2 Existing Conditions

Chapter Sections:

2.1 Overview

The status quo for bicycle transportation in Durham is described in this chapter through several different levels of analysis. First, an overview of the existing conditions for bicycling is provided by applying demand and benefit models to existing population and transportation data for Durham. This analysis is followed by a brief summary of bicycle-related needs and concerns expressed by area residents through this Plan's public input process. Finally, the profiles of 25 major travel corridors in Durham are listed to provide a sample of area bicycling conditions, identifying common constraints and summary assessments. The chapter concludes with an inventory of Durham's existing bicycle facilities

2.2 Existing Demand

A variety of demand models are often used to quantify usage of existing bicycle facilities and to estimate the potential usage of new facilities. The purpose of these models is to provide an overview of the demand and benefits for bicycling in Durham. As with all models, the results presented show a range of accuracy that can vary based on a number of assumptions and the available data. The models used for this study incorporated information from existing publications as well as data from the U.S. Census. All data assumptions and sources are noted in the tables following each section of the analysis.

The Durham bicycle demand model consisted of several variables, including commuting patterns of working adults and predicted patterns for area students. For modeling purposes, the study area included all residents within the City of Durham in 2000. Commuter trips from the rural areas of the county were not counted in the model due to the travel distances involved and the limits of available data. The information was ultimately aggregated to estimate the total existing demand for bicycle facilities in the city.

Table 2.1 identifies the variables used in the model. Data regarding the existing labor force (including number of workers and percentage of bicycle commuters) was obtained from the 2000 Census. In addition to people commuting to the workplace via bicycle, the model also incorporated a portion of the labor force working from home. Specifically, it was assumed that about half of those working from home would make at least one bicycling or walking trip during the workday. The 2000 Census was also used to estimate the number of children within the study area. This figure was combined with data from National Safe Routes to School surveys to estimate the proportion of children riding bicycles to and from school. College students constituted a third variable in the model due to the presence of the three universities in Durham. Data from the Federal Highway Administration regarding bicycle mode share in university communities was used to estimate the number of students bicycling to and from campus. Finally, data regarding non-commute trips was obtained from the 2001 National Household Transportation Survey to estimate bicycle trips not associated with traveling to and from school or work.

Table 2.1 summarizes estimated existing daily bicycle trips in Durham. The table indicates that nearly 28,000 bicycle trips are made on a daily basis. Most bicycle commuting trips are made by college students while school children make the fewest trips. The model also shows that non-commuting trips comprise the vast majority of existing bicycle demand.

Figure 2.1 - Bike to Work Day, Durham, 2006.

Table 2.1 - Estimate of Existing Daily Bicycling Activity in Durham

Variable	Figure	Calculations
Employed Adults, 16 Years and Older		
a. Study Area Population (1)	*187,193*	
b. Employed Persons (2)	*93,057*	
c. Bicycle Commute Percentage (2)	*0.4%*	
d. Bicycle Commuters	*372*	*(b*c)*
e. Work-at-Home Percentage (2)	*2.7%*	
f. Work-at-Home Bicycle Commuters (3)	*1,256*	*[(b*e)/2]*
School Children		
g. Population, ages 6-14 (4)	*21,135*	
h. Estimated School Bicycle Commute Share (5)	*2%*	
i. School Bicycle Commuters	*423*	*(g*h)*
College Students		
j. Full-Time College Students	*16,936*	
k. Bicycle Commute Percentage	*10%*	
l. College Bicycle Commuters	*1,694*	*(j*k)*
Work and School Commute Trips Sub-Total		
m. Daily Commuters Sub-Total	*3,745*	*(d+f+i+l)*
n. Daily Commute Trips Sub-Total	*7,490*	*(m*2)*
Other Utilitarian and Discretionary Trips		
o. Ratio of "Other" Trips in Relation to Commute Trips (8)	*2.73*	*ratio*
p. Estimated Non-Commute Trips	*20,447*	*(n*o)*
Total Estimated Bicycle Trips in Study Area	**27,936**	*(n+p)*

Notes:
Census data collected from 2000 U.S. Census for Durham.
(1) 2000 U.S. Census, STF3, P1.
(2) 2000 U.S. Census, STF3, P30.
(3) Assumes 50% of population working at home makes at least 1 daily bicycle trip.
(4) 2000 U.S. Census, STF3, P8.
(5) Estimated share of school children who commute by bicycle, as of 2000 (source: National Safe Routes to School Surveys, 2003).
(6) Spring 2005 full-time enrollment (source: Duke University and NC Central University).
(7) Review of bicycle commute share in 7 university communities (source: National Bicycling & Walking Study, FHWA, Case Study #1, 1995).
(8) 27% of all trips are commute trips (source: National Household Transportation Survey, 2001).

2.2.1 Existing Mode Share for Durham Commuters

The 2000 Census data shows that of the 112,433 workers living in Durham County, a significant majority (75%) work within Durham County. In contrast, of the 166,048 people who worked in Durham County in 2000, around 51% were Durham residents, with 26% from Wake County, 10% from Orange County, and 7.5% from other counties. This 2000 Census data (County-to-County Worker Flow Files) leads to the following general observations:

- Durham has higher commuter inflows from Wake and Orange counties than outflows to these counties
- Internal traffic flows within Durham County (to/from local origins and destinations) generates at least half of the morning rush hour traffic
- Regional commute traffic flows are heaviest to and from the east, followed by flows to and from the south and north

Regarding mode choice, Durham County residents show a clear preference for driving alone to work. This is evident from Summary File 3 (SF-3) data of the Census 2000 (summarized in Table 2.2, below). This data illustrates that bicycling has yet to become a viable mode of travel, at least for commuting purposes. Table 2.2 also illustrates how Durham's bicycle mode share for commuting adults (0.4%) compares to other modes of transportation, and to other nearby counties.

Table 2.2 - Choice of Transportation Mode to Work

Transportation Mode	Durham County Workers	Durham County Percent	Wake County Workers	Wake County Percent	Orange County Workers	Orange County Percent
Drove alone	84,063	74.8%	274,674	81.1%	42,668	70.1%
Carpooled	17,927	15.9%	37,823	11.2%	7,149	11.7%
Bus or trolley bus	3,141	2.8%	3,340	1.0%	2,489	4.1%
Streetcar or trolley	0	0.0%	30	0.0%	16	0.0%
Subway/Elevated	16	0.0%	44	0.0%	26	0.0%
Railroad	19	0.0%	42	0.0%	8	0.0%
Ferryboat	0	0.0%	18	0.0%	0	0.0%
Taxicab	208	0.2%	679	0.2%	27	0.0%
Motorcycle	115	0.1%	306	0.1%	108	0.2%
Bicycle	396	**0.4%**	643	**0.2%**	1,124	**1.8%**
Walked	2,959	2.6%	5,847	1.7%	4,263	7.0%
Other means	539	0.5%	2,419	0.7%	295	0.5%
Worked at home	3,050	2.7%	12,737	3.8%	2,687	4.4%
TOTAL:	112,433	100%	338,602	100%	60,860	100%

Source: Census 2000 Summary File 3, Table P30 Means of Transportation to Work for Workers 16 years and over.

2.2.2 Estimating Future Bicycle Demand

According to the Triangle Regional Model (see page 2-6) there are 933,673 daily trips in Durham. According to the estimate of existing bicycle demand, there are nearly 28,000 daily bicycle trips (see table 2.1). This translates to an overall 2.9 percent daily mode split for bicycling in Durham. While this figure appears to be high (compared to the 0.4 percent mode split noted in table 2.2), it is deemed reasonable given the additional inclusion of non-commute trips, recreational uses, and student trips.

Taking the estimated 28,000 / 2.9 percent existing ridership, and applying it to projected 2030 socio-economic data for Durham, it is estimated that the total daily bicycle trips in the study area could increase by 144 percent to 68,200 trips, or 4.2 percent of total daily trips. With aggressive implementation of bicycle improvements and policies, it is possible to push this mode share even higher, to 5.8 percent by 2030. Therefore, Durham's new bicycle facilities will need to serve not only the existing ridership and its natural growth, but also those estimated to ride as a result of the plan itself. The future bicycle trip demand estimation, and its rationale, is summarized below.

Table 2.3 – 2030 Daily Bicycle Trip Demand for Durham

Variable	Existing (2000)	Future (2030)	Data Source	Rationale for future estimate
Percent of Durham Workers riding Bicycle to Work	0.4%	2.0%	Census 2000 SF-3, P30	Durham will at least exceed the observed Orange County Bicycle mode split value of 1.8% by 2030, in response to higher fuel prices, life style changes and better bicycle environment
Percent of Durham Workers Working at Home	2.7%	5.4%	Census 2000 SF-3, P30	With technology boom and more women entering the work force, the share of Work at Home Durham workers will at least exceed the observed Orange County value of 4.4% and possibly double by 2030. About half of these workers would use bicycle for commute purposes.
Percent of Durham School Students Bicycling to School	2%	2%	National Safe Route to School Surveys, 2003	It is possible that more students would bike to school in the future with increased emphasis on safe routes to school. However, to account for busy life style of tomorrow's parents and to remain on the conservative side it is assumed that this variable will remain flat in the future.
Percent of Durham College Students Bicycling to College	10%	10%	National Bicycling and Walking Study, FHWA, Case Study #1, 1995	It is possible that more college students would bike to school in the future with high student parking costs and housing growth in and around the Duke and NCCU campuses. However, to account for busy student schedule at Duke and other campuses and to remain on the conservative side it is assumed that this variable will remain flat in the future.
Number of Workers living in Durham Urban Area	93,057	136,798	Census 2000	Woods & Poole 2004 State Profile forecasts shows 47 percent growth in total employment between 2000 and 2030, which was deemed reasonable for the urban area growth as well.
Number of School-age children living in Durham	21,135	34,027	Census 2000	Woods & Poole 2004 State Profile forecasts shows 61 percent growth in school-age children between 2000 and 2030, which was deemed reasonable.
Number of College Students enrolled in Duke & NCCU	16,936	20,323	Duke & NCCU Enrollment Stats	Assumed 20% growth by 2030, given the current Duke University master planning activities.
Daily Person Trips in Durham	933,673	1,553,680	Triangle Regional Model (TRM)	Forecast is based on TRM, disaggregated for Durham County. Trips include Home-based Work, Home-based Other, Home-based Shopping, Home-based School and Home-based College
Daily Bicycle Trips	27,900	68,200	Draft Task 3 Report	Using the Triangle Regional Model daily person trip estimates, bicycle mode split is 2.9% in existing conditions and 4.2% in future conditions.

The Triangle Regional Model (TRM) service bureau, in cooperation with regional stakeholders (CAMPO, DCHC-MPO, NC DOT, and the Triangle Transit Authority), performs travel modeling for Durham and the surrounding region. The 2030 traffic projections obtained from the TRM shows that traffic volume and congestion will increase significantly for all major freeway and arterial corridors in the study area.

Map 2.1 – Projected 2030 Daily Vehicle Trips (TRM)

The increased traffic congestion will provide further impetus to switch to bicycle mode for work and non-work related trips, especially for shorter-distance trips.

TRM's 2030 Daily Person Trip Data provides a sense of where people in Durham are traveling to and from, now and in the future. A full demand profile of the Durham County daily person trips is presented in Map 2.2 (below) by Durham sub-areas for 2002 and 2030. One chart shows the daily person trips at the home-end (known as trip productions) and the other shows the daily person trips at the work-end (known as trip attractions). Trips in 2002 are shown in blue, and those in 2030 are shown in red.

Map 2.2 – Daily Person Trips for Durham County

A review of these maps and the associated data shows that key market segments for bicycle demand within Durham and neighboring areas include the following destinations:

- Downtown Durham
- Duke University Campus
- NCCU Campus
- UNC Chapel Hill Campus
- Chapel Hill Specialty Retail Areas
- Durham County Middle and High Schools
- Streets at Southpoint Shopping Mall
- Research Triangle Park (RTP)

These destinations were included in the prioritization process for this plan, among other factors and criteria (see Appendix B: Phasing and Prioritization).

2.3 Benefits Analysis

The many benefits of bicycling are described in Chapter One; this section analyzes those benefits that are *quantifiable* for Durham. A variety of models exist that quantify the benefits of non-moterized facilities. Two of the models used for this plan are connected to programs in the Durham / Research Triangle region:

The Physical Inactivity Cost Calculator is made available by the Active Living Leadership Program and the Active Living by Design Program at the UNC School of Public Health (*www.activelivingleadership.org/costcalc.htm*); and,

The BikeCost Model is made available by the U.S. Pedestrian and Bicycle Information Center (PBIC), which is based at the UNC Highway Safety Research Center (*www.bicyclinginfo.org/bikecost*).

These models were used to estimate the positive air quality, public health, transportation, and recreation benefits associated with existing and future bicycle travel in Durham.

2.3.1 Air Quality Benefits

Non-moterized travel directly and indirectly translates into fewer vehicle trips and an associated reduction in vehicle miles traveled and auto emmissions. The variables and assumptions used as model inputs generally resembled those in the demand model shown in Table 2.1 . Table 2.4, below, summarizes existing and potential future air quality benefits associated with bicycling in Durham. Bicycling currently replaces over 2,600 weekday vehicle trips in the city, eliminating nearly 20,000 vehicle miles traveled. Bicycling also prevents over 350 tons of particulates from entering the ambient air each weekday. Bikeway network enhancements are expected to generate more bicycle trips in the future. This growth is expected to improve air quality by further reducing the number of vehicle trips, vehicle miles traveled and associated vehicle emissions.

Table 2.4 - Existing and Potential Future Air Quality Benefits

Vehicle Travel Reductions	**Existing**	**Future**
Reduced Vehicle Trips per Weekday (1)	2,649	4,057
Reduced Vehicle Trips per Year (2)	691,431	1,058,995
Reduced VMT per Weekday (3)	19,625	32,458
Reduced VMT per Year (2)	5,122,146	8,471,642
Vehicle Emissions Reductions	**Existing**	**Future**
Reduced PM10 (tons per weekday) (4)	361	597
Reduced NOX (tons per weekday) (5)	9,789	16,190
Reduced ROG (tons per weekday) (6)	1,425	2,356
Reduced PM10 (tons per year) (7)	94,427	155,878
Reduced NOX (tons per year) (7)	2,554,926	4,225,655
Reduced ROG (tons per year) (7)	371,868	815,041

Table 1.1 Notes: VMT means Vehicle Miles Traveled

(1) Assumes 73% of bicycle trips replace vehicle trips for adults/college students; 53% reduction for school children.

(2) Weekday trip reduction multiplied by 261 weekdays per year. (3) Assumes average bicycle round trip of 8 miles for adults/college students; 1 mile for school children.

(4) PM_{10} reduction of 0.0184 tons per mile.

(5) NO_X reduction of 0.4988 tons per mile.

(6) ROG reduction of 0.0726 tons per mile.

(7) Weekday emission reduction multiplied by 261 weekdays per year.

2.3.2 Other Quantifiable Benefits for Durham

Non-motorized transportation can also serve recreational purposes, improve mobility and improve health. The "BikeCost" model, made available by the National Pedestrian and Bicycle Information Center, quantifies these benefits. Though focused primarily on bicycling, the model provides a starting point for identifying the potential cost savings of improving Durham's non-motorized transportation system.

Several modeling assumptions should be discussed. First, the BikeCost model is project-specific, requiring specific information regarding project type, facility length and year of construction. Because this study focuses on a larger study area, several variables were used. The model was based on the 118 miles of proposed new off-street trails identified in the Durham Trails and Greenways Master Plan. The model was also based on a future system of new striped bicycle lanes that could supplement the trail network. The additional bicycle lane network was assumed to be roughly twice the length of the new off-street trail system. The expected "mid year" of construction for the new system was assumed to be 2011. The model also required other inputs obtainable from the 2000 U.S. Census, including bicycle commute mode share, average population density and average household size. Refer to Chapter Four for specific figures on the proposed bicycle network.

Based on the variables described above, the BikeCost model estimated annual recreational, mobility and health benefits. The benefits were quantified based on a combination of research from previous studies as well as other factors (identified in the footnotes of Table 2.5).

Table 2.5 summarizes the estimated benefits of an enhanced bikeway network in Durham. Except for mobility benefits, the model outputs represent aggregate benefits of a potential future system of trails and bicycle lanes. Potential annual recreational benefits range from a low estimate of about $7 million to a high estimate of over $56 million. Annual health benefits range from about $492,000 to about $2.2 million. Mobility benefits were estimated on a per-trip, daily and annual basis. The roughly $5 per-trip benefit of off-street trails could translate to an annual benefit of nearly $3 million, while the $4 per-trip benefit of bicycle lanes could yield annual benefits of over $5 million. Decreased auto usage could also generate monetary benefits. As most of the study area is generally urban in character, the enhanced bikeway network could generate over $312,000 in annual savings from reduced vehicle trips.

Table 2.5 - Estimated Aggregate Annual Benefits of an Enhanced Bicycle Network

Recreational Benefits [1]	**Low Estimate**	**Mid Estimate**	**High Estimate**
	$7,011,813	$23,840,165	$56,095,507
Mobility Benefits [2]	**Per-Trip**	**Daily**	**Annually**
-Off-Street Trail Network [3]	$4.96	$11,989	$2,997,214
-Bicycle Lane Network [4]	$4.20	$20,169	$5,042,493
Health Benefits [5]	**Low Estimate**	**Mid Estimate**	**High Estimate**
	$491,788	$1,018,932	$2,213,844
Decreased Auto Use	**Urban**	**Suburban**	**Rural**
	$312,170	$192,104	$24,013

Source: Benefit-Cost Analysis of Bicycle Facilities ("BikeCost") Model, Pedestrian and Bicycle Information Center.

(1) Recreational benefit estimated at $10 per hour (based on previous studies). Assumes one hour of recreation per adult. $10 value multiplied by the number of new cyclists minus the number of new commuters. This value multiplied by 365 days to estimate annual benefit.

(2) Assumes an hourly time value of $12. This value multiplied by 15.38 minutes (the amount of extra time bicycle commuters are willing to spend to travel on a bicycle lane without adjacent on-street parking). Per-trip benefit then multiplied by the daily number of existing and induced commuters. This value then doubled to account for round-trips, to reach daily mobility benefit. Daily benefit then multiplied by 50 weeks per year and 5 days per week.

(3) Based on a network of 118 additional miles of off-street trails.

(4) Based on a network of 236 additional miles of on-street bicycle lanes.

(5) Annual per-capita cost savings from physical activity of $128 based on previous studies. This value then multiplied by total number of new cyclists.

In addition to estimating the benefits of physical activity in a community, it is also possible to estimate the costs of physical inactivity. Active Living by Design, a national program of the Robert Wood Johnson Foundation, recently developed the "Physical Inactivity Cost Calculator" to estimate such costs. The model was developed through compiling and averaging roughly 76 million records from seven U.S. case studies. The calculator estimates annual monetary costs of physical inactivity, and expresses them in terms of medical care costs, workers' compensation costs and costs related to lost productivity. For more information please go to: *www.activelivingleadership.org/costcalc.htm* .

The Physical Inactivity Cost Calculator requires several data elements, including number of working adults, population age 18 and over, and population age 65 and over. The calculator also incorporates median incomes. This data was obtained from the 2000 U.S. Census.

Table 2.6 summarizes estimated annual costs of physical activity in Durham. The table indicates that physical inactivity generates over $575,000 in workers' compensation costs each year. Inpatient and outpatient claims, and out-of-pocket medical expenses cost Durham residents nearly $28 million. These costs however are far exceeded by costs associated with lost productivity. The costs of work absenteeism and 'presenteeism' exceed $165 million each year. The model also estimates that the $194 million in total costs translates to about $1,345 per person.

The Physical Inactivity Cost Calculator also estimates cost reductions associated with increased physical activity. For example, about $9.7 million could be saved if an additional 5 percent of Durham's population becomes physically active.

Table 2.6 - Estimated Aggregate Annual Costs of Physical Inactivity in Durham

Variable	Estimated Annual Cost
Medical Care Costs	$27,765,946
Workers' Compensation Costs	$575,279
Lost Productivity Costs	$165,769,237
Total Costs	**$194,100,462**

Footnotes

[1] U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (1996). Physical Activity and Health: A Report of the Surgeon General. Washington, DC: Government Printing Office.

[2] U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (2002). Guide to Community Preventive Services.

[3] U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (1996). Physical Activity and Health: A Report of the Surgeon General. Washington, DC: Government Printing Office.

[4] Image courtesy of: http://www.msac.com.au

[5] Image courtesy of: http://www.geocities.com

2.4 Community Concerns, Needs, and Priorities

Numerous concerns, needs, and priorities were identified through the public input process. That process included three public workshops, public outreach efforts, public opinion forms, and steering committee comments guidance. Appendix A contains compiled results from the public opinion forms.

The public input process highlighted a need for more bicycle facilities, with an emphasis on safety and connectivity between bicycle routes and destinations. In addition to a lack of existing facilities, the public has also indicated that heavy motorized traffic, high speed motorized traffic and narrow roads are the most significant barriers preventing people from bicycling more often. Schools, workplaces, greenways and parks topped the list of destinations that Durham bicyclists are eager to cycle to. These and other concerns were taken into account throughout the development of this plan, and some have been incorporated directly into the route prioritization process (see Appendix B: Phasing and Prioritization).

2.5 Bicycle Friendliness of Local Transportation System

A field survey was conducted by a team of professional engineers and planners to evaluate the bicycle friendliness of the City of Durham and Durham County's transportation system. The routes that are profiled on the following pages represent major travel corridors in the study area and provide a good sample of routes in terms of geographic coverage, lane configuration, and bicycle environment. Table 2.4 includes fifty roadway segments with summary profiles of each. In addition, needs and priorities for improvements were identified to accommodate bicycle travel and to enhance bicycle safety along these routes.

In general, many of these routes were found to be unsuitable for bicycle travel under existing conditions, especially for Type B and C (less experienced) bicycle riders. Unsuitability was due to a number of factors, including restrictive lane width, high traffic volume and speed, lack of shoulder space, lack of dedicated space through interchange areas, shared use with truck traffic, and lack of warning and destination signage.

Table 2.4 – Profile of Existing Conditions for Cyclists on Durham Roadways

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
NC HIGHWAY 54 From S Miami Blvd To Davis Dr (#1)	• 45 mph speed • 2-ln cross-section after Miami Blvd transitions to 5-ln cross-section near Davis Dr • Office uses on both sides	• Narrow lanes between Miami Blvd and Nortel Dr • High traffic volume	• A multi-use path on right (WB) already exists in the western half of the segment • Narrow 2-lane segment might be widened in future • Railroad bridge already widened • Need to connect the multi-use path throughout the segment • Need pedestrian signals at intersections	Currently unsafe due to excessive traffic volume and speed, but has potential with improvements
NC HIGHWAY 54 From Davis Dr To TW Alexander Dr (#2)	• 45 mph speed • 5-ln cross-section • Office and some retail use on both sides	• No pedestrian signals at intersection • Multi-use path on the other (EB) side • Multi-use path missing on bridge over Durham Freeway	• A multi-use path on left (EB) already exists in the western half of the segment • Need better connection between existing paths • Need pedestrian signals at intersections	Fair condition for bicycle travel; Could be improved with small improvements in the future
NC HIGHWAY 54 From TW Alexander Dr To NC Highway 55 (#3)	• 35 mph posted speed • 5-ln cross-section • Curb and gutter with no shoulder • High density retail near NC 55	• High traffic volume • High speed • Limited sidewalks	• Adequate right of way for having separate bicycle facility • Need separate facility because of high traffic • Connects Lowe's Grove elementary and middle schools	Currently unsafe due to excessive traffic volume and speed; sidewalks are not connected throughout
NC HIGHWAY 54 From NC Highway 55 To Fayetteville Rd (#4)	• 45 mph posted speed • 2 to 3-ln cross-section with turn lanes at residential developments • Curb and gutter • Residential uses on both sides	• Unconnected sidewalks • Narrow Shoulder • I-40 overpass bridge before Fayetteville Rd	• Adequate right of way for having separate bicycle facility • Need separate facility because of high traffic	Currently unsafe due to excessive traffic volume and speed

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
NC HIGHWAY 54 From Fayetteville Rd To Hope Valley Rd (Hwy 751) (#5)	• 45 mph posted speed • 5-ln cross-section near Fayetteville Rd which drops to 3- lane cross-section • Vacant / low density land use in the western half of the segment	• Narrow structures over low lying , marshy area • Limited sidewalks • Standard 12 feet lanes with narrow shoulder • Southpoint Mall near Fayetteville Rd and other development	• Close to American Tobacco Trail, Woodcroft Parkway and Jordan High School	Currently unsafe due to excessive traffic volume with high speed
NC HIGHWAY 54 From Hope Valley Rd (Hwy 751) To I-40 (#6)	• 45 mph posted speed • 3-ln cross-section with two-way center turn lane • Some residential development on both sides • Fairly busy traffic volume	• Narrow structures over low lying , marshy area • Limited sidewalks • Standard 12 feet lanes with narrow shoulder	• Sidewalks in front of developments	Currently unsafe due to high traffic, high speed and narrow lanes with limited shoulder
NC HIGHWAY 54 From I-40 To Durham County Line (#7)	• 45 mph posted speed • 5-ln cross-section transitions to 4-ln south of Albany St • Very busy traffic	• Frontage road not continuous • 4 lane bridge over creek with no shoulder	• Existing frontage roads which can be used by bikes • Connects to Chapel Hill	Currently unsafe due to high traffic and speed
STATE HIGHWAY 751 From Fayetteville Rd To I-40 (#8)	• 45-55 mph posted speed • 2-lane cross-section with turn lanes for residential developments • 4 lane divided near I-40	• Narrow lanes • Narrow shoulder • High speed • High traffic	• Adequate right of way for bike facility • Sidewalks in front of some developments	Unsafe until major improvement is done
STATE HIGHWAY 751 From I-40 To NC Highway 54 (#9)	• 45 mph posted speed • 2-lane cross-section with turn lanes for residential developments • 4 lane divided near I-40	• High traffic volume • 12 feet lanes with no shoulder in the northern half • Conflicts with I-40 ramps	• Existing sidewalk in the southern half • Sidewalk extends over I-40 bridge	Currently unsafe due to excessive traffic volume and speed, but has potential with improvements

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
WOODCROFT PARKWAY From State Highway 751 To Fayetteville Rd (#10)	• 35 mph posted speed • 2-ln divided cross-section with turn lanes • Residential area • Low traffic	• Some driveways	• Existing multi-use path on the side • Nice pedestrian crossings • Existing MUTCD signs	Nice multi-use path ideal for bicyclists already exists
E WOODCROFT PARKWAY / CARPENTER FLETCHER RD From Fayetteville Rd To NC Highway 55 (#11)	• 35 mph posted speed • 2-ln divided cross-section with wide lanes; curb and gutter • Residential area • Low traffic	• Some parts have curve and grade • Carpenter Fletcher Rd is narrow 2-lane undivided with no shoulder	• Nice sidewalk instead of multi use path • Sidewalk can be improved to a better facility	Environment is conducive to bicycle travel; Carpenter Fletcher is unsafe but has potential with improvements
HOPE VALLEY RD (HWY 751) From NC Highway 54 To Martin Luther King Jr Pkwy / Archdale Dr (#12)	• 35 mph posted speed • 2-ln cross-section • Residential area • Moderate traffic	• Narrow 2-lane cross-section with no shoulders	• Few sidewalks	Currently unsafe; improvements are needed to make bicycle friendly
OLD CHAPEL HILL RD From Durham County Line To Garrett Rd (#13)	• 35 mph posted speed • Mostly 2-ln cross-section with turn lanes • Mixed residential and commercial use	• Narrow lanes and shoulder • Narrow bridges over I-40 and creek • Unconnected sidewalks	• Middle school with 30 mph posted speed	Currently unsafe for bicycle travel
OLD CHAPEL HILL RD From Garrett Rd To University Dr (#14)	• 35 mph posted speed • 2 to 3-ln cross-section • Mostly residential	• Narrow lanes and shoulder • Many driveways		Currently unsafe for bicycle travel
MARTIN LUTHER KING JR PARKWAY From Hope Valley Rd To Fayetteville Rd (#15)	• 45 mph posted speed • 5-lane cross-section • Striped Bike-lane and sidewalks	•	•	Already suitable for bicycle travel

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
MARTIN LUTHER KING JR PARKWAY From Fayetteville Rd To NC Highway 55 (#16)	• 45 mph posted speed • 5-lane cross-section • Striped Bike-lane and sidewalks	•	•	Already suitable for bicycle travel
ERWIN RD From Durham County Line To Cornwallis Rd (#17)	• 45 mph posted speed (35 near school) • 2-ln cross-section • Low traffic volume	• Narrow lanes • Narrow shoulder • Rolling terrain	• Some areas have relatively wide shoulders	Environment is suitable but facility is unsafe for bicycle travel
CORNWALLIS RD From Durham County Line To Erwin Rd (#18)	• 45 mph posted speed • 2-ln cross-section undivided	• Narrow lanes • Narrow shoulder • Rolling terrain	• Low traffic	Environment is suitable but facility is unsafe for bicycle travel
CORNWALLIS RD From Erwin Rd To University Dr (#19)	• 35 to 45 mph posted speed • 2- to 4-ln cross section	• Narrow Lane	• Connects to RTP	Need bicycle improvements
CORNWALLIS RD From University Dr To NC Highway 55 (#20)	• 35 to 45 mph posted speed • 2- to 4-ln cross section • Bike lane starts around Fayetteville Rd	• Narrow Lane	• Connects to RTP	Need bicycle improvements
CORNWALLIS RD From NC Highway 55 To S Miami Blvd (#21)	• 45 mph posted speed • 4-ln divided • Bike lane on both sides	•	• Connects to RTP	Already suitable for bicycle traffic
CAMERON BLVD From Erwin Rd To Duke University Dr (#22)	• 35 mph posted speed on Cameron Blvd • 4-ln undivided curb and gutter with no shoulder	• High traffic • No shoulder • Narrow underpass with 15-501		Currently unsafe; need improvements

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
DUKE UNIVERSITY DR / W CHAPEL HILL ST From Cameron Blvd To Duke St (#23)	• 35 mph posted speed • 2 to 3-ln cross-section (5-lane after Kent St in downtown area) • Low traffic volume • Duke university area	• Duke University Dr has 12 feet lanes with narrow bike lanes • W Chapel Hill St has wide lanes with on street parking and sidewalks		Environment is in fair condition for bicycle travel; Could be improved with small improvements
S DUKE ST From W Chapel Hill St To University Dr (#24)	• 35 mph posted speed • 2-ln cross-section • One way • Sidewalks on both sides	• On street parking • Some sight distance issues		Environment is suitable for bicycle travel but needs improvement
UNIVERSITY DR From S Duke St To Academy Rd (#25)	• 35 mph posted speed • 2 to 4-ln cross section	• Many driveways	• Has wide outside lane closer to downtown • Connects to commercial, multi-family areas	Need bicycle improvements

Figure 2.4 - Durham bicyclists traversing the intersection of Broad Street and Main Street

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
HILLSBOROUGH RD (US 70 Bus) From Hillandale Rd To Cole Mill Rd (#26)	• 35 mph posted speed • 5-ln cross-section • Commercial uses on both sides	• Many driveways • Limited sidewalks • High traffic volume • Turning movement conflicts with US 15-501 ramp traffic at the overpass	• Has wide outside lane • Need edge of pavement marking • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design treatment for the outside lane	Potential with small improvements
COLE MILL RD From Hillsborough Rd (US 70 Bus) To Rose of Sharon Rd (#27)	• 40 mph posted speed (35 mph on horizontal curves) • 4-ln cross-section, except between Hillsborough Rd and Medford Rd where the roadway flares to 6 to 7 lanes to accommodate I-85 ramp movements at the underpass • Residential uses on both sides • Popular route for bicycle riders	• Lane width less than 12 feet • No Shoulder • No sidewalks, north of Medford Rd • Turning movement conflicts with I-85 ramp traffic at the underpass	• Need striped bike lane between Hillsborough Rd and Medford Rd with adequate pavement markings • Need edge of pavement marking • Need Bike Route signs (MUTCD D11-1) • Need 4-feet paved shoulder	Potential with small improvements
COLE MILL RD From Rose of Sharon Rd To Umstead Rd (#28)	• 45 mph posted speed • 2-ln cross-section • Low density upscale residential uses on both sides	• Lane width less 12 feet • No Shoulder • No sidewalks • Rolling terrain • Traffic speeding	• Need 4-feet paved shoulder • Need Bike Route signs (MUTCD D11-1) • Need traffic speed monitor	Currently unsafe due to excessive speed of traffic, but has potential with small improvements
UMSTEAD RD From Cole Mill Rd To Guess Rd (#29)	• 45 mph posted speed • 2-ln cross-section with turn lanes at residential developments • Low density upscale residential uses on both sides	• Lane width less 12 feet • No Shoulder • No sidewalks • Rolling terrain • Traffic speeding	• Need 4-feet paved shoulder • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need traffic speed monitor • Need innovative bicycle design signal treatment at the Umstead Rd/Guess Rd intersection	Currently unsafe due to excessive speed of traffic, but has potential with small improvements

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
GUESS RD From Umstead Rd To Rose of Sharon Rd (#30)	• 45 mph posted speed • 5-ln cross-section with raised landscaped median • Residential uses on both sides, mixed with neighborhood commercial near intersections • Sidewalks on both sides • Low traffic volume	• No signs for motorist alert	• Has wide outside lane • Need edge of pavement marking • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design and signal treatments at the Umstead Rd/Guess Rd intersection	Environment is conducive to bicycle travel; Potential with small improvements
GUESS RD From Rose of Sharon Rd To Carver St (#31)	• 35 mph posted speed • 5-ln cross-section with two-way center turn lane • Residential uses on both sides, mixed with commercial strips near intersections • Sidewalks on both sides • Fairly busy traffic volume	• No signs for motorist alert	• Has wide outside lane • Need edge of pavement marking • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design and signal treatments at the intersections with Horton Rd and Carver St	Environment is conducive to bicycle travel; Potential with small improvements
GUESS RD From Carver St To Broad St (#32)	• 35 mph posted speed • 5-ln cross-section transitions to 4-ln south of Albany St • Strip commercial uses on both sides, mixed with some residential uses • I-85 interchange at Guess Rd is under construction • Fairly busy traffic volume	• Many driveways • Discontinuous sidewalks • No signs for motorist alert • Lanes narrower south of the I-85 interchange • Existing Right-of-Way appears to be inadequate south of the I-85 interchange	• Has wide outside lane north of the I-85 interchange • Need edge of pavement marking • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design and signal treatments through the I-85 interchange underpass including striped bike lane	Environment is not conducive to bicycle travel due to current construction, but has potential with future interchange- and bicycle-related improvements

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
BROAD ST From Guess Rd To W. Main St (#33)	• 35 mph posted speed • 4-ln cross-section transitions to 3-ln near Duke University East Campus • NC School of Science & Math and Duke University East Campus buildings on both sides, mixed with some office and residential uses • Leafy trees and on-street parking on both sides	• Discontinuous sidewalks • No signs for motorist alert	• Connects with university and school campuses • Need edge of pavement marking • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design and signal treatments through the I-85 interchange underpass including striped bike lane	Environment is conducive to bicycle; has potential with small improvements
SWIFT AVE From W. Main St To Duke University Rd (#34)	• 35 mph posted speed, drops to 15 mph near the Duke University campus • 3-ln cross-section • Duke campus uses on both sides • On-street parking on both sides	• Turning movement conflicts with Highway 147 ramp traffic at the overpass	• Connects with university and school campuses • Need edge of pavement marking • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design and signal treatments including striped bike lane	Environment is conducive to bicycle travel; has potential with small improvements
PETTIGREW ST From Swift Ave To Roxboro St (#35)	• 25 mph posted speed • 3-ln cross-section • Commercial & industrial uses • On-street parking	• Many driveways	• Connects with Downtown Durham • Need edge of pavement marking • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design and signal treatments including striped bike lane	Environment is conducive to bicycle travel; has potential with small improvements

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
ROXBORO ST From Pettigrew St To Geer St (#36)	• 35 mph posted speed • 3-ln cross-section • Commercial & office uses • On-street parking on the east side • One-way street (northbound)		• Connects with Downtown Durham • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design and signal treatments including striped bike lane	Environment is conducive to bicycle travel; has potential with small improvements
ROXBORO ST From Geer St To I-85 interchange (#37)	• 35 mph posted speed • 3-ln cross-section transitions into 2-lane • Commercial, office and residential uses • On-street parking on the east side • One-way street (northbound) • S. Mangum St serves as the one-way couplet for southbound traffic	• Turning movement conflicts with I-85 ramp traffic at the underpass	• Has wide outside lane • Connects with Downtown Durham • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need innovative design and signal treatments including striped bike lane for the one-way couplet	Environment is currently suitable for bicycle travel; could be further improved with small improvements
ROXBORO ST From I-85 interchange To Old Oxford Rd (#38)	• 45 mph posted speed • 5-ln cross-section transitions into 4 lane • Commercial uses	• Built-out environment • Outside lane is not wide • Heavy traffic volume	• Connects with Downtown Durham • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1)	Environment is currently unsuitable and unsafe for bicycle travel; Duke Street might be a better north-south route; Guess Road is even a better choice
ROXBORO ST From Old Oxford Rd To Infinity Rd (#39)	• 45 mph posted speed • 5-ln cross-section (4 lane between Denfield St and Duke St) • Medical office, big box retail and institutional uses	• Outside lane is not wide consistently • Heavy traffic volume • Traffic speeding • No signs for motorists alert	• Connects with Durham Regional hospital • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need outside lane widening at some locations	Environment is currently unsuitable and unsafe for bicycle travel; Duke Street might be a better north-south route; Guess Road is even a better choice

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
ROXBORO ST From Infinity Rd To Snowhill Rd (#40)	• 45 mph posted speed • 5-ln cross-section with two-way center turn lane • Roadway turns into a divided highway with 55 mph north of Snowhill Rd • Institutional and residential uses	• Outside lane is not wide • High-speed traffic volume • No signs for motorists alert • No sidewalks	• Connects with Northern High, Carrington Middle and Eno Valley Elementary schools • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need outside lane widening	Environment is currently unsuitable and unsafe for bicycle travel; Milton Road might be a better back route
SNOWHILL RD From Roxboro St To Old Oxford Rd (#41)	• 45 mph posted speed • 2-ln cross-section, with turn lanes near Snowhill Preserve and Treyburn subdivisions • Low traffic volume • Rural and suburban residential uses	• Sparse rural land use • High-speed traffic volume • No signs for motorists alert • No sidewalks and paved shoulder	• Connects with Durham Technical Community College and Little River Elementary School • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need 4-feet wide shoulder	Environment is currently unsuitable and unsafe for bicycle travel; Could serve recreational bicycle travel in the long-term future
OLD OXFORD RD From Snowhill Rd To Roxboro St (#42)	• 45 mph posted speed • 2-ln cross-section • Low traffic volume • Traffic lights at Hebron Rd, Hamlin Rd, Dearborn Dr and Meriwether Dr • Rural residential uses mixed with industrial land and warehouses	• Sparse rural land use • High-speed traffic volume • No signs for motorists alert • No sidewalks and paved shoulder	• Connects with Treyburn Corporate Park to the northwest • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need 4-feet wide shoulder	Environment is currently unsuitable and unsafe for bicycle travel; Could serve recreational bicycle travel in the long-term future
HOLLOWAY ST From US 70 Bypass To Junction Rd (#43)	• 35 mph posted speed • 4-ln cross-section undivided	• Outside lane is not wide • High rush hour traffic volume • No signs for motorists alert • No sidewalks • Railroad crossing	• Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need outside lane widening	Environment is currently unsuitable and unsafe for bicycle travel; Could be improved with moderate improvements

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
JUNCTION RD From Holloway St To Cheek Rd (#44)	• 35 mph posted speed • 2-ln cross-section • Very low traffic volume • Sparse residential uses	• Outside lane is not wide • No signs for motorists alert • No sidewalks • Railroad tracks on the west side	• Need Bike Route signs (MUTCD D11-1) • Need 4-feet paved shoulder	Environment is in fair condition for bicycle travel; Could be improved with small improvements when needed in the future
CHEEK RD From Junction Rd To Carpenter Rd (#45)	• 45 mph posted speed • 2-ln cross-section • Very low traffic volume • Sparse residential uses	• Outside lane is not wide • Unmarked street • No sidewalks or shoulders	• Need Bike Route signs (MUTCD D11-1) • Need 4-feet paved shoulder • Need pavement markings	Environment is in fair condition for bicycle travel; Could be improved with small improvements when needed in the future
JUNCTION RD From Cheek Rd To Geer St (#46)	• 45 mph posted speed • 2-ln cross-section • Very low traffic volume • Sparse residential uses	• Outside lane is not wide • No sidewalks or shoulders	• Need Bike Route signs (MUTCD D11-1) • Need 4-feet paved shoulder	Environment is in fair condition for bicycle travel; Could be improved with small improvements when needed in the future
GEER ST From Junction Rd To Cheek Rd (#47)	• 45 mph posted speed (reduces to 35 mph closer to Downtown) • 2-ln cross-section, with turn lanes at subdivisions • Designated truck route • Industrial uses west of US 70 Bypass, residential uses to the east	• Outside lane is not wide • No sidewalks or shoulders • Pavement has deteriorated due truck traffic	• Need 4-feet paved shoulder • Need pavement maintenance	Environment is unsuitable and unsafe for bicycle travel
CHEEK RD From Geer St To Junction Rd (#48)	• 35 mph posted speed • 2-ln cross-section, except near the US 70 Bypass interchange where it is 5-ln • Low traffic volume • Residential uses	• Outside lane is not wide except near the US 70 interchange area • No sidewalks or shoulders	• Connects to Southern High and Merrick Moore Elem. schools and Park • Need Bike Route signs (MUTCD D11-1) • Need 4-feet paved shoulder • Need striped bike lane in the interchange area	Environment is in fair condition for bicycle travel; Could be improved with small improvements

Roadway Segment	Notable Features	Constraints for Bicycle Travel	Opportunities for Bicycle Accommodation	Summary Assessment
GEER ST From Cheek Rd To Mangum St (#49)	• 35 mph posted speed • 2-ln cross-section, except between Miami Blvd and Alston Ave where it is 4-ln • Designated truck route • Sidewalks on the south side	• Outside lane is not wide • No shoulder • Several intersection pose sight distance issues • Pavement has deteriorated due truck traffic	• Need wide outside lane • Need pavement resurfacing	Environment is unsuitable and unsafe for bicycle travel
HOLLOWAY ST From Roxboro St To US 70 Bypass (#50)	• 35 mph posted speed • 3-ln cross-section with curb & gutter (2 inbound and 1 outbound lanes); transitions to 4-ln east of Miami Blvd • Sidewalks on both sides • On-street parking for residences fronting the street	• Lane is narrow under the US 70 bridge • Interchange area is unsafe for bicycle travel	• Connects to the Village shopping area near Miami Blvd • Need Share the Road and Bike Route signs (MUTCD W11-1 and D11-1) • Need lane widening for the inbound outside lane	Environment is in fair condition for bicycle travel; Could be improved with moderate improvements

2.6 Inventory of Existing Bicycle Facilities

Durham currently has a limited number of on road bicycle facilities and greenways. Presently these facilities do not constitute a bicycle network, but merely offer isolated bicycle facilities in two distinct regions of Durham. Striped bicycle lanes currently serve roads surrounding and contained within Duke University and southeastern Durham. While these facilities are limited they provide safe and well used options for cyclists in Durham. The existing bicycle facilities in Durham serve as a foundation to build a complete and safe network for cyclists of all abilities.

Currently, striped bicycle lanes exist on the following roads in Durham, totalling approximately 14 miles:

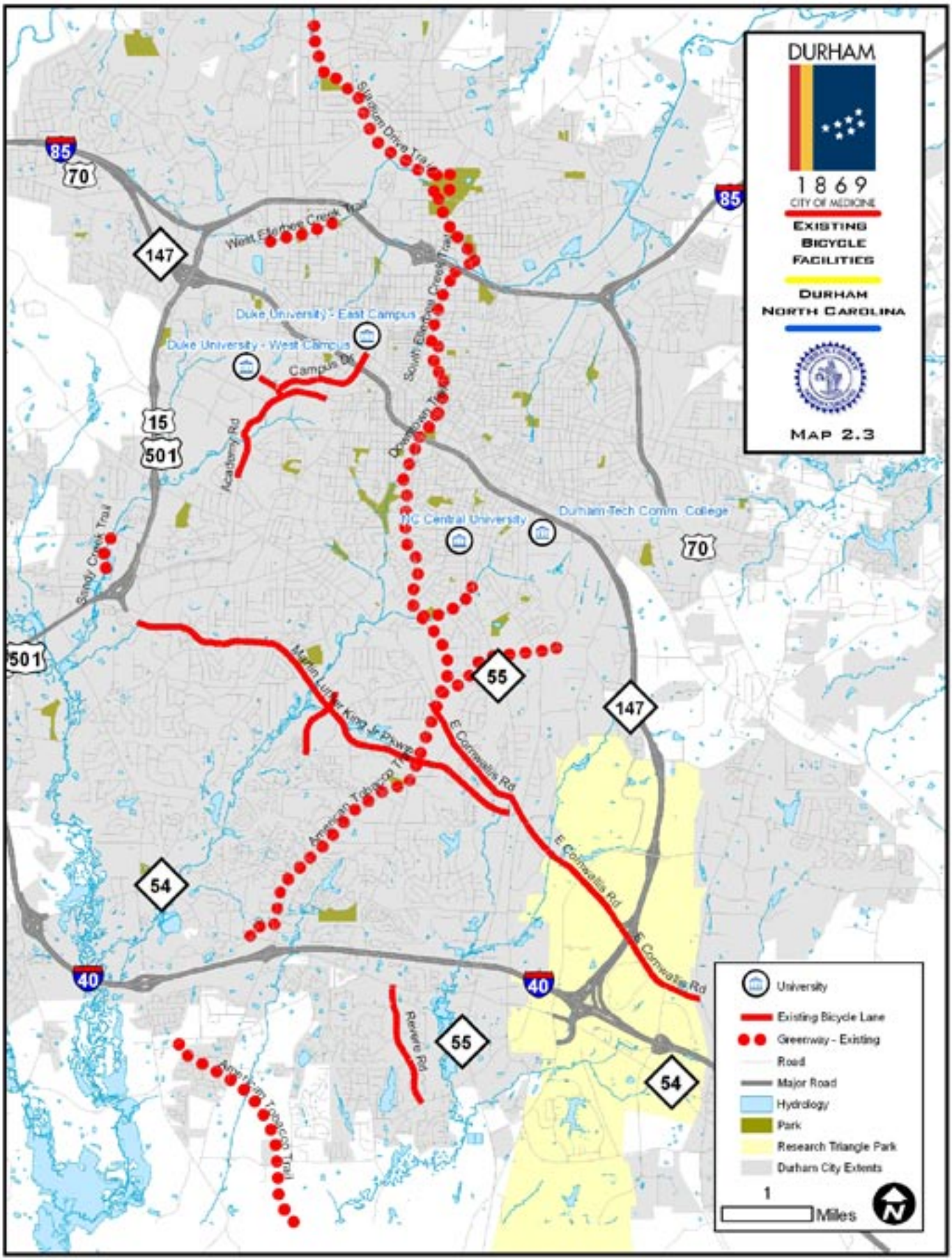
- Cornwallis Rd. from Miami Blvd. to Fayetteville Rd. (4.5 miles)
- Martin Luther King Jr. Blvd. from NC 55 to Hope Valley Rd. (4.0 miles)
- S. Roxboro from Martin Luther King Jr. Blvd. to Juliette Dr. (0.8 miles)
- Revere Rd. From Sedwick Rd. to NC 54 (1.4 miles)
- Duke University Rd. From Swift Ave. to Academy Rd. (1.1 miles)
- Academy Rd. from Pinecrest Rd. to Duke University Rd. (0.5 miles)
- Campus Dr. from Duke East Campus to Duke University Rd. (1.5 miles)

It should be noted that roads on Duke University property are private roads and many of the existing bicycle facilities on these roads, such as Campus Drive, do not meet NCDOT, AASHTO or any recognized bicycle facility standard.

The following multi-use greenway trail are currently suitable for bicycle travel in Durham, totaling approximately 18 miles:

- American Tobacco Trail from Morehead to NC54 (6.8 miles, paved)
- Downtown Trail (1.4 miles, paved)
- Stadium Drive Trail (2.5 miles, paved)
- Sandy Creek Trail (0.5 miles, paved)
- Ellerbee Creek Trail (0.3 miles, paved)
- South Ellerbee Creek Trail (0.9 miles, paved)
- West Ellerbee Creek Trail (0.8 miles, paved)
- Riddle Road American Tobacco Trail Spur (1.5 miles, paved)
- Rocky Creek Trail (0.7 miles, paved)
- American Tobacco Trail from Massey Chapel Rd., south to Chatham County (2.5 miles, unpaved)

Map 2.3, on the following page, features the striped bicycle lanes and trail listed above that make up Durham's existing network of bicycle facilities. The fragmented nature of this existing 'network' leaves gaps in the system where users have no choice but to ride on unsuitable, and often unsafe roadways.


DURHAM
1869
CITY OF MEDICINE
EXISTING BICYCLE FACILITIES
DURHAM NORTH CAROLINA
MAP 2.3
Duke University - East Campus
Duke University - West Campus
NC Central University
Durham Tech Comm. College
Campus Dr
Academy Rd
Sandy Creek Trail
Martin Luther King Jr Pkwy
E Cornwallis Rd
Revere Rd
American Tobacco Trail
University
Existing Bicycle Lane
Greenway - Existing
Road
Major Road
Hydrology
Park
Research Triangle Park
Durham City Extents
1
Miles