CHAPTER FOUR OUTLINE:
Overview
Methodology for Network Design
Recommended Facility Types
Bicycle Stations and Parking
Bicycle Facility Network Maps
Public Transit Access
Regional Connections

CHAPTER FOUR: BICYCLE NETWORK

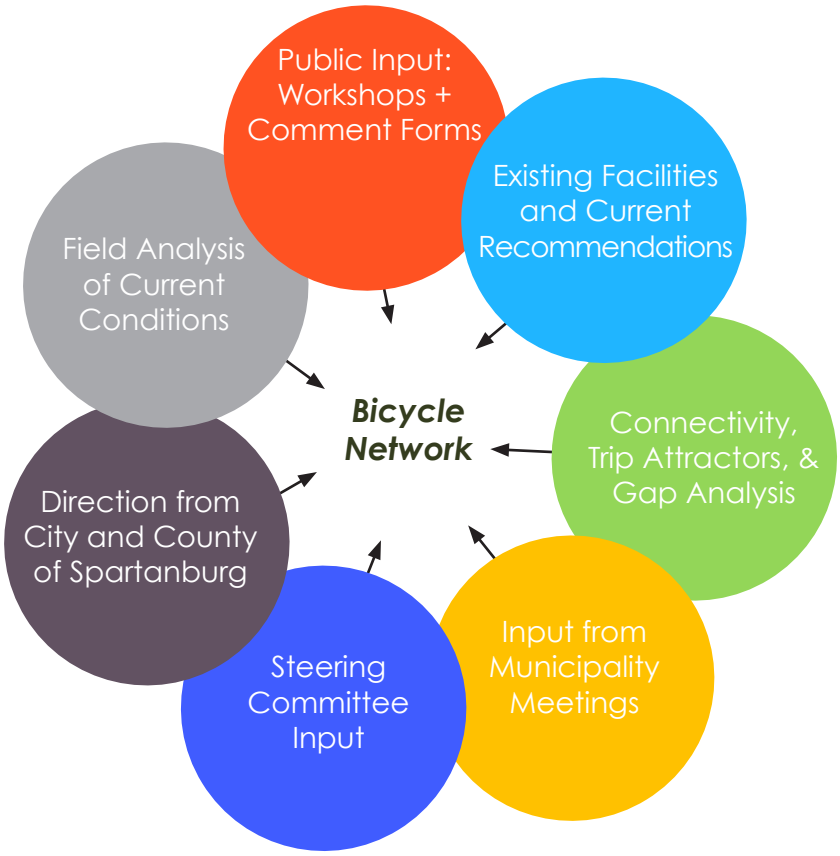
OVERVIEW

Spartanburg County's Bicycle Facility Network represents a comprehensive set of existing and proposed bicycle transportation facilities. The network includes paved shoulders, shared lane markings, bicycle lanes, side paths and greenways. In total, there are approximately 747 miles of recommended bicycle facilities, all of which are shown in Map 4.1

The following sections of this chapter include 1) how the network was designed; 2) brief descriptions of the types of facilities that make up the network; and 3) Spartanburg County and City network maps. Project pages and recommended network maps for Spartanburg County municipalities may be found in Chapter 6. Priority projects and strategies for implementation may be found in Chapter 9: Implementation.

INPUTS FOR NETWORK DEVELOPMENT

The diagram below illustrates the inputs used to design the Bicycle Network.



METHODOLOGY FOR NETWORK DESIGN

The bicycle facility network was designed by first assembling all existing bicycle-related recommendations and information from current plans and studies. Secondly, a thorough analysis with geographic information systems (GIS) and fieldwork was conducted to examine roadways for recommendations. The assembled information was then presented to the public, local government staff, the Steering Committee, and various project stakeholders. Together, the input from these groups helped to inform the overall network design; through writing and drawing on input maps, filling-out comment forms, direct dialogue, and e-mailed comments. These and other key inputs are shown in the diagram (at left).

RECOMMENDED FACILITY TYPES (MAPS 4.1 AND 4.2)

A variety of bicycle facilities are recommended due to 1) the range of skill and comfort levels involved in bicycling, and 2) the range of conditions for bicycling on different roadway environments. These recommendations are at a planning level only and will require further analysis before implementation.

The recommended bicycle network is made up of six core types of bicycle facilities. Descriptions and standards for each type are described in Chapter 10: Design Guidelines. The images and descriptions below are provided for a quick reference when viewing the Bicycle Facility Network Maps (Maps 4.1 and 4.2, at the end of this chapter).

BICYCLE LANE

A bicycle lane is a portion of the roadway that has been designated by striping, signing, and pavement markings for the preferential and exclusive use of bicyclists. Bicycle lanes are always located on both sides of the road (except one way streets), and carry bicyclists in the same direction as adjacent motor vehicle traffic. The minimum width for a bicycle lane is four feet; five- and six-foot bike lanes are typical for collector and arterial roads.

Above: example bicycle lane.

SHARED LANE MARKINGS ("SHARROWS")

It is recommended that bicycle shared lane markings (or 'sharrows') be approached incrementally as a new facility treatment. Shared lane markings are used on roadways where dedicated bicycle lanes are desirable but are not possible due to physical or other constraints. Placed in a linear pattern along a corridor (typically every 100-250 feet), shared lane markings make motorists more aware of the potential presence of cyclists; direct cyclists to ride in the proper direction; and remind cyclists to ride further from parked cars to avoid 'dooring' collisions.

Above: example shared lane marking.

WIDE OUTSIDE LANE

A wide outside lane refers to the through lane closest to the curb and gutter of a roadway. The American Association of State Highway and Transportation Officials (AASHTO) standard lane width to accommodate both motorists and bicyclists is 14'. This facility type allows motorists to more safely pass slower moving bicyclists without changing lanes. Wide outside lanes are intended for bicyclists with traffic-handling skills.

Above: example wide outside lane.

Above: paved shoulder examples.

PAVED SHOULDERS

Paved shoulders are the part of a roadway which is contiguous and on the same level as the regularly traveled portion of the roadway. There is no minimum width for paved shoulders, however a width of at least four feet is preferred. Ideally, paved shoulders should be included in the construction of new roadways and/or the upgrade of existing roadways, especially where there is a need to more safely accommodate bicycles. Paved shoulders make up the majority of recommendations in this Plan because of the substantial mileage of rural roadways. When development occurs, roadways are reconstructed, and/or curb and gutter are added in the future, bicycle lanes should be considered for some of these roadways.

Above: example side path.

SIDEPATHS

Multi-use paths located within the roadway corridor right-of-way, or adjacent to roads, are called 'Sidepaths'. Sidepaths are most appropriate in corridors with few driveways and intersections. Bicycle routes where side paths are recommended should also have adequate on-road bicycle facilities (such as paved shoulders or bicycle lanes) wherever possible.

Above: example signed route.

SIGNED BICYCLE ROUTE

These routes are recommended in locations that serve as alternate routes for dangerous roadways. They were chosen as part of the network because of the importance of overall system connectivity and connectivity to destinations such as parks and schools. This designation includes signage but not necessarily any on-road facility or marking because the routes follow less busy, residential roads.

Above: example multi-use trail/ greenway.

MULTI-USE PATHS OR GREENWAYS

Multi-use paths are completely separated from motorized vehicular traffic and are constructed in their own corridor, often within an open-space area. Multi-use paths include greenway trails, rail-trails and other facilities built exclusively for bicycle and pedestrian traffic. In this plan, the greenway recommendations were generated from the Enhancement Master Plan and are amended with further recommendations. In total, there are over 200 miles in the recommended off-road greenway system.

TABLE 4.1 **SPARTANBURG COUNTY** ON-ROAD BICYCLE FACILITY RECOMMENDATIONS

Recommended Facility	*Method*	*Mileage*
Bicycle Lane	Stripe	16
Bicycle Lane	Restripe	60.5
Bicycle Lane	Road diet	7
Bicycle Lane	New construction	36
Shared lane markings	Stripe	20.5
Paved shoulder	New construction	518.7
Wide outside lane	Stripe	72.8
Signed bicycle route	Signage	4.9
Sidepath	New construction	10.7
TOTAL Recommended		*746.6 miles*

TABLE 4.2 **CITY OF SPARTANBURG** ON-ROAD BICYCLE FACILITY RECOMMENDATIONS

Recommended Facility	*Method*	*Mileage*
Bicycle Lane	Stripe	6.6
Bicycle Lane	Restripe	32.4
Bicycle Lane	Road diet	4.8
Bicycle Lane	New construction	3.8
Shared lane markings	Stripe	17.4
Paved shoulder	New construction	7.3
Wide outside lane	Stripe	15.7
Signed bicycle route	Signage	3.2
Sidepath	New construction	3.4
TOTAL Recommended		*94.6 miles*

NETWORK MAP SUBCATEGORY DEFINITIONS

As indicated in the legend of the bicycle network maps, some facilities are broken down into sub-categories for method of development. Those for bicycle lanes are explained below:

- *Bicycle Lane - Road Diet:*

  Road diets typically involve reducing the number of travel lanes (from a four-lane road to a two-lane road with center turn lane, for example) allowing adequate space for bicycle lanes. Road diets also have traffic calming benefits. These projects can occur during roadway resurfacing projects.

- *Bicycle Lane - Stripe:*

  Refers to projects that require only the striping of a bicycle lane, with no other changes needed to the roadway or existing roadway striping.

- *Bicycle Lane - Restripe:*

  Refers to projects that require restriping travel lanes (often to a more narrow width) allowing adequate space for bicycle lanes. Narrowing the widths of travel lanes has been demonstrated to have no affect on overall roadway capacity (for more on this topic, refer to the following section on 'lane narrowing'). These projects can occur during roadway resurfacing projects.

- *Bicycle Lane - New Construction*
  and Paved Shoulder – New Construction:

  Refers to projects that require adding additional pavement width to the roadway to allow adequate space for bicycle lanes or shoulders. It is likely that these bicycle facilities will be implemented to coincide with future roadway construction projects.

BICYCLE LANE DEVELOPMENT & TRAVEL LANE NARROWING

One means of developing bicycle lanes is through restriping or travel lane narrowing. In laying out the bicycle network facility recommendations and methods, it was determined that 10' travel lanes were acceptable in order to fit bicycle lanes into the existing roadway environment. For example, an existing five lane cross section with 12' lanes (Total roadway width of 60') could be altered to 10' lanes with 5' bicycle lanes (Total roadway width of 60'). This methodology used in developing recommendations is supported by research in both automobile traffic safety and bicycle level of service improvements.

Current AASHTO literature, research, and precedent examples support the notion of reducing 12' travel lanes to 10' lanes. The 2004 AASHTO Green Book states that travel lanes between 10 and 12 feet are adequate for urban collectors and urban arterials. (1) "On interrupted- flow operating conditions at low speeds (45 mph or less), narrow lane widths are normally adequate and have some advantages." At the 2007 TRB Annual Meeting, a research paper using advanced statistical analysis, supported the AASHTO Green Book in providing flexibility for use of lane widths narrower than 12 feet on urban and suburban arterials. The paper indicates there is no difference in safety on streets with lanes ranging from 10 to 12 feet. "The research found no general indication that the use of lanes narrower than 12 feet on urban and suburban arterials increases crash frequencies. This finding suggests that geometric design policies should provide substantial flexibility for use of lane widths narrower than 12 feet." The research paper goes on to say "There are situations in which use of narrower lanes may provide benefits in traffic operations, pedestrian safety, and/or reduced interference with surrounding development, and may provide space for geometric features that enhance safety such as medians or turn lanes. The analysis results indicate narrow lanes can generally be used to obtain these benefits without compromising safety." and "Use of narrower lanes in appropriate locations can provide other benefits to users and the surrounding community including shorter pedestrian crossing distances and space for additional through lanes, auxiliary and turning lanes, bicycle lanes, buffer areas between travel lanes and sidewalks, and placement of roadside hardware." (2)

Above, example bicycle lane 'road diet' opportunity on Drayton Street.

Above, example bicycle lane 'stripe' opportunity on Drayton Street.

Precedent examples also show the large number of communities around the United States that have narrowed travel lanes to enable the development of bicycle lanes. The Missoula Institute for Sustainable Transportation accumulated a list of these communities through information provided by members of the Association of Pedestrian and Bicycle Professionals. The webpage titled "Accommodating Bike Lanes in Constrained Rights-of-Way (http://www.strans.org/travellanessurvey.htm) lists the community, their methods, and contact information. Cities such as Arlington, VA, Cincinnati, OH, Charlotte, NC, Houston, TX, and Portland, OR have regularly narrowed travel lanes to 10' or even commonly use them in new roadway development. Arlington, VA has been installing bicycle lanes on streets when they are repaved and have a number of streets with 10' lanes and bicycle lanes that have been functioning well without operational issues and complaints. Cincinnati, OH uses a policy that 10 foot lanes on collectors and arterials are always permitted. New installations

Sources for Bicycle Lane Development & Travel Lane Narrowing:

1) American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, Washington, DC 2004.

2) Relationship of Lane Width to Safety for Urban and Suburban Arterials, Ingrid B. Potts, Harwood, D., Richard, K, TRB 2007 Annual Meeting

of 10 foot travel lanes with bicycle lanes require a speed limit of 35mph or under. By restriping 12 foot lanes to 10 feet, the City of Houston, TX has converted 30 miles of arterial streets.

Lane narrowing and the addition of bicycle lanes will require consultation with SCDOT and further analysis beyond this planning effort. Changing the roadway design may also require a reduction in speed limit and consideration of traffic calming designs such as median islands. For roadways with higher speed limits and traffic volumes, wider vehicular and bicycle lanes may be warranted. Further analysis of bicycle lane restriping projects is warranted to determine appropriateness of lane narrowing, bicycle lane widths, and speed limits that impact both motorists and bicyclists.

For more information on these resources and studies please see:

Dan Burden (2000a), Traffic Calming, Traditional Neighborhood Streets and Emergency Responders, Center for Livable Communities, (http://www.lgc.org/freepub/docs/community_design/fact_sheets/er_street_design.pdf)

LGC (2007), Emergency Response and Traditional Neighborhood Street Design, Local Government Commission (www.lgc.org); at http://www.lgc.org/freepub/community_design/factsheets/er_streetdesign.html

Narrowing roadways for traffic calming purposes and bicycle facilities are common occurrences now since planners and engineers are trying to not only accommodate vehicles but bicyclists and pedestrians as well. Narrowing roadways to allow for bicycle lanes or other bicycle facilities is needed in some instances where current roadway widths and traffic volume do not allow for a simple "re-stripe" to paint in a bicycle lane.

One argument against this often comes from emergency responders who are concerned about narrow roadways limiting their access for vehicles such as fire trucks. Some research on this topic comes up with several resources. In summary, the emergency responders were contacted directly about the potential roadway narrowing projects and they were asked for input on solutions and were also educated to the facts about increased safety and reduced traffic accidents by the implementation of traffic calming measures such as roadway narrowing. The per capita risk of death from residential fires is far lower than from pedestrian crashes, which suggests that traffic calming can provide net safety benefits, although exact impacts vary depending on circumstances.

In most cases, the emergency responders and the City were able to reach agreements and design standards that allowed access for both bicyclists/pedestrians and emergency equipment. In some instances, if one roadway was getting narrowed then the emergency responders were able to focus their access route on adjacent roadways without causing any increased response time delay. In other instances, if no adjacent roadway was available to use, the City and emergency responders worked together on the specific roadway designs.

BICYCLE STATIONS AND PARKING

Bicycle parking is an essential component of the bicycle network by providing increased convenience and accessibility. During this planning process, Partners for Active Living (PAL) and SPATS determined sites for "Cycle Stations."

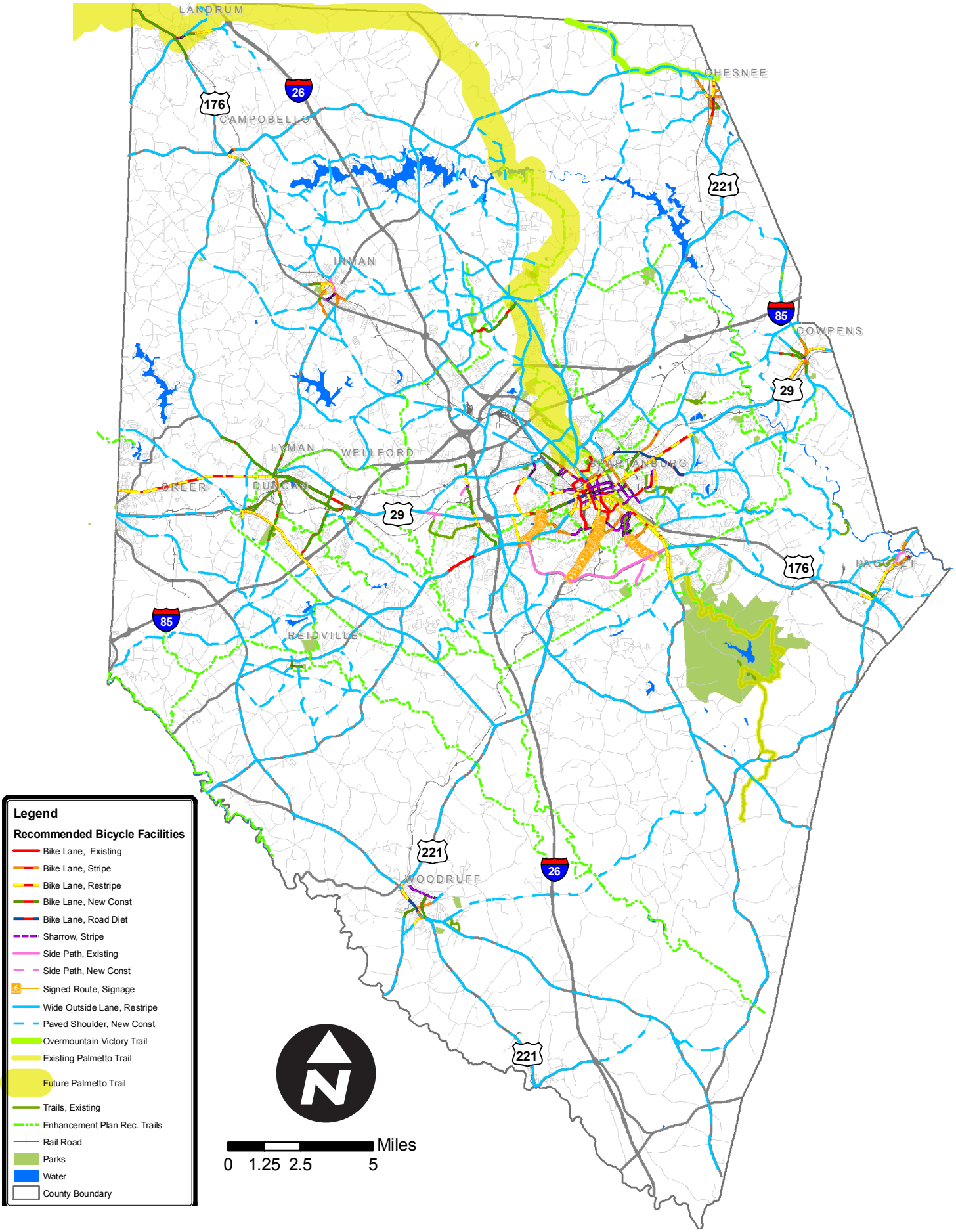
These bicycle stations are recommended at important destination hubs sited throughout the metro Spartanburg area and are displayed in the network maps. Integrating bicycle facilities with transit modes allows bicyclists to expand their range of travel through "trip chaining." Bicycle racks are recommended at strategic locations in the downtown area such as parking garages. These locations are listed below.

Cycle Station is a project that has received a large percentage of the funding necessary, with implementation possibly starting in the Fall 2009. This project may happen in a few stages. Stations would be locations with bicycles available, making trips or portions of trips possible by bicycle. The target locations and ideas are:

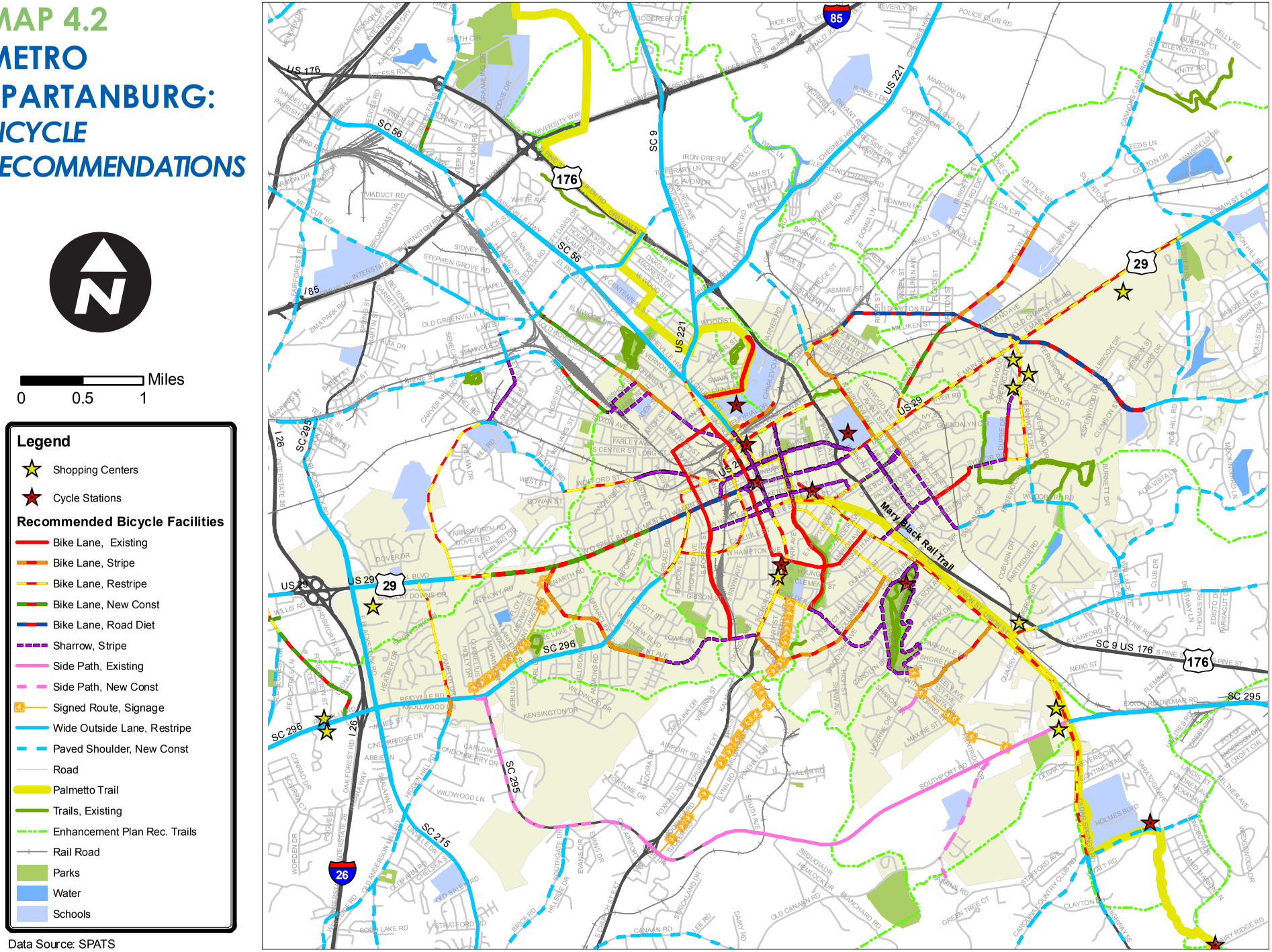
- Morgan Square
- Marriott
- Wofford College
- Converse College
- Mary Black Rail Trail
- South Side Grocery
- Duncan Park
- Library

It is recommended that further analysis be conducted to place bicycle racks at key destinations such as bus stops, shopping centers, and office complexes. Bicycle parking should also be made available with new development. Further information about bicycle parking and stations can be found in Chapter 10: Design Guidelines.

MAP 4.1 SPARTANBURG COUNTY: *BICYCLE RECOMMENDATIONS*



MAP 4.2
METRO SPARTANBURG: *BICYCLE RECOMMENDATIONS*



Data Source: SPATS

PUBLIC TRANSIT ACCESS

Above: examples of existing transit stops in Spartanburg.

It is critical that transit stops and their surrounding environments be safe and accessible for every transit user, in order to protect transit riders as well as better support and encourage transit use. Transit users need safe and convenient routes to get to and from transit. Riders will typically walk one-fourth to one-half mile (about a 5 to 10-minute walk for most people) to and from transit. Riders typically walk to a transit stop, board the bus, get off, and then walk to their final destination. Thus, the riders' needs as pedestrians extend beyond the bus stop to and from the surrounding neighborhood.

Many bus stops in the Spartanburg region area only marked with a sign and are without benches, sidewalks, safe crossings, and shelters. As a result, pedestrians must often cross busy streets and cut through parking lots to get to the bus stop or train station.

Transit agencies need to cooperate with SPATS and the City of Spartanburg to improve pedestrian access to transit. Building sidewalks will make bus stops more accessible. Safe and convenient crossings are also essential, especially for mid-block bus stops. New stops and stations can be placed with pedestrian (and bicycle) access in mind.

Above: example of a bus stop with sidewalks, shelter, area map and bicycle racks.

Providing a few amenities can make waiting for the bus or train a much more pleasant experience. Shelters with seating can offer protection from rain, snow, wind, and sun. Many transit agencies provide shelters at frequently-used bus stops and at outdoor rail stations. The shelters should be positioned so riders in wheelchairs have enough room to enter and exit the shelter. The sidewalk behind the shelter should be wide enough for two wheelchair users to pass each other and to handle the expected levels of pedestrian activity, including those who are just walking by. The best location for bus shelters is in the furniture zone, away from the walking zone.

Schedules and route maps should be placed at bus stops or in train stations to orient riders. Current technology makes it easy to have video monitors with bus arrival times in real time, displaying the number of minutes until the next bus or train and its destination.

REGIONAL CONNECTIONS

Spartanburg County should continue looking beyond its county limits and link bicycle facilities to neighboring and regional destinations. It is recommended that Spartanburg County continue to coordinate efforts with surrounding counties and communities such as Greenville County, Cherokee County, Polk County (NC), and others to create long distance connections for alternative transportation and recreation. Recently, Greenville County completed a greenway master plan. It will be critical to ensure compatibility and connectivity with these planning efforts and actual bicycle and pedestrian facilities that meet at municipality borders.

Regional greenway corridors such as the Palmetto Trail and Overmountain Victory National Historic Trail will encourage and draw users from all over the region into the area and to other locations, boosting tourism and interest in trail expansion. Long-range efforts should be made to connect to this regional network.