



BIKE!CORNELIUS

BICYCLE MASTER PLAN

Cornelius, North Carolina



ADOPTED

JANUARY 3, 2017 FOR



PREPARED BY



ACKNOWLEDGMENTS

The project team would like to recognize and express appreciation for the myriad of individuals who participated in the development of this Plan. Special thanks to the project advisory committee for their commitment to making Cornelius an active and thriving community.

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BIKE!CORNELIUS

BICYCLE MASTER PLAN

Cornelius, North Carolina

EXECUTIVE SUMMARY



ADOPTED
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PLANNING PROCESS

Bike!Cornelius, the Bicycle Master Plan of Cornelius is made possible by a 2014 North Carolina Department of Transportation (NCDOT) Bicycle and Pedestrian Planning Grant Initiative award. It combines past planning efforts with new research and analysis and includes a full public input process. A proposed on- and off-street bike facility network is included in this plan, as well as recommended policies and programs to encourage more bicycling activity and to promote safe bicycling and driving practices. These combined elements establish a complete, up-to-date framework for moving forward with improvements to the bicycling environment of Cornelius.

DATA COLLECTION AND ANALYSIS

Town staff, the Project Steering Committee, and stakeholders provided baseline information about the existing conditions of Cornelius. Through aerial photography, geographic information systems (GIS) data, on-the-ground field investigation, and

RECOMMENDATIONS

The Town of Cornelius currently has 8.2 miles of bicycle facilities, which is comprised of 2.3 miles of bicycle lanes and 5.9 miles of greenways and sidepaths. **This plan recommends expanding these facilities into a comprehensive network of bike lanes, marked shared lanes, greenways, sidepaths, and low stress bike routes, totaling 97.4 miles (see map on following pages). Twelve priority projects and five signed bike routes have been identified for near-term development** that will provide critical connections and routes for safe bicycling in Cornelius.

To complement these infrastructure recommendations, a suite of programs and policies are recommended to address the "5 E's of bicycle planning": engineering, education, encouragement, enforcement, and evaluation. Equity serves as a sixth 'E', and is considered an integral component of each of the other 5 E's. **Priority programs and**

review of existing planning documents, the project consultants identified opportunities and constraints for bicycle facility development.

PUBLIC INVOLVEMENT

Outreach to the citizens and visitors of Cornelius included two public workshops, a public planning workshop (charrette), an online and hard-copy citizen comment form, and a dedicated project webpage. Four Project Steering Committee meetings provided additional information about public concerns and preferences. The committee was made up of citizen advocates and representatives from multiple stakeholder organizations and local groups, including the NCDOT and Cornelius Planning, Park and Recreation (PARC), Police, and project management staff; the regional Active Routes to Schools (ARTS); among others.

policies for implementation include the formation of a permanent Bicycle Advisory Committee for the Town of Cornelius, as well as the **adoption of a Complete Streets policy**, whereby bicycle (and pedestrian) facilities will be an integral component of all transportation projects in the future. In addition, **bicycle educational programming** and **events** during National Bike Month in May, and throughout the year, will be critical for the development of a safe bicycling culture throughout the community.

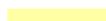
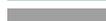
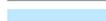
Finally, an overarching goal of this plan is to help the **Town of Cornelius become a designated Bicycle Friendly Community** within the next one to two years, and with the recommendations included herein, there is the potential to be designated above the bronze level.

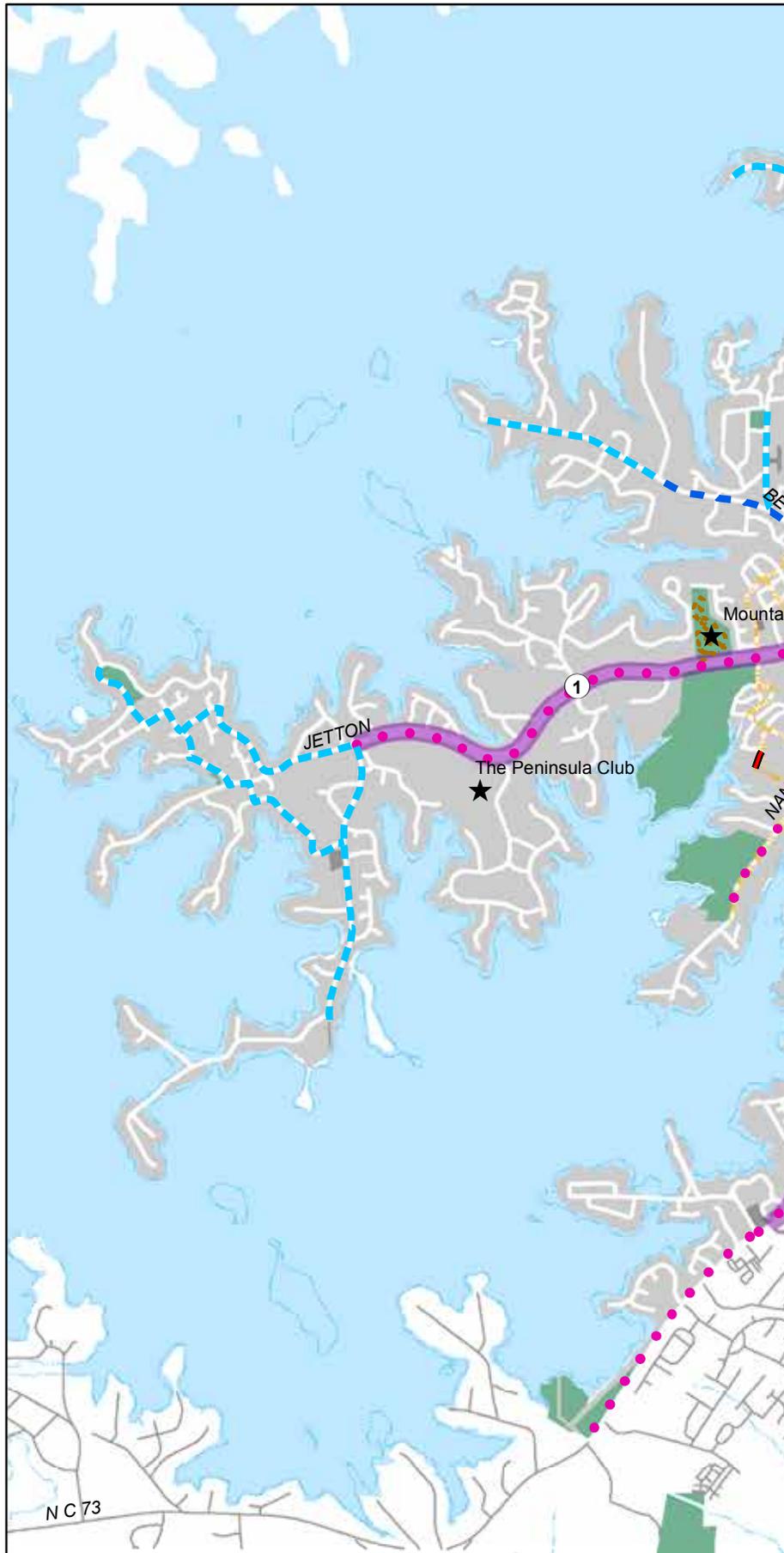
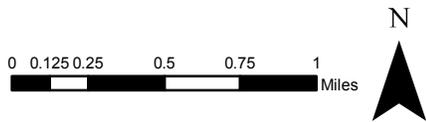
Bike!Cornelius

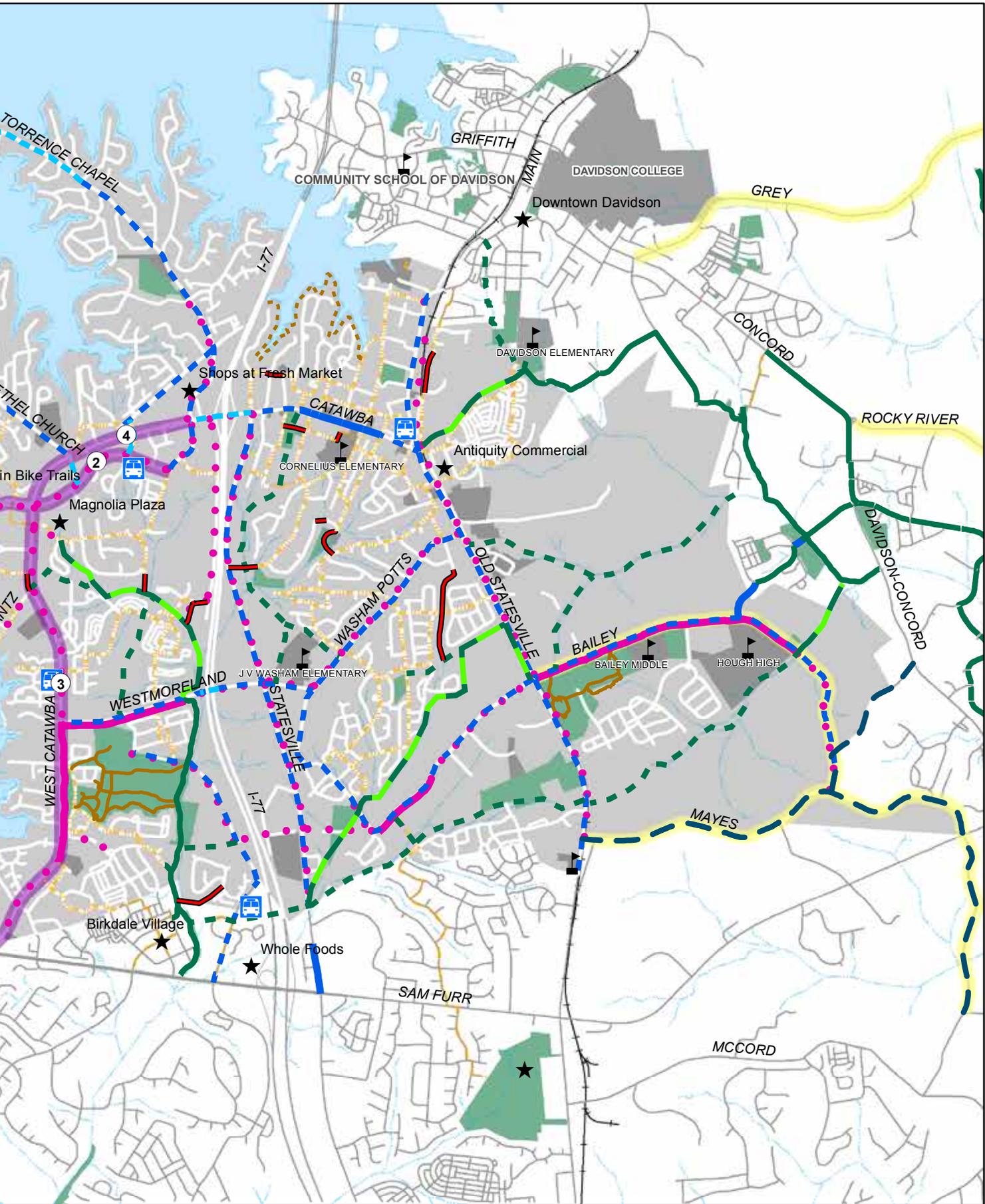
Cornelius, NC

Bicycle Master Plan

Bicycle Facility Recommendations

-  Bike-Ped Connectors
-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Dedicated Bikeways-Proposed
-  Road Bike Routes
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride





VISION STATEMENT:

Cornelius will be a premier bicycling destination in the state and region:

- The Town will provide **a network of safe and comfortable on-street and off-road bike facilities** for residents and visitors of **all ages and abilities**.
- **Increased connections between the bike facility network and community attractions** such as parks, schools, workplaces, services, civic destinations, and adjacent communities.
- **Bicycling will be seen as a viable form of transportation.** The Town will increase awareness of cycling.
- Cornelius will be the **Charlotte region's next Bicycle Friendly Community.**



Cornelius residents gather for a Community Bike Ride in May, 2015. This Plan is intended to capture and build upon Cornelius's existing cultural resources and natural resources, such as Lake Norman, the McDowell Creek Greenway, public parks and recreation areas, and the vibrant community.

I. INTRODUCTION & VISION

"It would be wonderful to be able to ride bikes with our children in Cornelius, up to the store or Carolina Cones as I did with my parents when I was young."

-- Cornelius resident

Plan Overview

In 2014, the North Carolina Department of Transportation (NCDOT) Bicycle and Pedestrian Planning Grant Initiative awarded the Town of Cornelius a matching grant for a bicycle master plan. The purpose of the grant program is to encourage municipalities to develop comprehensive bicycle plans and pedestrian plans. This program has assisted more than 100 North Carolina communities and is administered through NCDOT's Division of Bicycle and Pedestrian Transportation (DBPT). The Bicycle and Pedestrian Planning Grant Initiative funded The Town of Cornelius Pedestrian Master Plan in 2010.

Bike!Cornelius, the comprehensive Bicycle Master Plan of Cornelius, combines past planning efforts with new research and analysis, and includes a full public input process. A proposed on- and off-street bike facility network is included in this Plan, as well as recommended policies and programs to encourage more bicycling activity and to promote safe bicycling and driving practices. These combined elements establish a complete, up-to-date framework for moving forward with improvements to the bicycling environment of Cornelius.

PLAN ORGANIZATION

SECTION 1 - INTRODUCTION & VISION

This section sets the tone of the Plan and establishes its overall goals; it answers the questions “Why has Cornelius developed a bicycle master plan?” and “What goals does this plan expect to accomplish?”

SECTION 2 - EXISTING CONDITIONS

Section 2 draws a picture of existing and proposed conditions for bicycling in Cornelius as gathered from review of existing planning documents, data analysis, field work, and an extensive public outreach process.

SECTION 3 - RECOMMENDATIONS

The network recommendations section presents the long-term vision for bicycling infrastructure throughout Cornelius and provides descriptions of the different facility types that should be used to meet this vision.

SECTION 4 - PROGRAMS & POLICIES

This section describes the supporting programs and policies recommended to transform Cornelius into a Bicycle Friendly Community.

SECTION 5 - IMPLEMENTATION STRATEGIES

This section outlines action steps for developing the bicycle network and implementing bicycle policies and programs including implementation priorities, staffing partners in implementation, facility development methods, project prioritization, and a programmatic timeline.

SECTION 6 - APPENDICES

This section summarizes the Citizen Comment Form as well as provides design guidance for facility development. The Design Guidelines 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, accessible community.

Background

Cornelius is situated along Lake Norman in northern Mecklenburg County and is approximately 15 square miles in area. Lake Norman has approximately 520 miles of shoreline, with Cornelius having the largest amount of shoreline of all the municipalities on the lake (approximately 70 miles). The lake is a large driver of economic activity, attracting new residents, businesses, and visitors to the town. The area is already popular with recreational cyclists, who come to the area to ride on scenic roads in town and around the lake.

Since 2000, the Town has experienced tremendous growth. The U.S. Census Bureau reported the Town's population as 11,969 in 2000. By the 2010 Decennial Census, Cornelius had grown to 24,866 residents. The 2014 estimate from the North Carolina Office of State Budget and Management (OSBM) reported the Town's population to be 28,540. This growth has led to increased activity within Cornelius and on its roads. While the Town sees this growth as positive, the stress of increased traffic demands a multi-modal approach to transportation and an increased focus on creating

a safe, convenient bicycle network that provides an alternative to automobile travel for local trips.

The Town of Cornelius' vision statement is:

"Cornelius is a vibrant and inclusive small community on Lake Norman, dedicated to promoting the highest quality of life for all residents."

The Town's transportation priority is a multi-modal network (automobile, transit, bicycle, and pedestrian) to address mobility and access concerns now and in the future.

The Town's Comprehensive Master Plan (2012) identifies a number of specific goals related to improving bicycle transportation. These include:

- Identify and prioritize bike lane improvements and connections,
- Update the Greenway Master Plan (completed in 2015),
- Improve Share the Road Signage for bicycles, and
- Create an annual Public Awareness Campaign for bicycle activity.



Cornelius residents kick off the Bike!Cornelius planning effort with a Community Bike Ride

The Town completed the Cornelius Pedestrian Master Plan in 2010 which includes recommendations for greenways and multi-use side paths. However, the plan does not specifically address the unique needs of cyclists or include on-road bike facilities such as bike lanes. Several other plans have been adopted or are in process by the Town and/or County that support improved bicycle mobility and quality of life. These include the Comprehensive Parks & Greenways Master Plan Update (adopted in 2015), Mooresville to Charlotte Trail Feasibility Study (2013), Carolina Thread Trail Master Plan for Mecklenburg County, Lake Norman Regional Bike Plan (2010), and Cornelius Greenway & Bike facility Master Plan (2004).

This Bicycle Master Plan will provide a much needed update to the 2004 Bike facility Plan, serve to complement and enhance the Town's pedestrian and greenway plans, and support bicycle-related goals of the adopted regional plans. In addition, the Charlotte Regional Transportation Planning Organization (CRTPO) developed a Comprehensive Transportation Plan (CTP) - NC's multi-modal transportation plan for the region, including Cornelius. The CTP includes a map and listing of recommended bicycle facilities through Cornelius that will be key connections to the regional bicycle network. A Town Bicycle Plan will enable Cornelius to locally support the CTP. Referenced plans are online at: <http://www.crtpo.org/plans-programs>

Cornelius is already well positioned as a key destination in the Lake Norman Bike Route (LNBR), the Mooresville-Charlotte Trail (MCT), and the Carolina Thread Trail network. Ensuring that the recommended bike facility network appropriately connects to these regional trail systems is a key recommendation of this plan. The plan also considers changes to the LNBR routing

through Cornelius and considers ways to increase awareness and the bikeability of the route.

With its political support for quality of life and economic development; some supportive existing street infrastructure and planning policies; planned and existing greenways and parks; revitalizing downtown and lake, park and commercial destinations, strong bicycling community, and proximity to regional biking venues and routes (including Fisher Farm and Lake Norman State Park, the Lake Norman Bike Route, Carolina Thread Trail, and quiet rural roads), **Cornelius is poised to be one of the premier bicycling destination communities in the state and region**, joining the ranks of other regional Bike Friendly Communities (BFC) including Davidson, Rock Hill, and Charlotte.

Bike!Cornelius planning efforts



Benefits of Bicycle Friendliness

A bicycle-friendly Cornelius will help to improve the health and fitness of residents, transportation options, the local economy, and environmental conditions while contributing to a greater sense of community – and fun! Scores of studies from the fields of public health, urban planning, urban ecology, real estate, transportation, and economics consistently affirm the value of supporting bicycling as it relates to these issues. Small towns, big cities, and entire regions across the United States and throughout the world are implementing strategies for creating bicycle-friendly communities, and have been doing so for many years.

A growing number of studies show that the design of our communities and the built environment—including neighborhoods, towns, transportation systems, parks, trails and other public recreational facilities—affects people’s ability to reach the recommended daily 30 minutes of moderately intense physical activity (60 minutes for youth).

Cornelius is representative of the health challenges facing the North Carolina communities. According to the CDC Behavioral Risk Factors Surveillance System, **nearly two thirds of Mecklenburg County adult residents is overweight or obese** (35.9 and 26.4 percent respectively) and **more than a fifth of the adult population is physically inactive** (20.2 percent).¹ Establishing a safe and reliable bicycle network in Cornelius will positively impact the health of local residents.

(Infographic source: Active Living Research)

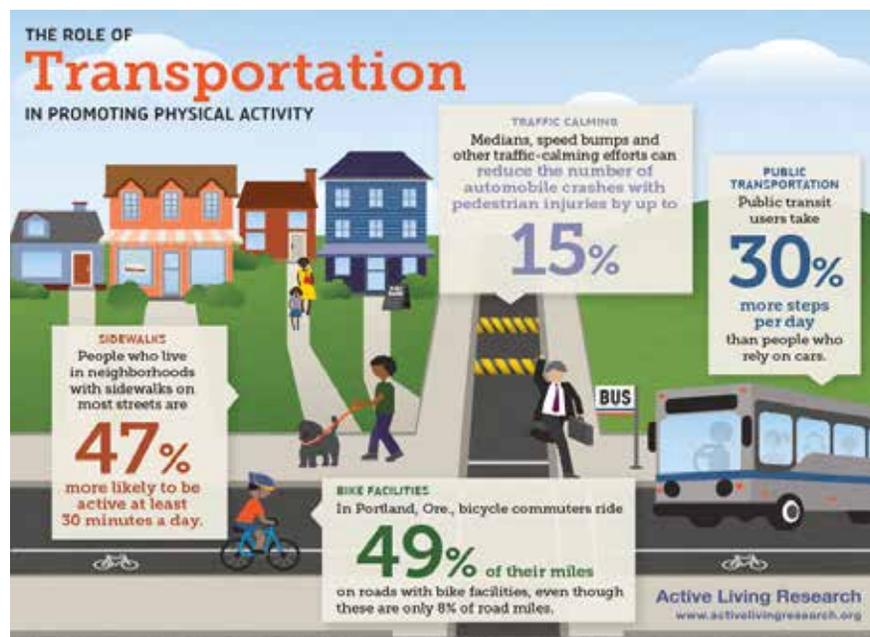
The Rails-to-Trails Conservancy puts it simply:

“Individuals must choose to exercise, but communities can make that choice easier.”

The *Facts on Active Transportation*, shared on the following pages, present some of the acute health, safety and economic issues many communities face today and the ways in which improved active transportation and recreation can have a positive impact. In the following section, a summary of the estimated quantified benefits that would result from increasing walking and bicycling rates and safety in Cornelius is presented. These benefits offer a powerful statement regarding Cornelius’s return on investment for implementing the recommendations in this Plan.

Refer to <http://www.walkbikenc.com/pillars-of-plan/> for more information.

¹ Centers for Disease Control. (2012). *Behavioral Risk Factors Surveillance System (BRFSS)*. Retrieved from <http://apps.nccd.cdc.gov/BRFSS-SMART/MMSACTyRiskChart.asp?MMSA=104&yr2=2012&qkey=8261&CtyCode=10370&cat=OB#OB>, (accessed February 2015).



The Facts on Active Transportation

ECONOMY

ISSUES

- Traffic congestion in 2011 caused Americans in cities to travel an additional 5.5 billion hours, purchase an additional 2.9 billion gallons of fuel, and spend an additional \$121 billion in gas. This means, **on average, each car commuter spends roughly 40 hours and over \$800 per year waiting in traffic.**

OPPORTUNITIES

- Reducing the dependence on personal motor vehicles decreases personal and family expenditures on autos, gas, and health care, potentially saving thousands of dollars per family annually.
- **The cost estimate to own and operate a bicycle is \$120 per year. The cost estimate to own and drive an automobile is \$7,800 per year. The average annual cost of a gym membership is about \$500 to \$775.**
- Trails are the number one amenity potential homeowners cite when they are looking at moving into a community. For example, the Midtown Greenway in Minneapolis and The Beltline in Old Fourth Ward Atlanta, have spurred development of new housing and businesses to take advantage of the prime locations next to the trail. Both projects brought significant revitalization to the surrounding neighborhoods
- Bike facilities and trails across many regions and cities have been shown to have a major economic impact. For example, following the opening of the Greenville, SC Swamp Rabbit Trail in 2011, **most businesses along the trail saw a 30%-50% increase in sales after the trail opened, and businesses that relocated to the trail observed a 30% to 90% increase in sales.**
- Pedestrian and bicycle infrastructure projects create 8–12 jobs per \$1 million of spending. Road infrastructure projects create 7 jobs per \$1 million of expenditures.
- Along the Virginia Creeper Trail, visitors spend \$1.59 million annually, and generated 27 new jobs.
- Focusing investment in pedestrian and bicycle infrastructure improvements has proven to be more cost effective than vehicular infrastructure across the board.
- Transportation and safety benefits of increased bicycling include reduced traffic congestion, decreased need for parking, and enhanced safety by providing paved shoulders and wide curbed lanes.

HEALTH

ISSUES

- **“Obesity costs American companies \$225.8 billion per year in health-related productivity losses.”**
- **“The estimated annual health care costs of obesity-related illness are a staggering \$190.2 billion or nearly 21% of annual medical spending in the United States.** Childhood obesity alone is responsible for \$14 billion in direct medical costs.”
- 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.”

OPPORTUNITIES

- A recent study shows that people who live within 0.6 miles of a pedestrian and bicycle path get 45 minutes more of exercise a week, on average.
- **“A 5% increase in walkability [has been found] to be associated with a per capita 32.1% increase in time spent in physically active travel, a 0.23-point reduction in body mass index, 6.5% fewer vehicle miles traveled, 5.6% fewer grams of oxides of nitrogen (NOx) emitted, and 5.5% fewer grams of volatile organic compounds (VOC) emitted.”**
- Multiple studies have shown that 30 minutes of physical exercise - including walking and bicycling - improves mental well-being, lowers blood pressure, the risk of certain cancers, improves self-esteem, reduces tiredness, cardiovascular risk, stress, difficulties with sleep, and increases productivity. All of which lower health costs.
- Cyclists breathe fewer pollutants than motorists despite higher respiration rates.

SAFETY

ISSUES

- Higher traffic speeds result in reduced driver response times and more severe injury to pedestrians. **A chance a pedestrian would survive if hit by a car traveling at 20 mph is 95%. This percentage is reduced to 60% at 30 mph, and to 20% at 40 mph.**
- Nationally, there were over 33,500 traffic fatalities reported in 2012. **The Alliance for Bicycling and Walking reports that 14.9% of traffic fatalities are pedestrian or bicyclists, while only 11.4% of all trips are made either walking or bicycling.**

OPPORTUNITIES

- Reducing speed limits will result in safer environments for cyclists and pedestrians.
- Employing education and encouragement strategies to increase the number of pedestrians and bicyclists along a corridor, and network-wide. The presence of more cyclists and pedestrians will, in turn, create a safer environment. Motorists expect the presence of these users and drive more cautiously as a result.
- Complete Streets improvements that reduce crossing distances for pedestrians and bicyclists, highlight conflict zones, create dedicated roadway space for non-motorized users, reinforce safe roadway behavior, increase visual stimulation or a sense of enclosure, and/or actively reduce speeds through geometric roadway changes foster safer speeds and behavior among all roadway users.

BICYCLE TOURISM

Investments in the bicycling environment can lead to increases in bicycling tourism. **In the Outer Banks, NC, bicycling is estimated to have a positive annual economic impact of \$60 million; 1,407 jobs are supported by the 40,800 visitors** for whom bicycling was an important reason for choosing to vacation in the area. The annual return on bicycle facility development in the Outer Banks is approximately nine times higher than the initial investment.

Even though there are substantial differences between the Town of Cornelius and the Outer Banks, Cornelius could still achieve positive economic gains proportional to its own attractions and its own future investments in community-wide bicycle facilities. The quality of bicycling in the Outer Banks region positively impacts vacationers' planning—it is not all about the beaches:

- 12% of vacationers report staying three to four days longer to bicycle.
- 43% of vacationers report that bicycling is an important factor in their decision to come to the area.
- 53% of vacationers report that bicycling will strongly influence their decision to return to the area in the future.

In terms of tourism, **Cornelius has the benefit of its proximity to Charlotte, NC; Lake Norman; and Charlotte Douglas International Airport; existing or soon-to-be built portions of the Carolina Thread Trail and local greenways; the Lake Norman Bike Route; the regional mountain bike venues at Fisher Farm, Lake Norman State Park and the National Whitewater Center; the new Rock Hill Velodrome; and scenic, low-volume rural roads that are already popular with existing cyclists from around the region.** The Town and the Lake Norman area are also popular locations for cycling events, including triathlons and organized bicycle rides. As Cornelius expands its attractive network of trails, bike facilities, and bicycle routes, the town will win over some bicycle-related tourism from other regions, and attract new tourists as an easily accessible bicycling destination.

Lake Norman and the Lake Norman Bike Route is a major attraction for bicycle tourism in Cornelius



TRANSPORTATION CHOICES

A National Household Travel Survey found that roughly 40% of all trips taken by car are less than two miles. **By replacing short car trips with bicycle trips, residents have a significant positive impact on local traffic and congestion.** Traffic congestion reduces mobility, increases auto-operating costs, adds to air pollution, and causes stress in drivers. Substituting bicycling for some of these trips relieves the congestion, benefiting all road users. In addition, an improved bicycle network provides greater and safer mobility for residents who do not have access to a motor vehicle.

The American Community Survey (ACS) estimates that **600 Cornelius households do not have access to a vehicle and over 3,500 (more than 14%) have access to only one.** American demographics show that typically around 30% of a community's population do not or cannot drive or own a car due to age (under 16), physical or mental disabilities or old age, and/or income. Bicycling for transportation is an important option for these populations, especially those with more than one working family member. Cornelius residents are already taking advantage of the transportation benefits of bicycling. **The town's Census-reported bicycle commute mode share of 0.3 percent indicates that some residents already are using bicycle transportation for commuting.** Feedback from the Steering Committee and other info shows that Cornelius residents are active sport and recreational cyclists, both in town and in the region.

ENVIRONMENTAL IMPROVEMENTS

As demonstrated by the Southern Resource Center of the Federal Highway Administration, when people get out of their cars and onto their bicycles, they reduce measurable volumes of pollutants. Other environmental impacts include a reduction in overall neighborhood noise levels and improvements in local water quality as fewer automobile-related discharges wind up in the local rivers, streams, and lakes.

Trails and greenways are also part of an attractive bicycle network, conveying unique environmental benefits. Greenways protect and link fragmented habitat and provide opportunities for protecting plant and animal species. Trails and greenways connect places without the use of emission-producing vehicles, while also reducing air pollution by protecting large areas of plants that create oxygen and filter pollutants such as ozone, sulfur dioxide, carbon monoxide and airborne particles of heavy metal. Greenways and trails also provide an opportunity to connect people to the natural environment, which improves their own wellbeing while at the same time increases their interest in protection such natural environments. Finally, greenway corridors can 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.

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 claim that access to alternative means of transportation and access to quality recreational opportunities such as parks, trails, greenways, and bicycle routes, are important factors for them in determining their overall pleasure within their community. Communities with bike facility and trail amenities can attract new businesses, industries, and in turn, new residents. Furthermore, quality of life is positively impacted by bicycling through the increased social connections that take place by residents being active, talking to one another and spending more time outdoors and in their communities.

According to the Brookings Institution, the number of older Americans is expected to double over the next 25 years. All but the most fortunate seniors will confront an array of medical and other constraints on their mobility even as they continue to seek both an active community life, and the ability to age in place. **Off-road trails built as part of the bicycle transportation network generally do not allow for motor vehicles; however, they do accommodate motorized wheelchairs, which is an important asset for the growing number of senior citizens who deserve access to independent mobility.** For those seniors who remain very ambulatory, off-road trails provide an excellent and safe opportunity for exercise and fitness.

Children under 16 are another important subset of our society who deserve access to safe mobility and a higher quality of life. According to the U.S. Environmental Protection Agency, fewer children walk or bike to school than did so a generation ago. In 1969, 48 percent of students walked or biked to school, but by 2001, less than 16 percent of students between 5 and 15 walked or biked to or from school.

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.” In a 2004 CDC survey, 1,588 adults answered questions about barriers to walking to school for their youngest child aged 5 to 18 years. The main reasons cited by parents included distance to school, at 62%, and traffic-related danger, at 30%. **A network of bike facilities in Cornelius could reduce the travel distance from homes to schools, and overall bicycle improvements can improve the safety of our roadways.** The availability of a good bicycle network has become a hallmark of a community with a high quality of life – one of the reasons that they are almost always included in new planned communities.

Planning Process

Town of Cornelius staff and the Project Steering Committee guided the development of the Comprehensive Bicycle Master Plan. The committee is made up of citizen advocates and representatives from multiple stakeholder organizations and local groups, including the NCDOT and Cornelius Planning, Park and Recreation (PARC), Police, and project management staff; CRTPO; the Centralina Council of Governments (CCOG); the Charlotte Area Bicycle Alliance (CABA); the Town's PARC Board, the regional Active Routes to Schools (ARTS); among others (listed in the Acknowledgments section of this plan). The Steering Committee met four times during the process and provided guidance on the overall vision, facility recommendations, programs, policies, and draft plan development.

DATA COLLECTION AND ANALYSIS

Town staff, the Project Steering Committee, and stakeholders provided baseline information about the existing conditions of Cornelius. Through aerial photography, geographic information systems (GIS) data, and on-the-ground field investigation, the project consultants identified opportunities and constraints for bicycle facility development. Field research also included examining portions of proposed trails, verifying certain road widths, studying lane configurations, and preparing a photographic inventory. A review of existing planning documents, policies, and existing bicycling programs supplemented the analysis of the physical environment.

PUBLIC INVOLVEMENT

Outreach to the citizens and visitors of Cornelius included two public workshops, a public planning workshop (charrette), an online and hard-copy citizen comment form, and a dedicated project webpage. Four Project Steering Committee meetings provided additional information about public concerns and preferences. Interested citizens and stakeholders signed-up to receive updates about development of the Comprehensive Bicycle Master Plan and other notifications about volunteering to support bicycling events.

PLAN DEVELOPMENT

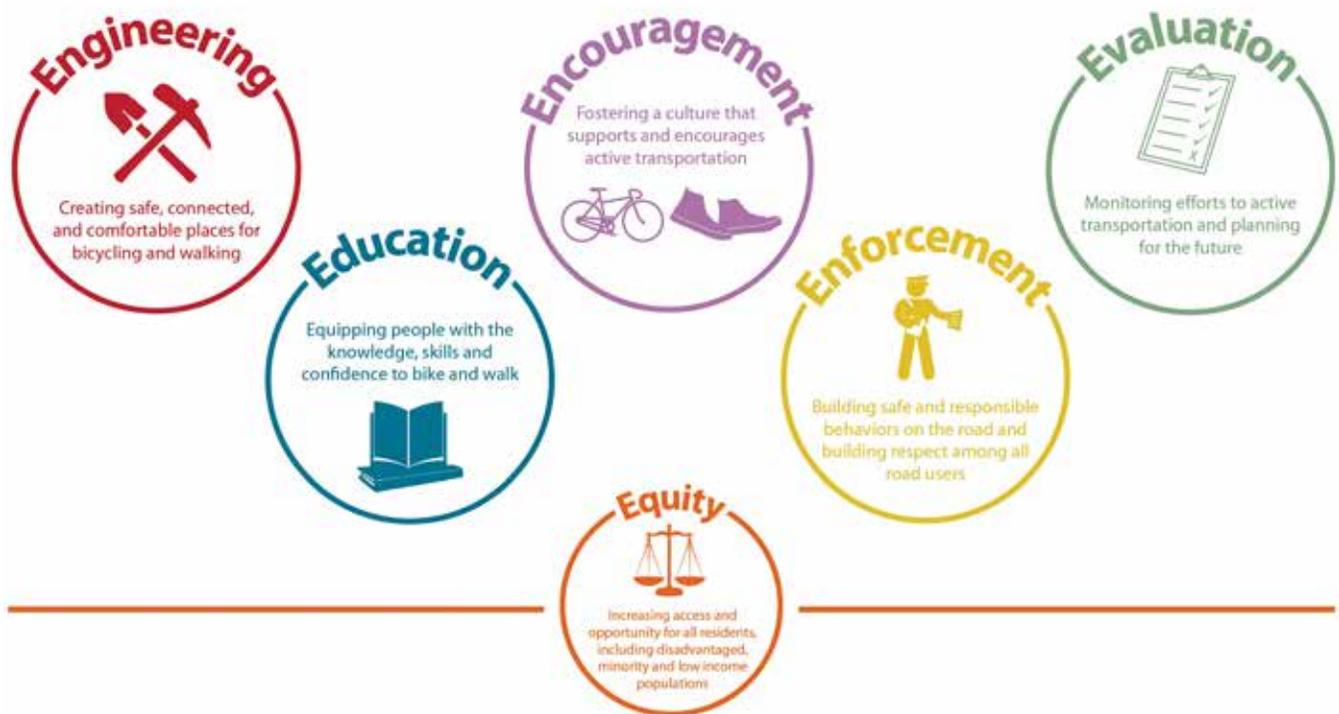
The draft plan reflects input from the public, the Project Steering Committee, Town staff, NCDOT staff, and the existing conditions analysis. The Town of Cornelius and NCDOT reviewed and commented on the initial draft, which was revised and presented to the Project Steering Committee. With the recommendation of the Project Steering Committee, Town staff and project consultants presented the draft plan to Town Council.

Six E's of Bicycle Planning

Research has shown that a comprehensive approach to bicycle-friendliness is more effective than a singular approach that addresses only one issue, such as tackling only infrastructure or bicyclist education. Recognizing this, the national Bicycle Friendly Community program, administered by the League of American Bicyclists, recommends a multi-faceted approach based on the following five E's: Engineering, Education, Encouragement, Enforcement, and Evaluation. For the purposes of this Plan, a sixth 'E', Equity, is considered an integral component of each of the five E's. 'Equity' takes

into account the distribution of impacts (benefits and costs) of bicycling programs, policies, and infrastructure improvements, and whether that distribution is appropriate.

This Plan has been developed using the Six E's approach as a means of providing action steps in each arena that the community can take towards becoming more bicycle-friendly. The Bicycle Friendly Community program is discussed in more detail in Chapter 2, as a useful framework for Cornelius's bicycle friendly initiatives.



Vision & Goals

The Project Steering Committee of the Cornelius Comprehensive Bicycle Master Plan met for the first of four meetings in February 2014. The group discussed overarching goals for the Plan, identified opportunities for improving conditions for bicyclists in Cornelius, and described desired outcomes of the Plan. Individual statements from the committee were combined into the following overall vision for this plan:

GOALS AND OBJECTIVES

Goals and objectives for this plan, using the 6 E's framework of the Bicycle Friendly Community program are outlined below, with more specific detailed on the following pages.

Figure 1.1. Goals and Objectives

GOALS AND OBJECTIVES	
Engineering	Increase the safety of bicycling in Cornelius for all users & types of cyclists.
	Create and maintain safe bike routes to all Cornelius schools: create a town sponsored Safe Routes to School action plan (walking and biking).
	Prioritize bike/pedestrian infrastructure to destinations (e.g. schools and other key locations).
Education & Encouragement	Increase community Awareness of bicyclists on the roadway: implement education campaigns, including in schools.
	Increase awareness of bicycling as a viable form of transportation in Cornelius by providing wayfinding signage to destinations and to educate "the 60%" of interested but concerned cyclists.
	Increase the number of kids on bikes. (30% fewer kids on bikes in the last 5 years.)
	Participate and piggyback on National Bike Month, Bike/Walk to School days, etc.
	Create community rides in conjunction with existing events, such as Symphony in the Park, Laketoberfest, Tawba Walk, etc. Use these events as a springboard for education and encouragement by providing information on biking in Cornelius and encouraging attendees to ride their bikes to the events.
Enforcement & Evaluation	Increase the safety of bicycling in Cornelius for all users/types of cyclists.
	Adopt this Bike Plan.
	Revisit codes and ordinance to include specific, enforceable bicycle infrastructure.
	Link advocacy, infrastructure, and efforts between Cornelius and Davidson, Huntersville, Mecklenburg County, local non-profits, and other agencies.
	Seek alternative forms of funding: develop a master list of funding opportunities.
	Become a Bicycle Friendly Community.



ENGINEERING (INFRASTRUCTURE)

- Increase the safety of bicycling in Cornelius for all users/types of cyclists.**
 - Ensure that every residence and business is within 1/4 mile distance from a safe bike facility.
 - Identify key points of conflict and create resolutions/design solutions.
 - Increase the number of dedicated bike facilities to 10 miles by 2025.
 - Link bicycle facilities together. Connect greenways with the on-road bike facility network.
 - Ensure that all funded road projects (new and widening projects) include bike/pedestrian facilities.
 - Identify “bike boulevards” (low stress bike connections) and provide signage/safe crossings.
 - Design signage for greenways to prevent conflicts between cyclists and pedestrians.
- Create and maintain safe bike routes to all Cornelius schools: create a town sponsored Safe Routes to School action plan (walking and biking).**
- Prioritize bike/pedestrian infrastructure to destinations (e.g. schools and other key locations).**
 - Create bike routes to restaurants and other destinations with various facility types.
 - Improve and expand current wayfinding signs for cycling by 2017.
 - Increase bike racks at destinations.
- Design bike routes and bike facilities for different bicycle type/users.**
 - Design for the Enthused and Confident and Interested but Concerned cyclists.
 - Create bike loops with known lengths and travel time for recreational riders.
 - Accommodate commuters/transportation cyclists.
 - Create a bike facility network that accommodates residents who want to “age in place.”
 - Provide bicycle network links to every residential development in Cornelius.
 - Consider electric-assist bike users in network design.





- **Increase community awareness of bicyclists on the roadway: implement education campaigns, including in schools.**
- **Increase awareness of bicycling as a viable form of transportation in Cornelius by providing wayfinding signage to destinations and to educate “the 60%” of interested but concerned cyclists.**
- **Increase the number of kids on bikes. (30% fewer kids on bikes in the last 5 years.)**
 - Prioritize destinations in planning to get youth and parents riding their bikes.
 - Create a town sponsored safe routes to school action plan (walking and biking).
- **Participate and piggyback on National Bike Month, Bike/Walk to School days, etc.**
- **Create community rides in conjunction with existing events, such as Symphony in the Park, Laketoberfest, Tawba Walk, National Bike Month (May), etc. Use these events as a springboard for education and encouragement by providing information on biking in Cornelius and encouraging attendees to ride their bikes to the events.**



- **Increase the safety of bicycling in Cornelius for all users/types of cyclists.**
- **Adopt this Bike Plan.**
- **Revisit codes and ordinance to include specific, enforceable bicycle infrastructure.**
 - Enhance bicycle parking requirements.
 - Include bike-friendly requirements for parking lots in commercial areas.
 - Adopt a policy for bicycle design in Cornelius using guidance from NCDOT Urban Street Design Guidelines and NACTO.
 - Borrow from Charlotte’s urban streets design guidelines and NACTO.
- **Link advocacy, infrastructure, and efforts between Cornelius and Davidson, Huntersville, and Mecklenburg County, local non-profits, and other agencies.**
- **Seek alternative forms of funding: develop a master list of funding opportunities.**
- **Become a Bicycle Friendly Community.**
 - Conduct bicycle counts to get a baseline of bicycle activity and repeat annually.
 - Apply for BFC status by 2017.
 - Achieve Silver status by 2025



A group of cyclists is gathered on a paved path. In the center, a man wearing a red helmet and a bright yellow-green high-visibility vest is looking at a smartphone. To his left, another cyclist in a white helmet and similar vest is also looking at the phone. In the foreground, a man in a grey t-shirt and black helmet is looking towards the camera. Other cyclists are visible in the background, some wearing high-visibility vests. The scene is outdoors on a sunny day with trees and a clear blue sky in the background.

Public input coupled with fieldwork and steering committee meetings shaped the Plan's network recommendations to reflect community desires and balance desirability with feasibility.

The Bike!Cornelius steering committee bike ride in May of 2015 gave the design team firsthand experience of Cornelius infrastructure and issues.

II. EXISTING CONDITIONS

*Transportation is about more than asphalt, concrete, and steel.
Ultimately it is about providing people with the opportunity for a
safer, happier, and more fulfilling life.*

-- Rodney Slater, Former US Secretary of Transportation

Overview

This chapter provides an overview of the major components of the bicycling environment of the Town of Cornelius. The assessment of existing conditions is based on information collected by gathering existing local and regional geographic information systems (GIS) data, conducting field work, requesting local information from the Town of Cornelius, internet research, and soliciting public input.

The existing conditions analysis includes the following elements:

- Bicycle Friendly Community Assessment
- Data Inventory
- Field Investigation
- Public Outreach
- Planning & Policy Review

The chapter concludes with an overview of key findings regarding strengths and challenges of the bicycling environment in Cornelius.

Bicycle Friendly Community Assessment

OVERVIEW OF BICYCLE FRIENDLY COMMUNITY DESIGNATION

The Bicycle Friendly Community (BFC) program is a national initiative intended to encourage cities and towns across the country to improve the bicycling environment in their community and to recognize communities who are successfully doing this. The program provides communities with invaluable resources related to bicycle planning and also generate positive media attention at the national and local level for communities who earn a designation.

The BFC program is administered by the League of American Bicyclists, a national bicycling advocacy organization based in Washington, D.C. As of early 2012, the League had received 490 applications and awarded 190 communities with “bicycle-friendly” status since the program began. Table 2.1 lists BFC designated communities in North and South Carolina and towns and cities noted as peers or aspirational models for Cornelius as noted by staff and elected officials.

The BFC program uses the six “E’s” of bicycle and pedestrian planning as the framework for identifying successful biking communities. As described in Chapter 1, the six “E’s” are: Engineering, Education, Encouragement, Enforcement, Evaluation, and Equity. A city, town or county must complete a detailed questionnaire developed by the League of American Bicyclists in order to apply for recognition. Four levels of award designation are possible: Bronze, Silver, Gold, and Platinum. An Honorable Mention category is offered, as well.

There are two opportunities to apply for a designation each year. Applications are due in February for the spring awards and in July for the fall awards.

Table 2.1. Designated Bicycle Friendly Communities in the Carolinas and peer communities as of February 2015

BFC LEVEL	NORTH CAROLINA	SOUTH CAROLINA	CORNELIUS PEER/ ASPIRATIONAL COMMUNITIES
BRONZE	Asheville, Cary, Chapel Hill, Charlotte, Davidson, Durham, Greensboro, Raleigh, Wilmington, Winston-Salem	Columbia, Greenville, Rock Hill, Spartanburg	Carmel, IN; Decatur, GA; Newton, MA
SILVER	Carrboro	Hilton Head	Burlington, VT
GOLD	-	-	Palo Alto, CA
PLATINUM	-	-	

ACHIEVING BICYCLE FRIENDLY COMMUNITY DESIGNATION

A BFC is described as a community that “**welcomes cyclists by providing safe accommodation for cycling and encouraging people to bike for transportation and recreation.**”¹ In order to achieve Bronze level status as a BFC, a community is expected to show a strong commitment to bicycling, even if that commitment is in its early stages. Bronze communities have “room to grow” and show potential for more successes in bicycle friendliness, but important steps in the right direction are already being taken.

To achieve a designation level higher than Bronze, significant advances within each of the five E’s must occur. An honorable mention may be awarded to a community that shows its potential to fit the characterization of a Bronze community in the near future. In particular, a community that has not yet had time to realize the full impact of important recent successes would be a likely candidate for an honorable mention award. While there is no

¹ Source: http://www.bikeleague.org/programs/bicyclefriendlyamerica/communities/bfc_about.php

clear benchmark that identifies communities within the four levels of BFC designation, Figure 2.1 on the following pages outlines the key factors found among designated BFCs around the country.

With the completion of this plan, several greenway and complete streets projects underway, and implementation of other plan recommendations, Cornelius has potential to achieve at least Bronze level status in a relatively short time frame.

Below: Cornelius residents participate in a public meeting in August, 2015 to gather feedback on the draft bicycle master plan.



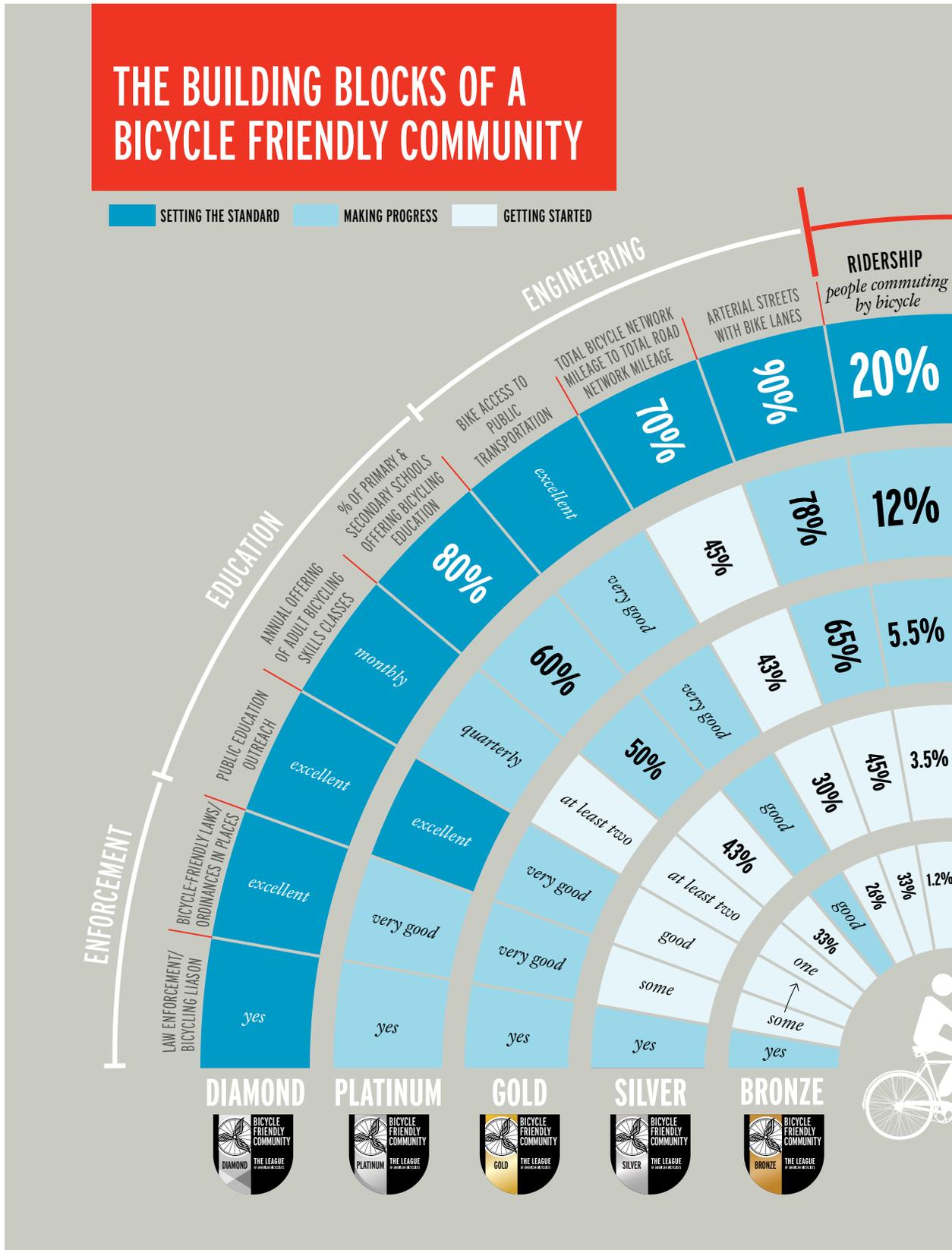
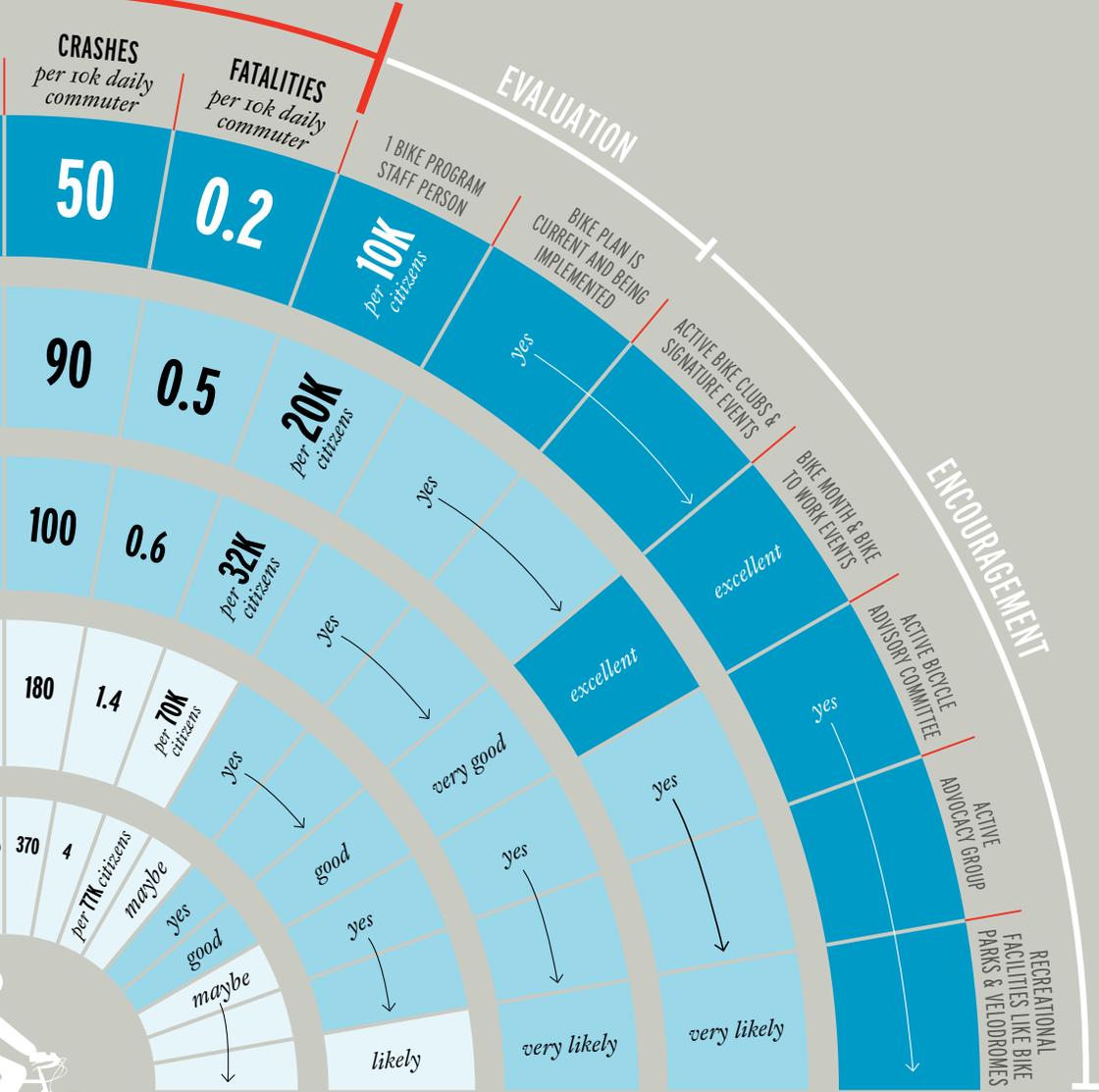


Figure 2.1. Building Blocks of Bicycle Friendly Communities, <http://bikeleague.org/sites/default/files/BFC%20infographic.pdf>

produced by
THE LEAGUE
 OF AMERICAN BICYCLISTS
 WWW.BIKELEAGUE.ORG
 Designed by Language Dept.

KEY OUTCOMES



There's no single route to becoming a Bicycle Friendly Community. In fact, the beauty of the BFC program is the recognition that no two communities are the same and each can capitalize on its own unique strengths to make biking better. But, over the past decade, we've pored through nearly 600 applications and identified the key benchmarks that define the BFC award levels. Here's a glimpse at the average performance of the BFCs in important categories, like ridership, safety and education.

CORNELIUS BICYCLE FRIENDLY COMMUNITY SCORECARD

By design, the process of filling-out the detailed questionnaires is an educational tool for communities seeking a national designation. Communities not only learn the variety of programmatic, policy, and infrastructure initiatives that contribute to becoming bicycle- and walk-friendly, but also learn the areas in which the community excels or needs improvement.

Table 2.2 offers an overview benchmarking report for the Town of Cornelius based on key elements of the Bicycle Friendly Community designation criteria. Though the scorecard is not a complete reflection of the criteria weighted within the Bicycle Friendly Community application, it is a practical tool for identifying key areas in need of improvement in the Town of Cornelius’s bicycling environment. Each criterion is worth one point, if present, and partial credit is given where possible.

Table 2.2. Assessment of Cornelius as a Bicycle Friendly Community

BICYCLE FRIENDLY COMMUNITY SCORECARD- CORNELIUS, NC		Yes	No
ENGINEERING			
Does your community have a comprehensive, connected and well-maintained bicycling network? (Comment: <i>Not yet, but plans are in place for a system of connected greenways and this plan will put forth a plan for a comprehensive system of on- and off-road bicycling facilities.</i>)			1
Is bike parking readily available throughout the community? (Comment: <i>Not yet, but there are some bike parking racks at some destinations.</i>)			1
Is there a Complete Streets ordinance or another policy that mandates the accommodation of cyclists on all road projects? (Comment: <i>NCDOT has a Complete Streets policy and a draft Complete Streets design guide. The Town also has complete streets development standards and recommended street design typologies.</i>)	1		
ENGINEERING SCORE TOTAL		1/3	
EDUCATION			
Is there a community-wide Safe Routes to School program that includes bicycling education? (Comment: <i>Not yet a community-wide effort, but SRTS or bicycle education and encouragement programs at individual schools, including JV Washam, Cornelius Elementary, and Hough High have been underway for the last few years SRTS action plans are underway for the Cornelius school campuses.</i>)	0.5		0.5
Are there bicycling education courses available for adults in the community? (Comment: <i>There are a number of certified League of American Bicyclists-certified cycling instructors in the area.</i>)			1
Does your community educate motorists and cyclists on their rights and responsibilities as road users?			1
EDUCATION SCORE TOTAL		0.5/3	

ENCOURAGEMENT		
Does your community have an up-to-date bicycle map?		1
Does the community celebrate bicycling during national Bike month with community rides, Bike to Work Day or media outreach? (Comment: <i>First community ride organized during Bike Month 2015.</i>)	0.5	0.5
Does the community host any major community cycling events or rides? (Comment: <i>Cornelius has been the site of events such as the Lake Norman Triathlon.</i>)	0.5	0.5
Is there an active bicycle advocacy group in the community? (Comment: <i>The Charlotte Area Bicycle Alliance is rebuilding. Also, the SAFE North Mecklenburg is an emerging organization focused on promoting safe cycling in the North Mecklenburg area: https://www.facebook.com/SAFENorthMeck</i>)	0.5	0.5
ENCOURAGEMENT SCORE TOTAL	1.5/4	
ENFORCEMENT		
Do law enforcement officers receive training on the rights and responsibilities of all road users?	1	
Does your community have law enforcement or other public safety officers on bikes? (Comment: <i>Bike Patrols are used primarily for events</i>)		1
Do local ordinances treat bicyclists equitably?	0.5	0.5
ENFORCEMENT SCORE TOTAL	1.5/3	
EVALUATION AND PLANNING		
Is there a specific plan or program to reduce cyclist/motor vehicle crashes?		1
Does your community have a current comprehensive bicycle plan? (Comment: <i>A plan is underway as part of this process and will be complete in late 2015.</i>)	1	
Is there a Bicycle advisory Committee that meets regularly? (Comment: <i>The Town has established a steering committee as part of the Bicycle Master Plan effort. Perhaps this could be the basis of an on-going Town advisory group.</i>)	0.5	0.5
Does your community have a bicycle program manager?		1
EVALUATION AND PLANNING SCORE TOTAL	1.5/4	
BICYCLE FRIENDLY COMMUNITY SCORECARD TOTAL		6.0/17

Score 0-8: Based on the criteria of the Bicycle Friendly Community program, this score indicates that Cornelius has some improvements to make before becoming a designated Bicycle Friendly Community. However, the momentum and the pieces are in place for Cornelius to become a Bicycle Friendly Community in a relatively short time frame by addressing some of the key factors above.

Data Inventory

The Town of Cornelius provided data related to the bicycling environment of the community. The data related to the following broad categories of existing conditions:

- Transportation (such as streets, traffic volumes, and traffic signal locations)
- Land use and ownership (such as parcel boundaries, and zoning designations)
- Points of interest (such as schools, parks, and retail centers)
- Physical geography (such as water bodies and streams)
- Administrative and jurisdictional boundaries (such as town borders)

A review of all relevant plans or planning documents related to bicycle activity in the region supplemented the data inventory. A summary of that review is provided on page 36.

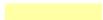
Table 2.3 outlines the existing bicycling facilities in the Town of Cornelius, and the map on the following page, Figure 2.2, depicts the locations of existing bike facilities. Additionally, Figure 2.3, on page 27, depicts the regional bike routes, including the Lake Norman Bike Route, the Carolina Thread Trail, and the Charlotte to Mooresville Trail.

Table 2.3 Existing Bike Facilities

FACILITY TYPE	MILES
Total Town Roadways	164.8
Greenways	3.0
Shared-Use Path	2.9
Bicycle Lanes	2.3
Natural Surface Trails	4.4
Total Designated Bike facility Mileage	16.1

Bike!Cornelius

Cornelius, NC Bicycle Master Plan Existing Conditions

-  Bike Lanes-Existing
-  Road Bike Routes
-  Sidepath-Existing
-  Greenways-Existing
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

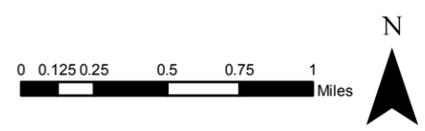
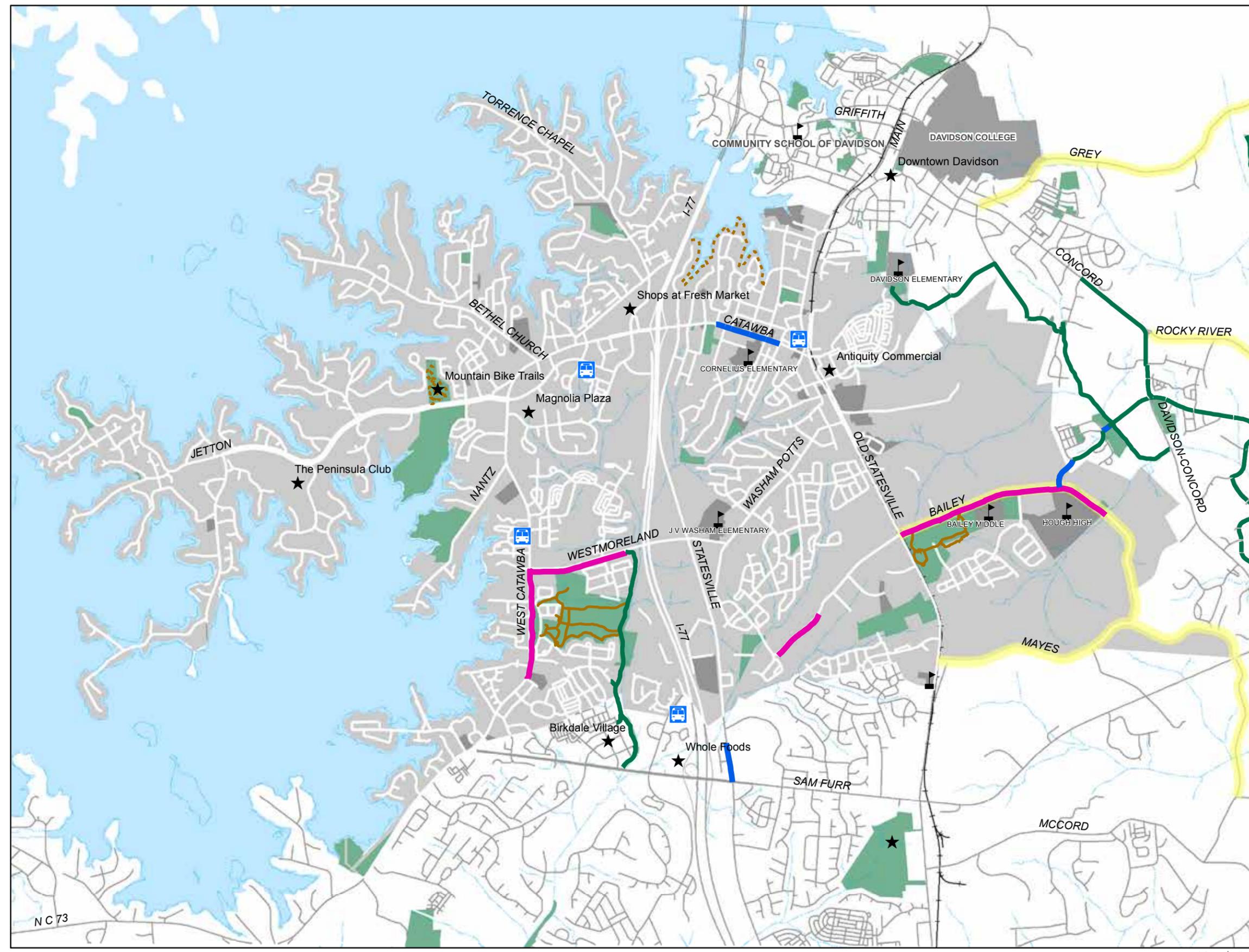


Figure 2.2. Existing Conditions Map

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Bike!Cornelius

Cornelius, NC Bicycle Master Plan Regional Bike Routes

-  Mooresville to Charlotte Trail
-  Lake Norman Bike Route
-  Carolina Thread Trail
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

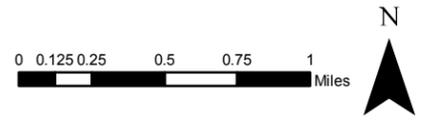
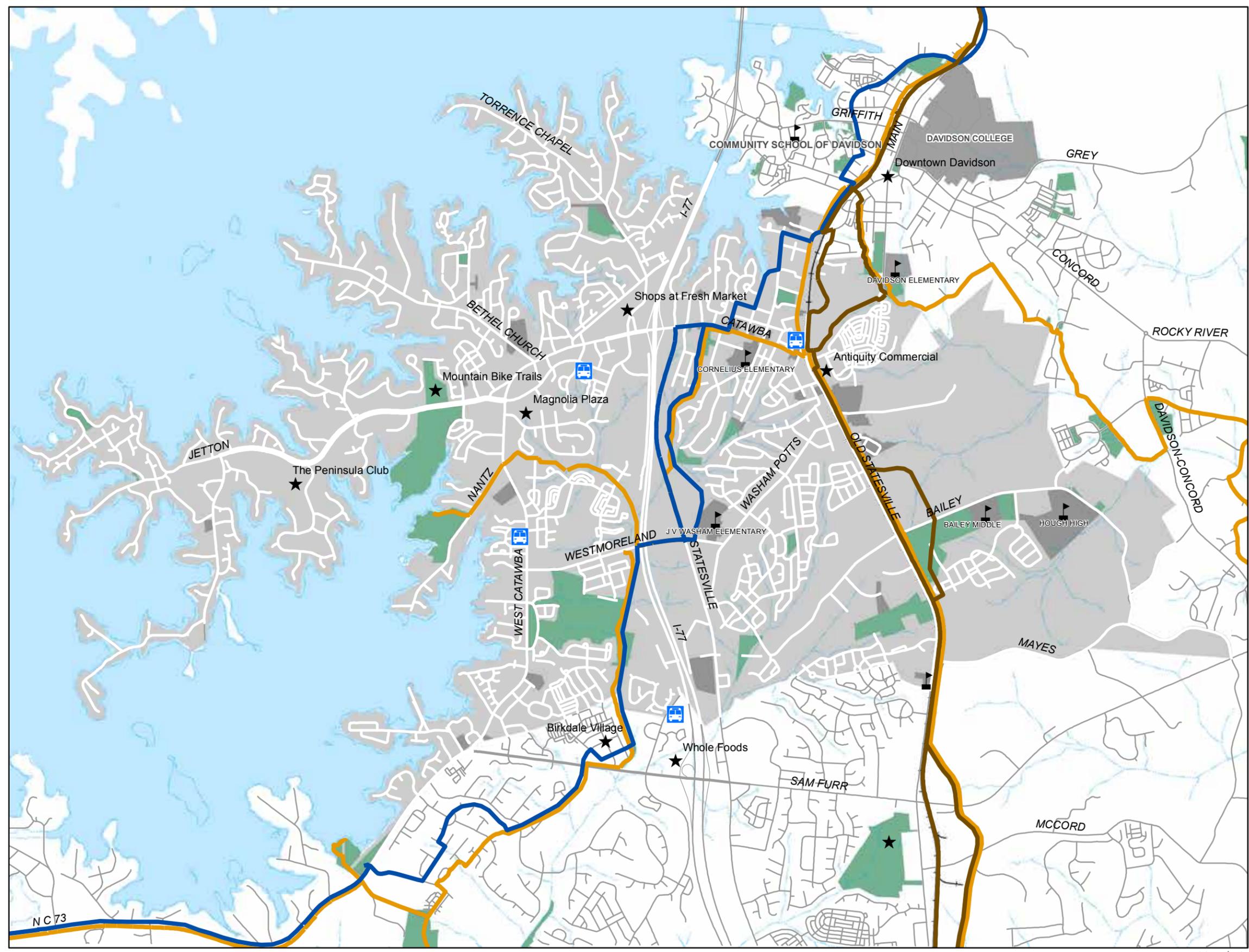


Figure 2.3. Regional Bike Routes Map

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BICYCLE CRASH DATA

In addition to existing conditions, the data inventory covered an assessment of bicycle crash data for Cornelius and the surrounding area. The following bicycle crash map (Figure 2.4) shows that there were several bicycle crashes in and around Cornelius between 2007 and 2012, including one fatality. These crashes generally occurred on arterial roads that have become popular bicycle routes but also have a high volume of motor vehicle traffic, such as Statesville Road/US Highway 21 and Catawba Avenue. Crashes along these roads demonstrate the need for new and improved bicycle facilities that provide comfortable local and regional connections for bicyclists of all skill levels.

EQUITY AND ACCESS

Access to bicycle facilities for bicyclists of all ages and abilities is especially a concern in the northeastern portion of Town, where more than 10% of residents do not have access to a vehicle and already rely on other modes for travel (see Figure 2.5 on page 31). The Town recognizes children and seniors as vulnerable populations who are in need of safe non-motorized connections to schools, businesses, services, and neighborhoods.

TRANSIT ACCESS

Cornelius is served by two transit routes, the 77X and the 97 Village Rider. All buses have bike-on-bus racks. The Town of Cornelius is also building a new park-and-ride facility on Sefton Parkway. All roadways in this plan that have transit service include recommendations for improved bicycle access.

TRANSPORTATION TO WORK

A large majority of Cornelius residents drive alone to work (77%), and very few bike (0.1%). However, in the northeast corner of Cornelius, there is a large concentration of people who bike to work. In this area, between 0.5% and 2.0% of residents commute to work by bike (See Figure 2.6 on page 32). This area of elevated bicycling levels also coincides with the area of town with the highest percentage of homes with no access to a vehicle (greater than 10%- see Figure 2.5 on page 31).

Table 2.4 Commute to Work by Travel Mode

MODE	CORNELIUS	MECK. CO.	NC
Drive alone	77.2%	77.3%	81.2%
Carpool	7.9%	10.0%	10.2%
Public Transportation	3.1%	3.4%	1.1%
Walk	0.8%	2.0%	1.8%
Bike	0.1%	0.3%	0.2%
Other	1.0%	1.1%	1.1%
Work at Home	10.0%	6.0%	4.5%

"Equity"- the 6th "E" of Bicycle Planning- suggests that bicycle facilities should be provided to accommodate the needs of all ages and abilities.



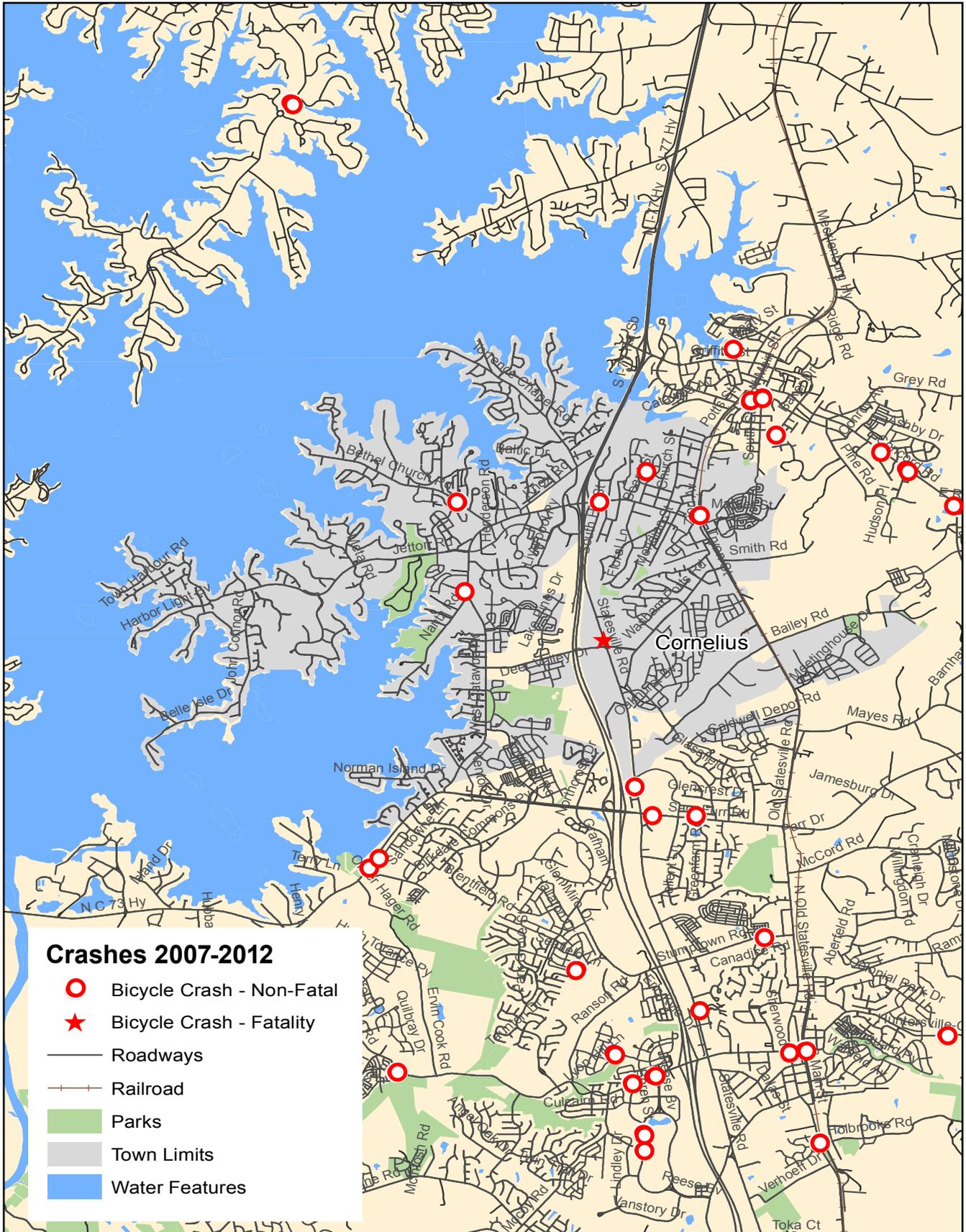


Figure 2.4 Bicycle Crash History Map

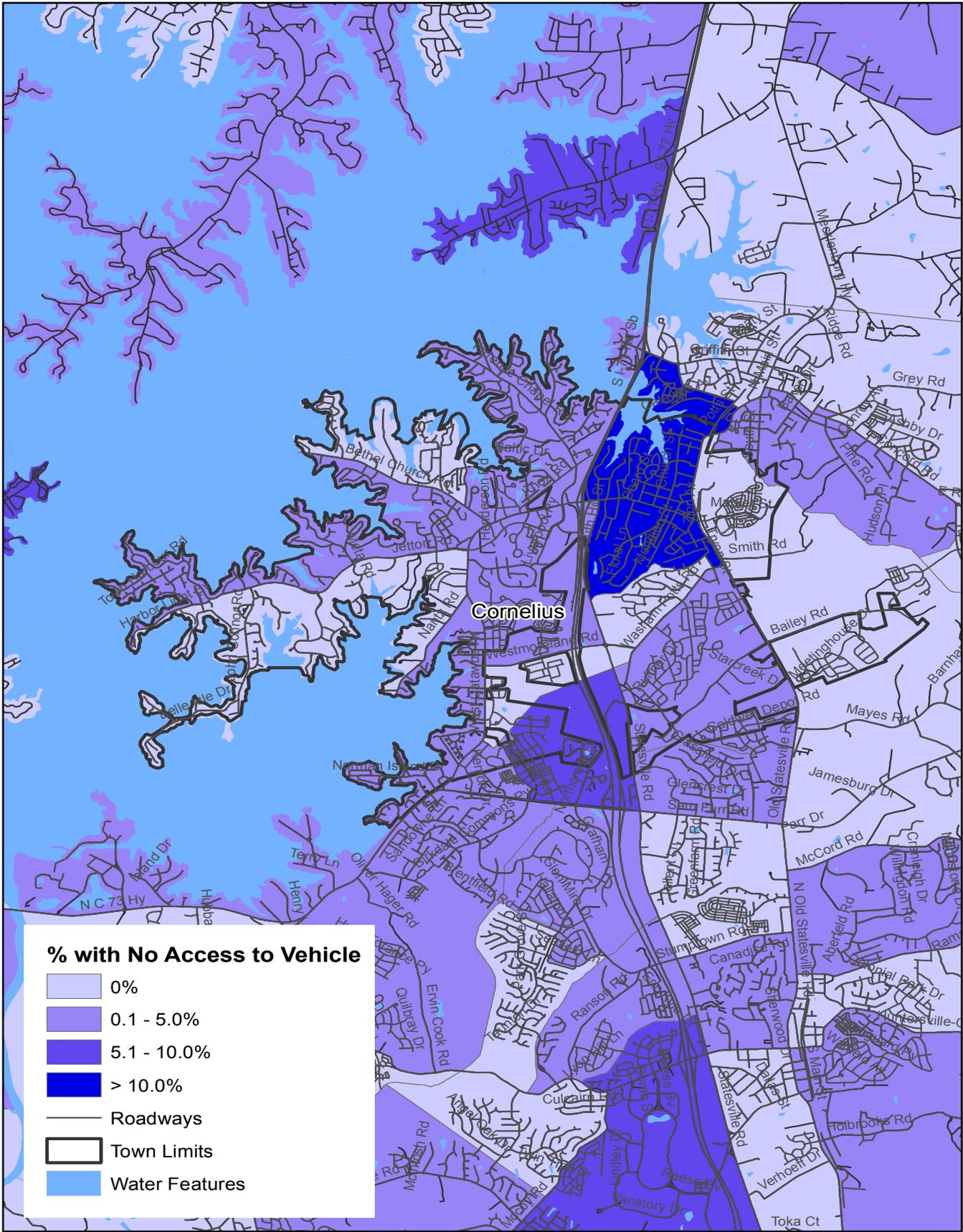


Figure 2.5 Equity Analysis- Access to Vehicle Map

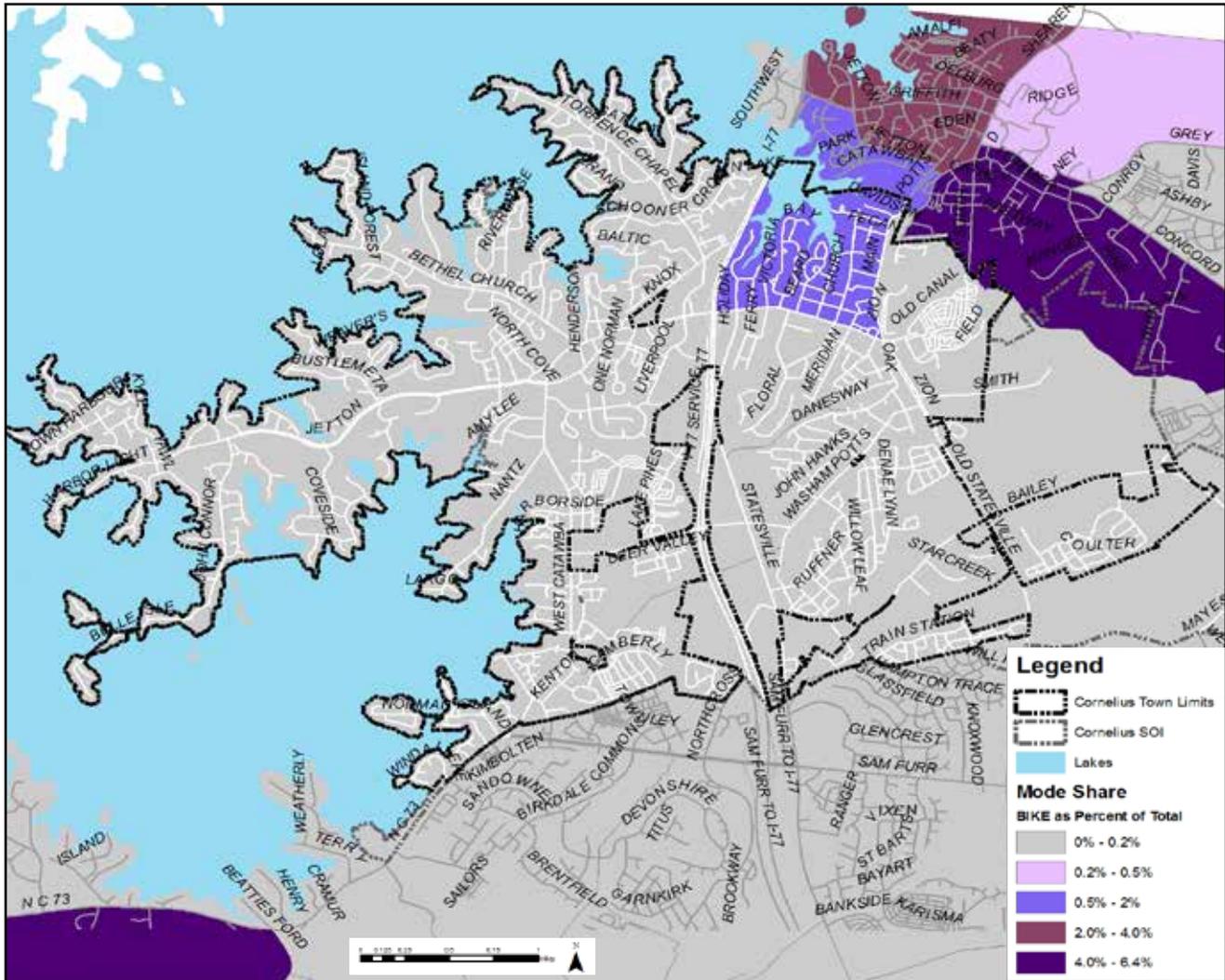


Figure 2.6 Bike Commute Mode Share

Field Investigation

The project team identified priority corridors and locations for field review throughout the town. Field work helps to identify roadway characteristics that may present opportunities or constraints for bicycle facilities - such as pavement width, shoulders, right of way, and intersections - to be inventoried and mapped. Areas targeted for field investigation are corridors and locations with:

- Key connectors between neighborhoods and retail and office destinations,
- Areas of high bicycle collisions, and
- Primary corridors for accessing destinations, such as commercial land uses, transit centers, parks, trails, and schools.

At the project kick-off meeting, the steering committee and staff identified key corridors and locations for field review. The committee identified connectivity between neighborhoods and to key destinations such as parks, schools, workplaces, and commercial centers as priorities for a future bike facility network.

Popular biking destinations are identified in Figure 2.7 on the following page. Preferred destinations include:

- The Peninsula Club
- Ramsey Creek, Robins, & Bailey Road Parks
- McDowell Creek & Rocky River Greenways
- The Home Depot
- Rubbermaid Headquarters
- Harris Teeter, Publix, Fresh Market
- the Rusty Rudder, Fork Restaurant, & McAlister's Deli
- Downtown Cornelius and Davidson
- YMCA
- Bailey Middle and Hough High Schools
- Birkdale Village

A summary of key issues and opportunities for the bicycling environment in Cornelius are detailed in the text and images on the subsequent pages.

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Overcoming barriers to connectivity, such as Interstate 77, are crucial to the success of the Plan.



Low-volume streets have unrealized potential as low stress bike routes.

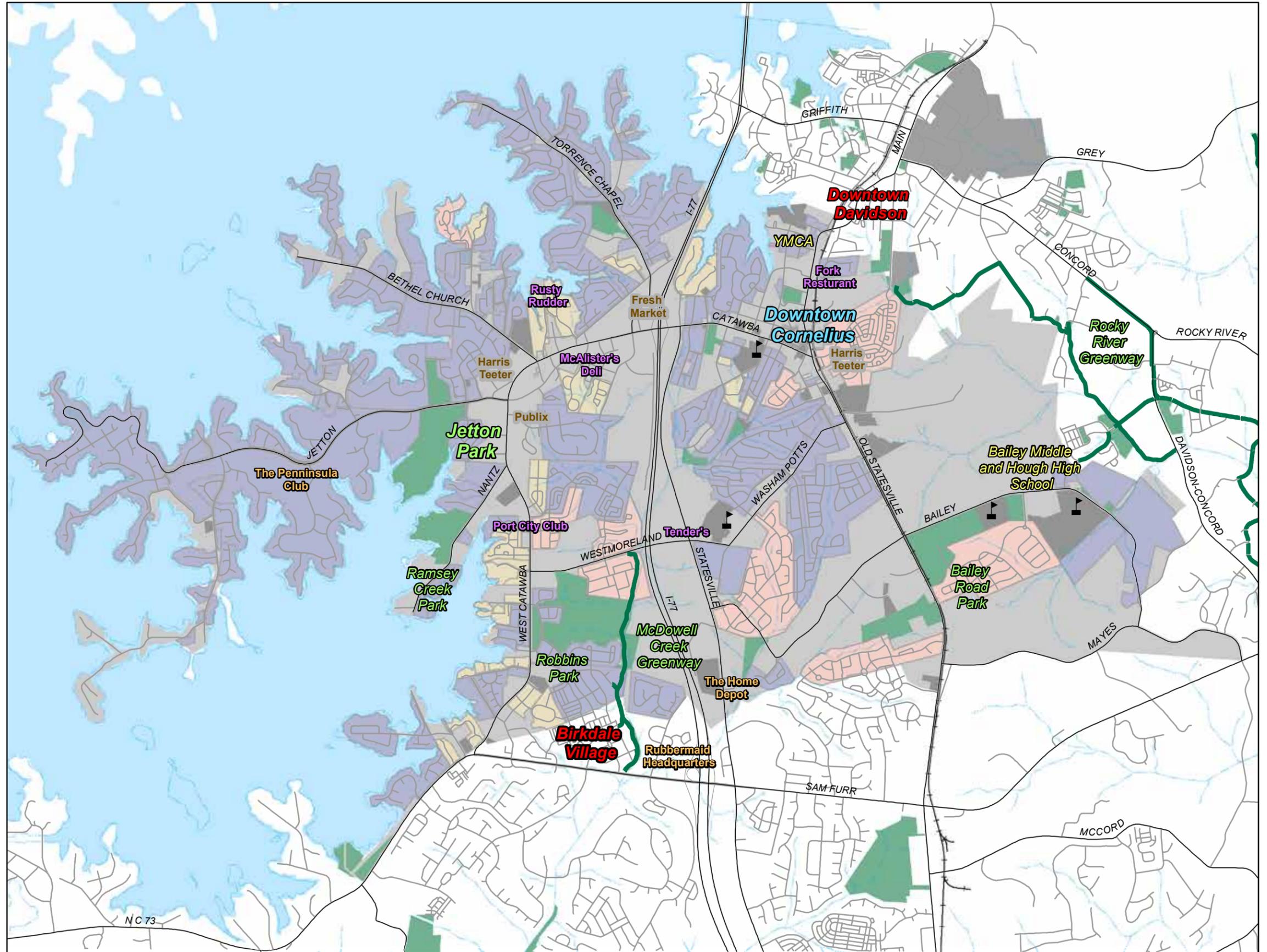
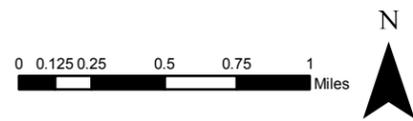
Bike!Cornelius

Cornelius, NC Bicycle Master Plan Preferred Destinations by Bicycle

-  Schools
-  Existing Greenways
-  Creeks and Streams
-  Multi-Family Subdivision
-  Mixed Residential Subdivision
-  Single Family Subdivision
-  Railroads
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI

BICYCLING DESTINATIONS

Bicyclists in Cornelius are most interested in accessing downtown, retail, and parks and recreation facilities by bike. The most popular destinations for bicyclists are downtown Cornelius and downtown Davidson, Birkdale Village, and Jetton Park.



OPPORTUNITIES & CONSTRAINTS



Investments in Bike Lanes and Trails. The Town and local developers have laid the foundation for a complete bike network with the construction of bike facilities and multi-use paths along key corridors, including E. Catawba Avenue (bike lanes), Westmoreland Road (sidepath and bike lanes), Bailey Road (sidepath), and a number of other corridors with partially completed facilities (see below). The Town currently has 2.3 miles of bike lanes.



The Town is Developing a Robust Greenway Network. Cornelius has 3.0 miles of existing greenways and multi-use paths and four new greenway projects that are in design totaling another 5 miles. See Table 3.8 on page 84 for more details.



Major Regional Bike Routes and Trails Cross Cornelius. Including NCDOT's Lake Norman Bike Route, the proposed Mooresville to Charlotte Trail, and key corridors of the Carolina Thread Trail. These provide connections to neighboring communities and the region.



Incomplete Bike Lanes. Cornelius has a number of streets where bike lanes have been built on one side only or where sections of bike lanes have been constructed, but not completed for the entire distance. While the community has been proactive in getting such facilities built through development/redevelopment, it has left prominent gaps in the bike facility network.

Key examples:

- Westmoreland Road
- Torrence Chapel Road
- Knox Road



Key Corridors lack Bike Accommodations.

Most of the major roadways lack formal bicycle facilities. Key corridors that lack bike facilities or shoulders include:

- West Catawba Ave.
- Jetton Rd.
- Jetton Rd. extension/ Sefton Park Rd.
- NC 115/ Main Street
- US 21
- Bailey Rd.
- Liverpool Parkway
- Washam Potts Rd.



Roadways with higher than needed speed limits

When speed limits are higher than necessary, motorists tend to drive faster than they ought to, creating the sense that other modes of transportation are unsafe and unwelcome along these corridors. Such roadways include Jetton Rd. and Bailey Rd.



7

Potential Retrofit Connections Available. Connectivity between neighborhoods and to destinations can be increased by creating connections at key points throughout the Town. These connections can dramatically reduce the distance required for biking to key destinations and thus make biking a more viable option to get around town. Examples include:

- Gem St. to Kimbrough Lane,
- Meridian St. to Danesway Lane
- I-77 service road to Westmoreland neighborhood
- Millard St. to Pine Ridge Dr.



8

Low Stress Bike Routes and Bike Boulevards.

There are a number of roads with low traffic volumes and speed limits that offer low-stress environments for biking. Minimal investment is needed to identify these routes with signage so they can be accessed by bicyclists of all ages and abilities.



9

Connections to Davidson are Difficult. Potts St. and the Railroad Bridge at 115 present challenges with physical constraints and very high traffic volumes. Connections through the Antiquity neighborhood are a great option.



10

Opportunities to Reconfigure Key Corridors.

Jetton and W. Catawba are potential roadway corridors that could be studied for reconfiguration to provide new bike facilities through re-striping projects.

Planning and Policy Review

The bicycling environment in the Town of Cornelius is impacted by existing codes, ordinances, and long-range planning efforts. This section provides a summary of bicycle planning-related efforts, as well as bicycling-related elements of the town’s Land Development Code and Municipal Code of Ordinances. Where quotations are used, the code is referenced verbatim.

The plans and documents reviewed are listed in Table 2.4. The following page provides brief summary of bicycle planning-related efforts and the full review of planning documents. The background document review included an assessment of bicycle-related planning documents.

Table 2.5 Previous Plans and Documents Related to Bicycle Planning

DOCUMENT NAME	AGENCY	YEAR
Comprehensive Parks and Greenways Master Plan	Town of Cornelius	2015
Mooresville-Charlotte Trail Technical Report	Mecklenburg County	2013
Comprehensive Pedestrian Plan	Town of Cornelius	2012
Lake Norman Regional Bicycle Plan	Centralina Council of Governments, NCDOT	2010
Mecklenburg County Carolina Thread Trail Master Plan for Mecklenburg County Communities	Mecklenburg County	2009
Centennial Transportation Plan	Town of Cornelius	2006
Parks and Recreation Comprehensive Master Plan	Town of Cornelius	2005

A survey done as part of the Cornelius Comprehensive Parks and Greenways Master Plan found that nearly **60% of respondents see a need for more greenways, bike facilities, and trails** in Cornelius.

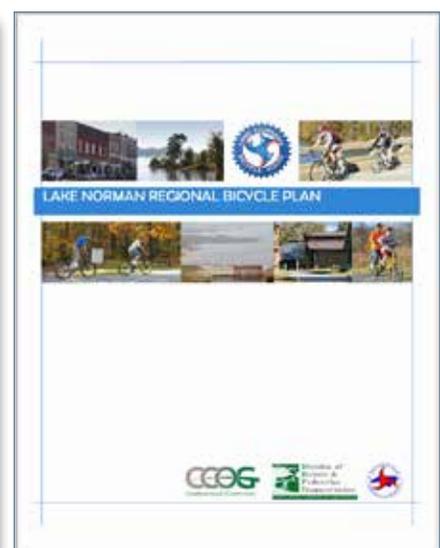
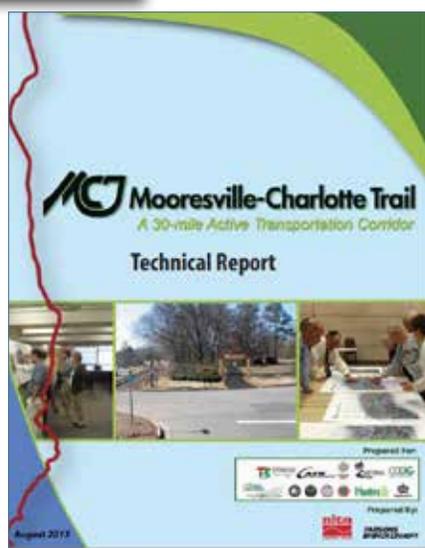
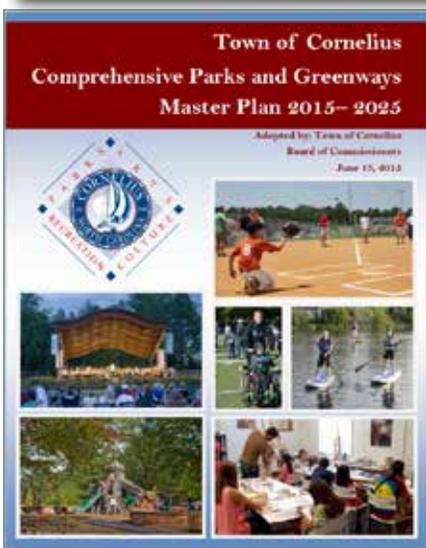
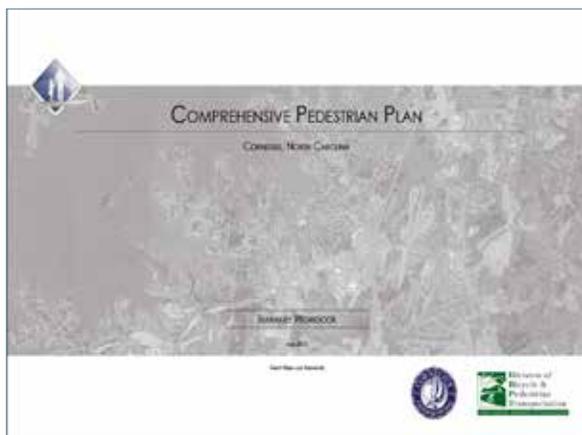
SUMMARY OF RECENT BICYCLE-RELATED PLANNING EFFORTS

The Town began the development of a comprehensive plan in March 2010. Entitled “Navigate Cornelius”, the plan includes theme committees intended to address the following topics:

- Economic Development
- Place Making and Town Services
- Mobility
- Community Service
- Leisure and Commerce

A recipient of a Carolina Thread Trail planning grant, Mecklenburg County adopted the Carolina Thread Trail Master Plan for Mecklenburg County Communities in 2009. The Town of Cornelius was part of the Carolina Thread Trail Steering Committee that supervised the planning process. The Carolina Thread Trail Master Plan includes 265 miles of existing and potential trails in Mecklenburg County, and several miles of trails in Cornelius, to create a comprehensive trail network across Mecklenburg County.

The Town also completed its Pedestrian Transportation Plan in 2012 and its Comprehensive Parks and Greenways Master Plan in 2015, both of which included recommendations for various greenway projects.



EXAMPLES OF LOCAL PLANNING DOCUMENTS REVIEWED FOR THIS PLAN:

SUMMARY OF LOCAL ORDINANCES

TOWN OF CORNELIUS LAND DEVELOPMENT CODE

The Town of Cornelius adopted the land development code in July 2003 and has updated the document since then. This code supports the Town’s Comprehensive Land Use Plan by encouraging the development of a network of sidewalks and bicycle lanes that provide an attractive and safe mode of travel for pedestrians and cyclists. The Town of Cornelius was one of the first communities to adopt a New Urbanist zoning ordinance that stresses the importance of walkable, bikeable, and sustainable communities. Below are some excerpts from the land development code related to bicycle-friendly development:

SECTION 7.1 GENERAL STREET DESIGN PRINCIPLES

The *Land Development Code* encourages the development of a network of interconnecting streets that work to disperse traffic while connecting and integrating neighborhoods with the existing urban fabric of the Town. Equally as important, the *Land Development Code* encourages the development of a network of sidewalks and bicycle lanes that provide an attractive and safe mode of travel for cyclists and pedestrians. In addition to dispersing traffic, interconnecting street networks encourage alternate modes of transportation to the automobile, enhance transit service opportunities, improve traffic safety through promoting slower speeds, and potentially reduce vehicle miles traveled within the street network. The overall network function, and the comfort and safety of multi-modal or “shared” streets to slow and disperse traffic are primary to vehicular efficiency.

It is the intent of this ordinance to build streets that are integral components of community design. Streets shall be detailed to compliment neighborhoods and commercial centers and shall be pedestrian in scale. Street materials shall conform to the provisions of the Town of Cornelius Transportation Plan and *Charlotte-Mecklenburg Land Development Standards Manual*. Exceptions may be made for pedestrian crosswalks. Sidewalk material may vary according to the overall design and character of the development. Streets are encouraged to be designed with onstreet parking. All streets shall be landscaped. In an effort to protect this investment, the Town views streets as the most important public space and therefore has developed a set of principles which permit this space to be used by both cars and people.

- Streets shall interconnect within a development and with adjoining development. Cul-de-sacs are permitted only where topographic conditions and/or exterior lot line configurations offer no practical alternatives for connection or through traffic. Street stubs should be provided with development adjacent to open land to provide for future connections. Streets shall be planned with due regard to the designated corridors shown on the Land Development Plan.

- Streets shall be designed as the main public space of the Town and shall be scaled to the pedestrian.
- Streets are designed to be only as wide as necessary to accommodate the vehicular mix serving adjacent land uses, while providing adequate access.

SECTION 7.2 STREET ENGINEERING AND DESIGN SPECIFICATIONS

Street designs shall permit the comfortable use of the street by cars, bicyclists, and pedestrians. Pavement widths, design speeds, and the number of vehicle lanes should be minimized without compromising safety. The specific design of any given street must consider the building types which front on the street and the relationship of the street to the Town's street network. New development with frontages on existing publicly maintained streets shall be required to upgrade all their frontages to meet the standards of this Section. The following specifications shall apply to street design:

4. BIKE PATHS

Bike lanes a minimum of 5 ft in width shall be installed by all development with frontage along the following streets: Catawba Avenue (West and East), Highway 115 (Main Street), Washam-Potts Road, Westmoreland Road, Torrence Chapel Road, Bethel Church Road, Jetton Road, and Nantz Road.

SECTION 7.4.M OFF STREET PARKING AREA DESIGN SPECIFICATIONS

Bicycle parking is encouraged for uses within the VC, TC, and NMX districts and all civic uses. Bicycle racks shall be located on the side or rear yards provided they do not block pedestrian access.

SECTION 13.1.H GENERAL PROVISIONS

Incorporate bike paths and pedestrian paths, which are designed to connect with similar planned or existing local or regional facilities as shown on official plans and maps of the Town of Cornelius, neighboring municipalities, or Mecklenburg County. Streets, pedestrian paths and bike paths shall contribute to a system of fully connected routes to all destinations. Designs shall encourage pedestrian and bicycle use by being spatially defined by buildings, trees, and lighting, and by discouraging high-speed traffic.

Public Outreach

Public outreach is essential to developing a town wide bicycle plan that addresses the needs of community members. This section provides an analysis of public input acquired through two public workshops, a public planning workshop (charrette), a public comment form, booths at community events, and the project website to identify issues and priorities related to bicycling in the Town of Cornelius. Invaluable input was provided during the planning charrette through the participation of members of Cornelius’s Parks, Arts, Recreation & Culture (PARC) Department and the PARC Commission, Mecklenburg County Safe Routes to School, North Carolina Active Routes to School, Cornelius Public Works Department, Cornelius Police Department North Carolina Department of Transportation (NCDOT), and the Charlotte Regional Transportation Planning Organization (CRTPO). The Plan is also informed by input garnered through stakeholder interviews, such as with Town staff, NCDOT staff, the local bicycle shop, and the Project Steering Committee.



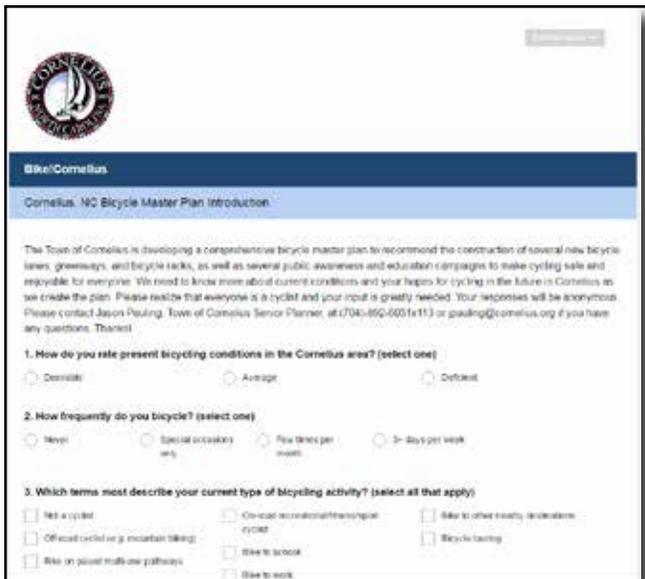
Above: Residents share ideas with the project team at the focus group and public meetings.

PUBLIC SURVEY

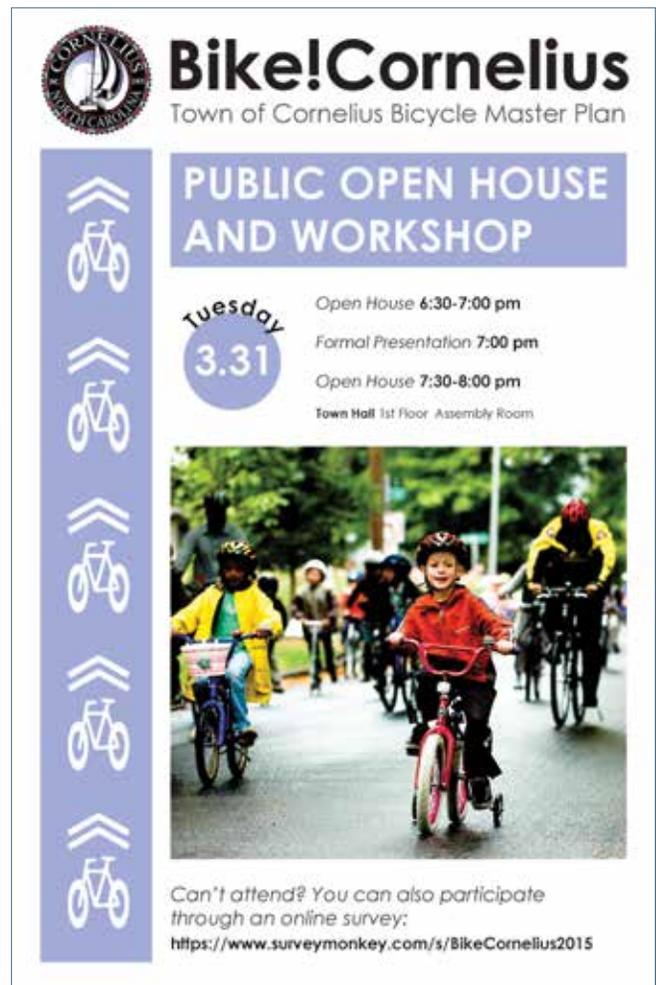
A public survey to gather information related to the Cornelius Bicycle Master Plan was available from March 2015 through May 2015. Cornelius residents submitted a total of 420 completed surveys. A summary of the results are discussed below.

KEY FINDINGS

- There is **significant demand and support for more bike facilities**, both on-street and off.
- There are many interested and enthusiastic bicyclists in Cornelius, but **most people (70%) find the bicycling facilities to be deficient**.
- Education for bicyclists, both children and adults, as well as education for motorists, about bicycle safety, are high priorities
- There is a **strong desire for maps and wayfinding signage** to facilitate safe biking



Snapshot of the online public survey used to obtain information on existing conditions in Cornelius at the onset of the Plan.



Above right: Flyer for the public input meeting held by the project team in March 2015 to collect input.

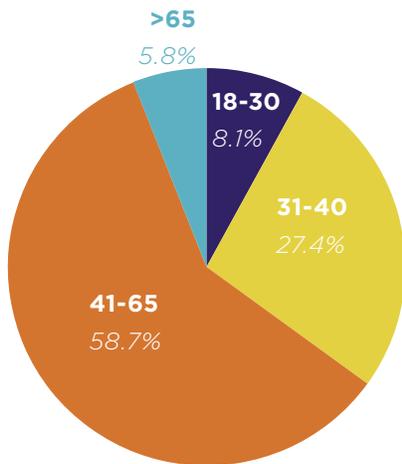
RESPONDENT CHARACTERISTICS

Of the 420 survey respondents

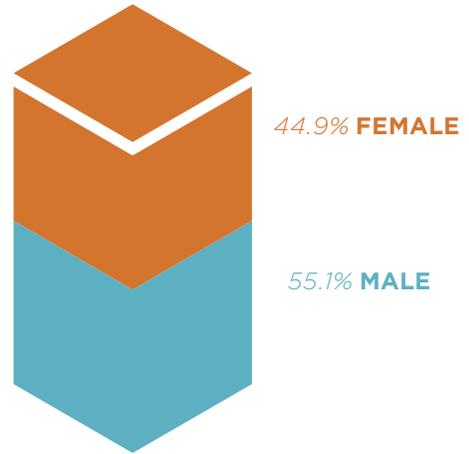
- 55% identify as male
- 71% live and/or work in the town
- 21% live in the neighboring towns of Davidson and Huntersville
- 99% have at least one bicycle in their household

The age break down of respondents is depicted below. Compared to the 2010 U.S. Census breakdown of ages in Cornelius, this represents an over-representation of residents aged 31 to 40 years and an under-representation of residents 41 years and over.

AGE OF SURVEY RESPONDENTS



GENDER OF SURVEY RESPONDENTS



Below: A poster from a public workshop records bicyclists' self-identified skill level. Participants mostly identified as "Enthusied and Confident" and "Interested but Concerned." They identified the same two categories of bicyclist types as the type of bicyclist for which the Town of Cornelius should plan facilities.

TYPES OF BICYCLISTS

Highly Experienced (approximately 1% of population)
Characterized by 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 shared-use paths.

Enthusied and Confident (approximately 10% of population)
This user group encompasses 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 levels of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.

Interested but Concerned (approximately 30% 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.

No Way, No How (approximately 50% 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 not ride a bicycle under any circumstances.

	WHICH TYPE OF BICYCLIST ARE YOU?	WHICH TYPE SHOULD THE TOWN PLAN FOR?
Highly Experienced	1 dot	0 dots
Enthusied and Confident	7 dots	6 dots
Interested but Concerned	5 dots	7 dots
No Way, No How	0 dots	0 dots

TYPES OF BICYCLISTS AND BICYCLING

Information provided by the survey respondents provides a general overview of bicyclists in the Cornelius community. Survey respondents identified their type based on the typology of bicyclists described in the Chapter 6 Design Guide. The typical distribution of bicyclist types is depicted below on the right; the distribution of Cornelius survey respondents is on the left.

Distribution of Bicyclist Types in Cornelius



Strong and Fearless



Enthusied and Confident



Interested but Concerned



No Way, No How



Typical Distribution of Bicyclist Types



Most of the respondents are uncomfortable bicycling in Cornelius, with 43% reporting feeling intimidated, and another 52% cautious, leaving less than 5% reported being comfortable cycling on Cornelius’s roads and streets.

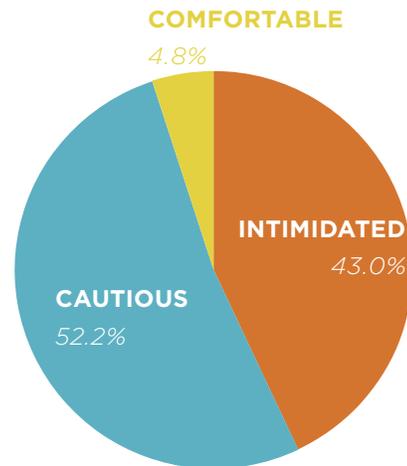
Respondents to the public comment form identify their current type of bicycling activity as mostly on-road recreational bicycling (65%) and biking on paved multi-use paths (58%).

The respondents’ frequency of bicycling varied significantly:

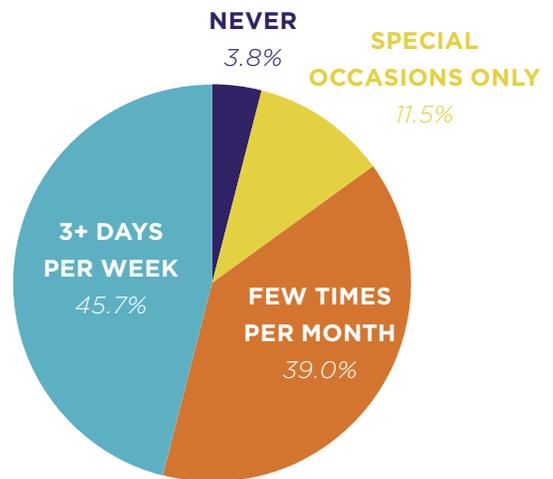
- 40% bike a few times per month,
- 45% bike a few times per week,
- 11% bike only for special occasions, and
- 4% of respondents do not bike at all.

The majority of respondents find the bicycling conditions in Cornelius to be deficient, and **would like to see the Cornelius bicycle network be designed for those “interested and concerned” bicyclists**, who typically only ride a bicycle on low-traffic streets or multi-use trails under favorable weather conditions.

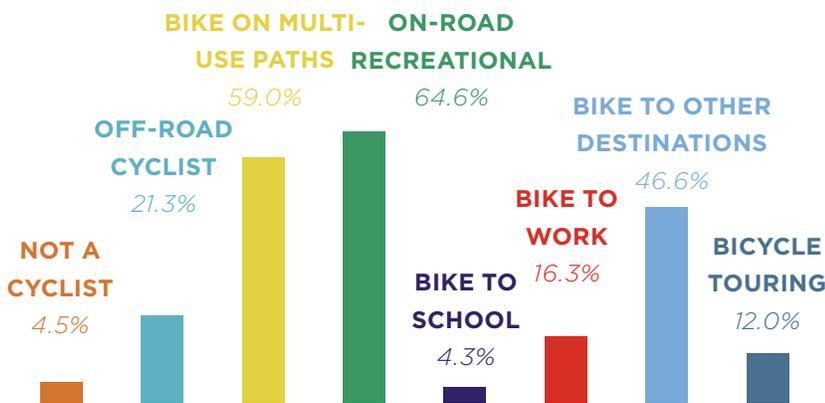
LEVEL OF COMFORT CYCLING IN CORNELIUS



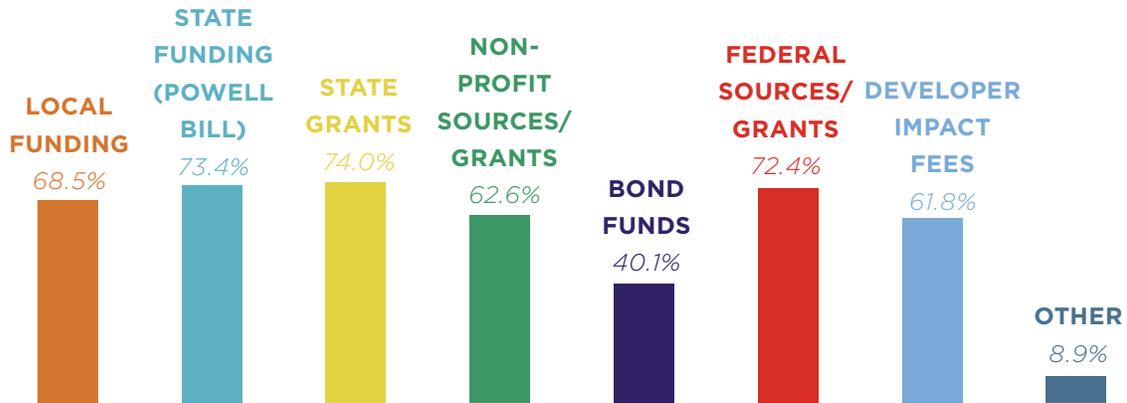
FREQUENCY OF BICYCLING



CURRENT TYPE OF BICYCLING ACTIVITY



PREFERRED FUNDING SOURCES FOR BICYCLE FACILITY IMPROVEMENTS



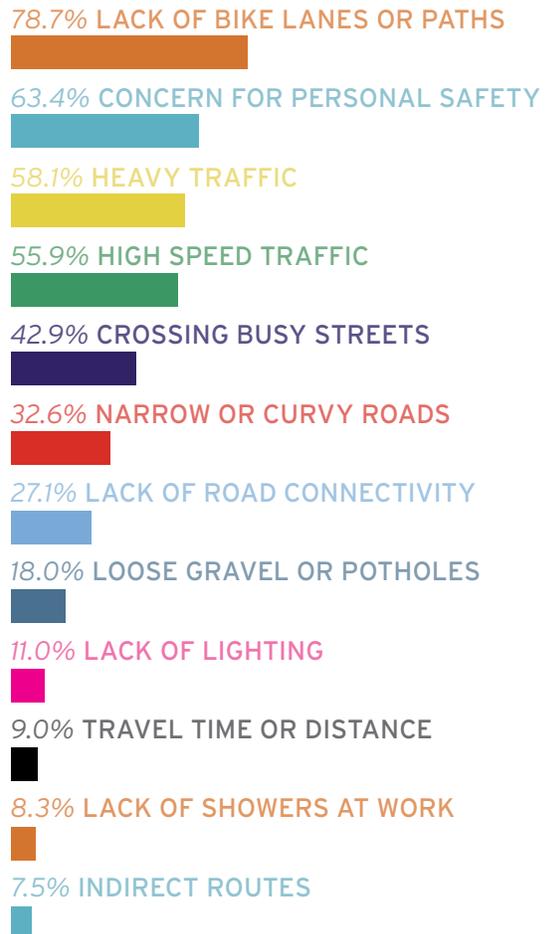
BICYCLING INVESTMENTS

A variety of funding sources are favored by respondents to the public survey. Over 70 percent suggest using state and federal funding or grants.

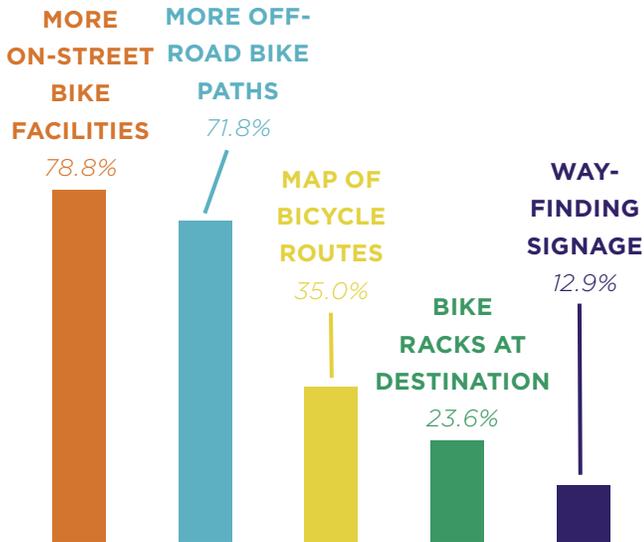
BICYCLING PREFERENCES

Graphs shown to the right and following pages identify existing issues related to bicycling in Cornelius and preferences for targeted improvements. Respondents identified a lack of bicycle facilities and inconsiderate motorists and traffic hazards (high speed and heavy traffic, crossing busy roads, etc) as primary concerns. Development of sidepaths, greenways, and designated bicycle lanes are the most popular approaches to improving the bicycling environment.

PHYSICAL FACTORS PREVENTING CORNELIUS RESIDENTS FROM BICYCLING MORE OFTEN

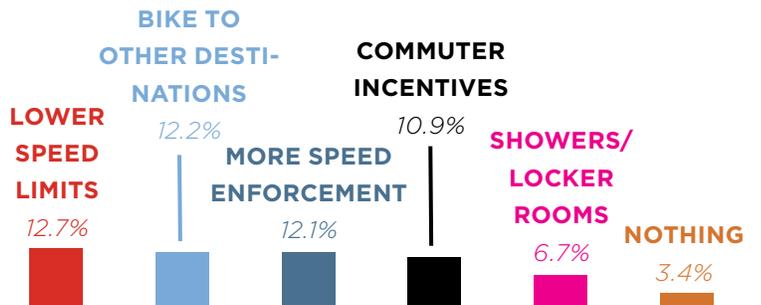


PHYSICAL CHANGES THAT WOULD ENCOURAGE MORE FREQUENT BIKING



BICYCLING PREFERENCES, CONTINUED

Over 70 percent of respondents to the public online survey indicated they would bicycle more often if there were more on-street (e.g., bike lanes) and off-street (e.g., bike paths and greenways) facilities. Over one-third of respondents also said having maps of bike routes would encourage them to bike more often.



Below: A poster from a public workshop records participants responses to the question, "What types of bike infrastructure would you most like to see in Cornelius?" Participants favored shared-use side paths along roadways, buffered bicycle lanes, and trails and greenways (full tally is recorded in chart below).

BICYCLE INFRASTRUCTURE Bike!Cornelius Master Plan

What types of bike infrastructure would you most like to see in Cornelius? (vote with 4 stickers)

<p>CYCLE TRACKS</p> <p>A cycle track is an exclusive bicycle facility physically separated from traffic, and distinct from the sidewalk.</p> <p>4 stickers</p>	<p>TRAILS AND GREENWAYS</p> <p>10 stickers</p>
<p>BICYCLE LANES</p> <p>4 stickers</p>	<p>SHARED-USE SIDE PATHS ALONG ROADWAYS</p> <p>12 stickers</p>
<p>BUFFERED BICYCLE LANES</p> <p>8 stickers</p>	<p>RAISED MEDIANS/CROSSING ISLANDS</p> <p>5 stickers</p>
<p>SHARED LANE MARKINGS (SHARROWS)</p> <p>1 sticker</p>	<p>BICYCLE-FRIENDLY INTERSECTIONS</p> <p>5 stickers</p>
<p>PAVED SHOULDERS</p> <p>2 stickers</p>	<p>BICYCLE BOULEVARDS</p> <p>Bicycle boulevards are streets with low traffic volumes and speeds, designated and designed to give priority to bicycle travel.</p> <p>2 stickers</p>

BIicycle Education Programs & Policies

Respondents also identified preferences for additional education and encouragement programs in Cornelius. The top four choices are:

- Safe Routes to School programs for students,
- Motorist education about safely sharing the road,
- Wayfinding signage and maps, and
- Adult bicyclist education.

PRIORITY Bicycle Programs & Policies

54.7% SRTS PROGRAMS



50.1% EDUCATION FOR MOTORISTS



34.1% WAYFINDING/MAPS/SIGNAGE



31.2% EDUCATION FOR CYCLISTS



28.9% MORE ORGANIZED BIKE RIDES



28.6% MORE POLICE ENFORCEMENT OF DRIVERS



26.1% KIDS BICYCLE SAFETY EVENTS



6.9% OTHER



Below: A poster from a public workshop records residents' responses to the question, "What would you most like to see in Cornelius?" Respondents noted a preference for Bicycle Friendly Community and Safe/Active Routes to School programming (full tally is recorded in chart below)

BIicycle Programs

Bike!Cornelius Master Plan



What would you most like to see in Cornelius? (vote with 3 stickers)

WAYFINDING SIGNAGE PROGRAM



PERMANENT BICYCLE ADVISORY COMMITTEE

The town should establish a permanent bicycle advisory committee, supported by town council. The responsibilities of the committee could include providing input and support to the town council on bicycle-related projects and programs, the town of Cornelius could create a bicycle advisory committee to provide input and support to the town council on bicycle-related projects and programs.



BIKE-FRIENDLY COMMUNITY (BFC)

The BFC program will be a program for the town of Cornelius that will be a national program developed to encourage towns and cities across the U.S. to create more bike-friendly communities. The program will be a national program developed to encourage towns and cities across the U.S. to create more bike-friendly communities.



EDUCATE MOTORISTS, CYCLISTS, AND PEDESTRIANS

A multi-pronged approach will be used to educate all road users about their rights and responsibilities to increase awareness and improve safety. This will be done through a combination of in-person and online education, signage, and other outreach efforts.



INCREASE NUMBER OF KIDS ON BIKES

To help increase the number of kids on bikes, the town should encourage schools to partner with parents to organize bike rides for the children and provide them with the necessary equipment and support.



OPEN STREET EVENTS/CICLOVIAS



FAMILY BIKING PROGRAMS

The town should create family biking programs that will be designed to provide a safe and fun environment for families to enjoy biking together.

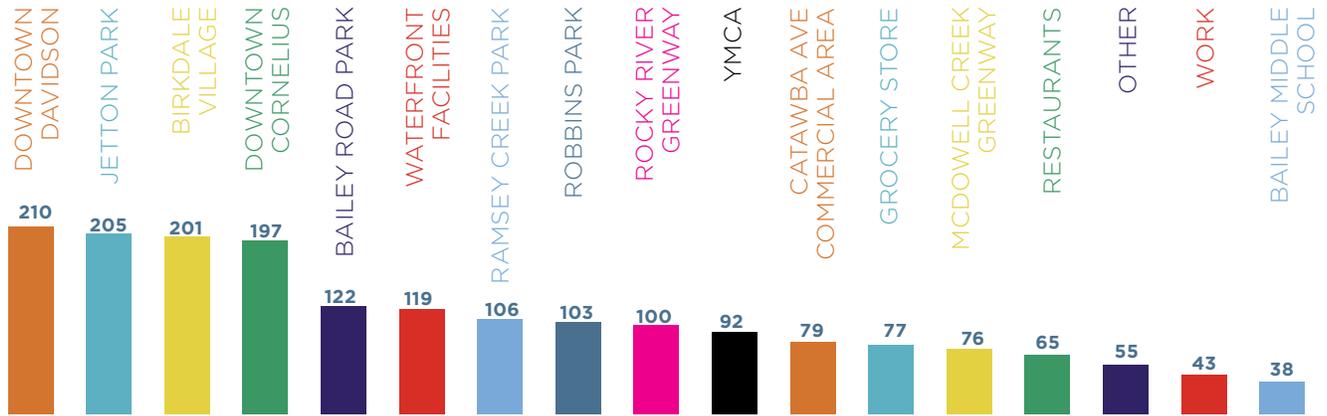


SAFE/ACTIVE ROUTES TO SCHOOL

The town should create safe and active routes to school that will be designed to provide a safe and fun environment for students to enjoy biking to school.



PREFERRED DESTINATIONS BY BICYCLE OR TRAIL (NUMBERS INDICATE TALLIED VOTES)



BICYCLING DESTINATIONS

Bicyclists in Cornelius are most interested in accessing downtown, retail, and parks and recreation facilities by bike. The most popular destinations for bicyclists are downtown Cornelius and downtown Davidson, Birkdale Village, and Jetton Park.

ROADS THAT NEED BICYCLE IMPROVEMENTS (TALLIES REFLECT # OF RESPONSES):



INTERSECTIONS THAT NEED BICYCLE IMPROVEMENTS (SIZE OF TEXT REFLECTS RELATIVE # OF RESPONSES):

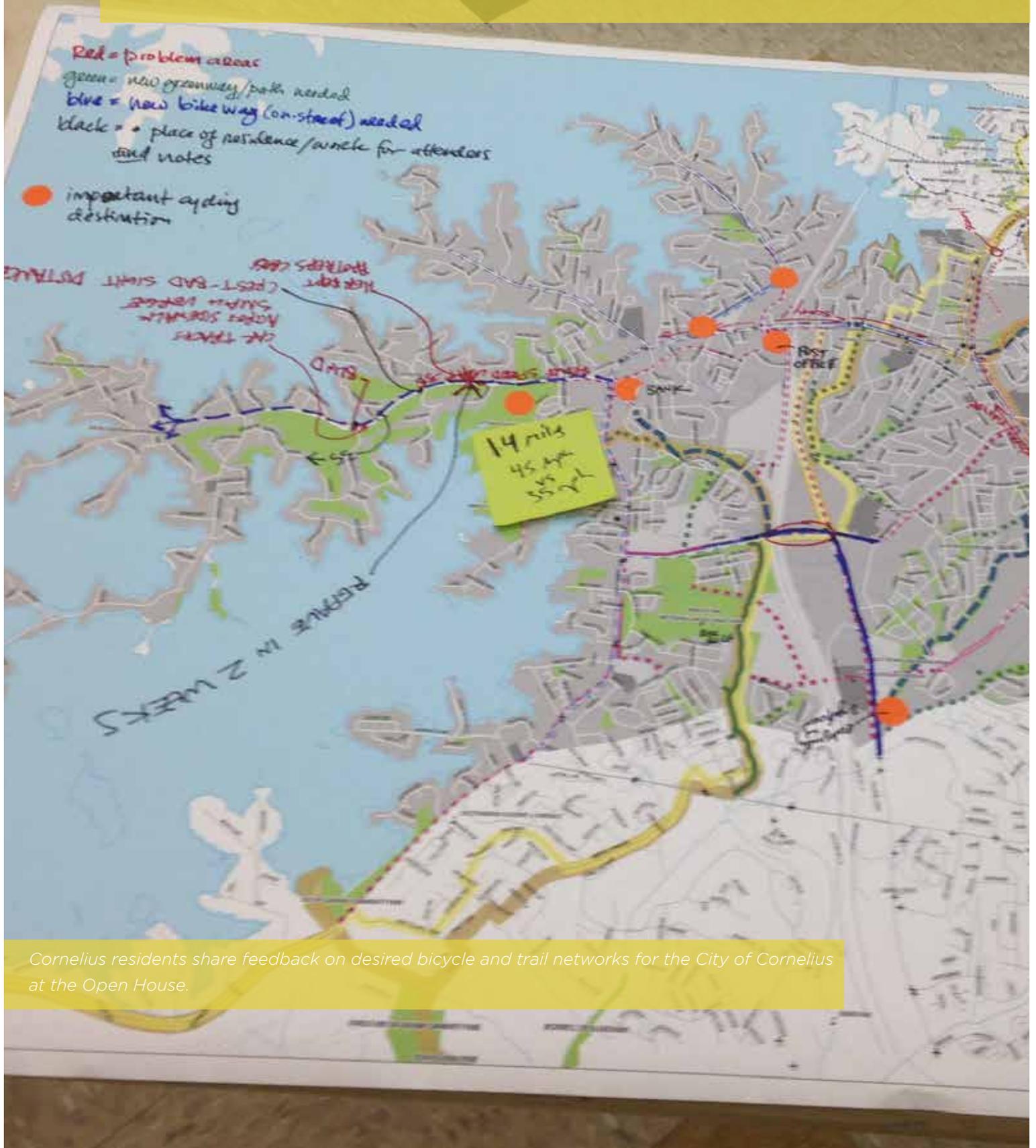


Conclusion

This section offers key findings of the bicycling environment in Cornelius. Examining the conditions of the existing bicycle infrastructure and the nature of existing policies, programs and planning documents is a critical first step prior to proposing a comprehensive bicycle network. In terms of infrastructure, the area's geographic characteristics, existing roadway configurations, and existing bicycle facilities significantly affect bicycle transportation and the everyday decisions by bicyclists and motorists. Non-infrastructure elements, such as education and encouragement for bicyclists and motorists and local policies, also affect bicycling activity and daily transportation decisions.



An iterative design and mapping process allowed the public, key stakeholders, and the design team opportunities to evaluate existing conditions and test feasibility of proposed recommendations.



Cornelius residents share feedback on desired bicycle and trail networks for the City of Cornelius at the Open House.

III. NETWORK RECOMMENDATIONS

Planning of the automobile city focuses on saving time. Planning for the accessible city, on the other hand, focuses on time well spent.

-- Robert Cervero, Chair of City & Regional Planning, UC Berkeley

Introduction

This chapter presents proposed bike facilities and bicycle support facilities identified through input from the community, the Plan Advisory Committee, and the needs analysis. The proposed improvements are intended to **make bicycling more comfortable and accessible for bicyclists of all skill levels and trip purposes**. Bicyclists have the same rights and responsibilities as motorists and are allowed to ride on all roads in Cornelius. Modifications to roadways in Cornelius, as well as the addition of off-street pathways, will make bicycling a safer and more viable form of transportation.

Overview of Planning Process

A variety of on and off-street bicycle facilities are recommended due to 1) the range of abilities and comfort levels of bicyclists; 2) the range of conditions for bicycling on different roadway environments; and 3) local preferences identified through the public input process. This section presents an overview of these facility types in order to orient the reader to the network recommendations presented in the following sections. More detailed information of the design of the bicycle facilities presented in this section can be found in the Design Guidelines presented in Appendix B.

The recommended bicycle network is made up of the following core types of facilities:

Table 3.1 Types of Bike Facilities and Corresponding Estimated Cost per Mile (in 2012 \$)

ON-ROAD FACILITIES	COST PER MILE*
Cycle Tracks	unavailable
Buffered Bicycle Lanes	\$133,170
Bicycle Lanes	\$133,170
Paved Shoulders	\$200,000**
Low Stress Bike Routes	\$25,070
Shared Lane Markings	\$6,300
Signed Bicycle Routes	\$25,070
OFF-ROAD FACILITIES	
Multi-use Paths (also known as greenways and shared use paths)	\$600,000
Sidepaths	\$600,000

*The source for the above costs is the 2013 report, "Costs for Pedestrian and Bicyclist Infrastructure Improvements" by the UNC Highway Safety Research Center (HSRC), prepared for the Federal Highway Administration.

** For paved shoulder improvements, narrowing roadway lane widths can lower project costs by lowering the amount of additional pavement space needed. This should be evaluated in project design on a case-by-case basis.

It is important to note that costs for bicycle and pedestrian infrastructure vary greatly from city to city and site to site. The cost information above should be used only for estimating purposes and not necessarily for determining actual bid prices for a specific infrastructure project.

The recommended strategies for implementing the proposed facilities include road widening, lane narrowing, lane reconfiguration, parking reduction, adding markings/signage, and new construction. These strategies are discussed in further detail on the following pages. In addition, strategic speed limit reductions and intersection improvements would add to overall bicycle and pedestrian safety and comfort throughout the City.

Bicycle Facility Types

ON-ROAD BICYCLE FACILITIES

On-road bike facility types are used typically on arterial, collector, and sub-collector roadways where motor vehicle traffic volumes or speeds are relatively high. These facility types are ordered hierarchically from greatest degree of bicycle/motor vehicle separation to lowest in the following sections. In general, higher order facilities are preferable on higher-order roadways streets and vice versa.

CYCLE TRACK



A cycle track is an exclusive bike facility that combines the user experience of a separated path 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. In situations where on-street parking is allowed, cycle tracks are located to the curb-side of the parking (in contrast to bike lanes).

Cycle tracks may be one-way or two-way, and may be at street level, sidewalk level or at an intermediate level. If at sidewalk level, a curb or median separates them from motor traffic, while different pavement color/texture separates the cycle track from the sidewalk. If at street level,

they can be separated from motor traffic by raised medians, on-street parking or bollards.

By separating bicyclists from motor traffic, cycle tracks can offer a higher level of comfort than bike lanes and are attractive to a wider spectrum of the public, including the “interested but concerned” category of cyclists that includes families and children. Intersections and approaches must be carefully designed to promote safety and facilitate left-turns from the right side of the street.

BUFFERED BICYCLE LANES



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 follow general guidance for buffered preferential vehicle lanes as per MUTCD guidelines.

Buffered bike lanes are designed to increase the space between the bike lane and the travel lane and/or parked cars, providing more comfortable conditions for bicyclists. This separation can make the facility more attractive for "interested but concerned" as well as the "enthused and confident" cyclists. 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.

BICYCLE LANES

A bicycle lane is a portion of the roadway that has been designated by striping, signing, and pavement



markings for the preferential and exclusive use of bicyclists. "Enthusied and confident" cyclists would feel most comfortable on these facilities. Bicycle lanes are always located on both sides of the road (except one way streets), and carry bicyclists in the same direction as adjacent motor vehicle traffic. The minimum width for a bicycle lane is four feet; five- and six-foot bike lanes are typical for collector and arterial roads.

Where bicycle lanes are recommended in this plan, speed limit reduction should be strongly considered.

PAVED SHOULDERS



Typically found in less dense areas, shoulder bike facilities are roadways with paved, striped shoulders. While there is no minimum width for paved shoulders, 4' or greater is preferred for cyclists. In addition to the safety and comfort benefits for cyclists, paved shoulders also reduce roadway maintenance, improve roadway drainage, provide a stable walking surface for pedestrians when sidewalks cannot be provided, reduce vehicular crashes, and provide emergency stopping space for broken-down vehicles.

Shoulder bike facilities often, but not always, include signage alerting motorists to expect bicycle travel along the roadway. This bike facility is preferred by more experienced cyclists, those who fall in the "strong and fearless" category. Shoulder bike facilities should be considered a temporary or rural treatment, with full bike lanes planned for construction if the roadway is widened or completed with curb and gutter.

LOW STRESS BIKE ROUTES



Low stress bike routes, also called bicycle boulevards or neighborhood greenways, are low-volume, low-speed neighborhood streets around core areas of the City modified to enhance bicyclist comfort and safety by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These bike boulevards are attractive to the less confident or experienced cyclists, those that fall in the category of "interested but concerned." Pedestrian and bicycle cut-throughs (recommended in the following section) can also be integrated into the low stress bike route network to allow for continuous bike travel off of major corridors. These treatments allow through bicycle movements while discouraging motorized through-traffic.

Jurisdictions throughout the country use a wide variety of strategies to determine where specific treatments are applied. While no federal guidelines exist, several best practices have emerged. **At a minimum, neighborhood greenways should include distinctive pavement markings and wayfinding signs.** They can also use combinations of traffic calming, traffic diversion, and intersection treatments to improve the bicycling environment.

The appropriate level of treatment to apply is dependent on roadway conditions, particularly motor vehicle speeds and volumes.

Traffic conditions on low stress bike routes should be monitored to provide guidance on when and where treatments should be implemented. When motor vehicle speeds and volumes or bicyclist delay exceed the preferred limits, additional treatments should be considered.

MARKED, SHARED LANES



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. Placed in a linear pattern along a corridor (typically every 100-250 feet), shared lane markings make motorists more aware of the potential presence of cyclists; direct cyclists to ride in the proper direction; and remind cyclists to ride further from parked cars to avoid "dooring" collisions.

In constrained conditions, the SLMs are placed in the middle of the lane. 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 and used on roadways with speed limits of 35 mph or less (below 30 mph preferred).

BIKE ROUTES



Bike routes employ bike facility signage, and may also use pavement markings, to guide bicyclists to popular destinations on low-volume, bike-friendly roadways. Bike routes are distinct from low stress bike routes in that they are mostly recommended as a rural roadway treatment. Like low stress bike routes, bike routes serve as an alternative to roads that are less comfortable for cycling due to higher motor vehicle volumes and/or speeds. They were chosen as part of the network because of the importance of overall system connectivity and connectivity to destinations such as parks, neighborhoods, and schools, but offer shorter connections than do low stress bike routes.

INTERSECTION TREATMENTS

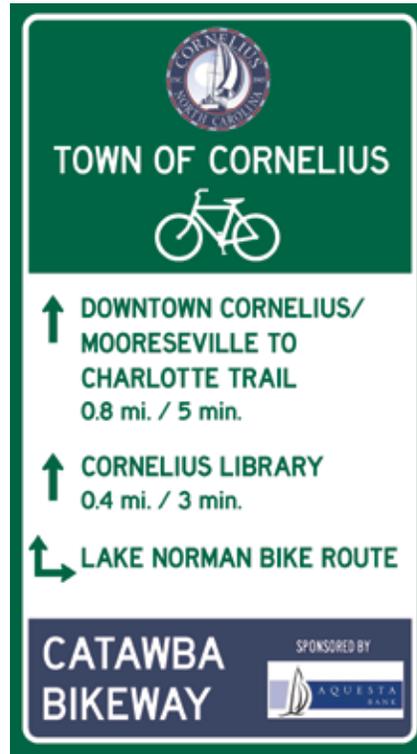


There are a variety of intersection treatments that can be applied to make a safer and more comfortable crossing environment for bicyclists. As seen in the example above, green paint delineates the preferred path of travel for the bicyclist through the intersection and indicates a potential conflict to motorists.

WAYFINDING

Wayfinding is spatial problem solving. Successful wayfinding orients people to their surroundings and informs them on how to best navigate to their destination along preferred bicycle routes. Apart from serving as a guide to destinations, wayfinding increases users' comfort and accessibility to the bike network. It can offer a sense of safety - familiarizing users with the network and overcoming "barriers to entry" for people who are not frequent bicyclists.

Basic elements to include in wayfinding signs include destinations, distances, and "riding time". Often the inclusion of riding times dispels common overestimations of time and distance thus encouraging walking or cycling instead of defaulting to the car. Signs should be placed at decision points (where the navigator must choose whether to continue their route or change direction) along bike routes and low stress bike routes or neighborhood greenways. See Appendix B for details on wayfinding sign types, sign placement, and maintenance.



Right: Bicycle wayfinding is not only an important for navigating the bicycle network, but also as an encouragement tool that makes people aware of how easy it can be to bicycle to popular destinations.

OFF-ROAD BICYCLE FACILITIES

Off-road bike facilities are intended to create completely separated spaces for pedestrians and bicyclists. These are the preferred facility for novice and average bicyclists. Special consideration must be given to environmental conditions and for all roadway crossings.

MULTI-USE PATH (GREENWAY)



Photo courtesy of charmeck.org

A multi-use path 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. Path facilities can also include amenities such as lighting, signage, and fencing (where appropriate). Key features of multi-use paths include:

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

SIDEPATH



Multi-use paths along roadways, also called Sidepaths, are a type of path that run adjacent to a street. Because of operational concerns it is generally preferable to place paths within independent rights-of-way away from roadways. However, there are situations where existing roads provide the only corridors available. When designed correctly, these facilities have the ability to provide a high level of comfort for pedestrians and bicyclists. However, the AASHTO Guide for the Development of Bicycle Facilities cautions practitioners of the use of two-way sidepaths on urban or suburban streets with many driveways and street crossings. Where implemented, sidepaths should be coupled with strict access management regulations or improvements.

Bike Facility Project Development

Bike facility network development utilized a number of different analyses, described in the Existing Conditions section of this plan, and planning judgment to determine what project types are warranted along roadways throughout Cornelius. These recommendations also include new off-street bicycle and pedestrian accommodation recommendations where they serve a major connectivity function in the network. The ultimate goal of the bike facility network is providing connectivity to destinations such as retail centers, job centers, schools, and recreation opportunities for all residents.

NATURE OF RECOMMENDATIONS

Recommended facilities for bicyclists strive to create a safe and comfortable biking environment for users of all ages and abilities and reflect national best practices in considering conditions such as traffic volumes, traffic speeds, and available roadway rights-of-way. Recommendations are considered planning-level, meaning that they should be used as a guide when implementing recommendations. In many cases, more detailed design studies will be required to examine specific site conditions and develop specific designs that reflect local conditions and constraints. In addition, these maps reflect the long-term vision for the network—implementation will not happen overnight. However, this Plan also contains an Implementation Plan which provides a roadmap for implementing recommendations in a logical manner. The Implementation Plan prioritizes the most feasible projects that provide the greatest return in terms of need, safety improvement, and costs. The Implementation Plan also projects

costs, develops a timeline for implementation and provides other resources such as potential funding sources.

RECOMMENDATIONS OVERVIEW

The tables below and on the following pages provide a summary of improvement recommendations shown in maps on the following pages, broken down by miles for linear facilities, or number of locations for spot improvements. Refer to the previous section for an overview of the different recommended improvement types. In some cases, the type of bicycle facility recommended for a particular road segment requires further study and is specified on the map as a "dedicated bike facility." This designation indicates that a facility dedicated to bicycles is recommended, but what form it takes has yet to be determined. It may be specified, through further study of conditions and needs, as a bike lane, buffered bike lane, cycle track, or sidepath.

Table 3.2 Mileage of Existing and Recommended Bike Facilities

FACILITY TYPE	EXISTING	RECOMMENDED
Cycle Track		TBD*
Bike Lanes/Paved Shoulders	2.3	19.9
Low Stress Bike Routes		33.5
Marked, Shared Lanes		6.5
Greenway	3.0	15.3
Sidepath	2.9	20.1
Bike-Ped Connectors		2.1
Total Mileage	8.2	97.4

* Depends on future improvements to Highway 115 / West Catawba Road.

Table 3.3 Recommended Dedicated Bike Facilities

	ROAD	FROM	TO	LENGTH (FEET)	LENGTH (MILES)
1	Jetton Rd	John Connors Rd	West Catawba Ave	10,343	1.96
2	Jetton Rd/Sefton Park Rd	West Catawba Ave	Liverpool Pkwy	4,119	0.78
3	West Catawba Ave*	Magnolia Estates Dr	Sam Furr Rd	12,414	2.35
4	West Catawba Ave*	Torrence Chapel Rd	Jetton Rd	2,487	0.94
Total Recommended Mileage					6.03

Cost estimates not available since type of facility is to be determined.

Table 3.4 Recommended Bicycle Lanes/Paved Shoulders

ROAD	FROM	TO	LENGTH (FEET)	LENGTH (MILES)	COST ESTIMATE*
Bethel Church Rd	West Catawba Ave	Bethelwood Ln	4,997	0.95	\$127,000
Bailey Rd ⁱ	Statesville Rd	Poole Place	3,058	0.58	\$77,000
Bailey Rd ⁱ	Poole Place	NC Route 115	5,895	1.12	\$149,000
Bailey Rd ⁱ	NC Route 115	Mayes Rd	15,461	2.93	\$390,000
Bailey Rd extension ⁱ	Statesville Rd	Poole Place	1854	0.35	\$47,000
Catawba Ave	Church St	Main St	1,558	0.29	\$400,000 ⁱⁱ
Knox Rd	Nautique Blvd	Torrence Chapel Rd	3,213	0.61	\$81,000
Liverpool Pkwy	West Catawba Ave	Sefton Park Rd	1,598	0.30	13,000 ⁱⁱ
Main St (NC 115) ⁱ	Catawba Ave	Potts St	4,422	0.84	TDB ⁱⁱ
Old Statesville Rd (NC 115) ⁱ	Catawba Ave	Will Knox Rd	12,105	2.29	\$305,000
Mayes Rd ⁱ	Old Statesville Rd	Sam Furr Rd	11,223	2.13	\$284,000
Northcross Dr extension	Forest Shadow Cir	Eagle Ridge Way	5,096	0.97	\$129,000
Statesville Rd (US 21) ⁱ	Catawba Ave	Huntersville town line	13,289	2.52	TDB ⁱⁱ
Torrence Chapel Rd	West Catawba Ave	Country Club Dr	7,753	1.47	\$196,000
Washam Potts Rd	NC Route 115	Bailey Rd	7,831	1.48	\$197,000
Westmoreland Rd	Washam Potts Rd	I-77 bridge	2,568	0.49	\$65,000
Westmoreland Rd	I-77 bridge	McDowell Creek Gwy	548	0.10	\$900,000 ⁱⁱ
Westmoreland Rd	Lake Pines Dr	West Catawba Ave	2,319	0.44	\$59,000
Total Recommended Mileage				19.86	\$3,419,000ⁱⁱⁱ

*Cost estimates based on figures provided in Table 3.1.

i. NCDOT Maintained roadway

ii. See pricing listed in Table 3.10 on page 92.

iii. Total is subject to change with respect to the Main St (NC 115) and Statesville Rd (US 21) projects.

Bike!Cornelius

Cornelius, NC Bicycle Master Plan Bicycle Facility Recommendations

-  Bike-Ped Connectors
-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Dedicated Bikeways-Proposed
-  Road Bike Routes
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

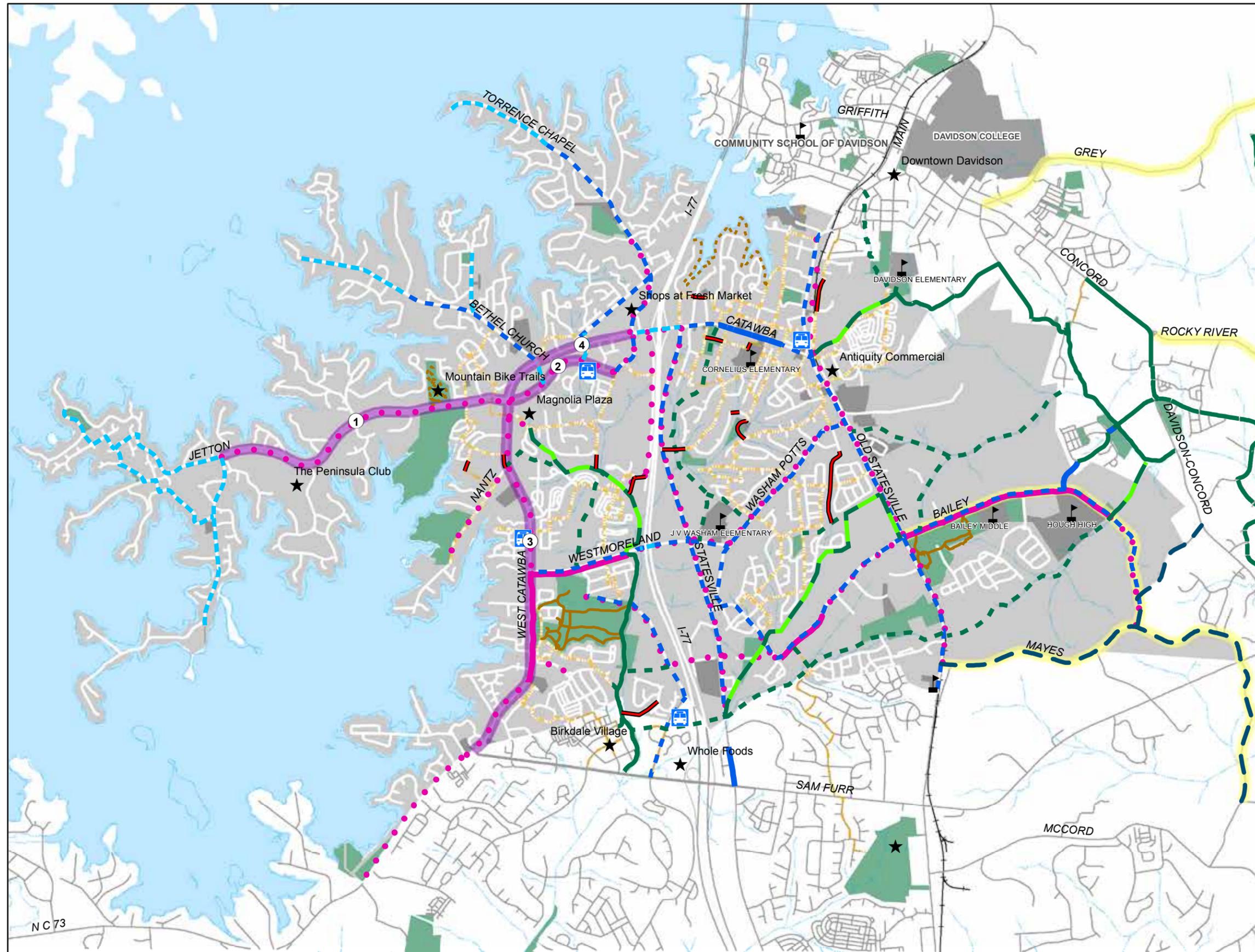
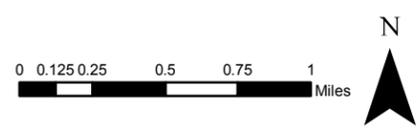


Figure 3.1. Comprehensive Bike!Cornelius Recommendations Map

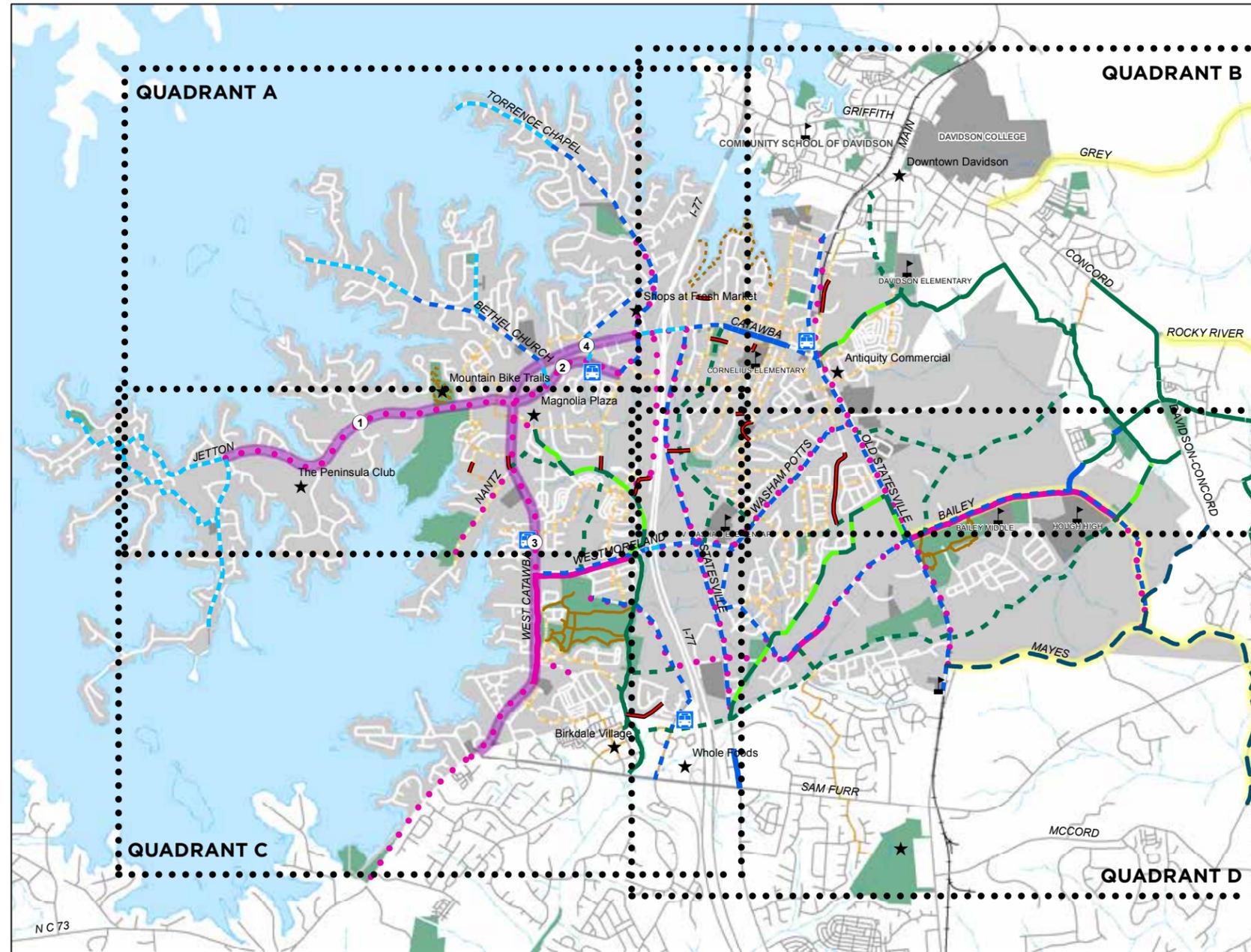
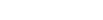


Figure 3.2. Inset Legend Map

Bike!Cornelius

Cornelius, NC Bicycle Master Plan Bicycle Facility Recommendations - A

-  Bike-Ped Connectors
-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Dedicated Bikeways-Proposed
-  Road Bike Routes
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

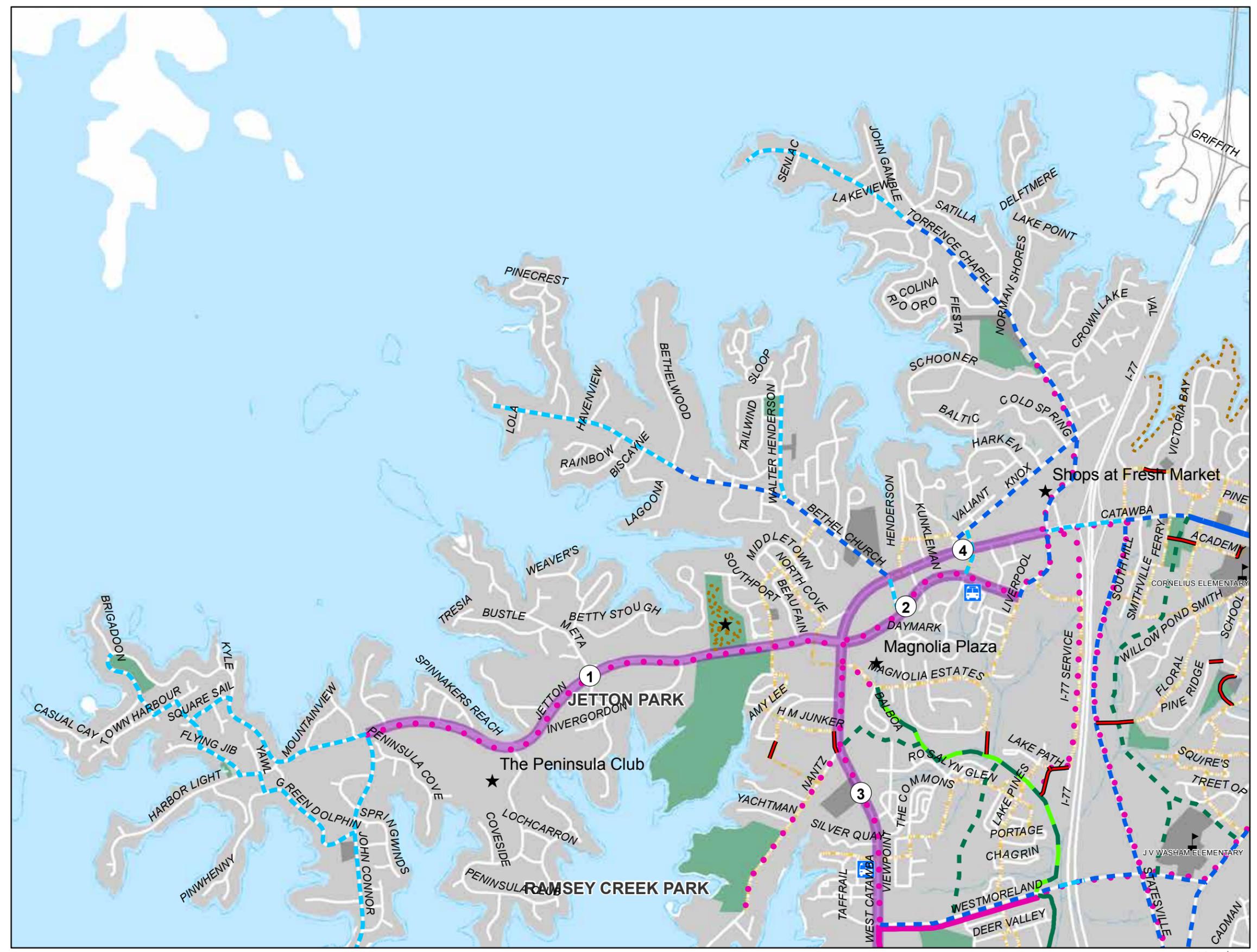


Figure 3.3. Comprehensive Bike!Cornelius Recommendations Map: Quadrant A

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Bike!Cornelius

Cornelius, NC Bicycle Master Plan Bicycle Facility Recommendations - B

-  Bike-Ped Connectors
-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Dedicated Bikeways-Proposed
-  Road Bike Routes
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

0 0.125 0.25 0.5 Miles

N



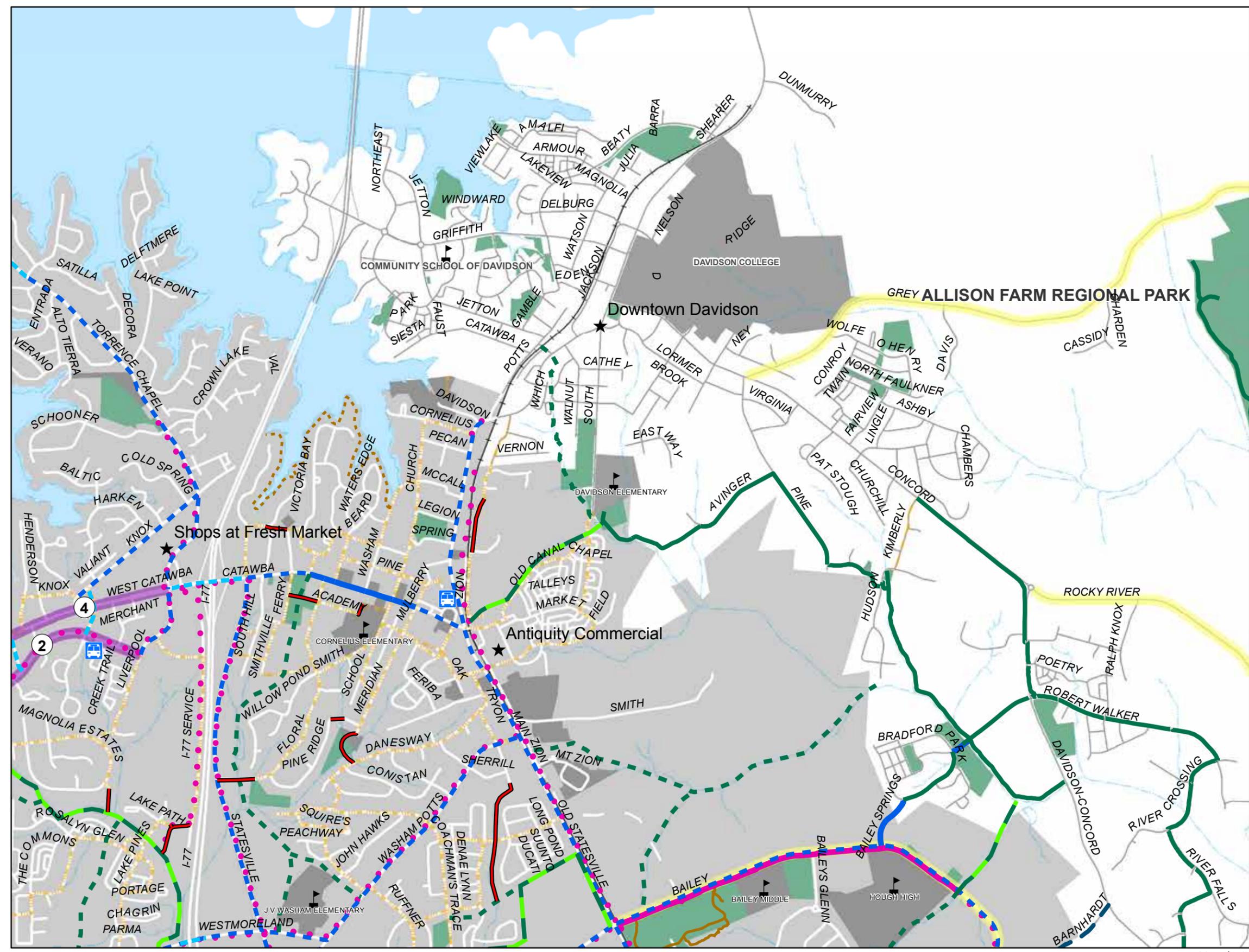


Figure 3.4. Comprehensive Bike!Cornelius Recommendations Map: Quadrant B

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Bike!Cornelius

Cornelius, NC Bicycle Master Plan Bicycle Facility Recommendations - C

-  Bike-Ped Connectors
-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Dedicated Bikeways-Proposed
-  Road Bike Routes
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

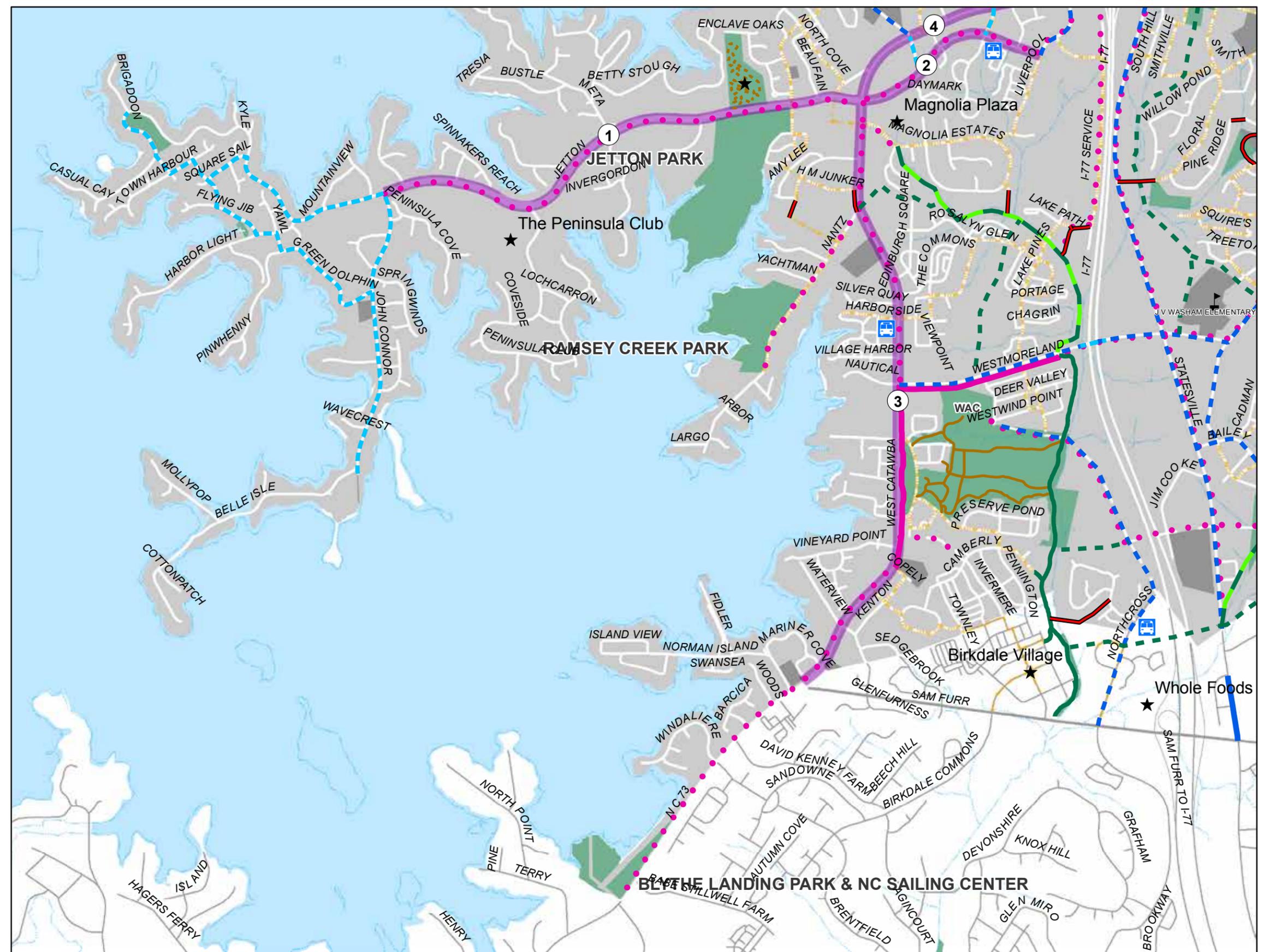
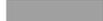
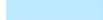


Figure 3.5. Comprehensive Bike!Cornelius Recommendations Map: Quadrant C

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Bike!Cornelius

Cornelius, NC Bicycle Master Plan Bicycle Facility Recommendations - D

-  Bike-Ped Connectors
-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Dedicated Bikeways-Proposed
-  Road Bike Routes
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

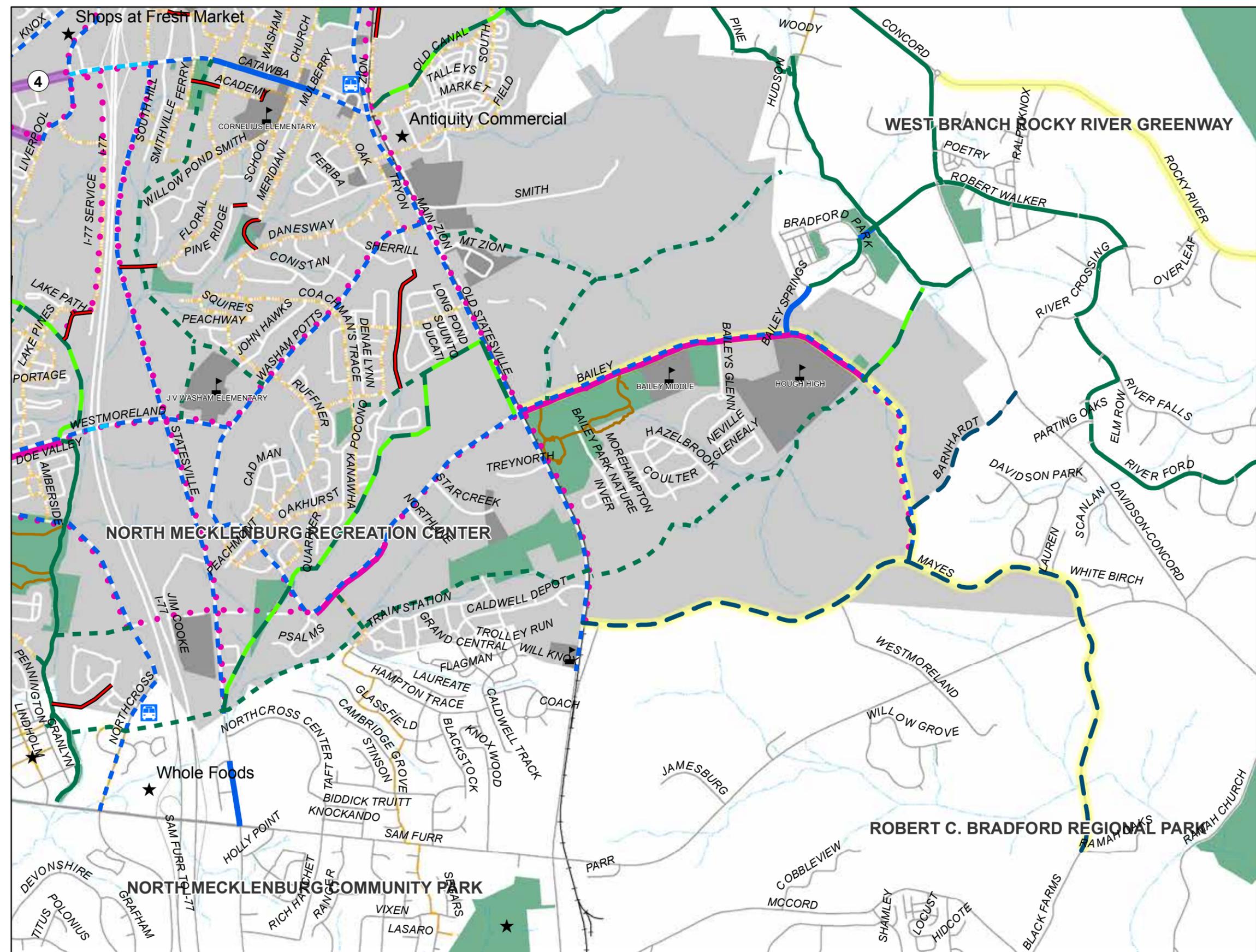


Figure 3.6. Comprehensive Bike!Cornelius Recommendations Map: Quadrant D

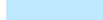
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Bike!Cornelius

Cornelius, NC

Bicycle Master Plan

Bicycle Facility Recommendations
Dedicated On Road Facilities

-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Dedicated Bikeways-Proposed
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

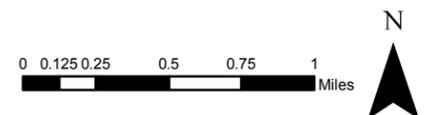
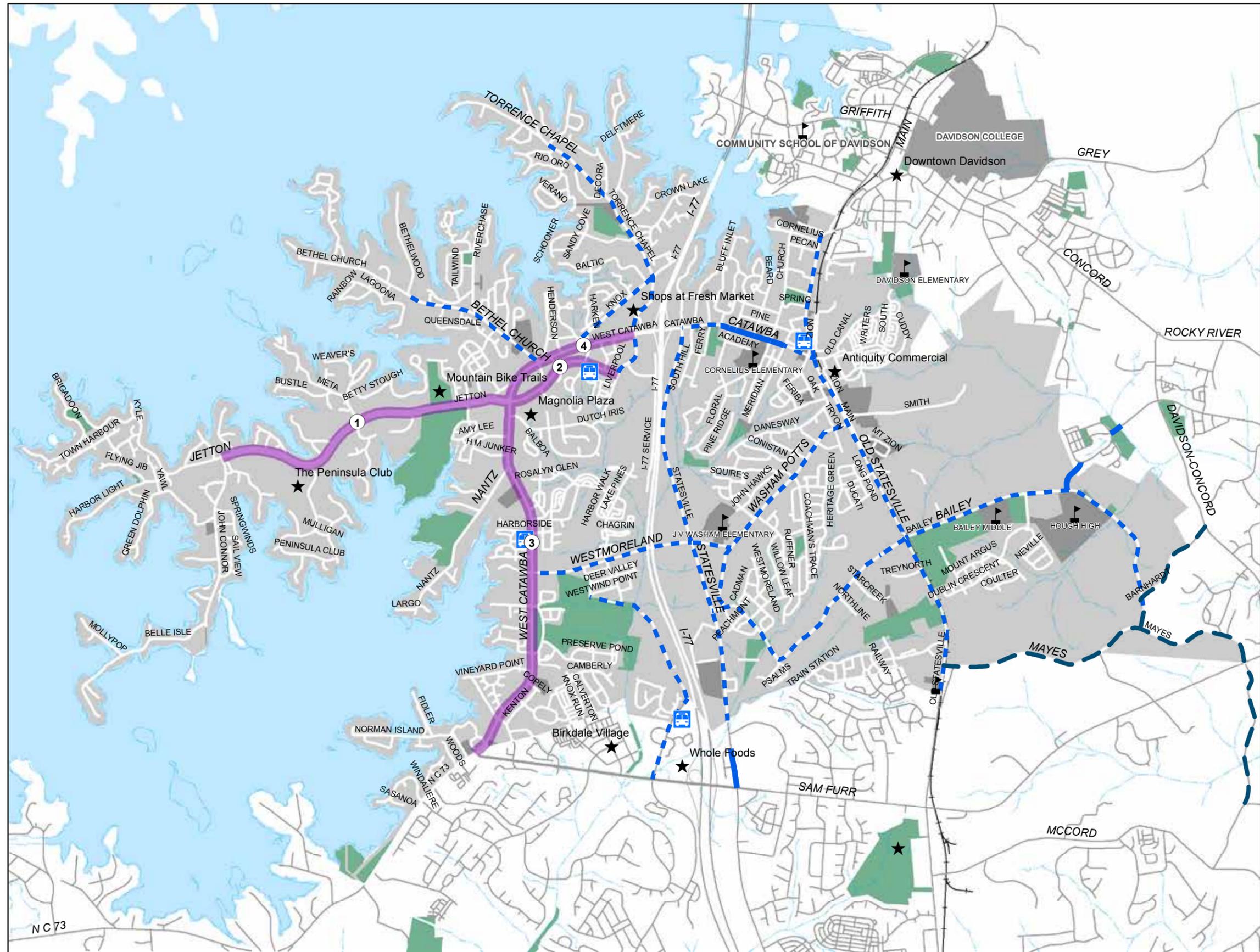


Figure 3.7. Dedicated On Road Facilities Map (Bike Lanes and Paved Shoulders)

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Bike!Cornelius

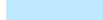
Cornelius, NC

Bicycle Master Plan

Bicycle Facility

Recommendations

Shared On Road Facilities

-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

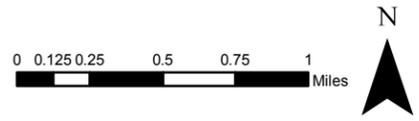
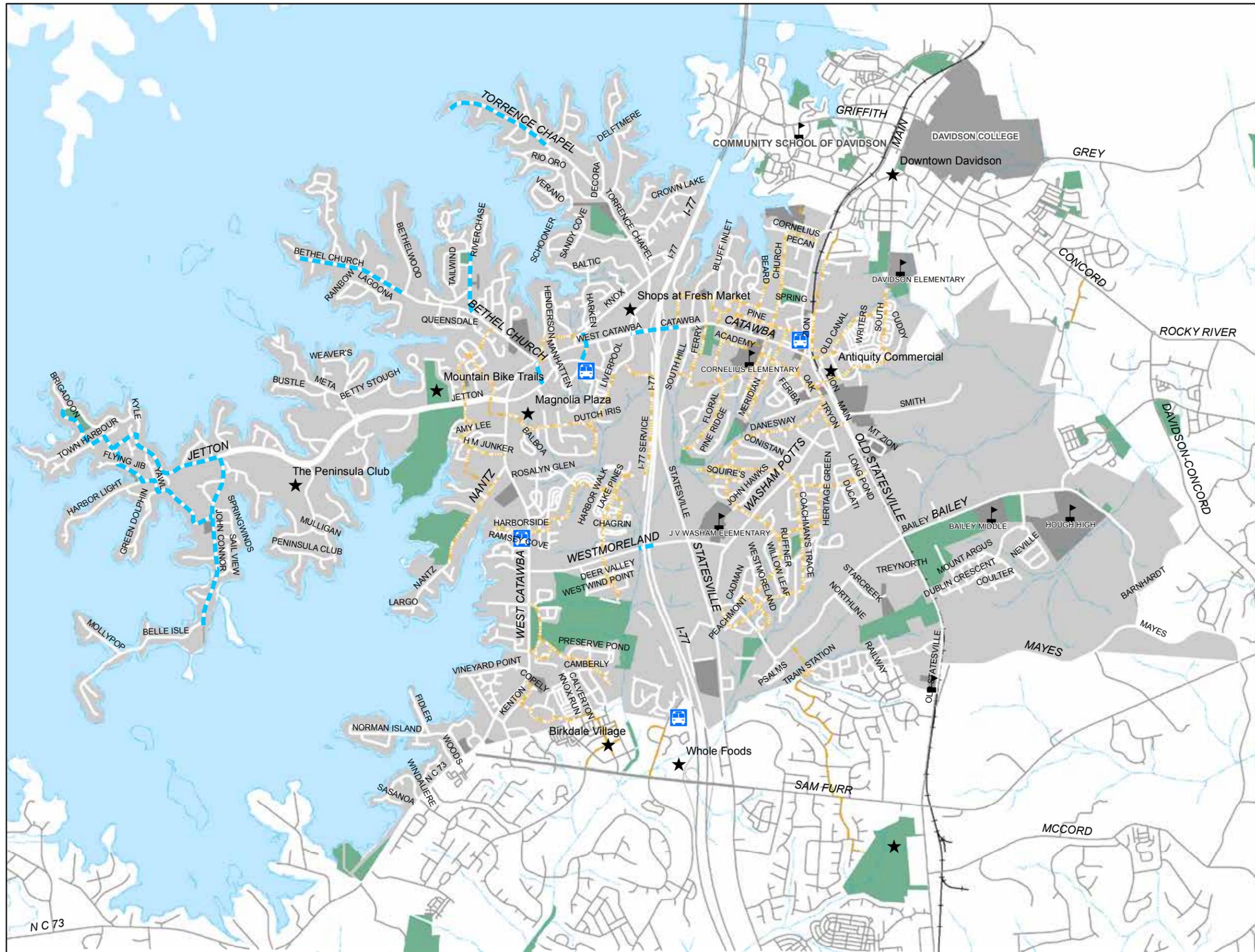


Figure 3.8. Shared On Road Facilities Map (Marked, Shared Roadways + Low Stress Bike Routes)

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Table 3.5 Recommended Marked, Shared Roadways

ROAD	FROM	TO	LENGTH (FEET)	LENGTH (MILES)	COST ESTIMATE
America Cup Rd	Town Harbour Rd	Flying Jib Rd	1,064	0.21	\$1,300
Bethel Church Rd	Bethelwood Ln	Staghorn Ct	3,838	0.73	\$4,600
Bethel Church Rd	Jetton Rd ext.	West Catawba Ave	752	0.14	\$900
Catawba Ave	Liverpool Pkwy	Statesville Rd	1,587	0.30	\$1,900
Flat Shoals Dr	Town Harbour Rd	Jetton Rd	455	0.09	\$600
Flying Jib Rd	America Cup Rd	Harbor Light Blvd	1,009	0.19	\$1,200
Green Dolphin Ln	Yawl Rd	John Connor Rd	2,453	0.46	\$2,900
Harbor Light Blvd	Flying Jib Rd	Yawl Rd	404	0.08	\$500
Jetton Rd	John Connor Rd	Square Sail Rd	3,574	0.68	\$4,300
Jetton Rd	Flat Shoals Dr	Brigadoon Pl	1,228	0.23	\$1,400
John Connor Rd	Jetton Rd	south terminus	5,744	1.09	\$6,900
One Norman Dr	Sefton Park Rd	Knox Rd	993	0.19	\$1,200
Square Sail Rd	Jetton Rd	America Cup Rd	946	0.18	\$1,100
Torrence Chapel Rd	Country Club Dr	west terminus	3,631	0.69	\$4,300
Town Harbour Rd	America Cup Rd	Flat Shoals Dr	526	0.10	\$600
Walter Henderson Rd	Bethel Church Rd	Deep Cove Ct	2,093	0.40	\$2,500
Westmoreland Rd	I-77 bridge		330	0.63	\$4,000
Yawl Rd	Harbor Light Blvd	Green Dolphin Ln	402	0.08	\$500
Total Recommended Mileage				6.47	\$40,700

Table 3.6 Recommended Bike-Ped Connectors (Retrofit connection between two streets or pathways)

CONNECTION FROM	TO	LENGTH (FEET)	LENGTH (MILES)	COST ESTIMATE	
Meridian St	Danesway Lane	890	0.17	\$102,000	
Floral Ln	Statesville Rd	758	0.14	\$84,000	
I-77 service rd/Lake Path Dr	McDowell Creek Greenway	1,004	0.19	\$114,000	
English Daisy Dr	McDowell Creek Greenway	463	0.09	\$54,000	
Summerbrook Dr	Zion Ave	1,113	0.21	\$126,000	
Academy St	Cornelius Elem. School driveway	249	0.05	\$30,000	
Academy St	S Ferry St	588	0.11	\$66,000	
N Ferry St	Sterling Bay Ln	448	0.08	\$48,000	
H. M. Junker Dr	Nantz Rd	440	0.08	\$48,000	
Harbor View Dr	long driveway off Nantz Rd	368	0.07	\$42,000	
Pine Ridge Dr	Millard St	285	0.05	\$30,000	
Barnette Ave	Caldwell Station Creek Greenway	2,519	0.48	\$288,000	
Forest Shadow Circle	McDowell Creek Greenway	1,349	0.26	\$156,000	
Gem St	Oak St	503	0.10	\$60,000	
Total Recommended Mileage				2.08	\$1,248,000

SIGNED BIKE ROUTES

The maps indicate low stress bike connections throughout the town. These routes primarily follow low-stress, low-volume neighborhood streets to connect destinations across neighborhoods in Cornelius. Four priority signed bike routes have been developed to help connect bicyclists across town via these low stress connections. These routes are outlined below and correspond to those marked on Figure 3.8 on the following page. Some of these routes require the completion of an off-road connector or a section of striped bike lane to complete the entire route.

Route 1: East Side- YMCA to Oakhurst

Church St > School St > Gem St > Willow St > Gem St > bike/ped connector > Oak St > Hickory St > Tryon St > Danesway Ln > Bon Meade Ln > Footsman Pl > Coachman's Trace > Oakhurst Blvd > Washam Potts

This route takes bicyclists on exclusively low stress neighborhood streets from the YMCA to the commercial area of Oakhurst. This route will connect to various other low stress roads, the town center, and the Caldwell Station Creek Greenway. In order to complete this route, the Gem St./Oak St. connector that is under design must be constructed. The crossing of Catawba Ave. is signalized, and there is an existing crosswalk to help calm traffic for the crossing of Washam Potts Rd. Sections of Oakhurst Blvd. at the southern end of this route are very wide and could use sharrows or other treatment to continue to make the riding environment comfortable.

Route 2: West Side- W. Catawba to Birkdale

Liverpool Pkwy > Chartwell Center Dr > Chartown Dr > bike/ped connector > Lake Path Dr > Lake Pines Dr > McDowell Creek Greenway

This route takes advantage of a long stretch of Chartown Dr. that carries very little vehicular traffic.

It begins at the intersection of Liverpool Pkwy. and W. Catawba Ave. and continues through the Westmoreland neighborhood (via a bike/ped connector) and onto the McDowell Creek Greenway to Birkdale. The two key components of this route are the striping of bike lanes on Liverpool Pkwy. within the existing roadway, and the construction of the very short bike/ped connector from Chartown Dr. to Lake Path Dr.

Route 3: The Four Peninsulas

Knox Rd > Nautique Blvd > Knox Rd > Henderson Rd > Bethel Church Rd > Charles Towne Ln > Lake Norman Cove Dr > Makayla Ln > Julian St > Amy Lee Dr > Juanita Ln > Coastal Crossing Dr > Courtside Landing Dr > Nantz Rd

This route takes cyclists from Torrence Chapel Rd. all the way around to Nantz Rd. without getting on W. Catawba Ave. This route can be used as a part of longer rides, where riders can choose to ride out and back each peninsula to add miles if they wish. Cyclists will pass Jetton Park as well as Ramsey Creek Park on this route. In order to connect this route in its entirety, the off-road connector that is required to be provided by the Courtyards at Nantz development must be constructed. When completely built out, this route will have a small section of multi-use path between Henderson Rd. and Bethel Church Rd., completed bike lanes on Knox Rd., and completed bike lanes on Bethel Church Rd. and Nantz Rd.

Route 4: Antiquity to Route 1

South St > Market St > Lovers Lawn Tc > Hickory St

This short route connects through Antiquity to Route 1. This is an alternative way to get from South St. in Davidson through Antiquity and across NC 115, as opposed to using the planned Antiquity Greenway. This route crosses NC 115 using a future signalized crossing at Hickory St., which will be

continued on page 81...

a more comfortable crossing than crossing at the Catawba Ave. intersection.

Route 5: DDI to Magnolia Plaza

Liverpool Pl > Dutch Iris Ln > Magnolia Estates Dr

Route 5 is a great connector from the DDI at exit 28 to the Magnolia Plaza shopping center (Publix grocery and restaurants) and the start of the future North McDowell Creek Greenway which is currently funded and under design. This route begins with bike lanes (future striping project) on Liverpool Py and then follows low stress bike connectors through the Magnolia Estates neighborhood to the Magnolia Plaza shopping center. Magnolia Estates Dr has existing traffic calming measure in place in the form of speed bumps that contribute to safe and comfortable cycling conditions.

Table 3.7 Signed Bike Routes

ROUTE	ROAD	FROM	TO	LENGTH (FEET)	LENGTH (MILES)	COST ESTIMATE	
1	Church Street	North Terminus	Catawba Ave	3,844	0.73	\$18,252	
	School Street	Catawba Ave	Willow St	528	0.10	\$2,507	
	Willow Street	School St	Meridian St	468	0.09	\$2,222	
	Gem Street	Meridian St	East Terminus	311	0.06	\$1,477	
	bike/ped connector	Gem St	Oak St	532	0.10	\$2,526	
	Oak Street	Aftonshire Dr	Hickory St	631	0.12	\$2,996	
	Hickory Street	Oak St	Tyron St	341	0.06	\$1,619	
	Tyron Street	Hickory St	Danesway Ln	906	0.17	\$4,302	
	Danesway Lane	Tyron St	Bon Meade Ln	3,358	0.64	\$15,944	
	Bon Meade Lane	Danesway Ln	Footsman Pl	315	0.06	\$1,496	
	Footsman Place	Bon Meade Ln	Coachman's Trce	433	0.08	\$2,056	
	Coachman's Trace	Footsman Pl	Oakhurst Blvd	5,577	1.06	\$26,480	
	Oakhurst Boulevard	Coahcman's Trce	Washam Potts Rd	2,992	0.57	\$14,206	
	Route Recommended Mileage					3.83	\$96,083
	2	Liverpool Parkway	W Catawba Ave	Chartwell Center Dr	1,099	0.21	\$5,218
Chartwell Center Dr		Liverpool Pkwy	Chartown Dr	1,128	0.21	\$5,356	
Chartown Drive		Chartwell Center Dr	bik/ped connector	3,383	0.64	\$16,063	
bike/ped connector		Chartown Dr	Lake Path Dr	399	0.08	\$1,894	
Lake Path Drive		East Terminus	Lake Pines Dr	239	0.05	\$1,135	
Lake Pines Drive		Lake Path Dr	McDowell Creek Greenway	3,080	0.58	\$14,624	
Route Recommended Mileage					1.77	\$44,290	

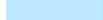
NETWORK RECOMMENDATIONS

ROUTE	ROAD	FROM	TO	LENGTH (FEET)	LENGTH (MILES)	COST ESTIMATE	
3	Knox Road	Torrence Chapel Rd	Nautique Blvd	3,225	0.61	\$15,313	
	Nautique Boulevard	Knox Rd	Knox Rd	164	0.03	\$779	
	Knox Road	Nautique Blvd	Henderson Rd	937	0.18	\$4,449	
	Henderson Road	Knox Rd	Bethel Church Rd	879	0.17	\$4,174	
	Bethel Church Road	Knox Rd	Charles Town Ln	1,808	0.34	\$8,585	
	Charles Towne Lane	Bethel Church Rd	Jetton Rd	2,978	0.56	\$14,140	
	Lake Norman Cove Dr	Jetton Rd	Makayla Ln	989	0.19	\$4,696	
	Makayla Lane	Lake Norman Cove Dr	Julian St	380	0.07	\$1,804	
	Julian Street	Makayla Ln	Amy Lee Dr	224	0.04	\$1,064	
	Amy Lee Dr	Julian St	Juanita Ln	441	0.08	\$2,094	
	Juanita Lane	Amy Lee Ln	Coastal Crossing Dr	342	0.06	\$1,624	
	Coastal Crossing Dr	Juanita Ln	Courtside Landing Dr	543	0.10	\$2,578	
	Courtside Landing Dr	Coastal Crossing Dr	Nantz Rd	1,094	0.21	\$5,194	
	Nantz Road	Courtside Landing Dr	Pompano Pl	2,920	0.55	\$13,864	
	Route Recommended Mileage					3.21	\$80,357
	4	South Street	Davidson Elementary	Market St	2,338	0.44	\$11,101
		Market Street	South St	Lovers Lawn Terrace	409	0.08	\$1,942
Lovers Lawn Terrace		Market St	Zion Ave	2,503	0.47	\$11,885	
Hickory Street		Zion Ave	Highway 115	172	0.03	\$817	
Route Recommended Mileage					1.03	\$25,744	
5	Liverpool Parkway	Sefton Park Rd	Dutch Iris Ln	1,652	0.31	\$7,844	
	Dutch Iris Lane	Liverpool Parkway	Magnolia Estates Dr.	372	0.07	\$1,766	
	Magnolia Estates Dr	Dutch Iris Lane	W Catawba Ave	2,905	0.55	\$13,793	
Route Recommended Mileage					0.93	\$23,403	
Total Recommended Mileage					10.76	\$269,878	

Bike!Cornelius

Cornelius, NC Bicycle Master Plan

Bicycle Facility
Recommendations
Signed Bike Routes

-  Low Stress Bike Connections
-  Signed Bike Routes
-  Creeks and Streams
-  Railroads
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Points of Interest
-  Schools
-  Park and Ride

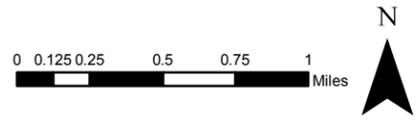
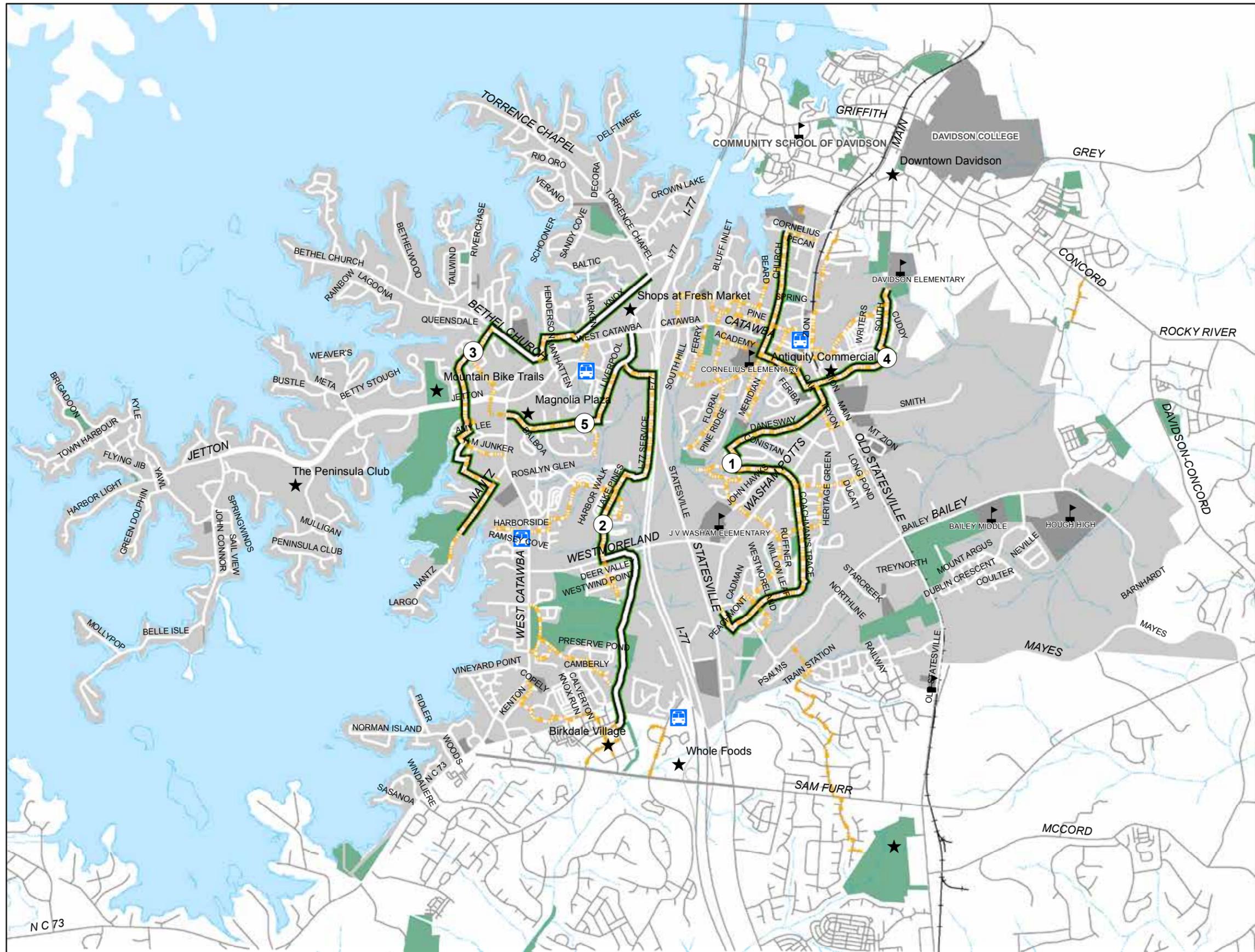


Figure 3.9. Signed Bike Routes Map (using Marked, Shared Roadways, Bike Lanes + Low Stress Bike Connections)

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GREENWAYS + SIDEPATHS

The Town of Cornelius Parks, Arts, Recreation and Culture Department updated the Town of Cornelius's Comprehensive Parks & Greenways Master Plan, which was completed with the Town Board approval in June 2015. The Parks & Greenways Master Plan recommends a total of 38.4 miles of greenways and sidepaths. The proposed greenway network includes segments of the regional Carolina Thread Trail and the Mooresville to Charlotte Trail. An overarching recommendation of the Plan is the "Emerald Necklace," which is an approximately 12.25-mile loop of separated bicycle and pedestrian facilities. The greenways are identified in Figure 3.10. This plan aims to help with the implementation of the Emerald Necklace.

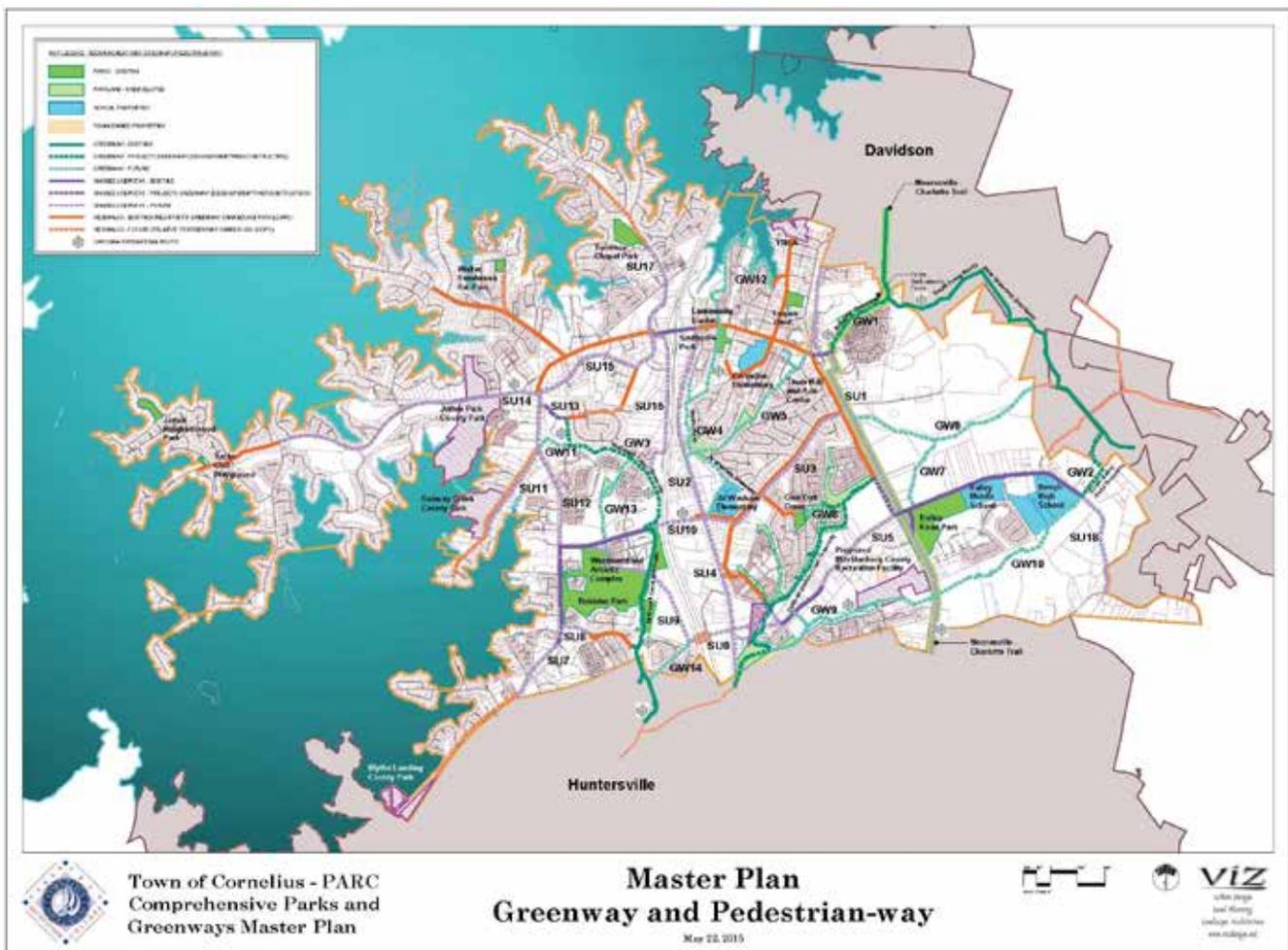


Figure 3.10. The Town of Cornelius's Comprehensive Parks & Greenways Master Plan (2015).

Table 3.8 Recommended Greenways

GREENWAY	FROM	TO	LENGTH (FEET)	LENGTH (MILES)	COST ESTIMATE
Antiquity Greenway (GW1)	Catawba Ave	South Prong Rocky River Greenway	3,405	0.64	\$384,000
Antiquity Greenway Spur	Antiquity Gwy	Potts St	4,175	0.79	\$474,000
Caldwell Station Creek Greenway	Statesville Rd	Old Statesville Rd	11,480	2.17	\$1,302,000
Caldwell Station Creek (South) Greenway (GW9)	Statesville Rd	Old Statesville Rd/ NC 115	9,146	1.73	\$1,038,000
Glen Oak Green Park Connector (GW8)	Caldwell St Cr Gwy near Heritage Green Dr	Coachmans Trace	1,624	0.31	\$186,000
McDowell Creek Greenway Phase 2 (GW3)	Westmoreland Rd	Magnolia Estates Dr	6,608	1.25	\$750,000
Nantz Road Connector Greenway (GW11)	McDowell Ck Gwy near Covedale Crossings	West Catawba Ave at Nantz Rd	1,962	0.37	\$222,000
North Bailey Rd Greenway (GW6)	Main St/NC 115	South Prong Rocky River Greenway	8,678	1.64	\$984,000
North Bailey Rd to Bailey Rd Connector (GW7)	Bailey Rd	Greenway 6	2,759	0.52	\$312,000
Smithville Park to JV Washam Greenway/Linear Park (GW4)	Westmoreland Rd	Catawba Ave	8,157	1.54	\$924,000
Smithville Park to JV Washam Greenway Spur	Washam Potts Rd	Smithville to J. V. Washam Gwy	1,705	0.32	\$192,000
South Bailey Rd Greenway (GW2)	Bailey Rd	South Prong Rocky River Greenway	2,173	0.41	\$246,000
South Bailey Rd Greenway Phase 2 (GW10)	Old Statesville Rd/NC 115	Bailey Rd	7,267	1.38	\$828,000
South Bailey Rd Greenway Phase 2 Spur	S Bailey Rd Gwy	Bailey Rd Park	3,738	0.71	\$426,000
Stratford Forest Greenway (GW14)	Northcross Dr extension	McDowell Ck Gwy	1,523	0.29	\$174,000
Westmoreland Park Greenway (GW13)	McDowell Ck Gwy near Westmoreland Lake Dr	Westmoreland Rd	3,254	0.62	\$372,000
Unnamed Greenway	McDowell Creek Greenway	Caldwell Station Creek Greenway	3,071	0.58	\$348,000
Total Recommended Mileage				15.27	\$9,162,000

(Bold are already under development or funded. Numbers in parentheses (GW#) correspond to greenway recommendations from the Comprehensive Parks & Greenways Master Plan)

Table 3.9 Recommended Sidepaths

ROAD	FROM	TO	LENGTH (FEET)	LENGTH (MILES)	COST ESTIMATE
Bailey Rd	Poole Place	Delmas Dr	857	0.16	\$96,000
Bailey Rd	Old Statesville Rd	south of Northline Dr	3,786	0.72	\$432,000
Bailey Rd	S Prong W Rocky River Tributary	Mayes Rd	3,970	0.75	\$450,000
Bailey Rd ext. (new roadway)	Bailey Rd/Poole Place	Northcross Rd ext.	5,093	0.96	\$576,000
I-77 service road	Liverpool Pkwy	Chartown Dr	5,047	0.96	\$576,000
Invermere Ave (new roadway)	Invermere Ave	Jettie Robbins Rd	1,177	0.22	\$132,000
Jetton Rd (Phase 1)	West Catawba Ave	Jetton Park Rd	7,820	1.48	\$888,000
Jetton Rd (Phase 2)	Jetton Park Rd	John Connor Rd	2,456	0.47	\$282,000
Jetton Rd ext./Sefton Park Rd	West Catawba Ave	Liverpool Pkwy	3,949	0.75	\$450,000
Liverpool Pkwy	Sefton Park Rd	West Catawba Ave	1,518	0.29	\$174,000
Magnolia Estates Dr	West Catawba Ave	McDowell Creek Greenway	841	0.16	\$96,000
Main St/NC Route 115	Cornelius St	Potts St	492	0.09	\$54,000
Nantz Rd	West Catawba Ave	Ramsey Creek Park	3,755	0.71	\$426,000
Northcross Dr ext. (new roadway)	Bailey Rd ext.	Eagleridge Way Ln	4,298	0.81	\$486,000
Old Statesville Rd/NC Route 115	Washam Potts Rd	Mayes Rd	7,900	1.50	\$900,000
Sam Furr Rd	West Catawba Ave	Oliver Hager Rd	5,437	1.03	\$618,000
Statesville Rd	Catawba Ave	Northcross Ctr Ct	13,180	2.50	\$1,500,000
Torrence Chapel Rd	West Catawba Ave	Torrence Chapel Park	3,743	0.71	\$426,000
Washam Potts Rd	Westmoreland Rd	Main St/NC Route 115	5,656	1.07	\$642,000
West Catawba Ave	Liverpool Pkwy	Statesville Rd	1,621	0.31	\$186,000
West Catawba Ave	Jetton Rd	Westmoreland Rd	5,778	1.09	\$654,000
West Catawba Ave	Bluff Point Rd	Sam Furr Rd	4,222	0.80	\$480,000
Westmoreland Rd	McDowell Creek Greenway	Washam Potts Rd	6,939	1.31	\$786,000
Zion Ave	south terminus	north terminus	6,340	1.20	\$720,000
Total Recommended Mileage				20.05	\$12,030,000

THE EMERALD NECKLACE

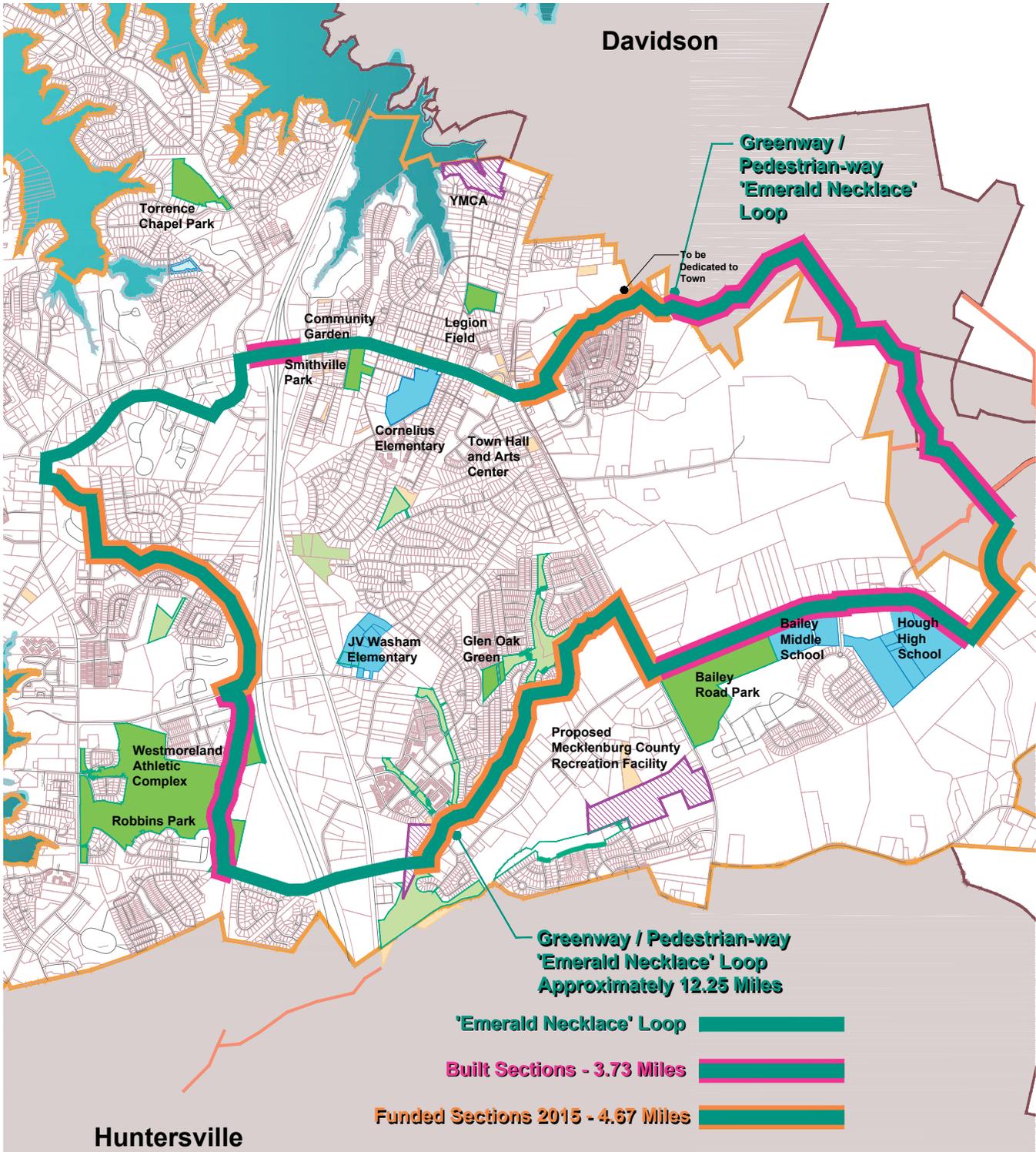


Figure 3.11. "Emerald Necklace" from the Town of Cornelius's Comprehensive Parks & Greenways Master Plan (2015).

Bike!Cornelius

Cornelius, NC Bicycle Master Plan

Bicycle Facility Recommendations Emerald Necklace

-  Emerald Necklace
-  Emerald Necklace-interim
-  Bike-Ped Connectors
-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Dedicated Bikeways-Proposed
-  Road Bike Routes
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

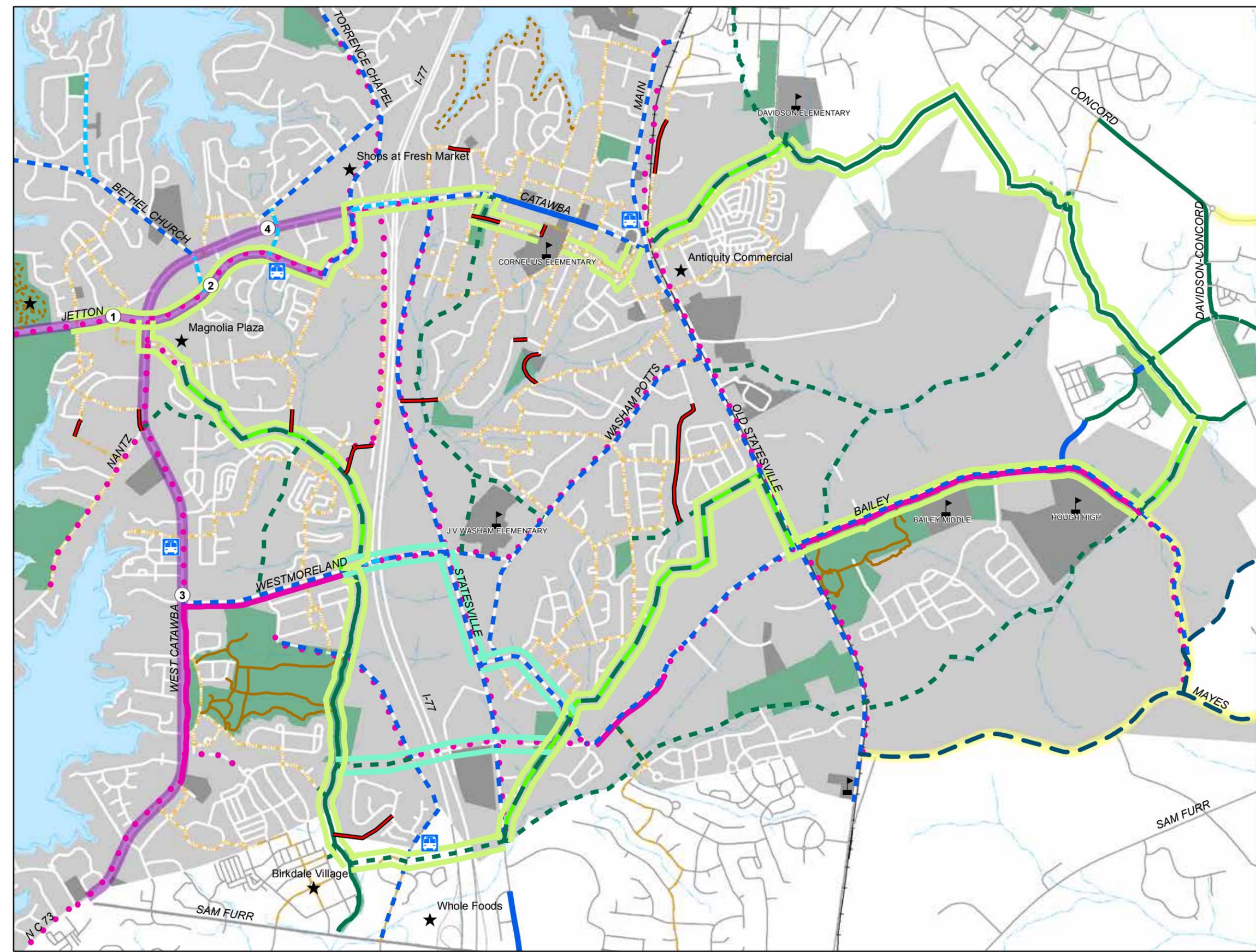
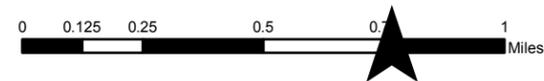


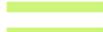
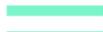
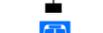
Figure 3.12. Emerald Necklace Map

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Bike!Cornelius

Cornelius, NC Bicycle Master Plan

Bicycle Facility Recommendations Multi-Use Paths

-  Emerald Necklace
-  Emerald Necklace- interim
-  Bike-Ped Connectors
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

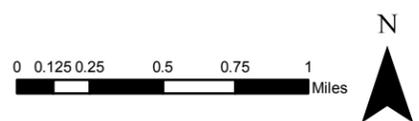
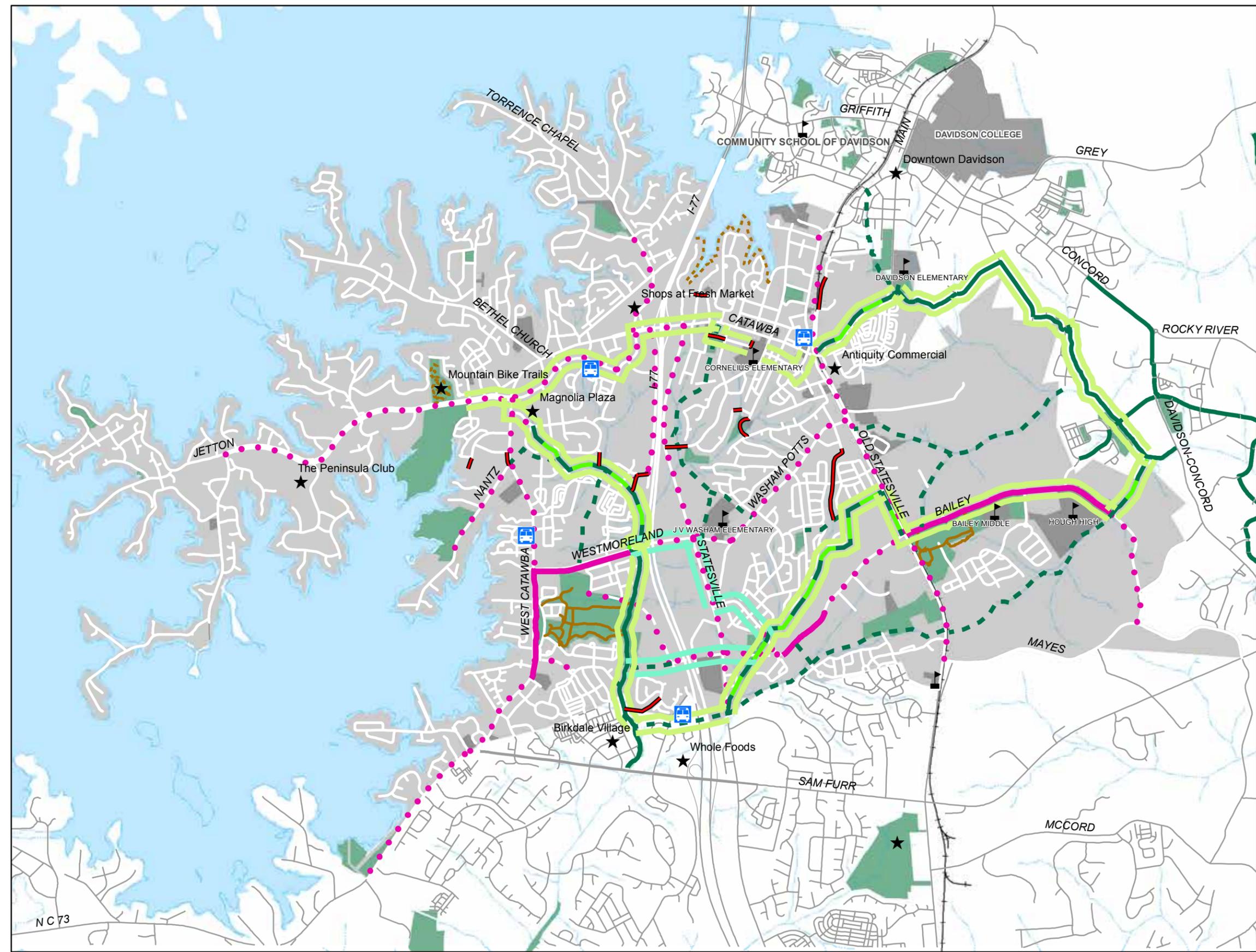


Figure 3.13. Multi-use paths Map (Greenways + Sidepaths)

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Project Prioritization

This section identifies the high priority projects recommended in the Plan. The Project Steering Committee and staff identified priority projects based on Town priorities, public input, and on-going bicycle facility and greenway development goals. Priority projects are described in cross-sections and concepts. Criteria used to determine the priority projects are:

- Connections to local destinations, such as downtown and parks
- Connections to existing trails, including the proposed Emerald Necklace greenway loop
- Near-term feasibility, such as facilities implemented through proposed or on-going projects or roadways slated for resurfacing
- Existing bicycle demand, as evidenced through the public involvement process of this Plan

In consideration of these criteria, all recommended bicycle boulevard/neighborhood routes are priority projects of this Plan. Bicycle boulevards are relatively easy to implement in that they use existing roads and pavement width and incur minimal associated costs. Additionally, a bicycle boulevard network serves as an encouragement tool for spurring increased bicycling activity among cyclists of all abilities and ages. By prioritizing bicycle boulevard development as an initial step in Plan implementation, Cornelius will broaden the base of public support for bicycle friendly efforts.

Several larger projects offer near-term potential for implementation and reflect community priorities. These projects are considered priorities of this Plan, as well:

- *Multi-use Path Connection to Jetton Park:* The Town of Cornelius has recommended a bicycle and pedestrian connection to Jetton Park in previous studies, including the recently adopted

Park and Recreation Master Plan Update. This connection would be a spur in the Emerald Necklace greenway loop.

- *Westmoreland Road Bridge Path:* The Town of Cornelius is completing a corridor study for the McDowell Creek Greenway on the north side of Westmoreland Road. A pathway along the bridge would provide a connection to existing pathways and greenways and be part of a near-term connection for the Emerald Necklace greenway loop and provide a safe bicycle and pedestrian connection to schools and other destinations on either side of the I-77 corridor.

Based on research, analysis and public input in the preparation of this Plan, the entire proposed bike facility network has evidenced merit. All proposed projects play an important role in completing the vision of the bike facility network and should be considered mid- to long-term projects.

10 YEAR ACTION PLAN

Cornelius is well situated to capitalize on large investments that are currently being made in the Town's state maintained roadway system and an expanding greenway network. With the adoption of this plan, the Town's goal is to maximize the accessibility and usefulness of infrastructure projects that are currently funded, as well as the biking infrastructure that exists today. These projects and roadways represent a portion of the recommended bikeway network. The time frames assigned to certain projects or objectives are not necessarily rankings — they are goals for town staff, and our community to strive for as we continue to connect our bicycle network.

INFRASTRUCTURE RECOMMENDATIONS

1. Coordinate with NCDOT on State Road projects to ensure bicycle improvements are incorporated and funded as follows. The timing of each project is dependent on the State Transportation Improvements Program, see <https://connect.ncdot.gov/projects/planning/pages/state-transportation-improvement-program.aspx>.
 - a. West Catawba Avenue, Phase II – Work with NCDOT on buffered bike lanes and cycle track concept.
 - b. Statesville Road (Hwy 21) – Bike lanes and shared use path on east side.
 - c. Main Street (Highway 115) – Bike lanes and sidewalks on both sides w/curb and gutter and buried utilities.
 - d. Torrence Chapel/Knox/Liverpool Pkwy – Install bike lanes and multi-use path connections as part of intersection improvement projects.
 - e. DDI – install sharrows/signage if possible as a part of the intersection improvement projects on either side of the DDI (Hwy 21 intersection and the Torrence Chapel intersection). Connect multi-use path through the DDI on both sides.
2. Provide connections to and between existing and funded Greenways, Parks and other Town projects capitalizing on the public investment the Town has made as follows:
 - a. **Existing McDowell Creek Greenway**
 - Provide signed route from Kenton Place to the Greenway. Likely along Camberly Road. Consider additional treatment along Camberly to improve the comfort of the route for bicyclists. (2-5 years)
 - Provide bridge connection to Stratford Forest neighborhood. (10 year)
 - b. **Caldwell Station Greenway**
 - Fix Westmoreland bridge crossing for bicycle/pedestrians on one side with railing. (2-5 years)
 - Connect N/S low stress route through Oakhurst to the Greenway. Signed Routes on Ruffner and/or Coachman’s Trace – Greenway will have a connection at Oakhurst Blvd. and Glen Ashley Drive. (2-5 years)
 - Provide shared use path from greenway entrance at NC 115 (north of Foamex) north to Washam Potts Road. (2-5 years)
 - Connect Greenway to Caldwell Depot Rd. Provides key linkage to two major neighborhoods, Hampton Trace and Caldwell Station, south of the proposed greenway. (5-10 years)
 - Establish on-street route through Caldwell Station neighborhood with signage and/or sharrows (Caldwell Depot Road). (5-10 years)
 - c. **Bailey Road**
 - Coordinate with Bailey Road Extension project to ensure bike/ped facilities are included. (1-2 years)
 - Complete bike lanes and sidewalk connection along Bailey Road from the greenway entrance through Oakhurst to Highway 21. (2-5 years)
 - d. **McDowell Creek Greenway, Phase II**
 - Complete Bike Lanes on Westmoreland Road. (3-5 years)
 - Provide safe greenway crossing of Westmoreland Road with signalized crosswalk, underpass, or both. (5-10 years)

- Fix Westmoreland bridge crossing for bicycle/pedestrians on one side with railing. (2-5 years)
 - Connect Lake Path/Lake Pines between McDowell Creek Greenway and the Chartown Dr. (5 years)
 - Once connected to Lake Path/Lake Pines, provide signage and/or sharrows on Chartown Dr. (5 years)
 - Complete multi-use path between Life Fellowship Church and Lake Path. (10 years)
 - Add sharrows, or signage to Magnolia Estates Drive. (5-10 years)
 - Complete multi-use path connection from end of greenway to Jetton Park. (10 years)
- e. **West Catawba/Catawba Ave/Antiquity Greenway**
- Connect Shared Use path along Chartown (I-77 Service Road) to DDI. (10 Years)
 - Reestablish the bike lanes on Catawba Ave during the next repaving. (5 years)
 - Connect existing bike lanes on Catawba with bike lanes or sharrows from Meridian Street to Town Center and Antiquity (Festival Street concept). (5-10 years)
 - Add sharrows and/or signage within Antiquity along Market Street and South Street. (5-10 years)
3. Begin targeted improvements along primary north-south, and east-west bike routes according to the plan as follows:
- a. North/South route from the YMCA to Washam Potts Rd – Following Church St, School St, Gem St, Oak St, Hickory St, Tryon St. Install signage and other traffic calming measure if necessary to establish this section of the north/south route from the YMCA to Northcross Center Ct. (2-5 years)
 - b. Lover’s Lawn/Hickory Street- Install signage of route in the short term. Potential sharrows in the long term once resurfaced. Include appropriate crosswalks and signalization at the new Hickory/115 intersection. (2-5 years)
 - c. South Street/School Street – Install signage of route, research speed limit/traffic calming to determine other treatment options such as bike lanes or sharrows. (2-5 years)
 - d. West Catawba parallel alternative route – begin to implement connections and improvements along the Catawba alternative bicycle route that connects all four major peninsulas.
 - Bike lanes on both sides of Knox (with development).
 - Provide connection between Henderson Rd and Bethel Church Road. (2-5 years)
 - Bike lanes on Bethel Church Road. (5-10 years)
 - Route signage or sharrows on Charles Towne Lane. (1-2 years)
 - Identify and sign bike route through Lake Norman Cove at Jetton neighborhood. (2-5 years)
 - Provide bike/ped connection between Harbor View Drive and Coastal Crossing Drive (EPCON Courtyards at Nantz subdivision). (2-5 years)

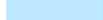
- e. Jetton Road Extension – Implement preferred alternatives from the plan. (5 years)

PRIORITY BIKE FACILITY RECOMMENDATIONS

The map at right and the cross sections on the following pages indicate high priority corridors, with proposed retrofit solutions. Unless otherwise noted, the proposed sections refer to long term implementation solutions and will require additional coordination and design. Refer to the Design Guidelines in Appendix B for more details about best practices for implementation.

Bike!Cornelius

Cornelius, NC Bicycle Master Plan Priority Sections

-  Priority Sections
-  Railroads
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI

- A** North Main Street
- B** Washam Potts Road
- C** Bailey Road
- D** Bailey Road
- E** Jetton Road
- F** Jetton Road Extension
- G** Liverpool Parkway
- H** Statesville Road
- I** Westmoreland Bridge over I-77
- J** Westmoreland Road
- K** West Catawba Avenue
- L** Catawba Avenue
-  AADT

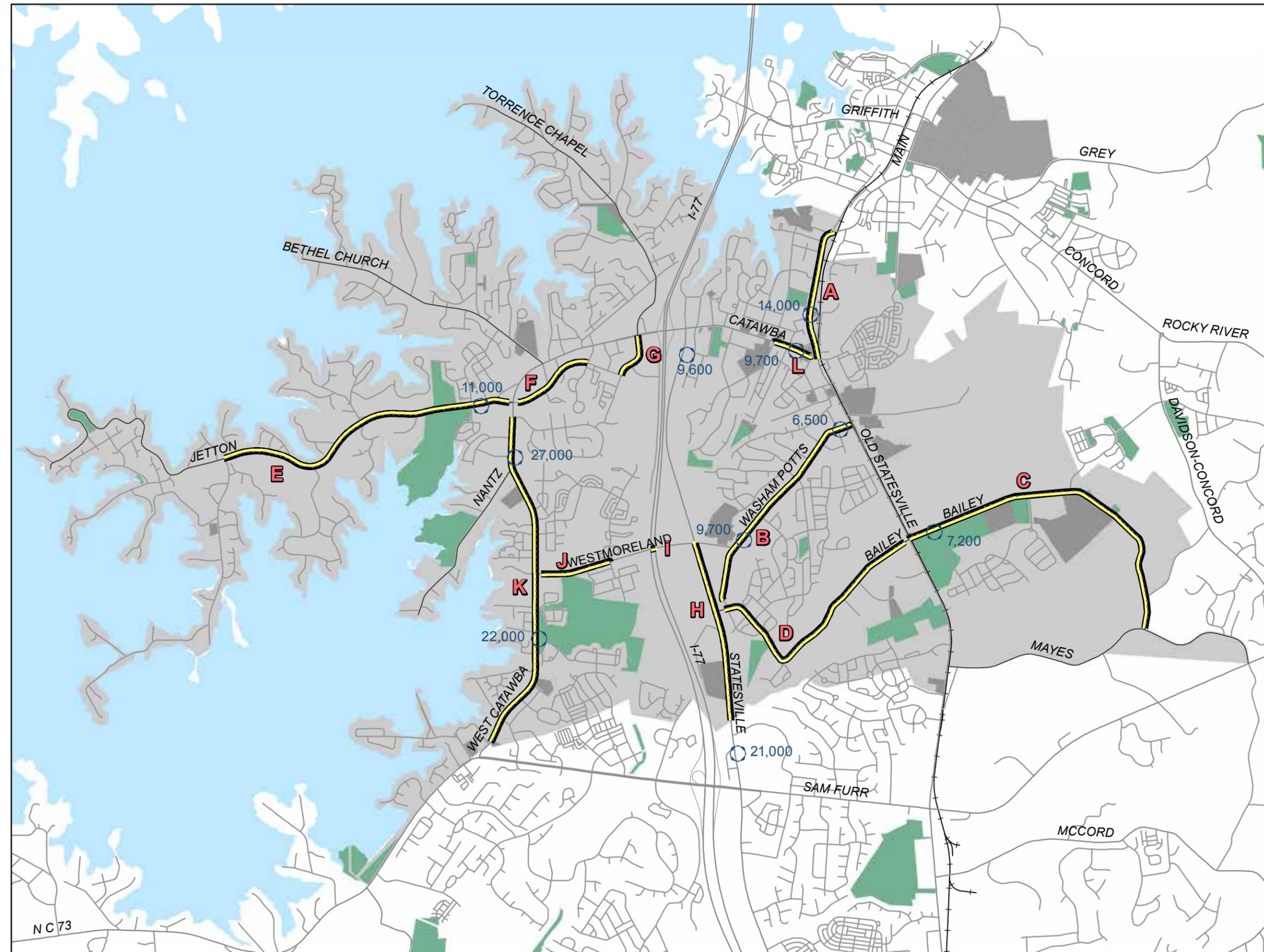
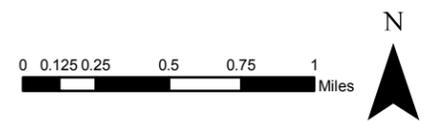


Figure 3.14. Priority Sections Map

Table 3.10 Summary of Existing Conditions of twelve (12) priority sections.

ROAD	FROM/TO	ROAD WIDTH	NUMBER OF LANES	AADT*	SPEED LIMIT	ON-STREET PARKING	C&G/ SHOULDER	IMPLEMENTATION NEEDS	CONSTRAINTS	LENGTH (MILES)	COST ESTIMATE**
A. North Main Street	Catawba Ave./Potts St.	35'	2	14,000	35	no	6.5' Shoulder Both sides	-add C&G	ROW constrained by concrete wall on east side, utility poles w/in ROW	0.84	TBD within cost estimate of NCDOT project
B. Washam Potts	NC Route 115/ Bailey Rd.	22	2	6,500/ 9,700	35	no	none	-extend shoulders to accommodate 5' bike lanes -add C&G -widen 5' sidewalk to 10' sidepath on N side -add 5' sidewalk to S side	ROW	1.48	bike lanes: \$197,100 sidepath: \$1,172,160 ⁱⁱ
C. Bailey Road (east)	NC Route 115/ Mayes Rd	33	3	7,200	45	no	2.5' Gutter Pan (South side) near school entrances	-extend shoulders to accommodate 5' bike lanes -extend sidepath along length of corridor -add sidewalk on N side		2.93	bike lanes: \$400,000
D. Bailey Road (west)	NC Route 21/ NC Route 115	33	3	unavailable	45	no	none	-extend shoulders to accommodate 5' bike lanes -extend sidepath along length of corridor -add sidewalk on N side		1.70	\$230,000
E. Jetton Road	W. Catawba Ave./ John Connor Rd.	44'	2	11,000	45	no	2.5' Gutter Pan (Both sides)	-widen 5' sidewalk to 10' sidepath		1.96	\$1,552,300
F. Jetton Road Extension	W. Catawba Ave./ One Norman Dr.	38	2	unavailable	25	9' Both Sides	2.5' Both Sides	-remove on-street parking and convert to 5' cycle tracks		0.56	\$86,000 ⁱⁱⁱ
G. Liverpool Parkway	W. Catawba Ave./ Sefton Park Rd.	30	2	unavailable	25	no	2.0' Along Median, 2.5' along outside	-restripe 15' travel lanes to 10' plus 5' bike lanes -widen 5' sidewalk to 10' sidepath on one side		0.30	\$13,000 ^{iv}
H. Statesville Road	Westmoreland Rd./ Huntersville town line	33	3	9,700/ 21,000 ⁱ	35	no	none	-add 2 travel lanes + bike lanes, separated by median	utility poles in ROW	1.14	TBD within cost estimate of NCDOT project
I. Westmoreland Road Bridge	bridge over I-77	36	2	unavailable	45	no	none	-restripe lanes to include 10' 2-way sidepath		0.06	\$400,000
J. Westmoreland Road	W. Catawba Ave./ Lake Pines Dr.	33	3	unavailable	45	no	none	-extend shoulders to accommodate 5' bike lanes -add C&G -add 5' sidewalk on N side		0.44	\$60,000
K. West Catawba Avenue	Magnolia Estates Dr./ Sam Furr Rd.	22	2	27,000/ 22,000	35	no	none	-add 2 travel lanes + bike lanes/cyle tracks, separated by median -add 5' sidewalk and 10' sidepath		2.35	TBD within cost estimate of NCDOT project
L. Catawba Ave	Mulberry St./ NC Route 115 (Main St.)	40	2	9,700	25	8' South side	none	-reduce travel lane width to accommodate extension of sidewalk on S side from 5' to 10' -add shared-lane markings in travel lanes		0.21	\$400,000-\$700,000 ^v

* 2014 Annual Average Daily Traffic (AADT) counts. Source: NCDOT https://xfer.services.ncdot.gov/imgdot/DOTTSUMaps/AADT_COUNTIES_2014/Mecklenburg/Mecklenburg_County_AADT_2014.pdf

** These cost estimates are based on 2012 estimated cost/mile figures provided in Table 3.1, unless otherwise noted, and are not meant to be final figures for these projects.

i. AADT is unavailable for the exact section of Statesville Rd that corresponds to this project's priority sections.

ii. Estimate based on similar project on West Catawba Ave, Cornelius, NC.

iii. Estimate based on similar project in Rocky Mount, NC, with a cost of \$155,000 per mile.

iv. Estimate based on striping costs only, at \$43,300 per mile.

v. Estimate includes cost estimation of design & construction costs, and will vary depending on materials. Estimate does not include costs related to contingencies, right-of-way and inspections.

N. Main Street/NC 115 (between Catawba Ave. and Potts St.)

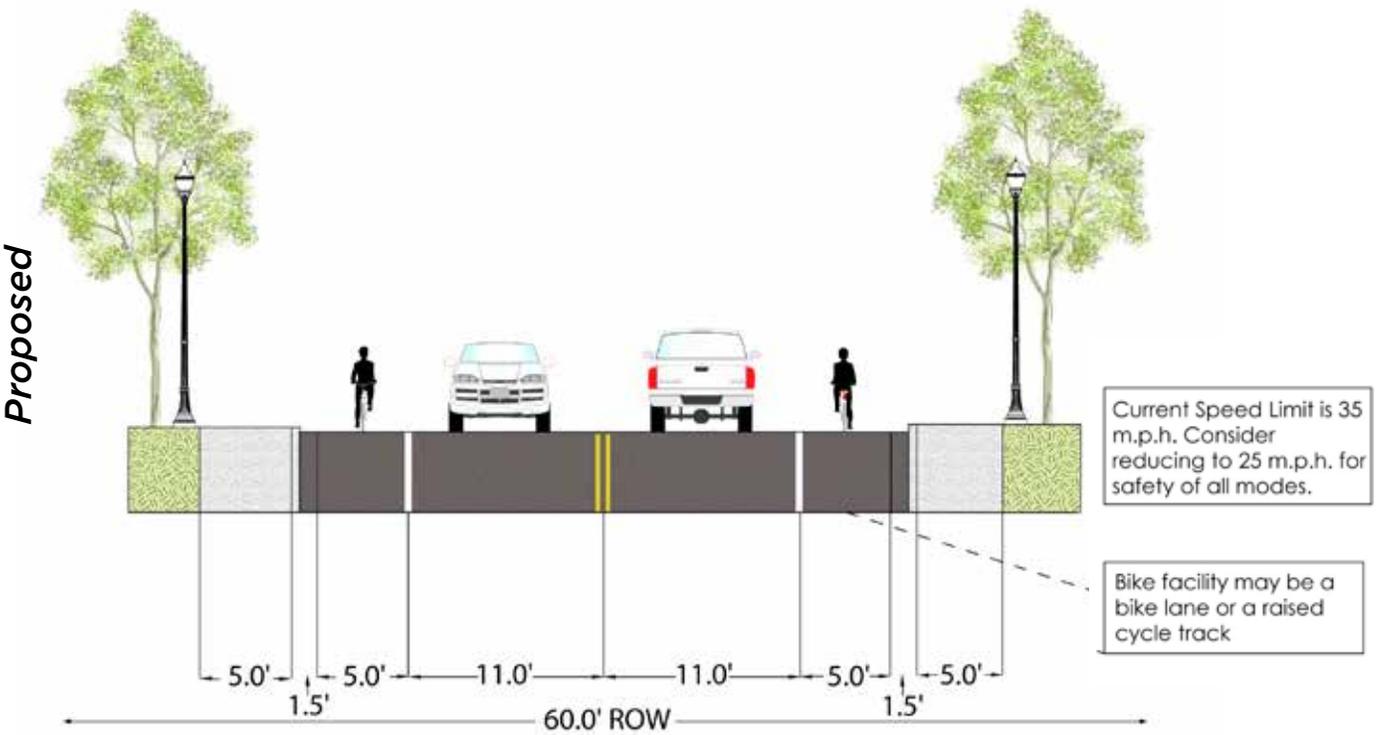
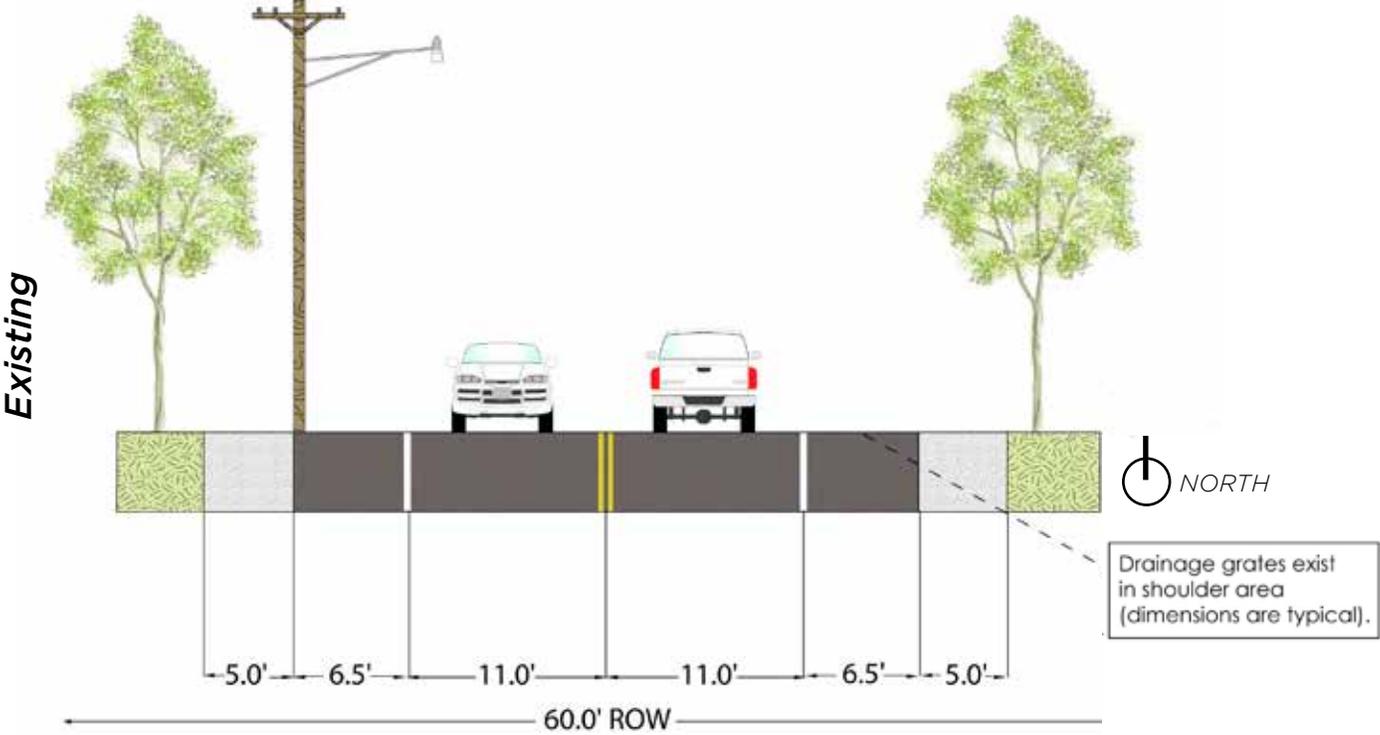


Figure 3.15. Main Street/NC 115 Reconfiguration Concept

Washam Potts Road (between NC 115 and Bailey Road)

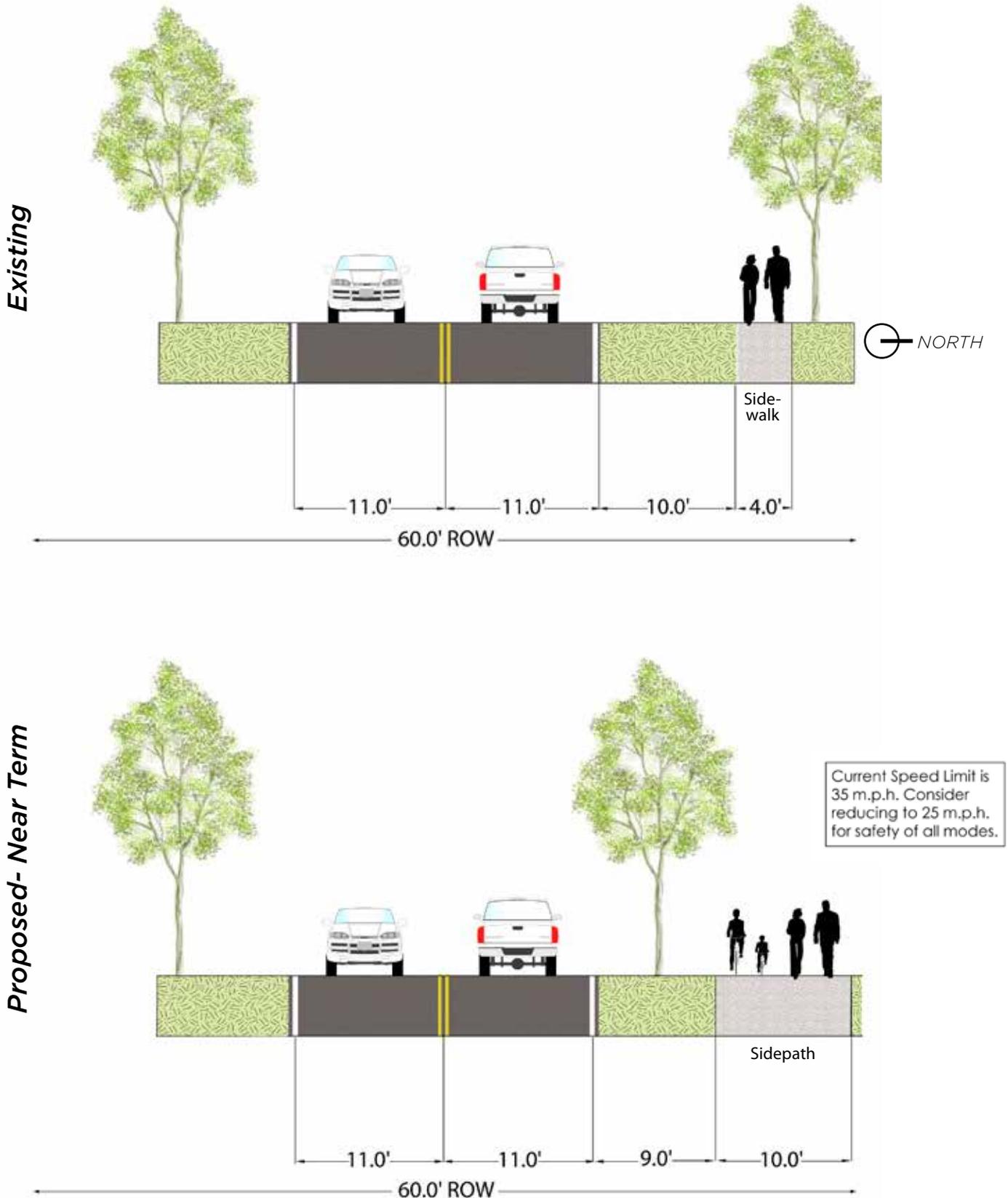


Figure 3.16. Washam Potts Road Near Term Proposed Sidepath

Washam Potts Road (between NC 115 and Bailey Road)

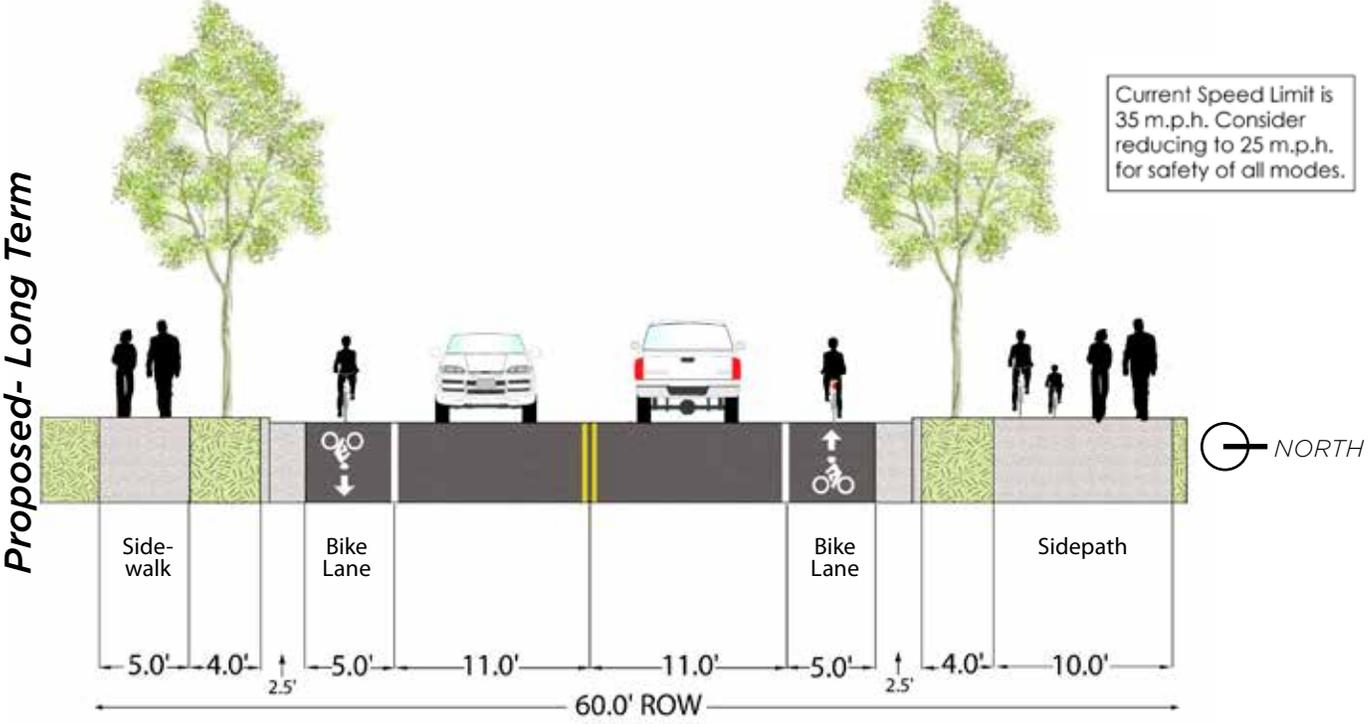


Figure 3.17. Washam Potts Long-Term Reconfiguration Concept with Bicycle Lanes and Sidepath

East Bailey Road (between NC 115 and Mayes Road)

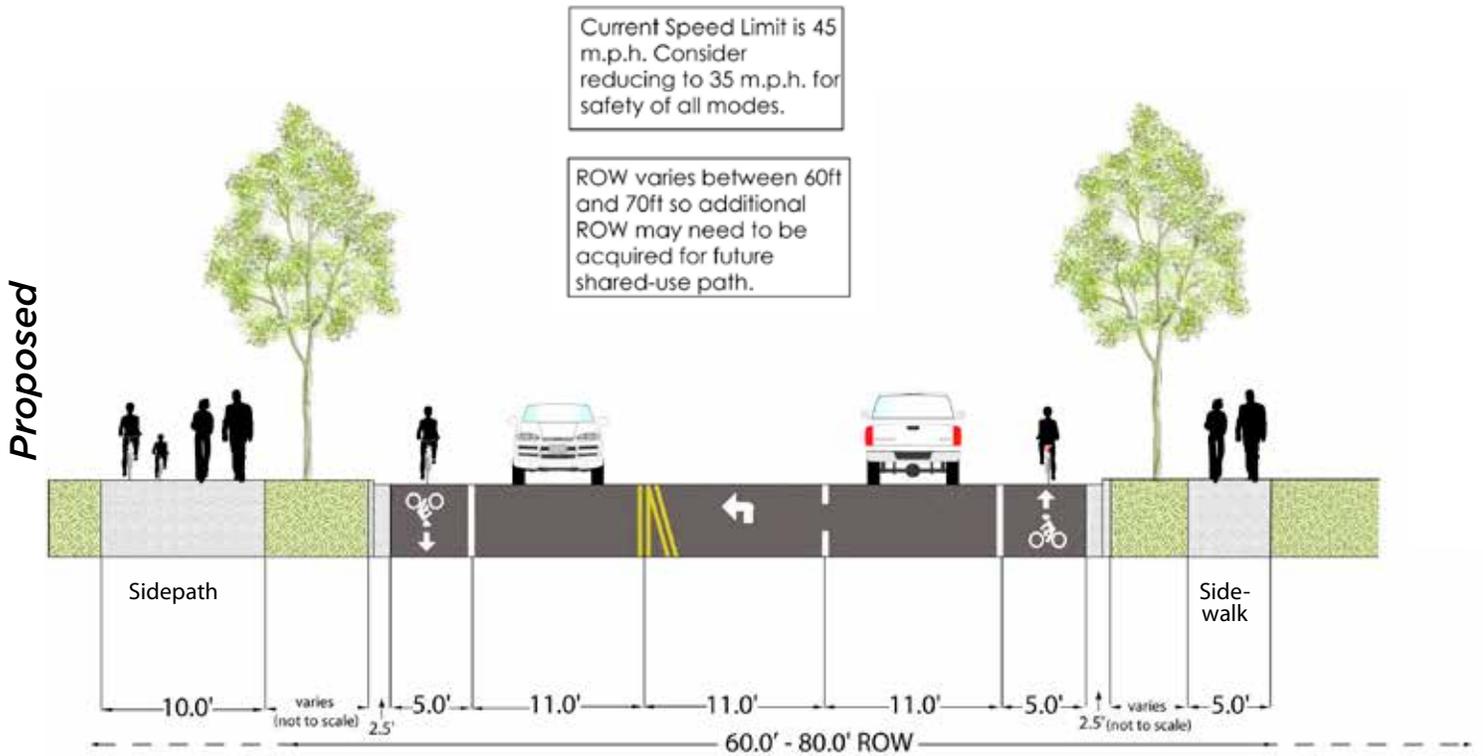
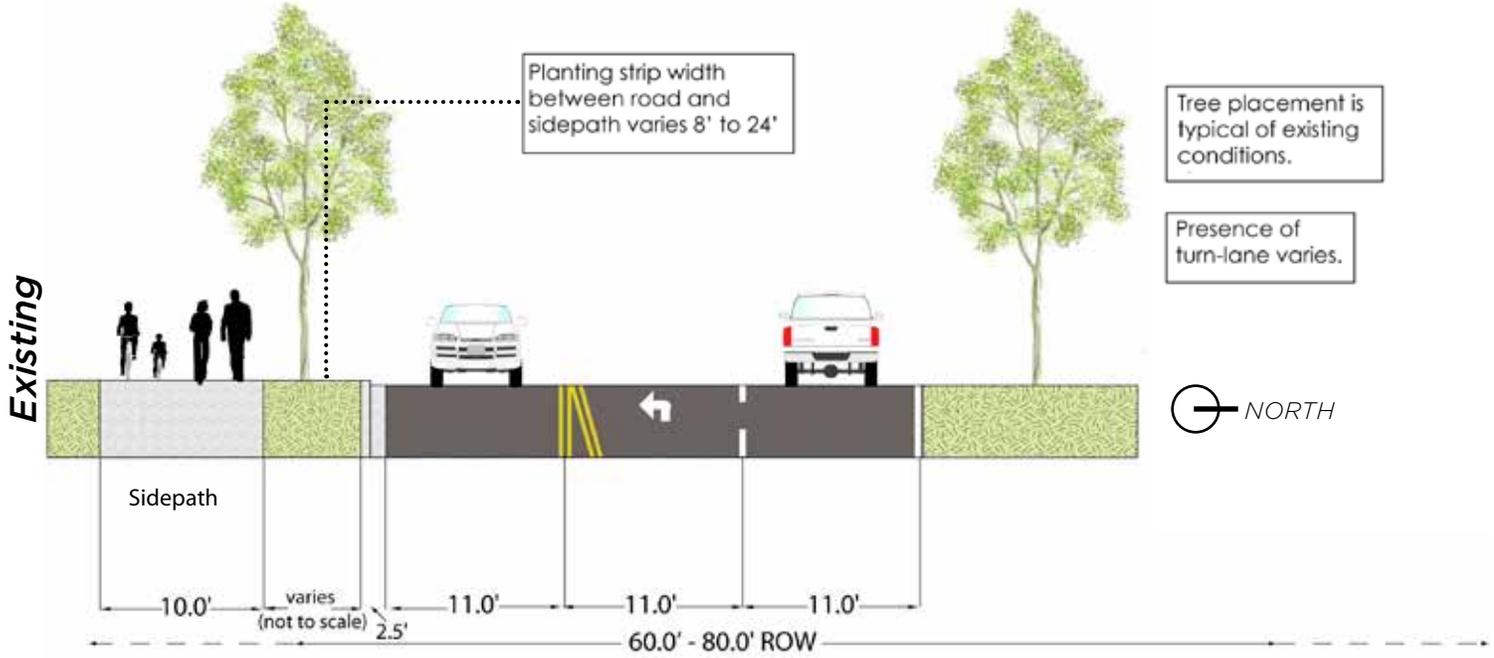


Figure 3.18. Bailey Road Reconfiguration Concept- East of NC 115

West Bailey Road (between NC 21 and NC 115- including Poole Place ext.)

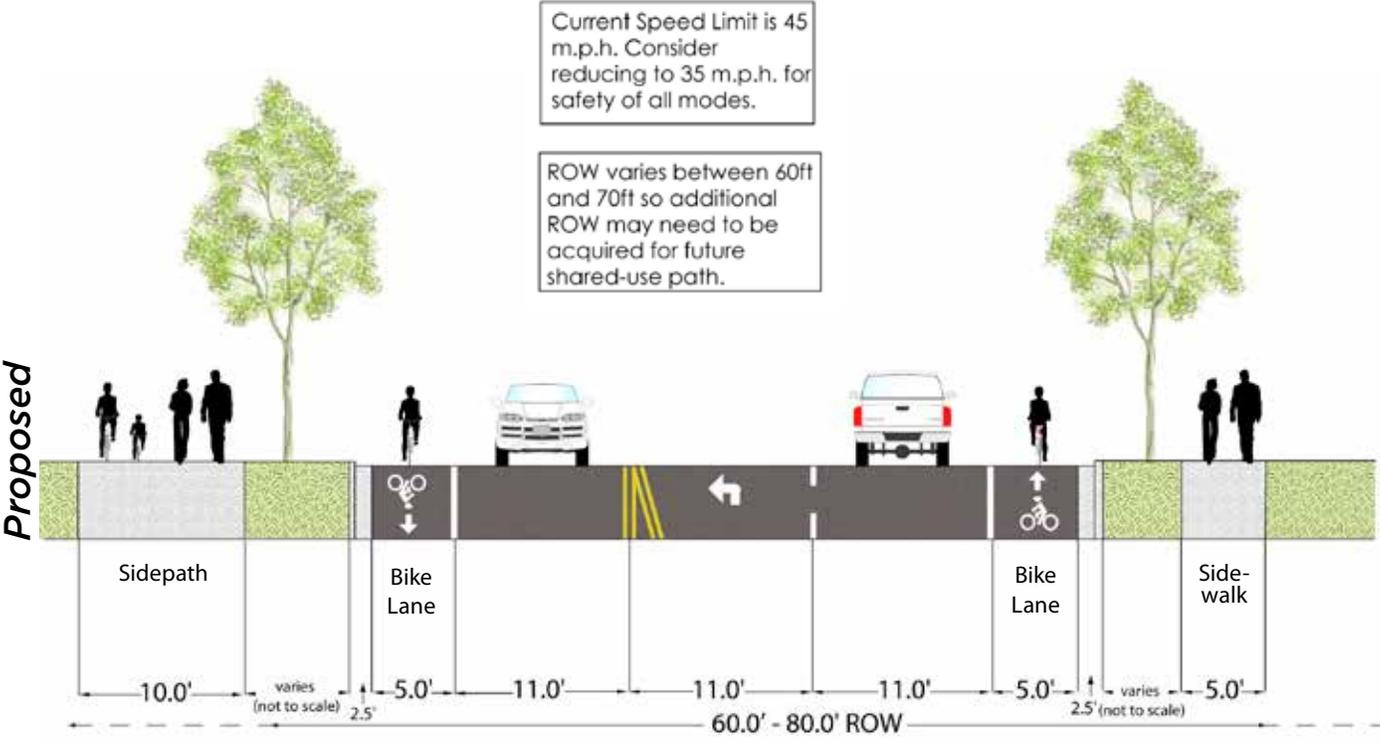
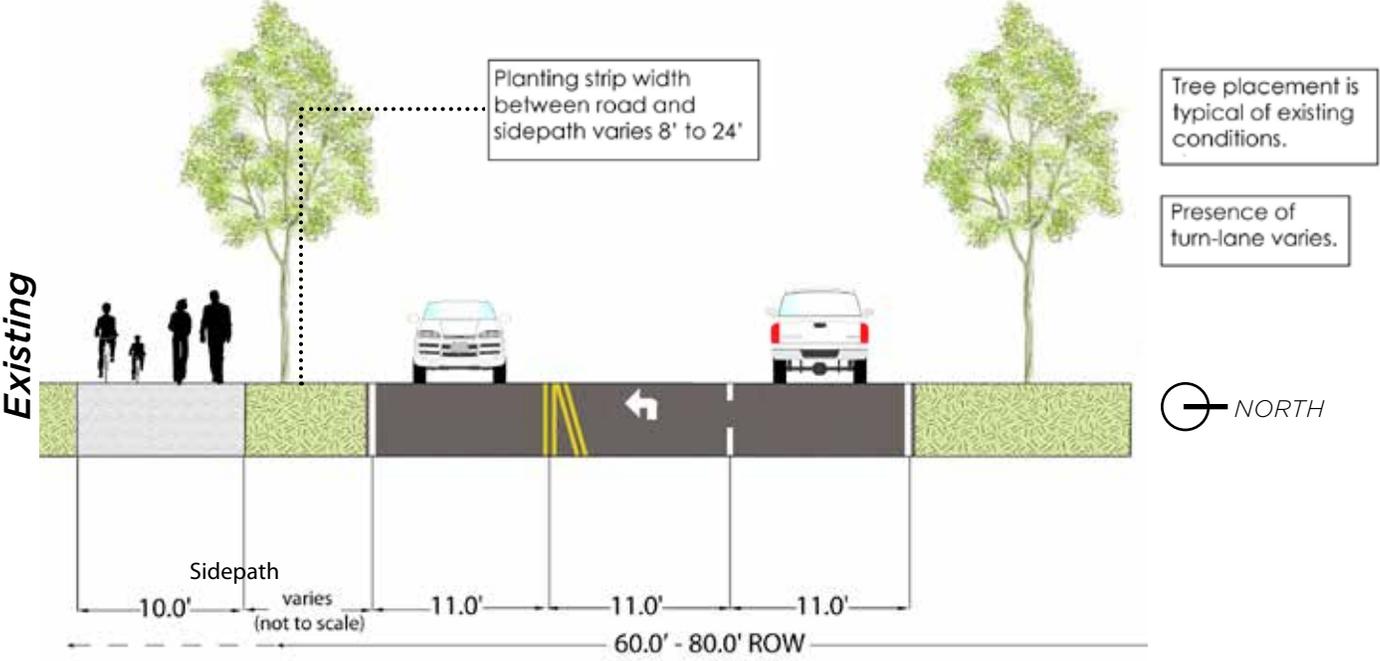
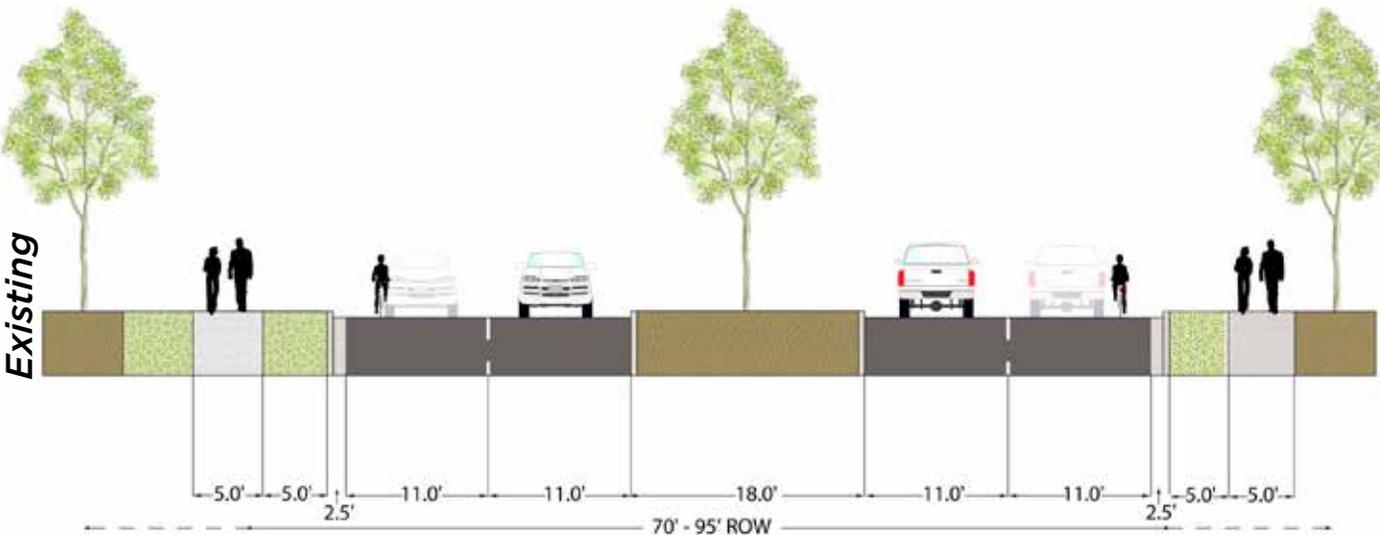


Figure 3.19. Bailey Road Reconfiguration Concept- West of NC 115



Figure 3.20. Bailey Road Reconfiguration Concept in Oakhurst neighborhood with mid-block crossing and Bicycle Lanes. (Road section pictured is different from recommendations)

Jetton Road (between West Catawba Ave. and John Connor Rd.)



NOTE: SIDEWALK VARIES

Speed Limit is 45 m.p.h. from West Catawba Ave. to Peninsula Shores Dr., and 35 m.p.h. west of Peninsula Shores Dr.

Presence of sidewalk on both sides of road varies.

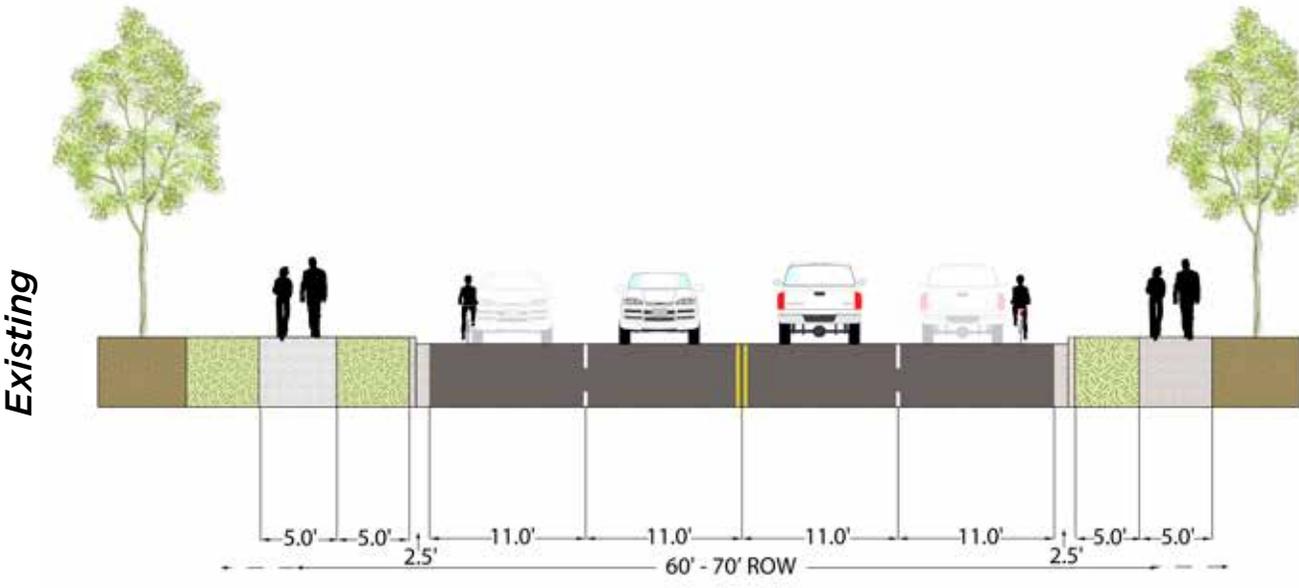
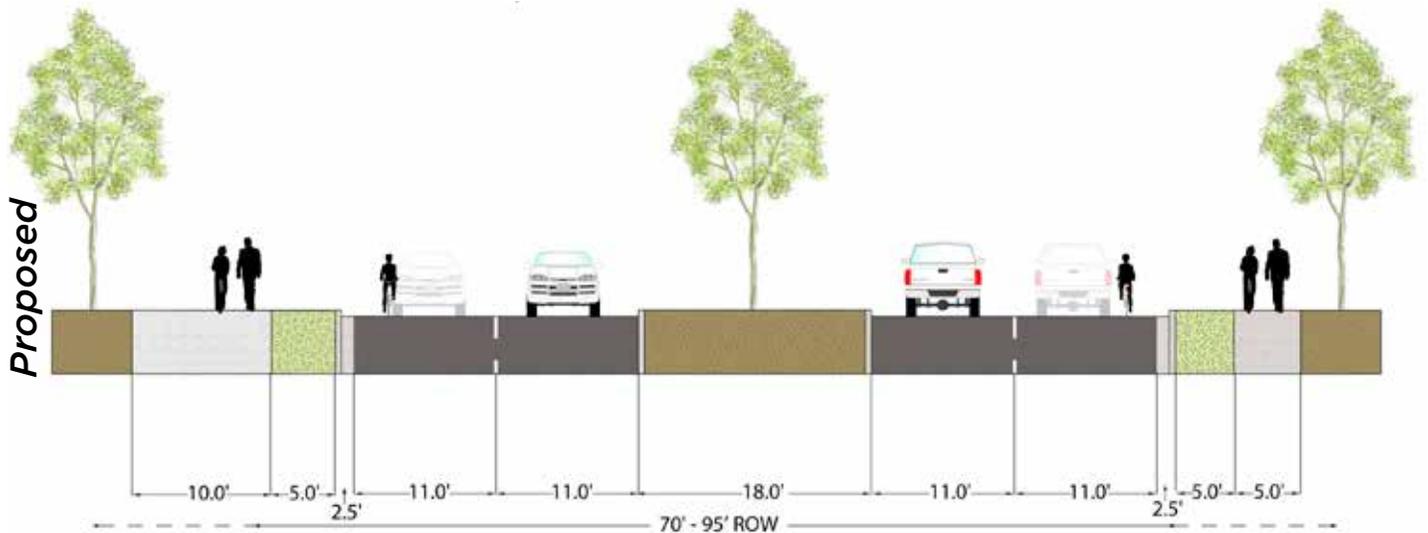


Figure 3.21. Jetton Road Existing divided 4-lane and undivided 4-lane Configuration

Jetton Road (between West Catawba Ave. and John Connor Rd.)



Side of road with sidepath will vary. Plan is already approved as part of the Town of Cornelius Comprehensive Parks and Greenways Master Plan.

Consider reducing speed limit to 35 m.p.h. for entire length of road for safety of all users

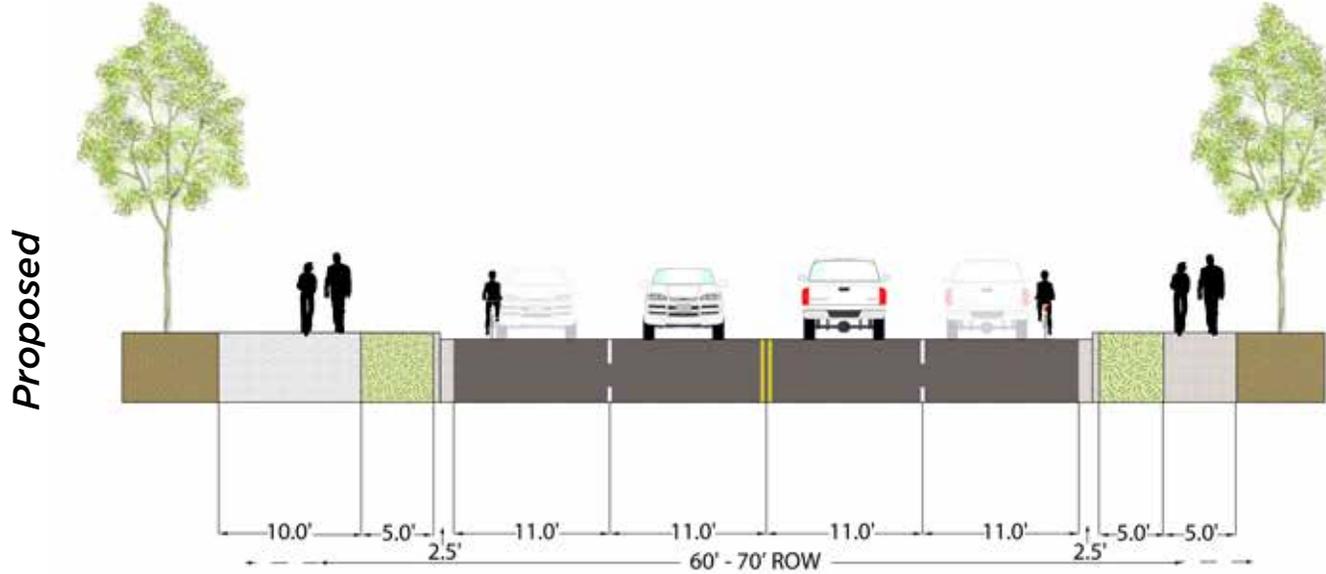


Figure 3.22 Jetton Road Reconfiguration Concept with Sidepath. This is recommended from Catawba Ave. to Jetton Park in the near term, and eventually to John Connor Rd.

Jetton Road Extension (between W. Catawba Ave. and One Norman Dr.)

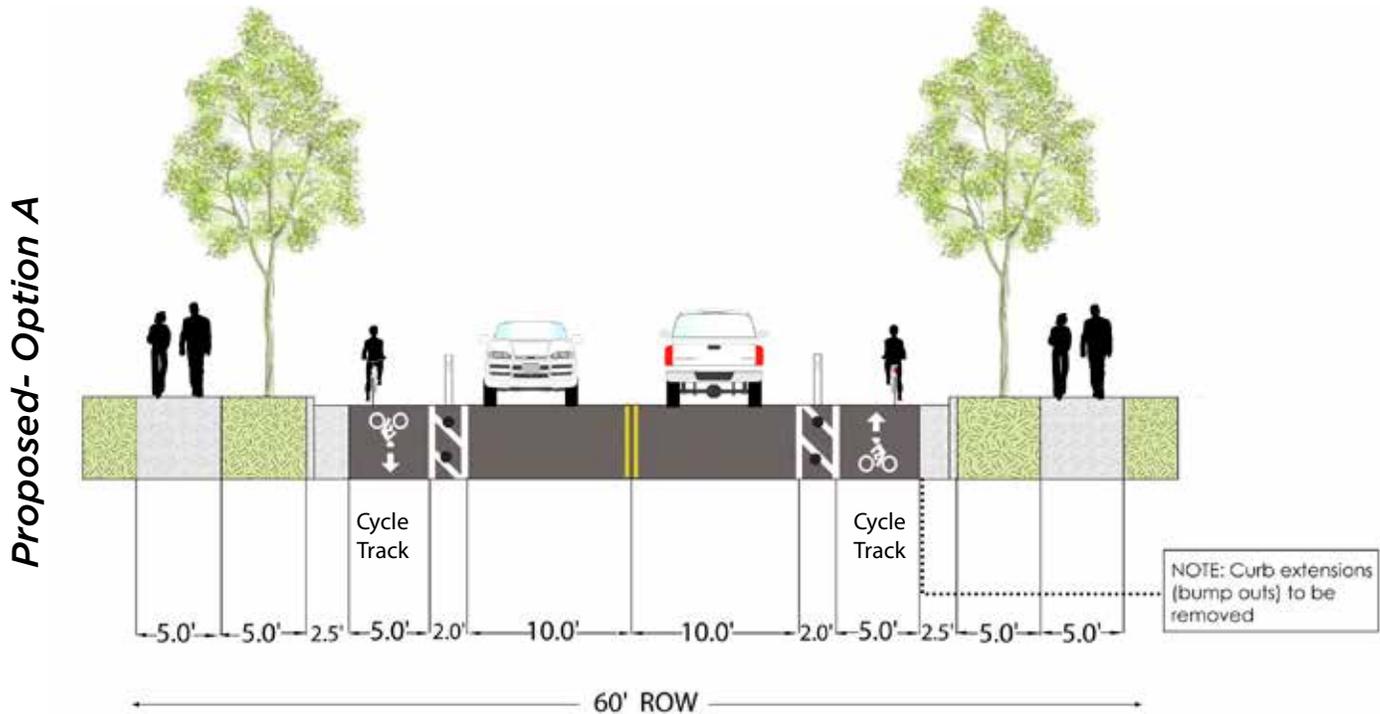
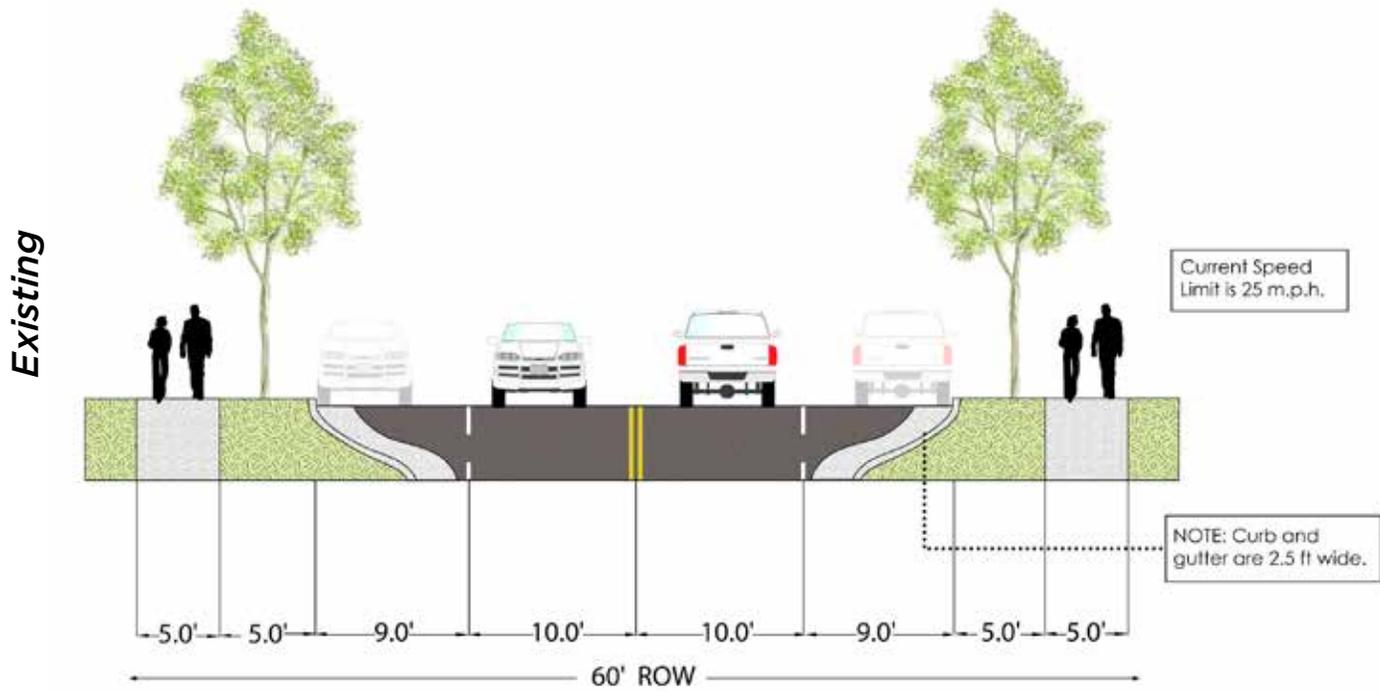


Figure 3.23. Jetton Road Extension existing undivided 2-lane with parking to proposed 2-lane Reconfiguration Concept- Option A with Protected Bicycle Lanes

Jetton Road Extension (between W. Catawba Ave. and One Norman Dr.)

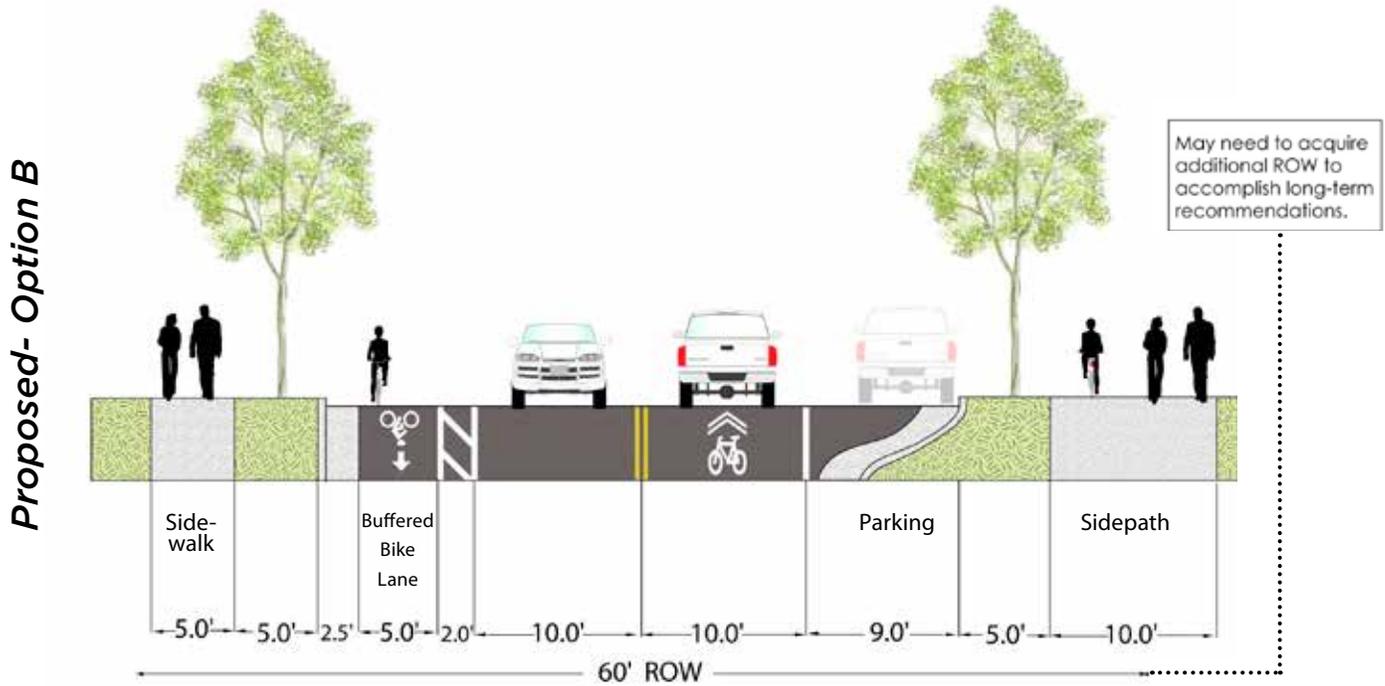


FIGURE 3.24. JETTON ROAD EXTENSION RECONFIGURATION CONCEPT - OPTION B WITH SIDE PATH, ONE-WAY PROTECTED BICYCLE LANE, AND 1 PARKING LANE

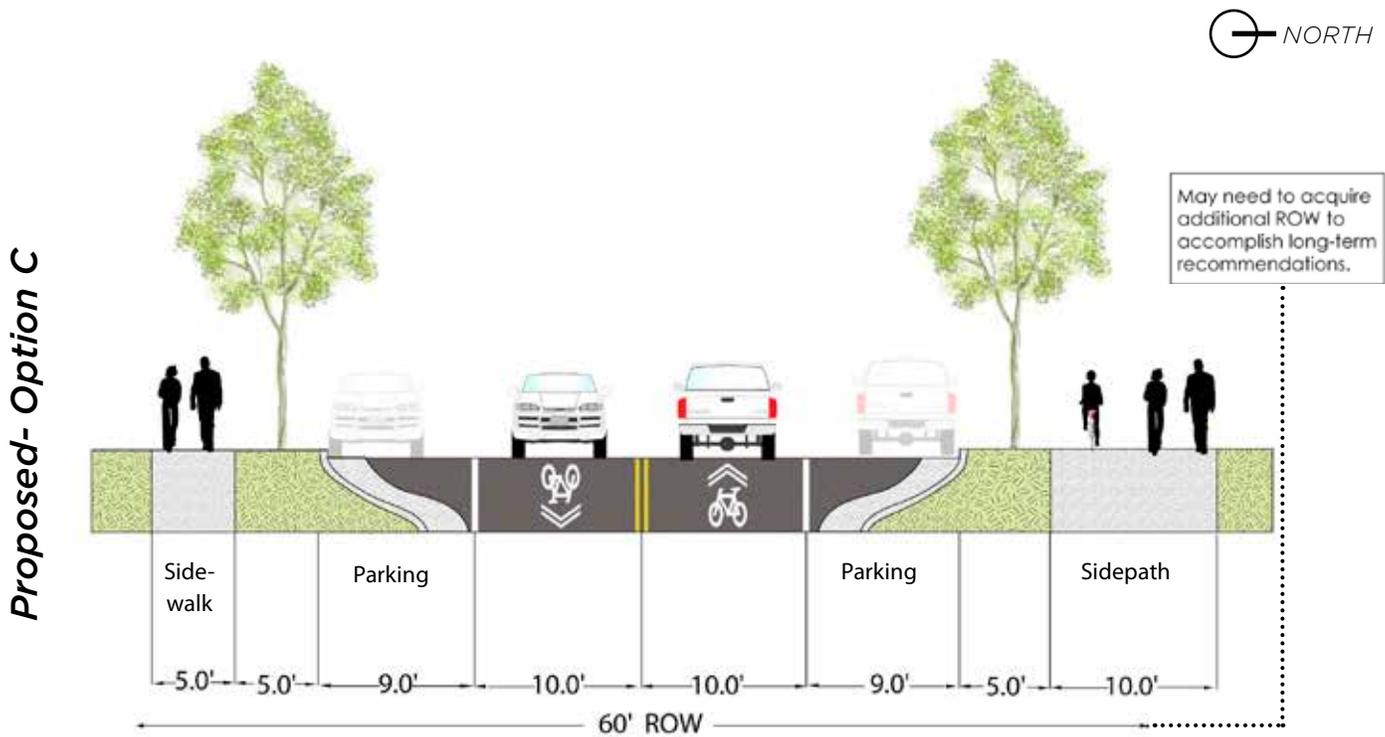


Figure 3.25. Jetton Road Extension Reconfiguration Concept- Option C with Sidepath and Shared-Lane Markings

Liverpool Parkway (between W. Catawba Ave. and Sefton Park Rd.)

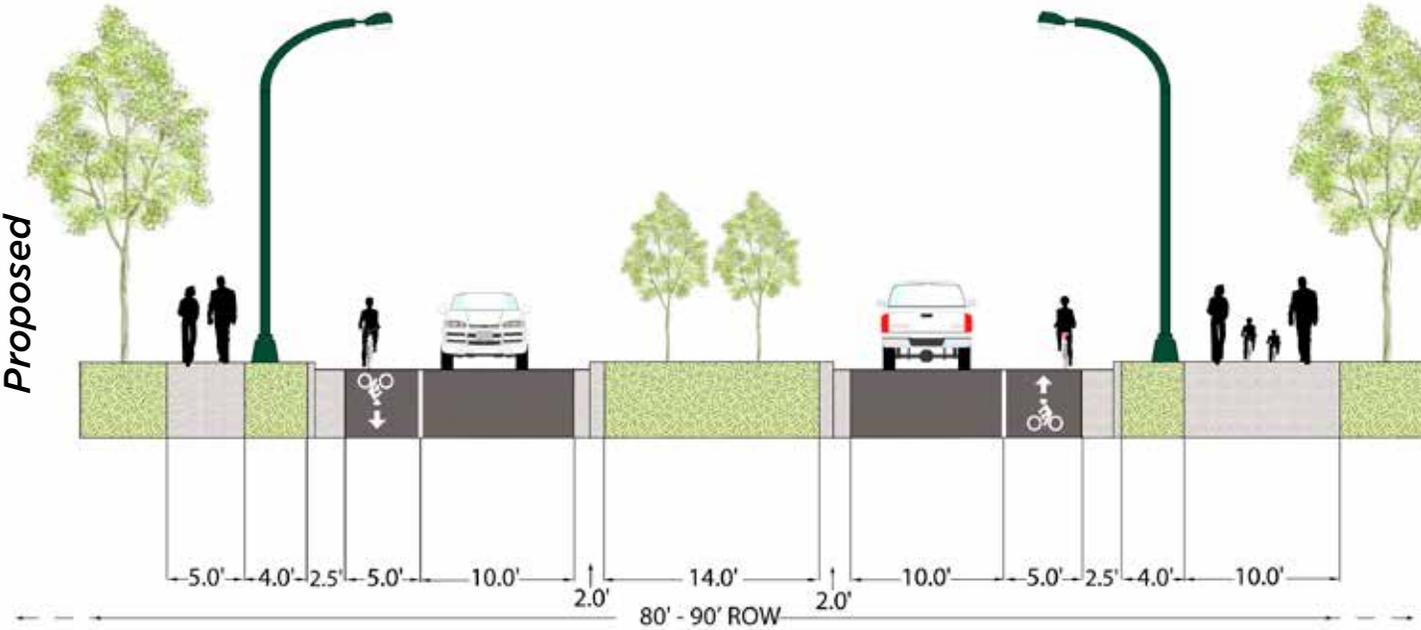
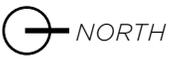
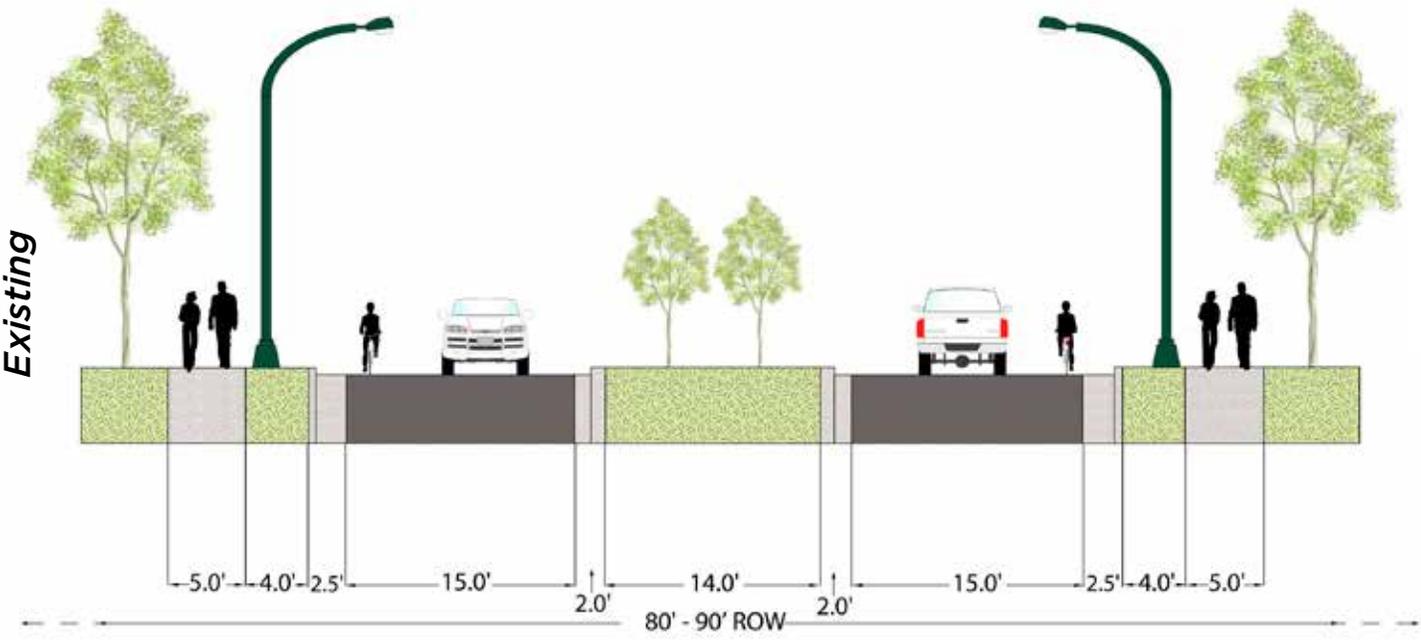


Figure 3.26. Liverpool Parkway existing divided 2-lane to proposed 2-lane Reconfiguration Concept with Bicycle Lanes and Sidepath

Statesville Road (between Westmoreland Rd. and Huntersville town line)

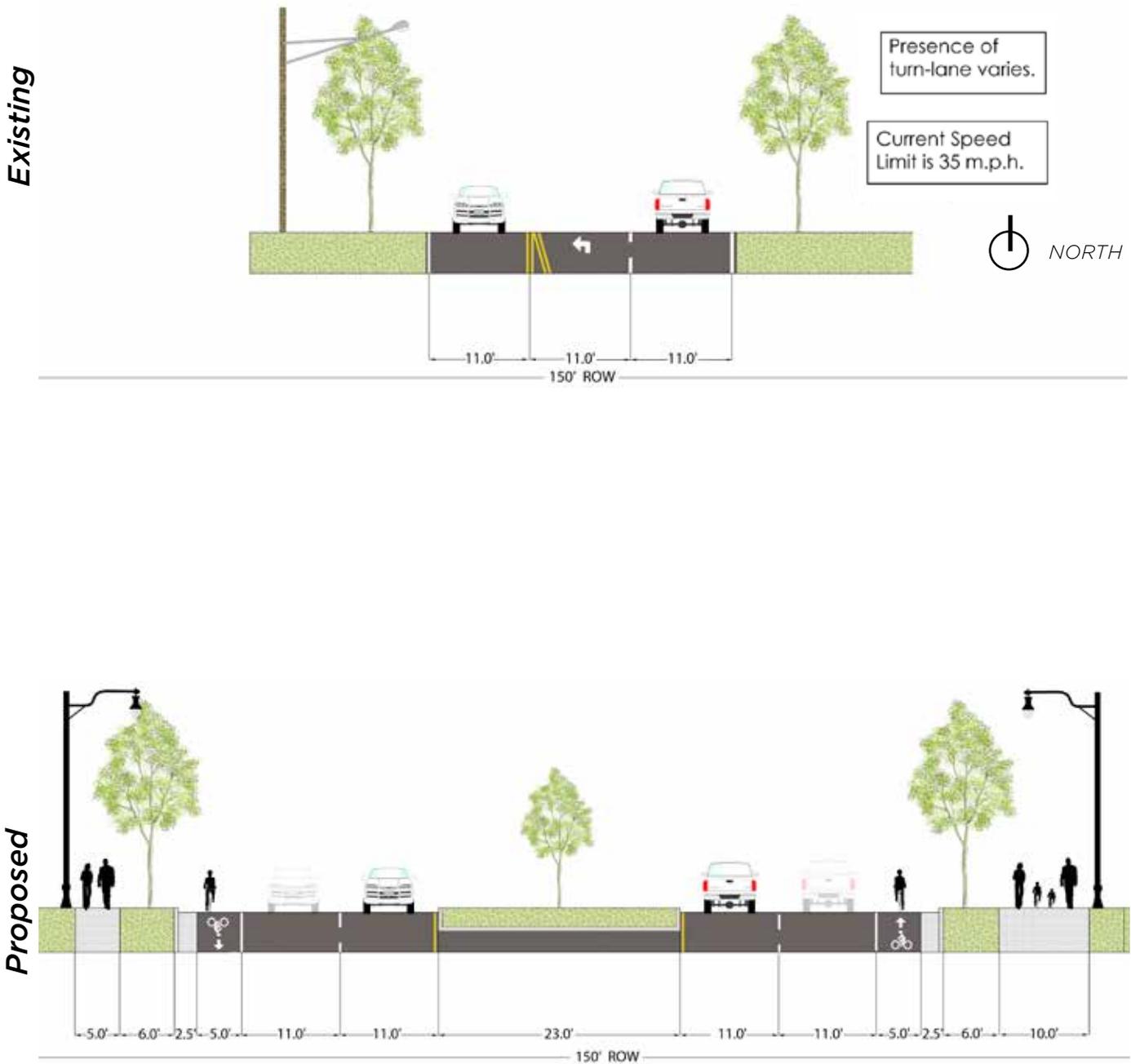


Figure 3.27. Statesville Road existing undivided 2-lane Road with Turning Lane and proposed Reconfiguration Concept with Sidepath, Sidewalk, and Bike Lanes. Note that Statesville Road is scheduled for widening.

Westmoreland Road Bridge over I-77 Existing

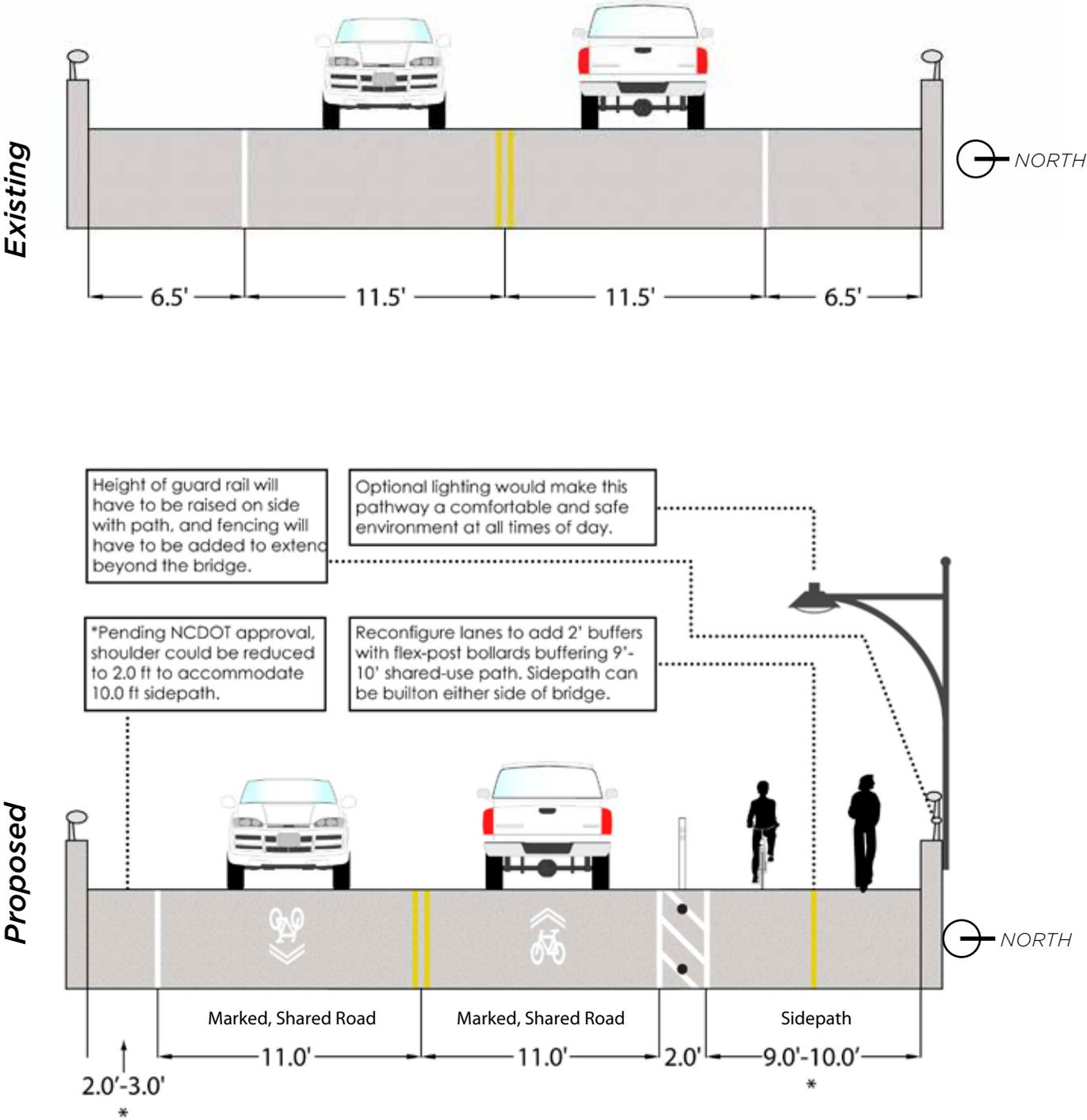
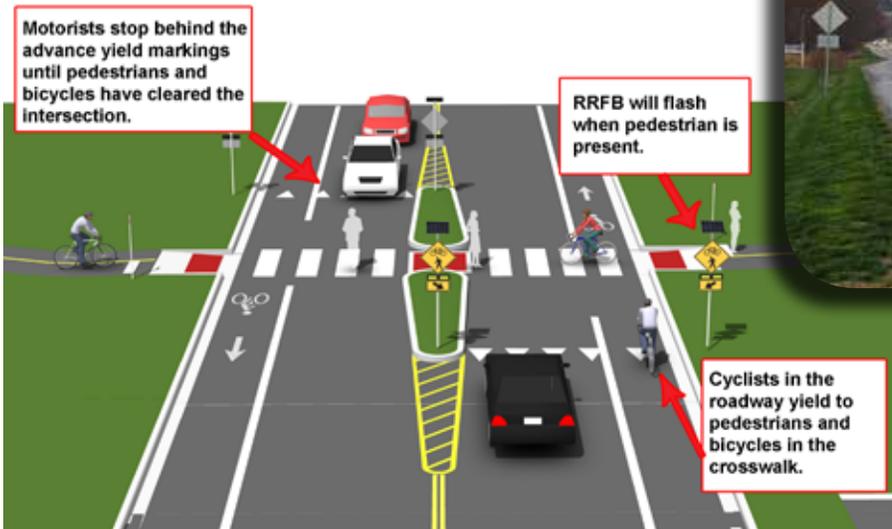


Figure 3.28. Westmoreland Road bridge Reconfiguration Concept includes a 2-way Sidepath

Westmoreland Road Greenway Crossing Options



Above: Existing conditions on Westmoreland Road, looking east toward the I-77 bridge.

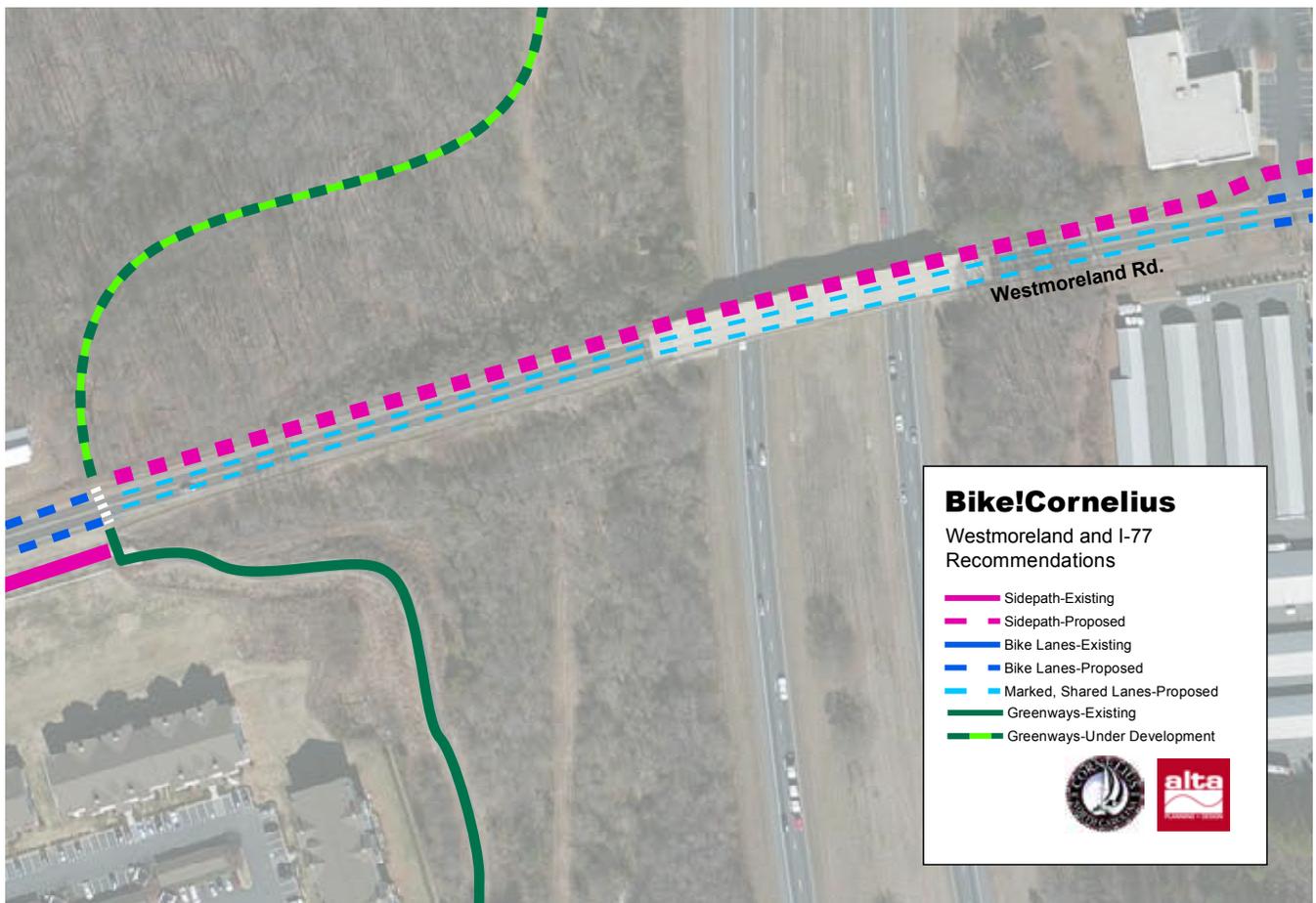


Figure 3.29. Existing View and Proposed Schematic Plan View of Westmoreland Road Bridge Reconfiguration and Sidepath

Westmoreland Road (between W. Catawba Ave. and Lake Pines Rd.)

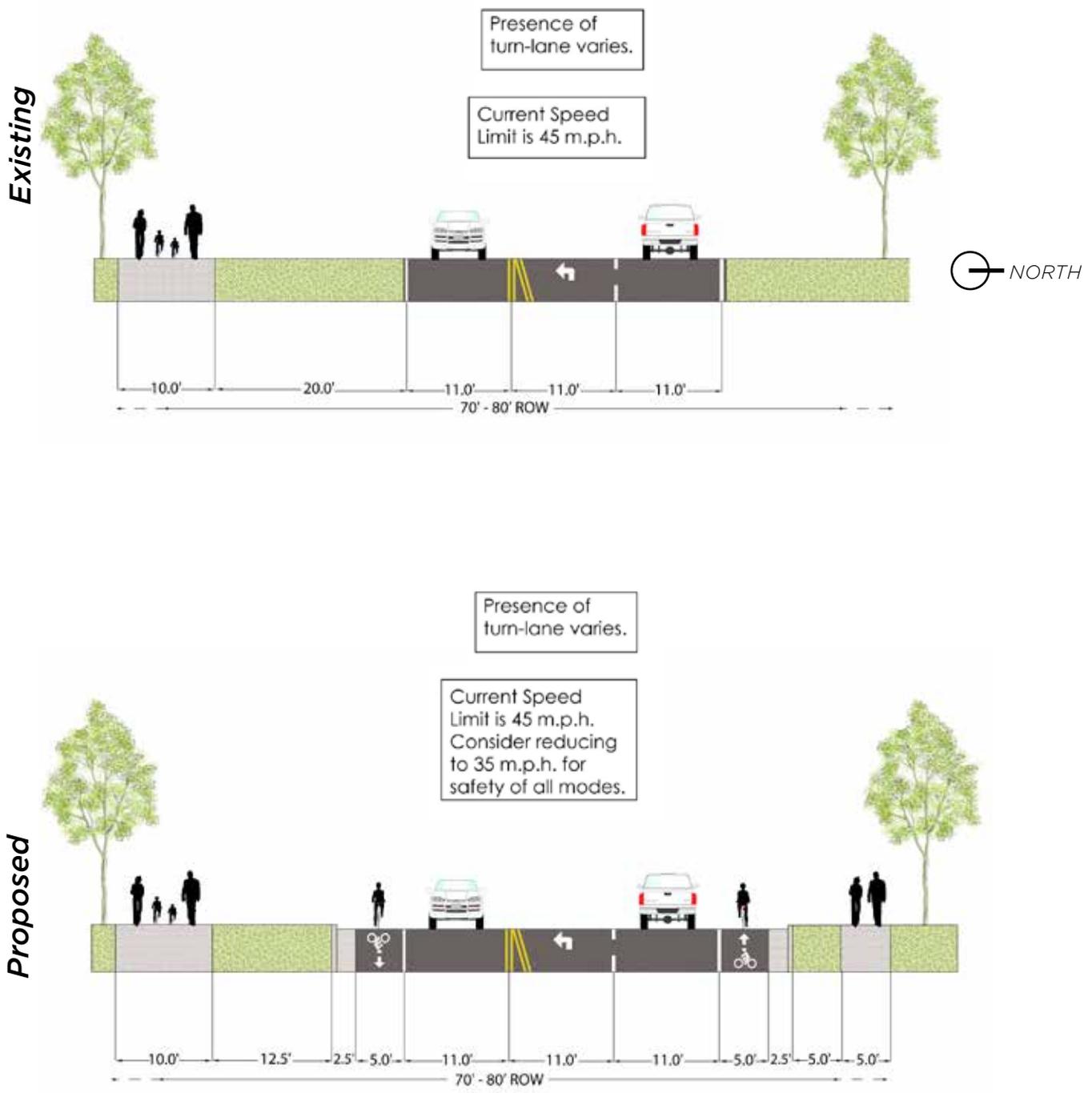
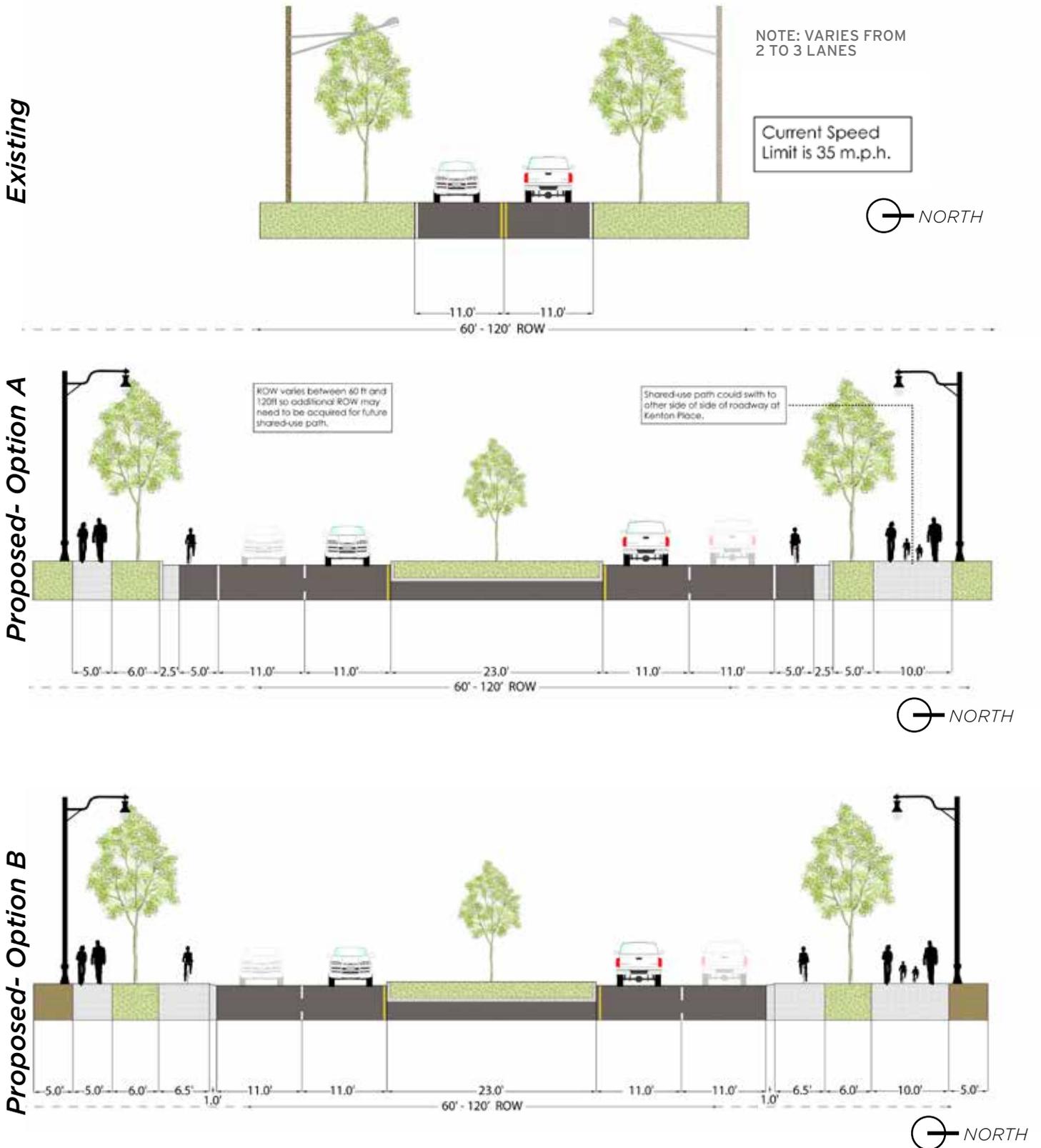


Figure 3.30. Westmoreland Road existing undivided 2-lane road with Turning Lane and proposed Reconfiguration Concept with Sidepath, Sidewalk, and Bike Lanes

West Catawba Avenue (between Magnolia Estates Dr. and Sam Furr Rd.)



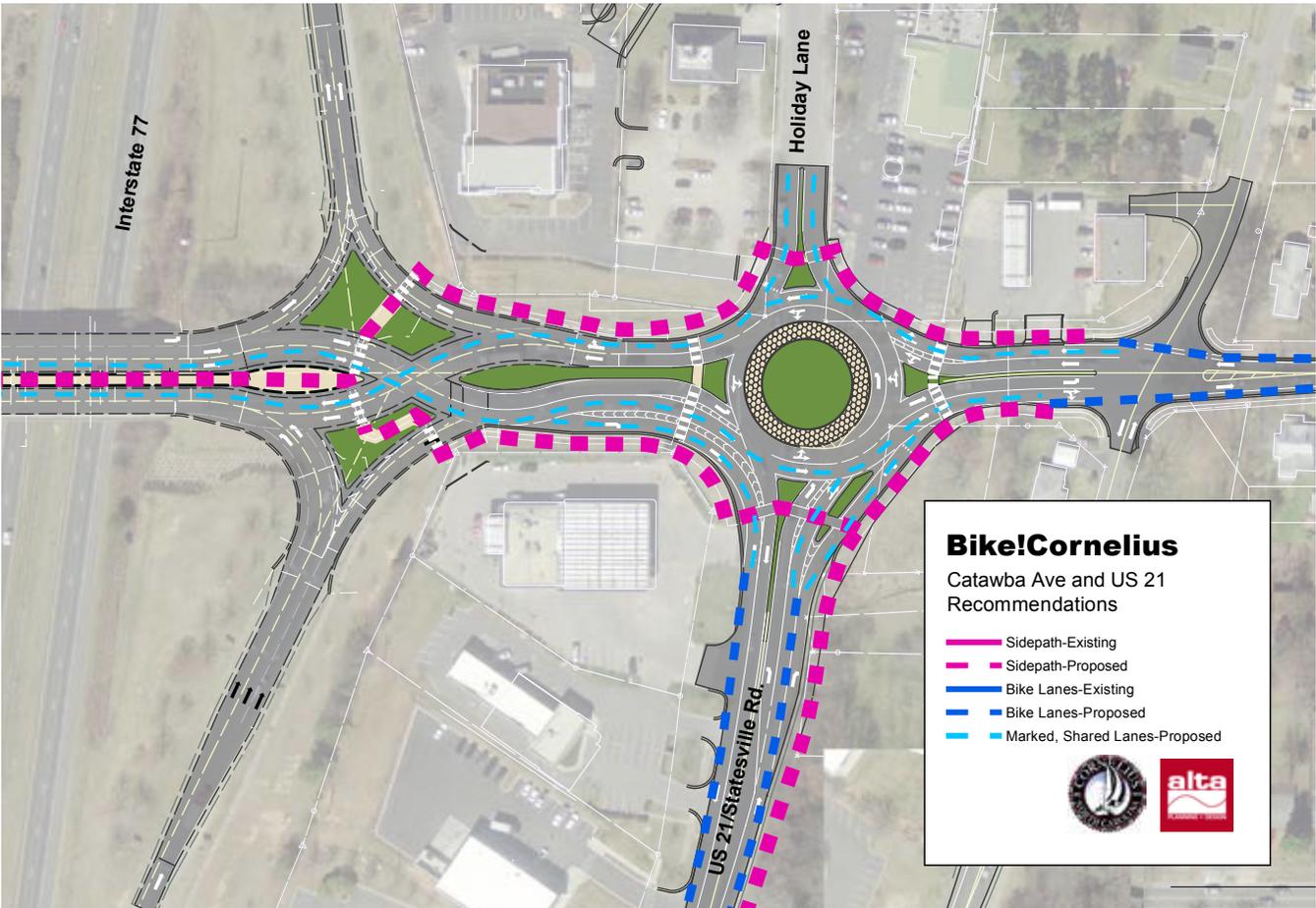


Figure 3.32. Catawba Avenue and Statesville Road/US 21 Intersection Recommendations

Catawba Avenue (between Meridian Street and Oak Street)

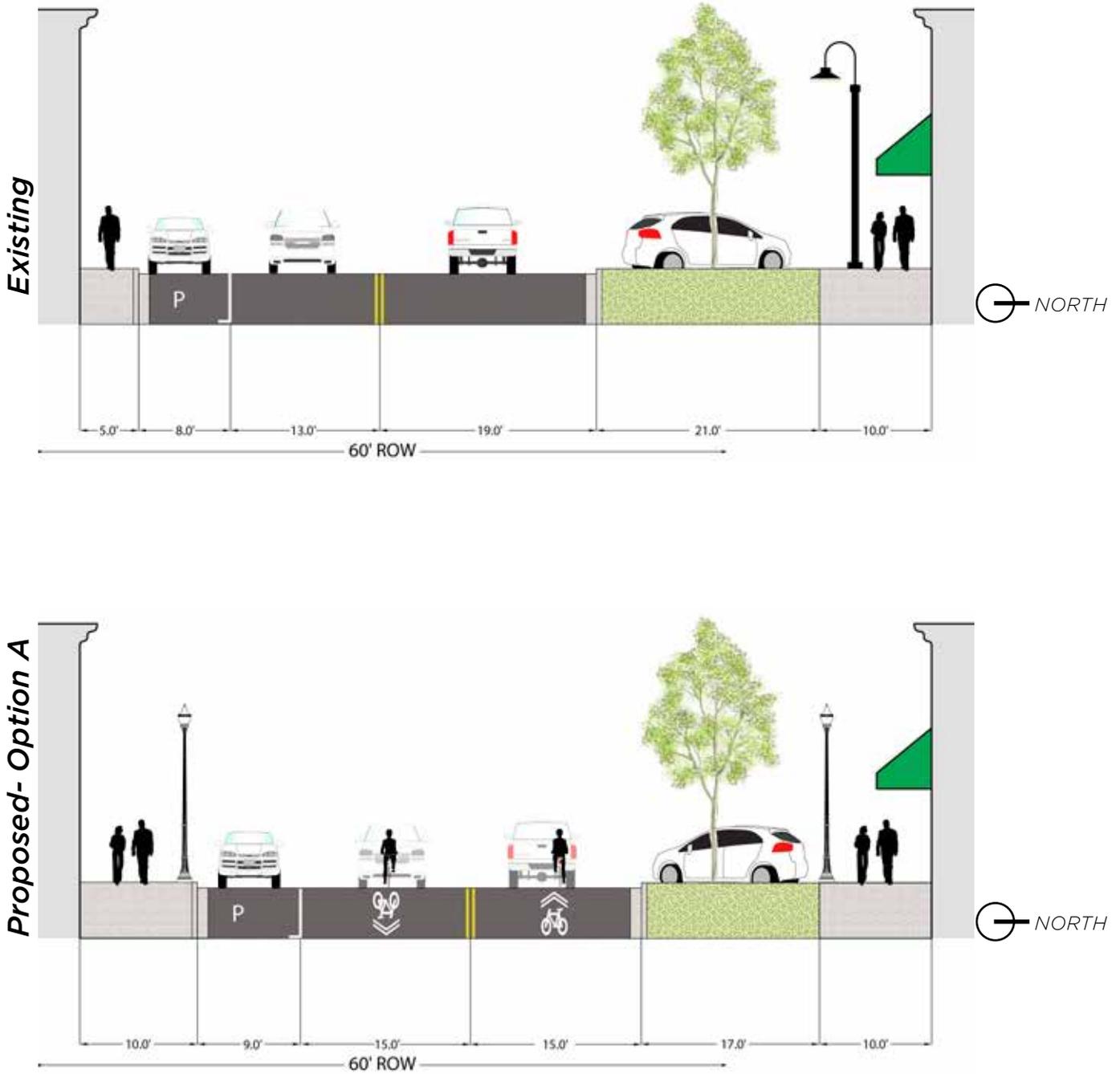


Figure 3.33. Catawba Avenue Commercial District Reconfiguration Concept with expanded Sidewalk, Shared-Lane Markings and reverse angled parking

Catawba Avenue (between Meridian Street and Oak Street)

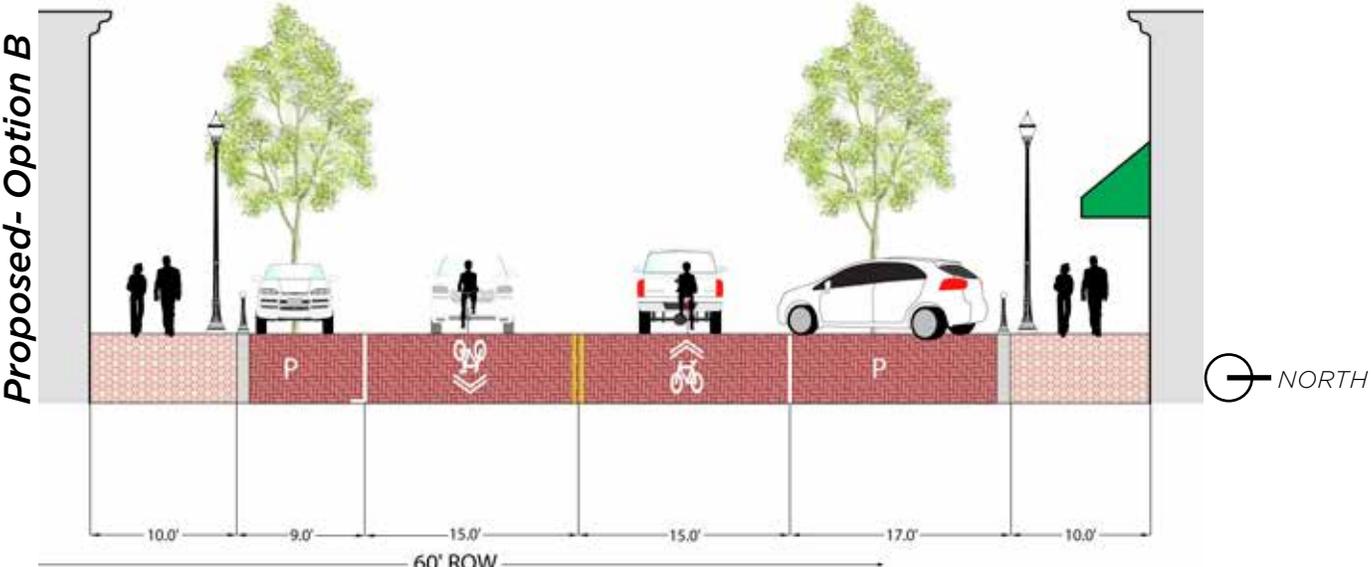


Figure 3.34. Catawba Commercial District Reconfiguration Concept with Festival Street, including level street and Sidewalk, specialty paving, Shared-Lane Markings, and reverse angle parking

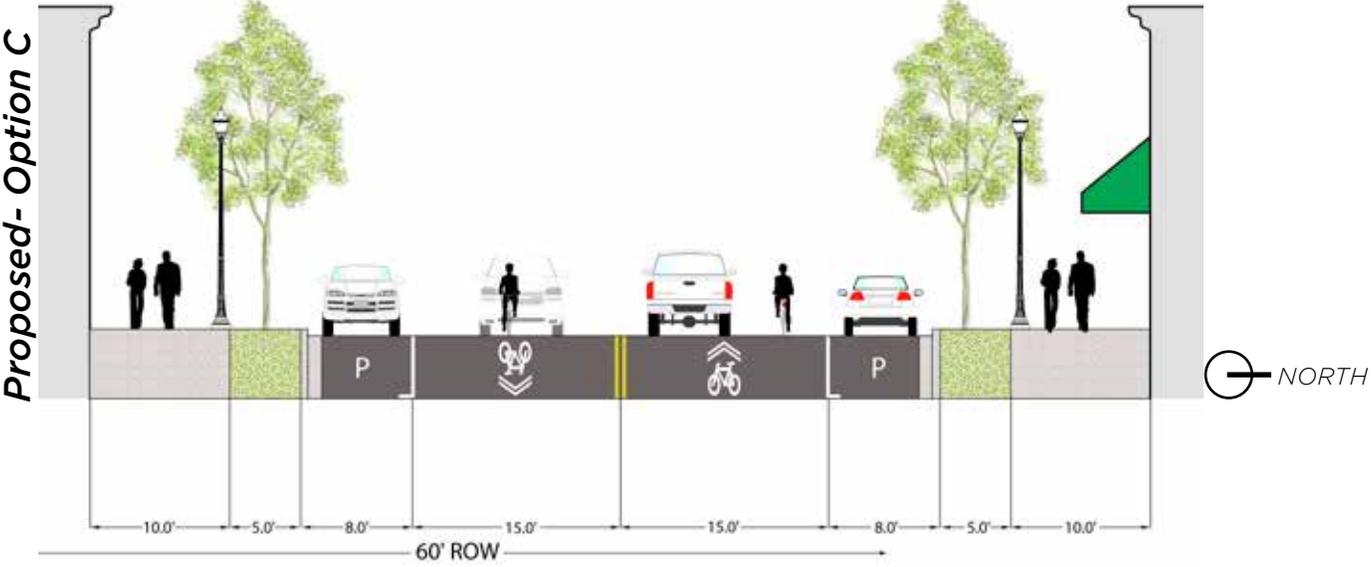


Figure 3.35. Catawba Avenue Commercial District Reconfiguration Concept with expanded Sidewalk, Shared-Lane Markings and 2-way parallel parking



Source: Ramblin' with Chuck and Pam Blog

Festival Street Precedent: Wall Street in Asheville, NC.



Source: John GreenfieldBlog

Festival Street Precedent: River Street in Batavia, IL

INTERSECTION IMPROVEMENTS

Comprehensive on-street and off-street bicycle facilities require particular attention to intersection treatments to avoid conflict. The following intersection improvements are recommended for consideration at key intersections in Cornelius. Additional improvements may be deemed necessary as intersections are improved or new bike facilities added to streets. Bicycle-specific intersection treatments are explained in the Design Guidelines and other design resources noted in that section. All should be the subject of an engineering study prior to application.

Table 3.11 Recommended Intersection Improvements

	ROAD 1	ROAD 2	POTENTIAL IMPROVEMENTS FOR CONSIDERATION
A	W Catawba Ave	Jetton Rd	- Detection/actuation for bicycles at traffic signal* - Two-stage turn box**
B	W Catawba Ave	Bethel Church Rd	- Detection/actuation for bicycles at traffic signal* - Two-stage turn box**
C	W Catawba Ave	Between Kunkleman Dr & Manhattan Pkwy	Provide a bicycle median crossing at or near these intersections
D	W Catawba Ave	One Norman Dr	- Detection/actuation for bicycles at traffic signal*
E	Catawba Ave	Statesville Ave/ Holiday Ln and the I-77 interchange	This will be location of future roundabout (RAB). Add multi-use path and ramps around outside of RAB and approaches to the I-77 interchange. See Figure 3.29 on page 102.
F	Catawba Ave	Smith Circle	- Detection/actuation for bicycles at traffic signal*
G	Catawba Ave	Church St	- Detection/actuation for bicycles at traffic signal*
H	Main St/NC 115	Potts St	(This intersection will be redesigned as part of upcoming 115 corridor study)
I	Catawba Ave	Main St/NC 115	- Detection/actuation for bicycles at traffic signal* - Two-stage turn box**
J	Main St/NC 115	Hickory St	- Detection/actuation for bicycles at traffic signal*
K	Old Statesville Rd/NC 115	RR Crossing (north of Bailey Rd)	Improve RR crossing design for bicycle safety. See page 32 of Design Guidelines.
L	Old Statesville/NC 115	Bailey Rd	- Detection/actuation for bicycles at traffic signal*
M	Statesville Rd/US 21	Westmoreland Rd	- Detection/actuation for bicycles at traffic signal* - Reduced turning radius or right turn island on northwest corner
N	Westmoreland Rd	McDowell Creek Greenway	Median island, striping, and RRFB (see image on page 100)
O	Westmoreland Rd	W Catawba Ave	The design of these intersections will be determined through the W. Catawba Phase 2 design. Safe crossings should be provided for bicyclists at or near these intersections.
P	W Catawba Ave	Harborside Dr	
Q	W Catawba Ave	Nantz Rd	
R	W Catawba Ave	Magnolia Estates Dr	
S	Sam Furr Rd	Sutters Run Ln/ Cambridge Grove Dr	Consider median crossing and signal such as HAWK for continuation of bicycle route (Huntersville jurisdiction).

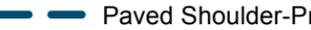
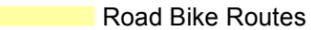
* See the following for guidance for bicycle detection and actuation at signalized intersections: <http://nacto.org/publication/urban-bike-facility-design-guide/bicycle-signals/signal-detection-and-actuation/> JANUARY 2017 | 117

** See page 33 in the Design Guidelines (Appendix B)

Bike!Cornelius

Cornelius, NC Bicycle Master Plan

Intersection Recommendations

-  Intersection Improvements
-  Bike-Ped Connectors
-  Bike Lanes-Existing
-  Bike Lanes-Proposed
-  Paved Shoulder-Proposed
-  Marked, Shared Lanes-Proposed
-  Low Stress Bike Connections
-  Dedicated Bikeways-Proposed
-  Road Bike Routes
-  Sidepath-Existing
-  Sidepath-Proposed
-  Greenways-Existing
-  Greenways-Future
-  Greenways-Under Development
-  Park Trails
-  Natural Surface Trails
-  Park Facilities
-  Civic Land Use
-  Lake Norman
-  Cornelius SOI
-  Railroads
-  Creeks and Streams
-  Points of Interest
-  Schools
-  Park and Ride

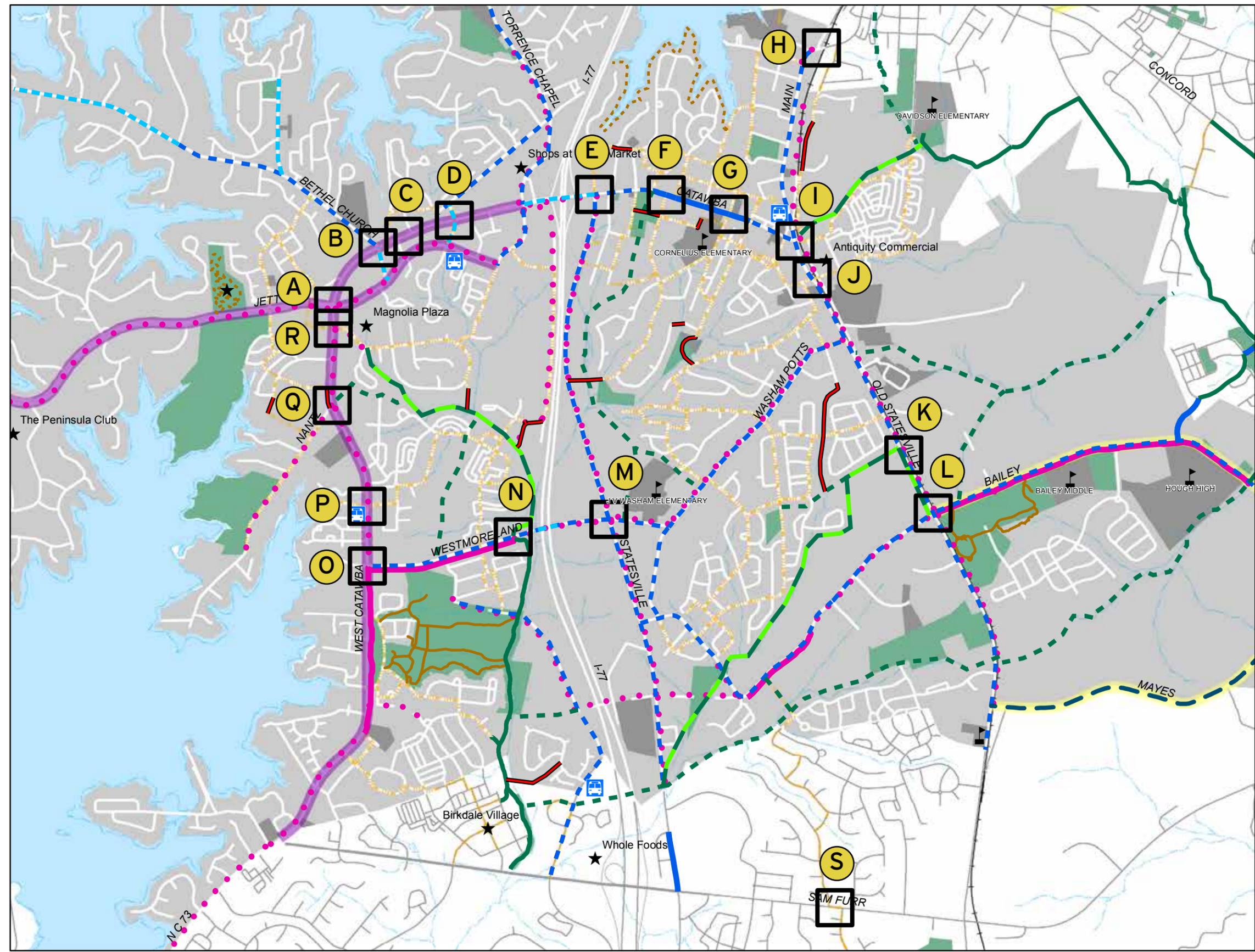
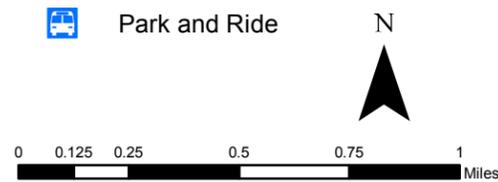


Figure 3.36. Intersection Improvements Map

Bike!Cornelius

Cornelius, NC

Bicycle Master Plan

Cornelius Neighborhoods

- Single Family Subdivisions
- Multi-family Subdivisions
- Additional Planned Developments
- Bike-Ped Connectors
- Bike Lanes-Existing
- Bike Lanes-Proposed
- Paved Shoulder-Proposed
- Marked, Shared Lanes-Proposed
- Low Stress Bike Connections
- Dedicated Bikeways-Proposed
- Road Bike Routes
- Sidepath-Existing
- Sidepath-Proposed
- Greenways-Existing
- Greenways-Future
- Greenways-Under Development
- Park Trails
- Natural Surface Trails
- Park Facilities
- Civic Land Use
- Lake Norman
- Cornelius SOI
- Railroads
- Creeks and Streams
- ★ Points of Interest
- 🏫 Schools
- 🚲 Park and Ride

0 0.125 0.25 0.5 0.75 1 Miles

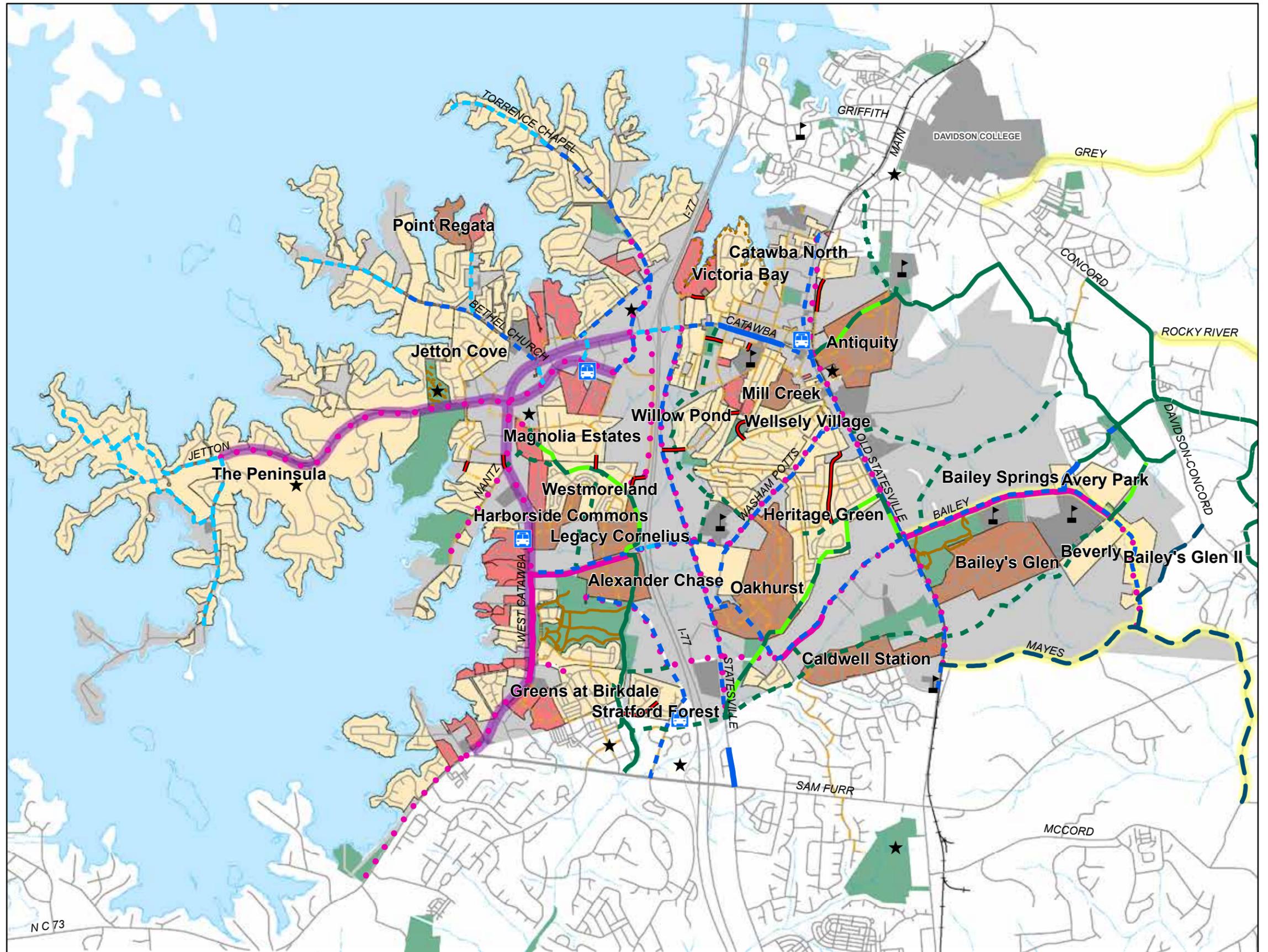


Figure 3.37. Bicycle Recommendations Neighborhood Impact Map
120 | CORNELIUS, NORTH CAROLINA, BICYCLE MASTER PLAN

NEIGHBORHOOD CONNECTIONS

The Bike!Cornelius planning efforts seek to connect the Town of Cornelius' to where they live, work, and play. The planning resulting recommendations emphasize connecting local neighborhoods to parks, retail, and schools. Figure 3.34 indicated how the proposed network connects to the various single family and multi-family residential developments within the Town. With increased enthusiasm for bicycling and bicycle infrastructure, each community can begin to organize and sponsor events such as Open Streets or Bicycle Rodeos to capitalize on proposed Low Stress Bike Routes and to encourage safe bicycling within and throughout neighborhoods.



Open Streets Event in Carrboro, NC, to utilize various recreation and educational activities.

The Plan is intended to capture and build upon Cornelius's existing programmatic resources and existing policies in place which enhance the vibrancy of Cornelius and surrounding areas.



Human-scaled streetscapes with amenities like benches, bicycle parking, landscaping, and pedestrian-scaled lighting, enhance quality of life.

IV. PROGRAM & POLICY RECOMMENDATIONS

Cities fail and succeed at the scale of human interaction.

-- Ethan Kent, Senior Vice President, Project for Public Spaces

Introduction

The following section presents existing and recommended programs and policies to support the vision and goals of this plan.

Bicycle-related policies affect all Five Es and serve as evaluation and planning tools for institutionalizing the principals of bicycle friendliness. Of the Five E's of bicycle planning, four are related to programs: encouragement, education, enforcement and evaluation. Programs will complement engineering improvements such as bike lanes, routes, and greenways by giving Cornelius residents the tools they need to safely and confidently use the bike facility network. All of the Five Es work together to enhance the bicycling experience in Cornelius.

These program and policy recommendations can be undertaken by local or regional agencies and community organizations, in addition to the Town of Cornelius.

Additionally, this section is intended to assist the Town in their effort to reach the status of a nationally designated Bicycle Friendly Community. For each program purpose, a description of the basic approach and, wherever possible, links to model programs and useful resources are provided.

Existing Resources and Programs

A number of initiatives are already in place at the state, regional and local level to promote bicycling in Cornelius. The program priorities range from transportation to youth sport development, from healthcare to injury prevention. The Bicycle Master Plan recognizes these efforts as part of the existing bicycling environment of Cornelius.

BE ACTIVE NORTH CAROLINA

Be Active North Carolina, Inc. is the statewide initiative committed to empowering North Carolinians to live healthy, physically active lives. Education and encouragement are key strategies in fulfilling the mission of Be Active. The nonprofit organization works to establish policies that make physical activity and good health convenient and accessible for all North Carolina residents.

For more information, visit:
www.beactivenc.org

CAROLINA THREAD TRAIL

The Carolina Thread Trail is a nonprofit organization focused on the planning and development of a 15-county regional trail network. The organization operates under the leadership of the Catawba Lands Conservancy. A Mecklenburg County committee exists to support development of the trail network within Mecklenburg County.

For more information, visit:
www.carolinathreadtrail.org

EAT SMART, MOVE MORE NC

Eat Smart, Move More NC is a statewide coalition that promotes increase opportunities for healthy eating and physical activity in North Carolina. The group provides resources for local communities related to best practices and health statistics, as well as funding opportunities.

For more information, visit:
www.eatsmartmovemorenc.com

MECKLENBURG COUNTY HEALTH DEPARTMENT

The Mecklenburg County Health Department (MCHD) is dedicated to improving the health status of citizens of Mecklenburg County. The MCHD project groups potentially relevant to bicycling initiatives in Cornelius include: the Healthy Weight, Healthy Kids Initiative; the Fitness and Wellness Division, Safe Kids Charlotte Mecklenburg, Healthy Mecklenburg by Design, and Working Toward Wellness.

For more information, visit:
www.charmeck.org/mecklenburg/county/healthdepartment/pages/default.aspx

BIKEWALKNC

BikeWalkNC is a membership-based advocacy organization promoting active transportation opportunities throughout the state of North Carolina. Information related to statewide policy, biking and walking transportation programs in NC cities, and biking and walking events is posted on their website.

For more information, visit:
www.bikewalknc.org

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

The official website of NCDOT provides numerous resources for traveling by bicycle. Information about both road and mountain biking is provided, as well as state, regional and local route maps.

For more information, visit:
www.ncdot.gov/bikeped/bicycle, www.walkbikenc.com, or www.ncbikefacilities.com

SAFE KIDS MECKLENBURG COUNTY

Safe Kids Charlotte Mecklenburg is a coalition of the National Safe Kids Network. Locally it is led by Carolinas Center for Injury Prevention and the Matthews Police Department. The organization is dedicated to the prevention of childhood injury and offers bicycle safety rodeos and bike safety curriculum to communities who are willing to sponsor the courses.

For more information, visit:
www.safekidscharmec.org/local-resources/

SAFE/ACTIVE ROUTES TO SCHOOL PROGRAMS

Safe Routes to School Programs (SRTS) provide funding for school based programs which encourage bicycling and walking to school. This typically involves examining conditions around public schools and providing programs to improve bicycle/pedestrian safety, accessibility and use. Managed by the North Carolina Department of Transportation (NCDOT), Transportation Mobility and Safety Division, SRTS is the source for federal SRTS funding amounts, SRTS applications and guidelines, and state SRTS program information.

In North Carolina, the SRTS program is part of the Active Routes to School project, which is funded through a partnership between the NCDOT and North Carolina Division of Public Health. North

Carolina's SRTS funding from FY2005-2011 totaled \$25,981,930. The NCDOT also seeks requests for SRTS Division Fund projects on a rolling basis and provides for infrastructure projects through its SRTS Division Fund program. Each Division has been allocated up to \$430,000 of SRTS funds for eligible projects along or intersecting with state-maintained roads. Projects must be within two miles of a school serving grades K-8. These funds are primarily intended for small safety improvements, as project requests can range from \$10,000 to \$100,000.

The Town of Cornelius is already a partner in the North Carolina Safe Routes to School program. Washam Potts Elementary School, Cornelius Elementary School, and Bailey Middle School will be developing Safe Routes to School action plans in summer 2015.

For more information, visit:
www.ncdot.gov/programs/safety
www.ncdot.gov/download/programs/srts/srts.pdf

SAFE NORTH MECK

SAFE North Meck is a bicycle infrastructure advocacy organization based in Huntersville, NC, comprised of bicycle clubs and shops whose members and patrons advocate for the implementation of minor and low-cost road design improvements (e.g. bike lanes, pavement markings, signage), bicycles and automobiles can safely co-exist on our local roadways.

For more information, visit:
www.facebook.com/SAFENorthMeck

Recommended Programs

The Town of Cornelius and its partners, including NCDOT and local, regional, and state organizations identified in Chapter II of this Plan, will work collaboratively to develop the following programs.

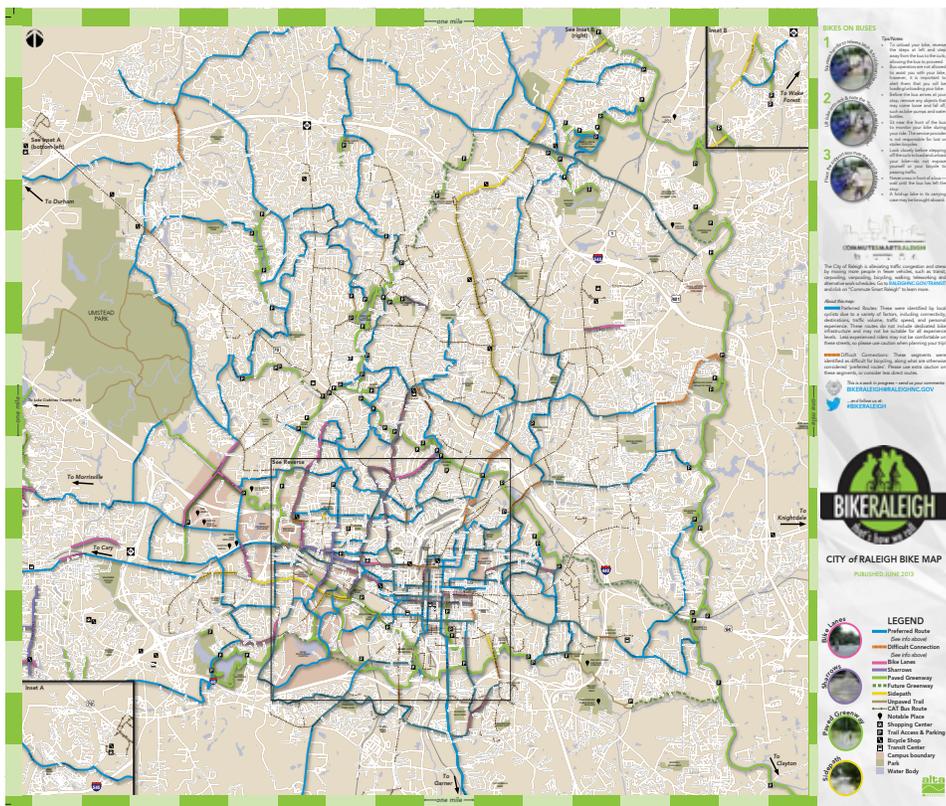
ENCOURAGEMENT

MAPS

An effective bicycle map does more than provide basic wayfinding information to cyclists—it presents a unique opportunity to celebrate and demonstrate the significant investments that a town has made to improve bicycling conditions. Bicycle maps provide the opportunity to display important information such as connections to local hot spots and amenities like multi-use paths, locations of park facilities, stairways, and hiking/walking trails.

Bicycle maps also serve as a source of local pride, and deliver a strong message that bicycling is an important, viable transportation mode. The map becomes a “must have” item for local bicyclists and visitors.

Bicycle maps often include a safety guide with valuable information regarding bicycle facilities and route options, key information such as the rules of the road, tips on safe cycling practices, and other important information such as group rides, bicycle shops, and local government and advocacy agencies.



Left: Example of a bicycle map for Raleigh, NC, that effectively communicates desired pertinent information.

COMMUTER INCENTIVES

Perhaps the best-known commuter incentive program, the Bicycle Commuter Act (or Transportation Fringe Benefit to Bicycle Commuters), passed in 2009, states that an employer may provide a reimbursement of up to \$20 per month for expenses incurred by an employee in conjunction with their commute to work by bike. Certain eligibility qualifications exist.

For more information, visit:

- www.bikeleague.org/content/bicycle-commuter-benefit
- www.irs.gov/pub/irs-pdf/p15b.pdf

Apart from the federal commuter benefit, some states, counties, and cities have tax credits and local tax incentives in place to encourage alternative modes of commuting. In Maryland, for example, businesses can claim a tax credit for 50 percent of the eligible costs of providing eligible commuter benefits up to a maximum of \$50 per employee per month.

Other program ideas and program resources include:

- Go Triangle
www.gotriangle.org/bike-walk/cyclist-resources

BIKE MONTH ACTIVITIES

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. An inaugural Bike Month event for Cornelius and family bike rides occurred as part of Bike Month 2015. These events are well-suited for the Cornelius community and are recommended strategies for encouragement.

It is recommended that the Town of Cornelius 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 Cornelius grows. Additional Bike Month activities may include:

- Bike to Work Day events: morning-commute energizer stations with food, encouragement, information, and sponsored goodies for participants; rally or celebration with raffles, food, and vendors.
- A group ride with the mayor.
- Discounts at local businesses for bicycle commuters.
- Short, themed community bicycle rides (six miles or less), such as a park tour, restaurant tour, or steeple chase (church tour).
- Participation in the national Ride of Silence bike ride to bring awareness to cyclist safety
- Mountain biking skills clinic.
- Adult Bicycle Commuter Course or Youth Bike Rodeo taught by nationally certified League Cycling Instructors



Program resources for Bike Month include:

- National Bike Month
www.bikeleague.org/bikemonth
- Greenville, SC Bike Month Events
www.greenvillesc.gov/ArchiveCenter/ViewFile/Item/187
- Atlanta, GA Bike Month Events
www.atlantabike.org/bike_month

SAFE ROUTES TO SCHOOL COMMITTEE

As referenced earlier, some Cornelius schools already have Safe Routes to School programming. Cornelius Elementary School and J. V. Washam Elementary School participate in the national Bike & Walk to School Day, and W. A. Hough High School has bicycle education as part of their physical education curriculum. A major next step in developing a community-wide approach to this program is to establish a Safe Routes to School Advisory Committee.

The committee will serve as a collaborative group representing multiple schools and neighborhoods and focused on leveraging volunteer time and resources. It will be a joint Town/school district committee that includes appointed parents, teachers, student representatives, administrators, police, active bicyclists, and engineering department staff.

The group can set benchmarks for tracking progress of implementation of the action plans and measure trends in walking and bicycling to school through tools such as bicycle and pedestrian counts or student and parent surveys. The committee will focus on encouraging bicycling and walking

to school, but will also contribute towards the other “Es” of engineering, education, enforcement, and evaluation. Coordinating with the regional NCDOT Safe Routes to School Coordinator will leverage resources useful in developing plans for implementation of this program. Contacts for the Town of Cornelius include: Ed Johnson, NCDOT Safe Routes to School Coordinator (919-707-2604 or erjohnson@ncdot.gov) and Terry Lansdell, State Advocacy Organizer for Safe Routes to School National Partnership (704-332-1796 or terry@saferoutespartnership.org)

Program resources for Safe Routes to School include:

- National Safe Routes to School Partnership www.saferoutespartnership.org
- National Center for Safe Routes to School www.saferoutesinfo.org
- SC Safe Routes to School Resource Center www.scsaferoutes.org
- Sample Safe Routes to School Encouragement Program (SC) <http://www.active-living.org/walking---bicycling-to-school>
- Sample Safe Routes to School Travel Plan (GA) www.saferoutesga.org/content/completed-travel-plans

OPEN STREET EVENTS

Open street events have many names: Sunday Parkways, Ciclovias, Summer Streets, and Sunday Streets. The events are periodic street “openings” (i.e., “open” to users besides just cars; usually on Sundays) that create a temporary park that is open

to the public for walking, bicycling, dancing, hula hooping, roller-skating, etc. They have been very successful internationally and are rapidly becoming popular in the United States. Open street events promote health by creating a safe and attractive space for physical activity and social contact, and are cost-effective compared to the cost of building new parks for the same purpose. Events can be weekly events or one-time occasions, and are generally very popular and well attended.

This Plan recommends that the Town of Cornelius and local partner groups, such as Safe Kids Mecklenburg County, Rocky River Road Club, SAFE North Meck, Bella Love, the Cornelius Cultural Arts Group (CCAG), and the Tarheel Trail Blazers, consider hosting open street events annually. The Town may choose a two-block section of street, with the intention of growing the spatial coverage of the event over time.

Program resources for open street events include:

- Atlanta Streets Alive www.atlantabike.org/atlanta_streets_alive
- Vancouver LiveStreets www.bikehub.ca/helpful-information-about-cycling-in-metro-vancouver



- San Francisco Sunday Streets
www.sundaystreetssf.com
- Oakland's Oaklavia
www.oaklavia.org
- Portland Sunday Parkways
www.portlandoregon.gov/transportation/46103

POSITIVE MEDIA CAMPAIGN

The term “cyclist” can generate negative stereotypes among members of the public who do not bicycle or do not know someone who does. A media campaign that shows a wide range of ordinary residents using their bicycles for a variety of purposes will help break down those stereotypes and raise awareness of bicycling and geniality towards people who ride bicycles. One excellent example is the “I Ride” campaign from the Community Cycling Center in Portland, Oregon. They have created well-photographed posters showing people in a wide variety of ages, races, body types, and with a wide variety of bicycle types, and each person has been invited to complete the sentence “I ride _____.” The images are being distributed as bus stop and bus bench ads, as well as online.

In the Town of Cornelius, the “I ride” slogan may be considered, or another equally humanizing slogan could be created. Donated media placement should be sought for print media and other public installations (such as benches, billboards, or other locations). A good photographer should be engaged and a well-known community member or local business owner could be invited to be one of the first faces of a media campaign. Other people may be invited to participate because

they demonstrate that women, families, or older residents ride bicycles in the community.

Program resources for positive media campaigns include:

- Portland “I Ride” Campaign
www.communitycyclingcenter.org/index.php/introducing-the-i-ride-bicycle-campaign

EDUCATION AND ENFORCEMENT

CAMPAIGN FOR RIGHTS AND RESPONSIBILITIES OF MOTORISTS AND BICYCLISTS

A joint educational campaign targeting both motorists and bicyclists creates a shared sense of responsibility among both roadway users, rather than singling out one user group. A joint campaign focuses on the rights and responsibilities of both bicyclists and motorists in sharing the road. Information may include important bicycle laws, bulleted tips for safe bicycle travel, helmet safety information, keys to safe motor vehicle operation around bicyclists, and general facility rules and regulations.

Educational materials are often available for download from national bicycle advocacy organizations, such as the Pedestrian and Bicycle Information Center (www.pedbikeinfo.org). Several examples of safety materials have already been developed for motorists as well. An example of a motorist guide is the North Carolina Driver’s Handbook has an entire section devoted to bicycles, bicyclists’ rights and responsibilities, and how motorists should behave (www.ncdot.gov/download/dmv/handbooks_ncdl_english.pdf).

This Plan recommends that the Town of Cornelius establish a variety of outreach strategies for educating motorists and bicyclists about safely sharing the road. Campaign activities can include informational brown-bag lunches and distributing materials at local events, such as the 'Tawba Walk during National Bike Month (May). Other forms of outreach such as print advertisements, billboards, postcards, 'earned' media, and public service announcements (PSAs) should be employed for the campaign to reach a broad audience.

Program resources for educational campaigns focused on rights and responsibilities of bicyclists and motorists include:

- See Share Be Aware (Wilmington, NC) www.seesharebeaware.com
- StreetSmart (Washington, DC) www.mwcog.org/transportation/activities/planning/safety.asp

NCDOT "WATCH FOR ME NC" CAMPAIGN

The "Watch for Me NC" campaign is intended to improve bicyclist safety by influencing the behaviors of drivers and bicyclists through safety messaging and enforcement. The program, which started with a pilot program in the Triangle region of North Carolina in 2012, is provided through Transportation Enhancement funding by the NCDOT, and communities are invited to become partner communities each year. This program and its resources could be used to complement the "I ride" media campaign.

The Town of Cornelius, which has the stated goal of creating an annual public awareness campaign for bicycle activity in its Comprehensive Master Plan, should become familiar with the "Watch

for Me NC" campaign, request that the NCDOT host an informational workshop for local officials and staff, and provide a "toolkit" of materials for implementing the program locally. The town should request funding for program development and guidance for utilizing local staff and resources to bolster the program.

For more information, visit: www.watchformenc.org

YOUTH BICYCLE SAFETY EDUCATION CLASSES

Typical school-based bicycle education programs educate students about the rules of the road, proper use of bicycle equipment, biking skills, street crossing skills, and the benefits of biking. Education programs can be part of a Safe Routes to School program and should be an objective of the Safe Routes to School Committee (see above). Youth Bicycle Rodeos held during Bike Month (see above) will complement the annual youth bicycle safety education classes held as part of the Safe Routes to School program.

Program resources for youth bicycle safety education classes include:



- League of American Bicyclists - Community - Education - Children and Youth Cycling Education
www.bikeleague.org/content/resources
- Safe Routes to School Rodeo Manual
www.saferoutestoschools.org/pdfs/lessonplans/RodeoManualJune2006.pdf
- Bicycle Transportation Alliance - Portland, OR
www.bta4bikes.org/resources/

FAMILY BIKING CLASSES

This Plan recommends hosting events and activities focused on bicycling education for families. Family Biking Classes are great tools for educating and encouraging families to ride bicycles. The activities provide an avenue for families to understand the differences between bicycling ability levels based on age, learn opportunities for families to safety bike together, and provide parents with the tools they need to build bicycling confidence in their children and to serve as role models for bicycle safety and handling. Education trainings and encouragement events can include:

- 'Freedom from Training Wheels' course
- Classes on how to carry children by bicycle
- Safety checks and instruction
- Basic bike maintenance classes
- Bicycle rodeos
- Bicycle parades around parks and schools

A family cycling class is organized through the Community Cycling Center in Portland, Oregon.

They teach urban riding and bicycle maintenance over five weekly sessions. They work with families to help them achieve the goals of improving fitness, reducing pollution, and having more fun.

The San Francisco Bike Coalition organizes a "Freedom From Training Wheels" event. Families meet at a park and attempt to teach their children to ride their bicycles without training wheels. The fun and encouraging atmosphere helps bring confidence to children learning to ride on two wheels.

Program resources for family biking include:

- Mayor's Family Bike Day (Baton Rouge, LA)
www.brgov.com/dept/mayor/bikeday.htm
- Family Bicycling Series (Minneapolis, MN)
www.ci.minneapolis.mn.us/bicycles
- San Francisco Bike Coalition (San Francisco, CA)
www.sfbike.org/our-work/youth-family

POLICE TRAINING PROGRAM

Police training courses provide police officers with safety education related to the rights and responsibilities of bicyclists, pedestrians, and motorists. The training will explain such matters as: common errors in reporting a bicycle collision; laws related to a motorist passing a bicyclist; etc. This Plan recommends that the Town of Cornelius contact BikeLaw.com to determine if any upcoming police trainings are scheduled within the state. Identify available trainers within the region (BikeLaw.com staff, League Cycling Instructors, or others) who could lead a police training course. Engage local police agencies in the task of determining training agenda, schedule, and trainers.

Program resources for police training include:

- Bike Law
www.bikelaw.com

BICYCLE LAW CITATION AND WAIVER PROGRAM

A bicycle law citation and waiver program may be implemented, the purpose of which is to encourage officers to issue citations to bicyclists in violation of traffic laws, enforce bicycle laws, educate bicyclists on the law, and encourage safe bicycling practices with the appropriate equipment and accessories.

A “first time offense citation waiver program” should be considered for a pilot program by the Cornelius Police Department. If a bicyclist is observed without the legal equipment and accessories for bicycling, a citation should be issued to the offending cyclist. The cyclist would purchase the necessary equipment or accessory (helmet, reflector, light, etc.) and present the item, a receipt of sale, and the citation to the Mecklenburg County Clerk of Courts Office. The Clerk’s Office would waive the citation fee if it was the first violation by the cyclist.

This program could be expanded to include violations of “rules of the road” for safe bicycling. If a bicyclist is observed bicycling on sidewalks or not bicycling properly with the flow of automobile traffic, a citation should be issued to the offending cyclist. The cyclist would have an option to participate in a bicycling safety education course to have the citation fee waived. Once they have completed a bicycling safety education course, the cyclist would present their citation, along with their certificate of course completion to the Mecklenburg County Clerk of Courts Office. The Clerk’s Office would waive the citation fee if it was the first violation by the cyclist.

SPEED FEEDBACK SIGNS & TRAILERS

Speed feedback signs show “Your Speed and the “Speed Limit” to alert drivers to their actual speed and the posted speed limit (speed trailers serve a similar function, but are portable). They work best if they flash or provide a SLOW DOWN message if drivers exceed a preset speed threshold. Other effective features can include flashing a bright white light that mimics a photo speed camera or a blue and red light that mimics a police car when drivers are moving too fast. Some speed trailers have the capability to collect traffic count data and speed data throughout the day, which can be used to identify the most dangerous traffic times when more enforcement is needed.



Additional guidance from SafeRoutesInfo.org:

- Speed feedback signs still need to be used with other standard speed limit signs placed in advance of or next to it

- Typically, officers do not issue tickets based on the speed on the display unit. Instead, they use certified radar equipment if they are monitoring speed at the location
- Speed trailers need to be placed in locations where they do not block pedestrians, bicyclists, motor vehicle traffic or other vital traffic control signs
- Speed trailers are not substitutes for permanent actions, such as traffic-calming treatments to address neighborhood speeding issues.

TRAFFIC STUDIES

Neighborhood residents and homeowners' associations can request that the Town of Cornelius do a traffic study for crosswalks and other traffic calming measures. Traffic studies can reveal deficiencies in facility design and engineering as well as dangerous behaviors that increase the risk of bicyclist crashes.

The Town of Cornelius can evaluate local crash data to identify the most common crash locations within Cornelius, and make it standard practice for traffic studies to be performed at these high-crash locations as they are discovered.

EVALUATION

BICYCLE STAFF POSITION

The Town of Cornelius should designate a staff member to “wear the hat” of local bicycle coordinator. While at this point in time the bicycle coordinator position does not need to be a full-time dedicated staff position, this Plan recommends that the Town assign an existing staff member to now dedicate some specified level of time (10-15%) to bicycle issues. The tasks of this staff member would include coordination with NCDOT and regional transportation planners at the Charlotte Regional Transportation Planning Organization (CRTPO) regarding infrastructure improvements for bicyclists. This staff member would also serve as liaison to the permanent bicycle advisory committee (see below) and to community members and organizations assisting in the development of a more bicycle friendly community.

PERMANENT BICYCLE ADVISORY COMMITTEE

Many cities have an official Bicycle Advisory Committee made of citizen volunteers, appointed by Town Council, to advise the town on bicycling issues. An advisory committee establishes the area's commitment to making bicycling and walking safer and more desirable, and has the potential to assist Cornelius in getting funding for bicycle projects. Establishing a committee is also desirable for pursuing a Bicycle Friendly Community designation for the town.

The Bicycle Advisory Committee (BAC) should be composed of no more than 15 representatives, and no less than five. Representative bicycling

stakeholder groups can include: road bicyclists, greenway cyclists, and mountain bicyclists. The Project Steering Committee already established for the purposes of this Plan provides an existing group of knowledgeable and interested stakeholders who could serve on a permanent Bicycle Advisory Committee.



The charges of the BAC include some to all of the following:

- Review and provide citizen input on capital project planning and design as it affects bicycling (e.g., corridor plans, street improvement projects, signing or signal projects, and parking facilities)
- Review and comment on changes to zoning, development code, comprehensive plans, and other long-term planning and policy documents
- Participate in the development, implementation, and evaluation of updates to the Bicycle Master Plan and bike facility facility standards
- Provide a formal liaison between local government, staff, and the public

- Develop and monitor goals and indices related to bicycling in the jurisdiction
- Promote bicycling, including bicycle safety and education

Because BAC members are volunteers, it is essential to have strong staffing supporting the committee in order for it to be successful. An agency staff person should be formally assigned to the BAC and should take charge of managing the application process, managing agendas and minutes, scheduling meetings, bringing agency issues to the BAC, and reporting back to the agency and governing body about the BAC's recommendations and findings. As stated, the committee should be appointed by Town Council and officially chartered as a commission of the council. The City of Beaver Creek, Ohio provides a useful example of a successful council-appointed BAC.

For more information, visit:

www.beavercreekohio.gov/137/bike-facility-and-non-motorized-transportation

Recommended Policies, Regulations, and Design Standards

Policy recommendations of the Cornelius Bicycle Master Plan are based on a review and assessment of existing codes, ordinances, and land use regulations for the Town of Cornelius (see Chapter 2: Existing Conditions).

While many elements of the Town of Cornelius’s policies are supportive of bicycle and pedestrian friendly development, it is evident that the Town could significantly strengthen several areas of policy regarding complete streets, bicycle parking standards, and general references to bicyclist conduct and safety. The following provides recommended “next steps” for improving the bicycle- friendliness of local policies.

UPDATE BICYCLE PARKING ORDINANCE

At present, bicycle parking within the Town of Cornelius is extremely limited. While the Town does have a codified bicycle parking requirement (Town of Cornelius Land Development Code 7.4.M), the code does not include specific bicycle parking standards.

This Plan recommends revising the existing bicycle parking requirements to include specific guidance for downtown businesses and bicycle parking standards. When new construction occurs or when a new business occupies an existing space or a major renovation to an existing space occurs, a downtown business could be required to provide bicycle parking spaces based on either the building square footage or building occupancy.

The Town should also adopt the bicycle parking standards included in Appendix B: Design Guidelines of this Plan as required standards for installations of bicycle parking. A lack of bicycle

parking standards generally results in bicycle parking that is limited in its functionality, difficult to find, impractical to use, or lacking in other ways. Ensuring best practices in the provision of bicycle parking will enable more trips to be made by bicycle.



Policy resources for bicycle parking include:

- Association of Pedestrian and Bicycle Professionals (APBP) [Bicycle Parking Guidelines](#)
- ChangeLabSolution’s [Model Bike Parking Policy](#)

SPEED LIMIT POLICY

Around the country, communities are now reconsidering lower speed limits, particularly on downtown streets. Cities as diverse as New York City, Burlington (VT), Miami Springs (FL), and San Mateo (CA) have recently implemented speed limits of 25 mph. While some larger arterials in Cornelius are likely to keep higher speeds in keeping with their role in regional travel, many arterial collector streets are appropriate for reduced speed limits.

Lower speeds produce less traffic noise, improve crosswalk yielding behavior, and contribute to a more people-friendly environment.

In addition to creating a more pleasant streetscape for people, reduced speed limits are critical for safety. Research shows that a pedestrian who is hit by a car traveling 30 mph is over twice as likely to die as someone hit by a car traveling 25 mph, and five-times more likely than someone hit by a car traveling only 20 mph.

The de facto speed limit in Cornelius is 35 mph when not otherwise posted. This applies to many local streets. However, most through streets in downtown are classified as collectors or arterials and many speed limits have been posted at 35 or 45 mph.

Lower speeds will also contribute to the safety and comfort of the emerging low stress bike facility network that the Town seeks to expand. Speed reductions should generally be achieved through physical roadway changes, including lane width reduction, bike lanes, street trees, spot medians, streetscape treatments, etc., rather than only changing signs. Studies show that most people will drive at a speed that feels safe based on the physical conditions presented to them. Arbitrarily lowering speed limits leads to poor compliance, difficult enforcement, and resentment of regulatory speed limits.

Cornelius should examine the speed limits on arterials and local streets and ensure that they are set at levels that ensure safe bicycling conditions.

UPDATE BICYCLE OPERATION ORDINANCES

The local ordinances in Cornelius relating to operation of a bicycle are outdated. The Town should update its laws related to bicycling to improve conditions for bicycling in Cornelius. As the laws are updated, law enforcement personnel should be trained to enforce the new provisions as part of the Police Training Program recommended in this chapter. The updated ordinance could include provisions such as:

- Specify that bicyclists may “share the road” (ride in the right-most lane of the cyclists’ direction of travel)
- Specifying that bicyclists may “take the lane” (when conditions warrant)
- Specifying that bicyclists may ride two-abreast
- Requiring a three-foot minimum passing distance when motorists pass a bicyclist
- Specifying that children may bicycle on sidewalks, or permitting other circumstances for bicycling on sidewalks outside of the central business district

Any updates to the local ordinances should remain in accordance with statewide bicycle laws (see: www.ncdot.gov/bikeped/lawspolicies).

Policy resources for bicycle operation ordinances include:

- Sioux Falls, SD Bicycle Ordinance Update www.siouxfalls.org/planning-building/planning/transportation/highlights/bicycle-planning/on-st-bike-ord-updates.apx
- Fort Wayne, IN Bicycle Ordinance Update www.cityoffortwayne.org.2289-proposed-changes-make-city-even-more-bike-friendly.html

10 YEAR ACTION PLAN

Cornelius is well situated to capitalize on large investments that are currently being made in the Town's state maintained roadway system and an expanding greenway network. With the adoption of this plan, the Town's goal is to maximize the accessibility and usefulness of infrastructure projects that are currently funded, as well as the biking infrastructure that exists today. These projects and roadways represent a portion of the recommended bikeway network. The time frames assigned to certain projects or objectives are not necessarily rankings — they are goals for town staff, and our community to strive for as we continue to connect our bicycle network.

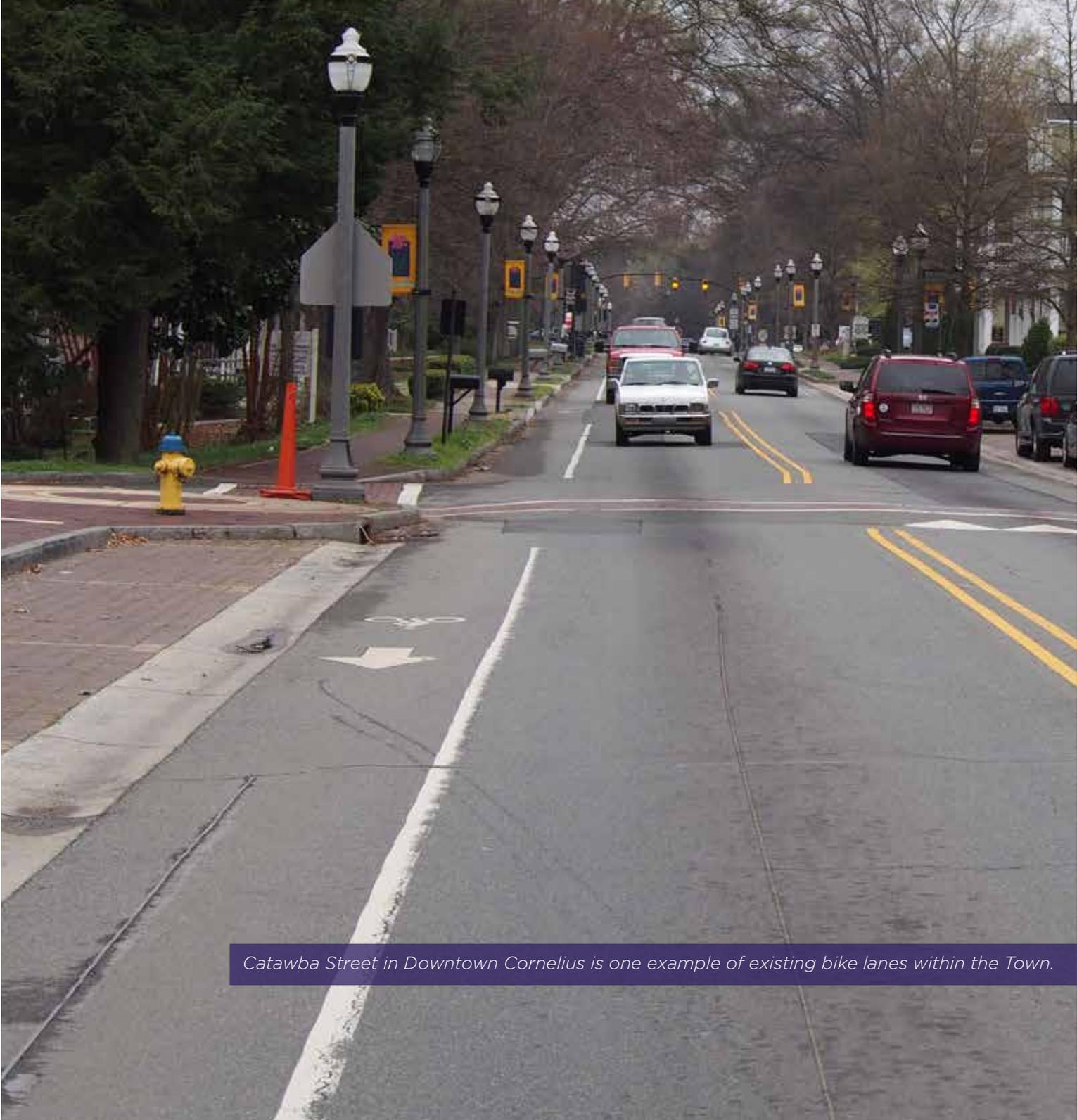
PROGRAM AND POLICY RECOMMENDATIONS

1. Finalize primary bike routes and create foldable map of bike routes/bike plan for distribution. (1-2 years)
2. Update the Land Development Code with new standards for provisions for bicycle facilities and bicycle parking. Also, update the Town's cross section details in Mecklenburg County's Land Development Standards Manual to ensure all new streets include bicycle facilities. (1-2 years)
3. Create a Cornelius Bicycle Advisory Committee (BAC) to advise the town on bicycling issues and help implement pieces of this plan. The BAC should drive community engagement and education activities for National Bike Month. The BAC should also guide the process of applying for and attaining Bicycle Friendly

Community Status from the League of American Bicyclists. (1-2 years)

4. Pass a resolution and policy in support of Complete Streets and create a street resurfacing policy that bicycle facilities must be accommodated per this plan where achievable. (1-2 years)
5. Create a new BIKE!CORNELIUS Wayfinding system (using new logos and design package by Alta as a guide) to designate routes and place signs those routes. Signs can be moved, and maps can change over time as the routes change (for example, Danesway route through Heritage Green may get rerouted to Washam Potts once Washam Potts is improved). (2-5 years)

I'm glad to see the effort put into improving cycling in our local communities. It impacts not just cyclist, but pedestrians as well as building a sense of community outside of our rolling steel boxes.
-Survey Response



Catawba Street in Downtown Cornelius is one example of existing bike lanes within the Town.

V. IMPLEMENTATION STRATEGIES

It requires really hard work to get beyond the dashboard view of our streets...The new blueprint is not anti-car. It is pro-choice.

-- Janette Sadik-Khan, Former NYC DOT Commissioner

Introduction

Implementing the recommendations of this Plan is essential to improving Cornelius's bicycle friendliness, both in the short- and long-term. Together, infrastructure and non-infrastructure recommendations address all of the five E's of bicycle planning (Engineering, Education, Encouragement, Enforcement, and Evaluation) and are equally crucial to realizing the vision of this Plan. This chapter outlines action steps for developing the bicycle network and implementing bicycle policies and programs including implementation priorities, staffing partners in implementation, facility development methods, project prioritization, and a programmatic timeline.

Implementation Agencies and Groups

TOWN OF CORNELIUS

The Town's Planning Director, PARC Director, Public Works, and City Manager's office are responsible for leading the implementation of this plan. The Town will continue to spearhead initiatives to manifest tangible results based on the recommendations of this plan.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

NCDOT Division 10 maintains most of the major roadways in Cornelius. Recommendations for bicycle facilities on NCDOT roads will have to be carried out through a coordinated effort between the Town of Cornelius and NCDOT Division 10. Some technical assistance can be provided through NCDOT's Division of Bicycle and Pedestrian Transportation (the Town should be proactive in seeking such assistance, and should refer NCDOT to this plan whenever possible).

CORNELIUS BICYCLE ADVISORY COMMITTEE

As recommended in the Evaluation Section, on page 131 of Chapter 4, Cornelius should convene an official Bicycle Advisory Committee, to advise the town on bicycling issues.

POLICE DEPARTMENT

The Cornelius Police Department plays a vital role in bicycle safety. All local police officers should be knowledgeable about North Carolina's bicycle laws to promote positive interactions between bicyclists and motorists. Local law enforcement should be familiar with The Guide to North Carolina Bicycle and Pedestrian Laws, written by the NCDOT Division of Bicycle and Pedestrian Transportation. The Police Department should continue to specifically target any known areas of bicycle use and motor vehicle speeding, such as along Bailey Road and Jetton Road.

VOLUNTEERS

Services from volunteers, students, local non-profits, and seniors, or donations of material and equipment provided in-kind are particularly beneficial for trail development and program implementation. Such contributions may offset construction and maintenance costs of trails. 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 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 Chapter 4 of this Plan. Advantages of utilizing volunteers include reduced or donated planning and construction costs, community pride and personal connections to the Town's trail and bike facility networks.

Priorities

ADOPT THIS PLAN

Through adoption, this Plan becomes an official planning document of the Town. Adoption shows that the Town of Cornelius has undergone a successful, supported planning process. The Town can then use this document to apply implementation funding through NCDOT and other sources. The Town staff, elected and appointed officials should be made aware of this Plan and support bicycle-related projects and policies. Finally, this Plan's recommendations should be integrated into existing and future Town of Cornelius policy and planning documents.

Primary Responsible Agency: Town of Cornelius

Additional Partners: Bicycle Advisory Committee (BAC)

BEGIN BUILDING PROJECTS

Project Steering Committee input, public input, existing plans, connectivity, and other factors were used to develop the recommended bicycle network (see Chapter 3). These projects should be implemented using a combination of grants, local funding, private and non-profit sector support, and state funding, and should be constructed in coordination with local development and state transportation projects.

Primary Responsible Agency: Town of Cornelius

Additional Partners: North Carolina Department of Transportation (NCDOT)

IMPROVE AND ENFORCE BICYCLE-RELATED REGULATIONS

Regulations and development standards should be enforced to ensure that future development provides for bicycle facilities in approved development plans, including development of adopted cross-sections or greenways and provision of bicycle parking. For State roadways (which comprise much of Cornelius's recommended bicycle network) see the **"Complete Streets"** policy that was adopted by NCDOT in 2009 and Complete Street Guidelines that were developed by NCDOT in 2012. The policy directs the Department to consider and incorporate all modes of transportation when building new projects or making improvements to existing infrastructure. Under the policy, the Department will collaborate with cities, towns and communities during the planning and design phases of projects. Together, they will decide how to provide the transportation options needed to serve the community and complement the context of the area. More information about the Complete Streets Policy, as well as other state and federal policies that are applicable to implementation of Cornelius's bicycle network, is included below:

- Complete Streets Policy – <http://www.completestreetsnc.org/> and http://www.bytrain.org/fra/general/ncdot_streets_policy.pdf
- NCDOT Complete Streets Guidelines -- <http://www.completestreetsnc.org/resources/>
- NCDOT Bicycle Policy Guidelines http://www.ncdot.gov/bikeped/download/bikeped_laws_Bicycle_Policy.pdf
- NCDOT Greenway Policy http://www.ncdot.gov/_templates/download/external.html?pdf=http%3A//www.ncdot.gov/bikeped/

download/bikeped_laws_Greenway_Admin_Action.pdf

- NCDOT Board of Transportation Resolution for Bicycling and Walking - http://www.ncdot.gov/bikeped/download/bikeped_laws_BOT_Mainstreaming_Resolution.pdf
- TND Guidelines - <http://ntl.bts.gov/lib/22000/22600/22616/tnd.pdf>
- Bridge Policy - <https://connect.ncdot.gov/projects/Roadway/RoadwayDesignAdministrativeDocuments/Bridge%20Policy.pdf>

Primary Responsible Agency: Town of Cornelius

Additional Partners: NCDOT, BAC

TAKE ADVANTAGE OF ALL OPPORTUNITIES

Some of the most cost-effective opportunities to provide bicycle facilities are routine roadway construction, reconstruction, and repaving projects. A new commercial development or a roadway widening project, for instance, would provide an opportunity to add shoulder width or paint shared lane markings as part of an existing effort, potentially saving costs. One role of the Permanent Bicycle Advisory Committee and the designated Bicycle Staff Position recommended on page 131 in Chapter 4 is to stay aware of upcoming roadway construction, reconstruction, and repaving projects and commercial development projects and identify opportunities for bicycle facility development. This requires ongoing communication with NCDOT and local developers.

Primary Responsible Agency: Town of Cornelius

Additional Partners: BAC, developers

SEEK MULTIPLE FUNDING SOURCES AND FACILITY DEVELOPMENT OPTIONS

Multiple approaches should be taken to support bicycle facility development and programming. It is important to secure the funding necessary to undertake short-term projects but also to develop a long term funding strategy to allow continued development of the overall system. A variety of local, state, and federal options and sources exist and should be pursued. Other methods of bicycle facility development that are efficient and cost-effective are described in the Design Guidelines Appendix and later in this chapter.

Primary Responsible Agency: Town of Cornelius

Additional Partners to consider: Charlotte Regional Transportation Planning Organization (CRTPO)

DEVELOP BICYCLE ENCOURAGEMENT AND EDUCATION PROGRAMS

It is important that implementation of bicycling programs occur in conjunction with implementation of bicycling infrastructure improvements. Cornelius can consider hosting public events and media outreach in conjunction with announcements for new bike facility and trail projects. Ensuring that these projects include wayfinding signage with known lengths and travel times will further encourage riders of all abilities. Refer to Chapter 4 of this Plan for a comprehensive list of program ideas.

Primary Responsible Agency: Town of Cornelius (Police Department & PARC)

Additional Partners to consider: BAC, Region 4 Active Routes to School (ARTS) Coordinator

ENSURE PLANNING EFFORTS ARE INTEGRATED REGIONALLY

Combining resources and efforts for bicycle planning and trail planning with surrounding municipalities, regional entities, and stakeholders is beneficial to all parties involved. Regional, long-distance trails often spark the most excitement, use, and tourism. The Town should continue to coordinate with NCDOT, Mecklenburg County and neighboring municipalities on regional bicycle route and trail initiatives, including the Carolina Thread Trail, the Mooresville to Charlotte Trail, the Lake Norman Bike Route and similar efforts. It is important to remain aware of other municipal, county, state, and NCDOT efforts to ensure the Town takes advantage of funding opportunities and support. After adoption by the Town, the Town should ensure that this document is recognized and utilized by regional transportation planning agencies, such as NCDOT Division 10 and CRTPO. The plan's recommendations should be programmed into the official work schedule and planning of these organizations.

Primary Responsible Agency: Town of Cornelius

Additional Partners to consider: CRTPO, Carolina Thread Trail

BECOME DESIGNATED AS A BICYCLE FRIENDLY COMMUNITY

This Bicycle Plan will help to transform Cornelius into a "Bicycle Friendly Community" (BFC). As described in Chapter 2, the Bicycle Friendly Community Campaign is an awards program that recognizes municipalities that actively support bicycling. The development and implementation of this Plan is an essential first step in becoming a Bicycle Friendly Community. Having a citizen's board officially dedicated to these issues, such as the Permanent Bicycle Advisory Committee recommended in Chapter 4, also helps tremendously. Cornelius should make progress in accomplishing the goals of this Plan, and then apply for BFC status.

Primary Responsible Agency: Town of Cornelius

Additional Partners: BAC

Performance Measures (Evaluation and Monitoring)

The Town of Cornelius should establish performance measures to benchmark progress towards implementing this plan. These performance measures should be stated in an official report within two years after the Plan is adopted. Establishing, tracking, and documenting progress is a task the Permanent Bicycle Advisory Committee can lead with support from staff, particularly the Bicycle Staff Position (see Chapter 4). Performance measures could address the following aspects of bicycle transportation and recreation in Cornelius:

- Measures of bicycle crashes and injuries or speeding in the Town.
 - Measures of how many bicycle facilities have been funded and constructed since the Plan's adoption and the numbers of people using the facilities (bicycle and pedestrian counts of bike facilities and greenways).
 - Measures of existing bicycle facility deficiency or maintenance needs.
 - Measures of the number of people who have participated in part of a bicycle program since the Plan's adoption.
 - Ensure that every residence and business is within 1/4 mile distance from a safe bike facility.
 - Increase the number of dedicated bike facilities to 10 miles by 2025.
 - Ensure that all funded road projects (new and widening projects) include bike/pedestrian facilities.
 - Improve and expand current wayfinding signs for cycling by 2017.
- Adopt a policy for bicycle design in Cornelius using guidance from NCDOT Urban Street Design Guidelines and NACTO.
 - Conduct bicycle counts to get a baseline of bicycle activity and repeat annually.
 - Apply for BFC status by 2017.
 - Achieve Silver status by 2025

Program & Policy Implementation

The Cornelius Bicycle Plan’s program and policy recommendations are designed for implementation within three years of adoption of the Plan. While the vast majority of infrastructure and policy recommendations fall within the exclusive jurisdiction of the Town of Cornelius and its governing authority, many program recommendations can, and should, fall under the banner of outside agencies, private sector partners, and nonprofit organizations including Mecklenburg County’s Safe Routes to School Program, NC Region 4 Active Routes to Schools program, the Carolina Thread Trail, Mecklenburg County Park and Recreation, and others. More information on Program & Policy Development can be found in Chapter IV, pages 117 and 127, respectively.

POLICY DEVELOPMENT

Following the establishment of a Permanent Bicycle Advisory Committee, the committee should work with Town of Cornelius staff to prioritize and advance the policy recommendations of the Plan. This Plan recommends allowing three to five months for policy research, development, stakeholder input, and formal adoption of program initiatives. While prioritization of policies is driven by local political will, the table below provides a guide for moving forward with policy adoption:

Table 5.1 Policy Development Strategies

STRATEGY	TARGET ADOPTION TIME-FRAME
Update Speed Limit Policy	Summer 2017
Update Bicycle Operations Ordinances	Summer 2017
Update Bicycle Parking Ordinance	Summer 2017

PROGRAM DEVELOPMENT

A collaborative approach to implementing and sustaining bicycling programs contributes to the broader vision of fostering a strong bicycle advocacy community and bicycle culture. Additionally, the minimal expense associated with most programs offers the unique opportunity for multiple, varied sectors of the community to contribute to the larger bicycle friendly community campaign.

For each of non-infrastructure recommendation of the Plan, Table 5.12 on the following page outlines the timeline for implementation and the frequency of the program's occurrence. The final column in the table provides a relative cost scale for implementing the program based on experiences in other communities.



Raised Cycle Track: Bend, OR.

Table 5.2 Program Development Strategies

STRATEGY	TIMELINE FOR COMMENCEMENT	DURATION/LEAD DEPARTMENTS	COST RANGE
Bicycle/Greenway Route Maps	Fall 2016	On-going (hard copy and on-line maps; update every 2 years). Planning & PARC	\$\$
Bicycle Staff Position	Fall 2016	Ongoing. Planning & Administration	\$
Speed Feedback Signs & Trailers	Fall 2016	On-going. Police	\$\$\$
NCDOT Watch for Me Campaign	Fall 2016	On-going. Police & Planning	\$
Permanent Bicycle Committee	Winter 2016	Ongoing. Planning & Administration	\$
Commuter Incentives	Spring 2017	On-going, Planning & Administration	\$
Traffic Studies	Spring 2017	On-going, Planning	\$\$
Safe Routes to School Committee	Spring 2017	On-going. Planning, Police, Mecklenburg County SRTS Program, Schools	\$
Open Street Events	Spring 2017	Bi-annually to monthly; Occurring Annually (2 months planning). PARC & Planning	\$\$
Positive Media Campaign	Spring 2017	1-2 months; Every Two Years (3 months planning). Planning & Administration	\$\$
Police Training Program	Spring 2017	Every Three Years. Police	\$\$\$
Bicycle Law Citation and Waiver Program	Spring 2017	On-going. Police	\$
Bike Month Activities	May 2017	Month of May; Occurring Annually (4 months planning). Planning & PARC	\$-\$-\$
Campaign for Rights and Responsibilities of Motorists and Bicyclists	May 2017	1-2 months; Every Two Years (3 months planning). Police & Planning	\$\$
Family Biking Classes	Spring/Summer 2017	Occurring bi-annually (2 months planning). PARC, Planning, Mecklenburg County SRTS Program	\$
Youth Bicycle Safety Education Classes	Spring/Summer 2017	Bi-annually (2 months planning). PARC, Planning, Mecklenburg County SRTS Program	\$

Corridors that are human-scaled and oriented for more than just the car offer a sense of safety for bicyclists. Providing safe roadway crossings along bicycle and pedestrian corridors can ensure continued use and increased enjoyment of facilities.



Proposed mid-block crossing and landscape improvements on Bailey Road.

VI. APPENDICES

Livability means being able to take your kids to school, go to work, see a doctor, drop by the grocery or post office, go out to dinner and a movie, and play with your kids at the park - all without having to get in your car.

-- Ray LaHood, Former United States Secretary of Transportation

Introduction

This section contains all supplemental material supporting the Plan. The order of the appendices follow the progression of the Plan's development, including resources for next steps. This chapter is organized to include:

- Appendix A- Citizen Comment Form
- Appendix B- Bicycle Facility Design Guidelines

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Appendix A - Citizen Comment Form

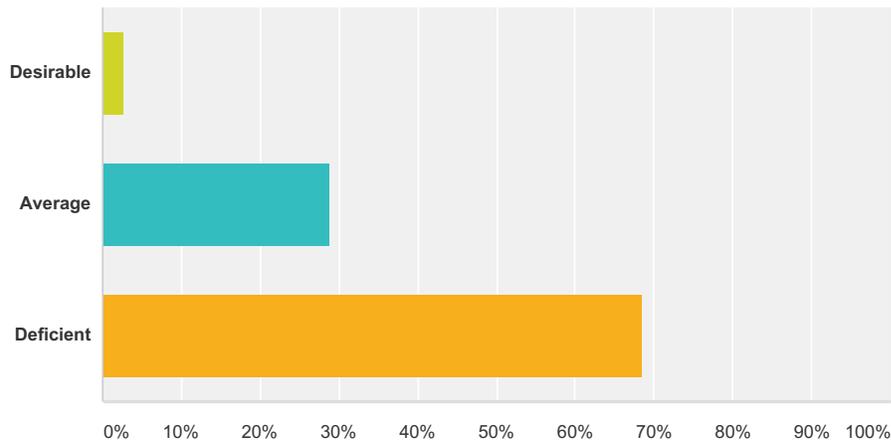
INTRODUCTION

This section includes supplemental figures and statistics gathered from the survey available from March 2015 to May 2015 that were not included in the main document text.

Bike!Cornelius

Q1 How do you rate present bicycling conditions in the Cornelius area? (select one)

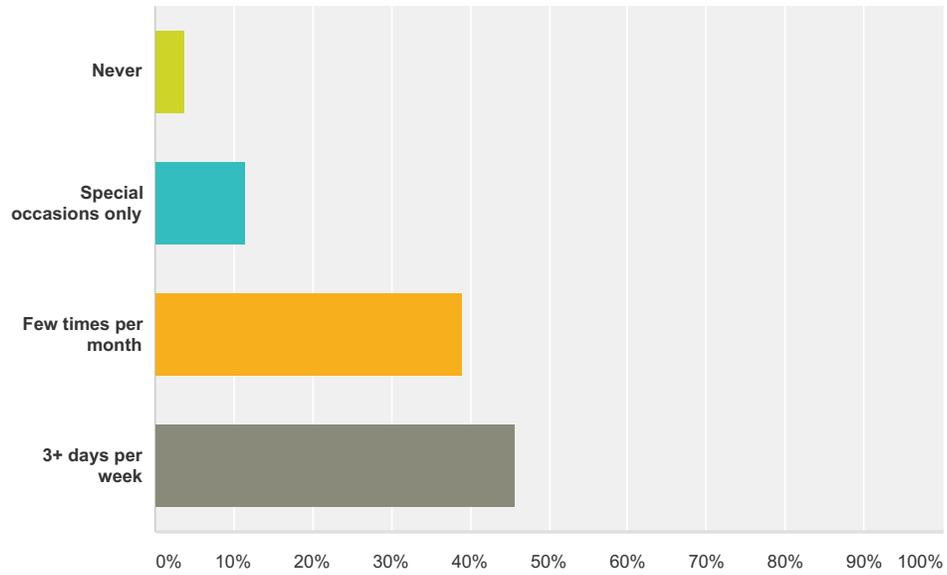
Answered: 416 Skipped: 4



Answer Choices	Responses
Desirable	2.64% 11
Average	28.85% 120
Deficient	68.51% 285
Total	416

Q2 How frequently do you bicycle? (select one)

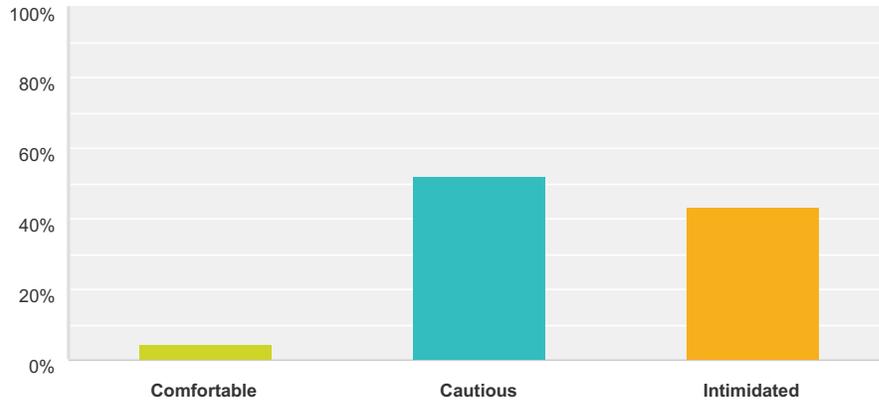
Answered: 418 Skipped: 2



Answer Choices	Responses
Never	3.83% 16
Special occasions only	11.48% 48
Few times per month	39.00% 163
3+ days per week	45.69% 191
Total	418

Q4 How comfortable are you cycling on Cornelius's roads and streets? (select one)

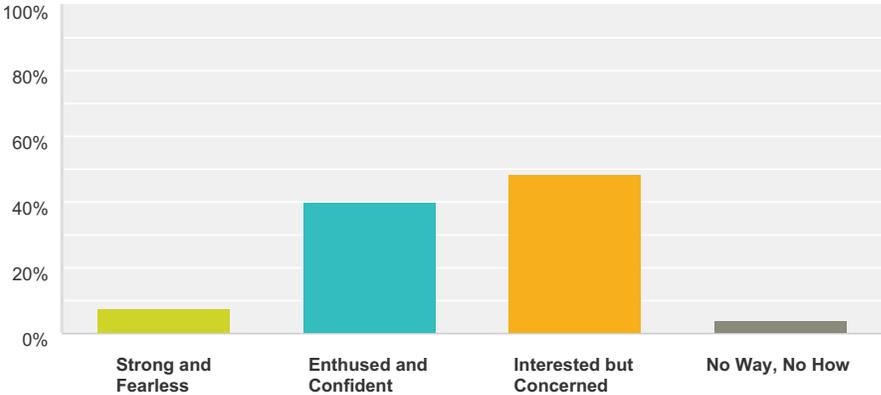
Answered: 416 Skipped: 4



Answer Choices	Responses
Comfortable	4.81% 20
Cautious	52.16% 217
Intimidated	43.03% 179
Total	416

Q5 Which type of bicyclist listed below would best describe you? (Select one)

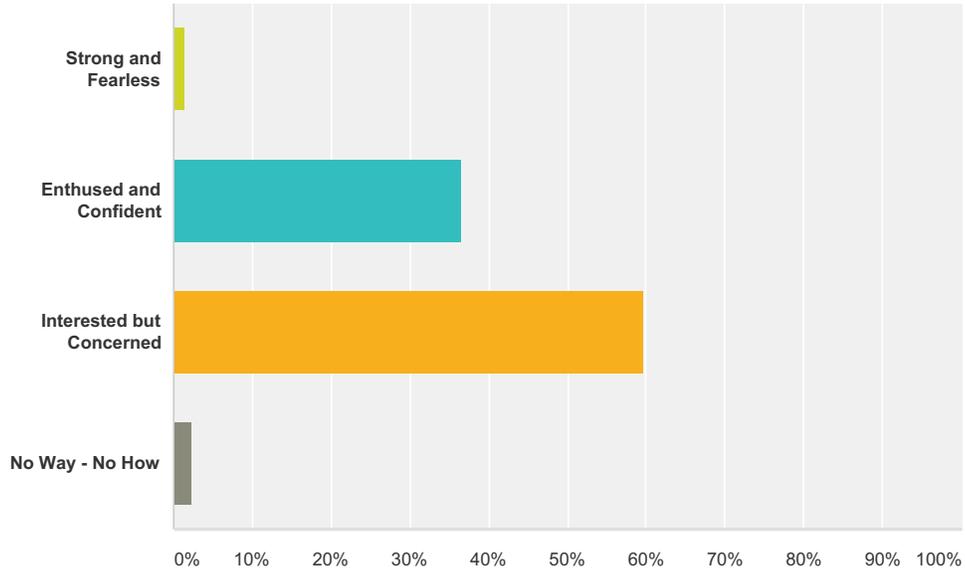
Answered: 415 Skipped: 5



Answer Choices	Responses
Strong and Fearless	7.47% 31
Enthused and Confident	40.24% 167
Interested but Concerned	48.43% 201
No Way, No How	3.86% 16
Total	415

Q6 For which type of bicyclist should the Cornelius bicycle network be designed? (Select one)

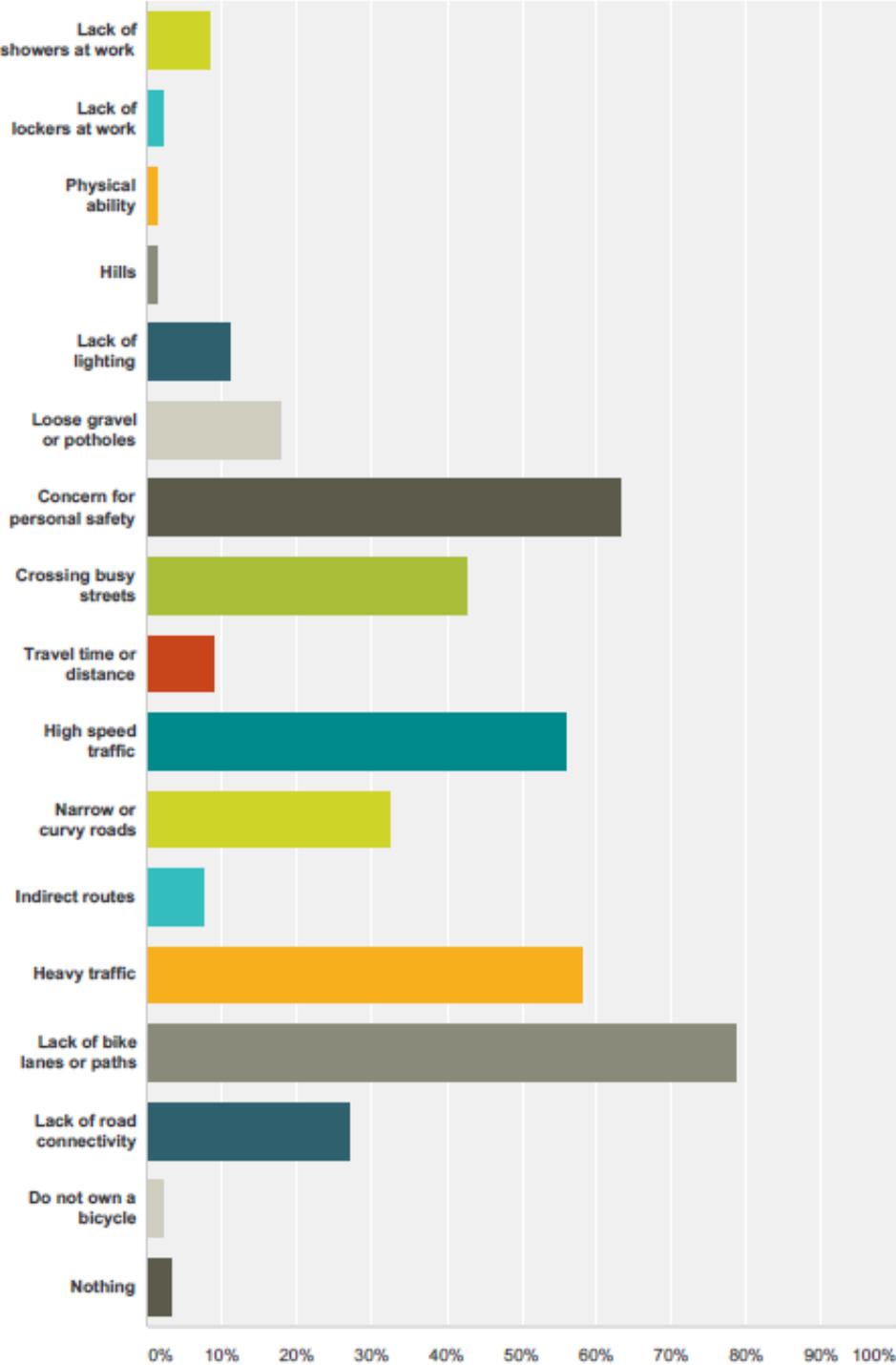
Answered: 395 Skipped: 25



Answer Choices	Responses
Strong and Fearless	1.52% 6
Enthused and Confident	36.46% 144
Interested but Concerned	59.75% 236
No Way - No How	2.28% 9
Total	395

Q7 Which of the following physical factors prevent you from bicycling or from bicycling more often? (please select up to three options)

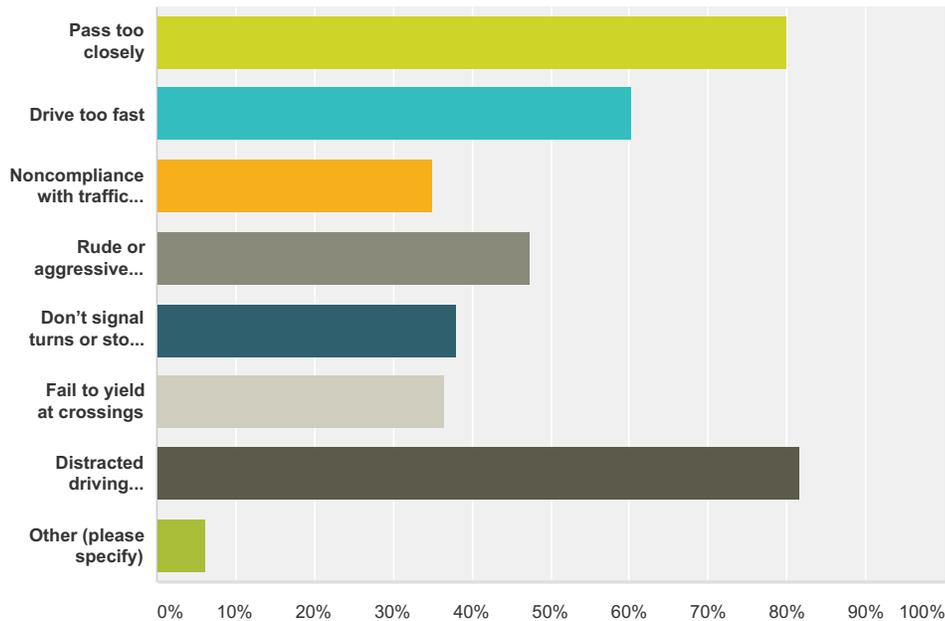
Answered: 399 Skipped: 21



Answer Choices	Responses	
Lack of showers at work	8.27%	33
Lack of lockers at work	2.01%	8
Physical ability	1.25%	5
Hills	1.25%	5
Lack of lighting	11.03%	44
Loose gravel or potholes	18.05%	72
Concern for personal safety	63.41%	253
Crossing busy streets	42.86%	171
Travel time or distance	9.02%	36
High speed traffic	55.89%	223
Narrow or curvy roads	32.58%	130
Indirect routes	7.52%	30
Heavy traffic	58.15%	232
Lack of bike lanes or paths	78.70%	314
Lack of road connectivity	27.07%	108
Do not own a bicycle	2.01%	8
Nothing	3.26%	13
Total Respondents: 399		

Q8 If and/or when you are bicycling in Cornelius, which driver behaviors cause you the greatest problems or concerns? (Select all that apply)

Answered: 394 Skipped: 26

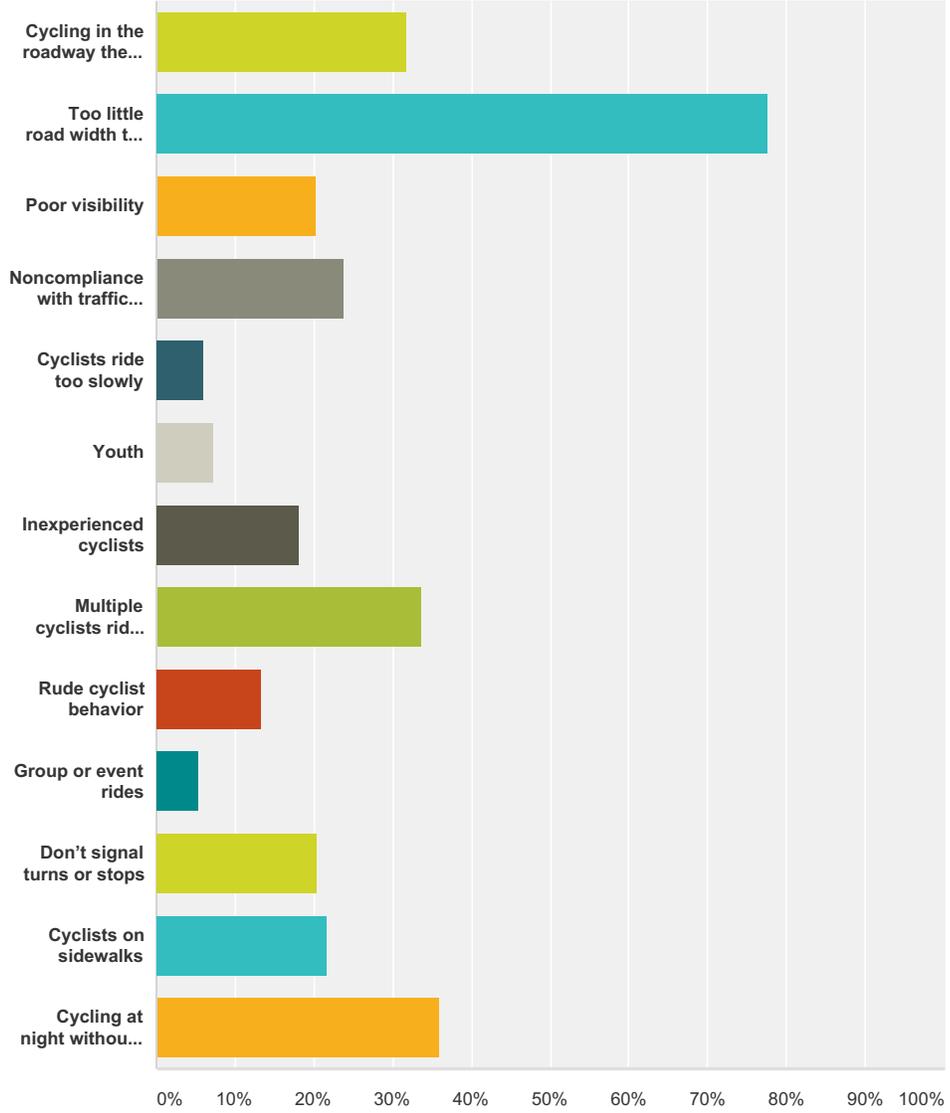


Answer Choices	Responses
Pass too closely	79.95% 315
Drive too fast	60.41% 238
Noncompliance with traffic laws	35.03% 138
Rude or aggressive language or behavior	47.46% 187
Don't signal turns or stop completely	38.07% 150
Fail to yield at crossings	36.55% 144
Distracted driving (texting, phone use, etc)	81.73% 322
Other (please specify)	6.35% 25
Total Respondents: 394	

#	Other (please specify)	Date
1	I was recently hit on my bike by a car in the Antiquity neighborhood, because the driver was distracted.	4/17/2015 6:35 PM
2	Drivers who make right turns in to your space	4/15/2015 11:11 AM
3	Roads are too narrow, no bike lanes.	4/9/2015 10:14 AM
4	I got harassed at least once a week	4/8/2015 4:59 AM
5	IGNORANCE TO THOSE NOT IN A MOTOR VEHICLE	4/5/2015 10:14 AM
6	The bicycle lanes are too narrow and feel unsafe.	4/1/2015 7:26 AM
7	too afraid to bike on roads	3/31/2015 9:15 PM
8	Sounding horn when passing - very dangerous	3/31/2015 5:35 PM
9	Lack of Driver Educ RE: Cyclists	3/24/2015 11:29 AM
10	Don't allow enough room when passing	3/19/2015 7:00 PM
11	Big scary vehicles	3/19/2015 12:51 PM
12	Divergent Diamond is nearly impossible for a biker to navigate	3/19/2015 12:46 PM
13	Bike seen as taking up space and slowing down traffic. vs being another PERSON who can be seriously injured by a car/truck side mirrors, POLICE DO NOT LOOK FOR SAFTEY of cyclist. Its a human life vs 5sec for a car to wait	3/19/2015 12:39 PM
14	everybody needs to know bicycle rules/rights; motorist awareness	3/19/2015 11:03 AM
15	Failure of licensed drivers to understand that it is legal to ride a bicycle on public roads.	3/19/2015 7:05 AM
16	Share the road (signage and obedience)	3/18/2015 10:07 PM
17	Bikes should be used inside the parks only and kept off the road.	3/17/2015 4:41 PM
18	ones that just dont listen to the driving laws	3/13/2015 2:34 PM
19	All of the above, and cars NEED room	3/10/2015 12:51 PM
20	Motorists Not knowing cycling laws	3/9/2015 10:55 PM
21	Other Bikes disrespect for traffic rules	3/9/2015 10:05 AM
22	Uncertainty of whether motorist(s) are aware of bike presence relative to their position	3/8/2015 11:43 AM
23	Drive into the bike lanes	3/7/2015 8:43 PM
24	Here is the #1 thing I don't understand: Why can't we bicycle on the sidewalks? Is it actually illegal? Whenever I bike, I just use the sidewalk or backstreets, because it is too unsafe otherwise. Even on busy roads with sidewalks, it is a worry that speed/distraction could cause someone to drive onto the sidewalk. I do not feel like the majority of roads in the entire region are safe for bicycling - at all - but unlike the majority of people concerned with this issue, I actually feel like it is the bicyclists who need to be more reasonable in their expectations. In other words, I am interested in bicycling to nearby destinations, but I am intimidated not just for my own safety as a bicyclist, but also as a driver. As a cyclist, I am realistic in my expectations (that people will be bad drivers, that the roads were built for cars, that it really isn't safe, etc.) and realistic in my priorities (in that I think it is unreasonable to force drivers to move over, risking accidents, and that my presence biking on the road makes things more unsafe for everyone involved). This is why I bike only on the sidewalk. I would NEVER bike on the road, bike lane or no - it is WAY too unsafe!	3/7/2015 12:59 PM
25	Difficult access to some neighborhoods - e.g. the areas south of town off Washam-Potts Road; 21 and Catawba are lethal.	3/6/2015 5:51 PM

Q9 When you are driving around Cornelius, which cyclist behaviors pose the greatest problems or concerns? (select all that apply)

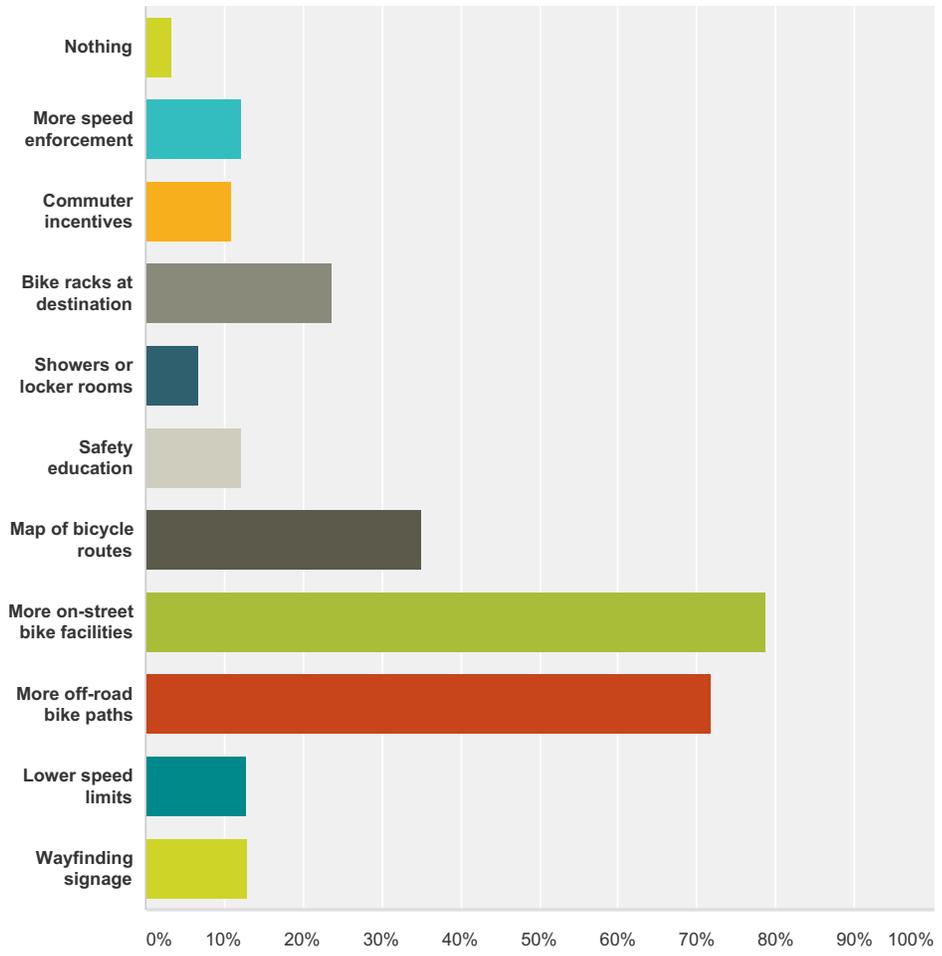
Answered: 382 Skipped: 38



Answer Choices	Responses	
Cycling in the roadway the opposing direction as vehicles	31.68%	121
Too little road width to pass safely	77.75%	297
Poor visibility	20.16%	77
Noncompliance with traffic laws	23.82%	91
Cyclists ride too slowly	6.02%	23
Youth	7.33%	28
Inexperienced cyclists	18.06%	69
Multiple cyclists riding abreast in the same travel lane	33.51%	128
Rude cyclist behavior	13.35%	51
Group or event rides	5.50%	21
Don't signal turns or stops	20.42%	78
Cyclists on sidewalks	21.73%	83
Cycling at night without lights	35.86%	137
Total Respondents: 382		

Q10 Which of the following changes would encourage you to bike more often?

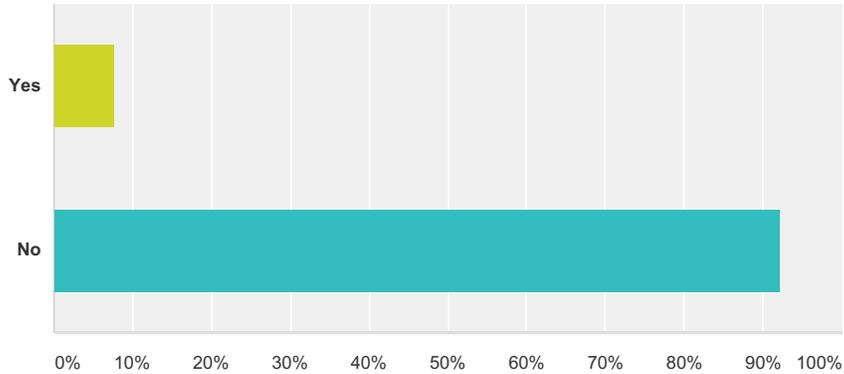
Answered: 386 Skipped: 34



Answer Choices	Responses	
Nothing	3.37%	13
More speed enforcement	12.18%	47
Commuter incentives	10.88%	42
Bike racks at destination	23.58%	91
Showers or locker rooms	6.74%	26
Safety education	12.18%	47
Map of bicycle routes	34.97%	135
More on-street bike facilities	78.76%	304
More off-road bike paths	71.76%	277
Lower speed limits	12.69%	49
Wayfinding signage	12.95%	50
Total Respondents: 386		

Q11 Have you ever used the bicycle racks on a CATS bus? (yes/no)

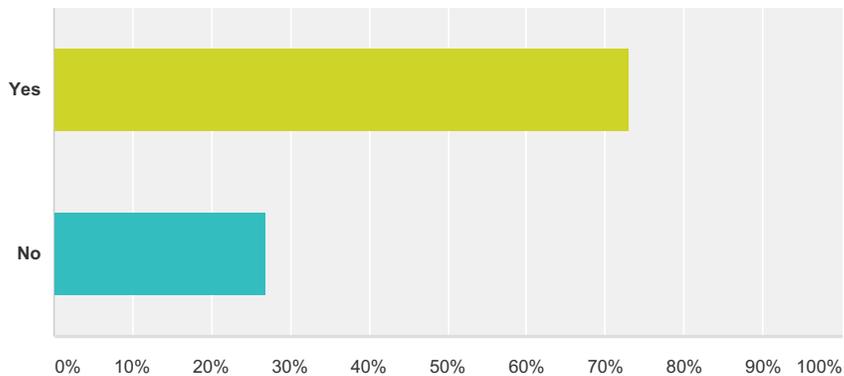
Answered: 384 Skipped: 36



Answer Choices	Responses
Yes	7.81% 30
No	92.19% 354
Total	384

Q13 Do you use existing bicycle facilities located in Cornelius (such as the McDowell Creek Greenway or other other bicycle paths, lanes or facilities)?

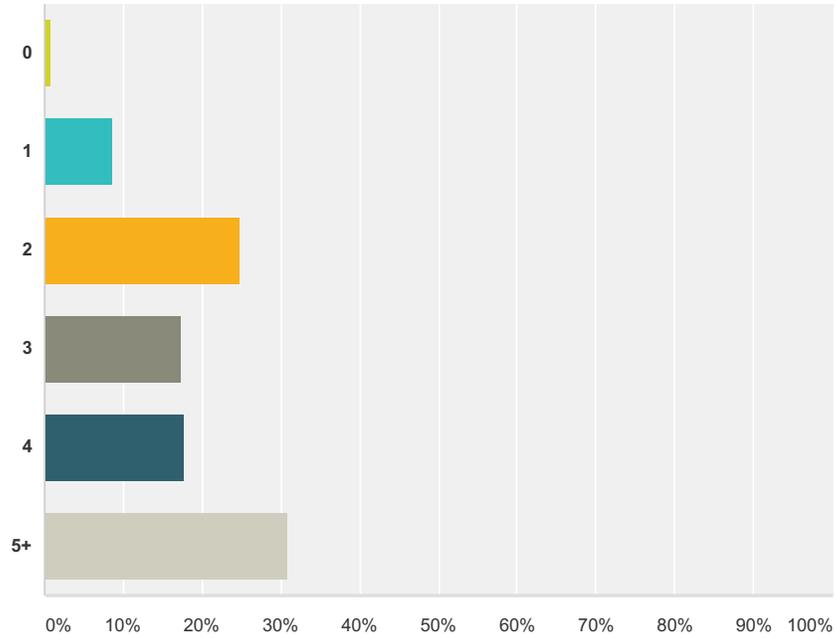
Answered: 387 Skipped: 33



Answer Choices	Responses
Yes	73.13% 283
No	26.87% 104
Total	387

Q12 How many bicycles do you have in your household? (select one)

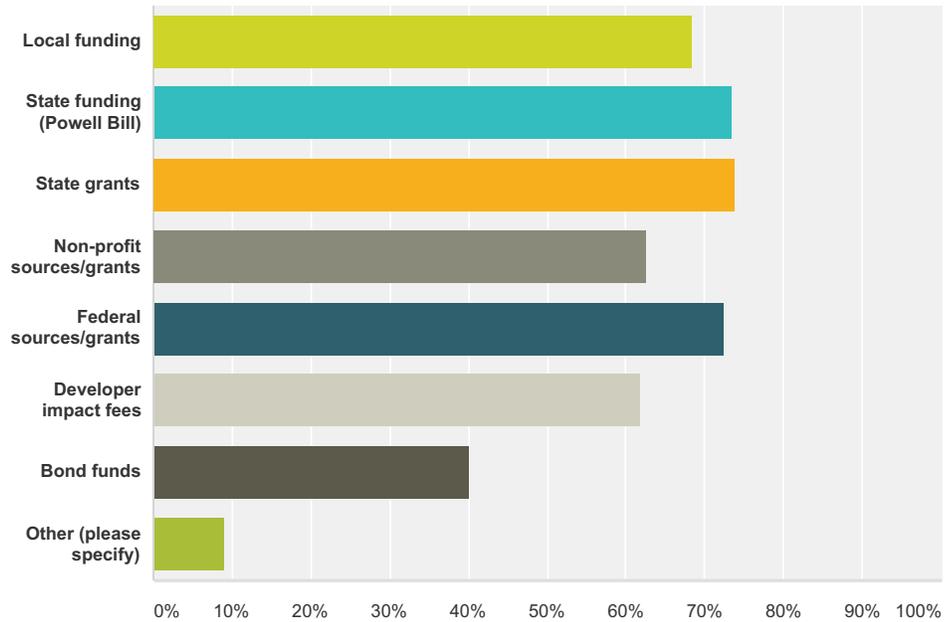
Answered: 389 Skipped: 31



Answer Choices	Responses
0	0.77% 3
1	8.48% 33
2	24.94% 97
3	17.22% 67
4	17.74% 69
5+	30.85% 120
Total	389

Q14 What ways should the Town of Cornelius look to fund bicycle facility improvements? (Select all that apply.)

Answered: 369 Skipped: 51

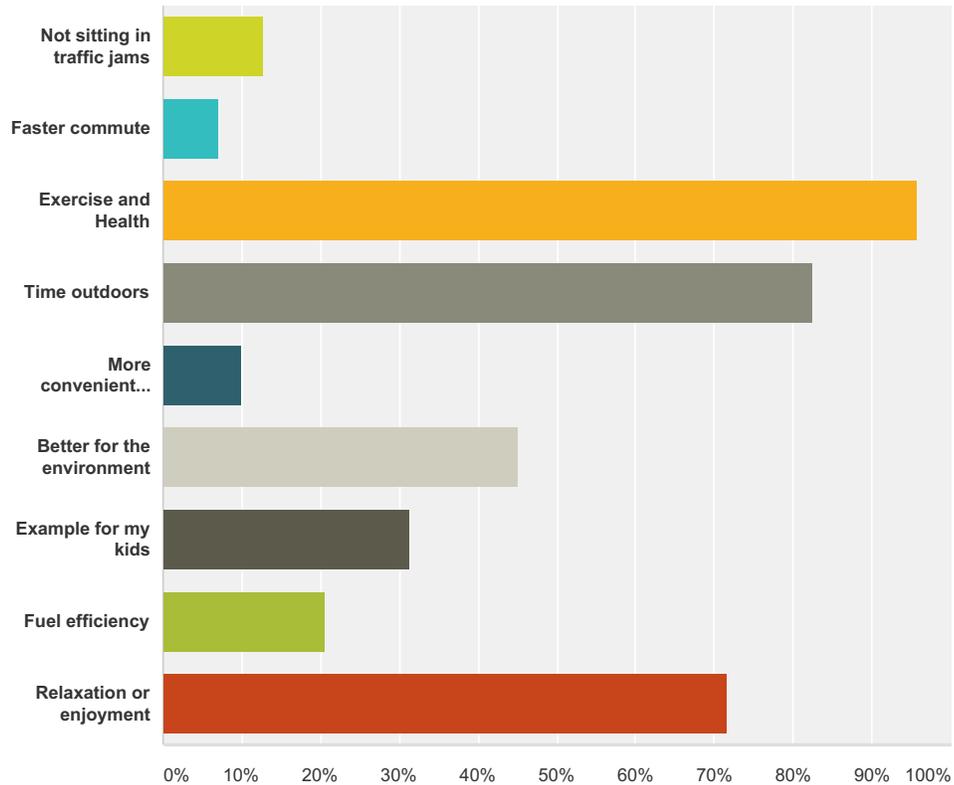


Answer Choices	Responses
Local funding	68.56% 253
State funding (Powell Bill)	73.44% 271
State grants	73.98% 273
Non-profit sources/grants	62.60% 231
Federal sources/grants	72.36% 267
Developer impact fees	61.79% 228
Bond funds	40.11% 148
Other (please specify)	8.94% 33
Total Respondents: 369	

#	Other (please specify)	Date
1	Sponsorships of greenways	4/19/2015 7:17 PM
2	Have the builders of all the apartments and condos provide funding.	4/17/2015 9:56 AM
3	Not familiar with NC funding	4/15/2015 11:57 AM
4	They spent a bunch on a needless safe-boat with cops that have no training... Absurd to buy such a boat. Spend the money on other things	4/10/2015 3:39 PM
5	Direct greenways towards business centers (i.e. the Huntersville/Cornelius connection to Birkdale) and have those business parks help fund the increased traffic streams.	4/10/2015 9:18 AM
6	create fundraising events	4/9/2015 1:31 PM
7	business owners, landscapers, architects,public	4/6/2015 4:18 PM
8	Fundraising Events	4/5/2015 9:32 AM
9	Best available	4/5/2015 8:50 AM
10	Corporate funding for signs and some facilities (bike racks)	4/1/2015 9:47 AM
11	any and all	3/31/2015 10:33 AM
12	Focus on connecting existing routes to make them more useful.	3/30/2015 12:45 PM
13	Look for sponsorship from local corporations such as the large grocery stores and other organizations	3/25/2015 2:51 PM
14	Local businesses that could benefit (restaurants, major corporations)	3/23/2015 5:31 PM
15	Cut your budget and use those funds. Government is big enough.	3/19/2015 10:40 PM
16	I am happy to pay myself to bicycle-dedicated improvements if other users chip in too.	3/19/2015 10:35 PM
17	Bake Sale	3/19/2015 2:54 PM
18	All options should be explored	3/19/2015 2:32 PM
19	increase taxes to help pay for for roads and cyclist safety	3/19/2015 12:42 PM
20	Races to raise money	3/19/2015 12:42 PM
21	Bike share program like in NYC	3/19/2015 12:08 PM
22	whatever funding you can get!! I wouldn't even mind a slight tax increase	3/19/2015 11:09 AM
23	shouldn't fund	3/18/2015 10:41 PM
24	partnerships/sponsorships by businesses	3/14/2015 10:38 AM
25	donation boxes at greenways trail heads	3/8/2015 3:47 PM
26	An information campaign for trail maps could be fairly cheap. Since I believe in biking on trails (or sidewalks if I have to) - not the road where I would cause an unsafe situation for everyone - I would say: connect to the same types of funding sources the trails have used previously. It seems like we already have a trail conenction plan that would open a lot more consumer destinations to bikers (connecting to the Target plaza on Rt. 73, for instance).	3/7/2015 12:59 PM
27	Require New Plans to have Bike paths	3/7/2015 12:48 PM
28	all sources	3/7/2015 8:10 AM
29	Business sponsorship "adopt a road"	3/7/2015 7:46 AM
30	Bike license (no plates!) with safety class required.	3/6/2015 8:39 PM
31	new zoning should change the way new areas are built up immediately	3/6/2015 5:52 PM
32	Private/public investment/incentives	3/6/2015 4:26 PM
33	Reduce expenses elsewhere	3/6/2015 3:57 PM

Q15 Which aspect of biking is most appealing to you? (please select up to three options)

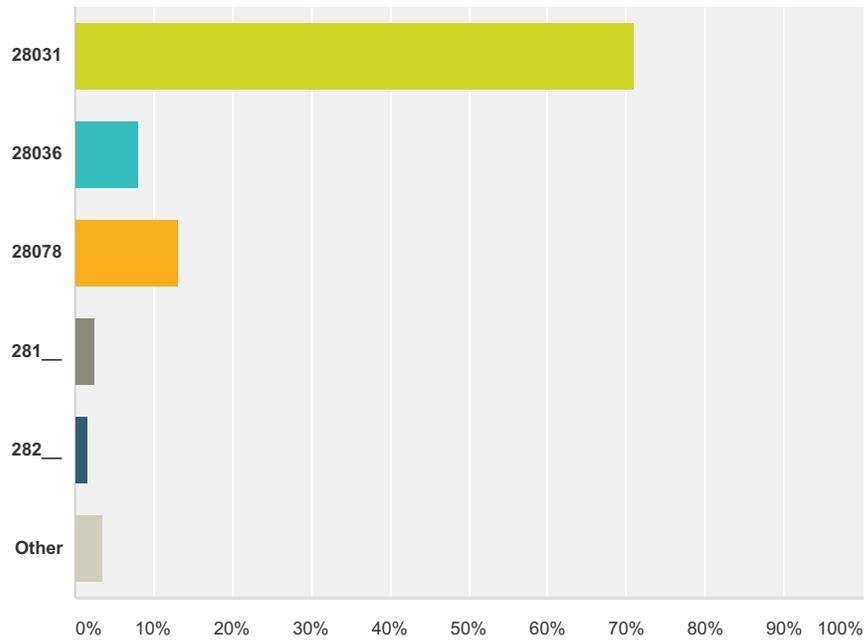
Answered: 383 Skipped: 37



Answer Choices	Responses
Not sitting in traffic jams	12.79% 49
Faster commute	7.05% 27
Exercise and Health	95.82% 367
Time outdoors	82.51% 316
More convenient parking	9.92% 38
Better for the environment	45.17% 173
Example for my kids	31.33% 120
Fuel efficiency	20.63% 79
Relaxation or enjoyment	71.54% 274
Total Respondents: 383	

Q22 What is your zip code?

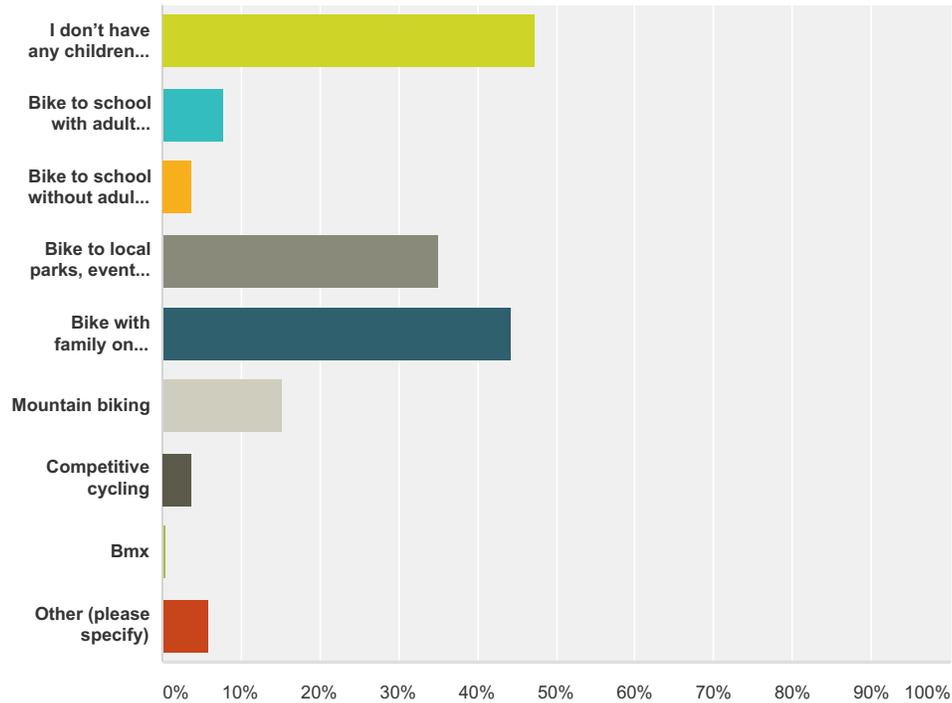
Answered: 366 Skipped: 54



Answer Choices	Responses
28031	71.04% 260
28036	8.20% 30
28078	13.11% 48
281__	2.46% 9
282__	1.64% 6
Other	3.55% 13
Total	366

Q16 If you have children between the ages of 5 and 16, please identify cycling activities that they participate in (select all that apply):

Answered: 296 Skipped: 124

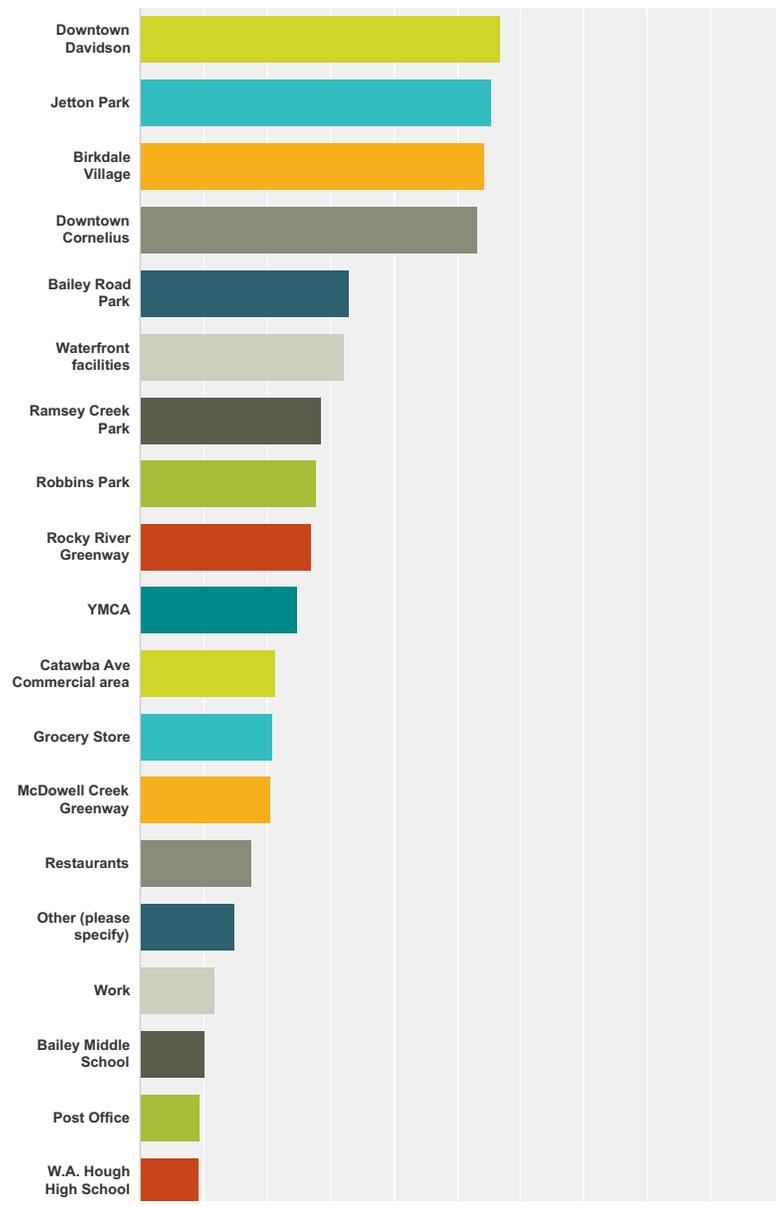


Answer Choices	Responses	Count
I don't have any children in this age group	47.30%	140
Bike to school with adult supervision	7.77%	23
Bike to school without adult supervision	3.72%	11
Bike to local parks, events or shopping	35.14%	104
Bike with family on greenways or other off road bike facilities	44.26%	131
Mountain biking	15.20%	45
Competitive cycling	3.72%	11
Bmx	0.34%	1
Other (please specify)	5.74%	17
Total Respondents: 296		

#	Other (please specify)	Date
1	Will bike to Tenders, other locations, friends homes, waffle house . Kids prefer to use the sidewalk because fear of driver not paying attention	4/21/2015 7:33 PM
2	Bike at Whitewater Center	4/9/2015 8:28 AM
3	We used to bike to school and my kids absolutely loved it. We moved and now they would have to cross Sam Furr which I would not allow them to do.	3/25/2015 2:37 PM
4	Bike around the neighborhood.	3/25/2015 8:39 PM
5	Sponsored, family group rides	3/24/2015 11:37 AM
6	Ride with friends in neighborhood	3/19/2015 4:47 PM
7	Triathlon program at Ymca	3/19/2015 1:23 PM
8	bike to friends' houses	3/19/2015 10:00 AM
9	recreational road riding	3/19/2015 7:09 AM
10	Biking in / around neighborhood	3/18/2015 10:38 PM
11	would like to a BMX track	3/8/2015 3:49 PM
12	My children can only bike in our neighborhood as there is no connectivity to the greenway. We are unable to cross 21 safely from Westmoreland Rd (JV Washam side of Westmoreland)	3/8/2015 12:02 PM
13	We are very interested in biking to school and the store, etc. We live within a mile of these places. While I am willing to ride on the sidewalk myself, I know we're really not supposed to, and I also worry about the speed of drivers on the road - they could easily drive up on the sidewalk, if goign too fast or not paying attention, which is common on this road. I'm willing to take the risk myself, but not with my kid.	3/7/2015 12:59 PM
14	neighborhood riding	3/7/2015 7:37 AM
15	bike around the neighborhood	3/6/2015 8:21 PM
16	bike in neighborhood	3/6/2015 4:06 PM
17	Bike to dinner out	3/6/2015 3:48 PM

Q17 What bicycling destinations in or around Cornelius would you most like to get to?

Answered: 370 Skipped: 50



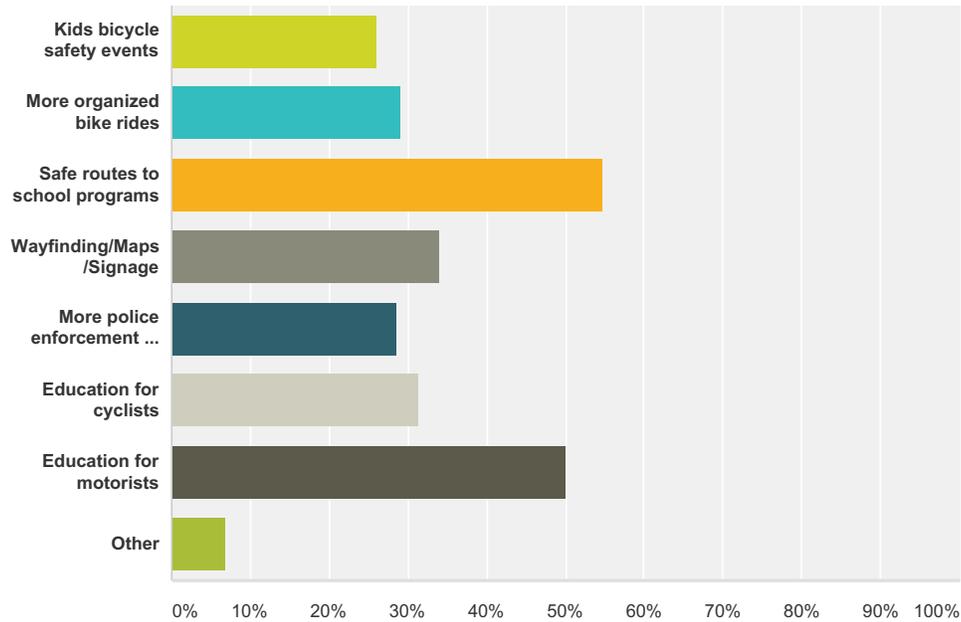
Answer Choices	Responses	
Downtown Davidson	56.76%	210
Jetton Park	55.41%	205
Birkdale Village	54.32%	201
Downtown Cornelius	53.24%	197
Bailey Road Park	32.97%	122
Waterfront facilities	32.16%	119
Ramsey Creek Park	28.65%	106
Robbins Park	27.84%	103
Rocky River Greenway	27.03%	100
YMCA	24.86%	92
Catawba Ave Commercial area	21.35%	79
Grocery Store	20.81%	77
McDowell Creek Greenway	20.54%	76
Restaurants	17.57%	65
Other (please specify)	14.86%	55
Work	11.62%	43
Bailey Middle School	10.27%	38
Post Office	9.46%	35
W.A. Hough High School	9.19%	34
Gym/fitness facility	7.84%	29
J.V. Washam Elementary	6.49%	24
Cornelius Elementary	6.22%	23
Park 'n Ride at Exit 25	4.59%	17
Other School	1.89%	7
Total Respondents: 370		

#	Other (please specify)	Date
1	Harris Teeter Jetton Village	5/17/2015 6:47 PM
2	Harris Teeter, Jack's Corner, Al's, El Toro, Lake Norman Baptist,	4/21/2015 7:33 PM
3	Community School of Davidson	4/19/2015 7:19 PM
4	fresh market, food lion	4/8/2015 8:55 PM
5	As an avid cyclist, I would liek ways to get out to country roads in a safe manner. That could mean bike slanes, greenways, or a combination of both.	4/8/2015 10:16 AM
6	Harris teeter	4/8/2015 6:59 AM
7	Harris Teeter and Fresh Market	4/6/2015 4:57 AM
8	Creating safe linked ways between parks	4/5/2015 8:54 AM
9	library	4/1/2015 6:40 AM
10	Publix or Harris Teeter	3/31/2015 9:46 PM
11	All parks and grocery store	3/31/2015 9:33 PM
12	harris teeter starbucks	3/31/2015 8:36 PM
13	Food Lion or new Harris Teeter coming	3/31/2015 5:09 PM
14	Harris Teeter and Publix off Catawba - Restaurants near Publix and Jetton Park area	3/31/2015 3:54 PM
15	Whole Foods Harris Teeter	3/31/2015 11:02 AM
16	If's a shame none of the schools in the area are bike accessible to kids	3/30/2015 12:47 PM
17	All	3/27/2015 1:22 AM
18	Harris teeter,	3/26/2015 2:54 PM
19	St Mark's Catholic School; The Target Complex North of Sam Furr	3/26/2015 2:37 PM
20	Library	3/25/2015 8:39 PM
21	Hwy 21	3/25/2015 2:29 PM
22	Publix or HTeeter, FLion	3/24/2015 11:37 AM
23	Fresh market, Davidson Day	3/23/2015 5:32 PM
24	Huntersville and Charlotte	3/23/2015 4:25 PM
25	Fresh Market, Fork	3/23/2015 12:40 PM
26	Whole Foods, Publix, Harris Teeter	3/23/2015 12:21 PM
27	Publix, Harris Teeter, Fresh Market, Whole Foods	3/20/2015 11:26 AM
28	Sangam	3/19/2015 10:38 PM
29	NEED A WAY TO GET ACROSS WESTMORELAND!!!!	3/19/2015 7:05 PM
30	Mooresville	3/19/2015 3:57 PM
31	Whole Foods	3/19/2015 2:34 PM

32	Mama pizza, Carolina cones, 131 main, all coffee shops	3/19/2015 1:23 PM
33	Torrence Chapel Park, Fresh Market, Shops on the Green	3/19/2015 12:28 PM
34	Pine Lake Prep	3/19/2015 12:09 PM
35	Food Lion on 115, any Cornelius/Davidson restaurants east of hwy 77	3/19/2015 10:17 AM
36	Food Lion at Town Center, new Antiquity Harris Teeter	3/19/2015 8:00 AM
37	HT, publix	3/18/2015 8:51 PM
38	Harris teeter at jetton	3/18/2015 12:11 PM
39	Soda Shop, Summit, Pickled Peach, Carrburritos	3/18/2015 10:55 AM
40	bike to Denver, around lake norman	3/13/2015 4:24 PM
41	CSD both campuses	3/9/2015 2:35 PM
42	We live on the East Side of Cornelius and would use sidewalks on 115 and Washam Potts Road. Grocery Store: FoodLion on 115/Main St. and the Target Plaza on Rt. 73, when they finish the greenway.	3/7/2015 12:59 PM
43	Jetton Teeter, restaurants on Catawaw,	3/7/2015 12:57 PM
44	Harris Teeter	3/7/2015 7:26 AM
45	Harris teeter. Catawba ave restaurants	3/7/2015 6:06 AM
46	Around the lake	3/6/2015 8:27 PM
47	All Harris Teeters, Fresh Market, Whole Foods	3/6/2015 8:25 PM
48	Shops on green and fresh market	3/6/2015 8:24 PM
49	Publix and harris teeter	3/6/2015 8:03 PM
50	Food Lion and new H-T in town center	3/6/2015 5:52 PM
51	Cork and Cask	3/6/2015 4:32 PM
52	Long distance riding	3/6/2015 4:29 PM
53	Publix	3/6/2015 3:58 PM
54	All Parks	3/6/2015 3:52 PM
55	rusty rudder, harris teeter	3/6/2015 3:39 PM

Q18 What other bicycle related improvements/programs do you consider priorities for Cornelius?

Answered: 349 Skipped: 71



Answer Choices	Responses
Kids bicycle safety events	26.07% 91
More organized bike rides	28.94% 101
Safe routes to school programs	54.73% 191
Wayfinding/Maps/Signage	34.10% 119
More police enforcement of drivers	28.65% 100
Education for cyclists	31.23% 109
Education for motorists	50.14% 175
Other	6.88% 24
Total Respondents: 349	

#	Other (please specify)	Date
1	Street sweeping Annual street sweeping of existing bike-ways to get rid of accumulated gravel and debris.	4/17/2015 6:50 PM
2	Enforcement of Cyclists Enforcement of cyclists not following right of way/rules of road	4/10/2015 3:42 PM
3	Wider Roads Wider roads!!!	4/9/2015 11:08 PM
4	Signage- bicyclists! perhaps road warning signs for roads commonly used by cyclists	4/8/2015 12:12 PM
5	Public Events & rides Public events build interest in bicycling versus driving	4/5/2015 9:43 AM
6	SRTS Our schools are islands only accessible by car - what a shame since they're so close.	3/30/2015 12:53 PM
7	bike infrastructure We simply need more bike lanes and greenways.	3/27/2015 11:23 AM
8	safe east/west crossing We really, really need a safe East West crossing route over highway 77. Westmoreland is the safest but with development ahead there's no other options for crossing the highway safely.	3/26/2015 2:41 PM
9	connectivity As Part of the Catawba expansion as well as the Jetton Road project, create a off street bike lane on the west side of the street connecting Blythe, robbins, ramsey and Jetton Parks together to create on big resource instead of 4 seperate parks. This will definitely increase tourism and retail, for Cornelius becoming a destination. Especially with the sailing center and beach coming on in the next months. After that connect to baily from the catawba path creating addition to that giant park as well as a safe way for our kids to get to school. That will increase our home values and likability overall.	3/20/2015 1:38 PM
10	bike infrastructure Wider Roads bike lanes and wider roads	3/19/2015 4:07 PM
11	bike infrastructure Off Road bike paths	3/19/2015 3:06 PM
12	bike infrastructure Bike lanes. I'm from the west where every road has a bike lane	3/19/2015 2:32 PM
13	enforcement of drivers bicycle related or not - Ticket drivers texting, distracted, or driving too slow	3/17/2015 2:36 PM
14	Enforcement of Cyclists More police enforcement of bicyclists	3/10/2015 2:49 PM
15	Community involvement Get more of the county involved	3/8/2015 8:23 PM
16	safe east/west crossing Making it safe to cross 21 from the east side of Cornelius (i.e. crossing 21 from Westmoreland Rd to get to the greenway, Robbins Park, etc. It is currently impossible to cross 21 safely and get across the 77 bridge to access the greenway to Birkdale, bike paths to Robbins Park, etc.	3/8/2015 12:08 PM
17	connectivity education enforcement of drivers Signage- bicyclists! The police enforcement on the roads is actually pretty good - these are roads where you know you could get a ticket if you speed. Problem is, they can't be there 24-7 enforcing, and so some folks take the risk or get complacent. The top 5 things I would suggest are: #1 Let us bike on sidewalks and have a "courtesy campaign"/signs to teach how to share the sidewalk (for example, bikers should move over for strollers, but dog walkers should move over for bikers, etc.); #2 Keep building out the trails and connect them to commercial centers; #3 Some automated enforcement of speeding on selected roads; #4 A program for cyclists that educates them about the safety problems that they cause themselves and others when they ride on the roads and directs them to alternatives (I know this is opposite what most "serious" cyclists want to hear - but it's the truth and the budget will never be there to make things safer on the actual road); #5 Signs that tell drivers exactly what to do - for example "Drivers must stop for bikers in crosswalk" (with blinking lights) or rules/laws re: passing bicyclists. I don't think anyone even knows what the rules are about this.	3/7/2015 1:19 PM
18	Wider Roads Widen and improve roads	3/7/2015 7:52 AM
19	connectivity Connected bike paths to parks	3/6/2015 8:33 PM
20	education Education for cyclists AND motorists.	3/6/2015 8:27 PM
21	Public Events & rides Organized leisure/destination rides (brewery bike tour?)	3/6/2015 4:41 PM
22	Signage- bicyclists! Identification of restrooms available/accessibile for bike riders along bikeways/routes	3/6/2015 4:34 PM
23	connectivity education 1. Fast-track the Mooresville-Charlotte Trail, particularly the N. Meck section. 2. Better pedestrian/cyclist coexistence on greenways.	3/6/2015 3:52 PM
24	Public Events & rides organized off-road rides	3/6/2015 3:52 PM

Q19 List three roads or streets that you think need the most bicycle improvements.

Answered: 281 Skipped: 139

Answer Choices	Responses
1	100.00% 281
2	90.75% 255
3	73.67% 207

#	1	Date
1	catawba	5/17/2015 6:50 PM
2	Catawba	4/28/2015 4:56 PM
3	catawba	4/24/2015 5:59 PM
4	Highway 115	4/22/2015 12:07 PM
5	Catawba	4/21/2015 7:36 PM
6	Catawba	4/19/2015 10:53 PM
7	115	4/19/2015 7:22 PM
8	Bike lane (on the road) the full length of Catwaba Ave, Rt21, and Rt115	4/17/2015 6:50 PM
9	Washam Potts Rd.	4/17/2015 10:15 AM
10	Catawba	4/16/2015 5:45 PM
11	Catawba	4/13/2015 2:03 PM
12	Catawba	4/10/2015 9:21 PM
13	Westmoreland Road	4/10/2015 3:42 PM
14	Catabwa ave	4/10/2015 3:41 PM
15	Catawba from 73 to 115	4/10/2015 9:33 AM
16	Westmoreland	4/10/2015 8:28 AM
17	115	4/9/2015 11:11 PM
18	Black farm road	4/9/2015 11:08 PM
19	Old Statesville Re	4/9/2015 3:55 PM
20	Westmoreland Road	4/9/2015 1:55 PM
21	115	4/9/2015 1:33 PM
22	Exit 28 overpass	4/9/2015 11:50 AM
23	Old Statesville	4/9/2015 11:33 AM
24	Catawba	4/9/2015 11:10 AM
25	Catawba Ave	4/9/2015 10:29 AM
26	All	4/9/2015 10:15 AM
27	Highway 115	4/9/2015 10:04 AM
28	Catawba	4/9/2015 8:29 AM

Q20 List three intersections in Cornelius that you think need the most bicycle improvements.

Answered: 204 Skipped: 216

Answer Choices	Responses	
1	100.00%	204
2	78.43%	160
3	51.47%	105

#	1	Date
1	jetton @ catawba	5/17/2015 6:50 PM
2	liverpool/catawba	4/24/2015 5:59 PM
3	21 and Catawba	4/22/2015 12:07 PM
4	Westmoreland & Catawba	4/21/2015 7:36 PM
5	Tenders restaurant intersection	4/19/2015 7:22 PM
6	Satesville/Westmoreland	4/17/2015 10:15 AM
7	Catawba Liverpool	4/16/2015 5:45 PM
8	Catawba/US 21	4/13/2015 2:03 PM
9	Hwy. 21 and Westmoreland	4/10/2015 3:42 PM
10	In general access to the east and west of 77 is non	4/10/2015 9:33 AM
11	Westmoreland and Statesville Road (old and new statesville road)	4/10/2015 8:28 AM
12	catawba and old Statesville	4/9/2015 3:55 PM
13	Exit 28 overpass	4/9/2015 11:50 AM
14	Old Statesville and Catawba	4/9/2015 11:33 AM
15	Westmoreland	4/9/2015 10:29 AM
16	Westmoreland - Catawba	4/9/2015 10:04 AM
17	catawba ave in general	4/8/2015 10:17 PM
18	Catawba and 77	4/8/2015 8:56 PM
19	westmoreland and statesville	4/8/2015 3:25 PM
20	Leaving the YMCA	4/8/2015 11:17 AM
21	Bailey School and Hwy 115	4/8/2015 11:07 AM
22	Any intersection along Hwy 115	4/8/2015 10:19 AM
23	west Moreland and Catawba	4/8/2015 5:07 AM
24	exit 28 overpass. bridge over 77	4/7/2015 10:34 PM
25	Catawba and Westmoreland	4/6/2015 8:20 AM
26	Catawba and Jetton	4/6/2015 7:37 AM
27	Jetton and catwba	4/6/2015 5:04 AM

Q21 List locations in Cornelius where bicycle parking is needed.

Answered: 122 Skipped: 298

Answer Choices	Responses
1.	100.00% 122
2.	68.85% 84
3.	40.98% 50

#	1.	Date
1	everywhere! parks, retail, health offices	5/17/2015 6:50 PM
2	fresh market	4/24/2015 5:59 PM
3	Harris Teeter	4/21/2015 7:36 PM
4	All grocery stores/commercial shopping	4/19/2015 7:22 PM
5	Promote bike racks at restaurants and bars. I think these business would greatly benefit because people might bike to a bar, so they don't have to worry about a DUI on the way back home.	4/17/2015 6:50 PM
6	Bus stops otherwise find a tree	4/17/2015 10:15 AM
7	Birkdale	4/13/2015 2:03 PM
8	Catawba Ave. shopping centers (Publix, Harris Teeter, Etc.)	4/10/2015 3:42 PM
9	All parks	4/10/2015 8:28 AM
10	All the parks	4/9/2015 1:55 PM
11	Jetton Village	4/9/2015 10:29 AM
12	Parks	4/9/2015 8:29 AM
13	any park	4/8/2015 10:17 PM
14	bailey rd park	4/8/2015 3:25 PM
15	downtown	4/8/2015 12:12 PM
16	Downtown	4/8/2015 11:07 AM
17	Without a significant greenway system with water/food stops, there is really no need for parking	4/8/2015 10:19 AM
18	all parks	4/8/2015 7:01 AM
19	birkdale	4/7/2015 10:34 PM
20	Jetton Park	4/6/2015 8:20 AM
21	Grocery stores,	4/6/2015 5:04 AM
22	ANYWHERE VEHICLES PARK	4/5/2015 10:21 AM
23	Catawba Ave & Main St	4/5/2015 9:43 AM
24	Birkdale	4/1/2015 9:52 AM
25	parks	3/31/2015 8:41 PM
26	Fresh Market lot	3/31/2015 5:43 PM
27	At shops / parks / schools	3/31/2015 5:41 PM

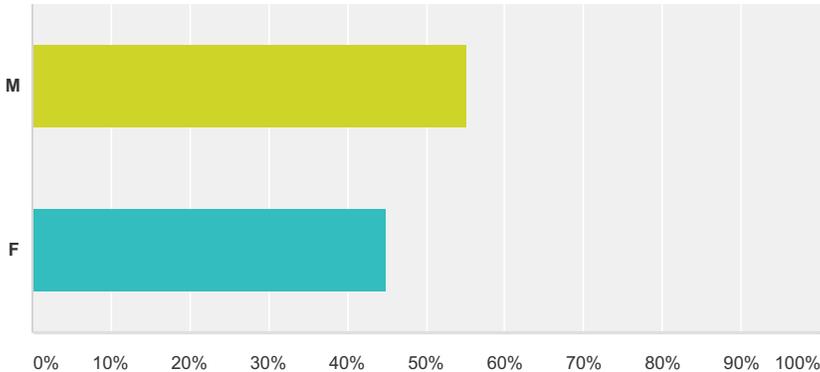
Q23 What is your neighborhood's name?

Answered: 307 Skipped: 113

#	Responses	Date
1	Harborgate	5/17/2015 6:50 PM
2	Antiquity	4/24/2015 6:21 PM
3	antiwuity	4/24/2015 5:59 PM
4	Victoria Bay	4/22/2015 12:10 PM
5	Patrick's Purchase	4/21/2015 7:36 PM
6	University City	4/19/2015 10:54 PM
7	Heritage Green	4/19/2015 7:22 PM
8	Glenridge	4/19/2015 6:48 PM
9	connor quay	4/17/2015 6:58 PM
10	Wesley Village	4/17/2015 10:21 AM
11	Deep Cove	4/16/2015 5:45 PM
12	St. Alban's	4/15/2015 5:06 PM
13	Blue stone harbor	4/15/2015 1:21 PM
14	Mayes Rd	4/13/2015 2:05 PM
15	Hampton Ridge	4/11/2015 5:56 AM
16	North Stone	4/10/2015 9:22 PM
17	Alexander Chase	4/10/2015 3:44 PM
18	Latta Springs	4/10/2015 9:40 AM
19	Westmoreland	4/10/2015 8:28 AM
20	Bailey Springs	4/10/2015 5:48 AM
21	Riverbend	4/9/2015 9:20 PM
22	The Hamptons	4/9/2015 3:56 PM
23	Peninsula	4/9/2015 1:57 PM
24	Shepherds Vineyard	4/9/2015 1:38 PM
25	Heritage green	4/9/2015 1:33 PM
26	River Run	4/9/2015 11:52 AM
27	Davidson Landing	4/9/2015 11:16 AM
28	Vermillion	4/9/2015 10:29 AM
29	One Norman	4/9/2015 10:16 AM
30	The Hamptons	4/9/2015 10:04 AM
31	Jetton Cove	4/9/2015 8:29 AM
32	vineyard point	4/8/2015 10:18 PM
33	Carrington Ridge	4/8/2015 9:41 PM

Q24 What is your gender?

Answered: 363 Skipped: 57



Answer Choices	Responses
M	55.10% 200
F	44.90% 163
Total	363

Q25 What is your age?

Answered: 346 Skipped: 74

#	Responses	Date
1	41-65 58	5/17/2015 6:50 PM
2	31-40 31	4/28/2015 4:56 PM
3	41-65 51	4/24/2015 6:21 PM
4	41-65 47	4/24/2015 5:59 PM
5	31-40 34	4/22/2015 12:10 PM
6	41-65 44	4/21/2015 7:36 PM
7	41-65 65	4/19/2015 10:54 PM
8	18-30 26	4/19/2015 7:22 PM
9	41-65 45	4/19/2015 6:48 PM
10	41-65 61	4/17/2015 6:58 PM
11	31-40 34	4/17/2015 10:21 AM
12	41-65 46	4/16/2015 5:45 PM
13	41-65 52	4/15/2015 5:06 PM
14	65+ 69	4/15/2015 1:21 PM

Q26 Do you have any general comments?

Answered: 158 Skipped: 262

#	Responses	Date
1	Please let us know what we can do to help make Cornelius a great place to ride. Also, I didn't see much on the survey about regional connectivity, but that is really important for long term cycling possibilities (Mooresville-Charlotte trail, Thread Trails, etc.). Thank you.	4/22/2015 12:10 PM
2	Try to build a biker community, where its cool to bike around. Maybe try a "Critical Mass" event, like in other cities. A Critical Mass event is when the streets in part of a city are shut down to cars for an afternoon and only bikes can use those streets. Maybe combine a Critical Mass with other bike related activities or bike race (like the Belmont NC criterium).	4/17/2015 6:58 PM
3	I really like sidewalks on even numbered sides on the roads. On the side of the road where home numbers end with an even number. I know the survey is for biking. Walking is similar and I like to walk my dogs and 1 year old on sidewalks. Organization is key to simplicity. Sidewalks and even numbers, Thanks!	4/17/2015 10:21 AM
4	Bicycle considerations are not as good as the last 2 states I have lived in I am doing ok here so far.	4/15/2015 1:21 PM
5	Most routing should lend itself to Birkdale Village and to Jetton Village as well as Westmoreland Park	4/13/2015 2:05 PM
6	I want to ride my bike around Cornelius more so some bike lanes would be great.	4/10/2015 9:22 PM
7	I think its fantastic this study takes both the cyclists' and drivers' perspectives into consideration. We should be working towards a common future of sharing the road rather than the common "us against them" mentality that is so prevalent. Education and training in this area may be a large consideration for local events that include cycling.	4/10/2015 3:44 PM
8	get rid of the mayor and police chief for purchasing the 200k safe boat on lake Norman and not training the cops to use it. Law suit waiting to happen	4/10/2015 3:42 PM
9	Road conditions in the area are marginally safe in a motor vehicle. Now imagine being on a human powered bicycle riding on a crumbling shoulder no wider than the white stripe on side of road. Any help to improve the accessibility to safe and convenient bicycling for people of all abilities is greatly appreciated! With a climate so conducive to being outdoors and cycling this area should be a leader in infrastructure rather than lagging behind many years when compared to other areas of the country. Particularly some that are in climates far worse than ours. Let's set the example that makes other municiple leaders want to model their program after ours! Thank you for the time and consideration.	4/10/2015 9:40 AM
10	This is a great idea and I look forward to seeing what comes of this survey and the Bicycle Master Plan.	4/10/2015 8:28 AM
11	Appreciate the survey. Drivers can also be rude, so interested that the choice was rude cyclist but no choice for rude drivers!	4/9/2015 11:10 PM
12	i would like to see a comprehensive bike lane plan for the three communities of Huntersville, Cornelius, and Davidson.	4/9/2015 3:56 PM
13	Safe biking access to a variety of destinations is the key to more cycling usage.	4/9/2015 1:57 PM
14	as traffic has increased, better accommodations for travel by bicycle are needed to create more separation between car & bike users	4/9/2015 11:52 AM
15	Bike lanes not only allow for better community connectivity, but also help make motorists feel safer when passing a cyclist.	4/9/2015 11:34 AM
16	add bike lanes/shoulders to most roads as not only does it help for cycling and people passing safely, but it also helps people move over for emergency vehicles	4/9/2015 11:19 AM
17	I live in Charlotte as well where bicyclist have become targets for motorist. I no longer feel safe on the road where a motorist dropping a phone can leave you dead even if you are in the bike lane. However, connectivity on back roads and with trails would be wonderful-they just don't go anywhere that we want to go-like restaurants and shopping-but we ride them anyway for entertainment and exercise. My fingers are crossed...We will take any improvement!	4/9/2015 11:16 AM
18	I would love to see Meck Co Greenways finished/extended.	4/8/2015 9:41 PM

19	Anything will help. Education for drivers licensing and bike lanes the biggest chances for improvement.	4/8/2015 8:58 PM
20	i am opposed to the greenway in my neighborhood. I think this will bring crime and safety concerns for our children. I would like to be informed of meetings regarding the greenway atstallings@yahoo.com	4/8/2015 6:58 PM
21	Need specific paths so bikers are off the road and traffic	4/8/2015 3:26 PM
22	Fear of getting hit by cars is keeping many recreational cyclists off the road, specifically me, my wife and our 3 kids. We'd love to ride more but safety concerns are too great. I like to ride, but limit my road rides to very early on weekends when there is little traffic, or at the business park off x23 where it is usually safe (but dull after riding the same loop multiple times).	4/8/2015 12:15 PM
23	I work in Charlotte so I don't think commuting by bicycle is in my near future but if safe and efficient links to transit could be made I would love to not have to use my car every day	4/8/2015 11:09 AM
24	I would have mostly the same comments for Huntersville and Davidson. A greenway system connecting the three tows, as well as Charlotte (as is being worked on), would be a significant enhancement to North Charlotte. In our 15 years here, cycling has grown dramatically, as has car traffic. A unique, safe greenway system could be used for cycling, walking and running and benefits everyone. There are many examples in the US of great cities with amazing greenways. Or better yet, let's copy what they do in Denmark! Cycling as a culture.	4/8/2015 10:23 AM
25	nope except it would be awesome to see more off road paved paths for cyclists	4/8/2015 7:02 AM
26	Please do something to stop motorist from driving up behind cyclist to honk, yell obscenities or throw items at them	4/8/2015 5:08 AM
27	Educate motorist on giving a cyclist 3 feet when passing. That cyclist have a right to the road. that it is not always safe for a cyclist to ride to the far right.	4/7/2015 10:39 PM
28	Sign me up And keep me posted!	4/6/2015 4:22 PM
29	Have enjoyed biking here so far but have avoided riding around the lake because of not being sure of the car traffic on the road ways.	4/6/2015 11:11 AM
30	I enjoy road cycling but I typically go into Mooresville to access lower traffic roads. I do not feel safe cycling on the roads in Huntersville and Cornelius because there are no bike lanes, high speed limits, and distracted drivers.	4/6/2015 8:22 AM
31	would like to have the ability to take long bike rides on greenways the connect the various town--primarily recreational interest	4/5/2015 7:44 PM
32	THANK YOU FOR RECOGNIZING THE NEED FOR SAFER AND MORE BICYCLE ROUTES.	4/5/2015 10:22 AM
33	My husband and I are avid cyclists; and support all efforts to increase bicycle use and safety. We also travel long and short distances by bicycle, here and in several other states. We have experienced many different bicycle facilities. We spend several weeks in Florida during the winter months and take day trips by bike to different communities. Florida has exceptional bikeway facilities that connect communities. We love it and remark every year how we wish our home state and communities offered similar opportunities. We are available to support this endeavor.	4/5/2015 9:52 AM
34	I rode a lot on streets prior to moving to Cornelius 20 years ago and then gave up street riding because of the dangerous street conditions and instead took up mountain bike riding. I bought a street bike this past year and have been riding with friends a couple of times per week on very selective roads that we consider safer. I welcome a more interconnected way to move safely via bike	4/5/2015 9:07 AM
35	I disagree with using "strong and fearless" label in this survey to describe bicyclists who are willing to use normal streets. I am not athletic and I care about my safety. I just don't think every street needs special bike markings on it in order to be reasonably safe for bicycling. Some roads could use improvements such as more pavement width to allow passing without waiting for oncoming traffic to clear. There are critical choke points that need to be addressed. But I think it's unrealistic to expect separate bikeways to go everywhere, and I think its counter-productive to set people up with the expectation that designated bikeways on every important road are required to get places safely. This framing marginalizes those of us who use the existing roads safely and deters novices from developing essential skills for using normal streets.	4/2/2015 11:21 AM
36	would love to have more trails like Denver	4/1/2015 5:37 PM
37	too much debris in bike lanes-where they actually exist.	4/1/2015 6:41 AM
38	No	3/31/2015 9:18 PM
39	nice survey but your age question and I am 67, is a jerk question, what does it matter????	3/31/2015 8:44 PM

40	I would like to see a bike path connecting Cornelius with downtown Davidson and Huntersville	3/31/2015 7:10 PM
41	Need the CMT very soon... Get town behind it, please...	3/31/2015 6:46 PM
42	Please add bike lanes and greenways! Follow Davidson's example - lots of connectivity and shopping /dining destinations accessible by bike. How about bike accessibility between Jetton and Kadifit parking area? Hold a farmer's market there? There are lots of great events in that area that most drive to.	3/31/2015 5:44 PM
43	Cycle lanes are too discontinuous to be safe for casual cyclists - need joined up thinking!	3/31/2015 5:43 PM
44	It would be wonderful to be able to ride bikes with our children in Cornelius up to the store or Carolina Cones as I did with my parents when I was young. But the traffic is too heavy for the roads we have today in "old Cornelius". This area has been forgotten as all the tax money seems to be spent on the lake side of the town.	3/31/2015 5:17 PM
45	Love the idea of improved bike paths and bike ways!	3/31/2015 4:51 PM
46	Overpasses would be great to alleviate bikes/pedestrians on the roadways. Connecting the McDowell Creek Greenway to the Publix area would be great but for night riding there should be some lighting necessary.	3/31/2015 4:02 PM
47	Way to improve cyclist safety (for those who choose to cycle) 1. Create physical barriers between vehicles and cyclists wherever possible. This is costly but a must if you want to create a physical fitness culture. 2. Create wider roads. Typically there are no shoulder's on the road and no berm in a lot of spots. It is either white line and drop off several inches. Bikes have to stay way clear of that or it is a no win for bike or vehicle. 3. Probably more clear signage that warns drivers to share the road or "else." Kind of like the older little signage that warns of dire circumstances if they hit a cyclist. *** These sound like costly and hard core responses but we either do it or not. More education, narrow and short strips of bike lanes do not go far enough. We either get fatter or fitter as a populace, its up to us.	3/31/2015 2:18 PM
48	Glad to see the interest in this topic. It is a quality of life issue for the community.	3/31/2015 10:36 AM
49	Aggressively educate drivers that we are fathers, mothers, spouses, friends, etc. so people don't think we are nothing more than road kill potential	3/30/2015 4:51 PM
50	I'd rather funding be used for connecting greenways and multi-purpose paths. It's a shame my kids can't bike safely to school - it's probably the single greatest improvement we could make for the health of our community while reducing a ton of school traffic at the same time.	3/30/2015 12:55 PM
51	Bike lanes are not always the answer, just a little extra width. As congestion worsens cycle commuting becomes more advantageous and as the number of cyclists increases it becomes safer.	3/30/2015 11:52 AM
52	I'm very pleased to see the town of Cornelius discussing bike safety and related topics. The cycling crowd is often affluent and a good base to keep happy for future elections or community involvement too.	3/30/2015 11:47 AM
53	More bike lanes and connected greenways/parks	3/28/2015 9:05 AM
54	I greatly appreciate the efforts of Town of Cornelius staff on this very important endeavor. I've always found Town staff to be helpful and courteous. I hope that this plan is followed up with funding to implement.	3/27/2015 12:04 PM
55	We are falling farther and farther behind as a community, more parks, more outdoor activity, biking running, botanical gardens etc	3/27/2015 11:30 AM
56	Please develop more bike paths and greenways!	3/27/2015 11:24 AM
57	Very passionate about this- I may not be able to attend on Tuesday as I have a newborn but please keep me on any distribution list- kay@kayfisherandassociates.com	3/27/2015 1:26 AM
58	no	3/26/2015 7:21 PM
59	My daughter was training for a cross country bike ride shortly after we moved to Cornelius and was very disappointed in the lack of safe areas to ride and in the disrespect she got while riding around the Cornelius roads. She often felt very unsafe. People would honk or yell at her(as there are not bike lanes). She rode a bike to her 3 jobs and loved the convenience, (no traffic, no gas) but hated the lack of support here for it.	3/26/2015 5:09 PM
60	None	3/26/2015 4:58 PM
61	I designed my life to walk/bike to work on McDowell Creek Greenway as have many other people. I cause little traffic on a day to day basis! Cornelius should design more infrastructure like the McDowell Creek Greenway so that kids going to school and workers to companies have options besides sitting in traffic.	3/26/2015 2:42 PM

62	Every other place that I've lived always had big long bike paths we could ride on as a family. It is the biggest downside of living here for me that all we have is little 1 1/2 mile greenways. We have this whole beautiful lake and yet no bike paths along it. I would love to be able to get out with my family and go on long rides to the lake etc. if the green ways could be connected that would be ideal.	3/25/2015 4:15 PM
63	I would like to be able to safely ride to Northcross for shopping and dining from Oakhurst. Our family also likes to ride to Birkdale via the Greenway. We access on Westmoreland, but are always nervous for our youngest on Westmoreland.	3/25/2015 2:35 PM
64	I believe more people would cycle if there are safe bike lanes in which to ride.	3/24/2015 11:48 AM
65	The biggest issue for cyclists is impatient and/or angry motorists. Motorists should be properly educated on the rights of cyclists. I have even been "buzzed" while riding my bike on hwy 115 by a Sheriff. So many motorists would rather see us injured than to see us riding the roads.	3/24/2015 7:46 AM
66	Would like to see more bike lanes so I can ride to work in Huntersville	3/23/2015 4:29 PM
67	I would also think about the 97 and expanding the current route to create a circle going past Bailey Park	3/20/2015 5:13 PM
68	We need more police protection at the pedestrian crossing at West Catawba and Westmoreland Rd. I recently had 5 cars turn in front of me when I had the right of way with 18 seconds to cross the St. I would have been struck 5 times!	3/20/2015 11:35 AM
69	Would like to see bike lanes on the secondary two-lane roads.	3/20/2015 8:26 AM
70	Cycling has a lot of upside for many individuals in the community and is worth the infrastructure investment.	3/19/2015 8:21 PM
71	The police officers need education on bicycle rules. My encounter with one was not good. He told me I was lucky that the car who illegally passed me and ran an oncoming car off the road didn't hit me. What?! The car shouldn't have passed me with oncoming traffic.	3/19/2015 8:07 PM
72	Thank you for showing continued interest in the cycling community. We enjoy our sport and we really don't enjoy holding up traffic, contrary to the beliefs of the vehicle queued behind us.	3/19/2015 7:14 PM
73	Any new development done in this area should be required to do so with cycling and walking paths	3/19/2015 7:01 PM
74	no	3/19/2015 5:34 PM
75	Wider roads are critical	3/19/2015 3:02 PM
76	So many reasons to promote cycling: Brings community together as families come to town centers for shopping & functions, good for business, health, and minimizes pollution.	3/19/2015 2:56 PM
77	I'm glad to see the effort put into improving cycling in our local communities. It impacts not just cyclist, but pedestrians as well as building a sense of community outside of our rolling steel boxes.	3/19/2015 2:40 PM
78	thanks for asking for feedback:)	3/19/2015 2:33 PM
79	Would like to see further construction of the Greenways for bike and pedestrian use. Let's connect Bailey to Birkdale to Robins Park!	3/19/2015 12:58 PM
80	The Gov needs to be doing a better job promoting cycling in the area along with safety for cyclist.	3/19/2015 12:46 PM
81	Thanks for asking!	3/19/2015 12:31 PM
82	those railroad tracks across 115 are dangerous and should be project #1. I have been taken out by those tracks as well as several friends!	3/19/2015 12:29 PM
83	I would like to see a bike share program. Also, communities install bike lanes but do not maintain them. I ride and have to avoid glass, trash and car parts such as hubcaps and bumpers.	3/19/2015 12:11 PM
84	I would DEFINITELY ride more if the environment was conducive to do so, both in Davidson and too Cornelius. It is way too dangerous in my opinion. The traffic volume with no respect for what little bike lanes we have makes it very unsafe and risky.	3/19/2015 11:17 AM
85	there should be a sidewalk and bike lane on 115 near the railroad bridge.	3/19/2015 10:23 AM
86	More bike paths and connected greenways! Could we get a bike path along the train track, since we don't seem to be able to get a commuter train?	3/19/2015 10:03 AM
87	I would like to see more bicycle path / greenway connectivity between Cornelius and Davidson	3/19/2015 9:53 AM

88	Thanks for anything you do to make cycling better - much appreciated	3/19/2015 9:00 AM
89	Thank you. Ride on!	3/19/2015 7:11 AM
90	let's not spend money on bicycle improvements.	3/18/2015 10:43 PM
91	I live in huntersville, work in davidson. Travel thru cornelius daily. Thanks!	3/18/2015 10:41 PM
92	Continuos biking network badly needed to support a biking friendly community	3/18/2015 10:21 PM
93	Thank you for the survey! I hope Cornelius and Davidson can get together to make 115 a safe commute.	3/18/2015 9:57 PM
94	I am an avid rider but have limited the amount of time on my bike because of the lack of infrastructure. Huntersville, Cornelius, and Davidson should be working together to improve the infrastructure to make this the top notch fitness community. I would like to see the Greenways extend to the lake front so more people will enjoy everything our community had to offer.	3/18/2015 8:57 PM
95	Improving bike facilities should be a very high town priority	3/18/2015 2:05 PM
96	I would love for my kids to bike more in Cornelius. Currently we head to Davidson for all our biking trip because it feels safer, more bike friendly, more bike destinations, easier greenway access. I bike alone, and allow them to go to these destinations alone as well. Wish Cornelius had more routes and safe destinations for us.	3/18/2015 10:58 AM
97	Cornelius is not very bike friendly, and neither is Davidson. I came from Plano TX where they had dedicated bike lanes with room for both motorists and cyclists. It would be wonderful if Cornelius created dedicated lanes for cyclists. It would be a real draw from all over the area, and good for our businesses, parks, greenways, and community in general.	3/18/2015 9:24 AM
98	More greenbeits please. More paved bike trails. We would like a nicer, family friendly, path to bike from Torrance Chapel Road to Birkdale Village. Thanks.	3/17/2015 7:00 PM
99	WE NEED MORE BIKE AND WALKING TRAILS AND CONNECTORS (OFF-ROAD) NEED CONNECTION to Caldwell Station!	3/17/2015 6:45 PM
100	I would like to see Cornelius become more bike friendly. I think the east side of town might be easier to start with. The westside is so car oriented and dangerous.	3/17/2015 6:03 PM
101	hire a planner so we don't continue to make mistakes	3/17/2015 4:50 PM
102	keep bikes off the road, they don't pay for a tag or any other road use taxes and should not be allowed to use the public streets.	3/17/2015 4:44 PM
103	I enjoy the fact that we can basically walk everywhere in our town. If we can improve bike paths and create more bike racks in parks and shopping areas, it would greatly benefit our communities quality of life. Thank you for offering this survey.	3/17/2015 3:18 PM
104	Would love to see more greenways and/or bike paths, especially up to exit 28 area and more alternatives to catawba ave.	3/17/2015 2:38 PM
105	Connectivity/safety is a big issue. My kids and I can ride from Robbins to Birkdale if you take the main cut through you're nearly run over ever five minutes by someone speeding/texting/etc. Riding to Jetton is too dangerous ... sidewalk ends on the south side of Catawba. People whip in and out of roads. Pay no attention to walkers/riders crossing roads.	3/15/2015 11:40 AM
106	Thanks for doing this survey! Davidson residents want to bike to many destinations in Cornelius.	3/14/2015 10:46 AM
107	There should be bike lanes on Catawba Ave., Jetton Rd., and Hwy 115	3/13/2015 4:28 PM
108	Spend more on bike improvement, less on more baseball/athletic complexes!	3/10/2015 8:18 PM
109	don't copy Davidson and make streets so narrow and bike lanes so big for "traffic calming" so that drivers have less and less road and are anything but "calm."	3/10/2015 1:01 PM
110	need to widen roads for bike lanes	3/9/2015 8:09 PM
111	Cornelius is dangerous for cyclists, especially when compared to Davidson. Speed limits on roads like Jetton, Bethel Church and Torrence Chapel are anti-cyclists, not to mention the fact that there are no bike lanes. Mysteriously, the bike lane on the north side of Westmoreland just ends, and ends abruptly. I can't picture riding east on Westmoreland, past the McDowell Creek Greenway, without taking your life in your hands.	3/9/2015 4:47 PM

112	I think a bicycle master plan should be considered along with the downtown (old cornelius) plan. The Antiquity community still under development has some good opportunities for connector access	3/9/2015 11:25 AM
113	Please run education in the Cornelius Today.....I have ask Mr. Duke and Mr Yochum to run an article and used Town of Davidsons article as an example. But no actin taken	3/9/2015 10:14 AM
114	I would hope that someday people think of Cornelius as a bike friendly town - today absolutely not. YOu go to Davidson for that..	3/9/2015 9:50 AM
115	Not sure why a greenway parallel to 77 couldn't run from Huntersville to Davidson. Already have greenway from Birkdale to west Moreland.	3/9/2015 8:20 AM
116	Safe passage over 77 on Westmoreland would be a dream come true.	3/9/2015 8:15 AM
117	None	3/8/2015 9:59 PM
118	My wife and I moved to Cornelius for the the great outdoor living. The town needs to act quickley and not sit on this issue. The safer we can make it for the community the more people will start to use. I would personally would like to see is more water fountains along cycling areas. And also waypoint signage i.e.: you are here to get to x its x miles.	3/8/2015 8:38 PM
119	As an avid cyclist in the Lake Norman community, the rural areas do well with cyclist, it's the downtown and interstate exit regions that struggle embracing cyclist. We're always "in the way".	3/8/2015 6:37 PM
120	I would love to see some improvements made to make this area more bike friendly. There are many days where I wish I could ride my bike to get a coffee or to the grocery store or just for recreation and do not feel safe on the roads for lack of shoulder or cars speeding. Hope to see improvements!	3/8/2015 1:10 PM
121	Thanks for trying to figure this puzzle out!	3/8/2015 12:24 PM
122	Please make it safe for me to ride to the greenway and Robbins Park with my children. It is currently easier and much safer for me to ride into Davidson than it is to ride in my own town. There is a complete lack of bicycle connectivity from the east side of I-77 to the west side. I would much rather bike to the greenway than put 5-6 bikes in my car to ride the greenway...kind of defeats the purpose if you ask me.	3/8/2015 12:11 PM
123	I love living in Cornelius. I think more outdoor-related and incentivizing steps taken by the town would further enhance the Cornelius experience and help set us apart from other communities. I think dedicated bike lanes (or at least multi-use sidewalks would be a great first step to encourage more bicycle/foot traffic in the area. Thanks for providing the survey and for seeking our comments.	3/8/2015 11:55 AM
124	I had to stop biking my children to school because I felt it wasn't safe enough to do, better routes and crossing places would help	3/8/2015 11:42 AM
125	n/a	3/7/2015 9:23 PM
126	extend McDowell creek greenway north of westmoreland.	3/7/2015 8:55 PM
127	-Please through this effort, explain why folks aren't supposed to bike on sidewalks, and change that, if possible. Establish a way to share the sidewalks, not the road. -Please focus on sidewalks, trails, and alternatives - most roads here need the shoulder just to let emergency vehicles pass, they are not ever going to be safe, in a connected way, for bikes on the actual road. Please educate bikers as to this. -Please focus on the people who use their bikes for transport - this will make the most social and environmental difference. The serious/spandex high-speed biking crew are in a completely different boat and I don't think we should be funding their recreation. We should focus on bikes as transport, safety for that purpose, and connectivity. Think about kids riding to school and growing up into being adult transport-related riders. Connect commercial areas. In the end, it will help the recreational bikers too.	3/7/2015 1:27 PM
128	Need to get all churches involved in this process.	3/7/2015 1:02 PM
129	Catawba been 115 and Exit 28 is too narrow with bike lanes. Can road be widened?	3/7/2015 9:54 AM
130	I am a Realtor and avid cyclists. My clients moving here often ask about safe cycling communities and now that Brawley School has bike lanes and Davidson is bike friendly those at the two areas I tell them about. I would love to add Cornelius!	3/7/2015 9:16 AM
131	I moved from AZ where I rode 20+ miles 4/5x per week in dedicated bike lanes. Not safe to do so here, roads too narrow.	3/7/2015 7:54 AM
132	no	3/7/2015 7:38 AM

133	Cornelius has so much to enjoy. Having more bike lanes, paths and rack will help reduce cars on the road and bolster our enjoyment of the area. I strongly support these improvements.	3/7/2015 6:15 AM
134	Bike Lanes and LED street lighting would be huge improvements	3/7/2015 6:14 AM
135	drivers do not stop at stop signs	3/7/2015 1:25 AM
136	No	3/6/2015 9:54 PM
137	Should look at bicycle flyovers at major roadways.	3/6/2015 9:23 PM
138	Trails around the lake round make Cornelius a major leisure destination	3/6/2015 8:35 PM
139	There isn't a good way to connect the west side of 77 with the east side of 77. Nor Cornelius to Davidson and Cornelius to Huntersville (both sides of 77).	3/6/2015 8:29 PM
140	Thank you for doing this!	3/6/2015 8:14 PM
141	I'm glad to see this finally being addressed. I've biked here all my life and have been constantly frustrated. Things have improved in the past 10-12 years though. I hope we keep heading in the right direction.	3/6/2015 7:35 PM
142	Thank you steering committee.	3/6/2015 6:33 PM
143	The roads to Bailey Middle and Hough are NOT safe for kids to ride to school and should be an alternative to driving since parking is restricted to seniors and kids need exercise.	3/6/2015 6:31 PM
144	As an avid recreational bike rider, I see car drivers riding too close to bike lanes and too fast on streets with bike lanes. Happy to see bike riding getting some attention!	3/6/2015 5:10 PM
145	Not really, just hoping for some improvements.	3/6/2015 5:03 PM
146	The only North South roads are US 21 and US 115. These roads need bike lane or sidewalks for pedestrian traffic. There are no North/South roads outside of these unless you ride through neighborhoods which will add miles to a bike trip. Most of Cornelius major roads are unsafe for Bicycle traffic.	3/6/2015 4:58 PM
147	Good luck	3/6/2015 4:43 PM
148	Thank You!	3/6/2015 4:41 PM
149	Thanks!	3/6/2015 4:40 PM
150	Connect all greenways in Cornelius (Emerald)	3/6/2015 4:36 PM
151	Using greenways to get around busy roads and intersections may be the best option. Safety and how to get along training would be beneficial for both cyclists and motorists.	3/6/2015 4:20 PM
152	I moved from CT where there were 50+ miles of contiguous rails to trails bicycle/walk paths. It became a popular and positive amenity for both businesses and residents located nearby	3/6/2015 4:18 PM
153	Concentrated use and application of developer infrastructure dollars would help (so many side walks in front of developments that lead to no where!!	3/6/2015 4:13 PM
154	I think our town could really benefit from being cycle friendly	3/6/2015 4:10 PM
155	We have six children who love riding their bikes into davidson because there are sidewalks the entire distance. Unfortunately because there aren't on the way into Cornelius they can't ride into town that way. Also, they would love to ride to the YMCA but cannot because there is no safe way to do that.	3/6/2015 4:04 PM
156	Thank you for offering this survey. We all know bikeway funding is extremely scarce, and bicycle infrastructure improvements, therefore, difficult to implement. But there are also tangible and intangible benefits to making such investments. Perhaps the survey results will help drive the community conversation and propel us in right direction.	3/6/2015 4:00 PM
157	I like the direction Cornelius is moving towards - being more bike friendly!	3/6/2015 3:52 PM
158	yes, I rode for several years on an almost daily basis (training for triathlons) and have chosen to no longer put myself in danger...	3/6/2015 3:49 PM

Appendix B - Bicycle Facility Design Guidelines

This section includes standards and recommendations for implementation of bicycle facilities.

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CORNELIUS, NORTH CAROLINA

Bicycle Facility Design Guidelines

July 2015

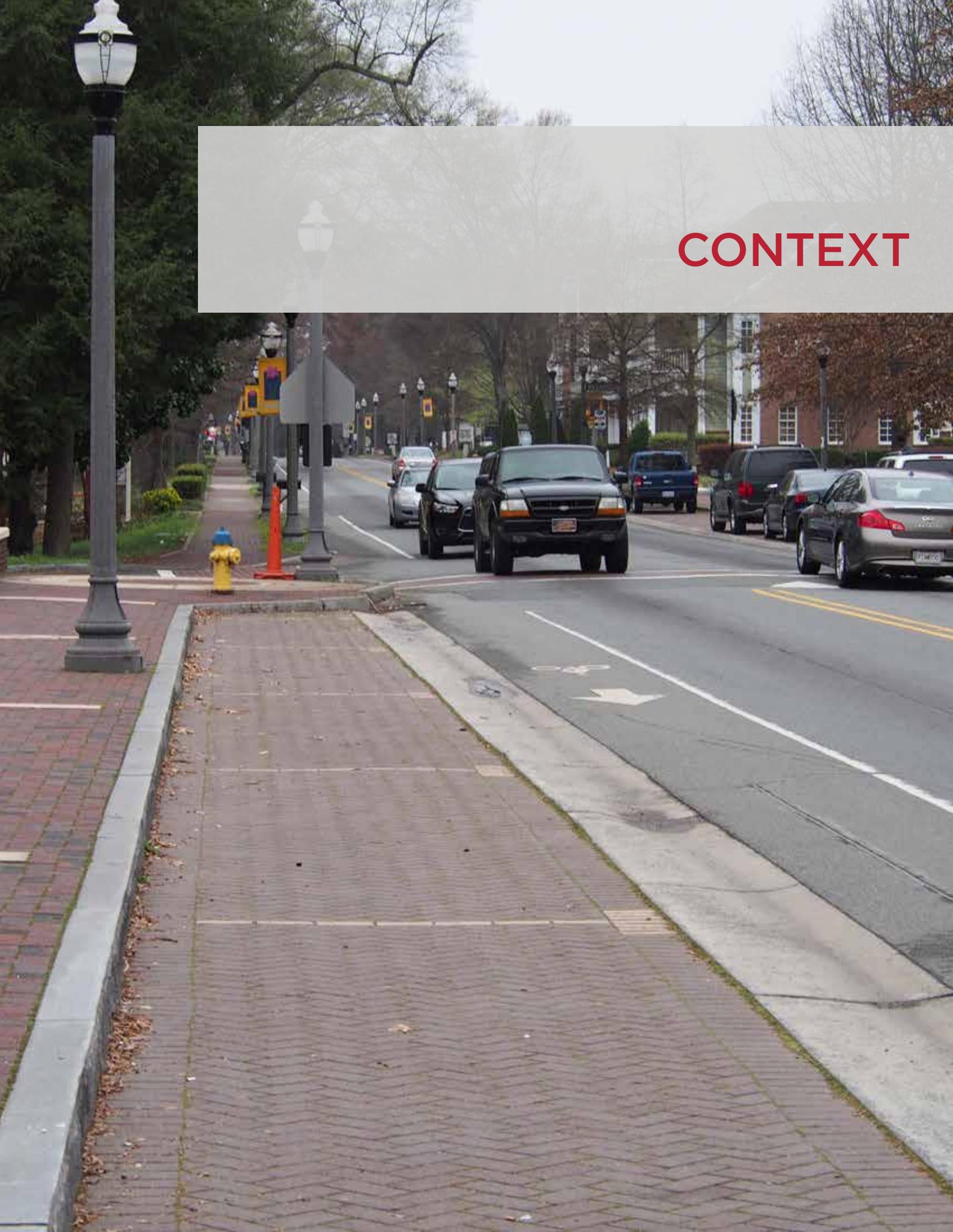
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CONTEXT

CONTEXT

GUIDANCE BASIS

The sections that follow serve as an inventory of bicycle design treatments and provide guidelines for their development. The guidelines are not, however, a substitute for a more thorough evaluation by a landscape architect or engineer upon implementation of facility improvements. The following standards and guidelines are referred to in this guide.

National Guidance

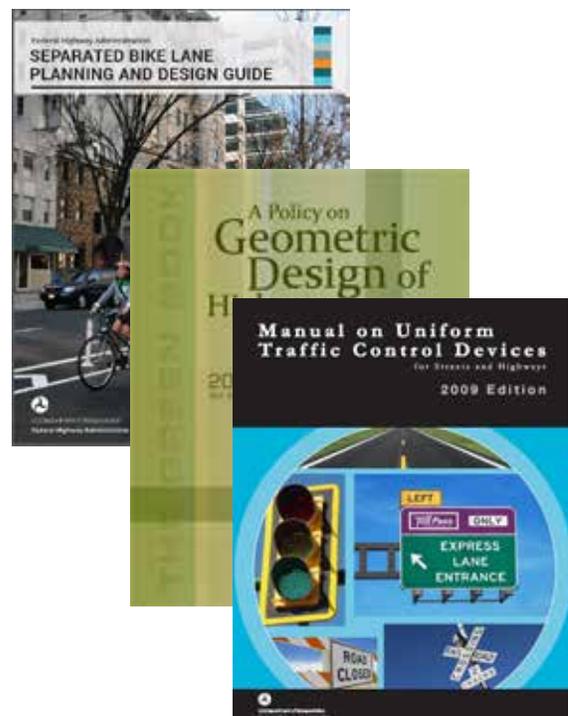
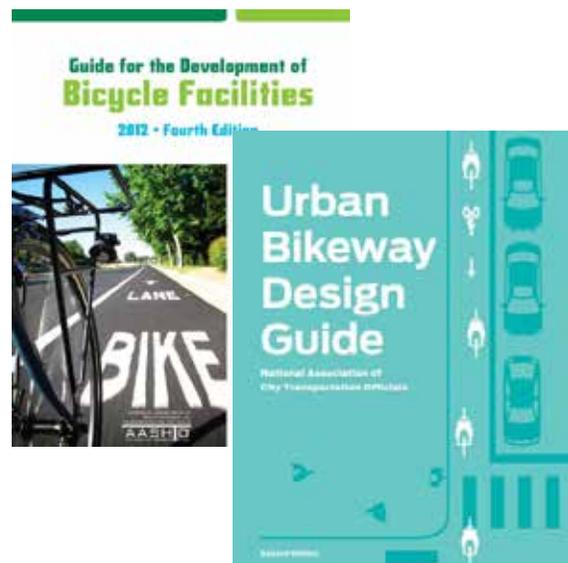
American Association of State Highway and Transportation Officials (**AASHTO**) **Guide for the Development of Bicycle Facilities (2013)**, updated in June 2012 provides guidance on dimensions, use, and layout of specific bicycle facilities.

The National Association of City Transportation Officials' (**NACTO**) **Urban Bikeway Design Guide (2012)** is the newest publication of nationally recognized bikeway design standards, and offers guidance on the current state of the practice designs.

The Federal Highway Administration's (FHWA) **Separated Bike Lane Planning and Design Guide (2015)** provides federal endorsement of physically separated bike lanes and preferred design standards.

The 2011 **AASHTO A Policy on Geometric Design of Highways and Streets (2011)** commonly referred to as the "Green Book," contains the current design research and practices for highway and street geometric design.

FHWA's **Manual on Uniform Traffic Control Devices (MUTCD) (2009)** defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public traffic. The MUTCD is the primary source for guidance on lane striping requirements, signal warrants, and recommended signage and pavement markings.



CONTEXT

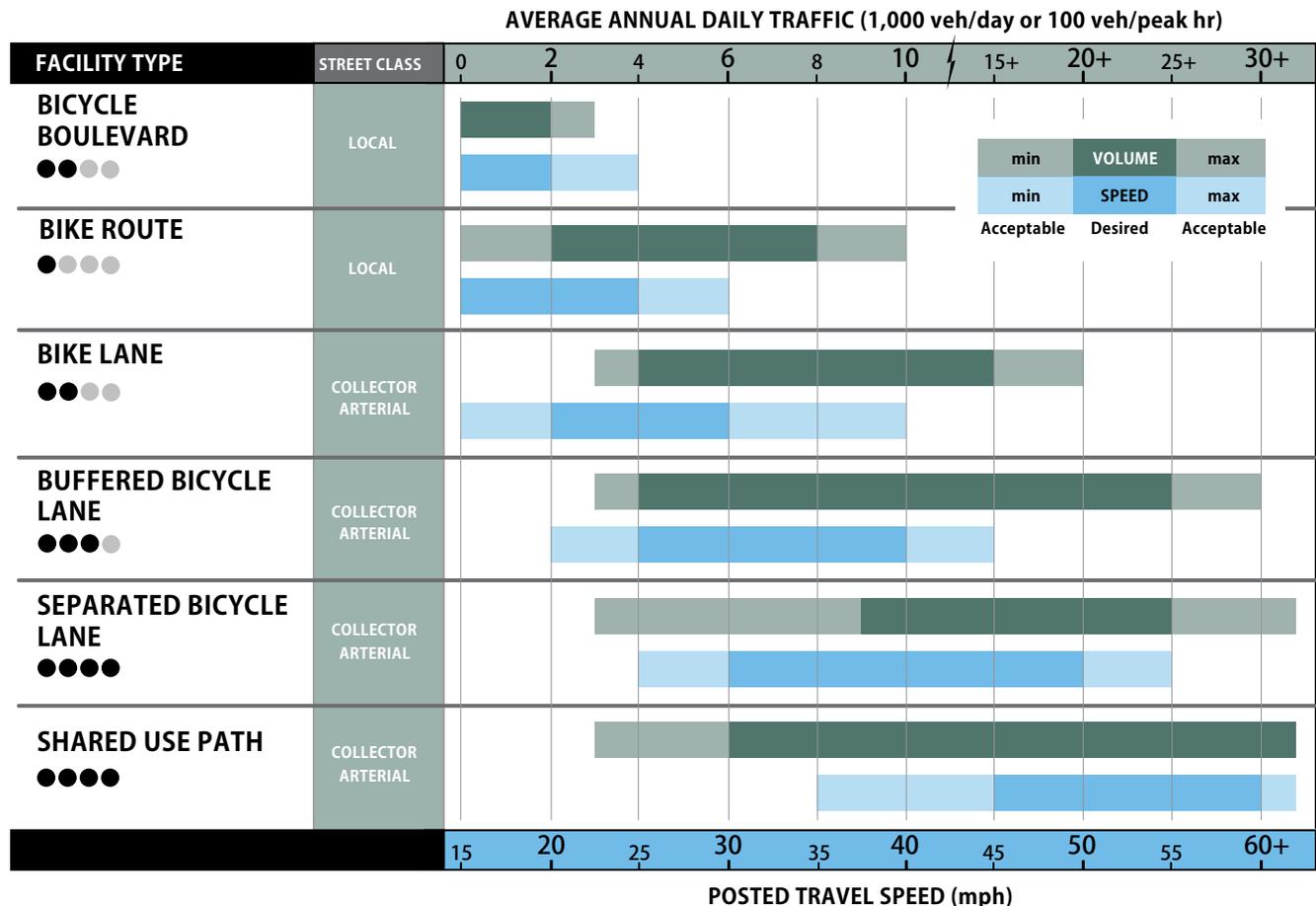
FACILITY SELECTION

Selecting the best bikeway facility type for a given roadway can be challenging, due to the range of factors that influence bicycle users' comfort and safety. There is a significant impact on cycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high.

Facility Selection Table

As a starting point to identify a preferred facility, the chart below can be used to determine the recommended type of bikeway to be provided in particular roadway speed and volume situations. To use this chart, identify the appropriate daily traffic volume and travel speed on or the existing or proposed roadway, and locate the facility types indicated by those key variables.

Other factors beyond speed and volume which affect facility selection include traffic mix of automobiles and heavy vehicles, the presence of on-street parking, intersection density, surrounding land use, and roadway sight distance. These factors are not included in the facility selection chart below, but should always be considered in the facility selection and design process.



CONTEXT

BICYCLIST USER TYPE

The current AASHTO Guide to the Development of Bicycle Facilities encourages designers to identify their rider type based on the trip purpose (Recreational vs Transportation) and on the level of comfort and skill of the rider (Casual vs Experienced). An alternate framework for understanding the US population’s relationship to transportation focused bicycling is illustrated in the figure below. Developed by planners in Portland, OR* and supported by research**, this classification identifies four categories to address varying attitudes towards bicycling in the US.

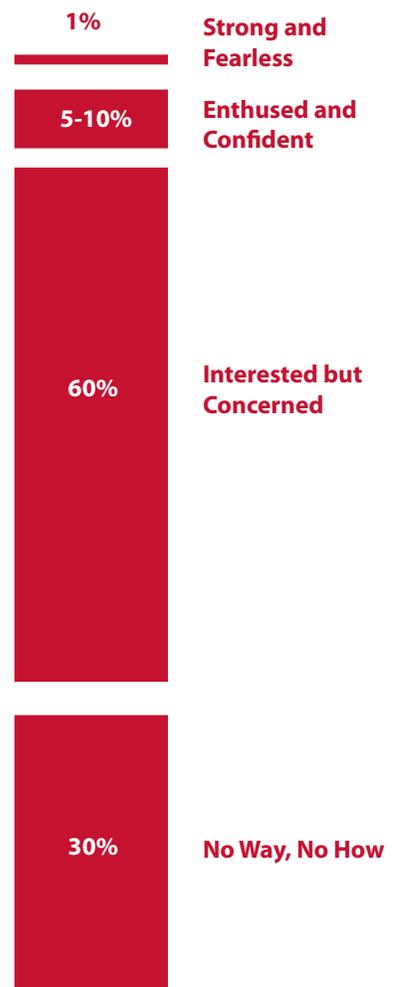
Four Types of Transportation Bicyclists

Strong and Fearless (approximately 1% of population) – Characterized by 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 shared-use paths.

Enthusied and Confident (5-10% of population) - This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared-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, recreationalists, racers and utilitarian bicyclists.

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 shared-use paths 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.

No Way, No How (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 not ride a bicycle under any circumstances.



Typical Distribution of Bicyclist Types

* Roger Geller, City of Portland Bureau of Transportation. Four Types of Cyclists. <http://www.portlandonline.com/transportation/index.cfm?&a=237507>. 2009.

** Dill, J., McNeil, N. Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential. 2012.

CONTEXT

USER DESIGN DIMENSIONS

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.

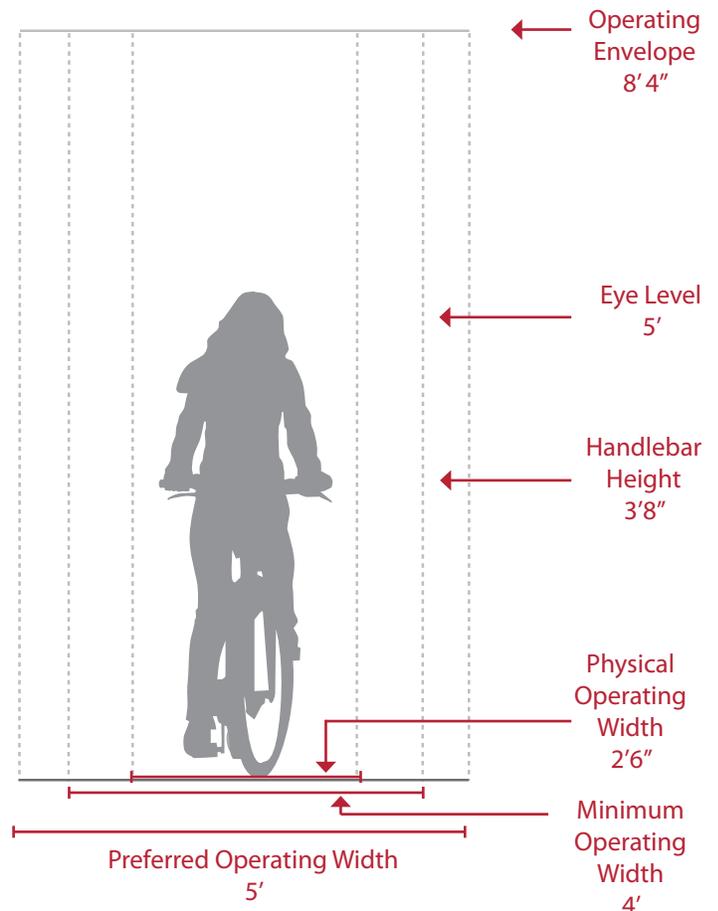
Bicycle as a Design Vehicle

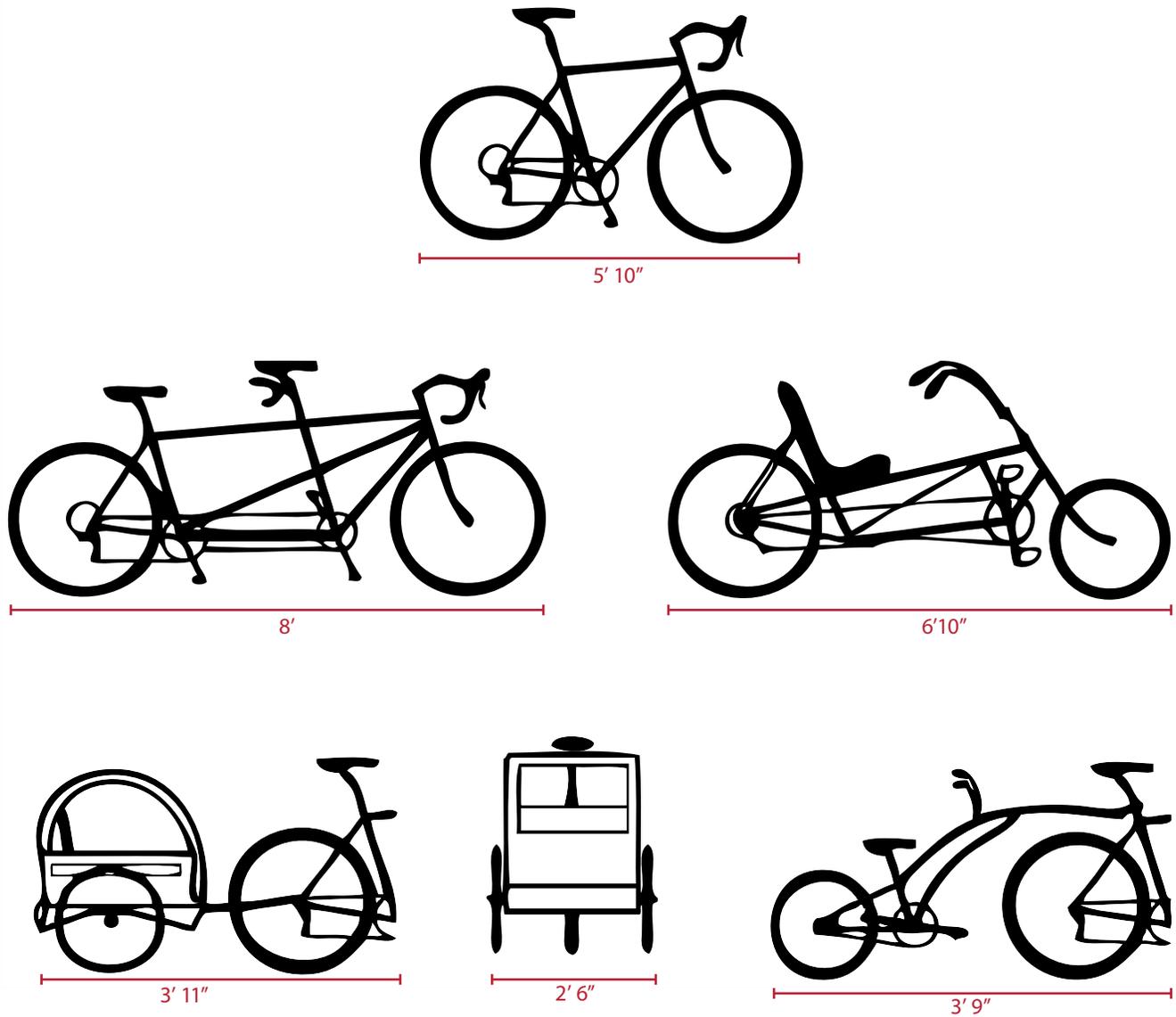
Similar to motor vehicles, bicyclists and their bicycles exist in a variety of sizes and configurations. These variations occur in the types of vehicle (such as a conventional bicycle, a recumbent bicycle or a tricycle), and behavioral characteristics (such as the comfort level of the bicyclist). The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

The figure to the right 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 to the left summarizes the typical dimensions for bicycle types.

Bicycle Rider - Typical Dimensions





Source: AASHTO Guide for the Development of Bicycle Facilities, 4th Edition

Design Speed Expectations

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

Bicycle as Design Vehicle - Design Speed Expectations

Bicycle Type	Feature	Typical Speed
Upright Adult Bicyclist	Paved level surfacing	8-12 mph*
	Crossing Intersections	10 mph
	Downhill	30 mph
	Uphill	5-12 mph
Recumbent Bicyclist	Paved level surfacing	18 mph

* Typical speed for causal riders per AASHTO 2013.

**PACIFIC
AVE
(BEACH)**

SHARED ROADWAYS

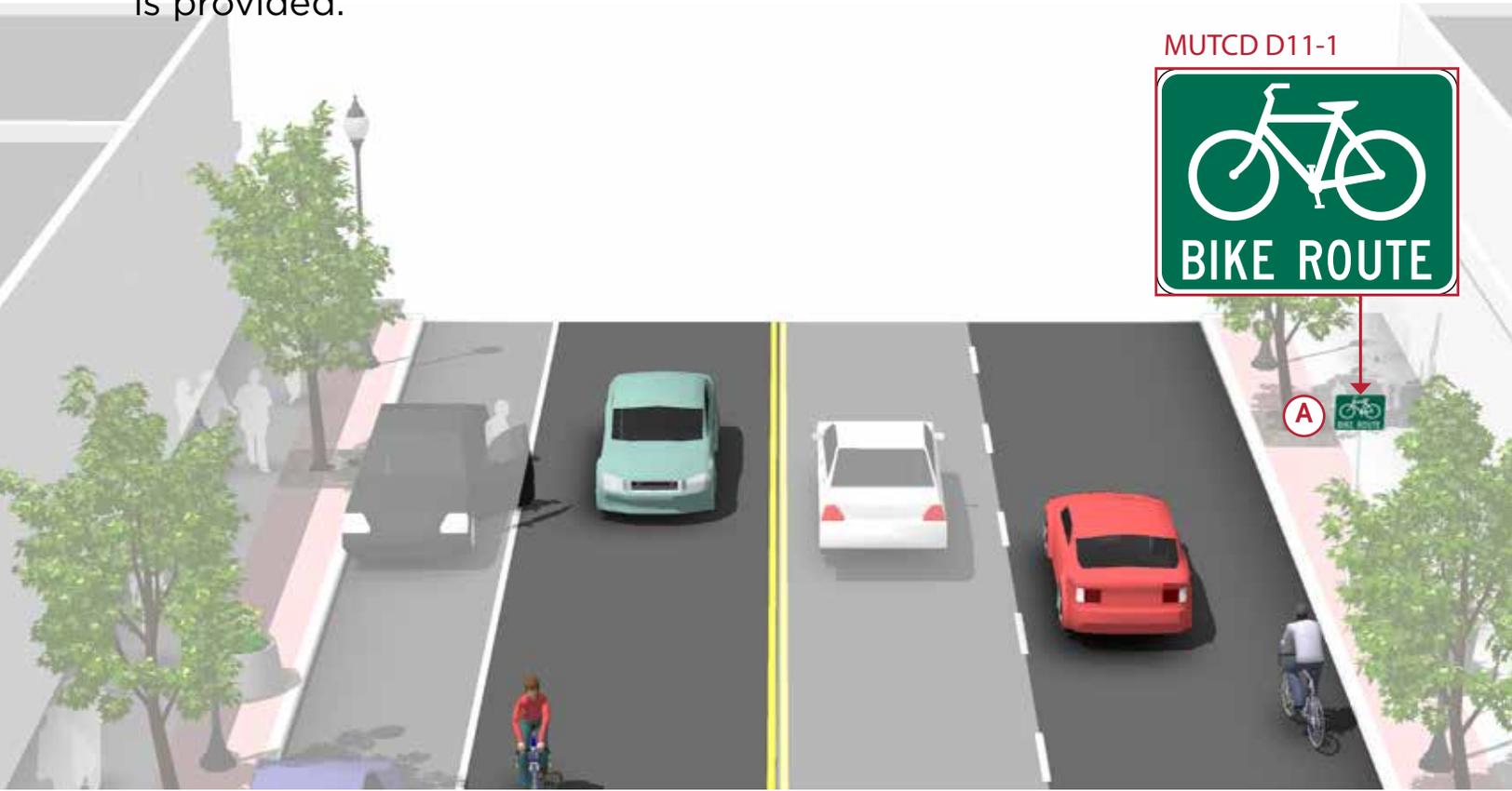


**MAY USE
FULL LANE**

SHARED ROADWAYS

SIGNED SHARED ROADWAY

Signed shared roadways are facilities shared with motor vehicles. 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.



MUTCD D11-1

**Typical Application**

- On low volume, low speed streets
- Used to provide continuity with other bicycle facilities (usually bike lanes).
- May be used on higher volume roads with wide outside lanes or shoulders. On these streets, signed shared roadways are not suitable for children or casual, less experienced bicyclists.

Design Features

Lane width varies depending on roadway configuration.

A Bike 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.

SHARED ROADWAYS

MARKED SHARED ROADWAY

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.



MUTCD R4-11
(optional)

MUTCD D11-1
(optional)



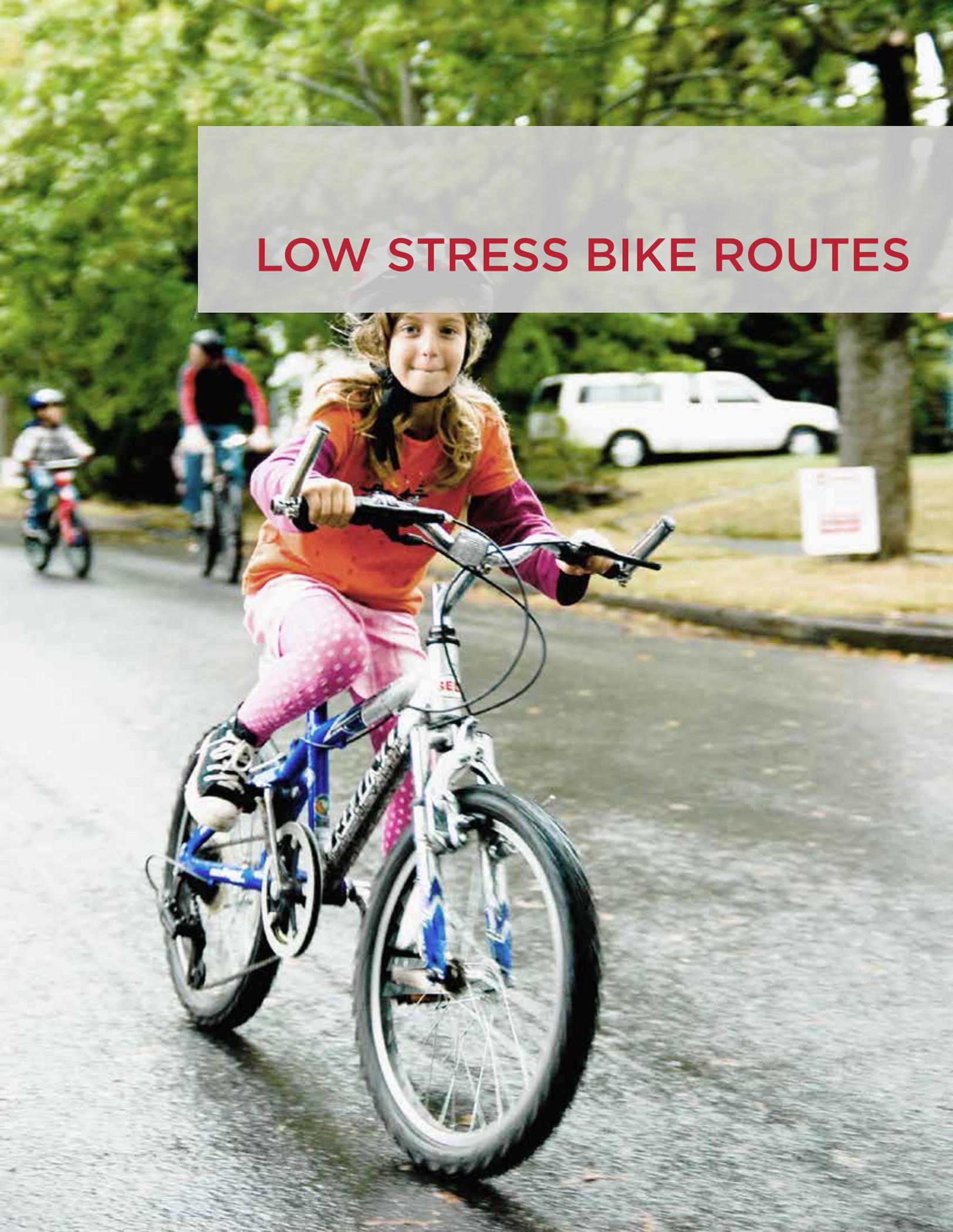
Typical Application

- May be used on streets with a posted speed limit of 35 mph or under, although vehicle speeds less than 30 mph is preferred.
- Used to provide continuity with other bicycle facilities (usually bike lanes).
- May be used on higher volume roads with wide outside lanes or shoulders. On these streets, signed shared roadways are not suitable for children or casual, less experienced bicyclists.

Design Features

- **A** In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- **B** On wide outside lanes with no parking (≥ 14 ft), place the marking 4 feet from edge of curb to promote bicycle travel to the right of motor vehicles.
- Minimum placement of SLM marking centerline is 11 feet from edge of curb where on-street parking is present. If parking lane is wider than 7.5 feet, the SLM should be moved further out accordingly.

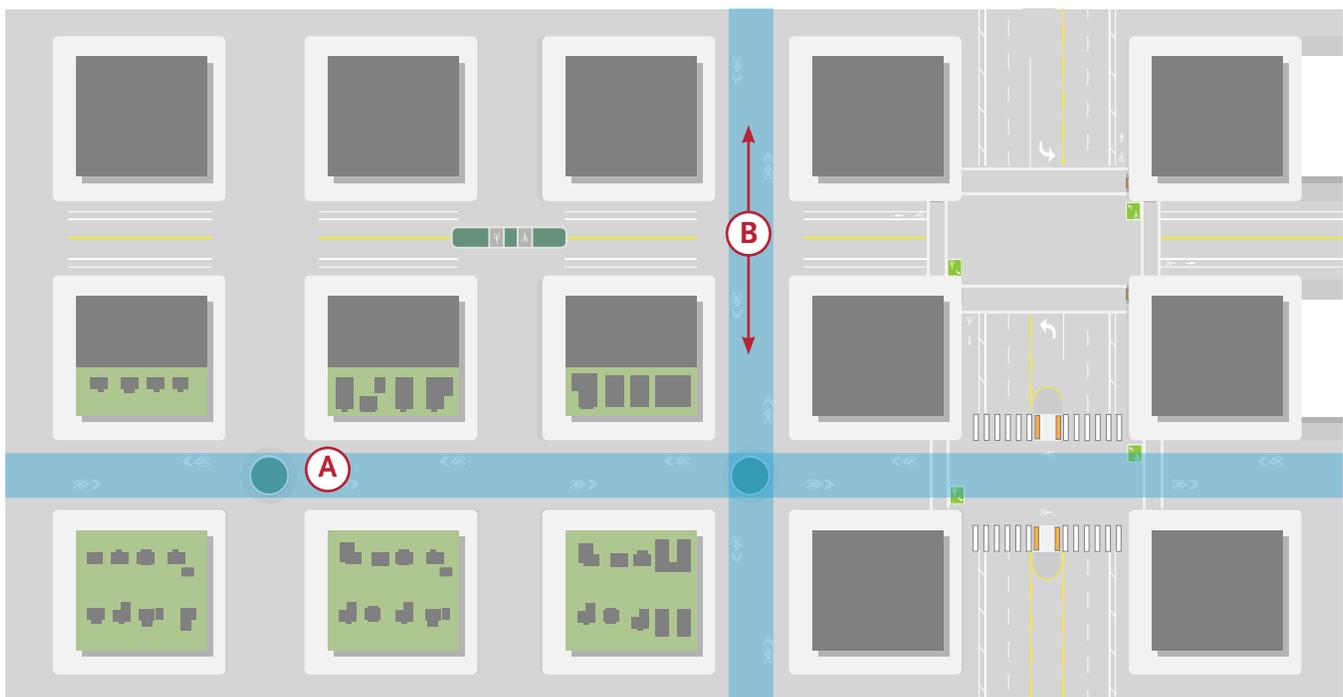
LOW STRESS BIKE ROUTES



LOW STRESS BIKE ROUTES

ROUTE SELECTION

Low stress bike routes should be developed on streets that improve connectivity to key destinations and provide a direct route for bicyclists. Local streets with existing traffic calming, traffic diversions, or signalized crossings or major streets are good candidates, as they tend to be existing bicycle routes and have low motor vehicle speeds and volumes.

**Typical Application**

- Routes should be parallel with and in close proximity to major thoroughfares
- Routes should closely follow a desire line for bicycle travel that is ideally long and relatively continuous (2-5 miles).
- Streets with travel speeds at 25 mph or less and with traffic volumes of fewer than 3,000 vehicles per day. These conditions should either exist or be established with speed and volume management techniques.

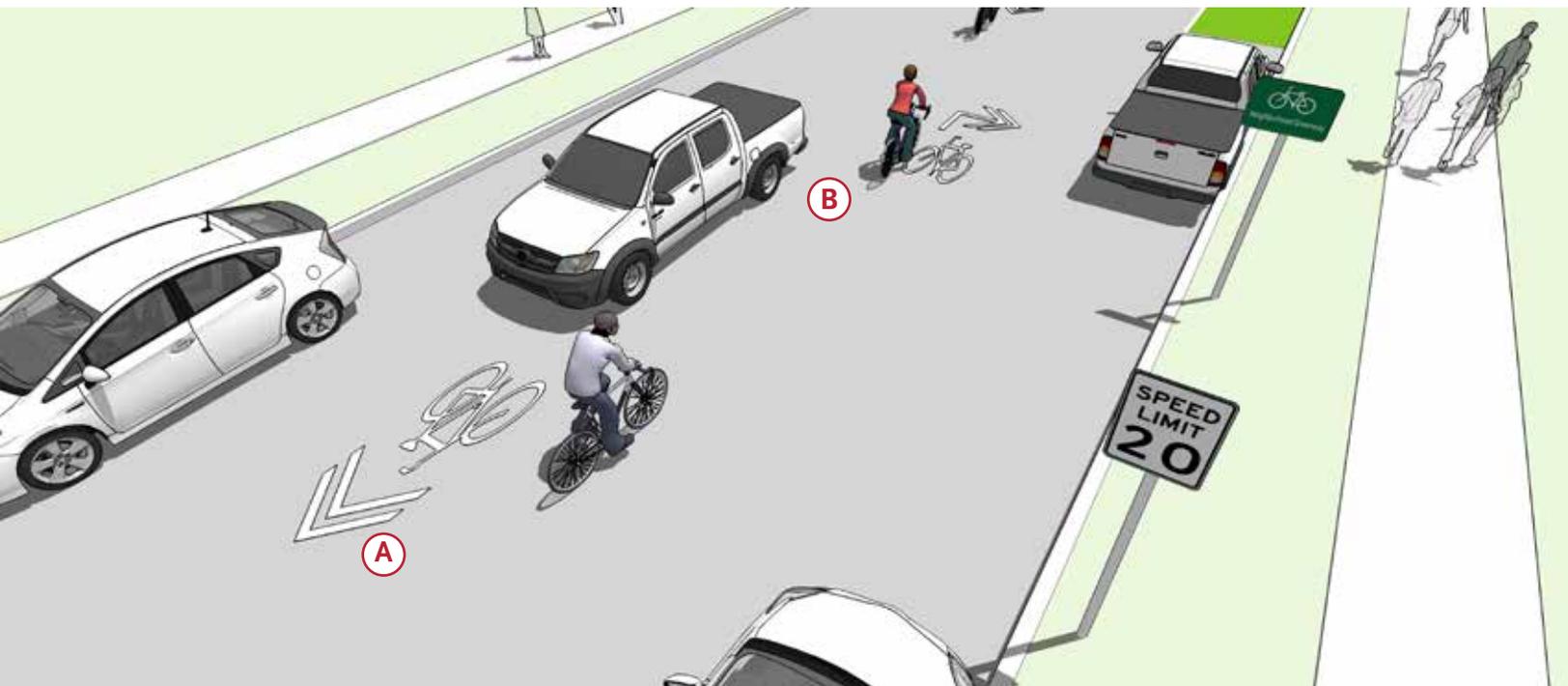
Design Features

- **A** Speed and volume management should be used to create appropriate conditions on routes that do not meet design thresholds.
- **B** Use of streets that parallel major streets can discourage non-local motor vehicle traffic without significantly impacting motorists.
 - Can benefit pedestrians and other users through crossing improvements, wayfinding, landscaping, and reduced motor vehicle speeds and volumes.

LOW STRESS BIKE ROUTES

SIGNS & PAVEMENT MARKINGS

Signs and pavement markings are the minimum treatments necessary to designate a street as a neighborhood bikeway. Together, they visibly designate a roadway to both bicyclists and motorists. Signs, and in some cases pavement markings, provide wayfinding to help bicyclists remain on the designated route.



Typical Application

- Pavement markings identify the route and can guide users through jogs in the route.
- Signs and markings differentiate bicycle boulevards from other local streets, reminding people driving to watch for bicyclists.
- Wayfinding signs displaying destinations, distances, and “riding time” can dispel common misperceptions about time and distance.

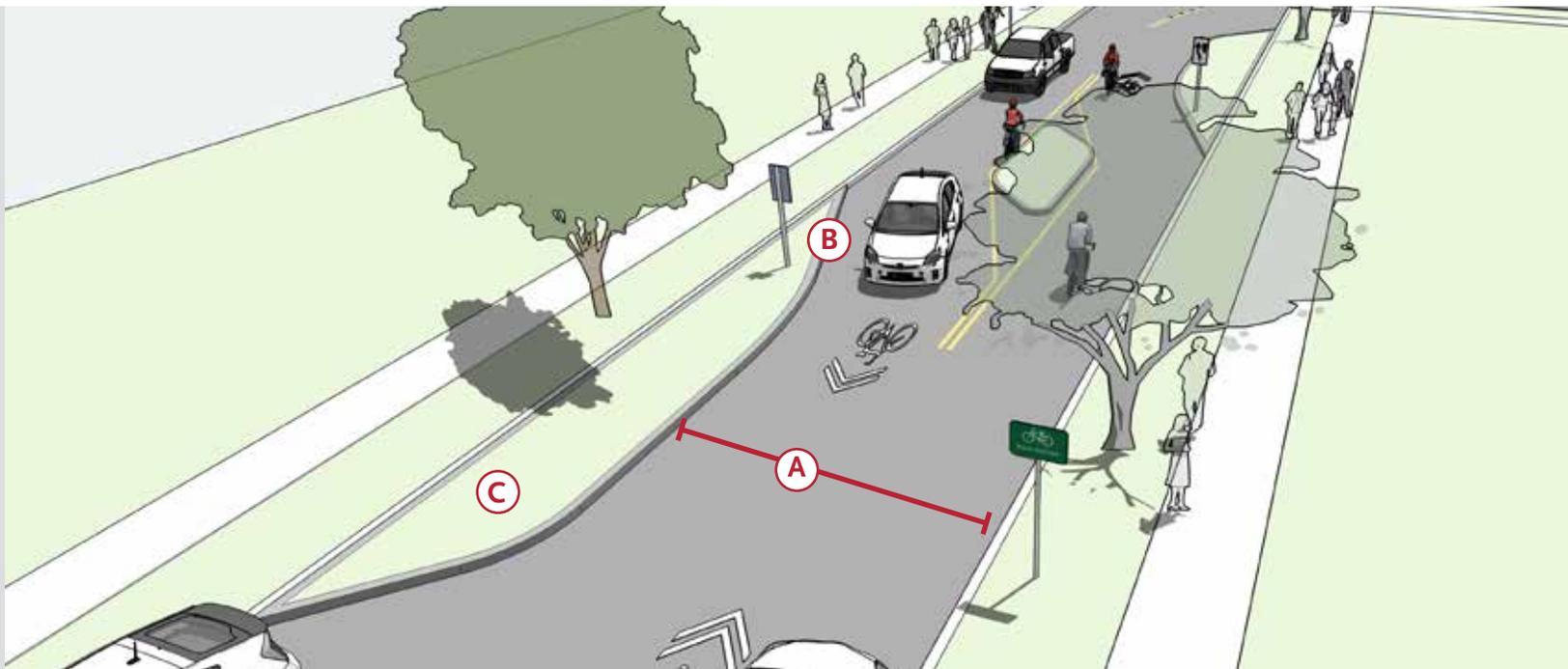
Design Features

- Ⓐ Place symbols every 150-300 feet along a Low stress bike route, as well as after every intersection.
- Ⓑ On narrow streets where a motor vehicle cannot pass a bicyclists within one lane of traffic, place markings in the center of the travel lane.
 - Modified street signs identify and brand the route without introducing a new sign.
 - Shared lane markings are a standard marking for shared lane conditions. Some cities use custom markings to identify their neighborhood bikeway network.

LOW STRESS BIKE ROUTE

SPEED MANAGEMENT

Traffic calming devices cause drivers to slow down by constricting the roadway space or by requiring careful maneuvering. Such measures may reduce the design speed of a street, and can be used in conjunction with reduced speed limits to reinforce the expectation of lowered speeds.

**Typical Application**

- On Low stress bike routes where a reduction of vehicle speeds is desired and where improved conditions for bicyclists, pedestrians and residents along the route is desired.
- Neighborhood bikeways should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.

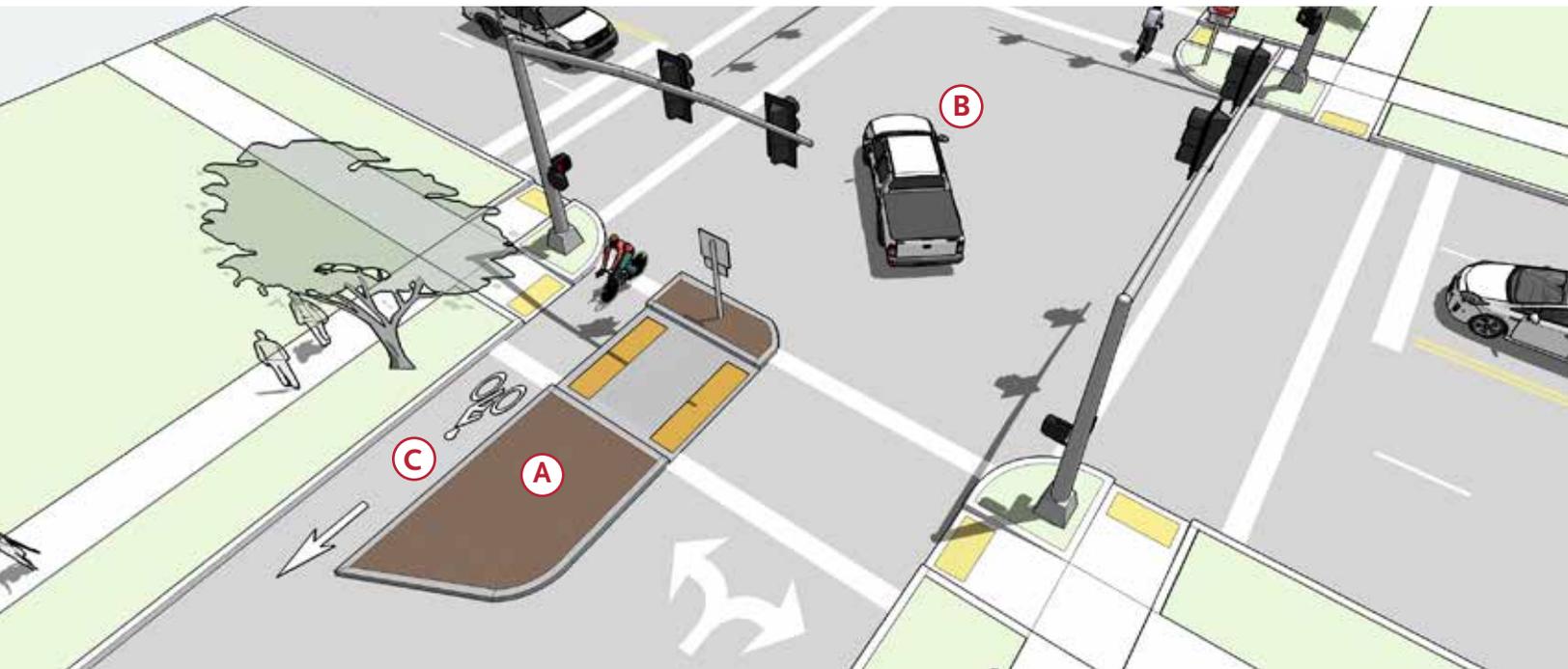
Design Features

- **A** Maintain a minimum clear width of 14 feet with a constricted length of at least 20 feet in the direction of travel.
- **B** Traffic calming should be designed to minimize impacts to street cleaning equipment.
- **C** Vegetation along the route should be regularly trimmed to maintain visibility and attractiveness.
 - Horizontal speed control measures should not infringe on bicycle space. Where possible, provide a bicycle route outside of the element so bicyclists can avoid having to merge into traffic at a narrow pinch point.

LOW STRESS BIKE ROUTE

VOLUME MANAGEMENT

Volume management measures reduce or discourage thru traffic on neighborhood bikeways by physically or operationally reconfiguring corridors and intersections along the route. Lower vehicle volumes increase bicyclists' comfort and reduce the number of potential conflicts. Implement volume control treatments based on the context of the neighborhood bikeway.



Typical Application

- Volume management techniques establish and reinforce bicycle priority by restricting vehicle through movements.
- On Low stress bike routes where a reduction of vehicle volumes down to 1,500 - 3,000 cars per day is desired and where improved conditions for bicyclists, pedestrians and residents along the route is desired.
- Where design treatments cannot reduce volumes below 3,000 cars per day, provide a on-street or physically Cycle Track.

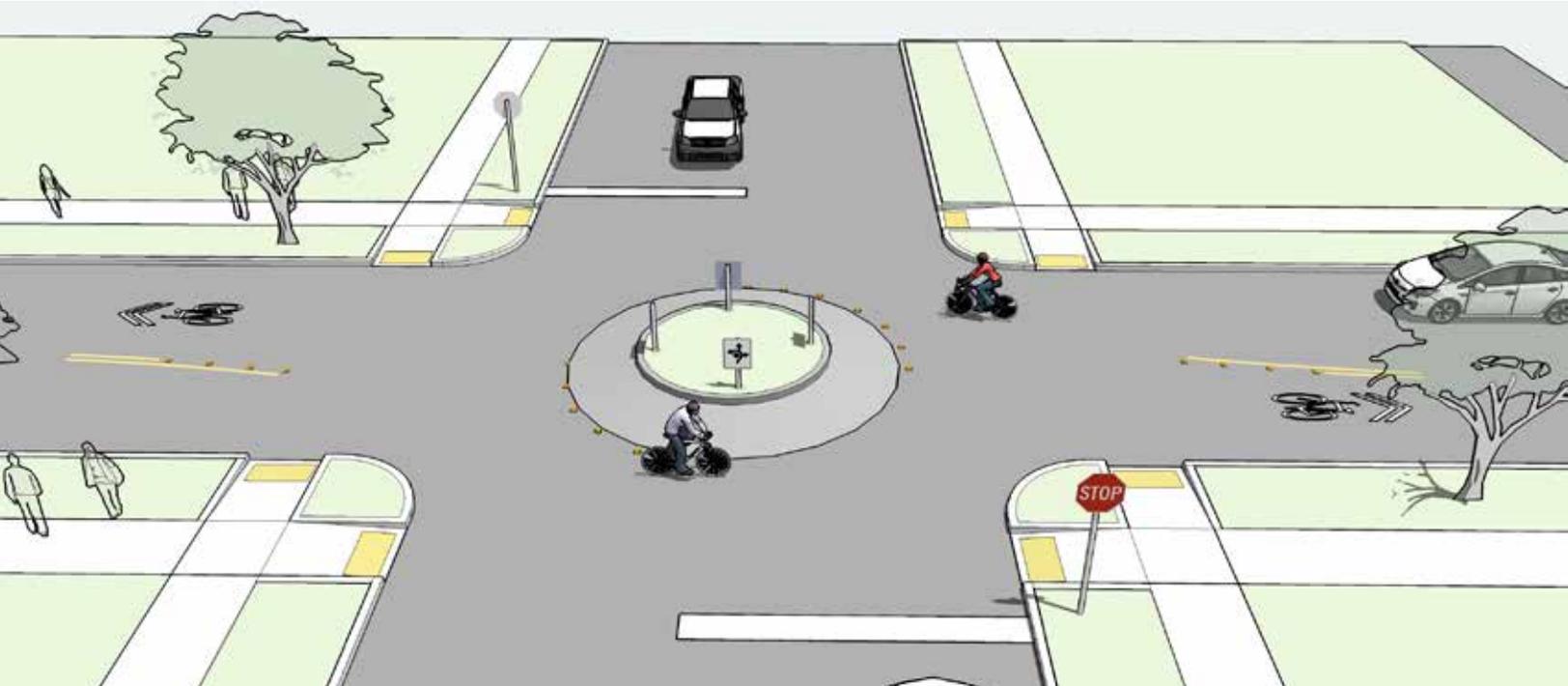
Design Features

- A While volume management methods are designed to restrict motor vehicle access, bicyclist passage should always be allowed.
 - May be combined with **Major Intersection Treatments**.
- B
 - Volume control measures should not prevent or slow down through bicycle travel. Markings should identify bicycle pass-through areas while restricting motor vehicle access.
- C

LOW STRESS BIKE ROUTE

MINOR INTERSECTION CROSSINGS

Treatments at minor roadway intersections are designed to improve the visibility of a neighborhood bikeway, raise awareness of motorists on the cross-street that they are likely to encounter bicyclists, and enhance safety for all road users.

**Typical Application**

- Where low stress bike routes must cross minor streets.
- On the bicycle boulevard, the majority of intersections with minor roadways should stop-control cross traffic to minimize bicyclist delay. This will maximize bicycling efficiency.
- Neighborhood bikeways should have fewer stops or delays than other local streets. A typical bicycle trip of 30 minutes can increase to 40 minutes if there is a STOP sign at every block. Mini traffic circles may be used to control intersection priority and slow motor vehicles.

Design Features

- Traffic circles are a type of horizontal traffic calming that can be used at minor street intersections. Traffic circles reduce conflict potential and severity while providing traffic calming to the corridor.
- Curb extensions can be used to move bicyclists closer to the centerline to improve visibility and encourage motorists to let them cross.
- If a stop sign is present on the neighborhood bikeway, a second stop bar for bicyclists can be placed closer to the centerline of the cross street than the motorists' stop bar to increase the visibility of bicyclists waiting to cross the street.

LOW STRESS BIKE ROUTE

MAJOR INTERSECTION CROSSINGS

The quality of treatments at major street crossings can significantly affect a bicyclist's choice to use a neighborhood bikeway, as opposed to another road that provides a crossing treatment.

**Typical Application**

- Where low stress bike routes must cross major streets. The quality of neighborhood bikeways are often compromised by the comfort of these crossings.
- Without treatments for bicyclists, these intersections can become major barriers along the neighborhood bikeway and negatively impact safety.

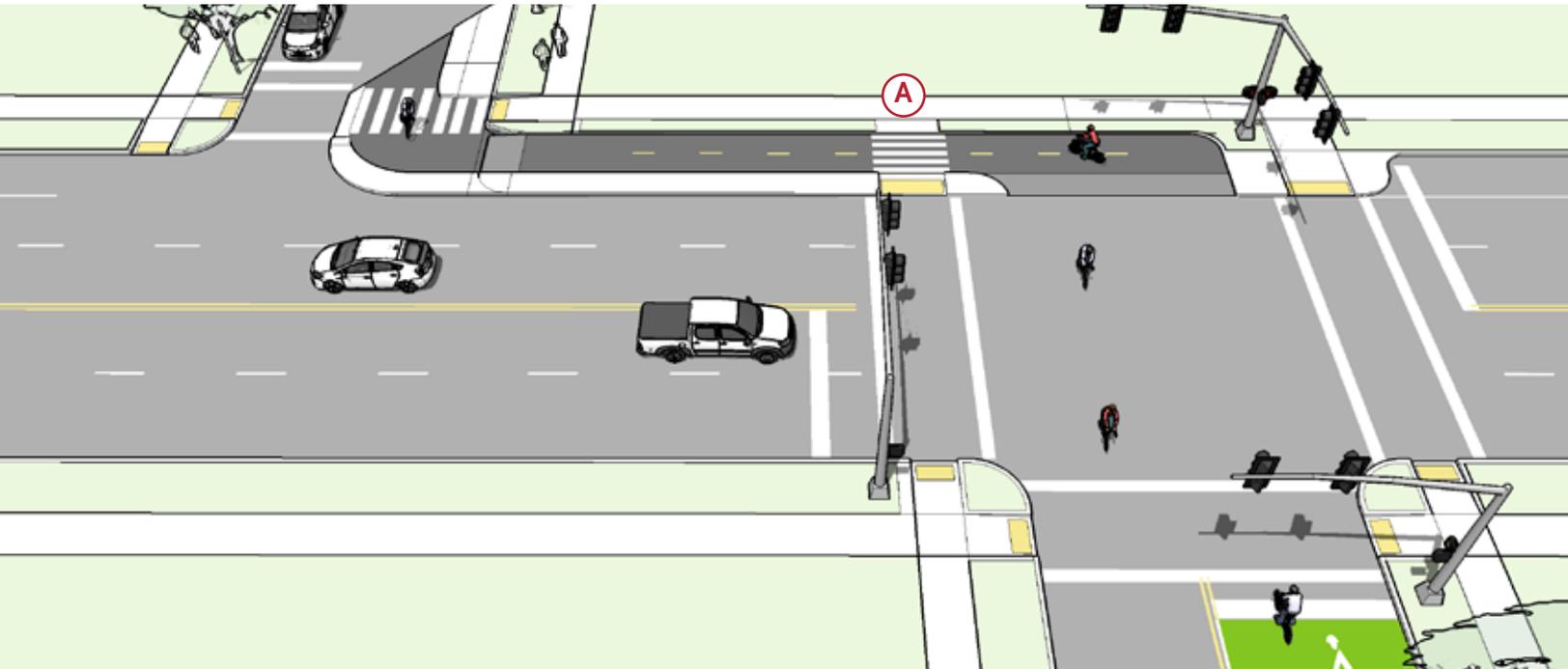
Design Features

- **A** **Hybrid beacons, active warning beacons and bicycle signals** can facilitate bicyclists crossing a busy street on which cross-traffic does not stop.
- **Bike boxes** increase bicyclist visibility to motorists and reduce the danger of right “hooks” by providing a space for bicyclists to wait at signalized intersections.
- **Median islands** provided at uncontrolled intersections of neighborhood bikeways and major streets allow bicyclists to cross one direction of traffic at a time as gaps in traffic occur.

LOW STRESS BIKE ROUTE

OFF-SET INTERSECTION CROSSINGS

Off-set intersections can be challenging for bicyclists who are required to briefly travel along the busier cross street in order to continue along the low stress bike route. Because low stress bike routes are located on local streets, the route is often discontinuous. Wayfinding and pavement markings assist bicyclists with remaining on the route.

**Typical Application**

- Where low stress bike routes must be routed through off-set or skewed intersections.
- Where a cyclist must travel on a busier street than the low stress bike route, in order to continue riding on the route.
- Appropriate treatments depend on volume of traffic including turning volumes, traffic speeds and the type of bicyclist using the crossing.

Design Features

- A A **two-way cycle track** can be provided on one side of a busy street to connect neighborhood bikeway segments. This maneuver may be signaled on one side.
 - **Bicycle left-turn lanes** can be painted where a neighborhood bikeway is offset to the right on a street that has sufficient traffic gaps. Bicyclists cross one direction of traffic and wait in a protected space for a gap in the other direction. The bike turn pockets should be at least 4 feet wide, with a total of 11 feet for both turn pockets and center striping.

ON-STREET BIKE LANES

A LANE OF YOUR OWN

Designated exclusively for bicycle travel, on-street bike lanes are distinct 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' path.
- Discouraging bicyclists from riding on the sidewalk.
- Reducing the incidence of wrong way riding.
- Reminding motorists that bicyclists have a right to the road.

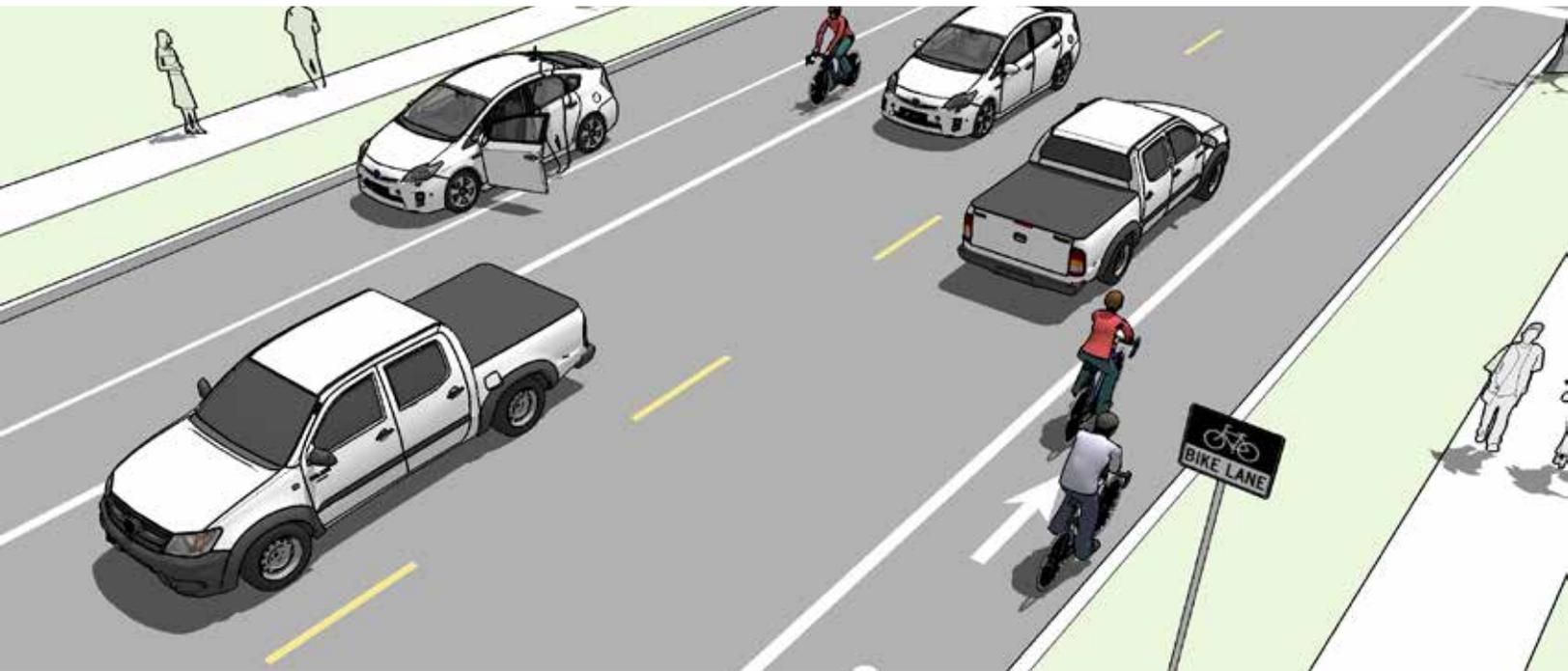
THE BETTER BIKE LANE

Recent innovations in bike lane designs provide experience and design features focused on reducing or removing "door zone" risks.

ON-STREET BIKE LANES

BICYCLE LANES

On-street bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is located directly 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.

**Typical Application**

- Streets with moderate volumes $\geq 6,000$ ADT ($\geq 3,000$ preferred).
- Streets with moderate speeds ≥ 25 mph.
- Appropriate for skilled adult riders on most streets.
- May be appropriate for children when configured as 6+ ft wide lanes on lower-speed, lower-volume streets with one lane in each.

Design Features

- Ⓐ 6 foot width preferred, particularly adjacent to on-street parking.
- 5 foot minimum width when adjacent to curb and gutter or 3 feet more than the gutter pan width if the gutter pan is wider than 2 feet.
- Widths greater than 7 ft may encourage motor vehicle use of bike lanes.

ON-STREET BIKE LANES

BUFFERED BICYCLE LANES

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.

**Typical Application**

- Anywhere a conventional bike lane is being considered.
- On streets with high speeds and high volumes or high truck volumes.
- On streets with extra lanes or lane width.

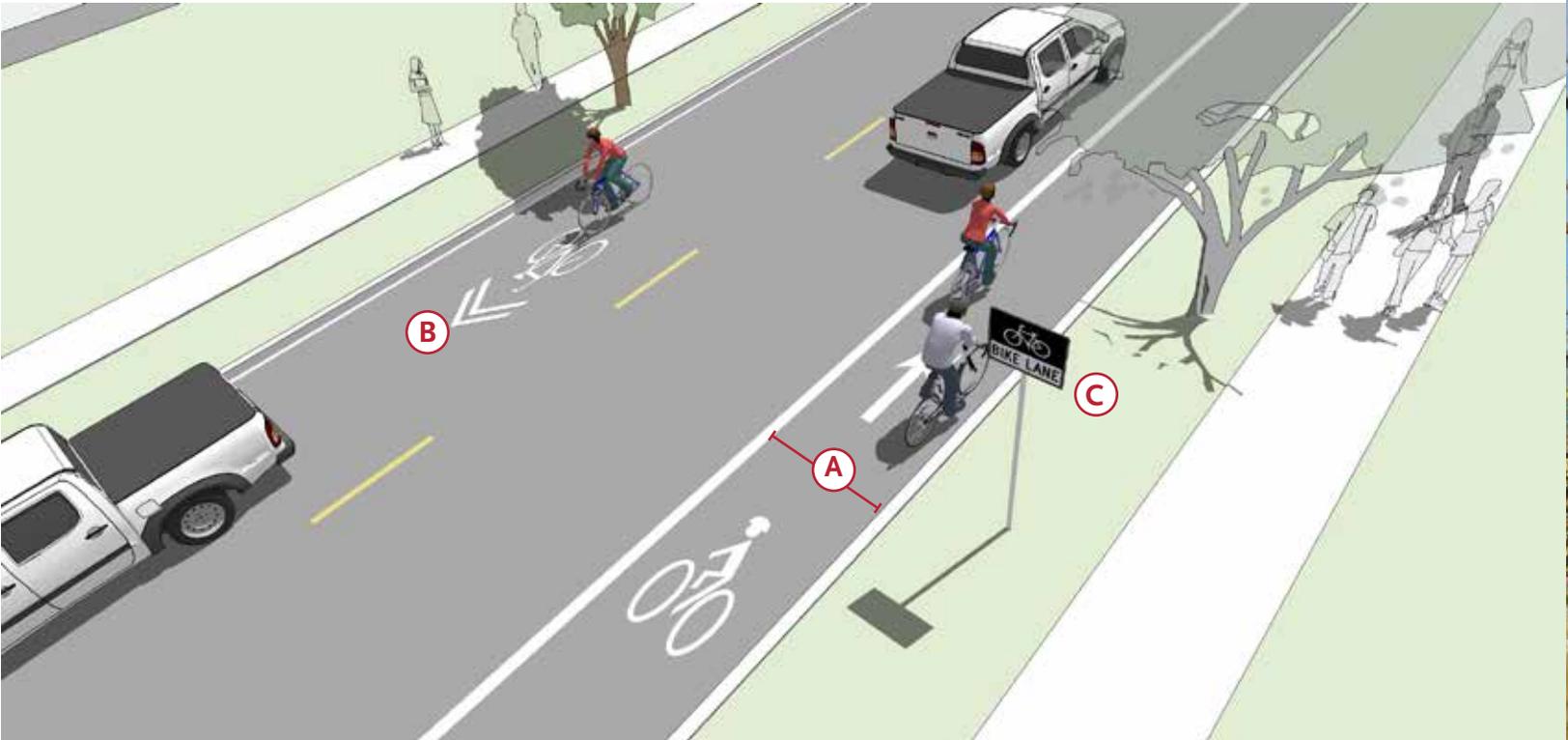
Design Features

- Ⓐ The minimum bicycle travel area (not including buffer) is 5 feet wide.
- Ⓑ Buffers should be at least 2 feet wide. If buffer area is 4 feet or wider, white chevron or diagonal markings may be used.
 - For clarity in potential conflict zones, such as driveways or minor street crossings, consider using a dotted line.
 - There is no standard for whether the buffer is configured on the parking side, the travel side, or a combination of both.

ON-STREET BIKE LANES

UPHILL BIKE CLIMBING LANE

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

**Typical Application**

- On streets with shared road bicycle facilities but no bike lanes, where a bicycle must travel uphill
- Where greater distance between motor vehicles and adjacent bicyclists is desired.

Design Features

- Ⓐ 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.
- Ⓒ May also include a Bike Lane sign (MUTCD R3-17).



CYCLE TRACKS

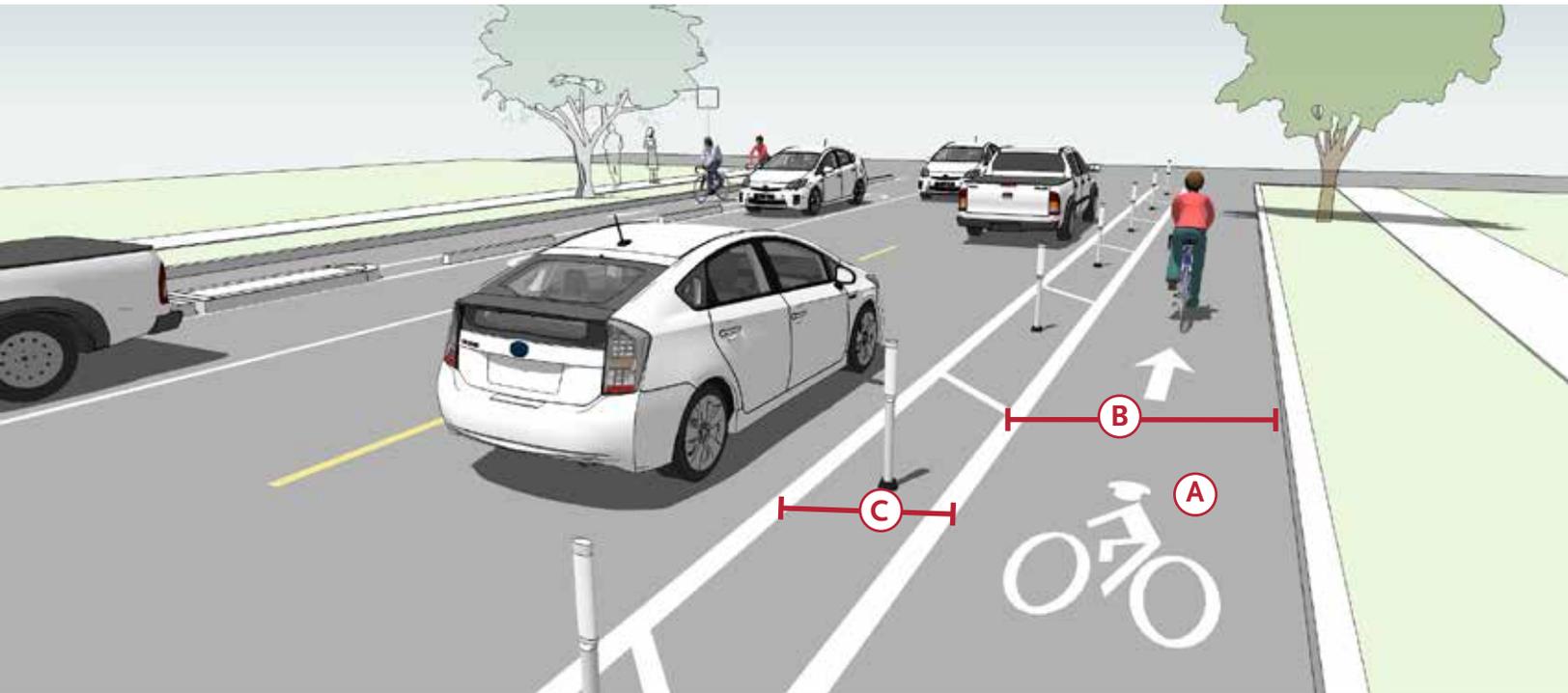
PHYSICAL SEPARATION MATTERS

A cycle track is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a on-street bike lane. A separated bicycle lane is physically separated from motor traffic by a vertical element and distinct from the sidewalk. In situations where on-street parking is allowed, cycle tracks are located between the parking and the sidewalk.

CYCLE TRACKS

ONE WAY CYCLE TRACKS

A one way cycle track provides protection to cyclists through physical barriers that can include bollards, parking, a planter strip, an extruded curb or on-street parking. Cycle tracks may be at street level or raised to the level of the adjacent sidewalk.

**Typical Application**

- Streets with high motor vehicle volumes and/or speeds and high bicycle volumes.
- Streets for which conflicts at intersections can be effectively mitigated using parking lane setbacks, bicycle markings through the intersection, and other signalized intersection treatments.
- Appropriate for most riders on most streets, although caution should be used when approaching intersections or other conflict areas.

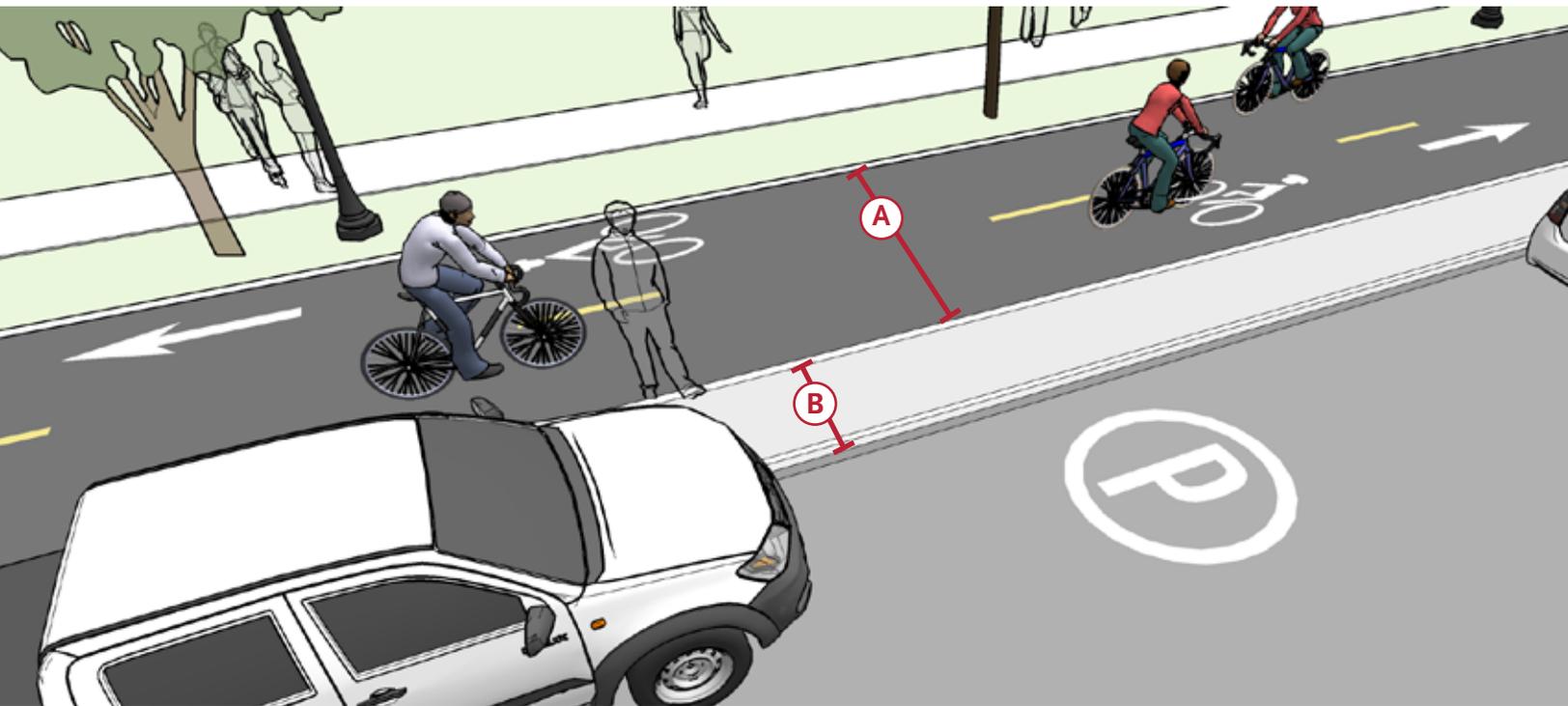
Design Features

- Ⓐ Pavement markings, symbols and/or arrow markings must be placed at the beginning of the cycle track and at intervals along the facility.
- Ⓑ 7 foot width preferred (5 foot minimum).
- Ⓒ 3 foot minimum buffer width adjacent to parking. 18 inch minimum adjacent to travel lanes (**NACTO, 2012**). Channelizing devices should be placed in the buffer area.
 - If buffer area is 4 feet or wider, white chevron or diagonal markings should be used

CYCLE TRACKS

TWO-WAY CYCLE TRACKS

Two-way cycle tracks are bicycle facilities that allow bicycle movement in both directions on one side of the road. Two-way separated bicycle lanes share some of the same design characteristics as one-way separated bicycle lanes, but may require additional considerations at driveway and side-street crossings.

**Typical Application**

- Works best on the left side of one-way streets.
- Streets with high motor vehicle volumes and/or speeds.
- Streets with high bicycle volumes.
- Streets with a high incidence of wrong-way bicycle riding.
- Streets with few conflicts such as driveways or cross-streets on one side of the street.
- Streets that connect to shared-use paths.

Design Features

- Ⓐ 12 foot operating width preferred (10 ft minimum) width for two-way facility.
 - In constrained an 8 foot minimum operating width may be considered.
- Ⓑ Adjacent to on-street parking a 3 foot minimum width channelized buffer or island shall be provided to accommodate opening doors. **(NACTO, 2012)**.
 - Separation may be narrower than 5 foot separation may be permitted if physical barrier separation is present. **(AASHTO, 2013)**
 - Additional signalization and signs may be necessary to manage conflicts.



INTERSECTION TREATMENTS

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 motor vehicles by heightening the level of visibility, denoting clear right-of-way and facilitating eye contact and awareness with other modes.

INTERSECTION TREATMENTS

BIKE LANES AT ADDED RIGHT TURN LANES

The appropriate treatment at right turn only lanes is to introduce an added turn lane to the outside of the bicycle lane. The area where people driving must weave across the bicycle lane should be marked with dotted lines and dotted green pavement to identify the potential conflict areas. Signage should indicate that motorists must yield to bicyclists through the conflict area.

**Typical Application**

- Streets with right-turn lanes and right side bike lanes.
- Streets with left-turn lanes and left side bike lanes.

Design Features

- Mark inside line with 6" stripe.
- Continue existing bike lane width; standard width of 5 to 6 feet (4 feet in constrained locations.)
- Use R4-4 BEGIN RIGHT TURN LANE YIELD TO BIKES signage to indicate that motorists should yield to bicyclists through the conflict area.
- Consider using colored in the conflict areas to promote visibility of the dashed weaving area.

INTERSECTION TREATMENTS

COLORED BICYCLE LANES

Colored pavement within a bicycle lane may be used to increase the visibility of the bicycle facility, raise awareness of the potential to encounter bicyclists and reinforce priority of bicyclists in conflict areas.



Typical Application

- Within a weaving or conflict area to identify the potential for bicyclist and motorist interactions and assert bicyclist priority.
- Across intersections, driveways and Stop or Yield-controlled cross-streets.

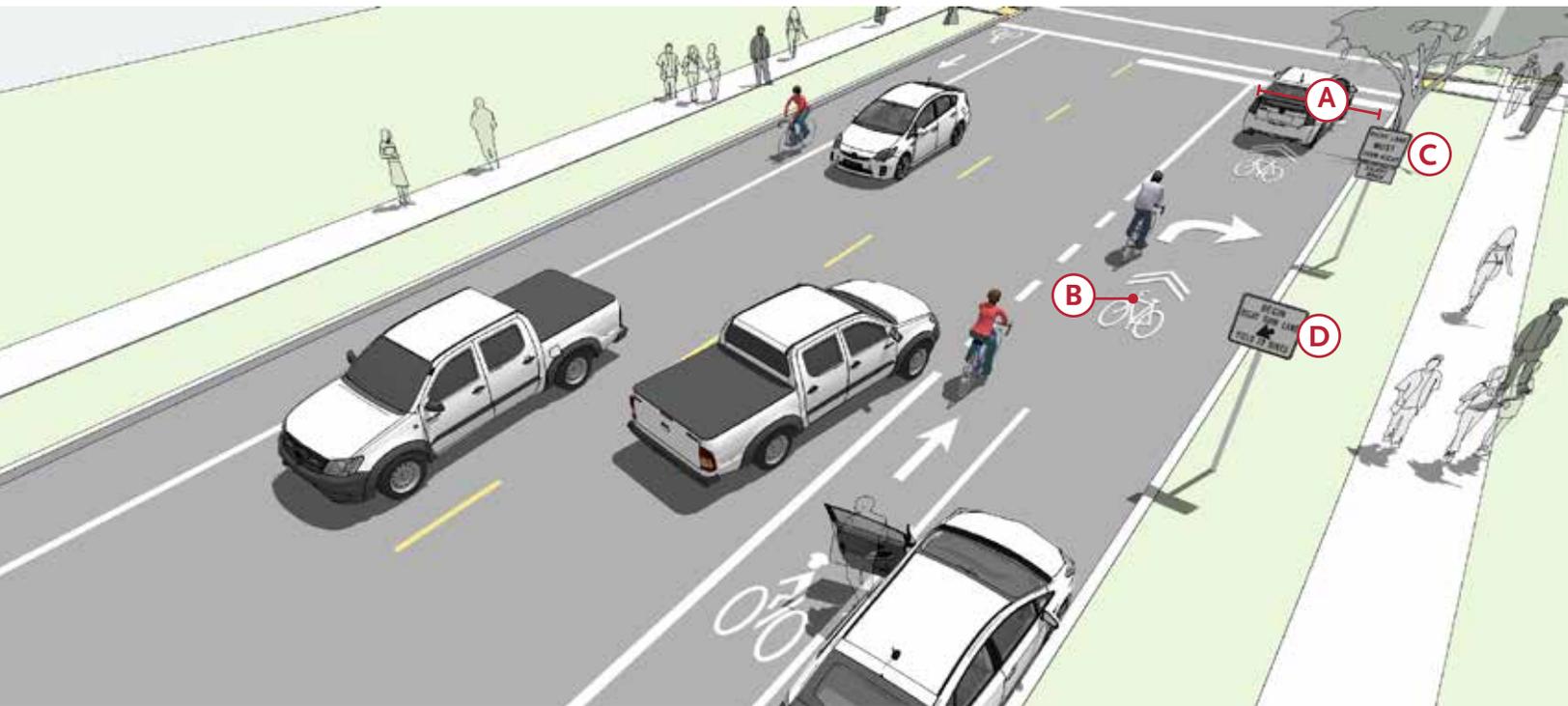
Design Features

- Typical white bike lanes (solid or dotted 6" stripe) are used to outline the green colored pavement.
- In exclusive use areas, color application should be solid green.
- In weaving or turning conflict areas, preferred striping is dashed, to match the bicycle lane line extensions.
- The colored surface should be skid resistant and retro-reflective.

INTERSECTION TREATMENTS

COMBINED BIKE LANE/TURN LANE

Where there isn't room for a conventional bicycle lane and turn lane a combined bike lane/turn lane creates a shared lane where bicyclists can ride and turning motor vehicles yield to through traveling bicyclists. The combined bicycle lane/ turn lane places shared lane markings within a right turn only lane.

**Typical Application**

- Most appropriate in areas 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.

Design Features

- (A)** Maximum shared turn lane width is 13 feet; narrower is preferable. (NACTO, 2012)
- (B)** Shared Lane Markings should indicate preferred positioning of bicyclists within the combine lane.
- (C)** A "RIGHT LANE MUST TURN RIGHT" sign with an "EXCEPT BIKES" plaque may be needed to permit through bicyclists to use a right turn lane.
- (D)** Use R4-4 BEGIN RIGHT TURN LANE YIELD TO BIKES signage to indicate that motorists should yield to bicyclists through the conflict area.

INTERSECTION TREATMENTS

INTERSECTION CROSSING MARKINGS

Bicycle pavement markings through intersections guide bicyclists on a safe and direct path through the intersection and provide a clear boundary between the paths of through bicyclists and vehicles in the adjacent lane.



Typical Application

- Streets with conventional, buffered or cycle tracks.
- At direct paths through intersections.
- Streets with high volumes of adjacent traffic.
- Where potential conflicts exist between through bicyclist and adjacent traffic.

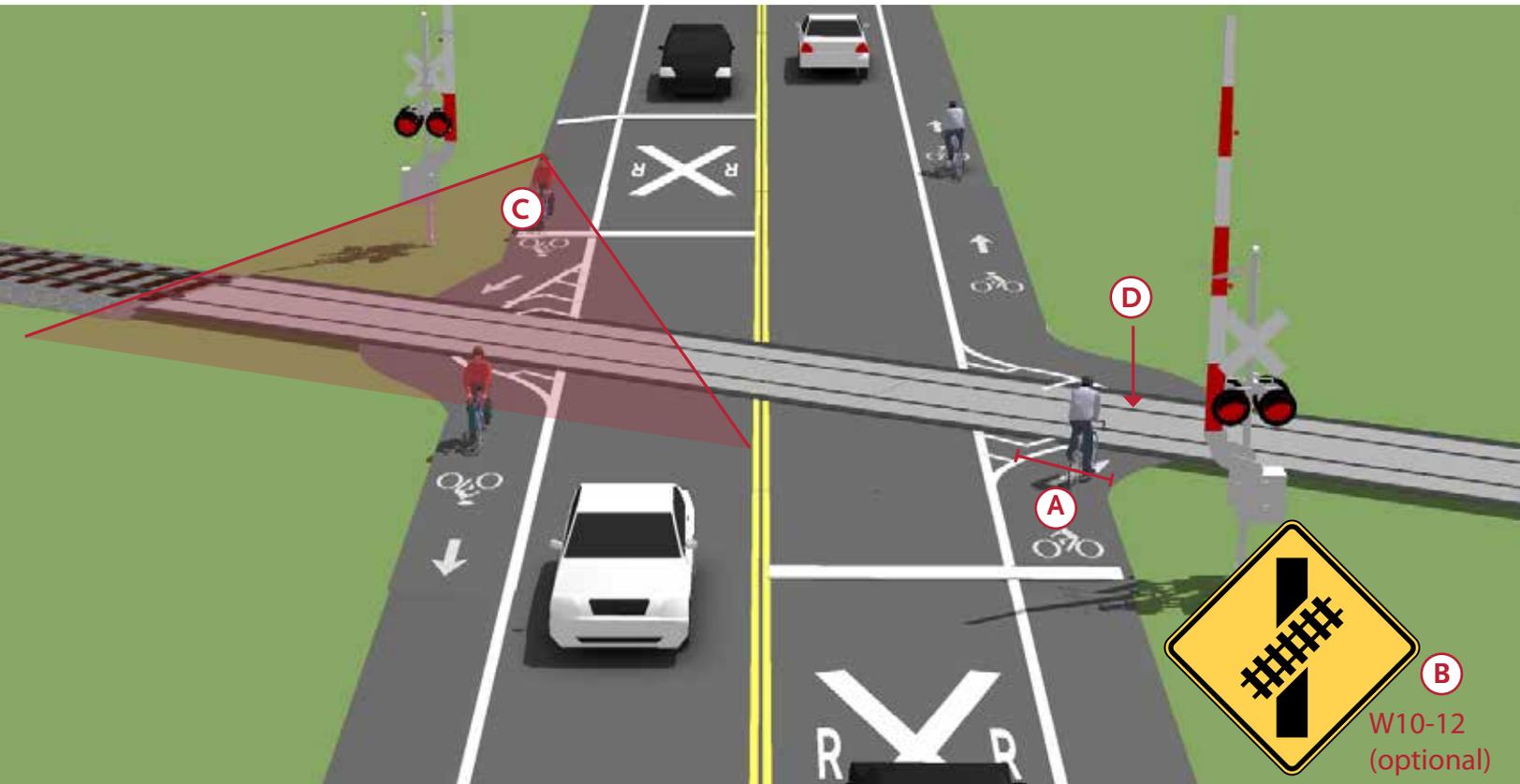
Design Features

- Intersection markings should be the same width and in line with leading bike lane.
- A** Dotted lines should be a minimum of 6 inches wide and 4 feet long, spaced every 12 feet.
- All markings should be white, skid resistant and retro reflective.
- B** Green pavement markings may also be used.

INTERSECTION TREATMENTS

AT-GRADE RAILROAD CROSSING

Bikeways that cross railroad tracks at a diagonal may cause steering difficulties or loss of control for bicyclists due to slippery surfaces, degraded rough materials, and the size of the flangeway gaps.

**Typical Application**

- Where bike lanes, shoulders or physically cycle tracks cross railroad tracks.
- Provide extra design attention to angled track crossings.
- Crossing design and implementation is a collaboration between the railroad company and highway agency. The railroad company is responsible for the crossbucks, flashing lights and gate mechanisms, and the highway agency is responsible for advance warning markings and signs.

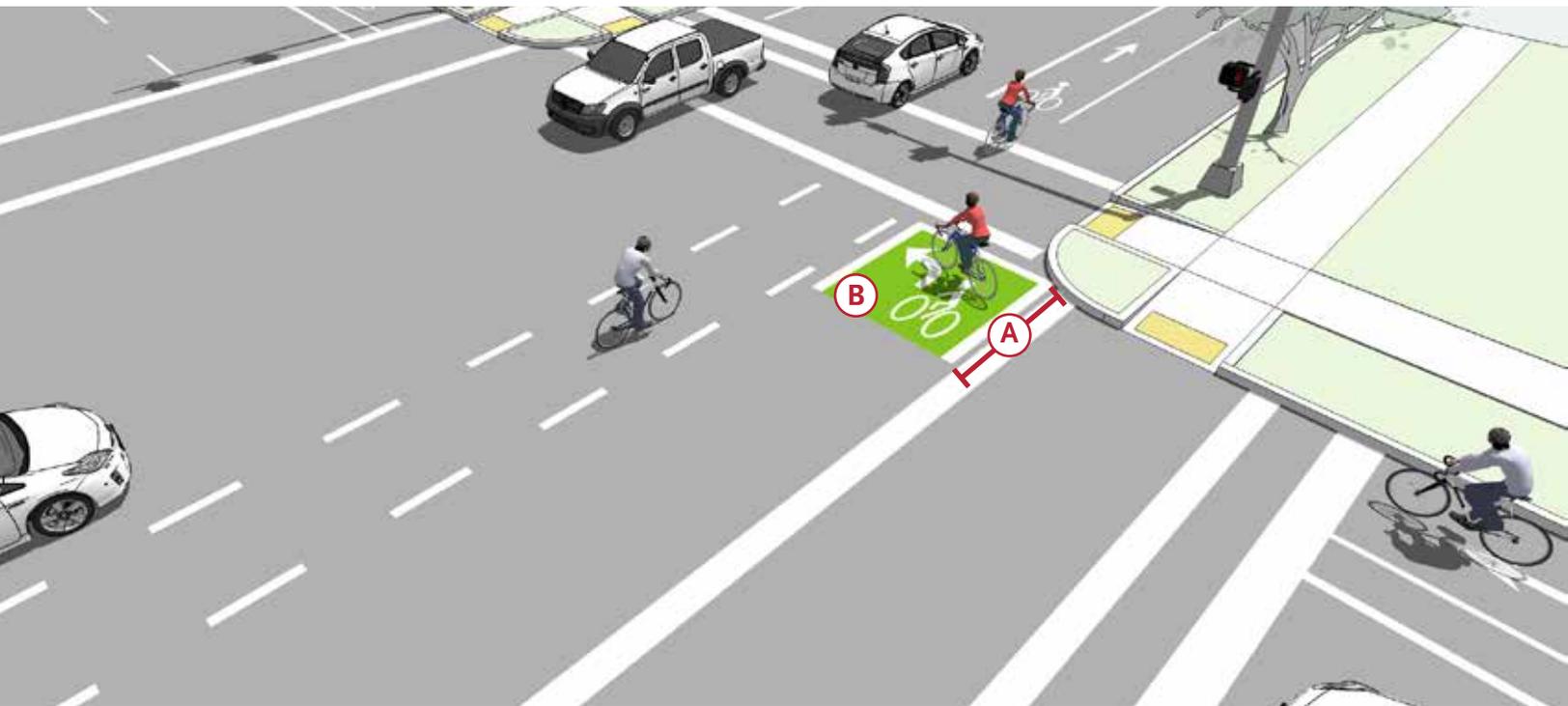
Design Features

- (A) 6 ft minimum shoulder/bike lane width.
- (B) Consider posting W-10 or W-12 signs to alert bicyclists.
- (C) Sight triangles of 50 feet by 100 feet will be provided at the railroad and street right of way. (Sight triangles are measured from the centerline of the railroad track).
- (D) Angled track crossings also limit sight triangles, impacting the ability to see oncoming trains. If the skew angle is less than 45 degrees, special attention should be given to the sidewalk and bicycle alignment to improve the approach angle to at least 60 degrees (90 degrees preferred where possible).

INTERSECTION TREATMENTS

TWO-STAGE TURN BOXES

Two-stage turn boxes offer bicyclists a safe way to make turns at multi-lane signalized intersections from a physically separated or conventional bike lane. On cycle tracks, bicyclists are often unable to merge into traffic to turn due to physical separation, making the provision of two-stage turn boxes critical.



Typical Application

- Streets with high vehicle speeds and/or traffic volumes.
- At intersections with multi-lane roads with signalized intersections.
- At signalized intersections with a high number of bicyclists making a left turn from a right side facility.

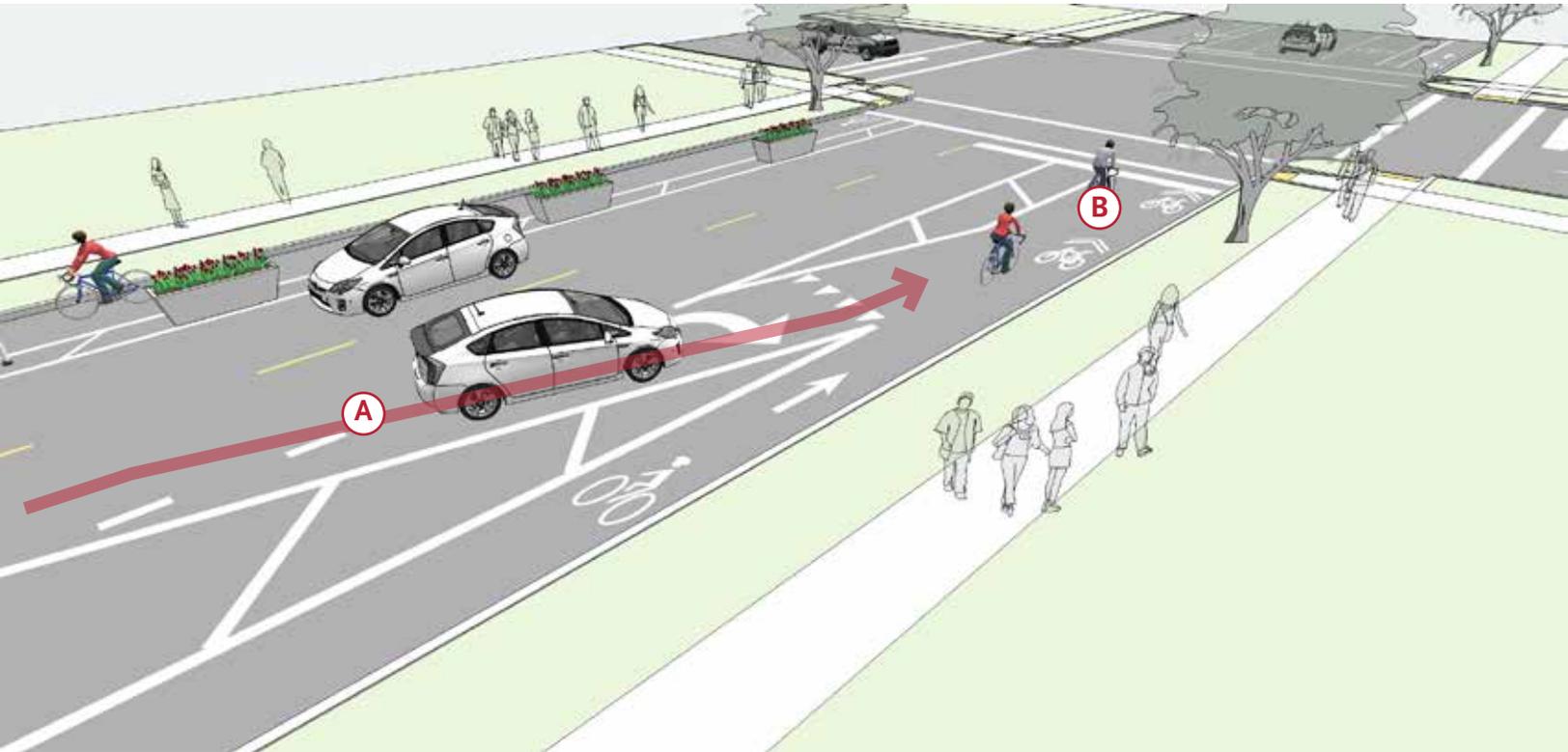
Design Features

- The two-stage turn box shall be placed in a protected area. Typically this is within the shadow of an on-street parking lane or protected bike lane buffer area and should be placed in front of the crosswalk to avoid conflict with pedestrians.
- **A** 8 foot x 6 foot preferred depth of bicycle storage area (6 foot x 3 foot minimum).
- **B** Bicycle stencil and turn arrow pavement markings shall be used to indicate proper bicycle direction and positioning. **(NACTO, 2012)**

INTERSECTION TREATMENTS

CYCLE TRACK MIXING ZONE

A cycle track mixing zone creates a shared-space travel lane where turning motor vehicles yield to through traveling bicyclists. Geometric design is intended to slow motor vehicles to bicycle speed, provide regulatory guidance to people driving, and require all users to negotiate conflicts upstream of the intersection.

**Typical Application**

- Where through bicyclists and right-turning automobile conflicts are common.
- Most appropriate in areas with low to moderate right-turn volumes.
- Streets with a right turn lane but not enough width to have a standard width bicycle lane at the intersection.

Design Features

- A** Use short transition taper dimensions and short storage length to promote slow motor vehicle travel speeds.
- B** The width of the mixing zone should be 9 feet minimum and 13 feet maximum.
 - The transition to the mixing zone should begin 70 feet in advance of the intersection.
 - Shared lane markings should be used to illustrate the bicyclist's position within the lane.
 - A yield line should be used in advance of the intersection.

INTERSECTION TREATMENTS

BICYCLE SIGNAL HEAD & PROTECTED SIGNAL PHASE

Protected bicycle lane crossings of signalized intersections can be accomplished through the use of a bicycle signal phase which reduces conflicts with motor vehicles by separating bicycle movements from any conflicting motor vehicle movements. Bicycle signals are traditional three lens signal heads with green, yellow and red bicycle stenciled lenses.

**Typical Application**

- Two-way protected bike lanes where contraflow bicycle movement or increased conflict points warrant protected operation.
- Bicyclists moving on a green or yellow signal indication in a bicycle signal shall not be in conflict with any simultaneous motor vehicle movement at the signalized location
- Right (or left) turns on red should be prohibited in locations where such operation would conflict with a green bicycle signal indication.

Design Features

- An additional “Bicycle Signal” sign should be installed below the bicycle signal head.
- Designs for bicycles at signalized crossings should allow bicyclists to trigger signals and safely maneuver the crossing.
- On bikeways, signal timing and actuation shall be reviewed and adjusted to consider the needs of bicyclists.

BICYCLE SIGNING & WAYFINDING

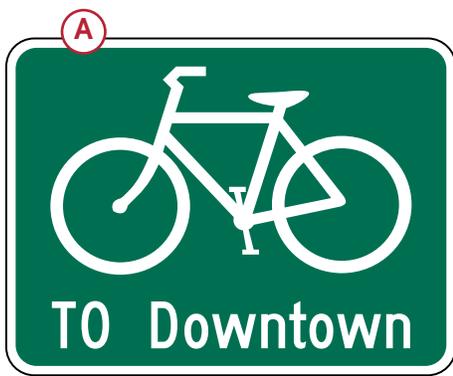


The ability to navigate through a city is informed by landmarks, natural features and other visual cues. Bicycle wayfinding can assist in navigation to guide bicyclists to their destinations along preferred bicycle routes. Signs are typically placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes.

BICYCLE SIGNING & WAYFINDING

WAYFINDING SIGN TYPES

The ability to navigate through a city is informed by landmarks, natural features and other visual cues. Signs throughout the city should indicate to bicyclists the direction of travel, the locations of destinations and the travel time/distance to those destinations. A bicycle wayfinding system consists of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes.



D11-1c



D1-1



D11-1/D1-3a

Typical Application

- Wayfinding 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)

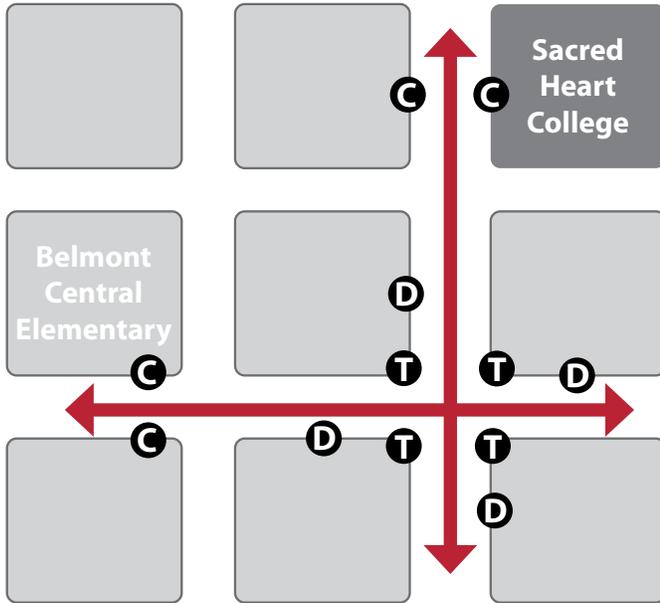
Design Features

- ◉ Confirmation signs indicate to bicyclists that they are on a designated bikeway. Make motorists aware of the bicycle route. Can include destinations and distance/time but do not include arrows.
- ◉ Turn signs indicate where a bikeway turns from one street onto another street. These can be used with pavement markings and include destinations and arrows.
- ◉ Decisions signs indicate the junction of two or more bikeways and inform bicyclists of the designated bike route to access key destinations. These include destinations, arrows and distances. Travel times are optional but recommended.

BICYCLE SIGNING & WAYFINDING

WAYFINDING SIGN PLACEMENT

Signs are 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.



D Decision Sign



C Confirmation Sign



T Turn Sign



Typical Application

Confirmation Signs

- Placed 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.

Decision Signs

- Near-side of intersections in advance of a junction with another bicycle route.
- Along a route to indicate a nearby destination.

Design Features

- MUTCD guidelines should be followed for wayfinding sign placement, which includes mounting height and lateral placement from edge of path or roadway.
- Pavement markings can be used to reinforce routes and directional signage.

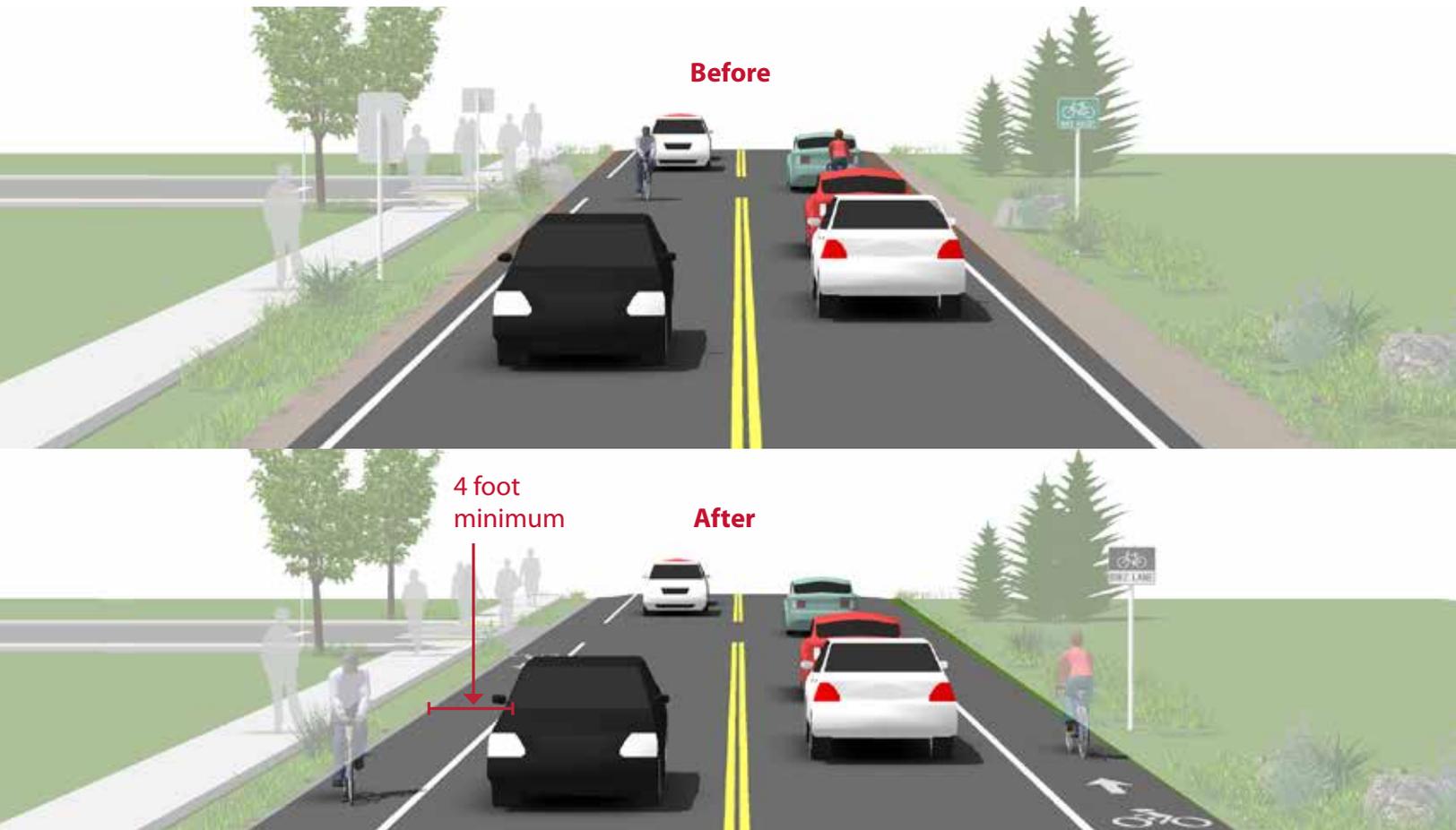
An aerial photograph of a two-lane asphalt road. A red car is driving away from the camera in the left lane. The road features a double yellow line in the center, a white line on the left edge, and a blue line on the right edge. A white line also runs parallel to the blue line on the right. The road is flanked by trees and foliage, with shadows cast across the pavement. A semi-transparent grey box is overlaid on the upper portion of the image, containing the text 'RETROFITTING STREETS' in red, bold, uppercase letters.

RETROFITTING STREETS

RETROFITTING STREETS

ROADWAY WIDENING

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.

**Typical Application**

- On existing streets that lack bicycle infrastructure.
- Roadway widening is most appropriate on roads lacking curbs, gutters and sidewalks.

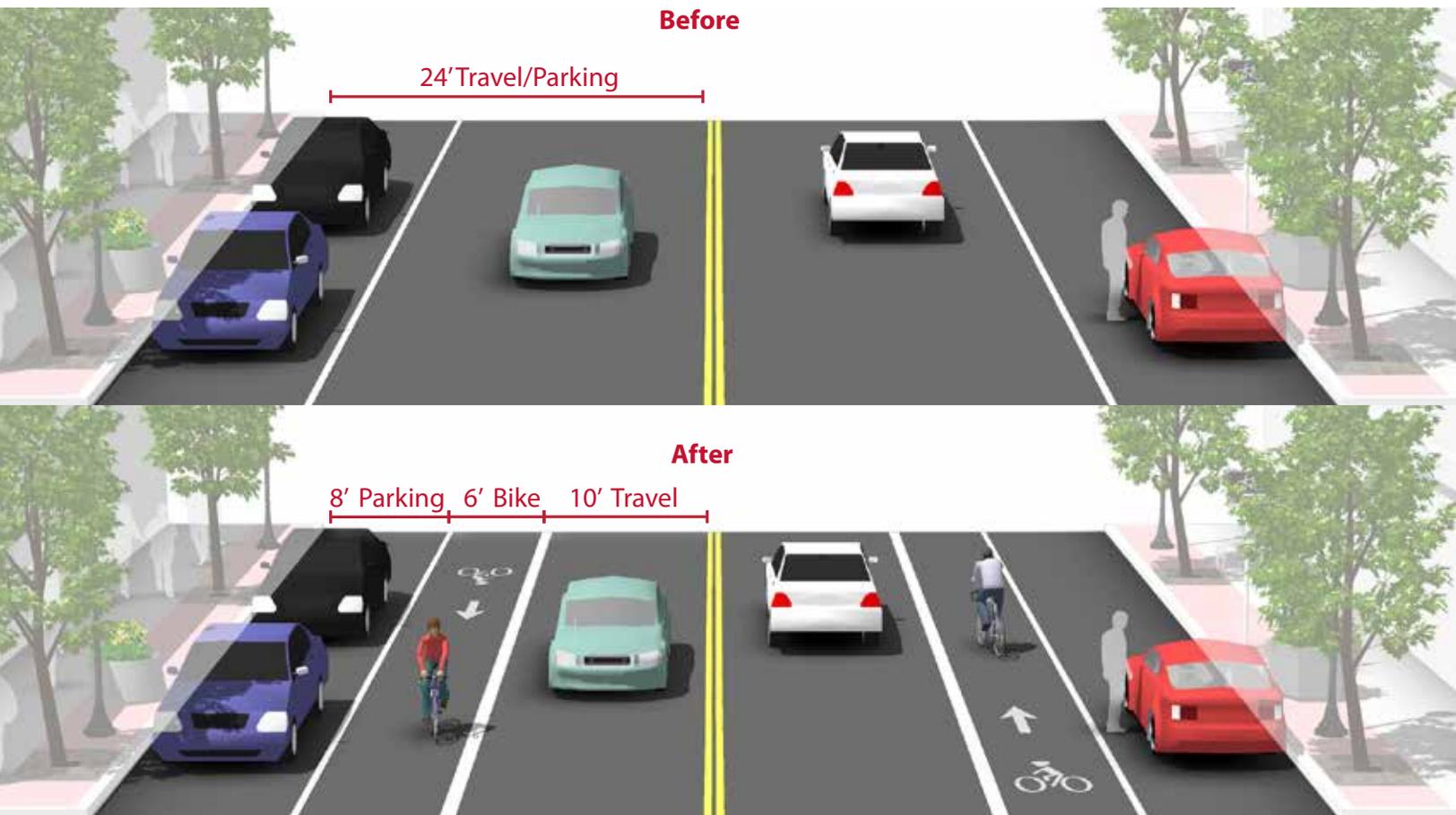
Design Features

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

RETROFITTING STREETS

LANE NARROWING

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.



Typical Application

- On existing streets with wide travel lanes (11-15 feet) that lack bicycle infrastructure.

Design Features

Vehicle lane width:

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

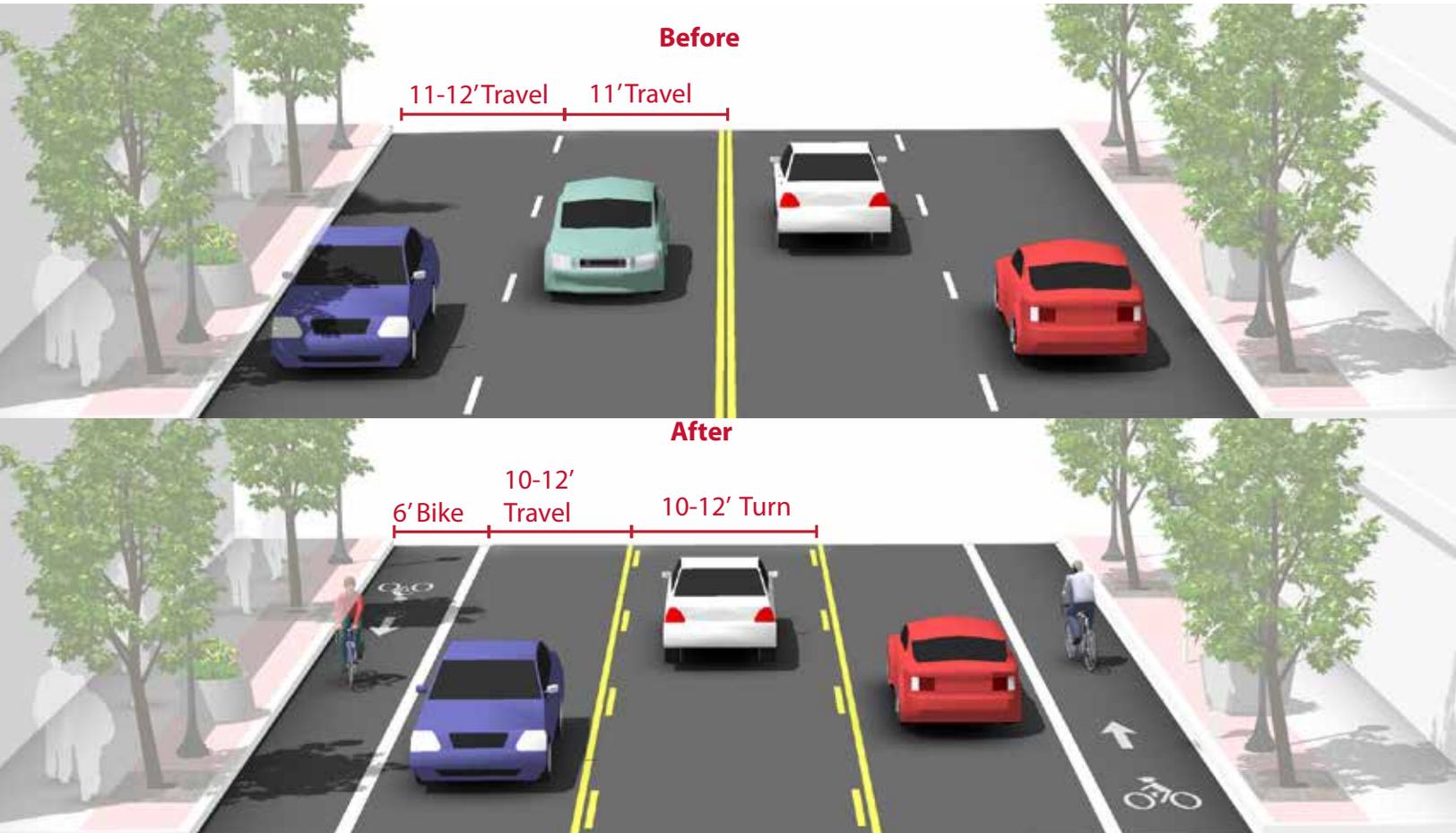
Bicycle lane width:

- 6 feet wide preferred (5 foot minimum)

RETROFITTING STREETS

LANE RECONFIGURATION

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 bicycle lane retrofit projects.



Typical Application

- On existing streets operating below current built capacity that lack bicycle infrastructure.
- One common conversion is from a four lane undivided streets to a three lane street including a center turn lane.

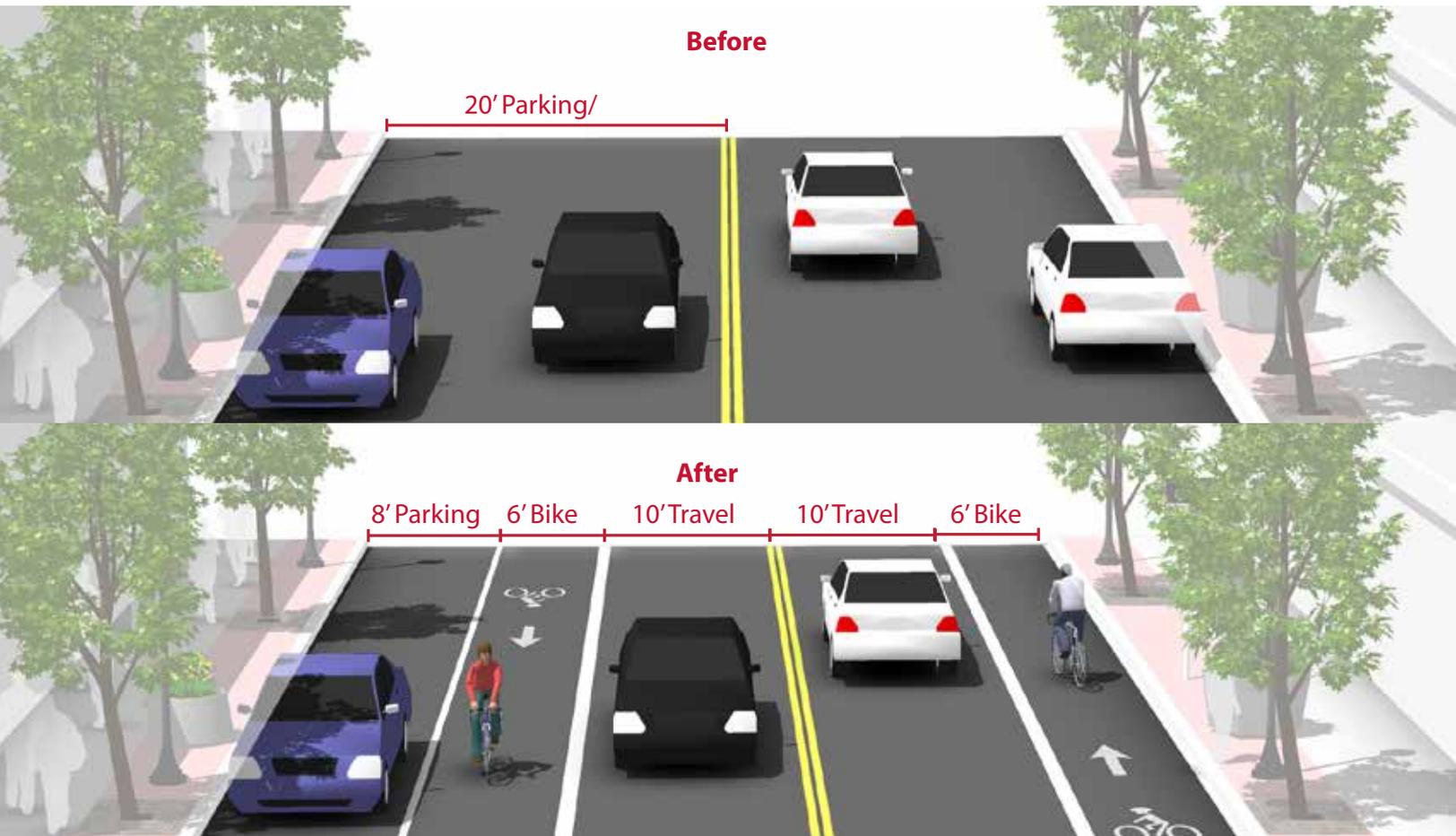
Design Features

- Vehicle lane width:
- Width depends on project. No narrowing may be needed if a travel lane is removed.
- Bicycle lane width:
- Guidance on bicycle lanes applies to this treatment.

RETROFITTING STREETS

PARKING REDUCTION

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.



Typical Application

- On existing streets with underutilized parking (< 50% occupancy)

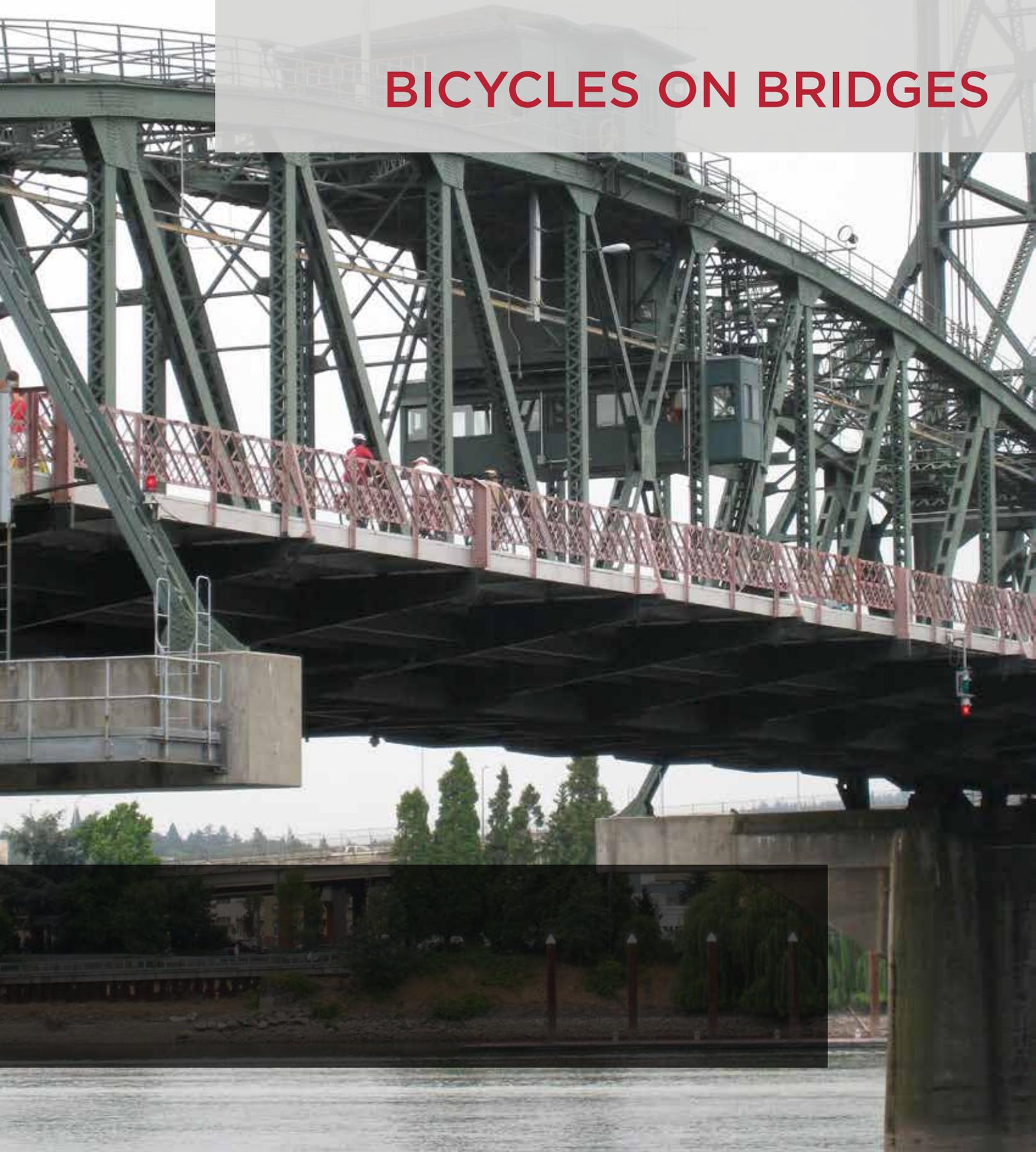
Design Features

Vehicle lane width:

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



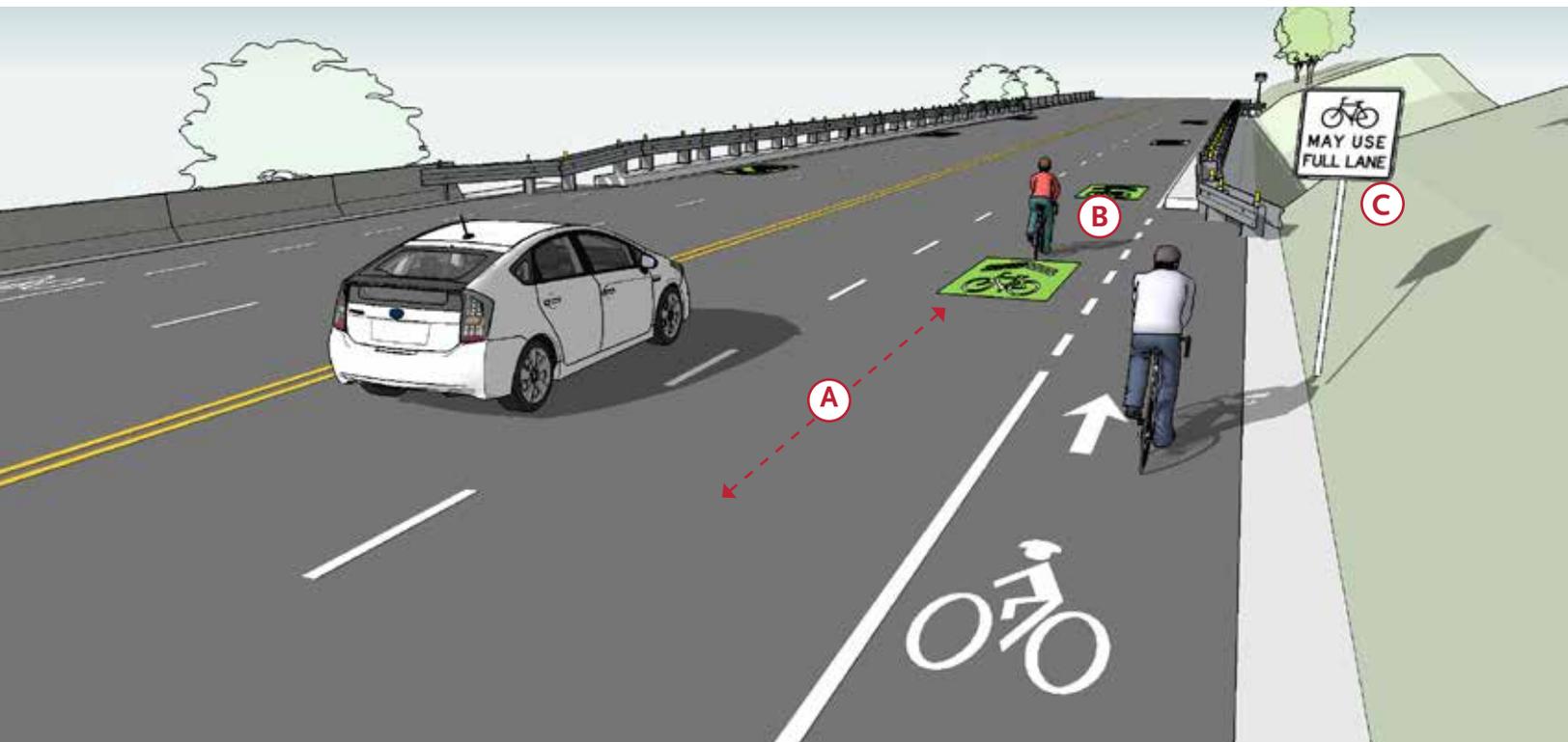
BICYCLES ON BRIDGES



BICYCLES ON BRIDGES

SHARED LANES ON BRIDGES

Constrained spaces such as bridges may require shared lane operation of bicyclists and cars for a short distance. Enhanced marking and signage can alert all road users to this changed condition.

**Typical Application**

- On existing bridges lacking space for dedicated bicycle facilities.

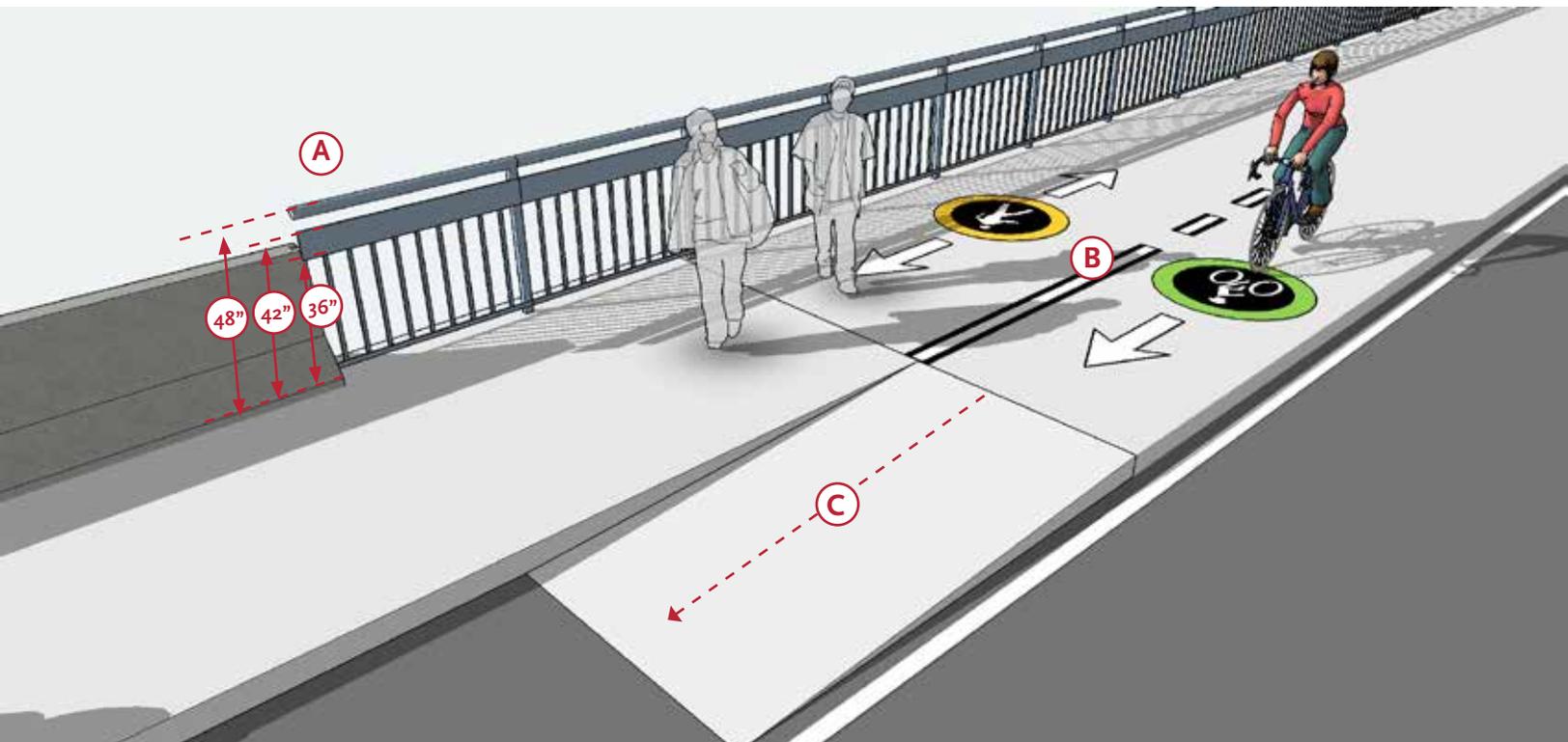
Design Features

- A** Shared lane markings should be placed in the center of the travel lane. If the outside lane is 14 ft wide, the center of the shared lane marking may be placed 4 ft from the curb line.
- B** Some jurisdictions are experimenting with green colored pavement to enhance the shared lane marking. (requires FHWA experimentation approval)
- C** Bikes May Use Full Lane sign (R4-11) should be used to remind users of the bicyclists right to occupy a travel lane.

BICYCLES ON BRIDGES

PATHS ON BRIDGES

Paths attached to bridges should provide adequate width for intended user type and travel direction and should use bicycle compatible railings.



Typical Application

- Paths retrofit on the side of bridges
- Wide bridge sidewalks functioning as multi-use paths

Design Features

- Ⓐ Bicycle compatible “Rub Rail” design should be used to prevent snags with bicycle handlebars.
- Ⓑ User stencils and striping may be used to clarify user mode and direction.
- Ⓒ Transition ramps off of the bridge path should be gradual.

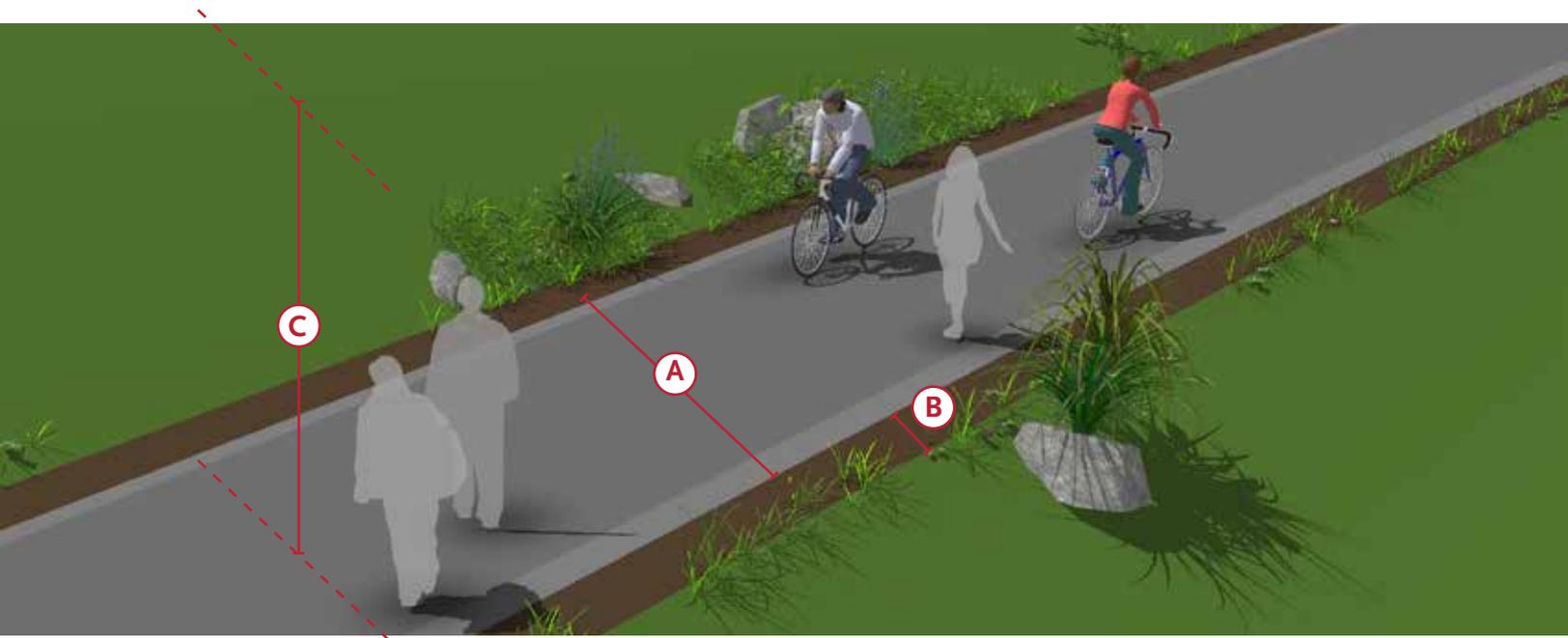
MULTI-USE PATHS



MULTI-USE PATHS

MULTI-USE PATHS

A multi-use path allows for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. Multi-use paths can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle paths should generally provide directional travel opportunities not provided by existing roadways.

**Design Features**

Width

- A 10 feet is recommended in most situations and will be adequate for low to moderate use. (8 ft constrained minimum)
- 12 feet is recommended for heavy use situations with high concentrations of multiple users. If additional width is available a separate track (5' minimum) can be provided for pedestrian use.

Lateral Clearance

- B A 2 foot or greater shoulder on both sides of the path 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.

- If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

Overhead Clearance

- C Clearance to overhead obstructions should be 10 feet (8 feet minimum)

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.

MULTI-USE PATHS

MULTI-USE PATHS IN RIVER & UTILITY CORRIDORS

Utility and waterway corridors often offer excellent multi-use path development and bikeway gap closure opportunities. These corridors offer excellent transportation and recreation opportunities for bicyclists of all ages and skills.



Typical Application

- Along utility and river corridors where public access is desired.
- Utility corridors typically include power line and sewer corridors, while waterway corridors include canals, drainage ditches, rivers, and beaches.

Design Features

Access Points

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

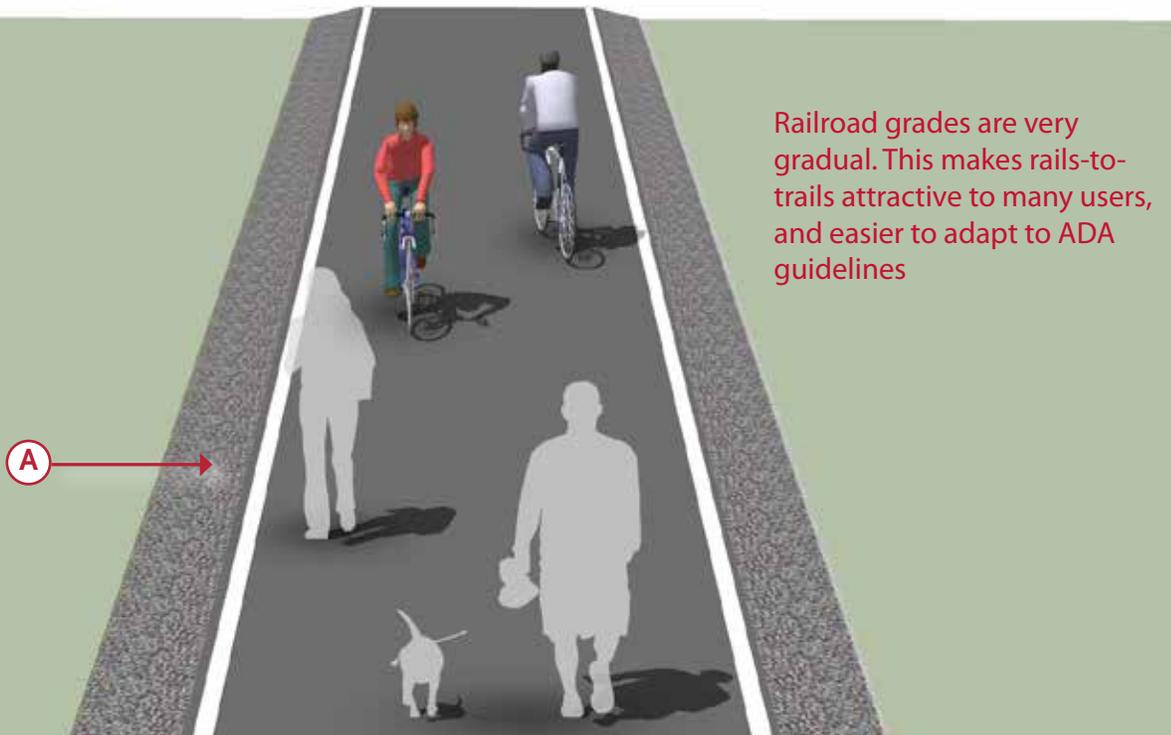
Path Closure

- Public access to the multi-use path may be prohibited during the following events:
- Canal/flood control channel or other utility maintenance activities
- Inclement weather or the prediction of storm conditions.

MULTI-USE PATHS

MULTI-USE PATHS IN ABANDONED RAIL CORRIDORS

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



Railroad grades are very gradual. This makes rails-to-trails attractive to many users, and easier to adapt to ADA guidelines

Typical Application

- Along abandoned railroad corridors where public access is desired.
- 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.

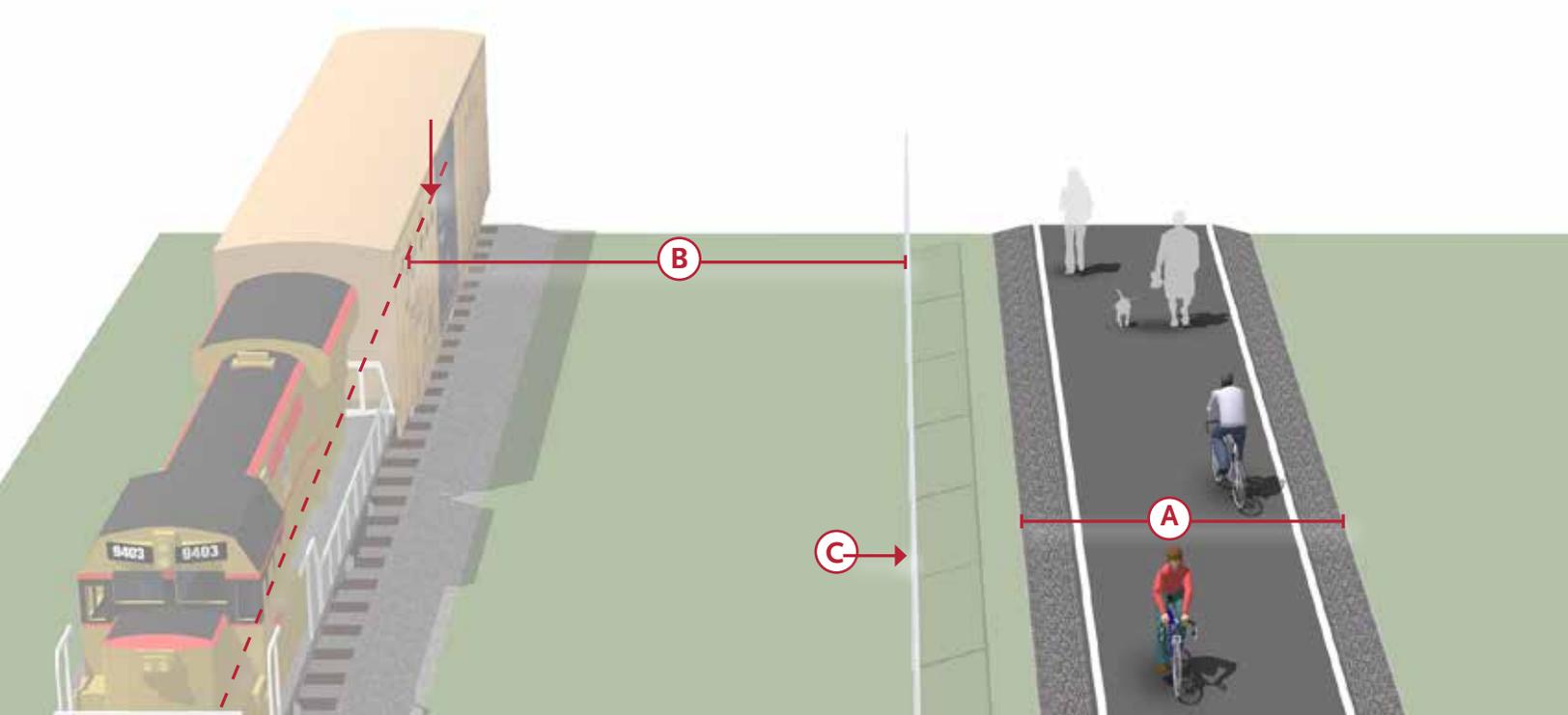
Design Features

- 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.
- A** Where possible, leave as much of the ballast in place as possible to disperse the weight of the rail-trail surface and to promote drainage

MULTI-USE PATHS

MULTI-USE PATHS IN ACTIVE RAIL CORRIDORS

Commonly referred to as Rails-with-Trails or Rail-Trails, these projects typically consist of paths adjacent to active railroads.



Typical Application

- Along active railroad corridors where public access is desired.
- In some cases, space needs to be preserved for future planned freight, transit or commuter rail service

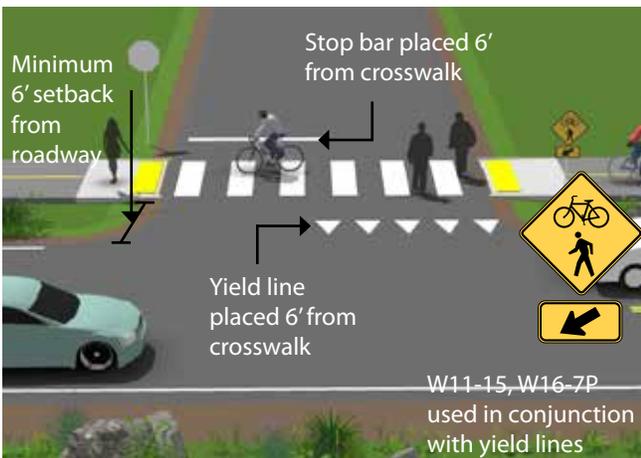
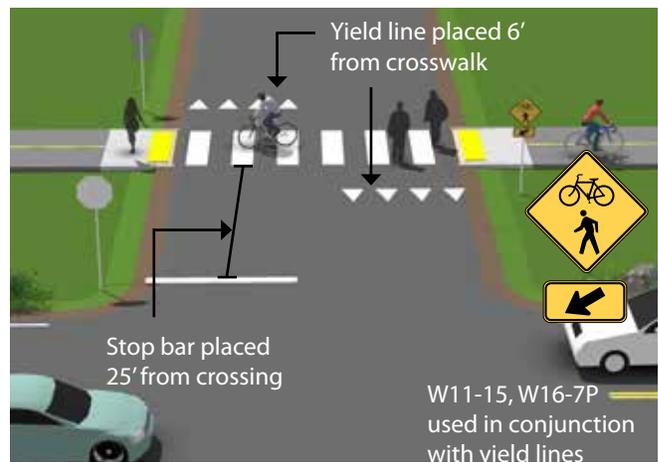
Design Features

- A** Multi-use paths in utility corridors should meet or exceed general design standards. If additional width allows, wider paths, and landscaping are desirable.
- B** Setback is based on space constraints, train frequency, train speed and physical separation, with 10-25 ft minimum from centerline of tracks.
- C** 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.

MULTI-USE PATHS

MULTI-USE PATH ALONG ROADWAYS

Multi-use paths along roadways, also called sidepaths, are a type of path that run adjacent to a street.

(A) Adjacent Path Crossing**(B) Setback Path Crossing****Typical Application**

- Where off-street bicycle and pedestrian facilities are desired.
- Because of operational concerns it is generally preferable to place paths within independent rights-of-way away from roadways. However, there are situations where existing roads provide the only corridors available

Design Features

In general, there are two approaches to crossings:

(A) ADJACENT PATH CROSSING

- A separation of 6 feet emphasizes the conspicuity of riders at the approach to the crossing.

(B) SETBACK PATH CROSSING

- A set back of 25 feet separates the path crossing from merging/turning movements that may be competing for a driver's attention.
- Crossing design should emphasize visibility of users and clarity of expected yielding behavior. Crossings may be STOP or YIELD controlled depending on sight lines and bicycle motor vehicle volumes and speeds.

MULTI-USE PATH CROSSINGS

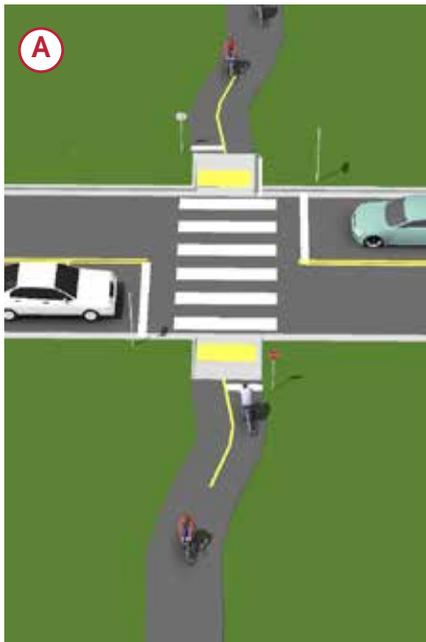


MULTI-USE PATH CROSSINGS

STREET CROSSINGS

The approach to designing path crossings of streets depends on an evaluation of vehicular traffic, line of sight, pathway traffic, use patterns, vehicle speed, road type, road width, and other safety issues such as proximity to major attractions.

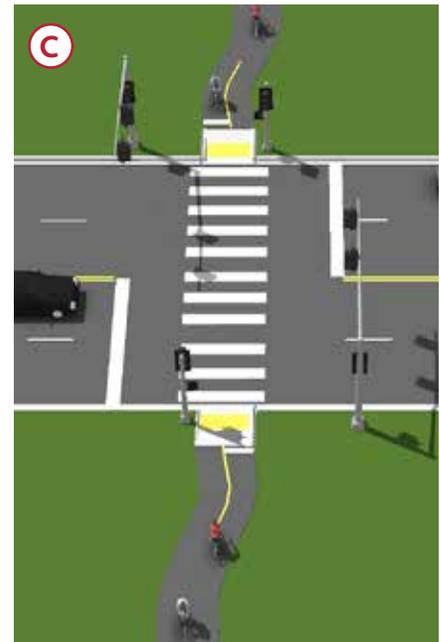
Marked Uncontrolled Crossing



Route Users to Signal



Signal Control



Typical Application

(A) MARKED CROSSINGS

- Appropriate on a two lane road with $\leq 9,000$ - $12,000$ Average Daily Traffic (ADT) volume, and ≤ 35 mph speed.
- Crossings of streets with higher speeds, higher volumes, and additional lanes requires additional enhancements such as median islands or active warning beacons.

(B) ROUTE USERS TO SIGNAL

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

(C) SIGNAL CONTROLLED CROSSINGS

- Barriers and signing may be needed to direct multi-use path users to the signalized crossings
- Full traffic signal installations must meet MUTCD pedestrian, school or modified warrants.
- Located more than 300 feet from an existing signalized intersection
- Push button actuation for multi-use path users
- The maximum delay for activation of the signal should be two minutes

MULTI-USE PATH CROSSINGS

GRADE SEPARATED CROSSINGS

Grade separated crossings provide critical non-motorized system links by joining areas separated by barriers such as railroads, waterways and highway corridors. In most cases, these structures are built in response to user demand for safe crossings where they previously did not exist.



Typical Application

- There are no minimum roadway characteristics for considering grade separation. Depending on the type of facility or the desired user group grade separation may be considered in many types of projects.
- Overcrossings require a minimum of 17 feet of vertical clearance to the roadway below versus a minimum elevation differential of around 12 feet for an undercrossing. This results in potentially greater elevation differences and much longer ramps for bicycles and pedestrians to negotiate.

Designs Features

- (A) OVERCROSSING:**
 - 14 feet width preferred, 8 foot minimum.
 - If overcrossing has any scenic vistas additional width should be provided to allow for stopping.
- (B) UNDERCROSSING:**
 - 14 foot minimum width, greater widths preferred for lengths over 60 feet.
 - 10 foot minimum height.
 - Lighting should be considered during the design process for any undercrossing.

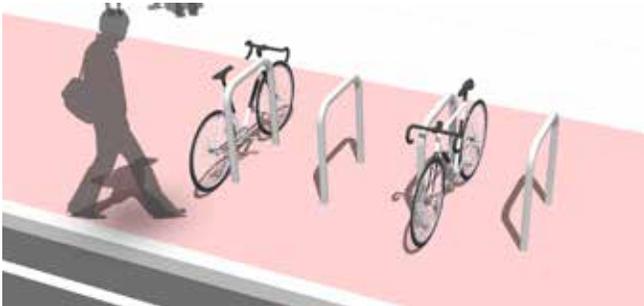
BICYCLE PARKING AND MAINTENANCE



BICYCLE SUPPORT FACILITIES

BIKE 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.

Bike Racks**Bike Corral****Bike Locker****Secure Parking Area****Design Features**

Bike Racks

- 2 feet minimum from the curb face to avoid 'dooring.'
- 4 feet between racks to provide maneuvering room.
- Locate close to destinations; 50 feet maximum distance from main entrance.
- Minimum clear distance of 6 feet should be provided between the bicycle rack and the property line.

Bike Corrals

- Bicyclists should have an entrance width from the roadway of 5-6 feet.
- Can also be used with angled parking.
- Parking stalls adjacent to curb extensions are good candidates for bicycle corrals since the concrete extension serves as delimitation on one side.

Bike Lockers

- Minimum dimensions: width (opening) 2.5 feet; height 4 feet; depth 6 feet.
- 4 foot side clearance and 6 foot end clearance. 7 foot minimum distance between facing lockers.

Secure Parking Area

- Closed-circuit television monitoring with secure access for users.
- Double high racks & cargo bike spaces.
- Bike repair station with bench and maintenance item vending machine.
- Bike lock "hitching post" – allows people to leave bike locks.

SWEEPING

Typical Application

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.



Further Considerations

- 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.

SIGNAGE

Typical Application

Bike lanes, shared shoulders, Bicycle Boulevards and paths all have different signage types for wayfinding and regulations. Such signage is vulnerable to vandalism or wear, and requires periodic maintenance and replacement as needed.



Further Considerations

- Check regulatory and wayfinding signage along bikeways for signs of vandalism, graffiti, or normal wear.
- Replace signage along the bikeway network as-needed.
- Perform a regularly-scheduled check on the status of signage with follow-up as necessary.
- Create a Maintenance Management Plan.

ROADWAY SURFACE

Typical Application

Bicycles are much more sensitive to subtle changes in roadway surface than are motor vehicles. Various materials are used to pave roadways, and some are smoother than others. Compaction is also an important issue after trenches and other construction holes are filled. Uneven settlement after trenching can affect the roadway surface nearest the curb where bicycles travel. Sometimes compaction is not achieved to a satisfactory level, and an uneven pavement surface can result due to settling over the course of days or weeks. When resurfacing streets, use the smallest chip size and ensure that the surface is as smooth as possible to improve safety and comfort for bicyclists.



PAVEMENT OVERLAYS

Typical Application

Pavement overlays represent good opportunities to improve conditions for bicyclists if done carefully. A ridge should not be left in the area where bicyclists ride (this occurs where an overlay extends part-way into a shoulder bikeway or bike lane). Overlay projects also offer opportunities to widen a roadway, or to re-stripe a roadway with bike lanes.



Further Considerations

- Maintain a smooth pothole-free surface.
- Ensure that on new roadway construction, the finished surface on bikeways does not vary more than ¼”.
- Maintain pavement so ridge buildup does not occur at the gutter-to-pavement transition or adjacent to railway crossings.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- If chip sealing is to be performed, use the smallest possible chip on bike lanes and shoulders. Sweep loose chips regularly following application.
- During chip seal maintenance projects, if the pavement condition of the bike lane is satisfactory, it may be appropriate to chip seal the travel lanes only. However, use caution when doing this so as not to create an unacceptable ridge between the bike lane and travel lane.

Further Considerations

- Extend the overlay over the entire roadway surface to avoid leaving an abrupt edge.
- If the shoulder or bike lane pavement is of good quality, it may be appropriate to end the overlay at the shoulder or bike lane stripe provided no abrupt ridge remains.
- Ensure that inlet grates, manhole and valve covers are within ¼ inch of the finished pavement surface and are made or treated with slip resistant materials.
- Pave gravel driveways to property lines to prevent gravel from being tracked onto shoulders or bike lanes.

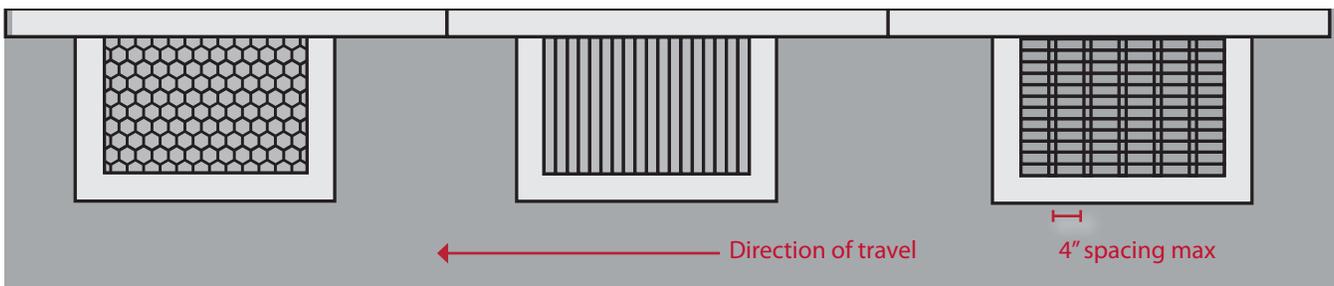
DRAINAGE GRATES

Typical Application

Drainage grates are typically located in the gutter area near the curb of a roadway. Drainage grates typically have slots through which water drains into the municipal storm sewer system. Many older grates were designed with linear parallel bars spread wide enough for a tire to become caught so that if a bicyclist were to ride on them, the front tire could become caught in the slot. This would cause the bicyclist to tumble over the handlebars and sustain potentially serious injuries.

Further Considerations

- Require all new drainage grates be bicycle-friendly, including grates that have horizontal slats on them so that bicycle tires and assistive devices do not fall through the vertical slats.
- Create a program to inventory all existing drainage grates, and replace hazardous grates as necessary - temporary modifications such as installing rebar horizontally across the grate should not be an acceptable alternative to replacement.



GUTTER TO PAVEMENT TRANSITION

Typical Application

On streets with concrete curbs and gutters, 1 to 2 feet of the curbside area is typically devoted to the gutter pan, where water collects and drains into catch basins. On many streets, the bikeway is situated near the transition between the gutter pan and the pavement edge. This transition can be susceptible to erosion, creating potholes and a rough surface for travel. The pavement on many streets is not flush with the gutter, creating a vertical transition between these segments. This area can buckle over time, creating a hazardous condition for bicyclists.

Further Considerations

- Ensure that gutter-to-pavement transitions have no more than a ¼" vertical transition.
- Examine pavement transitions during every roadway project for new construction, maintenance activities, and construction project activities that occur in streets.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- Provide at least 3 feet of pavement outside of the gutter seam.



LANDSCAPING

Typical Application

Bikeways can become inaccessible due to overgrown vegetation. All landscaping needs to be designed and maintained to ensure compatibility with the use of the bikeways. After a flood or major storm, bikeways should be checked along with other roads, and fallen trees or other debris should be removed promptly.



Further Considerations

- Ensure that shoulder plants do not hang into or impede passage along bikeways
- After major damage incidents, remove fallen trees or other debris from bikeways as quickly as possible

MAINTENANCE MANAGEMENT PLAN

Typical Application

Bikeway users need accommodation during construction and maintenance activities when bikeways may be closed or unavailable. Users must be warned of bikeway closures and given adequate detour information to bypass the closed section. Users should be warned through the use of standard signing approaching each affected section (e.g., “Bike Lane Closed,” “Trail Closed”), including information on alternate routes and dates of closure. Alternate routes should provide reasonable directness, equivalent traffic characteristics, and be signed.



Further Considerations

- Provide fire and police departments with map of system, along with access points to gates/bollards
- Enforce speed limits and other rules of the road
- Enforce all trespassing laws for people attempting to enter adjacent private properties

