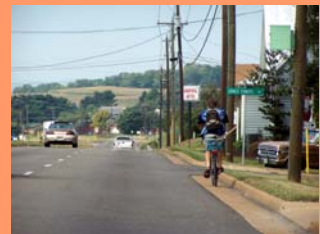


CENTRAL SHENANDOAH VALLEY BICYCLE PLAN

DRAFT PLAN
JUNE 2005



ACKNOWLEDGEMENTS

As an outcome of an earlier regional greenways planning process, a group of citizens throughout the Central Shenandoah Valley formed “Citizens for Safe Cycling”. This group served as the catalyst to seek funding and support for the development of a region-wide bicycle plan. Citizens for Safe Cycling and now the newly appointed Central Shenandoah Valley Bicycle Advisory Committee (BAC) recognized the potential transportation, health, recreational, tourism, and economic benefits of bicycling, and accordingly, advocated to make roads in the Central Shenandoah Valley safer for persons who bicycle, including children, families, and commuters as well as for motorists. Funds to support the development of the Central Shenandoah Bicycle Plan were provided by the Virginia Department of Transportation through their Rural Transportation Planning Grant Program, and were matched with funds by the Harrisonburg-Rockingham Metropolitan Planning Organization, each of the cities and counties in the Central Shenandoah Planning District, as well as Milepost Zero, a regional bicycle club. The project was administered by the Central Shenandoah Planning District Commission.

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I. INTRODUCTION

The Central Shenandoah Valley's bucolic landscapes, quaint cities and towns, and various historic, natural and cultural resources provide an ideal setting for bicyclists. Bicycling in the region is growing rapidly in popularity, and the Central Shenandoah Valley is increasingly recognized as a bicycle touring destination.

The *Central Shenandoah Valley Bicycle Plan* provides a coordinated and strategic approach to the development of a regional transportation system that accommodates and encourages bicycling in the Central Shenandoah Valley. The *Plan* meets the goals of the region to create a comprehensive network of cycling facilities connecting neighborhoods, communities, and key destination points.



Staunton, VA

The central element of the *Plan* is the identification of a regional network of on-road bikeways to improve non-motorized access for residents and visitors. A system of bikeways will connect and enhance the historic, cultural and recreational resources of the region. Policy and program recommendations are included in this plan to support and encourage bicycling and bicycle tourism. Education, encouragement and enforcement programs are proposed to ensure that residents and visitors share the roads safely. Recommendations are made for ongoing regional coordination and citizen involvement that will be a necessary part of implementing this plan.

As a regional planning effort, the focus of this study is on connections that link the region's 21 jurisdictions together--the counties of Augusta, Bath, Highland, Rockbridge and Rockingham; the cities of Buena Vista, Harrisonburg, Lexington, Staunton and Waynesboro, and the eleven towns that lie within the study area. In many cases, more detailed planning will be needed at the local level to develop additional linkages within each community. There are several local bicycle planning efforts currently underway that will improve local bicycle access within cities and towns.

The Importance of Bicycling in the Central Shenandoah Valley

The Central Shenandoah Valley has become a popular place to settle as well as to visit given the region's natural beauty, access to outdoor activities, amenities such as educational institutions and retail shops, and abundance of historic and cultural resources. This growth has created dramatic changes in transportation and land use. Roadways throughout the region are seeing increases in traffic, thus causing concerns that roads are becoming less safe for bicycling.

Efforts should be made now to ensure that bicyclists will be able to use the roadway network in the Central Shenandoah Valley in the future. As the transportation system is enhanced to accommodate increased traffic volumes, it must also be designed to preserve the ability for people to walk and bicycle to their destinations.

There are a variety of reasons why bicycling is essential to the Central Shenandoah Valley:

#1: Bicycling is a necessary part of the transportation system in Central Shenandoah Valley.

- Many of the region’s residents currently use bicycles for transportation. Bicycle facilities are needed to create important connections in the Central Shenandoah Valley between regional activity centers, population centers, shopping areas, parks, tourist attractions and other cultural resources in the region.
- Many people in the region need an alternative mode of travel. Because of age or economic circumstances, many of the region’s residents - children, students, low-income households and retirees - do not have access to an automobile. Bicycling is an extremely affordable option when compared to the expense of owning and operating an automobile (\$120 per year compared to over \$5,000 per year).
- The region’s residents will be more likely to use bicycles for transportation if there are safe places to ride. A 1990 Louis Harris Poll found that 40% of U.S. adults say they would commute by bike if bike lanes and pathways were available. Over 80% of the respondents to the online survey conducted for this plan replied that if better bicycle facilities (bike lanes, wider shoulders separate bike paths bike racks route maps etc.) were available they would bike more often.

#2: Developing a trails and bikeways network makes good economic sense for Central Shenandoah Valley.

- Bicycle tourism is big business in the United States, bringing millions of dollars in tourism revenue to some parts of the country. In Vermont, for example, bicycle touring brings in more revenue than the maple syrup industry. A questionnaire of Delaware cyclists in 1997 found that bicycle tourists were willing to spend between \$35.59 and \$84.77 per day, with the amount increasing as the number of days touring increases.
- The Central Shenandoah Valley has a multitude of outdoor activities to offer visitors in addition to bicycling, such as hiking (Shenandoah National Park, the Blue Ridge Parkway and the Appalachian Trail are all located in the region), camping, fishing, canoeing and tubing. The region has an opportunity to build a reputation as a destination for people seeking an active vacation.
- Bicycle touring is a low impact tourist activity that can bring dollars to many small town businesses, museums, and other cultural institutions, but does not generate overwhelming numbers of cars or people. Realizing economic benefit from appropriate use of rural road resources and trails coincides with the region’s desire to maintain its rural nature and quality of life.
- Businesses tend to invest in locations that have a high quality of life, and corporate employers have an easier time attracting skilled workers to these locations. Outdoor activities such as bicycling contribute to a region’s quality of life.



Stuarts Draft, Augusta County

#3: Increased bicycling in Central Shenandoah for transportation can help to improve air quality and reduce traffic congestion.

- Increased levels of bicycling and walking can play an important role in reducing air pollution. 48.8% of all trips we make are less than 3 miles in length. By substituting a bicycling or walking trip for these short auto trips

to the nearby grocery store or workplace, area residents can impact the amount of pollutants generated by automobiles. Sixty percent of the pollution created by automobile emissions is emitted in the first few minutes of operation, before pollution control devices begin to work effectively.

- Air pollution is a serious threat – it contributes to the deaths of 60,000 people nationwide each year (Harvard University School of Public Health).

#4: Bicycling can play a vital role in improving the health of residents of the Central Shenandoah Valley.

- Lack of recommended daily physical activity is having significant negative impacts on the health and wellbeing of the US population. According to the New England Journal of Medicine (*Olshansky, Passaro, et al. March 17, 2005, Number 11*), parents are raising the first generation of children in over 100 years who are likely to have statistically shorter life expectancies than their parents due to the afflictions of sedentary living. Today, there are nearly twice as many overweight children and almost three times as many overweight adolescents as there were in 1980.
- Residents of this region need opportunities to meet the Surgeon General's recommendation of 30 minutes of physical activity per day. 60% of Americans lead completely sedentary lifestyles, and 40% are clinically overweight. Efforts to integrate physical activity into people's daily routines are critically important (1998 report of the American Medical Association).
- Research conducted in 1999 by the Centers for Disease Control found that "obesity and overweight are linked to the nation's number one killer – heart disease – as well as diabetes and other chronic conditions". The report also states that one reason for Americans' sedentary lifestyle is that "walking and cycling have been replaced by automobile travel for all but the shortest distances." (October 1999 issue of the JAMA - Journal of the American Medical Association).
- Total costs attributed to obesity (medical costs and lost productivity) amounted to an estimated \$117 billion in the year 2000, 10% of total national health care costs.

Bicycle Planning Environment

Transportation agencies have provided a tremendous level of support and funding for bikeways, greenways and sidewalks. While local jurisdictions play a large role in establishing transportation priorities in Virginia, the Virginia Department of Transportation (VDOT) is the agency responsible for constructing and maintaining many of the primary and secondary roads throughout the Central Shenandoah Valley. The development of a regional bikeway network is supported by state transportation policy goals.

On March 18, 2004 the Commonwealth Transportation Board adopted a new state policy for integrating bicycle and pedestrian accommodations into roadway projects (often termed "incidental" improvements – bikeways and sidewalks that are built as part of new roadway construction or roadway reconstruction). This policy essentially reverses previous VDOT policies which required substantial public and political support for bikeways and sidewalks to be *considered* for inclusion in transportation projects.

The new policy states that “VDOT will initiate all highway construction projects with the presumption that the projects shall accommodate bicycling and walking,” and essentially requires bikeways and sidewalks whenever a roadway project occurs in an urban or suburban area. The policy provides some exemptions under which facilities may not be provided, such as in situations where:

- scarcity of population, travel, and attractors, both existing and future, indicate an absence of need for such accommodations
- environmental or social impacts outweigh the need for these accommodations
- safety would be compromised
- total cost of bicycle and pedestrian accommodations to the appropriate system (i.e., interstate, primary, secondary, or urban system) would be excessively disproportionate to the need for the facility
- purpose and scope of the specific project do not facilitate the provision of such accommodations (e.g., projects for the Rural Rustic Road Program)
- bicycle and pedestrian travel is prohibited by state or federal laws

VDOT’s new policy applies to all projects that reached the scoping phase after the adoption date of March 18th 2004. As with all major policy changes, it will take several years before the “on the ground” results of VDOT’s new policy will be evident as projects move through the pipeline from initial scoping, through the planning and design phases and eventually into construction.

It is critical that local governments continue to show support for the inclusion of bicycle and pedestrian accommodations in state roadway projects. This includes projects at all levels: maintenance, design and construction, and operations. The level of accommodation provided in VDOT projects is likely to be commensurate with the level of support expressed by local citizens, agency staff and elected officials.

The complete version of VDOT’s *Policy for Integrating Bicycle and Pedestrian Accommodations* can be found in Appendix B or on the VDOT website (www.virginia.gov) in the Program section of the website, under Bicycling and Walking.

Federal transportation policies also support the development of a regional bicycle plan. The U.S. Congress has also provided a consistent source of funding for these activities for the past ten years.

Planning Process

The planning process for this study involved a number of different activities and outreach efforts. The process is briefly outlined below.

1. Field Analysis

An analysis of existing conditions was conducted in the field for key roadway segments. It included roadway lane width measurements, pavement conditions, presence of shoulder, posted speed limits and connections to key destinations.

2. Public and Jurisdiction Input

A considerable effort was undertaken to gather input for the bikeway planning from residents and key stakeholders from each of the five counties and from a wide range of cities and towns. The public input



Roadway measurement on Route 11

process was an essential component in selecting and prioritizing locations for improvements. The process is described in more detail in the section below.

3. *Draft and final Plan and Route Network*

The *Central Shenandoah Valley Bicycle Plan* was developed in coordination with the Bicycle Advisory Committee and the Central Shenandoah Planning District Commission.

Summary of Public and Key Stakeholder Input

Input in the development of the *Central Shenandoah Valley Bicycle Plan* was achieved through a number of strategies:

- A Bicycle Advisory Committee was formed to guide the planning process and ensure that the needs of residents would be addressed by the final plan. The Committee was comprised of representatives from various jurisdictions. They were closely involved throughout the development of the plan, commenting on the route network and program and policy recommendations.
- An online questionnaire was developed and distributed to the general public through mass email lists, word-of-mouth, and flyers offered at local community centers, schools, and workplaces. Over one thousand responses were received from residents representing all five counties and many of the region's cities and towns (see Appendix A for sample of Questionnaire).
- Public workshops and/or open meetings were held in Harrisonburg/Rockingham County, Staunton/Waynesboro/Augusta County, and Lexington/Buena Vista/Rockbridge County. Participants included citizens and members of local bicycling clubs.
- Meetings were held with key stakeholders from many of the local jurisdictions to gather input from planners, parks and recreation staff, tourism offices, and city/county officials.



Public workshop in January

Participants of the public input process included both bicyclists and non-bicyclists. Their comments revealed considerable support for the development of the *Plan*. The following issues were identified as being important for the future of bicycling in the Central Shenandoah Valley.

- *Safety.* Participants of the public input process expressed concern for the safety of all users sharing the region's roadways. They stated that the addition of bike facilities would improve their communities by increasing the safety of families bicycling, while also improving the safety of motorists sharing the road with cyclists.
- *Desire for bike lanes.* Building bike lanes or paths is the number one strategy residents believed would encourage greater rates of bicycling in the region.
- *Connectivity.* Residents want to be able to ride to key destinations including schools, shopping, and tourist/cultural sites.
- *Places for families and new riders.* Residents believe that there is a lack of off-road facilities for children or new riders to learn how to bike.
- *Sharing the road.* Both motorists and bicyclists perceive the other user of the roadway to be negligent in properly sharing the road.
- *Recreation/Tourism.* Participants of the public input process cited a need for recreational bicycling loops and rides that promote the region's tourism destinations.

Residents and key stakeholders who participated in the public outreach for this *Plan* were asked to identify destinations they would like to reach by bicycle for commuting, shopping or running errands. The most frequently cited include:

- James Madison University
- Eastern Mennonite College
- The Valley Mall, Harrisonburg
- The Colonial Mall in Staunton
- Augusta Medical Center
- Woodrow Wilson Rehabilitation Center
- Rockbridge County High School
- Public libraries in general
- Shopping in general (such as coffee shops, bookstores)
- Public grade and high schools in general



Bicyclist crossing in front of JMU

Several public schools in Staunton and Waynesboro were identified as popular meeting locations for recreational rides because of the available parking and central location. Improving bicycle access to and from schools should be a priority for the benefit of students who would like to bike to school. Those schools identified as meeting locations for recreational cyclists include:

- Beverley Manor School, West of Staunton
- William Perry Elementary School, Waynesboro
- Ladd Elementary School, Waynesboro
- Westwood Elementary School, Waynesboro

Many recreational and tourist destinations were identified as needing bicycle access. The most frequently cited include:

- Fulks Run
- Singers Glen
- Mount Clinton
- Lacey Spring
- Reddish Knob
- Weyers Cave
- Natural Chimneys
- Gypsy Hill Park
- Frontier Culture Museum
- Warm Springs
- Hot Springs
- Blue Ridge Parkway/Skyline Drive
- Natural Bridge
- Rockbridge Baths

All of the key destinations identified above are indicated with blue circles on the route network map.

II. VISION, GOALS AND MILESTONES FOR ACCOMMODATING BICYCLE TRAVEL IN THE REGION

The recommendations of the *Central Shenandoah Valley Bicycle Plan* are based on a long-term vision for bicycle transportation in the Central Shenandoah Valley. The vision is an important statement, intended to guide the overall direction of future transportation efforts in the region, and local jurisdictions and the implementation of this plan.

THE CENTRAL SHENANDOAH VALLEY SHOULD BECOME A PLACE:

- ◇ WHERE RESIDENTS AND VISITORS HAVE THE CONVENIENT AND SAFE OPTION OF TRAVELING BY BICYCLE TO KEY DESTINATIONS THROUGHOUT THE REGION FOR RECREATION AND TRANSPORTATION.
- ◇ WHERE THERE ARE FACILITIES TO ACCOMMODATE BICYCLISTS OF ALL LEVELS.
- ◇ WHERE BICYCLISTS ARE CONSIDERED TO BE LEGITIMATE AND WELCOME USERS OF THE TRANSPORTATION SYSTEM.

Goals

The following goals build on the strengths of the Central Shenandoah Valley, and are designed to help achieve the vision for improving bicycle accommodations in the region.

GOAL 1

Provide a comprehensive, interconnected network of on-road and off-road bicycle facilities for transportation and recreation. This network should link cities, towns, and key destinations throughout the Central Shenandoah Valley.

GOAL 2

Conduct outreach to public officials, the general public and business and community leaders to promote the benefits of bicycling, the safety needs of bicyclists, and rules for sharing the road.

GOAL 3

Increase the safety and security of bicyclists traveling through the Central Shenandoah Valley region through education, enforcement and improved facilities.

GOAL 4

Increase the region's draw of bicycle tourism while maintaining the rural nature and quality of life of the Central Shenandoah Valley.

Milestone

Recommendations presented in the *Plan* are designed to increase levels of bicycling in the Central Shenandoah Valley. A milestone should be established to help measure the success of future efforts to improve bicycle accommodations.

A baseline count should be done over the next two years to determine current levels of bicycling. The count should be coordinated by the CSPDC and the BAC.

An appropriate counting methodology should be selected that aligns with the region's bicycling goals. A milestone should be established to double the region's current level of bicycling in ten years.

BICYCLING MILESTONE		
2017	>	Double existing levels of bicycling in the region

III. EXISTING BICYCLING CONDITIONS IN CENTRAL SHENANDOAH VALLEY

This chapter describes current levels of bicycling, bicycling conditions, and barriers to bicycling in the Central Shenandoah Valley.

Current Levels of Bicycling

Input provided throughout the public participation process revealed that most bicycling in the Central Shenandoah Valley today is recreational riding. There are a number of bicycling clubs and groups, and numerous organized rides and bicycling events that take place throughout the year. The region is also a well-known destination for advanced road cyclists who enjoy climbing challenging hills.

Most bicycle commuting in the Central Shenandoah Valley occurs in the region's cities, particularly those with colleges or universities. Region-wide, the incidence of bicycle commuting is low compared to other counties in the state, as well the national average.

Bicycling Conditions

On-road bicycling conditions in the region have a significant impact on riders' ability to get to and from their destinations. Multi-lane intersections, narrow bridges, lack of shoulders, high speeds, and high traffic volumes all contribute to the perception among residents and visitors that bicycling is unsafe on key routes in the region.

On-road bike lanes and bike routes in the Central Shenandoah Valley are currently limited. Harrisonburg has several segments of roadways with bike lanes or signed bike routes and is the only jurisdiction with an adopted bicycle plan at this time. The region is home to a segment of the Transamerica Route 76 (a cross-country cycling route from Oregon to Virginia). Many roadways in the region have paved shoulders that provide space for bicyclists to ride. Off-road facilities for bicyclists (i.e. trails) are even more limited. Several of the universities and colleges offer bicycle parking areas (outdoor racks) on campus.

Barriers to Bicycling

The Central Shenandoah Valley region covers 3,439 square miles. Road conditions for bicycling are extremely variable, ranging from rural roadways with paved shoulders and very low volumes of traffic, to suburban arterials with no bicycle facilities, high traffic volumes and speeds. Specific hazards that bicyclists have mentioned include:

- Narrow, rural roadways with high speed traffic and a lack of paved shoulders, conditions which force bicyclists to share the lanes with motor vehicles.
- Hostility from motorists who do not respect bicyclists' legal right to share the road.
- Inadequate shoulder maintenance – debris frequently collects in the shoulder, reducing the space available for bicycling.
- Key arterials that connect cities to rural riding routes with multiple lanes and substantial traffic volumes and no bicycling facilities.
- Large intersections with multiple turning lanes creating long signal phases and wide crossings in all directions. These intersections can put bicyclists in

conflict with turning vehicles. Often signal timing is inadequate to enable a bicyclist to clear the intersection, and some signals do not respond to bicyclists (actuation system does not detect the presence of a bicycle).

- Lack of off-road trails for less experienced bicyclists.
- Lack of signage and route maps to provide bicyclists with information on routes.
- The region's highways (namely Interstates 81 and 64) divide communities and create significant barriers to bicycling. Highway interchanges require bicyclists to share the road with high speed traffic merging on and off highway ramps. An example is I-81 at the Frontier Culture Museum.

Land use patterns can also be a deterrent to bicycle travel for transportation in suburban and rural locations in the Central Shenandoah Valley. Low density and sprawling development have created longer travel distances between origins and destinations. Housing communities are isolated from services, workplaces and schools, and are divided by wide arterials uncomfortable for bicycle riding. Many of the suburban areas in the region will require significant retrofit to accommodate and encourage bicycle transportation. On the other hand, bicycling has the potential to be very convenient in established urban areas such as Lexington, Staunton and Waynesboro. These jurisdictions have higher building densities, streets with lower motor vehicle speeds and a greater mix of offices, stores, parks and residences.

The Central Shenandoah Valley has a mix of opportunities and challenges to bicycle transportation. Progress to improve bicycle mobility will depend on the region's ability to overcome the barriers identified in this plan, as well as to capitalize on the region's strengths and the growing popularity of recreational riding.

IV. BICYCLE FACILITY DESIGN GUIDELINES

All new roadways in Virginia should be planned and designed as multi-modal facilities, consistent with the new VDOT policy. This section provides design guidelines for incorporating bicycle facilities into transportation and development projects in the Central Shenandoah Valley. The end of this section provides guidelines for bicycle parking facilities.

Recommended On-Road Bikeway Types

Shared Roadways

- Shared Roadways are those streets and roads where bicyclists may be adequately served by sharing the travel lanes with motor vehicles. Usually, these are streets with very low traffic volumes and/or low speeds, which do not need special bicycle accommodations in order to be bicycle-friendly. In the Central Shenandoah Valley this includes rural, low volume roadways, as well as residential (local) streets.

Striped/Paved Shoulders

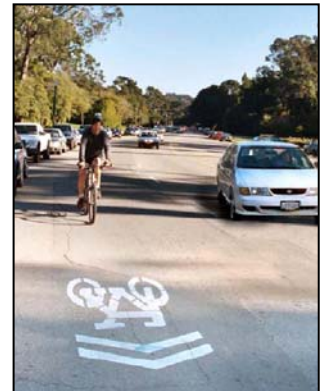
- Striped/paved shoulders can provide cyclists with extra riding space to increase their comfort when traveling adjacent to motor vehicle traffic. There is no minimum width for paved shoulders, however a width of at least 4 feet outside the lane edge stripe is preferred. According to the AASHTO Guide for the Development of Bicycle Facilities (1999), “where 4-foot widths cannot be achieved, any additional shoulder width is better than none at all”.

Bike Lanes

- A bike lane is a portion of the roadway that has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes are always located on both sides of the road (except one way streets), and carry bicyclists in the same direction as adjacent motor vehicle traffic. The minimum width for a bicycle lane is 4 feet on roads without curb and gutter, and 5 feet with a curb and gutter (5' includes the 2' gutter pan). Five- and six-foot bike lanes are typical for collector and arterial roads.

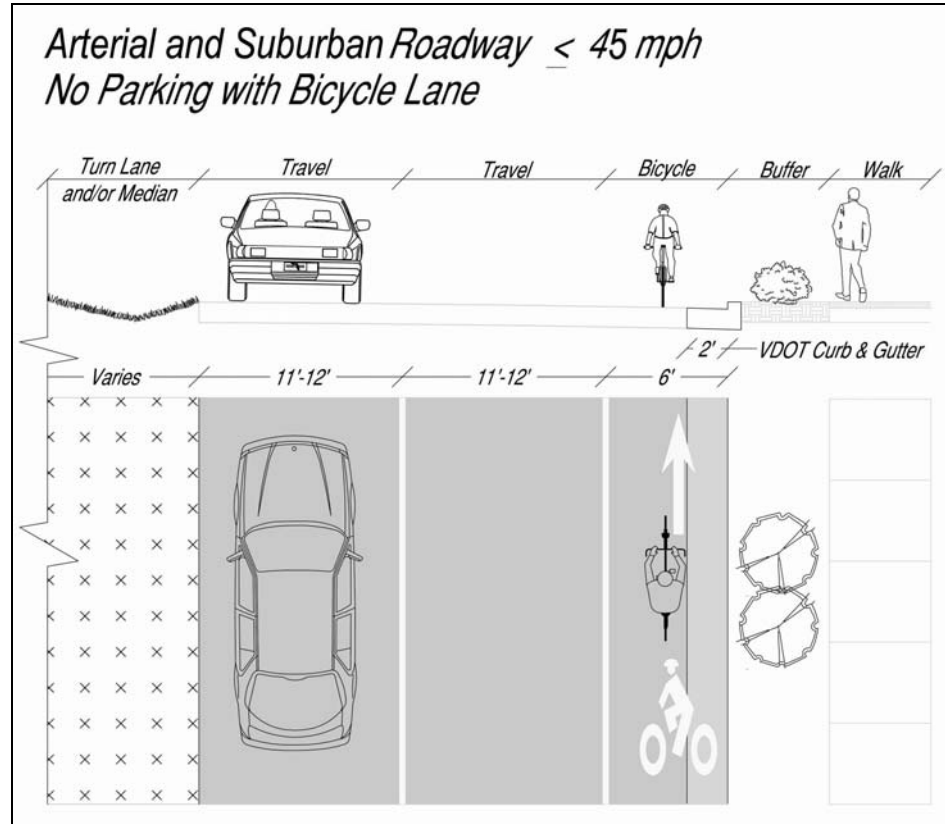
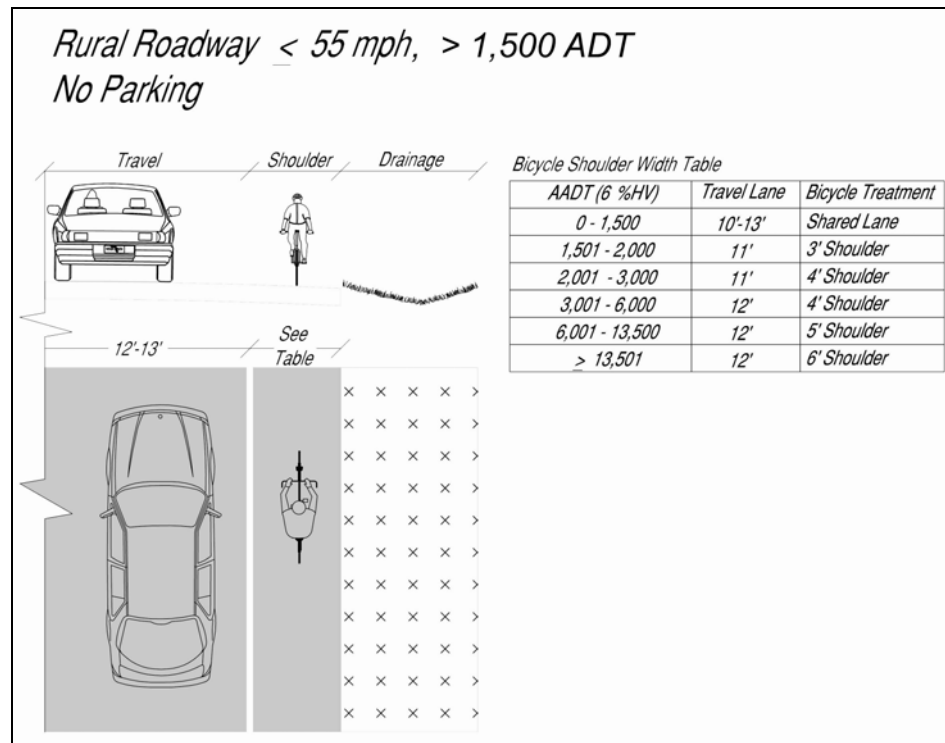
Sharrows

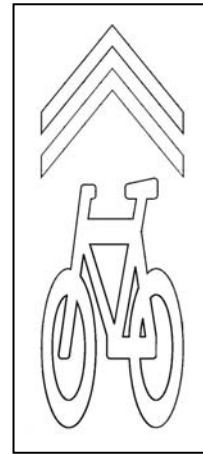
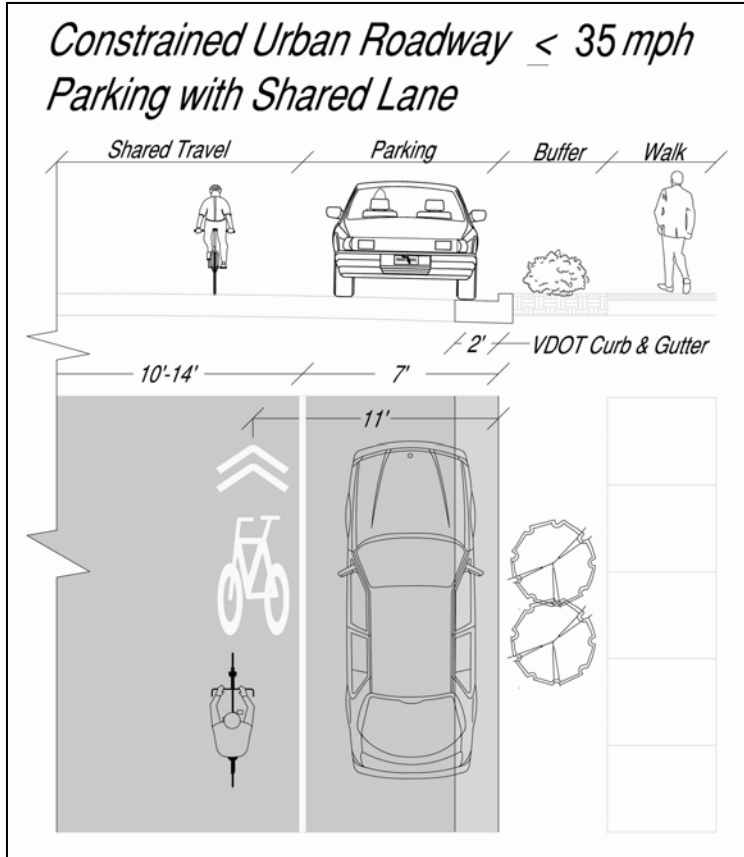
- A sharrow is a pavement symbol that can be used on roadways to indicate that it is shared space, typically used on roads where there is not enough space to stripe bike lanes. A stencil is applied in the form of a bike and chevron marking to indicate direction of travel (see photo right). The stencil is called a "sharrow" for shared lane and arrow. Sharrows are meant to alert motorists to expect and accept cyclists as users of the roadway. They should be painted near the center of the right lane on a road with multiple narrow lanes to condition motorists to expect cyclists to use the full lane.



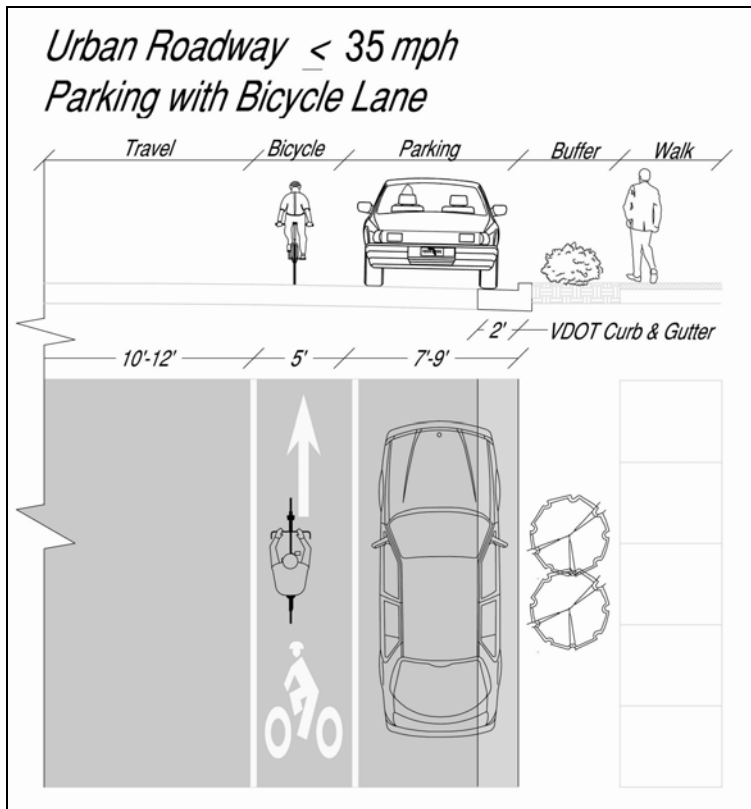
Bicycle symbol and “sharrow”

Recommended Facilities by Roadway Type





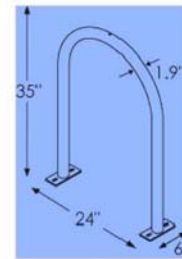
Sharrow pavement marking



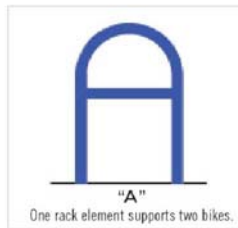
Bicycle Parking

ACCEPTABLE BICYCLE RACK DESIGNS

ACCEPTABLE DESIGNS



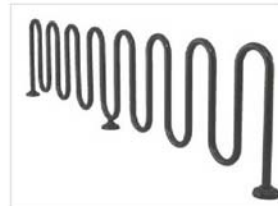
Dimensions vary by manufacturer and model.



UNACCEPTABLE DESIGNS



This type of rack can bend the wheel.



This type of rack does not support the bicycle frame in at least 2 places.

RACK ELEMENTS

The rack must:

- Support the bicycle frame in at least 2 places, allowing the frame and wheel to be locked using a U-lock or cable lock.
- Prevent the wheel of the bicycle from tipping over.
- Not damage the bicycle.
- Be durable and securely anchored.
- Allow front-in or back-in parking.

ACCEPTABLE BICYCLE RACK DESIGNS

Central Shenandoah Valley Bicycle Plan
June 2005

V. RECOMMENDED PHYSICAL IMPROVEMENTS

This chapter provides recommendations for a comprehensive bicycle route network in the Central Shenandoah Valley. The recommendations were developed with the goal of creating an interconnected regional bicycling network that provides a more comfortable, convenient and safe recreation and transportation option.

Bicycle Route Network

RECOMMENDATION 1: ESTABLISH A REGIONAL NETWORK OF ON-ROAD BICYCLE FACILITIES BETWEEN KEY DESTINATIONS IN THE REGION.

This section describes the proposed route network and route map for the Central Shenandoah Valley, and the strategy used to develop the network. The recommendations in this section refer to a series of maps at the end of this chapter, and a fold-out map found inside the back cover. The map's legend can be referenced on this page. The bicycle route network is comprised of three types of routes:

1. Roadways that were indicated by local bicyclists as being good places to ride in their current condition. These routes typically have low volumes of traffic or a wider shoulder/outside lane. These routes are indicated in orange on the route network map.
2. Downtown or narrow neighborhood routes that are in need of bike lanes or other urban improvements to increase the comfort and safety of bicyclists. These roadways typically have higher traffic volumes than the region's rural roadways, and often have no additional width for bicyclists. These routes are indicated in purple on the network map.
3. Arterial, suburban or rural roadways that are in need of some improvement to increase the safety of bicyclists. Roadway widths and traffic volumes vary. These routes are indicated in red on the network map.

Legend	
	Proposed bike lane/sharrow
	Proposed wide shoulder
	Bike route recommended by public
	Needed crossing improvement
	Existing bike lane or route
	Roadway
	Destination for bicyclists
	Higher Education
	River
	Body of water
	National Park Service Trail
	City/Town
	County boundary
	Public land

Bicycle Route Network map legend

The establishment of a regional network of bikeways in the Central Shenandoah Valley will require a partnership among local jurisdictions and the state. New bicycle facility projects will need to be coordinated through VDOT's Six Year Transportation Improvement Program. Since VDOT's programmed improvements are a response to requests made by local jurisdictions, it will be necessary for local governments to continue to advance high priority regional bikeway projects, including upgrades to substandard shared-use paths, locations for new trails and on-road bikeways, and bicycle retrofit projects during roadway resurfacing.

Route Development and Key Destinations

The development of the route network relied heavily on the public participation process, including consultation with the Bicycle Advisory Committee, public meetings throughout the region, and responses from the online questionnaire. Fieldwork was also conducted to verify public comments on various routes in the network.

Public input revealed that Central Shenandoah Valley residents want to be able to ride between the region's cities and towns. The route network therefore creates at least one direct route for bicyclists between each city and most towns. In many instances these direct routes – for example Route 250 from Staunton to Waynesboro - have high traffic volumes, are currently unsafe for bicycling. These

routes will require substantial improvements to provide a comfortable bicycling environment. However, in the long run, these routes are ideal for cyclists traveling for transportation because of the direct access they provide to cities, towns, and countless other destinations along the way. Until improvements are made to the direct access roadways, more comfortable alternate routes – such as Barterbrook Road – are also indicated on the route network map.

A number of criteria were used in the route network development. The routes indicated on the network map:

- Provide direct access between cities and towns
- Provide access to popular recreational bicycling loops
- Provide access to proposed off-road facilities such as greenways, parks, and rails-to-trails projects, mountain biking trails
- Provide access to and at tourist attractions
- Provide access to requested functional (commuting) ends such as universities, libraries, shopping, and work locations
- Were most frequently requested
- Have lower Average Annual Daily Traffic (AADT is an estimate of typical daily traffic on a road segment for all days of the week, over the course of one year.) and % heavy vehicle (the % of total traffic that is estimated to be trucks) than parallel routes creating the same connection.

Routes recommended by the public as pleasant for riding in their current condition are primarily recreational loops outside the boundaries of the region’s cities and towns. These are popular riding routes that vary in length and topography, are known to be scenic, and often have a parking facility available nearby such as a public school, or community center. The network includes routes in to and out of cities and towns to provide access to these popular loops. While these routes are considered to be comfortable for riding in their current condition, further investigation is recommended to insure that facilities adhere to the guidelines established in Section IV of this plan.

Principal Route Descriptions

The bicycle route network includes over fifty routes to connect key destinations and recreational riding loops across the Central Shenandoah Valley. Principal routes are described below and all routes are identified on the route network map.

Route 11 ~ Shenandoah County to Natural Bridge

Route 11 provides an opportunity to create a principal bicycle route that spans the region from north to south, connecting cities and towns from the northern boundary of Rockingham County, through Lexington. Route 11 also connects the region to Shenandoah County to the north and Botetourt County to the South facilitating statewide bicycle travel. This roadway serves an important purpose for local travel, providing access to local businesses and cities and towns. Bicyclists will benefit from having the same access to these local destinations as motor vehicles.



Route 11, Augusta County

Route 11 varies in width from 2-lane (most often with a center turn lane) to 4-lane, and in character from a rural route to a small-town main street. Average daily traffic ranges from 2,600 to a peak of 23,000 depending on the land use the roadway is passing through. These volumes are very low compared to typical roadway capacities in rural and suburban areas. Interstate 81 parallels the entire length of the roadway through the region, diverting much of the heavy traffic away from Route 11.

In order to clearly designate Route 11 as a bicycle corridor, it is recommended that bike lanes and paved shoulders be provided along its entire length. It is anticipated that Route 11 will become a popular route for bicycling tourists as it connects many of the region's tourist destinations.

Route 33 ~ East and West of Harrisonburg

Route 33 west of Harrisonburg provides access to Mount Clinton, Singers Glen and George Washington National Forest. Traffic volumes on this segment of Route 33 are relatively low – from 3,000 to 8,500. Route 33 provides a main east-west bicycling corridor through Harrisonburg and East to Skyline Drive. The roadway also provides access to the Valley Mall and an exit toward Elkton. The road ranges from 2 to a maximum of 6 lanes with a continuous right turn lane near the Valley Mall. To make bicycling comfortable in the downtown portions of this route, substantial improvements, such as reducing lane-width and providing bike lanes, will be needed.

Route 42 ~ from Churchville through Bridgewater and Harrisonburg to Broadway

Many respondents to the online questionnaire requested bicycle facilities on Route 42 from Harrisonburg to Bridgewater. This route will link the city and town as well as James Madison University and Bridgewater College. Route 42 south of Bridgewater provides access to Natural Chimneys Regional Park and to forest trails in George Washington National Forest. Route 42 will also link to Churchville and Route 250 into Staunton and Highland County.

Traffic volumes on Route 42 north of Bridgewater are about 15,000 AADT with only 4% heavy vehicle. South of Bridgewater volumes decrease to a range of 2,000 to 4,000 but heavy vehicle rates increase to 8%.

Route 220 ~ from Monterey to Warm Springs

Route 220 provides a north to south bicycle route through Highland and Bath Counties, linking routes 250 and 39. The road is two-lane of rural character. Traffic volumes are less than 1,000 AADT with 9% heavy vehicle.

Route 250 ~ from Staunton to Waynesboro

Route 250 is one of the most frequently requested routes to receive bicycle accommodation. It provides direct access between two of the region's largest population and activity centers, Staunton and Waynesboro, also links Fishersville, the Augusta Medical Center, American Frontier Culture Museum and the Woodrow Wilson Rehabilitation Center. The road carries almost 20,000 AADT and for most of its length is 4 or 5 lane with additional turning lanes at intersections. The road narrows as it reaches the very centers of Staunton and Waynesboro.



Route 250, Staunton

Route 250 ~ from Waynesboro to Blue Ridge Parkway/Skyline Drive

Route 250 east of Waynesboro provides critical access to the Blue Ridge Parkway and Skyline Drive.

Route 608 ~ from Grottoes to Stuarts Draft

Route 608 links Route 256 into Grottoes to Waynesboro, and the popular destination of Stuarts Draft. The road is largely rural in nature and connects many other rural routes north and south of Waynesboro. However, construction plans have been under review at VDOT to create a 4-lane highway on Route 608 in Fishersville. The County and VDOT have conducted corridor studies on 608 from Route 250 to Route 340 and envision an urban roadway. Any future improvements to or widening of Route 608 should include facilities to accommodate bicyclists.

Route 252 ~ from Staunton to Rockbridge Baths

Route 252 links numerous rural bicycling loops between Staunton and Lexington. The roadway has low traffic volumes and has many segments that are comfortable for cycling in their current condition.

Route 39 ~ from Rockbridge Baths through Goshen to Warm Springs

Route 39 creates access from Rockbridge Baths and Goshen through Bath County to Warm Springs and connects to Route 220. Traffic volumes range from 1,500 to 1,900. East of Rockbridge Baths, Route 39 is less amenable to bicycling. However several alternate routes are available to connect Rockbridge Baths to Lexington.

Routes 501 and 130 ~ from Buena Vista to Natural Bridge

From Buena Vista, bicyclists can take Routes 501 and 130 to reach Natural Bridge, a key tourist destination for the region. Route 130 also connects to Route 11 and Route 610 which provide access north to Lexington.

The following steps should be followed to establish the regional network of on-road facilities for bicycles.

STEP 1: CONDUCT A CORRIDOR-LEVEL ANALYSIS OF KEY ROADWAYS IN THE REGION TO IDENTIFY THE MOST APPROPRIATE BICYCLE ACCOMMODATIONS.

There are three general classifications of roads most commonly found in the region (with the exception of limited access freeways); rural, arterials and collectors, and downtown streets and narrow neighborhood streets. A description and examples are provided for each of these roadway types, in addition to general recommendations for accommodating bicycles. Detailed cross sections of recommended bicycle facilities are provided in Section III. Bicycle Facility Design Guidelines.

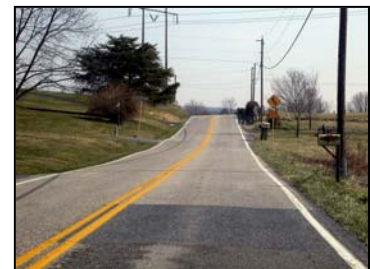
These recommendations represent ideal facilities for bicyclists and are meant to be flexible. The particular type of facility has not been determined for each route in the proposed regional network. This type of determination should be made by the local jurisdiction according to their respective adopted plans and in coordination with VDOT during the project development stage. The CSPDC should encourage creative solutions based on the Bicycle Facility Design Guidelines that respond to existing conditions and constraints for each specific project. Solutions should address the needs of non-motorized roadway users at all stages of project development, should provide satisfactory linkages and contribute to system connectivity, be cost-effective and safe. The CSPDC should maintain and update these design guidelines as a resource for land and transportation planners from the region’s jurisdictions.

An overview follows of the basic facility types that are recommended within this plan for the three general classifications of roads in the Central Shenandoah Valley.

Recommended Facilities for Rural Roadways

The majority of roadways in the Central Shenandoah Valley region would be classified as rural roads. These are typically two-lane roadways with limited shoulders, and speeds ranging from 35mph to 55mph. Examples include:

- Route 259 West of Broadway
- Route 613 West of Harrisonburg



Route 254, Augusta County

- Route 252 South of Staunton
- Route 608 North of Waynesboro
- Route 610 South of Lexington

Traffic volume estimates are employed to provide more detailed specifications for bicycle treatments on rural roads (www.virginiadot.org/comtravel/ct-TrafficCounts.asp). Traffic counts on most of the region’s rural roads range from 200 to 2,500 AADT. The recommended cross section in the Bicycle Facility Design Guidelines indicates that rural roads with less than 1,500 AADT should have a 10-13’ vehicle travel lane that is shared with bicyclists. With such low traffic volume, cyclists should be able to ride in the lane, and motorist should be able to pass without difficulty. There are exceptions. If the road is particularly hilly and cyclists are traveling at a much slower speed than motorists, a wide shoulder can be provided on the climbing side of hills. This allows the slower-moving bicyclist to be more safely passed by motorists. Similarly, if the road has sharp turns and sight distances are low, shoulders can be used at the turn to give bicyclists extra space. Other treatments including sharrows or warning signage can also be used at pinch points such as bridges, stone walls or a rock face.

For roadways with AADT over 1,500, a range of 3 to 6 -foot shoulder is recommended depending on the specific AADT and lane width.

Recommended Facilities for Arterial and Collector Roadways

Many arterials and collectors are found leading in to and out of the region’s larger cities: Harrisonburg, Staunton and Waynesboro. These are typically four to six lane roadways with center turn lanes and occasional right hand turn lanes at intersections. These roads carry heavy traffic, have posted speed limits of 35mph – 45mph, and typically have driveways every few hundred feet. Several suburban arterials in the region have sidewalks abutting the road. Examples of arterial and collector roadways include certain segments of:

- Route 250 from Staunton to Waynesboro
- Route 11 through Harrisonburg
- Route 11 South of Staunton
- Route 33 through Harrisonburg



Route 33, Harrisonburg

Each roadway should be evaluated to determine if existing motor vehicle lanes can be reduced to 11’ with the goal of providing a minimum of 5’ bike lanes or a shoulder whenever possible.

Recommended Facilities for Downtown and Neighborhood Streets

The downtown streets and narrow neighborhood streets of the region’s cities and towns are most often two-lane roads with parking on both sides and speed limits set at 25mph. Two separate cross sections are provided in the Bicycle Facility Design Guidelines for these roadway types - with and without space constraints.

In the historic downtowns, space is typically limited due to narrow street widths, parking demands and limited building setbacks. Examples include Main Street in Lexington, and Johnson Street in Staunton. In these instances, sharrows are recommended which do not require dedicated road space as do bike lanes, but still alert drivers that bicyclists are sharing the road.

When adequate space exists, bike lanes are recommended. 10’ travel lanes provide adequate width for motor vehicles given speed limits of 25mph. Parking lanes can be set to a minimum of 7’ to provide extra space for bike lanes.



Downtown street in Lexington

STEP 2: CONTINUE TO IDENTIFY KEY LOCAL CONNECTIONS THAT SUPPORT THE REGIONAL BICYCLE NETWORK.

The bicycle route network developed for this plan is the backbone of a regional transportation system that accommodates bicycles. Continued effort will need to be made by each locality to develop local routes that link key destinations in each jurisdiction and support the regional network.

The list of destinations to which residents would like to be able to bike (see Section I) is derived from the two month public participation process for this regional bicycle plan. This list however is a not comprehensive examination of all destinations that need bicycle access at the local level. Special focus should be given to identifying additional schools, colleges and universities, major employers, libraries, retail activity centers and other commuting destinations in each locality, and integrating them into the bicycle route network.

STEP 3: PROVIDE BICYCLE ACCESS ACROSS MAJOR BARRIERS.

There are currently many barriers to regional bicycle travel in the Central Shenandoah Valley, namely highways and interchanges, and intersections of major arterial roadways. Improving access across these barriers may be costly and should be based on an analysis of existing hazards and potential demand. In many instances, the roadway being used by bicyclists as part of the route network, such as Route 11, passes under an Interstate-81 interchange with free-flowing on- and off-ramps.

The Oregon Department of Transportation's Bicycle and Pedestrian Plan addresses bicycle accommodation across highway interchanges. This document should be used as a reference in determining how to provide bicycle access across these types of barriers (www.odot.state.or.us/techserv/bikewalk/planimag/117g.htm).

STEP 4: COORDINATE MAINTENANCE ACTIVITIES FOR ROADWAYS IN THE ROUTE NETWORK TO ENSURE SAFETY FOR ALL USERS.

Roadway maintenance was a frequently-cited problem throughout the public participation process. Citizens feel unsafe riding at the edge of a roadway with debris covering the pavement. Most bicycles lack suspension and have narrow wheels making them sensitive to irregularities in pavement condition caused by tree roots, weathering, snow, ice and other surface debris. Certain surface treatments routinely used by VDOT for maintenance, such as tar and gravel or chip and seal, can also pose hazards for bicyclists. In addition to improving bicycling conditions, proper maintenance of roadways in the bicycle route network will also serve to reduce state and local governments' exposure to liability claims.

Maintenance of bicycle facilities in the Central Shenandoah Valley is shared by VDOT, local jurisdictions, federal and regional agencies. On-road bike lanes and shoulders are included as a part of regular roadway maintenance programs. It is recommended that VDOT and local jurisdictions coordinate regular and remedial maintenance of bicycle facilities in the region. The program should be funded jointly by VDOT and local jurisdictions, with VDOT designating a team to proactively monitor and correct problems on the designated route network, and local jurisdictions on other bikeways.

Bicycle Signage

RECOMMENDATION 2: DEVELOP A ROUTE SIGNAGE SYSTEM THAT IS EASILY AND QUICKLY UNDERSTOOD BY BICYCLISTS AND PROVIDES WAYFINDING.

Existing signage in the region is limited to several Interstate Bicycle Route Signs (see right). A more comprehensive signage system should be developed to uniquely identify the Central Shenandoah Valley regional bicycle network. Residents and visitors bicycling through the region should be aware that they are riding on a route that is part of an interconnected system of bikeways throughout the Central Shenandoah Valley.

The signs, which should contain an image specifically designed for this region, should be placed along all designated bicycle routes. The signage system should be designed to indicate key destinations, distances, and/or a bikeway route name or number. This signage system is a critical step in efforts to create a successful bicycle touring program in the Central Shenandoah Valley. The development of a signage program should be fully coordinated with local and state tourism agencies.



Interstate Bicycle Route Sign, Skyline Drive

Bicycle Parking

RECOMMENDATION 3: PROVIDE BICYCLE PARKING AT KEY DESTINATIONS THROUGHOUT THE REGION.

In general, bicycle parking is lacking at most destinations in the Central Shenandoah Valley. Availability of bike parking is very important – a lack of bike parking tends to deter bicycle transportation, particularly to such common destinations as employment centers, stores and schools. Bike parking at historic and recreation areas is needed to support bike tourism. A preferred type of bike rack is the inverted U-Rack, which is designed to support the frame of the bicycle (refer to Section IV. Bicycle Facility Design Guidelines). *Racks which only support the front wheel of the bicycle are not recommended, for two reasons:*

- They encourage users to only lock the front wheel of the bicycle, which can easily be removed in order to steal the rest of the bike.
- The bicycle wheel can easily be damaged if the bicycle tips over while locked to the rack.

Bicycle parking is needed both at public destinations such as schools, parks, libraries, park-and-ride lots (and transit stops), community centers, etc., as well as at commercial developments such as shopping centers, office parks, and other destinations. Bicycle racks should be placed in plain sight near the entrance to the building or facility they are intended to serve. As a general rule bike racks should be located at least as close to an entrance as the nearest parking space. In order to ensure that development projects include bike parking, it will be important in the future for each jurisdiction to adopt a bike parking ordinance, similar to ordinances that have been adopted in other parts of the country.



Bicycle parked on signpost

Off-Road Facilities

RECOMMENDATION 4: ACTIVELY PURSUE THE DEVELOPMENT OF OFF-ROAD FACILITIES FOR BICYCLISTS

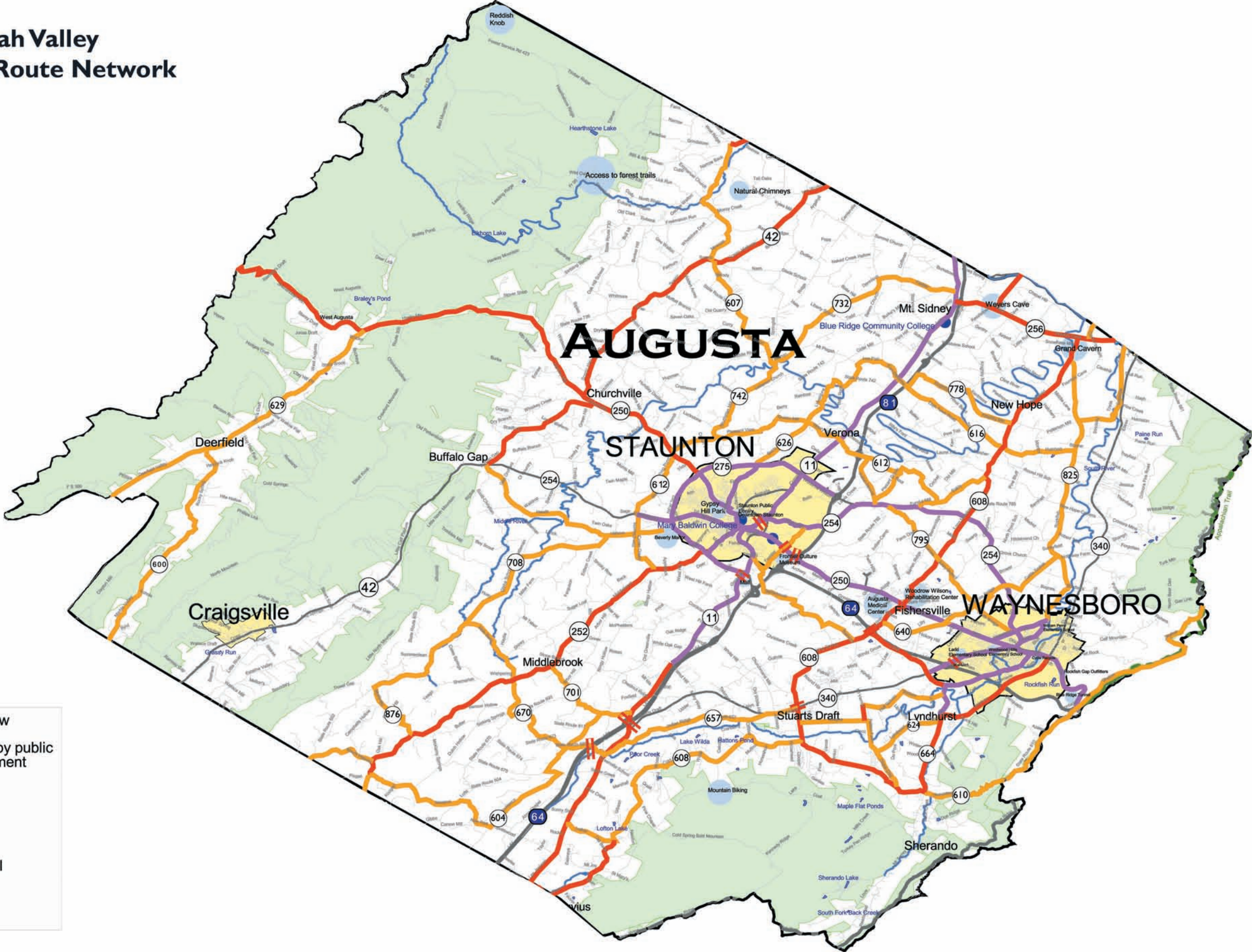
A critical need for off-road facilities for bicyclists was identified through the public participation process, fieldwork and data collection efforts. Without off-road accommodations, children and novice bicyclists must learn to bike while sharing the road with motor vehicles. Long distance off-road paths and mountain biking trails also support bicycle tourism. These types of off-road paths draw large numbers of people and provide facilities for users who are not comfortable sharing roadways with vehicles. Developing and promoting mountain bike riding also serves to broaden the options of outdoor recreational activities for tourists.

Several off-road projects have been proposed in the region, and these should be actively pursued to provide bicycle access. The most frequently cited off-road projects identified during the development of this plan include:

- Bridgewater-Dayton-Stokesville rails-to-trails
- Harrisonburg railroad (to link JMU, EMU, Chestnut Ridge residential neighborhood, Reherd Acres, Sunset Heights, Preston Heights, Harmony Heights, Maplehurst)
- Chessie Trail in Rockbridge County
- New waterline to be constructed between Massanetta Springs and Harrisonburg. Right-of-way could be used to build a bike path
- A portion of Berry Farm near Verona in Augusta County could be developed into a mountain biking or off-road trail suitable for families to ride or walk together
- Multi-use trail system designed for wheelchair users and bicyclists at the Woodrow Wilson Rehabilitation Center.
- Blue Ridge Tunnel at Rockfish Gap
- Blacks Run Greenway in Harrisonburg
- Waynesboro's South River Greenway
- Abandoned logging roads in the national forests

Special attention should also be given to creating bicycle access from the route network to these proposed facilities and to popular community parks. Gypsy Hill Park is a popular destination for Staunton and Augusta County residents, particularly families, yet there are no bicycle or pedestrian facilities on roadways leading to the park from adjacent neighborhoods.

Central Shenandoah Valley Proposed Bicycle Route Network Augusta County



Legend

- Proposed bike lane/sharrow
- Proposed wide shoulder
- Bike route recommended by public
- Needed crossing improvement
- Existing bike lane or route
- Roadway
- Destination for bicyclists
- Higher Education
- River
- Body of water
- National Park Service Trail
- City/Town
- County boundary
- Public land

**Central Shenandoah Valley
Proposed Bicycle Route Network
Bath County**



Legend

- Proposed bike lane/sharrow
- Proposed wide shoulder
- Bike route recommended by public
- Needed crossing improvement
- Existing bike lane or route
- Roadway
- Destination for bicyclists
- Higher Education
- River
- Body of water
- National Park Service Trail
- City/Town
- County boundary
- Public land

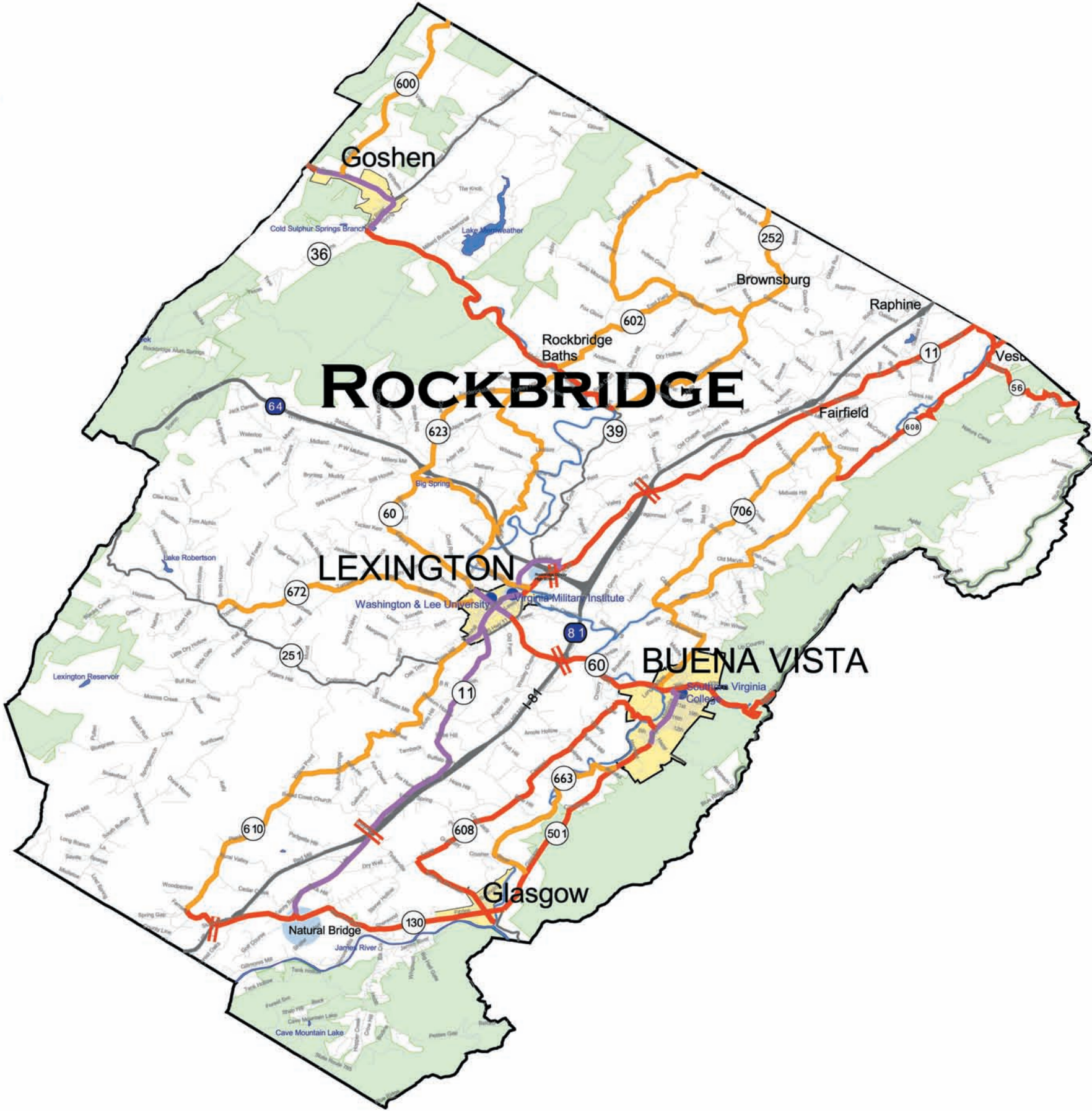
**Central Shenandoah Valley
Proposed Bicycle Route Network
Highland County**



Legend

- Proposed bike lane/sharrow
- Proposed wide shoulder
- Bike route recommended by public
- Needed crossing improvement
- Existing bike lane or route
- Roadway
- Destination for bicyclists
- Higher Education
- River
- Body of water
- National Park Service Trail
- City/Town
- County boundary
- Public land

**Central Shenandoah Valley
Proposed Bicycle Route Network
Rockbridge County**



Legend

- Proposed bike lane/sharrow
- Proposed wide shoulder
- Bike route recommended by public
- Needed crossing improvement
- Existing bike lane or route
- Roadway
- Destination for bicyclists
- Higher Education
- River
- Body of water
- National Park Service Trail
- City/Town
- County boundary
- Public land

**Central Shenandoah Valley
Proposed Bicycle Route Network
Rockingham County**



Legend

- Proposed bike lane/sharrow
- Proposed wide shoulder
- Bike route recommended by public
- Needed crossing improvement
- Existing bike lane or route
- Roadway
- Destination for bicyclists
- Higher Education
- River
- Body of water
- National Park Service Trail
- City/Town
- County boundary
- Public land

VI. INSTITUTIONAL FRAMEWORK AND REGIONAL COORDINATION

This section addresses the need for continued oversight and coordination to insure successful implementation of the *Central Shenandoah Valley Bicycle Plan*. This plan serves as a starting point to provide direction for improving bicycling conditions in the region and to encourage local jurisdictions to perform further investigation into bicycling needs for their specific localities.

RECOMMENDATION 5: ESTABLISH A PERMANENT BICYCLE ADVISORY COMMITTEE RESPONSIBLE FOR ONGOING COORDINATION AND THE IMPLEMENTATION OF THE BICYCLE PLAN.

Evidence from around the country indicates that successful bicycle and pedestrian programs result from well-organized advocacy and inter-agency support. The Bicycle Advisory Committee (BAC) involved in the development of this plan, is perfectly positioned to stimulate and coordinate regional bicycle activities. The BAC should continue to function following the completion of the *Central Shenandoah Valley Bicycle Plan*. The BAC's charge will be to coordinate and regularly inform the CSPDC, the MPO, local jurisdictions, and the community on the implementation of bicycle projects and programs, as well as on related local and statewide initiatives, such as the VDOT Statewide Bicycle Plan.

A variety of agencies throughout the Central Shenandoah region will need to share the responsibility of implementing this plan. Local planners, engineers, schools, police and VDOT officials, as well as private sector advocacy and interest groups, all play an important role in the development of an effective and safe bicycling network. The BAC should consider broadening its membership to include organizations whose activities or mission play a role in building or supporting bicycle projects and programs. For example, each of the following organizations could designate a liaison to participate in the BAC. The liaisons' role would be to participate in network meetings, share information and ideas, and shape joint initiatives for implementation through the resources of their organizations.

- Central Shenandoah PDC (liaison from the Bicycle Advisory Committee)
- Local government departments: Planning, Public Works, Health, Parks and Recreation, Economic Development, and County Extension agents
- Local police and sheriff's departments
- State law enforcement officers
- University and College representatives including cycling-related organizations and police
- VDOT District Planner and State Bicycle Planner
- FHWA VA Region Bicycle Planner
- National Park Service
- Local school superintendents
- Agencies and civic organizations for seniors
- Agencies and organizations for children & youth (Boy/Girl Scouts, YMCA, Big Brothers/Big Sisters, etc)
- Representatives of Mennonite communities with an interest in safe routes for buggies and bicycles
- Local, regional and state tourism organizations and leaders, such as the Downtown Development Association, Chamber of Commerce, Tourism Departments, Visitors Bureaus



Bicycle Advisory Committee Meeting

- Rails-to-trails groups such as the Shenandoah Valley Railroad Association, the Stokesville rail-trail project, Chessie Trail
- Local Transit Systems
- Local, state and national cycling organizations, such as Milepost Zero, the Tour de Gap, and the Fall Foliage Tour and the Tour of Shenandoah (professional bike race)
- Environmental agencies with an interest in greenways, such as the Lewis Creek Committee, Valley Conservation Council, Rockbridge Conservation Council
- Cycling-related retailers, such as bike shops and outdoor recreation stores
- Local hospitals, public health agencies, and advocacy groups such as the American Lung Association who can provide information, research, and encouragement to promote bicycling for public health reasons.
- Statewide agencies and associations with relevant interest and resources such as VDOT, DCR, DOF, BikeWalk Virginia, and others.

RECOMMENDATION 6: DEDICATE 20% OF A CSPDC STAFF MEMBER'S TIME TO IMPROVING THE REGION'S BICYCLE ACCOMMODATIONS.

A portion of a CSPDC staff member's time, supported by ongoing funds from the PDC and MPO, would initiate efforts to improve bicycling accommodations in the region and would provide support to the BAC. This staff member will organize meetings, facilitate communication among BAC members, and prepare regular briefings to the PDC, MPO and local governments on BAC accomplishments and activities.

VII. STRATEGIES FOR ENCOURAGEMENT, EDUCATION AND ENFORCEMENT

Improving conditions for bicyclists traveling in the Central Shenandoah Valley will require encouragement, education and enforcement in addition to improvements to the physical environment. Promoting the benefits of better bicycle accommodations to elected officials, the business community, and the public will help build broad support for the plan, and will ultimately improve the Plan's success. Included in this section are recommendations to encourage bicycling activity and recommendations to educate specific target audiences on bicycling and traffic safety.

Encouraging Bicycling Activity

RECOMMENDATION 7: CONDUCT COMMUNITY-WIDE ENCOURAGEMENT PROGRAMS FOR BICYCLING AND WALKING ON AN ONGOING BASIS.

Community-wide encouragement and advocacy for bicycling and walking can be achieved through events, ongoing programs, and city- or county-sponsored initiatives. An important key to success is having a coordinated approach, a consistent message and focused activities. Suggested activities, coordinated through the BAC, include the following:

Media Outreach and Website: the BAC should develop a media outreach plan to educate and promote the *Plan* to various constituencies throughout the region. This could include the development of a regional bicycling website for local bicyclists as well as visitors to the area. The site could include maps of on- and off-road facilities, recommended touring routes, resources such as bicycle shops, bike clubs, and a calendar of events.

Plan Dedication: Upon completion of the *Central Shenandoah Valley Bicycle Plan*, a promotional event should be organized where public officials dedicate the plan. The event should be coordinated by the CSPDC, and conducted as a field visit to also educate public officials and community leaders about the *Plan* and its benefits for the region.

Community Events: Local, statewide, and national cycling groups sponsor regular rides and events in the Central Shenandoah Valley. They are a logical source to help CSPDC and BAC members broaden the offerings to include events such as community bike rides for children, walk-a-thons to raise awareness, community trail walks, and guided walking and cycling tours for elected officials. The CSPDC should also encourage individual localities to organize and participate in annual bike-to-work day activities.

Bicycle and Traffic Safety Education

A majority of the participants of the public input process expressed a desire for motorists to have greater respect for bicyclists who are lawfully using the region's roadways, and for bicyclists to follow the basic rules of the road. An effective strategy for improving the safety and security of all roadway users must include education and enforcement for both bicyclists and motorists. Following are education strategies designed for specific target population groups.

Children and Youth

It is estimated that up to thirty percent of morning peak hour vehicle trips are school bound trips or include dropping students at schools (Dan Burden Presentation, March 2003). Increasing the numbers of students that bicycle and walk to school can help mitigate the negative impacts of children being driven to school, including health risks associated with inadequate daily physical activity, and increased emissions at school sites caused by idling vehicles. The following recommendations are intended to make bicycling and walking to school safer and to encourage more children (and parents) to walk and bike to school.

RECOMMENDATION 8: IMPLEMENT A BICYCLE AND PEDESTRIAN SAFETY EDUCATION CURRICULA INTO ELEMENTARY AND MIDDLE SCHOOLS THROUGHOUT THE REGION.

Bicycle and pedestrian issues can be incorporated into a variety of existing curricula at elementary and middle school levels. There are a number of existing sources for funding and assistance in integrating bicycle and pedestrian safety education into schools.

Bike Smart, Virginia! is an initiative of the Virginia Department of Health to prevent bicycle-related injuries and fatalities in communities throughout the state. The initiative has several components to educate citizens about bicycle safety and to make safety equipment, such as bicycle helmets, available. Additional information about the initiative can be found at www.vahealth.org/civp/bike/index.asp.

One component, Bike Smart, Virginia Schools! is a collaborative project with the Virginia Departments of Education, Health and Motor Vehicles and the non-profit organization, Bike Walk Virginia. The project's goal is to teach children safe biking behavior to reduce the numbers of injuries and fatalities. This is accomplished through training-the-trainer workshops held around the state. School health and PE teachers receive 2 days of training in methods of teaching bicycle safety and become Bike Smart Basics Certified. The six-week course for elementary and middle schools includes on-the bike instruction (including: helmet safety, crash avoidance, bike handling skills, rules of the road etc.) and is taught as part of the school's Health and P.E. curriculum. Trainings are offered throughout the year across the state.

The CSPDC should encourage the health and P.E. coordinator for the Central Shenandoah Valley's school districts to conduct additional research into the program and encourage local schools to participate. There is an ideal opportunity to procure the bicycles and related safety equipment needed for the Bike Smart, Virginia Schools! program. A local Rockbridge County resident has available for public use a trailer with about 30 bikes, adjustable, helmets, and materials such as cones and signs to set up bike safety courses, and educational materials. The trailer was developed by the Rockbridge County Schools several years ago with materials from the bicycle information center at the University of Florida (Gainesville), but is no longer used on a regular basis within school programs. With assistance from the BAC, the trailer could be more widely and regularly utilized by local schools as well as youth programs. Additionally, funding can be sought through the Department of Motor Vehicles (DMV).



Safety lesson in Rockville, MD through Maryland Pedestrian and Bicycle Safety Education Program

RECOMMENDATION 9: SEEK FUNDING TO INITIATE A *SAFE ROUTES TO SCHOOL* PILOT PROGRAM

Parents and school officials will feel more comfortable encouraging students to use local streets and sidewalks if safe routes to area schools are identified. Safe Routes to School (SR2S) programs have been implemented successfully around the world for more than 20 years. Most programs include some combination of engineering, encouragement, and enforcement strategies aimed at making it safe for more children to walk in their communities.

Funding for SR2S programs has been secured in the past from a variety of sources, including state programs, federal 402 and Congestion Air Quality Mitigation (CMAQ) funds, and even local Parent Teacher Organizations (PTOs). A viable source for funding in Virginia is the Department of Motor Vehicle's Safety Grant. The Virginia DMV accepts grant applications each year in March that support Virginia's primary transportation safety goal of "reducing the number of deaths and serious injuries that result from traffic crashes". Applications must also support specific safety areas that are highlighted each year, and often include pedestrian/bicycle safety. Grant applications are accepted from state agencies, universities, localities and non-profit organizations and the typical funding year is from October 1st through September 30th. Guidelines for the current year's application can be found at www.dmvnow.com/webdoc/pdf/tss10a.pdf

The CSPDC should consider applying for the Virginia DMV Safety Grant in March, 2006 for the October 2006 to September 2007 funding cycle to fund a regional SR2S pilot program. This pilot program could be based on existing models used in Charlottesville, Virginia and elsewhere to plan physical improvements (including for example bicycle parking, crossing treatments, sidewalk plans and/or construction) and implement safety education programs and enforcement initiatives at one or two schools. The goal would be to expand the SR2S program to other schools over time. While many schools in the Shenandoah Valley are in rural areas where distances are too far for children to walk to school, SR2S programs have been successfully implemented in similar environments using outdoor facilities on the school property.

RECOMMENDATION 10: INCORPORATE *SHARE THE ROAD* AND BICYCLING SAFETY CONCEPTS INTO EXISTING HIGH SCHOOL DRIVER EDUCATION COURSES.

Currently, high school programs are the only source of driver education for most citizens of the region. The BAC should place a high priority on ensuring these driver education programs include *share the road* and bicycling safety concepts. Educating young drivers will reduce future need for adult education. Adults who are taking driver's education courses for purposes such as senior safety or DUI requirements can also benefit from this emphasized information.

College and University Students

RECOMMENDATION 11: LAUNCH A CORRIDORS-TO-CAMPUS INITIATIVE TO SUPPORT WALKING AND BIKING TO CAMPUSES THROUGHOUT THE REGION.

The Central Shenandoah Valley is home to over ten colleges and universities. These institutions are typically located in high density areas of their respective city or town and generate a substantial number of vehicle trips. Additionally, most students tend to live in close proximity to campus. This captive student population presents an enormous opportunity to reduce congestion and increase student health by replacing vehicle trips with bicycling trips.

Working with University officials, the BAC should launch a corridors-to-campus initiative designed to identify, evaluate and prioritize the most cost effective strategies to support walking and cycling to and from each college or university in the region. As an example, the University of Florida, in cooperation with the City of Gainesville, conducted such an effort in 1998 as part of an overall mobility management effort. The study entailed intercept questionnaires and ranking of routes from surrounding neighborhoods and apartment complexes that would benefit from specific bicycle and pedestrian improvements. The results were programmed into the MPO's Transportation Improvement Program as well as University capital investment and program budgets.

RECOMMENDATION 12: DEVELOP EDUCATIONAL AND ENCOURAGEMENT MATERIALS AND EVENTS TO PROMOTE STUDENT BICYCLING TO AND AROUND CAMPUS.

Local universities should incorporate bicycle and pedestrian information into their regular student publications and resources, such as orientation packets, the school website, campus maps, and student organizations. Cornell University, whose flagship bicycle promotion program supports a bike/walk rate of as much as 40 percent in the hilly, snowy city of Ithaca, NY, can be a source of ideas for student outreach in the Central Shenandoah Valley.

Annual events at universities should also be held to stimulate ongoing involvement and support for biking and walking among students and staff. An example is the 2003 "Walk-In" campaign hosted by the University of Washington in Seattle, which included production of a campus walking map, information and activities organized by an employee steering committee, a lecture series, and an inter-departmental walking challenge to achieve the most miles walked per year (www.washington.edu/upass/walkin).

Working age adults

RECOMMENDATION 13: COORDINATE WITH THE REGION'S MAJOR EMPLOYERS TO DISTRIBUTE SHARE THE ROAD AND BICYCLING SAFETY EDUCATIONAL MATERIALS, AND TO DEVELOP ENCOURAGEMENT PROGRAMS TO INCREASE BICYCLE COMMUTING.

Employers are a key resource to distribute bicycle and pedestrian safety information and encouragement to working age adults. Information developed through the BAC can be distributed by the Chamber of Commerce to major



Program at Evergreen College to encourage use of alternative modes of transportation

employers, such as hospitals, universities and factories. Venues for distribution can include brochures, company email networks and websites. In addition, the BAC can take the lead to work with area employers and fitness centers to identify and improve facilities such as bike lockers, bike parking, and showers available for employees who commute to work by bike or on foot.

Employers are also encouraged to develop transportation demand management programs to support and promote bicycle commuting, to increase public awareness of bicycling as a mode of transportation, and to provide educational opportunities for motorists and bicyclists. Employers should make efforts to reduce employee motor vehicle trips to the workplace by offering incentives to those who choose to bicycle or walk.

Senior Citizens

The BAC can draw upon the growing number of senior-related organizations to promote senior fitness and independence through walking and cycling by developing and distributing information and programs. In addition, economic development agencies participating in the BAC can identify and promote ways in which the Central Shenandoah region can attract active retirees who want to locate in a community that supports active living.

Cycling groups

RECOMMENDATION 14: UTILIZE LOCAL CYCLING GROUPS AS AVENUES FOR COMMUNITY-BASED TRAINING AND ADVOCACY PROGRAMS.

Local cycling groups such as Milepost Zero and the Shenandoah Bicycle Club are very active in the community and communicate with residents frequently through newsletters and an electronic listserv. Individuals in these groups can take the lead in educating other recreational riders regarding the rules of the road. They can also take the lead in community-wide education and advocacy through activities such as organizing volunteer-led commuter cycling courses and developing route maps. The BAC can provide logistical assistance such as obtaining grant funds to create maps and train volunteer course leaders.

Enforcement and Security

In addition to educating motorists and cyclists regarding the rules of the road, enforcement is a necessity to increase the incidence of adhering to those rules and to increase bicyclists' perceived personal security while using the region's roadways.

Maintaining personal security for public activities and in public places is an important aspect of bicycling and walking. Actual and perceived personal security is a significant factor that influences a person's decision to bike or walk, especially for women and children, and especially during non-daylight hours. Public perception of safety and security in a neighborhood and on public streets is a key component of determining an area's friendliness to bicyclists.

One of the single biggest factors that influences security in a public space is the level of use it receives. The more people are bicycling and walking on streets, sidewalks and trails, the safer they will be. Professional police patrols and volunteer neighborhood patrols provide formal support to the base of security which results from regular use.

RECOMMENDATION 15: IMPROVE ENFORCEMENT OF LAWS CONCERNING THE SAFE INTERACTION OF PEDESTRIANS, BICYCLISTS, AND MOTORISTS IN SHARED ENVIRONMENTS.

Education should be provided to law enforcement officers who may not be aware of rules of the road and aggressive motor vehicle behavior toward cyclists. The Maryland Office of Highway Safety for example, organizes safety training events for officers to raise awareness of rights, rules, and appropriate responses to incidents involving conflicts between motor vehicles, bicycles and pedestrians.

Bicycle patrol is another strategy for increasing the visibility of bicycling in the region and involving law enforcement more extensively in bicycling issues. A number of localities currently have bicycle squads in place. Bicycle squad members work with local staff to provide bike and pedestrian safety education through youth groups and schools, as well as simply talking with residents on their beats. The BAC should coordinate grants and other resources to help build more bike patrols throughout the region's towns and cities.

Professional law enforcement can also be supplemented with volunteer and community-based patrols. This approach can be used with great success on multi-use trails, and along walking and biking routes to school.

RECOMMENDATION 16: IDENTIFY IMPROVEMENTS THAT CAN BE MADE TO THE PHYSICAL ENVIRONMENT TO INCREASE PERSONAL SECURITY

The CSPDC and local planning departments should work with local law enforcement agencies to identify ways in which personal security, particularly for pedestrians and cyclists, can be improved through better physical design, landscaping, and lighting. This is an important principle that must be the cornerstone of the design for new trails and shared-use paths to be constructed in the region. The BAC can begin to identify specific routes or corridors where security is a real and/or perceived problem, and propose specific ways to address this issue.

VIII. BICYCLE TOURISM

The Central Shenandoah Valley is recognized as a key destination for bicyclists and is poised to become a major bicycle touring destination. Many bicyclists are already aware of the touring opportunities available in the region. The Central Shenandoah Valley is home to numerous active bike clubs that provide resources and rides, to several large-scale bicycling events such as the *Tour of Shenandoah* and the *Shenandoah Fall Foliage Bike Festival*, and to part of the Transamerica Route 76. Developing bicycle touring routes and a signage system, and ensuring that these roadways provide safe accommodation for cyclists will create more positive experiences for bicyclists and will draw new bicycle tourists to the region.

RECOMMENDATION 17: INCREASE COORDINATION AND EXPAND FACILITIES AND PROGRAMS TO SPECIFICALLY ENCOURAGE BICYCLE TOURISM.

Bicycle tourism is currently a part of the region’s economy and should become a greater focus of the Central Shenandoah Valley’s tourism strategy.

Providing specific infrastructure and services is vital to a successful bicycle tourism program. Many of these already exist in the Central Shenandoah Valley, but they should be identified and highlighted. Infrastructure/services needed to support bicycle tourism include:

- A well-planned route network along scenic roads with low traffic volumes, rest stops, convenience stores, etc.
- Water fountains and rest room facilities along trails as well as notification of available water and restrooms for on-road bicyclists.
- Quality touring maps that show routes and locations of bicycle-friendly lodging, bike shops, and attractions
- Access to historic, cultural and recreational attractions along bicycle touring routes
- Lodging opportunities along touring routes (hotels, B&B’s, campgrounds) which are friendly to bicycles
- A combination of well-built trails and on-road routes
- Bicycle-friendly towns with bicycle shops and bicycle parking



Blue Ridge Parkway, Augusta County

The following steps are designed to help develop a more successful bicycle touring program in the Central Shenandoah Valley.

STEP 1: CONVENE A MEETING OF THE CSPDC, THE BAC AND REGIONAL TOURISM AND ECONOMIC DEVELOPMENT ORGANIZATIONS TO COLLABORATE ON A BICYCLE TOURISM STRATEGY.

The region has many existing resources to support tourism and economic development including the Shenandoah Valley Travel Association, the Harrisonburg-Rockingham Convention & Visitors Bureau, the Crossroads of the Shenandoah Valley, the Lexington and Rockbridge Area Visitors’ Center, and Chambers of Commerce, Blue Ridge Parkway Planners, and the Shenandoah Valley Partnership (SVP). The CSPDC and BAC should coordinate a meeting to draw upon the resources and expertise of these regional tourism and economic development organizations. A strategy should be developed for implementing the

recommendations in the *Central Shenandoah Valley Bicycle Plan* that will support bicycle tourism.

STEP 2: COMPLETE THE DEVELOPMENT OF THE BICYCLE SIGNAGE SYSTEM FOR THE CENTRAL SHENANDOAH VALLEY.

In section V. Recommended Physical Improvement, recommendations are made for the development of a signage system that is unique to the region and provides wayfinding. The CSPDC, BAC and interested tourism and economic development agencies should be involved in the development of this signage system to insure it meets the needs of the region's visitors.

STEP 3: IDENTIFY AND EVALUATE BICYCLE TOURING ROUTES.

The CSPDC and BAC should work with tourism agencies to identify touring routes and develop a strategy to designate them. A system of on-road bicycle routes has been identified for this plan and is illustrated on the Bicycle Route Network map. Bicycling conditions on routes identified as suitable in their present condition should be re-examined to verify that they are appropriately designated and are ready to be signed as part of the touring network. Routes that need improvement prior to designating them as bicycle touring routes should be prioritized to help plan future roadway projects.

The following safety criteria should be considered before signing touring routes (derived from the *AASHTO Guide for the Development of Bicycle Facilities, 1999*):

- Traffic conditions and cross section design is sufficient to support bicycling. This should be measured using standard Bicycle Level of Service measures (see Appendix C).
- Traffic signals should be adjusted to accommodate bicycles. This may include placement of bicycle-sensitive detectors where bicyclists are expected to stop, and adjusting signal timing to provide adequate time for bicyclists to clear the intersection during the green phase.
- Smooth pavement should be provided. Paved shoulders and travel lanes that have poor pavement quality can be very hazardous for bicycling. Specific conditions that can be a problem include:
 - chip and seal surfaces and other types of loose pavements
 - potholes and excessively patched pavements
 - sunken (or raised) utility covers
 - drain grates with openings that are parallel to the bicycle wheel
 - rough and/or angled railroad crossings
 - steel bridge decks (which become slippery when wet)
 - rumble strips on the shoulder or in the travel lane
- Maintenance of the route will be sufficient to prevent accumulation of debris on shoulders.
- An adequate bicycle level of service should be provided on designated routes. The level of service accommodation should be checked following any route upgrades routes or other infrastructure and capital improvements.

STEP 4: DEVELOP A PRINTED GUIDE TO BICYCLE TOURING IN THE CENTRAL SHENANDOAH VALLEY

The guide to bicycle touring in the Central Shenandoah Valley is envisioned as a combination booklet/map. The guide should include a map of the entire touring system with brief descriptions of the individual touring routes. The descriptions should include information about routes (route mileage, level of difficulty, access), historic and cultural destinations, and places to eat and spend the night. Certain routes indicated on the Bicycle Network Map completed for this plan are acknowledged for advanced riders. Literature and signage should reflect various levels of difficulty. The guides should be distributed through local tourism offices and at bicycle shops both within the region, and other key markets outside of the area.

IX. THREE-YEAR WORK PLAN AND FUNDING OPPORTUNITIES FOR IMPLEMENTATION

Implementation of the recommendations in this plan will take leadership, commitment, and continuous coordination among the region's cities, towns and counties. This section of the plan sets priorities for program and facility improvements for the first three years following the Plan's adoption. Criteria for prioritizing projects include level of investment, need (critical to the plan's implementation, presence of safety concerns), and level of coordination. Following Year 3, the BAC should convene and reassess priorities for future implementation projects.

Year 1 Work Plan

- Establish a permanent BAC responsible for ongoing coordination and the implementation of the Bicycle Plan. The BAC should broaden its membership to include organizations whose activities or mission play a role in building or supporting bicycle projects and programs. (Recommendation 5)
- Dedicate 20% of a CSPDC staff member's time to improving the region's bicycling accommodations. (Recommendation 6)
- Plan and design a route signage system that is easily and quickly understood by bicyclists and will help to identify the Central Shenandoah Valley regional bicycle network. (Recommendation 2)
- Increase coordination and expand facilities and programs to encourage bicycle tourism. (Recommendation 17)
 - Step 1: Convene a meeting of the CSPDC, the BAC and regional tourism and economic development organizations to collaborate on a bicycle tourism strategy.
- Apply for state funds for the bike signage project and/or a mapping project (public map, tourism oriented). See potential funding sources on next page. (Recommendation 2 and 17)

Year 2 Work Plan

- *Establish a regional network of on-road bicycle facilities between key destinations in the region.* (Recommendation 1)
 - Prioritize and sign several roadways as bike routes. Select from those routes that were indicated by local bicyclists as being good places to ride in their current condition (indicated in orange on the Route Network map).
 - Advance shoulder improvements on one or more segments of principal routes, such as Route 11.
- Seek funding to initiate a *Safe Routes to School* pilot program. (Recommendation 9)
- Utilize local cycling groups as avenues for community-based training and advocacy programs. Develop a relationship with cycling groups and garner support for current initiatives. (Recommendation 14)

Year 3 Work Plan

- Launch a Corridors-to-Campus initiative to support walking and biking to campuses throughout the region. Evaluate and prioritize the most cost effective strategies to support walking and cycling to and from each college or university in the region. (Recommendation 11)
- Actively pursue the development of off-road facilities for bicyclists. Through funding grants from VDOT (see potential funding sources below), advance a promising trail and/or on-road improvement project in the region. (Recommendation 4)
- Incorporate *Share the Road* and bicycling safety concepts into existing high school driver education courses. (Recommendation 10)
- Begin implementing a SRTS program. (Recommendation 9)
- Make the bicycle map publicly available. (Recommendation 17, Step 4)

Funding Sources

There are various means through which bicycle recommendations can be funded, including:

- Highway construction funds
- Transportation Enhancement Program
- Congestion Mitigation and Air Quality funds (CMAQ)
- Recreational Access Program
- Hazard Elimination Safety Program
- Safe Routes to School
- Revenue Sharing Program
- Scenic Byways Program
- Public Lands Highways Program
- Transportation and Community System Preservation Program
- State Aid Transit Grants
- Virginia Recreational Trails Fund Program (RTP)
- 402 Highway Safety Program

A number of the actively funded programs are described below:

Rural Transportation Planning Program

<i>Purpose</i>	This program provides funds to planning district commissions to carry out transportation planning for rural areas.
<i>Funding</i>	<ul style="list-style-type: none"> ▪ Federal funds finance 80% of program activities and grants ▪ A match of at least 20% from a planning district commission or locality is required
<i>Eligible projects</i>	<ul style="list-style-type: none"> ▪ Bicycle and pedestrian planning, greenway planning
<i>Eligible applicants</i>	<ul style="list-style-type: none"> ▪ Planning district commissions
<i>Contact</i>	Peggy Todd; peggy.todd@vdot.virginia.gov; 804-371-3092 VDOT Transportation and Mobility Planning Division

Highway Construction Program

<i>Purpose</i>	This program provides funding for the preliminary engineering, right of way acquisition, and construction of highway projects.
<i>Funding</i>	No local match is needed for projects on primary and secondary system roads. A 2% local match is required for projects on urban system roads
<i>Eligible projects</i>	<ul style="list-style-type: none"> ▪ Bicycle and pedestrian accommodations can be built as part of highway projects ▪ Bicycle and pedestrian accommodations can be built as individual projects, separate from the construction of highways, either on highway or independent

	right of way
Contact	VDOT district offices – www.VirginiaDOT.org

Bicycle and Pedestrian Safety Program

Purpose	This program was developed to implement safety projects addressing bicycle and pedestrian crashes or the potential for such crashes, with evaluations based on risk and applications competing with like projects.
Funding	<ul style="list-style-type: none"> ▪ Up to 90% of a project can be financed with federal funds ▪ A project must have a minimum 10% match
Eligible projects	<ul style="list-style-type: none"> ▪ Construction of on-street facilities and shared use paths ▪ Development of treatments for intersections ▪ Installation of signs and pavement markings
Eligible applicants	<ul style="list-style-type: none"> ▪ State and local agencies may apply to the program
Contact	VDOT Mobility Management Division – HSIProgram@vdot.virginia.gov 804-786-9094

Transportation Enhancement Program

Purpose	This program is an initiative to focus on enhancing the travel experience and fostering the quality of life in American communities
Funding	<ul style="list-style-type: none"> ▪ Up to 80% of a project can be financed with federal funds. A local match of at least 20%, from other public or private sources, is required. ▪ Local matches may be in-kind contributions including tangible property, professional services and volunteer labor ▪ This is a reimbursable program
Eligible projects	<ul style="list-style-type: none"> ▪ Pedestrian and bicycle facilities such as sidewalks, bike lanes and shared use paths ▪ Pedestrian and bicycle safety and educational activities such as classroom projects, safety handouts and directional signage for trails ▪ Preservation of abandoned railway corridors such as the development of a rails-to-trails facility
Eligible applicants	<ul style="list-style-type: none"> ▪ Any local government, state agency, group or individual may apply to the program. All projects need to be formally endorsed by a local jurisdiction or public agency.
Contact	Transportation Enhancement Program Staff, VDOT Local Assistance Division www.VirginiaDOT.org , “Programs” section

Recreation Access Program

Purpose	This program provides bicycle access to public recreational facilities or historic sites operated by a state agency, a locality, or a local authority, either with an access road or on a separate bicycle facility.
Funding	<ul style="list-style-type: none"> ▪ This program uses state funds only. ▪ Up to \$75,000 may be awarded for bicycle access to a facility operated by a state agency. ▪ UP to \$60,000 may be awarded for bicycle access to a facility operated by a locality or local authority, with a \$15,000 match.
Eligible projects	Construction, reconstruction, maintenance, or improvement of bikeways.
Eligible applicants	A governing body of a county, city or town may make an application to this program
Contact	Hugh Adams, 804-786-2744, hugh.adams@vdot.virginia.gov VDOT Local Assistance Division

National Scenic Byways Program

<i>Purpose</i>	This program supports projects to improve the quality and continuity of the traveler's experience on highways designated as National Scenic Byways, All American Roads, or a state scenic byway.
<i>Funding</i>	<ul style="list-style-type: none"> ▪ Up to 80% of a project can be financed with federal funds ▪ A project must have a minimum 20% match ▪ This is a reimbursable program
<i>Eligible projects</i>	<ul style="list-style-type: none"> ▪ Construction of a facility for pedestrian and bicyclists along a scenic byway ▪ Safety improvements to reduce or eliminate the incidence or likelihood of crashes or conflicts with bicyclists and pedestrian
<i>Eligible applicants</i>	Any local government, state agency, group or individual may apply to the program.
<i>Contact</i>	Scenic Byways Program Staff VDOT Local Assistance Division 804-786-2264 h.chenault@vdot.virginia.gov www.bywaysonline.org, "Grants" section

Virginia Recreational Trails Fund Program

<i>Purpose</i>	This grant program was established to provide and maintain recreational trails and trails-related facilities.
<i>Funding</i>	<ul style="list-style-type: none"> ▪ Up to 80% of a project can be financed with federal funds. ▪ A project must have a minimum 20% sponsor match ▪ This is a reimbursable program
<i>Eligible projects</i>	<ul style="list-style-type: none"> ▪ Build new trails ▪ Restore damaged existing trails ▪ Develop trailside and trailhead facilities ▪ Provide feature to facilitate access and use by people with disabilities
<i>Eligible applicants</i>	<ul style="list-style-type: none"> ▪ Any local government, government entity, or private organization may apply to the program ▪ Federal government entities may be eligible if teamed with private trail groups and organizations
<i>Contact</i>	Virginia Recreational Trails Fund Program Department of Conservation and Recreation 804-786-3218 or 804-786-4379 www.dcr.virginia.gov, "Recreation Planning" section

CONCLUSION

The recommendations described above form the basis for the creation of a bikeway facilities network. This will provide the option of bicycling as a practical mode of transportation as well as for recreation to major destinations throughout the region. These recommendations are intended to guide local activities and motivate coordination between jurisdictions as these facilities, programs and policies are put in place.

Appendix A ~ Sample of Online Questionnaire

Central Shenandoah Valley Bicycle Plan Helping to Improve Biking in the Central Shenandoah Valley

The Central Shenandoah Planning District Commission is working on the Central Shenandoah Valley Bicycle Plan which includes the counties of Rockbridge, Augusta, Rockingham, Bath and Highland; the cities of Buena Vista, Harrisonburg, Lexington, Staunton and Waynesboro and the towns of Glasgow, Goshen, Craigsville, Monterey, Grottoes, Mt. Crawford, Dayton, Bridgewater, Elkton, Broadway, and Timberville.

The Plan will address topics such as:

- bicycle facilities for key roadways, including striped bike lanes, shared lanes, expanded shoulders, and separate bike paths
- signage, bicycle maps, and brochures
- regional goals for creating a comprehensive network of cycling facilities connecting neighborhoods, communities, and key destination points
- opportunities to promote the health, recreational, tourism, transportation and economic benefits of cycling
- educational and safety initiatives to make roads in the region safer for persons who cycle (including children, families, and commuters) and motorists

This survey is an essential component in the development of the Central Shenandoah Valley Bicycle Plan. Public input from cyclists and non-cyclists is CRITICAL to the planning process and the success of the Plan. By completing this survey, you will be able to share your opinions, help us to understand citizen concerns, and aid in formulating ideas about what can be done to improve bicycling in the region.

Information collected will be confidential and will be used solely for the development of the Plan. The survey should take 5 to 10 minutes to complete and will be available online from February 1, 2005 through March 15, 2005. Thank you for taking the time to complete this survey. Your responses are very much appreciated!

How would improved bike facilities (bike lanes racks route maps) MOST benefit your community? Please select the 2 greatest benefits.

	First choice	Second choice
Don't know		
Bike facilities would not benefit my community		
By drawing more cyclists to the area enhancing tourism and economic development		
By improving conditions for avid cyclists		
By improving the safety of students who bike to school/college		
By promoting a healthy lifestyle		
By encouraging residents to bike for transportation		
By improving the safety of motorists sharing the road with cyclists		
By improving the safety of families riding for recreation and exercise.		

How often do you ride a bicycle (on average)?

- 5 or more times a week
- One to four times a week
- Once or twice a month
- A few times a year
- Rarely, if ever

What is the primary purpose of most of your bicycle trips?

- For exercise/ recreational activity
- Travel to work
- Other
- Travel to College / University
- Personal business / errands

Travel to school
Visit friends /social /entertainment
Travel to public transp /carpool

How far is your typical bicycle trip?

Less than 5 miles
5 to 10 miles
10 to 20 miles
more than 20 miles

On which streets/roads do you bike most often? Please be specific - type road name "from ___ to ___" town city and/or county if possible. You may list up to five.

Street/road #1
Street/road #2
Street/road #3
Street/road #4
Street/road #5

What do you usually do to make your bike ride safer? Check all that apply.

Wear a bicycle helmet
Obey traffic signals and signs
Signal my turns
Ride with (not against) traffic
Use lights and/or reflective materials at night
Am courteous to other travelers (motorists, pedestrians, etc.)
Avoid properties with aggressive dogs
Other (please specify)

city and/or county if possible. Skip question if you don't know.

Street/road #1
Street/road #2
Street/road #3
Street/road #4
Street/road #5

How would you describe the behavior of most bicyclists that you see on the road? Check all that apply.

None of the above
Other
Signal their turns
Use lights and/or reflective materials at night
Are courteous to other travelers
Obey traffic signals and signs
Wear bicycle helmets
Ride with (not against) traffic

Please list up to 3 destinations that you frequently travel to or would like to travel to on bicycle. (These could also include roads/routes you enjoy riding for recreation.) Please be specific list town city or county if possible.

Destination #1
Destination #2
Destination #3

How do drivers in your area typically behave around bicyclists? Please check all that apply.

- Run red lights or stop signs
- Harass bicyclists
- Other (please specify)
- Do not signal
- Cut bicyclists off
- Fail to yield to bicyclists crossing a street
- Courteous, yield and give bicyclists space
- Drive too fast
- Pass bicyclists too close

On which streets/roads would you like to see bicycle lanes or paths (i.e. wider shoulder with painted bike lane or separate dedicated path next to road) or other facilities such as bike route signs? Please be specific - type road name "from ___ to ___" t

- Street/road #1:
- Street/road #2:
- Street/road #3:
- Street/road #4:
- Street/road #5:

At which locations would you like to see additional bicycle parking (racks or lockers) provided? Please provide a neighborhood address intersection business name transit stop or shopping district.

- Location #1:
- Location #2:
- Location #3:
- Location #4:
- Location #5:

Which of the following factors deter you from riding a bike to places you go often? Select all that apply.

- Physical ailments
- Other (please explain)
- Availability of showers/changing facilities
- Lack of interest in bike riding
- Availability of bicycle parking
- Hills
- Distance
- Weather
- Lack of dedicated bike lanes or paths
- Safety of travel route for bicyclists
- Traffic (volume and/or speed)

Which ONE of the following do you think would do the MOST to encourage bicycling in the Central Shenandoah Valley?

- Reduce street traffic
- Nothing
- Provide bicycle storage
- Don't know
- Conduct safety outreach and education
- Enforce laws applying to motorists

Other
Enforce laws applying to bicyclists
Create a map or list of routes appropriate/safe for biking
Build bike lanes or paths

If better bicycle facilities (bike lanes wider shoulders separate bike paths bike racks route maps etc.) were available would you bike more often?

Yes
No

In which of the following areas do you live?

Town of Craigsville	Town of Dayton	Rockbridge County
Town of Monterey	Highland County	Rockingham County
Town of Timberville	City of Buena Vista	City of Harrisonburg
Town of Elkton	Town of Broadway	City of Waynesboro
Town of Glasgow	Town of Bridgewater	Augusta County
Town of Goshen	Bath County	City of Staunton
Town of Grottoes	City of Lexington	Other (please specify)
Town of Mt. Crawford		

Are you a student faculty or staff member at a college or university in the Central Shenandoah Valley region?

Yes
No

With which of the following schools are you affiliated (enrolled employed etc)?

James Madison University
Washington and Lee University
Mary Baldwin College
Virginia Military Institute
Bridgewater College
Eastern Mennonite University
missing one ...
Other (please specify)

Please add any additional comments or suggestions related to the Central Shenandoah Valley Bicycle Plan here:

During the development of the Bicycle Master Plan we will be conducting a number of meetings open to the public. If you would like to be notified of these events please provide the following contact information.

Name:
Email Address:
Street Address:
Apt/Suite Number:
City:
State:
ZIP:

APPENDIX B: VIRGINIA DEPARTMENT OF TRANSPORTATION POLICY FOR INTEGRATING BICYCLE AND PEDESTRIAN ACCOMMODATIONS

1. Introduction

Bicycling and walking are fundamental travel modes and integral components of an efficient transportation network. Appropriate bicycle and pedestrian accommodations provide the public, including the disabled community, with access to the transportation network; connectivity with other modes of transportation; and independent mobility regardless of age, physical constraints, or income. Effective bicycle and pedestrian accommodations enhance the quality of life and health, strengthen communities, increase safety for all highway users, reduce congestion, and can benefit the environment. Bicycling and walking are successfully accommodated when travel by these modes is efficient, safe, and comfortable for the public. A strategic approach will consistently incorporate the consideration and provision of bicycling and walking accommodations into the decision-making process for Virginia's transportation network.

2. Purpose

This policy provides the framework through which the Virginia Department of Transportation will accommodate bicyclists and pedestrians, including pedestrians with disabilities, along with motorized transportation modes in the planning, funding, design, construction, operation, and maintenance of Virginia's transportation network to achieve a safe, effective, and balanced multimodal transportation system.

For the purposes of this policy, an accommodation is defined as any facility, design feature, operational change, or maintenance activity that improves the environment in which bicyclists and pedestrians travel. Examples of such accommodations include the provision of bike lanes, sidewalks, and signs; the installation of curb extensions for traffic calming; and the addition of paved shoulders.

3. Project Development

The Virginia Department of Transportation (VDOT) will initiate all highway construction projects with the presumption that the projects shall accommodate bicycling and walking. Factors that support the need to provide bicycle and pedestrian accommodations include, but are not limited to, the following:

- project is identified in an adopted transportation or related plan
- project accommodates existing and future bicycle and pedestrian use
- project improves or maintains safety for all users
- project provides a connection to public transportation services and facilities
- project serves areas or population groups with limited transportation options
- project provides a connection to bicycling and walking trip generators such as employment, education, retail, recreation, and residential centers and public facilities
- project is identified in a Safe Routes to School program or provides a connection to a school
- project provides a regional connection or is of regional or state significance
- project provides a link to other bicycle and pedestrian accommodations
- project provides a connection to traverse natural or man-made barriers
- project provides a tourism or economic development opportunity

Project development for bicycle and pedestrian accommodations will follow VDOT's project programming and scheduling process and concurrent engineering process. VDOT will encourage the participation of localities in concurrent engineering activities that guide the project development.

3.1 Accommodations Built as Independent Construction Projects

Bicycle and pedestrian accommodations can be developed through projects that are independent of highway construction, either within the highway right-of-way or on an independent right-of-way.

Independent construction projects can be utilized to retrofit accommodations along existing roadways, improve existing accommodations to better serve users, and install facilities to provide continuity and accessibility within the bicycle and pedestrian network. These projects will follow the same procedures as those for other construction projects for planning, funding, design, and construction. Localities and metropolitan planning organizations will be instrumental in identifying and prioritizing these independent construction projects.

3.2 Access-Controlled Corridors

Access-controlled corridors can create barriers to bicycle and pedestrian travel. Bicycling and walking may be accommodated within or adjacent to access-controlled corridors through the provision of facilities on parallel

roadways or physically separated parallel facilities within the right-of-way. Crossings of such corridors must be provided to establish or maintain connectivity of bicycle and pedestrian accommodations.

3.3 Additional Improvement Opportunities

Bicycle and pedestrian accommodations will be considered in other types of projects. Non-construction activities can be used to improve accommodations for bicycling and walking. In addition, any project that affects or could affect the usability of an existing bicycle or pedestrian accommodation within the highway system must be consistent with state and federal laws.

3.3.1 Operation and Maintenance Activities

Bicycling and walking should be considered in operational improvements, including hazard elimination projects and signal installation. Independent operational improvements for bicycling and walking, such as the installation of pedestrian signals, should be coordinated with local transportation and safety offices. The maintenance program will consider bicycling and walking so that completed activities will not hinder the movement of those choosing to use these travel modes. The maintenance program may produce facility changes that will enhance the environment for bicycling and walking, such as the addition of paved shoulders.

3.3.2 Long Distance Bicycle Routes

Long distance bicycle routes facilitate travel for bicyclists through the use of shared lanes, bike lanes, and shared use paths, as well as signage. All projects along a long distance route meeting the criteria for an American Association of State Highway and Transportation Officials (AASHTO) or *Manual on Uniform Traffic Control Devices* (MUTCD) approved numbered bicycle route system should provide the necessary design features to facilitate bicycle travel. Independent construction projects and other activities can be utilized to make improvements for existing numbered bicycle routes. Consideration should be given to facilitating the development of other types of long distance routes.

3.3.3 Tourism and Economic Development

Bicycling and walking accommodations can serve as unique transportation links between historic, cultural, scenic, and recreational sites, providing support to tourism activities and resulting economic development. Projects along existing or planned tourism and recreation corridors should include bicycle and pedestrian accommodations. In addition, the development of independent projects to serve this type of tourism and economic development function should be considered and coordinated with economic development organizations at local, regional, and state levels, as well as with other related agencies. Projects must also address the need to provide safety and connectivity for existing and planned recreational trails, such as the Appalachian Trail, that intersect with the state's highway system.

3.4 Exceptions to the Provision of Accommodations

Bicycle and pedestrian accommodations should be provided except where one or more of the following conditions exist:

- scarcity of population, travel, and attractors, both existing and future, indicate an absence of need for such accommodations
- environmental or social impacts outweigh the need for these accommodations
- safety would be compromised
- total cost of bicycle and pedestrian accommodations to the appropriate system (i.e., interstate, primary, secondary, or urban system) would be excessively disproportionate to the need for the facility
- purpose and scope of the specific project do not facilitate the provision of such accommodations (e.g., projects for the Rural Rustic Road Program)
- bicycle and pedestrian travel is prohibited by state or federal laws

3.5 Decision Process

The project manager and local representatives will, based on the factors listed previously in this section, develop a recommendation on how and whether to accommodate bicyclists and pedestrians in a construction project prior to the public hearing. The district administrator should confirm this recommendation prior to the public hearing. Public involvement comments will be reviewed and incorporated into project development prior to the preparation of the design approval recommendation. When a locality is not in agreement with VDOT's position on how bicyclists and pedestrians will or will not be accommodated in a construction project, the locality can introduce a formal appeal by means of a resolution adopted by the local governing body. The resolution must be submitted to the district administrator to be reviewed and considered prior to the submission of the design approval recommendation to the chief engineer for program development. Local resolutions must be forwarded to the chief engineer for program development for consideration during the project design approval or to the Commonwealth Virginia Department of Transportation Policy for Integrating Bicycle and Pedestrian Accommodations Transportation Board for consideration during location and design approval, if needed for a project. The resolution and supporting information related to the recommendation must be included in the project documentation.

The decisions made by VDOT and localities for the provision of bicycle and pedestrian travel must be consistent with state and federal laws regarding accommodations and access for bicycling and walking.

4. Discipline Participation in Project Development

VDOT will provide the leadership to implement this policy. Those involved in the planning, funding, design, construction, operation, and maintenance of the state's highways are responsible for effecting the guidance set forth in this policy. VDOT recognizes the need for interdisciplinary coordination to efficiently develop, operate, and maintain bicycle and pedestrian accommodations.

Procedures, guidelines, and best practices will be developed or revised to implement the provisions set forth in this policy. For example, objective criteria will be prepared to guide decisions on the restriction of bicycle and pedestrian use of access-controlled facilities. VDOT will work with localities, regional planning agencies, advisory committees, and other stakeholders to facilitate implementation and will offer training or other resource tools on planning, designing, operating, and maintaining bicycle and pedestrian accommodations.

4.1 Planning

VDOT will promote the inclusion of bicycle and pedestrian accommodations in transportation planning activities at local, regional, and statewide levels. These planning activities include, but are not limited to, corridor studies, small urban studies, regional plans, and the statewide multimodal long-range transportation plan. To carry out this task, VDOT will coordinate with local government agencies, regional planning agencies, and community stakeholder groups. In addition, VDOT will coordinate with the Virginia Department of Rail and Public Transportation (VDRPT) and local and regional transit providers to identify needs for bicycle and pedestrian access to public transportation services and facilities.

4.2 Funding

Highway construction funds can be used to build bicycle and pedestrian accommodations either concurrently with highway construction projects or as independent transportation projects. Both types of bicycle and pedestrian accommodation projects will be funded in the same manner as other highway construction projects for each system (i.e., interstate, primary, secondary, or urban). VDOT's participation in the development and construction of an independent project that is not associated with the interstate, primary, secondary, or urban systems will be determined through a negotiated agreement with the locality or localities involved. Other state and federal funding sources eligible for the development of bicycle and pedestrian accommodations may be used, following program requirements established for these sources.

These sources include, but are not limited to, programs for highway safety, enhancement, air quality, congestion relief, and special access. VDOT may enter into agreements with localities or other entities in order to pursue alternate funding to develop bicycle and pedestrian accommodations, so long as the agreements are consistent with state and federal laws.

4.3 Design and Construction

VDOT will work with localities to select and design accommodations, taking into consideration community needs, safety, and unique environmental and aesthetic characteristics as they relate to specific projects. The selection of the specific accommodations to be used for a project will be based on the application of appropriate planning, design, and engineering principles. The accommodations will be designed and built, or installed, using guidance from VDOT and AASHTO publications, the MUTCD, and the *Americans with Disabilities Act Accessibility Guidelines (ADAAG)*. Methods for providing flexibility within safe design parameters, such as context sensitive solutions and design, will be considered.

During the preparation of an environmental impact statement (EIS), VDOT will consider the current and anticipated future use of the affected facilities by bicyclists and pedestrians, the potential impacts of the alternatives on bicycle and pedestrian travel, and proposed measures, if any, to avoid or reduce adverse impacts to the use of these facilities by bicyclists and pedestrians. During project design VDOT will coordinate with VDRPT to address bicyclist and pedestrian access to existing and planned transit connections.

Requests for exceptions to design criteria must be submitted in accordance with VDOT's design exception review process. The approval of exceptions will be decided by the Federal Highway Administration or VDOT's Chief Engineer for Program Development. VDOT will ensure that accommodations for bicycling and walking are built in accordance with design plans and VDOT's construction standards and specifications.

4.4 Operations

VDOT will consider methods of accommodating bicycling and walking along existing roads through operational changes, such as traffic calming and crosswalk marking, where appropriate and feasible. VDOT will work with

VDRPT and local and regional transit providers to identify the need for ancillary facilities, such as shelters and bike racks on buses, that support bicycling and walking to transit connections. VDOT will enforce the requirements for the continuance of bicycle and pedestrian traffic in work zones, especially in areas at or leading to transit stops, and in facility replacements in accordance with the MUTCD, *VDOT Work Area Protection Manual*, and *VDOT Land Use Virginia Department of Transportation Policy for Integrating Bicycle and Pedestrian Accommodations*

Permit Manual when construction, utility, or maintenance work, either by VDOT or other entities, affects bicycle and pedestrian accommodations. VDOT will continue to research and implement technologies that could be used to improve the safety and mobility of bicyclists and pedestrians in Virginia's transportation network, such as signal detection systems for bicycles and in-pavement crosswalk lights.

4.5 Maintenance

VDOT will maintain bicycle and pedestrian accommodations as necessary to keep the accommodations usable and accessible in accordance with state and federal laws and VDOT's asset management policy. Maintenance of bike lanes and paved shoulders will include repair, replacement, and clearance of debris. As these facilities are an integral part of the pavement structure, snow and ice control will be performed on these facilities.

For sidewalks, shared use paths, and bicycle paths built within department right-of-way, built to department standards, and accepted for maintenance, VDOT will maintain these bicycle and pedestrian accommodations through replacement and repair. VDOT will not provide snow or ice removal for sidewalks and shared use paths. The execution of agreements between VDOT and localities for maintenance of such facilities shall not be precluded under this policy.

5. Effective Date

This policy becomes effect upon its adoption by the Commonwealth Transportation Board on March 18, 2004, and will apply to projects that reach the scoping phase after its adoption. This policy shall supersede all current department policies and procedures related to bicycle and pedestrian accommodations. VDOT will develop or revise procedures, guidelines, and best practices to support and implement the provisions set forth in this policy, and future departmental policies and procedural documents shall comply with the provisions set forth in this policy.

APPENDIX C: BICYCLE LEVEL OF SERVICE SUMMARY AND DATA COLLECTION AND INVENTORY GUIDELINES



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Background

Level of Service (LOS) is a framework that transportation professionals use to describe existing conditions (or suitability) for a mode of travel in a transportation system. The traffic planning and engineering discipline has used LOS models for motor vehicles for several decades. Motor vehicle LOS is based on average speed and travel time for motorists traveling in a particular roadway corridor. In the 1990s, new thinking and research contributed to the development of methodologies for assessing levels of service for other travel modes, including bicycling, walking, and transit. Specific methodologies for bicycle level of service have been developed and used by a number of cities, counties, and states around the U.S. since the mid-1990s. This Plan recommends the Bicycle Level of Service (Bicycle LOS) Model assessment method.

When considering level of service in a multi-modal context, it is important to note that LOS measures for motor vehicles and bicycles are based on different criteria and are calculated on different inputs. Motor vehicle LOS is primarily a measure of speed, travel time, and intersection delay. Bicycle LOS is a more complex calculation, which represents the level of comfort a bicyclist experiences in relation to motor vehicle traffic.

Bicycle Level of Service Model Description

The *Bicycle Level of Service Model (Bicycle LOS Model)* is an evaluation of bicyclist perceived safety and comfort with respect to motor vehicle traffic while traveling in a roadway corridor. It identifies the quality of service for bicyclists or pedestrians that currently exists within the roadway environment.

The statistically calibrated mathematical equation entitled the *Bicycle LOS Model¹ (Version 2.0)* is used for the evaluation of bicycling conditions in shared roadway environments. It uses the same measurable traffic and roadway factors that transportation planners and engineers use for other travel modes. With statistical precision, the *Model* clearly reflects the effect on bicycling suitability or “compatibility” due to factors such as roadway width, bike lane widths and striping combinations, traffic volume, pavement surface condition, motor vehicle speed and type, and on-street parking.

The *Bicycle Level of Service Model* is based on the proven research documented in *Transportation Research Record 1578* published by the Transportation Research Board of the National Academy of Sciences. It was developed with a background of over 150,000 miles of evaluated urban, suburban, and rural roads and streets across North America. Many urban planning agencies and state highway departments are using this established method of evaluating their roadway networks. The Virginia Department of Transportation is using the *Bicycle LOS Model* in both the Richmond and Northern Virginia regions. The model has also been applied in Anchorage AK, Baltimore MD, Birmingham AL, Buffalo NY, Gainesville FL, Houston TX, Lexington KY, Philadelphia PA, Sacramento CA, Springfield MA, Tampa FL, Washington, DC, and by the Delaware Department of Transportation (DelDOT), Florida Department of Transportation (FDOT), New York State Department of Transportation (NYDOT), Maryland Department of Transportation (MDOT) and many others.

Widespread application of the original form of the *Bicycle LOS Model* has provided several refinements. Application of the *Bicycle LOS Model* in the metropolitan area of Philadelphia resulted in the final definition of the three effective width cases for evaluating roadways with on-street parking. Application of the *Bicycle LOS Model* in the rural areas surrounding the greater Buffalo region resulted in refinements to the “low traffic volume roadway width adjustment”. A 1997 statistical enhancement to the *Model* (during statewide application in Delaware) resulted in better quantification of the effects of high speed truck traffic [see the $SP_i(1+10.38HV)^2$ term]. As a result, *Version 2.0* has the highest correlation coefficient ($R^2 = 0.77$) of any form of the *Bicycle LOS Model*.

Version 2.0 of the *Bicycle Level of Service Model (Bicycle LOS Model)* can be employed to evaluate collector and arterial roadways in the Central Shenandoah Valley. Its form is shown on the following page.

¹Landis, Bruce W. et.al. “Real-Time Human Perceptions: Toward a Bicycle Level of Service” *Transportation Research Record 1578*, Transportation Research Board, Washington, DC 1997.

$$\text{Bicycle LOS} = a_1 \ln(\text{Vol}_{15}/L_n) + a_2 \text{SP}_t (1 + 10.38 \text{HV})^2 + a_3 (1/\text{PR}_5)^2 + a_4 (\text{W}_e)^2 + C$$

Where:

Vol_{15} = Volume of directional traffic in 15 minute time period

$$\text{Vol}_{15} = (\text{ADT} \times D \times K_d) / (4 \times \text{PHF})$$

where:

ADT = Average Daily Traffic on the segment or link

D = Directional Factor (assumed = 0.565)

K_d = Peak to Daily Factor (assumed = 0.1)

PHF = Peak Hour Factor (assumed = 1.0)

L_n = Total number of directional *through* lanes

SP_t = Effective speed limit

$$\text{SP}_t = 1.1199 \ln(\text{SP}_p - 20) + 0.8103$$

where:

SP_p = Posted speed limit (a surrogate for average running speed)

HV = percentage of heavy vehicles (as defined in the 1994 Highway Capacity Manual)

PR_5 = FHWA's five point pavement surface condition rating

W_e = Average effective width of outside through lane:

where:

$$\text{W}_e = \text{W}_v - (10 \text{ ft} \times \% \text{ OSPA})$$

and $\text{W}_i = 0$

$$\text{W}_e = \text{W}_v + \text{W}_i (1 - 2 \times \% \text{ OSPA})$$

and $\text{W}_i > 0$ & $\text{W}_{ps} = 0$

$$\text{W}_e = \text{W}_v + \text{W}_i - 2 (10 \times \% \text{ OSPA})$$

and $\text{W}_i > 0$ & $\text{W}_{ps} > 0$

and a bikelane exists

where:

W_t = total width of outside lane (and shoulder) pavement

OSPA = percentage of segment with occupied on-street parking

W_i = width of paving between the outside lane stripe and the edge of pavement

W_{ps} = width of pavement striped for on-street parking

W_v = Effective width as a function of traffic volume

and:

$$\text{W}_v = \text{W}_t \quad \text{if ADT} > 4,000 \text{ veh/day}$$

$$\text{W}_v = \text{W}_t (2 - 0.00025 \times \text{ADT}) \quad \text{if ADT} \leq 4,000 \text{ veh/day,}$$

and if the street/ road is undivided and unstriped

a_1 : 0.507

a_2 : 0.199 a_3 : 7.066 a_4 : - 0.005

C: 0.760

(a_1 - a_4) are coefficients established by the multi-variate regression analysis.

The Bicycle LOS score resulting from the final equation is pre-stratified into service categories “A”, “B”, “C”, “D”, “E”, and “F” (“A” is best, and “F” is worst), according to the ranges shown in Table I, reflecting users’ perception of the road segments level of service for bicycle travel. This stratification is in accordance with the linear scale established during the referenced research (i.e., the research project bicycle participants’ aggregate response to roadway and traffic stimuli). The *Model* is particularly responsive to the factors that are statistically significant. An example of its sensitivity to various roadway and traffic conditions is shown on the following page.

Because the model represents the comfort level of a hypothetical “typical” bicyclist, there are some bicyclists who may feel more comfortable and others who may feel less comfortable than the Bicycle Level of Service calculated for a roadway. A poor Bicycle Level of Service grade does not mean that bikes should be prohibited on a roadway.

Bicycle Level-of-Service Categories

LEVEL-OF-SERVICE	Bicycle LOS Score
A	≤ 1.5
B	> 1.5 and ≤ 2.5
C	> 2.5 and ≤ 3.5
D	> 3.5 and ≤ 4.5
E	> 4.5 and ≤ 5.5
F	> 5.5

The Model represents the comfort level of a hypothetical “typical” bicyclist. Some bicyclists may feel more comfortable and others may feel less comfortable than the Bicycle LOS grade for a roadway. A poor Bicycle LOS grade does not mean that bikes should be prohibited on a roadway. It suggests to a transportation planner that the road may need other improvements (in addition to shoulders) to help more bicyclists feel comfortable using the corridor.

Application

The *Bicycle LOS Model* is used by planners, engineers, and designers throughout the US and Canada in a variety of planning and design applications. Applications include:

1. Conducting a benefits comparison among proposed bikeway/roadway cross-sections
2. Identifying roadway restriping or reconfiguration opportunities to improve bicycling conditions
3. Prioritizing and programming roadway corridors for bicycle improvements
4. Creating bicycle suitability maps
5. Documenting improvements in corridor or system-wide bicycling conditions over time

Bicycle LOS Model Sensitivity Analysis

$$\text{Bicycle LOS} = a_1 \ln(\text{Vol}_{15}/\text{Ln}) + a_2 \text{SP}_t (1 + 10.38\text{HV})^2 + a_3 (1/\text{PR}_5)^2 + a_4 (W_e)^2 + C$$

where: a_1 : 0.507 a_2 : 0.199 a_3 : 7.066 a_4 : -0.005 C: 0.760
T-statistics: (5.689) (3.844) (4.902) (-9.844)

Baseline inputs:

ADT = 12,000 vpd % HV = 1 L = 2 lanes
 SP_p = 40 mph W_e = 12 ft PR_5 = 4 (good pavement)

	<u>BLOS</u>	<u>% Change</u>
Baseline BLOS Score (Bicycle LOS)	3.98	N/A

Lane Width and Lane striping changes

W_t = 10 ft		4.20	6% increase
W_t = 11 ft		4.09	3% increase
W_t = 12 ft	-- (baseline average) -----	3.98 -----	no change
W_t = 13 ft		3.85	3% reduction
W_t = 14 ft		3.72	7% reduction
W_t = 15 ft ($W_l = 3$ ft)		3.57 (3.08)	10%(23%) reduction
W_t = 16 ft ($W_l = 4$ ft)		3.42 (2.70)	14%(32%) reduction
W_t = 17 ft ($W_l = 5$ ft)		3.25 (2.28)	18%(43%) reduction

Traffic Volume (ADT) variations

ADT = 1,000	Very Low	2.75	31% decrease
ADT = 5,000	Low	3.54	11% decrease
ADT = 12,000	Average - (baseline average) --	3.98 -----	no change
ADT = 15,000	High	4.09	3% increase
ADT = 25,000	Very High	4.35	9% increase

Pavement Surface conditions

PR_5 = 2	Poor	5.30	33% increase
PR_5 = 3	Fair	4.32	9% reduction
PR_5 = 4	-- Good - (baseline average) ---	3.98 -----	no change
PR_5 = 5	Very Good	3.82	4% reduction

Heavy Vehicles in percentages

HV = 0	No Volume	3.80	5% decrease
HV = 1	--- Very Low - (baseline average) --	3.98 -----	no change
HV = 2	Low	4.18	5% increase
HV = 5	Moderate	4.88	23% increase _a
HV = 10	High	6.42	61% increase _a
HV = 15	Very High	8.39	111% increase _a

^aOutside the variable's range (see Reference (1))

Data Collection and Inventory Guidelines

Instructions for field data collectors

Safety - IMPORTANT

- **All data collectors who are working in the street environment SHALL WEAR SAFETY VESTS.** There are no exceptions to this rule.
- All data collectors should use utmost caution in crossing streets and driveways, and shall follow traffic laws at all times.
- All data collectors should maintain a constant awareness of surrounding traffic conditions and should ensure that data collection activities do not interfere with their attention to safety within the roadway environment. If you feel at any point that your safety is compromised, you should immediately **STOP** collection data and move to a safer location.

Bicycle Level of Service Model Data Needs

The following data items are used to compute the final Bicycle Level of Service (BLOS) score for each roadway segment. Please use the following guidelines when gathering available roadway data and making measurements and observations in the field.

Existing Data (from maps and electronic databases)

Annual Average Daily Traffic (AADT) – Enter this information into the database for each roadway segment from existing traffic count databases. If necessary, use assumed values based on surrounding land uses or taking 15 minute counts in the field. AADT is converted by the database to hourly traffic volume by lane in one direction of travel.

Percent Heavy Vehicles (% HV) – Enter this information into the database from existing traffic composition databases. Generally, a heavy vehicle is any large truck with six or more tires. If necessary, use assumed values based on surrounding land uses or taking 15 minute counts in the field.

Field Data (from data collection measurements)

Number of lanes of traffic (L) - Record the total number of *through* traffic lanes, in both directions, of the road segment. The presence of continuous right-turn lanes should be noted in the comments field (they should not be counted as through lanes).

Configuration (Cnfg.) – Record the configuration of the road segment as D = Divided (has a median), U = Undivided, OW = One-Way, or S = Center Turning Lane. The programmed database will output the number of travel lanes in each direction. **Note in the comments if there are a different number of through lanes in the opposing directions.**

Posted Speed Limit (SP_p) - Record as posted in m.p.h. The database is programmed to add approximately 9 m.p.h. (15 k.p.h) to the posted speed to reflect the typical 85th percentile speed (unless 85th percentile speeds are available from existing sources).

Width of pavement for the outside lane and shoulder (W_t) – This measurement is taken from the center of the road (yellow stripe) to the gutter pan of the curb (or to the curb if there is no gutter present). In the case of a multilane configuration, it is measured from the outside lane stripe to the edge of pavement. **W_t does not include the gutter pan.** When there is angled parking adjacent to the outside lane, W_t is measured to the traffic-side end of the parking stall stripes. **The presence of unstriped on-street parking does not change the measurement; the measurement should still be taken from the center of the road to the gutter pan.**

Width of paving between the shoulder/edge stripe and the edge of pavement (W_1) – This measurement is taken when there is additional pavement to the right of an edge stripe, such as when striped shoulders, bike lanes, or parking lanes are present. It is measured from the shoulder/edge stripe to the edge of pavement, or to the gutter pan of the curb. **W_1 does not include the gutter pan.** When there is angled parking adjacent to the outside lane, W_1 is measured to the traffic-side end of the parking stall stripes.

Width of pavement striped for on-street parking (W_{ps}) – **Record this measurement only if there is parking to the right of a striped bike lane.** If there is parking on two sides on a one-way, single-lane street, the combined width of striped parking is reported. W_{ps} does not include the gutter pan.

Total Roadway Width (TRW) – This measurement is taken from one shoulder or curb face to the other shoulder or curb face. **This measurement DOES include the gutter pan.** If the roadway is divided, the width of the grass/concrete median should be included in the measurement and the width of the median itself should be listed in the comments field.

Pavement Condition:

Travel Lane (PC_t) - Pavement condition of the outside motor vehicle travel lane is evaluated according to FHWA’s five-point pavement surface condition rating shown below. Unpaved travel lanes should be scored with a zero (0).

Shoulder or Bike lane (PC_s) - Pavement condition of the shoulder or bike lane is evaluated according to the FHWA’s five-point pavement surface condition rating shown below. (If there is an unpaved shoulder, PC_s should be left blank. See roadside profile condition.)

Pavement Condition Descriptions

RATING	PAVEMENT CONDITION
5.0 (Very Good)	Only new or nearly new pavements are likely to be smooth enough and free of cracks and patches to qualify for this category.
4.0 (Good)	Pavement, although not as smooth as described above, gives a first class ride and exhibits signs of surface deterioration.
3.0 (Fair)	Riding qualities are noticeably inferior to those above; may be barely tolerable for high-speed traffic. Defects may include rutting, map cracking, and extensive patching.
2.0 (Poor)	Pavements have deteriorated to such an extent that they affect the speed of free-flow traffic. Flexible pavement has distress over 50 percent or more of the surface. Rigid pavement distress includes joint spalling, patching, etc.
1.0 (Very Poor)	Pavements that are in an extremely deteriorated condition. Distress occurs over 75 percent or more of the surface.

Source: U.S. Department of Transportation. Highway Performance Monitoring System-Field Manual. Federal Highway Administration. Washington, DC 1987.

% Occupied On-Street Parking - This is an estimate on the percentage of the segment (excluding driveways) along which there is occupied on-street parking at the time of survey. Each side is measured in increments of 25% and is recorded separately: “N/E” is the North or East side of the road and “S/W” is the South or West side of the road. **If the parking is allowed only during off-peak periods, this should be indicated in the comments field (this is typically indicated by a parking restriction sign).** Angled parking is also reported in the comments field.

Curb – “Y” is recorded if there is a curb on the segment. “N” is entered if there is an open shoulder.

Gutter Pan – “Y” indicates that the segment has a gutter pan (usually concrete, but can be brick); otherwise “N” is entered.

Designated Bike Lane - “Y” indicates that a bike lane is designated (by sign or pavement markings) on the segment, otherwise “N” is entered.

Designated Bicycle Route – “Y” indicates that the segment is marked with bicycle route (segment has green “BIKE ROUTE” signs or signs with a specific bike route letter or number), otherwise “N” is entered.

Share the Road Signs – “Y” indicates that the segment is marked with “Share the Road” signs (yellow bike warning sign with "Share the Road" beneath), otherwise “N” is entered.

Rumble Strips – “Y” indicates that the segment has shoulder rumble strips, otherwise “N” is entered. Note the approximate width of the rumble strips in the comments field and whether they are on the shoulder or travel lane.

Steep Grade – “Y” indicates that the segment has a steep grade. A steep grade is considered to be a grade of over 8%, as estimated by the data collection team.

% of Segment with Sidewalk or Sidepath - The percentage of sidewalk coverage (estimated in increments of 10%) of the segment is to be collected for both sides of the roadway. Sidepaths and trails within the roadway right-of-way should be considered to be sidewalks for the purpose of data collection. Make sure to collect information about sidewalks on bridges. Each side is measured in increments of 10% and is recorded separately: “N/E” is the North or East side of the road and “S/W” is the South or West side of the road.

Buffer Width (W_b)- The width of a grass or other buffer between the edge of the pavement (or curb face, which includes the top of the curb, if present) and the beginning edge of the sidewalk. If the sidewalk contains a line of trees, mailboxes, plantings, etc., the width of these obstructions should be included in the buffer width measurement. The gutter pan is not included in the buffer. If the buffer is different on each side of the road, the average width is recorded.

Tree Spacing in Buffer - The spacing of trees within a buffer measured from foot on center (length of spacing between trees). Trees can either be in a grass buffer or in a sidewalk. Trees that are not between the sidewalk and roadway should not be considered. If the tree spacing is different on each side of the road, the average spacing is recorded.

Sidewalk/Sidepath Width (W_s) - The width of the sidewalk (or sidepath), measured from the edge of the buffer to the backside of the sidewalk. If a grass buffer is not present, the width is measured from the curb face (the top of the curb is included in the measurement). Each side is measured separately: “N/E” is the North or East side of the road and “S/W” is the South or West side of the road.

Roadside Profile Condition – This data item will be used to assist in determining the condition of the lateral area available for bikeway, sidepath or sidewalk construction. This evaluation is meant to be general, and is applied to area between the outside edge of the pavement and the right-of-way line, or the 10-20 feet of space adjacent to the edge of the pavement. Roadside profiles will be rated 1, 2, or 3. Condition 1 represents generally good conditions for building a shoulder, sidewalk, or sidepath, such as a built gravel shoulder of 4’+ or 10-12 feet of clear space, free of obstructions and with a grade similar to the roadway. Condition 2 represents a somewhat buildable shoulder which may be narrower, have more frequent obstructions or some areas with steeper grades. Condition 3 represents roadside conditions with severe slopes, ditches, trees or other features making it unbuildable without a major construction effort. **If the Roadside Profile Condition is 1 or 2, you may make a general assessment of the type of facility that could be constructed (see final two data collection items, below).**

Potential Shoulder – “Y” indicates that a paved shoulder could be added to the segment without significant landscaping or reconstruction work; “N” suggests that adding a paved shoulder would require modification of the roadway or adjacent properties (such as filling ditches/regrading the land adjacent to the roadway, narrowing the roadway, moving utility poles, cutting down trees, razing buildings, etc.).

Potential Sidewalk/Sidepath – “Y” indicates that a sidewalk/sidepath could be added to the segment without significant landscaping or reconstruction work; “N” suggests that adding a sidewalk/sidepath would require modification of the roadway or adjacent properties (such as filling ditches/regrading the land adjacent to the roadway, narrowing the roadway, moving utility poles, cutting down trees, razing buildings, etc.

Notes:

The accuracy of all width measurements is 0.5 feet. Measurements should be taken from the middle of roadway stripes (or the middle between the two centerline stripes). When there is a major change in roadway cross-section within a segment (i.e. the road changes from 2 lanes to 4 lanes in the middle of the segment), the two parts of the segment should be entered on two separate lines on the data collection sheet. Minor changes, such as changes in speed limit, several feet of variation in paved shoulder width, or narrowing of lanes at a small bridge do not require resegmentation. **In these cases, the predominant cross-section characteristics should be recorded and notes regarding variations should be recorded in the comments field.** In addition, if there is any noticeable difference in the above parameters between two directions (north/south or east/west) on a roadway segment, the data describing the other direction should be recorded in the comment field of the database, along with the direction. All other special conditions and assumptions made during the data collection on the segments should be recorded in the comments field of the database.