

An Assessment of Sidewalk Conditions: The City of Asheboro, North Carolina

by

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CHAPTER 1: INTRODUCTION AND PURPOSE

Much recent attention has been focused on sidewalks and paths for pedestrians to promote health benefits, provide walkers a refuge from traffic, offer an alternative to the motor vehicle as the sole means of transportation and enhance community identity and a sense that one is inhabiting a livable place. While the inclusion of new sidewalks in new and existing development is certainly laudable, there is little literature addressing planning strategies to maintain the physical condition of sidewalks with an empirical and practical implementation strategy at the local level. As stated by the Federal Highway Administration, a sidewalk with the most ideal engineering and site design loses its utility if adequate resources are not allotted towards ongoing maintenance (United States Department of Transportation, 2006). The purpose of this internship report is to highlight a program and methodology to evaluate the physical conditions of sidewalks within the broader context of a comprehensive pedestrian planning effort that is occurring in Asheboro, North Carolina. This report will demonstrate step-by-step an example of a crucial but often overlooked strategy for evaluating sidewalk maintenance, by means of fieldwork and developing a rating system that grades each section of sidewalk based on its condition and commensurate level of utility to the pedestrian. This strategy addresses the public interest in several ways. First, prioritization is needed when addressing maintenance concerns, especially due to tight budgetary constraints and the need for fiscal responsibility. Focusing on those geographic areas with the greatest maintenance needs first will allow a greater strategic framework in assessing areas that need new

sidewalk infrastructure. The ultimate goal of this effort is to create a cohesive and well-maintained sidewalk network connecting commercial, institutional and residential uses together in an environment that offers safety and comfort to the pedestrian. The pedestrian network is a mosaic of older sidewalks and those that have been constructed recently or will be constructed in the near future. An inventory of the current conditions of sidewalks will allow the City to assess the extent to which resources need to be concentrated in existing areas in addition to any new sidewalks that need to be constructed. The potential for receiving additional grants for any additional new sidewalk infrastructure is greater when a good faith effort and strategy is executed to maintain the existing stock of sidewalks. Thus, in order for a local government and its citizens and visitors to realize the benefits of an efficient sidewalk network, a uniform and rational system to account for each sidewalk's condition should be implemented. In order to fully engage the public to fully utilize sidewalks, they must be maintained with safety and pedestrian comfort as paramount goals.

This internship report is an analysis of the field inventory that documented the maintenance conditions of public sidewalks inside the city limits of Asheboro, North Carolina, a community of almost 25,000 people in the southern portion of the Greensboro/Winston-Salem-/High Point Metropolitan Statistical Area. Although Asheboro is located well south of the densest urban centers of the region, it has a dense older urban core that has existed in some form since it was first incorporated in 1796. An earlier version of this internship report was one of the tools utilized to obtain a 2006

Pedestrian Planning Grant from the North Carolina Department of Transportation to complete a comprehensive pedestrian plan. The assessment of current sidewalk conditions complements analysis already completed in the comprehensive plan that will seek public input to prioritize construction of new sidewalks in areas that have significant demand for sidewalks.

CHAPTER 2: LITERATURE REVIEW

a.) Key Concepts

The literature addressing sidewalk maintenance embodies the physical comfort and safety needs of pedestrians, public health implications, financing and funding sources of sidewalk improvements and linking maintaining sidewalks to the overall pedestrian environment. Sidewalks have long been considered an urban amenity to allow pedestrians to walk in a safe and orderly manner, to serve as a place for neighbors to exercise and in some cases as a place for people to socialize. The academic literature assessing sidewalk conditions is not as bountiful as the academic literature addressing the benefits for constructing new sidewalks or proclaiming the health benefits of walking. There is a heightened interest in promoting mixed land uses and urban design to give people a chance to meet and greet their neighbors and have an alternative to the private motor vehicle as the sole means of transportation to conduct simple errands (Calthorpe, 1995; Tegan, Simoes, Brownson, et. al., 2003). Balsas (2002) acknowledges that pedestrian planning has only recently emerged as a prime research area and focus of planning education. Interest has been increasing in this area, and policy continues to evolve to address this interest, heightened in part by the passage of the Intermodal Surface Transportation Act of 1991, which concentrates much of its funding on non-motorized forms of transportation including sidewalks and bicycling (Balsas, 2002). The review will also examine different qualitative and quantitative methods used to analyze

sidewalk conditions and then synthesize these into a research design relevant to Asheboro.

b.) Importance of Physical Comfort and Safety

The surface of sidewalks should be kept in a well-maintained condition free of vegetation impediments, especially vegetation adjacent to fences and other potential hiding places for criminals (Zelinka & Brennan, 2001). If inappropriate and mature vegetation is allowed to become overgrown, this may not only present a physical obstruction to the pedestrian but, at worst, may create an opportunity for a perpetrator to commit a crime against a pedestrian. This risk factor increases at night, which also makes appropriate lighting near sidewalks necessary (Zelinka & Brennan, 2001). In addition to discouraging would-be robbers from finding a hiding refuge, a well-maintained “streetscape” including well maintained sidewalks is one of many visual cues indicating a cohesive community that may indirectly create a sense of safety and deter criminal behavior since would be criminals view the residents as caring about their environment and therefore likely to report crime (Zelinka & Brennan, 2001). Sidewalk maintenance alone may not dramatically reduce criminal activity but can be one component of an overall environment that makes a neighborhood uninviting for potential criminal activity (Zelinka and Brennan, 2001).

In order to encourage sidewalk usage to its fullest potential, a pedestrian should feel a sense of physical and psychological security that is created by an appropriate design context for the walking environment. However, the pedestrian environment is

often replete with discomfort in its physical design. Sidewalks may be built along a busy multi-lane thoroughfare with no vegetation (grassy planting strips and street trees) as appropriate barriers separating traffic from pedestrians. If there is a buffer, in most instances, only two or three feet of grass typically separate pedestrians from high speed traffic, creating a lack of desirable walking space (Hall, Porterfield, 2001). Sarkar found that the level of perceived comfort is often the greatest predictor as to whether someone will walk to and from a destination. A sidewalk segment that is suddenly discontinued, lacks curb ramps for wheelchairs and has other design shortcomings leads to a negative psychological perception of the sidewalk segment and consequently discourages walking. Yet these sidewalks still must be maintained, so if few people are using them due to their unattractive nature to the pedestrian, this is not a fiscally sound situation. Unabated noise from passing vehicles may also be a negative environmental factor discouraging walking (Sarkar, 2003).

c.) Public Health Implications

One key issue presented in the literature is the promise that not only having sidewalks, but well-maintained sidewalks have an impact on the physical well being of residents. Much literature supports the idea that the presence of sidewalks serves the public health by reducing obesity and other health problems (Catlin, Simoes, & Brownson, 2003 et. al). However, findings by Sharpe, Granner, Hutto and Ainsworth in 2004 extend this hypothesis not only to the presence but to the condition of sidewalks, surmising that sidewalks that are perceived to be well maintained offer a much greater

health benefit in encouraging people to walk than do poorly maintained sidewalks. The researchers conducted a random digit phone survey of respondents having a sidewalk along at least one side of the street at their residences. Those who self rated their sidewalks as “well-maintained” were twice as likely to be involved in moderate physical activity as those who rated the sidewalk in their respective neighborhood as being “poorly maintained” (Williams, Evans, Kirkland, et. al. 2005).

d.) Common Assessment Methods of Sidewalk Facilities

Measurements of sidewalk service levels typically address the physical design of a sidewalk (in terms of width, freedom from impediments such as utilities, and a pedestrian’s ability to maintain a desirable walking speed) (Sarkar, 2003). This addresses the level of service sidewalks offer based on the pedestrian volume and congestion (much like the level of service criteria evaluating traffic congestion on roads) and the functional design of the sidewalks. Some studies evaluate level of service based on comfort and aesthetic issues. For example, Masamitsu and Tsukaguchi study pedestrian sitting places and stopping places in determining a sidewalk’s utility and attractiveness to pedestrians (1987).

Most assessment methods on the condition of sidewalks tend to provide a somewhat subjective overview based on opinion and the perception of the condition of sidewalks in a particular area (Centers for Disease Control, 2005, et. al.). These surveys often ask citizens to rate sidewalks using a Likert scale to assess their preferences and general satisfaction about the upkeep and environment surrounding sidewalks

(O'Sullivan, Russell and Berner, 2003). For example, a survey may inquire from participants if they “strongly agree,” “agree,” “disagree” or “strongly disagree” that “this sidewalk is pleasant,” or “this sidewalk seems to be maintained.” Local governments using these surveys may recruit volunteer citizens to take notes on issues relating to sidewalk conditions. Gaining insight into these public perceptions can be quite helpful in gauging the support for sidewalk improvements in specific areas. The downside of such subjective measures is that varying perceptions of what constitutes “good” or “poorly maintained” sidewalks often leads to a lack of uniformity and in equitable treatment in determining where repair or improvement priorities should be implemented. A key goal should be to balance the evaluation of public participation with a quantifiable and objective measurement. However, developing an empirically derived tool to allocate scarce resources and develop a plan of action to repair sidewalks with an accompanying budget has been unaddressed by the existing literature.

A survey by researchers from the University of South Carolina in Sumter, South Carolina was groundbreaking in its empirical assessment of sidewalk conditions, at least as addressed by the academic literature (Williams, Evans, Kirkland, et al., 2005). In partnership with the City of Sumter, Williams et. al (2001) developed an assessment tool for rating the maintenance of sidewalks. One of their stated goals in creating an assessment system was that it be transferable to other communities who wish to utilize the tool in their assessments. Sumter, South Carolina is a city with a population of approximately 40,000 in central South Carolina (United States Bureau of the Census,

2000). The methodology was developed in consultation with the City of Sumter, South Carolina) and the South Carolina Prevention Council. Specifically, the Sumter County Active Lifestyles Committee (part of the South Carolina Prevention Council) developed a rating system. To test the ratings, the following procedure was utilized:

1. Forty community members evaluated sidewalks in the downtown area using these methods. Discrepancies were noted and a second assessment was made to ensure the uniformity of one rater to another. Using SAS (Statistical Analysis System) software, a statistical test determined that the testers were reliable.
2. Three graduate students conducted the rating for all sidewalks. A total of 99.4 miles of sidewalks were rated taking an average of 8 to 12 minutes per block.

Ratings were based on five components including levelness of the sidewalk (heaves, uneven surface slants, misalignment between sections), obstructions blocking the sidewalks (cars, trash cans, etc.), natural vegetation on sidewalks, cleanliness (cans, litter, etc.), and the condition of the sidewalks (weeds growing through concrete, broken sections, etc.). On each of the 1,090 blocks of sidewalk within the city of Sumter, conditions were evaluated for each block as well maintained, somewhat well maintained, or not well maintained. Specifically, the researchers tested each variable by computing both the number and severity of problems on a given sidewalk block and gave each block an appropriate rating based on the number and severity of problems. For example, to evaluate the levelness of a block of sidewalk, one major section misalignment in excess of two inches would earn a block a “not well maintained” rating, while three minor

section misalignments between one half an inch and two inches would earn a “somewhat well maintained” score. The researchers gave each of the five categories a non-weighted score in each category, which was computed into a composite score. For example, a poor score for “items blocking sidewalk” (such as a portable sign blocking passage of the sidewalk) would have the same effect as a poor score for “condition of sidewalk”(such as several major vertical misalignments of sidewalk sections). The results of this study indicate that 23 percent of sidewalks were not well maintained, 63 percent were somewhat well maintained and 14 percent were well maintained (Williams, Evans, Kirkland, et al., 2005).

After reviewing this research, the block by block quantification of sidewalk conditions appears innovative in its use of an empirical methodology to rate sidewalks against all other sidewalks within a study area. In doing this, this research is not merely conceptual, but it creates a scoring system for localities to use in assigning a consistently objective score. The notes that are taken could be modified to give a generic indication of the repair costs or replacement costs of a particular sidewalk block. Due to its simple precision when conducting a field survey, the researchers found that it offers the advantage of being usable in a community that is not necessarily a large or affluent city with a large budget to conduct the study. As a basis for comparison, the per capita income of Sumter (\$31,590), for example, is very close to that of Asheboro (\$31,676) in the year 1999 (United States Census Bureau, 2000). The ability to score the sidewalks based on their condition, while still time consuming, seems more feasible for those

communities without the financial resources to hire consultants and engineers to conduct a study.

The research does raise some questions in applying the findings to assign an overall score for each block of sidewalk. While it is useful to rate these non-structural factors (such as cleanliness of a sidewalk), the system weighs these factors equally with more serious structural defects such as deteriorating concrete. The level of cleanliness of the sidewalk or the presence of a car improperly parked on a sidewalk may be a very transitory problem and much more easily remedied (both physically and monetarily) than major structural factors. Structural issues require expensive repairs but these were not given additional weight in the ratings. This may be fine for an overall insight into the upkeep of an area, but it seems to be of less utility in terms of physical construction issues and for budgetary projections.

Much literature regarding specific scoring methods and sidewalk replacement and maintenance policies are found from various local government jurisdictions that post their sidewalk policies on the internet. One source of broad policy guidance in establishing an evaluation methodology is the Federal Highway Administration (FHA). For example, the FHA identifies a vertical displacement of greater than one-half inch or cracks in concrete of greater than one-half inch as in need of maintenance attention (US Department of Transportation Chapter 10, 2006). Different localities may use slightly different criteria in their assessment. For example, Carrollton, Texas recognizes a crack of one inch in a sidewalk as criteria for repair or replacement. An established threshold

indicating an impaired sidewalk in Omaha, Nebraska is a crack in the surface that is larger than a finger, which equates to approximately one-half inch to three-quarters of an inch (Neighborhood Scan, 2004). Boulder, Colorado targets sidewalk repair when a vertical displacement (where the surface of one sidewalk section is higher than the adjacent one) is in excess of three-quarters of an inch and for cracks of greater than one inch (City of Boulder Colorado, 2006), Sidewalk vertical misalignment guidelines (in which one sidewalk section is vertically higher than the adjoining one) in which replacement is recommended range from five-eighths of an inch in Laurel, Maryland to one and one quarter inches by Local Government Insurance Trusts guidelines (City of Annapolis, 2005).

There are some jurisdictions that do conduct regular inventories of sidewalk conditions and not all of these are large cities that tend to have large specialized public works programs. Tremonton, Utah, for example has a 2000 population of 5,592 and conducts a three-year inspection on approximately 500,000 linear feet of sidewalks, in which conditions are ranked on vertical displacement alignment of sections and uneven grade (City of Tremonton, Utah, 2005). These are ranked on a simple four-point scale. A “rating 1” sidewalk is considered to be in poor condition with a misalignment greater than two inches. These comprise one percent of all sidewalks and represent the highest repair priority. A “rating 2” sidewalk is still considered to be in poor condition with a misalignment of between one half inch and two inches between sections. These comprise two percent of all sidewalks and are considered the next highest priority repair. A “rating

3” sidewalk appears to have a ½ inch or less vertical misalignment and is considered to be in fair condition and a lower repair priority. A “rating 4” sidewalk has no apparent misalignment between sections, comprises 96 percent of the community’s sidewalks and is not a repair priority.

Periodic sidewalk evaluation can be based on the density of pedestrian activity in a particular area and the level of use a sidewalk is likely to receive. For example, city workers in Portland, Oregon inspect the city’s sidewalks every 20 years in all districts, and every five years in the central business district due to the greater intensity of usage and density of pedestrians in the central business district (City of Portland, 2005). This would appear infrequent enough to be manageable in terms of labor costs even in those communities with relatively limited resources and staff members. Some guidelines advocate sidewalk inspection every year (California Joint Powers, 2006), yet more sporadic inspection would appear to be more strategic than no periodic plan for inspection and it may be prudent to vary the frequency of inspection based on the amount of usage a sidewalk likely will receive based on land use patterns.

e.) Prioritization of Maintenance

Sidewalk replacement or construction can be prioritized based on demographic factors and the likelihood a sidewalk will encounter heavy use. It can be contentious to have to prioritize what streets receive sidewalk improvement immediately and which ones need to have a delay in seeing these improvements, but there are ways to set priorities on a rational basis. For example, Charlotte, North Carolina gives special

priority to sidewalk investment in areas in which per capita automobile ownership is below average, and in the older urban core of Charlotte known as the “city within a city” which is sensitive due to generally lower socioeconomic status of residents in that area compared with outlying areas of the city (City of Charlotte, 2006). The City of Charlotte made a policy decision to offer additional support and incentives to the “city within a city” area regarding many city services due to its special needs.

Additionally, there are some populations who are especially affected by the condition of sidewalks, including children, the elderly and persons with disabilities. Children are an especially important demographic group relating to pedestrian facilities. Creating an environment in which children have a safe route to school is especially important, considering the implications to traffic safety and the overall health benefit of physical activity, which has received heightened attention as concerns have risen that children do not get enough physical activity (Boarnet, Anderson, Day, McMillan, Alfonzo, 2005). The Safe Routes to School program seeks to address local concerns by providing infrastructure for students to be able to walk to school, to make walking to school a pleasant and safe experience, and to aid sustainable transportation by reducing traffic congestion, fossil fuel consumption and other externalities private motor vehicles pose. The program was created pursuant to Section 1404 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users Act (SAFETEA-LU) (Federal Highway Administration, 2006). This Act was developed pursuant to the broader Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and The

Transportation Equity Act for the 21st Century (TEA-21). These two landmark acts shifted the sole focus of federal transportation infrastructure from roads designed only for the private automobile to an emphasis on other modes of non-motorized transportation, such as walking and bicycling (Federal Highway Administration, 2006). A study of ten elementary schools in economically and socially diverse areas of Southern California indicated that of those children whose regular route followed sidewalk improvements after the enactment of the Safe Routes to School program, 15.4 percent increased walking to school while only 4.3 percent of children with routes in which no improvement occurred walked more. The percentage of children who walked less did not vary greatly between these two groups (Boarnet, Anderson, Day, McMillan, Alfonzo, 2005). The Safe Routes to School (SR2S) program is a federally funded program sponsored by the United States Department of Transportation Federal Highway Administration. Additionally, areas near retirement homes and medical facilities should be given high priority for sidewalk infrastructure (Federal Highway Administration, Chapter 13, 2006). These areas have a high concentration of older adults who may have limitations to driving a private motor vehicle.

f.) Funding and Financing for Sidewalk Improvements

A city needs to consider the costs not only associated with constructing sidewalks but variable costs associated with ongoing maintenance of sidewalks. Budgetary constraints often restrict an adequate level of funding for sidewalk maintenance, especially in regard to deferred maintenance that results in a costly improvement plan.

One city in which these policies were examined is Annapolis, Maryland. The City of Annapolis formed a Sidewalk Task Force to evaluate sidewalk conditions and policies of the city. In Annapolis, according to figures published by the city, a conservative estimate is that 60 percent of sidewalks are due for replacement (City of Annapolis, 2005). This equates to 1,406,000 square feet to replace. A cost estimate to complete this task is \$6,336,000 (conservatively) based on materials, design and labor expenses. In the case of Annapolis, the budget for sidewalk improvements in 2004 was only \$250,000, creating the acute need for long term planning of sidewalk improvements and a strategy to address the most egregious issues and to ideally find outside funding sources. Annapolis is choosing to budget \$100,000 for sidewalk improvements and retrofitting curbs so that they are wheelchair accessible in compliance with the Americans With Disabilities Act of 1991. \$100,000 of the \$250,000 is to repair sidewalks in front of city owned property and at locations where city street trees have damaged sidewalks. The remaining \$50,000 of this budget is appropriated for loans at below-market rates for individuals to repair sidewalks based on financial need in those cases where it is the private citizen responsible for the repair (City of Annapolis, 2005).

It is often desired to find outside sources of funding for sidewalks so that neither the private property owner nor the local government are paying the majority of sidewalk costs. Opportunities for funding may exist from a plethora of sources but not necessarily one sole source. For example, funding from the Transportation Equity Act for the 21st Century may assist in making sidewalks accessible to persons with disabilities which

would be of great assistance for this purpose as well as improving any conditions on the segment of each sidewalk where the sidewalk intersects with each street (Transportation Equity Act Summary, 2005). The Safe Routes to School Program, pursuant to TEA-21, for example has \$1 million in funding available for projects within North Carolina in Fiscal Year (FY) 2005, \$2.3 million in FY 2006, and a projected \$4.8 million available by FY 2009. The funds are distributed to each state that can use them on programs promoting both infrastructural and non-infrastructural programs near schools. One of the infrastructural uses of these funds available to states is improvement to the safety of sidewalks, such as creating greater separation distances between traffic and pedestrians (Federal Highway Administration Safe Routes to Schools, 2006).

g.) The Public Versus the Private Realm: Responsibilities and Benefits

Issues often arise with property owners over the liability of sidewalks in front of their property and sidewalks infringing on private property rights. The sidewalk is defined as being part of the public realm, available for not only the public to walk along, but to engage in conduct that is protected by the United States Constitution, such as handing out leaflets. These rights also endow a responsibility upon the recipient not to engage in activities considered to breach the public peace or safety (Lawlor, 2005). The distinguishing of rights between public assembly and peaceful enjoyment of private property, however, has not been without some controversy for the owners of property adjacent to public sidewalks.

Whether the maintenance of the sidewalk is the local government's responsibility or the private property owner's responsibility has been a somewhat ambiguous issue. In Annapolis, Maryland, the City Code specifies property owners are responsible for maintaining the sidewalk adjacent to their properties. However, the task force in that city found that in practice this is often not enforced and the courts have been shifting sidewalk maintenance responsibility away from property owners onto local government due to property owners not having expertise in how to maintain sidewalks. This shift in the reasoning of the courts is attributable to the opinion of the courts that the sidewalk is also part of the public realm (in which a private property owner cannot exclude the public) not the private realm, and therefore the public at large should share in the responsibility of the upkeep rather than the one abutting property owner. Court cases, such as the refusal of the United States Supreme Court to hear an appeal of the 9th Circuit U.S. Court of Appeals 2002 ruling that the City of Sacramento, California must maintain sidewalks in a manner clear and accessible to persons with disabilities, continue to further this idea (American Public Works Association, 2003). Private property owners are often determined by the courts not to be solely responsible for upkeep of a public amenity and cannot be expected to have the expertise available to effectively be liable for sidewalk repairs the same way a local government does (City of Annapolis, Maryland, 2005). The sidewalk policy in Annapolis is complaint driven. Once a complaint is received, an evaluation of the sidewalk in questions is made, the city public works department contacts the adjoining property owner and advises the owner of qualified professionals

who can repair sidewalk. Notification of sidewalk defects may also be made when building permits are issued or if staff sees an issue in carrying out assigned duties.

In terms of policy directed at who bears the costs of sidewalk repair, some cities handle sidewalk repair costs in their entirety, some jurisdictions participate in cost sharing with property owners whose property abuts sidewalks, and some leave the entire burden to the private property owner (and enforce a policy requiring property owners whose property abuts a public sidewalk to maintain and repair their respective sections).

Each method has its own philosophical advantages and disadvantages in its perceived fairness by citizens. Some argue that private property owners should pay the full cost of repair since sidewalks are an amenity that enhances the value of private property that is realized and mainly the property owner realizes the price appreciation. Others believe requiring private property owners to pay the entire cost of sidewalk repair unduly imposes a burden on the private property owner for financing a benefit that is enjoyed by the public to which the public has undeniable access. Among the larger cities, in North Carolina, Raleigh requires abutting property owners to pay for sidewalk repair, in Greensboro, the city pays for the sidewalk repair. In Winston-Salem, the city pays two-thirds of the repair costs, with abutting property owners paying one-third of the cost (Shaffer, 2005). Part of this difference, however, would appear to not be related to each city's support of sidewalks, but a difference in philosophies of having a property tax rate as opposed to placing a cost burden on user fees for a project in which a particular property owner is most likely to enjoy a financial or other benefit. In 2003-2004,

Greensboro's tax rate was the highest of these three cities with \$0.5675 charged for every \$100 of property valuation, Winston-Salem's was \$0.485 per \$100 of property, and Raleigh's was the lowest at \$.395 per \$100 of property valuation (North Carolina League of Municipalities, 2006). Evidence does indicate property owners adjacent to a sidewalk can benefit financially in terms of property values in comparison to one that does not adjoin a public sidewalk. The Federal Highway Administration indicates that a section of sidewalk five feet in width with two street trees raises the property value of a residence between \$3,000 and \$5,000. A sidewalk (and street trees) raises the property value of raw land by one to three percent (Federal Highway Administration Chapter 13, 2006).

CHAPTER 3: RESEARCH DESIGN

a.) Creation of Scoring System

This survey assessed a total of 25.5 linear miles of sidewalks within the City of Asheboro. Figure 1 shows the locations and widths of sidewalks within Asheboro. The primary objective in measuring sidewalk maintenance needs is to determine the proportion of sidewalks where impairment exists on each segment of sidewalk. The methodology to determine the severity of impairment (i.e. moderate, significant) was devised after a review of literature as cited in the literature review of this paper and in consultation with the City of Asheboro Public Works Director and City of Asheboro Engineering Department. The scoring system utilized a composite of these resources with some variation from the author in consultation with the Public Works Director. Additionally, once the scoring methodology was created, the Public Works Director cross-scored several blocks that were first tested by the author and any major discrepancies in the scoring were noted. The Public Works Director was in general agreement with the findings; therefore, the field analysis continued using the methodology.

Several completed examples of the assessment form used in the evaluation project are included in the Appendix of this report. The initial field survey resulted in 312 pages of field notes concerning 235 blocks of sidewalk.

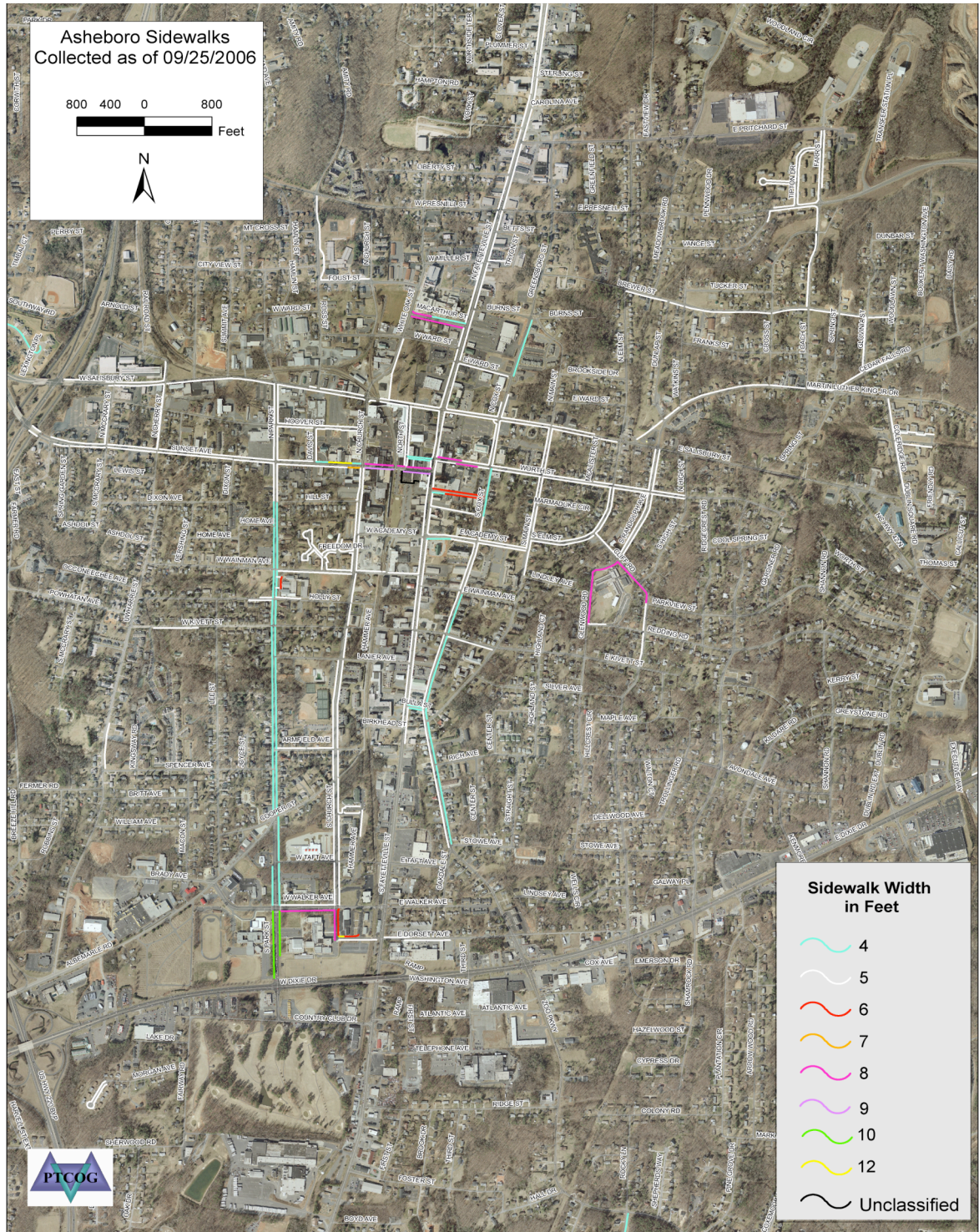


Figure 1: Location and Width of Sidewalks (Map by Piedmont Triad Council of Governments)

b.) Distinguishing Characteristics of Significant and Moderate Impairment

This study divides the sidewalks into two categories of severity: **significant impairment** or **moderate impairment**. These sections of sidewalk are given additional weight in the impairment calculation due to the fact that they represent a more noticeable change in the experience of a pedestrian traversing a sidewalk. A small “hairline” type crack over a five-foot section of sidewalk may indicate a maintenance need that is not as severe as a major vertical displacement over a five-foot sidewalk section that disrupts walking and deserves a score commensurate with the pedestrian experience.

Significant impairments are defined and visually depicted as follows:

Significant Vertical Displacement Defined: A vertical displacement in the sidewalk’s pavement of greater than one inch. Such displacement occurs when there is a sudden drop or rise in the grade of the sidewalk within a section, or more typically, the misalignment that occurs when one section of sidewalk is higher than another.



Significant Vertical Displacement: *Photo by John Evans*

Significant Vegetation Defined: Overgrown vegetation that is significantly blocking the sidewalk covering more than one half of the sidewalk area or growing over the sidewalk to the point that it appears to substantially impede pedestrian movement.



Significant Vegetation on Sidewalk (covering more than half of sidewalk):
Photograph by John Evans



Significant Vegetation blocking Sidewalk (blocking more than half of sidewalk):
Photograph by John Evans

Significant Surface Deterioration Defined: A segment of sidewalk that has deteriorated to the point that its value as a section of sidewalk is limited due to the impediment it creates to pedestrians.



Significant Surface Deterioration: *Photograph by John Evans*

Significant Cracking Defined: A crack that exceeds one inch in width.



Significant Cracking: *Photograph by John Evans*

Moderate impairments are defined and visually depicted as follows:

Moderate Vertical displacement defined: Displacement of greater than one-fourth inch but less than one inch.



Vertical Displacement between sections is less than an inch.

Moderate Vertical Displacement: *Photograph by John Evans*

Moderate Vegetation Impairment Defined: Overgrown vegetation that is significantly blocking the sidewalk (up to one half of the width) but can be addressed through regular maintenance or pruning.



Moderate Vegetation on Sidewalk: *Photograph by John Evans*



Moderate Vegetation Blocking Sidewalk: *Photograph by John Evans*

Moderate Surface Deterioration Defined: An area of broken and weathered pavement that generally does not impede travel noticeably and does not rise to the level of *significant impairment*.



Moderate Surface Deterioration: *Photograph by John Evans*

Moderate Cracking Defined: Cracking of the sidewalk surface is less than one inch.



Moderate Cracking: *Photograph by John Evans*

c.) Field assessment methods

While the standards established in the research design are objectively measured, the notes in the field inventory are invaluable in highlighting the context and practical reality of each issue. Moderate surface deterioration may only occur on a small portion of sidewalk section and it may be possible to repair this section. This is different from a cracked sidewalk that occurs due to the upheaval of concrete, which must be replaced. As shown in the photograph above, moderate cracking may not be severe enough to receive the “significant” grading, it is likely that without maintenance, future weathering and stress on the concrete may cause upheaval of the cracking to the point that surface

deterioration occurs. If this happens, replacement becomes necessary. An issue deemed repairable at the time of the initial assessment will not be if significant time is allowed to pass before repair considerations are addressed.

Admittedly, there are some sections of sidewalk that may have a maintenance issue that does not meet the criteria for being classified as a sidewalk with either a significant or moderate impairment. These sections are not counted as part of the percentage of each section that needs replacement or maintenance activity. For example, there may be vertical displacement in which one sidewalk section is one-eighth inch higher than another section, but does not meet the threshold of one-quarter of an inch. However, to offset such issues, extensive notes were taken when conducting this survey. In evaluating each section of sidewalk, there were some sections of sidewalk where a difficult judgment had to be made concerning the appropriate remedy for correcting the impairment. For example, there were some sections that exhibited a condition that involved cracking of the surface, but also some surface deterioration that may or may not be remedied by filling the deteriorated area with concrete. In these cases, it may be necessary to carefully balance the ability of a repair to restore the sidewalk to its fully operational condition and the durability of a repair to be sustained over time versus the cost of replacing the sidewalk entirely. In evaluating the impairment levels on the assessment forms, some sections are rated as having a severity level of M/S, as opposed to “M” (moderate impairment) or “S” (significant impairment). This notation signifies that the sidewalk section generally has significant maintenance or replacement issues, but

may have a portion of the sidewalk that only rises to a moderate level of impairment. However, in calculating the scores shown in the aggregated data, the M/S score is computed as a significant impairment.

This assessment is a preliminary impression and as such, before expending funds on the repair or replacement of each section, it may be helpful to examine certain issues on a case-by-case basis. For example, it is possible that some sidewalks with vertical displacement may be repairable (by grinding and leveling disjointed sections) if the vertical displacement is not severe enough. Topography, the surrounding environment, and the age and structural condition of adjacent sidewalks are also relevant deciding factors in determining the proper remedial action for an impaired sidewalk.

Specifically, the procedure in conducting the inventory is as follows:

Field Procedures for Evaluating Each Section of Sidewalk:

1. On the sidewalk block evaluation form, the street being evaluated is listed.
2. Beginning in the section “from” to the section “to” on the form, measurements using a measuring wheel are created and each moderate or significant issue is noted on the form. The measurements under “station” are the number of linear feet that an issue is from the starting point. Measurements are taken from the centerline of a road at 0’. For example, if
3. Each issue is categorized as either “moderate” or “significant.”
4. The number of linear feet for the total block is placed on form.
5. The number and percentage of linear feet of sidewalk that appears to need replacement are calculated using the guidelines.
6. The number and percentage of linear feet of sidewalk that appears to need maintenance procedures is calculated using the guidelines.

A hypothetical example of a sidewalk assessment completed using this guideline is listed on the following page (Figure 2).

A hypothetical sidewalk map/diagram

Station 0' begins at street Centerline.

Lane A

30' (VD- Sig.)

Sidewalk

130' (SD- M/S)

170' (V-Moderate)

Lane B

Station 200' Ends at centerline

NOT TO SCALE

[illegible]

This methodology is designed not to only quantify sidewalk conditions on a block-by-block level, but also to utilize notes that measure the number of feet a particular impairment is from an intersection. This is helpful for several reasons:

1. Repair personnel in the field will know the exact location of sidewalk impairment and a work order can easily be produced from this research, including an estimate of costs for any project.
2. A consistent auditing system is available for use in any follow-up action.
3. Knowledge of the number of sidewalk sections requiring replacement and/or maintenance creates the ability to assign a definitive budget need to remedy a sidewalk's condition in a specific place. This is helpful in long-range planning regarding the monetary commitment needed to upgrade the sidewalks. This approach also has the potential for being helpful in grant applications, in that the requests are backed by field data and available for cross-examination and clarification for any specific issue with grantees, facilitating straightforwardness and trust between a grantee candidate and potential grantor.
4. An estimate of the exact number of linear feet allows budgeting and prioritization in an efficient manner and the strategic utilization of public resources for the public benefit. Utilizing grant applications in combination with budgetary planning for maintaining sidewalks shows a good faith effort that the community is working to address the condition of its sidewalks in a rational way and therefore increases the likelihood of funding.

Another issue is that some blocks of sidewalk that fall below a certain threshold to receive designation as moderately or significantly impaired, however, appear to be very close to meeting these thresholds. In this case, this condition is included on the notes. Also, some blocks of sidewalks, in addition to having the impairments that are noted, may have multiple impairments on one section. For example, a sidewalk section between 100' and 105' from the starting station point may have a moderate vertical displacement, a severe crack, and moderate vegetation growing on the sidewalk. In this case, if the vertical displacement warrants replacement of the sidewalk section to adequately address the problem, only 5' is figured into the replacement segment of the sidewalk and no value is counted towards maintenance (normally would be prescribed for the severe crack and moderate vegetation growing on the sidewalk) due to the fact the sidewalk needs to be replaced. The survey assessed a total of 25.5 linear miles of sidewalks within the City of Asheboro, **Some sidewalks were eliminated from this assessment. These include the following:**

Sections of sidewalks that are less than three (3) years old:

- North Fayetteville Street (between Pritchard Street and Old Liberty Road) (approx. 2.4 miles)
- Sunset Avenue (section in central business district recently replaced between Fayetteville Street and Church Street).
- Lexington Commons Drive (Lexington Commons Townhomes)
- Lexington Place (Lexington Commons Townhomes)
- Cannon Court (Lexington Commons Townhomes)
- Sykes Farm Road



Figure 3: Excluded Portion of Sidewalk *Survey not completed on newly redesigned Sunset Avenue section in the central business district. This section of sidewalk was resurfaced and various traffic calming devices (“neckdown”) utilized funded by a grant from North Carolina Department of Transportation Enhancements (GRANT E-4785).*

- Any sidewalk that is located on a privately maintained street, such as one within a townhouse planned unit development.
- Any sidewalk on privately or publicly owned property that is not along a street. For example, a walkway in front of a privately owned shopping mall is privately maintained and not computed in this survey.
- Any sidewalk on publicly owned property that is not along frontage of a public street is included. For example, although a walkway in front of a school building may be for public use, if this sidewalk is 200 feet from the closest public street, it is considered to be oriented towards the land use of the property and students, employees and visitors

Section under Construction at Time of Assessment:

- Hill Street (sidewalk under construction at S. Church Street in front of new Farmer’s Market)

d.) Comparison of the Asheboro Method with Other Methods

More general Likert scale type surveys (i.e. literature from Walkable Communities organizations) are perhaps more appropriately useful to gauge public opinion, while actual field measurements (percent and location impaired and in need of repair and/or replacement) are more appropriate for staff to use to estimate practical cost and labor required to improve overall sidewalk conditions. The Likert scale type (strongly agree or disagree that “this area is pleasant” or “this sidewalk seems to be maintained”) survey

completed by citizens may be of limited assistance in assigning budgetary estimates and setting goals for completion of projects improving sidewalks. However, when coupled with the technical review of sidewalk conditions, these community preference surveys can be very helpful when detailed survey notes for two sidewalk sections receive an identical score in terms of the needs for repair and replacement. In this case, one option in deciding which sidewalk receives preference of repair may be the results of citizen input on a preference survey. For example, if two sidewalks both require ten percent of a section to be replaced and ten percent to be repaired, but fifty percent of citizens rated Sidewalk “A” as in poor condition while ten percent rated sidewalk “B” as in poor condition, Sidewalk A would receive the priority for improvement. The analysis by staff combined with citizen input creates a less arbitrary prioritization while also allowing better citizen input.

CHAPTER 4: FINDINGS

a.) Overall Trends

The field inventory (as indicated on Table 4) found that overall 28 percent of Asheboro sidewalks (7.1 linear miles) have an impairment that is either in need of maintenance or replacement based on this internship report. More specifically, 16.9 percent of Asheboro sidewalk (4.3 miles) needs replacement, and 11.16 percent (2.9 miles) appears to need maintenance activity. 2.6 percent (0.7 linear miles) has significant maintenance impairment, and 8.63 percent (2.2 linear miles) has a significant impairment in which the replacement of the sidewalk is recommended.

TABLE 4: CITY OF ASHEBORO SUMMARY OF FIELD INVENTORY

	<u>FEET</u>	<u>MILES</u>	<u>PERCENTAGE</u>
Number of linear feet surveyed:	134,619	(25.496 miles)	
Total # of linear feet needing replacement:	22,704	(4.3 miles)	<u>16.87 %</u>
Total # of linear feet needing maintenance:	15,023	(2.85 miles)	<u>11.16 %</u>
Total needing maintenance/replacement	37, 737	(7.13 miles)	<u>28.03 %</u>
<u>Total # of linear feet with significant Maintenance issues</u>	3,460	(0.66 miles)	<u>2.57%</u>
<u>Total # of linear feet with significant Replacement issues</u>	8,160	(1.55 miles)	<u>6.06 %</u>
<u>Total Significant Impairment (of all sidewalk in study)</u>	11,620	(2.2 miles)	<u>8.63 %</u>
Number of blocks surveyed:	<u>235</u>		

These findings should not be interpreted to mean that the remaining 72 percent of sidewalks in Asheboro are in perfect condition. These remaining sidewalks were in varying conditions, from just old enough to be studied but lacking in defects, to older sections of sidewalk that could easily become notably defective if placed under any increased level of stress, such as expanding tree roots or weathering from intense sunlight. But 28 percent of sidewalks are clearly evident in need of either maintenance or replacement. Those that were considered close to needing attention but did not rise to the threshold of needing maintenance or replacement may be mentioned in the notes and flagged for closer monitoring in the near future. Examples of detailed results of each block of sidewalk are included in the appendix of this paper. The results from each individual block were tabulated with basic statistics tabulated using SPSS statistical software.

Table 5 shows the maintenance and replacement of sidewalks recommended for main corridors in Asheboro. Figures 6, 7, and 8 show the aggregated percentage of sidewalks that need replacement, maintenance, and overall have some type of impairment along transportation corridors. Figures 6 and 7 indicate that the corridors that have high replacement needs also typically have relatively high combined (replacement and maintenance) needs for improvement. However, as Table 8 indicates, the areas that have a relatively high need for maintenance (such as Brewer Street) did not have an overall great need for replacement. This finding is possibly explained by sidewalk repair and

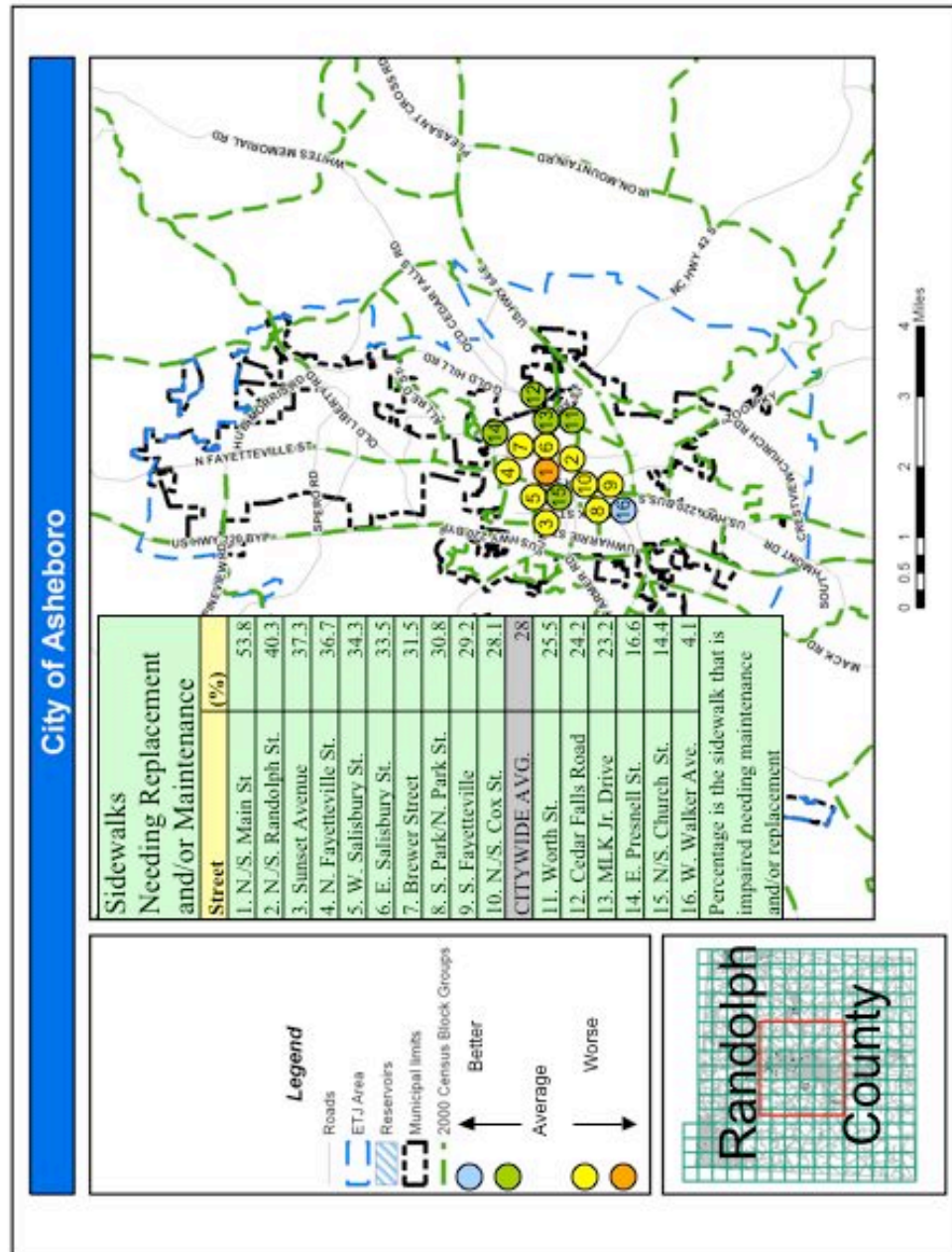
maintenance being sometimes complaint-driven, with areas receiving more complaints generally prioritized more for intensive maintenance.

TABLE 5: REPLACEMENT AND MAINTENANCE NEEDED ON SIDEWALKS (BY CORRIDOR)

Street/Rank (worst to best)	Linear (ft.)	Replace (ft.)	Replace (%)	Maint. (ft.)	Maint. %	Combined (ft.)	Combined (%).
1.N./S. Main St	3,655	1240	33.9	725	19.8	1965	53.8
2.N./S. Randolph St.	4,288	890	20.8	840	19.6	1730	40.3
3. Sunset Ave.	7,471	1,820	24.4	965	12.9	2785	37.3
4.N. Fayetteville St.	7916	2055	26	850	10.7	2905	36.7
5.W.Salisbury St.	6,162	1,535	24.9	580	9.4	2115	34.3
6. E. Salisbury St.	3,982	650	16.3	685	17.2	1335	33.5
7. Brewer Street	3,283	300	9.1	735	22.4	1035	31.5
8. N./S. Park St.		3475	24.8	840	6	4315	30.8
9. S. Fayetteville	6824	1375	20.2	620	9.1	1995	29.2
10. N./S. Cox St.	11,053	1450	13.1	1655	15	3105	28.1
11. Worth St.	6,067	920	15.1	630	10.5	1550	25.5
12.Cedar Falls Rd.	786	105	13.4	85	10.8	190	24.2
13. Martin Luther King Jr. Dr.	2,577	385	14.9	212	8.2	597	23.2
14. E. Presnell St.	1,174	130	11.1	65	5.5	195	16.6
15. N./S. Church St.	11957	855	7.2	865	7.2	1720	14.4
West Walker Ave.	1450	15	1	45	3.1	60	4.1
CITYWIDE	134,619	22,704	16.9	15,023	11.2	37,737	28
LEGEND	Condit ion	Corridors with above average (greater than the mean) combined replacement and maintenace needs are highlighted in yellow.					
	Worst	The corridor with the greatest needs in each category is highlighted in orange (combined score has name highlighted).					
		Corridors with below average needs are highlighted in green.					
	Best	The corridor with the lowest maintenance and replacement needs is highlighted in blue.					

Figure 6

Combined Sidewalk Impairment Scores by Corridor: Maintenance and Replacement Needed
 The combined score is calculated by combining the percentage of sidewalks needing repair with the percentage of sidewalks needing replacement.



Combined Sidewalk Impairment Scores by Corridor: Replacement Needed

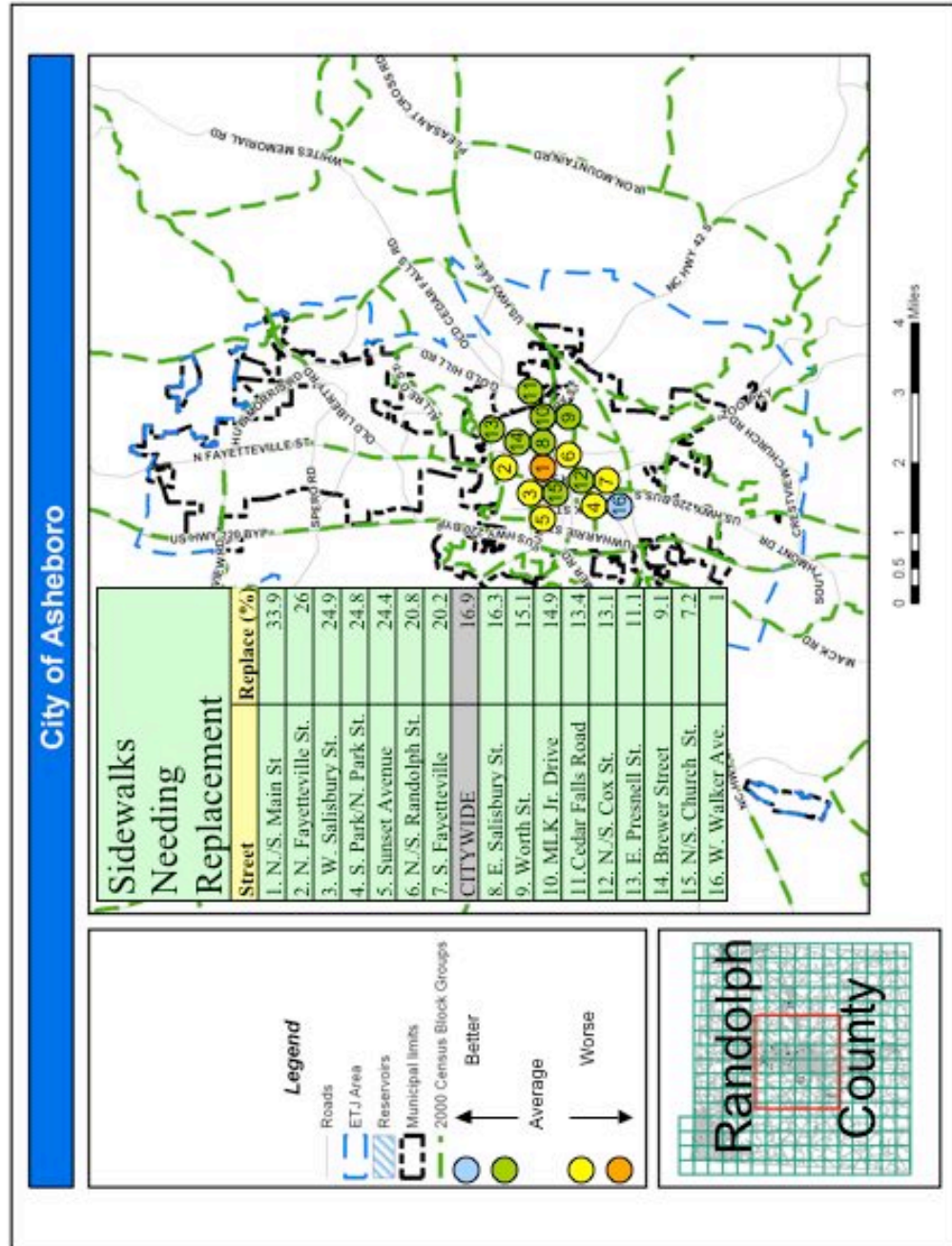


Figure 7

Combined Sidewalk Impairment Scores by Corridor: Maintenance Needed

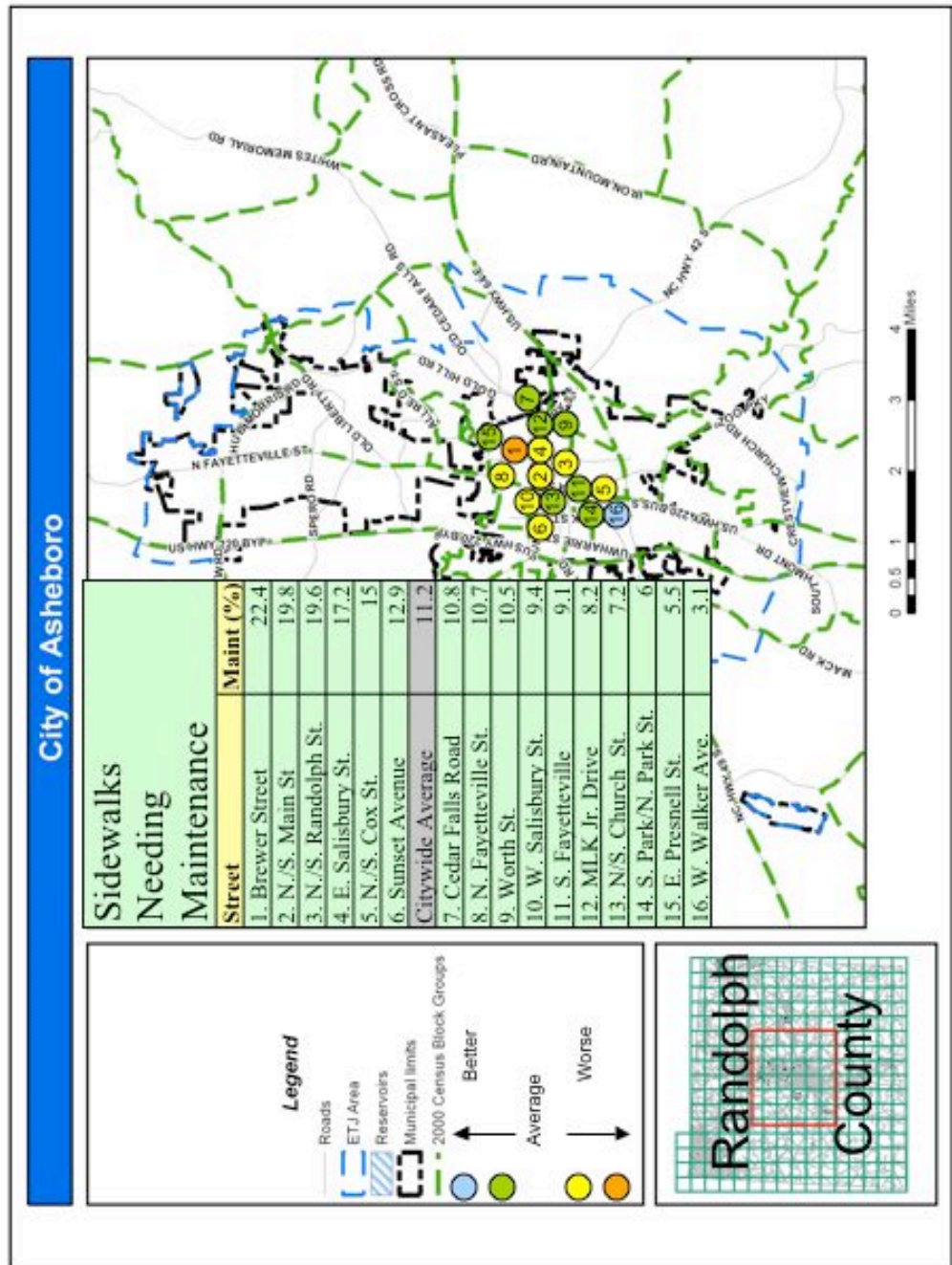


FIGURE 8

b.)Blocks with Significant Replacement Needs

These blocks are important to focus on for two reasons. First, conditions are simply such that replacement is in order as the sidewalks are too deteriorated to repair. Second, the sidewalk is rated as significantly impaired and is likely to create a more negative psychological and physically obstructing experience to a pedestrian's travels. The citywide average of sidewalks that are significantly deteriorated and need replacement is 8,160 linear feet, or just over six percent of the city's sidewalks. The areas that tend to have above average *significant* replacement needs not surprisingly have a greater than average proportion of sidewalks that are generally impaired and need replacement or maintenance. Also, not surprisingly, these areas tend to be in the older areas of the community. Fifteen hundred twenty (1,520) linear feet of sidewalk need to be replaced along North and South Park Street, or 10.8 percent of the total sidewalk area is significantly deteriorated. At the time of the study, along Sunset Avenue, 770 linear feet (10.3 percent) of the total seven thousand four hundred and 7,471 linear feet was significantly impaired to the point that it needs to be replaced. Sunset Avenue has recently been resurfaced and the majority of the sidewalk has been repaired by North Carolina Department of Transportation. In general, it is recommended that those segments of sidewalk that are significantly impaired needing replacement should be the top priority to replace.

c.) Special Needs Areas of the City

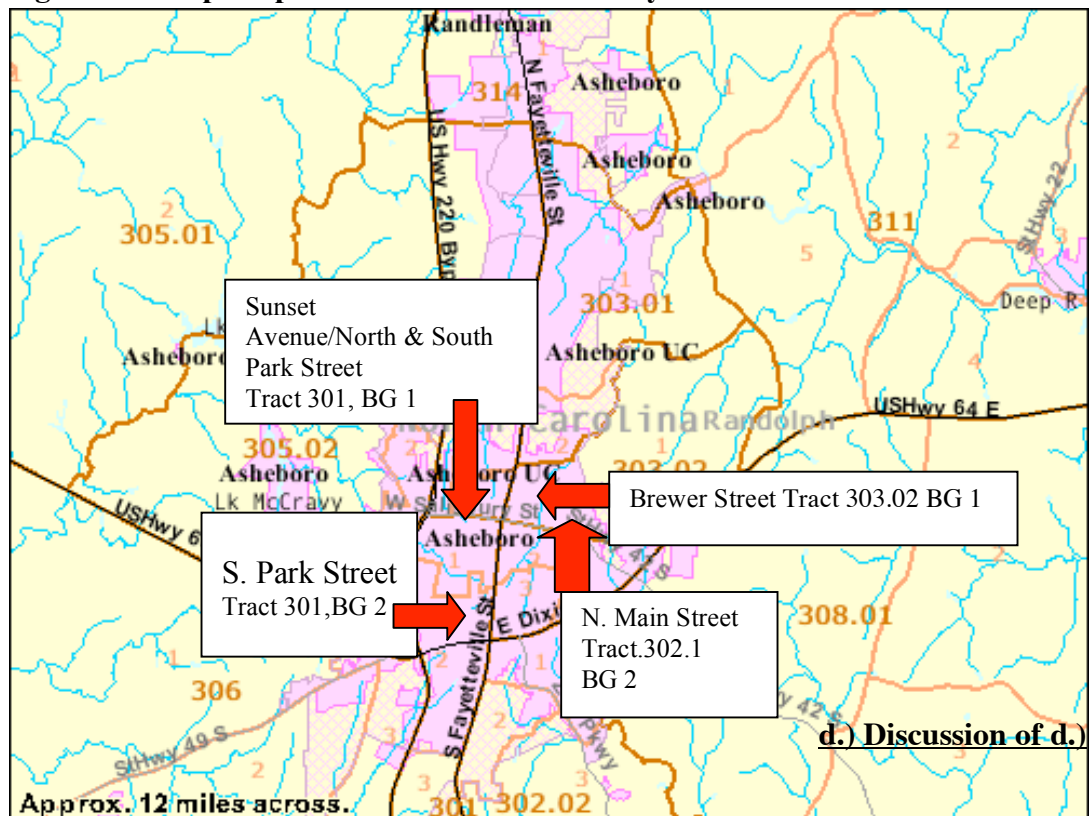
There are several areas that had some unique features in evaluating the sidewalk conditions of the City of Asheboro. It needs to be explicitly stated that the areas profiled as focus areas are not areas that will or even should receive additional resources above any other areas. The public workshops that will be held and surveys that will be distributed will develop the City's Comprehensive Pedestrian Plan and will determine the areas that should receive the greatest attention as a matter of policy. The purpose of selecting special needs areas is to offer examples of the types of considerations that often weigh into policy decisions for focusing additional attention on a particular area of the city. Mixed land uses, with schools, offices, businesses, civic and cultural uses, and residences in close proximity to one another create a much greater demand for sidewalks. Certain segments of the population may receive an even greater benefit from sidewalks than the public at large. For instance, an area may have a high concentration of adults with disabilities or a high percentage of persons in poverty or without access to a vehicle that may need access to pedestrian facilities more than other groups of people. In this analysis, the age of persons with a disability (between 21 and 64) was chosen because this age group may need specific pedestrian-friendly environments (i.e. curb ramps, well-maintained sidewalks, suitable for wheelchairs). Additionally, the elderly were also considered since they may be unable to drive as they age.

Table 9: Socioeconomic data of special needs areas of the city

AREAS	N./S. Park St./ Sunset Ave.	S. Park Street	Brewer Street	N. Main Street	City of Asheboro	NC
Corresponding census tract and census block group	Tract 301 BG 1	Tract 301 BG 2	Tract 303.2 BG 1	Tract 301.2 BG 2		
% of persons > 65 years of age	13	15.9	19	20.9	15.1	12
% of persons ages 21-64 with disability	31.4	17.7	34.8	27.3	19.2	17.0
Median Household Income (1999)	\$29,926	\$30,354	\$25,471	\$27,241	\$31,676	\$39,184
Percent of People with no access to a vehicle	11	5.1	16.1	16.8	8.9	7.5
Percent of workers who walk or bike to work	5	1.5	1.5	3.2	5.2	2.1
Persons of person in poverty	16.2	22.2	27.9	9.7	15.8	12.3

Source: United States Census Bureau, Block Groups, 2000

Figure 10: Map of special needs areas in the city



d.) Discussion of Special Needs Areas

Sunset Avenue:

Sunset Avenue is a corridor classified by the North Carolina Department of Transportation as a major thoroughfare that has the greatest overall impairment score in this classification. Sunset Avenue is located in the same census tract and block group as the northern section of Park Street (Tract 301, Block Group 1). Although some local streets on a whole have a higher impairment score, Sunset Avenue serves as a gateway between the four-lane divided US Hwy 220 Bypass (Future Interstate I-73/I-74), and the downtown area. Therefore, Sunset Avenue is a corridor that serves as a first impression for many travelers entering the central business district of Asheboro. One segment of Sunset Avenue located in the core of the central business district, between South Church Street and South Fayetteville Street, was not surveyed due to sidewalk, landscaping, and traffic calming improvements being completed in 2004, and, thus, this section was excluded from the field inventory.

Sunset Avenue is located within Census Tract 301, Block Group 1. In this block group, 11 percent of housing units do not have access to a private automobile. However, just a few blocks to the north of Sunset Avenue, in Census Tract 304, Block Group 2, 28.1 percent of households do not have access to a vehicle, which is more than triple the city's average. At the time of the survey, 24.9 percent of sidewalks along Sunset Avenue needed to be replaced, compared with 16.9 percent of sidewalks that needed to be replaced citywide. Recently, the North Carolina Department of Transportation made

improvements to the roadway surface along Sunset Avenue; therefore, sidewalk improvements (resurfacing and rebuilding the sidewalk) have been completed to enhance the area's transportation infrastructure.

North and South Park Street:

North and South Park Street is considered a major thoroughfare by the North Carolina Department of Transportation. Park Street includes two census block groups. The northern portion is located in the same census block group as the Sunset Avenue corridor (Census Tract 301, Block Group 1). The southern portion of Park Street is located in Census Tract 301, Block Group 2). The street is worth mentioning in part because of its land uses. The street is home of two city parks, Asheboro's only high school, South Asheboro Middle School, Loflin Elementary School and serves as a main gateway between the central business district and one of Asheboro's key arterial roads, US Highway 64 (Dixie Drive). The percentage of adults over age 65 in Block Group 1 is slightly below the city average (City average=15.1 percent) at 13 percent, but Block Group 2 is about the city average at 15.9 percent. The percentage of adults with a disability in the census block groups corresponding with Park Street are 31.4 percent and 17.2 percent for Block Group 1 and 2, respectively, compared to the citywide average of 19.2 percent. The area's median household income is slightly lower than the city's average of \$31,676, with Block Group 1 having a median household income of \$29,926 and Block Group 2 having a median household income of \$30,354. Community interest by both government and citizens in the use of this area for walking is notable. The City of

Asheboro Parks and Recreation Department and the Randolph County Health Department in conjunction with the Randolph Health Improvement Partnership sponsored a Weekday Walking Program, encouraging people to walk for fitness along this corridor during the lunchtime hours each Tuesday and Thursday. Low income housing for elderly persons is located within two blocks of South Park Street in both the northern and southern portions of the corridor. Additionally, 11 percent of occupied housing units in the northern portion of this area (Tract 301, Block Group 1) do not have access to a private motor vehicle, compared to 8.9 percent of residents within the city as a whole. Moreover, 10.8 percent of the sidewalks along Park Street are impaired significantly to the point of needing replacement compared to the citywide average of 6.1 percent.

Brewer Street:

Brewer Street serves the residential neighborhoods to the east of the Asheboro central business district. The percentage of sidewalks that appears to be due for replacement is 9.1 percent. This is just a little more than half of the overall citywide rate of 16.9 percent of sidewalks that needs to be replaced. As shown on Table 5, approximately 22.4 percent of all sidewalks need some type of maintenance work, the highest of any corridor, compared to the citywide average of 11.2 percent of sidewalks that need maintenance attention. Focusing on areas such as Brewer Street that need maintenance will prevent maintenance issues, such as minor cracking, from progressing to significant surface deterioration at a greater cost to remedy. Socioeconomic factors also create an acute need for sidewalks along this corridor. Brewer Street has the highest

proportion of residents in poverty of the special needs areas (27.9%) and the highest percentage (34.8%) of adults between 21 and 64 years of age with a disability.

North Main Street:

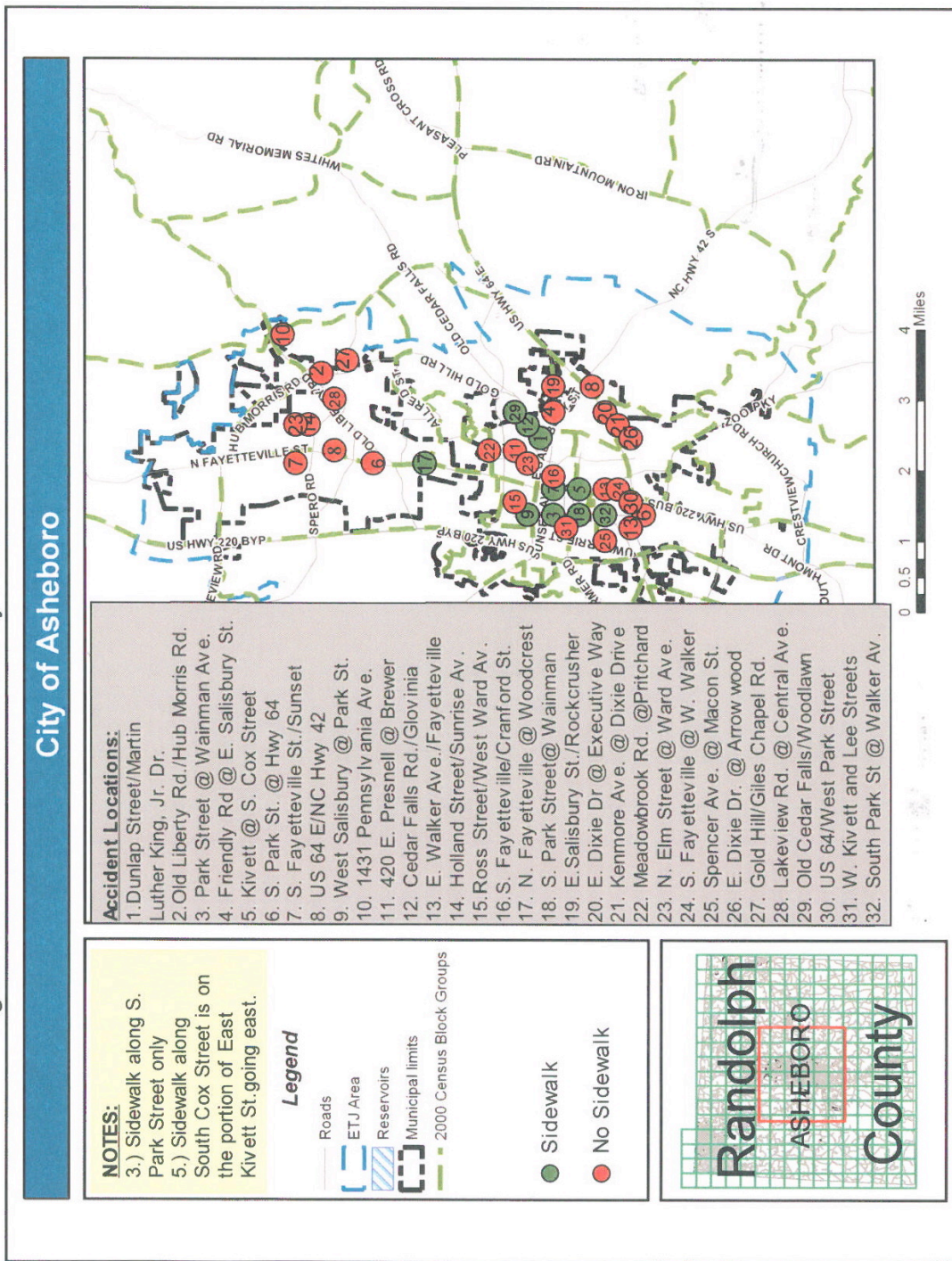
The block of North Main Street between East Salisbury and Worth Streets (on the west side of the street) has the greatest replacement percentage of any block within the City of Asheboro. Approximately 73 percent of this sidewalk needs to be replaced, and 1.3 percent needs some maintenance work. The replacement percentage of this sidewalk is more than four standard deviations above the mean value citywide at 16.3 percent of all city sidewalks. In addition, the sidewalk is located between the Randolph County Courthouse and the Randolph County library, just outside the central business, resulting in a substantial amount of pedestrian activity. Poverty in the Census Block Group (Tract 301.2, Block Group 2) in which North Main Street is located is lower than both Asheboro and North Carolina. However, it is located in a census block group with a relatively low median household income (\$27,241) that is below both the city and state median. North Main Street has both a higher percentage of older adults and adults between the ages of 21 and 64 with a disability compared with Asheboro and North Carolina.

e.) Pedestrian Accidents and Sidewalks:

One of the criteria often used to determine where sidewalk improvements need to be made is the frequency of pedestrian accidents that occur in a specific area. While many of these accidents are undoubtedly caused by random factors not associated with the presence or lack of sidewalks, an overview of where the pedestrian accidents have

occurred is helpful in evaluating the safety needs of the community. In evaluating pedestrian accidents in Asheboro (Figure 11) (those occurring on private property are excluded), there are several areas in which pedestrian accidents appear to be clustered.

Figure 11: Pedestrian Accidents by Presence of Sidewalks: 2001 to 2005



There is a cluster of accidents in the downtown area, particularly west of South Fayetteville Street and north of East Salisbury Street. These areas contain mixed land uses, including schools, public buildings, offices, commercial, religious civic and residential land uses that experience a higher level of pedestrian activity. Many of these are in the vicinity of several schools, including Asheboro High School, South Asheboro Middle School, and Donna Loflin B. Elementary School. These areas are especially conducive to the support of the Safe Routes to School programs discussed in this analysis. The second cluster is along East Dixie Drive, which is a higher speed arterial providing much of the retail hub for Asheboro with retail big box stores, fast food outlets and the like, yet in close proximity to several residential areas, many of which house employees of these businesses. The third main cluster of activity is in north Asheboro, particularly north of the intersection of North Fayetteville Street and Vision Drive. This area has a mix of land uses and has experienced much recent residential construction, particularly of multi-family apartment complexes along North Fayetteville Street. Despite the increasing density, this area lacks sidewalks along North Fayetteville Street south of the Vision Drive/Old Liberty Road intersection.

Of the 32 pedestrian accidents occurring in Asheboro between 2001 and 2005, only ten of these occurred at a location with public sidewalks. Table 12 compares Asheboro's pedestrian accident rates with similar cities based on data obtained from the North Carolina Department of Transportation statistics and the University of North Carolina Highway Safety Research Center. The cities chosen were selected based on a

similar socioeconomic and spatial morphology and are also those comparison cities used in Asheboro's comprehensive Land Use Plan data and Strategic Planning initiative. Asheboro has a higher than average accident rate than the state as a whole and Randolph County (Table 13 and 14). For example, while Asheboro comprises only 16.6 percent of Randolph County's population, it accounts for exactly half of the 164 pedestrian accidents between 1997 and 2004. As indicated on the following page (Table 13), one pedestrian accident occurred for every 264.3 Asheboro residents (2000 Census). This was slightly higher than the one pedestrian accident for each 306.3 residents in the five comparison cities (not including Randolph County as a whole). The percentage of pedestrian accidents attributable to the fault of a motor vehicle in Asheboro was higher than all the comparison areas, but comparable to the state as a whole. (See Table 14 on following page.)

Table 12: Comparison Cities and Number of Pedestrian Accidents

	Population: 2000 Census	Pedestrian Accidents (1997-2004)
Sanford	23,220	91
Shelby	19,477	87
Asheboro	21,672	82
Lexington	19,953	54
Reidsville	14,485	50
Shelby	26,462	45

Table 13: Asheboro Pedestrian Accidents Per Capita and Comparison With Similar Areas

	Population: 2000 Census	Pedestrian Accidents (1997-2004)	Ratio: Population per Accident
Salisbury	26,462	45	588
Lexington	19,953	54	369.5
Reidsville	14,485	50	289.7
Asheboro	21,672	82	264.3
Sanford	23,220	91	255.2
Shelby	19,477	87	223.9
Mean of Comparison Cities	-	-	331.8
Randolph Co.	130,454	164	795.5
NC	8,049,313	18538	434.2

Table 14: Percentage of Pedestrian Accidents in which the Motor Vehicle is at Fault

	Population: 2000 Census	Pedestrian Accidents (1997-2004)	% Vehicle Fault
Asheboro	21,672	82	31.7
Reidsville	14,485	50	30
Lexington	19,953	54	27.8
Shelby	19,477	87	27.6
Sanford	23,220	91	25.3
Salisbury	26,462	45	20
Mean of Comparison Cities	-	-	27.1
Randolph Co.	130,454	164	30.5
NC	8,049,313	18538	31.9

Source: North Carolina Department of Transportation.

CHAPTER 5: CONCLUSION AND BROADER PLANNING IMPLICATIONS

The base of information gained from this survey lends itself to many future research opportunities. Due to the recent enactment by City Council on January 6, 2005 requiring developers of new non-residential construction to provide a sidewalk along the frontage of public streets, this research can show where sidewalk quality needs to be addressed to provide the best connections to new sidewalks. The inventory of sidewalk needs also lends itself to demographic analysis in the provision of sidewalk repair and sidewalk replacement and prioritization. A scoring methodology similar to the one proposed in this internship report could help further prioritize the funding and support of sidewalk projects. A considerable amount of support exists for additional research and public input activities in the form of a 2006 Pedestrian Planning Grant. The research conducted thus far lends itself to the application of additional grants, and as the maintenance needs are addressed from city funds based on a knowledge of greatest need, it illustrates to any potential grantor that the City has a rational strategy for improving its pedestrian environment as opposed to a completely reactive system of addressing those issues that are only brought to attention by complaint.

A pedestrian planning grant was recently awarded to the City of Asheboro by the North Carolina Department of Transportation. In partnership with the North Carolina Department of Transportation, the city committed \$9,000 of local funds to develop a

comprehensive pedestrian plan to be matched by \$21,000 of state funds for the comprehensive planning process. Asheboro was one of 39 communities to apply for the Planning Grant. Ultimately, the pedestrian grant was awarded to only six municipalities (Table 15).

Table 15: North Carolina Department of Transportation Pedestrian Planning Grant Recipients

Municipality	Population	Funds Awarded	Type of Plan
Asheboro	22,709	\$21,000	Pedestrian
Badin	1,971	\$16,000	Pedestrian
Black Mountain	7,598	\$20,000	Pedestrian
Cramerton	3,200	\$19,200	Pedestrian
Hertford	2,000	\$20,000	Pedestrian
Kinston	23,688	\$31,500	Pedestrian

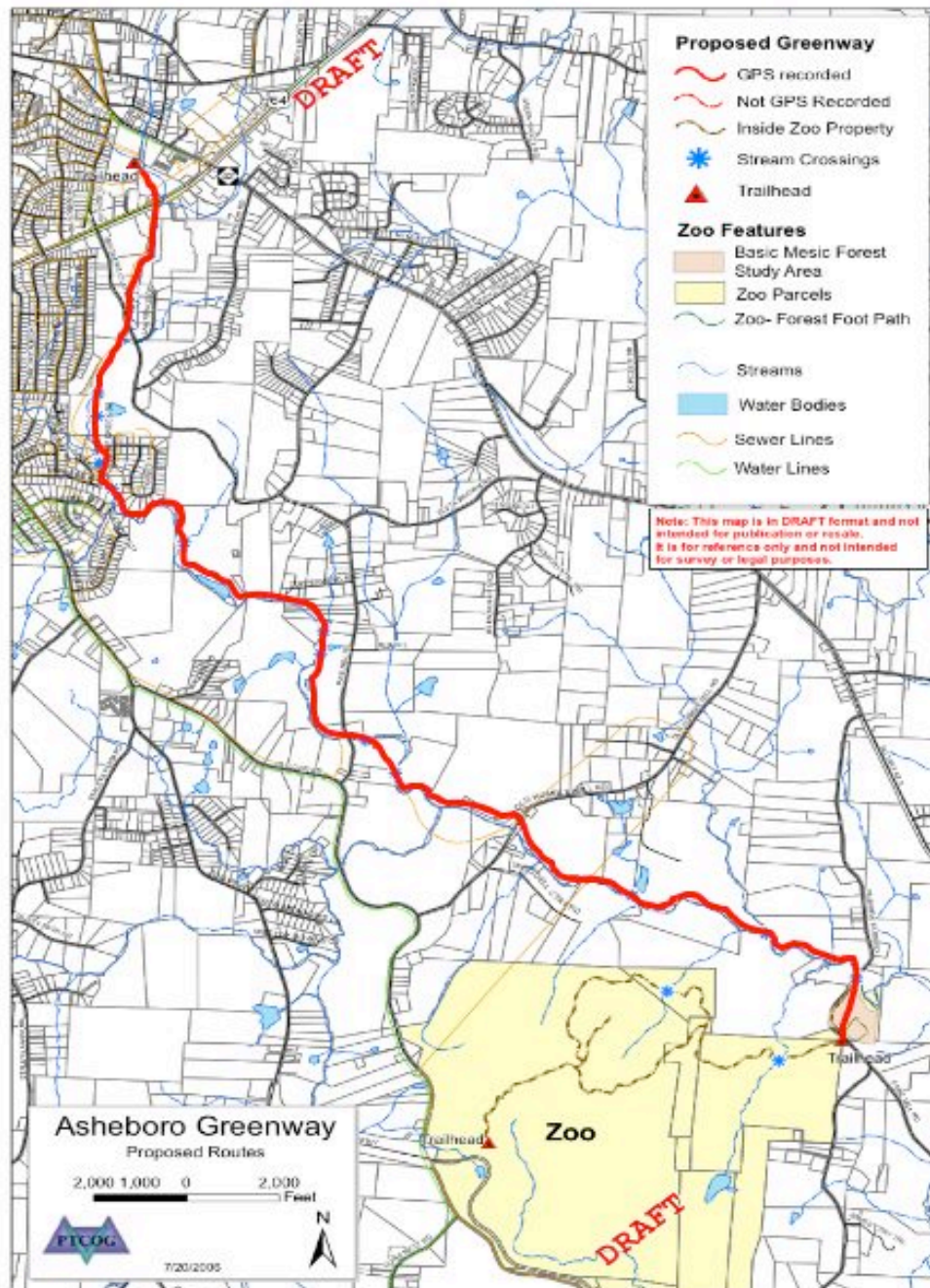
Source: North Carolina Department of Transportation, 2006

This grant award will allow Asheboro to examine the pedestrian environment in more detail. In addition to the maintenance issues addressed in this paper, the comprehensive plan will focus on prioritizing the expansion of sidewalks and creating a better overall pedestrian network in Asheboro. The plan will focus on safety and enforcement programs, such as school crossing guards, accessibility of sidewalks to persons with disabilities, the relationship of land use patterns to sidewalks, and opportunities for greenways. The City will work in conjunction with requirements of the Grantee, the North Carolina Department of Transportation, the respective rural planning organization (RPO), and consultants in gaining public insight into the current situation and challenges facing Asheboro's pedestrian environment. This grant will also likely better position the City to receive awards for specific sidewalk projects, since one of the selection criteria listed by North Carolina Department of Transportation to receive

Transportation Improvement Program funds is the existence of comprehensive planning activities (North Carolina Department of Transportation, 2006). The Comprehensive Pedestrian Plan will also complement updates to the Comprehensive Land Use Plan, Zoning and Subdivision regulations, and Strategic Planning initiative that Asheboro is currently undergoing.

Information obtained regarding sidewalk conditions can also complement the city's Park and Recreation Master Plan that was adopted in 2004 and includes provisions for greenway construction. The city has a greenway around the Lake Lucas Park and North Asheboro Park but desires to see the expansion of greenways both within the City limits and within the extraterritorial zoning jurisdiction. A challenge in connecting the greenways to the sidewalks is the often-piecemeal construction of isolated sidewalk and/or greenway segments that are built pursuant to regulations that require a developer to include sidewalks, but the process must start before substantial progress can be realized over a sustained period of time. An ambitious effort that is now in its embryonic stage is to eventually connect the City's greenway system to the North Carolina Zoological Park, approximately six miles south of Asheboro. Recently, the North Carolina Department of Transportation funded a feasibility study to study the possibility of this greenway and to negotiate with private property owners along the greenway to grant a greenway easement. The Asheboro-Randolph Chamber of Commerce originally proposed the greenway project. Currently, the City is in the process of negotiations with property owners along the proposed route. The ultimate feasibility of the greenway is

dependent on the level of community support, particularly by property owners adjacent to the proposed greenway. Figure 16 illustrates the approximate location of the proposed greenway, although no final alignment has been made. The greenway ultimately could connect with the city's sidewalks and the starting point is within a quarter of a mile of several area hotels, which also would offer tourists a scenic route to the zoo by bicycle for those that prefer not to drive to the zoo. Citizen input has been keen and citizens have rallied both in favor and in opposition to the greenway proposal. Those in favor of the greenway have cited the improvement to Asheboro's recreational opportunities, public health benefits, and economic development. Opponents have primarily been property owners along the proposed route who have concerns over privacy, public access across their properties once an easement is granted, and the potential liability that this access may create. A preliminary estimate to construct the greenway, not including any bridge crossings that may be necessary, is \$2.4 million. The North Carolina Department of Transportation has indicated a willingness to pay the costs to construct the greenway if the city negotiates easement locations from property owners on the greenway path. A tentative construction timeline is between 2010 and 2012 if the project proceeds.



Map courtesy of Piedmont Triad Council of Governments and modified by John Evans.

Figure 16: Approximate location of proposed Greenway to the Zoo

Figure 17: Along the Path of the Potential Greenway to the Zoo Corridor



Above: An area along the proposed Greenway to the Zoo corridor, approximately 2 miles south of US Hwy 64.

Currently, when a conditional use permit for a planned unit development is applied for, a condition that has been imposed by Council has been that the developers provide a greenway easement in the subdivision. Future plans include requiring these conditions as part of the subdivision ordinance instead of a condition for specific special or conditional use permits and to record the easement with the Register of Deeds instead of simply as part of a site plan approved and administered by the Zoning and Subdivision Ordinance. The internship report methodology could be used to determine where to prioritize maintenance projects of existing sidewalks so that each segment of the city receives a reasonably equitable provision of services and a network of well maintained sidewalks exists from each direction from the periphery to the central core of Asheboro.

One additional challenge facing Asheboro in its sidewalk network is construction of sidewalks on non curb and gutter streets, particularly those that have large right-of-way distances between the edge of the pavement and those in which the street will likely be widened, necessitating relocation of a sidewalk. Currently, Asheboro's ordinance has no different provision for sidewalk construction on streets without curb and gutter. The current best practices in engineering call for sidewalks on such streets to be located outside the public right-of-way, essentially on private property. (See Figure 18 on following page.) This requirement has led to five Board of Adjustment requests for relief from the sidewalk requirement along streets without curb and gutter. In three of four cases (with one pending), the Board of Adjustment has granted the variance to exempt these properties from sidewalk construction. In spirit, the necessity for sidewalks along these streets is no less than streets with curb and gutter, which also create an additional barrier between motorists and pedestrians. However, due to the impending comprehensive pedestrian plan, and the prospect of finding a more workable solution that balances the public need for sidewalks with private property rights, the City Council voted in October, 2007, to exclude the requirement of the property owner constructing sidewalks on streets without curb and gutter or on streets with platted right-of-way, but where no street exists. One recommendation the Planning Department staff has offered to City Council for consideration is to require sidewalks in all new major land subdivisions, which is a requirement that currently does not exist.



Figure 18: *Sidewalk is to be constructed approximately where the line is drawn on a street without curbing and guttering. One concern that has been raised is that this conflicts with the ability to use a substantial area of land on a smaller lot due to the large setback of sidewalks.*

Empirical data gathered in this internship report is intended to be a springboard that complements the ongoing Pedestrian Master Plan. Public input is especially crucial in determining the success of sidewalk revitalization in Asheboro. To this end, a continuing phase of this project will be gauging public opinion by means such as surveying citizens through various methods. Several options include surveying all residential and water customers by means of a mailed postcard, surveying a random sample of water customers, or surveying those most likely affected by sidewalks, such as civic groups that meet for walking.

One of the key goals City Council articulated in its Annual Planning Retreat in May, 2004, was the development of a sidewalk repair plan (City of Asheboro, 2004). This effort is intended to address this important goal. The opinions expressed in this document are meant to be “talking points” to allow the community to articulate a vision for sidewalks, but there is a realization that this document is limited if not implemented. The most fundamental goal of this paper is that it can be utilized as a tool to spur the interests of citizens, elected officials, governmental agencies within and outside of city government, and the business and development community. With the financial and moral support of all these stakeholders, a quality pedestrian environment in Asheboro will flourish.

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APPENDICES

The following pages are illustrative examples of data compiled after evaluating each block of sidewalk in the field. The results of each block's condition are included in 60 pages of data for the entire city of Asheboro after each block of sidewalk was physically inspected and rated based on its condition. The results shown in these appendices were tabulated from the database used when assessing specific deficiencies of each block of sidewalk in the field, identical to the example shown in Figure 2. The database for specific sidewalk deficiencies and their locations on each block of sidewalk is contained in another database containing 312 pages evaluating the 235 sidewalk blocks that are rated in this internship report.

Appendix 1: Illustrative Example of Database Collected (Sidewalks with Greatest Combined Replacement and Maintenance Needs)

Blocks in the bottom 25th percentile with the greatest combined replacement and maintenance needs ($\geq 37.5\%$) are highlighted in yellow.

Street	Direction	Start	End	Linear Feet	Replace/Maint (ft)	Total Impaired (%)
S. Park	east	Hill	Sunset	501	115	23
S. Park	east	Wainman	Hill	848	375	44.2
S. Park	east	Holly	Wainman	374	175	46.8
S. Park	east	Holly	Kivett	337	155	46
S. Park	east	Kivett	Lanier	390	165	42.3
S. Park	east	Lanier	Armfield	1177	630	53.5
S. Park	east	Cooper	Armfield	830	365	44
S. Park	east	Taft	Cooper	580	165	28.4
S. Park	east	Walker	Taft	569	120	21.1
S. Park	east	Walker	Dixie	592	0	0
S. Park	west	Sunset	Home	805	315	39.1
S. Park	west	Home	Wainman	536	175	32.6
S. Park	west	Wainman	Holly	375	110	29.3
S. Park	west	Holly	Kivett	337	75	22.2
S. Park	west	Kivett	Spencer	1791	550	30.7
S. Park	west	Cooper	Spencer	631	160	25.4
S. Park	west	Walker	S. of LGCU	522	60	11.5
S. Park	west	Walker	Dixie	835	50	6
N. Park	east	Hoover	Sunset	469	50	10.7
N. Park	east	W. Salisbury	Hoover	526	240	45.6
N. Park	west	Sunset	Hoover	465	65	14
N. Park	west	Hoover	Salisbury	528	200	37.9
W. Walker	south	S. Park	S. Church	725	20	2.8
W. Walker	north	S. Church	S. Park	725	40	5.5
Holly	north	S. Park St.	Driveway	249	45	18.1
Holly	north	S. Park St.	End (west)	188	30	16
Holly	south	sidewalk end	E. of S. Park	138	30	21.7
Armfield	north	Bryan	S. Park	380	30	7.9
Kivett	south	S. Park St.	end	289	60	20.8
W. Kivett	south	E. Hanover	end	519	145	27.9

Appendix 2: Illustrative Example of Database Collected (Sidewalks Needing Replacement)

Overall Scores by Block Sidewalks in bottom 25th percentile (with greater than 24.4 percent of sidewalks needing replaced) are highlighted in yellow.

Street	Direction	Start	End	Linear Feet	Replace. (ft)	Replace (%)
S. Park	east	Hill	Sunset	501	90	18
S. Park	east	Wainman	Hill	848	275	32.4
S. Park	east	Holly	Wainman	374	150	40.1
S. Park	east	Holly	Kivett	337	140	41.5
S. Park	east	Kivett	Lanier	390	150	38.5
S. Park	east	Lanier	Armfield	1177	525	44.6
S. Park	east	Cooper	Armfield	830	245	29.5
S. Park	east	Taft	Cooper	580	140	24.1
S. Park	east	Walker	Taft	569	85	14.9
S. Park	east	Walker	Dixie	592	0	0
S. Park	west	Sunset	Home	805	275	34.2
S. Park	west	Home	Wainman	536	150	28
S. Park	west	Wainman	Holly	375	90	24
S. Park	west	Holly	Kivett	337	65	19.3
S. Park	west	Kivett	Spencer	1791	435	24.2
S. Park	west	Cooper	Spencer	631	135	21.4
S. Park	west	Walker	S. of LGCU	522	40	7.7
S. Park	west	Walker	Dixie	835	40	4.8
N. Park	east	Hoover	Sunset	469	40	8.5
N. Park	east	W. Salisbury	Hoover	526	180	34.2
N. Park	west	Sunset	Hoover	465	55	11.8
N. Park	west	Hoover	Salisbury	528	170	32.2
W. Walker	south	S. Park	S. Church	725	0	0
W. Walker	north	S. Church	S. Park	725	15	2.1
Holly	north	S. Park St.	Driveway	249	35	14.1
Holly	north	S. Park St.	End (west)	188	20	10.6
Holly	south	sidewalk end	E. of S. Park	138	25	18.1
Armfield	north	Bryan	S. Park	380	5	1.3
Kivett	south	S. Park St.	end	289	45	15.6
W. Kivett	south	E. Hanover	end	519	80	15.4

Appendix 3: Illustrative Example of Database Collected (Sidewalks Needing Maintenance) The bottom 25th percentile (with greatest maintenance needs) (in which >= 13.5 percent needing maintenance) are highlighted in yellow.

Street	Direction	Start	End	Linear Feet	Maint. (ft)	Maint. (%)
N. Church	west	Hoover	W. Salisbury	413	25	6
N. Church	west	Sunset	Hoover	452	10	2.2
N. Church	east	W. Salisbury	Sunset	845	65	7.7
S. Church	east	Sunset	W. Academy	863	55	6.4
S. Church	east	W. Academy	W. Wainman	471	45	9.6
S. Church	east	Holly	W. Wainman	391	25	6.4
S. Church	east	Kivett	Holly	305	30	9.8
S. Church	east	Lanier	Kivett	404	20	5
S. Church	east	Armfield	Lanier	1133	105	9.3
S. Church	east	Cooper	Armfield	349	40	11.5
S. Church	east	Caspn	Cooper	468	30	6.4
S. Church	east	Taft	Caspn	592	120	20.3
S. Church	east	W. Walker	Taft	580	55	9.5
S. Church	west	Hill	Sunset	450	10	2.2
S. Church	west	Freedom	Hill	632	45	7.1
S. Church	west	W. Wainman	Freedom	263	35	13.3
S. Church	west	Lanier	Armfield	1132	0	0
S. Church	west	Armfield	Cooper	404	30	7.4
S. Church	west	Cooper	Taft	1000	50	5
S. Church	west	Taft	W. Walker	575	70	12.2
S. Church	west	W. Walker	W. Dorsett	235	0	0
Armfield	north	S. Church	Bryan	345	0	0
Hammer	west	Caspn	end	342	25	7.3
Caspn	north	S. Church	Hammer	298	15	5
W. Dorsett	south	S. Church	S. Fayette.	460	25	5.4
E. Dorsett	north	S. Fayette.	End (East)	353	40	11.3
Wainman	north	S. Church	S. Fayette.	794	70	8.8
Wainman	south	S. Park	S. Church	927	105	11.3
Wainman	north	S. Church	Independ.	342	60	17.5

Appendix 4: Illustrative Example of Database Collected (Sidewalks with Significant Replacement Needs)

The following sidewalk blocks are in the bottom 25th percentile for having a “significant” impairment issue that needs replacement (≥ 7.4 percent of sidewalks).

Street	Direction	Start	End	Linear Feet	SR (ft.)	SR (%)
S. Park	east	Hill	Sunset	501	15	3
S. Park	east	Wainman	Hill	848	60	7.1
S. Park	east	Holly	Wainman	374	95	25.4
S. Park	east	Holly	Kivett	337	35	9.4
S. Park	east	Kivett	Lanier	390	30	7.7
S. Park	east	Lanier	Armfield	1177	305	25.9
S. Park	east	Cooper	Armfield	830	60	7.2
S. Park	east	Taft	Cooper	580	35	6
S. Park	east	Walker	Taft	569	15	2.6
S. Park	east	Walker	Dixie	592	0	0
S. Park	west	Sunset	Home	805	125	23.3
S. Park	west	Home	Wainman	536	105	19.6
S. Park	west	Wainman	Holly	375	60	1.6
S. Park	west	Holly	Kivett	337	25	7.4
S. Park	west	Kivett	Spencer	1791	160	8.9
S. Park	west	Cooper	Spencer	631	60	9.5
S. Park	west	Walker	S. of LGCU	522	0	0
S. Park	west	Walker	Dixie	835	10	1.2
N. Park	east	Hoover	Sunset	469	10	2.1
N. Park	east	W. Salisbury	Hoover	526	135	25.7
N. Park	west	Sunset	Hoover	465	35	7.5
N. Park	west	Hoover	Salisbury	528	145	2.7
W. Walker	south	S. Park	S. Church	725	0	0
W. Walker	north	S. Church	S. Park	725	0	0
Holly	north	S. Park St.	Driveway	249	0	0
Holly	north	S. Park St.	End (west)	188	0	0
Holly	south	sidewalk end	E. of S. Park	138	0	0
Armfield	north	Bryan	S. Park	380	0	0
Kivett	south	S. Park St.	end	289	0	0
W. Kivett	south	E. Hanover	end	519	20	3.9

Appendix 5: Illustrative Example of Database Collected (Sidewalks with Significant Maintenance Needs)

The following sidewalk blocks are in the bottom 25th percentile for having a “significant” impairment issue that needs replacement (\geq 2.6 percent of sidewalks).

Street	Direction	Start	End	Linear Feet	SM (ft.)	SM (%)
S. Park	east	Hill	Sunset	501	10	2
S. Park	east	Wainman	Hill	848	0	0
S. Park	east	Holly	Wainman	374	0	0
S. Park	east	Holly	Kivett	337	0	0
S. Park	east	Kivett	Lanier	390	0	0
S. Park	east	Lanier	Armfield	1177	0	0
S. Park	east	Cooper	Armfield	830	5	0.6
S. Park	east	Taft	Cooper	580	0	0
S. Park	east	Walker	Taft	569	0	0
S. Park	east	Walker	Dixie	592	0	0
S. Park	west	Sunset	Home	805	25	4.7
S. Park	west	Home	Wainman	536	0	0
S. Park	west	Wainman	Holly	375	5	1.3
S. Park	west	Holly	Kivett	337	0	0
S. Park	west	Kivett	Spencer	1791	15	0.8
S. Park	west	Cooper	Spencer	631	0	0
S. Park	west	Walker	S. of LGCU	522		0
S. Park	west	Walker	Dixie	835	0	0
N. Park	east	Hoover	Sunset	469	10	2.1
N. Park	east	W. Salisbury	Hoover	526	10	1.9
N. Park	west	Sunset	Hoover	465	5	1.1
N. Park	west	Hoover	Salisbury	528	0	0
W. Walker	south	S. Park	S. Church	725	10	1.4
W. Walker	north	S. Church	S. Park	725	0	0
Holly	north	S. Park St.	Driveway	249	0	0
Holly	north	S. Park St.	End (west)	188	10	5.3
Holly	south	sidewalk end	E. of S. Park	138	0	0
Armfield	north	Bryan	S. Park	380	0	0
Kivett	south	S. Park St.	end	289	10	3.5
W. Kivett	south	E. Hanover	end	519	0	0