WALKABILITY AROUND NEIGHBORHOOD PARKS: AN ASSESSMENT OF FOUR PARKS IN SPRINGFIELD, OREGON

by

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Walkability is an emerging and hot topic in the study of urban form. Many planning scholars and practitioners alike have already examined the many components of the land use-transportation connection and built environment-physical activity link. A rapidly growing area of urban form research concerns how to measure the level of walkability of neighborhoods. Walkability, also referred to as pedestrian accessibility, has and is being measured from a variety of angles. Some of these have used GIS and some others have not. However, very few to none have examined walkability on a street-by-street basis. This study performed a fine-grained walkability assessment at the street level by collecting data in a cutting edge, high-tech manner using a mobile GIS. Four neighborhood parks in Springfield, Oregon were studied. There were twenty 'key' indicators of walkability that were aggregated to the census block level in order to derive an average walkability score. Delineating pedestrian catchment areas around each park using the average walkability score, U.S. Census Bureau TIGER data, and Lane Council of Governments local government street classifications allowed an analysis of the walkable area and quality of the pedestrian amenities. In the end, some indicators were found to be better indicators of walkability, sidewalks being the more prevalent, and that some GIS data can be a substitute for more refined methods of collecting data.

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CHAPTER I

INTRODUCTION

Among urban planners, transportation engineers, and those in the public health field, walkability is a hot topic of debate these days. Walkability is seen by many as a crucial ingredient in an attempt to create more livable communities. Many individuals have attempted to measure walkability, but few have used a GIS-based environmental audit instrument. To date, all the environmental audit instruments created by planners have been designed for pen and paper. A walkability assessment using a cutting edge, high-tech methodology, on the other hand, may lead to a new generation of understanding urban form at a very micro scale.

Research Questions

This terminal project proposes to expand upon the existing literature on walkability measurement techniques, namely the research performed by Schlossberg and Brown (2004) on transit-oriented development walkability. The objective is to measure the walkability of four neighborhood parks in Springfield, Oregon using a mobile GIS device. The four parks are Douglas Gardens, Meadow, Thurston, and Tyson Park. All parks are under the jurisdiction of the Willamalane Park and Recreation District and are classified as neighborhood parks. The questions that will be answered are: 1) are parks being located in the best walkable environments and 2) does this highly advanced data collection tool really illuminate its value added when compared with cheaper and easier to use analysis methods based on U.S. Census Bureau or local government data.

Summary of Literature Review

The literature review is broken into three separate discussions. The first two discussions are brief and focus on land use – transportation connections and the built environment – physical activity relationship. Most of the literature review is spent discussing current attempts at measuring walkability.

Methodology Overview

The four parks being studied are Douglas Garden, Meadow, Thurston, and Tyson. Douglas Garden is located on the urban fringe of the city. Meadow is located in the historic center. Thurston is a suburban park and Tyson is located in the commercial/industrial core. Attempting to answer the research questions will require data collection with a mobile GIS device. Walkability will be measured by collecting data on twenty indicators of walkability. All the specific details of the methods are discussed later.

Delimitations of this Project

This neighborhood park walkability assessment will be an important study for furthering people's understanding of how a walkability assessment can be conducted and of the main factors that should be considered when determining future park locations. People that would be most interested in the findings and recommendations would be future scholars and university students, local planners in Eugene and Springfield, engineers, elected officials, and anyone else interested in the pursuit of more livable communities. The results will be important to any future research on urban form and walkability, but ultimately, the findings only apply to the local area.

Outline of Remainder of Paper

The following is the order of discussion for the remainder of the document: Literature Review, Methodology, Findings, and Analysis and Recommendations.

CHAPTER II

LITERATURE REVIEW

A variety of disciplines; including urban planning, transportation engineering, urban design, and public heath, have devoted a lot of attention recently to the issue of walkability (please be aware that walkability is used interchangeably in this chapter with the term pedestrian accessibility).

Land Use – Transportation Connection

Walkability is part of a larger area of research examining the connections between land use and transportation; and specifically how the two can be utilized to create more livable communities. Much of the land use/transportation literature focuses on urban design features such as sidewalks, enhanced landscaping, availability of public transit, and number of dead end streets, which can be utilized to affect our transportation choices (Handy 1996; Ewing 1997; Transit Cooperative Research Program 1998; Knack 2002; Handy, Paterson et al. 2003). Also, much of the buzz about how urban design features can impact transportation (i.e. reduced automobile dependence) has been echoed by New Urbanists. New Urbanism is a movement to bring back more traditional neighborhood design focusing on higher densities, mixed uses, public transit being easily accessible, pedestrians and cyclists being accommodated, and interconnected streets (Southworth 1997; Talen 2002; Krizek 2003).

Many studies on the land use – transportation connection have provided evidence that urban design features that seek greater pedestrian accessibility do in fact lead to less automobile dependence and increased frequency of walking (1000 Friends of Oregon 1993;

Corti, Donovan et al. 1996; Kitamura, Mokhtarian et al. 1997; Moudon, Hess et al. 1997; Shriver 1997; Hess, Moudon et al. 1999; Handy and Clifton 2001). However, there are those such as Crane (2000) who are more cautious and would contend that it has not been proven yet that any specific urban design feature will actually result in a change in travel behavior. Guiliano (1995) is another that would probably agree with not jumping to conclusions about how land use and transportation might be the solution to many problems that plague cities, because land use may not directly effect individuals travel behavior.

Built Environment and Physical Activity

Additional research on urban form (also referred to as the built environment) has focused on physical activity and its link to the built environment. The reason a lot of attention is focused on this aspect of urban form is the mountain of evidence on the positive heath benefits that come with moderate physical activity and that too few are meeting minimum recommendations for physical activity (U.S. Department of Health and Human Services 1996; Jones, Ainsworth et al. 1998; Stofan, DiPietro et al. 1998; Mokdad, Serdula et al. 1999; Barnes and Schoenborn 2003). However, it should be made clear that planners have been concerned with the built environment and physical activity for a long time. In fact, many of the earliest planning initiatives such as the Zoning Enabling Act, a result of the 1926 Supreme Court case *Euclid v. Ambler Realty,* had health concerns as a primary reason for there creation (Frank and Engelke 2001).

Researchers studying the built environment have compared walkability measures (such as average block size) to health data and found that physical activity levels are higher in areas that are more walkable (Saelens, Sallis et al. 2003; Doyle, Kelly-Schwartz et al. in press). More common however in the literature on the built environment and physical activity are discussions about how residents of traditional neighborhoods, and more urban locations, seem to walk more; which many contend results in better individual health (Handy 1992; Friedman, Gordon et al. 1994; Holtzclaw 1994; Cervero and Gorham 1995; Handy 1996; Handy 1996; Moudon, Hess et al. 1997; Shriver 1997). However, there are those such as Kitamura, Mokhtarian et al. (1997) and Krizek (2000) who have pointed out that the built environment may not be the reason for increased physical activity; it could be more a matter of self-selection. Basically, this means that people who want to walk more and engage in more activities for personal fitness may choose to live in neighborhoods considered more walkable.

Currents Attempts to Measure Walkability

There are several significant and recent attempts made at measuring or understanding pedestrian accessibility. While the specific area of interest in each of these studies is different and not necessarily related to neighborhood parks, the underlying concept is very relevant to how walkability can be studied around neighborhood parks. For the purposes of this discussion, the literature is divided into three categories: conceptual frameworks for studying walkability, non-GIS methodologies, and GIS-based approaches.

Conceptual Frameworks

McMillan

McMillan (2005) provides a conceptual framework for others to follow when studying urban form, including the measurement of pedestrian accessibility. The conceptual framework proposed by McMillan (2005) clarifies the relationship between urban form and a child’s trip to school. Urban form does not directly impact how a child gets to school, but rather a set of mediating and moderating factors do (McMillan 2005). The mediating factors are neighborhood and traffic safety, as well as, available household transportation options (this includes distance from home to school and number of cars at home) (McMillan 2005). Moderating factors include parent attitudes, social or cultural norms, and sociodemographic characteristics (McMillan 2005). To illustrate how urban form, these factors, and a child's trip to school are related it is best to use an example. Let's say the urban form of a neighborhood has an insufficient number of streetlights and this causes there to be many poorly lit areas. This has an impact on neighborhood safety. If neighborhood safety is compromised because of these poorly lit areas then parents may feel as through the area is not safe enough for there children to walk to school; thus choosing to drive them to school instead. Parents could also decide that driving their kids to school is better because of a longer distance between home and school. In the example, urban form is not the direct cause of the child's trip to school (McMillan 2005). Parental decision-making is the real cause, but is influenced by elements such as neighborhood safety and neighborhood safety is thus influenced by number of streetlights, or urban form (McMillan 2005).

The conceptual framework of a child's trip to school is important for three reasons. Once the key decision-maker of a child's travel behavior is identified, the factors that go into making travel decisions are considered, and most importantly the framework highlights the factors that influence urban form (McMillan 2005).

Moudon and Lee

As McMillan did, Moudon and Lee (2003) have provided a conceptual framework for measuring walkability in order to help direct future research efforts. Moudon and Lee (2003) performed an exhaustive review of over thirty methodologies that have been developed for use in assessing walkability. All of the methods discussed are called environmental audit instruments: tools for inventorying and assessing environmental conditions that are associated with walking (Moudon and Lee 2003). The framework provided by Moudon and Lee (2003) for future audit instruments is that they especially need to focus on characteristics of place. This includes the origin, destination, and area that a pedestrian walks within (Moudon and Lee 2003). This idea of using the characteristics of where a person starts or ends their trip gets at the elements controlling why urban form affects travel behavior. This is similar to what McMillan proposed when she discusses the mediating factors that influence parent's decisions on how their child gets to school (McMillan 2005).

Non-GIS Methodologies

There are numerous approaches to measuring walkability, but two of the better examples are addressed below as a representation of the types of literature that is available on non-GIS methods.

Partnership for a Walkable America

A fairly simple approach is a questionnaire created by the Partnership for a Walkable America. The questionnaire is one-page long, contains five easy to answer questions, and results in a score from five to thirty points (Partnership for a Walkable America, Pedestrian and Bicycle Information Center et al. 2005). The questionnaire is reminiscent of a relationship quiz someone might find in a supermarket magazine that any layperson could complete. Given the recent popularity of livable communities among scholars, planners, policy makers, and the general public it is not surprising to find a non-scientific, user-friendly questionnaire available as one means to measure walkability. The questionnaire makes people aware of what makes a community pedestrian-friendly by asking the following questions: did you have room to walk, was it easy to cross streets, were drivers well behaved, and were safety rules easy to follow (Partnership for a Walkable

America, Pedestrian and Bicycle Information Center et al. 2005). Each of these questions can be related to one of the walkability indicators used in this neighborhood park study; specifically sidewalk condition, pedestrian crossing aids, safety of the area, and traffic control devices and signs.

Pikora and Colleagues

A much more scholarly-oriented methodology for studying walkability was developed by Terri Pikora and colleagues. Their research approach is the use of an observational-based tool: an environmental audit instrument (Pikora, Giles-Corti et al. 2003). The audit instrument created by Pikora, Giles-Corti et al. (2003) is a systematic pedestrian and cycling environmental scan (SPACES) that uses checklists to collect data in the field. The SPACES tool is a comprehensive inventory of the characteristics of the roadway and elements surrounding the roadway (Pikora, Giles-Corti et al. 2003) and data is intended to be collected on a street-by-street basis (Pikora, Giles-Corti et al. 2003).

The methods that Pikora, Giles-Corti et al. (2003) went through to develop the SPACES tool were extensive. Researchers working on developing this tool first categorized all the different environmental factors that could possibly affect walking into four classifications. These are functional (physical attributes of the street), safety (characteristics of a safe environment), aesthetic (elements such as trees or gardens), and destination (relationship of neighborhood services to residences) (Pikora, Giles-Corti et al. 2003). From these classifications of numerous environmental factors, interviews and panel discussions with local experts were held in order to reach a consensus on the factors that most affect whether people walk or not (Pikora, Giles-Corti et al. 2003). Factors concerning personal safety, aesthetics, and having a destination to travel to were determined to be the important elements that influence walking the most (Pikora, Giles-

Corti et al. 2003).

GIS-Based Approaches

Aultman-Hall and Colleagues

While the previous walkability assessment techniques provide valuable results about pedestrian accessibility, the use of a GIS can dramatically increase what is possible. An early attempt at using GIS to measure pedestrian accessibility was done by Aultman-Hall, Roorda et al. (1997). The goal of their research was to demonstrate that pedestrian-friendly suburban developments are possible. Their measure of neighborhood accessibility was the distance between home and neighborhood destinations (schools, transit, and open space) (Aultman-Hall, Roorda et al. 1997). This research took the original layout for one neighborhood in Ontario, Canada (58 acres in size) and redesigned it in a more sustainable, pedestrian accessible way through the use of a design charrette (Aultman-Hall, Roorda et al. 1997). In the design charrette process, the aim was to come up with a site plan that promoted the use of nonmotorized and public transit, higher densities, reduced stormwater runoff, preservation of ecologically sensitive areas, neighborhood gardening, reduced consumption of municipal services per person, and increased open space (Aultman-Hall, Roorda et al. 1997). Both the original and redesigned layouts were digitized into ArcInfo GIS software (Aultman-Hall, Roorda et al. 1997). Lines (representing the roads and pedestrian paths) and points/nodes (representing each of the residential structures) represented the urban fabric of the neighborhood in the GIS (Aultman-Hall, Roorda et al. 1997). A GIS macro program computed the shorted walking distances from every residence to the neighborhood school, and was repeated two more times for the nearest open space (including parks) and nearest transit stop (Aultman-Hall, Roorda et al. 1997). The results confirm that if suburban developments are redesigned to be more sustainable and pedestrian-friendly that average accessibility should increase (Aultman-Hall, Roorda et al. 1997). Specifically, average pedestrian accessibility in the redesigned layout, compared with the original plan, was reduced about 400 feet to a value below the ¼ mile distance used as a threshold for 'good' walkability (Aultman-Hall, Roorda et al. 1997). The flaw of this study as other researchers, such as McMillan (2005) and Moudon and Lee (2003), would probably agree with is that the work does nothing to address the factors behind whether people would actually walk more.

Randall and Baetz

Another GIS approach used to measure walkability refined the research conducted by Aultman-Hall, Roorda et al. (1997). Randall and Baetz (2001) went a step further and proposed that not only route distance, but also route directness should be used to assess neighborhood walkability. A street system with short block lengths and well-gridded streets would have a very direct route as compared with a curvilinear pattern found in many conventional suburban developments. Pedestrian route directness (PRD) was defined as a ratio of route distance to geodetic (straight-line) distance (Randall and Baetz 2001). A ratio of 1.0 would be an excellent route. Using these two measures, Randall and Baetz (2001) developed an ArcView GIS extension called PRD Evaluate that calculated both route distance and directness for a neighborhood. This research is unique in that it allows the user to modify the pedestrian environment by adding, for example, an extra pedestrian path in a strategic location and then re-calculate the two route distance and PRD values (Randall and Baetz 2001). Their recommendation is that only one modification be made in between successive calculations of route distance and PRD; because, that way each modification can be judged against the others in order to find the best one (Randall and Baetz 2001). For the planning practitioner, this tool allows possible retrofits to an existing urban form to be found. However, this research also does little to determine whether people would actually walk more.

The specific neighborhood in Ontario, Canada that Randall and Baetz (2001) used to test their GIS program had areas with short block lengths and well-gridded streets, as well as, more conventional curvilinear streets and cul-de-sacs. The PRD for the well-gridded street patterns was 1.4 to 1.5 and 1.63 to 1.88 for the conventional areas (Randall and Baetz 2001). Shorter pedestrian routes were found in the areas categorized by shorter block lengths and a more well-gridded street network. As confirmation of their findings, Hess (1997) in a similar study of Seattle neighborhoods found that the PRD for the more conventional suburban developments was 1.7 compared with 1.2 for a traditional neighborhood. In other words, the conventional suburban neighborhood had average routes that were forty percent longer (Hess 1997).

Talen

Emily Talen is another scholar who has conducted an assessment of neighborhood accessibility using a GIS-based approach. Talen (2003) specifically looked at Portland, Oregon. Much like Aultman-Hall, Roorda et al. (1997) discussed above, distance is the primary measure used by Talen (2003) in her walkability study. However, Talen (2003) took her analysis to another level and used additional data to characterize places, which are either the origin or destination locations. Talen’s approach builds on the idea of Moudon and Lee (2003) and McMillan (2005) who advocated the need for additional characteristics or factors be considered when conducting a walkability assessment.

The following are specifics of the GIS methods used in this study of neighborhood accessibility in Portland. First, U.S. Census Bureau block group data was assigned to represent the characteristics of the origins (housing units) and neighborhood parks, elementary schools, and local retail stores were determined to be the destinations (Talen 2003). With this information in hand, ArcView GIS was used to compute distances between all the origin and destination locations based on the Manhattan block distance method (this method is approximately equal to a standard street grid) (Talen 2003). Finally, the minimum distance approach was used to approximate the accessibility of neighborhoods in Portland (Talen 2003). According to Talen (2003), the minimum distance approach finds the shortest path between any origin and a specific destination location. A finding of Talen (2003) that is relevant to this study of neighborhood parks is that only thirty percent of Portland neighborhoods have at least half of their block groups (housing unit representation) within the minimum acceptable distance of one mile to a neighborhood park. This means that in Portland neighborhoods parks are not being located in the most accessible portions of a neighborhood.

Handy and Clifton

To this point, the significant GIS-based approaches that have been discussed have revolved around using GIS to compute distance measurements between various locations as a means of measuring neighborhood walkability. Handy and Clifton (2000) however propose a different, but equally valid method of conducting a walkability assessment. Their study involved a detailed analysis of land use patterns, specifically locations of retail establishments, within neighborhoods. In this study seven Austin, Texas neighborhoods are studied (Handy and Clifton 2000). Each neighborhood represents a different urban form (style of development) (Handy and Clifton 2000). The neighborhoods fall on a spectrum from traditional neighborhood design with its well-gridded streets and short block lengths to conventional suburban design with its move curvilinear street network and cul-de-sacs (Handy and Clifton 2000). Three of the specific measures of accessibility used were intensity (total number of establishments), diversity (the number of different types of retail establishments), and choice (the number of options for each type of retail present) (Handy and Clifton 2000). Location quotients were also used to measure the amount of retail present in a neighborhood; more retail being an indication of greater accessibility. Location quotients are a ratio that compares the share (percentage) of a type of retail in one region with the total amount of that same type of retail in the larger region (Handy and Clifton 2000). A ratio over one means a neighborhood is being overserved by the specific type of retail and value under one means the neighborhood is being underserved. Finally, Handy and Clifton (2000) looked at total coverage of establishments, which is the percentage of neighborhood streets that fall within a specified distance of a specific retail establishment. This approach is a means of determining whether there is an equitable distribution among neighborhood residents of retail establishments (Handy and Clifton 2000). Like many others who have studied urban form, Handy and Clifton (2000) found that the more traditional neighborhoods were more accessible than conventional ones.

Schlossberg and Brown

Schlossberg and Brown (2004) conducted a study on transit-oriented developments (TOD) in Portland, Oregon. The goal was to do an assessment on the walkability around eleven TOD hoping to tell if these developments are really being located in the best locations for walking (Schlossberg and Brown 2004). Schlossberg and Brown (2004) used a GIS to derive pedestrian catchment areas and intersection densities. Pedestrian catchment areas (PCA) (also referred to as ped sheds) define the area around some point that one could access via a path network using a fixed distance (i.e. ½ mile) (Congress for the New Urbanism 1998). This walkable zone can be compared with a theoretical circle around the same point (i.e. ½ mile) to derive a ratio (the PCA) indicating amount of walkable area. A sixty percent ratio is considered a 'good' walkable environment (Congress for the New Urbanism 1998). Schlossberg and Brown (2004) using an ArcView GIS extension called Network Analyst computed pedestrian catchment areas for each TOD. Pedestrian catchment areas were also computed with any pedestrian-hostile street removed from consideration; this resulted in an impeded pedestrian catchment area (IPCA) (Schlossberg and Brown 2004). The IPCA, then, gives an indication of the degree to which hostile/large streets impact the likely walkable area around a fixed location. Additional GIS analysis was done to compute the density of dead-ends and three or four-way intersections around each TOD (Schlossberg and Brown 2004).

Concluding Remarks

This walkability assessment is about accessibility and neighborhood parks, which lacks a rich literature in and of itself. Research mentioned previously such as Aultman-Hall, Roorda et al. (1997) and Talen (2003) discusses neighborhood parks as one of several types of neighborhood-level destinations that they examined. This does help to explain that neighborhood parks are just as important to study in relation to walkability as say schools are, but does not explain much else. Other literature makes reference to the importance of parks with statistics about how areas with more parkland have higher percentages of people who walk or bike, but again this appears to be the extent of the discussion about parks (Health Behavior News Service 2005). The importance of having an equitable distribution of neighborhood parks and parks that are as close to as many people as possible is being grasped by local park and recreation departments all across the country (Harnik and Simms 2004). There are numerous gaps in the literature about neighborhood parks and hopefully the research presented in this report can fill some of these gaps.

Summary

Walkability is part of a larger body of literature on urban form. Urban form research has been most concerned with examining the linkages between land use and transportation, as well as, how the built environment effects physical activity. Those researchers interested more specifically in walkability have come up with numerous methods for measuring pedestrian accessibility, but few have discussed accessibility around neighborhood parks.

This walkability assessment of neighborhood parks in Springfield, Oregon utilizes a modified version of the Pedestrian Environment Data Scan (PEDS) created by Clifton and Livi (2004). Questions on PEDS are divided into six sections: segment number and type, environment, pedestrian facility, road attributes, walking/cycling environment, and subjective assessment (Clifton and Livi 2004). Their tool is designed to assess walkability street segment by street segment (Clifton and Livi 2004). A street segment is normally the stretch of street between two cross-streets or intersections. Clifton and Livi (2004) developed PEDS to be used for measuring pedestrian and cyclist accessibility, as well as, the characteristics of the automobile traffic. Appendix A has a copy of the audit protocol for PEDS. This neighborhood park walkability study also uses GIS analytical techniques described earlier, mainly those employed by Schlossberg and Brown (2004). This study builds upon both the non-GIS and GIS-based approaches and could best be described as creating a link between the two styles. In this way, the study fits nicely into the existing literature and fills a gap in the knowledge base. The environmental audit instruments that have thus far been done by paper and pen will now be completed via a cutting edge, high-tech mobile GIS; something that almost no one else has done before.

CHAPTER III

METHODOLOGY

Walkability is an emerging concept, and rapidly gaining momentum, in the field of planning as a means for developing more livable communities. As mentioned previously in Chapter II (Literature Review), the research on walkability and neighborhood parks is incomplete and there are numerous areas where further studies can be very beneficial to advancing the importance of livable communities. The research question for the study at hand, on walkability and neighborhood parks, seeks to expand on the current research by determining the extent to which neighborhood parks are constructed in pedestrian-friendly locations. In addition, the secondary goal is to compare these results, obtained with complex mapping software, with two more simplified approaches using TIGER data and Lane Council of Governments (LCOG) local government street classifications in the hopes of demonstrating how planners and policy makers can, in some capacity, begin to incorporate walkability studies into future planning actions. Before examining the results of the study, this chapter will explain step-by-step the methodological procedures used for this assessment. The order of discussion for the chapter:

1. What parks and why,
2. Data collection procedure,
3. Scoring system, and
4. Analysis step-by-step.

What Parks and Why?

There are four parks being analyzed in this walkability assessment. These are Douglas Gardens Park, Meadow Park, Thurston Park, and Tyson Park. Douglas Gardens

Park is located along the urban fringe, Meadow Park in the historic downtown area, Thurston Park in a suburban setting, and Tyson Park in the commercial/industrial area in the middle of the city. These preceding park descriptions are specific to this study and were conceptualized while data collecting within the area around each park. Each park is one of the sixteen neighborhood parks located in Springfield, Oregon and operated by the Willamalane Park and Recreation District (Willamalane Park and Recreation District 2004). A neighborhood park in Springfield is intended to be "located within walking or biking distance of users" and has a service radius of ¼ to ½ mile (Willamalane Park and Recreation District 2004). The reason neighborhood parks were chosen for this study was that these types of parks are most oriented to pedestrians. In addition, as mentioned earlier, Schlossberg and Brown (2004) explain that ¼ to ½ mile is the standard distance in the literature for how far people can be assumed to walk to urban services, including parks. Given that the service area of neighborhood parks in Springfield is the same as the standard for used in the literature, these parks were ideal for this study. Furthermore, parks were selected that were approximately the same size and to the greatest extent possible in different geographic locations. The size of the park took precedence over the location. These four parks range in size from just under 4 acres to just above 7 acres. The overall range for neighborhood parks in the city is .81 to 7.1 acres (Willamalane Park and Recreation District 2004). The remainder of this section is devoted to providing a brief description of each park, including pictures, to illustrate that the four parks chosen are indeed similar and good candidates for study and comparison. Information in Table 3-1 below summarizes the four parks.

Table 3-1: Summary of Four Neighborhood Parks

Park Name	Size (Acres)	Facilities	Number of Street Segments	Miles of Streets
Douglas Gardens	6.13	Basketball Court, Playground, Sports Fields, and a Tennis Court	169	12.2
Meadow	7.1	Basketball Court, Community Garden, Playground, Sports Fields, and Tennis Court	280	20.1
Thurston	5.54	Basketball Court and Playground	178	10.4
Tyson	3.91	Basketball Court, Playground, and Softball Field	141	10.9

Source: (Willamalane Park and Recreation District 2004).

Figure 3-1 below provides pictures from each of the four parks that are the subject of this walkability assessment. For a vicinity map of where each park is located in reference to each other, as well as, the other neighborhood parks in Springfield please refer to Appendix B.

Figure 3-1: Pictures of the Four Neighborhood Parks

Source: (Stevens 2005)

Data Collection Procedure

The level of measurement for this walkability assessment was the street segment. The data chosen to represent street segments was the TIGER files from the U.S. Census Bureau. A street segment is the section of street between two intersecting cross-streets or intersections. The lines in the TIGER files that represent actual streets were already divided into individual line segments; thus the existing data very much approximated street segments. The data about each street segment that was collected are all 'key' indicators of walkability. Twenty indicators of walkability were collected and mapped within a half-mile of each park.

In the field, the data collection process involved surveying both sides of the street first before inputting any information into the mobile GIS. This technique provided an opportunity to count street segment features, as necessary, and to get a good overall impression of the walkability at that particular location. During data collection, there were certain assumptions that were made (See Appendix C). This fieldwork took roughly thirty to thirty-five hours to complete.

The method for collecting data was the Pedestrian Environment Data Scan (PEDS) tool created by Clifton and Livi (2004) at the Universities of Maryland and North Carolina, and adapted for use on a PDA by Dr. Marc Schlossberg at the University of Oregon. However, for this study the tool was modified further. The twenty walkability indicators were collected on a PDA using a mobile GIS software program called ArcPad. ArcPad allows data to be entered on the fly, eliminating numerous post-processing procedures. Figure 3-2 is a picture of a PDA with ArcPad loaded and pedestrian assessment tool open and ready for data entry.

Figure 3-2: PDA Ready for Data Collection

Source: (Schlossberg 2004)

The original assessment tool (PEDS) contained roughly seventy-seven walkability indicators (See Appendix A for a copy of the original PEDS tool). The PEDS, as mentioned in the previous chapter, provides a mechanism for not only studying walkability, but also bikeability and characteristics of the vehicular traffic. This neighborhood park study examined only the twenty 'key' indicators of pedestrian accessibility and a pilot project in the West University Neighborhood (WUN) of Eugene, Oregon conducted previously by the author showed that these indicators are the most critical components that seem to affect a pedestrians environment. From the WUN project, the indicators for bikeability and road characteristics appeared to have little influence on the assessment of walkability; thus the reason for exclusion of these other indicators. In addition, the WUN project showed that these twenty indicators appeared to make the most practical sense for any pedestrian accessibility study in Eugene and Springfield, Oregon. The table below lists the walkability variables included in this study.

Table 3-2: Walkability Indicators

Walkability Indicator
1. Attractive for Walking
2. Safe for Walking
3. Traffic Volume
4. Sidewalk Condition
5. Segment Continues?
6. Sidewalk Complete
7. Land Uses
8. Number of Traffic Lanes
9. Buffers Present?
10. Speed Limit
11. Building Setbacks?
12. Path Setbacks?
13. On Street Parking?
14. Traffic Control Devices
15. Transit Stops
16. Walk Through Parking Lots
17. Crossing Aids
18. Lighting
19. Number of Street Trees
20. Driveways

Scoring System

Each street segment received a score based on the presence or absence of a particular indicator, or more points depending on the quality and quantity of the indicator. The reason for a scoring system was so that a cumulative score could be determined, providing meaningful information about how good the area around a specific park is for walking.

The points were pre-assigned within the ArcPad data entry interface, saving valuable processing time later. When a particular response for an indicator was selected, a set number of points were automatically entered into the database for that particular street segment. Except for three subjective indicators (attractiveness for walking, safe for walking, completeness of the sidewalk), all indicators were worth 1 or 2 points. For example, the presence of transit stops was 1 point. If the speed limit was under 20 miles per hour the points assigned were 2 and between 20 and 30 miles per hour was 1 point.

The subjective indicators were worth more points and based on a sliding scale. For example, if the response to sidewalk condition was excellent than 8 points were assigned, a good response was worth 6 points, average condition worth 4 points, fair 2 points, and poor worth zero points. The subjective measures were weighted more heavily because ultimately the ‘feel’ of an environment is what is important. It is possible that certain objective measures of a streetscape might technically score well, but the resulting environment does not ‘feel’ particularly attractive to walk within. Over weighting the subjective measures ensured that the overall atmosphere is given more importance than any individual part. Table 3-3 is the point system used.

Table 3-3: Point Scoring System

Walkability Indicator	Points
1. Attractive for Walking	
Strongly Agree	8
Agree	6
Neutral	4
Disagree	2
Strongly Disagree	0
2. Safe for Walking	
Strongly Agree	8
Agree	6
Neutral	4
Disagree	2
Strongly Disagree	0
3. Traffic Volume	
High	0
Low	1
4. Sidewalk Condition	
Excellent	8
Good	6
Average	4
Fair	2
Poor	0
5. Segment Continues?	1
6. Sidewalk Complete	4
7. Land Uses	1 point per use
8. Number of Traffic Lanes	
1 or 2	2
more than 2	1
9. Buffers Present?	1 point per buffer present
10. Speed Limit	
less than 20 mph	2
20 to 30 mph	1
greater than 30 mph	0
11. Building Setbacks?	
less than 10 feet	2
10-20 feet	1
greater than 20 feet	0
12. Path Setbacks?	
less than 1 feet	0
1-3 feet	1
3-10 feet	2
greater than 10 feet	3
13. On Street Parking?	
both sides	2
one side	1
none	0
14. Traffic Control Devices	1 point per device present
15. Transit Stops	
Yes	1
No	0
16. Walk Through Parking Lots	
Yes	0
No	1
17. Crossing Aids	1 point per aid present
18. Lighting	
fewer than 3 sources	0
3-6 sources	1
greater than 6 sources	2
19. Number of Street Trees	
fewer than 5 trees	0
5-10 trees	1
greater than 10 trees	2
20. Driveways	
fewer than 5 driveways	2
5-10 driveways	1

Analysis Step-by-Step

The analysis phase of the methodology occurred in ArcGIS. There are a couple of steps involved. First of all, all the points that a street segment earned were added together to yield a cumulative score. This score was mapped by aggregating the streets to the census block level resulting in a polygon layer that when mapped revealed patterns much easier than with simply mapping by line segments. The aggregation process was done using the ArcGIS spatial join procedure. In ArcGIS a spatial join procedure selects all the line segments (i.e. street segments) that fall within a specified polygon boundary (i.e. census blocks) and then a summary of all numerical data fields are calculated using the individual attributes of each selected line within the specific polygon. Using this procedure, a street segment (a line in a GIS) was aggregated to a specific census block by virtue of its spatial location and every street segment represented attributes of both sides of the street. For example, the number of street trees assigned to each street segment was based on trees located on either side of the street. In short, aggregation to the census block level counts attributes for both sides of the street. A street segment, through the aggregation process, could be counted for two census blocks, but only because the street segment falls within more than one census block.

Next in the analysis was creating catchment areas using park entrance locations as the centroids of the polygons. Multiple centroids (park entrances) were used for the park locations because these locations better represented how a pedestrian would interpret where the boundaries of a park are as opposed to using one centroid located in the center of the park. One centroid would not represent the geographical extent of the park. This multiple centroid method also seemed appropriate given that catchment areas are designed to reflect an actual walkable area. It should also be noted that the theoretical circle however was only based on one centroid because the circle is designed not to reflect an actual walkable area.

A catchment area delineates the ½ mile area in which streets are available for pedestrians to use. The process of creating catchment areas involved the use of ArcView's Network Analyst extension. The catchment area can be compared to the theoretical ½ mile circle around the park that does not take into consideration where pedestrians can actually walk. Two catchment areas were generated. The first involved all street segments; this was the standard pedestrian catchment area (PCA). The other method involved using the cumulative score to remove the most hostile street segments. This results in the impeded pedestrian catchment area (IPCA). The generation of a PCA and IPCA were repeated using TIGER data and LCOG local government street classifications, replicating Schlossberg and Brown's (2004) analysis of transit-oriented development walkability. In this way, results from the ArcPad-based walkability assessment, which is of finer delineation and more time-intensive to employ, can be compared to TIGER and LCOG based analysis, which is simpler and cheaper to conduct. This comparison can hopefully illuminate if there is value added by the more advanced walkability assessment tool.

CHAPTER IV

FINDINGS

The organization of this chapter will be to present the findings on the total walkable area around each park first, in both tabular and graphical form, then examine the quality of the numerous pedestrian amenities that ultimately determine the total walkability. This chapter will simply present findings and provide a few comments.

Walkable Area Around Neighborhood Parks

Average Walkability Scores

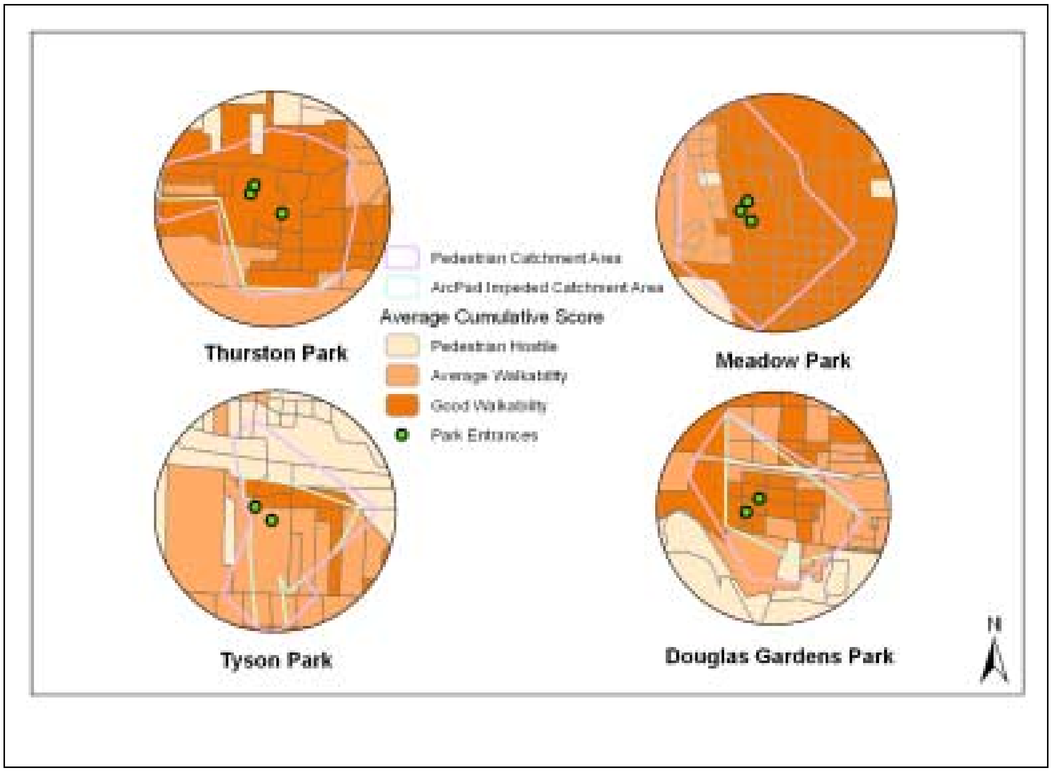
The average walkability scores for each neighborhood park show a significant variation. Two parks are rated better and the remaining two parks have scores significantly lower. Meadow Park, located in the historic downtown, had the highest average walkability with a score of 35. A surprise however in second place is the suburban park, Thurston, with a score of 34. Douglas Gardens and Tyson are third and fourth in that order with noticeably lower scores of 27 and 24, respectively. The ranges of average scores for individual street segments are within ten points. There is some significant variation in the results. Table 4-1 provides a summary of these average walkability scores.

Table 4-1: Walkability Scores

Park	Mean	Minimum	Maximum	Range
Douglas Gardens	27	8	51	43
Meadow	35	9	48	39
Thurston	34	14	47	33
Tyson	24	7	44	37

The average cumulative walkability scores can also be examined graphically. Examining Map 4-1, it is obvious that Meadow and Thurston Park have the best walkable environments given the abundance of the dark orange shading.

Map 4-1: Average Walkability Scores

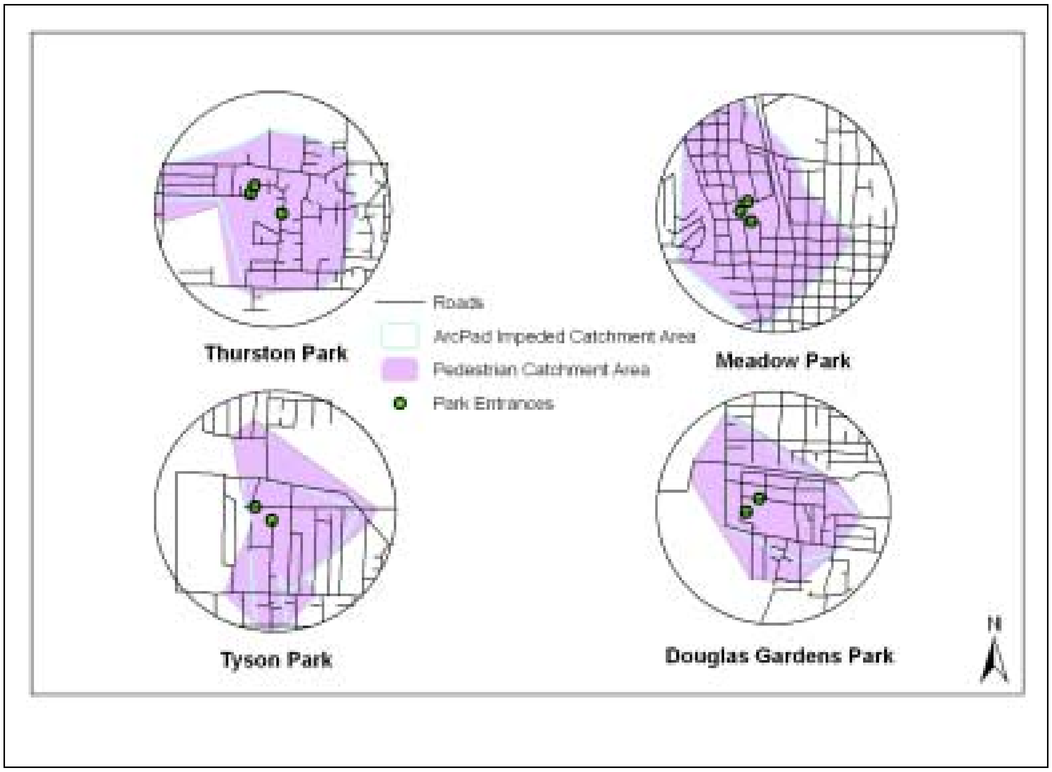


The significant variation between the two previously named parks and Tyson and Douglas Gardens Park is even more apparent when looking at the maps. There is much less dark orange shading for Tyson and Douglas Gardens Park. Tyson Park's lowest score is not as apparent when looking at tabular data, but this map makes it very clear.

Pedestrian Catchment Areas

Overall walkability of an area is also examined by looking at the accessibility of the neighborhood. Pedestrian catchment areas (PCA) were calculated to discover how much of the area around each of the neighborhood parks is actually accessible. Map 4-2 illustrates that the two parks with the highest walkability scores (Meadow and Thurston) also are the most accessible by pedestrians.

Map 4-2: Pedestrian Catchment Areas



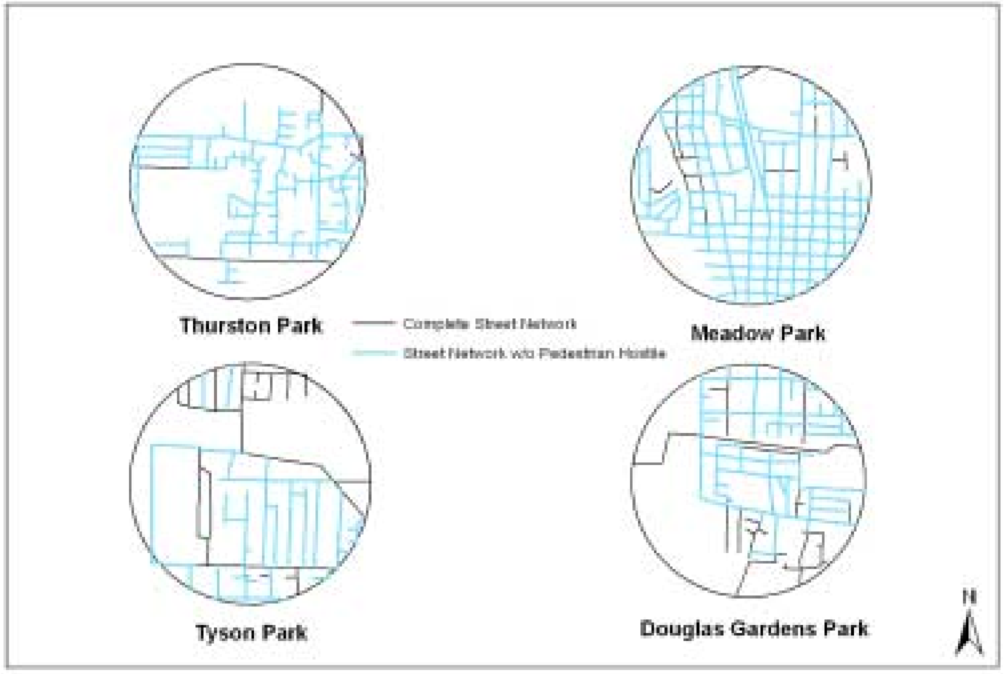
Douglas Gardens and Tyson Park have significantly smaller PCA. This is not surprising given the lower average walkability scores and lack of street connections. On the same map above, the impeded pedestrian catchment areas (IPCA) are delineated in light blue. IPCAs resemble accessibility much like the PCA except that pedestrian-hostile street segments are removed. Meadow Park has an identical PCA and IPCA, which means that there are no pedestrian hostile roads in close proximity to the park. Tyson Park has a significantly smaller IPCA, which is not surprising given that there are typically many more pedestrian-hostile streets in commercial/industrial areas of cities. To get a better handle on the PCA and IPCA ratios, refer to Table 4-2. Table 4-2 lists the quantitative PCA and IPCA results (ratios above 60% are considered extremely walkable).

Table 4-2: Accessibility Ratios for Catchment Areas

Park	PCA (1/2 Mile)	Impeded PCA (1/2 Mile) (PDA)	Impeded PCA (1/2 Mile) (TIGER)	Impeded PCA (1/2 Mile) LCOG
Douglas Gardens	40%	26%	40%	22%
Meadow	55%	55%	55%	50%
Thurston	52%	47%	49%	41%
Tyson	38%	22%	33%	18%

The interesting thing about these results is that none of the parks exceeds the 60% threshold for ‘good’ walkability. Not even Meadow and Thurston Park, the most walkable parks of this study. The sharp drop in the PCA and IPCA ratios for Douglas Gardens and Tyson Park is intriguing. Map 4-3 shows the hostile streets that were removed from consideration when calculating the IPCA and the number of street segments removed for Douglas Gardens and Tyson makes the sharp decline in ratios more understandable.

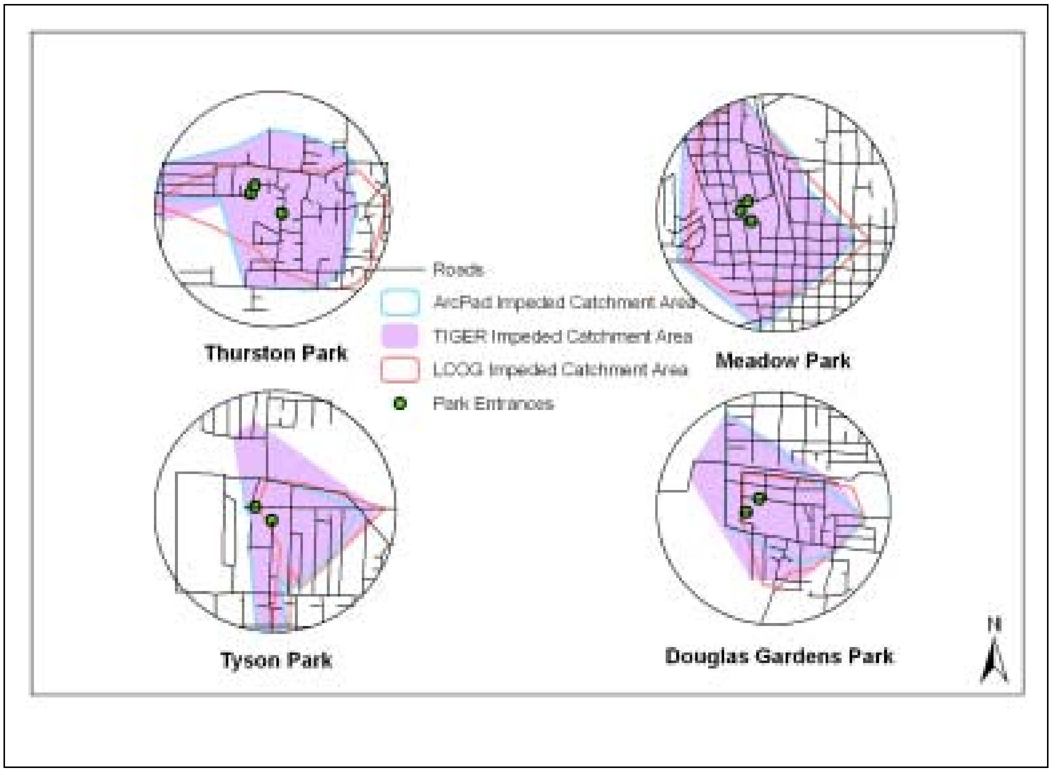
Map 4-3: Pedestrian Hostile Streets Identified



Differing Methods of Calculating Impeded Catchment Areas

Before moving on to present the findings of the quality of pedestrian amenities this is a good time to present the results of using TIGER and LCOG data along with the average walkability score derived from the pedestrian audit instrument to calculate IPCA. Using TIGER data, all streets classified as anything except local streets are removed from consideration. Using the average walkability score from the audit instrument, all street segments that had a score of 20 or less were removed. With LCOG data, all streets that are classified by the local government as arterial or collector were removed. Looking back at Table 4-2 the TIGER-based IPCA ratios are almost identical to PCA ratios, indicating that all streets are essentially equally pedestrian friendly. Only Tyson Park had a TIGER-based IPCA ratio that is noticeably different. The LCOG-based IPCA ratios are similar to those from this study, which suggests that LCOG data may be a good substitute for time-intensive fieldwork. However, the LCOG ratios are even lower than those in this neighborhood park study probably because of the fact that if a street is pedestrian-hostile the entire street is removed from consideration. On the other hand, this fine-grained approach with a mobile GIS can include many other factors, which means a street could be more walkable than its classification alone would suggest. A graphic portrayal of this difference is shown in Map 4-4.

Map 4-4: Audit Instrument Scores versus TIGER/LCOG Classifications



The LCOG IPCA delineation roughly resembles the ArcPad IPCA based on the average walkability score.

Quality of Pedestrian Amenities

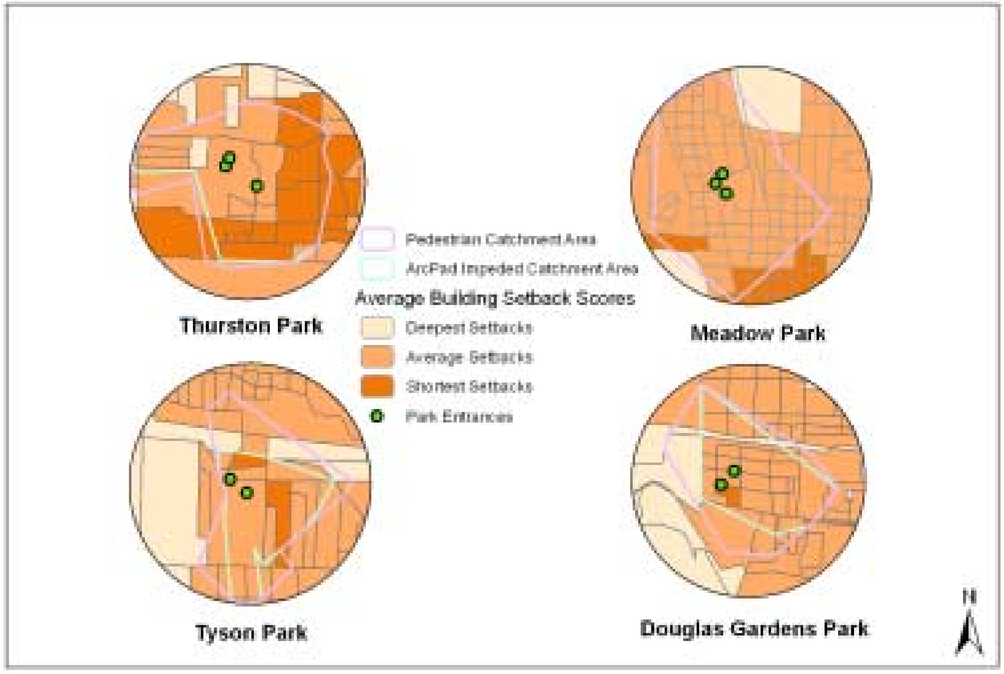
Now that the findings for the total walkable area of each neighborhood park has been presented, in this section the quality of the pedestrian amenities will be presented.

The idea behind this strategy is that some amenities will probably produce more similar results with regard to where the more walkable areas around a neighborhood park are than other amenities. These pedestrian amenities should be seen as playing a more important role when it comes to measuring total walkability. The order of presentation for the individual amenities of the pedestrian environment is building setback, number of complete sidewalks, number of driveways, street lights, amount of on-street parking, pedestrian path setback, sidewalk condition, speed limit, number of low volume streets, number of transit stops, and street trees. Please remember that these amenities are being presented as either averages or sums that were derived through data aggregation. No raw data on street segments is being presented.

Building Setback

The best building setbacks are those that are the shortest. In referring to Map 4-5, the shortest building setbacks along streets around each park, except for Meadow Park, are located within the impeded catchment areas. This area being the more accessible within the half-mile buffer that surrounds each park. Thurston Park and Meadow Park however all the only two parks that really have any building setbacks better than average.

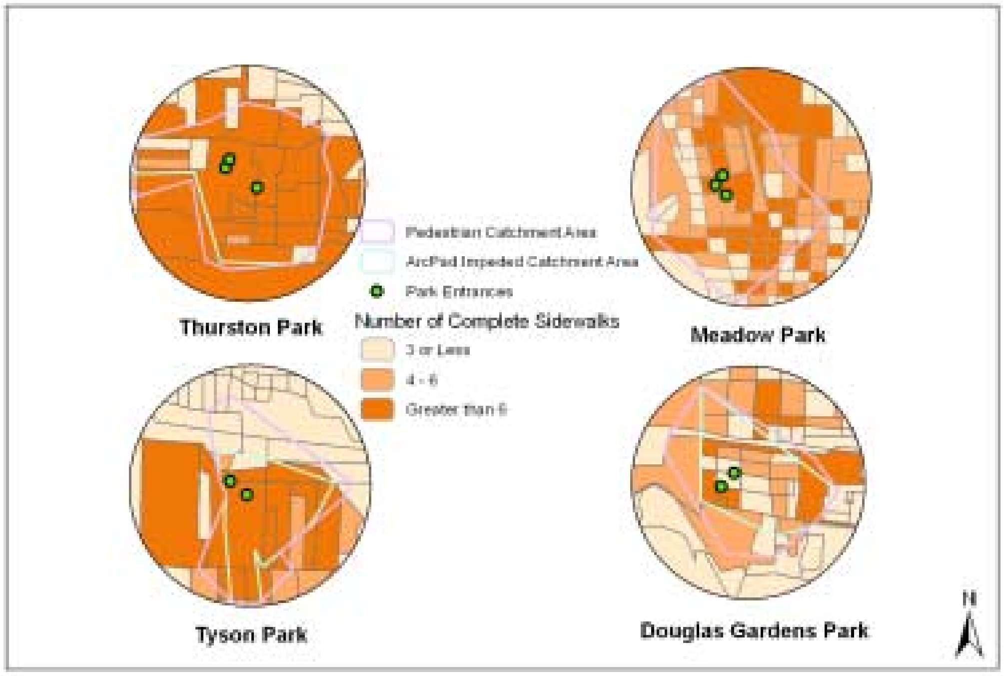
Map 4-5: Average Building Setback Scores



Sidewalk Network

Having a complete sidewalk network is important for pedestrians for reasons of connectivity and safety. According to Map 4-6, there is a strong tendency that areas in which there are the greatest number of complete sidewalk networks occurs within the more accessible portions of the neighborhood. Sidewalk completeness could be a predictor of overall walkability.

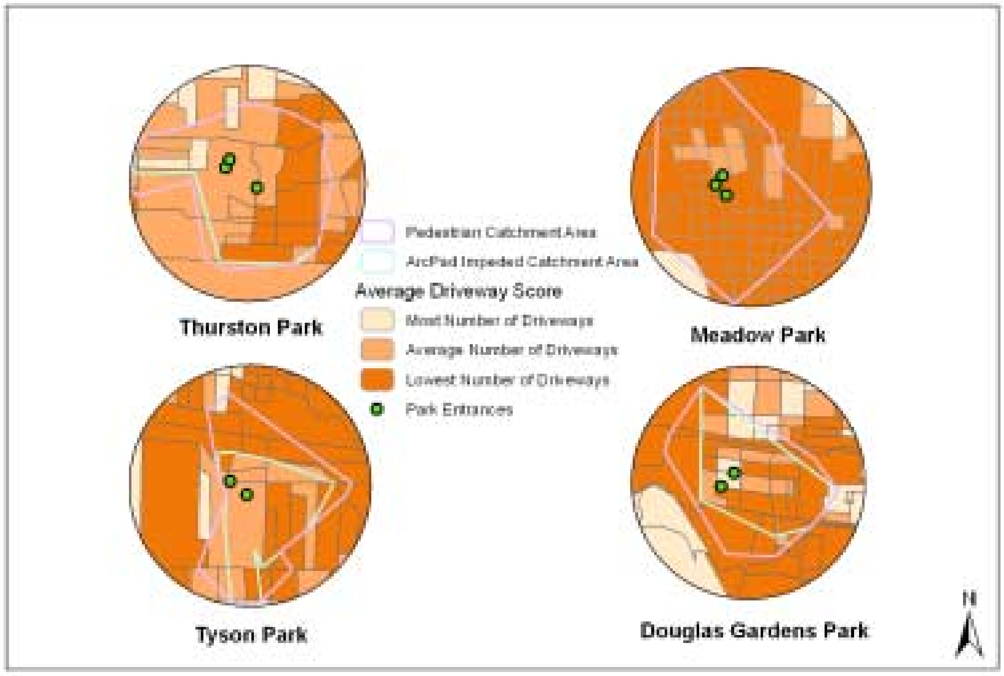
Map 4-6: Number of Complete Sidewalks



Frequency of Driveways

The frequency, or amount, of driveways is important for reasons of safety. A higher number of driveways provides for possibilities for pedestrian – automobile collisions. Map 4-7 does not seem to present any patterns with regard to number of driveways. Each park seems to demonstrate a different pattern.

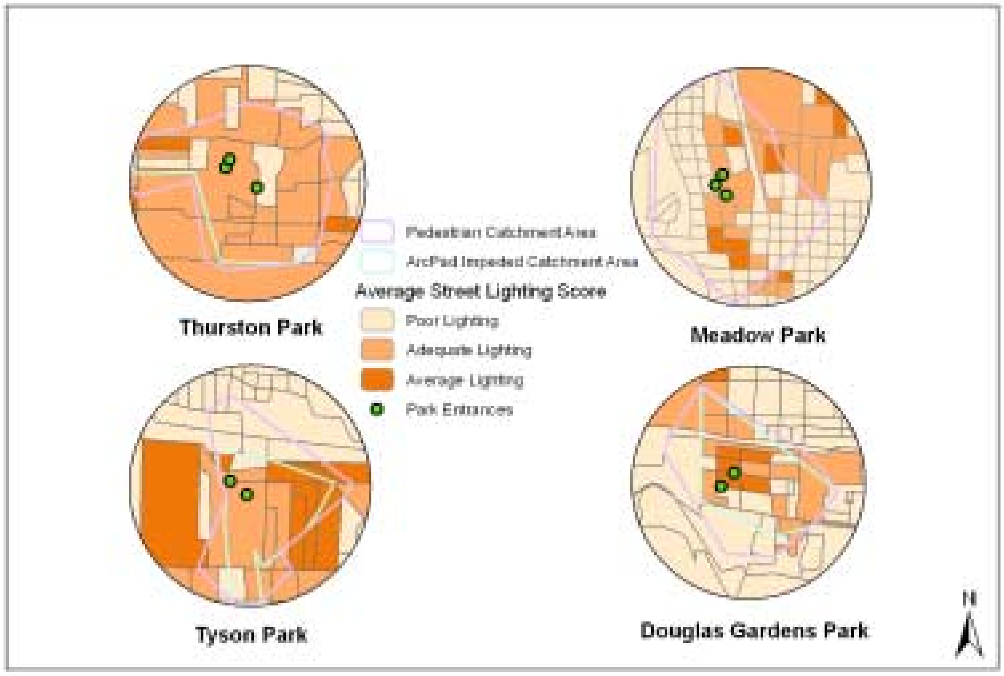
Map 4-7: Average Number of Occurrences for Driveways



Presence of Street Lights

Having streetlights is a matter of safety. Around the four parks studied the most noticeable thing about streetlights is the large amount of areas without adequate lighting (see Map 4-8). Even more alarming is that the more accessible areas, areas within the catchment area delineations, have a significant number of areas without enough streetlights.

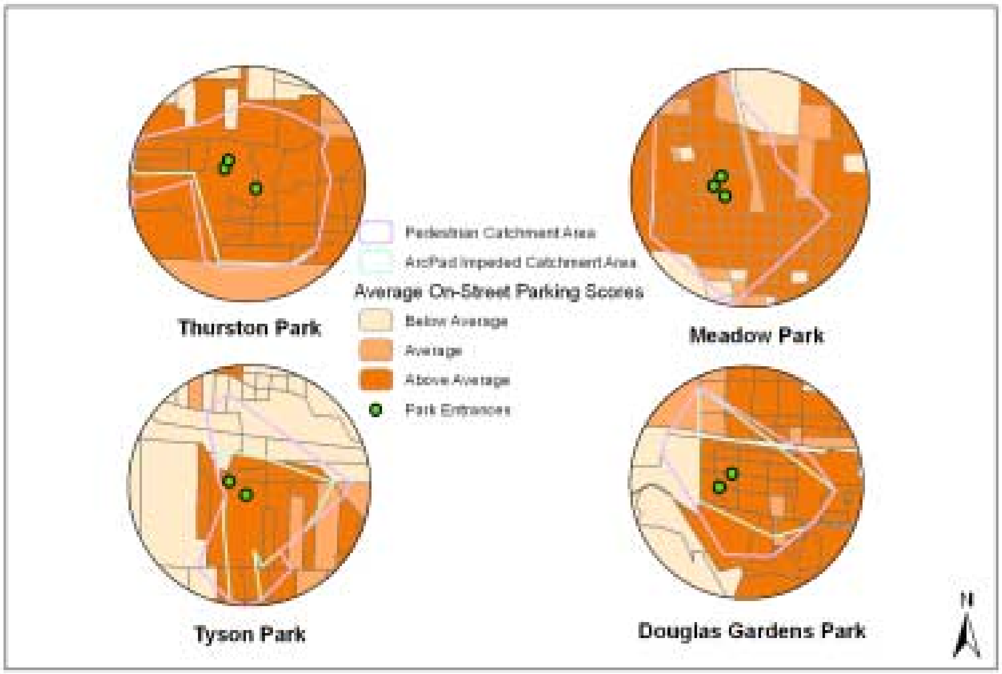
Map 4-8: Average Street Lighting Score



Provisions for On-Street Parking

On-street parking is a way of providing a buffer between the pedestrian and motor vehicle traffic. In examining, Map 4-9, Thurston and Meadow Park are mostly covered with streets that provide above average on-street parking. Above average being where most streets have parking on both sides of the street. Douglas Gardens and Tyson have a lot fewer areas with adequate on-street parking provisions, but where it does occur is concentrated mostly within the IPCA. The provision of on-street parking might be a more important predictor of walkability than other components.

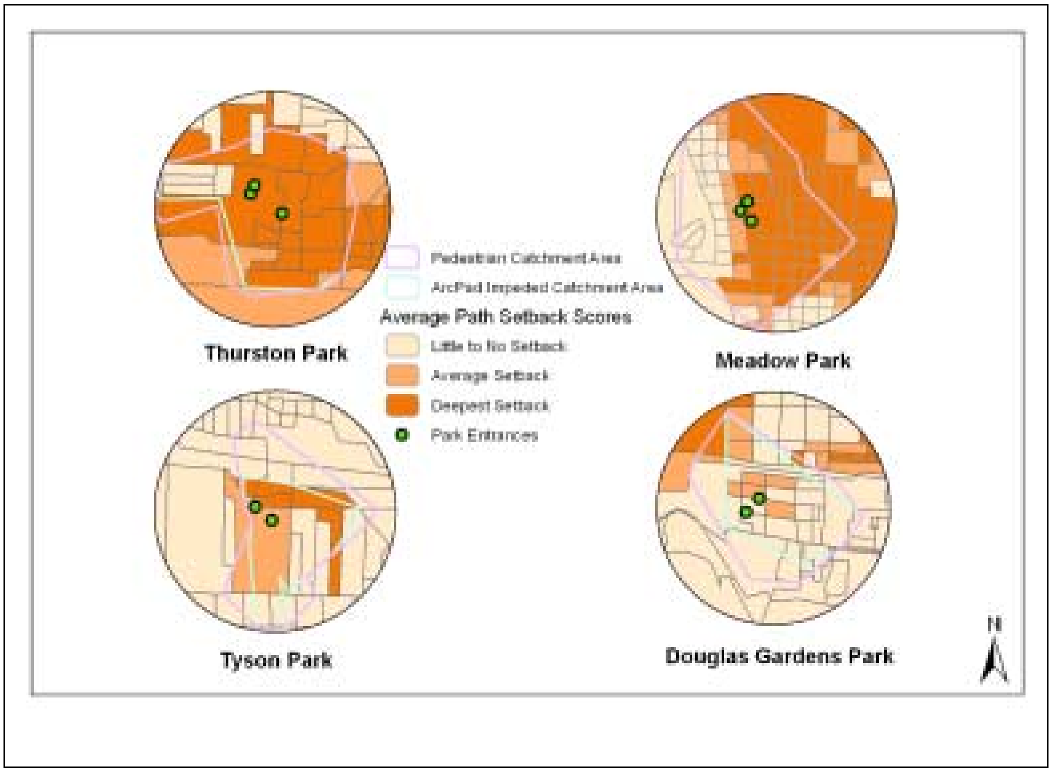
Map 4-9: Average On-Street Parking Scores



Pedestrian Path Setback

Sidewalk to curb setbacks is an additional buffering technique to protect the pedestrian. Areas around Thurston, Tyson, and Meadow Park where there are the deepest path setbacks are within the more walkable areas, within the catchment areas. Refer to Map 4-10. However, Tyson Park overall has only a couple of areas that have good sidewalk to curb setbacks. Douglas Gardens on the other hand is mostly dominated with average to short path setbacks.

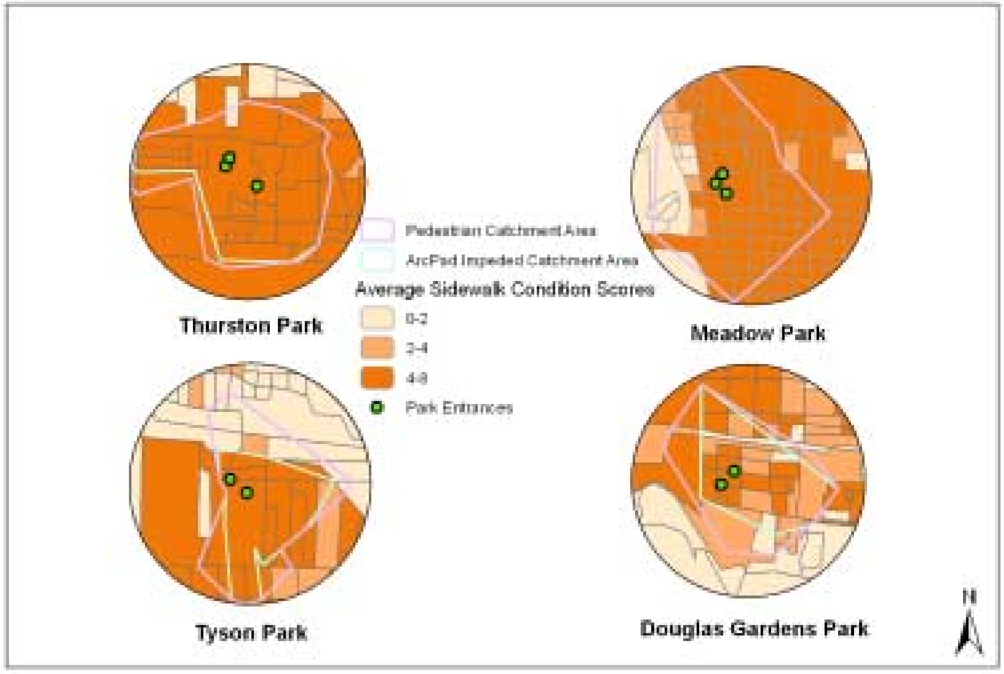
Map 4-10: Average Path Setback Score



Sidewalk Condition

Sidewalk condition is just as important as having a complete sidewalk in place. Having a sidewalk in disrepair can increase the possibilities for pedestrian accidents, such as tripping and falling. Examining Map 4-11, Thurston and Meadow Park sidewalks are in good condition. A note to the reader, the higher the score the better condition the sidewalk is in. Much of the sidewalks in good repair around Tyson and Douglas Gardens are concentrated around the center of the IPCA. Sidewalk condition may also be a more important predictor of total walkability within an area.

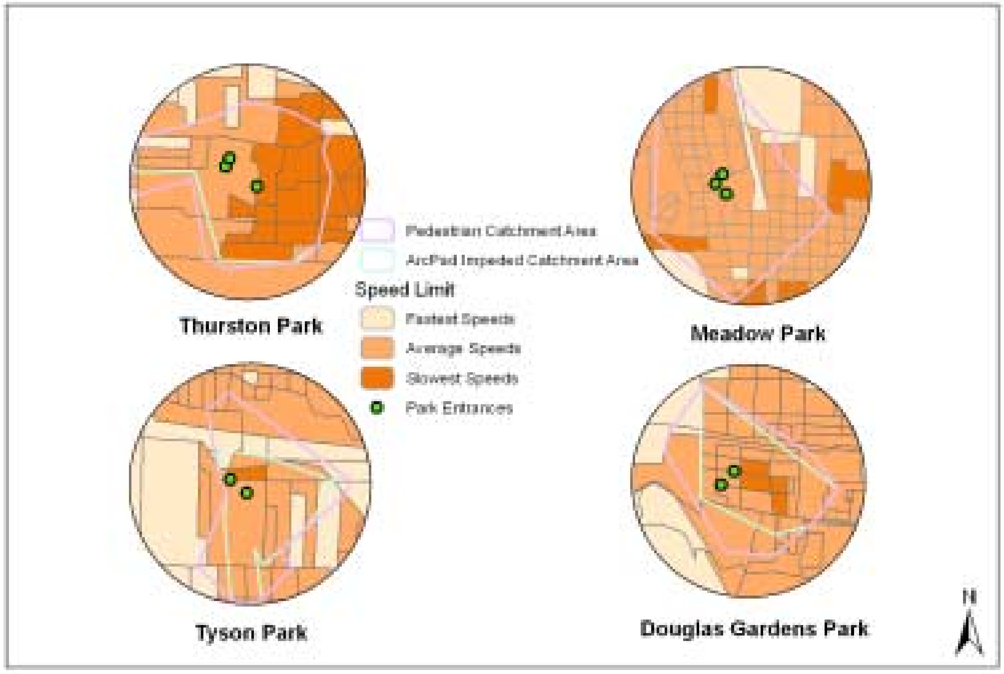
Map 4-11: Average Sidewalk Condition Score



Speed Limit

The speed at which cars travel is important especially for the 'feeling' of safety and security or insecurity it can bring to the pedestrian. For example, the pedestrian can feel much less safe in an environment where cars are racing by and he or she can feel the wind at their back every time a car passes them. Meadow, Douglas Gardens, and Tyson Park have areas where the speed of travel is slowest, but there is no real pattern. Refer to Map 4-12. This is especially surprising around Meadow Park because of its highest average walkability score.

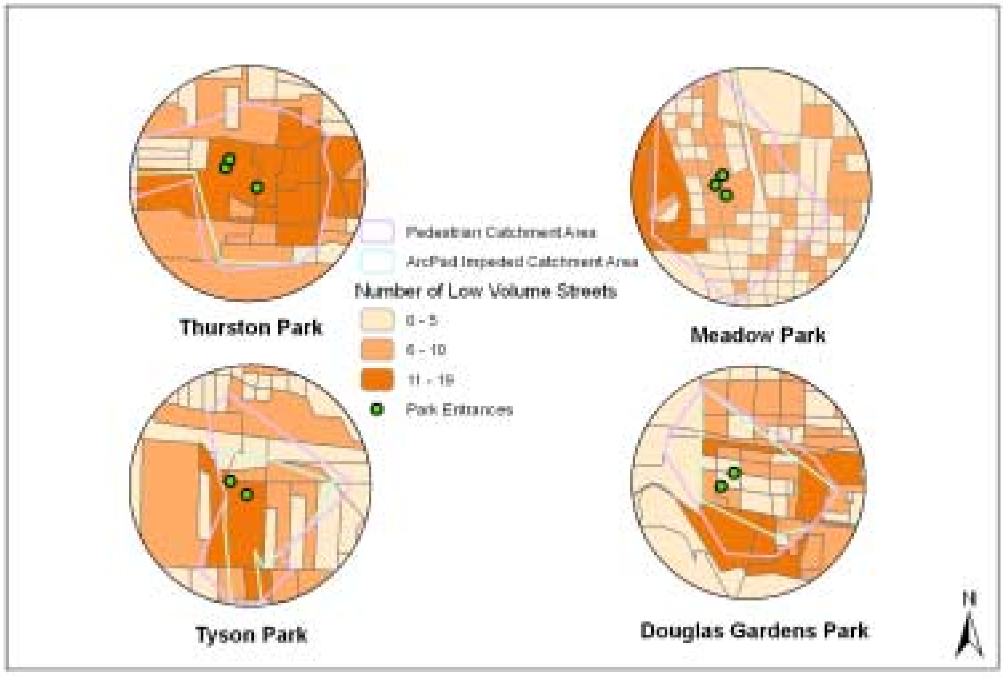
Map 4-12: Relative Speed Limits



Number of Low Volume Streets

The occurrence of low volume streets seems to follow the last walkability component discussed. As Map 4-13 illustrates, Meadow and Douglas Gardens Parks have fewer low volume streets and the highest number of these streets are more or less surrounding the more walkable areas around the park, not concentrated within the more walkable areas.

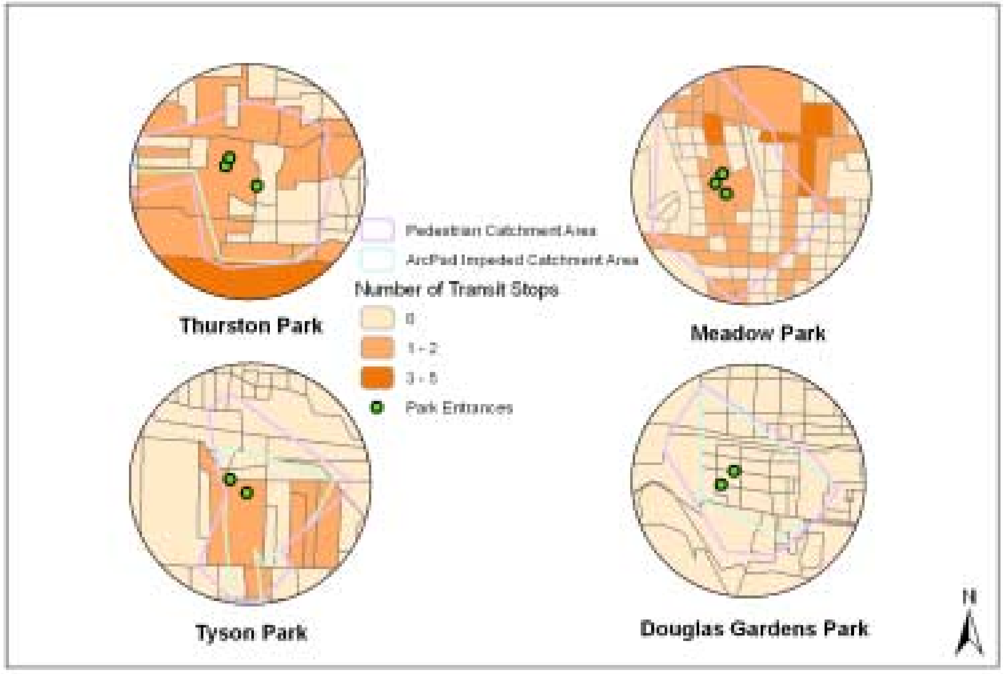
Map 4-13: Number of Low Volume Streets



Number of Transit Stops

What can be said about the number of transit stops is that there are very few of them. Especially surprising is that there are no transit stops located in the half-mile area surrounding Douglas Gardens Park. Refer to Map 4-14.

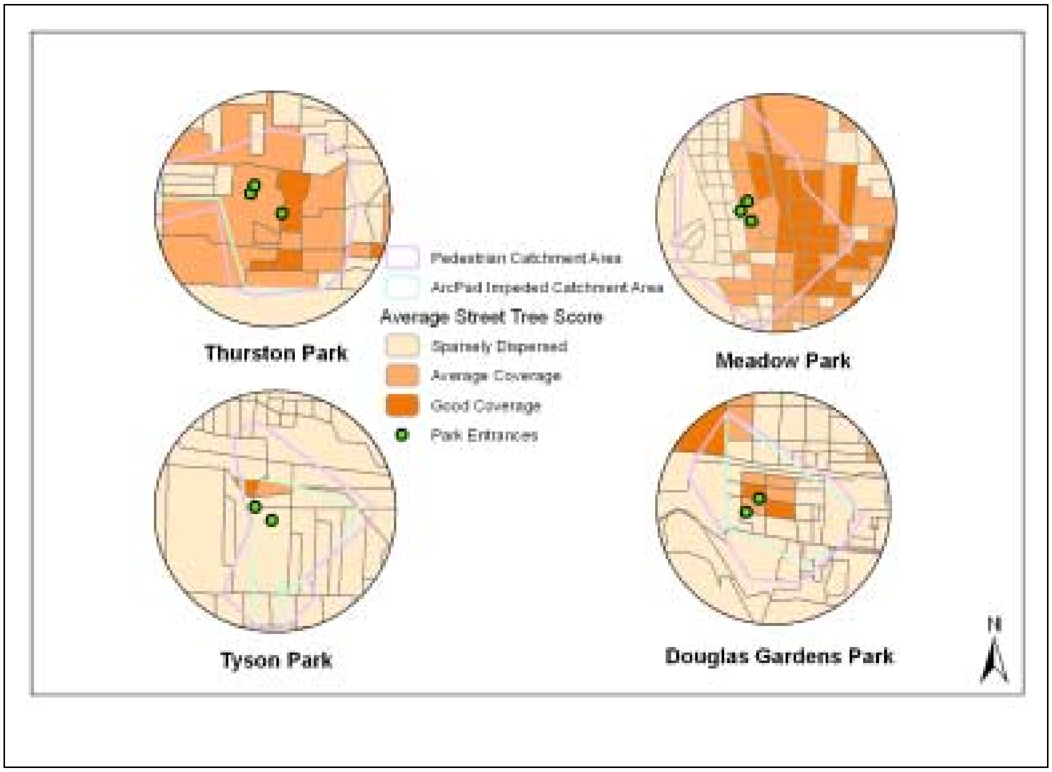
Map 4-14: Number of Transit Stops



Presence of Street Trees

The final walkability component that will be individually presented in this chapter is the presence of street trees. Street trees are yet another technique for buffering the pedestrian from traffic. Map 4-15, indicates mostly average coverage of street trees around Douglas Gardens and Tyson Park. However, where there is more adequate coverage it is located within the catchment area delineations. The more adequate coverage of street trees around the two other parks seems to concentrate within the more accessible areas. The best coverage of street trees around Meadow Park is clustered around Pioneer Parkway. Street trees may to some lesser extent also be a predictor of total walkability.

Map 4-15: Average Street Tree Score



Concluding Remarks

In exploring the findings from this neighborhood park walkability assessment, Meadow and Thurston Park have the largest walkable area. Douglas Gardens is third and Tyson Park seems to lag further behind in total walkability. Examining individual pedestrian amenities and the quality of each around the neighborhood parks, sidewalk completeness and condition, as well as, adequate on-street parking and street tree coverage may play more of a role in determining where the best walkable zone around a park is.

CHAPTER V

ANALYSIS AND RECOMMENDATIONS

Up to this point, the literature on urban form and walkability, methods used in this walkability assessment, and findings of the study have been discussed. However, the picture remains incomplete for this walkability assessment. It is pertinent at this time to explore the findings and there implications. Following this discussion a few words on using TIGER and LCOG classifications, implications for parks planning, as well as, recommendations for future research will be provided.

What do the Findings Tell Us?

Review of Results

As a review of the previous chapter, Meadow and Thurston Parks had the largest walkable areas and overall are the most walkable parks. Douglas Gardens and Tyson Park are significantly less walkable than the first two parks based on walkable area available to the pedestrian. In terms of quality of the pedestrian environment (amenities available), the results were much the same. Please refer to Table 5-1 for a simple summary of the pedestrian amenities discussed in the last chapter. A plus indicates that there appears to be a fairly good correlation between walkable area (area within catchment delineations) and the specific amenity. A minus is the exact opposite and ‘N’ is neutral/hard to tell. It is clear that Meadow and Thurston Parks also have the most pedestrian amenities, in terms of quantity and quality.

Table 5-1: Summary of Pedestrian Amenity Quality

Amenities of Pedestrian Environment	Meadow Park	Thurston Park	Douglas Gardens Park	Tyson Park
Building Setback	N	+	N	+
Number of Complete Sidewalks	+	+	+	+
Number of Driveways	+	+	-	-
Street Lights	+	+	+	N
Amount of On-Street Parking	+	+	+	+
Pedestrian Path Setback	+	+	-	+
Sidewalk Condition	+	+	+	+
Speed Limit	N	N	N	N
Number of Low Volume Streets	N	+	-	+
Number of Transit Stops	N	N	-	-
Street Trees	+	+	-	-
Total Pluses (+):	**7**	**9**	**4**	**6**
Total Minuses (-):	**0**	**0**	**5**	**3**

Discussion

As mentioned before Meadow Park is located within the historic core of the city, Thurston within a conventional suburban development, Douglas Gardens on the urban fringe, and Tyson Park in the commercial/industrial core of the city. Meadow Park and Thurston Park were found to have the best overall walkability. In the case of Meadow Park this is not surprising at all given the more well-gridded street network, more dense street coverage, and location in the city; the literature on urban form would also follow this logic. Thurston Park however is a bite more surprising. Normally planners are used to suburban developments being less desirable, attractive, and walkable. However, in this case that while there are a lot of cul-de-sacs around Thurston Park (typical of suburbs) the overall pedestrian environment is well maintained. There are many pedestrian-friendly amenities, such as street trees and complete sidewalks. What these findings illustrate is that a suburban environment if developed, or retrofitted, with adequate pedestrian amenities can significantly affect the total walkability of the area.

Tyson and Douglas Gardens Park had lower walkability scores. In reviewing the data collected, it became apparent that there are so many more streets with long block lengths, no sidewalks, gravel surfacing, and less on-street parking availability. Given that the findings from the last chapter suggest that sidewalk completeness and condition and on-street parking availability seem to play a greater role in determining overall walkability, these lower walkability scores seem to make perfect sense. Also, the locations of these parks (commercial/industrial core and urban fringe) are indicative of these walkability findings. Typically in the urban fringe area street improvements, for example, lag behind development in the area because jurisdictions have not been able to extend services yet. Commercial-industrial areas are usually just not well suited to the pedestrian because of the prevalence of heavy machinery, odors, and excessive noise. For both of these reasons, lower walkability is not surprising and unfortunately should be expected in these areas.

Better Indicators of Walkability

Walkable neighborhoods tend to be those with more pedestrian-friendly amenities. The real question is what amenities are better indicators of the size of a walkable area around a neighborhood park. In examining the findings in the previous chapter and Table 5-1, the better scores for sidewalk existence and condition, availability of on-street parking, and street trees seem to be more or less clustered, for each park, within the best walkable area around the park. The other walkability indicators do not appear to present the same results for all parks. As further proof that these four pedestrian amenities may have a greater role in determining walkability, maps were made that show the average walkability scores (all indicators used) side-by-side with an average score for only one indicator at a time. The thinking is that if the indicator is a better predictor of walkability the patterns of the two maps will be somewhat similar. These maps are located in Appendix D. The color scheme on these maps is that the darker colors represent the better scores.

Using Alternative Classification Methods

Now that some analysis as to why the findings may of come out the way they did in this study has been done, I would like to briefly provide some thoughts on using TIGER or LCOG (local government) classifications when delineating impeded pedestrian catchment areas (IPCA). The IPCAs based on TIGER were the same as the pedestrian catchment areas generally, except for Tyson Park. The overwhelming reason why this is seems to stem from the fact that the audit instrument collects data on a street-by-street basis. The results are thus very detail-oriented. The TIGER data from the U.S. Census Bureau however is a national dataset that only classifies streets as interstate, highway, primary road, or local street. The audit instrument paints a more accurate picture of the actual walkable area around a park as opposed to using TIGER data. Accordingly, because TIGER data is not of a fine enough grain it's use should be limited. However, because financial resources are usually limited and may not allow for a detailed, time-consuming approach using an audit instrument, a more locally oriented street database could be used instead. As the findings demonstrated, the LCOG-based IPCA ratios were much closer to those from this walkability study. In fact, the LCOG-based ratios were on average even lower. However, this is not surprising given that using street classifications to define pedestrian-hostile streets does not allow individual amenities that might be present along some arterials or collectors, which makes a high volume street seem more attractive to be included. What the findings demonstrate is that a locally-oriented database can do a good job at measuring pedestrian accessibility with results similar to a more advanced tool; but if resources permit there is still good reason to collect data with a mobile GIS because of the additional insights that can be gained.

Implications for Parks Planning

There are many implications for the type of results that this Springfield neighborhood park walkability study found, especially in the siting of future parks. Park master plans, the guiding document for a parks planner, typically include recommendations for future park facilities and locations. With the knowledge from a walkability study such as this one, planners can evaluate future park locations with pedestrian-friendly amenities in mind. If a potential location has more pedestrian amenities within the ¼ to ½ mile buffer around it than another location, planners could feel more assured of what location would be more walkable.

Recommendations

Based on the findings and analysis presented earlier, I would like to make the following recommendations for future research.

- In the literature reference is made to a sixty percent pedestrian catchment area (PCA) ratio being the threshold for 'good' walkable areas. However, as the results here demonstrate not even the parks with the best walkability scores and greater abundance of quality pedestrian amenities could reach the sixty percent mark. Based on findings in this neighborhood park walkability assessment, I would recommend that fifty percent is a more appropriate cut-off.

- Given that this study used data aggregation rather than mapping the actual line segments, it opens the door for future researchers to compare these results with that of census data. For example, someone could look at whether population density, median household income, travel time to work, age, or gender have any correlations with walkability levels.

- Another area for future research would be to develop a more detailed GIS database, which would include not only street classifications but also speed limit, existence of sidewalks, street trees or lights, or availability of on-street parking along a street segment. A detailed database could allow a fine-grained study such as this one be done in the office, not in the field.

- Future research can also repeat this mobile GIS-based walkability assessment by doing a second walkability assessment, but placing stronger controls on certain walkability indicators so that an even greater understanding of the causes of 'good' walkability might be discovered.

- I recommend that a local government street classification system can be used in place of an advanced environmental audit instrument based on the finding that LCOG data was similar to the results from the mobile GIS collection device.

- Parks planners should start writing policies into their park master plans that emphasizes siting neighborhood parks in the most walkable area of neighborhoods. Planners could use a method similar to this study, but using local government street classifications instead of fieldwork, to perform a cursory walkability analysis on a potential park location.

APPENDIX A

PEDESTRIAN ENVIRONMENT DATA SCAN (PEDS)

The following text was extracted from the protocol manual for the Pedestrian Environment Data Scan (PEDS) to give the reader an idea of the original audit instrument that was modified for this walkability assessment.

GENERAL DIRECTIONS:

Surveyors will go out each day with their team. Maps of segments and a list of segments will be given each morning to direct surveyors regarding which segments they should survey. Surveyors will return to Caroline Hall each day to upload completed entries.

In case of inclement weather, the Undergraduate and Graduate Fellows will assess the situation and decide whether surveying should be postponed.

SUPPLIES:

- Map of area with segments detailed
- Master list of segments
- PDA

PROCEDURES AT EACH SEGMENT:

1. Identify the segment on your map and check it against the master list. Start a new entry and input the segment number, your name, the time, day and weather.

2. Make sure you locate the beginning and endpoint of the segment. Look at the map to find the information.

3. Walk the segment once WITHOUT writing anything on the survey form. You should look around in all directions, without forgetting to look up and down as well.

4. Walk the segment again, this time while filling out the survey (as explained below). Go back and forth as often as necessary in order to fill in each question. Make sure you are in agreement with your teammate about your choices.

NOTE: The audit only consists of "check" (boxes) and "fill in number" (line) questions. For the numeric answer, use integers only. If you need to round the number, always round up.

5. When you have filled each question, go over the entire survey again to make sure you have completely answered the form and that you are satisfied with your answers (in the paper audit, this means you will have at least one check mark per cluster of boxes). You can then move on to the next segment, following the same procedure.

6. Make sure to record any modifications such as segments that are merged or do not exist.

Also, make note of any questions or problems that arose while surveying the segment.

QUESTION BREAKDOWN:

The following section of the protocol describes each question and response category to aid the administrators in dealing with variations in the environment. The administrators are encouraged to read through this section and use it as a reference while surveying the segments.

For each question, the name and number are in bold, the answer options are in *italics* and the comments, definitions or directions in regular text.

SECTION 0: SEGMENT NUMBER & TYPE

0. Segment Type

Low volume road – audit both sides
High volume road – audit this side only
Bike or ped path – skip section C

SECTION A: ENVIRONMENT

1. Uses In Segment

Housing – Single Family Detached
Housing – Multi-Family: attached housing, apartments, duplexes.
Housing – Mobile Homes
Office/Institutional: office parks, corporate campuses, public buildings, schools, churches, hospitals etc. This also includes professional offices in residential buildings (dentist, lawyer, doctor, accountant, etc.)
Restaurant/Café/Commercial: restaurants, stores, malls, gas stations etc.
Industrial: factories, mills, industrial complexes, etc.

Vacant/Undeveloped: cleaned or cleared off lots, naturally occurring vegetation, natural features such as lakes and rivers.
Recreation: parks, golf courses, basketball courts etc. Official paths coming off a segment can count as recreation.

2. Slope

Flat: there is no discernable hill walking the segment.
Slight Hill: there is a slight hill in the segment, but not enough to make walking uphill difficult.
Steep Hill: the hill in the segment makes walking or biking it difficult.

3. Segment Intersections (check all that apply)

Segment has 3-way intersection
Segment has 4-way intersection
Segment has other intersection
Segment dead ends
Segment dead ends but path continues
Segment has no intersections

SECTION B: PEDESTRIAN FACILITY

4. Type(s) of Pedestrian Facility (check all that apply)

Footpath (worn dirt path)
Paved Trail: a paved trail is any paved walkway that is not associated with a roadway.
Sidewalk: a walkway will only be considered a sidewalk if it is associated with a roadway.
Pedestrian Street (closed to cars)

NOTE: The rest of the questions in this section refer to the BEST pedestrian facility selected above.

5. Path Material

Asphalt
Concrete
Paving Bricks or Flat Stone
Gravel
Dirt or Sand

6. Sidewalk Condition/Maintenance

Poor (many bumps/cracks/holes): A sidewalk will be considered “poor” if a stroller cannot be pushed along the sidewalk without many jarring motions and/or if it clearly needs to be replaced (patches would not be sufficient)
Fair (some bumps/cracks/holes): A sidewalk will be considered “fair” if a stroller can easily be pushed along the sidewalk with few jarring motions to the passenger

and/or it only needs patches or other minor repair.
Good (very few bumps/cracks/holes): A sidewalk will be considered "good" if a stroller can easily be pushed along the sidewalk without jarring motions to the passenger and/or it needs no repair at this time.
Under Repair: A sidewalk will only be considered "under repair" if there is evidence of work being done to improve the sidewalk. Orange cones are not enough. If construction work is being done adjacent to the sidewalk, blocking it off as a result, it is considered "under repair."

7. Path Obstructions (check all that apply)

NOTE: An object is only a path obstruction if it severely reduces or completely blocks off the pedestrian facility. Threshold: Could you get by in wheelchair or while pushing a stroller?

Poles or Signs
Parked Cars: cars in driveways that block the sidewalk should be counted.
Greenery
Garbage Cans
Other
None

If the pedestrian facility in the segment is not a sidewalk, skip now to section C

8. Buffers between road and path (check all that apply)
Fence
Trees: trees are only a buffer if they are part of a landscape/grass buffer or if they occur regularly enough on the street to discourage pedestrians from walking along the roadway. Trees within a grass buffer count as a buffer.
Hedges
Landscape
Grass
None

9. Distance from curb
At Edge
< 5 feet
> 5 feet

10. Sidewalk width
< 4 feet
Between 4 and 8 feet
> 8 feet

11. Curb Cuts

None
1 to 4
> 4

12. Sidewalk Completeness/Continuity

Sidewalk is complete: a sidewalk is complete if it does not have any breaks within the segment.
Sidewalk is incomplete: a sidewalk is incomplete if it ends or has gaps within the segment.

13. Sidewalk connectivity to other sidewalks/crosswalks

This refers to the number of connections the segment sidewalk has to crosswalks and other sidewalks. Stop signs at the end of the segment can be treated as a crosswalk. This will be scored as follows:

At the beginning of the segment, looking backward 180 degrees, +90 degrees and –90 degrees: how many sidewalks or crosswalks are there?

At the end of the segment, looking forward, +90 degrees and –90 degrees: how many sidewalks or crosswalks are there?

In the middle of the segment: are how many sidewalks or crosswalks are there?

These three scores should be added to make up the connectivity score.

A very well connected segment will have a score of six plus any crosswalks that may exist along the segment.

SECTION C: ROAD ATTRIBUTES

NOTE: skip this section if path only

14. Condition of Road

Poor (many bumps/cracks/holes): the potholes, cracks, etc. present would cause a vehicle driving the segment to rock, dip or otherwise disrupt driving.
Fair (some bumps/cracks/holes): there are potholes, cracks etc., but not enough to cause problems for a vehicle driving the segment.
Good (very few bumps/cracks/holes): there are no large potholes or other problems that would cause problems for a vehicle driving the segment.
Under Repair: A roadway will only be considered “under repair” if there is evidence of work being done to improve it. Orange cones are not enough.

15. Number of Lanes
Minimum number of lanes to cross
Maximum number of lanes to cross

16. Posted Speed Limit
None Posted
(mph): _______

17. On Street Parking
Parallel or Diagonal
None

18. Off-Street Parking Lot Spaces
Count all off-street parking spaces in segment. Cars in single family home driveways do not count. Only cars in actual parking lots count (apartment complexes, commercial parking, office parking etc.) There must be access to the lot from the segment.

19. Must you walk through a parking lot to get to most buildings?
Yes
No

20. Presence of High-Medium Volume Driveways
< 2
2 to 4
> 4

21. Traffic Control Devices (check all that apply)
Traffic Light
Stop Sign
Traffic Circle: counts on all the segments that go into the circle. Triangular traffic control devices can also be counted under this category.
Speed Bumps
Chicanes or Chokers: chicanes are a series of narrowings or curb extensions that alternate from one side of the street to the other forming S-shaped curves. Chokers are curb extensions at midblock or intersection corners that narrow a street by extending the sidewalk or widening the planting strip.

22. Crosswalks
None
1 to 2
3 to 4
> 4

23. Crossing Aids in Segment (check all that apply)
Pavement Markings
Yield to Ped Paddles
Pedestrian Signal
Crossing Aids
Median/Traffic Island
Curb Extension
Overpass/Underpass
Warnings to Cars
Pedestrian Crossing Street Sign: street sign without flashing light. Children at play signs can also be included here. Yield signs for cars do not count.
Flashing Warning
Share the Road Warning

24. Bicycle Facilities (check all that apply)
No designated bikeway
Bicycle route signs
Striped bicycle lane designation
Visible bicycle parking facilities: these facilities must be useable by the public, not for private use only
Bicycle crossing warning.

SECTION D: WALKING/CYCLING ENVIRONMENT

25. Roadway/Path Lighting
No Lighting: there is no artificial lighting in the area.
Road-oriented lighting: there are public light fixtures that aim light at the road or are very high and illuminate broad expanses.
Pedestrian-scale lighting: there are public light fixtures that aim light at the walking path.
Other lighting: lighting from stores, apartments etc. that lights the road and/or pedestrian path.

26. Amenities (check all that apply)
Garbage Cans: only public use garbage cans count. Residential garbage cans do not count.
Benches
Water Fountain
Street Vendors/Vending Machines: this includes soda machines, candy machines, public pay phones, mailboxes and newspaper dispensers.

27. Are there Wayfinding Aids Present?

Yes A wayfinding aid is a sign identifying the name of the cross streets. Any sign visible from the segment at the pedestrian level counts as a wayfinding aid, even if it is actually locate on another segment.
No

28. Number of Trees Shading Path

None or Very Few: the path is not shaded by any trees (or only one tree) along the segment. (less than 25% is covered)
Some: the path is covered between 25 and 75% of the way.
Many/Dense: more than 75% of the path is shaded by trees.

29. Degree of Enclosure

Little or no enclosure: the view from the sidewalk is open in both directions for more than 15 feet for most of the segment. It is a wide-open, unconstrained space.
Some enclosure: the view is partially enclosed, but there is still some wide-open spaces.
Highly enclosed: the buildings lining the street are within 10 feet of the sidewalk and there is a cross-sectional design ratio of approximately one (height) to two (width), or less.

30. Powerlines along segment?

No
Low Voltage/Distribution Line
High Voltage/Transmission Line

31. Overall Cleanliness and Building Maintenance

Poor: there is noticeable garbage, graffiti and/or broken glass along the segment.
Fair: there are a few wrappers, or other litter but no graffiti or other garbage evident.
Good: there is no obvious garbage, graffiti, litter or broken glass in the segment.

32. Articulation of Building Designs

Little or no articulation: the façades of buildings along the segment are unadorned and do not have many window openings.
Some articulation: the façades of buildings along the segment are similar in style and/or are not very ornate.
Highly articulated: the façades of buildings along the segment are complex and varied.

33. Building Setbacks

Answer Options
At edge of sidewalk
Within 20 feet of sidewalk
More than 20 feet from sidewalk

34. Building Height

Short: 1-2 stories, except with big box buildings or other buildings with tall floors.
Medium: 3-5 stories (with same exceptions.)
Tall: buildings taller than 5 stories (with same exceptions.)

NOTE: Average height is to be measured here, not the maximum or minimum height.

35. Bus Stops

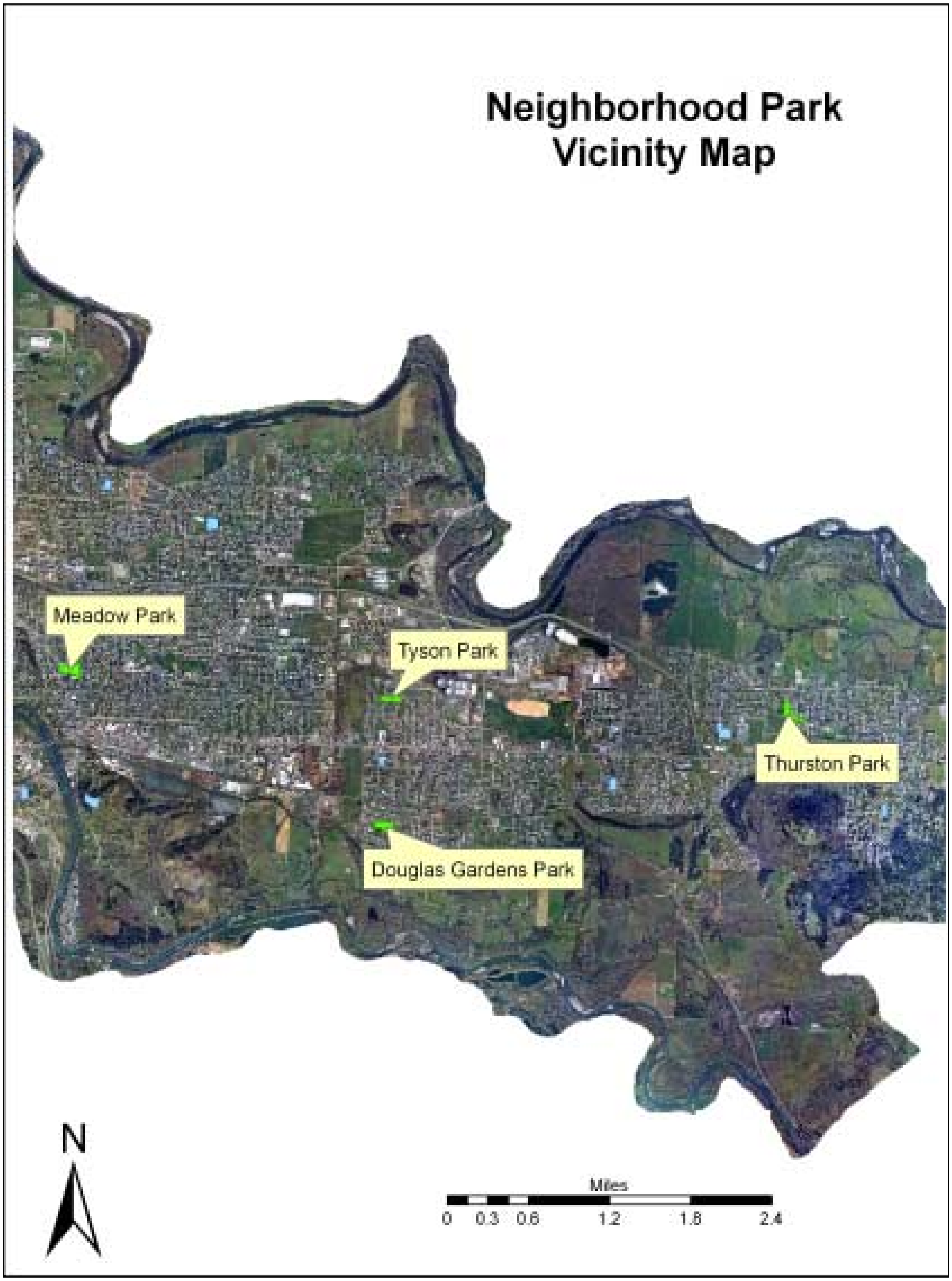
Bus stop with shelter
Bus stop with bench
Bus stop with signage only

SECTION SA: SUBJECTIVE ASSESSMENT

Enter 1, 2, 3 or 4 for:
1 = Strongly Agree
2 = Agree
3 = Disagree
4 = Strongly Disagree

Segment…
… is attractive for walking
… is attractive for cycling
… feels safe for walking
… feels safe for cycling

APPENDIX B



Neighborhood Park
Vicinity Map
Meadow Park
Tyson Park
Thurston Park
Douglas Gardens Park
N
Miles
0 0.3 0.6 1.2 1.8 2.4

APPENDIX C

DATA COLLECTION ASSUMPTIONS

In the process of data collection using ArcPad, there are some assumptions that had to be made because the pedestrian assessment tool used is generic and designed for use in many different environments. The tool could not possibly plan for every possible scenario that a data collector might face in the field. Without these assumptions, comparisons among the four parks would be much more difficult if not impossible. The assumptions follow.

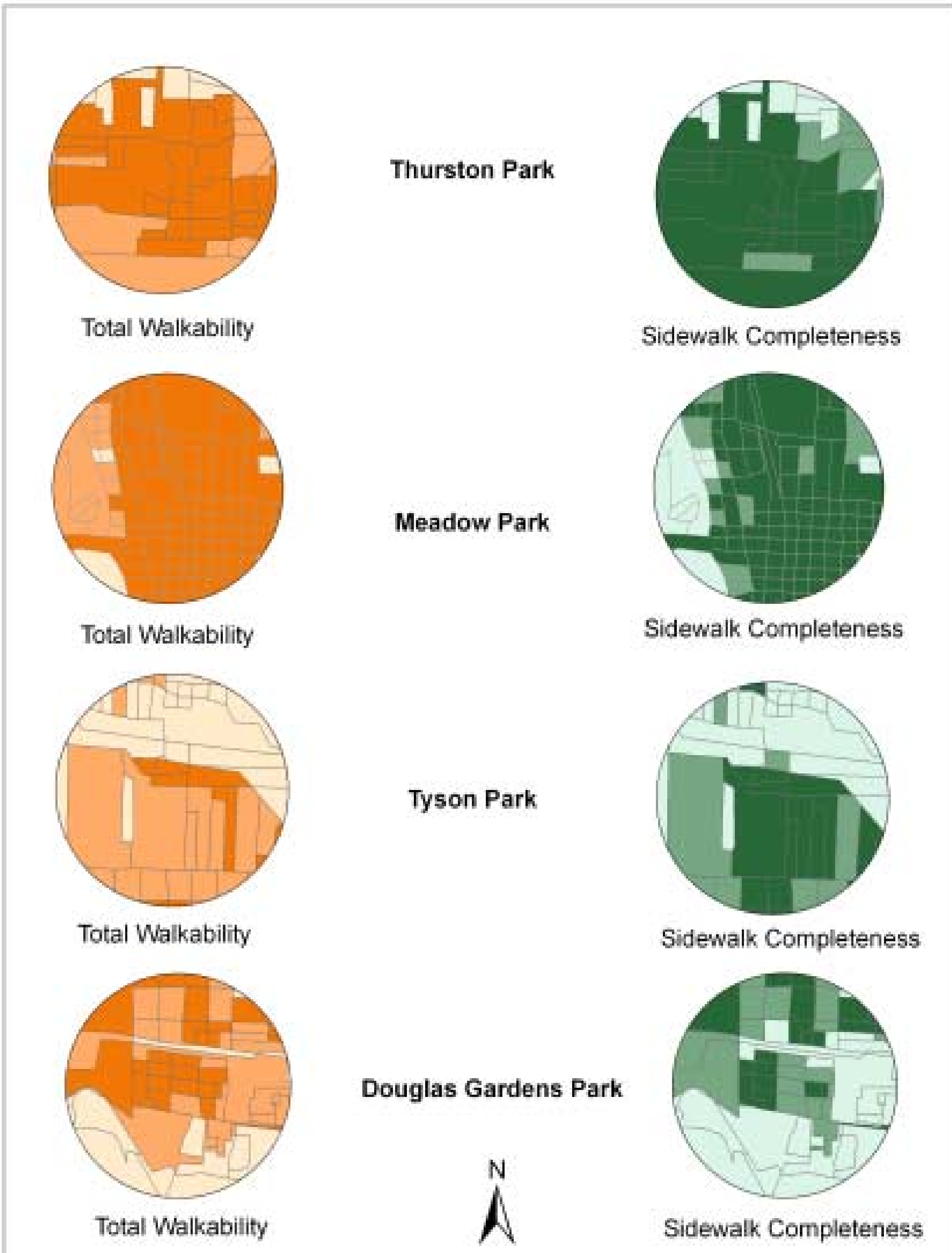
- The difference between high and low volume streets was whether the average speed of cars was over thirty miles per hour.
- Land along a street segment that was vacant or used for religious purposes was listed under the 'other' category.
- When a street segment had sidewalks only on one side of the street or gaps in the sidewalk network were present, the sidewalk was deemed incomplete.
- If a cul-de-sac had no posted speed limit than the speed limit was considered to be twenty miles per hour when the cul-de-sac was around 100 feet. The assumption was that on such a short street segment cars have little opportunity to get going at higher rates of speed.
- A walk through parking lot was any parking lot that did not have a fence around it and was located next to the sidewalk. Thus making it easy for pedestrians to utilize the parking lot as additional space for walking. In essence a parking lot is an added width for walking, which can add more buffering between pedestrians and automobiles.
- At an intersection, a pedestrian control signal was any device that allows a pedestrian to request a 'walk signal'. The 'walk sign' itself is a pedestrian crossing sign.
- All distances were measured by visual estimation, using nearby objects with known distances as reference.

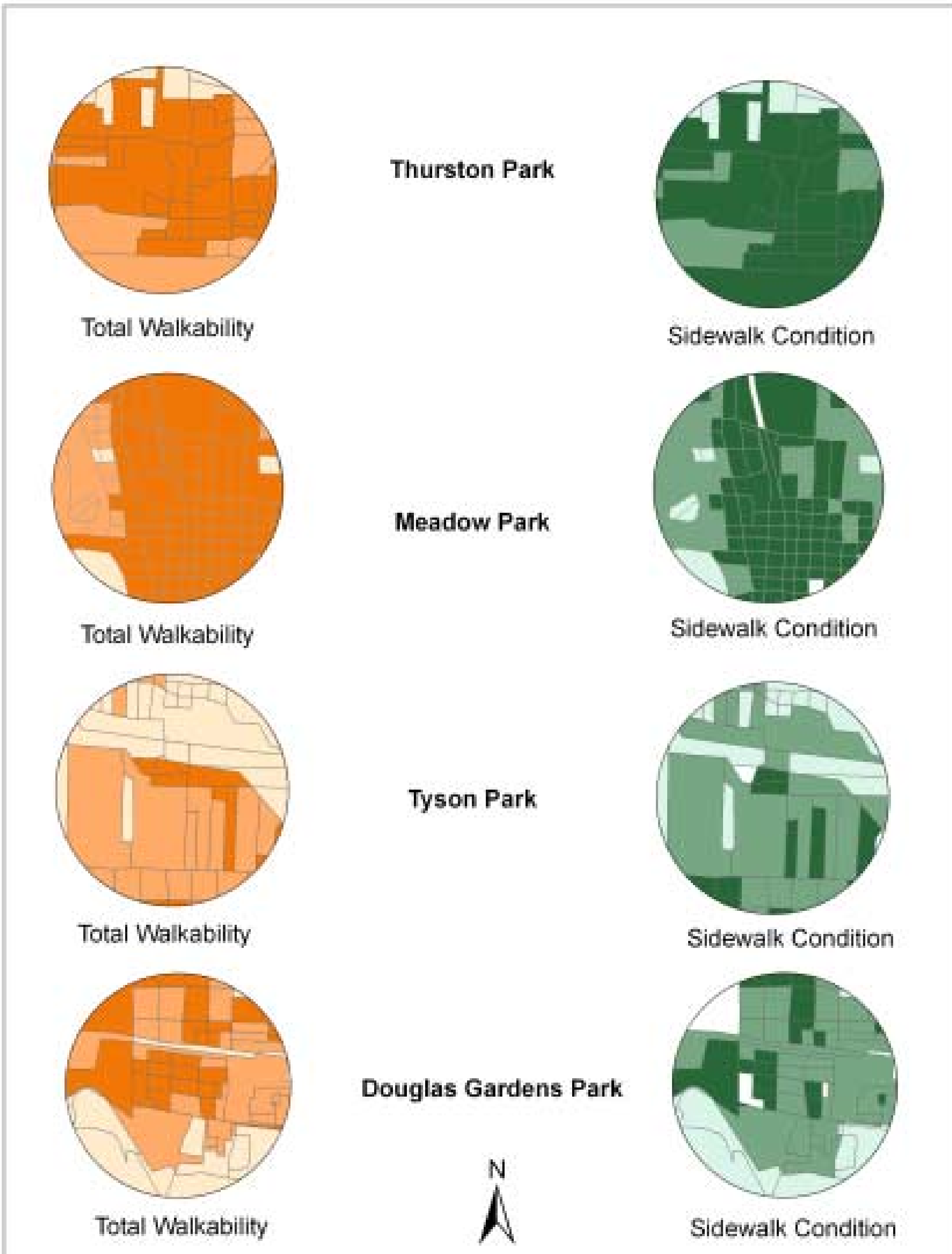
- In situations where sidewalk setbacks had variable widths, the width chosen for the street segment was whichever width was the most common.

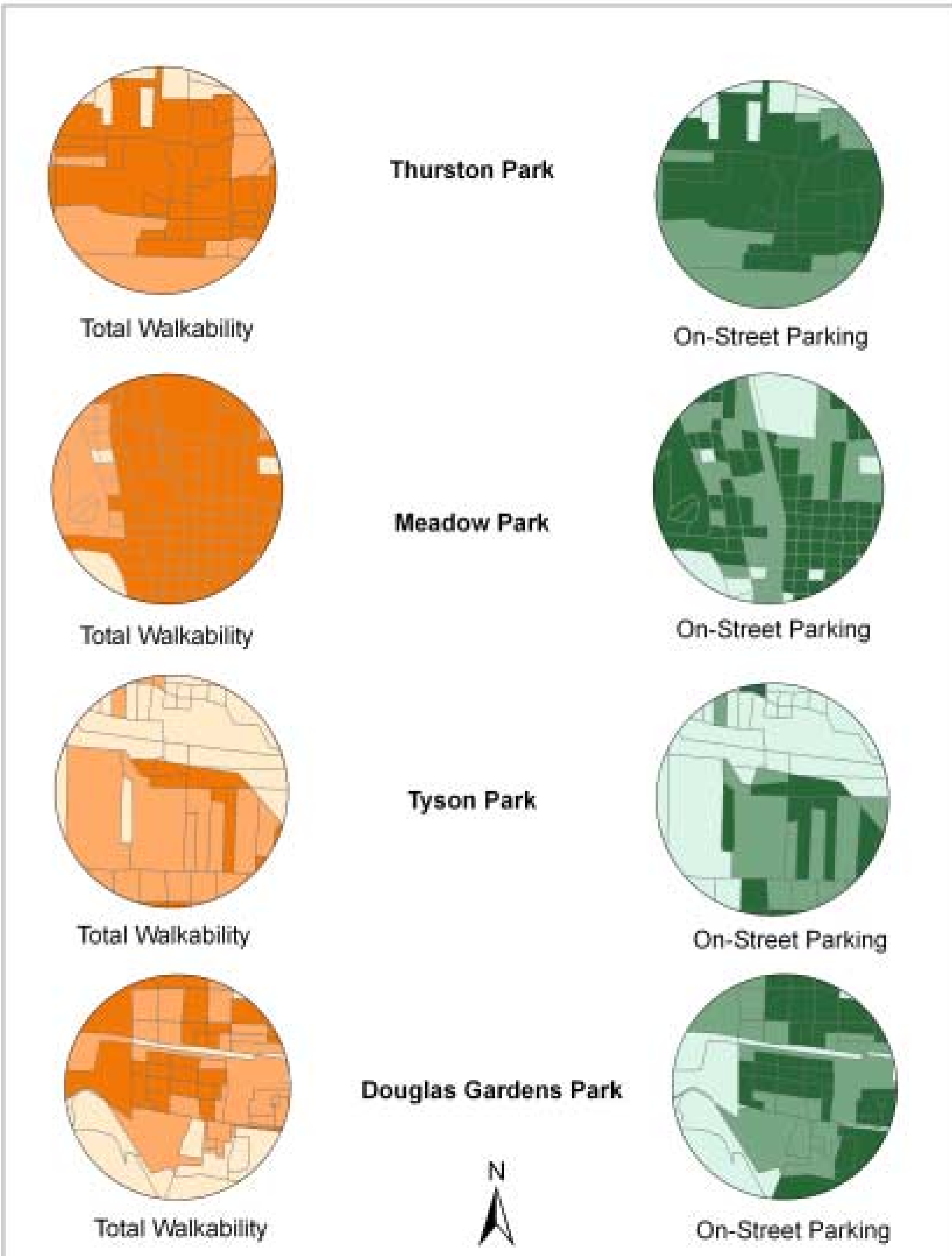
- Observations of a street segment, in which one sidewalk was in a dramatically better condition than the other sidewalk, were recorded using the better sidewalk. The assumption is that people will naturally choose to walk on the better side of the street.

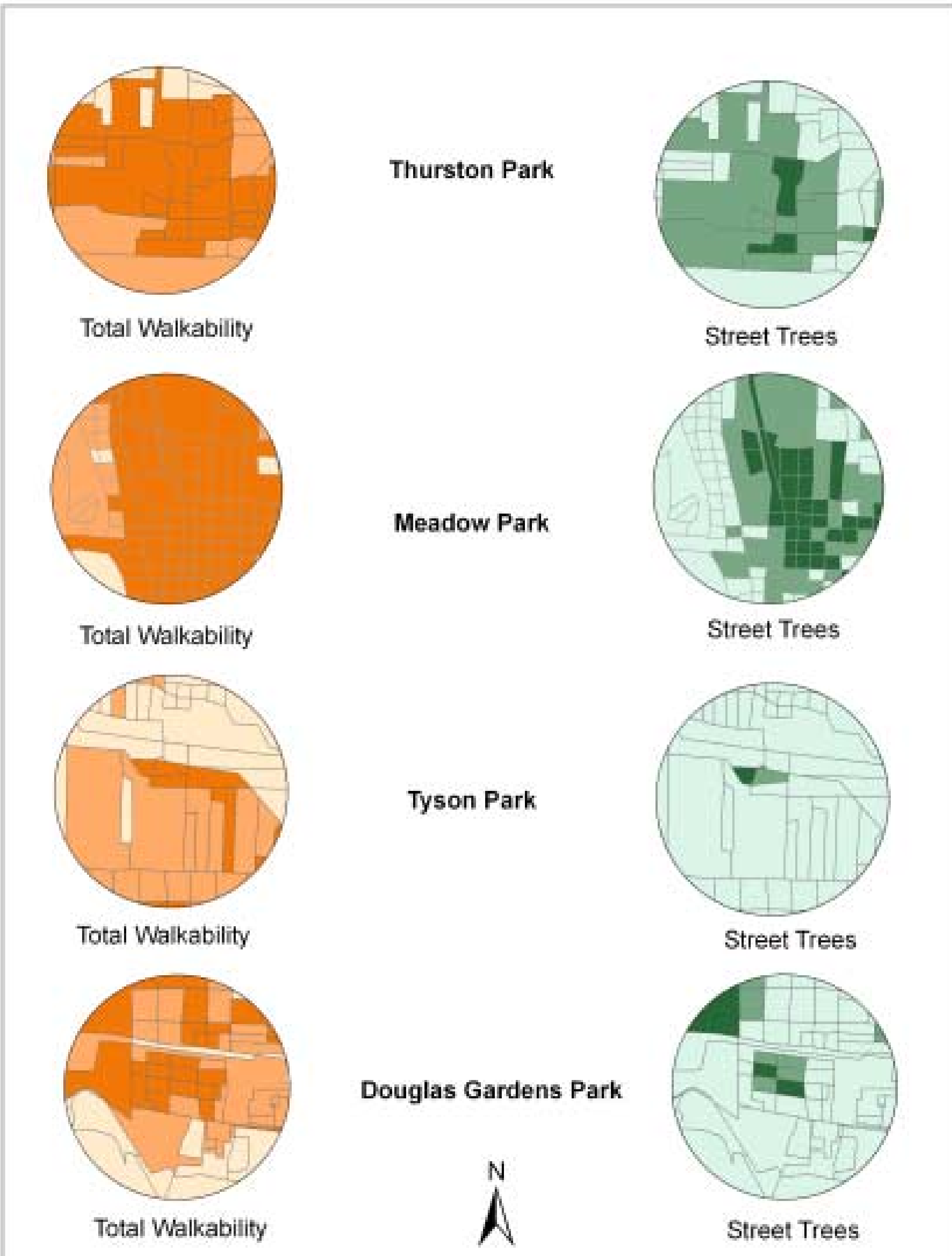
- The four subjective indicators were based on the ‘feeling’ of the data collector. This was done to ensure that street segments that normally people would judge as good for walking are not inadvertently classified as average or worse because of the presence of only a few indicators of good walkability.

APPENDIX D


Thurston Park
Total Walkability
Sidewalk Completeness
Meadow Park
Total Walkability
Sidewalk Completeness
Tyson Park
Total Walkability
Sidewalk Completeness
Douglas Gardens Park
Total Walkability
N
Sidewalk Completeness


Thurston Park
Total Walkability
Sidewalk Condition
Meadow Park
Total Walkability
Sidewalk Condition
Tyson Park
Total Walkability
Sidewalk Condition
Douglas Gardens Park
Total Walkability
Sidewalk Condition
N


Thurston Park
Total Walkability
On-Street Parking
Meadow Park
Total Walkability
On-Street Parking
Tyson Park
Total Walkability
On-Street Parking
Douglas Gardens Park
N
Total Walkability
On-Street Parking


Thurston Park
Total Walkability
Street Trees
Meadow Park
Total Walkability
Street Trees
Tyson Park
Total Walkability
Street Trees
Douglas Gardens Park
Total Walkability
N
Street Trees

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