

Appendix A

The Southeast High Speed Rail Multi-Use Trail Concept Design Guidelines were finalized in 2009. The most up-to-date design manuals are to be used during final design. As of July 2015, the following manuals referenced in this guide have been updated to the following versions:

Guide for the Development of Bicycle Facilities by the American Association of State Highway and Transportation Officials (AASHTO, 2012)

Manual on Uniform Transportation Control Devices for Streets and Highways by the United States Department of Transportation Federal Highway Administration (MUTCD, 2009)

Separated Bike Lane Planning and Design Guide by United States Department of Transportation the Federal Highway Administration (FHWA, 2015)

Architectural Barriers Act (ABA) Accessibility Guidelines for Outdoor Developed Areas; Proposed Rule by the Architectural and Transportation Barriers Compliance Board (Access Board, 2013)



SOUTHEAST HIGH SPEED RAIL MULTI-USE TRAIL CONCEPT

Design Guidelines

Richmond, VA, to Raleigh, NC
December 2009

US Department of Transportation
Federal Railroad Administration

Prepared by:
Michael Baker Engineering, Inc.

Prepared for:
North Carolina Department of Transportation (NCDOT)
Virginia Department of Rail and Public Transportation (DRPT)



Introduction

This document is intended to serve as a guideline for the design of a multi-use trail (ie: shared-use path) associated with the Southeast High Speed Rail (SEHSR).

The guidelines presented herein are intended to provide the general framework for the multi-use trail concept. More detailed designs will be required at the local and regional level as the trail progresses from concept to reality. Some areas will have specific design considerations, such as equestrian use, steep terrain obstacles or limitations, or bridging issues. Final design in these areas will reflect these considerations. This general framework is intended to provide the flexibility to incorporate local and regional considerations in final design.

Please note that the trail concept portion of the SEHSR, and thus the preliminary designs that will be developed as part of the SEHSR project, extends from Burgess (south of Petersburg) to the Neuse River (north of Raleigh). The Tier II EIS for the SEHSR, however, extends from downtown Richmond to downtown Raleigh.

These guidelines are divided into the following main subjects:

1. Destinations and Connections
2. Safety Design Considerations
3. Construction Recommendations

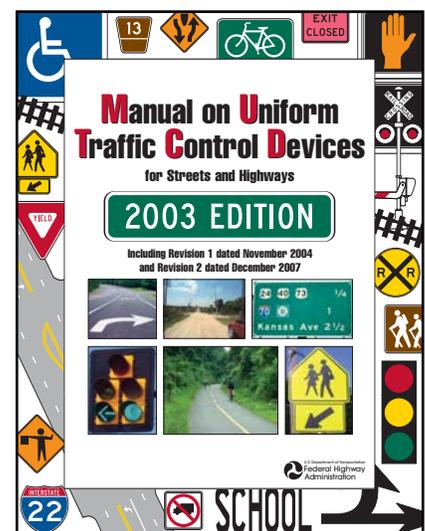
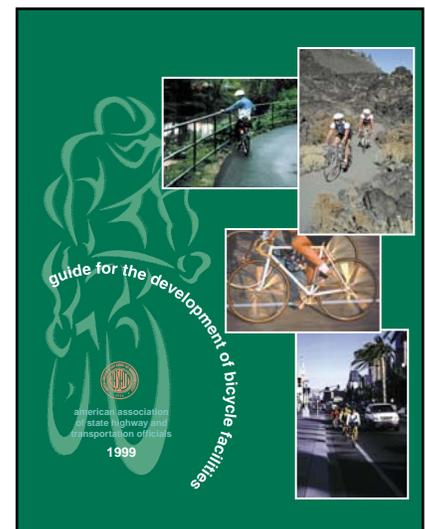
The information included in the destinations and connections is culled from state, regional and local master plans and the SEHSR Draft EIS and is intended to provide context for trail design including destinations that may warrant spur trails and inclusion on signage and trail maps.

The safety, construction and maintenance recommendations are based upon the following resources:

- Guide for the Development of Bicycle Facilities by the American Association of State Highway and Transportation Officials (AASHTO, 1999)
- Manual on Uniform Transportation Control Devices for Streets and Highways by the United States Department of Transportation Federal Highway Administration (MUTCD, 2003)
- Designing Sidewalks and Trails for Access Part II of II: Best Practices Design Guide by the Federal Highway Administration and Beneficial Designs, Inc (FHWA, 2001)
- North Carolina Bicycle Facilities Planning And Design Guidelines, by the North Carolina Department of Transportation, Office of Bicycle and Pedestrian Transportation (NCDOT, 1994)
- Architectural Barriers Act (ABA) Accessibility Guidelines for Outdoor Developed Areas: Proposed Rule by the Architectural and Transportation Barriers Compliance Board (Access Board), 2007
- State and local guidelines as noted

The MUTCD defines a multi-use trail (ie: shared use path) as:

“A bikeway outside the traveled way and physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent alignment. Shared-use paths are also used by pedestrians (including skaters, users of manual and motorized wheelchairs, and joggers) and other authorized motorized and nonmotorized users.”



Major population centers:

Tri-Cities
Dinwiddie County
Brunswick County
Mecklenburg County

1.1 Commonwealth of Virginia

These report sections were designated based on city/county boundaries and coordinate with the major population centers along the route. These sections include the

Tri-Cities
Dinwiddie County
Brunswick County
Mecklenburg County.

1.1.1 Tri-Cities

The northern terminus of the multi-use trail is just south of Petersburg and would provide access to the Tri-Cities area, which includes Chester, Colonial Heights, and Petersburg. Land use near Chester and north of Colonial Heights are mostly suburban residential, with some fragmented woodland areas. Near Dunlop, VA and continuing into the City of Petersburg the land begins to include some industrial uses. Colonial Heights and Petersburg essentially form a single urbanized area, with Colonial Heights accounting for much of the suburban residential and commercial development, while Petersburg accounts for much of the urban residential and industrial development. The tri-cities area, which includes Colonial Heights, Petersburg and Hopewell, had an estimated population of over 70,000, according to the US Census Bureau.



Fort Lee employee population will increase with additional workers from the BRAC.

Attractions

The Tri-Cities area historic significance during the Civil War and therefore many visitors are attracted by the numerous battlefields, museums, and historic sites pertaining to the war. Virginia State University is located here and a few major medical facilities; Southside Regional Medical Center and John Randolph Medical Center. Several public schools are located along the corridor including Ettrick Elementary, Chester Middle, Lakeview Elementary, North Elementary, J.E.B. Stuart Elementary, and Westview Elementary. In addition to these medical and educational facilities, the Tri-Cities region also houses Ft. Lee, headquarters of the US Army Combined Arms Support Command. According to the 2000 Census over 7,000 people live within the base, making this major military institution a large generator and attractor of trips.



Pamplin Museum in Petersburg, VA

Recreation

There are several parks this section of the SEHSR corridor, including:

Petersburg National Battlefield - a National Historic Landmark and the only National Park located within the study area. The existing active rail corridor passes through both the Confederate defense and Union siege lines south of the city along a route parallel with the old Petersburg and Weldon Railroad of the Civil War era. Fort Wadsworth and the site of the Battle of the Weldon Railroad are adjacent to the rail corridor. The study area includes extensive Core Battlefield Areas as identified by the National Park Service (NPS). The Petersburg Breakthrough Battlefield at Pamplin Historical Park is also a National Historic Landmark.

Ettrick Park – 24 acres, including baseball diamonds, football fields, tennis courts, basketball courts, restroom/concession, playground equipment, shelter, picnic area, and community building.

Ettrick Riverside Park – along the Appomattox River, picnicking space available.

Upper Appomattox Canal Trail – jogging/walking trail along 2-mile watered section and towpath in Appomattox Riverside Park opposite Matoaca.

West End Park Fairgrounds – once used as Petersburg’s fairgrounds, contains a running track and basketball courts.

Chester Kiwanis Historical Park – in planning stage, will be located along Curtis and Richmond Streets in Chester, VA.

Tourism

As the site of a critical Civil War battle Petersburg has numerous historic sites and buildings, and heritage tourism is a growing part of the economy. Within the region are various battlefields and historic sites, such as Pamplin Park and the Petersburg National Battlefield Park. Related attractions include the National Museum of the Civil War Soldier, Siege Museum, Blandford Church and Centre Hill Museum. Fort Lee houses the Army Quartermaster and Army Women’s Museums. In addition, Petersburg continues to revitalize its downtown as an arts and entertainment district. For example, the Shockoe Bottom Arts Center recently relocated there from Richmond. There are also local theater groups, a symphony, and a ballet company. The popular Artfest (previously called the Poplar Lawn Arts Festival) is held in the spring. The Virginia Motorsports Park also brings drag racing fans to the area. Virginia State University is located in Ettrick across the Appomattox River from Petersburg.

Existing Greenway/Bike Facilities

There are no existing bike facilities along Section 2 of the SEHSR multi-use trail corridor. However, each locality has outlined its plans for bike and pedestrian facilities in the Tri-Cities area.

Chesterfield County - In 1989, Chesterfield County Bikeway Plan was developed which proposes a combination of exclusive bicycle roadways (bike paths separated from automobile traffic), bicycle lanes (paved areas designated for bicyclists along existing highways) and bike routes (existing low volume highways signed for bike traffic, but not widened). The plan has been used in consideration of development proposals and public capital improvements projects.

The plan is considered as the first step in developing a comprehensive bikeway facility plan for the County. It identifies the primary routes for bike travel. Follow-up plans should be undertaken to address local and neighborhood level needs. It is also recognized that less hazardous bicycle travel over many of the identified routes can only be achieved when the existing highways are improved to include bike trails or lanes.....



Civil War Monument



Colonial Heights –There are currently no existing bikeways in Colonial Heights, however, in the City’s adopted Recreation and Open-Space Master Plan (prepared by the Crater Planning District Commission in 1973) specific streets have been planned for a bikeway system, including: US 301, Eilerslie Avenue, Temple Avenue, Conduit Road, Sherwood Drive, Forest View Drive, Fairmont Drive, Biltmore Drive, Carrol Avenue, Chesterfield, Avenue, Battery Place, Meridian Avenue, East Westover Avenue, Flora Avenue, and a rails to trail program along the Lakeview, Springdale, Woodlawn, Seaboard Railroad right of way.



Battersea Plantation in Petersburg, Virginia

Petersburg – The City of Petersburg adopted its Comprehensive Plan in February, 2001. The Plan places a heavy emphasis on downtown planning and returning of pedestrian to downtown. Programming frequent outdoor activity is one way to attract people and create a sense of excitement.

It further identifies the Appomattox River Heritage Trail as an important linkage. The goal is completion of the trail along the entire downtown waterfront and then at least as far west as Battersea; a preferable alignment would extend the trail west to the Appomattox Riverside Park.

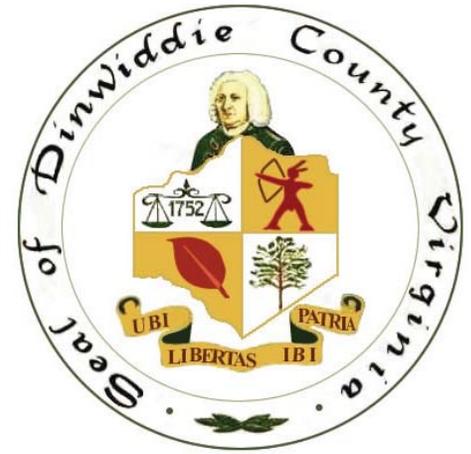
Currently, there is no designated bikeway in Petersburg. However, the City recognizes the need of a bikeway system in the City. The Comprehensive Plan recommends that a city bikeway plan should be developed to accommodate increased bicycle traffic.

Historic & Archaeological Sites

This section of the study corridor is known mostly for its historical significance during the Civil War. During this time Petersburg was the second largest city in Virginia, and due to the presence of numerous rail lines, it served as a major supply line for the Confederacy. Therefore, many of the area’s battlefields are admired for their historic significance. Sites listed on the National Register of Historic Places with significance during the Civil War include; Pocahontas Island, Lee Memorial Park, People’s Memorial Cemetery, and Poplar Lawn Historic District. With its rich history, Petersburg houses several more historic sites, such as; the Battersea, a James River plantation home; the Nathaniel Friend House, built in 1816 for the wealthy merchant; Blandford Cemetery and Church; Appomattox Iron Works; Folly Castle Historic District; Petersburg Courthouse and City Hall; and several more historic houses and churches.

1.1.2 Dinwiddie County

The SEHSR Multi-Use Trail Concept begins near this section at Burgess, just south of Petersburg. This section traverses the entirety of Dinwiddie County; starting at the Petersburg/Dinwiddie County line in the north and ending at the Brunswick/Dinwiddie County line in the south. The trail takes a different orientation as it starts heading in a slightly westward direction through Dinwiddie, parallel with Interstate 85. The surrounding environment also shifts from primarily urban industrial to mostly rural agricultural. Population is sparse through this segment of the trail, but community centers do exist in Dinwiddie and McKenney, VA. Utilizing population data by zip code from the 2000 Census, together these population centers account for slightly more than 5,000 total residents.



Attractions, Recreation & Tourism

Dinwiddie County is part of the Petersburg/Colonial Heights economic region such that roughly twice as many county residents commute to jobs outside the county as work within it. Major manufacturing employers are Chaparral Virginia Inc, Philip Morris USA and Tindal Concrete Co. Other major employers include Central State Hospital and Wal-Mart. Much of the northern Dinwiddie is associated with the Petersburg National Battlefield Civil War Park. The SEHSR multi-use trail proposed corridor passes Southside Elementary, located at 10305 Boydton Plank Road, near Dinwiddie village, and Sunnyside Elementary, located at 10203 Sunnyside Road in McKenney.

Most of Dinwiddie County contains a rural residential and agricultural development pattern, within large tracks of woodlands, with some scattered residential and commercial development along major roads such as US 1. As such, Dinwiddie County is home to many open spaces and small parks that residents are able to utilize for personal recreation. Most notably, Dinwiddie County is home to the privately-owned Pamplin Historical Park, which is located at the site of the Petersburg Breakthrough Battle and includes the Museum of the Civil War Soldier. The park is located approximately three miles west of the study area.

Existing Greenway/Bike Facilities

On August 7, 2002, the Dinwiddie County Board of Supervisors adopted Dinwiddie County's Comprehensive Plan Update. The County acknowledges the importance of alternative mode of transportation in the County. (See sidebar).

In addition, Dinwiddie County initiated a "Trekking Dinwiddie" project. The purpose of this initiative is to use a trail system to educate visitors and citizens alike, link communities and historic battlefield sites in the County.

The proposed trail system focuses on developing a regional network linking Dinwiddie battlefield sites, schools, and facilities with extensions to the Appomattox River and neighboring localities. The foundation for this system currently exists by utilizing inactive railroad rights-of-way, utility corridors, and roads that could total approximately 100 miles.

"Encourage the use of alternative modes of transportation to provide for an efficient intermodal transportation system".

"Pursue the development of a connecting network of linear park, trail and/or greenway to connect with a future regional greenway system".

(Objectives in Dinwiddie County's Comprehensive Plan Update)



Dinwiddie Courthouse

Multiple trails for walking, biking, and equestrian use could be developed with numerous trailheads. These trails could connect regional destinations such as Appomattox Riverside Park, Lake Chesdin, Petersburg National Battlefield, and Pamplin Historical Park with communities such as DeWitt, Carson, Sutherland, and Dinwiddie.

The proposed battlefield trails network would link sites identified by the Civil War Sites Advisory Commission as significant to the Petersburg Campaign. These battlefield areas include: Boydton Plank Road, Five Forks, Globe Tavern, Hatchers Run, Lewis Farm, Peebles Farm, Petersburg Breakthrough, Reams Station, Sutherland Station, and White Oak Road”.

Historic & Archaeological Sites

With close proximity to Petersburg, the historic sites in Dinwiddie County share similar a similar association with the Civil War. Several Civil War Battlefields in Dinwiddie are listed as National Historic Places, such as; Petersburg National Battlefield, Petersburg Breakthrough Battlefield, Pamplin Historical Park, Five Forks Battlefield and Burnt Quarter. Other historic sites include the Dinwiddie County Courthouse; Mayfield Cottage, an old plantation home; and the Conover Archaeological Site, known for its Paleo-Indian artifacts.

1.1.3 Brunswick County

This section begins at the Dinwiddie/Brunswick County line, also the Nottoway River. It continues southwestwardly along I-85, as in section 3, traverses through Brunswick County and ends at the Meherrin River, a short distance from the Mecklenberg County line. This section passes through mostly forests and farms, along with small rural communities such as Rawlings, Kress and Warfield.

Midway through the county, the study corridor passes through the town of Alberta, VA, and crosses an inactive NS rail corridor, close to the town core. At the time of this document many of the commercial buildings are vacant and houses exist in varying states of maintenance, however the town has received substantial federal funding for downtown revitalization efforts.

South of Alberta, the study corridor crosses both I-85 and US 1, moving through more woodlands then crosses the Meherrin River, listed on the National Rivers Inventory as “wild”, meaning the river corridor and surrounding watershed area is largely undeveloped.



Attractions, Recreation & Tourism

Brunswick County is part of the south-central Piedmont Region of Virginia, which is also known as Southside Virginia. This is an agricultural area between the Richmond-Petersburg region in Virginia and the Triangle region in North Carolina. Major manufacturing employers include Brick & Tile Corp, Brunswick Box Co, Hyponex Corp, Virginia Carolina Forest Inc, and Vulcan Materials. Other major employers include Brunswick Correctional Center, Southside Virginia Community College and St. Paul's College.

Tourism in Brunswick County is primarily associated with Lake Gaston, especially for activities such as bass fishing tournaments. However, visitors are also drawn to the Brunswick County Lake, Great Creek Lake, Nottoway River reservoir and Buggs Island Lake.

Existing Greenway/Bike Facilities

The Tobacco Heritage Trail, a rails-to-trails corridor along an abandoned Norfolk-Southern rail corridor, intersects the study area in Alberta, VA (as well as in La Crosse, in the next section to the south). The Tobacco Heritage Trail will connect existing trail segments and create new trails within five Virginia counties: Brunswick, Mecklenburg, Halifax, Charlotte, and Lunenburg, with a potential spur trail connection to Dinwiddie County.

Historic & Archaeological Sites

Section 4 of the study corridor passes through the Lawrenceville Historic District, which includes several places on the National Register of Historic Places. These sites include; Bentfield, a single dwelling unit off Plank Road; Brick House, a single dwelling unit designed by Jacob Holt that once housed William Edward Brodnax; Brunswick County Courthouse Square, which includes many of the government offices in Lawrenceville; and Fort Christanna, built in 1713 and for a time served as a Native American reservation.

1.1.4 Mecklenburg County

The fourth and final section of the SEHSR multi-use trail concept in Virginia starts at the Meherrin River, crosses the county line into Mecklenburg County, and heads in a more traditional north-south direction, ending at Lake Gaston near the North Carolina border.

Within the northern part of the county, the study corridor passes through mostly forested areas with some farmlands and occasional residential developments before curving to the south. The corridor runs directly through the small town center of La Crosse, VA, composed mostly of residences and a few small commercial shops and industrial development. After La Crosse the land is mostly rural farmland and forested area until the Lake Gaston area which has a few lake-oriented subdivisions, golf courses and tourist amenities.



Bugg's Island

Attractions, Recreation & Tourism

Mecklenburg County is part of the south-central Piedmont Region of Virginia, which is also known as Southside Virginia. This is traditionally an agricultural area between the Richmond-Petersburg region in Virginia and the Triangle region in North Carolina, although manufacturing has increased in importance. Recreation associated with Lake Gaston and Kerr Lake (also known as Buggs Island Lake) accounts for some of service and trade employment. Major manufacturing employers include American Building Co, Brodnax Mills Inc, Carlisle Motion Control, International Veneer Co, Lawson Mardon Wheaton Inc, Sherwood Foods Inc., Virginia Homes Manufacturing, and Virginia Quilting Inc. Other major employers include Community Memorial Health Center, Huss Inc., Mecklenburg Electric Cooperative, Parker Oil Co., and The DRS Group. Recent closings, reductions and layoffs have affected textiles and clothing-related operations.

Tourism in Mecklenburg County is primarily associated with Lake Gaston, especially for activities such as bass fishing tournaments. Other attractions include MacCallum More Museum, Gardens and the Roanoke River Museum in the Prestwoud Plantation house, and Centennial Park in South Hill.



Tobacco Heritage Trail Map

Existing Greenway/Bike Facilities

The Tobacco Heritage Trail, a rails-to-trails corridor along an abandoned Norfolk-Southern rail corridor, intersects the study area in La Crosse, VA (as well as in Alberta, in the next section to the north). The Tobacco Heritage Trail will connect existing trail segments and create new trail within five Virginia counties: Brunswick, Mecklenburg, Halifax, Charlotte, and Lunenburg, with a potential spur trail connection to Dinwiddie County.



Boyd's Tavern

Historic & Archeological Sites

Many of the historic and archeological sites in Mecklenburg County are located around Buggs Island Lake; near the towns of Clarksville and Boydton. These sites include; the Boydton Historic District; Boyd's Tavern, another Jacob Holt design; an archeological site at Buffalo Mineral Springs and Elm Hill; Ivy Hill Plantation; Moss Tobacco Factory; Occoneechee Plantation; and several other structures and dwellings. The Colonial Theatre, originally built in 1925 by Gilbert Saunders, is located in the central business district of South Hill. South Hill is located just a couple miles west of I-85 from La Crosse.

1.2 North Carolina

Population Centers

Based on 2007 estimates by the North Carolina State Demographics unit, there are several populated areas within 0.5 miles of the SEHSR corridor which are discussed in detail:

Norlina (1,083)
Middleburg (168)
Henderson (16,315)
Kittrell (135)
Franklinton (2,460)
Youngsville (1,168)
Wake Forest (4,793)
Raleigh (367,098)

North Carolina Attractions

Vance and Warren Counties also depend heavily on Lake Gaston and Kerr Lake, as well as other water-related recreation destinations, to attract visitors. In Warren County, other attractions include the Lakeland Cultural Arts Center, Norlina Train Museum and Medoc Mountain State Park. Vance County is home to the East Coast Drag Times Hall of Fame, which includes the annual Corbitt Truck Show and “Show, Shine, Shag and Dine Car Show.” Harper’s Motor Speedway is located near Kittrell. Tourism is a very minor economic activity in Franklin County. Agri-tourism is the most common activity with some arts and crafts activities as well.

As a state capital, the Raleigh metropolitan area is home to the North Carolina Museum of History, Museum of Science and Art, and Marbles Kids Museum, among others. Other attractions include historic sites and houses, the JC Raulston Arboretum, Progress Energy Center for the Performing Arts, Time Warner Cable Music Pavilion at Walnut Creek, Booth Amphitheater, and various other theaters and performing arts companies, as well as festivals ranging from St. Patrick’s Day to Lazy Daze Arts & Crafts. Raleigh is home to the Carolina Hurricanes hockey team, as well as the athletic and cultural events of North Carolina State University, Peace College, Shaw University, Meredith College, Saint Augustine’s College and other schools. The Greater Raleigh Convention & Visitors Bureau estimates visitors to the region contributed over \$1.2 billion to the economy.





Lake Gaston
(www.northcarolinafishingonline.com)

1.2.1 Norlina

Recreation Areas

Medoc Mountain State Park
Lake Gaston

Historic Areas

Chapel of the Good Shepherd (1977 in Ridgeway, south of Norlina Building #77001013)
William J. Hawkins House (1978 in Ridgeway, south of Norlina Building #78001982)

Tourism Sites

Based on an internet query, the nearest hotels to the Town of Norlina are located on US 1, north of the town, and southeast of Norlina in the City of Warrenton. Retail facilities and restaurants are found along US 1 and Hyco Street.

Connections to Greenway/Bicycle Facilities

According to the Draft 2007 Warren County Comprehensive Plan, the county hopes to construct on-road bike lanes on SR 1306 (Wise/Five Forks Road) and on SR 1320 (Warren Plains Road). There are two existing bike routes in the county that cross the SEHSR study areas, SR 1224 (Ridgeway Road) and SE 1200 (Drewry Road), both are listed as needing improvements.

U.S. Bicycle Route 1 (often called U.S. Bike Route 1) is a cross-country bicycle route that runs the length of the United States eastern seaboard from Florida to Maine. It is one of the two original U.S. Bicycle Routes, the other being U.S. Bicycle Route 76. AASHTO recognizes the segments in North Carolina and Virginia as being the only “official” segments of U.S. Bicycle Route 1. The other segments, even if signed or mapped, have not been submitted to AASHTO for formal inclusion or recognition in the U.S. Bicycle Route system. According the NCDOT’s Division of Bicycle and Pedestrian Transportation, the route covers almost 200 miles in North Carolina. Destinations along the route include San-Lee Park, Umstead State Park, and Kerr Lake State Recreation Area. Other points of interest include the Indian Museum of the Carolinas, Weymouth Woods Sandhills Nature Preserve, House in the Horseshoe State Historic Site, and the numerous historic sites and museums of the Raleigh/Capital City area.



Kerr Lake
(www.vancecounty.com)

1.2.2 Middleburg

Recreation Areas

Kerr Lake

Historic Areas

Pleasant Hill/Hawkins House (1979, Building #79001758)

Tourism Sites

Based on an Internet search, the nearest hotels to Middleburg are located in the City of Henderson. Retail and restaurants are found on Chestnut Street and Broad Street.

Connections to Greenway/Bicycle Facilities

Based on an Internet review, no additional connections to greenways or bicycle facilities are available in Middleburg.

1.2.3 Henderson

Recreation Areas

- Vulcan Greystone Private Park (North of Henderson)
- Chestnut Street Park, tennis and racquetball facilities
- King Daughters I Park, tennis, picnic area, playground
- Jackson Street Park, playground, basketball facilities
- Jaycee Park, picnic area
- Owen-Davis Park, playground, basketball facilities
- South Henderson Park, football, softball/baseball
- North Henderson Park, soccer, softball/baseball
- Rollins Park, softball/baseball, tennis
- Pinkston Park, basketball
- Eaton-Johnson Park, softball/baseball

Historic Areas

- Ashland (1973, Building #73001371)
- Daniel Stone Plank House (1984, Building #84002531)
- Henderson Central Business Historic District (1987, District #87001249)
- Henderson Fire Station and Municipal Building (1978, Building #78001973)
- Henderson Institute Historical Museum (1995, Building 95001399)
- Mistletoe Villa (1978, Building #78001974)
- Maria Parham Hospital (1994, Building 94001066)
- Vance County Courthouse (1979, Building #79001757)
- West End School (2005, Building #04001585)
- Zollicoffer’s Law Office (1978, Building #78001975)

Tourism Sites

Based on an Internet review, hotels in Henderson are mainly clustered along I-85 interchanges, with a smaller group located along Garnett Street. Similar groupings are encountered for restaurants and retail areas, with the greatest concentration of retail areas being found on Garnett Street in the midtown area and North Henderson.

Connections to Greenway/Bicycle Facilities

US 158 provides east/west access through the Henderson, NC, area and is designated as the North Carolina bicycle highway “North Line Trace.” According to the NCDOT Division of Bicycle and Pedestrian Transportation, this route, NC Bike Route 4, runs east-west just south of



Kerr Lake
(www.ncparks.gov)



Henderson Fire Station No. 2
(www.hendersonnc.us)



St. James Episcopal Church
(www.flickr.com)

the Virginia border from the mountains to the coast. The 400-mile route provides access to six state parks and several other recreation areas, including Stone Mountain, Pilot Mountain and Hanging Rock State Parks, Hyco Reservoir, Kerr Lake and Lake Gaston Recreation Areas, Merchants Millpond State Park, and the Dismal Swamp and Currituck Sound areas. Campgrounds are spaced up to 75 miles apart and motels are scarce.

1.2.4 Kittrell

Recreation Areas

Harper's Motor Speedway
Tar River (South of Kittrell)

Historic Areas

Ashburn Hall (1977, Building #77001009)
St. James Episcopal Church and Rectory (1978, Building #78001976)

Tourism Sites

Based on an Internet query, Kittrell has no hotel or restaurants. There are retail destinations along US 1.

Connections to Greenway/Bicycle Facilities

Based on an Internet review, no additional connections to greenways or bicycle facilities are available in Kittrell.

1.2.5 Franklinton

Recreation Areas

Franklinton Elementary School (has playgrounds and sports fields available for public use)
Franklinton Park

Historic Areas

Franklinton Depot (1990, Building #90001941)
Dr. J. H. Harris House (1975, Building #75001260)
Shemuel Kearne, House (1975, Building #75001261)
Dr. J. A. Savage House (1980, Building #80002834)
Sterling Cotton Mill (1996, Building #96000568)

Tourism Sites

Based on an Internet query, there is a hotel on US 1, south of Franklinton. Restaurants are clustered along Main Street, as are retail areas.

Connections to Greenway/Bicycle Facilities

The county has expressed interest in a greenway facility paralleling the Tar River.



Franklinton Depot
(www.franklinton-chamber.org)

1.2.6 Youngsville

Recreation Areas

Luddy Park, softball/baseball, basketball facilities

Historic Areas

William A. Jeffreys House (1976, Building #76001323)
Person-McGhee Farm (1979, Building #79003343)

Tourism Sites

Based on an Internet query, there is a hotel on East Main Street. Restaurants and retail establishments are clustered on East Main Street, especially near the intersection with US 1.

Connections to Greenway/Bicycle Facilities

According to the Franklin County Comprehensive Plan, the State Bike Trail (East) extends approximately 12 miles along state roadways from the Nash County line to US 401 at Harris Crossroads. The State Bike Trail (West) extends approximately 11 miles along state roadways from Harris Crossroads at US 401 through Youngsville, proceeding westward, then south to the Wake County line. This is part of NC State Bike Route 6.

1.2.7 Wake Forest

Recreation Areas

Several local parks are located within one half mile of the proposed SEHSR multi-use trail. They include:

J.B. Flaherty Park - 100-acre park with lighted athletic fields, picnic shelter, 2 ponds, 4 lighted tennis courts, and a community center

Taylor Street Park – 1.5-acre park, home to the Alston-Massenburg Center, which is available for rent

Ailey Young Park - 15-acre neighborhood park with a baseball field, basketball courts, playground, and picnic tables

H.L. Miller Park - 2-acre wooded park with picnic tables and paved trails
Tyler Young Park - 9-acre park is located within the Tyler Run/Holding Ridge subdivision

Holding Park - 5-acre site consisting of the Wake Forest Community House and the Town's 50-meter swimming pool

Smith Creek Soccer Center - 17-acre facility that houses 3 full-size soccer fields

Kiwanis Park - 1-acre site offers a playground, picnic shelter, and a paved greenway trail; adjacent to library.



*Christmas Tree Lighting at Mitchell Park
(www.yabaonline.com)*



*Flaherty Park Dog Park
(www.wakeforestnc.gov)*



Historic Downtown Wake Forest
(www.city-data.com)

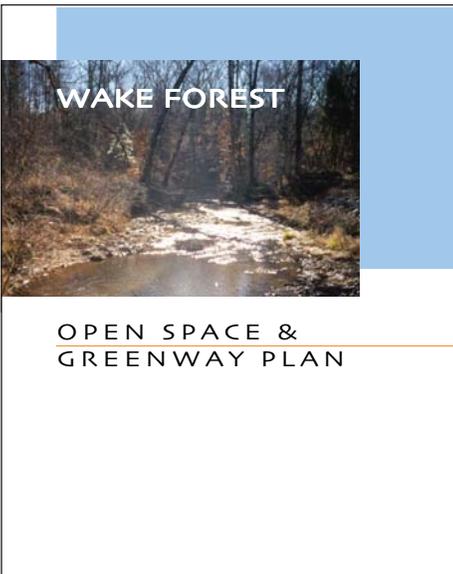
Historic Areas

There are several sites listed on the National Register of Historic Places in the Town of Wake Forest that are within 0.5 mile of the proposed project. They include:

- DuBois, W. E. B., School (1993, Building #93000998)
- Downtown Wake Forest Historic District (South White St. roughly from E. Roosevelt Ave. to Owen Ave.), (2002, District #02000059)
- Glen Royall Mill Village Historic District (1999, District #99001046)
- Lea Laboratory (Southeastern Baptist Theological Seminary) (1975, Building #75001298)
- Oakforest (Tryst Oak; Seawell House) (1998, Building #98000689)
- Powell House (1974, Building #74001381)
- Royall Cotton Mill Commissary (1991, Building #91001504)
- Wake Forest Historic District (Bounded by Oak St., RR tracks, Holding St., W. Vernon Ave., S. Wingate, N. Wingate, Durham Rd. and N. College Sts (2003, District #03001301).

Tourism Sites

Based on an Internet query, hotels are located along US 1 (Capital Boulevard) and Main Street near the intersection with Durham Road. Restaurants and retail outlets are also found in this area, and are most concentrated along the US 1 exit at Durham Road, the US 1 intersection at South Main Street, and the intersection of Durham Road with Main Street.



By Greenways Incorporated, 2002
(www.wakeforestnc.gov)

Connections to Greenway/Bicycle Facilities

According to the Wake Forest Open Space and Greenway Plan (prepared by Greenways, Incorporated for the Wake Forest Planning Department and the Wake Forest Parks and Recreation Department in 2002), there are three potential greenway connections with the proposed SESHR multi-use trail within the Town's ETJ. The Wake Forest plan allows for several different types of multi-use paths, including areas without facilities in environmentally sensitive areas; limited development, low-impact uses for poorly drained areas; multi-use, unpaved trail development; multi-use, paved trail development; on-road (sidewalks and bikeways); and equestrian trails.

The 2002 plan focused on improving street accessibility to bicycles and pedestrians. In Phase One, on-road improvements were proposed along the east/west corridor that follows Wait Avenue and Durham Road through the downtown area. The improvements would have potential recreational opportunities at either end (Wake Forest Reservoir to the east and Falls Lake to the West), however it is assumed that the principal purpose of the facility is for economic development. The facility would improve bicycle and pedestrian access to the shopping center to the west of US 1/Capital Boulevard as well as to the downtown historic district, which has many small shops. The traditional shopping district is heavily dependent on foot traffic. In Phase Two of the project, two additional on-road improvements were proposed that could connect to the proposed

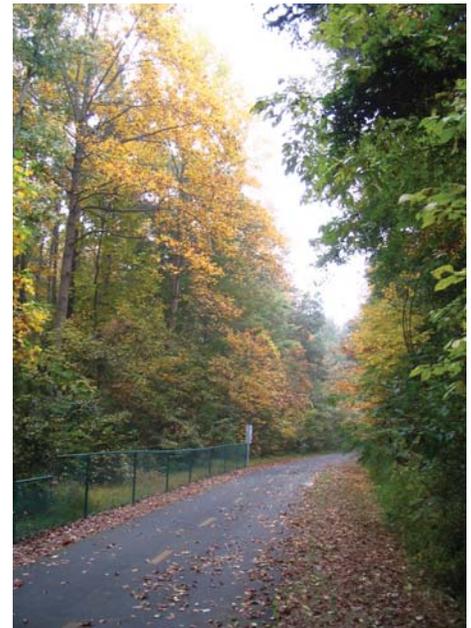
SEHSR multi-use path. The first connection would link the Glen Royall Mill Village with Purnell Road and the Wakefield, while a second on-road facility is proposed on Jenkins Road to serve as an east-west connection through the town that would end just west of the SEHSR corridor.

The current design of the SEHSR project does not have planned crossings where the improvements intersect with the project corridor. Currently, the SEHSR design includes one pedestrian crossing through Wake Forest, that being located south of the proposed Purnell Road greenway. Access from the west to the crossing could be accomplished by taking Main Street to East Cedar Avenue, a diversion of approximately 1,500 feet. The diversion from the west along Main Street for users of the potential Jenkins Road Greenway would be approximately 3,000 feet. The diversion from the west for users of the proposed Wait Avenue/Durham Road greenway would be approximately 4,000 feet.

Diversions from the east for each of these potential greenways would be longer, as there is no continuous north/south road east of the proposed crossing. Users of the proposed Purnell Road route would likely take Taylor Road to Groveton Trail. The potential Jenkins Road route does not extend east of the SEHSR project area. Users of the Proposed Wait Avenue/Durham Road route would take Taylor Road South to East Spring Street, and west to North White Street to Wait Avenue.

The Plan was updated in 2009, with the addition of a potential greenway constructed parallel to the Highway 98 corridor. The major goal of this effort would be to enhance bicycle and pedestrian circulation by constructing a 10-foot wide travel path on each side of the east-west bypass to serve as gateways to Wake Forest and to create east-west routes through the Town. The route would feature grade-separated crossings at major road connections and/or main greenway trail connections. It is also anticipated that pedestrian and bicycle connections would extend from front doors of businesses to nearby public sidewalks and greenways. The path would connect to the Town's proposed Richland Creek Greenway, as well as, via connecting routes, to Falls Lake. The Town also anticipates that the Richland Creek (western portion of town) and Smith Creek (eastern portion of town) could be connected by the Purnell Road facility to the north and by a greenway at the Neuse River to form a loop around the Town.

Land use for all of these paths is primarily urban or residential, as would be expected for a greenway anticipated to serve economic needs. Greenway connections are proposed that would extend into more rural areas along Sanford Creek towards Rolesville to the east and along Richland Creek, which flows from north to south to the west of the SEHSR project corridor.



*American Tobacco Trail
(By Michael Baker Engineering, Inc)*



Raleigh City Market (1928)
(www.city-data.com)

1.2.8 Raleigh

Recreational Areas

Recreational areas near Raleigh include Falls Lake, a number of City parks, the State Capital, North Carolina Museum of History, Museum of Science and Art, and Marbles Kids Museum, among others. Other attractions include historic sites and houses, the JC Raulston Arboretum, Progress Energy Center for the Performing Arts, Time Warner Cable Music Pavilion at Walnut Creek, Booth Amphitheater, and various other theaters and performing arts companies. According to the City of Raleigh website, there are 95 parks in the City.

Historic Areas

According to the North Carolina State Historic Preservation Office, Raleigh has almost 100 historic sites and districts listed in the NRHP.

Connections to Greenway/Bicycle Facilities

According to the City of Raleigh website, the city has 63 miles of greenways. While the proposed SEHSR multi-use trail would end at the Neuse River, it is anticipated that it would be possible to access portions of the Raleigh greenway system at some point, either through connections with the Wake Forest System or by accessing the Neuse River Trail. The trail connects with Falls Lake to the north trends to the southeast, connecting with several city parks as well as the Crabtree Creek Trail and the Lower Walnut Creek Trail.



Reedy Creek Pedestrian Bridge
(www.goodnightraleigh.com)

2.0 General Design Considerations

The design guidelines presented herein provide a conceptual framework for a multi-use trail (ie: shared-use path) associated with the Southeast High Speed Rail (SEHSR). More detailed designs will be required at the local and regional level as the trail progresses from concept to reality. For example, some areas will have specific design considerations, such as equestrian use, steep terrain obstacles or limitations, or bridging issues that must be considered in more detailed design. This general framework is intended to provide the flexibility to incorporate local and regional considerations in final design.

While the SEHSR multi-use trail design at this stage is conceptual for estimating impacts, the design team will be using the following Architectural Barriers Act (ABA) guidance as appropriate and practicable.

ABA Trail Design Technical Guide Quick Reference

<i>Feature</i>	<i>Standards</i>	<i>Comments</i>
Surface	Concrete, asphalt or gravel	Trail surface will vary depending on the application. Sensitive areas such as wetlands and poor soils may warrant boardwalks.
Running/Longitudinal Slope	0 - 5% max.	Try to keep the overall slope to a minimum for the benefit of all users. However, where a minimum slope is not practical,* the following short segments of steep trail are allowed with resting intervals (per the Accessibility Guidelines for Outdoor Developed Areas - see comparison): 1:20 (5%), any length; 1:12 (8.33%), for up to 200 feet; 1:10 (10%), for up to 30 feet; 1:8 (12.5%), for up to 10 feet. No more than 30% of the total trail length shall exceed 1:12.
Cross Slope	2% cross slope (NOT crowned) on paved surfaces for drainage	2% desired for adequate drainage and ease of wheelchair use.
Width	10' trail surface with 2' shoulder on both sides (14' total corridor)	12'-16' wide for trails with anticipated high volume or length greater than 1/2 mile length. Min. 3' clearance from objects adjacent to the trail. (see signage)
Vertical Clearance / Protuding Objects	10' min. vertical clearance, NO protruding objects	Tree limbs, signs, lighting, overpasses, etc.
Tread Obstacles	No tread obstacles allowed	Maintain a smooth tread surface
Passing Space	N/A if trail width is 10'	
Resting Intervals	N/A if trail width is 10' and slope is <5%	Locate at both ends of steep slope segments of trail
Edge Protection / Railings	42" min. height railings	42" min. height railings where >30" drop in grade OR > 3:1 side slope adjacent to trail if < 5' shoulder < 4" gap in railings
Buffers/Barriers (from railroad)	min. 30' from edge of trail and 7' ht fence/barrier AND/OR grade separation AND/OR min. 50' separation w/o fence/barrier	Depending upon the speed of the rail traffic, studies showed 30' minimum distance between rail and trail is desired. However, in instances where there is not adequate ROW, trail can be closer and additional safety measures taken such as raising the grade of the trail and installing fencing and wall barriers.
Openings/Gaps	max. 1/4 inch (6 mm)	Try to avoid any openings or gaps in the trail surface.
Signage	Part 9 of the MUTCD	

Trail Design Guideline Comparison (ABA vs. AASHTO)

	SEHSR Multi-Use Trail Concept Design Guidelines (page #)	Accessibility Guidelines for Outdoor Developed Areas; Proposed Rule (ABA, 2007)	Guide for the Development of Bicycle Facilities (AASHTO, 1999)
Surface	Firm and Stable such as concrete or asphalt	Firm and Stable	Bicycles need the same firmness and stability as wheelchairs; skaters usually require a smooth, paved surface. Most shared use paths are paved, although crushed aggregate surfaces are used on some paths.
Running/Longitudinal Slope	0 - 5% max.	1:20 (5%), any length; 1:12 (8.33%), for up to 200 feet; 1:10 (10%), for up to 30 feet; 1:8 (12.5%), for up to 10 feet. No more than 30% of the total trail length shall exceed 1:12.	Running slopes on shared use paths should be kept to a minimum; grades greater than 5 percent are undesirable. Grades steeper than 3 percent may not be practical for shared use paths with crushed stone or other unpaved surfaces. Where terrain dictates, grade lengths are recommended as follows: -5% (<1:20), any length; 5-6% (1:20-16.7), for up to 240 m (800 feet); 7% (1:14.3), for up to 120 m (400 feet); 8% (1:12.5), for up to 90 m (300 feet); 9% (1:11.1), for up to 60 m (200 feet); 10% (1:10), for up to 30 m (100 feet); 11+ (1:9.1), for up to 15 m (50 feet).
Cross Slope	2% cross slope (NOT crowned) on paved surfaces for drainage	Cross Slope: 1:20 (5%) maximum; exceptions for open drains up to 1:10 (10%).	For drainage, shared use paths should have a minimum 2 percent (1:50) cross slope on a paved surface. On unpaved shared use paths, particular attention should be paid to drainage to avoid erosion. Curves on shared use paths may require super elevation beyond 2% (1:50) for safety reasons. The Guide suggests limited cross slope for accessibility reasons.
Width (Clear Tread Width)	10' trail surface with 2' shoulder on both sides (14' total)	36 inches (3 feet; 915 mm); exception for 32 inches (815 mm).	Shared use paths usually require a minimum 3 meter (10 foot) width, plus a 0.6 meter (2 foot) safety buffer on both sides. A 2.4 m (8 foot) width may be allowed in low use facilities. Posts or bollards installed to restrict motor vehicle traffic should be spaced 1.5 m (5 feet) apart. Posts or bollards should be brightly painted and reflectorized for visibility. When more than one post is used, use an odd number, with one on the centerline to help direct opposing traffic.
Vertical Clearance / Protuding Objects	10' Vertical Clearance, NO protruding objects	Protruding Objects:T405 provide a warning if vertical clearance is less than 80 inches (2030 mm).	Protruding objects should not exist within the clear tread width of a shared use path. Vertical clearance on shared use paths should be a minimum of 3 m (10 feet) or the full clear width including safety buffers. Where vertical barriers and obstructions, such as abutments, piers, and other features are unavoidable, they should be clearly marked.
Tread Obstacles	None	Tread Obstacles (Changes in level, roots, rocks, ruts): Up to 2 inches (50 mm); exception up to 3 inches (75 mm).	Tread obstacles are hazardous to bicyclists and skaters. The surface of a shared use path should be smooth and should not have tread obstacles.
Passing Space	N/A if trail width is 10'	Passing Space: At least 60 inches (1525 mm) width within 1,000 foot (300 m) intervals. Advisory recommends more frequent intervals for some trail segments.	Shared use paths should have a minimum clear width of 3 m (10 feet); exception for 2.4 m (8 feet).
Resting Intervals	N/A if trail width is 10' and slope is <5%	Resting Intervals: Size: 60 inch (1525 mm) length, at least as wide as the widest trail segment adjacent to the rest area. Less than 1:20 (5%) slope in all directions. Resting areas are required where trail running slopes exceed 1:20 (5%), at intervals no greater than the lengths permitted under running slope	The Guide does not address resting intervals.
Edge Protection / Railings	42" min. height railings for any $\geq 30"$ drop in grade OR > 3:1 side slope adjacent to trail if < 5' shoulder	Edge Protection: Where provided, 3 inch (75 mm) minimum height. Handrails are not required.	The Guide does not address edge protection. Some kinds of edge protection may be hazardous to bicyclists and skaters. The Guide has minimum railing height recommendations when needed for safety reasons.
Buffers/Barriers (from railroad)	min. 30' from edge of trail and 7' ht fence/barrier AND/OR grade separation AND/OR min. 50' separation with no fence/barrier	N/A	N/A
Openings/Gaps	max. 1/4 inch (6 mm)	To prevent wheelchair wheels and cane tips from being caught in surface openings or gaps, openings in trail surfaces shall be of a size which does not permit passage of a 1/2 inch (13 mm) diameter sphere; elongated openings must be perpendicular or diagonal to the direction of travel; exception to permit parallel direction elongated openings if openings do not permit passage of a 1/4 inch (6 mm) sphere; second exception to permit openings which do not permit passage of a 3/4 inch (19 mm) sphere.	The AASHTO Guide does not specify a maximum dimension for a surface opening, but openings should be minimized. Openings should not permit a bicycle wheel to enter. Grates should be flush with the surface, and elongated openings should be perpendicular to the direction of travel (diagonal openings are more difficult for bicyclists to negotiate). Where openings are unavoidable, they should be clearly marked.
Signage	Part 9 of the MUTCD	Accessible trails require designation with a symbol of accessibility, and information on total length of the accessible segment. No traffic control sign information.	Guidance on signing and marking is provided in the Manual on Uniform Traffic Control Devices (MUTCD), incorporated by reference as a Federal regulation (23 CFR 655.601). A proposed amendment for Part 9 (Traffic Controls for Bicycle Facilities) was published in the Federal Register on June 24, 1999 (64 FR 33802).

General Considerations for Rails With Trails (RWT) ([Trails and High Speed Rail: Are They Compatible?](#) By Alta)

- potential hazards to trail users from wind and debris,
- likelihood of injuries in the case of a derailment,
- impact to railroad future plans for double tracking,
- need for maintenance access, and
- security and safety needs in the wake of the events of Sept 11, 2001.

2.1 Safety Design Considerations

This document section addresses safe design practices including horizontal and vertical alignments, clearances, Americans with Disabilities Act of 1990 (ADA) Access, signage and security site furnishings.

2.1.1 Trail Width

Purpose

To provide safe passing distance between various trail users and avoid conflicts.

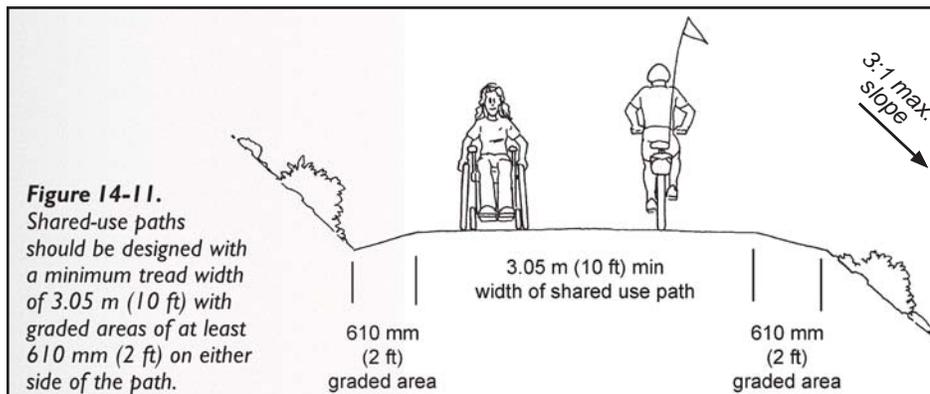
Guidelines/Considerations

10'-0" minimum trail plus 2' shoulder width is recommended for a shared-use path/trail (total 14' cross-section). 12'-16' width is recommended for trails with high volumes of users and with lengths greater than 1/2 mile. Secondary paths, such as spur trails connecting the primary trail to adjacent destinations, could be 5' wide.

Dual-tread trails and/or two separate trails may be designed to accommodate different trail users (see sidebar photo).



Example of Dual-Tread Trails
(www.americantrails.org)



(Designing Sidewalks and Trails for Access Part II of II: Best Practices Design Guide, FHWA, 2001)

2.1.2 Trail Clearance

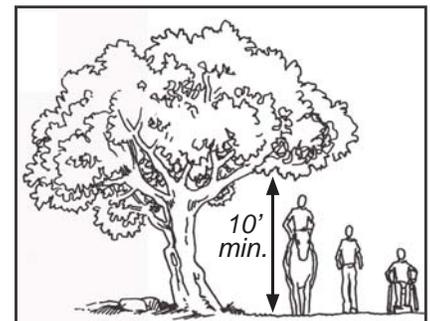
Purpose

To allow safe passage of trail users and avoid conflicts with objects adjacent and above trail such as rocks, tree limbs, fences, lights and signs (see Signage for more information on sign locations).

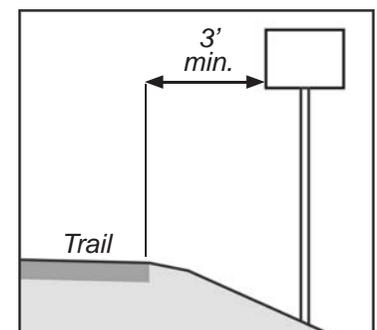
Guidelines/Considerations

10'-0" minimum height clearance from finished grade of trail surface.

3'-0" minimum width clearance from outside edge of trail to any object.



(FHWA, 2001)



(MUTCD, 2003)

2.2 Trail Alignment

2.2.1 Trail Curve Radii

Guidelines/Considerations

AASHTO recommends a minimum design speed of 30 km/h (20mph) for shared-use paths. A minimum centerline curve radii of 100' is recommended (per the chart below). When a downgrade exceeds 4 percent, or where strong prevailing tailwinds exist, a design speed of 50 km/h (30 mph) or more is advisable. (AASHTO, 1999)

Design Speed (V)		Minimum Radius (R)	
km/h	(mph)	m	(ft)
20	(12)	12	(36)
30	(20)	27	(100)
40	(25)	47	(156)
50	(30)	74	(225)

(Guide for Development of Bicycle Facilities, AASHTO, 1999)

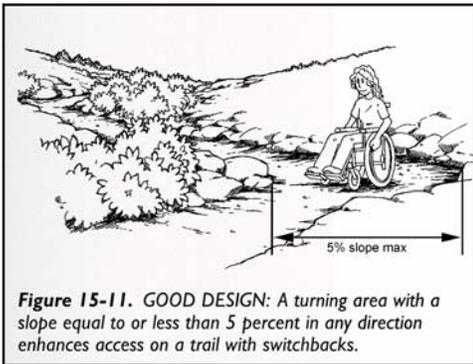


Figure 15-11. GOOD DESIGN: A turning area with a slope equal to or less than 5 percent in any direction enhances access on a trail with switchbacks.

Turning area along switchbacks.
(FHWA, 2001)

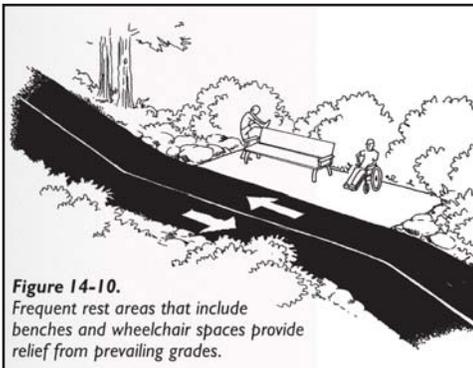


Figure 14-10. Frequent rest areas that include benches and wheelchair spaces provide relief from prevailing grades.

Rest area adjacent to rest interval between two steep grade trail segments.
(FHWA, 2001)



Concrete rest interval
(ncaonline.org)

2.2.2 Longitudinal Slopes (Grade)

Guidelines/Considerations

Trails should be designed with the **most gentle slope possible** for the benefit of all trail users. Where practicable, a maximum slope of 5% is desired for ADA accessibility. However, if there are short segments of trail (less than 30 percent of the total length of trail) that need to be at a steeper grade, there should be a smooth transition as well as rest intervals (see Rest Intervals) and the following guidelines apply: (from the Designing Sidewalks and Trails for Access Part II of II: Best Practices Design Guide by the Federal Highway Administration and Beneficial Designs, Inc (FHWA, 2001)).

- 8.3 % for a maximum of 61.0 m (200 ft);
- 10 % for a maximum of 9.14 m (30 ft)
- 12.5 % for a maximum of 3.05 m (10 ft)

2.2.3 Rest Intervals

Guidelines/Considerations

Locate rest intervals within 25 feet of the top and bottom of a maximum grade segment. Rest intervals may be located on the shared-use path but should ideally be located adjacent to the path for the safety of all users. Well-designed rest intervals should have the following characteristics:

- A firm and stable surface
- Max. 5% longitudinal/running grade
- Max. 2% cross-slope on paved surfaces
- Max. 5% cross-slope on non-paved surfaces
- A width equal to or greater than the width of the path segment
- Min. 5'-0" length
- A minimum change of grade and cross slope on the segment connecting the rest interval with the shared-use path.

2.2.4 Trail Cross Slopes

Guidelines/Considerations

Trail cross slopes are important for proper drainage to prevent water from pooling and possibly freezing and causing unsafe conditions for trail use. A 2% maximum cross slope is desired for a paved surface trail for drainage and ease of wheelchair use.



Gravel Trails require adequate cross slope for drainage

(Photo: BikePedImages/Dan Burden (FHWA, 2001))

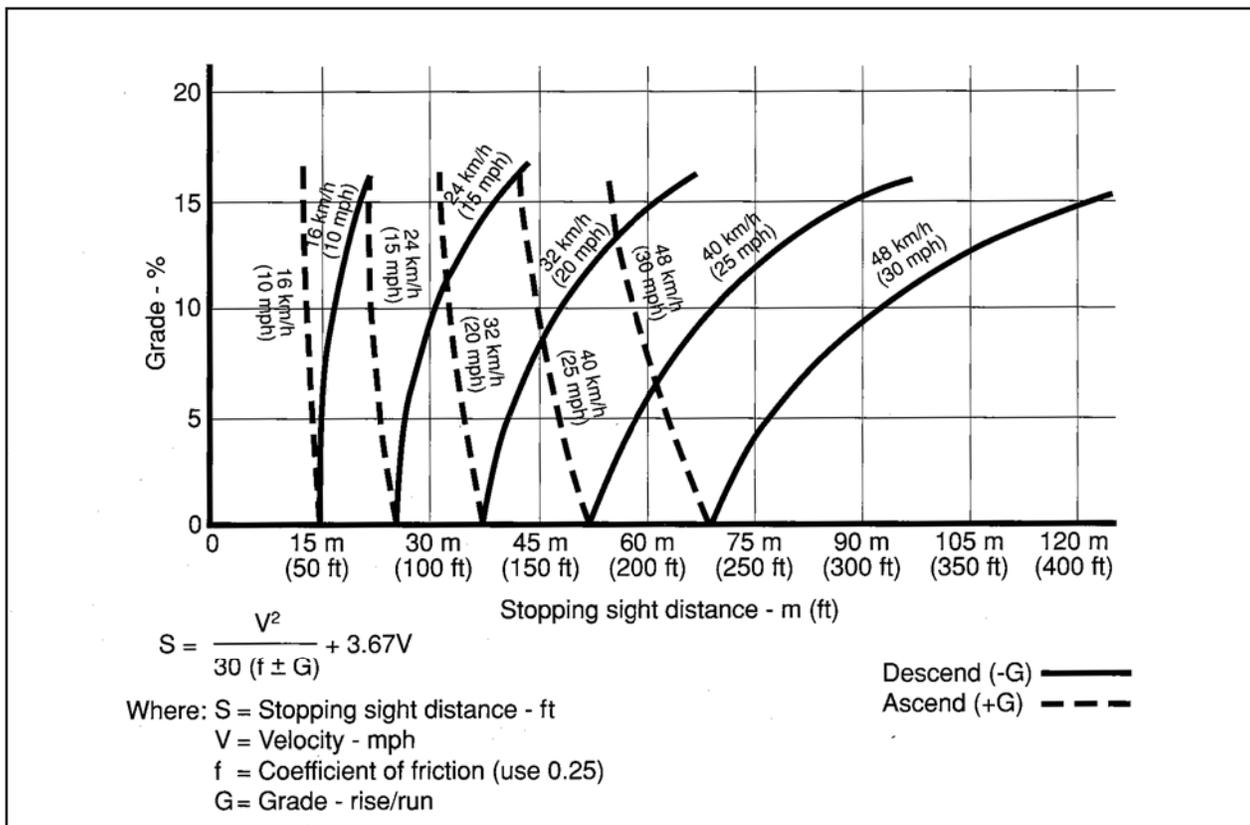
2.2.5 Sight Distances

Guidelines/Considerations

To provide bicyclists with an opportunity to see and react to the unexpected, a shared use path should be designed with adequate stopping sight distances. The distance required to bring a bicycle to a full controlled stop is a function of the bicyclist's perception and brake reaction time, the initial speed of the bicycle, the coefficient of friction between the tires and the pavement, and the braking ability of the bicycle. (AASHTO, 1999)

The following charts give guidance for:

- minimum stopping sight distance for various design speeds and grades
- minimum length of vertical curve to provide minimum stopping sight distances (on vertical curve crests)
- minimum clearance to line-of-sight obstructions for horizontal



a) Stopping Sight Distances on Bicycle Paths

(North Carolina Bicycle Facilities Planning And Design Guidelines, NCDOT, 1994)

(Guide for the Development of Bicycle Facilities, AASHTO, 1999)

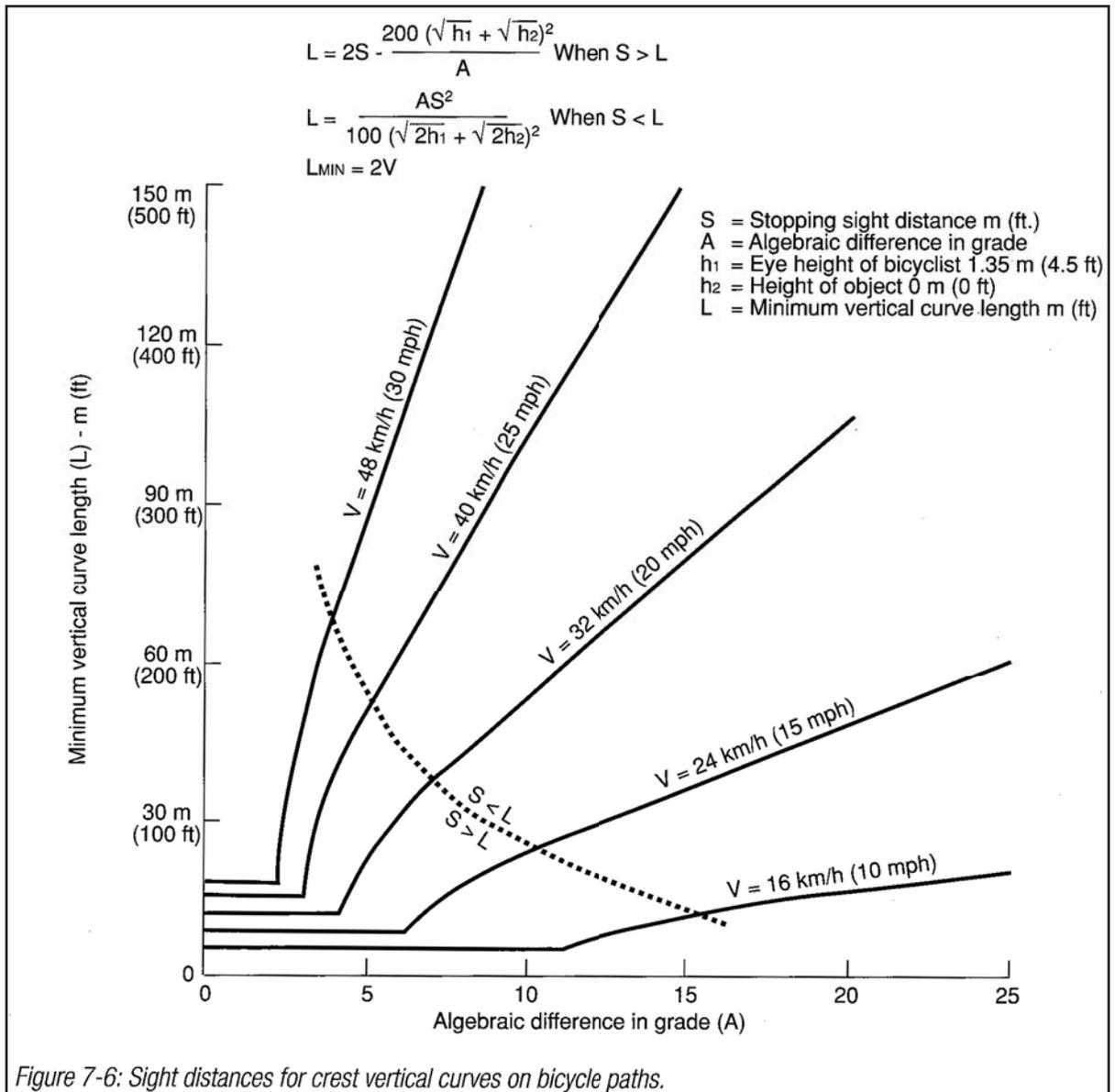


Figure 7-6: Sight distances for crest vertical curves on bicycle paths.

b) Minimum Length of Vertical Curve
 (North Carolina Bicycle Facilities Planning And Design Guidelines, NCDOT, 1994)
 (Guide for the Development of Bicycle Facilities, AASHTO, 1999)

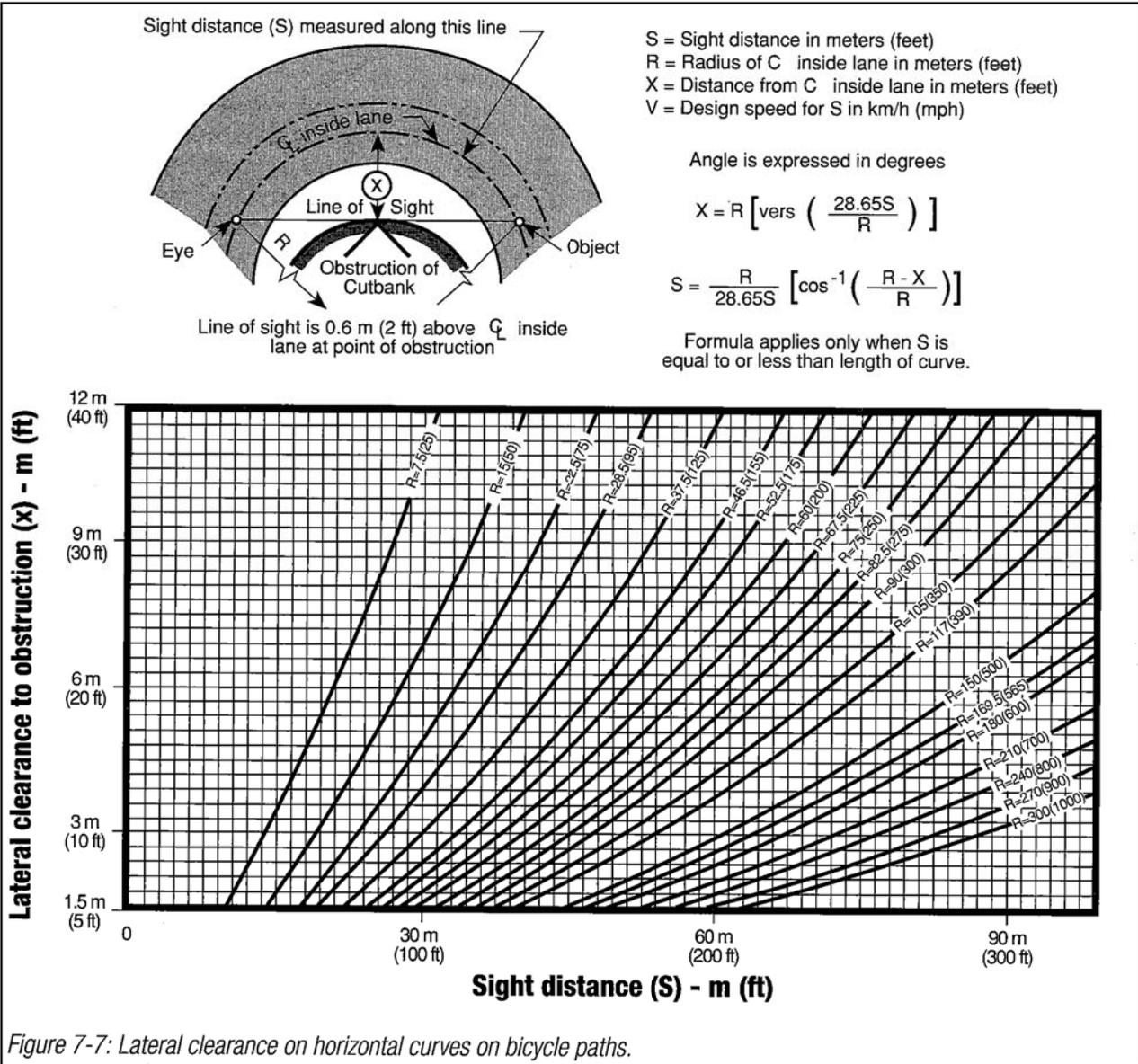


Figure 7-7: Lateral clearance on horizontal curves on bicycle paths.

c) Horizontal Line-of-Sight
 (North Carolina Bicycle Facilities Planning And Design Guidelines, NCDOT, 1994)
 (Guide for the Development of Bicycle Facilities, AASHTO, 1999)

2.2.6 Maximum Straight Segments of Trail

Purpose

To prevent excessive speeds of wheeled trail users and to enhance trail experience.

Guidelines/Considerations

When designing long lengths of straight or perceived straight trail, consider the experience of the trail user and how to capitalize on existing view sheds or create new ones if in a forested area.

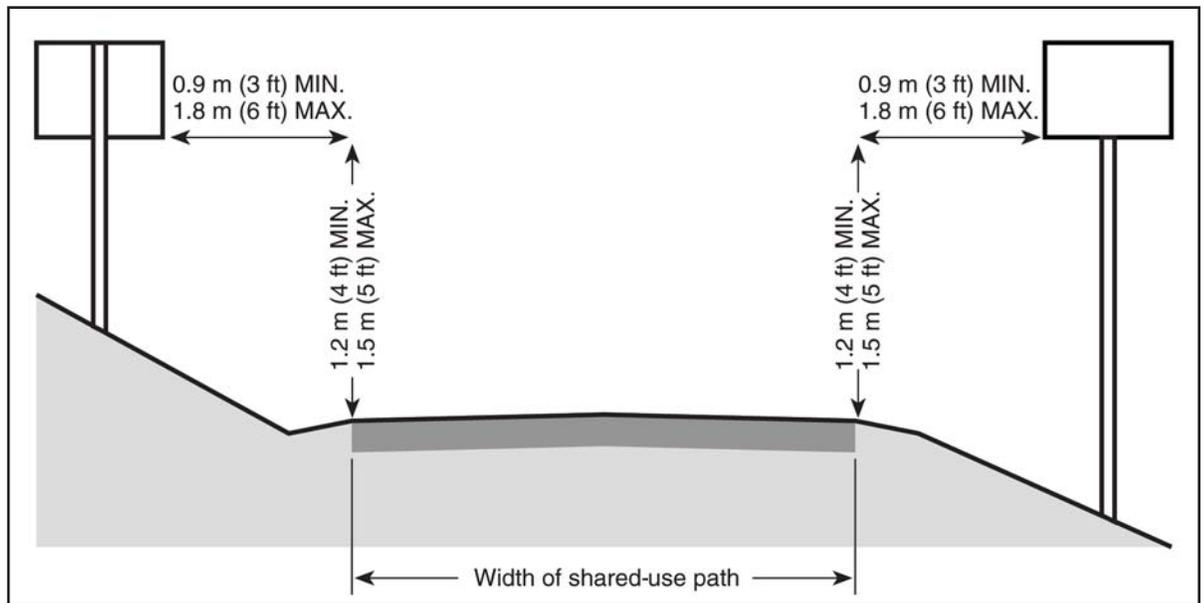
2.3 Signage and Pavement Markings

An overall signage plan should be designed to insure the safe and efficient placement of signs. There are three basic purposes of signs: regulatory, warning and guide signs. Regulatory and warning signs should be used judiciously as they tend to lose their effectiveness if overused. Guide signs, such as mile markers, can be placed more frequently as they help orient trail users and emergency personnel. Part 9 of The Manual on Uniform Traffic Control Devices (MUTCD) provides detailed information related to bicycle and multi-use path signage and pavement markings. Summarized information follows:

2.3.1 Sign Placement

Guidelines/Considerations

The illustration below shows recommended safe locations for signs along a shared-use path. If signs are intended to serve motor vehicles along a road also, such as directing motorist to the trail parking or along a bicycle route, then Part 2 of the MUTCD shall apply



*Sign Placement on Shared-Use Paths
(MUTCD, 2003)*

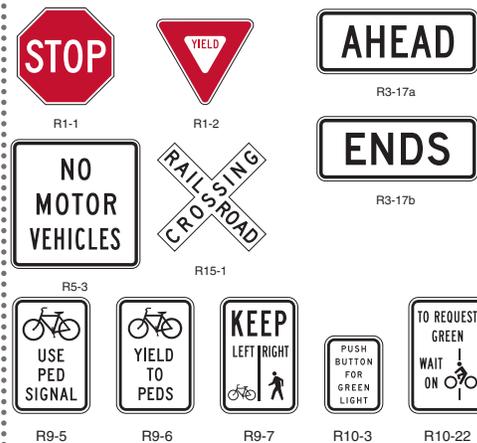
2.3.2 Regulatory Signs

Purpose

To inform trail users (and motorists) of traffic laws or regulations such as stop, yield and prohibited traffic.

Guidelines/Considerations

Place signs at the locations where they apply and per the MUTCD placement, standard color and appropriate size.



Regulatory Sign Examples
(MUTCD, 2003)

2.3.3 Warning Signs

Purpose

To warn trail users (and motorists) of existing or potentially hazardous conditions on or adjacent to a trail such as low clearance, steep slopes and upcoming stops and yields.

Guidelines/Considerations

Minimal use of these signs makes them most effective, so use judiciously in close proximity of the hazard per the MUTCD recommendations.



Warning Sign Examples
(MUTCD, 2003)

2.3.4 Guide Signs

Purpose

To inform trail users of trail routes and distances and their location along the trail.

Guidelines/Considerations

Locate trail route signs at trail decision points. Depending upon the length of trail, locate mile markers every 1/4 mile. Make sure that the mile markers are cumulative so that emergency, patrol and maintenance personnel can locate specific areas along the trail (ie: 1/4 mile, 1/2 mile, 3/4 mile, 1 mile, 1-1/4 mile).



Guide Sign Examples
(MUTCD, 2003)



Mile Marker Example
(American Tobacco Trail,
Durham, NC www.wayfinding.com)

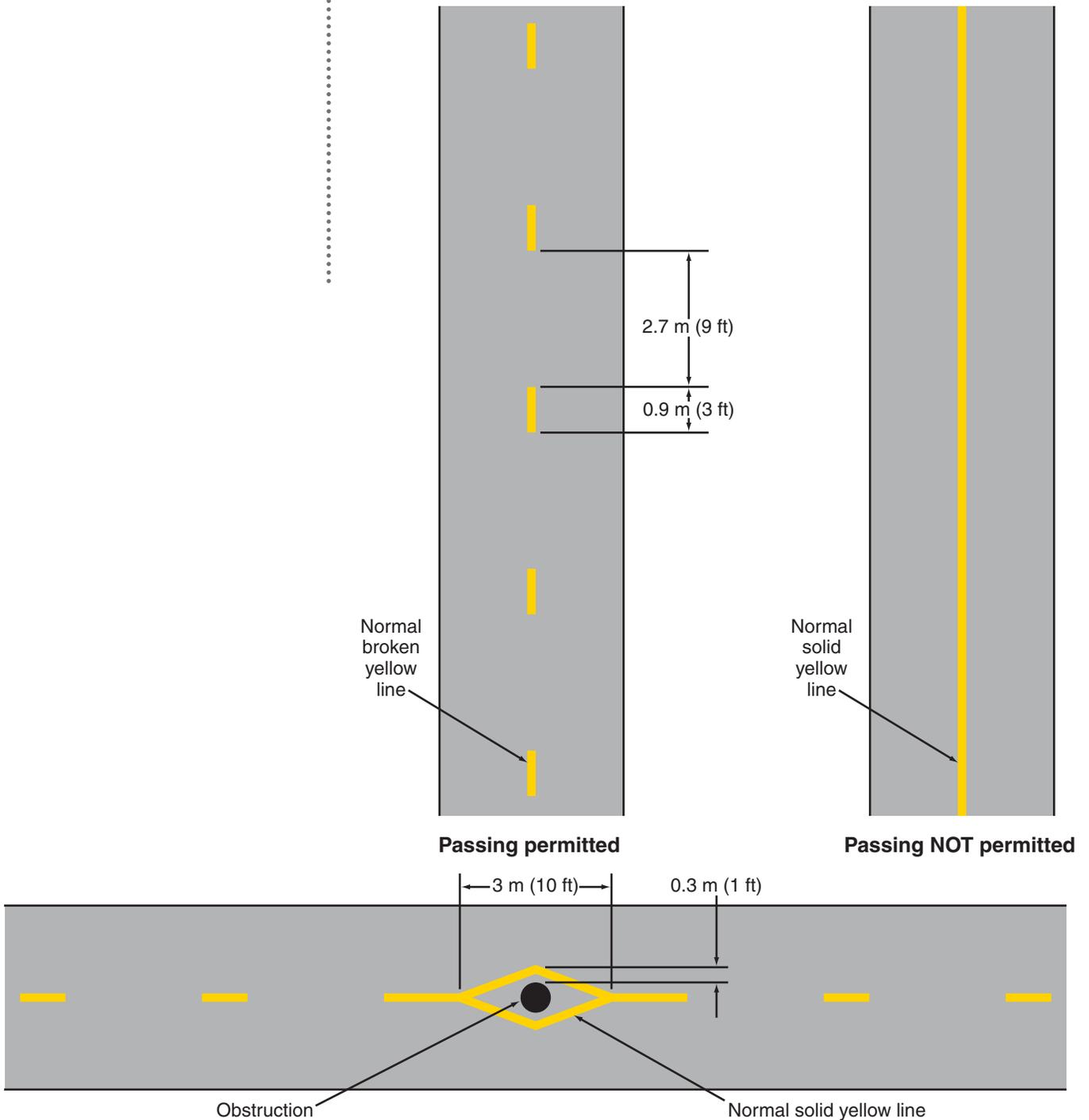
2.3.5 Pavement markings

Purpose

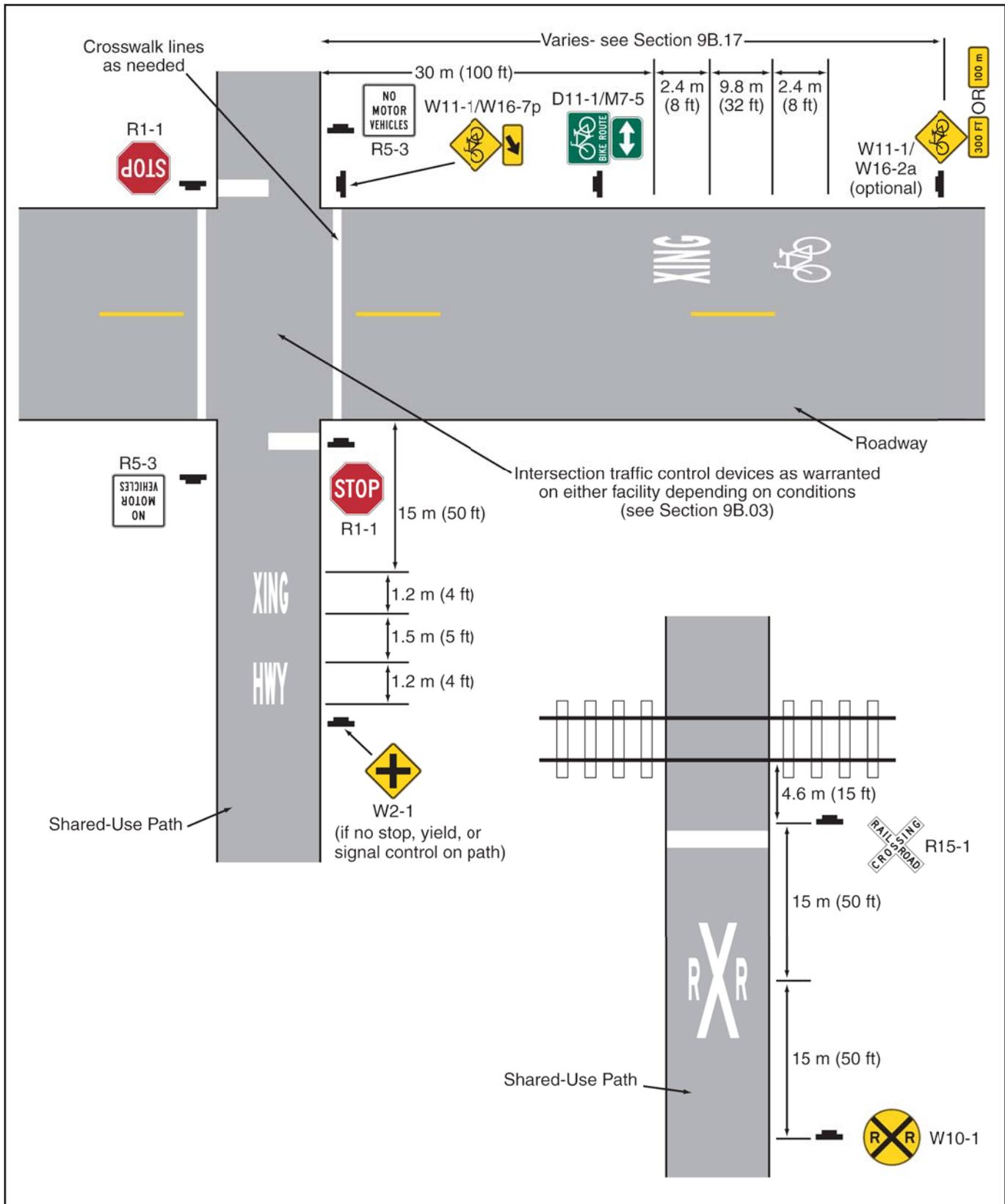
To control multi-use and two-way traffic along the trail.

Guidelines/Considerations

Markings shall be retroreflectorized and per the Part 9 MUTCD recommendations.



Examples of Centerline Markings for Shared-Use Paths
(MUTCD, 2003)



Examples of Signage and Pavement Markings on Shared-Use Paths
 (Road and Railway Crossings)
 (MUTCD, 2003)

2.4 Grade Separated Crossings

Limiting the number of crossings along a trail corridor is desirable to avoid potential conflicts and to enhance the trail users experience by maintaining a continuous corridor. However, some crossings are inevitable and care should be taken to design them in the safest manner possible. Recommendations for safe crossing designs are provided below.

Purpose

To provide a safe crossing of obstacles that might include roadways and water bodies.

Guidelines/Considerations

Refer to section 2.3: Trail Alignment for specific information about ADA slopes and rest intervals and section 2.7 for railings and section 2.4 for signage.



Trail Bridge Stream Crossing
(Photo: S. Kirk)



Trail Bridge Roadway Crossing
(Photo: K. Gilland)

2.4.1 Trail Bridges

Purpose

To provide a safe crossing over roadways and water bodies. Can range from utilitarian to a signature bridge.

Guidelines/Considerations

Minimum 10' clear trail width with minimum 42" height railings is recommended. If crossing is over a roadway or railroad, consider overhead (Cyclone) fencing as an additional safety measure to prevent thrown objects.

Other considerations include: design load, any existing support structures, footings, and floodplain and floodway issues.

Bridge decking can vary from concrete and asphalt to wood and recycled plastic materials depending on the application.

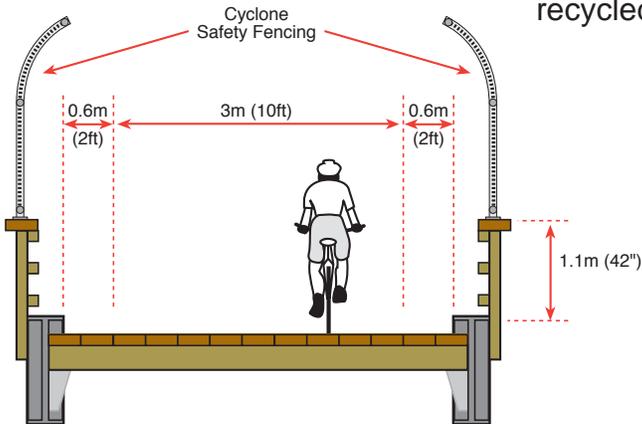


FIGURE 5.33 RWT track overcrossing
Railroad Overcrossing Cross Section
(Rails-With-Trails: Lessons Learned)

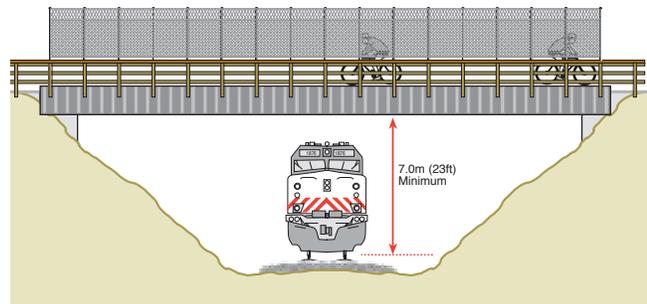


FIGURE 5.34 RWT track overcrossing (meets Amtrak required clearance height for non-electrified track)

Bridge Elevation
(Rails-With-Trails: Lessons Learned)

2.4.2 Trail Underpasses/Tunnels/Culverts

Purpose

To provide a safe grade crossing beneath a road or railway.

Guidelines/Considerations

Minimum 12' wide and 8' height clearance with signage about low clearance. Underpass should be designed as short as possible and adequately lighted for safety.



Trail Underpass

(www.pedbikeimages.org/Dan_Burden)



Trail Underpass with Lighting

(Photo: Rails to Trails Conservancy)

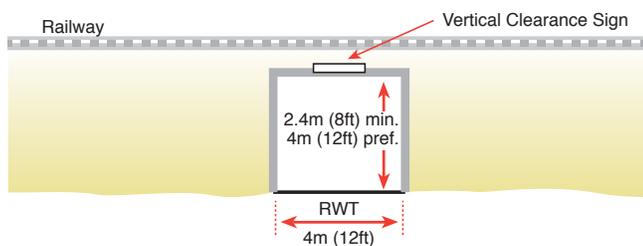


FIGURE 5.31 RWT culvert under tracks
Trail Culvert
(*Rails-With-Trails: Lessons Learned*)

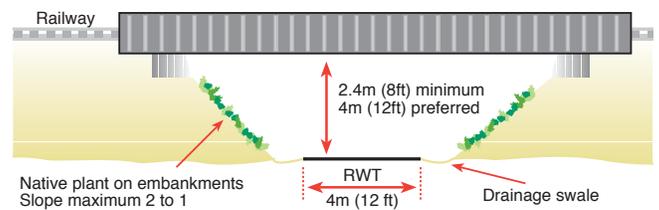


FIGURE 5.32 RWT track undercrossing
Trail Underpass
(*Rails-With-Trails: Lessons Learned*)



Trail Underpass with Lighting and Murals

(Photo: BikePedImages/Dan Burden)



Trail Gates at Road Crossing
(Photo: RTC)

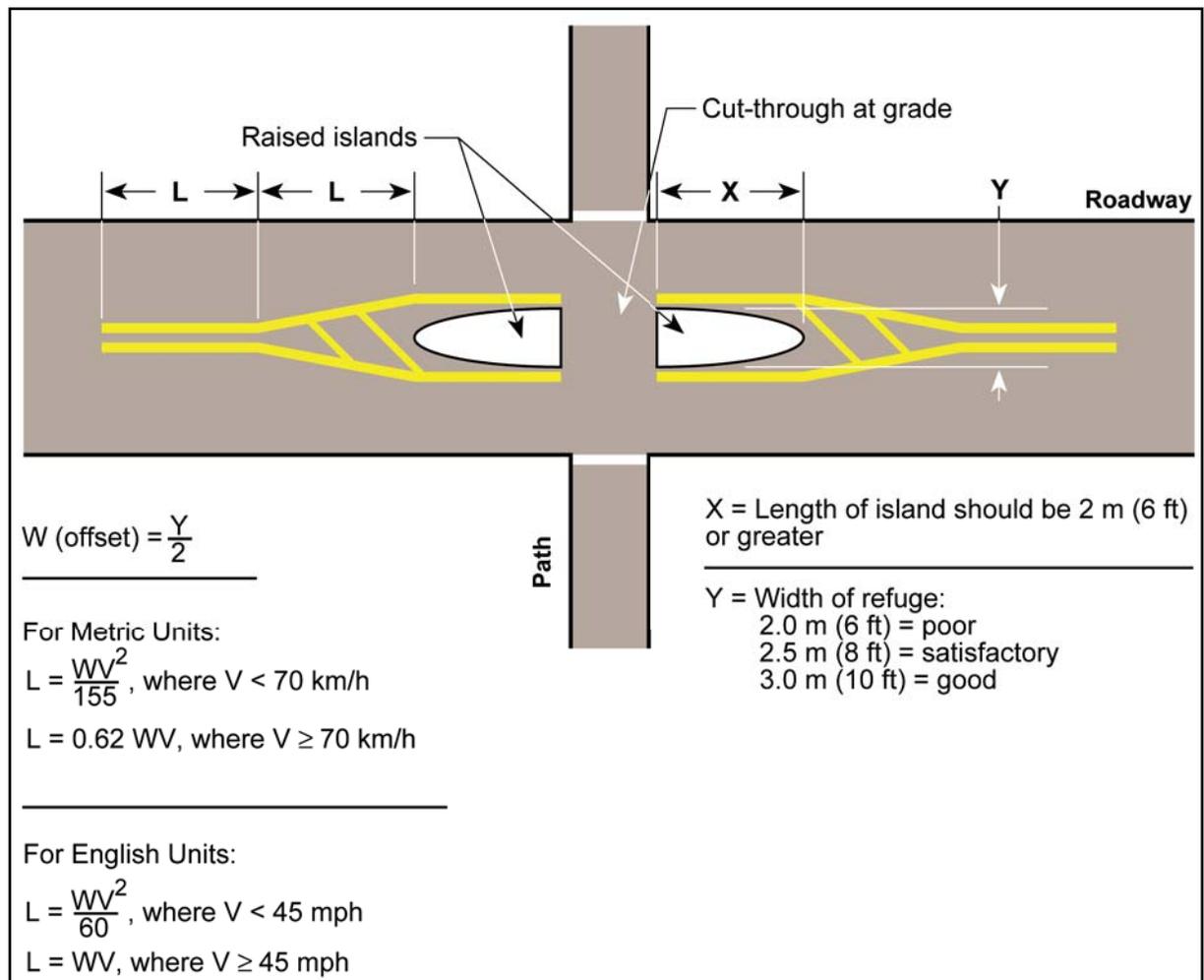
2.5 At-Grade Crossings

Purpose

Where a grade-separated crossing is not feasible.

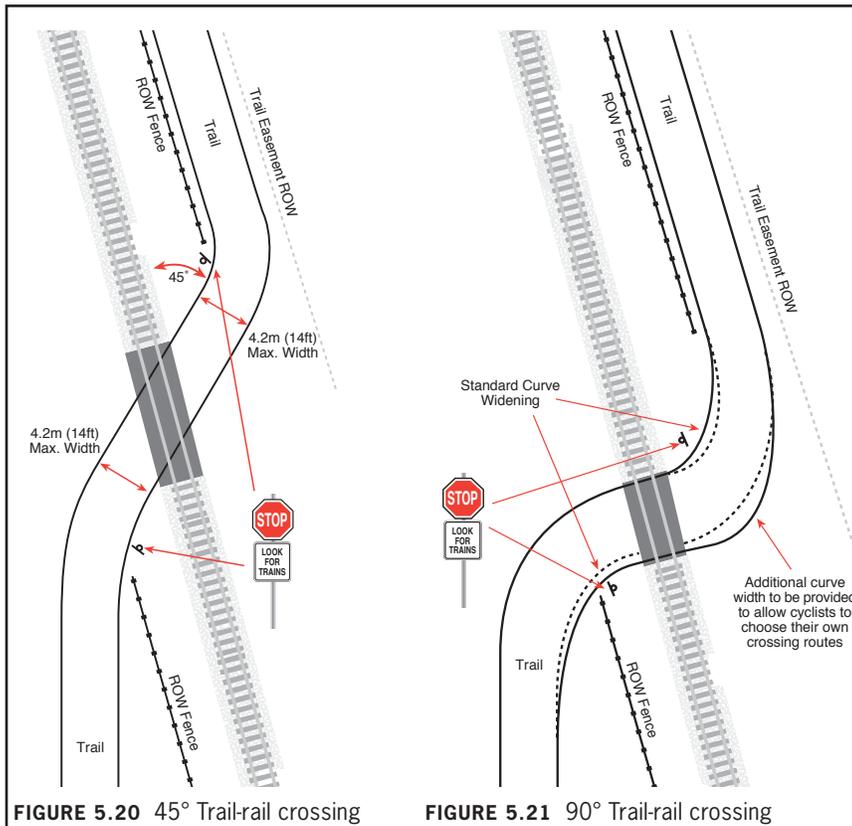
Guidelines/Considerations

Safety is the most important consideration when designed at-grade crossings of roads and railways. Visibility of trail users and on-coming traffic, crossing surfaces, signage are all important considerations. Depending upon the width of the road, a refuge island may be appropriate (see below). Gates are also an option to slow trail users on the approach to a crossing (see photo at left).



Refuge Island at Road Crossing
(AASHTO, 1999)

At-grade railroad crossings should be limited wherever possible. Illustrations of potential railroad crossing conditions follow:



Trail and Railway Crossing Examples
(*Rails-With-Trails: Lessons Learned*)

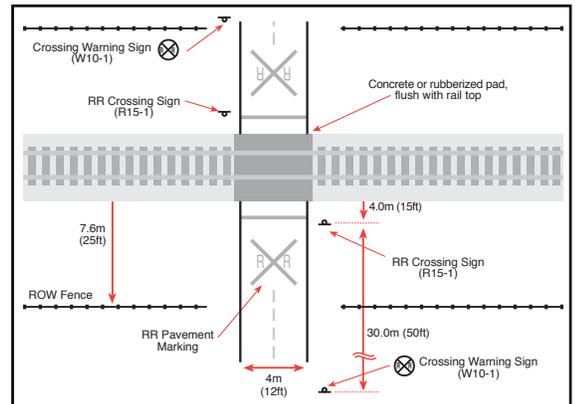


FIGURE 5.22 Crossing equipped with passive warning devices (MUTCD Fig. 9B-3)

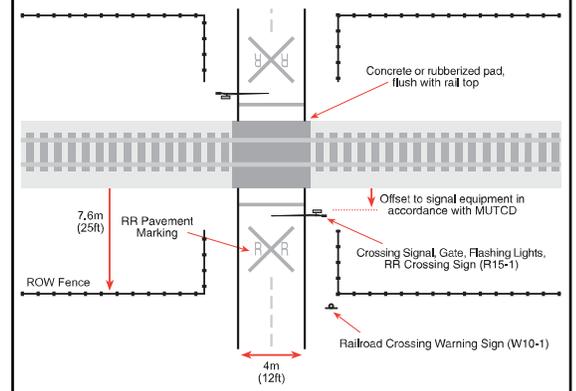


FIGURE 5.23 Crossing equipped with active warning devices and fencing

Trail and Railway Crossing Warnings
(*Rails-With-Trails: Lessons Learned*)



Figure 16-1. Installing a rubber surface rather than asphalt on a shared use path is an example of how rail crossings can be improved for pedestrians.

Trail Surface at Railroad Crossing
(FHWA, 2002)



Bollards and Alignment at Railroad At-Grade Crossing
(Photo: RTC)

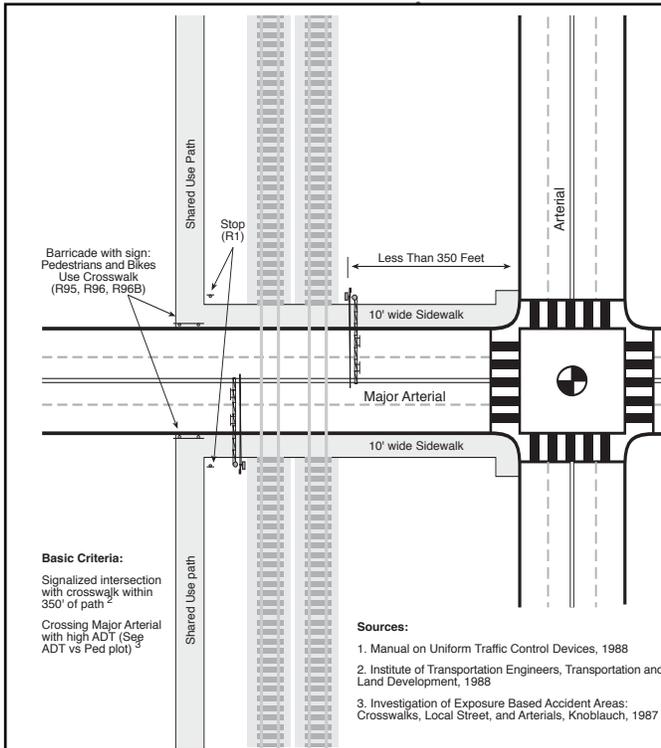


FIGURE 5.35 Roadway crossing type 1 (reroute to nearest intersection)

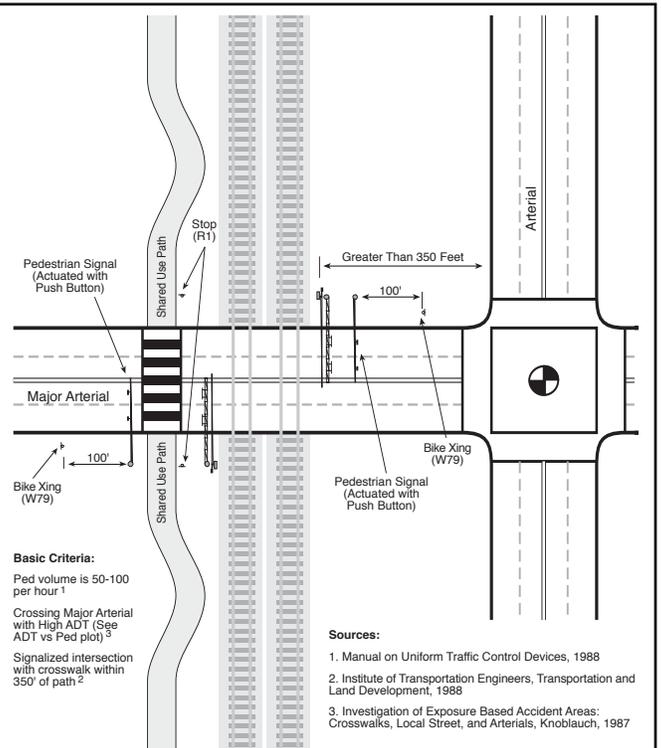


FIGURE 5.36 Roadway crossing type 2 (new signal)

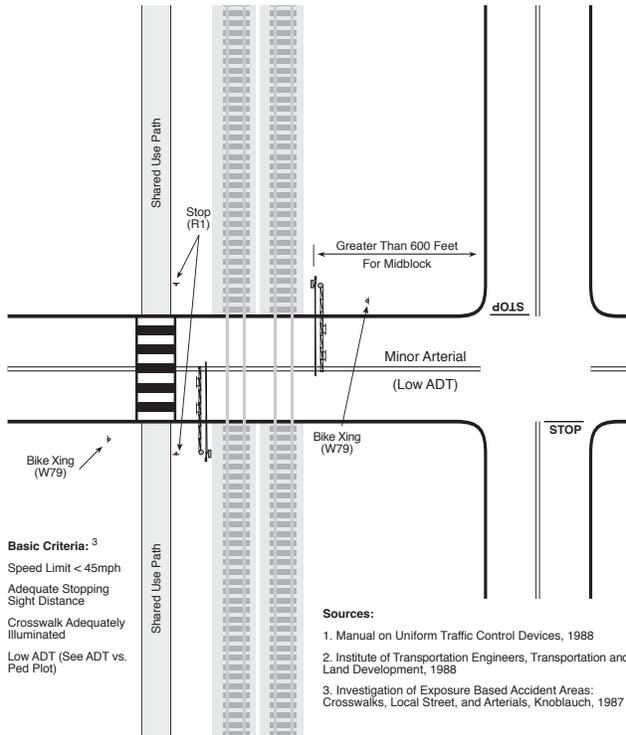


FIGURE 5.37 Roadway crossing type 3 (unprotected crossing)

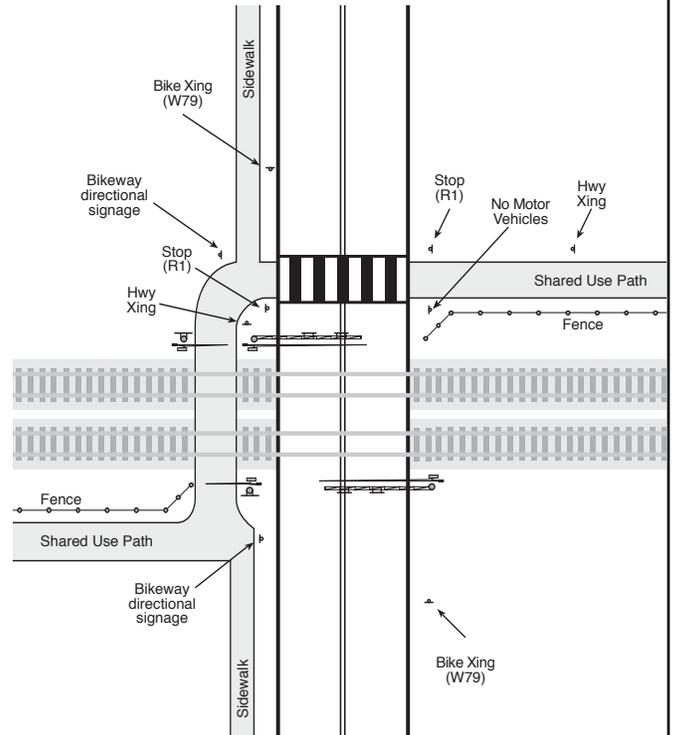


FIGURE 5.38 Roadway and track crossing

*Trail and Railway Crossing Examples
 (Rails-With-Trails: Lessons Learned)*

2.6 Buffers/Barriers

Purpose

To create a safe separation between trail users and potential railway and adjacent uses or site condition hazards.

Guidelines/Considerations

The Trails With Trails: Lessons Learned document found that trails located a minimum of 30' from a railway had very little impact from a 90 mph trail wind and debris. It is desirable to separate the trail as far as possible from the railway, but in constrained corridors, additional barriers such as retaining walls and fencing or grade separation may be warranted.

Additional site conditions that may warrant buffers include steep slopes, unattractive or unsafe land uses and water bodies.



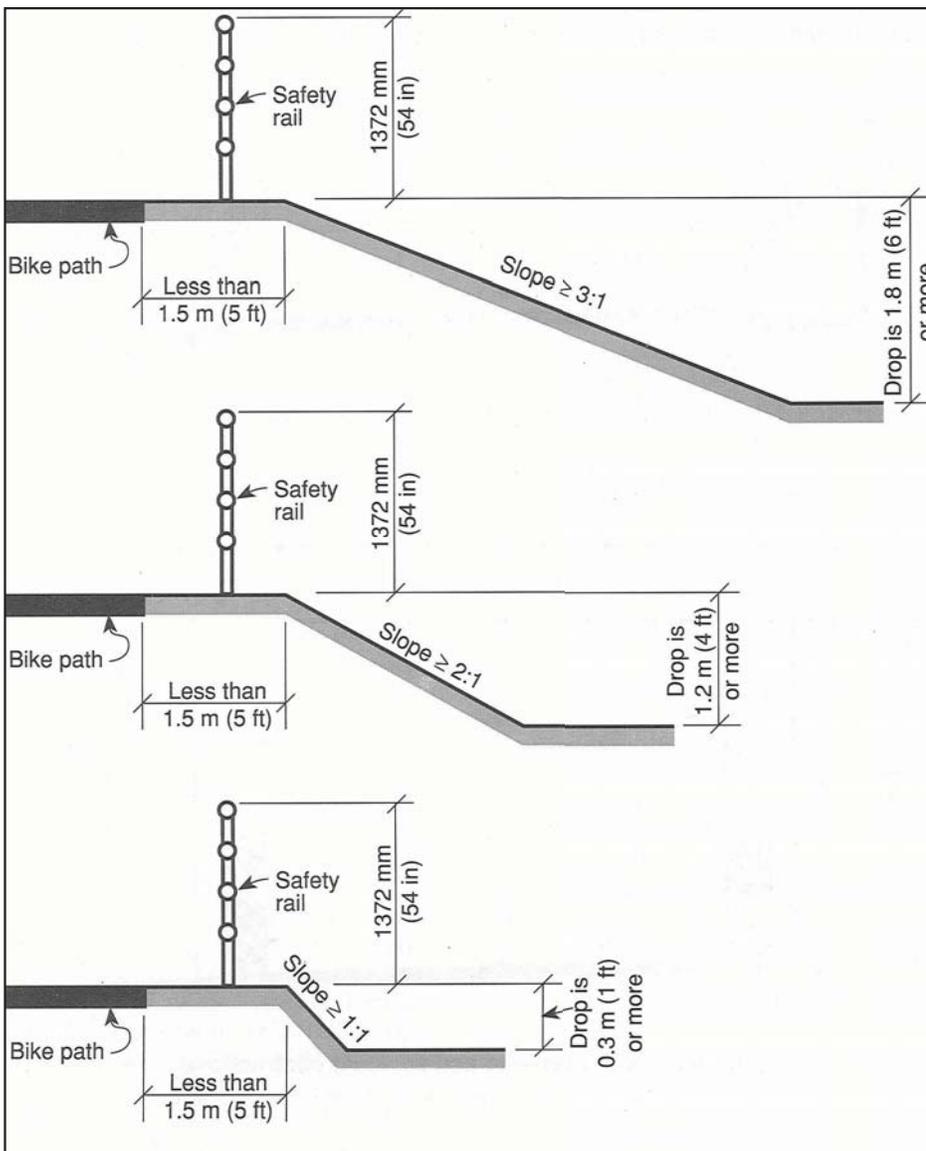
Trail and Rail Buffer
(RWT: Lessons Learned, 2002)



Trail and Rail Buffer
(Photo: AmericanTrails.org)



Trail and Rail Buffer
(Photo: BikePedImages/Dan Burden)



Safety Rail Recommendations

(North Carolina Bicycle Facilities Planning And Design Guidelines, NCDOT, 1994)



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3.0 Construction Recommendations

These construction recommendations are formulated from a combination of references and will vary depending on existing site conditions such as subsurface soils, hydrology and adjacent land uses and local building codes. A geotechnical specialist and structural engineer should be consulted for any structural considerations.

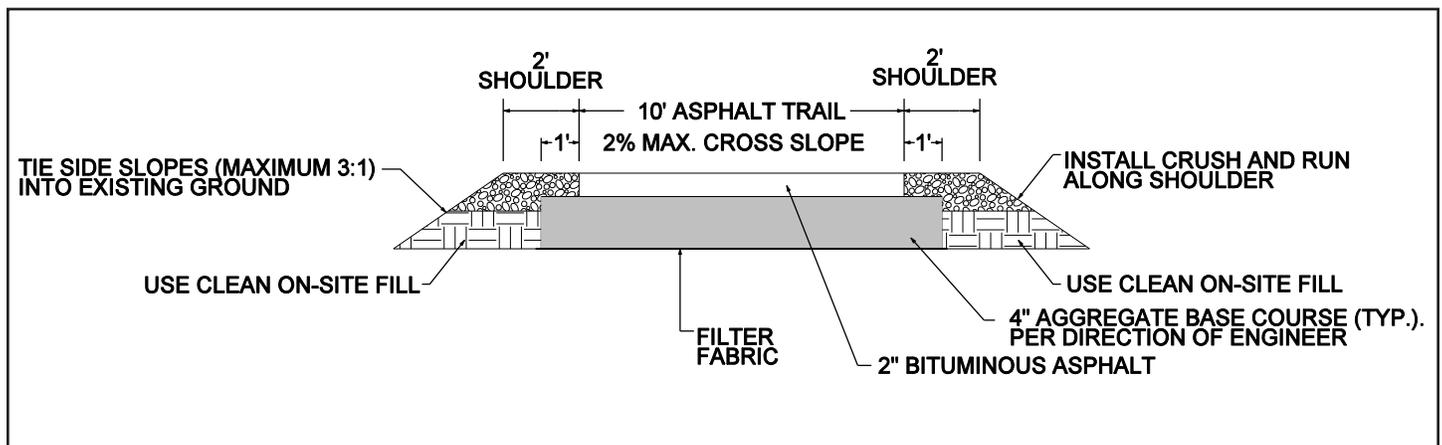
3.1 Trail Cross Sections

3.1.1 Asphalt

Guidelines/Considerations

In normal stable soils, the construction cross section of trail includes (in order from the surface) 2" of asphalt, 4" of compacted aggregate base course - extending 1' on either side of asphalt, non-woven geotextile fabric, compacted subsoil (90% compaction).

If poor soils are encountered, consult a structural engineer. In general, poor soils may be removed and replaced with compactable soils and/or the aggregate base course depth increased.



*Asphalt Trail Cross Section
(Ararat River Greenway Trail)*

3.1.2 Concrete

Guidelines/Considerations

In normal stable soils, concrete installation is similar to asphalt, however, expansion joints should be installed according to the width of the trail to avoid cracking (ie. every 10' if the trail is 10' wide).



*Boardwalk with Curb Rails
(Photo: RTC)*

3.1.3 Boardwalk

Guidelines/Considerations

Boardwalks are recommended for sensitive site areas such as wetlands, areas of endangered species and sites prone to flooding and/or with poor soils. Boardwalks can also enhance the trail user's experience by providing observation areas in a wetland or marsh area.

A structural engineer may be needed to design proper support for the boardwalk structure depending upon site conditions and load. Boardwalks may also require 42" minimum height railings if there is a 30" or greater drop from the walking surface to the finished grade. A curb rail is recommended in areas where a 42" railing is not needed to aid visually impaired trail users, children and wheeled trail users.



*Boardwalk with Safety Railings
and Wildlife Viewing Area
(Photo: York Bridge Concepts)*

Boardwalk decking can be made of a variety of materials including wood, composite (such as Trex) and recycled plastic. Note that recycled materials may require more structural support than traditional wood decking.

3.1.4 Crusher Run Fine Aggregate

Guidelines/Considerations

Particles shall be 3/8" minus (dust to 3/8" maximum) stone and compact to a smooth and stable surface. Depending upon site and soil conditions, a stabilizing agent may be required. A geotextile fabric is recommended beneath the crusher run on top of the graded and compacted subgrade.



*Crusher Run Fine Aggregate Trail
(Photo: AmericanTrails.org)*

Drainage and grading of the subsurface is important and should be designed to keep water from concentrating across the trail surface to avoid washing out surface materials.

3.1.5 Dual Tread

Guidelines/Considerations

Dual tread trails can provide more desirable surface material for specific trail users such as a gravel for runners and/or natural surface equestrian trails.



*Dual Tread Trails
(Photo: AmericanTrails.org)*

3.2 Trail Amenities

Amenities add to the comfort of trail visitors as well as to the overall experience of travelling on the trail.

3.2.1 Trailheads

Purpose

To provide a departure and/or meeting point for trail visitors where they can park their motor vehicles, secure bicycles, and use the support facilities as needed.

Guidelines/Considerations

Design trailhead such that accessible parking spaces are in close proximity to accessible restrooms and other facilities. Additional accessible facilities should include:

- Picnic tables
- Water fountains (people/dog)
- Restrooms
- Benches
- Trash/recycling receptacles
- Bike racks
- Trail maps and signage

Trailheads can be created from existing structures along the trail including historical sites or even railroad cars.

3.2.2 Benches

Purpose

Seating and gathering places for trail visitors. Benches can be utilitarian or signature - even designed by artists. They can help create an identity for the trail by using uniform materials and colors.

Guidelines/Considerations

Locate benches 3' clear from edge of trail and 5' clear from restrooms and other structures. Design a firm, stable approach and base to the bench such as a concrete pad or compacted fine aggregate (crusher-run). Benches can be installed permanently inground or surface mount.

In locations with multiple benches, consider armrests for some benches for ease of use by disabled patrons.

Install benches at trailheads, scenic views and other interesting and/or convenient resting locations along the trail such as at the top/bottom of steeper trail segments.



Trailhead along the Virginia Creeper Trail

(Photo: www.vacrepertrail.com/JohnGrogan)

Total Parking in Lot	*Required Minimum Number of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2 percent of total
1001 and over	20, plus 1 for each 100 over 1000

(*ADA Design Standards for Accessible Design)



Thermoplastic coated, surface-mounted bench by UltraPlay with concrete base.

(Photo: S. Kirk)



Wheelchair accessible picnic tables
(left: ncaonline.org and right: picnictable-source.com)



Trash receptacle with emergency phone
(www.fortlewis.edu)



Barrier-Free drinking fountain
with dog bowl manufactured by
HAWS (www.belson.com)



Biological Mediation Systems, Inc. (BMS)



AES Pre-Cast 2-stall, pre-fab restroom

3.2.3 Picnic Tables

Guidelines/Considerations

Typically, picnic tables are located only at trail heads and other interesting sites along the trail.

50% of provided picnic tables shall be ADA accessible which means space for a wheelchair and the table must be approachable and installed on a firm and stable surface such as concrete. Wheelchair spaces can be located at the center or end of rectangular tables as well as circular tables. Picnic tables shall be installed 5' minimum clearance from other structures.

3.2.4 Trash/Recycle Receptacles

Guidelines/Considerations

Trash and recycle receptacles are made in a wide variety of materials, colors and styles and should be coordinated with other site furniture. Locate receptacles in proximity to benches (1 per every 2 benches), picnic areas (1 per each picnic table) and restrooms at trailheads and along the trail and a minimum of 5' from other structures.

3.2.5 Drinking Fountains

Guidelines/Considerations

Several manufacturers make outdoor drinking fountains that are ADA accessible ('Barrier-Free') and have attached dog/pet-height drinking bowls. Consider locating drinking fountains near restrooms and picnic areas.

3.2.6 Restrooms

Guidelines/Considerations

Many manufacturers offer pre-fabricated restrooms that are appropriate for a variety of sites, however, consult state and local health and building codes for appropriate locations of restrooms in sensitive areas such as floodplains. Some restrooms are available with composting toilets and solar power for installation in remote areas without power and water/sewer lines.

Stick-built restrooms are also an option depending upon aesthetics and budget. Outdoor, frost-free, vandalism-proof hosebibs should also be installed outside the restroom for maintenance purposes.

3.2.7 Lighting

Guidelines/Considerations

Most trails and recreation areas are intended for daytime use and lighting is not a part of the design. However, segments of trails with potentially high volumes of traffic may warrant safety/security lighting. Trail head parking areas should be adequately lighted for security personnel to see any undesirable activity. Solar lighting is also an option for remote areas.



(left) Solar powered LED light fixture by Sol
(right) Examples of bollard lighting.

3.2.8 Bike Racks

Purpose

Temporary bicycle storage for trail users.

Guidelines/Considerations

Bike racks should be located at all trail heads as well as near transit stations for potential commuter use. There are a variety of styles of bike racks available. The 'rolling rack' (right) is a common, lower-cost bike rack capable of securing numerous bikes depending upon the length. Bike lockers (far right) are also an option for longer term or inclement weather storage.



Examples of a 'rolling' bike rack (left) and bike lockers at a transit station (right).

3.2.9 Fencing

Purpose

Fences can serve as safety and/or security barriers, property property lines and ornamental edges along the trail.

Guidelines/Considerations

Example locations of safety and/or security fences include areas of steep side slopes, roadways, undesirable and/or dangerous site uses.

Fences that are serving as safety and/or security barriers should typically be installed at 42" height minimum. These fences might be utilitarian such as powder-coated chainlink or a type of ornamental depending upon the adjacent site uses.

Property line fences can be as simple as a split-rail fence where there is no safety considerations.



Security fence
(Photo: Omega Fence)



Trail property line fencing in rural area
(Photo: BikePedImages/Dan Burden)

.....
: **3.30 Landscaping**

: *Purpose*

: Beautification along the trail corridor and trail heads as well as screening
: and shading/protecting warm areas.
:

: *Guidelines/Considerations*

: Shrubs and ground covers should be maintained to a maximum height
: of 3 feet or designers/constructors should only install dwarf material with
: an ultimate height of 3'. Trees should be limbed up a minimum of 8
: feet. Anything between 3' and 8' tall could provide cover for undesirable
: activities, hiding locations and overall unsafe conditions.
:

.....
: **3.31 Historical/Educational Signage**

: *Guidelines/Considerations*

: As described in the trail corridor sections of Virginia and North Carolina,
: there is an abundance of potential historical sites and places of interest
: to highlight along the trail.
:

The same safety guidelines apply for specialty signage as for the safety
signage, however, there is more opportunity for unique information and
aesthetics. Signs should have a coherent design theme and/or made of
similar materials to create a sense of uniformity throughout the trail.

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BY MIA L. BIRK, PRINCIPAL, ALTA PLANNING + DESIGN

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