



TOWN OF BOONE, NORTH CAROLINA BICYCLE PLAN



Division of
Bicycle &
Pedestrian
Transportation

TOWN OF BOONE, NORTH CAROLINA
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF BICYCLE AND PEDESTRIAN TRANSPORTATION



ACKNOWLEDGEMENTS

CITIZEN INVOLVEMENT

A special thanks to the over 700+ local residents who participated in this bicycle planning process through comment forms, public workshops, and meetings.

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“We will have a vibrant, attractive, walkable, bikable and transit-friendly community that is financially, socially, and environmentally sustainable.”

- Boone 2030 Land Use Plan (2009)

“Our vibrant downtown and the university is surrounded by strong neighborhoods, successful and beautiful corridors, and an easily accessible university campus.”

- Boone 2030 Land Use Plan (2009)



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1 PROJECT OVERVIEW

Chapter Contents

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The Planning Process
and Public Involvement
(1-3)

Benefits of a Bicycle-
Friendly Community
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PURPOSE & BACKGROUND

Bike Boone 2013 will guide the Town of Boone, NCDOT, and other local and regional partners in improving the existing bicycle infrastructure, constructing new facilities for bicyclists in Boone, and fostering a ‘bicycling culture’ through the development of related programs and policies. *Bike Boone 2013* builds on recent momentum from *Walk Boone 2011*, and strives to diversify the current transportation system to provide transportation choices for all users.

This plan combines past local and regional planning efforts with new research and analysis, and includes public outreach and engagement. The result is a complete, up-to-date framework for moving forward with tangible bicycle-related improvements. Beyond physical improvements, this plan also outlines policies and programs to help encourage people to bicycle more often, drive more safely, and to grow as a community with the needs of bicyclists taken into full consideration.

NCDOT’S BICYCLE AND PEDESTRIAN PLANNING GRANT INITIATIVE

In 2010, the Town of Boone was awarded a matching grant from the North Carolina Department of Transportation (NCDOT) Bicycle and Pedestrian Planning Grant Initiative for the *Walk Boone 2011 Pedestrian Transportation Plan*. The purpose of the grant is to encourage municipalities to develop comprehensive bicycle plans and pedestrian plans. This program has assisted more than 140 North Carolina communities and is administered through NCDOT’s Division of Bicycle and Pedestrian Transportation (DBPT). In 2012, the Town of Boone pursued a grant through the same initiative to develop the *Bike Boone 2013 Bicycle Transportation Plan*, and was selected as a grant recipient.



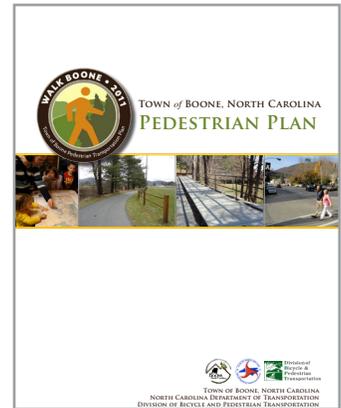
A bicyclist rides toward downtown on King Street/US-421.



PAST AND CURRENT PLANS AND INITIATIVES

Several past and current plans at the municipal and regional levels have identified opportunities for improving bicycling in Boone. This plan draws upon previous recommendations for both on- and off-road bicycle facilities. See Chapter 2 for a summary of the following plans and their recommendations as they relate to bicycling:

- 2006 Comprehensive Plan Update – Boone, NC
- Boone, NC Smart Growth Audit 2007
- Boone 2030 Land Use Plan
- 2004 Feasibility Study for Alternative Transportation Improvements
- 2009 Roadway and Sidewalk Program Handbook
- Appalachian State University Master Plan 2020
- 2013 Watauga County Comprehensive Transportation Plan
- *Walk Boone 2011: Town of Boone, NC Pedestrian Plan*
- 2013 Regional Bicycle Plan, High Country Council of Governments
- Boone Bicycle Initiative Bike-Ability Map



Walk Boone 2011 and other plans were used to inform *Bike Boone 2013* recommendations.

COMMUNITY VISION

The Town of Boone adopted the Boone 2030 Land Use Plan in 2009, and two of the five vision statements relate directly to making Boone more accessible and bicycle friendly:

- “We will have a vibrant, attractive, walkable, bikable and transit-friendly community that is financially, socially, and environmentally sustainable.”
- “Our vibrant downtown and the university is surrounded by strong neighborhoods, successful and beautiful corridors, and an easily accessible university campus.”

PLAN COMPONENTS

This plan is designed to guide the Town of Boone in fulfilling its vision by providing a clear purpose (Chapter 1), an assessment of where things stand today (Chapter 2), detailed recommendations for bicycle facilities (Chapter 3), and implementation strategies for bicycle-related policies, programs, and infrastructure (Chapter 4). Also included in this plan are appendices that are designed to be used as implementation resources. They cover topics such as design guidelines, program ideas, policy recommendations, facility development resources, and a summary of public comments.



THE PLANNING PROCESS AND PUBLIC INVOLVEMENT

THE PROJECT STEERING COMMITTEE

The Alternative Transportation Subcommittee made up approximately 1/3 of the Project Steering Committee, which also included a Council member, Town residents, a Watauga County Schools representative, Council of Government representative, bicycle advocate, NCDOT, ASU representative, and the Watauga County Parks and Recreation Director. The ATS is part of the larger Town of Boone Transportation Committee and focuses on issues related to walking, bicycling, and transit. The Project Steering Committee met with project consultants from Alta/Greenways four times throughout the process, focusing on project vision and goals (April 2013), existing conditions (June 2013), the draft plan (October 2013), and the final plan (TBD 2013).



The project steering committee at the plan kick-off meeting in April 2013.

DATA COLLECTION AND ANALYSIS

After collecting baseline information about the study area in spring 2013, the consultants began assessing existing conditions, which are the focus of Chapter 2 of this plan. Consultants used aerial photography and geographic information systems (GIS) data to identify opportunities and constraints for bicycle facility development. These preliminary findings were then tested for applicability and appropriateness through on-the-ground field research. Field research also included an intersection inventory and a photographic inventory. The existing conditions and the preliminary findings were presented to the Steering Committee on June 19, 2013 and to the public on June 15, 2013 at the Watauga County Farmers' Market.



PUBLIC INVOLVEMENT & PLAN DEVELOPMENT

In May 2013, a public comment form was made available online for this plan and yielded responses from more than 780 people. Chapter 2 includes a summary of the actual results, which indicate the need for bicycle improvements in Boone. The Public Outreach & Engagement Appendix details all outreach and engagement efforts conducted during the bicycle planning process.

In June 2013, project consultants set up an informational booth at the Watauga County Farmers Market. People were invited to learn about the plan and provide input via a public comment form about where they would like to see improvements for bicycling. A public input map, newsletters, and posters were provided for review and two project consultants answered questions and took comments. More than 50 people stopped by to learn about the plan and directly provide input. The general feedback was highly positive, with many people interested in seeing Boone become a more bike-friendly community.

In July and August 2013, the draft plan was developed through input gathered during the steps described above. The draft plan was available for review and comment during an October 2013 Steering Committee meeting at Council Chambers, and was posted online for public review shortly thereafter. The second public outreach event was held on Wednesday, October 23rd, from 2 pm to 5:30 pm in the Plemmons Student Union at Appalachian State University. The project team set up boards and maps displaying existing conditions, draft infrastructure recommendations, program recommendations, and implementation strategies. A few dozen students stopped by the booth to review the draft plan materials, ask questions, and provide feedback.

Members of the project team also partnered with the High Country Council of Governments to present draft plan recommendations during the Regional Bicycle Plan Community Workshop. The workshop was held on Wednesday, October 23rd, from 5:30pm to 7:30pm at the High Country Council of Governments office in Boone. Workshop attendees were supportive of the plan and expressed interest in seeing Boone become a more bicycle-friendly town.

Comments from the committee, the public, NCDOT, and other stakeholders were collected, and the plan was then revised into the final version that was presented to NCDOT and Town Council in (TBD 2013).



Left: At the Watauga County Farmers Market, people provided feedback on how to improve cycling in Boone.

Below: Kids at the Watauga County Farmers Market had their photo taken at the public engagement booth.





BENEFITS OF A BICYCLE-FRIENDLY COMMUNITY

When considering the level of dedication in time and valuable resources that it takes to create a bicycle-friendly community, it is also important to assess the immense value of bicycle transportation. Better bicycling facilities improve safety and encourage more people to ride, which in turn improves health, provides a boost to the local economy, creates a cleaner environment, reduces congestion and fuel costs, and contributes to a better quality of life and sense of community.

Communities across the country are experiencing the benefits of providing a supportive environment for bicycling. With a better bicycle network, Boone can create a stronger, more vibrant community and take advantage of the many types of benefits described below.

HEALTH AND PHYSICAL ACTIVITY BENEFITS

A growing number of studies show that the design of our communities—including neighborhoods, towns, transportation systems, parks, trails and other public recreational facilities—affects our level of physical activity. Regular physical activity is recognized as an important contributor to good health; the Centers for Disease Control and Prevention (CDC) recommend 30 minutes of moderate physical activity each day for adults and 60 minutes each day for children.¹ Unfortunately, many people do not meet these recommendations because they lack environments where they can be physically active. The CDC reports that “physical inactivity causes numerous physical and mental health problems, is responsible for an estimated 200,000 deaths per year, and contributes to the obesity epidemic.”² These conditions also increase families’ medical expenses; each year North Carolinians spend over \$24 billion on health care costs associated with a lack of physical activity, excess weight, type II diabetes, and poor nutrition.³

Having accessible bicycle facilities available, such as bike lanes and paths, can help people more easily incorporate physical activity into their daily lives. Sixty percent of North Carolinians say they would increase their level of physical activity if they had better access to walking and bicycling facilities, such as sidewalks and trails.⁴ Regular physical activity, such as bicycling, is shown to have numerous health benefits:⁵

- Reduces the risk and severity of heart disease and diabetes
- Reduces the risk of some types of cancer
- Improves mood
- Controls weight
- Reduces the risk of premature death



THE COST OF TRANSPORTATION-RELATED HEALTH OUTCOMES

The National Health Costs of...	\$\$ (Billions)	Estimate Includes	Source
Obesity and overweight	\$142	<ul style="list-style-type: none"> Healthcare costs Lost wages due to illness & disability Future earnings lost by premature death 	<p>National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. Statistics Related to Overweight and Obesity: The Economic Costs.</p> <p>Available at: http://win.niddk.nih.gov/statistics/index.htm</p>
Air pollution from traffic	\$50-80	<ul style="list-style-type: none"> Health care costs Premature death 	<p>Federal Highway Administration. 2000. Addendum to the 1997 Federal Highway Cost Allocation Study Final Report, May 2000.</p> <p>Available at: www.fhwa.dot.gov/policy/hcas/addendum.htm</p>
Traffic crashes	\$180	<ul style="list-style-type: none"> Healthcare costs Lost wages Property damage Travel delay Legal/administrative costs Pain & suffering Lost quality of life 	<p>AAA. Crashes vs. Congestion? What's the Cost to Society? Cambridge, MD: Cambridge Systematics, Inc.; 2008.</p> <p>Available at: www.aaanewsroom.net/assets/files/20083591910.crashesVscongestionfullreport2.28.08.pdf</p>

Source: The American Public Health Association, 2010, The Hidden Health Costs of Transportation.

The American Public Health Association also recognizes the health benefits of walk- and bike-friendly communities. According to its 2010 report, “Investments in transit, walking and bicycling facilities support transit use, walking and bicycling directly; they also support the formation of compact, walkable, transit-oriented neighborhoods that in turn support more walking, bicycling and transit and less driving. These built environments have repeatedly been associated with more walking, bicycling and transit use, more overall physical activity, and lower body weights; lower rates of traffic injuries and fatalities, particularly for pedestrians; lower rates of air pollution and greenhouse gas emissions; and better mobility for non-driving populations.”⁶

The CDC determined that creating and improving places to be active could result in a 25 percent increase in the number of people who exercise at least three times a week.⁷ This is significant considering that for people who are inactive, even small increases in physical activity can bring measurable health benefits. The establishment of a safe and reliable network of bikeways and trails can have a positive impact on the health of nearby residents. The Rails-to-Trails Conservancy puts it simply: “Individuals must choose to exercise, but communities can make that choice easier.”⁸



ECONOMIC BENEFITS

TRANSPORTATION SAVINGS

When it comes to transportation costs, bicycling is one of the most affordable forms of transportation available, second only to walking. According to the American Automobile Association, the cost of owning and operating a medium-sized sedan for one year, assuming one drives 10,000 miles per year, is approximately \$7,804.⁹ Owning and operating a bicycle costs just \$120 per year, according to the League of American Bicyclists.¹⁰ The Pedestrian and Bicycle Information Center explains how these lower costs help individuals and communities as a whole: “When safe facilities are provided for pedestrians and bicyclists, more people are able to be productive, active members of society. Car ownership is expensive, and consumes a major portion of many Americans’ income.”

To determine your driving costs accurately, keep personal records on all the costs listed below. Use this worksheet to figure your total cost to drive.

Annual Cost Per Mile

costs		yearly totals
operating costs		
gas per mile		_____
total miles driven	×	=====
total gas	=	=====
maintenance	+	_____
tires	+	=====
total operating costs	+ =	=====
ownership costs		
depreciation		_____
insurance	+	_____
taxes	+	_____
license and registration	+	_____
finance charges	+	=====
total ownership costs	+ =	=====
other costs (washing, accessories, etc.)	+	=====
total driving costs	=	_____
total miles driven	÷	=====
cost per mile	=	_____

Driving Costs Worksheet. American Automobile Association, Your Driving Costs Report: 2013 Edition.

Bicycling becomes even more attractive from an economic standpoint when the unstable price of gasoline is factored into the equation. Oil prices more than quadrupled between 2000 and 2008, when gasoline prices topped \$4 a gallon.¹¹ The unreliable cost of fuel reinforces the idea that local communities should be built to accommodate people-powered transportation, such as walking and biking. Many older North Carolina communities already have traditional mixed-use and generally compact land development patterns; when combined with new strategies for improving bicycle transportation, many such communities could foster local reductions in auto- and oil-dependency.



PROPERTY VALUES

Bicycle facilities such as bike lanes, paths, and greenway trails are popular community amenities that add value to properties nearby. According to a 2002 survey by the National Association of Realtors and the National Association of Homebuilders, homebuyers rank trails as the second-most important community amenity out of 18 choices, above golf courses, ball fields, parks, security, and others.¹² This preference for trails is reflected in property values around the country. In the Shepard's Vineyard residential development in Apex, North Carolina, homes along the regional greenway were priced \$5,000 higher than other residences in the development – and these homes were still the first to sell.¹³ A study of home values along the Little Miami Scenic Trail in Ohio found that single-family home values increased by \$7.05 for every foot closer a home is to the trail.¹³ These higher prices reflect how trails and greenways add to the desirability of a community, attracting homebuyers and visitors alike.



Greenway trails such as the South Fork New River Greenway (left) encourage physical activity, provide a low-cost alternative to driving, and boost property values of adjacent development.

ENVIRONMENTAL BENEFITS

AIR QUALITY

Providing the option of bicycling as an alternative to driving can reduce the volume of gasoline consumed and resulting car-related emissions, which in turn improves air quality. Cleaner air reduces the risk and complications of asthma, particularly for children, the elderly, and people with heart conditions or respiratory illnesses.¹⁴ Lower automobile traffic volumes also help to reduce neighborhood noise levels and improve local water quality by reducing automobile-related discharges that are washed into local rivers, streams, and lakes. Furthermore, every car trip replaced with a bicycle trip reduces U.S. dependency on fossil fuels, which is a national goal. According to a survey by the National Association of Realtors and Transportation for America, 89 percent of Americans agree that transportation investments should support the goal of reducing energy use.¹⁵

ENVIRONMENTAL SERVICES OF GREENWAYS

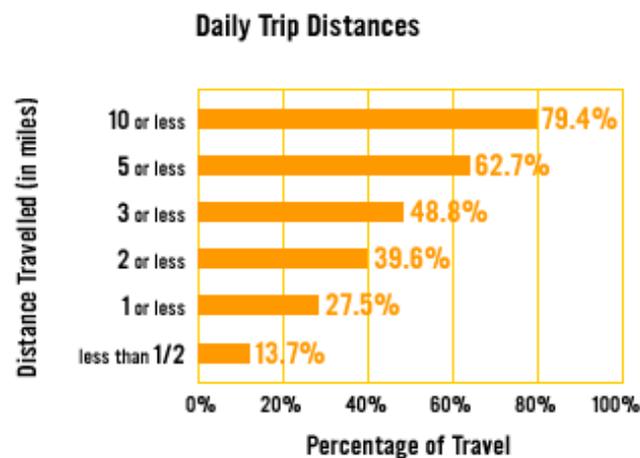
Greenways and trails are a key component of any bicycle network and carry environmental benefits as well. Greenways protect and link fragmented habitat and provide opportunities for protecting plant and animal species. By conserving plant cover, greenways also preserve the natural air filtration processes provided by plants, filtering out harmful pollutants, such as ozone, sulfur dioxide, carbon monoxide, and airborne heavy metal particles. Finally, greenways improve water quality by creating a natural buffer zone that protects streams, rivers and lakes, preventing soil erosion and filtering pollution caused by agricultural and road runoff. Greenways also act as a line of defense against natural hazards, such as flooding.



TRANSPORTATION BENEFITS

Many North Carolinians do not have access to a vehicle or are unable to drive. According to the 2001 National Household Travel Survey, 12 percent of persons age 15 or older do not drive, and 8 percent of U.S. households do not own an automobile. Providing a well-connected bicycle network provides those who are unable or unwilling to drive with a safe transportation option. Bicycle improvements can increase access to important destinations for the young, the elderly, low-income families, and others who may be unable to drive or do not have a motor vehicle.

Investing in bicycle facilities can also help to reduce congestion and the pollution, gas costs, wasted time, and stress that comes with it. Each person who makes a trip by bicycle is one less car on the road or in the parking lot. A network of wide shoulders, bike lanes, and paths gives people the option of making a trip by bike, which helps to alleviate congestion for everyone. Bicycle facilities can also help to substantially reduce transportation costs by providing a way of getting around without a car for some trips. About half of all trips taken by car are three miles or less, equivalent to a 15-minute bike ride.¹⁶ With a safe, convenient bicycle network, some of these shorter trips could be comfortably made by bike, saving money on gas, parking costs, and vehicle wear and tear over time.



Almost 50 percent of all trips are 3 miles or less, or less than a 15-minute bike ride. Source: Pedestrian and Bicycle Information Center; www.ped-bikeinfo.org

QUALITY OF LIFE

Many factors go into determining quality of life for the citizens of a community: the local education system, prevalence of quality employment opportunities, and affordability of housing are all items that are commonly cited. Increasingly though, citizens are demanding a cleaner, safer, more enjoyable community that provides amenities for adults and children alike. Communities with quality greenways, trails, and bicycle routes attract new residents as well as new businesses and industries. Getting outdoors and being physically active also helps to relieve stress, improve mood, and foster social connections between residents.



Transportation and recreation options will be especially important for older Americans in the coming years. According to the Brookings Institution, the number of older Americans is expected to double between 2000 and 2025.¹⁷ Seniors who find themselves unable to drive or who become uncomfortable with driving will find that their mobility is severely limited if another transportation option isn't available. Trails and paths will provide seniors with a place to take a low-intensity bike ride or a stroll around the neighborhood, or a way to get to nearby shops and services. Paths and trails are also valuable transportation connections for the elderly because they accommodate motorized wheelchairs, which can provide many seniors with the independent mobility that they would not have otherwise.

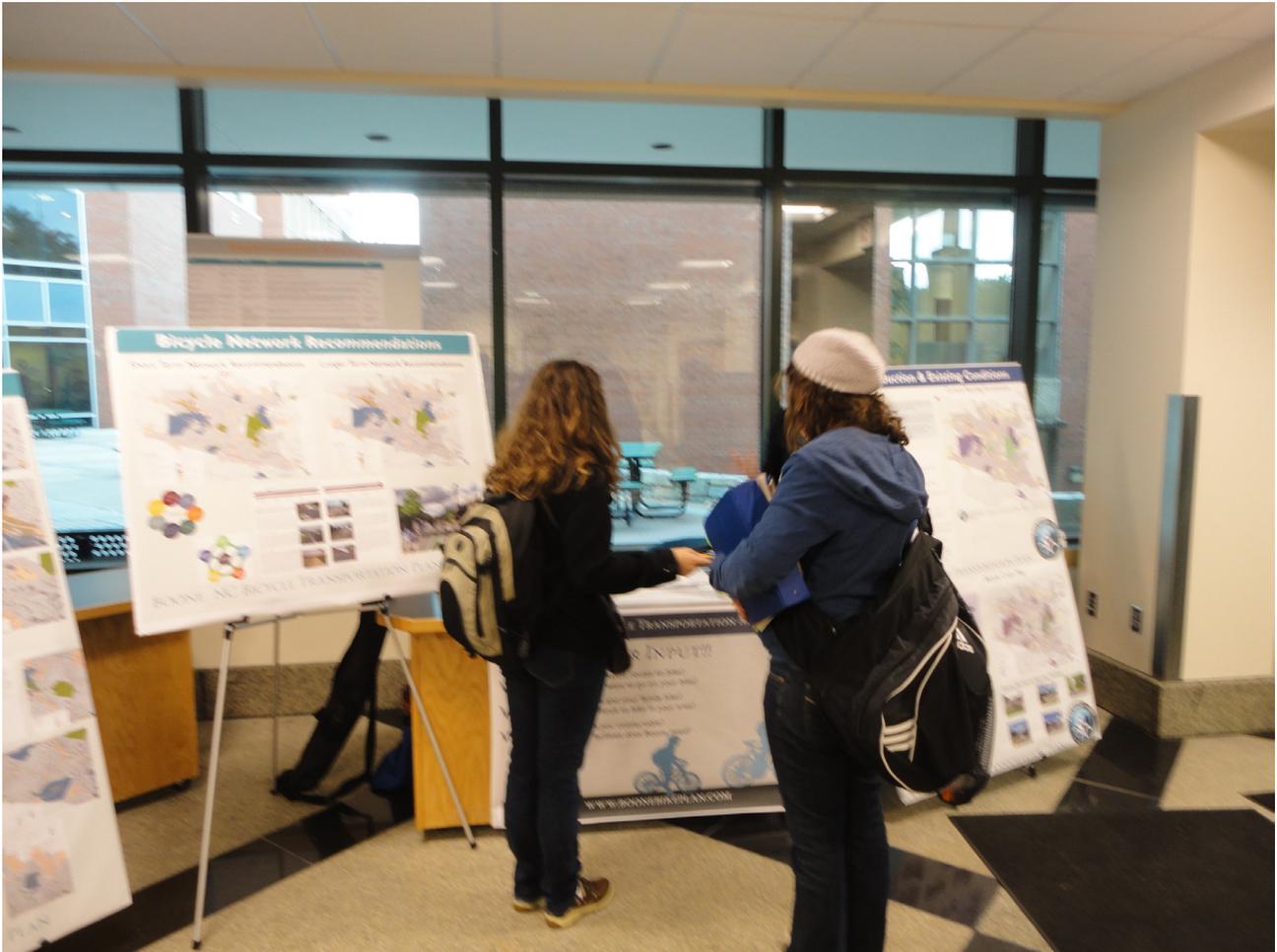
Children under 16 are another important subset of our society who deserve access to safe mobility and a higher quality of life. In recent years, increased traffic and a lack of pedestrian and bicycle facilities have made it less safe for children to travel to school or to a friend's house. In 1969, 48 percent of students walked or biked to school, but by 2001, less than 16 percent of students walked or biked to or from school.

In a 2004 Centers for Disease Control and Prevention survey, 1,588 adults answered questions about barriers to walking to school for their youngest child aged 5 to 18 years.¹⁸ The main reasons cited by parents included distance to school, at 62%, and traffic-related danger, at 30%. Strategic additions to the bicycle and pedestrian network could shorten the distance from homes to schools, and overall pedestrian and bicycle improvements can improve the safety of our roadways so that children within Boone could once again safely bike in their communities. According to the National Center for Safe Routes to School, "Walking or biking to school gives children time for physical activity and a sense of responsibility and independence; allows them to enjoy being outside; and provides them with time to socialize with their parents and friends and to get to know their neighborhoods."¹⁹ Ensuring that children have safe connections to their schools and throughout their neighborhoods can encourage them to spend time outdoors, get the physical activity they need for good health, and enjoy a higher quality of life.



ENDNOTES

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ASU students stopped by the *Bike Boone 2013* informational booth on October 23, 2013 to learn more about the plan.



EXISTING CONDITIONS

Chapter Contents

- Introduction (2-1)
- Geographic Information Systems (GIS) Analysis (2-1)
- Trip Attractors (2-3)
- Demographic Analysis (2-4)
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- Public Comments about Existing Conditions (2-18)
- Past and Current Bicycle-Related Programs (2-22)
- Existing Policies & Plans Related to Bicycling (2-24)

INTRODUCTION

Nestled in the Blue Ridge Mountains of northwestern North Carolina, the Town of Boone is home to approximately 17,000 residents. The bustling, compact downtown business district with locally owned stores and restaurants makes Boone a popular destination for visitors. This attractive resort town is home to Appalachian State University (ASU) and an undergraduate student population of roughly 15,000 and a graduate student population of roughly 2,000, doubling the population size of the town during the school year. Throughout the year, Boone has as many as 30,000-40,000 visitors each weekend who come to watch ASU football games in the fall, escape the summer heat, or enjoy local ski resorts in the winter. While this level of activity and interest in the Town of Boone is beneficial, it also puts pressure on local traffic conditions, making alternative transportation infrastructure a crucial component in meeting the needs of both residents and visitors.

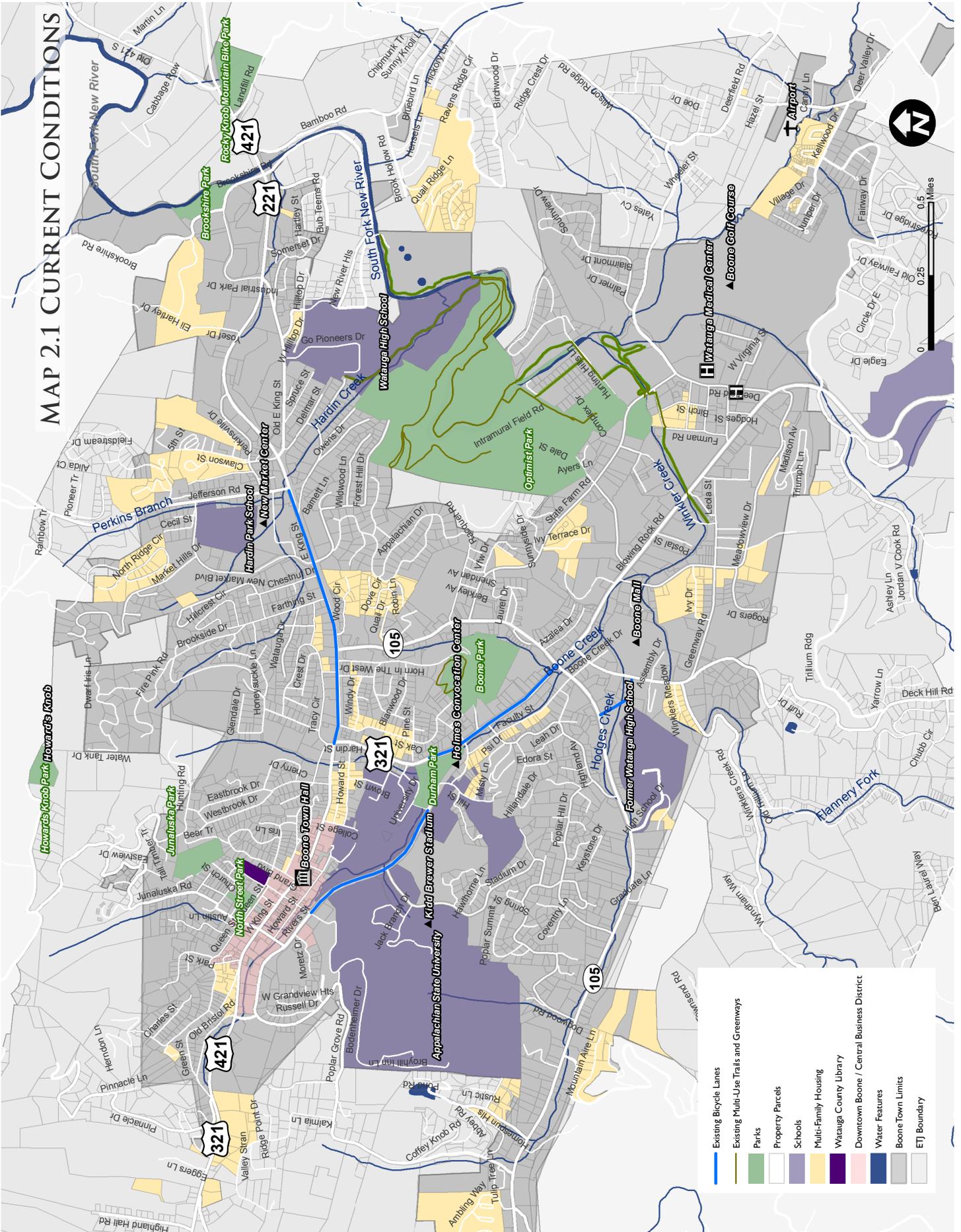
This chapter describes the existing bicycling environment in Boone, the town's bicycle system strengths and weaknesses, and public comments about Boone's current bicycling conditions. Later sections of the chapter identify past and current bicycle-related programs; review the existing plans, policies, and programs that have shaped the present-day bicycling environment; and discuss current institutional challenges that need to be addressed in order to improve conditions for bicyclists. Relevant data collected for this plan is also presented throughout the chapter to provide further insight into existing conditions in the Town of Boone.

GEOGRAPHIC INFORMATION SYSTEMS (GIS) ANALYSIS

Geographic Information Systems (GIS) data was obtained from the Town of Boone, Watauga County, and the State of North Carolina. Map 2.1, titled "Current Conditions," on page 2-2, presents existing conditions in Boone and serves as the foundation for analyzing the current bicycling environment. The analysis included evaluating the roadway network, locations of bicycle-related accidents, the identification of popular destinations and bicycling routes, existing facilities, topography, and various demographic patterns that may be useful in assessing need for future bicycle facilities.



MAP 2.1 CURRENT CONDITIONS



- Existing Bicycle Lanes
- Existing Multi-Use Trails and Greenways
- Parks
- Property Parcels
- Schools
- Multi-Family Housing
- Watauga County Library
- Downtown Boone / Central Business District
- Water Features
- Boone Town Limits
- ETJ Boundary



TRIP ATTRACTORS

People currently drive, walk, or bike to a variety of destinations across Boone for various purposes. These potential destinations and points of origin for bicyclists are referred to in this document as ‘trip attractors’. Many, but not all of the trip attractors in Boone are labeled on Map 2.1. Trip attractors in Boone include the following:

- Downtown Boone
- Lee & Vivian Reynolds Greenway Trail, and other trails
- Durham Park, Optimist Park, Brookshire Park, Rocky Knob Mountain Bike Park, Daniel Boone Native Gardens, Junaluska Park, Boone Jaycee Park, North Street Park
- Large employers: Appalachian State University, Watauga Medical Center and Industrial Park
- Restaurants
- Shopping locations: King Street corridor, US-321 corridor, NC 105 corridor, Boone Mall, grocery stores, drug stores, banks, etc.
- Higher density/Multi-family residential areas
- The Watauga County Farmer’s Market
- Public destinations : Jones House Community & Cultural Center, Watauga County Public Library, schools, post offices, etc.
- Horn in the West, Hickory Ridge Living History Museum, other historic sites and points of interest
- Places of employment: ASU, Watauga County offices, schools, shopping centers, IRC/TT Electronics, Downtown Boone

Each of these categories of bicycle trip attractors were considered when determining locations for recommended bicycle facility improvements. They represent important starting and ending points for bicyclist travel and provide a good basis for planning ideal routes.



Soccer Complex near Brookshire Park, Boone, NC.



Jones House Community Center, King Street, Boone, NC.



DEMOGRAPHIC ANALYSIS

The bicycling needs and demands of different populations in Boone can be better understood through an analysis of demographic information. 2010 U.S. Census Bureau data and 2007-2011 U. S. Census Bureau, American Community Survey (ACS) data were obtained and analyzed during the current conditions evaluation of this plan. It is important to note that the ACS considers residents currently living or staying at an address for more than two months, a current resident of that address. In Boone, the undergraduate and graduate student populations of ASU are considered residents by the ACS and are included in the demographic data presented in this section. Data sets such as population density, minority populations, citizens without access to a vehicle, people who bike to work, and median household income were mapped by Census Block or Block Group.



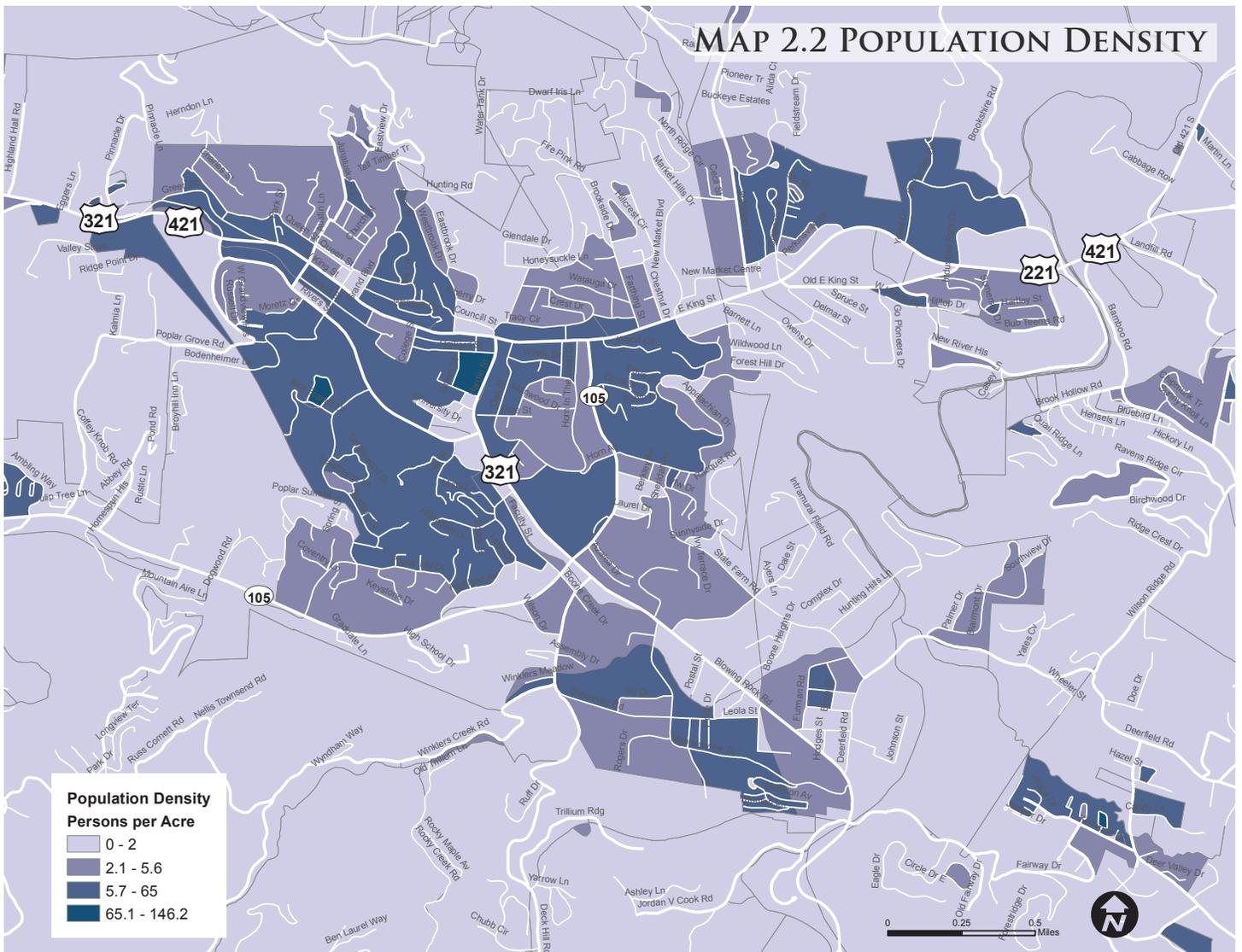
Hardin Street between King Street and Rivers Street is the most densely populated area within Boone due to a high concentration of campus dorms and apartment complexes.



POPULATION CHARACTERISTICS & DENSITY

As of the 2012 U.S. Census *estimate*, Boone had a total population of 17,774. In Boone, females represent 52 percent of the population and males 48 percent. The majority of the population (88.1 percent) falls between the ages of 18 and 65 years old.

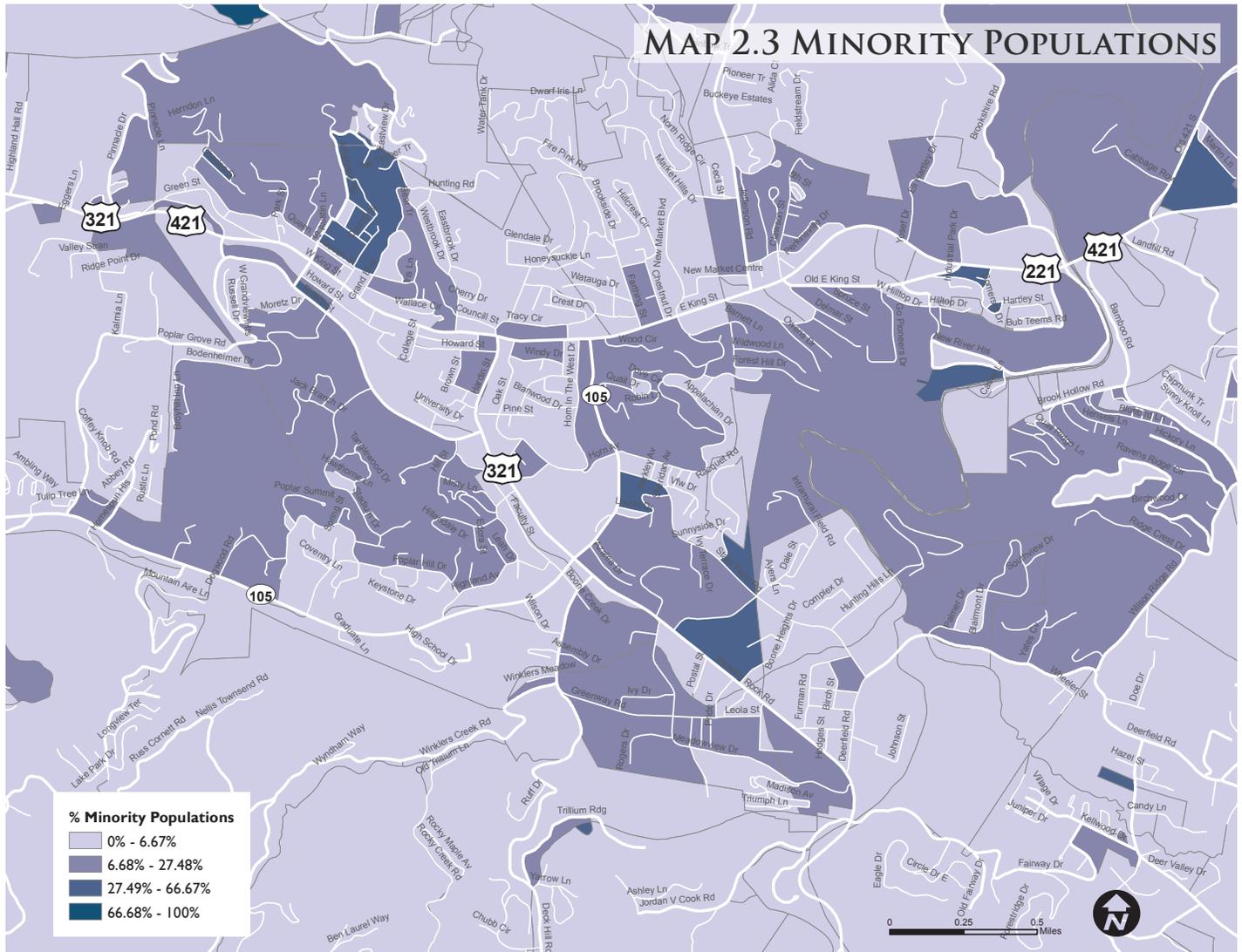
Map 2.2, titled “Population Density,” shows population density by U.S. Census Block in Boone. The two most densely populated areas are located along Hardin Street near ASU campus and along Jack Branch Drive on ASU campus, with 146 persons per acre and 118 persons per acre, respectively. There are additional areas with population densities ranging between 29 persons per acre and 67 person per acre surrounding the ASU campus, along Rivers Street, and adjacent to US-421. Providing safe access between highly populated areas and destinations such as commercial centers, employment areas, and the downtown business district should be considered high priorities for Boone.





MINORITY RACE POPULATIONS

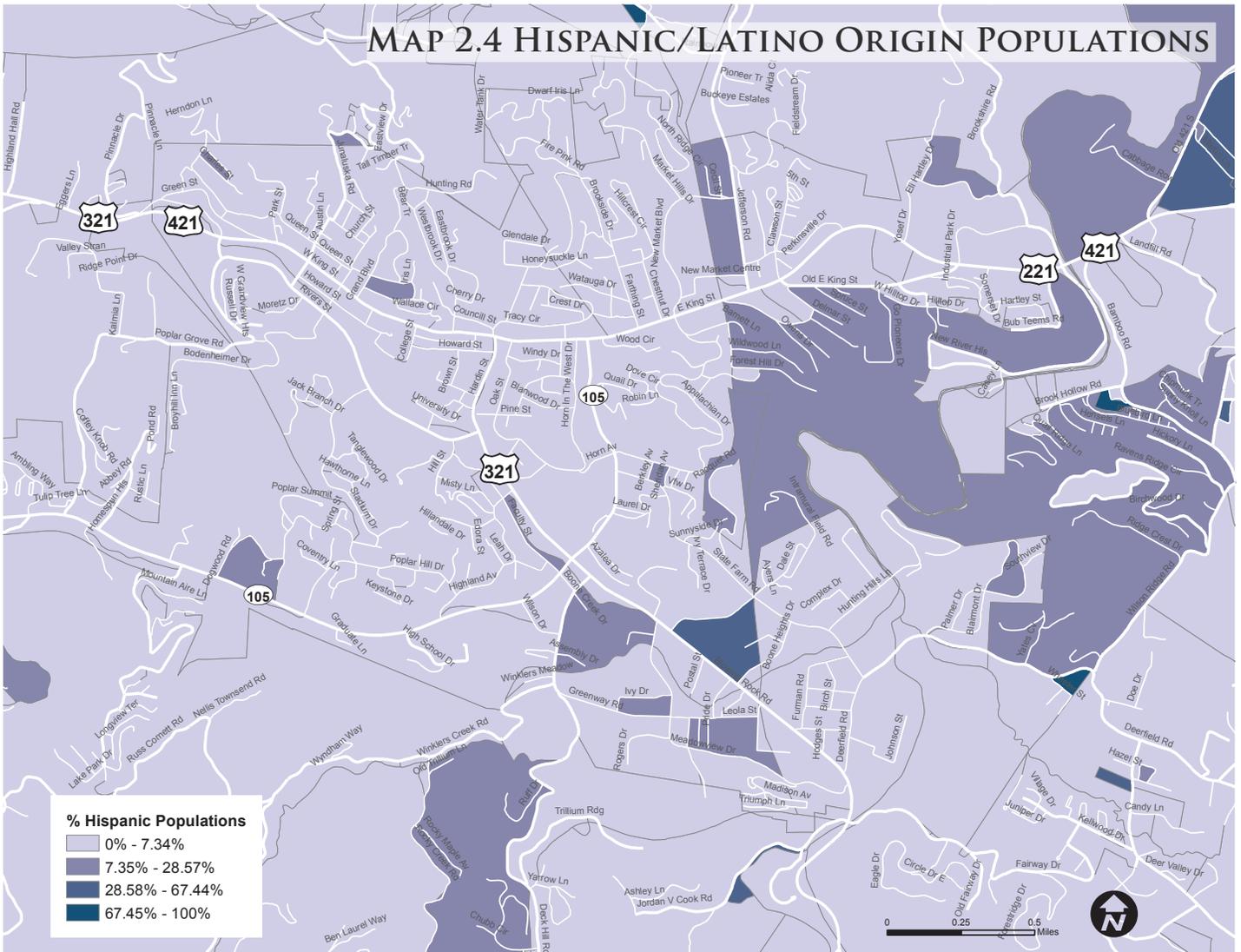
According to the 2010 U.S. Census, 10.1 percent of the total population in Boone is considered to be minority. Map 2.3, titled “Minority Populations,” is a map of the minority populations within Boone. Higher density clusters of minority populations exist adjacent to Junaluska Road, and north of the downtown business district along North Water Street, North Depot Street, Church Street, Queen Street, and Charles Street. It is important to consider these areas when planning for bicycle infrastructure projects to ensure that the town provides equitable access to the bicycle network.





HISPANIC OR LATINO ETHNICITY/ORIGIN POPULATION

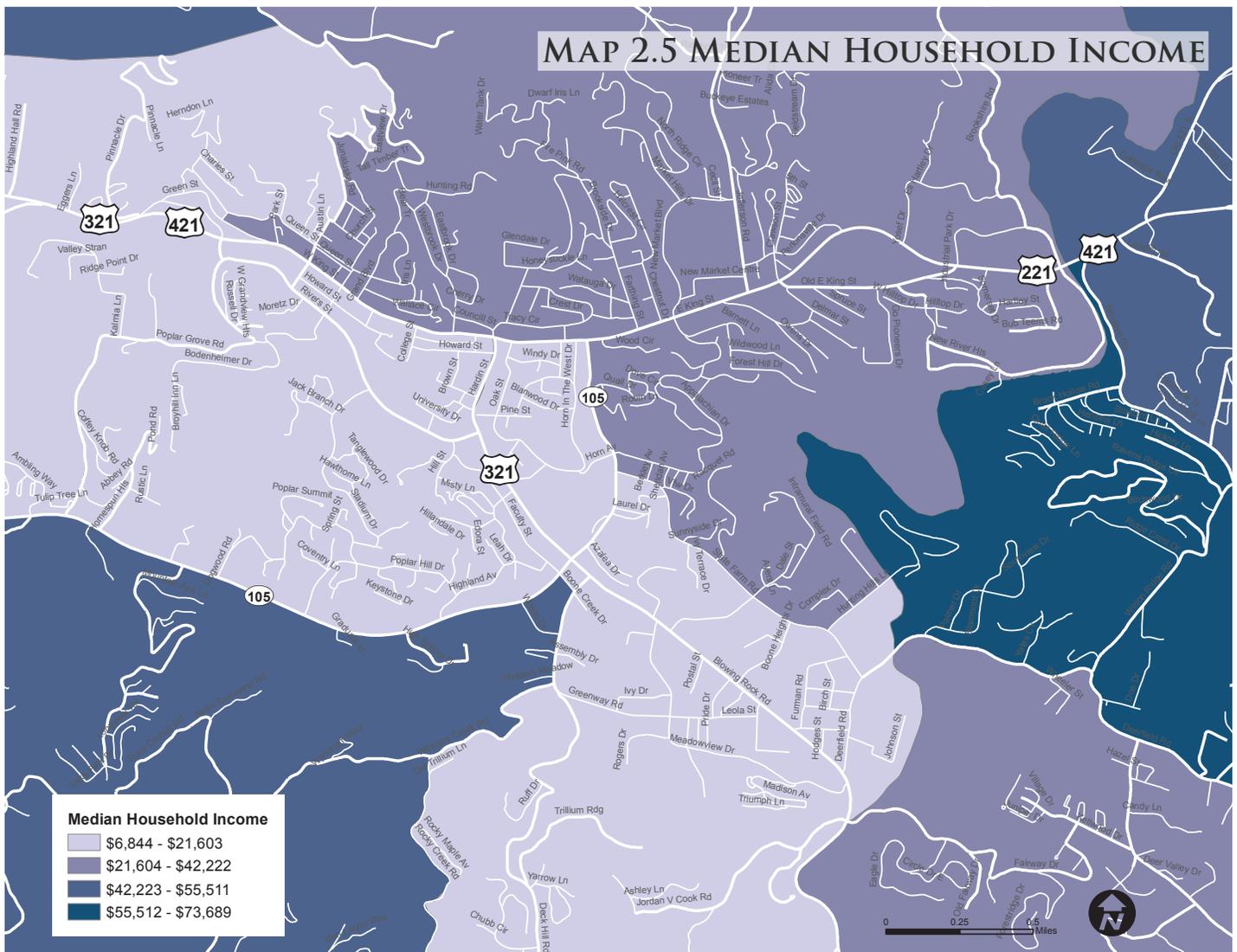
According to the 2010 U.S. Census, approximately 3.3 percent of Boone’s total population are considered to be of Hispanic or Latino ethnicity/origin. Map 2.4, titled “Hispanic/Latino Origin Populations,” illustrates the concentrations of the Latino population in Boone. Higher density clusters of Latino populations exist in the eastern portions of Boone, along Old East King Street, Bamboo Road, Deerfield Road, Wilson Ridge Road, Shadowline Drive, and Blowing Rock Road. It is important to consider these areas when planning for bicycle infrastructure projects to ensure that the town provides equitable access to the bicycle network.





MEDIAN HOUSEHOLD INCOME LEVELS

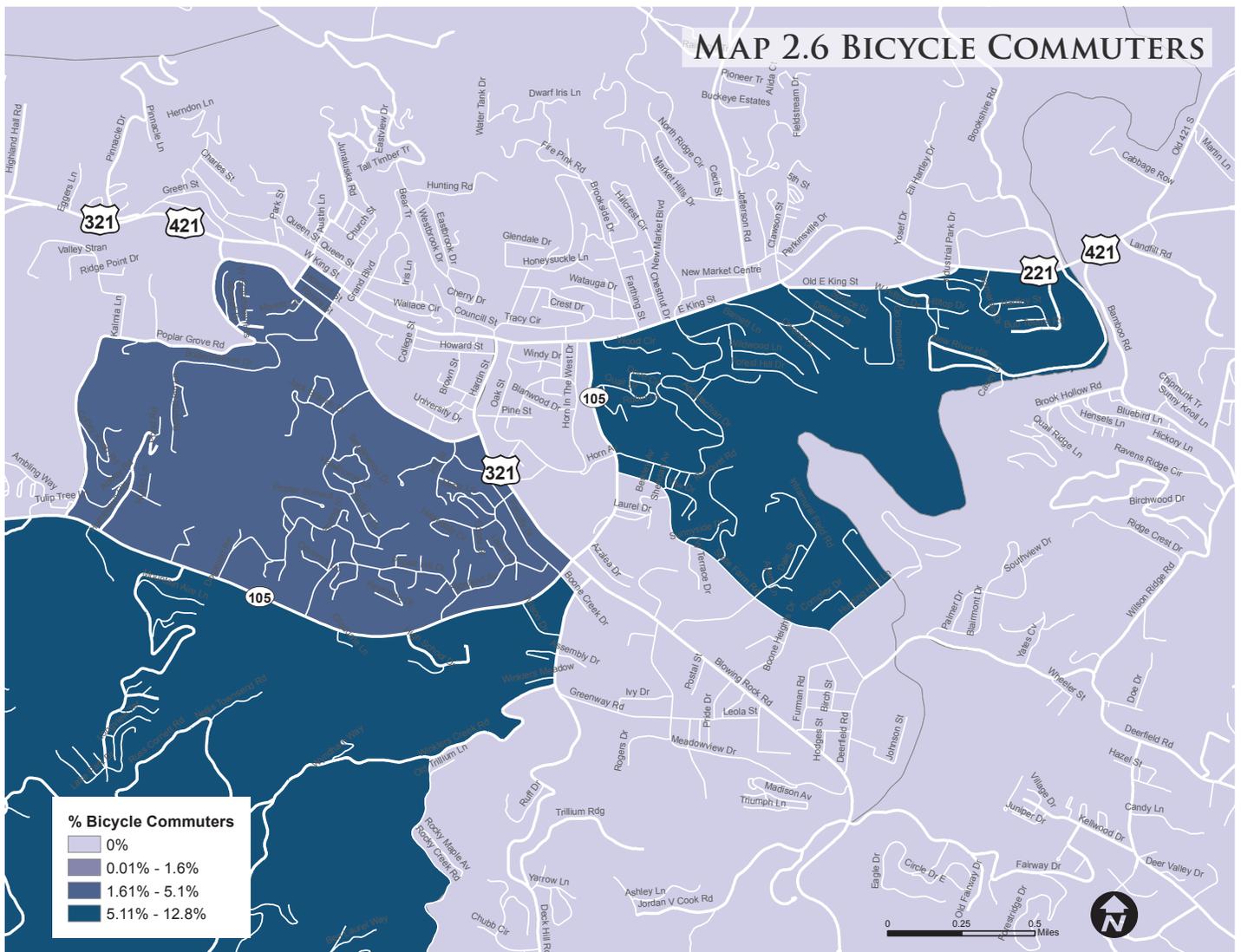
Median household income is mapped by U.S. Census Block Group, as data are not available at the Census Block level. According to 2007-2011 U.S. Census ACS data, the median household income for Boone is \$18,668 (see description of ACS data in introduction paragraph on page 2-4). Median household income levels for Boone Census Block Groups are illustrated in Map 2.5, and range from \$6,844 to \$73,689. To ensure convenient bicycling opportunities, a strong bicycle network should be in place to safely connect residents of all income levels to important destinations in Boone to access basic needs.





COMMUTE BY BICYCLING POPULATIONS

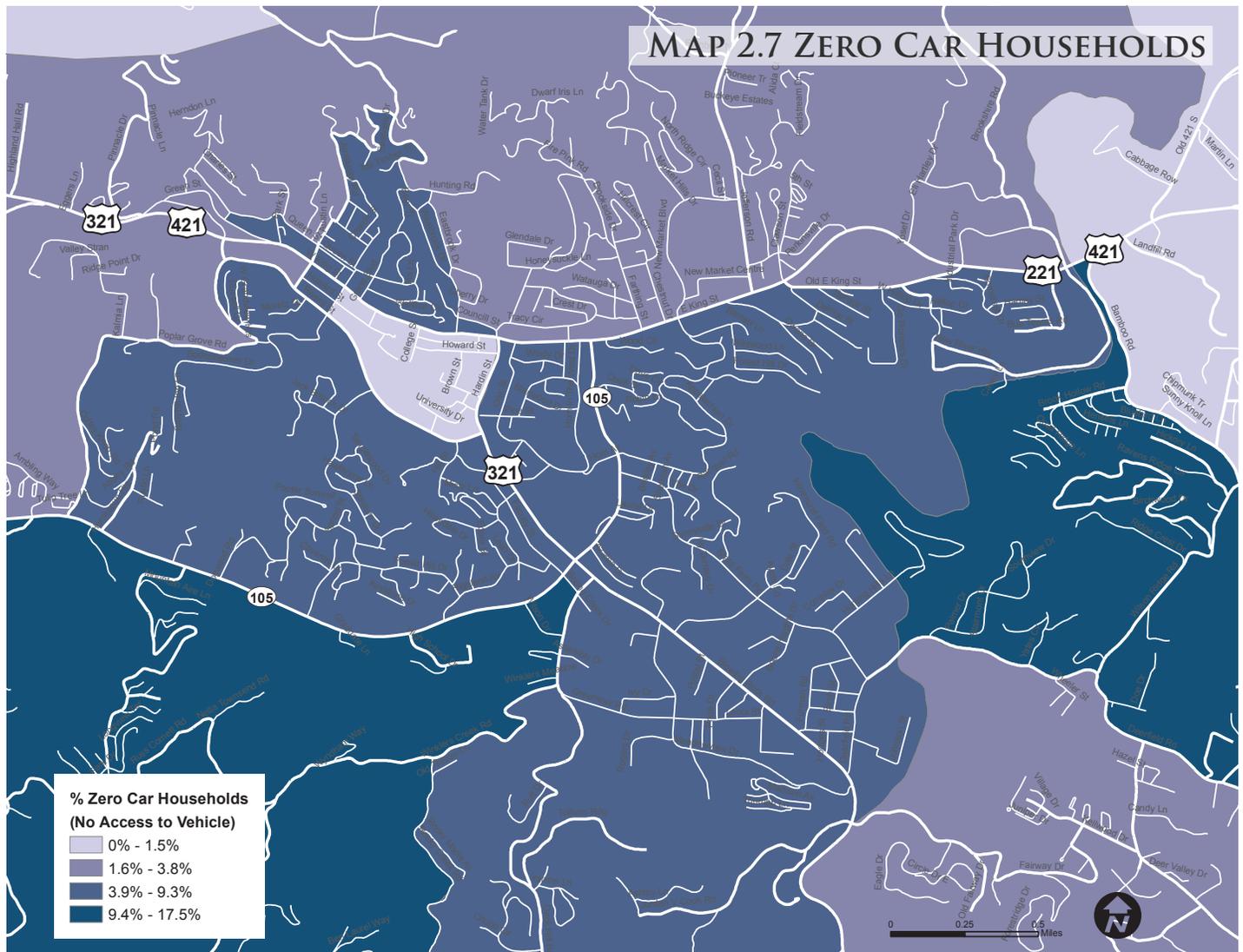
The overall commute by bicycling average for the Town of Boone as reported by the 2010 U.S. Census is 0.7 percent, which is greater than the State of North Carolina average of 0.2 percent. Map 2.6, titled “Bicycle Commuters,” illustrates ACS Census Block Group data for the populations in Boone that commute by bicycle. The ACS Census Block Group with the highest percentage (12.7%) of bicycle commuters exists east of NC 105 and south of US Highway 421. Areas with a high proportion of bicycle commuters have an immediate need for safe, connected bicycle facilities. Areas with a low proportion of bicycle commuters likely have many potential bicyclists who would choose to bike more with better infrastructure, education, and encouragement. Improved facilities and access would enable residents to consider bicycling to their place of employment or other high priority destinations.





POPULATION WITH NO ACCESS TO VEHICLE (ZERO CAR HOUSEHOLDS)

Map 2.7, titled “Zero Car Households,” illustrates the concentrations of Zero Car Households in and around the Town of Boone. Based on 2007-2011 U.S. Census ACS estimates, more than 12.3 percent of the population in two Census Block Groups (as high as 17.5 percent in one Census Block Group) do not have access to a vehicle, and can be referred to as “zero car households.” These Census Block Groups are illustrated by the darkest blue color on Map 2.7. Two other Census Block Groups located south of US-421 and the downtown business district have populations of zero car households ranging between 6.9 percent and 12.3 percent. Residents without access to a vehicle rely on bicycling or another form of non-motorized transportation; therefore safe routes and facilities for non-motorized transportation should be provided for these residents in the short-term.





SUMMARY

During the planning process, it was crucial to consider the needs of all populations living in Boone. The need for improved bicycle and pedestrian access is greatest where higher populations of lower-income, commute by bicycle, minorities, and zero car households overlap, as these are places where the maximum number of residents would benefit from the development of bicycle and pedestrian facilities. These demographic factors were included in the project prioritization process as described in Chapter 3.



Above: Old East King Street is the northern boundary of the block group with the highest percentage of bicycle commuters in Boone.



Left: State Farm Road and The Greenway Trail serve the block group with the highest percentage of bicycle commuters.



NCDOT-REPORTED BICYCLE CRASHES

Data for bicycle crashes involving motor vehicles from 2007-2013 was provided by NCDOT early in the planning process. It is important to note that not all bicycle-related crashes are reported to the police, and only reported crashes are included in this evaluation. The 36 crashes are mapped on page 2-13. Twenty of the crashes resulted in evident injuries, eight resulted in possible injuries, seven resulted in no injury, and one crash was reported as unknown injury.

The locations of all 36 crashes were assessed during field work investigations. Existing intersection crossing conditions and the bicycling environment were noted, as well as any barriers to bicyclist or motorist safety. Examples of existing barriers to bicycle travel in Boone are presented on page 2-15. The recommendations presented in Chapter 3 take into account the locations of the 36 crashes and the results of the field work assessment of each crash location.

Table 2.1 contains a listing of bicycle-auto crash locations and crash frequencies. The majority of crashes took place along US-321 (Blowing Rock Road) and Rivers Street, with additional crashes in Downtown Boone, near ASU campus, and other locations.

TABLE 2.1 BICYCLE-AUTO CRASHES IN BOONE, 2007-2013 (NCDOT)

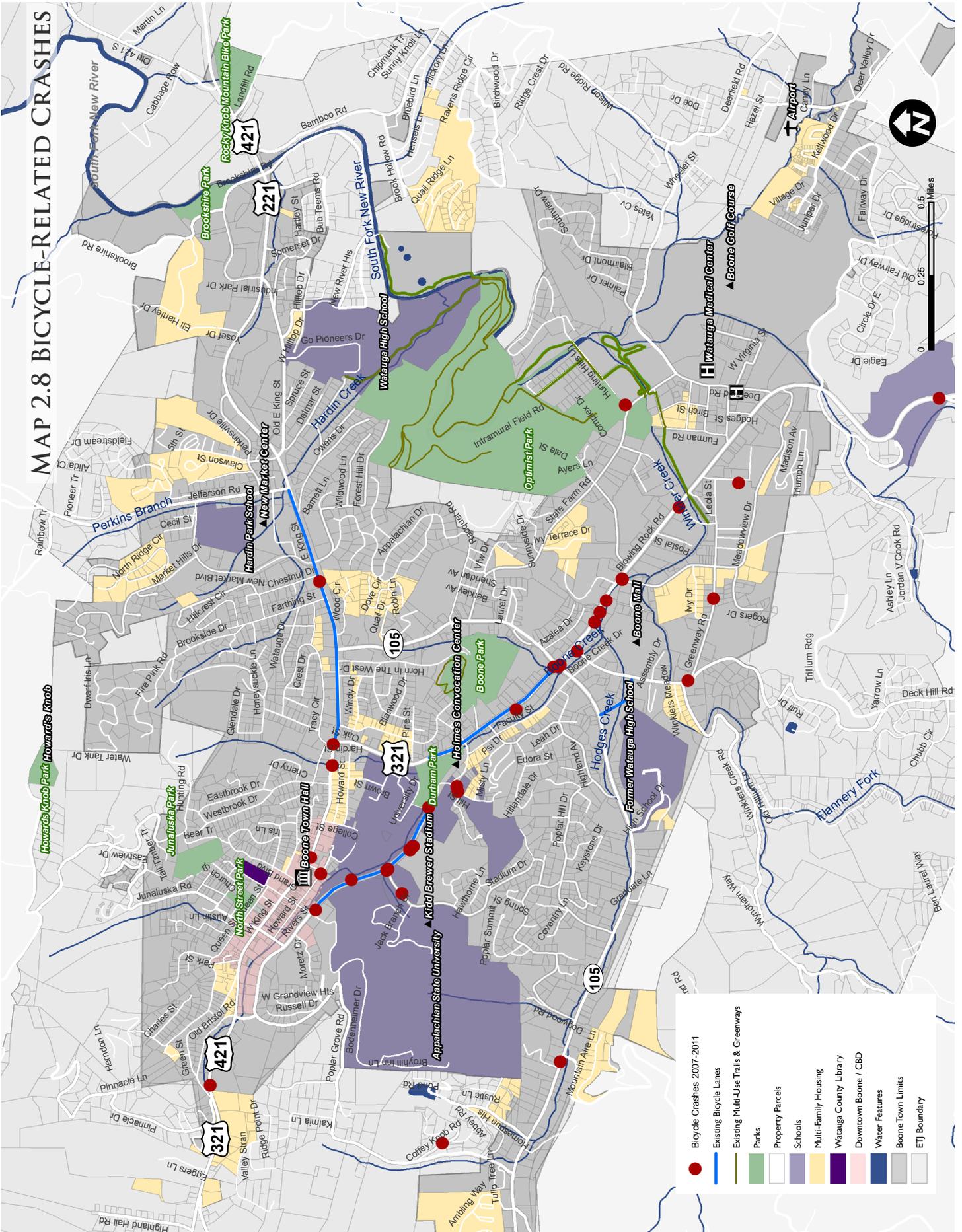
Bicycle Crash Location	Number of Crashes
US-321 (Blowing Rock Road)	11
Rivers Street	9
East King Street	3
West King Street	2
Hill Street	2
Greenway Road	2
NC 105	1
Stadium Drive	1
All other locations	6



Numerous crashes have occurred on this section of US-321/Blowing Rock Road near Shadowline Road.



MAP 2.8 BICYCLE-RELATED CRASHES





FIELD INVENTORY AND OBSERVATIONS

Bicycling in Boone is quite challenging due to the lack of connected bicycle facilities, the presence of high traffic volume roadways, a disconnected roadway network, and significant changes in topography. The bustling downtown core and surrounding areas offer on-street parking and the significant pedestrian activity reduces automobile traffic speeds. This environment creates favorable opportunities for cycling along King Street, Howard Street, Queen Street, Depot Street, Howard Street, and Water Street. There are less favorable cycling conditions along NC 105, US-321/Blowing Rock Road, and US-421/East King Street (east of the NC 105 intersection). The following narrative presenting strengths and weaknesses corresponds to the photographic inventory presented on pages 2-16 and 2-17.

EXISTING BICYCLE SYSTEM STRENGTHS

While Boone currently lacks a variety of on-road bicycle facilities, the town has many assets that provide a strong base for expanding and creating additional opportunities for bicycling. The Town of Boone is relatively compact, affording a realistic opportunity to bicycle for short trips, commute across town, and easily access scenic routes to connect to regional destinations. Also, commercial, institutional, and residential areas are interspersed throughout the town, increasing Boone’s overall bikeability—as long as safe linkages between destinations are made available and are well maintained.

Key strengths of the existing bicycle system and roadway network:

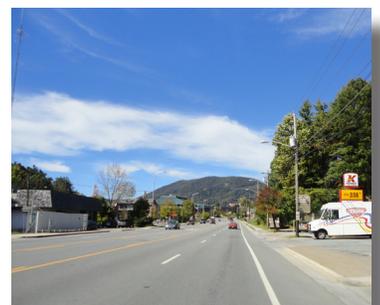
- Approximately five miles of greenway, mainly along the South Fork of the New River and its tributaries in a beautiful rural setting;
- Bicycle lanes currently exist on US-421/E. King Street between Hardin Street and Old E. King Street, on Wilson Road, on Rivers Street, and on US-321/Hardin Street between Rivers Street and NC 105;
- Numerous traffic calming devices (specifically speed humps and signage) provided throughout Boone;
- Favorable roads exist for bicycling such as Queen Street, King Street (between Old Bristol Road and Hardin Street), Old E. King Street, Howard Street, Poplar Hill Drive, Highland Avenue, and other neighborhood roads near Downtown and ASU;
- Watauga County recently completed a 40+ acre mountain bike site, Rocky Knob Park, adjacent to the Town’s ETJ border;
- The AppalCART public transportation buses feature bike racks on the front (with space for two bicycles).



Queen Street with speed humps.



Howard Street pedestrian walkway.



Hardin Street/US-321 bicycle lanes.



EXISTING BARRIERS TO BICYCLING MOBILITY

The Town of Boone serves as the transportation crossroads for several multi-lane regional highways, each featuring high traffic volumes that make traveling by bicycle difficult and unsafe. Many local roadways are narrow and lack paved shoulders, however cyclists were observed electing to travel on local roadways rather than the regional highways.

Key weaknesses of the existing bicycle system and roadway network:

- Other than the bicycle lanes along US-421, Wilson Drive, and Rivers Street, and the portion of the Boone Greenway Trail that travels alongside the roadway, the Town has no on-road bicycle facilities linking destinations;
- The current trail system does not connect with ASU, downtown, or the many neighborhood areas adjacent to downtown;
- The roadway network is not well-connected; developments with curvilinear streets and a single-point entry to major arterials are more commonplace than a grid network;
- Existing right-of-way limitations and topographic constraints pose significant challenges to the implementation of bicycle facilities that would require widening during future roadway reconstruction;
- Safely accommodating bicyclists on Boone's main arterial thoroughfares (specifically US-421, US-321, NC 105, and NC 194) that carry high traffic volumes and numerous driveway entrances creates multiple conflict zones between bicyclists and motorists;
- There are few parallel roadway alternatives with lower traffic volumes that serve as alternate routes to the main arterial thoroughfares.



Deerfield Road connects to US-321/Blowing Rock Road and is a winding road with inadequate paved shoulder widths for cycling.



PHOTOGRAPHIC INVENTORY OF EXISTING BICYCLE SYSTEM STRENGTHS



Boone's compact downtown core means that many key destinations are within bicycling distance of each other.



Residents in Boone enjoy the existing mountain biking trails in the new 40+ acre Rocky Knob Park, located on US-421, just east of town.



With minor improvements, low-volume neighborhood streets such as Faculty Street can offer an ideal environment for bicycling and serve as an alternative route for cyclists wishing to avoid traveling on US-321.



The existing bicycle lanes on Rivers Street provide access to ASU campus destinations.

One segment of Howard Street currently features one-way automobile travel and a pedestrian walkway. Cyclists were observed using the pedestrian walkway area as an alternative east-west route to cycling along King Street.





PHOTOGRAPHIC INVENTORY OF EXISTING BARRIERS TO BICYCLING MOBILITY



Insufficient bicycle parking near important destinations results in bicycles being secured to public property such as sign posts or trees.



Multi-lane, high vehicle-speed highways such as US-321, US-421, and NC 105 are challenging for cyclists. Many cyclists were observed riding on sidewalks instead of in the roadway.



Narrow roadway corridors are constrained by topography and have insufficient widths for drivers to safely pass bicyclists.



The majority of intersections in Boone lack any crossing treatments, and where crossing treatments do exist, crosswalks are faded. Currently, no bicycle loop detectors or bicycle boxes exist in Boone.



Hilly terrain and steep climbs pose challenges to cyclists in shared-lane environments, such as along East King Street near Cherry Street.



PUBLIC COMMENTS ABOUT EXISTING CONDITIONS

There were more than 780 responses to the *Bike Boone 2013* public comment form during the development of this plan. The overwhelming majority (>95%) of Boone respondents either feel “Intimidated” or “Cautious” bicycling on Boone’s roads, suggesting that there is some considerable room for improving bicycling conditions in town. The most desired improvements to encourage more bicycling among Boone residents are adding more bike lanes (81%) and providing more off-road bike paths or greenways (67%). When asked which two roads in Boone are most in need of bicycle improvements, respondents overwhelmingly listed major arterials that provide access to shops, restaurants, parks, schools, and a number of neighborhoods. The top three responses were Blowing Rock Road / US-321 (62%), NC 105 (48%), and King Street / US-421 (40%).

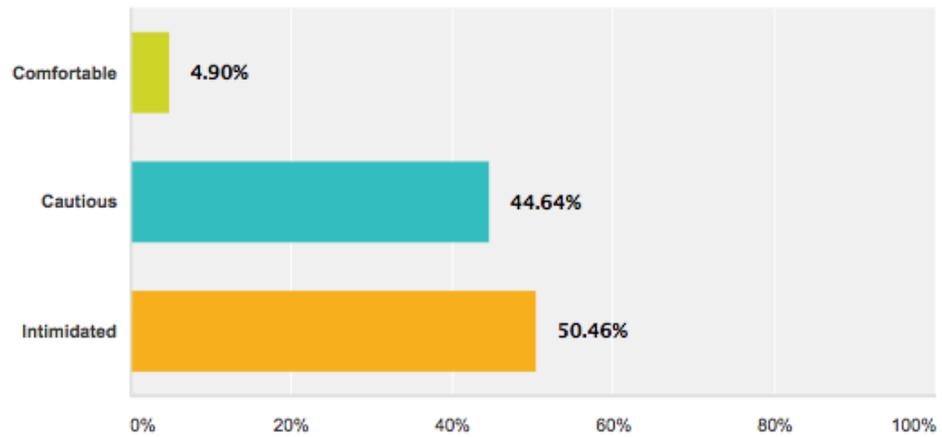
Whether they are driving or bicycling, Boone residents would like to see greater separation between bicyclists and auto traffic. The two driver behaviors or conditions that pose the greatest problem to Boone cyclists are drivers passing too closely (71%) and a lack of separate bike lanes (70%). Similarly, the two cycling behaviors or conditions that most concern Boone drivers are having too little roadway to pass bicyclists safely (74%) and a lack of separate bike facilities (50%). Providing more bicycle facilities in Boone would improve the comfort and safety of drivers and bicyclists alike.

Bicycle facilities should not only improve the comfort, safety, and mobility of bicyclists, but should also connect bicyclists to the places they want to get to most. The top three destinations that Boone residents would most like to bicycle to are trails and greenways (72%), Appalachian State University (60%), and Downtown Boone (52%). Providing connections to these destinations should therefore be considered a priority as Boone’s bicycle network is improved.

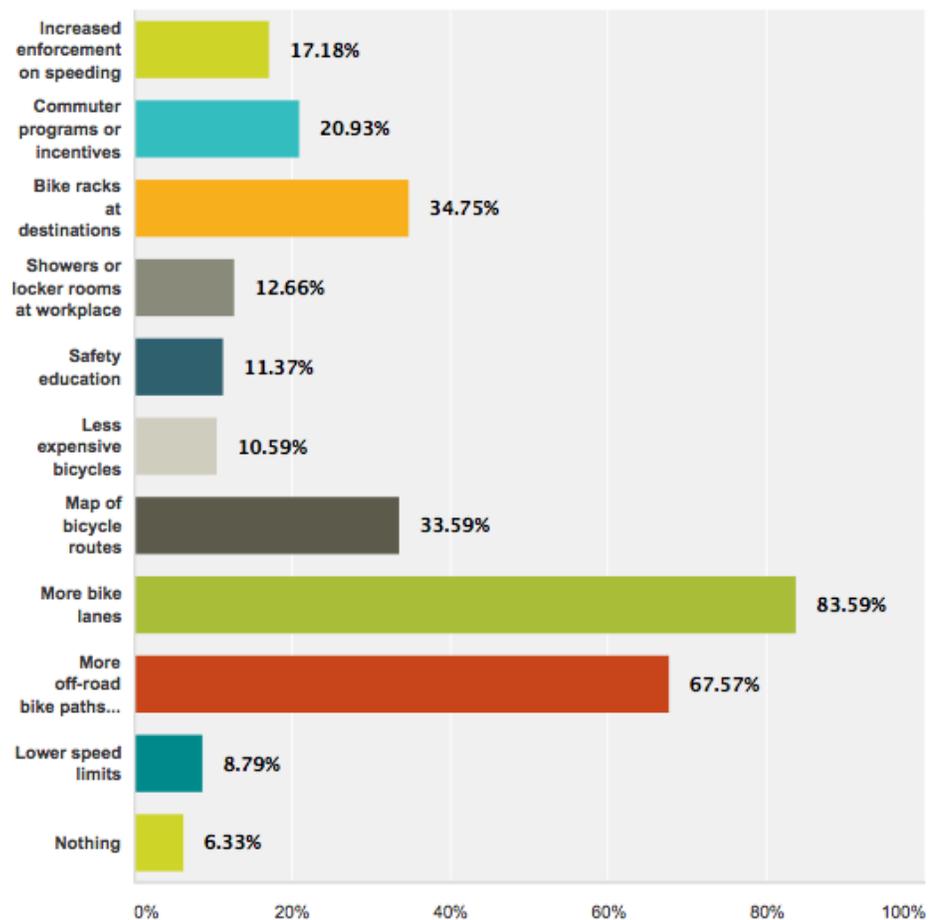
The following charts and tables represent responses collected as part of this plan’s public comment form that relate to existing conditions. A full report of public comments received during the planning process is included in Appendix F of this plan.



Q3 How comfortable are you cycling on Boone's roads and streets? (please select one)

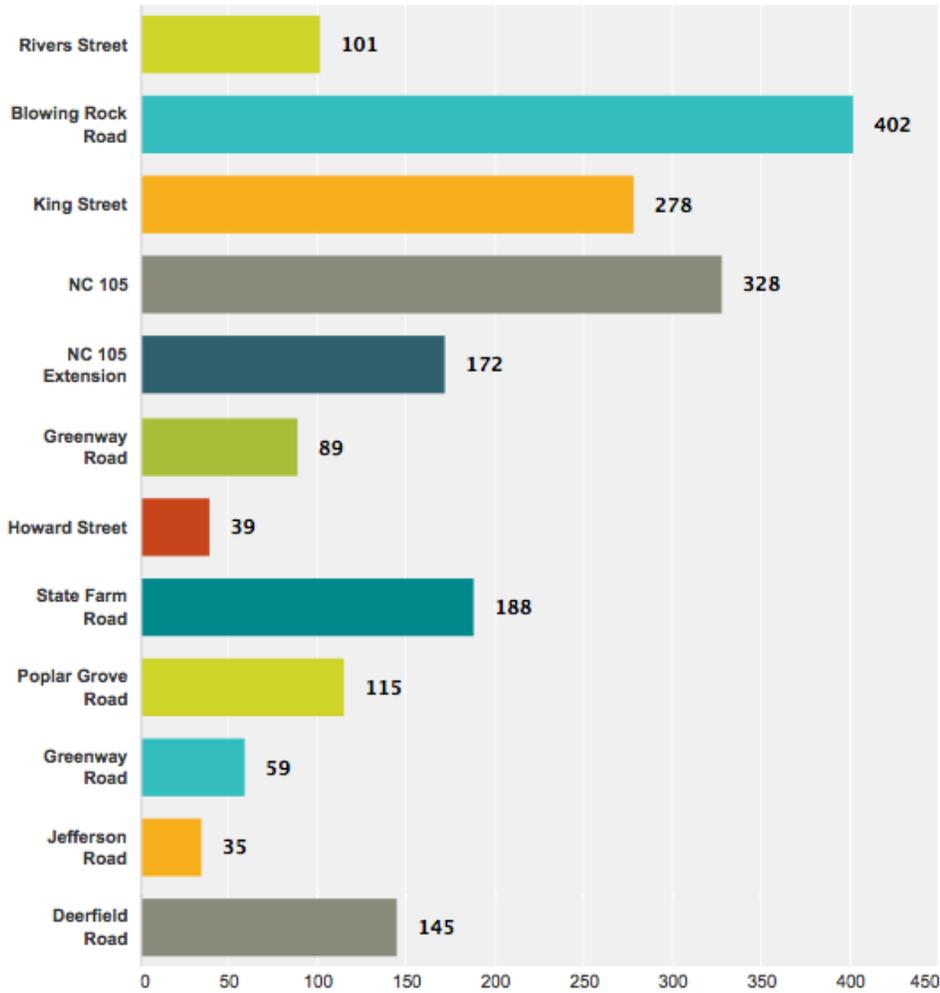


Q4 Which of the following changes would encourage you to bike more often? (please select up to three options)

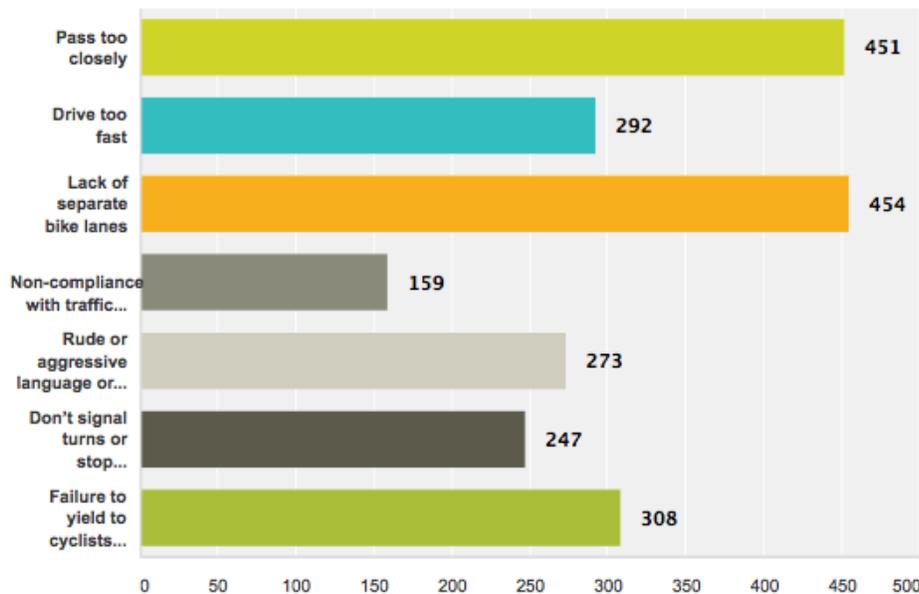




Q5 In your opinion, which roads in Boone are most in need of bicycle improvements? (please select two)

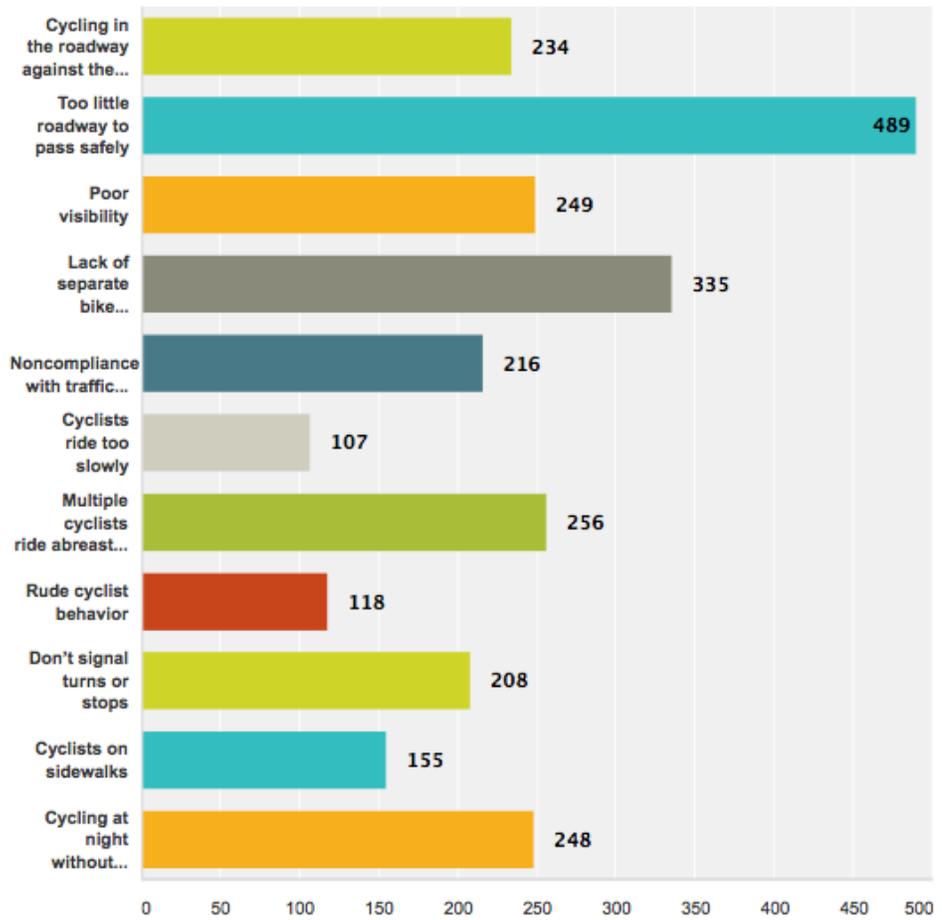


Q9 When you are cycling, which driver behaviors pose the greatest problems or concerns? (please select all that apply)

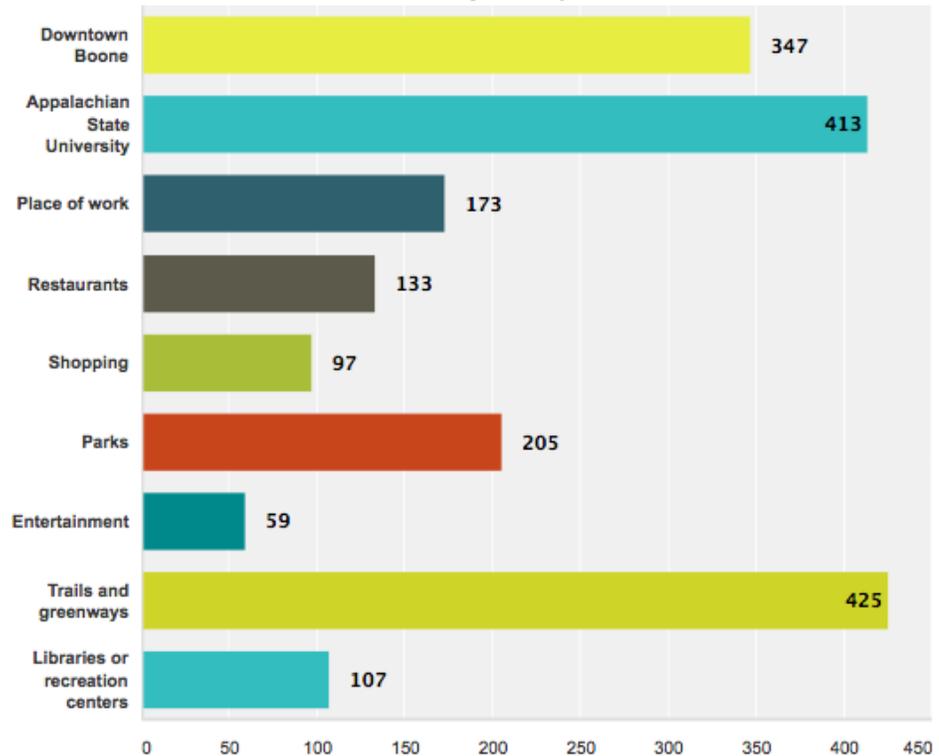




Q10 When you are driving, which cyclist behaviors pose the greatest problems or concerns? (please select all that apply)



Q11 What bicycling destinations would you most like to get to? (please select up to three options)





PAST AND CURRENT BICYCLE-RELATED PROGRAMS

In fiscal years 2008 and 2009, the Town of Boone partnered with the Appalachian District Health Department and were awarded the *Childhood Obesity Grant* from the Robert Wood Johnson Foundation. The grant funded pedestrian and bicycle related activities that targeted school age children, and provided funding to construct a 0.75 mile connector trail from Watauga High School to the local greenway system. The connector has made possible the use of the greenway system for physical education and cross-country sports.

CURRENT PROGRAMS

CYCLO.VIA

Ciclovias, which originated in Bogotá, Colombia (hence the Spanish name), are periodic street closures (usually on Sundays) that create a temporary park that is open to the public for walking, bicycling, dancing, hula hooping, roller skating, and other forms of human-powered activity. These programs are known by many names: Ciclovias, Open Streets, Sunday Parkways, Summer Streets, and Sunday Streets. They have been very successful internationally and are rapidly becoming popular in the United States. They promote health by creating a safe and attractive space for physical activity and social interaction, and are cost-effective compared to the cost of building new parks for the same purpose. These events can be weekly events or one-time events, and are generally very popular and well-attended.

Boone Area Cyclists hosted the inaugural Cyclo.Via event in Boone on June 26, 2011. The project was supported by the Watauga County Tourism Development Agency and the Boone Convention and Visitors Bureau. The most recent Cyclo.Via was held on August 4, 2013 and included street closures on portions of Howard Street, Depot Street, and Rivers Street. Zumba, a BMX show, a competitive jump rope team, tricycle races, and the Kids' Bike Rally were some of the activities featured at the event.

Below: A competitive jump rope team and road cyclists took part in Cyclo.Via 2013.

Source: www.boonecyclovia.com





ORGANIZED BICYCLE RIDES AND RACES

Boone is host to a number of bike rides and races every year that cater to a variety of ages, cyclist types, and skill levels. Annual rides and races held in Boone include the Boone Roubaix (April), the High Country Kids' Triathlon (April), the Gap Grind Metric (May), Blood Sweat and Gears (May), The Grizzly Metric (June), Rock the Blue Ridge (July), Watauga Lake Triathlon (October), and the High Country Cyclocross Series (October).

Not only do these events provide fun and competitive environments for cyclists, but they also generate considerable economic benefits for the community. The Blood, Sweat, and Gears ride nets an average of \$70,000 each year from direct event revenue. When lodging, food, transportation, and other rider expenditures are accounted for, this ride generates roughly \$1 million in annual economic benefits for the Boone community.

Below left: Kids participate in Take a Kid Mountain Biking Day.

Below right: Cyclists prepare for the start of the Blood, Sweat, and Gears race.



IMBA TAKE A KID MOUNTAIN BIKING DAY

2013 marks the tenth year of this event sponsored by the International Mountain Bicycling Association (IMBA). The event is intended to encourage youth to develop a stronger connection with the natural environment, particularly local parks and recreation lands. Boone Area Cyclists started hosting a local Take a Kid Mountain Biking Day event in 2010. The event is held annually at Rocky Knob Mountain Bike Park on the first Saturday in October.

BICYCLE LOANER PROGRAM

The Boone Bicycle Initiative bicycle loaner program provides bicycles to underserved individuals in the Boone community at little to no cost. The goal of the program is to improve the mobility of these individuals and their access to employment opportunities, community activities, and social outings.



EXISTING POLICIES AND PLANS RELATED TO BICYCLING

OVERVIEW OF LOCAL POLICIES

Existing land development, zoning and subdivision ordinances and technical standards have a significant effect on bicycle transportation and greenway trail development in Boone. The Town of Boone Unified Development Ordinance (UDO) was reviewed as part of this bicycle transportation planning process. This section presents a summary of this policy document and identifies the specific areas that should be strengthened to improve accommodations for non-motorized transportation and recreation facilities. A full, detailed review of the UDO document along with recommended language revisions is presented in Appendix C of this plan.

TOWN OF BOONE UNIFIED DEVELOPMENT ORDINANCE

The Town's Unified Development Ordinance (UDO) combines the zoning and subdivision authority of Boone into one document. The UDO recites applicable statutory authority, the applicability of the UDO to various uses of the town, consistency with the Comprehensive Plan, coordination with other regulations, the effective date, violations, and related matters.

Bicyclists and their needs were not covered in any significant detail or depth in the UDO. There is potential for confusion as bicyclists were not called out specifically in many situations where vehicular traffic is referenced but where directives did not seem to apply to bicyclists. Where bicycling was specifically mentioned, the primary focus was on bicycling for recreation, with no mention of the role of bicycling as a mode of transportation with wide-spread benefits for the community. Please refer to Appendix C: Policy Resources for recommended policy changes and additions.



PREVIOUS PLANNING EFFORTS

Numerous plans, guidelines, and strategies have addressed topics related to on-road bicycle facilities and off-road greenway trails in Boone. They have addressed improvements to existing parks and facilities and made suggestions for new parks, greenway trails, and other facilities. All of these documents represent important efforts, provide valuable insight and background, and have influenced the development of this bicycle plan.

The following plans were reviewed early in the planning process as they relate to existing conditions and future needs for on-road bicycle facilities, trails, and greenways. For further information, please consult the documents in their entirety.

- Boone / Blowing Rock Alternative Transportation Plan (1995)
- Boone, NC 2006 Comprehensive Plan Update
- Boone, NC Smart Growth Audit 2007
- Boone 2030 Land Use Plan
- 2004 Feasibility Study for Alternative Transportation Improvements
- 2009 Roadway and Sidewalk Program Handbook
- Appalachian State University Master Plan 2020
- 2013 Watauga County Comprehensive Transportation Plan
- Walk Boone 2011: Town of Boone, NC Pedestrian Plan
- 2013 Regional Bicycle Plan, High Country Council of Governments
- Boone Bicycle Initiative Bike-Ability Map



TABLE 2.3 2006 COMPREHENSIVE PLAN UPDATE

Page	Section	Project/Task	Contents
1.1 Overall Objectives			
15	Bikeways		Implement the planned system of bikeways as a legitimate transportation alternative. Unify with greenways and other facilities where possible
16	Pedestrian Movement		Encourage a system of sidewalks, paths, crosswalks and compact development patterns which make it easy to get around Boone on foot
16	Downtown		Support and enhance the cultural and historic significance of downtown Boone, and affirm its appealing, pedestrian orientation.
2.0 Policies for Growth and Development			
24	2.1.2 Commercial Development	Buffer large scale land uses from adjacent residential areas, but make such uses accessible from the neighborhood.	When plant material, fences, or walls are created or preserved as buffer strips, they should include pedestrian and bicycle paths which penetrate the buffer from the adjacent residential area.
25		Integrate small scale pedestrian oriented shopping and work places into the design of new neighborhoods.	
25		Consider automated neighborhood services	Such as walk-up post offices, automated bank teller machines... to be made readily available at the pedestrian-oriented neighborhood scale
26		Coordinate the location of neighborhood businesses and small places of work with transit stops and bikeways	Neighborhood businesses and small places of work should be located so as to reinforce and support the transit system and bikeway system.
26		Use on-street parking in coordination with a limited amount of off-street parking	On-street parking can be highly effective in meeting the parking needs of small, pedestrian-oriented stores and businesses. By limiting the amount of off-street parking, the store or place of business is made less convenient to cross-town motorists, but no less accessible to the neighborhood resident on foot or bicycle.
27		Policies and Actions	J. Highway Oriented Commercial uses shall be clustered along segments of major streets and contain land uses which are mutually compatible and reinforcing in use and design. Businesses shall be encouraged to coordinate their site designs with other nearby businesses. Design factors shall include, at a minimum, shared parking and street access, convenient pedestrian and vehicular movement, and consistent sign standards.



Page	Section	Project/Task	Contents
31	2.1.4 Agricultural and Rural Development	Policies and Actions	A. Farms and woodlands shall be recognized as an integral part of the planning area's open space system. A.1 ...These areas should be considered in the planning for pedestrian ways, bikeways, greenways, and other open space needs.
33	2.1.5 Downtown		The master plan fro the downtown should include, at the minimum, the following elements: An idealized land use pattern including the placement, size and use of buildings and land, traffic flow, parking areas and pedestrian movements.
35		Bus and Bicycle Needs	In keeping with the pedestrian-oriented character of the downtown, no other part of Boone should receive a higher priority for mass transit service and secure places for bicycle parking.
35		Polices and Actions	E.1 Evaluate the need for additional sidewalks and crosswalks and make physical improvements to existing sidewalks and crosswalks in the downtown area. E.2 Evaluate the needs of bicyclists and take appropriate action regarding bicycle travel and storage needs in the downtown area. E.4 Planned improvements shall emphasize needs of the pedestrian.
40	2.2.1 Transportation	Transit Sensitive Development	Applying the AppalCART Systems to the transit systems creates the opportunity to develop 'pedestrian pockets', that present convenient features that enhance pedestrian use, for example, heater or weatherized shelters, market services, convenient stores and coffee shops.
40		Central Medians	There is a need to place central medians down the middle of several of the town's major streets. Specific examples include Rivers Street and Blowing Rock Road. In addition to providing an aesthetic improvement to the roadway corridor, central medians can provide a "safe island" for pedestrians trying to cross these busy streets.
40		Bikeways	Boone is uniquely positioned to develop an outstanding combination bikeway-greenway system. The Town's adopted "Alternative Transportation Plan" short and long term plans for development of greenways, pedestrian ways, and mass transit.



Page	Section	Project/Task	Contents
40			Another attractive long term alternative to the automobile is the Town's development of a comprehensive bikeway system. Bike routes may be any combination of: (1) compatible bike lanes on through streets, (2) paths not on the street but within the street right-of-way, (3) separated off street trails, and (4) effective use of side streets, alleyways, or other available corridors.
			If the bicycle is to achieve meaningful status as a legitimate transportation alternative, it will be important to provide secure bike storage convenient to all land use activities. At the very least, bike storage should include bicycle racks convenient to the entrances of buildings and other activities.
41		King and Howard Streets Downtown	Retain the present character and design of King Street, in terms of pedestrian and automobile movement and on-street parking
42		Pedestrian Crossings	Another specific recommendation involves the placement of one or more elevated pedestrian crossings over River Street in conjunction with a landscaped central median barrier to effectively eliminate unsafe, at-grade pedestrian crossings.
42		Policies and Actions	<p>B. Planned systems of pedestrian ways, bikeways, greenways, and similar facilities shall be encouraged as energy efficient and environmentally sound transportation alternatives. Site planning that incorporates secure bicycle storage at places of living, working or schooling, shopping, and gathering shall be required, where appropriate.</p> <p>B.1 Encourage and legitimize alternative transportation through the enhanced use of bikeways, pedestrian ways, and greenways throughout the Town. Link existing bike, pedestrian, and greenways where possible and continue efforts for expansion.</p> <p>B.3 Provide safe and convenient bicycle and pedestrian crossings at major intersections along Highways 321, 421, and 105.</p> <p>B.4 • B.4. Explore funding options for alternative transportation projects throughout Town.</p>
43			D. Properly designed major street intersections containing right and left turn bays shall be encouraged where crosswalks and pedestrian traffic do not have first priority



Page	Section	Project/Task	Contents
			<p>G. The operational success of the area's mass transit system shall be enhanced through the encouragement of compact, transit sensitive development patterns. Site planning that incorporates transit stops and convenience clusters shall be required, where appropriate.</p> <p>G.I Evaluate and amend site plan standards to include provisions for transit stops, sidewalks and pedestrian ways, bikeways and secure bicycle storage.</p>
44			<p>H. Policies that have the effect of reducing automobile dependency, use, and congestion in the heart of the urban area shall be supported.</p> <p>H.I Prepare educational information concerning the location and use of bikeways, greenways, the bus system, and other forms of transportation as alternatives to the automobile.</p>
44			<p>L. All future road construction within the Town shall be examined for bike and pedestrian feasibility. Wherever possible, compatible bike lanes and pedestrian walkways shall be implemented in conjunction with accompanying road construction.</p>
51	2.2.3 Parks, Recreation and Open Space	Policies and Actions	<p>D. Land acquisition for new recreation sites in advance of need shall be encouraged to achieve desirable locations at cost effective levels.</p> <p>D.2 Consider the establishment of a land dedication provision or fees in lieu of land dedication in the Town's development regulations. Coordinate such dedications fully with pedestrian, bikeway or greenway space objectives.</p>
54	2.2.4 Public Safety	Continue community programs	<p>A.I Continue on-going community programs such as the Ride Long Program, D.A.R.E. Program, Police Explorers, School Resource Officers, Bicycle Safety Program, and Traffic Related Safety Programs.</p>
63	2.3.1 Community Appearance		<p>Give high visibility, pedestrian-scaled area first priority. King Street and Howard Street are on-going project priorities for the Town of Boone.</p>
73	2.3.3 Housing and neighborhoods		<p>In regard with new housing development, this development should be designed to be supportive of bikeways, pedestrian ways, and the AppalCART transit system whenever possible.</p>
73		Policies and Actions	<p>A. The protection and rehabilitation of viable neighborhoods shall be encouraged to insure their continued existence as a major housing source and as a reflection of the area's image as an attractive, highly livable community.</p>



Page	Section	Project/Task	Contents
74			<p>B. Street system designs which discourage through traffic on purely local streets while allowing for free circulation within the neighborhood shall be encouraged.</p> <p>B.1 Update the Town’s standards for subdivision street layouts, emphasizing circulation between neighborhoods and the ability of pedestrians and bicyclists to travel on back streets throughout the town.</p> <p>B.2 To the extent federal and state funding programs will allow, seek and apply for at least one grant to provide for bicycle paths to connect residential areas with commercial and university districts.</p>

TABLE 2.4 BOONE SMART GROWTH AUDIT 2007

Page	Section	Contents
I. Mix Land Uses		
16	Develop Strategic Land Use Master Plan	A land use master plan would identify with precision the type of development that is desired for each part of Boone and appropriate locations, density, and design standards for such
18	Apply the Transect	As part of a town wide plan, the Transect model should be applied at the “pedestrian shed” level (1/4 mile radius or a five-minute walk).
18	Allow Mixed-Use Development by Right	Mixed-Use Districts outlines by pedestrian oriented designs are encouraged and have been adopted by Boone. However, the problem with these districts is that they are optional and subject to approval process under Town Council regulations.
20	Details for Form-Based Codes	5. Streets should be pedestrian-scaled and multimodal 9. Neighborhoods should be compact, pedestrian-friendly, and mixed-use.
2. Compact Building Design		
21	Opportunities and Challenges	“Housing should be encouraged that is mass-transit and pedestrian friendly”
23	Concentrate Commercial Development in Mixed-Use Nodes	This report suggests that the Town consolidate commercial zoning into nodes that can become truly mixed-use districts by: <ul style="list-style-type: none"> • Allowing greater range of uses and intensity of development (coupled with pedestrian-oriented design standards) in the nodes to facilitate walkable, commercial centers.
23	Locate Highest Density Residential Near Existing and Future Mixed-Use Centers	The best locations for high density development should be evaluated in the context of an overall community master plan effort.



Page	Section	Contents
24	Reduce Setback/ Dimensional Standards	By permitting a reduction in front setbacks—such as 10 feet instead of 25 feet—house lots can increase the private, useable space of the rear yard as well as the building envelope and increase pedestrian friendliness of the street by bringing buildings closer to the sidewalk.
28	Revise Screening / Buffer Standards	The distance between land uses and creating mixed-use centers of activity, negatively affect pedestrian access to goods and services because they have to travel further to get to destinations that are severely affected by setbacks.
28	Revise Parking Standards	Require bicycle parking
4. Create Walkable Communities		
35	Vision	<ul style="list-style-type: none"> • “Create a walkable community” • “Create a pedestrian friendly downtown” • “Improved streetscape (lighting, landscaping, etc.), pedestrian friendliness, and sidewalks that connect to other parts of town.”
36	Recommendations	Census data shows that Boone has one of the highest rates of pedestrian commuters of any community in the state, most likely due to the number of students who walk to ASU
36		Boone also has good basic requirements for sidewalks in its UDO and is spending money on sidewalk and other pedestrian improvements in neighborhoods and downtown.
36		<ul style="list-style-type: none"> • Sidewalks should be required in new developments based on a number of objective standards such as density, street type, and development context (rural versus urban). • Sidewalks should be required on both collector and arterial streets in the urbanized area. • The sidewalk requirement for streets abutting new subdivisions is good. However, developers should also be required to build or improve sidewalks and other streetscape amenities in the public right of way for all development projects except individual single-family homes. • Minimum sidewalk widths should generally be 5 feet. • In higher density and mixed-use developments and along collector and thoroughfare streets sidewalks should be on both sides of the street with a width of six to twelve (6-12) feet based on use type. <p>Pedestrian-friendly streetscapes, particularly on streets with higher traffic volumes and commercial uses, should include the planting of canopy trees such as oaks and maples at a regular interval.</p>
38		<p>Adopt a Pedestrian Network Requirement</p> <p>Town officials should consider an amendment to the UDO to require that all new development or expansions to existing development provide sidewalk connections from the buildings on the site to the existing pedestrian network, including surrounding sidewalks and trails.</p>
38		Support Safe Routes to School Initiatives and Infrastructure



Page	Section	Contents
38		Make Pedestrian Crossings Safer High-visibility crosswalk markings, reduce turning radii, improve curb ramps, pedestrian/bicycle activated signals, mid block crossings, and pedestrian islands where right turn lanes are present.
39		Lobby NCDOT for other Walkable Facilities Especially referring to the US-421 widening, the town should lobby to include: low design speeds and posted speeds, pedestrian refuges, small curb radii, separation between roadway and sidewalks (preferably with street trees), bike lanes, sidewalks that are at least 6 feet wide on thoroughfares, restricted driveways and medians, and pedestrian friendly intersections (including right turn islands and pedestrian countdown signals).
39		Continue Walkability audits
39		Pedestrian - oriented design standards Boone recently adopted Mixed-Use Districts.
40		Restrict Drive-Thrus in Walkable Districts
5. Communities with a Strong Sense of Place		
42	Recommendations	Require Attractive Streetscapes
59	Recommendations	Develop a Downtown Master Plan
8. Provide a Variety of Transportation Choices		
63	Strengths/ Advantages/ Accomplishments	Bicycle group at ASU: New initiative to rent bikes to students and promote bicycling
63	Opportunities and challenges	“Oak Street was made one way and narrowed. Delivery trucks are parking over bike lanes, which are trying to foster pedestrian, bike transportation.”
65	Recommendations	Update Thoroughfare Plan and Prepare Master Plan for Transportation ...provide attractive route alternatives from neighborhoods to major activity centers for motorists, transit, cyclists, and pedestrians.
65		Update Plans for Transit, Pedestrian, & Bicycle Infrastructure Plan updates should include greenway linkages, on-street facilities such as bike lanes and sidewalks, as well as off-street facilities such as bicycle and pedestrian connections between existing residential neighborhoods and across waterways. Such a network should be implemented through the development process and as opportunities and funding arises through roadway projects or other capital funding.
66		Establish Retrofit Connectivity Program: In order to expand and enhance the existing transportation network, especially for pedestrians and cyclists, Boone should consider a funded program to identify, prioritize, and construct bicycle and pedestrian connections between existing neighborhoods and other developed areas.
66		Require Bicycle Parking for New Development
67		Provide Bicycle Parking at Existing Development
69		Improve Roadway Connectivity Standards
70		Apply (and enforce) appropriate urban speed limits on major streets Regulate speeds to 20MPH in pedestrian areas



Page	Section	Contents
70		Initiate Education and Encouragement Efforts: Town events to promote walking, bicycling, transit; Bicycle education courses
71		Allocate Transportation Funding Based on Smart Growth Priorities The Town should compare at all of its current funding for transportation projects (including parking, resurfacing, maintenance, transit, etc.) against the population in the town that does not drive due to age, income, or physical disability (typically around 30%, although probably higher in a college town). Set a goal that funding for transit and active modes (i.e., walking, bicycling) begin to reflect that portion of the population, at least.

TABLE 2.5 BOONE 2030 LAND USE PLAN (OCTOBER 2009)

Page	Section	Contents
3. Civic Dialogue and Participation		
23	Public Input & Communities Priorities	In summary, the public would like to see the following improvements: 3. Provide transportation choices; Make it practical for people to bicycle/walk 5. Develop a vibrant downtown 6. Create attractive streetscapes and corridors 7. Encourage denser /pedestrian-friendly, mixed-use Development
24	Advisory Committee	One of the goals of the advisory committee is for Howard St to be a pedestrian safe walking area.
25	Community Survey	Top 5 Transportation Priorities: - Provide on-street bicycle facilities and network - Provide off-street bicycle facilities and network
25		Town staff, the Advisory Committee, and the consultants developed and distributed a survey to elicit feedback on community priorities. According to the 132 completed surveys, some of the top 10 community objectives are: Implement the planned system of bikeways. Unify with greenways and other pedestrian facilities. Improve and expand the pedestrian network Pedestrian and bike bridges (e.g., NC 105 at Faculty St)
26		Capital Spending Priorities: - Bicycle facilities (bike lanes, paths) (ranked #1) - Greenways (ranked #3)
26		Make it practical for people to bike/walk - Connecting bike lanes, greenways, sidewalks, and parks - Pedestrian and bike bridges - Local businesses to sponsor a bike rack
28	Vision for Boone	Transportation choices - more bicycling and walking throughout town and surrounding areas



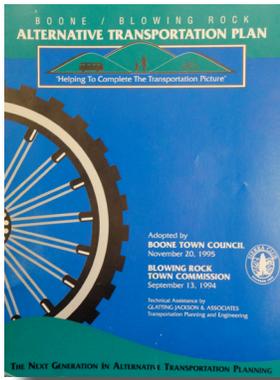
Page	Section	Contents
4. The Framework Plan		
35	Vision for Boone 2030	To have: Vibrant, pedestrian-friendly downtown with adequate parking (wider, brick sidewalks, streetscape furnishings) Greenway systems: pedestrian and bikes and creeks. More multi-modal route options
37		Subdivide regional sectors into transect zones and develop/apply new context-based development standards.
6. Transportation		
66	Principle 3: Build Complete Streets	Complete streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and bus riders of all ages and abilities are able to safely move along and across a complete street.
67	Principle 5: Promote Walkability	Several aspects contribute to the walkability of a community. In general, pedestrians need safe, comfortable, and accessible routes covering the entire Town of Boone. A pedestrian system can encourage walking as a viable mode of transportation as well as a recreational activity. Strategic planning plays a vital role in the planning of a connected system of pedestrian facilities. In this way, policy commitments that actively encourage the development of pedestrian facilities can aid the Town in ensuring that pedestrian facilities are implemented.
67	Principle 9: Become a Bike-Friendly Community	To establish a functional, efficient, and usable bikeway system across the Boone area, an extensive network of bicycle facilities linking on-street bicycle lanes, neighborhood streets, and greenways is needed. Road safety, connectivity, directness of routes, attractiveness of the route, and comfort all need careful attention in the design process. In addition, the design process needs to be carried out in a collaborative manner involving community members, cyclists, property owners, AppalCART, NCDOT, the Town of Boone, and other stakeholders.
72	Capital Improvements	Consider capital improvements for downtown including: improved pedestrian and intersection safety; consider reverse angle parking, and consider a festival street section for Howard Street. Implement by Town of Boone.
72	Downtown Transportation	Recommendations Improve pedestrian and intersection safety Consider a Festival Street Section for Howawrd Street
73	US-421/East king Street	Recommendations Implement planned pedestrian and bicycle improvements with the US-421 Widening The cross section should include the following elements: A planted median instead of the concrete monolithic median as proposed to aesthetically soften the cross section; The use of high-visibility crosswalks at both signalized and unsignalized intersections; and The use of a “sharrow” marking on the wide outside lane to emphasize shared use with cyclists and to give guidance to cyclists on safe lane positioning.



Page	Section	Contents
75	US-321 South	<p>Recommendations</p> <p>Consider an Urban Boulevard as One Possible Long-term Solution for US-321.</p> <p>This is a long term vision that would include walkable, parallel access roads along US-321</p> <p>Implement planned pedestrian and bicycle improvements to corridor</p>
76	Other Roadway recommendations	<p>Reallocate Space on Rivers and Hardin Streets to Other Modes of Transportation</p> <p>King Street to Rivers Street have excess roadway capacity that could be reallocated to create a street that is safer for all users and at the same time more walkable, bikeable, and attractive, while adding needed on-street parking.</p>
78	Additional roadway network connections and enhancements recommendations	<p>Continue the implementation of bicycle racks on buses</p>
81	<p>Bicycle and Pedestrian Access & Mobility - Pedestrian Facilities</p> <p>See map: Pedestrian Recommendations page 82</p>	<p>Complete a Pedestrian Master Plan. The Town should complete a pedestrian master plan to identify locations and prioritize funding for sidewalks, and Safe Routes to School facilities and safety programs. Such a plan can be partially funded through an NCDOT grant. Recommendations from the plan should be implemented through the Town's Capital Improvement Plan (CIP) and through State and local transportation and development projects. Consider partnering with the University for funding and implementation of the plan.</p>
		<p>Make Changes to the Unified Development Ordinance. The 2007 Boone Smart Growth Audit recommended numerous changes to the Town's UDO that would create a more walkable community. These should be prioritized for integration into the current UDO.</p>
		<p>Prioritize sidewalk construction around identified nodes and key pedestrian routes.</p> <ul style="list-style-type: none"> • Link disconnected segments of sidewalk around activity nodes in the Town. • Provide additional sidewalks near the periphery of town, including King Street between Green Street and NC 105 Spur; and State Farm Road between NC 105 and Deerfield Road; • Add side paths along Poplar Grove and Stadium Drive (cantilevered if necessary) to provide pedestrian access to the university from the south side • Incorporation of an approximately 20 foot wide pedestrian promenade into the US-321 Multi-way Boulevard Concept.
		<p>Improve pedestrian safety at intersections and crossings. Improve pedestrian safety along major corridors through high-visibility crosswalks, activated strobe signage, pedestrian refuge medians, and lighting at appropriate locations. Provide pedestrian signal heads and countdown clocks at all signalized intersections within the Town.</p>



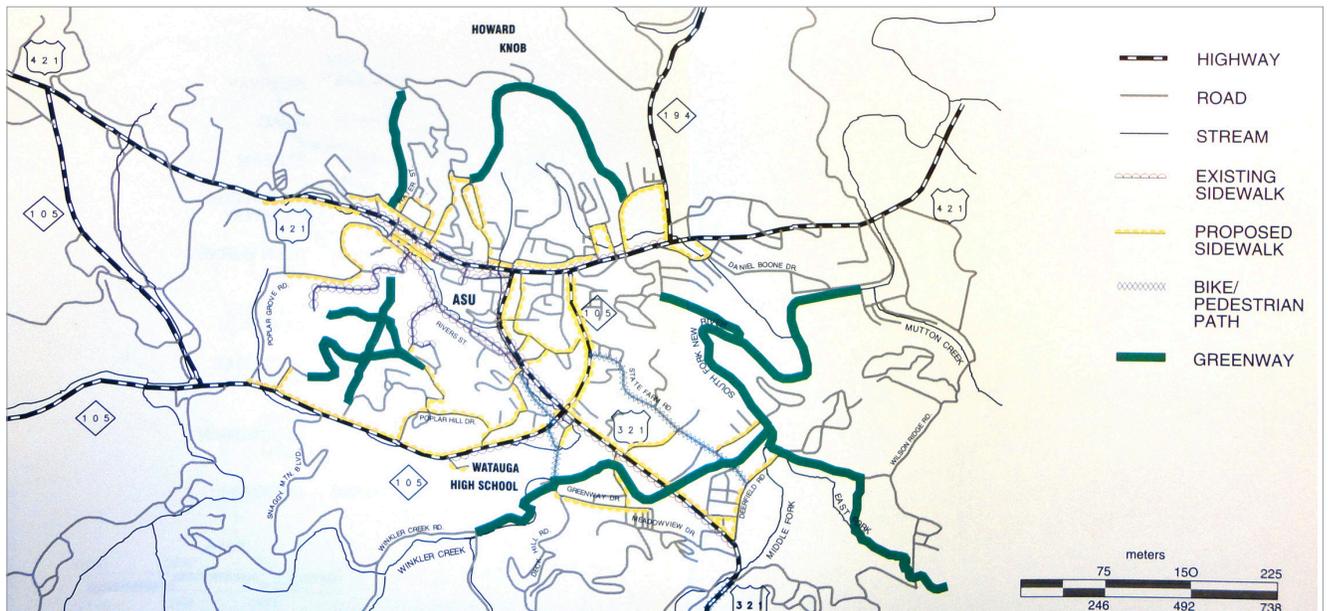
Page	Section	Contents
81	Bicycle and Pedestrian Access and Mobility - Bicycle Facilities	<p>Develop bicycle facilities as part of proposed or planned roadway projects</p> <ul style="list-style-type: none"> - Add shared roadway bicycle markings (“sharrows”) to the outside lane as part of the King Street widening project; - Restripe Rivers and Hardin Streets to provide bike lanes or bus/bike lanes - Explore opportunities for sharrows or bike lanes on US-321 and NC 105 and other major corridors - Implement other bicycle facilities, including sidepaths where appropriate, as shown on Map 6.9.
		<p>Complete a Bicycle Master Plan. The 1994 Alternative Transportation Plan was a great start for Boone and the recommendations in this plan build upon that vision. However, a more detailed study and recommendations for a bicycle network (including on-street facilities, greenways, and neighborhood connections), and program of bicycle education, enforcement, and encouragement and evaluation is necessary to achieve the community’s goals. Such a plan can also be partially funded by NCDOT and should include participation from ASU.</p>
	Bicycle and Pedestrian Access and Mobility - Greenways	<ul style="list-style-type: none"> - Extend existing greenway termini west to Boone Mall and the university, North to Brookshire Park, and connect with the new high school. - Investigate opportunities to obtain funding for the Middle Fork Greenway between Blowing Rock and Boone. - Link disconnected neighborhoods with greenways to make the community more walkable and bikeable - Investigate opportunities to develop greenways by implementing a boardwalk or elevated walkway on fore slopes or back slopes in mountainous terrain in order to reduce the need for retaining walls with sidewalks. One candidate corridor might include Poplar Grove Road.
Section 7. Downtown Boone		
87	Short Term Improvements	<ul style="list-style-type: none"> • New street paint (Depot & River) [Pedestrian cross walk enhancements] • Pedestrian scaled lighting on King Street (north side very dark @ night) • Sidewalk cafes
89	Recommendations	Create a green pedestrian alley/public space between King and Howard Streets
Section 8. Special Focus Areas		
106	Kraut Creek/ Boone Creek Restoration concept	<p>Showcase the site as a “green” redevelopment opportunity</p> <p>Restoring the creek to its natural state would be the first step to creating this living laboratory. A public green space with pervious walking trails would be another component of the design with strategic pedestrian crossings at different locations along the creek.</p>
109	Redevelopment of Kmart site	<p>Eventually, the site can begin to fill in with the same amount of square footage as a big box (around 100,000 sf) but with a mix of uses and parking hidden behind buildings. This mixed use development creates not only a pedestrian friendly environment but an economically sustainable opportunity.</p>



BOONE/BLOWING ROCK ALTERNATIVE TRANSPORTATION PLAN (1995)

This 1995 plan laid the groundwork for much of the alternative transportation facilities, programs, and initiatives in existence today for Boone, including the Alternative Transportation Subcommittee. The plan makes the case for why alternative transportation planning is necessary, and analyzes demand and level of service for alternative transportation. The plan also features specific recommendations for pedestrian facilities, as shown in the ‘Boone Walkways Long Range Plan,’ which identifies proposed sidewalks, bike/ped paths (sidepaths), and greenways (multi-use trails). Since adoption, the Town of Boone has made great strides in installing many of the recommended facilities.

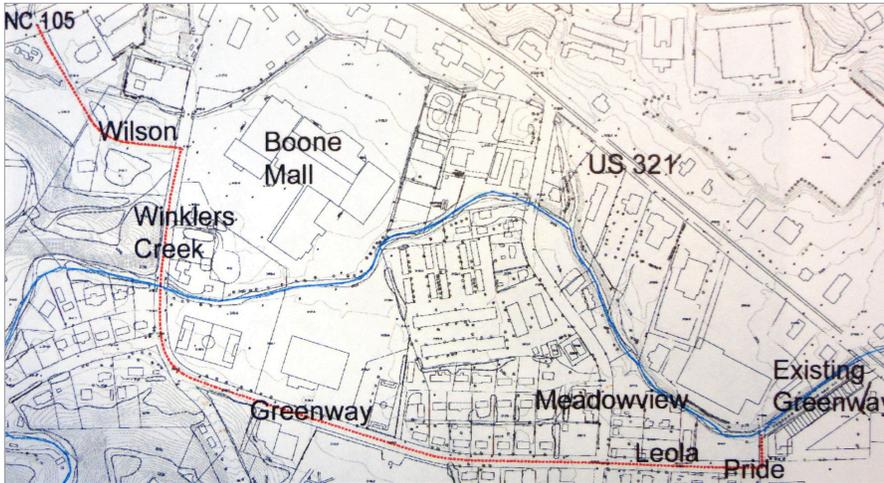
Below The Boone Walkways Long Range Plan (1995).





FEASIBILITY STUDY FOR ALTERNATIVE TRANSPORTATION IMPROVEMENTS (2004)

This study builds off recommendations from the Boone/Blowing Rock Alternative Transportation Plan, specifically for the construction of sidewalks and bicycle lanes along the project study area bounded between the greenway trail at Pride Drive and NC 105. The improvements are proposed along Pride Drive / Leola Road / Greenway Rd / Winklers Creek Road and Wilson Drive. While some sections of sidewalk have been constructed, the project as a whole has yet to be built.



Right: Route overview map for the feasibility study.

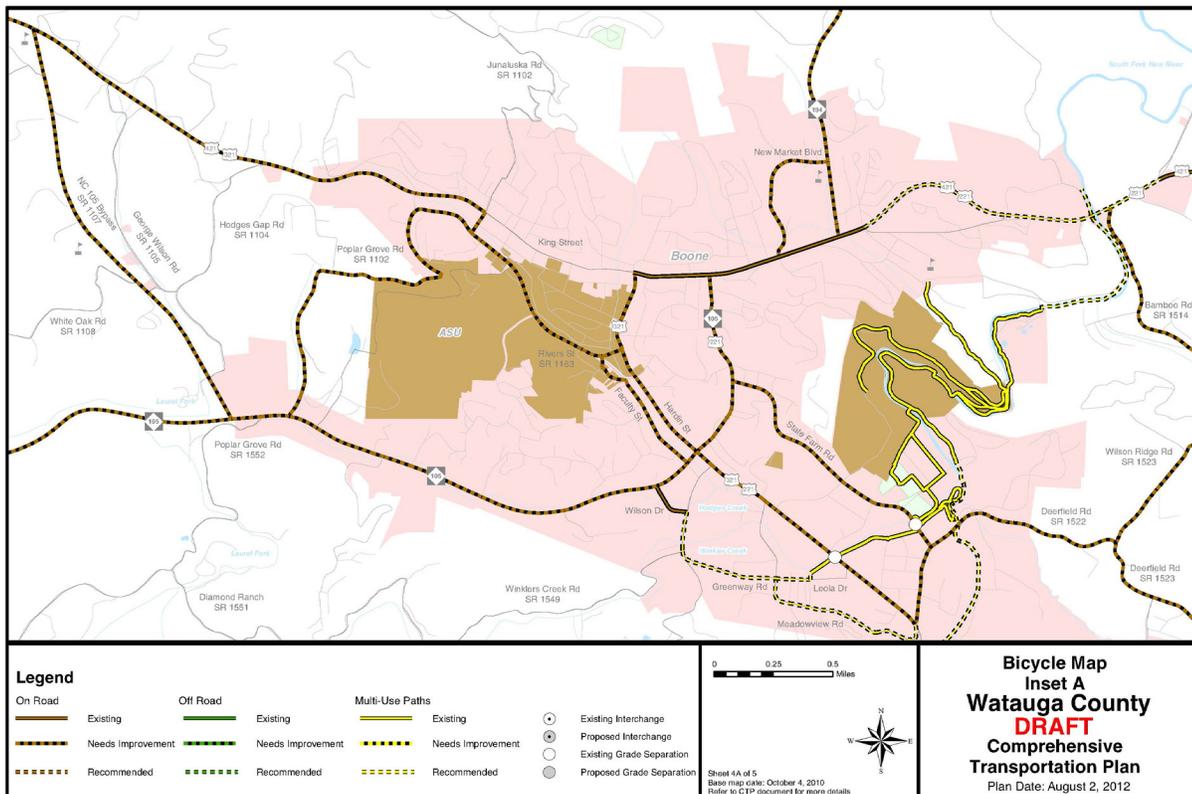
ROADWAY & SIDEWALK PROGRAM HANDBOOK (2009)

The Public Works Department designed this handbook in an effort to promote consistent street and sidewalk infrastructure within the Town of Boone. This handbook sets forth expectations to citizens, engineers, developers and contractors and should be incorporated into plans and specifications for future projects. The handbook includes roadway standard drawings, sidewalk standard drawings, and maintenance, repair & replacement guidelines.

ASU CAMPUS MASTER PLAN 2020

As part of the master plan’s guiding principles, the ‘Pedestrian Priority states: “The University shall develop an efficient and safe transportation network that encourages walking, biking, and the use of transit throughout the campus and town. Automobiles will be intercepted at the periphery of campus in structured parking, creating a pedestrian-oriented central campus accessed by pedestrian and bicycle-friendly streets and pathways as well as integrated, high-frequency transit service.” The plan’s design considerations for parking, multimodal access and circulation, and street design are as follows:

- Explore parking management strategies that reduce the ratio of cars per student living on campus, expand the Town of Boone bicycle network, promote ridesharing, and continue expansion of transit services.



2030 WATAUGA COUNTY COMPREHENSIVE TRANSPORTATION PLAN

Watauga County and the Towns of Beech Mountain, Blowing Rock, Boone, and Seven Devils, working in coordination with the High Country Council of Governments, and NCDOT’s Transportation Planning Branch, developed a Comprehensive Transportation Plan (CTP) for Watauga County. A steering committee comprised of planning staff and elected officials from the county and municipal governments along with representatives from ASU, AppalCART, the Blue Ridge Conservancy, Chamber of Commerce, and NCDOT developed the draft recommendations for the plan. The plan recommends bicycle facility improvements to several roads in or near the Town of Boone, which have been incorporated into this plan.

Above: The bicycle map for the Watauga County Comprehensive Transportation Plan.

WALK BOONE 2011: TOWN OF BOONE, NC PEDESTRIAN PLAN

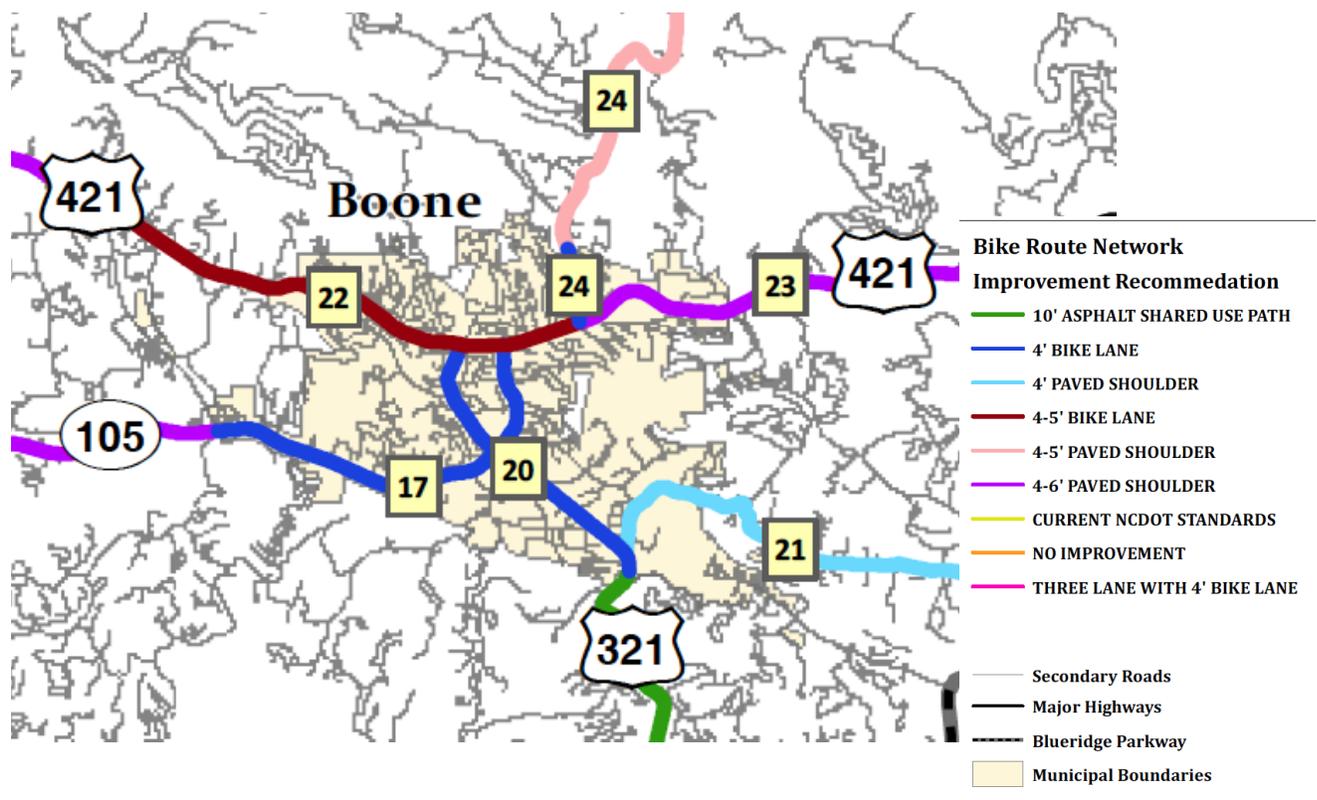
Serving as a guide in making Boone a walkable, pedestrian-friendly community, the 2011 Town of Boone Pedestrian Plan established a network of pedestrian facility recommendations along with complementary programs and policies. Included in the network of pedestrian facility recommendations are multi-use trails, which are relevant to this bicycle plan. This plan builds upon the recommendations made in *Walk Boone 2011* to develop an active transportation network that is safe and efficient for both bicyclists and pedestrians.



2013 REGIONAL BICYCLE PLAN, HIGH COUNTRY COUNCIL OF GOVERNMENTS

The High Country Council of Governments (HCCOG) was contracted by NCDOT to develop a Regional Bike Plan for the seven-county region, which includes Watauga County and the Town of Boone. The plan is intended to improve safety, access, and mobility for cyclists by designating logical routes that connect municipalities and other major destinations in the region. The plan identifies needed bicycle improvements to existing roadways and prioritizes improvement recommendations for the region. The Regional Bike Plan complements and builds off of existing municipal bicycle plans to create a connected regional bicycle network. The following is a list of key improvement recommendations that fall within the Boone Town Limits, which were taken into consideration during the development of network recommendations for the *Bike Boone 2013* plan:

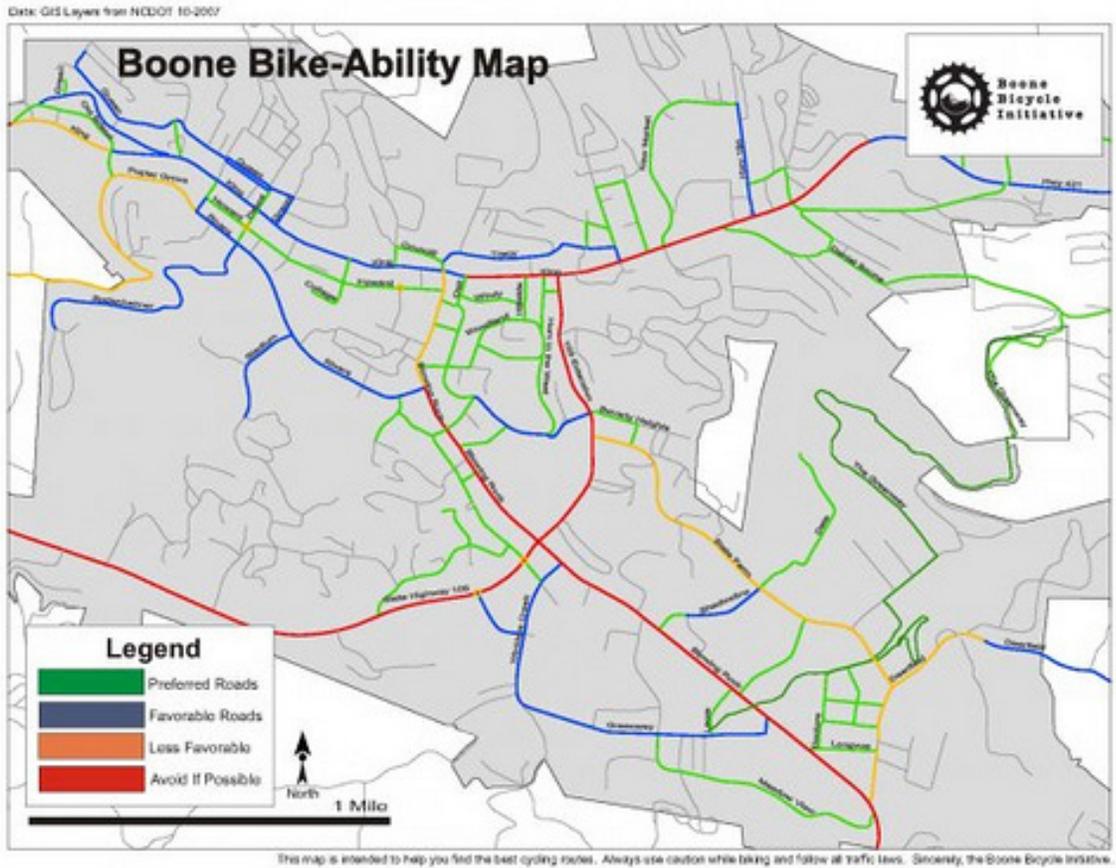
- 17: NC 105 from western town limits to US-421: 4 foot bike lane
- 20: US-321 from US-421 to southern town limits: 4 foot bike lane
- 21: Deerfield Road from US-321 to eastern town limits: 4 foot paved shoulder
- 22: US-421 from western town limits to NC 194: 4-5 foot bike lane
- 23: US-421 from NC 194 to eastern town limits: 4-6 foot paved shoulder
- 24: NC 194 from US-421 to northern town limits: 4 foot bike lane





BOONE BICYCLE INITIATIVE BIKE-ABILITY MAP

The Boone Bicycle Initiative (BBI) is a local community-based bicycle organization that seeks to increase bicycle ridership and safety. In 2009, BBI released the “Boone Bike-Ability Map”, which classified Boone roads based on the level of comfort that they provide to bicyclists. This map helped to identify challenges and opportunities for bicycling in Boone based on local cyclists’ perceptions of road conditions.





3 NETWORK RECOMMENDATIONS

Chapter Contents

- Overview (3-1)
- Methodology (3-2)
- Types of Cyclists (3-3)
- Bicycle Facility Types (3-4)
- The Bicycle Network: Short-Term (3-6)
- The Bicycle Network: Longer-Term (3-11)
- Project Prioritization Process (3-15)
- Priority Project Cut-sheets (3-15)

OVERVIEW

This chapter contains recommended changes to the Town of Boone's physical environment that will create a safe, accessible, and connected bicycle network. The network consists of existing and proposed on-road and off-road facilities such as bicycle lanes, signed routes, and greenways. Conceptually, the bicycle facility recommendations and the destinations they connect can be seen as a network of 'hubs and spokes'. Downtown Boone, shopping centers, parks, ASU, neighborhoods, schools, and other places where people bicycle to and from are the 'hubs', whereas bicycle lanes, trails, and other bicycle facilities are the 'spokes' that connect them (see below).

The following section covers the methodology for developing the bicycle network, describes the different types of bicyclists and different facility types that are necessary for a truly comprehensive network, and overall network maps showing short-term and long-term bicycle network recommendations.

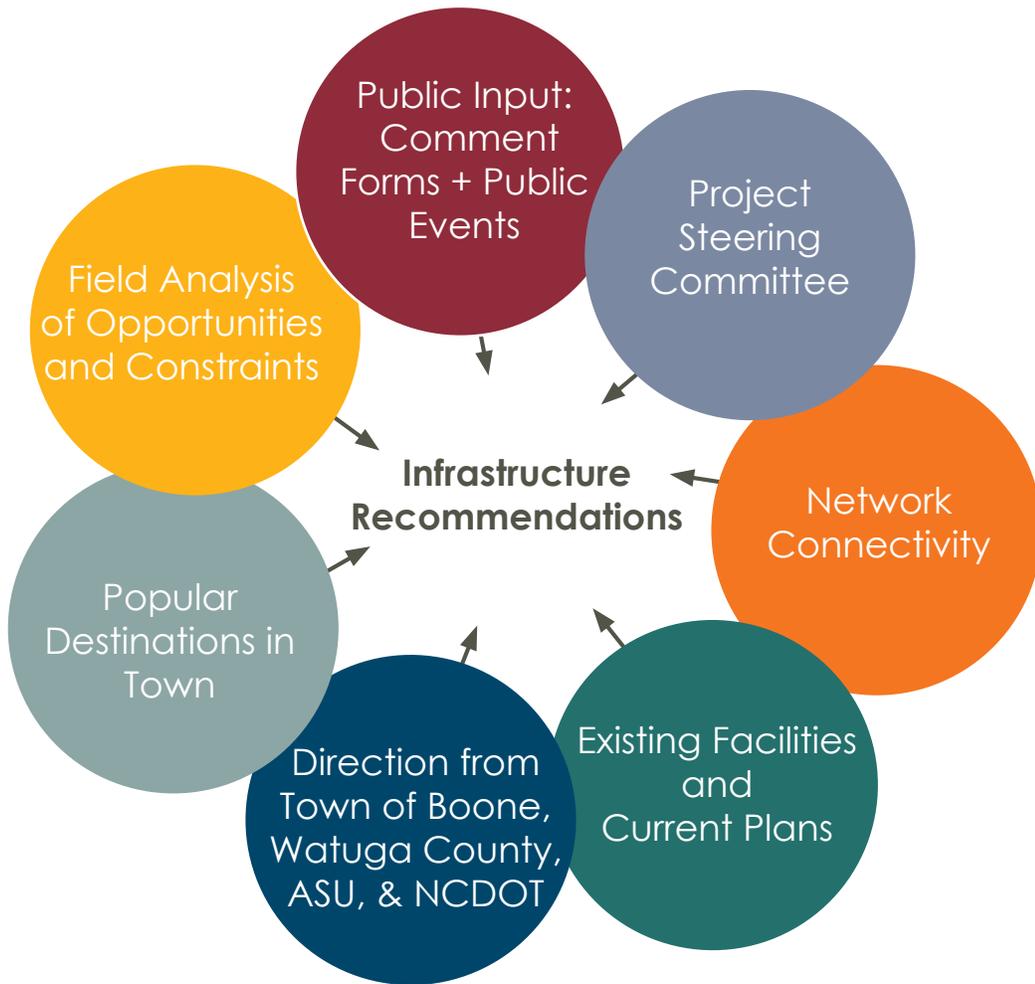


The 'hubs and spokes' model conceptually illustrates how destinations in Boone will be linked through various types of bicycle facilities.



METHODOLOGY FOR BICYCLE NETWORK DESIGN

The recommended bicycle network was developed based on information from several sources: input from the staff and Steering Committee, public input obtained through public comment forms and in-person workshops, previous plans and studies, review of existing bicycle facilities, noted bicycle destinations, and the consultant’s field analysis. Field work examined the potential and need for bicycle facilities along key roadway corridors and to make connections between key destinations in Boone, as well as consideration of trail and greenway opportunities. Input sources for the plan are summarized by the diagram below.



This diagram illustrates the inputs used to develop this plan’s recommendations.



TYPES OF CYCLISTS

Bicyclists can be categorized into four distinct groups based on comfort level and riding skills. Bicyclists' skill levels greatly influence expected speeds and behavior, both in separated bikeways and on shared roadways. Each of these groups has different bicycle facility needs, so it is important to consider how a bicycle network will accommodate each type of cyclist when creating a non-motorized plan or project. The bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people. In the US population, people are generally categorized into one of four cyclist types. The characteristics, attitudes, and infrastructure preferences of each type are described below.



“Strong and Fearless”

STRONG AND FEARLESS

(Approximately 1% of population)

This cyclist type is characterized by the bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes, and will typically choose roadway connections even if shared with vehicles over separate bicycle facilities such as multi-use paths.

ENTHUSED AND CONFIDENT

(5-10% of population)

This user group includes bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or multi-use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreational riders, racers, and utilitarian bicyclists.



“Enthusied and Confident”

INTERESTED BUT CONCERNED

(Approximately 60% of population)

This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or multi-use trails under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become “Enthusied & Confident” with encouragement, education, and experience.



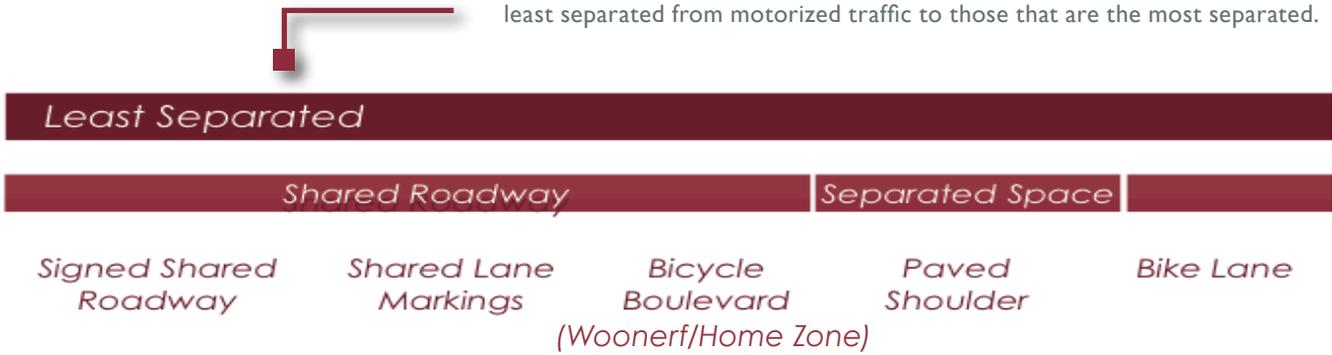
“Interested but Concerned”

NO WAY, NO HOW (NOT PICTURED HERE)

(Approximately 30% of population)

Persons in this category are not bicyclists and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will never ride a bicycle other than on rare occasions or under special circumstances (e.g., in a park, with a child).

This diagram illustrates the spectrum of bicycle facility types, from those that are least separated from motorized traffic to those that are the most separated.



BICYCLE FACILITY TYPES

The descriptions on this page offer a brief overview of the primary facility types recommended in this plan. For more information on facility design, please see Appendix A: Design Guidelines.

SHARED LANE MARKINGS (SHARROW)

Shared lane markings are pavement markings used to indicate shared space for bicyclists and motorists. Sharrows are used on roads where dedicated bicycle lanes are desirable but not possible due to constraints (roadway width, on-street parking, etc). Placed every 100 to 250 feet along a corridor, sharrows make motorists aware of the potential presence of cyclists, direct cyclists to ride in the proper direction, and remind cyclists to ride further from parked cars to avoid ‘dooring’ collisions.



Shared Lane Marking (Sharrow)

WOONERF/HOME ZONE

A street that uses traffic calming, low speed limits, and a shared space concept to give bicyclists and pedestrians priority, both legally and through the street’s design, is called a Woonerf or ‘home zone.’ The concept is similar to bicycle boulevards in the United States and was first developed and implemented in the Netherlands; the term “woonerf” is Dutch for “living street”. Rather than using signage to control and inform road user behavior, a woonerf or home zone is generally devoid of signage, and instead is negotiated through eye contact and human interaction between motorists, bicyclists, and pedestrians. A woonerf is ideal for neighborhood streets with low traffic volumes and for portions of commercial centers that wish to encourage a lively street life that is welcoming to and safe for pedestrians and bicyclists.



Woonerf/Home Zone
Wall Street, Asheville, NC
(image by Beth Meckley)

PAVED SHOULDERS

A paved shoulder is the part of a roadway that is contiguous to the travel lane, separated by a stripe. There is no minimum width for paved shoulders, although a width of at least four feet is preferred where possible. Paved shoulders are appropriate on rural roadways with low traffic volumes. Ideally, paved shoulders should be included in the construction of new roadways or the upgrade of existing roadways, especially where there is a need to safely accommodate bicycles.



Paved Shoulder



Buffered Bike Lane

Cycle Track: protected with parking

Cycle Track: curb separation or raised

Multi-Use Trail



Bicycle Lane

BIKEWAY LANES

Bicycle lanes are described as a portion of the roadway that has been designated by striping, signing, and pavement markings for the preferential and exclusive use of bicyclists. Bicycle lanes are always located on both sides of the road (except on one way streets), and carry bicyclists in the same direction as adjacent motor vehicle traffic. The minimum width for a bicycle lane is four feet; five- and six-foot bicycle lanes are typical for collector and arterial roads. As a general practice in the future, any local roadway that is widened or reconstructed with curb and gutter should incorporate bicycle lanes, with consideration for speed limit reductions. For additional design guidance on these methods, see the Appendix A: Design Guidelines section titled ‘Retrofitting Existing Streets to Add Bikeways.’



Buffered Bicycle Lane

BUFFERED BICYCLE LANE

Similar to regular bicycle lanes, buffered bicycle lanes have additional marked buffer space between the edge of the bicycle lanes and the automobile lanes. The purpose of a buffered bicycle lane is to increase the separation between motor vehicle traffic and bicyclists on high volume or high-speed roads, especially those with large-vehicle traffic, thereby improving bicyclist safety and comfort.

SHARED-USE TRAIL

A shared-use trail is a facility that is separated from the roadway designed for both bicycling and walking. Shared-use trails are the preferred facility for novice and average bicyclists. Shared-use trails located within the roadway corridor right-of-way, or adjacent to roads, are called ‘side paths.’ Those within or adjacent to railroad rights-of-way are called ‘Rail-Trails’, and shared-use trails within a greenspace corridor, utility corridor, or public use easement, are referred to as ‘greenway trails.’



Shared-Use Trail



THE BICYCLE NETWORK: SHORT-TERM

Map 3-1, titled “Short-Term Bicycle Network,” on page 3-9, shows the preliminary bicycle network recommendations for the Town of Boone. One facility type will not fit all roadways because of variations in roadway configurations and land use; thus a toolbox of facility types is used. The variety of bicycle facilities recommended in the short-term for Boone, account for the following conditions:

- 1) the range of skill and comfort levels involved in bicycling;
- 2) the range of existing conditions for bicycling in different landscapes and on different roadway environments.

The proposed short-term network facility recommendations include bicycle lanes, a bicycle lane transit bypass, paved shoulders, shared lane markings (sharrows), and a woonerf that together will make it possible for bicyclists to more safely and comfortably travel throughout town. The challenges of and opportunities for bicycling in Boone, as discussed in Chapter 2: Existing Conditions, were taken into account to draft recommendations that are tailored to Boone’s unique built and natural environment. The short-term recommended facility types and their role in the larger network for Boone are described below.

- **Bicycle lane (light blue lines):** Bicycle lanes are recommended on roads with moderate to heavy traffic that have sufficient corridor width for a separate bicycle facility. Hardin/US-321 from King/US-421 to Rivers Street is ideal for bicycle lanes, providing for more comfortable bicycle connections to schools, major commercial centers, parks, and neighborhoods. The NC 105 bicycle lanes will provide a cross-town connection to many shopping centers and residential areas. Extending the existing bicycle lanes on Rivers to South Water Street and north to King Street will provide a connection between ASU and downtown.
- **Bicycle Lane Transit Bypass (blue dashed lines):** The existing bicycle lanes, automobile travel lanes, and AppalCART transit stops on Rivers Street between Depot Street and Center Street create multiple conflict points between roadway users. This section of roadway should be the focus of a future detailed engineering study and solutions be developed through collaboration between the Town of Boone, ASU, and NCDOT. One potential solution to reduce conflict points between bicyclists and the AppalCART is to reconfigure the roadway corridor to reroute the bicycle lanes and effectively bypass the transit stop locations. Please refer to page A-21 of Appendix A, Design Guidelines for more information on the bicycle lane transit bypass.



Bicycle lanes on South Water Street will provide a key bicycle connection between Downtown Boone and the ASU Campus.



- **Bicycle climbing lane with downhill sharrows (blue and yellow dashed lines):** On narrow roads with steep terrain, low traffic volumes, and low automobile speeds, a bicycle climbing lane is recommended for the uphill side of the street, with sharrows on the downhill side where bicyclists will be able to more easily keep speed with traffic. These facilities will provide bicycle access to neighborhoods north of King Street, to downtown, to ASU, and to Optimist Park.
- **Paved shoulder climbing lane with downhill sharrows (red and yellow dashed lines):** Guidance obtained from NCDOT Division II engineers indicates that roads without curb and gutter should be treated as paved shoulders rather than marked bicycle lanes. On steep roads that lack curb and gutter and therefore do not meet guidance for bicycle lanes, a 4-foot paved shoulder climbing lane with downhill sharrows is recommended.
- **Paved shoulder (red lines):** Paved shoulders are recommended for regional connections or where the current roadway cannot accommodate bicycle lanes. A minimum of 4 feet is preferred for paved shoulders on roadways with speed limits below 45 MPH, but some roads will require a narrower shoulder until the road is widened or travel lanes are narrowed through resurfacing projects.
- **Shared lane facility/Sharrows (yellow lines):** Shared lane facilities are recommended in the short term on roadways that are currently too narrow to accommodate more separated facilities, or roads with low traffic volumes and speeds that do not required a separated facility. As the King Street bicycle lane approaches downtown from the east, the speed limit drops to 20 miles per hour, on-street parking begins, and pedestrian and bicycle traffic increases. All of these factors create a traffic calming effect that allows a shared lane facility to be an adequate facility recommendation for King Street downtown.
- **Signed Bike Route (orange lines):** Signed bike routes are recommended on low-volume roads that serve as connections to bicycle facilities and key destinations. While no pavement markings are recommended along these segments, bike route signage and wayfinding signage will help bicyclists navigate through Boone. These routes will be particularly important for those bicyclists who value comfort over travel time and are seeking low-volume route options throughout town. Signed bike routes on Stadium Drive provide a link into the ASU campus. Signed routes north of King Street link other recommended facilities and provide a guide for accessing the downtown from the northern neighborhoods. Neighborhoods directly west of Watauga High School could be better connected with signed routes linking to the high school and the Greenway Trail, as well as from the existing bicycle lanes on King Street to the proposed facility on Beverly Heights Avenue.
- **Woonerf (purple lines):** Upgrade Howard Street to a woonerf/home zone. A woonerf, or “living street” (see page 3-4), will give bicyclists and pedestrians priority on the roadway while also permitting low-speed motor vehicle traffic. The Town of Boone is currently conducting traffic studies along Howard Street and the surrounding area to determine the feasibility of implementing a Woonerf and traffic calming measures in downtown Boone.



The proposed woonerf for Howard Street would provide a high level of comfort for pedestrians and bicyclists and create a lively streetscape.



SHORT-TERM NETWORK MAP:
11X17



SHORT-TERM NETWORK MAP:
11X17 BACKSIDE



THE BICYCLE NETWORK: LONGER-TERM

Many of the projects recommended in the preliminary bicycle network above could be improved upon with greater investment. As Boone continues to grow, roads will be widened and development density will increase. These are ideal opportunities to ensure that safe and adequate bicycle facilities are included in the re-design of current roadways and in all future development. These recommendations include and build upon recommendations from previous plans, including the Watauga County Transportation Plan and the Boone 2030 Land Use Plan, which propose significant changes to some roads in Boone. Town staff should work closely with NCDOT on these longer-term recommendations to ensure that they are incorporated into the early planning, design, and programming of road improvement projects.

- **Shared-use Trail:** Shared-use trails are recommended along roads with high traffic volume and/or speed, including portions of US-321, NC 105, US-421, and Deerfield Road. These facilities are also recommended for connecting residential areas to parks (Horn in the West, Deerfield, US-421) and to schools (Brookshire). Shared-use trails can be constructed by the Town of Boone, or through updates to local development policies that require shared-use trail construction with new development or redevelopment.
- **Buffered Bicycle Lane:** As road improvements are designed for NC 105, upgrade the short-term bicycle lanes between the NC 105 “Extension” which runs from King/US-421 to Blowing Rock Rd/US-321 to buffered bicycle lanes for increased bicyclist safety and comfort along this busy corridor.
- **Bicycle Lane:** As road widening projects are planned with curb and gutter, upgrade paved shoulders, climbing lanes, and sharrows to bicycle lanes. Upgraded bicycle lanes are recommended on Jefferson/NC 194 and sections of King Street, as well as downtown corridors, streets within or adjacent to ASU campus, and other connecting roadways such as Winklers Creek Road and Greenway Road.
- **Paved Shoulder:** Upgrade sharrows on Poplar Grove and climbing lanes throughout town to two-way paved shoulder to improve the separation between bicyclists and motor vehicle traffic. Construct paved shoulders on King/US-421 from where the proposed shared-use trail ends at Rocky Knob Park east to the town limits, providing an improved regional connection out of Boone.
- **Shared lane facility/Sharrows (yellow lines):** Add shared lane markings to Poplar Hill Drive and Highland Avenue to make motorists aware that bicyclists may use the full lane, and to make bicyclists aware that these are good connecting routes to Faculty Street and US-321, as well as to Stadium Drive into ASU.



TABLE 3.1 BICYCLE NETWORK SUMMARY TABLE

Existing Facility Type	Length (Miles)
Bicycle Lanes	~2.15 miles
Multi-Use Trails/Greenway Paths	~6.51 miles
Proposed Facility Type (short-term recommendations)	Length (Miles)
Bicycle Lanes	2.89
Uphill Bicycle Climbing Lane with Downhill Shared-lane Facilities “Sharrows”	2.53
Uphill Paved Shoulder with Downhill Shared-lane Facilities “Sharrows”	0.72
Paved Shoulders	9.73
Shared-lane Markings “Sharrows”	8.71
Woonerf/Home Zone	0.55
Signed Bicycle Route	6.39
Proposed Facility Type (longer-term recommendations)	Length (Miles)
Uphill Bicycle Climbing Lane with Downhill Shared-lane Facilities “Sharrows”	0.63
Bicycle Lanes	7.19
Buffered Bicycle Lanes	0.81
Paved Shoulders	4.76
Shared-lane Facilities “Sharrows”	3.52
Shared-Use Trail	9.26



LONG-TERM NETWORK MAP:
11X17



LONG-TERM NETWORK MAP:
11X17 BACKSIDE



PROJECT PRIORITIZATION PROCESS

The project prioritization process began with making a list of all of the bicycle network recommendations proposed in this Plan. The segments were broken down at logical points, such as at major crossings and at connections to existing facilities. Criteria (shown in Table 3.2 below) were then used to rank each segment. These criteria were custom designed for Boone, based on public input, committee input, and available GIS data.

TABLE 3.2 PROJECT PRIORITIZATION CRITERIA

Prioritization Criteria
Top Recommendation from 2013 Public Comment Form
Town of Boone 2013 Greenway Priority List
Watauga County CTP Priority Project
High County Council of Governments Regional Bike Plan Priority Project
Boone 2030 Land Use Plan Priority Project
Bicycle Crash Location
Connection to a School or Library
Connection to Appalachian State University
Serves Downtown Boone
Connection to a Park
Connection to an Existing Trail or Facility (at least one end is connected)
Regional / Longer Connectivity to other facilities and/or communities
Connection to Commercial Centers, Retail Centers, Medical Centers
Connection to Multi-Family/High-Density Residential Areas
Connection to AppalCART Stop(s)
Repaving Schedules

PRIORITY PROJECT CUT-SHEETS

The cut-sheets on the following pages illustrate and describe the priority bicycle projects recommended in this plan. These project cut-sheets provide a planning-level of analysis only. Actual development of facilities may differ according to specific site conditions, project funding, and factors unforeseen at the time this plan was developed. These cut-sheets can be used to communicate the individual projects to stakeholders involved in implementation, such as local staff and officials, NCDOT staff, potential funding agencies, and interested citizens.

PLANNING-LEVEL COST ESTIMATES

Each project cut-sheet offers a planning level cost estimate for the priority project. The cost estimates are based on the most recently available per unit cost information obtained from NCDOT District II Engineering staff. Project costs vary over time and by geography. Further evaluation during project design will be needed to determine exact project costs. A summary table (Table 3.4) of cost estimates for the top priority projects is included at the end of this chapter.



1

Hardin Street/US-321 Bicycle Lanes

From: King Street/US-421

To: Rivers Street

Distance: ~700 feet (0.13 miles)

Speed Limit: 35 mph

Prioritization score: 14 out of 15 points

Reasons for priority ranking:

- #1 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- High motor vehicle volume necessitates a separate facility for bicyclists
- Serves Downtown Boone, ASU, Durham Park, Boone Park, and many shops and restaurants along the corridor
- Connects to existing bicycle lane on Hardin Street/US-321 from Rivers to NC 105, and to recommended bicycle facilities on King Street, Rivers Street, and NC 105

- Serves multiple AppalCART stops
- Multiple bicycle crashes reported
- Connects to existing bicycle lanes on Hardin Street/US-321
- Identified as a priority in the Boone 2030 Land Use Plan, the Watauga County CTP, and the High Country COG Bike Plan

Short-term Recommendation

Provide 4-foot bicycle lanes on both sides of the street to separate bicyclists from high volume and high speed auto traffic. Intersection treatments should include clear pavement markings and signage to guide bicyclists safely along the corridor and to alert right-turning drivers of bicycle traffic. Investigate access management opportunities to minimize driveways.

Long-term Recommendation

Extend bicycle lanes southeast past NC 105 and implement access management strategies to minimize the number of bicycle/motor vehicle conflict points (see priority recommendations #7 and #10).



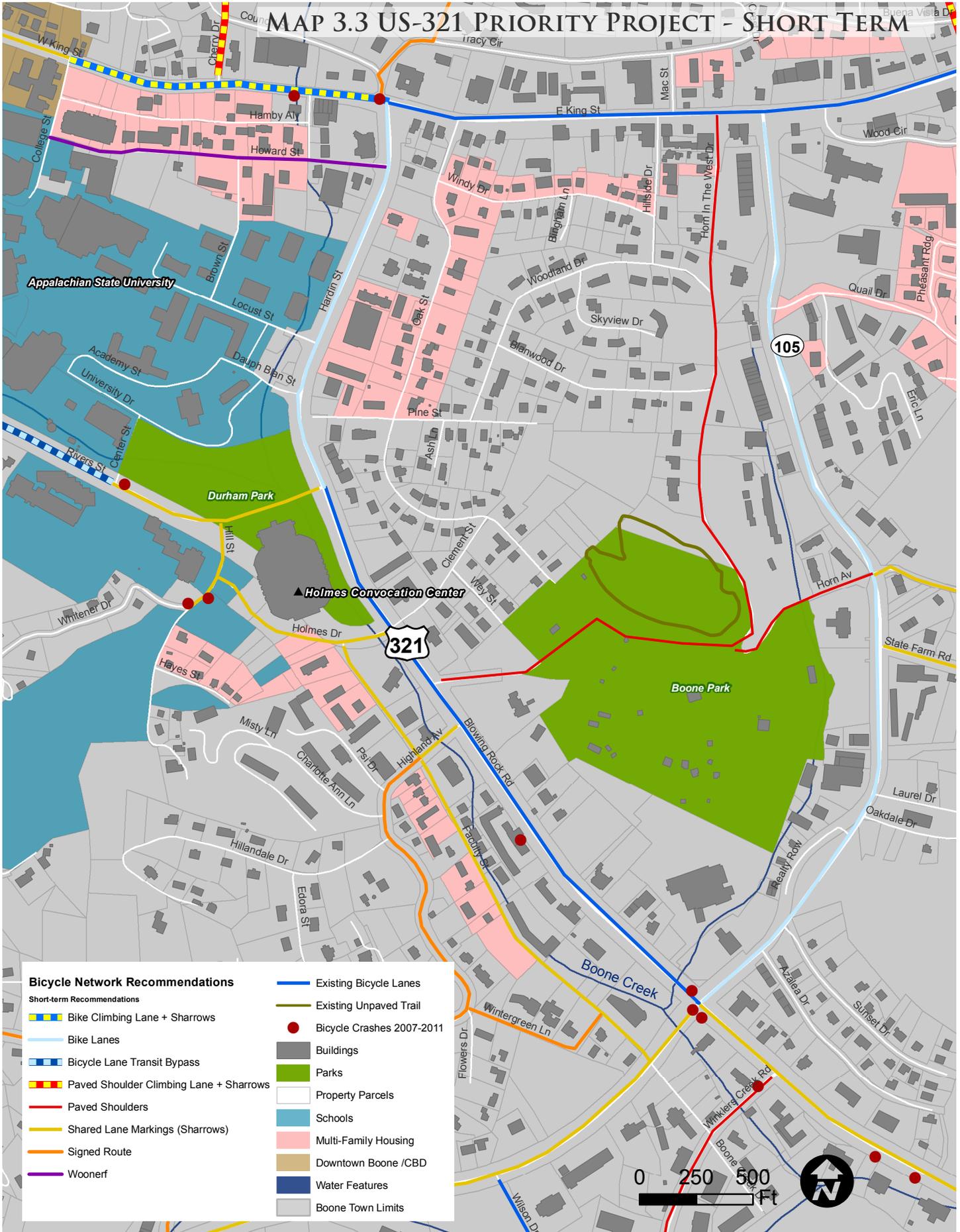
Left: Existing roadway conditions on US-321.

Below: Proposed roadway conditions with bicycle lanes.





MAP 3.3 US-321 PRIORITY PROJECT - SHORT TERM



Bicycle Network Recommendations	
Short-term Recommendations	
	Bike Climbing Lane + Sharrows
	Bike Lanes
	Bicycle Lane Transit Bypass
	Paved Shoulder Climbing Lane + Sharrows
	Paved Shoulders
	Shared Lane Markings (Sharrows)
	Signed Route
	Woonerf
	Existing Bicycle Lanes
	Existing Unpaved Trail
	Bicycle Crashes 2007-2011
	Buildings
	Parks
	Property Parcels
	Schools
	Multi-Family Housing
	Downtown Boone / CBD
	Water Features
	Boone Town Limits



2

King Street/US-421 Climbing Lane and Shared Lane

From: Hardin Street / US-321

To: College Street

Distance: 1,432 feet (0.27 miles)

Speed Limit: 25 mph

Prioritization score: 13 out of 15 points

Reasons for priority ranking:

- #3 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Connects to the existing bicycle lanes on King Street to Downtown Boone and to recommended shared lanes on King
- Connects bicyclists to ASU and downtown shops and restaurants
- Multiple bicycle crashes reported
- Provides a separate facility for bicyclists traveling uphill at slower speeds than automobile traffic

- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide a climbing lane for westbound cyclists on King to provide for safer, more comfortable bicycle travel uphill towards downtown. Include dashed transition markings before the left turn stall begins at the College Street intersection, with signage to indicate that the bicycle lane ends, so that bicyclists can safely merge with motorized traffic at the intersection. Provide shared lane markings (sharrows) on the eastbound side to inform bicyclists and drivers that bicyclists may use the full lane. The downhill slope of this section will make it easier for bicyclists to keep pace with motor vehicle traffic, which makes sharrows a sufficient recommendation in the short-term. Provide “Bicyclists May Use Full Lane” signage and bicycle route signage.

Long-term Recommendation

With road widening, upgrade to 5-foot bicycle lanes on both sides of the street.



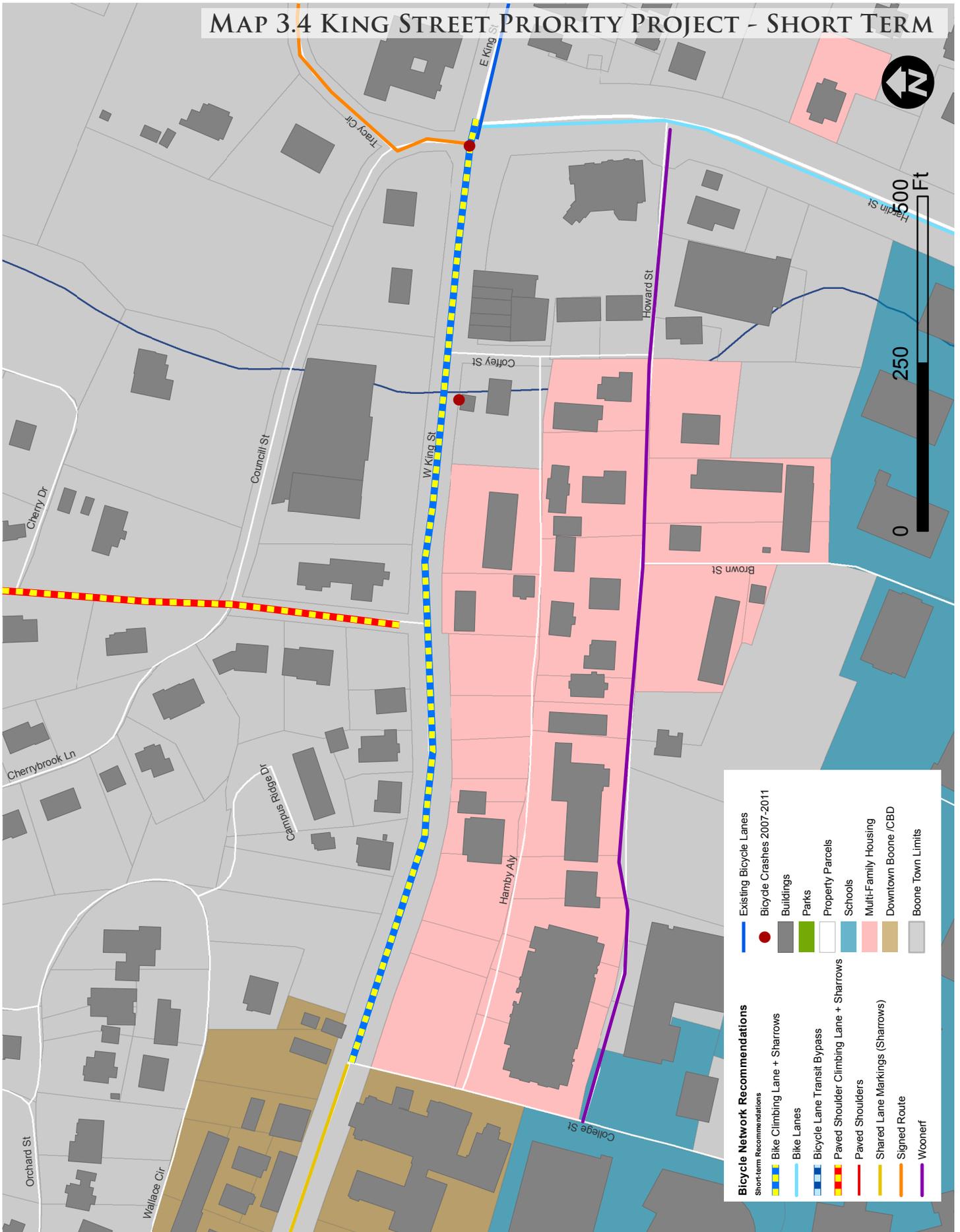
Left: Existing roadway conditions along King Street / US-421.



Below: Proposed roadway conditions with a climbing lane westbound uphill and sharrows eastbound downhill.



MAP 3.4 KING STREET PRIORITY PROJECT - SHORT TERM



	Existing Bicycle Lanes
	Bicycle Crashes 2007-2011
	Buildings
	Parks
	Property Parcels
	Schools
	Multi-Family Housing
	Downtown Boone / CBD
	Boone Town Limits
Bicycle Network Recommendations	
Short-term Recommendations	
	Bike Climbing Lane + Sharrow
	Bike Lanes
	Bicycle Lane Transit Bypass
	Paved Shoulder Climbing Lane + Sharrow
	Paved Shoulders
	Shared Lane Markings (Sharrow)
	Signed Route
	Woonerf



3

US-421 Bicycle Lanes

From: Jefferson Road/NC-194

To: Rocky Knob Mountain Bike Park

Distance: 7,307 feet (1.38 miles)

Speed Limit: 45 mph; 55 mph where divided highway begins east of Old US-421 S

Prioritization score: 12 out of 15 points

Reasons for priority ranking:

- #3 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Extends the existing bicycle lanes on US-421 eastward to Rocky Knob Park and near Brookshire Park
- Segment scheduled for repaving in 2014
- Connects to proposed sharrows on Old East King Street and Watauga High School

- Links east neighborhoods to downtown
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Narrow the existing travel lanes and extend the existing bicycle lanes on US-421 eastward to Rocky Knob Mountain Bike Park. Intersection treatments should include pavement markings and signage that help to safely guide bicyclists along the corridor and make right-turning drivers aware of bicyclists' presence.

Long-term Recommendation

From Jefferson Road/NC 194 to Rocky Knob Park, construct a 10-foot shared-use trail along US-421 to connect to the recommended extension of the South Fork New River Greenway to Brookshire Park, and to the recommended shared-use trail along Jefferson Road to Hardin Park School.

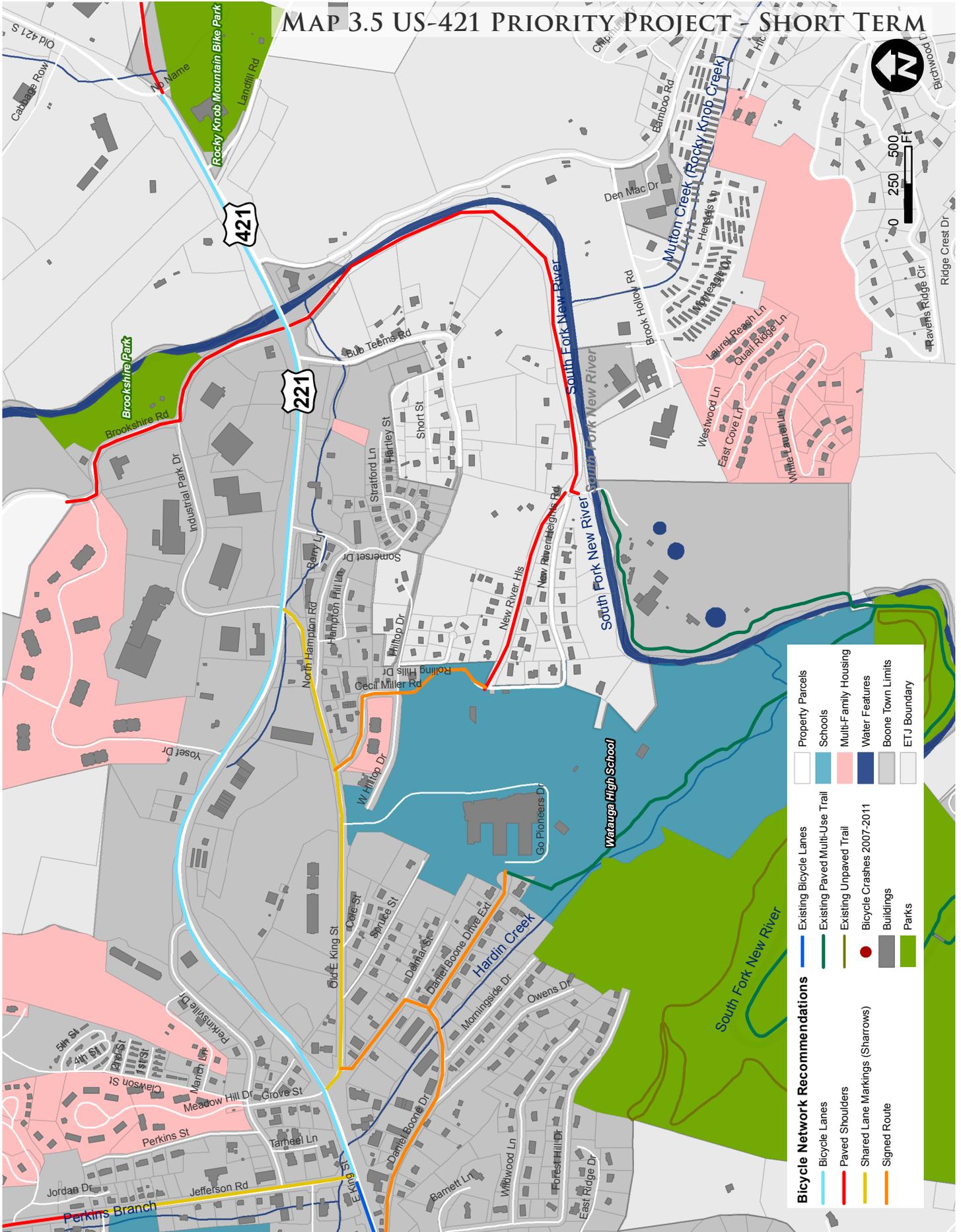


Above: The Rocky Knob Mountain Bike Park provides an attractive bicycling destination along US-421.

Left: Narrowing travel lanes, or adding additional corridor width during the next resurfacing project on US-421 would provide room for bicycle lanes.



MAP 3.5 US-421 PRIORITY PROJECT - SHORT TERM



Bicycle Network Recommendations		Property Parcels	
	Existing Bicycle Lanes		Property Parcels
	Bicycle Lanes		Schools
	Paved Shoulders		Multi-Family Housing
	Shared Lane Markings (Sharrows)		Water Features
	Signed Route		Boone Town Limits
	Existing Paved Multi-Use Trail		ETJ Boundary
	Existing Unpaved Trail		Bicycle Crashes 2007-2011
	Bicycle Crashes 2007-2011		Buildings
	Buildings		Parks
	Parks		



4

King Street Shared Lanes/ Sharrows

From: Green Street

To: College Street

Distance: 3,075 feet (0.58 miles)

Speed Limit: 20 mph

Prioritization score: 12 out of 15 points

Reasons for priority ranking:

- #3 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Provides bicycle access to shops and restaurants within Downtown Boone
- Connects to climbing lanes north of King Street to access nearby neighborhoods, parks, and the library
- Connects to recommended bicycle facilities south to ASU campus and west to paved shoulders on US-421 leading out of Boone
- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide a shared lane facility with pavement markings (sharrows) and signage along the downtown portion of King Street from Green Street to College Street. At signalized intersections, provide intersection markings and a bicycle box behind the stop bar to make bicyclists aware that they should wait in the travel lane, not off to the side, at stop lights. Post “Bicycles May Use Full Lane” signage along the corridor. (See Appendix A: Design Guidelines.)

Parking on both sides of King Street limits space for a separated bicycle facility, and shared lane markings make both bicyclists and drivers aware that bicycles may use the full travel lane. Sharrows will also direct bicyclists to safely ride outside of the “door zone” of parked cars.

Long-term Recommendation

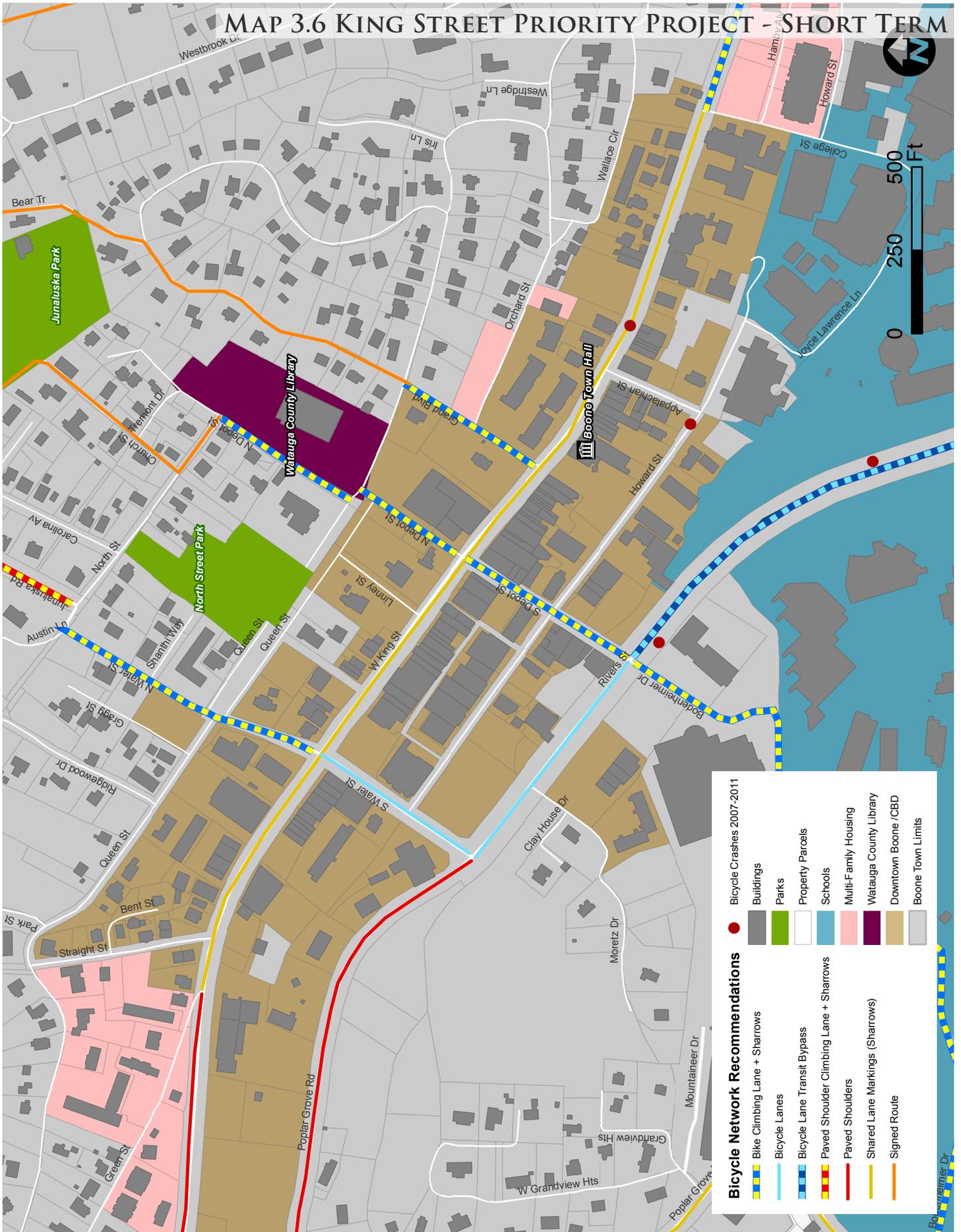
None.



Above & Left: King Street, downtown Boone.



MAP 3.6 KING STREET PRIORITY PROJECT - SHORT TERM



5

US-421 Paved Shoulders

From: Western ETJ limits

To: Green Street

Distance: 6,176 feet (1.17 miles)

Speed Limit: 20 mph

Prioritization score: 11 out of 15 points

Reasons for priority ranking:

- Connects to recommended King Street sharrows and Downtown Boone shops and restaurants
- Connects several major apartment complexes and businesses to town
- Serves multiple AppalCART stops
- Provides a regional bicycle connection westward out of Boone

- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Stripe paved shoulders on US-421 from Green Street westward to the ETJ boundary. 4-foot paved shoulders are recommended on both sides where possible. In areas where corridor constraints do not allow for 4 feet, provide as wide of a shoulder as possible until the shoulder can be extended. Provide bicycle route signage along the corridor.

Long-term Recommendation

With road widening and curb and gutter construction, upgrade paved shoulders to 5-foot bicycle lanes.

US-421 looking east towards Downtown Boone.

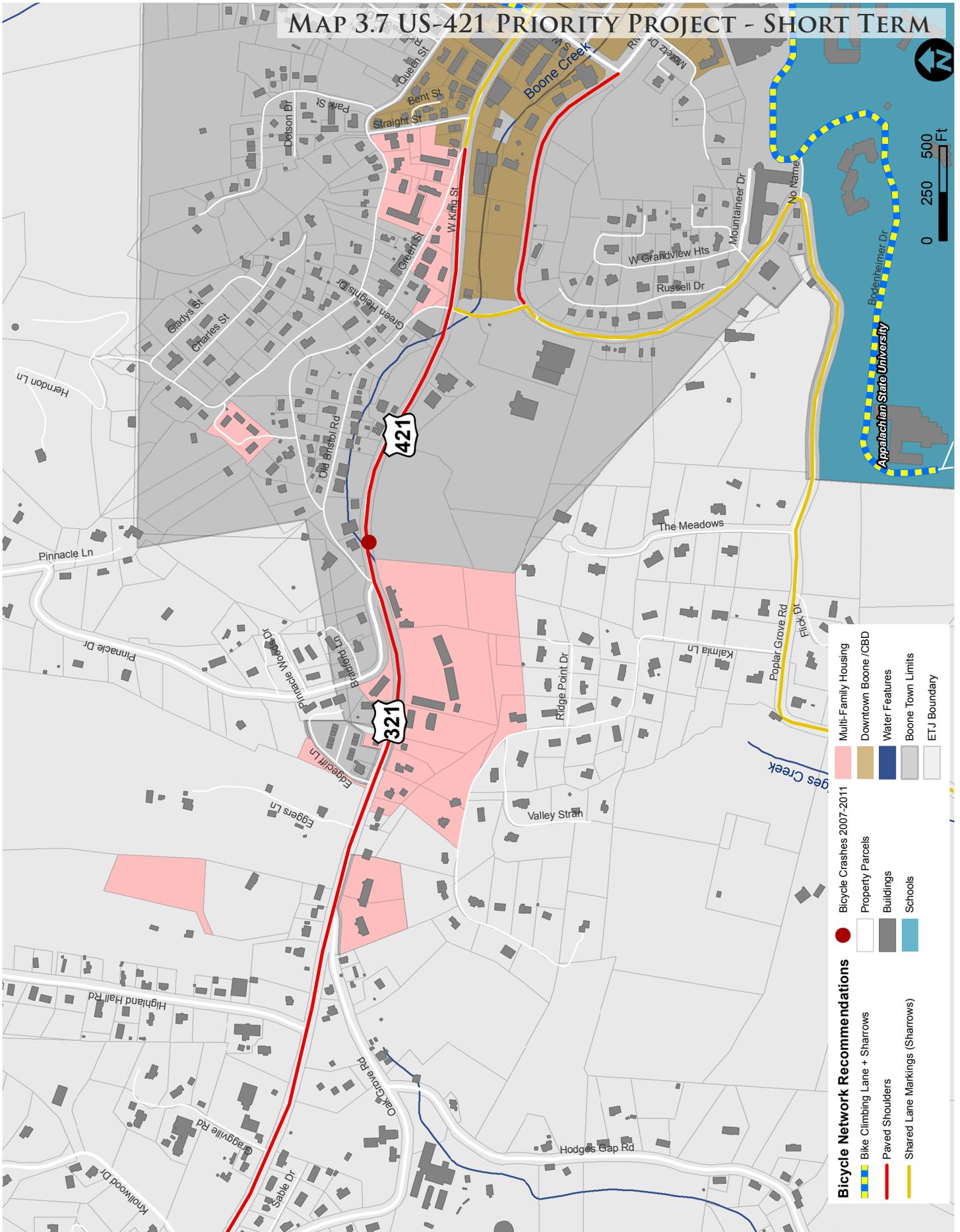


US-421 looking west out of town, with limited shoulder shown on the westbound side of the corridor.





MAP 3.7 US-421 PRIORITY PROJECT - SHORT TERM



Bicycle Network Recommendations

- Bike Climbing Lane + Sharrows
- Paved Shoulders
- Shared Lane Markings (Sharrows)

Bicycle Crashes 2007-2011

- Bicycle Crashes 2007-2011

Property Parcels

- Property Parcels
- Buildings
- Schools

Multi-Family Housing

- Multi-Family Housing

Downtown Boone / CBD

- Downtown Boone / CBD

Water Features

- Water Features

Boone Town Limits

- Boone Town Limits

ETJ Boundary

- ETJ Boundary





6

US-321 Shared Lanes/Sharrows

From: NC 105

To: Boone Heights Drive

Distance: 3,705 feet (0.70 miles)

Speed Limit: 35 mph

Prioritization score: 11 out of 15 points

Reasons for priority ranking:

- #1 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Provides access to apartment complexes along US-321 as well as Boone Mall, Shops at Shadowline, Watauga Village Shopping Center, and several other businesses and restaurants
- Connects to the Greenway Trail
- Multiple bicycle crashes reported
- High motor vehicle volume necessitates a designated facility for bicyclists

- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide a shared lane facility with pavement markings and signage along US-321 from NC 105 to Boone Heights Drive. At signalized intersections, provide clear pavement markings and a bicycle box behind the stop bar to make bicyclists aware that they should wait in the travel lane, not off to the side, at stop lights. Use signage to guide bicyclists safely along the corridor and to alert turning drivers of bicycle traffic. Investigate access management opportunities to minimize driveways.

Long-term Recommendation

The recommended UDO policy revisions, covered in Appendix C, call for driveway access management and the improvement of existing 5-foot sidewalks to 10-foot sidepath with redevelopment. As access management strategies are implemented to reduce the number of driveways and conflict points between bicycles and motor vehicles, upgrade the shared lane facilities to bicycle lanes along the corridor.

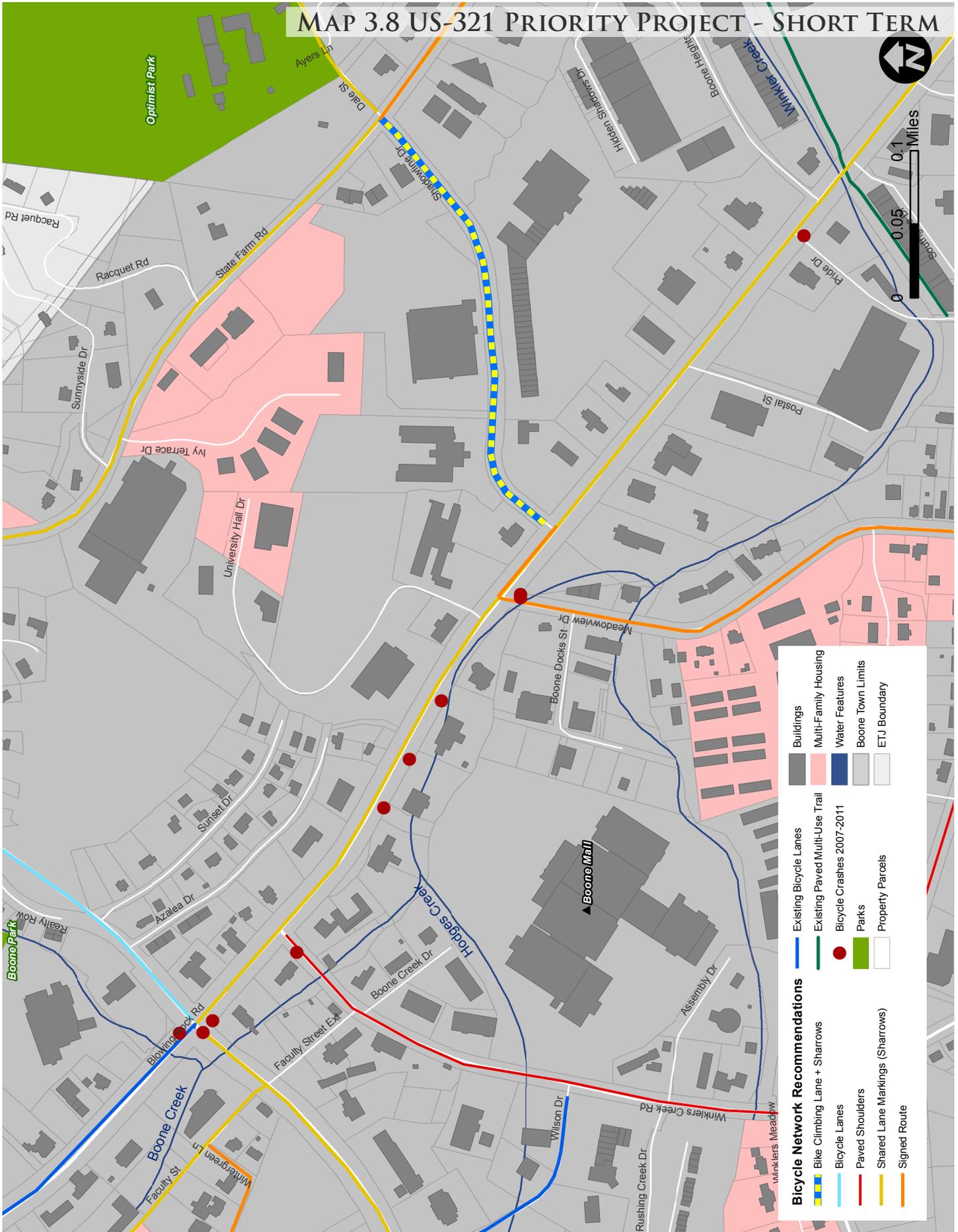


US-321, Boone, NC.





MAP 3.8 US-321 PRIORITY PROJECT - SHORT TERM





7

NC 105 Bicycle Lanes

From: King Street / US-421

To: Blowing Rock Road / US-321

Distance: 4,253 feet (0.81 miles)

Speed Limit: 35 mph

Prioritization score: 10 out of 15 points

Reasons for priority ranking:

- #2 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Connects to existing bicycle lanes on US-421 and US-321
- Connects to recommended paved shoulders on Horn Avenue and shared lanes on US-321, NC 105, State Farm Road, and Beverly Heights Avenue
- Improves access to Boone Park, surrounding neighborhoods, and businesses along the corridor

- Multiple crashes reported at the intersection of NC 105 and US-321
- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Narrow the existing travel lanes and stripe 4-foot bicycle lanes along the NC 105 “Extension” from King Street/US-421 to Blowing Rock Road/US-321. Investigate access management opportunities to minimize driveways. Provide pavement markings, signage, and spot medians at major intersections to help bicyclists safely navigate the corridor and alert right-turning drivers of bicyclists’ presence.

Long-term Recommendation

Upgrade bicycle lanes along NC 105 to buffered bicycle lanes, with 4-foot bicycle lanes and 2-foot striped buffers.

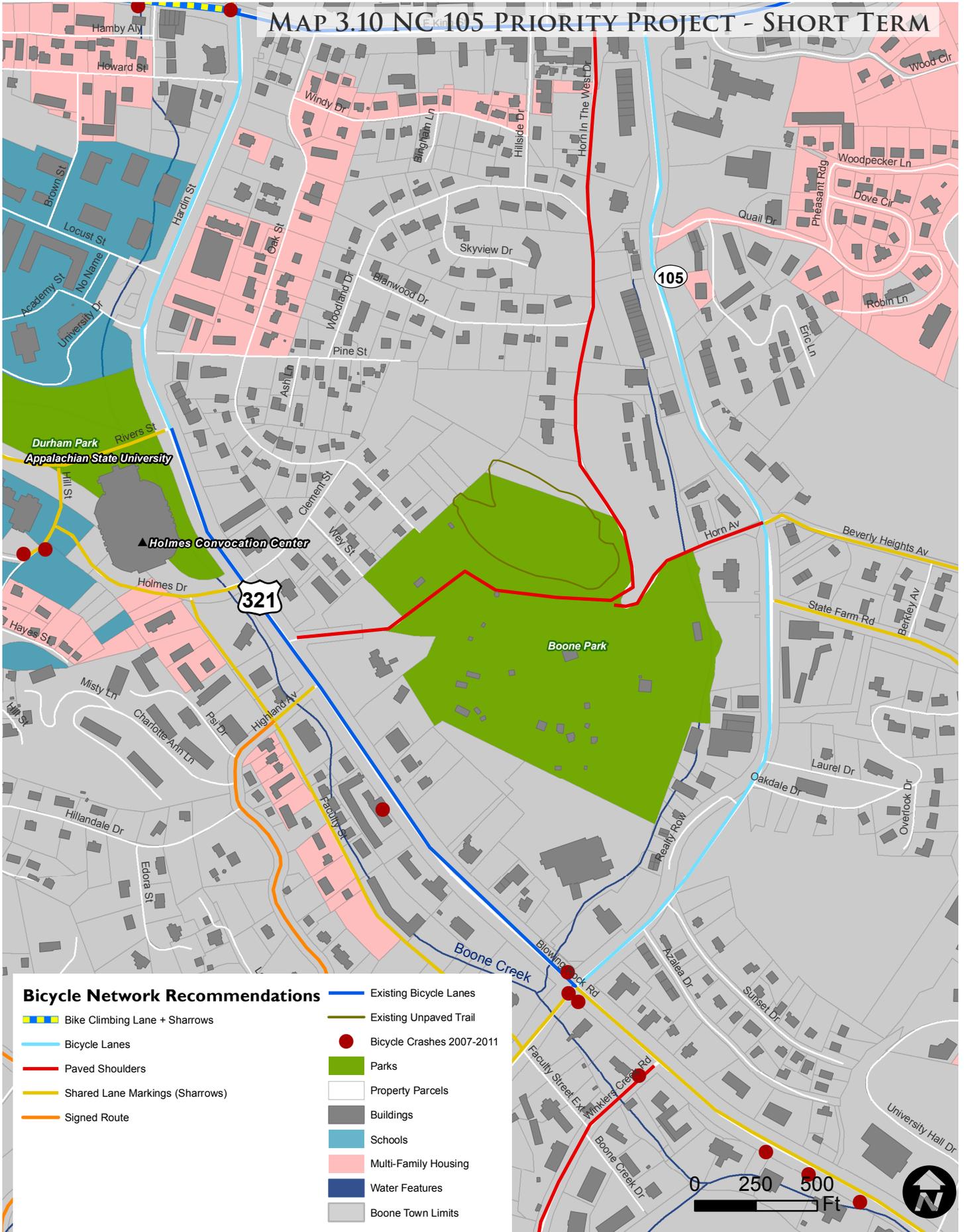


Above: Existing conditions on NC 105 near US-421, facing south.

Right: Narrowing the travel lanes on NC 105 would provide room for the addition of bicycle lanes to connect from bicycle lanes on US-421 to bicycle lanes on US-321.



MAP 3.10 NC 105 PRIORITY PROJECT - SHORT TERM





8

Rivers Street Shared Lanes/ Sharrows

From: Center Street

To: Blowing Rock Road / US-321

Distance: 932 feet (0.18 miles)

Speed Limit: 25 mph

Prioritization score: 10 out of 15 points

Reasons for priority ranking:

- Links the recommended retrofit of existing bicycle lanes on Rivers Street to buffered bicycle lanes on US-321
- Serves multiple AppalCART stops
- Improves bicyclist access to ASU, Durham Park

Right: Existing conditions on Rivers Street east of Center Street.

Below: Proposed shared lane facility on Rivers Street. Continuing bicycle facilities on Rivers Street east of Center Street would provide bicycle access to the Holmes Convention Center (shown here) and to existing bicycle lanes on US-321.

- Multiple bicycle crashes reported
- Identified for improvements in the Watauga County CTP and High Country COG Bike Plan

Short-term Recommendation

Provide shared lanes with pavement markings and signage on Rivers Street from Center Street to US-321/Blowing Rock Road. The landscaped median along this segment constrains the roadway and leaves insufficient space for a separated bicycle facility in the short-term, and shared lanes will inform both bicyclists and drivers that bicyclists may use the full travel lane. Provide “Bicyclists May Use Full Lane” signage along the segment.

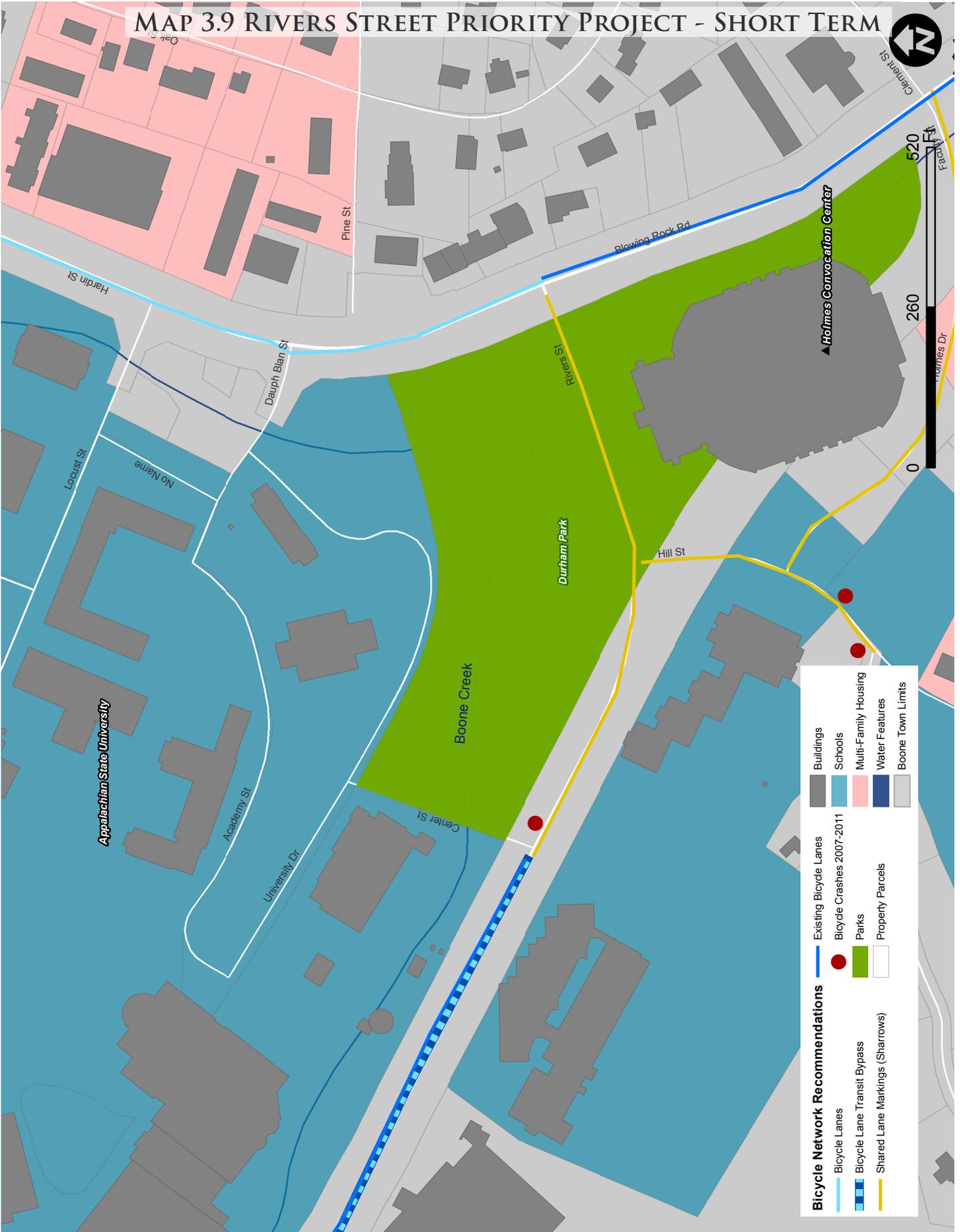
Long-term Recommendation

If a road diet is pursued along this segment, upgrade the shared lanes to 4-foot bicycle lanes.





MAP 3.9 RIVERS STREET PRIORITY PROJECT - SHORT TERM





9

US-321 Shared Lanes/Sharrows

From: Boone Heights Drive

To: Deerfield Road

Distance: 2,467 feet (0.47 miles)

Speed Limit: 35 mph

Prioritization score: 10 out of 15 points

Reasons for priority ranking:

- #1 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Connects to the Greenway Trail, Optimist Park, and multiple major commercial centers, including Boone Heights, Southgate, and Watauga Village Shopping Centers
- Connects to recommended paved shoulders on Deerfield Road and Watauga Medical Center
- High motor vehicle volume necessitates a designated facility for bicyclists
- Serves multiple AppalCART stops

Below: US-321 shared outside lanes would provide improved bicycle access to homes and destinations along the corridor.

- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide a shared lane facility with pavement markings and signage along US-321 from Boone Heights Drive to Deerfield Road. At signalized intersections, provide clear pavement markings and a bicycle box behind the stop bar to make bicyclists aware that they should wait in the travel lane, not off to the side, at stop lights. Use signage to guide bicyclists safely along the corridor and to alert turning drivers of bicycle traffic.

This facility will provide bicyclists with directional guidance to access commercial destinations and provide a key link to the hospital. Investigate access management opportunities to minimize driveways.

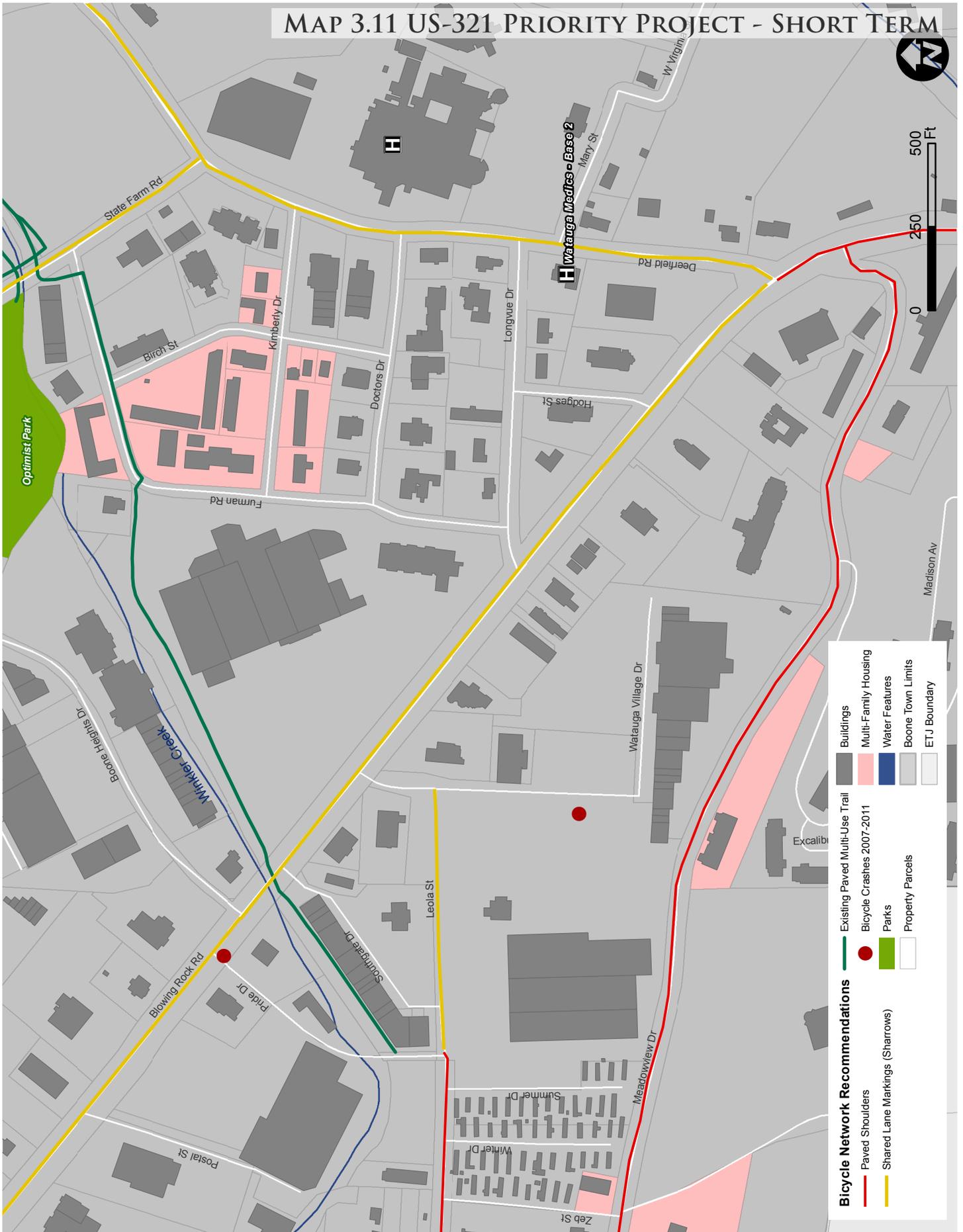
Long-term Recommendation

The recommended UDO policy revisions, covered in Appendix C, call for driveway access management and the improvement of existing 5-foot sidewalk to 10-foot sidepath with redevelopment. As access management strategies are implemented to reduce the number of driveways and conflict points between bicycles and motor vehicles, upgrade the shared lane facilities to bicycle lanes along the corridor.





MAP 3.11 US-321 PRIORITY PROJECT - SHORT TERM





10

NC 105 Shared Lanes/Sharrows

From: Poplar Hill Drive

To: Blowing Rock Road / US-321

Distance: 5,194 feet (0.98 miles)

Speed Limit: 35 mph

Prioritization score: 10 out of 15 points

Reasons for priority ranking:

- #2 recommended roadway for bicycle improvements from the *Bike Boone 2013* Public Comment Form
- Connects west neighborhoods to central destinations, including Boone Park, Boone Mall, and businesses along US-321
- Multiple bicycle crashes reported at NC 105/US-321 intersection
- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Include a shared lane facility with pavement markings and signage on the outside lanes of NC 105 to connect to recommended bicycle lanes on US-321 and recommended paved shoulder on NC 105 west of Poplar Hill Drive. At signalized intersections, provide clear pavement markings and a bicycle box behind the stop bar to make bicyclists aware that they should wait in the travel lane, not off to the side, at stop lights. Use signage to guide bicyclists safely along the corridor and to alert turning drivers of bicycle traffic. Reduce the speed limit along this segment from 35 mph to 30 mph.

Long-term Recommendation

Upgrade NC 105 shared lanes to a paved shared-use trail from US-321 to Poplar Grove Road. Existing sidewalk along NC 105 should be widened to provide a shared use path. Areas along corridor with no sidewalk should construct new shared-use trail. A 10-foot wide path is recommended, though can be narrower in sections of the corridor that are constrained by topography or right-of-way.



Left: Existing roadway conditions on NC 105, with two lanes in each direction and a center turn lane.

Below: Proposed roadway conditions with sharrows in the outside lane and a speed limit reduction to 30 mph.



11

Greenway Road Paved Shoulders

From: Winklers Creek Road

To: Pride Drive

Distance: 2,823 feet (0.53 miles)

Speed Limit: 25 mph

Prioritization score: 8 out of 15 points

Reasons for priority ranking:

- Provides bicycle access to several apartment complexes, restaurants, and businesses
- Connects to multiple major commercial centers: Southgate Shopping Center, Watauga Village, and nearby Boone Mall
- Multiple bicycle crashes reported

- Provides an east-west alternative to US-321/Blowing Rock Road
- Serves multiple AppalCART stops
- Identified for improvements in the 2030 Land Use Plan, Watauga County CTP, and High Country COG Bike Plan

Short-term Recommendation

Provide 4-foot paved shoulders on Greenway Road, where possible. In places where the roadway corridor does not provide sufficient width, stripe as wide of a paved shoulder as possible until the pavement can be extended. Provide bicycle route signage along the corridor.

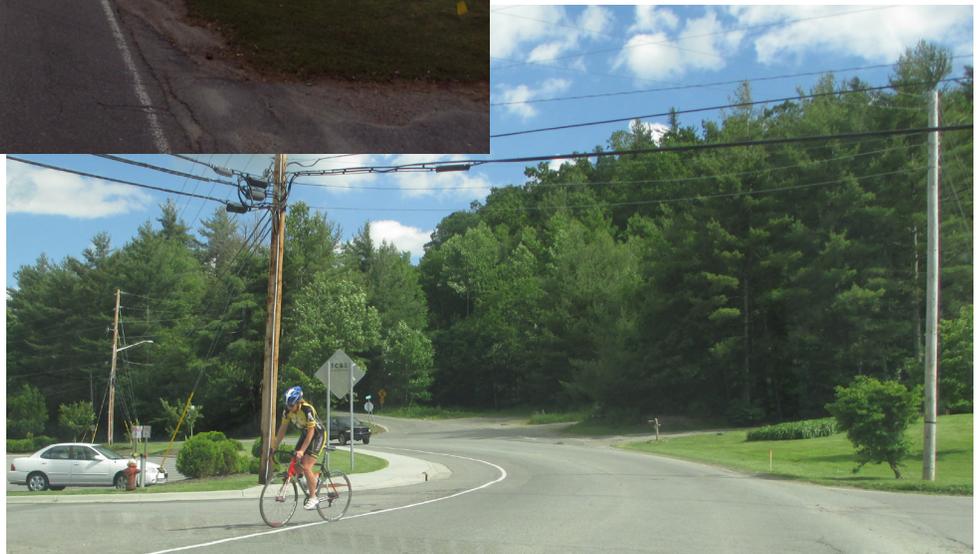
Long-term Recommendation

With road widening and curb and gutter construction, upgrade paved shoulders to bicycle lanes.



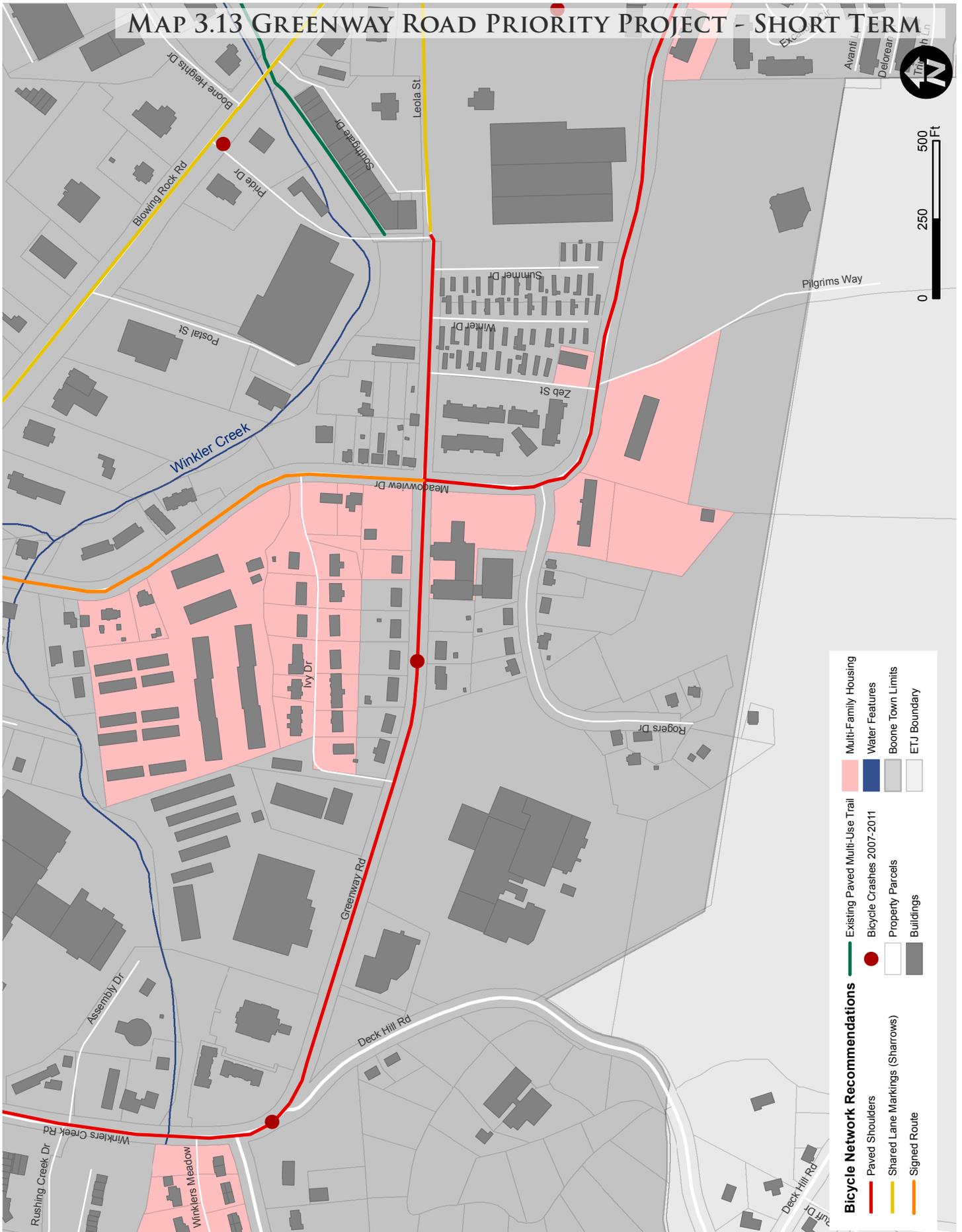
Above: Existing conditions on Greenway Road with no shoulder.

Right: Greenway Road connecting to Winkler’s Creek Road is a popular route for local bicyclists.





MAP 3.13 GREENWAY ROAD PRIORITY PROJECT - SHORT TERM



- Bicycle Network Recommendations**
- Paved Shoulders
 - Shared Lane Markings (Sharrows)
 - Signed Route
 - Existing Paved Multi-Use Trail
 - Bicycle Crashes 2007-2011
 - Property Parcels
 - Buildings
 - Multi-Family Housing
 - Water Features
 - Boone Town Limits
 - ETJ Boundary



12

Jefferson Road Sharrows and Paved Shoulders

From: US-421

To: Northern ETJ limits

Distance: 2,986 feet (0.57 miles)

Speed Limit: 35 mph

Prioritization score: 7 out of 15 points

Reasons for priority ranking:

- Provides bicycle access to destinations along Jefferson Road and New Market Boulevard, including Hardin Park Elementary School and several shops and restaurants
- Scheduled for resurfacing in 2014
- Multiple AppalCART bus stops nearby
- Identified for improvements in the Watauga County CTP and High Country COG Bike Plan
- Connects to existing bicycle lanes on US-421/King Street and the recommended shared lanes on New Market Boulevard

Right: Paved shoulders and an eventual shared-use trail would greatly improve bicycle and pedestrian access to Hardin Park Elementary School and other destinations along Jefferson Road and New Market Boulevard.

Short-term Recommendation

From US-421 to New Market Boulevard, include a shared lane facility with sharrows with the scheduled 2014 resurfacing of Jefferson Road. North of New Market Boulevard, stripe 4-foot paved shoulders where possible, though narrower shoulders are acceptable where space is constrained. Provide bicycle route signage along the corridor. Install “No Parking” signage and inform residents that they should not park within the roadway right-of-way.

Long-term Recommendation

Investigate the possibility of a bicycle lanes on Jefferson Road leading from the recommended shared-use trail extension on US-421 to Hardin Park Elementary School on New Market Boulevard. Bicycle lanes on Jefferson Road will provide a connection to bicycle facilities on New Market Boulevard and improve bicycle and pedestrian access to the school, Boone United Methodist Church, and neighborhoods and businesses on New Market Boulevard.





MAP 3.14 JEFFERSON ROAD PRIORITY PROJECT - SHORT TERM

Bicycle Network Recommendations

- Existing Bicycle Lanes
- Bicycle Climbing Lane + Sharrows
- Bicycle Lanes
- Paved Shoulder Climbing Lane + Sharrows
- Paved Shoulders
- Shared Lane Markings (Sharrows)
- Signed Route
- Bicycle Crashes 2007-2011
- Property Parcels
- Buildings
- Schools
- Multi-Family Housing
- Water Features
- Boone Town Limits

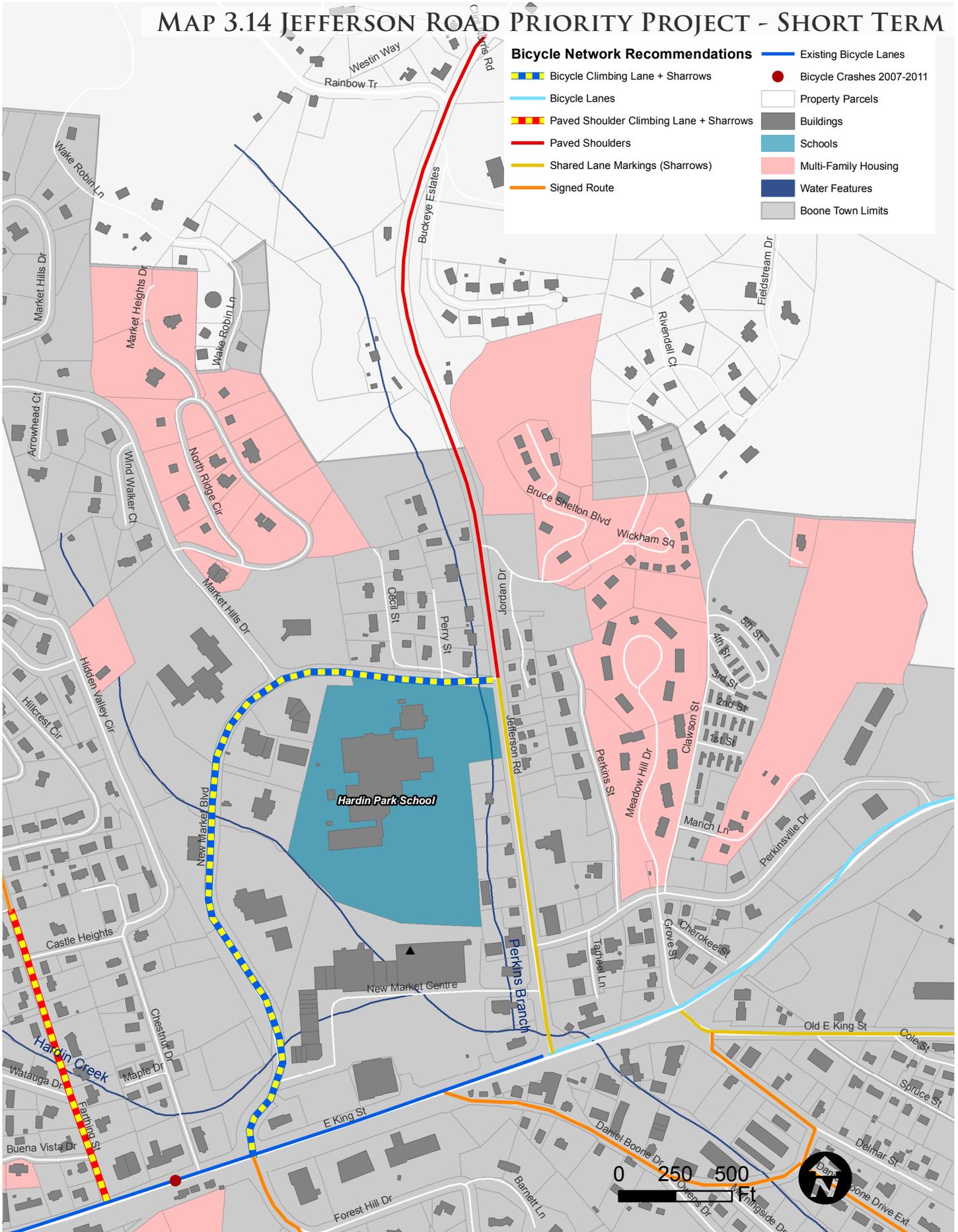




TABLE 3.3 PROJECT PRIORITIZATION WORKSHEET

Project Name	Total	Public Input	Greenway Priority List	CTP Recommendation	HCCOG Regional Bike Plan Recommendation	2030 Land Use Plan Recommendation	Bicycle Crash Location	Access to School or Library	Access to ASU	Access to Downtown	Access to Park	Connects to Existing Bicycle Facility	Connects to Proposed Bicycle Facility	Access to Commercial Centers	High Density Area	Serves AppalCART Stops
1. US-321 Bicycle Lanes	14	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
2. King Street/US-421 Climbing Lane + Sharrows	13	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
3. US-421 Bicycle Lanes	12	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
4. King Street Shared Lanes/Sharrows	12	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
5. US-421 Paved Shoulders	11	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
6. US-321 Shared Lanes/Sharrows	11	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1
7. NC 105 Bicycle Lanes	10	1	0	1	1	1	1	0	0	0	1	1	1	1	1	1
8. Rivers Street Shared Lanes/Sharrows	10	0	1	1	1	0	1	0	1	1	1	1	0	1	1	1
9. US-321 Shared Lanes/Sharrows	10	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1
10. NC 105 Shared Lanes/Sharrows	10	1	0	1	1	1	1	0	0	0	1	1	1	1	1	1
11. Greenway Road Paved Shoulders	8	0	0	1	0	1	1	0	0	0	1	1	1	1	1	1
12. Jefferson Road Paved Shoulders	7	0	0	1	1	0	1	0	0	0	1	1	1	1	1	1



TABLE 3.4 PRIORITY PROJECT COST ESTIMATES

Priority	Street Name	Start/End Point	Facility Type	Facility Length (Feet)	\$2.00/LF per single solid line removal*	\$0.25/LF per single dashed line removal*	\$1.85 per single solid line to stripe**	\$0.46 per single dashed line to stripe**	# of bicycle symbol markings (placed every 250 ft)**	\$220 per bicycle symbol marking*	# of bicycle signs (placed every 600 ft)**	\$170 per bicycle sign*	\$7 per reflective marker (66 per mile)*	# of intersection conflict areas	Total \$ Estimate***
1	US 321	US 421 to Rivers Street	Bicycle Lanes	700	\$0.00	\$0.00	\$2,590.00	\$0.00	6	\$1,320.00	0	\$0.00	\$0.00	2	\$5,508.50
2	King Street	College Street to US 321	Climbing Lane + Sharrows	1,432	\$0.00	\$0.00	\$2,649.20	\$0.00	12	\$2,640.00	3	\$510.00	\$0.00	2	\$7,175.08
3	US 421	Old East King Street to Eastern town limits	Bicycle Lanes	7,307	\$29,228.00	\$7,307.00	\$54,071.80	\$13,444.88	60	\$13,200.00	0	\$0.00	\$1,278.73	3	\$137,827.97
4	King Street	Green Street to College Street	Shared Lanes/Sharrows	3,075	\$0.00	\$0.00	\$0.00	\$0.00	26	\$5,720.00	12	\$2,040.00	\$0.00	4	\$8,924.00
5	US 421	Western ETJ limits to Green Street	Paved Shoulders	6,176	\$49,408.00	\$0.00	\$45,702.40	\$0.00	0	\$0.00	22	\$3,740.00	\$540.40	0	\$114,299.42
6	US 321	NC 105 to Boone Heights Drive	Shared Lanes/Sharrows	3,705	\$0.00	\$0.00	\$0.00	\$0.00	30	\$6,600.00	14	\$2,380.00	\$0.00	4	\$10,327.00
7	Rivers Street	Center Street to US 321	Shared Lanes/Sharrows	932	\$0.00	\$0.00	\$0.00	\$0.00	8	\$1,760.00	4	\$680.00	\$0.00	2	\$2,806.00
8	NC 105	King Street to US 321	Bicycle Lanes	4,253	\$0.00	\$2,126.50	\$15,736.10	\$3,912.76	36	\$7,920.00	0	\$0.00	\$744.28	3	\$36,523.58
9	US 321	Boone Heights Drive to Deerfield Road	Shared Lanes/Sharrows	2,467	\$0.00	\$0.00	\$0.00	\$0.00	20	\$4,400.00	10	\$1,700.00	\$0.00	3	\$7,015.00
10	NC 105	Poplar Hill Drive to US 321	Shared Lanes/Sharrows	5,194	\$0.00	\$0.00	\$0.00	\$0.00	42	\$9,240.00	18	\$3,060.00	\$0.00	3	\$14,145.00
11	Greenway Road	Winklers Creek Road to Pride Drive	Paved Shoulders	2,823	\$5,646.00	\$0.00	\$10,445.10	\$0.00	0	\$0.00	10	\$1,700.00	\$0.00	0	\$20,459.77
12	Jefferson Road	US 421 to Northern ETJ limits	Paved Shoulders	2,986	\$11,944.00	\$0.00	\$11,048.20	\$0.00	0	\$0.00	10	\$1,700.00	\$0.00	1	\$28,396.03
Totals				41,050	\$96,226.00	\$9,433.50	\$142,242.80	\$17,357.64	\$240.00	\$52,800.00	\$103.00	\$17,510.00	\$2,563.41	\$27.00	\$393,407.35

*per unit cost estimates are based on information provided by the Town of Boone and the NCDOT Division 11 Engineers in August 2013

**based on AASHTO guidance

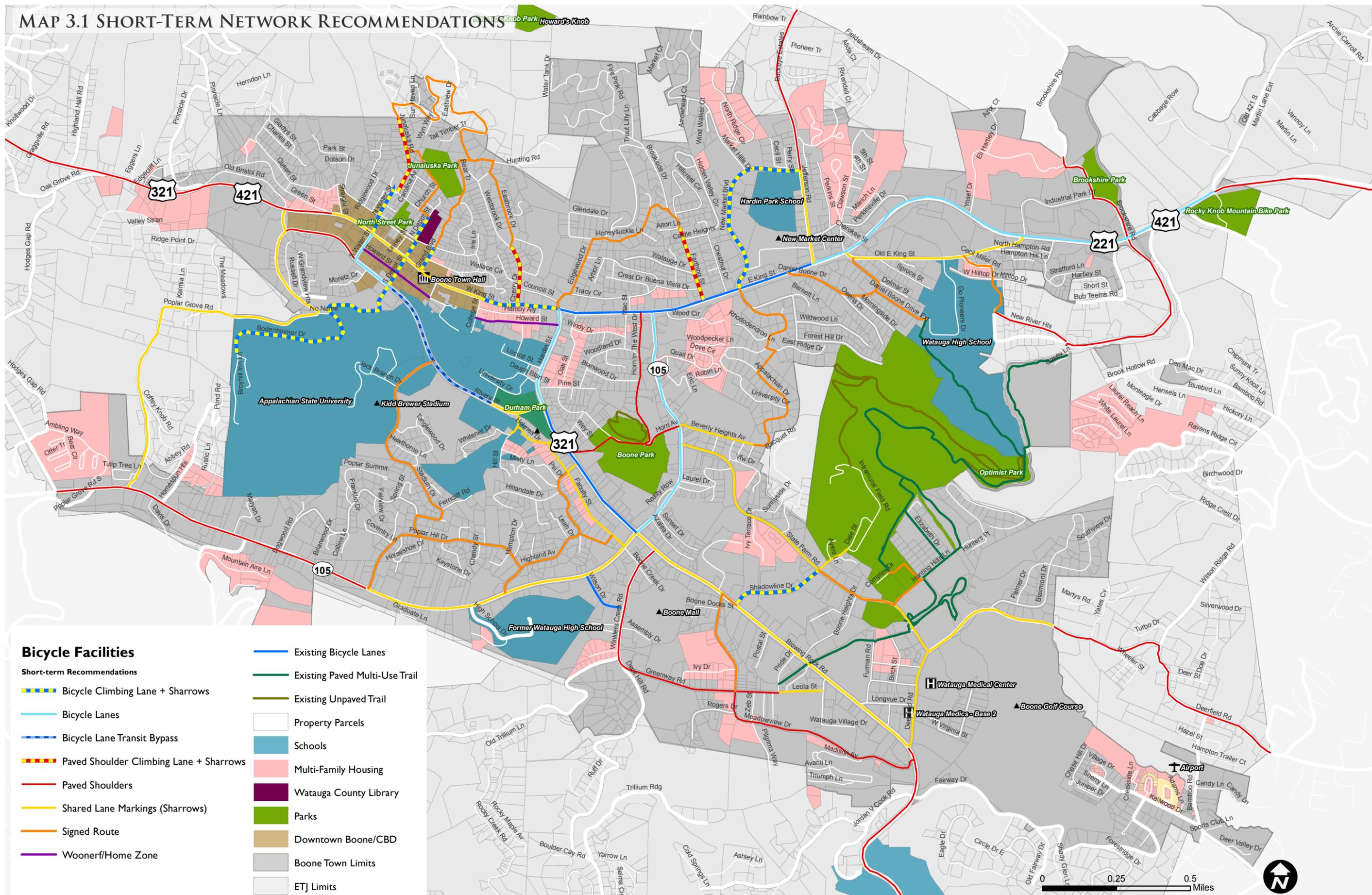
***estimates include a 15% contingency



Bicycle lanes on Hardin Street/US-321 between Rivers Street and NC 105.



MAP 3.1 SHORT-TERM NETWORK RECOMMENDATIONS



Bicycle Facilities

Short-term Recommendations

- Bicycle Climbing Lane + Sharrows
- Bicycle Lanes
- Bicycle Lane Transit Bypass
- Paved Shoulder Climbing Lane + Sharrows
- Paved Shoulders
- Shared Lane Markings (Sharrows)
- Signed Route
- Woonerf/Home Zone

- Existing Bicycle Lanes
- Existing Paved Multi-Use Trail
- Existing Unpaved Trail
- Property Parcels
- Schools
- Multi-Family Housing
- Watauga County Library
- Parks
- Downtown Boone/CBD
- Boone Town Limits
- ETJ Limits

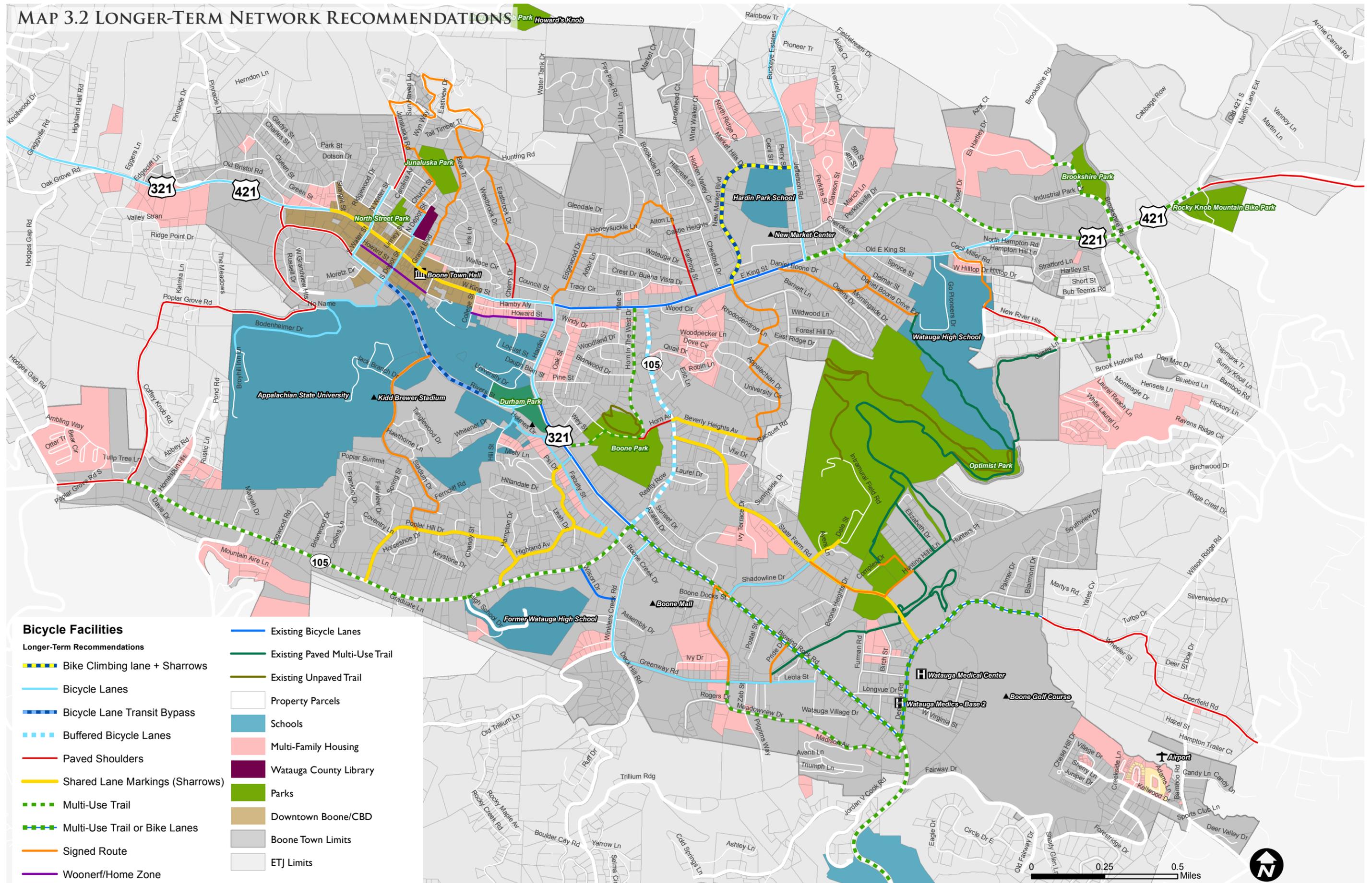




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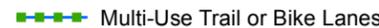
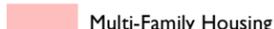


MAP 3.2 LONGER-TERM NETWORK RECOMMENDATIONS



Bicycle Facilities

Longer-Term Recommendations

-  Bike Climbing lane + Sharrows
-  Bicycle Lanes
-  Bicycle Lane Transit Bypass
-  Buffered Bicycle Lanes
-  Paved Shoulders
-  Shared Lane Markings (Sharrows)
-  Multi-Use Trail
-  Multi-Use Trail or Bike Lanes
-  Signed Route
-  Woonerf/Home Zone
-  Existing Bicycle Lanes
-  Existing Paved Multi-Use Trail
-  Existing Unpaved Trail
-  Property Parcels
-  Schools
-  Multi-Family Housing
-  Watauga County Library
-  Parks
-  Downtown Boone/CBD
-  Boone Town Limits
-  ETJ Limits





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Chapter Contents

- Overview (4-1)
- Key Action Steps (4-2)
 - Policy Action Steps (4-2)
 - Program Action Steps (4-4)
 - Infrastructure Action Steps (4-7)
- Key Partners in Implementation (4-8)
- Performance Measures (4-13)
- Facility Development Methods (4-13)
- Implementation Action Steps Table (4-17)

OVERVIEW

This chapter defines a structure for managing the implementation of the *Bike Boone 2013 Bicycle Transportation Plan*. Implementing the recommendations within this plan will require leadership and dedication to bicycle facility development on the part of a variety of agencies. Equally critical, and perhaps more challenging, will be meeting the need for a recurring source of revenue. Even small amounts of local funding could be very useful and beneficial when matched with outside sources. Most importantly, the local governments within the region need not accomplish the recommendations of this plan by acting alone; success will be realized through collaboration with state and federal agencies, the private sector, and non-profit organizations. Funding resources that may be available to Boone are presented in Appendix D of this plan.

Given the present day economic challenges faced by local governments (as well as their state, federal, and private sector partners), it is difficult to know what financial resources will be available at different time frames during the implementation of this plan. However, there are still important actions to take in advance of major investments, including key organizational steps, the initiation of education and safety programs, and the development of strategic, lower-cost on-road bicycle facilities. Following through on these priorities will allow the key stakeholders to prepare for the development of the regional network over time while taking advantage of strategic opportunities, as they arise. Key action steps fall into three categories: policies, programs, and infrastructure. Each of the recommendations that constitute these categories have been presented in the previous chapters of this plan. Table 4.1 on page 4-16 summarizes these action steps, along with all other recommendations made throughout the plan, and defines recommended actions, responsible agencies, and phasing. Finally, this plan's appendices provide a variety of in-depth resources for assisting in carrying out these tasks.



KEY ACTION STEPS

POLICY ACTION STEPS

Several policy steps are crucial to the success of future facility development. These steps will legitimize the recommendations found in this plan and enable the right-of-way acquisition necessary to carry out those recommendations.

ADOPT THIS PLAN

Before any other action takes place, the Town of Boone should adopt this plan. This should be considered the first step in implementation. Through adoption of *Bike Boone 2013* and its accompanying maps as the Town of Boone's official bicycle transportation plan, Boone will be better able to shape transportation and development decisions so that they fit with the goals of this plan. Most importantly, having an adopted plan is extremely helpful in securing funding from state, federal, and private agencies. Adopting this plan does not commit the Town of Boone to dedicate or allocate funds, but rather indicates intent to implement this plan over time, starting with these action steps.

Adoption procedures vary from community to community depending on existing plans and policies. In each jurisdiction, the planning board (as applicable) should review and recommend the plan to its governing body, which in turn must consider and officially incorporate the recommended infrastructure improvements of this plan into its land-use plans. The following entities should adopt this plan:

- The Town of Boone
- High Country Rural Planning Organization

Adoption of this plan also signifies that the design guidelines provided in Appendix A are established as bicycle facility standards for each of the adopting agencies. This will establish consistency in design across jurisdictional boundaries, ensuring that future facilities will be developed with consistency and will accommodate a variety of user types.

This plan and its recommended on- and off-road facilities should be approved by the NCDOT, and they should be included in the future planning of each agency. This plan's recommendations should be integrated into an update to the Comprehensive Transportation Plan for Watauga County. NCDOT should refer to this document when assessing the impact for future projects and plans. Likewise, NCDENR's Division of Parks and Recreation should refer to this plan in any projects relating to any state parks in the Boone region.



ESTABLISH LAND RIGHT-OF-WAY ACQUISITION MECHANISMS

It is recommended that each local zoning and subdivision ordinance be amended to ensure that, as developments are planned and reviewed, the bicycle facilities and greenway corridors identified in this plan are protected. This would entail amending development regulations to have developers set aside land for trails whenever a development proposal overlaps with the proposed routes, as adopted. Town of Boone staff should ensure that an effective review of all bicycle and pedestrian elements of proposed developments takes place.

In addition, local policies should be revised to reflect the language recommendations presented in Appendix C of this plan. For example, revising policy language to allow for public access for trail users, as a matter of right, on all new sewer and utility easements, or to mandate the improvement of identified five foot sidewalks to eight-foot side paths along roadways designated as corridor overlay districts, during future redevelopment projects. The implementation of these policies would have a significant impact on the bicycling environment in Boone.

ADOPT A “COMPLETE STREETS” POLICY

There is a growing national trend towards integrating bicycling, walking and transit as a routine element in highway and transit projects. This movement has developed under the name of “Complete Streets,” which is defined by the Complete the Streets Coalition as follows: “Complete Streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and bus riders of all ages and abilities are able to safely move along and across a complete street.”

The N.C. Department of Transportation adopted a “Complete Streets” policy in July 2009 and offers regional workshops and training courses to learn more about implementing complete streets policies and practices in communities.

The Town of Boone adopted a Complete Streets Resolution on May 21, 2012.

COORDINATE DEVELOPMENT PLANS

The Town of Boone should ensure that adopted bicycle, pedestrian, and multi-use path recommendations from this plan are included in future residential and commercial developments that connect with such proposed facilities.

Implement Driveway Access Management

The Town of Boone should consider revising the access management language included in the UDO for both future development and retrofits to existing development, especially along high priority roadways such as US-421, US-321 and NC 105. Specific language guidance is included in Appendix C of this plan.

The NCDOT’s policy on ‘Street and Driveway Access to North Carolina Highways’ provides examples on how to reduce conflict points between motor vehicles and pedestrians and bicyclists. For more information: www.ncdot.org/doh/preconstruct/altern/value/manuals/pos.pdf.



PROGRAM ACTION STEPS

While policies provide a legal basis for on- and off-road facility development, the program recommendations included in Appendix B of this plan will build community support for the creation of new facilities and establish a strong bicycling and walking culture.

DESIGNATE STAFF

Designate staff to oversee the implementation of this plan and the proper maintenance of the facilities that are developed. It is recommended that a combination of existing planning staff and public works staff oversee the day-to-day implementation of this plan. In many municipalities, this task is covered by a full-time bicycle and pedestrian coordinator, but in smaller towns, such as Boone, it makes more sense to fold these responsibilities into current staff responsibilities.

MAINTAIN ALTERNATIVE TRANSPORTATION SUBCOMMITTEE (ATS)

The Town of Boone should maintain the Alternative Transportation Subcommittee to assist in the implementation of this plan. The ATS should have representation from active pedestrians and commuting and recreational cyclists, and should champion the recommendations of this plan. The existence of this group represents a significant step in becoming designated as a Bicycle Friendly Community (see information below). The ATS should continue to provide a communications link between the citizens of the community and local government. They should also continue to meet periodically, and be tasked with assisting the Town of Boone staff in community outreach, marketing and educational activities recommended by this plan.

BECOME DESIGNATED AS A WALK-FRIENDLY AND/OR BICYCLE FRIENDLY COMMUNITY

The Town of Boone recently received an Honorable Mention for a Bicycle-Friendly Community by the League of American Bicyclists. A goal for Boone may be to seek a bronze or silver level “Bicycle Friendly Community” (BFC) designation. The Bicycle Friendly Community campaign is an award program that recognizes municipalities that actively support bicycling activities and safety. A Bicycle Friendly Community provides safe accommodation for bicycling and encourages its residents to bicycle for transportation and recreation. The program is administered through the League of American Bicyclists and many North Carolina communities have become designated as Bicycle Friendly Communities or are seeking designations as such.

The development and implementation of this plan is an essential first step toward becoming a bronze or silver level Bicycle Friendly Community. With ongoing efforts and the short-term work program recommended here, the Town should be in a position to apply again for, and receive BFC status within a few short years.



COMMUNICATION AND OUTREACH

The ATS should establish a communication campaign to celebrate successes as facilities are developed and otherwise raise awareness of the overall bicycle networks and its benefits. A key first task of this group is to design and launch a one-stop website.

Many current and potential bicyclists do not know where to turn to find out about bicycling laws, events, maps, tips, and groups. Developing a “Bike Central” website provides information to a wide audience and encourages people to bicycle. A one-stop bike website is not usually difficult to set up, but it will only be successful if the site is both easy to use and updated frequently. All website content should be reviewed regularly for accuracy. The bicycling community can assist in keeping the site up to date. The Boone Bicycling Initiative may be an ideal partner in this effort and could help to post information and event updates to the website.

ESTABLISH A MONITORING PROGRAM

From the beginning, and continuously through the life of a pedestrian or bicycle facility project, the ATS should brainstorm specific benchmarks to track through a monitoring program and honor the completion of projects with public events and media coverage. Monitoring should be supported by the programmatic recommendations included in Appendix B, such as a bicycle and pedestrian needs checklist and a facility inspection and maintenance program. Benchmarks should be revisited and revised periodically as the bicycle facility network evolves.

BEGIN ANNUAL MEETING WITH KEY PROJECT PARTNERS

Coordination between key project partners will establish a system of checks and balances, provide a level of accountability, and ensure that recommendations are implemented. This meeting should be organized by the designated Town staff, and should include representatives from the Organizational Chart shown on page 4-2. The purpose of the meeting should be to ensure that this plan’s recommendations are integrated with other transportation planning efforts in the region, as well as long-range and current land use planning, economic development planning, and environmental planning. Attendees should work together to identify and secure funding necessary to immediately begin the first year’s work, and start working on a funding strategy that will allow the Town to incrementally complete each of the suggested physical improvements, policy changes and programs over a 5-10 year period. A brief progress benchmark report should be a product of these meetings, and goals for the year should be reconfirmed by participants. The meetings could also occasionally feature special training sessions on bicycle, pedestrian, and trail issues.

SEEK MULTIPLE FUNDING SOURCES AND FACILITY DEVELOPMENT OPTIONS

Multiple approaches should be taken to support pedestrian facility development and programming. It is important to secure the funding necessary to undertake priority projects but also to develop a long-term funding strategy to allow continued development of the overall system. A priority action is to immediately evaluate the recommendations against transportation projects that are currently



programmed in the Transportation Improvement Program (TIP) to see where projects overlap, compliment, or conflict with each other. The Town should also evaluate which of the proposed projects could be added to future TIP updates.

Capital and local funds for bicycle and pedestrian facilities and trail construction should be set aside every year, even if only for a small amount. Small amounts of local funding can be matched to outside funding sources or could be used to enhance NCDOT projects with bicycle or pedestrian features that may otherwise not be budgeted for by the state. A variety of local, state, and federal options and sources exist and should be pursued. These funding options are described in Appendix D: Funding Resources.

DEVELOP BICYCLE AND PEDESTRIAN FACILITY DESIGNS AND SPECIFICATIONS FOR PROPOSED PROJECTS

Town of Boone staff could prepare these in-house to save resources, using the design guidelines of this plan and the project cut-sheets as starting points. The public should have an opportunity to comment on the design of new facilities.

IMPROVE EXISTING PROGRAMS AND LAUNCH NEW PROGRAMS

Appendix B: Program Resources provides a set of programmatic resources for outreach, education, enforcement, and evaluation/policy that will support the goals of *Bike Boone 2013*. The Town should reference the recommendations in the appendix to expand and improve upon existing programs, as well as to develop new programs that promote bicycling.

Through cooperation with the Town of Boone, the Alternative Transportation Committee, and groups such as walking and bicycling clubs, strong education, encouragement, and enforcement campaigns could also occur as new facilities are built. When an improvement has been made, the roadway environment has changed and proper interaction between motorists and pedestrians is critical for the safety of all users. A campaign through local television, on-site enforcement, education events, and other methods will bring attention to the new facility, and educate, encourage, and enforce proper use and behavior. Appendix B: Program Resources, provides program ideas to choose from, many of which are also included in the action steps table at the end of this chapter.

PROVIDE ENFORCEMENT AND EDUCATION TRAINING FOR POLICE OFFICERS

Law enforcement officers have many important responsibilities, yet pedestrians and bicyclists remain the most vulnerable forms of traffic. The Boone Police Department has been aware of this planning process, and should be involved in implementation. In many cases, citizens (and even sometimes officers) are not fully aware of state and local laws related to bicyclists and pedestrians. Training on this topic can lead to additional education and enforcement programs that promote safety. Training for Boone's officers could be done through free online resources available from the National Highway Traffic Safety Administration (NHTSA) (see links at www.bicyclinginfo.org/enforcement/training.cfm) and through webinars available through the Association of Pedestrian and Bicycle Professionals (APBP).



INFRASTRUCTURE ACTION STEPS

While establishing the policies and programs described, Boone should move forward with the design and construction of priority projects. They should also work to identify funding for long-term, higher-cost projects.

IDENTIFY FUNDING

Achieving the vision defined within this plan will require, among other things, a stable and recurring source of funding. Communities across the country that have successfully engaged in bicycle programs have relied on multiple funding sources to achieve their goals. No single source of funding will meet the recommendations identified in this plan. Instead, stakeholders will need to work cooperatively with municipality, state, and federal partners to generate funds sufficient to implement the program.

A stable and recurring source of revenue is needed that can then be used to leverage grant dollars from state, federal, and private sources. The ability of local agencies to generate a source of funding for bicycle facilities depends on a variety of factors, such as taxing capacity, budgetary resources, voter preferences, and political will. It is very important that these local agencies explore the ability to establish a stable and recurring source of revenue for facilities.

Donations from individuals or companies are another potential source of funding. The ATS should establish an Adopt-A-Greenway program as a mechanism to collect these donations for the development of the greenway trail recommendations discussed in Chapter 3. In addition to a formalized program, a website should be set up as an easy way for individuals to donate smaller amounts. The need for a donation mechanism was identified during the stakeholder interviews that took place at the beginning of the planning process.

Federal and state grants should be pursued along with local funds to pay for necessary ROW acquisition and project design, construction, and maintenance expenses. “Shovel-ready” designed projects should be prepared in the event that future federal stimulus funds become available. Additional recommended funding sources may be found in Chapter 5: Funding Resources.

COMPLETE SHORT-TERM PRIORITY PROJECTS

By quickly moving forward on priority projects, Boone will demonstrate its commitment to carrying out this plan and will better sustain the enthusiasm generated during the public outreach stages of the planning process. Refer to Chapter 3: Network Recommendations for priority project ranking and the prioritization methodology.



KEY PARTNERS IN IMPLEMENTATION

ROLE OF THE BOONE TOWN COUNCIL

The Town Council will be responsible for adopting this plan. Through adoption, the Town of Boone's leadership is further recognizing the value of bicycle and pedestrian transportation and is putting forth a well-thought out set of recommendations for improving public safety and overall quality of life (see the 'Benefits of a Walkable and Bikeable Community' section starting on page I-3). By adopting this Plan, the Town Council is also signifying that they are prepared to support the efforts of other key partners in the plan's implementation, including the work of Town departments and the local NCDOT Division II.

Adoption of this Plan is in line with public support. Boone's online comment form for the bicycle planning process yielded over 780 responses and showed strong support for improving bicycling conditions. Though not a statistically valid survey, the comment form results do represent the opinions of hundreds of local residents. See Appendix E: Public Outreach and Engagement for more information.

ROLE OF THE TOWN OF BOONE PLANNING COMMISSION

The Town of Boone Planning Commission serves as an advisory board to the Council on matters of planning and zoning. The Planning Commission should be prepared to:

- Become familiar with the recommendations of this plan, and support its implementation.
- Learn about pedestrian-related policies as detailed in Appendix C of this plan.

ROLE OF THE TOWN OF BOONE PUBLIC WORKS DEPARTMENT

The Public Works Department handles the responsibility for the construction and maintenance of pedestrian facilities on locally owned and maintained roadways, as well as on NCDOT roadways, where encroachment agreements are secured. The Department also maintains Town parks and greenways. The department should be prepared to:

- Communicate and coordinate with other town departments and the ATS on priority bicycle and pedestrian projects.
- Become familiar with the standards set forth in Appendix A of this plan, as well as state and national standards for bicycle and pedestrian facility design.
- Secure encroachment agreements for work on NCDOT-owned and maintained roadways.
- Design, construct, and maintain pedestrian and bicycle facilities.



- Communicate and coordinate with Watauga County, High Country COG, and neighboring municipalities on regional trails; partner for joint-funding opportunities, such as SRTS.
- Communicate and coordinate with NCDOT Division II on this plan's recommendations for NCDOT-owned and maintained roadways. Provide comment and reminders about this Plan's recommendations no later than the design phase.
- Work with Division II to ensure that when NCDOT-owned and maintained roadways in Boone are resurfaced or reconstructed, that this Plan's adopted recommendations for bicycle and pedestrian facilities are included on those streets. If a compromise to the original recommendation is needed, then contact NCDOT Division of Bicycle and Pedestrian Transportation for guidance on appropriate alternatives.

ROLE OF THE TOWN OF BOONE PLANNING & INSPECTIONS

Planning & Inspections' planning staff will take primary responsibility for the contact with new development to implement the plan (with support from the Public Works Department). For example, the staff should be prepared to:

- Communicate and coordinate with local developers on adopted recommendations for bicycle and pedestrian facilities, including paved multi-use trails.
- Assist the Public Works Department in communicating with NCDOT and regional partners.
- Refer often to Appendix C: Policy Resources for information that may apply to bicycle and pedestrian facility development in Boone.

ROLE OF THE ALTERNATIVE TRANSPORTATION SUBCOMMITTEE

See pages 4-2 and 4-5 for more information. The committee should be prepared to:

- Meet with staff from Planning & Inspections and the Public Works Department; evaluate progress of the plan's implementation and offer input regarding pedestrian, bicycle, and trail-related issues; assist Town of Boone staff in applying for grants and organizing bicycle and pedestrian-related events and educational activities.
- Build upon current levels of local support for pedestrian and bicycle issues and advocate for local project funding.



ROLE OF THE LOCAL NCDOT DIVISION 11

Division II of the NCDOT is responsible for the construction and maintenance of pedestrian and bicycle facilities on NCDOT-owned and maintained roadways in the Town of Boone, OR is expected to allow for the Town to do so with encroachment agreements. Division II should be prepared to:

- Recognize this plan as not only as an adopted plan of the Town of Boone, but also as an approved plan of the NCDOT.
- Become familiar with the bicycle and pedestrian facility recommendations for NCDOT roadways in this Plan (Chapter 3); take initiative in incorporating this plan's recommendations into the Division's schedule of improvements whenever possible.
- Become familiar with the standards set forth in Appendix A of this plan, as well as state and national standards for facility design; construct and maintain recommended facilities using the highest standards allowed by the State (including the use of innovative treatments on a trial-basis).
- Notify the Town of Boone Public Works Department of all upcoming roadway reconstruction or resurfacing/restriping projects in Boone, no later than the design phase. Provide sufficient time for comments from the planning staff.
- If needed, seek guidance and direction from the NCDOT Division of Bicycle and Pedestrian Transportation on issues related to this plan and its implementation.

ROLE OF THE TOWN OF BOONE POLICE DEPARTMENT

The Town of Boone Police Department is responsible for providing the community the highest quality law enforcement service and protection to ensure the safety of the citizens and visitors to the Town of Boone. The Police Department should be prepared to:

- Become experts on bicycle and pedestrian-related laws in North Carolina. (see: www.ncdot.gov/bikeped/lawspolicies/laws/)
- Continue to enforce not only bicycle and pedestrian-related laws, but also motorist laws that affect walking and bicycling, such as speeding, running red lights, aggressive driving, etc.
- Participate in bicycle and pedestrian-related education programs.
- Review safety considerations with the Public Works Department as projects are implemented.



ROLE OF DEVELOPERS

Developers in Boone can play an important role in facility development whenever a project requires the enhancement of transportation facilities or the dedication and development of on-road bicycle facilities, sidewalks, trails or crossing facilities. Developers should be prepared to:

- Become familiar with the benefits, both financial and otherwise, of providing amenities for walking and biking (including trails) in residential and commercial developments.
- Become familiar with the standards set forth in Appendix A of this plan, as well as state and national standards for facility design.
- Be prepared to account for bicycle and pedestrian circulation and connectivity in future developments.

ROLE OF LOCAL & REGIONAL STAKEHOLDERS

Stakeholders for bicycle and pedestrian facility development and related programs, such as Watauga County, the High Country COG, ASU, and local economic development organizations play important roles in the implementation of this plan. Local and regional stakeholders should be prepared to:

- Become familiar with the recommendations of this Plan, and communicate & coordinate with the Town for implementation, specifically in relation to funding opportunities, such as grant writing and developing local matches for facility construction.
- The RPO operates as part of the COG and provides transportation planning-related services. The RPO should work with the Town of Boone on populating the Transportation Improvement Program (TIP) with pedestrian and bicycle infrastructure projects.
- Watauga County should coordinate with the Town on trail development and SRTS grants.
- ASU and local economic development groups, such as downtown organizations and chambers, should look for opportunities to partner on specific projects, such as improvements to Howard Street, or comprehensive signage and wayfinding projects.

ROLE OF LOCAL RESIDENTS, CLUBS AND ADVOCACY GROUPS

Local residents, clubs and advocacy groups play a critical role in the success of this plan. They should be prepared to:

- Continue offering input regarding pedestrian and bicycling issues in Boone.
- Assist Town of Boone staff and the Alternative Transportation Subcommittee by volunteering for bicycle and pedestrian-related events and educational activities and/or participate in such activities.

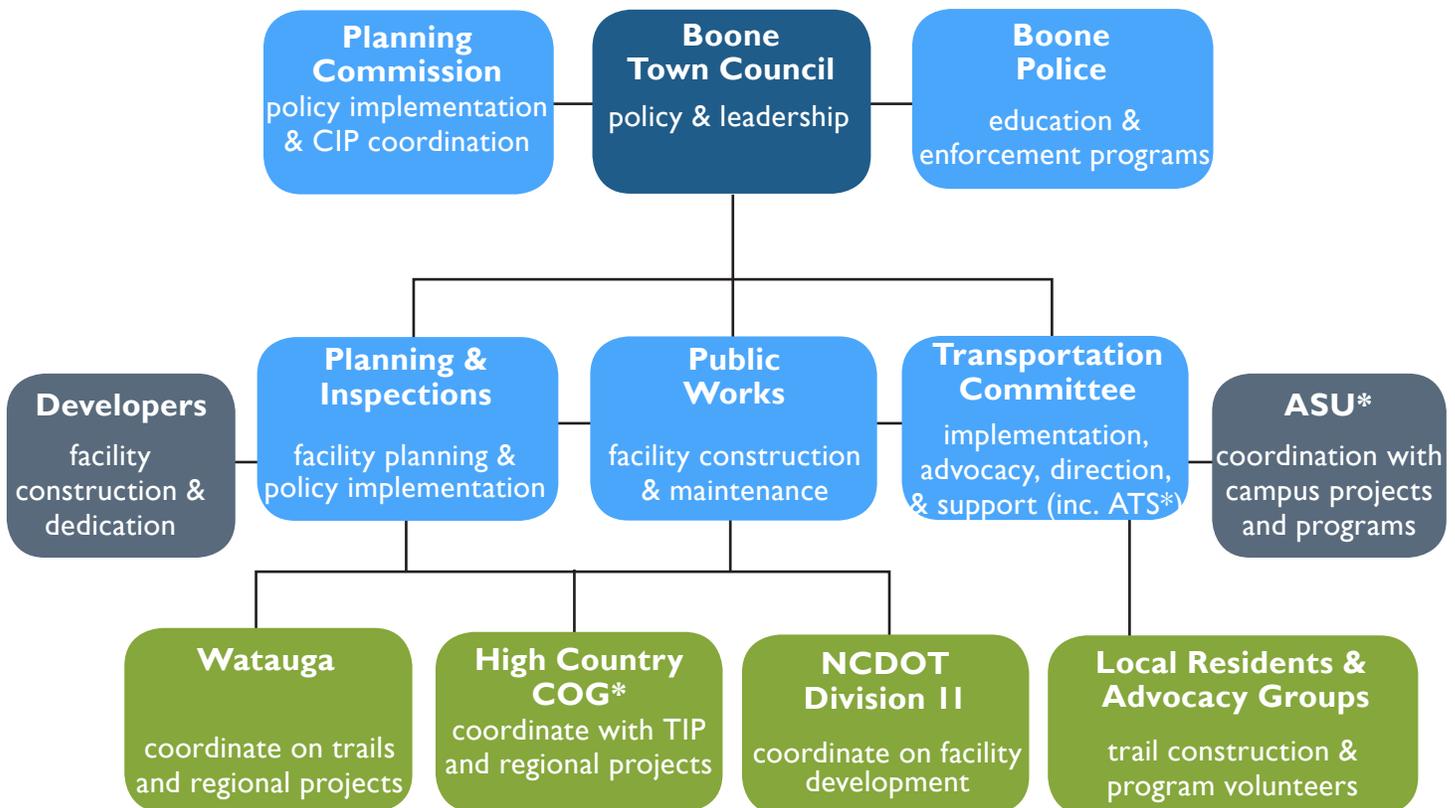


- Assist Town of Boone staff and the Alternative Transportation Subcommittee by speaking at Town Council meetings and advocating for local pedestrian and bicycle project and program funding.

ROLE OF VOLUNTEERS

Services from volunteers, student labor, and seniors, or donations of material and equipment may be provided in-kind, to offset construction and maintenance costs. Formalized maintenance agreements, such as adopt-a-trail/greenway or adopt-a-highway can be used to provide a regulated service agreement with volunteers. Other efforts and projects can be coordinated as needed with senior class projects, scout projects, interested organizations, clubs or a neighborhood’s community service to provide for many of the program ideas outlined in Appendix B of this plan. Advantages of utilizing volunteers include reduced or donated planning and construction costs, community pride and personal connections to the town’s greenway, bicycle, and pedestrian networks.

ORGANIZATIONAL FRAMEWORK FOR IMPLEMENTATION



*ATS = Alternative Transportation Sub-committee

*ASU = Appalachian State University

*COG = Council of Governments



PERFORMANCE MEASURES (EVALUATION AND MONITORING)

The Town of Boone should establish performance measures to benchmark progress towards fulfilling the recommendations of this plan. These performance measures should be stated in an official report within two years after the Plan is adopted. Performance measures could address the following aspects of pedestrian and bicycle transportation and recreation in Boone:

- *Safety.* Measures of pedestrian and bicycle-related crashes and injuries.
- *Facilities.* Measures of how many pedestrian and bicycle facilities have been funded and constructed since the plan's adoption.
- *Maintenance.* Measures of existing sidewalk/crosswalk or bicycle facility deficiency or maintenance needs.
- *Counts.* Measures of pedestrian and/or bicycle traffic at specific locations.
- *Education, Encouragement and Enforcement.* Measures of the number of people who have participated in part of a pedestrian or bicycle-related program since the plan's adoption.

FACILITY DEVELOPMENT METHODS

This section describes different construction methods for the proposed pedestrian and bicycle facilities outlined in Chapter 3. Note that many types of transportation facility construction and maintenance projects can be used to create new bicycle and pedestrian facilities. It is much more cost-effective to provide bicycle and pedestrian facilities during roadway construction and re-construction projects than to initiate the improvements later as “retrofits”.

To take advantage of upcoming opportunities and to incorporate bicycle and pedestrian facilities into routine transportation and utility projects, the Town of Boone should keep track of NCDOT's projects and any other local transportation improvements. While doing this, town staff should be aware of the different procedures for state and local roads and interstates.

NCDOT TRANSPORTATION IMPROVEMENT PROGRAM

The Transportation Improvement Program (TIP) is an ongoing program at NCDOT which includes a process asking localities to present their transportation needs to state government. Pedestrian and bicycle facility and safety needs are an important part of this process. Every other year, a series of TIP meetings are scheduled around the state. Following the conclusion of these meetings, all requests are evaluated. Pedestrian and bicycle improvement requests, which meet project selection criteria, are then scheduled into a four-year program as part of the state's long-term transportation program.

There are two types of projects in the TIP: incidental and independent. Incidental projects are those that can be incorporated into a scheduled roadway improvement project. Independent are those that can stand alone such as a greenway, not related to a particular roadway.



The Town of Boone, guided by the priority projects within this plan, should present bicycle and pedestrian projects along State roads to the COG and State. Local requests for small pedestrian projects, such as crosswalks and smaller segments of sidewalk, can be directed to the COG or the local NCDOT Division II office. Further information, including the criteria evaluated can be found at: http://www.ncdot.org/transit/bicycle/funding/funding_TIP.html

LOCAL ROADWAY CONSTRUCTION OR RECONSTRUCTION

Pedestrians and cyclists should be accommodated any time a new road is constructed or an existing road is reconstructed. In the longer-term, all new roads with moderate to heavy motor vehicle traffic should have sidewalks, bicycle facilities, and safe intersections. However, side paths can be an acceptable solution when a road has few driveways and high-speed, high-volume traffic.

Also, case law surrounding the ADA has found that roadway resurfacing constitutes an alteration, which requires the addition of curb ramps at intersections where they do not yet exist. The Department of Justice and the Federal Highway Administration recently released guidance on the Title II of the Americans with Disabilities Act requirement to provide curb ramps when streets, roads, or highways are altered through resurfacing. More information is available on the following website:
<http://www.ada.gov/doj-fhwa-ta.htm>.

RESIDENTIAL AND COMMERCIAL DEVELOPMENT

The construction of sidewalks, bicycle facilities, trails, and safe crosswalks should be required during development. Construction of facilities that corresponds with site construction is more cost-effective than retro-fitting. In commercial development, emphasis should also be focused on safe pedestrian and bicyclist access into, within, and through large parking lots. This ensures the future growth of the pedestrian and bicycle networks and the development of safe communities.

REMOVING PARKING

Some neighborhood collector roadways are wide enough to stripe with bike lanes, but they are used by residents for on-street parking, especially in the evening. In locations like this, removing parking is likely to create considerable controversy and is not recommended unless there is no other solution (unless the parking is never used). In the rare case that removing parking is being considered, the parking should not be removed unless there is a great deal of public support for the bike lanes on that particular roadway and a full public involvement process with adjacent residents and businesses is undertaken prior to removing parking.

If it is not practical to add a bike lane, edgelines and shared lane markings may be considered. On roads where the outside lane and parking area combined are more than 17-foot-wide, 10-foot-wide travel lanes can be striped with an edgeline, leaving the rest of the space on either side for parking. The stripe would



help slow motor vehicles and provide extra comfort for bicyclists, especially during the daytime when fewer cars would be parked along the curb. On roads with outside lane and parking areas that are narrower than 17-foot-wide, shared lane markings can be provided every 100 to 200 meters on the right side of the motor vehicle travel lane to increase the visibility of the bike route.

REPAVING

Repaving projects provide a clean slate for revising pavement markings. When a road is repaved, the roadway should be restriped to create narrower lanes and provide space for bicycle lanes and shoulders, where feasible.

In addition, if the spaces on the sides of non-curb and gutter streets have relatively level grades and few obstructions, the total pavement width can be widened to include paved shoulders.

INSTALLING SHARED LANE MARKINGS

The Town of Boone should adopt the use of shared lane markings, or “sharrows,” as one of its bicycle facility types. Shared lane markings have been newly incorporated into the Manual on Uniform Traffic Control Devices (MUTCD). They take the place of traditional bicycle lanes where travel lanes cannot be narrowed, where speeds do not exceed 35 mph, and/or where there is on-street parking. The intent of the shared lane marking is threefold:

1. They draw attention to the fact that the roadway is accommodating bicycle use and traffic;
2. They clearly define the direction of travel for both bicyclists and motorists; and
3. With proper placement, they remind bicyclists to bike further from parked cars to prevent “dooring” collisions.

While shared-lane markings are not typically recommended or needed on local, residential streets, they are sometimes used along such streets when part of a signed route or bicycle boulevard. It should be noted that sharrows are not a replacement for bicycle lanes in their effectiveness or use.

The Town of Boone should partner with NCDOT Division II through a Memorandum of Agreement regarding the installation and future maintenance of “sharrows” along NCDOT roadway corridors in Boone.

RETROFIT ROADWAYS WITH NEW BICYCLE AND PEDESTRIAN FACILITIES

There may be critical locations in the bicycle network that have bicycle safety issues or are essential links to destinations. In these locations, it may be justifiable to add new bicycle facilities before a roadway is scheduled to be repaved or reconstructed. In some other locations, it may be relatively easy to add sidewalk or to add extra pavement for shoulders, but other segments may require removing trees, relocating landscaping or fences, re-grading ditches or cut and fill sections. Retrofitting roadways with side paths creates similar challenges. Improvements in these locations are typically recommended in the long-term.



Some roads may require a “road diet” solution in order to accommodate bicycle facilities. Road diets involve reallocating motor vehicle travel lanes for the benefit of increasing roadway safety and efficiency for all users, and in some cases increasing space for other uses such as parking, on-street bicycle facilities, sidewalks, and/or side paths. These are generally recommended only in situations where the vehicular traffic count can be safely and efficiently accommodated with a reduced number of travel lanes. When considering how a road diet might affect road capacity, however, it is important to keep in mind that bicycle facilities may increase roadway capacity by allowing a greater number of total vehicles - including bicycles - to move along the roadway in a given time period. Further study may be necessary for recommended road diets to ensure that the needs of all road users are being met.

BRIDGE CONSTRUCTION OR REPLACEMENT

Provisions should always be made to include a walking and bicycling facility as a part of vehicular bridges, underpasses, or tunnels. All new or replacement bridges should accommodate two-way travel for all users. Even though bridge construction and replacement does not occur regularly, it is important to consider these policies for long-term bicycle and pedestrian planning. NCDOT bridge policy states that sidewalks shall be included on new NCDOT road bridges with curb and gutter approach roadways. A determination of providing sidewalks on one or both sides is made during the planning process. Facility design standards such as widths of facilities and heights of handrails are presented in Appendix A: Design Guidelines.

SIGNAGE AND WAYFINDING PROJECTS

A relatively low-cost, short-term action that the Town of Boone can pursue immediately is to develop and adopt a signage style policy and procedure, to be applied throughout the entire community, to make it easier for people to find destinations. Signage programs that include informational, warning, and regulatory signage along specific routes or in an entire community can be updated to include wayfinding signage to make it easier for people to find destinations. Bicycle route signs are one example of these wayfinding signs, and should be installed along routes independently of other signage projects or as a part of a more comprehensive wayfinding improvement project. Posting signage that includes bicycle travel times to major destinations can help to increase awareness of the ease and efficiency of bicycle travel. See Appendix A: Design Guidelines for more detailed guidance on signage and wayfinding improvements.

For a step-by-step guide to help non-professionals participate in the process of developing and designing a signage system, as well as information on the range of signage types, visit the Project for Public Places website: www.pps.org/info/amenities_bb/signage_guide

TOWN EASEMENTS

The Town of Boone should explore opportunities to revise existing easements to accommodate public access greenway facilities. Similarly, as new easements are acquired in the future, the possibility of public access should be considered. Sewer easements are very commonly used for this purpose, offering cleared and graded corridors that easily accommodate trails. This approach avoids the difficulties associated with acquiring land, and it better utilizes the Town’s resources.



TABLE 4.1 IMPLEMENTATION ACTION STEPS

Task	Lead Agency	Support	Details	Phase
Present Plan to Town Council	Project Consultants	Public Works	Presentation to Town Council in Fall 2013	Fall 2013
Approve this plan	NCDOT Bike/Ped Division	Project Consultants	Official letter of approval in Winter 2013/2014	Winter 2013/2014
Adopt this plan	Town Council	Public Works, Project Consultants	Through adoption, the Plan becomes an official planning document of the Town. Adoption shows that the Town of Boone has undergone a successful, supported planning process.	Fall 2013
Designate Staff	Town Council	Leadership of Town Departments	Designate staff to oversee the implementation of this plan and the proper maintenance of the facilities that are developed. It is recommended that a combination of existing staff from Public Works and Planning & Inspections oversee the day-to-day implementation of this plan.	Fall 2013
Present this plan to other local and regional bodies and agencies.	Transportation Committee	Public Works, Planning & Inspections, ATS	This Plan should be presented to other local and regional bodies and agencies. Possible groups to receive a presentation might include: the High Country Regional Planning Organization, regional transportation planners, Watauga County planners, Appalachian Partners in Public Health, and Boone Area Cyclists.	Short-Term (2014)
Reconfirm goals of the Alternative Transportation Subcommittee (ATS)	Town Council	ATS	Reconfirm goals of the ATS to include assistance in the implementation of <i>Bike Boone 2013</i> .	Fall 2013
Explore possibility of a regional multi-modal coordinator	Town Council	ATS, High Country COG, neighboring municipalities	Explore the possibility of partnership with neighboring municipalities in hiring a regional full-time Multi-Modal Transportation Coordinator	Mid-Term (2015)
Begin Annual Meeting With Key Project Partners	Public Works	Planning & Inspections, NCDOT, ATS, and local & regional stakeholders	Key project partners (see org. chart on page 4-2) should meet on an annual basis to evaluate the implementation of this Plan. Meetings could also occasionally include on-site tours of priority project corridors	Ongoing/ Beginning Spring 2014
Ensure planning efforts are integrated regionally	Transportation Committee	High Country COG, Watauga County, neighboring municipalities, ATS	Combining resources and efforts with surrounding municipalities, regional entities, and stakeholders is mutually beneficial, especially with trail development. Communicate and coordinate with the regional partners on regional trails, bicycle, and pedestrian facilities; partner for joint-funding opportunities. After adoption by the Town, this document should also be recognized in regional transportation plans, including future updates to the Watauga County CTP.	Ongoing/ Beginning Fall 2013



Task	Lead Agency	Support	Details	Phase
Develop a long term funding strategy	Public Works	Town Council, Planning & Inspections, ATS	To allow continued development of the overall system, capital funds for bicycle and pedestrian facility construction should be set aside every year. Powell Bill funds should be programmed for pedestrian facility construction. Funding for an ongoing maintenance program should also be included in the Town's operating budget.	Short-Term (2014)
Seek Multiple Funding Sources and Facility Development Options	Public Works	Planning & Inspections, ATS	Chapter 3 contains project cost estimates and Appendix D contains potential funding opportunities, updated based on DBPT funding seminar in August 2013.	Ongoing/ Winter 2013/2014
Apply for Safe Routes to School Grants and Infrastructure Funding	Transportation Committee	High Country COG, NCDOT Division II, ATS	Establish 'bike-to-school' groups, 'walking school buses' or other similar activities for children through the Safe Routes to School Program. Inquire about bicycle and pedestrian infrastructure funding for projects within 1.5 miles of schools through NCDOT Division II. Continue to pursue efforts for the Hardin Park School SRTS project.	Ongoing/ Beginning Fall 2013
Establish Land Right-of-Way Acquisition Mechanisms	Town Council	Planning & Inspections, Public Works, ATS	Amend development regulations to have developers set aside land for trails whenever a development proposal overlaps with the proposed routes, as adopted. Town of Boone staff should ensure that an effective review of all bicycle and pedestrian elements of proposed developments takes place.	Short-Term (2014)
Improve Local Policies	Town Council	Planning & Inspections, Public Works, ATS, NCDOT	Suggested revisions to the Town of Boone UDO are outlined in Appendix C. The changes suggested clarify some basic policy positions regarding future development and the provision of bicycle and pedestrian facilities. Some changes are also suggested for terminology that is more inclusive and Complete Streets-oriented, and reflect the adopted NCDOT Complete Streets policy. Boone should also consider developing and adopting a separate Complete Streets Policy, in addition to the suggested UDO revisions. The existing access management policy should also be revised with assistance from NCDOT, especially for high priority roadways in the corridor overlay districts such as US-421, US-321 and NC 105.	Beginning Winter 2013/2014
Develop Bicycle and Pedestrian Facility Specifications	Public Works	Planning & Inspections, NCDOT	Town staff could prepare these in-house to save resources using the design guidelines of this plan and the project cut-sheets as starting points. Specifically, the resources listed on page A-1 will be very useful in drafting such documents.	Ongoing/ 2014



Task	Lead Agency	Support	Details	Phase
Improve Existing Programs and Launch New Programs	Transportation Committee	Public Works, Planning & Inspections, ATS	Assist in the coordination of programs, such as those described in Appendix B: Program Resources.	Short-Term (2014-2015)
Provide Enforcement and Education Training for Police Officers	Police Department	NCDOT Bike/Ped Division	Provide police officers with training through free online resources available from the National Highway Traffic Safety Administration, and through webinars available through the Association of Pedestrian and Bicycle Professionals. Provide police officers with an informational handout to be used during bicycle and pedestrian-related citations and warnings. Utilize available WatchForMeNC materials, and request that Boone is included when WatchForMeNC is integrated statewide.	Short-Term (2014-2015)
Complete two of the short-term top priority projects	Public Works + NCDOT Division II	High Country COG, NCDOT Bike/Ped Division	Chapter 3 provides a list of bicycle and pedestrian projects with a general priority ranking. Immediate attention to the higher ranking projects will instantly have a large impact on the bicycle and pedestrian environments in Boone. Aim to complete at least two of these projects by the end of 2015.	Short-Term (2014-2015)
Communication & Outreach	ATS, Boone Area Cyclists	Planning & Inspections, High Country COG	ATS should establish a communication campaign to celebrate successes as facilities are developed and otherwise raise awareness of the overall bicycle network and its benefits. A key first task of this group is to design and launch a one-stop website. Set up the one-stop website providing information to residents and tourists on bicycling in the region. To begin, the website can include the maps included in this plan.	Short Term (2014-2015)
Establish a Monitoring Program	Planning & Inspections	Public Works, ATS, Boone Area Cyclists, General Public	ATS should brainstorm specific benchmarks to track through a monitoring program and honor the completion of projects with public events and media coverage.	Ongoing/ Beginning 2014
Maintain pedestrian facilities	Public Works, NCDOT Division II	ATS + General Public (for reporting maintenance needs)	Public Works and NCDOT should make improvements to faded crosswalks and address crosswalks that are missing (see table 2.1)	Ongoing/ Beginning 2014
Notify the Public Works Department of all upcoming roadway reconstruction or resurfacing/restriping projects, no later than the design phase.	Public Works Director, and NCDOT Division II	Planning & Inspections, NCDOT Bike/Ped Division	Provide sufficient time for comments; Incorporate bicycle pedestrian recommendations from this Plan into future updates to the CTP and into future project design plans. If a compromise to the original recommendation is needed, then contact NCDOT Division of Pedestrian and Pedestrian Transportation for guidance on appropriate alternatives.	Ongoing/ Beginning 2014



Task	Lead Agency	Support	Details	Phase
Policy Orientation	All Stakeholders	NCDOT Bike/Ped Division	Become familiar with State and Federal bicycle and pedestrian policies, as outlined in Appendix C.	Short-Term (2014)
Design Orientation	Public Works and NCDOT Division II	NCDOT Bike/Ped Division	Become familiar with the standards set forth in Appendix A of this Plan, as well as state and national standards for bicycle and pedestrian facility design.	Short-Term (2014)
Seek designation as a Walk-Friendly and Bicycle-Friendly Community	Planning & Inspections	Town Council, Public Works, Transportation Committee, ATS	The development and implementation of this plan is an essential first step toward becoming a designated Walk-Friendly or Bicycle-Friendly Community. With ongoing efforts and the short-term work program recommended here, the Town should be in a position to apply again for, and receive at least a Bronze-level status within a few short years.	Mid-Term (2015-2016)



A DESIGN GUIDELINES

Appendix Contents OVERVIEW

Overview (A-1)
Design Needs of Bicyclists (A-2)
Types of Bicyclists (A-4)
Bicycle Facility Selection Guidelines (A-5)
Facility Classification (A-6)
Facility Continua (A-7)
Separated Bikeways at Intersections (A-18)
Signage Programs (A-25)
Retrofitting Existing Streets to Add Bikeways (A-30)
Shared-use Trails and Off-Street Facilities (A-35)
Shared-use Trail Crossings (A-44)
Bikeway Support and Maintenance (A-48)
Standards Compliance (A-50)

The sections that follow serve as an inventory of bicycle design treatments and provide guidelines for their development. These treatments and design guidelines are important because they represent the tools for creating a bicycle-friendly, safe, and accessible community. The guidelines are not, however, a substitute for a more thorough evaluation by a landscape architect or engineer upon implementation of facility improvements. Some improvements may also require cooperation with the NCDOT for specific design solutions. The following standards and guidelines are referred to in this guide.

- The Federal Highway Administration's **Manual on Uniform Traffic Control Devices (MUTCD)** is the primary source for guidance on lane striping requirements, signal warrants, and recommended signage and pavement markings.
- American Association of State Highway and Transportation Officials (AASHTO) **Guide for the Development of Bicycle Facilities**, updated in June 2012 provides guidance on dimensions, use, and layout of specific bicycle facilities.
- The National Association of City Transportation Officials' (NACTO) 2012 **Urban Bikeway Design Guide** is the newest publication of nationally recognized bikeway design standards, and offers guidance on the current state of the practice designs. All of the NACTO Urban Bikeway Design Guide treatments are in use internationally and in many cities around the US.
- Meeting the requirements of the Americans with Disabilities Act (ADA) is an important part of any bicycle facility project. The United States Access Board's proposed **Public Rights-of-Way Accessibility Guidelines (PROWAG)** and the **2010 ADA Standards for Accessible Design (2010 Standards)** contain standards and guidance for the construction of accessible facilities.
- The North Carolina Department of Transportation **Complete Streets Planning and Design Guidelines**, released in 2012, provide NCDOT and municipality staff with a guide to planning and designing streets that meet the needs of all users, including pedestrians, bicyclists, and motor vehicles. The guidelines include detailed information on the processes, street types, and recommendations for creating complete streets in North Carolina.

Should these standards be revised in the future and result in discrepancies with this chapter, the standards should prevail for all design decisions. A qualified engineer or landscape architect should be consulted for the most up to date and accurate cost estimates.



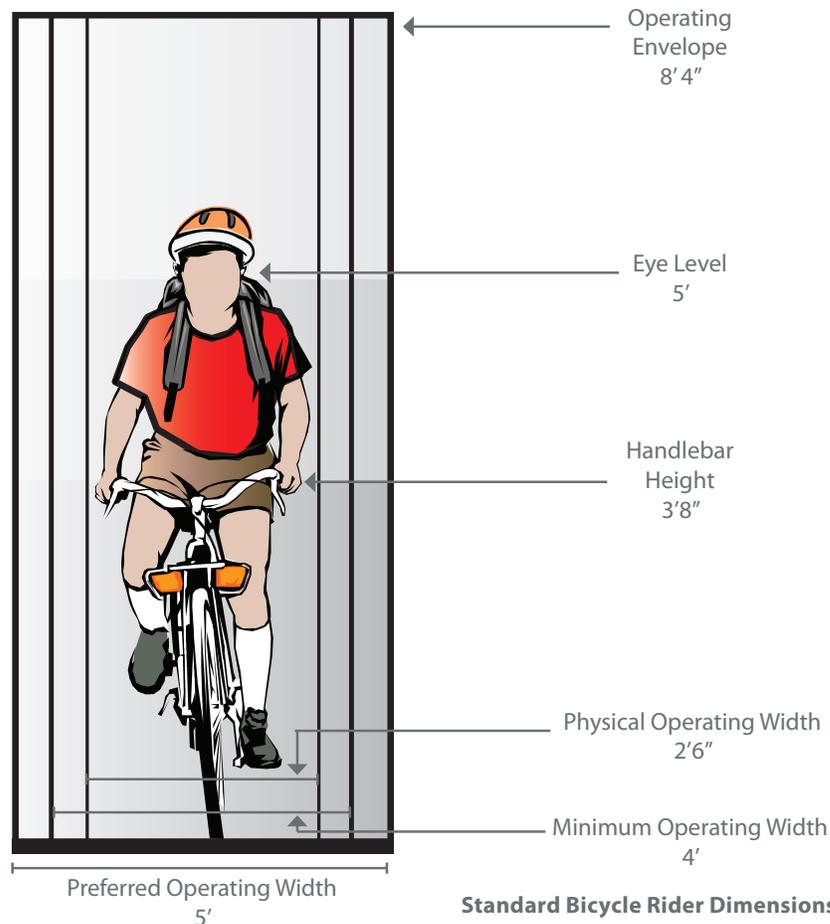
DESIGN NEEDS OF BICYCLISTS

The purpose of this section is to provide the facility designer with an understanding of how bicyclists operate and how their bicycle influences that operation. Bicyclists, by nature, are much more affected by poor facility design, construction, and maintenance practices than motor vehicle drivers. Bicyclists lack the protection from the elements and roadway hazards provided by an automobile's structure and safety features. By understanding the unique characteristics and needs of bicyclists, a facility designer can provide quality facilities and minimize user risk.

BICYCLE AS A DESIGN VEHICLE

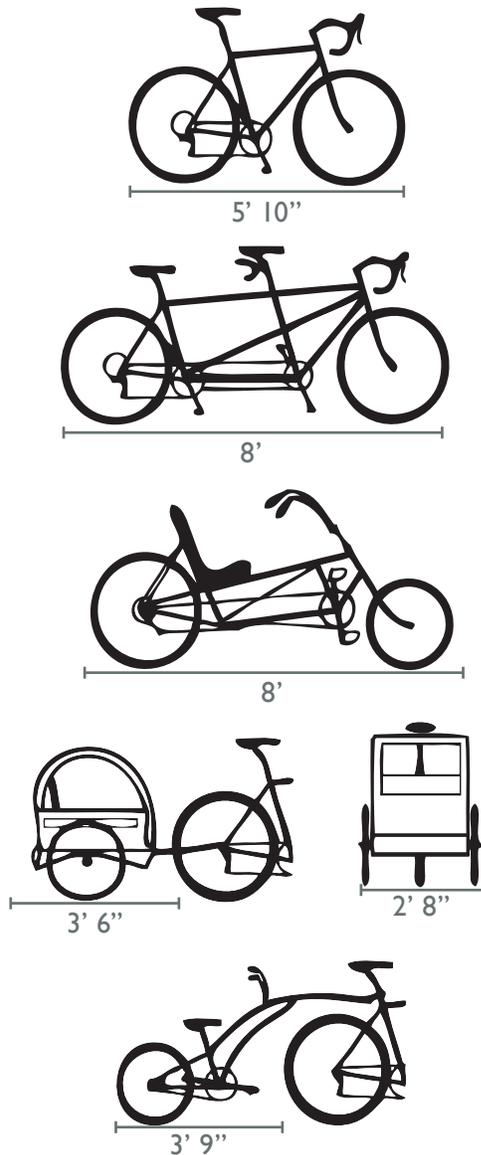
Similar to motor vehicles, bicyclists and their bicycles exist in a variety of sizes and configurations. These variations occur in the types of vehicle (such as a conventional bicycle, a recumbent bicycle or a tricycle), and behavioral characteristics (such as the comfort level of the bicyclist). The design of a bikeway should consider reasonably expected bicycle types on the facility and utilize the appropriate dimensions.

The figure below illustrates the operating space and physical dimensions of a typical adult bicyclist, which are the basis for typical facility design. Bicyclists require clear space to operate within a facility. This is why the minimum operating width is greater than the physical dimensions of the bicyclist. Bicyclists prefer five feet or more operating width, although four feet may be minimally acceptable.





In addition to the design dimensions of a typical bicycle, there are many other commonly used pedal-driven cycles and accessories to consider when planning and designing bicycle facilities. The most common types include tandem bicycles, recumbent bicycles, and trailer accessories. The figure and table below summarize the typical dimensions for bicycle types.



Bicycle as Design Vehicle - Typical Dimensions

Source: AASHTO Guide for the Development of Bicycle Facilities, 3rd Edition *AASHTO does not provide typical dimensions for tricycles.

Design Speed Expectations

The expected speed that different types of bicyclists can maintain under various conditions also influences the design of facilities such as shared-use trails. The table to the right provides typical bicyclist speeds for a variety of conditions.

BIKE AS DESIGN VEHICLE - TYPICAL DIMENSIONS

Bicycle Type	Feature	Typical Dimensions
Upright Adult Bicyclist	Physical width	2 ft 6 in
	Operating width (Minimum)	4 ft
	Operating width (Preferred)	5 ft
	Physical length	5 ft 10 in
	Physical height of handlebars	3 ft 8 in
	Operating height	8 ft 4 in
	Eye height	5 ft
	Vertical clearance to obstructions (tunnel height, lighting, etc)	10 ft
Approximate center of gravity	2 ft 9 in - 3 ft 4 in	
Recumbent Bicyclist	Physical length	8 ft
	Eye height	3 ft 10 in
Tandem Bicyclist	Physical length	8 ft
Bicyclist with child trailer	Physical length	10 ft
	Physical width	2 ft 8 in

Bicycle as Design Vehicle - Design Speed Expectations

Bicycle Type	Feature	Typical Speed
Upright Adult Bicyclist	Paved level surfacing	15 mph
	Crossing Intersections	10 mph
	Downhill	30 mph
	Uphill	5-12 mph
Recumbent Bicyclist	Paved level surfacing	18 mph

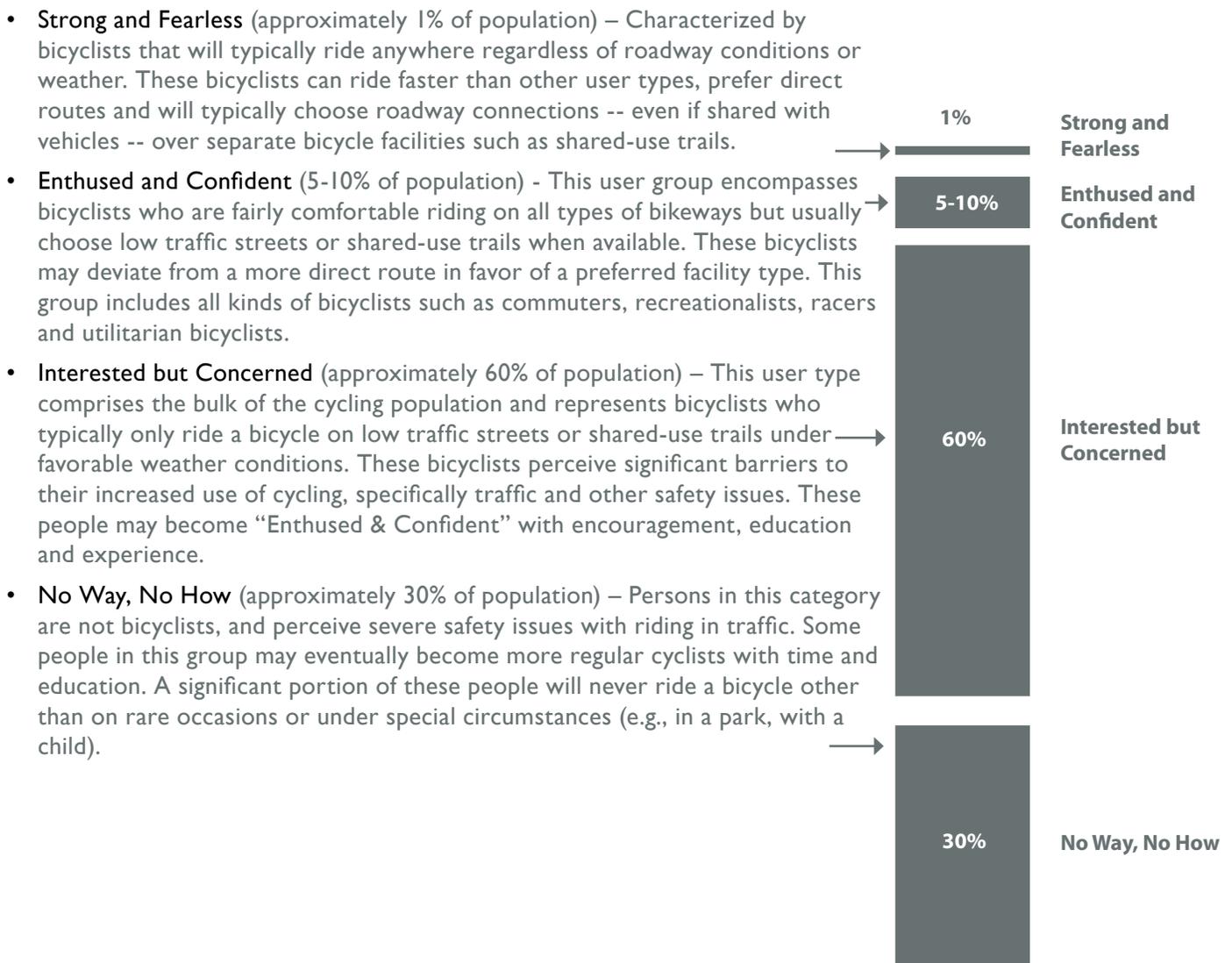
*Tandem bicycles and bicyclists with trailers have typical speeds equal to or less than upright adult bicyclists.



TYPES OF BICYCLISTS

It is important to consider bicyclists of all skill levels when creating a non-motorized plan or project. Bicyclist skill level greatly influences expected speeds and behavior, both in separated bikeways and on shared roadways. Bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people.

The bicycle planning and engineering professions currently use several systems to classify the population, which can assist in understanding the characteristics and infrastructure preferences of different bicyclists. The most conventional framework classifies the “design cyclist” as **Advanced**, **Basic**, or **Child**¹. A more detailed understanding of the US population as a whole is illustrated in the figure below. Developed by planners in Portland, OR² and supported by data collected nationally since 2005, this classification provides the following alternative categories to address varying attitudes towards bicycling in the US:



1 *Selecting Roadway Design Treatments to Accommodate Bicycles.* (1994). Publication No. FHWA-RD-92-073
 2 *Four Types of Cyclists.* (2009). Roger Geller, City of Portland Bureau of Transportation. <http://www.portlandonline.com/transportation/index.cfm?&a=237507>

Typical Distribution of Bicyclist Types



BICYCLE FACILITY SELECTION GUIDELINES

This section summarizes the bicycle facility selection typology developed for the Town of Boone. The specific facility type that should be provided depends on the surrounding environment (e.g. auto speed and volume, topography, and adjacent land use) and expected bicyclist needs (e.g. bicyclists commuting on a highway versus students riding to school on residential streets).

FACILITY SELECTION GUIDELINES

There are no ‘hard and fast’ rules for determining the most appropriate type of bicycle facility for a particular location – roadway speeds, volumes, right-of-way width, presence of parking, adjacent land uses, and expected bicycle user types are all critical elements of this decision. Studies find that the most significant factors influencing bicycle use are motor vehicle traffic volumes and speeds. Additionally, most bicyclists prefer facilities separated from motor vehicle traffic or located on local roads with low motor vehicle traffic speeds and volumes. Because off-street trailways are physically separated from the roadway, they are perceived as safe and attractive routes for bicyclists who prefer to avoid motor vehicle traffic. Consistent use of treatments and application of bikeway facilities allow users to anticipate whether they would feel comfortable riding on a particular facility, and plan their trips accordingly. This section provides guidance on various factors that affect the type of facilities that should be provided.



This section includes:

- Facility Classification
- Facility Continua

FACILITY CLASSIFICATION

DESCRIPTION

Consistent with bicycle facility classifications throughout the nation, these Bicycle Facility Design Guidelines identify the following classes of facilities by degree of separation from motor vehicle traffic.

Shared Roadways are bikeways where bicyclists and cars operate within the same travel lane, either side by side or in single file depending on roadway configuration. The most basic type of bikeway is a signed shared roadway. This facility provides continuity with other bicycle facilities (usually bike lanes), or designates preferred routes through high-demand corridors.

Shared Roadways may also be designated by pavement markings, signage and other treatments including directional signage, traffic diverters, chicanes, chokers and /or other traffic calming devices to reduce vehicle speeds or volumes. Shared-lane markings are included in this class of treatments.

Separated Bikeways, such as bike lanes, use signage and striping to delineate the right-of-way assigned to bicyclists and motorists. Bike lanes encourage predictable movements by both bicyclists and motorists. Paved Shoulders are also included in this classification.

Cycle Tracks are exclusive bike facilities that combine the user experience of a separated trail with the on-street infrastructure of conventional bike lanes.

Shared-use Trails are facilities separated from roadways for use by bicyclists and pedestrians. Greenway trails and side trails are included in this classification.





FACILITY CONTINUA

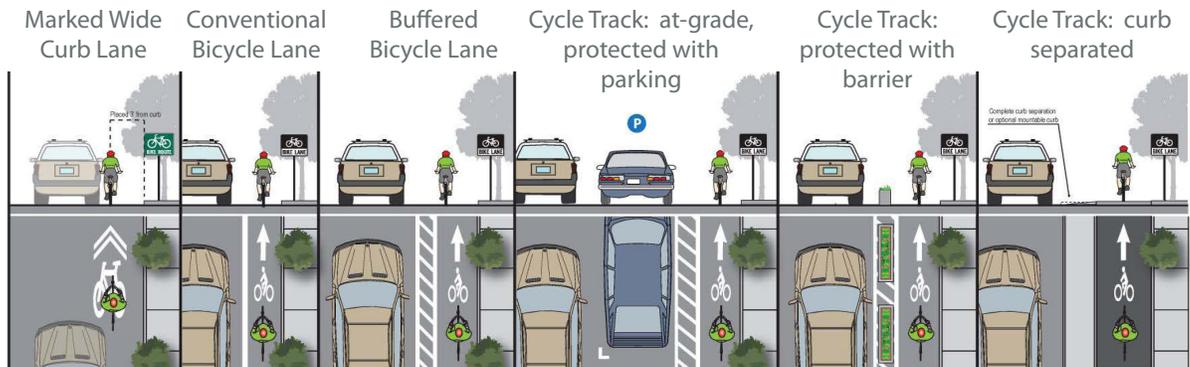
The following continua illustrate the range of bicycle facilities applicable to various roadway environments, based on the roadway type and desired degree of separation. Engineering judgment, traffic studies, previous municipal planning efforts, community input, and local context should be used to refine criteria when developing bicycle facility recommendations for a particular street. In some corridors, it may be desirable to construct facilities to a higher level of treatment than those recommended in relevant planning documents in order to enhance user safety and comfort. In other cases, existing and/or future motor vehicle speeds and volumes may not justify the recommended level of separation, and a less intensive treatment may be acceptable.



Arterial/Highway Bikeway Continuum (without curb and gutter)



Arterial/Highway Bikeway Continuum (with curb and gutter)



Collector Bikeway Continuum



SHARED ROADWAYS

On shared roadways, bicyclists and motor vehicles use the same roadway space. These facilities are typically used on roads with low speeds and traffic volumes, however they can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Shared roadways employ a large variety of treatments from simple signage and shared lane markings to more complex treatments including directional signage, traffic diverters, chicanes, chokers, and/or other traffic calming devices to reduce vehicle speeds or volumes.

This section includes:

- Signed Shared Roadway
- Marked Shared Roadway
- Bicycle Boulevard





SIGNED SHARED ROADWAYS

DESCRIPTION

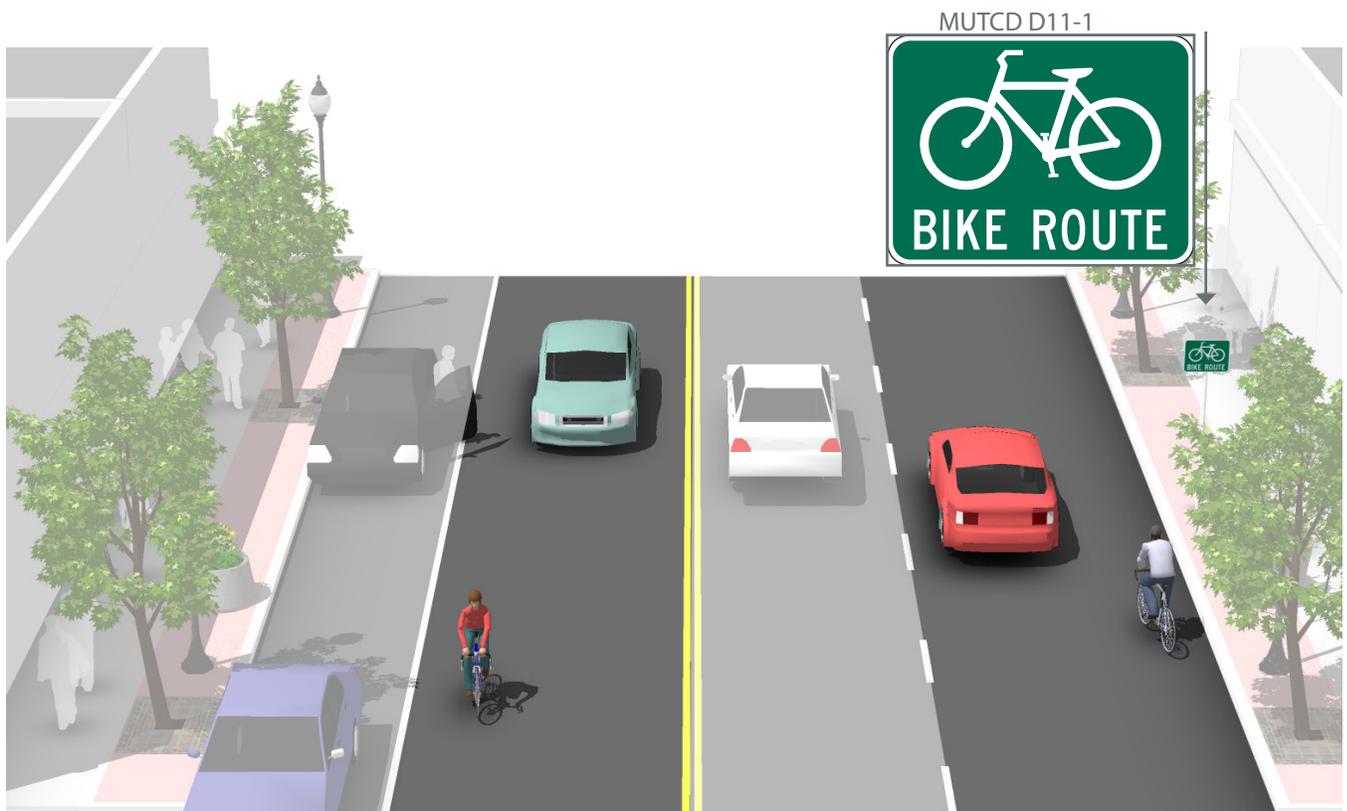
Signed Shared Roadways are facilities shared with motor vehicles. They are typically used on roads with low speeds and traffic volumes, however can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

GUIDANCE

Lane width varies depending on roadway configuration.

Bicycle Route signage (D11-1) should be applied at intervals frequent enough to keep bicyclists informed of changes in route direction and to remind motorists of the presence of bicyclists. Commonly, this includes placement at:

- Beginning or end of Bicycle Route.
- At major changes in direction or at intersections with other bicycle routes.
- At intervals along bicycle routes not to exceed ½ mile.



Discussion

Signed Shared Roadways serve either to provide continuity with other bicycle facilities (usually bike lanes) or to designate preferred routes through high-demand corridors.

This configuration differs from a **Bicycle Boulevard** due to a lack of traffic calming, wayfinding, pavement markings and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
FHWA. (2009). Manual on Uniform Traffic Control Devices.

Materials and Maintenance

Maintenance needs for bicycle wayfinding signs are similar to other signs, and will need periodic replacement due to wear.



MARKED SHARED ROADWAY

DESCRIPTION

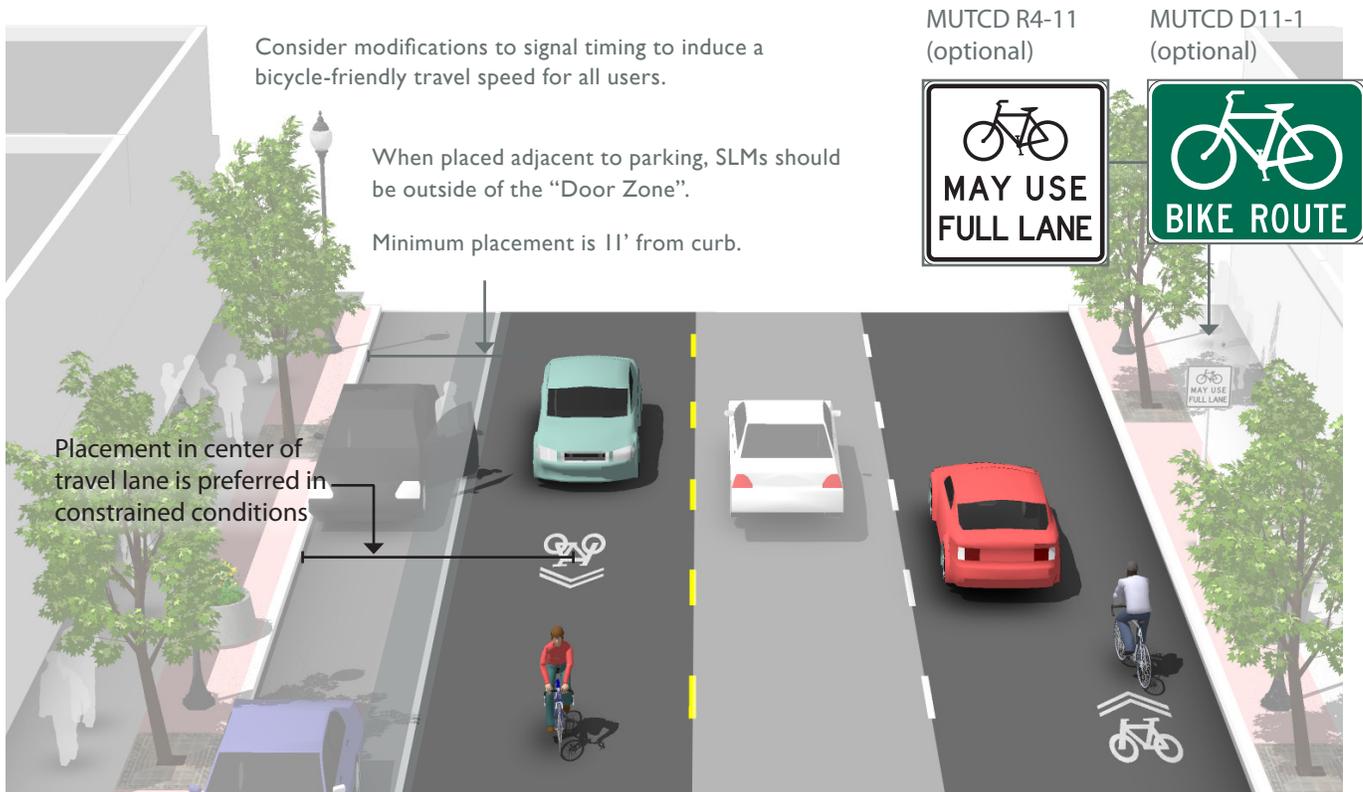
A marked shared roadway is a general purpose travel lane marked with shared lane markings (SLM) used to encourage bicycle travel and proper positioning within the lane.

In constrained conditions, the SLMs are placed in the middle of the lane to discourage unsafe passing by motor vehicles. On a wide outside lane, the SLMs can be used to promote bicycle travel to the right of motor vehicles.

In all conditions, SLMs should be placed outside of the door zone of parked cars.

GUIDANCE

- In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- Minimum placement of SLM marking centerline is 11 feet from edge of curb where on-street parking is present, 4 feet from edge of curb with no parking. If parking lane is wider than 7.5 feet, the SLM should be moved further out accordingly.



Discussion

Bike Lanes should be considered on roadways with outside travel lanes wider than 15 feet, or where other lane narrowing or removal strategies may provide adequate road space. SLMs shall not be used on **shoulders**, in designated **Bike Lanes**, or to designate **Bicycle Detection** at signalized intersections. (MUTCD 9C.07)

This configuration differs from a **Bicycle Boulevard** due to a lack of traffic calming, wayfinding, and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 NACTO. (2012). Urban Bikeway Design Guide.
 NCDOT. (2000). Traditional Neighborhood Development (TND) Guidelines.

Materials and Maintenance

Placing SLMs between vehicle tire tracks will increase the life of the markings and minimize the long-term cost of the treatment.



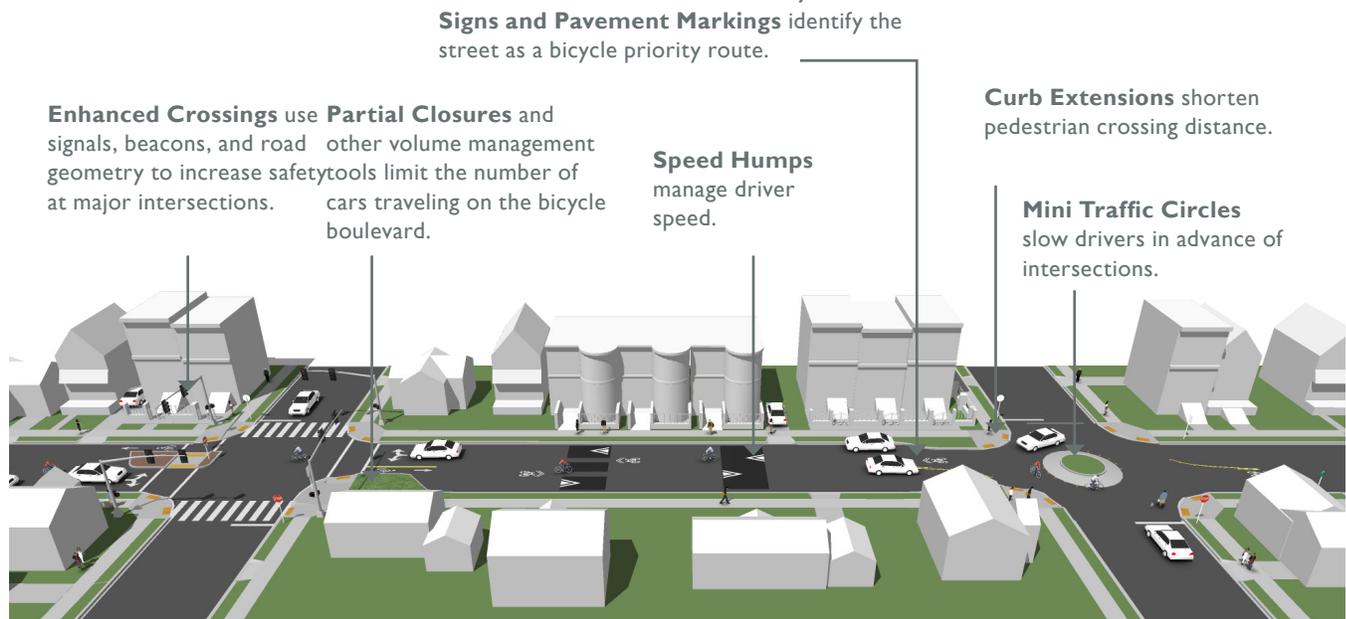
BICYCLE BOULEVARD

GUIDANCE

DESCRIPTION

Bicycle boulevards are a special class of shared roadways designed for a broad spectrum of bicyclists. They are low-volume, low-speed local streets modified to enhance bicyclist comfort by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through-trips by non-local motorized traffic.

- Signs and pavement markings are the minimum treatments necessary to designate a street as a bicycle boulevard.
- Bicycle boulevards should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Implement volume control treatments based on the context of the bicycle boulevard, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day.
- Intersection crossings should be designed to enhance safety and minimize delay for bicyclists.



Discussion

Bicycle boulevard retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers along the bicycle boulevard and compromise safety.

Traffic calming can deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Additional References and Guidelines

Alta Planning + Design and IBPL. (2009). Bicycle Boulevard Planning and Design Handbook.

BikeSafe. (No Date). Bicycle countermeasure selection system.

Ewing, Reid. (1999). Traffic Calming: State of the Practice.

Ewing, Reid and Brown, Steven. (2009). U.S. Traffic Calming Manual.

Materials and Maintenance

Vegetation should be regularly trimmed to maintain visibility and attractiveness.

SEPARATED BIKEWAYS

Designated exclusively for bicycle travel, separated bikeways are segregated from vehicle travel lanes by striping, and can include pavement stencils and other treatments. Separated bikeways are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation.

Separated bikeways can increase safety and promote proper riding by:

- Defining road space for bicyclists and motorists, reducing the possibility that motorists will stray into the bicyclists' trail.
- Discouraging bicyclists from riding on the sidewalk.
- Reducing the incidence of wrong way riding.
- Reminding motorists that bicyclists have a right to the road.



This section includes:

- Shoulder Bikeways
- Bicycle Lanes
- Buffered Bike Lanes
- Uphill Bicycle Climbing Lane
- Cycle Tracks





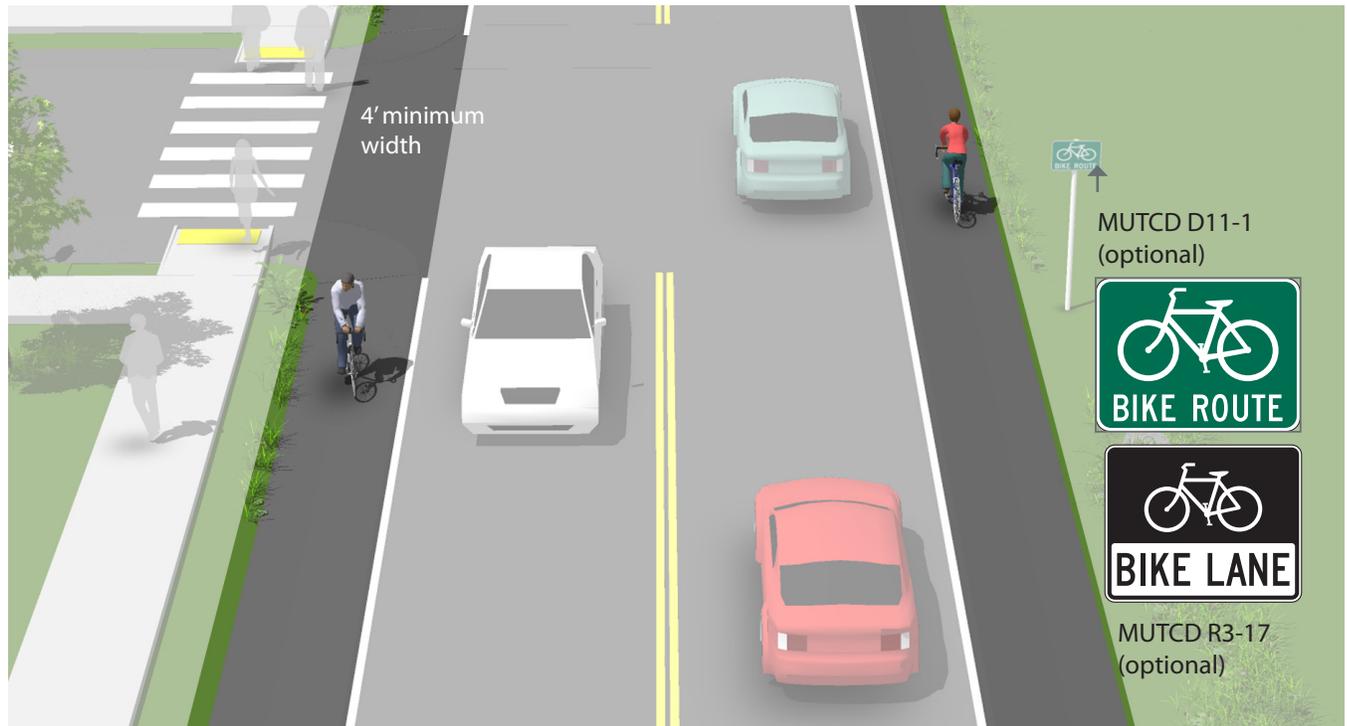
SHOULDER BIKEWAYS

DESCRIPTION

Typically found in less-dense areas, shoulder bikeways are paved roadways with striped shoulders (4'+) wide enough for bicycle travel. Shoulder bikeways often, but not always, include signage alerting motorists to expect bicycle travel along the roadway. Shoulder bikeways should be considered a temporary treatment, with full bike lanes planned for construction when the roadway is widened or completed with curb and gutter. This type of treatment is not typical in urban areas and should only be used where constraints exist.

GUIDANCE

- 4 foot minimum width. Greater widths preferred.
- If it is not possible to meet minimum bicycle lane dimensions, a reduced width paved shoulder can still improve conditions for bicyclists on constrained roadways. In these situations, a minimum of 3 feet of operating space should be provided.



Discussion

A wide outside lane may be sufficient accommodation for bicyclists on streets with insufficient width for bike lanes but which do have space available to provide a wider (14'-16') outside travel lane. Consider configuring as a **marked shared roadway** in these locations.

Where feasible, **roadway widening** should be performed with pavement resurfacing jobs.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 NCDOT. (1994). Bicycle Facilities Planning and Design Guidelines.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Shoulder bikeways should be cleared of snow through routine snow removal operations.



BICYCLE LANES

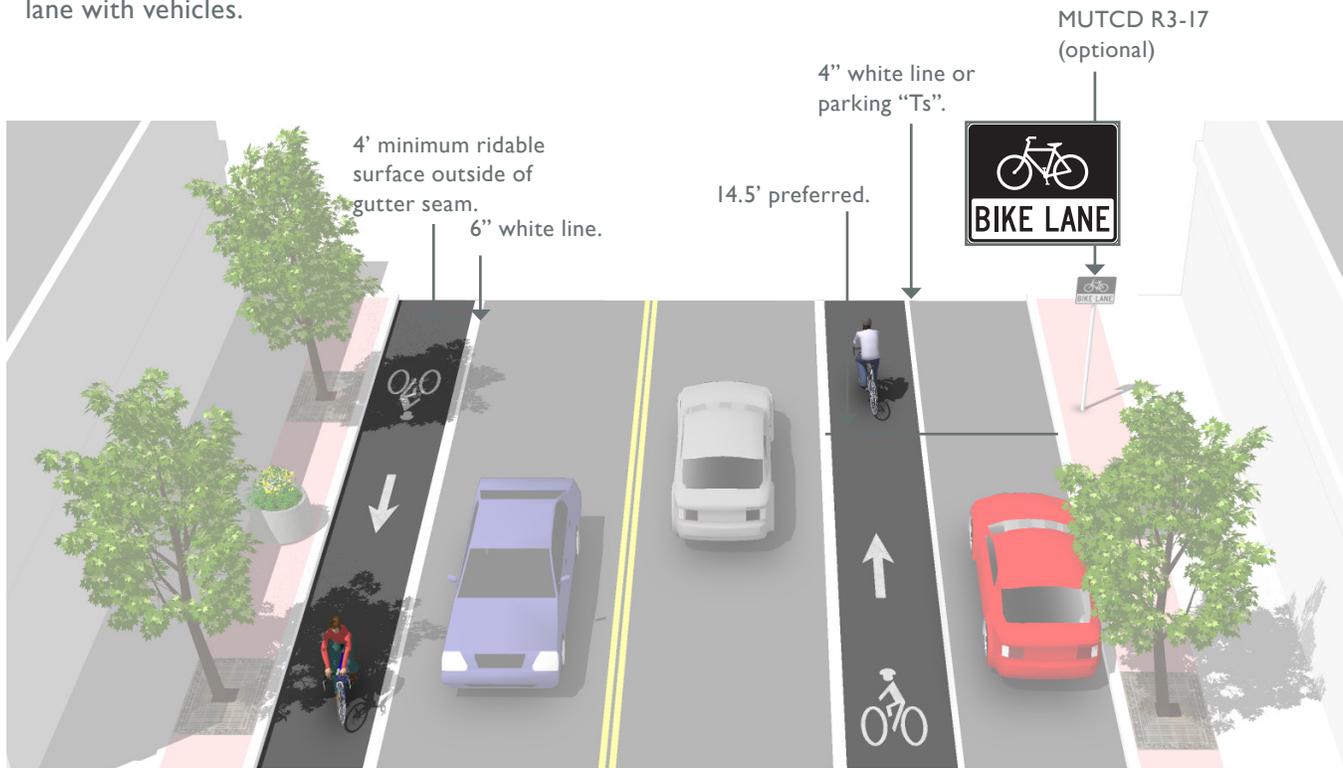
GUIDANCE

DESCRIPTION

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is located adjacent to motor vehicle travel lanes and is used in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge or parking lane.

Many bicyclists, particularly less experienced riders, are more comfortable riding on a busy street if it has a striped and signed bikeway than if they are expected to share a lane with vehicles.

- 4 foot minimum when no curb and gutter is present.
- 5 foot minimum when adjacent to curb and gutter or 3 feet more than the gutter pan width if the gutter pan is wider than 2 feet.
- 14.5 foot preferred from curb face to edge of bike lane. (12 foot minimum).
- 7 foot maximum width for use adjacent to arterials with high travel speeds. Greater widths may encourage motor vehicle use of bike lane.



Discussion

Wider bicycle lanes are desirable in certain situations such as on higher speed arterials (45 mph+) where use of a wider bicycle lane would increase separation between passing vehicles and bicyclists. Appropriate signing and stenciling is important with wide bicycle lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane. Consider **Buffered Bicycle Lanes** when further separation is desired.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 NACTO. (2012). Urban Bikeway Design Guide.
 NCDOT. (2000). Traditional Neighborhood Development (TND) Guidelines.
 NCDOT. (1994). Bicycle Facilities Planning and Design Guidelines.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.



BUFFERED BIKE LANES

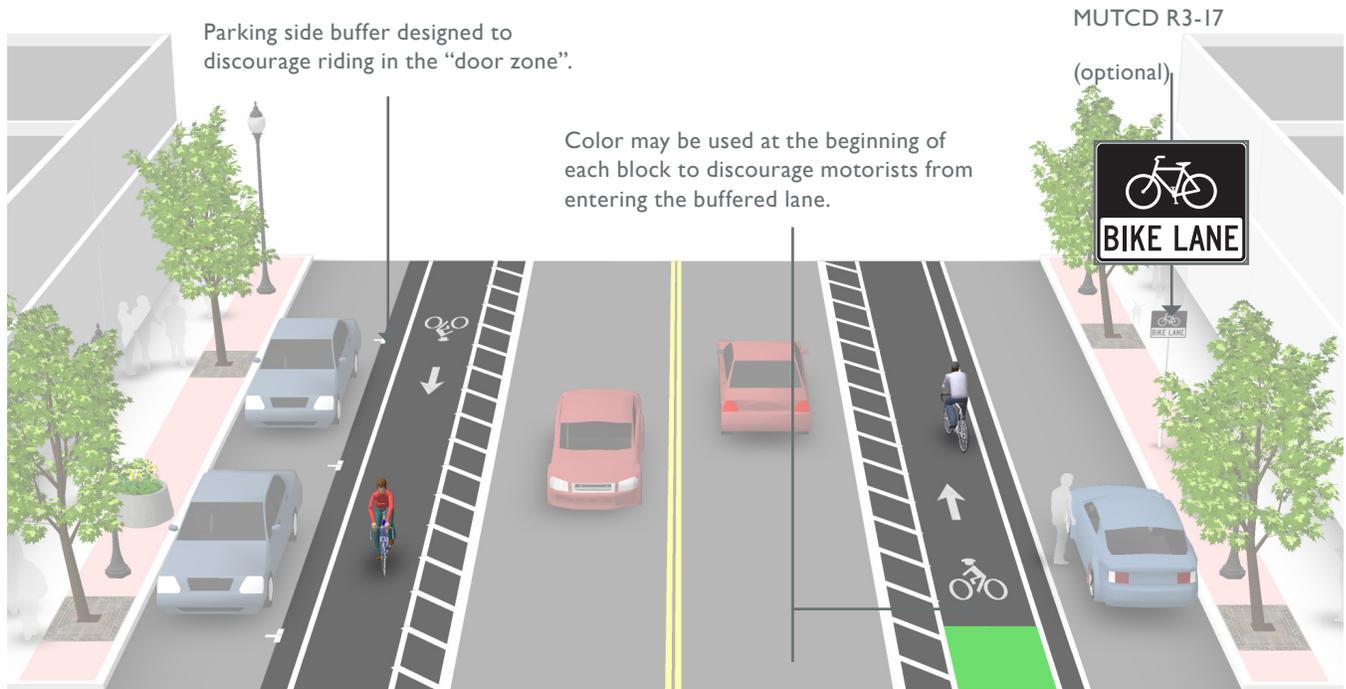
DESCRIPTION

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. Buffered bike lanes are allowed as per MUTCD guidelines for buffered preferential lanes (section 3D-01).

Buffered bike lanes are designed to increase the space between the bike lane and the travel lane or parked cars. This treatment is appropriate for bike lanes on roadways with high motor vehicle traffic volumes and speed, adjacent to parking lanes, or a high volume of truck or oversized vehicle traffic.

GUIDANCE

- Where bicyclist volumes are high or where bicyclist speed differentials are significant, the desired bicycle travel area width is 7 feet.
- Buffers should be at least 2 feet wide. If 3 feet or wider, mark with diagonal or chevron hatching. For clarity at driveways or minor street crossings, consider a dotted line or colored pavement for the inside buffer boundary where cars are expected to cross.



Discussion

Frequency of right turns by motor vehicles at major intersections should determine whether continuous or truncated buffer striping should be used approaching the intersection. Commonly configured as a buffer between the bicycle lane and motor vehicle travel lane, a parking side buffer may also be provided to help bicyclists avoid the 'door zone' of parked cars.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices. (3D-01)
 NACTO. (2012). Urban Bikeway Design Guide.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.



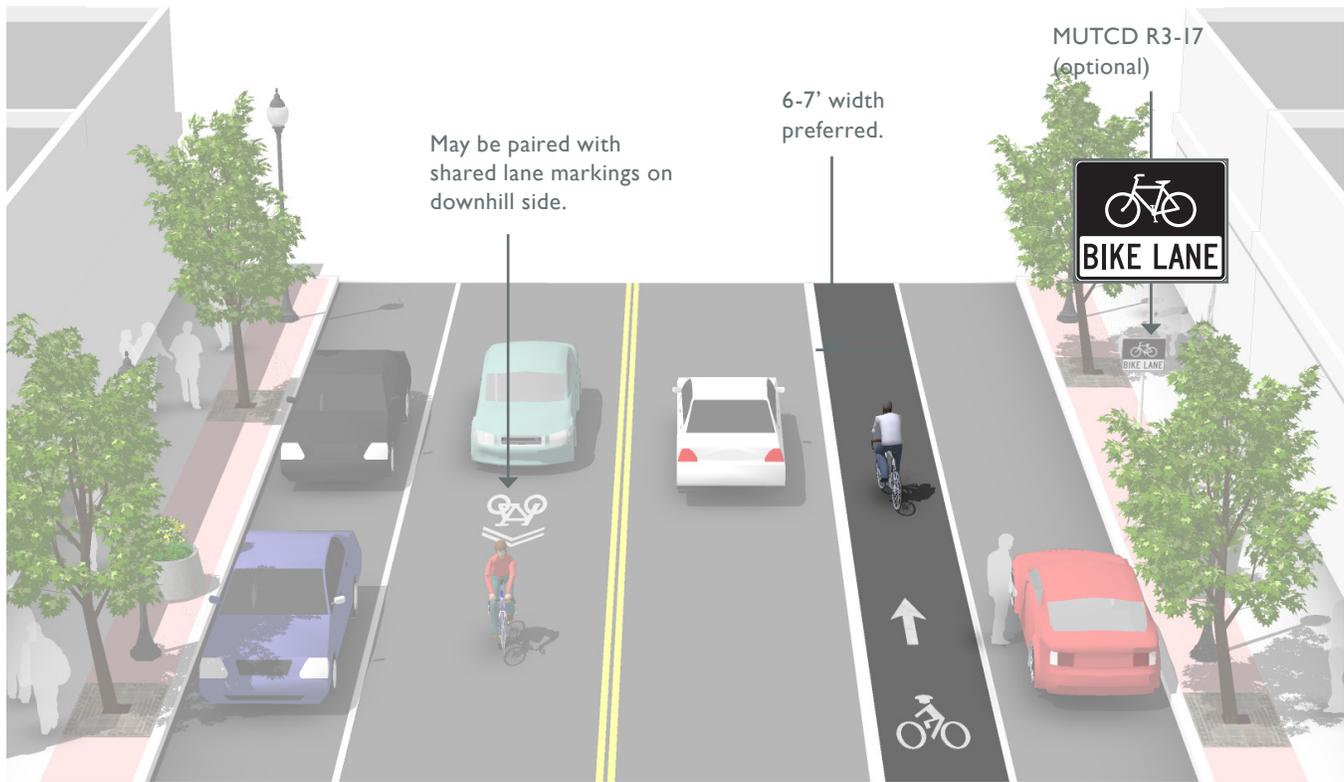
UPHILL BICYCLE CLIMBING LANE

DESCRIPTION

Uphill bike lanes (also known as “climbing lanes”) enable motorists to safely pass slower-speed bicyclists, thereby improving conditions for both travel modes.

GUIDANCE

- Uphill bike lanes should be 6-7 feet wide (wider lanes are preferred because extra maneuvering room on steep grades can benefit bicyclists).
- Can be combined with **Shared Lane Markings** for downhill bicyclists who can more closely match prevailing traffic speeds.



Discussion

This treatment is typically found on retrofit projects as newly constructed roads should provide adequate space for bicycle lanes in both directions of travel. Accommodating an uphill bicycle lane often includes delineating on-street parking (if provided), narrowing travel lanes and/or shifting the centerline if necessary.

Additional References and Guidelines

- NACTO. (2012). Urban Bikeway Design Guide.
- AASHTO. (2012). Guide for the Development of Bicycle Facilities.
- FHWA. (2009). Manual on Uniform Traffic Control Devices.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.



CYCLE TRACKS

DESCRIPTION

A cycle track is an exclusive bike facility that combines the user experience of a separated trail with the on-street infrastructure of a conventional bike lane. A cycle track is physically separated from motor traffic and distinct from the sidewalk. Cycle tracks have different forms but all share common elements—they provide space that is intended to be exclusively or primarily used by bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks.

Raised cycle tracks may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk to separate the cycle track from the pedestrian area.

GUIDANCE

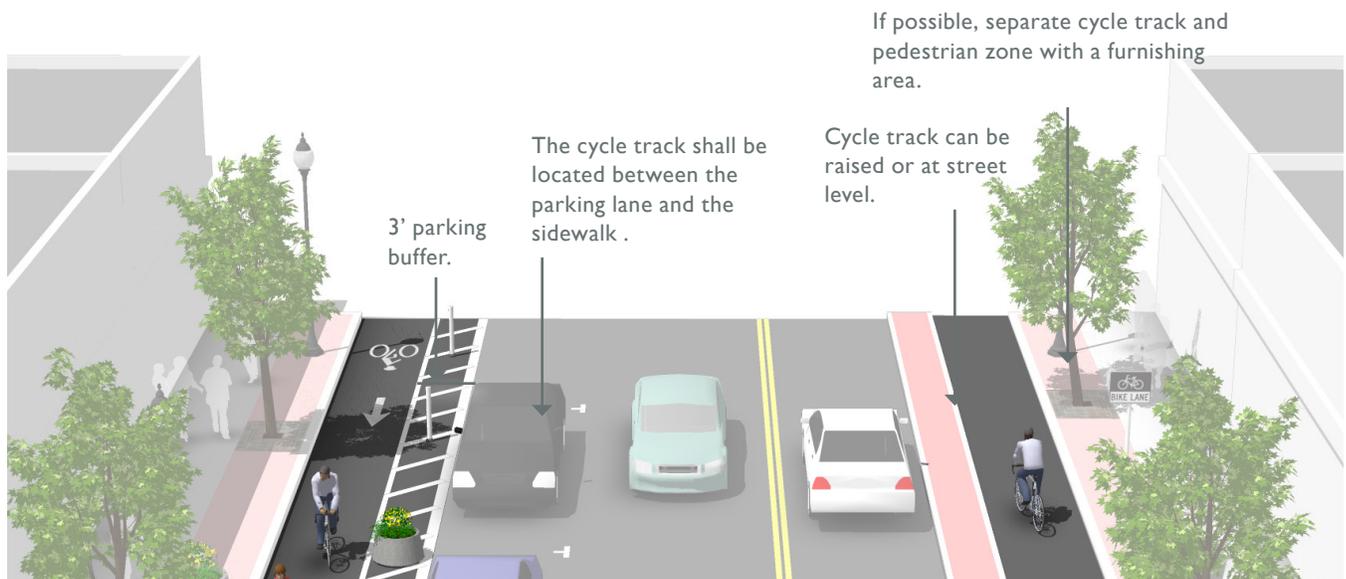
Cycle tracks should ideally be placed along streets with long blocks and few driveways or mid-block access points for motor vehicles.

ONE-WAY CYCLE TRACKS

- 7 foot recommended minimum to allow passing. 5 foot minimum width in constrained locations.

TWO-WAY CYCLE TRACKS

- Cycle tracks located on one-way streets have fewer potential conflict areas than those on two-way streets.
- 12 foot recommended minimum for two-way facility. 8 foot minimum in constrained locations



Discussion

Special consideration should be given at transit stops to manage bicycle and pedestrian interactions. Driveways and minor street crossings are unique challenges to cycle track design. Parking should be prohibited within 30 feet of the intersection to improve visibility. Color, yield markings and “Yield to Bikes” signage should be used to identify the conflict area and make it clear that the cycle track has priority over entering and exiting traffic. If configured as a raised cycle track, the crossing should be raised so that the sidewalk and cycle track maintain their elevation through the crossing.

Additional References and Guidelines

NACTO. (2012). Urban Bikeway Design Guide.

Materials and Maintenance

In cities with winter climates, barrier separated and raised cycle tracks may require special equipment for snow removal.

SEPARATED BIKEWAYS AT INTERSECTIONS

Intersections are junctions at which different modes of transportation meet and facilities overlap. An intersection facilitates the interchange between bicyclists, motorists, pedestrians and other modes in order to advance traffic flow in a safe and efficient manner. Designs for intersections with bicycle facilities should reduce conflict between bicyclists (and other vulnerable road users) and vehicles by heightening the level of visibility, denoting clear right-of-way and facilitating eye contact and awareness with other modes. Intersection treatments can improve both queuing and merging maneuvers for bicyclists, and are often coordinated with timed or specialized signals.

The configuration of a safe intersection for bicyclists may include elements such as color, signage, medians, signal detection and pavement markings. Intersection design should take into consideration existing and anticipated bicyclist, pedestrian and motorist movements. In all cases, the degree of mixing or separation between bicyclists and other modes is intended to reduce the risk of crashes and increase bicyclist comfort. The level of treatment required for bicyclists at an intersection will depend on the bicycle facility type used, whether bicycle facilities are intersecting, and the adjacent street function and land use.



This section includes:

- Bike Lanes at Right Turn Only Lanes
- Colored Bike Lanes in Conflict Areas
- Combined Bike Lane/Turn Lane
- Intersection Crossing Markings
- Bicycles at Single Lane Roundabouts





BIKE LANES AT RIGHT TURN ONLY LANES

DESCRIPTION

The appropriate treatment at right-turn lanes is to place the bike lane between the right-turn lane and the right-most through lane or, where right-of-way is insufficient, to use a **shared bike lane/turn lane**.

The design (right) illustrates a bike lane pocket, with signage indicating that motorists should yield to bicyclists through the conflict area.

GUIDANCE

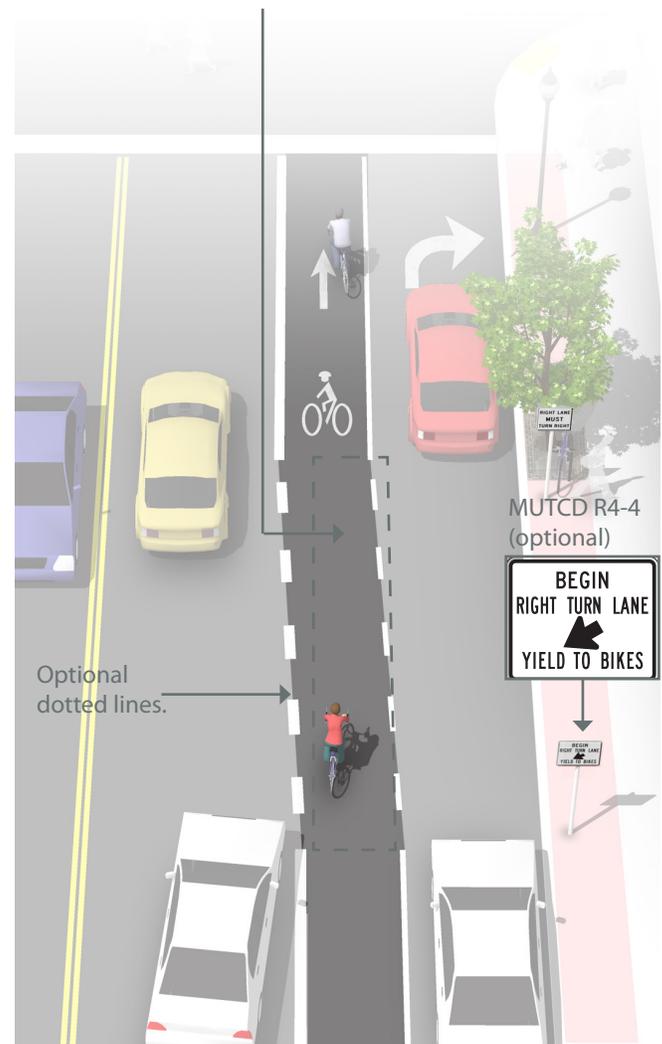
At auxiliary right turn only lanes (add lane):

- Continue existing bike lane width; standard width of 5 to 6 feet or 4 feet in constrained locations.
- Use signage to indicate that motorists should yield to bicyclists through the conflict area.
- Consider using **colored conflict areas** to promote visibility of the mixing zone.

Where a through lane becomes a right turn only lane:

- Do not define a dotted line merging trail for bicyclists.
- Drop the bicycle lane in advance of the merge area.
- Use shared lane markings to indicate shared use of the lane in the merging zone.

Colored pavement may be used in the weaving area to increase visibility and awareness of potential conflict.



Discussion

For other potential approaches to providing accommodations for bicyclists at intersections with turn lanes, please see **shared bike lane/turn lane**, **bicycle signals**, and **colored bike facilities**.

Additional References and Guidelines

AASHTO. (2012). *Guide for the Development of Bicycle Facilities*.
 FHWA. (2009). *Manual on Uniform Traffic Control Devices*.
 NACTO. (2012). *Urban Bikeway Design Guide*.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.



COLORED BIKE LANES IN CONFLICT AREAS

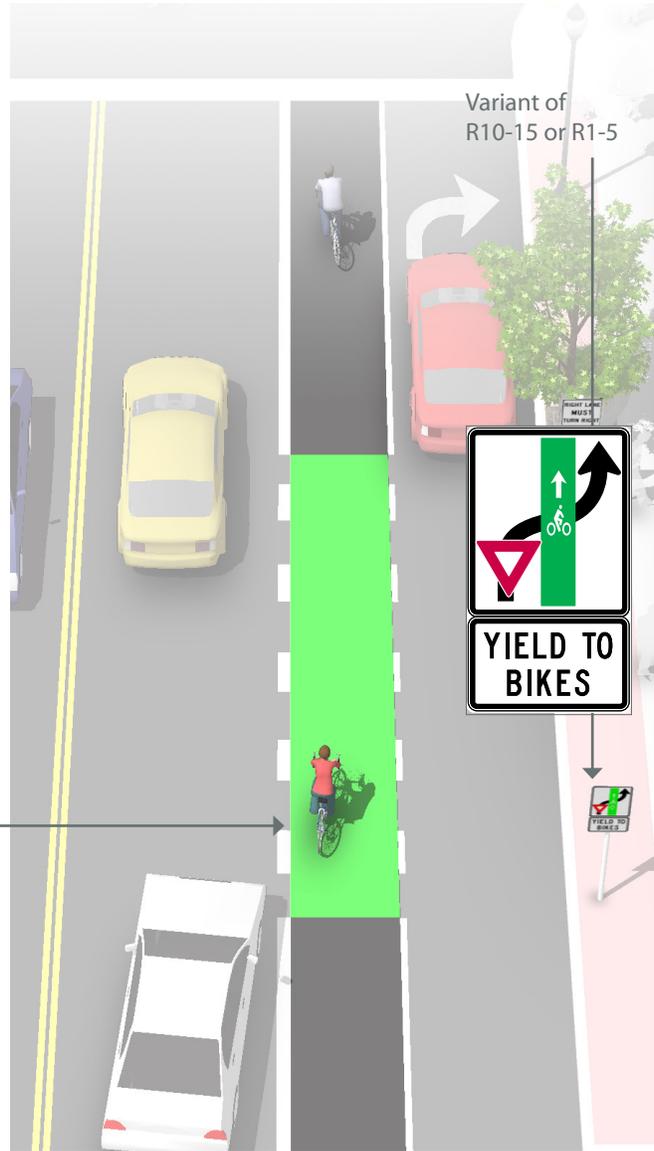
DESCRIPTION

Colored pavement within a bicycle lane increases the visibility of the facility and reinforces priority of bicyclists in conflict areas.

GUIDANCE

- Green colored pavement was given interim approval by the Federal Highways Administration in March 2011. See interim approval for specific color standards.
- The colored surface should be skid resistant and retro-reflective.
- A “Yield to Bikes” sign should be used at intersections or driveway crossings to reinforce that bicyclists have the right-of-way in colored bike lane areas.

Normal white dotted edge lines should define colored space.



Discussion

Evaluations performed in Portland, OR, St. Petersburg, FL and Austin, TX found that significantly more motorists yielded to bicyclists and slowed or stopped before entering the conflict area after the application of the colored pavement when compared with an uncolored treatment.

Additional References and Guidelines

FHWA. (2011). Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10

NACTO. (2012). Urban Bikeway Design Guide.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.



BICYCLE LANE TRANSIT BYPASS

DESCRIPTION

The bicycle lane transit bypass is a channelized lane for bicycles designed to allow bicyclists to pass stopped buses, and prevent conflicts with buses pulling to the curb. This is particularly helpful on corridors with high volumes of transit vehicles and bicyclists, where “leapfrogging” may occur.

GUIDANCE

- Appropriate in areas with high volumes of buses and bicyclists.
- 6 foot minimum width bypass lane.
- Transit shelter requires adequate transit island width. 8 ft preferred.
- Transit island length: 40-75 ft

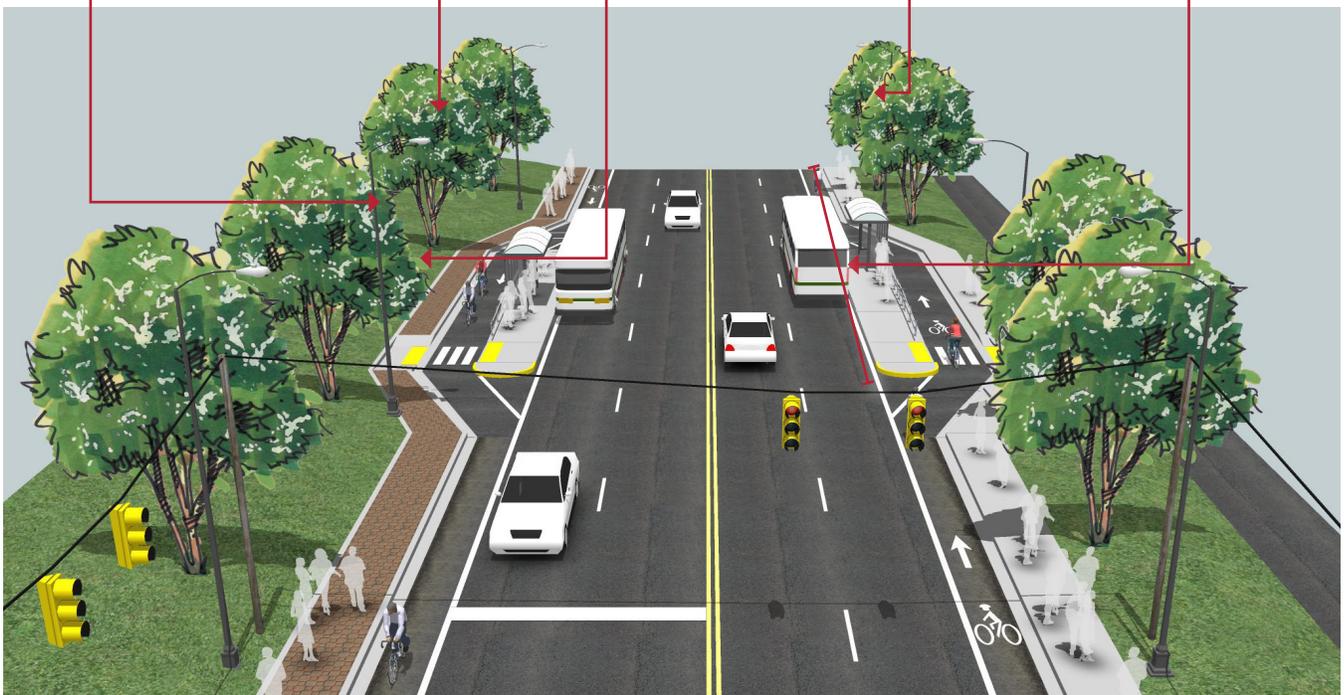
Bypass bike lane: 6 ft min.

Taper varies- gradual transition preferred.

Consider railing to manage bike/pedestrian conflicts.

Transit shelter requires adequate transit island width. 8 ft preferred.

Transit island length: 40-75 ft



Discussion

Ensure an adequate width bicycle lane where the bypass lane rejoins the roadway so that bicyclists do not encroach into adjacent lanes.

Conflicts with pedestrians may be increased over conventional bus stop designs. Consider railings to direct pedestrians to a single location where they may cross to the sidewalk.

Additional References and Guidelines

NACTO. (2012). Urban Bikeway Design Guide.

Materials and Maintenance

The channelized bicycle lane may require additional sweeping to maintain free of debris.



COMBINED BIKE LANE / TURN LANE

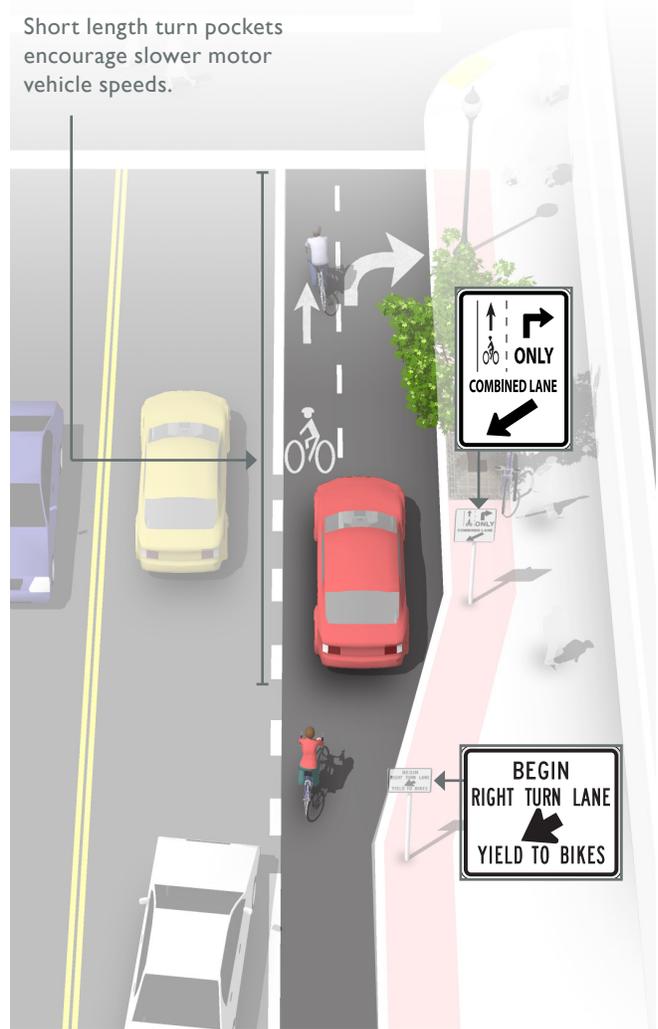
GUIDANCE

- Maximum shared turn lane width is 13 feet; narrower is preferable.
- Bike Lane pocket should have a minimum width of 4 feet with 5 feet preferred.
- A dotted 4 inch line and bicycle lane marking should be used to clarify bicyclist positioning within the combined lane, without excluding cars from the suggested bicycle area.
- A “Right Turn Only” sign with an “Except Bicycles” plaque may be needed to make it legal for through bicyclists to use a right turn lane.

DESCRIPTION

The combined bicycle/right turn lane places a standard-width bike lane on the left side of a dedicated right turn lane. A dotted line delineates the space for bicyclists and motorists within the shared lane. This treatment includes signage advising motorists and bicyclists of proper positioning within the lane.

This treatment is recommended at intersections lacking sufficient space to accommodate both a standard through bike lane and right turn lane.



Discussion

Case studies cited by the Pedestrian and Bicycle Information Center indicate that this treatment works best on streets with lower posted speeds (30 MPH or less) and with lower traffic volumes (10,000 ADT or less). May not be appropriate for high-speed arterials or intersections with long right turn lanes. May not be appropriate for intersections with large percentages of right-turning heavy vehicles.

Additional References and Guidelines

NACTO. (2012). Urban Bikeway Design Guide.
 This treatment is currently slated for inclusion in the next edition of the AASHTO Guide for the Development of Bicycle Facilities

Materials and Maintenance

Locate markings out of tire tread to minimize wear. Because the effectiveness of markings depends on their visibility, maintaining markings should be a high priority.



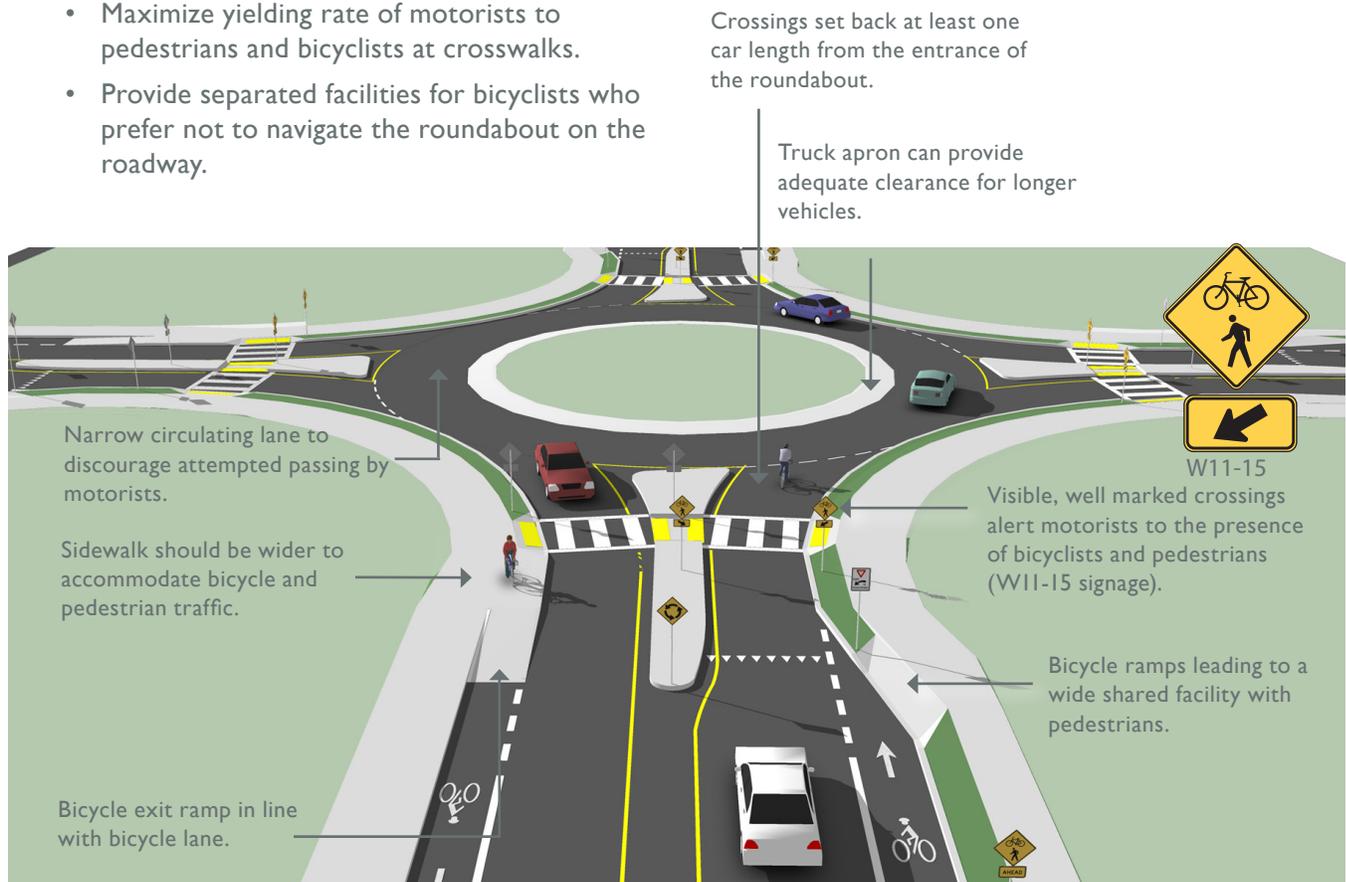
BICYCLISTS AT SINGLE LANE ROUNDABOUTS

GUIDANCE

- 25 mph maximum circulating design speed.
- Design approaches/exits to the lowest speeds possible.
- Encourage bicyclists navigating the roundabout like motor vehicles to “take the lane.”
- Maximize yielding rate of motorists to pedestrians and bicyclists at crosswalks.
- Provide separated facilities for bicyclists who prefer not to navigate the roundabout on the roadway.

DESCRIPTION

In single lane roundabouts it is important to indicate to motorists, bicyclists and pedestrians the right-of-way rules and correct way for them to circulate, using appropriately designed signage, pavement markings, and geometric design elements.



Discussion

Research indicates that while single-lane roundabouts may benefit bicyclists and pedestrians by slowing traffic, multi-lane roundabouts may present greater challenges and significantly increase safety problems for these users.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2000). Roundabouts: An Informational Guide
 FHWA. (2010). Roundabouts: An Informational Guide, Second Edition. NCHRP 672

Materials and Maintenance

Signage and striping require routine maintenance.

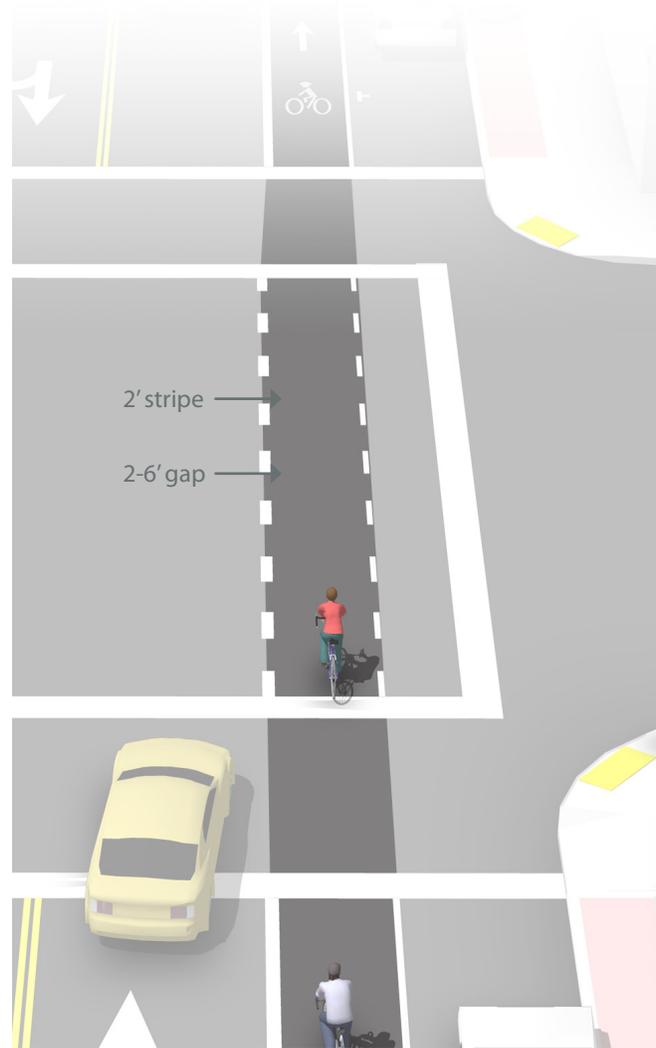
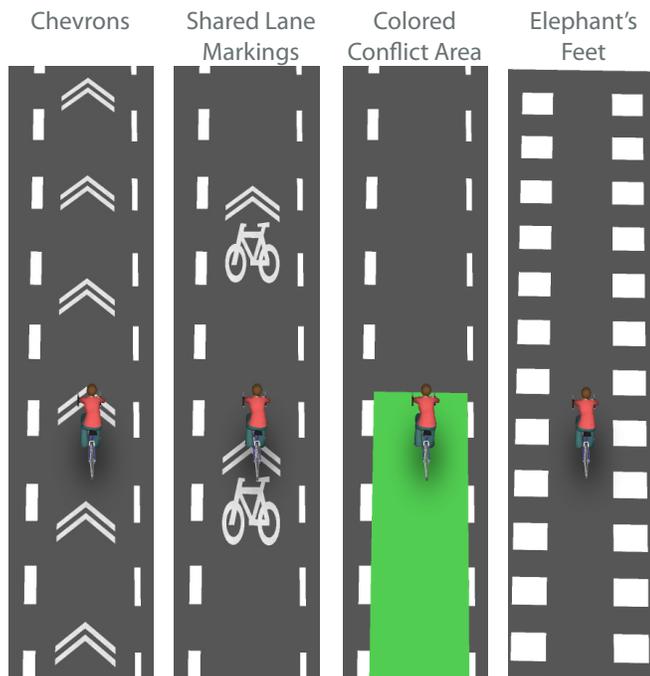
INTERSECTION CROSSING MARKINGS

GUIDANCE

- See MUTCD Section 3B.08: “dotted line extensions”
- Crossing striping shall be at least six inches wide when adjacent to motor vehicle travel lanes. Dotted lines should be two-foot lines spaced two to six feet apart.
- Chevrons, shared lane markings, or **colored bike lanes in conflict areas** may be used to increase visibility within conflict areas or across entire intersections. Elephant’s Feet markings are common in Canada, and in use in Chicago, IL.

DESCRIPTION

Bicycle pavement markings through intersections indicate the intended trail of bicyclists through an intersection or across a driveway or ramp. They guide bicyclists on a safe and direct trail through the intersection and provide a clear boundary between the trails of through bicyclists and either through or crossing motor vehicles in the adjacent lane.



Discussion

Additional markings such as chevrons, shared lane markings, or **colored bike lanes in conflict areas** are strategies currently in use in the United States and Canada. Cities considering the implementation of markings through intersections should standardize future designs to avoid confusion.

Additional References and Guidelines

- AASHTO. (2012). Guide for the Development of Bicycle Facilities.
- FHWA. (2009). Manual on Uniform Traffic Control Devices. (3A.06)
- NACTO. (2012). Urban Bikeway Design Guide.

Materials and Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority.



SIGNAGE PROGRAMS

A comprehensive system of signage ensures that information is provided regarding the safe and appropriate use of all facilities, both on-road and on shared-use trails. The bicycle network should be signed seamlessly with other alternative transportation routes, such as bicycle routes from neighboring jurisdictions, trails, historic and/or cultural walking tours, and wherever possible, local transit systems.

Signage includes post- or pole-mounted signs and pavement striping. Signage is further divided into information signs, directional/wayfinding signs, regulatory signs and warning signs. Trail signage should conform to the Manual on Uniform Traffic Control Devices and the American Association of State Highway Transportation Official Guide for the Development of Bicycle Facilities. Bicycle signage should also be coordinated with local colleges and universities.

Share the Road signs remind motorists that bicyclists have the right to ride on the roadway.



The “Bikes Allowed Use of Full Lane” sign is currently used on an experimental basis in several cities.

DIRECTIONAL SIGNS

Implementing a well-planned and attractive system of signing can greatly enhance bikeway facilities by signaling their presence and location to both motorists and existing or potential bicycle users. Effective signage can encourage more bicycling by leading people to bikeways, and by creating a safe and efficient transportation option for local residents and visitors.

The signage examples to on page B-27 show a number of different signs and markings, both on poles and on the roadway. Wayfinding signs such as these improve the clarity of travel direction while illustrating that destinations are only a short ride away. The signs shown are provided only as a point of reference for the purposes of these guidelines and are not being adopted by Boone.

REGULATORY/WARNING SIGNS

Regulatory and warning bicycle signage like the examples shown on page B-25 should conform to the Manual on Uniform Traffic Control Devices (MUTCD). The signage on page B-25 are examples of regulatory signs for bicycle (their labels are sign reference numbers for the MUTCD).

SPECIAL PURPOSE SIGNAGE

The “Share the Road” sign (to the left), is designed to advise motorists that bicyclists are allowed to share and have the right to cycle on narrow roadways with motor vehicles. For more on the “Share the Road Initiative” go to: http://ncdot.org/transit/bicycle/safety/programs_initiatives/share.html

Innovative signage is often developed to increase bicycle awareness and improve visibility (such as ‘Bikes Allowed Use of Full Lane’, bottom left). Special purpose signs to be installed on public roadways in North Carolina must be approved by NCDOT’s Traffic Control Devices Committee and/or the Town of Boone. New designs can be utilized on an experimental basis with NCDOT approval.



R1-1



R1-2



R3-17



R3-17a



R3-17b



R4-1



R4-2



R4-3



R4-4



R4-7



R5-1b



R5-3



R5-6



R7-9



R7-9a



R9-3c



R9-3a



R9-5



R9-6



R9-7



R10-3



R10-22



R15-1



BIKEWAY SIGNING

The ability to navigate through a town is informed by landmarks, natural features and other visual cues. Signs throughout the town should indicate to bicyclists:

- Direction of travel
- Location of destinations
- Travel time/distance to those destinations

These signs will increase users' comfort and accessibility to the bicycle systems.

Signage can serve both wayfinding and safety purposes including:

- Helping to familiarize users with the bicycle network
- Helping users identify the best routes to destinations
- Helping to address misperceptions about time and distance
- Helping overcome a “barrier to entry” for people who are not frequent bicyclists (e.g., “interested but concerned” bicyclists)

A community-wide bicycle wayfinding signage plan would identify:

- Sign locations
- Sign type – what information should be included and design features
- Destinations to be highlighted on each sign – key destinations for bicyclists
- Approximate distance and travel time to each destination

Bicycle wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes. Too many road signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists rather than per vehicle signage standards.



Sign Types



Sign Placement

This section includes:

- Sign Types
- Sign Placement



SIGN TYPES

DESCRIPTION

A bicycle wayfinding system consists of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes. There are three general types of wayfinding signs:

CONFIRMATION SIGNS

Indicate to bicyclists that they are on a designated bikeway. Make motorists aware of the bicycle route. This signage can include destinations and distance/time, but does not include arrows.

TURN SIGNS

Indicate where a bikeway turns from one street onto another street. This signage can be used with pavement markings, and does include destinations and arrows.

DECISIONS SIGNS

Mark the junction of two or more bikeways and informs bicyclists of the designated bike route to access key destinations. Destinations and arrows, distances and travel times are optional but recommended.

ALTERNATIVE DESIGNS

A customized alternative design may be used to include pedestrian-oriented travel times, local town logos, and sponsorship branding.



Discussion

There is no standard color for bicycle wayfinding signage. Section 1A.12 of the MUTCD establishes the general meaning for signage colors. Green is the color used for directional guidance and is the most common color of bicycle wayfinding signage in the US, including those in the MUTCD.

Additional References and Guidelines

- AASHTO. (2012). Guide for the Development of Bicycle Facilities.
- FHWA. (2009). Manual on Uniform Traffic Control Devices.
- NACTO. (2012). Urban Bikeway Design Guide.

Materials and Maintenance

Maintenance needs for bicycle wayfinding signs are similar to other signs and will need periodic replacement due to wear.



SIGN PLACEMENT

GUIDANCE

Signs are typically placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes.

DECISIONS SIGNS

Near-side of intersections in advance of a junction with another bicycle route.

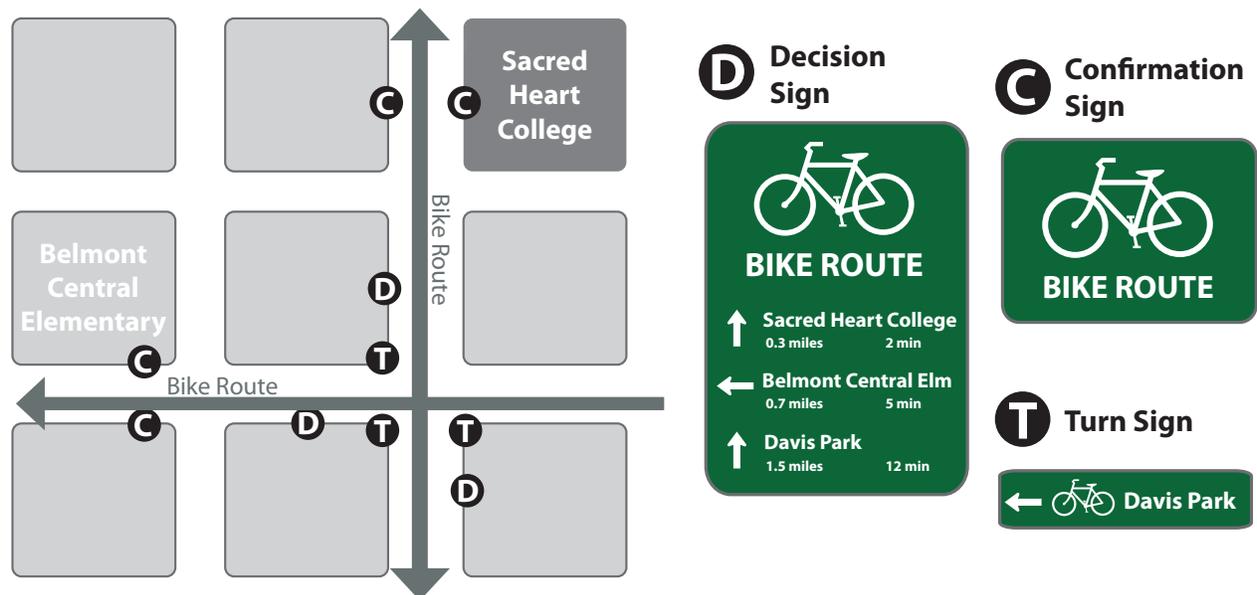
Along a route to indicate a nearby destination.

CONFIRMATION SIGNS

Every ¼ to ½ mile on off-street facilities and every 2 to 3 blocks along on-street bicycle facilities, unless another type of sign is used (e.g., within 150 ft of a turn or decision sign). Should be placed soon after turns to confirm destination(s). Pavement markings can also act as confirmation that a bicyclist is on a preferred route.

TURN SIGNS

Near-side of intersections where bike routes turn (e.g., where the street ceases to be a bicycle route or does not go through). Pavement markings can also indicate the need to turn to the bicyclist.



Discussion

It can be useful to classify a list of destinations for inclusion on the signs based on their relative importance to users throughout the area. A particular destination's ranking in the hierarchy can be used to determine the physical distance from which the locations are signed. For example, primary destinations (such as the downtown area) may be included on signage up to five miles away. Secondary destinations (such as a transit station) may be included on signage up to two miles away. Tertiary destinations (such as a park) may be included on signage up to one mile away.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
FHWA. (2009). Manual on Uniform Traffic Control Devices.
NACTO. (2012). Urban Bikeway Design Guide.

Materials and Maintenance

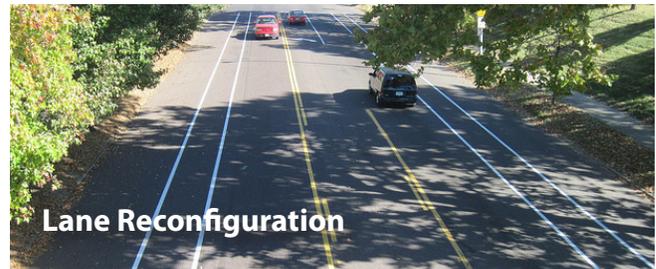
Maintenance needs for bicycle wayfinding signs are similar to other signs and will need periodic replacement due to wear.



RETROFITTING EXISTING STREETS TO ADD BIKEWAYS

Most major streets are characterized by conditions (e.g., high vehicle speeds and/or volumes) for which dedicated bike lanes are the most appropriate facility to accommodate safe and comfortable riding. Although opportunities to add bike lanes through roadway widening may exist in some locations, many major streets have physical and other constraints that would require street retrofit measures within existing curb-to-curb widths. As a result, much of the guidance provided in this section focuses on effectively reallocating existing street width through striping modifications to accommodate dedicated bike lanes.

Although largely intended for major streets, these measures may be appropriate for any roadway where bike lanes would be the best accommodation for bicyclists.



This section includes:

- Roadway Widening
- Lane Narrowing
- Lane Reconfiguration
- Parking Reduction



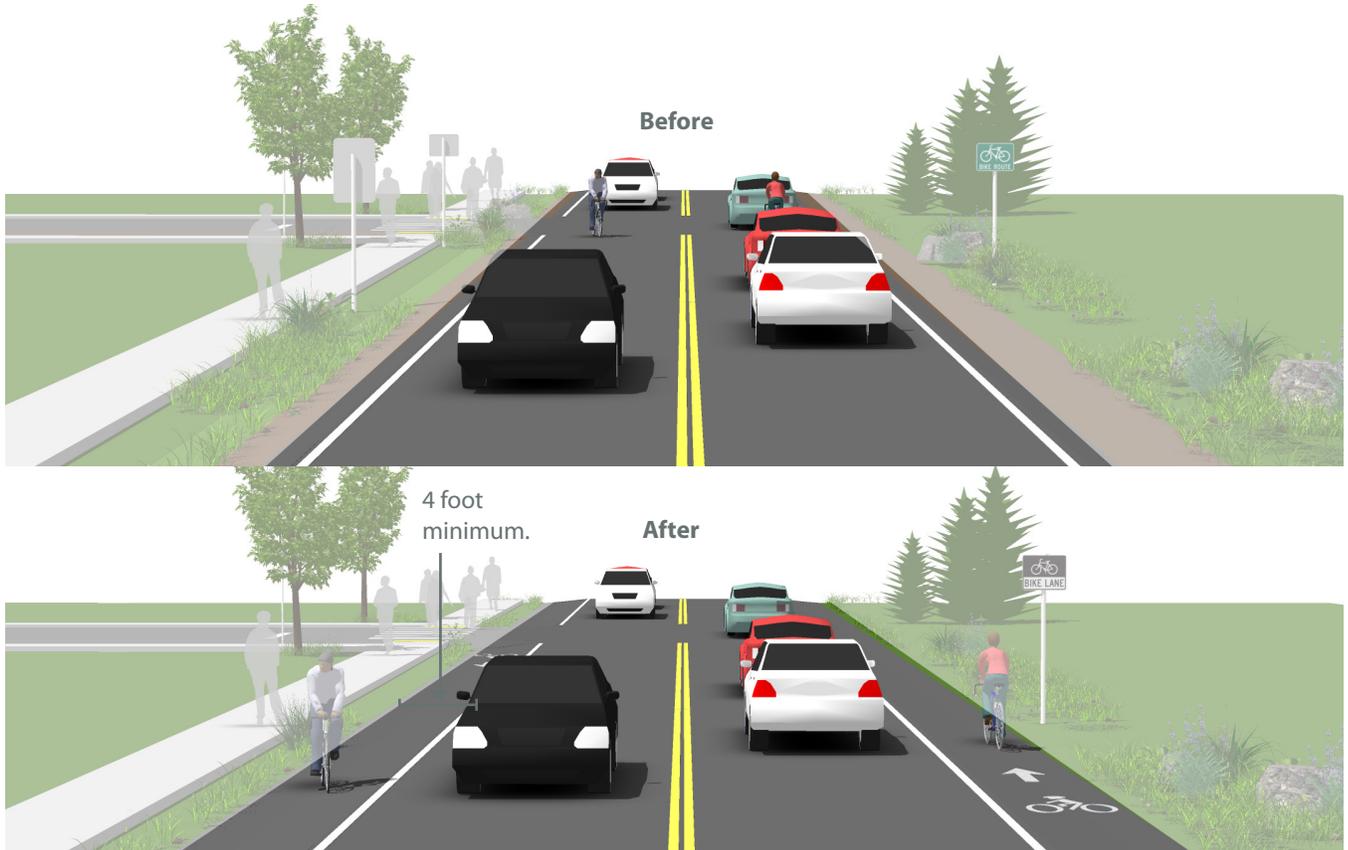
ROADWAY WIDENING

DESCRIPTION

Bike lanes can be accommodated on streets with excess right-of-way through shoulder widening. Although roadway widening incurs higher expenses compared with re-striping projects, bike lanes can be added to streets currently lacking curbs, gutters and sidewalks without the high costs of major infrastructure reconstruction.

GUIDANCE

- Guidance on **bicycle lanes** applies to this treatment.
- 4 foot minimum width when no curb and gutter is present.
- 6 foot width preferred.



Discussion

Roadway widening is most appropriate on roads lacking curbs, gutters and sidewalks.

If it is not possible to meet minimum bicycle lane dimensions, a reduced width paved shoulder can still improve conditions for bicyclists on constrained roadways. In these situations, a minimum of 3 feet of operating space should be provided.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.

Materials and Maintenance

The extended bicycle area should not contain any rough joints where bicyclists ride. Saw or grind a clean cut at the edge of the travel lane, or feather with a fine mix in a non-ridable area of the roadway.

LANE NARROWING

DESCRIPTION

Lane narrowing utilizes roadway space that exceeds minimum standards to provide the needed space for bike lanes. Many roadways have existing travel lanes that are wider than those prescribed in local and national roadway design standards, or which are not marked. Most standards allow for the use of 11 foot and sometimes 10 foot wide travel lanes to create space for bike lanes.

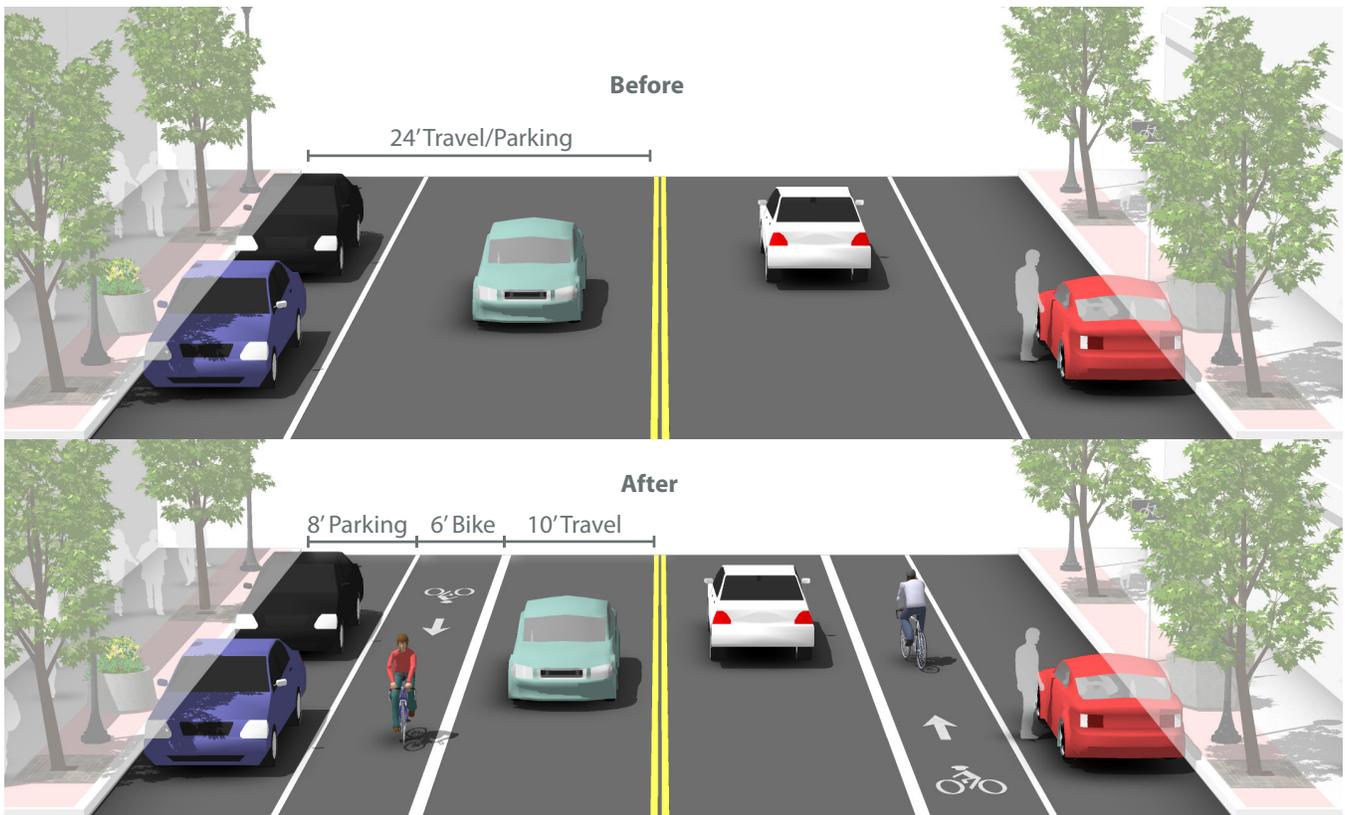
GUIDANCE

Vehicle lane width:

- Before: 10-15 feet
- After: 10-11 feet

Bicycle lane width:

- Guidance on **Bicycle Lanes** applies to this treatment.



Discussion

Special consideration should be given to the amount of heavy vehicle traffic and horizontal curvature before the decision is made to narrow travel lanes. Center turn lanes can also be narrowed in some situations to free up pavement space for bike lanes.

AASHTO supports reduced width lanes in *A Policy on Geometric Design of Highways and Streets*: “On interrupted-flow operation conditions at low speeds (45 mph or less), narrow lane widths are normally adequate and have some advantages.”

Additional References and Guidelines

AASHTO. (2012). *Guide for the Development of Bicycle Facilities*.
 AASHTO. (2004). *A Policy on Geometric Design of Highways and Streets*.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.



LANE RECONFIGURATION

DESCRIPTION

The removal of a single travel lane will generally provide sufficient space for bike lanes on both sides of a street. Streets with excess vehicle capacity provide opportunities for bike lane retrofit projects.

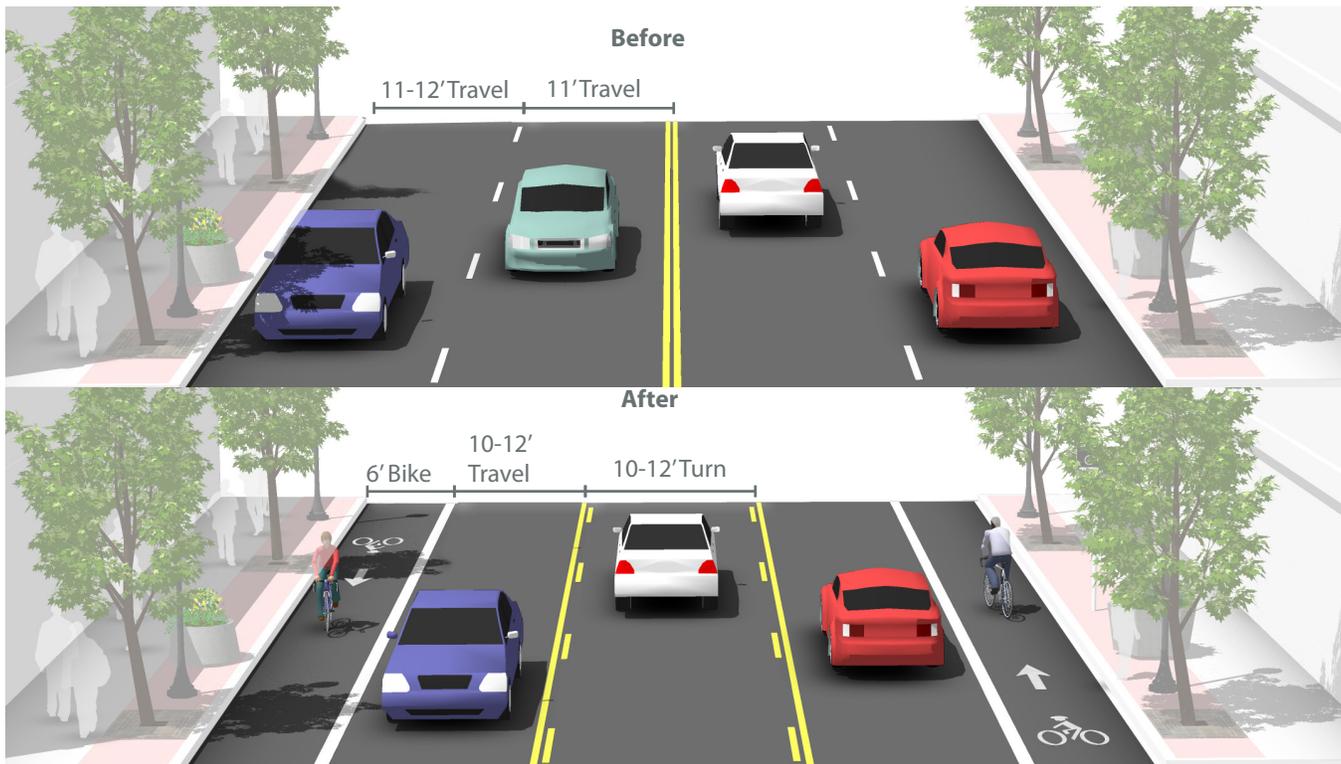
GUIDANCE

Vehicle lane width:

- Width depends on project. No narrowing may be needed if a lane is removed.

Bicycle lane width:

- Guidance on **Bicycle Lanes** applies to this treatment.



Discussion

Depending on a street's existing configuration, traffic operations, user needs and safety concerns, various lane reduction configurations may apply. For instance, a four-lane street (with two travel lanes in each direction) could be modified to provide one travel lane in each direction, a center turn lane, and bike lanes. Prior to implementing this measure, a traffic analysis should identify potential impacts.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2010). Evaluation of Lane Reduction "Road Diet" Measures on Crashes. Publication Number: FHWA-HRT-10-053

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.



PARKING REDUCTION

DESCRIPTION

Bike lanes can replace one or more on-street parking lanes on streets where excess parking exists and/or the importance of bike lanes outweighs parking needs. For example, parking may be needed on only one side of a street. Eliminating or reducing on-street parking also improves sight distance for bicyclists in bike lanes and for motorists on approaching side streets and driveways.

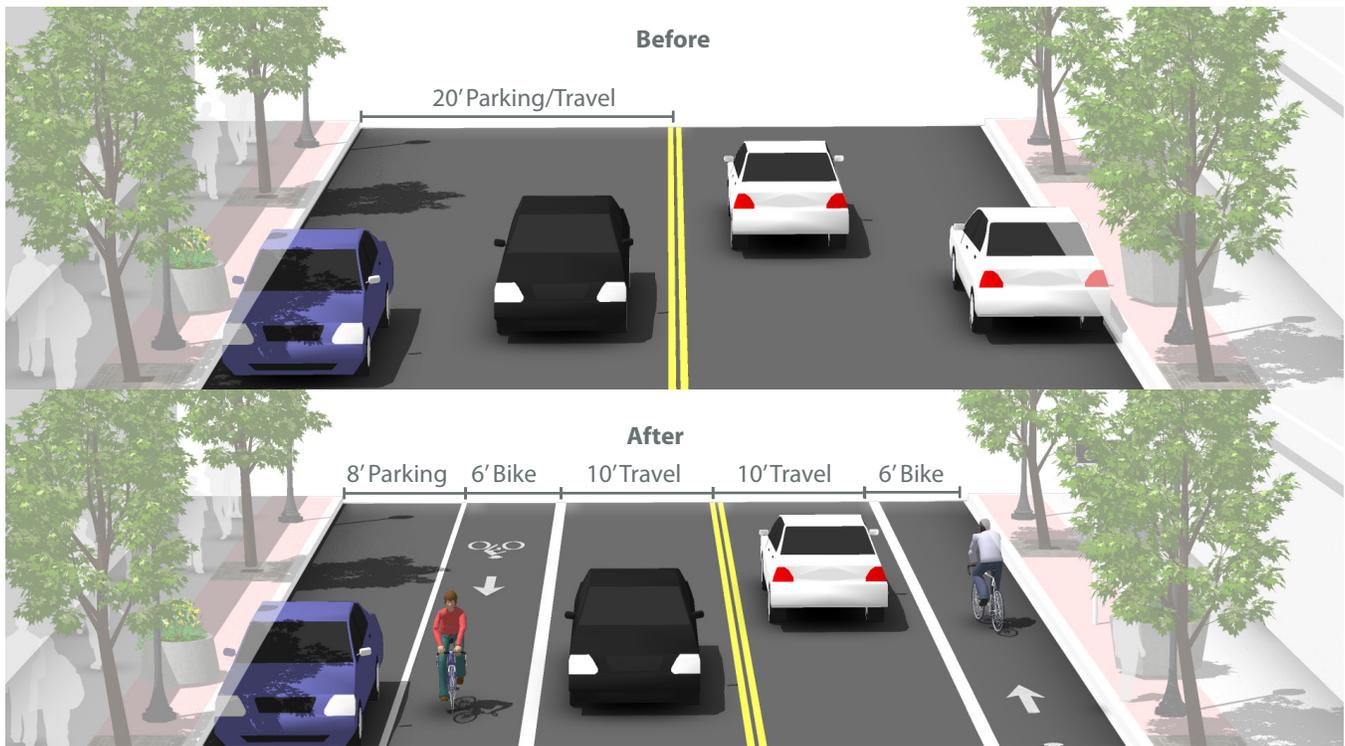
GUIDANCE

Vehicle lane width:

- Parking lane width depends on project. No travel lane narrowing may be required depending on the width of the parking lanes.

Bicycle lane width:

- Guidance on **Bicycle Lanes** applies to this treatment.



Discussion

Removing or reducing on-street parking to install bike lanes requires comprehensive outreach to the affected businesses and residents. Prior to reallocating on-street parking for other uses, a parking study should be performed to gauge demand and to evaluate impacts to people with disabilities.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
AASHTO. (2004). A Policy on Geometric Design of Highways and Streets.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.



SHARED-USE TRAILS AND OFF-STREET FACILITIES

A shared-use trail (also known as a greenway) allows for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. These facilities are frequently found in parks, along rivers, beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles. Trail facilities can also include amenities such as lighting, signage, and fencing (where appropriate).

Key features of shared-use trails include:

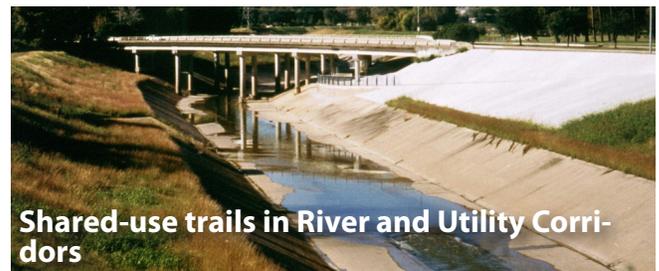
- Frequent access points from the local road network.
- Directional signs to direct users to and from the trail.
- A limited number of at-grade crossings with streets or driveways.
- Terminating the trail where it is easily accessible to and from the street system.
- Separate treads for pedestrians and bicyclists when heavy use is expected.

This Section Includes:

- General Design Practices
- Shared-use Trails in River and Utility Corridors
- Shared-use Trails in Abandoned Rail Corridors
- Shared-use Trails in Active Rail Corridors
- Neighborhood Greenways
- Local Neighborhood Accessways
- Natural Surface Greenways
- Shared-use Trails along Roadways



General Design Practices



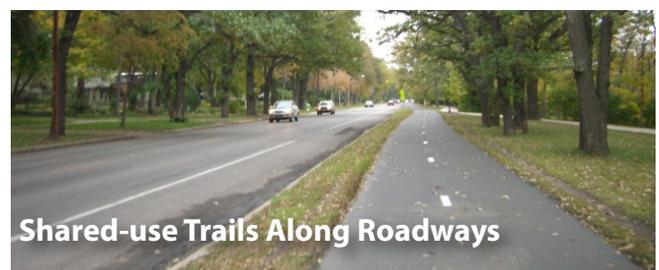
Shared-use trails in River and Utility Corridors



Shared-use trails in Abandoned Rail Corridors



Local Neighborhood Accessways



Shared-use Trails Along Roadways



GENERAL DESIGN PRACTICES

DESCRIPTION

Shared use trails can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle trails should generally provide directional travel opportunities not provided by existing roadways.

Terminate the trail where it is easily accessible to and from the street system, preferably at a controlled intersection or at the beginning of a dead-end street.

GUIDANCE

Width

- 8 feet is the minimum allowed for a two-way bicycle trail and is only recommended for low traffic situations.
- 10 feet is recommended in most situations and will be adequate for moderate to heavy use.
- 12 feet is recommended for heavy use situations with high concentrations of multiple users. A separate track (5' minimum) can be provided for pedestrian use.

Lateral Clearance

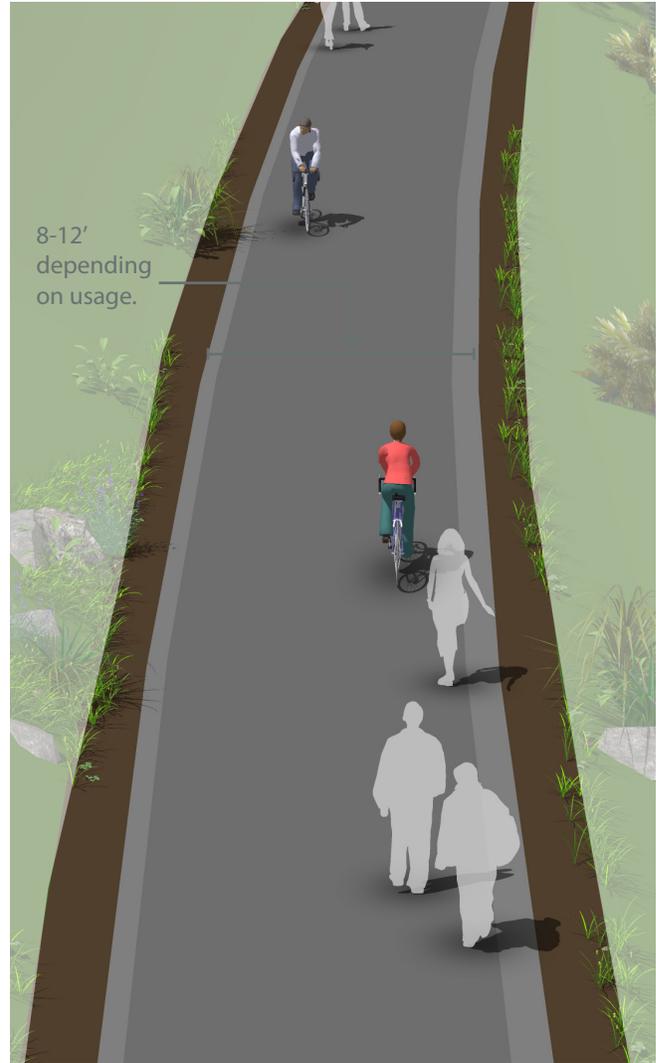
- A 2 foot or greater shoulder on both sides of the trail should be provided. An additional foot of lateral clearance (total of 3') is required by the MUTCD for the installation of signage or other furnishings.

Overhead Clearance

- Clearance to overhead obstructions should be 8 feet minimum, with 10 feet recommended.

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.
- Solid centerlines can be provided on tight or blind corners, and on the approaches to roadway crossings.



Discussion

The AASHTO Guide for the Development of Bicycle Facilities generally recommends against the development of **shared use trails along roadways**. Also known as “sidetrails”, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding when either entering or exiting the trail.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 Flink, C. (1993). Greenways: A Guide To Planning Design And Development.

Materials and Maintenance

Asphalt is the most common surface for bicycle trails. The use of concrete for trails has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of trail users.



SHARED-USE TRAILS IN RIVER AND UTILITY CORRIDORS

DESCRIPTION

Utility and waterway corridors often offer excellent shared-use trail development and bikeway gap closure opportunities. Utility corridors typically include powerline and sewer corridors, while waterway corridors include canals, drainage ditches, rivers, and beaches. These corridors offer excellent transportation and recreation opportunities for bicyclists of all ages and skills.

GUIDANCE

Shared-use trails in utility corridors should meet or exceed **general design practices**. If additional width allows, wider trails, and landscaping are desirable.

ACCESS POINTS

Any access point to the trail should be well-defined with appropriate signage designating the trailway as a bicycle facility and prohibiting motor vehicles.

TRAIL CLOSURE

Public access to the shared-use trail may be prohibited during the following events:

- Canal/flood control channel or other utility maintenance activities
- Inclement weather or the prediction of storm conditions



Discussion

Similar to railroads, public access to flood control channels or canals is undesirable by all parties. Hazardous materials, deep water or swift current, steep, slippery slopes, and debris all constitute risks for public access. Appropriate fencing may be required to keep trail users within the designated travel way. Creative design of fencing is encouraged to make the trail facility feel welcoming to the user.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 Flink, C. (1993). Greenways: A Guide To Planning Design And Development.

Materials and Maintenance

Asphalt is the most common surface for bicycle trails. The use of concrete for trails has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of trail users.



SHARED-USE TRAILS IN ABANDONED RAIL CORRIDORS

DESCRIPTION

Commonly referred to as Rails-to-Trails or Rail-Trails, these projects convert vacated rail corridors into off-street trails. Rail corridors offer several advantages, including relatively direct routes between major destinations and generally flat terrain.

In some cases, rail owners may rail-bank their corridors as an alternative to a complete abandonment of the line, thus preserving the rail corridor for possible future use.

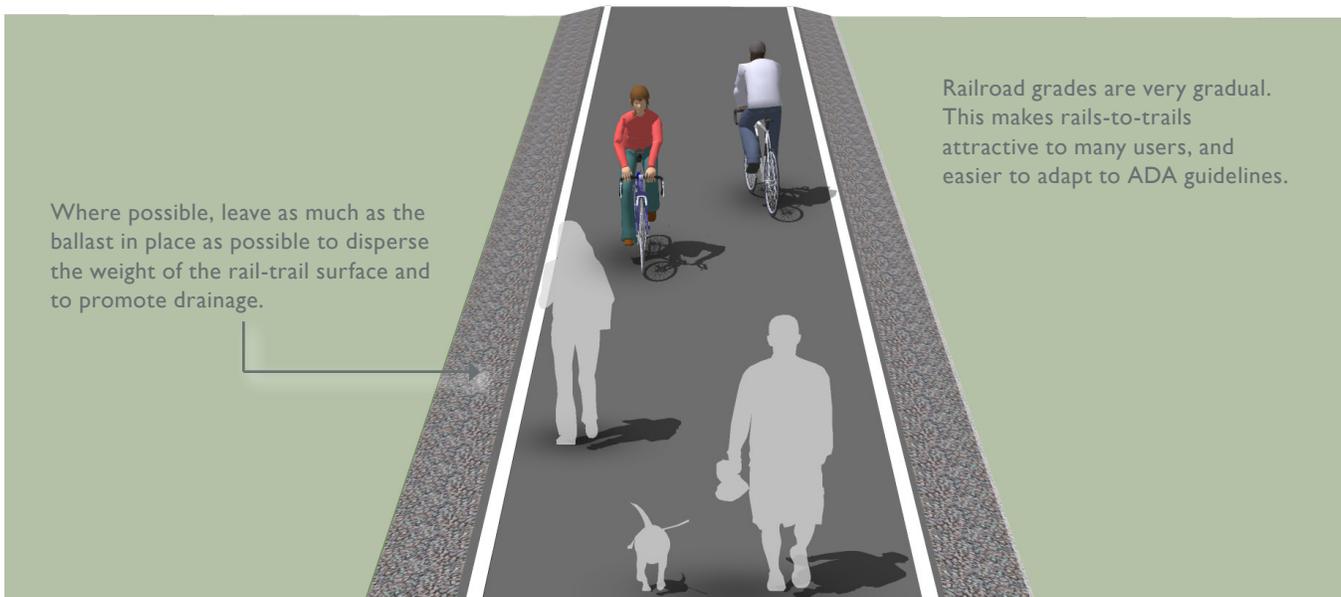
The railroad may form an agreement with any person, public or private, who would like to use the banked rail line as a trail or linear park until it is again needed for rail use. Municipalities should acquire abandoned rail rights-

GUIDANCE

Shared-use trails in abandoned rail corridors should meet or exceed **general design practices**. If additional width allows, wider trails, and landscaping are desirable.

In full conversions of abandoned rail corridors, the sub-base, superstructure, drainage, bridges, and crossings are already established. Design becomes a matter of working with the existing infrastructure to meet the needs of a rail-trail.

If converting a rail bed adjacent to an active rail line, see **Shared-use trails in Existing Active Rail Corridors**.



Discussion

It is often impractical and costly to add material to existing railroad bed fill slopes. This results in trails that meet minimum trail widths, but often lack preferred shoulder and lateral clearance widths.

Rail-to-trails can involve many challenges including the acquisition of the right of way, cleanup and removal of toxic substances, and rehabilitation of tunnels, trestles and culverts. A structural engineer should evaluate existing railroad bridges for structural integrity to ensure they are capable of carrying the appropriate design loads.

Additional References and Guidelines

- AASHTO. (2012). Guide for the Development of Bicycle Facilities.
- FHWA. (2009). Manual on Uniform Traffic Control Devices.
- Flink, C. (1993). Greenways: A Guide To Planning Design And Development.

Materials and Maintenance

Asphalt is the most common surface for bicycle trails. The use of concrete for trails has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of trail users.



SHARED-USE TRAILS IN ACTIVE RAIL CORRIDORS

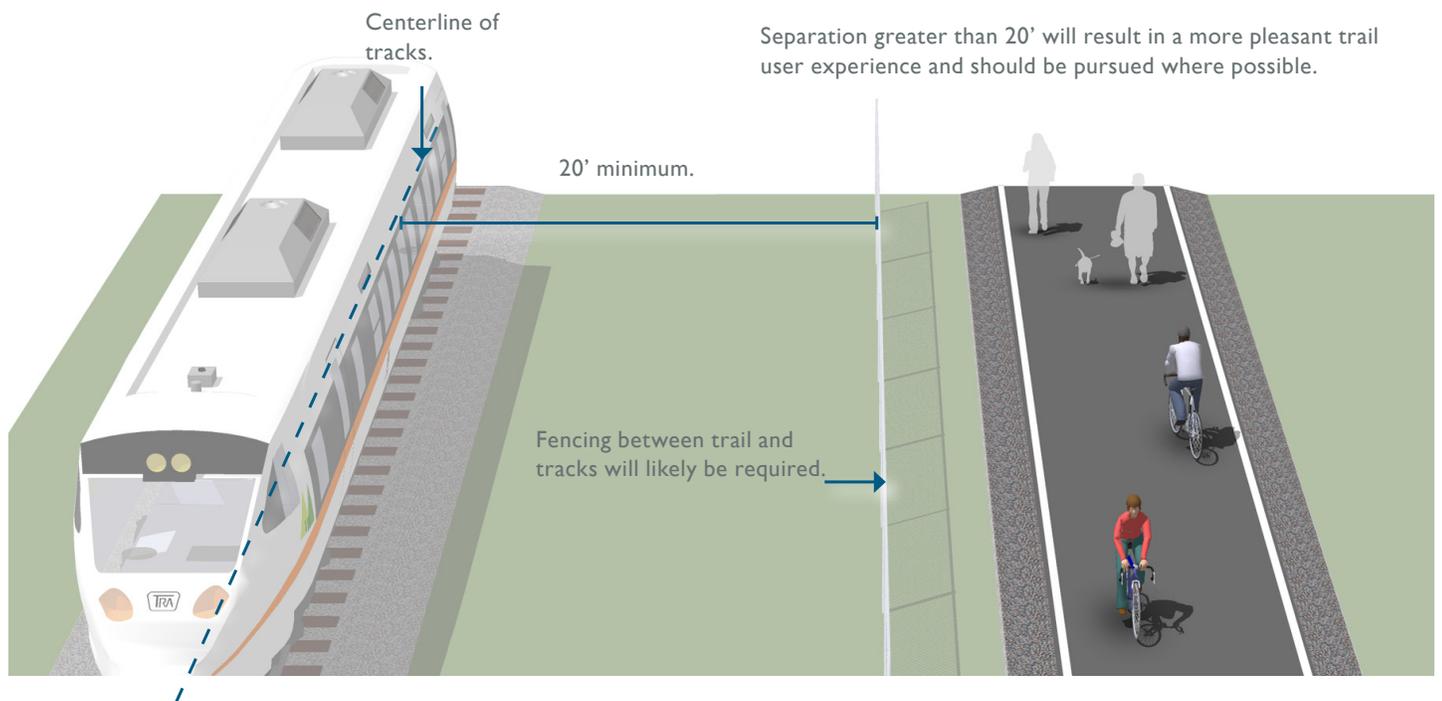
DESCRIPTION

Rails-with-Trails projects typically consist of trails adjacent to active railroads. It should be noted that some constraints could impact the feasibility of rail-with-trail projects. In some cases, space needs to be preserved for future planned freight, transit or commuter rail service. In other cases, limited right-of-way width, inadequate setbacks, concerns about safety/trespassing, and numerous mid-block crossings may affect a project's feasibility.

GUIDANCE

Shared-use trails in active rail corridors should meet or exceed general design standards. If additional width allows, wider trails, and landscaping are desirable.

If required, fencing should be a minimum of 5 feet in height with higher fencing than usual next to sensitive areas such as switching yards. Setbacks from the active rail line will vary depending on the speed and frequency of trains, and available right-of-



way.

Discussion

Railroads typically require fencing with all rail-with-trail projects. Concerns with trespassing and security can

Materials and Maintenance

Concrete trails may cost more to build than asphalt trails but do not become brittle, cracked and rough with age, or deformed by roots. vary with the amount of train traffic on the adjacent rail line and the setting of the shared-use trail, i.e. whether the section of track is in an urban or rural setting.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities. FHWA.

(2009). Manual on Uniform Traffic Control Devices.

FHWA. (2002). Rails-with-Trails: Lessons Learned.



NEIGHBORHOOD GREENWAYS

DESCRIPTION

Neighborhood greenways are low-volume, low-speed streets modified to enhance bicyclist comfort by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through-trips by non-local motorized traffic.

GUIDANCE

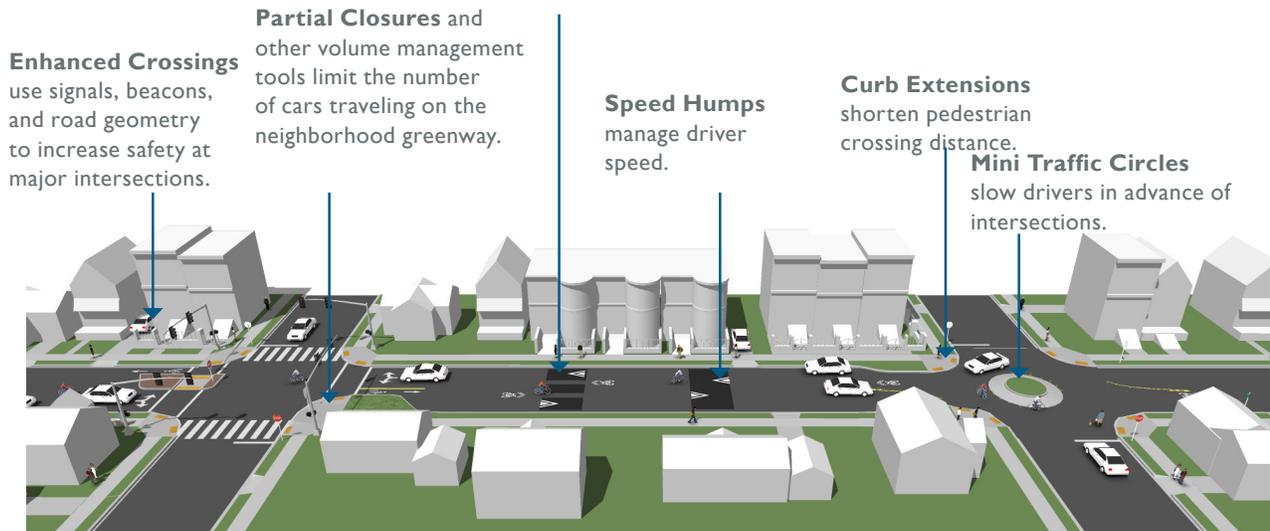
Signs and pavement markings are the minimum treatments necessary to designate a street as a neighborhood greenway.

Neighborhood greenways should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.

Implement volume control treatments based on the context of the neighborhood greenway, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day.

Intersection crossings should be designed to enhance safety and minimize delay for bicyclists.

Signs and Pavement Markings identify the street as a pedestrian and bicycle priority route.



Discussion

Neighborhood greenway retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments to assist pedestrian crossing, these intersections can become major barriers along the neighborhood greenway and compromise safety.

Traffic calming can deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes.

Additional References and Guidelines

- Alta Planning + Design and IBPI. (2009). Bicycle Boulevard Planning and Design Handbook.
- BikeSafe. (No Date). Bicycle countermeasure selection system.
- Ewing, Reid. (1999). Traffic Calming: State of the Practice.
- Ewing, Reid and Brown, Steven. (2009). U.S. Traffic Calming Manual.

Materials and Maintenance

Maintenance needs for bicycle signs are similar to other signs. Signs will need periodic replacement due to wear.



LOCAL NEIGHBORHOOD ACCESSWAYS

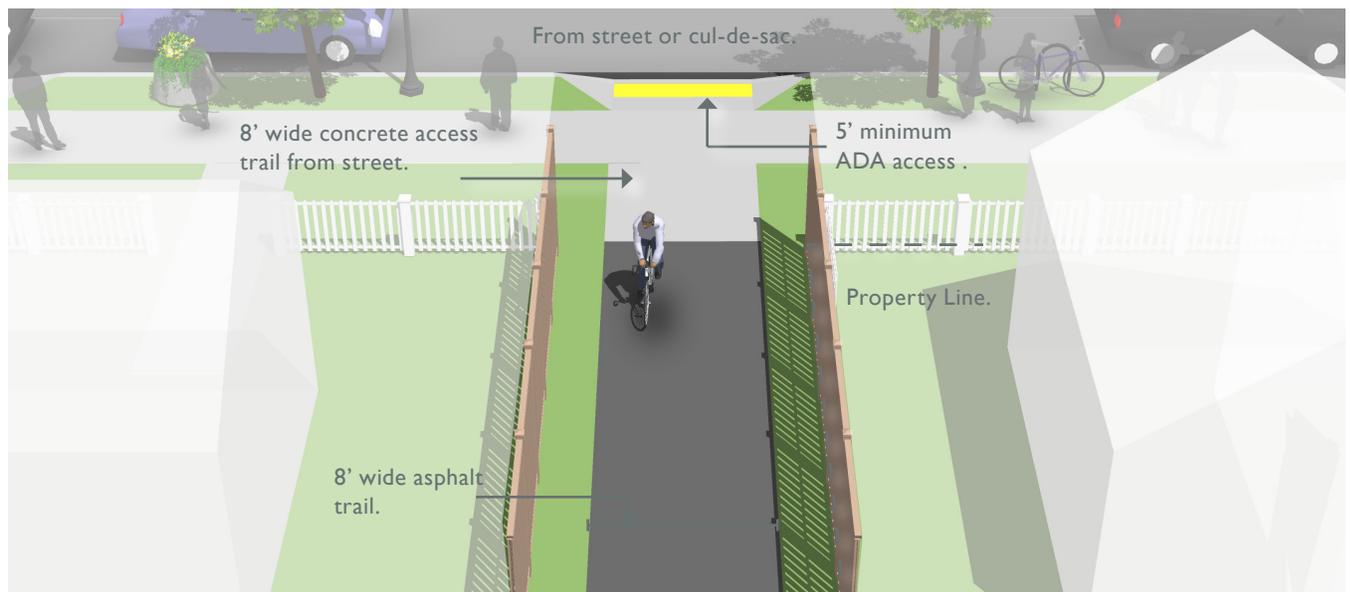
DESCRIPTION

Neighborhood accessways provide residential areas with direct bicycle and pedestrian access to parks, trails, greenspaces, and other recreational areas. They most often serve as small trail connections to and from the larger trail network, typically having their own rights-of-way and easements.

Additionally, these smaller trails can be used to provide bicycle and pedestrian connections between dead-end streets, cul-de-sacs, and access to nearby destinations not provided by the street network.

GUIDANCE

- Neighborhood accessways should remain open to the public.
- Trail pavement shall be at least 8' wide to accommodate emergency and maintenance vehicles, meet ADA requirements and be considered suitable for shared-use.
- Trail widths should be designed to be less than 8' wide only when necessary to protect large mature native trees over 18" in caliper, wetlands or other ecologically sensitive areas.
- Access trails should slightly meander whenever possible.



Discussion

Neighborhood accessways should be designed into new subdivisions at every opportunity and should be required by town/county subdivision regulations.

For existing subdivisions, Neighborhood and homeowner association groups are encouraged to identify locations where such connects would be desirable. Nearby residents and adjacent property owners should be invited to provide landscape design input.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 FHWA. (2006). Federal Highway Administration University Course on Bicycle and Pedestrian Transportation. Lesson 19: Greenways and Shared Use Trails.

Materials and Maintenance

Asphalt is the most common surface for bicycle trails. The use of concrete for trails has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of trail users.

NATURAL SURFACE GREENWAYS

DESCRIPTION

Sometimes referred to as footpaths or hiking trails, the natural surface trail is used along corridors that are environmentally-sensitive but can support bare earth, wood chip, or boardwalk trails. Natural surface trails are a low-impact solution and found in areas with limited development or where a more primitive experience is desired.

Guidance presented in this section does not include considerations for bicycle users. Natural surface trails designed for bicycle users are typically known as single track trails.

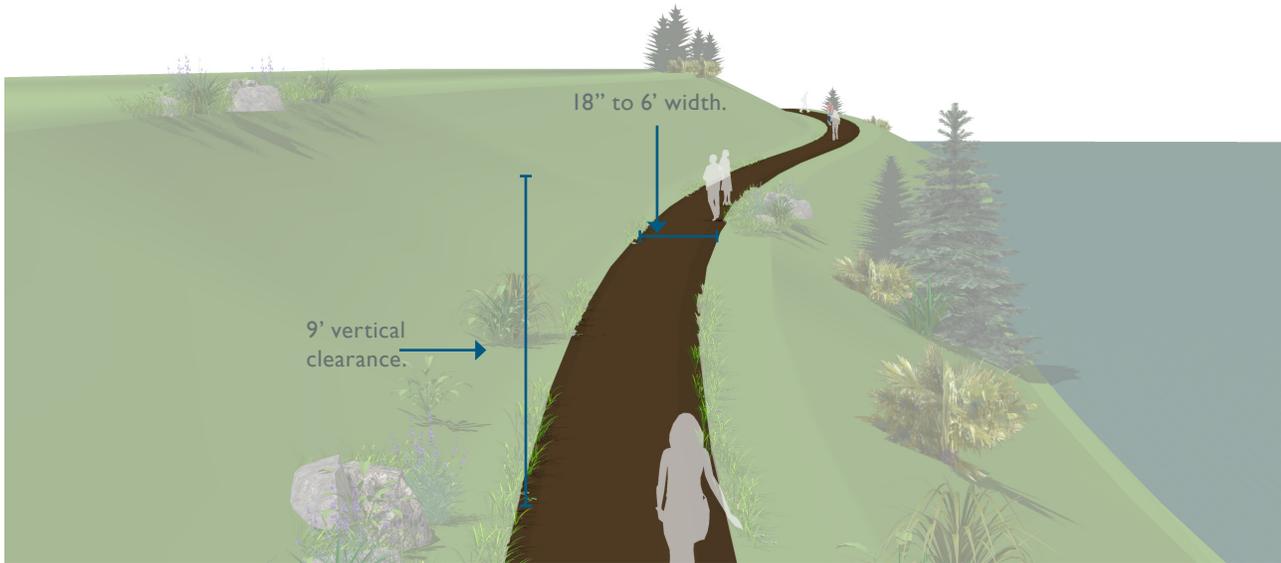
GUIDANCE

Trails can vary in width from 18 inches to 6 feet or greater; vertical clearance should be maintained at nine-feet above grade.

Base preparation varies from machine-worked surfaces to those worn only by usage.

Trail surface can be made of dirt, rock, soil, forest litter, or other native materials. Some trails use crushed stone (a.k.a. “crush and run”) that contains about 4% fines by weight, and compacts with use.

Provide positive drainage for trail tread without extensive removal of existing vegetation; maximum slope is five percent (typical).



Discussion

Trail erosion control measures include edging along the low side of the trail, steps and terraces to contain surface material, and water bars to direct surface water off the trail; use bedrock surface where possible to reduce erosion.

Additional References and Guidelines Materials and Maintenance

Flink, C. (1993). Greenways: A Guide To Planning Design And Development.

Consider implications for accessibility when weighing options for surface treatments.



SHARED-USE TRAILS ALONG ROADWAYS

DESCRIPTION

A shared-use trail allows for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. These facilities are frequently found in parks, along rivers, beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles.

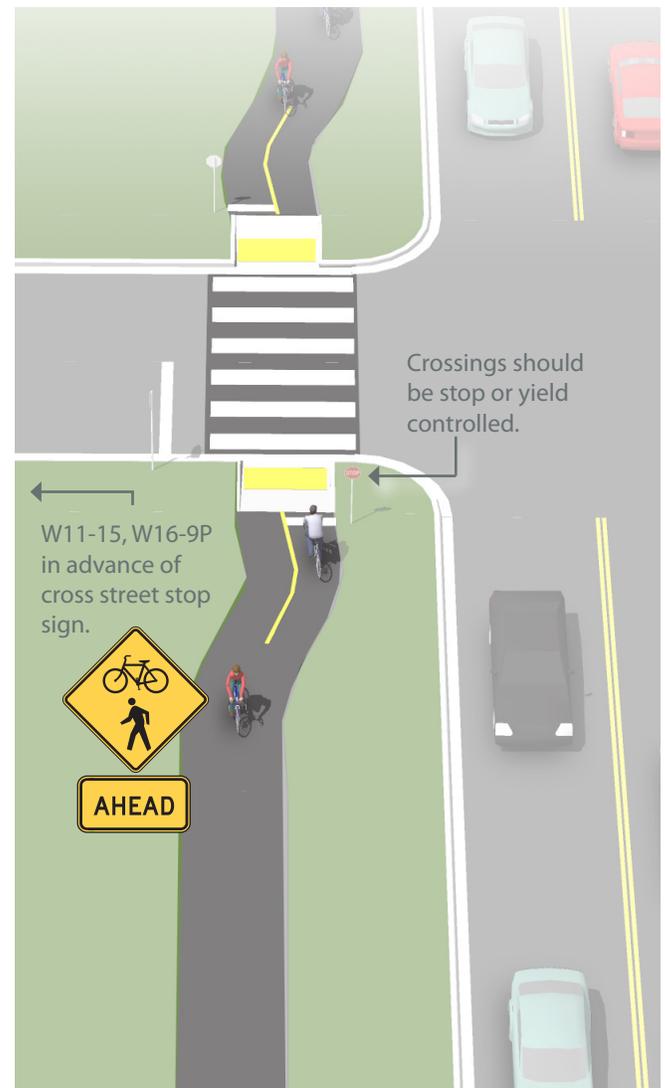
Along roadways, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding where bicyclists enter or leave the trail.

The AASHTO Guide for the Development of Bicycle Facilities generally recommends against the development of shared-use trails directly adjacent to roadways.

GUIDANCE

- 8 feet is the minimum allowed for a two-way bicycle trail and is only recommended for low traffic situations.
- 10 feet is recommended in most situations and will be adequate for moderate to heavy use.
- 12 feet is recommended for heavy use situations with high concentrations of multiple users such as joggers, bicyclists, rollerbladers and pedestrians. A separate track (5' minimum) can be provided for pedestrian use.
- Bicycle lanes should be provided as an alternate (more transportation-oriented) facility whenever possible.

Pay special attention to the entrance/exit of the trail as bicyclists may continue to travel on the wrong side of the street.



Discussion

When designing a bikeway network, the presence of a nearby or parallel trail should not be used as a reason to not provide adequate shoulder or bicycle lane width on the roadway, as the on-street bicycle facility will generally be superior to the “sidetrail” for experienced bicyclists and those who are cycling for transportation purposes.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 NACTO. (2012). Urban Bikeway Design Guide. See entry on Raised Cycle Tracks.
 NCDOT. (1994). Bicycle Facilities Planning and Design Guidelines.

Materials and Maintenance

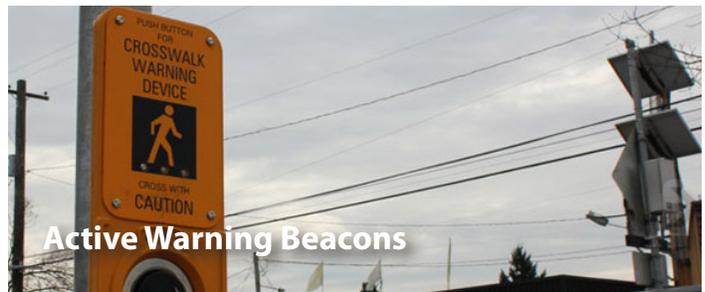
Asphalt is the most common surface for bicycle trails. The use of concrete for trails has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of trail users.

SHARED-USE TRAIL CROSSINGS

At-grade roadway crossings can create potential conflicts between trail users and motorists, however, well-designed crossings can mitigate many operational issues and provide a higher degree of safety and comfort for trail users. This is evidenced by the thousands of successful facilities around the United States with at-grade crossings. In most cases, at-grade trail crossings can be properly designed to provide a reasonable degree of safety and can meet existing traffic and safety standards. Trail facilities that cater to bicyclists can require additional considerations due to the higher travel speed of bicyclists versus pedestrians.

Consideration must be given to adequate warning distance based on vehicle speeds and line of sight, with the visibility of any signs absolutely critical. Directing the active attention of motorists to roadway signs may require additional alerting devices such as a flashing beacon, roadway striping or changes in pavement texture. Signing for trail users may include a standard “STOP” or “YIELD” sign and pavement markings, possibly combined with other features such as bollards or a bend in the trailway to slow bicyclists. Care must be taken not to place too many signs at crossings lest they begin to lose their visual impact.

A number of striping patterns have emerged over the years to delineate trail crossings. A median stripe on the trail approach will help to organize and warn trail users. Crosswalk striping is typically a matter of local and State preference, and may be accompanied by pavement treatments to help warn and slow motorists. In areas where motorists do not typically yield to crosswalk users, additional measures may be required to increase compliance.





UNSIGNALIZED MARKED CROSSINGS

DESCRIPTION

An unsignalized marked crossing typically consists of a marked crossing area, signage and other markings to slow or stop traffic. The approach to designing crossings at mid-block locations depends on an evaluation of vehicular traffic, line of sight, trailway traffic, use patterns, vehicle speed, road type, road width, and other safety issues such as proximity to major attractions.

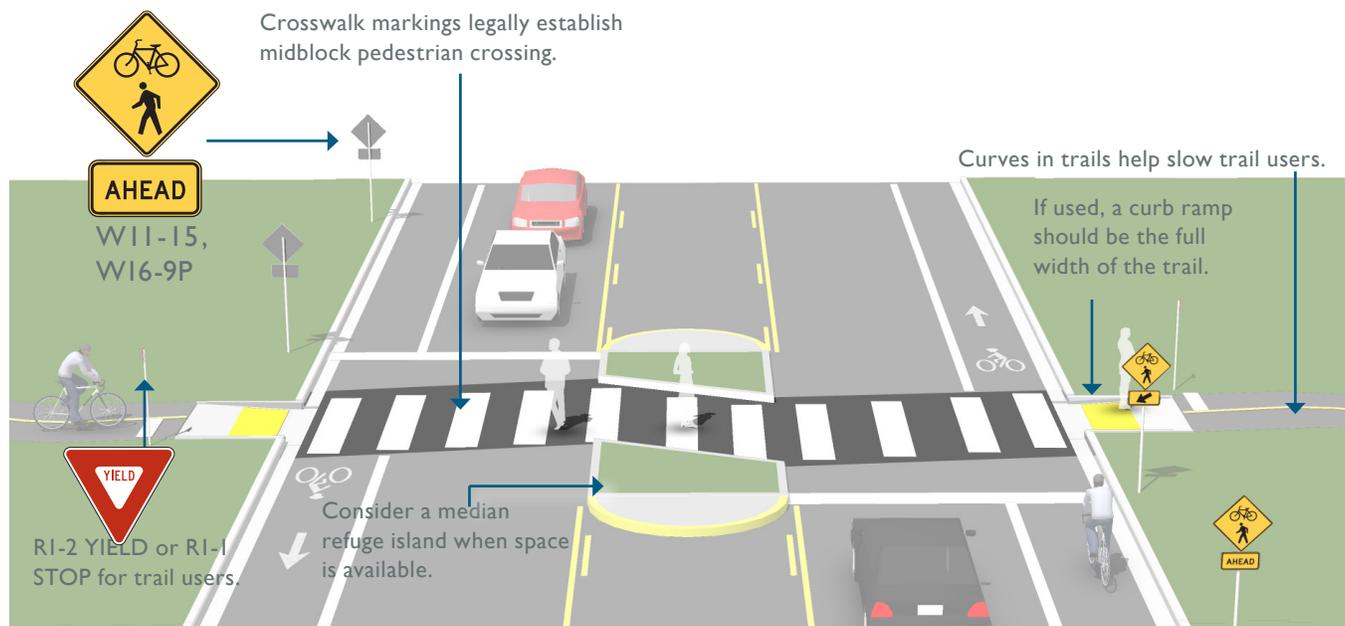
When space is available, using a median refuge island can improve user safety by providing pedestrians and bicyclists space to perform the safe crossing of one side of the street at a time.

GUIDANCE

Refer to the FHWA report, “Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations” for specific volume and speed ranges where a marked crosswalk alone may be sufficient.

Where the speed limit exceeds 40 miles per hour, marked crosswalks alone should not be used at unsignalized locations.

Crosswalks should not be installed at locations that could present an increased risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices.



Discussion

Marked crosswalks alone will not make crossings safer, nor will marked crosswalks necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g. raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions, etc.) as needed to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding which treatment to use.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices. NCDOT.
 (2012). Complete Streets Planning and Design Guidelines.

Materials and Maintenance

Locate markings out of wheel tread when possible to minimize wear and maintenance costs.

ACTIVE WARNING BEACONS

DESCRIPTION

Enhanced marked crossings are unsignalized crossings with additional treatments designed to increase motor vehicle yielding compliance on multi-lane or high volume roadways.

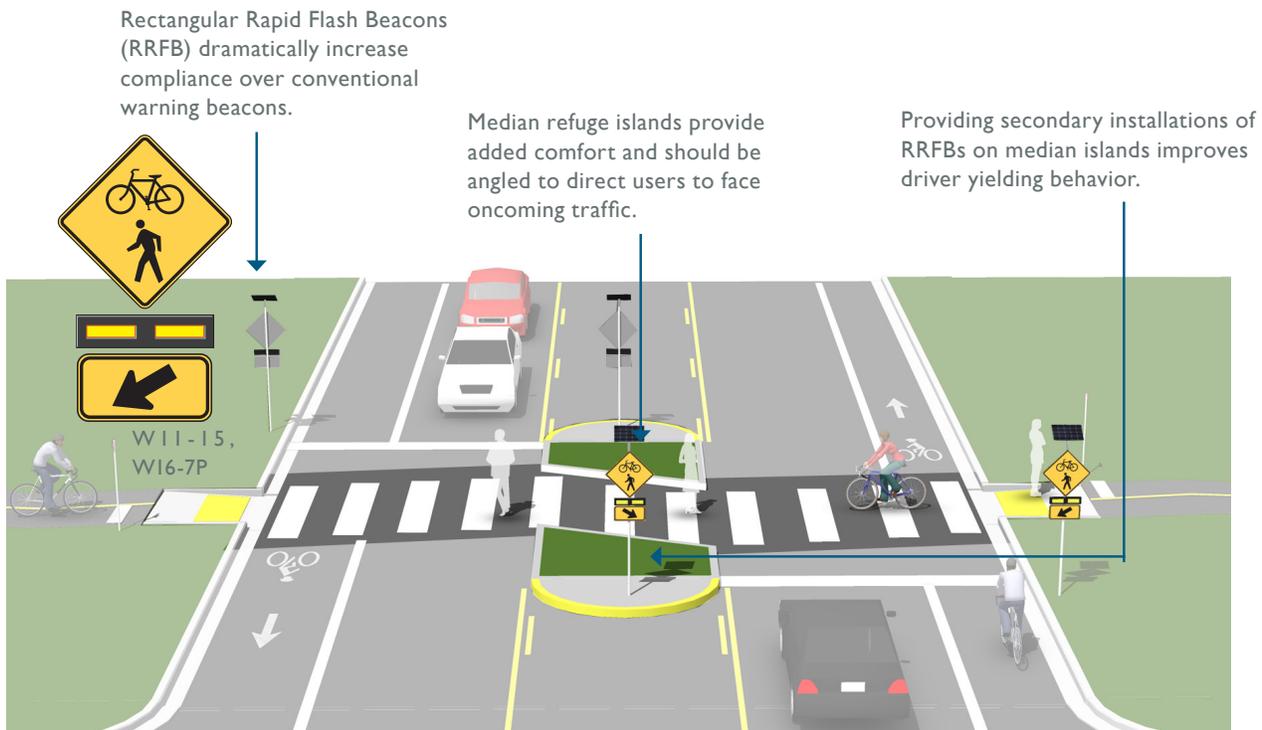
These enhancements include trailway user or sensor actuated warning beacons, Rectangular Rapid Flash Beacons (RRFB) shown below, or in-roadway warning lights.

GUIDANCE

Guidance for Unsignalized Marked Crossings applies.

Warning beacons shall not be used at crosswalks controlled by YIELD signs, STOP signs, or traffic control signals.

Warning beacons shall initiate operation based on user actuation and shall cease operation at a predetermined time after the user actuation or, with passive detection, after the user clears the crosswalk.



Discussion

Rectangular rapid flash beacons show the most increased compliance of all the warning beacon enhancement options.

A study of the effectiveness of going from a no-beacon arrangement to a two-beacon RRFB installation increased yielding from 18 percent to 81 percent. A four-beacon arrangement raised compliance to 88%. Additional studies of long term installations show little to no decrease in yielding behavior over time.

Additional References and Guidelines

NACTO. (2012). Urban Bikeway Design Guide.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 FHWA. (2008). MUTCD - Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11) NCDOT. (2012). Complete Streets Planning and Design Guidelines.

Materials and Maintenance

Depending on power supply, maintenance of active warning beacons can be minimal. If solar power is used, signals should run for years without issue.



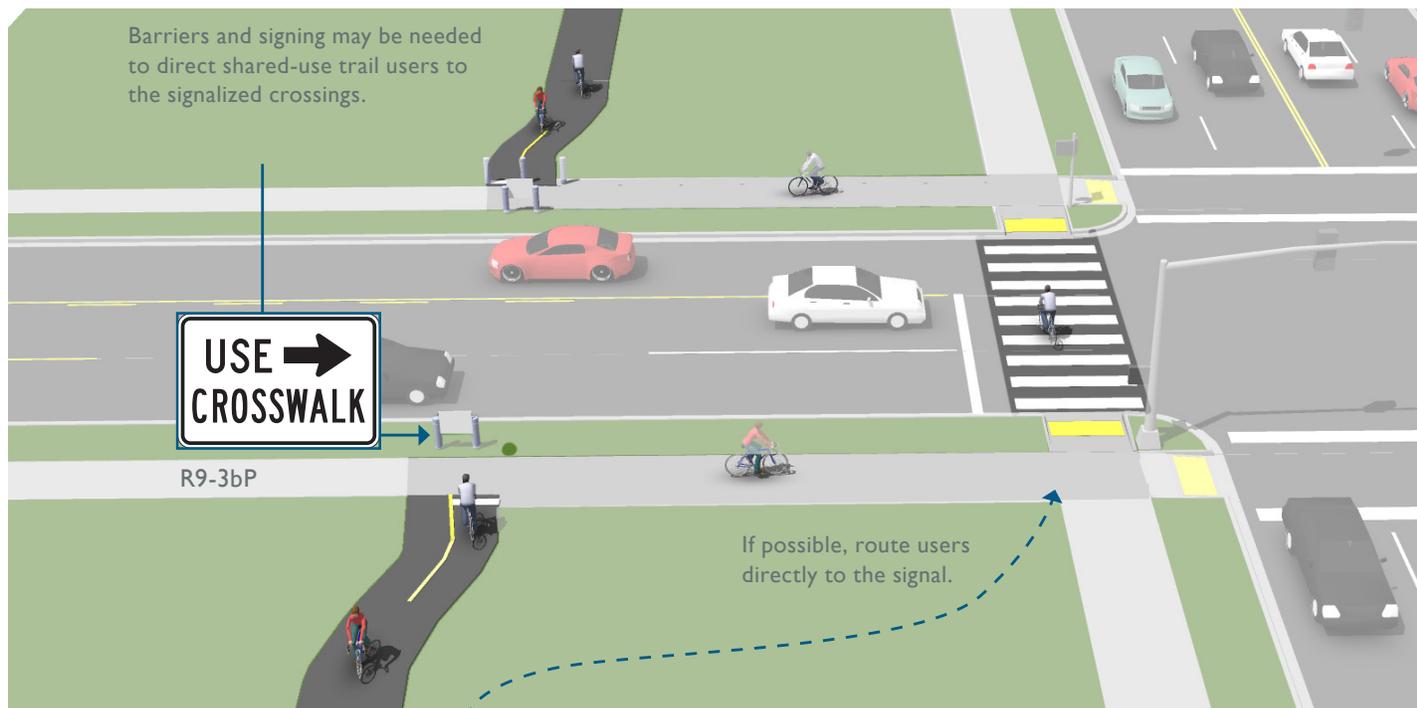
ROUTE USERS TO SIGNALIZED CROSSINGS

DESCRIPTION

Trail crossings within approximately 400 feet of an existing signalized intersection with pedestrian crosswalks are typically diverted to the signalized intersection to avoid traffic operation problems when located so close to an existing signal. For this restriction to be effective, barriers and signing may be needed to direct trail users to the signalized crossing. If no pedestrian crossing exists at the signal, modifications should be made.

GUIDANCE

Trail crossings should not be provided within approximately 400 feet of an existing signalized intersection. If possible, route trail directly to the signal.



Discussion

In the US, the minimum distance a marked crossing can be from an existing signalized intersection varies from approximately 250 to 660 feet. Engineering judgement and the context of the location should be taken into account when choosing the appropriate allowable setback. Pedestrians are particularly sensitive to out of direction travel and jaywalking may become prevalent if the distance is too great.

Additional References and Guidelines

AASHTO. (2012). Guide for the Development of Bicycle Facilities.
AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.

Materials and Maintenance

Municipalities should maintain comprehensive inventories of the location and age of bicycle wayfinding signs to allow incorporation of bicycle wayfinding signs into any asset management activities.



BIKEWAY SUPPORT AND MAINTENANCE

BICYCLE PARKING

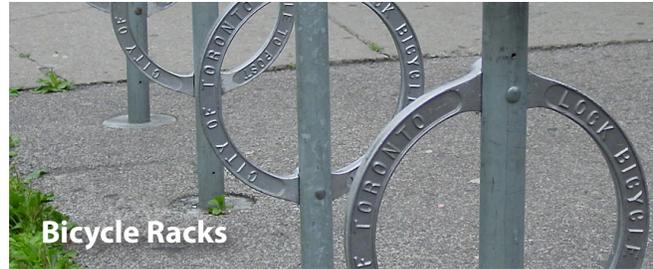
Bicyclists expect a safe, convenient place to secure their bicycle when they reach their destination. This may be short-term parking of 2 hours or less, or long-term parking for employees, students, residents, and commuters.

MAINTENANCE

Regular bicycle facility maintenance includes sweeping, maintaining a smooth roadway, ensuring that the gutter-to-pavement transition remains relatively flat, and installing bicycle-friendly drainage grates. Pavement overlays are a good opportunity to improve bicycle facilities.

RECOMMENDED BIKEWAY MAINTENANCE ACTIVITIES

Maintenance Activity	Frequency
Inspections	Seasonal – at beginning and end of Summer
Pavement sweeping/blowing	As needed, with higher frequency in the early Spring and Fall
Pavement sealing	5 - 15 years
Pothole repair	1 week – 1 month after report
Culvert and drainage grate inspection	Before Winter and after major storms
Pavement markings replacement	As needed
Signage replacement	As needed
Shoulder plant trimming (weeds, trees, brambles)	Twice a year; middle of growing season and early Fall
Tree and shrub plantings, trimming	1 – 3 years
Major damage response (washouts, fallen trees, flooding)	As soon as possible



This Section Includes:

- Bicycle Racks
- Sweeping



BICYCLE RACKS

DESCRIPTION

Short-term bicycle parking is meant to accommodate visitors, customers, and others expected to depart within two hours. It should have an approved standard rack, appropriate location and placement, and weather protection. Racks should:

- Support the bicycle in at least two places, preventing it from falling over.
- Allow locking of the frame and one or both wheels with a U-lock.
- Is securely anchored to ground.
- Resists cutting, rusting and bending or deformation.

Bicycle shelters include structures with a roof that provides weather protection.



GUIDANCE

- 2' minimum from the curb face to avoid 'dooring.'
- Close to destinations; 50' maximum distance from main building entrance.
- Minimum clear distance of 6' should be provided between the bicycle rack and the property line.
- Locate racks in areas that cyclists are most likely to travel.

SWEEPING

GUIDANCE

- Establish a seasonal sweeping schedule that prioritizes roadways with major bicycle routes.
- Sweep walkways and bikeways whenever there is an accumulation of debris on the facility.
- In curbed sections, sweepers should pick up debris; on open shoulders, debris can be swept onto gravel shoulders.
- Pave gravel driveway approaches to minimize loose gravel on paved roadway shoulders.
- Perform additional sweeping in the Spring to remove debris from the Winter.
- Perform additional sweeping in the Fall in areas where leaves accumulate.

DESCRIPTION

Bicyclists often avoid shoulders and bike lanes filled with gravel, broken glass and other debris; they will ride in the roadway to avoid these hazards, potentially causing conflicts with motorists. Debris from the roadway should not be swept onto sidewalks (pedestrians need a clean walking surface), nor should debris be swept from the sidewalk onto the roadway. A regularly scheduled inspection and maintenance program helps ensure that roadway debris is regularly picked up or swept.





STANDARDS COMPLIANCE

Some of these treatments covered by these guidelines are not directly referenced in the current versions of the AASHTO Guide or the MUTCD, although many of the elements of these treatments are found within these documents. An “X” marking in the following table identifies the inclusion of a particular treatment within the national and state design guides. A “-” marking indicates a treatment may not be specifically mentioned, but is compliant assuming MUTCD compliant signs and markings are used.

In all cases, engineering judgment is recommended to ensure that the application makes sense for the context of each treatment, given the many complexities of urban streets.



	Manual of Uniform Traffic Control Devices (2009)	Guide for the Development of Bicycle Facilities (2012)	Urban Bikeway Design Guide (2012)	NCDOT Bicycle Facilities & Planning Design Guidelines
Signed Shared Roadway	X	X		X
Marked Shared Roadway	X	X	X	
Bicycle Boulevard		X	X	
Shoulder Bikeway	X	X		X
Bicycle Lane	X	X	X	X
Buffered Bike Lane	-	X	X	
Uphill Bicycle Climbing Lane	-	X	X	
Cycle Tracks	-	Called "one-way sidetrail"	X	
Bike Lanes at Right Turn Only Lanes	X	X	X	X
Colored Bike Lanes in Conflict Areas	Interim Approval Granted	X	X	
Combined Bike Lane/Turn Lane	-		X	
Intersection Crossing Markings	X	X	X	
Bicyclists at Single Lane Roundabouts	-	X		
Wayfinding Sign Types	X	X	X	X
Wayfinding Sign Placement	X	X	X	X
Shared-use Trails/Greenways	X	X		X
Shared-use Trails along Roadways	X	Discouraged		Discouraged








PROGRAM RESOURCES

Appendix Contents

- Introduction (B-1)
- Partners (B-2)
- Existing Programs (B-4)
- Outreach Resources (B-7)
- Education Resources (B-11)
- Policy and Evaluation Resources (B-16)
- Enforcement Resources (B-19)
- Programmatic Recommendations Table (B-20)

INTRODUCTION

The purpose of this appendix is to provide a set of programmatic resources for outreach, education, enforcement, and evaluation/policy that will support the goals of the *Bike Boone 2013 Bicycle Transportation Plan*. The information that follows is for guidance and discussion purposes; actual program implementation will vary depending on the particular needs and goals determined by those involved in organizing such efforts.

While improving bicycle infrastructure is critical to increasing bicycling rates and bicycling safety, the importance of outreach, education, evaluation, and enforcement efforts should not be underestimated. These programs can ensure that more residents will know about new and improved facilities, learn about the benefits of walking, and receive positive reinforcement about why and how to integrate bicycling into their everyday lives. In essence, these efforts market bicycling to the general public and ensure the maximum “return on investment” in the form of more Boone residents bicycling and a higher degree of safety and awareness around bicycling in Boone.

In addition to providing bicycle-specific program resources, this appendix also includes program information and resources listed in the *Walk Boone 2011 Pedestrian Transportation Plan*, updated to include a bicyclist element where applicable. The following sections contain information about current and potential program partners, existing programs, and new programs to pursue, with a description of the basic approach and, wherever possible, links to model programs.

[Chapter heading photo courtesy of Boone Area Cyclists.]



PARTNERS

- **Town of Boone** – The town’s Transportation Committee will work with Public Works, Planning & Inspections, and the Alternative Transportation Subcommittee to assist in the coordination of programs.
- **Alternative Transportation Subcommittee (ATS)** - The ATS serves to represent the community’s interests regarding alternative transportation issues in Boone. The subcommittee reviews development and improvement considerations that affect walking and bicycling conditions and make recommendations for street and sidewalk improvements. An active contributor to the development of the *Walk Boone 2011* Plan, this group will also be an important partner in implementing bicycle programs and pursuing the recommendations made in this plan.
- **North Carolina Department of Transportation (NCDOT)** – NCDOT will necessarily be involved in any project on state-owned facilities, and can be a strong partner as well for trainings related to active transportation. See www.ncdot.gov/bikeped/safetyeducation/ for more information about safety and education program resources offered by NCDOT.
- **Be Active-Appalachian Partnership** – Collaboration between Be Active North Carolina and Appalachian State University, supported by a five-year grant from Blue Cross and Blue Shield of North Carolina and housed in Appalachian’s Institute for Health and Human Services. It promotes physical activity for the citizens of western North Carolina through programming, people and policies. The Partnership can play a role in implementing key recommendations in this plan that will help Boone residents get more physical activity.
- **Watauga County Health Department** – One of the WCHD’s priorities is to promote physical activity for all ages. They will be a natural partner on programs that result in increased physical activity.
- **CPPW Leadership Team** – This team was brought together for the purposes of implementing the Communities Putting Prevention to Work grant. The CPPW program aims to achieve broad reaching, highly impactful, and sustainable change to reduce chronic disease morbidity and mortality associated with obesity and tobacco use. If this team agrees to continue meeting, they could be effective partners in implementing many of the recommendations in this plan as they relate to promoting increases in physical activity (particularly Safe Routes to School).
- **Appalachian State University** – Because it is so centrally located, ASU contributes materially to the pedestrian and bicycle environment in Boone. ASU representatives may be natural partners for certain bicycle safety campaigns that are aimed at students and at the campus bicycling environment.
- **Town of Boone Police Department** – The Police Chief already sits on the Transportation Committee, and the Police Department has been involved in identifying traffic safety problems and executing enforcement campaigns. The enforcement recommendations in this appendix can only be implemented with the partnership and support of the Town of Boone Police Department.





- **Watauga County School District** – Schools in Boone are natural partners for Safe Routes to School efforts as well as on enforcement actions related to student safety. A representative from Watauga County School District sits on the CPPW Leadership Team, which may be sufficient for coordination purposes if that group continues to meet in the future.
- **Parent Teacher Associations (PTAs)** – PTAs can be effective partners in implementing Safe Routes to School efforts and other school-oriented traffic safety initiatives.
- **Watauga County Parks & Recreation** – Parks and Recreation are natural partners for public events and classes.
- **Watauga County Project on Aging** – This county department serves as the focal point for aging services in Watauga County and will be a natural partner for programs aimed at helping seniors increase their levels of physical activity.
- **Boone Area Cyclists** – This local cycling club is open to cyclists of all ages, abilities, and styles of riding. With their history of hosting local events and fundraising for bicycle facilities, the BAC may be interested in supporting bicycle education and outreach programs and events.
- **Boone Bicycle Initiative** – This community-based organization dedicates its resources to addressing bicycle safety and awareness in Boone, as well as operating a low-cost bicycle loan program. In the past the organization has offered bike maintenance classes and rules of the road workshops, and may be interested in partnering on bicycle education and outreach programs and events.
- **Boone Area Chamber of Commerce** – The Chamber may be interested in supporting initiatives that bring residents and visitors to downtown Boone, such as Cyclo.Via, bicycle races, organized rides, and similar events.
- **Boone Convention and Visitor's Bureau** – The Visitor's Bureau may be interested in supporting initiatives that bring residents and visitors to downtown Boone, such as Cyclo.Via, bicycle races, organized rides, and similar events.
- **Downtown Boone Development Association** – The DBDA may be interested in supporting initiatives that bring residents and visitors to downtown Boone, such as Cyclo.Via, bicycle races, organized rides, and similar events.
- **Watauga County Tourism Development Agency** – The Tourism Development Agency may be interested in supporting initiatives that bring residents and visitors to downtown Boone, such as Cyclo.Via, bicycle races, organized rides, and similar events.

EXISTING PROGRAMS

CYCLO.VIA

Ciclovias, which originated in Bogotá, Colombia (hence the Spanish name), are periodic street closures (usually on Sundays) that create a temporary park that is open to the public for walking, bicycling, dancing, hula hooping, roller skating, and other forms of human-powered activity. These programs are known by many names: Ciclovias, Open Streets, Sunday Parkways, Summer Streets, and Sunday Streets. They have been very successful internationally and are rapidly becoming popular in the United States. They promote health by creating a safe and attractive space for physical activity and social interaction, and are cost-effective compared to the cost of building new parks for the same purpose. These events can be weekly events or one-time events, and are generally very popular and well-attended.

Boone Area Cyclists hosted the inaugural Cyclo.Via event in Boone on June 26, 2011. The project was supported by the Watauga County Tourism Development Agency and the Boone Convention and Visitors Bureau. The most recent Cyclo.Via was held on August 4, 2013 and included street closures on portions of Howard Street, Depot Street, and Rivers Street. Zumba, a BMX show, a competitive jump rope team, tricycle races, and the Kids' Bike Rally were some of the activities featured at the event.



Cyclo.via provides a fun and encouraging environment for bicyclists of all ages, types, and skill levels.



Recommendation: For future expansion of the program, organizers should consider lessons learned and best practices from other communities. Some recommendations include:



A Kids' Bike Rally and a BMX Show were some of the activities included in Cyclo.via 2013.

- Make sure that there are programmed, family-friendly activities along the route; an “open street” alone is not sufficient to draw participants (and especially not on a repeat basis).
- These events lend themselves to innovative partnerships and public/private funding. Health care providers whose mission includes facilitating physical activity are often major sponsors. Businesses may also support the event if it brings customers to their location.
- The cost of organizing the event can be mitigated through volunteer participation, as this type of event lends itself to enthusiastic volunteer support. However, this will require a high level and quality of volunteer recruitment and management to be sustainable in the long run.
- Police costs to manage the road closure will be one of the largest costs. Work with the police to develop a long-term traffic closure management strategy that uses police resources where needed but also allows well-trained volunteers to participate in managing road closures.
- Informing residents along the route about what it means for them is essential. They should be informed numerous times (3-6 times is not too much), including a reminder the day before the event. Expectations about vehicle access to and from residences should be managed clearly.
- Consider linking parks, schools, and other public assets. If possible, organize a route that introduces residents to good walking and bicycling routes that they can use at other times as well.
- The greatest value to the community comes when a ciclovía event happens on a regular basis (e.g. monthly during pleasant weather months). For this to be successful, different routes and/or different activities should be considered.

One community (Portland, OR) assembled a training manual for other communities based on their experience with ciclovías; this may be useful for Boone as the event grows in popularity: <http://www.portlandonline.com/transportation/index.cfm?c=51522&a=274625>

- Videos of Sunday Parkways events: <http://www.streetfilms.org/tag/ciclovias/>



ORGANIZED BICYCLE RIDES AND RACES

Boone is host to a number of bike rides and races every year that cater to a variety of ages, cyclist types, and skill levels. Annual rides and races held in Boone include the Boone Roubaix (April), the High Country Kids' Triathlon (April), the Gap Grind Metric (May), Blood Sweat and Gears (May), The Grizzly Metric (June), Rock the Blue Ridge (JULY), Watauga Lake Triathlon (October), and the High Country Cyclocross Series (October).

Not only do these events provide fun and competitive environments for cyclists, but they also generate considerable economic benefits for the community. The Blood, Sweat, and Gears ride nets an average of \$70,000 each year from direct event revenue. When lodging, food, transportation, and other rider expenditures are accounted for, this ride generates roughly \$1 million in annual economic benefits for the Boone community.

Recommendation: Continue to organize annual and semi-annual bike rides and races within Boone. Many of the events that currently exist are oriented towards adults who are experienced riders. Consider adding ride events that cater to less experienced cyclists, such as greenway trail rides, mountain bike events, and events that cater to children. Providing a place for children to ride in a controlled, supervised environment can help to boost their riding confidence and help them learn safe skills and behaviors for riding a bicycle.



Bicyclists in the Blood, Sweat, and Gears ride.

IMBA TAKE A KID MOUNTAIN BIKING DAY

2013 marks the tenth year of this event sponsored by the International Mountain Bicycling Association (IMBA). The event is intended to encourage youth to develop a stronger connection with the natural environment, particularly local parks and recreation lands. Boone Area Cyclists started hosting a local Take a Kid Mountain Biking Day event in 2010. The event is held annually at Rocky Knob Mountain Bike Park on the first Saturday in October.

Recommendation: Annual events like Take a Kid Mountain Biking Day offer ideal opportunities to provide bicycle education and outreach to children. In addition to encouraging children to get out and ride a bike and appreciate the natural environment, the event could be coupled with a Bicycle Rodeo or similar educational event that teaches children bicycle skills and how to safely ride both on- and off-road. This larger event could be held in the Rocky Knob Mountain Bike Park parking lot and could include a bicycle challenge course, helmet fittings, a safety information booth with prizes, and other engaging educational activities.



Kids participating in Take a Kid Mountain Biking Day at Rocky Knob Park.

- National Center for Safe Routes to School Bicycle Rodeo Guide: <http://www.saferoutesinfo.org/program-tools/organizers-guide-bicycle-rodeos>



BICYCLE LOANER PROGRAM

The Boone Bicycle Initiative bicycle loaner program provides bicycles to underserved individuals in the Boone community at little to no cost. The goal of the program is to improve the mobility of these individuals and their access to employment opportunities, community activities, and social outings.

Recommendation: As more bicycle facilities are built and bicycle ridership in Boone continues to increase, the town should consider supporting the Bicycle Loaner Program and related efforts of the Boone Bicycle Initiative. The loaner program would be an ideal way to provide educational materials to citizens and to promote other local bicycle-related events. A safety packet on bicyclist rights and responsibilities could be provided to each borrower, or borrowers could be required to complete bicycle safety skills training before checking out a bike. The Boone Bicycle Initiative may also be interested in assisting the town with outreach and education programs and would be a valuable partner in these efforts.

- Hub Cycle, Partners for Active Living, Spartanburg, SC:
<http://www.active-living.org/Hub-Cycle-2.html>



OUTREACH RESOURCES

SAFE ROUTES TO SCHOOL (SRTS)

Purpose: Promote physical fitness and health by helping children walk and bicycle to school; improve school traffic safety through physical improvements and programs

Audience: School-aged children and their parents; school administrators, faculty, and staff

Partners: Watauga County School District, Parent-Teacher Associations, CPPW Leadership Team, Town of Boone Police Department, Town of Boone Public Works Staff, community members

Safe Routes to School programs use a “5 Es” approach of Engineering, Education, Encouragement, Enforcement, and Evaluation strategies to improve safety and encourage children to walk and bike to school. The programs are usually run by a coalition of city government, school and school district officials and teachers, parents and students, and neighbors.

In a rural environment, a majority of school trips will be too long for students to make the entire trip by walking or bicycling. For this reason, the focus should be on creative efforts to help schoolchildren increase their physical activity in other ways.

For example, a Safe Routes to Bus Stops program can help children safely access bus transportation by biking, and International Walk to School Day in October can be an excellent annual event that offers all families and children the opportunity to participate in healthy school transportation.

A next step towards creating safer active travel opportunities for schoolchildren would be creating a Safe Routes to School Plan for every elementary and middle school in the Watauga County School District. This will necessarily be a coalition effort, and the CPPW Leadership Team may be well suited to coordinating this effort. This planning project may be eligible for grant funding through the NCDOT Safe Routes to School program, though because of the uncertain outlook for this federal funding program, it is recommended that this funding source be investigated sooner rather than later.



Parents and kids bike to school as part of the Safe Routes to School Program in Marin County, CA.

Another important step for SRTS programs in Boone would be to host a Safe Routes to School Community Workshop. Designed to help communities develop sound SRTS programs based on their unique local context, this is a one-day event that provides information on best practices, useful strategies, and available resources. NCDOT's Safe Routes to School Program offers a customized version of the "Safe Routes to School National Course," developed by the National Center for Safe Routes to School and the Pedestrian and Bicycle Information Center.

Sample Programs:

- Marin County National Model Program: <http://www.saferoutestoschools.org/index.shtml>
- Laura Richards School Walking School Bus Program (Gardiner, ME): <http://www.msad11.org/node/3705>
- Walking School Bus and Park and Walk Programs (Windsor, VT): <http://www.saferoutesinfo.org/data-central/success-stories/windsor-vermont-parent-volunteers-lead-walking-school-buses-forward>
- Ira B. Jones School Walking to School Program (Asheville, NC): <http://www.saferoutesinfo.org/data-central/success-stories/asheville-north-carolina-encouragingwalking-and-wheeling-school-wide>

WALKING/BICYCLING MAPS

Purpose: Encourage walking and biking by providing route and facility information and highlighting walking and bicycling destinations

Audience: General public

Partners: Downtown Boone Development Association, Boone Area Chamber of Commerce, Boone Convention and Visitor's Bureau, Appalachian State University, Town of Boone GIS Department



One of the most effective ways of encouraging people to walk and bicycle is through the use of maps and guides to show where you can walk and bike, and to guide people to enjoyable routes and destinations for walking and biking. Boone already has a map that shows the Greenway Trail and other destinations. The map should be reprinted as needed and actively distributed to residents and visitors; it should also be updated on a regular basis as new facilities are implemented.

As a next step, the town should create a dedicated Boone Bicycle Network Map to reflect the most current bicycle infrastructure in town, including on-road bicycle facilities and off-road greenways and trails. The map could also list dedicated bicycle routes and provide suggestions for self-guided bike rides around town. The map should be distributed in a variety of high-quality formats, both in print and online, to maximize its availability and use.

Boone already has numerous partners and resources who may be able to help research bicycling routes and self-guided rides. Downtown Boone Development Association, Boone Area Chamber of Commerce, Boone Convention and Visitor's Bureau may be willing to partner based on the nexus with tourism and economic development. The DBDA Public Art program is an excellent starting place for a public art tour. Appalachian State University may be able to assist with historic research and through the Recreation Management Program. Researching and developing tour routes and creating supporting materials might be a good student project, for example. The online Boone Historic Archives may also be a resource for this effort (<http://www.booneonline.com>).

Sample Self-Guided Rides and Maps:

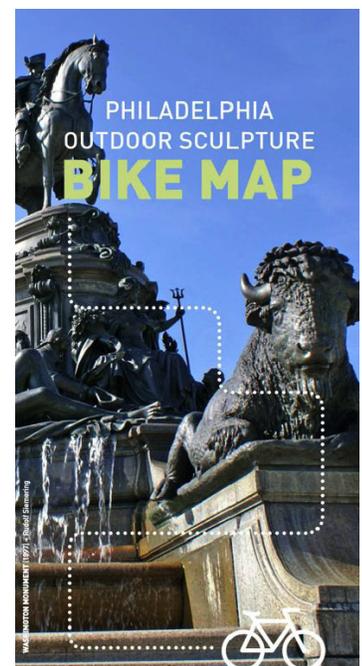
- Arlington History Ride (Arlington, VA): <http://www.bscl.org/histride.htm>
- A Bicycle Tour of Historic Lexington (Lexington, KY): <http://www.visitlex.com/idea/bicycle-tour.php>
- Philadelphia Outdoor Sculpture Bike Map (Philadelphia, PA): <http://museumwithoutwallsaudio.org/wp-content/uploads/2012/03/PHL-Outdoor-Public-Art-Bike-Map.pdf>

Public art bike map and self-guided tour in Philadelphia, PA.

These routes are recommended for urban cyclists with experience riding on busy streets or in traffic. Please be courteous, wear a helmet, and use proper hand signals. You are responsible for your own safety. Visit WWW.BICYCLECOALITION.ORG for safe city biking.

- WASHINGTON MONUMENT** (1897) MW
Rudolf Siemering
- THE LION FIGHTER** (1858, cast 1892) MW
Albert Wolff
- MOUNTED AMAZON ATTACKED BY A PANTHER** (1839, cast 1929) MW
August Kiss
- ROCKY** (1980) MW
A. Thomas Schomberg
- IROQUOIS** (1983-1999) MW
Mark di Suvero
- CHARIOTEER OF DELPHI** (5th c. BC, cast ca. 1977) MW
Artist Unknown
- JOAN OF ARC** (1890) MW
Emmanuel Frémiet
- SILENUS AND THE INFANT BACCHUS** (4th c. BC, cast ca. 1885)
Praxiteles
- ABRAHAM LINCOLN** (1871) MW
Randolph Rogers
- THE WEDGES** (1970) MW
Robert Morris
- THE PILGRIM** (1904) MW
Augustus Saint-Gaudens
- THORFINN KARLSEFNI** (ca. 1918) MW
Einar Jonsson
- ELLEN PHILLIPS SAMUEL MEMORIAL** (1933-61) MW
Works by various sculptors
- JAMES A. GARFIELD MONUMENT** (1895) MW
Augustus Saint-Gaudens
- COWBOY** (1938) MW
Frederic Remington
- PLAYING ANGELS** (ca. 1950) MW
Carl Milles
- SLEEPING WOMAN** (1991) MW
Stephen Berg and Thomas Chimes
- GENERAL ULYSSES S. GRANT** (1897) MW
Daniel Chester French and Edward C. Potter
- JOHN B. KELLY** (1965) MW
Harry Rosin
- SCENIC VIEW FALLS BRIDGE** (1894-95)
George S. Webster and James H. Wundrim
- SCENIC VIEW ACROSS THE RIVER LAUREL HILL CEMETERY**
- SCENIC VIEW BELMONT MANSION PHILADELPHIA SKYLINE**
- HORTICULTURE CENTER THE WRESTLERS** (rd c. BC, cast ca. 1885)
Artist Unknown
- JOSEPH HAYDN** (1906)
Brosch & Son
- FRANZ SCHUBERT** (1891)
Henry Baerer
- GIUSEPPE VERDI** (1907)
G.B. Sashanellofast
- NIGHT** (1872)
Edward Stauch
- SUNDIAL** (1903)
Alexander Stirling Calder
- GOETHE** (1890)
Heinrich Carl Johan Manger
- SCHILLER** (1864)
Heinrich Carl Johan Manger
- PAVILION IN THE TREES** (1992)
Martin Puryear
- MAJOR GENERAL GEORGE GORDON MEADE** (1887)
Alexander Milne Calder
- SMITH MEMORIAL ARCH** (1897-1912)
Works by various sculptors
- ST. GEORGE & THE DRAGON** (1877)
Artist Unknown
- ALEXANDER VON HUMBOLDT** (1871)
Friedrich Drake
- SCENIC VIEW ACROSS THE RIVER BOATHOUSE ROW FAIRMOUNT WATER WORKS**

START/STOP ●
10 MILE LOOP STOPS 1-17 ●●●●●●●●●●
4 MILE LOOP STOPS 1, 12-17 ●●●●●●●●●●
MUSEUM WITHOUT WALLS AUDIO MW





WAYFINDING SIGNAGE PROGRAM

Purpose: Enhance resident and visitor orientation by directing pedestrians, bicyclists, and motorists to popular destinations around town

Audience: General public

Partners: Town of Boone Public Works Department, Downtown Boone Development Association, Boone Area Chamber of Commerce, Boone Convention and Visitor’s Bureau, Appalachian State University

Wayfinding signage, as part of a signage program that also includes warning and regulatory signage, enhances resident and visitor orientation. A clear wayfinding system should contribute to economic development by indicating key destinations around town. Directional signage targeted for use by motor vehicle drivers, pedestrians, and cyclists will complete a multimodal legibility package.

Boone should develop a customized wayfinding program that provides effective orientation and direction to key destinations. Materials for signage should reflect the character of Boone and Watauga County and be selected for longevity and ease of maintenance. A wayfinding program can include directional signage, on-road markings, and kiosks with town maps. The Downtown Boone Development Association, Boone Area Chamber of Commerce, and Boone Convention and Visitor’s Bureau may be willing to partner based on the nexus with tourism and economic development. Appalachian State University could assist with wayfinding signage development and placement near campus to most effectively direct pedestrians, bicyclists, and motorists to and from ASU destinations.

Sample wayfinding signage programs:

- Oakland, CA: <http://www2.oaklandnet.com/oakca/groups/pwa/documents/report/oak025118.pdf>
- London, England: <http://www.tfl.gov.uk/microsites/legible-london/>

ONE STOP WEBSITE

Purpose: Provide bicycling information to current and potential bicyclists in an accessible online format

Audience: General public

Partners: Town of Boone Public Works Department, Town of Boone Alternative Transportation Subcommittee, Boone Planning & Inspections Department

Many current and potential bicyclists do not know where to find information on bicycling laws, events, maps, tips, and groups. The Town of Boone could develop a “one-stop” website with comprehensive bicycling information. A website is not usually difficult to set up, but it will only be successful if the site is both easy to use and updated frequently. All content should be reviewed regularly for accuracy. The bicycling community can assist in keeping the site up to date. Other recommended programs in this appendix could be housed on the website, such as the maintenance request form, speed feedback sign request form, and walking and biking maps.

Sample bicycle information websites:

- Portland, OR: <http://www.portlandoregon.gov/transportation/34772>
- Austin, TX: <http://austintexas.gov/bicycle>



Bicycle and pedestrian wayfinding signage examples.



BIKE MONTH ACTIVITIES

Purpose: To showcase the benefits of bicycling and to encourage current and potential bicyclists to incorporate bicycling into their everyday lives

Audience: General public, ASU students, commuters

Partners: Boone Area Cyclists, Boone Bicycle Initiative, Town of Boone Alternative Transportation Subcommittee, Boone Police Department, ASU



A police officer provides free bike lights to cyclists during Bike Month to encourage safe riding.

Cities and towns across the country participate in National Bike Month annually during May. The League of American Bicyclists (LAB) hosts a website for event organizers. The website contains information on nationwide and local events, an organizing handbook, and promotional materials. Boone could host National Bike Month events and activities annually, with the support of local bicycling groups and shops. Events and activities for Bike Month may change from year to year, and the total number of activities should increase each year as the bicycling community in Boone grows.

LAB Bike Month information:

- <http://www.bikeleague.org/content/national-bike-month>

EDUCATION RESOURCES

MEDIA CAMPAIGN TO EDUCATE MOTORISTS, CYCLISTS, AND PEDESTRIANS

Purpose: Educate all road users about their rights and responsibilities to increase awareness and improve traffic safety

Audience: General public

Partners: Town of Boone Police Department, ASU Police Department, ASU staff, Boone Area Cyclists, Boone Bicycle Initiative, Town of Boone Alternative Transportation Subcommittee

Watch for Me NC is a comprehensive campaign aimed at reducing the number of pedestrians hit and injured in crashes with vehicles. The campaign consists of safety messages directed toward drivers and pedestrians; educational messages to better inform drivers, cyclists, and pedestrians about safety laws; and an enforcement effort by area police in several Triangle communities: Raleigh, Durham, Chapel Hill, and Carrboro. The campaign is programmed to expand and include bicycling laws, and expand statewide. The Town could use the educational materials made available by NCDOT to distribute at local festivals and other events. Boone Area Cyclists may be willing to help the town raise funds to produce bicycle safety panels for display on the outside of AppalCART buses.

Watch for Me NC website:

- <http://www.watchformenc.org/>



YOUTH BICYCLING SAFETY EDUCATION COURSES

Purpose: Educate children and youth on how to safely ride a bicycle and develop bicycle skills

Audience: Children and youth

Partners: Watauga County School District, School Administration, Watauga County Parks and Recreation Department, Boone Area Cyclists, Boone Bicycle Initiative, local bike shops

Typical school-based bicycle educational programs teach students about the rules of the road, the proper use of bicycle equipment, biking skills, street crossing skills, and the benefits of biking. Educational programs can be part of a Safe Routes to School program (see Outreach section) or a stand alone “bike rodeo” event, where kids can learn and practice bicycling skills in a controlled, supervised environment. Youth bicycle classes held during Bike Month in May will complement the annual youth bicycle safety education classes held as part of the Safe Routes to School program.

Youth bicycle safety education resources:

- National Center for Safe Routes to School: <http://www.saferoutesinfo.org/program-tools/organizers-guide-bicycle-rodeos>
- Safe Kids Worldwide: <http://www.safekids.org/sites/default/files/documents/Bike-Rodeo-Station-Guide.pdf>



Youth bicycling safety courses provide a safe place for kids to build their bicycling skills and learn the rules of the road.



ADULT & FAMILY BICYCLING CLASSES



Family bicycling classes educate parents on how to safely ride with their kids.

Purpose: Encourage families to ride bicycles together and teach bicycle safety and skills

Audience: Families

Partners: Boone Area Cyclists, Boone Bicycle Initiative, local bike shops

Family bicycling classes are great tools for encouraging families to ride bicycles. The activities provide an avenue for families to understand the differences between bicycling ability levels, learn about opportunities to safely bike together, and build bicycling confidence in their children. These classes also teach parents to serve as role models for bicycle safety and handling.

Family bicycle class examples:

- Pima County, AZ: <http://bikeped.pima.gov/allsafetyclasses.html>
- East Bay Bicycle Coalition, CA: <https://www.ebbc.org/safety>

PROFESSIONAL DEVELOPMENT COURSES

Purpose: Educate and train planners and engineers on pedestrian and bicycle facilities and policy issues

Audience: Professionals in planning, engineering, landscape architecture, etc.

Partners: Town of Boone Public Works staff, Town of Boone GIS staff, County staff, NCDOT staff, ASU staff

Professional development courses provide training to transportation and other professionals who may not have received extensive experience or training in pedestrian and bicycle facilities. This can be a successful way to institutionalize knowledge of pedestrian and bicycle facility design at an institution and create an agency culture that values bicycling. Dozens of free or low-cost training webinars are offered by the Pedestrian and Bicycle Information Center (PBIC), Association of Pedestrian and Bicycle Professionals (APBP), Federal Highway Administration (FHWA), Institute of Transportation Engineers, and others.

Potential topics include:

- Pedestrian and Bicycle Facilities Standards - NACTO, MUTCD, AASHTO
- ADA Compliance for Transportation Facilities - PROWAG, ADA Transition Plans, liability issues, etc.
- Complete Intersections – including operations, planning, accessibility, etc.
- Complete Streets – implementing the policy
- Greenway and Path Crossings
- Bicycle Facilities – Planning, Design and Implementation
- Working with Law Enforcement on Traffic Safety Campaigns

Sample program:

- Institute for Bicycle and Pedestrian Innovation: <http://www.ibpi.usp.pdx.edu/>



DIVERSION CLASS

Purpose: Educate motorists, pedestrians, and bicyclists on roadway safety and traffic laws

Audience: General public, usually first-time offenders of particular traffic violations

Partners: Town of Boone Police Department, ASU Police Department, Watauga County Court System, Alternative Transportation Subcommittee

A diversion class is offered to first-time offenders of certain community-related traffic violations, such as motorists speeding, pedestrians jaywalking, or bicyclists running a stoplight on a bike. It can be aimed at pedestrians, bicyclists, and motorists. In lieu of receiving a citation and/or fine, individuals can take a one-time, free or inexpensive class instead. In Marin County, CA, interested citizens can take the class even if they did not receive a ticket. This program is a good way to educate all road users about road user rights and responsibilities.

Sample programs:

- Portland, OR: <http://www.legacyhealth.org/body.cfm?id=1928>
- Marin County, CA: <http://www.marinbike.org/Campaigns/ShareTheRoad/Index.shtml#StreetSkills>

FRIENDS OF THE GREENWAY GROUP

Purpose: Foster community pride and stewardship of the Greenway; promote public safety and responsible behavior by path users

Audience: Users of shared-use paths

Partners: Greenway, Parks and Gardens Committee; Town of Boone Police Department; Boone Area Cyclists; High Country Pathways; other interested citizens

A Friends of the Greenway organization can help to create community pride and a sense of ownership about the greenway while also reducing the potential for public safety issues and promoting responsible user behavior.

A Friends of the Greenway group must primarily be a citizen-led initiative that may eventually become a registered nonprofit corporation if desired. Numerous other partners can support and partner with the Friends group, however, both to create the group and to help it be successful in the long run.

Major campaigns for Friends of the Greenway may include:

- Annual Greenway Clean-Up Days - This effort would harness and organize volunteers to install and maintain plantings, remove trash, install benches, signs and other amenities, and create a sense of community pride in the facility. Different groups could be invited to participate for specific events, such as scout troops, seniors (perhaps as part of the Senior Strolls program recommended in the pedestrian plan), and schoolchildren (as part of a Safe Routes to School program or for Earth Day).
- Greenway Ambassadors - Greenway Ambassadors are trained residents who regularly walk or bicycle along the greenway to identify maintenance or



Greenway Ambassadors help to improve safety on the trail by monitoring activity and reporting any emergencies.



safety concerns, report illegal trail dumping, erosion, or vandalism, and make the Town of Boone aware of any security issues or other needs early so they can be dealt with promptly. The presence of trained Ambassadors, who should wear specific t-shirts or other identifying garments, can serve an “Eyes on the Street” function (similar to a “Block Watch” program) to alert the entire community that the facility is being monitored, and that legitimate users take an active role in monitoring the trail.

- Share the Greenway Outreach - Conflicts between greenway users can be a major issue on popular, well-used path systems. Some communities have launched successful “share the path” events to help educate users about safety and courtesy. These programs educate users about expected behavior and how to limit conflicts. Volunteers often give out brochures and engage with users in a non-confrontational way. Media outreach should be included as well. Common strategies include a bicycle bell giveaway, handing out maps and information, posting signs, tabling, and ‘stings’ that reward good behavior.
- Greenway Celebration Days - Regular festivals and organized outings will help Boone residents experience the greenway in a fun and supportive atmosphere. Possible themes include a fun run/walk, a family bike parade for Mother’s Day or Father’s Day, a celebration for International Walk to School Day (in October), or a bike ride with the mayor during Bike Month (in May).



A Friends of the Greenway Group can promote greenway celebration days and rides that encourage cyclists of all skill levels to use the trail.



POLICY AND EVALUATION RESOURCES

COMMUNICATE MAINTENANCE SCHEDULES

Purpose: Improve the coordination between local and state-level planning and engineering staff to ensure that bicycle facilities are included in planning and design phases of upcoming transportation projects

Audience: Town of Boone staff

Partners: NCDOT Division staff

Communication and coordination between NCDOT and communities that includes early notification to planning and engineering staff of maintenance and restriping schedules is an effective way to have bicycle facilities included in the design of upcoming transportation projects. Annual meetings could be held when updated maintenance and restriping schedules are released to allow for face to face conversation between local staff and NCDOT Division staff. This information allows communities an opportunity to provide input regarding their bicycle facility needs and support accommodation measures, such as restriping to include bicycle lanes and other relevant markings.



PEDESTRIAN AND BICYCLE COUNTS PROGRAM

Purpose: Gather important benchmarking information about walking and cycling rates

Audience: Agency staff

Partners: Town of Boone Public Works Department; Alternative Transportation Subcommittee; Greenway, Parks, and Gardens Committee; Watauga County Parks and Recreation

In order to determine this plan’s success at helping Boone residents bike more, it is necessary to establish an annual data collection program. At a minimum, this program should tally the number of pedestrians and cyclists at key locations around the community (particularly at pinch points, in downtown, near schools, and on the greenway); the same locations should be counted in the same manner annually. If major bicycle or greenway infrastructure projects are planned, baseline and post-construction user counts can be performed through this coordinated annual count

Good communication between agencies can help to ensure that bicycle facilities are included in road projects.



Bicycle counts help to track ridership over time and can be used to support the case for greater investment in sustainable transportation.

process for maximum efficiency. This will provide the town with information about increases in walking and bicycling rates.

It is recommended that the data collection program use methodology developed by the national National Bicycle and Pedestrian Documentation Project (NBPDP). Counts should be performed in the second week in September; one weekday count (from 5-7 PM on a Tuesday, Wednesday, or Thursday) and one Saturday count (12 noon – 2 pm) should be completed. Counters can be volunteers or agency staff, as long as proper training is provided. If desired, surveys can also be included in the data collection effort to learn more about walking and bicycling demographics, trip origin/destinations, etc.

The NBPDP website includes count and survey instructions, forms, and participant training materials:

- <http://bikepeddocumentation.org>.

WALKING, BICYCLING, AND GREENWAYS REPORT CARD

Purpose: Share information about key walking and bicycling metrics

Audience: General public; elected officials and decision makers

Partners: Town of Boone Public Works Department; Alternative Transportation Subcommittee; Greenway, Parks, and Gardens Committee; High Country Pathways

It can be a useful benchmarking activity to publish an annual report measuring accomplishments and performance against benchmarks. An annual report should include relevant bicycling metrics (bicycling count results, new bicycle facility miles, major completed projects, bicycle-involved crashes) and may also include information on user satisfaction, public perception of safety, or other qualitative data that has been collected related to bicycling.

Sample program:

- City of San Francisco - San Francisco, CA: http://www.sfbike.org/download/reportcard_2006/SF_bike_report_card_2006.pdf

MAINTENANCE HOTLINES

Purpose: Allow road users to report safety problems related to walking and bicycling facilities and request facilities

Audience: Boone residents who walk and bicycle

Partners: Town of Boone Public Works Department; Alternative Transportation Subcommittee

The Town of Boone can work together with residents to identify bicycling safety issues by creating web forms and/or hotlines that residents can use to request maintenance or enhancements. This benefits the public by helping them route their concerns to the correct party. It benefits the town by making sure they hear about potential safety and liability issues early so they can take action. Many jurisdictions also find that this approach is beneficial because their scheduled maintenance and complaint-based inspection approach cannot identify every legitimate issue, so



hotlines and web forms can essentially distribute the job of inspecting facilities to all residents.

The highest priority should be creating a mechanism for residents to report bicycling safety issues such as cracked pavement, blocked drains, malfunctioning crossing signals, encroaching vegetation, debris in bike lanes, etc. Residents may also file complaints about property owners who repeatedly fail to clear snow from sidewalks. If desired, additional input may be invited such as allowing residents to request bicycling and walking maps by mail, allowing residents to request parking enforcement that impacts walking and bicycling (e.g. parked cars blocking ADA ramps or bike lanes), and/or allowing residents to request traffic safety enforcement.

Sample program:

- Durham “Report a Problem” web page: http://www.bikewalkdurham.org/BPAC_report.html

BIKE-FRIENDLY COMMUNITY (BFC) DESIGNATION

Purpose: To recognize the Town of Boone’s efforts in creating a Bicycle-Friendly Community and to receive feedback on areas to target for improvement

Audience: Town of Boone staff

The Bike Friendly Communities program (administered by the League of American Bicyclists) is a national recognition program developed to encourage towns and cities across the U.S. to create more bikeable environments. The Town of Boone applied for BFC recognition in 2012 and received an Honorable Mention. The Town could improve upon this success by improving a wide range of conditions related to bicycling, including safety, mobility, access, and comfort.

League of American Bicyclists BFC website:

- <http://www.bikeleague.org/content/communities>



The Bicycle Friendly Community designation awards communities for improving their bicycling environment and provides feedback on areas for improvement.

BICYCLE-FRIENDLY UNIVERSITY (BFU) DESIGNATION

Purpose: To recognize Appalachian State University’s efforts in creating a Bicycle-Friendly University and to receive feedback on areas to target for improvement

Audience: Appalachian State University staff

Similar to the BFC, the BFU program was developed by the League of American Bicyclists to recognize universities nationwide for creating bikeable campus environments. Working with the Town of Boone, ASU could pursue campus-related recommendations contained in this plan and apply for BFU recognition.

League of American Bicyclists Bicycle Friendly University website:

- <http://www.bikeleague.org/content/universities>



ENFORCEMENT RESOURCES

20'S PLENTY CAMPAIGN

Purpose: Reduce crashes and crash severity by lowering vehicle speeds on neighborhood streets to 20 MPH

Audience: Drivers

Partners: Town of Boone Police Department, ASU Police Department, Watauga County Court System, Alternative Transportation Subcommittee, Town of Boone Public Works Department

More and more communities are realizing that lowering residential speeds to 20 MPH has enormous safety benefits for all users, including cyclists, by lowering both the rate and severity of crashes. One campaign, from the United Kingdom, is called "20's Plenty."

A successful campaign will bring together several different strategies, including:

- Changing the legal guidelines around minimum speed and/or authority to set speed limits. For example, the State Legislature may consider passing a law that would permit towns and cities to set speed limits on certain types of roadways, based on classification or designation in an adopted plan.
- Making residents aware of the benefits of 20 MPH roadways and engaging their partnership on raising awareness and buy-in from their neighbors.
- Identifying specific streets on which a 20 MPH speed limit is appropriate. Likely candidates would include designated school walking or bicycling routes, roads identified in pedestrian or bicycle plans as important corridors for those uses, and residential streets whose residents request inclusion in a 20 MPH program.
- Traffic engineering to ensure that the design speed of the street matches the new posted speed.
- Partnership with law enforcement to issue warnings and moving violations on designated 20 MPH streets.
- Evaluation of vehicle speeds and reported crashes (number and severity) before and after the integrated campaign is implemented to the effort to measure results and correct course.

Video about UK "Twenty's Plenty" campaign:

- <http://www.streetfilms.org/no-need-forspeed-20s-plenty-for-us/>



SPEEDING ENFORCEMENT

Purpose: Reduce speeding

Audience: Motorists

Partners: Town of Boone Police Department, ASU Police Department, Watauga County Court System, Town of Boone Public Works Department, Alternative Transportation Subcommittee

Speeding vehicles endanger all road users, including bicyclists. High-speed driving results in more frequent crashes and crashes that are more likely to result in serious injury or death. Targeted speed enforcement activities are a proven way to improve road safety and make bicycling more appealing.

Law enforcement officials should enforce speed near schools, in downtown, at major ASU entrances/exits, and at locations that are known to have speeding problems (as identified by the Alternative Transportation Subcommittee in consideration of resident complaints). These campaigns are ideal for a Safe Routes to School Program (see page B-6); many towns hold an annual “Back to School Blitz” to enforce speed limits in school zones.

As part of ongoing enforcement against speeding, the Town of Boone Police Department should also consider creating a speed feedback sign request program to deploy speed feedback signs at the request of neighborhood associations and schools. The signs serve as a traffic calming device when used temporarily at strategic roadway locations. The town should also use speed feedback signs on streets with new bicycle facilities. The signs should be mounted temporarily (e.g., for two weeks) and then be moved to another location to keep motorists from becoming inured to the speed feedback sign effect.

Example speed feedback sign request program:

- Toronto, Canada: <http://www.toronto.ca/transportation/walking/wysp/>



Speed feedback signs help drivers self-regulate their speed and can be placed near new bicycle facilities to increase driver awareness.



Crosswalk “stings” help to educate drivers about yielding to people in crosswalks and encourage safer driving through targeted enforcement.



TABLE B.1 PROGRAMMATIC RECOMMENDATIONS

Strategy	Target Audience	Lead Facilitator	Partnerships for Success	Time Frame	Duration	Projected Cost*
Education						
Media Campaign to Educate Motorists, Cyclists, and Pedestrians	General public, ASU students	Town of Boone	Boone & ASU Police Departments, ASU staff, Boone Area Cyclists, Boone Bicycle Initiative, Boone Alternative Transportation Subcommittee (ATS)	Short-term	Ongoing	\$\$\$\$\$
Youth Bicycling Safety Education Courses	Children and youth	Watauga County School District, School Administration	Boone Area Cyclists, Boone Bicycle Initiative, local bike shops, Watauga County Parks & Recreation	Short-term	Ongoing	\$
Adult and Family Bicycling Classes	Adults, Families	Town of Boone, Boone Area Cyclists	Boone Bicycle Initiative, local bike shops	Short-term	Ongoing	\$
Professional Development Courses	Town Staff, Law Enforcement	Town of Boone Staff	Boone Public Works Staff, GIS Staff, Watauga County Staff, NCDOT Staff, Boone Police Department, ASU staff	Medium-term	Semi-Annual	\$
Diversion Class	General public	Boone Police Department	Watauga County Court System, ASU police, ATS	Medium-term	Ongoing	\$\$\$
Friends of the Greenway Group	Interested stakeholders	Greenway, Parks, and Gardens Committee	Boone Police Department, Boone Area Cyclists, other interested citizens, High Country Pathways	Short-term	Ongoing	\$
Encouragement						
Safe Routes to School (SRTS)	Children and youth	Watauga County Schools, School Administration, Town of Boone	Parent-Teacher Associations, Boone Police Department, Town of Boone Public Works Staff, community members	Medium-term	Ongoing	\$\$\$-\$\$\$\$\$
Walking/Bicycling Maps	General public	Town of Boone Public Works Department	Downtown Boone Development Association, Boone Area Chamber of Commerce, Town of Boone GIS Department, Boone Convention and Visitor's Bureau, Appalachian State University (ASU)	Short-term	Annual	\$\$\$

*\$ = Low cost program, \$\$\$ = Medium cost program, \$\$\$\$\$ = High cost program. Costs for each program are estimated relative to other programs to guide decision-making and do not represent an absolute dollar amount. These estimates are planning level estimates only; project costs may vary widely depending on the project scope, materials, and staffing pursued.



Strategy	Target Audience	Lead Facilitator	Partnerships for Success	Time Frame	Duration	Projected Cost*
Wayfinding Signage Program	General public	Town of Boone Public Works Department	Downtown Boone Development Association, Boone Area Chamber of Commerce, Boone Convention and Visitor's Bureau, ASU	Medium-term	Ongoing	\$\$\$\$\$
One Stop Website	General public	Town of Boone staff	Town of Boone Planning & Inspections Department, Public Works Department, ATS	Short-term	Ongoing	\$\$\$
Bike Month Activities	Commuters, general public, ASU students	Boone Area Cyclists	Town of Boone staff, ASU, ATS, Boone Police Department, Boone Bicycle Initiative	Short-term	Annual	\$
Enforcement and Evaluation						
Communicate Maintenance Schedules	Town of Boone staff	Town of Boone Public Works Department	NCDOT Division staff, Town of Boone Planning & Inspections Department	Short-term	Ongoing	\$
Pedestrian and Bicycle Counts Program	Town of Boone staff	Town of Boone Public Works Department, Planning and Inspections Department	ATS, Greenway, Parks, and Gardens Committee, Watauga County Parks and Recreation	Medium-term	Ongoing	\$\$\$
Walking, Bicycling, and Greenways Report Card	General public, elected officials and decision-makers	Alternative Transportation Subcommittee (ATS)	Town of Boone Public Works Department, Greenway, Parks, and Gardens Committee	Short-term	Annual	\$
Maintenance Hotlines	Boone residents who bicycle or walk	Town of Boone Public Works Department	Alternative Transportation Subcommittee (ATS)	Medium-term	Ongoing	\$
Bicycle-Friendly Community Designation	Town of Boone staff, elected officials	Town of Boone Public Works Staff, Planning & Inspections Staff	ATS, Boone Area Cyclists, Boone Bicycle Initiative, Greenway, Parks, and Gardens Committee	Medium-term	Annual	\$
Bicycle-Friendly University Designation	ASU community, elected officials, decision-makers	Appalachian State University staff	ATS, Town of Boone staff, Boone Area Cyclists, Boone Bicycle Initiative	Medium-term	Annual	\$
20's Plenty Campaign	Drivers	Boone & ASU Police Departments	Town of Boone Public Works, Watauga County Court System, ATS	Medium-term	Ongoing	\$\$\$\$\$
Speeding Enforcement	Drivers	Boone & ASU Police Departments	Town of Boone Public Works, Watauga County Court System, ATS	Short-term	Ongoing	\$\$\$

*\$ = Low cost program, \$\$\$ = Medium cost program, \$\$\$\$\$ = High cost program. Costs for each program are estimated relative to other programs to guide decision-making and do not represent an absolute dollar amount. These estimates are planning level estimates only; project costs may vary widely depending on the project scope, materials, and staffing pursued.



C POLICY RESOURCES

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*Federal and State Policies
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*NCDOT Complete Streets
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(C-40)*

OVERVIEW

This appendix serves as a resource for the Town of Boone to evaluate and update their local policies with the goals of becoming more pedestrian and bicycle friendly. Key state and federal policies that support bicycle and pedestrian infrastructure are provided for reference and guidance. This appendix presents a detailed review of the Town of Boone's Unified Development Ordinance (UDO) featuring recommendations for language revisions. A brief summarizing access management language and concepts is included at the end of this appendix.

FEDERAL AND STATE POLICIES

US DOT Policy Statement Integrating Bicycling and Walking into Transportation Infrastructure

A United States Department of Transportation (US DOT) policy statement regarding the integration of bicycling and walking into transportation infrastructure recommends that, "bicycling and walking facilities will be incorporated into all transportation projects" unless exceptional circumstances exist. The Policy Statement was drafted by the U.S. Department of Transportation in response to Section 1202 (b) of the Transportation Equity Act for the 21st Century (TEA-21) with the input and assistance of public agencies, professional associations and advocacy groups. USDOT hopes that public agencies, professional associations, advocacy groups, and others adopt this approach as a way of committing themselves to integrating bicycling and walking into the transportation mainstream. The full policy can be found here:

www.fhwa.dot.gov/environment/bikeped/design.htm

NCDOT Policy on Street and Driveway Access to NC Highways

Refer to the NCDOT policy on 'Street and Driveway Access to North Carolina Highways' for examples on how to reduce conflict points between motor vehicles and pedestrians and bicyclists. Consider access management for both future development and retrofits to existing development:

www.ncdot.org/doh/preconstruct/altern/value/manuals/pos.pdf



US DOT Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations

The DOT policy is to incorporate safe and convenient walking and bicycling facilities into transportation projects. Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. Because of the numerous individual and community benefits that walking and bicycling provide — including health, safety, environmental, transportation, and quality of life — transportation agencies are encouraged to go beyond minimum standards to provide safe and convenient facilities for these modes. The full policy can be found here: www.fhwa.dot.gov/environment/bikeped/policy_accom.htm

NCDOT Board of Transportation Resolution: Bicycling and Walking in North Carolina: A Critical Part of the Transportation System

The North Carolina Board of Transportation strongly reaffirms its commitment to improving conditions for bicycling and walking, and recognizes nonmotorized modes of transportation as critical elements of the local, regional, and national transportation system.

WHEREAS, increasing bicycling and walking offers the potential for cleaner air, healthier people, reduced congestion, more liveable communities, and more efficient use of road space and resources; and

WHEREAS, crashes involving bicyclists and pedestrians represent more than 14 percent of the nation’s traffic fatalities; and

WHEREAS, the Federal Highway Administration (FHWA) in its policy statement “Guidance on the Bicycle and Pedestrian Provisions of the Federal-Aid Program” urges states to include bicycle and pedestrian accommodations in its programmed highway projects; and

WHEREAS, bicycle and pedestrian projects and programs are eligible for funding from almost all of the major Federal-aid funding programs; and

WHEREAS, the Transportation Equity Act for the 21st Century (TEA-21) calls for the mainstreaming of bicycle and pedestrian projects into the planning, design and operation of our Nation’s transportation system;

NOW, THEREFORE, BE IT RESOLVED, the North Carolina Board of Transportation concurs that bicycling and walking accommodations shall be a routine part of the North Carolina Department of Transportation’s planning, design, construction, and operations activities and supports the Department’s study and consideration of methods of improving the inclusion of these modes into the everyday operations of North Carolina’s transportation system; and

BE IT FURTHER RESOLVED, North Carolina cities and towns are encouraged to make bicycling and pedestrian improvements an integral part of their transportation planning and programming. (Adopted by the Board of Transportation on September 8, 2000)



NCDOT Administrative Action to Include Local Adopted Greenways Plans in the NCDOT Highway Planning Process and Design Guidelines

In 1994 the NCDOT adopted administrative guidelines to consider greenways and greenway crossings during the highway planning process. This policy was incorporated so that critical corridors which have been adopted by localities for future greenways will not be severed by highway construction. The text for the Greenway Policy and Guidelines for implementing it can be found here:

www.ncdot.org/bikeped/lawspolicies/policies/

NCDOT's Traditional Neighborhood Development Street Design Guidelines

These guidelines are available for proposed TND developments and permits localities and developers to design certain roadways according to TND guidelines rather than the conventional subdivision street standards. The guidelines recognize that in TND developments, mixed uses are encouraged and pedestrians and bicyclists are accommodated on multi-mode/shared streets. The guidelines can be found here:

www.ncdot.org/doh/preconstruct/altern/value/manuals/tnd.pdf

NCDOT Bicycle Policy

General: Pursuant to the Bicycle and Bikeways Act of 1974, the Board of Transportation finds that bicycling is a bonafide highway purpose subject to the same rights and responsibilities and eligible for the same considerations as other highway purposes, as elaborated below.

1. The Board of Transportation endorses the concept that bicycle transportation is an integral part of the comprehensive transportation system in North Carolina.
2. The Board of Transportation endorses the concept of providing bicycle transportation facilities within the rights-of-way of highways deemed appropriated by the Board.
3. The Board of Transportation will adopt Design Guidelines for Bicycle Facilities. These guidelines will include criteria for selecting cost-effective and safety-effective bicycle facility types and a procedure for prioritizing bicycle facility improvements.
4. Bicycle compatibility shall be a goal for state highways, except on fully controlled access highways where bicycles are prohibited, in order to provide reasonably safe bicycle use.



5. All bicycle transportation facilities approved by the Board of Transportation shall conform with the adopted “Design Guidelines for Bicycle Facilities” on state-funded projects, and also with guidelines published by the American Association of State Highway and Transportation Officials (AASHTO) on federal aid projects.

Planning and Design: It is the policy of the Board of Transportation that bicycle facility planning be included in the state thoroughfare and project planning process.

1. The intent to include planning for bicycle facilities within new highway construction and improvement projects is to be noted in the Transportation Improvement Program.

2. During the thoroughfare planning process, bicycle usage shall be presumed to exist along certain corridors (e.g., between residential developments, schools, businesses and recreational areas). Within the project planning process, each project shall have a documented finding with regard to existing or future bicycling needs. In order to use available funds efficiently, each finding shall include measures of cost-effectiveness and safety-effectiveness of any proposed bicycle facility.

3. If bicycle usage is shown likely to be significant, and it is not prohibited, and there are positive cost-effective and safety-effective findings; then, plans for and designs of highway construction projects along new corridors, and for improvement projects along existing highways, shall include provisions for bicycle facilities (e.g., bike routes, bike lanes, bike paths, paved shoulders, wide outside lanes, bike trails) and secondary bicycle facilities (traffic control, parking, information devices, etc.).

4. Federally funded new bridges, grade separated interchanges, tunnels, and viaducts, and their improvements, shall be designed to provide safe access to bicycles, pursuant to the policies of the Federal Highway Administration.

5. Barriers to existing bicycling shall be avoided in the planning and design of highway projects.

6. Although separate bicycle facilities (e.g., bike paths, bike trails) are useful under some conditions and can have great value for exclusively recreational purposes, incorporation of on road bicycle facilities (e.g., bicycle lanes, paved shoulders) in highway projects are preferred for safety reasons over separate bicycle facilities parallel to major roadways. Secondary complementary bicycle facilities (e.g., traffic control, parking, information devices, etc.) should be designed to be within highway rights-of-way.

7. Technical assistance shall be provided in the planning and design of alternative transportation uses, including bicycling, for abandoned railroad rights-of way. This assistance would be pursuant to the National Trails act Amendment of 1983, and the resultant national Rails to Trails program, as will the Railway Revitalization Act of 1975.

8. Wherever appropriate, bicycle facilities shall be integrated into the study, planning, design, and implementation of state funded transportation projects involving air, rail, and marine transportation, and public parking facilities.



9. The development of new and improved bicycle control and information signs is encouraged for the increased safety of all highway users.

10. The development of bicycle demonstration projects which foster innovations in planning, design, construction, and maintenance is encouraged.

11. Paved shoulders shall be encouraged as appropriate along highways for the safety of all highway users, and should be designed to accommodate bicycle traffic.

12. Environmental Documents/Planning Studies for transportation projects shall evaluate the potential use of the facility by bicyclists and determine whether special bicycle facility design is appropriate.

13. Local input and advice shall be sought, to the degree practicable, during the planning stage and in advance of the final design of roadway improvements to ensure appropriate consideration of bicycling needs, if significant.

14. On highways where bicycle facilities exist, (bike paths, bike lanes, bike routes, paved shoulders, wide curb lanes, etc.), new highway improvements shall be planned and implemented to maintain the level of existing safety for bicyclists.

15. Any new or improved highway project designed and constructed within a public-use transportation corridor with private funding shall include the same bicycle facility considerations as if the project had been funded with public funds. In private transportation projects (including parking facilities), where state funding or Department approval is not involved, the same guidelines and standards for providing bicycle facilities should be encouraged.

Construction: It is the policy of the Board of Transportation that all state and federally funded highway projects incorporating bicycle facility improvements shall be constructed in accordance with approved state and federal guidelines and standards.

1. Bicycle facilities shall be constructed, and bicycle compatibility shall be provided for, in accordance with adopted Design Guidelines for Bicycle Facilities and with guidelines of the American Association of State Highway and Transportation Officials.

2. Rumble strips (raised traffic bars), asphalt concrete dikes, reflectors, and other such surface alterations, where installed, shall be placed in a manner as not to present hazards to bicyclists where bicycle use exists or is likely to exist. Rumble strips shall not be extended across shoulder or other areas intended for bicycle travel.

3. During restriping operations, motor vehicle traffic lanes may be narrowed to allow for wider curb lanes.

Maintenance: It is the policy of the Board of Transportation that the state highway system, including state-funded bicycle facilities, shall be maintained in a manner conducive to bicycle safety.

1. State and federally funded and built bicycle facilities within the state right-of-way are to be maintained to the same degree as the state highway system.



2. In the maintenance, repair, and resurfacing of highways, bridges, and other transportation facilities, and in the installation of utilities or other structures, nothing shall be done to diminish existing bicycle compatibility.

3. Rough road surfaces which are acceptable to motor vehicle traffic may be unsuitable for bicycle traffic, and special consideration may be necessary for highways with significant bicycle usage.

4. For any state-funded bicycle project not constructed on state right-of-way, a maintenance agreement stating that maintenance shall be the total responsibility of the local government sponsor shall be negotiated between the Department and the local government sponsor.

5. Pot-holes, edge erosion, debris, etc., are special problems for bicyclists, and their elimination should be a part of each Division's maintenance program. On identified bicycle facilities, the bike lanes and paths should be routinely swept and cleared of grass intrusion, undertaken within the discretion and capabilities of Division forces.

Operations: It is the policy of the Board of Transportation that operations and activities on the state highway system and bicycle facilities shall be conducted in a manner conducive to bicycle safety.

1. A bicyclist has the right to travel at a speed less than that of the normal motor vehicle traffic.

In exercising this right, the bicyclist shall also be responsible to drive his/her vehicle safely, with due consideration to the rights of the other motor vehicle operators and bicyclists and in compliance with the motor vehicle laws of North Carolina.

2. On a case by case basis, the paved shoulders of those portions of the state's fully controlled access highways may be studied and considered as an exception for usage by bicyclists where adjacent highways do not exist or are more dangerous for bicycling. Pursuant to federal highway policy, usage by bicyclists must receive prior approval by the Board of Transportation for each specific segment for which such usage is deemed appropriate, and those segments shall be appropriately signed for that usage.

3. State, county, and local law enforcement agencies are encouraged to provide specific training for law enforcement personnel with regard to bicycling.

4. The use of approved safety helmets by all bicyclists is encouraged.



Education: It is the policy of the Board of Transportation that education of both motorists and bicyclists, regarding the rights and responsibilities of bicycle riders, shall be an integral part of the Department's Bicycle Program. School systems are encouraged to conduct bicycle safety education programs as a part of and in addition to the driver's education program, to the maximum extent practicable, and in conjunction with safety efforts through the Governor's Highway Safety Program. The Division of Motor Vehicles is also urged to include bicycle safety and user information in its motor vehicle safety publications.

Parking: It is the policy of the Board of Transportation that secure and adequate bicycle parking facilities shall be provided wherever practicable and warranted in the design and construction of all state-funded buildings, parks, and recreational facilities.

This policy can also be found at: www.ncdot.org/bikeped/download/bikeped_laws_Bicycle_Policy.pdf



BICYCLE LAWS OF NORTH CAROLINA

In North Carolina, **the bicycle has the legal status of a vehicle**. This means that bicyclists have full rights and responsibilities on the roadway and are subject to the regulations governing the operation of a motor vehicle.

Bicyclists' rights:

- The bicyclist has a right to ride on any state maintained road, except roads of the Interstate Highway system and other fully-controlled access highways.
- While a bicyclist should ride as far to the right as practicable, a bicyclist may ride well out into the traffic lane under the following conditions:
 - if he or she can maintain the same speed as other vehicles on the roadway;
 - if the right-hand edge of the roadway is in poor condition or is littered with debris.
- A bicyclist is not required to ride on the shoulder, since the shoulder is not legally defined as part of the roadway.
- A bicyclist may choose to make a left turn from the appropriate lane, like a vehicle, or may dismount and walk the bicycle across the intersection, like a pedestrian.

North Carolina traffic laws require bicyclists to:

- Ride on the right in the same direction as other traffic
- Obey all traffic signs and signals
- Use hand signals to communicate intended movements
- Equip their bicycles with a front lamp visible from 300 feet and a rear reflector that is visible from a distance of 200 feet when riding at night. (Note: Rear lights are more effective than a rear reflectors)
- Wear a bicycle helmet on public roads, public paths and public rights-of-way if the bicyclists is under 16 years old
- Secure child passengers in a child seat or bicycle trailer if under 40 pounds or 40 inches

Although the law does not require adult bicyclists to wear helmets, they are strongly encouraged to do so. Some localities within the state have enacted ordinances requiring cyclists to wear helmets.

Laws pertaining to the operation of a bicycle vary from state to state. Below are three issues of bicycling that North Carolina law currently does not clarify.

Bicycling on Interstate or fully controlled limited access highways, such as beltlines, is prohibited by policy, unless otherwise specified by action of the Board of Transportation. Currently, the only exception to the policy is the US 17 bridge over the Chowan River between Chowan and Bertie Counties.



There is no law that requires bicyclists to ride single file, nor is there a law that gives cyclists the right to ride two or more abreast. It is important to ride responsibly and courteously, so that cars may pass safely.

There is no law that prohibits wearing headphones when riding a bicycle; however, it is not recommended. It is important to use all your senses to ensure your safety when riding in traffic.

This text presents only some parts of the North Carolina Motor Vehicle Code that relate to bicycle travel. These laws are subject to change, so please check the North Carolina General Statutes website for new laws and proposed legislation affecting bicyclists:
www.ncga.state.nc.us/Statutes/Statutes.html

or the NCDOT Bicycle and Pedestrian Division website:

www.ncdot.gov/bikeped/lawspolicies/laws/

http://www.ncdot.org/bikeped/download/bikeped_safety_materials_handout_RightsNResp.pdf



PEDESTRIAN LAWS OF NORTH CAROLINA

Pedestrians' Right-of-Way at Crosswalks:

- Where traffic-control signals are not in place or in operation the driver of a vehicle shall yield the right-of-way to a pedestrian crossing the roadway within any marked crosswalk or within any unmarked crosswalk at or near an intersection.
- Whenever any vehicle is stopped at a crosswalk at an intersection to permit a pedestrian to cross, the driver of any other vehicle approaching from the rear shall not overtake and pass such stopped vehicle.
- Pedestrians have the right-of-way when approaching an alley, building entrance, private road, or driveway, from any sidewalk or walkway.

Other Crossings and Along the Highway:

- Every pedestrian crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection shall yield the right-of-way to all vehicles upon the roadway.
- Any pedestrian crossing a roadway at a point where a pedestrian tunnel or overhead pedestrian crossing has been provided shall yield the right-of-way to all vehicles upon the roadway.
- Between adjacent intersections at which traffic-control signals are in operation pedestrians shall not cross at any place except in a marked crosswalk.
- Where sidewalks are provided, it shall be unlawful for any pedestrian to walk along and upon an adjacent roadway. Where sidewalks are not provided, any pedestrian walking along and upon a highway shall, when practicable, walk only on the extreme left of the roadway or its shoulder facing traffic which may approach from the opposite direction. Such pedestrian shall yield the right-of-way to approaching traffic.
- Notwithstanding the provisions of this section, every driver of a vehicle shall exercise due care to avoid colliding with any pedestrian upon any roadway, and shall give warning by sounding the horn when necessary, and shall exercise proper precaution upon observing any child or any confused or incapacitated person upon a roadway.

This text presents only some parts of the North Carolina Motor Vehicle Code that relate to pedestrian travel. These laws are subject to change, so please check the North Carolina General Statutes website for new laws and proposed legislation affecting pedestrians: www.ncga.state.nc.us/Statutes/Statutes.html

or the NCDOT Bicycle and Pedestrian Division website:
www.ncdot.gov/bikeped/lawspolicies/laws/



NCDOT COMPLETE STREETS POLICY

NCDOT has developed guidelines to implement this policy. The guidelines include basic Complete Street typologies for various road types within various contexts, along with a framework document that outlines implementation process. More information about these guidelines can be found at the project website: www.nccompletestreets.org

NCDOT's Complete Streets Policy is part of a national movement. The Complete Streets Act of 2009 (S.B 584 and H.R. 1443) was adopted in recognition of the significant influence that street design has on safety, environmental integrity, public health, economic vitality and community livability. The bill directs state Departments of Transportation and Metropolitan Planning Organizations to adopt policies that support inclusive and innovative transportation planning policies and apply these policies to future federally funded transportation projects. As a result of this legislation, state and local Complete Streets policies are emerging.

A. Definition

Complete Streets is North Carolina's approach to interdependent, multi-modal transportation networks that safely accommodate access and travel for all users.

B. Policy Statement

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

The North Carolina Department of Transportation, in its role as stewards over the transportation infrastructure, is committed to:

- providing an efficient multi-modal transportation network in North Carolina such that the access, mobility, and safety needs of motorists, transit users, bicyclists, and pedestrians of all ages and abilities are safely accommodated;
- caring for the built and natural environments by promoting sustainable development practices that minimize impacts on natural resources, historic, businesses, residents, scenic and other community values, while also recognizing that transportation improvements have significant potential to contribute to local, regional, and statewide quality of life and economic development objectives;
- working in partnership with local government agencies, interest groups, and the public to plan, fund, design, construct, and manage complete street networks that sustain mobility while accommodating walking, biking, and transit opportunities safely.

This policy requires that NCDOT's planners and designers will consider and incorporate multimodal alternatives in the design and improvement of all



appropriate transportation projects within a growth area of a town or city unless exceptional circumstances exist. Routine maintenance projects may be excluded from this requirement if an appropriate source of funding is not available.

C. Purpose

This policy sets forth the protocol for the development of transportation networks that encourage non-vehicular travel without compromising the safety, efficiency, or function of the facility. The purpose of this policy is to guide existing decision-making and design processes to ensure that all users are routinely considered during the planning, design, construction, funding and operation of North Carolina's transportation network.

D. Scope and Applicability

This policy generally applies to facilities that exist in urban or suburban areas, however it does not necessarily exclude rural setting; and is viewed as a network that functions in an interdependent manner.

There are many factors that must be considered when defining the facility and the degree to which this policy applies, e.g., number of lanes, design speeds, intersection spacing, medians, curb parking, etc. Therefore, the applicability of this policy, as stated, should be construed as neither comprehensive nor conclusive. Each facility must be evaluated for proper applicability.

Notwithstanding the exceptions stated herein, all transportation facilities within a growth area of a town or city funded by or through NCDOT, and planned, designed, or constructed on state maintained facilities, must adhere to this policy.

E. Approach

It is the Department's commitment to collaborate with cities, towns, and communities to ensure pedestrian, bicycle, and transit options are included as an integral part of their total transportation vision. As a partner in the development and realization of their visions, the Department desires to assist localities, through the facilitation of long-range planning, to optimize connectivity, network interdependence, context sensitive options, and multimodal alternatives.

F. Related Policies

This policy builds on current practices and encourages creativity for considering and providing multi-modal options within transportation projects, while achieving safety and efficiency.

Specific procedural guidance includes:

- Bicycle Policy (adopted April 4, 1991)
- Highway Landscape Planting Policy (dated 6/10/88)
- Board of Transportation Resolution: Bicycling & Walking in North Carolina, A Critical Part of the Transportation System (adopted September 8, 2000)



- Guidelines for Planting within Highway Right-of-Way
- Bridge Policy (March 2000)
- Pedestrian Policy Guidelines –Sidewalk Location (Memo from Larry Goode, February 15, 1995)
- Pedestrian Policy Guidelines (effective October 1, 2000 w/Memo from Len Hill, September 28, 2000)
- NCDOT Context Sensitive Solutions Goals and Working Guidelines (created 9-23-02; updated 9-8-03)

G. Exceptions to Policy

It is the Department's expectation that suitable multimodal alternatives will be incorporated in all appropriate new and improved infrastructure projects. However, exceptions to this policy will be considered where exceptional circumstances that prohibit adherence to this policy exist. Such exceptions include, but are not limited to:

- facilities that prohibit specific users by law from using them,
- areas in which the population and employment densities or level of transit service around the facility does not justify the incorporation of multimodal alternatives.

It is the Department's expectation that suitable multimodal alternatives will be incorporated as appropriate in all new and improved infrastructure projects within a growth area of a town or city.

As exceptions to policy requests are unique in nature, each will be considered on a case-by-case basis. Each exception must be approved by the Chief Deputy Secretary.

Routine maintenance projects may be excluded from this requirement if an appropriate source of funding is not available.

H. Planning and Design Guidelines

The Department recognizes that a well-planned and designed transportation system that is responsive to its context and meets the needs of its users is the result of thoughtful planning. The Department further recognizes the need to provide planners, designers and decision-makers with a framework for evaluating and incorporating various design elements into the planning, design, and construction phases of its transportation projects. To this end, a multi-disciplined team of stakeholders, including transportation professionals, interest groups, and others, as appropriate, will be assembled and charged with developing comprehensive planning and design guidelines to support this policy.

These guidelines will describe the project development process and incorporate transparency and accountability where it does not currently exist; describe how (from a planning and design perspective) pedestrians, bicyclists, transit, and motor vehicles will share roads safely; and provide special design elements and traffic management strategies to address unique circumstances. An expected delivery date for planning and design guidelines will be set upon adoption of this policy.



I. Policy Distribution

It is the responsibility of all employees to comply with Departmental policies. Therefore, every business unit and appropriate private service provider will be required to maintain a complete set of these policies. The Department shall periodically update departmental guidance to ensure that accurate and up-to-date information is maintained and housed in a policy management system.

TOWN OF BOONE UNIFIED DEVELOPMENT ORDINANCE

Existing land development, zoning and subdivision ordinances and technical standards have a significant effect on bicycle transportation and multi-use trail development in Boone. The Town of Boone Unified Development Ordinance (UDO) was reviewed as part of this bicycle transportation planning process. This section presents a summary of this policy document and identifies the specific areas that should be strengthened to improve accommodations for non-motorized transportation and recreation facilities.

UNIFIED DEVELOPMENT ORDINANCE REVIEW

The Town's Unified Development Ordinance (UDO) combines the zoning and subdivision authority of Boone into one document. The UDO recites applicable statutory authority, the applicability of the UDO to various uses of the town, consistency with the Comprehensive Plan, coordination with other regulations, the effective date, violations, and related matters.

Bicyclists and their needs were not covered in any significant detail or depth in the UDO. There is potential for confusion as bicyclists were not called out specifically in many situations where vehicular traffic is referenced but where directives did not seem to apply to bicyclists. Where bicycling was specifically mentioned, the primary focus was on bicycling for recreation, with no mention of the role of bicycling as a mode of transportation with wide-spread benefits for the community.



TABLE 2.1

Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
Basic Definitions and Interpretations	2-2	Bicycle: A pedal-driven, human-powered vehicle with two wheels attached to a frame, one behind the other.	"This definition does not cover alternative bicycles designs favored especially among older and disabled riders. Suggest using the MUTCD definition: Bicycle -- a pedal-powered vehicle upon which the human operator sits."
Basic Definitions and Interpretations	2-7	"Greenway: A corridor of protected open space, usually located adjacent to natural features, that is managed for conservation, recreation and/or active transportation purposes."	
Basic Definitions and Interpretations	2-11	"Livability Space: That part of total open space appropriately improved and, if necessary, located as outdoor living space and for aesthetic appeal, including natural areas, lawns and other landscaped areas, walkways, paved terraces and sitting areas, outdoor recreational areas, and landscaped portions of street right-of-way, but not including open space used for motorized vehicles, except for incidental service, maintenance, or emergency actions."	Many terms such as walkways/paths/sidewalks/trails/shared use paths are used to refer to walking facilities. When differing terms are subsequently used in the ordinance, it becomes unclear whether they are intended for different users or uses such as bicyclists, etc. Suggest defining all of the terms to be used and then standardizing the nomenclature throughout.
Basic Definitions and Interpretations	2-16	"Parking Garage: A structure used for automobile and bicycle parking which is partially or wholly enclosed and includes any above-grade decks. Parking, Off-Street: Space located outside of any street right-of-way or easement that is designed to accommodate the parking of motor vehicles and bicycles. Parking Space: A portion of the vehicle accommodation area set aside for the parking of one vehicle."	These definitions focus solely on vehicular parking and could be readily expanded to include bike parking.
Basic Definitions and Interpretations	2-18	Road: All public or private ways used to provide motor vehicle access to three (3) or more lots.	Suggest replacing this definition as it is unclear about provisions for non-motorized users. The MUTCD definition for 'road' or 'roadway' states: that portion of a highway improved, designed, ordinarily used for vehicular travel and parking lanes, but exclusive of the sidewalk, berm, or shoulder.... (continues)



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in <i>red</i> . Attention is drawn to italicized text.	Comments
Basic Definitions and Interpretations	2-19	"Street: A public street or a street with respect to which an offer of dedication has been made."	Does this include areas dedicated to non-motorized users? Are areas beyond the pavement/curb part of this definition? It is unclear whether sidewalk or other parts of the ROW are included in this definition of 'street'. Many terms such as walkways/paths/sidewalks/trails/shared use paths are used to refer to walking facilities. With the differing street definitions, it becomes unclear whether these areas are intended for different users or uses such as bicyclists, etc. Suggest using the MUTCD definition:
Basic Definitions and Interpretations	2-19	Street, Arterial: A major street in the town's street system that serves as an avenue for the circulation of traffic onto, out, or around the town and carries high volumes of traffic.	The MUTCD definition for Arterial Street (Highway) definition includes all of the right-of-way.
Basic Definitions and Interpretations	2-19	"Street, Collector: A street whose principal function is to carry traffic between minor, local, and subcollector streets and arterial streets but that may also provide direct access to abutting properties. It serves or is designated to serve, directly or indirectly, more than one hundred (100) dwelling units and is designed to be used or is used to carry more than eight hundred (800) trips per day."	



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
	2-20	<p>"Street, Local: A street whose sole function is to provide access to abutting properties. It serves or is designed to serve at least ten (10) but not more than twenty five (25) dwelling units and is expected to or does handle between seventy five (75) and two hundred (200) trips per day.</p> <p>Street, Marginal Access: A street that is parallel to and adjacent to an arterial street and that is designed to provide access to abutting properties so that these properties are somewhat sheltered from the effects of the through traffic on the arterial street and so that the flow of traffic on the arterial street is not impeded by direct driveway access from a large number of abutting properties.</p> <p>Street, Minor: A street whose sole function is to provide access to abutting properties. It serves or is designed to serve not more than nine (9) dwelling units and is expected to or does handle up to seventy five (75) trips per day.</p> <p>Street, Subcollector: A street whose principal function is to provide access to abutting properties but is also designed to be used to connect minor and local streets with collector or arterial streets. Including residences indirectly served through connecting streets, it serves or is designed to serve at least twenty six (26) but not more than one hundred(100) dwelling units and is expected to or does handle between two hundred (200) and eight hundred (800) trips per day.</p> <p>Streetline: The line where the edge of the right-of-way of a street meets the abutting property."</p>	<p>It is not fully clear but it seems that the definitions cover vehicular access and trips while many or all of these streets may act as an element of pedestrian/ bicycle trips also. Suggest defining all of the street terms per the MUTCD so that it is clear whether bicyclist or pedestrian space and access are included either on the pavement or in the adjacent right of way.</p>
	2-21	<p>Surface Parking Area: Off-street automobile and short- and/or long-term bicycle parking area which is not enclosed within a building.</p>	<p>This definition seems focused solely on vehicular parking and could be readily expanded to include bike parking.</p>



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red . Attention is drawn to italicized text.	Comments
	2-1 to 2-25	General comment	<p>"Suggest the following additional definitions be added: bicycle facilities, pedestrian and sidewalk. Suggest using the MUTCD (2009) definition: Bicycle Facilities—a general term denoting improvements and provisions that accommodate or encourage bicycling, including parking and storage facilities, and shared roadways not specifically defined for bicycle use. Pedestrian - a person on foot, in a wheelchair, on skates, or on a skateboard Sidewalk—that portion of a street between the curb line, or the lateral line of a roadway, and the adjacent property line or on easements of private property that is paved or improved and intended for use by pedestrians."</p>
	4-5	<p>In addition to the information included in Appendix A, certain projects may by, virtue of size, location or configuration of access points to the public road system, be required to have a traffic impact analysis performed. In those instances where a traffic impact analysis is requested by the Administrator, the study must be completed and submitted in order for the application to be considered. A traffic impact analysis may be required when any of the following conditions exist:</p>	<p>Typically Traffic Analysis have not included bicycling and walking trips although programs are now available to consider .</p>
Permits and Final Plat Approval	4-25	<p>[17] The location and dimensions of all rights-of-way, utility or other easements, riding trails, natural buffers, sidewalks, pedestrian or bicycle paths and trails, and areas to be dedicated to public use with the purpose of each stated,</p>	



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
Permits and Final Plat Approval	4-28	"Certificate of Ownership and Dedication I hereby certify that I am the owner of the property described hereon, which property is located in the subdivision regulation jurisdiction of the Town of Boone, that I hereby freely adopt this plan of subdivision and dedicate to public use all areas shown on this plat as streets, alleys, sidewalks, trails , parks, open space, and easements, except those specifically indicated as private, and that I will maintain all such areas until the offer of dedication is accepted by the appropriate public authority. All property shown on this plat as dedicated for a public use shall be deemed to be dedicated for any other public use authorized by law when such other use is approved by the Boone Town Council in the public interest."	
Permits and Final Plat Approval	4-29	Approval of a plat does not constitute acceptance by the town of the offer of dedication of any streets, sidewalks, parks or other public facilities shown on a plat. However, the town may accept any such offer of dedication by resolution of the council or by actually exercising control over and maintaining such facilities.	The certificate of ownership refers to 'walks' while this definition refers to 'sidewalks' -- it will be clearer to streamline the nomenclature and definition for all walking/trail facilities
	9-2	The B-2 Neighborhood Business District is intended to provide for the development of low-density commercial and services that are accessible by pedestrians and bicyclists from surrounding neighborhoods, which serve the day to day convenience needs of surrounding neighborhoods, and are of such nature as to minimize conflicts with- the neighborhoods they serve.	
Section 158. Corridor Districts	9-5	"[b] The purpose and intent for creating the corridor districts are:... [4] To consider transportation, including access management , vehicular access, driveway limitations and traffic impact, safety and conflicts , while protecting the public investment and lengthening the time during which highways can continue to serve their functions, without expansion or relocation, by expediting the free flow of traffic and reducing the hazards to drivers, bicyclists and pedestrians arising from unnecessary points of ingress and egress and cluttered roadside development and improving roadway operations along the corridor. "	It is recommended to expand the purpose and intent to reference the benefits of access management techniques in the subsequent requirements. It is suggested to clarify that the hazards that arise in the vicinity of entrances impact bicyclists and pedestrians as well as vehicular traffic.



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	9-6	<p>[e] The requirements for all properties are listed below.</p> <p>[1] Allowed Access: All lots recorded and shown on tax maps at the Watauga County Register of Deeds and Tax Office as of the effective date of this ordinance shall be permitted one driveway access. If projects are proposed that encompass more than one parcel as recorded at the date of adoption of this ordinance, they shall be permitted only one driveway access for the project. If any street(s) or road(s) other than the thoroughfare(s) protected by this ordinance is (are) available for access to any parcel, tract or development, access must be taken from the alternate street(s). If the alternate street access is not adequate to serve the parcel, tract or development, or do not meet the safety requirements for an access, a single access point to the regulated thoroughfare may be allowed. The selected permitted single access location should be based on a review of safety considerations including sight distance, turning conflicts, and spacing relative to other existing entrances.</p>	<p>As well as limiting the number of access point, it should be clarified that the permitted single access meets safety requirements such as sight distance and that the selected location consider spacing relative to other existing entrances so as not to create a new turning conflict. This would apply also when the alternate street access is not adequate also.</p>
	9-7	<p>[3] Corner Clearance: No driveway, except single-family residential access, shall be allowed within one hundred fifty [150] feet of the centerline of an intersecting street.</p>	
	9-7	<p>[4] Driveway Spacing: The distance between any two [2] drives shall be one hundred fifty [150] feet on the protected thoroughfare[s].</p>	
	9-7	<p>[5] The driveway spacing requirement in Subsection 158 [e] [4] above shall be measured along the right-of-way line from the centerline of the driveway.</p>	
	9-7	<p>[6] Subdivision Frontage: Any tract proposed for subdivision which borders the protected thoroughfare(s) shall provide sufficient frontage on another street [either pre-existing or created as part of the subdivision] for all lots created out of such tract so that direct access to lots does not need to be provided on the protected thoroughfare[s].</p>	



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
	9-7	[7] Access Driveways: To large scale developments [greater than 50,000 square feet of floor area] and fronting the protected thoroughfare[s] shall provide landscaped medians which incorporate a safe pedestrian crossing within the access driveway.	This requirement potentially increases pedestrian crossing distances, increasing their exposure to risk from vehicle as they cross the entrance, unless the median is designed incorporating pedestrians needs into the design. The entrance median can be employed to improve safety by allowing pedestrians to break the crossing into two phases and allowing them to cross one direction of entrance traffic at a time as well as providing a safe resting area mid-way.
	9-7	[8] Access not Prohibited: Any parcel of record on the effective date of this ordinance that has been prohibited all vehicular access based on the provisions herein shall be allowed one (1) access point to its street frontage while meeting the intent of the technical and safety requirements as is practical.	For any new driveway location selected, the issues of sight distance, turning conflicts and spacing relative to other entrances should be considered.
	9-8	Coordination of Access: Access shall be provided and coordinated between adjoining properties for vehicles, pedestrians and bicycles creating aisles to efficiently move vehicles off street and internally . Pedestrian linkages must be in an acceptable form such as sidewalks, maintained gravel paths and paved walks (trails?).	Promoting the interconnection of parking lots and on-site circulation systems, reduces the need for access points and may actually enhance access between local businesses. In addition to the gravel paths, all of these facilities need to be maintained for safe use by pedestrians and bicyclists. Pedestrians and bicyclists are more sensitive than motorized users to poor maintenance both in terms of comfort and safety.
		Listing of additional suggestions for access management techniques which could be deployed as part of the corridor district.	<ul style="list-style-type: none"> • Establishing standards for the width and throat length of driveways accessing properties • Incorporating right- and left-turn lanes into roadway designs. • Installing a median on an undivided roadway • Closing or replacing full median openings with directional openings • Replacing an existing continuous two-way left-turn lane with a median



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		<p>Suggested additional language to address wider sidewalk widths in Corridor Districts: Side paths shall be required for all new construction and in connection with improvements, renovations, additions or expansions to existing structures within the Corridor District. Side paths shall be required along the entire length of any portions of public streets which abut the development parcel in the designated corridor. Side path will be constructed to 8' to 10' wide and will be constructed in accordance with the Roadway & Sidewalk Program Handbook for the Town of Boone. Any deviation from the requirements must be approved by the Administrator. Deviations may only be allowed when strict compliance with the Roadway & Sidewalk Program Handbook for the Town of Boone is impractical due to topography or because of existing site conditions.</p>	<p>Suggest revising the Roadway & Sidewalk Program Handbook for the Town of Boone to include design requirements for 8' or 10' wide side paths as an upgrade from current sidewalk design requirements.</p>
Section 179. Mixed Use Districts Established [a]	11-1	<p>.....providing options for living, working, and shopping environments in close proximity to each other; facilitating more efficient use of land while minimizing potentially adverse impacts; and providing options for pedestrian- and bicycling-oriented lifestyles....</p>	
Supplementary Use Regulations [9]	11-3	<p>....except where necessary to provide landscaped courtyards, plazas, pocket parks, other pedestrian- and bicycling-oriented amenities, or when there would be interference with public utilities.</p>	<p>Bicycling amenities may include short- and long-term parking, bicycle lockers and public maintenance equipment (such as air pump stations).</p>
Supplementary Use Regulations [11c] [6]	11-3	<p>Building facades may be no further than 0'-0" from the street right-of-way line, except where necessary to preserve existing significant or historic trees, which shall be preserved, if practical, or to provide landscaped courtyards, landscaped greenspace, plazas, pocket parks, other pedestrian oriented amenities, in which case the maximum setback shall not exceed 20' or when there would be interference with public utilities.</p>	



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Supplementary Use Regulations [c] [8]	11-4	Pedestrian weather protection such as awnings or canopies are encouraged along the public street provided they do not encroach into the roadway, but if they invade the space above a town sidewalk, may be placed only in accordance with an encroachment agreement authorized by the Town Council. Such awnings or canopies count toward the Recreation Space requirements found in Section 204 of this Ordinance.	Where bicycles are permitted, clearance should be 8' feet from ground surface.
Supplementary Use Regulations [d] [A] iv.	11-4	Building facades may be no further than 10' from the street right-of-way line, except where necessary to preserve existing significant or historic trees which shall be preserved, if practical, or to provide landscaped courtyards, landscaped greenspace, plazas, pocket parks, other pedestrian- or bicycling-oriented amenities, in which case the maximum setback shall not exceed 20' or there would be interference with public utilities, or the placement of stormwater facilities and no reasonable alternative to that placement exists.	
	11-7which shall be preserved, if practical, or to provide landscaped courtyards, landscaped greenspace, plazas, pocket parks, other pedestrian- or bicycling-oriented amenities, in which case the maximum setback shall not exceed 20' or...	
section 4	11-11	A temporary mobile medical unit shall not encroach upon or disturb traffic movements and pedestrian circulation or sight triangles either within the site or on the adjacent streets and sidewalks.	
	14-1/2	The classification of streets dedicated to public use shall be as follows: [1] Minor:...[2] Local:...[3] Cul-de-sac:...[4] Subcollector:...[5] Collector:...[6] Arterial:...[7] Marginal Access Street:...	The subsequent street classifications are solely based on vehicular traffic and do not seem to recognize pedestrian/ bicycling access or trips.



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	14-2	Private streets will be permitted to serve as access within residential developments, however, the dedication of public streets and other rights-of-way or easements may be required if they are indicated in official plans adopted by the Town Council. Public streets and or other rights-of-way or easements of public access over private streets will be required where the North Carolina Department of Transportation, or Public Works Commission determines that such access is necessary for promotion of public health, safety and welfare.	Ensure that bicycling travel and parking are explicitly permitted on private streets. In some locations, private streets ban bicycling even though it is a mode of transportation for many.
	14-2	[d] The developer shall reserve a minimum thirty (30) feet right-of-way width along all private streets. The reserved area may not be used to satisfy lot area requirements or be included in any required yard space. Private streets may be utilized under the following conditions.	Ensure that bicycling travel and parking are explicitly permitted on this right-way adjacent to private streets.
Section 233. Access to Arterial Streets	14-3	Whenever a major subdivision that involves the creation of one or more new streets borders on or contains an existing proposed arterial street, no direct driveway access may be provided from the lots within this subdivision onto this street.	Provisions for walking and bicycling access and connections from the subdivision to the arterial are encouraged even though motorized access is not. Otherwise, this restriction may create lengthy walking and bicycling routes that discourages participation in these options particularly for the young and those with mobility limitations.
Section 234. Entrances to Streets	14-3	All driveway entrances and other openings onto streets within the town’s planning jurisdiction shall be constructed so that: [1] Vehicles can enter and exit from the lot in question without posing any substantial danger to themselves, pedestrians, or vehicles traveling in abutting streets, [2] Sight lines are maximized and maintained for all users, [3] Interference with the free and convenient flow of traffic in abutting or surrounding streets is minimized and [4] Driveway crossings of sidewalk are wide enough to provide a level pedestrian crossing and a suitable ramp to the street.	Driveways are potential conflict points among motorists, pedestrians and bicyclists. Consideration should be given to the practice of vehicles pulling across the driveway to enhance their sight lines, which will block the pedestrian path of travel. Reducing the turning radii at driveways will slow motor vehicles entering/exiting the roadway and establish pedestrian right-of-way. Consolidation of driveways should be considered where possible to reduce conflict points.



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	14-4	<p>If a traffic impact analysis is performed and that analysis concludes that improvements are required to the transportation system; the applicant may be required to complete those improvements in connection with the project as a condition of issuing a permit. Unless an agreement is executed by the town in which the time for the improvement is specified the improvement shall be completed prior to issuance of a certificate of occupancy. The fact that the obligation to construct lies with the applicant does not preclude the town from entering into an agreement to participate if that will be in the interest of the town.</p>	<p>Any traffic impact analysis should address all modes of transportation including walking and bicycling.</p>
	14-4	<p>The street and network system of a subdivision shall be coordinated with existing, proposed, and anticipated streets, sidewalks, and trails outside the subdivision or outside the portion of a single tract that is being divided into lots (hereinafter, “surrounding streets”) as provided in this section. While continuous sidewalks are the goal, highest priority should be locations near transit stops, schools, parks, public buildings, and other areas with high pedestrian concentrations.</p>	
	14-4	<p>Subcollector, local, and minor residential streets shall connect with surrounding streets where necessary to permit the convenient movement of traffic between residential neighborhoods or to facilitate access to neighborhoods by emergency service vehicles or for other sufficient reasons, but connections shall not be permitted where the effect would be to encourage the use of such streets by substantial through traffic.</p>	<p>This policy should be examined in the context of providing better walking and bicycling trip connections and more logical and shorter routes. In many cases, adding street connections and encouraging a grid network can reduce motorized trip length and need considerably while simultaneously facilitating and encouraging walking and bicycling trips.</p>



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	14-4	Whenever connections to anticipated or proposed surrounding streets are required by this section, the street right-of-way shall be extended and the street developed to the property line of the subdivided property (or to the edge of the remaining undeveloped portion of a single tract) at the point where the connections to the anticipated or proposed street is expected. In addition, the permit issuing authority may require temporary turnarounds to be constructed at the end of such streets pending their extension when such turnarounds appear necessary to facilitate the flow of traffic or accommodate emergency vehicles. Notwithstanding the other provisions of this subsection, no temporary dead end street in excess of one thousand (1000) feet maybe created unless no other practicable alternative is available.	Connections may not always be related to street or future street installation.
	14-5	Street rights-of-way are designed and developed to serve several functions: (i) to carry motor vehicle traffic, and in some cases allow on street parking; (ii) to provide a safe and convenient passageway and crossings for pedestrian and bicycling traffic; and (iii) to serve as an important link in the town's drainage system. In order to fulfill these objectives, all public streets shall be constructed to meet either the standards set forth in Subsection [b] or Subsection [c].	
	14-5	[b] The following classifications of streets may be constructed with four foot wide shoulders and drainage swales on either side in lieu of curb and gutter, so long as the street grade does not exceed a grade of fifteen percent (15%). Such streets shall be constructed to meet the criteria indicated in the table that follows as well as specifications referenced in Section 240.	Shoulder and drainage swales can make walking uncomfortable or impossible, especially for the young or those with mobility issues. It can also discourage bicycling by less experienced riders not comfortable riding on the road.
Section 238. General Layout of Streets	14-6	[b] Cul-de-sacs and loop streets are encouraged so that through traffic on residential streets in minimized. Similarly, to the extent practicable, driveway access to collector streets shall be minimized to facilitate the free flow of traffic and avoid traffic hazards	The policy of cul de sacs and loops should be examined in the context of providing better walking and bicycling trip connections and more logical and shorter routes. In many cases, adding street connections and encouraging a grid network can reduce motorized trip length and need considerably while simultaneously facilitating and encouraging walking and bicycling trips.



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Section 238. General Layout of Streets	14-6	[f] Streets shall be laid out so that residential blocks do not exceed eighteen hundred (1800) feet, unless no other practicable alternative is available.	A block length of eighteen hundred (1800) feet is lengthy and can influence pedestrian behaviors in several ways. In areas with long blocks, widely-spaced intersections mean that pedestrians have to go out of their way for trips and the widely-spaced intersections mean fewer safe crossing opportunities such as marked or controlled crosswalks.
Section 241. Public Streets and Private Roads in Subdivisions	14-6	Architecturally integrated subdivisions containing any number of dwelling units may be developed with private roads that do not meet the public street and sidewalk standards of this ordinance but that are not intended for dedication to the public so long as:.....The proposed development will have direct access onto a public street or, if the tract has access to a public street only via a private road, such private road is improved to public street standards	Walking and bicycling facilities provisions should be included as part of private road design as they improve safety dramatically. In addition, provision for walking and bicycling access and connections from the private roads are encouraged even where motorized access is not.
Section 242. Road Requirements in Un-subdivided Developments	14-8	[a] Within un-subdivided developments, all private roads and access ways shall be designed and constructed to facilitate the safe and convenient movement of motor vehicle and pedestrian and bicycle traffic. Widths of roads, use of curb and gutter, and paving specifications shall be determined by the provisions of this ordinance dealing with parking (Article XIX) and drainage (Article XVII).	
	14-8	Architecturally integrated subdivisions containing any number of dwelling units may be developed with private roads that do not meet the public street and sidewalk standards of this ordinance but that are not intended for dedication to the public so long as: [1] The proposed development will have direct access onto a public street or, if the tract has access to a public street only via a private road, such private road is improved to public street standards, [2] No road intended to be private is planned or expected to be extended to serve property outside the development, and [3] The subdivider demonstrates to the reasonable satisfaction of the council that the private roads will be properly maintained.	Walking and bicycling facilities provisions should be included as apart of private road design. In addition, provision for walking and bicycling access and connections from the private roads are encouraged even where motorized access is not.



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Section 243. Pedestrian Circulation and Sidewalk Requirements	14-9	Purpose. The purpose of this section is to provide minimum standards for the provision of sidewalks within the Town of Boone and the Town of Boone extraterritorial planning jurisdiction. The construction and maintenance of comfortable and well-designed sidewalks and crosswalks promotes public health, safety and welfare by providing improved pedestrian safety, expanded opportunities for recreational walking, improved network connectivity and easier access to goods and services, and reduces automobile dependency. Crosswalk locations should be convenient for pedestrian access and to indicate preferred crossing locations.	It is important that crosswalk markings are visible to motorists, particularly at night. There are many treatments to greatly enhance the safety of crossing locations including raised medians, beacons, signs and warning.
	14-9	When Sidewalks Must Be Constructed. Sidewalks shall be required for all new construction and in connection with improvements, renovations, additions or expansions to existing structures which fall into one of the following categories:	Is there an exception policy? If so what are the criteria which must be met to allow an exception?
	14-9	Design Requirements.m[1] Sidewalks shall be required along the entire length of any portions of public streets which abut the development parcel.	This does not address the need to connect new sidewalks to existing facilities which may not lead up directly to the edge of the developed property. Only requiring sidewalk along the property frontage can lead to short stretches of sidewalk that may not connect on either end. This also does not address the possible need for sidewalk on the side of the street opposite the newly developed parcel.
	14-10	Sidewalks will be constructed in accordance with the Roadway & Sidewalk Program Handbook for the Town of Boone. Any deviation from the requirements must be approved by the Administrator. Deviations may only be allowed when strict compliance with the Roadway & Sidewalk Program Handbook for the Town of Boone is impractical due to topography or because there exists site conditions beyond the applicant's control and not of the applicant's making.	The stated exceptions (grade-related and site conditions) does not discuss the efforts that are required to be made to address or mitigate these issues so that sidewalks can be constructed in accordance with the Handbook.



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	14-10	Whenever curb and gutter construction is used on public streets, wheelchair ramps for persons with disabilities shall be provided at intersections and other major points of pedestrian flow. Sidewalks, wheelchair ramps, and depressed curbs shall be constructed in accordance with the published standards of the North Carolina Building Code, Volume I-C, Accessibility.	The ramp design selection should also consider other users such as bicyclists to avoid creating safety hazards for them.
	14-10	[5] In all multi-family residential development, sidewalks shall be provided linking dwelling units with other dwelling units, the public street, and on site activity centers such as parking areas, transit access , laundry facilities, and recreational areas and facilities.	Walking and bicycling are key components of transit access.
	14-10	Alternative Methods for Pedestrian Circulation: In circumstances when an alternative method of public pedestrian circulation has been identified in a duly adopted governmental alternative transportation plan, or where a proposed public greenway will connect to an existing public greenway the permit issuing authority may allow the installation of a public greenway instead of sidewalks.	When replacing an otherwise required sidewalk with a public greenway, consideration should be given to where sidewalks act as links for bicyclists in areas where it is unsafe or they are not brave enough to ride on the road in an otherwise bikable trip.
	14-10	The developer with written authorization from the property owner shall submit a written request for an alternative method for pedestrian circulation to the administrator. The request shall specify the method proposed as a substitute for sidewalk installation. A site plan depicting the location and dimensions of the alternative method of pedestrian circulation and any other information deemed necessary by the administrator shall be included with the request.	When replacing an otherwise required sidewalk, consideration should be given to the range of impacts including where sidewalks act as network links for bicyclists.
	14-10	All alternative methods will be constructed to meet Town of Boone standards and will require the dedication of an assignable permanent easement to the Town of Boone.	The issue of long-term maintenance and repair should be addressed also.



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	14-11	<p>Except for development along a Primary Sidewalk Priority Route where there is contiguous sidewalk infrastructure in place (as shown on the Sidewalk Priorities Plan duly adopted by the Town), when a developer is required under Section 243(b) to construct a sidewalk, the developer may in lieu of such construction deposit funds into a sidewalk fund maintained by the Town of Boone. Fee-in-lieu is not an option when existing sidewalks are removed during the course of construction; in this case sidewalks must be replaced.</p>	<p>This policy may allow gaps to remain in the network and does not encourage them to be addressed during development. The ultimate cost of constructing a sidewalk in front of that development may be higher due to factors such as grading and drainage which would have been incorporated into the original development design. Where sidewalk is not required to be installed at time of development, guidelines are required for when the sidewalk installation will be triggered and how they will be funded at that time. At minimum all ROW for future full-width sidewalk installation (including grading) should be acquired as part of development approval.</p>
	14-11	<p>All funds collected in lieu of construction shall be in addition to all other sidewalk funding and shall be placed in a separate account to be used only for costs associated with new sidewalk construction as shown on the Sidewalk Priorities Plan duly adopted by the Town.</p>	<p>What is the impetus or requirement to not have the funds remain unused for an extended period of time?</p>
	14-11	<p>Whenever the permit issuing authority finds that a means of pedestrian access is necessary from the subdivision to schools, parks, playgrounds, or other roads or facilities and that such access is not conveniently provided by sidewalks adjacent to the streets, the developer may be required to reserve an unobstructed easement of at least ten (10) feet in width to provide such access.</p>	<p>Suggest requiring a wider easement such as 15-18 feet. The minimum recommended dimension for a shared use trail is 10 feet of paved surface and addition width may be needed for grading and locating other facilities such as benches, trash cans, etc.</p>
Section 245. Bridges	14-12	<p>All bridges shall be constructed in accordance with the standards and specifications of the North Carolina Department of Transportation, except that bridges on roads not intended for public dedication may be approved if designed by a licensed architect or engineer.</p>	<p>Bridges are critical links in the network and frequently become impassable pinch points in the system or else difficult and dangerous for pedestrians and bicyclists to cross. They are also constructed with a much longer planned life. Therefore, it is important to ensure that when they are widened, modified or replaced that they provide safe accommodations for pedestrians and bicyclists.</p>



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	15-1	In any case in which a developer installs or causes the installation of water, sewer, electrical power, telephone, or cable television facilities and intends that such facilities shall be owned, operated, or maintained by a public utility or any entity other than the developer, the developer shall transfer to such utility or entity the necessary ownership or easement rights to enable the utility or entity to operate and maintain such facilities.	The location of a utility easement may provide an opportunity to also create a connection in the network or construction of a trail. It is recommended to use the utility easement opportunity to include language to allow use for such purposes also.
	15-2	[a] Subject to Subsection [b], all public streets, sidewalks, bike parking , and other common areas or facilities in subdivisions created after the effective date of this ordinance shall be sufficiently illuminated to ensure the security of property, and the comfort, safety and security of persons using streets, sidewalks, and other common areas or facilities. Light fixtures should be selected to efficiently direct light to the desired area of the public street, sidewalk and other facilities.	"Pedestrians are adversely affected by low-light conditions (dusk and dawn) with lighting particularly important at intersections, midblock crossings, and close to locations such as transit stops. Illumination levels should be determined by the type and nature of the development and the levels of use during low-light conditions. Refer to Recommended Pedestrian Illumination Guidelines (Illuminating Engineering Society of North America) for minimum illumination levels for different uses. Although bikes are required to be fitted with lights, provision of adequate lighting is a particular issue for (1) illuminating the roadway or path surface and surroundings when riding and (2) enhancing visibility of riders to other users and (3) for improving personal security of bicyclists when parking/unlocking bikes."
	15-3	All roads, driveways, sidewalks, parking lots, and other common areas and facilities in non subdivided developments shall be sufficiently illuminated to ensure the security of property and the safety of persons using such roads, driveways, sidewalks, trails, parking lots, and other common areas and facilities.	Illumination levels should be determined by the type and nature of the development and the levels of use during low-light conditions. Refer to Recommended Pedestrian Illumination Guidelines (Illuminating Engineering Society of North America) for minimum illumination levels for different uses.
	15-5	All utility facilities shall be constructed in such a manner as to minimize interference with pedestrian or vehicular traffic and to facilitate maintenance without undue damage to improvements or facilities located within the development.	Possible issues include damage to pedestrian facilities when utility trucks drive and park on them, blocking of access and use by utilities vehicle, and prompt restoration to original condition after any disturbance. It may be necessary to create a detour if the facility is to be disturbed for utility work, especially if that disturbance will last an extended time period.



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	17-30	Golf courses, driving ranges, archery ranges, picnic grounds, parks, hiking, bicycle or horseback riding trails, open space and other similar private and public recreational uses.	Trail surface should be considered in areas where frequent flooding is expected. Additional maintenance may be required to remove silt and debris in areas that flood or where water pools on a trail.
	18-1	[a] The purpose of the sign ordinance is:..... [4] to protect pedestrians, bicyclists and motorists of the town from damage or injury caused or partially attributable to the distractions, obstructions, and blocking of sight lines or views which are hereby declared to be caused by improperly sized or situated signs;.....[6] to promote public safety, welfare, convenience and enjoyment of travel and the free flow of traffic as well as the safety and comfort of pedestrians and bicyclists within the town;	Illegal sign placement and incorrect types of signs may particularly block the view of small children, especially when placed too low to the ground in the area of an intersection or pedestrian crossing.
	18-7	Vision Obstruction: The placement of a sign that would limit a full view of both pedestrian, bicycling and vehicular traffic to less than seventy (70) feet measured along the right of way line.	Signs which do not allow a view beneath them may completely block views and leave drivers unaware of the close proximity of pedestrians or bicyclists, particularly children.
	18-7	[b] Vision Obstructions: No signs shall create any vision obstructions onto a public right of way, alley, sidewalk, adjacent drive or private drive entering onto a street. Signs or floodlights erected or placed in such a manner as to cause glare that impairs driver, pedestrian or bicyclist vision on a roadway or causes a nuisance to adjacent property as defined in North Carolina General Statute 136-32.2 are also prohibited	Signs and lights may create similar vision obstruction problems for pedestrians and bicyclists also. They have similar needs to be able to see as well as be seen. A cyclist can smack into a sign if it is incorrectly installed or overhangs into the bicyclist operation area which can extend to a height of eight feet.
	18-10	[10] Subdivisions, multi-family residential developments, and mobile home parks may display one sign announcing the name of the development at each entrance. The sign copy is limited to the name of the development only and may be freestanding or placed on the entrance wall of the development. The sign may be illuminated and the size may not exceed thirty (30) square feet in area, or eight (8) feet in height.	An eight foot high sign will completely obscure all pedestrians and bicyclists from view. Therefore, care must be taken that the sign is not installed within the sight triangle area or within an area that is impact by variations in grade or curvature of the road.
	18-11	[15] Signs which obstruct views of other signs, other property, or sight into public right-of-ways.	The sight triangle area for any property driveways or public right-of-ways should be kept clear of signs.
	18-12	[2] Any Use 5.2 Churches, Synagogues and Temples is permitted two signs from the following categories: attached or freestanding. a. Freestanding signs may not exceed thirty (30) square feet in area or eight (8) feet in height.	An eight foot high sign will completely obscure all pedestrians and bicyclists from view. Therefore, care must be taken that the sign is not installed within the sight triangle area or within an area that is impact by variations in grade or curvature of the road.



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
	18-14	The neighborhood business district provides a variety of commercial services. It is oriented to vehicular traffic as well as pedestrian and bicycling traffic. The signs allowed in this area permit an efficient means of information transfer consistent with the size of the streets and speed of the traffic, including pedestrians and bicyclists.	The size and location of signs and messages for pedestrians and bicyclists differs from those aimed at moving vehicles.
	18-30	Any inflatable sign must be set back and away from any pedestrian or vehicular right of way, any utility poles, above ground utility lines and any other hazardous structure, at least the vertical distance from the ground to the top of the sign when it is displayed at its maximum height, plus ten (10) feet while also not blocking the sight triangle area.	
	18-33	[1] Each sign that is illegally displayed shall be subject to a civil penalty of \$100.00 per sign, per day. If prohibited signs are creating a public safety hazard and/or found in the right-of-way, the owner will be subject to the civil penalties and a representative of the town may pick up the prohibited signs. The town will assess a \$10.00 pick-up fee for each sign the town removes. The signowners will be notified by phone and/or first-class mail that the signs may be picked up after payment of the associated penalties within ten (10) business days at the Development Services Department before the sign(s) are destroyed.	Suggest considering escalating penalties for repeat offenders.
	18-33	No permit for a sign which will be displayed or located within an access easement may be issued unless there are no roads contiguous with the lot upon which the development is located, or the access easement in which the sign is to be located is the only available and planned vehicular access to the aforementioned lot. Sign placement will be outside of the sight triangle area for the access easement intersection.	
	19-1	[7] Parking Space or Area: A portion of the vehicle accommodation area set for the parking of one vehicle or an area dedicated to the parking of a bicycle.	
	19-3	[a] All developments in all zoning districts shall provide a sufficient number of parking spaces to accommodate the number of vehicles that ordinarily are likely to be attracted to the development in question.	Where the surrounding bike network is good, suggest considering the possibility of reducing the vehicle parking space requirement through the installation of short- and long-term bike parking.



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
19-3	<p>"I] The minimum parking required for a Use I.300 Multi-Family Residences shall be reduced by a factor of 10% for each one of the following, with a maximum reduction of 20% based on these factors:</p> <p>[A] The development is located within 1 mile of linear sidewalk distance from any portion of the Appalachian State University library, and public sidewalks or trails or public pedestrian walkways exist or will be constructed in connection with the development which allow safe pedestrian or bicyclist travel between the development and the main campus."</p>		
19-6	<p>[e] Driveways shall not be less than eleven (11) feet in width for one way, traffic and eighteen (18) feet in width for two way traffic, except that eleven feet wide driveways are permissible for two way traffic when, (i) the driveway is not longer than fifty feet, (ii) it provides access to not more than six spaces, and (iii) sufficient turning space is provided so that vehicles need not back into a public street.</p>		
19-7	<p>Circulation areas shall be designed so that vehicles can proceed safely without posing a danger to pedestrians, bicyclists or other vehicles and without interfering with vehicle or bicycle parking areas.</p>		
19-13	<p>[a] The B – I Central Business zoning district is exempt from the requirements of Section 355 Bicycle Parking.</p>	<p>It is unclear why the Business district should be exempt from bicycle parking requirements: short-term bike parking is needed for customers and long-term parking for employees. Space used for on-street parking may provide usable space for bicyclist and can be used as a treatment to improve sight distance in the area of a mid-block driveway or close to an intersection.</p>	
19-13	<p>The number of bicycle spaces included in the required bicycle parking facilities shall be determined by the following table of uses. Use descriptions are abbreviated and are for descriptive purposes only.</p>	<p>Refer to APBP Bike Parking Guidelines 2nd Edition, Pages 3-2 to 3-4 for updated guidelines on parking requirements for different uses.</p>	
19-15	<p>Each bicycle parking space shall be no less than six (6) feet long by two (2) feet wide, plus sufficient area for access. A "rack" is a bicycle facility which includes multiple contiguous bicycle parking spaces. Exact conformity with the following diagram for a single rack bicycle facility is not required, but adherence</p>	<p>Refer to APBP Bike Parking Guidelines 2nd Edition, Pages 2-31 to 2-38 for updated guidelines on dimensional layouts for different bike rack configurations.</p>	



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
19-16		No less than four (4) feet must be provided between parallel racks.	Four feet is the recommended distance between parallel bike racks. Refer to APBP Bike Parking Guidelines 2nd Edition, Pages 2-31 to 2-38 for dimensional details for other bike rack layout configurations.
19-16		Bicycle parking facilities shall be constructed of materials of sufficient strength to significantly resist their displacement or removal, and they shall be securely anchored in concrete or other equivalent material or system of sufficient strength to significantly resist removal. Bicycle parking facilities shall support bicycles in a stable position without damage to wheels, frame or other components and allow for the use of either a cable, U-shaped, or similar lock to secure the bicycle.	For additional detailed information about materials and securing racks, refer to APBP Bike Parking Guidelines 2nd Edition
19-16		Outside bicycle parking facilities shall be illuminated in conformity with the standards for "open parking areas" of UDO Section 396. Inside bicycle parking facilities shall be illuminated in conformity with the standards for "building entries" of UDO Section 396.	Inadequate lighting can be a safety concern and discourage many users from participation in bicycling. These areas are also frequently lightly trafficked so security cameras may be recommended in some bike parking areas for safety and security also. Maintenance and repairs of lights and any cameras is required also.
19-16		<p>Parking requirements should be balanced with an active pedestrian network to minimize pedestrian, bicycle and vehicle conflicts as much as possible. Bicycle approaches and parking shall be designed so as to avoid impeding or creating a hazard or obstacle to pedestrians or obstruct the accessible path of travel for persons with disabilities. Bicycle approaches and parking shall be designed to avoid creating a hazard to bicyclists or bicycles from pedestrians, automobiles or other motor vehicles. Bicycle racks installed on private sidewalks within the development must provide a clear, unobstructed passage of at least five (5) feet for pedestrians and should be installed at least three (3) feet from the face of any curb. Bicycle racks may not be installed on public sidewalks without the express authorization of....</p>	



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
19-17		Outside bicycle parking facilities shall be illuminated in conformity with the standards for "open parking areas" of UDO Section 396. Inside bicycle parking facilities shall be illuminated in conformity with the standards for "building entries" of UDO Section 396.	Inadequate lighting can be a safety concern and discourage many users from participation in bicycling. These areas are also frequently lightly trafficked so security cameras may be recommended in some bike parking areas for safety and security also. Maintenance and repairs of lights and any cameras is required also.
19-17		Areas set aside for short-term bicycle parking shall be clearly marked and reserved for bicycle parking only. Where the location of long-term parking is not easily visible from the street, a sign that does not exceed four (4) square feet in area and directs cyclists to parking shall be provided on site and must be visible from the street or from the main building entrance. For purposes of this Section, "main building entrance" shall connote and refer to the primary doorway by which residents, visitors or customers enter and exit a building, whether or not said entrance is oriented facing the public street.	Short-term bike parking should always be visible and convenient to the bicyclist and entrance. Long-term parking can be set up in less convenient locations where signs may be needed to direct users and alert them to it's presence.
19-18		Long term bicycle parking is intended or utilized for daily, overnight or even longer duration bicycle parking by residents and employees. Long term bicycle parking shall be covered or enclosed, and must provide security and protection from weather and the elements. Long term bicycle parking should be incorporated whenever possible into the building design. Outreach may be needed to alert potential users to the presence of the long-term parking.	For long-term bike parking, safeguards such as better lighting, security cameras, and controlled access are recommended.
19-18		Bicycle parking exceeding the requirements of subsection [b] may reduce by up to 10% required motor vehicle parking for residential uses and other uses where a parking demand analysis establishes a minimum motor vehicle parking expectation. For every five bicycle parking spaces in excess of the short or long term bicycle parking requirements of subsection [b], the use's motor vehicle parking requirement is reduced by one (1) space. Existing parking may be converted to take advantage of this provision.	Suggest increasing the potential parking reduction to 20%. In addition, suggest adding a provision so that existing parking can be eliminated.



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
	19-20	Required bufferyards shall not be disturbed for any reason except for approved driveway openings, pedestrian or bicycle paths, sidewalks, trails , designated greenways, utilities, drainage ways, bio-retention areas, walls, fences, and other passive or minor uses compatible with the general separation of land uses and provided that the total number of required plantings are still met....	
"Landscape Standards Section 358. The Purpose and Intent"	20-1	The purpose of this article is to regulate the planting and preservation of landscape material, to promote the general health, safety and welfare of this community; to facilitate the creation of an attractive environment; to prevent blocking of sight triangles , to protect property values; to further the urban design and economic development of the community; and to encourage skilled installation and continued maintenance of all plant materials.	
	20-3	[c] To ensure that landscape materials do not constitute a traffic hazard, a sight triangle ten (10) feet by seventy (70) feet will be observed at all intersections of driveways/ streets with adjacent streets, driveways, and private rooms (see diagram below). Required street trees shall be planted outside of the sight triangle area. Shrubs planted within sight distance triangles shall be of a type with a maximum mature height of twenty (24) inches. See note following table Section 363 [b].	Maintenance of plant height is a critical component of keeping the sight triangle view clear.
	20-7	[c] To ensure that landscape materials do not constitute a traffic hazard, a sight triangle ten (10) feet by seventy (70) feet will be observed at all intersections of driveways/ streets with adjacent streets (see diagram below). Required street trees shall be planted outside of the sight triangle area. Shrubs planted within sight distance triangles shall be of a type with a maximum mature height of twenty (24) inches. See note following table Section 363 [b].	Maintenance of plant height is a critical component of keeping the sight triangle view clear.
	20-12	Plantings shall be arranged so as not to interfere with driver, pedestrian or bicyclist vision or circulation .	Poorly pruned plantings frequently block views unnecessarily and create a preventable safety hazard.



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
	20-13	[d] Parking areas shall be separated from the exterior wall of a structure by landscaped planting areas at least four (4) feet in width. Planting areas may be omitted where necessary to accommodate pedestrian and bicyclist entrance ways. Alternative planting areas meeting the purpose and intent of this section may be approved by the Administrator.	
	22-2	[a] Pedestrian-Orientation The intent of this section is to provide a design of buildings that support a safe and attractive pedestrian environment.	Suggest bicycling design and access considerations be added to this section.
	22-3	The main building entrance, when not facing the primary public way, shall provide a safe and convenient access for pedestrians from the main building entrance to the primary public way. The pedestrian way must provide additional landscape amenities.	This location should also include short-term bike parking.
	22-8	[c] The following are specific standards for lighting intensity based upon the land use involved. Values are presented in allowable foot-candles (fc) maintained (measured horizontally) at grade and are to be averaged throughout the site to avoid hot spots, i.e. areas of extreme light intensity relative to the remainder of the site:	The levels of illumination are lower than those recommended elsewhere. Refer to Recommended Pedestrian Illumination Guidelines (Illuminating Engineering Society of North America) for minimum illumination levels for different uses.
	22-10	An area lighting plan, drawn to scale, indicating all structures, parking lots, building entrances, vehicular and pedestrian traffic areas, vegetation that may interfere with lighting, and adjacent land uses that may be adversely impacted by the lighting. Light fixtures should be selected to efficiently direct light to the desired area of parking lot, pedestrian traffic area, sidewalk and other facilities. The plan...	



Ordinance	Page	Existing Ordinance Text (Abridged) Suggested additions shown in red. Attention is drawn to italicized text.	Comments
A-5		<p>[b] Development site plans shall also show proposed new legal features (especially new property lines, street right-of-way lines, sidewalk, trail, and utility and other easements), as well as proposed man made features, including, but not limited to, the following:.....[10] Sidewalks and walkways, showing widths and surface material. [11] Bridges. [12] Outdoor illumination with lighting fixtures sufficiently identified..... [14] Above ground utility lines and other facilities.....[19] Vehicle accommodation areas (including parking areas, loading areas, and circulation areas), all designated by surface material and showing the dimensions and layout of proposed parking spaces and the dimensions and direction of travel of lanes, aisles and driveways.</p>	
A-7		<p>"[a] In addition to the written application and the plans, whenever the nature of the proposed development makes information or documents such as the following relevant, such documents or information shall be provided. The following is a representative list of the types of information or documents that may be requested:....</p> <p>[10] The environmental impact of a development, including its effect on historically significant or ecologically fragile or important areas and its impact on pedestrian or traffic safety or congestion.</p> <p>[11] The walking and bicycling impact of a development, including its effect on access, safety, comfort, and connectivity as well as health, environmental and congestion benefits."</p>	



ACCESS MANAGEMENT CONCEPTS AND LANGUAGE

Access management goal: The goal of access management is to incorporate good management principles in locating driveways, entrances, and side-streets whenever land is developed thereby improving upon existing operations as well as safety of all in the vicinity. Safety is reduced for all when access is not properly located and designed as each access point creates a potential conflict point (i.e. crash) between through on-road and sidewalk traffic (vehicles, bicyclists and pedestrians) and those using that access. Access management separates and better defines the access points so that turning and crossing movements occur at fewer locations and the overall potential for conflict is reduced. Through drivers, bicyclists and pedestrians can better predict the turning and crossing trajectories of drivers turning and crossing into entrances and driveways and across sidewalks. Managing and consolidating entrances may also allow room for a center left turn lane which can further improve driving safety.

ACCESS MANAGEMENT APPLICATION AND POLICY:

Access management is achieved through the systematic application of policy, planning, regulatory, and design strategies. Methods can include statutes, regulations, plans, land acquisition, and operational and geometric design standards. A local agency may adopt specific policies, directives, or guidelines that are directly or indirectly related to access management. Policies may be established by resolution or through comprehensive plan. Access management issues can sometimes also be addressed through local design standards and guidelines.

Commonly used access management methods include:

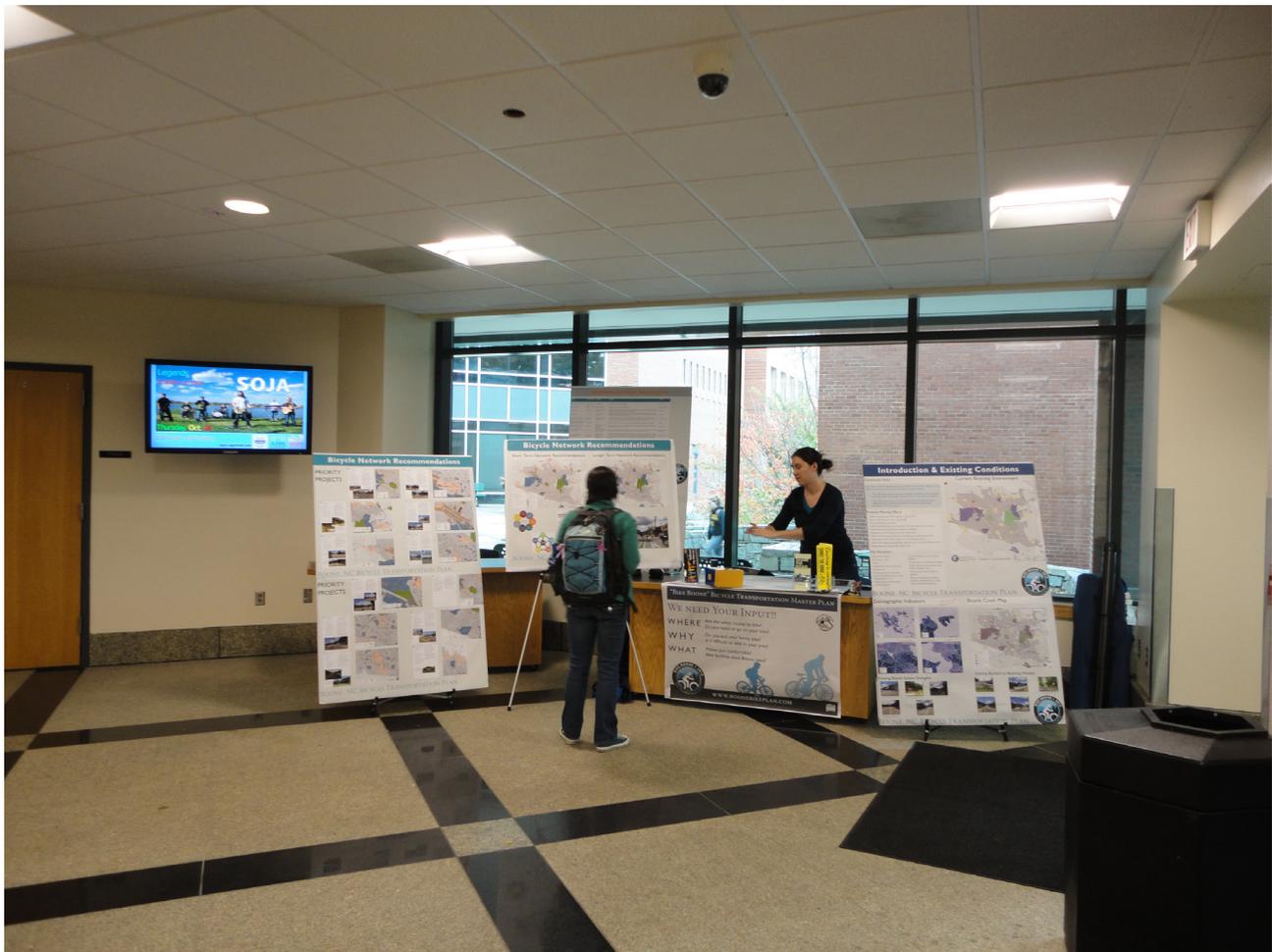
- Regulating the minimum spacing of driveways and street connections
- Limiting the number of entrances per property
- Consolidating existing entrances and encouraging shared driveway designs
- Establishing standards for the width and throat length of driveways accessing properties
- Moving driveways and entrances further from signalized intersections and highway ramps
- Providing service roads, parallel collector roads or side street access for properties along arterial roadways.
- Creating internal aisles to efficiently move vehicles off the adjacent street
- Promoting the interconnection of parking lots and on-site circulation systems



- Incorporating right- and left-turn lanes into roadway designs.
- Installing a median on an undivided roadway
- Closing or replacing full median openings with directional openings
- Replacing an existing continuous two-way left-turn lane with a median
- Sidewalk improvements

Additional resources:

- Smart Growth America provides information to specifically assist jurisdictions in adding new policies: <http://www.smartgrowthamerica.org/guides/smart-growth-at-the-state-and-local-level/transportation/develop-an-access-management-program/>
- Florida Access Management program: <http://www.dot.state.fl.us/planning/systems/sm/accman/>
- Institute of Transportation Engineers Access Management fact sheet: <http://www.ite.org/technical/IntersectionSafety/access.pdf>



ASU students stopped by the *Bike Boone 2013* informational booth in the Plemmons Student Union on October 23, 2013 to learn more about the bicycle network recommendations.



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OVERVIEW

When considering possible funding sources for the Town of Boone's bicycle projects, it is important to remember that not all construction activities or programs will be accomplished with a single funding source. It will be necessary to consider several sources of funding, that when combined, will support full project completion. Funding sources can be used for a variety of activities, including: programs, planning, design, implementation, and maintenance. This appendix outlines the most likely sources of funding from the federal, state, and local government levels as well as from the private and non-profit sectors. A summary table of funding sources is included at the end of this appendix. It should be noted that this section reflects the funding available at the time of writing. The funding amounts, fund cycles, and even the programs themselves are susceptible to change without notice.

FEDERAL FUNDING SOURCES

Federal funding is typically directed through state agencies to local governments either in the form of grants or direct appropriations. Federal funding typically requires a local match of anywhere from five percent to 50 percent, but there are sometimes exceptions, such as the recent American Recovery and Reinvestment Act stimulus funds, which did not require a match. The following is a list of possible Federal funding sources that could be used to support construction of pedestrian and bicycle improvements.

MOVING AHEAD FOR PROGRESS IN THE TWENTY-FIRST CENTURY (MAP-21)

The largest source of federal funding for pedestrian and bicycle projects is the USDOT's Federal-Aid Highway Program, which Congress has reauthorized roughly every six years since the passage of the Federal-Aid Road Act of 1916. The latest act, Moving Ahead for Progress in the Twenty-First Century (MAP-21) was enacted in July 2012 as Public Law 112-141. The Act replaces the Safe, Accountable, Flexible, Efficient Transportation Equity Act – a Legacy for Users (SAFETEA-LU), which was valid from August 2005 - June 2012.



U.S. Department
of Transportation

**Federal Highway
Administration**



MAP-21 authorizes funding for federal surface transportation programs including highways and transit for the 27 month period between July 2012 and September 2014. It is not possible to guarantee the continued availability of any listed MAP-21 programs, or to predict their future funding levels or policy guidance. Nevertheless, many of these programs have been included in some form since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991, and thus may continue to provide capital for active transportation projects and programs.

In North Carolina, federal monies are administered through the North Carolina Department of Transportation (NCDOT) and Metropolitan Planning Organizations (MPOs). Most, but not all, of these programs are oriented toward transportation versus recreation, with an emphasis on reducing auto trips and providing inter-modal connections. Federal funding is intended for capital improvements and safety and education programs, and projects must relate to the surface transportation system.

There are a number of programs identified within MAP-21 that are applicable to pedestrian and bicycle projects. These programs are discussed below.

For more information, visit: <http://www.fhwa.dot.gov/map21/summaryinfo.cfm>

TRANSPORTATION ALTERNATIVES

Transportation Alternatives (TA) is a new funding source under MAP-21 that consolidates three formerly separate programs under SAFETEA-LU: Transportation Enhancements (TE), Safe Routes to School (SR2S), and the Recreational Trails Program (RTP). These funds may be used for a variety of pedestrian, bicycle, and streetscape projects including sidewalks, bikeways, multi-use paths, and rail-trails. TA funds may also be used for selected education and encouragement programming such as Safe Routes to School, despite the fact that TA does not provide a guaranteed set-aside for this activity as SAFETEA-LU did.

Average annual funds available through TA over the life of MAP-21 equal \$814 million nationally, which is based on a 2% set-aside of total MAP-21 allocations. Note that state DOT's may elect to transfer up to 50% of TA funds to other highway programs, so the amount listed on the website represents the maximum potential funding. Remaining TA funds (those monies not re-directed to other highway programs) are disbursed through a separate competitive grant program administered by NCDOT. Local governments, school districts, tribal governments, and public lands agencies are permitted to compete for these funds.

Each State Governor is given the opportunity to “opt out” of the Recreational Trails Program. However, as of the date of the writing of this Plan, only Florida and Kansas have “opted out” of the RTP. For all other states, dedicated funds for recreational trails continue to be provided as a subset of TA. MAP-21 provides \$85 million nationally for the RTP.

For the complete list of eligible activities, visit: http://www.fhwa.dot.gov/environment/transportation_enhancements/legislation/map21.cfm

For funding levels, visit: <http://www.fhwa.dot.gov/MAP21/funding.cfm>



SURFACE TRANSPORTATION PROGRAM

The Surface Transportation Program (STP) provides states with flexible funds which may be used for a variety of highway, road, bridge, and transit projects. A wide variety of pedestrian and bicycle improvements are eligible, including trails, bike lanes, sidewalks, crosswalks, crossing signals, and other ancillary facilities. Modification of sidewalks to comply with the requirements of the Americans with Disabilities Act (ADA) is also an eligible activity. Unlike most highway projects, STP-funded pedestrian and bicycle facilities may be located on local and collector roads which are not part of the Federal-aid Highway System. 50 percent of each state's STP funds are allocated by population to the MPOs; the remaining 50 percent may be spent in any area of the state.

For more information: <http://www.fhwa.dot.gov/map21/stp.cfm>

HIGHWAY SAFETY IMPROVEMENT PROGRAM

MAP-21 doubles the amount of funding available through the Highway Safety Improvement Program (HSIP) relative to SAFETEA-LU. HSIP provides \$2.4 billion nationally for projects and programs that help communities achieve significant reductions in traffic fatalities and serious injuries on all public roads, bikeways, and walkways. MAP-21 preserves the Railway-Highway Crossings Program within HSIP but discontinues the High-Risk Rural roads set-aside unless safety statistics demonstrate that fatalities are increasing on these roads. Bicycle and pedestrian safety improvements, enforcement activities, traffic calming projects, and crossing treatments for non-motorized users in school zones are eligible for these funds.

For more information: <http://www.fhwa.dot.gov/map21/hsip.cfm>

CONGESTION MITIGATION/ AIR QUALITY PROGRAM

The Congestion Mitigation/Air Quality Improvement Program (CMAQ) provides funding for projects and programs in air quality non-attainment and maintenance areas for ozone, carbon monoxide, and particulate matter which reduce transportation related emissions. States with no non-attainment areas may use their CMAQ funds for any CMAQ or STP eligible project. These federal dollars can be used to build bicycle and pedestrian facilities that reduce travel by automobile. Purely recreational facilities generally are not eligible. Communities located in attainment areas who do not receive CMAQ funding apportionments may apply for CMAQ funding to implement projects that will reduce travel by automobile.

For more Information: <http://www.fhwa.dot.gov/map21/cmaq.cfm>



FEDERAL TRANSIT ADMINISTRATION (FTA) METROPOLITAN PLANNING

This program provides funding for metropolitan coordinated transportation planning. Federal planning funds are first apportioned to State DOTs. State DOTs then allocate planning funding to MPOs. Eligible activities include pedestrian or bicycle planning to increase safety for non-motorized users, and to enhance the interaction and connectivity of the transportation system across and between modes.

For more information: <http://www.fhwa.dot.gov/map21/mp.cfm>

FEDERAL TRANSIT ADMINISTRATION ENHANCED MOBILITY OF SENIORS AND INDIVIDUALS WITH DISABILITIES

This program can be used for capital expenses that support transportation to meet the special needs of older adults and persons with disabilities, including providing access to an eligible public transportation facility when the transportation service provided is unavailable, insufficient, or inappropriate to meeting these needs.

For more information: http://www.fta.dot.gov/documents/MAP-21_Fact_Sheet_-_Enhanced_Mobility_of_Seniors_and_Individuals_with_Disabilities.pdf

PARTNERSHIP FOR SUSTAINABLE COMMUNITIES

Founded in 2009, the Partnership for Sustainable Communities is a joint project of the Environmental Protection Agency (EPA), the U.S. Department of Housing and Urban Development (HUD), and the U.S. Department of Transportation (USDOT). The partnership aims to “improve access to affordable housing, more transportation options, and lower transportation costs while protecting the environment in communities nationwide.” The Partnership is based on five Livability Principles, one of which explicitly addresses the need for bicycle and pedestrian infrastructure (“Provide more transportation choices: Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation’s dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health”).

The Partnership is not a formal agency with a regular annual grant program. Nevertheless, it is an important effort that has already led to some new grant opportunities (including both TIGER I and TIGER II grants). North Carolina jurisdictions should track Partnership communications and be prepared to respond proactively to announcements of new grant programs. Initiatives that speak to multiple livability goals are more likely to score well than initiatives that are narrowly limited in scope to bicycle or pedestrian improvement efforts.

For more information: <http://www.sustainablecommunities.gov/>

<http://www.epa.gov/smartgrowth/partnership/>

Resource for Rural Communities: http://www.sustainablecommunities.gov/pdf/Supporting_Sustainable_Rural_Communities_FINAL.PDF





LAND AND WATER CONSERVATION FUND



The Land and Water Conservation Fund (LWCF) provides grants for planning and acquiring outdoor recreation areas and facilities, including trails. Funds can be used for right-of-way acquisition and construction. The program is administered by the Department of Environment and Natural Resources as a grant program for states and local governments. Maximum annual grant awards for county governments, incorporated municipalities, public authorities, and federally recognized Indian tribes are \$250,000. The local match may be provided with in-kind services or cash.

More information: http://www.ncparks.gov/About/grants/lwcf_main.php

RIVERS, TRAILS, AND CONSERVATION ASSISTANCE PROGRAM

The Rivers, Trails, and Conservation Assistance Program (RTCA) is a National Parks Service (NPS) program providing technical assistance via direct NPS staff involvement to establish and restore greenways, rivers, trails, watersheds and open space. The RTCA program provides only for planning assistance—there are no implementation funds available. Projects are prioritized for assistance based on criteria including conserving significant community resources, fostering cooperation between agencies, serving a large number of users, encouraging public involvement in planning and implementation, and focusing on lasting accomplishments. This program may benefit trail development in North Carolina locales indirectly through technical assistance, particularly for community organizations, but is not a capital funding source.

More information: <http://www.nps.gov/ncrc/programs/rtca/> or contact the Southeast Region RTCA Program Manager Deirdre “Dee” Hewitt at (404) 507-5691

NATIONAL SCENIC BYWAYS DISCRETIONARY GRANT PROGRAM



The National Scenic Byways Discretionary Grants program provides merit-based funding for byway-related projects each year, utilizing one or more of eight specific activities for roads designated as National Scenic Byways, All-American Roads, State scenic byways, or Indian tribe scenic byways. The activities are described in 23 USC 162(c). This is a discretionary program; all projects are selected by the US Secretary of Transportation.

Eligible projects include construction along a scenic byway of a facility for pedestrians and bicyclists and improvements to a scenic byway that will enhance access to an area for the purpose of recreation. Construction includes the development of the environmental documents, design, engineering, purchase of right-of-way, land, or property, as well as supervising, inspecting, and actual construction.

More information: <http://www.bywaysonline.org/grants/>



FEDERAL LANDS TRANSPORTATION PROGRAM

The FLTP funds projects that improve access within Federal lands (including national forests, national parks, national wildlife refuges, national recreation areas, and other Federal public lands) on federally owned and maintained transportation facilities. \$300 million per fiscal year has been allocated to the program for 2013 and 2014.

More information: <http://www.fhwa.dot.gov/map21/fltp.cfm>

ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANTS

The Department of Energy's Energy Efficiency and Conservation Block Grants (EECBG) may be used to reduce energy consumptions and fossil fuel emissions and for improvements in energy efficiency. Section 7 of the funding announcement states that these grants provide opportunities for the development and implementation of transportation programs to conserve energy used in transportation including development of infrastructure such as bike lanes and pathways and pedestrian walkways. Although the current grant period has passed, more opportunities may arise in the future.

More information: <http://www.eere.energy.gov/wip/eecbg.html>





STATE FUNDING SOURCES

The funding sources covered in this section were updated in the Fall of 2013 and reviewed for accuracy by NCDOT Division 8 staff as well as staff from the Division of Bicycle and Pedestrian Transportation. However, at the time of development of this plan, the Strategic Transportation Investment initiative was being reviewed by the Joint Legislative Transportation Oversight Committee. Therefore, the status of future funding sources is subject to change. The availability of these funding resources should be confirmed during the implementation of a project.



NCDOT Current STIP

August 2013

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT) STATE TRANSPORTATION IMPROVEMENT PROGRAM

The NCDOT's State Transportation Improvement Program is based on the Strategic Transportation Investments bill, signed into law in 2013. The Strategic Transportation Investments (STI) initiative introduces the Strategic Mobility Formula, a new way to fund and prioritize transportation projects to ensure they provide the maximum benefit to our state. It allows NCDOT to use its existing revenues more efficiently to fund more investments that improve North Carolina's transportation infrastructure, create jobs and help boost the economy.

The new Strategic Transportation Investments initiative is scheduled to be fully implemented by July 1, 2015. Projects funded for construction before then will proceed as scheduled under the current Equity Formula; projects slated for after that time will be ranked and programmed according to the new formula. The new Strategic Mobility Formula assigns projects for all modes into one of three categories: Statewide Mobility, Regional Impact, and Division Needs. All independent bicycle and pedestrian projects are placed in the "Division Needs" category, and are ranked on the following five criteria:

- Safety
- Access
- Demand or density
- Constructability
- Benefit/cost ratio



This ranking largely determines which projects are included in the department's State Transportation Improvement Program (STIP). The STIP is a federally mandated transportation planning document that details transportation improvements prioritized by stakeholders for inclusion in the Work Program over the next ten years. The STIP is updated every two years.

The STIP contains funding information for various transportation divisions of NCDOT including: highways, aviation, public transportation, rail, bicycle and pedestrian, and the Governor's Highway Safety Program. Access to many federal funds require that projects be incorporated into the STIP. The STIP is the primary method for allocating state and federal transportation funds. However, beginning July 1, 2015, state funds cannot be used to match federally funded projects. Only Powell Bill or local funds can be used as a match for federally funded bicycle and pedestrian projects.



For more information on STI: www.ncdot.gov/strategictransportationinvestments/

To access the STIP: <https://connect.ncdot.gov/projects/planning>

For more about the STIP process: <http://www.ncdot.org/performance/reform/>

INCIDENTAL PROJECTS

Bicycle and pedestrian accommodations such as bike lanes, sidewalks, intersection improvements, widened paved shoulders and bicycle and pedestrian-safe bridge design are frequently included as incidental features of highway projects.

In addition, bicycle-safe drainage grates are a standard feature of all highway construction. Most pedestrian safety accommodations built by NCDOT are included as part of scheduled highway improvement projects funded with a combination of federal and state roadway construction funds or with a local fund match.

More information: <http://www.ncdot.gov/bikeped/funding/process/>

SPOT SAFETY PROGRAM

The Spot Safety Program is a state funded public safety investment and improvement program that provides highly effective low cost safety improvements for intersections, and sections of North Carolina's 79,000 miles of state maintained roads in all 100 counties of North Carolina. The Spot Safety Program is used to develop smaller improvement projects to address safety, potential safety, and operational issues. The program is funded with state funds and currently receives approximately \$9 million per state fiscal year. Other monetary sources (such as Small Construction or Contingency funds) can assist in funding Spot Safety projects, however, the maximum allowable contribution of Spot Safety funds per project is \$250,000.

The Spot Safety Program targets hazardous locations for expedited low cost safety improvements such as traffic signals, turn lanes, improved shoulders, intersection upgrades, positive guidance enhancements (rumble strips, improved channelization, raised pavement markers, long life highly visible



pavement markings), improved warning and regulatory signing, roadside safety improvements, school safety improvements, and safety appurtenances (like guardrail and crash attenuators).

A Safety Oversight Committee (SOC) reviews and recommends Spot Safety projects to the Board of Transportation (BOT) for approval and funding. Criteria used by the SOC to select projects for recommendation to the BOT include, but are not limited to, the frequency of correctable crashes, severity of crashes, delay, congestion, number of signal warrants met, effect on pedestrians and schools, division and region priorities, and public interest.

For more information: <https://connect.ncdot.gov/resources/safety/Pages/NC-Highway-Safety-Program-and-Projects.aspx>

PEDESTRIAN FUNDS

Each of the 14 NCDOT Highway Divisions administers \$100,000 in pedestrian funds within its jurisdiction. These funds are used for new sidewalk construction. A written request should be submitted to the Division Engineer providing technical information such as justification, location, improvements being requested, timing, etc., for thorough review.

HIGH HAZARD ELIMINATION PROGRAM

The Hazard Elimination Program is used to develop larger improvement projects to address safety and potential safety issues. The program is funded with 90% federal funds and 10% state funds. The cost of Hazard Elimination Program projects typically ranges between \$400,000 and \$1 million. A Safety Oversight Committee (SOC) reviews and recommends Hazard Elimination projects to the Board of Transportation (BOT) for approval and funding. These projects are prioritized for funding according to a safety benefit to cost (B/C) ratio, with the safety benefit being based on crash reduction. Once approved and funded by the BOT, these projects become part of the department's State Transportation Improvement Program (STIP).

More information: <https://connect.ncdot.gov/resources/safety/Pages/NC-Highway-Safety-Program-and-Projects.aspx>

NCDOT CONTINGENCY FUND

The Statewide Contingency Fund is a \$10 million fund administered by the Secretary of Transportation. The Division Engineer elicits written requests from municipalities, counties, businesses, schools, citizens, legislative members and NCDOT staff. The appeals are reviewed on their merits by the Contingency and Small Urban Funds Committee, which makes recommendations for funding to the Secretary. Written requests must provide technical information such as justification, location, improvements being requested, timing, etc., for thorough review.

More information: https://connect.ncdot.gov/resources/safety/Tepl/Pages/Tepl-Topic.aspx?Topic_List=F19



SMALL URBAN FUNDS

Each NCDOT Highway Division administers \$2 million of funds for small-scale improvement projects in urban areas. Projects must be within 2 miles of city limits and have a maximum cost of \$250,000. Requests for small urban funds may be made by municipalities, counties, businesses, school and industrial entities. A written request should be submitted to the Division Engineer providing technical information such as justification, location, improvements being requested, timing, etc., for thorough review.

SPOT IMPROVEMENT PROGRAM

The Division of Bicycle and Pedestrian Transportation (DBPT) budgets \$500,000 per year for “spot” safety improvements throughout North Carolina. Eligible improvements include drain grate replacement, bicycle loop detectors, pedestrian signals and other small-scale improvements. These funds are used for small-scale projects not substantial enough to be included in the STIP. Proposals should be submitted directly to the Division of Bicycle and Pedestrian Transportation.



SMALL CONSTRUCTION FUNDS

Each of the 14 NCDOT Highway Divisions administers \$357,000 of small construction funds. The purpose of these funds is to finance improvements on the State System (US, NC, and SR routes) to be used for projects anywhere in the counties. These funds are used to fund a variety of transportation projects for municipalities, counties, businesses, schools, and industries throughout the state. There is a \$250,000 maximum amount per request per fiscal year. Any project with a total cost greater than \$150,000 requires a resolution or a letter of support for the project from the local jurisdiction. The former NCDOT Statewide Discretionary Funding program has been consolidated into this funding mechanism.

More information: <http://www.nctransportationanswers.org/ourforms/SMALLCONSTRUCTIONFORM.pdf>

GOVERNOR'S HIGHWAY SAFETY PROGRAM

The Governor's Highway Safety Program (GHSP) funds safety improvement projects on state highways throughout North Carolina. All funding is performance-based. Substantial progress in reducing crashes, injuries and fatalities is required as a condition of continued funding. This funding source is considered to be “seed money” to get programs started. The grantee is expected to provide a portion of the project costs and is expected to continue the program after GHSP funding ends. State Highway Applicants must use the web-based grant system to submit applications.

More information: <http://www.ncdot.org/programs/ghsp/>



BICYCLE AND PEDESTRIAN PLANNING GRANT INITIATIVE

The Bicycle and Pedestrian Planning Grant Initiative is a matching grant program administered through NCDOT that encourages municipalities to develop comprehensive bicycle plans and pedestrian plans. The Division of Bicycle and Pedestrian Transportation (DBPT) and the Transportation Planning Branch (TPB) sponsor this grant. All North Carolina municipalities are eligible and are encouraged to apply. Funding allocations are determined on a sliding scale based on population. Municipalities who currently have bicycle plans or pedestrian plans, either through this grant program or otherwise, may also apply to update their plan provided it is at least five years old.

More information: <https://connect.ncdot.gov/municipalities/PlanningGrant/Pages/default.aspx>

EAT SMART, MOVE MORE NORTH CAROLINA COMMUNITY GRANTS



The Eat Smart, Move More (ESMM) NC Community Grants program provides funding to local communities to support their efforts to develop community-based interventions that encourage, promote and facilitate physical activity. The current focus of the funds is for projects addressing youth physical activity. Funds have been used to construct trails and conduct educational programs.

More information: <http://www.eatsmartmovemorenc.com/Funding/CommunityGrants.html>

THE NORTH CAROLINA DIVISION OF PARKS AND RECREATION

The North Carolina Division of Parks and Recreation and the State Trails Program offer funds to help citizens, organizations and agencies plan, develop and manage all types of trails ranging from greenways and trails for hiking, biking and horseback riding to river trails and off-highway vehicle trails.

More information: <http://www.ncparks.gov/About/>

NC PARKS AND RECREATION TRUST FUND (PARTF)

The Parks and Recreation Trust Fund (PARTF) provides dollar-for-dollar matching grants to local governments for parks and recreational projects to serve the general public. Counties, incorporated municipalities and public authorities, as defined by G.S. 159-7, are eligible applicants.

A local government can request a maximum of \$500,000 with each application. An applicant must match the grant dollar-for-dollar, 50 percent of the total cost of the project, and may contribute more than 50 percent. The appraised value of land to be donated to the applicant can be used as part of the match. The value of in-kind services, such as volunteer work, cannot be used for the match.

For more information: http://www.ncparks.gov/About/grants/partf_main.php



NC DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES – RECREATIONAL TRAILS AND ADOPT-A-TRAIL GRANTS



The State Trails Program is a section of the N.C. Division of Parks and Recreation. The program originated in 1973 with the North Carolina Trails System Act and is dedicated to helping citizens, organizations and agencies plan, develop and manage all types of trails ranging from greenways and trails for hiking, biking and horseback riding to river trails and off-highway vehicle trails. The Recreation Trails Program awards grants up to \$75,000 per project. The Adopt-A-Trail Program awards grants up to \$5,000 per project.

POWELL BILL FUNDS

Annually, State street-aid (Powell Bill) allocations are made to incorporated municipalities which establish their eligibility and qualify as provided by G.S. 136-41.1 through 136-41.4. Powell Bill funds shall be expended only for the purposes of maintaining, repairing, constructing, reconstructing or widening of local streets that are the responsibility of the municipalities or for planning, construction, and maintenance of bikeways or sidewalks along public streets and highways. Beginning July 1, 2015 under the Strategic Transportation Investments initiative, Powell Bill funds may no longer be used to provide a match for federal transportation funds such as Transportation Alternatives.

CLEAN WATER MANAGEMENT TRUST FUND



This fund was established in 1996 and has become one of the largest sources of money in North Carolina for land and water protection, eligible for application by a state agency, local government, or non-profit. At the end of each year, a minimum of \$30 million is placed in the CWMTF. The revenue of this fund is allocated as grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. Funds may be used for planning and land acquisition to establish a network of riparian buffers and greenways for environmental, educational, and recreational benefits.

For more information: <http://www.cwmtf.net/#appmain.htm>

COMMUNITY DEVELOPMENT BLOCK GRANT FUNDS

Community Development Block Grant (CDBG) funds are available to local municipal or county governments that qualify for projects to enhance the viability of communities by providing decent housing and suitable living environments and by expanding economic opportunities, principally for persons of low- and moderate-income. State CDBG funds are provided by the U.S. Department of Housing and Urban Development (HUD) to the state of North Carolina. Some urban counties and cities in North Carolina receive CDBG funding directly from HUD. Each year, CDBG provides funding to local governments for hundreds of critically-needed community improvement projects throughout the state.



These community improvement projects are administered by the Division of Community Assistance and the Commerce Finance Center under eight grant categories. Two categories might be of support to pedestrian and bicycle projects in 'entitlement communities': Infrastructure and Community Revitalization.

SAFE ROUTES TO SCHOOL PROGRAM (MANAGED BY NCDOT, DBPT)

The NCDOT Safe Routes to School Program is a federally funded program that was initiated by the passing of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005, which establishes a national SRTS program to distribute funding and institutional support to implement SRTS programs in states and communities across the country. SRTS programs facilitate the planning, development, and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption, and air pollution in the vicinity of schools. The Division of Bicycle and Pedestrian Transportation at NCDOT is charged with disseminating SRTS funding.

The state of North Carolina was allocated \$15 million in Safe Routes to School funding for fiscal years 2005 through 2009 for infrastructure or non-infrastructure projects. In 2009, more than \$3.6 million went to 22 municipalities and local agencies for infrastructure and non-infrastructure projects. All proposed projects must relate to increasing walking or biking to and from an elementary or middle school. An example of a non-infrastructure project is an education or encouragement program to improve rates of walking and biking to school. An example of an infrastructure project is construction of sidewalks around a school. Infrastructure improvements under this program must be made within 2 miles of an elementary or middle school. The state requires the completion of a competitive application to apply for funding.

For more information: <https://connect.ncdot.gov/projects/BikePed/Pages/Safe-Routes-To-School.aspx>

<http://www.ncdot.gov/download/programs/srts/SRTS.pdf>

Or contact DBPT/NCDOT at (919) 807-0774.

URBAN AND COMMUNITY





FORESTRY GRANT

The North Carolina Division of Forest Resources Urban and Community Forestry grant can provide funding for a variety of projects that will help toward planning and establishing street trees as well as trees for urban open space. The goal is to improve public understanding of the benefits of preserving existing tree cover in communities and assist local governments with projects which will lead to a more effective and efficient management of urban and community forests. Grant requests should range between \$1,000 and \$15,000 and must be matched equally with non-federal funds. Grant funds may be awarded to any unit of local or state government, public educational institutions, approved non-profit 501(c)(3) organizations and other tax-exempt organizations. First-time municipal applicant and municipalities seeking Tree City USA status are given priority for funding.

For more about Tree City USA status, including application instructions, visit: http://ncforests-service.gov/Urban/urban_grant_overview.htm





LOCAL GOVERNMENT FUNDING SOURCES

Municipalities often plan for the funding of pedestrian and bicycle facilities or improvements through development of Capital Improvement Programs (CIP). In Raleigh, for example, the greenways system has been developed over many years through a dedicated source of annual funding that has ranged from \$100,000 to \$500,000, administered through the Recreation and Parks Department. CIPs should include all types of capital improvements (water, sewer, buildings, streets, etc.) versus programs for single purposes. This allows municipal decision-makers to balance all capital needs. Typical capital funding mechanisms include the following: capital reserve fund, capital protection ordinances, municipal service district, tax increment financing, taxes, fees, and bonds. Each category is described below. A variety of possible funding options available to North Carolina jurisdictions for implementing pedestrian and bicycle projects are described below. However, many will require specific local action as a means of establishing a program, if not already in place.

CAPITAL RESERVE FUND

Municipalities have statutory authority to create capital reserve funds for any capital purpose, including pedestrian facilities. The reserve fund must be created through ordinance or resolution that states the purpose of the fund, the duration of the fund, the approximate amount of the fund, and the source of revenue for the fund. Sources of revenue can include general fund allocations, fund balance allocations, grants and donations for the specified use.

CAPITAL PROJECT ORDINANCES

Municipalities can pass Capital Project Ordinances that are project specific. The ordinance identifies and makes appropriations for the project.

LOCAL IMPROVEMENT DISTRICT (LID)

Local Improvement Districts (LIDs) are most often used by cities to construct localized projects such as streets, sidewalks or bikeways. Through the LID process, the costs of local improvements are generally spread out among a group of property owners within a specified area. The cost can be allocated based on property frontage or other methods such as traffic trip generation.

MUNICIPAL SERVICE DISTRICT

Municipalities have statutory authority to establish municipal service districts, to levy a property tax in the district additional to the town-wide property tax, and to use the proceeds to provide services in the district. Downtown revitalization projects are one of the eligible uses of service districts, and can include projects such as street, sidewalk, or bikeway improvements within the downtown taxing district.



TAX INCREMENT FINANCING

Project Development Financing bonds, also known as Tax Increment Financing (TIF) is a relatively new tool in North Carolina, allowing localities to use future gains in taxes to finance the current improvements that will create those gains. When a public project (e.g., a greenway trail) is constructed, surrounding property values generally increase and encourage surrounding development or redevelopment. The increased tax revenues are then dedicated to finance the debt created by the original public improvement project. Streets, streetscapes, and sidewalk improvements are specifically authorized for TIF funding in North Carolina. Tax Increment Financing typically occurs within designated development financing districts that meet certain economic criteria that are approved by a local governing body. TIF funds are generally spent inside the boundaries of the TIF district, but they can also be spent outside the district if necessary to encourage development within it.

OTHER LOCAL FUNDING OPTIONS

- Bonds/Loans
- Taxes
- Impact fees
- Exactions
- Installment purchase financing
- In-lieu-of fees
- Partnerships



PRIVATE AND NON-PROFIT FUNDING SOURCES

Many communities have solicited greenway funding assistance from private foundations and other conservation-minded benefactors. Below are several examples of private funding opportunities available.

LAND FOR TOMORROW CAMPAIGN

Land for Tomorrow is a diverse partnership of businesses, conservationists, farmers, environmental groups, health professionals and community groups committed to securing support from the public and General Assembly for protecting land, water and historic places. The campaign was successful in 2013 in asking the North Carolina General Assembly to continue to support conservation efforts in the state. The state budget bill includes about \$50 million in funds for key conservation efforts in North Carolina. Land for Tomorrow works to enable North Carolina to reach a goal of ensuring that working farms and forests; sanctuaries for wildlife; land bordering streams, parks and greenways; land that helps strengthen communities and promotes job growth; and historic downtowns and neighborhoods will be there to enhance the quality of life for generations to come.

For more information: <http://www.land4tomorrow.org/>

THE ROBERT WOOD JOHNSON FOUNDATION

The Robert Wood Johnson Foundation was established as a national philanthropy in 1972 and today it is the largest U.S. foundation devoted to improving the health and health care of all Americans. Grant making is concentrated in four areas:

- To assure that all Americans have access to basic health care at a reasonable cost
- To improve care and support for people with chronic health conditions
- To promote healthy communities and lifestyles
- To reduce the personal, social and economic harm caused by substance abuse: tobacco, alcohol, and illicit drugs

For more specific information about what types of projects are funded and how to apply, visit www.rwjf.org/applications/



Robert Wood Johnson Foundation



NORTH CAROLINA COMMUNITY FOUNDATION

The North Carolina Community Foundation, established in 1988, is a statewide foundation seeking gifts from individuals, corporations, and other foundations to build endowments and ensure financial security for nonprofit organizations and institutions throughout the state. Based in Raleigh, North Carolina, the foundation also manages a number of community affiliates throughout North Carolina, that make grants in the areas of human services, education, health, arts, religion, civic affairs, and the conservation and preservation of historical, cultural, and environmental resources. The foundation also manages various scholarship programs statewide.

For more information: <http://nccommunityfoundation.org/>

NORTH CAROLINA COMMUNITY FOUNDATION



WALMART STATE GIVING PROGRAM

The Walmart Foundation financially supports projects that create opportunities for better living. Grants are awarded for projects that support and promote education, workforce development/economic opportunity, health and wellness, and environmental sustainability. Both programmatic and infrastructure projects are eligible for funding. State Giving Program grants start at \$25,000, and there is no maximum award amount. The program accepts grant applications on an annual, state by state basis January 2nd through March 2nd.

Online resource: <http://foundation.walmart.com/apply-for-grants/state-giving>

THE RITE AID FOUNDATION GRANTS

The Rite Aid Foundation is a foundation that supports projects that promote health and wellness in the communities that Rite Aid serves. Award amounts vary and grants are awarded on a one year basis to communities in which Rite Aid operates. A wide array of activities are eligible for funding, including infrastructural and programmatic projects.

Online resource: <https://www.riteaid.com/about-us/rite-aid-foundation>



Z. SMITH REYNOLDS FOUNDATION

This Winston-Salem-based Foundation has been assisting the environmental projects of local governments and non-profits in North Carolina for many years. They have two grant cycles per year and generally do not fund land acquisition. However, they may be able to offer support in other areas of open space and greenways development.

For more information: www.zsr.org

BANK OF AMERICA CHARITABLE FOUNDATION, INC.

The Bank of America Charitable Foundation is one of the largest in the nation. The primary grants program is called Neighborhood Excellence, which seeks to identify critical issues in local communities. Another program that applies to greenways is the Community Development Programs, and specifically the Program Related Investments. This program targets low and moderate income communities and serves to encourage entrepreneurial business development.

For more information: www.bankofamerica.com/foundation

DUKE ENERGY FOUNDATION

Funded by Duke Energy shareholders, this non-profit organization makes charitable grants to selected non-profits or governmental subdivisions. Each annual grant must have:

- An internal Duke Energy business “sponsor”
- A clear business reason for making the contribution

The grant program has three focus areas: Environment and Energy Efficiency, Economic Development, and Community Vitality. Related to this project, the Foundation would support programs that support conservation, training and research around environmental and energy efficiency initiatives.

For more information: <http://www.duke-energy.com/community/foundation.asp>

AMERICAN GREENWAYS EASTMAN KODAK AWARDS

The Conservation Fund’s American Greenways Program has teamed with the Eastman Kodak Corporation and the National Geographic Society to award small grants (\$250 to \$2,000) to stimulate the planning, design and development of greenways. These grants can be used for activities such as mapping, conducting ecological assessments, surveying land, holding conferences, developing brochures, producing interpretive displays, incorporating land trusts, and building trails. Grants cannot be used for academic research, institutional support, lobbying or political activities.

For more information: www.conservationfund.org



NATIONAL TRAILS FUND

American Hiking Society created the National Trails Fund in 1998, the only privately supported national grants program providing funding to grassroots organizations working toward establishing, protecting and maintaining foot trails in America. 73 million people enjoy foot trails annually, yet many of our favorite trails need major repairs due to a \$200 million backlog of badly needed maintenance. National Trails Fund grants help give local organizations the resources they need to secure access, volunteers, tools and materials to protect America's cherished public trails. To date, American Hiking has granted more than \$240,000 to 56 different trail projects across the U.S. for land acquisition, constituency building campaigns, and traditional trail work projects. Awards range from \$500 to \$10,000 per project.



Projects the American Hiking Society will consider include:

- Securing trail lands, including acquisition of trails and trail corridors, and the costs associated with acquiring conservation easements.
- Building and maintaining trails which will result in visible and substantial ease of access, improved hiker safety, and/or avoidance of environmental damage.
- Constituency building surrounding specific trail projects - including volunteer recruitment and support.

For more information: <http://www.americanhiking.org/national-trails-fund/>

THE CONSERVATION ALLIANCE

The Conservation Alliance is a non-profit organization of outdoor businesses whose collective annual membership dues support grassroots citizen-action groups and their efforts to protect wild and natural areas. Grants are typically about \$35,000 each. Since its inception in 1989, The Conservation Alliance has contributed \$4,775,059 to environmental groups across the nation, saving over 34 million acres of wild lands.

The Conservation Alliance Funding Criteria:

- The Project should be focused primarily on direct citizen action to protect and enhance our natural resources for recreation.
- The Alliance does not look for mainstream education or scientific research projects, but rather for active campaigns.
- All projects should be quantifiable, with specific goals, objectives and action plans and should include a measure for evaluating success.
- The project should have a good chance for closure or significant measurable results over a fairly short term (one to two years).
- Funding emphasis may not be on general operating expenses or staff payroll.

More information: <http://www.conservationalliance.com/grants>



NATIONAL FISH AND WILDLIFE FOUNDATION (NFWF)

The National Fish and Wildlife Foundation (NFWF) is a private, nonprofit, tax-exempt organization chartered by Congress in 1984. The National Fish and Wildlife Foundation sustains, restores, and enhances the Nation's fish, wildlife, plants and habitats. Through leadership conservation investments with public and private partners, the Foundation is dedicated to achieving maximum conservation impact by developing and applying best practices and innovative methods for measurable outcomes.

The Foundation awards matching grants under its Keystone Initiatives to achieve measurable outcomes in the conservation of fish, wildlife, plants and the habitats on which they depend. Awards are made on a competitive basis to eligible grant recipients, including federal, tribal, state, and local governments, educational institutions, and non-profit conservation organizations. Project proposals are received on a year-round, revolving basis with two decision cycles per year. Grants generally range from \$50,000-\$300,000 and typically require a minimum 2:1 non-federal match.

Funding priorities include bird, fish, marine/coastal, and wildlife and habitat conservation. Other projects that are considered include controlling invasive species, enhancing delivery of ecosystem services in agricultural systems, minimizing the impact on wildlife of emerging energy sources, and developing future conservation leaders and professionals.

For more information: <http://www.nfwf.org/pages/grants/home.aspx>

THE TRUST FOR PUBLIC LAND

Land conservation is central to the mission of the Trust for Public Land (TPL). Founded in 1972, the Trust for Public Land is the only national nonprofit working exclusively to protect land for human enjoyment and well-being. TPL helps conserve land for recreation and spiritual nourishment and to improve the health and quality of life of American communities.

More information: <http://www.tpl.org>

BLUECROSS BLUESHIELD OF NORTH CAROLINA FOUNDATION (BCBS)

Blue Cross Blue Shield (BCBS) focuses on programs that use an outcome approach to improve the health and well-being of residents. The Health of Vulnerable Populations grants program focuses on improving health outcomes for at-risk populations. The Healthy Active Communities grant concentrates on increased physical activity and healthy eating habits. Eligible grant applicants must be located in North Carolina, be able to provide recent tax forms and, depending on the size of the nonprofit, provide an audit.

For more information: <http://www.bcbsncfoundation.org/>

THE
TRUST
for
PUBLIC
LAND





ALLIANCE FOR BIKING & WALKING: ADVOCACY ADVANCE GRANTS

Bicycle and pedestrian advocacy organizations play the most important role in improving and increasing biking and walking in local communities. Advocacy Advance Grants enable state and local bicycle and pedestrian advocacy organizations to develop, transform, and provide innovative strategies in their communities. With sponsor support, the Alliance for Biking & Walking has awarded more than \$500,000 in direct grants, technical assistance, and scholarships to advocacy organizations across North America since the Advocacy Advance Grant program's inception. In 2009 and 2010, these one-year grants were awarded twice annually to startup organizations and innovative campaigns to dramatically increase biking and walking. The Advocacy Advance Partnership with the League of American Bicyclists also provides necessary technical assistance, coaching, and training to supplement the grants.

For more information, visit www.peoplepoweredmovement.org

LOCAL TRAIL SPONSORS

A sponsorship program for trail amenities allows smaller donations to be received from both individuals and businesses. Cash donations could be placed into a trust fund to be accessed for certain construction or acquisition projects associated with the greenways and open space system. Some recognition of the donors is appropriate and can be accomplished through the placement of a plaque, the naming of a trail segment, and/or special recognition at an opening ceremony. Types of gifts other than cash could include donations of services, equipment, labor, or reduced costs for supplies.

CORPORATE DONATIONS

Corporate donations are often received in the form of liquid investments (i.e. cash, stock, bonds) and in the form of land. Municipalities typically create funds to facilitate and simplify a transaction from a corporation's donation to the given municipality. Donations are mainly received when a widely supported capital improvement program is implemented.

PRIVATE INDIVIDUAL DONATIONS

Private individual donations can come in the form of liquid investments (i.e. cash, stock, bonds) or land. Municipalities typically create funds to facilitate and simplify a transaction from an individual's donation to the given municipality. Donations are mainly received when a widely supported capital improvement program is implemented.





FUNDRAISING / CAMPAIGN DRIVES

Organizations and individuals can participate in a fundraiser or a campaign drive. It is essential to market the purpose of a fundraiser to rally support and financial backing. Often times fundraising satisfies the need for public awareness, public education, and financial support.

VOLUNTEER WORK

It is expected that many citizens will be excited about the development of a greenway corridor. Individual volunteers from the community can be brought together with groups of volunteers from church groups, civic groups, scout troops and environmental groups to work on greenway development on special community workdays. Volunteers can also be used for fund-raising, maintenance, and programming needs.



FUNDING SOURCE SUMMARY TABLE

Funding Source	Planning	Programming	Design/ Construction
FEDERAL FUNDING			
Transportation Alternatives	x	x	x
Surface Transportation Program			x
Highway Safety Improvement Program		x	x
Congestion Mitigation/Air Quality		x	x
FTA Metropolitan Planning Program	x		
FTA Enhanced Mobility of Seniors and Individuals with Disabilities		x	x
Partnership for Sustainable Communities	x	x	x
Land and Water Conservation Fund	x		x
Rivers, Trails, and Conservation Assistance Program	x		
National Scenic Byways Discretionary Grant Program			x
Federal Lands Transportation Program	x		x
Energy Efficiency and Conservation Block Grants	x		x
STATE FUNDING			
NCDOT State Transportation Improvement Program			x
Incidental Projects			x
Spot Safety Program			x
Pedestrian Funds			x
High Hazard Elimination Program			x
NCDOT Contingency Fund			x
Small Urban Funds			x
Spot Improvement Program			x
Small Construction Funds			x
Governor's Highway Safety Program			x
Bicycle and Pedestrian Planning Grant Initiative	x	x	
Eat Smart, Move More North Carolina Community Grants		x	x
The North Carolina Division of Parks and Recreation			x
The North Carolina Parks and Recreation Trust Fund (PARTF)			x
Adopt-a-Trail Program			x
Powell Bill Funds			x
Community Development Block Grant	x	x	x
Clean Water Management Trust Fund	x	x	x
Safe Routes to School Program	x	x	x
Urban and Community Forestry Grant	x		x



Funding Source	Planning	Programming	Design/ Construction
LOCAL FUNDING			
Capital Reserve Fund			x
Capital Project Ordinance			x
Local Improvement District			x
Municipal Service District			x
Tax Increment Financing			x
Bonds and Loans			x
Revenue Bonds			x
General Obligation Bonds (cities, counties, and service districts)			x
Special Assessment Bonds			x
State Revolving Fund Loans			x
Sales Tax	x		x
Property Tax	x		x
Excise Tax			x
Occupancy Tax			x
Stormwater Utility Fees			x
Streetscape Utility Fees			x
Impact Fees			x
Exactions			x
Installment Purchase Financing			x
In-Lieu-of Fees			x
PRIVATE/NON-PROFIT FUNDING			
The Robert Wood Johnson Foundation	x	x	
North Carolina Community Foundation	x	x	
Walmart State Giving Program	x	x	x
The Rite Aid Foundation Grant		x	x
Z. Smith Reynolds Foundation			x
Bank of America Charitable Foundation	x	x	
Duke Energy Foundation		x	
American Greenways Eastman Kodak Awards	x	x	x
National Trails Fund		x	x
The Conservation Alliance	x	x	
National Fish and Wildlife Foundation	x	x	x
The Trust for Public Land	x	x	
Blue Cross Blue Shield of North Carolina Foundation		x	x
Alliance for Biking and Walking Advocacy Advance Grants			x
Local Trail Sponsors			x
Corporate Donations	x	x	x
Private Individual Donations	x	x	x
Fundraising/Campaign Drives	x	x	x
Volunteer Work	x	x	x



US-421 near Rocky Knob Mountain Bike Park, scheduled for resurfacing in 2014.



F PUBLIC ENGAGEMENT

Appendix Contents

Overview (E-1)

Steering Committee
Meetings (E-1)

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OVERVIEW

Public engagement involved numerous components to spread awareness of the *Bike Boone 2013 Bicycle Transportation Plan* and to ensure a variety of local perspectives containing essential insight were appropriately incorporated into the plan. Various mediums and resources were constructed so that all members of Boone, Watauga County, and the surrounding areas had the opportunity to participate. Some people prefer or only have the resources to communicate in person, in writing, and/or electronically. The public engagement component included the following:

1. Steering Committee Meetings
2. Public Outreach Events
3. Project Information Resources
 - Project website with link to online comment form
 - Project comment forms
 - Project information cards
 - Draft plan information boards
 - Static informational project display board

STEERING COMMITTEE MEETINGS



October 2013 Steering
Committee Meeting.

The Project Steering Committee for the bicycle plan consisted primarily of members of the Town of Boone's Alternative Transportation Subcommittee, but also included representatives from Appalachian State University and downtown businesses. The ATS is part of the larger Town of Boone Transportation Committee and focuses on issues related to walking, bicycling, and transit. The Project Steering Committee was involved throughout the process and met with project consultants from Alta/Greenways four times, focusing on project vision and goals (April 2013), existing conditions (June 2013), the draft plan (October 2013), and the final plan (TBD 2013). During the April 2013 meeting, the group reviewed and provided feedback on the project website, project comment form, established a mission statement and goals for the plan, and discussed the timeline and schedule of the planning process. In June 2013, members of the Steering Committee worked with the consultant team to mark up local and regional maps to identify gaps in the current network and high priority areas. The final two meetings involved making revisions and addenda to the plan document. Input from the Steering Committee is reflected throughout the recommendations of this plan.



STAKEHOLDER MEETINGS & PUBLIC OUTREACH EVENTS

WATAUGA COUNTY FARMERS MARKET

Project consultants set up an informational booth at the Watauga County Farmers Market on Saturday June 15, 2013. People were invited to learn about the plan and provide input via a public comment form about where they would like to see improvements for bicycling. A public input map, newsletters, and posters were provided for review and two project consultants answered questions and took comments. More than 50 people stopped by to learn about the plan and directly provide input. The general feedback was highly positive, with many people interested in seeing Boone become a more bike-friendly community.

NCDOT DIVISION 11 MEETING

In August 2013, Town staff and project consultants met with NCDOT Division 11 representatives, and a representative from NCDOT's DBPT to discuss *Bike Boone 2013* goals, planning process, preliminary bicycle network recommendations and the top 10 high priority projects. Each project located on NCDOT-owned roadways were reviewed and implementation strategies were discussed.

Below: Parents and kids visited the project information booth at the farmer's market to fill out the public comment form and provide feedback on how to improve biking conditions in Boone.





Above left: People stopped by the project information booth at the farmer's market to learn more about the plan and provide input.

Above right: Kids had their photo taken at the public engagement booth.

ASU INFORMATION TABLE

An informational tabling event for the *Bike Boone 2013* draft plan was held in the Plemmons Student Union at Appalachian State University on October 16. Project information boards and bicycle safety information materials were displayed and made available to students. Students who stopped by the table expressed interest in and support for the draft plan recommendations.

HCCOG REGIONAL BIKE PLAN WORKSHOP

Informational materials for the *Bike Boone 2013* draft plan were displayed at the High Country Council of Governments Regional Bike Plan workshop on October 16. Members of the consultant team were available to answer questions and record feedback to incorporate into the plan.

At all meetings, events, and workshops, public input was obtained in the form of map markups, written comments, verbal question and answer sessions, and discussions between citizens, consultant staff and representatives of the Steering Committee. In addition, hardcopy public comment forms were distributed for hand written responses during each event. These were important opportunities to connect with a wide range of citizens in the area.



PROJECT RESOURCES

A number of resources were developed to enhance project awareness and participation. These tools also played a significant role in ensuring all members of the general public would have the opportunity to participate.

PROJECT WEBSITE

A project website was developed to provide further project information, maps, contact information, and additional resources. The website also featured a link to the online public comment form page, offering an additional medium for the Boone community to become engaged and participate in the planning process.

PUBLIC COMMENT FORM

A comment form was developed and was made available in both hard copy and online formats. The comment form was available online throughout the duration of the project. To maximize responses to the online form, the web address was distributed at public meetings, advertised in press releases, sent out to local interest groups, and included on flyers that were distributed around town. Over 780 residents completed the comment form.

Results of the comment form were collected and tabulated by the Consultant to provide insight into local residents' values and opinions about the project. The form can be seen on the following page and the results are included in this Appendix.

PROJECT INFORMATION CARDS

The information card shown on the following page was designed to spread awareness of the project as well as to direct interested citizens to the website and to project contacts for further information. By providing the general public with access to different avenues of public input, these public engagement components provided a variety of opportunities for the voices of the Boone community to be heard.

Left: Project information card for *Bike Boone 2013*. Above: Public input banner displayed at public outreach events.



PUBLIC COMMENT FORM

1. Which terms best describes your current level of bicycling activity?

- Do not bike
 Bike for exercise/ recreation
 Off-road bike
 Bike to school/ work
 Bike to nearby destinations

2. How frequently do you bicycle? (please select one)

- Never
 Special occasions only
 Few times per month
 3+ days per week

3. How comfortable are you cycling on Boone's roads and streets? (please select one)

- Comfortable
 Cautious
 Intimidated

5. Which of the following changes would encourage you to bike more often? (please select up to three options)

- Increased enforcement on speeding
 Commuter programs or incentives
 Bike racks at destination
 Showers or locker rooms at workplace
 Safety education
 Less expensive bicycles
 Map of bicycle routes
 More bike lanes
 More off road bike paths or greenways
 Lower speed limits
 Nothing

5. In your opinion, which roads in Boone are most in need of bicycle improvements? (please select two)

- | | |
|--|--|
| <input type="checkbox"/> River Street | <input type="checkbox"/> Howard Street |
| <input type="checkbox"/> Blowing Rock Road | <input type="checkbox"/> State Farm |
| <input type="checkbox"/> King Street | <input type="checkbox"/> Poplar Grove |
| <input type="checkbox"/> NC 105 | <input type="checkbox"/> Greenway Road |
| <input type="checkbox"/> NC 105 Extension | <input type="checkbox"/> Jefferson |
| <input type="checkbox"/> Stadium Drive | <input type="checkbox"/> Deerfield |
| <input type="checkbox"/> Hill Street | <input type="checkbox"/> Bodenheimer Drive |
| <input type="checkbox"/> Greenway Road | |

Other: _____

6. Which intersection is most in need of bicycle improvements?

- | | |
|---|--|
| <input type="checkbox"/> King and Blowing Rock | <input type="checkbox"/> 105 and 321 |
| <input type="checkbox"/> Blowing Rock and 105 | <input type="checkbox"/> King St and 105 |
| <input type="checkbox"/> Rivers and Stadium Dr. | <input type="checkbox"/> King St and Hardin St |
| <input type="checkbox"/> Rivers and Center St. | <input type="checkbox"/> 321 and Deerfield |
| <input type="checkbox"/> Other: _____ | |

7. Rank the following bicycle facilities, 1-7 based on their level of desirability. (1= most desirable, 7= least desirable)

- ____ Shared roadway (no separated facility)
 ____ Bike lane/ shoulder
 ____ Buffered bike lane
 ____ Separated/ protected bikeway/ cycletrack
 ____ Bike boulevard/ quiet street
 ____ Side Path (shared use path along a roadway)
 ____ Greenway (shared use path not along a roadway)

8. What other bicycle related improvements/programs do you consider priorities? (please select up to three options)

- Kids bicycle safety events
 More organized on-road bike rides
 Safer routes to school for pedestrians and cyclists
 Signage
 More police enforcement of drivers
 Education for cyclists (who might not be following rules of the road)
 Education for motorists (who might not be following rules of the road)

9. When you are cycling, which driver behaviors pose the greatest problems or concerns? (please select all that apply)

- Pass too closely
 Drive too fast
 Lack of separate bike lanes
 Non-compliance with traffic laws
 Inexperienced drivers
 Rude or aggressive language or behavior
 Don't signal turns or stop completely
 Failure to yield to cyclists crossing roadway

10. When you are driving, which cyclist behaviors pose the greatest problems or concerns? (please select all that apply)

- Cycling in the roadway against the direction of traffic
 Too little roadway to pass safely
 Poor visibility
 Lack of separate bike facilities
 Noncompliance with traffic laws (Cyclists on sidewalks)
 Cycling at night without lights
 Cyclist ride too slowly / youth riders / inexperienced
 Rude cyclist behavior, Group or event rides
 Don't signal turns or stops

11. What bicycling destinations would you most like to get to? (please select up to three options)

- | | |
|---|--|
| <input type="checkbox"/> Downtown Boone | <input type="checkbox"/> Restaurants |
| <input type="checkbox"/> Appalachian State University | <input type="checkbox"/> Shopping |
| <input type="checkbox"/> Student housing | <input type="checkbox"/> Parks |
| <input type="checkbox"/> Appalcart bus stop | <input type="checkbox"/> Entertainment |
| <input type="checkbox"/> Place of work | <input type="checkbox"/> Trails and greenways |
| <input type="checkbox"/> School | <input type="checkbox"/> Libraries or recreation centers |

Please return completed forms to:

Mr. Eric Gustavson, Facilities Maintenance Superintendent, 567 West King Street, PO Box 192, Boone, NC 28607

Above: Public comment form for *Bike Boone 2013*.



DRAFT PLAN INFORMATION BOARDS

A series of project information boards were created to showcase and invite feedback on the draft plan. These boards presented existing bicycle conditions in Boone, priority project recommendations, bicycle program recommendations, and implementation action steps. The boards were displayed in October 2013 at the Steering Committee meeting and draft plan presentation, during the October 16 tabling event at Appalachian State University, and at the High Country Council of Governments Regional Bike Plan workshop. Feedback received on the boards was incorporated into the final plan.

Bicycle Network Recommendations

Short Term Network Recommendations

Longer Term Network Recommendations

BOONE, NC BICYCLE TRANSPORTATION PLAN

Programmatic Resources

New Program Recommendations

Strategy	Target Audience	Lead Facilitator	Partnerships for Success	Time Frame	Duration	Projected Cost
Education						
Neighborhood Safety Education	General public	Town of Boone	Town of Boone Police Department, Boone Area Cyclists, Boone Bicycle Initiative, Town of Boone Alternative Transportation Subcommittee (ATS)	Short-term	Ongoing	\$5
South Bicycle Safety Education	Children and youth	Watauga County School District, School Administration	Boone Area Cyclists, Boone Bicycle Initiative, local bike shops	Short-term	Ongoing	\$5
Family Bicycling Classes	Families	Town of Boone, Boone Area Cyclists	Boone Bicycle Initiative, local bike shops	Short-term	Ongoing	\$5
Professional Development Courses	Town Staff, Law Enforcement	Town of Boone Staff	Town of Boone Public Works Staff, GIS Staff, Watauga County Staff, NCOTD Staff, Town of Boone Police Department	Medium-term	One-time	\$5
Division Class	General public	Town of Boone Police Department	Watauga County Court System, ATS	Medium-term	Ongoing	\$55
Friends of the Greenway Group	Interested stakeholders	Greenway, Parks, and Gardens Committee	Town of Boone Police Department, Boone Area Cyclists, other interested citizens	Short-term	Ongoing	\$5
Encouragement						
Safe Routes to School (SRTS)	Children and youth	Watauga County Schools, School Administration, Town of Boone	Parent Teacher Association, Town of Boone Police Department, Town of Boone Public Works Staff, Community members	Medium-term	Ongoing	\$5-\$55
Walking/Bicycling Maps	General public	Town of Boone Public Works Department	Greenway, Boone Development Association, Boone Area Chamber of Commerce, Town of Boone GIS Department, Boone Chamber and Wilson's Barbecue, Appalachian State University (ASU)	Short-term	Annual	\$55
Wayfinding Signage Program	General public	Town of Boone Public Works Department	Greenway, Boone Development Association, Boone Area Chamber of Commerce, Boone Chamber and Wilson's Barbecue, ASU	Medium-term	Ongoing	\$555
2nd Stop Website	General public	Town of Boone staff	Town of Boone Planning & Inspections Department, ATS	Short-term	Ongoing	\$5
Bike Month Activities	Communities, general public	Boone Area Cyclists	Town of Boone staff, ATS, Town of Boone Police Department, Boone Bicycle Initiative	Short-term	Annual	\$5
Enforcement and Evaluation						
Administrative Maintenance Schedule	Town of Boone staff	Town of Boone Public Works Department	NCOTD Division staff, Town of Boone Planning & Inspections Department	Short-term	Ongoing	\$5
Pedestrian and Bicycle Counts Program	Town of Boone staff	Town of Boone Public Works Department, Planning and Inspections Department	ATS, Greenway, Parks, and Gardens Committee, Watauga County Parks and Recreation	Medium-term	Ongoing	\$55
Walking, Bicycling, and Greenways Report Card	General public, elected officials, and decision-makers	Alternative Transportation Subcommittee (ATS)	Town of Boone Public Works Department, Greenway, Parks, and Gardens Committee	Short-term	Annual	\$5
Maintenance Initiatives	Boone residents who bicycle or walk	Town of Boone Public Works Department	Alternative Transportation Subcommittee	Medium-term	Ongoing	\$5
Bicycle-Friendly Community Designation	Town of Boone staff, elected officials and decision-makers	Town of Boone Public Works Staff, Planning & Inspections Staff	ATS, Boone Area Cyclists, Boone Bicycle Initiative, Greenway, Parks, and Gardens Committee	Medium-term	Annual	\$5
Bicycle-Friendly University Designation	ASU community, elected officials, decision-makers	Appalachian State University staff	Alternative Transportation Subcommittee, Town of Boone staff, Boone Area Cyclists, Boone Bicycle Initiative	Medium-term	Annual	\$5
20% Plan Campaign	Drivers	Town of Boone Police Department	Town of Boone Public Works, Watauga County Court System, ATS	Medium-term	Ongoing	\$555
Speeding Enforcement	Drivers	Town of Boone Police Department	Town of Boone Police Department	Short-term	Ongoing	\$55

Existing Programs

Cyclo.Via

Boone Area Cyclists hosted the inaugural Cyclo.Via event in Boone on July 20, 2013. The event began in downtown Boone at Howard Street, Depot Street, and Myers Street. Zumba, a bike show, a competitive group ride, bicycle races, and the local bike rally were some of the activities featured at the event.

Organized Bicycle Rides & Races

Boone Area Cyclists started hosting a local "Take a Kid Mountain Biking Day" event in 2010. The event is held annually at Rocky Creek Mountain and runs on the first Saturday in October. The event is intended to encourage youth to develop a stronger connection with the natural environment, particularly local parks and recreation lands.

Bicycle Loaner Program

This program provides bicycles to underserved individuals in the Boone community at little or no cost. The goal of the program is to improve the mobility of these individuals and their access to employment opportunities, community activities, and social outings.



BOONE, NC BICYCLE TRANSPORTATION PLAN

Project information boards displayed at meetings and public outreach events.



STATIC INFORMATIONAL DISPLAY EXHIBIT

An informational display board featuring *Bike Boone 2013* project information was developed in the summer of 2013. The board was put on display at various locations around town and during local meetings and public events, such as Cyclo via 2013, to raise awareness about the project and direct interested citizens to the project website. An image of the display board can be seen below.



Purpose

This Bicycle Transportation Plan will guide the Town of Boone, NCDOT, and other local and regional partners in improving the existing infrastructure and constructing new facilities for bicycles in Boone and fostering a 'bicycling culture' through the development of related programs and policies. transportation options for all users.

Background

NCDOT's Bicycle and Pedestrian Planning Grant Initiative

In 2010, the Town of Boone was awarded a matching grant from the North Carolina Department of Transportation (NCDOT) Bicycle and Pedestrian Planning Grant Initiative, for a Pedestrian Transportation Plan. The purpose of the grant is to encourage municipalities to develop comprehensive bicycle plans and pedestrian plans. In 2012, the Town of Boone pursued a grant through the same initiative to develop a Bicycle Transportation Plan, and was selected as a grant recipient.

Community Initiative

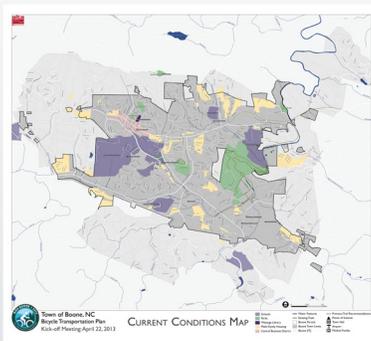
This Plan combines past local and regional planning efforts with new research and analysis, and includes public outreach and engagement. The result is a complete, up-to-date framework for moving forward with tangible bicycle-related improvements. Beyond physical improvements, this Plan also outlines policies and programs to help encourage people to bicycle more often, drive more safely, and to grow as a community with the needs of cyclists taken into full consideration.



Developing a Bicycle Network

Vision Statement

We will have a vibrant, attractive, walkable, bikable and transit friendly community that is financially, socially and environmentally sustainable.



Current conditions (above)

Corridor Improvements

During the planning process, corridors like the example below should be evaluated for potential greenway or on-road facility opportunities. Improvements such as crosswalks, vegetative buffers, signs and signals help to create safer more pleasing environments for pedestrians, cyclists and motorist.



Planning Process Underway

On Monday, April 22nd, 2013 the Steering Committee kicked-off the Bicycle Transportation Plan and established the Town's vision and goals to guide the planning process.



Public Outreach Events Planned

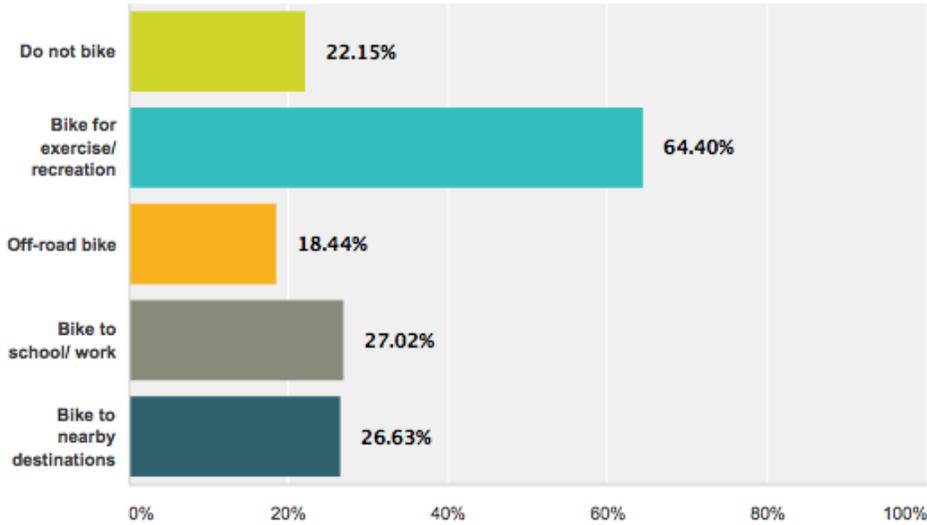
The project team has planned for two public engagement events. The first public meeting will occur during the Watauga County Farmers' Market in Boone's Town Square on Saturday, June 15th. Come out to the Farmers' Market and stop by our booth to learn more about the Bicycle Plan.



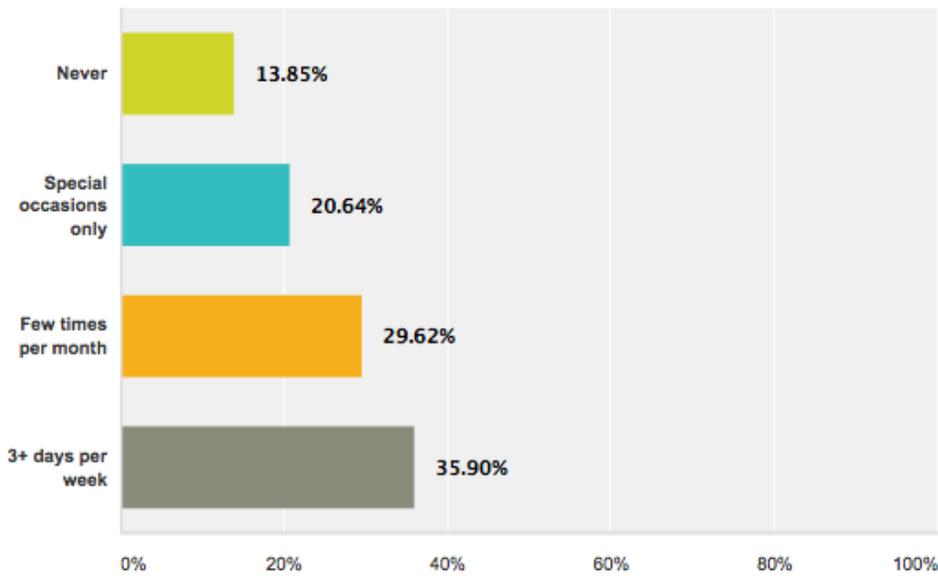


PUBLIC COMMENT FORM RESPONSES

1. WHICH TERM(S) BEST DESCRIBES YOUR CURRENT LEVEL OF BICYCLING ACTIVITY?

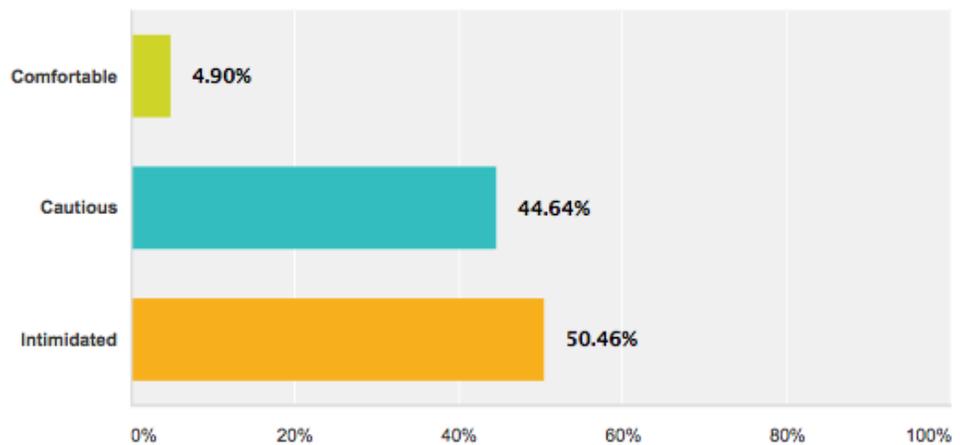


2. HOW FREQUENTLY DO YOU BICYCLE? (PLEASE SELECT ONE)

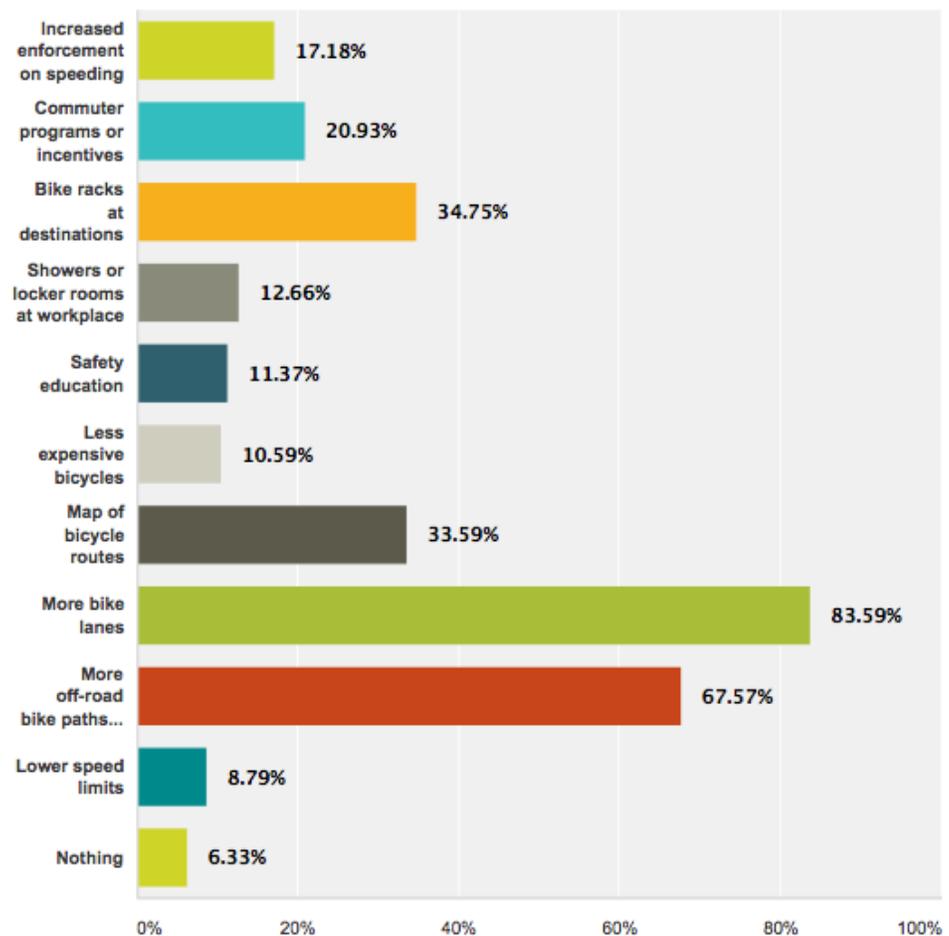




3. HOW COMFORTABLE ARE YOU CYCLING ON BOONE'S ROADS AND STREETS? (PLEASE SELECT ONE)

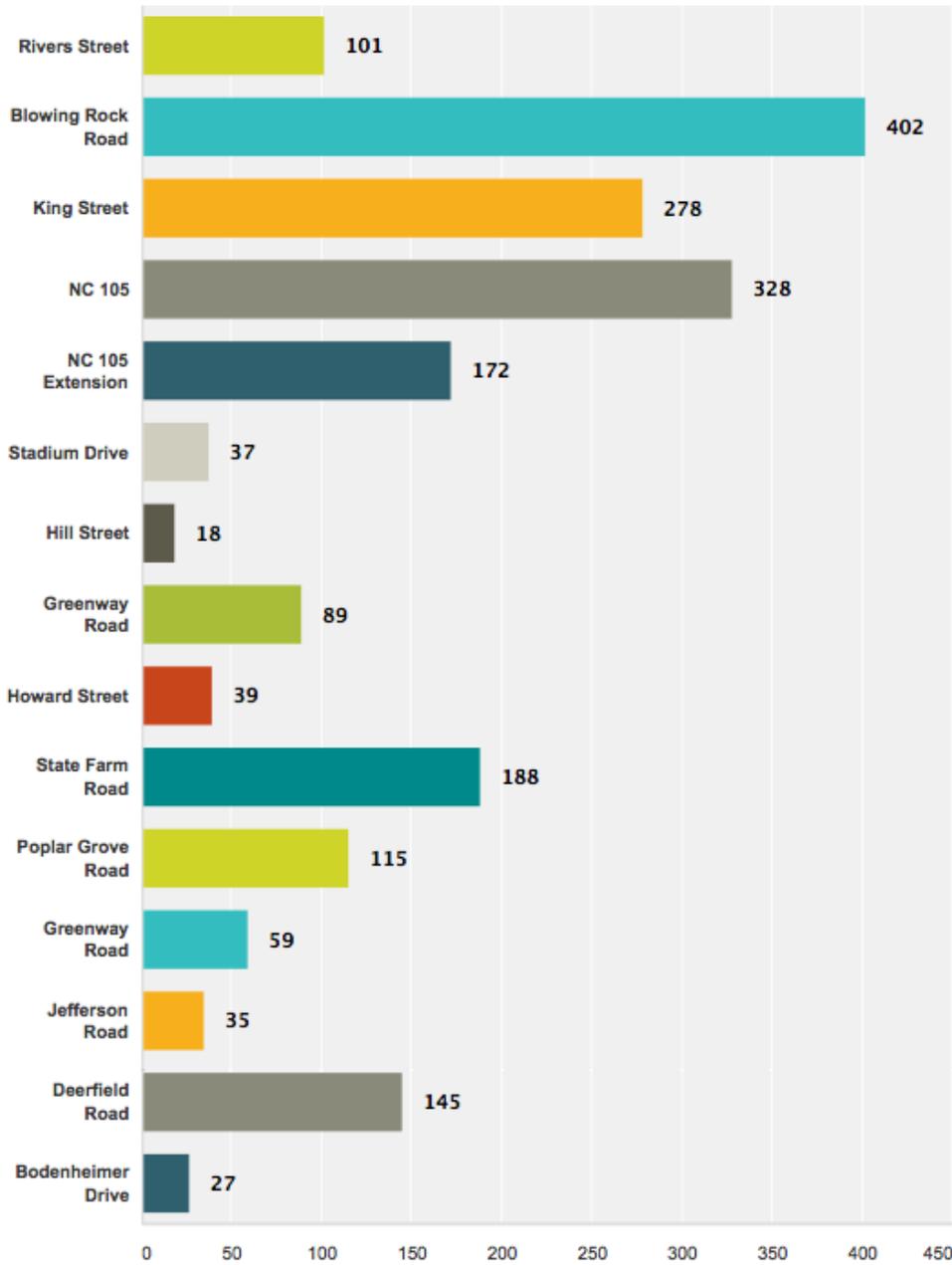


4. WHICH OF THE FOLLOWING CHANGES WOULD ENCOURAGE YOU TO BIKE MORE OFTEN? (PLEASE SELECT UP TO THREE OPTIONS)



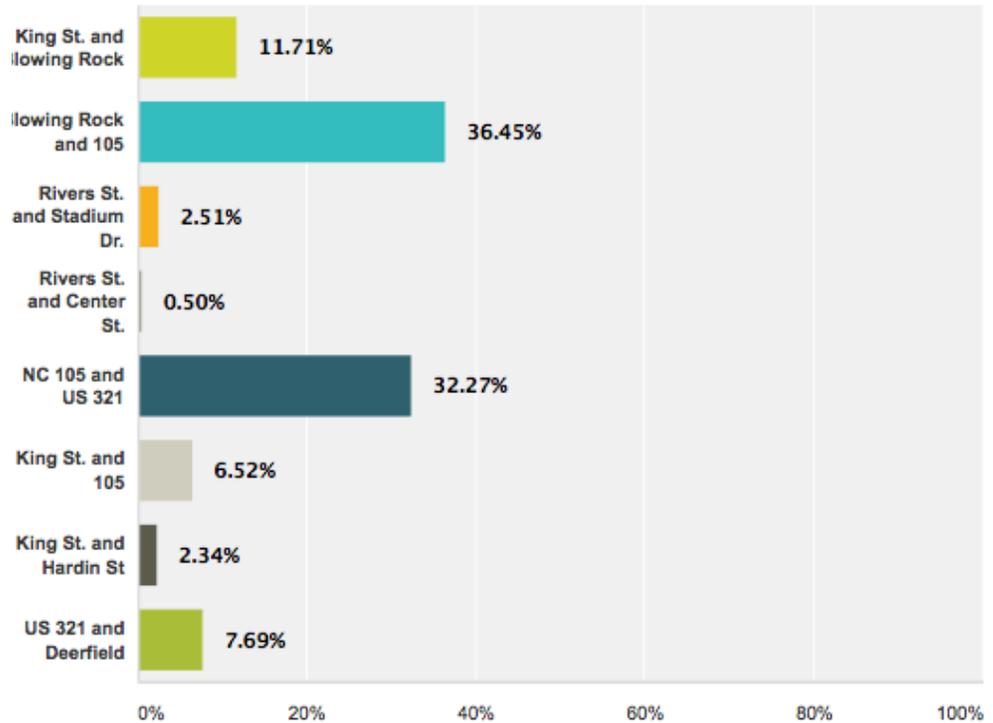


5. IN YOUR OPINION, WHICH ROADS IN BOONE ARE MOST IN NEED OF BICYCLE IMPROVEMENTS? (PLEASE SELECT TWO)

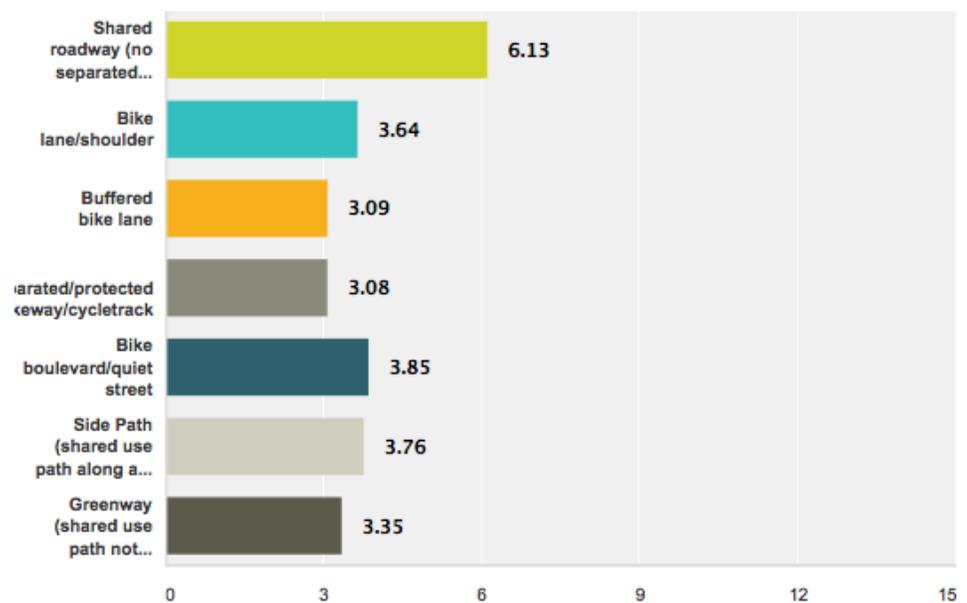




6. WHICH INTERSECTION IS MOST IN NEED OF BICYCLE IMPROVEMENTS?

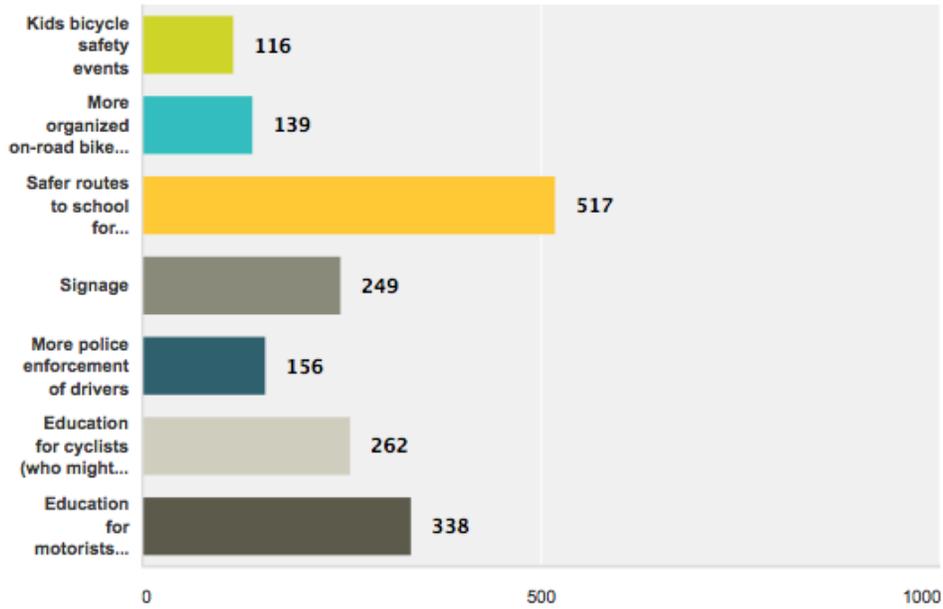


7. RANK THE FOLLOWING BICYCLE FACILITIES, 1-7 BASED ON THEIR LEVEL OF DESIRABILITY. (1= MOST DESIRABLE, 7= LEAST DESIRABLE)

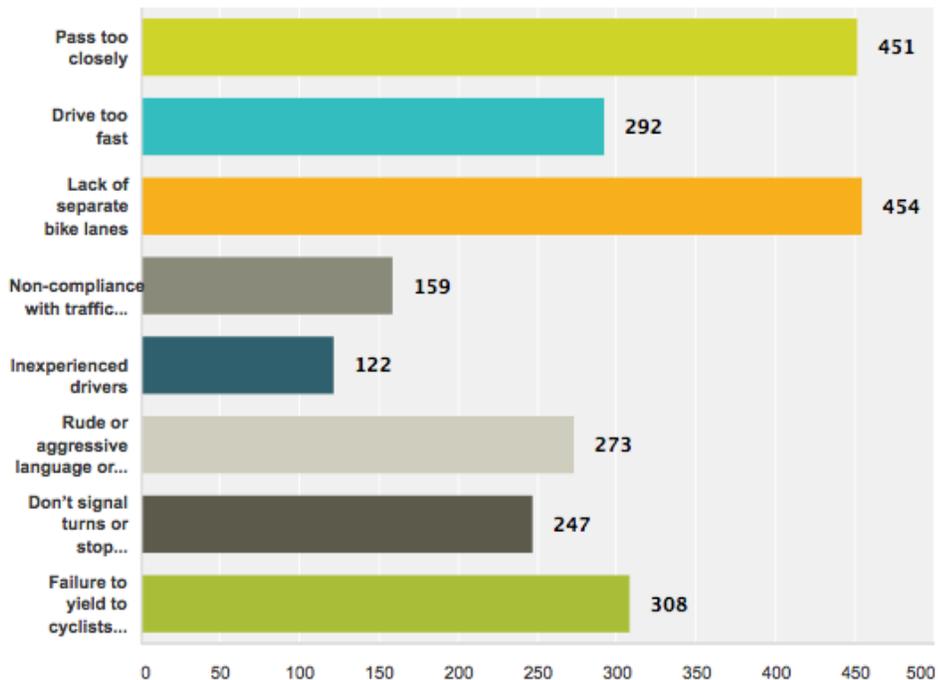




8. WHAT OTHER BICYCLE RELATED IMPROVEMENTS/PROGRAMS DO YOU CONSIDER PRIORITIES? (PLEASE SELECT UP TO THREE OPTIONS)

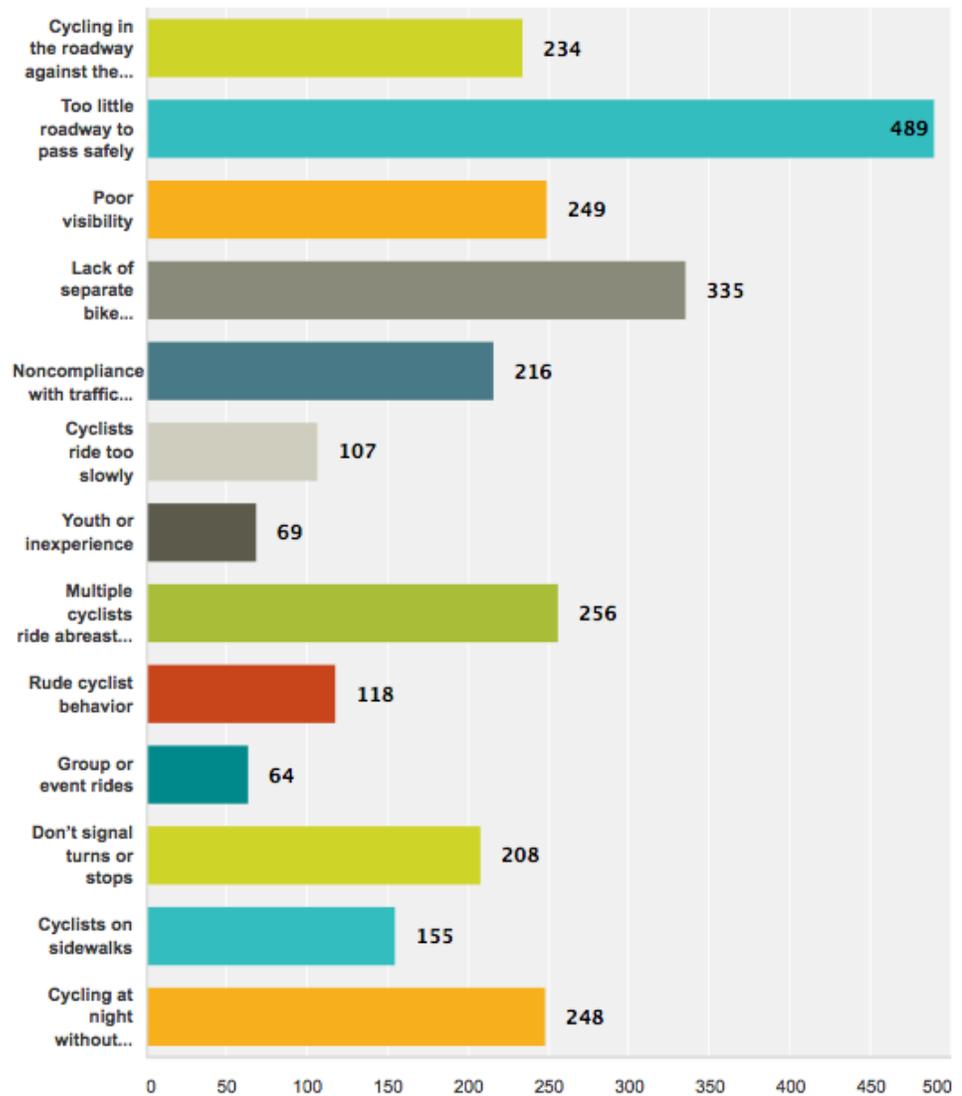


9. WHEN YOU ARE CYCLING, WHICH DRIVER BEHAVIORS POSE THE GREATEST PROBLEMS OR CONCERNS? (PLEASE SELECT ALL THAT APPLY)



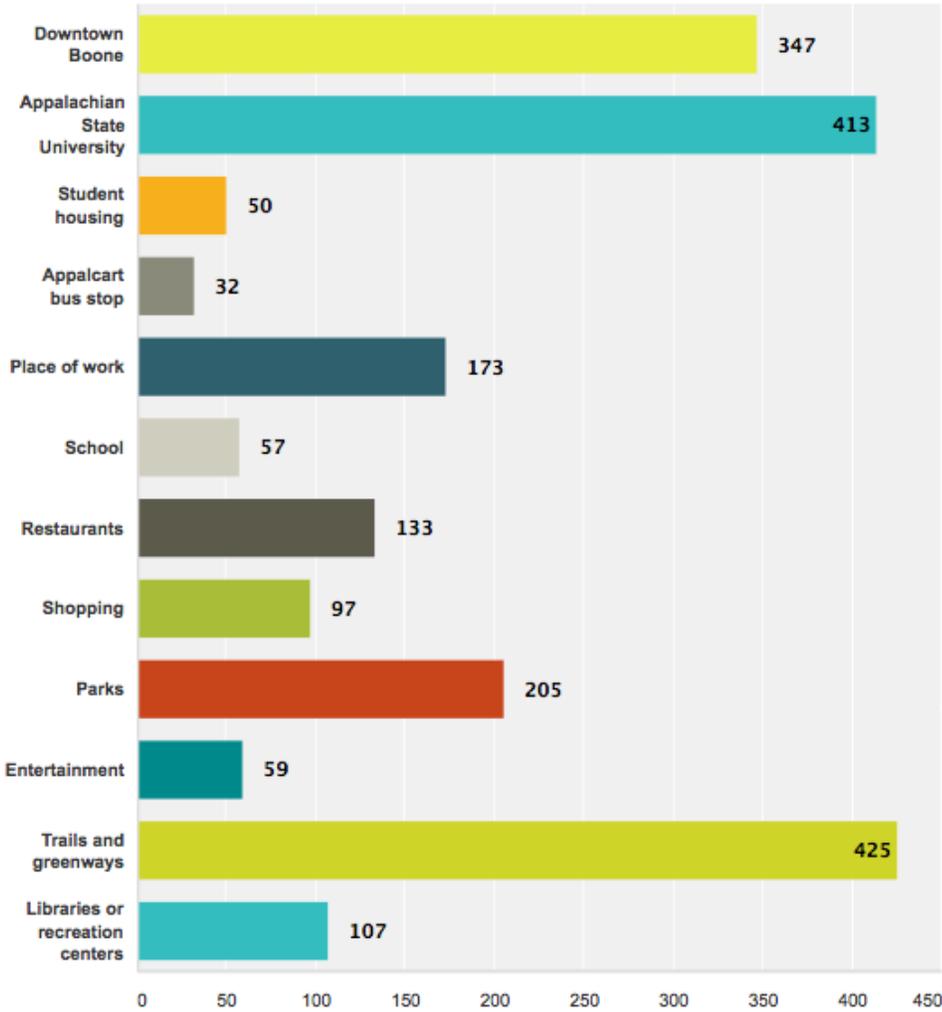


10. WHEN YOU ARE DRIVING, WHICH CYCLIST BEHAVIORS POSE THE GREATEST PROBLEMS OR CONCERNS? (PLEASE SELECT ALL THAT APPLY)



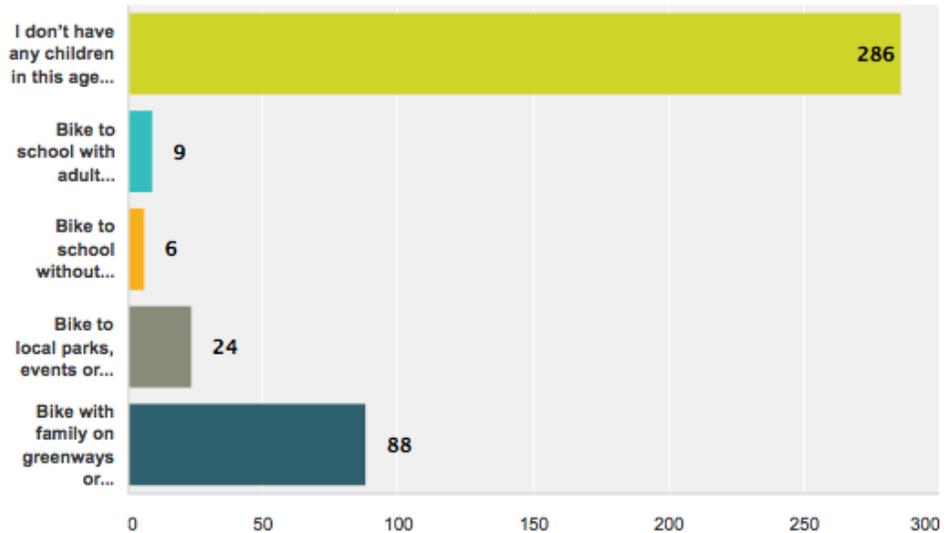


11. WHAT BICYCLING DESTINATIONS WOULD YOU MOST LIKE TO GET TO? (PLEASE SELECT UP TO THREE OPTIONS)

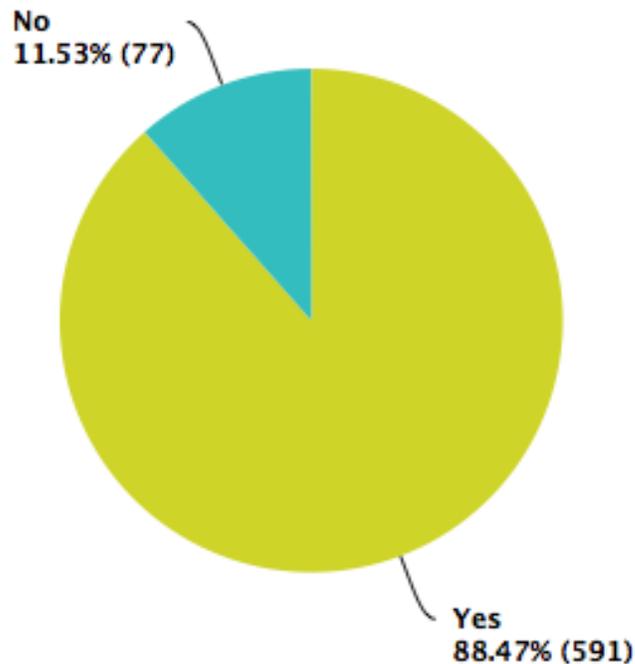




12. IF YOU HAVE CHILDREN BETWEEN THE AGES OF 5 AND 9, PLEASE IDENTIFY CYCLING ACTIVITIES THAT THEY FREQUENTLY PARTICIPATE IN. (PLEASE SELECT ALL THAT APPLY)

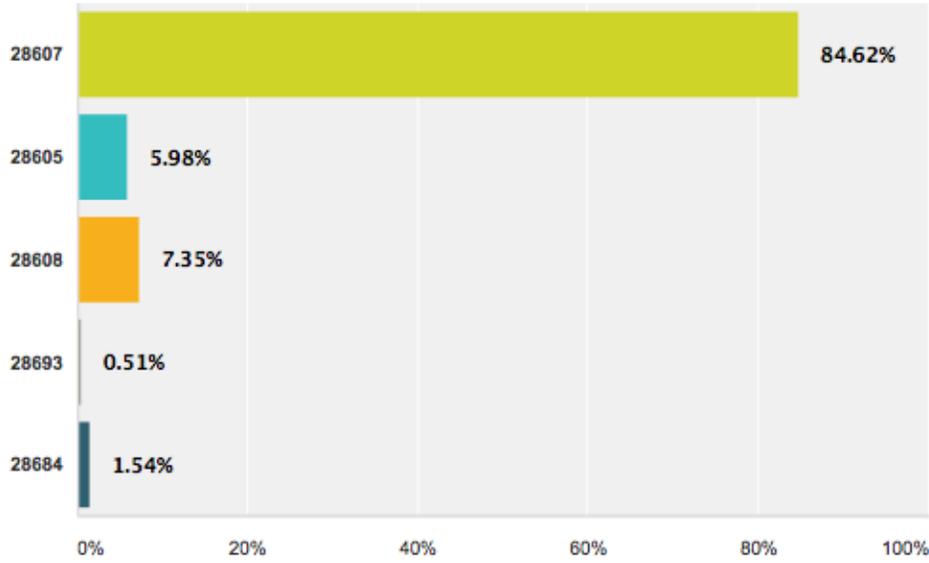


13. IF GRANTS OR DEVELOPMENT DO NOT BECOME AVAILABLE IN THE NEXT 5 YEARS TO BUILD ADDITIONAL GREENWAYS OR BICYCLE LANES, SHOULD THE TOWN OF BOONE USE LOCAL REVENUE TO FUND BICYCLE IMPROVEMENTS?

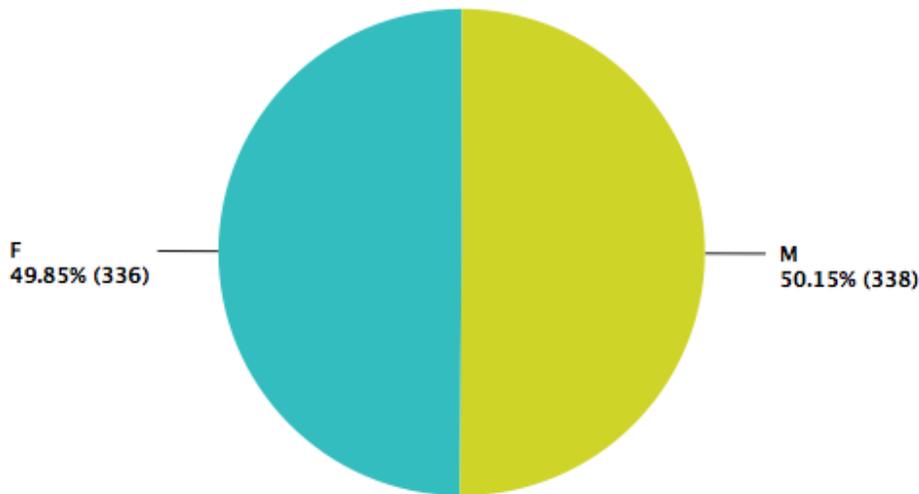




14. WHAT IS YOUR ZIP CODE?

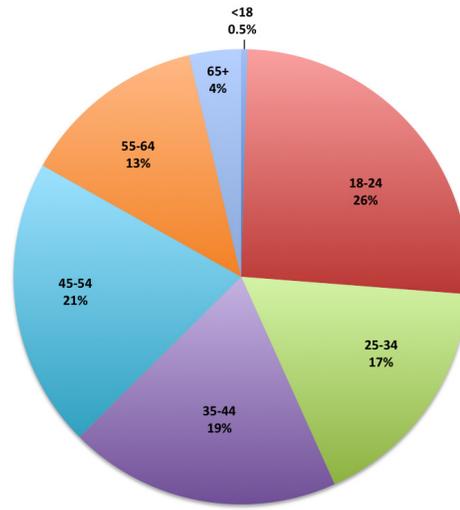


15. WHAT IS YOUR GENDER?





16. WHAT IS YOUR AGE?



17. ARE YOU A COLLEGE STUDENT?

