Chapter 4 – Bicycle and Pedestrian Recommendations

Introduction

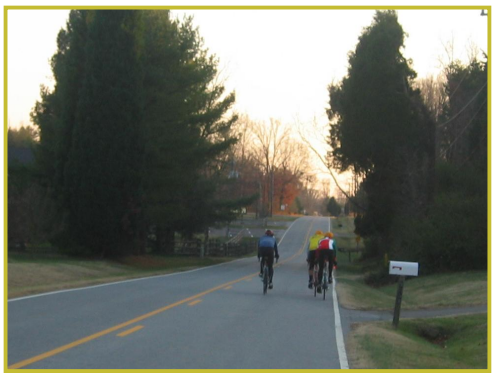
Throughout the nation, communities are turning to cycling and walking as viable means of transportation. Sometimes commuters find cycling more efficient, affordable, and convenient than traveling by automobile on congested urban streets. And while most people in the United States choose to travel by automobile, cycling and walking remains the only option for some people. The benefits of cycling and walking are numerous, as discussed in **Chapter 2**.

Even after conveying the personal, societal, and environmental benefits to prospective cyclists and pedestrians, the transition in Clemmons from potential use of non-motorized transportation to its reality is not easy. The increasing demand for bicycle and pedestrian facilities has culminated in an enhanced focus on these modes during the Village transportation planning process. Throughout the planning process, residents noted a need for improved bicycle and pedestrian facilities and programs to balance the region's transportation network. The non-motorized recommendations that follow have evolved as a product of community input and outreach, including stakeholder interviews, informal discussions with members of the Advisory Committee, and a special bicycle and pedestrian workshop. This element builds on the existing conditions presented in **Chapter 2** by describing in more detail facility and program opportunities and presenting recommendations based on the "Five E's of Bicycle and Pedestrian Planning."

Facility and Program Opportunities

In order to develop and integrate the recommended bicycle and pedestrian network into the overarching vision for the Village transportation system, the types of users, facilities, and programs must be understood.

Bicyclists on Lasater Road



Bicycle Users

The most effective set of bicycle recommendations addresses the needs and expectations of all users — regardless of skill level. The following "ABCs" of cyclists need to be clear for both planners and end users.

Advanced

Advanced cyclists — usually the most experienced on the road — have the ability to safely ride in typical arterial conditions of higher traffic volume and speeds. Most advanced cyclists prefer shared

roadways in lieu of striped bike lanes and paths, but may be more willing to accept striped bike lanes when the street gutter is cleaned regularly. Although this group represents approximately 20% of all cyclists, they account for nearly 80% of annual bicycle miles traveled.

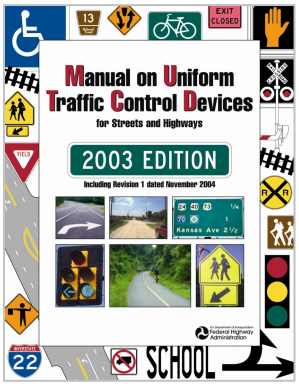
Basic

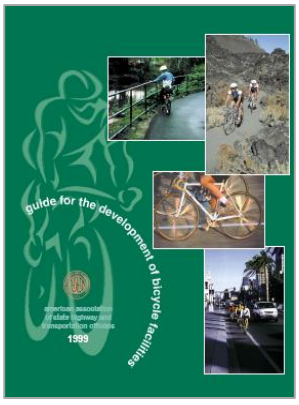
Due to being less secure in their ability to ride in traffic without special accommodations, basic cyclists are casual or new adult/teenage riders who typically prefer multi-use paths or bike lanes. Such facilities reduce basic cyclists' exposure to fast-moving and heavy traffic. Surveys of the cycling public indicate that about 80% of cyclists can be categorized as basic cyclists.

Child

The children on bicycles that make up this group have a limited field of vision while riding and generally keep to neighborhood streets, sidewalks, and greenways. On busier streets, this group is likely to stay on sidewalks or off-street facilities that protect them from traffic. The Village of Clemmons does not prohibit bicyclists from riding on sidewalks. While in general riding on sidewalks should be discouraged, the comfort level of child and basic cyclists may warrant riding on sidewalks provided they yield to pedestrians.

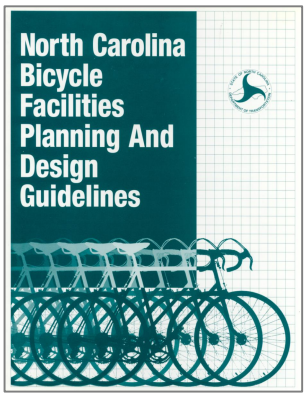
Bicycle Facilities





Like drivers, cyclists gain experience over time by riding. As cyclists ride and gain more experience operating in traffic, they graduate from basic to advanced skill. To make sure adequate amenities are available to users of all skill levels, the facilities identified here should be incorporated into roadway projects. Three bicycle design guideline documents were reviewed for this chapter:

- ***AASHTO Guide for the Development of Bicycle Facilities*** — Referred to as the Bicycle Guide, this is a federal document which sets forth the current design practices accepted by FHWA. This document discusses planning, design, operations, and maintenance issues associated with bicycle facilities. With respect to design, it addresses width dimensions, grades, cross slopes, radii, acceleration rates, deceleration rates, and sight distances. The Bicycle Guide is not intended to establish strict standards. It provides "sound guidelines that are valuable in attaining good design sensitive to the needs of both bicyclists and other highway users" (p. 2).
- **FHWA *Manual on Uniform Traffic Control Devices (MUTCD*)** — Unlike the AASHTO Bicycle Guide, the MUTCD does constitute a standard. Failure to comply with the MUTCD can result in being denied federal funds and makes liable non-compliant jurisdictions in the event of a crash. The MUTCD addresses standards for signing, striping, markings, signals, islands, and traffic work zone devices (e.g., cones and barricades). It provides information on what symbols may be used on signs and when sign text can



vary from the signs provided. The color, width, types, and applications of striping are defined in detail. It also provides dimensions and shapes of pavement markings and pavement lettering.

- ***North Carolina Bicycle Facility Planning and Design Guidelines*** — Design standards and guidelines for developing bicycle facility projects in North Carolina are provided in the *North Carolina Bicycle Facility Planning and Design Guidelines*. This document seeks to clarify specific aspects of standards that should be used when designing bicycle facilities. These standards apply to roads within the federal aid system and are consistent with the AASHTO guidelines. Demonstration projects outside the scope of North Carolina guidelines can be undertaken on municipal streets.

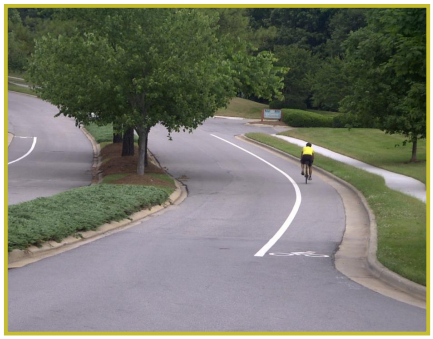
Roadway designers should understand how roadway and traffic characteristics affect bicyclists. Several research studies have suggested the following factors influence bicyclist safety and comfort when riding on a roadway segment:

- Effective width of the roadway, which includes the width of the outside lane and paved shoulder/bike lane space
- Presence of a bike lane or paved shoulder
- Motor vehicle traffic volumes on the roadway
- Traffic from intersecting roadways/driveways
- Speed of the traffic on the roadway
- Percent heavy vehicles on the roadway
- On-street parking
- Pavement surface condition

Facility Descriptions and Guidelines

This section provides a description of bicycle facility types and guides their proper implementation as recommended for the Village of Clemmons. A summary in tabular form of the major facility types is provided on page 4-10.

Striped Bike Lanes



A bike lane is a portion of the roadway adjacent to the outermost travel lane that has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes are always located on both sides of the road (except one way streets), and carry bicyclists in the same direction as adjacent motor vehicle traffic. Increasing the width of bike lanes provides greater comfort for bicyclists; however, excessive width in a bike lane may create the impression that parking or driving is allowed in the lane, which can be confusing to motorists.

Bike lanes typically are 4-foot wide. However in situations where a striped lane encounters on-street parking, a minimum of one additional foot (5-foot

total lane width) is typical. The minimum width for striped bike lanes does not include any gutter that may exist. Striped bike lanes are one of the facilities of choice for basic and intermediate cyclists because they offer a measure of security (separation from vehicles) not found with wide outside lanes.

Wide Outside Lanes

Also referred to as a "shared lane" or a "wide curb lane," these facilities provide extra width in the outermost travel lane on either single- or multi-lane roadways to accommodate cyclists. Typically, shared lane facilities have an outer lane width of 14 feet on multi-lane roadways and 15 feet on two-lane roadways. As is the case with striped bike lanes, the lane width measured on this facility type does not include the width of the gutter adjacent to the travel lane. The collection of debris, potential for pooling water, and proximity to the curb of the gutter area makes bicycle travel along the gutter hazardous. Wide outside lanes are most appropriate on travel routes with moderate traffic volumes and are suitable for cyclists who are comfortable riding with the flow of regular traffic. While these routes can be ridden by all cyclists, they are most often preferred by advanced cyclists.

Paved Shoulders

Paved shoulder space improves the safety and comfort of bicyclists and also extends the service life of the road surface by reducing edge deterioration. There is no minimum width for paved shoulders; however, a width of 4 feet is preferred. Even wider shoulders provide greater levels of bicyclist safety and comfort. On many roadways, motor vehicle travel lanes can be narrowed to provide more shoulder space. According to the AASHTO Bicycle Guide, "where 4-foot widths cannot be achieved, any additional shoulder width is better than none at all." Paved shoulders also improve safety for motor vehicles, prevent pavement damage to the travel lanes, and provide space for pedestrians. While paved shoulders are generally acceptable for roadway sections without frequent intersections, on those where intersections are frequent, appropriate bike lane striping should be applied.

Signed Bike Routes

Signed routes can be an option where room does not permit nor does the need exist to create additional pavement width for cyclists. Local routes typically can be found on low volume, low speed local streets. Other signed routes can occur on roadways with bike facilities. Often, signed routes lead cyclists through the "quieter" streets of a town, using neighborhood streets where traffic speeds and volumes are low. For rural areas, signed routes can be used to note low-traffic roads frequently used by bicyclists. This type of route is used by for cyclists of all

levels. The routes are typically not the first choice of advanced cyclists because local signed routes and streets do not provide the most direct route. Signed routes are helpful in wayfinding to link neighborhoods with networks of greenways and other bike facilities. State signed bike routes are typically found on higher level thoroughfares and provide relatively direct connections between state parks, forests, and specific areas of interests across the state.

SHARE THE ROAD signs (MUTCD W11-1 warning sign with W28-1 subplate) can be used to alert drivers to the presence of bicyclists. They are typically considered when one or more of the following criteria are met:

- Safety problems exist and the roadway cannot be improved with bicycle lanes
- Bicycling volumes are high
- A conflict or obvious courtesy problem exists between motor vehicle and bicycle traffic sharing the road

BIKE ROUTE signing (MUTCD D11-1 sign with D1-1b subplate) is another treatment which can be implemented to improve conditions for bicyclists. BIKE ROUTE signs help guide bicyclists to preferred routes — roads with lower motor vehicle traffic speeds, fewer trucks, or lower volumes. Typically they are supplemented with destination and distance signing.

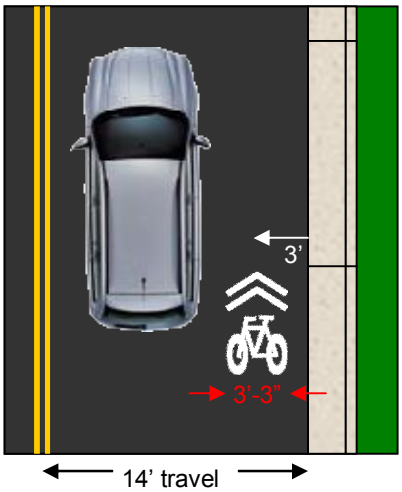
Special signs can be designed to guide bicyclists along the recommended routes. These signs can incorporate their own colors and logo so that they can be recognized easily and help advertise the route to potential bicyclists, and should include the name of the route being utilized.

Signed routes will provide strategic connections within the proposed bicycle network for the Village. Roadways recommended for signed routes have been selected not only because they offer connectivity to other routes and facilities but also because motor vehicle traffic and the design of the roadway permit the safe accommodation of cyclists.

Shared Lane Markings (Sharrows)

For some streets, the installation of striped bike lanes would require widening streets that recently have been widened or are not scheduled or budgeted to be improved in the near future. In other cases, streets with existing wide outside lanes give the appearance of not having extra room to accommodate cyclists. While efforts to provide cyclists space on its transportation system is a big part of the *Village Transportation Plan*, the majority of the cycling public either do not recognize the existing provision of wide outside lanes or are not comfortable riding there.

An option to remedy this confusion,is to use ***shared lane markings***. Also called sharrows, these markings make all roadway users aware of the on-street bike facility by indicating the recommended position for bicyclists in a shared travel lane less than 15 feet wide. Also, placed approximately three feet into the travel lane of a street with on-street parking, the symbol indicates where bicyclists should ride to avoid being hit by suddenly opening car doors. An added benefit is that it helps reduce sign clutter. These markings currently are being used in the San Francisco and Portland regions with success and praise from cyclists and transportation professionals. Such markings can make all roadways users aware of the on-street bike facility. Although no routes are recommended for sharrows as part of the Clemmons Village Transportation Plan, this facility type may be considered as the area's bicycle network matures.



Other Bicycle Facilities and Amenities

The *North Carolina Bicycle Facility Planning and Design Guidelines* also provide design considerations and recommendations for other types of ancillary bicycle facilities and amenities. These items, such as bike racks, bikes on buses, and bike-friendly drainage grates and railroad crossings help complete the bicycle system by eliminating barriers and providing security. In addition, the guidelines also discuss the maintenance of bicycle facilities, which is essential for the continued safe travel of bicyclists. Ancillary bicycle facilities and amenities are discussed beginning on page 4-19.

Pedestrian Facilities

Analysis and development of the non-motorized recommendations involved reviewing pedestrian facility design guidelines for sidewalks and walkways, curb ramps, marked crosswalks and other enhancements.

Facility Guidelines

Sidewalks and Walkways

The Federal Highway Administration (FHWA) defines sidewalks as "walkways that are parallel to a street or highway" and walkways as "pedestrian paths, including plazas and courtyards." The FHWA recommends that sidewalks and walkways be designed with the following characteristics in mind:

- Wide pathways with minimal obstacles or protruding objects
- Clearly defined pedestrian furniture, and frontage zones
- Moderate grades and cross slopes
- Rest areas outside of pedestrian zone
- Minimal changes in level
- Firm, stable, and slip resistant surfaces
- Good lighting

The Institute of Traffic Engineers (ITE), the American Association of State Highway and Transportation Officials (AASHTO), and FHWA all recommend a minimum width of 5 feet for a sidewalk or walkway to allow two people to pass comfortably or to walk side-by-side, and they prefer 4- to 6-foot buffer zones be provided to separate pedestrians from the street. For those with mobility impairments, sidewalks and walkways should be designed to minimize grades and cross slopes. FHWA recommends that the grade and cross slope not exceed 5% and 2%, respectively, wherever possible.

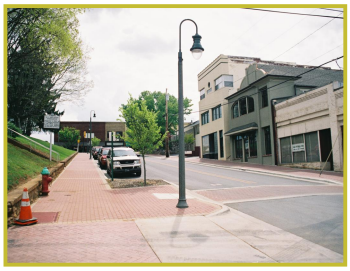
Curb Ramps

For persons with disabilities, curb ramps provide critical access between the sidewalk and street. While allowing for site-specific designs for curb ramps, FHWA suggests the ramp provide a level land area, be within the marked crosswalk area, avoid large changes of grade, and be distinguishable from surrounding terrain. The Federal Americans with Disabilities Act (ADA) mandates curb ramps at all intersections and mid-block locations where pedestrian crossings exist.

Marked Crosswalks and Enhancements

Marked crosswalks indicate the optimal location for pedestrians to cross a street. While crosswalks are usually installed at signalized intersections, mid-block crosswalks are becoming more popular. In locations that require increased levels of pedestrian visibility, the following enhancements can be incorporated into the crosswalk and street design:

- **Raised Crosswalk**. A raised crosswalk elevates the roadway by 3 to 6 inches, in effect reducing the speed of automobiles and providing increased visibility for high pedestrian-traveled areas. Raised crosswalks must be well-lit and well-marked to allow motorists to detect them at night and during inclement weather.
- **Pedestrian Refuge Island**. These raised islands in the center of a street protect pedestrians from vehicles. At such crossings, pedestrians can concentrate on one direction of traffic at a time by crossing to the center island and waiting for a gap in traffic to complete the trip across the street.



- **Curb Extensions**. Curb extensions can be placed at intersections or mid-block crossings. They extend the sidewalk into the street to improve pedestrian safety by calming traffic, increasing driver awareness of pedestrian activity, and shortening the crossing distance for pedestrians. When combined with landscaping, curb extensions can compensate for overly wide streets and improve the street's character.

In North Carolina, pedestrians within a crosswalk have the right-of-way and motorists must yield.

Multi-Use Facilities

Some facilities are designed to accommodate both bicyclists and pedestrians. These multi-use facilities separate non-motorized users from automobile traffic.

Facility Guidelines

Multi-Use Paths on Independent Alignments

Multi-use paths — or shared use trails — are becoming quite popular, not only with bicyclists, but also with many non-motorized transportation device users across the country. They can provide a high-quality bicycling experience in an environment that is protected from motorized traffic because they are constructed in their own corridor, often within an open-space area. Multi-use paths can be paved and should be a minimum of 10-feet wide. Their width may be reduced to 8 feet if there are physical or right-of-way constraints. Additional width should be considered for areas with difficult terrain or heavy traffic.

Multi-use paths are, in effect, little roads and should be designed with clearance requirements, minimum radii, stopping sight distance requirements, and other criteria just as roadways are designed. Additionally, designers must comply with the MUTCD and AASHTO Bicycle Guide when designing these facilities.

Though paths should be thought of as roadways for geometric and operational design purposes, they require much more consideration of amenities. Shade and rest areas with benches and water sources should be designed along multi-use paths. Where possible, vistas should be preserved. Way finding signs (e.g., how far to Tanglewood Park, the next rest area, or directions to restrooms) are important for non-motorized users. These types of design considerations can help make a multi-use path more attractive to potential users.

Multi-Use Path – This type of facility can provide a high-quality bicycling experience in an environment protected from motorized traffic. Multi-use paths should be constructed at a minimum width of 10 feet or 8 feet in locations with physical or right-of-way constraints. This facility type should not be constructed where frequent curb cuts and intersections increase potential conflict points between vehicles and cyclists. Beginner and basic cyclists prefer this facility type.

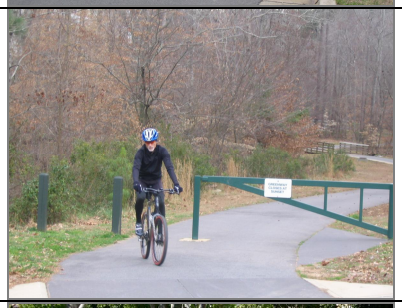
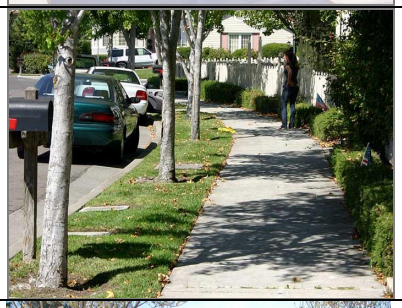
Greenways & Park Trails – A greenway is a linear parcel of land set aside to preserve open space. Greenways generally are located in floodplain areas, along wooded stream corridors unsuitable for development. Because of trail or natural conditions, cycling may be prohibited to minimize impacts to environmentally-sensitive areas or the trail itself. Greenway and park trails typically are 8 to 10 feet in width or greater and may or may not be paved. Greenways can begin as unpaved trails and evolve as more bikers, hikers, and pedestrians take advantage of their location. The low cost and relative ease of construction make trails attractive and a quick way to expand the bicycle and pedestrian network. Also, greenways provide a good opportunity for community involvement, as civic and youth organizations can and often do play a role in the construction and maintenance of the trails.

Sidepaths/Wide Sidewalks

A sidepath is essentially a multi-use path that is oriented alongside a road. The AASHTO Guide to the Development of Bicycle Facilities strongly cautions those contemplating a sidepath (or wide sidewalk) facility to investigate various elements of the roadway corridor environment and right-of-way before deciding upon a final design. AASHTO provides nine cautions/criteria (pp. 34-35) for designing sidepaths. Research confirms that bicycle/motor vehicle crash rates can be higher for bicyclists riding on a sidepath compared to riders on the roadway. Crashes between motor vehicles and bicyclists on sidepaths can occur when motorists falsely expect bicyclists to yield at all cross streets and driveways. Likewise, stopped vehicles entering or exiting side streets or driveways may block the bicyclists' path. However, careful design can mitigate some of these concerns.

Some high-volume, high-speed roadways exist where sidepaths are the best bicycle facility that can be provided without costly changes to the roadway corridor. In these cases, it may be desirable to provide a sidepath. This decision must consider the magnitude of intersecting driveway and roadway conflicts. If possible, sidepaths should be provided on both sides of the roadway to encourage bicyclists to ride in the same direction as adjacent traffic. The long-term strategy on these roadways should be to widen the road or narrow the lanes to provide additional space for bicyclists in on-street bike lanes or shoulders.

Table 4.1 Bicycle and Pedestrian Facility Overview

Striped Bike Lanes **Description** • Exclusive-use area adjacent to the outer most travel lane • Typical width: 4' to 5'		**Target User** • Basic and Intermediate Cyclists **Estimated Cost** • $18,000 per mile
Wide Outside Lane **Description** • Extra width in outermost travel lane • Best on roadways with speed limits of 35 mph or higher and moderate to high daily traffic volumes • Typical width: 14' outside lane preferred		**Target User** • Advanced Cyclists **Estimated Cost** • $18,000 per mile
Multi-Use Path **Description** • Separated from traffic and located in open space (greenway) or adjacent to road with more setback and width than sidewalks (sidepath) • Typical width: 10' preferred; 8' in constrained areas		**Target User** • All Cyclists; Pedestrians **Estimated Cost** • $600,000 per mile
Sidewalk **Description** • Dedicated space within right-of-way for pedestrians • Should include a landscaped buffer from roadway • Typical width: 5' preferred		**Target User** • Pedestrians **Estimated Cost** • $150,000 per mile
Unpaved Trail **Description** • Formal/informal hiking trail made of dirt, mulch, or pea gravel • Typically connects recreational and environmental features of a community • Typical width: 5-8' footpath; 8-10' bike trail		**Target User** • Off-Road Cyclists; Pedestrians; Hikers **Estimated Cost** • $10,000 to $20,000 per mile

Recommendations

As mentioned in **Chapter 1**, the tremendous growth Clemmons and the immediate surrounding areas have experienced in the last few years is expected to continue. The Village Transportation Plan overall and the bicycle and pedestrian recommendations in particular indicate the community's commitment to proactive, sustainable growth.

The package of projects and programs recommended for Clemmons relies on the "Five E's of Bicycle and Pedestrian Planning." Addressing these interrelated components helps create a transportation network that balances the needs of bicyclists, pedestrians, and motorists.

Engineering

Engineering refers to the network of pathways that must be planned, designed, and constructed. A well-planned bicycle and pedestrian system can enhance user safety and enjoyment and may increase the attraction of each mode.

Education

Once the pathways are in place, new and experienced cyclists and pedestrians must be made aware of their locations and the destinations that can be reached by using them. Bicyclists, pedestrians, and motorists must be educated on the "rules of the road" to ensure everyone's safety while operating on and adjacent to the bicycle and pedestrian facilities.

Encouragement

People need to be encouraged to bicycle and walk. Encouragement should become easier as the network of pathways makes the Village and surrounding area more bicycle- and pedestrian-friendly. Encouragement becomes more critical as these facilities are constructed to justify the investment.

Enforcement

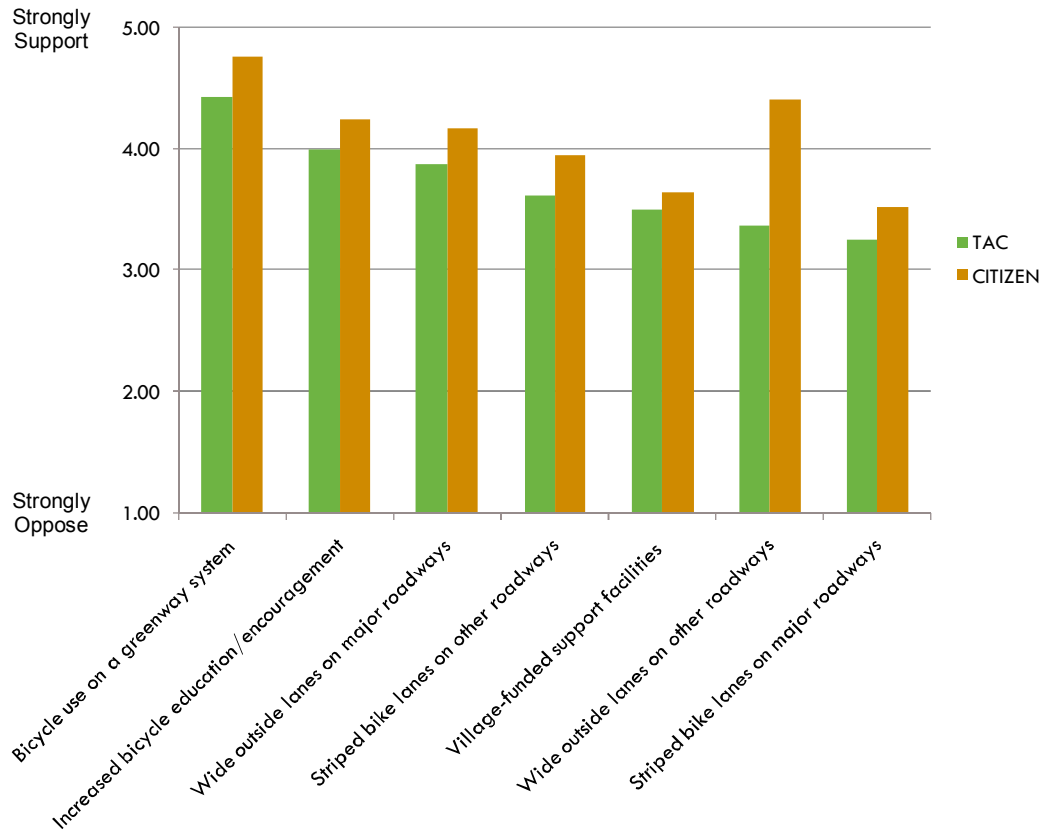
To ensure the safety of all users and the long-term sustainability of the bicycle and pedestrian system, the formal and informal "rules of the road" must be heeded by all.

Evaluation

Periodic monitoring and evaluation of usefulness and actual conditions is warranted. Just as organizations and individuals were included during the development of the bicycle and pedestrian element for this VTP, local residents should be included in the future evaluation of the region's programs and facilities.

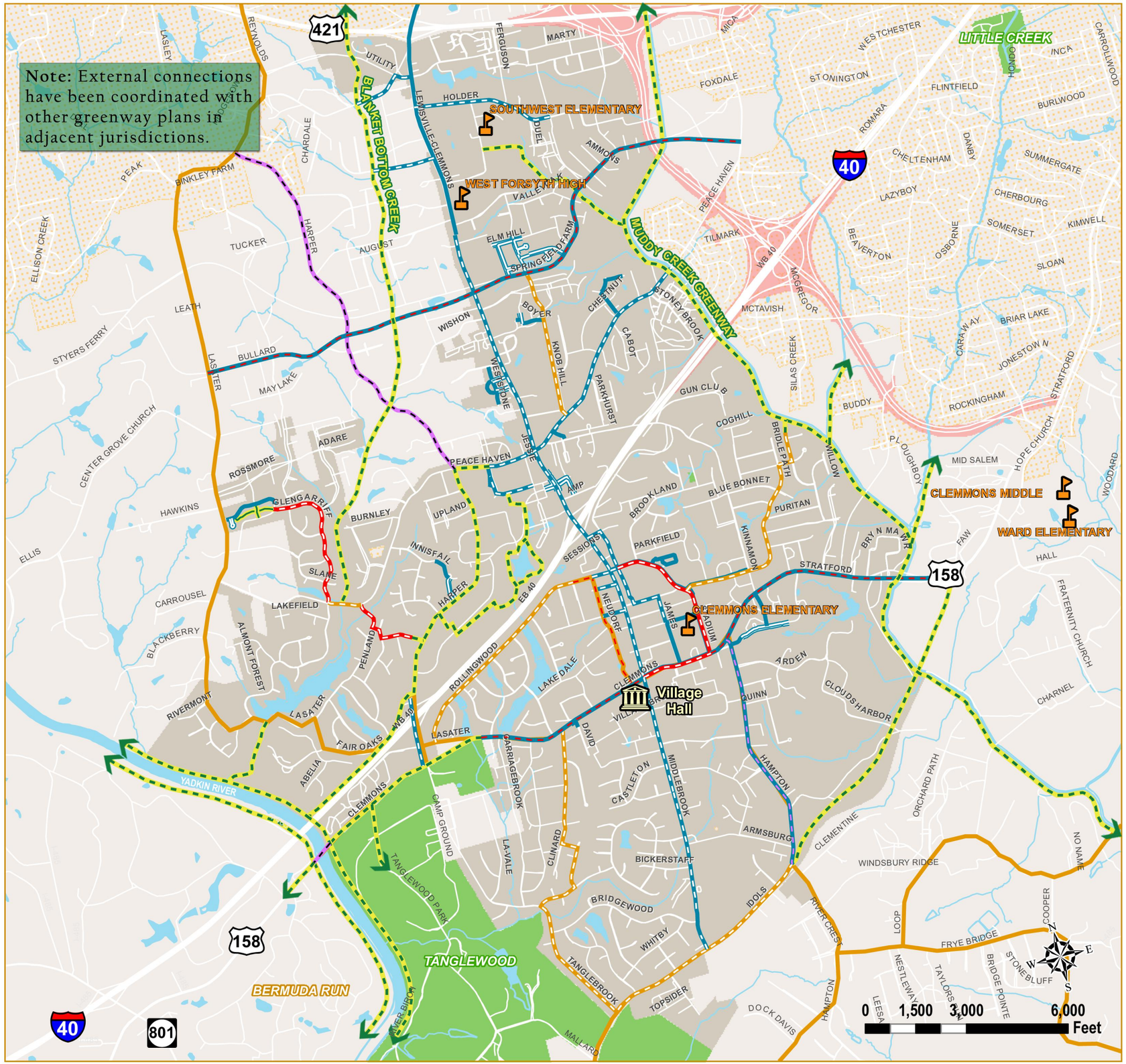
Facility Recommendations

Survey results from both the Clemmons Area Development Guide (CADG) and the Village Transportation Plan indicate a public desire for more investment in bicycle and pedestrian facilities. Respondents to the VTP survey acknowledged the poor condition of existing facilities and a general lack of cohesiveness for the system as a whole. The citizens strongly supported a variety of improvements to the bicycle and pedestrian network, as evidenced by the chart below. The Facility Recommendations included in **Figure 4.1** include a collection of on-street bicycle facilities, sidewalks, and multi-use paths.



On a scale of 1 to 5, where 1 is strongly oppose and 5 is strongly support, what is your opinion on the following measures to improve Clemmons's bike system?

The construction of bicycle and pedestrian facilities can occur as stand-alone enhancement projects or can be incorporated into public and private infrastructure projects. The second option may be more time- and cost-effective. Infrastructure projects include roadway widening, regular street maintenance, utility work, and new road construction. Adopted Village policies should require these projects to provide new bicycle and pedestrian facilities. Connectivity should continue to be an integral part in all residential and commercial developments. Where connections for motor vehicles are not possible or are not provided, multi-use paths can establish connections within and shortcuts through neighborhoods (i.e. connecting two cul-de-sac streets).



CLEMMONS
Village Transportation Plan
Staging the Future for Mobility and Livability

Legend

Bicycle & Pedestrian Facilities

Existing Facility
- Sidewalk, One Side
- Sidewalk, Both Sides
- Multi-Use Path
- Signed Bike Route

Recommended Facility
- Striped Bike Lane
- Wide Outside Lane or Shoulder
- Signed Bike Route
- Priority Sidewalk
- Multi-Use Path
- Sidewalk & Striped Bike Lane
- Sidewalk & Signed Bike Route
- Sidewalk & Wide Outside Lane

Other Elements
- Bodies of Water
- Clemmons
- Proposed Beltway Corrdior
- Neighboring Communities
- Parks

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Recommended Bicycle and Pedestrian Facilities

Figure 4.1

On-Street Bicycle Facilities

Recommended on-street facilities include striped bike lanes, wide outside lanes, paved shoulders, and signed bicycle routes. These facilities are shown in **Figure 4.1** and described briefly below.

Striped Bike Lanes

Bike lanes along Clemmons Road/Stratford Road (US 158) will provide safe on-street accommodations for east-west travel, in turn offering connections to Village Hall, retail stores, and Clemmons Elementary School. In addition, the bike lanes will connect the historic core of Clemmons and create a bicycle and pedestrian-friendly environment in the corridor. Although adequate right-of-way to implement these bike lanes currently exists, additional pavement width will be required.

East-west bicycle mobility also will be enhanced by the bike lane and sidewalk provisions included in the proposed Peace Haven Road/Styers Ferry Road Connector and improvements to the existing Springfield Farm Road. The Village of Clemmons has partnered with Forsyth County and NCDOT to map and protect a preferred alternative. Preliminary conceptual roadway design plans developed as part of this project include striped bike lanes and sidewalks along a combination of new location and existing roadway retrofit. The bike lanes along this corridor will be an incidental project occurring in tandem with the roadway improvements.

A third corridor provides a striped bike lane along North Lake Shore Drive and Glengarriff Road in the Waterford neighborhood near Lasater Lake. The facility connects to the existing multi-use path near Waterford Village Drive. Together, the recommended striped bike lanes account for slightly more than 8.5 miles of on-street facilities targeted toward basic and intermediate cyclists. Glengarriff Road currently has adequate width to accommodate striped bike lanes without adding any additional pavement.

Springfield Farm Road Improvements

Wide Outside Lanes / Paved Shoulder

Both wide outside lanes and paved shoulders provide extra room for bicyclists and motorists without having to exclusively dedicate pavement to bicyclists. The corridors identified for these treatments help complete the bicycle network by connecting to other existing and recommended facilities. Harper Road from Peace Haven Road north to Styers Ferry Road connects recommended on-street facilities at Peace Haven Road and the Peace Haven Road/Styers Ferry Road Connector, a multi-use path that parallels Blanket Bottom Creek, and the existing signed bike route on Styers Ferry Road. South of US 158, a wide outside lane/paved shoulder on Hampton Road between Idols Road and Clemmons Road (US 158) offers a north-south alternative to Middlebrook Drive. Together, the recommended wide outside lanes/paved shoulders account for more than 3.75 miles of on-street facilities targeted toward advanced cyclists.

Signed Routes

With the exception of a few short multi-use paths, signed routes represent the only existing bicycle facilities in the Village. A collection of on- and off-street bicycle facilities are recommended for roadways currently signed as bicycle routes. The addition of these facilities will enhance the cycling experience and add a measure of comfort and safety to encourage basic and intermediate cyclists to use the signed routes. Traffic conditions, geometry of the road, and potential connections to other existing and recommended facilities were factors in recommending the following routes as signed routes:

- Hampton Road to Tanglebrook Trail via Idols Road
- Clemmons Road (US 158) to Idols Road via Clinard Road, Barr Lane, Barkworth Road, Roquemore Road, and Tanglebrook Trail
- Bridle Path
- Knob Hill Drive connecting Springfield Farm Road with Peace Haven Road

A short segment of signed route on Peace Haven Road connects the recommended striped bike lanes on Glengarriff Road and Lasater Road. A long-term option for this segment could include a separate bridge for bicycle and pedestrian traffic. In total, approximately 7.5 miles of signed routes are recommended.

Sidewalks

Sidewalks are necessary elements in urban areas that have higher land use intensity and diversity as well as more pedestrian activity. Sidewalks in the historic downtown area and in activity centers should be wide enough to provide at least a 5-foot-wide clear width for walking, plus a furniture zone next to the street (for benches, waste receptacles, poles, street trees, and newspaper racks). Consideration also should be given to an edge zone next to buildings. This would allow space for plants and people to stand while window-shopping, or café tables if adjacent business owners want to offer sidewalk service to their customers. The minimum sidewalk width in a downtown retail area is 12 feet.

In other areas, a network of sidewalks on one side of the street, multi-use paths, and trails should serve pedestrians. In general, sidewalk widths should be a minimum of 5 feet in residential neighborhoods with at least a 5-foot-wide buffer to the travelway. Sidewalks adjacent to the street without a buffer should be discouraged because of the discomfort it creates for pedestrians.

The recommended sidewalks shown in **Figures 4.1** provide connections within and to existing neighborhoods and activity centers to make the Village more walkable. Key recommendations link areas with the potential for high pedestrian activity. In particular, sidewalks are recommended for Lewisville-Clemmons Road, Middlebrook Drive, and Hampton Road to provide north-south pedestrian connectivity through the Village and for Peace Haven Road and for the proposed Peace Haven Road/Styers Ferry Road Connector to provide east-west connectivity.

Other recommended sidewalks focused on the active pedestrian zones created by the presence of a school. To ensure the safety of students of all ages, sidewalks are recommended on the following roadways:

- James Street and Cook Avenue (Clemmons Elementary School)
- Holder Road and Southwest School Drive (Southwest Elementary School and West Forsyth High School)

Other sidewalks are recommended one block west of Lewisville-Clemmons Road on Neudorf Road and within shopping areas as a way to provide an alternative to walking alongside Lewisville-Clemmons. In total, these recommendations will add approximately 18 miles of sidewalks within the Village.

Multi-Use Paths

Multi-use paths provide bicyclists and pedestrians a high-quality experience protected from traffic. Often, these facilities take advantage of linear tracts of protected land such as a stream buffer and connect homes with businesses, schools, and park and recreation facilities. The recommended multi-use paths shown in **Figure 4.1** include greenways along creeks and sidepaths that parallel roadways. These facilities can be paved, gravel, or natural surface, depending on what facility fits the terrain, connections, and user groups best. It should be noted that these facilities can evolve from informal gravel or mulch trails into more formal paved paths. This evolution allows the initial momentum for a path to be created by the Village or volunteer groups at a much lower cost. As use of the path increases, the demand may justify the allocation of local funds to pave the trail and add other amenities along the corridor.

Proposed greenway corridors fall on both the east and west sides of the study area. To the east, recommended greenways parallel Muddy Creek, crossing US 158, I-40, and US 421. The Muddy Creek greenway will connect with a larger facility currently planned by Forsyth County to be part of the redesignated Mountains to Sea Route. To the west, a greenway corridor is recommended from Tanglewood Park north to US 421 along portions of the Yadkin River and

Multi-use paths can evolve from informal gravel or mulch trails into more formal paved paths. This evolution allows the initial momentum for a path to come from a variety of sources at a fraction of the cost. As use of the path increases, the demand may justify the allocation of local funds to pave the trail and add other amenities along the corridor. These photos illustrate potential options for a path along the Yadkin River.

Blanket Bottom Creek. Improvements for bicycle and pedestrian access at the southern entrance to Tanglewood Park were requested by the community and should be coordinated with the appropriate park and recreation officials.

Sidepaths provide a similar cycling and walking experience as the greenway but are oriented alongside a road. Recommended sidepaths can be constructed with private funds as negotiated in the land development review process or constructed with public funds by taking advantage of extra right-of-way allocated to proposed roadways. The following roadway segments are recommended for sidepaths:

- Clemmons Road adjacent to Tanglewood Park
- Harper Road from Fair Oaks Road to Peace Haven Road
- Peace Haven Road from Harper Road to the YMCA
- The proposed Idols Road Extension from Hampton Road to Stratford Road (US 158)

The proposed Idols Road extension presents a unique opportunity to evaluate the optimal bicycle and pedestrian facility types and placement. Since this is a new location facility, a range of different bicycle and pedestrian facility types were considered. This plan recommends the construction of a sidepath in order to maximize safety of bicyclists and pedestrians on this proposed freight. However, it is also recommended that this route include paved shoulders, which will better accommodate truck traffic, minimize pavement deterioration, and provide on-road bicyclists with a refuge area.

Together, the multi-use paths recommended as greenways and sidepaths account for approximately 23 miles of new pathways for cyclists and pedestrians.

Intersection Improvements

At the Bicycle and Pedestrian Workshop, several intersections were identified as particularly dangerous for bicyclists and pedestrians. The following three intersections were identified as priority areas for improvement to the bicycle and pedestrian environments:

- Lewisville-Clemmons Road at US 158 – bicycle lanes, sidewalks, crosswalks, and curb ramps
- Peace Haven Road at Harper Road – roundabout with sidewalks and sidepath
- Lewisville-Clemmons Road at the Peace Haven Road/Styers Ferry Road Connector – new roadway with striped bike lanes and sidewalks

A conceptual rendering of the proposed roundabout at Peace Haven Road and Harper Road is shown below.

Ancillary Facilities

In order to form a complete system, the recommended on-street facilities, sidewalks, and multi-use paths need to be supplemented with ancillary facilities. These facilities are often low-cost measures designed to enhance the functionality and safety of the bicycle and pedestrian network. Ancillary facilities include physical components of education, encouragement, and enforcement programs recommended later in this chapter.

Traffic Calming

The importance of traffic calming increases as motorists find short cuts around congested roads and intersections. Even the best planned street networks fall prey to unwanted cut-through and speeding traffic. Traffic calming includes a variety of tools to slow speeds, reduce cut-through traffic, and improve the appearance of the street while increasing safety for pedestrians, bicyclists, and vehicles.

Best practices for traffic calming are widely published, but the best programs include specific measures and general methods tailored to local travel patterns and citizen expectations. As increasing speeds and changing travel habits continue to threaten bicyclists and pedestrians, the Village is encouraged to develop traffic calming plans for the most unsafe roadways. One roadway identified by the public as particularly dangerous was Idols Road west of Tanglebrook Trail.

Signage and Mapping Projects

Comprehensive Route Systems

In order to maximize the use of the new and retrofitted facilities, users must know the location of routes, accessible destinations, connections to other routes, and provisions along the way. A route signage plan is recommended to include information on the direction and distance to destinations, spaced so bicyclists receive periodic confirmation that they remain on the right route. Different types of facilities can benefit from comprehensive route systems, including multi-use paths, bike lanes, shoulders, and wide outside lanes. At the second public workshop, the community expressed the need for improved signage along the trails within Tanglewood Park. These improvements should be coordinated with the Forsyth County Parks and Recreation Department.

In addition to comprehensive route signing, informative maps of bicycle routes and pedestrian trails and pathways should be produced.

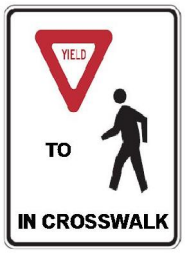
Share the Road Signing Initiative

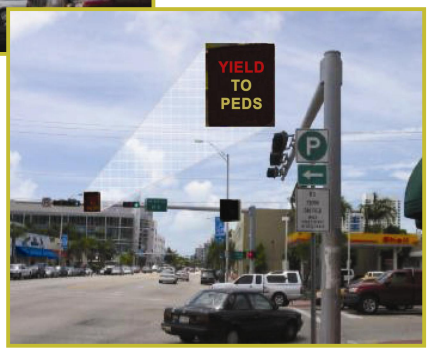
"Share the Road" signs make motorists more aware of the presence of bicyclists on high-use roads with potentially hazardous conditions. These signs serve as

important and cost-effective safety and education tools. In July 2005, North Carolina acknowledged the visibility and impact of these signs by issuing a "Share the Road" license plate. For each plate issued, the Division of Bicycle and Pedestrian Transportation (DBPT) receives $20 to apply to various bicycle education and safety initiatives.

Intersection Signage

Static and blank out signs reduce vehicular crashes with pedestrians. Static signs with messages such as "No Turn on Red When Pedestrians Present" or "Left Turning Vehicles Yield to Pedestrians" should be used only where problems have been documented and relatively constant pedestrian/bicycle use exists. Any overuse of the signs limits their effectiveness by diluting the ability of the sign to command the attention of motorists.





At locations where conflicts are not frequent enough to warrant a static sign, a blank out sign may be appropriate. These signs are activated when there is a potential conflict. Thus, if a pedestrian enters the crosswalk, the motorist will see a "Yield to Pedestrian" sign next to the permissive turn signal. The real-time aspect ensures the signs will be visible when needed and never relegated to visual clutter.

Bicycle Parking Facilities

Like motorists, bicyclists need a place to park their bicycles. It is recommended that bicycle parking be included near shopping areas, schools, and recreational areas as well as in downtown and near business frequented by bicycle riders.

It is not enough simply to place a bike rack at a random location. The bike rack should be highly visible, preferably near store fronts or in high pedestrian use zones to reduce the threat of theft. If bicycles are parked after dark, the area should also be well lit. The necessary protection varies according to the purpose of the bicycle trip. For short trips, a U-shaped bicycle rack may be acceptable. For commuter trips, bike lockers or covered parking may be more appropriate. Finally, bicycle racks also provide an opportunity to enhance the character of an area when they reflect the community culture or character.

For additional information on bike rack designs, the Association of Pedestrian and Bicycle Professionals has produced a guidance document that covers rack design, rack placement, and specifics for appropriate layout of the rack area in dimensions and relation to the surrounding land uses.

In addition to bicycle parking facilities, benches, water fountains, public restrooms, and changing areas would be helpful near popular downtown locations and near major destination points such as shopping areas and schools.

Spot Improvement and Maintenance Programs

General Considerations

Regarding bicycle safety, several questions should be used to assess the maintenance of a roadway — Has debris collected in the bike lane? Are longitudinal cracks present? Are there longitudinal drainage grates? Are utility covers uneven with the roadway surface?

An answer of "yes" to any of these questions should result in roadway maintenance. All bicycle facilities, including trails and the right side of roadways, require additional effort to ensure acceptable maintenance. A more frequent maintenance cycle to address these defects should be provided for bicycle routes. Likewise, areas where excessive debris tends to build and bicyclists have limited refuge should be maintained even more frequently.

Traffic Signal Considerations

Traffic signal location, timing, and loops along bicycle facilities require extra attention. The MUTCD requires signal faces to be adjusted or separated for optimal visibility by bicyclists and for signal timing to consider the needs of bicyclists. Additional guidance for signal timing and loops is provided by AASHTO.

Roadway Symbol Buildup

Bike lane symbols, lane directional symbols, and crosswalks use thermoplastic markings. To prevent handling problems for bicyclists, the number of layers of thermoplastic should be limited to one. In addition to build-up, the slipperiness of thermoplastic and paints can cause problems. The texture of the treatment can be altered by adding sharp silica sand to the glass spheres during application.

Safety Railings along Bicycle Facilities

Bridge railing heights have been the subject of recent revisions to the AASHTO Bicycle Guide and ongoing debates among bicycle facility design professionals. The current guide states that railing heights should be at least 42 inches to prevent bicyclists who hit the railing from tipping over the top. However, the current AASHTO Bridge Specifications require a 54-inch railing. In practice, designers have been using the 54-inch railing when a structure is being built to the AASHTO specifications and a 42-inch railing along non-structural locations, such as when protecting bicyclists from embankments.

Program Recommendations

The facility recommendations described above must be supplemented with coordinated education, enforcement, and encouragement programs. Some programs instruct and encourage bicyclists and pedestrians in the full and proper use of the non-motorized transportation network. Other programs ensure the safety of the system is upheld by enforcing rules and regulations.

Education Programs

Education programs can be initiated from a variety of sources. Local governments can host workshops and bike rodeos, law enforcement officers can launch school-based education programs, and local advocacy groups can distribute educational materials.

School-Based Safety Education

More than any other age group, school-age children need to be educated about bicycle and pedestrian safety. Education programs can be incorporated into local school curricula and tailored to specific age groups. Younger children could be taught pedestrian safety, while older students could receive hands-on bicycle safety lessons. The program can be a collaborative effort of the city and county, local law enforcement departments, and local advocacy groups.

Bike Rodeos

At bike rodeos, school-age children learn bicycling skills, rules, and safety tips in a fun, interactive environment. Bike rodeos are flexible in that they can be part of a larger safety education program, an independent program, or part of other fun group riding activities.

Walkable Community Workshops

These interactive workshops bring a variety of experts and stakeholders to the table with residents to identify real-world problems and proactive solutions for their community. The workshops last several hours and include an educational presentation, walking audit, and strategy session. The key to Walkable Community Workshops are the walking audits in which a professional leads participants on a tour to identify problems and solutions.

Public Outreach

Public service messages on television and radio can be created to inform the public about proper bike riding techniques, the meaning of singed bike routes and “Share the Road” signs, and driver courtesy. Other campaigns can be tailored to target any age group and can be directed at pedestrians, bicyclists, or motorists. Outreach efforts such as these should be encouraged.

Encouragement Programs

Encouragement programs are important regardless of age. The programs that follow include individual and city-wide endeavors.

Safe Routes to School

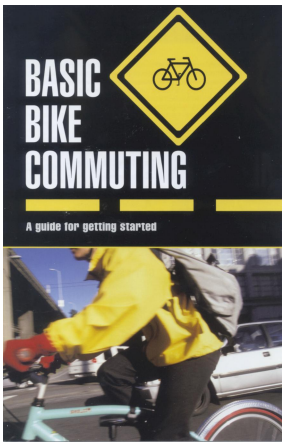
Safe Routes to School (SRTS), a national initiative, has encouraged many children to bike and walk to school by promoting bicycle and pedestrian education. The Village and Forsyth County should partner with local schools and advocacy groups to leverage state funding. Establishing a Safe Routes to School program for Clemmons Elementary School has been identified as a priority for the Village. The Village has begun working on the initial steps for a SRTS program by surveying students at Clemmons Elementary School and Southwest Elementary School to determine how they get to school. This information will position the Village favorably as they apply for grant funding to implement a SRTS program. More information on the program can be found at www.saferoutestoschool.org.

Walk or Bicycle to School Day

The Village of Clemmons should work with local schools to increase participation in International Walk and Bicycle to School Day. Walk to school days have been instituted at many schools throughout North Carolina over the past decade. These programs provide local schools a forum in which to promote bicycling and walking as a fun, healthy way for children to travel that also reduces automobile congestion and pollution near schools. At the same time, the programs allow users to identify necessary improvements to make walking or bicycling safer and easier.

Bicycle Rideabout

At a bicycle rideabout, local citizens take part in a short 3- to 5-mile ride along bicycle-friendly roads and attend informational sessions about bicycle safety and ongoing projects in the community. The events should include local law enforcement officers to promote safety and local advocacy groups to recruit new members. A bicycle rideabout can be a stand-alone fun activity or part of a larger event. A rideabout is also a great way to kick off a new initiative or open a new facility.

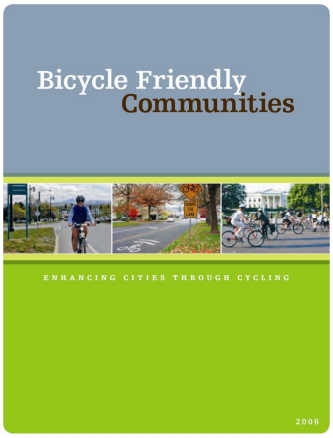


Bicycle-to-Work Week

For adults, Bicycle to Work Week can serve as a week-long reminder that bicycling can be a good way to get to work. The League of American Bicyclists sponsors a Bike-to-Work week every May, which has been designated National Bike Month. The success of Bicycle-to-Work Week often depends on local employers. Successful programs have included friendly competition between employers to see which can get the highest percentage of employees to ride bikes to work. Employers could also sponsor a raffle for employees that bike to work during the week to give away a new bicycle, helmet, or gift certificates to local bike shops.

Bicycle Mentor Program

This program matches experienced riders with those who want to learn more about commuting by bicycle. Volunteers from local riding clubs such as the Piedmont Flyers can organize and provide volunteers. The idea is to help a new rider find the best route to work and to educate him or her on how to ride in traffic, in the dark, or in poor weather.



Bicycle Friendly Community

A Bicycle Friendly Community is designated by the League of American Bicyclists as a way to recognize communities that provide safe accommodations for bicyclists and encourages bicycling as a means of transportation and recreation. Currently, three North Carolina communities – Carrboro, Cary, and Charlotte – have been designated a Bicycle Friendly Community at the Bronze Level. As the network in Clemmons improves and programs mature, the Village should seek this designation.

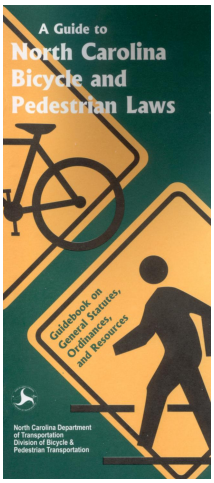
Enforcement Programs

North Carolina affords bicycles the same legal status as motor vehicles. As such, bicyclists have all the rights on the roadway as a motorist while being subject to the same rules, regulations, and responsibilities. Other laws specific to bicyclists include:

- Bicyclists traveling below the posted speed limit must ride in the right-hand lane or as close as practicable to the right-hand curb or highway edge, except when passing another vehicle or preparing for a left turn.
- Bicyclists must obey all traffic signs and signals
- Bicyclists must use a front lamp and rear reflector when riding at night

Rules and regulations such as these should be conveyed during education and encouragement initiatives. To ensure the safety of bicyclists, pedestrians, and motorists, education and encouragement programs must be supplemented with enforcement. This task often falls into the hands of local and state law enforcement. The Village and Forsyth County should partner with local officers to develop a coordinated bicycle pedestrian enforcement campaign.

Bicyclists, pedestrians, and motorists contribute to unsafe roadways. Bicyclists often ignore traffic laws by running red lights and stops signs or by riding on the wrong side of the street. Many bicyclists riding at night do not have proper reflectors and lights. Pedestrians break the law by crossing streets between parked cars and at unmarked mid-block locations rather than at intersections. Motorists often pass too close to bicyclists or do not yield to turning bicyclists. These unlawful and potential harmful habits must be broken to maintain a safe transportation network. Local authorities should extend to cyclists of all ages the state bicycle helmet law that requires children under the age of 16 to wear a helmet. The programs identified here should accompany the increased enforcement campaign.



Local policy allows bicyclists ride on sidewalks within the Village. While the Village presently supports this policy, as ridership increases and experience level improves the Village may want to revisit this policy.

Bicycle Licensing/Registration Program

Bicycle licensing should be considered as a way to enforce bicycle safety and reduce losses to theft. A registered bicycle helps local authorities identify an unresponsive cyclist in the event of an accident and return a stolen bicycle to its owner.

Positive Reinforcement

Positive reinforcement can be a valuable way to encourage safe actions by bicyclists and pedestrians. Police departments across the nation have recognized and rewarded children operating their bicycle in a safe manner. The rewards can include coupons for free ice cream, pizza, or movie tickets, or for discounts at local bicycle shops. This program encourages the child to continue to act safely and encourages their peers to follow their example.

Program Recommendation Priorities

Support for specific bicycle and pedestrian programs became evident through discussions with local staff, stakeholders, and the general public. These programs include Pedestrian Walkabouts, Bicycle Rideabouts, and Bicycle Rodeos. Support is more apparent when considering that the local bicycle shop – Clemmons Bicycle – is working with the local YMCA branch to actively implement these types of events in the community.

Success in implementing bicycle and pedestrian programs can be enhanced by combining new programs with established community events. One example is to combine a bicycle rodeo or other education event with the annual Tour to Tanglewood. The Tour to Tanglewood is a 90-mile bicycle ride and fundraiser that supports the National Multiple Sclerosis Society. The coordination of education events with the Tour also would help match beginner and advanced riders.