



**KNOXVILLE**

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**REGIONAL**

**BICYCLE PLAN**

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**2002**



PREPARED BY  
THE KNOXVILLE REGIONAL TRANSPORTATION PLANNING ORGANIZATION  
IN COOPERATION WITH THE  
TPO BICYCLE ADVISORY COMMITTEE

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**KNOXVILLE REGIONAL TRANSPORTATION PLANNING ORGANIZATION**

Suite 403, City-County Building  
400 Main Street  
Knoxville, TN 37902  
865-215-2500  
www.knoxtrans.org

**PROJECT MANAGER:**

Kelley Segars  
kelley.segars@knoxmpc.org

**BICYCLE ADVISORY COMMITTEE:**

Caroline Cooley, Chair  
Steve Bacon  
Greg Brown  
Stephen Dupree  
Jim Hagerman  
Tim Kuhn  
Roger Macklin  
Jamey Robbins  
Tina Rosling  
Brigham Thomas  
Addison West

**SPECIAL THANKS TO:**

Sarah Powell, MPC Graphic Designer  
Jeff Welch, TPO Director

**ADOPTED BY THE  
KNOXVILLE REGIONAL TRANSPORTATION PLANNING ORGANIZATION  
EXECUTIVE BOARD ON OCTOBER 23, 2002**

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# EXECUTIVE SUMMARY

The 2002 Knoxville Regional Bicycle Plan establishes a vision for a convenient, efficient transportation system where people can bike safely to all destinations. Fulfilling this vision will require the cooperation of many agencies and organizations to implement more than 50 action steps. These action steps cover a wide range of topics, from engineering to enforcement.

Nationwide, communities are realizing that they cannot build their way out of congestion. They must look to other solutions, such as transit, bicycling, walking and carpooling. A healthy transportation system provides safe, convenient choices. Improving bicycling conditions provides alternatives for the increasing numbers of citizens who don't want to, can't afford to or are physically unable to drive their own vehicles

Nationwide, about 40% of motor vehicle trips are less than 2 miles in length, which is an easy bike ride for most people. Bicycling saves money, improves air quality and is good exercise. The cost of owning and operating an automobile has increased 300% in the past 20 years. A 4-mile round trip bicycle trip keeps about 15 pounds of pollutants out of the air. Exercise is a vital part of a healthy lifestyle, while obesity and diabetes have been declared national epidemics. Health care costs have also escalated.

This is Knoxville's fourth bicycle plan, and the most comprehensive to date. The first one was developed in 1975, with subsequent ones in 1985 and 1995. The 2002 Plan has been a cooperative effort of the Knoxville Regional Transportation Planning Organization and its 11-member Bicycle Advisory Committee. Key activities in the process included four interagency review meetings, a Bike Summit with regional bike organizations and three public meetings.

The 2002 Plan is based on three basic principles:

- There are many different kinds of bicyclists.
- Bicycles should be expected on every street.
- A good bicycle system needs more than just facilities.

The 2002 Bicycle Plan is intended to be reviewed every two years and updated every five. The action steps that will lead toward fulfillment of the Vision have been prioritized in four categories. Priority I items will be worked on immediately, along with the ones in the Continual category. Priority II items should be implemented in the second year. Priority III items will be worked on in years three through five.

Below are the major sections of the Plan and some of the action steps under each topic.

## POLICY AND PLANNING

### Bicycle System

The purpose of the bicycle system is to provide a framework for bicycle travel for both advanced and basic cyclists. It does not imply that bicyclists should only use roads designated as bike routes or with bicycle lanes. By law, bicyclists are allowed on all streets. The bicycle system is a tool that allows local governments to focus and prioritize implementation efforts where they will provide the greatest community benefit. The bicycle system should form a grid pattern with connections every half-mile in order to provide direct and convenient routes. This Plan does not include a bicycle system map; however, it does describe the criteria and methodology that will be used to develop the bicycle system. Additional data must be gathered and analyzed before the bicycle system is created.



*Policy:*

Bicycle facilities should be implemented as part of all transportation projects (see Bicycle Accommodation Policy).

*Action Step:*

Utilize Bicycle Compatibility Index analysis to develop a recommended bicycle system for the TPO study area, with a prioritized implementation plan.

## **Bicycle Accommodation Policy**

*Action Step:*

Adopt the US DOT Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure.

## **Signage Policy**

*Action Step:*

Identify locations for “Share the Road” and other related signs and recommend to the appropriate departments/agencies.

## **Funding**

*Action Steps:*

Pursue grants and other sources in addition to TEA-21 funding.  
Make transportation funding information available so the public has a better understanding of how projects get funded.

## **Bicycle Program**

*Action Steps:*

Establish a Bicycle Program staffed at a level sufficient to implement the Bicycle Plan.  
Ensure that all jurisdictions support and participate in the Bicycle Program.

## **Transportation Planning Organization**

*Policy:*

The Bicycle Plan shall be integrated into the Long Range Transportation Plan, and bicycle projects will be included in the Transportation Improvement Program.

*Action Step:*

Continue to support the efforts of the Bicycle Advisory Committee.

## **Community Involvement**

*Action Steps:*

Work with bike organizations to implement the Bicycle Plan in conjunction with their groups’ missions.  
Provide information on how the public can get information and comment on transportation projects.

## **Transit**

*Action Steps:*

Provide bike parking at major transit stops and transfer points, including short-term and long-term parking.  
Ensure that all buses within the TPO boundary, including downtown trolleys, have racks to carry at least two bicycles.  
Consider including a bikestation in the Downtown Intermodal Transfer Center and at the University of Tennessee.

## **Trip Reduction**

*Action Step:*

Work with TPO Smart Trips Program to encourage employers to implement incentive programs and develop facilities to encourage employees to bicycle to work

## **Subdivision and Zoning Regulations**

*Action Steps:*

Develop a coordinated land use and transportation plan for more efficient use of land and infrastructure in the future.  
Revise zoning and subdivision regulations to include bicycle-friendly policies as requirements of developments.

## **Bike Parking**

*Action Steps:*

Adopt the Bicycle Parking Requirements and Guidelines included in the Appendix.  
Implement and continue the TPO Bicycle Parking/Enhancement Program.

## Economic Development

### *Action Step:*

Form a committee to pursue issues related to economic development and bicycle tourism.

## DESIGN AND ENGINEERING

### On-Street Facilities

#### *Policies:*

On arterial and collector roadways, provide on-street bicycle facilities with a Bicycle Compatibility Index (BCI) of “C” or above.

Seek to provide a higher BCI on roadways included in the bicycle system.

### Shared Use Paths

#### *Policies:*

Avoid locating shared use paths adjacent to roadways unless specified guidelines are met.

Design new shared use paths according to AASHTO standards.

### Intersections

#### *Policies:*

Consider the needs of bicyclists when designing and reconstructing intersections, including loop detector sensitivity.

Consider bicyclists when coordinating traffic signal timing along a corridor.

### Barriers

#### *Policies:*

All bridge projects should include adequate space for bicyclists.

Ensure that at-grade railroad crossings are safe for bicyclists.

#### *Action Steps:*

Develop improvement projects to focus on “weak links” in the bicycle system.

Pursue a policy change with the Tennessee Department of Transportation to allow bicyclists on certain portions of limited access highways.

## Traffic Calming

### *Policy:*

Traffic calming programs shall consider the needs of bicyclists in design and engineering.

### *Action Step:*

Develop a funded Traffic Calming Program in each jurisdiction.

## Construction Access

### *Action Steps:*

Develop a policy requiring that bicycle access be maintained during construction. When access is not feasible, detour routes should be as short as possible. Provide better signage during construction to indicate work in progress, road or path conditions and, alternate route information when applicable.

## MAINTENANCE

### Sweeping

#### *Action Step:*

Develop a policy regarding sweeping of roads, including shoulders and bike lanes, that addresses bicyclists’ needs.

## Minor Repairs/Improvements

### *Policies:*

When resurfacing roadways with sufficient width, restripe lane widths for bicyclists.

Raise drainage grates when resurfacing roadways to ensure a smooth, level surface for bicycling.

### *Action Step:*

Develop and implement an inspection and maintenance program that addresses minor repairs such as potholes, improper drainage grates, broken pavement and other hazards to bicyclists.

## Bicycling Improvement Program

### *Action Step:*

Develop a Bicycling Improvement Program to



gather and respond to citizen complaints and recommendations, utilizing a telephone hotline, Website and comment card.

## ENFORCEMENT

### *Action Steps:*

Establish a policy clarifying law enforcement agency's procedures regarding enforcement of laws concerning bicycles, including motorist behavior. Increase traffic law enforcement efforts focusing on those violations most likely to lead to bicycle-motor vehicle crashes. Issue a press release clarifying the traffic laws with respect to bicyclists and motorists.

### **Bike Patrols**

#### *Action Steps:*

Continue to train officers for bike patrols. Increase the use of bike patrols for standard duty, rather than concentrating on special events.

## EDUCATION AND SAFETY

### *Action Steps:*

Provide and promote safety education and encouragement programs targeted to bicyclists and motorists. Work with Tennessee Department of Safety on updates to the Drivers' Handbook to strengthen the bicycle section and include exam questions relating to bicycle issues. Work for inclusion of motorist-bicyclist safety information in defensive driving courses.

### **Crashes**

#### *Action Steps:*

Continue to monitor and improve the data available on bicycle crashes. Train law enforcement staff in the investigation of crashes involving bicyclists.

## OUTREACH AND PROMOTION

### **Public Information**

#### *Action Steps:*

Promote bicycling for transportation as well as recreation, particularly for trips to school, work, shopping and special events. Develop a public information and education campaign to encourage bicycling and improve the behavior of both motorists and bicyclists. Develop a bicycle map of downtown, UT and surrounding neighborhoods showing existing conditions on roadways to highlight the best ways to travel by bicycle. Establish, maintain and publicize a Webpage and telephone hotline with information and links to other agencies/organizations/Websites.

### **Programs/Special Events**

#### *Action Steps:*

Continue to increase the number of special events and programs that encourage bicycling, including bicycle rides, bike giveaways and Bike Week events. Develop a Safe Routes to School program.

### **Community Services**

#### *Action Steps:*

Coordinate and continue bike light, helmet and bike giveaway efforts. Increase and publicize the number of free repair classes offered throughout the community.

### **Workshops**

#### *Action Steps:*

Provide regular workshops and other training opportunities for local planners, engineers, representatives from enforcement and emergency response, and other professionals on bicycle transportation and facility design issues. Develop a presentation on bicycling issues and the Bicycle Plan for a speakers' bureau.



# VISION

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## STATEMENT

**The Knoxville Regional Bicycle Plan envisions a convenient, efficient transportation system where people can bike safely to all destinations.**



# PRINCIPLES

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### **Principle #1—All Bicyclists Are Different**

The Federal Highway Administration designates three types of bicyclists—Advanced, Basic, and Children—but in reality there is even more variation in skill level and needs for different riders. Cyclists ride for many different reasons, including commuting, running errands, recreation, exercise and competitive sport.

### **Principle #2—Expect Bicycles on Every Street**

Bicyclists want to go to the same places motorists want to go; therefore, cyclists will ride on every street to some extent. While the bicycle system, once completed, will provide suggested routes for cyclists, those routes cannot possibly serve every destination or satisfy every cyclist's unique criteria for directness and comfort.

### **Principle #3—It's More Than Just Getting There**

On-street bicycle facilities are not enough to make Knoxville a good bicycling city. Support facilities such as bike parking and signage, and programs like enforcement and safety education are integral parts of an overall plan.



# BACKGROUND

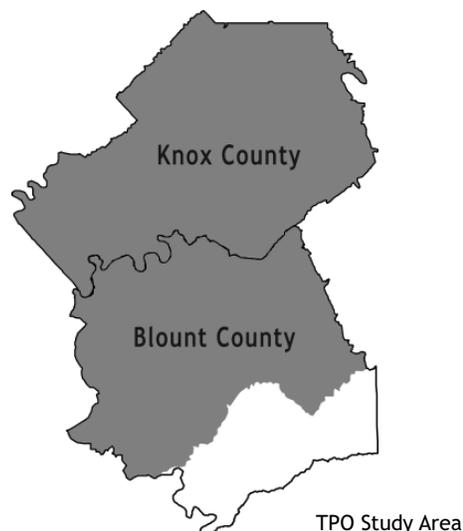
In 1975, a *Preliminary Bikeway Plan for Knoxville-Knox County* was developed for the Metropolitan Planning Commission (MPC) with support from the Federal Highway Administration. The project staff was comprised of an architect/planner, a bikeway planner, a psychologist, an environmental engineer and a member of the MPC staff. The process included a Bikeways Study Advisory Committee and an informal survey that garnered 744 responses. The plan covered topics such as development of a bikeway system, facility design, promotion, education, enforcement, data collection and safety. Goals and objectives from a statewide study of bicycling in Tennessee were listed, along with local goals and objectives as recommended by the Advisory Committee. The overall goal was to “encourage the use of the bicycle as a means of transportation in Knoxville and Knox County.” The plan went on to recommend policies that would achieve the objectives. The recommended bikeway network included 105 miles of trails as well as bike lanes on arterial streets. The network was intended to connect major residential and activity centers throughout the community. System-related programs recommended by the plan included bicycle safety education and maintenance.

In 1985, a *Knoxville-Knox County Bikeway Plan Update* was completed for the MPC as a result of the City’s Recovery Action Program. The RAP identified the need for more community bicycle facilities and recommended preparation of the First Creek Bikeway and Recreation Area Plan and development of bikeways along First Creek, Middlebrook Pike, Morrell Road and Neyland Drive/Third Creek. The Knoxville Bicycle Advisory Committee that formed in 1983, along with RAP’s recommendations, resulted in the need to reassess the 1975 Bikeways Plan. The intent of the 1985 Plan was to determine current trends and problems, update

bicycle use habits and trends, and identify strengths and weaknesses in the adopted plan network.

A survey was conducted as part of the 1985 planning process. The 1985 survey was administered to a larger, more random sample than the 1975 survey. Bicycle ownership was found to have increased between 1975 and 1985. Conditions related to unsafe roads were reported to be the primary limitation to bicycle use. The 1985 Plan did not change the 1975 proposed bikeway system, although it did suggest that recent growth in the west and north sections of the county might call for additional routes. The 1985 Plan also reinforced the 1975 Plan’s recommendations for safety education programs.

The Knoxville Regional Transportation Planning Organization (TPO; see p. 21) and a Bicycle Plan Committee developed the 1995 *Bicycle Plan for the Knoxville Urban Area*. The Plan was adopted by the TPO Executive Board as part of the Long Range Transportation Plan in May 1995. The purpose of the 1995 Plan was to develop a bicycle-friendly transportation system within the TPO’s boundaries.





The two goals of the plan were to accommodate bicycling as a part of a fully integrated transportation system, and provide additional facilities and programs to ensure safe bicycling options for all ages and skill levels. The Plan also included a network map and roadway design guidelines.

In 2001, the TPO Executive Board developed a citizen Bicycle Advisory Committee (BAC) with eleven members. There are many duties of the BAC: updating and maintaining the Bicycle Plan for the Knoxville Urban Area; making recommendations and encouraging the implementation of bicycle provisions and opportunities to the TPO Technical Committee, Executive Board and implementing agencies; and working with local businesses, agencies and organizations to encourage bicycling and promoting community investment in bicycle racks, signage and other facilities/programs.

The BAC, along with TPO staff, began working on an update to the 1995 Bicycle Plan. The BAC divided into six working groups to develop a draft plan. The working groups were policy and planning; design and engineering; safety and education; maintenance; enforcement; and outreach/promotion. Once a draft plan was developed, it was sent to various agencies for review and input, including: city and county engineering and planning departments, public works/maintenance departments, law enforcement agencies and University of Tennessee staff.

Bike organizations and clubs were invited to review the draft Plan and attend a Bike Summit on June 26, 2002. The purpose of this meeting was to discuss how all the bike groups in the region could help implement the Bicycle Plan.

Public meetings were held July 29, 30 and August 1 in the Cedar Bluff area, downtown Knoxville and Maryville. Approximately 20 people attended each meeting. Public comments on the draft Plan generally complimented the comprehensive nature of the Plan and focused on priorities and implementation.



www.pedbikeimages.org / Dan Burden

## Importance of Cycling

*“Just as an ecological system is healthiest when it displays great diversity...so too is a transportation system most healthy and robust when diverse modal options are available to those moving people and goods. A transportation system dependent only on one or two modes of transport is far more susceptible to disruption and system failure.”*

—Transportation coordinator and author, Michael Replogle

Bicycling is growing in importance as a mode of transportation because rising vehicle miles traveled (VMT) threatens air quality, consumes limited fossil fuels and increases traffic congestion. Studies have shown that communities cannot depend on continual road expansion to solve traffic congestion problems. Adding lanes is expensive (about \$1 million per mile), divides neighborhoods and induces additional traffic, which creates the need to expand again.

Bicycling has many benefits, including:

- Improved mobility, especially for those who cannot drive
- Lower road maintenance costs
- Fewer crashes and less property damage
- Less traffic congestion
- Less road widening and fewer parking lots
- Improved air quality
- Improved health/reduced health care costs

Many people do not have access to an automobile or cannot drive, including children, the elderly and people with disabilities. Senior citizens are the fastest growing segment of the population. Older people depend more on rides from others, walking, and public transportation. Nationally, 50% of non-driving seniors say they cannot walk to a bus stop and 53% cannot walk to a grocery store. The major limitations are no place to rest between home and the destination, and no services within a convenient distance of home.

The cost of operating an automobile has increased 300% in the last 20 years. Nationally, 26% of low-income households and 8% of all households do not have an automobile. Nationally as well as locally, more than 30% of households have only one motor vehicle, often with more than one employed person in the family.<sup>1</sup> Just in the Knoxville urban area, there are 46,000 people with no access to a car and more than 120,000 with limited access.<sup>2</sup> Safe, efficient, convenient facilities for non-motorized travel are a requirement for these populations, not an amenity. Bike facilities and programs create opportunities for them to participate in the social, economic and cultural life of the community.

Cycling is often the fastest mode of transportation from door to door for distances up to 6 miles in urban areas. People usually do not consider the time it takes to get from a parking lot or parking garage to the front door. Short distance motor vehicle trips are also the least fuel efficient and generate the most pollution per mile.

Ten bicycles can be parked in the space needed for one motor vehicle. The cost of a typical parking space in a parking garage can be up to \$10,000 compared to \$125 to manufacture and install a bicycle rack to park 2 bicycles or \$1,000 for a high security bicycle locker.

Regular physical activity is essential for a healthy life.

Exercise helps prevent heart disease, hypertension, osteoporosis, colon cancer, depression and anxiety. People who exercise routinely live longer and better, according to the Centers for Disease Control and Prevention (CDC). Obesity among adults has increased by almost 60% since 1991. “The continuing epidemic of obesity is a critical public health problem,” says Dr. Jeffrey Koplan, CDC’s Director. CDC suggests several measures to control the obesity epidemic, including providing more sidewalks, bikeways and other alternatives to cars. A study published in the *AMA Journal of Internal Medicine* showed that bicycling to work decreased the risk of mortality by 40%.<sup>3</sup>

More than half of women’s travel time is for family and personal business, including taking children to school and organized sports/recreation. Nationally, people spend an average of 73 minutes per day in the automobile, driving an average of 32 miles a day. Non-motorized trips can replace some of this travel. With safe, interconnected non-motorized facilities, children could walk or bicycle to school, soccer fields, the library and other destinations, without having to be driven.



www.pedbikeimages.org / Dan Burden

<sup>1</sup> 1995 Nationwide Personal Transportation Survey, FHWA, [www.cta.ornl.gov/npts/1995/Doc/trends\\_report.pdf](http://www.cta.ornl.gov/npts/1995/Doc/trends_report.pdf)

<sup>2</sup> 2000 Census data

<sup>3</sup> This study followed 30,000 people over a 14-year period. The average commute time was 18 minutes each way.



## Bicycling by the Numbers

In July 2001, approximately one in four Americans reported to the Bureau of Transportation Statistics that they had used a bicycle in the last 30 days. That equates to more than 49 million people, of which 20 million had ridden between 3 and 10 days in the last month. Almost 8 million people had used their bicycles between 11 and 19 days, and 5 million had ridden 20 or more days. The majority reported bicycling primarily for recreation (54%) and exercise (31%). More than 3 million people (8%) reported commuting to work or school as the primary reason for bicycling. More than 3.5 million people (7%) bicycled for personal errands or some other purpose. The majority of respondents who reported bicycling in the last 30 days primarily used paved roads (49%). An equal percentage used shoulders of paved roads and bike lanes on roads (4% each). Almost 9 million (18%) used sidewalks, and 14% used bike paths. Unpaved roads were the primary facility for 7%. Of the total respondents, including those who did not report using a bicycle, 38% said that the availability of bike facilities, walking paths and sidewalks is very important.<sup>4</sup>

In the Nationwide Personal Transportation Survey, the percentage of overall trips (including errands and social) by bicycle in 1995 was 0.7%, which equates to approximately 3 billion miles traveled and 9 million daily bicycle trips. Social and recreational trips were the primary purpose of 60% of these bicycle trips, with personal and family business as the purpose of 22% of trips. Commuting to work was the purpose of 8% of the bicycle trips. School/church/civic trips made up 9% of bicycle trips.<sup>5</sup>

Figures compiled by Bicycle Retailer and Industry News show that in 1998, more than 16 million bicycles were sold in the U.S., of which 11.2 million were “adult” bicycles. Between 1993 and 1997, the

average number of bicycles sold was 16.2 million. The Bicycle Market Research Institute estimates that the total value of the overall U.S. bicycle market has grown from \$3.6 billion in 1990 to \$5.6 billion in 1998.<sup>6</sup>

The Nationwide Personal Transportation Survey shows that approximately 75% of trips one mile or less are made by motor vehicle. The average commute trip has increased from 8.5 miles in 1983 to 11 miles in 1995, but 44% of commute trips are still five miles or less.

A 1997 survey of U.S. voters found that 64% of respondents support using money from Federal gasoline taxes for things like sidewalks, bike lanes and trails. A quarter of respondents “strongly support” this.<sup>7</sup>

## Laws/Policies

### *Federal*

The US Department of Transportation has released a policy statement on integrating bicycling and walking into transportation infrastructure. Essentially, the statement says that well-designed bike facilities must be included in roadway projects. For more information, see the full statement on page 53.



Cades Cove Visitors Center

<sup>4</sup> Bureau of Transportation Statistics, [www.bts.gov/omnibus/results/household.html](http://www.bts.gov/omnibus/results/household.html)

<sup>5</sup> 1995 Nationwide Personal Transportation Survey, FHWA, [www-cta.ornl.gov/npts/1995/Doc/trends\\_report.pdf](http://www-cta.ornl.gov/npts/1995/Doc/trends_report.pdf)

<sup>6</sup> [www.bicycleretailer.com/2000media/statistics.art/statistics.pdf](http://www.bicycleretailer.com/2000media/statistics.art/statistics.pdf)

<sup>7</sup> Survey done by Lake, Sosin, Snell and Associates for Bikes Belong! campaign

*Bicycle and Pedestrian Provisions*, FHWA, 1998. [www.fhwa.gov/environment/bikeped/bp-broch.htm](http://www.fhwa.gov/environment/bikeped/bp-broch.htm)

TEA-21 includes some policy provisions with regard to bicycle accommodation. When a highway bridge deck on which bicyclists are legally permitted or may operate at each end of the bridge is being replaced or rehabilitated with Federal funds, safe accommodation of bicycles is required unless the Secretary of Transportation determines that this cannot be done at a reasonable cost.

#### *Tennessee Code*

Every person riding a bicycle upon a roadway is granted all of the rights and is subject to all of the duties applicable to the driver of a vehicle, according to Tennessee Code. Bicyclists are required to:

“...ride as close as practicable to the right-hand curb or edge of the roadway, except under any of the following situations: (A) When overtaking and passing another vehicle proceeding in the same direction; (B) When preparing for a left turn at an intersection or into a private road or driveway; or (C) When reasonably necessary to avoid conditions including, but not limited to, fixed or moving objects, parked or moving vehicles, pedestrians, animals, surface hazards, or substandard width lanes that make it unsafe to continue along the right-hand curb or edge.”

Bicyclists may ride side-by-side (no more than two abreast) so long as they do not impede the normal and reasonable movement of traffic and ride within a single lane.

Bicyclists riding at night must have a light on the front visible from a distance of at least 500 feet and a red reflector on the rear visible from 50 feet to 300 feet. A rear red light visible from a distance of 500 feet may be used in addition to the red reflector. The bicycle's brakes must allow its driver to stop within 25 feet from a speed of 10 mph on dry, level, clean pavement.

Bicyclists under the age of 16 must wear a helmet.

#### *Tennessee Driver's Handbook*

Chapter 12 includes information on sharing the roadway with bicyclists. The handbook points out that cyclists have the same rights and responsibilities as other drivers. It discusses the road hazards that cyclists must avoid, and explains that cyclists who are not on the extreme right side of the road “are not being careless, but are in fact attempting to account for traffic conditions.” The handbook states that drivers turning left in front of oncoming cyclists are the cause of a large percentage of car/cycle crashes. Drivers turning right in front of a cyclist are another significant cause of crashes.

#### *City of Knoxville*

The Knoxville Code includes the Tennessee Code, but expands to include bicycle parking regulations. Bicycle parking is allowed on sidewalks unless specifically prohibited and as long as it does not impede pedestrian movement. Bicycles may be parked on roadways where parking is allowed and as long as it does not impede the movement of a legally parked motor vehicle. Bicycles can be secured to publicly owned poles or posts for up to 12 hours, unless specifically prohibited and as long as it does not impede movement of pedestrians or other traffic.

In addition to front lights and rear reflectors, the Knoxville Code requires bicycles ridden from 30 minutes after sunset to 30 minutes before sunrise to be equipped with side reflectors visible from 500 feet away.

Bicycles are allowed on sidewalks, but bicyclists must proceed slowly and give audible warnings to pedestrians before passing on the left. Bicyclists on sidewalks should behave like pedestrians.

#### *Farragut, Maryville, Alcoa*

These municipal codes also state that bicyclists have the rights and duties of motorists, and must adhere to the Tennessee Code.



## Existing Conditions

The Knoxville region has made significant progress in the construction of shared use paths (also known as “greenways” or “trails”). The existing facilities are listed in Table A. The Knoxville and Knox County parks departments have Greenways Coordinators. Alcoa, Maryville, Blount County and Farragut have also committed much time and effort toward developing trail systems. There are several organizations working toward developing an interconnected regional system, including the Knox/Blount Greenways Commission, Tennessee Valley Greenways Coalition and the Great Smoky Mountains Regional Greenways Board. Several

plans dealing with trails and greenways have been adopted, including Alcoa’s Trail System Master Plan (2002), Knox County’s Greenways Plan (1994), and Knoxville’s Greenways Commission Report (1992).

The region has had made less progress in the pursuit of on-street facilities as called for in previous Bicycle Plans (1975, 1985 and 1995). Magnolia Avenue is the only street with bike lanes in Knoxville. Alcoa has bicycle lanes on Lincoln Road and Wright Road, and has plans for additional lanes. Greater coordination between the BAC, all jurisdictions and Greenways organizations should occur in order to achieve the most effective system of on-street and off-street facilities.

**Table A: Greenways Inventory**

Name	Location	Length	
<b>Knoxville</b>			
Bearden Greenway	Sutherland Ave;	0.8 miles	<i>under construction</i>
Cavet Satation Greenway	I-40 to Middlebrook Pike	1 mile	
Community Unity Greenway	Montgomery Village Housing Area	0.6 mile loop	
First Creek Greenway	I-40 to Broadway along First Creek	0.9 mile	
Fountain City Greenway	Fountain City Park	0.6 mile loop	
Gary Underwood Greenway	Gary Underwood Park	0.8 mile loop	
Holston River Greenway	Holston River Park	2.0 mile loop	
James White Greenway	Neyland Greenway to Morningside Greenway	1.5 miles	<i>under construction</i>
Jean Teague Greenway	West Hills Elementary School to West End Church of Christ	1.1 miles	<i>extension under construction</i>
Lakeshore Greenway	Lakeshore Park	2.25 mile loop	
Love’s Creek Greenway	Holston Middle School	0.23 mile loop	
Malcom Martin Greenway	Ed Cothran pool	0.3 mile loop	
Mary Vestal Greenway	401 Maryville Pike	0.4 miles	
Middlebrook Greenway	Middlebrook Pike	0.8 miles	
Morningside/Alex Haley Greenway	Dandridge Avenue	1.0 miles	
Neyland Greenway	Neyland Drive from Volunteer Landing to Faculty Club	3.0 miles	
Northwest Middle School Greenway	Northwest Middle School	1.0 mile loop	<i>extensions in Victor Ashe Park and to Badgett Field in progress</i>
Parkside Greenway	Campbell Station Road to Lovell Road	2.6 miles	
Sequoyah Greenway	median of Cherokee Boulevard	2.6 miles	
Sue Clancy Greenway	Adair Park	0.8 mile loop	
Third Creek Greenway	Lake Loudon to Bi-Lo at Forest Park Boulevard	4.5 miles	
Weisgarber Greenway	Middlebrook Pike to Papermill Road	1.0 mile	<i>under construction</i>
Westview Greenway	Westview Park	0.26 mile loop	
Will Skelton Greenway	Ijams Nature Center to Forks of the River WMA	2.3 miles	<i>extension under construction</i>

Table A: Greenways Inventory (continued)

Name	Location	Length	
<b>Farragut</b>			
Anchor Park	Anchor Park	0.8 mile loop	
Campbell Station Park	Campbell Station Park	1.0 mile loop	
Grigsby Chapel Greenway	Berkeley Park Subdivision to Farragut Commons to Grammar Lane	2 miles	
Mayor Bob Leonard Park		0.9 mile loop	
Parkside Greenway	Campbell Station Road to Lovell Road along the south border of I-40/75	2.6 miles	
Turkey Creek Greenway	Audubon Hills to Anchor Park to Brixworth—west along Turkey Creek Road;	1.6 miles with a 0.3 mile spur to Turkey Creek Woods	
<b>Knox County</b>			
Halls Greenway Trail	Halls Community Park to new library site on Emory Road	1.2 miles	<i>under construction</i>
Pellissippi Greenway Trail	south from Pellissippi State Community College along Pellissippi Parkway	1.5 mile	
Powell Greenway	Emory Road from Powell High School to Powell Middle School	1.5 miles	
Sterchi Hills Greenway Trail	Knox County/AYSO Soccer Complex	2.1 miles and 0.3 loop	
Stock Creek Greenway Trail	French Memorial Park to South Doyle High School		<i>construction in 2003</i>
Ten Mile Creek Greenway Trail	Walker Springs Park	0.1 mile walking loop and a 0.4 mile segment to creek	<i>future construction</i>
<b>Alcoa</b>			
Bicentennial Greenbelt Park Trail	Bicentennial Park	2 mile loop	
Maryville-Alcoa Greenway	Maryville to Springbrook Park Springbrook Park Trail Springbrook Corporate Loop & Connector Clayton's Segment Springbrook Road & Wright Road	3.5 miles 1.4 miles 0.8 miles 1 mile 1.5 miles	
<b>Maryville</b>			
Bicentennial Greenbelt Park Trail	Bicentennial Park	2 mile loop	
Maryville-Alcoa Greenway	Maryville to Springbrook Park Springbrook Park Trail Springbrook Corporate Loop & Connector Clayton's Segment Springbrook Road & Wright Road	3.5 miles 1.4 miles 0.8 miles 1 mile 1.5 miles	
Sandy Springs Park Trail			
<b>Townsend</b>			
Townsend Bicycle Trail	US 321 from Walland Highway bridge to Potleg Hill Road	9 miles	



# POLICY AND PLANNING

## BICYCLE SYSTEM

*“Bicyclists have the same mobility needs as every other user of the transportation system and use the highway system as their primary means of access to jobs, services and recreational activities. Planning for existing and potential bicycle use should be integrated into the overall transportation planning process.”*

*—Guide for the Development of Bicycle Facilities, AASHTO, 1999.*

Bicyclists legally have the same rights and responsibilities as motorists, and can ride on all public roads (except limited access freeways). Bicyclists should be expected on all streets. Many streets, including those with low speeds or low traffic volumes, accommodate bicycles safely with no special accommodation. The recommended bicycle system includes bicycle lanes, bicycle routes and shared use paths that connect Knoxville area residents to major destinations such as colleges, schools, shopping centers, employment centers, libraries, parks and business districts. A bicycle system is a network of facilities<sup>8</sup> that, for a variety of reasons, provide a superior level of service for bicyclists.

The purpose of the bicycle system is to provide a framework for bicycle travel for both advanced and basic cyclists. It does not imply that bicyclists should only use roads designated as bike routes or with bicycle lanes. By law, bicyclists are allowed on all streets. The bicycle system is a tool that allows local governments to focus and prioritize implementation efforts where they will provide the greatest community benefit.

The bicycle system should form a grid pattern with connections every half-mile in order to provide direct and convenient routes.

The first task in developing a bicycle system is to inventory the existing conditions. The Bicycle Compatibility Index (BCI), is an emerging national standard for quantifying the bike-friendliness of a roadway.<sup>9</sup> While other level of service standards relate to traffic capacity, BCI measures bicyclist comfort level for specific roadway geometries and traffic conditions. BCI is based on factors including curb lane width, traffic speed and volume, adjacent land use, and width of bike lane/shoulder. Roadways are scored A to F score with A rated as the most attractive for cyclists. Many professionals feel that a BCI grade of C is the minimum acceptable grade for casual cyclists.

BCI evaluation may be useful in several ways:

- A bicycle map can be produced for the public to assist them in route selection.
- The most appropriate routes for inclusion in the community bicycle system can be identified.
- “Weak links” in the system can be determined and proposed improvements prioritized.
- Alternate treatments for improving bike-friendliness of a roadway can be evaluated.

After using BCI to inventory existing conditions on arterials and collectors in the TPO boundary area, the next step is to identify key corridors using the following criteria:

<sup>8</sup> “Bicycle facilities” is a general term meaning improvements and provisions made by public agencies to accommodate or encourage bicycling, bike lanes, paved shoulders and wide outside lanes.

<sup>9</sup> *The Bicycle Compatibility Index: A Level of Service Concept, Implementation Manual.* FHWA, 1998.



- Existing bicycling patterns
- Connectivity
- Directness
- Amount of side conflict (e.g. driveways, side streets)
- Number of destinations served, especially residential areas, schools, parks, employment centers and transit stops
- Topography
- Crash data and safety concerns
- Existing bottlenecks or constraints
- Existing opportunities (e.g. planned roadway reconstruction)

Once the system is mapped, design alternatives for each corridor need to be developed. Different designs can be evaluated using the BCI model to determine which has the most impact. Constraints such as right-of-way width will also influence the design.

The Knoxville region has made significant progress in the construction of shared use paths/greenways. These facilities, both existing and planned, will also be considered in the development of the bicycle system. In some cases, shared use paths are efficient transportation routes and these will be included in the bicycle system. Some paths are intended primarily for recreation due to location, length, design or other factors and these would not be included in the system.

A list of proposed projects will be prioritized using the following criteria:

- Land uses served: higher priorities for projects that serve intensive land uses, trip generators and commercial areas apt to attract bicyclists.
- Barriers overcome: higher priority for a bikeway that helps to overcome barriers such as river crossings (e.g. bridge improvements); freeway, arterial or railroad crossings; and other “squeeze points” such as lack of shoulders on high speed/volume roadways, complicated intersections, etc.
- Potential cyclist usage: higher priority for projects that have or are likely to have high cyclist usage for recreational and transportation use.



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- Connectivity: higher priority for projects that connect to existing or funded bikeways, including shared use paths/greenways, and to transit routes.
- Lack of parallel facilities: higher priority for those projects where an existing parallel route is not nearby;
- Ease of implementation: higher priority for those projects that will be relatively easy to implement (e.g. no contentious parking removal, signal modifications, other design issues).
- Topographical constraints: higher score for those projects without terrain that limits potential usage (e.g. steep slopes, limited access).

The project list will be divided into three categories: priority one (within five years), priority two (within 10 years), and priority three (within 20 years) priority projects. This list should not be considered an absolute ranking; rather, it will provide a general sense of each project's priority given the state of the bicycle system today. No matter where a project is on the list, its implementation should be pursued if an opportunity arises through another construction project or development.

#### *Policies:*

Bicycle system and facility needs shall be integrated into all City and County planning documents and capital improvement projects.

Bicycle facilities should be implemented as part of all transportation projects (see Bicycle Accommodation Policy), including resurfacing projects.

Ensure that all traffic impact studies, analyses of proposed road changes and development projects address impacts of bicycling and bicycle facilities. Specifically, the following should be considered:

- Consistency with the Bicycle Plan
- Impact on the existing Bicycle System
- Degree to which bicycle travel patterns are altered or restricted due to the projects
- Safety of future bicycle operations

*Action Steps:*

Establish clear roles and responsibilities for all affected City and County departments in the implementation of the Bicycle Plan, including funding, construction, operation and maintenance of the bicycle facilities.

Utilize Bicycle Compatibility Index analysis to develop a recommended bicycle system for the TPO study area, with a prioritized implementation plan.

## Bicycle Accommodation Policy

1. Appropriate bicycle and pedestrian facilities shall be established in new construction and reconstruction projects in all urbanized areas unless one or more of three conditions are met:

Bicyclists and pedestrians are prohibited by law from using the roadway. In this instance, a greater effort may be necessary to accommodate bicyclists and pedestrians elsewhere within the right-of-way or within the same transportation corridor.

The cost of establishing bikeways or walkways would be excessively disproportionate to the need or probable use. Excessively disproportionate is defined as exceeding twenty percent of the cost of the larger transportation project.

Sparsity of population or other factors indicate an absence of need.

2. In rural areas, paved shoulders should be included in all new construction and reconstruction projects on roadways used by more than 1,000 vehicles per day. Paved shoulders have safety and operational advantages for all road users in addition to providing a place for bicyclists and pedestrians to operate. Rumble strips or raised pavement markers are not recommended where shoulders are used by bicyclists unless there is a minimum clear width of 1' from the rumble strip to the traveled way, 4' from the rumble strip to the outside edge of the paved shoulder or 5' to the adjacent guardrail or curb.
3. The design and development of the transportation infrastructure shall improve conditions for bicycling and walking through the following additional steps:

**Planning projects for the long-term.**

Transportation facilities are long-term investments that remain in place for many years. The design and construction of new facilities that meet the criteria in item 1) above should anticipate likely future demand for bicycling and walking facilities and not preclude the provision of future improvements. For example, a bridge that is likely to remain in place for 50 years, might be built with sufficient width for safe bicycle and pedestrian use in anticipation that facilities will be available at either end of the bridge even if that is not currently the case.

**Addressing the need for bicyclists and pedestrians to cross corridors as well as travel along them.** Even where bicyclists and pedestrians may not commonly use a particular travel corridor that is being improved or constructed, they will likely need to be able to cross that corridor safely and conveniently. Therefore, the design

of intersections and interchanges shall accommodate bicyclists and pedestrians in a manner that is safe, accessible and convenient. **Getting exceptions approved at a senior level.** Exceptions for the non-inclusion of bikeways and walkways shall be approved by a senior manager and be documented with supporting data that indicates the basis for the decision. **Designing facilities to the best currently available standards and guidelines.** The design of facilities for bicyclists should follow design guidelines and standards that are commonly used, such as the AASHTO *Guide for the Development of Bicycle Facilities* and AASHTO’s *A Policy on Geometric Design of Highways and Streets*.

*Action Step:*

Adopt the US DOT *Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure*.

**Signage Policy**

*Part 9 of the Manual on Uniform Traffic Control Devices 2000 (MUTCD) shall be followed in providing traffic controls for bicycle facilities. Below is additional information to assist in determining placement of signs.*

“Bike Lane”

In accordance with the MUTCD, the “Bike Lane” signs (R3-16 and R3-17) shall be used only in conjunction with the Bicycle Lane Symbol pavement marking. The signs shall be used in advance of the beginning of a marked bicycle lane to call attention to the lane and the possible presence of bicycles. The R3-16a sign may be used to notify bicyclists that the bicycle lane is ending. The R3-17a sign may be used when the bicycle lane is adjacent to on-street parking, to alert bicyclists that they may encounter parked vehicles.

“Bike Route”

The “Bike Route” sign (D11-1) can be used for long distance touring routes primarily in rural areas. Bike



route signs should be supplemented with guide signs (D1-1) when located along routes leading to high demand destination (e.g. “To Downtown”). Signs should be provided at decision points along designated bicycle routes, including signs to inform bicyclists of route changes and confirmation signs for direction, distance and destination. Signs should be repeated at regular intervals to ensure that bicyclists entering from side streets know they are on a bicycle route. “Bike Route” signs should only be used on roads that have a Bicycle Compatibility Index rating of C or better. Coordination between jurisdictions should occur to ensure continuation of bike routes whenever possible. “Begin” and “End” bike route signs should not be used to indicate county or city boundaries.

“Share the Road”

The “Share the Road with Bicyclists” sign (R9-8-24) is for use on facilities where there are no designated bike lanes or wide paved shoulders (at least 4’ or 1.2 m.). The sign can be used on roads meeting any of the following conditions:

- Observed bicycle traffic

- A higher than normal potential for conflict between cyclists and motorists such as at the end of designated bike lanes, or at narrow bridges
- Part of a formally adopted bicycle route system
- One or more documented bicycle/motor vehicle crash
- Expected presence of number of cyclists, such as during an organized bicycle ride or event where the road will continue to be open to motor vehicles (under this condition, signs should be mounted on portable type assemblies, to be in place only during the event)
- Where a traffic engineering study indicates a need for this type of sign
- Where bicycle traffic is affected by construction, especially where a bike lane is closed. Temporary signs will be placed to announce the closed bike lane, along with a “Share the Road” sign.

#### *Action Steps:*

Identify locations for “Share the Road” and other related signs and recommend to the appropriate departments/agencies.

Develop and implement destination-based signing for the bicycle system.

## Funding

### *TEA-21*

The Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21), signed into law on June 8, 1998, is the most significant funding program for transportation, including bicycle projects. TEA-21 continues the integration of bicycling into the transportation mainstream that began with Intermodal Surface Transportation Efficiency Act, the previous funding program that expired in 1997. TEA-21 increases communities’ ability to invest in projects that enhance the safety and practicality of bicycling.

Bicycle projects are eligible for funding from almost all categories of TEA-21. Bicycle projects must be “principally for transportation, rather than recreation, purposes” and be designed and

located in coordination with State and MPO/TPO transportation plans.

Surface Transportation Program (STP) funds may be used to construct bicycle facilities and for other projects (such as maps, brochures and public service announcements) related to safe bicycle use. Ten percent of each state’s STP funds are set aside for Transportation Enhancement (TE) projects. The list of eligible projects for TE funds includes “provision of facilities for pedestrians and bicycles, provision of safety and educational activities for pedestrians and bicyclists,” and the “preservation of abandoned railway corridors (including the conversion and use thereof for pedestrians and bicycle trails.” TE-funded bicycle/pedestrian facilities must be used primarily for transportation purposes, not for recreational use. Mixed uses that include some recreation trips may be allowed. Another ten percent of the state’s STP funds are set aside for the Hazard Elimination and Railway Highway Crossing program, which addresses motorist, bicyclist and pedestrian safety issues.



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Congestion Mitigation and Air Quality Improvement (CMAQ) program funds may be used for the construction of bicycle transportation facilities, and other projects (such as maps, brochures and public service announcements) related to safe bicycle use.

Recreational Trails Program funds may be used for a variety of trail projects, including motorized and non-motorized. Of the funds allocated to the state, 30% must be used for non-motorized trails and 40% for diverse trail uses (any combination of motorized and non-motorized). States are required to have a State Trails Advisory Committee, which recommends projects for funding.

National Highway System (NHS) funds may be used to construct bicycle transportation facilities on land adjacent to any highway on the NHS.

The Federal Lands Highway Program includes provisions for bicyclists in conjunction with roads, highways and parkways on land owned by the federal government (such as US Forest Service and Bureau of Land Management). The National Scenic Byways program allows funding to be used to the construction of shared use paths along scenic byways.

Job Access and Reverse Commute Grants are available to support projects, including bicycle-related services, designed to transport welfare recipients and eligible low-income individuals to and from employment.

Federal Transit Program funds can be used for improving bicycle access to transit facilities and vehicles. Transit Enhancement Activity funds are designated for a variety of projects, including “bicycle access, including bicycle storage facilities and installing equipment for transporting bicycles on mass transportation vehicles.”

Highway Safety Programs place a priority on bicycle and pedestrian safety. Grants are available to states that submit a Performance Plan and a Highway Safety Plan.

In general, the federal share of transportation project costs is 80%, with a 20% state or local match.

#### *National Park Service Programs*

The Rivers and Trails Conservation Assistance Program, administered by the National Park Service, provides planning and organizational assistance for community projects that promote nature-based recreation and conservation projects, including trails. The Land & Water Conservation Fund program provides matching grants to States and local government for the acquisition and development of public outdoor recreation areas and facilities. The program is intended to create and maintain a nationwide legacy of high quality recreation areas and facilities and to stimulate non-federal investments in the protection and maintenance of recreation resources across the United States. As of this writing, Tennessee is out of compliance with regulations for this program, and funding has been suspended.

#### *Resource Conservation and Development Funds*

This program is administered by the USDA Natural Resources Conservation Service and provides 50% matching funds for recreation projects, including parks and land acquisition. The funding is available to state and local governments and non-profit organizations. Resource Conservation and Development (RC&D) helps people care for and protect their natural resources to improve their area’s economy, environment and living standards. RC&D provides a way for local residents to work together and plan how they can actively solve environmental, economic and social problems facing their communities.

#### *Other Federal Programs*

There are several other federal grants encouraging urban redevelopment, community non-profit groups and economic development that can be used for bicycle and pedestrian projects. These include Community Development Block Grants and the Entitlement Program.

### *State General Fund*

General funds from the state budget can be used for bicycle projects. This source requires strong statewide public interest and political support.

### *Grants*

Grants are available from a number of foundations and organizations.

### *Local Funding*

Funding for local bicycle projects and the local match for federal funding usually comes from city and county general funds and private donations. Local land trusts, other special interest groups, service clubs and interested individuals often donate time, money and materials.

### *Policy:*

When a roadway is constructed or reconstructed with STP (Surface Transportation Program) funds, the bicycle and pedestrian facilities should be included. TE and CMAQ funding shall not be used to provide bicycle facilities in these cases.

### *Action Steps:*

Pursue grants and other sources in addition to TEA-21 funding.

Make transportation funding information available so the public has a better understanding of how projects get funded.

## **Bicycle Program**

In order to implement the Knoxville Regional Bicycle Plan, a Bicycle Program needs to be established with at least one full-time staff person. A bicycle coordinator can be critical to a strong and active bicycle program. The position provides a focal point within the government for the program, oversees implementation of the Bicycle Plan,

coordinates with other agencies and acts as a spokesperson for bicycle issues. In addition to the state bicycle/pedestrian coordinators required by TEA-21, there are hundreds of local coordinators in the United States.

### *Action Steps:*

Establish a Bicycle Program staffed at a level sufficient to implement the Bicycle Plan.

Ensure that all jurisdictions support and participate in the Bicycle Program.

## **Transportation Planning Organization**

The Knoxville Regional Transportation Planning Organization is required by federal law to perform transportation planning in Knox and Blount counties, including the urbanized areas of Knoxville, Farragut, Alcoa and Maryville.<sup>10</sup> The TPO is required to develop a multimodal transportation plan that forecasts population and traffic growth at least 20 years out. The 1995 Bicycle Plan was adopted as part of the Long Range Transportation Plan in May 1995. The Transportation Improvement Program is a list of all the projects that will use federal transportation funding in the next three years.

The TPO Executive Board created the Bicycle Advisory Committee (BAC) in 2001. There are eleven members from different jurisdictions within the TPO boundary. The duties of the BAC include: updating and maintaining the Bicycle Plan for the Knoxville Urban Area; making recommendations and encouraging the implementation of bicycle provisions and opportunities to the TPO Technical Committee, Executive Board and implementing agencies; and working with local businesses, agencies and organizations to encourage bicycling and promote community investment in bicycle racks, signage and other facilities/programs.

<sup>10</sup> US Census 2000 data will result in the addition of new urbanized areas to be included in the TPO boundary.



*Policy:*

The Bicycle Plan shall be integrated into the Long Range Transportation Plan, and bicycle projects will be included in the Transportation Improvement Program.

*Action Steps:*

Review the Bicycle Plan every two years and revise as necessary. Update the Plan every five years.  
Continue to support the efforts of the BAC.  
Produce quarterly progress reports on Bicycle Plan implementation.

## Community Involvement

Implementing the recommendations from this Bicycle Plan will take more than government action. Citizen involvement is vital to achieve a successful bicycle system and varied programs. Communicating information to the public about transportation meetings, bicycle events and the need for volunteers will enable citizens to get involved and make a difference. Maintaining a mailing list of interested people, as well as utilizing the TPO website and various e-mail listservs are just a few of the ways to keep citizens informed.

Finding partners in the community will also contribute to the success of this Plan. Businesses, schools and universities are just some of the potential partners. The University of Tennessee is especially significant because of the high concentration of bicyclists around university campuses, and the potential for increasing bicycle use among students. Hospitals could also be important partners because of the health benefits of bicycling. Tennessee has a prevalence of bike clubs and related groups that could help advocate implementation.

*Action Steps:*

Work with the TPO *Smart Trips* Program to promote bicycling and bicycle facilities to employers.  
Work with bike organizations to implement the Bicycle Plan in conjunction with their groups' missions.

Facilitate citizen involvement by providing information on bicycle programs and events, and comment on transportation projects.

## Transit

Improving the bicycle-transit link is an important part of making bicycling a part of daily life. Linking bicycles with mass transit overcomes such barriers as steep terrain, poor weather and concerns about riding at night. It extends the range of destinations that people can reach without having a private vehicle. This is important for those who do not have an automobile, as well as those who choose not to or cannot drive.

The bicycle-transit link can also make access to transit less expensive. In suburban communities, population densities are often too low to offer transit service within walking distance (¼ mile) of every commuter. Within the last 20 years, many transit agencies have built expansive motor vehicle park-and-rides as an alternative to costly feeder bus service. But as cities fight to maintain air quality and transit agencies tighten their budgets further, the concept of park-and-rides is being re-examined. Many of the auto trips to park-and-rides are less than 2 miles—an easy bicycling distance. Bicycling to transit instead of driving benefits communities by reducing taxpayer costs, air pollution, demand for park-and-ride land, energy consumption and traffic congestion with relatively low cost investments.



There are four main components of bicycle-transit integration:

- allowing bicycles on transit;
- offering bicycle parking at transit locations;
- improving bike facilities to transit stops; and
- encouraging usage of bicycle and transit programs.

To enable and encourage the use of transit and bicycling, bike racks should be provided on all buses. This allows flexibility. If the weather turns bad during the day, a bicyclist can take the bus home and still bring the bike. A cyclist can take the bus to work in the morning and bike home in the evening, or vice versa.

If long-term bike parking (such as bike lockers) is provided, people can bike to the bus stop and then store their bikes instead of having to bring the bike along. Alternately, people can keep a bike on the destination end of the trip—take the bus to downtown, for instance, and then bike to work from the transfer center.

Some communities are moving beyond simply providing bike parking at transit stops, and building bikestations. A bikestation offers secure, personally attended bicycle parking in a central location and convenient hub of transit-oriented activity. While bikestations vary in size and details, all of them focus on safely parking and storing bicycles while the riders walk and shop nearby, or take the bus to work. Transit and bicycle-related brochures and maps, as well as a staff person, offer information. The first bikestation in the U.S. opened in Long Beach, CA in 1996, offering free valet parking for up to 150 bikes, a restroom/changing room and bike repair services. Other bikestations offer bike rentals, coffee and classes on bike maintenance.

In order to use transit, people must be able to reach the transit stops. The bicycle system around transit stops, therefore, is important. When developing the bicycle system, location of transit routes and stops will be considered.

#### *Action Steps:*

Provide bike parking at major transit stops and transfer points, including short-term and long-term parking.

Ensure that all buses within the TPO boundary, including downtown trolleys, have racks to carry at least two bicycles.

Research the ability to carry more bicycles on buses where the racks are frequently full.

Advertise the availability of bike racks on buses and bike parking.

Consider including a bikestation in the Downtown Intermodal Transfer Center and at the University of Tennessee.

### **Trip Reduction**

Trip reduction, also known as transportation demand management, means reducing the number of people driving alone, rather than continuing to increase road capacity. Bicycling is one of the transportation choices promoted through trip reduction. The commute trip has been the target of most efforts, focusing on getting employers to offer incentive programs. Built into all trip reduction programs should be a marketing campaign to raise awareness of transportation options as well as the incentive programs and other available strategies.

Strategies used in other communities include community (rather than just employer) incentive programs, car sharing club, location efficiency mortgages (to reward people for living where they can bike, walk or use transit rather than drive), preferential carpool parking, vanpools and guaranteed ride home programs. Employers can offer cash to employees who do not wish to use a parking space, recognizing that parking has not been quantified as an employee benefit in many places. Some communities and states have made trip reduction mandatory through Commute Trip Reduction ordinances.

To specifically encourage bicycling, employers should make secure, protected bicycle parking available for employees. Showers, or partnerships with nearby



health clubs for shower use, also helps during summer months and if the employee has a long or hilly commute. Employers can also add bicycles to their fleet of vehicles available for errands and work trips. In downtown areas, bicycling is usually faster than either walking or driving. Many workplaces have Wellness or Health Programs that encourage employees to walk on their lunch hour or work out at gyms. Encouraging employees to bicycle to work should be integrated into these programs.

*Action Steps:*

- Work with TPO *Smart Trips* Program to encourage employers to implement incentive programs and develop facilities to encourage employees to bicycle to work
- Implement the Bicycle Parking/Enhancement Program, which provides bicycle parking facilities and “company” bicycles to businesses and agencies.

**Subdivision and Zoning Regulations**

The convenience and ease of bicycling is significantly influenced by land use patterns, which are guided by subdivision and zoning regulations. Much of recent development is highly automobile-oriented, with segregated land uses, large parking lots between the buildings and the street, and high traffic volumes and speeds. One of the reasons for higher traffic volumes is a move away from the grid street pattern with many route choices for getting around, to a curvilinear pattern with many cul-de-sacs and few alternate routes.

Land use patterns that make bicycling easier include higher housing densities, mixed use zoning and grid street patterns. Mixed use zoning and higher densities allow people to live closer to schools, parks, work and shopping so that bicycling and walking are practical choices for transportation. Grid street patterns disperse traffic because they offer many alternative routes. Grid patterns usually result in shorter trip distances to destinations than cul-de-sac patterns.

Integrating land use and transportation planning allows new developments to implement these strategies from



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the beginning. Infill development can help meet some of these goals in established areas of the community. Changes in zoning laws and subdivision regulations are necessary to support balanced transportation.

New Urbanism (also called or related to: Neotraditional Design, New Community Design, Traditional Neighborhood Development and Transit Oriented Development) is a set of development practices to create more attractive and efficient communities. These can significantly improve accessibility and reduce motor vehicle travel. Efficient land use can be implemented at different geographic levels. New Urbanism is neighborhood-level, while Smart Growth is regional in scope.

Some design features of New Urbanism developments include:

- Streets designed for walking and cycling, with sidewalks on both sides, bike lanes where needed, safe pedestrian crossings and traffic calming features.
- Streets that form a continuous, interconnected network with numerous access points to adjacent neighborhoods, dispersing traffic.
- Relatively narrow streets shaded by street trees that slow traffic and create a bicycle and pedestrian-friendly environment.

- Places to work and shop within and adjacent to the neighborhood. The places to shop are sufficiently varied to meet common household needs.
- An elementary school within a mile so that most children can walk or bike.
- Parks, playgrounds and trails within a quarter mile of all houses.

Barriers to New Urbanism can be found in many zoning and subdivision regulations. For example, zoning often requires segregated land uses, which means neighborhoods cannot include any stores. Zoning might also require more parking and wider streets than considered appropriate in New Urbanism.

In New Urbanist developments, bike lanes are generally not recommended on streets with design speeds of 25 mph or less, widths 26 feet or less and average daily traffic 5,000 or less. With these criteria met, cyclists can usually mix safely with motor vehicle traffic. On streets that are likely to function as collectors, with higher speeds or traffic volumes, bike lanes should be installed.

Knoxville recently adopted Town Center districts into the City and County zoning regulations and Traditional Neighborhood district (TND) into City regulations. TND calls for an interconnected street system, sidewalks on both sides of the street and street trees, traffic calming, links to adjacent neighborhoods and neighborhood centers for shopping and working. The design speed for local residential streets in this district is 20 mph.

The Town Center district is intended to create a compact, pedestrian-oriented, mixed-use urban development that would reduce reliance on private automobiles. Flexible land use and development standards are offered as an incentive.

#### *Action Steps:*

Develop a coordinated land use and transportation plan for more efficient use of land and infrastructure in the future.

Revise zoning and subdivision regulations to include bicycle-friendly policies as requirements of developments.

### **Bike Parking**

Parking standards in most zoning ordinances means automobile parking. Many communities, however, are realizing that bicycle parking standards are a vital part of a successful bicycle system. Some of the cities that have bicycle parking requirements include Denver, Boulder, Cambridge, Madison, Palo Alto, Portland, Eugene and Austin.

Bike parking should be clearly designated, safe, secure and convenient. At least part of the parking (that intended for employees, for instance) should be covered or inside. See p. 63 for information on the design and proper placement of bike parking.

#### *Action Steps:*

Adopt the Bicycle Parking Requirements and Guidelines included in the Appendix (p. 63).

Implement and continue the Bicycle Parking/Enhancement Program, which provides bicycle parking facilities to businesses and agencies.



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## Economic Development

Bicycle friendly communities can benefit through economic development. Knox and Blount Counties have significant potential for bicycle tourism because of the proximity to the Smoky Mountains. Bicycle tourism includes lodging, restaurants and bicycle rentals that cater to the bicycle tourist. Bicycle tourism can have tremendous economic impacts. In Maine, a study by Wilbur Smith Associates<sup>11</sup> estimated that bicycle tourism generates \$61.3 million a year in economic activity. The study also reports that 1,200 full-time jobs are attributable to bicycle tourism, totaling \$17.9 million in wages (average salary of \$14,900).

To realize the potential of bicycle tourism in the region, a marketing plan should be developed to identify the types of touring activities appropriate for the Smokies and to create the desired marketing messages to emphasize in campaigns. A committee of interested organizations and businesses should meet to discuss how bicycle tourism can benefit them, and how they can best promote this type of tourism.

*Action Step:*

Form a committee of businesses, organizations and agencies interested in economic development and bicycle tourism.

<sup>11</sup>*Bicycle Tourism in Maine: Economic Impacts and Marketing*, Wilbur Smith Associates, 2001.

# DESIGN AND ENGINEERING

The design guidelines in this chapter are intended to serve as a primer on bicycle facilities for planners, engineers and others in accommodating bicycle traffic in different riding environments. Appropriate facility design also encourages predictable bicycling behavior. The guidelines are based on the national guidelines as outlined in AASHTO's 1999 *Guide to the Development of Bicycle Facilities* and the USDOT's *Manual of Uniform Traffic Control Devices*, but also considers other information (see References, p. 69).

These guidelines should be used in conjunction with, not separate from, the AASHTO and MUTCD documents. The information here highlights important issues, but more detail is contained in the national documents. Bicycle facility guidelines will not cover all the details encountered in the development of facilities. Where details are not covered, appropriate engineering principles and professional judgement must be applied in providing for the safety and convenience of bicyclists, pedestrians and motorists. The human and environmental factors contributing to bicycle crashes are important for facility designers to be aware of. Bicycle facilities, which include bike lanes, wide curb lanes and designated shoulders, should be included as part of all appropriate projects unless there is a compelling reason not to include them (see US DOT Policy Statement, p. 55). Judging the need for facilities based on current bicycle counts or projected levels is often unreliable due to existing disincentives for bicycling. Paved shoulders, bike lanes and wide curb lanes provide a number of other benefits related to maintenance, general safety and joint uses, and can often be justified for these reasons.

Since facilities are constructed on a project-by-project basis, bicycle facilities should generally be provided

even for short sections (like intersection improvements or bridges). If desired and appropriate, bike facility signing and marking can be delayed until the segment is connected to a longer facility. If the justification for bicycle facilities is questioned (e.g. due to the need to purchase additional right-of-way or remove parking), the priority level of the project should be examined (see p. 16).

## On-Street Facilities

The appropriate bicycle facility for any given roadway depends on the roadway's classification, pavement and right-of-way width, motor vehicle speeds, traffic volumes, adjacent land use and other factors (see p. 15). On-street facilities typically consist of bicycle lanes, paved shoulders, wide curb lanes and shared roadways. The travel volumes and choice of roadway design will affect the level of use by bicyclists. For example, a four-lane divided highway with high traffic speeds and volumes, even with paved shoulders, will attract only more experienced bicyclists. Bicycle facilities are needed on major roadways despite the limited use by bicyclists in order to provide access to destinations and





to get across barriers (e.g. interstates or rivers). No one type of facility will serve all bicyclists.

### *Shared Roadway*

All roadways, except limited access freeways, are open to bicyclists; therefore, most are “shared roadways” where the bicyclist and motorist share the same travel lanes. There are no specific standards for shared roadways. Local streets with low traffic volumes generally accommodate bicyclists (except young children) safely with no additional treatment. Shared roadways with 11’ or 12’ travel lanes and speed limits of 30 mph or less, and average daily traffic (ADT) of 5,000 or less are usually adequate for bicyclists. Streets on which traffic is traveling at higher speeds than they were designed for can be made more suitable for bicyclists through traffic calming (see p. 34). In rural areas, the suitability of a roadway decreases as traffic volumes reach 1,000 ADT because of higher traffic speeds and a larger percentage of truck traffic.

### *Signed Shared Roadway*

Using signage to identify preferred bike routes can be used in certain situations:

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

Signing of shared roadways indicates that there are advantages to using these routes compared with other routes. This means the responsible agencies have taken action to ensure that these roadways are suitable for bicycling and will be maintained. (See p. 18 for signage policies.)

### *Bike Lanes*

Bike lanes are provided on arterial and major collector



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streets. Bike lanes may also be used on rural roadways near urban areas, where there is high potential for bicycle use. Bike lanes are generally not recommended on rural highways with posted speed limits of 55 mph because of difficulties at intersections. Shoulder bikeways should be used in these situations.

Bike lanes are one-way facilities that carry bicycle traffic in the same direction as adjacent motor vehicle traffic. Bike lanes should always be provided on both sides of a two-way street. Motorists are prohibited from using bike lanes for driving and parking, but may use them for emergency breakdowns or avoidance maneuvers.

Bike lanes are designated with pavement markings as well as signs along the street. A typical bike lane width is 5’ from the face of curb or guardrail to the bike lane stripe. Bicycle lane widths of 6 feet maximum may be desirable when one or a combination of the following conditions exists:

- traffic volumes and speeds are high;
- adjacent parking use and turnover is high;
- catch basin grates, gutter joints and other obstacles are present in the bicycle lane
- steep grades exist;
- truck volumes are high;
- bicycle volumes are high.

Bicycle lane widths of 4' minimum may be acceptable when:

- physical constraints exist (for a segment of less than 1 mile that links to existing bikeways on both ends);
- implemented in conjunction with traffic calming devices;
- adjacent to parking with very low use and turnover, and low speed limits and traffic volumes;
- adjacent to an uncurbed street shoulder.

Additionally, for on-street parking, an 8' (7' minimum) parking area width adjacent to the bicycle lane is recommended.

The travel lane width adjacent to a bicycle lane should be 11' (10' minimum). A 4' bicycle lane should not be used in combination with a 7' parking lane and/or a 10' travel lane.

Since bicyclists tend to ride a distance of 32–40" from the curb face, it is vital that this surface be smooth and free of structures. Drainage grates and utility covers that extend into this zone may cause cyclists to swerve and effectively reduce the width of the bike lane.

Where these structures exist, it may be necessary to increase the bike lane width accordingly.

Among the benefits of bike lanes are:

- Defining a space for bicyclists to ride, helping less experienced cyclists feel more confident and willing to ride on busier streets;
- Reducing motorist lane changing when passing bicyclists;
- Increasing the visibility of bicyclists in the transportation system.

Other benefits include:

- Reducing pedestrian/bicyclist conflicts due to fewer cyclists on the sidewalks;
- Creating a buffer between pedestrians and motor vehicles;

- Increasing effective turn radii at driveways and intersections;
- Improving sight distances;
- Providing space for emergencies/breakdowns.

Bicycle lanes can be implemented by narrowing existing travel lanes; removing a travel lane; removing parking, except where it is essential to serve adjacent land uses; and shoulder widening. Bicycle lanes may be implemented through stand-alone bikeway projects, through reconstruction or construction of roadways, and through routine resurfacing of roadways when the street configuration can be modified without parking removal or serious additional congestion.

Some streets where bicycle lanes are the preferred treatment have circumstances that make bicycle lane installation very difficult. These circumstances include: harm to the natural environment or character of the natural environment due to additional pavement; severe topographical constraints; economic or aesthetic necessity of retaining parking on one or both sides of the street; and serious traffic congestion that would result from eliminating travel lanes. These circumstances are to be evaluated very carefully before a decision is made to implement an alternative treatment.

For example, before deciding that on-street parking is necessary, off-street (including driveways and garages) and alternative parking opportunities (such as parking on the opposite side of the street) must be investigated. As another example, a travel lane should be removed even if traffic congestion may increase, unless the congestion that may be caused by lane removal cripples the flow of people and goods.

Traffic calming improvements, wide outside lanes or alternative parallel bikeways may be substituted only after careful investigation has proven bicycle lanes to be unfeasible.

#### *Wide Curb Lane*

For streets with traffic volumes of more than 3,000



ADT and speeds above 30 mph where there is inadequate width to provide the required bicycle lanes or shoulder bikeways, a wide curb lane (or wide outside lane) may be provided that accommodates both cyclists and motor vehicles. This could occur on retrofit projects where there are severe physical constraints, and all other options have been pursued, such as removing parking or narrowing travel lanes to minimum acceptable widths.

A wide curb lane is typically 14' wide. Usable width is normally measured from curb face to the center of the lane stripe, but adjustments need to be made for drainage grates, parking, and longitudinal ridges between pavement and gutter sections. For widths of 15' or more, a bicycle lane or shoulder bikeway should be striped.

### *Shoulder Bikeway*

Adding or improving paved shoulders is often the best way to accommodate bicyclists on rural roads. Paved shoulders have many benefits for motor vehicle traffic, as well as for cyclists. Shoulders should be at least 4' wide for bicycle travel. However, where 4' is not feasible, any shoulder width is preferable to none. It is desirable to increase the shoulder width where higher levels of bicycling are anticipated. Additional width is also needed when motor vehicle speeds exceed 50 mph or when the percentage of truck traffic is high.

Rumble strips or raised pavement markers are not recommended where shoulders are used by bicyclists unless there is a minimum clear width of 1' from the rumble strip to the traveled way, 4' from the rumble strip to the outside edge of the paved shoulder or 5' to the adjacent guardrail or curb.

On projects that widen shoulders for the benefit of bicyclists, there may be some opportunities to reduce costs by building to a lesser thickness. If the following conditions are met, 3" to 4" of asphalt and 2" to 3" of aggregate over existing roadway shoulders may be adequate:

- There are no planned widening projects for the road section in the foreseeable future.
- The existing shoulder area and roadbed are stable and there is adequate drainage or adequate drainage can be provided without major excavation and grading work.
- The existing travel lanes have adequate width and are in stable condition.
- The horizontal curvature is not excessive, so that the wheels of large vehicles do not track onto the shoulder area. On roads that have generally good horizontal alignment, it may be feasible to build only the inside of curves to full depth.
- The existing and projected average daily traffic and heavy truck traffic is not considered excessive (e.g., under 10% of total).

The thickness of pavement and base material will depend upon local conditions and engineering judgment should be used. If there are short sections where the travel lanes must be reconstructed or widened, these areas should be constructed to normal full-depth base design standards.

### *On-Street Parking*

On-street parking increases the potential for conflicts between motor vehicles and bicyclists. Bicyclists are susceptible to opening car doors, vehicles exiting parking spaces and obscured views of intersecting traffic. For shared use between bicyclists and parking, a minimum width of 12' is recommended. A 5' bike lane and a 7' parking lane should be striped in order to define the parking spaces and give bicyclists adequate room to avoid hazards.

### *Innovative Treatments*

Treatments such as raised bike lanes, bicycle boulevards and colored bike lanes have been used in other communities. The purpose of these treatments is to improve safety for bicyclists by either increasing the separation from motorized traffic or raising the motorists' awareness of bicyclists. The success of these treatments has not yet been fully determined.

*Policies:*

Fully integrate the use of a consistent set of bicycle facility design standards, based on the 1999 AASHTO *Guide for the Development of Bicycle Facilities* and the bicycle facility guidelines included above.

On arterial and collector roadways, provide on-street bicycle facilities with a Bicycle Compatibility Index (BCI) of “C” or above.

Seek to provide a higher BCI on roadways included in the bicycle system.

*Action Steps:*

Provide for appropriate access control on arterial roadways in order to increase the function and safety of these roadways for both bicyclists and motorists, while at the same time ensuring adequate access and crossing opportunities for pedestrians and bicyclists.

Continue to research innovative treatments used in other communities and determine if they would be applicable in Knoxville.

**Sidewalks**

In general, the designated use of sidewalks for bicycle travel is not recommended. Widening sidewalks does not necessarily enhance the safety of sidewalk bicycle travel, because the extra width encourages faster bicycle speeds which increases the potential for conflict with motor vehicles at intersections and with pedestrians along the corridor.

Sidewalk bikeways should only be considered under limited circumstances:

- To provide bikeway continuity along high speed or heavily traveled roadways having inadequate space for bicyclists, and uninterrupted by driveways and intersections for long distances.
- On long, narrow bridges. In such cases, ramps should be installed at the sidewalk approaches. If approach bikeways are two-way, sidewalk facilities also should be two-way.

In residential areas, sidewalk riding by young children is common. This type of sidewalk bicycle use is accepted, but it is inappropriate to sign these facilities as bike routes.

*Policy:*

Evaluate the need for sidewalk bike facilities on a case-by-case basis using the criteria stated above.

**Shared Use Paths**

Shared use paths, or trails, are facilities on exclusive right-of-way and with minimal cross flow by motor vehicles. Users are non-motorized and may include in-line skaters, bicyclists, pedestrians, joggers and wheelchair users. These facilities are usually designed for two-way travel and can serve a variety of purposes, from recreation to transportation. These paths should be considered as a part of an overall bicycle system, not as a substitute for on-street bicycle facilities. In some communities, greenway systems include shared use paths. Depending on the funding source and purpose, all greenway trails may not be designed to AASHTO guidelines. Shared use paths within greenway systems that could receive high levels of bicycle use, however, should follow AASHTO.

The key components to successful shared use paths are:

- Continuous separation from traffic (e.g. along a river or railroad);





- Scenic qualities;
- Connection to major destinations (e.g. shopping malls, downtown, schools, parks);
- Well-designed street crossings;
- Shorter trip lengths than the road network offers;
- Visibility (e.g. proximity to housing and businesses);
- Good design; and
- Proper maintenance.

When shared use paths are located adjacent to a roadway, some problems are likely to occur. When the path ends, bicyclists going against traffic will tend to continue to travel on the wrong side of the street. Wrong-way riding is a significant cause of bicyclist/motorist crashes. At intersections, motorists entering or crossing the roadway often will not notice bicyclists approaching from the motorist's right, as they are not expecting contra-flow vehicles. Many bicyclists will continue to use the roadway rather than the path because they have found the roadway is more convenient, better maintained or safer. Bicyclists using the roadway may be harassed by motorists who assume the bicyclists should be using the path.

Shared use paths along roadways may be appropriate if the following conditions are met:

- Bicycle and pedestrian use is anticipated to be high;
- The adjacent roadway has high traffic volumes and speeds with no room for on-street bike facilities;
- The path will generally be separated from motor vehicle traffic with few driveway or roadway crossings; and
- There are no reasonable alternatives for bikeways on nearby parallel streets.

#### *Policies:*

Avoid locating shared use paths adjacent to roadways unless above guidelines are met. Design new shared use paths according to AASHTO standards.

## Intersections

Most conflicts between motorists and bicyclists occur at intersections. Good intersection design indicates to road users what path to follow and who has the right of way. Bicyclists' movements are complicated by their lesser speed and visibility.

Traffic signals should allow enough time for bicyclists to cross the intersection. Signal timing along a corridor can be a problem for cyclists who are trying to maintain a constant speed to take advantage of their momentum. The cyclist may be able to get through a few lights, but then has to stop and wait, and then have to build up momentum again. This can tempt bicyclists to run red lights out of frustration. Traffic signals in downtown and other dense areas should be timed for speeds of 12–16 mph, which would allow bicyclists to ride with traffic.

Demand-actuated signals, which usually use loop detectors embedded in the pavement, are often problematic for bicyclists. There are several improvements that can be made to help cyclists:

- Place loop detectors in bike lanes, especially on side streets with lower traffic volumes.
- Increase sensitivity of detectors.
- Paint stencils to indicate the most sensitive area of the loop.



- Place push-buttons close to the roadway for cyclists to reach without dismounting.
- Use quadrupole loop detectors rather than the standard square loops.
- Use visual or motion detection rather than loop detectors.

In general, bike lane striping should not continue through intersections. The AASHTO guide provides detail on bike lane and intersection treatments.

#### *Policies:*

Use quadrupole loop detectors at all signalized intersections.

Consider visual or motion detection at locations where a high level of bicycle use exists or is anticipated.

Consider the needs of bicyclists when designing and reconstructing intersections.

Consider bicyclists when coordinating traffic signal timing along a corridor.

## Barriers

Barriers to bicycle travel include rivers, major roadways, and railroads. Barriers, or “weak links” in the bicycle system, can seriously inhibit bicycling in a community by making it difficult to travel safely to destinations. A good implementation plan should address these issues.

### *Rivers*

Waterways can be significant barriers to transportation that are expensive to remedy. Because bridges are typically expected to last up to 50 years, bicycle facilities need to be included in all major bridge projects. Even if bicycle facilities do not currently exist on either end of the bridge, they may be developed within 50 years.

### *Roads*

Many arterials in a community are as much a barrier to crossings as rivers. Interstates and highways are also barriers. Bicycle crossings of these wide, busy roads are challenging and often hazardous. Crossing



opportunities can often be widely spaced. Bridges over Interstates and highways have similar issues to those over rivers.

### *Railroads*

Because of their tendency to grab and channelize bicycle tires, railroad crossings present a difficult challenge for bicyclists. Three main factors affect crossing safety: the angle of the crossing, the surface quality and the width of the flange between the pavement and rail is also a factor.

Unsafe railroad crossings on the bicycle system should be considered of highest priority. The maintenance and repair of railroad crossings are the responsibility of rail companies for commercial rail lines.

Bridges over railroads have similar issues to bridges over rivers. At-grade crossings can also be difficult for bicyclists, either because of rough or broken pavement or because of slippery surfaces.

#### *Policies:*

Accommodate all users in design of new and reconstructed transportation projects.

Conveniently spaced, safe crossings should be designed into roadway projects. These may be signalized crossings or grade-separated.

All bridge projects should include adequate space for bicyclists.



Ensure that at-grade railroad crossings are safe for bicyclists.

*Action Steps:*

Develop improvement projects to focus on critical areas or “weak links” in the bicycle system.  
Pursue a policy change with the Tennessee Department of Transportation to allow bicyclists on certain portions of limited access highways, such as the Pellissippi Parkway Bridge over Fort Loudoun Lake.

### Traffic Calming

Traffic Calming Programs work to improve neighborhood livability by addressing the impacts of excessive traffic and speeds. These program plan and implement projects on local streets to encourage the use of the arterial system and reduce traffic speeds. Traffic calming programs also aim to slow traffic speeds on residential neighborhood collector streets and make neighborhood more pedestrian and bicycle-friendly.

Most traffic calming projects involve the installation of such measures as traffic circles, speed humps, curb extensions, and diverters. Generally, these measures are complementary to bicycle travel. However, these measures can also be problematic to bicycles if not well planned and installed. The following considerations apply to all streets, but in particular, those streets on the Bicycle System.



Curb extension

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#### *Circles*

In general, cyclists often complain that they feel “squeezed” by motor vehicles trying to pass at a traffic circle. On streets where bicycle lanes are recommended (generally on streets above 5000 ADT), speed humps are preferable to traffic circles. When implementing traffic circles, careful consideration should be given to the impact of the circle on bicycle travel.

#### *Curb Extensions*

On streets without a centerline stripe, motor vehicles can safely pass cyclists at an intersection with a curb extension. On streets with a centerline stripe, the curb extension should be placed such that a 12’ (minimum) to 14’ (preferred) outside lane is left on the roadway to allow bicyclists to pass through the intersection safely. A 10’ auto lane next to a 4’ (minimum) bicycle lane is also acceptable. Otherwise, bicyclists will have to veer out into traffic, or motor vehicles will “squeeze” bicyclists going through the intersection.

#### *Speed Humps*

Speed humps should be built to the standard of 14’ or 22’ to slow motor vehicles while providing a smooth ride for cyclists.

#### *Diverters*

All traffic diverters should preserve bicycle turning movement options and through access unless



Traffic circle



Speed hump (raised crosswalk) [www.pedbikeimages.org](http://www.pedbikeimages.org) / Dan Burden

overriding safety concerns exist. A bicycle “cut-through” at full diverters should be wide enough (4’) to accommodate a bicycle trailer.

#### *Narrow Lanes*

Narrowing lanes by adding striped bike lanes or a striped shoulder can be used to reduce traffic speeds, and improve the street for bicyclists.

#### *Policy:*

Traffic calming programs shall consider the needs of bicyclists in design and engineering.

#### *Action Step:*

Develop a funded Traffic Calming Program in each jurisdiction.

### **Signage and Pavement Markings**

Well-designed roads usually require very little signing, because they are built so all users understand how to proceed. An overabundance of warning and regulatory signs may indicate a failure to address design problems. The attention of drivers, bicyclists and pedestrians should be on the road and other users, not on signs along the side of the road.

Part 9 of the *Manual on Uniform Traffic Control Devices 2000* and the 1999 *AASHTO Guide to the Development of Bicycle Facilities* should be followed in

providing traffic controls for bicycle facilities. See also p. 18 for signage policies.

### **Universal Design/ADA**

The American Disabilities Act was signed into law in 1990. The US Access Board is responsible for developing accessibility guidelines to ensure that new construction and reconstruction covered by ADA is readily accessible and usable by people with disabilities.

Universal design, also called accessibility, refers to facility designs that accommodate the widest range of users. Anything that makes facilities more accessible for people with disabilities improves accessibility for everyone. For example, curb ramps are necessary for wheelchair users but also aid parents with strollers or carts, child cyclists, rollerbladers and the elderly.

### **Construction Access**

Access for bicyclists must be maintained during construction and other projects disrupting travel, particularly on bridges. Bicyclists are sensitive to changes in their normal travel routes because of their slower speeds and exposure to noise, dirt and fumes. Temporary lane restrictions, detours and other traffic control measures instituted during construction should be designed to accommodate non-motorized travelers whenever possible, especially in areas where bicycling is common.

If the disruption occurs in a bicycle lane over a short distance (approximately 500’ or less), bicyclists should be routed to share a motor vehicle lane. For longer distances or on busy roadways, a temporary bicycle lane or wide outside lane should be provided. Bicyclists should not be routed onto sidewalks with pedestrians unless the traffic engineer deems there to be no reasonable alternative. If the proposed work is on a designated bikeway and there can be no accommodation for bicyclists, a reasonable detour needs to be established and signed (refer to the *Manual on Uniform Traffic Control Devices*, Part 9).



Important considerations for street disruptions include:

- Metal plates create a slick and dangerous surface for cyclists, and are not easily visible at night or in the rain. If metal plates are to be used to accommodate traffic, the plates may not have a vertical edge greater than one inch without a temporary asphalt lip to accommodate bicyclists. Barricades with flashers should be placed at least 20 feet in advance.
- Construction holes or depressions should never be left without physical barriers preventing cyclists from falling in. For holes that need to be left for over two days, temporary fill should be used to create a level surface for the hole or depression. If the hole is to remain for less than two days, barricades with flashers should be placed to prevent cyclists from riding into it.
- In all cases of road surface construction or other disruptions, barricades with flashers should be placed at least 20 feet in advance.
- The placement of advance construction signs should not obstruct the bicyclist's path. Where there is sufficient room, placing signs half on the sidewalk and half on the roadway may be the best solution where there is no planting strip.

*Action Steps:*

Develop a policy requiring that bicycle and pedestrian access be maintained during construction. When access is not feasible, detour routes should be as short as possible. Educate project managers about the policy and its significance. Provide better signage during construction to indicate work in progress, road or path conditions and, alternate route information when applicable.

# MAINTENANCE

Bicyclists are more susceptible to irregularities in roadway conditions than motor vehicles, due to bicycles' narrow tires and light weight. Deterioration of the road surface such as potholes and debris increases the potential for injury. Continued and improved maintenance of roadways is essential to ensuring a high level of comfort and safety for bicyclists. Another benefit is decreased potential liability for local governments.

## Sweeping

Debris, such as gravel, glass and leaves, in the roadway is not only an impediment to bicycling, it is also a hazard. Motor vehicle traffic tends to push debris from the travel lanes to the outside of the travel lane, which is the very area that bicyclists are utilizing. All collectors and arterials should be swept several times a year, but bike lanes and shoulders need to be swept even more often to be kept clean.

### *Action Steps:*

- Develop a policy regarding sweeping of roads, including shoulders and bike lanes, that addresses bicyclists' needs.



- Ensure that maintenance workers are aware of the policy.

## Minor Repairs/Improvements

The roadway edge is often the first part of the road to experience pavement cracking or break-up. This is also the area most traveled by bicyclists. The current practice for identifying these locations relies on requests from the public. A more proactive approach is needed.

Problems are not limited to potholes and pavement cracks. As streets have been resurfaced, drainage grates and gutters have remained at their original height, resulting in sometimes several inches of difference between the height of the road and the height of the grate or gutter. This creates a dangerous situation for bicyclists. Similarly, the direction of the grate slots should be perpendicular to the direction of travel. Bicycle tires can get caught in slots that are parallel, resulting in bicyclist injuries and property damage.

Loop detectors at traffic signals are a difficult problem, which is addressed on page 32 under "Intersections."



Often, bicycles and even motorcycles do not trigger the detector, resulting in a continual red light. The sensitivity of the detectors can be adjusted, and this should be the first attempt to fix a problem intersection.

When roads are resurfaced, there is opportunity to provide bicycle facilities inexpensively. If there is sufficient width, restriping could provide space for bicycles through bike lanes, shoulders or wide curb lanes. Bicycle Compatibility Index analysis can provide input on what type of facility would be appropriate for a specific road (see p. 15).

Unpaved roads and driveways can be a problem when they intersect a paved roadway. Debris is tracked onto the paved surface by motor vehicles. This is not only a hazard for bicyclists, but also contributes to air pollution (particulate matter). Requiring a paved apron on the unpaved roads and driveways would reduce the amount of debris on the main road.

While bicycling on sidewalks is not encouraged, in some locations there is little alternative due to road width, traffic volumes and traffic speeds. To facilitate bicyclists, as well as people with disabilities, curb ramps should be installed at every intersection and access (driveway). The preferred design is with two ramps, one on each street. As long as the single ramp is large enough to encompass both crosswalks, this meets ADA guidelines. These large ramps, however, allow motorists to go faster and cut corners, which can endanger pedestrians and cyclists.

*Policies:*

When resurfacing roadways with sufficient width, consider restriping lane widths for bicyclists (consult with Bicycle Advisory Committee and/or use Bicycle Compatibility Analysis).

Raise drainage grates when resurfacing roadways to ensure a smooth, level surface for bicycling.

When resurfacing roadways with gutters, taper the asphalt at the edge of the road to meet the gutter edge.



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Curb cuts at intersections should be updated to current ADA standards, ideally with curb ramps on each street, rather than a single one on the corner.

*Action Steps:*

Develop a policy requiring 5'-10' aprons on gravel driveways or roads to be paved wherever a roadway is constructed or widened to prevent loose gravel from being carried out onto the shoulders.

Develop and implement an inspection and maintenance program that addresses minor repairs such as potholes, improper drainage grates, broken pavement and other hazards to bicyclists.

Ensure that vegetation does not encroach on sidewalks, bike lanes or shoulders, and does not impede sight distance at intersections.

Adjust sensitivity of loop detectors at traffic signals to detect bicycles.

Ensure that maintenance workers are aware of policies and bicyclists' needs.

## **Bicycling Improvement Program**

Requests from the public are a significant part of the maintenance program, and will continue to play an important role even as maintenance programs get more proactive. Currently, citizens can report problems such as potholes by calling 215-6000 in Knoxville, 966-7057 in Farragut, 215-5800 in Knox

County, 981-3302 in Maryville, 981-4146 in Alcoa and 982-4652 in Blount County.

Other cities have developed Bicycling Improvement Programs, which include a hotline, a postcard distributed throughout the area, and a website form. Currently, there is a volunteer Bicycle Hotline (675-BIKE) with links to area bicycle clubs and organizations. It could be possible to utilize this existing number to provide links to the city and county maintenance/public works departments.

*Action Step:*

Develop a Bicycling Improvement Program to gather and respond to citizen complaints and recommendations, utilizing a telephone hotline, Website and comment card.

### **Signage/Pavement Marking**

Pavement markings for bicycle lanes and other facilities need to be restriped occasionally, as do any other pavement markings. Signage needs to be replaced when damaged. Citizen reports can aid in identifying needed maintenance, but a regular inspection program should also be developed.

*Action Step:*

Develop and implement an inspection and maintenance program to address signage and pavement marking issues.



# ENFORCEMENT

Enforcement is necessary to enhance safety and promote proper observance of traffic laws. It is important for all road users to follow the rules—however, bicyclists are more vulnerable than motorists and are the ones usually hurt in a crash. A significant percentage of motor vehicle-bicycle crashes occur because the motorist failed to yield to a bicyclist at an intersection. Often, the motorist is not paying adequate attention, or does not realize that bicycles have the same rights as motor vehicles. Bicyclists who flagrantly disobey traffic laws give a bad name to cyclists in general, as well as endanger themselves and others.

The speed of motor vehicles can be a barrier to safe bicycling, so enforcement of speed limits should be encouraged. Enforcement of the laws relating to bicycle lanes is also important. Depending on the location of the bike lane, illegal parking may be an issue.

### *Action Steps:*

Establish a policy clarifying law enforcement agency's procedures regarding enforcement of laws concerning bicycles, including motorist behavior. Increase traffic law enforcement efforts focusing on those violations most likely to lead to bicycle-motor vehicle crashes.

Issue a press release clarifying the traffic laws with respect to bicyclists and motorists.

Educate and train law enforcement personnel in bicycle enforcement through recruit training, roll call training and/or in-service refresher courses.

Keep up-to-date on code/ordinance modifications that could affect bicyclists.

### **Bike Patrols**

The recent “police on bicycles” movement began in Seattle, WA, where the police department started using

bicycles because of congested downtown streets. The League of American Bicyclists sponsored a Police on Bikes Conference in 1991, and the International Police Mountain Bike Association was later formed. Currently, more than 10,000 police officers from 45 states have completed the IPMBA *Police Cyclist* training.

Bike patrols are cost effective—10 to 15 officers can be fully outfitted for the cost of one patrol car. Officers on bicycles can travel faster and farther than foot officers, and are able to patrol and pursue in areas inaccessible by car. Bicycles are quiet, allowing officers to ride up to the crime scene before being noticed. This has increased arrest rates in street crime. Police on bikes are much more approachable than officers in cars, resulting in improved public relations. Departments have also cited lower health care costs due to more healthy officers.

In addition to the benefits for the police department, bike patrols have significant benefits for the cycling community. Bicyclists are most easily recognized as legitimate road users when people see police on bikes. Other police personnel are exposed to the bicycle issues, and enforcement of traffic laws for all road users





becomes more consistent. Bike officers can initiate requests for road improvements where necessary for safe bicycle use.

Most jurisdictions within the TPO boundary have bicycle patrols. Some utilize the patrols primarily for special events rather than as a regular patrol unit.

*Action Steps:*

- Continue to train officers for bike patrols.
- Increase the use of bike patrols for standard duty, rather than concentrating on special events.
- Encourage bicycle patrol officers to continue to report road hazards to maintenance departments.

# EDUCATION AND SAFETY

Education of both motorists and bicyclists is an important way to prevent crashes and build a successful bicycle transportation system. Education programs can help dispel myths about bicycling, and encourage courteous and lawful behavior. Bicycle education programs are designed to increase bicycle safety by improving the ability to ride with traffic as well as heighten motorist awareness. The difficulties facing safety education programs results from the wide range of age groups requiring the training, and the need to adapt the training for each group.

There are three basic components of bicycling education:

- Developing safe cycling skills in children;
- Teaching adult cyclists their rights and responsibilities; and
- Teaching motorists how to more effectively share the road with cyclists.

## Cyclists

### *Youth Bicyclists*

School children are most effectively reached using an action-oriented teaching approach and repetitive practice along with awards and incentives. Awards and incentives can consist of certificates of completion or bicycle/pedestrian licenses, bicycle helmets and other accessories, or discount coupons for area bicycle shops.

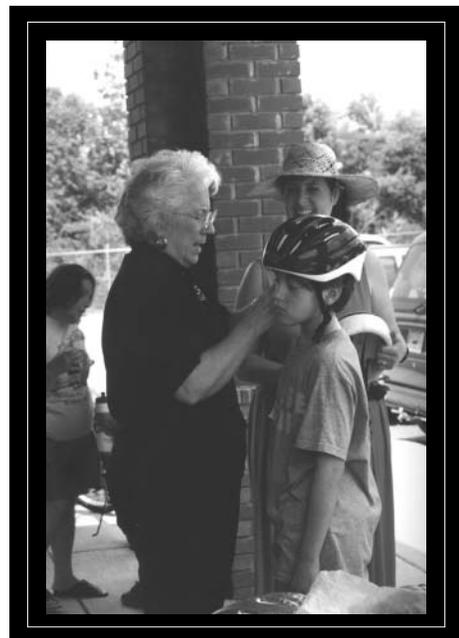
To reach the most children, it is important to work closely with schools so that children are receiving an age-appropriate bicycle safety message and are learning skills that will help them function safely on the roads. The following messages should be consistently taught:

- **Wear a helmet.** In the event of a bicycle crash, wearing a helmet reduces the risk of serious head injury by up to 85%. It could save your life.

- **Obey all traffic laws.** Bicyclists have the same rights and responsibilities as motorists.
- **Look left, then right, then left again before crossing streets.**
- **Always be alert.** Make eye contact with drivers and always be aware of what's going on around you.
- **Always ride with the flow of traffic.**
- **Be predictable.** Always signal your intentions.
- **Be visible.** Wear light-colored clothing and bright or reflective clothing and always use a front light and rear reflectors at night.
- In addition, very young children (seven or younger) should ride with supervision.

### *Adult Bicyclists*

Adult bicyclists fall into several different categories of riders. Some adults are comfortable riding on busy streets and mixing with traffic while others prefer quieter streets or paths. There are adults who ride a





bicycle only a few times a year and those who ride often but primarily for recreation. Each type of cyclist has his/her own concerns and philosophy about how bicycles fit into the transportation system. Education efforts must recognize this and tailor messages to each group.

It is also important to reach as wide a range of bicyclists as possible. Since adults do not often group together as a captive audience as school children do, it is important to offer a wide range of opportunities to improve their knowledge and skills related to bicycling. The following messages should be consistently taught:

- **Be alert.** Watch for other users and sudden behavior changes. Also, pay careful attention to potential road hazards, such as potholes and gravel. Adjust speed to maintain control of the bicycle. Make eye contact with drivers to ensure that they have seen you.
- **Obey all traffic laws.** Though it is tempting to run through traffic signals and stop signs, do not do it. Bicyclists have the same rights and responsibilities as motorists. Disobeying traffic laws gives cyclists a bad reputation and is potentially dangerous.
- **Always ride with the flow of traffic.** Ride where motorists and others expect cyclists, and never against traffic.
- **Be predictable.** Signal your turns, do not weave in and out of traffic and stay as far to the right as is practicable, except when:
  - traveling the same speed as traffic (as in downtown)
  - avoiding hazardous conditions
  - preparing to make a left turn, passing another vehicle or using a one-way street (in which case riding alongside the left curb is permitted)
  - the roadway is too narrow for a bicycle and a motor vehicle to travel safely side by side
- **Be visible.** Wear light-colored, bright or reflective clothing and use front lights and rear reflectors or lights at night.

- **Wear a helmet.**
- **Stay off sidewalks, whenever possible.** Bicycles are legally classified as vehicles and should behave as such. Sidewalks are intended for use by pedestrians not cyclists. When using sidewalks, bicyclists are should warn pedestrians audibly when passing, yield the right-of-way in conflict situations and travel at a walking speed at driveways and intersections when a motor vehicle is approaching. Remember, motorists are not expecting cyclists coming at them at driveways or approaches.
- **Do not drink alcohol and ride.** You are operating a vehicle. Take it seriously.

Currently, safety education programs in the region primarily reach children. Safety City, in conjunction with the Knoxville Police Department, coordinates three Safety Fairs each year with an emphasis on bike safety. (These fairs do reach parents since they must accompany their children.) Safety City conducts classes, which include bike rodeos, for second grade students throughout the year. Officers also go to day cares, civic groups such as Boy and Girl Scouts, apartment complexes and other locations to talk about bike safety. The University of Tennessee Police Department sends out safety flyers with registration information and provides information during orientation. The Maryville Police Department sponsors Bicycle Safety classes for kids, using bike rodeos sponsored by local businesses. The Tennessee Department of Health's Website has a Kids' Page with *10 Tips for Cyclewise Kids*.

### Motorists

Motorists are probably the most difficult group to reach with bicycle education. Education programs aimed at motorists can most easily take place during existing programs such as driver's training courses, driver's licensing exams and traffic school courses for violators.

Motorists should learn to look for cyclists in traffic just as they check for cars, especially when switching lane position, turning or going through an intersection. They

should look for cyclists in parking lots, and when entering and exiting roadways. Motorists should pay special attention to child cyclists, particularly in residential areas and near schools. Children often ride on the sidewalk, so motorists should check for them when entering or exiting driveways. Kids do not judge distance or speeds well, and the motorist should give them extra space and attention. Motorists should learn to be predictable by signaling turns well before an intersection.

Other topics to teach:

- Bike lanes and how to operate motor vehicles around them
- Why bicyclists choose to ride on arterials and collectors
- How to safely pass a bicyclist
- Why crashes happen and how to prevent them
- Importance of sharing the road and respecting other road users
- Why people bicycle—for health and fitness, transportation, recreation, the environment and to save money
- Why bicyclists sometimes swerve (to avoid road hazards such as broken glass or potholes)

Chapter 12 of Tennessee Drivers' Handbook has information on sharing road with cyclists. The drivers' exam, however, has no questions on Chapter 12 or bicycles.

*Action Steps:*

Coordinate the bicycle safety programs being conducted by various agencies, health care providers and organizations.

Provide and promote safety education and encouragement programs taught by qualified instructors and targeted to youth and adult bicyclists and motorists.

Increase the availability of and participation in

cyclist training courses for college students and adult bicyclists. (The adult-targeted *Effective Cycling* course by the League of American Bicyclists would serve the need and could be offered at bike shops and community centers.) Educate parent groups and adult groups that supervise children, such as PTAs, day care centers and youth camp operators.

Work with Tennessee Department of Safety on updates to the Drivers' Handbook to strengthen the bicycle section and include exam questions relating to bicycle issues.

Work for inclusion of motorist-bicyclist safety information in defensive driving courses.

## Crashes

The number of deaths nationwide due to bicycle-motor vehicle crashes has declined 20% in the past 10 years, from 859 in 1990 to 690 in 2000. The number of reported injuries is also decreasing, but this number is less reliable. From research in hospital records, it has been shown that many injuries from bicycle crashes are not reported to the police, and therefore do not show up in statistics. Approximately 40% of bicycle fatalities occur in 4 states: California, Florida, New York and Texas.

By analyzing the causes of nationwide bicycle-motor vehicle crashes, it is revealed that 21.6% of crashes are caused by a motorist failing to yield to a bicyclist. Just over 12% are caused by a motorist turning or merging into the path of a cyclist. Less than 9% are caused by a motorist overtaking a cyclist. About 28% are caused by a bicyclist failing to yield to a motorist, and 7% by a bicyclist turning into the path of a motorist.<sup>12</sup>

*Action Steps:*

Continue to monitor and improve the data available on bicycle crashes.

<sup>12</sup> www.bicyclinginfo.org

Identify locations and corridors with more than one crash reported, and look for potential improvements.

Train law enforcement staff in the investigation of crashes involving bicyclists.

# OUTREACH AND PROMOTION

## Public Information

Well-designed and distributed public information can vastly increase the community's awareness and use of bicycling. It can also help modify behavior of motorists and bicyclists, and galvanize public interest in bicycling issues and trends.

The volunteer Bicycle Hotline (675-BIKE) has information on bike rides and other events sponsored by various bike clubs around the area. Most bike clubs and bike shops have Websites with information on various events.

### *Action Steps:*

Promote bicycling for transportation as well as recreation, particularly for trips to school, work, shopping and special events.

Increase awareness of the benefits of bicycling, and the rights and responsibilities of bicyclists and motorists.

Develop a public information and education campaign to encourage bicycling and improve the behavior of both motorists and bicyclists.



October 2001 neighborhood bike ride.

Develop a bicycle map of downtown, UT and surrounding neighborhoods showing existing conditions on roadways to highlight the best ways to travel by bicycle.

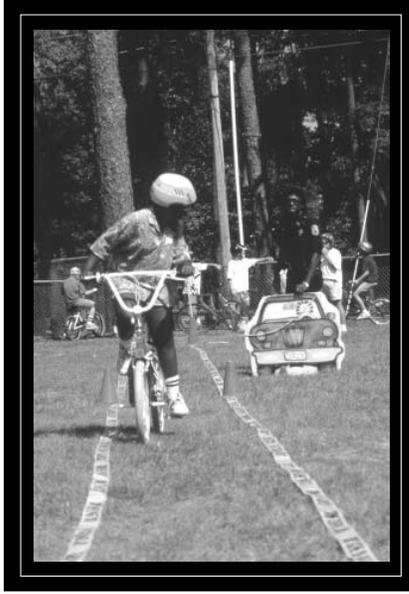
Establish, maintain and publicize a Webpage and telephone hotline with information and links to other agencies/organizations/Websites.

Develop a *Guide to Bicycle Resources* with information on bike clubs, shops, events and other useful information.

Develop a *Bike to Work Guide* for Knoxville, with information for employers and employees on benefits, safety and available resources.

## Programs/Special Events

Programs and special events can increase public awareness of bicycling in a positive light. Programs such as bike rides can also introduce people to bicycling in a fun and easy way, making it more likely that they will try bicycling again. Bike Week events can be diverse enough to capture a wide audience, including children, college students and adults. The City of Chicago Mayor's Office has a *Bicycling Ambassadors* Program, which sends Ambassadors to festivals, parks, libraries, community meetings and other public places to promote bicycling safety and encourage bicycling. The Ambassadors offer many services, including bicycle safety checks, demonstrations of bike racks on buses, teaching people how to ride to work/school and instruction on the use of bike lanes. Chicago also has a *Safe Routes to School* program, coordinated by the Chicagoland Bicycle Federation and sponsored by the Chicago Department of Transportation. Schools can receive help from transportation and bicycle safety experts to develop a safe way for children to ride to school.



www.pedbikeimages.org / Dan Burden

Knoxville had a Bike to Work Day in 2001, with over 100 participants. In 2002, Knoxville's first Bike Week was held from April 227 to May 4. There were more than 15 different events throughout the week.

#### *Action Steps:*

Continue to increase the number of special events and programs that encourage bicycling, including bicycle rides, bike giveaways and Bike Week events. Develop a *Safe Routes to School* program in conjunction with Bike to School Day during Bike Week, but to be used year-round.

## Community Services

Many communities have strong, diverse volunteer efforts to support bicycling services. Some are educational efforts, while others are repair and maintenance-oriented. Bike clubs or bike shops can offer repair classes for free or a nominal fee. Police departments and hospitals often sponsor bicycle light and helmet giveaways. Some communities have free public bikes for people to use; others have checkout bike programs.

Portland has a *Create A Commuter* Program, sponsored by the Community Cycling Center in partnership with many social service agencies, and with funding from the federal Job Access program. The program equips low-income participants with commuter bicycles with lights, rack, fender, helmet, maps and raingear. Participants attend a workshop teaching them the basics of urban bicycle commuting, safety, basic maintenance and roadside repair. Currently, the Center has funding for 100 participants a year.

#### *Action Steps:*

Coordinate and continue bike light, helmet and bike giveaway efforts by various agencies and groups.

Develop a bicycle checkout program focused at the University of Tennessee and downtown.

Increase and publicize the number of free repair classes offered throughout the community.

## Workshops

Most planners and engineers have had no training in bicycle issues. Workshops, including on-the-bike sessions, can help expose these professionals to the needs and rights of bicyclists, and the proper design of bicycle facilities. The Chicagoland Bicycle Federation's Streets for Cycling program takes city traffic planners and engineers out on bike tours to show them that bike lanes are used, and to get them to think about bike lanes in their design work.

#### *Action Steps:*

Provide regular workshops and other training opportunities for local planners, engineers, representatives from enforcement and emergency response, and other professionals on bicycle transportation and facility design issues.

Develop a presentation for interested groups, such as Leadership Knoxville and Leadership Blount.



# APPENDIX A:

# GLOSSARY

## **Bicycle (or “Bike”)**

A vehicle propelled by human power upon which any person may ride, having two tandem wheels, except scooters and similar devices. The term also applies to three- and four-wheeled human-powered vehicles, but not tricycles for children.

## **Bicycle Facilities**

A general term denoting improvements and provisions made by public agencies to accommodate or encourage bicycling, including parking and storage facilities, bike lanes, paved shoulders and wide outside lanes.

## **Bicycle Lane (“Bike Lane”)**

A portion of a roadway that has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists.

## **Bicycle Path (“Bike Path”)**

See *Shared Use Path*

## **Bicycle System**

A system of bikeways designated by the jurisdiction having authority with appropriate directional and informational signage. Bicycle systems should establish a continuous routing, but may be a combination of any and all types of bikeways.

## **Bikeway**

A generic term for a road, street, or path that in some way 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. *This term can be used interchangeably with “bicycle facility.”*

## **Greenway**

A corridor of undeveloped land, usually in an urban area, which is set aside or used for conservation and/or recreation. Greenways can also serve as pedestrian and bicycle facilities for recreation and transportation. In this region, the term is often used to mean a *Shared Use Path*, rather than the more complete definition of greenway.

## **Right-of-Way**

A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to transportation purposes.

## **Right of Way**

The right of one vehicle or pedestrian to proceed in a lawful manner in preference to another vehicle or pedestrian.

## **Roadway**

A general term denoting a public way intended for vehicular use.

## **Rumble Strips**

A textured or grooved pavement sometimes used on or along shoulders of highways to alter motorists who stray onto the shoulder.

## **Shared Roadway**

A roadway that is open to both bicycle and motor vehicle travel. This may be an existing roadway, street with wide curb lanes or road with paved shoulders.

## **Shared Use Path**

A bikeway physically separated from motorized vehicular traffic by an open space or barrier and either within the roadway right-of-way or within an independent right-of-way. Shared use paths may also be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users.

## **Shoulder**

The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use and for lateral support of sub-base, base and surface courses. In rural areas, this portion may also be used for bicycle and pedestrian travel.

## **Sidewalk**

The portion of the street or highway right-of-way designated for preferential or exclusive use of pedestrians.

## **Signed Shared Roadway (Signed Bike Route)**

A shared roadway that has been designated by signing as a preferred route for bicycle use.





## APPENDIX B:

# PRIORITIZED ACTION STEPS

### CONTINUAL

- Pursue grants and other funding sources in addition to TEA-21 monies.
- Continue to support the efforts of the Bicycle Advisory Committee.
- Produce quarterly progress reports on Bicycle Plan implementation.
- Work with bike organizations to implement the Bicycle Plan in conjunction with their groups' missions.
- Make transportation funding information available so the public has a better understanding of how projects get funded.
- Facilitate citizen involvement by providing information on bicycle programs and events, and comment on transportation projects.
- Advertise the availability of bike racks on buses and bike parking.
- Provide for appropriate access control on arterial roadways in order to increase the function and safety of these roadways for both bicyclists and motorists, while at the same time ensuring adequate access and crossing opportunities for pedestrians and bicyclists.
- Research innovative treatments used in other communities and determine if they would be applicable in Knoxville.
- Provide better signage during construction to indicate work in progress, road or path conditions and, alternate route information when applicable.
- Ensure that vegetation does not encroach on sidewalks, bike lanes or shoulders, and does not impede sight distance at intersections.
- Adjust sensitivity of loop detectors at traffic signals to detect bicycles.
- Educate and train law enforcement personnel in bicycle enforcement.
- Keep up-to-date on code/ordinance modifications that could affect bicyclists.
- Continue to train officers for bike patrols.
- Encourage bicycle patrol officers to continue to report road hazards.
- Provide and promote safety education and encouragement programs taught by qualified instructors and targeted to youth and adult bicyclists and motorists.
- Work with Tennessee Department of Safety on updates to the Drivers' Handbook to strengthen the bicycle section and include exam questions relating to bicycle issues.
- Work for inclusion of motorist-bicyclist safety information in defensive driving courses.
- Continue to monitor and improve the data available on bicycle crashes.
- Identify locations and corridors with more than one crash reported, and look for potential improvements.
- Train law enforcement staff in the investigation of crashes involving bicyclists.
- Continue to increase the number of special events and programs that encourage bicycling, including bicycle rides, bike giveaways and Bike Week events.
- Coordinate and continue bike light, helmet and bike giveaway efforts by various agencies and groups.
- Provide regular workshops and other training opportunities for local planners, engineers and parks and recreation professionals on bicycle transportation and facility design issues.



## PRIORITY I (FIRST YEAR)

- Establish clear roles and responsibilities for all affected agencies and departments in the implementation of the Bicycle Plan.
- Utilize Bicycle Compatibility Index analysis to develop a recommended bicycle system for the TPO study area, with a prioritized implementation plan.
- Develop improvement projects to focus on “weak links” in the bicycle system.
- Pursue a policy change with the Tennessee Department of Transportation to allow bicyclists on certain portions of limited access highways.
- Adopt the US DOT *Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure*.
- Identify locations for “Share the Road” and other related signs and recommend to the appropriate departments/agencies.
- Work with Knoxville *Smart Trips* Program to encourage employers to implement incentive programs and develop facilities to encourage employees to bicycle to work
- Consider including a bikestation in the Downtown Intermodal Transfer Center and at the University of Tennessee.
- Implement the Bicycle Parking/Enhancement Program, which provides bicycle parking facilities and “company” bicycles to businesses and agencies.
- Develop a policy requiring that bicycle and pedestrian access be maintained during construction. When access is not feasible, detour routes should be as short as possible.
- Educate project managers about the construction access policy and its significance.
- Develop a policy regarding sweeping of roads, including shoulders and bike lanes, that addresses bicyclists’ needs.
- Develop and implement an inspection and maintenance program that addresses minor repairs such as potholes, improper drainage grates, broken pavement and other hazards to bicyclists.
- Ensure that maintenance workers are aware of the maintenance policies.
- Develop a Bicycling Improvement Program to gather and respond to citizen complaints and recommendations, utilizing a telephone hotline, Website and comment card.
- Issue a press release clarifying the traffic laws with respect to bicyclists and motorists.
- Establish a policy clarifying law enforcement agency’s procedures regarding enforcement of laws concerning bicycles, including motorist behavior.
- Increase the use of bike patrols for standard duty, rather than concentrating on special events.
- Coordinate the bicycle safety programs being conducted by various agencies, health care providers and organizations.
- Promote bicycling for transportation as well as recreation, particularly for trips to school, work, shopping and special events.
- Increase awareness of the benefits of bicycling, and the rights and responsibilities of bicyclists and motorists.
- Develop a public information and education campaign to encourage bicycling and improve the behavior of both motorists and bicyclists.

- Develop a bicycle map of downtown, UT and surrounding neighborhoods showing existing conditions on roadways to highlight the best ways to travel by bicycle.
- Establish, maintain and publicize a webpage and telephone hotline with information and links to other agencies/organizations/websites.
- Develop a *Guide to Bicycle Resources* with information on bike clubs, shops, events and other useful information.
- Develop a *Bike to Work Guide* for Knoxville, with information for employers and employees on benefits, safety and available resources.
- Increase and publicize the number of free repair classes offered throughout the community.
- Develop a presentation for interested groups, such as Leadership Knoxville and Leadership Blount.

## PRIORITY II (SECOND YEAR)

- Establish a Bicycle Program staffed at a level sufficient to implement the Bicycle Plan.
- Ensure that all jurisdictions support and participate in the Bicycle Program.
- Ensure that all buses within the TPO boundary, including downtown trolleys, have racks to carry at least two bicycles.
- Revise zoning and subdivision regulations to include bicycle-friendly policies as requirements of developments.
- Adopt the Bicycle Parking Requirements and Guidelines included in the Appendix.
- Develop a policy requiring 5 to 10 foot aprons on gravel driveways or roads to be paved wherever a roadway is constructed or widened to prevent loose gravel from being carried out onto the shoulders.
- Develop and implement an inspection and maintenance program to address signage and pavement marking issues.
- Increase traffic law enforcement efforts focusing on those violations most likely to lead to bicycle-motor vehicle crashes.
- Increase the availability of and participation in cyclist training courses for college students and adult bicyclists. (The adult-targeted *Effective Cycling* course by the League of American Bicyclists would serve the need and could be offered at bike shops and community centers.)
- Develop a bicycle checkout program focused at the University of Tennessee and downtown.
- Review the Bicycle Plan every two years and revise as necessary.



### PRIORITY III (3 - 5 YEARS)

- Develop and implement destination-based signing for the bicycle system.
- Research the ability to carry more bicycles on buses where the racks are frequently full.
- Provide bike parking at major bus stops and transfer points, including short-term and long-term parking.
- Develop a coordinated land use and transportation plan for more efficient use of land and infrastructure in the future.
- Form a committee of businesses, organizations and agencies interested in economic development and bicycle tourism.
- Develop a funded Traffic Calming Program in each jurisdiction.
- Educate parent groups and adult groups that supervise children, such as PTAs, day care centers and youth camp operators.
- Develop a *Safe Routes to School* program in conjunction with Bike to School Day during Bike Week, but to be used year-round.
- Update the Plan every five years.

DESIGN GUIDANCE  
ACCOMMODATING BICYCLE AND PEDESTRIAN TRAVEL:  
A RECOMMENDED APPROACH

US DOT POLICY STATEMENT  
ON INTEGRATING BICYCLING AND WALKING  
INTO TRANSPORTATION INFRASTRUCTURE

### Purpose

**Accommodating Bicycle and Pedestrian Travel: A Recommended Approach** is a policy statement adopted by the United States Department of Transportation. USDOT hopes that public agencies, professional associations, advocacy groups, and others adopt this approach as a way of committing themselves to integrating bicycling and walking into the transportation mainstream.

The Design Guidance incorporates three key principles:

- a) a policy statement that **bicycling and walking facilities will be incorporated into all transportation projects** unless exceptional circumstances exist;
- b) an approach to achieving this policy that has already worked in State and local agencies; and
- c) 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.

The Policy Statement was drafted by the U.S. Department of Transportation in response to Section 1202 (b) of the Transportation Equity Act for the 21st Century (TEA-21) with the input and assistance of public agencies, professional associations and advocacy groups.

### Introduction

Bicycling and walking issues have grown in significance throughout the 1990s. As the new millennium dawns public agencies and public interest groups alike are striving to define the most appropriate way in which to accommodate the two modes within the overall transportation system so that those who walk or ride bicycles can safely, conveniently, and comfortably access every destination within a community.

Public support and advocacy for improved conditions for bicycling and walking has created a widespread acceptance that more should be done to enhance the safety, comfort, and convenience of the nonmotorized traveler. Public opinion surveys throughout the 1990s have demonstrated strong support for increased planning, funding and implementation of shared use paths, sidewalks and on-street facilities.

At the same time, public agencies have become considerably better equipped to respond to this demand. Research and practical experience in designing facilities for bicyclists and pedestrians has generated numerous national, State and local design manuals and resources. An increasing number of professional planners and engineers are familiar with this material and are applying this knowledge in towns and cities across the country.



The 1990 Americans with Disabilities Act, building on an earlier law requiring curb ramps in new, altered, and existing sidewalks, added impetus to improving conditions for sidewalk users. People with disabilities rely on the pedestrian and transit infrastructure, and the links between them, for access and mobility.

Congress and many State legislatures have made it considerably easier in recent years to fund nonmotorized projects and programs (for example, the Intermodal Surface Transportation Efficiency Act and the Transportation Equity Act for the 21st Century), and a number of laws and regulations now mandate certain planning activities and design standards to guarantee the inclusion of bicyclists and pedestrians.

Despite these many advances, injury and fatality numbers for bicyclists and pedestrians remain stubbornly high, levels of bicycling and walking remain frustratingly low, and most communities continue to grow in ways that make travel by means other than the private automobile quite challenging. Failure to provide an accessible pedestrian network for people with disabilities often requires the provision of costly paratransit service. Ongoing investment in the Nation's transportation infrastructure is still more likely to overlook rather than integrate bicyclists and pedestrians.

In response to demands from user groups that every transportation project include a bicycle and pedestrian element, Congress asked the Federal Highway Administration (FHWA) to study various approaches to accommodating the two modes. The Transportation Equity Act for the 21st Century (TEA-21) instructs the Secretary to work with professional groups such as AASHTO, ITE, and other interested parties to recommend policies and standards that might achieve the overall goal of fully integrating bicyclists and pedestrians into the transportation system.

TEA-21 also says that, "Bicycle transportation facilities and pedestrian walkways shall be considered, where appropriate, in conjunction with all new construction

and reconstruction of transportation projects, except where bicycle and pedestrian use are not permitted." (Section 1202)

In August 1998, FHWA convened a Task Force comprising representatives from FHWA, AASHTO, ITE, bicycle and pedestrian user groups, State and local agencies, the U.S. Access Board and representatives of disability organizations to seek advice on how to proceed with developing this guidance. The Task Force reviewed existing and proposed information on the planning and technical design of facilities for bicyclists and pedestrians and concluded that these made creation of another design manual unnecessary. For example, AASHTO published a bicycle design manual in 1999 and is working on a pedestrian facility manual.

The area where information and guidance was most lacking was in determining when to include designated or special facilities for bicyclists and pedestrians in transportation projects. There can also be uncertainty about the type of facility to provide, and the design elements that are required to ensure accessibility.

For example, when a new suburban arterial road is planned and designed what facilities for bicyclists and pedestrians should be provided? The task force felt that once the decision to provide a particular facility was made, the specific information on designing that facility is generally available. However, the decision on whether to provide sidewalks on neither, one or both sides of the road, or a shoulder, striped bike lane, wide outside lane or separate trail for bicyclists is usually made with little guidance or help.

After a second meeting with the Task Force in January 1999, FHWA agreed to develop a **Policy Statement on Accommodating Bicyclists and Pedestrians in Transportation Projects** to guide State and local agencies in answering these questions. Task Force members recommended against trying to create specific warrants for different facilities (warrants leave

little room for engineering judgement and have often been used to avoid providing facilities for bicycling and walking). Instead, the purpose of the Policy Statement is to provide a recommended approach to the accommodation of bicyclists and pedestrians that can be adopted by State and local agencies (as well as professional societies and associations, advocacy groups, and Federal agencies) as a commitment to developing a transportation infrastructure that is safe, convenient, accessible, and attractive to motorized AND nonmotorized users alike. The Policy Statement has four elements:

- a) an acknowledgment of the issues associated with balancing the competing interests of motorized and nonmotorized users;
- b) a recommended policy approach to accommodating bicyclists and pedestrians (including people with disabilities) that can be adopted by an agency or organizations as a statement of policy to be implemented or a target to be reached in the future;
- c) a list of recommended actions that can be taken to implement the solutions and approaches described above; and
- d) further information and resources on the planning, design, operation, and maintenance of facilities for bicyclists and pedestrians.

## The Challenge: Balancing Competing Interests

For most of the second half of the 20th Century, the transportation, traffic engineering and highway professions in the United States were synonymous. They shared a singular purpose: building a transportation system that promoted the safety, convenience and comfort of motor vehicles. The post-war boom in car and home ownership, the growth of suburban America, the challenge of completing the Interstate System, and the continued availability of cheap gasoline all fueled the development of a transportation infrastructure focused almost exclusively on the private motor car and commercial truck.

Initially, there were few constraints on the traffic engineer and highway designer. Starting at the centerline, highways were developed according to the number of motor vehicle travel lanes that were needed well into the future, as well as providing space for breakdowns. Beyond that, facilities for bicyclists and pedestrians, environmental mitigation, accessibility, community preservation, and aesthetics were at best an afterthought, often simply overlooked, and, at worst, rejected as unnecessary, costly, and regressive. Many States passed laws preventing the use of State gas tax funds on anything other than motor vehicle lanes and facilities. The resulting highway environment discourages bicycling and walking and has made the two modes more dangerous. Further, the ability of pedestrians with disabilities to travel independently and safely has been compromised, especially for those with vision impairments.

Over time, the task of designing and building highways has become more complex and challenging. Traffic engineers now have to integrate accessibility, utilities, landscaping, community preservation, wetland mitigation, historic preservation, and a host of other concerns into their plans and designs - and yet they often have less space and resources within which to operate and traffic volumes continue to grow.

The additional “burden” of having to find space for pedestrians and bicyclists was rejected as impossible in many communities because of space and funding constraints and a perceived lack of demand. There was also anxiety about encouraging an activity that many felt to be dangerous and fraught with liability issues. Designers continued to design from the centerline out and often simply ran out of space before bike lanes, paved shoulders, sidewalks and other “amenities” could be included.

By contrast, bicycle and pedestrian user groups argue the roadway designer should design highways from the right-of-way limits in, rather than the centerline out. They advocate beginning the design of a highway with the sidewalk and/or trail, including a buffer before



the paved shoulder or bike lane, and then allocating the remaining space for motor vehicles. Through this approach, walking and bicycling are positively encouraged, made safer, and included as a critical element in every transportation project rather than as an afterthought in a handful of unconnected and arbitrary locations within a community.

Retrofitting the built environment often provides even more challenges than building new roads and communities: space is at a premium and there is a perception that providing better conditions for bicyclists and pedestrians will necessarily take away space or convenience from motor vehicles.

During the 1990s, Congress spearheaded a movement towards a transportation system that favors people and goods over motor vehicles with passage of the Intermodal Surface Transportation Efficiency Act (1991) and the Transportation Equity Act for the 21st Century (1998). The call for more walkable, liveable, and accessible communities has seen bicycling and walking emerge as an “indicator species” for the health and well-being of a community. People want to live and work in places where they can safely and conveniently walk and/or bicycle and not always have to deal with worsening traffic congestion, road rage and the fight for a parking space. Vice President Gore launched a Livability Initiative in 1999 with the ironic statement that “a gallon of gas can be used up just driving to get a gallon of milk.”

**The challenge for transportation planners, highway engineers and bicycle and pedestrian user groups, therefore, is to balance their competing interest in a limited amount of right-of-way, and to develop a transportation infrastructure that provides access for all, a real choice of modes, and safety in equal measure for each mode of travel.**

This task is made more challenging by the widely divergent character of our nation’s highways and byways. Traffic speeds and volumes, topography, land

use, the mix of road users, and many other factors mean that a four-lane highway in rural North Carolina cannot be designed in the same way as a four-lane highway in New York City, a dirt road in Utah or an Interstate highway in Southern California. In addition, many different agencies are responsible for the development, management, and operation of the transportation system.

In a recent memorandum transmitting Program Guidance on bicycle and pedestrian issues to FHWA Division Offices, the Federal Highway Administrator wrote that “We expect every transportation agency to make accommodation for bicycling and walking a routine part of their planning, design, construction, operations and maintenance activities.” The Program Guidance itself makes a number of clear statements of intent:

- Congress clearly intends for bicyclists and pedestrians to have safe, convenient access to the transportation system and sees every transportation improvement as an opportunity to enhance the safety and convenience of the two modes.
- “Due consideration” of bicycle and pedestrian needs should include, at a minimum, a presumption that bicyclists and pedestrians will be accommodated in the design of new and improved transportation facilities.
- To varying extents, bicyclists and pedestrians will be present on all highways and transportation facilities where they are permitted and it is clearly the intent of TEA-21 that all new and improved transportation facilities be planned, designed and constructed with this fact in mind.
- The decision not to accommodate [bicyclists and pedestrians] should be the exception rather than the rule. There must be exceptional circumstances for denying bicycle and pedestrian access either by prohibition or by designing highways that are incompatible with safe, convenient walking and bicycling.

The Program Guidance defers a suggested definition of what constitutes “exceptional circumstances” until this Policy Statement is completed. However, it does offer interim guidance that includes controlled access highways and projects where the cost of accommodating bicyclists and pedestrians is high in relation to the overall project costs and likely level of use by nonmotorized travelers.

Providing access for people with disabilities is a civil rights mandate that is not subject to limitation by project costs, levels of use, or “exceptional circumstances”. While the Americans with Disabilities Act doesn’t require pedestrian facilities in the absence of a pedestrian route, it does require that pedestrian facilities, when newly constructed or altered, be accessible.

### Policy Statement

1. Bicycle and pedestrian ways shall be established in new construction and reconstruction projects in all urbanized areas unless one or more of three conditions are met:

bicyclists and pedestrians are prohibited by law from using the roadway. In this instance, a greater effort may be necessary to accommodate bicyclists and pedestrians elsewhere within the right of way or within the same transportation corridor. the cost of establishing bikeways or walkways would be excessively disproportionate to the need or probable use. Excessively disproportionate is defined as exceeding twenty percent of the cost of the larger transportation project. where sparsity of population or other factors indicate an absence of need. For example, the Portland Pedestrian Guide requires “all construction of new public streets” to include sidewalk improvements on both sides, unless the street is a cul-de-sac with four or fewer dwellings or the street has severe topographic or natural resource constraints.

2. In rural areas, paved shoulders should be included in all new construction and reconstruction projects on roadways used by more than 1,000 vehicles per day, as in States such as Wisconsin. Paved shoulders have safety and operational advantages for all road users in addition to providing a place for bicyclists and pedestrians to operate.

Rumble strips are not recommended where shoulders are used by bicyclists unless there is a minimum clear path of four feet in which a bicycle may safely operate.

3. Sidewalks, shared use paths, street crossings (including over- and undercrossings), pedestrian signals, signs, street furniture, transit stops and facilities, and all connecting pathways shall be designed, constructed, operated and maintained so that all pedestrians, including people with disabilities, can travel safely and independently.

4. The design and development of the transportation infrastructure shall improve conditions for bicycling and walking through the following additional steps:

planning projects for the long-term. Transportation facilities are long-term investments that remain in place for many years. The design and construction of new facilities that meet the criteria in item 1) above should anticipate likely future demand for bicycling and walking facilities and not preclude the provision of future improvements. For example, a bridge that is likely to remain in place for 50 years, might be built with sufficient width for safe bicycle and pedestrian use in anticipation that facilities will be available at either end of the bridge even if that is not currently the case. addressing the need for bicyclists and pedestrians to cross corridors as well as travel along them. Even where bicyclists

and pedestrians may not commonly use a particular travel corridor that is being improved or constructed, they will likely need to be able to cross that corridor safely and conveniently. Therefore, the design of intersections and interchanges shall accommodate bicyclists and pedestrians in a manner that is safe, accessible and convenient. getting exceptions approved at a senior level. Exceptions for the non-inclusion of bikeways and walkways shall be approved by a senior manager and be documented with supporting data that indicates the basis for the decision. designing facilities to the best currently available standards and guidelines. The design of facilities for bicyclists and pedestrians should follow design guidelines and standards that are commonly used, such as the *AASHTO Guide for the Development of Bicycle Facilities*, *AASHTO's A Policy on Geometric Design of Highways and Streets*, and the ITE Recommended Practice "*Design and Safety of Pedestrian Facilities*".

## Policy Approach

### "Rewrite the Manuals" Approach

Manuals that are commonly used by highway designers covering roadway geometrics, roadside safety, and bridges should incorporate design information that integrates safe and convenient facilities for bicyclists and pedestrians — including people with disabilities - into all new highway construction and reconstruction projects.

In addition to incorporating detailed design information - such as the installation of safe and accessible crossing facilities for pedestrians, or intersections that are safe and convenient for bicyclists - these manuals should also be amended to provide flexibility to the highway designer to develop facilities that are in keeping with transportation needs, accessibility, community values, and aesthetics. For example, the Portland Pedestrian Design Guide (June

1998) applies to every project that is designed and built in the city, but the Guide also notes that:

"Site conditions and circumstances often make applying a specific solution difficult. The Pedestrian Design Guide should reduce the need for ad hoc decision by providing a published set of guidelines that are applicable to most situations. Throughout the guidelines, however, care has been taken to provide flexibility to the designer so she or he can tailor the standards to unique circumstances. Even when the specific guideline cannot be met, the designer should attempt to find the solution that best meets the pedestrian design principles described [on the previous page]"

In the interim, these manuals may be supplemented by stand-alone bicycle and pedestrian facility manuals that provide detailed design information addressing on-street bicycle facilities, fully accessible sidewalks, crosswalks, and shared use paths, and other improvements. Examples: Florida DOT has integrated bicycle and pedestrian facility design information into its standard highway design manuals and New Jersey DOT is in the process of doing so. Many States and localities have developed their own bicycle and pedestrian facility design manuals, some of which are listed in the final section of this document.

## Applying Engineering Judgement to Roadway Design

In rewriting manuals and developing standards for the accommodation of bicyclists and pedestrians, there is a temptation to adopt "typical sections" that are applied to roadways without regard to travel speeds, lane widths, vehicle mix, adjacent land uses, traffic volumes and other critical factors. This approach can lead to inadequate provision on major roads (e.g. a four foot bike lane or four foot sidewalk on a six lane high-speed urban arterial) and the over-design of local and neighborhood streets (e.g. striping bike lanes on low volume residential roads) , and leaves little room for engineering judgement.

After adopting the policy that bicyclists and pedestrians (including people with disabilities) will be fully integrated into the transportation system, State and local governments should encourage engineering judgement in the application of the range of available treatments.

For example:

- Collector and arterial streets shall typically have a minimum of a four foot wide striped bicycle lane, however wider lanes are often necessary in locations with parking, curb and gutter, heavier and/or faster traffic.
- Collector and arterial streets shall typically have a minimum of a five foot sidewalk on both sides of the street, however wider sidewalks and landscaped buffers are necessary in locations with higher pedestrian or traffic volumes, and/or higher vehicle speeds. At intersections, sidewalks may need to be wider to accommodate accessible curb ramps.
- Rural arterials shall typically have a minimum of a four foot paved shoulder, however wider shoulders (or marked bike lanes) and accessible sidewalks and crosswalks are necessary within rural communities and where traffic volumes and speeds increase.

This approach also allows the highway engineer to achieve the performance goal of providing safe, convenient, and comfortable travel for bicyclists and pedestrians by other means. For example, if it would be inappropriate to add width to an existing roadway to stripe a bike lane or widen a sidewalk, traffic calming measures can be employed to reduce motor vehicle speeds to levels more compatible with bicycling and walking.

## Actions

The United States Department of Transportation encourages States, local governments, professional associations, other government agencies and community organizations to adopt this Policy

Statement as an indication of their commitment to accommodating bicyclists and pedestrians as an integral element of the transportation system. By so doing, the organization or agency should explicitly adopt one, all, or a combination of the various approaches described above AND should be committed to taking some or all of the actions listed below as appropriate for their situation.

- a) Define the exceptional circumstances in which facilities for bicyclists and pedestrians will NOT be required in all transportation projects.
- b) 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.
- c) 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.
- d) 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.

## Conclusion

There is no question that conditions for bicycling and walking need to be improved in every community in the United States; it is no longer acceptable that 6,000 bicyclists and pedestrians are killed in traffic every year, that people with disabilities cannot travel without encountering barriers, and that two desirable and efficient modes of travel have been made difficult and uncomfortable.



Every transportation agency has the responsibility and the opportunity to make a difference to the bicycle-friendliness and walkability of our communities. The design information to accommodate bicyclists and pedestrians is available, as is the funding. The United States Department of Transportation is committed to doing all it can to improve conditions for bicycling and walking and to make them safer ways to travel.



# APPENDIX D: PROPOSED BICYCLE PARKING REQUIREMENTS

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The ordinances/regulations concerning off-street parking should be amended to include bicycle parking facilities. The ordinance should address how many bicycle parking spaces are required for developments and the design, maintenance, location and spacing of parking facilities. The purpose of such a change is to provide adequate and safe facilities for the storage of bicycles. This ordinance would require the provision of off-street bicycle parking for new developments, expansion of existing developments and changes in use that would require additional parking. For expansions or changes in use, bicycle parking is required based only on the extra amount needed by the addition or change in use, not for the entire development. The number of bicycle parking spaces required for a development is determined by the Zoning Administrator based on guidelines included in the ordinance.

Bicycle parking requirements can be fulfilled by bike lockers, racks or equivalent structures in or upon which the bicycle may be locked by the user. All racks must be securely anchored to the ground or building surface. Racks must be designed to accommodate U-shaped locks. U-locks are designed to allow the user to lock a wheel and the bicycle frame to a stationary object. The *Eligible Parking Devices* list is attached.

Bicycle parking needs to be located in a clearly designated, safe and convenient location. Required bicycle parking must be located within 50' of a well-used entrance to the building. With permission from the appropriate agency/department, bicycle parking may be located in the public right-of-way. If motor vehicle parking is covered, required bicycle parking must also be covered. If 10 or more bicycle spaces are required, then at least 50 percent of the bicycle spaces must be covered. Bicycle parking may be provided within a building, but the location must be easily accessible to bicycles. If the bicycle parking is not visible from the street, then a sign must be posted indicating the location of the bicycle parking facilities. Surfaces around the bicycle racks must be maintained to be clear of debris.

See the *Design and Location Checklist* and *Spacing for Bike Racks* for further information on placement of racks.



## OFF-STREET BICYCLE PARKING GUIDELINES

Land Use	Minimum Bicycle Parking Spaces Required
Retail uses	10% of automobile requirements
<i>Exceptions:</i>	
Bar/nightclub	1 per 2000 sq ft
Convenience store/gas	1 per 2000 sq ft
Restaurants	1 per 1000 sq ft
Theater	1 per 500 sq ft
Multi-family residential	1 per unit
Office	1 per 2500 sq ft
Schools	1 per 10 students above second grade plus employees
Manufacturing	1 per 5000 sq ft

### GOOD BIKE PARKING: DESIGN AND LOCATION CHECKLIST

#### Secure

- Can cyclists secure one or both tires and the frame to the rack?
- Does the rack accommodate a variety of locks, especially U-locks?
- Is the rack securely anchored to an immovable surface, and impervious to common cutting devices?
- Is parking located in well-monitored, well-lit areas (near foot traffic and/or building entrances) to help reduce vandalism and theft?

#### Convenient

- Is parking located close (within 50 feet) to building and transit entrances?
- Is it as or more convenient than car parking?

#### Visible

- Is it easy to find the parking from the normal travel routes?

#### Sheltered

- Does the parking provide protection from rain, snow, and sun? (This protects bicycles and makes it easier for cyclists while locking and loading purchases.)

#### Space Efficient

- Does the parking minimize conflicts with pedestrian traffic?
- Does it encourage orderly parking?

#### Easy to Maintain

- Does the parking have few, if any, moving parts?
- Will the construction material endure weather extremes?

## ELIGIBLE PARKING DEVICES

The recommended bike rack for most sites is the “Inverted U” rack because of its simplicity and security, and for the low cost and ease of installation. Transportation Planning Organization staff, in coordination with the Bicycle Advisory Committee, will make an initial determination as to whether a rack meets the requirements. Any person or organization selecting a bicycle rack not on this list provided may request that the TPO staff review the rack for acceptance.

### **Inverted U Racks**

The Inverted U rack can be 35.5” tall, with uprights 16.5” apart, and an outside diameter of 2.375” galvanized steel pipe. There are several variations of the U-rack, some called hoop racks and bike docks. Each rack can accommodate two bicycles. Multiple racks can be installed at one location in various configurations. The rack can be surface mounted on concrete or asphalt, or set in post holes.

### **Guard Rail Racks**

The Guard Rail rack is extra long (60”), 35” tall, and has a second rail to help prevent bicycles from sliding under the rack if the bicycle is inadvertently moved. Each rack accommodates two to four bicycles. The top rail is 1.875” outside diameter, and the second rail is 1.625” diameter.

### **Bicycle Lockers (polyethylene)**

Lockers provide maximum security from theft and vandalism, and protection from rain. They should be installed on a concrete pad.

## SPACING FOR BIKE RACKS

### **Spacing between racks:**

Each bike bar accommodates two bicycles, and requires a total footprint of 2’ by 6’. Aisles between the footprints should be at least 1’ wide, but 2’ aisles are preferred. Bars should be centered in the footprint space.

### **Spacing between racks and buildings (parallel):**

When bicycles will be parking parallel to a building, bike racks should be located at least 3’ from the wall to allow for maneuvering handlebars between the racks and the building.

### **Spacing between racks and curb (parallel):**

When bicycles will be parked parallel to a curb, bike racks should be at least 2’ from the curb.

**Spacing between racks and obstructions (perpendicular):**

When bicycles will be parked perpendicular to a building, curb or other obstruction, racks may be located in the center of the 2 X 6 footprint, with the edge of the footprint immediately adjacent to the obstruction.

**Spacing between racks and obstructions (diagonal):**

When bicycle racks will be placed diagonally to a building or other obstruction, the angle may be varied. The bike parking area must still maintain a 2 X 6 footprint and the aisles between the footprints should be at least 1' but preferably 2'.



# APPENDIX E: CITIZENS GUIDE TO TRANSPORTATION PROJECTS

## PROCESS

These are the typical steps taken in road projects:

- Needs Assessment and Definition—the initial idea by a government agency to upgrade an existing road or build a new one. Typical sources of information include traffic counts, crash statistics, or development plans which are likely to generate additional traffic.
- Phase I Engineering—the scope of the project is determined in sufficient detail to develop a cost estimate. This is the phase at which the project first appears in the TPO's Transportation Improvement Program (TIP), usually labeled as Preliminary Engineering (PE). Public hearing usually takes place after this phase.
- Phase II Engineering—the project is designed sufficiently for bidding by contractors. Usually labeled PE—Phase II in the TIP.
- Bid Letting—project designs are sent to contractors for bids.
- Bid Award—a contractor is selected for construction.
- Construction

## HOW YOU CAN INFLUENCE DESIGN

### 1. Get the Facts

Call the project contact and ask if bicycle accommodations are being considered. The project contact should be listed in any meeting notices. If you do not know the project contact, call the agency who is responsible for the road—either the City, County, or State transportation agency.

If bicycle accommodation is being considered for the road, ask what type—shoulders, bike lanes, etc. Find out when public hearings or other meetings are being held for this project.

### 2. Make the Point

Write to the project contact. If bicycle accommodations are planned for the project, thank them. If not, ask for them. Support your request by listing important destinations linked with the project. Describe any existing facilities (trails, bike lanes) that link to the project. Send a copy of your letter to the head of the agency, and to your appropriate elected official.

### 3. Follow Up

Attend public hearings about the project and encourage your cycling friends to attend. These events are typically informal “open houses” where you can see project layouts and ask questions one-on-one. Your objectives are to meet the project planners and leave a written record of your attendance and your comments.





# APPENDIX F:

# REFERENCES

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## FEDERAL DOCUMENTS

- The Bicycle Compatibility Index: A Level of Service Concept, Implementation Manual*, FHWA, 1998
- Guide for the Development of Bicycle Facilities*, AASHTO, 1999
- Implementing Bicycle Improvements at the Local Level*, FHWA, 1999
- Improving Conditions for Bicycling and Walking: A Best Practices Report*, FHWA, 1998
- Manual on Uniform Traffic Control Devices, Part 9*, FHWA, 2000
- The National Bicycling and Walking Study*, FHWA, 1994.
- The National Bicycling and Walking Study: Five Year Status Report*, FHWA, 1999.

## WEBSITES

- Pedestrian and Bicycle Information Center, [www.bicyclinginfo.org](http://www.bicyclinginfo.org)
- FHWA Bicycle Safety Program <http://safety.fhwa.dot.gov/fourthlevel/bike.htm>

## KNOXVILLE BICYCLE PLANS

- Preliminary Bikeway Plan for Knoxville-Knox County*, MPC, 1975.
- Knoxville-Knox County Bikeway Plan Update*, MPC, 1985.
- Bicycle Plan for the Knoxville Urban Area*, MPC, 1995.

## OTHER BICYCLE PLANS

- Berkeley Bicycle Plan*, 1999.
- Bicycle Transportation Plan for Madison Urban Area and Dane County*, 2000.
- Charlotte-Mecklenburg Bicycle Transportation Plan*, 1999.
- Missoula Non-Motorized Transportation Plan*, Missoula Office of Planning and Grants, 2001
- Oregon Bicycle and Pedestrian Plan*, ODOT, 1995.
- Toronto Bike Plan*, 2001.



# APPENDIX G: PUBLIC COMMENTS

## COMMENTS SENT VIA E-MAIL:

1. I have read over the transit section on the bike plan. The transit section outlines several good steps for action. Mainly, I would like to see bike parking at the bus stops, nothing more than a simple metal bike rack concreted into the ground. This past year I lived in an off campus apartment while attending UT. I took the 50C bus from golf range apartments to campus. I lived in a privately owned apartment complex about 1/4 mile from golf range, so I walked to the bus stop every morning and walked back to my apartment every evening. Being able to park and lock my bike to a rack at the bus stop would have reduced the time it took to get to the bus stop from about 10 minutes walking to about 2 minutes biking. There is also a nice stop that KAT renovated at Forest Park and Kingston Pike where I think a bike rack might be of use, especially since the Third Creek Greenway begins there now with the new extension that was added this year.

Also, I would like to see greater promotion of biking in general and biking to transit stops. This might help the transit system increase its ridership. It seems that first you would need to establish that there is a safe route for biking to transit stops (and if there is not a safe route, then create one) and then promote it as much as possible.

Additionally, I liked the idea of a map showing safe biking routes that was suggested in the meeting. It would be nice if such a map was constructed so as to allow a person to pinpoint a location of interest, easily determine what bus stops are nearby, and then determine a safe biking route to reach the bus stop.

2. Here are a few things that I saw in the Executive Summary that stood out and could be implemented to start the process and make it more visible to the general public. These are mostly educational and safety issues.
  - “Share the Road” signs.
  - Sweeping shoulders and intersections
  - When resurfacing roads, restripe lane widths for bicyclists
  - Raise drainage grates and repair pot holes and broken pavement.
  - Issue press release clarifying traffic laws relating to bicyclists and motorists
  - Work to update TN Driver’s Handbooks relating to bicycle issues.
  - Train law enforcement in the investigation of crashes involving bicyclists.
  - Develop a public information campaign to encourage bicycling and improve the behavior of bicyclists and motorists.
3. Thanks for all you and the TPO are doing to promote and improve bicycling in our area. I attended the public meeting at the Cedar Bluff library yesterday evening. I have included herein a list of Priority 1 action items that I think would be good to work on first.
  - Establish clear roles and responsibilities for all affected agencies.....
  - Utilize Bicycle Compatibility Index analysis to develop a recommended bicycle system.....
  - Adopt the US DOT Policy Statement on Integrating Bicycling and Walking.....
  - Issue a press release clarifying the traffic laws..... (also explain the TPO’s bicycle initiative)
  - Increase the use of bike patrols for standard duty.....
  - Coordinate the bicycle safety programs being conducted by various agencies.....
  - Increase awareness of the benefits of bicycling....
  - Develop a public information and education campaign to encourage bicycling and improve the behavior.....
  - Develop a bicycle map of downtown, UT.....
  - Develop a presentation for interested groups.....



4. I looked over the plan and found that it was pretty comprehensive. I ride Kingston Pike occasionally and it's not bad where there is a good shoulder and the road debris is not too dense. I was concerned that the plan might tell me I can't ride there because there are much more than 5000 cars per day on it? The traffic lights with triggers is a problem. Most bicyclists will normally proceed through these lights once traffic is cleared. Many people have non-ferrous bikes so they wouldn't ever trigger the light as I understand it works; is that true? My personal approach to such lights is to slow (walking stop) and then proceed when the traffic is clear. Since falling off a bike is a big problem, coming to a complete stop will cause injuries, especially for new cyclists. Also, better bikes have clips that hold your feet in so it is best not to stop completely. For these reasons, bicyclists need some leeway and police need to appreciate these issues. I doubt if police give many tickets to bicyclists but I think they should be limited to instances where the bicyclist is clearly reckless.
5. I read through the draft and it seems that all the bases are covered for beginning to implement a bicycle transport system for Knoxville. I just wanted to add a few thoughts before they left me. We hope we can help Knoxville advance in this area! I have a few insights from European city plans. It can be overwhelming to any transportation planning office to convert to bicycling. Some physical infrastructure is needed at basic points such as bike lock stands at bus stops, schools or post offices and high bike traffic potential areas such as university and downtown. In Europe, roads are designated as priority and are off limits to bicycles. Priority roads are high traffic, higher speed roads that really are unsafe for bicycles. Lesser roads that parallel these high traffic areas are designated as bikeways. I know the demand has to be there, but if the infrastructure is available, more people will eventually use it. It seems to me the best place to start is at the university area and to combine the bikeways with walking paths. The greenway is an excellent start! I look forward to a bicycle route map for Knoxville!
6. I was at the meeting the other evening and was pleased to see and hear about how much is being done to promote bike riding in the area.

My thoughts on the topic:

See to it that as many cycling-related stories appear in the paper, so as to promote interest in the activity. Earlier on the day of the meeting I wrote to the News-Sentinel stating that the Tour de France should be listed in the TV Sports page listing. It now is...

One of the most important steps to take in the Knoxville area is to identify areas most likely to be used by cyclists and then to see to it that those areas can indeed be used. I think that there would be more cycling-related activities if the already existing areas were safer to use. Cycling cannot be properly promoted if that activity can be life threatening.

Examples based on my experience as a resident of west Knoxville between Lakeshore and the West Town Mall: To get to the 3rd-creek bike trail is a three-mile venture. I can either use Lyon's view Rd, which takes a certain amount of courage, even on well-paved roads, or I can go along Northshore. To continue to Kingston Pke is a chore: the bike path narrows to one foot; the traffic forces the rider onto the sidewalk which is a disaster area with broken pavement; one then has to ride on sidewalks along K. Pke until one can gain access to the bike trail at Bi-Lo. An alternative is to use side streets beginning at Ham and Goodies. Once the trail is extended along Sutherland to connect with Kingston Pke beyond the Post Office, access will be made simpler. For now, thought, some cleaning up is necessary.

To go to the West Town Mall is a simpler task if one can avoid Westland as much as possible. Morrell has a tiny bike lane, more or less safe if the cars are inclined to go under 40 mph and stay away a bit from the bike lane. Along this road, one can get to the shopping center where Border's is, an apparently bicycle friendly area. There are no bike racks, however, and one is forced to attach one's vehicle to benches, garbage cans or trees.

To sum up: identify and publicize areas which can be used now, see to it that they are safe, make parking places available to riders who use them.

As for bringing safe paths to the public's attention, perhaps using the maps found in the telephone directory to highlight safe bicycle paths might help.

7. On page four of the plan under Outreach & Promotion there's a mention of promoting cycling as transportation to schools. In Knox County there's a one mile "parental responsibility" zone around schools in which kids cannot ride a bus to school. The result is large traffic jams and lots of cars sitting in line for a longer period of time than it would take to ride a bike or even walk one mile to school. Why don't kids walk or ride bikes? Because with few exceptions there's no safe path to schools for walkers or bike riders. In my neighborhood in Halls the Middle & High School kids cut their own path and built their own bridge thru private property just to be able to walk to and from school. As a matter of fact at the new addition and driveway at the Elementary school there's no consideration in the design for anything but bus & car riders. A good place to start might be to make it safe for kids to ride a bike or walk within the one mile zone around the schools, especially since the school system mandated that kids can't ride the bus within that zone.
8. I regret that I could not attend one of the meetings. However, I would like the opportunity to submit comments. I assume that e-mail is the appropriate venue.
- I congratulate you and the preparers on a job well done. A plan such as this is a policy document, and I can find few (no?!) holes in the policy. I would truly like to see an aggressive implementation plan to see this put into action. Plans are a tool, not a product. The product is seeing the plan implemented on the ground.
  - In thinking of other bicycle friendly communities, I find that they focus on continuity as you suggest in the plan. However, it moves beyond linking one bike route to another. Also linked are off-road bicycle paths, greenway paths, rural road riding routes, etc. Suggest you incorporate same.
  - Similar to the above, the bicycle plan should consider destination points. Working this in with the downtown re-vitalization seems like a natural. Twice a week or more I go from downtown to the Volunteer Landing area and back. Ever try that? It's not fun. But it could be with a good bike path extension of the greenway. Seems that businesses such as coffee shops would have a vested interest in this.
  - Implement via the "spoke" concept first. Arteries from outlying areas to downtown which would then link to spokes would at least provide access to other parts of town. Ex. currently there is poor access from the North. I end up going east to get to Magnolia so that I can get downtown.

## COMMENTS FROM POSTCARDS:

1. *Ideas for making region more bike friendly:*

Bike routes with tree buffers from 55 mph hazards and pollutions. Great signage where no bike space is available. Aerodynamic wind tunnels as shown on biketrans.com. Safe routes from Rutledge Pike to Asheville Hwy (Mascot Bridge and Holston Rd)

*Issues added to Bike Plan:*

Implementation and the website discussed as top priority.

2. *Ideas:* Crack down in a draconian fashion on speeders.

*Issues:* Bike racks/locking facilities at commercial establishments.

3. *Ideas:* Take action to encourage more riders. Add more bike parking, especially at KAT bus stops.

*Issues:* More about connections with KAT transit.

4. *Ideas:* Pass legislation to require bike lanes on all newly built roads and all roads being repaired. Set up a central contact for reporting problems and empower them to work toward solutions.

5. *Ideas:* Action action action. Monthly bike events/rides, repair clinics for community encouragement. Safe routes around UT. "Yellow bikes"/community shared klunkers.

*Issues:* Bicycle protection—high theft in "urban" Knoxville.





# APPENDIX H:

# FINANCIAL IMPACT STATEMENT

These are estimates for additional costs incurred for implementation of this Plan. The following costs are only estimates, given that implementation could occur any number of ways. Potential funding sources are listed on p. 17 of the Plan. Other grants and funding sources will be pursued as well. The estimates do not include construction costs for implementing a bicycle system, since a proposed bicycle system has not yet been developed. Costs in bold are annual. All other costs are one-time.

## POLICY AND PLANNING

Establish clear roles and responsibilities for all affected agencies and departments in the implementation of the Bicycle Plan. ....	N/A
Utilize Bicycle Compatibility Index analysis to develop a recommended bicycle system f or the TPO study area, with a prioritized implementation plan. ....	\$2,500
Adopt the US DOT <i>Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure</i> . ....	N/A
Identify locations for “Share the Road” and other related signs and recommend to the appropriate agencies/departments. ....	N/A
Develop and implement destination-based signing for the bicycle system. ....	<b>\$5,000</b>
Pursue grants and other funding sources in addition to TEA-21 monies. ....	<b>\$500</b>
Make transportation funding information available so the public has a better understanding of how projects get funded. ....	<b>\$200</b>
Establish a Bicycle Program staffed at a level sufficient to implement the Bicycle Plan. ....	<b>\$50,000</b>
Ensure that all jurisdictions support and participate in the Bicycle Program. ....	N/A
Review the Bicycle Plan every two years and revise as necessary. ....	\$3,000
Update the Plan every five years. ....	\$15,000
Produce quarterly progress reports on Bicycle Plan implementation. ....	<b>\$600</b>
Continue to support the efforts of the Bicycle Advisory Committee. ....	<b>\$5,000</b>
Work with Knoxville <i>Smart Trips</i> Program to encourage employers to implement incentive programs and develop facilities to encourage employees to bicycle to work. ....	<b>\$500</b>
Work with bike organizations to implement the Bicycle Plan in conjunction with their groups’ missions. ....	<b>\$500</b>
Facilitate citizen involvement by providing information on bicycle programs and events, and comment on transportation projects. ....	<b>\$1,500</b>
Provide bike parking at major bus stops and transfer points, including short-term and long-term parking. ....	\$20,000
Research the ability to carry more bicycles on buses where the racks are frequently full. ....	N/A
Advertise the availability of bike racks on buses and bike parking. ....	\$2,000
	<b>\$500</b>



Consider including a bikestation in the Downtown Intermodal Transfer Center and at the University of Tennessee. ....	N/A
Ensure that all buses within the TPO boundary, including downtown trolleys, have racks to carry at least two bicycles. ....	\$10,000
Implement the Bicycle Parking/Enhancement Program, which provides bicycle parking facilities and “company” bicycles to businesses and agencies. ....	<b>\$20,000</b>
Revise zoning and subdivision regulations to include bicycle-friendly policies as requirements of developments. ....	\$10,000
Adopt the Bicycle Parking Requirements and Guidelines included in the Appendix. ....	N/A
Develop a coordinated land use and transportation plan for more efficient use of land and infrastructure in the future. ....	unknown
Form a committee of businesses, organizations and agencies interested in economic development and bicycle tourism. ....	N/A

## DESIGN AND ENGINEERING

Provide for appropriate access control on arterial roadways in order to increase the function and safety of these roadways for both bicyclists and motorists, while at the same time ensuring adequate access and crossing opportunities for pedestrians and bicyclists. ....	N/A
Research innovative treatments used in other communities and determine if they would be applicable in Knoxville. ....	\$600
Develop improvement projects to focus on “weak links” in the bicycle system. ....	<b>\$2,000</b>
Pursue a policy change with the Tennessee Department of Transportation to allow bicyclists on certain portions of limited access highways. ....	N/A
Develop a funded Traffic Calming Program in each jurisdiction. ....	<b>\$100,000</b>
Develop a policy requiring that bicycle and pedestrian access be maintained during construction. When access is not feasible, detour routes should be as short as possible. ....	N/A
Educate project managers about the construction access policy and its significance. ....	N/A
Provide better signage during construction to indicate work in progress, road or path conditions and, alternate route information when applicable. ....	<b>\$2,000</b>

## MAINTENANCE

Develop a policy regarding sweeping of roads, including shoulders and bike lanes, that addresses bicyclists’ needs. ....	N/A
Develop and implement an inspection and maintenance program that addresses minor repairs such as potholes, improper drainage grates, broken pavement and other hazards to bicyclists. ....	<b>\$80,000</b>
Ensure that maintenance workers are aware of the maintenance policies. ....	N/A
Develop a Bicycling Improvement Program to gather and respond to citizen complaints and recommendations, utilizing a telephone hotline, Website and comment card. ....	<b>\$5,000</b>

Ensure that vegetation does not encroach on sidewalks, bike lanes or shoulders, and does not impede sight distance at intersections. ....	N/A
Develop a policy requiring 5 to 10 foot aprons on gravel driveways or roads to be paved wherever a roadway is constructed or widened to prevent loose gravel from being carried out onto the shoulders. ....	N/A
Develop and implement an inspection and maintenance program to address signage and pavement marking issues. ....	<b>\$10,000</b>
Adjust sensitivity of loop detectors at traffic signals to detect bicycles.....	\$3,000
	<b>\$1,500</b>

**ENFORCEMENT**

Issue a press release clarifying the traffic laws with respect to bicyclists and motorists. ....	N/A
Establish a policy clarifying law enforcement agency’s procedures regarding enforcement of laws concerning bicycles, including motorist behavior. ....	N/A
Increase the use of bike patrols for standard duty, rather than concentrating on special events. ....	N/A
Educate and train law enforcement personnel in bicycle enforcement. ....	<b>\$5,000</b>
Keep up-to-date on code/ordinance modifications that could affect bicyclists. ....	N/A
Continue to train officers for bike patrols. ....	none
Encourage bicycle patrol officers to continue to report road hazards. ....	none
Increase traffic law enforcement efforts focusing on those violations most likely to lead to bicycle-motor vehicle crashes. ....	N/A

**EDUCATION AND SAFETY**

Coordinate the bicycle safety programs being conducted by various agencies, health care providers and organizations. ....	N/A
Provide and promote safety education and encouragement programs taught by qualified instructors and targeted to youth and adult bicyclists and motorists.....	<b>\$5,000</b>
Increase the availability of and participation in cyclist training courses for college students and adult bicyclists. (The adult-targeted <i>Effective Cycling</i> course by the League of American Bicyclists would serve the need and could be offered at bike shops and community centers.) .....	<b>\$5,000</b>
Educate parent groups and adult groups that supervise children, such as PTAs, day care centers and youth camp operators.....	<b>\$3,000</b>
Work with Tennessee Department of Safety on updates to the Drivers’ Handbook to strengthen the bicycle section and include exam questions relating to bicycle issues. ....	\$500
Work for inclusion of motorist-bicyclist safety information in defensive driving courses. ....	\$500
Continue to monitor and improve the data available on bicycle crashes. ....	<b>\$1,000</b>
Identify locations and corridors with more than one crash reported, and look for potential improvements. ....	<b>\$1,500</b>
Train law enforcement staff in the investigation of crashes involving bicyclists. ....	<b>\$1,000</b>



## OUTREACH AND PROMOTION

Promote bicycling for transportation as well as recreation, particularly for trips to school, work, shopping and special events. ....	See below
Increase awareness of the benefits of bicycling, and the rights and responsibilities of bicyclists and motorists. ....	See below
Develop a public information and education campaign to encourage bicycling and improve the behavior of both motorists and bicyclists.....	<b>\$50,000</b>
Develop a bicycle map of downtown, UT and surrounding neighborhoods showing existing conditions on roadways to highlight the best ways to travel by bicycle. ....	\$5,000 <b>\$1,000</b>
Establish, maintain and publicize a webpage and telephone hotline with information and links to other agencies/organizations/websites. ....	<b>\$2,000</b>
Develop a <i>Guide to Bicycle Resources</i> with information on bike clubs, shops, events and other useful information. ....	\$2,000
Develop a <i>Bike to Work Guide</i> for Knoxville, with information for employers and employees on benefits, safety and available resources.....	\$2,000
Continue to increase the number of special events and programs that encourage bicycling, including bicycle rides, bike giveaways and Bike Week events. ....	<b>\$4,000</b>
Develop a <i>Safe Routes to School</i> program in conjunction with Bike to School Day during Bike Week, but to be used year-round.....	<b>\$5,000</b>
Coordinate and continue bike light, helmet and bike giveaway efforts by various agencies and groups. ....	N/A
Develop a bicycle checkout program focused at the University of Tennessee and downtown. ....	\$10,000 <b>\$2,500</b>
Increase and publicize the number of free repair classes offered throughout the community.....	N/A
Provide regular workshops and other training opportunities for local planners, engineers and parks and recreation professionals on bicycle transportation and facility design issues. ....	\$4,000 <b>\$1,500</b>
Develop a presentation for interested groups, such as Leadership Knoxville and Leadership Blount.....	\$1,000

**Annual costs**  
**\$373,500**

**One-time costs**  
**\$91,600**



**KNOXVILLE REGIONAL  
TRANSPORTATION PLANNING ORGANIZATION**

**SUITE 403 CITY COUNTY BUILDING  
400 MAIN STREET  
KNOXVILLE, TENNESSEE 37902**

**865-215-2500  
[WWW.KNOXTRANS.ORG](http://WWW.KNOXTRANS.ORG)**