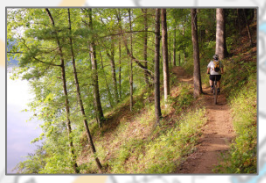
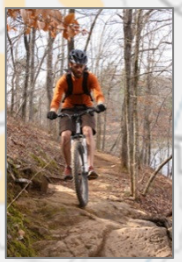




CLEMSON UNIVERSITY

Bikeways Master Plan 2012

UNIVERSITY PLANNING & DESIGN OFFICE

FINAL PLAN | ADOPTED JUNE 2012

Introduction

Clemson University is committed to being a state and national leader, aiming to be one of the top 20 public institutions by 2020. With that goal in mind, we are taking steps to transform the way we work, learn, play, move and live.

In 2007, President Barker signed the American College and University Presidents' Climate Commitment along with more than 750 institutions of higher learning across the country. In 2009, the President's Commission on Sustainability was formed to guide the university community on matters of energy, conservation and transportation through specific action steps outlined in the Clemson University Sustainability Action Plan. Through this commission, campus sustainability has becomes a guiding principle within the campus culture.

Campus recreation also plays an important role in campus life. The natural landscape provides many inspirational places and facilities for people to enjoy. Students can play on the green, lush fields on campus, read under trees, relax on the beach and explore the acres of the Clemson Experimental Forest.

Developing a bikeway system supports the University's commitment to environmental sustainability and provides engaging opportunities to promote health and wellness for active lifestyles for members of the Clemson community. This plan outlines a comprehensive network of bike lanes, shared roadways, shared use paths and mountain biking trails that connects the entire extended campus. Looking at previous campus planning efforts, a history of the Clemson Experimental Forest and how other university and colleges have been transformed by bicycle infrastructure investments, this plan hopes to provide a framework for developing an integrated, comprehensive bikeway network at Clemson University.

CLEMSON
UNIVERSITY

Acknowledgements

Clemson University Planning and Design Office

Planning Staff

Gerald Vander Mey Director

Tanya DeOliveira Planner

Graduate Student

Erika Mueller

Table of Contents

Approved by the Clemson University Administrative Council on June 11, 2012.

Section 1. Vision & Goals

Vision

Create a bicycle system that promotes safety and provides a robust network of commuting and recreational pathways that connect the entire extended campus.

Goals

1. **Develop integrated bikeways and linkages that connect to important destinations and recreations areas.**

Objective

1.1 Establish linkages and connections to on-campus housing, academic and athletic facilities and other major activity centers on campus. Extend the network to promote connections to off-campus facilities.

1.2 Promote the connection of the Campus to the north and south areas of the Clemson Experimental Forest.

1.3 Develop a specific, prioritized set of trail heads and bike trails in the Clemson Experimental Forest that are regularly managed and maintained.

2. **Provide an environment that will lead to a pleasant bicycling experience.**

Objective

2.1 Expand bicycle signage and pavement markings to promote bicycle route connectivity, a sense of safety and a place for those who ride bicycles.

2.2 Develop a comprehensive, clear wayfinding system for those who ride bicycles on the extended campus, including the development of trail heads and trail signage throughout the roads and trails of the Clemson Experimental Forest.

2.3 Provide and maintain a Clemson University Bicycle map.

2.4 Provide space to install adequate, safe and attractive bicycle storage and/or parking facilities at important locations and destinations.

2.5 Discuss with SCDOT engineers and other officials about the installation of bicycle detection facilities at critical signalized intersections.

3. **Develop a bikeway system that supports and inspires users of all ages and abilities.**

Objective

3.1 Provide connections between on-road and recreational bikeways.

3.2 Coordinate bikeway routes to provide connections to the CAT bus system where feasible.

3.3 Ensure that new and improved bicycle facilities conform to best practices and guidelines provided by SCDOT, AASHTO and other state and national performance standards.

Section 2. Background

Clemson University's Existing Plans

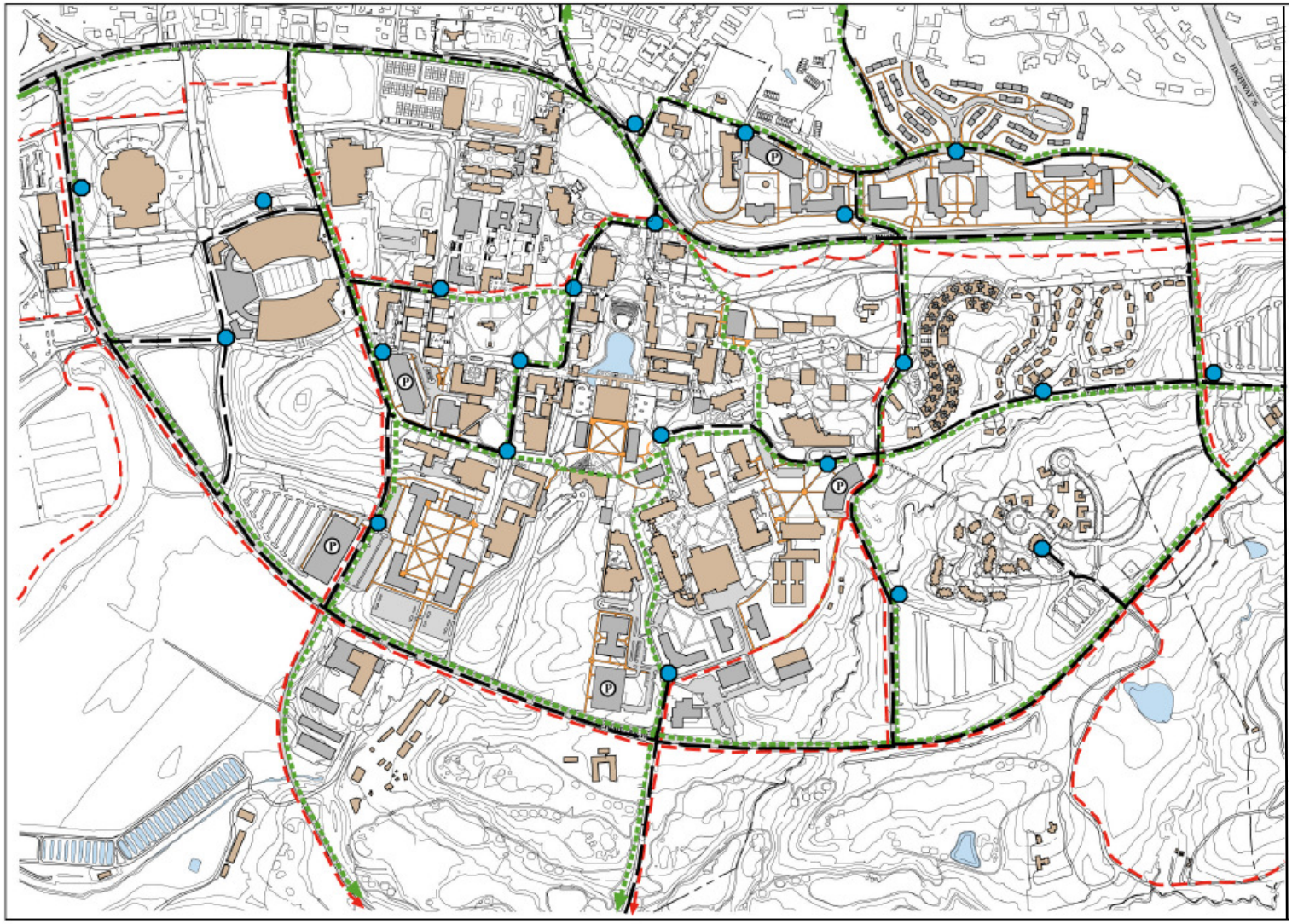
Clemson University's previous master planning efforts have broadly supported the development of bikeways within the campus. Related to transportation, the University's previous planning efforts have focused on circulation and transportation from a vehicular and pedestrian perspective.

Since the 1980's, the University has planned for basic bikeway facility improvements on campus. The Bicycle System Design Guidelines for Clemson University were developed as part of the 1982 Clemson University Comprehensive Master Plan. The guidelines describe procedures and standards for unifying the bike routes, paths, lanes, lighting, racks, parking areas and storage areas on campus. The proposed bicycle system map found in the 1982 Master Plan lead to bikeway planning efforts in the 1990's.

Stemming from the Design Guidelines and the Areawide Transportation Study that was prepared for the City of Clemson and Clemson University in 1988, a bikeway network was proposed for parts of downtown Clemson and Clemson University's campus. In 1990, graduate students from the University prepared the Clemson Bikeway preliminary bicycle plan for the City of Clemson's Planning Commission. The bikeway routes proposed were similar to those suggested in the 1988 plan. The plan took an in-depth approach to bicycle planning by identifying the need for a defined bikeway system as well as explaining bikeway classifications, the need for construction and maintenance, safety, budget guidelines and recommended improvements.

The Clemson University 1992 Long Range Master Plan laid out a bikeway network of along the major streets of campus: Perimeter Road, Cherry Road, Williamson Drive, Centennial Boulevard, Old Greenville Highway and parts of McMillan Road. In the mid-1990's, based on plan recommendations, a bike lane was installed along Perimeter Road from Old Greenville Highway to Cherry Road. A shared roadway was officially designated on Old Greenville Highway from Cherry Road to Perimeter Road by the installation of one "share the road" sign. The University won a Transportation Enhancement grant that provided funds for construction of the bikeways.

The 2002 Campus Master Plan was the last planning document that identified improvements to the bikeway network on campus. Other University Plans (Center of Centers Master Plan 2003, High Ground Precinct Master Plan 2008) that have been written since have mentioned the existence of bicycles on campus by either stating that students use them or the need for additional bike racks.

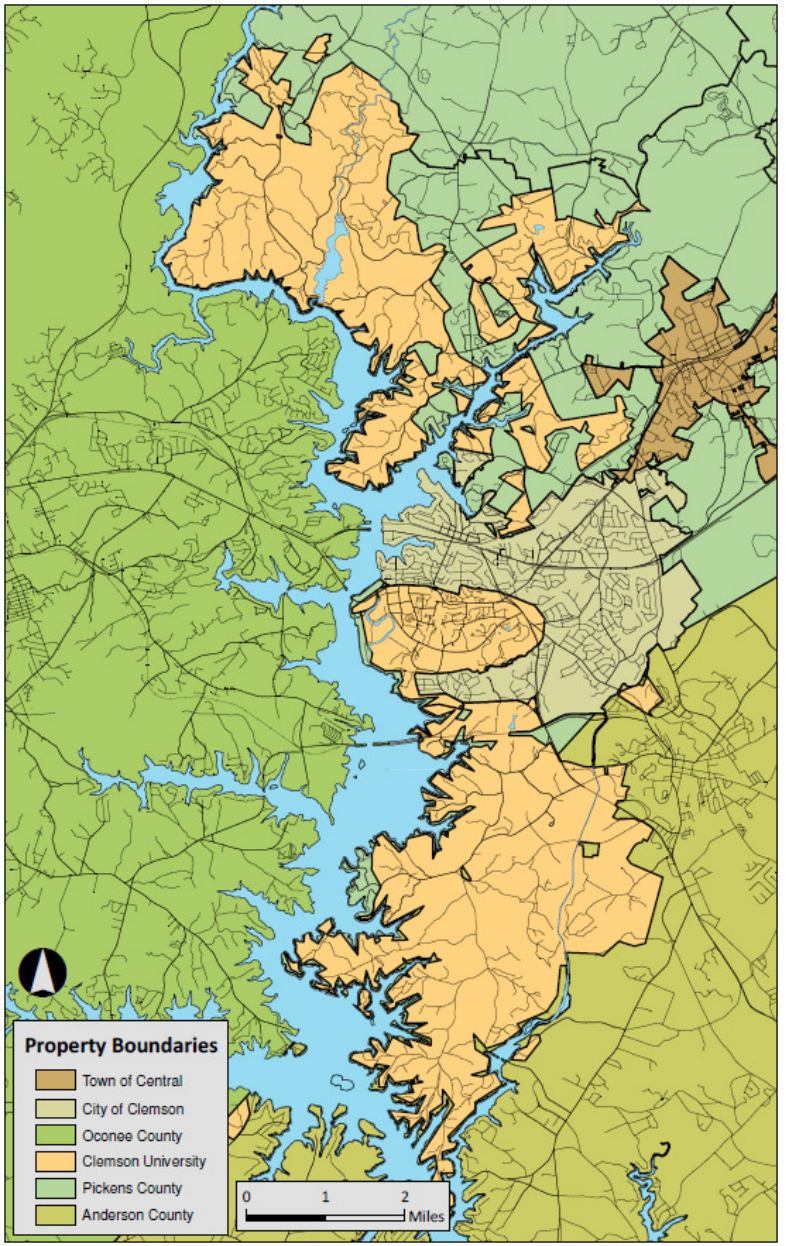


Traffic Circulation Map. Campus Master Plan. Clemson University 2002

Local Community Plans

Many of the local communities surrounding Clemson University have plans that support the development of bikeways. The Town of Pendleton and the cities of Clemson, Easley, Anderson and Greenville have plans that support the development of bikeways. The Clemson Bikeway Plan completed in 1990 was the first bicycle plan for the area. In 1997, the City of Clemson completed a Clemson Bikeways plan that outlined a bikeway system that included routes, bike lane classes, signage, budget and other bike facilities. Most of the plan's recommendations have been achieved, providing some basic improvements to bicycle infrastructure and safety. The City of Clemson Comprehensive Plan 2014 supports improvements to the existing bikeways system within the city limits.

In the early 2010's, the cities of Greenville and Easley completed bike plans. Though these cities are outside of the typical planning area of the University, connections could potentially be made with the CU-ICAR facility in Greenville to establish a larger, regional bikeway system.



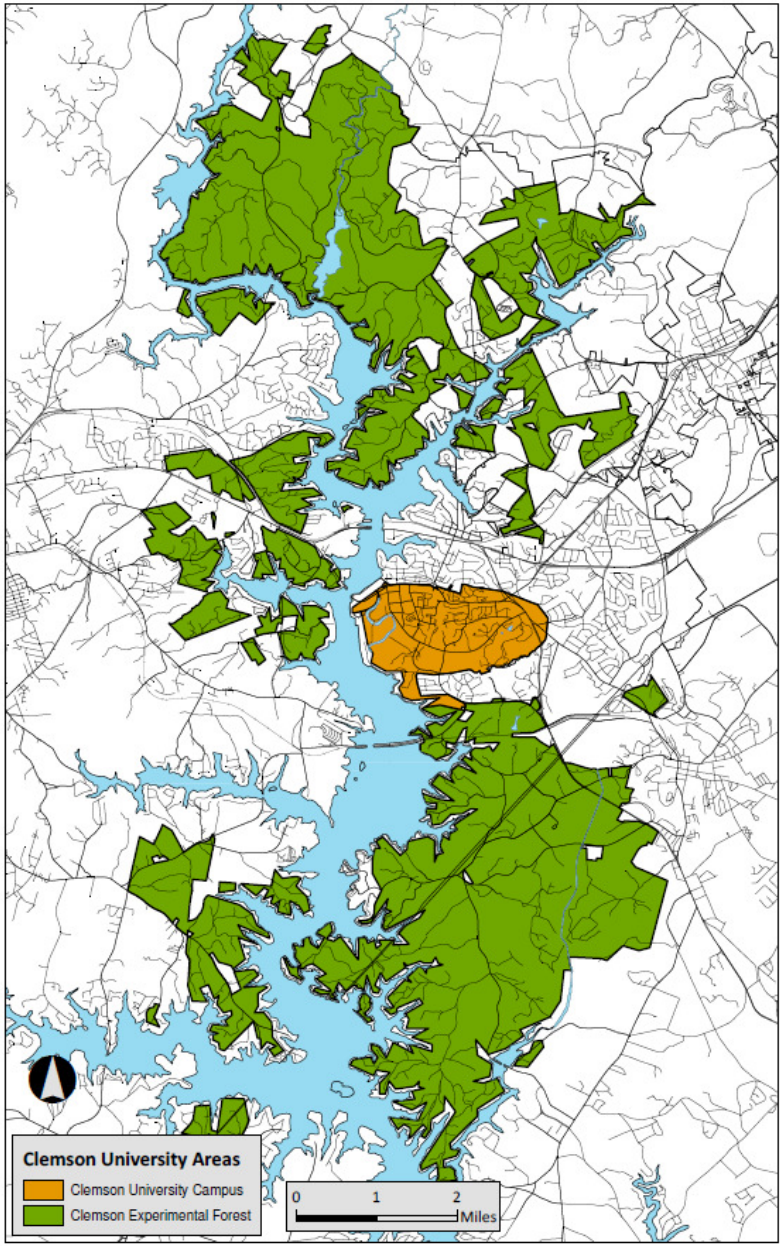
University and local community boundaries

Clemson Experimental Forest History

Dating back to the Roosevelt Administration's New Deal Program of the 1930's, the Clemson Experimental Forest was developed "to improve the state of the impoverished people and degraded lands surrounding Clemson College." Nearby worn-out farmland and low-grade timber areas were cleared and planted with pine and hardwood seedlings, setting the stage for the enjoyment and management of the natural resources near the University. Lake Issaqueena was established and stocked with fish. Roads, bridges, trails and other recreational facilities were developed in the Forest. In 1939, Clemson entered into a lease agreement with the federal government to take over the administrative responsibilities of the forest land and project. In 1954, the Forest was deeded to Clemson College.

The 1950's brought change to the Forest. Lake Hartwell was developed and flooded portions of the property. The primary purpose became natural resource education and research. Forest management continued to play a minor role until 1947. In the 1960's, recreational horseback riding became more common as the equestrian program in animal science grew. By 1976, as the College came to be a leader in forest management research, college officials incorporated forest management activities into the mission of the Forest.

Recreation use increased as mountain bikers began to explore the forest in the early 1980's. Interest in the sport continued to climb, especially after the Atlanta 1996 Summer Olympics, when Mountain Biking became an official Olympic sport. Mountain bikers across the Southeast are

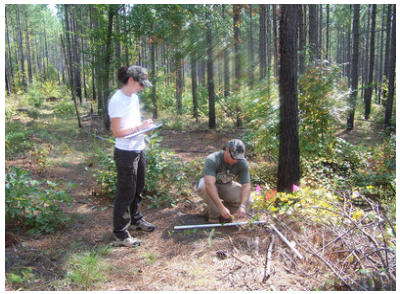


Clemson Experimental Forest

drawn to the Forest due to its unique terrain, proximity to major urban areas (Greenville, Atlanta, Charlotte) and lack of user or park fees.

Hunting and fishing have also been permitted in the Forest, and, since 1980, portions of the forest have been included in the South Carolina Wildlife Management Areas program. Licensed fishing is allowed in areas that are not under university research. Hunting by rifle, shotgun and archery is permitted with a state hunting license and WMA permit in designated areas, during certain times of year and within game limits. Signs with information about hunting data, game and allowable ammunitions are posted in the Forest.

With the increase in use of the Forest, the 2000 Management Plan recognized the need to manage recreational resources to reduce the associated liability. The decision acknowledged the Forest as a place to experiment with trail design, maintenance technologies and strategies, dividing Forest use by trail users and use intensities, including use as an outdoor classroom. Using a collaborative adaptive management process, various users, managers and scientists have been invited to work together to devise the best plan for the Forest trails and resources. The trail system and management plan that developed set the stage for the use and management of the Forest for over the next ten years.



Use of the Forest has increased over time. Timber production has been a long-standing, major activity in the Forest, and for many years has been main revenue generator. Academic and recreational users from the Clemson area and beyond are drawn to the Forest to conduct research and enjoy the natural resources and trails. Community groups have played a role in developing the trail system since the 1930's. Students are drawn to use the forest for academic projects and recreation. The Forest continues to be managed today as it began, as a resource for the Clemson community to enjoy and preserve for future generations.

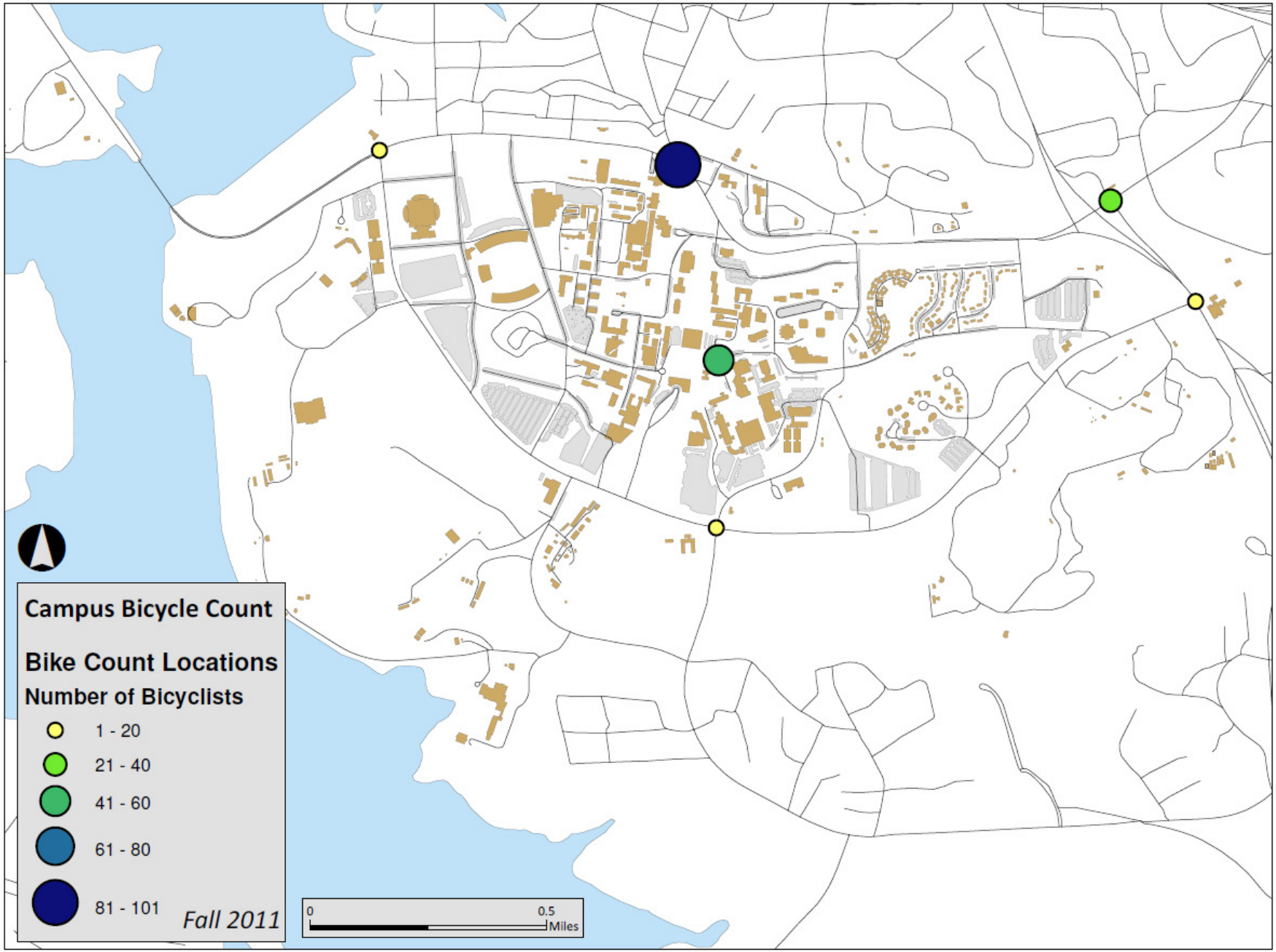
Institutional Support

Since 2000, the University has invested in and promoted sustainable, environmental plans, programs and initiatives on campus. In 2005, a Sustainable Building Policy was developed to demonstrate the University's commitment to environmental, economic and social stewardship. In 2009, The President's Commission on Sustainability was formed to creatively address sustainability by integrating education, research and public service. The Solid Green campaign is Clemson's environmental sustainability campaign that encourages conservation and recycling. The President's 2010 – 2011 Report summarized new future program goals and developments, including investments in transportation technology, greener energy and sustainability. The 2020 Road Map, a ten year plan, has pushed the University to strive to achieve significant goals that focus on addressing the major challenges of health, energy, transportation issues and create a sustainable environment. In 2012, a car-sharing program began that includes low emission and electronic automobiles and the ride-sharing program called Zimride.

Surveys and Studies

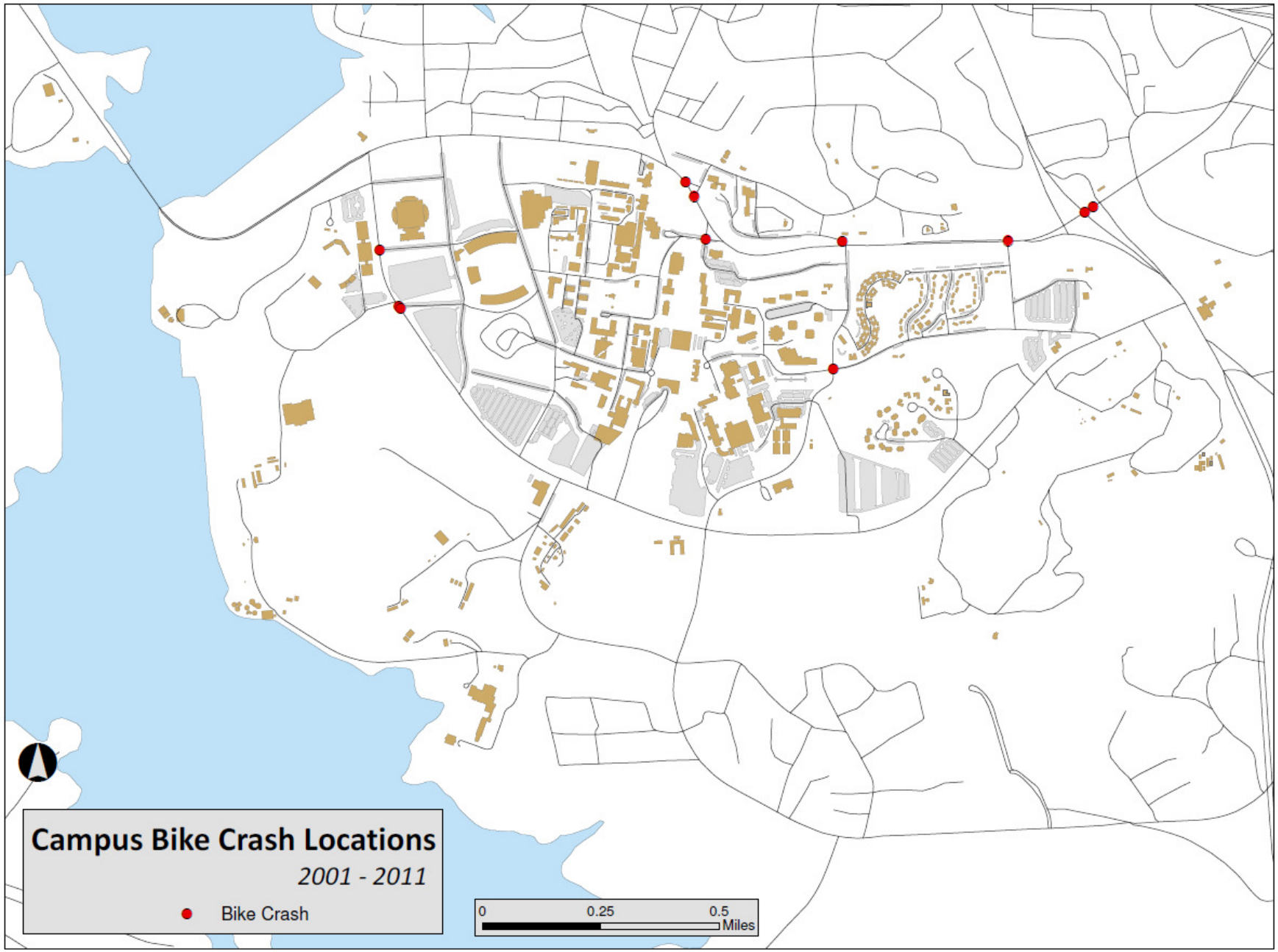
Bicycle Count

In late fall of 2011, a bicycle count was conducted at several intersections within the University boundaries. Volunteers counted a total of 218 cyclists on the first Tuesday afternoon and Wednesday morning in November 2011. Volunteers were trained using information from the National Bicycle and Pedestrian Document program, and then recorded information in the field for two hour increments at several locations on campus roads. Most of the count stations were on the perimeter of campus, providing information on the number of cyclists riding in and out of campus. See the map on the following page for more detailed information. The highest counts were recorded the intersection of Old Greenville Highway and College Avenue.


Campus Bicycle Count
Bike Count Locations
Number of Bicyclists
1 - 20
21 - 40
41 - 60
61 - 80
81 - 101
Fall 2011
0
0.5
Miles

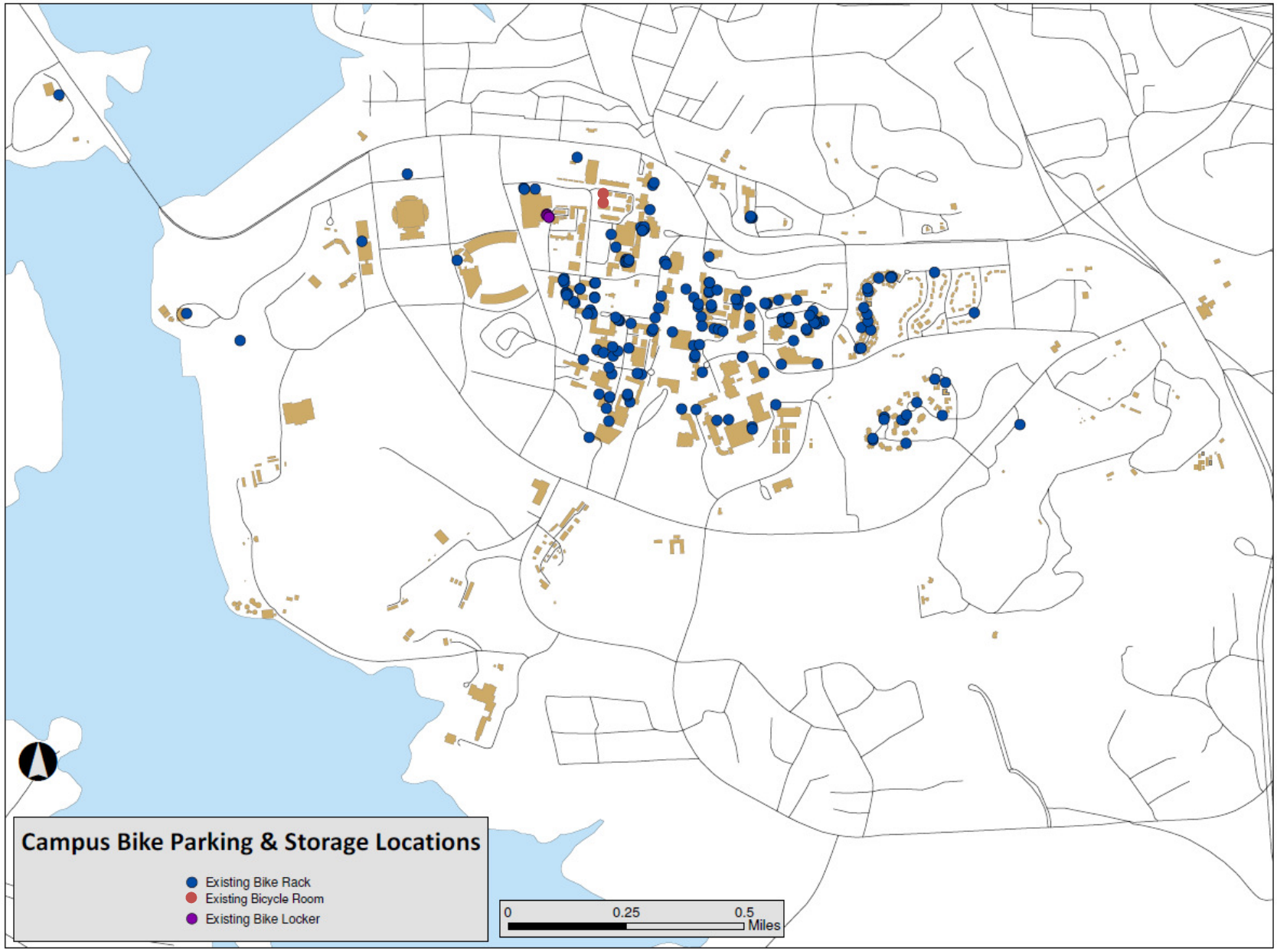
Crashes

Data for bike crashes was collected from the Clemson University Police Department and SC DOT from 2001 – 2011. There were 11 crashes total. The intersections of Press Road and Perimeter Road and Hwy 93 and the off/on road ramps of Hwy 76 each had two reported crashes. It should be noted that University Police cover a majority of calls on campus roads. Additionally, University Police TR 310 crash reports do not provide a way to classify and track bicycle-related crashes. Information related to an event involving a bicycle is only recorded in the general comments section of the report, and no further tracking is done. See the map on the following page for crash locations.


Campus Bike Crash Locations
2001 - 2011
Bike Crash
0
0.25
0.5
Miles

Bicycle Parking

In the first half of 2012, a bicycle rack survey was completed by student volunteers used a PinPoint GPS device. Information on individual bike rack location, the number of bikes at each rack, type, potential capacity and various other rack conditions about racks on campus was collected. A photo of each bike rack was also taken to start an inventory of the different bicycle rack types that are used at Clemson University. A small group of bicycle lockers were also located on campus. They are owned by CORE, and are currently not being used. See the map on the following page for bicycle parking locations.


Campus Bike Parking & Storage Locations
Existing Bike Rack
Existing Bicycle Room
Existing Bike Locker
0
0.25
0.5
Miles

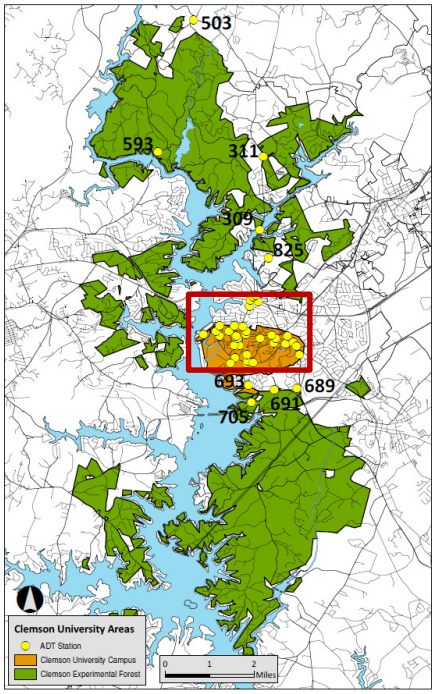
Traffic Counts

Annual average daily traffic (ADT) counts are taken every year by the South Carolina Department of Transportation. Traffic count stations are placed on many of the Campus and Forest roads. Traffic counts are useful to keep track of traffic volume trends and can be used to help determine what bikeway facility type (bike lane, shared roadway) should be used. Roads that contain ADT volumes that are less than 5,000 and have speed limits posted at 35 mph or less may be best suited for shared roadways. Roads with ADT volumes greater than 5,000 and have speeds limits that are posted at greater than 35 mph may be best suited for bike lanes. The following table records annual ADT data from 2006 – 2010 on Campus and Forest roads. A map with station locations can be found on the following page.

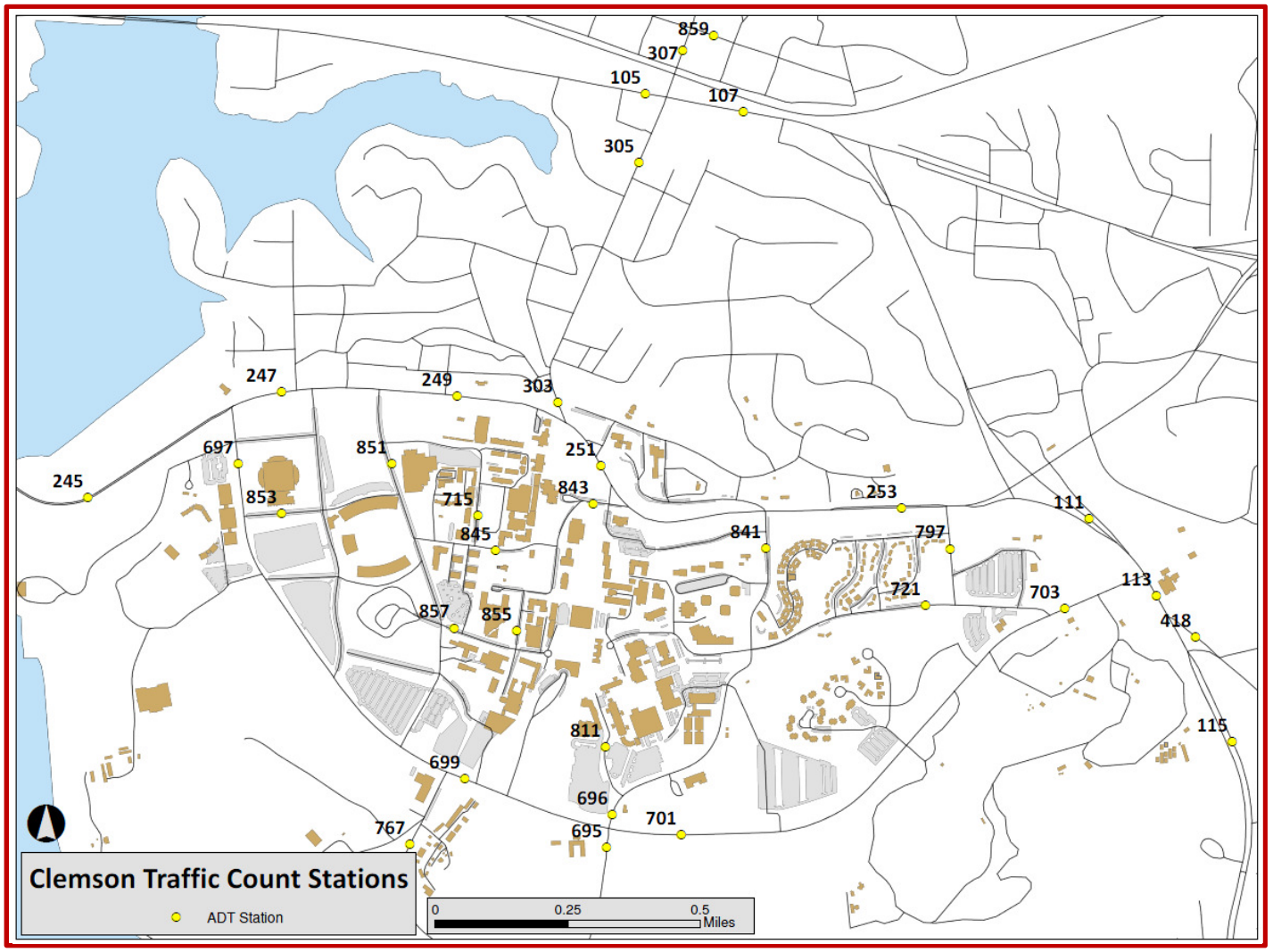
Table 1. Annual Average Daily Travel Counts, 2006 - 2010

Road Name	Station	2006	2007	2008	2009	2010	Percentage Change 2006 - 2010
Hwy 123	105	28,800	28,800	27,500	26,700	28,200	-0.4%
Hwy 123	107	31,700	34,000	31,600	30,900	32,900	0.7%
Hwy 76	111	21,800	22,000	22,900	22,500	22,700	0.8%
Hwy 76	113	20,900	20,900	21,200	21,500	21,300	0.4%
Hwy 76	115	14,100	14,400	14,300	14,800	16,300	2.7%
Old Grnvl Hwy	245	11,400	10,900	10,900	10,600	11,000	-0.7%
Old Grnvl Hwy	247	7,800	8,800	7,800	7,200	7,100	-2.0%
Old Grnvl Hwy	249	12,300	13,300	11,500	10,700	11,200	-2.0%
Old Grnvl Hwy	251	14,300	14,300	13,500	13,100	14,300	0.0%
Old Grnvl Hwy	253	15,200	15,100	16,900	16,700	16,100	1.1%
College Ave	305	15,700	16,000	4,100	14,100	15,200	-0.7%
College Ave	307	13,500	15,100	15,100	13,800	12,700	-1.3%
Six Mile Hwy	309	6,000	6,100	6,100	5,600	5,700	-1.1%
Six Mile Hwy	311	5,600	4,900	4,900	4,800	5,300	-1.1%
College Ave	303	11,300	11,900	11,000	10,600	11,700	0.7%

Road Name	Station	2006	2007	2008	2009	2010	Percentage Change 2006 - 2010
Pendleton Rd	418	7,300	7,300	7,200	6,800	7,100	-0.6%
Old Seneca Rd	503	1,500	1,500	1,850	1,550	1,600	1.3%
Old Seneca Rd	593	1,300	1,350	1,700	1,350	1,400	1.4%
Old Stone Church Rd	689	2,600	3,100	3,200	3,000	3,600	5.6%
Old Stone Church Rd	691	8,300	8,500	8,900	8,200	9,100	1.8%
Old Cherry Rd	693	6,400	6,900	7,100	6,900	7,000	1.7%
Old Cherry Rd	695	6,700	6,600	7,100	6,600	6,200	-1.6%
Cherry Rd	696	7,500	7,600	7,500	7,000	7,400	-0.3%
Perimeter Rd	697	9,500	9,300	9,000	9,100	9,300	-0.4%
Perimeter Rd	699	11,800	12,300	12,100	11,900	11,500	-0.5%
Perimeter Rd	701	8,400	8,400	8,600	7,700	7,700	-1.8%
Perimeter Rd	703	8,900	9,100	9,200	9,600	9,300	0.9%
Old Cherry Rd	705	4,900	4,500	4,700	5,000	5,400	1.9%
Klugh Ave	715	2,500	2,300	2,300	2,200	1,950	-5.6%
McMillan Rd	721	3,300	3,200	2,900	2,500	2,800	-3.6%
Old Stadium Rd	767	1,750	1,850	1,900	1,450	1,350	-5.9%
Newman Rd	797	3,400	3,200	3,100	2,400	2,400	-8.3%
Jersey Ln	811	850	900	900	900	1,000	3.0%
Clemson St	825	325	300	275	300	350	1.4%
Cherry Rd	841	8,400	7,900	7,700	7,400	7,900	-1.3%
Calhoun Dr	843	4,900	4,200	3,800	4,200	4,200	-3.3%
Fort Hill St	845	3,000	3,200	2,700	2,900	2,800	-1.4%
Williamson Rd	851	6,400	6,600	7,400	5,700	5,800	-2.1%
Avenue of Champions	853	750	750	950	1,000	1,200	7.5%
Fernow St	855	2,500	2,300	2,400	2,000	2,400	-0.8%
S Palmetto Blvd	857	3,200	3,000	2,700	2,400	2,800	-2.9%
Calhoun St	859	3,300	3,900	4,000	3,700	3,700	2.2%



Clemson Area Traffic Count Stations. See map on the right for more details of station locations around Clemson University campus.



Clemson University Sustainability Survey

A Clemson University Sustainability Survey was completed in the spring of 2011. 60% of respondents felt that it is important that the University be a leader in sustainability and the environment. A majority of respondents felt a sense of responsibility and an ability to protect the environment. Despite these attitudes and feelings, 70% of respondents indicated that they drove cars when given a choice to either ride a bike or drive a car.

CUPD Bike Patrol Survey

The Clemson University Police Department has a Bicycle Patrol volunteer program. Police officers that choose to be part of the program are trained, and divide their patrol time between using cars and bicycles during their shift on the main part of the campus. The Department has a Bike Patrol Survey available online that provides feedback on the service of the program. Respondents felt that officers on bikes were more approachable, they were an asset to forming a safer campus community and that the program was a way to promote the Clemson Solid Green program. They also indicated that the bike patrol was not that visible on campus.

Student Projects Related to Bikeways

A 2011 Landscape Architecture Capstone Project looked at biking in the greater Clemson area. A survey on biking and walking habits was included. Over half of respondents indicated that they would be more comfortable biking to campus if it was safer. 40% said that if they had a bike or if their bike was fixed they would be more likely to bike. Of those that currently bike, 70% like to bike because it's good exercise. Respondents also indicated that a major barrier to not biking is the lack of having a working bicycle.

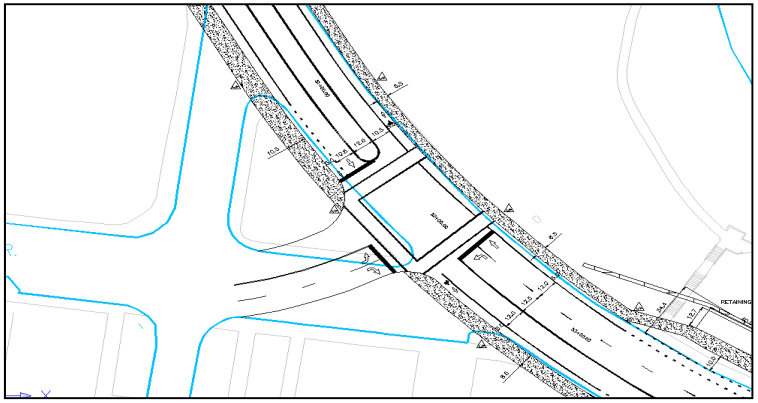


Image of Old Greenville Highway reduced to 3 lanes. Intersection near Sikes Hall

In 2011, a Civil Engineering Capstone Project proposed a 3-lane road diet for the Old Greenville Highway corridor that runs from the intersection of Perimeter Road to the intersection of Cherry Road. The project included designs that reduced the total number of vehicular traffic lanes from four to three with the additional space dedicated to bike lanes, sidewalks and bus shelters.

Trail use in the North Forest was the focus of a 2012 thesis by a doctoral student in the Department of Parks, Recreation and Tourism Management. Trail conditions, use and design was reviewed and mapped throughout the North Forest to evaluate use and inform management decisions in the future. Visitor experience and distribution was also assessed. The intent of the study is to conduct a comprehensive assessment of how visitors use and influence the North Forest and how North Forest management can best serve visitors. Thesis results were not available at the time of the completion of this plan but will be reviewed and incorporated into this plan as appropriate.

2007 Parking and Transportation Master Plan

In 2007, the University developed a Parking and Transportation Master Plan. Transportation demand management programming was examined, and Cornell University was used as a case study university. According to the plan, two key elements were required for a successful bicycle program at Clemson: secure parking and safe routes. The plan mentioned that a bike path to Hwy 76 was planned and that starting a small pilot bike share program should be considered. A recommendation of the plan was to increase covered, enclosed bicycle storage on campus.

2005 Clemson Travel Patterns

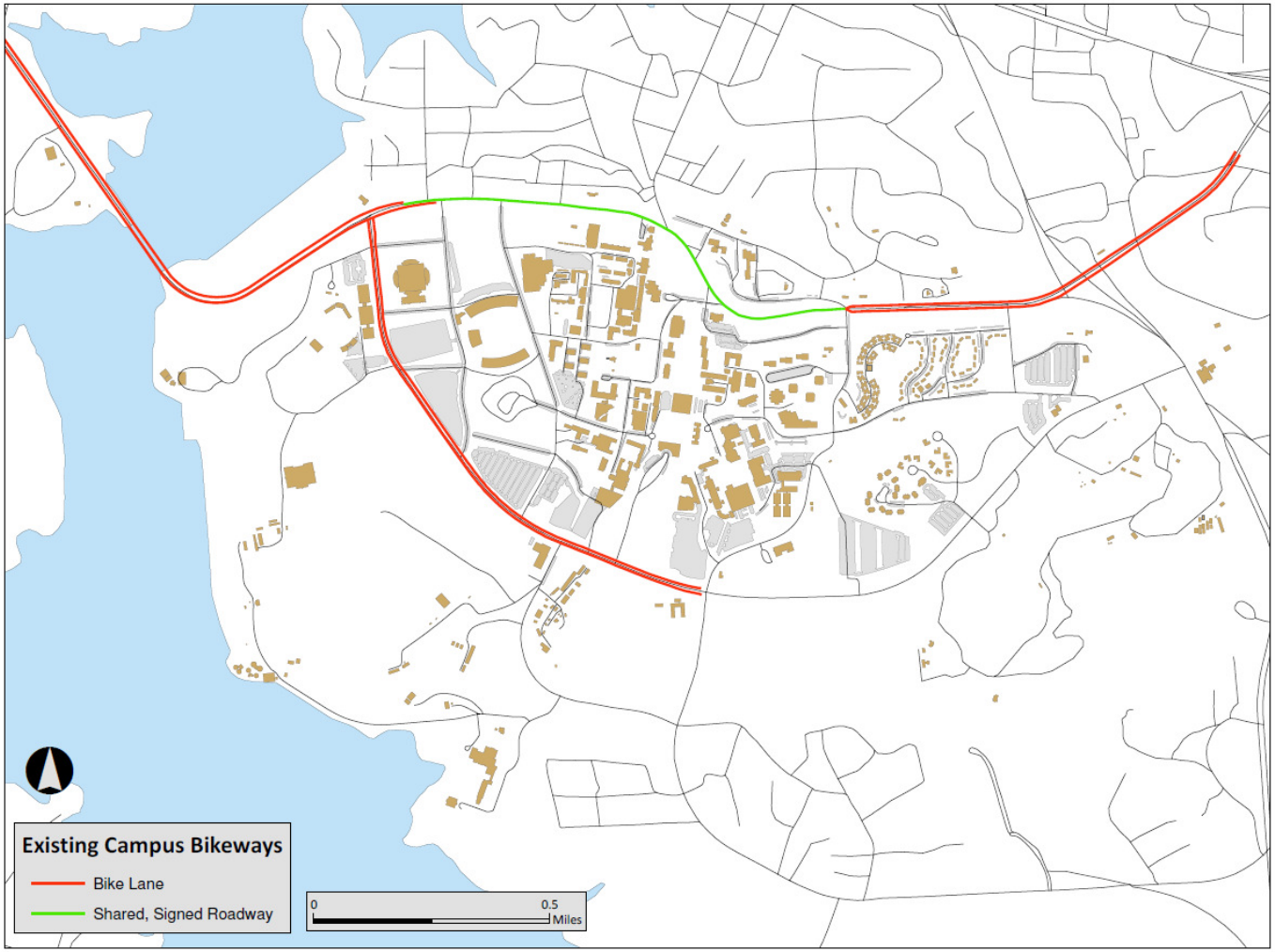
In 2005, a City and Regional Planning Studio examined travel patterns on campus. Survey results indicated that the ideal bicycle commute time would be between 5-15 minutes. 4% of respondents used a bicycle to travel to campus. A majority of respondents indicated that they would like more bike lanes, and 48% requested covered bike racks. One-fifth of those respondents would be willing to pay higher student fees for these facility improvements. Aggressive Drivers and a lack of bike lanes were the main issues identified as reasons why cyclists avoid certain parts of Clemson. The survey found that biggest barrier to biking was not having a bike on campus.

Section 3. Existing Conditions

Existing Campus Conditions

Existing Bikeways

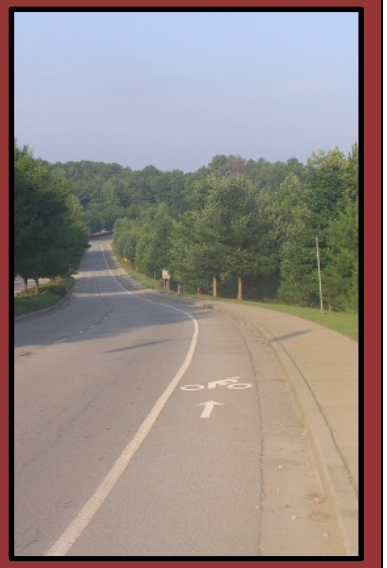
There are approximately 4.24 miles of existing bikeways on campus. Bikeways were installed on a few campus roads in the mid 1990's with an ISTEA grant from the federal government based on 1992 Campus Master Plan recommendations. Bike lanes exist along the far western and eastern sections of Old Greenville Highway within Clemson University Campus boundaries and along the western half of Perimeter Road as shown on the map. Old Greenville Highway is designated as a shared roadway from the intersection of Cherry Road to the intersection of Perimeter Road.



Existing Campus Bikeways

The condition of the bikeways on campus ranges from debris-free and clearly designated to poorly signed, debris covered and narrow. The shared roadway, which runs for one mile along Old Greenville Highway, is designated by only one "Share the Road" sign. Speed limits on Perimeter Road range from 35 mph to 45 mph. The table below contains photos of some of the existing bikeways conditions on campus roads. The conditions are listed below and range from good to poor. The photos are useful in identifying the characteristics of good and poor bikeways conditions.

Table 2. Campus Bikeways Photos and Conditions

Photographs of Existing Bike Lanes and Conditions on Campus			
Good	**Fair**	**Poor**	**Poor**
			
Bike Lane ***Old Greenville Hwy.*** **Good Pavement Marking.** **Debris-Free Bike Lane.**	**Bike Lane** ***Perimeter Road.*** **Road Debris. Hidden Sign.**	**Bike Lane** ***Perimeter Road.*** **Overgrown vegetation.** **Poor pavement condition.** **Raised/uneven bike lane.**	**Shared Roadway** ***Old Greenville Hwy.*** **Lacks Signs, Shared Lane Markings**

To get a better understanding of campus roadway design and conditions, a roadway cross-section inventory was completed for several roads. Each cross section spans the roadway, and includes sidewalk, shoulder, parallel parking spots, bike lane and travel lane widths, if they are present. Recording this information is helpful in seeing how the road width and design changes and can show how the condition can shape the feeling of traveling by car, bike or on foot.

Results from the inventory show that many roads have varying shoulder, traffic lane and parallel parking widths over short distances. This can make traveling by bicycle difficult. If a bicyclist has to merge from the shoulder to sharing the travel lane in a short distance with no visible signage or pavement markings communicating expected behavior, this can create an unsafe condition on the roadway. Inconsistencies like this along a roadway can create an unsafe environment for bicyclists if their place is not clearly designated.

There are a couple of places on campus where this occurs. For example, along Cherry Road, which is less than a mile long, there are at least 5 different roadway widths and conditions. Perimeter Road, from Old Greenville Highway to Cherry Road, also has a number of inconsistencies and road condition changes that may lead to an unsafe feeling for bicyclists. A cross section of Perimeter Road is shown on the following page. More consistency in road, shoulder and parallel parking striping efforts can dramatically affect on-road bikeway facilities. Please see Appendix B for more on campus roadway cross sections.

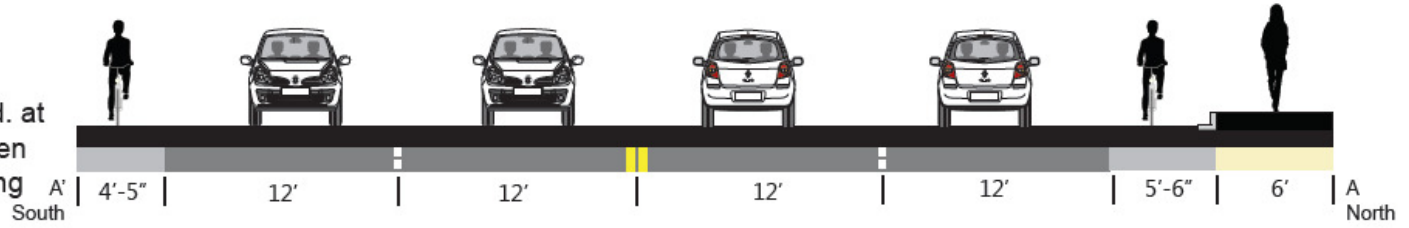
Clemson University Bikeways Master Plan
Cross Sections

Perimeter Rd.
Existing Conditions

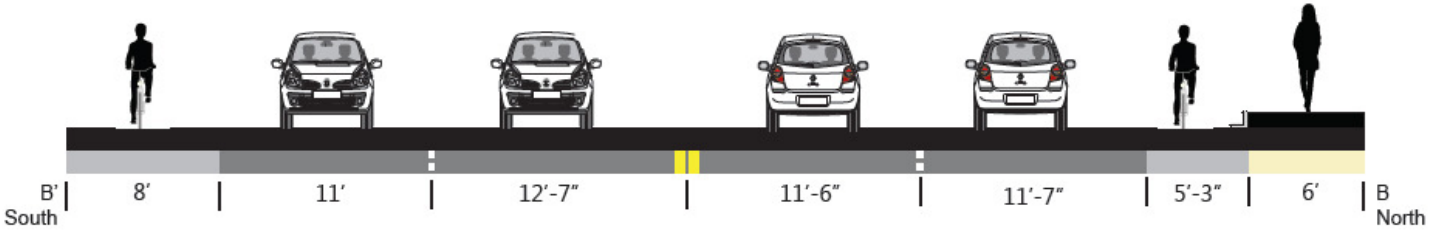
May 2012

A, B, & C - Perimeter Rd.

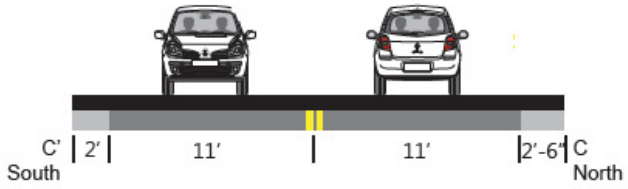
A - Perimeter Rd. at Press Rd. between P3 and P4 Parking Lots



B - Perimeter Rd. between Lambda St. & Kappa St.



C - Perimeter Rd. at Duck Pond Rd.



Sidewalks and Bicyclists

Many bicyclists use the sidewalk on campus, even along areas where a designated bikeway exists. In some areas, cyclists do not feel safe or comfortable riding in the road with traffic and will ride on the sidewalk instead. In other area, sidewalks provide quicker, more convenient paths than the road. Cyclists riding on the sidewalk create many opportunities for potential conflict with pedestrians, especially in high traffic areas like near the Cooper Library and along Old Greenville Highway in front of Bowman Field.

Bicycle rider on the sidewalk near Bowman Field.

Signage & Pavement Markings

Bikeway signage and pavement markings are present on some bikeways on campus. Standard bike lane pavement markings are found on some of the bike lanes on campus. All of the existing bike lanes are appropriately striped, but some are missing a MUTCD bike lane figure. Current bike lane signage is also missing from all bike lanes. The bike lane signs on Perimeter Road are out of date, and need to be replaced. Standard, consistent markings are preferred on all bike lanes. (Refer to page 3.1 to review the existing campus bikeways map.)

The designated shared roadway found along part of Old Greenville Highway only has one “Share the Road” sign, and is only facing one direction. No other bikeway signage, pavement markings or designation exists along this route. This is the only shared roadway within the boundaries of the University campus.

Bike Racks

Design Guidelines written in 1982 provides recommendations for bicycle parking, including a preferred bicycle rack and guidelines for rack placement. The actual type of bicycle rack found around the campus varies. Many racks are found behind or to the sides of buildings, pushed up against plants or buildings, on uneven ground, covered by wood chips and in other inconvenient places, reducing rack access and usability. In some areas on campus, bicycle riders improvise, creating their own bike

Bicycles parked on the railing near the Cooper Library entrance.

racks. Racks located near campus housing or academic buildings are often overcrowded, especially during class time.

Maintenance

There is no maintenance schedule for clearing bikeways on campus. Bike lanes are rarely swept, and especially littered with debris after storm events. In some areas, grass and tree branches are impeding the bikeway, making the lanes dangerous to use. Bike lane striping and pavement markings on Old Greenville Highway are in good condition.

Design Guidelines

Design Guidelines for bicycle facilities on campus came out of the 1982 Clemson University Comprehensive Plan. Recommendations for bicycle facility and amenity development as they relate to pedestrian and vehicular systems, plantings, site furnishings, site lighting, site work and buildings are found throughout. Design guidelines for bike paths, routes, lanes, multi-use paths, bicycle parking, bicycle storage, signage, bicycle racks and pavement are provided. An update to the Bikeway Design Guidelines can be found in the appendix.

The Clemson Area Transit Bus System

The Clemson Area Transit (CAT) Bus System is the free, public transit system that circulates through campus and the local, extended community. All buses have bike racks, allowing cyclists to reach destinations that might be difficult by bicycle alone. Bus travel beyond the campus boundaries, stretching to Seneca, Central, Pendleton and Anderson, along with stops along major routes in the City of Clemson. Some bus stops are designated with a sign or shelter, but many are not. Bus drivers will also stop anywhere along a route at undesignated areas if a patron flags them down, especially along routes outside of campus. Bus route maps are available at places on campus, on buses and at some local businesses.

Campus Outdoor Recreation and Education (CORE)

Clemson's CORE program has a bike rental program. Students can rent a hybrid bicycle, helmet, bike and lock for $50 a year, $30 a semester or $10 a month. Students are offered a brief orientation with the bike and equipment. The cost includes one tune up and one tube replacement per semester. In the fall of 2011, CORE owned 50 commuter bikes and was looking to expand the program. Bikes sold out on

CORE's office.

the first day of class. CORE also has 15 mountain bikes for rent on a short term (daily, weekend or weekly rental) basis. Beginner mountain biking trips to the Clemson Experimental Forest and other popular mountain biking destinations locally and across the country are also offered. CORE also provides a bike shop where the campus community can work on their bikes with tools that Clemson provides. In the fall of 2010 they started to offer a maintenance class twice a semester to students, faculty and staff that has been popular.

Existing Forest Conditions

The Clemson Experimental Forest is managed by the Clemson Forest Manager. Trail maintenance is primarily performed by volunteers from various user groups. The trails are maintained by the users, like local equestrian groups and mountain bike riders, with occasional help from other community groups like the Boy Scouts.

Trails and Roads

Trails have been developed by various forest user groups. Over time, some have fallen out of use, while other are have continuous heavy use. New trails also appear from time to time, sometimes replacing older trails and other times adding extensions to existing trails and, therefore, adding to the total mileage of trails in the forest. Managing official trails and activities in the forest is difficult due to limited staff and budgets. Most trails and roads are open to non-motorized users year round. Trails are closed in designated areas during hunting season, product removal and occasional special user group events. The map on page 3.10 shows approximately 113.8 miles of existing forest trails open to various users.

A road classification system was developed by the Forest Manager to manage the location, condition and identity of trails and roads in the Forest. This information also is useful in managing activities, especially timber removal. The table on the next page shows that road classes 1 – 6 are unpaved roads or trails. Road classes 8 and higher are paved or public roads. All users of the forest may use class 1, 2, 6 and 8 roads for non-motorized recreational use. Gated forest roads are closed to vehicles except for official university use or other permitted access. Class 1 roads are maintained for year round use. Class 2 roads are open during good and fair weather, and are closed when the road conditions become hazardous. Class 4 trails are closed to horse and bicycle traffic. Class 3 roads are not maintained, and may be overgrown and fall out of use over time. Classes 5 and 7 are reserved and have not been used to classify any roads at the forest. Classes 8 and higher are used to classify public roads.

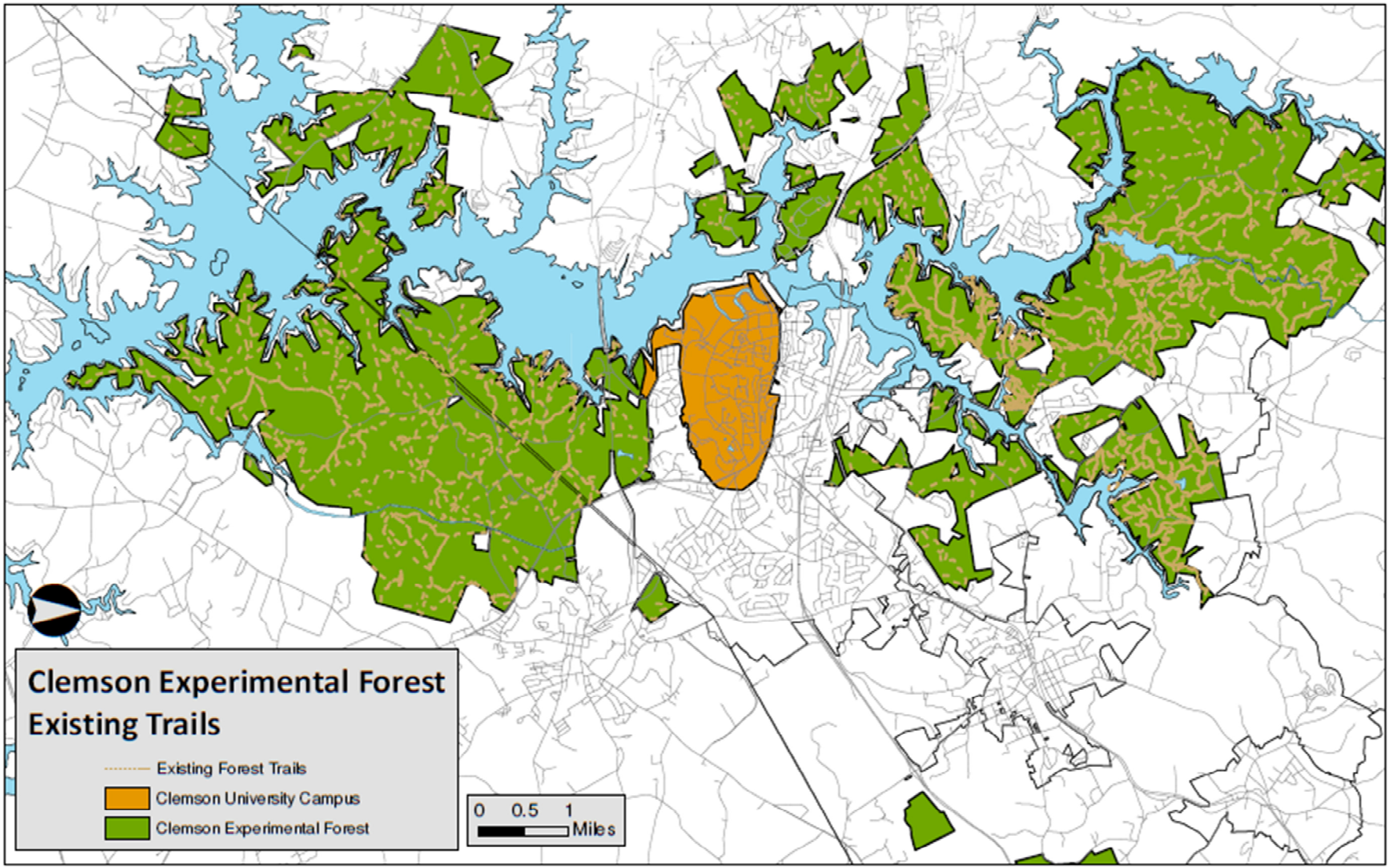
Table 3. Forest Road and Trail Classifications

Forest Road Class	Road Type	Allowed Activity*	Road Example
1	**All Weather Road**	**Vehicular, Hike, Bike and Horse**	**Issaqueena Lake Road (North Forest)**
2	**Fair Weather Road**	**Vehicular, Hike, Bike and Horse**	**Turkey Creek Trail (North Forest)**
3	**Product Removal Road**	**Hiking, Bike and Horse**	**Parts of Six Mile Creek Trail (North Forest)**
4	**Foot Traffic Only**	**Hiking Only**	**Issaqueena Lake Trail (North Forest)**
6*	**Multiple Use Trails**	**Hike, Bike and Horse**	**Seed Orchard Road (South Forest)**
8 (and higher)	**Public Roads**	**Vehicular Traffic and Bike**	**Fant's Grove Road (South Forest)**

* Roads and trails are open to timber removal as needed. Actual timber removal activities may cause the periodic closure of some trails and road.

**(Classes 5 & 7 are not currently used to classify roads.)

This information has been used to manage the network of Forest trails and roads. Most of the roads and trails are classified using this class system, however, there are some trails that have not been recorded or classified using this system because they may be new, were not officially sanctioned by the University or time limitations of staff. Maintaining trail and road condition, location and activity is difficult in the forest because the information is not kept up to date. Enforcing trail closures and trail user-group policy's is also hard because of staff limitations.


Clemson Experimental Forest
Existing Trails
Existing Forest Trails
Clemson University Campus
Clemson Experimental Forest
0 0.5 1
Miles

Maps

Maps are available in a limited capacity. In the South forest, trails have been identified as foot, horse and bicycle trails or foot traffic only based on the road classification system. A Clemson University map of trails in the South Forest is available through the Forest website, though it is not regularly updated. In the North Forest, the road classification system has been used to identify some of the roads and trails that are available on some publicly available maps, however it has not been used to make a comprehensive map of trails. The road classification system has not been used to develop a comprehensive network of trails in the Forest. Non-University North Forest maps have been developed by user groups, and are available online.

Trail Management, User Group Conflict

Even though there are trails and maps, a major issue for the Forest trail system is trail management. Maintaining the conditions of current roads and trails, minimizing the development of unofficial trails and enforcing trail policies and rules are important strategies in having a recreation component to the forest. Creating an environment where people feel comfortable to explore and recreate in the 17,500 acres of Forest is also critical. Currently, users say that finding their way can be confusing. Trails lack signs, trail heads and other markings that provide a sense of connection along a trail or between places. Managing trail closures is another issue. Parts of the Forest and trails are occasionally closed to the public for product removal, hunting, special events, trail maintenance and other reasons. Keeping this information up to date and posting it at trail heads is important to promoting a sense of safety.

Additionally, all people who ride bikes in the forest are not looking for the same experience. Some bicyclists will want to ride on paved roads while others will want to ride on various unpaved trails.

Funding

Funds for maintaining, managing and staffing all activities in the forest are funded from the profits of selling timber. The Forest Manager is in charge of managing stands of timber in the forest. There are less than 10 full, part time and student employees to manage the 17,000 acre forest. There are no additional funds from student, recreation, laboratory or community user fees collected to support activities in the forest.

Section 4. Case Studies

Case studies and best practices from other universities and recreation areas across the country were reviewed to provide examples for future bikeway development on campus and in the forest.

University Case Studies

The bicycle planning practices and networks at Clemson Peer Institution and potential Clemson Transportation Peer Institution Virginia Polytechnic Institute (Virginia Tech), Cornell University and the University of Maryland were reviewed to understand how these institutions addressed bikeway facility development and related topics. The schools were selected based on similar community influence and/or size, climate, topography, institution type, and transportations issues.

Table 4. Case Study University and Community Facts

	Clemson University	Cornell University	Virginia Tech	University of Maryland
City	Clemson, SC	Ithaca, NY	Blacksburg, VA	College Park, MD
City Population	13,002	30,013	42,881	27,286
University Enrollment (2009)	20,494	20,053	32,827	42,586
Climate & Topography	Hilly, humid summers and cool, dry winters.	Hilly, sometimes hot and humid summers, cold, snowy winters	Somewhat hilly, summers warm and humid, winters cool to cold with warm periods.	Somewhat hilly, warm spring, fall, cool winters.

These institutions were chosen[1] because each achieved various awards in alternative transportation excellence. The University of Maryland and Virginia Tech were recognized as a Best Workplaces for Commuters by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Transportation. The University of Maryland and Cornell University had achieved the League of American Bicyclist's Bronze Certification Level in the Bicycle Friendly University Program. The Bicycle Friendly University Program was developed by the League of American Bicyclists to recognize institutions of higher education for promoting and providing a more bicycle-friendly campus for students, staff and visitors. The program provides a roadmap and technical assistance to create better bicycling environments at institutions of higher learning.

A summary of university bicycle infrastructure and program elements from these university are found on the following pages.

University Bicycle Plan and Goals

Virginia Tech

In the 2002 Parking and Transportation Master Plan, a bicycle section was included. The following goals are taken from the plan:

1. Improve Bicycle Lanes – ensure easily acceptable bicycle lanes exist from the perimeter of campus to the central campus.
2. Bicycle lanes and pedestrian paths should be well lit, provide ample space for passing bicycles/pedestrians, and provide properly spaced emergency call boxes.
3. All new roads constructed on campus should consider installing either a bicycle lane or a separate bicycle path. Bicycle lanes are preferred for routes where there are frequent intersections/driveways and a separate bicycle path is preferred for routes with infrequent intersections/driveways.

[1] For a list of all schools reviewed, please see the appendix.

4. All new residence halls constructed on campus should include bicycle shelters over bicycle racks as an integral part of the design. Existing residential halls should have bicycle shelters installed near them.
5. The University should establish a capital budget for bicycle and pedestrian facilities. This budget should be used for improvements and maintenance to the bicycle and pedestrian network.

Cornell University

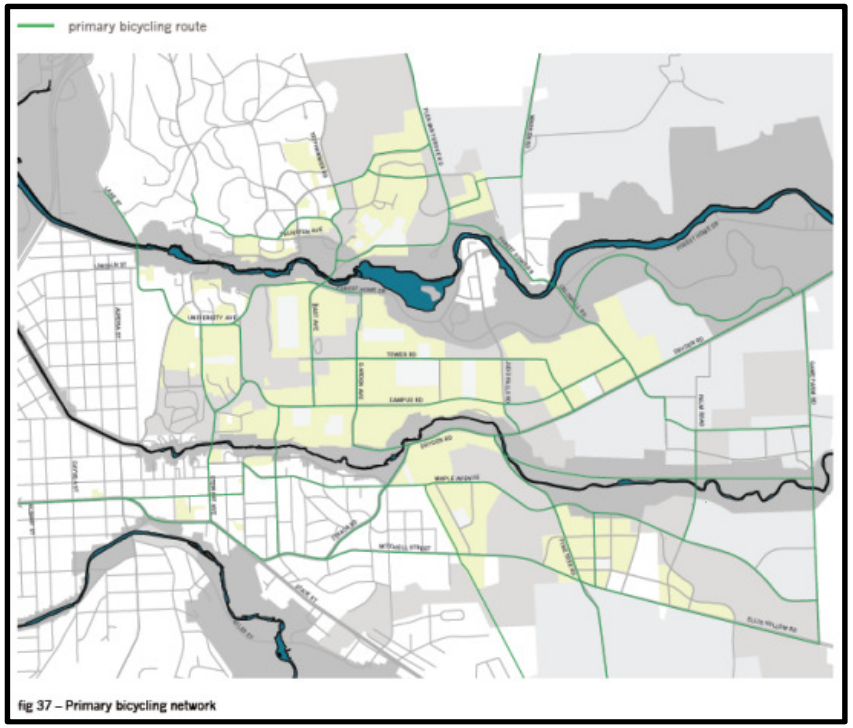
The 2005 Cornell's Campus Master Plan was a new development strategy to guide land development over the next 30 – 60 years. As part of the larger Campus Master Plan, campus transportation and circulation was reviewed. A summary of planning priorities, key movement strategies and initiatives from the transportation and circulation element of the Campus Master Plan is as follows:

1. Bike racks should be located outside of all buildings, with weather protection provided wherever possible. Most new buildings should include indoor bicycle storage facilities and change rooms. Require bike racks, indoor bike storage facilities and change rooms in major new buildings.
2. The steep grades in certain areas of campus deter high use of bicycles, and in some places walking a bike is the only choice. Install, wherever possible, bike stairs on all future stairways and retrofit existing stairways in these areas. Bike stairs simply include narrow ramps adjacent to the steps that allow bicyclists to roll their bicycle uphill. Install bike stairs where primary cycling routes to campus cross the gorges.
3. The bike network should discourage cyclists from using heavily-traveled pedestrian routes, and along shared paths and trails, signage should remind cyclists to look out for and give way to pedestrians. Identify and sign primary bike routes to and through campus.
4. Consider a bike share program. A bike-share program would allow a member to pick up a bike at one location on campus and leave it at separate location, avoiding a long walk or short drive. Also, bike rentals should be investigated, perhaps by partnering with the bike shop. Cornell should consider subsidizing bicycle rental costs for students or employees who wish to rent a bicycle for the semester instead of applying for a parking permit. Develop and implement an effective bike share program.

University of Maryland

In 2008, a Bicycle Study was completed at the University of Maryland that recommended improvements to bicycle infrastructure and parking on campus. Enhancing policies and programs for bicycle management, safety, and security was also encouraged. Goals and strategies to highlight the cornerstone of its transportation and sustainability commitment are listed below:

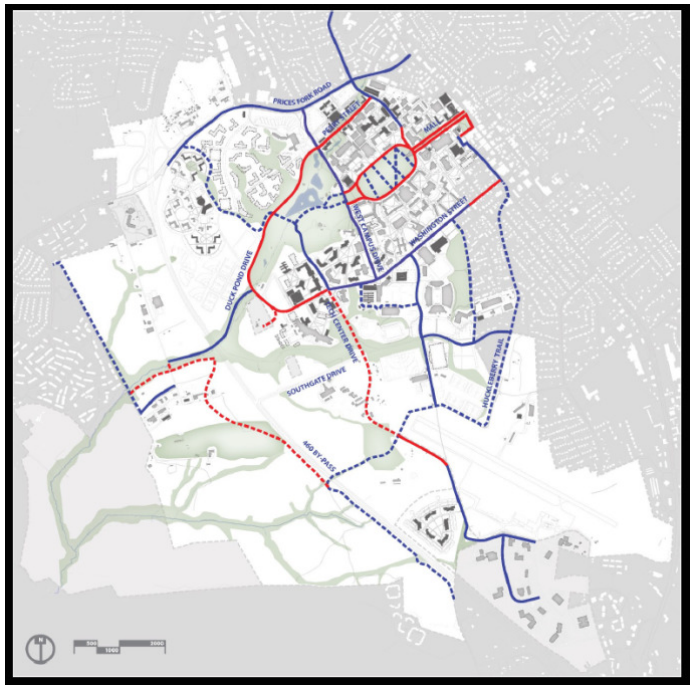
1. Significantly increase bicycling on campus as an alternative to automobile travel. Reduced automobile use will reduce congestion and emissions, reduce the amount of space and money dedicated to motor vehicle parking, contribute to sustainability efforts and improve campus wellness
2. Increase safety and mobility.
3. Model engagement in collaborative partnerships as indicated in the campus Strategic Plan.
4. Identify several roads throughout campus as vehicular/bike roadways as designed by the State and add covered parking. Suggested routes will be highlighted in educational brochures and signs will be added to the exits of some parking lots.
5. Install racks at key buildings. Existing racks have been mapped.



Cornell University Bike Map

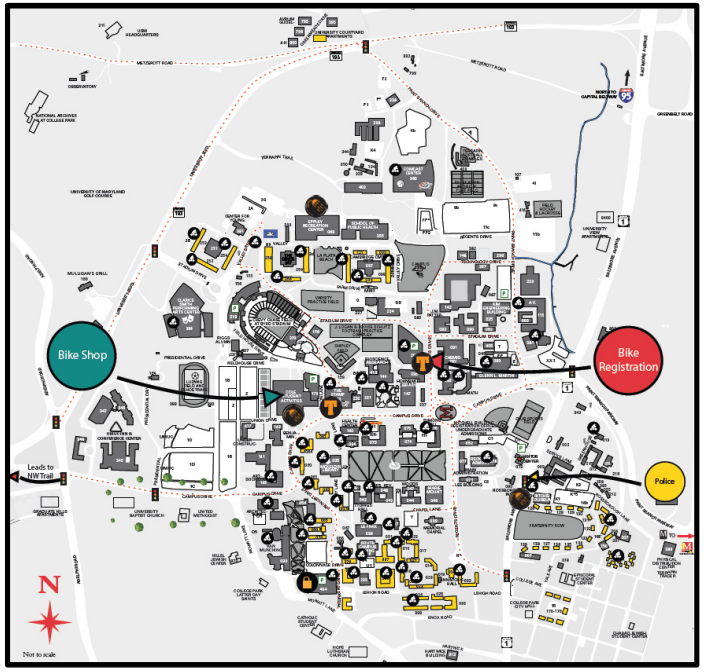
Bicycle Networks

Cornell University has a primary bicycle network that provides connections to destinations on campus and to off-campus bike routes. The network is comprised of bike lanes, shared road bike routes, shared paths and dismount zones. Common signage prominently identifies primary bicycle routes. Dismount zones are signed in areas where bicyclists should walk their bike. Riding on a bike through these areas is prohibited.



Virginia Tech Bike Map

Virginia Tech has a small system of bike lanes and paved off-road shared use paths. The 2006-2016 Master Plan calls for an expansion of that network. Route expansion will increase the number of bike lanes on campus and provide more off-road bike paths to improve connections across the entire university property. The goal is to encourage greater use of bicycles as a primary mode of transportation.



University of Maryland Bike Map

The University of Maryland has a network of on-campus bikeways providing a high level of connections to destinations on campus. The bikeway is made up of mostly shared roadways that are marked with shared lane markings and one shared use path. The location of the campus bicycle shop, bicycle registration office, bicycle racks, shower facilities, campus police and other bicycle-related are shown on the official university bike map.

Bicycle Parking and Storage Facilities

All three institutions provide bicycle parking and a map showing the locations of bike racks on campus. All three also have the inverted "U" bicycle racks. At Virginia Tech, a covered bike rack provides shelter for a series of the inverted U racks. At Cornell, bikes can be parked inside a building with persmissions from the Building Director. The University of Maryland provides group bike lockers. The lockers contain double decker bike racks that are equipped with security cameras inside campus parking garages. The rack space is available to rent for an annual rate of $45, $25 for fall, spring and summer semesters and $10 for winter break. Bikes must be registered before locker can be rented. Locker codes are electronic and change with every new person. Telephone support is also available.

Inverted "U" bicycle rack.

Covered bike rack at Virginia Tech.

Bicycle Share and Bike Rental

Cornell's Big Red Bikes

The Big Red Bikes Bike Share program at Cornell University began in 2011 as a student initiative. Students must register to use the program. The first 25 hours of use a week are free. After that, rates are $5/hour for the first 5 hours, and any additional time is billed at $20/hour. A student can obtain a key for a bike by showing a student I.D. Users are allowed "one strike" for any problems or misuse before a fee is charged. Groups of 7 or more can reserve bikes a week in advance. At the University of Maryland, Trek Alliant Cruisers are available for students to rent for the semester at the Campus Bike Shop. The $70 rental fee includes a U-Lock and priority maintenance guarantee. There is a short bicycle use orientation. Mountain bikes can be rent for $10/day, $35/week. Helmets and locks are each $2/day, $5/week.

Bicycle/Pedestrian Conflict Management

Cornell University has designated dismount zones in designated areas to try to minimize bicycle accidents with pedestrians. They also have a policy that limits biking on campus unless it's on a signed, shared path. At Virginia Tech, separate facilities are being developed for bicycles and pedestrians. These multi-use paths, called greenways, are 12 feet wide which allow room for bicyclists to pass pedestrians, and are paved with asphalt to distinguish them from pedestrian only sidewalks. Bicycle crashes and path maintenance issues can be reported through an online form at the University of Maryland and Virginia Tech. Users can report an issue in real-time, providing instant feedback for facilities management.

Bicycle Advocacy

There have been a few different student groups involved in bicycle advocacy Virginia Tech. In the last several years, "Bike Challenges" have been held to get people to commute by bike. In 2009, The Bicycle Advocacy Group ran the events, and in 2006, The Environmental Coalition had 315 participants who rode 14,351 bicycle commuter miles during the challenge. Cornell University has a Bicycle and Pedestrian Traffic Safety committee that covers issues pertaining to improving the cycling and walking environment on campus. University staff from Transportation Services, Environmental Health and Safety, Police, Planning and the Judicial Administrator's office are on the committee. Interested students and staff may also join. The University of Maryland's Bicycle Advisory Group meets bi-monthly to discuss developments and issues in campus biking. Members are from different departments on and off campus. Additionally, the Bike UMD program is funded by student fees and monies recouped by lower than expected fuel costs for the campus shuttle system.

Enforcement and Education

Each of the institutions has an educational and enforcement component to their bicycle program. Each school provides state and university bicycle policy and rules online. All of the institutions provide free bicycle registration online for those who parking and operate on campus online. Virginia Tech requires bicycle registration. Bicycles on campus without it may be fined or impounded. Registration is designed to help improve bicycle facilities, prevent theft and assist with the recovery of stolen bicycles on campus.

Through the Cornell University Extension program, there is a Pedestrian and Bicycle Website that is a resource for information on local events, state programs and policies, campus programs and other topics. The University also offers a bike riding safety brochure, and offers beginner bike, traffic skills, maintenance classes.

The University of Maryland Department of Transportation Services website contains images as well as text that shows the proper way to lock a bike, load and unload a bike on a bus and where to locate a bicycle serial number, which is typically used for university bike registration. This website also provides information on bicycle commuting. Virginia Tech also provides a number of education resources on its website.

Bicycle or Alternative Transportation Use Incentives

These institutions also provide different kinds of incentives to those who ride bikes. At Cornell University, students and staff who biked to campus and need to shower before class or work are allowed to use the athletic shower facilities for free. Virginia Tech provides repair kits on campus and free enrollment in an emergency ride home program. At the University of Maryland, committed cyclists receive 15 discounted daily parking permits for $15 per semester. Helmets, U-Locks and front and rear lights are offered at a discounted rate through the University of Maryland.

University Departments and Bikeway Development

Each university has a pair of departments that work together to implement and support the bikeway development and related topics. The following table lists the lead and support university departments involved with bikeway develop.

Table 5. Case Study University Departments involved with Bikeways

	Virginia Tech	Cornell University	University of Maryland
Lead Department	Facility Services	Commuter and Parking Services	Transportation Services
Support Department	Campus Police	Cornell Outdoor Education, Extension	Campus Sustainability

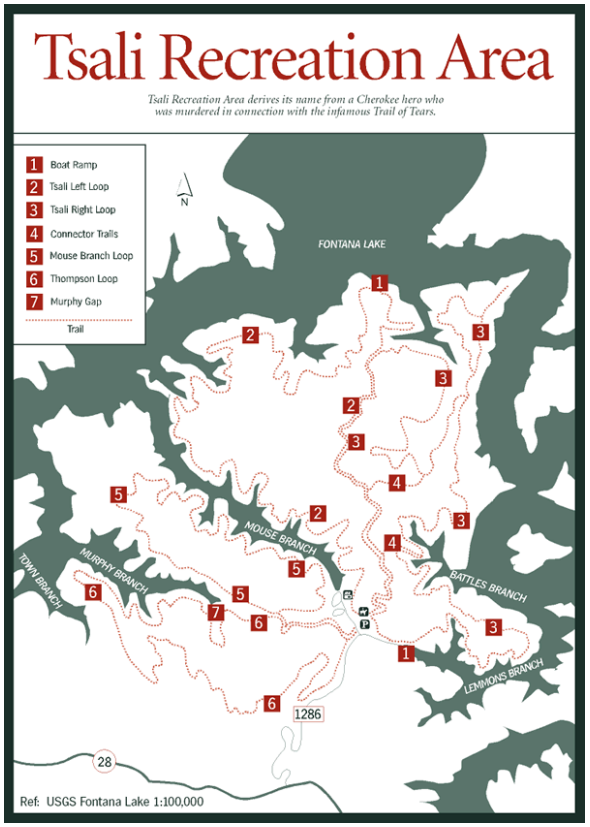
Outdoor Recreation Areas Case Studies

The Forest is a unique feature of Clemson University. Natural resource education and forest management historically have played a large role in use of the forest, but in more recent decades, recreation in the form of hiking, biking and horseback riding has increased. There are two nationally recognized outdoor recreation areas just a few hours from Clemson University that provide good comparative case studies for mountain biking, trail management and user-group conflict. The Tsali Recreation Area in Western North Carolina is rated as one of the top places for mountain bike riding in the country. Lake Norman State Park is a center for outdoor recreation activities, including mountain biking, and is located outside of the growing Charlotte, North Carolina metropolitan area.

Tsali Recreation Area

The Tsali Recreation Area is a destination for mountain biking in the eastern part of the country. Located in Western North Carolina, 17 miles north of Robbinsville in the Nantahala National Forest, this recreation area contains almost 40 miles of trails. Rated as one of the top places to mountain bike in the country, the area is located on a hilly peninsula reaching into Fontana Lake at the base of the Great Smoky Mountains.

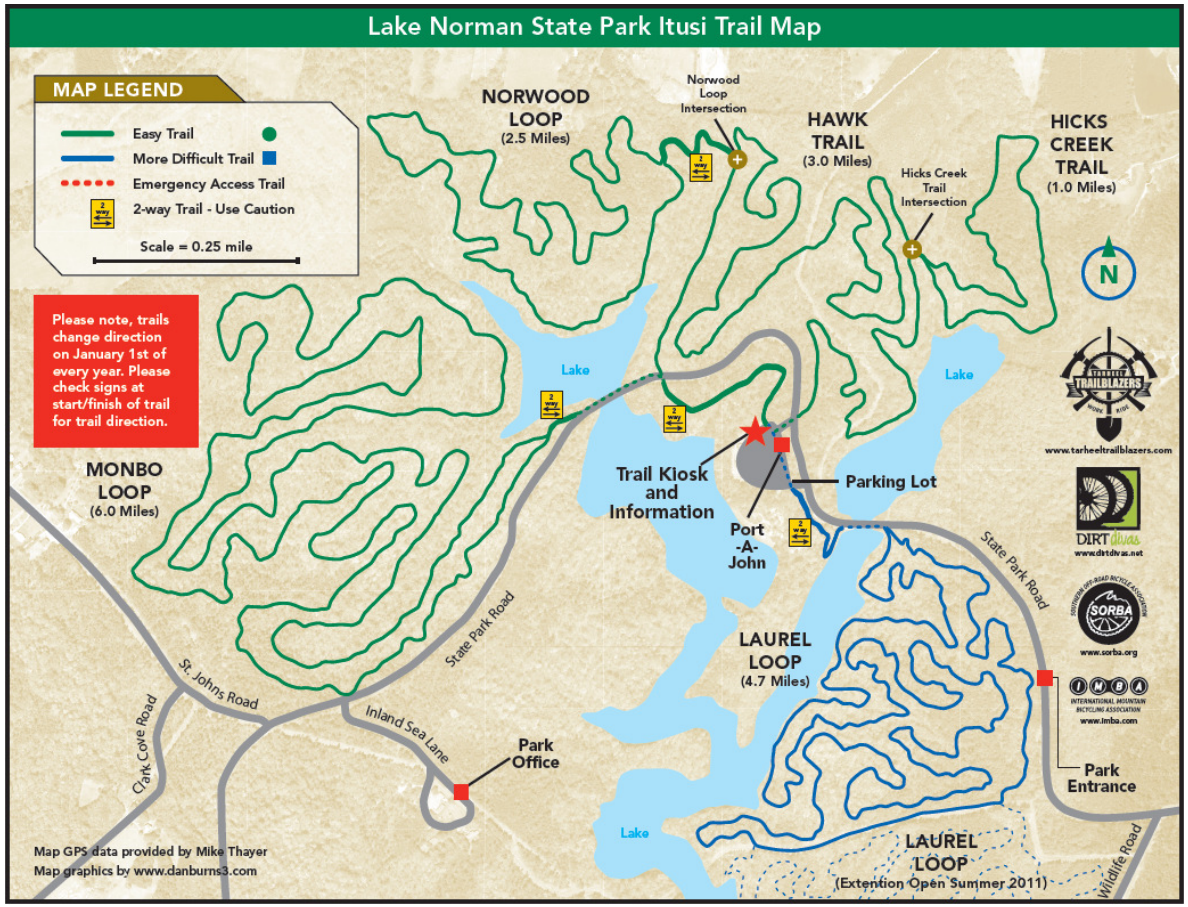
The four long main trails wind along the lake shore and into the wooded interior. There are several connector trails, gravel roads and extension trails that give a few more options for rides besides the main loops. The trails are well designed for mountain bikers and heavily used. User-group conflicts are managed by alternating open trails on different days of the week. Two trails are always be open to mountain biking. Hikers and hunters are urged to choose a trail not in use by mountain bikers. Users are advised to watch for signs of forest management and to stay off “Road Closed” signs. There is a $2.00 trail use fee per day. Maps and information are available online and at trailheads.



Tsali Recreation Area Trail Map

Lake Norman State Park

Lake Norman State Park is about 40 miles north of Charlotte. There are many different recreational activities that are permitted in the park, including the Itusi trails for mountain bikers. The trails are designated by signs for travel in one direction for bikers and the other direction for hikers to maximize visibility in the event of trail user conflict. The one-way travel design allows users to ride mountain bikes without worrying about meeting hikers from behind or collisions from on-coming riders. Each loop of the trail is ridden in a counter-clockwise direction during odd-numbered years and clockwise during even numbered years. The trail is reversed each January 1st to give the riders a new riding experience and to allow the trail to heal. On the International Mountain Bicycling Association, trail maps indicate the level of difficulty in each trail by color designation.



Lake Norman State Park Trail Map

Summary of Recommendations from Case Studies

The following are recommendations for bikeway development at Clemson University, including areas on campus and in the forest.

Campus Recommendations

- Develop a network of integrated primary and secondary bikeways.
- Create a bike map, and have it available online.
- Develop a bicycle ownership policy.
- Include bicycling as part of the larger Transportation Demand Management Strategy.
- Set a bicycle operation policy that defines where bicycles are allowed and prohibited on roads, sidewalks and multi-use trails with a clear enforcement strategy.
- Incorporate bicycle facilities in new developments.
- Improve short term and long term bicycle parking facilities.
- Develop a Bicycle Advisory Committee comprised of University Students, Faculty and Staff, City Employees and Local Advocates.
- Develop incentives for students, faculty and staff that choose to ride their bike to campus as a form of transportation.

Forest Recommendations

- Identify a network of named trails, including off-road (unpaved) and on-road (paved) trails for bicyclists. Consideration should be given to classify trails in ways that might indicate primary trails and secondary trails as well as level of difficulty.
- Develop and install a trail marking or wayfinding system in the Forest for all users.
- Set a trail user policy that will minimize user-group conflict and, therefore, maximize trail use.
- Develop a road and trail closure policy and marking program.
- Create an official trail map that has contains the official rules, policies and trails of the forest.

Section 5. Recommendations

Campus Network

Bike lanes, shared roadways and shared use paths comprise the campus bikeway network. Bicycle routes build off existing bikeways and major transportation corridors on campus. The network is intended to increase bicycle accessibility and provide a legitimate place for bicyclists. A map of this network can be found on page 5.4.

Roads on Campus

All roads on campus should be open to bicycles, including those that do not have shared roadway signs or pavement markings. Signage and pavement markings can indicate preferred routes and circulation for cyclists.

Bikeway Types

The campus bike network should consist of clearly marked primary bikeways, secondary bikeways and shared-use paths. Primary bikeways should be designated by either an on-street bike lane or signed, marked shared roadways. Bike lane design should meet state minimum standards (4 feet wide), but to promote safety, recommended bike lanes widths should be designed to national guidelines (5 feet wide). Conventional and buffered bicycle lanes could be considered for campus roads.

Example of a bike lane.

Secondary bikeways should be designated by signed, marked shared roadways. Shared roadways signs and lane marking should be clearly visible to help promote safety and communicate preferred bicycle circulation. Pavement markings are preferably paced in the center of the travel lane to minimize wear and to promote single file travel. Shared use paths should be wide enough to accommodate two-way traffic, as well as accommodate the needs and minimize conflicts between pedestrians and bicyclists.

Shared-use paths are another type of bikeway intended for use by bicyclists and pedestrians. As a recreational feature of the campus bikeway network, they provide connections between destinations on campus as well as become their own recreation destination. Shared-use paths are typically designed for cycling at slower speeds than on-street bikeways.

There are places on the campus where a shared-use path will enhance bicycle recreation opportunities and circulation on campus. Developing the trail found along the dike, stretching from the Madren Center, crossing Old Greenville Highway to the University and City property line will provide a long path for bicyclists to use and enjoy. Other shared-use paths include: the continuation of Jervey Meadows past the baseball diamond, connecting to East Beach Drive; connect through Calhoun Courts, connecting Morrison St. to McMillan and Cherry St; near Lee Hall, connecting Fernow Street with Lambda Street; around Lehotsky Hall and Poole Agricultural Center area and on the eastern edge of campus, east of Hwy 76; and through the southern portion of the Douthit Hills development. Please see page 5.3 for a map.

Dismount Zones, areas where there is high pedestrian activity and it may not be appropriate for bicyclist to ride, also have a place. There are two areas on campus where this bikeway facility may be found: the plaza behind Cooper Library and the Pedestrian Bridge by the Lightsey Bridge Apartments. Policies to enforce and inform the campus community should be established, including sign placement and content.

Campus Beach

Considerations for bikeways should also be included at the beach in its present condition and in future developments. Bike lanes on Old Greenville Highway provide access to the Campus Beach, however, current conditions do not provide a safe environment for bicyclists. There are few bicycle facilities at the beach site. Despite these conditions, students still bike from campus to the beach.

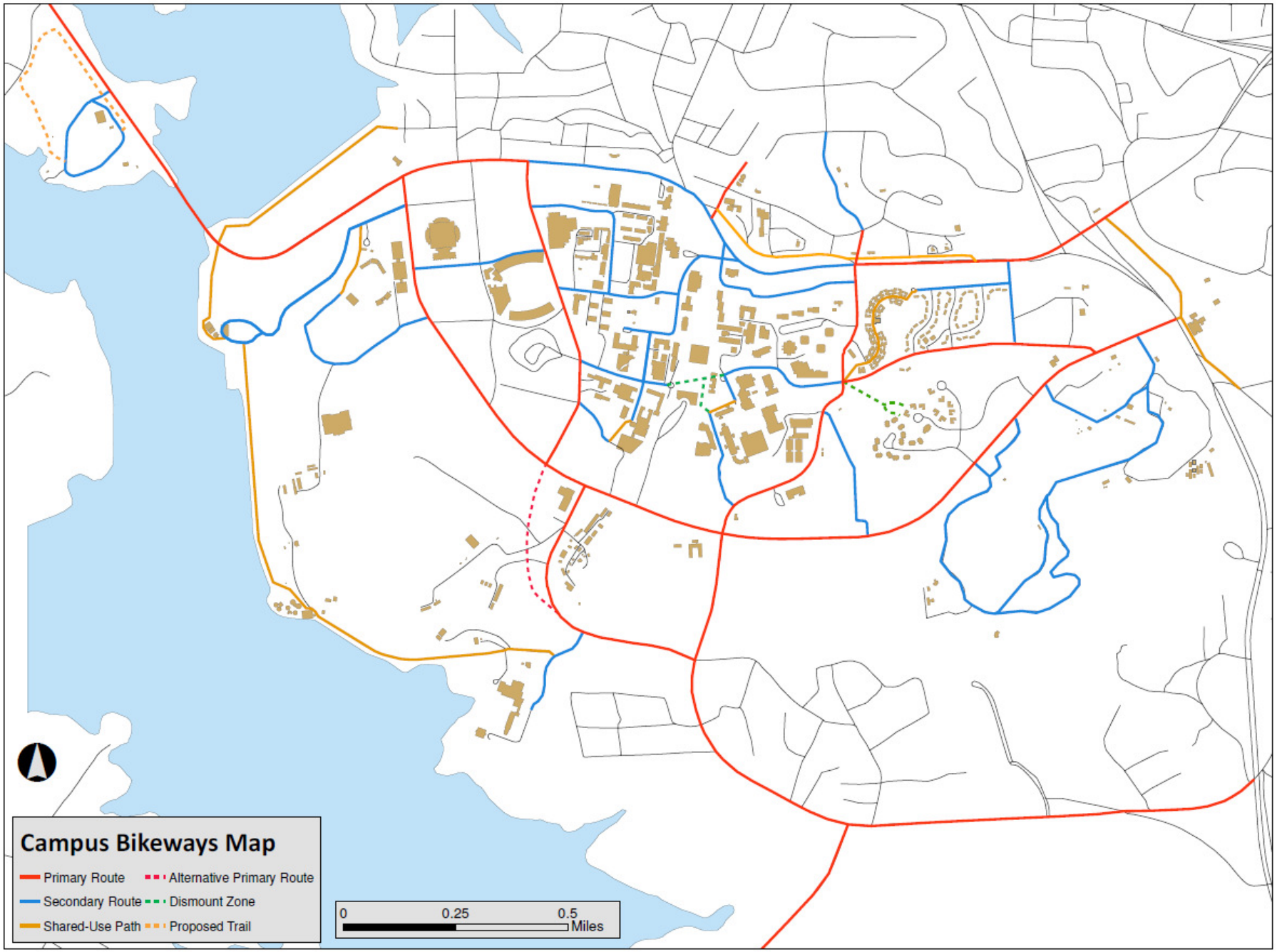
Road at Campus Beach site

As improvements on the site are considered and developed, enhancements to the bicycle facilities on site should be included. Providing a bikeway that connects Old Greenville Highway to the beachfront is important. Developing a shared roadway on YMCA Circle is appropriate for the beach in its current condition. However, as demand, development and traffic increases, shared roadways and bike lanes should be installed as appropriate. Developing a shared path that enhances

recreational activities, provides additional circulation opportunities and connects the Ravenel Center and the Beach should be considered.

Signs directing bicyclists to the water front, the home of CORE, the campus bike shop and other destinations should be provided. Bicycle parking should also be added and located in close proximity to the beachfront, the CORE offices and other future destination points and recreational facilities. Consideration for covered, long-term parking should also be included.

Bikeway wayfinding signage on campus could include directions to the Campus Beach. If part of the site is developed as a parking lot, considerations should be made to make this a “Park and Bike” lot.


Campus Bikeways Map
Primary Route
Alternative Primary Route
Secondary Route
Dismount Zone
Shared-Use Path
Proposed Trail
0
0.25
0.5
Miles

On-Road Bikeway Recommendations

The table below provides detailed information for bikeways and improvement type for some specific campus and forest roads. A more comprehensive listing of bikeway improvements is found in Section 6. Implementation.

Table 6. On-Road Bikeway Recommendations

Project Segment	From	To	# Travel Lanes	Recommended Bikeway Type	Miles	Improvement Type
Perimeter Rd	Old Greenville Hwy	Cherry Rd	4	Bike Lane	1.16	Shoulder Improvements, Signage, Pavement Marking
Perimeter Rd	Cherry Rd	McMillan Rd	2	Bike Lane	0.98	Signage, Pavement Marking
Perimeter Rd	McMillan Rd	Hwy 76	2	Bike Lane	0.16	Signage, Pavement Marking
Old Greenville Hwy	Seneca Creek Rd	Perimeter Rd	4	Bike Lane	1.14	Signage, Pavement Marking
Old Greenville Hwy	Perimeter Rd	Williamson Rd	4	Bike Lane	0.28	Pavement Marking
Old Greenville Hwy	Williamson Rd	Cherry Rd	4	Shared Roadway	0.83	Signage, Pavement Marking
Old Greenville Hwy	Cherry Rd	Hwy 76	4	Bike Lane	0.57	Signage, Pavement Marking
Cherry Rd	Old Greenville Hwy	McMillan Rd	2	Bike Lane	0.29	Signage, Pavement Marking
Cherry Rd	McMillan Rd	Old Cherry Rd	2	Bike Lane	0.47	Pavement Marking
Zeta Theta St	Cherry Rd	Perimeter Rd	2	Shared Roadway	0.30	Pavement Marking
Williamson Rd	Old Greenville Hwy	Perimeter Rd	2	Bike Lane	0.71	Pavement Marking
Old Stadium Rd	Perimeter Rd	Old Cherry Rd	2	Bike Lane	0.63	Realignment, Pavement Marking
Madren Center Dr	Old Stadium Rd		2	Shared Roadway	0.24	Pavement Marking
Avenue of Champions	Perimeter Rd	Williamson Rd	2	Shared Roadway	0.29	Pavement Marking
East Beach Dr	Perimeter Rd		2	Shared Roadway	0.71	Pavement Marking
Heisman Dr	Perimeter Rd	Klugh Avenue	2	Shared Roadway	0.19	Pavement Marking
Klugh Avenue	Heisman Dr	Fort Hill St	2	Shared Roadway	0.17	Pavement Marking
Fort Hill St	Williamson Rd	Calhoun Dr	2	Shared Roadway	0.27	Signage, Pavement Marking

Project Segment	From	To	# Travel Lanes	Recommended Bikeway Type	Miles	Improvement Type
S Palmetto Blvd	Williamson Rd	Library	2	Shared Roadway	0.21	Pavement Marking
McMillan Rd	Cherry Rd	Perimeter Rd	2	Bike Lane	0.57	Signage, Pavement Marking
McMillan Rd	Cherry Rd	Library	2	Shared Roadway	0.29	Signage, Pavement Marking
McGinty Ct	McMillan Rd		2	Shared Roadway	0.06	Pavement Marking
Jersey Ln	Cherry Rd		2	Shared Roadway	0.23	Pavement Marking
Calhoun Dr	Old Greenville Hwy	Frenow St	2	Shared Roadway	0.38	Signage, Pavement Marking
Fernow St	Calhoun Dr		2	Shared Roadway	0.19	Pavement Marking
Lambda St	Lambda St	Williamson	2	Shared Roadway	0.11	Signage, Pavement Marking
Parkway Dr	Old Greenville Hwy	Cherry Rd	2	Shared Roadway	0.38	Signage, Pavement Marking, Bi-Directional for Bicycles
Morrison Dr	Newman Rd	Calhoun Courts	2	Shared Roadway	0.19	Pavement Marking
Sherman St	Old Greenville Hwy		2	Bike Lane	0.13	Signage, Pavement Marking
Newman Rd	Old Greenville Hwy	McMillan	2	Shared Roadway	0.15	Pavement Marking
Martin St	Daniel Dr.	Wyatt Ave	2	Shared Roadway	0.19	Signage, Pavement Marking
Cherry St Extension	Cherry St	Martin St	2 or 4	Bike Lane	0.06	Signage, Pavement Marking
Garden Trl	Perimeter Rd		2	Shared Roadway	2.28	Signage
Jervey Meadows	Perimeter Rd		2	Shared Roadway	0.66	Signage, Pavement Marking
YMCA Circle	Old Greenville Hwy		2	Shared Roadway	0.51	Signage, Pavement Marking
Bikeway to South Forest	Old Cherry Rd	Queen St	3	Bike Lane	1.42	Signage, Pavement Marking
Paved Bikeway in North Forest	Old Jewell Bridge Rd	Old Six Mile Rd	2	Shared Roadway	3.79	Signage, Pavement Marking
Paved Bikeway in South Forest	Queen St	Fants Grove Rd	2	Shared Roadway	5.50	Signage, Pavement Marking

Wayfinding, Signage and Pavement Markings Recommendations

The existence of a defined, clearly marked bikeway network will help cyclists navigate their way around the campus to other university destinations like the Beach and Forest, and will help to promote a sense of safety. A designated, marked bikeway network also provides a place for and legitimizes the role of bicycles as a part of the transportation network. It helps familiarize users with the bicycle network, identifies the best routes to destinations, highlights potential conflict areas and overcomes a "barrier to entry" for infrequent bicyclists. Signage and pavement markings also passively market the bicycle network by providing unique and consistent imagery throughout the campus.

Pavement marking examples. Shared Lane Marking ("sharrow") above, directional bike dot below

Signs and pavement markings, also known as shared lane markings, should be designed and used in tandem to create a clear, unique wayfinding system that's easy to understand and visually appealing to first-time and long-time users. They should be consistently applied on and near bikeways, and should be visible to pedestrian, motorist and cyclist. Roadway signs should be updated to follow the Manual on Uniform Traffic Control Devices (MUTCD), as well as other state and national bikeway guidelines, like SCDOT, AASHTO and the NACTO Urban Bikeway Design Guide. Additionally, signs and shared lane markings at the Campus Beach, in the Forest and on Campus should be related, share similar elements and be part of the same, comprehensive wayfinding systems.

Various bicycle route signs

Intersections

As the bikeway network becomes enhanced on campus, configuring intersections to promote safety and reduce potential conflicts where bicyclists, pedestrian, motorist and other forms of transportation interact should be considered. Designs for intersections with bicycle facilities should reduce conflict between bicyclists and vehicles by heightening the level of visibility, denoting a clear right-of-way, facilitating eye contact and awareness with competing transportation modes. Intersection treatments can resolve queuing and merging maneuvers for bicyclists, sometimes including timed or specialized signals.

A variety of elements contribute to a more bicycle-friendly intersection, yet the issues and level of treatment are different at every intersection. The level of treatment required for bicyclists at an intersection will depend on the bicycle facility type used (bike lane, shared roadway), whether the bicycle facilities are intersecting, function of the adjacent street and sidewalk, traffic volume and land use. Bike boxes, intersection crossing markings, through bike lanes, combined bike lane/turn lane and median refuge island may be some of the ways to promote safety at intersections on campus.

Additionally, bicycles can be better detected by using bicycle-activated loop detection devices. These devices trip the signal light, recognizing the presence of a bicyclist, providing extra "green light" time before the light turns yellow. Typical signals, like the ones found on Old Greenville Highway, do not recognize bicycles because they are too light. Signs and pavement markings can be used to help communicate the adjustments in behaviors. Other devices like hybrid beacons (also known as a high-intensity activated crosswalks or "HAWK") may also be used as the need arises. Hybrid beacons, like the ones found at intersections along Old Greenville Highway and College Avenue or near Sikes Hall, help to improve non-motorized crossings on major streets.

Example of a bike box and a bike lane at an intersection.

Bicycle-activated loop detector and pavement marking.

Bicycle Parking

Providing bicycle parking on campus is essential to the implementation of the Bikeway Plan. Without appropriate bicycle parking facilities on campus, bicycle facilities built on campus will be underutilized, especially by more experienced riders who hesitate to park in areas that are unsecure, unlit and uncovered. Providing appropriate bicycle parking in convenient areas can demonstrate the University's commitment to sustainability and alternative transportation.

Covered back rack at Virginia Tech.

Appropriate short-term and long-term bicycle parking facilities should be available to the campus community. Bicycle racks are appropriate for short-term use and should be placed near academic buildings, residence halls, athletic facilities and other activity centers. Covered, lit and secure bicycle racks, bicycle lockers and bicycle storage rooms should be considered for long-term use, especially in or near residence halls for students who bring a bicycle to campus. Consideration should also be given to provide supervised temporary bicycle parking at events. Bicycle racks that are used should:

- Support the bicycle in at least two places to prevent it from falling over;
- Allow locking of the frame and one or both wheels;
- Be securely anchored to the ground;
- Resist cutting, rusting and deformation.

More detailed information about bicycle parking can be found in the Bikeway Design Guidelines in the Appendix.

Bike room at Olin College

Forest Bike Network

Forest Roads

Paved public roads through the Forest should be open to bicycles. Some roads in the South Forest, like Fants Grove Road and Queen Road, should have signage and pavement markings to encourage bicycling. Placing shared roadway signs along Old Six Mile Road in the North Forest may also be advisable to encourage motorists to slow down and respect cyclists' right to the road. The University will need to work with Pickens and Anderson counties to mark and sign the roads. State law allows bicycles on the road, and, therefore, forest policy should not prohibit bicycles on any paved roadway. Signage and pavement markings can indicate preferred routes for cyclists.

Mountain Bike Trails

Hikers, horseback riders and mountain bikers are the main trail users in the Forest. Trail design, grade, condition, type and user route knowledge currently drives trail usage, as the absence of trail signs and maps make getting around in the forest difficult especially for new users. There are some trails that are preferred and more heavily used by horseback rider, which can affect the trail condition for mountain bike riding and hiking in a negative way. Horses tend to pack down paths, wear out creek crossings and leave waste on the trail, making it less desirable for other users.

The trail outlined in the North and South Forest follows existing trails and fire roads and is used by the local mountain biking community. Considerations should be made to advertise and develop the routes for new riders. Both trails have a relatively easy level of difficulty, provide an interesting, fun recreational experience and connect to other trails in the forest. They are also connected to fire and paved roads that act as outlets. Outlets act as "safety valves" for mountain bike riders if they become too tired or overwhelmed on a trail. The trails also start and end at areas that have parking lots and act as unofficial trailheads. Consideration should be given to providing mountain bike facilities like a bike washing station and a portable water station.

Bike washing station

Establishing a primary mountain bike trail in each of the North and South forest areas will provide preferred routes for mountain bikers to use. There is a route in each of the North and South Forest area that should be developed as the primary route, as found on the maps on the following pages. Trailhead locations are also suggested. In addition to having primary trails, a policy limiting or prohibiting horseback riding should also be developed to help keep these particular trails in a better condition for mountain biking. In the future, a trail-user policy should be developed and implemented for all trails in the Forest.

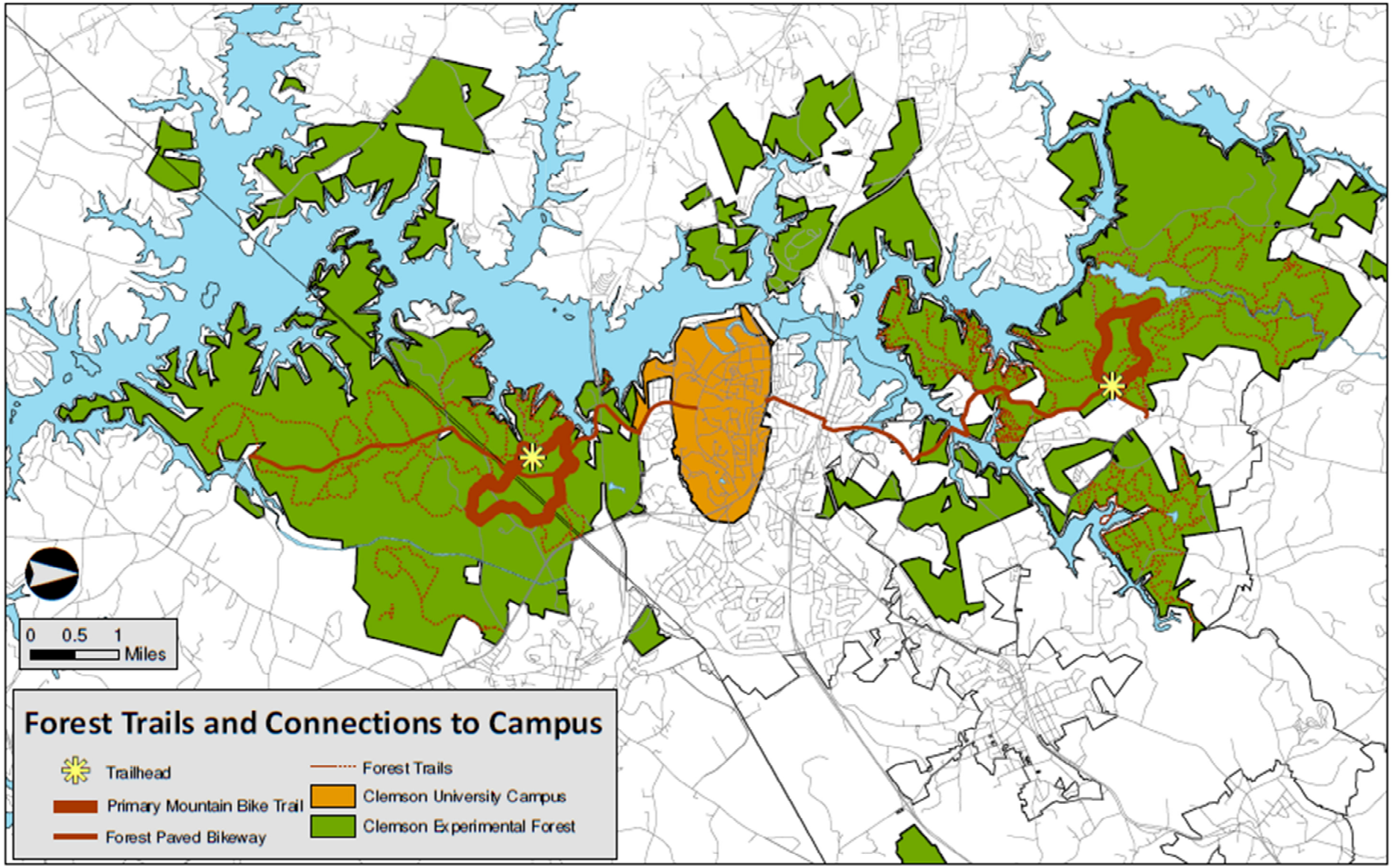
Connections

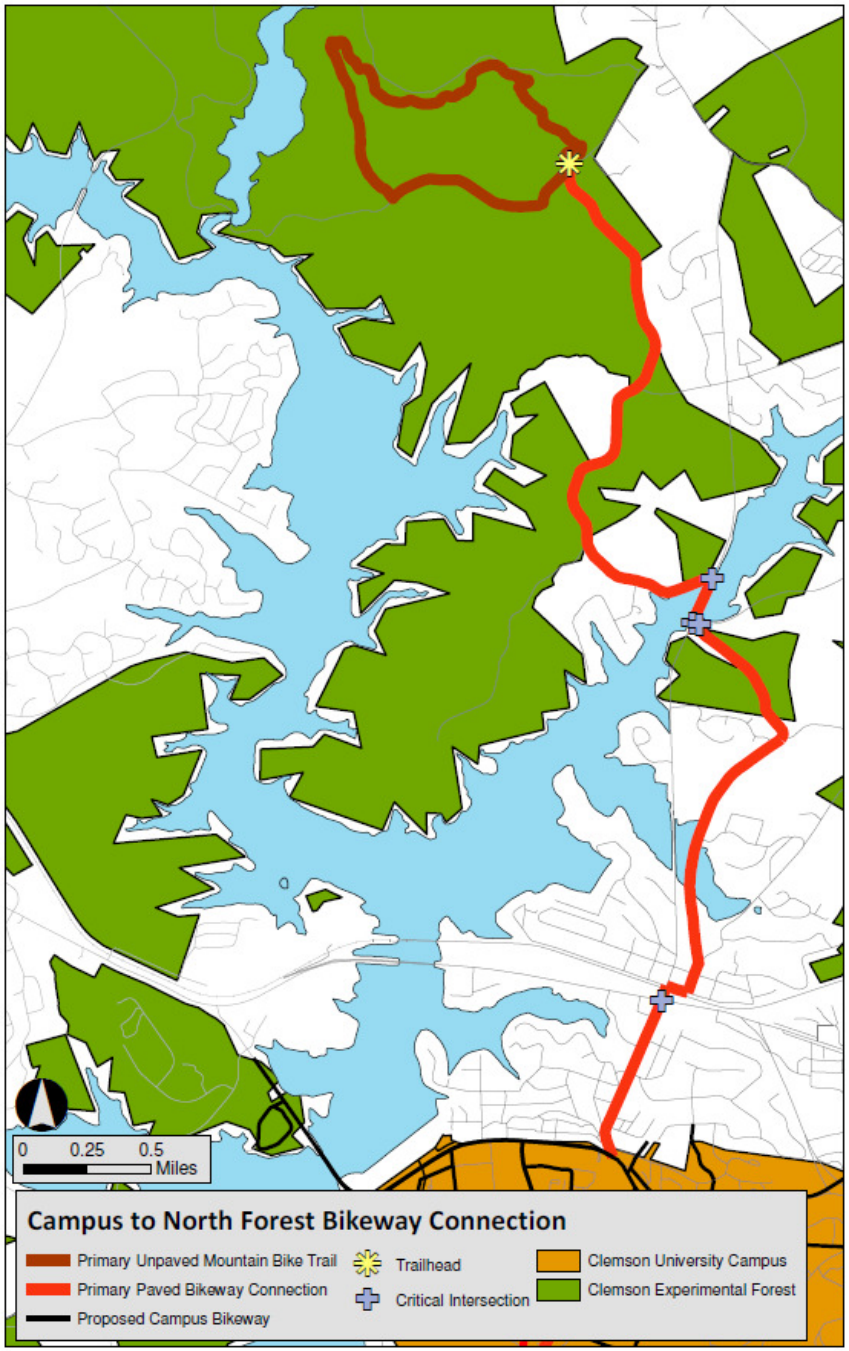
Enhancing the connections between the Forest and Campus can provide a richer experience for the Clemson University community. The 17,000 acres of the North and South Forest are just a few miles from the campus. The South Forest is directly accessible from campus, whereas the North Forest is a few miles farther away.

Developing a marked, signed bikeway from the campus to the North and South Forest will be an important step to increase connectivity. Wayfinding signs should be used to direct bicyclists to the forest, to a trail head and to other bikeway system elements in the forest. Establishing the bikeway route between the campus and South Forest may be relatively easier than establishing the route to the North Forest due to the proximity to campus. The route to the North Forest is located primarily outside the border of the University and within boundaries of the City of Clemson. Partnering with them to establish this route will increase recreational opportunities in the greater Clemson community. Considerations should also be given for providing a CAT Bus route or University group vanpool to each of the forest identified trails heads. A list of critical improvement areas that is important to increasing connections between the campus and forest is found below. Please see the following pages for maps that contain connections and critical intersections.

Critical Intersection Improvement Areas

- Old Cherry Road and Old Stone Church
- Old Cherry Road and Queen Street
- College Avenue and Hwy 123
- Area around the bridge across Hwy 133 (The intersections of Pike Road + Hwy 133 and Old Six Mile Road + Hwy 133.)


0 0.5 1
Miles
Forest Trails and Connections to Campus
Trailhead
Primary Mountain Bike Trail
Forest Paved Bikeway
Forest Trails
Clemson University Campus
Clemson Experimental Forest


0 0.25 0.5
Miles
Campus to North Forest Bikeway Connection
Primary Unpaved Mountain Bike Trail
Primary Paved Bikeway Connection
Proposed Campus Bikeway
Trailhead
Critical Intersection
Clemson University Campus
Clemson Experimental Forest


0 0.25 0.5
Miles
Campus to South Forest Bikeway Connection
Primary Unpaved Mountain Bike Trail
Primary Paved Bikeway Connection
Proposed Campus Bikeway
Trailhead
Critical Intersection
Clemson University Campus
Clemson Experimental Forest

Trailhead Design

Forest trailheads should be visible from the road and be the head of several trails or a primary trail. Adequate space for parking and equipment should also be provided. Trailheads should provide information on user group conflict policy, trail name, route, level of difficulty, intersection with other trails, permitted (or prohibited) user groups and the lead University organization or department. Trailheads should be designed in a way that establishes a sense of arrival, location and fun, setting the tone for the forest wayfinding and trail system. Trailheads should denote the specific area or part of the forest the user is in. They should also be consistent with the identity of the University, re-enforcing the idea that the University and Forest are unique parts of the same system. There could also be some connection or consideration made to establish visual cues between the bikeways and network on campus and those in the forest at trailheads. Trailhead design could incorporate elements of national and state forestry signs, but considerations should also be given to previous signage and wayfinding efforts at the University.

Sample trailhead design

Ideas in Need of a Champion

Based on the review of the other universities in the Case Study section on the plan, there are other bikeway-related topics that are important to consider beyond bikeway facility development. Even though some of the ideas do not fit within the scope of the Clemson University Bikeways Plan, recording them is an important step in building a comprehensive bikeway network and program. The following is a list of ideas and recommendations that other University departments, organizations or even through a partnership with the City of Clemson, groups may choose to take on and address.

- As the bikeway network is developed, create a map that highlights preferred routes and bicycle parking facilities. Have the map available in paper and digital form.
- Provide opportunities to learn about basic bicycle user, safety, commuter and maintenance skills. Consider developing a university web-site, holding educational classes/workshops, providing printed materials and other ways to outreach to the Clemson community.
- Develop a campus coalition and policy to determine the designation, signage and enforcement of "Dismount Zones" for the campus area. Discussions and decisions should address the expected behavior of bicyclists in pedestrian-oriented areas, paths and spaces in places like south of Cooper Library, Core Campus, the Campus Green and in the vicinity of Tillman Hall.
- Develop a bicycle parking strategy that includes addressing the needs of long term and short term, covered and uncovered bicycle parking.
- Develop a bicycle crash reporting and classifying system to monitor and track bicycle crashes on campus.
- Consider collaborating with the City of Clemson and other local communities to develop fun and educational bicycling programs, events and activities.
- Provide information about bikeways, state and local laws and safety tips in student orientation and new faculty and staff information.
- Conduct biannual bike counts to track the number of bicyclists on campus.
- Develop a bicycle operation and ownership policy that defines where bicycles are allowed and prohibited on roads, sidewalks and multi-use trails with clear enforcement strategies.
- Develop incentives for students, faculty and staff that choose to ride their bike to campus as a form of transportation.
- Include bicycling as part of the larger University transportation demand management strategy.

- Examine the role, location and improvement needed to service the campus community at the campus bike shop.
- Hold events to promote bicycling to and around campus and in the forest.
- Develop a Bicycle Advisory Committee comprised of committed University faculty, staff, students, City of Clemson employees and community members.
- Increase the number of rental bikes available to students. Successful programs have started small with miles of bicycle infrastructure in place. Consider investing in and developing the program sustainably over time.
- Provide bicycle rentals at the Madren Center.
- Consider the need for hiring a Bicycle Coordinator.
- Develop and provide a "first-time offenders" class for bicyclists that break the law. Instead of just handing out tickets and collecting fines for violation of local, university and state bicycling laws, use enforcement as a way to teach and promote safer bicycling. Pilot programs include the City of Madison, Wisconsin.
- Host car-free events that open parts of the campus and forest to bicyclists and pedestrians.
- Complete an inventory of existing trails and roads in the North and South Forest to determine route location and suitability for the various user groups.
- Manage user group conflicts in the Clemson Experimental Forest. Decide what trails are open (or closed) for each user-group. Establish a policy on user-group conflict on the trails.
- Develop a comprehensive forest bikeway network that includes on-road, off-road, paved and unpaved routes. Determine a primary network of bikeways trails and roads as well as those that are open to bicycles.
- Develop a trail rating system that indicates the level of difficulty for each of the user-groups permitted to use the trail.
- Create a map of the comprehensive forest bikeway network that includes information about trailheads, user-group conflict policy, emergency contact information and clear network connections to the campus. Make it available online and at various locations in the University and community.
- Develop and promote "Park and Bike" commuter lots where people who drive into Clemson can drive in from Anderson, Greenville or other, places park their car in a lot and ride into the interior of campus on their bike. Also consider putting bike racks in parking lots so students who may have a car on campus can bike to their car in a lot and securely park their bike.

Section 6. Implementation

Priority Projects

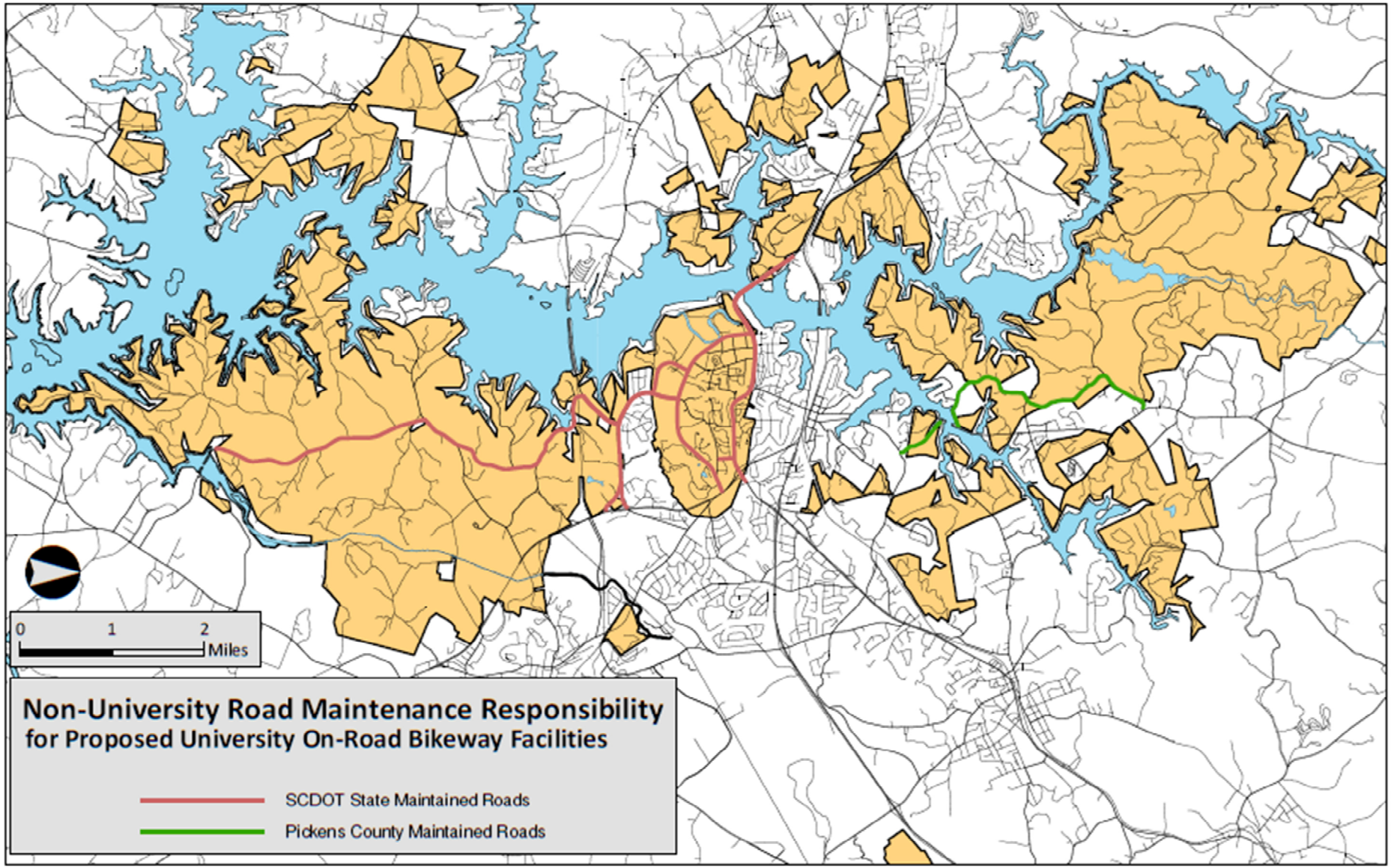
Prioritizing projects is an important part of implementing a network of bicycle facilities. A list of the top priority bikeway projects are found in this section along with prioritized project lists for interior campus roads, forest and exterior campus roads, shared use paths and mountain bike trails. Addressing implementation for intersection, bicycle parking, trailhead and wayfinding is also included.

The implementation of bikeways can occur as designated bikeway project pieces as well as a part of repaving, road widening and building site construction and repair projects. Updating roadways to accommodate bicycles according to the plan may make sense during general road construction projects. Installing bikeways on several roads at the same time should also be considered. For example, the cost of pavement markings on shared roadways is relatively small, and developing a plan to mark several roads at once will keep the cost of labor down. Implementing the bikeway network should occur over time, as project scheduling and budgets allow.

Even though the lists found in this section have been prioritized, completing a bikeway project when a roadway is ripe for resurfacing should not be overlooked just because others with a higher priority have not been installed. The lists are meant to guide bikeway development, and not necessarily as a hard and fast rule.

The University and SCDOT will be the implementing agencies on many roads at the University. Many of the major roads, like Perimeter Road and Old Greenville Hwy, are part of the SCDOT maintenance system. The two agencies will need to coordinate development and on-going maintenance. The University may need to work with the Army Corps of Engineers for any proposed projects that run along the water front. Maintenance on other roads like Williamson and McMillan is covered by the University.

Bikeway facility improvements for roads in the North and South pieces of the Clemson Experimental Forest will be different. In the South Forest, Queens Road and Fant's Grove Road are maintained by SCDOT. Implementation along the roadway will need to be coordinated between Clemson University and SCDOT. In the North Forest, Old Six Mile and Old Jewell Bridge Road are maintained by Pickens County. Any improvements along these roadways will need to be coordinated between Clemson University and Pickens County. A map on the following page outlines state and county road maintenance, as they fall within the boundaries of University properties on proposed bikeways.


0
1
2
Miles
Non-University Road Maintenance Responsibility
for Proposed University On-Road Bikeway Facilities
SCDOT State Maintained Roads
Pickens County Maintained Roads

Bikeway Infrastructure Prioritization

Proposed infrastructure improvements in the plan include over 40 miles of new bikeway facilities, with 27.62 miles of on-street bikeways. Implementation will help promote safety and provide a comprehensive, connected bikeway for the extended campus. Pavement markings and signage will support the network by providing identification and a means of wayfinding. Shared use paths and mountain bike trails will provide recreational riding options for many bicyclists.

To help determine which projects are a high priority to implement, two sets of criteria are developed that highlight the features most important to developing a bikeway network: Bikeway Prioritization and Safety Concerns. Each criteria statement was given a ranking range that demonstrated its value compared to the other statements. Each bikeway project segment was evaluated using both priority worksheets. A cumulative score for each bikeway project segment was found by adding up the total scores from both criteria sets. A copy of each set of criteria can be found on the pages 6.4 and 6.5.

Table 7. Priority Worksheet #1. Bikeway Prioritization. Evaluation of the criteria determined the prioritization of each proposed bikeway.

Bikeway Priorization			
Criteria	Ranking Range	Score	Description
Connections to Destinations	3-5		Is a direct connection to major university destinations like housing, academic buildings, sport facilities and forest trail head locations.
	3-5		Is a direct connection to visitor sites, the beach, non-university areas or is an indirect connection to the North and South pieces of the Forest.
On a primary bikeway	3-4		Is on a designated primary bikeway.
	3-4		Connects directly to a primary bikeway.
Safety Issues	4-5		Bikeway is on a roadway where the 5 year average ADT traffic counts are 5,000 or greater.
	3-5		Bikeway is on roadway where there is on-street parking.
	3-4		Existing bikeway needs to be improved to meet current safety standards.
	3-5		Bikeway will overlap with pedestrian walkway.
Recreation	3-5		Bikeway is recreational in nature.
	3-5		Bikeway is directly connected to a recreational bikeway or a shared use path.
Ease of Implementation	3-5		Facility can be constructed/installed with little or no changes to the existing roadway/land development.
	3-4		Facility is on university owned land or right of way.
Transit Access	1-2		Bikeway is on a CAT bus route.
	1-2		Bikeway directly connects to the CAT bus route.
Transforming Project	1-5		Bikeway will contribute to or be a part of a project that will have a major impact on the University.
	1-5		Bikeway will directly connect to a project that will have a major impact on the University.
Project Value *Please pick **one** of the following descriptions and its corresponding score value.*	4-5 **or**		Facility requires minor construction/improvements/will have a modest budget/serve a large population on daily/weekly basis. *(Example projects include pavement markings, signage, etc.)*
	2-3 **or**		Facility requires some construction/considerable more improvements/will have a moderate budget/serve a moderate population. (*Example projects include restriping, forest unpaved trail improvements, etc.)*
	1		Facility requires sigficant construction/many improvements/have a substantial budget/serve a small population on a weekly basis OR large, non-weekly events. (*Example projects include acquistions, road widening, paving,*
Total			/75 possible points

Table 8. Priority Worksheet #2. Safety Concerns. Evaluation of the criteria determined the prioritization of each proposed bikeway.

Safety Concerns			
Criteria	Ranking Rage	Score	Safety Criteria Description
Traffic	1-3		Busy vehicle traffic area, includes bus routes*
	1-3		Busy pedestrian traffic area
	1-2		High ADT counts (above 5,000)
MPH	1-2		High speed limits (above 35 mph)
Current Bikeway	1-2		Existing bikeway needs improvement to meet current safey standards.
Road Design	1-4		Bikeway contains/intersects road design that is especially unsafe or creates unusual vulnerability for cyclists.
Parking Turnover *Please pick **one** of the following descriptions and its corresponding score value.*	1		Facility has few - no parking spaces/very little to no parking turnover.
	2		Facility has residential-housing-type parking/low parking turnover.
	3		Facility has employee parking/moderate parking turnover.
	4		Facility has commuter parking/ high parking turnover.
Total			*/20 possible points*

Top On-Road Bikeway Projects

A list of the highest scoring on-road bikeway projects is listed below. These bikeway projects are critical to implementing a comprehensive, connected bikeway network at Clemson University. They are important projects that should be considered first as the University moves forward to build a better network to support bicyclists. See pages 6.10 and 6.11 for a map with marked project segments. The Project Segment Number corresponds with the project segment on the maps on pages 6.10 and 6.11.

Table 9. Top On-Road Bikeway Projects

Project Segment	Project Segment Number	Boundaries	*Bikeway Facility*	Cumulative Score
Cherry Rd	1	Old Greenville Hwy to McMillan	*Bike Lane*	80 pts
Calhoun Dr	2	Old Greenville Hwy to Fernow St	*Shared Roadway*	77 pts
McMillan Rd	3	Cherry Rd to Library	*Shared Roadway*	77 pts
Cherry Rd Extension	4	Cherry Rd to Martin Rd	*Bike Lane*	77 pts
Old Greenville Hwy	5	Williamson Rd to Cherry Rd	*Shared Roadway*	75 pts
Old Greenville Hwy	6	Cherry Rd to Hwy 76	*Bike Lane*	75 pts
Williamson Rd	7	Old Greenville Hwy to Perimeter Rd	*Bike Lane*	75 pts
Cherry Rd	8	Mc Millan Rd to Old Cherry Rd	*Bike Lane*	74 pts
Sherman St	9	Old Greenville Hwy extending to beyond the University Foundation	*Bike Lane/Shared Use Path*	74 pts
Perimeter Rd	10	Old Greenville Hwy to Cherry Rd	*Bike Lane*	73 pts
Fort Hill St	11	Williamson Rd to Calhoun Dr	*Shared Roadway*	73 pts

Interior Campus On-Road Bikeway Projects

Developing an integrated network of bikeways on interior campus roads will help bicyclists travel around the campus along preferred routes, arrive at destinations and provide an increased sense of safety. The following prioritized list is for bikeways on the interior campus roads. Each project's cumulative score is also listed. The Project Segment Number corresponds with the project segment on the maps on pages 6.10 and 6.11.

Table 10. Interior Campus On-Road Bikeway Projects

Project Segment	Project Segment Number	Boundaries	*Bikeway Facility*	Cumulative Score
Lambda St	47	Williamson Rd to Lee Hall Trl	*Shared Roadway*	72 pts
S Palmetto Blvd	12	Williamson Rd to Library	*Shared Roadway*	72 pts
Parkway Dr	13	Old Greenville Hwy to Cherry Rd	*Shared Roadway*	71 pts
Fernow St	14	Calhoun Dr	*Shared Roadway*	71 pts
Jersey Ln	15	Cherry Rd	*Shared Roadway*	69 pts
Heisman Dr	16	Perimeter Rd to Klugh Ave	*Shared Roadway*	68 pts
Zeta Theta St	17	Cherry Rd to Perimeter Rd	*Shared Roadway*	68 pts
McMillan Rd	18	Cherry Rd to Perimeter Rd	*Bike Lane*	67 pts
Avenue of Champions	19	Perimeter Rd to Williamson Rd	*Shared Roadway*	66 pts
Garden Trail	20	Perimeter Rd	*Shared Roadway*	65 pts
McGinty Court	21	McMillan Rd	*Shared Roadway*	64 pts
Klugh Ave	22	Heisman Dr to Fort Hill St	*Shared Roadway*	64 pts
Morrison Dr	23	Newman Rd to Calhoun Courts	*Shared Roadway*	61 pts

Forest and Exterior Campus On-Road Bikeway Projects

Many students, staff and faculty live off campus, and providing bikeways on the periphery of campus provides important entry and exit points for bicyclists. There are recreational opportunities at the beach, the Botanical Gardens and in the Forest that are also accessible by bicycle. Some of the bikeways will also provide connecting points to future off-campus networks. Getting to the campus, the beach and the North and South pieces of the Forest by bike will be enhanced by developing the following prioritized list of bikeways. Each project's cumulative score is listed. The Project Segment Number corresponds with the project segment on the maps on pages 6.10 and 6.11.

Table 11. Forest and Exterior Campus On-Road Bikeway Projects

Project Segment	Project Segment Number	Boundaries	*Bikeway Facility*	Cumulative Score
Perimeter Rd	24	McMillan Rd to Hwy 76	*Bike Lane*	72 pts
Martin St.	25	Daniel Dr to Wyatt Ave	*Shared Roadway*	72 pts
Bikeway to South Forest*	26	Old Cherry Rd, Queen St	*Bike Lane*	72 pts
Perimeter Rd	27	Cherry Rd to McMillan Rd	*Bike Lane*	69 pts
Paved Bikeway in North Forest	28	Old Six Mile Rd, Old Jewell Bridge Rd	*Shared Roadway*	69 pts
Old Greenville Hwy	29	Seneca Creek to Perimeter Rd	*Bike Lane*	68 pts
Paved Bikeway in South Forest	30	Queen St, Fant's Grove Rd	*Shared Roadway*	68 pts
Old Greenville Hwy	21	Perimeter Rd to Williamson Rd	*Bike Lane*	66 pts
Madren Center Rd	32	Old Stadium Rd	*Shared Roadway*	65 pts
Jervey Meadows	33	Perimeter Rd	*Shared Roadway*	64 pts
Newman Rd	34	Old Greenville Hwy to McMillan Rd	*Shared Roadway*	63 pts
Old Stadium Rd	35	Perimeter Rd to Cherry Rd	*Bike Lane*	62 pts
East Beach Dr	36	Perimeter Rd	*Shared Roadway*	61 pts
Old Stone Church	37	Old Cherry Rd to Hwy 76	*Bike Lane*	61 pts
YMCA Circle	38	Old Greenville Hwy	*Shared Roadway*	58 pts

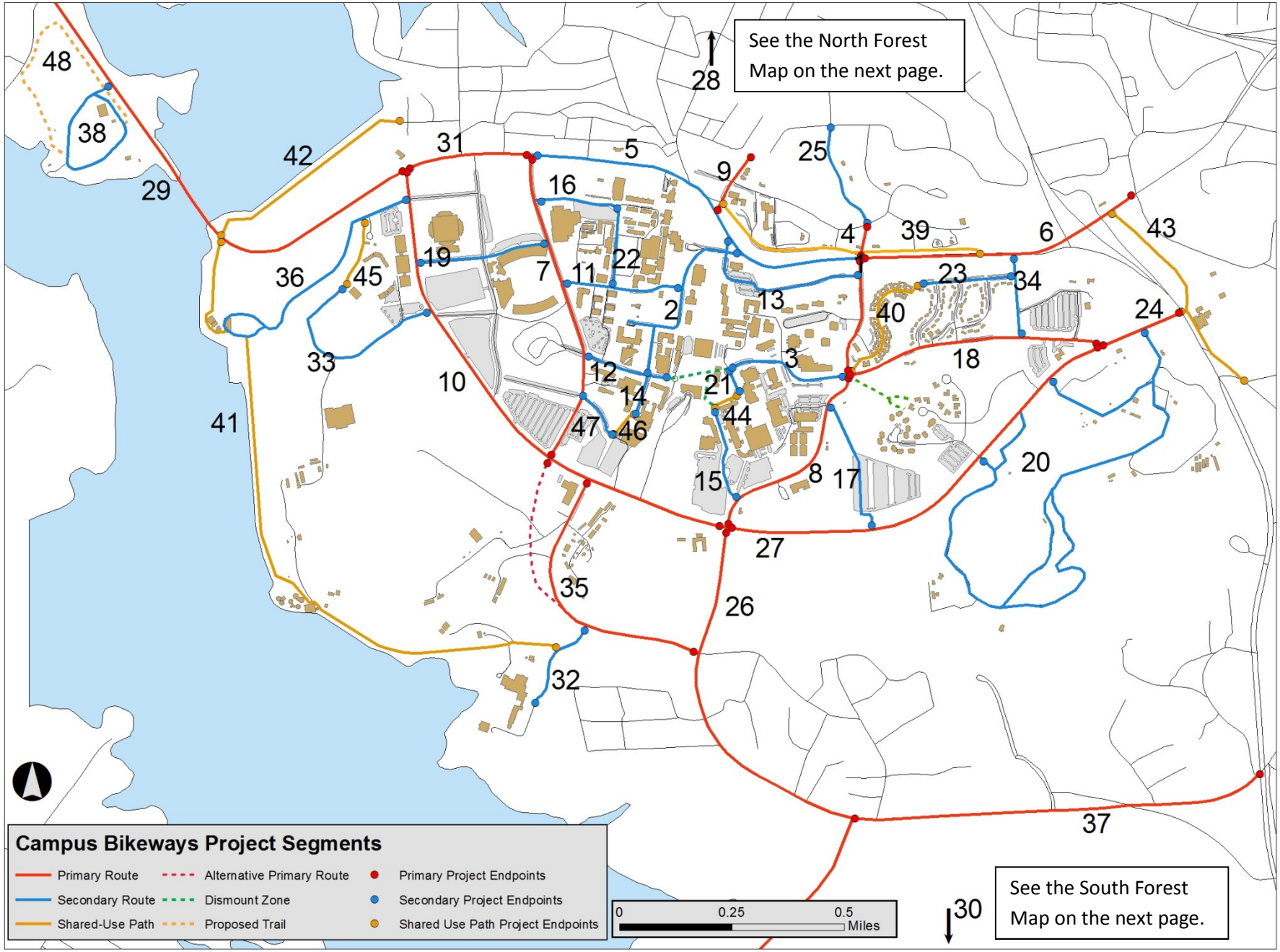
*Contains "Critical Intersection Improvement Area" mentioned in Section 5. Recommendations.

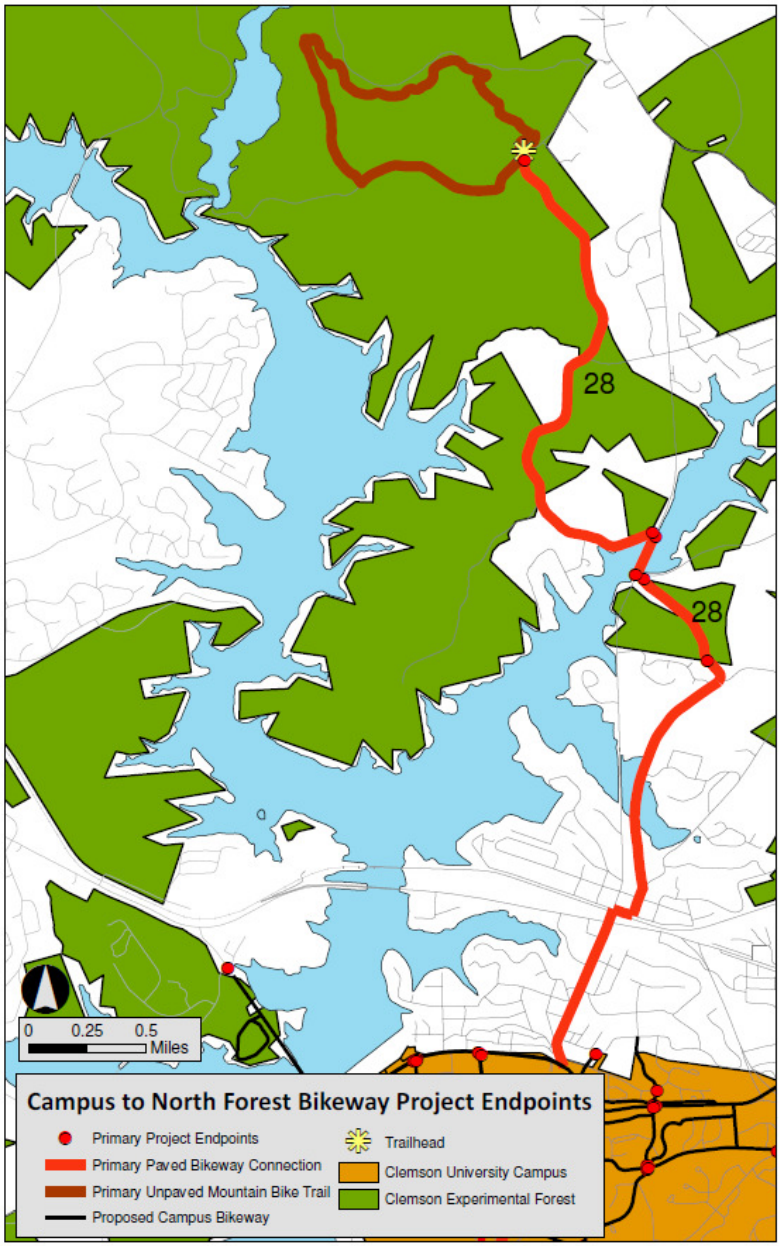
Shared Use Path Projects

Shared use paths provide places for bicycles and pedestrians to co-exist along non-motorized transportation routes. Shared use paths may be designed and used primarily for transportation, recreation or both. Paths should be designed to accommodate bicyclists and pedestrians equitably. The following prioritized list of shared paths will help with project implementation. Each project's cumulative score is listed. The Project Segment Number corresponds with the project segment on the maps on pages 6.10 and 6.11.

Table 12. Shared Use Path Projects

Project Segment	Project Segment Numbers	Boundaries	Cumulative Score
Douthit Hills Shared Use Path	39	Douthit Hill Development area	77 pts
Calhoun Courts Shared Use Path	40	Morrison Dr to Cherry Rd	70 pts
Lee Hall Trail	46	Fernow St to Lambda St	62 pts
Dike Shared Use Path	41	Madren Center to Old Greenville Hwy	69 pts
Dike Shared Use Path	42	Old Greenville Hwy to City of Clemson boundary	68 pts
Trail East of Hwy 76	43	Hwy 93 to Pendleton Rd	66 pts
Jersey Lane/McGinty Court Connection	44	Jersey Lane to McGinty Court	62 pts
Jervey Meadows Trail Extension	45	Jervey Meadows Rd to East Beach Dr.	59 pts
Beach Path	48	Campus Beach Site	59 pts


See the North Forest Map on the next page.
28
See the South Forest Map on the next page.
30
Campus Bikeways Project Segments
Primary Route
Secondary Route
Shared-Use Path
Alternative Primary Route
Dismount Zone
Proposed Trail
Primary Project Endpoints
Secondary Project Endpoints
Shared Use Path Project Endpoints
0
0.25
0.5
Miles


28
28
0 0.25 0.5 Miles
Campus to North Forest Bikeway Project Endpoints
Primary Project Endpoints
Primary Paved Bikeway Connection
Primary Unpaved Mountain Bike Trail
Proposed Campus Bikeway
Trailhead
Clemson University Campus
Clemson Experimental Forest

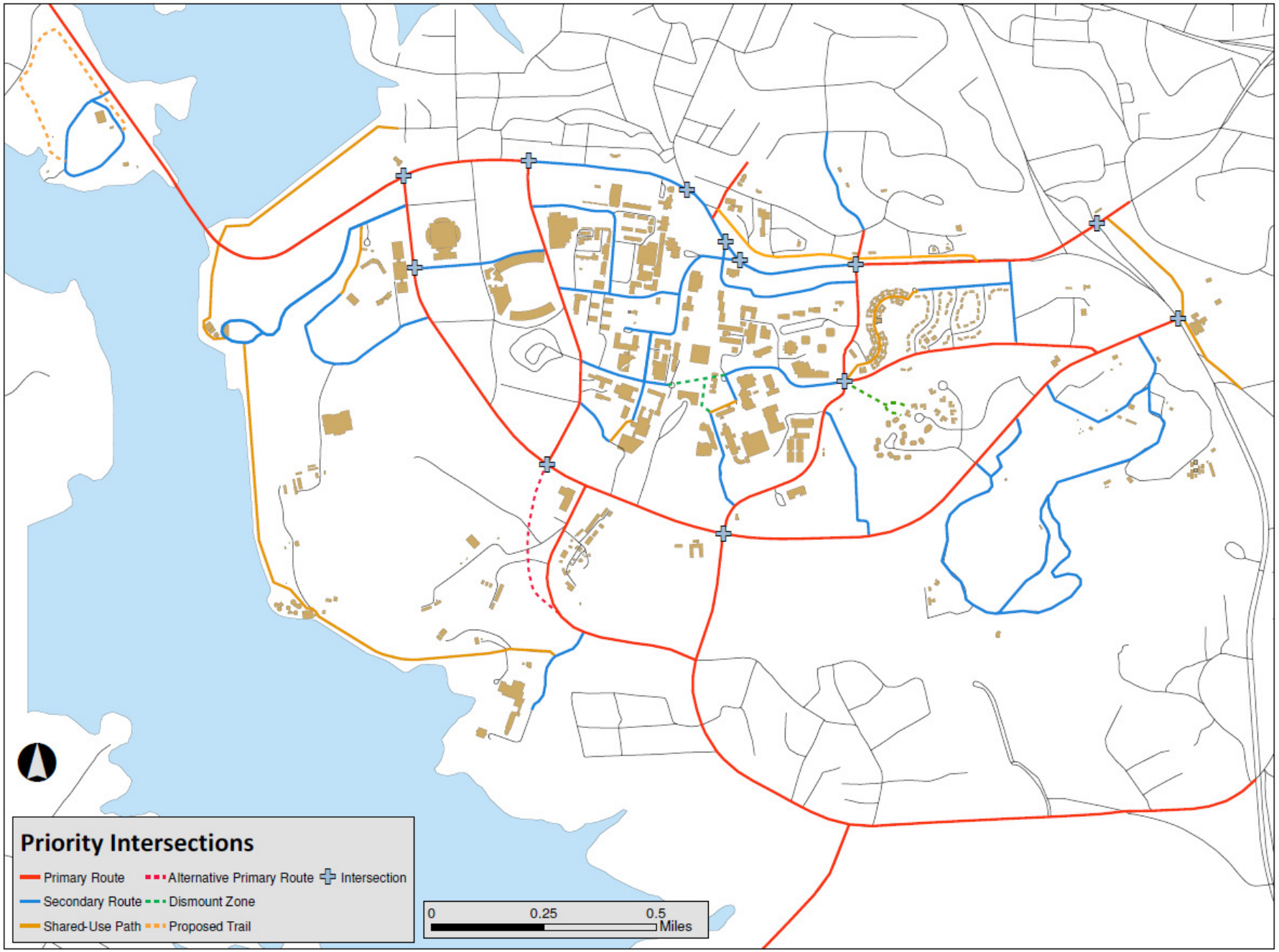

26
30
0 0.25 0.5 Miles
Campus to South Forest Bikeway Project Endpoints
Prmry_endpts
Primary Unpaved Mountain Bike Trail
Primary Paved Bikeway Connection
Proposed Campus Bikeway
Trailhead
Clemson University Campus
Clemson Experimental Forest

Intersections

Helping motorists, pedestrians and bicyclists move through an intersection is important in developing a comprehensive, connected bikeway network. Using guidance from the Bikeway Design Guidelines (found in the Appendix), the plan recommends installing bicycle detection devices at the actuated intersections along the existing and proposed bikeways. The University should also consider installing bicycle detection devices at all other actuated intersections. Implementation should occur in conjunction with signal or intersection upgrade projects and in coordination with SCDOT. Facility improvements should begin with the following list of intersections, and other projects should be installed over time. Bicycle detection devices should be installed on the primary road as it intersects the cross street, as listed in the table. Intersections that may be ripe for the installation of bike boxes in the future have also been listed, pending coordination and approval with SCDOT. (See the Recommendations section or the Bikeway Design Guidelines for more information on bike boxes.) Please see page 6.13 for a map.

Table 13. Priority Intersections

Primary Road	Cross Street	Possible future bike box intersections
Cherry Rd	McMillan Rd	**x**
Old Greenville Hwy	Hwy 76	
Perimeter Rd	Hwy 76	
Old Greenville Hwy	Cherry Rd	**x**
College Avenue	Old Greenville Hwy	**x**
Old Greenville Hwy	Calhoun Dr	
Old Greenville Hwy	Williamson Rd	**x**
Old Greenville Hwy	Perimeter Rd	


Priority Intersections
Primary Route
Alternative Primary Route
Intersection
Secondary Route
Dismount Zone
Shared-Use Path
Proposed Trail
0
0.25
0.5
Miles

Wayfinding

Implementing a bikeways wayfinding system should occur once major segments of the bikeway facilities have been installed. Wayfinding elements should follow guidance from the Bikeway Design Guidelines and University Sign Design Guidelines. Pavement markings that are part of the system should be installed following state and national standards. In some cases, using or making minor improvements to the University's existing wayfinding signs may be appropriate.

Bicycle Parking

A bike rack inventory was completed, providing insights on the current bicycle parking facilities. A bicycle parking section that explores the existing types and locations of the bicycle parking facilities, explanations of the different kinds and possible suggestions for future investments is included in the appendix. This information can be used to help with any updates to and investments in future bicycle parking facilities. The Bicycle Design Guidelines contain updated standards for preferred bike rack type and placement and guidance for long term bicycle parking. As sites on the campus, beach and forest are scheduled for construction, renovation and updating, provision for the quantity, placement, role and bicycle parking facility type should be included. Consideration should also be given to developing a plan for priority bike parking installation, which could be a stand-alone plan or part of an alternative transportation plan. User input should be obtained in the decision-making process to gain valuable insights in bicycle parking priority areas.

Mountain Biking Trails

The primary mountain bike trails that are outlined in the plan overlay current trails in the forest. To establish each route as a primary mountain biking facility, each trail should be reviewed for possible material and design improvements to enhance a mountain bike rider's safety and experience. Each trail should be designed and maintained for the novice rider. Considerations for possible connections to other mountain bike trails should also be given as well as directions on how other, non-mountain bike riders are permitted on the trail. After trail revisions are complete, trail markers should be designed and installed along the path with important information like trail direction, trail outlets or escape and mileage to trailhead.

In completing the evaluation criteria, the primary mountain biking trail in the North and South Forest was found to have the same cumulative score. Installation of each trail should be considered equally important in providing more recreational riding opportunities through the University. Further analysis may be necessary to establish which trail should be developed first.

1. Primary Mountain Bike Trail, North Forest (60 pts)
2. Primary Mountain Bike Trail, South Forest (60 pts)

Trailheads

Before installation, trailhead designers should obtain input from the users of the forest, especially from the Forest Manager and mountain bike riders. Consideration should be given to how forest trail markers, campus bikeway signage and the trailheads will relate and how users may interact with it. Some elements of the trailhead should be designed to accommodate information changes over time. Installation of trailheads at the designated areas should occur once the primary mountain bike trails have been established and more clearly marked.

Infrastructure Improvement Preliminary Cost Estimates and Total Mileage

The following tables provide information on the planning-level cost estimates for the network of bikeway facilities recommended in the Clemson University Bikeway Plan and total mileage. The cost of bikeway facility types vary greatly. For example, placing shared lane markings on existing roadways costs significantly much less per mile than installing bike lanes. However, some roadways require a more robust bikeway facility to enhance the bicycling experience. Therefore, different roadway treatments are necessary to provide adequate bikeway facilities for all users. The estimates listed in Table 8 include the total planning, engineering, environmental and contingency costs. Table 4 shows estimates for total project mileage. A total bikeways cost estimate is not given because some facility costs estimates have wide ranges. Please see the tables on the following pages.

Table 14. Preliminary Project Estimates

Facility	Cost	Materials	Additional Costs
Bola Bike Rack (ea) *preferred bike rack*	$210	Rack	30%
*Singletrack Mountain Bike Trail, difficult conditions (lin. ft)	$6	Soft Surfaces (gravel, rock fines)	30%
*Singletrack Mountain Bike Trail, difficult conditions (lin. ft)	$3	Soft Surfaces (gravel, rock fines)	30%
*Singletrack Mountain Bike Trail, repair (lin. ft)	$1	Soft Surfaces (gravel, rock fines)	30%
Bike Wash Station	$2,500	Gravel, Hose, Bike Hanging Rack, Water Source	30% + water service
Loop Detectors (ea)	$1,500	Detector, Stencil, Labor, Signs	30%
Bike Box (ea)	$5,000	Thermoplastic, Signage	30%
Signs: Share the Road (ea)	$150	Signs, Posts	15%
Signs: Wayfinding (ea)	$200	Signs, Posts	15%
Trailhead	$9,000 - $12,000	Map Board, Kiosik	30%
Pavement Marking: Shared Roadway (ea)	$200	Stencils (20 per mile)	30%
Pavement Marking: Bike route (per mile)	$2,600	Pavement stamp	30%
Shared Lane Markings (per mile)	$6,500	Pavement Marking, Signage	30%
Bike Lanes: Restripe w/ resurfacing project (per mile)	$8,000	Striping, Signage	30%
Bike Lanes: Restripe (per mile), retrofit on street	$15,000	Striping, Signage	30%
Bike Lanes: Add pavement, no curb with resurfacing (per mile)	$28,000	Asphalt, Striping, Signage	30%
Bike Lanes: On-street widening w/ curb & gutter (per mile)	$250,000	Roadway Widening	40%
Shared Use Path (per mile)	$300,000 - $800,000	Construction, Signage	30%

*Costs may be less if volunteers are used for appropriate tasks in some phases of development.

Table 15. Preliminary Total Project Miles and Cost

Project Type	Total Miles
Bike Lane	9.5
Shared Roadway	18.12
Shared Use Path	4.44
Mountain Bike Trail	9.19
On-Road Bikeways (Bike Lanes + Shared Roadways)	27.62
Off-Road (Shared Use Paths + Mountain Bike Trails)	13.63
Clemson University Bikeways	**41.25**

Appendix A

Bikeway Design Guidelines

Clemson University Bikeway Design Guidelines

University Planning & Design
Spring 2012

Bikeway Design Guidelines

The Clemson University Bikeway Plan recommends implementing a series of bike lanes, shared roadways and other bikeway facilities on campus and within the Clemson Experimental Forest. The Bikeway Design Guidelines are meant to be used in guiding bikeway facility and related development at Clemson University in a consistent manner. The University is committed to creating a bicycle system that promotes safety and provides a robust network of commuting and recreational pathways that connect the extended campus.

The design specifics and recommendations are in accordance with the American Association of State Highway and Transportation Officials (AASHTO), the Manual on Uniform Traffic Control Design (MUTCD) and other state and national standard publications. References to these guiding documents can be found in the References section. Some of the images used were created by the firm Alta Planning + Design, and come from the City of Greenville Bicycle Master Plan Design Guidelines. Used with permission by Alta Planning + Design.

Section I

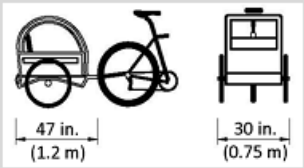
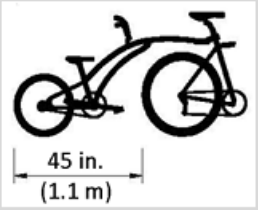
Bicycle Design Characteristics

Bicycles are:

- Built in a variety of sizes and styles and have unique physical characteristics.
- Designed to provide a variety of comfort levels for different riding behaviors.
- Have different operation and safety envelopes that depend on the bicycle types (adult upright, recumbent, tandem) and the attachment of any accessories like trailers.

Bicycle Design Characteristics

Table 1 Different Bicycle Types and Operating Features

Bicycle Type	Physical Width	Operating Envelope	Physical Length	Eye Height	Example
Conventional Bicycle	2' 6"	4' min. 5' prefer	5' 10'	5'	
Recumbent Bicycle	2' 6"	4' min. 5' prefer	8'	3' 10"	
Tandem Bicycle	2' 6"	4' min. 5' prefer	8'	5'	
Bike Trailer	2' 6"	4' min. 5' prefer	10'	5'	 or 

Bikeway design should consider the physical, safety and performance demands of bicycles and the expected behavior of bicyclists.

Section II

Bicycle Operation and Safety Envelopes

I. Typical Bicycle Speeds:

- Conventional bicycles may travel at slower speeds when pulling a trailer.
- Recumbent bicyclists typically travel at faster speeds than conventional bicyclists.

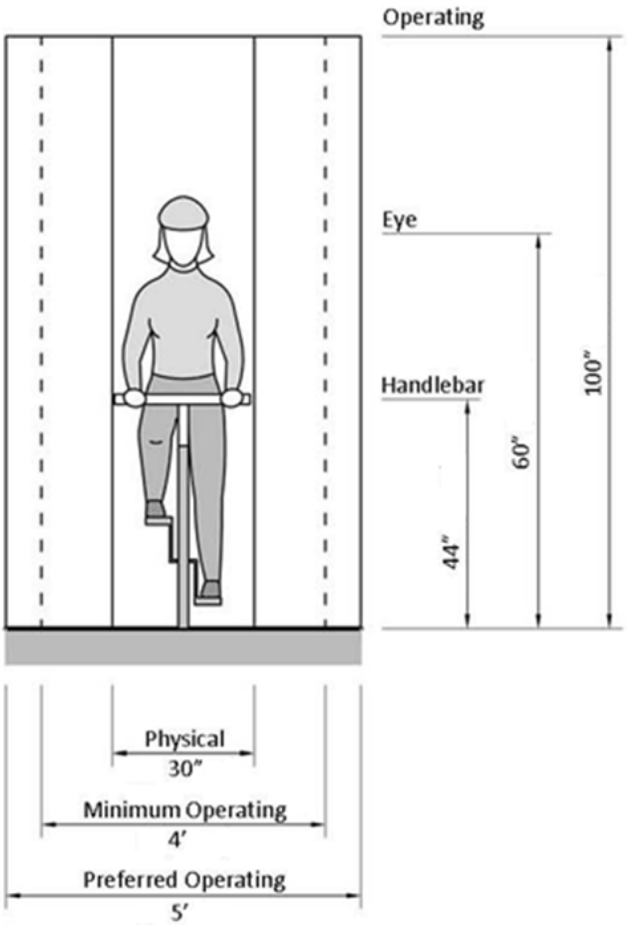
Table 2 Design Speed Expectations

Bicycle	Travel	Typical Speed
Conventional Bicycle	Paved level surface	15 mph
	Intersection	10 mph
	Downhill	30 mph
	Uphill	5-12 mph
Recumbent	Paved Level Surface	18 mph

II. Safety Operating Envelope

Recommended guidelines:

- Preferred operating envelope: 5 feet
- Minimum operating envelope: 4 feet
- Due to the operational demands of bicycles, the minimum operating space is wider than a bicycle's physical operating space.



Operating envelope for a typical bicycle.

Section III

Bikeways

1.1 Bike Lanes

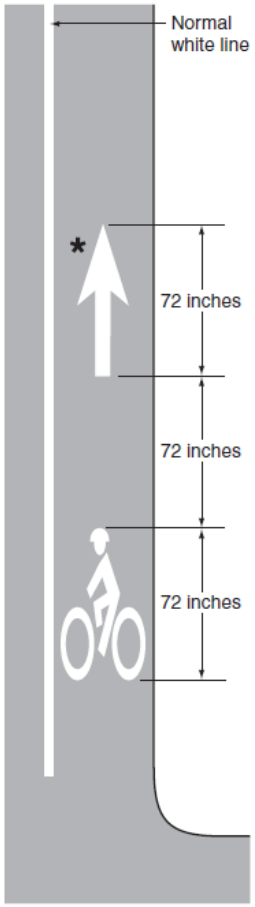
A bike lane is a defined travel lane in the roadway that is free of vehicular traffic where bicyclists are encouraged to ride. It is important that the pavement surface be smooth and free of structures. Drain inlets and utilities covers that are in the bike lane effectively reduce usable width. Where these structures exist, the bike lane width may need to be adjusted.

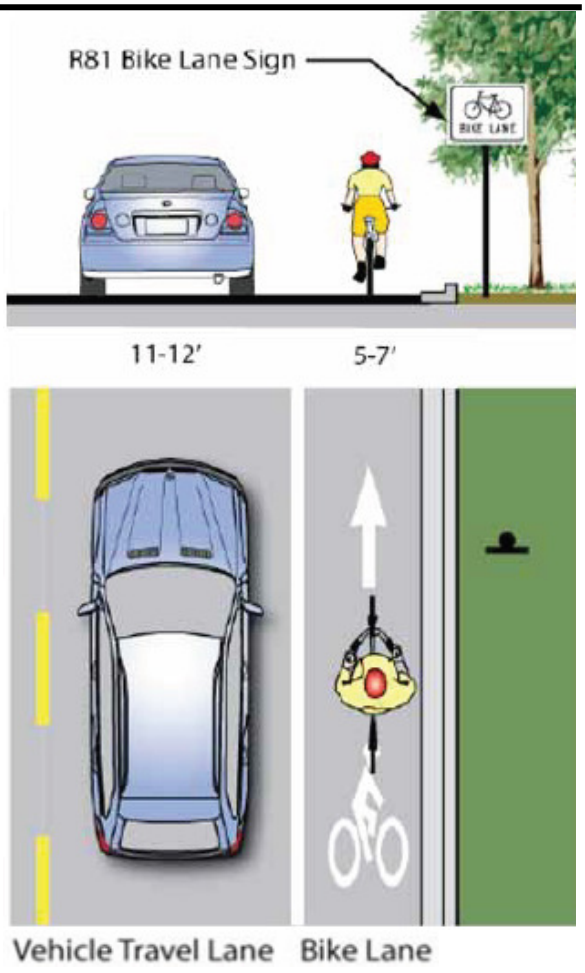
Recommended guidelines

- Preferred minimum width: 5 feet + 1 foot gutter pan
- Allowable minimum width: 4 feet + 1 foot gutter pan
- Striping line: 6 inches wide
- Pavement marking: MUTCD Figure 9C-3
  At the beginning & end of a bicycle lane at approach to intersection.

Bike Lane Example

The image to the right is a preferred pavement marking for a bike lane. MUTCD Figure 9C-3. The image on the far right is an example of a bike lane.





Section III

Bikeways

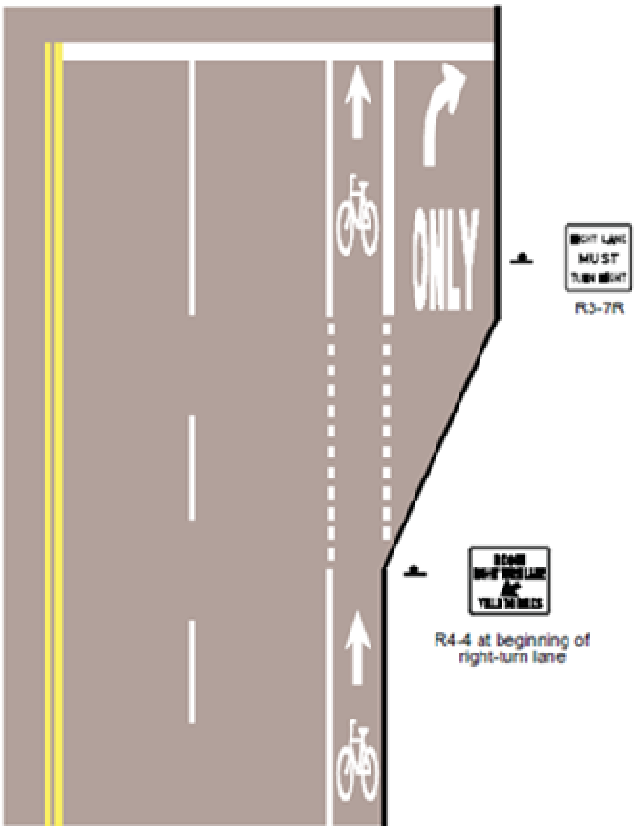
1.2 Bike Lanes next to Vehicular Turning Lanes

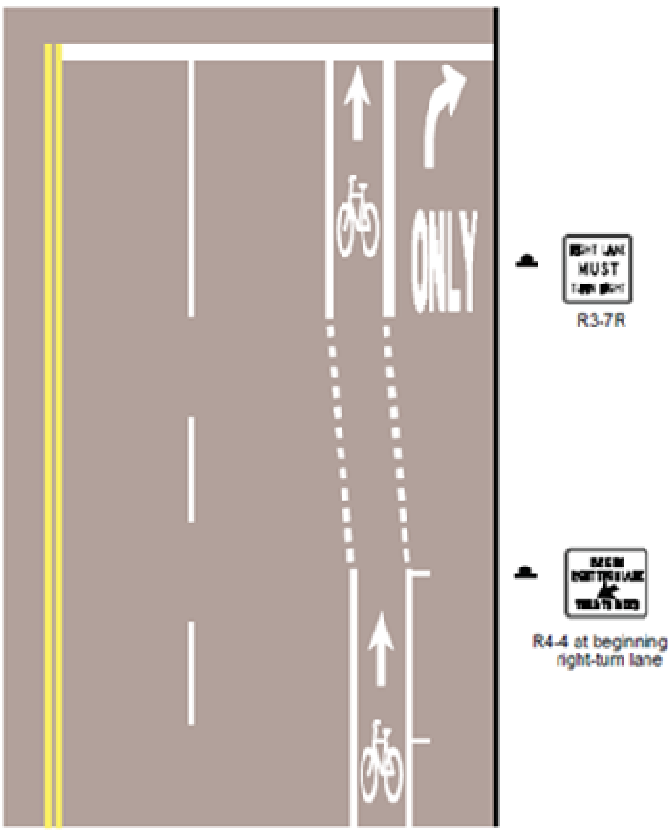
A bike lane next to a vehicular turning lane makes bicyclists more visible near intersections and encourage merging through the bike lane before the intersection. Left-turning bicyclists should be allowed to merge and use the left turn vehicle traffic lane or exit the road and use the pedestrian crosswalk.

Recommended guidelines

- The bike lane should be located to the left of the Right Turn lane.
- The lane should be marking with dotted lines to demonstrate the merging bicycle and vehicle traffic area.
- The bike lane should be marked up to the intersection stop line.
- MUTCD signs R10-6a, R10-6, R10-15, R1-5, R1-5a may be used near the intersection to communicate desired vehicular traffic behaviors.

Bike Lane next to Vehicular Turning Lane Examples





Section III

Bikeways

1.3 Uphill Bike Lanes (Climbing Bike Lanes)

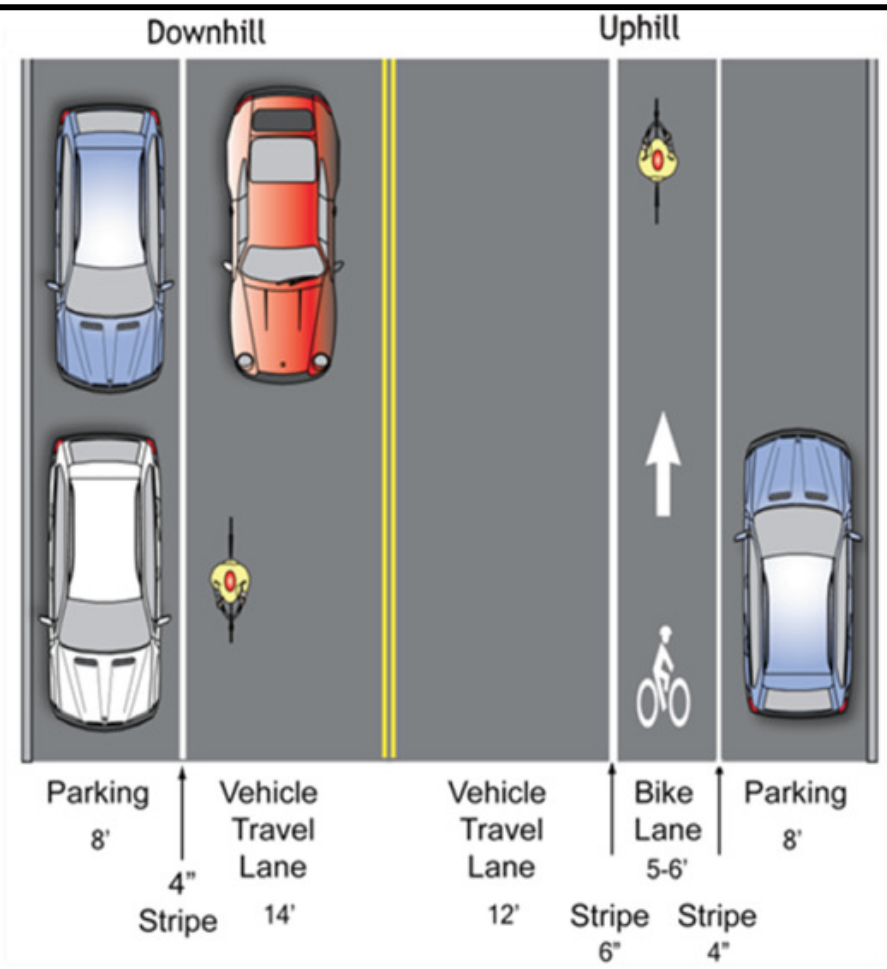
Descending bicyclists are often able to maintain vehicular traffic speeds, while bicyclists riding uphill tend to lose momentum. The speed reduction creates greater speed differentials and uncomfortable riding conditions between bicyclists and motorists. Providing a separated bike lane enables motorists to pass cyclists in a safer manner.

Recommended guidelines

- Minimum width: 5 feet + 1 foot gutter pan
- Shared lane markings should be used on the downhill part of the roadway.

Uphill Bike Lane Example

A shared lane marking may be present in the downhill lane.



Section III

Bikeways

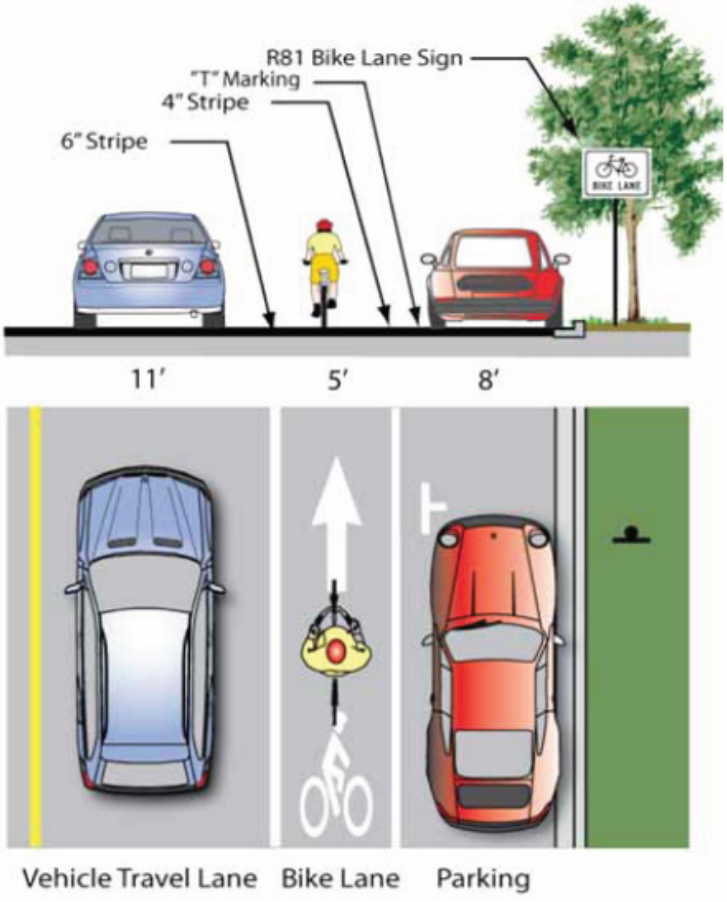
1.4 Bike Lanes and Parallel Parking

The bike lane should be located between the parking area and the travel lane. Consideration for the bicycle path location and the "door zone" should be given. See Section 2.1 for more information.

Recommended guidelines

- Minimum width: 5 feet
- Striping line width: 4 inches next to parking
  6 inches next to travel lane
- Curb face to outer edge of bike lane: 14.5 feet optimal
  12.0 feet minimum

Bike Lanes and Parallel Parking Example



Section III

Bikeways

1.5 Bike Lanes and Diagonal Parking

When diagonal on-street parking is present near a bike lane, signage should indicate that back-in parking is preferred.

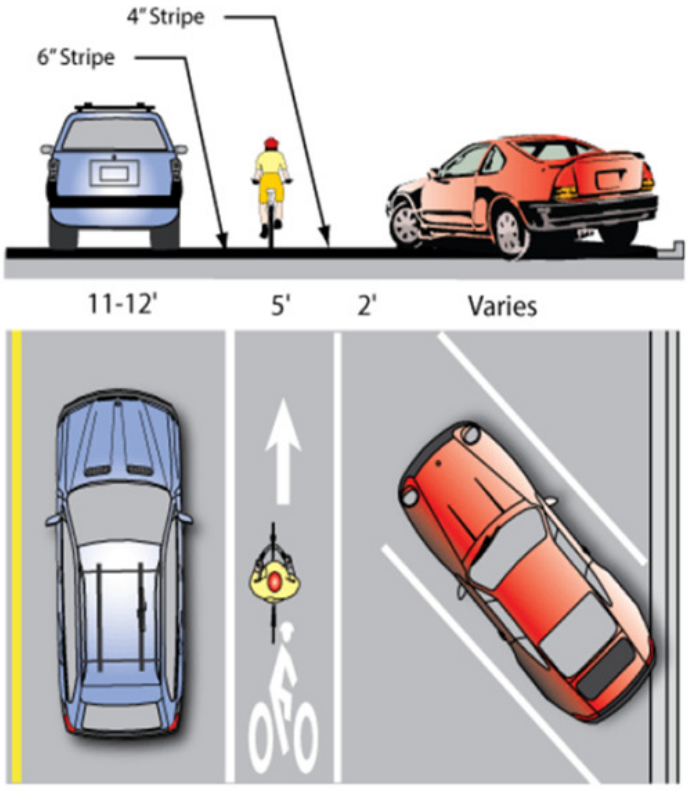
Back in diagonal parking:

- Provides better visibility for bicyclist than typical on street parallel parking.
- Minimizes open door conflicts between vehicles, pedestrians and bicyclists.
- Improves the ease of loading and unloading vehicle trunks via the sidewalk as opposed to loading and unloading from the road.

Recommended guidelines

- See guidelines for Parallel Parking
- Parking stalls should be long enough so most vehicles do not protude into the bike lane.

Bike Lanes and Diagonal Parking



Section III

Shared Roadways

2.1 Shared Roadways & Shared Lane Markings

Shared roadways are areas where bicyclists and motorists share the road. State law does not prohibit bicycle operation on most roadways, with the exception of highways and interstates. They can also be used on streets with angled parking if a bike lane is undesirable. Treatments on roads with on-street parking should place the path of the bicyclist outside of the "door zone." Signs and pavement markings should also be present.

Recommended guidelines

- Maximum speed limit: 35 mph

2.2 Shared Lane Markings

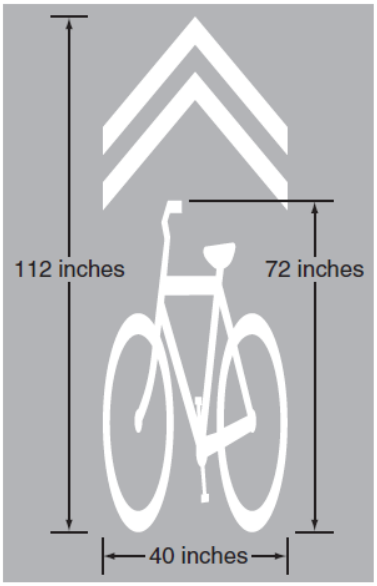
Shared lane markings are used to demonstrate a shared lane environment on the roadway.

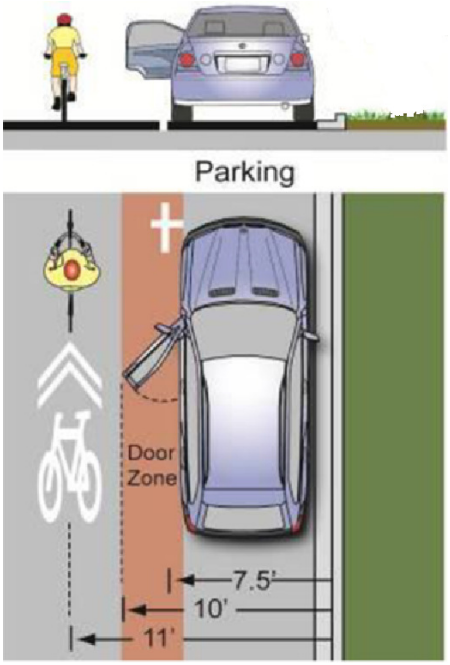
Recommended guidelines

- Placement: 4 feet from curb face minimum
  Immediately after an intersection
  250 feet intervals
- Placement on street with parking: 11 feet from curb face or
  1 foot outside "door zone"

Shared Roadway and Shared Lane Marking Examples

To the right, a shared lane marking, also called a "sharrow." To the far right, an example of how on-street parking can affect the path of a bicyclist.





Section III

Shared Use Paths

3.1 Shared Use Paths

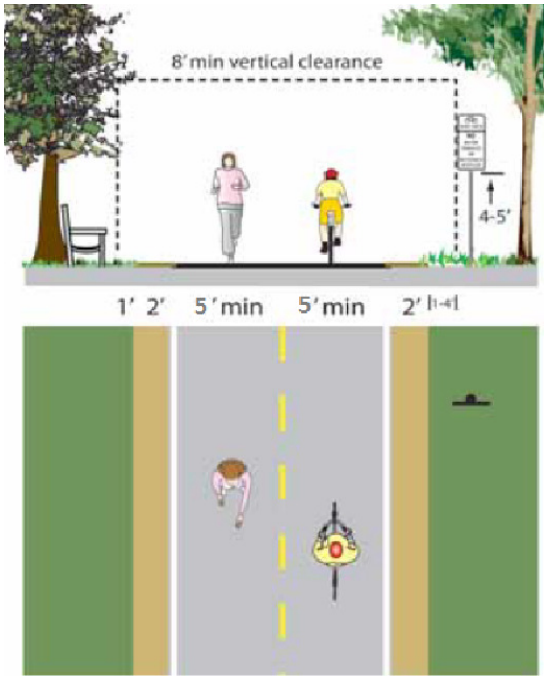
Off-road bicycle paths provide recreational riding opportunities that can be pleasant and have minimal interaction with vehicular traffic. These paths can also provide bicycle routes for less skilled riders and children. Paths should be designed to accommodate shared uses like bicycle riding, walking, running and other activities. Fencing or shrubs may be considered on paths with steep slopes or embankments. Design and placement for lighting, drainage signage and pavement type should be considered. For more information on grading, superelevation and stopping distance, please see AASHTO.

Recommended guidelines

- Minimum width: 10 feet
- Minimum grade: 2 feet
- Maximum grade slope adjacent to path: 1:6 ratio maximum
  1:3 ratio near steep slopes
- Minimum clearance to obstructions: 3 feet lateral clearance
  8 feet vertical clearance
- Maximum design speed: 20 mph paved path
  15 mph unpaved path

Shared Use Path Examples

The 3 foot lateral clearance to obstructions can be 3 feet of the same treatment or broken up to give the path a bit of a shoulder, as seen in the image to the right.



Section III

Traffic Control Facilities at Intersections

4.1 Bike Lanes through a Major Intersection

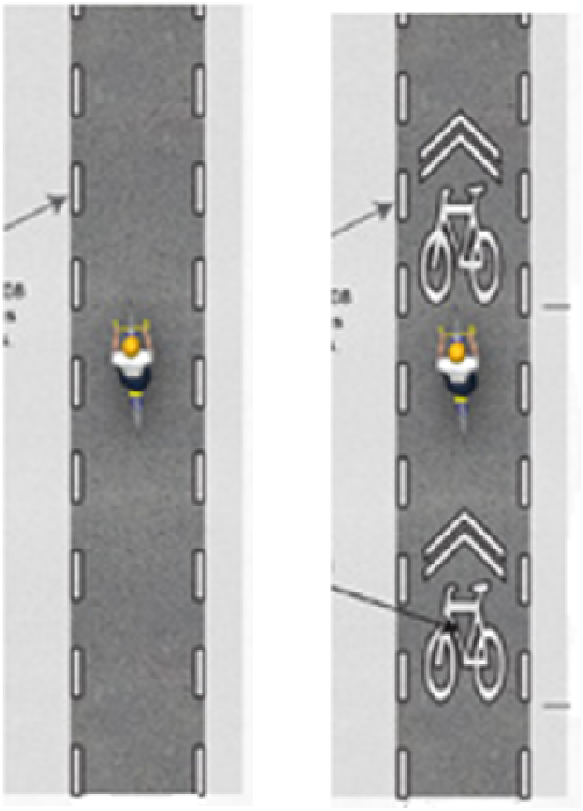
Marking a bike lane through an intersection can reduce conflicts between bicyclists and motorists, guide a straight or directional bicycle path and promote the multi-modal nature of the corridor. It should not be installed over a pedestrian crosswalk.

Recommended guidelines

- Minimum width: Match preceding bike lane
- Striping: 2 feet dotted lines
  6 feet intervals
- Shared lane markings may be present

Bike Lanes through a Major Intersection Example

A bike lane does not have to be marked through an intersection. Example of bike lane markings in an intersection can be found to the right.



Section III

Traffic Control Facilities at Intersections

4.2 Loop Detectors

Bicycle-activated loop detectors allow a bicycle to trigger a change in the traffic cycle. The purpose of using a bicycle loop is to detect bicycles at intersections and to give extra green light time to bicyclists before the light turns yellow to make it through a signalized intersection. Types A (6 foot square) and E (unmodified circle) are not bike-sensitive in their center and are not preferred.

Recommended guidelines

- Preferred loop detector types: Quadrapole Loop—Type C or Diagonal Quadrapole Loop – Type D
- Acceptable loop detector types: Type B - 5 feet square diamond
Type C - quadrapole
Type D - diagonal slashed
Type Q
Type E - circle with a slash
- Placement: 100 feet from the stop line and
At the stop line

4.3 Loop Detector Pavement Markings and Signage

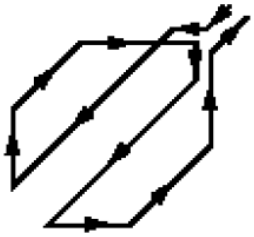
Loop detectors that are sensitive to detect bicycles should have pavements markings and signage that instructs cyclists how to trip them.

Recommended guidelines

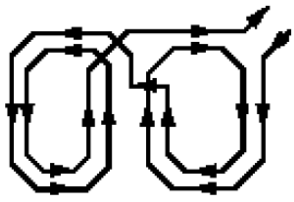
- Placement: Over bicycle-activated loop detectors

Loop Detectors, Pavement Markings and Signage Examples

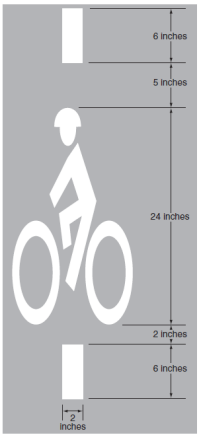
Preferred loop detectors found below. To the right, loop detector pavement markings and signage.



Diagonal Quadrupole Loop Type D



Quadrupole Loop - Type C



Section III

Traffic Control Facilities at Intersections

4.4 Bike Box

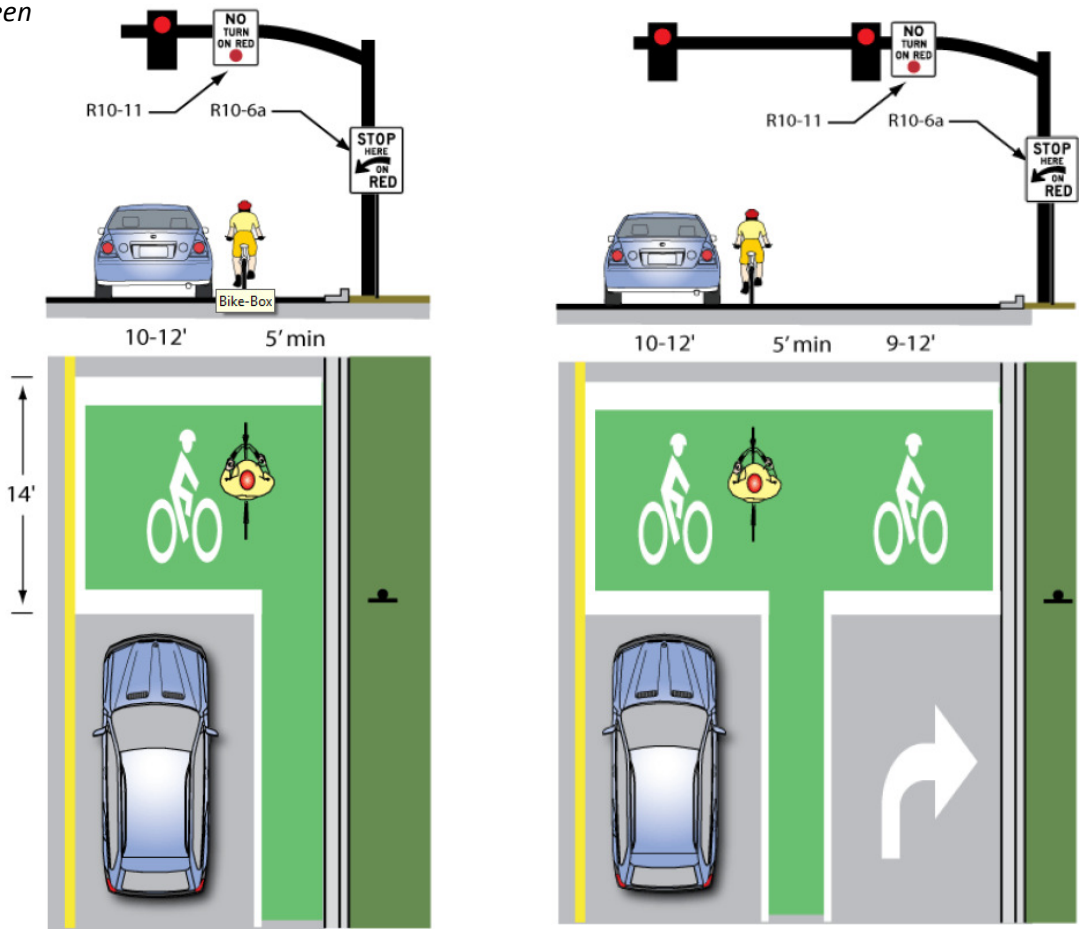
A bike box is a box just before the intersection formed by the stop line, the crosswalk and the curb. It's used to hold queuing bicyclist at an intersection. A bike lane should lead directly to the bike box. They increase bicyclist visibility and allow groups of bicyclists to clear an intersection quickly, minimizing impediment to traffic. They are typically used at an intersections with high bicycle traffic as well as where there may be a right or left turning conflicts, though other considerations may be given. Traffic signs should be present to communicate expected bicycle and vehicular traffic behaviors.

Recommended guidelines

- Placement: Before intersection
  Across one or two lanes of traffic
- Width: 10 feet minimum
  16 feet maximum
- Pavement markings: Centered in the box

Bike Box Examples

Bike box examples can be seen here. The image on the far right is preferred in areas where there are wide lanes and/or where cyclists may need make left turns.



Section III

Signs

5.1 Wayfinding and Guidance Signs

The design and feel of the Clemson University bikeway wayfinding sign system should evoke a similar, yet distinct feel to the existing university image, identification and wayfinding system. It should be designed to communicate and inform bicyclists about the location of bicycle routes, destinations and mileage. The signing system should enhance the connections between the campus and the Clemson Experimental Forest.

Recommended guidelines

- Sign Placement: After turns
  Where a route changes
  At destinations
- Pavement markings can also be a part of the wayfinding system.

Wayfinding Sign Examples

Bicycle Route Sign. *Signs can include route name and/or unique symbol.*

Decision Signs. *Signs can help bicyclists find their way to a destination and include mileage and time.*

Section III

Signs

5.2 Warning Signs

Warning signs advise motorists to share the road and watch for bicyclists. Warning signs should also be placed on streets near bikeways to alert motorists of bicycle crossings. Sign placement should be consistent to help the flow of pedestrian, bicycle and vehicular traffic. It is a cost-effective, highly-visible treatment that can help the riding environment for bicyclists on designated roads within campus boundaries.

Recommended guidelines

- Sign Placement:

  Near major activity centers
  Major roadways
  Major intersections

Warning Sign Examples

Warnings signs can help communicate expected bicycle, vehicular and pedestrian behaviors and interactions. They should be used to delineate shared roadways and bike lanes. Other signs can found in the MUTCD.

Section III

Bicycle Parking

6.1 General Bicycle Parking

Bicycle parking is a support facility that provides bicycle storage at a destination. There are two different types of bicycle parking: short term and long term. Short term parking is recommended when storing a bicycle for a short period of time, quick activities or errands. Long term bicycle storage is recommended for long periods of time, overnight or all day for some commuters.

Bicycle Parking Facilities Guidance

- A bicycle rack should support a bicycle fame at two different points. Poorly designed bicycle parking can bend wheels and damage bicycles.
- Place racks in visible areas to increase security and highlight bicycling a visible travel option.
- Place racks close to buildings and outside of landscape screening area to minimize theft or vandalism.
- Provide lighting for bicycle parking areas.
- When possible, provide shelter over a bike rack to protect the bicycle from exposure to the elements, even for short periods of time.
- Racks should be mounted into the ground.
- Consider that all bicycle racks do not necessarily hold the number of bicycles advertised. Actual spacing between rack elements may be inadequate and may result in damaged bicycles. Some rack designs may encourage incorrect use and may inadvertently lower rack capacity.

Recommended guidelines for rack placement

- Distance from curb: 24 to 30 inches
- Distance from other street furniture: 3 feet minimum
- Distance from other bicycle racks: 4 feet minimum
- Distance from a crosswalk or intersection : 5 feet minimum
- Distance from building: 50 feet maximum
- Short term bicycle space requirement : 1 space per 10 students (2 space minimum)
- Long term bicycle space requirement: 1 space per 10 students + 1 space per 10 employees

Section III

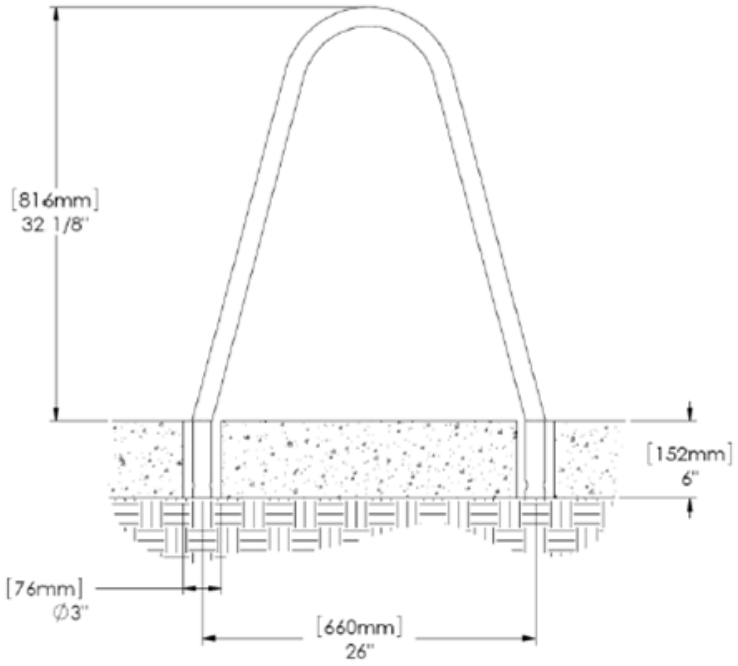
Bicycle Parking

6.1 General Bicycle Parking (continued)

Bike Rack Examples

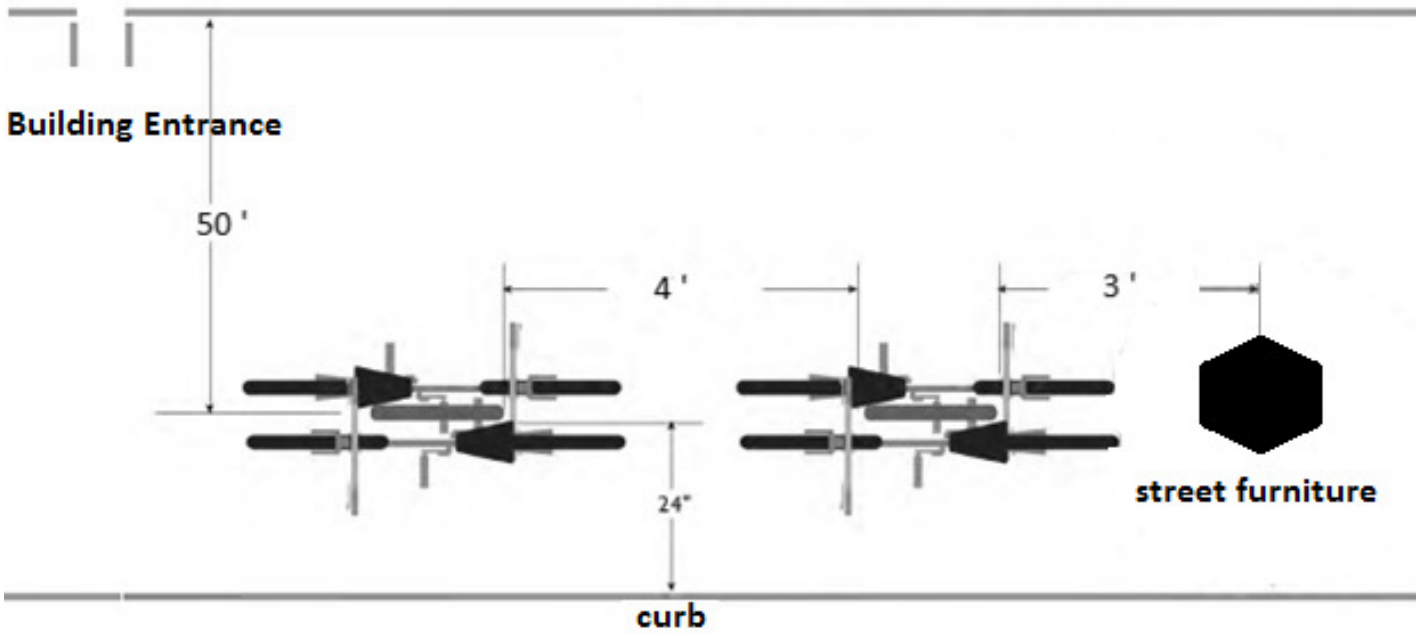
Bola Bike Rack, Landscape Form, *preferred*

This is the preferred bike rack design, but other acceptable racks may fall under the "Inverted U" or "Post and Ring" bike rack type. See the APBP Bicycle Parking Guidelines further guidance, including photos of acceptable bike racks.



Bike Rack Layout Example

The image below provides a visual for bicycle rack placement guidelines on the following. The following page. Image is not drawn to scale.



Section III

Bicycle Parking

6.2 Long Term Bicycle Parking

Specific design guidelines for long term bicycle parking will be further developed as the need arises. Long term parking should be sheltered and provide enhanced security. The location of long term storage will vary on campus. Considerations should be given to those who live on campus as well as those who live off campus. Long term parking areas should be convenient and near a bikeway.

Long Term Bicycle Parking Facilities include:

- Covered bicycle racks
- Bicycle storage rooms
- Bicycle lockers

Recommended guidelines

• Expected parking time:	More than 2 hours
• Long term space requirement: (planned capacity)	1 space per 10 students 1 space per 10 employees or 1 space per 20,000 sq ft

Long Term Bicycle Parking Examples

Covered bike racks, found below, can be used as short term or long term parking. Bike rooms, top left, can provide limited access which may be preferable in university environments where there is high turn over and traffic in buildings on a daily basis. Bike lockers, bottom left provide individual security which may be preferred for daily commuters. Bike rooms or cages provide group security.

Section IV

References

7.1 References

The bikeway design guidelines recommendations in this document were developed using national recommendations and standards to guide future local development. Innovations in bikeway facility design and standards are continually being developed. The resources should be consulted for more detailed information on recommended designs and treatments. For further reference, please refer to the most up-to-date publications of the following resources.

Reference List

- Clemson University Design Guidelines
- Clemson University Sign Guidelines
- South Carolina Department of Transportation, Engineering Directive Memorandum 22
- 1999 AASHTO Guide for the Development of Bicycle Facilities (an updated guide is expected to be released in 2012)
- 2009 Manual on Uniform Traffic Control Devices
- National Association of City Transportation Officials Cities for Cycling Urban Bikeway Design Guide
- FHWA Designing Sidewalks and Trails for Access Part II of II: Best Practices Design Guide
- 2004 Characteristics of Emerging Road and Trail Users and Their Safety
- APBP Bicycle Parking Guidelines, 2nd Edition (2010)
- City of Greenville Bicycle Master Plan Design Guidelines

Section IV

Acknowledgements

Clemson University

University Planning and Design

Staff

Gerald Vander Mey	Director
Tanya DeOliveira	Planner

Appendix B

Bicycle Parking

Bicycle Parking

Bicycle parking is a bikeways support facility that provides bicycle storage at a destination. There are two different types of bicycle parking: short term and long term. Short term parking is recommended when storing a bicycle for a short period of time (2 hours or less), quick activities or errands. Long term bicycle storage is recommended for long periods of time (2 hours or more), overnight or all day for some commuters. The following section explores the existing types and locations of the bicycle parking facilities at Clemson University, explanations of the different kinds and possible suggestions for future investments.

Existing Bicycle Parking On Campus, at the Beach and in the Forest

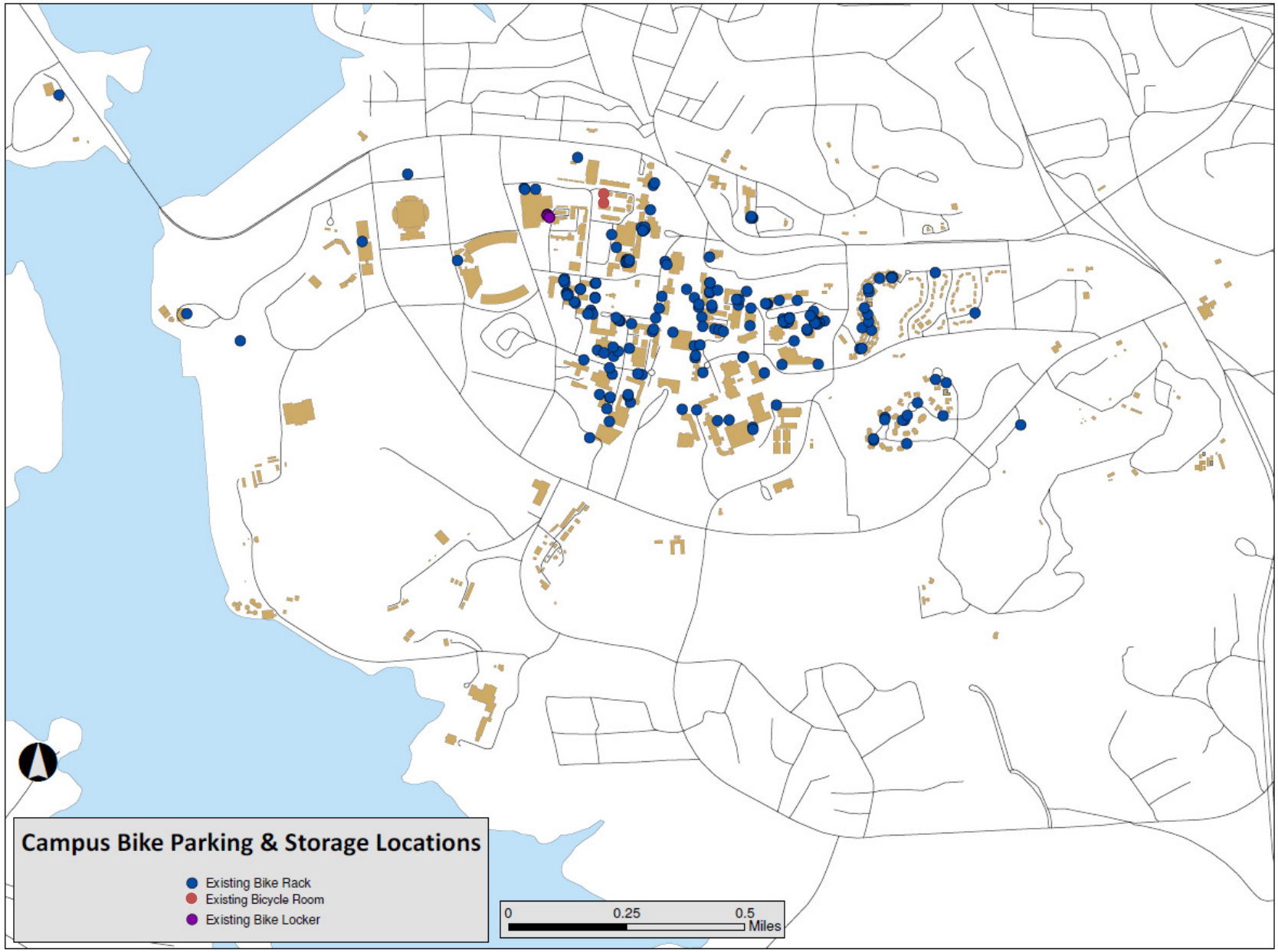
Clemson University has approximately 188 different bicycle parking locations on campus, at the beach and in the forest. There are eight bicycle lockers (currently not in use), two bicycle storage rooms and the rest are various types of bike racks. The table below shows the eight different styles of existing bike racks and a location where they can be found. Please see the map on the following page to see the current locations of the bicycle parking facilities.

Table 1 Most common bike racks at Clemson University

			
Type: Cycloops	Type: Comb A	Type: The Wave	Type: Comb B
Location: Bracket	Location: University Housing	Location: Smith Building	Location: University Housing

Table 2 Other bike racks at Clemson University

			
Type: Raised Comb	Type: Bola Rack	Type: Bike Seat Rack	Type: Inverted U
Location: Near Martin Hall	Location: Lee Hall III	Location: Near Littlejohn	Location: The Beach


Campus Bike Parking & Storage Locations
Existing Bike Rack
Existing Bicycle Room
Existing Bike Locker
0
0.25
0.5
Miles

Bicycle Racks

A bike rack can be used for short term or long term parking. Bike racks are best used for short term parking because they are designed to be convenient places to store a bike for a short period of time (less than 2 hours). Racks should be mounted to the ground at locations where they are meant to be part of the daily, on-going bicycle support facilities. They should be placed outside of the path of travel on sidewalks and bikeways, but they can also be placed on the street. A bike corral, as on-street bike parking is also called, when done properly, can also be an effective bike parking area. Mounting racks on paved or pervious pavement pads is preferred. Other types of bike rack pads like mulch, dirt, sand, gravel or grass impede movement, wear away or get muddy over time.

Security for bike racks is generally passive, meaning that people walking by provide surveillance. A bike lock is used to secure a bike to the rack. A mounted bike rack increases the security of the bicycle parking element, and gives users an additional feeling of security.

Bike racks should support a bicycle frame at two different points, as shown in the middle photo below. A poorly designed bicycle rack can bend wheels and damage a bicycle. Racks that only capture the front or back wheel do not provide enough support, and bikes can swivel or fall. Some racks do not necessarily hold the number of bicycles advertised. Some rack designs may encourage incorrect use and may inadvertently lower rack capacity. Actual spacing between rack elements may also be inadequate and may result in damaged bicycles. More information on racks can be found in the Clemson University Bikeway Design Guidelines.

Bike racks at Lee Hall III. Preferred University bike rack.

Bikes supported at two locations on bike rack.

Bike rack over capacity. Design prohibits proper bike frame support. Near Lowry Hall.

On-street bike parking or bike corral.

Covered Racks

Covered bike racks can be used as short term and long term bicycle parking facilities. They are typically a series of bike racks that are covered to protect bicycles from the weather. Any rack that is covered should support a bicycle in the same way as an uncovered facility. They should be placed near entrances, lit at night and could contain surveillance cameras for increased security. Users may choose to store their bike at these facilities over long periods of time (several weeks or throughout the semester) if they are well-designed, placed at convenient locations and a sense of security persists at the facility

Bicycle racks can be covered by placing them under building overhangings, near covered entrances outside of the path of travel or in parking garages. They can also be purchased as a separate bicycle parking facility unit. If units are purchased, care should be taken to make sure that the design fits the site context, provides adequate protection from the weather and complement existing structures on campus. For example, some transit stops on campus have covered shelters, similar to the photo on the bottom right. Similar designs, with enhancements to the shelter, could be used around Clemson University.

Covered bike parking at Byrnes Hall. Near building entrance. Clemson University.

Covered bike parking at Cooper Library. Clemson University.

Covered bike rack at Penn State.

Temporary Event Bicycle Parking

Temporary bicycle parking, sometimes referred to as valet bike parking, is useful at events where people may choose to ride their bike to arrive at the destination instead of drive their car. This kind of parking it typically comprised of bike racks that are movable and located in a designated, secured area. Temporary bike parking may be supervised, but ensuring that each bike is secure, yet accessible to each bicyclist is a critical component.

Supplying additional bike parking increases bicycle parking capacity. It encourages more bike riding to the event, and may decrease automobile traffic. Events where temporary bike parking may be useful include athletic events, concerts and festivals. Advertising that bike parking will be available is important.

Temporary racks can have varying characteristics, depending on how the security is programmed. Bike racks where bikes are hung from seat racks, as seen in the photo to the right, are less secure but can fit more bikes per rack. Security may be based on a "bike-check" or valet system. Bike racks may also be based on individuals providing their own lock, like that found in the middle photo. Bike racks that are movable and already owned by Clemson could be used as temporary bike parking. Both options are realized in the photo to the far left. Temporary bike parking can be adjusted based on the expected bike-riding crowd and security program at each event.

Temporary bike parking in a parking lot. Notice the number of bicycles that fit in the parking space. Portland, OR.

Valet bike parking. University of Maryland.

Bikes parked from seat. Temporary bike parking.

Bicycle Storage Rooms

A bicycle storage room, or bike room, is a large, sheltered area that is used to store a large number of bikes. Security is based on access and locking mechanism. Users may be permitted individually or by a person with security access. Periods of access can range from 24 hour/7 days a week to restricted hours of operation. Installing surveillance cameras can deter or be used to help capture theft or vandalism inside the bike room.

Rooms can be locked by keys or electronically. Key access is not susceptible to computer malfunctions, however, providing access can be complicated by one lock and many users over time. There may be a need for changing the locks periodically. Electronic locking mechanisms may be used to limit access to designated groups during designated time periods. They may also be used to track use, which can help with vandalism issues and provide information about the use of the space over time. Clemson University Student Identification cards could be considered and programed as a way to control access to these facilities.

Bike rooms layouts can range from open (many floor-mounted bike racks) to highly organized (a combination of floor-mounted, wall-mounted, and tiered bicycle racks). Storage room capacity is important. Design and organization of the room can be used to increase capacity in any given space. Bikes can be stored horizontally or hang from the wall vertically. In-room parking facilities should also encourage and allow users to lock their bike to racks to enhance individual bicycle security.

Room and rack access should not be overlooked for storage capacity. Providing room for allowing the movement of bikes in and around the room is important. Space and a travel path for maneuvering a bicycle down aisles, in and out of the room and to a building entrance that is near a bikeway should be considered. Rooms in the bottom level of the buildings can be a good area to store bikes in areas where there is less demand for space. However, storage rooms near building entrances may provide better access to bikes and may result in more people using their bikes. Considerations should be made to ensure that storage rooms lacks water leaks and other building maintenance issues.

To help with the cost of maintenance, security and limit access to users, asking users to pay a fee to store a bike could also be considered. Specific areas on campus could offer in between semester storage during winter and summer breaks. Bringing bikes home on semester breaks may not be an option for some students. Charging a small fee is not uncommon for this service. A nominal fee prevents “anyone” from having access and may deter theft.

There are two designated bike rooms on campus. One is in the basement of Wannamaker Hall and the other is in the basement of Bradley Hall. Neither have been maintained, and future plans may include expanding general building storage to these rooms, excluding their use for bicycle storage.

Bike storage in Wannamaker Hall. Students in nearby units have access to this storage. Clemson University.

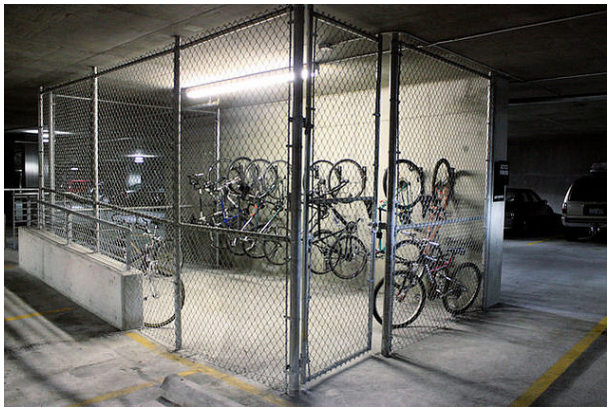
Wall-mounted racks. Off-setting provides double the bike storage capacity. Cable allows bike owners to loop and lock up bikes. Condominium.

Bike room at Olin College

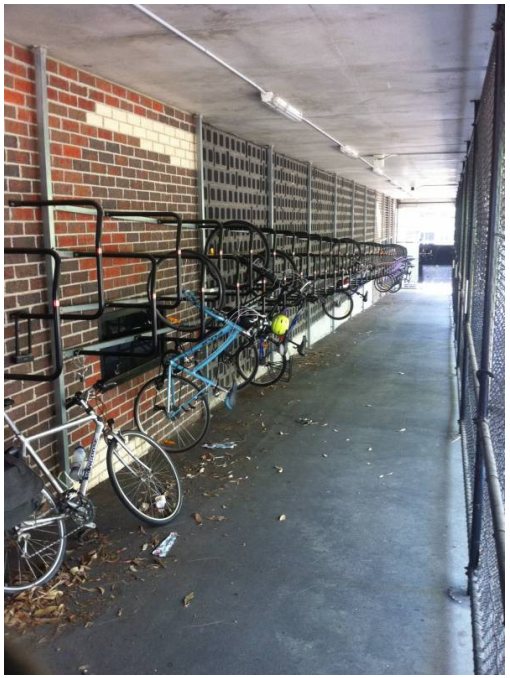
Bicycle Storage Cages

An alternative to the bike rooms is a bicycle storage cage. This area is sectioned off by a large cage or fencing that is either covered or in a larger, sheltered area like a parking garage. The function, organization, access, security and issues associated with a bicycle storage cage are very similar to a bicycle storage room. The major difference is that the cage is not in a controlled environment, and the bikes are exposed to the weather.

Outdoor bike cage. United Kingdom.



Bike cage in a parking garage in Oregon.



Bike cage on a campus in Australia.

Bicycle Lockers

Bicycle lockers can provide more security than bike racks. Bikes are stored out of site, and access to the locker is limited. However, they are bulky bicycle parking facility and take up more room than bike racks.

The security of the locker depends on the wall panels, door, frame and locking mechanism. They can be made out of metal, plastic or fiberglass. Metal is durable, however, it can become hot on sunny days. Plastic will not become as hot, but some weaker types like polyurethane can be cut or pried away from the locker frame. Fiberglass is resistant to cutting and most prying. Poorly engineered panel joints or door frames can be susceptible to vandalism and destruction. Investing in quality locker door mechanisms that insert two or more tabs into the internal frame will help defeat prying thieves. Additionally, investing in higher-quality door-frame construction will also minimize wear over time. Lower quality lockers have doors that are made of panels attached to angle-iron or U-channel frame that may bend, brake or prohibit the door to latch and lock with repeated use and outdoor exposure.

Locker doors should open to at least 90 degrees. They should also be clearly identified as bicycle lockers. Information about how to use and sign up for lockers should be posted nearby. Some lockers are designed with windows. Being able to see inside is useful to view whether or not the bike inside has been abandoned and if the locker is being used as intended.

There are 8 bike lockers on campus. They are owned by CORE, and located on the east side of Fike Recreation Center.

Bike lockers at Clemson University.

Bike lockers near bike racks.

Bike locker. Michigan State University.

Suggested Future Locations

Investments in future bicycle parking facilities should be considered in strategic ways and opportunities. As sites and areas are being redeveloped on University property, considerations should be made for bicycle parking types, locations and potential user group feedback. User groups include students, staff, faculty, alumni, visitors and community members.

The placement of bike parking facilities should be destination oriented. Having bike parking at places like academic buildings, university housing sites, student activity centers, visitor sites, athletic and event facilities is important. Having bike parking at some transportation transitions areas like parking lots and bus stops is also important.

Bicycle Racks

Bicycle racks are the most basic and best investment in bike parking. Furnishing enough well-designed, well-placed bike racks will go far to support the campus bikeways network on a daily basis. There should be a strategic effort to invest in new and update the existing bike racks that do not meet current design and performance standards to ensure that there is enough adequate bicycle parking on campus, at the beach and in the forest. Racks should also be placed in convenient places, outside the path of travel in parking lots, near transit tops and forest trailheads.

The Clemson University Bikeways Design Guidelines identify the “Bola” Bike Rack from Landscape Forms, as they meet current performance and design standards. This design should be used as the new University standard, replacing the old “Cycleloops” bike racks. Replacing racks should occur as sites are being redeveloped and in phases, starting with any racks that are not mounted to the ground. Any rack that does meet performance and safety standards should be considered for replacement.

Placing a bike parking site that serve key academic, housing and other university facilities include: Lehotsky, McAdams Hall, Newman Hall and Poole Agriculture Center; Martin Hall, Kinard Laboratory of Physics, Strode Tower, Daniel Hall and Long Hall; Cooper Library, the Academic Success Center and Thurmond Institute; Lee Hall and Lowry Hall; Smith Building, Fluor Daniel Building; and Tillman Hall, Johnstone, and University Union. Racks should be placed within 50 feet of a building entrance.

Covered Bicycle Racks

Covering bike racks when possible will increase the versatility and rate of use. Mounting racks in covered areas under building over hangings at places like Cooper Library, Lee Hall, Lightsey Bridge Apartments, Byrnes Hall, Lever Hall and Manning Hall should be considered as long as there is adequate space. Opportunities will arise for investments in new covered bike parking as new buildings are being designed and constructed.

The use of individual covered bike racks units should be considered within the context of the site and by the needs of the surrounding users. Commuting students, faculty and staff that plan on being at a site or building over an extended period of time may desire to have covered bike racks. In the process of developing the design of a facility consideration should be given to the inclusion of covered bike racks.

Bicycle Storage Rooms

Providing bike rooms in residence halls will provide students a secure area to store their bikes over the course of semester. Bike rooms could be in each university housing build or one room may serve a few nearby buildings. Some may not use their bike on a daily basis and others may desire a more secure parking area than an outdoor bike rack. Developing, maintaining and monitoring bike rooms will demonstrate the University's commitment to the role of biking on campus, as a way of life, in recreation and as a part of the campus transportation system.

For more information on bike racks, please see the Clemson University Bikeway Design Guideline and the APBP Bicycle Parking Guidelines, 2nd Edition.

Bicycle Parking Preliminary Cost Estimate

The following table provides information on the planning-level cost estimates for the bicycle parking and storage facilities recommended in the Clemson University Bikeway Plan Bicycle Parking Appendix. The cost of bike parking facility types vary greatly. For example, the estimates listed in Table 3 include the total planning, engineering, equipment and construction costs including a significant contingency. A total bicycle parking cost estimate is not given because some facility costs estimates have wide ranges.

Table 3 Preliminary Cost Estimate

Facility	Cost	Materials	Additional Costs
Bola Bike Rack (ea) *preferred bike rack*	$210	Rack	30%
Bike Rack Cover, Kaleidoscope Straight Canopy Unit, 3 posts, 2 bays	$12,000	Cover for a bike rack	40%
Bike Rack Cover, Kaleidoscope Straight Canopy Unit, 4 posts, 3 bays	$16,000	Cover for a bike rack	40%
Kaleidoscope Lighting, per every 2 units	$550	2 light fixtures, 2 transformers	30%
Kaleidoscope solar light kit, per every 2 units	$3,370	Single solar system	30%
Temporary bike parking, university-owned rack	$0	Bike rack	30%
Temporary bike parking, race smith bike rack	$40	Bike rack	30%
Temporary bike parking, dero bike rack	$492	Bike rack	30%
Temporary bike parking, security personnel, general	$11	Student patrol	30%
Temporary bike parking, security personnel, officer	$34	Campus police officer	30%
Bike Room, sq ft university housing space	$290	Rack materials, security, space	30%
Bike Cage, sq ft low cost	$100	Fencing, locking mechanism	40%
Bike Cage, sq ft high cost	$115	Fencing, locking mechanism	40%
Bike Locker, Model 301V, per locker	$2,000	Plastic, metal	30%

Appendix C

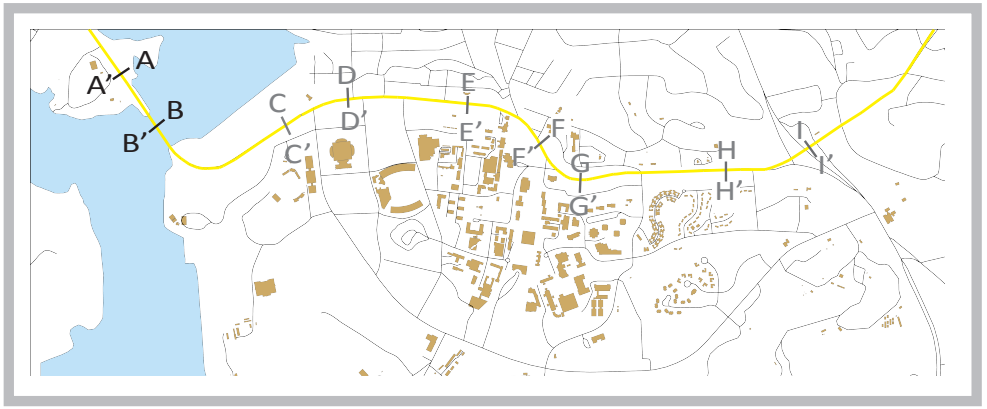
Cross Sections

Clemson University Bikeways Master Plan
Cross Sections

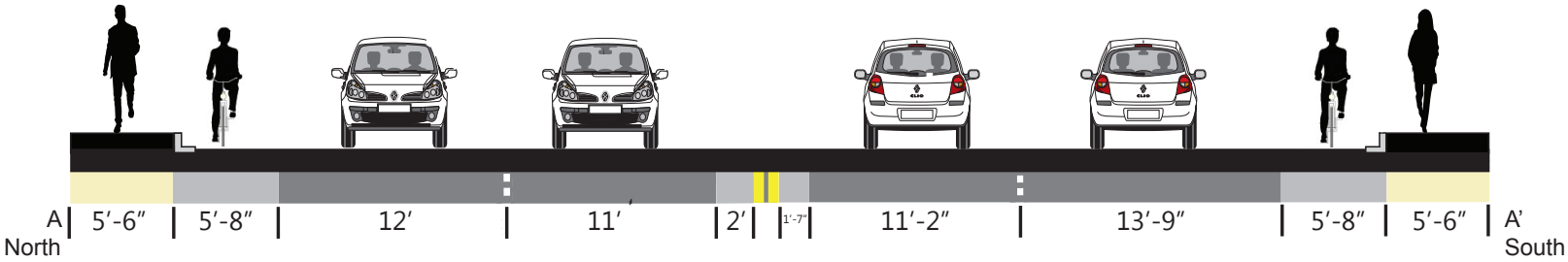
Old Greenville Hwy.
Existing Conditions

May 2012

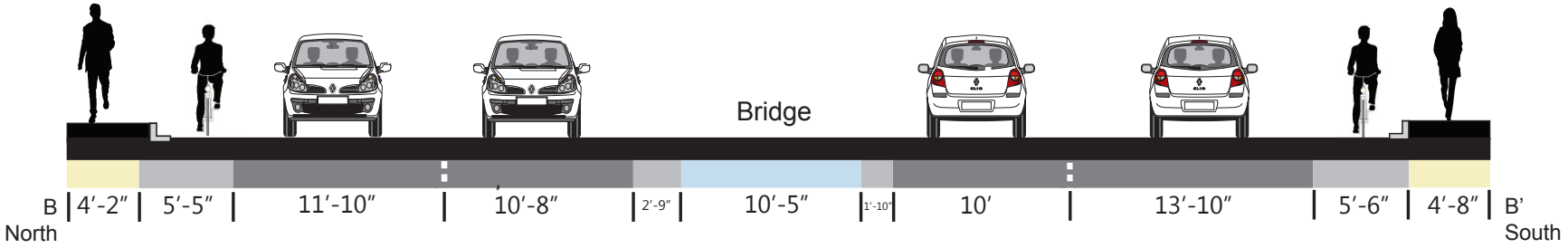
A & B - Old Greenville Hwy. west



A - Old Greenville Hwy. near Old YMCA Circle



B - Old Greenville Hwy. on bridge

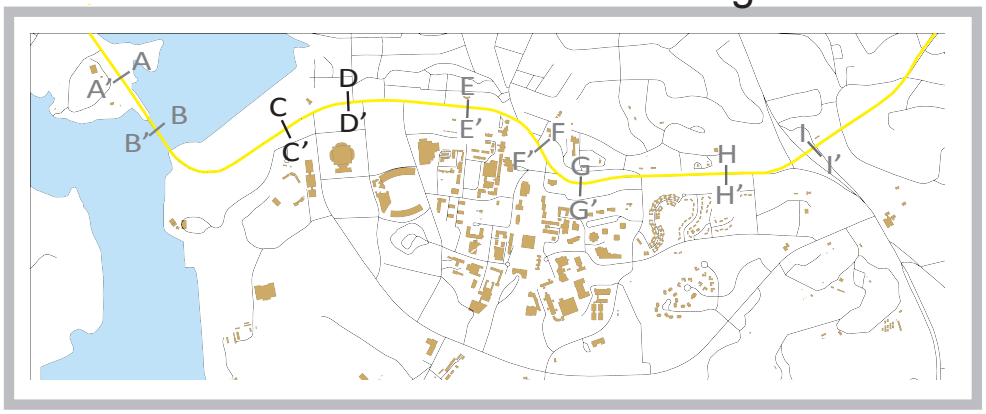


Clemson University Bikeways Master Plan
Cross Sections

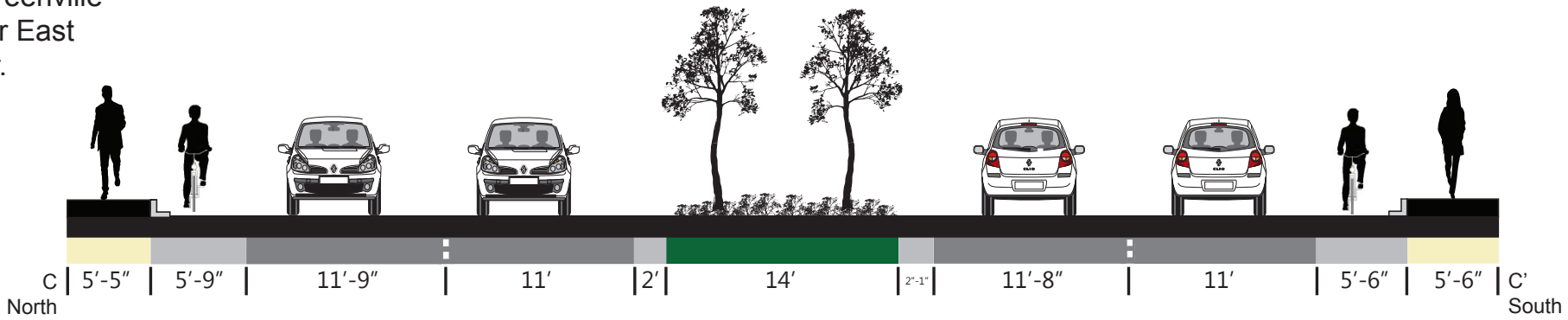
Old Greenville Hwy.
Existing Conditions

May 2012

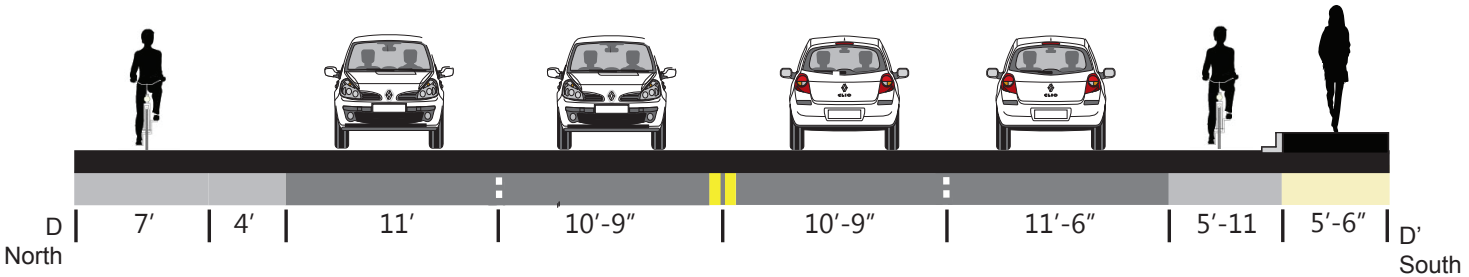
C & D - Old Greenville Hwy. between Bridge & Oak St.



C- Old Greenville Hwy. near East Beach Dr.



D - Old Greenville Hwy. near Oak St. (Esso Club)

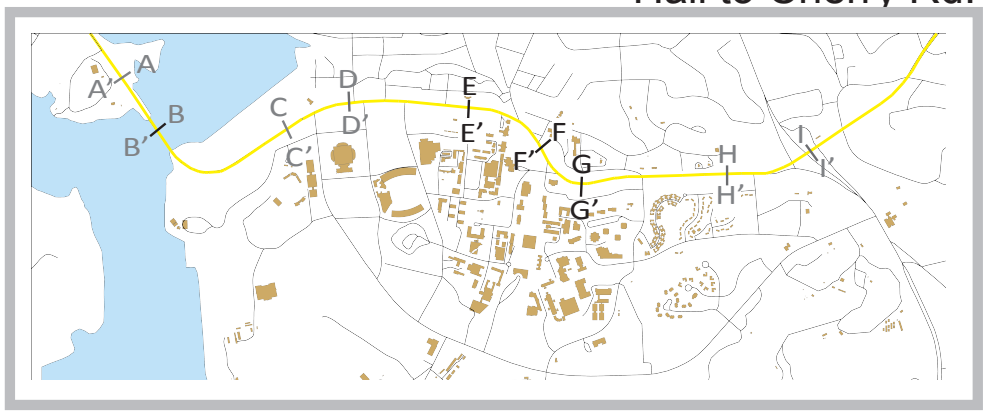


Clemson University Bikeways Master Plan Cross Sections

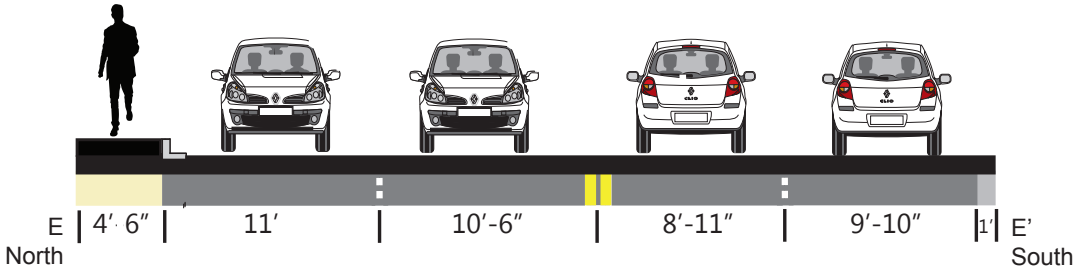
Old Greenville Hwy. Existing Conditions

May 2012

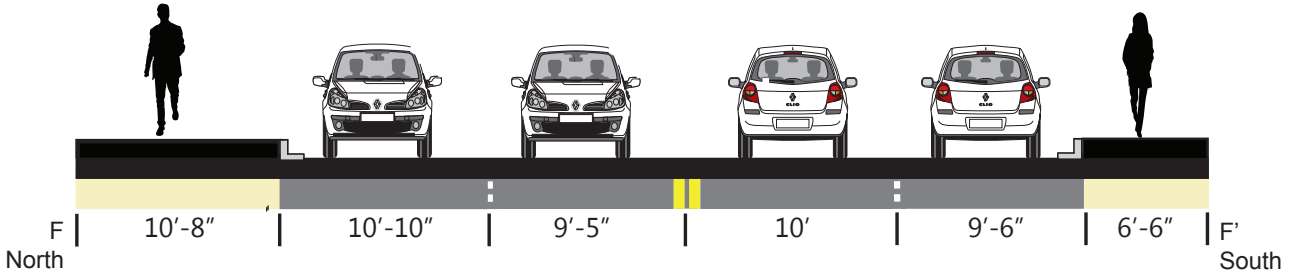
E, F, & G - Old Greenville Hwy. - Gentry Hall to Cherry Rd.



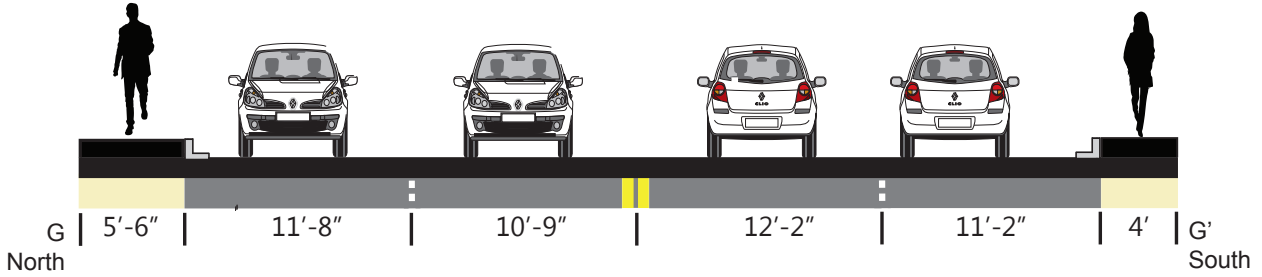
E - Old Greenville Hwy. near Gentry Hall



F- Old Greenville Hwy. near Bowman Field



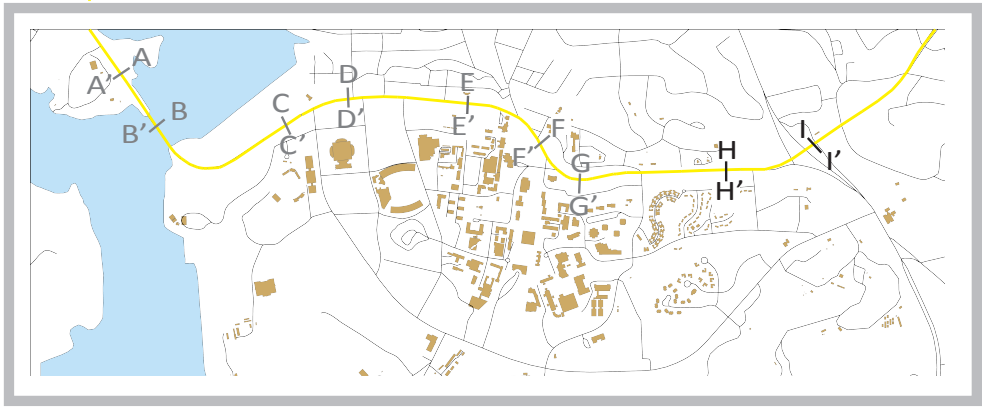
G - Old Greenville Hwy. between Calhoun Dr. & Cherry Rd.



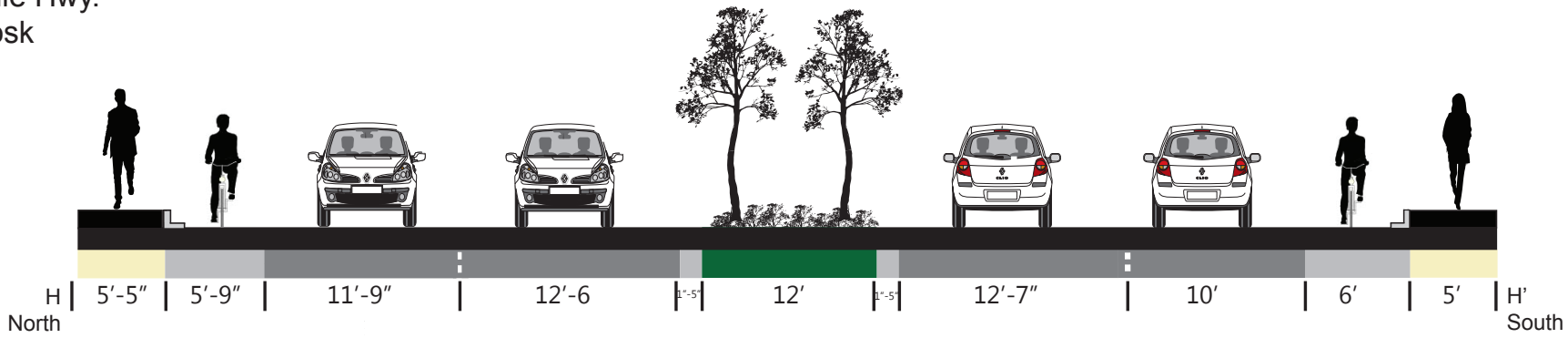
Clemson University Bikeways Master Plan
Cross Sections

Old Greenville Hwy.
Existing Conditions

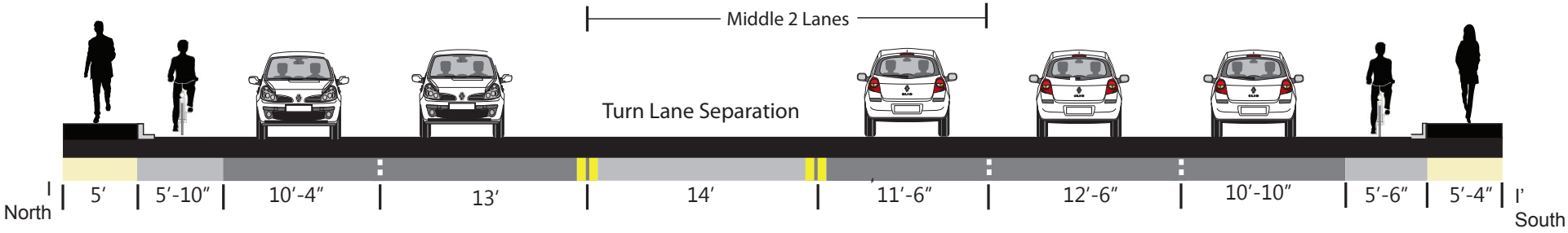
May 2012



H- Old Greenville Hwy. near visitors kiosk



I - Old Greenville Hwy. on Hwy 76 overpass bridge



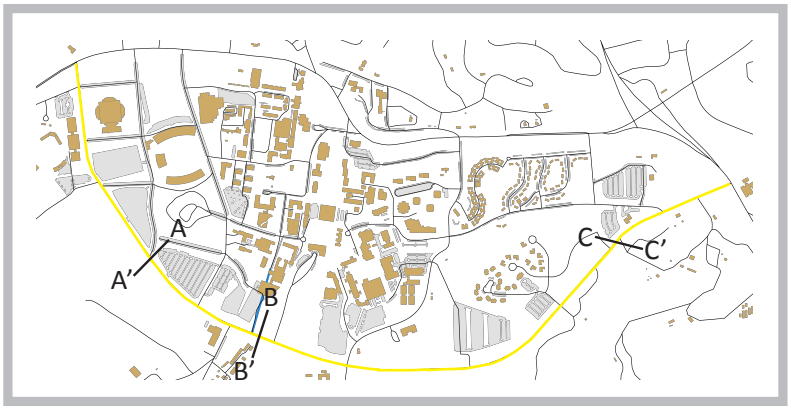
The bridge has a consistent width for the duration of its length. However, the middle 2 lanes act as turn lanes at each end of the bridge providing access to on ramps to Hwy 76.

Clemson University Bikeways Master Plan
Cross Sections

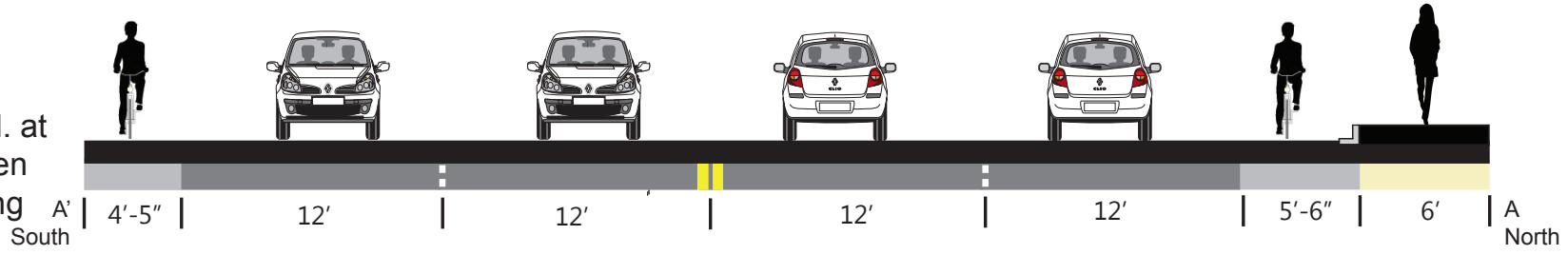
Perimeter Rd.
Existing Conditions

May 2012

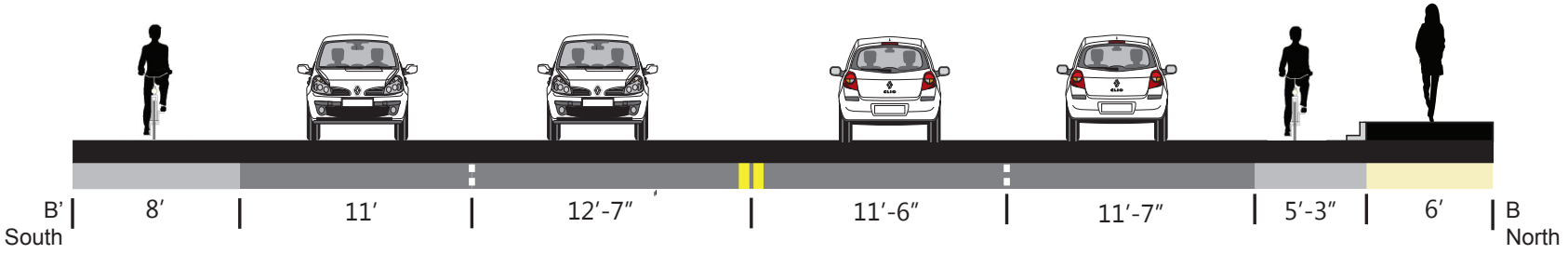
A, B, & C - Perimeter Rd.



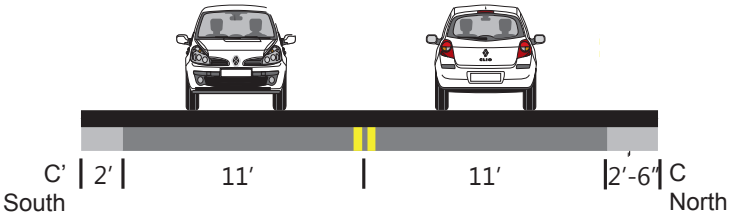
A - Perimeter Rd. at Press Rd. between P3 and P4 Parking Lots



B - Perimeter Rd. between Lambda St. & Kappa St.



C - Perimeter Rd. at Duck Pond Rd.

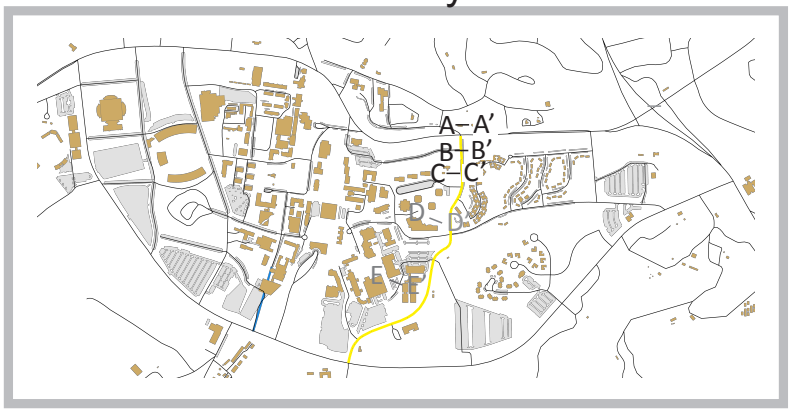


Clemson University Bikeways Master Plan
Cross Sections

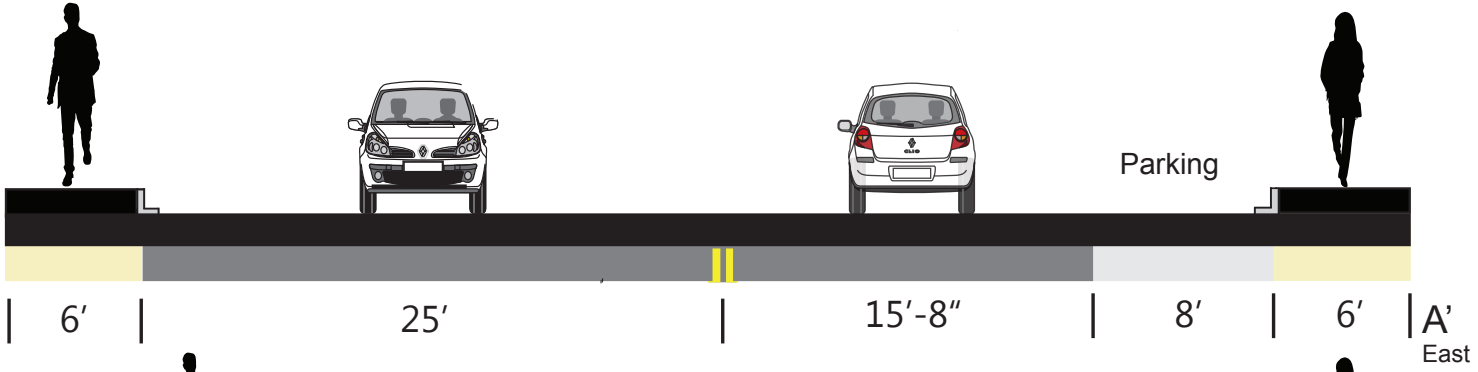
Cherry Rd.
Existing Conditions

May 2012

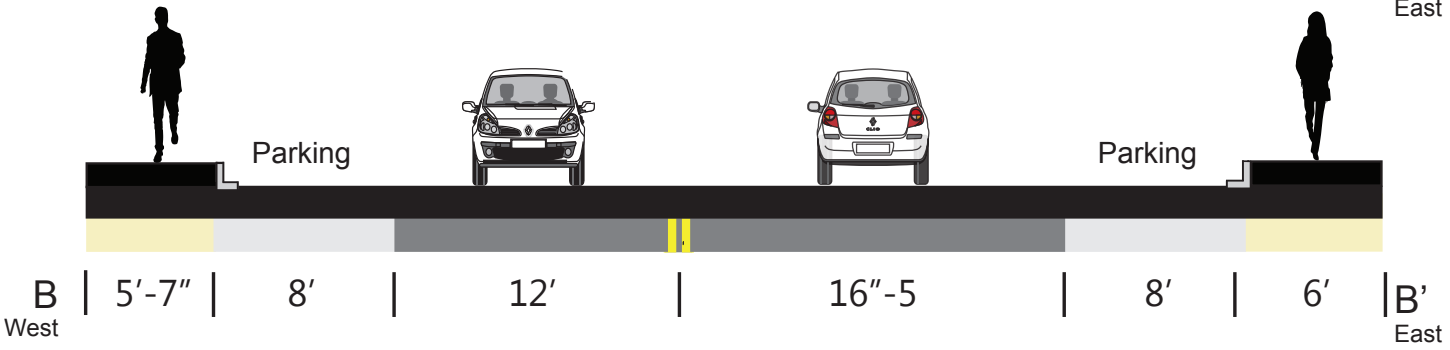
A, B, C - Cherry Rd. between Old Greenville Hwy. & McMillan Rd.



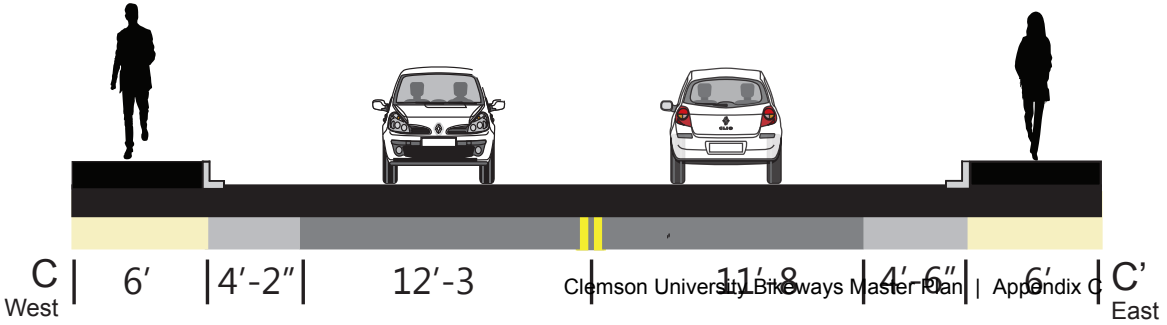
A - Cherry Rd.
near Parkway Rd.



B - Cherry Rd.
near Bryan Circle



C - Cherry Rd. at
Sheep Barn

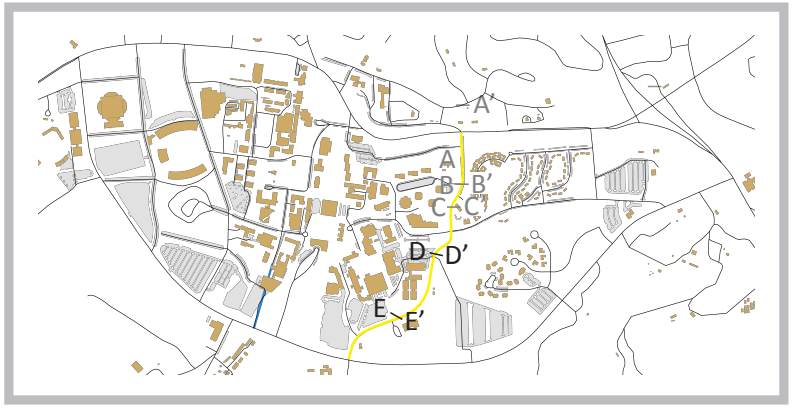


Clemson University Bikeways Master Plan
Cross Sections

Cherry Rd.
Existing Conditions

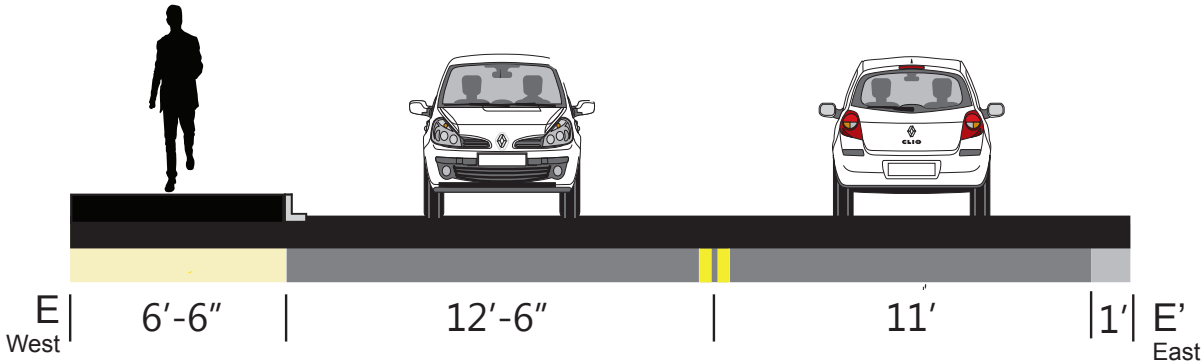
May 2012

D & E - Cherry Rd. between Perimeter Rd. & McMillan Rd.



D - Cherry Rd.
near Collins Rd.

E - Cherry Rd. between
C1 & R5 Parking Lots &
McMillan Rd.

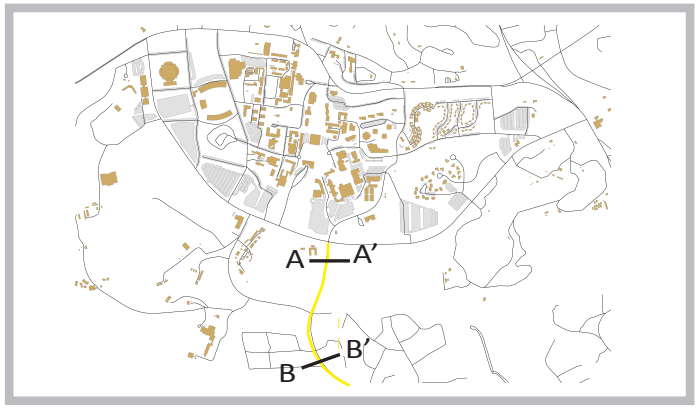


Clemson University Bikeways Master Plan
Cross Sections

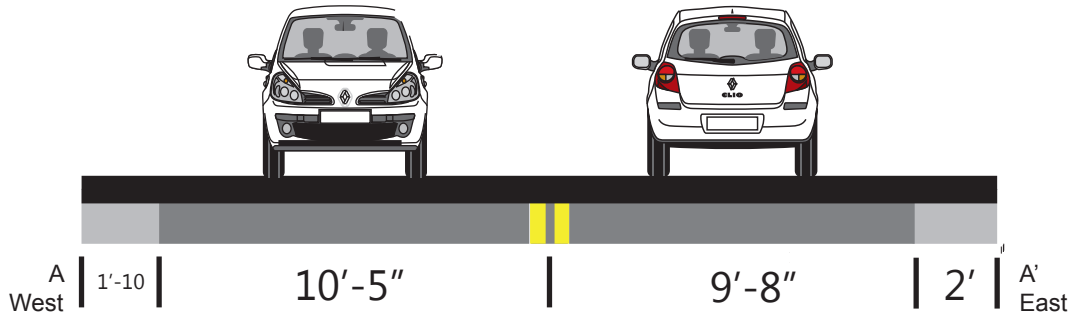
Lower Cherry Rd.
Existing Conditions

May 2012

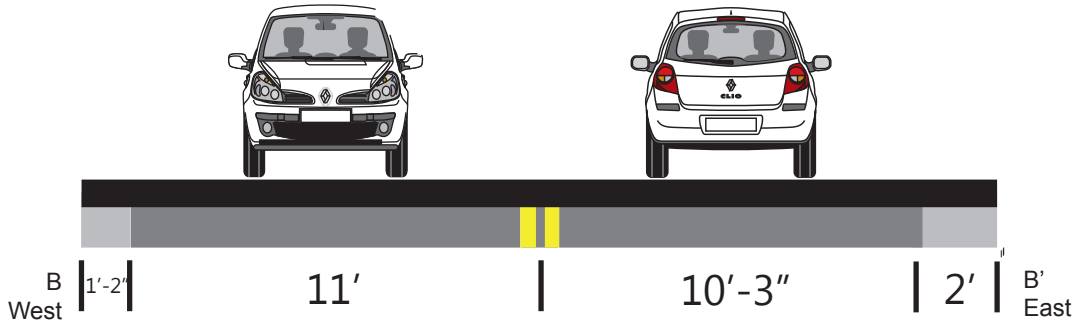
A & B - Cherry Rd. south of Perimeter Rd.



A - Cherry Rd. at Lewis Rd



B - Cherry Rd. at Golf Course

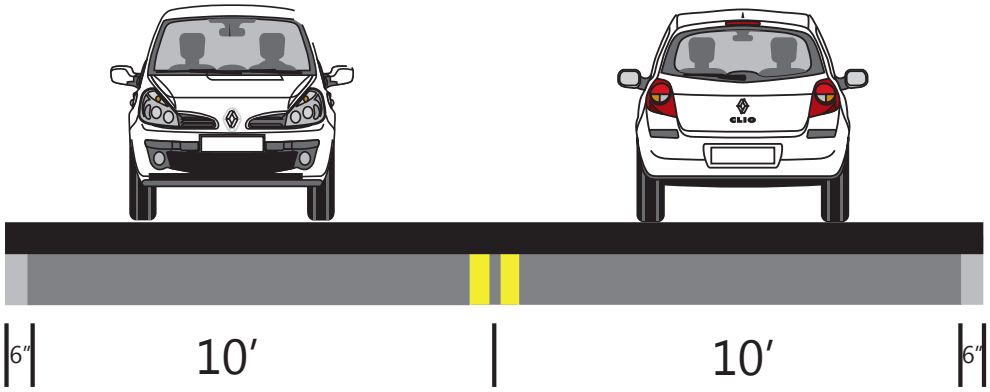


Clemson University Bikeways Master Plan
Cross Sections

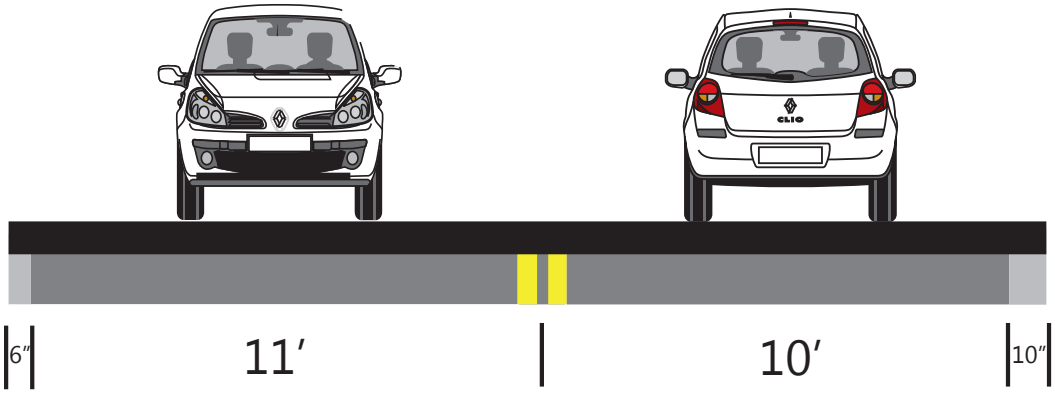
Old Cherry Rd. & West Queen St.
Existing Conditions

May 2012

A & B - Old Cherry Rd. & West Queen St.



A - West Queen St. near RR tracks, gravel driveway and "old coal pile"



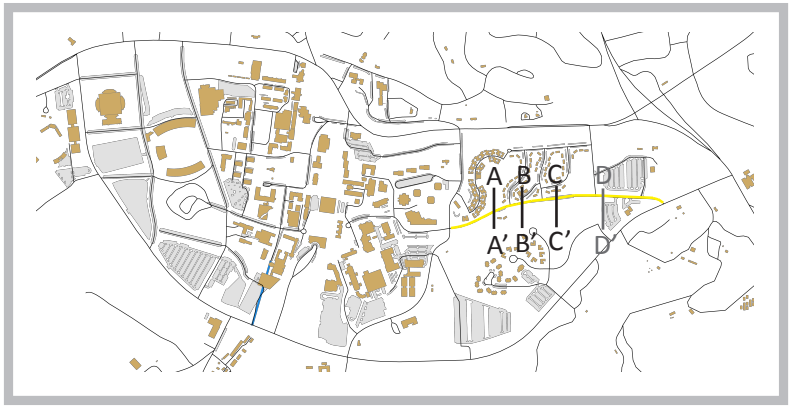
B - Old Cherry Rd. near Cooper Agricultural Lab

Clemson University Bikeways Master Plan Cross Sections

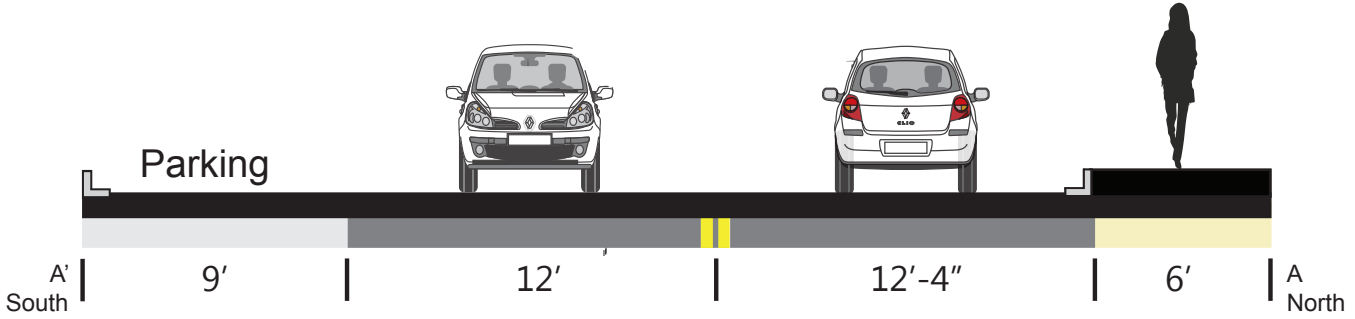
McMillan Rd. Existing Conditions

May 2012

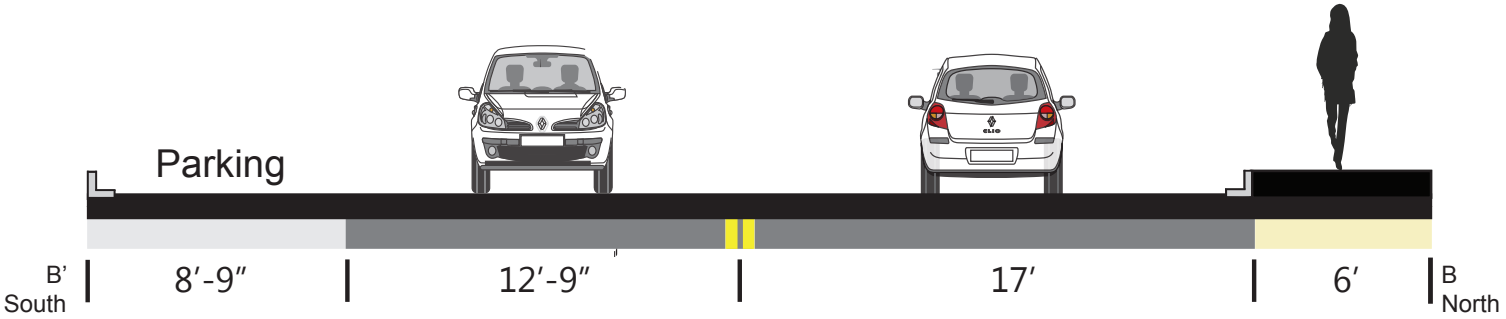
A, B, & C - McMillan Rd. between Cherry Rd. & Dunavan Rd.



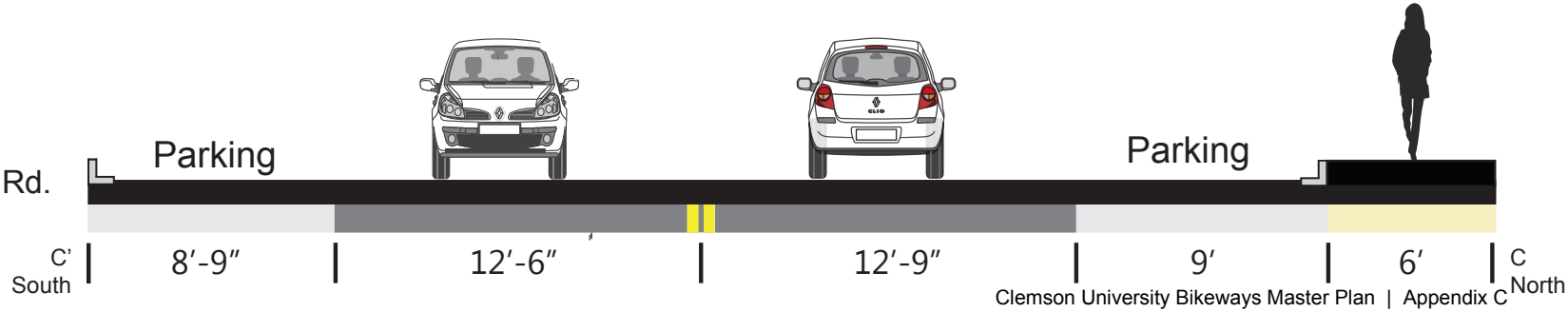
A - McMillan Rd. between Cherry Rd. & Colonial Circle



B - McMillan Rd. between Dunavan Rd. & Mills Rd.



C - McMillan Rd. between Newman Rd. & Dunavan Rd.

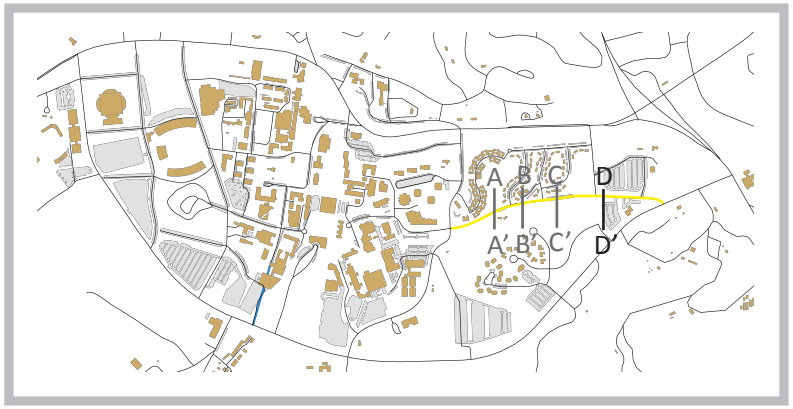


Clemson University Bikeways Master Plan
Cross Sections

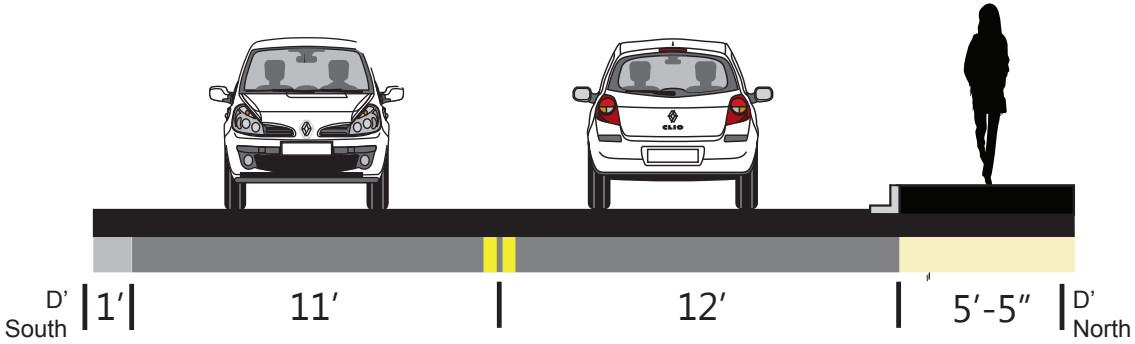
McMillan Rd.
Existing Conditions

May 2012

D - McMillan Rd. near Newman Rd.



D - McMillan Rd. near Newman Rd.

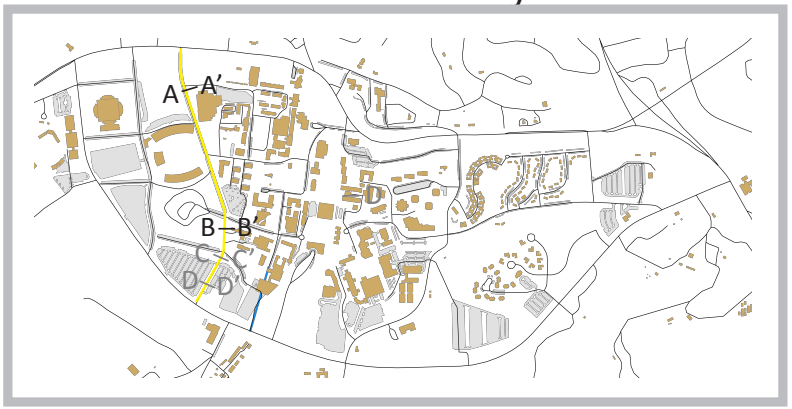


Clemson University Bikeways Master Plan Cross Sections

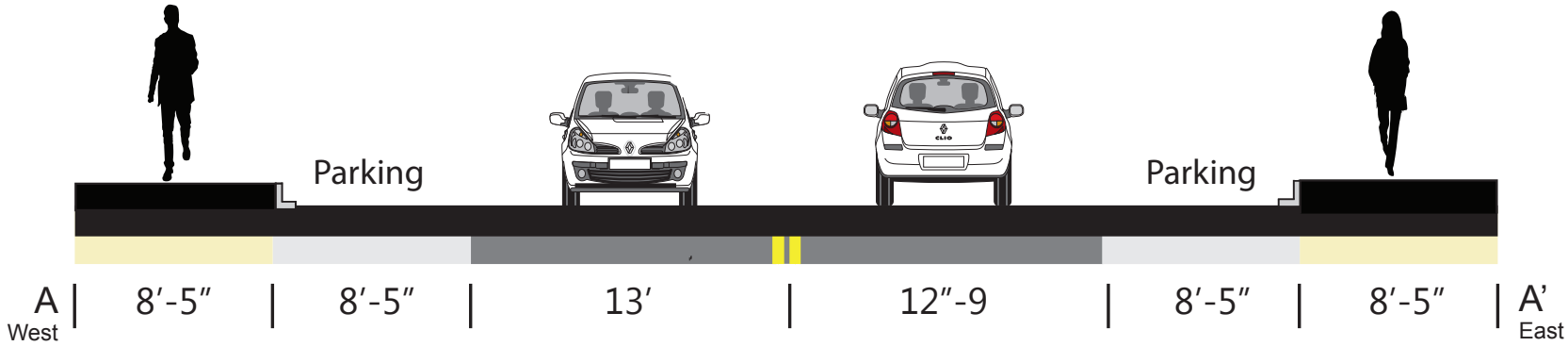
Williamson Rd.
Existing Conditions

May 2012

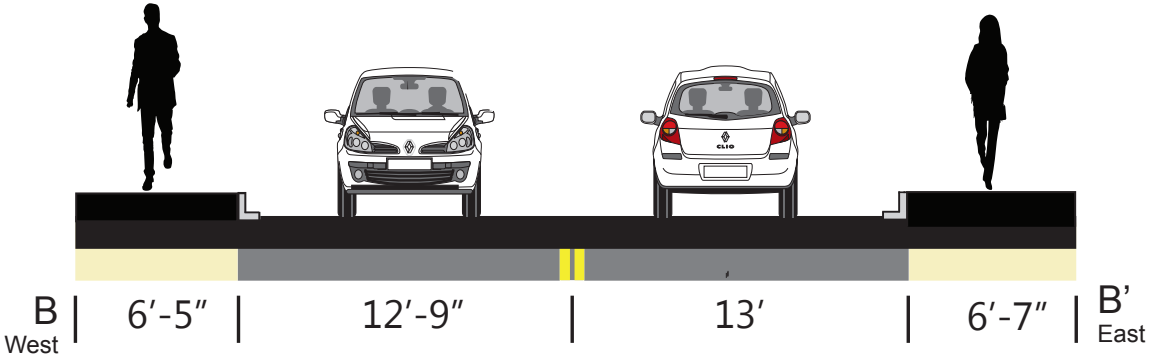
A & B - Williamson Rd.between Old Greenville Hwy. & Earle Hall



A - Williamson Rd. near Klugh Ave.



B - Williamson Rd. near Earle Hall

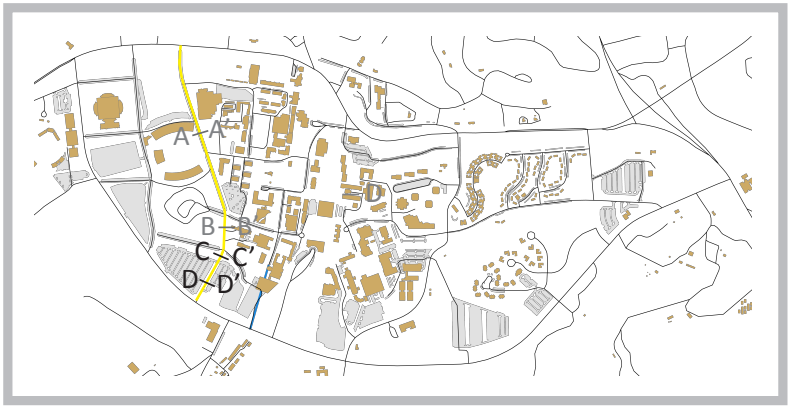


Clemson University Bikeways Master Plan
Cross Sections

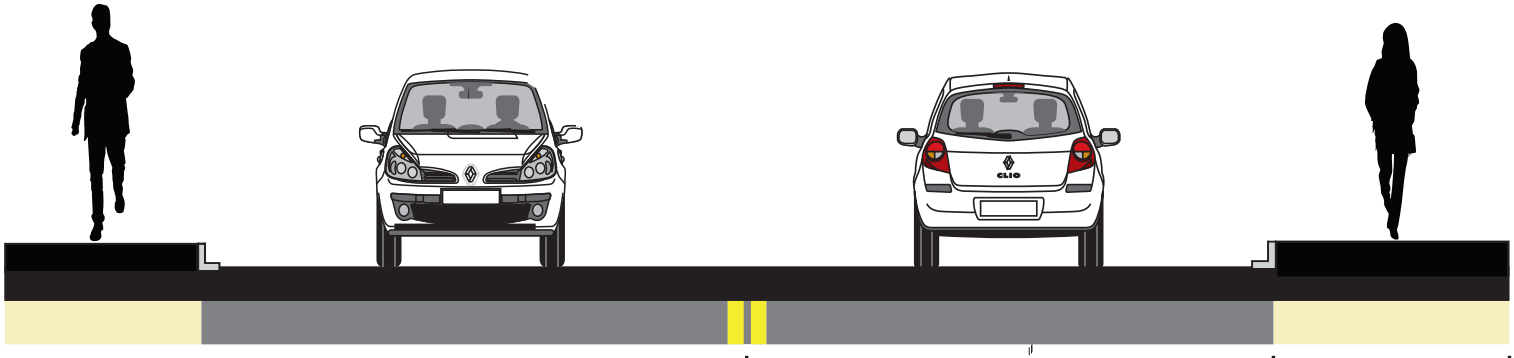
Williamson Rd.
Existing Conditions

May 2012

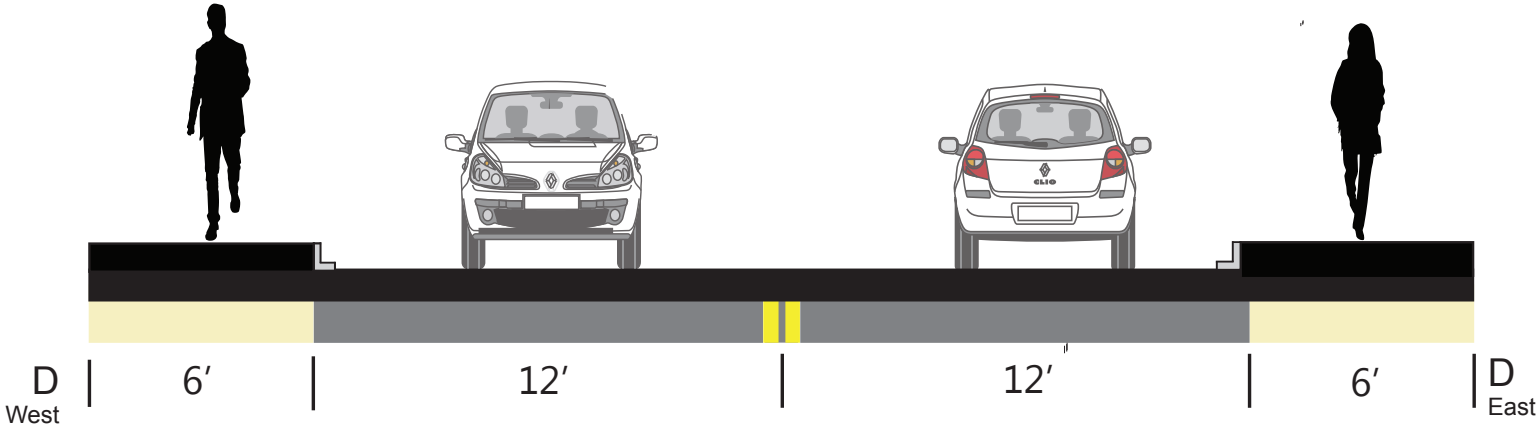
C & D - Williamson Rd. south of Earle Hall



C - Williamson Rd. above and below C2 & C12 Parking Lots



D - Williamson Rd. just north of bus stop near Perimeter Rd.



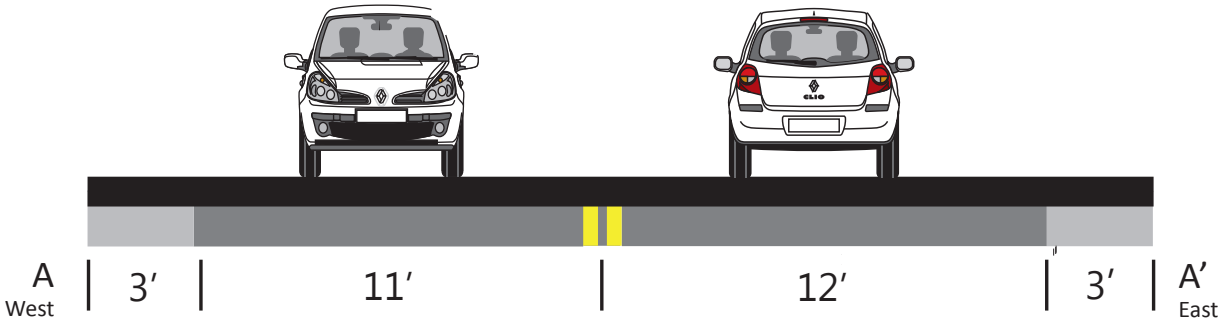
Clemson University Bikeways Master Plan Cross Sections

Stadium Rd.
Existing Conditions

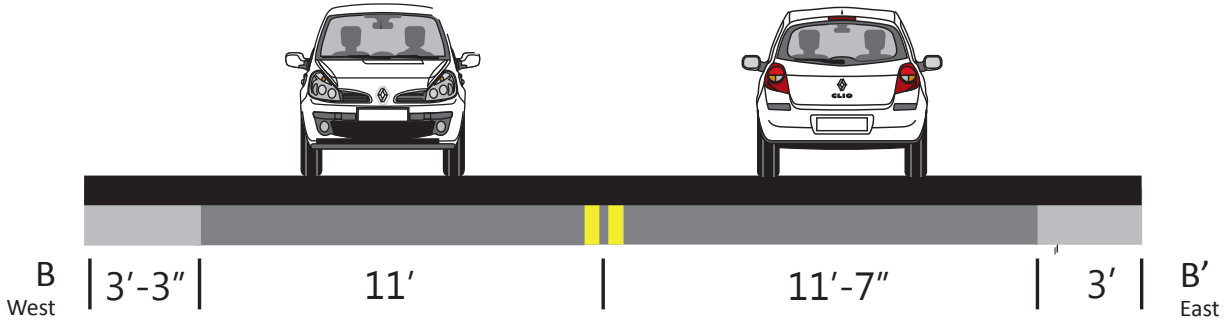
May 2012

A & B - Stadium Rd. between Perimeter Rd. & Cherry Rd.

A - Stadium Rd. just south of Parking Lot E-9



B - Stadium Rd. near entrance to Madren Center Dr.



Appendix D

Bicycle Friendly University Chart

Bikeway Case Study Decision Chart

BFU 2011 Status*	Clemson University Peer	Schools	Infrastructure: Bikeways (Lanes, Tracks, Paths)	Bike Racks	Bike Storage (rooms, cages, etc.)	Bike Lockers	Program: Bike Plan**	Bike Map	Community Interaction, Group	Awareness Campaign (TV, Radio, Fliers, Student Interaction, YouTube)	Bike Classes for first time offenders	Bike Classes	Bike Rental Program	Bike Repair Shop	Bike Center	Bike Valet	Program for incoming First Years and Parents	Call to report bikeway maintenance	Student Fee for Bike Path Maintenance	Incentives***	Biking on the Web: Blog	Bike Program Website	Bike Laws Listed on Campus website
Platinum																							
		Stanford University	x	x		x	x	x	x	x		x	x	x	x					x		x	x
Gold																							
		UC -Davis	x	x	Off-Site		x	x	x	x	x	x	x	x	x					x		x	x
		UC-Santa Barbara	x	x		x	x	x	x	x				x	x				x	x		x	x
Silver																							
		California State Long Beach	x	x	BikeStation			x	x	x		x		BikeStation						x	x	x	x
		Colorado State University	x	x			x	x	x	x	x						x						x
		Portland State University	x	x	x	x		x	x	x		x	x	x	x			x		x	x	x	x
		University of Arizona	x	x	x	x		x		x	x	x	Share	x	x	x				x	x	x	x
		UC-Irvine	x	x	Off-Site		x	x	x	x	x		Share	x	x			x		x		x	x
		University of Minnesota	x	x	x	x	x	x	x	x			Share	x	x					x		x	x
		University of Oregon	x	x	x	x	x	x	x	x			x	x	x					x		x	x
		University of Washington	x	x	x	x	x	x	x	x		x		x	x			x		x		x	x
		UW-Madison	x	x	x	x	x	x	x	x	Through City		x	x	x					x		x	x
Bronze																							
		Boise State	x	x			x	x	x	x		x			x					x		x	x
		Cornell University	x	x	x		x	x	x			x	Share							x		x	x
		Emory University	x	x				x	x	x		x	x	Mobile	x					x		x	x
		Indiana University	x	x			x	x												x		x	x
	#	Michigan State University	x	x	x		x	x		x		x	x	x	x					x		x	x
		UNC-Greensboro	x	x			x			x										x		x	x
		UCLA	x	x		x	x	x	x	x		x	x	x	x						x	x	x
		University of Maryland	x	x		x			x	x				x	x						x	x	x
		Clemson	*x*	*x*									*x*	*x*	*x*					*x*			

* The League of American Bicyclist's 2011 Bicycle Friend University Status awarded levels

** Bike or Alternative Transportation Plan that was available on-line

*** Incentives could mean anything from a discounted rate on bikes and accessories to "Guaranteed Ride Home Programs" to free stuff

^ A review of Clemson University Peer Institutions was conducted, and Virginia Tech, though not an official BFU, was included over Michigan State University because of more shared characteristics.