Winston-Salem Urban Area
Comprehensive Bicycle Master Plan

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# Winston-Salem Urban Area Comprehensive Bicycle Master Plan

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The City of Winston-Salem and surrounding communities seek to develop a plan that improves the safety, efficiency, and convenience of the area’s bicycle network. The 2005 Winston-Salem Urban Area Comprehensive Bicycle Master Plan has been developed to provide the necessary updates to the original bike route map and to support the integration of bicycle planning into the long-range growth management efforts of the community.

The plan is divided into five main chapters and six appendices. Chapter 1 defines the scope and purpose of this bicycle planning effort, reminds area residents and policy-makers of the many benefits of bicycling, and establishes a vision for the new bicycle network.

Chapter 2 covers the existing conditions of cycling in the Winston-Salem Urban Area through a report on the inventory of conditions completed by the consulting team. The inventory examined bicycle trip attractors - origination and destination points - as well as the condition of the existing bicycle facilities and the roadways where new facilities might be proposed.

One of the primary products of this inventory was a map showing the Bicycle Level of Service on over 900 miles of roadway in the Winston-Salem Urban Area. The Bicycle Level of Service (BLOS) model uses conditions such as traffic speed, traffic volume, pavement conditions, and shoulder width to compute a grade that corresponds with the comfort level that a typical cyclist would feel on that roadway. The Winston-Salem BLOS results were used as one of the primary foundations for the new network proposal.

Chapter 3 describes the facilities that are recommended for the future bicycle network. These include off-road trails as well as designated bike lanes and wide shoulders along many of the area’s roadways.
To describe the new network in appropriate detail, the document breaks down the entire urban area into 13 geographic units and presents bicycle network recommendations for each unit.

The implementation steps necessary to change the vision into an on-the-ground reality are provided in Chapter 4. Here, maps and text describe the phasing of the entire network in three categories for implementation: short-term, medium-term, and long-term. In addition to these phases, top priority projects are listed for bicycle route signage, intersection maintenance and updates, and roadway improvements. Each of these top-priority projects are designed to maximize safety throughout the bicycle network and lead to a prompt and cost-effective approach to expanding and improving the existing bicycle route system.

Chapter 5 is designed to assist the City and its implementation partners by providing summary information about proper bicycle facility design. Images and text describe typical roadway cross-sections that should be used to provide improved bicycle safety and comfort when roadways are built or reconstructed. This chapter also describes the appropriate use of signage as well as general rules for bike lane widths, curve radii, and other facility specifics.

The appendices offer supplementary details that support the main body of the plan. Types of information here include a summary of the public involvement process, funding tools, and more detailed information on the Bicycle Level of Service model, including individual areas of the bicycle network, such as bicycle facilities recommended for Downtown Winston-Salem.

When combined, the individual components of this planning document lay out a complete new network of bicycle facilities for the Winston-Salem Urban Area and detail the tools and steps necessary to complete it.

High levels of interest and participation in cycling are apparent in the Winston-Salem area. The November 2004 Winston-Salem Urban Area Bicycle and Pedestrian Survey was distributed in all parts of the region and revealed that 65% of respondents rode a bicycle at least one time in the last month for recreation alone, not including other trips such as to work, school, social activities, training, shopping and other trips. Cyclists can be seen on urban and rural roads on almost any day and programs to promote bicycle safety and the health benefits of cycling are common. In addition, the local and regional planning documents include many references to the continued commitment of the community to improve bicycling opportunities in the area and ensure that bicycle planning is well-integrated into the current and long-range planning operations of the community.

With time and commitment, this Comprehensive Bicycle Master Plan will guide the Winston-Salem Urban Area to the creation of a first-class bicycle network that improves the lives of the residents and is enjoyed for many years to come.
chapter one

introduction

1.1 Scope and Purpose

In August of 2004, the City of Winston-Salem contracted with Greenways Incorporated (GWI) to create a Bicycle Master Plan for the Winston-Salem Urban Area. The project area includes all of the incorporated municipalities in Forsyth County as well as the City of King in Stokes County, the Town of Bermuda Run in Davie County, and some portions of northern Davidson County.

The planning process took nine months to complete and included regular input from a number of local advisory committees and technical committees related to transportation planning in general and bicycle planning specifically. The City of Winston-Salem worked closely with the GWI consulting team to ensure significant levels of public input including two public open house opportunities and an area-wide survey of the bicycle interests and uses of area residents.

This document presents the findings of these surveys and public input sessions along with an examination of the existing bicycling conditions in the Winston-Salem Area. Also included is a set of phased recommendations for updating the current system to meet the future needs of the area’s cycling public. The recommendations include actual physical changes as well as policy changes and program possibilities.

1.2 Benefits of Bicycling

For many years, small and large communities across America and throughout the world have been implementing strategies for serving the bicycle needs of their communities. They do this because of their obligations to promote safe travel and recreational opportunities for their residents and because of growing awareness of the many benefits of a bicycling. These
benefits can include increased health and fitness, additional recreation and transportation options, lower levels of traffic congestion on area roadways, improved air quality from lower rates of vehicle emissions, and increased sense of community among residents that experience their community at bicycle-scale.

1.2.1 Increased Health and Fitness
Obesity from poor eating habits and lack of exercise has become a critical issue in America today. Our unhealthy lifestyles lead to increased rates of many diseases. The increased rates of disease reduce overall quality of life for individuals and lead to increased medical costs for families, companies, and local governments. Increasing our activity levels is a crucial part of any strategy directed at improving overall community health, and bicycling is an excellent way to increase regular activity levels.

1.2.2 Environmental Improvements
When people choose to get out of their cars and onto their bicycles, they make a positive environmental impact. They reduce their use of gasoline which then reduces the volume of pollutants in the air. Other impacts can be a reduction in overall neighborhood noise levels and improvements in local water quality as fewer automobile-related discharges wind up in the local rivers, streams, and lakes.

1.2.3 Transportation Benefits
In 2001, The National Household Travel Survey found that roughly 40% of all trips taken by car are less than 2 miles. By taking these short trips on a bicycle, rather than in a car, citizens can have a substantial impact on local traffic and congestion. Additionally, many people do not have access to a vehicle or are not able to drive. An improved bicycle network provides greater and safer mobility for these residents.

1.2.4 Quality of Life
Many factors go into determining the quality of life for the citizens of a community: the local education system, prevalence of quality employment opportunities, and affordability of housing are all items that are commonly cited. Increasingly though, citizens claim that access to alternative means of transportation and access to quality recreational opportunities such as parks, trails, greenways, and bicycle routes, are important factors for them in determining their overall pleasure within their community. Communities that are attractive for residents can also attract new businesses and industries, and in turn, additional residents.

1.2.5 Summary and Additional Resources
Many private and public organizations have completed studies and surveys that show the many benefits of bicycling. The ideas presented above are only a small sample of the information that is available. If you would like to learn more about the benefits of bicycling, the internet can be a great source of information. Two good starting points are:

http://www.hhh.umn.edu/centers/slp/bike_bib.htm This site is maintained by the State and Local Policy Program of the Hubert Humphry Institute of Public Affairs at the University of Minnesota. Their website lists dozens of studies related to economic, social, and natural resource impacts associated with cycling.

http://www.bicyclinginfo.org/pp/benefits/ This website is provided by the Pedestrian and Bicycling Information Center based in Chapel Hill, NC

1.3 Prior Efforts
This Bicycle Master Plan is part of the City of Winston-Salem’s ongoing effort to provide safe and enjoyable bicycling opportunities to the residents of the metropolitan area. Earlier plan and map efforts have had a significant impact on the region’s physical bicycling infrastructure and the plans and documents that guide the community’s growth. Before implementing a new bicycle plan, it is important to understand the history of bicycle planning in the area.

The State of North Carolina’s Department of Transportation (NCDOT) has provided funding assistance to create this plan, as well as the previous plans and physical bicycle facilities. The Bicycle and Bikeway Act of 1974 directs the NCDOT to assist local govern-
ments with the development of bicycle programs, construct a statewide bikeway system, develop policies and standards for facilities, and develop safety training programs. In 1992, Winston-Salem and Forsyth County worked with the NCDOT Bicycle Program to create the community’s first public Bike Map. In addition to the map, bike route signs were posted on roadways to mark these routes. The new bicycle network described in this document recommends changes and additions to the 1992 bike routes.

In more recent years, the City and the residents of the community have created other important documents to assist and plan for the community’s cyclists. In 2000, the book *Great Bike Rides In and Around Winston-Salem* was published. It describes commonly used routes for cyclists who are interested in cycling outside the routes shown on the 1992 Bike Map.

In January 2003, the community completed a Greenway Plan that illustrates a number of critical routes that could accommodate shared use between cyclists, pedestrians, and other users. Additionally, the City/County Comprehensive Plan, or Legacy Development Guide, has specific sections that directly relate to planning for bicycle users, including the chapters on parks, open space, greenways, and transportation alternatives.

Local communities have also played an important role in planning bicycle improvements. The TAC (Transportation Advisory Committee) and the BAC (Bicycle Advisory Committee) worked together in the early part of the decade to create a set of priority bicycle and pedestrian project requests that were included in the 2003 Transportation Needs Report.

Finally, the 2025 Multi-Modal Long Range Transportation Plan includes a Bicycle Plan that is the result of input from the community and from transportation planners in the area.

Combined, these documents, plans, maps, and facilities represent a continued interest in the community in supporting bicycle transportation and a commitment to integrating bicycle needs into the physical development of the community’s transportation infrastructure.

### 1.4 Vision and Goals

The goal of improving bicycling in the Winston-Salem area has been established in many of the regions official planning documents. Listed below are a sample of statements found in those documents.

- **To promote safe and effective bicycling in Winston-Salem and Forsyth County for all types of cyclists and to promote the safe interaction of motorists and cyclists.** *(Winston-Salem DOT, Transportation Element, Bicycle Facilities Plan)*
- **Decrease reliance on the automobile and reduce traffic congestion by investing in attractive modes of transportation such as bus, light rail, bicycle, and improved pedestrian facilities.** *(Summary of the Legacy Comprehensive Plan, Legacy Principles)*
- **Develop a system of parks and natural areas connected by a greenway and open space network.** *(Summary of the Legacy Comprehensive Plan, Legacy Principles)*
- **Create a bikeway/sidewalk/greenway network that is an integral part of the transportation system and provides an alternative means of transportation as well as recreation opportunities.** *(Legacy Comprehensive Plan, Transportation Alternatives Section)*
- **Clearly marked and separated bike lanes on streets, bike trails, convenient bike parking, showers at destinations, and transit equipped to carry bikes are the kinds of enhancements that would provide an improved bicycling environment.** *(Legacy Comprehensive Plan, Transportation Alternatives Section)*
- **To facilitate the use of all modes of transportation, streets and highways must be designed to accommodate the various users by providing facilities for pedestrians, bicyclists and transit users.** *(Legacy Comprehensive Plan, Transportation Alternatives Section)*
Winston-Salem Urban Area

- Increase public awareness of the legal rights and responsibilities of bicyclists and motorists; Create and expand on and off-road cycling opportunities; Improve the health of the residents of Winston-Salem/Forsyth County. (Goals of the Bicycle Advisory Committee)

- Our mission is to move people and goods safely and efficiently on the surface transportation system in Winston-Salem and Forsyth County. We aspire to plan, design, construct and operate our system so that congestion, delay and traffic accidents are minimized while transportation choices are maximized. (Goals/Mission of City DOT)

Taken together, and combined with the goals articulated by the participants at the fall 2004 public workshop, a vision of what the community wants to achieve becomes apparent:

**Vision Statement of the Winston-Salem Urban Area Bicycle Plan**

In an integrated and thoughtful manner, create a safe and effective system of bicycle facilities that links together existing resources and destinations, supports alternatives to automobile travel, increases recreation opportunities, and provides improved options for advancing the community’s mobility, health, and quality of life.

Many types of cyclists can be seen in Winston-Salem. This planning effort is designed to improve the opportunities for each of them.

**20th Street**

**Shallowford Road**

**Liberty Street**

**Old Greensboro Road**

**WSTA Transit Center**
chapter two
cycling today

2.1 Current Bicycle Documents

Bicycle planning in Winston-Salem is shaped by planning and project development at many levels. The Federal Government produces standards and guidelines that are then customized at the state, regional and local levels. The State also produces long-range policy, project, and funding documents that are based on local-level needs and state-level interests and capacities.

Of all the plans, guidelines, and strategies, the most commonly referenced documents for guiding the development of the bicycle transportation system in the Winston-Salem area are: NCDOT’s Long-Range Statewide Multimodal Transportation Plan (updated in 2004), The North Carolina Bicycle Facilities Planning and Design Guidelines, The Winston-Salem Urban Area Long Range Transportation Plan, and the City-County Planning Board’s Legacy Development Guide. Their function is to coordinate and guide bicycle planning in a manner that meets the most critical needs first by developing projects that serve the greatest number and types of users.

In Winston-Salem, there are few outright bicycle policies and ordinances noted in the local planning and zoning documents. As is the case in many municipalities, guidelines and goals are prevalent, but rules and requirements are less common. The following paragraphs summarize the key documents that were referenced when designing the new bicycle network for the Winston-Salem Urban Area.

2.1.1 NCDOT Statewide Transportation Plan
The latest version of this document calls for connectivity improvements between different modes of transportation as well as the development
of new opportunities for bicycle transportation. To achieve this, the plan recommends a larger financial investment in bicycle facilities than has historically been available. It also promotes the idea of strengthening the importance of community-level goals in transportation planning and “mainstreaming” the development of bicycle facilities, i.e. ensuring that bicycle facility planning is considered early on in the project planning and is a regular part of everyday transportation across the state rather than a secondary consideration or overlooked component.

2.1.2 NC Bike Facilities Guidelines
This is the primary guidebook for designing bicycle facilities in North Carolina. It includes recommendations for the bicycle planning process and then borrows heavily from the AASHTO Design Guidelines and those of other states to recommend a set of guidelines that maximize safety, efficiency, and conformity of facilities. The document was created by the UNC Institute of Bicycle and Pedestrian Transportation for the NCDOT Office of Bicycle and Pedestrian Transportation. At the end of the document are excerpts from the MUTCD and State level bicycle policy and law.

2.1.3 Winston-Salem/Forsyth County LRTP
This is Winston-Salem’s equivalent of the State level multimodal transportation plan. It covers all forms of transportation including bicycle and pedestrian uses. It documents the community’s long-term (2025, in this case) transportation goals and objectives that were developed through a combination of citizen involvement, professional expertise and conformity with the City-County Legacy Plan. Two particularly pertinent sections of this document are the Street and Highway Plan and the Bicycle Facilities Plan. Both of these sections demonstrate the community’s interest in developing bicycle facilities as part of all new roads and road improvements. Passage of this document is a critical step in establishing specific bicycle facility projects that are needed and ensuring that road development and maintenance projects are done in a way that facilitates implementation of this Bicycle Plan.

2.1.4 Legacy Development Guide
This is the comprehensive plan for Winston-Salem and Forsyth County and serves as the primary reference for growth management strategies, community development practices, and resource protection activities in Forsyth County and all eight of its municipalities. It was adopted in 2001 and has a horizon date of 2015. Updates and companion documents are regularly produced. During the creation of this comprehensive plan, a vision for the area’s transportation options was developed along with a set of ten guiding principles. The vision includes expansion of bicycling opportunities, and the ten principles represent the continuing interest in expanding transportation options, promoting connectivity between destinations, and ensuring that the character of the community supports human-scale experiences and improves overall livability. Chapter 4 (Transportation Alternatives) and Chapter 8 (Open Space, Parks, and Greenways) contain very detailed action items and policy statements that reflect the community’s sincere commitment to expanding and improving opportunities for cyclists.

The Legacy Development Guide is the comprehensive plan for Forsyth County and its eight municipalities. It contains detailed information about the communities’ vision for bicycle planning.
2.2 Current Bicycle Maps

Like many North Carolina communities in the 1990s, Winston-Salem and Forsyth County used funding assistance from the NCDOT Bicycle Program to create a Bike Map. The original alignments for the bike routes shown on the map were created by citizens on the Bikeway Planning Committee. The routes remain signed today. This document recommends a number of changes to the existing bicycle routes to facilitate improved safety and usability. A new Bicycle Map is being produced in 2005 as part of this planning process.

Another commonly-used map resource for cycling in the Winston-Salem area is the book, “Great Bike Rides In and Around Winston-Salem”. Produced by Judi Lawson Wallace and Ken Putnam, Jr. in 2000, the book provides maps and brief descriptions of over 50 bicycle rides in the area surrounding Winston-Salem.

2.3 Current Bicycle Programs

The Winston-Salem Urban Area has an active cycling community and benefits from many events and programs designed to promote cycling and safety among cyclists. A list of some of these is below:

- Be Healthy Coalition
- Bicycle Safety Month (May)
- Bike to Work Day
- Tour de Tanglewood
- Bike races
- WePLAY
- Behind the Badge
- Local Police Department’s Bicycle Patrol
- Bicycle Rodeo
- Various bicycle tours

For further information on bicycle programs, see section 4.7.4.
2.4 Inventory of Bicycle Conditions

Cycling conditions vary considerably across the Winston-Salem Urban Area. Existing greenways, low volume residential streets, and several collector and arterial roadways with stripped shoulders provide safe and convenient access by bicycle. However there are many other high-volume roadways with high speeds and little shoulder where bicyclists are not safe. Other existing roadways are difficult to cross because of high volume and speeds, traffic signals timed for autos, and lack of curb ramps. As a whole, the comfortable facilities that exist are often disconnected, making it difficult to find routes to destinations and facilities for recreation.

To understand the character of the community, its current bicycle system, and potential areas for improvement, the consultant team investigated a number of factors that affect the condition of the overall bicycle facility. The findings are presented on the following pages. Maps and charts are used to supplement the text descriptions.

2.4.1 Trip Attractors

People in the Winston-Salem Urban Area currently bicycle to a variety of destinations for a great number of activities. Each of these destination points is referred to in this document as a bicycle attractor. The most common categories of bicycle trip attractors include:

- Employment centers (e.g. downtown Winston-Salem, Hanes Mall area, Summit Square Shopping Center area)
- Schools (e.g. all public and private elementary, middle, and high schools)
- Colleges (e.g. Wake Forest University, Winston-Salem State University, Salem College, Forsyth Technical Community College, NC School of the Arts)
- Parks (e.g. Tanglewood Park, Reynolds Park)
- Greenways (e.g. Salem Creek Trail, Newell/Massey Trail)
- Hospitals (e.g. Wake Forest University Baptist Medical Center, Forsyth Medical Center)
- Shopping areas (e.g. Hanes Mall, Northside Shopping Center)
- Transportation centers (e.g. Winston-Salem Transportation Center)
- Community and recreation centers (e.g. Martin Luther King, Jr. Community Recreation Center)
- Tourism destinations (e.g. Old Salem, Reynolda House and Gardens)

Each of these categories of bicycle trip attractors were considered when determining locations for the physical improvements recommended later in this Plan. Some of the most important destinations that were identified are shown on the Bicycle Trip Attractors map on the following page.

2.4.2 Land Use Characteristics

Forsyth County has over 306,000 residents, including 185,480 in the City of Winston-Salem. The greatest population density and many of the key destinations in the region are in the City of Winston-Salem. Particularly dense neighborhoods are located within two miles of the Winston-Salem central business
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district. In many parts of the City, residential areas are within bicycling distance of parks, libraries, schools, universities, and other bicycle destinations.

The communities of Walkertown, Kernersville, Clemmons, Lewisville, Tobaccoville, and King have traditional downtowns that were developed with concentrated residential neighborhoods, business districts, parks, and other activities. Though these downtowns do not cover large areas, their land use patterns are conducive to bicycling. However, bicycling to activities in newer parts of these communities and other suburban parts of the region can be unattractive to many people because residential areas and bicycling destinations are spaced further apart. In addition, bicyclists traveling in these areas often need to ride along or cross wide arterial roadways with high traffic volumes, such as Reynolda Road and New Walkertown Road.

2.4.3 Connectivity
As the analysis in the next section will show, there is a lack of connectivity between current greenway path, shoulder, and bike lane facilities in the Winston-Salem Urban Area. Barriers between existing facilities make it difficult to travel by bicycle. The recommendations in this Plan will help improve bicycling conditions along many routes in the Winston-Salem Urban Area. Improved bicycle facilities will provide better connectivity between residences and common destinations for bicycling. By helping bicyclists overcome obstacles such as limited roadway width and heavy traffic, the number of trips that are made by bicycle will increase.

2.4.4 Existing Bicycle Facilities
The City of Winston-Salem developed a 68-mile system of bicycle routes in 1992. These loop routes reach all parts of the City. Major intersections along the routes have signs that show a map of the entire route. The Winston-Salem’s bike routes connect to a 130-mile bike route system in Forsyth County.

Approximately 22 miles of shared-use paths (greenway paths) have also been developed. These pathways currently serve some of the more popular recreation areas in the Winston-Salem Urban Area, including Salem Lake, Winston Lake, Historic Bethabara, Shaffner Park, and Civitan Park. Many more greenway paths are recommended in the 2003 Greenway Plan. The map on the following page (Existing Bicycle Facilities) shows the shared-paths, signed bicycle routes, and other bicycle facilities.

Bicycle parking is provided at the Winston-Salem Transportation center and at many other important bicycle destinations in the region. Research for the bicycle section of the Winston Salem/Forsyth County Long Range Transportation Plan found that there were bicycle racks at 22 of the 55 Winston-Salem/Forsyth County schools, at seven of the eleven Forsyth county libraries, at thirteen of the 21 city park and recreational centers, at five of the eight county parks,
The Bicycle LOS Model uses letter grades to describe existing conditions. Level “A” reflects the best conditions for bicyclists; level “F” represents the worst conditions. Appendix B provides a detailed description of the Bicycle LOS Model used in the Winston-Salem Urban Area. The field measurements taken by the City for use in the model are described in Appendix C.

The City of Winston-Salem conducted a field inventory to evaluate Bicycle LOS on 937 miles of roadways within the MPO urban area boundary in Fall 2004. The field analysis network represented about 28 percent of all roadway miles in the urban area. While all roads were not included, most of the major arterial and collector roadways in the County were analyzed in the field. These main roadways serve the most traffic and provide the best connectivity between neighborhoods and destinations, and require analysis to develop recommendations for improvement. Many

Many of the existing bicycle facilities in the Winston-Salem Urban Area are disconnected. Sections of roadway with paved shoulders are often less than one-mile long. The 22 miles of greenway paths are broken into five different segments in different parts of the Urban Area. Though the bike routes in Winston-Salem and Forsyth County are marked as continuous routes, there are some parts of the routes with high volumes of fast traffic, rough pavement, difficult intersections to cross, and other uncomfortable conditions for bicycling.

2.4.5 Suitability

The Bicycle Level of Service (Bicycle LOS) Model was used to evaluate bicycle suitability on roadways in the Winston-Salem Urban Area. The Bicycle LOS Model is a scientifically-calibrated method of evaluating the comfort level of bicyclists on a roadway segment, given existing bicycling conditions in relation to motor vehicle traffic. It uses objective, quantitative data to produce a measure of the level of service perceived by a typical bicyclist. Model inputs include measurable traffic and standard roadway factors such as:

- Lateral separation between bicyclists and adjacent motor vehicle traffic (measured by the width of the right-most lane and paved shoulder)
- Presence and width of a paved shoulder or bike lane
- Volume and speed of motor vehicle traffic
- Percentage of heavy trucks
- Number of travel lanes
- Presence of on-street parking
- Pavement condition

The Bicycle Level of Service Model was developed using the perceptions of a diverse group of bicyclists. These cyclists represented a wide range of ages and experience levels. Each of the cyclists rated their own level of comfort as they rode on roadway segments with a wide variety of traffic conditions and street layouts. Their responses were combined using statistical modeling techniques to determine which measurable traffic and roadway characteristics had significant relationships to the comfort levels reported by all of the bicyclists. A quantitative model was developed from these data to predict, with the greatest possible accuracy, how a diverse set of bicyclists would feel on a roadway with any given combination of traffic and roadway characteristics. Therefore, a “typical” bicyclist is a bicyclist that is most closely represented by the wide range of ages and experience levels present in the original Bicycle Level of Service experiment. In general, it is expected that more experienced cyclists would independently rate roadways higher than a “typical” cyclist because they are more likely to be comfortable riding in more difficult conditions. Please see Appendix B for additional background on the Bicycle Level of Service Model.
of the minor roadways that were not included in the analysis are more conducive to bicycling (and would likely have high Bicycle LOS grades) because of lighter traffic volumes and slower traffic speeds.

The Bicycle LOS results show that about one-third (34.1%) of the study network roadways have Bicycle LOS scores of “C” or better. However, most roads have grades of “D” or worse, indicating poor comfort for bicyclists (see Table 1 and Figure 1). This is comparable to other urban areas similar to Winston-Salem in Maryland and Virginia.

Roadways with the highest suitability for bicycling can be found in all parts of the study area, but most segments with good conditions are short and disconnected from other high-suitability segments. In general, the highest Bicycle LOS grades throughout the urban area are on road segments with low traffic volumes (under 1,000 vehicles per day).

Most of the streets in the Winston-Salem downtown area have moderate Bicycle LOS grades of “C” and “D”. The east side of Downtown Winston-Salem tends to have higher grades than other parts of the

### Table 1. Winston-Salem Urban Area Roadway Inventory Summary Table

<table>
<thead>
<tr>
<th>Study Network Roadways</th>
<th>Miles</th>
<th>% of Miles</th>
<th>Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Study Network*</td>
<td>937.3</td>
<td>100.0%</td>
<td>1693</td>
</tr>
<tr>
<td>Bicycle Level of Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>37.0</td>
<td>3.9%</td>
<td>98</td>
</tr>
<tr>
<td>B</td>
<td>78.2</td>
<td>8.3%</td>
<td>158</td>
</tr>
<tr>
<td>C</td>
<td>204.5</td>
<td>21.8%</td>
<td>437</td>
</tr>
<tr>
<td>D</td>
<td>391.1</td>
<td>41.8%</td>
<td>713</td>
</tr>
<tr>
<td>E</td>
<td>179.8</td>
<td>19.2%</td>
<td>225</td>
</tr>
<tr>
<td>F</td>
<td>46.0</td>
<td>4.9%</td>
<td>57</td>
</tr>
<tr>
<td>No Grade**</td>
<td>0.7</td>
<td>N/A</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>937.3</td>
<td>100.0%</td>
<td>1693</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study Network Roadways</th>
<th>Miles</th>
<th>% of Measured Miles</th>
<th>Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segments with 3-foot or wider shoulders</td>
<td>18.3</td>
<td>1.9%</td>
<td>46</td>
</tr>
<tr>
<td>Segments designated as Bike Routes***</td>
<td>62.4</td>
<td>6.7%</td>
<td>147</td>
</tr>
<tr>
<td>Segments with &quot;Share the Road&quot; Signs</td>
<td>12.4</td>
<td>1.3%</td>
<td>28</td>
</tr>
<tr>
<td>Segments with Steep Grades (&gt;5%)</td>
<td>59.0</td>
<td>6.3%</td>
<td>78</td>
</tr>
<tr>
<td>Segments with some Sidewalk on N/E side</td>
<td>120.8</td>
<td>12.9%</td>
<td>515</td>
</tr>
<tr>
<td>Segments with some Sidewalk on S/W side</td>
<td>127.2</td>
<td>13.6%</td>
<td>534</td>
</tr>
<tr>
<td>Segments with some Sidewalk</td>
<td>151.9</td>
<td>16.2%</td>
<td>608</td>
</tr>
<tr>
<td>Segments with Complete Sidewalks on Both Sides</td>
<td>85.9</td>
<td>9.2%</td>
<td>416</td>
</tr>
<tr>
<td>Linear Miles of Sidewalk</td>
<td>238.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Study network includes collector and arterial roadways and excludes local streets and freeways.  
**Segments with no grade include road segments that were too short to take measurements and private streets.  
***Segments with "Bike Route" signs visible to data collectors—does not represent total route mileage.
downtown area because several of the main roads in this area have wide lanes and relatively low traffic volumes. Most of the thoroughfares that go between the urban core of Winston-Salem and outlying areas have low Bicycle LOS grades. University Parkway and Silas Creek Parkway have especially challenging conditions (most segments are “D”, “E”, or “F”). Others have moderately low grades (most segments are “D”), including Peters Creek Parkway, Stratford Road, Country Club Road, Robinhood Road, Reynolda Road, Old Walkertown Road, New Walkertown Road, Reidsville Road, Reynolds Park Road, and Martin Luther King, Jr. Drive.

**Bicycle Level of Service Considerations**

The Bicycle LOS Model should be used with the following considerations in mind:

- BLOS grades represent the *perceived* level of comfort experienced by a typical bicyclist.
- BLOS grades are not associated with safety or reported crashes.
- The BLOS model is a roadway segment analysis; it does not apply to intersections.

**Other BLOS Applications**

In addition to evaluating current conditions for bicycling in the Winston-Salem Urban Area, the Bicycle LOS Model was used to help select routes for recommended bicycle facility improvements and to display bicycle suitability on the publicly-distributed Winston-Salem Bicycle Map. The Bicycle LOS Model is also a tool that can be used to calculate how alternative scenarios for a proposed roadway project would affect bicyclists.

Figure 2 shows an example of how the Bicycle LOS Model can be used to test alternative roadway cross-sections. Currently, the section of Reynolds Park Road between Martin Luther King Jr. Drive and Peachtree Street is a two-lane undivided road with moderate levels of traffic, average pavement, and no on-street parking. Under current conditions, this road segment receives a Bicycle LOS grade of “D” (below average). Repaving the roadway can raise the Bicycle LOS grade to a “C” (average). Striping a five-foot bike lane can also raise the Bicycle LOS grade to “C”. Combining the two treatments would result...
in the greatest improvement in bicycling conditions. Repaving and adding a bike lane stripe would improve the Bicycle LOS grade to “B” (above average).

The Bicycle LOS Model is a useful tool for analyzing bicycle suitability for proposed roadway projects. It is also important to evaluate the impacts of alternatives on all types of roadway users, including motor vehicle drivers, public transit users, and pedestrians.

2.5 Current Bicycle Usage

In coordination with the plan, the Winston-Salem Department of Transportation (WSDOT), decided to conduct a bicycle and pedestrian survey to gauge current bicycle usage. On January 18, 2005, the survey was randomly mailed to 6000 residents within the Winston-Salem Urban Area, with the expectation of a 10% return. The survey was also sent home with fifth graders at 16 Winston-Salem Forsyth County Schools, handed out by a variety of cycling constituents, and an online version placed on the City of Winston-Salem’s main webpage and the WSDOT webpage.

The purpose of the survey is to better understand the bicycle and pedestrian transportation needs of the citizens in the Winston-Salem Urban Area and to be able to use the results of the survey statistics in support for the addition of bicycle and pedestrian amenities.

2.5.1 Survey Methodology

Ideas, questions and methods were developed by researching the 1996 Travel Survey Manual produced by the U.S. Department of Transportation and the U.S. Environmental Protection Agency and on the Bureau of Transportation Statistics: National Household Travel Survey webpage. The survey was designed in a four-page, newsletter format and printed on 11”x17” paper (see Appendix A, section A.6 for a copy of the survey forms). The first page is a cover letter.
which states the purpose of the survey and provides instructions. The inside two pages consist of the 26 questions. Another page lists contact information to WSTA for questions and comments, and includes a return postage paid stamp.

**Random Mail Surveys**
On January 18, 2005, the survey was mailed to a random set of 6,000 households within the City and surrounding urban area. In order to distribute the surveys evenly across the study area, surveys were mailed to 300 households in each of 20 distinct areas. These areas included each of the 17 zip codes in Forsyth County and the portions of the three surrounding counties in the study area. Of the 300 addresses selected in each area, 60 were renters and 240 were property owners. The addresses for the residents were selected from geographic information systems (GIS) property parcel data provided by each of the four counties in the study area. A total of 591 random mail surveys were completed and returned.

**Elementary School Surveys**
In order to target input from minority populations, 1,062 surveys were sent home with fifth grade students at 16 Winston-Salem Forsyth County Schools (in February 2005). Students were given three weeks to return the surveys back to the school, completed by the student or by a parent/guardian. As an incentive for returning a completed survey, each student’s name was placed in a drawing to win a bicycle and a helmet. One winner was selected from each school. The cover letter of the survey was changed slightly to address parents, but the same survey questions were used. The City received 330 completed surveys from this distribution method, including 25 versions that were translated into Spanish.

**Online Surveys**
The City of Winston-Salem posted an online version of the survey on the City website for people to complete (in February and March 2005). All questions were identical to the other surveys. However, the online format allowed participants to click boxes or use drop-down menus to enter their responses. Due to the anonymity of the online survey process, there was no way to determine if someone completed the survey multiple times. In addition, some citizens may have pressed the return button before completing the survey and then started over again. This would cause the result database to have two response records (one complete and the other incomplete) for the same person. A total of 235 surveys were completed online.

**Miscellaneous Surveys**
As a supplement to the other forms of survey distribution, cycling enthusiasts were encouraged to take surveys and pass them out at various locations (in February and March 2005). The enthusiasts were asked to put a specific code on each survey to identify the location of distribution. Distribution locations included:

- Recreation centers
- Bicycle shops
- Public health organizations
- Major employers
- Churches
- Colleges
- Tourist Destinations

A total of 132 miscellaneous surveys were completed and returned to the City.
2.5.2 Survey Results
Below are samples of the information gathered from the combined responses received from all completed and returned surveys. See Appendix A for tables listing the combined responses of each survey questions asked.

A) How many times per month do you ride a bicycle for the following purposes?

<table>
<thead>
<tr>
<th></th>
<th>To work</th>
<th>To School</th>
<th>Rec. Exercise</th>
<th>Social Activities Events</th>
<th>Touring</th>
<th>Training</th>
<th>Shopping Errands</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 10</td>
<td>52</td>
<td>17</td>
<td>660</td>
<td>185</td>
<td>170</td>
<td>121</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>11 to 20</td>
<td>7</td>
<td>0</td>
<td>125</td>
<td>9</td>
<td>26</td>
<td>7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>20+</td>
<td>4</td>
<td>3</td>
<td>37</td>
<td>7</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

B) Which of the following factors plays a role in whether or not you ride a bicycle to a destination?

<table>
<thead>
<tr>
<th></th>
<th>Travel time</th>
<th>Bike Parking</th>
<th>Route Safety</th>
<th>Level of Traffic</th>
<th>Cost of gas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>328</td>
<td>182</td>
<td>696</td>
<td>535</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Need for Exercise</td>
<td>Shower Changing Facility</td>
<td>Weather Hills</td>
<td>Theft Bike Security</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>459</td>
<td>134</td>
<td>359</td>
<td>239</td>
<td>245</td>
</tr>
</tbody>
</table>

C) Is there a bicycle route, greenway or trail near your home?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>434</td>
<td>763</td>
</tr>
</tbody>
</table>

D) If yes, do you use the bicycle route, greenway or trail?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>285</td>
<td>142</td>
</tr>
</tbody>
</table>

E) If no, would you use a bicycle route, greenway or trail if it were near your home?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>607</td>
<td>106</td>
</tr>
</tbody>
</table>

F) Should public funds be used to improve pedestrian or bicycle transportation options?

<table>
<thead>
<tr>
<th>Pedestrian Options</th>
<th>Bicycle Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

G) Did you bicycle mostly on:

<table>
<thead>
<tr>
<th>Paved Roads</th>
<th>Shoulders of Paved Roads</th>
<th>Bike Lanes on Roads</th>
<th>Bike Paths Trails</th>
<th>Unpaved Roads</th>
<th>Sidewalks</th>
<th>Grass</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>487</td>
<td>93</td>
<td>26</td>
<td>173</td>
<td>16</td>
<td>69</td>
<td>26</td>
<td>35</td>
</tr>
</tbody>
</table>

H) Which type of bicycle facility would you like to use when riding to a destination?

<table>
<thead>
<tr>
<th>Paved Shoulders</th>
<th>Green-ways Off Road Trails</th>
<th>Vehicle Travel Lanes</th>
<th>Striped Bike Lanes</th>
<th>Wide Vehicle Travel Lanes</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>414</td>
<td>634</td>
<td>101</td>
<td>714</td>
<td>183</td>
<td>414</td>
</tr>
</tbody>
</table>
chapter three
new bike network

3.1 Overview

Based on an examination of the existing conditions (Chapter 2) and an understanding of the community’s vision and goals for improved cycling opportunities (Chapter 1), the Winston-Salem Urban Area has adopted a new Bicycle Network.

Some of the individual Bicycle Network components that are described in this chapter include recommended bicycle facility types, major corridors that shape the network, and a number of specific recommendations for needed, individual changes. The methodology that was used to develop the network is briefly introduced in section 3.3.

This chapter describes the facilities recommended for this new Bicycle Network, while priorities, time lines, and steps for implementing the plan are presented in Chapter 4 - Implementation. Together, these two chapters provide a complete picture of the nature and design of the new Bicycle Network as well as the steps that are necessary for turning the vision into a reality.

3.2 The Network

The Bicycle Network is the set of routes that should be improved to create a system of safe and convenient bicycle facilities throughout the Winston-Salem Urban Area. The newly proposed network includes 1,245 miles of bicycle facilities. These facilities include paved shoulders, bike lanes, shared-use paths, and other bicycle accommodations. It is anticipated that the full network will be complete by 2030.

The Bicycle Network is shown on two large maps included at the back of this document and available online at: www.cityofws.org/DOT. Map 1, the Winston-Salem Urban Area Bicycle Network Facility
Recommendations Map, designates key road corridors where bicycle facilities should be added or improved to provide connectivity for biking throughout the region (see Map Insert 1). Map 2, the Winston-Salem Urban Area Signed Bicycle Route System, shows which roads and shared-use paths should be signed as official bike routes (see Map Insert 2). The signed bicycle route system (Map 2) is a subset of the larger bicycle network (Map 1), which includes facilities that serve cyclists all over the Winston-Salem area, but are not signed as specific bicycle routes.

Development of the Winston-Salem Urban Area Bicycle Network will require a long-term, cooperative effort between the City of Winston-Salem, the North Carolina Department of Transportation, Forsyth County, Davidson County, Davie County, Stokes County, and other local and state agencies.

### 3.3 Bicycle Network Methodology

A variety of information sources were consulted during the development of the Bicycle Network, including previous plans and studies, recommended projects, the consultants’ field work, and noted bicycle trip attractors. A more complete list of information inputs is found in the box below (Figure 3.1). The process of selecting roadways and facilities for the Bicycle Network also considered existing roadway cross-sections, traffic patterns, and surrounding land use characteristics.

Several concepts were developed as guides for the network development process. These concepts represented the interests expressed by the client, the BAC, and the public. They also help achieve the goals articulated in other local planning documents. Some of the concepts that guided the development of the network include:

1) Residents who live within two miles of Downtown Winston-Salem should not be more than one-half mile from the closest bike route in the network.

2) Residents who live in all other parts of the Winston-Salem area should not be more than two miles from the closest bike route in the network.

3) Most of the network’s roadway segments should serve as connectors to important destinations.

4) Other roadway segments within the network should fill in the transportation gaps between destination points.

5) Bicycle network roadways that are part of a signed bike route should have a Bicycle Level of Service of “C” or better.

Figure 3.1

**Winston-Salem Urban Area Bicycle Network**

**List of Information Inputs**

1) Locations of the existing signed bike routes in the City of Winston-Salem and Forsyth County
2) 2003 Greenway Plan for Winston-Salem and Forsyth County
3) Scoring reports from the consultants’ Bicycle Level of Service study
4) Public comments made during community workshops
5) Responses from the City of Winston-Salem’s Bicycle Survey
6) Recommendations from representatives of the Bicycle Advisory Committee
7) Field observations made in Fall 2004
8) Projects listed in the 2004-2010 Metropolitan Transportation Improvement Program (MTIP)
10) Projects listed in the 2003 NCDOT Moving Ahead Program
11) Projects listed in the Winston-Salem Urban Area Thoroughfare Plan
12) Existing parks, hospitals, schools, colleges, transit facilities, and other pedestrian and bicycle attractors
3.4 Recommended Facilities

There are many facility types that support bicycle use. The primary ones recommended in this plan are shown in Table 2 (below). For each of these facility types, the miles that currently exist and the miles that this plan recommends as part of the network are also listed. The different facility types have specific design components that are appropriate for particular types of roadways. Selection of a facility type depends on roadway specifications such as volume of traffic flow, speed of traffic, amount of space available, and surrounding land use characteristics. Each of the facility types noted in Table 2 is described in more detail on the following paragraphs.

3.4.1 Shared Roadways (No special bicycle facilities)

Shared roadways are streets and roads where bicyclists can be served by sharing the travel lanes with motor vehicles. Usually, these are streets with low traffic volumes and/or low speeds, which do not need special bicycle accommodations in order to be bicycle-friendly. The Bicycle Network Facility Recommendations Map includes 99.5 miles of on-road bikeway connectors. These are shared roadways that provide important connections to other recommended bicycle facilities and destinations in the region. They do not require any new facilities.

Examples: Ivy Avenue; Grubbs Road

3.4.2 Striped/Paved Shoulders

Paved shoulder space improves the safety and comfort of bicyclists. There is no minimum width for paved shoulders, however a width of 4 feet is preferred1,2,3. On many roadways, motor vehicle travel lanes can be narrowed to provide more shoulder space. According to the AASHTO Guide for the Development of Bicycle Facilities (1999), “where 4-foot widths

Table 2. Winston-Salem Urban Area Bicycle Network Recommended Facilities

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Existing Facilities</th>
<th>Miles1</th>
<th>Recommended Bicycle Network</th>
<th>Miles1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signed bicycle route2</td>
<td>198.1</td>
<td></td>
<td>Roads that could be signed as bicycle routes3</td>
<td>463.3</td>
</tr>
<tr>
<td>Paved shoulder</td>
<td>21.4</td>
<td></td>
<td>Paved shoulder</td>
<td>386.7</td>
</tr>
<tr>
<td>Bicycle lane</td>
<td>0.6</td>
<td></td>
<td>Bicycle lane</td>
<td>64.0</td>
</tr>
<tr>
<td>Shared-use path/Greenway</td>
<td>22.2</td>
<td></td>
<td>Shared-use path/Greenway</td>
<td>171.3</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td>Other on-road bicycle accommodation3</td>
<td>27.1</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
<td>Other on-road bicycle facility, but sidepath may be used in the short-term4</td>
<td>114.0</td>
</tr>
<tr>
<td>Unknown facility</td>
<td></td>
<td></td>
<td>Unknown facility</td>
<td>18.0</td>
</tr>
<tr>
<td>Total</td>
<td>242.2</td>
<td></td>
<td>Total</td>
<td>1244.5</td>
</tr>
</tbody>
</table>

1Centerline miles (facilities on both sides of the road are not counted separately).
2These figures include bike routes being considered for the public bicycle map, which total 175.5 miles. Note that some roadway segments recommended for bicycle routes are also included in the other categories.
3Other on-road bicycle accommodations include edgelines and shared pavement markings.
4The long-term goal for roads in this category is to provide on-road facilities for bicyclists. However, a sidepath adjacent to the roadway can be acceptable in the short-term when a roadway has high-speed, high-volume traffic and few intersecting roadways and driveways and there is no other option for widening the roadway. Sidepath bikeways in locations with frequent driveways are not a good solution due to conflicts with turning vehicles. If used, these facilities should not be signed as bike routes. NOTE: The GIS database lists this category as “Sidepath” or “Wide Sidewalks”.

Buena Vista Road is an example of a shared roadway.
cannot be achieved, any additional shoulder width is better than none at all\(^1\). Paved shoulders also improve safety for motor vehicles, prevent pavement deterioration at the edge of the travel lanes, and provide space for pedestrians. In rural parts of the Winston-Salem Urban Area, shoulders were recommended on roads for three main reasons: 1) field data collectors noted that it may not be difficult to add a shoulder to the side of the road (few obstructions, generally level grade); 2) the road serves as a logical recreational route; 3) the road has a Bicycle LOS grade lower than “C”, and adding a shoulder would help improve the Bicycle LOS.

*Examples: Hawthorne Road; parts of Germanton Road*

### 3.4.3 Bike Lanes

A bike lane is a portion of the roadway that has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes are always located on both sides of the road (except one way streets), and carry bicyclists in the same direction as adjacent motor vehicle traffic. The minimum width for a bicycle lane is 4 feet; five- and six-foot bike lanes are typical for collector and arterial roads.

*Example: Tallison Drive*

### 3.4.4 Shared-Use Paths/Greenways (Separated from the roadway right-of-way)

Shared-use paths (multi-use trails) are an important component of a bicycle and pedestrian transportation system. They can provide a high-quality bicycling experience in an environment that is protected from motor traffic because they are constructed in their own corridor, often within open-space areas. Shared-use paths can be paved and should be a minimum of 10-feet wide. Their width may be reduced to eight feet if there are physical or right-of-way constraints. Greenway paths that are recommended in this Plan provide important connections that complement on-road bicycle facilities. The 2003 Greenway Plan recommends other multi-use trails that should also be developed.

*Examples: Salem Creek Trail; Bethabara Trail*

### 3.4.5 Signed Bike Routes

A signed bike route is a shared roadway which has been designated by signing as a preferred route for bicycle use. Bike route signs can be posted on key routes to indicate to bicyclists that particular advantages exist to using these routes compared with alternative routes. Bike route signs can also be used with a variety of other bicycle facility types, including shared roadways, bike lanes, paved shoulders, and greenways. Road segments on bike routes should be Bicycle LOS “C” or better.

*Examples: Kernersville Loop Bike Route; North Carolina Bike Route 2*

### 3.5 Other Improvements for Bicyclists

Signed bike routes, paved shoulders, bike lanes, and shared-use paths are the most common facilities that will be used to develop the Bicycle Route Network in the Winston-Salem Urban Area. Yet, it is not possible to provide these types of facilities in some locations. In certain cases, other types of improvements that benefit bicyclists are recommended. These other beneficial bicycle facilities are described below.

#### 3.5.1 Edgelines

Edgelines are pavement stripes that narrow the motor vehicle travel lanes to 10- or 11-feet wide and provide a shoulder or a wide striped parking lane that bikes can use. However, they do not create enough space for a designated bike lane. Edgelines define the space for automobiles, can help slow
3.5.2 Shared Roadway Pavement Markings

Shared roadway pavement markings can be used to mark bike routes and show the proper direction for cycling on the road and provide a visual cue that bikes are welcome on the road. They can be used on roadways where there is not enough space to provide standard, 5-foot-wide bike lanes. Because they do not require as much paint, these markings are also less expensive than bike lanes. These markings have been used in communities such as Denver, CO, Gainesville, FL, and San Francisco, CA.

3.5.3 Sidepaths (Adjacent to roadways)

This type of path is similar to a multi-use trail (recommended 10-foot width), but it is constructed within a roadway corridor right-of-way. Bicyclists retain the right to use the roadway even if a sidepath is adjacent to it. A sidepath can be acceptable in the short-term when a roadway has high-speed, high-volume traffic and few intersecting roadways and driveways and there is no other option for widening the roadway. However, in the long-term, all roads should provide on-road facilities for bicyclists. When used, it is desirable to have sidepaths on both sides of the roadway to make it easier for bicyclists to ride in the same direction as motor vehicle traffic.

Sidepaths are most appropriate in corridors with few driveways and intersections because conflicts between turning motorists and bicyclists are less of a problem. Routes where sidepaths are recommended should not be designated as signed bike routes unless adequate on-road bike facilities are provided.

3.5.4 Bicycle racks and bicycle lockers

Secure bicycle parking located close to building entrances and transit entry points can make bicycling more attractive to potential cyclists. It also reduces the risk of bicycle damage or theft. Bike rack design and site location are discussed in the Bicycle Parking Guidelines, developed by the Association of Pedestrian and Bicycle Professionals. Bike lockers provide added protection from theft and weather. Bike parking is important at destinations such as town centers, historic sites, transit stations and park-and-ride lots. It is also good to have bike parking available near business entrances and at employment sites.

3.5.5 Bike-friendly traffic signals

There are a variety of ways to make traffic signals more suitable for bicyclists. These treatments include changing signal timing so that bicyclists are able to clear intersections during yellow, reducing the wait time for bicyclists on side streets, and installing improved detection equipment.

3.5.6 High-visibility bicycle warning signs

Advance warning signs can be posted to make drivers more aware of trail and other key bike route crossings. “Share the Road” signs can be posted on roads that bicyclists use regularly. These signs can increase awareness of bicyclists, especially in areas where bicyclists may not be expected or where many drivers are tourists. A new fluorescent yellow/green color has been approved in the national Manual on Uniform Traffic Control Devices and can be used on these signs. Signs should be used judiciously—too many signs can cause visual clutter and lead to non-compliance.
3.5.7 Bike-friendly traffic calming

Slowing motor vehicle speeds helps improve the Bicycle LOS of a road. Striping narrower lanes can help slow motor vehicles, and it can also create more space on the road for bicyclists. Traffic circles and medians are other examples of facilities that can be added to a roadway to slow motor vehicles.

3.6 Roadway Crossings and Intersections

In addition to modifications to the actual throughways for cyclists, it is also important to ensure that intersections are appropriately designed to facilitate safe and efficient bicycle traffic. High-speed, multi-lane arterial roadways and freeway access ramps are particularly important crossings to address. Driveways in residential and commercial areas also create the potential for conflict between bicycles and turning motor vehicles. Map 3, in Chapter 4, pinpoints the most critically needed intersection modifications in the study area.

Accommodations for bicyclists at intersections is discussed in detail in the Design Guidelines in Chapter 5. Treatments that can be used to improve intersections in the Winston-Salem Urban Area include:

- High-visibility crosswalks
- Roadway medians/median crossing islands
- Bike-friendly traffic signals
- Advance warning signs and flashing lights
- Reduced (i.e., 15-foot) motor vehicle turning radii (to reduce motor vehicle turning speeds)

3.7 Key Corridors and Areas

Section 3.7 describes the major, on-road connections that make up a significant portion of the proposed bicycle network. The section is divided into 13 subsections which focus on individual geographic parts of the project area. In each subsection, specific recommended projects are discussed. Implementation phasing and timing, however, are not presented until Chapter 4 - Implementation.

In each subsection, only major corridors are listed. Smaller projects are described later in the document. Subsections 3.7.1 - 3.7.7 focus on the City of Winston-Salem. Subsections 3.7.8 - 3.7.13 cover the surrounding communities, e.g. Kernersville, King, and Lewisville.

The proposed Northern Beltway will include new freeway ramp intersections. It is essential that these intersections be designed to allow safe and convenient bicycle crossings. In addition, some roadways are likely to be cut off by the new freeway. Though the roads will be closed to motor vehicle traffic, a pedestrian and bicycle tunnel can be provided under the freeway to maintain access for pedestrians and bicyclists. Because these roads will have significantly lower traffic volumes, but still provide tunnel access, they can become excellent through-routes for bicycling.

3.7.1 Downtown Winston-Salem

Downtown Winston-Salem has the greatest concentration of employment in the urban area and is surrounded by some of the highest density residential neighborhoods in the study area. This area has excellent potential to serve more bicycle trips, particularly work commute trips.

Block-by-block bicycle facility recommendations for the streets of Downtown Winston-Salem are listed in Appendix E. There is adequate roadway space to provide one-way bike lanes on Main and Liberty Streets through the entire downtown area. All downtown streets bounded by Sixth Street (north), First Street (south), Main Street (east), and Poplar Street (west) should be designated with signs reminding people to drive slowly and share the road with bikes, regardless of the presence of bike lanes. These signs should be placed strategically so that they do not add sign clutter to the downtown area.

The main east-west connections through the east side of Downtown Winston-Salem will be on Third, Fourth, and Fifth Streets. The City should restripe the existing lanes on these streets and include new
bike lanes. West of Liberty Street, the City should designate bicycle routes on First, Second, and Sixth Streets. This will move part of the existing bike routes from Fourth and Fifth Streets to wider streets with less traffic.

Many of the streets immediately outside Downtown Winston-Salem will be improved with new facilities. On the south side, Salem Avenue should be striped with bicycle lanes to connect the downtown area with Salem College. On-road bicycle facilities should be added to South Marshall and Broad Street to provide connections into neighborhoods south of the urban core.

The reconstruction of Business Interstate 40 is an excellent opportunity for providing better bicycle access between Downtown Winston-Salem and the south side of the City. The City of Winston-Salem should work closely with NC DOT throughout this project to ensure that bicycle access is provided across new bridges and ramps. Recommendations for bicycle facilities on the bridges across Business Interstate 40 are contained in Appendix E.

To the west, on-road facilities should be added to First Street and the existing bike route will be maintained on Fourth Street to connect to the West End neighborhoods. This bike route can continue west on Glade Street and south on Crafton Street to cross under Business Interstate 40.

On the north side, a short connector path should be provided through Drayton Pines Park to connect to North Cherry Street. This will make it easier for bicyclists to use Cherry Street as an alternative to University Parkway. Other connections out of downtown to the north include new on-road facilities on Trade Street and Patterson Avenue. A bike route should be signed to provide access to the northeast of Downtown Winston-Salem along Liberty Street, Fourteenth Street, and Cleveland Avenue.

Connections to neighborhoods on the east side should be provided with on-road facilities on Highland Avenue, Cleveland Avenue, and by maintaining the existing bike route that uses File Street, East Tenth Street, and Cameron Avenue. Shoulder bike lanes should be added to Martin Luther King, Jr. Drive in the long-term. However, sidepaths may be installed to serve bicyclists before the road is reconstructed or widened. The bicycle facilities on Martin Luther King, Jr. Drive, a new bicycle route connection on Stadium Drive, and a new path and bike lanes on Vargrave Street will provide connectivity to Winston-Salem State University.

The City of Winston-Salem should coordinate the planning and construction of bikeways on the
southeast side of Downtown with the development of the Piedmont Triad Research Park. The Piedmont Triad Research Park Master Plan, produced by !dealiiance, Inc. in 2002, emphasizes providing bicycle and pedestrian facilities for recreation:

“A key element of the Research Park will be a 45-acre “greenspace network” of new parks and open space. The network will consist of a stream corridor, a series of urban parks, natural green spaces and a recreational trail system. The result will be a continuous greenway extending through virtually the entire park.”

3.7.2 East Side of Winston-Salem
The City should provide several significant connections on the east side of Winston-Salem. New bike lanes should be striped along Old Greensboro Road to connect the downtown Winston-Salem area with Petree Elementary School and the new high school. Bike lanes should be striped on Bowen Boulevard to provide better bicycle access to the park. Bike lanes should also be provided on most of Carver School Road to provide connections to Carver High School and the Winston Lake area. A combination of bike lanes and other on-road facilities should be added to Reynolds Park Road to improve bicycle access between the Winston-Salem State Campus area and Reynolds Park and Salem Lake. The existing bike routes in the Salem Lake area should be maintained.

New shoulder facilities on less-developed sections of New Walkertown Road, Reidsville Road, Reynolds Park Road, and Kernersville Road should be provided to connect neighborhoods in the City of Winston-Salem with rural areas east of the city.

3.7.3 South Side of Winston-Salem
The neighborhoods on the south side of Winston-Salem should be connected with the downtown area along several different routes. On-road bicycle facilities should be provided on Waughtown Street, Main Street, and Broad Street. Similar facilities should be used to provide east-west connectivity through these neighborhoods on Waughtown Street, Sprague Street, and Acadia Avenue. Paved shoulders should be added to the section of Peters Creek Parkway between Downtown Winston-Salem and Clemmonsiville Road when it undergoes construction. This will provide better conditions for both bicyclists and pedestrians traveling to the many restaurants and stores in the corridor. It will also provide students at Parkland High School and Independence High School with better access along the corridor. Sidepaths should be considered for improving bicycling conditions on this roadway in the short-term if no other options are available.

Shoulders should be provided on less-developed parts of Thomasville Road, Old Lexington Road, Main Street, Peters Creek Parkway, and Ebert Road, to connect the neighborhoods with rural areas south of the City.

3.7.4 West Side of Winston-Salem
Several important bike routes should be maintained as connections from communities on the west side of Winston-Salem to the downtown area. Bike routes
on streets such as Elizabeth Avenue, Brent Street, and Ardsley Street feed into Crafton Street, which goes under Business Interstate 40 and into the West End neighborhood. The bike routes that use Runnymede Road, Buena Vista Road, and Yorkshire Road should also continue to provide low-traffic alternatives to Country Club Road, Robinhood Road, and Peace Haven Road. The existing shoulders on Hawthorne Road should be extended towards Wake Forest University Medical Center, bike lanes should be added to North Stratford Road, and other on-road facilities should be provided on Miller Street, Knollwood Street, and Academy Street. These facilities will help improve access to the Wake Forest and Forsyth Medical Centers.

South Stratford Road, Country Club Road, Robinhood Road, Peace Haven Road, and Reynolda Road are important bikeway corridors that should be improved with shoulder bike lanes in the long-term. However, sidepaths should be considered along parts of these roadways with low numbers of turning vehicles. While these sidepaths will not be recommended as signed bike routes, they can help some bicyclists reach the restaurants, shops, and office destinations on these roads. These sidepaths would also benefit pedestrians because they would be wider than the existing sidewalks.

Silas Creek Parkway connects many of the neighborhoods on the west side of Winston-Salem. While the southern sections of this road may have enough space to add shoulders, there are physical constraints to widening the road footprint in other parts of the corridor. In addition, there are several on- and off-ramps along this route that make adding safe bicycle facilities difficult. Therefore, bicycle facilities for the western side of this route should be determined when plans are made to reconstruct the road.

3.7.5 Wake Forest University Area
Connections between Wake Forest University and Downtown Winston-Salem are important because these are two of the most significant trip attractors in the urban area. Bike lanes should be provided on Reynolda Road between West End Boulevard and Stratford Road. Though the opportunities for bicycle facilities between Stratford Road and Wake Forest Drive are currently constrained, bicyclists can use a driveway through the Reynolda House and Gardens to access a greenway path that connects to Faculty Drive on the Wake Forest Campus. This connection should be formalized as a bicycle route.

The other route between the downtown and campus areas should take advantage of the path through Drayton Pines Park and use Cherry Street. This connects to the intersection of University Parkway and Twenty-Seventh Street. From this location, shoulders should be added to Coliseum Drive to provide access from University Parkway to Reynolda Drive. In addition, an on-road bicycle facility should be added to University Parkway in the long-term to provide a connection between the Fairgrounds, the Coliseum area, and the main campus. In the short-term, sidepaths should be provided along University Parkway. An on-road facility along Thurmond Street can also provide access between the west side of the downtown area and Twenty-Fifth Street, which connects to Cherry Street.

Polo Road (top) and Reynolda Road (bottom)
There are several other important routes that provide access to the Wake Forest Campus. An on-road bike facility should be added to Polo Road and Reynolda Road (see images on previous page). Because the on-road bicycle facility on Reynolda Road may not be completed for many years, sidepaths should be provided on both sides of Reynolda Road and connected into the University area. Access from the northwest should also be provided by adding shoulders on parts of Bethabara Road and a shared-use path to connect the northwest end of Bethabara Road (dead end) with Bethania-Rural Hall Road in Bethania. This would provide a continuous bikeway from Wake Forest University to Bethania.

3.7.6 North Side of Winston-Salem
The redeveloping neighborhoods near Drayton Pines Park and other north side neighborhoods should be connected to downtown Winston-Salem with bike facilities on several streets. The City should provide on-road bicycle facilities on Trade Street, Patterson Avenue, and Liberty Street. East-west routes through these neighborhoods should include on-road facilities on the existing Twenty-Fifth Street bike route and new on-road bike facilities on the one-way pair of Twenty-Seventh and Twenty-Eighth Streets. Because this one-way pair has low traffic volumes, it may be possible to remove a motor-vehicle lane from each road to provide space for one-way bike lanes. On-road bicycle facilities should also be provided if these roads are converted to two-way traffic. The lane configuration on sections of Indiana Avenue should also be changed to include on-road bike facilities.

3.7.7 Northeast Side of Winston-Salem
Several bikeway connections are recommended in the neighborhoods on the northeast side of Winston-Salem. Bike lanes should be included when Reidsville Road and Waterworks Road are reconstructed. Shoulders should be added to Baux Mountain Road, Williston Road, Walnut Cove Road, Belews Creek Road, Lansing Drive, and Northampton Drive. In addition, the Lowery Creek Greenway should be constructed between Salem Lake and Riedsville Road, south of Walkertown. A bike route should be signed through the northeast part of the City using Bowen Boulevard, Carver School Road, Butterfield Drive, Oak Ridge Drive, and Dippen Road. This route would serve Forsyth Community College.

3.7.8 Walkertown Area
Old Walkertown Road and New Walkertown Road are important connections between Winston-Salem and Walkertown. Shoulders should be provided on both of these roads. North Carolina State Highway 66 serves the south side of Walkertown, and it should have wide sidewalks on both sides between Salem Road and Reidsville Road. These sidewalks will benefit both bicyclists and pedestrians accessing the commercial buildings and schools in this area. Shoulders should be added along all other parts of State Highway 66 to provide a connection for bicyclists between King, Rural Hall, Walkertown, and Kernersville. Several other roadways in the Walkertown Area should also have shoulders, including Baux Mountain Road, Williston Road, Walnut Cove Road, Belews Creek Road, and Reidsville Road.

The Mill Creek Greenway Path should also be constructed between the Summit Square shopping area and Walkertown. This path would use some short

Germanton Road is an example of a road that could accommodate a newly paved shoulder.
sections of existing streets, including Chris Drive and Amarillo Lane. Sidewalks should be provided along Main Street in the short-term, but on-road facilities should be provided in the long-term. This would make it possible to provide a signed bicycle route on Harley Drive, Main Street, and Darrow Road in the future, and would in turn provide an on-road connection between recommended shared-use paths on the west and southeast sides of Walkertown.

3.7.9 Kernersville Area

Parts of North Main Street, Old Greensboro Street, Broad Street, Pineview Drive, Oakhurst Drive, and Southern Street can be signed as bike routes. These routes can provide connectivity between Downtown Kernersville and surrounding neighborhoods. Traffic volumes and/or speeds on these roads are low enough to provide suitable bicycling conditions without additional bicycle facilities.

Bike facilities should be constructed on several roads in the Kernersville area. Shoulders should be added to East Mountain Street, Graves Street, and Old Greensboro Road on the east side of town. Shoulders should be added to North Main Street, Piney Grove Road, Linville Springs Road, Kerner Road, and Dobson Street to the north of Kernersville. On the west side of town, shoulders should be added to Old Winston Road and Hopkins Road. West Mountain Street should have on-road bicycle facilities in the town area, shoulders on the section immediately west of Kernersville, and a sidewalk beside the road next to the railroad tracks between Weslo Drive and Old Greensboro Road. Shoulders should be added to Shields Drive, Whicker Road, Hastings Hill Road, Old Salem Road, Linville Road, Oak Grove Church Road, Glenn Hurd Road, and Wallburg Road south of Kernersville. Sidewalks should be provided on both sides of South Main Street/Kernersville Road to serve this commercial corridor until space can be provided for on-road bicycle facilities.

Several important greenway paths should be constructed in the Kernersville area. This includes a section of the Piedmont Greenway Trail between Salem Lake and Greensboro, a greenway path through the neighborhoods on the west side of Downtown Kernersville, and two greenway paths leading south from the east side of Downtown Kernersville. In addition, a shared-use path should be provided along with the freeway loop that is proposed to go on the north side of Kernersville (Transportation Improvement Plan Project U-2800). It will be important to provide connector pathways to connect this main path with surrounding neighborhoods.

3.7.10 Clemmons Area

Two of the major bicycle trip attractors in the Clemmons Area are Downtown Clemmons and Tanglewood Park. Shoulders should be added to several sections of the Forsyth County Bike Route through Clemmons (North Carolina Bicycle Route 2). These route sections include parts of Lasater Road, Fair Oaks Drive, Harper Road, Hampton Road, Frye Bridge Road, and Fraternity Church Road. Other roads that should receive new shoulders include Middlebrook Drive and parts of Idols Road. While shoulders or bike lanes should be added to Clemmons Road through Downtown Clemmons to provide bicycle and pedestrian access to public buildings and commercial properties in the future, sidewalks should be used as a short-term solution. Sidewalks should also be provided on the entire length of South Stratford Road between Winston-Salem and Clemmons. It may be possible to construct the sidewalk on the east side of the road as a rail-with-trail. This corridor is developing rapidly to the south of Interstate 40, and it will be important to
provide sidepaths and on-road bicycle facilities as development occurs.

Lewisville-Clemmons Road is an important connector between two downtown areas, serving several schools, commercial stores, and restaurants. Shoulders or bike lanes should be included in future roadway widening projects on Lewisville-Clemmons Road. Sidepaths should be installed on both sides of the road between Peace Haven Road and Clemmons Road in the short-term to provide better pedestrian and bicycle access to this the commercial area. Sidepaths should also be used as a short-term solution between Styers Ferry Road and August Drive to serve West Forsyth High School and Southwest Elementary School.

A path should be provided on the east side of the Yadkin River. This Yadkin River Greenway Path would connect roads in Davidson County to Tanglewood Park. It would also connect Lewisville with the Yadkin River and Tanglewood Park. Greenway paths should be constructed in many of the stream valleys in the Clemmons area. One of these paths should connect Stratford Road on the east side of Clemmons to the Salem Creek Greenway on the south side of Winston-Salem.

Several proposed roadway extensions are excellent opportunities to provide bicycle facilities when construction occurs. The Pope Road Extension, Idols Road Extension, and Springfield Farm Road Extension projects should include both on-road and off-road bicycle facilities.

In Davie County, shoulders should be added to US Highway 158 and North Carolina Highway 801. If the proposed “Davie County-Forsyth County Connector” is constructed across the Yadkin River south of Tanglewood Park, this new roadway should include wide paved shoulders and sidepaths (wide sidewalks should be provided on the Yadkin River Bridge to accommodate pedestrian and bicycle activity). The MPO should work closely with Davie County and the community of Bermuda Run to develop additional bicycle routes in Davie County.

### 3.7.11 Lewisville Area
Several Forsyth County bike routes pass through the Lewisville Area. Shoulders should be added to sections of these routes, including parts of Shallowford Road, Reynolds Road, Lewisville-Vienna Road, and Vienna-Dozier Road (south of Skylark Road). Shoulders should also be provided on other roads that are not currently bike routes, including Styers Ferry Road and the sections of Shallowford Road between Williams Road and the Yadkin River.

A new signed bike route should be established between Lewisville and Clemmons. This route should follow Reynolds Road, Styers Ferry Road, Harper Road, Peace Haven Road, Lasater Road, and Fair Oaks Drive.

A system of greenway paths should also be constructed in the Lewisville area. These paths will utilize several residential streets, including Poplar Ridge Road, Conrad Circle, and North Street to save on new path construction costs. It will be important to provide signage in the areas of these streets to direct bicyclists to the greenway paths.

### 3.7.12 Tobaccoville and Rural Hall Area
On-road bicycle facilities should be added to several roads when they are widened in the developing part of this region. In the shorter-term, sidepaths should be provided on both sides of Broad Street to the south of North Carolina Highway 65 and on North Carolina Highway 65 to the east of Broad Street in the historic Rural Hall area. Additionally, on-road bicycle facilities should be added to University Parkway between Old Hollow Road and North Cherry Street, Hanes Mill Road in the Summit Square shopping area, Bethabara Park Boulevard, Home Road, North Point Boulevard, and Bethabara Road.

Many roads in this area should receive new shoulders. In many locations, these shoulders can be added when development occurs. Shoulders should be added to Tobaccoville Road, Doral Drive, Main Street Bethania, Bethania Road, Transou Road, Shattalon Drive, Bethania-Rural Hall Road, Ziglar Road, Oak
Summit Road, Old Hollow Road, North Patterson Avenue, Germanton Road, and Old Rural Hall Road.

A new signed bicycle route should be provided between Bethania and King. This route would use Main Street (Bethania), Bethania-Tobaccoville Road, Doral Drive, Griffen Road, Westinghouse Road, Tobaccoville Road, Jefferson Church Road, Moore Road, Spanihour Road, and Kirby Road. This route should be connected to the City of Winston-Salem bicycle route on Oak Summit Road using Bethania-Rural Hall Road, Walker Road, Murray Road, and Shattalon Drive.

Historic Bethabara is an attractive destination for bicyclists, and is currently served by the Bethabara Trail. This path should be extended to Bethabara Road. Bicycle facilities should be improved along Bethabara Road to connect Historic Bethabara with Bethania. This would include providing shoulders on Bethabara Road between Bethabara Park Boulevard and Shattalon Road and constructing a greenway path from the Bethabara Road dead end to Bethania-Rural Hall Road. In addition, greenway paths should be developed to connect the Lewisville area to Historic Bethabara from the southwest and to connect the Summit Square shopping area to Historic Bethabara from the northeast.

New greenway paths should also be provided between Historic Bethabara and Rural Hall and between the Summit Square shopping area and Horizons Park.

### 3.7.13 King Area

Main Street King is a commercial destination and a through-route for bicyclists. On-road bicycle facilities should be incorporated into future roadway widening projects on Main Street. In the short-term, sidepaths should be provided on both sides of the street between US Highway 52 and Winchester Drive on the north side of King. Dalton Road and Old US Highway 52 should be signed as a bike route to connect King with other parts of Davie County. Shoulders should be added along all parts of this route except West Dalton Road in King where there is insufficient space.

In the long-term, shoulders should be added to other roads in the area, including North Carolina Highway 66, Meadowbrook Drive, Butner Road, Spainhour Mill Road, Moore Road, and parts of Southern Road, Hartgrove Road, and Mountain View Road.

### Notes


4.1 Overview

The text and images in this chapter describe how the City of Winston-Salem and its partners can turn the vision of a connected network of safe bicycle routes into a reality. The strategy for doing so involves physical changes, as well as new policy and program considerations. The bulk of this chapter deals with specific recommended physical changes and includes several maps. Following the physical recommendations are the policy and program considerations. All of these fit together to form the implementation program.

4.2 Opportunities and Strategies

Improving bicycle transportation in the Winston-Salem Urban area can build on previous efforts. Three main opportunities available to the City of Winston-Salem are 1) building on a committed base of bicyclists in the area, 2) improving on the existing signed bicycle route system, and 3) taking advantage of land use patterns that have placed many residents within bicycling distance of activities.

Chief among the opportunities available to the City of Winston-Salem is the opportunity to build upon an already committed and active base of bicycle users in the area. Through their organizations, institutions, publications, and networks, the City can advertise and encourage other residents of the urban area to take advantage of bicycle facilities and programs.

Second among the opportunities is the availability of the existing signed bicycle route system. Though some changes are being suggested to the existing routes in the short-term and a much expanded network is suggested for the long-term, the presence of bike route signs provides a strong foundation from which to
build. Residents are used to seeing bicycle route signs and are accustomed to seeing cyclists on the roadways. Building on their existing awareness is much easier than beginning from scratch.

The final category of opportunity is the existing patchwork of destination points. The land uses and development patterns in Central Winston-Salem and some other parts of the region have created a tight network of destinations from parks to residential areas, to schools, to employment centers, to shopping and touring opportunities. Because the distance between many destination points is quite short, there is significant potential for residents to make trips by bicycle. This pattern of land uses makes it easier to build the network incrementally - constantly expanding the service and opportunities until a wide ranging network has been completed.

From these opportunities comes the framework for an initial implementation strategy:

1) **Build on Previous Interest and Accomplishments.**
Use the strong base of bicyclists and strong interest in cycling to slowly grow the awareness of the benefits of bicycling. Furthermore, educate bicyclists and motorists about safe behaviors; change the culture of the region to be more supportive of bicycle transportation.

2) **Make Physical Changes to Roadways**
Grow and modify the existing bicycle facility network so that it better meets the needs of the present day community and more accurately fits with the status of the present transportation infrastructure.

3) **Modify Signed Bicycle Routes**
Modify bike routes so that bike route signs provide logical and safe connections between residences, activities, and other destinations. Once the existing routes are appropriately adjusted, start making the critical connections between destination points that will allow for a continuous growth of and improvement in the network and its associated opportunities.

These three steps represent the core of the implementation strategy. They are the hooks on which the community should hang the many sets of individual actions that this document contains. As the individual policy recommendations and physical recommendations are addressed, they should each fit with one of these three primary strategies.

### 4.3 Adopting this Plan

Before any other action takes place, the local governments within the Winston-Salem Urban Area should focus on adopting this plan. This should be considered the first step in implementation. Through adoption of this document and its accompanying maps as the area’s official bicycle plan, the community is able to shape larger regional decisions so that they fit with the goals of this plan. The City also gives itself greater authority in shaping local land use decisions so that they achieve the goals and vision of this plan.

### 4.4 Key Steps in Implementation

Other key implementation steps may begin after the plan is adopted, some occurring simultaneously:

1) Create the necessary governance capability and administration capability to oversee the implementation of this plan and the proper maintenance of the facilities that are developed.

2) Secure the funding necessary to immediately begin the first year’s work, and start working on a funding strategy that will allow the community to incrementally complete each of the suggested physical modifications over a 15 - 20 year period.

3) Remove the bicycle route signs from the route segments that did not score a grade of “C” or above on the BLOS. (See Top-Priority Bike Route Signage Improvements map, section 4.5.1)

4) Add signs to the replacement routes shown on this map so that a functional, safe, updated signed bicycle route system is immediately available to the community.
5) Start the process of education and awareness building by holding a public event to announce the adoption of the bicycle plan, system of signed bicycle routes, and some of the upcoming projects.

6) Begin working on the Top Priority Activities listed in subsections 4.5.2 and 4.5.3. (See Top-Priority Roadway Improvement map and Critical Intersection Improvements map)

7) Ensure that bicycle planning is integrated with other transportation planning efforts in the community as well as long-range and current land use planning, economic development planning, and environmental planning.

### 4.5 Physical Project Priorities

The entire Winston-Salem Urban Area Bicycle Route Network is described in Chapter 3. However, the system will likely be developed incrementally. Development will occur piece by piece, in a coordinated effort between the City of Winston Salem, surrounding communities, and other local and state government bodies. This section describes how the recommended facilities in the Bicycle Network are prioritized.

Higher priorities have been assigned to projects that are in areas with higher concentrations of population and/or trip attractors. Projects that can be integrated with other repaving or reconstruction improvements that are scheduled in the near future have also been given a high priority.

Lower-priority projects are in areas with less population, areas where the trip attractors will likely serve fewer cyclists, and roadways that are not scheduled for regular transportation improvements. These projects may also be in areas where it is difficult to add shoulders or other bike facilities due to right-of-way constraints.

The Bicycle Network Phasing Map (following page) reflects prioritization by showing three categories of recommended facilities: short-term, medium-term, and long-term. A supplement to the map (Table 3), shows the total miles of recommended facilities for each of the three phases.

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Short Term</th>
<th>Medium Term</th>
<th>Long Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads that could be signed as bicycle routes(^2)</td>
<td>226.0</td>
<td>-</td>
<td>237.4</td>
</tr>
<tr>
<td>Paved shoulder</td>
<td>74.8</td>
<td>87.9</td>
<td>223.9</td>
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<tr>
<td>Bicycle lane</td>
<td>41.3</td>
<td>20.2</td>
<td>2.6</td>
</tr>
<tr>
<td>Shared-use path/Greenway</td>
<td>47.0</td>
<td>3.6</td>
<td>120.8</td>
</tr>
<tr>
<td>Other on-road bicycle accommodation(^3)</td>
<td>18.0</td>
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<td>2.2</td>
</tr>
<tr>
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<td>43.0</td>
<td>41.9</td>
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<tr>
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<td>6.1</td>
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<tr>
<td><strong>Total</strong></td>
<td>437.2</td>
<td>167.6</td>
<td>639.6</td>
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</table>

\(^1\) Centerline miles (facilities on both sides of the road are not counted separately).

\(^2\) These figures include bike routes being considered for the public bicycle map, which total 175.5 miles. Note that some roadway segments recommended for bicycle routes are also included in the other categories.

\(^3\) Other on-road bicycle accommodations include edgelines and shared pavement markings.

\(^4\) The long-term goal for roads in this category is to provide on-road facilities for bicyclists. However, a sidepath adjacent to the roadway can be acceptable in the short-term when a roadway has high-speed, high-volume traffic and few intersecting roadways and driveways and there is no other option for widening the roadway. Sidepath bikeways in locations with frequent driveways are not a good solution due to conflicts with turning vehicles. If used, these facilities should not be signed as bike routes. NOTE: The GIS database lists this category as "Sidepath" or "Wide Sidewalks".
In general, short-term projects should be completed within the next five years, medium-term should be completed within 10 years, and long-term should be completed within 20 years. A prioritized list of all the projects is provided in Appendix F.

### 4.5.1 Top Priority Projects

In addition to the short-term, medium-term, and long-term project phasing, the consultant team has created a list of top-priority action items that should receive immediate attention. These are specific improvements and changes that will facilitate an immediate increase in safety and a timely and orderly start to completing the short-term and medium-term project phases.

These action items are listed in the following section, 4.5.2, and are shown on the three maps following that section: Top Priority Bike Route Signage Improvements, Top Priority Roadway Improvements, and Critical Intersections for Improvement.

All signed routes shown on the Top Priority Bike Route Signage Improvement map should be addressed immediately. Completion of these actions will result in the creation of a new, modified system of signed bike routes based on the existing routes but with several changes for improving safety. For example, the signs on Summit Street between Fourth and Sixth Streets and the signs on Sixth Street between Summit Street and Trade Street would replace the existing bike routes on Fourth and Fifth Streets in the west part of Downtown Winston-Salem.

Below, Table 4 shows the mileage of Top Priority Projects by facility type for all projects and for those within Winston-Salem City limits. On the following page are the top priority action items that include bicycle lanes, shoulders, sidewalks, and other facility types.

---

### Table 4. Top-Priority Projects

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Miles²</th>
<th>Facility Type</th>
<th>Miles²</th>
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<tr>
<td>Signed bicycle route</td>
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<td>Signed bicycle route</td>
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<td>0.6</td>
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<td>Shared-use path/Greenway</td>
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<td>6.7</td>
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<td>Other on-road bicycle accommodation</td>
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<td>Other on-road bicycle accommodation</td>
<td>7.5</td>
</tr>
<tr>
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<td>7.3</td>
<td>Other on-road bicycle facility, but shared-use path may be used in the short-term</td>
<td>4.7</td>
</tr>
<tr>
<td>Unknown facility</td>
<td>0.0</td>
<td>Unknown facility</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>226.6</td>
<td><strong>Total</strong></td>
<td>106.5</td>
</tr>
</tbody>
</table>

¹All top-priority projects are also included in either the short-term, medium-term, or long-term categories in the table above. Most are short-term projects; some roadways have bike route signs recommended as top-priority projects and other facilities recommended in the medium- or long-term.

²Centerline miles (facilities on both sides of the road are not counted separately).

³These figures represent the bicycle routes that are being considered for the public bicycle map. Note that some roadway segments recommended for bicycle routes are also included in the other categories.

⁴Other on-road bicycle accommodations include edgelines and shared pavement markings.

⁵The long-term goal for roads in this category is to provide on-road facilities for bicyclists. However, a sidepath adjacent to the roadway can be acceptable in the short-term when a roadway has high-speed, high-volume traffic and few intersecting roadways and driveways and there is no other option for widening the roadway. Sidepath bikeways in locations with frequent driveways are not a good solution due to conflicts with turning vehicles. If used, these facilities should not be signed as bike routes. NOTE: The GIS database lists this category as "Sidewalk" or "Wide Sidewalks".

⁶Top-Priority Projects within the City limits are also counted as a part of All Top-Priority Projects.
Winston-Salem Urban Area

Comprehensive Bicycle Master Plan

Bicycle Network: Phasing
### 4.5.2 Top Priority Action Items

The numbers next to the items match the numbers on the corresponding map.

#### Bicycle Lanes

1. Salem Avenue: Bicycle lanes between First Street and Main Street
2. Reynolda Road: Bicycle lanes between Stratford Road and Buena Vista Road
3. Reynolds Park Road: Bicycle lanes between Martin Luther King, Jr. Drive and Reynolds Park
4. Old Greensboro Road: Bicycle lanes between Fifth Street and Reidsville Road
5. Stratford Road: Bicycle lanes between Runnymede Road and Reynolda Road
6. Bowen Boulevard: Bicycle lanes between Twenty-Fifth Street and Rosemary Drive
7. Carver School Road: Bicycle lanes between Lansing Drive and Walkertown Road (except the blocks next to Carver High School where left-turn lanes are provided)
8. Cleveland Avenue: Bicycle lanes between Martin Luther King, Jr. Drive and Fourteenth Street and on-road facilities between Fourteenth Street and Twenty-Fifth Street
9. Liberty Street: Bicycle lanes between Martin Luther King Jr. Drive and Fifth Street
10. Main Street: Bicycle lanes between Fifth Street and Martin Luther King, Jr. Drive and on-road bicycle facilities between Waughtown Street and Clemmonsville Road

#### On-Road Facilities

11. Cassell Street: On-road bicycle facilities between Main Street and Old Lexington Road
12. Patterson Avenue: On-road bicycle facilities between Fourteenth Street and Indiana Avenue
13. Trade Street: On-road bicycle facilities between Fourth Street and Martin Luther King, Jr. Drive; bicycle lanes between Martin Luther King, Jr. Drive and Northwest Boulevard
14. Broad Street: On-road bicycle facilities between Business Interstate 40 and Acadia Avenue
15. Sixth Street: On-road bicycle facilities between Trade Street and Main Street

#### Shoulders

16. Shallowford Road: Shoulders between Williams Road and the Yadkin River (includes bike lanes b/w Williams and Lewisville-Vienna)
17. Old Lexington Road: Shoulders between Hillhaven Drive and Barnes Road
18. Union Cross Road: Shoulders between Ridgewood Road and Sawmill Road
19. Frye Bridge Road: Shoulders between Friedburg Church Road and Sunset Road
20. NC 150: Shoulders between Sunset Road and Community Road
21. Bethania-Tobaccoville Road: Shoulders between Bowens Road and Turfwood Drive

#### Shared-Use Paths (separated from roadways)

22. Piedmont Greenway: Shared-use path east of Salem Lake
23. Brushy Fork Creek Trail (Virginia K. Newell/Ann Massey Trail): Shared-use path between Old Greensboro Road and the Salem Lake Trail (near Reynolds Park Road)
24. Salem Creek Trail Extension: Shared-use path between Market Place Mall and London Lane
25. Peters Creek Greenway Trail: Shared-use path between Reynolda Road and Salem Creek Trail Extension (as an alternative to Peters Creek Parkway for through bicyclists)

#### Sidewalks (adjacent to roadways)*

26. Peters Creek Parkway: Sidewalks on both sides between the interchange with Business Interstate 40 and Clemmonsville Road (as facilities for pedestrians and bicyclists who are accessing destinations on Peters Creek Parkway)
27. University Parkway: Sidewalks on both sides between Silas Creek Parkway and Hanes Mill Road
28. Lewisville-Clemmons Road: Sidewalks on both sides between Styers Ferry Road and Peace Haven Road

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*On road bicycle facilities should be provided in the longer-term, but sidepaths can be beneficial on high-speed, high-volume roads when there are few intersecting roads and driveways.
4.6 Methods for Developing Facilities

This section describes types of transportation facility construction and maintenance projects that can be used to create new bicycle facilities. Note that roadway and transit construction and re-construction projects offer excellent opportunities to incorporate facility improvements for bicyclists. It is much more cost-effective to provide a bicycle facility when these road projects are implemented than to initiate the improvement as a “retrofit.”

In order to take advantage of upcoming opportunities to incorporate bicycle facilities into routine transportation projects, the City of Winston-Salem should continue to track the Metropolitan Transportation Improvement Program (MTIP), repaving schedules, and other lists of projects. As the MTIP is updated in future years, bicycle improvements should be included in all programmed projects.

4.6.1 Restriping

The simplest type of restriping project is the addition of bicycle lanes, edgelines, or shoulder stripes to streets without making any other changes to the roadway. In the Winston-Salem Urban Area, opportunities for this type of improvement are found on some neighborhood collector streets within the City of Winston-Salem that are 30-, 34-, 36-, and 40-feet wide from curb to curb and are not used for on-street parking. Examples include sections of Reynolds Park Road and Carver School Road.

Bicycle lanes, edgelines and shoulder stripes can also be added by narrowing the existing travel lanes or removing one or more travel lanes. In some locations where the existing lanes are 12- or 13-feet wide, it may be possible to narrow them to 10 feet. This requires changing the configuration of the roadway during a resurfacing project. Potential locations for this treatment include parts of Linden Street, Indiana Avenue, Liberty Street, and Polo Road.

4.6.2 Removing parking

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

If it is not practical to add a bike lane, edgelines and shared lane markings may be considered. On roads where the outside lane and parking area combined are more than 17-feet-wide, 10-foot-wide travel lanes can be striped with an edgeline, leaving the rest of the space on either side for parking. The stripe would help slow motor vehicles and provide extra comfort for bicyclists, especially during the daytime when fewer cars would be parked along the curb. On roads with outside lane and parking areas that are narrower than 17-feet-wide, shared lane markings can be provided every 100 to 200 meters on the right side of the motor vehicle travel lane to increase the visibility of the bike route.

4.6.3 Repaving

Repaving projects provide a clean slate for revising pavement markings. When a road is repaved, the

Hawthorne Road, repaved with space for cyclists.
roadway should be restriped to create narrower lanes and provide space for bike lanes and shoulders. In addition, if the space on the sides of the roadway has a relatively level grade and few obstructions, the total pavement width can be widened to include paved shoulders. There are many rural roadways in the Winston-Salem Urban Area where this type of improvement can be made.

### 4.6.4 Roadway Construction and Reconstruction

Bicycles should be accommodated any time a new road is constructed or an existing road is reconstructed. In the long-term, all roadways should have on-road bicycle facilities. However, sidewalks can be an acceptable solution in the short-term when a road has few driveways and high-speed, high-volume traffic. Roads should be designed according to the revised Thoroughfare Plan cross-sections (see Chapter 5).

### 4.6.5 Bridge Replacement

All new or replacement bridges should accommodate bicycles with on-road facilities on both sides of the bridge. If the bridge is in a developed area or an area that may experience development in the future, it should also have wide sidewalks on both sides to accommodate all types of bicyclists and pedestrians.

Federal law, as established in the Transportation Equity Act for the 21st Century (TEA-21), makes the following statements with respect to bridges:

“In any case where a highway bridge deck is being replaced or rehabilitated with Federal financial participation, and bicyclists are permitted on facilities at or near each end of such bridge, and the safe accommodation of bicyclists can be provided at reasonable cost as part of such replacement or rehabilitation, then such bridge shall be so replaced or rehabilitated as to provide such safe accommodations.” (23 U.S.C. Section 217)

On urban and suburban bridge projects, bridge shoulders should be a minimum of 5.5-feet wide and sidewalks should be a minimum of 5.5-feet wide if traffic volumes are projected to be less than 15,000 vehicles per day. If traffic volumes are projected to be 15,000 or more vehicles per day, the shoulders should be at least 6.5-feet wide and sidewalks should be at least 7-feet wide.

Bridge replacement projects on controlled access freeways where pedestrians and bicyclists are prohibited by law will generally not include facilities to accommodate bicyclists and pedestrians. In cases, however, where a bridge replacement project on a controlled access freeway impacts a non-controlled access roadway (i.e., a new overpass over an arterial roadway), the project should include the necessary access for pedestrians and bicyclists on the non-limited access roadway (i.e., paved shoulders, sidewalks, and pedestrian/bicycle crossing improvements).

### 4.6.6 Retrofit Roadways with New Bicycle Facilities

There may be critical locations in the Bicycle Route Network that have bicycle safety issues or are essential links to destinations. In these locations, it may be justified to add new bicycle facilities before a roadway is scheduled to be repaved or reconstructed. For example, Old Walkertown Road is currently a Forsyth County Bike Route, but it carries heavy, fast traffic and does not have shoulders. Adding five-foot shoulders to this roadway as a retrofit project would raise its Bicycle LOS grade in the area of Ibraham Elementary School from “D” to “B”.

In some places, it may be relatively easy to add extra pavement for shoulders, but others may require removing trees, moving landscaping or fences, or regrading ditches or hills. Retrofitting roadways with sidewalks creates similar challenges. Improvements in these locations are typically recommended in the long-term.

### 4.6.7 Signage and Wayfinding Projects

Signage along specific routes or in an entire community can be updated to make it easier for people to find destinations. Bicycle route signs are one example of these wayfinding signs, and they
can be installed along routes independently of other signage projects or as a part of a more comprehensive wayfinding improvement project.

### 4.7 Bicycle Policies

Creation of a successful Bicycle Network will involve more than facility improvements. The long-term success of the bicycle network will also depend on how the City builds facility maintenance and long-term facility planning into its existing maintenance and planning practices. The subsections below detail these critical policy areas.

#### 4.7.1 Maintenance

Regular maintenance of the community’s bicycle facilities will be essential to maintain the safety of the facilities and their overall usability. To facilitate the practice of regular maintenance, the City should integrate bicycle facility maintenance into the maintenance routines of the DOT and the Parks and Recreation Department.

Types of maintenance required include:

- Repair of pavement
- Restriping of lanes/remarking of pavement
- Replacement or repair of route signs due to damage caused by vandalism or general wear
- Removal of debris from roadway shoulders, bike lanes, and shared-use paths (including trash and vegetation)
- Replacement and repair of bicycle parking and storage facilities

Many of these maintenance projects are already regularly completed for the area’s roadways. They now should be expanded to include the bicycle facilities as well. Off-road bicycle routes may require the attention of separate agencies.

Using the Bicycle Advisory Committee, the existing Bicycle planning staff from the City’s DOT, and the bulleted list above, the City should develop a standard bicycle maintenance schedule for incorporation into the activities of all the appropriate City agencies.

#### 4.7.2 Context Sensitive Design

Context Sensitive Design changes the thinking and design of transportation planning so that roadways accommodate communities rather than communities accommodating roadways. Many of the principles of Context Sensitive Design are reflected in the planning documents of the MPO, but it is still important that the community establish policy standards that reflect these principles.

These policies should ensure that all roadway projects are designed to maximize the safety of the facility user and the safety of the surrounding community. The policies should also require that all transportation facility construction be completed in a manner that is consistent with the community’s economic, social, and environmental objectives.

In the end, the benefits of embracing this type of approach to transportation planning are more efficient use of transportation construction dollars, better preservation of community resources, increased safety, and improved livability in the community.

Continued adherence to the principles of Context Sensitive Design will require the full support of the locally elected officials as well as continued support through state-level transportation actions.

#### 4.7.3 Future Bicycle Facility Development

Elected leaders should allocate sufficient resources on an annual basis to regularly expand the bicycle network and maintain the facilities as they are completed. This will ensure that the bicycle facilities recommended in this document and requested by the residents of the community will come to fruition. There must be commitment to a phased time line of roadway modification and facility construction must be adopted and followed.

Regarding bicycle facilities on county and state roads, it will be important to understand how NCDOT and
the counties are involved in the approval process for reconstruction, repaving, and restriping projects on different roads in the Winston-Salem Urban Area. In some cases, the recommended facilities in the bicycle plan will not match the cross-sections recommended by the Winston-Salem Urban Area Thoroughfare Plan. If NCDOT or one of the counties has the authority to deny a recommendation from the bicycle plan, it will be important to discuss controversial issues with them during the planning process. The issues could potentially include:

- Striping 10-foot-wide motor vehicle travel lanes to slow traffic and provide space for bicycle lanes
- Striping bicycle lanes instead of providing wide outside motor vehicle travel lanes
- Adding shoulders to roads, which will require regrading the shoulder/ditch area and relocating existing mailboxes

4.7.4 Education, Encouragement, Enforcement

The recommended facilities will serve Winston-Salem most successfully with the continued support for programs that focus on the three E’s of bicycle planning: Education, Encouragement, and Enforcement.

**Education:** Schools should be used to teach children about bicycle safety. Motorists should be taught to expect and work with cyclists who are sharing their travel corridors. Families should be given tools to help them understand how cycling opportunities can improve their lives.

**Encouragement:** Financial incentives and/or public praise can be provided to local businesses who support cycling through their actions. Awards can be created to celebrate advances in the community’s bicycle facilities, bicycle ridership, and overall bicycle friendliness.

**Enforcement:** The rights of cyclists to share the road and observance of traffic rules among cyclists must be enforced. Good policies are meaningless if they are not enforced.

Winston-Salem has several existing programs in place (section 2.3); building on those programs will enhance awareness of safety issues while promoting the use of the facilities. Programs to start immediately could include:

- **Safe Routes to School** (SRTS) programs aim to improve the health of kids and the community by making walking and bicycling to school safer, easier and more enjoyable. Winston-Salem could build on the experiences of other communities while taking advantage of state and federal funding. (www.walktoschool.org)

- **Bicycle Safety Education** programs for children and adults could be conducted through police departments, local bike clubs, and other public organizations. Such programs could take place in physical education classes at elementary, middle, and high schools, and through free programs at community centers and parks.

- **Cyclist Awareness Campaigns** could be used to advertise the benefits of biking not only for recreation, but also for practical purposes such as getting to work, school, or shopping. Campaigns could also be aimed at drivers to educate them about the safe operation of their vehicles near cyclists. These campaigns could be done through radio, television, and newspaper announcements.

- **General Promotion** could take place through enhancement of the City of Winston-Salem’s bicycle web page. It could advertise benefits of cycling, explain relevant rules, show bike route plans and recommendations, and provide information about the latest successful projects. Distribution of the Bike Map could also raise awareness of cycling as an option.

Education is a critical element within the recommendations of this chapter. Efforts to educate both cyclists and motorists should be undertaken immediately for the facilities to reach their full potential.
Winston-Salem Urban Area
Comprehensive Bicycle Master Plan

Top Priority Roadway Improvements

Legend

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<td>4th St &amp; MLK Jr Dr</td>
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<td>40</td>
<td>5th St &amp; MLK Jr Dr                                   Carver School Rd &amp; New Walkertown</td>
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<td>41</td>
<td>Carver School Rd &amp; New Walkertown &amp; NC 66</td>
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<td>42</td>
<td>Indiana Ave &amp; Liberty St</td>
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<td>43</td>
<td>Carver School Rd &amp; Old Walkertown Rd</td>
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<td>Old Greensboro Rd &amp; Reidsville Rd</td>
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<td>Harley &amp; Salem &amp; Old Walkertown</td>
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<td>NC 66 &amp; Reidsville Rd</td>
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<td>48</td>
<td>NC 66 &amp; West Mountain St</td>
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<td>East Mountain St &amp; NC 66/NC 150</td>
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<td>50</td>
<td>East Mountain St &amp; Old Greensboro Rd</td>
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<td>Union Cross Rd &amp; Sedge Garden Rd</td>
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<tr>
<td>52</td>
<td>Kernersville Rd &amp; Business I-40</td>
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<tr>
<td>53</td>
<td>MLK Jr Dr &amp; Waughtown &amp; Thomasville</td>
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<td>54</td>
<td>Stratford Rd &amp; I-40</td>
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<td>Stratford Rd &amp; Silas Creek Pkwy</td>
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chapter five
facility standards

5.1 General Guidelines

This section of the report provides design guidelines for the development of bicycle and pedestrian facilities. They are based on the best practices in use throughout the United States, as well as accepted state and national standards for bicycle and pedestrian facilities. The recommended standards in this report meet or exceed national standards found in the AASHTO Guide for the Development of Bicycle Facilities, the Manual on Uniform Traffic Control Devices, and NCDOT Bike Facility Guidelines. As state and national standards are revised, any resulting design discrepancies should favor the updated standards.

5.2 Typical Roadway Cross-Sections

All new and reconstructed roadways in the Winston-Salem Urban Area should be designed to accommodate bicycles. While each roadway construction, paving, or striping project must be appropriate for the topography and land use of the corridor, the Winston-Salem/Forsyth County Urban Area Thoroughfare Plan (2002) includes typical roadway cross-sections as guidelines for designing new and reconstructed roads.

Two sets of cross-sections are shown in the Thoroughfare Plan: 1) typical bicycle cross-sections and 2) typical thoroughfare cross-sections. While the bicycle cross-section designs offer some improvements over existing roadway cross-sections for bicycle travel, the City of Winston-Salem should work with NC DOT to consider adopting the revised cross-sections presented in this section. These new cross-sections could provide even more significant increases in bicycle safety and comfort.
5.2.1 Typical Bicycle Cross-Sections

One of the objectives of the Thoroughfare Plan is “to provide opportunities for bicycles and pedestrians to safely share the right-of-way with motor vehicles.” National research has shown that bicyclists feel more comfortable and motor vehicles give bicyclists more lateral space when a shoulder or bike lane stripe is provided (Landis, et al. 1996; Harkey, et al. 1998; Hunter, et al. 1999; City of Cambridge, MA 2005). This research is supported by policies in the AASHTO Bicycle Guide (1999)\(^2\), which states:

“Bike lanes are intended to delineate the right of way assigned to bicyclists and motorists and to provide for more predictable movements by each. Bike lanes also help to increase the total capacities of highways carrying mixed bicycle and motor vehicle traffic…[Bike lanes may be provided] by reducing the width of vehicular lanes or prohibiting parking…” (p. 8)

Based on this guidance, five-foot-wide striped bike lanes\(^3\) should be added to all of the typical bicycle cross-sections in the

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**Figure 5-1. Proposed Modifications to Typical Bicycle Cross-Sections**

A-B: Two lanes - Curb & gutter

B-B: Two lanes - Curb & gutter

C-B: Five lanes - Curb & gutter

D-B: Four lanes divided with raised median - Curb & gutter

E-B: Four lanes - Curb & gutter
Figure 5.1 (continued)

Thoroughfare Plan except for cross sections I-B (a two-lane road with four-foot shoulders) and J-B (a two-lane road with bike lanes). The bicycle lanes can often be accommodated in these cross-sections by reducing the width of the motor vehicle travel lanes by one or two feet. Several of the cross-sections would include the gutter pan width to meet the minimum five-foot bike lane standard. It will be important to ensure that the edge of the pavement is flush with the gutter pan.
Winston-Salem Urban Area

Figure 5.2 Proposed Modifications to Typical Thoroughfare Cross-Sections

B

SEVEN LAKES - CURB & GUTTER WITH STRIPED BICYCLE LANES

C

FIVE LAKES - CURB & GUTTER

D

SIX LAKES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER WITH STRIPED BICYCLE LANES

E

FOUR LAKES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER WITH STRIPED BICYCLE LANES

F

FOUR LAKES DIVIDED - BOULEVARD GRASS MEDIAN WITH STRIPED BICYCLE LANES
5.2.2 Typical Thoroughfare Cross-Sections
The typical thoroughfare cross-sections do not currently include bicycle facilities. While a few of these cross-sections will be used on freeways, most will be used on roadways where bicycles are permitted. In order to provide adequate accommodations for bicyclists, the City of Winston-Salem should work with NC DOT to revise several of these typical thoroughfare cross-sections.

Bike lanes can be incorporated into typical thoroughfare cross-sections B, D, E, F, and M by reducing the width of some lanes and medians (see Figure 5.2). Bicycle accommodation can also be improved by widening the paved shoulder in cross-section K to four or five feet and by striping a three-and-one-half-foot shoulder (including gutter pan) in cross-section C.

5.2.3 Applying the Revised Typical Cross-Sections
It is important for roadway designers and engineers to consider the unique characteristics of each roadway when choosing the appropriate cross-section. This includes roadway geometrics, functional classification, traffic volume and speed, use by large trucks, and surrounding land use characteristics.

Narrowing the motor vehicle lanes in several of the current bicycle and thoroughfare cross-sections would provide extra space for shoulders and bicycle lanes. In some situations this may also have a desired traffic calming effect, slowing typical motor vehicle traffic by several miles per hour. According to AASHTO’s Guide for Achieving Flexibility in Highway Design (2004), the normal range of design lane width is between nine feet and 12 feet. This guide states:

“In urban areas and along rural routes that pass through urban settings, narrower lane widths may be appropriate. For such locations, space is limited and lower speeds may be desired. Narrower lane widths for urban streets lessen pedestrian crossing distances, enable the provision for on-street parking and transit stops, and enable the development of left-turn lanes for safety.”

None of the revised cross-sections would require striping motor vehicle travel lanes narrower than 10 feet, a width that is already used on several roadways in the Winston-Salem Urban Area. Wider lane widths are typically used on roads with higher speeds and volumes and to accommodate wider vehicles, such as trucks and buses.

Figure 5.2 (continued)
Because traffic characteristics vary across the Winston-Salem Urban Area, some of the lane widths in the revised bicycle cross sections (see Figure 5.1 and Figure 5.2) would only be appropriate for specific types of roadways.

According to the AASHTO Policy on Geometric Design of Highways and Streets (2004, p. 425, 433), minor thoroughfares (collector roadways) can be designed with 10-foot motor vehicle travel lanes. Wider widths should be considered in rural areas if the roadway has high traffic volumes or speeds and considered in urban areas if the roadway carries a large amount of truck traffic.

Major thoroughfares (arterial roadways) are commonly designed with 11-foot travel lanes. However, in urban areas, some major thoroughfares can have narrower lanes. The AASHTO guide states, “Lane widths of 3.0 m [10 ft] may be used in highly restricted areas having little or no truck traffic” (p. 472).

5.3 Typical Multi-Use Cross-Sections

Multi-use trails are physically separated from motor vehicle traffic and are built either within an independent right-of-way (e.g. a utility or railroad right-of-way), or along specially acquired easements across private lands. Such trails cater to a variety of different users including bicyclists, pedestrians, joggers, roller bladers, and skateboarders. Possible conflicts between these user groups must be considered during the design phase, as cyclists often travel at faster speeds than other users. Multi-use paths can help bicyclists and walkers avoid congested areas, although they sometimes do not provide access to important destinations in congested areas. Off-road trails offer a convenient and pleasant alternative, as well as an opportunity for a novice cyclist to get some riding experience in a less threatening environment. Although multi-use trails usually attract a higher percentage of “B” and “C” cyclists, “A” cyclists can also benefit from their use. (A, B, and C bicycle user types are described in section 5.4.)

Figure 5.3. Typical Multi-Use Trail Cross-Section
The minimum width for a multi-use trail is 10 feet. However, a 12 foot or 14 foot trail is preferred when heavy usage is expected. Appropriate signage should be used to reflect rules and speed limits. Pavement markings should also be used to delineate usage.

5.4 Bicycle User Types

Cycling has become a diversified pursuit for millions of Americans. Today, equipment modifications have enabled users to access and ride within a variety of landscapes. The design of bicycle facilities has evolved to keep pace with these changes.

In most states, bicyclists are regarded as vehicle operators and are therefore subject to the laws, rules, and regulations that govern the operation of vehicles within the public rights-of-way and on roadways. Common causes of bicycle/motor vehicle collisions are bicyclists riding the wrong way on the road or riding on the sidewalk.

Bicyclists can be divided into one of the following categories:

“A” or Expert Cyclist: These cyclists use their bicycles for transportation and athletic purposes. They are confident in their ability to control their vehicle and ride in a variety of conditions, including along side motor vehicle traffic. They are comfortable using urban, suburban, and rural roads that do not provide shoulders, bike lanes, or other special accommodation for bicycles.

“B” or Casual Cyclists: These cyclists use their bicycles for both recreation and transportation purposes. While they will ride within the roadway environment, they generally avoid high speed, heavy traffic roads, unless bike lanes or paved shoulders are provided. They often prefer quiet, less traveled streets and shared-use paths that are separated from the road environment.

“C” or Inexperienced Cyclists: Many of these cyclists are children, seniors, or people who have not had the opportunity to learn safe cycling skills. They are either novice or inexperienced riders that have neither an understanding of traffic laws and regulations nor a good grasp of how to control their vehicle. They may also be dependent on their bicycle as a form of transportation (to friends’ homes, jobs, schools, and recreation venues). This user group is most comfortable on shared-use, off-road paths.

A comprehensive and functional bicycle system caters to the needs of all three cyclist categories.

5.5 Bicycle Facility Design Criteria

National standards for the design of bicycle facilities are provided by AASHTO through their “Guide for the Development of Bicycle Facilities” (1999). Nearly 1/3 of the guide is devoted to trail design and the requirements are quite detailed. AASHTO’s guide should be used as a companion to the following sections. Key elements to good bicycle facility design are as follows.

5.5.1 Location and Use

A bicycle route is a “suggested way” for a cyclist to get from a point of origin to a destination. They are chosen because they offer preferable degrees of directness, scenery, congestion and traffic speed.

Bicyclists will typically use the most direct route from an origin to a destination. Roadway and pathway systems need to be planned to accommodate this demand. The incorporation of off-road, multi-use paths into the network can help bicyclists and walkers avoid congested urban areas. A drawback of this type of facility is that they sometimes do not provide access to important destinations in the more congested areas.

Facility selection involves a critical analysis of the types of bicyclists that are likely to use the corridor, as well as the current conditions within the corridor. If the candidate route is along an existing or planned roadway, the following factors should be considered.
• primary design bicyclist
• width of road pavement
• number of travel lanes
• traffic volume
• traffic speed
• sight distance
• presence of truck traffic
• adjacent land uses

5.5.2 Intermodal Connections and Bicycle Parking
Bicycle racks on buses have proven to be a cost effective way to increase transit ridership and extend the range of service beyond the typical walking distance of transit stops. Once cyclists reach their destination, short-term storage solutions, such as bicycle racks, should be provided as part of streetscape planning. For long-term solutions, bicycle lockers should be installed.

5.5.3 Width
The minimum preferred width for a bike lane is 5-feet. However, bike lanes can be 4-feet wide if they are adjacent to a gutter pan and there is no seam between the street surface and the gutter pan. On roads with parallel parking, bike lanes should be a minimum of 5-feet wide and should be installed adjacent to the motor vehicle lanes, rather than between the parking lane and the curb. Along streets with higher motor vehicle speeds and traffic volumes, wider bike lanes are recommended.

The minimum width for two-directional trails is 10 feet. However, 12-foot and 14-foot widths are preferred where heavy traffic is expected.

If space does not currently exist to create a bicycle lane, other options may be possible, such as reducing lane widths, removing the parking lane on one side of the street, or eliminating a travel lane (given that this does not lower the current level of service for motor vehicles to an unacceptable level), or road widening.

Another option to provide more space for bicyclists is to widen the shoulder. Paved shoulders that are 2- to 3-feet wide can improve conditions and are recommended in cases where 4-foot widths cannot be achieved. However, shoulders less than 4-feet wide should not be designated as bicycle facilities with signage or on official bicycle route maps. “Share the Road” signs would be acceptable in these locations, as they would serve to warn motorists of the likely presence of bicyclists.

Outside lanes that are wider than the standard 12-foot travel lane can also provide more space for cyclists and easier passing for motorists. Under most conditions, automobiles and bicycles can co-exist in a 14-foot wide curb lane, without the need for the motorist to move into the next adjacent lane.

5.5.4 Speed
The design speed for a given facility is determined by calculating the maximum speed for the cyclist. Most off-road shared-use paths should have design speeds around 15-20 miles per hour. The design speed for an on-road bicycle facility will share the design speed of an associated roadway.

The average speed of a cyclist is 10 miles per hour. However it is not uncommon for cyclist speeds to exceed 20 miles per hour.

5.5.5 Other On-Road Bicycle Facility Design Considerations
Roadway width and traffic volumes should be taken into account before identifying a bike lane on a roadway. All potential bicycle hazards such as unsafe drainage grates, excessive drop-offs along the gutter pan, and angled railroad crossings must be removed from the roadway or modified.

Rumble strips and rough pavement provide an unrideable surface for bicyclists and should be repaved in order to accommodate bicycle users. As with bicycle lanes, paved shoulders should have the same pavement depth and sub-base as the adjacent roadway and should be regularly swept and kept free of potholes. Areas such as unpaved parking lots, driveways, and unimproved roads may cause debris to enter the bike lane. A solution may be to pave...
an adequate distance into the driveways and access roads to reduce the encroachment of debris onto the shoulder.

5.5.6 Shared-Use Path Design and Alignment
All bicycle facilities should have a minimum curve radius of 100 feet. When this standard cannot be achieved, warning signs must be used to alert cyclists of the sub-standard curve. Path widening is also recommended for safer turns.

5.5.6 Shared-Use Path Paving
Trails designed to serve bicycle transportation purposes should be composed of a hard surface such as asphalt or concrete, and should be designed to withstand the loading requirements of occasional maintenance and emergency vehicles. Installation of a geotextile fabric beneath a layer of aggregate base course can help to maintain the edges of an asphalt trail. It is also important to provide a 2-foot-wide graded shoulder to prevent trail edges from crumbling.

5.6 Transportation Enhancement Guidelines
In addition to the previous design criteria, the following guidelines are provided by the NCDOT for applicants wishing to use Transportation Enhancement funds.

- Bike paths must be at least 10’ in width
- Bike paths must have an established design speed
- Bike paths must connect logical, accessible termini
- Bike path surfaces typically include concrete or asphalt; however, other materials may be acceptable (as long as they meet ADA standards)
- Paved shoulders/bike lanes must be at least 4-feet in width and located on both sides of the road
- Bicycle facilities must primarily serve a transportation purpose—not a recreation purpose
- Bicycle designs must be consistent with the NCDOT “roadway standard drawings” and the “standard specifications” publications available from the NCDOT Highway Design Branch, and the “North Carolina Bicycle Facilities Planning and Design Guidelines” publication available from the NCDOT Division of Bicycle and Pedestrian Transportation office.

5.7 Facility Development Costs
The tables at the end of Appendix D (section D.5) contain information in response to Council’s request for cost estimates on the Bicycle Plan’s Recommendations. A sample of cost estimates based on the 2000 Bond Referendum road projects has been included. Cost estimates are only provided for projects within the city limits.

A primary goal of the Bicycle Plan is to guide the Winston-Salem Urban Area in the creation of a first-class bicycle network by coordinating the recommendations in the plan with state and local road improvements, such as repavings, widenings, and extensions.
Incidental roadway improvement projects, like bike facilities, that are added to a roadway reconstruction project and are funded with state and federal dollars are built at no cost to the locality\(^1\). The cost of the bicycle facility is rolled into the overall cost of the project, therefore the locality only loses the opportunity to gain a bicycle facility at no cost if it fails to include the request for the bicycle improvement along with the roadway improvement.

In locally funded projects, NCDOT generally found that the addition of the bicycle facility is <1% of the total cost\(^5\). Typically, the addition does not change the amount of ROW that NCDOT purchases, nor are mobilization costs any higher. The negligible costs for the additional width lie in the additional soil grading that may be needed, and additional materials. (See section D.5 for sample project costs)

Additionally, Shared-Use Paths (Greenways) make up 21% of the total plan cost. These recommended greenways come from the proposed greenways identified in the 2015 Winston-Salem And Forsyth County Greenway Plan adopted in 2003. Although the plan provides cost estimates for some of the Proposed Priority trails, it does not provide estimates for all of the proposed trails. One of the four Shared-Used Paths in the Top Priority Road Improvements currently has funding for construction and is in the design phase. The other three all have funding identified for feasibility studies in the 2006-2012 Draft Transportation Improvement Program (TIP).

Finally, the tables in section D.5 display that the average cost per mile to construct 315 miles of the recommended bicycle facilities, with the exception of signs and the unknown facilities, is approximately $393,700. This approximation is compared to the average cost per mile to construct 6 miles of Bond projects at $4,397,000.

**Notes**

1 With the exception of freeways/expressways where bicycles are prohibited. In these situations, bicycles should be accommodated on a shared-use path or other parallel route nearby.

2 In addition, AASHTO’s *Guide for Achieving Flexibility in Highway Design* (2004) states, “Paving part or all of the shoulder...helps reduce crash rates...and helps to facilitate use of the road by bicyclists. Shoulder paving also reduces maintenance requirements....Where a ‘full width’ shoulder cannot be achieved, the designer should strive to provide as wide a shoulder as possible that meets functional requirements” (p. 66).

3 Recommended bicycle cross-sections D-B, E-B, F-B and H-B have bike lanes that use 4-feet of pavement width. The AASHTO Bicycle Guide (1999) allows gutter pan width to be included to meet the 5-foot minimum bike lane width standard as long as the gutter pan is flush with the pavement surface.

4 Recommended typical thoroughfare cross-sections B, D, E, and M have bike lanes that are 4-feet wide. Though the preferred width for bike lanes is 5 feet, the AASHTO Bicycle Guide (1999) allows this narrower width if the bike lane is adjacent to a gutter pan that is flush with the pavement surface.

**References**


