places people want to walk or bicycle. Research has shown that our current development patterns make active lifestyles almost impossible, and are the major reason our health and sense of community has declined in this country. TDOT has a very limited role in shaping local land use and development policies, but it

can promote land use, development, and roadway policies and designs that 'build-in' opportunities for people to walk and bicycle. Communities that have these features are consistently the places people want to live and work, which has a direct economic impact on local communities, private employers, and the State of Tennessee.

7.6.1.1 Land Use Policy Recommendations

Promote Livable Communities

Community structure is the basis for a pedestrian-friendly environment. A community's transportation system needs to provide a full range of transportation choices in a balanced and integrated manner. However, sidewalks and streets alone cannot create a complete pedestrian-friendly environment. There must be a complementary relationship between the transportation system and the land uses it serves.

Local jurisdictions may be interested in identifying specific locations in their community as having a focus on pedestrian accessibility, especially to transit stations and hubs as identified in local transit plans. The purpose of designating these areas is to encourage an appropriate mixture of uses and activities within a walkable distance and with transportation improvements to support walking as a convenient and safe choice.

Model guidelines provide recommendations for achieving goals. Mixing of uses either vertically (within a building) or horizontally (within a center, district, or corridor) adds to the vitality, walkability, and safety of neighborhoods throughout the day. Traffic management techniques, coordination with bicycle facilities and parking, and defining the appropriate access to transit facilities are also discussed, since they are necessary to ensure a circulation system that is comfortable for pedestrians.

The guidelines recognize that in most Tennessee communities, the existing circulation system is established and in some cases it is not conducive to pedestrian travel. Retrofitting options are presented to achieve pedestrian design principles. Changes can be made within public right-of-ways to begin "mending" a disconnected system. Measures include installing sidewalks in neighborhoods where they are lacking, improving street crossings, and installing traffic calming elements (i.e., reduce the speed of turning movements, slowing speed while maintaining traffic flow, etc.).

7.6.1.2 Urban Design

The principal issue in the design of a pedestrian-supportive street is how to allocate its space: calculate and provide the space needed for pedestrians to create active public space, as well as maintain appropriate space for parking, bicycles, vehicular movement, and deliveries. The four significant considerations related to effective pedestrian design are: ADA Accessibility, New

Good urban design encourages walking.

Development vs. Retrofit, Relation to Current Standards and Practices, and Relation to Transit.

The pedestrian environment should improve the overall aesthetics of the community and be appreciated at a human-scale, close-up and at slower speeds. This can be described as “placemaking” in the pedestrian realm. If properly implemented, facility improvements can make pedestrians feel they belong. This creates a “virtuous circle” (as opposed to a “vicious circle”) – an environment that supports pedestrians, attracts more development and investment that in turn attracts more pedestrians, and so on.

Key to establishing a successful pedestrian realm is determining the width of walking space, a task that is more complex than it initially appears. Sidewalks are actually divided into imaginary lanes or "zones"- the “Edge Zone” immediately next to the roadway; the “Furnishing Zone” accommodating amenities such as street trees and transit facilities; the “Through Zone” that is the absolute minimum allowable for unobstructed movement (dictated by ADA); and the “Frontage Zone,” the clear space between a building frontage and the Through Zone.

The pedestrian realm can also be considered the nexus of the disciplines of transportation engineering, landscape architecture, architecture, and planning. Therefore, an integral component of a strong pedestrian realm is the adjacent site design and architecture. Architectural designs should address and enliven the street – facades that are human-scaled and preferably "transparent," giving the pedestrian an understanding of activities taking place near them.

Special attention should also given to the needs of children and seniors, and to non-roadway improvements such as trails, accessways, and stairways that improve connectivity, making walking a viable mode. Finally, public art, specialized signage, and attractive, well-located open space contribute to a "sense of place" and the pedestrian's enjoyment of public spaces. (Excerpted from SANDAG *Planning and Design for Pedestrians*, 2002)

7.6.1.3 New Development

New developments offer a unique opportunity to make sure that internal bicycle and pedestrian circulation is ‘built-in’ to the development by the provision of sidewalks, connector paths, and bike lanes, and that connectivity to external destinations (schools, parks, transit, work, etc.) are also included. Local agencies hold the key to these goals in their approval process for new developments. Local agencies that have adopted these types of goals, including a community bikeway and pedestrian plan, will be in a better position to require specific types of improvements than those communities with no adopted plans. TDOT could provide resources and encouragement for local agencies to adopt zoning and land use regulations that require the development of bikeways, greenways, and pedestrian facilities in all new planned unit developments (PUDs).

Research into Land Use and Transportation

TDOT could play a role in initiating and encouraging timely research on how land-use decisions affect transportation choices. TDOT could subsidize research led by Tennessee universities, or develop ‘demonstration’ sites that could act as laboratories for innovative land use and transportation policies. In other states, university communities are used as demonstration or case studies to examine how innovative decision-making affects land use and transportation patterns.

7.6.2 Livable Tennessee

'Livable Tennessee' is a new program to make the state a more attractive place for businesses, employees, and tourists by working towards the types of environments that support those activities and people. States around the country are starting to consider bicycle and pedestrian facilities not just as transportation, mobility, environmental, or safety enhancements, but as economic tools vital to their economies. Livable communities, of which pedestrian and bicycle facilities often are key elements, help attract and retain high quality employees. With active tourism and health as two of the top interests of the public, a high quality bicycle and pedestrian system can greatly increase the number and duration of visitor trips to an area. Locations considered to be livable usually also have an extensive network of trails and bikeways, such as Minneapolis, San Francisco, and San Diego. Even the #1 tourist destination in the United States, Disney World, has a replica of a pedestrian-friendly 'Main Street' at its core.

7.6.2.1 Livable Tennessee Recommendations

TDOT, in coordination with tourism and economic development agencies, should work to promote and inform residents and visitors about the existing opportunities in Tennessee. Some of these tools include:

- **Development of regional and statewide bikeways**. By helping local agencies plan, design, fund, and construct high quality bikeways, TDOT will be helping to achieve these goals.
- **Identify and promote statewide facilities**. Facilities with strong concepts, such as the five routes identified in *Cycling Tennessee's Highways*, not only capture the public's attention, but also help gather support to see continuous high-quality facilities through to completion. TDOT should continue and expand support of these facilities by measures such as comprehensive signing on State highways.
- **Website/coordinated visitor information.** TDOT may wish to develop a website specifically for people desiring information on places to ride, including recommended routes, contact information, and so forth. This site could be linked to the existing TDOT Bicycle/Pedestrian web site.
- **Partner with the National Park Service.** The NPS has been working for many years on methods of getting people out of their cars, and encouraging walking or bicycling once in a national park. TDOT should form a partnership with the NPS to help study and implement innovative non-motorized facilities and programs to achieve mutual goals. One opportunity is with the Cumberland Gap / Highway 25E, which is reverting to its original state upon completion of the twin tunnels. Allowing bicyclists to travel on this former highway would provide an excellent, traffic-free environment for people who wish to bicycle into Kentucky or simply recreate in the area.
- **Promotional advertising.** TDOT should consider promoting bicycling and walking opportunities a commuting alternative, a visitor experience, and part of a healthy lifestyle. These ads could be co-funded with the Tennessee Department of Health or other agencies.
- **Statewide Bicycle Map**. A Statewide Map of Bicycle Facilities (web-based and hard copy) that links to local communities and major destinations could help generate economic activity in those areas, especially as greenways and similar facilities are developed.

- **Annual Bicycle and Pedestrian Conference.** Many states now sponsor annual or semi-annual bicycle and pedestrian conferences. TDOT could sponsor this conference and bring together people from throughout the state and the country who are interested in trail, bikeway, and pedestrian issues.

7.7 Promote Stewardship of the Environment

This section recommends policies, procedures, and practices consistent with the Guiding Principles of environmental stewardship, including specific methods to reduce vehicle congestion and pollution (transportation demand management), and developing greenways and connector trails.

7.7.1 Promote the Benefits of an Active Lifestyle

Most people are aware of the major health concerns in the country today, but few are aware of how the built environment around them influences their health. The most important segment of the population to reach is children, since habits established at this age will carry into adult life. The same efforts made to reduce cigarette smoking could be used to warn about the dangers of a sedentary lifestyle.

7.7.1.1 Active Lifestyles Recommendation

Promote Active Lifestyles in Schools

TDOT could provide funding to programs that encourage people, especially children, to lead more active lifestyles. Many of these efforts (providing additional facilities, addressing safety concerns, Safe Routes to School programs) can be found in this plan. Additional efforts could include public service announcements and advertising that identifies the benefits of exercise and the options available to incorporate it into daily life.

7.7.2 Transportation Demand Management (TDM)

TDM techniques include a variety of programs to help lessen single occupant vehicle (SOV) usage, especially for work-related trips. Usually, these programs are put in place because of a region's need to conform to Federal clean air requirements, with a regional air district serving as the lead agency for regulations and enforcement. TDM programs themselves are typically operated and managed by large employers or groups of employers, and include efforts to reduce SOV usage through efforts like carpooling, on-site showers and lockers, transit subsidies, and other efforts.

7.7.2.1 TDM Recommendation

Encourage Public-Private TDM Programs

TDOT could provide encouragement and resources to local agencies to establish programs and incentives to implement bicycle and pedestrian TDM measures. Incentives could include tax-credits, zoning bonuses, or other tools that would help 'build-in' facilities such as lockers and

showers for people who would like to walk or bicycle to work. Section 7.3.5 Local Agency Support and Bicycle/Pedestrian Plans provides detail on bicycle parking model ordinances.

7.7.3 State Greenway and Pathway Systems

Greenways, trails, and paths in Tennessee have been addressed in detail in the *Tennessee Greenways and Trails Plan* and the 1995-1999 and 2003-2008 *Tennessee State Recreation Plan*. They are addressed in this Plan as well for several reasons. First, greenways, paths, and trails can and do serve as parts of the transportation system in Tennessee, and can provide important connections and alternatives for bicyclists and pedestrians who would otherwise have to use roadways. Second, funding for paved multi-use trails can come from Federal and State transportation grants, and in fact, these often represent the single largest available funding source. Third, potential corridors for these facilities are often on existing or former transportation corridors (such as railroad lines). Finally, while TDOT's focus is on transportation versus recreational facilities, any facility that reduces trips—including recreational trips—could be considered as having a transportation benefit.

With regions like Chattanooga and Nashville developing comprehensive greenway systems, these facilities will serve as an alternative transportation network for bicyclists and pedestrians. TDOT can play an important role in helping local and regional agencies develop paved greenways, trails, and paths.

7.7.3.1 Greenway and Pathway Recommendations

TDOT Right-of-Way and Structures

TDOT can develop new policies, practices, and procedures for developing (or allowing local agencies to develop) multi-use pathways within its right-of-way, especially to help communities provide important connections. In some cases, a pathway may be designed within the TDOT right-of-way as part of a new highway or expansion project. In other cases, TDOT may construct or re-construct a new bridge with a pathway element to help connect segments of a greenway system. The minimum standards, guidelines, and requirements for these types of facilities would need to be reviewed by TDOT, especially as they relate to safety, liability, fencing, and maintenance.

Greenways and Trails Plan Recommendations

Recommendations in the *Tennessee Greenways and Trails Plan* related to TDOT are listed below. This plan outlines many progressive goals and recommendations that would improve the quality of bicycling and walking in Tennessee. Some of these recommendations have already been implemented by TDOT, while many others are reiterated in this plan or enhanced.

<u>Goals</u>

- Make Tennessee's roadways bicycle and pedestrian friendly and encourage alternative transportation.
- Enhance and expand opportunities for non-motorized recreation trail development.

- Establish dedicated full-time Greenways and Trails support positions within the Tennessee Department of Environment and Conservation (TDEC) and TDOT to provide technical and educational assistance to agencies and organizations implementing the greenways and trails plan.
- Encourage TDEC, TDOT, the Tennessee Wildlife Resources Agency (TWRA), the Tennessee Department of Agriculture (TDOA), and federal partners to coordinate efforts to develop statewide greenways and trails.
- Preserve Tennessee's abandoned railroad corridors and possible future transportation corridors for recreational opportunities.

Recommendations

TDOT is encouraged to create a full-time Bicycle/Pedestrian Coordinator position responsible for:

- Being an advocate for bicyclists and pedestrians within TDOT
- Providing technical information to communities regarding bicycle and pedestrian design standards and safety information
- Seeking the support of the TDOT Survey Design Office to facilitate implementation of bicycle/pedestrian access to State highways through the design and construction phases of development
- Expanding appropriate designated bike routes throughout Tennessee
- Seeking expansion of bicycle/pedestrian responsibilities with larger staff in the future

TDEC, TDOT, and the Department of Tourist Development (DTD) should collaborate to publish a map of community, regional, and statewide trail opportunities in Tennessee.

TDOT should consider developing special bicycle safety signage promoting Tennessee's bicycle-friendly roadways and encouraging motorists to respect bicycle users. TDOT should consider development of a 'Bicycle Friendly Community' Program to encourage communities to develop bicycle facilities. This program should provide special signage for designated communities.

TDOT is encouraged to continue to focus distribution of Transportation Enhancement funds for greenways and trail projects.

TDOT should encourage communities to seek funding through other eligible funding mechanisms provided through TEA-21 for greenway and trails (including CMAQ, Scenic Byways, and FHWA Discretionary Funds) and consider using portions of remaining Surface Transportation funds for bicycle and pedestrian access development both statewide and locally (beyond 10% Transportation Enhancement funds).

TDOT should reconsider current departmental policy prohibiting the eligibility of acquisition projects under the Transportation Enhancement Program that meets the requirements of TEA-21.

Communities should coordinate with their local MPO or the TDOT Office of Local Programs to establish bicycle and pedestrian improvement projects as a local and state priority and ensure eligibility through federal TEA-21 programs.

TDEC-RES and TDOT should work cooperatively, and with private partners such as the Tennessee Parks and Greenway Foundation, to identify and implement funding mechanisms for greenway and trail planning.

TDOT's Bicycle/Pedestrian Coordinator should collaborate to prepare a statewide Bicycle Plan every five years that includes existing and potential bicycle routes or incorporate bicycle/pedestrian facility needs within the state transportation Plan.

TDOT should establish bike routes along all state scenic routes where feasible.

TDOT should meet local and statewide needs for bicycle and pedestrian facilities.

All state and local highway projects should be planned with bicycle and pedestrian access where appropriate and feasible.

TDOT is encouraged to add to public meeting notifications an invitation to bicycle and pedestrian advocates in establishing bicycle and pedestrian facilities in the design of new roads.

TDOT and local governments should incorporate bicycle lanes, where feasible and appropriate, in the planning, design, and acquisition stages of new highway and rehabilitation projects to ensure adequate right-of-way is acquired.

Communities, TDOT, and TDEC–State parks should be proactive in preserving abandoned rail corridors for recreation use, alternative transportation, and the possible need for future re-establishment of railroad use before railroad abandonment occurs.

TDOT should develop bicycle and pedestrian facilities in combination with all new state road construction and improvement projects where feasible and safe. Sufficient right-of-way should be purchased to safely accommodate bicycle lanes.

TDOT's Office of Local Programs is encouraged to work with local officials to evaluate proposals for rails-to-trails.

TDOT should adopt and implement AASHTO design guidelines for bicycle and pedestrian access on all state roadways, including urban routes. Federal AASHTO pedestrian design guidelines have recently been published; bicycle facility guidelines have been available since 1999. Special consideration should be given to user design concerns including inadequate shoulder width, intersections, bridge crossings, safety signage, access, sight distance, pedestrian road crossing, and maintenance of road shoulders. "Rumble strips" and storm sewer grate placement should be designed so they do not reduce bicycle use or enjoyment, especially on designated bike routes. A good reference to incorporate is *Flexibility in Highway Design* published by the FHWA.

TDOT shall properly oversee existing and future bike routes by eliminating hazardous debris and perform timely repairs to pavement damage. Where maintenance contracts exist, TDOT should strengthen contract language to ensure clear bike routes and oversight.

Communities are encouraged to work with TDOT to preserve historic bridges for use with trail projects.

Inventory of Rail and Other Corridors

TDOT should undertake an inventory of existing and abandoned rail corridors in the state in order to (a) understand their current conditions and potential for shared use; (b) identify future needs for the corridor for transit, passenger rail service, multi-use trails, and/or utilities; and (c) prepare for rail banking if the line is abandoned in the future and a public need is identified. This could be coordinated with efforts from other departments identified in the Greenways and Trails Plan that call for TDEC-RES to 'map all existing greenways and trails using GPS.' As part of this effort, TDOT may also identify utility and other natural and manmade corridors that may be used as part of future greenway systems that would provide alternatives to bicyclists to using State highways.

Rail corridors offer opportunities for shared use paths.

TDOT Highway Crossings

TDOT should work with local agencies and organizations to facilitate appropriate trail, pathway, and greenways crossings of State highways. This includes developing appropriate policies, practices, and procedures for at-grade crossings of State highways that may require additional safety devices (warning lights, signing, medians), and appropriate over- or undercrossings of limited access highways. TDOT should work with local agencies and organizations in the feasibility, permitting, design, and construction process, in order to facilitate the process and ensure that safety, traffic, maintenance, and other issues are addressed.

7.7.4 Local Pathways and Connections

Direct pedestrian and bicycle connections via short connector trails linking residential areas to schools, parks, businesses, and commercial areas are likely to be addressed in the local bicycle and pedestrian plans identified in Section 7.3.5, the land use treatments discussed in Section 7.6.1, greenways and trails as discussed in Section 7.7.3, and schools discussed in Section 7.8.2.

7.7.4.1 Local Pathway and Connections Recommendation

Connector Trail Development

TDOT can provide resources and incentives to local agencies to connect existing communities and destinations such as schools, and to 'build-in' these connectors as new communities are

developed, in a variety of ways. TDOT can set requirements for local bicycle and pedestrian plans (Section 7.3.5) that should identify the need for these connectors as part of the outreach and inventory process. TDOT can provide information and education to local agencies on land use and development guidelines (Section 7.6.1), work with local organizations and agencies in the planning, design, funding, and development of trails, paths, and greenways (Section 7.7.3), and fund Safe Routes to School programs which may be used to develop connector paths to schools (Section 7.8.2).

7.7.5 Access Management

Access management refers to the number, location, operation, and design of driveways and side streets on State highways. TDOT's interest is in balancing access to State highways with providing adequate safety and traffic capacity. Access to State highways has traditionally been accommodated with little or no efforts to control, with the result that commercial highway strips found throughout the country are also found in Tennessee. These are most commonly found outside of the traditional downtown area, consisting of chain stores and restaurants, numerous driveways, high traffic volumes, and numerous turning movements. Bicycle and pedestrian movement can be severely hampered in these areas due to the high incidence of driveway traffic, car-oriented development patterns, lack of sidewalks, landscaping, and other pedestrian elements, long blocks combined with a lack of crossing opportunities, and other items. Bicycle, pedestrian, and motor vehicle safety can be impacted on these corridors due to the combination of heavy car and truck volumes combined with very wide roadways, wide radius curves at intersections resulting in high speed turning movements, multiple driveways typically requiring center turn lanes, and a confusion of signage resulting in distracted drivers.

7.7.5.1 Access Management Recommendation

Access Management Policies and Guidelines

TDOT can play a leading role on improving safety, capacity, and non-motorized circulation on State highways through a combination of requirements, standards, and 'best practices.'

Existing State highways that have access management issues as previously described require a partnership approach with the local agency. TDOT may take the lead on addressing access issues if they are identified as causing major safety or traffic congestion problems. The local agency would take the lead if the major issues were land use, economic, and other non-traffic issues. Reconfiguration of a State highway with access management issues would require in-depth analysis in the form of a **Corridor Plan**, which would analyze all aspects of the corridor from current and future land uses, zoning, bicycle and pedestrian circulation, transit, sign ordinances, average daily and peak period traffic, levels of service, safety, streetscape treatments, and other items. The recommendations from the Plan may include the acquisition of additional right of way, consolidation of driveways, land use and urban design changes, the provision of landscaping and gateway treatments, re-configuration of travel and turn lanes, and provision of sidewalks and bikeways. As a partner on this process, TDOT would play an important role in helping to improve safety for all users, along with addressing long-term traffic needs.

TDOT could develop an Access Management handbook or include access management topics for use by local agencies in the proposed *Local Streets: Flexibility in Design and Operations* handbook (Section 7.3.2).

The existing requirements for new access to State highways could be reviewed and strengthened, with consideration for increased bicycle and pedestrian safety as a factor for approval. TDOT could also require local agencies to conduct a Corridor Plan if traffic congestion reached LOS D or worse, collision rates were 20% over the State average, the area was zoned commercial, and/or with over 20 driveways per mile on State highways. This requirement could also be triggered by any new development or redevelopment that would result in new driveways on State highways.

7.8 Emphasize Financial Responsibility

This section addresses the issues of fiscal responsibility, efficiency, and accountability, and specifically TDOT administrative functions, Federal and State funding programs, and project development and ranking methodologies.

7.8.1 Bicycle and Pedestrian Program Management

Currently, the TDOT Bicycle Coordinator works under the Planning Division of the Environment and Planning Bureau. There is currently no TDOT Pedestrian Coordinator or department that specifically handles pedestrian issues. The State Greenways and Trails Plan recommended expanded responsibilities and staffing for TDOT to address the issues of bikeways, pedestrian facilities, and greenways. All of the additional recommendations identified in this plan could be added to that list of potential responsibilities.

7.8.1.1 Bicycle/Pedestrian Program Recommendations

Enhance the TDOT Bicycle and Pedestrian Coordinator Office

TDOT plays a leadership role in bicycle and pedestrian facility development in Tennessee. Documents such as AASHTO's *Guide for the Development of Bicycle Facilities* contain mandatory standards that apply to bicycle facilities throughout the state. The effectiveness of this leadership is directly tied to the office of the TDOT Bicycle and Pedestrian Coordinator, which currently is staffed with one full time staff person at headquarters. Given the size and rapidly growing nature of the state, the demand for guidance from TDOT staff and local agencies, and the policy, funding, and research role of TDOT, the following changes are recommended for consideration.

Increase the Budget and Staffing

Bicycling and walking modes are directly tied to the elements that are essential to a healthy Tennessee. They are intrinsically linked to what makes Tennessee attractive to residents, visitors, and businesses: (a) livable communities, (b) opportunities for exercise and recreation, (c) mobility options, (d) safe routes to transit and schools, and (e) a healthy environment. The State of Tennessee should, at a minimum, dedicate the same amount of budget for the Bicycle/Pedestrian Coordinator on a per capita basis as the average for the rest of the 49 states.

Given the importance of visitors, health, and safety in the state, it is recommended that this budget figure exceed rather than meet this average budget figure.

In addition, it is recommended that each Region have a Bicycle/Pedestrian Coordinator position, and that staff member play an active role in supporting local agencies; reviewing plans and proposals; ensuring that state policies, design standards, and guidelines are enforced: and facilitate the resolution of problems that involve TDOT facilities and/or policies, design standards, or projects funded with TDOT funding.

Meet the NCBW Benchmarks for a State DOT

The adoption of this Plan and the implementation of the recommendations will ensure that TDOT meets or exceeds all of these benchmarks.

The National Center for Bicycling and Walking conducted a survey in February 2003 of all state DOT bicycle and pedestrian coordinators/representatives to gauge the progress of bicycle and pedestrian planning and facility development since the establishment of the Intermodal Surface Transportation Efficient Act (ISTEA) of 1991. Four benchmarks were established with indicator criteria for each.

Benchmark 1: Does the state DOT have a long-range bicycle and pedestrian plan element? If so, does the plan element conform to the guidance issued by the FHWA?

1(a): Does the DOT have a plan as a document entitled "Bicycle Plan," "Bicycle and Pedestrian Plan," or similar; or, a chapter or section on bicycle and walking in the statewide long-range transportation plan, if the chapter or section has the same format and scope as the chapters on other modes?

1(b): Did the plan contain measurable objectives by which to evaluate whether the goals of the plan are being met or not?

Benchmark 2: Does the state DOT routinely include accommodations for bicycles in all state highway projects?

Benchmark 3: Does the state DOT include sidewalks in all state highway projects in urban areas?

3(a): Are sidewalks included in all new state highway projects in urban areas (except where pedestrians are prohibited)?

3(b): Are sidewalks included in most state highway reconstruction projects in urban areas?

3(c): Are sidewalks generally included in state highway projects in urban areas?

Benchmark 4: Does the state have any special programs (i.e., Safe Routes to School, training programs, building trails, improving connections to transit, creating statewide bike routes, creating maps, etc.)?

By completing this State Bicycle and Pedestrian Plan, TDOT will meet most of these benchmarks.

Adopt Specific Performance Measurements and Benchmarks

Performance measurements and benchmarks are tools that can be used either internally or publicly to gauge the success of programs or policies. The measurements are similar to goals and objectives, but are differentiated by the fact that they contain specific, measurable elements. Performance measurements and benchmarks can be used internally by TDOT to evaluate the effectiveness and budget needs of various programs, or in the Bicycle and Pedestrian Plan as measurable components of the adopted goals and objectives. A sample performance measurement would compare the investments in new bikeways with increases in ridership that can be attributed to those facilities. Due to the general lack of data on bicycle and pedestrian modes, it can be more difficult to apply specific performance measures and benchmarks.

Measure 1: Measuring Safety Improvements

(1) Collision Reduction: A 10% reduction in bicycle and pedestrian collisions on State and local roads by 2010, and a 20% reduction by 2020. Collision reductions should be measured by jurisdiction as a rate against the number of people walking or bicycling to work as a primary mode of transportation from the latest U.S. Census source.

Measures 2-5: Completion of Facilities

(2) Pedestrian Facilities: Sidewalks or walkways on one or both sides of roadway will be provided on 70% of all TDOT and local agency roads carrying over 10,000 vehicles per day and in developed areas by 2010, 80% by 2015, and 90% by 2020.

(3) Bicycle Facilities: Adopted regional and statewide bikeway routes on TDOT roads will be 50% complete by 2010, 75% complete by 2015, and 100% complete by 2020.

(4) ADA Facilities: ADA improvements, such as curb ramps, will be included as part of all major TDOT construction and re-construction (including repaving) projects. TDOT will identify existing ADA deficiencies on TDOT roadways and program sufficient funds to complete the top 10% of projects annually.

(5) Bicycle and Pedestrian Plans: Achieve a 25% completion rate of bicycle and pedestrian plans to specific standards by all regions and counties in the State by 2010, 50% by 2015, and 100% by 2020.

Measures 6 and 7: Increases in Bicycling and Walking

(6) Bicycle and Pedestrian Mode Shares: Achieve a 5% increase annually in the mode share for bicycling and walking for utilitarian trips, work trips, school trips, transit-linked trips, and discretionary trips.

(7) Bicycle and Pedestrian Counts: Achieve a 5% increase annually in bicycle and pedestrian counts at 40 selected locations around the State, taken during time periods to be established in

the State Bicycle and Pedestrian Plan. Require all local agencies receiving over $500,000 annually in bikeway or pedestrian funding to conduct annual counts within these parameters for five years and report the count data to TDOT.

Measure 8: Training

(8) Training of TDOT Staff: Offer in-classroom bicycle and pedestrian training to 5% of TDOT staff annually, with a goal of 20% staff being trained by 2010, 30% by 2015, and 50% by 2020. Offer web-based and interactive CD training to all TDOT staff by 2010.

Bicycle and Pedestrian Level of Service and Suitability Analysis

A modified suitability system based on FHWA's suitability system was used as part of this plan to identify roadway conditions for bicyclists, using available data (shoulders, traffic volumes). TDOT may wish to use this system, or, as more data becomes available, expand the data sources (trucks, speeds, number of driveways, crashes, etc.) to create a Suitability Mapping System that can be used to target improvements. TDOT may also consider the use of proprietary methods such as the Bicycle Level of Service (BLOS), Pedestrian Level of Service (PLOS), and other systems, with the understanding that the purchase cost, data requirements, and training for these models can be very expensive.

A separate layer could be created for developed areas focusing on pedestrian conditions, using consistent data provided by local agencies. This would include presence and condition of sidewalks, surrounding land uses, types of crosswalks and intersection control, presence of parked cars, landscaping, street trees, planting strips, and other categories. It is recommended that TDOT conduct a demonstration project in one city to determine the cost and effectiveness of this effort prior to committing to doing it statewide.

7.8.2 Safe Routes to Schools

The Safe Routes to School program in the United States was initiated nationwide with the funding of two national demonstration projects by FHWA (Marin County, California, and Boston, Massachusetts). The Safe Routes program evolved out of numerous efforts: bicycle and pedestrian advocates, health and safety organizations, local community groups, parent-teacher groups, school districts, and law enforcement. These and other groups identified the school commute period as critical for a variety of reasons. First, school-related traffic accounts for up to 20% of the AM peak period traffic congestion in neighborhoods near schools. Second, the percent of children walking or bicycling to school dropped substantially from over 20% to under 10% over the past 20 years. Third, children's activity levels have also been dropping while overall health and obesity have been skyrocketing. Fourth, establishing active lifestyles at an early age is easier than trying to re-educate adults who have entrenched habits. And finally, safe routes improvements are actually neighborhood and community improvements with a broad constituency and strong political support.

Given these factors, some states have adopted Safe Routes to School funding programs, and the Federal government is planning on having a Safe Routes to School element in its next transportation legislation.

7.8.2.1 Safe Routes to School Recommendation

Create a Safe Routes to School Program

It is recommended that TDOT consider creating a Safe Routes to School program that would include both a new funding source and resources for local agencies and organizations. The funding source could come from existing safety grants or other sources, or entirely from federal funding once this becomes available. Local agencies and organizations would be able to apply for these grants every year on a competitive basis for a variety of projects and programs, including:

Safe Routes to School programs include educational components.

- Program initiation
- Safety training
- Promotion and marketing
- New bikeways and pedestrian facilities
- Safety enhancements

As part of this effort, TDOT could produce a Safe Routes to School handbook utilizing publications by NHSTA, FHWA, and other groups. This document would help inform agencies and groups about the program, the steps needed to initiate the program locally, funding resources, and types of programs and improvements that can be funded. In addition, TDOT may wish to include or enhance specific school-related safety vehicle codes and roadway design standards and guidelines to reflect the state-of-the-practice in this field. Sample topics include:

School Zones: It may be useful to describe the extent of school area 25 MPH limits, as measured from a school. This would assist local agencies with a major arterial roadway next to a school control speed limits that would be difficult to enforce given roadway geometrics, volumes, and approach speeds. The same is true for an agency with a major roadway located one or two blocks from a school on the main school commute route.

Types of Crossing Supervision. Student crossing guards have been phased out in some states. It is unclear if this was based on actual research or a high profile incident, but the repercussion is that there are fewer crossing guards available today than in the past. Allowing children over a specific age, such as 12, to serve as crossing guards on lower traffic streets at controlled intersections without adult supervision could be a way to increase the ability of schools to provide this service.

Typical School Route Plan. Local agencies could prepare a school commute map showing routes and types of crossing treatments. The map shown would provide great planning information for engineering, education, and enforcement improvements to Suggested Routes to

School programs. Input from teachers, parents, administrators, students, local agency staff, and law enforcement officials is likely to show commonly used existing school commute routes. Arbitrary circuitous routes are unlikely to be well used. These maps should also be designed to be sent out to parents at the start of every school year, and used to teach their children the best route to use to reach school.

7.8.3 Project Development, Ranking, and Funding

The quality and consistency of bikeway and pedestrian projects and grant applications received by TDOT from local agencies is possibly the most important element in using available funding cost effectively. The fragmented state of non-motorized facilities in Tennessee today can be attributed to both limited funds and the quality of projects and project applications. In some cases, projects were developed independently of a master plan, public input, needs analysis, or system-wide planning. In other cases, the basic feasibility of the project was not resolved prior to submitting a grant application and receiving funds, or basic access or connectivity issues were not resolved. The lack of tangible projects and a coherent system in turn lowers the enthusiasm by agency staff and elected officials to pursue more projects, and lowers support for funds by the public and elected officials.

Recommendations in this plan will go a long way toward developing feasible and functional projects and implementing them in a rational way over time.

7.8.3.1 Project Development Recommendations

Project Ranking Method

Recommendations in this plan for local agencies to complete bicycle and pedestrian plans will directly result in higher quality projects and funding applications. It is recommended that local agencies adopt and use one of the two project ranking methods described in this section in their local bicycle or pedestrian plans, that MPOs and RTPOs utilize one of these methods in their ranking of regional priorities, and that TDOT use these systems when evaluating projects. By making this ranking methodology transparent and available to local agencies, the quality of projects and grant applications will also increase as staff begins to understand what makes a high quality project.

7.8.3.2 Project Evaluation Methodologies

The proposed TDOT ranking methodologies are intended to:

- Help coordinate implementation efforts between jurisdictions.
- Ensure that counties and local agencies receive their fair shares of competitive funding.
- Prioritize projects so that those with the greatest benefit are implemented in the short term.

TDOT recognizes that cooperation between local agencies in the selection of priority projects and the allocation of local funding is critical to ensuring an orderly implementation of an effective bicycle or pedestrian system.

This section presents two methodologies that can be used internally by local agencies and TDOT to evaluate bikeway and pedestrian projects prior to applying for funding. These methodologies will also help improve the consistency of project quality and evaluation throughout the state, and could ultimately be used by TDOT to evaluate statewide bikeway projects in the future. It is important to note that the orientation of specific funding sources influences project rankings to some extent, and may not be reflected in the proposed methodologies. For example, a safety grant program would weigh safety benefits much higher than the other proposed criteria.

One of the greatest benefits of ranking projects is not only to identify the highest priority projects, but also to assure other project sponsors that their project will be funded in time through a rational process. This process eliminates the constant evaluation of new projects and ensures that viable top-priority projects have access to matching funding. It provides each city and local agency a five- to 10-year schedule so that they may program their resources and feel assured that their project will be implemented in the short term. Each year, county advisory committees and MPO staff will review the list of projects slated for that year, review the project readiness of each project to be funded, and evaluate requests for changes to the sequencing of the projects.

This monitoring and review process does not preclude cities and local agencies from continuing to submit other local projects for funding.

RANKING METHOD 1: Quantitative Analysis

Defining a Bikeway or Pedestrian Project

How a bikeway or pedestrian project is conceptualized and defined has a direct impact on its eventual ranking. Its ranking is most often related to its (a) length, (b) number of jurisdictions involved, (c) quantifiable benefits, (d) complexity, (e) cost, and (f) connections to major destinations. For example, a project that is too long, costly, or complex may be very difficult to fund and implement. Likewise, a project that is too short or inexpensive may not justify the effort to fund and develop. A properly conceptualized project that responds to the criteria identified in this section will often score higher than other projects.

Inventory and Data Collection

The more information available on a proposed bikeway or pedestrian project, the more likely it is that a compelling argument can be made for a higher ranking. Sometimes, this information is difficult to obtain without planning, preliminary design, feasibility, or environmental work. The recommended ranking criteria are nevertheless intended to minimize the amount of primary data required. Typical criteria are listed below.

Existing Conditions – Existing facilities in the project area should be clearly mapped and evaluated, along with any connecting facilities. Important land uses in the area should also be mapped. Counts of bicyclists or pedestrians during a typical weekday and weekend should be performed.

Motor Vehicle Volumes – Average daily or peak-hour volume data of autos, trucks, and buses, no more than three years old. This may be available or can be collected with manual counting boards, automatic-counting devices, or by reviewing video logs.

Motor Vehicle Speeds – This can help determine what bikeway treatment is desirable. Speeds are typically collected with radar, two-hose counters, or other types of sensors, and compared with posted speed limits to determine if the 85th percentile speed is being exceeded.

Side Conflict – The number of side streets, freeway/expressway ramps, driveways, and their turning speeds and traffic volumes indicate potential safety problems for bicyclists. This information is collected in the field or from striping plans or aerial photographs.

Curb-to-Curb Width – Widths and assignments of each lane, shoulders, and median clearances are important to determine the feasibility of re-striping, especially of the curb lane, and can be determined in the field or through striping plans or aerial photographs.

Pavement Condition – Surface condition, gutters, drain grates, and railroad crossings can be identified and evaluated in the field.

Topography – Grade and curvature information is available on contour maps or by measurement in the field.

On-Street Parking – Type (parallel, diagonal, perpendicular), time limits, and turnover all affect bicyclists and pedestrians, and can be determined from field surveys or agency parking maps (if available).

Crash Statistics – Bicycle or pedestrian-related crash statistics should be collected and analysis performed to determine trends in cause, fault, etc. for the location or corridor for the past three years.

Right-of-Way and Utilities – Right-of-way ownership should be clearly mapped on any improvement plan, including any easements and surface or sub-surface utilities.

This information can stand alone or be used with one of several analytical tools, including the Bicycle Suitability Index, to support the contention that a project will rectify an existing deficiency on a specific corridor. Because this information is not always readily available, it is not a required input for this method.

RANKING METHOD 2: Ranking System Evaluation

This method requires the following inputs:

Benefits

Usage – Projects should serve the greatest existing and future usage. Existing counts should be conducted as described elsewhere in this chapter. Future usage should be projected using available counts and an accepted demand model with adequate documentation; and projections should be compared with local transportation model assumptions (as available). Bicycle usage forecasts for on-street bikeways will typically be factored from existing usage levels, whereas new bike paths will require a more in-depth analysis. Pedestrian estimates will be based on existing counts and projects will be based on new or existing land uses in the immediate vicinity.

All forecasts should include estimates of the number of *new* bicyclists and pedestrians in the corridor, plus the number of *transportation* (versus recreation) trips being made.

Safety – Safety is an important but difficult criterion to develop. A project that will make a significant improvement (such as new bike lanes or a new high visibility crosswalk) on a corridor or at a specific location where there are (a) documented concentrations of bicycle or pedestrian collisions and/or (b) significant existing bicycle or pedestrian usage in tandem with a low suitability rating, or other documented poor conditions for bicyclists or pedestrians, will score well on this criterion. Documentation on conditions listed in the previous section will also help.

Note: The number of bicycle or pedestrian-involved collisions on a given segment cannot be directly compared because base volume information (counts), which is needed to normalize the crash totals into a rate, is typically unavailable.

Destinations – A project should enhance connections to local and regional destinations, including schools, community centers, colleges and universities, employment centers, and commercial areas. These destinations should be within 500 feet maximum of the project, or connected directly with an existing bikeway segment up to one mile from the project (see Gap Closure projects below).

Multimodal Connections – A project that connects directly to or is within or part of a major multimodal destination or system, including bus, rapid transit, commuter rail, or light rail stations or systems, will score well. The present and future number of boardings from bicyclists should be provided.

Gap Closure – Some projects may not directly serve many or any regional destinations, but nonetheless provide an important link between existing bikeway or sidewalk/pathway segments, or help overcome major physical barriers (topography, water) or human-made barriers (highways, roadways, railroads) that currently inhibit bicycling or walking.

Range of Users/Skill Levels Served – The FHWA identifies two distinct types of bicycle riders, Class A (experienced adult riders) and Class B (less experienced adults, children, senior citizens). Wherever a regional bikeway or multi-use path proposal relies on the use of major arterial streets, alternative parallel routes attractive to Class B riders should be considered. These include streets with lower traffic volumes or wide outside curb lanes, and bicycle boulevards. Some bikeways, such as bike paths, may appeal to Class B riders but not Class A riders due to conflicts with pedestrians or circuitous routes. Projects that appeal to both types would receive additional points.

Opportunity/Synergy – Projects that are proposed as part of larger transportation improvements, and can benefit from the synergy of that project, or take advantage of a limited opportunity such as the availability to purchase rights-of-way, will receive additional points.

Multi-jurisdictional – Projects that involve two or more agencies and show multi-jurisdictional cooperation merit additional points.

Costs

Feasibility and Cost Estimates – A project should be designed to a level of detail so that the overall feasibility can be determined, and reasonably accurate cost estimates and environmental impacts identified. The exception to this would be a project attempting to obtain funding to perform feasibility and environmental analysis. The costs of a project should be broken down into major components (with unit cost estimates), and those costs should be compared to local averages. The score of this criterion is based on the quality of feasibility and cost information provided with the application.

Cost/Benefit

The total benefit points are compared with the project cost to arrive at a cost/benefit ratio. This ratio directly influences a project's ranking.

Other Criteria

The remaining criteria are required to determine if there are any fatal flaws in a specific project. A project must adequately address all of these criteria or be eliminated.

Control of Right-of-Way - Does the project lie entirely within public right-of-way or have an easement on private property? If the project includes the purchase of private property, is there written proof of a willing seller? Does the funding source allow for the purchase of property?

Local Approval - Is the project identified in an adopted local bicycle or pedestrian plan that has been approved by the local advisory committee, planning commission, and council/board, and that included adequate public input and environmental review?

Matching Funding - Has the local agency obligated sufficient local matching funds for the project?

Design Conformance - Does the proposed project conform with relevant local, state, and federal design standards?

Geographic Balance – While not included in this exercise, geographic balance in terms of how funds are appropriated in Tennessee will ultimately become one of the evaluation tools. This may be accomplished by annual or five- to ten-year goals in the total funds appropriated to each county.

Weighting of Criteria

There is no objective method of arriving at a weighting for the criteria listed above. The weighting scheme used in the prototype evaluation model described next is a simplified approach that may be adjusted over time, as needed. The criteria weighting can also be changed for specific funding programs. For example, the importance of safety can be adjusted for a safety grant program.

Analysis of Ranking System

The Ranking System evaluation method outlined above blends a variety of criteria, including benefits and costs, in a manner that allows cross comparison of different types of projects. For example, the sample projects shown in Table 7-1 include a 1.3-mile bike path, a 7.6-mile bike lane project, and a bike parking project at a transit hub. Under the benefit scoring, the bike parking project scores lowest primarily because of the low absolute numbers of bicyclists benefiting from the project (100 versus 1,450 for the bike path). Under the cost/benefit scoring, the bike parking project scores the highest since its cost per benefit is by far the lowest. The final scoring blends the two systems so that a balanced scoring appears. In the final scoring, the bike path project scores highest (it also is a gap closure and opportunity project), followed by the bike parking (good cost/benefit ratio) followed by the bike lane project. While this system may be fine-tuned over time, it represents a reasonable approach to evaluating bicycle and pedestrian projects.

Table 7-1. Proposed Ranking System: Sample Project Evaluation Worksheet

	WEIGHTING	PROJECT #1	PROJECT #2	PROJECT #3
BACKGROUND				
Project Name		Bike Path	Bike Lane	Bike Parking
Lead Agency		City	County	Transit Agency
Contact Name		n/a	n/a	n/a
Amount Requested (000s)		$1,200	$500	$40
Length		1.3	7.6	-
BENEFITS				
Usage Projections[3]	20	3.6	.4	.25
Safety[4]	20	2	3	1
Destinations[5]	20	12	8	4
Multi-Modal[6]	20	1	2	3
Gap Closures[7]	20	3	3	1
Range of Users[8]	10	2	2	1
Opportunity[9]	10	3	1	2
BENEFIT SCORE[10]		482	358	215
COST				
Feasibility[11]	5	3	1	2
Cost Estimates[12]	5	2	2	3
COMBINED SCORE		507	373	240
Project Cost[13]		$1,500	$650	$45
BENEFIT/COST RATIO[14]		.34	.57	5.33
OTHER CRITERIA				
Right-of-Way		Yes	Yes	Yes
Local Approval		Yes	Yes	Yes
Matching Funding		Yes	Yes	Yes
Design Conformance		Yes	Yes	Yes
Geographic Balance		Yes	Yes	Yes

[3] Future average daily usage based on accepted demand model, divided by 1000.

[4] 1 = no safety improvement, 2 = moderate safety improvement, 3 = major safety improvement.

[5] 1 point for each school, commercial, or employment center under 500 employees or students;
2 points for each school, commercial, or employment center between 501 and 1,000 employees or students;
3 points for each school, commercial, or employment center over 1,001 employees or students.

[6] 1 = no multi-modal connection; 2 = indirect multimodal connection, 3 = direct multimodal connection.

[7] 1 = no gap closure; 2 = indirect or local gap closure; 3 = direct or regional gap closure.

[8] 1 = one group only; 2 = Class A & B riders; 3 = Class A, B, & school commute route.

[9] 1 = no opportunity/synergy; 2 = average opportunity/synergy; 3 = strong opportunity/synergy.

[10] Benefit scores are calculated by taking the raw score for each category and multiplying it by the weighting factor, and then adding it in the benefit total row.

[11] Feasibility, design, environmental analysis: 1 = none, poor; 2 = average quality; 3 = strong, detailed.

[12] Cost estimates: 1 = none, poor; 2 = average quality; 3 = strong, detailed, realistic.

[13] Should include all costs, including land, environmental, design, and construction, in 000s.

[14] Combined score dvided by cost (000s). The lower the score, the lower the cost effectiveness

New Funding Programs

TDOT could consider developing new funding programs with either federal and/or state moneys. TDOT could also provide project development and grant writing assistance to local agencies to help maximize obligation of federal funds.

Comprehensive Bicycle and Pedestrian Facilities Plan

Funds may be allocated for these plans (emphasis should be for accommodation of bicycle commuters rather than recreational bicycle uses). A city or county would be eligible to receive an allocation for these plans not more than once every five years.

Bicycle Transportation Fund (BTF)

A BTF could be established under a new state law and provide funds for city and county projects that improve safety and convenience for bicyclists. The source of these funds would need to be determined. States that currently have this type of program use a portion of gas tax moneys to fund the program at varying levels. For example, California's program allocates $7 million annually. Pro-rating this amount to Tennessee, the BTF would be approximately $1 million per year in Tennessee. TDOT would require that local agencies have adopted bicycle transportation plans (BTP) that meet specific requirements identified in the State Bicycle and Pedestrian Plan. The BTP would need to be updated at least every four years.

Pedestrian Transportation Account (PTA)

While the BTF could fund a wide variety of bicycle facilities, the PTA would help fund a broad variety of pedestrian improvements. Pedestrian projects are typically funded through local agency general funds rather than through specific State programs. If a PTA were created, Safe Routes to School and other safety programs could be included within the fund, along with a broader array of project types, including Safe Routes to Transit, ADA, streetscape, and traffic calming projects.

7.8.4 Federal Funding

Congress passed SAFETEA-LU in 2005, a re-authorization of federal transportation legislation. SAFETEA-LU includes many of the former programs that were included in TEA-21 in addition to several new programs such as Safe Routes to Transit and provisions for moneys directed at the NPS..

7.8.4.1 Funding Recommendation

Maximize Federal Funding

It is recommended that TDOT obligate the maximum amount of federal moneys possible towards non-motorized projects, and develop new funding programs as appropriate. Summaries of the likely new federal funding programs are presented below.

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)

Several categories of federal transportation funding may be expended for bicycle and pedestrian projects. This section summarizes the federal funding sources available for non-motorized transportation projects and estimates the fiscal impact of these sources.

Transportation Enhancement Activities Program

Ten percent of each state's annual Surface Transportation Program (STP) must be set aside for Transportation Enhancement Activities (TEA). Three of the twelve defined TEA categories are bicycle and pedestrian related:

- Provision of Facilities for Bicyclists and Pedestrians
- Provision of Safety and Educational Activities for Pedestrians and Bicyclists
- Preservation of Abandoned Railway Corridors

TEA funds may be used for the construction of bicycle transportation facilities and pedestrian walkways, or non-construction projects such as training, brochures, and route maps related to safe bicycle use.

Congestion Mitigation and Air Quality (CMAQ) Improvement Program/Regional Surface Transportation Program

The CMAQ program directs funds to transportation projects in Clean Air Act non-attainment areas for ozone and carbon monoxide. These projects should contribute to meeting the attainment of national ambient area air quality standards (NAAQS). CMAQ funds may be used for construction of bicycle transportation facilities and pedestrian walkways, or non-construction projects, such as brochures and route maps, related to safe bicycle use. Bicycle projects must be primarily for transportation rather than recreation, and be included in a plan developed by each MPO and the State. TEA 21 made projects that bring sidewalks into compliance with the ADA eligible for these funds.

Regional Surface Transportation Program (RSTP)

The RSTP is a block grant program that annually is available statewide for roads, bridges, transit capital and bicycle and pedestrian projects. Metropolitan Planning Organizations (MPOs) can transfer funds from other federal transportation funding sources to the RSTP program if they want more flexibility in how they allocate their funds. SAFETEA-LU requires states to set aside ten percent of their RSTP funds for safety construction activities and another ten percent for the Transportation Enhancement Activities (TEA) Program.

Applicants eligible for RSTP funds include cities, counties, metropolitan planning organizations (MPOs), transit operators, and the TDOT. Non-profit organizations and special districts also may apply for funds, but they must have a city, county or transit operator sponsor and, in some cases, administer the project.

Chapter 8

Policy Guidance by Environment

This chapter provides guidance to TDOT and local agency staff on policies, practices, and procedures applied to the type of environments found in Tennessee. The term 'environments' refers to variety of settings ranging from rural areas to suburban and urban, plus specific settings such as school zones. While TDOT has its own roadway design standards and has adopted bicycle and pedestrian standards and guidelines from AASHTO, MUTCD, ADA, and other sources, understanding the needs of each environment and applying an appropriate 'package' of improvements from a toolbox will help identify potential best practices. These recommendations supplement but do not replace existing or future policies or standards, nor do they replace sound local planning and engineering efforts.

8.1 Assessing Existing Conditions

Understanding local conditions in a variety of environments is a key first step to selecting the appropriate types of measures. A Pedestrian or Bicycle Audit is a simple process that could help initiate additional studies and, ultimately, design and construction for non-motorized or multi-modal projects. The typical sequence of project development is shown below, and shows how an audit fits into this typical process.

Problem Recognition. A TDOT Division, local agency, organization, or a member of the public identifies a transportation problem that has a bicycle or pedestrian element. If this is TDOT or a local agency, the problem may have been identified formally in the past in the form of a planning document or a capital improvement program. If the problem is coming from an organization or the public, it may have been presented to local or TDOT staff directly or through local elected officials. Sometimes a problem is also created by an unexpected surge in crashes, environmental problems, or other unexpected occurrences.

Project Sponsor. In order to become a project, every problem needs a sponsor. This is a public agency willing and able to take on the responsibility for planning, design, and construction. In some cases, this may be multiple agencies with one lead agency, and in other cases a project may have a different development sponsor versus operating sponsor. The sponsoring agency must agree to take on specific responsibilities in order for a problem to become an official project, such as devoting staff time, matching moneys, and/or including the project in its official plans. For TDOT, this would require adding the project to the approved capital improvement list.

Project Definition. Problems identified by TDOT staff, local agencies, organizations, or the public need to be converted into projects. A project is a problem or a collection of problems that has a sponsor and has been assembled into a coherent package that can then be studied, approved, funded, and constructed. For example, a pedestrian crash pattern at a specific intersection may be a problem. The project may be a series of corridor improvements within a specific project area with a specific scope of work that address a series of problems and issues, including the initial crash location.

Feasibility Study. Once a sponsor defines a project, resources need to be allocated to perform an initial analysis of the project so that the full extent of conditions, needs, and costs can be

identified. For larger projects, this could be a formal feasibility study (also known as preliminary engineering). This study will indicate right-of-way needs, preferred alignments or designs, safety analysis, traffic analysis, costs, needs, phasing, standards, and other information.

Funding. The feasibility study will help develop reasonably accurate costs for the project, which can then be used to obtain funding. The funding could come from a variety of sources, including local general funds, competitive grants, TDOT capital projects, and earmarks.

Final Design. Once funding is obtained for a project, it moves into final design. This is likely to include engineering (hydrology, soils, civil, traffic, and structural), landscape architecture, urban design, and other specialties. This effort often also includes obtaining environmental, encroachment, and other permits associated with the project, along with any needed easements and management agreements.

Construction. The final effort is the construction of a project.

A Pedestrian or Bicycle Audit could be used in any of the first four stages to help assess existing conditions for the non-motorized mode, and identify types of solutions. Sample audits are presented below.

8.2 Sample Audits

Many different types of pedestrian audits have been developed around the world, each with a slightly different focus and format. This pedestrian audit is designed to be used by a person with some knowledge of pedestrian needs, design standards, and transportation planning, who can use this system to inventory and rate conditions at a specific location or in a corridor or a small area.

The following survey identifies distinct types of environments along with the type of features typically associated with each environment. Identify the environment that most closely meets your study area, and then identify the features typically found in those areas that make them bicycle or pedestrian friendly. Your location will score one point.

8.2.1 Environments

Table 8-1. Environment Types

Type A	Commercial Center (Large City): for any city with over 100,000 people, this would include the central commercial areas including office, retail, restaurant, and other uses.
Type B	Commercial Center (Medium City): for any city with between 5,000 and 100,000 persons, this would include the central commercial areas including office, retail, restaurant, and other uses.
Type C	Commercial Center (Small City or Town): for any small city or town with less than 5,000 people, this would include the central commercial areas including office, retail, restaurant, and other uses.
Type D	Strip Commercial: for any corridor dominated by stand-alone commercial businesses, numerous driveways, and parking located between buildings and the roadway.
Type E	Shopping Mall or Center: for any single-owner complex of commercial uses over 50,000 gross square feet, served by large parking area.
Type F	Residential Neighborhood (Multi-Family): for any neighborhood with multi-family residences, which may also include some limited commercial land uses.

Type G	Residential Neighborhood I (Single Family): for any neighborhood with all single-family housing in a traditional suburban development pattern.
Type H	Residential neighborhood II (Single Family): for any neighborhood with all single-family housing in an older, lower density, more rural type of setting.
Type I	Rural Area: for any area with very little or no development, including rural, agricultural, forested, or similar areas.
Type J	School zones: any area within one block of a elementary or high school, or five blocks of a college or university.
Type K	Major Activity Center: and location that attracts over 500 people on any given day, including libraries, medical centers, community centers, parks, etc.
Type L	Gaps and Barriers: any location that is also a major gap or barrier in a community, including freeway interchanges, railroad tracks, rivers, bridges, etc.

Note: Your location may meet more than one of these criteria. If this is the case, score each environment separately, and then determine the average score.

8.2.2 Features and Conditions

Identify the features and conditions below by the environment type. If at an intersection, include all legs. If on a corridor, include both sides of the street. If in a corridor or a study area, select typical locations for analysis.

8.2.2.1 Pedestrian Conditions

Table 8-2. Pedestrian Conditions by Environment Type

	Applicable Zones	Points
1. Sidewalk widths:		
a. 6 - 10 feet wide	A	5
b. 6 – 8 feet wide	B, J	3
c. 4 – 6 feet wide	C, D, E, F, G, J, K, L	1
2. Shoulders or Paths (assumes no sidewalks present):		
a. Shoulder 4 feet or wider	H, I	2
b. Shoulder 2-3 feet	H, I	1
c. ADA accessible pathway along road	H, I	5
3. Continuity of sidewalks, shoulders, or pathways:		
a. Continuous - both sides of street	All	7
4. Condition of sidewalks, shoulders, or pathways:		
a. Excellent	All	3
b. Some cracks, heaving, etc.	All	2
c. Striping, signing is visible	All	1
d. Adequate drainage and dry surface	All	1
5. Crosswalks:		

a. All 4 legs of intersections	A, B, C, J, K, L	5
b. Mid-block crossings on blocks over 500 feet	A, B, C, J, K, L	5
c. Mid-block crossings on blocks over 1000 feet	D	3
d. Adequate lighting	All	3
e. High visibility crosswalk	All	1
f. Adequate visibility	All	1
g. Median Refuges	All	2
h. Crosswalks 48 feet long or less (excluding medians)	All	1
i. Warning signs	All	1
j. Warning flashers	All	2
6. Support Facilities:		
a. Benches	A, B, C, E, K	1
b. Drinking fountains	A, B, C, E, K	1
c. Public art	A, B, C, E, K	1
7. Connectivity		
a. Maximum block length is 500 feet or less	A, B, C, D	3
b. Good access to all major destinations	A, B, C, D, J, K	2
c. Pedestrian over or under crossings	All	3
8. Land Use/Urban Design		
a. Buildings on or near street and sidewalk	A, B, C, D, E, K	5
b. Mixture of commercial and residential uses	A, B, C, D, E	5
c. Parking facilities located behind buildings	A, B, C, D, E, K	3
d. Parking buffered by landscaping	A, B, C, D, E, K	3
9. Trees, Landscaping		
a. Street trees	All	5
b. Public landscaping	All but I	1
10. Driveways		
a. No driveways	All	7
b. Occasional driveways (fewer than 5 per 1,000 feet)	All	3
c. Residential alleys	A, B, C, F	2
11. Security		
a. Adequate lighting	All but I	2
b. Crossing guards	J	10
12. Buffers		
a. Planting strip at least 2 feet wide	All but H, I	1
b. On-street parking	All	1
c. Shoulder or bike lane	All	1

13. Traffic		
a. Traffic speeds are 35 mph or lower	All	3
b. Traffic speeds are 25 mph or lower	All	5
c. Traffic volumes are 5,000 vpd or lower	All	5
d. Traffic volumes are 10,000 vpd or lower	All	3
14. Intersections		
a. No free right turn lanes	All	3
b. Controlled right turn lanes	All	3
c. Curve radius under 15 feet (10 mph)	All	5
d. Walk interval 60 seconds or less	All but H, I	3
e. Pedestrian clearance time sufficient for width	All but H, I	5
f. Pedestrian activated signals	All but H, I	3
g. Pedestrian 'walk/don't walk' heads	All but H, I	3
h. Countdown pedestrian signals	All but H, I	3
i. Advanced stop bars	All	2
j. Protected left turn signals only	All but H, I	2
k. Transit stops located on far side of intersections	All	2
15. Americans with Disabilities		
a. Curb ramps at all intersections	All	10
b. Audible signals	All but G, H, I	5
c. No rough surfaces	All	2
d. No obstacles in sidewalks	All	5
e. Large push button for signal activation	All	1
16. Pedestrian Volumes and Safety at Specific Locations		
a. Over 100 people/hr, 12-1pm	All	13
b. 50-99 people/hr, 12-1pm	All	8
c. 25-49 people/hr, 12-1pm	All	4
d. Crash rate is less than state average	All	5

8.2.2.2 Score Interpretation for Pedestrian Conditions

Locations, corridors, or areas scoring less than 'good' in this audit should consider conducting a study of potential improvements, including those elements identified in the Toolbox section of this chapter.

Table 8-3. Scores for Pedestrian Conditions

	Perfect	Good	Marginal	Poor	Very Poor
A	193	145	97	48	19
B	191	143	96	48	19
C	189	142	95	47	19
D	177	133	89	44	18
E	168	126	84	42	17
F	155	116	78	39	16
G	148	111	74	37	15
H	135	101	68	34	14
I	132	99	66	33	13
J	178	134	89	45	18
K	179	134	90	45	18
L	163	122	82	41	16

8.2.3 Bicycling Conditions

Table 8-4. Bicycling Conditions by Environment Type

	Applicable Zones	Score
1. Bikeways		
a. Bike path (excl path along road)	All	15
b. 5-6 feet wide bike lane	All	10
c. 4 feet wide bike lane	All	8
d. Signed bike route	All	2
e. Stenciled bike route (bike-in-box)	All	2
f. Wide curb lane (14 feet or wider)	All	5
2. Shoulders or Bike Paths		
a. Shoulder 4 feet or wider	All	7
b. Shoulder 2-3 feet	All	3
c. Bike path along road (5< driveways/streets per 1000 ft)	All	5
3. Continuity of bikeways, shoulders, or pathways		
a. Continuous facility	All	10

b. Both sides of streets (excluding bike paths)	All	10
4. Condition of bikeways, shoulders, or pathways		
a. Excellent	All	3
b. Occasional sweeping, patching	All	2
c. Striping, signing is visible	All	1
d. Smooth pavement/gutter transition	All	2
5. Support Facilities		
a. Bike racks at all activity centers	All	5
b. Occasional bike racks	All	1
c. Acceptable types of bike racks	All	1
d. Lockers at major destinations	All	1
e. Employee bike storage required	All	1
f. Employee showers/lockers required	All	1
g. Bike racks on all buses	All	2
h. System or directional signs for bicyclists	All	1
i. 'Share the Road' signs	All	1
6. Connectivity		
a. Bikeways connect to all major activity centers	All	7
b. Pathway connections between streets	All	2
c. Bikeway over or under crossings	All	3
7. Driveways		
a. No driveways	All	7
b. Occasional driveways (less than 5 per 1,000 feet)	All	3
8. Parking		
a. No on-street parking	All	2
b. Long term on-street parking only	All	1
c. Back-in diagonal parking	All	1
d. Enforcement of double-parking laws	All	1
9. Traffic		
a. Traffic speeds are 35 mph or lower	All	5
b. Traffic speeds are 25 mph or lower	All	7
c. Traffic volumes are 5,000 vpd or lower	All	7
d. Traffic volumes are 10,000 vpd or lower	All	5
10. Intersections and Interchanges		
a. No free right turn lanes	All	1
b. Controlled right turn lanes	All	1
c. Curve radius under 15 feet (10 mph)	All	1
d. Clearance time sufficient for width	All	1

e. Bicycle activated signals	All	2
f. Protected left turn signals only	All	1
g. Bike through or left turn pockets at intersections	All	1
h. Stop or Signal Protection on all bike routes/lanes	All	5
i. Adequate protection at all path crossings	All	2
j. On- and Off-Ramps have special signing/striping	All	1
11. Bicycle Volumes and Safety at Specific Locations		
a. Over 50 bicyclists/hr, 8-9am, weekday	All	15
b. 25-49 bicyclists/hr, 8-9am, weekday	All	10
c. 10-24 bicyclists/hr, 8-9am, weekday	All	5
d. Bicycle crash rate is less than State average	All	5

8.2.3.1 Score Interpretation for Bicycle Conditions

Just as roadway facilities conform to uniform standards in rural and urban environments, bicycle facilities are also expected to be uniform regardless of location. The few exceptions to this (bike lanes in developed areas versus shoulders in rural areas), score the same in this system. Therefore, the scores below are applicable to all environments.

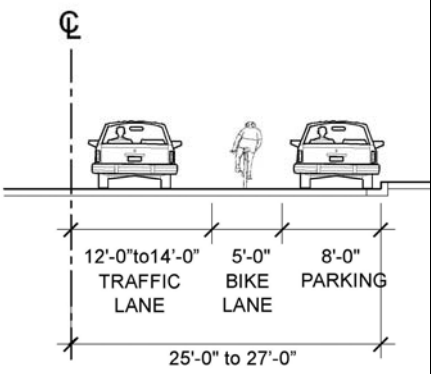
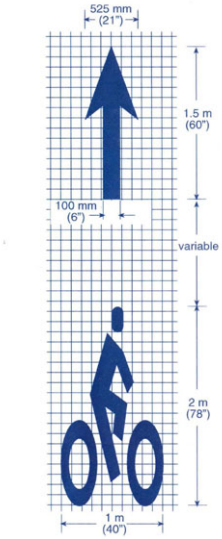
	Perfect	Good	Marginal	Poor	Very Poor
All	205	154	103	51	21

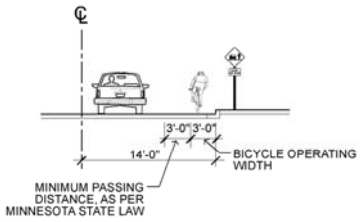
Locations, corridors, or areas scoring less than 'good' in this audit should consider conducting a study of potential improvements, including those elements identified in the Toolbox section of this chapter.

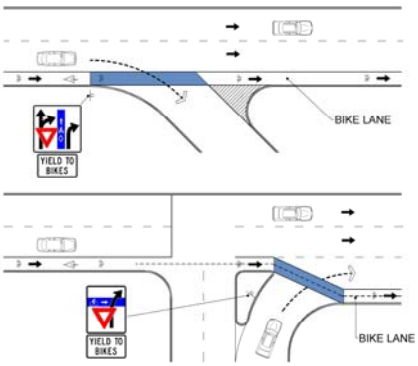
8.3 Toolbox of Measures

This section identifies the typical improvements that are applicable to the environments previously identified. The pedestrian and bicycle audit methodology not only indicates the general 'score' of a location or area, but it also identifies the types of measures that can be implemented by TDOT or local agencies. This toolbox is not intended to replace sound engineering practices, nor to supplant TDOT, AASHTO, MUTCD, or other standards or guidelines. In all cases, the final selection of measures should be based on professional engineering expertise in conformance with established standards and practices.

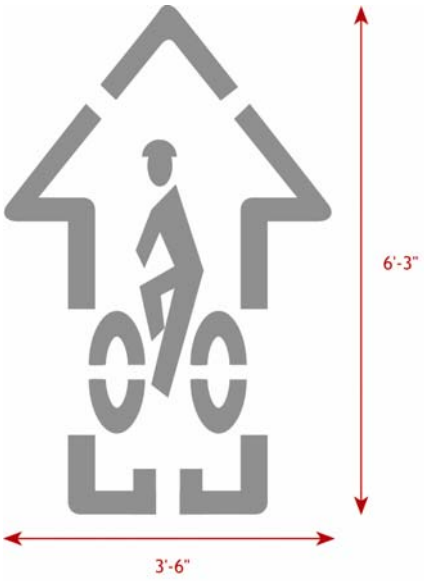
8.3.1 Bicycle Treatments

B1: BICYCLE LANES		
Purpose	To provide bicycles a section of roadway designated by striping, signing and pavement markings for preferential bicycle use. Bicycle lanes must be well marked.	
Where to Use	• On urban arterial and major collector roadways • Average vehicle speeds > 48 km/h (**30 mi/h**) • ADT > 10,000 • Vehicle mix includes a significant number of heavy trucks and/or buses	
Guidelines	• To retrofit existing lanes, reduce width of (or eliminate) travel, turning or parking lanes. • Bike lanes should be 1.5 m (**5 ft**) wide from face of curb or guardrail to the bike lane stripe. There should be at least 1.2 m (**4 ft**) of rideable surface if the gutter pan joint is not smooth. • Wider bike lanes (e.g., 1.8 m [**6 ft**]) are recommended adjacent to parallel parking lanes to account for the door-opening zone. • In outlying areas without curbs and gutters, a minimum width of 1.2 m (**4 ft**) is recommended. A width of 1.5 m (**5 ft**) or greater is preferable where substantial truck traffic is present or where motor vehicle speeds exceed 80 km/h (**50 mi/h**).	  **Source: Oregon Department of Transportation**

B2: WIDE OUTSIDE / CURB LANE		
Purpose	A 4.2 m (**14 ft**) minimum outside travel lane can better accommodate bicyclists and motorists in the same lane. In most cases, the motorist will not need to change lanes to pass the bicyclist. Bicyclists have more maneuvering room at driveways and in places with limited sight distance.	 WIDE CURB LANE
Where to Use	• Vehicle speeds < 48 km/h (**30 mi/h**) • ADT < 10,000 • In urban areas on major streets where experienced cyclists will likely be operating	
Guidelines	• Usable width is from edge stripe to lane stripe or from the longitudinal joint of the gutter pan to lane stripe • Gutter pan should not be included as usable width. If there is no gutter pan, add 0.3 m (**1 ft**) minimum shy distance from face of curb • 4.5 m (**15 ft**) of usable width is desirable on sections of roadway where bicyclists need more maneuvering room (e.g., steep grades, limited sight distance) • If traffic speeds exceed 64 km/h (**40 mi/h**) and ADT exceeds 10,000, 4.5 – 4.8 m (**15 – 16 ft**) lanes are desirable	

B3: BLUE BIKE LANES		
Purpose	Colored bicycle lanes are used to increase visibility of bicyclists by explicitly defining the bicyclist's path of travel and to remind motorists that they are crossing a bicycle lane and a high-conflict zone. The color is obtained by using a dyed asphalt mix, thermoplastic treatment, or paint.	
Where to Use	• At high-conflict locations where motorists are permitted or required to merge into or across the bicycle lane • Conflict points at highway or bridge on/off ramps and busy intersections • On commuter and/or high use bicycle routes	
Guidelines	• Identify high-conflict locations • Pavement markings similar to standard bicycle lane but filled with color at the transition point • "Yield to Bikes" signs must accompany the treatment • May be used in combination with bicycle pavement markings	

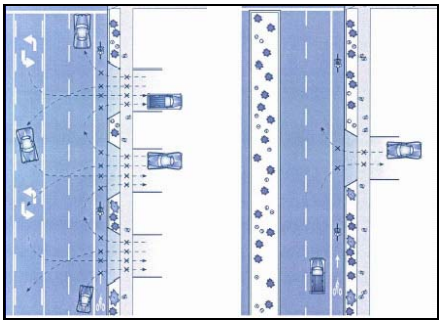
B4: SHARED LANE MARKING		
Purpose	To direct bicyclists to where they should ride in the roadway out of the "door zone"; to alert motorists that bicycles are riding in a shared roadway.	
Where to Use	• Vehicle speeds < 48 km/h (**30 mi/h**) • ADT < 10,000 • On urban roadways with width constraints due to on-street parking and/or limited right-of-way. • On suburban/rural roadways to indicate	

Guidelines	• The center of the marking should be 11'0 ft from the curb where parking is allowed, marking placement can be increased for:
	  • Downhill sections (greater then 5%)
	  • Areas where wider vehicles park
	  • Where cyclists at 11' still may encourage motorists to pass without changing lanes
	• The center of the marking should be 4' from curb face to centerline where parking is not allowed, but could be shifted according to:
	  • Lane widths, to position cyclist to either completely take lane or allow for side by side sharing of lane
	  • Obstacles along curb such as seams, depressed grates, etc
		

B5: BICYCLE SIGNALS		
Purpose	A bicycle-dedicated signal used in conjunction with a pre-existing traffic signal that directs bicyclists to take specific action to address recommended problems	
Where to Use	• At an intersection at which two or more bicycle-related collisions have occurred in one year that could conceivably have been prevented by a bicycle signal. • Intersections at which the volume warrant (product of bicycle traffic count and vehicular traffic count at the same peak hour) is greater than 50,000, provided the bicycle traffic count is greater than 50.	
Guidelines	• Bicycle signals can allow abnormal bicycle movements similar to a pedestrian scatter phase. • Engineering studies must be completed to ensure the bicycle signal will have the desired effect.	

B6: SHARED-USE PATHS/GREENWAYS		
Purpose	Bicycle paths (shared use paths) can enhance bicycle and pedestrian travel in urban areas where the existing road system does not adequately serve these modes. They are also used in natural or manmade corridors.	
Where to Use	• In corridors along rivers, lakes, greenbelts, power lines, railroad tracks, or limited access freeways that link parks, schools, shopping, and/or public transportation • Where there are fewer than 2 driveway/intersection/road crossings per 1.6 km (**1 mi**) with a combined ADT of less than 500 • In areas of poor connectivity – to link neighborhoods to schools, parks, shopping and community centers	
Guidelines	• 3.0 m (**10 ft**) standard width, 3.7 m (**12 ft**) minimum width in high use areas • Well-signed with destination and directional information • Pathway overhead clearance of at least 3.0 (**10 ft**) • Accessible to sweeping/snow removal machines and maintenance/emergency vehicles • Provide safe crossings at intersections and mid-block crossings	

B7: ROUTE SIGNAGE		
Purpose	Special signs used to guide touring and recreational bicyclists through urban areas and along popular rural bicycling routes.	
Where to Use	• On designated or popular bicycling routes • To guide bicyclists through an urban area	
Guidelines	• Use signs sparingly, primarily at intersections and junctions with other bicycle routes • A consistent and recognizable logo, arrows and a destination should be on the sign to clearly direct bicyclists • Bicycle route sign should be accompanied with destination and direction plaques	

B8: ACCESS MANAGEMENT		
Purpose	To avoid conflict at access points onto the main right-of-way between cyclists and motor vehicles	 **Source: Oregon Department of Transportation**
Where to Use	• On roads with multiple driveway access points. • At entryways for parking garages. • At entryways for apartment complexes or other locations of high vehicular use.	
Guidelines	• Driveways can be consolidated from several parking lots to reduce vehicle-cyclist conflict points. • Enough parking spaces should be provided to prevent vehicles parking in the public right-of-way. • A median preventing turning to/from the far right-of-way lane(s) can significantly reduce the potential conflict points for cyclists. • Stop or yield signs, mirrors, flashing lights, or audible signals can be directed to drivers, not cyclists, in places of low sight distance.	

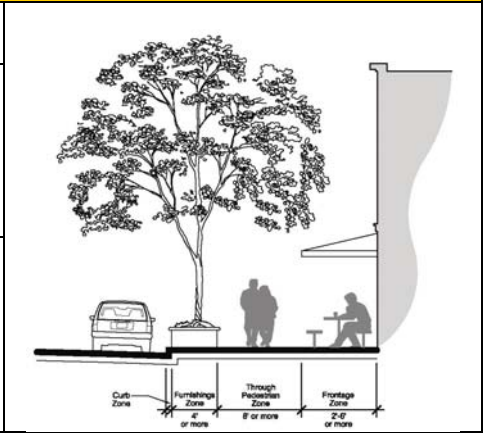
B9: GRADE-SEPARATED CROSSING: OVERPASSES		
Purpose	A shared use bridge structure allows bicyclists and pedestrians to cross over busy roadways, railways, or bodies of water, and to reach popular destinations	 
Where to Use	• At locations that would otherwise be unsafe, difficult, or impossible for bicycles and pedestrians to cross (over freeways, rivers/creeks, multiple railroad tracks, etc.) • Connecting neighborhoods to local schools over high volume and high speed arterials/highways where signalized crossings more than 137.2 m (**450 ft**) apart • Use only when a safe and direct on-road alignment is not available • Use only when bicyclists and pedestrians aren't required to negotiate significant elevation changes	
Guidelines	• Full engineering and design analysis required	

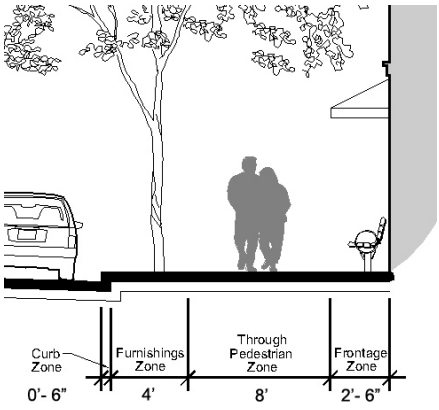
B10: GRADE-SEPARATED CROSSING: UNDERPASSES		
Purpose	A shared use tunnel allows bicyclists and pedestrians to cross high volume/high speed roadways, railroads and/or freeway ramp crossings.	
Where to Use	• When a safe and direct on-street alignment is not available to cross a high volume/high speed roadway or railroad • If the high volume/high speed roadway is elevated • If an existing motor vehicle undercrossing is too narrow for a bicycle and pedestrian facility • Use only when bicyclists and pedestrians aren't required to negotiate significant elevation changes	
Guidelines	• Full engineering and design analysis required • Must have adequate lighting and sight distance for safety • Must have adequate overhead clearance of at least 3.1 m (**10 ft**) • Tunnels should be a minimum 4.3 m (**14 ft**) for several users to pass one another safely; a 3.0 m x 6.0 m (**10 ft** x **20 ft**) arch is the recommended standard • "Channeling" with fences and walls into the tunnel should be avoided for safety reasons • May require drainage if the sag point is lower than the surrounding terrain	

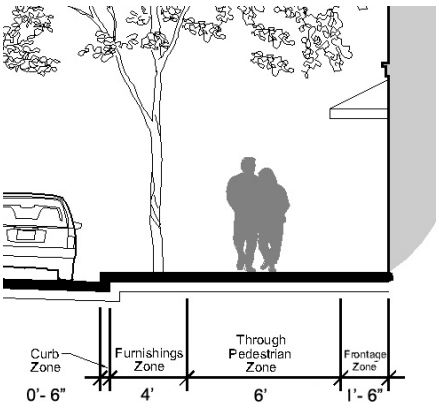
B11: GRADE-SEPARATED CROSSINGS: BICYCLE SIDEWALK PATHS		
Purpose	In *very rare* cases the sidewalk on a bridge or in a tunnel is used by bicyclists and pedestrians. Generally these sidewalks are at least 2.4 m (**8 ft**) wide.	
Where to Use	• On bridges with constrained right-of-way or narrow outside travel lanes, steel grating, or other unfriendly bicycle and pedestrian elements • In tunnels with restricted lane width without shoulders	
Guidelines	• If bridge does not have a sidewalk, a sidewalk with a curb must be installed with appropriate drainage, ramps, and signage • Approaches to the bridge must be accessible to bicyclists and pedestrians	

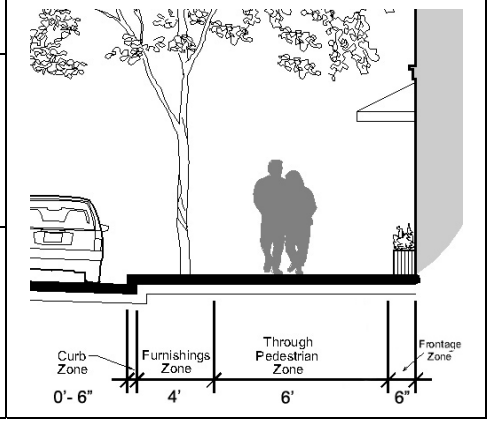
B12: SHOULDERS		
Purpose	The roadway shoulder is striped and divided for one-way bicycle traffic.	
Where to Use	• On designated bicycle routes and/or popular bicycling roadways • ADT > 2,000 • Average vehicle speeds > 56 km/h (**35 mi/h**) • When there is inadequate sight distance (e.g. corners and hills)	
Guidelines	• Shoulder should be ≥ 1.2 m (**4 ft**) • Shoulder should be ≥ 1.5 m (**5 ft**) from the face of the guardrail, curb or other roadside barriers • Shoulder should be ≥ 2.4 m (**8 ft**) if motor vehicle speeds exceed 80 km/h (**50 mi/h**) or if the percentage of trucks, buses and recreation vehicles is high • Shoulders should be wider where higher volumes of bicyclists are expected	

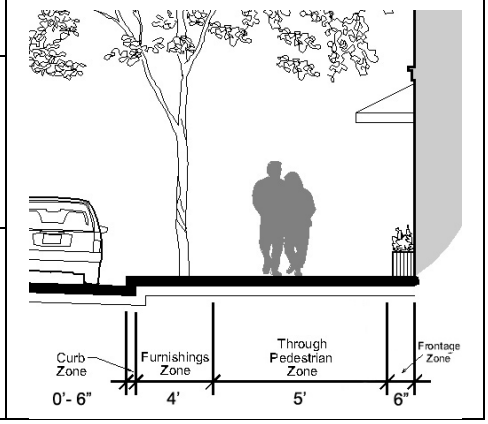
8.3.2 Pedestrian Corridor Treatments

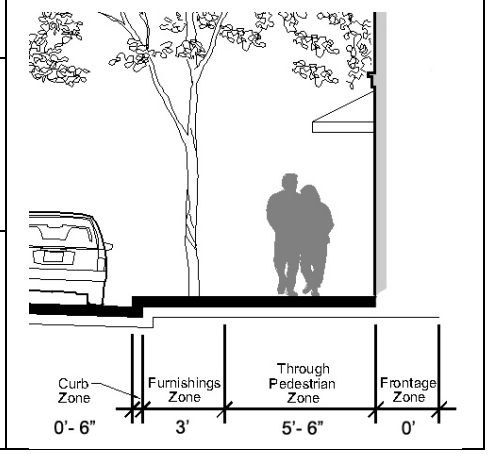
C1: SIDEWALK CORRIDOR: GREATER THAN 15 FOOT ZONE – HIGH PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	In sidewalk corridors with high pedestrian use that are greater than 15 feet wide.	
Guidelines	Recommended minimums in High Pedestrian Use Areas along State Street, especially for arterial streets or where ROW width is 80 feet or greater. Where outdoor café seating is desired, the Frontage Zone may be wider, so long as the Through Pedestrian Zone is maintained.	

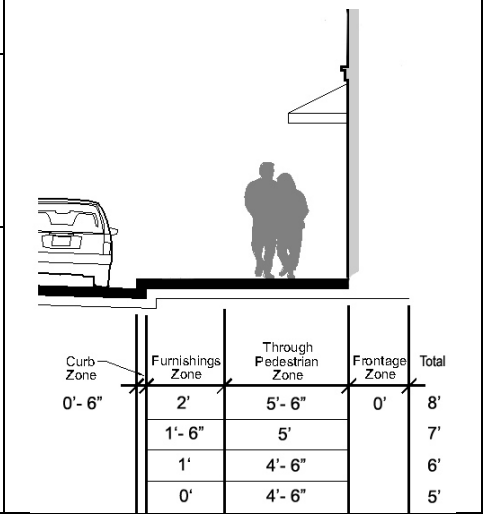
C2: SIDEWALK CORRIDOR: 15 FOOT ZONE – HIGH PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with high pedestrian use that are 15 feet wide.	
Guidelines	• Recommended minimums in High Pedestrian Use Areas along retail-commercial streets, especially for arterial streets or where ROW width is 80 feet or greater. • Where outdoor café seating is desired, the Frontage Zone may be wider, so long as the Through Pedestrian Zone is maintained.	

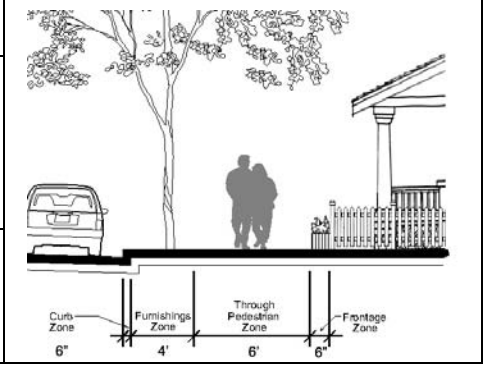
C3: SIDEWALK CORRIDOR: 12 FOOT ZONE – HIGH PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with high pedestrian use that are 12 feet wide.	
Guidelines	• Recommended minimums for walkways along other commercial streets, other local streets in highly traveled pedestrian areas, and for streets where ROW width is 60 feet or greater.	

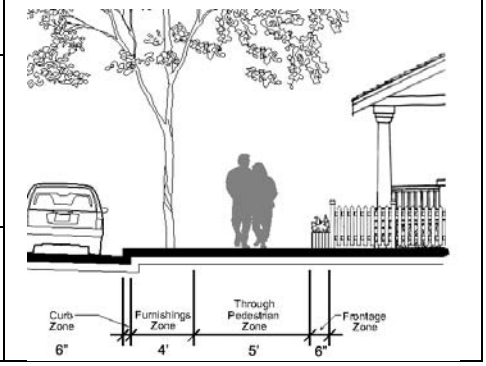
C4: SIDEWALK CORRIDOR: 11 FOOT ZONE – HIGH PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with high pedestrian use that are 11 feet wide.	
Guidelines	• Recommended minimums for walkways along local service streets where ROW is 50 feet or greater.	

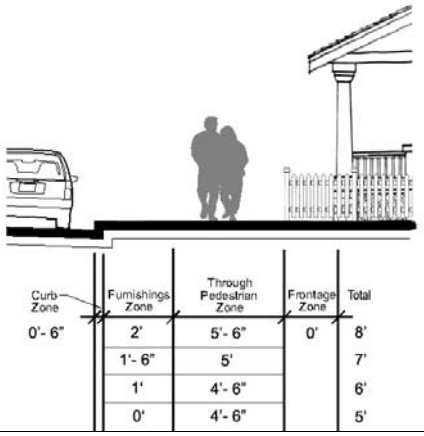
C5: SIDEWALK CORRIDOR: 10 FOOT ZONE – HIGH PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with high pedestrian use that are 10 feet wide.	
Guidelines	• Recommended for local service walkways in residential zones where ROW width is less than 50 feet.	

C6: SIDEWALK CORRIDOR: 9 FOOT ZONE – HIGH PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with high pedestrian use that are 9 feet wide.	
Guidelines	• NOT RECOMMENDED for new construction or reconstruction. • Accepted in existing constrained conditions when increasing the sidewalk Zone is not practical.	

C7: SIDEWALK CORRIDOR: LESS THAN 9 FOOT ZONE – HIGH PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with high pedestrian use that are less than 9 feet wide.	
Guidelines	• NOT RECOMMENDED. • Accepted in existing constrained conditions when increasing the Sidewalk Zone width is not practical.	

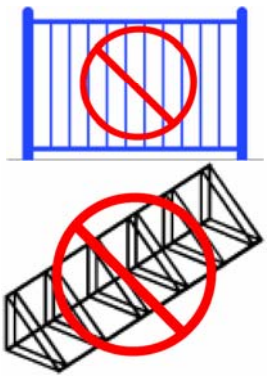
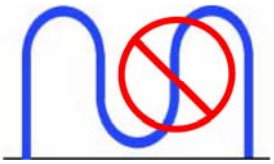
C8: SIDEWALK CORRIDOR:, 11 FOOT ZONE - LOW PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with low pedestrian use that are 11 feet wide.	
Guidelines	• Recommended minimums in Low Pedestrian Use areas along medium- and high-density residential streets, especially for arterial streets or where right-of-way (ROW) width is 50 feet or greater.	

C9: SIDEWALK CORRIDOR:, 10 FOOT ZONE - LOW PEDESTRIAN USE		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with low pedestrian use that are 10 feet wide.	
Guidelines	• Recommended minimums for low-density residential street where ROW width is less than 50 feet.	

C10: SIDEWALK CORRIDOR: LOW PEDESTRIAN USE, 5 TO 10 FT		
Purpose	To provide pedestrians a pleasant, inviting, and safe right-of-way.	
Where to Use	• In sidewalk corridors with low pedestrian use that are 5 to 10 feet wide.	
Guidelines	• Accepted in existing constrained conditions when increasing the sidewalk corridor width is not practical.	

C11: FURNISHINGS: TREES		
Purpose	To provide shade, a buffer from motor vehicles, and comfort for pedestrians. To enhance air quality.	
Where to Use	• Urban retail and commercial centers	
Guidelines	• Care must be taken to avoid conflict with overhead utilities, furniture, or opening car doors. This can be accomplished with trees by trimming branches at least 2.1m (**7** ft) high. • Trees should be well placed so as not to interfere with pedestrians crossing the street. • Types of trees used generally vary by geographical region. Trees with potentially disruptive root systems, either on nearby buildings or sidewalks, should be avoided.	

C12: FURNISHINGS: FURNITURE		
Purpose	To provide pedestrians a more comfortable and attractive setting. To provide a respite for mobility-challenged pedestrians or others seeking to relax while enjoying pedestrian facilities.	  
Where to Use	• Urban retail and commercial centers • Any locations where pedestrians might feasibly want to sit down	
Guidelines	• Furniture should be placed out of the primary pedestrian throughway, complying with ADA standards. • Furniture can be artfully designed to be visually appealing or entertaining and simultaneously functional. • Although security sometimes requires furniture to be fastened to the ground, specific settings sometimes allow furniture to be unsecured, allowing users greater freedom of placement.	

C13: FURNISHINGS: BICYCLE RACKS		
Purpose	To provide a safe place for bicyclists to lock their bikes.	 **Acceptable Bicycle Racks**   **Unacceptable Bicycle Racks**
Where to Use	• Urban retail and commercial centers • Pedestrian malls • At specific juncture points: carpool lots, bus and train stations, trailheads for bicycle paths • At any location with a high current or expected amount of bicycle traffic • Bicycle parking should be situated no farther than the closest motor vehicle parking space from a building, and within 15.2m (**50 ft**) from the building's main entrance.	
Guidelines	• Quality racks should be properly secured to the ground to prevent theft. • Racks should allow the user to lock her bike frame and front wheel to the rack using a standard "U-Lock". • Unacceptable racks include "wheelbender" racks or others that do not allow proper locking. • Weather protection should be afforded whenever possible	

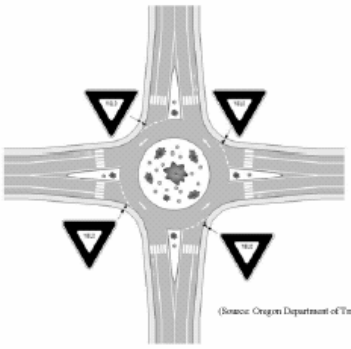
C14: FURNISHINGS: PUBLIC ART		
Purpose	To encourage use of a pedestrian right-of-way through an increased sense of place. To display local art to the public.	
Where to Use	• Urban retail and commercial centers • Pedestrian malls	
Guidelines	• Art must be kept out of the normal travel path (exceptions include ground-level art such as sidewalk paintings or mosaics). • Art can provide functional use as well: a bench, a water fountain, or a bike rack can be artfully designed.	 **Examples of public art**  **Public Art integrated into the sidewalk**

C15: FURNISHINGS: LIGHTING		
Purpose	To encourage pedestrian use of an area by increasing visibility, comfort, and perceived safety.	
Where to Use	• Intersections, pedestrian crossing areas • Areas of high nighttime pedestrian activity (commercial districts, places of worship, schools)	
Guidelines	• Pedestrian-level lighting is encouraged in addition to street-lighting in places of high use. • Urban areas should receive continuous lighting • Mercury vapor, metal halide, or incandescent are preferred pedestrian-level lighting. • Low-pressure sodium lighting should be avoided due to the resulting color distortion.	

C16: FURNISHINGS: WAY-FINDING SIGNS		
Purpose	Providing pedestrians with a continuous walking environment through timely information.	
Where to Use	• Museums, libraries, entertainment centers, schools, retail districts, or other locations of high use (especially by tourists). • At detours, trailheads, other turning points on a route	
Guidelines	• Signs should be posted **8 ft** above ground level.	

Way-Finding Sign showing multiple attractions and directions (downtown Atlanta, Georgia)

C17: FURNISHINGS: BUS STOPS		
Purpose	Provide a safe location for people to wait for the bus.	
Where to Use	• At all bus stops and transfer points	
Guidelines	• Covered bus stops provide protection from rain, snow, wind, and, on hot days, sun. • Covered bus stops and lighting increases perceived safety and subsequent usage.	

C18: ROUNDABOUTS		
Purpose	Reduce speed of traffic and simplify pedestrian crossings.	
Where to Use	• At high-traffic intersections where space allows • Freeway-to-street interchanges and other points at which minimal queuing space is available	
Guidelines	• Roundabouts reduce the number of potential conflict points between motorists and pedestrians from six to two per crossing leg. • Significant signage is required to ensure pedestrians properly traverse the roundabout and their behavior is predictable to motorists. • Extra consideration must be given for sight-impaired pedestrians • The center of the roundabout provides an opportunity for landscaping.	 (Source: Oregon Department of Transportation)

C19: GATEWAYS		
Purpose	Provide visual cues indicating to motorists that they are entering a downtown area with significant pedestrian traffic and generally lower posted speed limits	
Where to Use	• At the boundaries of a region with low motor vehicle speeds	
Guidelines	• Gateways help to define a sense of place for users • Should not visually impair the driver or her ability to react and respond to other vehicles, bicyclists, and pedestrians. • Should not interfere with a pedestrians ability to maneuver along the sidewalk.	

C20: NO PEDESTRIAN CROSSING		
Purpose	To avoid conflicts between pedestrians and traffic in situations that are especially dangerous.	 **No Pedestrian Crossing sign**
Where to Use	• Prohibiting crossing should be considered only in very limited circumstances, for example: • Where it would be very dangerous for pedestrians to cross, as where visibility (for pedestrians or motorists) is obstructed and the obstruction cannot be reasonably removed • Where so many legal crosswalks exist that they begin to conflict with other modes, as on an arterial street with multiple offset or "T" intersections • Where there are unique considerations at a particular intersection and pedestrian mobility is not disproportionately affected by the closure	
Guidelines	• Do not close crosswalks at “T” and offset intersections unless there is a safer crosswalk within 30 m (100 ft) of the closed crosswalk • Use "Pedestrians Use Marked Crosswalk" signs for crosswalks closed to reduce an excess of crosswalks on a street with “T” or offset intersections • Use "No Pedestrian Crossing" signs for crosswalks closed for pedestrian safety	

8.3.3 Pedestrian Intersection Treatments

<table>
<tr><th colspan="3">I1: CROSSWALKS</th></tr>
<tr><td>Purpose</td><td colspan="2">To provide a safe path for pedestrians to cross a motor vehicle right-of-way.</td></tr>
<tr><td>Where to Use</td><td colspan="2">• See Table 1 for crosswalk type based on ADT, speed, and number of lanes.</td></tr>
<tr><td>Guidelines</td><td>• Type 1 Marked/unprotected crossing consists of a crosswalk, signing, and often no other devices to slow or stop traffic.
– The approach depends on an evaluation of vehicular traffic, line of sight, trail traffic, use patterns, vehicle speed, road type and width, and other safety issues such as the proximity of schools.
– Warning signs should be installed warning both pedestrians and drivers of the crossing.
• Type 1+ Enhanced crossings are designed for multi-lane, higher volume arterials over 15,000 ADT.
– High ADT streets may have enhanced crossings if the following guidelines are met:
• excellent sight distance
• sufficient crossing gaps (more than 60 per hour)
• median refuges
• active warning devices like flashing beacons or in-pavement flashers
• inappropriate if many school children use the crossing
• must consider existing and potential future usage
• A flashing yellow beacon activated by pedestrians may be used.</td><td> 
 
Type 1 Crossings
 
Type 1+ Crossing</td></tr>
</table>

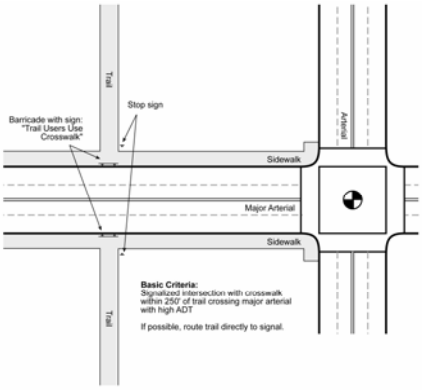
I1: CROSSWALKS (continued)		
Guidelines	• **Type 2** Pedestrians are diverted to a signalized intersection with an existing pedestrian crosswalk within 250 ft, rather than unsafe mid-block crossings. – Barriers and signing may be needed to direct trail users to the signalized crossings – Generally, signal modifications would be made to add pedestrian detection and to comply with ADA. – Often, such as on most community trails parallel to roadways, crossings are simply part of the existing intersection and are not a significant problem for trail users. • **Type 3** To be used at pedestrian crossings on high-speed corridors more than 250 ft. from an existing signalized intersection to which pedestrians can be diverted. – Where 85th percentile speeds are 40 mi/h and above and/or ADT exceeds 15,000 vehicles. – Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety. – The maximum delay for signal activation should be two minutes, with minimum crossing times determined by street width. – The signals may rest on flashing yellow or green for motorists when not activated, and should be supplemented by standard advanced warning signs. – Typical costs for a signalized crossing range from $150,000 to $250,000. – Trail signals are normally activated by push buttons, but also may be triggered by motion detectors.	 **Type 2 Crossing**  **Type 3 Crossing** NOTE: The Pedestrian Volume signal warrant is intended for the application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. For signal warrant analysis, a location with a wide median, even if the median width is greater than 9 m (30 ft), should be considered as one intersection.

Table 8-5. Summary of Trail-Roadway Crossing Recommendations[15]

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT > 9,000 to 12,000			Vehicle ADT > 12,000 to 15,000			Vehicle ADT > 15,000		
	Speed Limit **											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h
2 Lanes	1	1	1/1+	1	1	1/1+	1	1	1+/3	1	1/1+	1+/3
3 Lanes	1	1	1/1+	1	1/1+	1/1+	1/1+	1/1+	1+/3	1/1+	1+/3	1+/3
Multi-Lane (4 or more lanes) with raised median ***	1	1	1/1+	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3
Multi-Lane (4 or more lanes) without raised median	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3

* **General Notes:** Crosswalks should not be installed at locations that could present an increased risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone **will not** make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. **These are general recommendations; good engineering judgment should be used in individual cases for deciding which treatment to use.**

For each trail-roadway crossing, an engineering study is needed to determine the proper location. For each engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites.

** Where the speed limit exceeds 40 mi/h (64.4 km/h), marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and AASHTO guidelines. A two-way center turn lane is not considered a median.

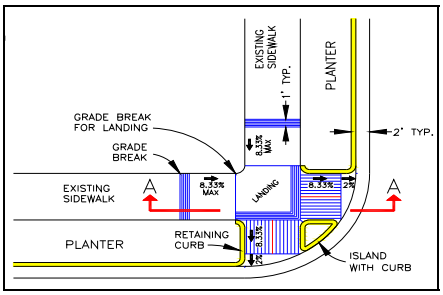
1= Type 1 Crossings. Ladder-style crosswalks with appropriate signage should be used.

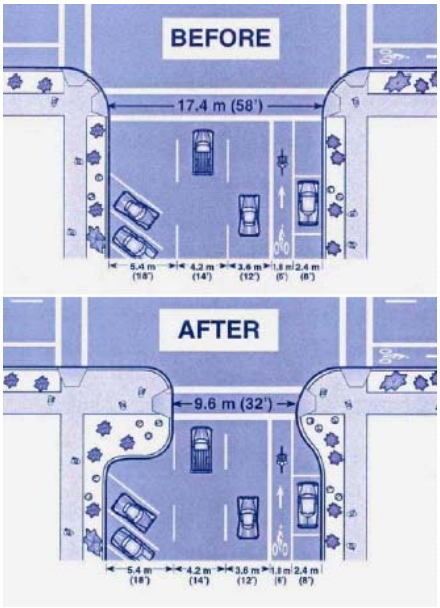
1/1+ = With the higher volumes and speeds, enhanced treatments should be used, including marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

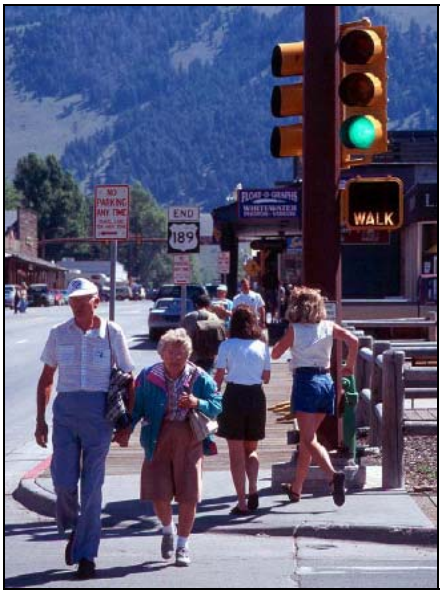
1+/3 = Carefully analyze signal warrants using a combination of Warrant 2 or 5 (depending on school presence) and EAU factoring. Make sure to project trail usage based on future potential demand. Consider Pelican, Puffin, or Hawk signals in lieu of full signals. For those intersections not meeting warrants or where engineering judgment or cost recommends against signalization, implement Type 1 enhanced crosswalk markings with marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

[15] This table is based on information contained in the U.S. Department of Transportation Federal Highway Administration Study, " Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations," February 2002.

I2: PEDESTRIAN SIGNAL		
Purpose	To indicate to pedestrians when to cross at a signalized crosswalk through a pedestrian activated traffic signal at a marked crosswalk.	
Where to Use	• All traffic signals should be equipped with pedestrian signal indications except where pedestrian crossing is prohibited by signage. • On mid-block crossings of high volume/high speed roadways • On roadways adjacent to schools or other high pedestrian activity areas where safety is paramount • Anticipated use must be high enough for motorists to get used to stopping frequently for a red light (a light that is rarely activated may be ignored when in use)	
Guidelines	• Signal needs to be timed with other local signals • Signal may be accompanied by other traffic calming treatments (e.g., raised medians, curb extensions) • Warning signs should be installed for motorists	

I3: CURBRAMPS AND LANDINGS		
Purpose	Following ADA guidelines, curb cuts make the sidewalk accessible from the roadway level of the crosswalk, while curb ramps make it possible to change direction after completing the ascent from street level, rather than during the rise, avoiding travel across the compound slope of a side flare. Top landings also allow pedestrians to bypass curb ramps entirely when traveling around a corner.	 **Curb cuts**
Where to Use	• At every intersection location where there is a crosswalk, whether or not the crosswalk is marked.	
Guidelines	• Ramp runs shall have a running slope not steeper than 1:12 • Cross slopes of ramp runs shall not be steeper than 1:48 • Counter slopes for of surfaces adjacent to curb ramps shall not exceed 1:20 • The landing shall be at least as wide as the ramp leading to it • The landing length shall be at least 1.5m (5 feet)	

I4: CURB EXTENSIONS		
Purpose	To minimize pedestrian exposure during crossing by shortening crossing distance and give pedestrians a better chance to see and be seen before committing to crossing.	 (Source: Oregon Department of Transportation) **Curb extensions**
Where to Use	• Appropriate for any crosswalk where it is desirable to shorten the crossing distance and there is a parking lane adjacent to the curb. • Note that if there is no parking lane, the extensions may be a problem for bicycle travel and truck or bus turning movements.	
Guidelines	• In most cases, the curb extension should be designed to transition between the extended curb and the running curb in the shortest practicable distance. • For purposes of efficient street sweeping, the minimum radius for the reverse curves of the transition is 3m (10 ft) and the two radii should be balanced to be nearly equal.	

I5: SIGNAL TIMING		
Purpose	To allow pedestrians enough time to fully cross the street without having to strain to complete the distance in time	 **Proper signal timing**
Where to Use	• At all signalized intersections	
Guidelines	• While MUTCD defines a "normal" walking speed as 1.22 m/s (**4 ft/sec**), research indicates that elderly pedestrians and women cross slower than younger pedestrians and men, respectively. Therefore, a signal timing of **2.5 ft/sec** is recommended when possible. • Signal timing can be combined with a **countdown signal** to inform pedestrians of the amount of time remaining before the signal changes.	 **Countdown signal**

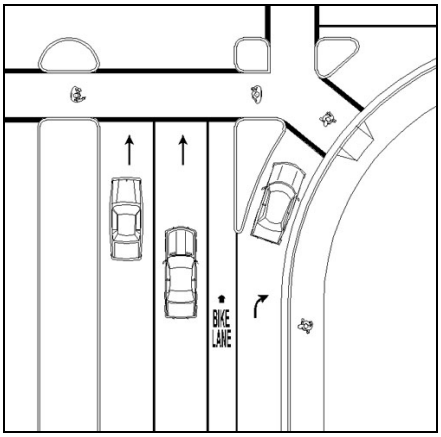
I6: AUDIBLE PEDESTRIAN TRAFFIC SIGNALS		
Purpose	To provide crossing assistance to pedestrians with vision impairment at signalized intersections	 **Speaker on pedestrian traffic signal**
Where to Use	• To be considered for audible signals, the location must first meet the following basic criteria: – The intersection must already be signalized. – The location must be suitable to the installation of audible signals, in terms of safety, noise level, and neighborhood acceptance. – There must be a demonstrated need for an audible signal device. The need is demonstrated through a user request. – The location must have a unique intersection configuration and characteristics.	
Guidelines	• Audible signals should be activated by a pedestrian signal push button with at least a one second-delay to activate the sound.	

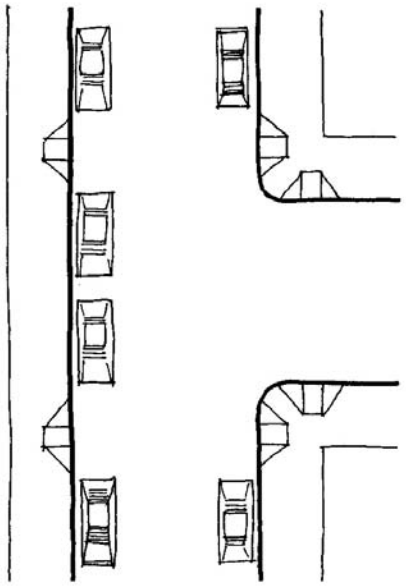
I7: TEXTURED CROSSWALKS		
Purpose	To better enable vision-impaired pedestrians to safely cross an intersection; to indicate to pedestrians the appropriate route across traffic; to remind motorists of the presence of pedestrian traffic	 (Source: http://www.sta.dst.ca.us/publications/Toolkit.pdf)
Where to Use	• At mid-block locations, crosswalks are textured where there is a demand for crossing, and there are no nearby marked crosswalks. • Where there has been a history of vehicle-crosswalk user conflicts.	
Guidelines	• If properly designed, textured crosswalks increase aesthetic appeal • Care must be taken to avoid the textures from impeding mobility-challenged individuals and bicyclists • Stamped concrete and asphalt concrete are preferred over brick or unit pavers.	

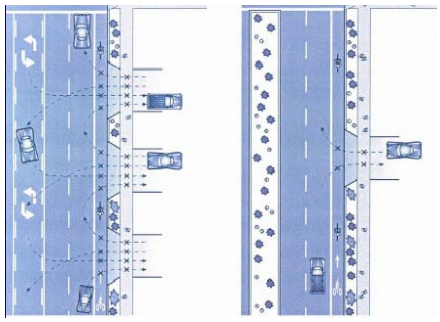
I8: GRADE-SEPARATED CROSSING		
Purpose	To completely separate pedestrian travel from vehicular travel	 **Grade-separated undercrossing**
Where to Use	• Use only where it is not possible to provide an at-grade facility. Examples include crossing a freeway or major highway, a rail yard, or a waterway.	
Guidelines	• The crossing must be accessible. • Grade changes should be minimized to the greatest extent possible. • Shared bicycle/pedestrian facilities should have a clear passage width of at least 3.7 m (12 ft).	

I9: PEDESTRIAN PUSH BUTTONS		
Purpose	To permit the signal controller to detect pedestrians desiring to cross	   **Pedestrian push buttons**
Where to Use	• At an actuated or semi-actuated traffic signal at crossings with low pedestrian volumes, and at mid-block crossings	
Guidelines	• When push buttons are used, they should be located so a wheelchair user can reach the button from a level area of the sidewalk without deviating significantly from the natural line of travel into the crosswalk. • The button should be marked (for example, with arrows) so that it is clear which signal is affected. • Use of pedestrian push buttons should be avoided in High Pedestrian Use areas. The pedestrian classification must be balanced with other street functions. In High Pedestrian Use areas, there must be a clear benefit for actuated signals before push buttons are installed. Criteria include: – the main street carries through traffic or transit, such as a major city traffic or transit street, or a district collector – traffic volumes on the side street are much lower than on the main street – the pedestrian signal phase is long (for example, on a wide street) and eliminating it when there is no demand would significantly improve the main street's level of service • Where push buttons must be installed in high pedestrian use areas, designers should consider operating the signal with a regular pedestrian phase during off-peak hours. • U.S. Access Board recommends buttons be raised above or flush with their housing, and large enough for people with visual impairments to see, min. 51 mm (2 in). • U.S. Access Board recommends the force to activate the signals should be no more than 22.2 N (5 lbf).	

I10: MEDIAN REFUGE ISLAND		
Purpose	To minimize pedestrian exposure during crossing by shortening crossing distance and increasing the number of available gaps for crossing.	 **Median refuge islands**
Where to Use	• Appropriate where the roadway to be crossed is greater than 15.2 m (50 ft) wide or more than four travel lanes; can be used where distance is less to increase available safe gaps. Use at signalized or unsignalized crosswalks.	
Guidelines	• The refuge island must be accessible, preferably with an at-grade passage through the island rather than ramps and landings. • A median refuge island should be at least 1.8 m (6 ft) wide between travel lanes and at least 6.1 m (20 ft) long. On streets with speeds higher than 25 mph there should also be double centerline marking, reflectors, and "KEEP RIGHT" signage. • If a refuge island is landscaped, the landscaping should not compromise the visibility of pedestrians crossing in the crosswalk. Tree species should be selected for small diameter trunks and tree branches should be no lower than 4.3 m (14 ft). Shrubs and ground plantings should be no higher than 457 mm (1 ft 6 in). • Refuge islands at intersections should have a median "nose" that gives protection to the crossing pedestrian (see illustration).	

I11: PORKCHOP REFUGE ISLAND		
Purpose	To shorten crossing distances and provide a refuge for pedestrians between separated traffic movements	 **Porkchop refuge island**
Where to Use	• Use with right turn slip lanes, modern roundabouts, or other intersection treatments where pedestrians benefit from a refuge. Can also use at "T" intersections between right-turning and left-turning travel lanes. Note that right-turn slip lanes are not recommended in areas of high pedestrian use.	
Guidelines	• Refuge must be accessible. • Crosswalks should be indicated with pavement markings to show pedestrians and motorists the correct crossing location. • Generally, the crosswalk should be set back 6.1 m (**20 ft**) from the point where the traffic merges, so that pedestrians cross behind the first vehicle, and should be oriented perpendicular to the line of vehicle travel.	

I12: PARKING CONTROL		
Purpose	To improve visibility in the vicinity of the crosswalk	 **In areas with high parking demand, compact parking may be permitted within the intersection, but crosswalks should be kept clear.**
Where to Use	• Parking is prohibited within all intersections and crosswalks unless otherwise signed. • At "T" and offset intersections, where the boundaries of the intersection may not be obvious, this prohibition should be made clear with signage. • In areas where there is high parking demand (as determined by the City Traffic Engineer), parking for compact vehicles may be allowed within "T" or offset intersections and on either side of the crosswalk. At these locations, signs will be placed to prohibit parking within the designated crosswalk areas. • Parking shall not be allowed within any type of intersection adjacent to schools, school crosswalks, and parks. This includes "T" and offset intersections.	
Guidelines	• Installation of parking signage to allow and/or prohibit parking within any given intersection will occur at the time that the Parking Control section is undertaking work at the intersection.	

C20: ACCESS MANAGEMENT		
Purpose	Minimize the potential for vehicle-pedestrian conflict at driveways and other entrance and exit points to the public right-of-way.	 (Source: Oregon Department of Transportation)
Where to Use	• On roads with multiple driveway access points. • At entryways for parking garages. • At entryways for apartment complexes or other locations of high vehicular use.	
Guidelines	• Driveways can be consolidated from several parking lots to reduce vehicle-pedestrian conflict points. • Enough parking spaces should be provided to prevent vehicle parking in the public right-of-way. • A median preventing turning to/from the far right-of-way lane(s) can significantly reduce the potential conflict points for sidewalk users. • Stop or yield signs, mirrors, flashing lights, or audible signals can be directed to drivers, not pedestrians, in places of low sight distance.	

C21: SEPARATED SIDEWALKS		
Purpose	Provide additional safety and comfort for pedestrians on long, open rights of way	
Where to Use	• Where space allows for a sidewalk separated from the vehicular right-of-way	
Guidelines	• A barrier of some kind (concrete wall, trees, public art, etc.) can be used to separate pedestrians from vehicular right-of-way	

C22: PEDESTRIAN SHOULDER		
Purpose	To provide a safe corridor for pedestrians where a sidewalk, trail, or other treatment is unnecessary or impractical.	
Where to Use	• Rural roads with low current and future pedestrian traffic volume.	
Guidelines	• 8’ minimum, keep swept • on bus route, provide larger area around bus stop	

Chapter 9
Implementation

9.1 Introduction

One of the main purposes of the Bicycle and Pedestrian element of the Long-Range Transportation Plan is for TDOT to take a leadership role in encouraging increased bicycle and pedestrian use in a safer bicycling and walking environment. To achieve this goal, many different entities will be called upon to implement this plan. This chapter discusses the costs associated with the facility and programmatic recommendations set forth in this plan that are necessary to achieve the guiding principles, goals, and objectives. It addresses facilities, funding, and cost estimates. Appropriate roles and responsibilities are also defined.

TDOT plays a role in the direct implementation of bicycle-related improvements on the State Highway system and encourages safer practices through its education and enforcement programs. It will take a number of years of implementation and additional investments to create a transportation system that fosters increased and safe bicycling and walking throughout the state. Perhaps more important than implementation of this plan is the development of a supportive environment for bicycling and walking in Tennessee. This can be achieved through a comprehensive effort involving local governments, counties, and even the private sector.

This chapter identifies estimated costs for the proposed improvements, maintenance, and programs, strategies on funding, and roles for TDOT, MPOs and local agencies.

9.2 Cost Estimates

Costs for the proposed program and physical improvements are presented in Table 9-1. Assumptions for the costs shown are provided below, and costs not shown are identified as well.

Total TDOT bicycle and pedestrian costs over the next 25-years are shown in Table 9-1. It is important to point out that these costs reflect TDOT-related costs, and not local costs. This includes TDOT administrative, operations, and program costs, and improvements to State highways. It does include several new TDOT-managed funding programs that would provide funding to local agencies for bikeway and pedestrian improvements for local improvements. Local costs are not included because most regions, counties, cities, and towns in Tennessee have not developed local bikeway or pedestrian plans with detailed long-term cost estimates.

The total 25-year estimated cost for all TDOT-related bicycle and pedestrian improvements is $194,975,000. Of this, about $16 million are program costs (research, administration, operations), $100 million are grant programs for local agencies, $57 million are for improvements to the Statewide Bicycle system, and $16 million are for maintenance costs.

Table 9-1. Proposed Program Cost Estimates

Item	Type	Annual Cost	25 yr. Cost
Programs, Research, and Administration			
Design Standards	Research		$ 100,000
Web-based Training/Resources	Admin		$ 200,000
ADA Resource	Admin		$ 50,000
Technical Research	Research	$ 50,000	$ 1,250,000
Training Materials and Curriculum	Admin		$ 50,000
Maintenance Research and Response	Operations	$ 20,000	$ 500,000
State Bicycle & Pedestrian Plan Update	Admin	$ 15,000	$ 375,000
Local Streets Handbook	Admin		$ 100,000
Local Agency Coordination	Admin	$ 50,000	$ 1,250,000
Technical Assistance Program	Admin	$ 100,000	$ 2,500,000
Local Bike/Ped Plans (Review/Approve)	Admin	$ 20,000	$ 500,000
State Bicycle Map	Admin	$ 10,000	$ 250,000
Annual Count Program/Forecasting	Admin	$ 50,000	$ 1,250,000
Crash Reporting Improvements	Admin		$ 500,000
Safety Programs	Admin	$ 50,000	$ 1,250,000[16]
Visitor Promotion/Website	Admin	$ 50,000	$ 1,250,000[17]
Annual State Conference (partial)	Admin	$ 50,000	$ 1,250,000
Right-of-Way Inventory	Research		$ 150,000
Access Management Policies	Research		$ 75,000
Expand Coordinators Office	Admin	$ 80,000	$ 2,000,000
Safe Routes to School Program	Admin	$ 2,000,000	$ 50,000,000[18]
Bicycle Transportation Fund	Admin	$ 1,000,000	$ 25,000,000[19]
Pedestrian Transportation Fund	Admin	$ 1,000,000	$ 25,000,000[20]
sub-total		**$ 4,545,000**	**$ 114,850,000**
Capital Projects			
Shoulder Improvements	Improvement		$ 40,125,000[21]
Signing state bicycle routes[22]	Improvement		$ 2,000,000
ADA Retrofitting of State Facilities	Improvement	$ 250,000	$ 6,250,000[23]
Gap Closure (Bridges, Under Crossings)	Improvement		$ 15,000,000[24]
sub-total		**$ 450,000**	**$ 63,375,000**
Operations			
Maintenance (sweeping)	Operations	$ 670,000	$ 16,750,000[25]
GRAND TOTAL			**$ 194,975,000**

[16] May appear in another budget
[17] May appear in another budget
[18] May come from Federal funds
[19] May come from Federal funds
[20] May come from Federal funds
[21] Assumes 30% of cost apportioned to the bicycle mode
[22] Assumes 2 signs every 10 miles and at every turn
[23] May appear in another budget
[24] May come from Federal funds
[25] Assumes $2,000/mile/year; one time per year on statewide system

9.3 Assumptions

Each of the programs or improvements identified in the cost table is detailed in Chapter 7. General and specific assumptions related to the cost estimates for those recommendations are presented below.

Table 9-2. Cost Estimate Assumptions

Program / Project	Assumption
Research, development, and publication costs	TDOT, research entities, and/or private consulting firms
Design Standards	one-time research appropriation
Web-based Training/Resources	one-time development appropriation plus minor maintenance
ADA Resource	one-time research and publication appropriation
Technical Research	annual research appropriation
Training Materials and Curriculum	one-time research and publication appropriation
Maintenance Research and Response	annual appropriation for internal TDOT monitoring and research
State Bicycle & Pedestrian Plan Update	update to be completed every 5 years or in conjunction with LRTP.
Local Streets Handbook	one-time research and publication appropriation
Local Agency Coordination	additional TDOT staff time and resources
Technical Assistance Program	additional TDOT staff time and resources, and/or outside contractors
Local Bike/Ped Plans (Review/Approve)	additional TDOT staff time and resources
State Bicycle Map	one-time development appropriation plus minor updating
Annual Count Program/Forecasting	annual program by TDOT or outside contractors
Crash Reporting Improvements	one-time development appropriation plus minor maintenance
Safety Programs	annual program performed by TDOT, THP, and/or grants to local contractors
Visitor Promotion/Website	one-time development appropriation plus minor maintenance
Annual State Conference (partial)	annual underwriting cost (partial)
Right-of-Way Inventory	one-time research and publication appropriation
Access Management Policies	one-time research and publication appropriation
Expand Coordinators Office	additional TDOT staff hours and resources
Safe Routes to School Program	competitive grant program administered by TDOT, source could be federal
Bicycle Transportation Fund	competitive grant program administered by TDOT, source could be federal
Pedestrian Transportation Fund	competitive grant program administered by TDOT, source could be federal
Shoulder Improvements	Total cost to provide minimum recommended shoulder width on State Bikeway System (see Table 9-3) factored by 30%

	to reflect the fact that shoulder widening is recommended by TDOT and ASSHTO and provides motor vehicle safety enhancements as well.
Sidewalks	Total estimated cost for sidewalks constructed by TDOT as part of state highway projects. This does not include local agency costs for constructing sidewalks within State Highway right-of-way. This also does not include estimated $16 million in Transportation Enhancement funds allocated to local agencies.
ADA Retrofitting of State Facilities	Total estimated cost for ADA retrofitting on TDOT maintained sidewalks. This does not include local sidewalks within State Highway right-of-way maintained by local agencies.
Statewide System signing, striping	Cost for system identification, warning, advisory, and directional signing and striping on Statewide Bikeway system.
Gap Closure (Bridges, Under Crossings)	Contributions of the bicycle funding (often from federal sources) to gap closure projects such as new or rehabilitated bridges that provide for bicycle and pedestrian access.
Maintenance (sweeping)	Estimated annual cost to sweep all shoulders on Statewide Bicycle System a least once a year. This could include new maintenance equipment as well.

9.4 Statewide Bikeway System

Details on the proposed Statewide Bikeway System including the estimated miles of deficient shoulders are shown in Table 9-3. Assumptions on the unit costs used in calculating these costs are shown in the footnotes and in Table 9-2 (above).

Once a state bicycle route system has been identified, the greatest challenge is to identify the top priority projects that will offer the greatest benefit to bicyclists if implemented. For the Bicycle and Pedestrian element of the Long-Range Transportation Plan, an initial list of priority projects was developed based on input from local MPOs and planning agencies, analysis as part of this plan, and the needs for build-out of the proposed state bicycle route system.

The project list represents a combination of both short-term projects that would be relatively inexpensive and easy to implement (restriping or paving a graded shoulder), as well as long-term, higher cost projects that, despite possibly being years away from implementation, are considered to be extremely important components of the comprehensive state bicycle network (e.g. connection over the Appalachian Mountains, Mississippi River, etc.).

The project list is separated into two categories: Proposed State Route gaps and Urban Corridor Gaps. The proposed state route gaps were identified using analyses from the suitability index discussed in the *Existing Conditions* chapter of this document. Urban Corridor Gaps were gaps identified through the local planning process. If a city or region had not developed a comprehensive bicycle plan with a list of gaps or priority projects by fall of 2004, they were not included in this plan.

It is important to remember that the bikeway system and the individual projects are flexible concepts that serve as guidelines to those responsible for implementation. The project list, and perhaps even the overall system and segments themselves, may change over time as a result of changing bicycling and motor vehicle patterns and implementation constraints and opportunities. Also, the proposed state routes may not consist of all of the "best" roadways and are likely to change upon public review.

Table 9-3. Proposed State Bicycle Route Gaps and Cost Estimates

Southern Rambler						
RT #	**From**	**To**	**Length (miles)**	**Region**	**Treatment**	**Estimated Cost**
57	Germantown	Collierville	6.6	4	widen shoulder	$2,475,000
205	Collierville	Fisherville	7.5	4	widen shoulder	$2,812,500
193	Macon	Williston	2.6	4	widen shoulder	$975,000
76	JCT of 195	Somerville	1.8	4	widen shoulder	$675,000
76	Somerville	JCT of 59	1.8	4	widen shoulder	$675,000
64	Somerville	east	1.5	4	widen shoulder	$562,500
64	Bolivar	18	3	4	widen shoulder	$1,125,000
100	JCT of 125	Henderson	9	4	widen shoulder	$3,600,000
13	Waynesboro	north	1	3	widen shoulder	$400,000
64	Fayetteville	west	1	3	widen shoulder	$375,000
64	Fayetteville	JCT of 50	1.5	3	widen shoulder	$562,500
50	JCT of 121	Cowan	11	2	widen shoulder	$4,400,000
41	JCT of I-24	west	8	2	bike lane	$3,400,000
64/72	I-24	11/64 - McCallie Ave	9	2	bike lane	$3,600,000
58	Wilder Street	Lightfoot Mill Road	1	2	bike lane/widen shoulder	$375,000
317	I-75	Apison	7.5	2	widen shoulder	$3,187,500
60	JCT of 40	south	2.5	2	widen shoulder	$1,000,000
64/74	JCT of 315	southeast - Ducktown	10	2	widen shoulder on uphill side	too expensive
Total			**86.3**			**$30,200,000**

Cumberland Traverse						
RT #	**From**	**To**	**Length (miles)**	**Region**	**Treatment**	**Estimated Cost**
64	Fayetteville	JCT of 50	1.7	3	widen shoulder	$680,000
55	Region border	JCT of ALT 41	2.5	2	widen shoulder	$1,000,000
ALT 41	Tullahoma	JCT of 55	1	2	widen shoulder	$375,000
55	Manchester	southeast	3.3	2	widen shoulder	$1,237,500
BR 55	JCT of 70S	McMinnville	3	2	widen shoulder	$1,125,000
30	JCT of 70S	east (Spencer)	4	2	widen shoulder	$1,700,000
101	Crossville	south	10	2	widen shoulder	$4,000,000

298	Crossville	north	3.6	2	widen shoulder (cross I-40)	$1,440,000
63	27	Huntsville	2.6	1	widen shoulder	$1,170,000
297	Jellico	south	2.7	1	widen shoulder	$1,215,000
25W	Jellico	I-75	0.5	1	widen shoulder	$200,000
Total			**34.9**			**$14,142,500**

Foothills Tour						
RT #	**From**	**To**	**Length (miles)**	**Region**	**Treatment**	**Estimated Cost**
39	JCT of 315	Tellico Plains	4	1	widen shoulder	$1,800,000
360	Vonore	Southeast	7	1	widen shoulder	$2,800,000
336	Maryville	South	4.8	1	widen shoulder	$1,920,000
321	Maryville	Walland	5.4	1	widen shoulder	$2,160,000
321	Townsend	JCT of 321/441	17.2	1	widen shoulder	$7,310,000
321/441	Pigeon Forge	Gatlinburg	8.5	1	widen shoulder	$3,825,000
91	Elizabethon	Winner	8.5	1	widen shoulder	$3,825,000
Total			**55.4**			**$23,640,000**

Mountain Valley – Watts Bar						
RT #	**From**	**To**	**Length (miles)**	**Region**	**Treatment**	**Estimated Cost**
30	Etowah	Athens	9	2	widen shoulder	$4,050,000
68	Watts Bar Dam	Spring City	8.2	2	widen shoulder	$3,485,000
68	Spring City	north	6	2	widen shoulder	$2,550,000
68	Grassy Cove	JCT 127	10.5	2	widen shoulder	$4,725,000
Total			**33.7**			**$14,810,000**

Land Between the Lakes						
RT #	**From**	**To**	**Length (miles)**	**Region**	**Treatment**	**Estimated Cost**
79	JCT of 120	Lake Barkley	7.5	3	widen shoulder	$3,000,000
49	Dover	east	1	3	widen shoulder	$400,000
13	Waverly	north	6.3	3	widen shoulder	$2,520,000
48	JCT of 100	JCT of 230	2.8	3	widen shoulder	$1,120,000
Total			**17.6**			**$7,040,000**

Stateline Route						
RT #	**From**	**To**	**Length (miles)**	**Region**	**Treatment**	**Estimated Cost**
78	JCT of Proctor City	JCT of 21	2	4	widen shoulder	$750,000
184	Union City	west	3.3	4	widen shoulder	$1,237,500
54	Dresden	JCT of 140	12	4	widen shoulder	$4,800,000
79	Lake Barkley	Woodlawn	13.2	3	widen shoulder	$4,950,000
79	JCT of 223	JCT of 374	4	3	widen shoulder	$1,500,000
374	JCT of 79	JCT of 237	2.5	3	widen shoulder	$937,500
112	JCT of 374	east	1.1	3	widen shoulder	$467,500
52	Region border	east	2.4	2	widen shoulder	$1,080,000
52	JCT 135	Celina	10	2	widen shoulder	$4,500,000
52	JCT of 53	JCT of 136	6	2	widen shoulder	$2,700,000
52	JCT of 28	east	9.7	2	widen shoulder	$4,122,500
32	Tazewell	Jct of 33	4.6	1	widen shoulder	$2,070,000
348	11E	west	2	1	widen shoulder	$850,000
Total			**72.8**			**$29,965,000**

Cumberland Loop						
RT #	**From**	**To**	**Length (miles)**	**Region**	**Treatment**	**Estimated Cost**
25W	LaFollette	Jacksboro	1.4	1	widen shoulder	$525,000
25W	Caryville	Lake City	6	1	widen shoulder	$2,700,000
441	Bethel	JCT of 170	5	1	widen shoulder	$2,125,000
32	Harrogate	Tazewell	2	1	widen shoulder	$900,000
Total			**14.4**			**$6,250,000**

Memphis Loop						
RT #	**From**	**To**	**Length (miles)**	**Region**	**Treatment**	**Estimated Cost**
57	Germantown	Collierville	6.6	4	widen shoulder	$2,475,000
205	Collierville	Fisherville	7.5	4	widen shoulder	$2,812,500
193	Macon	Williston	2.6	4	widen shoulder	$975,000
76	Junction 195	Somerville	1.8	4	widen shoulder	$720,000

76	Somerville	JCT 59	1.8	4	widen shoulder	$720,000
			20.3			**$7,702,500**

Total Mileage of Gaps in State Route System: **335.4** **Total Cost to Improve:** **$133,750,000**

*Note: Estimated cost based on average cost per mile. Base cost of **$350,000/mile** used for **new** construction of **4'** shoulders on **both** sides of the roadway including all associated costs for paving, grading, extending box culverts, drainage, etc. Prices were then adjusted based on the amount of anticipated cut and earthwork costs. The earthwork costs ranged from $25,000 (light, mostly fill) to $100,000 (deep cuts) depending on the characteristics of the roadway segment.*

9.4.1 Urban Corridor Gaps

Many of the existing plans in Tennessee identify numerous needs and general projects, but few plans break those general recommendations into specific feasible and fundable projects, prioritize those projects, define the projects into enough detail so that costs and impacts are known, or integrate those projects into a 20-year capital improvement program. This makes it difficult to translate excellent overall strategies into a program that results in an orderly and effective implementation scheme. Without this step, local agencies end up competing against each other for limited funds, unfeasible projects receive funding, and agencies obtain insufficient funding for a project. Consistent cost information was not provided by the local planning agency for most of the urban corridor gaps. Instead, this list was developed as a starting point, to highlight some of the urban corridor gaps, and to generate a priority project list after the projects have undergone a cost analysis and feasibility study.

Table 9-4. Urban Corridor Gaps

City Connectors	RT#	From	To	Length (miles)	Location	Treatment
Bicycle Access Across Mississippi River	I-55	Downtown Memphis	West Memphis, Arkansas	1	Memphis	Sidewalks, multi-use path improvements
Meeman-Shelby Forest access	MRT	Downtown Memphis	Meeman-Shelby Forest	15	Memphis	Widen shoulder
North-South Access Shelby County	varies	south county	north county	30	Memphis	Widen shoulder
Shelby Farms Access	varies	Memphis	Shelby Farms	10	Memphis	Widen shoulder
US 70S/SR100	US 70S	Downtown Nashville	Natchez Trace Parkway	15	Nashville	Widen shoulder
Gallatin Rd.	US 31	Downtown Nashville	Riverside Dr.	8	Nashville	Bike lanes
Lebanon Rd.	US 70	Downtown Nashville	Downtown Lebanon	25	Nashville	Widen shoulder
Pellissippi Parkway	I-140	Topside Rd	Northshore Rd	5	Knoxville	Bicycle access on existing shoulder

Kingston Pike and Cumberland Rd	SR 1	I-140	downtown Knoxville	10	Knoxville	Widen/Add shoulder, fill in sidewalk gaps
Chapman Highway	SR 71	Gov. John Sevier Hwy	downtown Knoxville	6	Knoxville	Resurface and re-stripe
Highway 153	153	Highway 41	State Line	5.1	Chattanooga	Bike lanes
Highway 58	58	Bonny Oaks Dr.	Ooltewah-Georgetown Rd	20.1	Chattanooga	Signage and Pavement Markings
Highway 193	193	Edge of Urban Area	Chickamauga Rd.	3	Chattanooga	Signage and Pavement Markings
Highway US 27 – Signal Mountain	27	Downtown Chattanooga	Highway 127	2	Chattanooga	Allow bicycle access on existing shoulder
Murfreesboro Rd	96	I-65	Eastern city limits	4.4	Franklin	Bike lanes
Highway 96W	96W	Western city line	7th Ave	4.3	Franklin	Bike lanes
Columbia Ave	31	Southern Boundary	5th Avenue	6.6	Franklin	Bike lanes, shared road signage
Lewisburg Ave	431	Harpeth River	Southern Boundary	5.3	Franklin	Bike lanes
US 45 Bypass	45	Airways Blvd	Hollywood Dr.	1.5	Jackson	Bike lanes
Southern Bypass (proposed)		South Highland Ave	US 45 Bypass		Jackson	Bike lanes
Hunters Point Pike-Canoe Branch	231	Lebanon	Old Hickory Lake	6.5	Wilson County	Shared Roadway
Carthage Highway	70N	Lebanon	Smith County	6.9	Wilson County	Shared Roadway
Sparta Pike	70/SR 26	Lebanon	Dekalb County Line	11.8	Wilson County	Shared Roadway
Murfreesboro Rd	231	Lebanon	Rutherford County line	9.4	Wilson County	Shared Roadway
SR 411	411	Wildwood Rd.	River Ford Rd.	2	Blount County	Widen shoulder
US 31E	31	Freehill Rd	Indian Lake Rd	5	Hendersonville	Bike Lane

9.5 Funding Sources

9.5.1 Transportation Funding

9.5.1.1 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)

Several categories of federal transportation funding were included for bicycle and pedestrian projects in the recent federal transportation legislation, SAFETEA-LU. This section summarizes the federal funding sources available for non-motorized transportation projects and estimates the fiscal impact of these sources.

9.5.1.2 Transportation Enhancement Activities Program

Ten percent of each state's annual Surface Transportation Program (STP) must be set aside for Transportation Enhancement (TE) activities. Three of the twelve defined TEA categories are bicycle and pedestrian related:

- Provision of Facilities for Bicyclists and Pedestrians
- Provision of Safety and Educational Activities for Pedestrians and Bicyclists
- Preservation of Abandoned Railway Corridors

TEA funds may be used for the construction of bicycle transportation facilities and pedestrian walkways, or non-construction projects such as training, brochures and route maps related to safe bicycle use.

9.5.1.3 Congestion Mitigation and Air Quality (CMAQ) Improvement Program

The CMAQ Program directs funds to transportation projects in Clean Air Act non-attainment areas for ozone and carbon monoxide. These projects should contribute to meeting the attainment of national ambient area air quality standards (NAAQS). CMAQ funds may be used for construction of bicycle transportation facilities and pedestrian walkways, or non-construction projects such as brochures and route maps related to safe bicycle use. Bicycle projects must be primarily for transportation rather than recreation, and be included in a plan developed by each Metropolitan Planning Organization. TEA 21 made projects that bring sidewalks into compliance with the Americans with Disabilities Act (ADA) eligible for these funds. Bicycle programs may include the creation of trails, storage facilities, and marketing efforts designed to support bicycles as a form of transportation.

9.5.2 Hazard Elimination Safety (HES) Program

The Hazard Elimination Safety Program (HES) is a federal safety program that provides funds for safety improvements on all public roads and highways. These funds serve to eliminate or reduce the number and/or severity of traffic accidents at locations selected for improvement and can be used to fund bicycle and pedestrian facilities. Tennessee's Hazard Elimination program received over $15 million in fiscal year 2000.

9.5.3 Recreation and Environmental Funding

Land and Water Conservation Funds are managed by the Tennessee Department of Environment and Conservation (TDEC). This federal grant program funds state and local governments' outdoor recreation projects.

Local Parks and Recreation Fund (LPRF) Grant Program is managed by TDEC with the purpose of awarding grants for the purchase and development of land, including greenways. The funds may also be used for trail development and capital projects in parks, natural areas, and greenways.

Recreation Trails Program (RTP) was established by the Transportation Equity Act for the 21st Century (TEA-21) and the funds are available for statewide motorized, non-motorized and multi-use recreation trail projects.

Appendix A

Annotated Bibliography

General Information and Design Resources

Accommodating Bicycle and Pedestrian Travel: A Recommended Approach, A US DOT Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure (2000), Federal Highway Administration.

> *This document is a policy statement adopted by the United States Department of Transportation that incorporates three key principles: a policy statement that bicycling and walking facilities will be incorporated into all transportation projects unless exceptional circumstances exist; an approach to achieving this policy that has already worked in State and local agencies; and a series of action items that a public agency, professional association, or advocacy group can take to achieve the overriding goal of improving conditions for bicycling and walking.*

Exemplary Bicycle and Pedestrian Plans (2002), Pedestrian and Bicycle Information Center.

http://www.bicyclinginfo.org/pp/exemplary_print.htm

> *This list of exemplary bicycle and pedestrian plans was compiled to provide easy access to a number of good examples of comprehensive bicycle and pedestrian planning.*

Flexibility in Highway Design (1997), Federal Highway Administration. HEP 30.

http://www.fhwa.dot.gov/environment/flex/

> *This guide provides guidance about designing highways that incorporate community needs. It is written for highway engineers and project managers who want to learn more about the flexibility available to them when designing roads and illustrates successful approaches used in other highway projects. It can also be used by citizens who want to gain a better understanding of the highway design process.*

Highway Capacity Manual (2000), Transportation Research Board.

> *The Highway Capacity Manual is a collection of procedures and methodologies for calculating highway capacity and level of service. The Manual neither constitutes nor attempts to establish legal standards for highway construction. Rather, it provides methods for analyzing in advance the quantity of service a highway can provide as well as the quality of that service. Chapter 19 focuses on bicycles.*

Manual on Uniform Traffic Control Devices *[MUTCD]* (2001), American Traffic Safety Services Association, American Association of State Highway Transportation Officials, and the Institute of Transportation Engineers.

http://mutcd.fhwa.dot.gov/

The Manual on Uniform Traffic Control Devices, or MUTCD defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F. Part 4, Section 4E.06 provides guidance, standards and support for the use of Accessible Pedestrian Signals. Section 4E.07 provides guidance, standards and support for the use of Pedestrian Detectors. Section 4E.08 provides guidance, standards and support for the use of Accessible Pedestrian Signals Detectors.

Pedestrian and Bicycling Information Center (PBIC)

http://www.bicyclinginfo.org (bicycling)
http://www.walkinginfo.org (walking)

The PBIC is a web-based clearinghouse for information about health and safety, engineering, design, advocacy, education, enforcement and access, and mobility with regard to bicycling and walking. The PBIC serves anyone interested in pedestrian and bicycle issues, including planners, engineers, private citizens, advocates, educators, police enforcement and the health community.

Policy on Geometric Design of Highways and Streets *[The Green Book]* (2001), American Association of State Highway and Transportation Officials.

The Green Book provides guidance for the design of roadways.

Recommendations for Traffic Provisions in Built-up Areas (1998), Centre for Research and Contract Standardization in Civil and Traffic Engineering – The Netherlands (CROW).

This publication discusses knowledge relating to the design, implementation and management of traffic provisions in built-up areas.

Roadside Design Guide (1988), American Association of State Highway and Transportation Officials.

This publication contains information on roadside safety and economics, topography and drainage features, sign and luminaire supports, roadside barriers, median barriers, bridge railings, and crash cushions.

Transportation and Traffic Engineering Handbook (1999), Institute of Transportation Engineers, James L. Pline (Editor).

This publication is a technical handbook that provides professionals with a day-to-day reference on principles and proven techniques of transportation and traffic engineering. The Handbook may be useful for non-technical readers, such as policy and neighborhood activists, who want to learn about transportation engineering basics.

Pedestrian Facility Design Resources

AASHTO Guide for the Planning, Design, and Operations of Pedestrian Facilities (2000), American Association of State Highway and Transportation Officials.

> *This guide compiled the most relevant existing information related to the planning, design, and operation of pedestrian facilities, including the accommodation of pedestrians with disabilities. It also developed guidelines for the planning, design, and operation of pedestrian facilities. As of summer 2003, this guide has not been published.*

Alternative Treatments for At-Grade Pedestrian Crossings (2001), Nazir Lalani and the Institute of Traffic Engineers Pedestrian and Bicycle Task Force.

> *This informational report documents studies on crosswalks and warrants used by various entities. The report summarizes studies on pedestrian crossings and assembles in a single document the various treatments currently in use by local agencies in the U.S., Canada, Europe, New Zealand and Australia to improve crossing safety for pedestrians at locations where marked crosswalks are provided. The report also summarizes the results of various studies conducted by public agencies on pedestrian-related collisions, including those documenting the results of removing crosswalk markings at uncontrolled locations.*

Design and Safety of Pedestrian Facilities: A Recommended Practice (1998), Institute of Transportation Engineers.

> *This recommended practice discusses guidelines for the design and safety of pedestrian facilities to provide safe and efficient opportunities for people to walk near streets and highways.*

Handbook on Planning, Design and Maintenance of Pedestrian Facilities (1989), Report No. FHWA-IP-88-019, Federal Highway Administration, B.L. Bowman, J.J. Fruin, and C.V. Zegeer.

Implementing Pedestrian Improvements at the Local Level (1999), Federal Highway Administration, HSR 20.

http://safety.fhwa.dot.gov/fourthlevel/pdf/LocalPedGuide.pdf

> *This publication reviews pedestrian-friendly policy and design recommendations that strive to improve the pedestrian environment in U.S. communities. It discusses the opportunities and challenges of implementing pedestrian improvements, and the necessary engineering, education, encouragement, and enforcement needed to make communities more pedestrian-friendly.*

Improving Pedestrian Access to Transit: An Advocacy Handbook (1998), Federal Transit Administration / WalkBoston, National Technical Information Service.

http://ntl.bts.gov/ruraltransport/card_view.cfm?docid=8764

This report was written as a teaching tool for ordinary citizens, and for transportation and urban planners working with citizen groups who advocate for public transit and walkable neighborhoods. It illustrates key steps that activists can take to ensure that public transit supports community needs and creates livable communities through improved pedestrian access. The authors present their personal experience in case studies that detail advocacy techniques and strategies, as well as identify some failures and setbacks. The report also discusses several public transit modes (e.g. bus, light rail, and subway) used in different kinds of communities (low income urban neighborhoods, upper and middle income inner suburb).

Pedestrians and Traffic Control Measures (1988), National Cooperative Highway Research Program, Synthesis of Highway Practice Report 139, Transportation Research Board, C.V. Zegeer and S. Zegeer.

Pedestrian Compatible Roadways: Planning and Design Guidelines (1995), Bicycle / Pedestrian Transportation Master Plan, Bicycle and Pedestrian Advocate, New Jersey Department of Transportation.

http://www.state.nj.us/transportation/publicat/pedest_guide.htm

This publication outlines pedestrian planning and design guidelines for the state of New Jersey. The document covers an introduction to pedestrian facilities, guidelines for accommodating pedestrians on roadways, guidelines for encouraging pedestrian travel and operations and maintenance.

Pedestrian Facilities Guidebook: Incorporating Pedestrians Into Washington's Transportation System (1997), Washington State Department of Transportation, Bicycle and Pedestrian Program.

http://www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/PedFacGB.pdf

This guidebook provides the basic principles behind planning for pedestrians and encourages good design practices for traffic and transportation engineers, planners and designers, cities, counties, private developers, design professionals, and others in designing, constructing, and maintaining pedestrian facilities in a variety of settings throughout Washington. The guidebook is also useful for school districts, neighborhood councils, metropolitan planning organizations and citizen advocates.

Pedestrian Facilities Reference Guide (2003), National Center for Bicycling and Walking.

http://www.bikewalk.org/walking/design_guide/pedestrian_design_guide_index.htm

This web-based reference guide provides links (html and pdf) to a variety of pedestrian facility related topics, including (but not limited to) walkways, intersections, crosswalks, curb ramps, signal timing, signing and marking, amenities, traffic calming, bridges, and the economic benefits of bicycle and pedestrian-based tourism. The documents discuss typical concerns, possible solutions, implementation strategies, and evaluation processes for each topic.

Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas, Report No. 294A, Transportation Research Board.

Portland Pedestrian Design Guide (1998), Portland Pedestrian Program.

http://www.trans.ci.portland.or.us/designreferences/Pedestrian/DesignGuide.PDF

> *The purpose of this comprehensive design document is to integrate the wide range of design criteria and practices of pedestrian planning and design into a coherent set of new standards and guidelines that, over time, will promote an environment conducive to walking.*

Bicycle Facility Design Resources

Bicycle Facility Design Standards (1998), City of Philadelphia Streets Department

Bicycle Facility Planning (1995), American Planning Association, Planning Advisory Service Report # 459, Pinsof & Musser.

Bicycle Facilities Reference Guide (2003), National Center for Bicycling and Walking.

http://www.bikewalk.org/bicycling/design_guide/bike_design_guide_index.htm

> *This web-based reference guide provides links (html and pdf) to a variety of bicycle facility related topics, including (but not limited to) major urban streets, trail networks, transit connections, railroad crossings, traffic signals, drainage grates, bicycle parking, and the economic benefits of bicycle and pedestrian-based tourism. The documents discuss an overview of the problem, typical concerns, possible solutions, implementation strategies, and evaluation processes for each topic.*

Collection of Cycle Concepts (2000), Danish Road Directorate.

http://www.cities-for-cyclists.org/dokumenter/cyccon.pdf

> *This publication is a Dutch-based collection of bicycle facility treatments that aim to improve safety and increase the number of people who choose bicycling for transportation.*

Evaluation of Shared-use Facilities for Bicycles and Motor Vehicles (1996), Florida Department of Transportation, Pedestrian and Bicycle Safety Office, David L. Harkey, J. Richard Stewart, and Eric A. Rodgman.

http://safety.fhwa.dot.gov/fourthlevel/pdf/UnivNCMar96.PDF

> *This study was completed to evaluate the safety and utility of shared-use facilities in order to provide engineers and planners comprehensive results that could be used in planning and designing roadways to be shared with motorists and bicyclists. The study*

concludes that the type of facility does not have an effect on the separation of motor vehicles and bicyclists.

Florida Bicycle Facilities Planning and Design Handbook (2000), Florida Department of Transportation, Pedestrian and Bicycle Safety Office.

http://www11.myflorida.com/Safety/ped_bike/ped_bike_standards.htm#Florida%20Bike%20Handbook

This comprehensive handbook is intended to aid to engineers, planners, architects, landscape architects, and citizens concerned with the planning and design of bicycle facilities. The handbook also serves as a reference text for FDOT's Bicycle Facilities Planning and Design Course. The chapters include Planning, Safety, On-road Facilities, Shared-use Trails, and Supplemental Facilities.

Guide for the Development of Bicycle Facilities (1999), American Association of State Highway and Transportation Officials.

This manual is designed to provide information on the development of facilities to enhance and encourage safe bicycle travel.

Implementing Bicycle Improvements at the Local Level (1998), Federal Highway Administration, HSR 20.

http://safety.fhwa.dot.gov/fourthlevel/pdf/LocalBike.pdf

This publication reviews policy and design recommendations to foster bicycle-friendly communities in the United States. It discusses the opportunities and challenges of implementing bicycle improvements, and the necessary engineering, education, encouragement, and enforcement needed to make communities more bicycle-friendly.

North Carolina Bicycle Facilities Planning and Design Guidelines (1994), North Carolina Department of Transportation.

Selecting Roadway Design Treatments to Accommodate Bicycles (1993), Publication No. FHWA-RD-92-073, Federal Highway Administration.

http://safety.fhwa.dot.gov/fourthlevel/pdf/Select.pdf

This report presents a set of tables that can be used to determine the recommended type of bicycle facility to be provided in particular roadway situations. In addition, the report presents a brief discussion of the "design user" for bicycle facilities, and presents a planning process for bicycle facilities.

Sign Up for the Bike: Design Manual for a Cycle-Friendly Infrastructure (1993), Centre for Research and Contract Standardization in Civil and Traffic Engineering – The Netherlands (CROW).

This Dutch technical design manual discusses the evolution and implementation of a comprehensive bicycle network. The manual covers design process, network development, designs for road sections, intersections, and road surfaces, traffic calming (speed inhibitors), unlawful parking, bicycle parking, dealing with construction and other temporary situations, bicycle amenities, and assessment and evaluation of the network.

Bicycle and Pedestrian Planning and Design Resources

Bicycling and Walking in North Carolina: A Long-Range Transportation Plan (1996), North Carolina Department of Transportation.

http://www.hsrc.unc.edu/pubinfo/ped_officeped.htm

This plan builds upon planning and programming which the NCDOT has been doing for the last 22 years. It sets the direction for future development of bicycling and walking provisions across the State through the use of major goals and specific focus areas. These goals and focus areas will give decision makers a vision as they provide North Carolina with a transportation system that meets the needs of bicyclists and walkers.

Capacity Analysis of Pedestrian and Bicycle Facilities: Recommended Procedures for the "Pedestrians" Chapter of the Highway Capacity Manual (1998), Publication No. FHWA-RD-98-107, Federal Highway Administration, N. Rouphail, J. Hummer, J. Milazzo II, and P. Allen.

http://www.tfhrc.gov/safety/pedbike/pubs/98-107/contents.htm

This report's objective was to develop revised operational analysis procedures for transportation facilities with pedestrian and bicyclist users. This document contains both new and revised procedures for analyzing various types of exclusive and mixed-use pedestrian facilities. These procedures are recommended to determine the level of service for pedestrian facilities on the basis of a summary of available U.S. and international literature.

Handbook for Pedestrian Action (1977), Columbia University/Housing and Urban Development, R. Brambilla and G. Longo.

Improving Conditions for Bicycling and Walking: A Best Practices Report (1998), Rails to Trails Conservancy and Association of Pedestrian and Bicycle Professionals.

http://safety.fhwa.dot.gov/fourthlevel/pdf/intro.pdf

This "best practices" report provides information on some outstanding pedestrian and bicycle projects that have been recognized for increasing walking and bicycling and improving user safety in communities across the Unites States.

Massachusetts Statewide Bicycle Transportation Plan (1998), Massachusetts Highway Department and Executive Office of Transportation and Construction.

National Bicycling and Walking Study: Transportation Choices for a Changing America (1994), Federal Highway Administration.

> *This report synthesizes 24 case-study research reports carried out for the National Bicycling and Walking Study. Current bicycling and walking levels, ways to increase them, and benefits of walking and bicycling are described. Actions to be carried out by various agencies of the U.S. Department of Transportation are listed. Action plans and programs at the State and local level similarly appear; additionally, specific city examples provide concrete data. Appendices include a list of the 24 case studies and a brief look at other nations' policies.*

Oregon Bicycle and Pedestrian Plan (1995), Oregon Department of Transportation, Bicycle and Pedestrian Program.

http://www.odot.state.or.us/techserv/bikewalk/obpplanold.htm

> *This comprehensive plan discusses bicycle and pedestrian planning and policy in the context of Oregon. It also provides design guidelines and best practices for nearly everything related to bicycling and walking and is considered a model plan for the United States. Part One contains the policies and actions that drive ODOT; Part Two, Sections I and II contain planning and design guidelines; Part Two, Section III has maintenance and construction guidelines; Part Two, Section IV contains information for bicycle and pedestrian safety. The appendices contain other information, such as the Oregon statutes that pertain to bicycling and walking.*

Vermont Pedestrian and Bicycle Facility Planning and Design Manual (2002), National Center for Bicycling and Walking, Vermont Agency of Transportation.

http://www.aot.state.vt.us/progdev/Documents/LTF/FinalPedestrianAndBicycleFacility/PedestrianandBicycleFacilityDesignManual.pdf

> *This manual is a compilation of national and state guidance and information, which has been adapted to the context of Vermont. This manual shows how to accommodate pedestrians and bicyclists in most environments but cannot cover all possible situations. It does not propose specific projects but offers the general principles and policies that VTrans will follow. It presents sound guidelines that will be valuable in attaining good design sensitive to the needs of pedestrians, bicyclists and other users specific to Vermont conditions. The manual covers planning, pedestrian facilities, on-road bicycle facilities, shared use paths, rails-trails and rails-with-trails, traffic calming, signs and pavement markings, landscaping and amenities, and maintenance.*

Trail Design Resources

Greenways: A Guide to Planning, Design, and Development (1993), The Conservation Fund.

> *This guide provides professionals and citizen activists with the tools for dealing with all aspects of developing a greenway plan. The volume offers guidance in approaching the overall process of greenway creation while providing as much detail as possible about each step along the way. Topics covered include: the physical development of a greenway, organizing community resources, forging partnerships among public agencies, private groups, citizens, and businesses, principles of ecological design, including wetland restoration, water quality, and wildlife issues.*

Trail Intersection Design Guidelines (1996), Florida Department of Transportation.

http://www11.myflorida.com/Safety/ped_bike/handbooks_and_research/TRAILINT.PDF

> *This handbook discusses design processes and principles of designing trail/roadway intersections. It includes information on various crossing types, regulating traffic and site design. This handbook also reviews some European trail crossing guidelines. Guidelines from the Netherlands and development of a bicycle crossing time equation are included in the appendices.*

Trails for the 21st Century: Planning, Design, and Management Manual for Multi-Use Trails (1993), Rails to Trails Conservancy, Charles A. Flink, Kristine Olka, and Robert M. Searns.

> *This book gives step-by-step guidance in all aspects of the planning, design, and management of multi-use trails. Topics discussed include: how to make physical and cultural assessments of the site and surrounding communities, planning the trail, public involvement, meeting the needs of adjacent landowners, compliance with legislation, designing the trail, meeting the needs of different users, working with special features, managing the trail, and maximizing the trail's potential.*

ADA-Related Design Resources

Accessible Pedestrian Signals (1998), U.S. Access Board.

http://www.access-board.gov/research&training/pedsignals/pedestrian.htm

> *This document discusses audible pedestrian signals and the accommodation of blind pedestrians at signalized intersections. The document provides design guidelines and implementation strategies for determining appropriate intersections, performing installations, and using advanced detection technology.*

Accessible Rights of Way: A Design Manual (1999), U.S. Access Board.

http://www.access-board.gov/publications/PROW%20Guide/PROWGuide.htm

This design manual is divided into two sections. The first section provides background information on the regulatory requirements for accessible public rights-of-way, including an overview of the Americans with Disabilities Act (ADA) and title II requirements. The second section discusses the Best Practices in accessible rights-of-way design and construction and provides detailed information about accessible pedestrian facilities.

ADA Accessibility Guidelines for Buildings and Facilities (1998), U.S. Access Board.

http://www.access-board.gov/adaag/html/adaag.htm

This document contains scoping and technical requirements for accessibility to buildings and facilities by individuals with disabilities under the ADA of 1990. These scoping and technical requirements are intended to be applied during the design, construction, and alteration of buildings and facilities covered by Titles II and III of the ADA.

Designing Sidewalks and Trails for Access, Part I of II (1999), Federal Highway Administration, HEPH-30.

http://www.fhwa.dot.gov/environment/bikeped/access-1.htm

The report is a compilation of data and designs gathered during a comprehensive literature search and site visits conducted throughout the United States. It presents a number of factors that affect the accessibility of sidewalks and trails in the United States. The history of accessibility legislation and an overview of current accessibility laws are provided. The travel characteristics of people with disabilities, children, and older adults are analyzed in relation to their use of sidewalks and trails. Current design practices used in the design of sidewalks and trails are described and analyzed in terms of accessibility, engineering, and construction.

Designing Sidewalks and Trails for Access: Part II of II, Best Practices Design Guide (2001), Federal Highway Administration, Barbara McMillen and others.

This guidebook is a companion piece to Designing Sidewalks and Trails for Access, Part I of II and is focused on the best practices for designing sidewalks and trails for access. This document provides planners, designers, and transportation engineers with a better understanding of how sidewalks and trails should be developed to promote pedestrian access for all users, including people with disabilities.

Recommended Street Design Guidelines for People Who Are Blind or Visually Impaired. American Council of the Blind.

Uniform Federal Accessibility Standards (1984), available from the U.S. Access Board.

http://www.access-board.gov/ufas/ufas-html/ufas.htm

This document presents uniform standards for the design, construction and alteration of buildings so that physically handicapped persons will have ready access to and use of them in accordance with the Architectural Barriers Act, 42 U.S.C. 4151-4157. This

document strived to minimize the differences in standards and develop standards for facility accessibility by physically handicapped persons for Federal and federally-funded facilities.

Universal Access to Outdoor Recreation: A Design Guide (1993), PLAE, Inc, MIG Communications.

This book provides the latest in universal design concepts and guidelines for outdoor environments, establishing a framework for determining the appropriate level of access in outdoor sites. It presents detailed design guidelines for the systems and elements necessary for ensuring accessibility to recreational trails, campsites, picnic areas, group meeting areas, and more. Examples demonstrate how the guidelines can be applied in typical outdoor settings to achieve a range of recreational opportunities for individuals of varying abilities.

Traffic Calming Design Resources

Florida Department of Transportation's Roundabout Guide (1999), Florida Department of Transportation, Institute of Transportation Engineers.

This guide developed guidelines to assist operating agencies with decisions regarding roundabout design and implementation. The purpose of the guide is to provide guidance for the planning, design and operation of roundabouts in Florida. It deals with the identification of appropriate sites for roundabouts, the geometric design of roundabouts to meet FDOT requirements and operational considerations such as signing, marking, lighting and landscaping.

Making Streets that Work (1996), City of Seattle.

This document is a two-part educational tool for the creation of strong, sustainable communities based on street design. The guidebook is divided into four chapters preceded by a brief introduction discussing general project information and followed by an extensive section on additional resources. The guidebook is intended to help communities better understand neighborhood issues, identify opportunities, and recommend changes to streets as part of their neighborhood's planning process.

National Bicycling and Walking Study: Case Study # 19, Traffic Calming and Auto-Restricted Zones and other Traffic Management Techniques - Their Effects on Bicycling and Pedestrians (1992), Federal Highway Administration.

http://www.fhwa.dot.gov/safety/fourthlevel/pdf/Case19.pdf

This report discusses traffic calming and other traffic management methods. The report is divided into three parts. The first two major sections examine the history and traffic-calming techniques installed in Europe, Japan, and the United States. The final section of the report examines the practical and policy implication of traffic calming.

Traffic Calming (1995), American Planning Association.

Traditional Neighborhood Development Street Design Guidelines (1997), Proposed Recommended Practice, Institute of Transportation Engineers.

http://safety.fhwa.dot.gov/fourthlevel/pdf/TND_Manual.pdf

> *This report includes a discussion of the concepts of traditional neighborhood development (TND), which are also referred to as "the new urbanism," as they relate to the role of streets in TND communities; a discussion of the community design parameters under which the guidelines would apply; presentation of the design principles underlying the guidelines; specific guidance on geometric street design; and an appendix that summarizes some recent findings on the relationship between urban design and travel demand.*

Traffic Calming: State of the Practice (1999), Institute of Transportation Engineers

http://safety.fhwa.dot.gov/fourthlevel/pdf/ite/intro.pdf (document in full)
http://www.ite.org/traffic/tcstate.htm#tcsop (by chapter)

> *This report contains a synthesis of traffic calming experiences to date in the United States and Canada. It includes information on traffic calming in residential areas and in areas where high speed rural highways transition into rural communities. The report draws from detailed information collected on traffic calming programs in twenty featured communities, another 30 communities surveyed less extensively, and a parallel Canadian effort by the Canadian ITE (CITE) and the Transportation Association of Canada (TAC). The intended audience is transportation professionals.*

Traffic Control Manual for In-Street Work (1994), Seattle Engineering Department, City of Seattle.

http://www.cityofseattle.net/transportation/trafficcontrolmanual.htm

> *This report provides information about establishing safe construction and work zones that consistently and clearly convey to motorists that work is being performed in the roadway.*

Safety

Bicycle Crash Types: A 1990's Informational Guide (1997), Publication No. FHWA-RD-96-104, Federal Highway Administration, W.H. Hunter, W.E. Pein, and J.C. Stutts.

http://www.tfhrc.gov/safety/pedbike/ctanbike/ctanbike.htm

> *This pedestrian crash type informational guide is a supplement to a research report entitled, "Pedestrian and Bicycle Crash Types of the Early 1990's" (FHWA-RD-95-163). The purpose of the research was to apply the basic NHTSA pedestrian and bicyclist typologies to a sample of recent crashes and to refine and update the crash type distributions with particular attention to roadway and locational factors. This particular informational guide provides detail on specific pedestrian-motor vehicle crash types (e.g., intersection dash) through two-page layouts that contain a sketch, description, and summary of the crash type, various graphs, and "bullet" information boxes.*

Bicycle Safety-related Research Synthesis (1995), University of North Carolina Highway Safety Research Center for Federal Highway Administration.

> *This synthesis reviews research into current and potential levels of bicycle use, identifies the scale and nature of crashes related to bicycle use; discusses engineering countermeasures to prevent crashes; and describes current practices related to bicycle facility selection and design. The report also introduces readers to traffic-calming techniques; discusses helmet use; and reviews education and enforcement programs. Conclusions on the current state of knowledge in this field are offered, and where possible, reference to current practices are included.*

Design of Major Urban Junctions: Review of Guidelines and Research Studies with Focus on Road Safety (1998), Note no. 52, Danish Road Directorate.

Developing Urban Management and Safety (DUMAS), Safety of Pedestrians and Two-Wheelers (1998), Note no. 51, Danish Road Directorate.

Injuries to Pedestrians and Bicyclists: An Analysis Based on Hospital Emergency Department Data (1999), Publication No. FHWA-RD-99-078, Federal Highway Administration, J.C. Stutts and W.W. Hunter.

http://www.tfhrc.gov//safety/pedbike/research/99078/contents.htm

> *The purpose of this study was to broaden understanding about the safety of pedestrians and bicyclists. Traditionally, the U.S. Department of Transportation has relied on State motor vehicle crash data, based on reports completed by police and other law enforcement officers, as their primary source of information on events causing injury to pedestrians and bicyclists. This study was conducted to provide a more accurate description of the entire spectrum of events causing injury to pedestrians and bicyclists, as an aid to more effective countermeasure and program development.*

Pedestrian and Bicycle Crash Analysis Tool (PBCAT), Software and User's Manual (1999), Publication No. FHWA-RD-99-192, Federal Highway Administration, D.L. Harkey, J. Mekemson, M.C. Chen, and K.A. Krull.

http://www.fhwa.dot.gov/safety/fourthlevel/pdf/pbcat.pdf

> *PBCAT is a software product intended to assist state and local pedestrian and bicycle coordinators, planners, and engineers with the problem of bicycle and pedestrian accidents and fatalities. PBCAT uses a data base to analyze details associated with crashes between motor vehicles and pedestrians or bicyclists. Once the data base is developed, the software can then be used to produce reports and select countermeasures to address the problems identified.*

Pedestrian and Bicycle Crash Types of the Early 1990's (1996), Publication No. FHWA-RD-95-163, Federal Highway Administration, W.H. Hunter, J.C. Stutts, W.E. Pein, and C.L. Cox.

Out of print.

> *The purpose of this research was to apply the basic National Highway Traffic Safety Administration (NHTSA) pedestrian and bicyclist typologies to a sample of recent crashes, and to refine and update the crash-type distributions, paying particular attention to roadway and locational factors.*

Pedestrian Crash Types: A 1990's Informational Guide (1997), Publication No. FHWA-RD-96-163, Federal Highway Administration, W.H. Hunter, J.C. Stutts, and W.E. Pein.

> *The purpose of the research was to apply the basic NHTSA pedestrian and bicyclist typologies to a sample of recent crashes and to refine and update the crash type distributions with particular attention to roadway and locational factors. This particular informational guide provides detail on specific pedestrian-motor vehicle crash types (e.g., intersection dash) through two-page layouts that contain a sketch, description, and summary of the crash type, various graphs, and "bullet" information boxes.*

Pedestrian Safety: The Identification of Precipitating Factors and Possible Countermeasures (1971), Publication No. FH-11-7312, National Highway Traffic Safety Administration, M.B. Snyder and R.L. Knoblauch.

Synthesis of Safety Research Related to Traffic Control and Roadway Elements, Volume 2, (1982) Publication No. FHWA-TS-82-233, Federal Highway Administration,