

Chapter 4: Design Features

How we design greenways and trails impacts the experience and, ultimately, the safety of the diverse set of users that take to greenways and trails for a variety of recreational, utilitarian, health and transportation purposes. This chapter illustrates aspects of facility design to help guide future actions by Buncombe County and its partners in planning for, designing, constructing and maintaining greenways that connects to a variety of destinations, promotes a diverse user experience and is built to a maintainable scale.

The Design User

A discussion on the design of greenways and trails should not begin with the dimensional aspects of the trail; rather it begins with understanding the different user types, how their needs are unique, and how those differences are accommodated into trail design and construction.

A well-connected greenway system is one the most diverse facets of our built environment in terms of how people interact. When compared to traditional walking trails or paved walkways within parks, their function transcends a recreational or experiential purpose to include a transportation element. When compared to other transportation facilities, greenways have a much more diverse set of user capabilities, “vehicles”, and speeds occupying and traveling through the same space.

A family walking the dog along a trail has different needs than the bicyclist using the greenway as a link between two roadways. The needs of a person in a wheelchair vary greatly from members of a running club, the romantic couple walking arm-in-arm or a child learning to ride a bike.

How we accommodate a multitude of functions de-

pends on understanding the context of the greenway and what user types are most likely to interact. Exhibit 4-1 on the following page illustrates the various functional widths required for the largest share of greenway users. Each type of user has a unique requirement in terms of operating width and clear space required for comfort and safety. These characteristics ultimately drive our design standards, design exceptions and location-based design decisions.

As we establish design standards and practices, it is important that they not conform to a “one-size-fits-all” approach. Such an approach detracts from aesthetics of the trail, thus negating the potential positive aspects of the experience. It can have negative safety impacts if applied universally without consideration of user characteristics.

Exhibit 4-2 illustrates the various contexts where user conflicts tend to be greatest. Not all conflicts can be avoided as the constraints of the natural and built environment oftentimes dictates how we design greenways and where we place them along a corridor. The design of greenways should consider where these conflicts are most likely to exist.

A greenway near an elementary school is likely to have students using the trail during the school day as an outdoor classroom. Children in groups tend to spread across the length of the trail, which creates conflicts with faster walkers, joggers, and bicyclists.

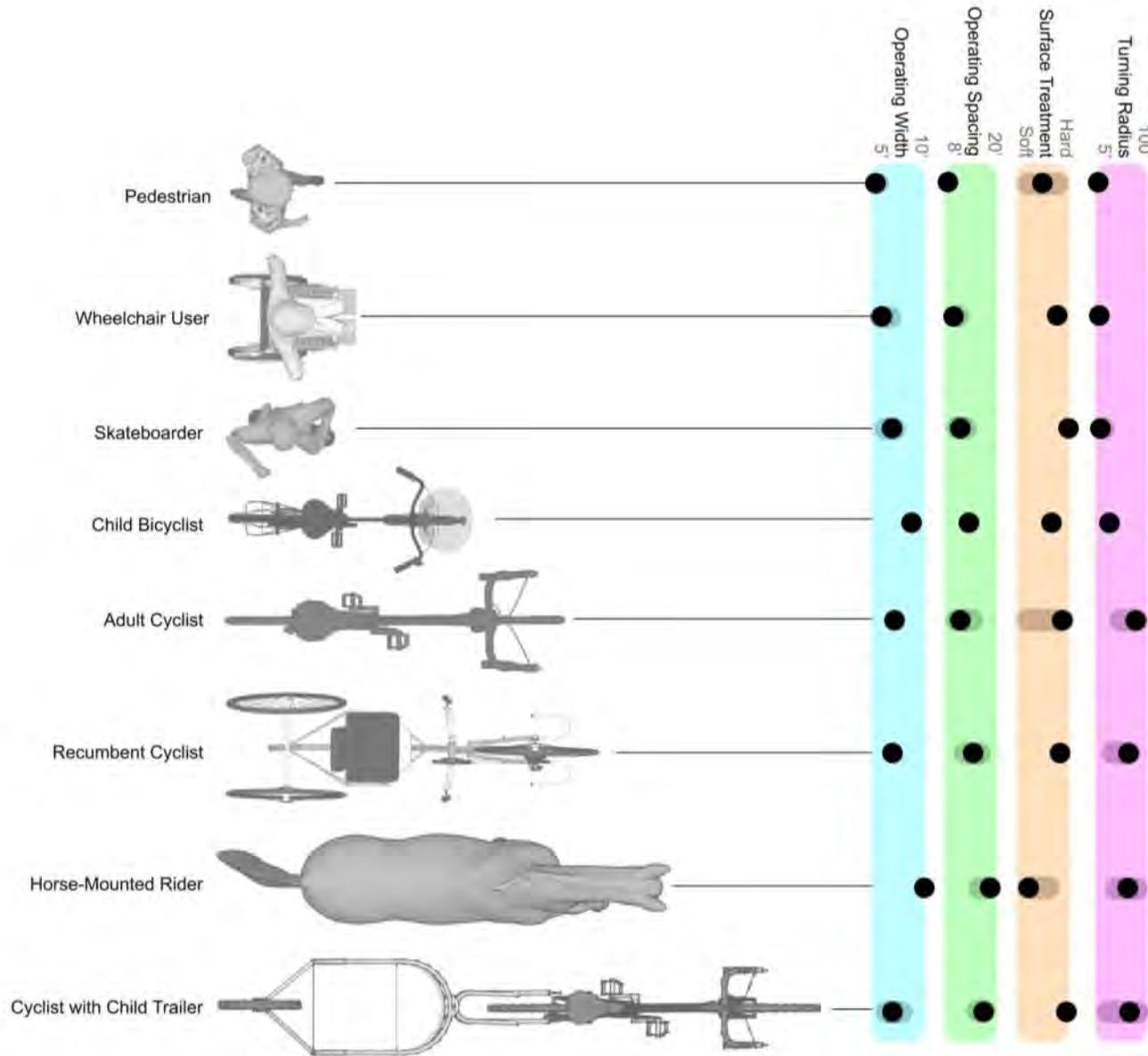
Places where terrain and resulting grades lead to faster speeds for bicyclists creates conflicts with pedestrians due to a greater speed differential as well as uphill bicyclists who need more space to climb.



The users of greenways and trails will vary greatly across Buncombe County as the setting, destinations and experience of users change based on the location of the trail. Understanding the variety of user types and their needs leads to better design decisions and ultimately safer interaction among users.

Photo Credit: Don Kostelec

Exhibit 4-1: Dimensions and Spatial Needs of Greenway Users



Typical operating widths, spacing requirements and turning radii depend on forward velocity as well as the experience of the operator. Skilled skateboarders frequently turn in less than the length of their own skateboards, for example. The preferred surface treatment for an adult cyclist will also depend on the type of bicycle (e.g., road or mountain or hybrid) that is being ridden as well as the purpose of the ride, for example, commuting as opposed to recreation.

Exhibit 4-2: Common User Conflicts

Common User Conflicts



In high traffic areas or where large groups, such as school classes, are a common user.



On bridges as widths may vary from the trail or are constrained due to cost, context and feasibility.

Sidepaths where bicycle traffic from the street is best accommodated on a shared use facility.



The intersections of on-road and off-road facilities, especially where tight turns are required.



Where grades lead to a greater difference in operating speed among modes or uphill vs. downhill users.

The intersection of two greenways where considerations such as sight distance, speed and turning radius should be closely examined.



Photo Credits: Don Kostelec

Greenway Character & Context Sensitive Design

Once user needs have been addressed in planning and design, the look and feel of the corridor should be closely examined to fit the setting while adhering to standard design policies. The countywide greenway system should focus on two primary points to help establish a greenway character that fits within the context of Buncombe County:

- ◆ First, it should take into consideration the unique aspects of the individual community or neighborhood in which the greenway will traverse; and
- ◆ Second, the greenway system should contain cohesive elements to unify the design.

These were key themes posed at the September 2011 Stakeholders Workshop. The participants felt

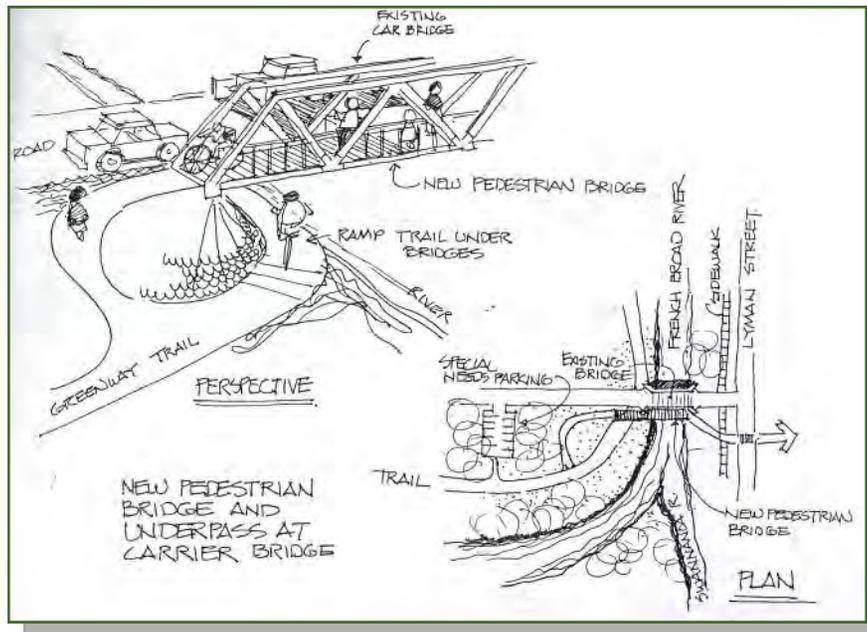
that a regional, coordinated approach to greenway investment was best, but in order to maximize the potential for funding and partnerships, each community should have some ability to control their own destiny through design features that reflect community standards.

By the nature of linear corridors, the greenway will ultimately pass through many communities and varying types of land uses. Sharing the sense of identities of these individual locations is highly encouraged. Design elements and amenities such as signage, trailheads, furnishings, etc. should reflect the "feel" of the community and should speak to the character and history of the communities in which they pass. Incorporating sense of place, or *genius loci*, provides residences an opportunity to share the unique natural systems, historic resources, and archaeological resources of the neighborhood.

Cities and towns involved in the planning and design process for greenways, along with local organizations, agencies and non-profits, feel more vested in the outcomes of the effort when their unique needs are incorporated into the design. For example, if a community has expressed concern about excessive parking, access to that section of greenway can be downplayed in contrast to a high use trailhead where parking, signage, and landscaping works together to create high visibility from the roadway.

As well, the vernacular architecture of a community should be considering when designing parking areas, trailhead signage, and other facilities such as shelters and pavilions.

Although elements from one location to another may appear different along the greenway system, they should all maintain some element of consistency whether by the use of logos, graphics, or materials.



Design sketch from the Asheville Riverfront Open Space Guidelines (1991).

This will serve to provide users the dependable visual recognition as being a part of an overall system. It also assist in the wayfinding and orientation.

Two seminal planning efforts in Buncombe County—conducted in the late 1980s and early 1990s addressed the importance of local context. The Riverfront Plan (1989) was a charrette-based plan focusing on the Asheville riverfront area.

In 1991 a set of design guidelines as part of The Asheville Riverfront Open Space Guidelines were crafted. Since many of the greenways identified as part of a countywide system follow natural waterways, these guiding principles are still applicable.

These guidelines addressed three distinct areas of focus in the design of greenways: access and landscape, structures and facilities, and graphics to help create an identifiable and unified greenway system.

Sustainability

Greenways are an integral part of the infrastructure that provides for a sustainable community. There are many definitions of sustainability but for the purpose of this plan, the following definition has been applied. Sustainability: Creating a meaningful, vibrant and affordable practice today that does not deplete our resources for tomorrow.

This is true for any practice—manufacturing, education, agriculture, etc. The bottom line of a sustainable model is the integration of the environment with social and fiscal responsibility. The following planning principles were part of what informed this Plan.

Principle 1: Connecting Infrastructure. A connected greenway system will support alternative transportation to a variety of destinations.

Principle 2: Social Equity. Greenways provide equitable access for all citizens to physical activity that can

improve health and wellness.

Principle 3: Economic Prosperity . Greenways are a proven economic development tool. The third largest industry in Buncombe County is Tourism and Services.

Principle 4: Environmental & Ecological. The greenways in Buncombe County should include ecological buffers that protect water bodies, steep slopes, and ridgelines.

In addition to the planning principles outlined above, the following guidelines should be applied during the design and implementation of greenways in Buncombe County. These guidelines will help foster the building of an environmentally sensitive greenways system and minimize environmental impacts of the construction process.

- ◆ Protect environmentally sensitive areas
- ◆ Reduce exotic invasive plants that outcompete natural vegetation
- ◆ Reduce sediment and erosion issued through the use of problems through use of best management practices (BMPs)
- ◆ Reduce stormwater runoff or treat runoff to improve water quality through the use of stormwater BMPs
- ◆ Increase wildlife habitat
- ◆ Increase / maintain floodplain flood storage
- ◆ Increase / maintain riparian buffers
- ◆ Maximize "soft" engineering solutions that utilize bio-engineering techniques
- ◆ Maximize "green" construction and maintenance practices
- ◆ Minimize life cycle and true environmental costs of greenway materials, construction methods, and maintenance activities.

“The greenway project has to be designed at 3 mph. We live in a 35 mph world, where everything in the street has to be simplified so drivers traveling at 35 mph can comprehend what they are passing. The greenway should be very detailed, full of variety and texture. It should be very complex and diverse, to engage and entertain people walking at 3 mph.”

- Rich Untermann,
Asheville Riverfront Open Space
Guidelines (1991)

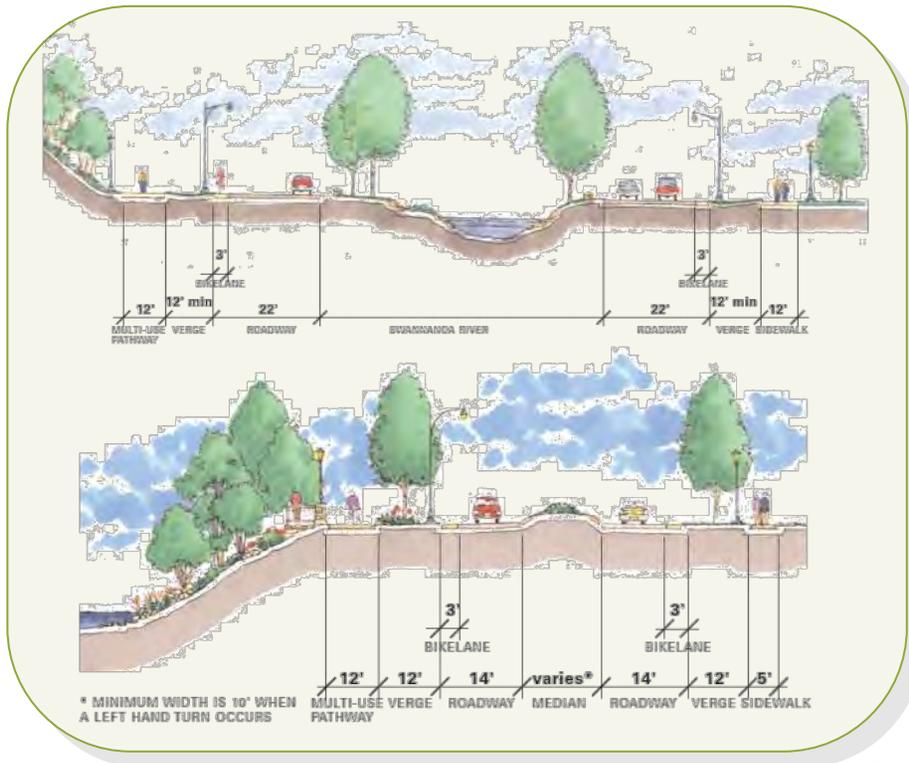


Exhibit 4-5: Full roadway & greenway design cross sections for portions of the Wilma Dykeman RiverWay.
Source: RiverLink



Exhibit 4-6: Conceptual design elements for Azalea Park, which connects to the planned Swannanoa River / US 70 Greenway.
Source: RiverLink



Typologies

During public involvement and stakeholder outreach for the Plan it was understood that citizens and potential partners desire greenways and trails that can be unique to their setting. The settings may vary based on environment, community, destinations, desired experience or funding source.

This section defines four typologies (Exhibit 4-7) for greenways and trails in Buncombe County. The typologies illustrated in this chapter are to serve as a starting point for planners, architects and engineers as the County embarks on more detailed analysis of the corridors identified in this Plan.

Buncombe County's context for greenways ranges from rural and natural area to suburban and urban neighborhoods. Even unincorporated areas have characteristics representative of an urban setting. Therefore, the range of typologies were developed to span these varied contexts and potential use.

Using Typologies. The natural and built environment will dictate how a greenway or trail is built. So will the types of landowners and their willingness to sell or dedicate a portion of their property for the greenway. Therefore, it is desirable that the County have a set of diverse design criteria to apply to greenways and trails to best respond to these influences.

Users of greenways and trails expect consistency in design. Consistent design also leads to safer use of the greenways because of predictability for users.

These typologies were developed to reflect the type of land use patterns, density, usage and types of users most likely to be on a greenway segment. As Buncombe County and its partners pursue more detailed corridor planning and design, these typologies should be used to begin the effort with modifi-

cations documented through location-specific analysis. It is also helpful to use these typologies when working with developers and other major landowners who are interested in incorporating a greenway or trail into their site plans.

Modifications should not be made so they create user conflicts or a non-conforming situation related to accessibility. The detailed GIS files produced for the Plan and submitted to Buncombe County for us contain attributes of recommended typologies for Priority Corridors identified in Chapter 3.

Understanding Costs. When determining the typology that best fit a section of greenway, it is not advisable to default to the lower cost design. As noted earlier, it is critical to understand the level of use and type of users. A greenway designed and built to a less than desirable standard can incur greater life-cycle costs and impact user safety by creating conflicts.

The construction ONLY cost estimates for the typologies are (in 2012 dollars):

- ◆ **Urban-Suburban High Use:**
\$200,000 to \$250,000 per mile.
- ◆ **Urban-Suburban Moderate Use:**
\$150,000 to \$200,000 per mile.
- ◆ **Suburban-Rural Moderate Use:**
\$75,000 to \$150,000 per mile.
- ◆ **Footpath / Hiking Trail:** Up to \$30,000 per mile.

The final cost of a greenway will vary greatly based on amenities; the number of access points (to neighborhood or at street crossing); acquisition costs; and life-cycle maintenance costs. The profiles apply a qualitative measure of these costs since they can differ from one area of the County to another. Tradeoffs of amenities and access in favor of getting a greenway built is something that should be analyzed during design.



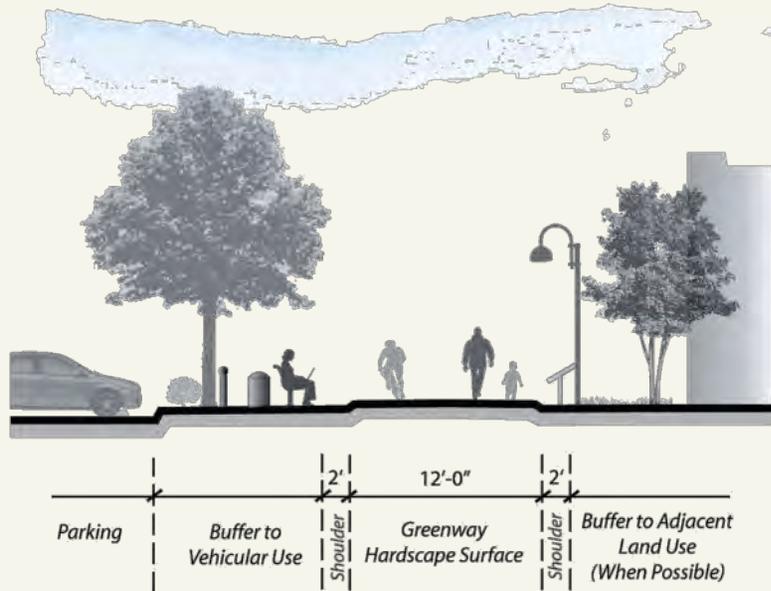
Greenways have to be designed and not simply built. The mounding of a greenway (above), even by just a few inches, maximizes the investment in the greenway by allowing for a better flow of water under the surface, minimizing encroachment of foliage, and protecting the trail surface from root heaves.

Photo Credit: Don Kostelec

Exhibit 4-7: Typologies

Costs Key: \$ = Low; \$\$ = Moderate; \$\$\$ = High

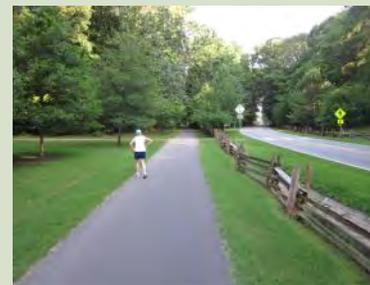
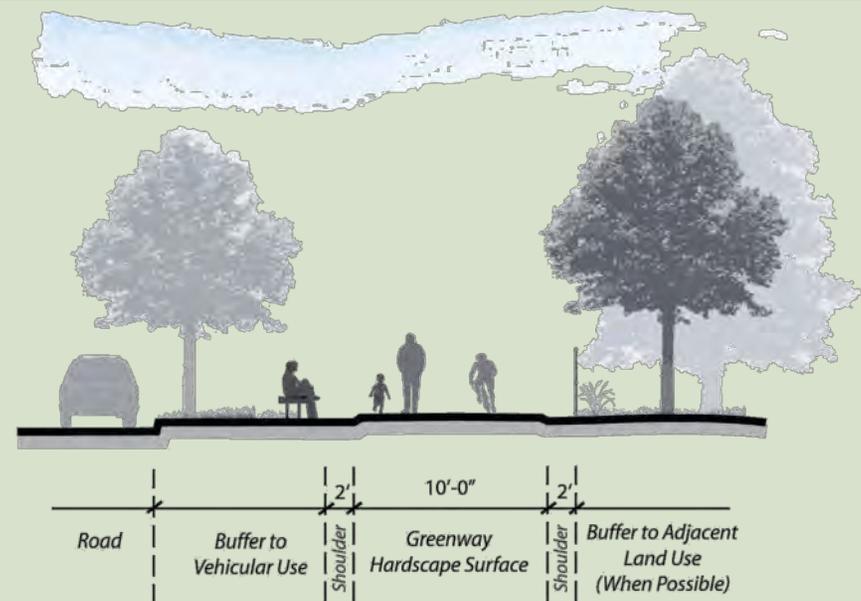
Urban-Suburban / High Use



Urban-Suburban / High Use greenways require careful consideration of destinations and the diversity of users. A 12-foot width with a paved surface is recommended and can have considerable acquisition costs. There is an expectation of high levels of amenities and access. Maintenance costs are influenced by landscaping, stormwater management, and tree roots causing heaving of pavement.

Costs	
Construction:	\$\$\$
Amenities:	\$\$\$
Access:	\$\$\$
Acquisition Costs:	\$\$\$
Contingencies:	\$\$\$
Maintenance:	\$\$ / \$

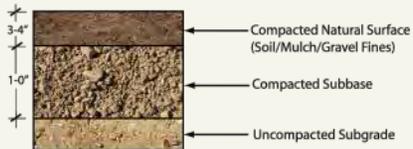
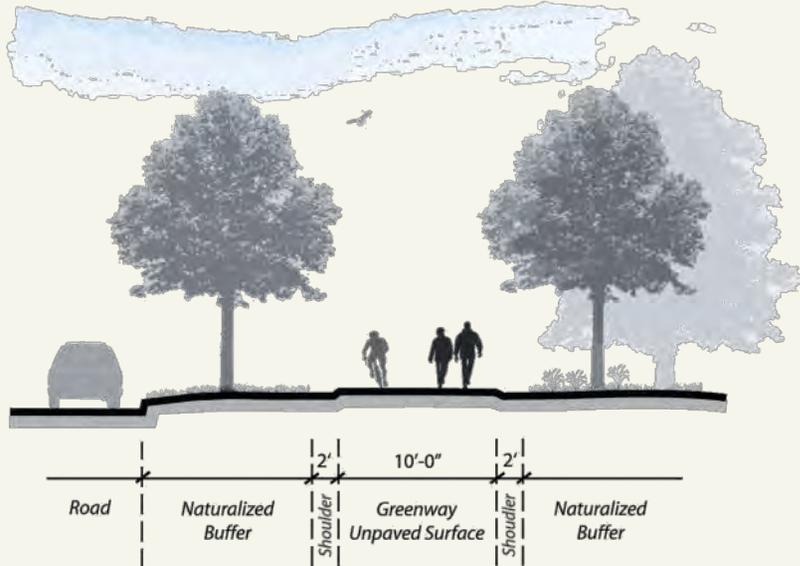
Urban-Suburban / Moderate Use



Urban-Suburban / Moderate Use greenways reflect the typical design for most corridors, with a 10-foot paved width and moderate level of amenities based on destinations and context. Acquisition costs are typically lower due to lower land values and less width along the corridor. Maintenance costs are similar to the Urban-Suburban / High Use typology.

Costs	
Construction:	\$\$\$
Amenities:	\$\$
Access:	\$\$\$
Acquisition Costs:	\$\$
Contingencies:	\$\$\$
Maintenance:	\$\$ / \$

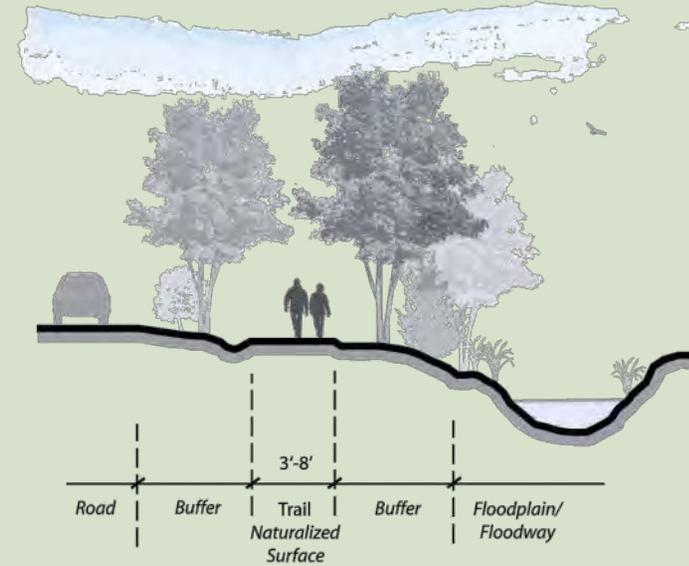
Suburban-Rural / Moderate Use



Suburban-Rural / Moderate Use greenways reflect a desire among users to have a more natural experience. Soil, mulch or gravel fines surface are desired and acquisition costs are typically lower due to land values, potential for easements and fewer access points. Maintenance costs can be influenced by the number of users and environment.

<u>Costs</u>	
Construction:	\$\$
Amenities:	\$
Access:	\$\$
Acquisition Costs:	\$\$\$
Contingencies:	\$\$\$
Maintenance:	\$\$\$

Foot Path / Hiking Trail



<u>Costs</u>	
Construction:	\$
Amenities:	\$
Access:	\$
Acquisition Costs:	\$
Contingencies:	\$
Maintenance:	Varies

The Foot Path / Hiking trail is a catch-all design for unpaved trails with low use in a natural setting. Costs are low for many features and maintenance may be done by volunteers. These greenways can provide parallel connectivity to other paved greenways to offer a different user experience.

Street Interface, Markings & Signage

An overlooked aspect of greenway and trail design is how facilities intersect and cross roadways. Just as design typologies vary by land use and environment, the interface with a variety of street types requires different considerations of design features and amenities to allow users to safely cross streets; transition from a greenway to a street, sidewalk or bike lane; access a bus stop; or reach a destination.

A street interface designed without consideration of context and user type can create a barrier effect that discourages use and is perceived as unsafe. Since the street interface is also likely to be an ingress and egress point to the sidewalk or other walkways, considerations for universal accessibility (e.g. Americans with Disabilities Act compliance) are also critical.

Many cities, towns and DOTs do not have design standards in place that consider the various characteristics of how a greenway interfaces with roadways (Chapter 11: Implementation includes recommendations for Buncombe County to develop standards and specifications for this and other greenway design features). Therefore, the street interface is often designed and built to reflect sidewalk-based standards. This is not recommended because widths are too narrow for multi-use trail requirements.

Features such as curb cuts/ramps and landing areas, crosswalks, refuge islands, advanced warning / signalization and signage are different for greenways and greenway user than they are for sidewalks and bike lane users. It is important to consider how both the motorist and the greenway user approach the street interface. Each has different expectations that vary by the type of setting.

The following pages contain a catalog of exhibits that identify common street interface features and ways to

incorporate the needs of the user in their design. This catalog is intended to generate ideas and serve as an example for how architects, planners and engineers consider the street interface when a greenway is designed.

Many of the street interface treatment images contained in this catalog are not included in most standard design drawings, but generally conform to accepted design principles. This has the potential to cause conflict depending on funding sources. For example, grants awarded through federal transportation programs will be channeled through NCDOT. NCDOT is likely to request or even mandate that the design of projects funded through these sources conform to the DOT's design specification that aren't suite for greenways.

It is imperative that Buncombe County, cities, towns and other stakeholders communicate that there is a need for special greenway-specific design considerations given the absence of design standards by funding agencies or others. The development of typical design standards for the street interface will help make this case. This catalog can be the starting point for development of design specifications. It is not intended to represent standards or specifications, which are a recommended Action Item in Chapter 10: Implementation.

The catalog is also an important resource for working with private landowners or developers who are interested in building greenways on their site but may not have the technical resources to develop special features at the street interface.

Technologies, materials and recommended treatments are continually evolving. It will be important for Buncombe County to determine which of these best fits the local context.

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The intersections of greenways and streets are the place where most conflicts occur. This street interface requires special consideration during the design phase of a project to find the best-fit solution. Specialized signage (above) alerts motorists and trails users to potential conflicts.

Photo Credit: Don Kostelec

Exhibit 4-8: Urban Street Interface

Urban Street Interface

The urban street interface poses the most challenges due to higher volumes of vehicles and trail users in combination with the constraints of the built environment. Connections to destinations from the trail are important, especially for schools, parks and transit stops as well as the transition to the trail from bike lanes. The greenway/sidewalk interface should

not be overlooked. The design of the trail and crossing treatments should be like that of an extra-wide sidewalk, with a preference for 12-foot crossing dimensions of the trail approach, crosswalks and curb ramps to account for diverse users and comply with ADA requirements. Some crossing may be signalized if not at an already-signalized intersection.

Signalized Trail Crossing

- A: Bollard & visible cue to channelize trail users and prevent vehicle use.
- B: Wayfinding / Pavement markings.
- C: Stop sign.



Crossing treated as 4-way Stop

- A: Lighting to provide visibility for trail users.
- B: Elongated, flat sidewalk that is flush with street to match trail surface and allow smoother transition for bicyclists from bike lane to greenway.



Mid-Block Crossing

- A: Bus stop connection, including paved apron to/from trail.
- B: Median for two-stage crossing.
- C: Signage for bicyclists entering from street.

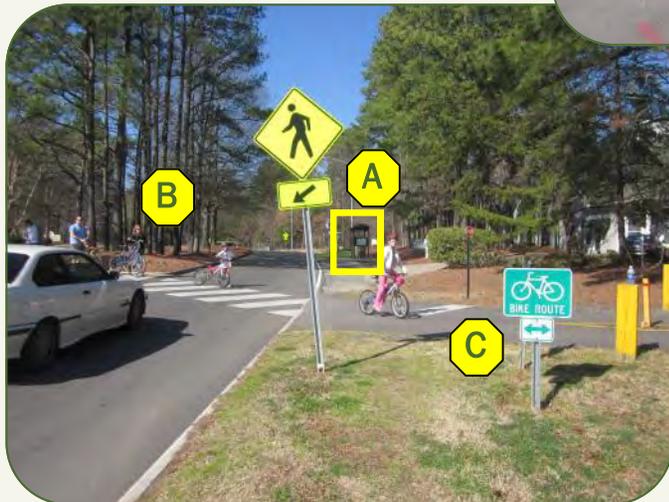


Photo Credits: Don Kostelec

Exhibit 4-9: Suburban Street Interface

Suburban Street Interface

In a suburban setting the most important considerations are:

- 1) Balancing considerations for higher vehicular volumes and higher trail volumes; and
- 2) Understanding the need for a higher level of design considerations, signage and technology integration to avoid motorist and user conflicts.

The expectations for whether the motorist or trail user should yield or stop is based on the unique characteristics of the crossing. Crossings should conform to ADA-compliant requirements similar to a mid-block sidewalk crossings: accessible ramps; flat landing areas; detectable warning surfaces; widths corresponding to multi-use trail dimensions. Note the crossings shown do not fully comply with ADA requirements.



Crossing in Residential Area

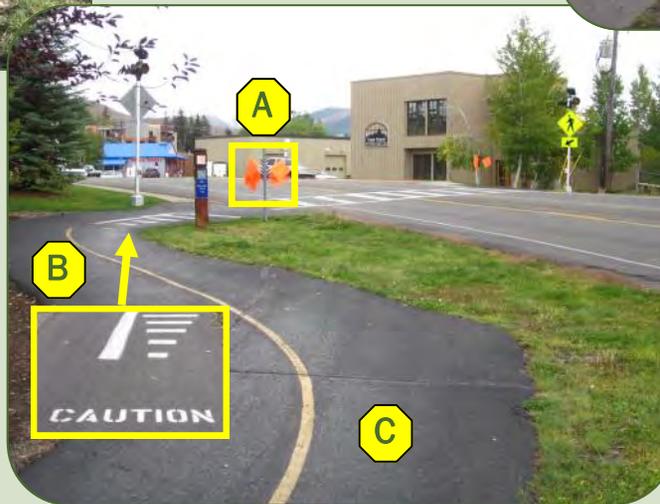
- A: Signal for trail users.
- B: Sidewalk crossing of trail.
- C: Advance warning for users.

Note: Signal is actuated by vehicles, giving priority to trail users. Therefore it does not require bicyclists to dismount to access push buttons.



Crossing in Commercial Area

- A: Special signage.
- B: Permanent speed detection sign.



Crossing in Commercial Area

- A: Flags for higher visibility for users.
- B: Trail pavement marking at street.
- C: Meander of trail on approach to street to slow users.

Photo Credits: Don Kostelec

Rural Street Interface

In a rural setting the most important considerations are:

- 1) Managing the expectations of the approach as pedestrian and bicycle crossings are not as common on rural roads; and
- 2) Maximizing visibility of both the motorist and trail user through signage, preservation of clear space within the “sight triangle” and specialized

crossing treatments based on the volume of vehicular and trail traffic.

The expectations should always be for the trail user to come a complete stop before crossing. The motorist may not be required to stop but notified in advance—at least 1,000 feet—that a trail crossing is ahead.

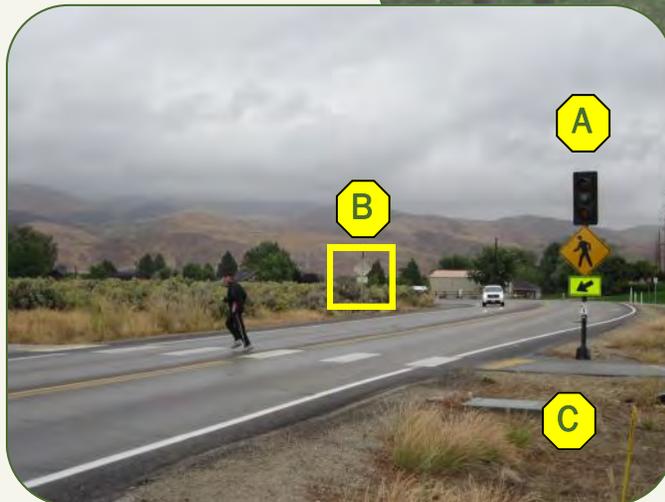


Crossing of Trail / Parking Area

A: Warning signs

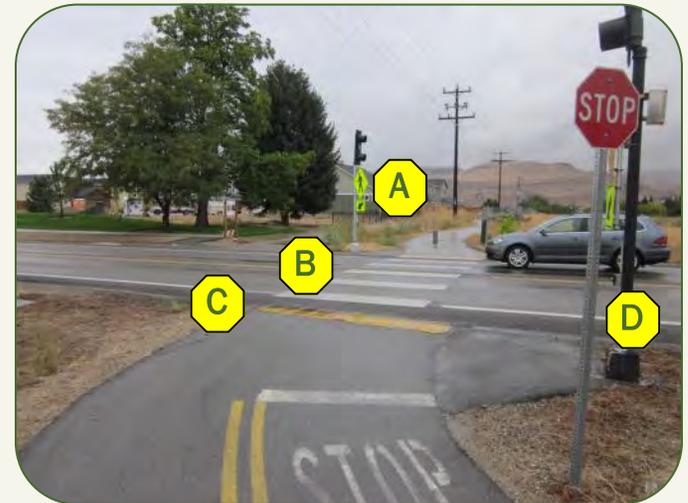
B: Crossing width matches trail

C: Clear space for visibility



Signalized Trail Crossing

- A: Flashing beacon with warning signs. Sign shown does not reflect new reflectivity standards.
- B: Advance warning sign.
- C: Clear space to allow for maximum visibility of trail crossing.



Signalized Trail Crossing

- A: Trail approach meanders to control speed of trail user.
- B: High visibility crosswalk with width to accommodate multi-use travel needs.
- C: Detectable warning surfaces to comply with ADA requirements.
- D: Push buttons for flashing beacons with paved area for access.

Photo Credits: Don Kostelec

Exhibit 4-11: Suburban Street Interface

Other Design Treatments



Pavement markings from private driveways alert motorists to expect users to cross in front of them along a sidepath.



Transit stops along greenways require a paved landing area—minimum dimension of 4' x 4', flat—connecting the pathway to the street. It should have been placed in the area outlined in this image.



High volume intersections of two pathways may require special design features, such as this greenway roundabout in Davis, CA.



High volume multi-use crosswalks, such as one connecting to a school or park, may require separation of uses to avoid user conflict.

On-street pathways can be used to fill gaps in greenways. The width and radius of the transition needs to consider the speed of bicycles.



Micropath connections from neighborhood streets to greenways include signage, smooth transition areas and bollards to prevent vehicle use.

Marking Obstacles / Obstructions

The Power of Paint

There will inevitably be obstacles and obstructions that have to be addressed in the design of greenways to alert users of potential hazards. The costs to change the placement of these obstacles and obstructions may be prohibitive or other features may be purposely designed for the greenway to handle stormwater.

Greenway users are typically traveling at a speed where these obstructions will not pose a serious safety threat but some may become tripping hazards or cause discomfort for bicyclists.



Sewer caps on the Virginia Creeper Trail are not flush with the trail surface. They are painted yellow as a warning for approaching users.



Sewer caps on paved greenways may be flush with the trail but can pose a hazard to bicyclists when wet.



Fences constructed to keep users out of private property can be marked with a line to delineate the clear zone, keeping users away from obstructions along the trail's edge.



Drainage grates may be necessary to control stormwater and can encroach on the trail. A marking around the grate alerts users to avoid it.



Drainage grates may also be marked with a diagonal line in the direction of travel for trail users so they can avoid it.

Exhibit 4-13: Signage

Signage

Signage, even along a greenway with few amenities, is important to providing users with information on destinations, obstacles and other features along the trail that may present a challenge or hazard.

On-street connections in Roanoke are marked with the logo of the greenway system on posts or on the pavement (inset).



It is important for users to know when to expect others to be crossing the trail. This is especially important in rural areas for private access roads (bottom) or farm crossings.



The name of the trail and mile markers help users orient themselves, plan their journey and track their progress.



These signs alert users of street crossings (top) and conflict areas (bottom)

The need for wayfinding starts at the access point as different users have different destinations.



Street signs direct users to neighborhood connections and motorists to look out for trail users.



Signage is critical in maximizing connections from the trail to destinations.



Exhibit 4-14: Amenities

Amenities & Structures

Trailheads & Information Kiosks



The type of amenities and structures, and the degree to which they are incorporated into design and construction should be based on:

- ◆ Setting & preferences;
- ◆ Budget & funding source requirements;
- ◆ Community context;
- ◆ Degree of public access;
- ◆ Sustainable design;
- ◆ Maintenance costs; and
- ◆ Screening adjacent properties.

These images reflect some options for amenities along greenways to consider as projects enter a design phase.



Bridges



Special Markings & Public Art



Benches



Exhibit 4-14 continued: Amenities

Amenities & Structures



Bag & Monofilament Depositories

Educational Kiosks



Bicycle Parking



Decorative Columns & Bollards

Piers, Shelters & Vault Toilets



Retaining Walls, Trail Edging & Fencing





“Transportation, quality of life, and economic development are all undeniably connected through well-planned, well-designed, and context-sensitive transportation solutions. To NCDOT the designations ‘well-planned’, ‘well-designed’ and ‘context-sensitive’ imply that transportation is an integral part of a comprehensive network that safely supports the needs of the communities and the traveling public that are served.”

- *NCDOT Complete Streets Policy Statement (2009)*

Complete Streets

The Buncombe County Comprehensive Land Use Plan Update acknowledges the growing urban influence in unincorporated areas of the county. As noted in Chapter 1, with this urbanization arises a demand for urban-like amenities for pedestrian and bicycle facilities. Some streets in Buncombe County have been identified in Chapter 3 Priority Corridors for “Complete Streets” treatments to reflect areas of notable demand for bicycle and pedestrian movements along streets. Some routes shown for Complete Streets are where corridors run along roadways or connection to a priority corridor should occur along a street.

A Complete Street can be defined as one that is designed to provide for the safe movement of all users of all abilities at all times. This does not mean that all streets are required or should have bicycle and pedestrian facilities. Some streets may have parallel off-road greenways to provide an accessible route while others may have sidepaths. Some may require a combination of sidewalks and bike lanes to serve as a greenway connection in a constrained area.

For streetside improvements in Buncombe County, a partnership and regular discussion with the North Carolina Department of Transportation (NCDOT) is required as the agency manages all streets in unincorporated areas. NCDOT’s Board adopted a “Complete Streets” policy in 2009 to acknowledge how the agency considers the needs of all users in the design of its street system.

Buncombe County should pursue adoption of a Complete Streets policies to help guide discussions with NCDOT, cities, towns and the French Broad River MPO. It will also help in developing partner-

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ships to fund greenways or associated bicycle and pedestrian facilities.

Further, incorporating Complete Streets elements in the built environment is challenging as buildings constructed in downtown areas and along other corridors create limited opportunities for optimal facilities, particularly in a retrofit situation. This is especially difficult in the mountains where many corridors are also constrained by topography and other natural features.

However, these constraints should be defined only as influences to the design of a Complete Street and not reasons to eliminate bicycle and pedestrian facilities or greenways from projects. The real challenges lie in how NCDOT and its partners consider trade-offs between vehicle usage and bicycle, pedestrian and transit usage to achieve a “best fit” solution for a street.

The process of designing a Complete Street must consider the existing and future likelihood of the types of pedestrians and bicyclists who will use a particular street or greenway corridor. For example, a road may exist in a rural setting but if that road connects schools, parks or recreation centers to a greenway or each other, then certain accommodations should be made when compared to a road in a rural setting that may only connect to other streets and provides access for low-density residential neighborhoods or farms.

Safe Routes to Schools

Buncombe County, through the Parks, Greenways and Recreation Service Department, Healthy Buncombe and the Health Department have been engaged in promoting walking and bicycling to school since 2009 through a Safe Routes to Schools (SRTS) program.

Like Complete Streets, this strategy by Buncombe County recognizes growing demand among parents, students, principals and teachers to find ways for students to travel to school via an active transportation mode. Increasing walking and biking options near schools also reduces traffic demands during arrival and departure times.

These programs help engage children in safe walking behaviors and encourage more bicycling and healthier lifestyles. Common steps to creating a successful program are to kick-off with an event on International Walk-to-School Day, then subsequently work with PTA members, teachers and students to identify needs and program ideas while incorporating encouragement measures and education into the school curriculum for students to learn safe walking and bicycling skills and the benefits of an active lifestyle.

Funding for SRTS through federal programs is in a state of flux due to changes and short-term passage of federal transportation legislation that funds the program. Grants for projects and educational efforts are available through the federal SRTS program and administered by NCDOT.

If SRTS funds are reduced or eliminated from future federal transportation funding programs, it is advisable for Buncombe County and its partners to pursue a commitment through NCDOT to dedicated state-generated transportation funding to continue the SRTS program. Only 25% of NCDOT's budget is generated through federal sources, with roughly the remaining 75% generated through state funding streams.

Buncombe County may also consider existing revenues such as vehicle property taxes, now at approxi-

mately \$8 million per year, to help fund local SRTS programs or other greenways investments to tie a transportation-based revenue source to a transportation expenditure.

Blue Ridge Parkway

The Parkway is a major destination for hikers and bicyclists. In Buncombe County, the Parkway is designated as part of North Carolina Bicycle Route 2 – Mountains to Sea. The Mountains-to-Sea Trail, which is for hikers only along the Parkway, runs parallel to the Parkway through Buncombe County. Greenway connections to the Mountains-to-Sea Trail should be designed with strong consideration for the user experience along the trail and not detract from its function and feel.

Connections are planned in several Priority Corridors that intersect the Parkway, including:

- ◆ Bent Creek Greenway;
- ◆ Lake Julian Greenway;
- ◆ Reynolds Greenway; and
- ◆ US 70 / Swannanoa River Greenway.

In some locations, these connections will likely be made via on-street bicycle access and a footpath for hikers. The interface with the Parkway is critical in ensuring the safety of users and collaborating with Parkway officials to determine the best location and best design of access points.

The Parkway is planning to consolidate many unauthorized, unpaved roadside parking areas hikers are using to access the Mountains-to-Sea Trail. Bicyclists are parking their vehicles at these spots to then ride their bikes along the road. These consolidated access points will likely result in paved parking areas with access to nearby trails.



Access to the Mountains-to-Sea Trail, which runs parallel to the Blue Ridge Parkway in Buncombe County, is becoming a challenge for the Parkway to manage unauthorized parking areas. The consolidation of these parking areas is an opportunity to coordinate access to planned greenway corridors.

Photo Credit: Friends of the Mountains-to-Sea Trail



Park-n-Pedal lots are designated areas in outlying locations or near commercial development for bicyclists to park and then travel by bike to their work or destination. Those shown in these images are near the Boise River and five miles from downtown Boise, Idaho.

Photo Credit: Don Kostelec

It is recommended Buncombe County work closely with Parkway officials to determine where these consolidated access points meet planned greenway corridors to co-locate access and manage ingress and egress from trails at a point where users are most visible.

Park-n-Pedal Lots

A new concept in promoting bicycling is the idea of designating parking lots, similar to park-and-ride lots used for transit and carpooling, whereby bicyclists can access via car to then make the remainder of their trip via bicycle.

These “Park-n-Pedal” lots are an encouragement technique that recognizes rural and suburban areas lack continuity in the bicycle transportation system or commute or travel distances are too great for many bicyclists to consider for regular use. They can also help attract weekend or touring riders from other areas who need a safe place to park while riding.

For example, a resident of Black Mountain who works in downtown Asheville, or vice versa, may not be able to ride along roadways that he or she would consider conducive to bicycle travel. However, the designation of a Park-n-Pedal lot in the Swannanoa area or at Azalea Park reduces the travel distance and travel time of the trip while still allowing for the bicyclist to have some level of physical activity.

Ideally, a Park-n-Pedal lot should be placed at a distance of approximately 3 to 5 miles from major destinations or employment centers, with special signage (example shown at left). These locations are on the edge of towns or communities and allow access to major destinations via lower volume, low speed roads or in combination with existing green-

ways.

These lots are also likely to be located where greenway parking lots are constructed. Promoting the lot as a park-n-pedal facility may require additional signage and marketing through efforts such as a Transportation Demand Management (TDM) program.

Bridges

Bridges are a necessary and very costly aspect of constructing and maintaining greenways. This is particularly true for entities that do not maintain other structures such as major culverts or bridges as part of a public roadway system. Generally, bridges along greenways are needed to traverse three types of barriers:

- ◆ Rivers and streams;
- ◆ Streets and highways; and
- ◆ Railroads.

The factors in bridging each type of barrier greatly impact the size, cost and permitting requirements associated with building the bridge. While a minimum width of 8-feet must be accommodated, that width is inadequate on bridges due to the influences of multi-use travel (unless dismount requirements are enforced) across them requiring more shy distance; therefore, a 10-foot or 12-foot width is preferred and has an even greater impact on cost.

Rivers and stream bridges. A Federal Emergency Management Agency (FEMA) no rise certification is needed whenever modifications are made in the 100 year floodplain of a river or stream. Bridges over streams will trigger the need for a no-rise analysis and report at each crossing. The FEMA no-rise report demonstrates, using modeling of FEMA stream data to reflect proposed changes in the 100 year floodplain, that there is no increase in the water depth at

the 100 year storm.

If the disturbance does cause a rise in the 100 year storm stream flood level, then a FEMA CLOMR (Conditional Letter of Map Revision prior to construction) and LOMR (Letter of Map Revision done post construction) is required. Because of both the expense and project delay associated with CLOMR and LOMR, the detailed designs for the greenway should endeavor to incorporate design elements which will meet the no-rise requirement and not trigger the more expensive and lengthy CLOMR permitting process. There is a fine balance between designing to avoid a CLOMR and adding additional cost to stream crossings to enable a no-rise or no-impact.

Streets and highways. Bridging of streets and highways for greenways and trails should be a last-resort design solution due to the cost related to the span of such bridges, which can be greater than 100 feet. Surface streets can be crossed in most situations by crosswalks or culverts under them (if incorporated as part of the project's design).

Although many places have attached pedestrian bridges to existing bridges, it is not the preferred approach by highway agencies such as NCDOT. It requires the bridge to have sufficient strength to hold the additional structure required for a pathway and would require an engineering study.

Railroads. Crossing railroad tracks is perhaps the most difficult barrier to overcome due to the requirements of the railroads related to the addition of no new at-grade crossings of their tracks. It is advisable to find an existing at-grade street crossing and work with the DOT and railroad to identify a way to include the greenway as a sidepath to the road to avoid having to construct a bridge.

If an overpass of a railroad is required, the challenges that arise are related to height / clearance requirements of the bridge. Vertical clearance requirements ensure the trail structure does not encroach on railroad right-of-way, while horizontal clearance requirements range from a minimum of 23-feet with most railroads requesting more than that.

Mountain Bike Trails

Mountain bikers are likely to use greenways to access their trails and consideration should be given to their needs. Mountain bike trails are located near planned Priority Corridors in Alexander along the proposed French Broad River / NC 251 Greenway, at the Bent Creek Experimental Forest at the southern terminus of the proposed Bent Creek Greenway, and along the Blue Ridge Parkway north of the US 70 / Swannanoa River Greenway.

Some mountain bikers have concerns over paved trails, but short distances are not detrimental to tire wear. Bicyclists just learning to mountain bike may prefer greenways in natural settings as a way to get used to riding.

Buncombe County should look for ways to incorporate singletrack trails near greenways where land is available. An example of this is in Franklin, NC, where a short 1.5-mile singletrack is located parallel to one section of their 6-mile greenway along the Little Tennessee River.

Mountain bike organizations such as Pisgah SORBA can be consulted on trail design, access and maintenance of mountain bike trails near or along greenways.



This bridge along the Flat Creek Greenway in Black Mountain represents one of the most common structures along greenway.

Photo Credit: Fred Grogan

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