APPENDIX A CONTENTS:

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Appendix A: Davidson Rapid HIA

Overview

This appendix presents the findings of the Rapid Health Impact Assessment (HIA) completed as part of the planning process for the Davidson Walks & Rolls: Active Transportation Plan. The Rapid HIA includes a report on the current and potential benefits of biking and walking in Davidson, as well as a Social and Health Equity Analysis that identifies High Priority Areas for future pedestrian and bicycle improvements.

The following are the main findings of the Rapid HIA:

- Current levels of active transportation in Davidson are roughly twice the national average with approximately 600,000 miles that could be made by car each year being made through walking or bicycling trips. This generates over $700,000 in environmental, social, and health savings annually.
- Davidson residents currently get over 200,000 hours of moderate intensity physical activity annually from bicycling or walking to places or making utilitarian trips (this excludes recreational bicycling or walking for exercise). By connecting popular destination with pedestrian and bicycling facilities such as sidewalks and bike paths, working physical activity into a person's daily routine will be easier.
- If Davidson were to increase bicycling rates to 4% of trips being made by bicycle (similar to Carrboro, NC) annual benefits from bicycling alone could equal over $700,000. If walking trips were to increase by 50% another $300,000 worth of benefits could be enjoyed by the Town totaling over $1 million in benefits just by encouraging walking and biking.
- Sixty percent of Davidson residents who participated in a survey conducted as part of the planning process indicated that bicycle and pedestrian facilities should be constructed for "Interested but Concerned" users which typically include women, children, and older adults.
- Youth, older adults, people with disabilities and low-income populations may also be more dependent on a transportation network that incorporates walking and rolling and does not require automobile operation to get around. Forty-four percent of Davidson's population is either under 18 or over 65 years of age. One out of five people will be born with or develop a disability during their lifetime and 13% of adults in Mecklenburg have a disability.

- The social and health equity analysis which mapped the location of high risk areas based on socioeconomic and health indicators, identified that 29% of Davidson's population is located in a high risk area and that the neighborhoods surrounding Beaty Street and between Griffith Street, Jetton Street, Potts Street, and Sloan Street are areas of high priority.
- Although the majority of high risk areas are located within the pedestrian or bicycle service area of multiple destinations (based on a half mile or one mile corridor from the destination) high traffic speeds, breaks in pedestrian or bicyclist facilities, and high traffic volumes may deter active transportation trips.

The following are the main recommendations from the Rapid HIA:

- Support the adoption and implementation of the Active Transportation Plan including additional infrastructure projects and programs to increase physical activity, safety, and health equity in Davidson and gain significant social, environmental, and health benefits.
- Consider the location of high risk areas determined by the social and health equity analysis when prioritizing pedestrian and bicycle infrastructure projects.
- Focus on connecting destinations and modes of transportation in order to increase the use of walking and bicycling for utilitarian trips and make it easier for residents to incorporate physical activity into their daily routines.
- As possible, design individual projects with the "Interested but Concerned" population in mind and involve these groups and at-risk populations within the planning process.
- Follow and improve upon Americans with Disabilities Act requirements, guidelines, and design standards when possible and keep all ages, sizes, and abilities in mind when designing infrastructure improvements or developing programs for walking and wheeling safety.
- Establish a baseline of pedestrian and bicyclist trips (counts and user surveys) and evaluate the Town's progress in increasing means of active transportation, trips, and the resulting health benefits.

The Rapid HIA process and the following report were completed with the assistance of Davidson Design for Life (see call-out box on page A-3).

DAVIDSON DESIGN FOR LIFE (DD4L)

Davidson Design for Life (DD4L) is an initiative of the Town of Davidson, North Carolina to foster healthy community design through the use of health impact assessments (HIA), public participation, and collaborative efforts in Davidson, the Charlotte-Mecklenburg region, and North Carolina. DD4L's mission is "To help Davidson be a community that is healthy today and even healthier tomorrow while serving as a model for other small towns by implementing healthy design."

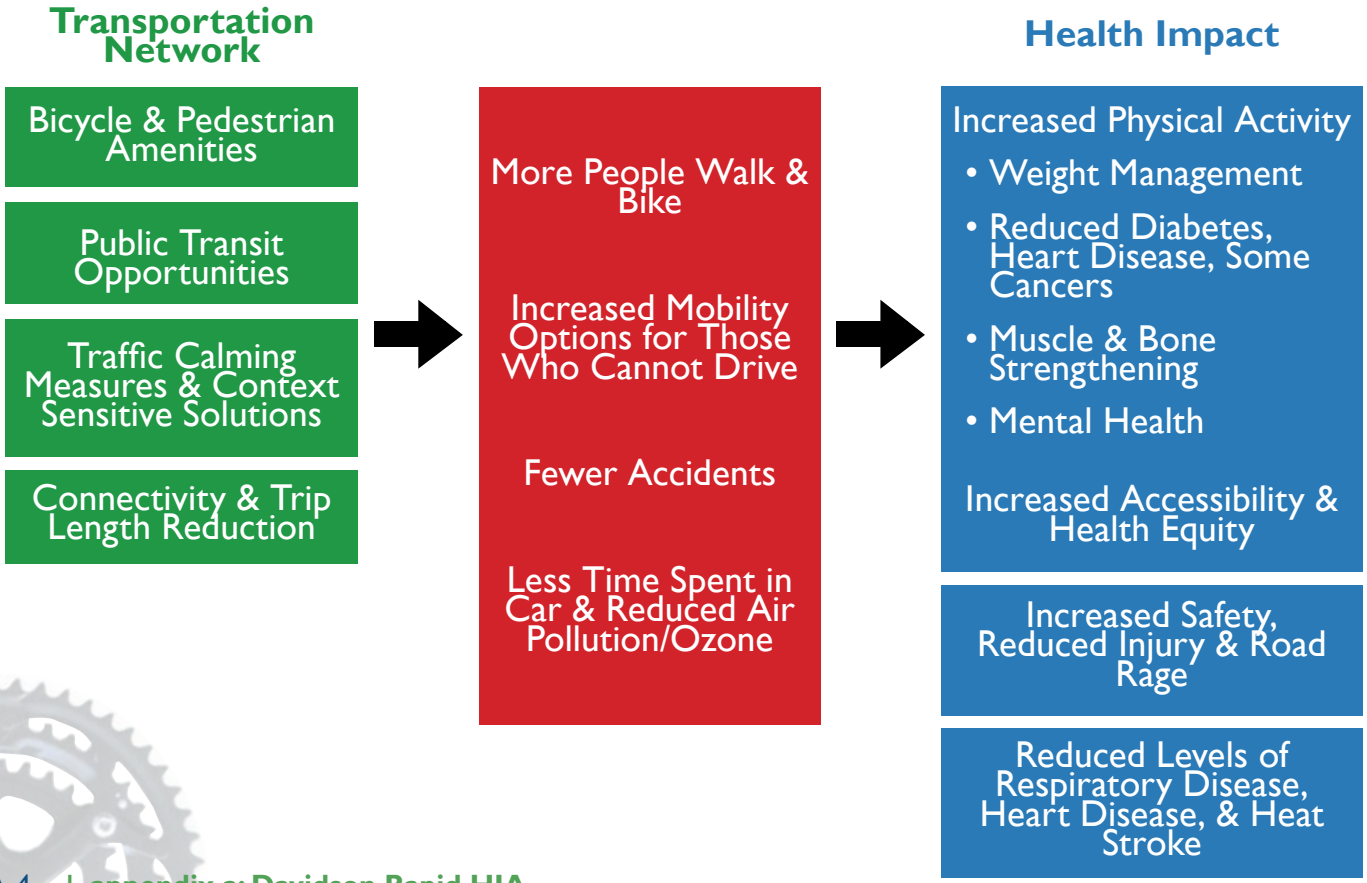
Health Impact Assessment

According to the Centers for Disease Control (CDC), the way we design and build our communities can affect our physical, mental, and social health (see diagram below). Health Impact Assessments (HIAs) can be used to integrate healthy community design and evidence-based health strategies into community planning, transportation and land use decisions. The Town of Davidson has included an HIA as part of the Active Transportation Plan to broaden the health considerations typically considered within pedestrian or bicycle planning (safety, air pollution, and increased physical activity) to include increased accessibility, mental heath, and health equity.

Health Impact Assessment (HIA) is a process used to estimate potential positive and negative health impacts of a proposed policy, plan, program or project on the community. This is accomplished through a combination of quantitative and/or qualitative methods and community engagement. At the conclusion of an HIA, recommendations are made to decision-makers to enhance the positive health implications of a decision and manage any negative health outcomes that may occur.

The Rapid HIA completed as part of this planning effort is an extension of the HIA done in 2012 on Davidson Street Design Standards and incorporated a health equity analysis and a quantitative estimate of the benefits of increasing active transportation opportunities. The findings of the HIA were used to inform the identification and prioritization of infrastructure projects in Davidson to increase the connectivity of the active transportation network and promote health equity.

The diagram on page A-5 outlines the 6 key steps to HIA: Screening, Scoping, Assessment, Recommendations, Reporting, and Monitoring and Evaluation.



THE SIX STEPS OF HEALTH IMPACT ASSESSMENT

Economic, Environmental, and Health benefits Analysis

Walking and bicycling are gaining new interest from communities across the United States after decades of neglect. As fuel prices continue to rise, making short trips by bicycling and walking instead of by car makes sense. However, due to low existing levels of use and funding for facilities, walking and bicycling advocates face an uphill battle to prove the utility of walking and bicycling as viable, efficient modes of transportation. Many of the greatest strengths of walking and bicycling – such as creating attractive, livable streetscapes and increasing community health through exercise – are not accounted for when evaluating transportation projects. Similarly, many of the external social costs of driving, such as traffic congestion, crashes, and climate change from greenhouse gas emissions, are not sufficiently weighted. By quantifying these factors, the importance of walking and bicycling transportation can be demonstrated and used by decision-makers to accurately compare the benefits of active transportation with facility and program costs.

The benefits created by walking and bicycling increase with use. For each additional mile traveled by walking or bicycling instead of driving, about one pound of greenhouse gas emissions are prevented, a few less cents are spent on gas, and a person gets a few minutes closer to reaching their recommended healthy levels of physical activity for the week. When walking and bicycling become part of people's daily activities, these benefits add up to create a healthier, more affordable community. To calculate the current benefits of walking and bicycling transportation and to extrapolate potential future benefits to additional bicycling and walking infrastructure in Davidson, the first step is to estimate existing levels of use.

ESTIMATING WALKING AND BICYCLING USE AND DEMAND

User counts and surveys are the two most commonly utilized tools for measuring walking and bicycling activity. The following section describes the strengths and weaknesses of each of these tools, and presents a methodology for estimating activity across an entire community.

USER COUNTS

User counts, typically conducted at selected points across the street network during peak travel hours, capture levels of walking and bicycling activity on street or paths during a short period of time. While user counts can be instructive in comparing relative levels of use between one street and another, they do not fully capture the spectrum of walking and bicycling activity happening across the community over the length of the year. Counts are well suited to studying where people walk and bike, but do not provide answers to other important questions, such as the following:

- What destinations are people walking and bicycling to, and where are they coming from?
- How far are they traveling?

- What is the purpose of their trip?
- How often do they make similar walking or bicycling trips?
- How often do they make other kinds of walking or bicycling trips?
- Do other residents also make similar types of trips by walking and bicycling, or do they typically travel by another mode?

Therefore, while user counts are a good tool for measuring walking and bicycling at a certain location, user surveys are needed to estimate the overall role of bicycling and walking in the transportation patterns of residents across the region.

USER SURVEYS

Transportation user surveys often ask respondents about their perceptions – e.g., their feeling of safety on a street – and about their usual travel behavior. The American Community Survey (ACS), an ongoing survey conducted by the US Census Bureau, collects social, economic and demographic information from respondents, and includes a question on respondents' commute to work. Sampling over 250,000 households per month, the ACS is the largest survey that asks Americans about their transportation habits, and the most widely available source of walking and bicycling data in communities. According to the 2007-2011 ACS, 0.9% of workers in Davidson bicycle to work, while 6.1% walk to work. These percentages are known as commute mode share; the percentage of a community's population making their journey to work by a certain mode of transportation compared to all modes.

Although commute mode share data is able to capture wider information about walking and bicycling than user counts alone, work commutes are just one type of trip. Davidson residents make many other types of trips (to school, college, shopping centers, etc.) by a variety of modes. Detailed household travel surveys can provide more information on travel patterns and help measure the full spectrum of walking and bicycling trips happening in the community.

Household travel surveys are usually conducted by phone and include a travel diary in which respondents are asked to record all their trips during a 24-hour period. Information on the qualities of each trip is collected, including the trip purpose, time of day, duration, length, mode, and more. By collecting this data from a large sample of people across the population, household travel surveys can provide information on where, why, and how far people are walking and bicycling for transportation. Though a local household travel survey is not available, national data from the 2009 National Household Travel Survey (NHTS 2009) can be used to estimate the number of other types of bicycling and walking trips being made in Davidson in addition to work trips.

ESTIMATING OVERALL WALKING AND BICYCLING ACTIVITY

Overall bicycling and walking activity can be estimated by combining available local data such as ACS commute mode share with national trip purpose information from NHTS 2009. On average, 1.6 other utilitarian bicycle trips are made for every bicycle-to-work trip in the United States, and 4.3 utilitarian walk trips are made for every walk-to-work trip (Figure A.1 and Figure A.2). A utilitarian trip is one that serves a purpose, as opposed to trips made solely for recreation or exercise.

Student commute trips to school and college are estimated independently of ACS data, because the populations making those trips are substantially different from the employed workforce surveyed by ACS. National data on walking and bicycling college trip mode share was used to represent trips to local schools like Davidson College. National baseline K-8 school trip data from Safe Routes to School (SRTS) was used to estimate mode share for K-12 school trips.

For each type of trip, average trip distance and vehicle trip replacement multipliers are applied to estimate the total distance traveled by walking and bicycling and the resulting reduction vehicle miles traveled (VMT). National average trip distance multipliers are sourced from NHTS and SRTS, ranging from 0.36 miles for the K-12 walk to school to 3.54 miles per adult bike commute trip.

Figure A.1: Ratio of bicycle-to-work trips to utilitarian bicycle trips (Source: NHTS 2009)

Figure A.2: Ratio of walk-to-work trips to utilitarian walk trips (Source: NHTS 2009)

Vehicle trip replacement multipliers assume that for each walking or bicycling trip, the chance of walking or bicycling replacing another mode for that trip is equal to the mode share of that other mode. In a simplified example, if a commute mode split were 70% drive alone, 10% carpool, 10% bike, and 10% transit, the vehicle trip replacement multiplier for bicycle trips would be 70% drive alone + 10% carpool our of a possible 90% (bicycling trips are removed from the total). Replaced carpool trips are weighted at 50% of a replaced single-occupancy vehicle trips when estimating VMT reduction, so the combined drive alone-equivalent vehicle trip replacement multiplier for bicycling would be 83.3 percent: 70 percent drive alone plus 10 percent carpool weighted at 50 percent totaling 75 percent drive-alone equivalent mode share out of a universe of 90 percent (75 percent divided by 90 percent equals 83.3 percent).

Figure A.3 provides a visual depiction of the steps used to translate local and national transportation data into an annual estimate of bicycling and walking activity currently happening in Davidson.

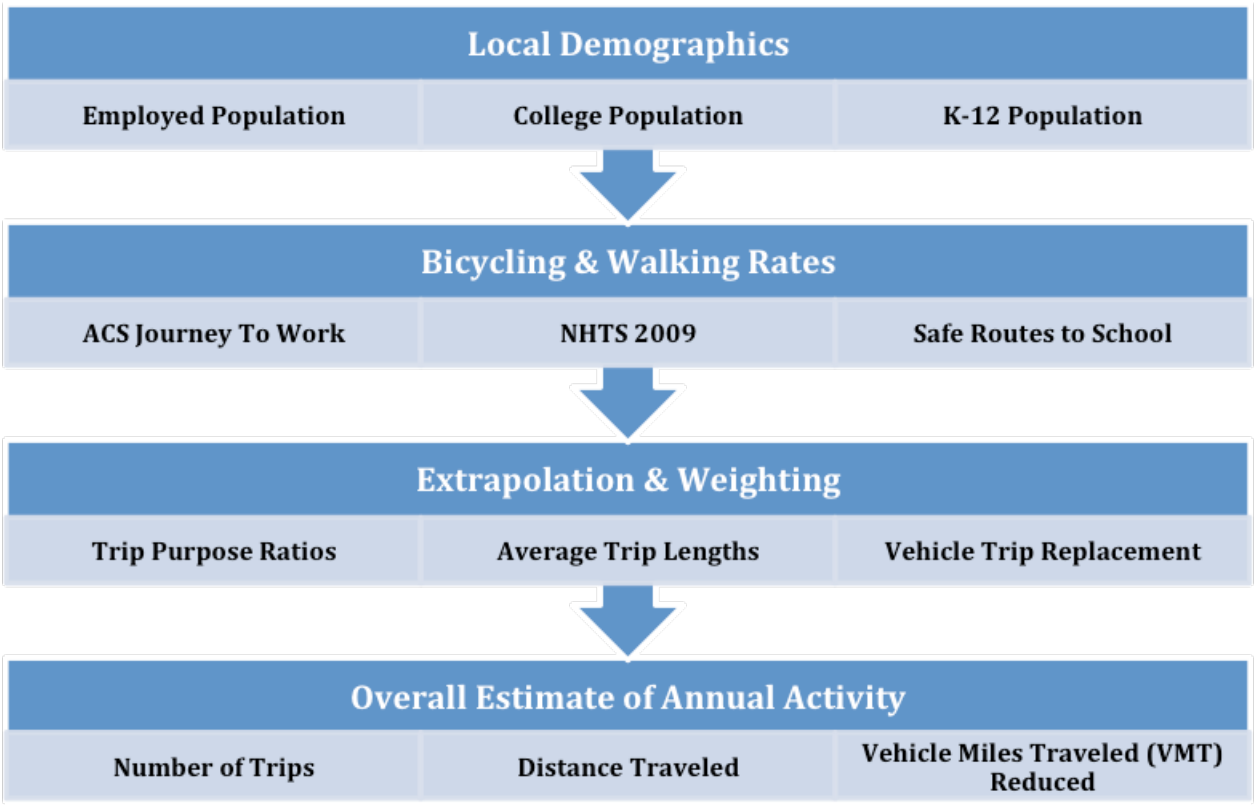


Figure A.3: Davidson existing walking and bicycling overall activity estimate methodology

ESTIMATING BICYCLING AND WALKING BENEFITS

The scale of the economic, environmental and health benefits created by bicycling and walking are based on the number of habitual utilitarian walkers and bicyclists and the distance they typically travel using active transportation. These estimates are developed in the overall demand estimate. Numerous studies have estimated the dollar value of the benefits of bicycling and walking such as reduced pollution from the reduction of vehicle travel, improved health from increased physical activity, and other benefits (see Table A.2). By multiplying quantitative demand estimates with figures from national benefit studies, overall levels of activity benefits can be expressed in terms of their dollar value to individuals and the community at large.

Table A.1: Bicycling and Walking Demand Estimation and VMT References (Demand/Activity Multipliers)

TRIP PURPOSE EXTRAPOLATION

Commute Trip Mode Share				*College Trip Mode Share*				*K-12 Trip Mode Share*			
Bike:	0.9%	Walk:	6.1%	Bike:	1.7%	Walk	6.8%	Bike:	1.0%	Walk:	13.4%
ACS 2007-2011				*NHTS 2009*				*SRTS 2009*			

Utilitarian Trip Multiplier			
Bike:	1.6	Walk:	4.3
NHTS 2009			

ANNUAL TRIP EXTRAPOLATION

Annual Work Days	*Annual College Class Days*	*Annual K-12 School Days*
251	150	180
261 weekdays - 10 Federal holidays	*Assumes three 10-week quarters*	*North Carolina minimum*

ANNUAL VEHICLE TRIPS REPLACED (SOV EQUIVALENT)

Commute Vehicle Trip Replacement				*College Vehicle Trip Replacement*				*K-12 Vehicle Trip Replacement*			
Bike:	88.0%	Walk:	88.6%	Bike:	81.5%	Walk:	86.0%	Bike:	42.6%	Walk:	48.7%
ACS 2007-2011				*NHTS 2009*				*SRTS 2009*			

ANNUAL VEHICLE MILES TRAVELED REDUCED

Commute Trip Distance				*College Trip Distance*				*K-12 Trip Distance*			
Bike:	3.54	Walk:	0.67	Bike:	2.09	Walk:	0.48	Bike:	0.77	Walk:	0.36
NHTS 2009				*NHTS 2009*				*SRTS 2009*			

Utilitarian Trip Distance			
Bike:	1.89	Walk:	0.67
NHTS 2009			

Table A.2: Bicycling and Walking Transportation Benefits References (Benefits Multipliers)

Reduced Emissions	Lb/VMT		Reduced Emissions Costs	$/ton		Reduced Externalities	$/VMT
Hydrocarbons	0.00300		Volatile Organic Compounds	1,700		Traffic Congestion	0.05
Particulate Matter	0.00002		Particulate Matter	168,000		Vehicle Crashes	0.36
Nitrous Oxides	0.00209		Nitrous Oxides	4,000		*AAA 2008*	
Carbon Monoxide	0.02734		Carbon Monoxide	n/a			
Carbon Dioxide	0.81351		Carbon Dioxide	36.03		Road Maintenance Costs	0.15
EPA 2007			*EPA 2007*			*Kitamura, Zhao & Gubby, 1989*	
Physical Inactivity Rate	**%**		**Reduced Healthcare Costs**	**$/year**		**Vehicle Operating Costs**	**$/VMT**
North Carolina	24.5%		Savings/Newly Active Person	$585.97		Operational Standard Mileage Rate	0.57
2010 BRFSS (CDC)			*Wang, McDonald et al, 2012*			*IRS 2013*	

ESTIMATE OF THE ECONOMIC BENEFITS OF ACTIVE TRANSPORTATION

EXISTING ECONOMIC BENEFITS

Current levels of walking and bicycling in Davidson are roughly twice the national average, and return significant benefits to the region and local residents in the form of improved air quality, reduced transportation costs, and improved health. Using ACS, NHTS, and Safe Routes to School data sources, it is estimated that nearly 600,000 miles of trips in Davidson that could be made by car are instead being made by bicycling and walking annually. Using the VMT reduction estimated in the previous section, and the multipliers described in Table A.1 and Table A.2, existing rates of bicycling and walking transportation in Davidson are estimated to generate over $700,000 in annual benefits.

Table A.3: Estimated Annual Benefits of Walking and Bicycling Transportation in Davidson	
Annual VMT Reduced	$90,000
Air Quality	
CO2 Emissions Reduced (pounds)	480,000
Other Vehicle Emissions Reduced (pounds)	19,000
Total Vehicle Emissions Costs Reduced	$14,000
Social Benefits	
Reduced Traffic Congestion Costs	$29,000
Reduced Vehicle Crash Costs	$213,000
Reduced Road Maintenance Costs	$89,000
Individual Benefits	
Household Vehicle Operation Cost Savings	$334,000
Healthcare Cost Savings from Physical Activity	$58,000
Total Monetized Benefits	***$736,000***

POTENTIAL ECONOMIC BENEFITS

Davidson is taking steps to improve the accessibility, safety and quality of the walking and bicycling environment, and has already been recognized as a bronze Bicycle Friendly Community (BFC) by the League of American Bicyclists. The implementation of this plan will lay the groundwork for higher levels of active transportation in the future. Analysis of current walking and bicycling benefits show how active transportation is a boon to local health and to the economy. Investing in additional improvements to bicycling and walking transportation networks could increase the use of these networks and return even greater annual benefits.

Other cities awarded Bicycle Friendly Community designation by the by the League of American Bicyclists can provide a valuable reference point for setting goals and creating a vision for what role bicycling could play in local transportation in future. Including Davidson, ten North Carolina cities and towns have been awarded BFC status as of 2013. Many bicycle friendly communities have reputations for their livability and the quality of their walking environment as well, providing strong examples of how to create healthy communities where active transportation is a feasible and convenient option.

Table A.4: North Carolina Bicycling and Walking Rate Comparisons					
Geography	**BFC Level**	**Population**	**Employed Population**	**Bicycle Mode Share**	**Walk Mode Share**
United States	-	306,603,772	139,488,206	0.53%	2.83%
Carrboro	Silver	19,367	11,281	4.00%	3.19%
Asheville	Bronze	82,823	39,600	0.92%	3.33%
Cary	Bronze	131,631	68,463	0.20%	1.37%
Chapel Hill	Bronze	56,289	25,208	2.09%	11.15%
Charlotte	Bronze	722,234	357,349	0.16%	2.03%
Davidson	**Bronze**	**10,544**	**4,813**	**0.87%**	**6.13%**
Durham	Bronze	224,930	109,922	0.68%	2.92%
Greensboro	Bronze	267,095	125,467	0.25%	1.97%
Raleigh	Bronze	395,091	201,928	0.44%	2.33%
Wilmington	Bronze	105,900	49,748	1.27%	2.38%

Table A.4 shows existing walking and bicycling rates in Davidson and other BFC cities in North Carolina alongside national averages.

The League of American Bicyclists reports that BFC-awarded cities have seen 80% growth in bicycling between 2000 and 2011. If Davidson continues to increase bicycling rates, future growth could generate economic, environmental and health benefits greater than the current estimate of $150,000 in annual benefits to the region. **In a scenario where bicycling rates increase to 4%, similar to Carrboro, local benefits from bicycling could reach over $700,000 per year.** Table A.5 provides example monetized annual benefits of bicycling in Davidson at increased rates.

Table A.6 explores the potential annual benefits of increased walking rates in Davidson. Bicycling rates are typically more responsive to changes in transportation infrastructure than walking. While national bicycling rates have trended upward for the last decade – growing nearly 50% over that time –national walking rates are still declining slowly. Because walking rates are more dependent on factors like distance to destinations and land use patterns that can be slow to change, bicycling rates in Davidson are more likely to increase at a faster relative rate. It may be challenging to quickly increase walking rates to the levels shown in Table A.6.

The potential benefits of increased walking and bicycling rates in Davidson make a strong case for increased investment in active transportation infrastructure. For example, **if Davidson were to increase walking trips by 50%, the community could enjoy additional health, environmental and economic benefits valued at approximately $300,000 per year.**

Table A.5: Potential Annual Benefits of Increased Bicycling in Davidson			
	Current	**Increase similar to Chapel Hill levels**	**Increase similar to Carrboro levels**
Bicycle Commute Mode Share	***0.9%***	***2.0%***	***4.0%***
Annual VMT Reduced	127,000	290,000	580,000
Air Quality			
CO2 Emissions Reduced (pounds)	103,000	240,000	470,000
Other Vehicle Emissions Reduced (pounds)	4,000	9,000	18,000
Total Vehicle Emissions Costs Reduced	$3,000	$7,000	$14,000
Social Benefits			
Reduced Traffic Congestion Costs	$6,000	$14,000	$28,000
Reduced Vehicle Crash Costs	$46,000	$110,000	$210,000
Reduced Road Maintenance Costs	$19,000	$40,000	$90,000
Individual Benefits			
Household Vehicle Operation Cost Savings	$72,000	$170,000	$330,000
Healthcare Cost Savings from Physical Activity	$11,000	$25,000	$50,000
Total Monetized Benefits	***$156,000***	***$370,000***	***$720,000***
Note: Estimates reflect conceptual benefits that would be generated at given mode shares as if they existed in Davidson today. Values are rounded for readability. Values are not discounted and do not reflect future demographic growth, cost changes or other multiplier changes.			

Table A.6: Potential Annual Benefits of Increased Walking in Davidson			
	Current	**25% increase from current levels**	**50% increase from current levels**
Walk Commute Mode Share	***6.1%***	***7.7%***	***9.2%***
Annual VMT Reduced	463,000	580,000	690,000
Air Quality			
CO2 Emissions Reduced (pounds)	377,000	470,000	570,000
Other Vehicle Emissions Reduced (pounds)	15,000	20,000	20,000
Total Vehicle Emissions Costs Reduced	$11,000	$10,000	$20,000
Social Benefits			
Reduced Traffic Congestion Costs	$23,000	$29,000	$35,000
Reduced Vehicle Crash Costs	$167,000	$210,000	$250,000
Reduced Road Maintenance Costs	$70,000	$90,000	$110,000
Individual Benefits			
Household Vehicle Operation Cost Savings	$262,000	$330,000	$390,000
Healthcare Cost Savings from Physical Activity	$47,000	$60,000	$70,000
Total Monetized Benefits	***$579,000***	***$730,000***	***$880,000***
Note: Estimates reflect conceptual benefits that would be generated at given mode shares as if they existed in Davidson today. Values are rounded for readability. Values are not discounted and do not reflect future demographic growth, cost changes or other multiplier changes.			

PHYSICAL ACTIVITY BENEFITS OF ACTIVE TRANSPORTATION

The Centers for Disease Control and Prevention (CDC) recognizes bicycling and walking as common activities that people can participate in to be physically active and increase their health. By walking and bicycling for transportation, Davidson residents can incorporate meaningful physical activity into their daily schedule. Exercise from bicycling and walking transportation typically falls under moderate intensity physical activity (see Figure A.4).

For many Davidson residents, meeting the CDC's recommended minimum guideline of 150 minutes of moderate intensity physical activity per week could be as simple as commuting or making daily errands by walking and bicycling. A daily walk commute of three quarters of a mile each way, or a bicycle commute of 2.5 miles each way, is sufficient to meet the CDC's recommended guideline if completed five days per week.

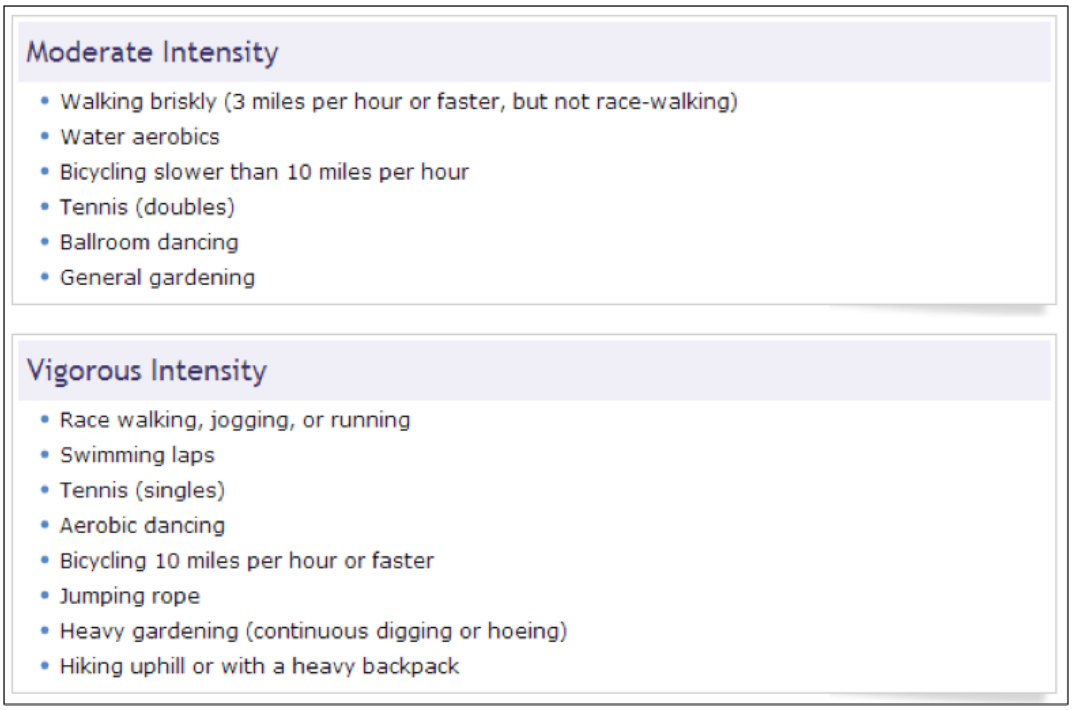


Figure A.4: Examples of moderate and vigorous physical activity.
Source: CDC, Measuing Physical Activity Intensity
(http://www.cdc.gov/physicalactivity/everyone/measuring/).

Table A.7: Example Physical Activity from Active Transportation			
Active transportation mode	***Commute Distance (miles, round trip)***	***Assumed Speed***	***Weekly Minutes of Exercise (assumes 5 day work week)***
Walking	1.5	3 mph	150
Bicycling	5.0	10 mph	150
CDC recommended weekly physical activity (minutes)			***150***

Current levels of bicycling and walking transportation already make a significant contribution to the overall level of physical activity and health of residents in the community. Using the estimates of annual active transportation activity calculated above, Davidson residents get over 200,000 hours of moderate intensity physical activity annually from utilitarian walking and bicycling trips (see Table A.8, Table A.9 and Table A.10). This number does not include additional recreational or exercise trips made by walking and bicycling.

By building safe and convenient facilities for bicycling and walking, Davidson can make it easier for residents to be physically active, improving the health of the entire community.

Table A.8: Davidson Estimated Annual Active Transportation Trips	
Estimated annual walking transportation trips	***914,166***
Commute walking trips	148,090
Utilitarian walking trips	640,260
K-12 school walking trips	85,835
College commute walking trips	39,981
Estimated annual bicycling transportation trips	***71,296***
Commute bicycling trips	21,084
Utilitarian bicycling trips	33,969
K-12 school bicycling trips	6,430
College commute bicycling trips	9,814
Estimated annual active transportation trips	***985,463***

Table A.9: Davidson Estimated Annual Distance Traveled using Active Transportation Modes		
Estimated annual miles walked	***Average Distance (miles)***	***Total Distance Traveled***
Commute walking trips	0.67	99,220
Utilitarian walking trips	0.67	426,842
K-12 school walking trips	0.36	30,482
College commute walking trips	0.48	19,191
Estimated annual miles biked		***71,296***
Commute bicycling trips	3.54	74,637
Utilitarian bicycling trips	1.89	64,314
K-12 school bicycling trips	0.77	4,938
College commute bicycling trips	2.09	20,480
Estimated annual miles traveled using active transportation		***740,104***

Table A.10: Davidson Annual Physical Activity Benefits from Active Transportation			
Active transportation mode	***Distance Traveled (miles)***	***Assumed Speed***	***Total Hours of Exercise***
Walking trips	575,735	3 mph	191,912
Bicycling trips	164,369	10 mph	16,437
Estimated annual physical activity from active transportation			***208,349***

Town of Davidson Social and Health Equity Analysis

According to Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", municipalities should identify and limit, to the greatest extent possible, disproportionately high and adverse human health or environmental effects that their programs, policies, and activities have on "communities of concern" or communities where economic, health and environmental impacts may be higher than the area average. Davidson's vision, core values, planning principles, and board goals align with Executive Order 12898 and exceed regulatory requirements in commitment to enhancing the physical, mental, and emotional wellbeing of Davidson residents, promoting community engagement on important decisions, and preserving racial and socioeconomic diversity within its population. Therefore, both the burdens and benefits of activities in Davidson should be equitably distributed across all populations and geographic areas of the community. Additionally, efforts should be made by the Town of Davidson to engage all members of the community during the master planning process.

As part of the Rapid HIA, a two-part equity analysis was performed. The purpose of the Social and Health Equity Analysis is to add value to the Davidson Active Transportation Master Plan by providing a deeper insight into the nexus of demographics, human and environmental health and accessibility to local amenities.

The consultant team worked with Davidson staff to perform demographics-driven equity analysis to answer the following questions during the planning process.

- What are the sizes of the "high priority areas" in the Town?
- How does the at-risk population compare to the general population of the Town?
- How are these population groups (communities of concern) geographically dispersed throughout the community?
- How do the population groups get to work?
- Where do these groups live relative to transit facilities and pedestrian and bicycle infrastructure?
- What are the benefits and burdens of the recommended project(s)?
- How are the benefits and burdens distributed across population groups?

The assessment includes three main components:

1. Defining High Priority Areas
2. Defining Walk and Bike Service Areas
3. Determining Bicycle and Pedestrian Suitability

The composite Social and Health Equity Model is shown in Figure A.5. This analysis draws on research, data, and/or design guidelines from Mecklenburg County, Portland State University Center for Transportation Studies, the City of London Cycling Design Standards Guidelines and the Mineta Transportation Institute.

DEFINING HIGH PRIORITY AREAS

For the purposes of the Davidson Active Transportation Plan, "high priority" areas are identified as areas where a high percentage of potentially disproportionately at-risk populations for health and environmental impacts are clustered.

High Priority Areas are a composite sketch of two equity models related to socio-economic, health and environmental factors. They are represented as Census blocks and defined using a combination of available Census block-level demographic metrics associated with typically underserved (low-income and populations of color) or particularly at-risk (youth, older adults, and those with disabilities) population groups.

Census blocks were chosen as the geographic measure for this model because their boundaries closely reflect Davidson's street patterns, which often represent neighborhood boundaries. Nuances in demographic patterns become apparent with small geographic boundaries. The features represented in the social and health equity models are listed in Table A.11.

SOCIAL EQUITY MODEL

The purpose of a social equity analysis is to ensure an equitable distribution of alternative transportation options. A successful social equity model will raise awareness about potential inequities in relation to alternative transportation infrastructure such as sidewalks, greenways, transit, and other facilities that enhance the mobility of a town. The features used in this model were collected through the US Census Bureau at the Census block level.

Youth Population (Figure A.5): This population group represents residents under 18 years old. This population group may need help with accessing amenities such as schools, local hangouts, or places of employment because they may not yet be of driving age. Due to their quicker respiratory rate and their shorter stature, youth are also at greater risk for exposure to asthma triggers such as air pollution and serious injury due to vehicular accidents. The youth population accounts for approximately 23% of the Town's total population.

Elderly Population (Figure A.6): This population group represents residents over 65 years of age. Similar to youth population, older adults may need help with accessing basic amenities and may not be able to drive safely anymore due to vision impairment, slower reflexes or cognitive difficulties. Older pedestrians are also at greater risk of death during a vehicular accident due to greater likelihood of existing conditions and slower recovery time. This population group accounts for approximately 21% of the Town's total population.

Non-White Population (Figure A.7): Historically across the nation, people of color have been underserved and have born a higher burden of environmental and health risks. This indicator is used to assess potential disparities in social, health and environmental risks across all races and ethnicities. These population groups account for approximately 12% of the Town's total population.

TABLE A.11 - METRICS DEFINING HIGH PRIORITY AREAS

SOCIAL EQUITY
% of Youth Population
% of Elderly Population
% of Non-White Population
Total Single Parent Households
HEALTH / ENVIRONMENTAL EQUITY
Transit Access
Transit Boardings
Medicaid Population
Subsidized Housing

Single-Parent Families (Figure A.8): This population group represents families of single mothers and fathers. These residents are likely to maintain at least one full time job in addition to raising one or more child. The likelihood of being impoverished is greater in single-parent households, especially those households led by a single-mother. Data on vehicle ownership at this geographic level is not available but it is assumed that, if a car is not owned, mobility is an even greater challenge for these families. This population group accounts for approximately 5% of the Town's total families.

People with Disabilities (spatial data not available): One out of 5 Americans will be born with or develop a disability within their lifetime. Although data on those with disabilities was not available at this geographic level, according to the Behavioral Risk Factor Surveillance System, 13% of adults in Mecklenburg County have a physical or mental disability that limits their daily activities. In terms of bicycle and pedestrian facilities, providing additional time to allow for safe street crossing, having both visual and auditory signaling at crossings, using large print on signs, and meeting other Americans with Disabilities guidelines can make a huge difference in the safe use of these facilities by those with disabilities. As individual projects are designed and programs are developed a variety of users should be kept in mind and involved with the planning process.

The feature's values are classified into four quartiles and scores on a scale of 1 to 4, with a score of 4 representing the highest concentration of each feature. The model's scores are described in Table A.12 and results are shown in Figures A.5 to A.8. The composite social equity model is shown in Figure A.9.

Table A.12: Social Equity Model Metrics

Feature	Determinant	Percent of Total Population	Score
% Youth Population - Population Under 18 Years Old	First Quartile	<17%	1
	Second Quartile	17-26%	2
	Third Quartile	26-38%	3
	Fourth Quartile	>38%	4
% Elderly Population - Population Over 65 Years Old	First Quartile	<12%	1
	Second Quartile	12-20%	2
	Third Quartile	20-34%	3
	Fourth Quartile	>37%	4
% Non-White Population	First Quartile	<4%	1
	Second Quartile	4-9%	2
	Third Quartile	9-20%	3
	Fourth Quartile	>20%	4
Total Single Parent Families	First Quartile	1 family	1
	Second Quartile	2-3 families	2
	Third Quartile	4-7 families	3
	Fourth Quartile	8-14 families	4

Figure A.5

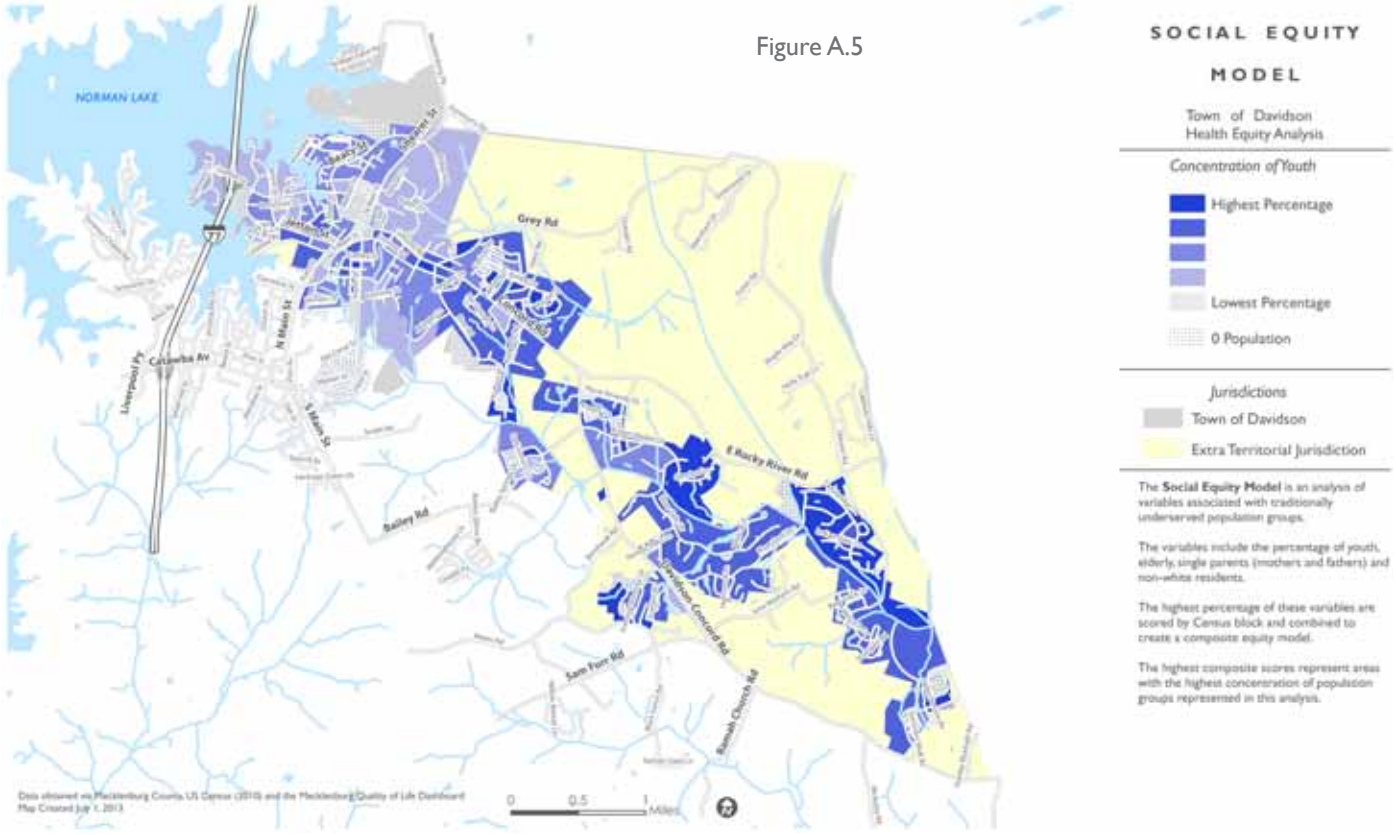


Figure A.6

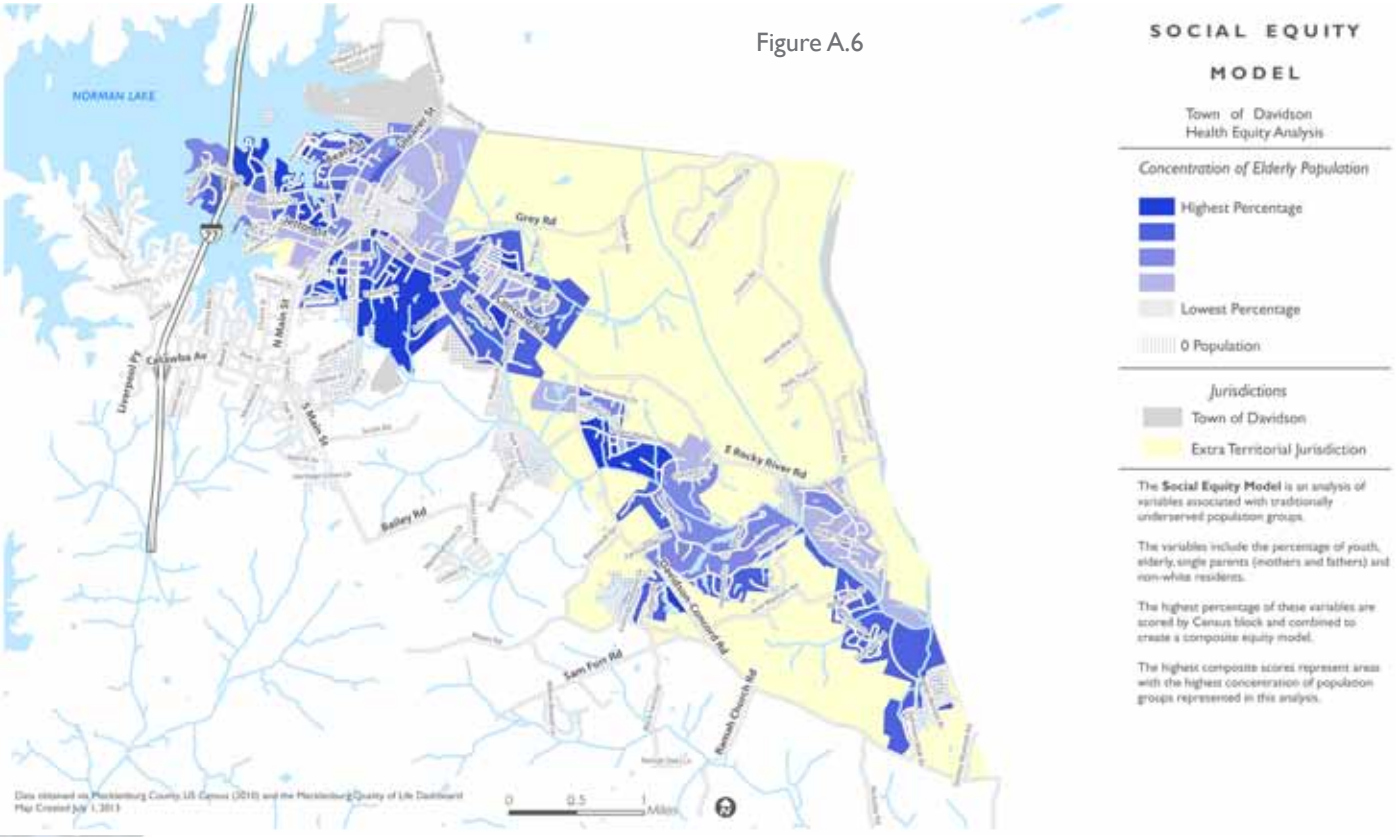
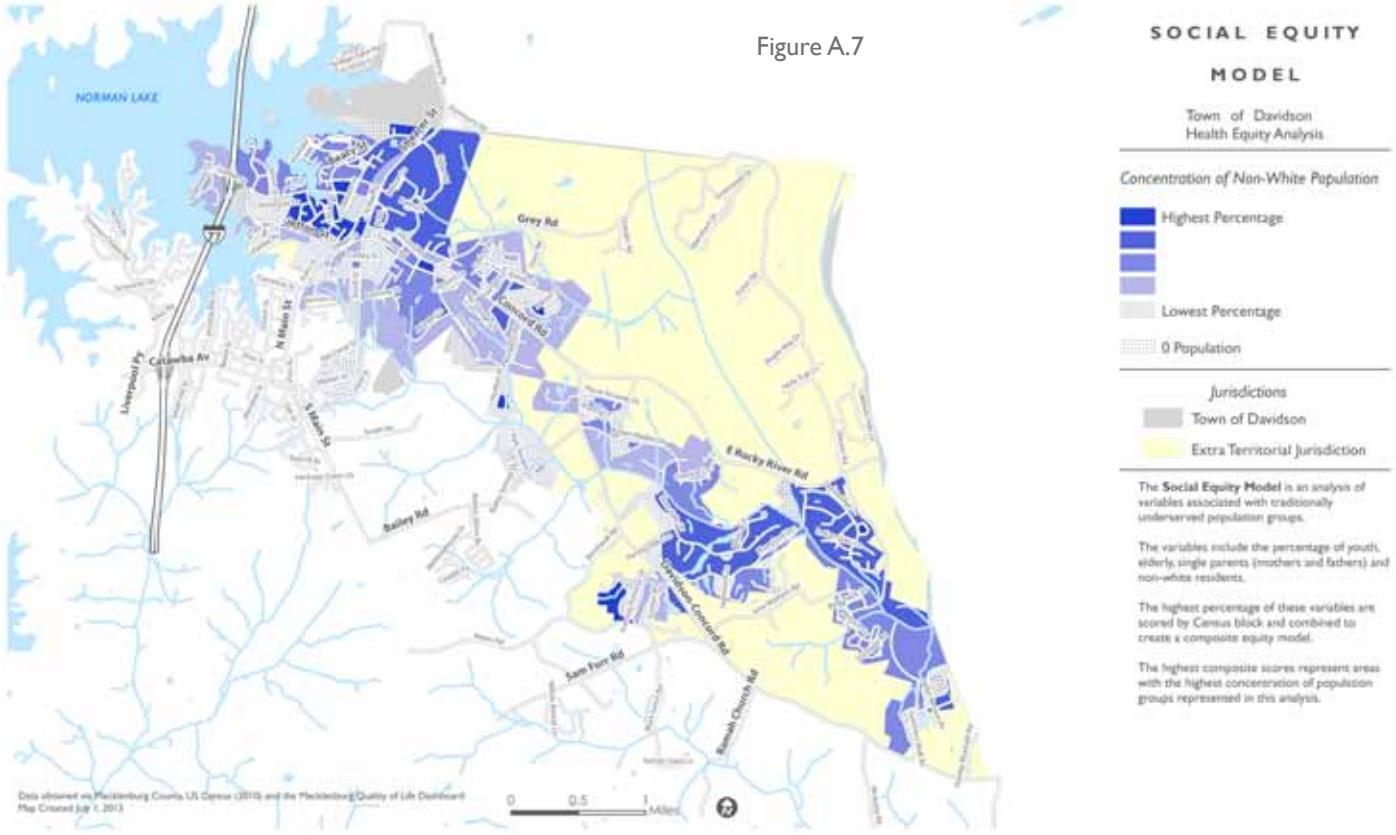


Figure A.7



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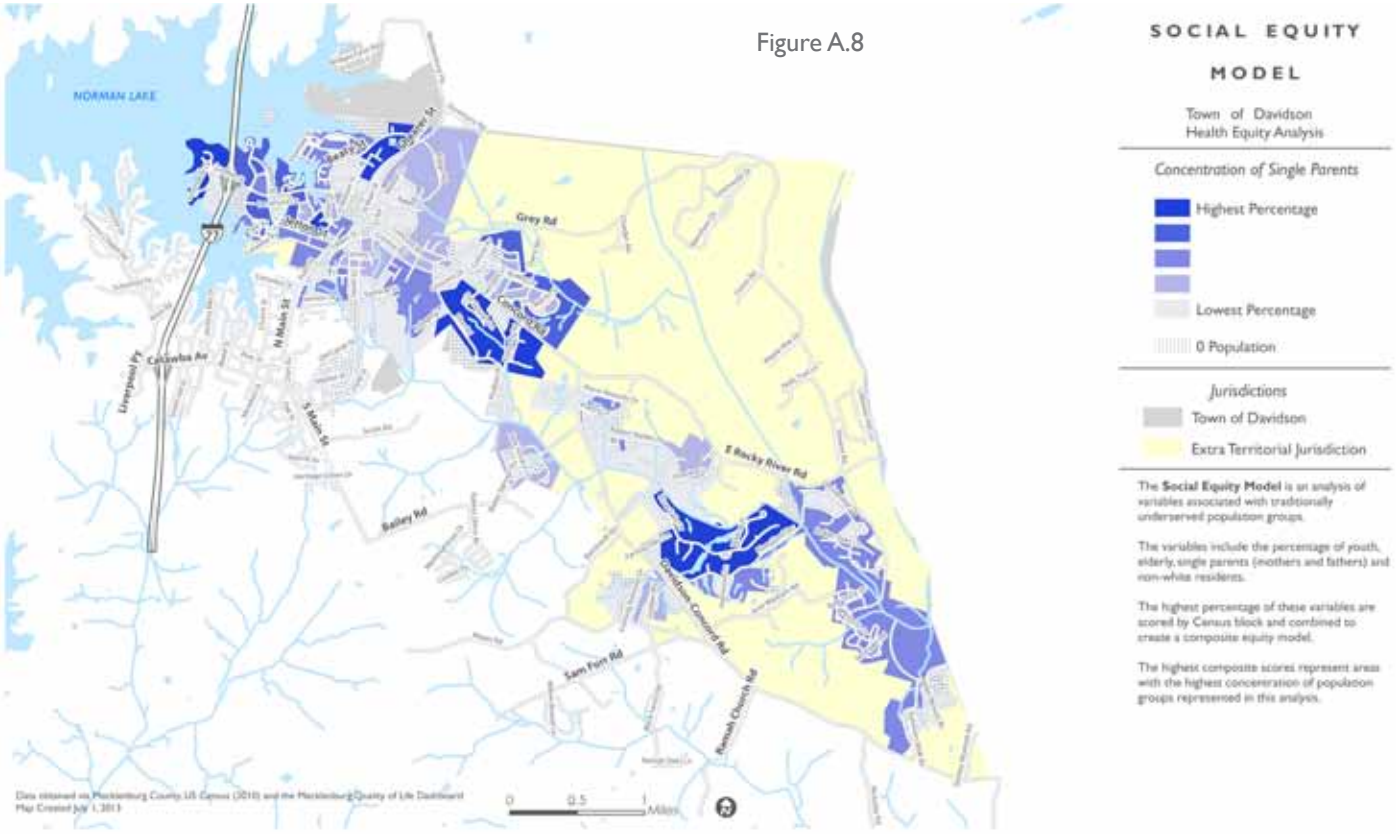

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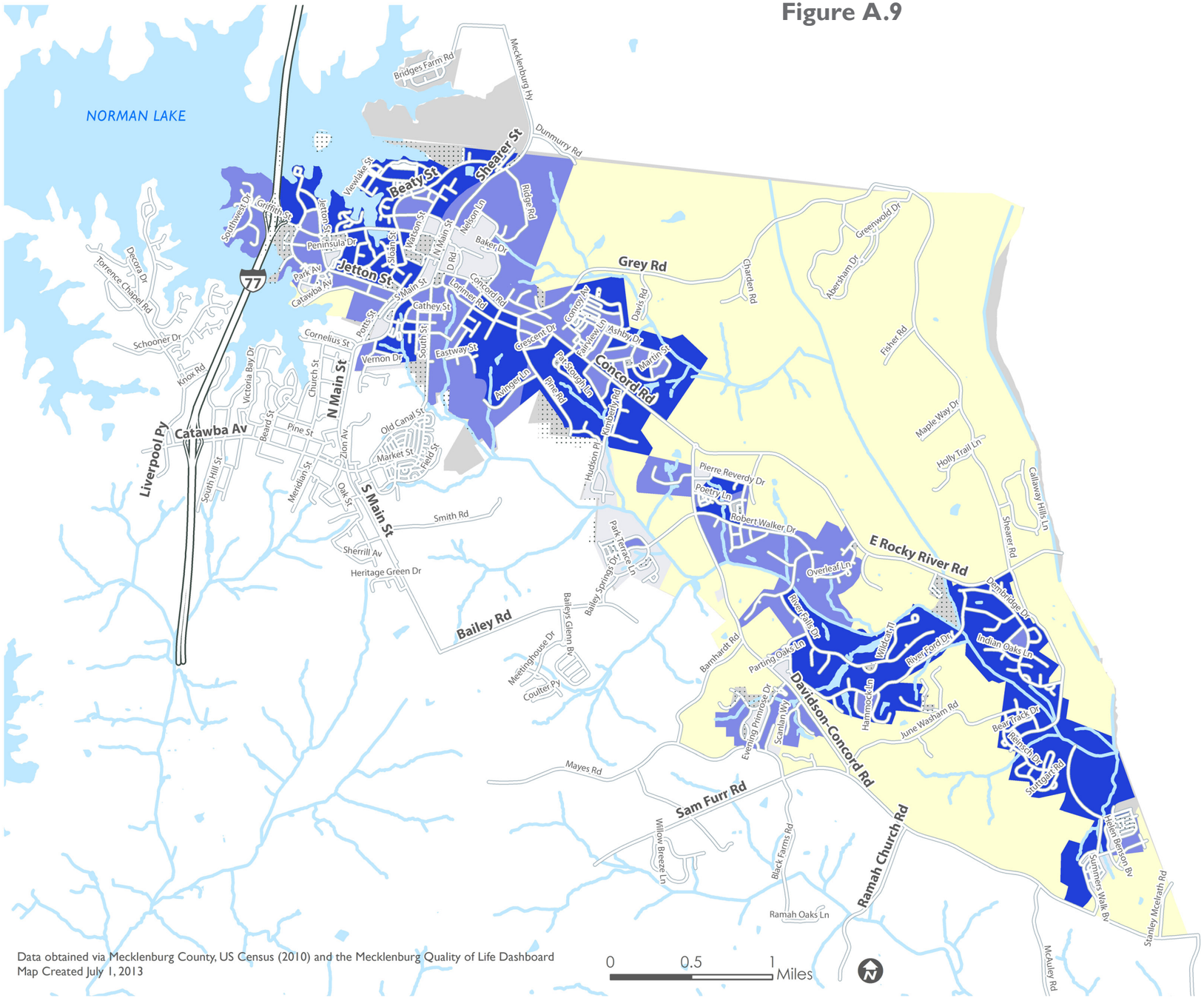
Figure A.9



Data obtained via Mecklenburg County, US Census (2010) and the Mecklenburg Quality of Life Dashboard
Map Created July 1, 2013

SOCIAL EQUITY MODEL

Town of Davidson
Health Equity Analysis

Composite Social Equity Model

- High Social Need
- Moderate Social Need
- Low Social Need
- 0 Population

Jurisdictions

- Town of Davidson
- Extra Territorial Jurisdiction

The **Health Equity Analysis** is an analysis of variables associated with health, housing and the environment.

The highest percentage of population groups associated with the combination of these variables represent the highest health equity need.

Data on transit use, environment and health is not available at the Census block or neighborhood level. Therefore Census blocks were scored if contained by the larger Census block groups with high concentrations of these variables.

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HEALTH AND ENVIRONMENTAL EQUITY MODEL

The purpose of a health and environmental equity analysis is to assess the general quality of life. A successful health and environmental equity model will raise awareness about where portions of the community are lacking in access to basic necessities. The features in this model reflect issues regarding transit, health and housing. These features are only available at the Census block group level which is larger and less granular than the Census blocks used in the Social Equity Model. To account for this data gap, Census blocks are included based on whether they are contained within Census block groups with high concentrations of underserved and at-risk populations. This model incorporates data available on Mecklenburg County's Quality of Life (QOL) Dashboard. The latest version of the QOL Dashboard, a joint effort complete in 2012 by Mecklenburg County and the University of North Carolina – Charlotte, draws from a variety of data sources such as the US Census, American Community Survey, Mecklenburg County Department of Public Health, Mecklenburg County Department of Social Services, Charlotte-Mecklenburg Police Department, Charlotte-Mecklenburg Schools, individual towns, Duke Energy and Piedmont Natural Gas.

Transit Access (Figure A.10)

The QOL uses a half-mile threshold to define access to public transit. Walking to and from a transit stop has been shown to increase levels of daily physical activity and with a nutritious diet can be an effective way to manage weight. Access to public transit is incredibly important for residents who desire to use alternative transportation modes and those who may not own or be able to drive a vehicle. Using the bus also means less traffic congestion, less air pollution and reduces the expenses associated with owning a vehicle. Decreases in these factors lead to improved mental health (less road rage and stress due to reduced congestion), improved physical health (fewer respiratory attacks and heat strokes due to reduced air pollution and ozone) and improved financial conditions for residents (reduced expenditure on vehicle maintenance and ownership that can be reallocated to health promoting items such as healthy food or medical care). The majority of Davidson's households are not within a half-mile of transit as Charlotte Transit System's bus stops are located in the downtown area. While downtown has a robust population, the majority of the residents live to the east of downtown.

Approximately 17% of the Town's residents are located in an area where over half the total housing units are beyond a half mile of public transit.

Transit Boardings (Figure A.11)

This feature is an indication of how many weekday public transportation trips occur annually. High boarding frequencies also indicate what portion of the population is opting to use alternative transportation. Analyzing this data overtime will show a trend in increased or decreased ridership which will help assess the need for future alternative transportation improvements. Davidson had approximately 160 average boardings per day in 2011. This figure is derived by dividing the total number of annual weekday boardings within each Census block group by the number of days in a year. The two Census block group areas with the highest weekday boardings, located in the northwestern sector, account for approximately 94% of the town's annual ridership.

Medicaid Population (Figure A.12)

Medicaid is a vital program for providing health care coverage to low-income households. The QOL indicates a high correlation between increasing numbers of Medicaid recipients and issues like unemployment, lack of health care access or changes in health care policy which could affect a person's eligibility status. Approximately 24% of the Town's residents receive Medicaid.

Subsidized Housing (Figure A.13)

Subsidized housing is highly correlated to low and very low income residents who may also depend on public or other alternative modes of transportation to access basic amenities. While the definition of subsidized housing varies in different municipalities, the development policies in Davidson aim to decentralize poverty and strive to enable residents of diverse backgrounds to enjoy access to basic amenities. Approximately 18% of the Town's residents live in subsidized housing units.

As the features in the Health and Environmental Equity Model were only available for Census block groups, it is difficult to derive a range of values. Therefore the values in this model are used in a binary analysis fashion; meaning the highest concentrations were assigned a 1 and the lower concentrations a 0. However, Medicaid and subsidized housing received a higher weight than the features related to transit. It is assumed that these indicators have a higher correlation to health inequities than proximity to transit. Table A.13 describes the Health and Environmental Equity Model scoring methodology:

Table A.13: Health and Environmental Equity

Feature	Determinant	Percent of Total Population	Score
Transit Access	Highest Concentration of Population Beyond 1/2 Mile of Public Transit	<17%	1
Transit Boardings	Highest Concentration of Daily Transit Boardings	10-225 Total Boardings	1
Medicaid Population	Highest Concentration of Population receiving Medicaid	18%	2
Subsidized Housing	Highest Concentration of Subsidized Housing Units	18%	2

Figure A.10

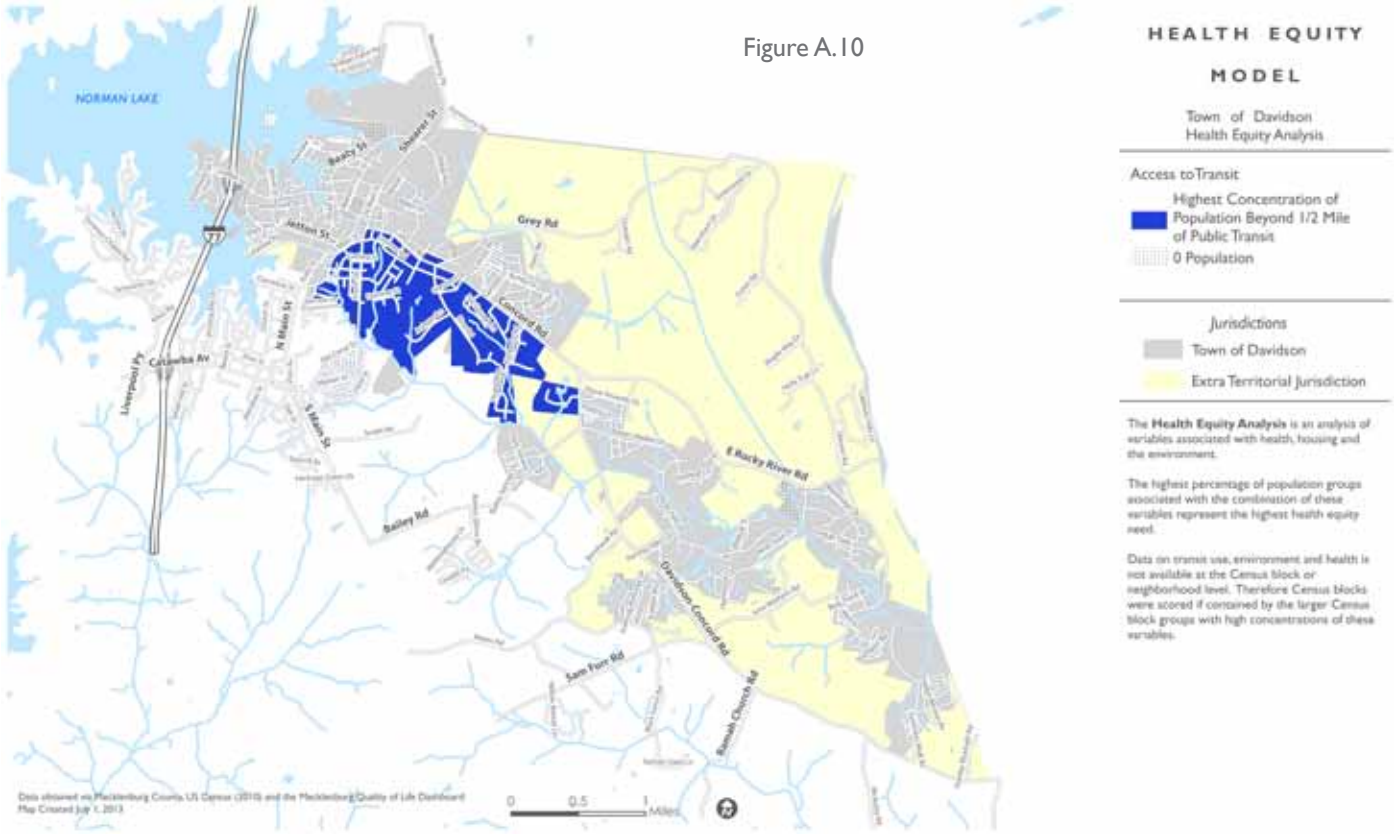


Figure A.11

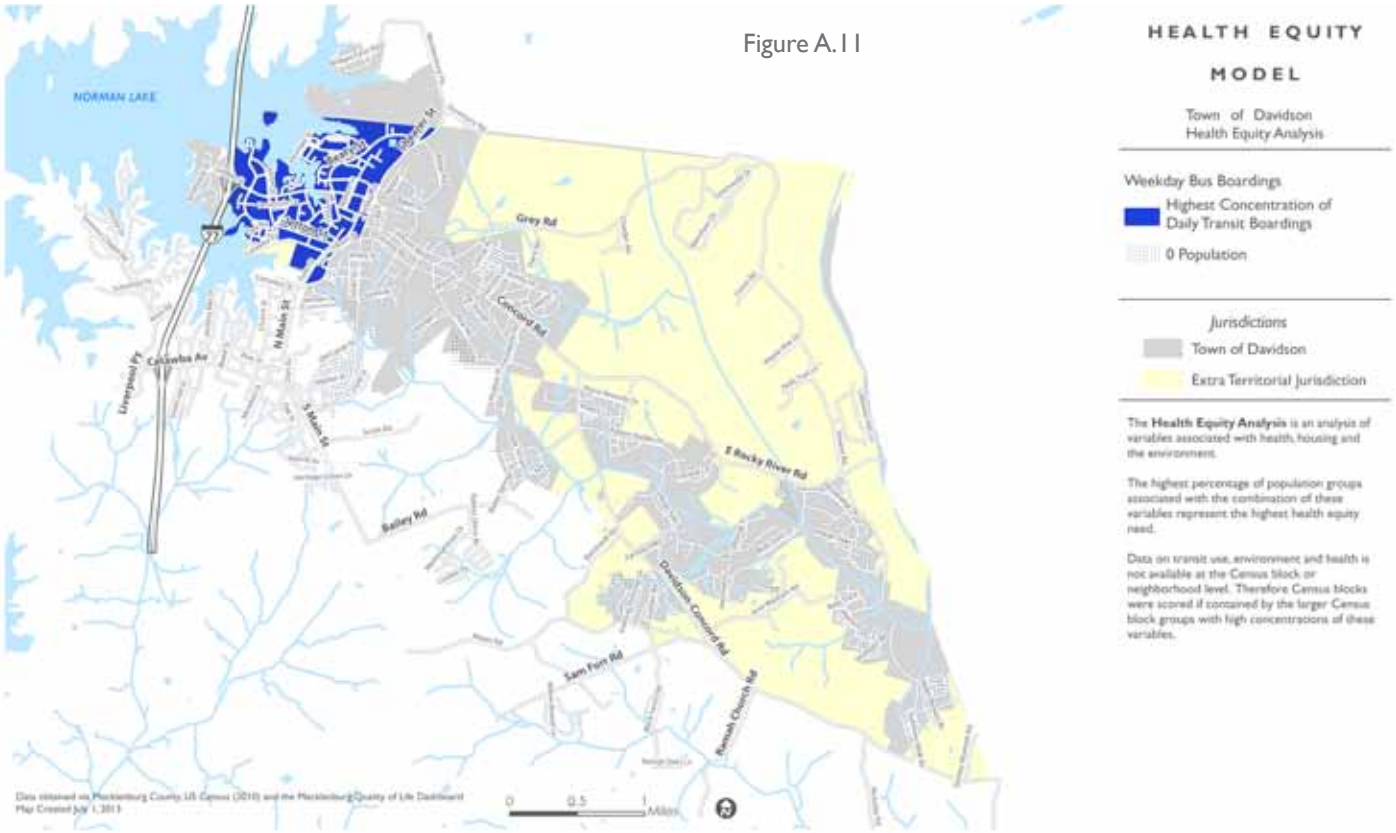


Figure A.12

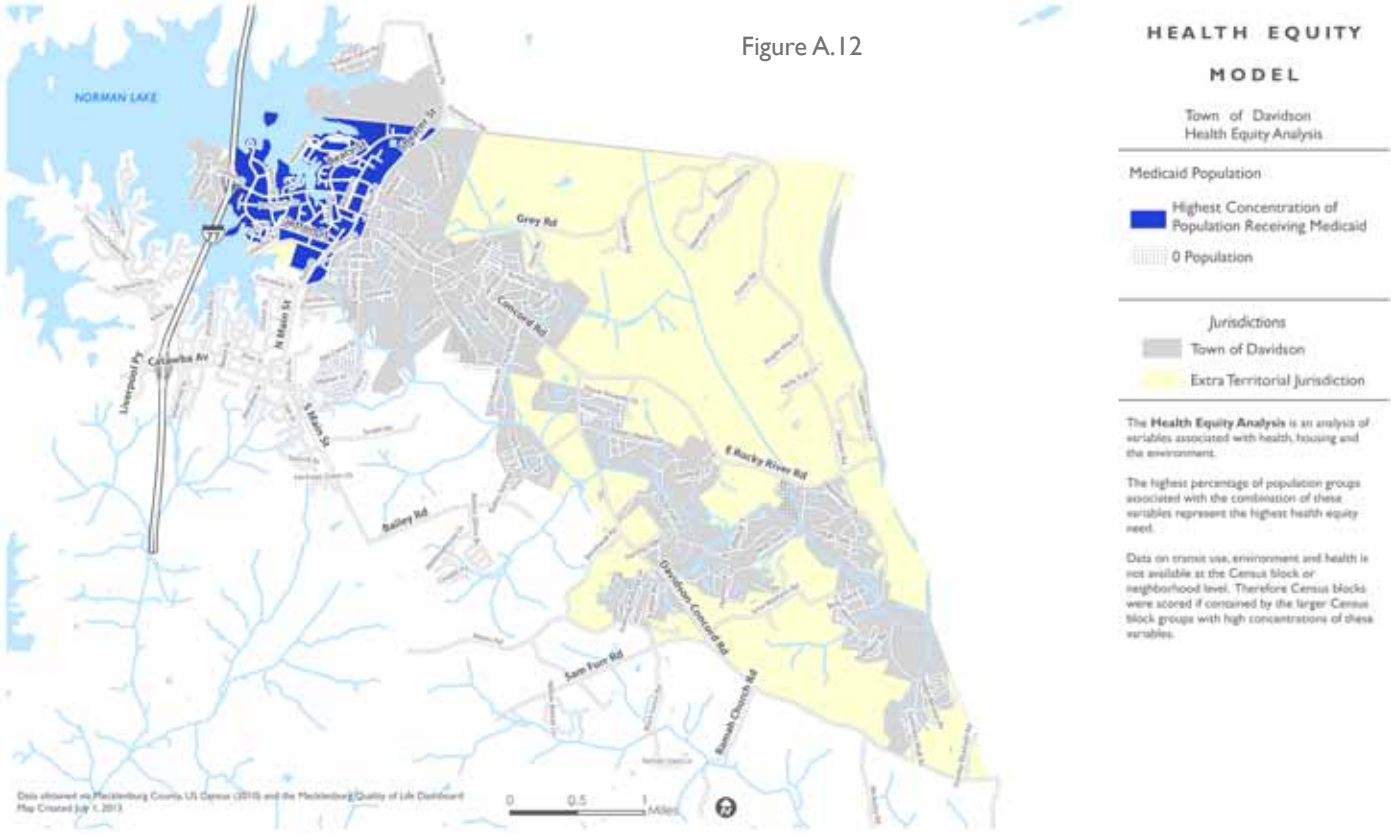


Figure A.13

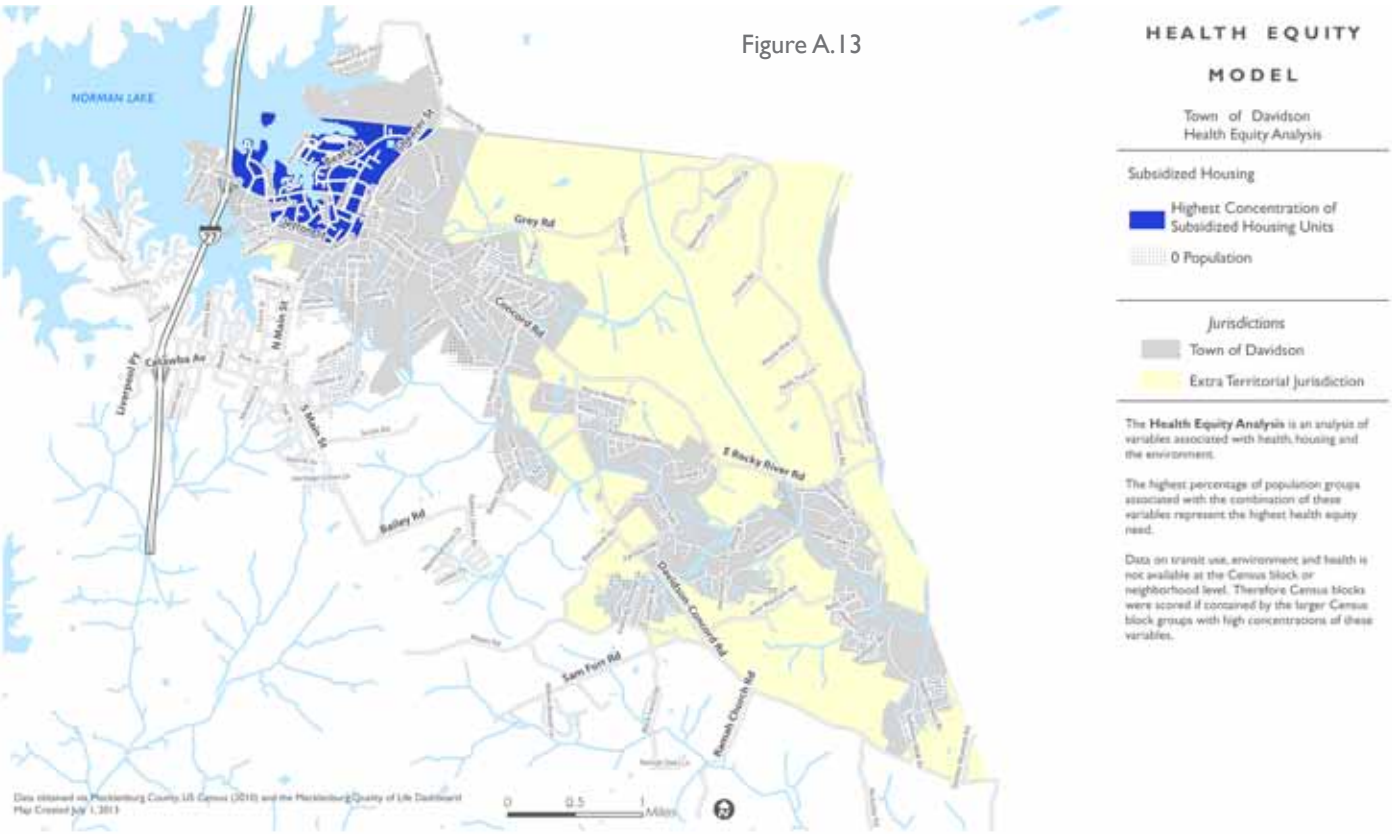
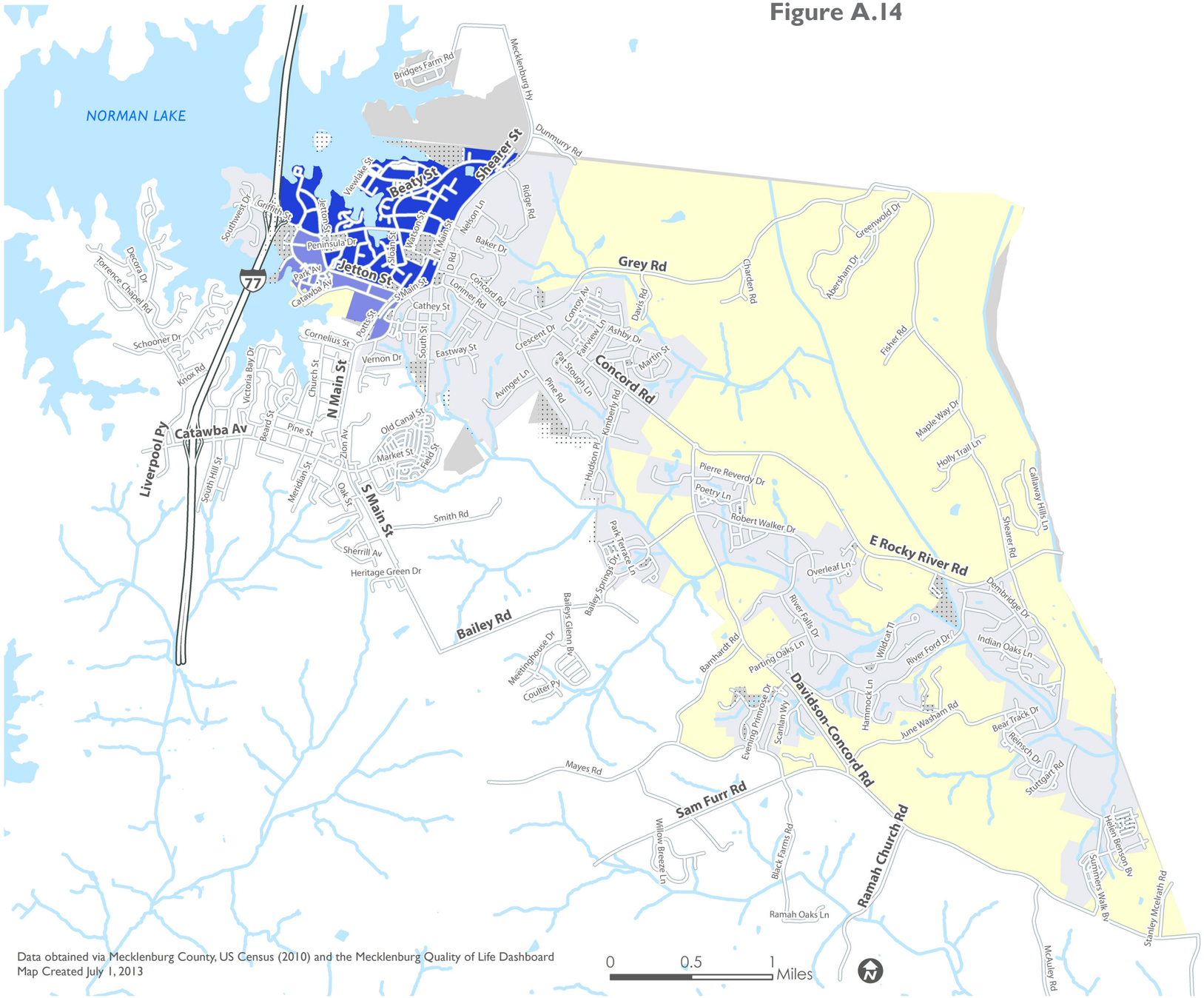


Figure A.14



Data obtained via Mecklenburg County, US Census (2010) and the Mecklenburg Quality of Life Dashboard
Map Created July 1, 2013

HEALTH EQUITY MODEL

Town of Davidson
Health Equity Analysis

Composite Health Equity Model

- Highest Health-Related Need
- Moderate Health-Related Need
- Lowest Health-Related Need
- 0 Population

Jurisdictions

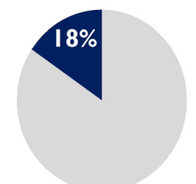
- Town of Davidson
- Extra Territorial Jurisdiction

The **Health Equity Analysis** is an analysis of variables associated with health, housing and the environment.

The highest percentage of population groups associated with the combination of these variables represent the highest health equity need.

Data on transit use, environment and health is not available at the Census block or neighborhood level. Therefore Census blocks were scored if contained by the larger Census block groups with high concentrations of these variables.

Percent of Population in Highest Health Need



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COMPOSITE SOCIAL AND HEALTH MODEL

The combinations of the scores in the two models create a composite model representing the range of overall need. As Davidson is a mix of suburban and rural land uses, there are several Census blocks with zero residents. This phenomenon will skew the composite model so had to be adjusted by normalizing population density on a scale of 0 – 1. Population density is defined as total people per acre using Census blocks. This methodology reduces composite values as population density decreases.

High priority areas are defined as a result of this analysis. The ranges of composite values are classified into three groups to define areas in high, moderate and little/no need.

HIGH PRIORITY AREAS AND WALK/BIKE ACCESS TO DESTINATIONS

As the health and social equity composite model shows in the following figures, access to basic amenities like healthy foods and other services is a challenge for a portion of the population. To assess the spatial links between these population groups and important destinations, walk and bike service areas (half mile and one mile buffers) were drawn around schools, major employment areas, shopping areas and recreation areas (Figures A.15 to A.18). The buffers are reflections of current walkable and bikable distances along the on and off-street network. Though some high priority areas are within the walk and bike service areas, the maps show several high priority areas outside of these sheds. Finally, the high priority areas within the walk and bike service areas, though within walking and biking distance to amenities, may still need to access other amenities beyond the service areas and could potentially face physical barriers such as sidewalk gaps, sidewalks on one side of the street, unsuitable street crossing conditions or streets with high traffic stress. The next section describes the street and sidewalk stress evaluation methodology.

BICYCLE AND PEDESTRIAN SUITABILITY INDEX

A bicycle and pedestrian network is likely to attract a large portion of the population if its fundamental attribute is low stress connectivity. In other words, a network should provide direct routes between origins and destinations that do not include links that exceed one's tolerance for traffic stress. The Bicycle and Pedestrian Suitability Indices (BSI and PSI respectively) are objective, data-driven evaluation models that identify high traffic stress links, bicycle and pedestrian network gaps, and gaps between "low stress" links. Table A.15 and Table A.16 describe the metrics used in BSI and PSI.

The premise for this analysis is that scores increase as stress-inducing factors, such as high traffic speeds and volume, increase. Street segments with bicycle and pedestrian facilities are intended to reduce stress levels and are therefore given a negative score. This model is based on the London Cycling Design Guideline which provides insight about how to accommodate cyclists given vehicular speeds and volumes.

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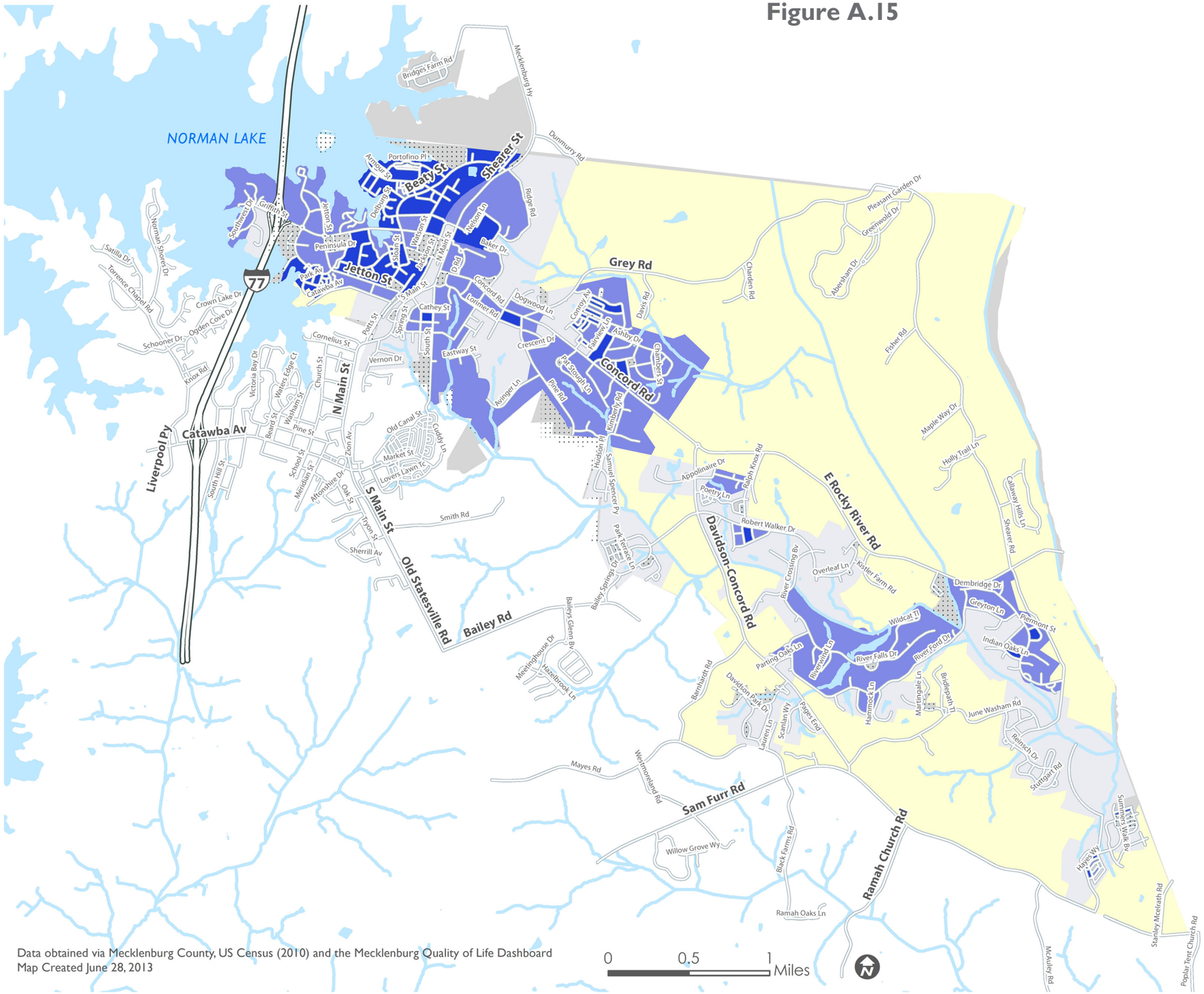
Figure A.15



Data obtained via Mecklenburg County, US Census (2010) and the Mecklenburg Quality of Life Dashboard
Map Created June 28, 2013

0 0.5 1 Miles

SOCIAL - HEALTH EQUITY MODEL

Town of Davidson
Health Equity Analysis

Composite Social - Health Equity Model

- High Priority Areas
- Moderate Need
- Lowest Need
- 0 Population

Jurisdictions

- Town of Davidson
- Extra Territorial Jurisdiction

The composite **Social - Health Equity Model** combines the variables in the social and health models. This composite model is adjusted to account for Census blocks with zero population.

The highest composite scores represent high priority areas.

Percent of Population in High Priority Communities

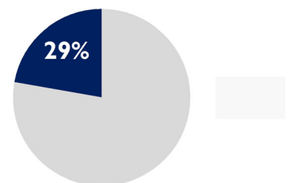


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Figure A.16

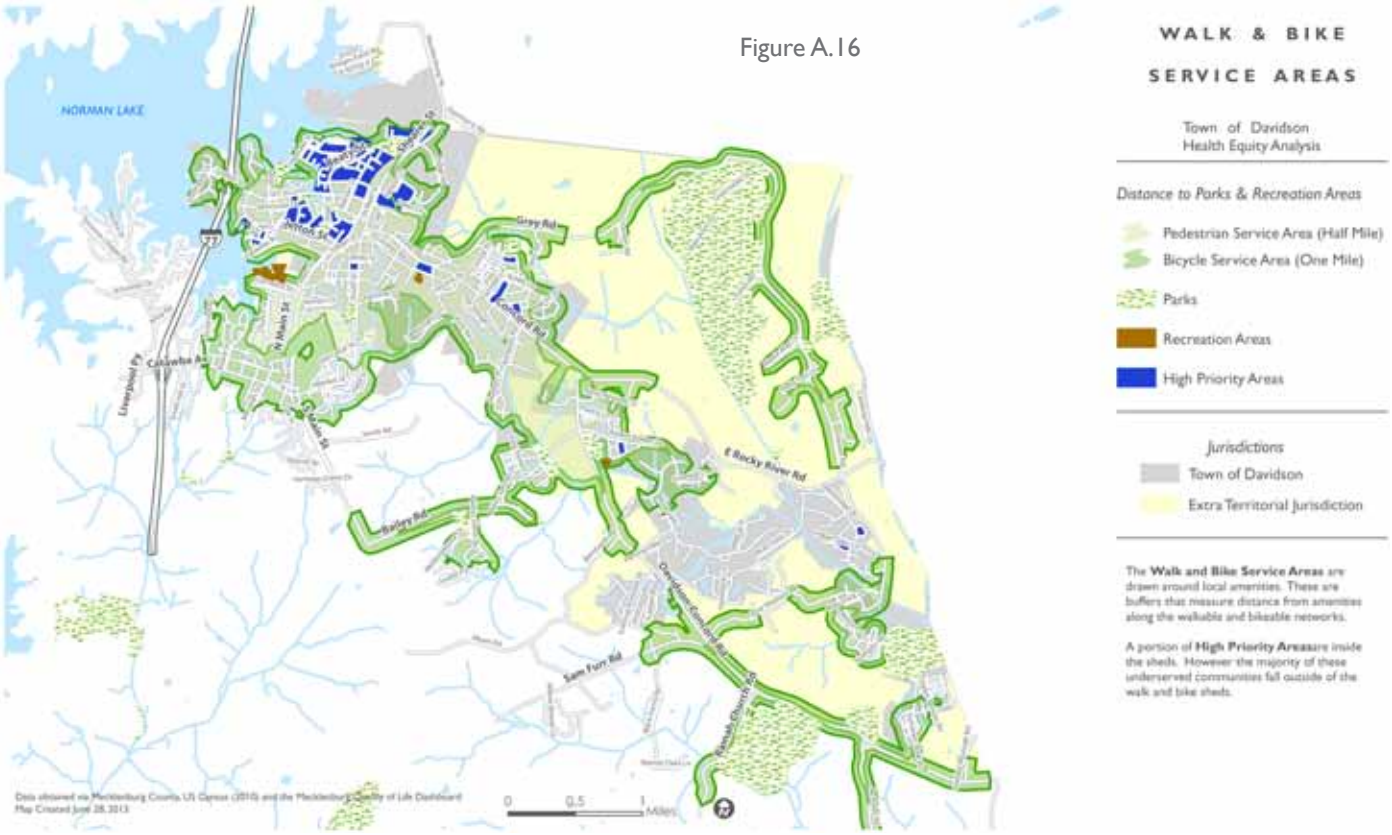


Figure A.17

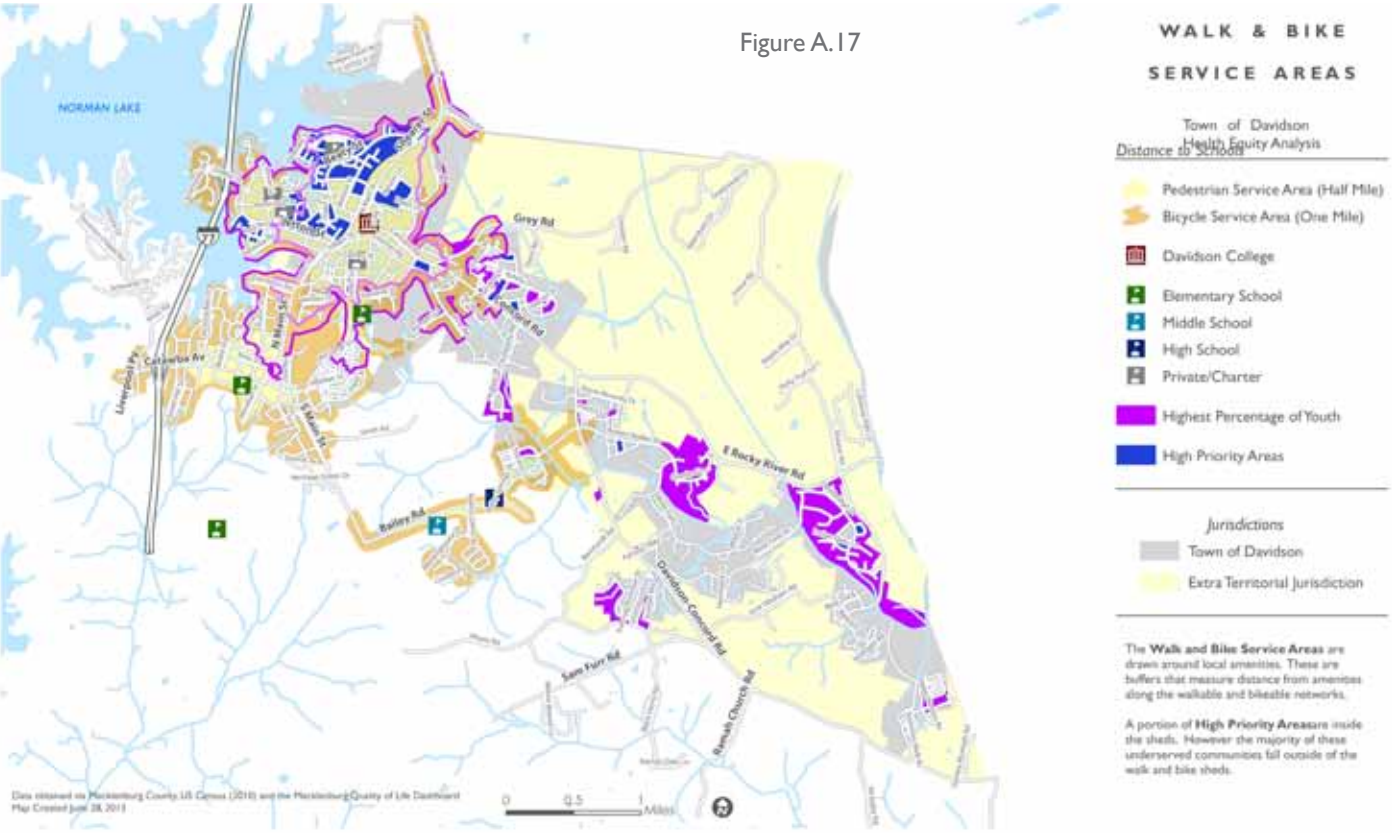
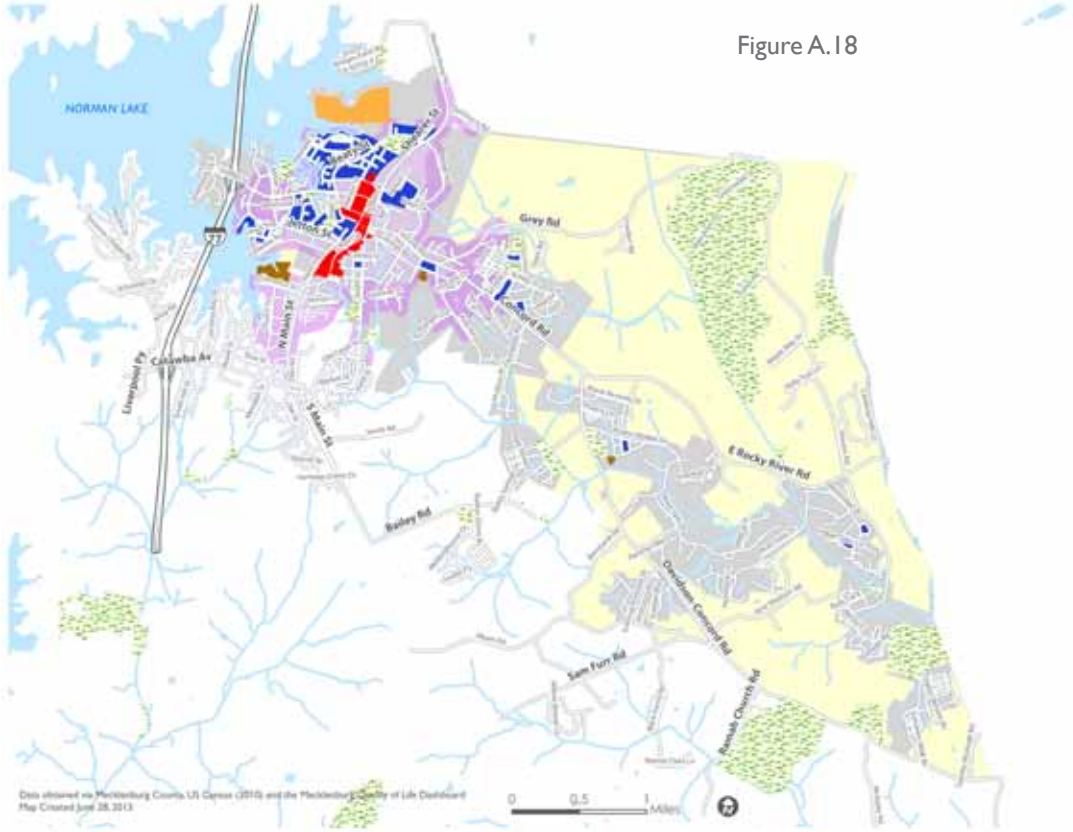


Figure A.18



WALK & BIKE SERVICE AREAS

Town of Davidson
Health Equity Analysis

Distance to Major Employment Areas

- Pedestrian Service Area (Half Mile)
- Bicycle Service Area (One Mile)
- Ingersoll Rand
- Parks
- Recreation Areas
- Downtown
- High Priority Areas

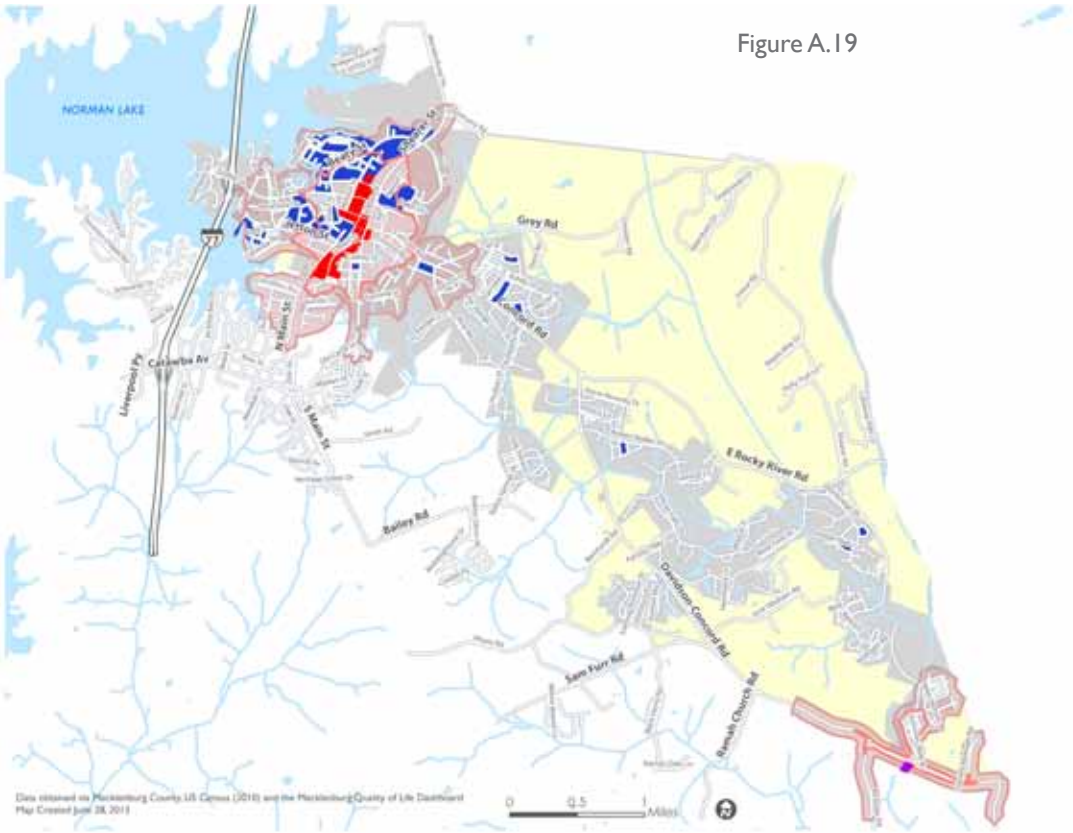
Jurisdictions

- Town of Davidson
- Extra Territorial Jurisdiction

The **Walk and Bike Service Areas** are drawn around local amenities. These are buffers that measure distance from amenities along the walkable and bikeable networks.

A portion of **High Priority Areas** are inside the sheds. However the majority of these underserved communities fall outside of the walk and bike sheds.

Figure A.19



WALK & BIKE SERVICE AREAS

Town of Davidson
Health Equity Analysis

Distance to Downtown & Shopping Areas

- Pedestrian Service Area (Half Mile)
- Bicycle Service Area (One Mile)
- Downtown
- Other Shopping
- High Priority Areas

Jurisdictions

- Town of Davidson
- Extra Territorial Jurisdiction

The **Walk and Bike Service Areas** are drawn around local amenities. These are buffers that measure distance from amenities along the walkable and bikeable networks.

A portion of **High Priority Areas** are inside the sheds. However the majority of these underserved communities fall outside of the walk and bike sheds.

Table A.15: BSI Metrics

Feature	Determinant	Score
Speed Limit	25 MPH or Less	0.2
	30-35 MPH	0.5
	Over 35 MPH	0.8
Traffic Volume	Less Than 1500	0.2
	1500-3000	0.4
	3000-8000	0.6
	8000-10000	0.8
	Over 10000	1
Bike Facilities	Bike lanes	0.4
	Bike routes	0.2
	Greenways	0.2
	Side paths	0.2
Other Barriers	Freeway Overpasses	1

BSI OUTCOMES

BSI results in three types of streets, defined by the metrics used to analyze them. The three types are "Family Friendly," "Confident Commuter" and "Bold Bicyclist."

Family Friendly streets primarily include all off street facilities such as greenways and sidepaths as well as low speed streets that do not exceed moderate traffic volumes. This category includes several of Davidson's bike facilities located on streets with low / moderate traffic speeds and volumes.

A typical outcome of this analysis results in the formation of "Family Friendly Islands" surrounded by two higher stress streets. This creates a barrier for cyclists with low tolerances for traffic stress.

Confident Commuter streets are predominantly high speed. However, their BSI score is reduced slightly by relatively lower traffic volume and, in some cases, the presence of a bike lane. These streets also include streets with high traffic volumes and low speeds.

Bold Bicyclist streets are all other streets in the network that do not comprise the Family Friendly or Confident Commuter categories. Bold Bicyclist streets represent significant barriers, especially for novice cyclists. They include streets with high speeds and traffic volumes even if an on-street bike facility is present. A major factor in this category is freeway overpasses. In some cases, such as along Bailey Road and Concord Road, a sidepath offers a parallel Family Friendly option. However, access to these facilities is via a Bold Bicyclist link.

BSI outcomes for Davidson are shown in Figures A.20 to A.22.

Slow speeds and low traffic volumes make Jackson Street a Family Friendly route that could be improved with a bike lane or sidepath.

Table A.16: PSI Metrics

Feature	Determinant	Score
Speed Limit	25 MPH or Less	0.2
	30-35 MPH	0.5
	Over 35 MPH	0.8
Traffic Volume	Less Than 1500	0.2
	1500-3000	0.4
	3000-8000	0.6
	8000-10000	0.8
	Over 10000	1
Pedestrian Facilities	Sidewalk on both sides of street	0.4
	Sidewalk on one side of street	0.2
	Greenways	0.2
	Side paths	0.2
Other Barriers	Sidewalk Gaps	1
	Freeway Overpasses	2

Concord Road is an example of a Confident Commuter route. A sidepath would provide a Family Friendly option along the corridor.

The I-77 bridge, exit ramps, and the adjacent section of Griffith Street are Bold Bicyclist streets due to high speeds, high traffic volume, and a lack of bicycle facilities.

PSI OUTCOMES

PSI results in three types of streets, defined by the metrics used to analyze them. The three types are "High Comfort", "Moderate Comfort", and "Low Comfort" Walkways.

High Suitability walkways are links with sidewalks on streets with low traffic speeds and volumes. They also include the greenway and sidepath network.

Moderate Suitability walkways are links without sidewalks on streets with low / moderate traffic speeds and volumes.

Low Suitability walkways are high speed and long links without sidewalks.

PSI results for Davidson are shown in Figures A.23 to A.25.

Many of the streets that provide access to local amenities currently cause too much stress to be a viable route for novice riders. With several Family Friendly Islands, low stress bicycle and pedestrian movement is hindered. However, the models help in the identification of gaps and barriers which can lead to a set of improvement project options. The Town of Davidson is currently developing bicycle and pedestrian improvement projects which will effectively increase the volume of low stress options.

Comparing the BSI and PSI outcomes to High Priority Areas offers a means of prioritizing bicycle and pedestrian projects. To help improve overall quality of life for the residents in these areas, a low stress means of access to local amenities is imperative not only to the immediate communities but to the links between the communities and essential amenities. Doing so will not only allow residents to overcome physical street barriers but also help overcome some of the social, health and environmental challenges they face.

Figure A.20

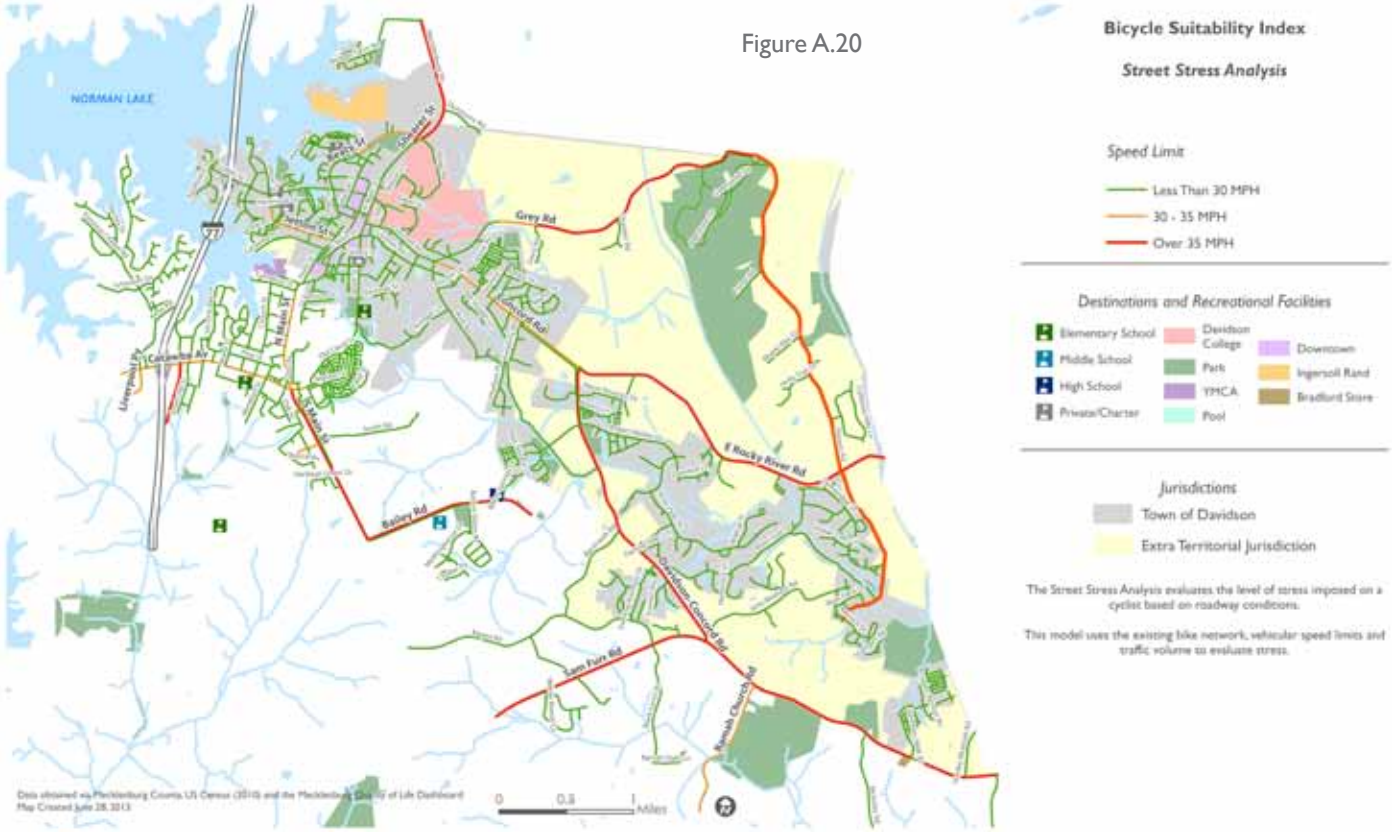


Figure A.21

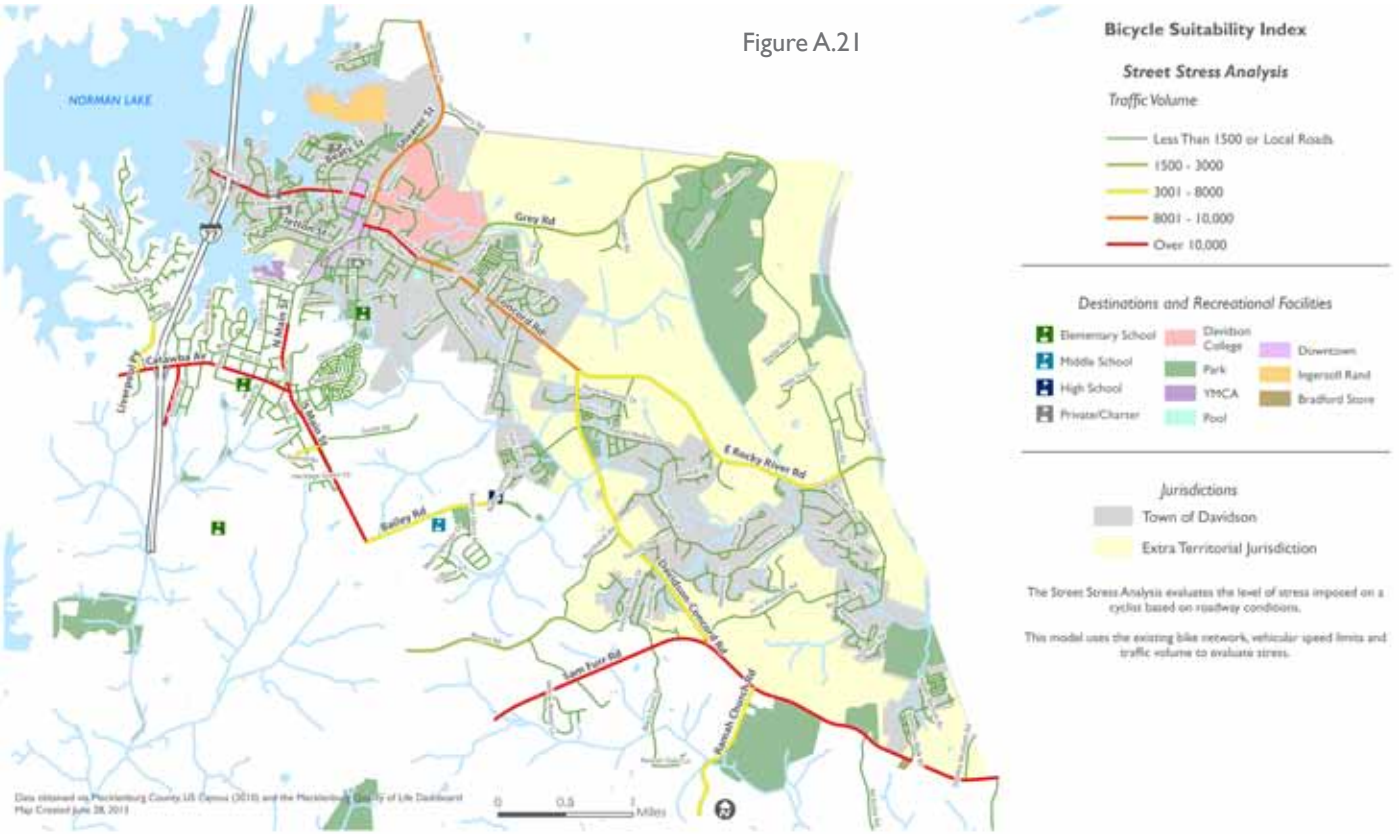


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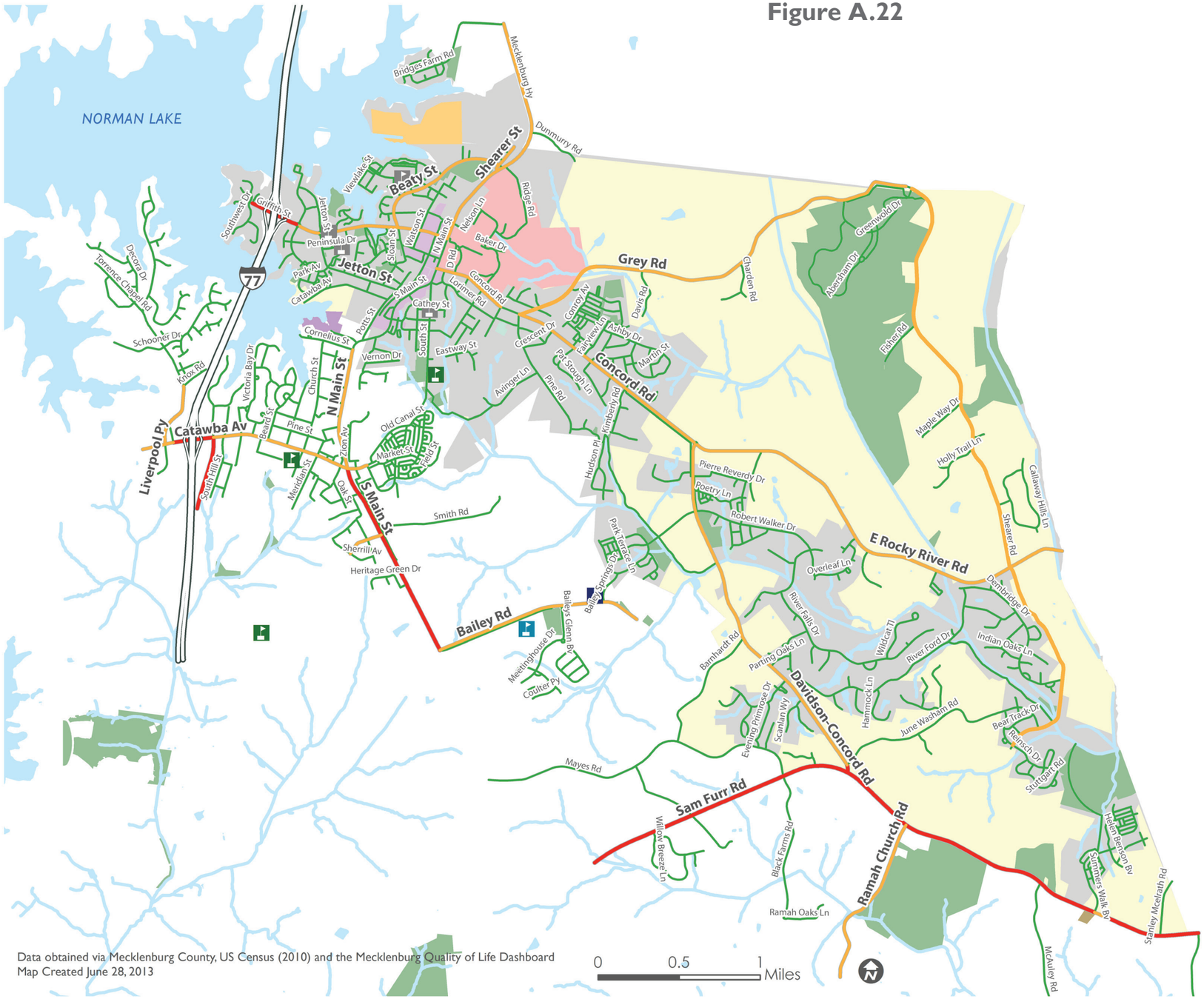
Figure A.22

Bicycle Suitability Index

Street Stress Analysis



Data obtained via Mecklenburg County, US Census (2010) and the Mecklenburg Quality of Life Dashboard
Map Created June 28, 2013

Bicycle Suitability Results

- Family Friendly
- Confident Commuter
- Bold Bicyclist

Destinations and Recreational Facilities

- Elementary School
- Middle School
- High School
- Private/Charter
- Davidson College
- Park
- YMCA
- Pool
- Downtown
- Ingersoll Rand
- Bradford Store

Jurisdictions

- Town of Davidson
- Extra Territorial Jurisdiction

The Street Stress Analysis evaluates the level of stress imposed on a cyclist based on roadway conditions.

This model uses the existing bike network, vehicular speed limits and traffic volume to evaluate stress.

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Figure A.23

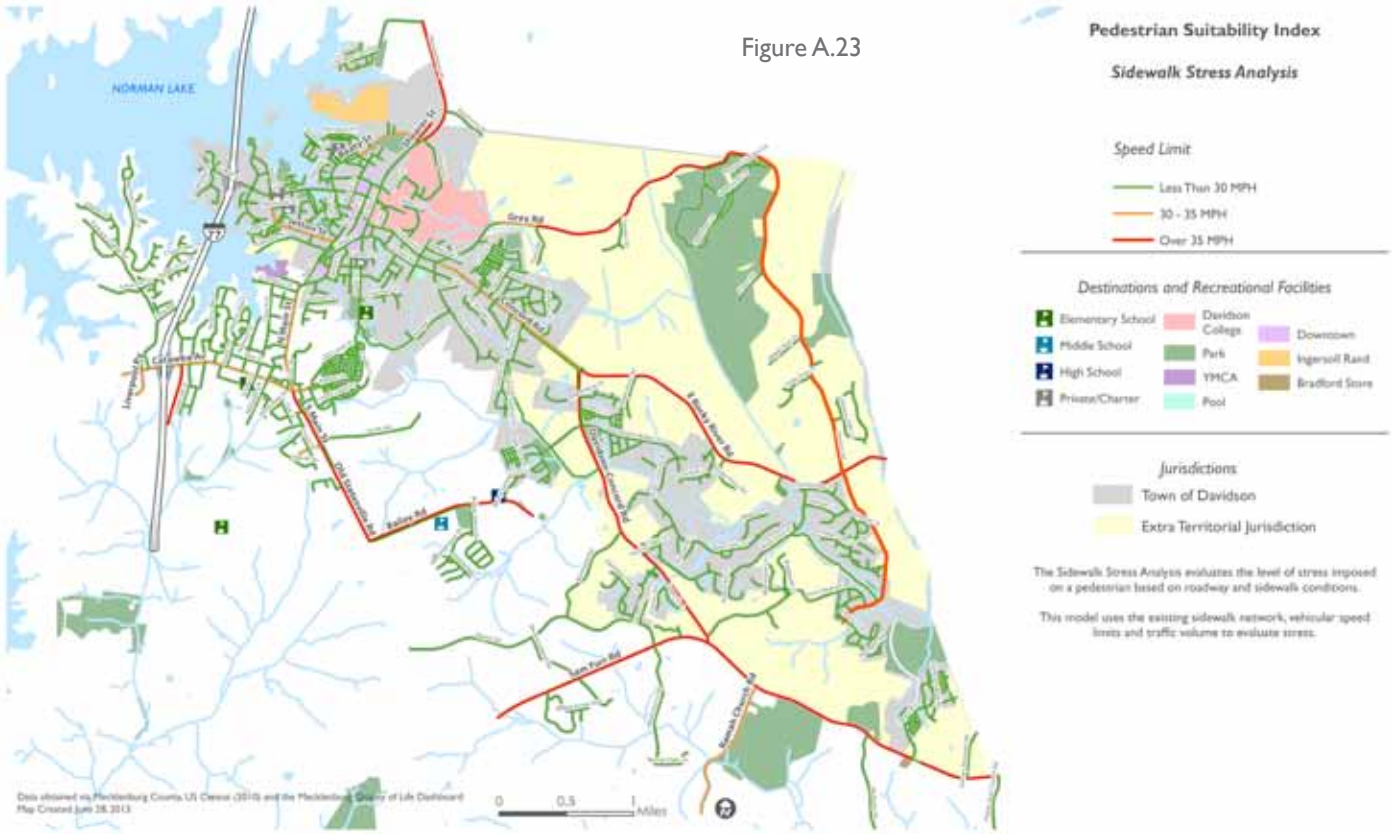

Figure A.24

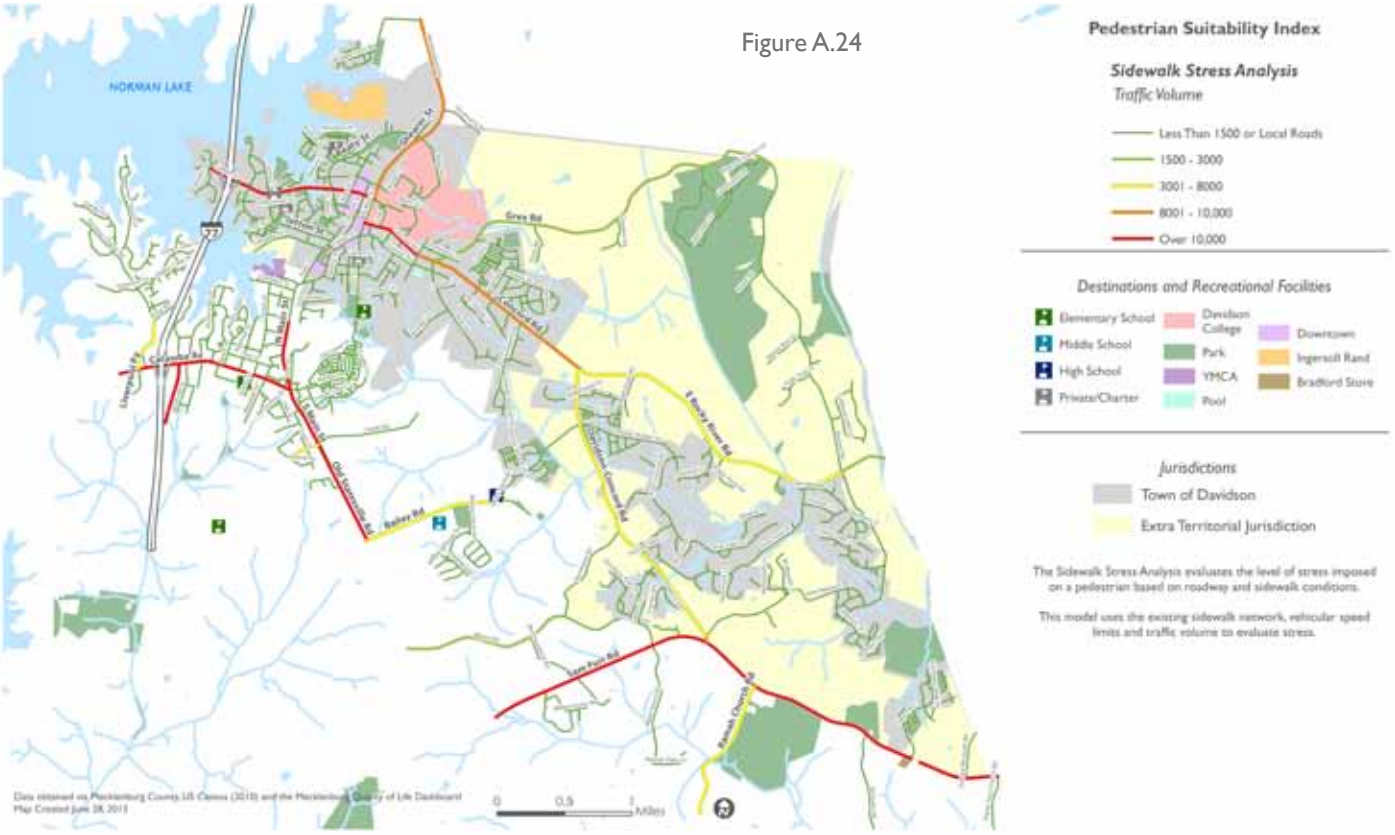

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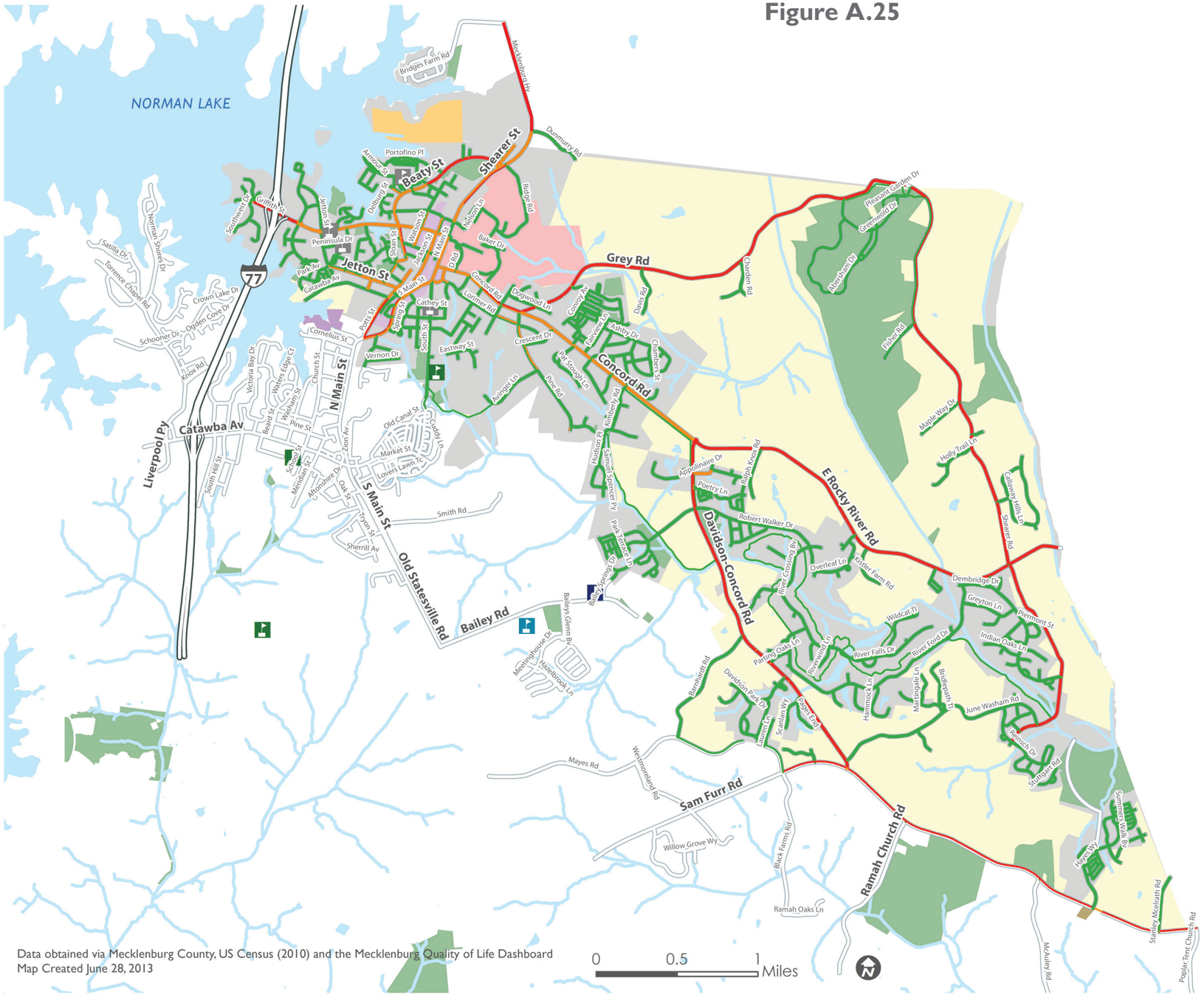
Figure A.25

Pedestrian Suitability Index

Sidewalk Stress Analysis



Data obtained via Mecklenburg County, US Census (2010) and the Mecklenburg Quality of Life Dashboard
Map Created June 28, 2013

Pedestrian Suitability Results

- High Comfort
- Moderate Comfort
- Low Comfort

Destinations and Recreational Facilities

- Elementary School
- Middle School
- High School
- Private/Charter
- Davidson College
- Park
- YMCA
- Pool
- Downtown
- Ingersoll Rand
- Bradford Store

Jurisdictions

- Town of Davidson
- Extra Territorial Jurisdiction

The Sidewalk Stress Analysis evaluates the level of stress imposed on a pedestrian based on roadway and sidewalk conditions.

This model uses the existing sidewalk network, vehicular speed limits and traffic volume to evaluate stress.

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Conclusion

The impacts of the Davidson Walks and Rolls: Active Transportation Master Plan are generally positive for the health and wellbeing of Davidson residents. As the plan is implemented, providing facilities and programs that encourage increased walking and bicycling and make it safer to do so, more people will use active transportation for a greater portion of their trips. It is the hope of this plan that by designing Davidson's transportation network to accommodate "Interested but Concerned" users, pedestrians and bicyclists of all ages, sizes, and abilities will be able to use the network to travel where they need to without relying on a personal vehicle. By exceeding recommended design guidelines including Americans with Disabilities Act standards, by incorporating multiple stakeholder groups within the planning process for individual projects, and by taking health and social equity into consideration when prioritizing projects, Davidson is expected to realize all of the social, environmental, and health benefits necessary to have a sustainable, socially just, and healthy community.