









Prepared for the Winston-Salem Department of Transportation (WSDOT), the City-County Planning Board (CCPB) of Forsyth County and Winston-Salem, and Wake Forest University (WFU)

Prepared by Alta/Greenways with Vanasse Hangen Brustlin, Inc



### **Acknowledgements**

Thank you to the local residents, students, faculty, and land government staff that participated in the development of this plan through meetings, events, volunteering, interviews, and plan review. Special thanks to those who participated as advisory group members, listed below.

### Stakeholder Advisory Group

A Stakeholder Advisory Group has been formed to guide this project, with representation from Wake Forest University (WFU), the community, and government entities.

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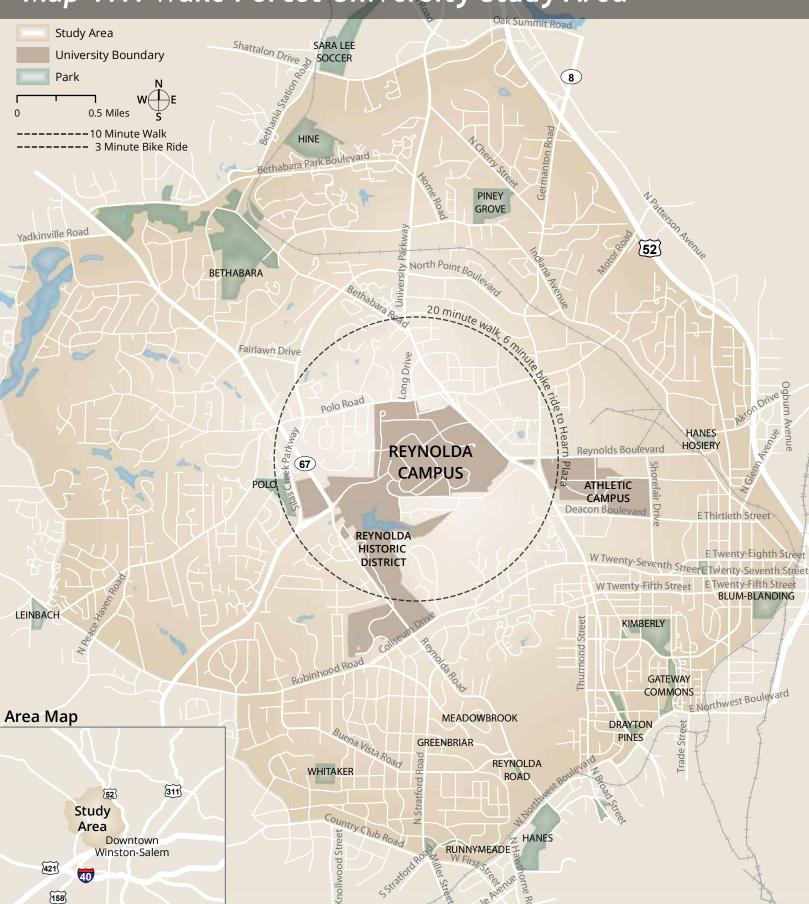


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# Map 1.1: Wake Forest University Study Area





# 1 INTRODUCTION

### PROJECT OVERVIEW

The Winston-Salem Department of Transportation (WSDOT) and the City-County Planning Board (CCPB) of Forsyth County and Winston-Salem, in cooperation with Wake Forest University (WFU), conducted a Bicycle, Pedestrian, and Transit Study for the Wake Forest University area in Winston-Salem. This project aims to improve active transportation and transit choices between the WFU campus and surrounding neighborhoods through infrastructure and policy changes. The City and University formed a Stakeholder Advisory Group to guide this project, with representation from the university, the community, and government entities.

### **BACKGROUND**

Several previous planning efforts and initiatives influenced the conception of this project:

- In 2002, the City of Winston-Salem and Forsyth County adopted the first greenway plan for the county, which proposed bicycle and pedestrian amenities to connect WFU, neighborhoods west of the campus, and the Bethabara Trail Greenway (the Wake Forest Connector).
- In 2008, the WSDOT established a Bicycle and Pedestrian Coordinator position to aid in implementing the *Comprehensive Bicycle Master Plan (2005)*, the *Sidewalk and Pedestrian Facilities Plan (2007)*, and now the *Long Range Transportation Plan (2013)* as well. WSDOT also works closely with the Winston-Salem Transit Authority (WSTA) and Piedmont Authority for Regional Transportation

- (PART) to evaluate and enhance local and regional transit opportunities with the goal of providing a safe and efficient public transportation system.
- In 2009, WFU completed the Reynolda Campus Master Plan which details specific recommendations for parking and vehicular traffic flow, as well as, bicycle and pedestrian accommodations within the campus and between the campus and major destinations.
- In 2012, the CCPB completed an update to the 2002 greenway plan. The update expanded the original scope of the Wake Forest Connector to include all neighborhoods surrounding the campus. The *Greenway Plan Update* was adopted by the City and County in June and August of 2012 respectively.

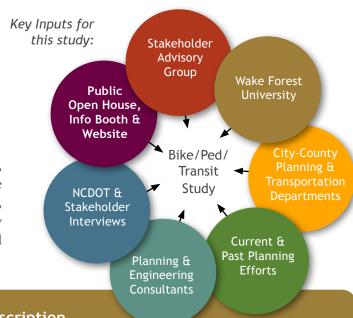
### **PURPOSE**

Together, aspects of the plans and partnerships noted above influenced the overall purpose of this study, which is to establish general and specific recommendations for active transportation choices between the WFU campus and surrounding neighborhoods. The study will address both infrastructure and policy recommendations to improve bicycle, pedestrian, and transit amenities and usage. The study will serve as a framework for similar future studies of other institutional campuses in Winston-Salem.



### **PROJECT SCHEDULE**

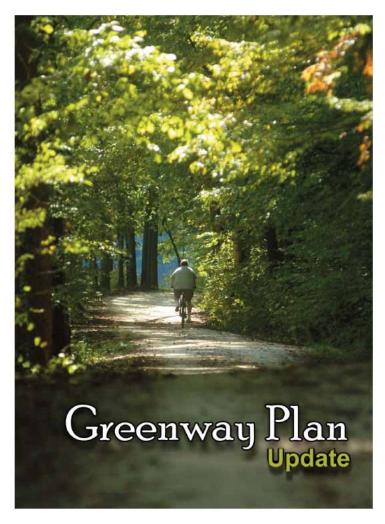
The process and schedule for the study is outlined below, followed by a brief summary of current conditions. The recommendations chapter makes up the bulk of the study, drawing upon the key inputs shown at right. The study concludes with a supporting implementation strategy and related appendices.

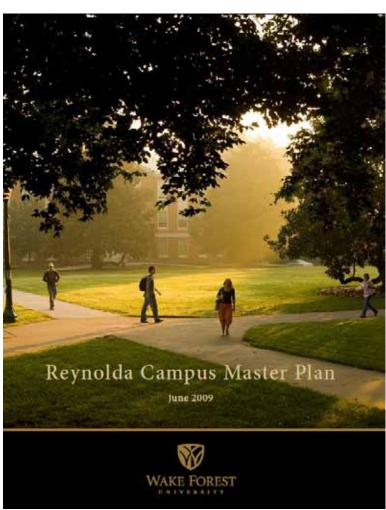


Time frame	Planning Process Description
	Project Kick-off Meeting with the Stakeholder Advisory Group: On October 31, 2013, the project team (including City staff, Wake Forest University (WFU) staff, project consultants, and the Stakeholder Advisory Group) met to review the scope of work for the project and discuss the desired outcomes of the project.
October 2013	<u>Campus Input Event:</u> On October 31, 2013, the project team members set up outside the Fresh Food Company dining hall as part of the Sustainability Office's Think Green Thursday series. The purpose was to tell students and faculty about the project and seek their input. Maps and other materials were on hand to communicate about the project and guide input.
November 2013	Project Team Charrette: During the week of November 11-15, 2013, project consultants interviewed stakeholders, conducted field analysis, and began developing conceptual recommendations for discussion. These ideas were presented and shared with City and University staff for input, followed by a public open house session (below). The week-long charrette was concluded with a second Stakeholder Advisory Group meeting to summarize findings to-date and next steps.  Public Open House: On November 14, 2013, project team members hosted a public open house to share information about the study and talk one-on-one with participants. A short presentation was given, followed by a small group session to discuss related issues, barriers, and potential solutions.
December 2013	<u>Draft Study Review with the Stakeholder Advisory Group:</u> Upon completion of the draft study, the Stakeholder Advisory Group will review and provide feedback on the draft. <u>Completed Study:</u> The final study will be revised and finalized based on feedback from the Stakeholder Advisory Group.



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July 2007





# **2 CURRENT CONDITIONS**

# EXISTING PLANS, POLICIES, AND PROGRAMS

The following plans, policies, and programs currently influence walking, bicycling, and transit conditions in the study area. A summary is provided here by geography: plans, policies and programs exist at the university, city, and state level.

### WAKE FOREST UNIVERSITY PLANS

### 2009 Reynolda Campus Master Plan

This plan took a comprehensive look at a campus issues, ways to accommodate growth, and the future vision of the university. The transportation element was primarily inwardly focused on circulation and parking issues on campus. A few campus connection pieces were identified, including providing transit shuttle service to apartment complexes north of campus and improving pedestrian and bicycle connections, particularly between main campus and the athletics area.

### 2011 Wake Forest University Parking Study

This study focused on campus parking needs and built on the findings of the 2009 Master Plan. The main findings were that parking demand exceeds practical capacity at peak times, and future growth will exacerbate these shortfalls. Transit was identified as a key to managing parking demand.

### WAKE FOREST UNIVERSITY PROGRAMS

#### Car Share

The University partners with Zipcar to have four car share vehicles parked on campus in easily accessible locations for Zipcar members to reserve by the hour or day. Members pay an annual fee and a rental fee of \$8.50 per hour, which covers all costs of vehicle ownership and operation (gas, insurance, maintenance, depreciation).

#### Rideshare

There are two rideshare programs which are available to university-affiliated individuals, Zimride and SharetheRideNC. Zimride facilitates sharing trips by making it easier to find people with similar trips to share a vehicle and split costs; this service focuses on longer trips (e.g., a trip out of state for a holiday break). SharetheRideNC is the state's ridematching program that helps interested carpoolers find people to share their trip. The University also incentivizes carpooling by offering desirable parking spaces to individuals who sign up for the carpool program.

### Education, Encouragement, and Enforcement

The Office of Sustainability coordinates, encourages, and promotes various types of alternative transportation to campus, including the Zipcar and carpooling/ridesharing programs. The Office of Sustainability also coordinates programs and events to encourage biking and walking to campus like the Campus/Community Bike Ride.

### WAKE FOREST UNIVERSITY POLICIES

#### **Parking Pricing**

The University requires employees and students to register their vehicle to park on campus. Students are charged \$500 per year for on-campus spaces and between \$200 and \$300 for off-campus lots. University



faculty and staff can park for free. Different lots are available to different groups depending on permit type.

### **Student Housing**

Currently, students are required to live on campus during their freshman, sophomore, and junior years of study.

### CITY OF WINSTON-SALEM PLANS

### Greenway Plan and 2012 Update

This Winston-Salem and Forsyth County plan focuses on providing connectivity between existing greenways, sidewalks and bikeways, as well as neighborhoods, major destinations and community facilities. By establishing a connected system, the City and County will be able to implement the *Legacy* recommendation of establishing an active transportation network.

### 2035 MPO Transportation Plan Update

The plan includes the Winston-Salem Urban Area Metropolitan Planning Organization (MPO) vision, policies and actions that guide transportation programs and projects. The plan includes recommendations for roadways, public and private transportation, and bicycle and pedestrian facilities.

### Legacy 2030 - Comprehensive Plan for Winston-Salem

The Legacy 2030 Plan for Winston-Salem and Forsyth County outlines the region's vision, goals, and objectives for growth and development over the next two decades. The plan is organized around three "Legacy Themes": Fiscal Responsibility, Livable Design, and Sustainable Growth. The plan includes policies and action items for improving the local and regional transit, bicycle, and pedestrian networks in order to support a more balanced, sustainable transportation system.

### Winston-Salem Comprehensive Bicycle Master Plan - 2005

The Comprehensive Bicycle Master Plan was drafted for the Winston-Salem Urban Area, which includes Winston-Salem, all of the incorporated municipalities in Forsyth County, and portions of Stokes County, Davie County, and Davidson County. The plan includes a set of phased infrastructure recommendations for updating the bicycle network, as well as policy changes

and program recommendations. The proposed network consists of 1,245 miles of bicycle facilities, including bike lanes, shared-use paths, paved shoulders, and signed routes.

### Winston-Salem Urban Area Sidewalk and Pedestrian Facilities Plan - 2007

This plan provides a vision for creating a pedestrian-friendly environment throughout the Winston-Salem Urban Area that "provides access for all, promotes healthy lifestyles, and improves air quality." The goals of the plan are to increase the quantity and quality of pedestrian facilities, improve pedestrian safety and security, include pedestrian considerations in all transportation and land use decisions, and enhance quality of life. A network of new and improved sidewalks, crosswalks, and intersection treatments are recommended, along with policy updates and education, encouragement, and enforcement programs.

### CITY OF WINSTON-SALEM PROGRAMS

### Bike Map

The City of Winston-Salem has a bike map showing bike facilities and preferred bike routes around the city.

### Education, Encouragement, and Enforcement

The City of Winston-Salem provides access to a variety of bicycling, walking, and transit information through its website. The Bicycling section includes access to brochures detailing bicyclist rights, safety tips, laws relating to bicycling, and activities aimed at cyclists. The Pedestrian section of the website shows similar safety and legal information, plus materials on Safe Routes to School and walking activities. The WSTA website provides information on bus routes, schedules, and fares. The City and WSTA also have a social media presence for increased visibility of programs and services.

**City Bicycling Information**: www.cityofws.org/departments/transportation/biking

**City Pedestrian Information**: www.cityofws.org/departments/transportation/pedestrians

WSTA Information: wstransit.com/



# Map 2.1: Previous City Greenway/Bikeway Proposals





### CITY OF WINSTON-SALEM POLICIES

### City of Winston-Salem/Forsyth County UDO

3-13 Street Standards Governing Vehicle and Pedestrian Circulation. (A) Pedestrian Transit and Bicycle Mobility

### **Sidewalk Requirements**

- New residential subdivision streets Sidewalks required on one side of cul-de-sac streets, local streets, and collector streets; required on both sides of minor thoroughfares.
- Non-residential streets or multi-family residential streets Sidewalks required along entire frontage for all new construction sites and major construction on existing sites, except where curb and gutter is not present.
- Sidewalks are also required along existing streets where subdivisions abut streets proposed for sidewalks as identified in the adopted Winston-Salem Urban Area Sidewalk and Pedestrian Facilities Plan.
- Sidewalks are required to be a minimum of five feet and with planting strip buffer. If there are limitations to providing a buffer as approved by the City, a wider sidewalk should be constructed.
- Payment In-Lieu When the City determines that sidewalk construction is unfeasible, the City will require either, (1) a payment in-lieu of sidewalk construction; (2) construction of sidewalks in the general vicinity of the project site; or (3) a combination of a conventional sidewalk, alternative walkway, or payment of a fee in-lieu.

### **Bicycle/Pedestrian Connectivity**

- Either wide outside travel lanes or bicycle lanes are required to be part of any road improvement made on roadways which are indicated as bicycle routes on the approved *Winston-Salem Urban Area Comprehensive Bicycle Master Plan*.
- Bicycle and pedestrian connections shall be made to any existing or proposed off-site bicycle or pedestrian facilities contiguous to the site.

#### **Street Connectivity Requirements**

 The street network for any subdivision with internal roads or access to any public road shall achieve a connectivity index of not less than 1.2, measured within the subdivision.

### 3-7 Protection of Public Rights-of-Way and Greenways

#### **Greenway Dedication**

 Before zoning permits are approved for lots within 50 feet of a stream identified for a greenway in adopted Greenway Plan, the adopting jurisdiction may assess the impact to future greenway construction and offer to purchase or protect the potential greenway corridor.

### NORTH CAROLINA POLICIES

# WalkBikeNC Statewide Pedestrian and Bicycle Plan (2013)

The *Statewide Plan* reconfirms the State's commitment to bicycle and pedestrian transportation. It builds the argument about the increased statewide need for safe, multi-modal transportation choices given demographic, economic, and health trends. It also identifies access to transit as a critical element. The Plan recommends data-driven approaches to support project development such as pedestrian and bicyclist counts. The Plan identifies partnerships between state and local public and private entities as critical for building pedestrian and bicycle projects.

### NCDOT Complete Streets Design Guidelines (2012)

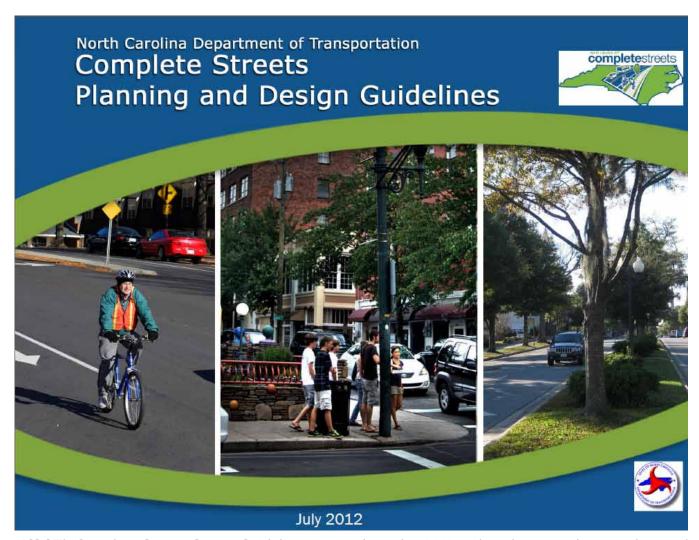
The NCDOT Complete Streets Design Guidelines are intended to provide comprehensive guidance for incorporating complete streets into everyday practice (including new construction, widening, modernization projects, and maintenance projects) so that North Carolina's streets increasingly support mobility for those using all travel modes. To facilitate implementation of the guidelines, NCDOT will work with local governments with newly identified roadway projects, existing projects that have not progressed to the design stage, and resurfacing projects.



# NCDOT Complete Streets Policy (Adopted July 2009)

"The NC Board of Transportation approval of the Complete Streets policy in 2009 required planners and designers to consider and incorporate multimodal alternatives in the design and improvement of all transportation projects within a growth area of a municipality. The policy expresses the need to develop an efficient multimodal transportation network for all transportation users, motorists, transit users, pedestrian and bicyclists of all ages and abilities; that meets their needs for safe access and mobility throughout the accommodation; while caring for the built and natural

environments by promoting sustainable development practices that minimize impacts on natural resources and community values and sites of interest. Under the Complete Streets policy, NCDOT is to collaborate with communities during the planning and design phase of new streets or improvement projects to decide how to provide transportation options needed to serve the community."



NCDOT's Complete Streets Design Guidelines were adopted in 2012 and are being implemented around the state.



### EXISTING BICYCLE INFRASTRUCTURE

Below is a photo-inventory of typical opportunities and constraints for bicycling found throughout the study area.

### OPPORTUNITIES FOR BICYCLING



Bicycle lanes on Reynolda Rd



Shared lane markings on Polo Rd



Bicycle parking (example shown here is on the WFU campus)





Bicycle route signage and other signage (several existing routes shown on Map 3 in light blue)

### CONSTRAINTS FOR BICYCLING

Current constraints for bicycling include existing facilities that end abruptly, such as the sidepath along Long Drive at University Parkway (shown below at left), the Silas Creek Greenway at Robinhood Road, and the Reynolda Road bicycle lanes. Busy roads without bicycling facilities, such as University Parkway and Silas Creek Parkway, also present major challenges, not only for riding safely along these roadways, but also for simply crossing them. Even roadways that have fewer lanes can be difficult to cross, such as Reynolda Road at Graylyn Court, shown below at right.



Long Dr. sidepath at University Pkwy.

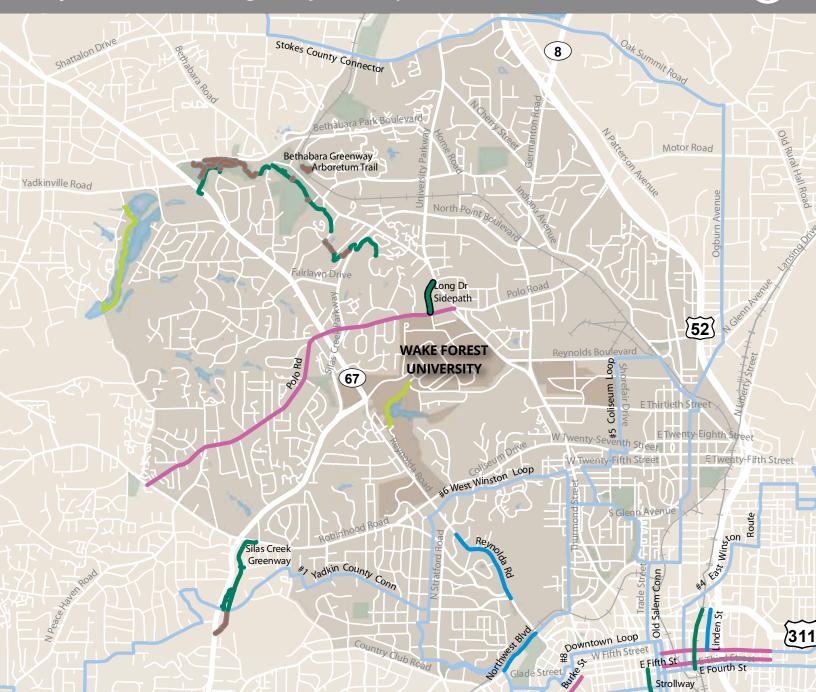


Reynolda Rd. at Graylyn Ct.



# Map 2.2: Existing Bicycle Infrastructure





### Legend + Existing Mileage

Bicycle Lanes Signed Bicycle Route	0.8 miles 18 miles
Shared-Lane Markings	3.0 miles
Greenway	1.8 miles
Sidepath	0.25 miles
Private Trail	1.5 miles
Unpaved Trail	1.7 miles



### EXISTING PEDESTRIAN INFRASTRUCTURE

Below is a photo-inventory of typical opportunities and constraints for walking found throughout the study area.

### OPPORTUNITIES FOR WALKING

Multi-use trails, sidewalks and crossing facilities make up most of the existing pedestrian infrastructure. Examples are shown below. Key elements of the improved intersection on the bottom right include high-visibility crosswalk markings, curb ramps with truncated domes, push-button countdown pedestrian signals, and a median refuge island.



Sidepath along Long Drive



Private greenway on WFU campus



Sidewalk on campus



Silas Creek Pkwy. and Bethabara Rd.

### CONSTRAINTS FOR WALKING

Multi-use trails are sparse in the study area, and about half of the existing mileage is private (see Map 4 on opposite page). Similarly, while sidewalks are present along some major roads in the study area, they are notably sparse compared with areas closer to downtown. The greatest challenges for pedestrians include walking along major roads without facilities and crossing roadways without sidewalks or other crossing devices, as shown below.



University Pkwy. near Bethabara Rd.



Pedestrian crossing Polo Road



Coliseum Drive







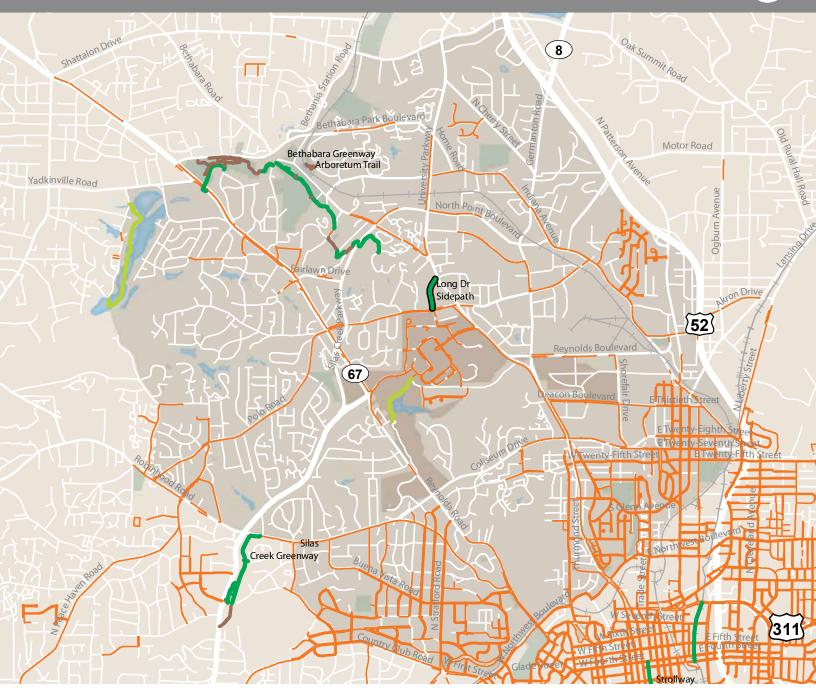
Pedestrians crossing University Parkway mid-block



# Map 2.3: Existing Pedestrian Infrastructure







### Legend + Existing Mileage

Sidewalk 96.0 miles
Greenway 1.8 miles
Sidepath 0.25 miles
Private Trail 1.5 miles
Unpaved Trail 1.7 miles



### **EXISTING TRANSIT SERVICE**

### RIDE THE WAKE SHUTTLE

Wake Forest operates six main shuttle lines providing service around campus and connecting to key locations near campus. The Gold and Black lines serve apartment complexes north of campus. Both routes have seen good levels of ridership. The University had to add a second bus to the Gold line last year and is considering a second bus on the Black line this year. Each route serves three different complexes on half hour headways and the routes drop at different places on campus. Both lines operate between 7:20 am and 9:20 pm. Deacon Station (not served by RtW shuttles) is a student-only community that has started its own shuttle to campus, which coordinates with RtW to avoid getting to the stop at the same time.

The Gray line provides service between main campus and the University Corporate Center (UCC) and freshman lot during the day on 30-minute headways. At 7:00 pm, the route switches to a night-time route that keeps the 30-minute headways but switches to provide circulation around main campus. A separate route with 30-minute headways provides service between campus and the freshman parking lot by the athletic fields. The gray line night service runs between 7:30 pm and 3:00 am. The freshman parking route provides fixed-route service between 7:30 pm and midnight, after which it switches to an on-call route throughout the night.

On Thursdays, Fridays, and Saturdays, there is a downtown shuttle bus that runs from 9:30 pm to 3 am (last downtown pickup is between 2:30 and 2:45 am). This shuttle does not maintain a consistent schedule, but rather runs continuously, with designated stops.

On Saturdays and Sundays, WFU operates a Hanes Mall shuttle that runs between campus, Hanes Mall and a Target. On Saturdays, the service runs from 11:00 am to 9:45 pm. On Sundays, it runs from 12:00 pm to 6:45 pm

Wake Forest University Baptist Medical Center operates an inter-campus shuttle between the Reynolda and Bowman-Gray campuses. This shuttle operates between 7:00 am and 6:00 pm and provides hourly service.

### WINSTON-SALEM TRANSIT AUTHORITY

The Winston-Salem Transit Authority (WSTA) operates two six-day routes with service on or adjacent to campus. Route 5 runs between the downtown transit center and the University via University Parkway, with a stop on campus near the corner of Wake Forest Road and Wingate Road. Route 16 runs between the downtown transit center and Old Town Shopping Center via Reynolda Road. Route 16 does not have a stop on campus, but has stops adjacent to campus along Reynolda Road. Both the 5 and the 16 routes operate basically between 6:00 am and 7:00 pm, Monday through Saturday. Both routes have one-hour headways.

Route 4 also comes fairly close to campus, operating for a stretch of University Parkway between Coliseum and N Cherry Street with a stop on N Cherry Street near Reynolds Boulevard. This route provides some service to the athletics fields and UCC. During the day, Route 4 has the same operating characteristics as Routes 5 and 16, but this route also has evening service (as Route 444) that operates between 7:00 pm and midnight on an hour and a quarter schedule.

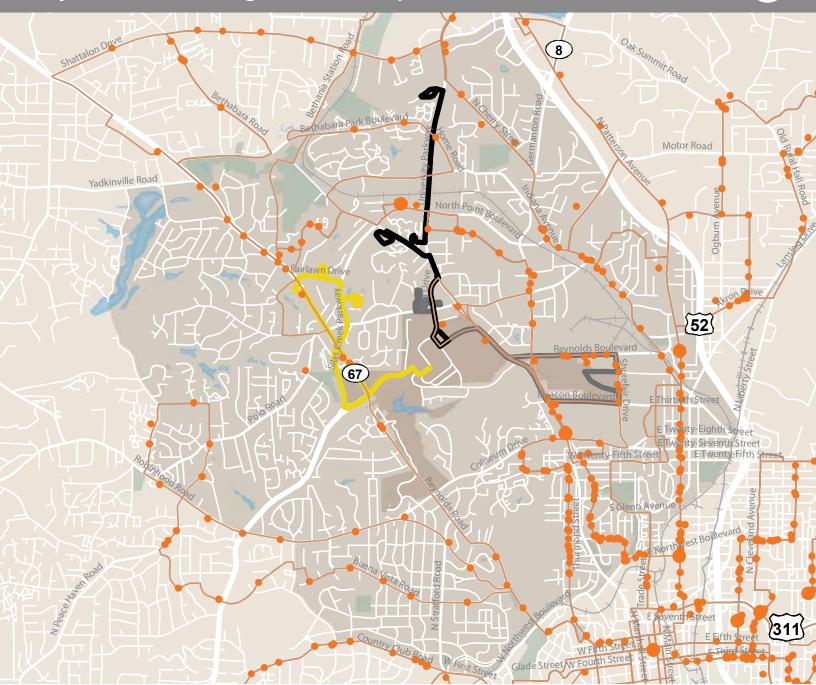
As of November 3, 2013, WSTA has begun running Sunday service, with one route, Route 74, a modified version of Route 4, providing service adjacent to the University via University Parkway. Service runs between 7:00 am and 7:00 pm on an hourly schedule.

WSTA has not seen significant demand originating on or going to campus. This is confirmed by the Transportation Survey recently undertaken by Wake Forest University. Out of over 2,000 respondents, only 4 reported using WSTA buses to get to campus. An interview with WSTA drivers and passengers indicated there may be about 10-20 regular daily riders who use the on-campus stop. WSTA is also in the process of reviewing and reorganizing their full route structure, with the output of the route reorganization study expected in early 2014.

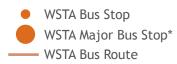


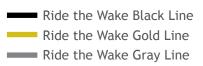
# Map 2.4: Existing Transit Infrastructure





### Legend





\*A WSTA Major Bus Stop is an important bus stop with high ridership that serves a regionally significant destination.



### Public Outreach Strategies



University Area.

We've looking for your ideas to make this happier. This website provides information on the project and ways to share your comments, concerns, and Hear. This community-led planning process aims to make active transportation and transit' viable and enjoyable choices for the mmunities in and around WPLI

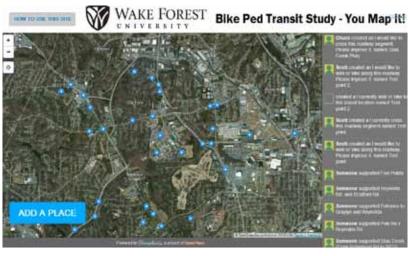
comments, and post project resources.





input on the interactive input map (see below), gather





An interactive input map allowed community members to highlight barriers and opportunities at specific locations.



A campus booth was set up outside the dining hall on October 31st, 2013.



A public workshop was held November 14th, 2013 at Winston-Salem First where over 50 attendees provided input.



Stakeholder interviews were conducted with more than ten individuals and groups.



# **3 NEEDS ANALYSIS**

### **OVERVIEW**

The needs of the university community and residents of the university area were analyzed with a variety of tools. These included several different forms of public outreach, a comprehensive survey of perceptions and behaviors conducted by Wake Forest University's Office of Sustainability, and bicycle and pedestrian counts conducted by volunteers. The results of these methods and a summary of needs by topic are presented in this section.

### **PUBLIC OUTREACH**

A comprehensive stakeholder and public engagement process took place as part of this planning effort. In addition to Stakeholder Advisory Group (SAG) meetings, multiple methods were used to receive input including an on-campus booth, project website, interactive input map, public workshop, and stakeholder interviews. Multiple Wake Forest University departments and stakeholders from adjacent neighborhood and business associations were informed and invited to participate.

The project team set up a **booth on campus** to intercept WFU students, faculty, and staff.

A **project website** was established to provide project background, input opportunities, and draft plan products.

An **interactive input map** allowed the opportunity to pinpoint locations where bicycle, pedestrian, and transit improvements are needed.

A **public workshop** was held at Winston Salem First Church at the corner of University Parkway and Polo Road. Approximately 50 community members attended to provide input on maps and concept projects.

Twelve **stakeholder interviews** occurred during the planning process to receive focused input from key university-based and surrounding community-based stakeholders.

### SURVEY FINDINGS

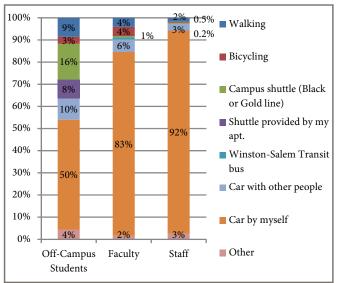
Wake Forest University's Office of Sustainability recently conducted a comprehensive transportation survey to understand current transportation behaviors and perceptions. Over 2,100 faculty, students, and staff participated. Key geographic and transportation trends indicate that a relatively small percentage of people walk, bike, or take transit to campus compared to the number of people who live within 1-2 miles of campus. Perceived barriers and benefits to walking and biking provide insight to programs that may encourage more to walk, bike, or take transit. Key takeaways from the survey are summarized on the following page.



### **COMMUTE MODE**

Twelve percent of responding off-campus students walk or bike to campus while almost 25% take a campus or apartment shuttle. No responding students take Winston-Salem Transit.

In comparison, 4% of responding faculty walk to campus and 4% of responding faculty bike to campus. Two and a half percent of responding staff walk or bike to campus. Three faculty respondents and one staff respondent take WSTA to campus, and 6% and 3% respectively carpool.



Current commute mode of off-campus students, faculty, and staff

#### DISTANCE TO CAMPUS

Sixty-nine percent of responding off-campus students, 23% of responding faculty, and 13% of responding staff live within 1-2 miles of campus. In total, 34% of all survey respondents live within 1-2 miles, and 52% live within 4 miles of campus.

Despite 69% of responding students living within a 15-30 minute walk or 5-10 minute bike ride, only 12% walk or bike to campus. Despite 23% of responding faculty living within a 15-30 minute walk or 5-10 minute bike ride, only 8% walk or bike. These proximities indicate that if some of the barriers in the following section are overcome, a large percentage of the university community is within a comfortable distance to walk or bike to campus.

### BARRIERS AND BENEFITS

Top 5 barriers to biking for responding students/faculty/ staff living 1-2 miles from campus

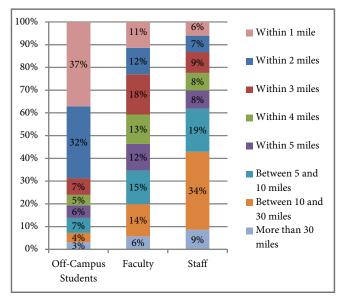
- Weather
- Safety (no safe route)
- Facilities (need for shower/change of clothes)
- Convenience (ability to get places quicker by car)
- Vehicle access (for child/elder care or errands)

Top 5 barriers to walking for responding students/ faculty/staff living 1-2 miles from campus

- Convenience (ability to get places quicker by car)
- Weather
- Vehicle access (for child/elder care or errands)
- Safety (no safe route)
- Distance

Top 4 perceived benefits of walking/biking

- Health
- Financial savings
- Environment/Public Health
- Emotional well-being



Distance to campus of off-campus students, faculty, and staff

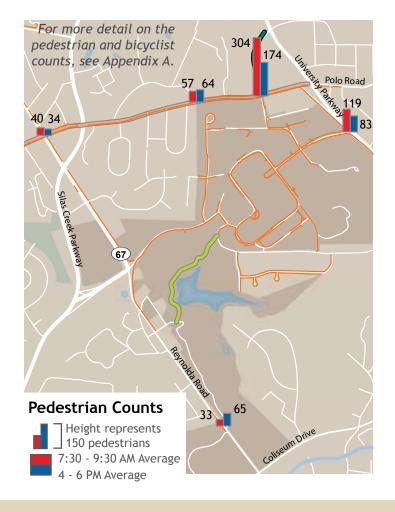


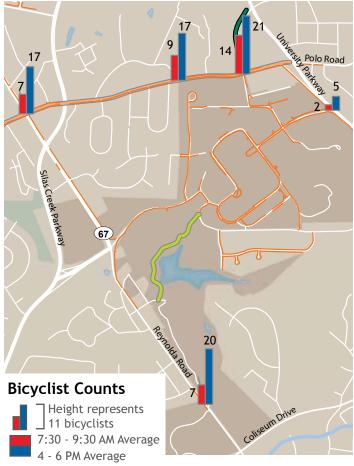
# BICYCLIST AND PEDESTRIAN COUNTS

Volunteers conducted bicycle and pedestrian counts on November 5th and 6th at five locations around the study area. Morning and afternoon counts were conducted. Locations were selected at the entrances to campus considered most likely for bicycle and pedestrian traffic. The results of these counts are shown below. Note that the pedestrian and bicyclist scales are not the same pedestrians were observed in much greater numbers than bicyclists.

These counts set a baseline for future monitoring of pedestrian and bicycle activity, and one means of measuring the impact of implementing the recommendations of this study. Several observations can be made from this small count sample. First, significant pedestrian and bicycle activity is already occurring despite the many challenges to walking and biking.

This was observed despite adverse weather conditions during one day of the counts. Second, bicycling activity is occuring more on the north and west sides of campus than the east. Third, significant pedestrian volumes are coming from parking lots north of Polo Road.







### SUMMARY OF INPUT FROM MEETINGS & INTERVIEWS

Main Themes of Input Received	Summary
Need for Safety	Many collisions have occurred around the study area.
	Gaps in the sidewalk system should be filled.
Improvements	Separated space from motor vehicles is needed for active modes
	<ul> <li>Roadway crossing improvements are needed.</li> </ul>
	<ul> <li>Major roads (Silas Creek Parkway, University Parkway, etc) are barriers to biking and walking.</li> </ul>
	<ul> <li>Better connections are needed from off-campus apartments.</li> </ul>
Need for Improved Bike/ Ped Access and	<ul> <li>A formalized bike/ped connection is needed from main campus to the athletic stadium, entertainment area, and University Corporate Center. This will create a cohesive identity across University Parkway.</li> </ul>
Connectivity	<ul> <li>More bicycle parking is needed on and campus and throughout the study area, including covered options.</li> </ul>
	<ul> <li>Provide connectivity to downtown and other redevelopment areas in the south portion of the study area.</li> </ul>
	<ul> <li>Polo Road - Traffic should be slowed, separated space for cyclists provided and crossings improved.</li> </ul>
	<ul> <li>University Parkway - An overall corridor improvement is needed. Fill the sidewalk gap north of Polo Road, provide a crossing at the campus entrance, improve the Coliseum Drive intersection, and address the crossing from the bus stop across from Goodwill Industries.</li> </ul>
Site-Specific Comments	Improve the Reynolda Road crossing at Graylyn Court.
Comments	<ul> <li>Improve pedestrian connectivity north on Reynolda Road to shopping from campus</li> </ul>
	Improve Polo Road/Reynolda Road intersection for pedestrians
	<ul> <li>Eastern portion of study area is lower-income (significant walking and biking in this region)</li> </ul>
	Better connect campus to Reynolda Historic District
Coordination with	<ul> <li>There is a redevelopment concept plan for the University Parkway, Baity Street, and stadium area.</li> </ul>
Current Plans and Future Development	<ul> <li>Connect the 3rd Street Greenway and WFU Innovation Quarter with the study area in the long-term.</li> </ul>
	<ul> <li>Surrounding small area plans are recently completed and ongoing.</li> </ul>

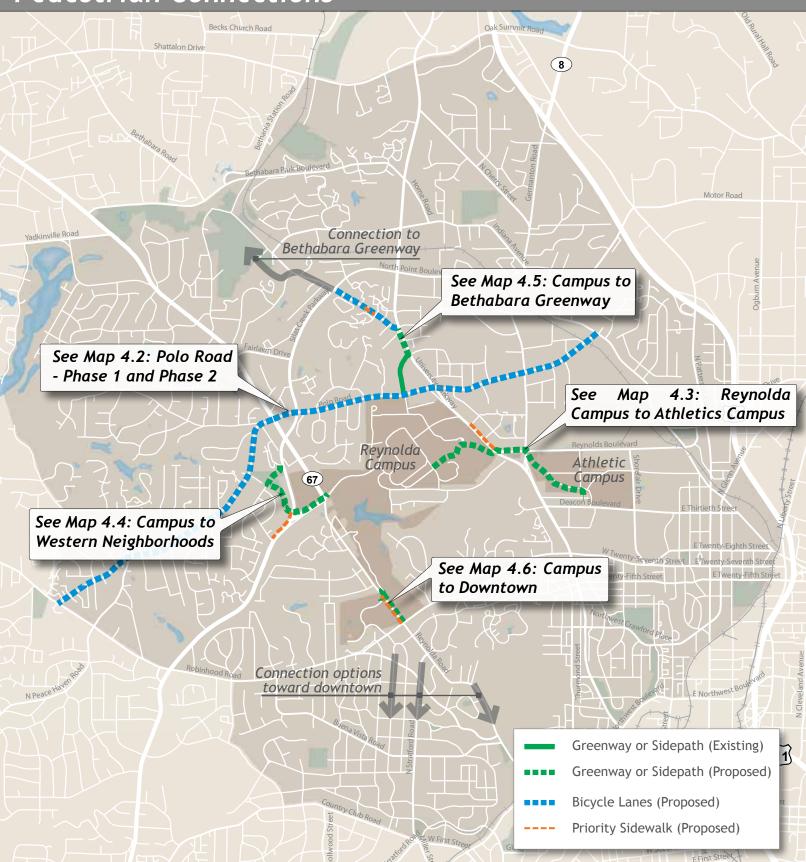


Main Themes of Input Received	Summary
Implementation Challenges	<ul> <li>Project funding</li> <li>Retrofitting roadways to accommodate all users</li> <li>Parking - Trends; campus policies, city policies</li> <li>Cultural change is needed for a vehicular-oriented community -</li> </ul>
	education/encouragement programs needed (rules of the road, safety information, <b>improved interaction</b> between bicyclists, pedestrians, and motorists)
	<ul> <li>The WFU Ride the Wake shuttles have growing ridership. The University has increased service hours later into the day on the Gold and Black lines.</li> </ul>
Ride the Wake Shuttles	<ul> <li>Several apartment complexes have requested shuttle service, and at least one apartment complex has begun its own service.</li> </ul>
	<ul> <li>WFU shuttle service is tailored to students, and less helpful to faculty, staff, and community members.</li> </ul>
	<ul> <li>There is a desire for more shopping- or recreation-focused transit services.</li> </ul>
	<ul> <li>The WSTA services are not well-known or used on campus. WSTA use to and from campus would likely increase with promotion.</li> </ul>
WSTA Transit	<ul> <li>The hour headways on WSTA routes that come on or near campus make the service inconvenient to use.</li> </ul>
	<ul> <li>WSTA is reviewing and revising all routes as part of a restructuring effort; the tentative plan now is to no longer have Route 5 stop on campus, but stop nearby on University Parkway.</li> </ul>
	<ul> <li>The University should consider, perhaps as part of student fees, providing free transit passes to all students and employees to encourage WSTA use.</li> </ul>
	<ul> <li>A big barrier to greater transit use is cultural - people need to get comfortable and acclimated to using transit services.</li> </ul>
General Transit	<ul> <li>Transit stops currently lack amenities and should be hubs of activity in addition to having nice fixtures. Shelters are needed at key stops and benches, signage, and maps should also be provided.</li> </ul>
	<ul> <li>Pedestrian and bicycle infrastructure around transit stops is lacking in places.</li> </ul>
	Transit would be more convenient for users with smaller headways.  A difficulty in encouraging transit use is the availability of free.
	<ul> <li>A difficulty in encouraging transit use is the availability of free parking for faculty and staff.</li> </ul>



# Map 4.1: Priority Bicycle & Pedestrian Connections







# **4 RECOMMENDATIONS**

### **OVERVIEW**

A comprehensive set of infrastructure improvements, policy changes, and programs are recommended to increase the safety, magnitude, and enjoyment of bicycling, walking, and riding transit in the Wake Forest University area. These recommendations should be implemented in parallel – as complements that together will reinforce each other's effectiveness.

Bicycle and pedestrian infrastructure recommendations are presented first, divided into three major sections: priority connections, bicycle infrastructure, and pedestrian infrastructure. These sections are followed by proposed transit improvements, proposed transportation demand management (TDM) strategies, and additional proposed programs and policies.

### PRIORITY CONNECTIONS

Several gaps in the pedestrian and bicycle networks were identified as critical barriers to safety and connectivity. Each of these barriers requires a set of bicycle and pedestrian infrastructure improvements along a particular corridor. Improvements range from on-road bicycle facilities, off-road multi-use trails, and sidewalks to intersection improvements, lane removal, etc.

Improvements termed 'Priority Connections' are recommended to overcome each of these barriers. A two-page summary of recommendations for each priority connection is provided. The set of improvements recommended for each priority connection are meant to be implemented at one time to create effective bicycle and pedestrian connectivity along the relevant corridor.

The following priority connection summaries include detailed design solutions, references to best practice examples, and cost estimates<sup>1</sup>. This set of projects will greatly improve connectivity and safety in the study area when implemented. The following priority order has been identified for priority connections from this study's Stakeholder Advisory Group. This order is presented from highest priority to lowest priority:

- · Polo Road
- Reynolda Campus to Athletic Campus
- Campus to Western Neighborhoods
- Campus to Bethabara Greenway
- Campus to Downtown

Each priority connection summary also distinguishes short-term and long-term projects. Map 4.1 only displays the short-term projects of the priority connections. Projects designated as short-term were selected for their impact on safety and connectivity, and feasibility based on planning-level analysis. Long-term projects are not critical to completing the specific connection identified, but will add to overall connectivity, linking additional destinations.

Following the priority connection sheets, full recommended bicycle and pedestrian networks are presented. A phasing of these full networks is also described, and includes short-term lower-cost bicycle and pedestrian improvements, such as roadway striping projects and sidewalk gaps.

<sup>1</sup>Cost estimates are planning level only. They are based on "Costs for Pedestrian and Bicyclist Infrastructure Improvements", released in October, 2013 by the UNC Highway Safety Research Center. Cost estimates include a 20% contingency.

### **BIKEWAY TYPES**

Several different kinds of bikeways are recommended throughout this chapter. Brief descriptions are provided here. For detailed design recommendations of each type, see the guides listed in the Best Practices section.

### **GREENWAY OR SIDEPATH**

A greenway is a multi-use trail separated from the roadway. A sidepath is a multi-use trail adjacent to a roadway.



### **BIKE LANE**

A portion of the roadway that has been designated by striping, signing, and pavement markings for the preferential and exclusive use of bicyclists.





### SHARED LANE MARKINGS

Pavement markings used to indicate shared space for bicyclists and motorists.



### CYCLE TRACK

A segregated portion of the roadway that is separated with a vertical barrier and designated exclusively for the use of cyclists.



### **BIKE BOULEVARD**

Low-volume and low-speed street that has been optimized for bicycle travel.



### PRIORITY CONNECTION: POLO ROAD - PHASE 1 AND PHASE 2

### PROJECT NEED

Polo Road provides a critical link to the neighborhoods west of the university. These neighborhoods were built with only one access point, so residents must walk or bicycle along Polo Road to access any destination. Polo Road is a major collector with a posted speed limit of 35 mph, 12,000 AADT west of University Parkway, and 6,500 AADT to the east. The road carries 12,000 AADT west of Reynolda Road and 15,000 AADT east of Reynolda Road. The road is marked as shared use for bicyclists, with shared lane markings and signage west of University Parkway. The road also connects a growing student population to the east of campus.

A sidewalk is present on the south side of Polo Road along the entire corridor from Robinhood Road to University Parkway. Several intersections are unimproved for pedestrians, however, like the crossing of Reynolda Road. Sidewalk is mostly absent on the north side of the road, and significant gaps exist east of University Parkway. The shared lane markings currently in place do not attract the majority 'interested but concerned' bicycling population and were described as insufficient by residents during public input.

### **Proposed Improvements**

A complete streets retrofit is recommended along Polo Road to accommodate a broader range of potential cyclists, create safe crossings for pedestrians, and maintain mobility for all modes. Roundabouts and traffic circles are recommended as part of the corridor redesign to allow removal of the center turn lane. These facilities allow fluid U-turns and reduce potential accidents with turning vehicles. The corridor redesign is recommended in two phases. This phasing prioritizes the segment north of the university between Reynolda Road and Long Drive. It will allow residents to see how the revised corridor functions and get comfortable with use of the roundabouts before a more extensive redesign is implemented west of Reynolda Road.

### Near-Term Improvements Phase 1

- A Remove the center turn lane on Polo Road between Polo Ridge Court and University Parkway, stripe bike lanes, and install roundabouts at Long Drive and Polo Ridge Court.
- Cut back vegetation at the University Parkway northbound ramp to improve sightlines for left-turning vehicles.
- Install a four-foot center median between Polo Ridge Court and Long Drive with a mix of university-branded pavers and landscaping.
- Provide pedestrian refuges within the median at Friendship Circle (both intersections) and the parking lot entrance west of Long Drive.
- Stripe bike lanes from University Parkway to Cherry Street (sharrows may be used in the constrained segment between University Parkway and Marlowe Avenue).
- Implement a complete streets retrofit from Cherry Street to Indiana Avenue, reconfiguring the roadway to a three-lane cross-section with bike lanes and center-turn lane.
- **G** Install high-visibility crosswalks, countdown pedestrian signal heads, and median refuges at Reynolda Road.

### Near-Term Improvements Phase 2

- Extend the corridor redesign with a planted median, one lane in each direction, and bike lanes west from Polo Ridge Court to Robinhood Road. Install roundabouts at Ransom Road and Peace Haven Road. Install offset roundabouts at the Polo Park entrance and entrance to the school to make use of public property at those locations.
- Install mini-roundabouts at several other locations along the corridor. Mini-roundabouts can generally be installed within the existing footprint of the intersection and should be located at intersections with the highest minor-road traffic for effective functioning. Mini-roundabouts have traversable central islands that allow trucks and other large vehicles to complete turns within their smaller footprint.

# Long-Term Improvements

- Fill all sidewalk gaps along the corridor, providing sidewalks on both sides of the roadway for the full length.
  - Build short greenway connections to neighborhood streets connected to Ransom Road and Silas Creek Parkway to improve area connectivity and provide broader pedestrian and bicycle access to Polo Road.





### PRIORITY CONNECTION: REYNOLDA CAMPUS TO ATHLETICS CAMPUS

### PROJECT NEED

Wake Forest University's Reynolda campus is currently separated from its athletic campus and the University Corporate Center by University Parkway. University Parkway is classified as a principal arterial, with thru travel lanes varying from two to four in each direction at various points between its intersections with Wake Forest Road and Coliseum Drive. The posted speed limit on University Parkway is 45 mph, and local residents complained of fast-moving traffic along this corridor during public input. Annual average daily traffic volumes (AADT) vary from 16,000 to 26,000, and have decreased from higher levels in 2001. Pedestrians were observed crossing the Parkway at several locations between Wake Forest Road and Reynolds Boulevard during fieldwork and pedestrian counts. A sidewalk exists along the western side of the parkway from Polo Road to Coliseum Drive, and the eastern side from Deacon Boulevard to Coliseum Drive.

University Parkway is a barrier to pedestrians and bicyclists travelling between the university's two campuses. The campuses are approximately one mile apart - an appropriate distance for walking and **biking.** There is no designated crossing of the parkway between Long Drive and Deacon Boulevard – a distance of 1.4 miles. Project stakeholders report that many students live in the neighborhoods east of University Parkway and walk across it to access campus near the entrance at Wake Forest Road. A signal was previously requested at this entrance to improve mobility for all modes, but was determined at the time not to meet the necessary warrants. The Corporate Center, athletics facilities, and freshman parking lot located south of Reynolds Boulevard create a desire for safe crossings further south as well. In addition to safety concerns, the lack of activity along the parkway between the Wake Forest Road campus entrance and athletics campus creates a perception that the two campuses are distant.

### **Proposed Improvements**

A high-quality fully-separated multi-use greenway is recommended between the two campuses to improve safety and convenience for pedestrians and cyclists. This connection was also recommended in the 2009 Campus Master Plan. In addition, several crossings and other corridor enhancements are recommended to improve mobility for these modes and the attractiveness of the corridor. Together these improvements will establish the corridor as a multi-modal gateway to the university's two campuses.

- Install a high-visibility crosswalk, median refuge, and High Intensity Activated Crosswalk Beacon (HAWK) north of the Howell Street intersection.
- B Construct a bicycle and pedestrian bridge across the parkway just north of Reynolds Boulevard, taking advantage of the slopes at this location.
- Connect this bridge to the center of the campus with a multi-use trail. Build pocket parks and trail amenities like seating and lighting to create activity nodes along the way.

### Near Term Improvements

- Continue the greenway as a sidepath along Reynolds Boulevard, heading south along Silas Creek, terminating at Baity Street. Provide seating and lighting along the way.
- Build a sidewalk on the east side of University from the HAWK crossing south to the proposed greenway crossing at Reynolds Boulevard

  Improve the sidewalk along the west side of University Parkway south of Reynolds Boulevard
- with landscaped buffers and street trees.

  Provide pedestrian improvements at the signal at Deacon Boulevard including high-visibility
- crosswalks, countdown pedestrian signal heads in every direction, and median refuges.
  - Construct a sidewalk along Cherry Street from Reynolds Boulevard to Deacon Boulevard.

    Reconstruct Baity Street as a curbless festival street to seamlessly tie the stadium to the emerging commercial and tailgate district along this street. Reconstruct the bridge at the end of Baity Street to provide an attractive gateway to BB&T Field.

# Long-Term Improvements



Study the University Parkway corridor between 25th Street and Reynolds Boulevard. Retrofit this roadway to a complete streets cross-section that includes on-road bikeways and buffered sidewalks with street trees. Use the Urban Street Design Guide's Boulevard cross-section as a model for the corridor. This connection will link the 25th Street bike route and the recommended greenway to the two campuses, and aesthetic enhancements will encourage investment along the corridor.







### BEST PRACTICE EXAMPLES & RESOURCES

- The Town of Boone, NC sited two High-Intensity Activated Crosswalk (HAWK) beacons to serve the area near Appalachian State University
- Wall Street in Asheville, NC is a well-designed curbless, shared street

# COST ESTIMATE (NEAR-TERM IMPROVEMENTS)

• \$1,237,875 (Excludes sidewalk enhancements to the existing sidewalk south of Reynolds Boulevard)







### PRIORITY CONNECTION: CAMPUS TO WESTERN NEIGHBORHOODS

### PROJECT NEED

As described in the Polo Road project, many residents in the western study area are isolated by a disconnected roadway network. In particular, many residents in this area are connected solely to Silas Creek Parkway, an urban freeway with over 40,000 AADT. Silas Creek Parkway is a major barrier for pedestrians and bicyclists travelling in both directions: it cuts off neighborhoods from campus and cuts off campus from commercial centers to the northwest and the Silas Creek greenway to the southwest.

On a larger scale, a greenway along Silas Creek, following Silas Creek Parkway, has been proposed in several previous plans and studies. This greenway is constrained by the proximity of the creek to the parkway. This gap between the Silas Creek greenway and the Bethabara greenway prevents a connected greenway network through northwest Winston-Salem

### **Proposed Improvements**

A safe pedestrian and bicycle crossing of Silas Creek Parkway is recommended. Given significant topographic constraints, this crossing is recommended at an existing signalized intersection. The following improvements will provide an effective connection to the neighborhoods west of campus.

- Construct a multi-use greenway through Polo Park to the signal at Silas Creek Parkway, beginning at Polo Road and with a connection to Quincy Drive and Ormond Drive.
- Improve the Silas Creek Parkway signalized intersection with crosswalks, countdown pedestrian signal heads, and median refuges.

# Near-Term Improvements

- Continue the greenway along the bank of the Reynolda Business Center property to the intersection of Reynolda Road and Wake Forest Road.
- Improve the intersection of Reynolda Road and Wake Forest Road with crosswalks, countdown pedestrian signal heads, and median refuges.
- Construct a sidewalk along Silas Creek Parkway from the Wake Forest Road intersection to Hope Valley Road to link residents to the recommended greenway connection.
- Construct short greenway connections between the neighborhood roads west of Silas Creek Parkway to link all residents in this neighborhood to the recommended greenway.

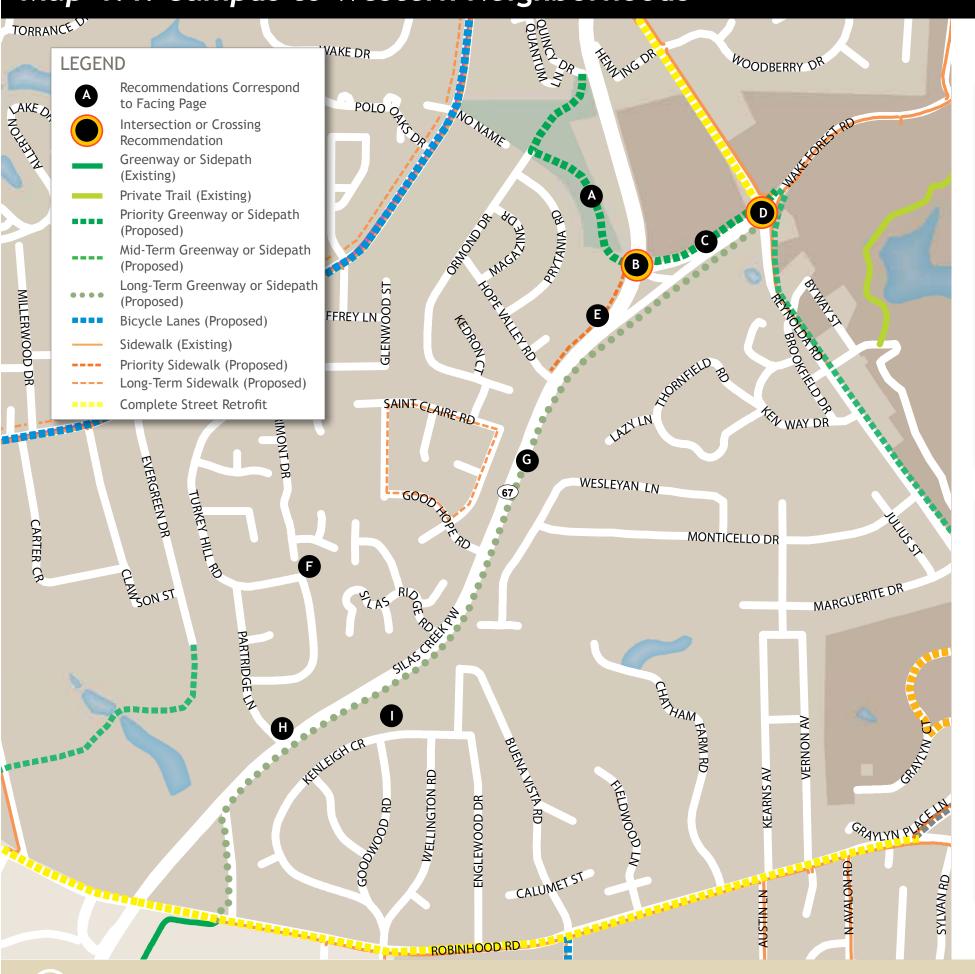
# Construct a greenway along the Silas Creek Parkway linking the existing Silas Creek greenway to the intersection of Reynolda Road and Wake Forest Road.

# Long-Term Improvements

- Construct underpasses or overpasses of the Silas Creek Parkway at Partridge Lane and Silas Ridge Road to connect residents to the recommended greenway.
- Construct short connections to Kenleigh Circle and Wesleyan Lane to connect residents to the recommended greenway.

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### BEST PRACTICE EXAMPLES & RESOURCES

• Neighborhood greenway connections in Chapel Hill, NC allow many residents to walk and bike to school.

### COST ESTIMATE (NEAR-TERM IMPROVEMENTS)

• \$906,185 (Excludes streetscape amenities)







### PRIORITY CONNECTION: CAMPUS TO BETHABARA GREENWAY

### **PROJECT NEED**

Several apartment complexes housing university students are located along Bethabara Road between Silas Creek Parkway and University Parkway. These apartments are located less than one mile from campus, but do not have a safe bicycle or pedestrian route. Bethabara Road is classified as a collector with one thru lane in each direction, a center turn lane, a posted speed limit of 45 mph, and 5000 AADT. Sidewalks are incomplete along Bethabara Road and do not exist along University Parkway between Bethabara Road and the Long Drive sidepath. Additionally, pedestrians and bicyclists have difficulty crossing University Parkway at Long Drive, where no crosswalks or pedestrian signals exist.

Additionally, a connection has been previously proposed to the Bethabara greenway, which terminates at Hayes Forest Drive. A connection through the neighborhoods north of Polo Road and west of University Parkway was originally envisioned, but several constraints limit this alignment. Significant topography through this area makes a paved multi-use trail difficult. The trail section between Old Town Road and Hayes Forest Drive is unpaved and inaccessible to many bicyclists. Further, potential links between the residential roadways of this area would traverse residential properties and may encounter political resistance.

### Proposed Improvements

A complete bicycle and pedestrian connection is recommended between the Bethabara greenway's intersection with Old Town Road and the Long Drive sidepath to provide access to the greenway and university for students, faculty, staff, and residents. This alignment avoids the difficulties of the neighborhood route and takes advantage of a low-cost restripe opportunity along Bethabara Road. The following improvements are recommended.

- Retrofit Bethabara Road between Silas Creek Parkway and University Parkway as a complete street by removing the center turn lane and striping five-foot bicycle lanes with the additional space.
- Reduce the posted speed limit on Bethabara Road to 35 mph.
- Extend the sidewalk on the south side of Bethabara Road to Hayes Forest Drive and install high-visibility crosswalks and pedestrian improvements at this intersection. **Improvements** 
  - Reconfigure the intersection of Bethabara Road and University Parkway to include a pedestrian crossing and slow motor vehicle turning movements (See diagram).
  - Extend the Long Drive sidepath to the intersection of Bethabara Road and University Parkway by narrowing southbound travel lanes, making full use of the right-of-way to the west of University Parkway, and constructing a retaining wall and safety railing between the sidepath and roadway. If needed, purchase additional property west of University Parkway from adjacent landowner at pinch point.
  - Install bicycle and pedestrian improvements at the intersection of Long Drive and University Parkway. These include high-visibility crosswalks, pedestrian signal heads, median refuges, and bicycle detector loops at the Long Drive approaches.
  - Construct a sidepath from the intersection of the Bethabara greenway and Old Town Road to the Silas Creek Parkway.

### Long-Term **Improvements**

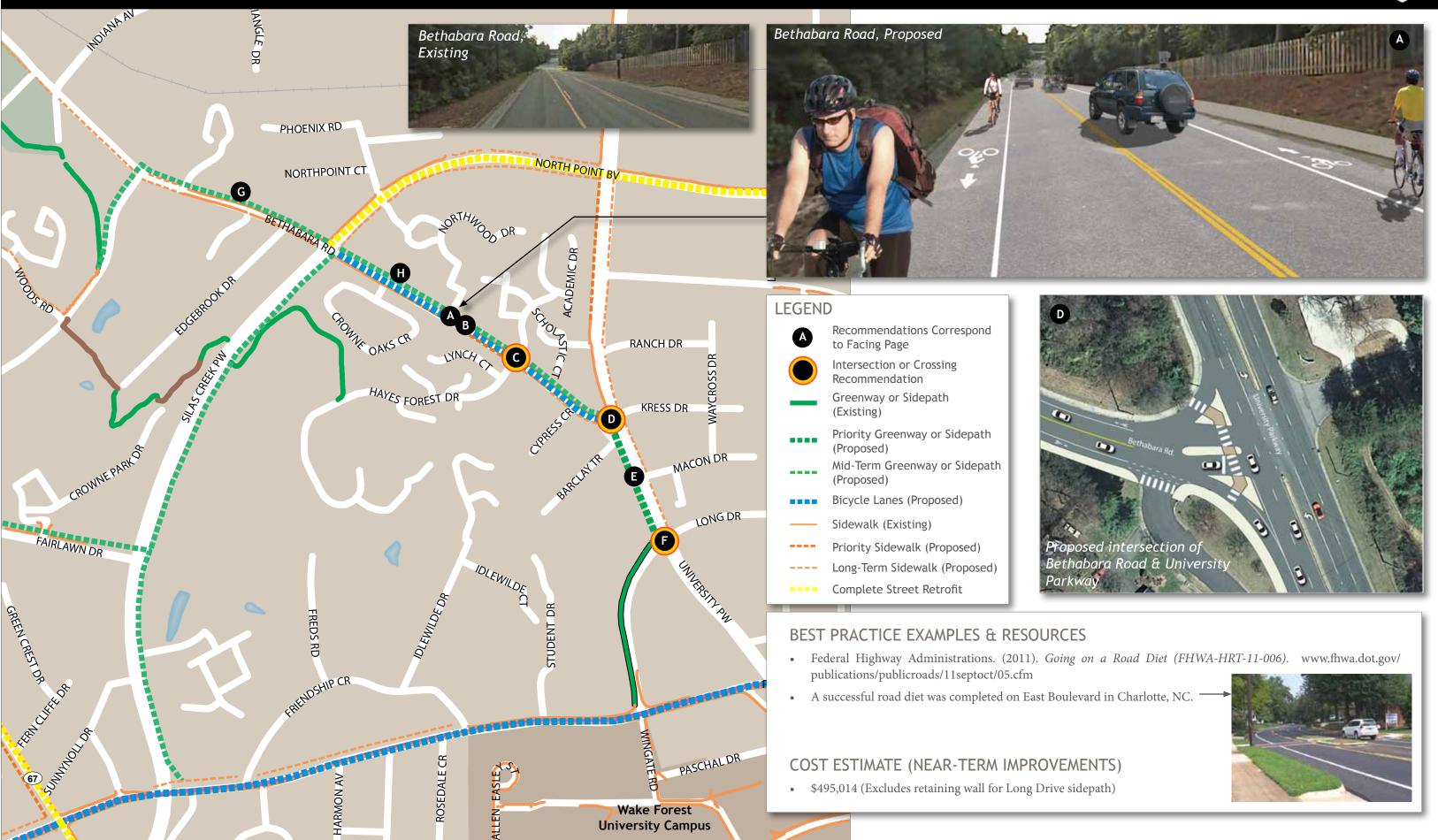
Near-Term

Expand the sidewalk on one side of Bethabara Road between Silas Creek Parkway and University Parkway into a multi-use sidepath and connect the sidepaths on either end to provide a consistent separated facility between the university and Bethabara Park and

4-11

RECOMMENDATIONS





Wake Forest University Area	Winston-Salem, NC

### PRIORITY CONNECTION: CAMPUS TO DOWNTOWN

### PROJECT NEED

Reynolda Road is a major collector with a posted speed limit of 35 mph, 16,000 AADT north of Coliseum Drive, and 15,000 AADT to the south decreasing to 8,300 AADT south of Stratford Road. This road provides a critical link from campus towards the Downtown area for cyclists, and a critical connection between neighborhoods and recreational trails of the Reynolda Historic District for pedestrians. Bike lanes exist along Reynolda Road north of Robinhood Road but stop at Stratford Road. A low-traffic roadway entrance to the Reynolda Historic District with a multiuse trail connection to campus begins near the intersection of Graylyn Court. While many novice or recreational cyclists make use of the posted bike route through the neighborhoods west of Reynolda Road to connect to this entrance via Graylyn Court, this route requires additional distance and stopping and is not ideal for utilitarian cycling. Many utilitarian cyclists enter Reynolda Road from

Stratford Road, which provides a direct connection from the five points intersection and is funded for bike facilities in the Long Range Transportation Plan.

Sidewalks are incomplete along Reynolda Road between Avon Road and By Way Street. Pedestrian intersections accommodations are not provided at Graylyn Court or Coliseum Drive. Currently, bicyclists and pedestrians are using the corridor despite a lack of facilities. Pedestrians have created a foot path along Reynolda Road north of Coliseum Drive. Many cyclists and pedestrians were observed along Reynolda Road and crossing Reynolda Road at Graylyn Court during field counts, despite adverse weather conditions.

Reynolda Road also acts as a barrier to cyclists making use of the signed bike route along Arbor Road. This bike route otherwise provides a low-traffic alternative to Coliseum Drive.

### Proposed Improvements

A multi-use sidepath is recommended along Reynolda Road north of Coliseum Drive in the short-term, while a complete streets retrofit with bike lanes and sidewalks is recommended along Reynolda Road from Avon Road to Coliseum Drive in the long-term. In addition, pedestrian crossing facilities and bicycle crossing improvements should be added at multiple locations.

- A Construct a sidepath along Reynolda Road from Coliseum Drive to Graylyn Court.
- Improve the intersection of Reynolda Road and Coliseum Drive with crosswalks, countdown pedestrian signal heads, and curb ramps.
- Add a bicycle/pedestrian crossing of Reynolda Road on the north side of the Graylyn Court intersection to include a median refuge island, high-visibility marked crosswalk, crosswalk signage, and a pedestrian-activated Rectangular Rapid Flash Beacon.

### Near-Term Improvements

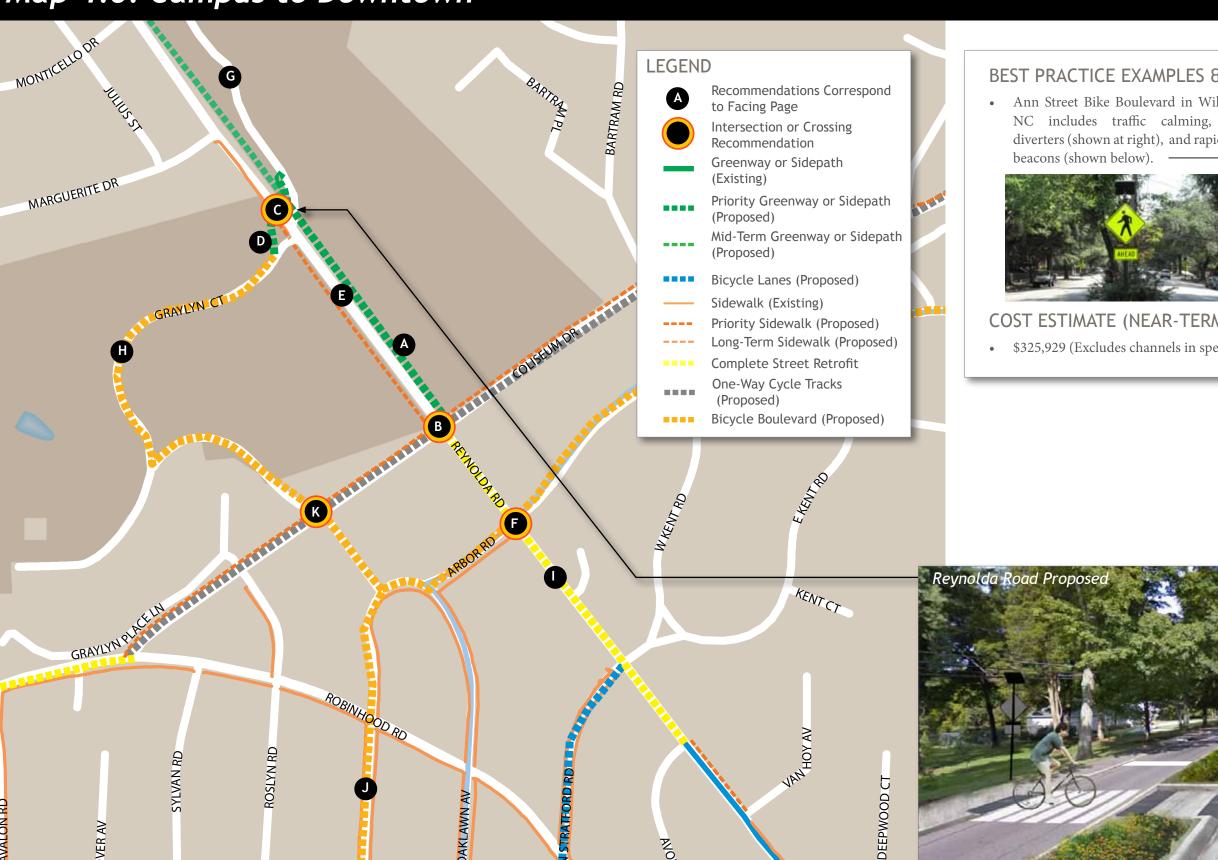
- Construct a short greenway diagonally connecting Graylyn Court and the Historic District roadway entrance to lead pedestrians and cyclists directly to the proposed crossing.
- Install a planted median north of Coliseum Drive between the beginning of the southbound left-turn lane and the turning space for the Graylyn Court intersection. This median will slow traffic as it nears the proposed pedestrian crossing at Graylyn Court.
- Add a median bicycle refuge and diverter at Arbor Road to reduce non-local traffic movement along the Arbor Road/25th Street signed bike route and recommended bicycle boulevard. This refuge will facilitate bicyclists crossing Reynolda Road.
- Stripe a southbound bike lane and northbound sharrows on the road heading to the historic district to make clear that the road is designated for two-way bike traffic.
- Provide channels for cyclists on speed humps on Graylyn Court.
- Implement a complete streets retrofit from Avon Road to Coliseum Drive providing bicycle lanes and sidewalks, and construct a short sidewalk connection from Avon Road to Van Hoy Avenue. This will require roadway widening within existing right-of-way.

### Long-Term Improvements

- Shift the Oaklawn Avenue bike route to Arbor Road heading south for a more direct connection toward downtown, and make improvements to formalize this route as a bicycle boulevard. A variety of traffic calming and volume management strategies may be used. Consult the NACTO Urban Bikeway Design Guide for specific strategies.
- K Improve the crossing of Graylyn Court and Coliseum Drive with crosswalks and signage.

SPRING GARDEN RD





### BEST PRACTICE EXAMPLES & RESOURCES

• Ann Street Bike Boulevard in Wilmington, NC includes traffic calming, signage, diverters (shown at right), and rapid flashing





### COST ESTIMATE (NEAR-TERM IMPROVEMENTS)

• \$325,929 (Excludes channels in speed humps on Graylyn Court)





# PROPOSED BICYCLE IMPROVEMENTS

A phased approach is recommended to improve bicycle conditions across the study area. This approach begins with the recommended priority projects, which should then be further connected by a set of low-cost striping projects. In the long term, several major roadways require a more extensive redesign to safely support all modes, as well as to support business success and expansion. The following phased strategy is recommended:

- Short-Term Striping Projects Several roadways in the study can accommodate on-road bikeways within their existing configuration. Recommended projects in this category can be implemented by restriping roadways, with no curb changes or roadway widening necessary.
- Interim Redesign Strategies Several roadways in the study have excess capacity that can accommodate innovative bikeways called 'cycle tracks'. Cycle tracks are recommended to be implemented in two phases an interim redesign using striping and temporary barriers, followed by observation and testing. Cycle tracks can then be formalized with permanent structures upon successful community buy-in.
- Complete Street Retrofits Several major corridors in the study area require full roadway reconfiguration to safely and effectively accommodate bicyclists, pedestrians, and vehicular traffic. Retrofits are recommended that will support the long-term needs of the transportation system while spurring economic development and street vitality through context-sensitive design.

The recommendations for each roadway that is a part of this phasing strategy were carefully selected based on current roadway characteristics as well as future planned characteristics. In each of the three following pages, a table of details is provided for each bikeway recommendation. The attributes in that table are defined here:

• **TYPE** - The type of facility recommended. These types were defined at the beginning of this chapter. For the complete street retrofits, the type represents the type of street cross-section that is recommended,

- which includes another facility type in it, such as a bike lane or cycle track.
- METHOD The method of implementing the recommended bikeway. In some cases, a stripe of paint will suffice to fit a bike lane, while in others more extensive reconstruction is necessary.
- PHASE The recommended phase of implementation of the project. Phasing should be considered flexible and projects implemented as opportunities arise.
- ROW The right-of-way owned by the City of Winston-Salem
- ROW (2035) The recommended minimum future right-of-way, in accordance with long range plans
- SPEED The current speed limit
- **SPEED** (2035) The recommended future speed limit, in accordance with long range plans
- **VOLUME** The most recently recorded annual average daily traffic volume
- VOLUME (2035) The anticipated future annual average daily trafifc volume, based on current models
- LANES The total number of vehicle lanes
- LANES (2035) The recommended future number of vehicle lanes, in accordance with long range plans
- WIDTH The current street width
- PROPOSED LANES The recommended number of lanes based on the findings of this study
- **PROPOSED SPEED** The recommended speed limit based on the findings of this study
- PRIORITY CONNECTION AND/OR
   INCLUSION IN THE 2035 TRANS. PLAN The
   timeline for funding for those projects currently
   included in the 2035 Transportation Plan Update.
   Those projects include in a priority corridor are
   listed as such in this column.



#### SHORT-TERM STRIPING PROJECTS

Many roadways in Winston-Salem, as across North Carolina, were constructed based on assumptions that are no longer considered best practice for roadway design. First, roadways were designed with wide lanes to accommodate observed speeds and control vehicles rather than target speeds and design vehicles (See Best Practices – Design Controls). Second, roadways were constructed for anticipated future traffic volumes based on transportation models that do not account for changing transportation preferences that have since been observed. Third, a high level of service for motor vehicle traffic has been considered a primary goal of street design, while not considering levels of service for other modes.

As a result of these assumptions, many roadways across the study area have excess lane width capacity or excess lanes. This presents a low-cost opportunity to retrofit these roadways during resurfacing projects, or as standalone repainting projects, to accommodate bicycle lanes. In some cases, speed reduction is recommended in conjunction with restriping to improve safety for bicyclists and pedestrians and better match the context of these urban roadways.

Restriping projects are shown on Map 4.7 and summarized in Table 4.1. The method of implementing the short-term striping projects falls into one of the two categories below.

- Stripe: Projects that require only the striping of a bicycle lane, with no other changes needed to the roadway.
- Road Diet: Projects reducing the number of travel lanes to accommodate bicycle lanes. Road diets typically change four-lane roads to three-lane roads with one center turn lane and have traffic calming benefits. These projects can occur during roadway resurfacing projects.

Table 4.1 Proposed Short-Term Striping Projects (data is left blank where not available)

NAME	FROM	то	ТҮРЕ	METHOD	PHASE	ROW*	ROW* (2035)	SPEED*	SPEED* (2035)
Bethabara Rd	Silas Creek Pkwy	University Pkwy	Bike Lane	Road Diet	Priority	72	80	45	45
Polo Rd	Reynolda Rd	University Pkwy	Bike Lane	Road Diet	Priority	60	80	35	35
Buena Vista Rd	Robinhood Rd	Reynolda Rd	Bike Lane	Stripe	Mid	60	85	35	35
Cherry St	Craft Dr	Reynolds Blvd	Bike Lane	Road Diet	Mid	60	110	35	35
Northwest Blvd	Reynolda Rd	Broad St	Sharrows	Stripe	Mid	50	85	25	25
Patrick Ave	Twenty-Eighth St	Twenty-Fifth St	Sharrows	Stripe	Mid	-	-	-	-
Patterson Ave	Burnham Dr	Indiana Ave	Bike Lane	Road Diet	Mid	150	110	35	35
Polo Rd**	Cherry St	Indiana Ave	Bike Lane	Road Diet	Mid	60	75	35	35
Polo Rd**	Robinhood Rd	Reynolda Rd	Bike Lane	Road Diet	Mid	60	80	35	35
Polo Rd	University Pkwy	Cherry St	Bike Lane	Stripe	Mid	60	80	35	35
Reynolda Rd	Buena Vista Rd	Northwest Blvd	Bike Lane	Stripe	Mid	60	110	35	35
Robinhood Rd	Coliseum Dr	Reynolda Rd	Buffered Bike Lane	Stripe	Mid	50	75	45	45
Stratford Rd	Country Club Rd	Reynolda Rd	Bike Lane	Stripe	Mid	60	85	35	35

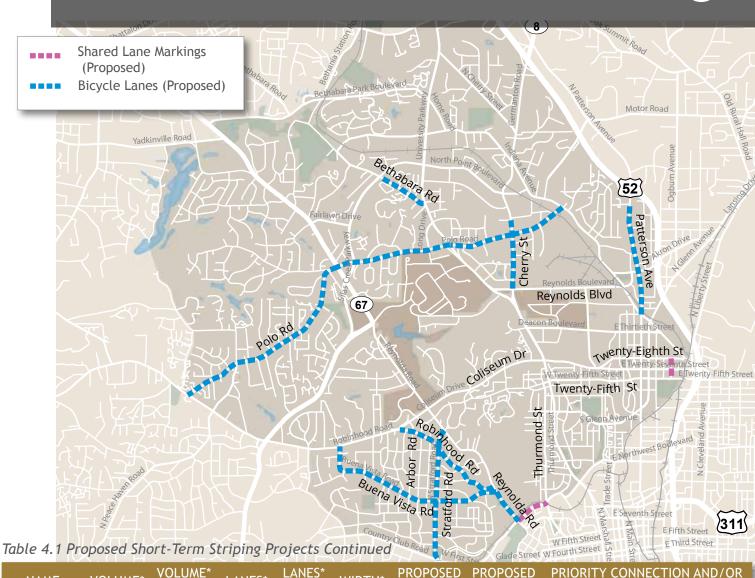
\*Where condition varies, typical condition is listed \*\*See Priority Connection: Polo Road for details on additional construction needed for this striping project

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### Map 4.7: Short-Term Striping Projects





NAME	VOLUME*	VOLUME* (2035)	LANES*	LANES* (2035)	WIDTH*	PROPOSED LANES	PROPOSED SPEED	PRIORITY CONNECTION AND/OR INCLUSION IN 2035 TRANS. PLAN
Bethabara Rd	5200	7000	3	3	36	2	35	Campus to Bethabara
Polo Rd	15000	18000	3	3	36	2	35	Polo Road
Buena Vista Rd	4500	5700	2	2	30	2	35	Funded (2016-2025)
Cherry St	8400	10200	4	4	52	3	35	Funded (2026-2035)
Northwest Blvd	8300	7200	2	2	34	2	25	Funded (2016-2025)
Patrick Ave	-	-	-	-	-	2	25	
Patterson Ave	1900	2200	4	4	48	3	35	Partially Funded (2026-2035)
Polo Rd	7000	9800	4	2	44	3	35	Polo Road, Funded (2026-2035)
Polo Rd	12000	18700	3	3	36	2	35	Polo Road
Polo Rd	7000	10600	2	3	29	2	35	Polo Road, Funded (2026-2035)
Reynolda Rd	13000	21300	4	4	46	3	35	Funded (2026-2035)
Robinhood Rd	4300	7800	2	2	34	2	35	Funded (2026-2035)
Stratford Rd	16000	18700	2	2	30	2	35	Funded (2012-2015)

<sup>\*</sup>Where condition varies, typical condition is listed



#### INTERIM REDESIGN STRATEGIES

"An interim design can serve as a bridge to the community, helping to build support for a project and test its functionality before going into construction"

- NACTO Urban Street Design Guide

Several roadways in the study area have the roadway width to support fully protected on-street bikeways called 'Cycle Tracks'. Cycle tracks include vertical separation from motor vehicle traffic in the form of raised planted medians or bollards. Planted medians can serve additional purposes as stormwater catchments and aesthetic enhancements. Cycle tracks have been implemented in cities in the southeast, including Atlanta, GA, and St. Petersburg, FL. Cycle tracks require careful design at intersections, and they may require additional accommodations like bicycle signal phases.

Given the greater investment required to effectively implement cycle tracks and the fact that no cycle tracks currently exist in Winston-Salem, an interim design strategy is recommended to implement cycle track corridors at a lower cost while building community support for their full implementation. Interim design strategies get facilities on the ground more quickly while building support for projects and are gaining popularity.

They can also be used to test functionality before full construction.

An interim approach is recommended first on Coliseum Drive, Twenty-Seventh Street, and Twenty-Eighth Street. The interim approach will allow the City to observe impacts on traffic patterns, particularly during events at Wake Forest University's athletic campus. The following approach is recommended:

- Post signs in advance of restriping warning motorists of coming changes.
- Work with the police department to monitor traffic patterns after restriping and issue warnings to motorists who drive in the revised facility.
- Encourage biking to events on the athletic campus after interim changes through promotion and the provision of temporary bicycle parking at events. Model the Durham Bull's recent 'Bike to the Ballpark' approach.

Pending an evaluation of the interim approach on the Coliseum/27th/28th corridor, consider a similar strategy on Reynolds Boulevard.

Table 4.2 Proposed Interim Redesign Strategies

NAME	FROM	то	TYPE	METHOD	PHASE	ROW*	ROW* (2035)	SPEED*	SPEED* (2035)
Coliseum Dr	Robinhood Rd	Shorefair Dr	Cycle Track	Retrofit	Mid	90	110	35	35
Twenty-Eighth St	Shorefair Dr	Indiana Ave	Cycle Track	Retrofit	Mid	60	85	35	35
Twenty-Seventh St	Shorefair Dr	Patrick Ave	Cycle Track	Retrofit	Mid	50	85	35	35
Reynolds Blvd	University Pkwy	Akron Dr	Cycle Track	Retrofit	Long	90	110	35	35
Shorefair Dr	Reynolds Blvd	Twenty-Fifth St	Cycle Track	Retrofit	Long	60	110	35	35

<sup>\*</sup>Where condition varies, typical condition is listed

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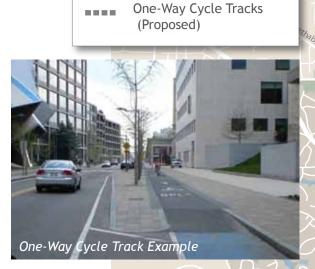
### Map 4.8: Interim Redesign Projects



Motor Road

**52** 







E Fifth Stre

Table 4.2 Proposed Interim Redesign Strategies Continued

						1.31	Ten	
NAME	VOLUME*	VOLUME* (2035)	LANES*	LANES* (2035)	WIDTH*	PROPOSED LANES	PROPOSED SPEED	PRIORITY CONNECTION AND/OR INCLUSION IN 2035 TRANS. PLAN
Coliseum Dr	11000	15400	4	4	60	2	35	Funded (2016-2025)
Twenty-Eighth St	1400	1600	2	2	34	1	25	Funded (2026-2035)
Twenty-Seventh St	2200	3000	2	2	30	1	25	Funded (2026-2035)
Reynolds Blvd	4900	7200	4	4	52	2	35	
Shorefair Dr	2300	2600	4	4	52	2	35	

<sup>\*</sup>Where condition varies, typical condition is listed



# COMPLETE STREET RETROFITS AND GREENWAYS/SIDEPATHS

The short-term restriping and interim redesign strategies described previously will greatly expand the bicycling network within the study area. Several major corridors within the study area require more intensive reconstruction, however, to safely accommodate all modes. A full complete streets retrofit is recommended on each of these corridors. In addition, off-road greenway and sidepath connections are recommended to serve both bicyclists and pedestrians and complement the on-road network for 'interested but concerned' cyclists. See Proposed Pedestrian Improvements for a table of proposed greenways and sidepaths.

For each retrofit, the proposed cross-section corresponds to the street type and available right-of-way. The following complete streets cross-sections are recommended on the streets indicated on Map 4.9 and in Table 4.3. Street types are based on the *NCDOT Complete Streets Guide* with updates from the more recent *NACTO Urban Street Design Guide*. These cross-sections should also be applied to any roadway in the study area that undergoes full reconstruction, whether or not it is included in one of the previous categories. Bike boulevards are represented as their own category in Map 4.9 since shared streets are recommended along these corridors rather than modal separation.

#### **Parkway**

A parkway operates with controlled access and carries high traffic volumes and moderate to high speeds. A separated multi-use path accommodates pedestrians and cyclists along a parkway.

#### **Boulevard**

A boulevard separates large streets into parallel realms divided by a planted center median. Boulevards may include a shared, low-speed frontage road that is shared by all users and separated by a planted median. Alternatively, a protected bikeway may be appropriate. Wide sidewalks with planted buffers should be provided.

#### Avenue

An avenue may function as an arterial or collector carrying a range of traffic volumes. An avenue should always have sidewalks and a delineated on-street bikeway, and it may have on-street parking. Avenues may include a center turn lane with intermittent landscaped islands.

#### Bicycle Boulevard

A bicycle boulevard is designed to give bicycle traffic priority and has low motorized traffic volumes and speed. Bicycle boulevards use a variety of traffic calming, signage, and volume management strategies. Detailed guidance on bicycle boulevard design is provided in the NACTO Urban Bikeway Design Guide.

Table 4.3 Proposed Complete Street Retrofits (data is left blank where not available)

NAME	FROM	то	TYPE	METHOD	PHASE	ROW*	ROW* (2035)	SPEED*	SPEED* (2035)
Reynolda Rd	Coliseum Dr	Avon Rd	Complete Street	Avenue	Priority	60	60	35	35
Arbor Rd	Reynolda Rd	Northwest Blvd	Bike Boulevard	Misc	Long	-	-	-	-
Bethabara Park Blvd	Reynolda Rd	Indiana Ave	Complete Street	Boulevard	Long	60	110	45	45
Fairlawn Dr	Polo Rd	Reynolda Rd	Complete Street	Avenue	Long	120	110	35	35
Indiana Ave	Bethabara Park Blvd	Twenty-Eighth St	Complete Street	Boulevard	Long	60	110	45	45
North Point Blvd	Bethabara Rd	Indiana Ave	Complete Street	Boulevard	Long	70	110	45	45
Reynolda Rd	Bethabara Park Blvd	Polo Rd	Complete Street	Boulevard	Long	90	110	35	35
Reynolda Rd	Polo Rd	Wake Forest Rd	Complete Street	Boulevard	Long	52	110	35	35
Robinhood Rd	Polo Rd	Silas Creek Pkwy	Complete Street	Avenue	Long	60	110	35	35
Robinhood Rd	Silas Creek Pkwy	Coliseum Dr	Complete Street	Avenue	Long	60	80	35	35
Twenty-Fifth St	Oaklawn Ave	Proposed Rail Trail	Bike Boulevard	Misc	Long	60	75	35	35
University Pkwy	Reynolds Blvd	Twenty-Fifth St	Complete Street	Boulevard	Long	110	110	45	45
Thurmond St	Twenty-Fifth St	Northwest Blvd	Bike Boulevard	Misc	Long	50	85	35	35

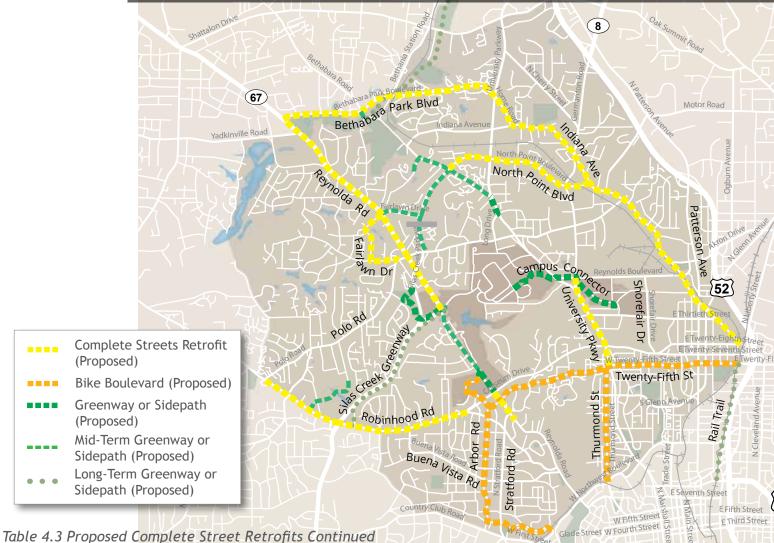
\*Where condition varies, typical condition is listed

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### Map 4.9: Complete Street Retrofits, Bike Boulevards, and Greenways/Sidepaths





NAME	VOLUME*	VOLUME* (2035)	LANES*	LANES* (2035)	WIDTH*	PROPOSED LANES**	PROPOSED SPEED**	PRIORITY CONNECTION AND/OR INCLUSION IN 2035 TRANS. PLAN
Reynolda Rd	7000	8600	2	2	36			Campus to Downtown
Arbor Rd	-	-	-	-	-	2	25	
Bethabara Park Blvd	9200	13100	4	4	46			
Fairlawn Dr	9900	12800	5	4	64			
Indiana Ave	13000	18200	5	4	56			Partially Funded (2026-2035)
North Point Blvd	18000	27800	5	4	64			Partially Funded (2026-2035)
Reynolda Rd	26000	31500	4	4	50			
Reynolda Rd	19000	25600	4	4	40			
Robinhood Rd	28000	41900	4	4	44			
Robinhood Rd	15000	22700	3	3	35			
Twenty-Fifth St	2400	2700	2	2	34	2	25	
University Pkwy	22000	33800	6	4	94			
Thurmond St	5600	6200	2	2	36	2	25	Funded (2016-2025)

<sup>\*</sup>Where condition varies, typical condition is listed \*\*To be determined for Complete Streets Retrofits



#### **BICYCLE PARKING**

Bike parking is an essential, but often forgotten, component of a complete bicycle network. Well-designed and well-placed bike parking at key destinations makes cycling a feasible option for trips to work, the grocery store, shopping, parks, and schools. Parking should be abundant, secure, and complementary to the surrounding streetscape. It should be as convenient as motor vehicle parking. Bike parking can be broadly defined as either short-term or long-term parking:

- Short-term parking is meant to accommodate visitors, customers, messengers and others expected to depart within two hours; requires approved standard rack, appropriate location, and installation. (Image: right, above)
- Long-term parking is meant to accommodate employees, students, residents, commuters, and others expected to park more than two hours. This parking is to be provided in a secure, weatherprotected manner and location.

Short-term bicycle parking facilities include racks which permit the locking of the bicycle frame and at least one wheel to the rack and support the bicycle in a stable position without damage to wheels, frame, or components. Short-term bicycle parking is currently provided in several locations on-campus (see below), but should be expanded off-campus at key destinations like commercial centers. Long-Term parking is not currently provided, and should be added on campus to serve commuters. For more resources and suggestions on long-term bicycle parking, see the Policies and Programs section.



Short-term bicycle parking on the Wake Forest University campus



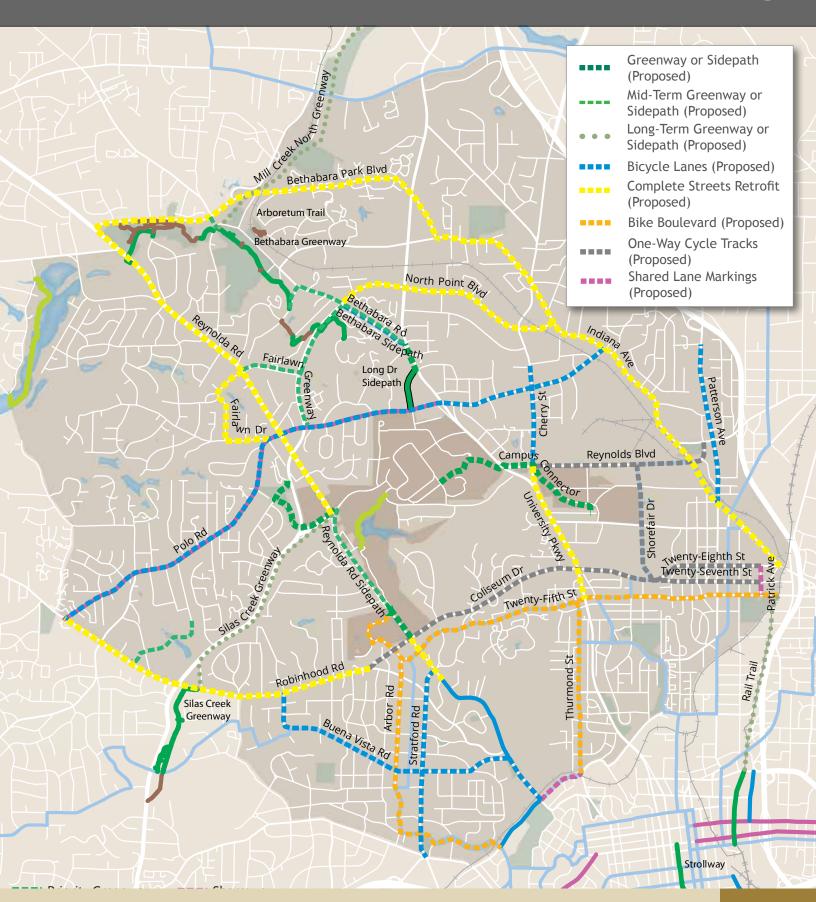
Long-term parking is an important ancillary facility needed for those parking their bicycles for more than two hours.



# Map 4.10: Full Proposed Bike Network -

1 1 MILE







# PROPOSED PEDESTRIAN IMPROVEMENTS

In the long term, a full network of walkways is recommended along all avenues and boulevards and select neighborhood streets. In the short term, key sidewalk gaps and intersection improvements are recommended that will greatly increase connectivity and safety for pedestrians. Gaps and intersections were selected based on access to destinations, access to transit, presence of collisions, and roadway type.

Key short- and long-term sidewalk recommendations are presented in Table 4.5. Fifteen sidewalk gaps are considered short-term priorities, six of which were recommended as part of priority projects. Recommended intersection improvements are presented in Table 4.6. Five intersections are short-term priorities for improvement, in addition to eight intersection improvements that were recommended as part of priority projects.

A network of greenways and sidepaths is recommended to complement the sidewalk network, serve pedestrians and cyclists along high-traffic roadways, and provide recreation opportunities for all user types. Recommended greenways and sidepaths are shown in Map 4.11 and summarized in Table 4.4.

Table 4.4 Proposed Greenways and Sidepaths

NAME	FROM	то	PHASE	PRIORITY CONNECTION AND/OR INCLUSION IN 2035 TRANS. PLAN
Campus Connector	Wingate Rd	Baity St	Priority	Campus to Athletics
Graylyn Connector	Graylyn Ct	Reynolda Hist. District Entrance	Priority	Campus to Downtown
Hope Valley Greenway	Polo Park	Reynolda Rd	Priority	Campus to Neighborhoods
Reynolda Rd Sidepath	Graylyn Ct	Coliseum Dr	Priority	Campus to Downtown
University Pkwy Sidepath	Long Dr	Bethabara Rd	Priority	Campus to Bethabara
Bethabara Greenway Connector	Bethabara Greenway	North Point Blvd	Mid	Campus to Bethabara
Bethabara Greenway Connector	Bethabara Park Blvd	Bethabara Greenway	Mid	
Bethabara Sidepath	North Point Blvd	University Pkwy	Mid	Campus to Bethabara
Fairlawn Greenway	Reynolda Rd	Polo Rd	Mid	
Reynolda Rd Sidepath	Polo Rd	Graylyn Ct	Mid	
Robinhood Connector	Robinhood Rd	Evergreen Dr	Mid	
Silas Creek Greenway North	Fairlawn Dr	Bethabara Rd	Mid	
Mill Creek North Greenway	Bethabara Greenway	Hanes Mill Rd	Long	Funded (2016-2025)
Rail Trail	Twenty-Fifth St	Martin Luther King Jr Dr	Long	Funded (2016-2025)
Silas Creek Greenway	Robinhood Rd	Reynolda Rd	Long	Campus to Neighborhoods



Map 4.11: Recommended Pedestrian Improvements

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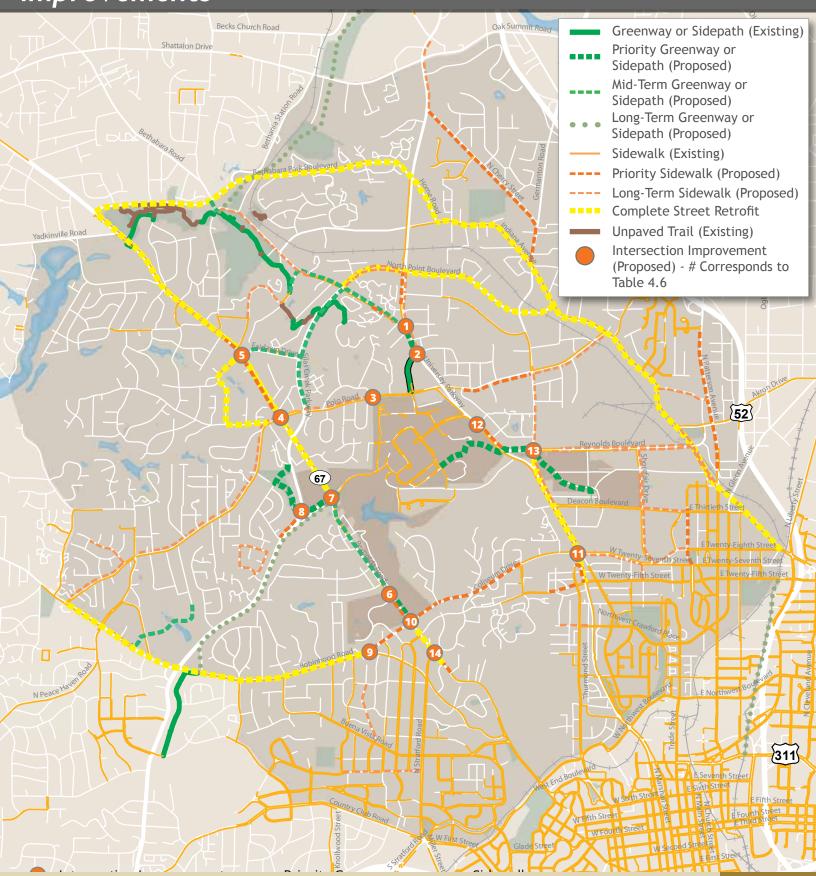




Table 4.5 Proposed Sidewalks

NAME	FROM	ТО	PHASE	PRIORITY CONNECTION AND/OR INCLUSION IN 2035 TRANS. PLAN
Bethabara Rd	Northwood Dr	Hayes Forest Dr	Priority	Campus to Bethabara
Cherry St	University Pkwy	North Point Blvd	Priority	
Coliseum Dr	Reynolda Rd	Pilgrim Ct	Priority	
Coliseum Dr	Robinhood Rd	Reynolda Rd	Priority	
Greenway Ave	Thirtieth St	Twenty-Seventh St	Priority	Funded (2012-2015)
Patterson Ave	Burnham Dr	Twenty-Third St	Priority	Funded (2012-2015)
Polo Rd	Brookwood Dr	Cherry St	Priority	Polo Road, Funded (2012-2015)
Reynolda Rd	Avon Rd	Van Hoy Ave	Priority	Campus to Downtown
Reynolda Rd	Fairlawn Dr	Polo Rd	Priority	
Reynolda Rd	Graylyn Ct	Coliseum Dr	Priority	Campus to Downtown
Silas Creek Pkwy	Hope Valley Rd	Wake Forest Rd	Priority	Campus to Neighborhoods
Twenty-Fifth St	Kirkwood St	Thurmond St	Priority	Funded (2012-2015)
University Pkwy	Howell St	Reynolds Blvd	Priority	Campus to Athletics
University Pkwy	North Point Blvd	Bethabara Rd	Priority	
University Pkwy	Twenty-Seventh St	Twenty Fifth St	Priority	
Abingdon Wy	Briarpatch Ln	Polo Rd	Long	Funded (2016-2025)
Bethabara Rd	Bethabara Greenway	Oldtown Rd	Long	Funded (2016-2025)
Bethabara Rd	Hayes Forest Dr	University Pkwy	Long	Campus to Bethabara
Cherry St	Polo Rd	Reynolds Blvd	Long	Funded (2012-2015)
Collins St	Twenty-Seventh St	Twenty-Fifth St	Long	Funded (2012-2015)
Forest Dr	Dartmouth Rd	Stratford Rd	Long	Funded (2012-2015)
Indiana Ave	Akron Dr	Patterson Ave	Long	
North Point Blvd	Bethabara Rd	University Pkwy	Long	
Perimeter Point Blvd	Indiana Ave	Patterson Ave	Long	Funded (2016-2025)
Polo Rd	Cherry St	Indiana Ave	Long	Polo Road
Polo Rd	Petree Rd	Reynolda Rd	Long	Polo Road
Polo Rd	University Pkwy	Rosedale Cr	Long	Polo Road
Polo Rd	Wimberly Ln	Abingdon Wy	Long	Polo Road
Reynolds Blvd	Cherry St	Indiana Ave	Long	
Shorefair Dr	Reynolds Blvd	Twenty-Seventh St	Long	
St Claire/ St George/ Good Hope	Saint George Rd	Saint Claire Rd	Long	Funded (2012-2015)
Thirtieth St	Shorefair Dr	Greenway Ave	Long	
Twentieth St	K Court Ave	Harrison Ave	Long	Funded (2012-2015)
Twenty-Eighth St	Shorefair Dr	Greenway Ave	Long	
Twenty-Seventh St	University Pkwy	Collins St	Long	Funded (2012-2015)
University Pkwy	Cherry St	Hanes Mill Rd	Long	Funded (2016-2025)
University Pkwy	North Point Blvd	Long Dr	Long	Funded (2016-2025)
University Pkwy	Reynolds Blvd	Deacon Blvd	Long	Campus to Athletics
Westover	Spring Garden Rd	Buena Vista Rd	Long	Funded (2016-2025)
Woods Rd	Columbine Dr	Oldtown Rd	Long	Funded (2012-2015)



Table 4.6 Proposed Intersection Improvements

ID	NAME	COUNTDOWN SIGNALS	HIGH-VIS. MARKED CROSSWALK	IMPROVE CURB RAMPS	MEDIAN REFUGE	ADDITIONAL NOTES
1	Bethabara Road & University Parkway		$\checkmark$	$\checkmark$		Crossing improvements across Bethabara only; Consider removal of free-flow right turn lane; if kept, transform pork chop island to refuge island
2	University Parkway & Long Drive	$\checkmark$	$\checkmark$	$\checkmark$		Transform pork chop island to refuge island; consider curb radius reduction
3	Polo Road & Friendship Circle		$\checkmark$		$\checkmark$	Part of overall corridor improvement to include roundabout
4	Polo Road & Reynolda Road	$\checkmark$	$\checkmark$	$\checkmark$		Consider curb radius reduction and extension of existing median islands to refuge islands
5	Reynolda Road & Fairlawn Road	$\checkmark$	$\checkmark$	$\checkmark$		Consider curb radius reduction
6	Reynolda Road & Graylyn Court		$\checkmark$	$\checkmark$	$\checkmark$	Add advanced crosswalk signage; consider flashing lights
7	Reynolda Road & Wake Forest Road	$\checkmark$	$\checkmark$	$\checkmark$		Further study needed on placement of crosswalk of Wake Forest Road and possible conversion of pork chop islands to refuge islands (campus side);
8	Silas Creek Prkwy & Wake Forest Road	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	Transform pork chop island to refuge island and enlarge; Consider improvement of existing median island to refuge island
9	Robinhood Road & Coliseum Drive		$\checkmark$	$\checkmark$		Sidewalk needed along north side of Robinhood; consider curb radius reduction; utilize islands as refuges
10	Reynolda Road & Coliseum Drive	$\checkmark$	$\checkmark$	$\checkmark$		
11	Coliseum Drive & University Parkway	$\checkmark$	$\checkmark$	$\checkmark$		Improve pork chop refuge islands
12	University Parkway & Howell Street		$\checkmark$		$\checkmark$	HAWK signal recommended.
13	Reynolds Boulevard & Cherry Street	$\checkmark$	$\checkmark$	$\checkmark$		Consider improvement of existing median islands to refuge islands
14	Reynolda Road & Stratford Road	$\checkmark$	$\checkmark$			Consider bicycle detection on Stratford Road



# PROPOSED TRANSIT IMPROVEMENTS

The following recommendations will improve the transit system, making it more accessible and convenient for all residents of the study area and the university community.

- Contract with apartment complexes to help cover operating costs of Ride the Wake Shuttles The University should partner with area apartment complexes to receive some degree of fee from the complexes to help cover the cost of operating services to that complex. Even a small fee helps support the system. This also provides a mechanism for complexes that are not part of the service to "buy in" to the service for expansions in the future. An option for a fee would be to institute a distance-based fee structure so the fee increases the further from campus a complex is.
- Increase the number of complexes serviced by the Ride the Wake Shuttles As funding and interest dictate, the University should expand service to additional complexes that show a possibility of supporting good levels of ridership.
- Increase shuttles to shopping and entertainment destinations The University should expand the days and times that the Hanes Mall shuttle operates and consider new shopping destinations that could be served, like Sherwood Plaza Shopping Center, University Plaza Shopping Center, or Old Town Shopping Center.
- Partner with WSTA on a downtown shuttle The downtown shuttle that the University operates on Thursday, Friday, and Saturday evenings is not well-known or utilized, in part because it doesn't keep a consistent schedule. This route should be formalized to run on a regular schedule, and the University should consider coordinating this service with WSTA since WSTA Route 5 currently connects the campus and downtown. WFU should also coordinate marketing strategies with WSTA regarding Route 5 to help advertise this route on campus and raise its visibility to WFU employees and students.

- Explore partnerships with other area agencies

   As the WFU shuttle service expands, it may be beneficial to explore how the service is run and administered whether it remains in house, is contracted out to PART or WSTA, or is joined with the Bowman-Gray medical shuttle to realize greater operating and administrative efficiencies.
- Coordinate with WSTA on the on-campus stop location and amenities WSTA is considering ending service onto the campus for Route 5 and changing this route to only stop adjacent to the campus. Although WSTA boardings and alightings on campus are currently few, moving the stop location adjacent to campus would make WSTA service less convenient for campus access. WFU should work with WSTA to retain the stop on campus and add amenties at this stop to increase its visibility and comfort for current and potential users.
- Coordinate with WSTA on near-campus stop locations and stop amenities Stops on and around campus should be coordinated with WFU and the WFU shuttles. Stop amenities should be provided to make the wait for transit more comfortable and to increase the visibility of stops. The current WSTA ridership is primarily comprised of employees who will benefit from improved amenities, but nicer stops may also help with visibility and encouraging student use.
- Improve pedestrian and bicycle infrastructure around transit stops - Some of the transit stops adjacent to campus lack adequate pedestrian infrastructure. Since transit users must walk (or bike) to stops, it is important to ensure safe and comfortable access to transit stops in order to encourage transit use. For the WSTA stops currently adjacent to campus and for the possible new adjacent stop if the Route 5 stop is shifted off-campus, it will be important to ensure good pedestrian and bicycle connectivity between transit stops and the campus core. All WFU shuttle buses currently have bike racks on the buses which helps encourage transit use and biking and improves flexibility on both ends of the transit trip. Bike rack usage should be monitored by shuttle drivers



- to verify how much, when, and by whom they are being used. Procurement of new vehicles (either replacement buses or new buses) should include bike racks as well.
- Free WSTA transit passes The University should explore the possibility of paying an annual fee to WSTA to allow students and possibly employees to ride for free on WSTA buses. The fee could be paid from student fees, potentially, and students and employees could ride for free by showing a university ID card. If affordable, this could encourage transit use. A smaller version of this program would provide a free transit pass only for those faculty/staff/students who register as transit commuters. This should not be undertaken at the expense of WFU shuttles, but a structure could be arrived at that makes WSTA services more visible/ available to WFU employees and students and provides funding for continued WSTA or improved WSTA services on campus.
- Coordinate service with other area schools The University could explore coordinating shuttles to link the other area schools and campuses together and to downtown. This could be done by working with other schools to coordinate any routes operated by the different schools that serve a common destination (e.g., a downtown stop). Route timing and stop locations could be matched to allow any WFU employees or students to transfer to the other school's service, if desired. Conversation channels should also be maintained in the future to determine if any need to more fully connect campuses arises.
- Participate in planning activities with the MPO – The University could advance its transit objectives by participating in the Winston-Salem Urban Area Metropolitan Planning Organization and influencing local decisions on transportation funding and programming priorities. MPO participation could also potentially open up access to grants or other types of joint funding for transit services.



Improved amenities at transit stops - like the benches, shelter, route map, and bicycle parking shown above - will increase transit riders' comfort and convenience.



# PROPOSED POLICIES AND PROGRAMS

Wake Forest University and the City of Winston-Salem have a number of existing plans, policies, and programs that seek to make access to the Wake Forest University campus easier, safer, and more comfortable for individuals choosing to arrive on campus by means other than a single-occupancy vehicle (SOV). Many of these plans focus on transit service or pedestrian and bicycle facilities and programs. Some of these plans and policies also are part of a Transportation Demand Management (TDM) program. A TDM program is an umbrella term for a suite of different program options and strategies designed to reduce the number of vehicular trips to campus by providing alternative travel options. Examples of programs that are commonly found within a TDM program are carpooling coordination programs, carsharing programs, incentives for alternative mode commuters, and guaranteed ride home programs. Taken together, the basket of policies and programs contained in a TDM program are designed to make non-SOV trips more convenient for participants.

In the future, parking on campus may not be as available as it currently is, either through loss of parking spaces due to construction or from a reduction of the parking ratio due to an increased campus population (without a commensurate increase in parking supply). A reduced availability of parking makes providing alternative methods of reaching and traveling around campus more important, be it through walking, biking, transit, ridesharing, or remote parking. The University will need to make decisions in coming years on the location of parking on campus, pricing of parking on campus, who is allowed to access on campus parking (and who must access off-campus parking or use alternative means), and how the land near the football stadium is developed and connected to campus (and how much parking will be available there). As the University grows and changes, these decisions regarding parking policies will be a large factor in determining the desirability (or undesirability) of many of the following alternative transportation policy options.

The following recommended policies and programs cover TDM strategies as well as broader education, encouragement, enforcement, and evaluation proposals.

# TRANSPORTATION DEMAND MANAGEMENT POLICIES AND PROGRAMS

### Charge Parking Fees to University Faculty and Staff

A limiting factor in encouraging alternative transportation to campus is the wide availability of free parking for staff and faculty. Charging a fee could encourage employees to seek alternative methods of reaching campus and also leads to a potential basket of incentives that the University can offer. With a parking fee, the University could provide free parking to commuters who sign up for the carpool program, instead of just offering more desirable parking spaces, which is the current system. As long as parking is free for faculty and staff, the success of TDM programs and policies aimed at these commuter groups will likely be limited. A parking fee will also generate new revenue, which can then be applied to other programs or infrastructure.

# Free Parking Passes for Alternative Transportation Commuters

The University could offer several free parking passes (e.g., ten per semester) for commuters who sign up as alternative transportation commuters (bikers, carpoolers, transit users, walkers, etc.). These individuals would normally commute by their alternative method, but have the options for bringing a car to campus several times a semester. This is a more enticing incentive if the University institutes a parking fee for faculty and staff. Similar options are in place at other institutions like Vanderbilt University, which charges \$5 for a one-time parking hangtag to alternative transportation commuters.

### Guaranteed Ride Home Program

Offer a limited number of taxi vouchers per semester to individuals who sign up as an alternative commuter (carpool, bicycling, walking, or transit), to provide a guaranteed way to get home should the need arise. A limiting factor in getting more adoption for alternative



transportation is the fear that an individual will be stranded on campus should something unforeseen arise; a guaranteed ride home program helps to partially allay these fears. The amount of the benefit could be capped to prevent excessively large taxi fees while helping to provide program participants with peace of mind. This program should be coordinated with the University Police Department for safety purposes and a local cab company (or multiple companies) to arrange fare payment and Guaranteed Ride Home use procedures.

### Parking Cash Out

Provide a financial incentive for alternative commuters by offering them a 'cash out' of \$100 for returning a parking permit. This provides a financial incentive for people to sign up as an alternative commuter. This could be increased from a one-time benefit to an annual or per semester benefit to encourage participation.

#### Park-and-Ride

If a parking fee for staff and faculty is instituted, a remote park-and-ride lot, with cheaper (or free) parking fees could be included to encourage employees to not bring a car onto campus. Park-and-ride can be coordinated with PART (which has developed and operates regional park-and-ride lots), the MPO, and other nearby employers to plan the size, location, access, and transit services.

# Coordinate with University Departments to Use Zipcar

The University could save money by encouraging some departments that do not make extensive use of departmental vehicles to get departmental Zipcar accounts instead of purchasing departmental vehicles.



#### **Alternative Commuter Rewards**

Regardless of whether a parking fee is introduced, prizes or rewards could be provided for individuals who sign up for alternative transportation programs. For people who register as being alternative transportation commuters, they could be entered into monthly raffles for a prize. Examples of prizes would be small gift cards to area restaurants and businesses that benefit by the visibility of participation. For more ideas, see Harvard University's Bicycle Commuter Benefit program: www.campusservices.harvard.edu/commuterchoice/bicycling/bicycle-commuter-benefit

# EDUCATION AND ENCOURAGEMENT PROGRAMS

Equally as important as providing bicycle and pedestrian infrastructure is ensuring that users are familiar with the treatments and know how to use them. Education programs targeting the university community are recommended to complement existing efforts at the city level. Similar to education programs, encouragement programs provide incentives and benefits to the public to try bicycling and walking.

#### Bicycle and Pedestrian Campus Orientation

A bicycle and pedestrian campus orientation for all incoming students at the beginning of each school year can introduce bicycling and walking on and around campus to freshmen and transfer students, and offers a refresher to returning students. A variety of outreach methods and materials can address important topics, such as rights and responsibilities, when and where not to bicycle on campus, and proper security measures. The University of Washington's Commuter Services bikespace webpage provides a great example for bike orientation: www.washington.edu/facilities/transportation/commuterservices/bike/commute-planning

#### WFU Campus/Community Bike Ride

In November of 2012, campus and community groups collaborated to hold a bike ride between the campus and downtown. This event should be continued annually to continue to raise awareness of existing biking opportunities on and around campus and remaining challenges.



#### Secure Bicycle Parking Facilities

Bike theft is rampant on college campuses, and can be a significant deterrent to bicycling to campus. Creating and promoting bicycle parking facilities can address this problem directly. Secure bicycle parking should provide shelter from the elements and limited access. The ideal system uses a smart card for entry rather than making students sign up for a one-locker/one-key system. Sample bike parking programs include the following:

- Portland State University / www.pdx.edu/bikehub/ bike-parking-amenities
- Arizona State University / bike valet / parking. arizona.edu/bikevalet/
- University of Washington / www.washington.edu/ facilities/transportation/commuterservices/bike/ parking



The University of Washington's bike parking website shows the location of all bicycle parking facilities

#### Bike to Work Week/Bike Month Festivities

This nationally-sponsored program by the League of American Bicyclists is promoted across Winston-Salem by the Bicycle & Pedestrian Coordinator. The Campus Bicycle and Pedestrian Advisory Committee (see Staffing and Coordination) should help to promote the event on-campus and establish competitions with nearby or peer institutions. Marketing of events should highlight the connection between active transportation and health and well-being. Model Programs include the following:

- Georgia Tech Bike Week / bike.gatech.edu/bikeweek-2013/
- California Polytechnic State University / afd.calpoly. edu/sustainability/events.asp

#### **Campus Bicycle Station**

Establish a campus bicycle station that provides safety features like bicycle lights, bells, and bicycle related services. Examples include the following:

- University of Arizona Campus Bicycle Station / parking.arizona.edu/bikestation/
- Portland State University Bike Hub / www.pdx.edu/ bikehub

#### Bike Share Program

Regular bicycle commuting requires some activities that not all people are interested in, such as finding secure parking areas and bicycle upkeep. Bike-sharing programs can encourage people to give bicycling a try by reducing these barriers. Bike-sharing programs include stations of bikes around a city or region available for checkout. Several different distribution models have been used, with varying levels of sophistication and investment. In the long-term, a bike share system throughout the City of Winston-Salem could serve Wake Forest University after priority investment projects improve access to campus. Given the walkable nature of the university, bike share is not recommended for the Reynolda campus alone at this time. If a campus-only bike share is pursued in the longer term, it is critical that a central bike shop or bike coop be in place that can organize the purchase of bikes and help with ongoing maintenance. Model bike share programs include the following:

- Cat Wheels bike loan program / University of Arizona / parking.arizona.edu/bikeshare/about.php
- Starter Bikes / GA Tech / bike.gatech.edu/samplepage/starter-bikes/
- Colorado State University / www.colostate-pueblo. edu/Communications/Media/PressReleases/2013/ Pages/11-3-2012.aspx

#### Bicycling Classes and Workshops

Providing free workshops to the student body about bicycling will help more students feel confident about bicycling to campus. Classes can cover timely topics (such as a "biking in the rain and cold" workshop in the fall), or reach out to specific demographic groups (such as a "women on bikes" workshop series). Basic and advanced maintenance techniques are always valuable. Workshops may occur in partnership with bike shops



or during existing bicycling events. Model workshops include:

- Bike Classes at University of Washington / www.washington.edu/facilities/transportation/ commuterservices/events/bikeclasses
- Bike Workshops at Portland State University / www. pdx.edu/bikehub/workshops-events
- Ohio State University / yaybikes.com/our-work/ cyclist-education/

#### **ENFORCEMENT PROGRAMS**

Enforcing traffic laws related to bicycling and walking helps to promote a safer environment for all road users.

#### Watch for Me NC

The North Carolina Department of Transportation's Bicycle and Pedestrian Division kicked off an education and enforcement campaign called Watch for Me NC in September, 2013 in Raleigh. This campaign should be expanded to Winston-Salem with an emphasis on the Wake Forest University area. The campaign aims to reduce pedestrian and bicycle collisions with motor vehicles through safety and educational messages and an enforcement effort by area police to crack down on safety law violations. More Information: www. watchformenc.org/



### **Targeted Enforcement**

In coordination with the Watch for Me NC campaign, the Winston-Salem Police department should enforce speed limits and yielding at crosswalks for targeted periods of time in the Wake Forest University Area.

#### STAFFING AND COORDINATION

Implementation of this plan will require ongoing leadership and support from within the university community. Two ongoing roles are recommended to lead that effort.

# Campus Trip Demand Management Program Coordinator

A number of universities around the country staff a part- or full-time Bicycle and Pedestrian Program Coordinator position to support programs, track implementation, coordinate with City agencies, and seek ongoing funding for capital projects. A Coordinator is recommended for Wake Forest University that will cover bicycle, pedestrian, and transit modes, similar to the role at Duke University. The role could be part-or full-time, and could be a shared position between the Parking & Transportation department and Campus Recreation.

# Campus Bicycle and Pedestrian Advisory Committee (BPAC)

An advisory committee composed of students, faculty, and staff can continually address walking and bicycling issues on and around campus and establish institutional commitment to making bicycling and walking safer. A grassroots advisory committee is already in place, but could be formalized and add interested members of the Stakeholder Advisory Group formed for this planning process. This group could also consider the needs of non-motorized coasting devices, such as skateboards and scooters.



#### **EVALUATION OF PROGRESS**

The two roles recommended above should monitor and report progress against bicycle, pedestrian, and transit goals. Progress reporting will continue to spread awareness of issues, encourage ongoing community buy-in, and communicate successes to the public. Several specific programs can help to track progress.

### Automated Bicycle and Pedestrian Counters

Bicycle and pedestrian counts act as a mechanism for tracking bicycling and walking trends over time and for evaluating the impact of bicycle and pedestrian projects, policies, and programs. Automated counters can increase the amount of data collected by consistently counting year-round. Information such as peak time of day and weather effects on bicycling and walking can be analyzed from data obtained through automated counters. Automated counters that publicly display the number of people biking and walking can be a way to encourage more people to bike and walk, as well.

### **Active Transportation Report Card**

An active transportation report card will provide an annual snapshot of relevant walking, bicycling, and transit metrics to track the efforts of the Bicycle and Pedestrian Advisory Committee. Results from bicycle and pedestrian counts, user surveys, and collision reports should be included in the report card, as well as recently completed improvement projects and programs. The report card should compare the changes and accomplishments from year to year, which will help focus the following year's improvements and goals.

### Bicycle-Friendly University

The League of American Bicyclists' Bicycle Friendly University program recognizes institutions of higher education for promoting and providing a more bikeable campus. WFU should seek this designation, which is currently held by four other universities in North Carolina: UNC Greensboro, UNC Wilmington, Duke University, and NC State University, as well as peers like Emory University. The application and review process results in feedback to the University on ways to become more bicycle-friendly, whether or not they win the designation. More information: www.bikeleague.org/content/universities



Several universities in the ACC have already been awarded Bicycle Friendly University status, including Clemson University (Bronze), Duke University (Bronze), Georgia Tech (Silver), University of Maryland (Silver), University of Miami (Bronze), NC State (Bronze), University of Virginia (Bronze), and Virginia Tech (Bronze).



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# **5 BEST PRACTICES**

### **BEST PRACTICES**

There are established best practices for the design and implementation of an effective bicycle, pedestrian, and transit system. These best practices should be followed to meet the City's and University's goal of enabling and encouraging active transportation and transit in the area around Wake Forest University. The following key practices guide the infrastructure, policy, and programming recommendations that follow.

#### **BUILD CONNECTED NETWORKS**

Providing a continuous network of bicycle and pedestrian facilities allows users to reach their destinations in a safer and more efficient manner. When bicyclists or pedestrians can navigate a network without gaps, their experiences are generally more positive, which increases the likelihood that they will commute by biking or walking in the future.

A well-connected bicycle network involves bicycle facilities that do not "drop" and leave bicyclists unexpectedly without a designated facility. The bicycle network should have a mix of facilities for riders of various types (e.g., 'interested but concerned' versus 'strong and fearless'). For example, bicycle lanes are more appropriate for experienced users, while bicycle boulevards (low volume streets with traffic calming) are often better for less experienced bicyclists.

A well-connected pedestrian network has a continuous network of sidewalks, paths, and crossings enabling a person to walk to their destinations without having to walk in the street with vehicular traffic. The network should be compliant with ADA standards, such as by having curb ramps at intersections to improve access for persons with disabilities.

# ACCOMMODATE ALL USERS AT INTERSECTIONS

Intersections have increased conflicts due to the multimodal nature of the space. The following key principles from the NACTO Urban Street Design Guide should guide intersection design in the study area:

- Design intersections to be as compact as possible –
  Compact intersections reduce pedestrian exposure
  to other traffic, slow traffic as it approaches a conflict
  point, and increase visibility for all users.
- Analyze intersections as part of a network, not in isolation – The impacts of a particular intersection reconfiguration should be considered in the context of a network. Tradeoffs may be possible between the intersection and the network.
- **Integrate time and space** Congestion or delay may be mitigated through reconfiguring the timing of signals, rather than through widening lanes.

In addition to the design principles above, intersection treatments for bicyclists and pedestrians highlight their presence and improve user comfort and safety. The following treatments are recommended in the study area.

- Intersection crossing markings guide bicyclists through the intersection by highlighting their intended path and providing a clear boundary between the paths of bicyclists traveling through the intersection and motor vehicles traveling either straight or executing a turn. Markings can be provided in a variety of forms, including a line of shared lane markings, chevrons, or colored pavement.
- **Bike boxes** are designated zones at the start of traffic lanes at signalized intersections that allow bicyclists to get ahead of queuing traffic during the red signal phase. By providing a designated space for bicyclists, they can help bicyclists turn left at intersections by allowing an easier transition across travel lanes. Since bike boxes are typically delineated with color to improve visibility, they can reduce the risk of a "right hook" from motorists turning right in front of approaching bicyclists. Pedestrians also receive potential benefits from the installation of bike boxes because they reduce vehicles encroaching into the crosswalk.



Bike boxes allow bicyclists to get ahead of queueing traffic

Bicycle detection at intersections allows bicyclists
to trigger a traffic signal without the presence of
motor vehicles. This helps to reduce delay in bicycle
travel and increase safety by reducing the need to
run red lights. Bicycle detection should be provided
in conjunction with signage or pavement markings
to clearly inform bicyclists how to detect the signal.
Methods of bicycle detection include in-pavement
loops, video, microwave, or push buttons.

 Median refuge islands provide a protected space for pedestrians and bicyclists in the middle of the road to allow the user to focus on crossing traffic in two phases and wait for acceptable gaps in traffic. Median refuge islands reduce conflicts because they minimize exposure of bicyclists and pedestrians to motor vehicles.



Pedestrian refuges improve safety at crossings

High visibility continental crosswalks can increase
motorists' awareness of pedestrians crossing.
Advance yield lines placed prior to crosswalks at
uncontrolled intersections can encourage motorists
to yield to pedestrians more quickly, and improve
sight distance for all users. Flashing beacons and inpavement flashers at crosswalks (a type of flashing
beacon) can also alert motorists to the presence of
pedestrians crossing and increase yielding.



High-visibility crosswalks warn motor vehicles of the presence of pedestrians at conflict points



# ACCOMMODATE ALL TYPES OF CYCLISTS

There are a variety of bicyclists of all skill levels. Bicycle infrastructure should accommodate as many user types as possible, with the goal of creating safe bicycling environments to encourage more ridership. A framework for understanding the characteristics, attitudes, and infrastructure preferences of different bicyclists in the US population as a whole is illustrated below.

Four Types of Cyclists. (2009). Roger Geller, City

of Portland Bureau of Transportation. Supported by data

collected nationally since 2005.

### TYPES OF BICYCLISTS<sup>1</sup> ~1% STRONG AND FEARLESS Characterized by bicyclists that will typically ride anywhere regardless ~5-10% 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 separated bicycle facilities such as shared use paths. ENTHUSED AND CONFIDENT This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets ~60% or multi-use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers, and utilitarian bicyclists. INTERESTED BUT CONCERNED 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 "Enthused & Confident" with encouragement, education, and experience. NO WAY, NO HOW ~30% 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.

<sup>5-4</sup> 



#### ESTABLISH DESIGN GUIDELINES

Street design should begin with an analysis of the street context. A particular street in the study area may pass through several different contexts – varying from residential to commercial to institutional – and its cross-section should vary in response to those contexts.

"Street design should both respond to and influence the desired character of the public realm."

- NACTO Urban Street Design Guide

Context-sensitive design guidelines begin by establishing design controls. Relevant design controls that should vary based on context include the following:

- **Design Speed** Design streets for the selected target speed rather than observed operating speed. Target speeds should be selected based on street type and context. Generally, 35 mph is the maximum appropriate target speed on urban arterial streets, and 30 mph is the maximum appropriate on urban collector or local streets.
- Design Vehicle Design streets for a 'design vehicle' and a 'control vehicle'. The design vehicle and control vehicle will vary based on the street type. The design vehicle is the largest typical street user and should dictate curb radii and lane widths. The control vehicle is the largest possible user and can be accommodated using the full intersection space.
- Design Hour Collect multi-modal data over 2-3 hours of peak traffic activity to understand how traffic behaves through an entire rush-hour period, and use average levels to design streets and intersections. Street design for peak-hour intervals relieves peak-hour congestion but results in unsafe, unattractive street environments during the rest of the day. Recognize that traffic patterns react to design changes and consider treatments in light of a network.
- Design Year Recent trends have seen traffic volumes leveling off or decreasing on many urban roadways. Transportation models have overestimated volume growth in the past, resulting in many excess capacity roadways. Design based on these recent trends, including increasing bicycling

and public transportation use, rather than assumed vehicular traffic increases based on outdated models.

Several existing guidelines should inform design of bicycle and pedestrian facilities in the study area.

- North Carolina Department of Transportation's (NCDOT) Complete Streets Guide
- National Association of City Transportation Official's (NACTO) Urban Street Design Guide
- National Association of City Transportation Official's (NACTO) Urban Bikeway Design Guide
- Association of Pedestrian and Bicycle Professionals' (APBP) Bicycle Parking Guidelines
- American Association of State Highway and Transportation Official's (AASHTO) Guide for the Development of Bicycle Facilities
- Manual on Uniform Traffic Control Devices (MUTCD)



The NACTO Urban Street Design Guide was developed by engineers, planners, and designers to lay out the best practices in urban street design for cities across the US.

#### PROVIDE EDUCATION PROGRAMS

Most bicyclists do not receive comprehensive instruction on safe and effective bicycling techniques, laws, or bicycle maintenance. Bike skills training courses are an excellent way to improve both bicyclist confidence and safety. The League of American Bicyclists (LAB) developed a comprehensive bicycle skills curriculum that is considered the national standard for those seeking to improve their on-bike skills. The classes available include bicycle safety checks and basic maintenance, basic and advanced on-road skills, commuting, and driver education.



The League of American Bicyclists has established bicycle training programs.

#### **INCREASE AWARENESS**

Many residents and members of the university community may not be aware of the bicycle, pedestrian, and transit options that do exist. Awareness campaigns, like bicycle and pedestrian orientation for incoming students and faculty and bicycle commuter campaigns, can help to communicate opportunities that exist and enhance everyone's awareness of alternative modes. Many programs are already in place through Wake Forest's Sustainability Office and the city's transportation program. Those programs should be expanded in conjunction with infrastructure investments to spread community support and encourage use of new facilities.

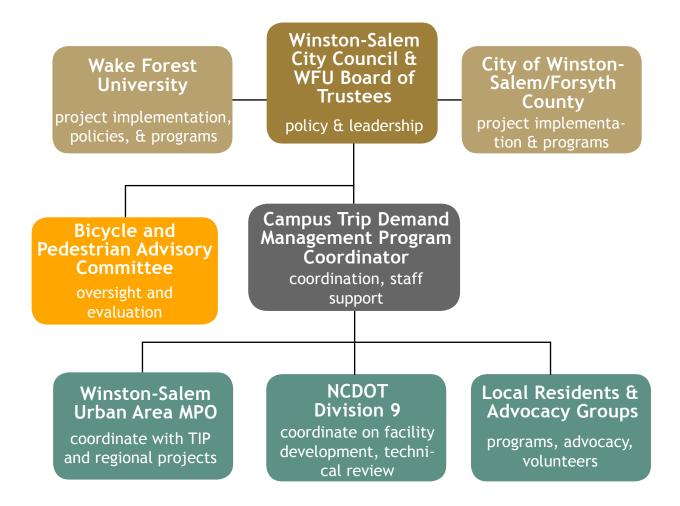
#### **EVALUATE PROGRESS**

The University and City should track the impacts of implementing the recommendations of this plan through ongoing evaluation of performance measures. Performance measures may include bicycle and pedestrian counts, transit use, university mode share, city mode share, and many others. The bicycle and pedestrian counts completed for this study can act as a starting point, as can the transportation survey recently conducted.

Tracking progress allows the implementing team to communicate successes to the community and adjust recommendations over time. Interim design strategies are recommended on some roadways in the previous section. The City can test ideas through these interim strategies and make decisions about greater cost investments after monitoring before and after traffic use and behavior. In addition to City and University staff, a campus bicycle, pedestrian, and transit advisory committee can be formed to assist with progress reporting and communication with the community.



#### Proposed Implementation Structure





# **6 IMPLEMENTATION**

### **OVERVIEW**

The implementation of this plan will require a concerted, collaborative effort of project partners. Some proposed priority projects will require significant funds, while other policy and program recommendations are inexpensive means to create a more walk, bike, and transit-friendly community around Wake Forest University. This chapter presents roles for key implementing agencies and a set of action steps to move the recommendations of this plan forward.

### ROLES FOR IMPLEMENTATION

# CAMPUS TRIP DEMAND MANAGEMENT PROGRAM COORDINATOR

- Provide staff support to the Campus Bicycle and Pedestrian Advisory Committee.
- Act as a liaison between the University and City planning staff.
- Coordinate the implementation of projects and programs and monitor facility planning, design, and construction.
- Identify new projects and programs that will improve the walking and bicycling environment in and around campus, educate all modes, and encourage walking, biking, and transit modes.
- Pursue funding sources for project and program implementation.

# CAMPUS BICYCLE AND PEDESTRIAN ADVISORY COMMITTEE

- Meet on a quarterly basis to continue momentum and act as a liaison to University faculty, staff, and students.
- Review and provide input on facility planning and design within the university area as it affects bicycling, walking, and transit.
- Participate in the development and implementation of priority projects adjacent to campus.
- Develop and monitor goals and indices related to bicycle, pedestrian, and transit use in the university community.
- Track progress against goals and adjust priorities as new opportunities or constraints arise.

#### CITY OF WINSTON-SALEM

- Adopt this plan and become familiar with the plan goals and recommendations (City Council).
- Integrate priority projects from this plan into the adopted City Capital Plan and Long Range Transportation Plan. Consider replacing some of the current projects identified in the latter with the priorities identified through this process. Projects from this plan could fall in the category of new sidewalk construction, street resurfacing projects, traffic calming projects, and traffic safety projects. The City should consider making bicycle and pedestrian improvements a part of scheduled roadway resurfacing projects.
- With support of Winston-Salem Urban Area MPO,

seek outside funding from federal and state sources, including CMAQ, HSIP, FTA, and the State Spot Improvement Program. City staff should also seek private funding, including potential collaborations with the business and health sectors.

- Collaborate regularly with NCDOT staff concerning recommended projects on DOT roadways, and seek opportunities to implement these projects during scheduled roadway rehabilitation projects.
- Ensure recommendations from this plan are integrated into adjacent small area plans, comprehensive plans, and transportation plans.
- Continue to enforce not only pedestrian- and bicycle-related laws, but also motorist laws that affect the safety of pedestrians and bicyclists (City Police).

#### WAKE FOREST UNIVERSITY

- Lead programmatic recommendations from this plan to encourage and educate WFU students (Office of Sustainability, Campus Life, Outdoor Pursuits, campus health initiatives, etc).
- Continue improving pedestrian, bicycle, and transit circulation and connectivity within campus to complement and support off-campus improvements.
- Considerallocating funds towards recommendations in this plan, especially the Campus to the Athletic Campus priority connector and other priority projects adjacent to campus.
- Seek private partners to support and fund project recommendations in this plan.
- As part of existing neighborhood association and landlord meetings and communication (including the University Area Community Partnership quarterly meetings), incorporate walk, bike, and transit information into discussion and products for off-campus students and faculty (Residence Life and Housing).

#### NCDOT DIVISION 9

 Communicate regularly with City staff concerning projects recommended in this plan, including opportunities to implement these projects during

- scheduled roadway rehabilitation projects.
- Participate and contribute to corridor studies and designs that come from this plan.
- Recognize this plan as an adopted plan of the City of Winston-Salem, and assist in the integration of this plan's recommendations into an update to the NCDOT's Comprehensive Transportation Plan for Forsyth County.
- Become familiar with the facility recommendations for NCDOT roadways in this plan and take initiative in incorporating this plan's recommendations into the Division's schedule of improvements whenever possible.

#### WINSTON-SALEM MPO

- Ensure recommendations from this plan are integrated into regional planning and project implementation.
- Consider priority projects for state funding and grant submittals.

# LOCAL STAKEHOLDERS AND ADVOCACY GROUPS

- Assist in carrying out Safe Routes To School (SRTS) workshops, programs, and grant applications (Local school system and local school leaders).
- Continue offering input regarding bicycle, pedestrian, and transit issues in and around Wake Forest University.
- Assist City and University staff by volunteering for pedestrian, bicycle, and transit-related events and educational activities, and participate in such activities.
- Assist City and University staff by speaking at meetings and advocating for local pedestrian and bicycle program and project funding.
- Grow and advance bicycle advocacy efforts such as group bike rides. Use bike rides or group runs to highlight and spread awareness about new projects as they are constructed.

Table 6.1 Proposed Action Steps

ACTION STEP	LEAD AGENCY	SUPPORT AGENCIES	TIMELINE
POLICY ACTION STEPS			
Adopt this plan (City and University adoption)	City of Winston-Salem; Wake Forest University		First Year
Hire a Campus Trip Demand Management Program Coordinator	Wake Forest University		First Year
Present this plan's recommendations to NCDOT Division 9 and District 2 Offices. This presentation may occur in conjunction with a presentation to the Transportation Advisory Committee for adoption.	City of Winston-Salem; Wake Forest University	NCDOT	First Year
Establish Campus Bicycle & Pedestrian Advisory Committee	Stakeholders Advisory Group;	NCDOT; City of Winston-Salem; Wake Forest University	First Year
Participate in the Winston-Salem MPO to advocate for the transit and transportation needs of the University.	WFU Parking and Transportation		1-2 years
Charge a fee for faculty and staff parking permits.  Geographic zones can be created to match supply and demand. Many of the alternative commute programs would be more successful with an employee parking fee.	WFU Parking and Transportation	WFU Office of Sustainability	1- 2 years
Offer participants in an alternative commuter program taxi vouchers for a ride home for emergency or unforeseen circumstances.	WFU Office of Sustainability		1-2 years
Explore the option of having partner apartment complexes pay a fee to partially cover Ride the Wake service; could be distance-based.	WFU Parking and Transportation		1-2 years
Partner with University departments who do not use departmental vehicles frequently to encourage the department to sign up for Zipcar in lieu of a departmental vehicle.	WFU Office of Sustainability		1-2 years
Explore the possibility of providing free WSTA transit passes to students (or potentially the whole University population, or just transit commuters), with cost sharing from a transportation fee.	WFU Office of Sustainability	WSTA	3-5 years
Provide cash or prize rewards for participants in alternative commute programs.	WFU Office of Sustainability	Area businesses	3-5 years
As the Ride the Wake service grows and expands, consider alternative administrative or operating arrangements for Ride the Wake service.	WFU Parking and Transportation		5-10 years
Investigate the possibility of beginning inter-campus shuttle service with the other colleges and universities in the Winston-Salem area.	WFU Parking and Transportation	City of Winston-Salem, WSTA, Winston-Salem State University, Salem College, North Carolina School of the Arts, Forsyth Technical Community College, Piedmont Baptist College	5-10 years
Incorporate recommendations from this Plan into small area plans, comprehensive plans, transportation plans	City of Winston-Salem	NCDOT; Winston-Salem Urban Area MPO	Ongoing

ACTION STEP	LEAD AGENCY	SUPPORT AGENCIES	TIMELINE
INFRASTRUCTURE ACTION STEPS			
Identify project locations where roadway rehabilitation/ resurfacing is scheduled; move these projects forward	City of Winston-Salem	NCDOT	First Year
Seek funding mechanisms for priority projects (public and private sector opportunities)	City of Winston-Salem; Wake Forest University	Winston-Salem Urban Area MPO; NCDOT	First Year
Identify and begin short-term, low-cost infrastructure projects	City of Winston-Salem	NCDOT	1-3 years
Add routes or stops or increase frequency on Ride the Wake services that serve shopping or entertainment options.	WFU Parking and Transportation		1-3 years
Partner with WSTA to provide enhanced stop amenities for transit stops on and near campus.	WFU Parking and Transportation	WSTA	1-3 years (as funding allows)
Explore coordination options with WSTA for WSTA Route 5 and the Ride the Wake downtown shuttle.	WFU Parking and Transportation	WSTA	3-5 years
Work with the City of Winston-Salem to ensure transit stops have high-quality pedestrian infrastructure around stops.	WFU Parking and Transportation	City of Winston-Salem	3-5 years
Design and implement longer-term projects to complete area connectivity	City of Winston-Salem	NCDOT; Wake Forest University	3 - 10 years
To alleviate parking demand on campus, provide off- campus parking options linked with shuttle service. This could also be free or cheap parking compared to on-campus spaces to encourage use.	WFU Parking and Transportation		5-10 years
PROGRAM ACTION STEPS			
Begin education, encouragement, and enforcement programs	Campus Trip Demand Management Program Coordinator, Campus Bicycle & Pedestrian Advisory Committee	Advocacy groups, City of Winston- Salem	1-2 years
As part of already established meetings with surrounding neighborhood associations and landlords (and University Area Community Partnership), incorporate walk/bike/transit information and encouragement for off-campus residents.	Wake Forest University Residence Life and Housing		1-2 years
Create an active transportation report card	Campus Trip Demand Management Program Coordinator, Campus Bicycle & Pedestrian Advisory Committee	City of Winston-Salem	1-2 years
Apply for Bicycle Friendly University Status	Campus Trip Demand Management Program Coordinator		3-5 years
Conduct regular pedestrian and bicyclist counts at same locations with automated counters and/or volunteers	Campus Trip Demand Management Program Coordinator	City of Winston-Salem; Volunteers	Ongoing



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# **APPENDIX A: COUNT DETAILS**

Annual counts conducted in a systematic manner provide strong benchmarking information on bicycling, walking, and related benefits. Count data can assist Wake Forest University and the City of Winston-Salem in understanding existing bicycling and pedestrian patterns, planning for future bikeways and walkways, and measuring the success of existing programs and facilities.

The count methodology used for this study is based on the *National Bicycle and Pedestrian Documentation project*, an annual bicycle and pedestrian count and survey effort sponsored by Alta Planning + Design with support from the Institute of Transportation Engineers (ITE). The second week in September is the recommended official annual national bicycle and pedestrian count week. In order to meet the timeline of this study, counts were conducted during the first week of November. The following count times were used, tailored to expected peak travel times to and from Wake Forest University:

DATE	TIME
Tuesday, 11/05/13	7:30 - 9:30 AM
Tuesday, 11/05/13	4:00 - 6:00 PM
Wednesday, 11/06/13	7:30 - 9:30 AM
Wednesday, 11/06/13	4:00 - 6:00 PM

Weather is a determinant on bicyclist and pedestrian activity, and weather conditions were recorded for each count location and time period for consideration as a factor in future analysis. Over time, counts will average out and overall trends in activity will become apparent. The following weather conditions were recorded during the counts conducted for this study:

DATE	TIME	WEATHER
11/05/13	AM	Partly cloudy, 36° F
11/05/13	PM	Partly cloudy, 54° F
11/06/13	AM	Partly cloudy, 48° - 54° F
11/06/13	PM	Sunny, 59° - 70° F

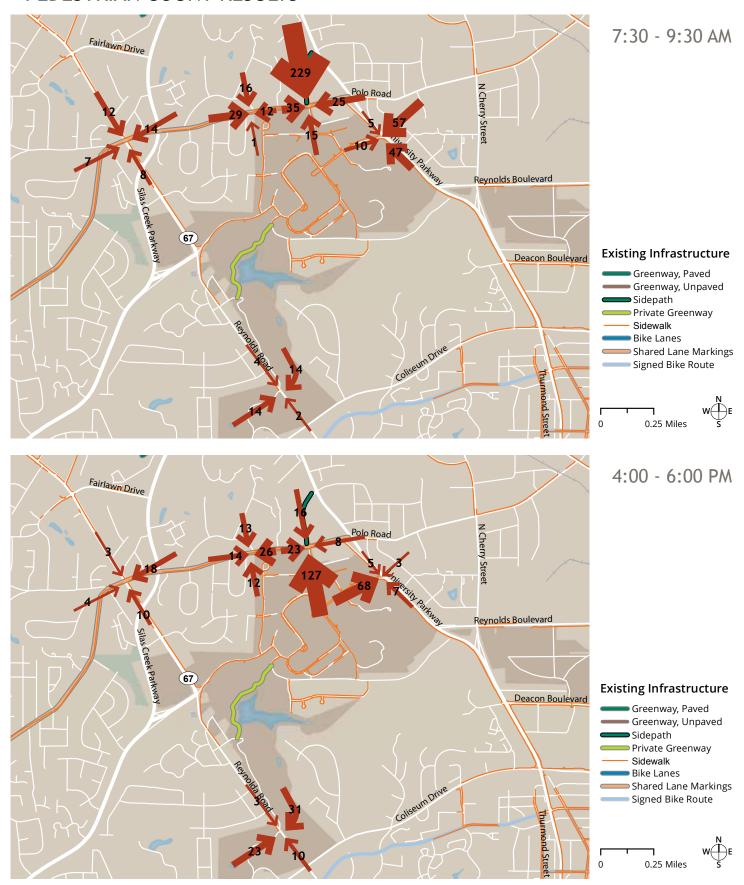
Counts were conducted at the following locations. For locations where counts were not conducted for all four count periods, the periods recorded are listed.

- University Pkwy & Wake Forest Rd (11/6 AM, 11/6 PM)
- Polo Rd & Friendship Cir
- Polo Rd & Reynolda Rd
- Polo Rd & Long Dr/Wingate Rd (11/5 AM, 11/6 AM, 11/6 PM)
- Graylyn Ct & Reynolda Rd

The total number of pedestrians and bicyclists recorded at each location were presented in *Chapter 3: Needs Analysis*. The following pages summarize the total number of pedestrians and bicyclists approaching each intersection. Approaches are presented for the AM period and PM period, and represent an average of the two count days where counts were recorded for the same time period on both count days.

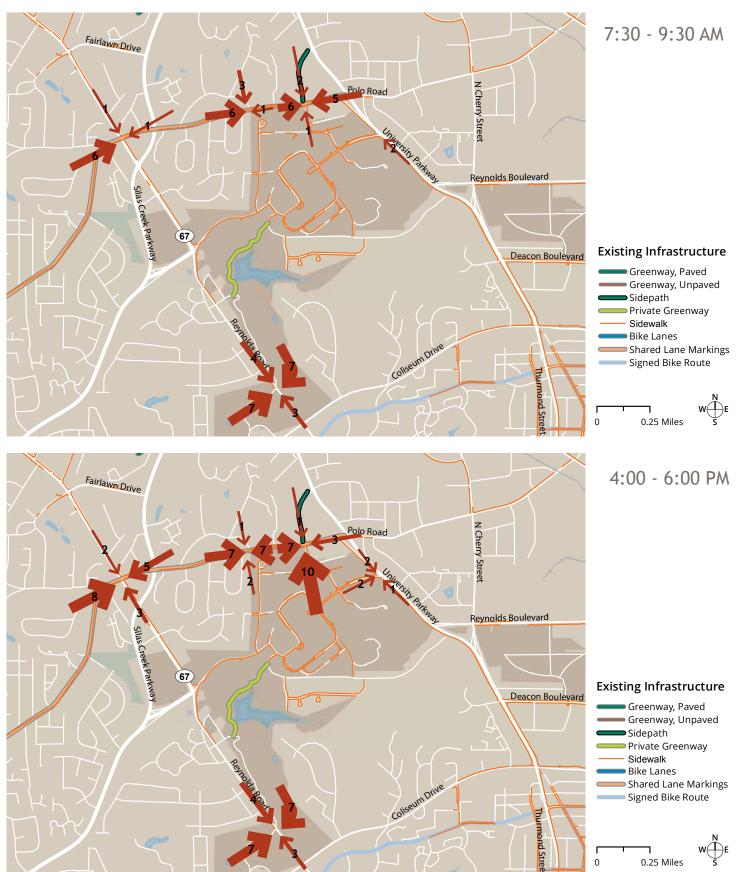


# PEDESTRIAN COUNT RESULTS





# **BICYCLIST COUNT RESULTS**



Intercept surveys were conducted at several count locations (where additional volunteers were available) to identify trip starting points and destinations, trip regularity, and other qualitative information from pedestrians and cyclists in the study area. This data was used to develop recommendations for this study. A summary of intercepts collected is provided below:

LOCATION	DAY & TIME	INTERCEPTS
Polo & Friendship	11/5, 7:30-9:30	8
Polo & Friendship	11/6, 7:30-9:30	14
Polo & Friendship	11/6, 4-6 pm	3
Graylyn & Reynolda	11/6, 4 - 6 pm	8
University & Wake Forest	11/6, 7:30-9:30	10

The table below summarizes quantitative data gathered through the intercept surveys:

	0	1	-
CATEGOR	Υ	PERCENTAGE OF RESPONDENTS	
Respondent T	ype		
	Pedestrian	74%	
	Cyclist	26%	
Trip Regular	ity		
	Every Day	67%	
A few time	es per week	16%	
0	nce a week	5%	
A few times	per month	2%	
A few tim	es per year	7%	
WFU is the Trip Dest	ination or	91%	
Starting Poi	nt		

Additionally, the following qualitative data was gathered through the intercept surveys:

LOCATION	DAY & TIME	COMMON STARTING POINT/DESTINATION (EXCLUDING WFU)	COMMENTS
Polo & Friendship	11/5, 7:30-9:30	Crowne Polo Apts (5)	
Polo & Friendship	11/6, 7:30-9:30	Crowne Polo Apts (3)	Enjoys improvements (sharrows) and would like more; Recommendation: Provide a crosswalk
Polo & Friendship	11/6, 4-6 pm		"I know it's illegal to bike on the sidewalk, but I'm not willing to risk it on the road. It's the only way I get exercise."; Recommendation: Provide a crosswalk with flashing lights (2)
Graylyn & Reynolda	11/6, 4 - 6 pm		Recommendations: Provide light for pedestrians (4); Provide bike lane or better (2)
University & Wake Forest	11/6, 7:30-9:30	University housing across Univ. Pkwy (3); House across Univ. Pkwy (3)	Recommendations: Provide light (5); Provide a crosswalk (3); Provide a pedestrian bridge (1)



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# **APPENDIX B: COST ESTIMATES**

### PRIORITY CONNECTION COST SUMMARY

CAMPUS TO ATHLETICS	COST
Howell Street Intersection - North Side	\$73,740
Bike/Ped Bridge - Across University Parkway at Reynolds	\$306,290
Boulevard	
Multi-Use Trail - University Parkway/Reynolds Boulevard to	\$206,890
campus center	
Multi-Use Trail - Campus center to Reynolds Boulevard to	\$336,798
Baity Street	
Sidewalk - University Boulevard/Howell Street to Reynolds	\$37,184
Boulevard	
Deacon Boulevard intersection	\$70,660
Total (including 20% contingency)	\$1,237,875

CAMPUS TO BETHABARA GREENWAY	COST
Bethabara Road Retrofit - Silas Creek Parkway to University	\$21,637
Parkway	
Bethabara Road Sidewalk Extension to Hayes Forest Drive +	\$66,040
intersection Improvements	
Bethabara & University Parkway intersection improvements	\$53,260
Long Drive sidepath extension to Bethabara Road/	\$182,954
University Parkway	
Long Drive/University Parkway intersection improvements	\$88,620
Deacon Boulevard intersection	\$70,660
Total (including 20% contingency)	\$495,014

POLO ROAD PHASE 1	COST
Polo Road improvements - Robinhood Road to University	\$1,359,148
Parkway, roundabouts at Long Drive & Polo Ridge Court	
Median - Reynolda Road to Long Rd	\$125,743
Pedestrian Refuges	\$40,560
Bike Lanes - University Parkway to Cherry Street	\$17,008
Complete Streets Retrofit - Cherry Street to Indiana Avenue	\$41,553
Polo Road/Reynolda Road intersection improvements	\$106,616
Total (including 20% contingency)	\$2,028,753

POLO ROAD PHASE 2	COST
Corridor redesign - Polo Ridge court to Robinhood Road,	\$3,426,125
roundabouts at Ransom, Peace Haven, Polo Park, School	
Total (including 20% contingency)	\$4,111,350

CAMPUS TO WESTERN NEIGHBORHOODS	COST
Multi-Use Trail - Polo Park at Polo Road to Silas Creek	\$259,816
Parkway, Quincy Drive, Ormond Drive	
Silas Creek Parkway intersection improvements	\$47,848
Multi-Use Trail to Reynolda Road/Wake Forest Road	\$91,417
Reynolda Road/Wake Forest Road intersection	\$78,320
improvements	
Sidewalk - Silas Creek Parkway from Wake Forest Road to	\$37,184
Hope Valley Road	
Greenway Connections - Neighborhoods west of Silas	\$240,570
Creek Parkway	
Total (including 20% contingency)	\$906,185

CAMPUS TO DOWNTOWN	COST
Intersection Improvements - Reynolda Road/Coliseum	\$52,536
Drive	
Bicycle/pedestrian crossing - Reynolda Road	\$38,910
Multi-Use Trail - Graylyn Court to Historic District	\$24,057
Multi-Use Trail - Reynolda Road to Graylyn Court	\$110,662
Median - Coliseum Drive/Graylyn Court	\$10,019
Bike lanes/sharrows - Historic District Road	\$6,844
Median Refuge - Arbor Road	\$28,580
Total (including 20% contingency)	\$325,929

Note: See page B-6 for cost estimate assumptions.

### CAMPUS TO ATHLETICS PRIORITY CONNECTION

LOCATION	IMPROVEMENT TYPE	UNIT TYPE	UNITS	UNIT COST	IMPROVEMENT COST	SUBTOTAL
HOWELL STREET INTERSECTION - NORTH SIDE	High-Visibility Crosswalk	Each	1	\$2,540	\$2,540	
	Median Refuge	Each	1	\$13,520	\$13,520	
	HAWK Signal	Each	1	\$57,680	\$57,680	\$73,740
BIKE/PED BRIDGE - ACROSS UNIVERSITY PKWY AT REYNOLDS BLVD	Bike/Ped Bridge (Pre-fab steel)	Each	1	\$206,290	\$206,290	
	Approach Work & Traffic Control		1	\$100,000	\$100,000	\$306,290
MULTI-USE TRAIL - UNIVERSITY PKWY/ REYNOLDS BLVD TO CAMPUS CENTER*	Paved Multi-Use Trail	Mile	0.43	\$481,140	\$206,890.20	\$206,890
MULTI-USE TRAIL - CAMPUS CENTER TO REYNOLDS BLVD TO BAITY STREET*	Paved Multi-Use Trail	Mile	0.7	\$481,140	\$336,798	\$336,798
SIDEWALK - UNIVERSITY BLVD/HOWELL STREET TO REYNOLDS BLVD	Sidewalk	Linear foot	1162	\$32	\$37,184	\$37,184
DEACON BLVD INTERSECTION	High-Visibility Crosswalks	Each	5	\$2,540	\$12,700	
	Pedestrian Signal with Countdown and Minor Signal Revisions	Each	1	\$25,000	\$25,000	
	Pedestrian Signal with		4	\$1,480	\$5,920	
	Countdown (additional)  Median Refuges	Each	2	\$13,520	\$27,040	\$70,660
					TOTAL	\$1,031,562
					20% Contingency	\$206,312
					GRAND TOTAL	\$1,237,875

<sup>\*</sup>Costs for streetscape amenities such as landscaping, seating, and lighting vary widely based on materials, planting type, ground conditions, and structural and decorative detail, and therefore are not included in the above cost estimates.



### CAMPUS TO BETHABARA GREENWAY PRIORITY CONNECTION

LOCATION	IMPROVEMENT TYPE	UNIT TYPE	UNITS	UNIT COST	IMPROVEMENT COST	SUBTOTAL
BETHABARA ROAD RETROFIT - SILAS CREEK PKWY TO UNIVERSITY PKWY	Solid 4" line removal	Linear foot	3168	\$2	\$6,336	
	Dashed 4" line removal	Linear foot	3168	\$0.25	\$792	
	Solid 4" line striping	Linear foot	6336	\$1.85	\$11,722	
	Bicycle symbol markings	1/250 ft	12.672	\$220	\$2,788	\$21,637
BETHABARA ROAD SIDEWALK EXTENSION TO HAYES FOREST DRIVE + INTERSECTION IMPROVEMENTS	Sidewalk	Linear foot	422	\$32	\$13,504	
	High-Visibility Crosswalk	Each	4	\$2,540	\$10,160	
	Curb Ramps	Each	8	\$1,062	\$8,496	
	Pedestrian Signal with Countdown and Minor Signal Revisions	Each	1	\$25,000	\$25,000	
	Pedestrian Signal with Countdown (additional)	Each	6	\$1,480	\$8,880	\$66,040
BETHABARA & UNIVERSITY PKWY	High-Visibility Crosswalk	Each	5	\$2,540	\$12,700	
INTERSECTION IMPROVEMENTS						
	Median Refuge Island	Each	3	\$13,520	\$40,560	\$53,260
LONG DRIVE SIDEPATH EXTENSION TO BETHABARA RD/UNIVERSITY PKWY*	Paved Multi-Use Trail	Mile	0.18	\$481,140	\$86,605	
	Dashed 4" line removal	Linear foot	1900	\$0.25	\$475	
	Dashed 4" line striping	Linear foot	1900	\$0.46	\$874	
	Safety railing	Linear foot	950	\$100	\$95,000	\$182,954
LONG DRIVE/UNIVERSITY PKWY INTERSECTION IMPROVEMENTS	High-Visibility Crosswalks	Each	5	\$2,540	\$12,700	
	Pedestrian Signal with Countdown, Bicycle loop detector, and Minor Signal Revisions	Each	1	\$40,000	\$40,000	
	Pedestrian Signal with Countdown (additional)	Each	6	\$1,480	\$8,880	
	Median Island	Each	2	\$13,520	\$27,040	\$88,620
					TOTAL	6412 512
					TOTAL	\$412,512
					20% Contingency	\$82,502.33
					GRAND TOTAL	\$495,014

<sup>\*</sup>Costs for the Long Drive sidepath retaining wall will vary depending on materials, ground conditions, and structural and decorative detail, and therefore are not included in the above cost estimates.

### POLO ROAD PHASE 1 PRIORITY CONNECTION

LOCATION	IMPROVEMENT TYPE	UNIT TYPE	UNITS	UNIT COST	IMPROVEMENT COST	SUBTOTAL
POLO ROAD IMPROVEMENTS - ROBINHOOD RD TO UNIVERSITY PKWY, ROUNDABOUTS AT LONG DR & POLO RIDGE CT	Solid 4" line removal	Linear foot	8660	\$2	\$17,320	
	Dashed 4" line removal	Linear foot	8660	\$0.25	\$2,165	
	Solid 4" line striping	Linear foot	17320	\$1.85	\$32,042	
	Bicycle symbol markings	1/250 ft	34.64	\$220	\$7,621	
	Roundabout	Each	2	\$650,000	\$1,300,000	\$1,359,148
MEDIAN - POLO RIDGE CT TO LONG RD*	4-foot center median	Square foot	17320	\$7.26	\$125,743	\$125,743
PEDESTRIAN REFUGES	Median Island	Each	3	\$13,520	\$40,560	\$40,560
BIKE LANES - UNIVERSITY PARKWAY TO CHERRY STREET	Solid 4" line striping	Linear foot	6230	\$1.85	\$11,525.50	
	Bicycle symbol markings	1/250 ft	24.92	\$220	\$5,482.40	\$17,007.90
COMPLETE STREETS RETROFIT - CHERRY STREET TO INDIANA AVE	Solid 4" line removal	Linear foot	5700	\$2	\$11,400	
	Dashed 4" line removal	Linear foot	5700	\$0.25	\$1,425	
	Solid 4" line striping	Linear foot	11400	\$1.85	\$21,090	
	Dashed 4" line striping	Linear foot	5700	\$0.46	\$2,622	
	Bicycle symbol markings	1/250 ft	22.8	\$220	\$5,016	\$41,553
POLO RD/REYNOLDA RD INTERSECTION IMPROVEMENTS	High-Visibility Crosswalks	Each	4	\$2,540	\$10,160	
	Pedestrian Signal with Countdown, and Minor Signal Revisions	Each	1	\$25,000	\$25,000	
	Pedestrian Signal with Countdown (additional)	Each	6	\$1,480	\$8,880	
	Median Islands	Each	4	\$13,520	\$54,080	
	Curb Ramps	Each	8	\$1,062	\$8,496	\$106,616
					TOTAL	\$1,690,628
					20% Contingency	\$338,125.58
					GRAND TOTAL	\$2,028,753

<sup>\*</sup>Costs for streetscape amenities such as landscaping, seating, and lighting vary widely based on materials, planting type, ground conditions, and structural and decorative detail, and therefore are not included in the above cost estimates.



#### POLO ROAD PHASE 2 PRIORITY CONNECTION

LOCATION	IMPROVEMENT TYPE	UNIT TYPE	UNITS	UNIT COST	IMPROVEMENT COST	SUBTOTAL
CORRIDOR REDESIGN - POLO RIDGE CT TO ROBINHOOD RD, ROUNDABOUTS AT RANSOM, PEACE HAVEN, POLO PARK, SCHOOL*	Solid 4" line removal	Linear foot	22700	\$2.00	\$45,400	
	Dashed 4" line removal	Linear foot	22700	\$0.25	\$5,675	
	Solid 4" line striping	Linear foot	45400	\$1.85	\$83,990	
	Bicycle symbol markings	1/250 ft	90.8	\$220	\$19,976	
	4-foot Median	Square foot	45400	\$7.26	\$329,604	
	Traffic Circles	Each	4	\$85,370	\$341,480	
	Roundabouts	Each	4	\$650,000	\$2,600,000	\$3,426,125
					TOTAL	\$3,426,125
					20% Contingency	\$685,225
					GRAND TOTAL	\$4,111,350

<sup>\*</sup>Costs for streetscape amenities such as landscaping, seating, and lighting vary widely based on materials, planting type, ground conditions, and structural and decorative detail, and therefore are not included in the above cost estimates.

#### **COST ESTIMATE ASSUMPTIONS**

The cost estimates provided in this appendix represent preliminary estimates of construction costs based upon the recommendations. Important assumptions used to arrive at these estimates include:

- Costs are primarily based on Costs for Pedestrian and Bicyclist Infrastructure Improvements, released in October, 2013 by the UNC Highway Safety Research Center. Certain unit costs not covered in this guide, such as roundabouts, are based on costs from recent NCDOT bids.
- Costs do not include property acquisition, utilities, and custom overpasses/underpasses (except where explicitly identified).
- Standard construction methods and materials are used.

Since these preliminary estimates are based on a planning-level understanding of project components, rather than on a detailed design, they should be considered as "Order of Magnitude". Planning levelcosts are appropriate given the level of uncertainty in project design at this point in the process. Many factors can affect final construction costs, including but not limited to:

- Final construction phasing
- Selected alignment
- Fluctuations in commodity prices during the design and permitting processes
- Selected construction materials
- Property Acquisition

As the project progresses through preliminary, semifinal and final design phases, these uncertainties begin to diminish. With each round of refinement a range of expected construction costs will become more accurately known.

# CAMPUS TO WESTERN NEIGHBORHOODS PRIORITY CONNECTION

LOCATION	IMPROVEMENT TYPE	UNIT TYPE	UNITS	UNIT COST	IMPROVEMENT COST	SUBTOTAL
MULTI-USE TRAIL - POLO PARK AT POLO ROAD TO SILAS CREEK PKWY, QUINCY DR, ORMOND DR	Paved Multi-Use Trail	Mile	0.54	\$481,140	\$259,816	\$259,816
SILAS CREEK PKWY INTERSECTION IMPROVEMENTS	High-Visibility Crosswalks	Each	2	\$2,540	\$5,080	
	Pedestrian Signal with Countdown, and Minor Signal Revisions	Each	1	\$25,000	\$25,000	
	Median Islands	Each	1	\$13,520	\$13,520	
	Curb Ramps	Each	4	\$1,062	\$4,248	\$47,848
MULTI-USE TRAIL TO REYNOLDA RD/WAKE FOREST RD	Paved Multi-Use Trail	Mile	0.19	\$481,140	\$91,417	\$91,417
REYNOLDA RD/WAKE FOREST RD INTERSECTION IMPROVEMENTS	High-Visibility Crosswalks	Each	5	\$2,540	\$12,700	
	Pedestrian Signal with Countdown, and Minor Signal Revisions	Each	1	\$25,000	\$25,000	
	Pedestrian Signal with Countdown (additional)	Each	2	\$1,480	\$2,960	
	Median Islands	Each	2	\$13,520	\$27,040	
	Curb Ramps	Each	10	\$1,062	\$10,620	\$78,320
SIDEWALK - SILAS CREEK PKWY FROM WAKE FOREST RD TO HOPE VALLEY RD	Sidewalk	Linear foot	1162	\$32	\$37,184	\$37,184
GREENWAY CONNECTIONS - NEIGHBORHOODS WEST OF SILAS CREEK PKWY	Paved Multi-Use Trail	Mile	0.5	\$481,140	\$240,570	\$240,570
					TOTAL	\$755,154
					20% Contingency	\$151,031
					GRAND TOTAL	\$906,185



# CAMPUS TO DOWNTOWN PRIORITY CONNECTION

LOCATION	IMPROVEMENT TYPE	UNIT TYPE	UNITS	UNIT COST	IMPROVEMENT COST	SUBTOTAL
INTERSECTION IMPROVEMENTS - REYNOLDA RD/COLISEUM DR	High-Visibility Crosswalks	Each	4	\$2,540	\$10,160	
	Pedestrian Signal with Countdown, and Minor Signal Revisions	Each	1	\$25,000	\$25,000	
	Pedestrian Signal with Countdown (additional)	Each	6	\$1,480	\$8,880	
	Curb Ramps	Each	8	\$1,062	\$8,496	\$52,536
BICYCLE/PEDESTRIAN CROSSING - REYNOLDA RD	Median Refuge Island	Each	1	\$13,520	\$13,520	
	High-Visibility Crosswalk	Each	1	\$2,540	\$2,540	
	Crosswalk Signage	Each	2	\$300	\$600	
	Rectangular Rapid Flash Beacon	Each	1	\$22,250	\$22,250	\$38,910
MULTI-USE TRAIL - GRAYLYN CT TO HISTORIC DISTRICT	Paved Multi-Use Trail	Mile	0.05	\$481,140	\$24,057	\$24,057
MULTI-USE TRAIL - REYNOLDA RD TO GRAYLYN CT	Paved Multi-Use Trail	Mile	0.23	\$481,140	\$110,662	\$110,662
MEDIAN - COLISEUM DR/GRAYLYN CT	Median	Square foot	1380	\$7.26	\$10,019	\$10,019
BIKE LANES/SHARROWS - HISTORIC DISTRICT ROAD	Solid 4" line striping	Linear foot	2500	\$1.85	\$4,625	
	Bicycle symbol markings	1/250 ft	10	\$220	\$2,200	
	Sharrows	Foot	10	\$2	\$19	\$6,844
MEDIAN REFUGE - ARBOR RD	Median Refuge Island	Each	1	\$13,520	\$13,520	
	Diverter	Each	1	\$15,060	\$15,060	\$28,580
					TOTAL	\$271,608
					20% Contingency	\$54,322
					GRAND TOTAL	\$325,0929







Prepared for the Winston-Salem Department of Transportation (WSDOT), the City-County Planning Board (CCPB) of Forsyth County and Winston-Salem, and Wake Forest University (WFU)

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