STUDY ON EFFECTS OF RESIDENT-PERCEIVED NEIGHBORHOOD BOUNDARIES ON PUBLIC SERVICES ACCESSIBILITY & ITS RELATION TO UTILIZATION: USING GEOGRAPHIC INFORMATION SYSTEM, FOCUSING ON THE CASE OF PUBLIC PARKS IN AUSTIN, TEXAS

A Dissertation

by

CHUN MAN CHO

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2003

Major Subject: Urban and Regional Science

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Approved as to style and content by:

Christopher D. Ellis (Chair of Committee)	Donald A. Sweeney (Member)
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ABSTRACT

Study on Effects of Resident-Perceived Neighborhood Boundaries on Public Services Accessibility & Its Relation to Utilization: Using Geographic Information System, Focusing on the Case of Public Parks in Austin, Texas. (August 2003)

Chun Man Cho, B.S., University of Seoul;
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Chair of Advisory Committee: Dr. Christopher D. Ellis

One of the most important issues in the study of Urban-Service Distribution is the choice of the unit of analysis. Because of the ready availability of various data at the level of residence units, census tracts have been the spatial units most commonly selected. In some cases, municipally defined service districts have also been selected, and they are, in fact, only the aggregates of several neighboring census tracts. The problem encountered in the current study is the fact that Census-based Neighborhoods such as census tracts and the aggregations of census tracts frequently do not correspond with commonly recognized neighborhoods experienced informally in daily life, and they do not match local residents' perceptions of their neighborhoods as social areas.

The primary purpose of this study was to investigate the effects of Resident-perceived Neighborhood Boundaries (as the alternative unit of analysis to conventionally-used Census-based Neighborhood Units) on the accessibility to public parks based on equity consideration and its relationship to park utilization. The study

also addressed whether the neighborhood boundaries perceived by the actual residents may exhibit more actual neighborhood construct than Census-based Neighborhood Units when the relationship between park accessibility and utilization is considered.

First, the results indicate that when Resident-perceived Neighborhood Boundaries are adopted, there is no significant change, either in accessibility measures or in the equity of public park distribution among neighborhoods of different social strata.

Second, there was no significant relationship between park accessibility and utilization, which means that even though a park may be closest to a household, it is not always true that the household will choose to use that park.

Third, it was confirmed that the relationship between park accessibility and utilization was significantly affected by some utilization factors. That is, travel distances to the parks were significantly affected by different types of utilization factors and, according to the classification of park type, the affecting utilization factors were different.

Lastly, as the spatial unit of analysis, Resident-perceived Neighborhood Boundaries do not significantly enhance the strength of the relationship between public services accessibility and utilization compared to using Census-based Neighborhood Units.

DEDICATION

I would like to dedicate this dissertation to my lovely wife, Young-Sun Kim. I truly give thanks for all her loving kindness, patience, hope, wisdom, self-confidence, sweet home, and my first son (Daniel Ju-Chan Cho) that she gave me all through my academic endeavors.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to my chairman, Dr. Christopher D. Ellis, for his inspiration and encouragement in the course of this research. He has been extremely patient and eager to help. Especially when I was sometimes sick and when I lost my mother in my home country, he gave me more than enough time to recover my health and confidence and get back on my feet. And I will never forget the taste of Starbucks coffee that he treated me to when I was recovering. Without his assistance and deep consideration, this dissertation would not exist.

I am also grateful for having had the opportunity to work with other members of my advisory committee: Dr. Donald A. Sweeney, Dr. Robert S. Bednarz, and Dr. Douglas F. Wunneburger. I thank them for showing me the value of education, for their continuous encouragement, and for their willingness to share their knowledge and experience with me. Especially, I want to thank Dr. Wunneburger for allowing me to access GIS software, computing facilities, and copy & print-out facilities while I was struggling with limited financial resources.

Personally, I am grateful to my friends who assisted me and inspired me and even gave me enough secluded time only to concentrate on the research. In particular, I offer special appreciation to Seong-Nam Hwang who helped me with my first-time survey procedure, and Sang-Woo Lee and Jin Kim who helped me with my statistical analyses. Last but not least, I want to especially thank Wang-Gun Lee and Jin-Ki Kim for their advice, encouragement, and friendship when I really needed someone to talk to.

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CHAPTER I

INTRODUCTION

Research Background

One of the most important issues in the study of Urban-Service Distribution is the choice of unit of analysis on services allocation. Operationally, public services tend to affect and benefit groups of people collectively, and they also show many of the characteristics of public goods (Ostrom 1974). Consequently, in public services distribution, some groupings of residents must be the unit of analysis (Rich 1982).

With relation to services distribution, the “people prosperity vs. place prosperity” problem has been a long-lasting issue in the planning and urban policy sphere (Whitman 1972; Snow 1995). Because most prior research of services distribution has focused on place prosperity through geographically distributed services rather than demographically targeted services, geographic groupings of residence units have been the most commonly used spatial units (Rich 1982).

Mainly because of the ready availability of various data at the level of residence units, census tracts have been the groupings that are most commonly selected, and in some cases, municipally-defined service districts such as postal codes, municipal utility districts, police patrol districts, school districts, and voting districts have been also

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This dissertation follows the style and format of *Journal of the American Planning Association.*

selected as part of those popular groupings (Rich 1982; Martin 1998; Coulton et al. 2001). However, these are, in fact, the aggregates of several neighboring census tracts.

Hence, the use of census data at census tract level has been dominantly recognized as an important component of many activities in public or private services delivery (Martin 1998). In his neighborhood identification study, Martin (1998, 107) mentioned the role of census tract data in neighborhood delineation saying that, "*conventionally, quantitative neighborhood delineation involves the use of multivariable data for small areas, usually drawn heavily on census tracts, augmented by other data sources*." Also, in the use of neighborhoods as the spatial unit of analysis for neighborhood effect studies, Coulton, et al. (2001, 371) pointed out the reason why the census tract data have been so useful by saying that "*the census tract has been a convenient geographic unit on which to base neighborhood measures, because of the large amount of information available in the decennial census as well as the potential to use administrative data, such as crime reports, or housing values, aggregated into units of census geography*."

Of course, it is also true that relatively limited data are only available at census block level. Moreover, most socio-economic and demographic information on individuals and household units are available at the levels of census tracts and block groups or higher (Sawicki & Flynn 1996). Nevertheless, there are still several distinctive reasons why census tracts are so useful in neighborhood studies as the following (White 1987; Census Bureau 2000).

First, census tracts are relatively permanent areas, so they are useful for comparisons from census to census.

Second, census tracts include the whole metropolitan area. In contrast, although blocks are the smallest geographic unit for which information is available, they are limited to the built-up areas. Likewise, block groups between the hierarchy of census tracts and blocks do not cover the whole metropolitan area.

Third, from the viewpoint of social science concepts such as neighborhood, census tracts show many advantages. Census tracts are homogeneous in terms of physical living conditions, population characteristics, and economic status.

Fourth, census blocks may vary in size from a low-density single-family housing block to a high-density public housing block. This variance in size also holds true with block groups. But, census tracts have the population size of roughly 4,000 people on average. This size is known to be very useful for statistical analyses of small areas, avoiding data manipulation such as data aggregation.

Fifth, census tracts are small enough to provide a wealth of information within the cities, and, on the other hand, they are large enough to avoid data aggregation problems. Blocks and block groups are too small and they are often subject to the problem of data aggregation about social and economic information of residents due to the confidentiality problem.

In brief, in his neighborhood indicators research, Sawicki & Flynn (1996, 175) mentioned the dominant role of census tracts in neighborhood research in the literature review; "*in many cities, nominal neighborhoods are made up of aggregated census* *tracts. These tracts, roughly 4,000 people on average, are the smallest unit of analysis for which the most reliable, detailed social and economic data on households, people, and housing are available from the Census Bureau each decade. Thus, researchers doing cross-sectional analyses of cities and their sub-areas use tracts.*"

Problem Statement

The problem encountered in the current study is the fact that census-based neighborhoods such as census tracts and the aggregation of census tracts may reflect many important features of urban social fabric, but frequently they do not correspond with the commonly recognized neighborhoods experienced informally and do not match local residents' perceptions of their neighborhoods as social areas (Sawicki & Flynn 1996; Martin 1998). Pacione (1982, 239) commented that "*the neighborhood remains a meaningful territorial component of urban life for most people and a planning ideal in many parts of the world.*" In addition, many a neighborhood effect research acknowledges that arbitrarily census-defined, or administrative neighborhood boundaries are not always real neighborhood boundaries that reflect actual residents' activities across the neighborhood (Coulton, et al. 2001).

Martin (1998, 110) suggested, "*free from arbitrarily predefined boundaries, more flexible ways of defining neighborhood boundaries may go some way towards improving the utility and acceptability of neighborhood definitions*. Hence, it is expected that finding a way to identify such neighborhoods may prove most useful for public services distribution, fundamentally depending on informally defined concepts of neighborhood

(Martin 1998).

Since Lee (1968) originated the use of neighborhood residents' perception of neighborhood boundary as a data acquisition method for informal neighborhood maps in an effort to investigate the urban neighborhood as a socio-spatial schema, many studies have emphasized the usefulness of Resident-perceived Neighborhood (Lee 1978; Golledge 1987; Aitken & Prosser 1990). It has been acknowledged among neighborhood studies that Resident-perceived neighborhood boundaries might produce more meaningful and more closely represent the neighborhood construct (Taylor, Gottfredson, & Brower 1984; Meyer & Jencks 1989; Burton, Price-Spratlen, & Spencer 1997; Korbin & Coulton 1997)".

In practice, much empirical neighborhood research supports the argument that the Resident-perceived Neighborhood Boundaries and Census-based Neighborhood Units show quite a difference in terms of area, shape and its scale (Lee 1968; Lee 1978; Golledge, et al. 1978; Mutter 1985; Gale, et al. 1990; Coulton et al. 2001).

Objective of the Study

(1) This study discovered how the boundary difference between traditionally used Census-based Neighborhoods and Residents-perceived Neighborhoods affects the equal distribution of public services among neighborhoods in terms of accessibility.

Figure 1.1 below shows the conceptual framework for the objectives of the current study. In planning, the distribution of public resources according to locational equity can be defined in different ways, but there have been at least four separate criteria for defining equity in distribution (Talen 1998): (1) equality; (2) need; (3) demand; and (4) market efficiency. While the relationship between equity and accessibility can be interpreted in different ways, accessibility has been widely adopted as an indicator of equity in most studies (Lindsey, et al. 2001). And, accessibility to public services across socio-economically and demographically diverse groups has been a way of determining the equity of urban public services distribution (McLafferty 1982; Talen 1998; Talen & Anselin 1998; Lindsey, et al. 2001).

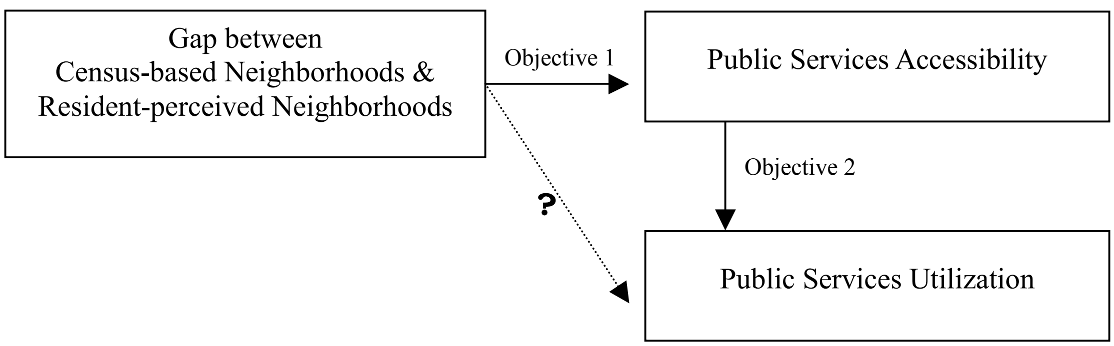


Figure 1.1: Conceptual Framework for Objectives of the Study

Considering the obvious characteristics of class and racial segregation in U.S. cities, when we measure service outcomes such as public services satisfaction and allocation, there has been a need for proxies for social class and racial groupings of persons (Rich 1982). As mentioned, conventionally, researchers and planners used to depend on Census-based Neighborhood boundaries such as census tracts or the aggregations of adjoining census tracts as the surrogates for those class and racial groupings because census variables at the level of census tract are considered to be good explanatory factors to capture the socio-economic characteristics of the residents.

For measuring accessibility to public services, the choice of the unit of analysis is an important procedure, and the MAUP (Modifiable Areal Unit Problem) is also to be considered. The MAUP is one of the most lasting problems regarding the use of aggregated areal units (Fotheringham, et al. 1991), because analytical results may vary depending on the definition of the unit of analysis for which data are collected and analyzed. The MAUP is, in fact, composed of two different but closely inter-related problems: the scale problem; and the zoning problem (Openshaw 1983; Fotheringham 1991). That is, any geographic area-dependent analytical results are likely to vary with the level of aggregation (scale problem), and with the alternative combination of areal units at similar scale (zoning problem). The current study will deal with both "*the scale and zoning problem of MAUP*" with relation to the choice of unit of analysis for public services distribution.

There are modifiable and non-modifiable geographic units of analysis, the adoption of which vary according to different researchers and research purposes. Though collected for non-modifiable entities (e.g., people, household unit), census data are published at the level of arbitrary and modifiable areal units (e.g., blocks, block groups, census tracts) after data aggregation. As a result, those census units may not possess enough of the geographical meaning unique to the area, and the results of ensuing analysis may not possess any validity independent of the areal units under study (Openshaw 1983).

Conventionally, as the literature indicates, most services distribution studies used census-based modifiable areal units. As the current study hypothesized, the choice of Residents-perceived Neighborhood Boundaries as the alternative analysis unit to traditionally used Census-based Neighborhood Units may affect the accessibility measures and decisions about equitable distribution of public services in urban areas. In keeping with Talen (1999, 544) who emphasized the importance of residents-perceived accessibility to public services, an objective of the current study is to see how the adoption of Resident-perceived Neighborhood Boundaries as the alternative unit of analysis alters accessibility measures and the degree of pre-established equity in public services distributions among neighborhoods of different social strata. Performance measures include the degree of overlap between Census-based Neighborhood Units and Resident-perceived Neighborhood Boundaries. One research question is whether or not the adoption of Resident-perceived Neighborhood boundaries as the unit of analysis will significantly change the pre-established equity in the distribution of public services in terms of accessibility.

(2) This study investigated the possible relationships between public services accessibility and utilization, when Resident-perceived Neighborhood Boundaries are adopted as the unit of analysis.

According to the literature, there are many socio-economic and demographic factors and reasons for selecting or not using certain facilities among publicly provided services. One of the objectives of the current study is to focus on the direct relationship between accessibility and service utilization. It is evident that in the utilization of public services, not only service level (or service quality), but the accessibility is equally important and must be taken into consideration for the assessment of service utilization. However, the current study assumes that facility-dependent factors such as Operation strategies (Scott & Jackson 1996), Promotion and marketing (Scott & Jackson 1996), Utilization Cost (Scott & Jackson 1996), and Service Quality or Service Level (Ottensmann 1994) are similar all across the public parks in Austin, and that those factors do not significantly affect the relationship between services accessibility and utilization .

In fact, the existing literature among the utilization studies of parks and recreation facilities does not indicate previous research that investigates the direct relationship between services accessibility and utilization. Conversely, among the studies of library and health services, there are many previous studies regarding the relation between services accessibility and utilization (Mark, et. al 1996; Ottensmann 1994; Zweizig & Dervin 1977; Palmer 1981), but the factors and constraints that affect services utilization are different. So, in investigating the relationship between the accessibility and utilization of parks services, the current study identified utilization factors that affect the relationship between services accessibility and utilization.

Utilization of park facilities was modeled as multiple regression models where the independent variables were those found to affect users' utilization the most. Therefore, the overall park facilities utilization behaviors were predicted. Furthermore, based on the modeling results, the importance of accessibility in services utilization was discussed.

Significance of the Study

Perceived Neighborhood Boundaries and the Equity of Accessibility. This study proposes to explain how the adoption of Resident-perceived Neighborhood Boundaries, as the alternative analysis unit to Census-based Neighborhood Units, affects accessibility and public services utilization.

When evaluating public services, in order to represent the unique characteristics of the constituents, it is important to choose as meaningful an areal unit for data gathering and analysis as possible in more substantively meaningful and less arbitrary and artificial terms. Therefore, as Rich (1982) pointed out, it is reasonable to assume that the use of artificial, arbitrary, geographic units of analysis may affect and bias public services output measures such as satisfaction. Hence, the current study intends to investigate the idea of Resident-perceived Neighborhood boundary as the unit of analysis for decisions on public services locations, and determine whether it proves to be a less-arbitrary, more substantially meaningful unit of analysis for public services distribution. It has been argued that neighborhood boundaries that capture residents' perceptions might exhibit more meaningful and relevant geographic units more closely representative of the local neighborhoods (Korin & Coulton 1997; Coulton, et al. 2001). And, many neighborhood studies within the fields of urban sociology and environmental psychology fields have been using residents' perceived delimitations or boundary definitions to study neighborhood's quality, and effects (Keller 1968; Lee 1968; Downs & Stea 1973; Aitkin 1990; Coulton et.al. 2001).

Relationship between Public Services Accessibility and Utilization. This study proposes to explore how the adoption of Resident-perceived Neighborhood boundary, as the alternative analysis unit to Census-based Neighborhood boundary, affects the relationship between public services accessibility and utilization. Regarding this issue, one of the questions of this study is whether the urban residents have the tendency to utilize more of the public facilities closer to their residence when there are services within a variety of distances. This simple but rather inclusive argument has been a long-lasting question and there have been many studies. It is, of course, that in the utilization of public services, not only service level (or service quality), but also the accessibility is equally important and must be equally taken into consideration for the assessment of service utilization (Ottensmann 1994). But, the current study assumes that facility-dependent factors, such as Operation strategies (Scott & Jackson 1996), Promotion and marketing (Scott & Jackson 1996), Utilization Cost (Scott & Jackson 1996), and Service Quality or Service Level (Ottensmann 1994) are similar all across the parks in Austin, and that those factors do not significantly affect the relationship between services accessibility and utilization .

In fact, throughout the literature and utilization studies of parks and recreation facilities, there is no previous research that investigates the direct relationship between services accessibility and utilization. In the meantime, among the studies of library and health services, there are many previous studies regarding the relation between services accessibility and utilization (Mark, et al. 1996; Ottensmann 1994l; Zweizig & Dervin 1977; Palmer 1981), but the factors and constraints that affect services utilization are different when urban public parks are involved as public facilities.

PPGIS (Public Participation GIS). Results will help to substantiate a bottom-up GIS approach in neighborhood planning. Talen (1999, 533) mentioned, "*GIS data and analysis at the neighborhood level have proliferated, but they continue to be fundamentally top-down*", which means that government-generated data are only available at local neighborhood level. The bottom-up approach, by which GIS data are generated by local residents rather than by municipalities is a newly-born component of current neighborhood GIS, and is in great need of evolution (Talen 1999). In this context, there is a need to use GIS in studying residents' perceptions of local neighborhood environments. This botton-up GIS is expected to validate the data gatherings of perceptual views of neighborhood environments in a GIS format (Talen 1999). For planners, this signifies a significant change to the current application of GIS at the level of local neighborhood environments.

Moreover, it is important to note that the efforts of gathering residents' perceptions of neighborhood environments into GIS format is related to an important current GIS issue - public participation GIS, or PPGIS (NCGIA 1998; Talen 1999). During the specialist meeting for NCGIA's Research Initiative 19 on GIS and Society, PPGIS was first termed as a next-generation GIS (i.e., GIS2) that would be more responsive to the needs of more comprehensive sectors of urban society (NCGIA 1998). One of five criteria as an initial set was that "*public participation would increase* *emphasis on the role of participants in creation and evaluation of data*" (Sheppard, et al. 1998, 71).

In this context, the current study will be a good exemplary effort to substantiate a bottom-up GIS (Talen 1999), as well as a public participation GIS in neighborhood planning (NCGIA 1998)

Hypotheses and Assumptions

Based on the introduction and literature review, the following hypotheses in this study was examined:

H1 – The choice of the unit of analysis between Census-based Neighborhood Units and Residents-perceived Neighborhood Boundaries affects the equity in public services distribution among neighborhoods of different social strata.

H2 – The accessibility to public services directly affects public services utilization.

H3 – The relationship between public services accessibility and utilization is affected by such social factors as age, gender, race, income, length of residence, child home, education level, education level, marital status, employment status, and such user factors as frequency of park visit, transit method, travel time, availability of leisure, fear of crime, information of parks, perception of others, and overall satisfaction.

H4 – The strength of the relationship between public services accessibility and utilization is weaker when Census-based Neighborhood Units are adopted as the unit of analysis compared to using Resident-Perceived Neighborhood Boundaries.

In conjunction with the hypotheses to be tested, there are certain assumptions that have been made: assumption 1) Neighborhoods in Austin, Texas, can be delineated through residents' perception procedure; assumption 2) Facility-dependent factors, such as Operation Strategies (Scott & Jackson 1996), Programs and Facilities (Hong 1988), Promotion and Marketing (Scott & Jackson 1996), Utilization Cost (Scott & Jackson 1996), and Service Quality or Service Level (Ottensmann 1994) do not significantly affect the relationship between accessibility and utilization of the public parks; assumption 3) the neighborhood residents travel to the public parks following the shortest path based on the actual street lines.

Figure 1.2 illustrates the overall view of the research framework of the current study, including the positions of the four hypotheses in the framework of the study.

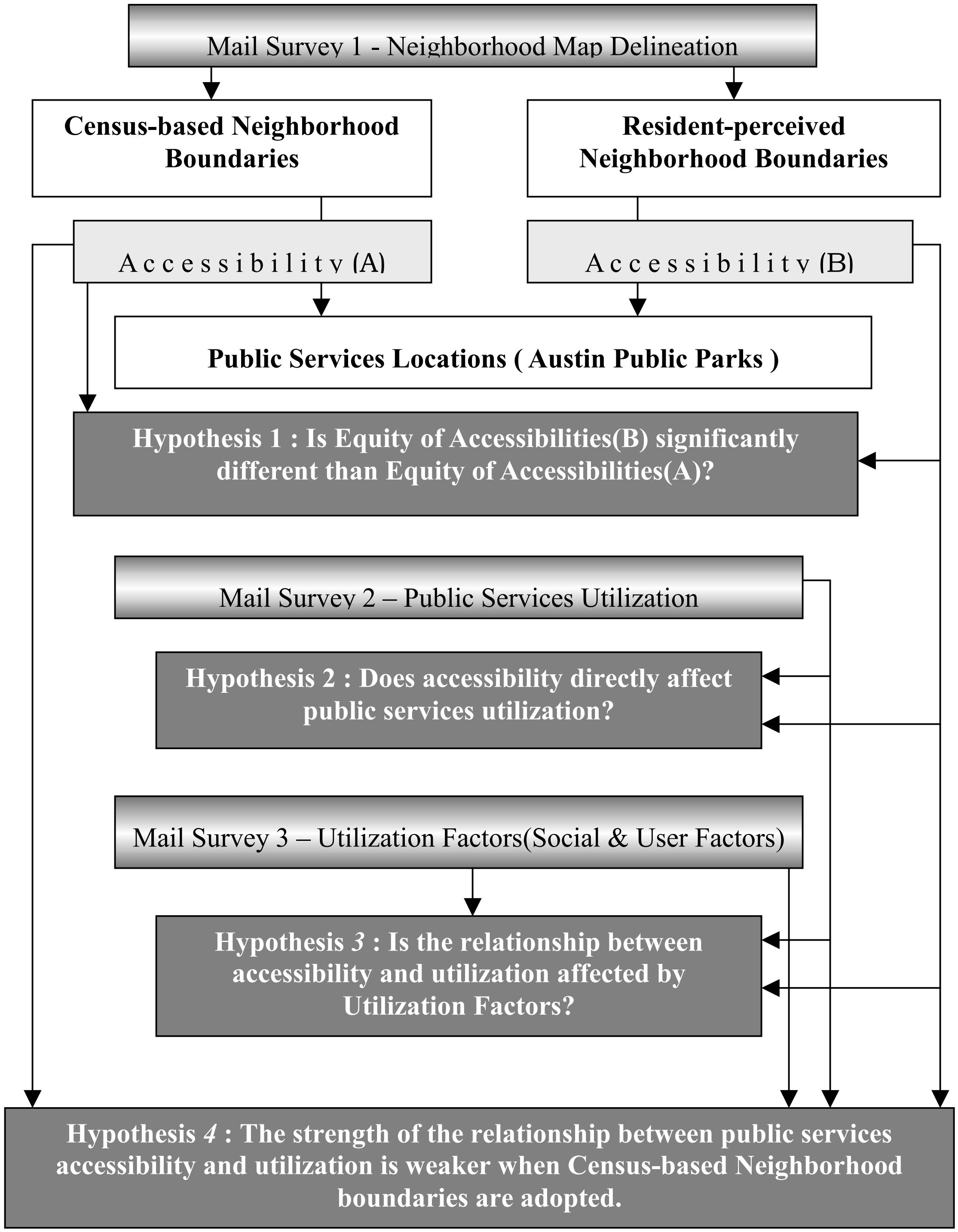


Figure 1.2: Overall Research Framework

CHAPTER II

LITERATURE REVIEW

Definition of Neighborhood

"Neighborhood" can be defined in diverse ways. In geographic scale, it generally means a spatial area smaller than a municipality but bigger than a block. Traditionally, neighborhood has approximately 5,000 to 10,000 inhabitants with similar levels of income, racial composition, and education (Sawicki & Flynn 1996). The elusiveness of neighborhood definition has been one of the major difficulties of neighborhood studies. If defined as a piece of physical territory, it is found to have little or no congruence with residents' behavior, and if defined as a non-physical, social, relationship, its geography doesn't coincide with it (Lee 1968). But, throughout the literature, what has been persistently attractive is the assumption that neighborhoods as a non-physical social relationship are somewhat inter-dependently co-related with neighborhoods as a physical territory (Lee 1968). This section will look into the concept of the neighborhood as a census unit defined by census geography.

Neighborhood in Census Geography. According to the Bureau of the Census (or the Census Bureau), neighborhood is currently defined as "a special purpose entity delineated for the Census Bureau's 1980 Neighborhood Statistics Program. Neighborhoods have locally defined boundaries, and the Census Bureau treated them as sub-areas within a legally defined government unit, usually an incorporated place or county" (Census Bureau 2000, G-35).

On a decennial basis, the Census Bureau, as an agency of the U.S. Department of Commerce, collects, tabulates, and disseminates statistical and geographic data to meet a variety of needs. One of its important roles is to provide the most comprehensive, and accurate, population count possible for apportionment of the seats in the U.S. House of Representatives (Census Bureau 1990). And, the distribution of public funds, the tracing of social and economic trends, and the administration of public and private programs are also included as part of its numerous other roles.

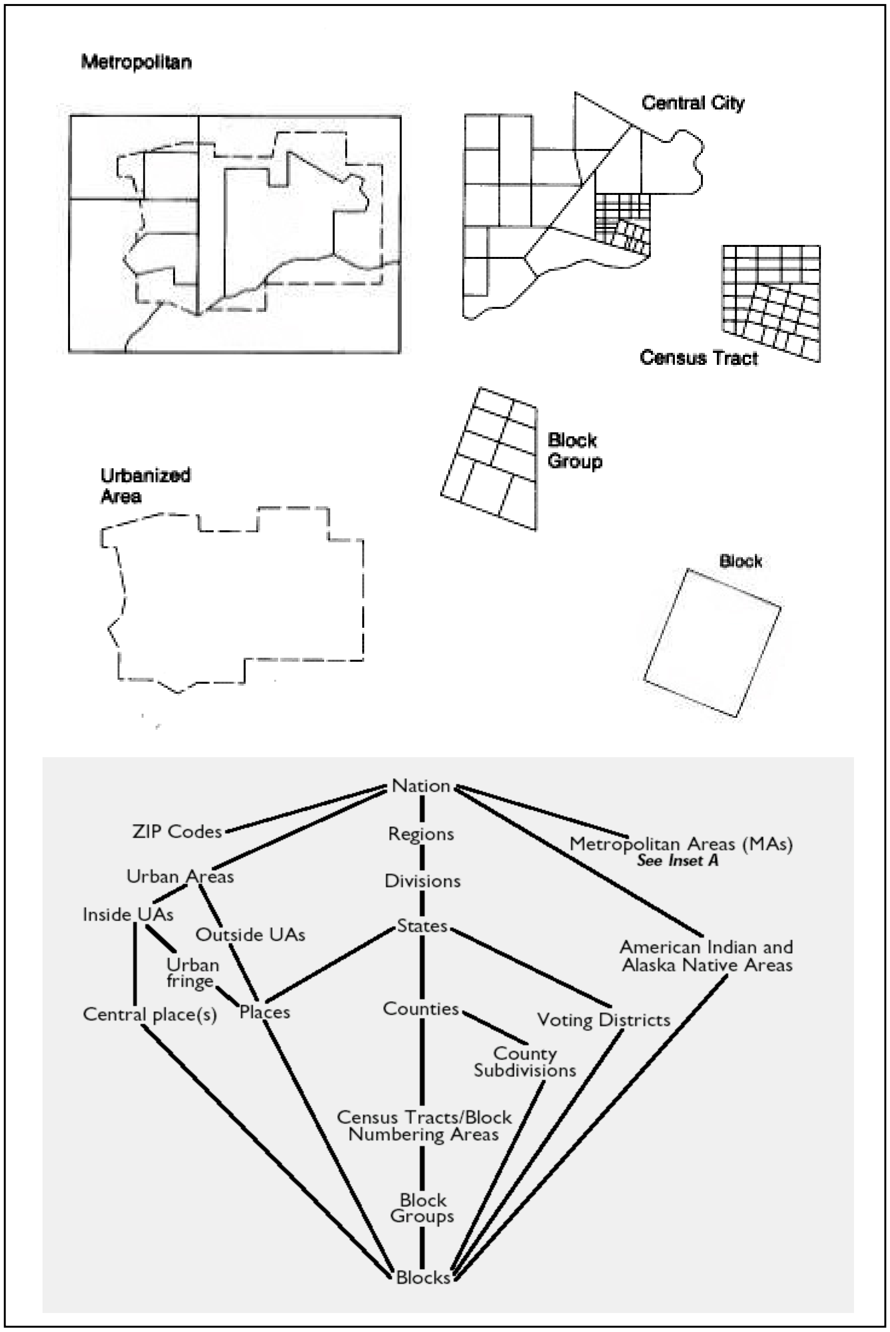
As well as its periodic sample surveys and estimates programs, the Census Bureau has been providing the general public with the tabulation and presentation of data from its decennial, economic, agriculture, and government censuses, in an effort to meet all needs of the public (Census Bureau 1990). Moreover, in as many geographic areas as possible such as legal, administrative, and statistical areas, the Census Bureau has been disseminating national data (Census Bureau 1990). For those individual needs, it is important to identify such spatial entities as legal, administrative, and statistical entities, and the data acquired about these entities are stored in the TIGER (**T**opologically **I**ntegrated **G**eographic **E**ncoding and **R**eferencing system) database, which supports the data collection and dissemination (Census Bureau 1990).

In census geography the concept of neighborhood areas was not included until the 1980 census. Before then, the census tracts were the only widely accepted unit of analysis for neighborhoods. Called "statistical neighborhoods" by White (1987, 8), census tracts were most widely used neighborhood proxy during the last century to respond to concerns for collecting local community's statistical data in a systematic way (White 1987). Since all the subsequent spatial analyses started from those census tracts as a set of boundaries, it is the census tracts to which planners and policy makers usually turn first to understand local communities. Based on the definition set by the Census Bureau, the census tracts have the features of relatively similar size, homogeneity, data availability, and comparability, which cause researchers to resort to census tracts as the desired spatial unit of analysis most closely resembling the construct of neighborhood.

In accordance with the reference resource for the 2000 census, census tracts are defined by the following features (Census Bureau 2000, A-11): (1) census tracts are small, relatively permanent statistical subdivisions of a county or statistically equivalent entity; (2) the primary purpose of census tracts is to provide a nationwide set of geographic units that have stable boundaries for the presentation of decennial census data; (3) tracts generally have between 1,500 and 8,000 people, with an optimum size of 4,000 people; (4) they are designed to be relatively homogeneous with respect to population characteristics, economic status, and living conditions; (5) its spatial size may vary widely depending on the density of settlement; (6) boundaries are delineated with the intention of being maintained over many decades so that statistical comparisons can be made from decennial census to decennial census; (7) physical changes in street patterns caused by highway construction, new development, and so forth, may require occasional boundary revisions; and (8) census tracts are occasionally split due to population growth or combined as a result of substantial population decline.

From the viewpoint of social scientists studying neighborhoods, census tracts, in theory, have a number of advantages as follows (White 1987): (1) all-inclusive, covering cover all the sub-areas of the metropolis; (2) relatively permanent; (3) homogeneous with respect to the socio-economic status and lifestyle; (4) constant in size, thus used for comparative analysis; and (5) having useful size for analyzing small areas of cities.

Meanwhile, from the 1980 census, the Census Bureau developed the new Neighborhood Statistics Program. This program was intended to provide a new spatial unit as a small area in census geography as an alternative to the conventional census tracts (Census Bureau 1980). Not in the form of geographic boundaries but as tabulated census data for small areas, the Bureau disseminated the neighborhood statistics data through this special program, (Census Bureau 1980). As a response to the needs from government agencies for small area statistics suitable for program and policy activity within their jurisdictions, the Neighborhood Statistics Program was actually originated. But, the data covered restricted areas which were not uniform in size, because the participation in the Neighborhood Statistics Program was not mandatory among municipalities,. Therefore, the Neighborhood Statistics Program did not successfully replace the census tracts and was discontinued for the 1990 census. Figure 2.1 below displays the actual hierarchy of the geographic units included in census geography



SOURCE: U.S. Bureau of the Census, 1980 Census and Population Housing: User's Guide. P.57 (up); 1990 Geographic Areas Reference Manual. Chapter 2. Graphic overview. p.2-7 (down);

Figure 2.1: Census Geographic Hierarchy

Studies on Neighborhood Spatial Perception

Delineating spatial neighborhoods from the perceptions of actual residents has a long history in the literature, which began with Kevin Lynch (1960) and Jane Jacobs (1961), and was elaborated upon by Terrence Lee (1968) and Milgram, et al. (1972).

Through the publication of "The Image", Boulding (1956) deeply influenced Kevin Lynch by asserting that people behave as if there is some kind of behavioral framework in their environment. But, Boulding didn't include any substantial methodology to explore this framework. Influenced by him, Lynch executed his subsequent studies on images of big cities such as Los Angeles and Boston. Through these studies, Lynch tried to capture the major physical characteristics of a city that give significant social and functional meanings to the residents. Interestingly, his actual methodology was to first ask the actual urban residents to verbally describe their living environments and then execute a simple drawing of the main characteristics of their living environments. In doing so, Lynch discovered that capturing the residents' mental images or perceived maps about their neighborhoods was quite possible. Then, most importantly, he developed five types of physical elements after organizing the captured perceived images by the residents. These elements included (Lynch 1960): (1) *Paths,* such as railroads, streets, highways, sideways, and; (2) *Edges,* such as the outline of a coast, barriers such as walls, and seams which bind the regions together; (3) *Districts*, identifiable by some common features, such as neighborhood; (4) *Nodes*, such as street corners or town squares; and (5) *Landmarks*, such as churches, neon signs, or mountains.

Studies Using Neighborhood Boundary Perception

The methodology that Lynch used in capturing residents' perceptions of their surrounding environment triggered many of subsequent studies by Lee (1968), Appleyard (1970), Milgram, et al. (1972), and Hunter (1974).

Among those studies, Lee (1968)'s study was probably the first to apply Lynch's methodology to investigate neighborhood-scale physical environment. He started the study arguing that the duality of physical and social neighborhoods can be joined, not by a statistical approach, but rather by a phenomenological approach. Lee conducted a survey on neighborhood residents' perception maps by asking housewives to draw a map of their neighborhood and then to describe in detail their behavior in the immediate environment. Along with this methodology, he adopted the concept of 'schema' as a way of representing individual's status of spatial familiarity with the environment. The size and composition of schemata are a function of both the physical environment and characteristics of the person (Lee 1968). The relevance of schema to urban planning was demonstrated through the development of an index named the Nh.Q. (i.e., Neighborhood Quotient). The Nh.Q. is a schema expressed as a ratio of the physical properties of the living environment, which actually means that the higher one's Nh.Q. the more the resident is involved in both the physical environment and social network (Lee 1968). He found that Nh.Q. varies with social class, age, length of residence, native status, type of house and husband's work location. One of the most significant contributions of this study was the realization that drawing residents-perceived neighborhood maps was obviously possible.

Through this study, Lee concluded that the neighborhood was something very easily described and portrayed to a total stranger as an obvious experience to individuals. Lee's neighborhood perception study was soon followed by a plethora of replicate studies such as Henry and Cox (1970), Sanoff (1970), S. A. Lee (1972), Zannaras (1976), Pacione (1982), all of which supported the conclusion that perceived neighborhood maps can be drawn successfully.

Since then, many neighborhood studies have utilized resident-perceived neighborhood maps such as neighborhood imageability studies (Haney and Knowles 1978; Stokols 1981) and neighborhood familiarity studies (Golledge, et al. 1978; Gale, et al. 1990; Aitken, et al. 1990). Normally, such spatial perception-based neighborhood studies carry out their analyses based on either statistical measures using census-based data or residents' written descriptions and boundaries drawn on existing maps by the responding residents.

Among them, Aitken, et al. (1990) tried to link the perceived neighborhood maps to environmental knowledge acquisition by investigating residents' perception of neighborhood form in terms of linear-based and areal-based knowledge structure. The findings suggested that there is a structured difference in the spatial familiarity of residents who perceive their neighborhood as an area and those who perceive it as a network.

Another study by Gale, et al. (1990) was also about spatial knowledge through spatial familiarity. As seen in the existing literature, they assumed a neighborhood is frequently defined in terms of the segment of space that is the most familiar to the members of a set of adjacent households. Four possible dimensions for the concept of spatial familiarity were explored: locational knowledge; visual cognition; name identification; and interaction frequency. As a result, they came to the conclusion that at the aggregate level all those dimensions were highly collinear and correlated except for the "interaction frequency". They also suggested that both perceptional and behavioral dimensions are embedded in the concept of spatial familiarity and must be part of the concept and any attempt to make it operational.

Neighborhood Effect Studies and Neighborhood Perception

Generally, the studies of neighborhood effects or neighborhood influences deal with the effects of specific neighborhood features on its constituent households. Since the 1980s, neighborhood effect studies have recognized the importance of the unit of analysis. Even while adopting census-based areal units as neighborhood units to their studies, researchers have acknowledged that census-based neighborhood boundaries such as census tracts, postal areas, or other administrative definitions of neighborhood boundaries are not real in essence (Hogan and Kitagawa 1985; Darling and Steinberg 1997).

Most recently, Claudia, et al. (2001) tried to established a methodology of retrieving residents' perceptions of neighborhood boundaries. As a pilot study, they explored several methods of defining neighborhood units based on maps drawn by neighborhood residents and compared the results with census definitions of neighborhoods. They found that the resulting units covered different spaces and produced different socio-economic values from the census-defined units. They also found that residents' agreement on their neighborhood boundaries differed, so they established a methodology of retrieving consensus areas in order to compare them with census-defined neighborhoods – census tracts & block groups. To note, they warned that neighborhood effects studies may have biases because they typically rely on census-based neighborhood units as units for neighborhoods. Finally, they suggested that the discrepancies between researchers and resident-defined neighborhoods may be a possible source of biases in studies of neighborhood effects (Claudia J., et al. 2001).

Variables Affecting Neighborhood-Boundary Perception

Along with the neighborhood perception studies, there have been studies to investigate the variables that affect residents' perceptions of the neighborhood environment.

Haney and Knowles (1978) studied the neighborhood perceptions of residents living in relatively undifferentiated inner-city, outer-city, and suburban areas of a middle-sized metropolitan area. The study indicated that the content of neighborhood images differed by area of the city. That is, suburban residents drew neighborhoods that were substantially larger than the inner-city neighborhoods. Besides this, it was also found that more negative characteristics of neighborhoods were described rather by urban residents than by suburban residents.

Lee, et al. (1991) investigated a simple question, "do blacks neighbor more than whites?" Through the literature, they found race and neighboring are infrequently included in the same analysis. So, they documented clear racial differences in urban neighboring behavior with South Nashville, Tennessee, residents as the study population. They showed that blacks interact with their neighbors more often than whites do, and in a greater variety of ways. Overall, their results support the argument that, as an informal channel, neighborhood relations have helped blacks catch up with relatively limited social opportunities and provided them with access to resources unavailable through formal institutional channels.

Also, it is clear from the huge amount of completed studies that different racial groups conceive of space in different ways. Maurer and Baxter (1972) studied the differences in the perceived images of neighborhood among black, white, and Mexican children. Ladd (1970) looked into how black youths view their neighborhood environment through neighborhood mapping. They found the relative neighborhood size and elements perceived and included in their neighborhood maps by each racial group differed.

Everitt and Cadwallader (1972) used the perception mapping methodology in establishing a home area concept in urban analysis. Men and women were asked to draw their home areas, and the resulting maps showed that the maps drawn by women were almost twice as big as the maps drawn by their husbands and that women have a more detailed view of their home area environment than men. Orleans and Schmidt (1972) found that women were inclined to draw boundaries with their home location at the center, and men tried to make use of the coordinate information of the given base map when drawing home area. Also, Guest and Lee (1984) found a difference between both gender and age in defining neighborhood boundaries.

Piaget, et al. (1960) originated the study of the relation between age and environmental perception. He conducted an experiment on children and found three stages in the development of abilities in cognitive representations, especially in large-scale areas. He emphasized that only children in stage three (8-12 years of age) could distinguish spatial relationships precisely. This argument was supported by Cannetello & Mark (1970) who suggested that cognitive abilities are not fully developed until around ten years of age.

Appleyard (1970) studied perception maps of the residents of a “new town” in Venezuela, and it found that people with a shorter length of residence have a tendency to produce linear maps, which reflect individual’s travel routes from home to workplace rather than network-oriented spatial maps. Delvin (1976) found an marked increase in the amount of acquired information of living environment through neighborhood mapping by women adjusting to a new residence. And Aitken, et al. (1990) tried to link the perceived neighborhood maps to environmental knowledge acquisition by investigating residents’ perception of neighborhood form in terms of linear-based and areal-based knowledge structure. The findings suggested that there is a structured difference in the spatial familiarity of residents who perceive their neighborhood as an area and those who perceive it as a network.

Socio-economic class has been acknowledged to be a variable affecting environmental perception (Stea 1974). In Appleyard’s (1970) perception study on Venezuela, he found that bus riders with lower education exhibited less accurate maps than more educated car-drivers who had opportunities to take alternate circuitous routes. Meanwhile, in study focusing on occupation level, Goodchild (1974) discovered that the maps of middle class residents showed a tendency to include a wider range of areas and covered more of surrounding transportation methods than the maps of working-class respondents.

Hence, until recently the variables that may affect neighborhood boundary perceptions have been found to be influenced by such factors as the urban-suburban location of neighborhoods (Haney & Knowles 1978), race (Lee, Campbell, & Miller 1991), gender (Everitt & Cadwallader 1972; Orleans & Schmidt 1972; Guest & Lee 1984) and age (Piaget et. al. 1960; Cannetello & Mark 1970), length of residence (Appleyard 1970; Davlin 1976; Aitken, et. al. 1990), and socio-economic class (Stea 1974; Appleyard 1970; Goodchild 1974).

Definition of Equity

In the utilization of public facilities, it is not always true to measure accessibility simply by means of simple distance. In other words, whether the facility is always open to urban residents and available to them is also a very important condition to consider in services allocation. Thus, a public service merely close and available to an individual only in terms of physical location does not mean that the person has enough accessibility to it. Sometimes, certain facilities may not be available to some individuals because the cost of using the facility may not be within the scope of the individual's social standing or financial capabilities (Joseph & Phillips 1984). For that individual, a more geographically distant facility may be more accessible.

Fundamentally, equity means the fairness of services allocation. The primary question of concern has been “Who gets what?” (Wichks & Crompton 1986). Given this unclear description, equity is an extremely difficult concept to define. Basically, the issue is whether or not equity should be defined in terms of perfect equality. Ideally, it can be said equity has been achieved when all residents have come to an agreement that they are equally treated and reallocation of public services is no more needed, but this situation is practically impossible (Talen 1998). In fact, it is acknowledged that social equity sometimes doesn't coincide with territorial justice (Pinch 1985), and equity in social goods such as public services is in conflict with environmental risk distribution (Humphreys 1988).

Hence, a definitive definition of equity has not yet been established, while diverse competing interpretations of equity prevail. With regard to the equity of services location decisions, Wicks and Crompton suggested three basic principles (1986, 344): (1) equal opportunity should be recognized as the point of departure; (2) deviations from this point of departure should be encouraged if they benefit the least advantaged; and (3) there should be a stated minimum level or floor below which quantity or quality should not fall. According to locational equity, there have been several efforts to categorize the definition of equity (Lucy 1981; Crompton & Wicks 1988; Marsh & Schilling 1994). Moreover, Talen (1998, 24) came up with four distinguishable categories of the definition of equity; (1) equality-based equity; (2) compensatory equity; (3) demand-based equity; and (4) market criteria-based equity.

In the current study, the locations of public services is analyzed according to the first category of equality-based distribution because it is more commonly used in accessibility studies (Ikporukpo 1986), and also because it is more amenable to precise measurement and its data requirements are less stringent than other approaches. Furthermore the determination of equity in terms of need, demand or market criteria may require information that may not be readily available and is beyond the scope of the current study.

Definition of Accessibility and Its Relation to Equity

The geographical accessibility of residents to urban public resources and facilities is one of the most important elements of quality of life (Pacione 1989). Many a study has demonstrated how minimizing travel costs to reach services and facilities can result in substantial reallocation of income between people (Pahl1971; Harvey 1971). Being physical close to public services contributes to people's welfare by enhancing their opportunity, enhancing the actual value of a residential property to lead to savings on travel costs that turn people's attention to other consumptions (Pacione 1989).

In empirical studies, different definitions of accessibility have been adopted (Hensen 1959; Cox & Johnson 1982; Suryanarayana, et al. 1986). The simple definition of accessibility is how fast it is to get there. It indicates the spatial relation between origin and destination, or the degree of connection between that location and all others in a region.

It is important to note that the distinction between accessibility (in terms of geographic relationship between locations) and equity (explained by fair opportunity in services allocation) is necessary. The most notable characteristics distinguishing the two concepts of equity and accessibility in services distribution are that accessibility is concerned more with efficiency in an attempt to distribute public facilities as uniformly as possible in the name of maximum access, while equity is more concerned with the impact of distribution of public resources or facilities to people who may use them (Nicholls 1999). Equity carries a meaning only on the basis of the user's socio-economic or demographic characteristics. Therefore, equity is not always in accordance with efficiency.

Recently, many urban studies have explored the issues related to accessibility and equity in services delivery (Ottensmann 1994; Talen 1998; Talen & Anselin 1998; Nicholls 1999; Lindsey, et al. 2001). Through those studies, accessibility has been used as an indicator of equity in distribution of services. As Talen & Anselin (1998, 596) put it, "*accessibility is a tool used to discover whether or not equity has been achieved, and the two concepts of accessibility and equity are the primary building blocks used to assess the spatial distribution or spatial pattern of public services*." Also, they pointed out the fact that the two issues are not always related (Talen & Anselin 1998). For example, in some cases, equity may be related to the amount of investment in specific public services, but sometimes it may have nothing to do with accessibility in terms of geographic location itself.

Accessibility Models

There have been a variety of accessibility measures from which to choose. Hodgart (1978), who provided a broad review of the literature until the 1970s, identified five categories of accessibility measure models: (1) travel cost minimization; (2) demand maximization; (3) equity maximization; (4) covering objectives; and (5) spatial interaction models. Similarly, in their research on accessibility of urban greenways, Lindsey, et al. (2001, 334) categorized five different accessibility measures as such: (1) container approach; (2) gravity models; (3) travel cost minimization models; (4) covering objectives; and (5) minimum distance models.

The gravity model is one of the simplest, yet most extensively used accessibility models (Pacione 1989). This model seeks to identify levels of human interaction between different locations based on the principles of Newtonian physics. That is, facilities are weighted by their size and adjusted for the 'friction of distance'. In this specific use of the model, the force of attraction between resident's location and facility location is in exact proportion to the attractiveness (or size) of the facility and inversely proportional to the distance between resident and facility. The basic form (Talen & Anselin 1998, 600) of this model is

$$Z_i^G = \sum \left[\frac{S_j}{d_{ij}^{\alpha}} \right],$$

where "Sj" reflects the number of facilities or their size, and for each facility location "j", "d_{ij}^{α}" is a distance decay factor, with distance "dij" between zone "i" and facility "j", and friction parameter "α" (Talen & Anselin 1998, 600).

By the way, the container approach measures accessibility by means of the presence of a facility within a specific area. A good example is the presence of a facility such as a park, health clinic, library, or post office within the unit of analysis such as census tract or municipally defined service areas. Political scientists, services distribution researchers, and planners have used this approach extensively (Lindsey, et al., 2001), because it is the simplest and saves time. As one of the most distinctive differences from the gravity model, this approach does not consider the frictional effect of distance traveling to the facilities. From an economic perspective, the travel distances contradict travel costs that reduce the value and utility of the service (Ottensmann 1994). In this approach, a count of services or facilities by any unit of analysis, such as census tracts, ward, etc., would be treated equally. Normally, the container model (Talen & Anselin 1998, 600) can be expressed as

$$Z_i^C = \sum_j S_j \,, \qquad \forall j \in I \,,$$

where "Z_i^C"is a container index for location (tract) "i", and the number or aggregate size, "S*j*", is summed for those facilities located within the boundaries "*I*" of "i" (Talen & Anselin 1998, 600). This container view is predominant in the political science literature (Talen & Anselin 1998). This model implies a fundamental assumption that the benefits of a public facility are only allocated to the constituents of the corresponding areal unit. Hence, the container approach restrictively defines the notion of access to the presence or number of facilities within the spatial unit of analysis. In this model, the higher the score (i.e. the higher the number of parks within the critical distance), the better. It is important to note that spatial externalities to other tracts are excluded from consideration.

The third approach is the minimum distance model. Inequity of access is unavoidable because some zones should be always closer to a specific facility than other zones. According to this approach, the index simply refers to the minimum travel distance between each location of origin and the nearest destination. The travel distance model (Talen & Anselin 1998, 600) is expressed as

$$Z_i^M = \min\left|d_{ij}\right|,$$

where "Z_i^M" is the index for minimum distance from zone "*i*" to the nearest facility (Talen & Anselin 1998, 600). In the case of this approach, the lower the value of the index, the higher the accessibility.

The fourth approach is based on the travel cost minimization model. It is simply a measure of the average or total distance between each origin (for example, centroid of census tract) and the destination of scattered facilities. As Talen & Anselin (1998, 600) put it, one of the advantages of using this approach is that the resulting value is expressed in simple distance units. In principle, the goal of this approach is to minimize the total cost of travel between origin and destination. Therefore, in contrast to the container approach and gravity model, the lower the score, the higher the accessibility. The accessibility through the travel cost minimization model (Talen & Anselin 1998, 600) is calculated as

$$Z_i^T = \sum_j \left[\frac{d_{ij}}{N}\right] \quad \text{or} \quad Z_i^T = \sum_j d_{ij}$$

where "d*ij*" is the distance between a zone "*i*" and facility location "*j*", and "N" is the total number of facilities (Talen & Anselin 1998, 600). If the total number of destinations is the same for each origin , whether average or total distance is calculated is a matter of choice (Talen & Anselin 1998).

Lastly, there is the covering objective model. In principle, this approach identifies the accessibility, not from the resident to the facility, but from the facility to the residents. According to model, a certain service boundary is defined and the facilities within the critical distance for each demand point are identified. The basic assumption of this approach is that the facility is equally utilized within a covering distance, and that beyond the specific radius (critical distance), use of the facility is diminished to none. In cases of public services areas such as fire services, streets and sewers, services are provided according to planned services areas.

Among the accessibility models above, the container approach is the only one that does not consider the effect of distance in accessibility. The rest of the four approaches incorporate the frictional effect of distance in measuring accessibility, but they are more time-consuming and more complex than the container approach (Lindsey, et al. 2001). Meanwhile, both the container approach and the minimum distance measure do not consider spatial externalities, and the externality consideration is different between them. For example, the minimum distance model always includes only one facility, even when the facility is not necessarily within the same zone. Specifically, when a zone does not include a facility, the container approach measurement will be zero, while the minimum distance measure will consider the distance to the nearest facility in another zone. When there are multiple facilities in a zone, the container approach will include them all, while the minimum distance measure will count only the distance to the closest facility. The gravity model and the travel cost minimization model, on the other hand, incorporate the spatial externalities of all the facilities.

Equity and Accessibility Studies

As previously mentioned, the literature shows that different accessibility models have been introduced. Among accessibility models, the container approach is identified as the most simple and commonly used method, while gravity models, travel cost minimization models, covering objectives, and minimum distance models are more complex and time consuming (Lindsay, et al. 2001).

Generally, accessibility is used as an indicator of equity in most studies (Talen 1999, 544). As Talen & Anselin (1998) describe the general relationship between equity and accessibility, the notion of equity is paramount in research that focuses on determining what factors account for territorial difference in services allocation. Accessibility, in turn, is a tool used to discover whether or not equity has been achieved.

For example, Talen (1998) used an equity mapping approach and a need-based measure of equity derived from professional park planning standards and planning policy documents to explore accessibility to parks in Pueblo, Colorado. She found that with certain definitions of access, low access appeared to correspond to areas of Hispanic populations. More recently, Lindsay, et al.(2001) explored the nature of green ways as public space in Indianapolis, Indiana. Their study used proximity as a measure of access and simple GIS analysis of census and other data to determine equality of access. Evidence indicates that minorities and the poor have disproportionate access to trails.

The Unit of Analysis Issue and MAUP (Modifiable Areal Unit Problem)

Operationally, public services tend to affect and benefit groups of people collectively, and they show many of the characteristics of public goods (Ostrom 1974). Consequently, in public services distribution, some grouping of persons must be the unit of analysis (Rich 1982). Because most prior research of services distribution has focused on place prosperity through geographically distributed services, rather than demographically targeted services, geographic groupings of residence units have been the most commonly used spatial units for public services distribution (Rich 1982).

In many cases, large predefined areal units, especially neighborhoods, are preferred or required for the following reasons (Hewko, et al. 2002, 1188). First, municipalities provide services at levels similar to neighborhood. Second, neighborhood associations, operating at the neighborhood level, may be responsible for the administration of the services. Third, detailed socio-economic data may not be available at less aggregate level, such as block groups or census blocks. For instance, most of socio-economic and demographic information is available only at census tract level. At a less aggregate level, such as census blocks or block groups, only the population data (i.e. STF1 or SF1 of census attribute data) are available. Moreover, housing or economic data are only available at census tract level. As long as they involve examining accessibility patterns in relation to various population characteristics such as in public services equity studies, compatibility with enough socio-economic data is indispensable for the services distribution analysis, (Talen & Anselin 1998; Hewko, et al. 2002)

Many services distribution studies have acknowledged that those studies allow for the impacts of scale and boundary effects. These impacts, so called MAUP (Modifiable Areal Unit Problem), reflect the sensitivity of analytical results to the definition of spatial units for which data are collected and analyzed (Openshaw 1984). The very basic assumption of most services distribution studies is that a distribution pattern observed at one aggregation level or under a zoning scheme will automatically hold at other levels or under different boundary configurations. Openshaw (1984), however, concluded that these basic assumptions of accessibility studies do not hold true.

The MAUP applies to two separate, but inter-dependent, problems with spatial data analysis. The first is the "scale problem", which indicates that each combination of spatial data aggregated into different spatial units may lead to different analysis results (Openshaw 1983). The second aspect of the MAUP is the "zoning problem", where reaggregating a given set of spatial units into different zones of the same size but locate differently may result in variation in data values and, consequently, different conclusions (Openshaw 1983).

In fact, numerous empirical studies have revealed that the inclusion of scale and zoning problems can alter the conclusions of locational analysis studies (Openshaw

1984; Tobler 1989; Fotheringham & Wong 1991; Amrhein 1995; Sui 1999). Information is often lost as spatial data are aggregated to coarser scales or resolutions. That is, significant changes may occur from one scale to another or from one zoning system to another. Each scale or zone has its own properties that cannot be derived by mere gathering of the disaggregated data. Therefore, general conclusions from previous studies regarding MAUP indicate that phenomena at a scale or unit of analysis are frequently not important or not predictive at another scale or unit.

Therefore, researchers must question the reliability of most analysis results based on aggregated data. Attempts to generalize analysis results to other zoning systems or to individuals are questionable as well. Generally called MAUP (Modifiable Areal Unit Problem), however, when individuals are the focus, it is also called the "ecological fallacy." The term "aggregation effects" is a generic term referring to either the MAUP or the ecological fallacy, or both (Larson 2000). So far, no ideal solutions have been developed to solve this long-standing problem in spatial analysis (Sui 1999). Yet, Openshaw (1983) suggested that for investigating the MAUP issue it is necessary to identify the spatial units and derive appropriate scales and zones for the phenomena being studied.

Definition of Public Services

A 'public service' (or public utility service) is generally defined as an economic activity of general interest at the initiative of public authorities. Although initiated and operated under public authority, the supply and maintenance of public services are supposed to be assigned to the enterprise of a public or private sector independent of the public authorities. Broadly speaking, among different types of public resources, the concept of public service applies mainly to network-based services such as gas, water, sewers, electricity and postal services.

It is generally accepted that the nature of the physical infrastructure required to provide those services affect the distribution of certain urban public services (Ottensmann 1994). Considering the role of infrastructure in services distribution, public services can be classified into three categories (Ottensmann 1994, 110): (1) services whose distribution does not depend on fixed infrastructure; (2) services provided by network infrastructure; and (3) services provided at fixed locations involving travel to and from those facilities.

Some services distribution is relatively independent of fixed infrastructure. Rather, the services are distributed through the service providers within each neighborhood. Police patrol, fire protection, and street sweeping are good examples of services that are not strongly related to fixed facilities (Ottensmann 1994). Other services such as transportation, streets, sewers, and water are provided through fixed networks. The service level is determined first by the presence of the extension of the service network to certain neighborhood area (Ottensmann 1994). Finally, the last type of urban services involves travel to or from fixed facilities from which the service is provided (Ottensmann 1994). This can involve travel by the residents to the facilities, as occurs with recreation facilities, parks, and libraries, or it can involve travel by the providers to the residents, as with fire protection. These situations present a complex problem in assessing services distribution because service provisions cover two dimensions. But most important in assessing the services distribution is the distance from the facility to the recipients.

Studies on Public Services Utilization

Among publicly provided services in Ottensmann's (1994, 110) classification are services that are provided through locationally fixed facilities including park and recreation services, libraries, and health clinics. Among those, park and recreation services are the services studied more and proved to be related to the most varied factors. This may be due to the fact that the policy, planning, and marketing strategies of the leisure market are concerned with and sensitive to the study results of leisure-related human behaviors such as park and recreation facilities utilization and constraints (Scott & Jackson 1996).

Blake (1984) performed a study on the effect of constraints in the use of public parks and recreation facilities in Austin, Texas, and Dade County, Florida. This study attempted to identify the constraints that affect the use of public parks facilities and to investigate the relationship between constraints, services utilization, socio-demographic characteristics, and attitudes toward leisure and work. The socio-demographic variables included sex, ethnicity, age, income, children home, age of youngest child, marital status, and utilization companionship. It was found that inclusion of non-participation as well as participation data greatly increased the explained variance of socio-demographic characteristics. Leisure and work attitude dimensions proved to be ineffective as predictors of participation or non-participation in specific activities. Selected socio-demographic characteristics, especially age, ethnicity, and income, are useful predictors of park facilities utilization or non-use. Lastly, there are significant differences in the impact of constraints affecting the utilization of public park facilities according to socio-demographic characteristics. In addition, six constraint factors were produced such as: (1) too distant; (2) lack of interest; (3) conflicts of staff; (4) health problems; (5) safety concern; and (6) lack of transportation.

Interestingly enough, there was a study utilizing resident-defined neighborhood boundary for neighborhood park use analysis. With the City of Bryan, Texas, as a study area, Mutter (1985) adopted a cognitive mapping and user analysis methodology in an attempt to investigate how much more neighborhood park utilization is affected by the resident-perceived neighborhood boundaries than in the traditional park service area. The standard park service area boundary used in this study was derived from the most recent NRPA (National Recreation and Park Assoiation) publication on recreation standards (Lancaser 1983). Using a compass scaled for a distance of one-half mile (2,640 feet), a perimeter was drawn around the center of the park (Mutter 1985). For the delineation of resident-perceived neighborhood boundaries, he utilized five criteria on the basis of cognitive mapping literature, such as: (1) cognitive distance based on residents-drawn maps; (2) major urban arterials; (3) socio-economic status; (4) measure of compactness; and (5) neighborhood size. His essential argument was that resident-defined neighborhood boundaries are a more appropriate planning unit for neighborhood park service area than a traditionally accepted standard park service area. His conclusion did not provide strong support for his argument, but found that the presence of a park within resident-perceived neighborhood boundaries and park utilization are strongly related. He also found that park utilization among households within resident-perceived neighborhood boundaries was significantly higher than that among those living outside resident-perceived neighborhood boundaries but within one-half mile standard service area boundaries.

Among the recent studies of park facility utilization, Scott and Jackson (1996) examined the constraints that limit people's use of public parks in an urban environment. Data from a survey of non-users of public parks in Greater Cleveland revealed that the most intense and widespread category of park use constraints related to the "availability of time", and that improved programming and promotion received the most widespread support as types of strategies to encourage park usage in the future. Also, park usage was found to be influenced by life cycle, in that older women were found to be influenced by safety issues, availability of companionship, and poor health. Most importantly, the study came up with a list of suggested changes from infrequent users and non-users that may encourage more use of public parks in the future. The top five change items were: (1) fear of crime; (2) information about existing parks and park programs; (3) park activities provided; (4) proximity to home; and (5) crowdedness.

In Erkip's study (1997), the distribution of urban public services was assessed using a study area in Ankara, Turkey. The park facilities were evaluated in terms of both services and user characteristics. He pointed out that, aiming for a just distribution claims, the local governments generally distribute the services "equally" on a geographic basis without consideration of the recipients' socio-economic or demographic characteristics. Therefore, he proposed distributional justice to achieve a truly equitable distribution, meaning that the distribution decisions should be sensitive to the characteristics of different citizen groups instead of the territorial justice that cannot satisfy the conditions of effective utilization.

Through his statistical analysis, it was found that "income level," "distance," "car ownership," and "perception of other users" are the factors that broadly affect the utilization of public parks. Like Scott and Jackson's previous study (1996), he listed several reasons for user dissatisfaction, such as: (1) lack of facility; (2) congestion and noise; and (3) service quality. Reasons for not using the nearest park were: (1) distance; (2) limited leisure time; (3) dislike for other users; and (4) no need for the service. There are several conclusions that are important for the study of public services utilization such as the following (Erkip 1997, 358). First, in the case of large parks, like other smaller-scale parks, proximity is found to be important for park use. Second, the age and size of the parks are not the factors that affect the citizens' choice of park use, and this may indicate a quality concern for large parks, as user expectation is higher due to their size and range of activities, as well as the time and money spent for their use. Third, the large parks utilization is not found to be dependent upon income level and car ownership, and this means that Users will travel more for better service or quality. The only significant relation appears between the perception of others and utilization, which means rate of utilization increases with a positive perception of others. Fourth, people sometimes utilize parks, not on the basis of landscape feature or recreational opportunities, but on the basis of other users (Hayward 1989). Fifth, demographic features and leisure time are not among the factors that determine service utilization. Sixth, the number and age of children are strongly related to nearest park utilization. Seventh, low-income groups are more concerned with facilities and security, while higher-income groups, with maintenance and facilities. Lastly, relevant services should be provided instead of a standardization of service output. In the literature on public services utilization, socio-economic and demographic factors that affect the utilization of public parks facilities are summarized in Table 2.1 below.

Table 2.1: Factors Affecting Parks Facilities Utilization

	Factors	Blake (1984)	Mutter (1985)	Scott & Jackson (1996)	Erkip (1997)	Pharr (2001)
Social Factors	Gender	O				O
	Race	O				O
	Age	O				O
	Life-cycle	O		O		
	Income				O	
	Home ownership					O
	Length of Residence		O			O
	Marital Status					O
	Car ownership				O	
	Level of education					O
	Employment status					O
	Availability of time			O		
Utilization Pattern Factors	Companionship pattern (group or individual)	O				
	Perception of other users				O	
	Fear of crime			O		
	Distance				O	
	Information of Parks			O		
Other	Neighborhood Boundary Perception		O			

Studies on Public Services Accessibility and Utilization

As shown by Table 2.1, there are many factors and reasons for usage or non-usage of certain facilities among publicly provided services, but the current study would like to focus on the relationship between accessibility and service utilization. In the case of utilization of public services, both service level (or service quality) and accessibility are equally important and must be taken into consideration for the assessment of service utilization. The current literature regarding the utilization studies of parks facilities indicate that none of the previous research has investigates the direct relationship between services accessibility and utilization.

Among the services provided by municipalities, library services seem to be one of the most frequently chosen for studying the relationship between accessibility and services utilization. For analyzing the direct relationship between accessibility and utilization, without considering service level or quality, the study results may not have much importance. Consequently, the service level or service quality should be controlled for comparative analysis. In studies on services other than library services, it is not easy to compare the service level or quality. But in most library service studies, assessing the service level was easier because comparative analyses could be performed on library branches where the "book stocks" were considered to be the service level provided to a specific facility (Zweizig & Dervin 1977; Plamer 1981; Ottensmann 1994)

Ottensmann (1994) came up with an interesting conclusion regarding library services utilization. He began his study by pointing out that for services provided at specific locations, service utilization studies often fail to incorporate the importance of travel to the facilities and the value placed on accessibility. So he examined twenty-one branch library services in Indianapolis using input and output measures in order to investigate both the library service level (that is, book stock) and the accessibility of neighborhood residents to the facilities. At the outset of his study, he said (p109), "*when a facility is located farther from the user, generally less of service provided will be used and the user will receive a lower level of utility and will have a lower level of satisfaction with the service provision.*" But, he did not specify the analysis to prove this initial statement but only concentrated on his hypotheses. As a conclusion, it showed clear tradeoffs between service level and accessibility by different residents in different parts of the city. Specifically, lower income residents of the city will have less access to automobiles, reducing their mobility. Thus, the achievement of greater equity in the distribution of output may require that higher levels of accessibility to library services be provided to lower income residents.

CHAPTER III

DATA AND METHODOLOGY

Target Population

The target population for this study is the urban neighborhood residents of Travis County. The study area was the city of Austin, Texas. The reasons for choosing this area are as follows. First, there is a great deal of spatial data available. The city provides numerous GIS database warehouses on-line and on the web, enough to carry out the current research (ftp://issweb.ci.austin.tx.us/pub/coa_gis.html). Second, city-wide, neighborhood planning has been very active since the Austin City Council adopted the Dawson Neighborhood Plan on August 28, 1998. Also, the city's Planning, Environmental & Conservation Services Department has taken the initiative to work with neighborhood representatives to produce a neighborhood plan. Subsequently, a lot of city background information regarding public services in relationship to neighborhood planning is available (Austin City Connection 2001).

Study Area & Sampling Procedure

As well as the cluster sampling, the current study utilized "*stratified random sampling*" which uses information known about the total population prior to sampling to make the sampling process more efficient. First, all elements of the total census tracts (N=181) of Travis County were distinguished according to their values on relevant characteristics. In doing so, Race (i.e., white, black, and hispanic), and Median

Household Income (high, medium, and low income levels based on 2000 census data) (White 1987, 69) formed the sampling strata. Next, census tracts were sampled randomly from within these strata. And, finally, census block groups are randomly selected from those census tracts chosen.

Sampling Procedure. First, among the total census tracts of Travis county (N=181), the tracts chosen sit exclusively within the administrative boundary of the city of Austin, and they included 120 census tracts.(see Figure 3.1). The total population of the chosen census tracts was 489,597. About 51.2% of the population was white, 32.8% Hispanic, 9.5% black, and 6.5% other. (see Table 3.1)

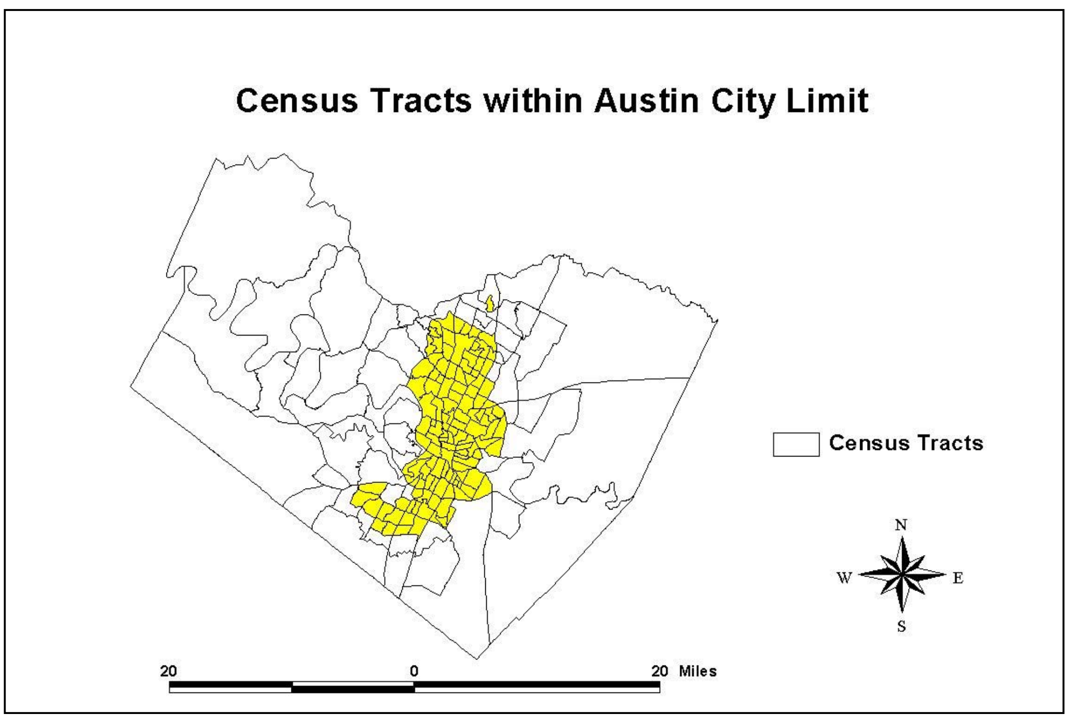


Figure 3.1: Census Tracts within Austin City Limit

Table 3.1: Racial Composition of Austin Census Tracts

	Total	White	Black	Hispanic	Other
Population	489,597	250,327	46,679	160,747	31,844
%	100%	51.2%	9.5%	32.8%	6.5%

As the following maps indicate, most of the White population is distributed across the west and northern part of the city, while the Hispanic population, as the second dominant racial group of the county, has spread to the southern part of the city, and the Black population is sited around the eastern side of the city. In particular, the majority of the minority population of the city of Austin is segregated and grouped together on the southern part of the Colorado river. The maps below demonstrate the actual distribution of those racial groupings in Austin and Travis County. (see Figures 3.2, 3.3, and 3.4)

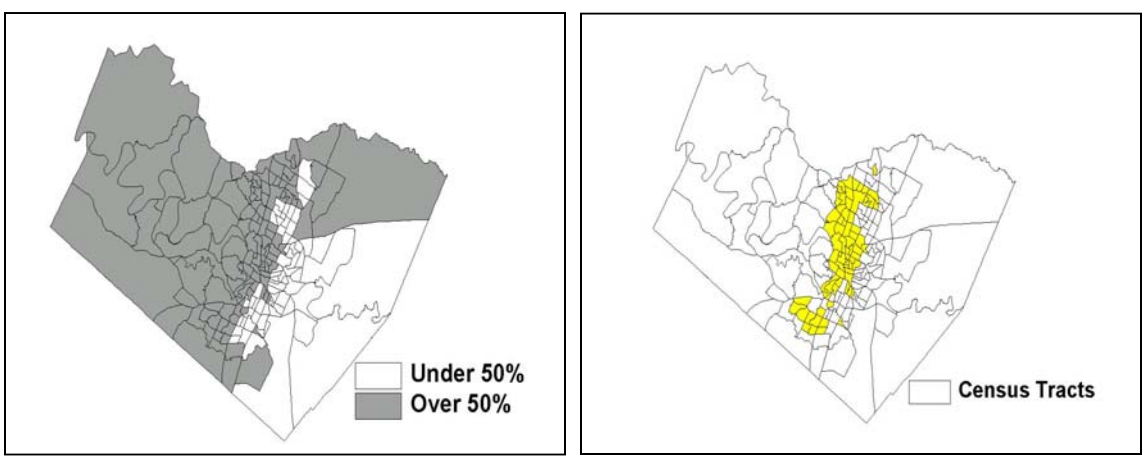


Figure 3.2: White Racial Composition of Travis County & Austin

Figure 3.3: Hispanic Racial Composition of Travis County & Austin

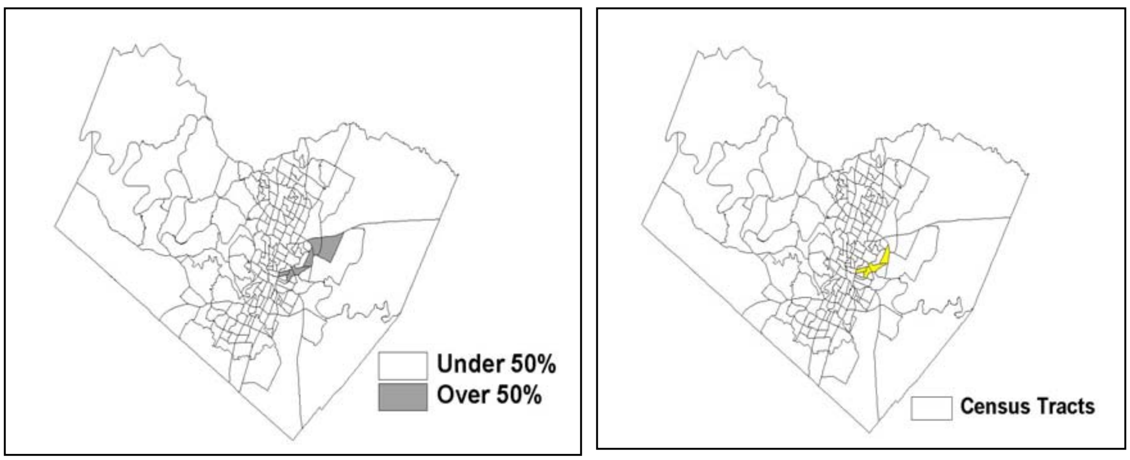


Figure 3.4: Black Racial Composition of Travis County & Austin

According to the 1990 Census Data, the Median Household Income of the city of Austin was $42,689. The income range is classified as high level ($60,000 and over), middle level ($30,000-$59,999), and low level (under $30,000), the distribution of those income levels is shown below. (see Figure 3.5) According to the income level distribution, high and low income groups are distinctively separated to the east and the west of the overall city area. As the map indicates, the higher income tracts are prominent to the west of the city, while the low-income class is on the opposite (eastern) side of the city.

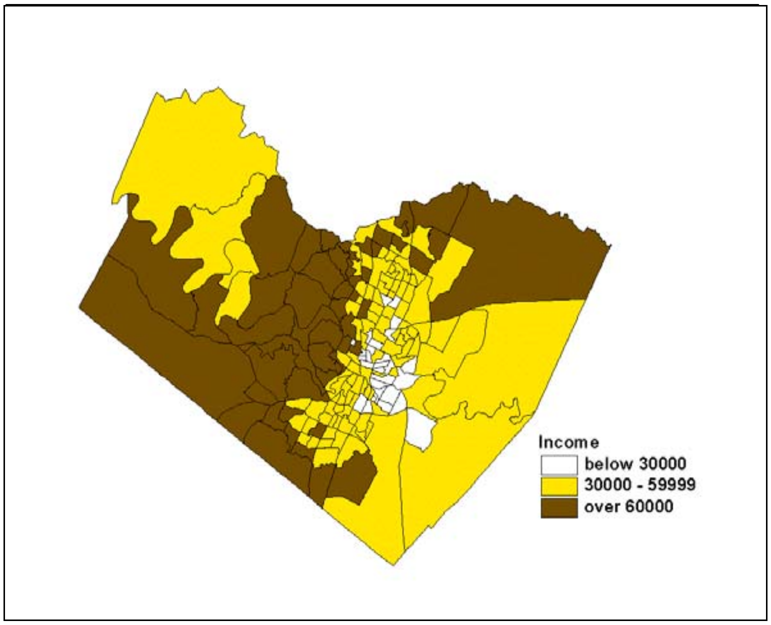


Figure 3.5: Median Household Income Distribution

As the total population of the census tracts exclusively within the jurisdiction of Austin is 489,597, at a 95% confidence level (confidence interval=5), the sample size has to be at least 234 people. The median population size of the total census tracts (N=120) of Austin was 3,902. The study population consists of residents in sampled census tracts who were over eighteen years of age and had lived at their present address for more than a year (Mutter 1985). As the total census tracts have to be stratified according to race as well as income level, and as the racial composition among White : Hispanic : Black was about 51% : 33% : 10%, the current study decided to choose 9 census tracts. Thus, 5 White census tracts are randomly sampled from the strata plus 3

Hispanic and 1 Black.

Assuming that the response rate will be about 33%, about 78 residents of the sampled census tracts will be sampled (N=710), so that about 26 respondents are expected to return the completed survey form to the current investigator. Therefore, the current sampling frame is expected to receive about 234 (i.e., 26*9) responses to be statistically analyzed afterwards. The median area of the total census tracts was 25,963,812 square yards, and the median population size was 3,902. The census tracts were sampled as close to those median values as possible in terms of area and population size. The final sampled census tracts are listed below (see Table 3.2), and their actual spatial distribution is shown in Figure 3.6.

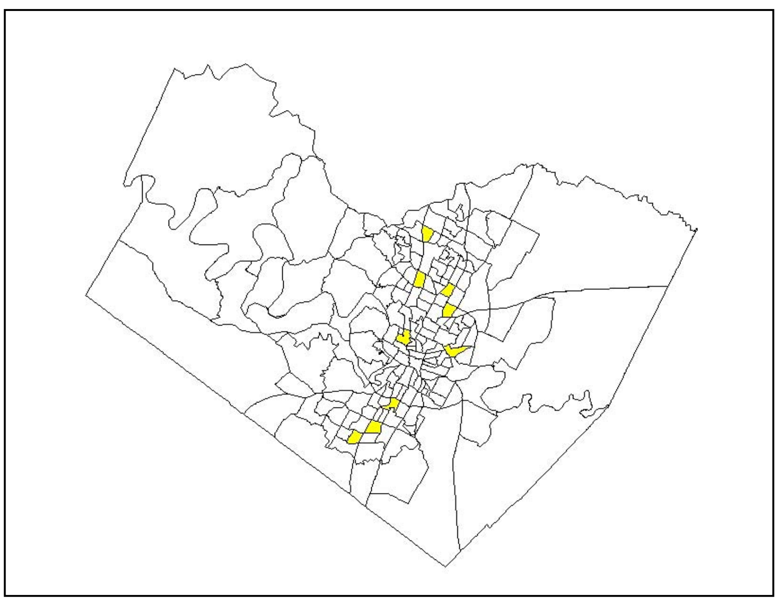


Figure 3.6: Distribution of the Census Tracts Sampled

Table 3.2: Social Strata of Census Tracts Sampled

Race	Income Level	Area (sq. yds)	Census tract	Population	Race (%)	Median Household Income
White	High	25,490,265.60	**18.28**	4,283	76.00	70,551.00
		27,562,774.97	**16.03**	4,202	93.00	84,338.00
	Medium	26,741,684.42	**18.17**	4,302	74.00	41,661.00
		29,599,799.61	**24.24**	3,626	50.00	41,711.00
		21,944,818.98	**17.47**	5,100	75.00	52,930.00
Hispanic	Medium	21,676,025.93	**20.03**	3,876	60.00	31,538.00
	Low	27,211,962.71	**18.12**	2,617	59.00	25,174.00
		25,508,135.06	**18.06**	4,576	84.00	23,597.00
Black	Medium	29,933,126.08	**21.09**	3,715	66.00	30,234.00

The following maps (see Figures 3.7 and 3.8) show the overall view of the block groups. Each census tract is composed of block groups counted between 2 and 5, and their shapes are very irregular from one another. One block group from each one of the 9 census tracts was randomly sampled (see Table 3.3). As the literature indicates, perceived neighborhood boundaries are normally smaller than a census tract (Mutter 1985), being between the size of a block group and a census tract and covering at least two census tracts and at least three block groups. (Coulton, et al. 2001, 377). Out of those block groups selected, about 78 residents of each block group were randomly selected among single family housing units.

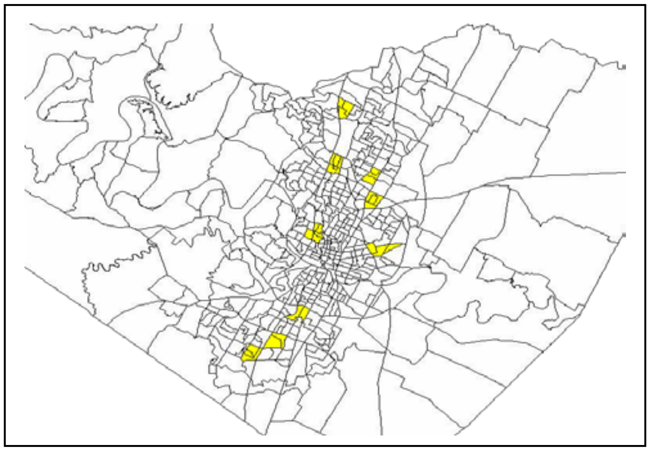


Figure 3.7: Distribution of Pre-selected Census Tracts

Figure 3.8: Distribution of Sampled Block Groups

Table 3.3: Sampled Block Groups

Race	Income Level	Census Tract	Block Group	Population	Race (%)	Median Household Income
White	High	18.28	1	1,830	82.50%	75,436.00
		16.03	5	1,318	95.68%	79,179.00
	Medium	18.17	2	1,285	89.10%	61,838.00
		24.24	2	2,716	61.93%	41,250.00
		17.47	3	1,672	66.57%	50,391.00
Hispanic	Medium	20.03	4	1,957	53.29%	38,636.00
	Low	18.12	3	1,750	76.06%	29,909.00
		18.06	3	3,224	52.85%	27,188.00
Black	Medium	21.09	2	1,570	59.60%	31,553.00

Data Sources and Preparation

The City of Austin has comprehensive data sources that make it possible to conduct accessibility and public services utilization studies at a census-based level. The data sets utilized for the current study are from six major sources (see Table 3.4).

The primary data sets are mainly GIS TIGER lines and their pertinent attribute tables are from the official website of Austin (www.ci.austin.tx.us). To enable spatial statistics to be used for analyzing socio-spatial equity, the data for each census unit had to be explicitly associated with that spatial unit in the GIS database. The configuration of the census areas in the census geography is recorded on the U.S. Bureau of the Census's TIGER (Topologically Integrated Geographic Encoding and Referencing) file. The boundary files of the census units are available from selected generalized extracts from the Census Bureau's TIGER geographic database designed for use in a Geographic Information System (GIS) or similar mapping system, or these files can be downloaded through the ESRI (Environmental Systems Research Institute)'s ArcData Online website (www.esri.com). The spatial and statistically available attribute data were then joined together to form single tables of information within ArcView software. The second data source is the 2000 Census from the U.S. Bureau of the Census. The Census data to be utilized in the analysis of the equity of the public parks were obtained from two sources: SF1 (Summary File 1) and SF3 (Summary File 3). Most of socio-demographic data for stratifying census tracts and other census units were from the SF1 of Census 2000. These were then disaggregated to the level of census block, the smallest census unit available. The remaining economic data, such as median household income, were from the SF3 of Census 2000. The third source of the data for this study is the official website of the city of Austin (i.e., Austin City Connection 2001). The website provided administrative boundaries, the locations of the public parks, street center lines, address points, and administrative services area boundaries, such as police patrol districts, neighborhood plan areas, neighborhood associations areas, zip code areas, voting areas. The fourth data source was the mail-out survey conducted during August and November of 2002. The survey questionnaire was composed of an introduction letter, questions about neighborhood perception, public parks utilization, and the respondents' background information as well as an actual map of the recipient's living area and the Austin public parks inventory for reference.

Table 3.4: List of Data Types and Sources

Sources	Data	Type	Format
Travis Central Appraisal District (TCAD)	Parcel GIS Attribute Table (owner's name & address)	Table	.dbf file
Austin GIS data set	City Boundary (full)	Polygon	Arcview shp
	Public Parks (city)	Polygon	Arcview shp
	School Districts	Polygon	Arcview shp
	Police Patrol Districts	Polygon	Arcview shp
	Zip Code Areas (postal areas)	Polygon	Arcview shp
	Voting Districts	Polygon	Arcview shp
	Neighborhood Plan Areas	Polygon	Arcview shp
	Neighborhood Assn. Areas	Polygon	Arcview shp
	Address Points	Point	Arcview shp
	Street Center-lines	Line	Arcview shp
	Austin Parcel Data	Polygon	Arcview shp
2000 Census Tiger data	County Boundary	Polygon	Arcview shp
	Census Tract Boundary	Polygon	Arcview shp
	Block Groups Boundary	Polygon	Arcview shp
2000 Census SF1	Socio-demographic data	Table	.dbf file
2000 Census SF3	Economic data	Table	.dbf file
Mail-Out Survey	Resident-perceived Boundaries	Polygon	Arcview shp
	Parks Utilization Data	Table	.dbf file
	Socio-demographic Info.	Table	.dbf file

Perceived Neighborhood Boundary (Mail-Out Survey)

The survey instrument was used to gather residents' neighborhood boundary perceptions. For the objectives of this study, the technique initially used by Lee (1968) would be the most appropriate for eliciting a perceived map of neighborhood. This technique enables the standardization of map data for GIS analysis so the residents are provided with a street map to outline neighborhood boundaries instead of drawing their neighborhood and its elements freehand on a blank sheet of paper (Mutter 1985, 18).

First, household members were asked to describe their neighborhood in terms of its important elements and boundaries, then they were asked to draw boundaries of their own neighborhood on the street map of the census tract. The census tract maps were printed so that the block group for the specific respondent appeared in the center of the map and the surrounding 8-mile radius was printed around it. This map size is small enough to fit on an 11" by 17" piece of paper and show sufficient detail (Coulton. Et al. 2001). To help the residents orient, street names were on the map, along with a few landmarks, such as railroads, and waterways.

Operationalization of Accessibility Measure

As mentioned above, different accessibility measures may produce different spatial patterns of accessibility and, depending on the concept of access, the distributional equity of public services may vary (Talen & Anselin 1998; Talen 1998). The choice among them depends on the relevant policy questions (Lindsey, et. al. 2001, 334). Accordingly, the current study considered the characteristics of public service (i.e., Austin public parks) under study, and the features that each of the five most widely used accessibility models: four models of Gravity Model; Minimum Distance Model, Travel Cost Minimization Model, Container Approach (after Talen & Anselin 1998); and Covering Objectives Model (after Nicholls 1999; Sui 1999; Lindsey, et al. 2001). According to the following considerations, the Gravity Model was employed for the current study to measure accessibilities of public parks that are mentioned below.

First, of those five accessibility models, approaches that incorporate distance or its units in measurements of accessibility include the former four models. Only the covering objectives model does not accept the distance friction between neighborhood and public service location. The neighborhoods within the covering distance of a service are assumed to have the same accessibilities to the concerning public service (see Accessibility Models in Chapter 3). The model assumes that the facility is equally used by any of the residents within the covering range, and that, beyond the particular range, the use is abruptly diminished and accessibility is almost zero (Talen 1998, 27). Considering that one of the purposes of the current study is to determine how Resident-Perceived Neighborhood Boundaries affect accessibility measurements traditionally assessed by Census-based Neighborhood Units, it was obvious that the covering objectives model would cause more errors in assessments of accessibilities than any other accessibility model. This is due to the fact that the various accessibility measures within the covering distance of a public service are too importance to be overlooked.

Second, as shown in Table 5.4, Austin public parks are composed of a hierarchy of six different park types, including neighborhood parks, district parks, metropolitan parks, greenbelts, special parks, and preserves. The mean scale of each park type is different. Among the four distance-based accessibility models (i. e., gravity model; minimum distance model, travel cost minimization model, container approach), only the gravity model considers the hierarchy of public parks by scale. The gravity model is based on an analogy between the interaction of groups of people and the attraction of a facility (e.g., physical scale), similar to the interaction between objects in Newtonian physics (Stan, et al. 1995, 69; Talen 1998, 27). As Ottensman (1994, 111) argued, the assessment of the distribution of such physically fixed services as libraries and public parks must consider the dimensions of facility service level (e.g., physical scale), as well as facility distance from neighborhoods. In this context, the current study took into consideration the hierarchy of Austin public parks differentiated by scale dimension, and only the gravity model fits into this research framework.

Third, in the measurement of the public's accessibility to a given facility or service, the gravity model is the most useful because it derives a weighted number or value that considers all the potential residents of near or distant neighborhoods. Another useful element of the gravity mode is that it incorporates interaction to be measured in a cumulative fashion, irrespective of the unit of analysis or boundaries. In reality, neighborhood residents routinely travel across arbitrary geopolitical units such as counties, census tracts, or zip code areas to access public parks.

This measure, called also the spatial interaction model, is one of the simplest, yet most widely used models (Pacione 1989). This model identifies levels of human interactions between different locations based on principles of Newtonian physics where facilities are weighted by their size and adjusted for the 'friction of distance'. In this specific use of the model, the force of attraction between resident's location and facility location is proportional to the attractiveness of the facility and inversely proportional to the distance between resident and facility. The basic form (Talen & Anselin 1998) of this model is

$$Z_i^G = \sum \left[\frac{S_j}{d_{ij}^{\alpha}} \right],$$

where "Sj" reflects the number of facilities or their size, and for each facility location "j", "d_{ij}^{α}" is a distance decay factor, with distance "d_{ij}" between zone "i" and facility "j", and friction parameter "α" (Talen & Anselin 1998). In this index equation, "α"is between 1 and 2, reflecting the rate of increase of the friction of distance (Stan, et al. 1995). The current study set the "α" value to be 1.

Public Parks Utilization (Mail-Out Survey)

The survey instrument asked residents about their satisfaction with public services. The survey also included use and non-use questions related to the public services included within the present research framework. The final section of the instrument consisted of socio-economic and demographic questions, including such utilization factors as level of education, ethnicity, age, gender, length of residence, home-owner status, household income, and type of occupation, etc. There were thirteen variables initially selected regarding public parks utilization pattern: (1) frequency of visit; (2) companionship pattern; (3) travel method; (4) travel time; (5) maximum travel time; (6) availability of leisure time; (7) fear of crime; (8) information about parks; (9) perception of other users; (10) purpose of visit; (11) overall satisfaction of park use; (12) attractions of park use, and (13) constraints of park use. The variable types and component groups for each variable are detailed in Table 3.5.

Table 3.5: Selected Utilization Factors for Public Parks

	Variable		Groups
Social Factors	Age	S	(18 and over)
	Gender	N	(1) female, (2) male
	Race	N	(1) white, (2) Hispanic, (3) Black, (4) other
	Income	O	(1) under $20,000, (2) $20,000-$40,000, (3) $40,000-$60,000, (4) $60,000-$80,000, and (5) greater than $80,000
	Length of residence	S	
	Education level	O	(1) less than high school, (2) high school / GED, (3) community college / technical school, (4) bachelor’s degree, and (5) master’s degree or higher
	Child Home	N	(1) yes, (2) no
	Marital status	N	(1) married, (2) widowed, (3) divorced, (4) separated, and (5) never married
	Employment status	N	(1) employed, (2) unemployed, (3) retired, (4) homemaker, and (5) student
User Factors	Frequency of visit	O	(1) over 4/month, (2) 4/month, (3) 3/month, (4) 2/month, (5) 1/month
	Companionship pattern	N	(1) friends, (2) neighbors, (3) family, (4) your child, (5) self, (6) relatives, (7) dogs, (8) other
	Travel method	N	(1) drive , (2) walk, (3) jog, (4) bicycle, (5) public transit, (6) d/w, (7) d/w/b, (8) d/b, (9) other
	Travel time	S	
	Max. travel time	S	
	Availability of leisure time	S	
	Fear of crime	S	
	Information of parks	S	
	Perception of others	S	
	Purpose of visit	N	(1) meet with people, (2) observe nature, (3) walk/hike, (4) walk dog, (5) picnic, (6) fish, etc.
	Overall satisfaction	S	
	Attractions to park use	N	(1) operation time, (2) low cost, (3) facility, (4) maintenance, (5) close to workplace, (6) information provision, etc.
	Constraints to park use	N	(1) fear of crime, (2) companionship, (3) programs, (4) health, (5) operation time, (6) facility, (7) perception of others, etc.

Note: N – nominal variables, O – ordinal variables, S – scale variables

Measuring Accessibility to Public Parks

The spatial distance may be calculated in various ways such as ‘straight-line distance (i.e.,“as the crow flies”)’, ‘network distance’, ‘travel-time distance’, and so on. The current study used ‘network distance’, which is measured by finding the shortest path applied to the actual street network lines. For this task, Network Analyst, an extension utility for Arcview software, was utilized. Also, the Avenue script was used for measuring the basic network distance between each park centroid location. The center of each neighborhood unit was obtained from ESRI online support center (http:// arcscripts. esri.com/details.asp?dbid=11572). By simulating the situation closer to the actual travel time of neighborhood residents between supply location and demand location rather than using straight-line distance measure, the accessibility measurement based on network distance is generally accepted as a better approach in accessibility studies (Geertman & Risema Van Eck 1995; Talen & Anselin 1998).

Meanwhile, the process of measuring the network distance between each neighborhood and public park is not possible without having the centeroid points of each neighborhood and public park. For this important process, the SpaceStat extension for Arcview was used (Anselin 1999), and the detailed procedure conformed to the instructions in “Spatial Data Analysis with SpaceStat and ArcView Workbook (3rd Edition)”. Adjusted to the current study, the analysis underwent the following steps (Anselin 1999, 9):

1. The SpaceStat extension was included into Arcview (File>extensions> mark the SpaceStat extension).

2. The theme (neighborhood units or parks) to give centroid points to is activated, and from the menu, “Data>Add Centroid Coordinates” were selected; this computed the centroid for each neighborhood or public park, and its centroid coordinates are to the theme’s attribute table as X_Coord and Y_Coord. With the attribute table active, from the menu, “Table>Properties” was selected; on the properties dialog window, all variables except Identifiable Number (i.e., ID, park ID number, census tract name, or whatever), X_Coord and Y_Coord. On clicking okay, the resulting attribute table will only show those checked fields. File>Export the newly-made table with new “.dbf” file name, and the original attribute table was returned to its original status after re-checking all variables contained.

3. Then, the new “.dbf” table was added to the project through its project view. And with the View window active, “View>Add Event Theme” was selected. On the dialog window, after choosing the name of the table (ooo.dbf), the X field (X_Coord) and the Y field (Y_Coord); click OK, the “ooo.dbf” was added as a theme to the View.

4. With the newly-added theme active, “Theme>Convert to shapefile” was selected, then, a new name for new point shape file was given. Then, the file became a shape file containing points of centroids.

Figure 3.9 below shows the actual distribution of the centroid points of the public parks in Austin.

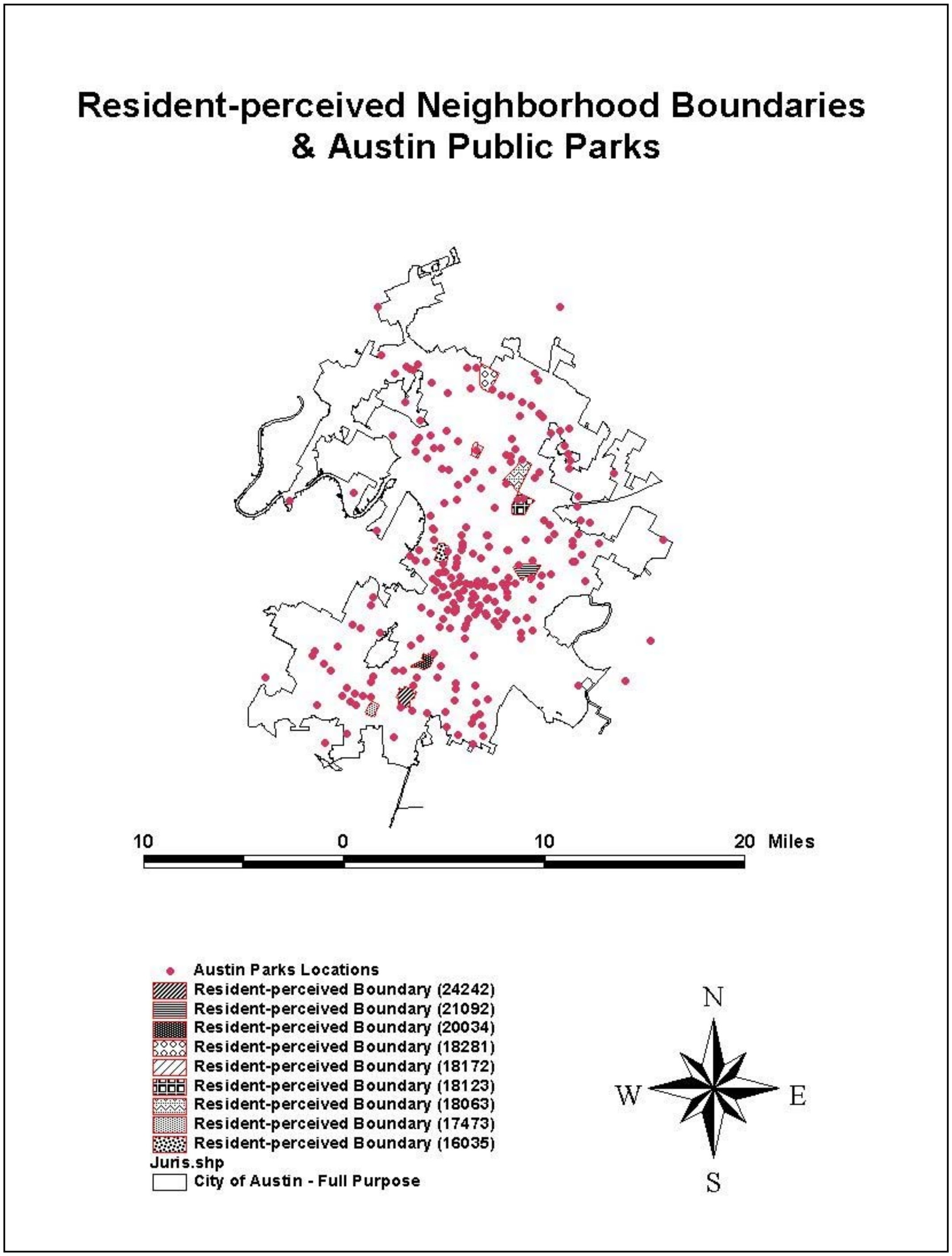


Figure 3.9: Distribution of the Centroid Points of Austin Public Parks

Spatial Aggregation Using Table Summarization

For the process of spatial aggregation between the analysis units, the "Table Summarization" function of Arcview GIS 3.2 was employed. As a traditional approach to measure the accessibilities of urban public services, spatial aggregation is a fundamentally required process (e.g., Al-Sahili 1991; Talen 1998; Coulton, et al. 2001; Hewko, et al. 2002). Through the census data, neighborhood residents' socio-demographic and economic characteristics are provided along with census boundaries such as census tracts, block groups, or census blocks. However, the most widely-used census geography for services accessibility studies is the census tract because it covers all U. S. territory and is publicly provided along with the most comprehensive set of socio-economic and demographic variables for entire areas of the nation (U.S. Census Bureau, Census 2000, Geographic terms and concepts, A-11). The socio-economic and demographic data regarding resident's characteristics were gathered through the attribute data of the census tracts that cover the current study area and they were appropriately spatial-aggregated for accessibility measurement. The basic spatial aggregation procedure using Arcview "Table Summarization" function referred to Anselin (1999)'s instructions in "Spatial Data Analysis with SpaceStat and ArcView Workbook (3rd Edition) The brief process is described as follows:

1. It was first determined over which census tracts each neighborhood unit is extended, and each unit name was denominated, such as RPNB-16035 (Resident-perceived Neighborhood Boundary–16035), NAA-18063 (Neighborhood Associations Areas-18063), and so on. And, finally, a (census tracts) look-up table was made.

2. A new field named ‘merger’, was added to the attribute table of census tract theme, and the fields were filled up with neighborhood unit names acquired through the previous process. Therefore, the census tracts to be spatially aggregated together were given the same unit name so that eventually they would become summarized into one record, taking on the sum or average values of each census variable.

3. The attribute table of Travis County census tracts was activated and the field ‘merger’ (names of neighborhood unit) was clicked; this is an indicator variable that takes on the same value for all the tracts in the same region.

4. Field>Summarize command was clicked on, and Summary Table Definition dialog opened.

5. Field>Summarize command; start this command to get the Summary Table Definition dialog. Then, a new file name in the “save as” item was given; then the “field” and “summarize by” were given appropriate items, and during this process, whether to sum, average, or other has to be decided for every “field” name. (click on the add button).

6. After completing adding “field-summarize by” couples, click okay. Then, a new table of the spatially aggregated boundaries will open.

CHAPTER IV

ANALYSIS RESULTS ONE – DESCRIPTIVE FINDINGS

The results of the survey data gathering procedures produced descriptive findings about survey respondents' general socio-economic and demographic information, as well as data used for delineating residents' perceived neighborhood boundaries, services accessibility and utilization. Analysis results are presented in four sections: [1] descriptive information about households in the survey; [2] information about resident-perceived neighborhood boundaries; [3] information about public services accessibility; and [4] the results of the hypothesis testing.

Descriptive Findings of Socio-demographic Characteristics

Background information of interest in the study included socio-demographic characteristics such as age, gender, race, marital status, employment status, household income, length of residence, home ownership, car ownership, and child living in the home.

Length of Residence. The sampled households responded to the survey showed an average length of residency of 13.6 years (S.D.=11.29). Homeowners occupied 93.7% of the total sample areas, while 3.1% rented.

Household Gross Income. The distribution of yearly household gross income levels indicated 12.6% with incomes between $20,000 and $40,000; 22.5% with incomes between $40,000 and $60,000; 24.6% with incomes between $60,000 and $80,000; and 21.5% with incomes over $80,000. Households with incomes under $20,000 comprised 8.4%.

Age and Gender. The study population varied in age from 24 to 90 years of age with an average age of 49 (S.D.=13.89). The predominant age groups in the sample were between 39 and 60 years of age, representing 50% of the total sampled residences. Gender distribution indicated 55% female and 41.9% male, while 3.1% of the respondents declined to answer the question regarding gender. The average number of persons per household was 2.53 (S.D.=1.26).

Race. Whites represented the largest racial groups in the study population followed by Hispanics, African-Americans, others. About 74.9% of the samples were Whites 11% were Hispanic, 8.4% were Black and Asians and others represented 2.1%.

Marital Status. About sixty-one percent (61.3%) of the respondents were married, and the second largest proportion was composed of divorced households with 14.1%. The rest of the respondents were never married (9.4%); widowed (8.9); and separated (1.6%). The cross tabulation between race and marital status showed some differences within-race marital status. That is, Whites showed 67% married, 14% divorced, 9.1% never married, and 7% widowed; while Hispanics showed 57.1% married, 19% never married, 14.3% divorced. In case of Blacks, 37.5% were married, 37.5% were widowed, 18.8% were divorced.

Employment Status. The respondents reported their employment status at the time of the survey. 67.5% of the respondents were self-employed or employed by someone else, and 16.8% were retired. Homemakers represented 8.4% of the sampled population, and the unemployed were 2.6%. The employment status within race was 71.3% (Whites), 81% (Hispanics), 37.5% (Blacks). Among the respondents, retired Blacks comprised 37.5% of within-race employment status which explains why the Blacks' employment percentage was so small among the categories of employment status.

Education Level. Among the classifications of education level, the largest proportion (38.2%) of the sampled population indicated Bachelor's degree as his or her highest education level. The second largest percent (26.7%) of respondents had Master's or higher degrees, 15.7% finished community college/technical school, and the rest of the respondents finished high school (12.6%) or less than high school (3.1%). The cross tabulation between race and education level shows that 64.9% of Whites, 61.9% of Hispanics, and 62.5% of Blacks attained bachelor's degree or higher, which means that, among survey respondents, there is no significant differences among races in terms of education achievement.

Home and Car Ownership. The survey results show that most of the respondents owned both their car and home. Over ninety three percent (93.7%) of the total respondents owned their own homes, and 3.1% rented. Over ninety five percent (95.3%) of the respondents owned their own cars (see Table 4.1).

Table 4.1: Socio-demographic Profile of Survey Respondents

Characteristics	N	%	Mean (S.D)
Length of residence			
total	206		13.6 (11.29)
Household gross income			
under $20,000	17	8.4	
$20,000 - 40,000	26	12.6	
$40,000 - 60,000	46	22.5	
$60,000 - 80,000	51	24.6	
over $80,000	44	21.5	
no response	21	10.4	
Age			
total	206		49 (13.89)
Gender			
female	113	55.0	
male	86	41.9	
no response	6	3.1	
No. household members			
total	206		2.53 (1.26)
Race			
white	154	74.9	
hispanic	23	11.0	
black	17	8.4	
other	4	2.1	
no response	7	3.6	
Marital status			
married	126	61.3	
divorced	29	14.1	
never married	19	9.4	
widowed	18	8.9	

Table 4.1 Continued

Characteristics	N	%	Mean (S.D)
separated	3	1.6	
no response	10	4.7	
Employment status			
employed	139	67.5	
retired	35	16.8	
homemaker	17	8.4	
unemployed	5	2.6	
other	10	4.7	
Education level			
bachelor's degree	79	38.2	
master's or higher degree	55	26.7	
community college / technical school degree	32	15.7	
high school degree	26	12.6	
less than high school	6	3.1	
no response	8	3.7	
Home ownership			
owned	193	93.7	
rented	6	3.1	
no response	7	3.2	
Car ownership			
owned	196	95.3	
other	3	1.6	
no response	6	3.1	

Descriptive Findings of Perceived Neighborhood Boundaries

The current study used neighborhood maps gathered through two distributions of mail-out surveys during October and December of 2002. The maps were drawn by 213 residents of nine census-defined block groups within the scope of the Austin city limits in Texas. There were already several other studies that compared resident-drawn neighborhood maps with census boundaries (Coulton, C. J., et al. 2001) or public service area maps (Pacione, M. 1982). Pacione (1982) compared resident-drawn boundaries with several public service area boundaries and concluded that most administrative service areas are much different than resident maps and that polling district boundaries may more closely reflect neighborhood boundaries that residents actually perceive. Meanwhile, Claudia (2001) found that resident-perceived neighborhood boundaries are different from census definitions of neighborhoods and that the discrepancy leads to different social indicator values than did census-defined units. There have also been many follow-up studies on how resident-perceived neighborhood boundaries are affected. Until recently the variables that may affect the neighborhood boundary perceptions have been found to be influenced by such factors as the urban-suburban location of neighborhoods (Haney & Knowles 1978), race (Lee, Campbell, & Miller 1991), gender (Everitt & Cadwallader 1972; Orleans & Schmidt 1972; Guest & Lee 1984), age (Piaget, et al. 1960; Cannetello & Mark 1970), length of residence (Appleyard 1970; Davlin 1976; Aitken, et al. 1990), and socio-economic class (Stea 1974; Appleyard 1970; Goodchild 1974).

Collecting Resident-perceived Maps. The instruments for gathering residents' perceptions of their neighborhoods included simple maps containing each of nine block groups. The maps were drawn using Arcview 3.2, a commercially available GIS software (ESRI). The current study used the print-out map size of an 8-mile radius around the center of a census tract which Coulton, et al. (2001) recommended in his previous study to obtain residents' neighborhood perceptions. This map size proved to be big enough and sufficiently detailed. The GIS software created resident-friendly maps incorporating street central lines, major roads with street names, parcel lines, and major park locations across the surrounding city areas. The maps were printed out in ways that allowed a specific respondent to be located at the center of the map. This helped the residents to become oriented to their neighborhood environment. An example of the survey map is shown in the attached survey booklet (see Appendix 1).

Two mail-out surveys successfully obtained a 25.4% of response rate (N=788). 206 residents from nine randomly sampled census tracts responded to the survey. As anticipated before mailing out the survey, there were differences in response rates according to respondents' socio-demographic backgrounds that varied from one census tract to another. The response rates are summarized below in Table 4.2.

Table 4.2: Survey Response Rates Classified by Census Tracts

Race	Income Level	Census Tract	Block Group	Income	No. Sampled	Responses	Rate
White	High	18.28	1	75,436.00	90	28	31.11
		16.03	5	79,179.00	90	31	34.44
	Medium	18.17	2	61,838.00	90	30	33.33
		24.24	2	41,250.00	90	23	25.56
		17.47	3	50,391.00	90	26	28.89
Hispanic	Medium	20.03	4	38,636.00	90	22	24.44
	Low	18.12	3	29,909.00	90	14	15.56
		18.06	3	27,188.00	90	17	18.89
Black	Medium	21.09	2	31,553.00	90	15	16.67
					810	206	25.43

As the table indicates, the return rates were not differentiated by racial backgrounds but rather by income levels, so that White neighborhoods of high/medium income level (31.11%, 34.44%, 33.33%, 25.56%, and 28.89%) and Hispanic neighborhoods of medium income level (24.44%) responded to the survey at much higher rates than Hispanic neighborhoods of low income level (15.56%, and 18.89%) and Black neighborhoods of medium income level (16.67%). The only black neighborhood was classified as medium in terms of income level, but the median household income ($31,553) belongs to lower medium income level. Its response rate was only 16.67%. The income levels were classified by the categories of Low (below $35,000), Medium ($35,000-70,000), and High (over $70,000) based on the STF1 and STF3 data of the U.S. Census 2000.

Neighborhood Descriptors. As a method of gathering residents' perception of neighborhood boundaries, the technique initially used by Lee (1968) was adopted as the most appropriate for eliciting a perceived map of neighborhood. According to his technique, before providing the residents with a street map to outline the boundaries, they were asked to recall several outstanding descriptors and memorable elements of the neighborhood in situ. Through the survey booklet, members of the households were given a question: "In general, what words would you use to describe your neighborhood to total strangers? In other words, how is your neighborhood different from other neighborhoods?". The responses were very comprehensive and subjectively described. The whole list of descriptions is summarized in Table 4.3 listing the most frequently used expressions.

Table 4.3: Neighborhood Descriptors Classified by Census Tracts

Neighborhood Descriptors	Census Tracts									Totals
	16035	17473	18063	18123	18172	18281	20034	21092	24242	
Quiet	15	15	4	1	18	8	6	5	10	82
Safe / low crime	10	9		1	6	6	6	3	3	44
Good neighbors	4	7	1		6	9	6	5	5	43
Well-kept yards	4	12	2		9	5	4	2	2	40
Mostly older	11	9	1	1	4		5	2	1	34
Older houses	6	1	3		3	2	4	1	1	21
Lots of kids	5		1	1	1	4	1	1	1	15
Mix of ages	4	1			5	1	1			12
Busy streets / traffic	1	1			2	2	5			11
Deteriorating			6			1		1	3	11
Close to necessities	5	1				4				10
Friendly	5	1			2	1				9
Lots of trees / greenery	3	2	1		1	1	1			9
Middle class	1				2	5			1	9
New (young) families	2	3			1	1	2			9
Family-oriented	3				3	2				8
Kept-up houses	2				1	3			2	8
Noisy		1		1			1	1	2	6
Mix of races		1			2			1	2	6
Good location in city				1	3	2				6
Mostly (many) rented					1	3	1		1	6
Small houses		2				1			3	6
Low income / poor				1	1		1	1	1	5
Close to major roads	1	1			1	2				5
Good Neighborhood	2	1			1	1				5
Lots of older residents	1	1	1					1	1	5
Blue collar					1		4			5

Note: The entire list of neighborhood descriptors is attached in the Appendix 3

Neighborhood Elements. As Table 4.4 shows, the residents of most neighborhood areas used positive descriptors to describe their neighborhoods, while residents of several neighborhoods used negative descriptors to depict their neighborhoods. Several descriptors commonly used by residents across all nine neighborhoods were “quiet”, “safe”, “good neighbors”, “well-kept”, “older”, and “kids”. Interestingly enough, the most common descriptors used all positive terms, while most negative descriptors, such as “noisy”, “deteriorating”, low income”, and “boring”, ranked lower on the descriptors list.

Before asking sampled residents to draw neigborhood boundaries, they were asked to recall the most distinctive elements of the neighborhood in situ. The households were given a question: “What elements of your neighborhood do you think are the most distinctive or stand out the most?” The responses were supposed to be physical elements of the residential environments, not being descriptive, but many of the respondents included descriptive remarks. The most frequently recalled physical elements gathered are listed in Table 4.4. Also, in this case, neighborhood elements may not be the same among different neighborhood environments, as long as the actual physical conditions vary according to what neighborhood a resident resides in. Thus, they were reclassified according to the census tracts provided by the U.S. Census 2000.

Generally, without regard to the physical conditions of neighborhoods, there were several commonly chosen neighborhood elements; “trees/greenery”, “streets”, stores/shopping centers”, “major roads”, “parks/creeks/greenbelts”, “open spaces”, and “schools”. “Trees/greenery” is an unparalleled neighborhood element that was listed across all neighborhoods. This indicates that the natural neighborhood environment plays an important role in residents’ neighborhood perceptions. Besides those major elements, it was found that such facilities as schools, libraries, community centers, churches, and post offices that provide public services in the neighborhoods help shape neighborhood perceptions. But those minor elements seem to be highly dependent upon the neighborhood’s development, whether highly developed or low.

Table 4.4: Neighborhood Elements Classified by Census Tracts

Neighborhood Elements	Census Tracts									Total
	16035	17473	18063	18123	18172	18281	20034	21092	24242	
Trees / greenery	17	9	2		6	6	6	1	4	52
Streets / roads (minor)	1	6		1	7	4	6	2	3	30
Stores / Shopping centers	5	6	3		2	3	1		2	22
Major roads	2	2	3	1	4	5	1		2	20
Parks / creeks / greenbelts	2	1	1	2	2	9	2		1	20
Open spaces	2	2	1	1	2		2	4		14
Schools	3				1	4	1		1	10
Elementary Schools					2	6				8
Libraries	1					6				7
Public facilities(comm.ctr.)	1			2		1		1	1	6
Church buildings	1		1			3				5
Restaurants	1	1				1				3
Golf courses	1							2		3
Post offices	2									2

Note: the entire list of neighborhood elements is attached in the Appendix 4

Finding Consensus of Perceived Neighborhood Boundary

Ideally, the residents of a neighborhood would have the perceptions of their neighborhood boundary perfectly overlapping one another, but in reality, it is almost impossible to find even two residents who have identical neighborhood boundary perceptions. Throughout the literature there have been many efforts to discover how neighborhood residents perceive and draw their neighborhood boundaries. Originally, Lee (1968) initiated the utilization of residents' perceived neighborhood maps as a method of defining a neighborhood. He considered an urban neighborhood as a socio-spatial schema, a sort of mental representation of physical-socio space. He developed an index with relation to urban planning, called "N.Q. (neighborhood quotient) (Lee, 1968, 244). Inspired by his methodology of neighborhood residents' environmental perception, Golledge and Spector (1978) explored the residents' perception of local environments and experiences, and Aiken and Prossor (1990) used neighborhood maps to investigate the characteristics of residents' spatial knowledge of neighborhood. Until recently there was no study that emphasized the importance of finding consensus of perceived neighborhood boundaries among residents of the same neighborhood environment. The literature considered perceived neighborhood as an individual experience, not a group experience that is possible to be achieved by consensus.

Recently, Coulton, et al. (2001) asked how to find commonly perceived neighborhood boundaries among residents, so they performed an experiment with alternative methods of finding resident-perceived neighborhood boundaries useful for research purposes. They used the areas, parameters, centroids of residents' maps and compared resident-perceived neighborhood boundaries with census-based neighborhoods (census tracts and block groups) defined by census geography based on the U.S. census 1990. As a means of comparison, they investigated how the differences between the two boundaries affect the changes in social indicators such as population, poverty, crime ratio and so on. One of the purposes of the current study is to compare the resident-perceived neighborhood boundaries with census-based neighborhoods, and then to determine whether the boundary differences affect the current equity of public parks accessibilities among neighborhoods. The current study also dealt with the 70% consensus area as the resident-perceived neighborhood boundary for each census-based block groups as in the study by Coulton, et al. (2001, 375).

Using Map Calculator to Get Perceived Neighborhood Boundaries. In finding the consensus of resident-perceived neighborhood boundaries, the Spatial Analyst program was used as one of the Arcview 3.0 extensions. Arcview Spatial Analyst provides a useful way to represent and analyze the geographic objects such as temperature, climate, and elevation that are distributed in a continuous manner across a surface. Instead of digitizing them in the form of shapes such as point, lines and polygons, it divides the whole surface and the shapes are turned into a matrix of identically-sized square cells, so- called grids (Ormsby and Alvi, 1999). Working with objects as numbers in cells is working with the raster data model, so the Arcview Spatial Analyst does not work with points, lines and polygons that are useful geographic objects for the vector data model. That is, each cell possesses a number that stores the geographic object's value at that exact location of the cell. In Spatial Analyst, the raster data sets themselves are called grids. The resident-perceived neighborhood boundaries were created through the following procedures:

1. Based on the survey and the map sketches done by the respondents to the survey booklet, each resident's perception of the boundaries were digitized using "add new theme" function of Arcview. The resulting theme is a polygon object for each resident.

2. Before rasterizing each polygon for map calculation, analysis properties were set. (Go analysis => Properties. Set Analysis Extent as block group layer, analysis cell size as "as below". Set cell size as 100 (miles). Push return button once and row and column numbers will change according to that. Set Analysis Mask as "no".)

3. In order to use Map Calculator, each cell was given the value of “1”. That is, cell values were changed from 0 (default) to 1 in every record of the attribute table of each polygon theme. Field name is set as a default as "ID", so it was changed to "value".

4. Then, each polygon as a shape file was rasterized using “Convert to Grid” function of ArcView. (Activate a shape file => Go to theme menu => Select “Convert to Grid” => Enter grid name => Pick value field => Join feature? No, add grid? Yes. => A new grid theme is generated and added to theme column on view window.)

5. Each Cell value was reclassified. Each raster grid was then reclassified to show a cell value of 1 if a cell is inside a resident's perceived neighborhood boundary, and 0 if outside that boundary. (Activate the new theme => Enter classify button. Set type as “Natural Breaks”, Number of Classes as 3, and Round Value as d. => Change old and new values as 1 to be 1, No Data to be 0) => Enter "+" to add new. Enter value as 0 to be “No Data”. => Return okay.) Then, a new theme is generated with three classifications (1,0,no data). Repeat from 1 thru 5 to all other shape files belonging to the same block groups.

6. Then, using Arcview Map calculator, each cell value is calculated according to how many cells are overlapped with one another. (Activate a grid theme created after reclassification. Go to Analysis menu => Select Map Calculator. => Select all reclassified grids titled “Reclass of Grid…”, adding “+” between two grids such as the following:

[(recalcu_2424_11)+(recalcu_2424_13)+(recalcu_2424_17)…………]

7. Using Legend Editor, the legend display of newly-generated shape file "map calculation1" was changed so that values were classified into 10 categories and the symbols are easy to understand after analysis. (Activate “map calculation 1”. => Go to theme menu and click “Edit Legend”. => Set legend type from “unique values” to “graduated values”. => Set classification field as “value” => Enter “classify” and set “number of classes” as 10. => Enter “Apply”.

Finally, the neighborhood maps showing the percents of overlap among individually perceived boundaries are displayed from Figures 4.1 to 4.9 below.

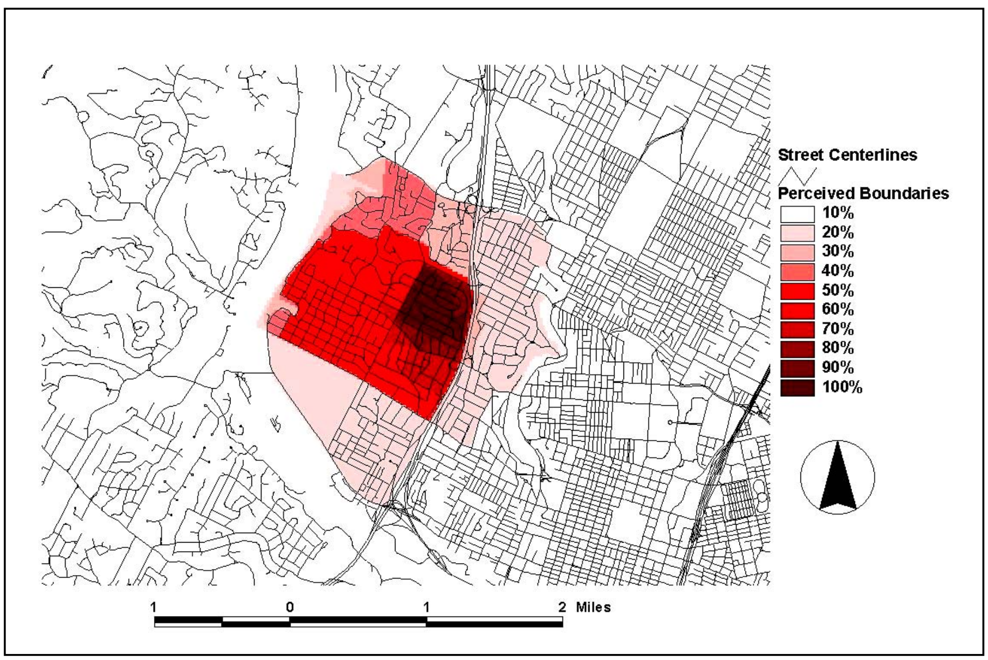


Figure 4.1: Resident-perceived Neighborhood Maps (BG-16035)

Figure 4.2: Resident-perceived Neighborhood Maps (BG-17473)

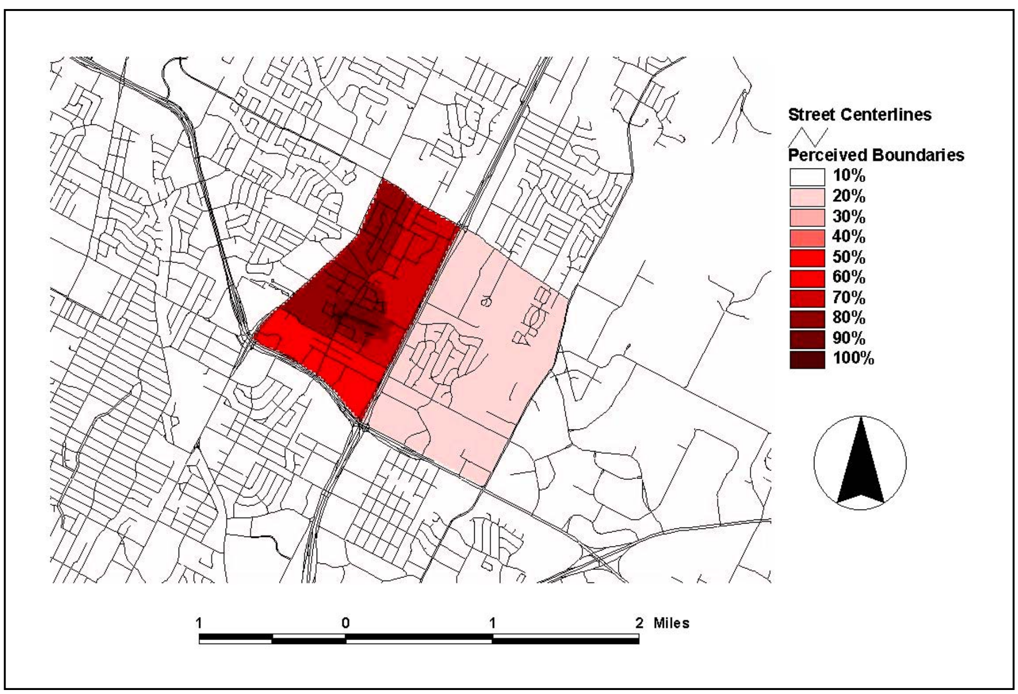


Figure 4.3: Resident-perceived Neighborhood Maps (BG-18063)

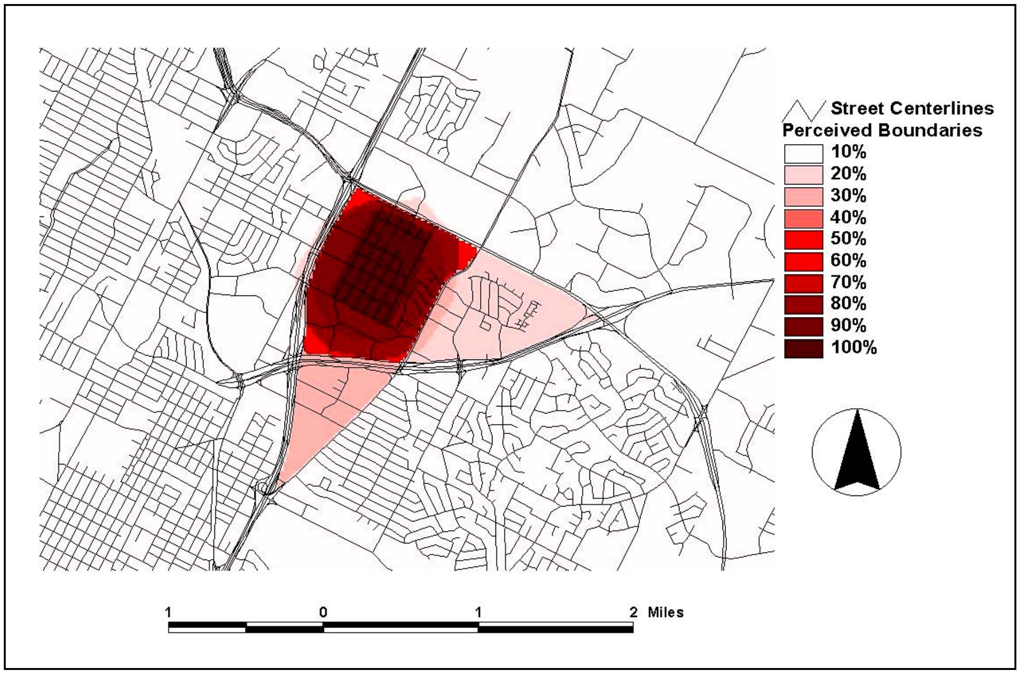


Figure 4.4: Resident-perceived Neighborhood Maps (BG-18123)

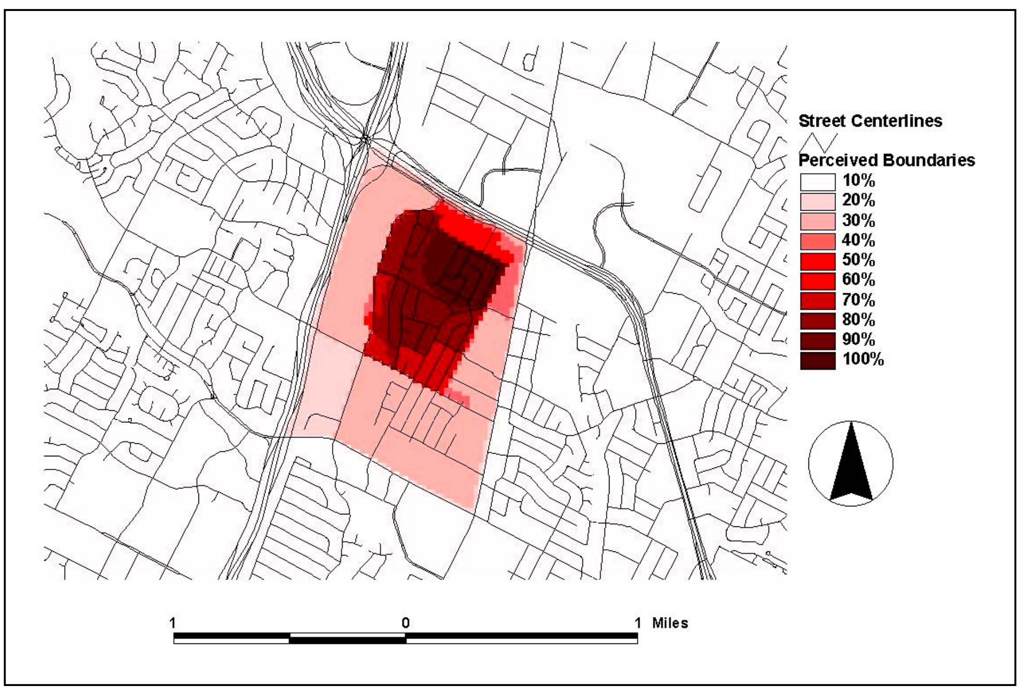


Figure 4.5: Resident-perceived Neighborhood Maps (BG-18172)

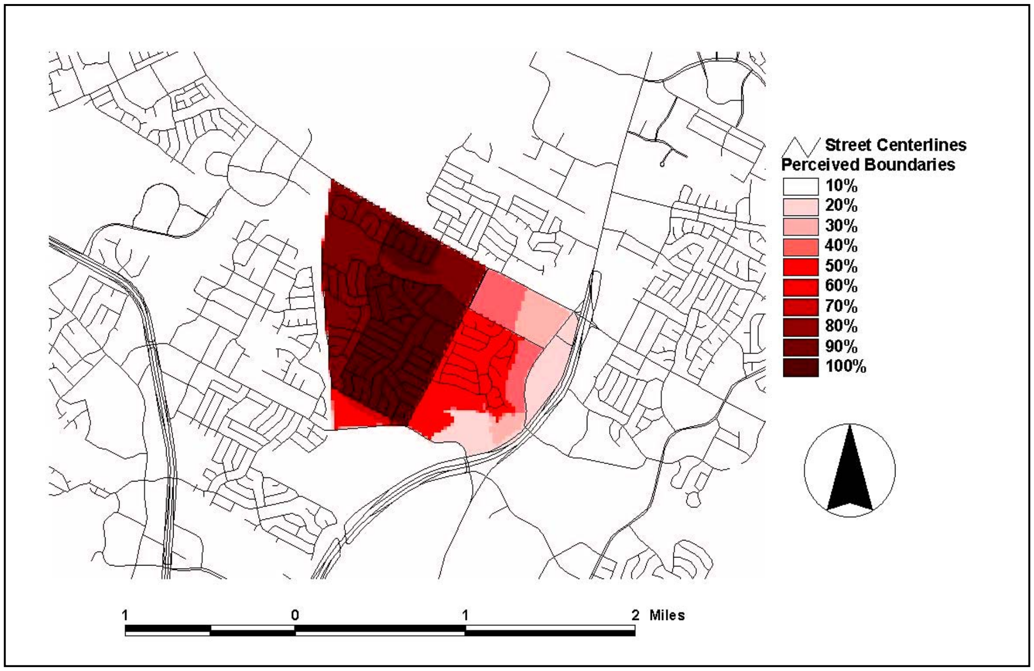


Figure 4.6: Resident-perceived Neighborhood Maps (BG-18281)

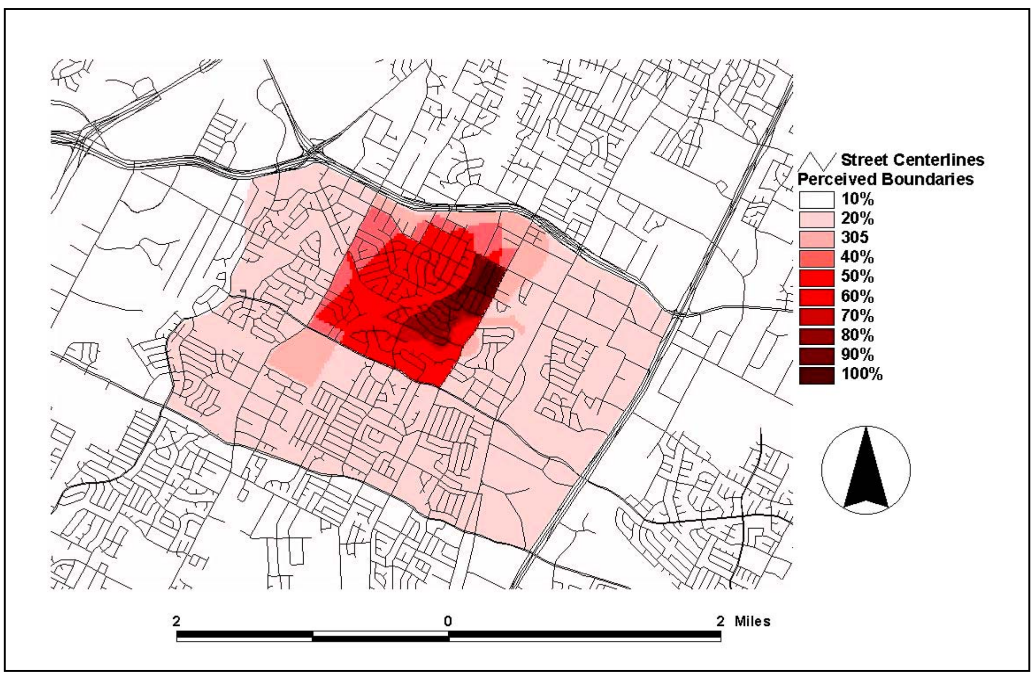


Figure 4.7: Resident-perceived Neighborhood Maps (BG-20034)

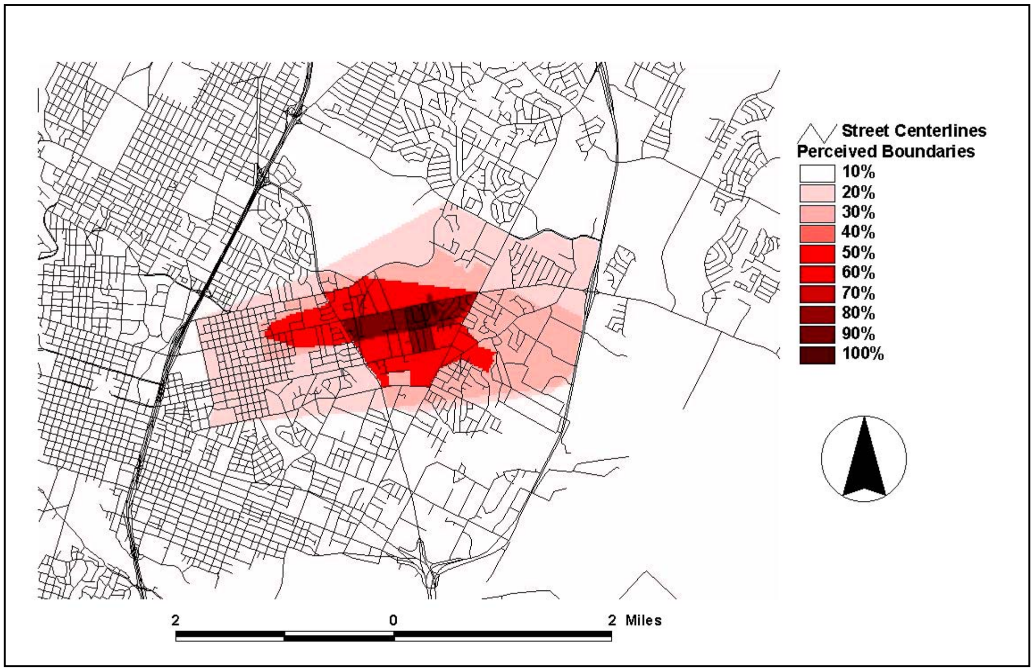


Figure 4.8: Resident-perceived Neighborhood Maps (BG-21092)

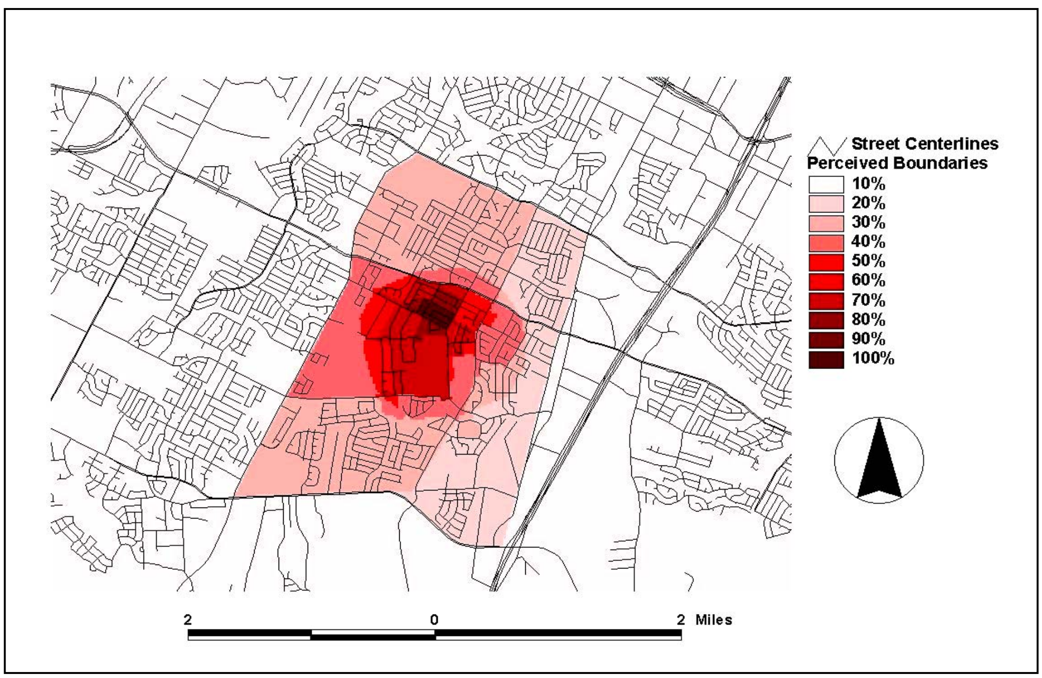


Figure 4.9: Resident-perceived Neighborhood Maps (BG-24242)

CHAPTER V

ANALYSIS RESULT TWO – UNIT OF ANALYSIS & ACCESSIBILITY

Comparing Residents' Maps among Neighborhood Areas

According to the system of census geography, census tracts are composed of several block groups, usually divided into 5 to 10 city blocks (Coulton, et. al, 2001, 373). As the literature of the current study pointed out, census tracts have been the most widely accepted census-defined neighborhoods that are readily available for neighborhood studies in planning. Several other spatial units, also considered as census-based neighborhoods, were other government-defined service districts, such as postal codes, municipal utility districts, police patrol districts, school districts, and voting districts (Rich, 1982; Martin, 1998; Coulton, et al., 2001), but they are, in fact, the aggregates of adjoining several census tracts.

In terms of the actual size of census tracts and its relation to that of resident-perceived neighborhood boundaries, there were several indications from the literature. Mutter (1985) linked residents' definitions of neighborhood boundaries and park uses, and one significant result showed that the resident-defined neighborhood areas were smaller than census tracts. Meanwhile, Coulton, et al. (2001) tried to gather resident-perceived neighborhood maps and find a methodology for generalizing residents' maps for further neighborhood studies such as investigating how the differences between census-defined neighborhoods and resident-perceived neighborhood boundaries will affect the social indicators necessary for neighborhood plans and public policies.

Another significant finding was that neighborhood boundaries perceived by residents do not coincide with census tracts, but rather they include a portion of at least two census tracts and at least three block groups (p377).

Therefore, the current study randomly sampled a block group of each of the nine randomly selected census tracts of the Austin city area. The residents were randomly selected within block groups rather than census tracts or larger census-based geographic units so that the mean distances among residents' locations would show less variation and a block group would represent each census tract. Then, the resident-perceived maps will be available for comparisons between each resident's map and census tract. The survey results regarding the size and shape of resident-perceived neighborhood boundaries and their consensus within neighborhoods are displayed in Table 5.1. Coulton, et al. (2001, 376)'s method of measuring resident maps was referred to as well.

Table 5.1 below displays the measures of perceived neighborhood boundaries and consensus areas within each block group. Overall, the mean area of the resident-perceived neighborhood boundary was 0.81 square miles, the mean parameter of it was 3.04 miles, and the mean compactness of it was 0.001810. However, as Table 5.1 indicates, there was obvious variation between resident's maps within and between each neighborhood in terms of the size (area, perimeter) and the shape (compactness) of the boundaries the residents drew. The range in the area of resident-perceived neighborhood boundaries among the nine block groups was between 0.28 as the smallest and 1.48 as the largest, the range in parameter was between 4.01 and 1.95, and the range in compactness was between 0.01220 and 0.03131. The coefficients of variation were calculated as a way of showing the degree of consensus among residents' maps within each neighborhood, and it is given by 'standard deviation/mean'. The coefficients of variation for area and perimeter were varied according to block groups, too. That is, the range in the coefficients of variation for area was between 0.71 and 2.48, while the range in the coefficients of variation for perimeter was from 0.31 to 0.91.

Table 5.1: Measures of Resident-perceived Neighborhood Maps

	Individual Perceived Neighborhoods (Mean / SD)			Consensus Areas		
Block Groups	Area ($mile^2$)	Perimeter (miles)	Compact-ness	Area ($mile^2$)	Perimeter (miles)	Compact-ness
16035	1.48 / 2.82 (1.91)	4.01 / 2.63 (0.66)	0.01548	0.55	2.89	0.0136
17473	0.28 / 0.22 (0.79)	1.95 / 0.75 (0.38)	0.01966	0.30	2.32	0.0159
18063	0.62 / 0.66 (1.06)	2.63 / 1.67 (0.63)	0.01616	0.98	4.10	0.0095
18123	0.77 / 0.31 (2.48)	3.49 / 1.08 (0.31)	0.01640	0.65	3.37	0.0118
18172	0.36 / 0.39 (1.08)	2.05 / 1.13 (0.55)	0.01736	0.26	2.00	0.0151
18281	0.80 / 0.57 (0.71)	3.66 / 1.32 (0.36)	0.01220	0.81	3.46	0.0063
20034	0.91 / 1.71 (1.88)	3.29 / 2.82 (0.86)	0.03131	0.43	2.14	0.0092
21092	1.05 / 1.39 (1.32)	3.61 / 2.64 (0.73)	0.01332	0.71	4.12	0.0131
24242	1.02 / 1.71 (1.68)	3.00 / 2.74 (0.91)	0.01999	0.66	3.65	0.0137
Total	**0.81 / 1.51**	**3.04 / 2.10**	**0.01810**	**0.59**	**2.87**	**0.0110**

Note: Coefficients of variation are also stated in parentheses.

Comparing Census-based & Resident-perceived Neighborhoods. Perry (1912) recommended that a neighborhood unit should coincide with the service area of elementary schools and other institutions that provide services to the neighborhood, and Ward (1913) proposed that urban neighborhoods should be conterminous with the school district and voting district. Later on, the Dudley Report (1944) emphasized the importance of the boundary coincidence of neighborhood as a natural area and administrative areas by saying, “it would be obviously sensible if the ward boundaries of a town followed the boundaries of neighborhood units which are strongly defined”. These recommendations are pretty much applicable to today’s planning circumstances, considering growing pressure for more open government and increased needs for public citizen participation.

As the literature emphasized, census-based neighborhood units such as census tracts, block groups, and other census tracts-aggregated service areas (i.e. postal codes, police patrol districts, school districts, and voting districts) were the most useful and readily relied-on proxies for urban neighborhoods. This part of the current sub-chapter will compare Resident-perceived Neighborhood Boundaries with Census-based Neighborhood Units on the size and shape of boundaries, and also investigate how selected social indicators – mainly race and income - will be affected by the choice of areal unit. In the following chapter, the social indicators of each boundary unit will be used to evaluate the equity of neighborhoods’ accessibility to public parks in the City of Austin.

The present study selected a set of two census-based and seven neighborhood units with clearly defined, widely acknowledged administrative boundaries within the study area. To public planners and policy makers it will be of interest to investigate how varied spatial boundaries of public services units will correspond with the concerned residents’ perception of neighborhood boundaries. The two census-defined neighborhoods are census tracts and block groups, and the seven census tract-based administrative neighborhood boundaries include school districts, voting precincts, fire department service areas, police patrol districts, postal districts (zip-code areas), neighborhood association areas, and neighborhood plan areas.

In measuring the coincidence of boundaries between Resident-perceived Neighborhood Boundaries and administrative boundaries, Pacione's index of congruity will be used and the index is measured by (Pacione, 1982, 240):

$$\mathrm{I}_c = \mathrm{k}\frac{C_b}{P_b}$$

where "I_c" is the index of congruity, "C_b" is the area of common boundary between resident-perceived neighborhood boundaries (i.e. consensus areas of residents' maps) and census-based neighborhood boundaries, "P_b" is the area of census-based neighborhood boundaries and k is a constant to scale the index values ranging from 0 to 100. This simple index indicates how each resident-perceived neighborhood coincides with the census-based boundaries in the locality and what portion of perceived neighborhood boundaries are used by each of the service areas. Table 5.2 shows the degree of coincidence of resident-perceived neighborhood boundaries and census-based neighborhood units.

(1) Census Tract

Urban areas are divided into census tracts which usually have a population range of between 2,000 to 4,000. According to the U.S. Census Bureau's definition of census geography, census tracts will provide a stable set of geographic units for the presentation of decennial census data (U.S. Census Bureau, Census 2000, Geographic terms and concepts, A-11). This is the first decennial census in which the entire United States is covered by census tracts.

The results of the current study displayed a relatively high level of consensus (I_c = 56.11) as the third highest among those nine neighborhood units, while the mean congruity index of all neighborhood units is 31.30. The mean area of the nine census tracts was 0.93 square miles which was much higher than that of residents' perceived neighborhood areas (0.59 square miles).

(2) School Districts

School districts are one of the geographic entities within which related government bodies, such as state, county, or local officials or the Department of Defense, provide public educational services for the area's residents. The U.S Census Bureau gathered the boundaries and names for school districts from state officials and tabulated data for three types of school districts: elementary, secondary, and unified for Census 2000 (U.S. Census Bureau, Census 2000, Geographic terms and concepts, A-20).

Within the study area, there was one ISD (Independent School District) that was related to the study area and only one ISD - Austin ISD - included all nine neighborhood areas. The ISD comprises 7 school districts (sd-171, sd-172, sd-174, sd-176, sd-179, sd-180, and sd-181). As the congruity index (3.06) and the difference of mean areas of school districts (29.77 sq. miles) and residents' maps (0.59 sq. miles) indicate, school districts showed one of the lowest level of agreement with the residents' maps.

Table 5.2: Congruity between Perceived and Census-based Neighborhoods

		16035	17473	18063	18123	18172	18281	20034	21092	24242	Total
	Residents' maps										
	Area (sq. miles)	0.55	0.3	0.98	0.65	0.26	0.81	0.43	0.71	0.66	0.59
Census Units	Census tract										
	Area (sq. miles)	0.99	0.93	0.75	0.9	0.96	0.91	0.78	1.07	1.06	0.93
	Common area	0.29	0.3	0.72	0.7	0.26	0.79	0.27	0.65	0.64	0.51
	Congruity	29.29	32.26	96.00	77.78	27.08	86.81	34.62	60.75	60.38	**56.11**
	Block group										
	Area	0.3	0.33	0.37	0.21	0.26	0.41	0.43	0.44	0.4	0.35
	Common area	0.28	0.16	0.35	0.11	0.21	0.4	0.26	0.37	0.24	0.26
	Congruity	93.33	48.48	94.59	52.38	80.77	97.56	60.47	84.09	60.00	**74.63**
Administrative Units	School districts										
	Area	14.78	107.54	17.62	22.14	32.04	17.62	17.04	22.14	17.04	29.77
	Common area	0.55	0.3	0.98	0.65	0.26	0.81	0.43	0.71	0.66	0.59
	Congruity	3.72	0.28	5.56	2.94	0.81	4.60	2.52	3.21	3.87	**3.06**
	Voting precincts										
	Area	1.56	0.95	0.67	0.9	0.89	0.79	0.65	0.71	1.43	0.95
	Common area	0.3	0.3	0.61	0.7	0.26	0.76	0.34	0.54	0.56	0.49
	Congruity	19.23	31.58	91.04	77.78	29.21	96.20	52.31	76.06	39.16	**56.95**
	Police patrol dist.										
	Area	5.68	3.82	1.03	0.75	1.87	6.66	1.19	4.31	3.65	3.22
	Common area	0.37	0.29	0.88	0.69	0.26	0.73	0.3	0.49	0.65	0.52
	Congruity	6.51	7.59	85.44	92.00	13.90	10.96	25.21	11.37	17.81	**30.09**
	Postal areas										
	Area	5.24	12.35	10.17	3.1	5.08	8.52	13.01	3.39	13.25	8.23
	Common area	0.55	0.3	0.97	0.75	0.26	0.79	0.43	0.51	0.65	0.58
	Congruity	10.50	2.43	9.54	24.19	5.12	9.27	3.31	15.04	4.91	**9.37**
	Nbrhd. assn. areas										
	Area	102.82	112.19	120.76	65.37	53.37	39.15	142.04	15.84	125.24	86.31
	Common area	0.55	0.3	0.98	0.65	0.26	0.81	0.43	0.71	0.66	0.59
	Congruity	0.53	0.27	0.81	0.99	0.49	2.07	0.30	4.48	0.53	**1.16**
	Nbrhd. plan areas	(Some areas not included into Austin neighborhood plan areas yet.)									
	Area	n/a	n/a	1.05	1.19	1.03	n/a	1.39	1.55	n/a	1.24
	Common area	n/a	n/a	0.98	0.65	0.26	n/a	0.43	0.71	n/a	0.61
	Congruity	n/a	n/a	93.33	54.62	25.24	n/a	30.94	45.81	n/a	**49.99**
	Total (Congruity)	20.43	15.38	52.98	42.56	20.31	38.49	23.32	33.46	23.38	**31.30**

(3) Voting Precincts (Voting Districts - VTD)

Voting district is the generic name for geographic entities, such as precincts, wards, and election districts, established by state, local and tribal governments for conducting elections. States may provide boundaries, codes, and names for VTDs to the U.S. Census Bureau (U.S. Census Bureau, Census 2000, Geographic terms and concepts, A-23). Note that the U.S. Census Bureau requires that VTDs follow the boundaries of census blocks. There were nine different voting precincts that covered the study areas and they were 0256 (16035), 0355 (17473), 0142 (18063), 0138 (18123), 0252 (18172), 0259 (18281), 0446 (20034), 0126 (21092), 0460 (24242). As Table 5.2 shows, the boundaries of several voting precincts displayed a strong congruity with those of the Resident-perceived Neighborhood Boundaries. For example, note that I_c=91.40 between neighborhood 18063 and voting precinct 0142, I_c =96.20 between neighborhood 18281 and voting precinct 0259, I_c=77.78 between neighborhood 18172 and voting precinct 0252, and I_c=76.06 between neighborhood 21092 and voting precinct 0126. Because of those high I_c values, mean congruity index for between perceived neighborhood boundaries and voting precincts showed the second highest (I_c=56.95) among nine neighborhood units, and was even higher than that of census tract boundaries.

(4) Police Patrol Districts

The police districts are split up into six service areas – northeast, northwest, central east, central west, southeast, and southwest. The Austin Police Department decentralized its operations and the City of Austin was divided into six area commands with resources transferred to the neighborhood level to solve problems at their source (Austin City Connection 2001). The mean area of police patrol districts (3.22 sq. miles) was much larger than that of perceived neighborhood boundaries (0.59 sq. miles), and it indicated a high level of incongruity between those two types of boundaries. The degree of congruency with perceived neighborhood boundaries was relatively low (I_c=30.09), but particularly high for neighborhood 18063 (I_c=85.44) and neighborhood 18123 (I_c=92.00). Therefore, police patrol districts are too large to accurately reflect perceived neighborhood boundaries.

(5) Postal Areas (Zipcodes)

Postal areas are gatherings of individual zipcode units that comprise small groups of houses. There are fifteen zipcode units that are wholly within the City of Austin. The mean area of postal areas (8.23 sq. miles) was one of the largest administrative boundaries and was much larger than that of perceived neighborhood boundaries (0.59 sq miles). Moreover, the degree of congruency with perceived neighborhood boundaries was one of the lowest (I_c=9.37), though that of neighborhood 18123 (I_c=24.19) was a little bit higher. Hence, postal areas are also too large to accurately coincide with residents' perceived neighborhood boundaries.

(6) Neighborhood Association Areas

There are over 400 neighborhood associations in Austin according to the community registry database maintained by the Neighborhood Planning and Zoning Department of Austin (Austin City Connection 2001). The Austin Neighborhoods Council acts as a coordinating body for Austin area neighborhood groups and as a clearinghouse for information, giving guidance to individual neighborhoods and the City of Austin for the betterment of neighborhoods and the promotion of civic awareness (ANC official website - http://www.ancweb.org).

The mean area of neighborhood association areas (86.31 sq miles) was the largest among the neighborhood units, much larger than that of perceived neighborhood boundaries (0.59 sq miles), and it indicated the highest level of incongruity between those two types of boundaries. The degree of congruency with perceived neighborhood boundaries was the lowest (I_c =1.16). It is very interesting that neighborhood association areas are often overlapped between adjacent areas so that it makes it much more complicated for planners and policy makers to deal with zone-based public services distributions based on city-wide neighborhood planning areas. So the current study averaged the total neighborhood association areas that cover the regarding perceived neighborhood boundary to achieve the congruity index. As a result, neighborhood association areas are not only too large to accurately reflect perceived neighborhood boundaries, but also not readily available for planning or policy making without further subdivision with clearly visible boundary demarcations.

(7) Neighborhood Plan Areas

City-wide, neighborhood planning has been very active since the Austin City

Council adopted the Dawson Neighborhood Plan on August 28, 1998. The Austin Neighborhood Planning and Zoning Department takes the initiative to work with neighborhood representatives to produce a successful neighborhood plan. The Austin Neighborhood planning is an opportunity for citizens to shape the neighborhoods where they live and work, covering neighborhood planning processes such as land use, transportation, services and infrastructure, and urban design issues (Austin city connection 2001).

Through telephone interviews with several planners of the Neighborhood Planning and Zoning Department, it was revealed that they do not use what many in the community consider traditional neighborhood boundaries because they discovered that the self-defined neighborhood boundaries that many neighborhood associations claim are often not very amenable for effective comprehensive planning. So they often group several neighborhoods into a single "neighborhood planning area", using several existing geographies: traditional neighborhood association boundaries; police patrol sectors; major roads; and physical barriers such as railroad tracks and bodies of water.

As Table 5.2 indicates, four out of nine neighborhood areas did not belong to the Austin neighborhood planning area boundaries. The neighborhood areas included by Austin planning areas were neighborhoods 18063, 18123, 18172, 20034, and 21092. Among those five neighborhood areas, the mean area (1.24 sq miles) was over two times larger than that of perceived neighborhood boundaries (0.59 sq miles), and the congruity index with perceived neighborhood boundaries was 49.99, and particularly high for neighborhood 18123 (I_c=93.33). Therefore, neighborhood plan areas are too large to accurately reflect perceived neighborhood boundaries.

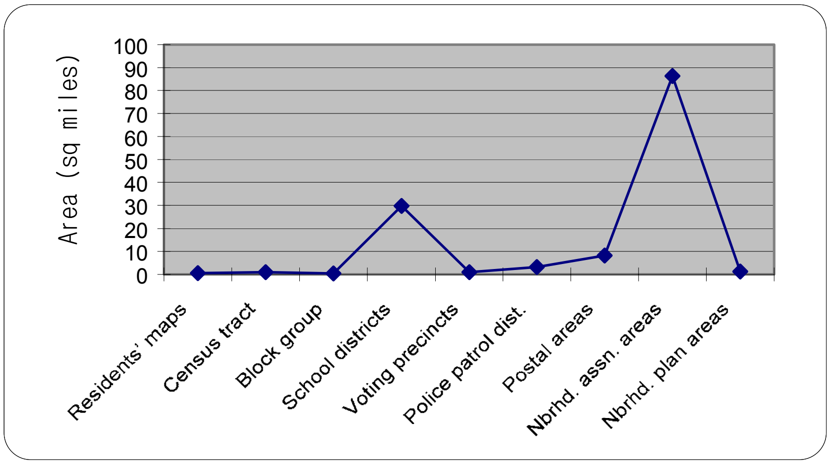


Figure 5.1: Comparison of Areas among Neighborhood Units

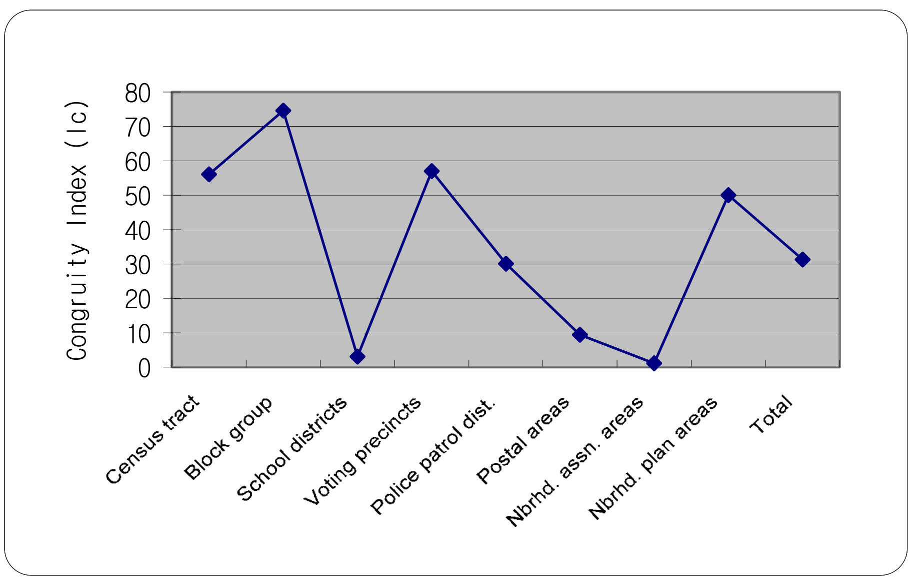


Figure 5.2: Comparison of Congruity Index (I_c) among Neighborhood Units

Figure 5.1 above displays the visual comparisons of area among nine neighborhood units. The neighborhood association areas are the largest, while the block groups are the smallest in square miles. In terms of area, the neighborhood units that are the most similar to resident-perceived neighborhood boundaries are census tracts, block groups, voting precincts, and neighborhood plan areas.

Figure 5.2 above illustrates the comparison of congruity index (I_c) among Neighborhood Units. The most congruent neighborhood units with resident-perceived neighborhood boundaries were block groups, while the least coincident boundaries were the neighborhood association areas. Census tracts, voting districts, and neighborhood plan areas proved to be among neighborhood units that are relatively congruent with resident-perceived neighborhood boundaries. Meanwhile, Figure 5.3 shows the inverse relationship between area and congruity index (I_c) among neighborhood units.

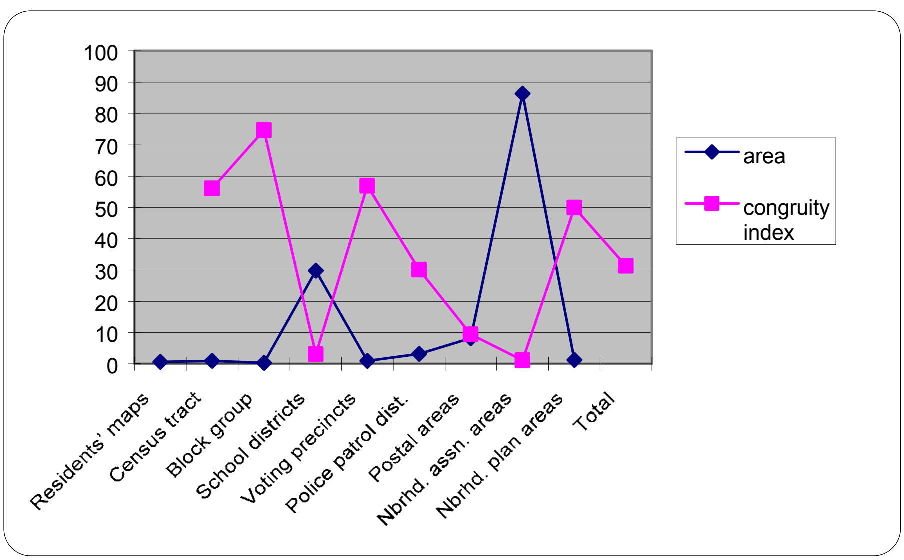


Figure 5.3: Comparison of Congruity Index (I_c) & Areas

Hence, the findings so far support the on-going arguments that administrative areas and perceived neighborhood boundaries do not coincide with each other. For example, it was argued that both official political units and standard planning units are too large to be congruent with subjective boundaries (Rapaport, 1977), and that very rarely do official political boundaries coincide with people's home areas or neighborhoods based on social or physical characteristics and boundaries (Royal commission on local government, 1969). Then, through those arguments and his own study, Pacione (1982) added to the argument by concluding that neighborhoods in the city are much smaller than most formal subdivisions.

Hypothesis 1 Testing - Unit of Analysis and Public Parks Accessibility

The current part of the chapter will be spent investigating whether or not the choice of unit of analysis (i.e. neighborhood units) for public services accessibility will affect the equity of the services distribution by changing measured values of each public service accessibility. Previously, it was stated that there were wide differences in terms of shape and size among neighborhood units. It is possible to anticipate that, according to what neighborhood unit is chosen as the unit of analysis for public parks accessibility measurement, the distribution of public parks across the neighborhoods of different socio-economic backgrounds may be interpreted in a very different. Therefore, the current chapter will look into the possible assumption that the choice of the unit of analysis will result in different conclusions of distributional equity of the public parks measured in terms of the accessibility among neighborhoods of different socio-economic subgroups of Austin residents.

For that purpose, the current chapter comprises four major parts; first, introduction to the locational standards for urban parks recommended by NRPA (National Recreational and Park Association); second, parks inventory that the current study included for analysis; third, overview of the accessibility measure the current study utilized for distributional equity of Austin public parks; and, lastly, the analysis of not only neighborhoods' accessibility to public parks, but the effect of the choice of the unit of analysis on neighborhoods' accessibility to parks.

NRPA's Distribution Standards for Urban Parks. The most common standards for park distribution guidelines, useful for park planners and concerning decision makers, are the publicly published standards of the National Recreation and Park Association (NRPA). In an attempt to make a set of standards for urban parks distribution more meaningful at the neighborhood level, the NRPA has classified urban parks, recreation areas, and open spaces into various types, and recommended certain locations, sizes, and service criteria for every classification.

The NRPA describes the purpose of establishing park and recreation standards as (NRPA, 1990, 11): "(*1) A national expression of minimum acceptable facilities for the citizens of urban and rural communities;(2) A guideline to determine land requirements for various kinds of park and recreation areas and facilities; (3) A basis for relating recreation needs to spatial analysis within a community wide system of parks and open space areas. ;(4) One of the major structuring elements that can be used to guide and* *assist regional development ; and (5) A means to justify the need for parks and open space within the overall land use pattern of a region or communit.y*" The NRPA added that "*These standards should be viewed as a guide, in that they address minimum, not maximum, goals to be achieved. The standards are to be coupled with conventional wisdom and judgement relating to special local needs and particular situation to which they are applied* (NRPA, 1990, 11)". Since 1971 when the guidelines for urban parks distribution by the NRPA were first proposed, the details of standards have been modified several times during the last 32 years.

Above all, the very basic standard for the provision of public parks is that there should be a minimum of 10 acres of open space for every 1,000 residents in an area.

In its Park, Recreation, Open Space and Greenway Guidelines (NRPA, 1996), NRPA defines several park types, including mini parks, neighborhood parks, community parks, school parks, metropolitan parks, natural resource parks and so on. The basic standards of public parks distribution comprises park types, location, size, and service area, and acres per 1,000 population. Table 5.3 below displays the details of the NRPA's urban parks distribution standards.

Table 5.3: NRPA's Urban Park Classifications and Guidelines

Type	Description	Size/acres	Service Area	Population served
Mini Park	/ used to address limited, isolated or unique recreational needs / the smallest park type specified by NRPA / intended to serve children under 12 years old	2500 sq. ft. - 1 acre / 5 acres (maximum)	within a 1/4 mile walking radius of the residential area	0.25-0.5 acres per 100 population
Neighborhood Park	/ basic unit of a park system / serves the recreational and social focus of the neighborhood / combining informal active and passive recreation on the neighborhood level / area for active recreation such as field games, court games, playgrounds, picnicking, etc.	5 to 10 (maximum) acres	within a 1/4 mile to 1/2 mile walking radius	1-2 acres per 1000 population
Community Park	/ serve more than one neighborhood and have facilities for programmed activities / a natural area or developed area for a variety of outdoor recreation / larger than neighborhood parks and serve several neighborhoods	Usually 20 - 50 acres	within a 1/2 to 3 mile distance	5-8 acres per 1,000 population
Metropolitan Park	/ serves the entire city / a natural area or developed area for a variety of outdoor recreation / accommodating many different types of recreational activities simultaneously and drawing both citywide and regional users	minimum of 50 acres, usually from 100-499 acres	entire city	5-10 acres per 1000 population

*etc (natural resource area, greenway, special use facility, sports complex, private park/recreation facility)
*All walking radii refer to straight-line distances "as the crow flies", without regard to roadway configuration, property ownership or other barriers

Source: Standards restructured based on Mertes, James D. and James R. Hall. 1995. Park, Recreatioin and Open Space and Greenways Guidelines, a publication of the National Recreation and Park Association.

Austin's Parks Classification System. As seen in Table 5.3, the standards concentrate on general park description, size, and service area. It is important to note that NRPA advises that these standards be viewed only as planning guidelines, and that the actual acreage and service areas allocated for park use should be assessed flexibly for each municipality according to the local requirements/expectations and physical environments. In the paragraphs below, the park types, uses, and service areas, established by Austin PARD (Parks and Recreation Department), are presented (from Austin City Connection, 2001).

(1) Neighborhood Parks. The neighborhood park is the basic unit of the park system and should serve as the recreational focus of an individual neighborhood. Surrounding uses should be predominantly single family or multi-family residential areas. These parks serve neighborhoods generally within a 1 mile radius_of the park. Most sites have basic features such as a playscape, picnic area and playing field.

(2) District Parks. There are twelve Austin parks that belong to this park classification. The twelve district parks are smaller than metropolitan parks and they are more highly developed to serve the needs of neighborhoods within a two-mile radius. District parks are typically larger than a neighborhood park and serve several neighborhoods with both active and passive recreational facilities. They may include highly used recreational facilities such as programmed athletic sports fields, swimming pools and recreation centers, which are less appropriate in neighborhood parks. These parks range from 30 to 200 acres of land. They are usually on minor arterial roadways to encourage access to public transit, but may be accessed by foot, bicycle and vehicle. The land's natural features play a large role in nature preservation and interpretation within the park.

(3) Metropolitan Parks. Showing potential for a wide range of different users, Metropolitan parks offer the largest and most diversified recreational experiences. They serve active and passive recreational needs and provide for cultural activities as well. Metropolitan parks are generally resource-based and often include a major water amenity. A principal role of these parks is to preserve ecologically unique areas and to provide places to observe and learn about nature. Metropolitan parks serve the whole city-wide population, usually encompassing over 200 acres. Most metropolitan parks are located on major highways. Active areas should be relatively compact with large surrounding areas of natural or open space.

(4) Greenbelts. Greenbelts are areas of open space that offer scenic beauty and safe, uninterrupted pedestrian or bicycle movement along natural or man-made pathways. They are generally located along bayous and streams or in association with major thoroughfares or boulevards. Pedestrian and bicycle trails can accommodate both recreational and purposeful trips. From the viewpoint of functionality, greenbelts can provide breaks in urban development patterns, and conserve ecologically unique areas. These parks serve neighborhoods generally within a one mile radius of the park. Most sites have basic features, such as a playscape, picnic area and playing field.

(5) Special Parks. This type of park has a wide variety of special facilities and places which provide locally unique or significant natural, cultural, or historic places or facilities. They can be independent or part of larger parks across the city. The City of Austin includes the following special parks: Cultural Facilities; Downtown Squares and Plazas; Museum, Historic structure or Place ; Recreation Centers; Scenic Points; Sports Facilities; and Swimming Pools.

(6) Preserves. These parks refer to lands that have been set aside for preserving significant natural resources, remnant landscapes, open space and visual or aesthetic buffering. The preserves are sanctuaries reserved for native plants, native animals and unique natural features mainly is to provide educational and scientific opportunities for city residents. This category includes land that offers natural resource potential, protected lands around waterways and wetlands, or individual sites exhibiting natural resources. Currently, the City of Austin maintains two types of preserves: the Central and Eastern Preserves operated by the Parks and Recreation Department of Austin; and the Balcones Canyonlands Preserves managed by the Water and Wastewater Utility.

Austin Parks Inventory. As of 2002, according to Austin City Connection 2001, the Austin Parks and Recreation Department oversees more than 23,800 acres of land containing 191 parks, 8,847 acres of preserves, and 3,394 acres of creeks and canyons under its jurisdiction. These consist of 84 neighborhood parks; 12 district parks (i.e., Balcones, Bartholomew, Northwest, Bull Creek, Dick Nichols, Dove Springs, Garrison, Givens, Mable Davis, Northeast, and Pease); 19 metropolitan parks (i.e., Circle C, Commons Ford, Emma Long, Walter E. Long, Mary Moore Searight, Roy G. Guerrero, 10 Town Lakes, Walnut Creek, and Zilker), 34 greenbelts, 29 special parks, and 14 preserves, as defined by Austin PARD.

The total public area covered by these various facilities and parks is approximately 23,800 acres of land, containing 191 parks, 9,114 acres of preserves, and 3,394 acres of creeks and canyons. In addition, the Parks and Recreation Department maintains and operates more than 74 miles of hike-and-bike trails; 40 miles of lake patrol; 172 athletic fields; and 90 playscapes. Other facilities include 16 Recreation Centers ;3 senior activity centers; the Austin Area Garden Center; the Austin Nature and Science Center; the Dougherty Arts Center; 4 museums, 6 amphitheaters (Austin City Connection, 2001). Table 5.4 shows a breakdown of this figure by the different kinds of park and open space. The entire list of Austin Parks Inventory is attached in Appendix 2.

Table 5.4: Public Parks Inventory of Austin PARD

Type of Parks	No. of Facilities	Acreage
Neighborhood Park	84	1,037.45
District Park	12	706.36
Metropolitan Park	19	12,548.71
Greenbelts	34	6875.99
Special Park	29	345.06
Preserves	14	9,114
Total	191	27,748.00

Note: Figures based on Austin Parks Directory, Austin City Connection, 2001

Parks Included in Study. Without exception, all of the parks listed in the Austin Parks inventory were attached to the survey booklet so that each resident could choose the park names when they answered the survey questions. As the table in the appendix indicates, park names were usually written in by most survey respondents as their representative names, not official designations. For example, instead of answering "onion creek metropolitan park", many of survey respondents wrote the answer as "onion creek park," which actually may indicate onion creek metropolitan park, onion creek greenbelt, onion creek preserve, or onion creek sports complex. This simple phenomenon signifies that most park users do not distinguish among detailed park types; they only perceive a body of park system with a single unique name. Of course, in most cases, the different types of park facilities are located by one another, and sometimes sited together in a metropolitan park.

It will not lead to a big aggregation error to represent park locations as a point of location for GIS to measure the accessibility to the park system. However, it should be acknowledged that not all of the park types were referred to in the current survey responses, but the 84 neighborhood parks, 12 district parks, and 19 metropolitan parks were chosen for inclusion in the current study because they are the three most common kinds of park in the city of Austin. Also, private sector alternatives were excluded from the analysis, since their finance, formulation and provision typically take place under very different circumstances from the public park systems, and they are beyond the scope of the current study. Figure 5.4 displays the locations of the Austin public parks included in the study.

Accessibility Model Used in Study. As mentioned in the literature review, different accessibility measures may produce different spatial patterns of accessibility and, depending on the concept of access, the distributional equity of public services may vary (Talen & Anselin ,1998; Talen 1998). The choice among them depends on the relevant policy questions (Lindsey, et. al, 2001, 334). Accordingly, the current study considered the characteristics of public service (i.e., Austin public parks) under study, and the features of the five most widely used accessibility models: four models of Gravity Model; Minimum Distance Model, Travel Cost Minimization Model, Container Approach (after Talen & Anselin,1998), and Covering Objectives Model (after Nicholls, 1999; Sui, 1999; Lindsey, et al., 2001). According to the following considerations, the Gravity Model was employed for the current study to measure accessibilities of public parks:

First, of those five accessibility models, approaches that incorporate distance or its units in measurements of accessibility include the former four models. Only the covering objectives model does not accept the distance friction between neighborhood and public service location. Neighborhoods, within the covering distance of a service are assumed to have the same accessibilities concerning public service (see Accessibility Models in Chapter III). The model assumes that the facility is equally used by any of the residents within the covering range, and that, beyond the particular range, the use is abruptly diminished and accessibility is almost zero (Talen, 1998, 27). Considering the fact that one of the purposes of the current study includes how Resident-Perceived Neighborhood Boundaries affect accessibility measurements traditionally assessed by

Census-based Neighborhood Units, it was obvious that the covering objectives model would cause bigger errors in assessments of accessibilities than any other accessibility models because the various accessibility measures within the covering distance of a public service are too importance to be overlooked.

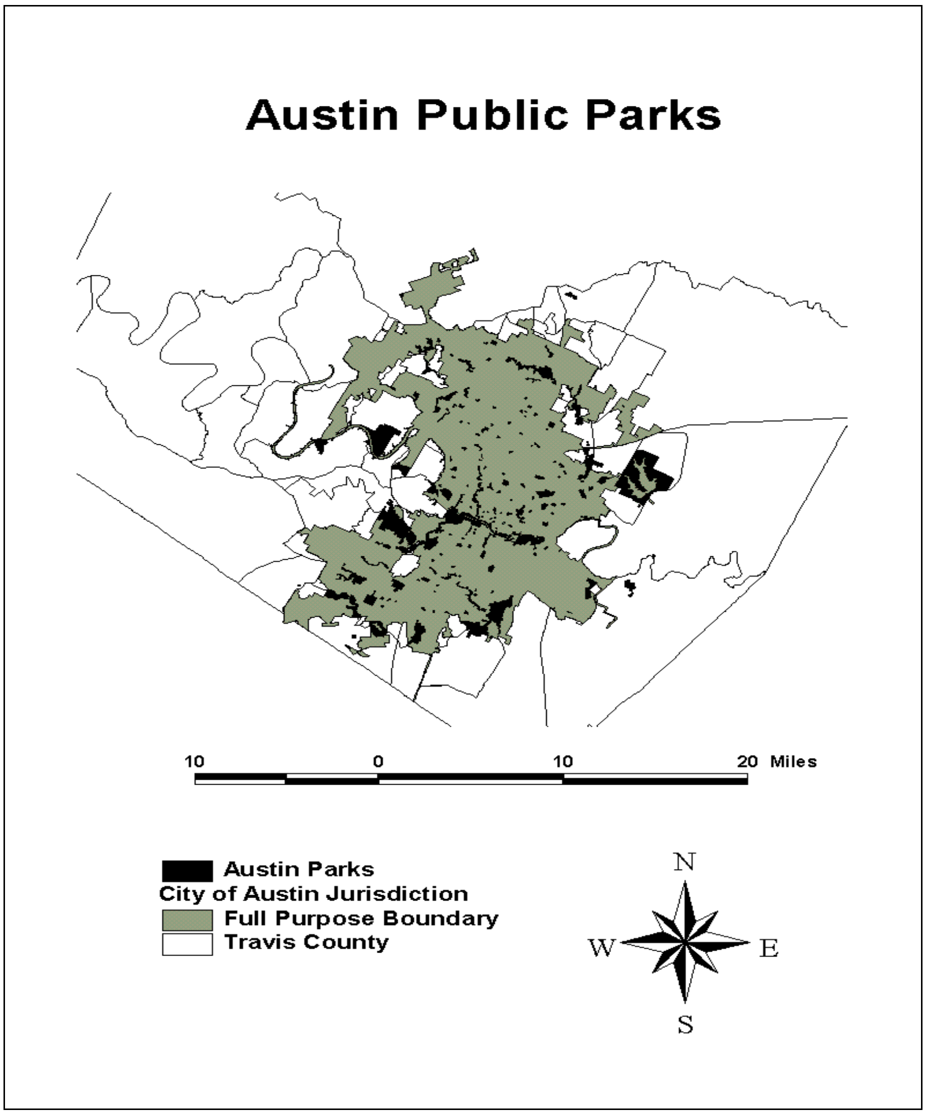


Figure 5.4: The Locations of Austin Public Parks

Second, as shown by Table 5.5, Austin public parks are composed of a hierarchy of six different park types, including Neighborhood parks, District parks, Metropolitan parks, Greenbelts, Special parks, and Preserves, and the mean scale of each park type ranges from 9.79 to 660.46 acres, as Table 5.5 indicates below.

Table 5.5: Hierarchy of Austin Public Parks by Mean Scale

Park Type	Count	Acreage	Mean
Metropolitan parks	19	12548.71	660.46
Greenbelts	34	6875.99	202.35
Preserves	14	9114.00	87.19
District Parks	12	706.36	58.86
Special parks	29	345.06	17.63
Neighborhood parks	84	1037.45	9.79

Among the four distance-based accessibility models, i. e., gravity model; minimum distance model, travel cost minimization model, and container approach, only the gravity model considers the hierarchy of public parks by scale. The gravity model is based on an analogy between the interaction of groups of people and the attraction of a facility (e.g., physical scale) similar to the interaction between objects in Newtonian physics (Stan, et. al, 1995, 69; Talen, 1998, 27). As Ottensman (1994, 111) argued, the assessment of the distribution of such physically fixed services as libraries and public parks must consider the dimensions of facility service level (e.g., physical scale) as well as facility distance from neighborhoods. In this context, the current study took into consideration the hierarchy of Austin public parks differentiated by scale dimension, and only the gravity model fits into this research framework.

Third, in the measurement of the people's accessibilities to a given facility or service, the gravity model is the most useful because the model derives a weighted number or value that considers all the potential residents of near or distant neighborhoods. As another useful element of the gravity mode, it incorporates interaction to be measured in a cumulative fashion, irrespective of the unit of analysis or boundaries. In reality, neighborhood residents routinely travel across arbitrary geopolitical units such as counties, census tracts, or zip code areas to access public parks.

Accessibility and Equity. To determine whether a particular geographic distribution of service is equal or equitable, it is necessary to examine the definition of equity and the measurement of equity in service distribution (Howard, 1988). In simple terms, inequity can be defined as systematic discrimination against particular groups of people in the distribution of public services or facilites. But equity is an extremely difficult concept to define (Smith, 1977). In the most common usage, equity is almost equal to arithmetic equality where everyone (or neighborhood or area) receives the same share of public resources (Ikporukpo, 1987). Table 5.6 lists four concepts of equity and definitions of each.

In the current study, a need-based equity was employed in analyzing the location of public parks according to a need-based distributional standard, arguing that some citizens have less accessibility to public services or facilities if they are either very young, elderly, or minority status, or earning a low income. As Nicholls (1999, 27) argued, “These are the factors that are likely to reduce their ability to make use of alternative, private recreational facilities located elsewhere, due to lower levels of wealth, mobility, etc." And, as Talen (1998, 23) pointed out, it is relatively easy to characterize the need on the basis of socio-economic variables of the population which can be simply achieved from census data. Meanwhile, the analysis of equity based on demand or market equity models requires data that may not be readily available or easily interpreted (Talen, 1998), and is beyond the scope of the current study and the budget limitations.

Table 5.6: Concepts of Equity

Concept	Definition
Equity as Equality	
equal share	*Each person receives an equal share
equal opportunity	*Person of equal ability have equal chances
compensatory equity	*Shares are distributed to balance existing inequities.
Need-based Equity	*Service is distributed proportional to need
Market Equity	*Benefits are related to the level of payments.
Demand-based Equity	*Benefits are distributed in proportion to level of citizen demand

Note: Based on Operational Definitions of Equity, made by Howard, Rebecca O. 1988. Equity in the distribution of parks services in Austin, Texas. Special project report. Lyndon B. Johnson school of public affairs. The University of Texas at Austin. p6.

Based on Nicholls (1999)'s nine socio-economic census variables which she selected for measuring the equitable distribution of public parks in the city of Bryan/College Station, seven variables were selected: (1) Population density; (2) percent White; (3) percent Hispanic; (4) percent Black; (5) median household income; (6) percent under the age of 18; and (7) percent over the age of 64. Percent of White was chosen to give a clearer view of the levels of accessibility to White neighborhoods as compared to the rest of the areas with different races. Percent Hispanic and percent Black were also included to provide the conditions of the levels of accessibility to neighborhoods of those races which are the second and the third largest racial groups in Austin. Percents of populations under the age of 18 and over the age of 64 were chosen for measuring the equity of accessibility in terms of distributional discriminations against particular age groups, while the median household income variable measured the possibility of inequity among different income groups.

Accessibility Indices by Neighborhood Units. Before considering the equality of park services distribution, the accessibility indices were measured by the gravity model. Table 5.7 shows the descriptive statistics of accessibilities by neighborhood units, indicating whether there is any significant difference in accessibility measurements between Resident-Perceived Neighborhood Boundaries and the rest of eight, census-based, neighborhood units. First of all, Table 5.7 doesn't show whether the means of accessibilities by neighborhood units are significantly different, but, in terms of arithmetic difference, the means of accessibilities measured based on Census Tracts (0.0063) and Block Groups (0.0084) are closer than those measured by Voting Precincts (0.0212), Police Patrol Districts (0.0735), Postal Areas (0.0186), and Neighborhood Plan Areas (0.0231), while accessibilities by School Districts (0.2074), Neighborhood Association Areas (0.1172) showed the least similar accessibility measures to those by Resident-Perceived Neighborhood Boundaries .

Besides the mean differences of accessibilities by neighborhood units, as Table

5.7 already showed, there was a need for investigating whether the accessibility indices are statistically significantly different between Resident-Perceived Neighborhood Boundaries and the rest of the census-based neighborhood boundaries. Table 5.8 below shows the result of paired-samples t-test of accessibilities by neighborhood units. The paired samples t-test compares the means of two variables, and compares the difference between the two variables for each case, and tests to prove if the average difference is significantly different and if the difference is significantly bigger than zero. The paired t-test is generally used when measurements are taken from the same subject before and after some manipulation as a treatment. The current analysis considered the accessibility measurements based on different neighborhood units as a treatment. In this sense, the paired samples t-test was employed for accessibility comparisons among neighborhood units.

Table 5.7: Descriptives of Accessibilities by Neighborhood Units

	Zones	Accessibility	Mean	S.D.	Mean Difference with RPNB
Resident-Perceived Neighborhood Boundaries (RPNB)	RPNB-16035	3.309	2.7379	0.3806	0
	RPNB-17473	2.721			
	RPNB-18063	2.569			
	RPNB-18123	2.678			
	RPNB-18172	2.424			
	RPNB-18281	2.055			
	RPNB-20034	2.997			
	RPNB-21092	3.148			
	RPNB-24242	2.740			
Census Tracts	CTR-16035	3.236	2.7316	0.3667	0.0063
	CTR-17473	2.672			
	CTR-18063	2.555			
	CTR-18123	2.669			
	CTR-18172	2.446			
	CTR-18281	2.049			
	CTR-20034	3.086			
	CTR-21092	3.050			
	CTR-24242	2.821			
Block Groups	BG-16035	3.217	2.7463	0.3757	(0.0084)
	BG-17473	2.686			
	BG-18063	2.570			
	BG-18123	2.672			
	BG-18172	2.386			
	BG-18281	2.095			
	BG-20034	3.108			
	BG-21092	3.168			
	BG-24242	2.815			
Voting Precincts	VP-16035	2.955	2.7167	0.3395	0.0212
	VP-17473	2.733			
	VP-18063	2.603			
	VP-18123	2.668			
	VP-18172	2.446			
	VP-18281	2.033			
	VP-20034	2.991			
	VP-21092	3.185			
	VP-24242	2.836			
Police Patrol Districts	PPD-16035	2.880	2.6644	0.2993	0.0735
	PPD-17473	2.461			
	PPD-18063	2.610			
	PPD-18123	2.682			
	PPD-18172	2.489			
	PPD-18281	2.063			
	PPD-20034	3.036			
	PPD-21092	2.845			
	PPD-24242	2.914			
Postal Areas	PA-16035	3.480	2.7193	0.4457	0.0186
	PA-17473	2.450			
	PA-18063	2.476			
	PA-18123	2.696			
	PA-18172	2.616			
	PA-18281	1.885			
	PA-20034	2.938			
	PA-21092	2.995			
	PA-24242	2.938			

Table 5.7 Continued

	Zones	Accessibility	Mean	S.D.	Mean Difference with RPNB
School Districts	SD-16035	4.126	2.9453	0.5347	(0.2074)
	SD-17473	2.860			
	SD-18063	2.395			
	SD-18123	2.781			
	SD-18172	2.702			
	SD-18281	2.395			
	SD-20034	3.234			
	SD-21092	2.781			
	SD-24242	3.234			
Neighborhood Association Areas	NAA-16035	3.307	2.8551	0.3496	(0.1172)
	NAA-17473	2.889			
	NAA-18063	2.700			
	NAA-18123	2.622			
	NAA-18172	2.622			
	NAA-18281	2.333			
	NAA-20034	2.703			
	NAA-21092	3.170			
	NAA-24242	3.350			
Neighborhood Plan Areas	NPA-16035	n/a	2.7167	0.3395	0.0212
	NPA-17473	n/a			
	NPA-18063	2.571			
	NPA-18123	2.461			
	NPA-18172	2.461			
	NPA-18281	n/a			
	NPA-20034	2.973			
	NPA-21092	3.108			
	NPA-24242	n/a			

As Table 5.8 indicates below, at the $p < 0.05$ level, this paired samples t-test analysis indicates that a significant correlation exists between each two variables (accessibilities by RPND and by each census-based neighborhood unit). In detail, Pearson's correlations between accessibilities by Resident-Perceived Neighborhood Boundary and by each census-based neighborhood boundary mostly exceeded 0.80 which is normally considered to be a very high correlation. But, relatively, correlations with School Districts and Neighborhood Association Areas were somewhat low, ranging between 0.761 to 0.769. Although this paired samples t-test shows strong correlations of accessibility mean values, the t-values, whether plus or minus, only indicate whether accessibility by RPNB is bigger than that by a paired census-based neighborhood unit. As significance of all eight t-values are over 0.05, precluding the significance at the $p < 0.05$ level, it indicates that it is not significant whether the mean accessibility by RPNB is bigger or smaller than that by a census-based neighborhood unit, and they are different case by case. As a result, there was no significant difference found between accessibilities by Resident-Perceived Neighborhood Boundaries and those by census-based neighborhood units.

Table 5.8: Paired Samples T-test of Accessibilities between by RPND & by Census-based Neighborhood Units

		Mean	N	S.D.	Correlation	Sig.	t	df	Sig.
Pair 1	RPND	2.738	9	0.381	**0.986**	0.000	0.299	8	0.772
	CTT	2.732	9	0.367					
Pair 2	RPND	2.738	9	0.381	**0.987**	0.000	-0.41	8	0.692
	BG	2.746	9	0.376					
Pair 3	RPND	2.738	9	0.381	**0.942**	0.000	0.491	8	0.636
	VP	2.717	9	0.339					
Pair 4	RPND	2.738	9	0.381	**0.846**	0.004	1.08	8	0.311
	PPD	2.664	9	0.299					
Pair 5	RPND	2.738	9	0.381	**0.924**	0.000	0.321	8	0.756
	PA	2.719	9	0.446					
Pair 6	RPND	2.738	9	0.381	**0.761**	0.017	-1.789	8	0.111
	SD	2.945	9	0.535					
Pair 7	RPND	2.738	9	0.381	**0.769**	0.016	-1.406	8	0.197
	NAA	2.855	9	0.350					
Pair 8	RPND	2.763	5	0.301	**0.947**	0.015	1.097	4	0.334
	NPA	2.715	5	0.304					

Note: RPNB = Resident-Perceived Neighborhood Boundaries, CTR = Census Tracts, BG = Block Groups, VP = Voting Precincts, PPD = Police patrol Districts, PA = Postal Areas, SD = School Districts, NAA = Neighborhood Association Areas, NPA = Neighborhood Plan Areas. / * statistically significant at 0.05 level.

Accessibility Indices by Zones. An ANOVA test was performed to see if there was any significant difference in accessibilities measured by Zones from 16035 to 24242 (see

Table 5.9). This time there was no distinction or comparison between accessibilities by resident-perceived and census-based neighborhood units, but the test was only made to determine if the accessibilities to all Austin parks measured between each zone have significantly different values.

Table 5.9: ANOVA Test of Accessibilities by Zones

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
16035	8	3.3138	.3817	.1349	2.9947	3.6328	2.88	4.13
17473	8	2.6840	.1610	5.692E-02	2.5494	2.8186	2.45	2.89
18063	9	2.5610	8.555E-02	2.852E-02	2.4952	2.6268	2.40	2.70
18123	9	2.6588	8.520E-02	2.840E-02	2.5933	2.7243	2.46	2.78
18172	9	2.5102	.1087	3.622E-02	2.4267	2.5937	2.39	2.70
18281	8	2.1135	.1676	5.925E-02	1.9734	2.2536	1.89	2.40
20034	9	3.0073	.1447	4.823E-02	2.8961	3.1186	2.70	3.23
21092	9	3.0500	.1487	4.957E-02	2.9357	3.1643	2.78	3.19
24242	8	2.9560	.2184	7.720E-02	2.7734	3.1386	2.74	3.35
Total	77	2.7614	.3762	4.287E-02	2.6760	2.8467	1.89	4.13

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.468	8	1.058	31.472	.000
Within Groups	2.287	68	3.363E-02		
Total	10.755	76			

Contrary to the results of the Paired Samples T-test which proved that there was no significant difference between accessibilities measured by Resident-Perceived Neighborhood Boundaries and those measured by census-based neighborhood units, the ANOVA test of accessibilities by each zone indicated that there were marginal significant differences existing within comparisons of accessibilities measured from nine different zones (F=31.472, p=0.000)

Measuring Equity of Accessibility Based on Gravity Model. In most studies of public services equity, accessibility between neighborhoods and the locations of public service has been used as an indicator of equity (Talen & Anselin 1998; Lindsey, et al. 2001). In measuring the equity of public services among neighborhoods, it was necessary to determine what kind of socio-economic indicators to include. According to the literature, the most important census-based social indicators have been about either very young, elderly, or minority status, or those earning a low income, so they have included class or income (Cingranelli 1981; Gobster 1996; Ruddick 1996), race (Ruddick 1996; Talen 1998), and age (Nicholls 1999). According to the literature, the variables used in the study in the analysis of public parks equity were: (1) median household income; (2) percent White population; (3) percent Hispanic population; (4) percent Black population; (5) percent under the age of 18; (6) percent over the age of 64.

Census Indicators by Neighborhood Units. With respect to the socio-economic indicators based on census tract-based data which might be used in the study of the distributional equity of public services, Table 5.10 displays the indicators according to boundary zones and various neighborhood units available to be used in neighborhood studies. Also, the accessibility indices are added to the table, showing how the accessibility values may vary according to how the neighborhood units are defined in the distributional studies of public services.

Table 5.10: Social Indicators and Accessibility by Zones and Units

Unit – Zone	Count	MHI	White%	Black%	Hisp%	Nonwit%	Under 18%	Over 64%	18-64 %	Accessibility
RPNB-16035	3	72154	93.16	0.76	6.08	6.84	21.52	11.28	67.20	3.309
RPNB-17473	1	51113	63.83	5.54	30.63	36.17	27.88	7.30	64.82	2.721
RPNB-18063	2	30183	37.74	12.57	50.69	62.26	24.82	5.47	69.72	2.569
RPNB-18123	1	25174	19.44	14.75	65.82	80.56	26.85	4.93	68.22	2.678
RPNB-18172	1	41661	79.36	3.42	17.22	20.64	13.46	13.09	73.45	2.424
RPNB-18281	1	70551	81.81	5.67	12.51	18.19	24.17	4.06	71.77	2.055
RPNB-20034	5	37478	44.75	6.25	49.01	55.25	25.85	6.13	68.02	2.997
RPNB-21092	2	30852	9.95	52.67	37.38	90.05	30.57	11.52	57.91	3.148
RPNB-24242	2	50380	55.09	6.66	38.25	44.91	26.71	5.78	67.51	2.740
CTR-16035	1	84338	94.65	0.43	4.93	5.35	22.25	11.42	66.33	3.236
CTR-17473	1	51113	63.83	5.54	30.63	36.17	27.88	7.30	64.82	2.672
CTR-18063	1	29047	33.29	15.72	50.99	66.71	26.24	2.97	70.79	2.555
CTR-18123	1	25174	19.44	14.75	65.82	80.56	26.85	4.93	68.22	2.669
CTR-18172	1	41661	79.36	3.42	17.22	20.64	13.46	13.09	73.45	2.446
CTR-18281	1	70551	81.81	5.67	12.51	18.19	24.17	4.06	71.77	2.049
CTR-20034	1	31538	35.32	4.31	60.37	64.68	25.57	5.93	68.50	3.086
CTR-21092	1	30234	5.79	67.05	27.16	94.21	27.40	16.74	55.85	3.050
CTR-24242	1	41711	53.45	6.37	40.18	46.55	24.41	9.60	66.00	2.821
BG-16035	1	84338	94.65	0.43	4.93	5.35	22.25	11.42	66.33	3.217
BG-17473	1	51113	63.83	5.54	30.63	36.17	27.88	7.30	64.82	2.686
BG-18063	1	29047	33.29	15.72	50.99	66.71	26.24	2.97	70.79	2.570
BG-18123	1	25174	19.44	14.75	65.82	80.56	26.85	4.93	68.22	2.672
BG-18172	1	41661	79.36	3.42	17.22	20.64	13.46	13.09	73.45	2.386
BG-18281	1	70551	81.81	5.67	12.51	18.19	24.17	4.06	71.77	2.095
BG-20034	1	31538	35.32	4.31	60.37	64.68	25.57	5.93	68.50	3.108
BG-21092	1	30234	5.79	67.05	27.16	94.21	27.40	16.74	55.85	3.168
BG-24242	1	41711	53.45	6.37	40.18	46.55	24.41	9.60	66.00	2.815
VP-16035	3	95679	95.45	0.49	4.06	4.55	22.40	15.28	62.31	2.955
VP-17473	4	54664	66.07	5.40	28.53	33.93	26.19	5.25	68.56	2.733
VP-18063	3	29562	36.68	12.71	50.61	63.32	26.15	5.48	68.37	2.603
VP-18123	1	25174	19.44	14.75	65.82	80.56	26.85	4.93	68.22	2.668
VP-18172	1	41661	79.36	3.42	17.22	20.64	13.46	13.09	73.45	2.446
VP-18281	1	70551	81.81	5.67	12.51	18.19	24.17	4.06	71.77	2.033
VP-20034	7	36485	48.02	5.79	46.19	51.98	24.63	8.10	67.27	2.991
VP-21092	3	29389	8.77	42.96	48.28	91.23	31.86	9.94	58.21	3.185
VP-24242	4	36512	66.84	3.27	29.89	33.16	20.19	19.12	60.69	2.836
PPD-16035	6	58649	92.98	0.98	6.04	7.02	14.38	12.77	72.86	2.880
PPD-17473	3	89423	83.15	2.74	14.11	16.85	31.82	3.91	64.27	2.461
PPD-18063	2	30183	37.74	12.57	49.69	62.26	24.82	5.47	69.72	2.610
PPD-18123	1	25174	19.44	14.75	65.82	80.56	26.85	4.93	68.22	2.682
PPD-18172	2	40711	60.35	4.62	35.04	39.65	19.10	10.47	70.43	2.489
PPD-18281	8	57329	80.63	5.89	13.48	19.37	17.15	3.96	78.89	2.063
PPD-20034	4	37220	40.90	6.96	52.13	59.10	26.49	5.32	68.18	3.036
PPD-21092	3	28014	5.36	42.58	52.05	94.64	31.42	11.56	57.01	2.845
PPD-24242	3	52954	55.88	6.57	37.55	44.12	27.12	5.08	67.81	2.914
PA-16035	6	51367	90.86	1.51	7.63	9.14	17.74	9.40	72.85	3.480
PA-17473	8	61183	68.17	4.90	26.92	31.83	29.08	4.63	66.29	2.450
PA-18063	10	46372	48.21	18.36	33.43	51.79	27.30	5.56	67.13	2.476
PA-18123	4	30621	33.81	12.46	53.73	66.19	23.79	6.82	69.39	2.696
PA-18172	5	45299	75.19	2.65	22.16	24.81	17.76	13.98	68.26	2.616
PA-18281	7	61948	79.74	6.13	14.13	20.26	21.84	3.91	74.24	1.885
PA-20034	13	43821	54.43	5.79	39.79	45.57	24.14	7.31	68.55	2.938
PA-21092	3	28014	5.36	42.58	52.05	94.64	31.42	11.56	57.01	2.995
PA-24242	13	43821	54.43	5.79	39.79	45.57	24.14	7.31	68.55	2.938

Table 5.10 Continued

Unit – Zone	Count	MHI	White%	Black%	Hisp%	Nonwit%	Under 18%	Over 64%	18-64 %	Accessibility
SD-16035	34	40296	67.25	10.58	22.17	32.75	16.28	8.33	75.39	4.126
SD-17473	31	61394	70.50	4.36	25.13	29.50	26.10	6.22	67.68	2.860
SD-18063	32	43527	54.34	11.94	33.72	45.66	22.45	5.95	71.60	2.395
SD-18123	29	32427	27.91	27.94	44.15	72.09	26.57	8.01	65.43	2.781
SD-18172	36	69275	85.27	2.51	12.22	14.73	18.08	9.88	72.04	2.702
SD-18281	32	43527	54.34	11.94	33.72	45.66	22.45	5.95	71.60	2.395
SD-20034	31	41908	59.03	5.68	35.29	40.97	21.82	6.66	71.52	3.234
SD-21092	29	32427	27.91	27.94	44.15	72.09	26.57	8.01	65.43	2.781
SD-24242	31	41908	59.03	5.68	35.29	40.97	21.82	6.66	71.52	3.234
NAA-16035	12	56044	91.37	1.30	7.33	8.63	14.27	8.39	77.34	3.307
NAA-17473	29	70037	79.19	2.94	17.87	20.81	26.18	6.52	67.30	2.889
NAA-18063	38	46838	55.99	12.80	31.21	44.01	24.05	5.56	70.39	2.700
NAA-18123	25	30439	23.83	25.76	50.42	76.17	25.96	8.72	65.32	2.622
NAA-18172	37	66968	84.61	3.37	12.01	15.39	18.97	9.02	72.01	2.622
NAA-18281	12	56390	78.70	6.57	14.73	21.30	18.72	4.74	76.54	2.333
NAA-20034	41	35976	41.55	8.15	50.30	58.45	24.11	5.58	70.30	2.703
NAA-21092	25	30439	23.83	25.76	50.42	76.17	25.96	8.72	65.32	3.170
NAA-24242	41	35976	41.55	8.15	50.30	58.45	24.11	5.58	70.30	3.350
NPA-16035	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NPA-17473	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NPA-18063	2	30183	37.74	12.57	49.69	62.26	24.82	5.47	69.72	2.571
NPA-18123	3	29884	36.52	10.49	52.99	63.48	23.48	6.86	69.66	2.461
NPA-18172	3	41561	84.31	2.41	13.28	15.69	11.93	11.35	76.72	2.461
NPA-18281	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NPA-20034	7	39095	50.84	5.63	43.53	49.16	24.70	8.69	66.61	2.973
NPA-21092	6	30813	11.38	42.91	45.71	88.62	31.11	8.15	60.75	3.108
NPA-24242	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Note: RPNB = Resident-Perceived Neighborhood Boundaries, CTR = Census Tracts, BG = Block Groups, VP = Voting Precincts, PPD = Police patrol Districts, PA = Postal Areas, SD = School Districts, NAA = Neighborhood Association Areas, NPA = Neighborhood Plan Areas.

At first glance, the table above obviously shows that the indicator values differ relatively from one zone to another in accordance with the definition of neighborhood units. The accessibility values are not so exceptional to the finding that the indices are showing differences among zones, varying from 1.885 to 4.126 when they are measured based on gravity model. Furthermore, it seems that the degree of agreement in values of census indicators between zones varies by neighborhood units, making it almost impossible to generalize the differences.

Correlations of Census Indicators (RPNB vs. Census Units). Aside from the degree of differences among all neighborhood units, the hypothesis of the current study is related to the relation between equities by Resident-Perceived Neighborhood Boundary and Census-Based Neighborhood Units. The investigation attempted to determine if there is any significant differences between social indicators of Resident-Perceived Neighborhood Boundaries and Census-Based Neighborhood Units. In order to make that analysis, several Paired Samples T-tests were performed and the results are displayed in Table 5.11.

Table 5.11: Paired Samples T–test of Census Indicators

< Median Household Income >

MHI		N	Correlation	Sig.	T	df	Sig. (2-tailed)
Pair 1	RPND & CTR	9	**0.969**	0.000	0.245	8	0.813
Pair 2	RPND & BG	9	**0.969**	0.000	0.245	8	0.813
Pair 3	RPND & VP	9	**0.930**	0.000	-0.349	8	0.736
Pair 4	RPND & PPD	9	**0.688**	0.041	-0.223	8	0.829
Pair 5	RPND & PA	9	**0.759**	0.018	-0.086	8	0.933
Pair 6	RPND & SD	9	**0.683**	0.638	0.05	8	0.962
Pair 7	RPND & NAA	9	**0.546**	0.129	-0.42	8	0.686
Pair 8	RPND & NAP	5	**0.953**	0.012	-1.336	4	0.252

< White Population % >

		N	Correlation	Sig.	T	df	Sig. (2-tailed)
Pair 1	RPND & CTR	9	**0.995**	0.0000	1.767	8	0.115
Pair 2	RPND & BG	9	**0.995**	0.0000	1.767	8	0.115
Pair 3	RPND & VP	9	**0.991**	0.0000	-1.441	8	0.188
Pair 4	RPND & PPD	9	**0.945**	0.0000	0.297	8	0.774
Pair 5	RPND & PA	9	**0.970**	0.0000	-1.171	8	0.275
Pair 6	RPND & SD	9	**0.817**	0.0070	-0.398	8	0.701
Pair 7	RPND & NAA	9	**0.931**	0.0000	-1.131	8	0.291
Pair 8	RPND & NAP	5	**0.968**	0.0070	-1.966	4	0.121

Table 5.11 Continued

< Hispanic Population % >

		N	Correlation	Sig.	T	df	Sig. (2-tailed)
Pair 2	RPND & CTR	9	**0.969**	0.000	-0.136	8	0.895
Pair 3	RPND & BG	9	**0.969**	0.000	-0.136	8	0.895
Pair 4	RPND & VP	9	**0.969**	0.000	0.297	8	0.774
Pair 5	RPND & PPD	9	**0.883**	0.002	-0.618	8	0.554
Pair 6	RPND & PA	9	**0.871**	0.002	0.617	8	0.555
Pair 7	RPND & SD	9	**0.685**	0.042	0.496	8	0.633
Pair 8	RPND & NAA	9	**0.820**	0.007	0.663	8	0.526
Pair 1	RPND & NAP	5	**0.906**	0.034	0.869	4	0.434

< Black Population % >

		N	Correlation	Sig.	T	df	Sig. (2-tailed)
Pair 2	RPND & CTR	9	**0.998**	0.000	-1.009	8	0.343
Pair 3	RPND & BG	9	**0.998**	0.000	-1.009	8	0.343
Pair 4	RPND & VP	9	**0.994**	0.000	1.416	8	0.195
Pair 5	RPND & PPD	9	**0.994**	0.000	1.007	8	0.344
Pair 6	RPND & PA	9	**0.980**	0.000	0.656	8	0.53
Pair 7	RPND & SD	9	**0.747**	0.021	-0.009	8	0.993
Pair 8	RPND & NAA	9	**0.789**	0.011	0.439	8	0.672
Pair 1	RPND & NAP	5	**0.996**	0.000	1.725	4	0.16

< % Population Under 18 >

		N	Correlation	Sig.	T	df	Sig. (2-tailed)
Pair 2	RPND & BG	9	**0.957**	0.0000	0.835	8	0.428
Pair 3	RPND & VP	9	**0.957**	0.0000	0.835	8	0.428
Pair 4	RPND & PPD	9	**0.883**	0.0020	0.814	8	0.439
Pair 5	RPND & PA	9	**0.719**	0.0290	0.208	8	0.841
Pair 6	RPND & SD	9	**0.829**	0.0060	0.549	8	0.598
Pair 7	RPND & NAA	9	**0.785**	0.0120	2.162	8	0.063
Pair 8	RPND & NAP	9	**0.689**	0.0400	1.788	8	0.112
Pair 1	RPND & CTR	5	**0.968**	0.0070	1.966	4	0.121

Table 5.11 Continued

		N	Correlation	Sig.	T	df	Sig. (2-tailed)
			< % Population Over 64 >				
Pair 2	RPND & BG	9	**0.876**	0.0020	-0.926	8	0.381
Pair 3	RPND & VP	9	**0.876**	0.0020	-0.926	8	0.381
Pair 4	RPND & PPD	9	**0.585**	0.1860	-1.111	8	0.299
Pair 5	RPND & PA	9	**0.907**	0.0010	1.368	8	0.208
Pair 6	RPND & SD	9	**0.893**	0.0010	-0.201	8	0.846
Pair 7	RPND & NAA	9	**0.811**	0.0080	0.546	8	0.600
Pair 8	RPND & NAP	9	**0.753**	0.0190	0.962	8	0.364
Pair 1	RPND & CTR	5	**0.782**	0.1180	0.112	4	0.916

Note: RPNB = Resident-Perceived Neighborhood Boundaries, CTR = Census Tracts, BG = Block Groups, VP = Voting Precincts, PPD = Police patrol Districts, PA = Postal Areas, SD = School Districts, NAA = Neighborhood Association Areas, NPA = Neighborhood Plan Areas.

Unlike Table 5.11 which showed that indicator values seem to differ relatively from one zone to another in accordance with the definition of neighborhood units, the correlation and t-values through the Paired Samples T-test of census indicators proved that pair-wise correlations for Resident-Perceived Neighborhood Boundaries and Census-based Neighborhood Units, computed for census-based indicators were very high, most exceeding 0.800, with average from 0.585 to 0.998. Furthermore, the t-values and each significance indicates the indicator values are not significantly different from one another between those of Resident-Perceived Neighborhood Boundaries and those of Census-Based Neighborhood Units (at the p-value < 0.05 level).

Hence, the result of the current analysis adds to Coulton, et al.'s (2001) study result that pair-wise correlations for census indicators of census boundaries and resident-defined neighborhoods all exceeded 0.80; their census neighborhoods were restricted only to census tracts and block groups that were similar to resident-defined neighborhoods in terms of scale, with no further larger neighborhood units. It is important that the current study included several more census-based, administrative, neighborhood units such as postal areas, voting precincts, police districts, school districts, neighborhood association areas, and neighborhood plan areas. The analysis results show that the census indicators, whatever neighborhood units are used as the unit of analysis, were highly correlated showing no significant differences between those by Resident-Perceived Neighborhood Boundaries and Census-based Neighborhood Units.

Equity of Accessibility. In order to decide how equitably Austin public parks are distributed, it was necessary to have census-based social indicators by different neighborhood units and accessibilities measured between each neighborhood unit and total public parks in Austin. After calculating these, it would be possible to analyze whether the parks are equitably distributed across different neighborhoods of various combinations of socio-economic characteristics represented by census-based social indicators. The investigation in the current chapter asked if there was any significant difference between accessibility measurements by Resident-Perceived Neighborhood Boundaries and Census-based Neighborhood Units. The result showed that there was no statistically significant difference in accessibility indices by whatever neighborhood units they were measured. Meanwhile, an analysis was made to see if the social indicators significantly changed according to which neighborhood unit was used for the measurement. The result showed that, whether they were measured by Resident-Perceived Neighborhood Boundaries or Census-based Neighborhood Units, there were not significant differences in the values of census-based social indicators. As a result, a change of neighborhood unit, whether Resident-Perceived or Census-based, doesn't affect, accessibility measurements (see Table 5.9 & 5.10), or the social indicators (see Table 5.11). It is reasonable to conclude that the adoption of Resident-Perceived Neighborhood Boundary as the alternative unit of analysis to traditionally used Census-based Neighborhood Units doesn't affect the equity measurements for public Parks in the city of Austin.

CHAPTER VI

ANALYSIS RESULT THREE – ACCESSIBILITY & UTILIZATION

Public Parks Utilization Factors

The current sub-chapter presents the descriptive findings from the survey of Austin parks utilization regarding respondents' general patterns of public parks utilization. One of the objectives of the current study is to determine whether selected utilization factors affect the relationship between accessibility and parks utilization - in other words, if any of the selected utilization factors will affect the parks utilization patterns in terms of accessibility. For that purpose, the current chapter investigated interrelationships among the selected utilization factors to determine if any hidden correlations among utilization factors could weaken the strength of regression analysis following the current correlation analysis. The Chi square test (χ^2) was used to test the independent relationship between two nominal variables, and Pearson's correlation test was used for analyzing the relationship between two scale variables. For the test of relationship between two ordinal variables, Spearman's rank order correlation test was used. Finally, for testing the interrelationship between a nominal variable and a ordinal variable, independent samples t-test, and GLM (General Linear Model) were used.

Nominal variable – Nominal variable : Chi square (χ^2) test

Ordinal variable – Ordinal variable : Kendal's tau b test

Scale variable – Scale variable : Pearson's Correlation test

Nominal variable – Ordinal variable : Independent Samples T–test or GLM

Nominal variable – Scale variable : Independent Samples T-test or GLM

Ordinal variable – Scale variable : Kendal's tau b test

The utilization factors selected by the current study consist of social factors (i.e., residents' socio-demographic variables) and user factors in parks utilization.

Descriptives of User Factors

The following synopsis describes a general view of findings that are summarized in Tables 6.2 through 6.14. This section belongs to the descriptives of the actual residents' patterns of the public parks utilization. Though not directly related to the research framework of this study, the findings were expected to provide important implications to the planners and practitioners regarding the public parks allocation. Detailed descriptions and statistical data for the bivariate relationships follow this section and are supported by several illustrations in the subsequent tables in this chapter.

Frequency of Park Visit. In the survey, members of households were asked to respond to the question: "In general, how frequently per month do you visit public parks in Austin?". Out of 206 respondents, 15 people (7.3%) didn't respond to this question. Interestingly, the result of a frequency test shows that more than 60% of the total respondents go to parks less than once per month or more than four times a month, and the responses from the rest of the respondents were sparsely distributed among one to four times a month (see Table 6.1). Above all, the category of highest frequency (78) is "less than one time a month" with 37.9%, which means that about four out of ten people in the survey visit public parks even less than once a month.

Table 6.1: Frequency Analysis of No. of Visits to Public Parks

	No. monthly visit to parks	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 1 time / month	78	37.9	40.8	40.8
	1 time / month	11	5.3	5.8	46.6
	2 times / month	27	13.1	14.1	60.7
	3 times / month	9	4.4	4.7	65.4
	4 times / month	20	9.7	10.5	75.9
	more than 4 times / month	46	22.3	24.1	100.0
	Total	191	92.7	100.0	
Missing	System	15	7.3		
Total		206	100.0		

Companionship Pattern. The survey respondents were asked to answer to the question: “With whom do you usually go to visit public parks?”. Initially, Austin park visitors’ companionship pattern variable was divided into seven categories, but, through survey data gathering, it was found out that people very often go to the parks with their dogs (2.5%), even more frequently than with their neighbors (2.2%) (see Table 6.2). So, “with dogs” was added to the categorization of companionship pattern. Among categories, the most frequent companionship pattern by park visitors was “with family (34.4%)”, which was followed by “with friends (24.6%)”, “self (17.0%)”, “with child (12.7%)”, and “with relatives (4.0%)”.

Table 6.2: Companionship Patterns When Visiting Public Parks

Companionship	Code	Count	Pct of Responses	Pct of Cases
With family	3	95	34.4	51.4
With friends	1	68	24.6	36.8
Self (alone)	5	47	17.0	25.4
With child	4	35	12.7	18.9
Wth relatives	6	11	4.0	5.9
With dogs	7	7	2.5	3.8
With neighbors	2	6	2.2	3.2
Other	8	7	2.5	3.8
Total resonses		276	100.0	149.2

Note :21 missing cases; 185 valid cases

Transit Method. The question about the transportation method used by Austin residents to visit public parks was "How do you usually travel to public parks? (check one only)". Though "check one only" was indicated, several survey respondents answered with more than one transit method. According to the result of frequency analysis, almost 70% of public park visitors go to the parks only "by driving (67%)" (see Table 6.3). Among single responses, the second most popular transit method was "by walking (10.7%)", followed by "by jogging (0.5%)" and "riding bikes (1.9%)". The multiple responses included "by drive/walk (4.4%)", "by drive/walk/bike (1.9%)", and "by drive/bike (1.5%)".

Table 6.3: Transit Method When Visiting Public Parks

	Transit Method	Frequency	Percent	Valid Percent	% Cumulative
Valid	Drive	138	67.0	76.2	76.2
	Walk	22	10.7	12.2	88.4
	Jog	1	.5	.6	89.0
	Bicycle	4	1.9	2.2	91.2
	Drive/walk	9	4.4	5.0	96.1
	Drive/walk/bike	4	1.9	2.2	98.3
	Drive/bike	3	1.5	1.7	100.0
	Total	181	87.9	100.0	
Missing	System	25	12.1		
Total		206	100.0		

Travel Time. Members of households were asked to respond to the open-ended question: "How long does it usually take you to travel to public parks? ____ minutes.", and a total of 182 people out of 206 responded to this question. On average, it takes about 13 minutes (mean=13.31 minutes) for public park visitors to go to the parks (see Table 6.4). The variation in travel time to public parks is between 2 (minimum) to 60 minutes (maximum), and it indicates that, in reality, the maximum travel time to public parks is an hour. As figure 6.1 indicates, most cases of travel time are concentrated from 2 to 20 minutes (89.0%). Fewer cases take longer than 20 minutes and travel time longer than 30 minutes only takes about 6.5% of total responses.

Table 6.4: Descriptive Statistics of Travel Time to Parks

	N	Minimum	Maximum	Mean	Std. Deviation
Travel_time	182	2	60	13.31	8.26
Valid N (listwise)	182				

Figure 6.1 below shows the histogram of the distribution of travel times the survey respondents usually spend on visiting the parks within the City of Austin.

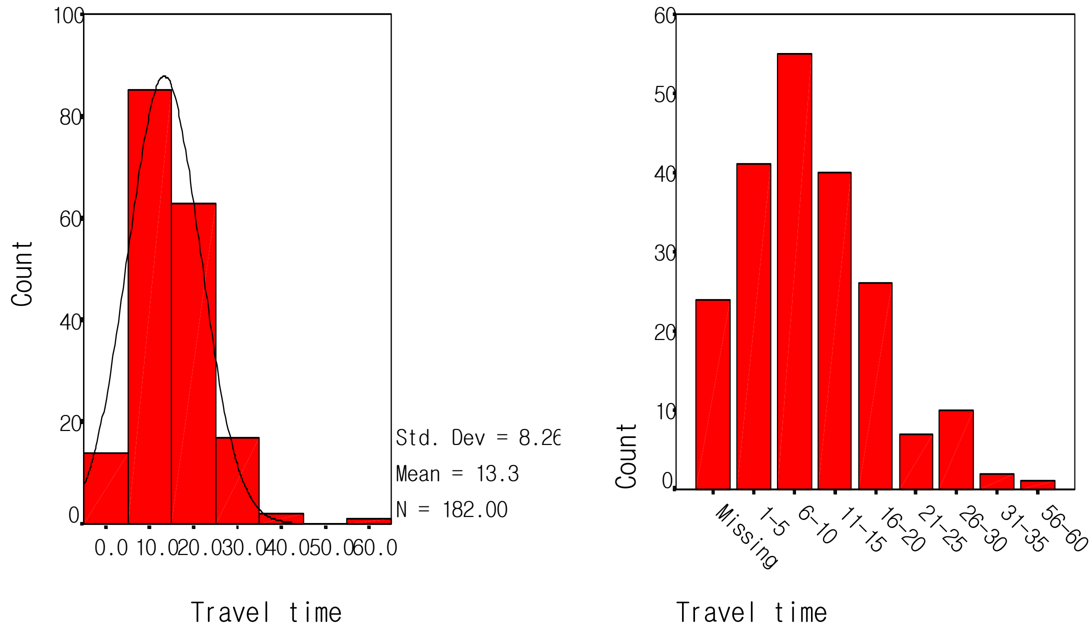


Figure 6.1: Histogram & Distribution of Travel Time to Public Parks

Maximum Travel Time. Respondents from the study population were asked to respond to the open-ended question: "How long would be the maximum amount of time you would spend on traveling to public parks? ____ minutes." A total of 177 people out of 206 survey respondents responded to this question. On average, the acceptable maximum travel time was about 30 minutes (mean=30.89 minutes) for public park visitors (see Table 6.5). The variation in acceptable maximum travel time to public parks was between 3 minutes (minimum) to 120 minutes (maximum). Though it appears that the acceptable maximum travel time to public parks is about two hours, the majority of responses were under 60 minutes (96.0%) of the total responses; cases with under 30 minutes took about 76.8%; only 4% of responses indicated one to two hours as acceptable maximum travel time. As Figure 6.2 indicates, most acceptable maximum travel times are concentrated from 3 to 30 minutes (76.8%).

Table 6.5: Descriptives of Acceptable MaximumTravel Time to Parks

	N	Minimum	Maximum	Mean	Std. Deviation
Maximum travel_time	177	3	120	30.89	21.37
Valid N (listwise)	177				

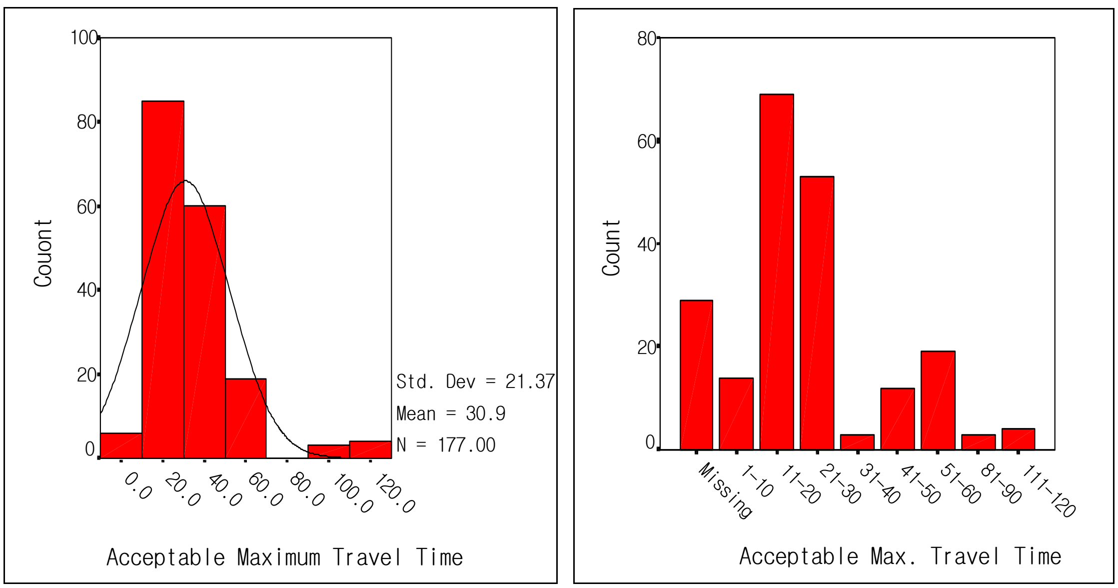


Figure 6.2: Histogram & Distribution of Acceptable Max. Travel Time

Availability of Leisure Time. People were asked to answer two question about the availability of leisure time: “How much leisure time do you usually have? Do you feel you usually have too many family obligations to spend on leisure activities?” and “…..you usually have enough time available to spend on leisure activities?” The questions were to be answered based on a seven-point Lickert scale from “none” to “very much” for both. The final availability index for each respondent’s case was acquired by taking the mean value from two answers for both questions. According to the result of descriptive statistics, survey respondents' mean availability of leisure time was about 3.7 on a seven-point Lickert scale (see Table 6.6), which indicates that Austin park users feel they have a relatively low level of availability of leisure time.

Table 6.6: Descriptive Statistics of Availability of Leisure Time

	N	Minimum	Maximum	Mean	Std. Deviation
Availability of Leisure time	183	1.0	7.0	3.733	1.445
Valid N (listwise)	183				

Fear of Crime. There were six questions regarding fear of crime that park uses had when they went to public parks and the questions were attached: "When you visit public parks, how safe do you feel from crimes like being attached and held up?" "Did fear of crime ever cause you to stop or change activities?", "Did ….. change park locations?", "Did…..avoid certain areas of the park?", "Did…..take any preventive measures?", "Did…..feel that the park police has to be reinforced?" For data reduction, the principal component factor analysis was conducted with a most commonly used varimax rotation. According to the result of the factor analysis, the first factor came predominantly through the answers about fear of crime, explaining 61.1 percent of the total variance of fear of crime. So, the first factor was used as a substitute for those six questions about fear of crime. According to the descriptive statistics, the average index of fear of crime by Austin park visitors was 3.8 on a seven-point Lickert scale (see Table 6.7). This indicates that they have a relatively low fear of crime when they go to parks.

Table 6.7: Descriptive Statistics of Fear of Crime

	N	Minimum	Maximum	Mean	Std. Deviation
Fear of Crime	184	1	7	3.835	1.718
Valid N (listwise)	184				

Information on Park Locations / Programs / Activities / Facilities. Questions about residents' information of parks were segmented into four parts: locations, programs, activities, and facilities. And, the actual questions were "How much information do you have about the locations of the parks in Austin?", "…. about the programs the parks provide?", "…. about the activities the parks provide?", and "…. about the facilities/equipment the parks provide?". Also, in this case, the principal component factor analysis for data reduction was performed with a varimax rotation. The result showed that the first factor came predominantly through the answers about information about Austin parks, explaining 80.7 percent of the total variance of information about public parks in Austin. So, the first factor was used as a substitute for the four questions about information of parks. The Kaiser Meyer Olkin measure, for measuring whether the distribution of values is adequate for conducting factor analysis, was 0.814. This indicated a very high level of adequacy for factor analysis. According to the descriptive statistics, the average index of information about parks by Austin park visitors was 3.9 on a seven-point Lickert scale (see Table 6.8) which indicates that they feel they possess relatively low information about public parks. Among the four types of information, Austin residents had information much more about park locations (mean=4.5) than about programs (mean=3.2), activities (mean=3.2), and facilities (mean=3.4).

Table 6.8: Descriptive Statistics of Information about Parks

	N	Minimum	Maximum	Mean	Std. Deviation
Factor 1 (INFO)	184	1	7	3.930	1.582
Valid N (listwise)	184				

	N	Minimum	Maximum	Mean	Std. Deviation
Info of location	187	1	7	4.456	1.626
Info of programs	186	1	7	3.213	1.600
Info of activities	186	1	7	3.204	1.586
Info of facilities	184	1	7	3.399	1.529
Valid N (listwise)	184				

Perception of Other Users. There were four questions regarding perception of other users that park users had when they went to public parks and the questions were: "How do you feel about other users when you visit the parks? Are you happy sharing the parks with other users?", "…. do others make you feel comfortable?", "…. do others make you feel threatened?", and "….how often do you witness inappropriate behavior of other users?" A factor analysis was conducted for data reduction, but it showed that there were no correlations between questions in group 1, 2 and group 3, 4. This may be primarily because because the first two questions were about positive aspects of perception and the latter two were negative, so the respondents may have answered with no distinction among the questions. So, only the first two questions were included in the descriptive analysis, and the mean value between the two were used for the representative value for park users perception of other users. According to the descriptive statistics, the average index of perception of other users by Austin park visitors was about 5.0 on a seven-point Lickert scale (see Table 6.9). This indicates that they have relatively high sense of perception of other users when they go to parks.

Table 6.9: Descriptive Statistics of Perception of Other Users

	N	Minimum	Maximum	Mean	Std. Deviation
Perception_mean	182	1.0	7.0	4.988	1.267
Valid N (listwise)	182				

Purpose of Park Visit. The survey respondents were asked to answer the question: "What activities do you usually enjoy at public parks in Austin?" They were allowed to check all that apply to their personal situation. The choices of activities included on survey sheet are displayed in Table 6.10 below. Out of 206 survey respondents, 180 people answered the question. Among categories, the most predominant purpose of park visit was "walk or hike (14.3%)", which was followed by "observe nature (12.5%)", "relax and enjoy nature (10.6%)", "picnic (8.8%)", "children's play (8.7%)", and so on.

Table 6.10: Multiple Responses Analysis of Purpose of Visit

	Frequency	Percent	Valid Percent	Cumulative Percent
Walk or hike	3	123	14.3	68.3
Observe nature	2	108	12.5	60.0
Relax and enjoy open space	12	91	10.6	50.6
Picnic	5	76	8.8	42.2
Children's play	13	75	8.7	41.7
Meet with people	1	68	7.9	37.8
Swim	7	63	7.3	35.0
Attend concerts	11	57	6.6	31.7
Run or jog	8	54	6.3	30.0
Walk dog	4	44	5.1	24.4
Bicycle	9	44	5.1	24.4
Tennis	10	19	2.2	10.6
Fish	6	10	1.2	5.6
Others	14	30	3.5	16.7
Total		862	100.0	478.9

Note :26 missing cases; 180 valid cases

Attractions to Park Use. A question was asked to investigate why park users like to go to the parks they chose, followed by a request to name the parks they usually visit. The actual question was "Why do you like to use the public parks you listed above" (check all that apply)". The list of attractions on the survey sheet is displayed in Table 6.11 below. Among attractions, the most important aspect of park attractions was the accessibility to the parks from home (close to home, 13.9%), and among the rest of the top five choices were "good natural environment (11.4%)", "low or no utilization cost (9.9%)", "cleanliness (9.3%)", and "good maintenance (8.6%)". Interestingly enough, attractions (underlined within table) regarding facilities, activities, programs, explained only 17% of total attractions to park visits, but instead, such non-built aspects as accessibility (i.e. close to home), nature (i.e., good natural environment), and maintenance (good maintenance, cleanliness) reflected over 50% of attractions to park use.

Table 6.11: Multiple Responses Analysis of Attractions to Park Use

	Code	Count	Pct of Responses	Pct of Cases
Close to home	16	127	13.9	71.3
Good natural environment	15	104	11.4	58.4
Low or no utilization cost	2	90	9.9	50.6
Cleanliness	17	85	9.3	47.8
Good maintenance	4	78	8.6	43.8
Public safety	9	74	8.1	41.6
Good facilities/equipment	3	67	7.4	37.6
Facilitating activities that meet my needs	7	64	7	36
Uniqueness	10	61	6.7	34.3
Operation times	1	39	4.3	21.9
Good perception of other users	11	35	3.8	19.7

Table 6.11 Continued

	Code	Count	Pct of Responses	Pct of Cases
<u>Good programs</u>	14	24	<u>2.6</u>	13.5
Other	12	20	2.2	11.2
Close to workplace	5	19	2.1	10.7
Available public transportation	8	11	1.2	6.2
Good at providing information on facility	6	8	0.9	4.5
Good promotion/marketing	13	5	0.5	2.8
Total responses		911	100	511.8

Note: 28 missing cases; 178 valid cases

Constraints in Park Use. The respondents of the study population were asked to respond to the question: “What are the constraints that prevent you from using the public parks in Austin more frequently? (check all that apply)” Table 6.12 below displays the list of possible attractions included in the survey. Among constraints, the most conspicuous reason was “lack of time to enjoy leisure activities (19.0%)”, which may be related to the level of availability of leisure time (3.7 on a seven-point Lickert scale, see Table 6.6) measured by the current study. The rest of the constraints were “pursue recreation in areas other than parks (14.0%)”, “too crowded (7.7%)”, “fear of crime (7.0%)”, “no one to go to the parks with (6.4%)”, and so on. While attractions to park use were more closely related to the park features, the constraints with higher responses concerned more personal reasons such as lack of time, other recreation than parks, fear of crime, and no companionship. To note, accessibility, as an attraction, was ranked on top, but as a constraint, it was ranked sixth. This difference can be understood by assuming that the parks they are currently using meet the needs of accessibility, so that further needs for accessibility to parks may have been precluded to a certain degree.

Table 6.12: Multiple Responses Analysis of Constraints in Park Use

	Code	Count	% Responses	% Cases
Lack of time to enjoy leisure activities	9	84	19	48.6
Pursue recreation in areas other than parks	10	64	14	37
Too crowded	18	35	7.7	20.2
Fear of crime	1	32	7	18.5
No one to go to the parks with	2	29	6.4	16.8
Location is too far away	21	29	6.4	16.8
Lack of information about programs	12	23	5.1	13.3
Overdeveloped	15	23	5.1	13.3
Lack of information about existing parks	11	20	4.4	11.6
Operation hours are limited	5	16	3.5	9.2
Only for children	16	16	3.5	9.2
Other	17	16	3.5	9.2
My poor health	4	13	2.9	7.5
Utilization cost is too much	14	10	2.2	5.8
Lack of facilities/equipment	6	9	2	5.2
Lack of activities/programs	22	9	2	5.2
Negative perception of other users	7	8	1.8	4.6
Poor maintenance	23	5	1.1	2.9
Poor maintenance	23	5	1.1	2.9
Public transportation is not easily available	13	4	0.9	2.3
Poor programs	3	3	0.7	1.7
The staff is unfriendly	19	3	0.7	1.7
No way to go to the facilities	8	2	0.4	1.2
Poor facilities/equipment	20	2	0.4	1.2
Total responses		455	100	263

Overall Satisfaction of Park Use. People were asked to respond to the question: “Overall, how satisfied are you with the public parks in Austin?” The answer was based on a Lickert scale from “very unsatisfied” to “very satisfied”, and the average point for the overall satisfaction was about 5.1% on the seven-point Lickert scale (see

Table 6.13). It indicates that,. from an overall point of view, Austin residents are relatively satisfied with the public parks in Austin.

Table 6.13: Overall Satisfaction with Public Parks Use

	N	Minimum	Maximum	Mean	Std. Deviation
Overall satisfaction	182	1.0	7.0	5.093	1.283
Valid N (listwise)	182				

Bivariate Correlation Analyses of Utilization Factors

In both explaining and predicting public parks utilization by neighborhood residents, the regression analysis will be used. The variables used for the regression analysis include dependent and independent variables. When independent variables are more than two, the regression becomes multiple regression analysis. For multiple regression analysis, the very basic precondition is that the independent variables are independent of one another (Kang 1996, 121). If a multiple regression analysis is conducted with two independent variables with a correlation coefficient over 0.9, it is similar to a situation where an independent variable was doubled without any effect. Therefore, a test for the existence of any high level or correlations among independent variables has to be performed ahead of any multiple regression analysis. Usually, when the correlation coefficient between two variables is over 0.9, it is not consided appropriate for them to be included into a regression analysis. In this context, the current part of this chapter will investigate whether there is a high level of correlations among independent variables.

Bivariate Relationships of Social Factors. When the accessibility (i.e. network-based distance) to Austin public parks is set as a dependent variable, socio-demographic characteristics of interest as a group of independent variables include age, gender, race, income, length of residence, education level, family life cycle, marital status, and employment status. The current section test the correlation among socio-demographic variables. Of those nine variables, the family life cycle was replaced by the presence or non-presence of children in a household because the variable "family life cycle" had various kinds of categories for services utilization studies. Initially, variables for family life cycle such as "children home", "children's age", "household size", "family average age" were considered as candidate variables, but the result of a series of bivariate correlation analyses between those and accessibilities to named parks showed that only "children home" had a significant correlation (t=-1.990, p=0.048) with accessibility. Only the variable "children home" was used as a substitute for the variable "family life cycle" (see Table 6.14).

(1) Age. Significant relationships were found between age and race (F=2.681, p=0.033), age and income (tau=-.187, p=0.001), age and length of residence (rho=0.600, p=0.000), age and children home (t=-6.600, p=0.000), age and marital status (F=11.184, p=0.000), age and employment status (F=28.274, p=0.000). Blacks were the oldest group of residents (mean=59.4), while Whites were 48.7, and Hispanics 45.9. Age and children home had an inverse relationship, which indicates the older generation tended to live independently of their children.

(2) Gender. Gender was significantly different only for employment status (χ^2=16.67 p=0.002). In other words, males had a greater tendency than females to be self-employed or employed by someone else.

(3) Race. There were significant relationships between race and income (F=4.496, p=0.002), and between race and length of residence (F=6.345, p=0.000). Whites were the richest group of respondents among Whites, Hispanics, and Blacks. In terms of length of residence, Blacks lived at the same residence the longest (mean=25.5 years), compared with Hispanics (13.1 years) and Whites (12.1 years).

Table 6.14: Bivariate Relationships among Social Factors

	Age	Gender	Race	Income	Length of residence	Education level	Child home	Marital status	Emplo-yme-nt
Age	-	-	-	-	-	-	-	-	-
Gender	t=-.473 p=0.637	-	-	-	-	-	-		-
Race	**F=2.681 p=0.033**	χ^2=3.326 p=0.505	-	-	-	-	-	-	-
Income	**tau=-.187 p=0.001**	t=-0.669 p=0.505	**F=4.496 p=0.002**	-	-	-	-	-	-
Length of Residence	**rho=0.600 p=0.000**	t=-1.516 p=0.131	**F=6.345 p=0.000**	**tau=-.153 p=0.007**	-	-	-	-	-
Education level	tau=-.010 p=0.850	t=0.294 p=0.769	F=1.033 p=0.392	**tau=.295 p=0.000**	tau=-.059 p=0.285	-	-	-	-
Child home	**t=-6.600 p=0.000**	χ^2=3.524 p=0.060	χ^2=1.604 p=0.808	t=1.707 p=0.090	t=-1.858 p=0.065	t=0.243 p=0.809	-	-	-
Marital status	**F=11.184 p=0.000**	χ^2=7.711 p=0.103	χ^2=24.33 p=0.083	**F=7.908 p=0.000**	**F=3.653 p=0.007**	F=0.569 p=0.686	**χ^2=19.96 p=0.001**	-	-
Employ-ment	**F=28.274 p=0.000**	**χ^2=16.67 p=0.002**	χ^2=21.14 p=0.173	**F=4.996 p=0.012**	**F=11.507 p=0.000**	F=1.084 p=0.366	**χ^2=20.16 p=0.000**	**χ^2=39.84 p=0.001**	-

Note: t=independent samples t-test, F=GLM F test, rho=pearson's correlation test, χ^2=Chi-square test, tau=kendal's tau b test, p=p-value at 0.005 level

(5) Length of Residence. There were significant relationships between length of residence and marital status (F=3.653, p=0.007), and between length of residence and employment status (F=11.507, p=0.000). Widowed residents were more likely to have a longer length of residence (mean=21.8 years) than any other group: married, 13.9 years; divorced, 11.3 years; never married, 10.9 years; and separated, 2.8 years. Retired people were more likely to live longer at the same residence (mean=24.8 years) than any other people: student, 12.4 years; homemaker, 10.8 years; and unemployed, 9.5 years.

(6) Child Home. The presence or absence of child home had significant relationships with both marital status (χ^2=19.96 p=0.001) and employment status (χ^2=20.16 p=0.000). Residents with children at home are more likely to be married and employed.

(7) Marital Status. Marital status was significantly different among the categories of employment status (χ^2=39.84, p=0.001). Married people were more likely to be self-employed or employed by someone else.

Bivariate Relationships of User Factors

Utilization factors except for socio-economic characteristics are the user factors. In the literature, the user factors belonged to the utilization factors that helped explain the urban residents' behaviors of utilizing the public parks in the community. But in this study, they are included as part of the utilization factors that will be used to explain the relationship between accessibility and parks utilization. The variables include frequency of visit, availability of leisure time, information of parks, perception of other users, transit method, travel time, allowable maximum travel time, and fear of crime. The current chapter will test the correlation among those user factors.

(1) Frequency of Visit and Availability of Leisure Time. There was a significant relationship between how much leisure time is available to a household and how frequently they go to the parks (tau=.134, p=..021).

(2) Frequency of Visit and Information of Parks. It was significant that the more information households possess, the more frequently they visited the parks (tau=.169, p=.002), and vice versa.

(3) Frequency of Visit and Perception of Other Users. The differences in frequency of visit were significantly different according to perception of others (tau=.113, p=.049). People with a higher evaluation of other users had a tendency to visit public parks more often.

(4) Transit Method and Travel Time. Depending on their transportation method, travel time was significantly different (F=5.926, p=.000). As Table 6.15 indicates, using bikes takes the longest travel time (mean=27.5 minutes) to parks, and jogging and walking take the shortest travel time (mean=5.0, 6.5 minutes each). The majority of survey respondents drive to the parks in an average time of about 14 minutes. Meanwhile, transit method didn't show any significant relationship with allowed maximum travel time (F=1.141, p=.341), perhaps because allowed maximum travel time doesn't reflect households' actual travel patterns but only their opinions on traveling farther distances rather than the reality.

Table 6.15: Travel Time by Transit Method

Transit Method	Mean (Travel Time)	N	Std. Deviation
drive	14.18	136	7.34
walk	6.50	22	3.35
jog	5.00	1	.
bicycle	27.50	4	23.63
drive/walk	11.00	9	8.70
drive/walk/bike	16.75	4	10.11
drive/bike	11.67	3	5.77
Total	13.34	179	8.30

(5) Travel Time and Allowed Maximum Travel Time. Households that usually travel longer distances to the parks tended to show more latitude toward traveling farther to other parks. This phenomenon was statistically significant (rho=.475, p=.000).

(6) Availability of Leisure Time and Fear of Crime. Availability of leisure time had a significantly inverse relationship to fear of crime (rho=-.150, p=.046). In other words, people who had a higher availability level of leisure time showed a lower level of fear of crime. It seems that there are at least two intervening variables - frequency of visit and perception of others – to explain this relationship. That is, as households with more available leisure time may go to the parks more often. Then, they may perceive other users more positively feel less fear of crime. Supporting this assumed explanation, all necessary relationships between “availability of leisure time and frequency of visit”, between “frequency of visit and perception of others”, and between “perception of others and fear of crime” already turned out to be significant, as Table 6.16 displays.

Table 6.16: Bivariate Relationships within User Factors

	Frequency	Transit method	Travel time	Max travel time	Avail. of leisure	Fear of crime	Info of parks	Perception of others	Satisfac -tion
Freq. of visit	-	-	-	-	-	-	-	-	-
Transit method	F=1.613 p=.146	-	-	-	-	-	-	-	-
Travel time	tau=-.009 p=.883	**F=5.926 p=.000**	-	-	-	-	-	-	-
Maximum travel time	tau=1.009 p=.443	F=1.141 p=.341	**rho=.475 p=.000**	-	-	-	-	-	-
Avail. of leisure	**tau=.134 p=..021**	F=.944 F=.465	rho=.056 p=.459	rho=.050 p=.521	-	-	-	-	-
Fear of crime	tau=-.014 p=.799	F=1.262 p=.277	rho=.084 p=.259	rho=.015 p=.845	**rho=-.150 p=.046**	-	-	-	-
Info of parks	**tau=.169 p=.002**	F=.762 p=.600	rho=-.083 p=.273	rho=-.030 p=.696	**rho=.192 p=.011**	rho=-.128 p=.085	-	-	-
Perception of others	**tau=.113 p=.049**	F=.493 p=.813	rho=.040 p=.598	rho=-.018 p=.811	**rho=.208 p=.006**	**rho=-.300 p=.000**	rho=.041 p=.583	-	-
Satisfactio n	tau=.103 p=.079	F=1.195 p=.311	rho=-.069 p=.359	rho=.016 p=.834	**rho=.250 p=.001**	**rho=-.229 p=.002**	rho=.131 p=.078	**rho=.356 p=.000**	-

Note: t=independent samples t-test, F=GLM F test, rho=pearson’s correlation test, χ^2 =Chi-square test, tau=kendal’s tau b test, p=p-value at 0.005 level

(7) Availability of Leisure Time and Information of Parks. Households having a higher level of availability of leisure time turned out to possess significantly more information about parks (rho=.192, p=.011).

(8) Availability of Leisure Time and Perception of Others. Availability of leisure time and perception of leisure time showed a significant interrelationship (rho=.208, p=.006). Thus, as people have more available leisure time, they may go to the parks more frequently, and as they go to the parks more often, they may evaluate others more positively.

(9) Availability of Leisure Time and Overall Satisfaction. People's overall satisfaction with the parks was significantly related to their availability of leisure time (rho=.250, p=.001). People with more available leisure time tended to be more satisfied with the parks they use. People's overall satisfaction is closely related to their perception of other users (rho=-.229, p=.002) and fear of crime (rho=.356, p=.000). And, as described above, the amount of available leisure time was closely related to fear of crime and perception of others. Therefore, as people have more available leisure time, they may have less fear of crime and better evaluation of others. As a result, these households may be more satisfied with the parks they usually visit.

(10) Fear of Crime and Perception of Others. In real life, it is usually true that if people feel less fear of crime when they go to the parks, they may perceive other users in a more positive manner. A bivariate analysis between fear of crime and perception of other users also indicates the same result - that there is a significant relationship between the two variables (rho=-.300, p=.000).

(11) Fear of Crime and Overall Satisfaction. Fear of crime has an inverse relationship with people's overall satisfaction with the parks. The Pearson's correlation test shows that having less fear of crime contributes to people's overall satisfaction with the parks (rho=-.229, p=.002).

(12) Perception of Others and Overall Satisfaction. While fear of crime inversely does, perception of others had a significant relationship with households' overall satisfaction with the parks (rho=.356, p=.000).

Bivariate Relationships of User Factors and Social Factors. In this section of the chapter, correlations between a group of user factors and socio-demographic variables were investigated. Table 6.17 below displays the overall view of the relationships between the two groups of variables. As the table indicates, frequency of park visit was related to age, income, child home, and employment status; travel time differences varied according to the level of income; allowed maximum travel time had a relationship with race and income; availability of leisure time was related to child home and employment status; fear of crime was related to gender; information of parks was different according to the segmentation of race, but transit method, perception of other users, and overall satisfaction were not significantly related to any socio-demographic variables. The rest of this section describes the details of those correlations by comparing means of each classification. Variables with multiple responses, such as companionship pattern, purpose of park visit, attraction to park visit, and constraints in park visit, were almost impossible to test for statistical significance of relationships in the following bivariate and multivariate analyses among study variables, so they remained meaningful only on the level of descriptive findings and were not included in the following bivariate and multivariate analyses.

Table 6.17: Bivariate Relationships between User Factors and Social Factors

	Age	Gender	Race	Income	Length of residence	Education level	Child home	Marital status	Employm e-nt status
Freq. of visit	**tau=-.234 p=.000**	t=-.977 p=.330	F=2.195 p=.071	**tau=.150 p=.017**	tau=-.082 p=.138	tau=.019 p=.760	**t=2.048 p=.042**	F=1.685 p=.255	**F=4.394 p=.002**
Transit method	F=.418 p=.867	χ^2=12.38 p=.054	χ^2=16.63 p=.864	F=.940 p=.442	F=.548 p=.997	F=.694 p=.597	χ^2=5.42 p=.491	χ^2=24.07 p=.458	χ^2=16.14 p=.883
Travel time	rho=.053 p=.481	t=-1.454 p=.148	F=.362 p=.835	**tau=-.179 p=.004**	rho=.046 p=.545	tau=-.081 p=.182	t=-1.781 p=.077	F=.498 p=.737	F=.363 p=.835
Max travel time	rho=.128 p=.094	t=-1.092 p=.177	**F=2.558 p=.041**	**tau=-.148 p=.018**	rho=-.018 p=.819	tau=-.053 p=.392	t=-1.633 p=.104	F=1.410 p=.233	F=1.571 p=.184
Avail. of leisure time	rho=.068 p=.366	t=-.392 p=.696	F=.668 p=.615	tau=.015 p=.197	rho=.095 p=.208	tau=.059 p=.312	**t=-2.56 p=.011**	F=1.369 p=.247	**F=4.075 p=.003**
Fear of crime	rho=-.055 p=.461	**t=2.892 p=.004**	F=.940 p=.442	tau=-.067 p=.244	rho=-.113 p=.131	tau=.032 p=.571	t=.058 p=.954	F=.143 p=.966	F=.461 p=.764
Info of parks	rho=.098 p=.190	t=-1.78 p=.077	**F=2.421 p=.050**	tau=.072 p=.217	rho=.110 p=.141	tau=.041 p=.468	t=.600 p=.549	F=1.357 p=.289	F=.744 p=.564
Perception of others	rho=-.117 p=.119	t=1.364 p=.174	F=.791 p=.532	tau=.106 p=.075	rho=-.091 p=.227	tau=-.038 p=.513	t=.760 p=.448	F=.792 p=.532	F=1.251 p=.291
Satisfaction	rho=-.036 p=.631	t=.894 p=.372	F=.630 p=.642	tau=.017 p=.774	rho=-.114 p=.055	tau=-.042 p=.480	t=-1.442 p=.154	F=1.808 p=.129	F=.731 p=.572

Note: t=independent samples t-test, F=GLM F test, rho=pearson's correlation test, χ^2 =Chi-square test, tau=kendal's tau b test, p=p-value at 0.005 level

(1) Frequency of Park Visit and Age. Among nine socio-demographic variables, age had a significant inverse relationship with frequency of park visit (tau=-.234, p=.000). As the Table 6.18 shows, there were no big differences in the mean values of frequency categories from more than 4 times/month to 1 time/month. People going to the parks less than 1 time/month were 56.45 years old on average, being much older than those in other frequency categories. The reason why older people go to the parks less often than others seems to be their personal health-related problems with no relation to availability of leisure time.

Table 6.18: Mean Ages by Frequency of Visit

Frequency of Visit	Mean (age)	N	Std. Deviation
less than 1 time / month	56.45	74	13.96
1 time / month	44.91	15	10.96
2 times / month	44.89	27	10.21
3 times / month	46.89	14	16.13
4 times / month	45.16	19	13.42
more than 4 times / month	46.82	44	12.31
Total	50.13	194	13.83

(2) Frequency of Park Visit and Income. Frequency of park visit was also significantly different according to residents' income levels (tau=.150, p=.017). As Table 6.19 describes, people going to the parks less than 1 time/month belongs to the lowest income group (mean=$54,701), but people showing the frequency of 4 time/month were the group of highest income (mean=$69,444). Income levels among other categories of frequency of visit didn't show big differences.

Table 6.19: Mean Incomes by Frequency of Visit

Frequency of Visit	Mean (income)	N	Std. Deviation
less than 1 time / month	$54,701	67	24585.67
1 time / month	$66,818	11	31801.94
2 times / month	$65,000	25	29190.47
3 times / month	$64,166	16	35272.75
4 times / month	$69,444	18	23382.30
more than 4 times / month	$66,222	45	28666.49
Total	$61,860	182	27359.92

(3) Frequency of Visit and Child Home. Whether child home or not is significantly related to the frequency of park visits (t=2.048, p=.042). According to Table 6.20, households visiting the parks less than 1 time/month were more likely not to have children home (yes:no=23:52), while people visiting the parks at least 1 time/month showed no significant difference in the numbers of cases having a child home. When children home, they went to the parks about 3.5 times/month on average. Households with no children at home visited the parks only about 2.8 times/month.

Table 6.20: Presence of Child Home by Frequency of Visit

Frequency of Visit	Child Home		Total
	yes	no	
less than 1 time / month	23	52	75
1 time / month	7	4	11
2 times / month	13	14	27
3 times / month	10	9	19
4 times / month	9	10	19
more than 4 times / month	22	22	44
Total	84	111	195

Child Home	Mean (Frequency of Visit/month)	N	Std. Deviation
yes	3.46	84	2.03
no	2.83	111	2.07
Total	3.10	195	2.07

(4) Frequency of Visit and Employment Status. According to the employment status, frequency of park visits were significantly different (F=4.394, p=.002) (see Table 6.21). Homemakers were the most frequent park visitors (mean=3.9 times/month) visiting more than any other groups of employment status, followed by those who were self-employed or employed by someone else, who visited the parks 2.6 times/month on average.

Unemployed (mean=1.9 times/month) and retired people (mean=1.3 times/month) who seem to have more availability of leisure time, turned out to be going to the parks less than any other group.

Table 6.21: Frequency of Visit by Employment Status

Employment status	Mean (frequency of visit)	N	Std. Deviation
self employed or employed by someone else	2.604	132	2.374
unemployed	1.920	5	1.639
retired	1.277	31	1.774
homemaker	3.913	16	2.086
student	2.000	1	.
Total	2.473	185	2.320

(5) Travel Time and Income. Average travel time by neighborhood residents had a significant relationship with income level (tau=-.179, p=.004). Table 6.22 shows an exact inverse relationship between income level and mean travel time to public parks. For households earning under $20,000 a year, it takes about 19.3 minutes to go to the parks on the average, but, as the income level increases up to and over $80,000, the time taken by households to go to the parks continuously decreased to 11.5 minutes.

Table 6.22: Travel Time to Parks by Income Level

Income Level	Mean (Travel Time)	N	Std. Deviation
under $20,000	19.25	16	8.02
$20,001-40,000	15.05	20	7.58
$40,001-60,000	13.45	42	7.97
$60,001-80,000	13.35	46	9.55
over $80,000	11.54	41	6.70
Total	13.70	165	8.30

(6) Allowed Maximum Travel Time and Race. Maximum travel time allowed by households differed significantly according to racial background (F=2.558, p=.041) (see Table 6.23). Among the three major racial groups, Whites were more generous (32.3 minutes) in spending travel time visiting the parks than the other racial groups. While maximum travel time allowable by Blacks was 27.5 minutes, Hispanics were the most stringent on spending travel time to the parks.

Table 6.23: Allowed Maximum Travel Time by Race

Race	Mean (Allowed Maximum Travel Time)	N	Std. Deviation
White	32.33	136	21.68
Black	27.50	16	14.72
Hispanic	24.12	17	11.76
other	45.00	4	50.00
Total	31.37	173	21.35

(7) Allowed Maximum Travel Time and Income. The relation between allowed maximum travel time and income turned out to be similar to that between travel time and income level (see Table 6.22, 6.24). Broadly speaking, the lower a household's income level, the more generous he or she is in allowing more travel time to public parks (tau=-.148, p=.018)

Table 6.24: Allowed Maximum Travel Time by Income Level

Income	Mean (Allowed Maximum Travel Time)	N	Std. Deviation
under $20,000	40.71	14	27.86
$20,001-40,000	45.38	31	35.64
$40,001-60,000	26.64	42	13.86
$60,001-80,000	29.77	44	18.43
over $80,000	27.13	40	15.31
Total	31.29	171	21.54

(8) Availability of Leisure Time and Child Home. As mentioned earlier, the level of the availability of leisure time was measured on a seven-point Lickert scale. As Table 6.25 indicates, the availability of leisure time had a significant relationship to the presence or non-presence of child home (t=-2.56, p=.011). Households with no child home showed a lower level of the availability of leisure time than those with child home.

Table 6.25: Availability of Leisure Time by the Presence of Child Home

Child Home	Mean (Availability of Leisure Time)	N	Std. Deviation
yes	3.413	86	1.297
no	3.968	103	1.526
Total	3.732	189	1.456

(9) Fear of Crime and Gender. Among the overall socio-demographic variables, fear of crime was significantly related to only the variable, "gender"(t=2.892, p=.004). Table 6.26 shows the mean value of the fear of crime on a seven-point Lickert scale, which indicates that, females are more influenced by and fearful of crime when they go to the parks.

Table 6.26: Fear of Crime by Gender

Gender	Mean (Fear of Crime)	N	Std. Deviation
female	4.106	102	1.764
male	3.511	79	1.634
Total	3.846	181	1.729

(10) Information of Parks and Race. Within the framework of the current study, race only had a significant relationship with information of parks (F=2.421, p=.050) (see

Table 6.27). The information of parks was also measured on a seven-point Lickert scale. Among the three major races, Blacks showed the highest level of parks information (mean=4.4), followed by Whites (mean=4.0) and Hispanics (mean=3.0).

Table 6.27: Information of Parks by Race

Race	Mean (Information of Parks)	N	Std. Deviation
white	3.990	140	1.576
black	4.440	15	1.737
hispanic	2.955	20	1.320
other	4.000	4	.658
Total	3.912	179	1.581

Summery of Relationships among Utilization Factors. In the current section of this chapter, utilization factors for public parks were listed and their bivariate relationships were investigated to see whether there is a significantly high correlation between any of those utilization factors. The bivariate analyses included relationships within socio-demographic variables, relationships within user factors, and relationships between a group of socio-demographic variables and a group of user factors. A series of bivariate tests showed that there are many significant correlations between various variables. In terms of the relationship between a group of socio-demographic variables and a group of user factors, there were twelve variables closely interrelated – six each from both socio-demographic variables and user factors. The diagram of interrelationships among those twelve variables is displayed in Figure 6.3 below. To note, the diagram indirectly indicates that only "race" and "income level" seem to be closely related to the accessibility (i.e. dependent variable of this study) of the parks that households usually go to. Of nine user factors, only “travel time” and “allowed maximum travel time” may reflect the degree of travel distance between neighborhood residents and the parks they usually visit.

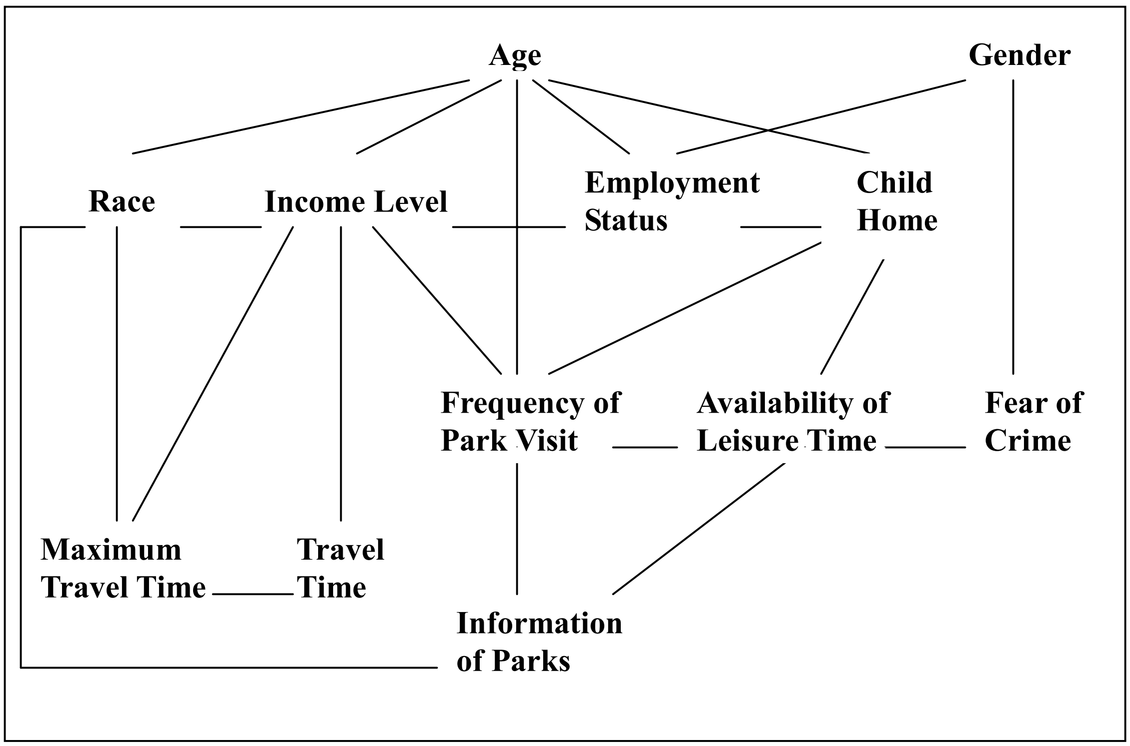


Figure 6.3: Diagram of Bivariate Relationships between User Factors and Socio-demographic Variables

Hypothesis 2 Testing - Public Parks Accessibility and Utilization

The second hypothesis of the current study was that accessibility to public services directly affects services utilization, which means that households are more likely to utilize the closer parks with more frequency. Through the previous subchapter, several significant relationships were found among utilization factors. The current section of this chapter investigated the relationships between parks accessibility (dependent variable) and utilization factors (independent variables). In this context, this section first described how the study dealt with the travel distances between the parks listed on the survey returned and the household locations. The descriptive findings of the travel distances followed classified by the hierarchy of Austin public parks. Second, bivariate analyses between travel distances and utilization factors were conducted. Suitable independent variables were selected for the multivariate analyses following this section. Finally, two multivariate analyses of the relationships between accessibility and utilization factors were executed.

With independent variables accountable for travel distances, the multiple regression analysis explained the phenomenon how long a distance a household usually travels to the parks they use. The travel distance was assumed to be different by the household's socio-demographic background (i.e., social factors) and their individually unique utilization patterns (i.e., user factors).

Descriptives of Named Parks. In the survey, respondents were asked to name the public parks they usually visit in the city of Austin. The park names were to be stated in the order of frequency. As a reference to help residents choose their usually visited park, Austin public parks inventory was attached to the survey booklet which included all the Austin park names and addresses that Austin PARD (Parks and Recreation Department) listed on Austin City Connection 2001.

(1) Multiple Responses Analysis of Named Parks. Table 6.28 below displays the result of a multiple responses analysis of named parks as a list of response rates for each named park by percent of responses. According to the result, out of 206 survey respondents, 177 people responded with at least one park name. Twenty-nine people didn't respond to the survey question. The count of total response is 597 which means 177 people responded to the park naming question with 597 park names. This indicates a respondent answered the question with 3.8 park names on average. Percent of responses is the rate of each count when the total number of responses (597) is considered as 100%. Percent of cases is the rate of each count when only the number of valid responses (177) is considered as 100%. As the table displays, Zilker Park, Balcones Park, Town Lake – Auditorium Shores, Pease Park, Mary Moore Searight Park are among the top five most frequently visited public parks in Austin. The total list of named parks with response rates, including % response rates under 1.0, is attached in the appendix 5.

Also, when the named parks were reorganized by park type, the percents of responses and the order of park types by percent of responses are ranked in Table 6.29 below. As the table indicates, the park type with the highest % responses was metropolitan park (37.2%), followed by neighborhood park (32.2%), district park (19.1%), and greenbelt (6.4%). Special park and preserve showed the lowest percent of responses with 2.7% and 1.7% each. The following graph in Figure 6.4 shows the comparison of the number of responses by park type.

Table 6.28: Named Parks with Response Rates (% response at least 1.0)

	Type	Area (mile)	Code	Count	Pct of Responses	Pct of Cases
Zilker Metropolitan Park	M	351.04	196	121	20.3	68.4
Balcones District Park	D	51.69	7	27	4.5	15.3
Town Lake-Auditorium Shores Metropolitan	M	508.89	162	26	4.4	14.7
Pease District Park	D	42.26	118	23	3.9	13
Mary Moore Searight Metropolitan Park	M	344.8	90	21	3.5	11.9
Tarrytown Park	N	2.25	161	21	3.5	11.9
Garrison District Park	D	40	60	19	3.2	10.7
Pillow Playground	N	7.2	122	19	3.2	10.7
Dittmar Park	N	12.86	46	18	3	10.2
Reed Park	N	6.27	129	17	2.8	9.6
Bull Creek District Park	D	48.06	30	16	2.7	9
Barton Creek Greenbelt	G	1,770.85	11	13	2.2	7.3
Walnut Creek Metropolitan Park	M	293.62	178	13	2.2	7.3
Westenfield Park	N	11.04	186	13	2.2	7.3
Emma Long Metropolitan Park	M	1,147.02	56	12	2	6.8
Town Lake-Lamar Beach Metropolitan Park	M	508.89	167	10	1.7	5.6
Dick Nichols District Park	D	152.92	45	9	1.5	5.1
Eilers (Deep Eddy) Park	N	8.96	54	9	1.5	5.1
Rosewood Park	N	13.9	135	9	1.5	5.1
Tanglewood Park	N	14.3	160	9	1.5	5.1
Beverly S. Sheffield Northwest District	D	30.75	16	8	1.3	4.5
Givens District Park	D	35.75	62	8	1.3	4.5
Mayfield Preserve	P	22	91	8	1.3	4.5
Mount Bonnell	S	5.36	95	8	1.3	4.5
Waterloo Park	N	10.74	181	8	1.3	4.5
Batholomew District Park	D	57.21	10	7	1.2	4
St. Elmo Playground	N	6.2	152	7	1.2	4
Town Lake-Butler Shores Metropolitan Par	M	508.89	163	7	1.2	4
Big Stacy Park	N	3.31	17	6	1	3.4
Northwest Balcones Park	N	6.5	104	6	1	3.4
Total responses				597	100	337.3

Note: 29 missing cases; 177 valid cases

Table 6.29: Response Rates by Park Type

Park type	Code	Count	Pct of Responses	Pct of Cases
Metropolitan	1	222	37.2	125.4
Neighborhood	6	192	32.2	108.5
District	4	119	19.1	67.2
Greenbelt	2	38	6.4	21.5
Special	5	16	2.7	9.0
Preserve	3	10	1.7	5.6
Total responses		597	100.0	337.3

Note :29 missing cases; 177 valid cases

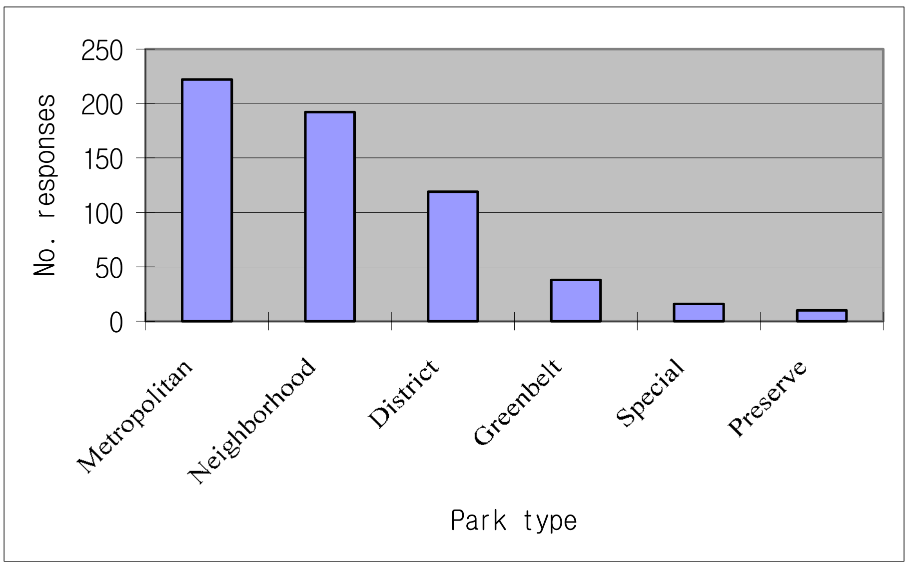


Figure 6.4: Comparison of No. Responses by Park Type

(2) Network Distances of Named Parks. The accessibility measures, represented by network distances of named parks, were obtained through measuring the network-based distances between the exact locations of survey respondents and the park locations they named on the survey. The distribution of those accessibility measures is summarized in Table 6.30. Roughly speaking, the mean network distance between households and public parks used is about 5.009 miles and the variation of the measures is between 0.1125 and 14.6034 miles.

Table 6.30: Descriptive Statistics of Network Distances

	N	Minimum	Maximum	Mean	Std. Deviation
DIST_MN	177	0.1125	14.6034	5.009049	2.946103

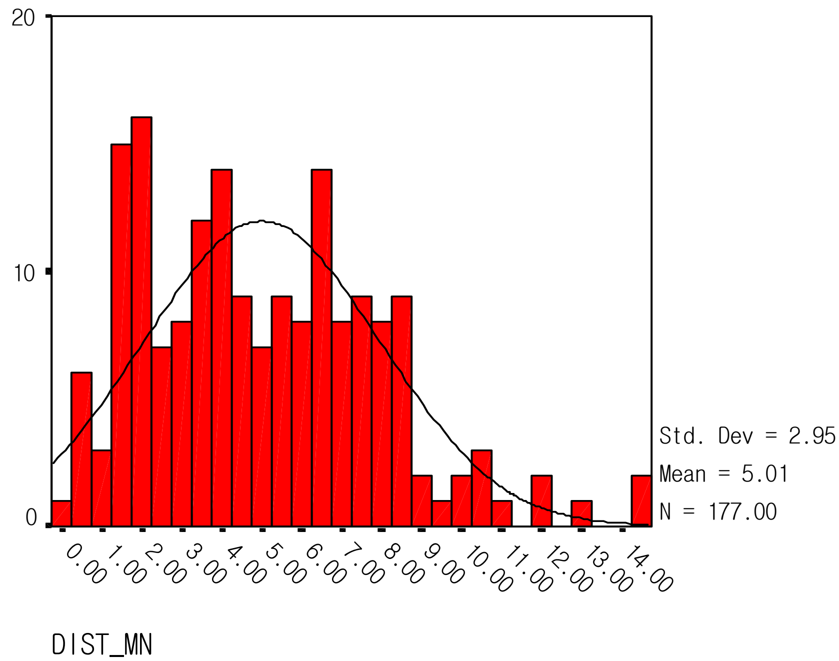


Figure 6.5: Histogram: Distribution of Network Distances (Named Parks)

(3) Network Distances by Park Type. The measures of network distance were divided into three segments: average network distance; average minimum network distance; and average maximum network distance. The parks named by survey respondents were mostly multiple up to the maximum of five, so it was necessary for the current analysis to acquire the average measures of minimum and maximum distances for each household. As Table 6.31 shows, among six park types, metropolitan parks showed the longest average distance (6.828 miles, S.D.=3.276) with the average minimum and maximum distances of 6.043 (S.D.=3.38) and 7.565 (3.811) each. In the order of average network distance, special parks (6.738 miles, S.D.=3.01), greenbelts (5.642, S.D.=4.210), preserves (4.586 miles, S.D.=3.529), neighborhood parks (3.362 miles, S.D.=4.429), and district parks (3.297 miles, S.D.=2.778) followed. In particular, the average network distance to neighborhood parks was a little longer than that of district parks, and as Figure 6.7 displays, neighborhood parks cover a wider range of network distances than district parks.

Table 6.31: Travel Distances by Park Type

Minimum Distance	N	Average Minimum Distance (S.D.)	Average Distance (S.D.)	Average Maximum Distance (S.D.)
Metropolitan parks	144	6.043636 (3.381332)	6.828027 (3.276318)	7.565831 (3.810599)
Special parks	16	6.738100 (3.009583)	6.738100 (3.009583)	6.738100 (3.009583)
Greenbelts	33	5.275306 (4.157363)	5.642115 (4.210448)	5.791652 (4.350943)
Preserves	10	4.585810 (3.528800)	4.585810 (3.528800)	4.585810 (3.528800)
Neighborhood Parks	114	2.544784 (4.106152)	3.361886 (4.238605)	4.179718 (4.951712)
District parks	94	2.742606 (2.650127)	3.296607 (2.778201)	4.007552 (3.587167)

And, on an average, the shortest network distance to neighborhood parks were at least 2.545 miles, while that of district parks was 2.743, but the individual case of shortest distance to neighborhood parks was 0.0827 miles, while that of district parks was 0.2863 miles. Figures 6.6 and 6.7 below show the differences of average distance and the range of travel distances by park type. And, the following scatterplots in Figures 6.8 - 6.11 also show the distribution of the average distances and the range of travel distances by park type.

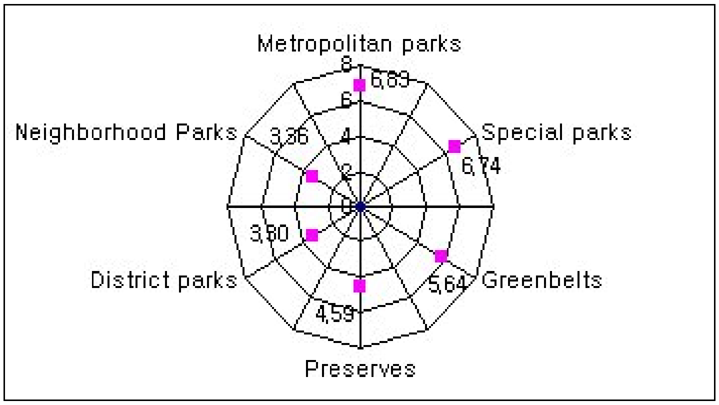


Figure 6.6: Diagram of Average Distance by Park Type

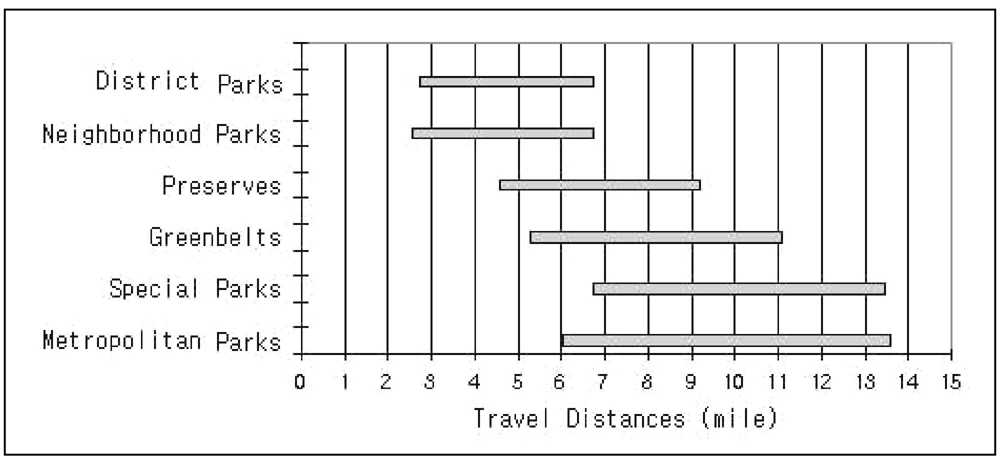


Figure 6.7: Diagram of Minimum & Maximum Distances by Park Type

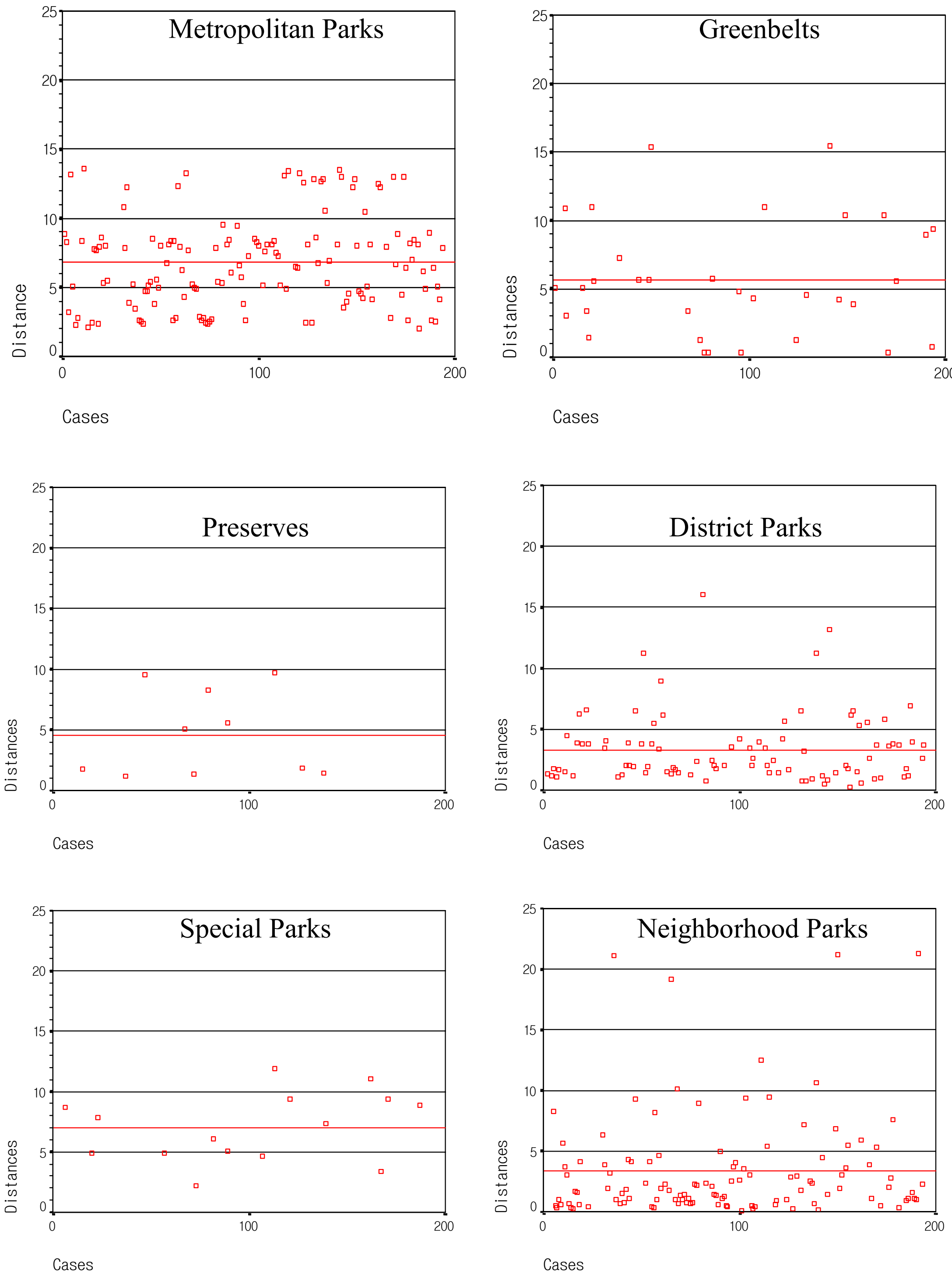


Figure 6.8: Scatterplot: Distribution of Travel Distances by Park Type

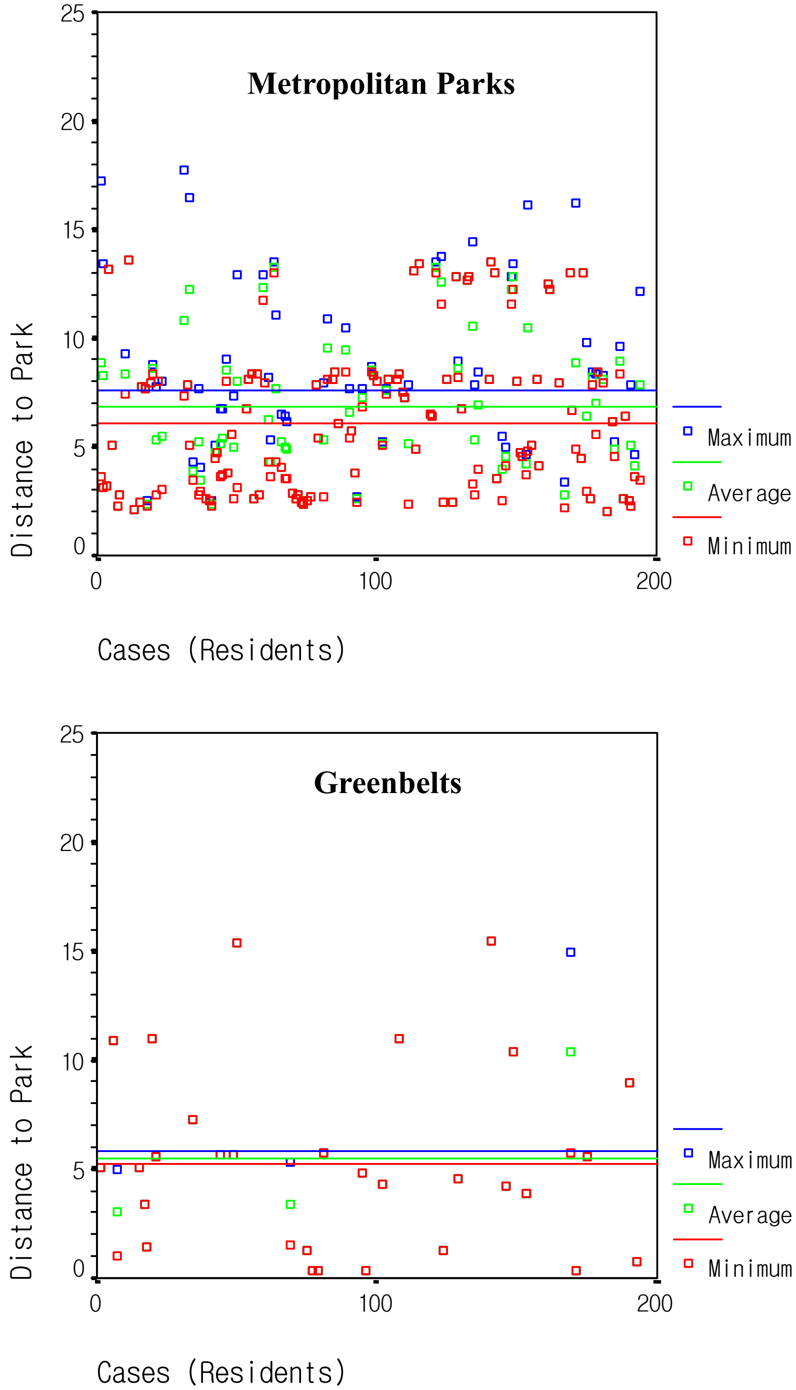
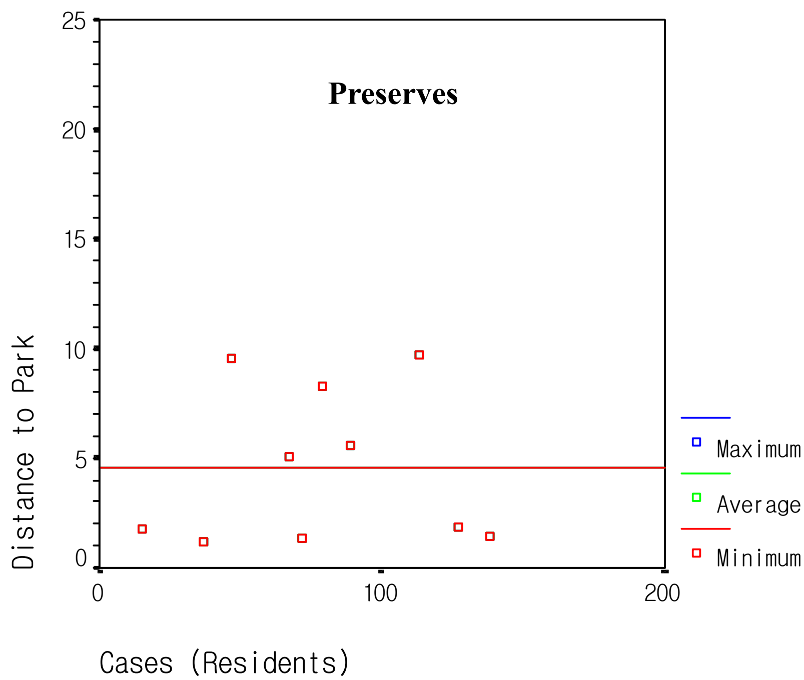


Figure 6.9: Scatterplot: Distribution of Distances by Park Type (#1)



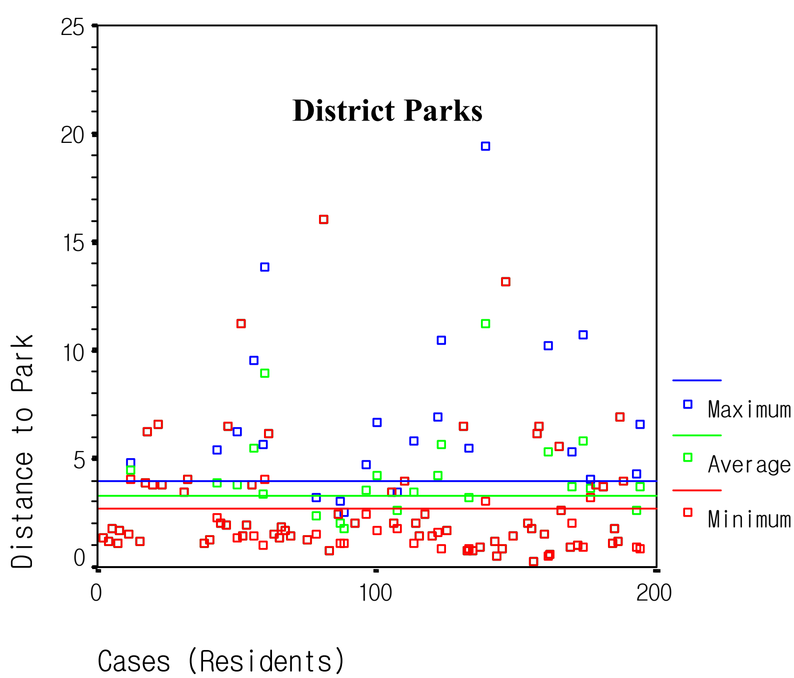
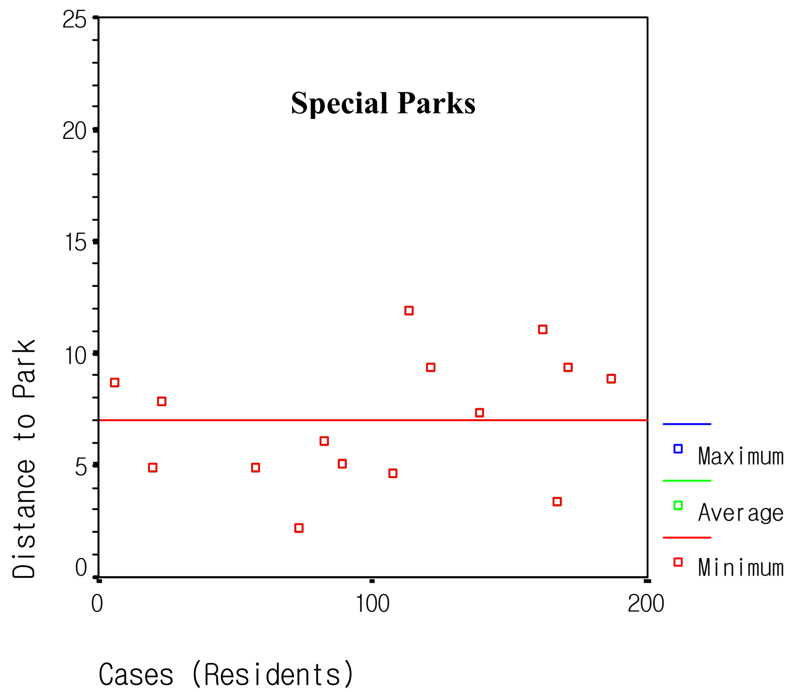


Figure 6.10: Scatterplot: Distribution of Distances by Park Type (#2)



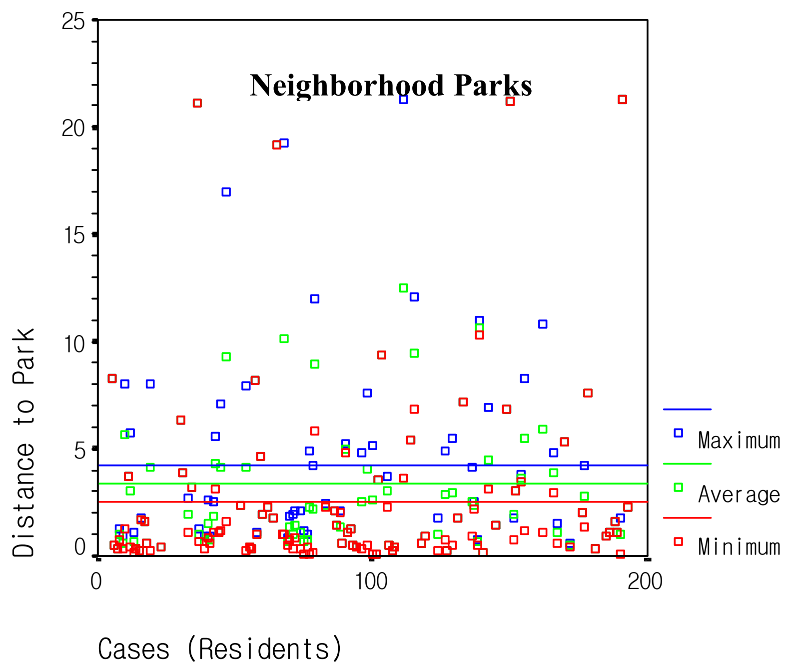


Figure 6.11: Scatterplot: Distribution of Distances by Park Type (#3)

Relationships of Network Distance and Utilization. The second hypothesis of the current study was that accessibility to public services directly affects public services utilization, which means that households are more likely to utilize the closer parks more frequently. As described in the following in detail, the analysis of the relationship between network distance and utilization precluded any simple generalization because the individual dimension of relationship between network distance and utilization was totally different from its general dimension of relationship between distance and utilization. Individually, people preferred closer parks by showing a higher frequency of visit to those parks once they had selected a group of public parks. From the viewpoint of overall parks, the group of their preferred parks denied any simple description of the relationship between network distance and utilization.

(1) Relationship between Distance and Utilization (Individual Dimension). As mentioned earlier in the survey, members of study population were asked to name the public parks they usually visit in the city of Austin and the names of those parks were to be stated “in the order of the frequency of visit”. The relationship between network distance and utilization was analyzed among the parks that were named by survey respondents, and the network distances of those named parks were calculated by the classifications of naming tiers (see Table 6.32).

Table 6.32: Differences of Distance by Utilization

	Naming Tiers (in order of the frequency of visit)				
	1st	2nd	3rd	4th	5th
Park Number	176	155	126	85	52
Distance (total)	772.5015	736.0124	680.9848	444.0247	316.4326
Distance (minimum)	.0817	.1706	.2878	.0908	.4277
Distance (maximum)	21.3087	19.1609	21.2961	17.1918	19.4341
Distance (mean)	**4.389202**	**4.748469**	**5.404619**	**5.223815**	**6.085348**
Std. Deviation	4.347851	3.960635	4.084297	4.383028	4.326402

Table 6.32 above displays the differences in distance by frequency of visit, that is, individual frequency of visit to chosen parks. As the table indicates, park visitors more frequently visited the closer parks among the public parks they chose. If one of the chosen parks is farther away from the households than the others, they tend to use the park less frequently. This relationship between travel distance and utilization only belongs to descriptive statistics and is not enough to lead to any statistically significant conclusion, and it may include some bias as different individuals' behavior of park choices may be more complicated. It is clear that once a household chooses a set of public parks, on the average, the residents tend to visit closer parks more frequently.

(2) Relationship between Distance and Utilization (General Dimension). Among the overall public parks, the relationship between network distance and utilization was investigated by checking whether a household chose the park closest to the residence. For this analysis, Arvciew 3.2 was used to gather the information about the closest parks from each residence. The closest park names, acquired by the help of Arcview 3.2 Network Analyst, were compared with the named parks that each survey respondent listed on the survey questionnaire. As Table 6.31 (Travel Distances by Park Type) above indicates, average distances of public parks are different by park type, i.e., park users' average travel distance to metropolitan parks (6.828 miles, S.D.=3.2763) is about two times longer than to neighborhood parks (3.3619 miles, S.D.=4.2386) and district parks, while distances to special parks, greenbelts, and preserves are in between. The relationship between network distance and utilization was analyzed according to the classifications of park types. The variables were transformed into nominal scale (i.e., "yes" if named park of a particular park type is identical to network-based closest park of the same park type; and "no" if not). A Chi-Square test was employed to analyze the relationship between network distance and utilization.

As Table 6.33 (Chi-Square Test of Network Distance and Utilization) shows, there is no significant relationship between network-based travel distance and park utilization. The chi-square values associated with one degree of freedom at the 0.005 level is 3.84, while the actual values from the analysis were between .026 and .522. None of the p-values were small enough (i.e. < 0.005) to reach a conclusion of any significant relationship, which is the same for all park types. Therefore, for overall parks, it is concluded that there is no significant relationship between network distance and utilization, which means that even though a park may be the closest to a household, it is not always true that a household will choose to use the closest park. In addition, though showing insignificant p-values, the Phi values for the total park types indicate an extremely low level of correlations (0.012 ~ 0.052) between network distance and utilization; a Phi value of 0 indicates no correlation, with a range of 0 to 1.

Table 6.33: Chi-Square Test of Network Distance and Utilization

Park Types	N	Visit to Closest Parks		Chi-Square Test			Correlations	
		% Yes (n)	% No (n)	Value	df	Sig.	Phi	Sig.
Metropolitan Parks	196	**19.4%** (38)	80.1% (157)	.242	1	**.623**	**.035**	.623
Greenbelts	196	**3.1%** (6)	96.4 (189)	.032	1	**.859**	**.013**	.859
Preserves	196	**2.6%** (5)	96.9% (190)	.026	1	**.871**	**.012**	.871
District Parks	196	**34.2%** (67)	65.3% (128)	.522	1	**.470**	**.052**	.470
Special Parks	196	**0%** (0)	99.5% (195)	n/a	n/a	**n/a**	**n/a**	n/a
Neighborhood Parks	196	**26.5%** (52)	73.0% (143)	.363	1	**.547**	**.043**	.547
Total (mean)	196	(14.3%)	(85.2%)					

Note: Sig. = significant at the 0.005 level

Hypothesis 3 Testing – Utilization Factors and the Relationship of Accessibility & Utilization

Once multiple regression analysis is employed for study, it is possible to gather a great number of independent variables expected to have relationships with or effects on a dependent variable. In conducting a multiple regression analysis, finding a set of appropriate independent variables may be the most fundamental and most important process. Generally, there are two criteria in choosing those independent variables for a multiple regression analysis (Yang-Suk Kang 1996, 113): first, the process of selecting independent variables is to find the variables with (high) correlation with a dependent variable; second, there shouldn't be high correlation or a multicollinearity (= intercorrelinearity) between independent variables, and generally, if Pearson's correlation coefficient is over 0.9, it is considered highly correlated.

Therefore, before conducting multiple regression analyses, it was necessary to look into bivariate relationships between network distances and utilization factors. First, it was necessary to be familiar with how network distances (dependent variable) differentiate according to utilization factors (independent variables) of public parks, and then to find the independent variables to be included in a multiple regression analysis. As mentioned above through tables and diagrams, the differences of network distance between households and public parks were distinctively different according to park type, so the correlation analyses between network distances and utilization factors will be conducted according to the categories of park type after finding correlations between network distances to overall parks and utilization factors. There were big differences in involved utilization factor variables that were significantly correlated with network distances according to park type. Meanwhile, among the six park types, the number of responses for the categories of preserves (n=16) and special parks (n=10) were very low for multiple regression analyses, so for the strength analyses the two park types were changed from the current bivariate analyses to multiple regression analyses.

Preparing for Selecting Independent Variables. For the process of multiple regression analysis, it was necessary to transform some variables or exclude some other variables to strengthen the results of the analyses so that the resulting model may reduce problems associated with low numbers of responses for categories and multicollinearity. Some variable categories were collapsed and some were deleted, as discussed below. These decisions were based on the category response numbers and significant diversity found in the bivariate analyses presented in the previous chapter

Utilization factors used in the current study included a set of socio-demographic variables of age, gender, race, income, length of residence, child home, education level, marital status, and employment status, a group of user factors of frequency of park visit, travel method, travel time, availability of leisure time, fear of crime, information of parks, and overall satisfaction. As described earlier in a series of bivariate analyses, detailed statistically significant relationships were found with the help of descriptive analyses and bivariate correlation analyses. There was a web of intercorrelations, high or low, among utilization factors, but there were no significant high correlations (i.e. Pearson's correlation coefficient over 0.9) to exclude a certain variable before regression analyses. But, as in bivariate analyses, variables with multiple responses were also excluded from a set of independent variables: purpose of park visit, companionship pattern, attractions to park visit, and constraints in park visit.

For greater strength of statistical analyses, some nominal variables were collapsed into ones with smaller numbers of categories. That is, the numbers of non-White population were relatively much smaller than that of White, precluding the significance of any statistical test, so race categories were collapsed into Whites (n=145) vs. non-Whites (n=51) (Blacks, Hispanics and others). Marital status categories were merged into married (n=120) vs. Non-married (n=76) (widowed, divorced, separated and never married). Employment status categories were collapsed into employed (n=133) vs. non-employed (n=63) (unemployment, retired, homemaker and student). Transit method categories were initially nine, but for the same reason that the numbers of households who use "other than driving" in individual categories were small, they were merged into driving (n=137) vs. non-driving (n=59). The independent variables for the multiple regression model and their types and categories are displayed in Table 6.34.

Table 6.34: Summary of Variables for Multiple Regression Analyses

	Variables	Categories (value)	Measures	Types
Dependent				
	Network distance to parks		Miles	Scale
Independent				
Social Factors	Age		Years	Scale
	Gender	female(1), female(0)		Ordinal
	Race	white(1), non-white(0)		Ordinal
	Income level			Ordinal
	Length of residence		Years	Scale
	Child home	presence(1),non-presence (0)		Ordinal
	Education level	over bachelor's(1), under bachelor's(0)		Ordinal
	Marital status	married(1), non-married(0)		Ordinal
	Employment status	employed(1), non-employed (0)		Ordinal
user factors	Frequency of visit			Ordinal
	Transit method	driving(1), non-driving(0)		Ordinal
	Travel time		Minutes	Scale
	Allowed Max. travel time		Minutes	Scale
	Availability of leisure time		Index	Scale
	Fear of crime		Index	Scale
	Information of parks		Index	Scale
	Overall satisfaction		Index	Scale

Utilization Factors and Travel Distance to Overall Parks. Though not very high, there were several utilization factor variables that were correlated with travel distances to parks; race (0.17), length of residence (-0.15), child home (-0.15), transit mode (0.269), travel time (0.302), allowed maximum travel time (0.214), and information of parks (-0.15). As described in the previous chapter that dealt with bivariate analyses between utilization factors, there were no significant correlations between variables that may cause any doubt about multicollinearity, so those seven utilization factor variables were included in the multiple regression analyses following. As Table 6.35 shows, the rest of the utilization factor variables such as age, gender, income, education level, marital status, employment status, frequency of park visit, availability of leisure time, fear of crime, and overall satisfaction were not significantly related to the average travel distances to overall parks that households usually traveled to. As the following analyses will describe, several of these variables were exceptionally related to several types of parks, such that "availability of leisure time" was exceptionally related to the travel distances of greenbelts. "Information of parks" was especially related to the travel distances of neighborhood parks, and "perception of others" was only correlated with the travel distances of district parks.

Table 6.35: Pearson Correlations Significant between Utilization Factors & Travel Distance to Overall Parks

	Average Travel Distance to All Parks (P-value)
Age	
Gender	
Race	0.17 (0.025)
Income	
Length of residence	-0.15 (0.045)
Child home	-0.15 (0.048)
Education level	
Marital status	
Employment status	
Frequency of park visit	
Transit method	0.269 (0.000)
Travel time	0.302 (0.000)
Maximum travel time	0.214 (0.005)
Availability of leisure time	
Fear of crime	
Information of parks	-0.15 (0.045)
Overall satisfaction	

Utilization Factors and Travel Distance to Metropolitan Parks. Of all types of public parks, particularly when households travel to metropolitan parks, the travel distances differed by "**race**", "**length of residence**", and "**transit method**". As Table 6.36 below indicates, according to race, length of residence, and transit method, the average travel distances were significantly different. But, unlike overall parks, "child home", "allowed maximum travel time" and "information of parks" were not significantly related to travel distances to metropolitan parks. And, unlike other park types, "transit method" was only related to the travel distances to metropolitan parks.

Table 6.36: Correlation Significant between Utilization Factors & Travel Distance to Metropolitan Parks

	Average Distance to All Parks	Average Distance to Parks
Age		
Gender		
Race	0.17 (0.025)	**0.17 (0.025)**
Income		
Length of residence	-0.15 (0.045)	**-0.2 (0.01)**
Child home	-0.15 (0.048)	
Education level		
Marital status		
Employment status		
Frequency of park visit		
Transit method	0.269 (0.000)	**0.2 (0.019)**
Travel time	0.302 (0.000)	
Maximum travel time	0.214 (0.005)	
Availability of leisure time		
Fear of crime		
Information of parks	-0.15 (0.045)	
Perception of others		
Overall satisfaction		

Note : 0.000 (0.000) = Pearson correlation (p-value); Underlined = generally related to overall parks but not to the current park type; Underlined = uniquely related to the current park type.

Utilization Factors and Travel Distance to Greenbelts. Among all those six types of public parks, especially when households travel to greenbelts, the travel distances were differentiated by their "**race**", and "**length of residence**", and "**availability of leisure time".** Only availability of leisure time was uniquely related to travel distances to the greenbelts. As Table 6.37 below indicates, people's travel distances were significantly different by age, length of residence, and availability of leisure time. The rest of the variables didn't have any significant relationship to travel distances to greenbelts.

Table 6.37: Correlation between Utilization Factors & Travel Distance to Greenbelts

	Average Distance to All Parks	Average Distance to Parks
Age		
Gender		
Race	0.17 (0.025)	**0.18 (0.037)**
Income		
Length of residence	-0.15 (0.045)	**-0.4 (0.01)**
Child home	-0.15 (0.048)	
Education level		
Marital status		
Employment status		
Frequency of park visit		
Transit method	0.269 (0.000)	
Travel time	0.302 (0.000)	
Maximum travel time	0.214 (0.005)	
Availability of leisure time		**-0.400 (0.017)**
Fear of crime		
Information of parks	-0.15 (0.045)	
Perception of others		
Overall satisfaction		

Note : 0.000 (0.000) = Pearson correlation (p-value); Underlined = generally related to overall parks but not to the current park type; Underlined = uniquely related to the current park type.

Utilization Factors and Travel Distance to District Parks. When households visited the district parks, travel distances were significantly different according to their "**travel time**" and "**perception of others**". As Table 6.38 below indicates, travel time and perception of others were significantly related to the average distance to the district parks. The other variables that were correlated with overall parks such as race, length of residence, child home, transit method, maximum travel time, and information of parks, didn't have any significant relationship to travel distances to district parks. Interesting to note, perception of others was only found to be significantly related to travel distances to district parks among all park types.

Table 6.38: Correlation between Utilization Factors & Travel Distance to District Parks

	Average Distance to All Parks	Average Distance to Parks
Age		
Gender		
Race	0.17 (0.025)	
Income		
Length of residence	-0.15 (0.045)	
Child home	-0.15 (0.048)	
Education level		
Marital status		
Employment status		
Frequency of park visit		
Transit method	0.269 (0.000)	
Travel time	0.302 (0.000)	**0.26 (0.013)**
Maximum travel time	0.214 (0.005)	
Availability of leisure time		
Fear of crime		
Information of parks	-0.15 (0.045)	
Perception of others		**0.21 (0.04)**
Overall satisfaction		

Note : 0.000 (0.000) = Pearson correlation (p-value); Underlined = generally related to overall parks but not to the current park type; Underlined = uniquely related to the current park type.

Utilization Factors and Travel Distance to Neighborhood Parks. Among all types of public parks in the study, particularly when households travel to neighborhood parks, the travel distances differed significantly by "**travel time**" and "**information of parks**". To note, information of parks was only correlated with travel distances, particularly to neighborhood parks. As Table 6.39 below shows, travel time and information of parks were significantly related to the average travel distances to the neighborhood parks. But, comparing those to overall parks, the rest of the variables were not significantly related to travel distances to neighborhood parks.

Table 6.39: Correlations between Utilization Factors & Travel Distances to Neighborhood Parks

	Average Distance to All Parks	Average Distance to Parks
Age		
Gender		
Race	0.17 (0.025)	
Income		
Length of residence	-0.15 (0.045)	
Child home	-0.15 (0.048)	
Education level		
Marital status		
Employment status		
Frequency of park visit		
Transit method	0.269 (0.000)	
Travel time	0.302 (0.000)	**0.25 (0.007)**
Maximum travel time	0.214 (0.005)	
Availability of leisure time		
Fear of crime		
Information of parks	-0.15 (0.045)	**-0.200 (0.020)**
Perception of others		
Overall satisfaction		

Note : 0.000 (0.000) = Pearson correlation (p-value); Underlined = generally related to overall parks but not to the current park type; Underlined = uniquely related to the current park type.

Summary of Relationships between Travel Distances and Utilization Factors. Through a series of bivariate correlation analyses in the categories of several utilization factor variables, significant differences were found among travel distances to the parks. The overview of correlations between utilization factor variables and travel distances are displayed in Table 6.40. As mentioned earlier, parks were analyzed first as a group of overall parks and then according to each park type. Initially, a total of six park types was included, but it was found that park types such as preserves and special parks had too few responses to show any significant relationships, so they were excluded. As the table below indicates, **race**, **length of residence**, **child home**, **transit method**, **travel time**, **allowed maximum travel time**, **availability of leisure time**, **information of parks**, and **perception of others** showed significant relationships with public parks, while age, gender, income, education level, marital status, employment status, frequency of visit, fear of crime, and overall satisfaction did not show any significant relationships with any park types. Park visitor's racial background affected their travel distances to overall parks and, in terms of park type, to metropolitan parks and greenbelts. According to compare- means statistics, Whites had a tendency to travel farther to metropolitan parks and greenbelts than non-Whites. Length of residence was also related to travel distances to overall parks, metropolitan parks, and greenbelts, but the relationship was inversely proportional. That is, as households live longer at the same residence, they tend to travel shorter distances to parks. The presence of child home seems to be correlated with travel distances to overall parks; this relationship doesn't apply to any specific park type but only to overall parks. If there is(are) a child(children) home, it seems that park visitors travel significantly shorter distances to overall parks. According to the transit method people use to go to the parks, the travel distances were significantly different to the overall parks and to metropolitan parks. As people selected driving to go to the parks, their travel distances were significantly longer, but only when they go to metropolitan parks. People's travel time was significantly related to travel distances to almost all park types except to greenbelts. When they go to greenbelts, no matter how long they travel, it didn't significantly affect their travel distance. Maximum travel time households would allow to travel to the parks affected the travel distances to overall parks, but not restrictively to a particular park type. People who are more generous in allowing travel distances to parks tend to travel farther to parks. People's level of availability of leisure time affected only the travel distances to greenbelts. The more leisure time they feel they have, the less distance they traveled to greenbelts.

Meanwhile, visitors' possession of park information seems to negatively affect the travel distances to overall parks, and neighborhood parks in particular; this relationship looks significant. As residents have more information of public parks, they tend to travel shorter distances to overall parks and particularly to neighborhood parks. Finally, it was also found that how park visitors evaluate other park visitors affects their park travel distance. This relationship only reveals itself when they visit the district parks. According to bivariate correlation analysis, perception of others affects people's average travel distance to the district parks. That is, when people evaluate other park visitors higher, they tend to choose the district parks at farther distances from the residence area.

Table 6.40: Overview: Correlations between Utilization Factors & Travel Distances by Park Types

	Overall Parks	Metropolitan Parks	Greenbelts	District Parks	Neighborhood Parks
Age					
Gender					
Race	●	●	●		
Income					
Length of residence	○	○	○		
Child home	○				
Education level					
Marital status					
Employment status					
Frequency of park visit					
Transit method	●	●			
Travel time	●	●		●	●
Maximum travel time	●				
Availability of leisure time			○		
Fear of crime					
Information of parks	○				○
Perception of others				●	
Overall satisfaction					

Note: ● - significantly related; ○ - inversely significantly related

Correlations among Selected Utilization Factors. Table 6.41 below displays the Pearson correlation coefficients among utilization factors found to be significantly related to travel distances to public parks. As described later in multiple regression analyses, due to the size of responded population in the survey (total number = 206), variables having correlation coefficients of over ± 0.1 between them showed the relationship of multicollinearity. According to Table 6.41, independent variables were included in or excluded from regression analyses based on their relative strength of influence on the dependent variable (i.e. travel distance).

Table 6.41: Overview: Correlations among Selected Utilization Factors for Multiple Regression Analyses

	Race	Child home	Length of residence	Transit method	Travel time	Maximum travel time	Availability of leisure time	Information of parks	Perception of others
Race									
Child home	-0.086								
Length of residence	**-0.176**	**-0.136**							
Transit method	0.038	-0.032	-0.018						
Travel time	0.058	**-0.12**	0.039	**0.175**					
Maximum travel time	**0.103**	**-0.119**	-0.03	**0.157**	**0.471**				
Availability of leisure time	-0.002	**-0.189**	0.095	**-0.106**	0.05	0.04			
Information of parks	0.093	0.045	**0.11**	0.018	-0.093	-0.014	**0.192**		
Perception of others	-0.064	0.057	-0.091	0.02	0.036	-0.031	**0.208**	0.041	

Multiple Regression Analyses of the Relationships between Travel Distance and Utilization Factors. This section reviews the process of choosing appropriate independent variables and the results from multiple regression analyses on the relationships between utilization factors and travel distances. The findings are more generally discussed and compared to previous research in the next discussion chapter.

One of the research questions of the current study is whether variation in accessibility measure (i.e. network-based travel distances) is affected by socio-demographic and utilization pattern-based characteristics. Until the previous sections of this chapter, correlations among independent variables were investigated and it was found that there were various kinds of interesting interrelationships among variables through descriptive analyses but none with correlations (i.e. correlation coefficients over 0.9) high enough to cause doubt about any multicollinearity when they are included into multiple regression analyses. Also, bivariate analyses between utilization factor variables and travel distances revealed that part of independent variables affected not only travel distances to overall parks, but also those to different park types (see Table 6.41 above). Based on Table 6.41, each set of independent variables was included in a multiple regression analysis according to the classifications of park type.

(1) Multiple Regression Analyses for Travel Distance to Overall Parks. The findings of the multiple regression analysis of network-based travel distance are presented in Table 6.42. This model accounted for approximately 18.4 percent of the variance in travel distances to overall parks (p=0.000, R^2=0.184). Although the R^2 value seems relatively small, it was described in the research framework with major predictors for park utilization as Promotion and Marketing (Scott & Jackson 1996), Utilization Cost (Scott & Jackson 1996), Service Quality or Service Level (Ottensmann 1994), and Facilities & Programs (Hong 1988) were considered as a constant in the current study. The independent variables for explaining parks utilization were only restricted to park users' characteristics. Table 6.42 below displays the result of a multiple regression analysis for average travel distances to overall parks. The method of entering variables was backward regression method. Durbin Watson's residuals index was 1.869, indicating that there were no significant correlations among residuals, which means that the regression model is valid. If the index is near 0 (+ correlations) or 4 (-correlations), the regression model becomes inappropriate because of the presence of significant correlations among residuals (Woo 2001, 338).

According to the result of an ANOVA test (F=8.823, Sig.=0.000), this multiple regression analysis has proved to be appropriate. As the table shows, four variables out of initial seven variables met the entry requirement to be included into the equation (length of residence, child home, transit method, and travel time) and three other variables didn't meet the entry requirement (allowed maximum travel time, information of parks, and race). The beta values indicate the relative influence of the entered variables on the dependent variable. Transit method (0.238) shows the greatest influence on network-based travel distance, followed by travel time (0.223), length of residence (-0.161), and child home (-0.155). The direction of influence for length of residence and child home were negative, while the rest were positive. The multiple R (0.428) shows a substantial correlation between the four predictor variables and the dependent variable.

Table 6.42: Result of Multiple Regression Analysis (backward) for Travel Distances to Overall Parks

Dependent Variable	Independent Variables	Standardized Coefficients (Beta)	Significance (P-value)	R^2	Durbin-Watson	ANOVA (P-value)
Travel Distance	**res_yr**	**-0.161**	**0.028**	0.184	1.869	0.000
	rnk_cld	**-0.155**	**0.037**			
	rnk_how	**0.238**	**0.001**			
	rank_tak	**0.223**	**0.003**			
	max_tak	0.039	0.624			
	fc_info	-0.091	0.258			
	rnk_rce	0.122	0.126			

Note: res_yr = length of residence; rnk_cld = child home; rnk_how = transit method; rnk_tak = travel time; max_tak = allowed maximum travel time; FC_INFO=info of parks; rnk_rce = race

(2) Multiple Regression Analyses for Network Distance to Metropolitan Parks. As shown in Table 6.43, the model accounted for approximately 8.9 percent of the variance in average network distances to metropolitan parks (p=0.000, R^2=.089). The method of entering variables was forward regression method. Durbin Watson's residuals index was 1.896, indicating that there were no significant correlations among residuals, which means that the regression model is valid, and the result of an ANOVA test (F=6.554, Sig.=0.002) also supported the validity of the regression model. The result of the analysis shows that two out of the four initial variables met the entry requirement to be included in the equation (length of residence, transit method). The rest didn't meet the entry requirement (race, travel time). There is a significant correlation between network distance & race, and travel time & transit method, and in this model the variable, "race" was in relationship of intercollinearity with length of residence, and travel time with transit method, affecting the p-values of both of the two variables. Entering length of residence and transit method only enhanced the strength (R^2) of accounting for the variance in network distances to metropolitan parks. Through the beta values, the relative influence of length of residence (-0.221) was the greatest on network-based travel distances, followed by transit method (0.194). The direction influence for length of residence was negative.

Table 6.43: Result of Multiple Regression Analysis (forward) for Average Travel Distances to Metropolitan Parks

Dependent Variable	Independent Variables	Standardized Coefficients (Beta)	Significance (P-value)	R^2	Durbin-Watson	ANOVA (P-value)
Travel Distance	**res_yr**	**-0.221**	**0.008**	0.089	1.574	0.002
	rnk_how	**0.194**	**0.019**			
	rnk_rce	0.143	0.085			
	rank_tak	0.107	0.196			

Note: dist_mn = average distance to overall parks; res_yr = length of residence; rnk_how = transit method; rnk_tak = travel time; rnk_rce = race

(3) Multiple Regression Analysis for Network Distance to Greenbelts. As shown in Table 6.44, the model accounted for approximately 32.2 percent of the variance in average network distances to greenbelts (p=0.004, R^2=0.322). The forward regressioin method was used to enter variables. Durbin Watson's residuals index 2.187 and an ANOVA test (F=6.660, Sig.=0.004), indicates that the regression model is valid. The result of the analysis shows that two out of three variables met the entry requirement to be included in the equation (race, availability of leisure time); travel time didn't meet the entry requirement. Through beta values, the relative influence of race (0.422) was the greatest on network-based travel distances to greenbelts, followed by availability of leisure time (-0.372). Interestingly, as people have more leisure time available, their travel distances to greenbelts were shorter.

Table 6.44: Result of Multiple Regression Analysis (forward) for Average Travel Distances to Greenbelts

Dependent Variable	Independent Variables	Standardized Coefficients (Beta)	Significance (P-value)	R^2	Durbin-Watson	ANOVA (P-value)
Travel Distance	**rnk_rce**	**.422**	**.011**	0.322	2.187	0.004
	lei avi	**-.373**	**.023**			
	res_yr	-.280	.081			

Note: res_yr = length of residence; lei_avl = availability of leisure time; rnk_rce = race

(4) Multiple Regression Analysis for Network Distance to District Parks. The only variables found to be related to average travel distances to district parks were travel time and perception of others. As shown in Table 6.45, travel time and perception of others were entered into the regression model for the average distance to the district parks. The model accounted for only approximately 7.4 percent of the variance in average network distances to district parks (p=0.035, R^2=0.074). The model used the ordinary method of entering variables into the regression model. Durbin Watson's residuals index, 1.648, and ANOVA test (F=3.475, Sig.=0.035), indicates that the regression model is valid. The result of the analysis shows that only travel time and perception of others could meet the entry requirement to be included in the equation.

Table 6.45: Result of Multiple Regression Analysis (enter) for Average Travel Distances to District Parks

Dependent Variable	Independent Variables	Standardized Coefficients (Beta)	Significance (P-value)	R^2	Durbin-Watson	ANOVA (P-value)
Travel Distance	**vis_take**	**.169**	**.013**	0.074	1.648	0.035
	percept	**.204**	**.048**			

Note: vis_take = travel time; percept = perception of others

(5) Multiple Regression Analysis for Network Distance to Neighborhood Parks. As shown in Table 6.46, the model accounted for approximately 9.6 percent of the variance in average network distances to neighborhood parks (p=0.004, R^2=0.096). Durbin Watson's residuals index 2.157 and ANOVA test (F=5.883, Sig.=0.004), indicates that the regression model is valid. The result of the analysis shows that information of parks and travel time to parks met the entry requirement to be included in the regression equation. Through the beta values, the relative influence of travel time (0.222) was bigger on average travel distances to neighborhood parks than that of information of parks (-0.187). To note, the direction of influence for information of parks was negative, which indicates that as people had more information of parks, their travel distances to neighborhood parks got shorter.

Table 6.46: Result of Multiple Regression Analysis (enter) for Average Travel Distances to Neighborhood Parks

Dependent Variable	Independent Variables	Standardized Coefficients (Beta)	Significance (P-value)	R^2	Durbin-Watson	ANOVA (P-value)
Travel Distance	**vis_take**	**.222**	**.017**	0.096	2.157	0.004
	fc_info	**-.187**	**.042**			

Note: ave6 = average travel disance; fc_info = info of parks; vis_take = travel time.

Summary of Multiple Regression Analyses. This section of the chapter investigated whether the selected utilization factors affect the network-based travel distances to public parks. As previously described, it was found that several utilization factors were significantly related to travel distances when residents choose and use their favorite public parks. The current study identified significant utilization factors (i.e. social factors & user factors) that differentiated travel distances to public parks. Major utilization predictors of public parks such as Promotion and Marketing (Scott & Jackson 1996), Utilization Cost (Scott & Jackson 1996), Service Quality or Service Level (Ottensmann 1994), and Facilities & Programs (Hong 1988) were considered to be constants in the current study, and the independent variables for explaining parks utilization were only restricted to park users' characteristics. Table 6.47 displays the summary of multiple regression models for network-based travel distances to public parks by park type.

Such socio-demographic variables as age, gender, income level, education, marital status, employment status, and such utilization-pattern variables as frequency of visit, fear of crime, and overall satisfaction were not significant predictors of network-based travel distance not only to overall parks, but also to any individual type of public park. Race, length of residence, child home, transit mode, travel time, allowable maximum travel time, availability of leisure time, information of parks, and perception of others were significant predictors for network-based travel distance to public parks. According to park type, the affecting variables were differed. Among those predictor variables, race, length of residence, and travel time were the strongest predictors of travel distance, and they were significantly related to the overall parks and also to at least two or more park types. Race and length of residence were not significantly related to travel distances to district parks and neighborhood parks. It indicates that Whites travel greater distances to overall parks, metropolitan parks and greenbelts than non-Whites, but not to district parks and neighborhood parks. As people live longer at the same residence, they are more likely to travel shorter distances to overall parks, metropolitan parks and greenbelts. This fact doesn't apply to district parks and neighborhood parks.

Meanwhile, having child home does affect travel distance to the overall parks ($\beta = -.155$) and, when they have children home, residents' travel distances to overall parks were significantly shorter. Users' travel time to parks affected travel distance to most of the park types except greenbelts. Interestingly, availability of leisure time only affected travel distance to greenbelts and its direction of influence was negative, so that people with more available leisure time had a tendency to travel shorter distances to greenbelts. Residents' allowable maximum travel time affected travel distance to overall parks ($\beta = .040$), but it didn't extend to other park types. The amount of information that people have about the parks affected travel distance to overall parks and uniquely to neighborhood parks. As residents have more information about parks, they tend to travel shorter distances to neighborhood parks. Lastly, how park visitors evaluate other visitors affected only the average distance to district parks ($\beta = .040$), but was not related to travel distance to any other park types.

Table 6.47: Summary of Multiple Regression Analyses for Network-based Travel Distances to Public Parks by Park Type

		Standardized Coefficients - Beta (bold when p-value < 0.005 and entered into the regression)				
Independent Variables (Dependent Variable : Network-based Travel Distance to Parks)		Over-all parks	Metropolitan Parks	Greenbelts	District Parks	Neighborhood Parks
R^2		.184	.089	.322	.066	.096
Social Factors	Age					
	Gender					
	Race	.111	.143	.422		
	Income level					
	Length of residence	-.161	-.221	-.280		
	Child home	-.155				
	Education level					
	Marital status					
	Employment status					
User Factors	Frequency of visit					
	Transit method	.238	.194			
	Travel time	.223	.107		.169	.222
	Max. travel time	.040				
	Avail. of leisure time			-.373		
	Fear of crime					
	Info. of parks	-.083				-.187
	Perception of others				.204	
	Overall satisfaction					

Hypothesis 4 Testing - Unit of Analysis and the Relationship between Accessibility and Utilization

The fourth hypothesis of the current study is that the strength of the relationship between public services accessibility and utilization is weaker when Census-based Neighborhood boundaries are adopted as the unit of analysis. Previously, in the bivariate analyses of accessibility and utilization factors, the method of measuring accessibility between residents and public parks used each address point of the survey respondents to measure travel distance between the origin (household) and the destinations (public parks). For the analysis of the fourth hypothesis, the unit of analysis for the measurement of travel distance is applied to measure the accessibility from households to the public parks they usually visit. The unit of analysis includes resident-perceived neighborhood boundary and four census-based neighborhood units (i.e., BG-block groups, VD-voting districts, CT-census tracts, and PA-postal areas). For the complexity of calculating the coefficients and the significance of difference between coefficients, the census-based neighborhood units were limited to those four units of different congruity indices, and they cover the whole range of congruity indices ranging from the highest (block group, I_c=74.63) to the lowest (postal areas, I_c=9.37). Though the congruity of neighborhood association boundaries with resident-perceived neighborhood boundaries is the lowest (I_c=1.16), as shown in Table 5.2 (p120, Congruity between Perceived and Census-based Neighborhood Units), it was not included for the analysis of the fourth hypothesis because, as mentioned earlier, the neighborhood association boundaries are mostly overlapping with adjacent boundaries, not being mutually exclusive, and it was not compatible with the method of analyzing the significance between correlation coefficients of accessibility and utilization factors.

According to park type, the accessibilities were measured and the Pearson's r values were calculated through the bivariate analyses between accessibility and utilization factors. Tables 6.48 through 6.52, following, display the correlation coefficients between accessibility and utilization factors by the unit of analysis for the overall parks. As the table indicates, instead of address points, when the units of analysis were applied to measure the accessibility between households and the public parks, the correlation coefficients of the relationships between accessibility and utilization factors look quite similar across all the park types, while the p-values for correlations between accessibility and utilization factors were a little bit bigger than when accessibilities were measured by address points. When compared between p-values of resident-perceived neighborhood boundaries and each census-based neighborhood unit (i.e., BG, VD, CT, and PA), there were no differences in terms of significance and insignificance at the 0.05 significance level.

Table 6.48: Comparison of Correlations by the Unit of Analysis (Overall)

	Correlations with Average Distance to Overall Parks (Sig.)					
	AP	RPNB	BG	VD	CT	PA
Age	-.088 (.247)	-.090 (.238)	-.100 (.188)	-.082 (.284)	-.087 (.256)	-.082 (.285)
Gender	-.036 (.637)	-.027 (.726)	.047 (.537)	.055 (.467)	.046 (.545)	-.031 (.688)
Race	**0.17 (.025)**	**.174 (.022)**	**.164 (.031)**	**.168 (.027)**	**.161 (.035)**	**.165 (.030)**
Income	-.070 (.377)	-.080 (.313)	-.075 (.342)	-.047 (.558)	-.084 (.291)	-.120 (.130)
Length of residence	**-0.15 (.045)**	-.139 (.067)	-.168 (.068)	-.149 (.050)	-.148 (.052)	-.140 (.065)
Child home	**-0.15 (.048)**	-.143 (.061)	-.142 (.062)	-.162 (.064)	-.146 (.054)	-.151 (.057)
Education level	-.101(.186)	-.103 (.176)	-.100 (.189)	-.087 (.252)	-.114 (.134)	-.147 (.152)
Marital status	-.004 (.963)	-.025 (.748)	-.032 (.678)	-.027 (.723)	-.030 (.692)	-.040 (.604)
Employment status	.072 (.346)	.072 (.345)	.067 (.382)	.050 (.513)	.068 (.370)	.071 (.350)
Frequency of park visit	-.075 (.323)	-.064 (.400)	-.060 (.434)	-.062 (.413)	-.068 (.373)	-.051 (.502)
Transit method	**0.269 (.000)**	**.263 (.000)**	**.250 (.001)**	**.252 (.001)**	**.259 (.001)**	**.268 (.000)**
Travel time	**0.302 (.000)**	**.319 (.000)**	**.285 (.000)**	**.286 (.000)**	**.300 (.000)**	**.303 (.000)**
Maximum travel time	**0.214 (.005)**	**.230 (.003)**	**.213 (.005)**	**.206 (.007)**	**.218 (.004)**	**.244 (.001)**
Availability of leisure time	.014 (.860)	.024 (.759)	.005 (.946)	.022 (.784)	.004 (.960)	-.026 (.743)
Fear of crime	-.026 (.733)	-.019 (.800)	-.034 (.658)	-.041(.589)	-.037 (.626)	-.031 (.686)
Information of parks	**-0.15 (.045)**	**-.168 (.027)**	**-.150 (.049)**	**-.157 (.040)**	**-.168 (.027)**	**-.176 (.021)**
Perception of others	-.039 (.606)	-.022 (.773)	-.045 (.561)	-.015 (.840)	-.040 (.599)	-.035 (.649)
Overall satisfaction	.033 (.664)	.040 (.598)	.031 (.685)	.044 (.565)	.038 (.615)	.014 (.854)

Note : AP – Address Points; RPNB – Resident Perceived Neighborhood Boundary; BG – Block Groups; VD – Voting Districts; and CT – Census Tracts; PA – Postal Areas.

Table 6.49: Comparison of Correlations by the Unit of Analysis (Metro. Parks)

	Correlations with Average Distance to Metropolitan Parks (Sig.)					
	AP	RPNB	BG	VD	CT	PA
Age	-.100 (.236)	-.091(.284)	-.105 (.214)	-.107 (.205)	-.090 (.289)	-.079 (.350)
Gender	-.036 (.669)	-.030 (.722)	.013 (.882)	.022 (.796)	-.028 (.746)	-.016 (.848)
Race	**.175 (.037)**	.157 (.063)	.151 (.075)	.167 (.078)	.146 (.084)	.124 (.144)
Income	.002 (.977)	-.028 (.745)	.004 (.961)	.051 (.560)	-.016 (.853)	-.088 (.309)
Length of residence	**-.215 (.010)**	**-.205 (.015)**	**-.214 (.011)**	**-.226 (.007)**	**-.206 (.014)**	**-.183 (.030)**
Child home	-.044 (.603)	-.059 (.486)	-.048 (.573)	-.068 (.427)	-.065 (.448)	-.066 (.440)
Education level	.001(.993)	-.038 (.652)	-.003 (.969)	.017 (.837)	-.034 (.688)	-.112 (.187)
Marital status	.079 (.353)	.039 (.651)	.049 (.569)	.070 (.410)	.049 (.565)	.015 (.858)
Employment status	.009 (.919)	.028 (.745)	.025 (.772)	.032 (.704)	.029 (.735)	.017 (.840)
Frequency of park visit	-.079 (.354)	-.063 (.458)	-.052 (.537)	-.053 (.536)	-.072 (.394)	-.060 (.483)
Transit method	**.197 (.019)**	.178 (.055)	.142 (.093)	.135 (.111)	.166 (.149)	.226 (.117)
Travel time	.133 (.117)	.173 (.061)	.128 (.132)	.119 (.160)	.171 (.154)	.195 (.051)
Maximum travel time	.018 (.839)	.048 (.579)	.016 (.849)	-.011 (.895)	.034 (.691)	.089 (.304)
Availability of leisure time	-.071(.421)	-.068 (.439)	-.069 (.435)	-.050 (.569)	-.068 (.441)	-.100 (.254)
Fear of crime	.038 (.651)	.043 (.613)	.045 (.597)	.030 (.726)	.032 (.711)	.009 (.912)
Information of parks	.023 (.786)	.025 (.769)	.070 (.407)	.059 (.484)	.031 (.718)	.003 (.974)
Perception of others	-.140 (.097)	-.120 (.158)	-.115 (.176)	-.108 (.203)	-.122 (.151)	-.071 (.405)
Overall satisfaction	-.077 (.364)	-.070 (.410)	-.083 (.329)	-.048 (.574)	-.067 (.426)	-.098 (.250)

Table 6.50: Comparison of Correlations by the Unit of Analysis (Greenbelts)

	Correlations with Average Distance to Greenbelts (Sig.)					
	AP	RPNB	BG	VD	CT	PA
Age	-.315 (.074)	-.408 (.073)	-.322 (.077)	-.336 (.065)	-.325 (.074)	-.329 (.070)
Gender	.008 (.964)	.107 (.568)	-.013 (.946)	-.010 (.959)	.024 (.898)	.076 (.685)
Race	**.396 (.025)**	**.501 (.005)**	**.406 (.026)**	**.396 (.030)**	**.410 (.025)**	**.466 (.010)**
Income	.119 (.532)	.062 (.748)	.056 (.774)	.109 (.572)	.118 (.543)	.036 (.855)
Length of residence	**-.447 (.010)**	**-.424 (.020)**	**-.415 (.023)**	**-.424 (.019)**	**-.423 (.020)**	**-.433 (.017)**
Child home	-.085 (.640)	-.096 (.608)	-.163 (.380)	-.166 (.373)	-.174 (.349)	-.179 (.334)
Education level	.262 (.140)	.253 (.170)	.271 (.141)	.289 (.115)	.264 (.150)	.244 (.185)
Marital status	-.119 (.515)	-.193 (.299)	-.201 (.279)	-.197 (.289)	-.205 (.269)	-.172 (.355)
Employment status	.245 (.169)	.343 (.059)	.228 (.218)	.235 (.203)	.258 (.161)	.267 (.146)
Frequency of park visit	.006 (.971)	.073 (.695)	-.004 (.981)	-.014 (.939)	.003 (.985)	-.001 (.995)
Transit method	.292 (.099)	.249 (.176)	.272 (.139)	.276 (.132)	.267 (.147)	.290 (.114)
Travel time	.042 (.815)	.159 (.392)	.177 (.341)	.129 (.490)	.156 (.401)	.122 (.513)
Maximum travel time	.215 (.236)	.141 (.458)	.274 (.143)	.240 (.202)	.264 (.159)	.287 (.125)
Availability of leisure time	**-.414 (.019)**	-.350 (.058)	-.334 (.071)	-.328 (.077)	-.343 (.064)	-.416 (.072)
Fear of crime	-.043 (.814)	-.033 (.859)	-.069 (.711)	-.072 (.699)	-.071 (.705)	-.059 (.752)
Information of parks	-.273 (.130)	-.330 (.075)	-.275 (.141)	-.257 (.170)	-.274 (.142)	-.279 (.135)
Perception of others	.078 (.667)	.173 (.353)	.113 (.546)	.107 (.566)	.116 (.533)	.109 (.560)
Overall satisfaction	-.117 (.523)	.054 (.779)	-.061 (.750)	-.065 (.735)	-.041 (.831)	.011 (.956)

Table 6.51: Comparison of Correlations by the Unit of Analysis (District Parks)

	Correlations with Average Distance to District Parks (Sig.)					
	AP	RPNB	BG	VD	CT	PA
Age	-.083 (.433)	-.023 (.826)	-.030 (.778)	-.016 (.883)	-.029 (.783)	-.034 (.751)
Gender	-.150 (.150)	-.210 (.054)	.201 (.055)	.159 (.131)	-.205 (.051)	-.188 (.073)
Race	.019 (.860)	.061 (.567)	.040 (.706)	.037 (.728)	.064 (.545)	.121 (.251)
Income	.010 (.929)	.011 (.917)	-.017 (.879)	.003 (.977)	-.017 (.878)	.033 (.765)
Length of residence	-.093 (.380)	-.026 (.805)	-.049 (.647)	-.042 (.697)	-.036 (.733)	-.078 (.462)
Child home	-.140 (.181)	-.156 (.137)	-.148 (.158)	-.164 (.118)	-.155 (.140)	-.183 (.081)
Education level	-.158 (.133)	-.121 (.253)	-.129 (.224)	-.121 (.253)	-.134 (.206)	-.126 (.235)
Marital status	-.008 (.939)	-.015 (.885)	-.029 (.784)	-.051 (.631)	-.011 (.921)	-.040 (.705)
Employment status	.051 (.627)	-.001 (.990)	-.001 (.991)	.003 (.974)	.008 (.941)	-.001 (.993)
Frequency of park visit	.009 (.931)	.013 (.900)	.022 (.836)	.055 (.604)	.023 (.829)	.009 (.929)
Transit method	.101 (.337)	.121 (.250)	.118 (.264)	.077 (.467)	.129 (.220)	.080 (.448)
Travel time	**.259 (.012)**	**.264 (.011)**	**.286 (.006)**	**.252 (.015)**	**.264 (.011)**	**.292 (.005)**
Maximum travel time	.190 (.071)	.181 (.089)	.194 (.067)	.171 (.107)	.179 (.091)	.221 (.037)
Availability of leisure time	-.057 (.606)	-.010 (.928)	-.022 (.844)	-.010 (.931)	-.025 (.819)	-.011 (.920)
Fear of crime	.140 (.182)	.158 (.132)	.168 (.110)	.154 (.144)	.159 (.130)	.136 (.195)
Information of parks	-.137 (.194)	-.132 (.219)	-.153 (.153)	-.154 (.150)	-.133 (.215)	-.081 (.451)
Perception of others	.063 (.556)	.025 (.813)	.028 (.796)	.051 (.638)	.034 (.752)	.010 (.922)
Overall satisfaction	.024 (.820)	-.011 (.920)	-.022 (.833)	.009 (.936)	-.016 (.881)	.005 (.964)

Table 6.52: Comparison of Correlations by the Unit of Analysis (Neighbor. Parks)

	Correlations with Average Distance to Neighborhood Parks (Sig.)					
	AP	RPNB	BG	VD	CT	PA
Age	-.078 (.407)	-.068 (.473)	-.064 (.497)	-.057 (.549)	-.058 (.538)	-.083 (.381)
Gender	.150 (.110)	.137 (.148)	-.142 (.133)	-.146 (.121)	.138 (.144)	.157 (.095)
Race	.128 (.175)	.116 (.220)	.108 (.255)	.108 (.255)	.102 (.281)	.133 (.161)
Income	-.154 (.117)	-.142 (.148)	-.149 (.130)	-.128 (.192)	-.124 (.208)	-.158 (.107)
Length of residence	-.010 (.915)	-.003 (.974)	-.003 (.976)	-.001 (.993)	.000 (.999)	-.014 (.880)
Child home	-.026 (.788)	-.036 (.702)	-.034 (.718)	-.050 (.602)	-.042 (.656)	-.027 (.776)
Education level	**-.186 (.047)**	<u>-.184 (.050)</u>	<u>-.179 (.057)</u>	<u>-.177 (.059)</u>	<u>-.174 (.065)</u>	<u>-.179 (.057)</u>
Marital status	-.002 (.985)	.000 (.996)	-.002 (.984)	.000 (.996)	-.003 (.978)	-.014 (.883)
Employment status	-.111 (.240)	-.095 (.315)	-.105 (.268)	-.126 (.185)	-.098 (.300)	-.055 (.565)
Frequency of park visit	.002 (.979)	.018 (.851)	.011 (.906)	.009 (.924)	.005 (.962)	.039 (.679)
Transit method	.155 (.098)	.159 (.090)	.147(.117)	.146 (.118)	.143 (.128)	.172 (.065)
Travel time	**.260 (.005)**	**.224 (.016)**	**.236 (.011)**	**.215 (.021)**	**.204 (.029)**	**.241 (.010)**
Maximum travel time	.076 (.427)	.068 (.478)	.067 (.488)	.072 (.451)	.046 (.630)	.084 (.379)
Availability of leisure time	.074 (.452)	.095 (.335)	.099 (.315)	.111 (.261)	.109 (.268)	.082 (.406)
Fear of crime	.057 (.548)	.046 (.630)	.052 (.584)	.026 (.780)	.036 (.702)	.060 (.527)
Information of parks	**-.218 (.020)**	**-.209 (.026)**	**-.210 (.025)**	**-.203 (.030)**	**-.203 (.031)**	**-.229 (.014)**
Perception of others	-.122 (.198)	-.105 (.269)	-.112 (.239)	-.087 (.361)	-.107 (.257)	-.098 (.302)
Overall satisfaction	.006 (.952)	.018 (.853)	.017 (.860)	.028 (.770)	.015 (.875)	.008 (.937)

Note : AP – Address Points; RPNB – Resident Perceived Neighborhood Boundary; BG – Block Groups; VD – Voting Districts; and CT – Census Tracts; PA – Postal Areas.

Just through Tables 6.48 to 6.52, it is not possible to prove the significance of the difference between correlation coefficients of the relationships between accessibility and utilization factors. Thus, it was necessary to utilize a statistic method to examine the significance of differences between correlation coefficients, and “Fisher’s Z transformation” method was used in the current study.

Fisher's Z Transformation. Generally, this method is used to examine whether r1 is significantly different (or stronger) than r2, when the correlation coefficient of variable A and B is r1 and that of variable A and C is r2. Usually, when a correlation coefficient is calculated, the p-value comes with the correlation coefficient, but it is only to examine the null hypothesis, H_0: r =0. In order to compare two correlation coefficients, the null hypothesis becomes H_0: r1 =r2 and Fisher's Z transformation is employed in this case. Statistically, the sampling distribution of Pearson's r is not normally distributed, so "Fisher's Z transformation" converts Pearson's r to the normally distributed variable Zr. The formula for the transformation is “Zr = .5[ln(1+r) - ln(1-r)]”, and 95% confidence intervals can be achieved by “Zr +/- 1.96[1/sqroot(n-3)]”. If not within this confidence interval, the null hypothesis, H_0: r1 =r2, is rejected, which leads to the conclusion that the difference between the two correlation coefficients is significant. In the Tables 6.53 to 6.57 below, when the calculated P value is less than 0.05, the conclusion is that the two coefficients indeed are significantly different.

Table 6.53: Significance of Difference between Correlation Coefficients by the Unit of Analysis (Overall Parks)

	AP	Zr	Confidence Interval		P-values for H0: Zr = r				
			(-)	(+)	RPNB	BG	VD	CT	PA
Age	-0.088	-0.0383	-0.1790	0.1024	0.9842	0.9052	0.9526	0.9921	0.9526
Gender	-0.036	-0.0156	-0.1564	0.1251	0.9294	0.414	0.3704	0.4196	0.9607
Race	0.17	0.0746	-0.0662	0.2153	0.9677	0.9517	0.9839	0.9276	0.9597
Income	-0.07	-0.0305	-0.1712	0.1103	0.9213	0.9606	0.8206	0.89	0.6201
Length of residence	-0.15	-0.0656	-0.2064	0.0751	0.9121	0.856	0.992	0.984	0.9201
Child home	-0.15	-0.0656	-0.2064	0.0751	0.944	0.936	0.9038	0.968	0.992
Education level	-0.101	-0.0440	-0.1847	0.0967	0.9842	0.9921	0.8896	0.8972	0.6462
Marital status	-0.004	-0.0017	-0.1425	0.1390	0.8365	0.7832	0.8212	0.7983	0.7234
Employment status	0.072	0.0313	-0.1094	0.1720	0.9999	0.9606	0.8283	0.9685	0.9921
Frequency of park visit	-0.075	-0.0326	-0.1734	0.1081	0.9135	0.8823	0.8979	0.9449	0.8129
Transit method	0.269	0.1198	-0.0209	0.2605	0.9494	0.8414	0.8578	0.9159	0.9916
Travel time	0.302	0.1354	-0.0053	0.2761	0.8534	0.855	0.8634	0.9828	0.9914
Maximum travel time	0.214	0.0944	-0.0463	0.2351	0.8687	0.9918	0.9345	0.9671	0.7558
Availability of leisure time	0.014	0.0061	-0.1346	0.1468	0.9217	0.9295	0.9373	0.9217	0.6943
Fear of crime	-0.026	-0.0113	-0.1520	0.1294	0.9451	0.9373	0.8827	0.9139	0.9608
Information of parks	-0.15	-0.0656	-0.2064	0.0751	0.856	0.9999	0.9439	0.856	0.793
Perception of others	-0.039	-0.0169	-0.1577	0.1238	0.8672	0.9529	0.8135	0.9921	0.9686
Overall satisfaction	0.033	0.0143	-0.1264	0.1551	0.9451	0.9843	0.9138	0.9608	0.8519

Note : Zr – Fisher's Z value (transformed coefficient); AP – Address Points; RPNB – Resident Perceived Neighborhood Boundary; BG – Block Groups; VD – Voting Districts; and CT – Census Tracts; PA – Postal Areas.

Table 6.54: Significance of Difference between Correlation Coefficients by the Unit of Analysis (Metropolitan Parks)

	AP	Zr	Confidence Interval		P-values for H0: Zr = r				
			(-)	(+)	RPNB	BG	VD	CT	PA
Age	-0.1	-0.0436	-0.1843	0.0971	0.9289	0.9604	0.9446	0.921	0.8353
Gender	-0.036	-0.0156	-0.1564	0.1251	0.9529	0.6302	0.5687	0.9373	0.8441
Race	0.175	0.0768	-0.0639	0.2175	0.8557	0.8086	0.9355	0.77	0.6082
Income	0.002	0.0009	-0.1399	0.1416	0.7682	0.9843	0.63	0.8596	0.3754
Length of residence	-0.215	-0.0949	-0.2356	0.0459	0.9192	0.9919	0.9096	0.9263	0.7434
Child home	-0.044	-0.0191	-0.1598	0.1216	0.8825	0.9686	0.813	0.8361	0.8284
Education level	0.001	0.0004	-0.1403	0.1412	0.6582	0.6869	0.5488	0.9216	0.5014
Marital status	0.079	0.0344	-0.1063	0.1751	0.6933	0.7673	0.9292	0.7673	0.5285
Employment status	0.009	0.0039	-0.1368	0.1446	0.4907	0.5947	0.6432	0.6222	0.5414
Frequency of park visit	-0.079	-0.0344	-0.1751	0.1063	0.8745	0.7899	0.7975	0.9449	0.8512
Transit method	0.197	0.0867	-0.0540	0.2274	0.8466	0.5779	0.531	0.7528	0.7655
Travel time	0.133	0.0581	-0.0826	0.1988	0.6874	0.9601	0.8889	0.7023	0.5312
Maximum travel time	0.018	0.0078	-0.1329	0.1485	0.768	0.9843	0.7757	0.875	0.4841
Availability of leisure time	-0.071	-0.0309	-0.1716	0.1098	0.9764	0.9842	0.836	0.9764	0.7741
Fear of crime	0.038	0.0165	-0.1242	0.1572	0.9608	0.9451	0.9373	0.9529	0.7756
Information of parks	0.023	0.0100	-0.1307	0.1507	0.9843	0.6435	0.7231	0.9373	0.8442
Perception of others	-0.14	-0.0612	-0.2019	0.0795	0.8416	0.8029	0.7495	0.8572	0.4929
Overall satisfaction	-0.077	-0.0335	-0.1742	0.1072	0.9449	0.9527	0.7749	0.9213	0.8353

Table 6.55: Significance of Difference between Correlation Coefficients by the Unit of Analysis (Greenbelts)

	AP	Zr	Confidence Interval		P-values for H0: Zr = r				
			(-)	(+)	RPNB	BG	VD	CT	PA
Age	-0.315	-0.1416	-0.2823	-0.0009	0.2927	0.939	0.8175	0.9129	0.878
Gender	0.008	0.0035	-0.1372	0.1442	0.3288	0.8366	0.8596	0.8751	0.5032
Race	0.396	0.1819	0.0412	0.3226	0.1956	0.9068	0.9999	0.8696	0.3979
Income	0.119	0.0519	-0.0888	0.1926	0.5723	0.5327	0.9207	0.9921	0.4118
Length of residence	-0.447	-0.2089	-0.3496	-0.0682	0.7804	0.6994	0.7804	0.7712	0.8646
Child home	-0.085	-0.0370	-0.1777	0.1037	0.9132	0.4362	0.4186	0.3736	0.3469
Education level	0.262	0.1165	-0.0242	0.2572	0.9246	0.9242	0.7741	0.9832	0.8502
Marital status	-0.119	-0.0519	-0.1926	0.0888	0.456	0.4081	0.4317	0.3853	0.5947
Employment status	0.245	0.1086	-0.0321	0.2493	0.2914	0.8596	0.917	0.8916	0.8171
Frequency of park visit	0.006	0.0026	-0.1381	0.1433	0.5096	0.9217	0.8442	0.9765	0.9452
Transit method	0.292	0.1306	-0.0101	0.2713	0.6485	0.831	0.8642	0.7899	0.9829
Travel time	0.042	0.0183	-0.1225	0.1590	0.245	0.1788	0.389	0.2575	0.4286
Maximum travel time	0.215	0.0949	-0.0459	0.2356	0.141	0.4526	0.7956	0.6095	0.4501
Availability of leisure time	-0.414	-0.1913	-0.3320	-0.0506	0.4614	0.3604	0.3267	0.4152	0.9811
Fear of crime	-0.043	-0.0187	-0.1594	0.1220	0.9216	0.7978	0.775	0.7826	0.8748
Information of parks	-0.273	-0.1216	-0.2624	0.0191	0.5378	0.9831	0.8658	0.9915	0.9491
Perception of others	0.078	0.0339	-0.1068	0.1747	0.3427	0.7286	0.7738	0.7063	0.7587
Overall satisfaction	-0.117	-0.0510	-0.1918	0.0897	0.0919	0.5791	0.6064	0.4523	0.2067

Table 6.56: Significance of Difference between Correlation Coefficients by the Unit of Analysis (District Parks)

	AP	Zr	Confidence Interval		P-values for H0: Zr = r				
			(-)	(+)	RPNB	BG	VD	CT	PA
Age	-0.083	-0.0361	-0.1768	0.1046	0.5544	0.6014	0.5092	0.5945	0.629
Gender	-0.15	-0.0656	-0.2064	0.0751	0.5423	0.5423	0.9278	0.5768	0.7007
Race	0.019	0.0083	-0.1325	0.1490	0.6794	0.8364	0.8595	0.6578	0.3135
Income	0.01	0.0043	-0.1364	0.1451	0.9922	0.7908	0.9452	0.7908	0.8212
Length of residence	-0.093	-0.0405	-0.1812	0.1002	0.5088	0.6639	0.6147	0.5738	0.882
Child home	-0.14	-0.0612	-0.2019	0.0795	0.8723	0.936	0.8093	0.8803	0.6644
Education level	-0.158	-0.0692	-0.2099	0.0715	0.7108	0.7711	0.7108	0.8096	0.7483
Marital status	-0.008	-0.0035	-0.1442	0.1372	0.9452	0.8365	0.6724	0.9765	0.7531
Employment status	0.051	0.0222	-0.1186	0.1629	0.6092	0.6092	0.637	0.6724	0.6092
Frequency of park visit	0.009	0.0039	-0.1368	0.1446	0.9687	0.8984	0.651	0.8906	0.999
Transit method	0.101	0.0440	-0.0967	0.1847	0.8423	0.8658	0.8121	0.7804	0.8352
Travel time	0.259	0.1151	-0.0256	0.2558	0.958	0.7745	0.9414	0.958	0.7257
Maximum travel time	0.19	0.0835	-0.0572	0.2243	0.927	0.9675	0.847	0.9109	0.7505
Availability of leisure time	-0.057	-0.0248	-0.1655	0.1159	0.6439	0.7305	0.6439	0.7528	0.6509
Fear of crime	0.14	0.0612	-0.0795	0.2019	0.8565	0.7781	0.8882	0.8486	0.968
Information of parks	-0.137	-0.0599	-0.2006	0.0808	0.9601	0.8724	0.8645	0.9681	0.5776
Perception of others	0.063	0.0274	-0.1133	0.1681	0.7084	0.7304	0.9059	0.7752	0.602
Overall satisfaction	0.024	0.0104	-0.1303	0.1511	0.7309	0.6513	0.8828	0.6943	0.8519

Table 6.57: Significance of Difference between Correlation Coefficients by the Unit of Analysis (Neighborhood Parks)

	AP	Zr	Confidence Interval		P-values for H0: Zr = r				
			(-)	(+)	RPNB	BG	VD	CT	PA
Age	-0.078	-0.0339	-0.1747	0.1068	0.9213	0.8901	0.8358	0.8435	0.9606
Gender	0.15	0.0656	-0.0751	0.2064	0.8963	0.936	0.968	0.9042	0.9439
Race	0.128	0.0559	-0.0848	0.1966	0.9047	0.8421	0.8421	0.7958	0.9601
Income	-0.154	-0.0674	-0.2081	0.0733	0.9041	0.9599	0.7944	0.7638	0.9679
Length of residence	-0.01	-0.0043	-0.1451	0.1364	0.9452	0.9452	0.9295	0.9217	0.9687
Child home	-0.026	-0.0113	-0.1520	0.1294	0.9217	0.9373	0.8133	0.875	0.9922
Education level	-0.186	-0.0817	-0.2224	0.0590	0.9838	0.9433	0.9272	0.903	0.9433
Marital status	-0.002	-0.0009	-0.1416	0.1399	0.9843	0.999	0.9843	0.9922	0.9062
Employment status	-0.111	-0.0484	-0.1891	0.0923	0.8738	0.9524	0.8812	0.8973	0.5795
Frequency of park visit	0.002	0.0009	-0.1399	0.1416	0.8751	0.9295	0.9452	0.9765	0.7161
Transit method	0.155	0.0679	-0.0729	0.2086	0.9679	0.9359	0.9279	0.904	0.8638
Travel time	0.26	0.1156	-0.0252	0.2563	0.7071	0.8016	0.6394	0.5608	0.8421
Maximum travel time	0.076	0.0331	-0.1076	0.1738	0.937	0.9292	0.9685	0.7674	0.937
Availability of leisure time	0.074	0.0322	-0.1085	0.1729	0.8354	0.8046	0.7139	0.7288	0.937
Fear of crime	0.057	0.0248	-0.1159	0.1655	0.9137	0.9607	0.7603	0.8362	0.9764
Information of parks	-0.218	-0.0962	-0.2369	0.0445	0.9262	0.9344	0.8775	0.8775	0.9094
Perception of others	-0.122	-0.0532	-0.1940	0.0875	0.8657	0.9207	0.7281	0.8813	0.8114
Overall satisfaction	0.006	0.0026	-0.1381	0.1433	0.9061	0.9139	0.8288	0.9295	0.9843

As the tables above indicate, there was no significance of difference between correlation coefficients of the correlations between accessibility and utilization factors. This applies to all types of public parks. Therefore, at the 0.05 level, the null hypothesis is rejected, which means that the choice of the unit of analysis for measuring the accessibility between households and the public parks doesn't significantly affect the correlation coefficients of the correlations between accessibility and utilization factors. In conclusion, as a unit of analysis, adopting resident-perceived neighborhood boundaries does not significantly enhance the strength of the relationship between public services accessibility and utilization factors more than using census-based neighborhood units.

CHAPTER VII

DISCUSSION AND CONCLUSIONS

The primary purpose of this study was to investigate the effects of Resident-Perceived Neighborhood Boundaries as the alternative unit of analysis to the conventionally used Census-based Neighborhood Units, on accessibility to public parks based on equity consideration and its relationship to residents' park utilization. Finally it was investigated whether or not the neighborhood boundaries perceived by the actual residents exhibit more actual neighborhood construct than Census-based Neighborhood Units where the relationship between parks accessibility and utilization is concerned. To accomplish this, several hypotheses were tested. A summary of the findings, summary of study population and methods, discussion, research implications, and suggestions for future research are presented in this chapter.

Summary of the Findings

The first hypothesis investigated whether or not the choice of the unit of analysis between Census-based Neighborhood Units and Residents-Perceived Neighborhood Boundaries affects the equity in public parks distribution among neighborhoods of different socio-demographic backgrounds. The results of this study suggest that when Resident-Perceived Neighborhood Boundaries are adopted as the unit of analysis instead of Census-based Neighborhood Units, there is no significant change, either in terms of accessibility measures (see Table 5.9), or in terms of the equity of public parks distribution (see Table 5.11) among neighborhoods of different socio strata.

The second hypothesis asked if there is any significantly strong relationship between accessibility to public parks and people's utilization of those parks. Data confirms that there is no significant relationship between parks accessibility (i.e., network distance) and utilization, which means that even though a park may be the closest to a household, it is not always true that the household will choose to use the closest park (see Tale 6.33).

The third hypothesis is that the relationship between public services accessibility and utilization is affected by such utilization factors as age, gender, race, income, length of residence, child home, education level, education level, marital status, employment status, frequency of park visit, transit method, travel time, availability of leisure, fear of crime, information of parks, perception of others, and overall satisfaction. For the purpose of testing this hypothesis, the public parks in study were grouped into 5 classifications: overall parks; metropolitan parks; greenbelts; district parks; and neighborhood parks. The results of this study confirmed that the relationship between parks accessibility and utilization was significantly affected by those utilization factors (see Table 6.47). Particularly, as described in Table 6.47 earlier, accessibility to the parks that households named as their usually-visited public parks is significantly affected by different types of utilization factors. That is, race, length of residence, child home, transit method, travel time, and information of parks affected the relationship between accessibility to and utilization of the overall parks with no classification of park type. Race, length of residence, transit method, and travel time affected the relationship between accessibility to and utilization of the metropolitan parks. Moreover, race, length of residence, and availability of leisure time affected the relationship between accessibility and utilization of the greenbelts. It was also found that travel time and perception of others affected the relationship between accessibility to and utilization of district parks. Lastly, travel time and information of parks affected the relationship between accessibility to and utilization of the neighborhood parks.

The fourth hypothesis examined whether the strength of the relationship between public services accessibility and utilization is weaker when Census-based Neighborhood Units are adopted as the unit of analysis than when Resident-Perceived Neighborhood Boundaries are used. As discussed earlier (see Table 6.53 to Table 6.57), this study confirms that the choice of the unit of analysis for measuring the accessibility between households and the public parks does not significantly affect the correlation coefficients of the correlation between accessibility and utilization factor. In conclusion, as the spatial unit of analysis, adopting Resident-perceived Neighborhood Boundaries does not significantly enhance the strength of the relationship between public services accessibility and utilization more than using Census-based Neighborhood Units.

Discussion

Conventionally, quantitative neighborhood delineation involves the use of multivariate data for small areas, usually drawn heavily on census tracts and augmented by other data sources. Due to the ready availability of data for these units, census tracts and municipally defined service districts have been the groupings most commonly selected (Rich 1982; Coulton et.al. 2001; Martin 1998). These census tracts, roughly 4,000 people on average, are the smallest unit of analysis for the most reliable, detailed socio-economic and demographic data on neighborhoods (Sawichi 1996). Thus, studies doing cross-sectional analyses of cities and neighborhoods normally utilize the census tracts as the unit of analysis (Hughes 1989; Gramlich et al. 1992; Galster & Mincy 1993). The problem noted as the primary reason for this study is the fact that the efforts of delineating neighborhood identities, which emerge from such approaches, frequently do not correspond with those used informally in daily life, or formally in local administration (Martin 1998). In fact, many studies recognize that arbitrarily census-defined, or administrative, neighborhood boundaries are not necessarily real neighborhood boundaries reflecting actual residents' activities across the neighborhoods (Brooks-Gunn, Duncan, Kleanov, & Sealand 1993; Crane 1991; Darling & Steinerg 1997; Duncan & Aber 1997). In practice, much empirical research supports the finding by arguing that perceived boundaries are different from census-based neighborhood units in terms of area, shape and scale (Lee 1968; Martin 1998; Coulton et al. 2001).

In this context, the current study investigated the actual usefulness of Resident-Perceived Neighborhood Boundaries as the alternative unit of analysis (for the distribution of urban public parks) to conventionally-used Census-based Neighborhood Units, in terms of both the equitable distribution of the public parks and people's overall accessibility-related parks utilization patterns.

Equal accessibility to public services across socio-economically and demographically different groups is determined by measuring the equity of urban public services distribution (Gobster 1995, 1998; Dwyer & Gobster 1997; Talen 1998; Talen & Anselin 1998). For measuring accessibility to public services, traditionally, researchers and planners have most often resorted to census-based neighborhood boundary as the unit of analysis because census variables are considered as good explanatory factors to capture the socio-economic characteristics of the residents (Talen 1998). The current study hypothesized that, in measuring accessibility to public services, changing the unit of analysis to Residents-perceived Neighborhood Boundaries would change the accessibility measures and, accordingly, the decisions about equitable distribution of public services in urban areas. As Talen (1999, 544) emphasized the importance of residents-perceived accessibility to public services, one of the objectives of the current study was to see how the adoption of residents-defined neighborhood boundaries as the alternative unit of analysis alters accessibility measures and pre-existing equity in public parks distribution among neighborhoods.

Meanwhile, the distribution of urban public services is one of the central issues in urban planning and development (Erkip 1997, 353). Let alone the equitable distribution of those public facilities, the effective distribution of these services is another focus of concern. As long as the households are heterogeneous in their character, it is difficult to provide such facilities as public parks, like other fixed facilities, while considering the characteristics of those individuals. Fundamentally, parks may be distributed ‘equally’ on a geographical basis, and this situation leads to territorial justice, the aim of which is to distribute services equally on a geographical basis (Lineberry 1977). Though, as Rich (1979) stated, services are equally distributed when everyone gets the same service, the impacts of service allocation may vary with user characteristics, including socio-economic backgrounds, needs, demands, and preferences (Erkip 1997). The question of who goes where requires a distinction between territorial justice – geographically equal – and efficient distribution with respect to the characteristics of citizen groups. Therefore, dominant utilization factors in the utilization of the public parks were first summarized through the literature, then the relationships between physical accessibility (i.e., travel distance) and utilization were explored. Furthermore, through bivariate and multiple regression analyses, it was found that several utilization factors affected the relationship between parks accessibility and utilization. Finally, by means of comparing correlation coefficients, the strength of the relationship between accessibility and utilization were re-analyzed between cases when Resident-perceived Neighborhood Boundaries are adopted and when Census-based Neighborhood Units are used as the unit of analysis for measuring the park services accessibility.

It was concluded that the use of Resident-perceived Neighborhood Boundaries as the alternative unit of analysis (for measuring the accessibility to parks) to Census-based Neighborhood Units, does not significantly affect the equity in the distribution of the public parks (Hypothesis 1 rejected), and does not significantly more clearly explain the relationship between accessibility to and the utilization of the public parks (Hypothesis 4 rejected). However, it was discovered that, though accessibility to public parks does not directly affect the utilization of those parks (Hypothesis 2 rejected), the relationship between accessibility and utilization of each park type is significantly affected by particular park utilization factors (Hypothesis 3 accepted).

The Issue of the Unit of Analysis for Services Allocation. It was critical to investigate the effect of the choice of Resident-perceived Neighborhood Boundaries as the unit of analysis for measuring accessibility to the public services on the equity of the distribution of those public services since it had never actually been studied. The result of testing Hypothesis 1 was expected to give very important iinformation to current practitioners and policy makers regarding public parks allocation. Coulton, et al. (2001, 382) suggested that if researches and policies rely only on census-based definitions, they may misunderstand neighborhood effects because residents' activities are not accurately represented within census boundaries.

Nevertheless, the results of the statistical test for the Hypothesis 1 - the choice of the unit of analysis between Census-based Neighborhood boundaries and Residents-perceived Neighborhood Boundaries affects the equity in public services distribution among neighborhoods of different socio-demographic backgrounds – was rejected and it was concluded that, whether Census-based Neighborhood Units or Resident-perceived Neighborhood Boundaries are used, there is no significant difference in the equity decisions in the distribution of the public parks.

Initially, regardless of whether the hypothesis would be rejected or accepted, that is, even if the Resident-perceived Neighborhood Boundaries will have no affect on the equity in the distribution of the public parks, both results were expected to have important implications for future considerations regarding urban public facilities distribution. Even though the Resident-perceived Neighborhood Boundaries were not found to have an affect on the equity in the distribution of the public parks, practitioners or planners may still gain useful indirect experiences in trying to find the utility of residents' perception of neighborhood construct in park services allocation. As this study suggests, as the unit of analysis for park services allocation, in spite of the probable investment of time and efforts, residents' commonly agreed neighborhood boundaries do not contribute to making differences in park services allocation.

It may be argued that, if other types of accessibility models are adopted, the result of the analysis may vary. As mentioned in the literature review, different accessibility measures may produce different spatial patterns of accessibility and, depending on the concept of access, the distributional equity of public services may vary (Talen & Anselin 1998; Talen 1998). Also, the choice among them has to depend on relevant policy questions (Lindsey, et. al. 2001, 334). As described earlier, the current study considered the characteristics of the Austin public parks and the features that each of the five most widely used accessibility models: four of gravity-based models - gravity model, minimum distance model, travel cost minimization model; container approach (after Talen & Anselin 1998); and covering objectives model (after Nicholls 1999; Sui 1999; Lindsey, et al. 2001). Through considerations mentioned earlier in the methodology chapter, the gravity model was employed, as suitable statistical analyses would be impossible using other types of accessibility models.

Accessibility and Utilization. The second hypothesis was that, "*the accessibility to public services directly affects public services utilization*". In other words, it was hypothesized that urban residents have the tendency to utilize the public facilities closer to the residence when there are services in a variety of distances. In the utilization of public services, not only service level (or service quality) but accessibility is equally important and must be taken equally into account for the assessment of service utilization (Ottensmann 1994, 111). However, the current study assumed that facility-dependent factors are similar all across the parks in Austin, and that those factors do not significantly affect the relationship between services accessibility and utilization .

Through the literature, among the utilization studies of parks facilities, there is no previous research that investigates the direct relationship between park services accessibility and utilization. In the meantime, among the studies of library and health services, there are many previous studies regarding the relation between services accessibility and utilization (Mark, et. al. 1996; Ottensmann 1994l; Zweizig & Dervin 1977; Palmer 1981), but the factors and constraints that affect parks utilization may be different, which was worth further investigation.

As described in detail in the following, the analysis of the relationship between accessibility and utilization precluded any simple generalization because the individual dimension of relationship between accessibility and utilization was totally different from its general dimension of the relationship between distance and utilization. Individually, people preferred closer parks by showing a higher frequency of visit to those parks once they had chosen a group of public parks they usually visit. Yet, from the viewpoint of overall parks, the group of their preferred parks denied any simple description of the relationship between accessibility and utilization, and the relationships were different individually and collectively.

According to the results of this study, individually, park visitors have the tendency to frequent closer parks among the public parks they usually chose (see Table 6.32). If as any of the chosen parks is farther away from the households than the other, they tend not to use the park so frequently. However, this relationship between travel distance and utilization only belongs to descriptive statistics, and is not strong enough to lead to any statistically meaningful conclusion. It may also include some biases as different individuals' behavior of park choices may be more complex. It is clear that, once a household chooses a set of public parks, on the average, they tends to visit closer parks more frequently.

On the other hand, overall, the relationship between accessibility and utilization was investigated by exploring whether households chose the parks closer to the residence. For this analysis, Arvciew 3.2 was used to gather the information showing the parks closest to each residence. The closest park names, acquired by the help of Arcview 3.2 Network Analyst, were compared with the named parks that each survey respondent listed on the survey questionnaire. As Table 6.31 (Travel Distance by Park Type) indicated, as a rule, average distances of public parks are different by park type. Consequently, the relationship between accessibility and utilization was analyzed according to the classification of park type. As Table 6.33 (Chi-Square Test of Travel Distance and Utilization) shows, there is no significant relationship between accessibility and park utilization. Therefore, for overall parks, it is concluded that there is no significant relationship between accessibility and utilization, which means that even though a park may be the closest to a household, it is not always true that the residents will choose to use the park.

Utilization Factors as Mediating Factors. Hypothesis 2 investigated the direct relationship between accessibility and utilization and it indicated that their direct relationship is not so simple as to be generalized. And, as the public parks in Austin are classified into six different types, it also seems to add to the complexity of the generalization. Therefore, the study recognized the need for some mediating factors that would connect the two variables – accessibility and utilization. Through the literature, it was found that there have been studies that explain some aspects of the relationship between accessibility and utilization. When accessibility and utilization were investigated and utilization factors were involved, it was possible to conclude that there was a significant relationship between accessibility and utilization (Ottensmann 1994; Rosenber & Hanlon 1996; Erkip 1997). Most of the utilization factors found in the literature thus far were gathered and included in the statistical analysis for the relationship between accessibility and utilization.

According to the results of this study, significant utilization factors (i.e. social factors and user factors) were found and they differentiated travel distances to public parks.

Resident-perceived Boundaries Vs. Census Units. Through the fourth hypothesis, as the unit of analysis for explaining the relationship between accessibility and utilization, the role of Resident-perceived Neighborhood Boundaries was expected to be of much interest as a contribution to the studies of neighborhood construct and neighborhood effects, as well as to the studies of public participation regarding the pubic services allocation. Even though this study only focuses on a single issue of the effect of Resident-perceived Neighborhood Boundaries on the statistical power of explaining the relationship between accessibility and utilization, as a rare empirical study in the literature, based on the actual households' utilization behaviors made possible by the survey method, the results were expected to show contributions significant enough to impact the literature not only of the neighborhood studies, but also the services allocation pursuing citizen participation.

Using Fisher's Z transformation to test of the significance of the difference between correlation coefficients, the results of this study concluded that there was no significant difference between correlation coefficients of the correlations between accessibility and utilization factors. This conclusion applies to all types of public parks. Therefore, the choice of the unit of analysis for measuring the accessibility between households and the public parks does not significantly affect the correlation coefficients of the correlations between accessibility and utilization factors. Adopting Resident-perceived Neighborhood Boundaries does not significantly enhance the strength of the relationship between public services accessibility and utilization more than using Census-based Neighborhood Units as the unit of analysis.

Ultimately, even though the neighborhood boundary through residents' boundary perceptions is the ideal unit of analysis that might generate more meaningful and relevant settings that more closely represent the neighborhood construct, the current study concludes that finding the Resident-perceived Neighborhood Boundaries, particularly as the unit of analysis for measuring the equity of accessibility to the public parks, does not play any significant role in representing a more real neighborhood construct. However, it is worth noting that the result only applies to explaining the differences of travel distance to the public parks that residents usually choose to visit.

Implications for Practitioners and Policy Makers

The results of the test of this hypothesis give several important implications for the practice of urban public parks distribution.

The Equity Issue of Services Allocation. The accessibility from people's residence to the public parks should not be measured or planned inclusively by a single criterion without the consideration of service recipients' utilization factors (i.e., social factors and user factors). Based on the results of this study, the parks that people usually choose to visit differed considerably from any expectation, and accordingly, the park users' travel distances to the parks seemed totally unpredictable. Yet, it was possible to generalize the actual utilization-reflected travel distances by users' utilization factors. Therefore, in the sense that urban residents tend to use public parks of their own choosing, this study supports the argument that true services allocation may not be based on just the equal services allocations (i.e., territorial justice, geographically equal services distribution), but should rather be based on people's socio-demographic backgrounds and utilization-related characteristics (after Erkip 1997). Also, for the enhancement of the effective utilization of the public parks, planners and practitioners need to have information of about neighborhood constituents (i.e., actual service recipients)' socio-demographic backgrounds and parks utilization-related features through various forms of feedback such as a survey.

Resident-perceived Neighborhood as the Unit of Analysis for Services Allocation. The first and the fourth hypotheses concerned the possible utility of Resident-perceived Neighborhood Boundaries as the alternative unit of analysis for parks allocation to Census-based Neighborhood Units. Through the test of the first hypothesis, whether Resident-perceived or Census-based Neighborhood Units were used did not affect either the accessibility measurements or the social indicators. Also, through the test of the fourth hypothesis, Resident-perceived Neighborhood Boundaries were not found to more strongly explain the parks users' travel distances to the parks they usually utilized. Hence, through the two hypotheses, the Resident-perceived Neighborhood Boundaries could not show the utility of its being the possibly alternative neighborhood unit to Census-based Neighborhood Units, at least when accessibility and its relationship to parks utilization are concerned.

The matter of choosing the spatial unit of analysis for services allocation is closely related to the issues of MAUP and citizen participation. First, in the literature of public services distribution since 1984, originated by Openshaw (1983), the issue of MAUP (Modifiable Areal Unit Problem) has been a very important component of methodological considerations for planners and policy makers. According to MAUP, selecting the appropriate unit of analysis is critical to most spatial analyses because different units of analysis may produce very different results (Openshaw 1983). As Hewko, et al. (2002, 1188) acknowledged, in many cases in the distribution of public services, large predefined spatial units such as neighborhoods are preferred for at least three reasons: first, cities provide services at the neighborhood level; second, operating at the neighborhood level, neighborhood organizations are responsible for administration; and third, detailed socio-economic data are not available at a less aggregate level. Second, as the literature of this study emphasized, the utility of Resident-perceived Neighborhood Boundaries has been much discussed in neighborhood studies. Citizen participation is one of the most important decision making processes in which local knowledge and narratives are captured and incorporated into making the decisions at the neighborhood level (Talen 1999). In this context, the issue of whether the alternative neighborhood unit drawn by the actual resident will make any difference in services allocation and provide important implications for practitioners and policy makers. In conclusion, as the spatial unit of analysis for achieving the equitable allocation in the distribution of the public parks, traditionally used Census-based Neighborhood Units play an effective role as Resident-perceived Neighborhood Boundaries. But among the most commonly used census units included in this study, in terms of the average scale, block groups (Ic=74.6) were the most similar to Resident-perceived Neighborhood Boundaries, while, of the rest of census units, voting districts (Ic=56.6), and census tract (Ic=56.1) were only over 50% congruent with residents-drawn neighborhood boundaries.

Service Area Standards in Services Allocation. Many of the communities of the United States have emphasized parks and open space as an integral part of their land use and comprehensive planning. To determine the locations and the appropriate number of public parks, practitioners utilized the standards and guidelines developed by the National Recreation and Park Association (NRPA) - an independent, non-profit organization whose purpose is to "advocate quality parks for the American people". Both the 1983 *Recreation, Park and Open Space Standards and Guidelines*, and the 1995 *Park, Recreation, Open Space and Greenway Guidelines* published by the National Recreation and Park Association have been generally utilized. In particular, NRPA's 1983 publication included specific acreage and service area recommendations for various types of parks, while its 1996 guidelines acknowledged the importance of the needs and desires of localities and encouraged more flexibility in both size and location in line with unique local factors and desires (Illinois Parks & Recreation 1997). In the years since 1996, the NRPA has strayed from these guidelines, preferring instead that communities establish their own standards to more accurately reflect the needs and desires of local residents. Accordingly, many communities started to determine their own standards by considering the results of public input such as citizen surveys. Throughout Austin, initiated by the city's Planning, Environmental & Conservation

Services Department, neighborhood level plans have been very active since the Austin City Council adopted the Dawson Neighborhood Plan on August 28, 1998 (Austin City Connection 2001). The results of this study were expected to add many practical implications to the practice of services allocation. Most importantly, discovering the actual neighborhood residents' average travel distances to each public park type would contribute to readjusting the service area boundaries based on park types.

As discussed earlier (see Table 5.3), there are four "core" types of parks according to the classification by the NRPA. Based on that, there are six park types: metropolitan parks; greenbelts; preserves; district parks; special parks; and neighborhood parks included in this study. Of these six core parks, only district parks and neighborhood parks were included in the NRPA's standards and this study, so the comparison between the standards and the actual Austin residents' tendency to travel distances would be possible within district parks and neighborhood parks. As normally expected, according to the results of this study, the ranges of people's travel distances to the public parks of various types were totally different from one another (see Table 6.10). For example, the range of people's travel distances to neighborhood parks was between 2.54 and 4.18 and to district parks between 2.74 and 4.01, while the standards by the NRPA recommended a service area boundary of between 0.25 to 0.5 miles for the neighborhood parks and between 0.5 to 3 miles for the district parks in the name of "community parks". Meanwhile, Table 7.1 below shows the minimum and maximum distances to the closest parks classified by the six park types.

Table 7.1: Difference between NRPA's Standards and the Actuality

	Travel Distance to Closet Parks		Travel Distance to Named Parks		NRPA's Standards		PARD's Standards
	Min	Max	Min	Max	Min	Max	Ave
Metropolitan Parks	2.19	5.92	**6.04**	**6.82**			
Greenbelts	0.63	3.33	**5.27**	**5.64**			
Preserves	1.71	6.30	**4.58**	**4.58**			
Special Parks	1.48	6.08	**6.73**	**6.73**			
District Parks	0.78	3.30	**2.74**	**4.01**	0.50	3.00	2.00
Neighborhood Parks	0.19	1.87	**2.54**	**4.18**	0.25	0.50	1.00

Note: Distance Unit = Mile

As seen in the patterns of the minimum and maximum travel distances in this study, Austin citizens' tendency to travel to parks shows that their actual travel distances are much longer than the distances to the closest parks and those standards set by the NRPA. This discrepancy between actuality and the standards may reflect the gap between actual urban residents' parks utilization behaviors and practitioners' conventional methods of public parks allocation. Nonetheless, there are some considerations before drawing to this conclusion.

First, the population that responded to the survey did not fully cover all minority groups, and was not exactly proportional to the racial composition of the city of Austin. At least within the gathered survey data, there were no significant differences in travel distances by different racial groups. The second consideration is that the type of travel distances set by the NRPA's service area standards are straight line-based distances which do not consider the actual patterns of street lines. The current study used the 'network distance' and measured the distance by finding the shortest path applied to actual street network lines. By means of simulating the situation closer to the actual travel time between supply location and demand location rather than using a straight-line distance measure, the accessibility measurement based on network distance is generally accepted as a better approach in accessibility studies (Geertman & Risema Van Eck 1995; Talen & Anselin 1998). As the results of this study indicate, the scale of differences between straight line-based standards and network-based travel distances are too big to reject the conclusion that there is a big difference between the Austin residents' actual travel distances to the parks they usually visit and the parks distributions classified by park type.

Utilization Factors in Services Allocation. Though there may be many concepts of being "equal," generally speaking, the ultimate goal of the public services allocation studies is the equal accessibility to services between the minority and the non-minority groups in the community. Given this, such social factors as race (Talen 1997, 1998), age (Nicholls 1999), gender (Ruddick 1996), and social class such as income level (Erkip 1997), housing property value (Talen 1998)), and population density (Linsey, et. al. 2001) have been the most dominant socio-demographic factors which researcher and policy use to determine fair allocation. One of the fundamental differences in viewing the relationship between social factors and service allocation is that, unlike the traditional way that does not consider the urban residents' actual needs and tendencies to choose their favorite places, this study hypothesized that, according to the unique park utilization factors (i.e., social factors and user factors) that urban residents possess, their travel distances to public parks of their own choosing would be significantly different.

The current study found that part of these traditionally used social factors significantly affected the residents' travel distances to parks, plus other new factors that the literature used to consider "user factors" in people's behavior of parks utilization.

As described in the analysis chapter, among the socio-demographic variables included, only race, length of residence, and child home were significant predictors of network-based travel distance to public parks. Among utilization pattern-related factors (i.e., user factors), transit mode, travel time, allowable maximum travel time, availability of leisure time, information of parks, and perception of others were also significantly related to travel distance to public parks. Age, gender, income level, education, marital status, employment status, and such utilization-pattern variables as frequency of visit, fear of crime, and overall satisfaction were not significant predictors of network-based travel distance to overall parks, as well as to any individual type of public park.

Interestingly enough, all those utilization factors were not unanimously related to people's travel distances to all types of parks, but according to park type, the significantly affecting variables were widely different. Regarding future parks allocation, the implications helpful for practitioners and the planners are as follows:

First, among those predictor variables, race (Pearson correlation =.17), length of residence (-.15), child home (-.15), transit method (.27), travel time (.30), allowable maximum travel time (.21), and information of parks (-.15) were the predictors of travel distance to overall parks without any classification of park type. However, length of residence, child home, and information of parks inversely affected travel distance to parks.

Second, people's racial background only affected travel distance to metropolitan parks and greenbelts. According to descriptive statistics, Whites travel greater distances to metropolitan parks (Whites, 7.11 miles; non-Whites, 5.56 miles) and greenbelts (Whites, 6.51; non-Whites, 2.04), but it does not apply to travel distance to district parks and neighborhood parks.

Third, residents' length of residence also affected travel distance to metropolitan parks and greenbelts. As people live longer at the same residence, they are more likely to travel shorter distances to overall parks, metropolitan parks and greenbelts, but this does not apply to travel distance to district parks and neighborhood parks

Fourth, whether a resident has a child or children in the home does affect travel distance to overall parks without the classification of park types. When people have children in the home, their travel distance (=4.52miles) to overall parks was shorter than that (=5.41miles) when there are no children at home.

Fifth, people's transit method affected travel distance only to metropolitan parks. According to descriptive statistics, when people only drove to parks, they traveled significantly longer distances (=7.17 miles) to metropolitan parks than when they visited parks not only by driving but by other travel methods or by a combination of both (=5.61miles).

Sixth, the maximum travel time that the residents would usually spend traveling to parks affects travel distance to overall parks, but not to any individual park type. The information of people's allowable maximum travel time is the maximum amount of time that park users are willing to allow when they travel to parks.

Seventh, park users' availability of leisure time affected travel distance only to greenbelts, but as they have more leisure time, they tend to choose greenbelts within a shorter travel distance from the residence.

Eighth, according to how much information the residents have, they chose neighborhood parks closer to their residence (rho=-.218, p=.020). It may indicate that people possessing more information about public parks in the community do not have to travel a long distance especially to neighborhood parks. The bivariate analysis between information of parks and park type also shows that information of parks is significantly related to only travel distance to neighborhood parks.

Lastly, according to how well the park users evaluate other park users, their travel distance is significantly different, particularly to district parks. If they evaluate other users higher, they tend to travel a longer distance to district parks. According to the descriptive analysis between utilization factors (see Table 6.17), people's fear of crime and perception of others were significantly inversely related (rho=.30, p=0.00). As people have lower level of fear of crime when they go to parks, they perceive other park users more positively. Then, eventually, it seems when they feel less threatened, they would travel a longer distance to district parks.

PPGIS (Public Participation GIS) in Services Allocation. Most of the research methodology, except for statistical analyses, was based on the use of Geographic Information System. In particular, ArcView Map Calculator was used to define the

Resident-perceived Neighborhood Boundaries to represent the 70% common areas among the constituents in-situ. Measuring the accessibilities from all 206 survey respondents in this study, or from the centroids of all nine types of neighborhood units, to all the 197 public parks in the entire city of Austin would be almost impossible without the use of the Avenue scripts (i.e. a customization language for ArcView) as well as the ArcView SpaceStat extension, as described in the methodology chapter. Also, this study needed the process of spatial aggregation by which all related attribute tables with social characteristics for each of the polygon layers, were spatially aggregated according to the type of neighborhood unit. Without the help of the basic spatial aggregation procedure using the ArcView Table Summerization function, the testing of the effect of the Resident-perceived Neighborhood Boundaries on the equity of parks allocation would have been almost impossible.

These days, in the public services allocation, GIS has become a powerful tool for analyzing and integrating information from a variety of sources ranging from sophisticated geo-referenced data collected from satellites in a diversity of frequencies of the electromagnetic spectrum to simple descriptive information entered through the computer keyboard. GIS is becoming the core information technology of all sectors of society, including the government, NGOs, and corporate information systems (Olivieri, 1995, 23). More recently, during the specialist meeting for NCGIA (National Center for Geographic Information & Analysis)'s Research Institute 19 on GIS and Society starting in February 1996, the question of the role of GIS was raised in the context of GIS becoming more responsive to the needs of broader segments of the society. GIS2 as an extension of the then current geographic information system (i.e., GIS1), PPGIS (Public participation GIS) has become the most widely accepted term for this pursuit. As the term public participation indicates, PPGIS is a widely inclusive way of utilizing GIS to identify all interest groups and invite all such groups to participate in the consensus building process (Sheppard, et al. 1998, 72).

Therefore, it is important to note that in this study the efforts of gathering residents' perceptions of neighborhood environments into a GIS framework is related to an important element of current GIS issue - public participation GIS, or PPGIS (NCGIA 1998; Talen 1999). In line with PPGIS, Talen (1999, 533) argued, "GIS data and analysis at the neighborhood level have proliferated, but they continue to be fundamentally top-down", which means that government-generated data are only available at the local neighborhood level. As Talen (1999) argued, the bottom-up approach is a new component of current GIS, by which GIS data can be produced by residents rather than by government agencies. There is also a need to use GIS in studying residents' perceptions of local neighborhood environments. In this study, the Resident-perceived Neighborhood Boundaries were proposed as the alternative spatial unit of analysis for park services allocation to the conventionally used Census-based Neighborhood Units. The current study is expected to be a good exemplary effort to substantiate a PPGIS, though the Resident-perceived Neighborhood Boundaries did not exhibit any significant difference, not only in the equity of the parks allocation, but also in exhibiting more real neighborhood construct. Additionally, the trials and errors of this study in finding the actual residents-perceived consensus areas as an alternative neighborhood unit, in re-interpreting the pre-existing equity in public services allocation, and in trying to understand the urban residents' current behavior in public parks utilization under the basis of new consensus areas (i.e., Resident-perceived Neighborhood Boundaries), would trigger and form the basis of similar consensus-building processes in public services decision-making.

Suggestions for Future Research

The research concluded here has provided a detailed explanation of the effects of the Resident-perceived Neighborhood Boundaries on public parks accessibility and their relationship to parks utilization with the help of a GIS and other statistical analysis tools. It is hoped that such a trial will encourage the public facilities professionals to increase their adoption of the actual residents' participation as a means of better understanding and serving the constituents in their community. Meanwhile, the analyses of this study have also exposed a variety of possibilities of other objectives and issues that might be considered for future follow-up studies in public services allocation and public participation.

Difference of Significant Utilization Factors by Park Type. In this study, the results of the bivariate and multiple regression analyses indicated that utilization factors showing significant effects on park visitors' travel distance to parks, were very different according to park type. Public parks accessibility studies focusing on the relationship between accessibility and utilization factors have not raised the issue of different characteristics of pubic parks by park type. Moreover, the park type most frequently used in parks accessibility studies with relation to parks utilization would be neighborhood park (e.g., Mutter 1985; Erkip 1997). Possibly because people belonging to minority groups conspicuously chose the parks closer to their neighborhoods, and because, among park types, only neighborhood parks exhibited the strongest social and spatial construct of living environment.

The actual means of distinguishing the reasons why part of the utilization factors affect only specific park types is, however, beyond the scope of this study, since it would involve a great deal of subjectivity; and one of the basic assumptions of this study was that facility-dependent factors do not significantly affect the relationship between accessibility and utilization of the public parks. If the differences in significant utilization factors by park type are to be investigated, it would be helpful to identify exactly how many facilities each park type averages and what kind of park facilities the park users prefer according to their utilization factors.

Difference between Public Facilities. The current study only focused on public parks in the city of Austin. According to Ottensmann's (1994, 110) classification of public services, there are three very different kinds of services provided publicly: services based on non-fixed infrastructure (e.g., police patrol, and street sweeping), services based on physically fixed infrastructure (e.g., parks, libraries, and hospitals), and services based on network infrastructure (e.g., streets, sewers, and electricity). Unlike the first and third types of public services, the physically fixed services mainly involve travel to and from public facilities, so these kinds of services are included when the equity issues of public services are raised. But even within the physically fixed services, many services are often so different as to be incompatible with each other even within a single research framework. The issue of the accessibility to these services also involves the more complex problem of quality and level of services provided (i.e., facility-side factors in utilization) (Ottensmann 1994).

With relation to the MAUP problem, it is obvious that the effect of Resident-perceived Neighborhood Boundaries on the equity of other physically fixed services allocation will be insignificant because, whatever public services are involved, the MAUP problem is only up to the scale and zone of the unit of analysis in the study (Openshaw 1983). Nonetheless, regarding the relationship between accessibility and utilization, changes in different public services may show quite different aspects of the relationship between accessibility and utilization.

Considering Utilization Factors & Facility Factors Together. In the literature of facility-side factors for explaining people's public services utilization behaviors, such factors as Operation Strategies (Scott & Jackson 1996), Programs and Facilities (Hong 1988), Promotion and Marketing (Scott & Jackson 1996), Utilization Cost (Scott & Jackson 1996), and Service Quality or Service Level (Ottensmann 1994) have been discussed. As described in the introduction, one of the assumptions of this study was that such facility-dependent factors do not significantly affect the relationship between accessibility and utilization of the public parks. It may not be possible to determine whether those facility factors would affect the relationship between accessibility and utilization may not be possible without considering the utilization factors. In this sense, involving both the utilization factors and facility factors in a research framework showing the relationship between accessibility and utilization would be the next step beyond this study. It may require a deep understanding and a wide literature review of both user and facility factors. There may also need to be an investigation to determine why certain utilization factors restrictively affect park users' travel distances to parks of a specific type.

Concept of Distance to Measure Accessibility. In this study, physical distance was used as the major criterion by which accessibility was measured. In the literature of public services studies, the levels of accessibility were decided under the basis of various types of distance concepts: 'straight-line distance ("as the crow flies")', 'network distance', 'travel-time distance', etc. The current study used the 'network distance', which is measured by finding the shortest path applied to the actual street network lines. Instead of a network distance-based mode of accessibility, by using other modes of travel distance, the results of this study may or may not change. Comparing the results of the questions raised in this study with cases using different distance concepts would be interesting. Furthermore, when differences in results are found, more appropriate modes of travel distance may be proposed for the studies on effects of Resident-perceived Neighborhood Boundaries as an alternative neighborhood unit for public services allocation.

Meanwhile, in the information society of our time, the concept of accessibility can be much more diversely operationalized and measured. For example, emphasizing the important role of resident-generated GIS in neighborhood planning, Talen (1999, 544) pointed out the possibility that the actual residents' experiences of accessibility can be different from that based on objectively determined measures of physical distance. She proposed a complementary approach where residents construct their own cognitive maps of accessibility through the visualizing power of GIS and multimedia. Thereby, if the residents' perceived or experienced accessibility or inaccessibility is different from objectively measured ones, this phenomenon could be investigated. As mentioned by Nicholls (1999), for example, subjective perceptions resulting from perceptual factors such as the “visibility” of the facility, residents’ levels of knowledge about it, and the number of street crossings to the facility, could become much more important in accessibility studies. Sheppard, et al. (1998), also, proposed a new mode of seeing the concept of accessibility in a totally different manner. They criticized the shortcomings of the current models of accessibility by saying that, “current modes are based on physical notions of distance and connectivity that are insufficient for understanding new forms of structures and behaviors characterizing the information age.” To this end, they proposed that “geographical and planning models incorporate measures that reflect restructuring of geographical space and space-time differentials in accessibility to virtual network” (Sheppard, et al. 1998, 61).

Longitudinal Studies. Following the current study, one of the valuable directions for future research would be the time-series reanalysis of the levels of accessibility and equity in park services allocation in the city of Austin. In the framework of this study, the effect of Resident-perceived Neighborhood Boundaries on the accessibility and equity of park services allocation can be reinterpreted once the citizens' behaviors of choosing their favorite parks change and once their perception of neighborhood areas is changed for some reasons, as well. For example, such future changes as new housing development, town-in-town redevelopment, population growth/decline, urban sprawl, or minority influx, could become a catalyst to give impetus to the changes of urban structure, which in turn may change people's patterns of park use and their perception of their neighborhood environment. Ever since 1990, the population of Travis County has sharply increased from 576,000 to 812,000, according to the U.S. Census 1999 and 2000. During the decade, there has been an abrupt change in ethnicity. Minority population predominance has continuously expanded throughout the eastern sector of the region, and middle class African-American households are leaving east Austin for the outskirts and are being replaced by Hispanic households (Austin City Connection 2001, http://www.ci.austin.tx.us/census/reports.htm). Moreover, these trends are expected to be accelerated as the city of Austin becomes one of the fastest growing cores of hi-tech industry.

Application of WebGIS as Public Participation Tool. The current study utilized the structured questionnaire in the form of a survey by which the neighborhood residents in the study area passively contributed to the data gathering regarding their perception of neighborhood boundaries and their individual parks utilization behaviors, as well as basic socio-demographic information. Generally, survey research involves the collection of information from a sample of individuals through their responses to questions. The survey method is an efficient study method in the sense that it systematically collects data from a broad spectrum of individuals and social settings. Attractions of survey research include its efficiency and simple generalizability (Schutt 2001, 209). That is, data can be collected from a lot of people at a relatively low cost, and a survey is often the only research method available for getting a representative look at a large population. Though most widely utilized in social studies, survey research is carried on in spite of many drawbacks. Particularly, in the case of a mailed, self-administered survey, as used in the current study, its success is dependent on maximizing the response rate. Without enough response rate, the efficiency of the method and the generalizability of the study results are at risk. Also, the survey method requires a longer time period than other study methods to achieve high response rates. And, it also needs to be data-coded into statistical tools, even after full returns at successful rates.

In the present information age, as an alternative research method, the current study would like to propose the adoption of WebGIS (Web-based Geographic Information System) in public services allocation. WebGIS refers to the existing and emerging computer technology of realizing spatial mapping and GIS (Geographic Information Systems) functionality on the Internet. Also called ‘online GIS’, ‘distributed GIS’, or ‘Internet mapping’, WebGIS has great potential. It enables worldwide accessibility from anywhere at any time to GIS data and services; it shows no need for proprietary GIS software for users to enjoy the GIS functionality on the web; and it is normally independent of platform type, so regardless of the platform, if any kind of non-text web browser (e.g., typically Internet Explorer, Netscape, or else) is available, WebGIS-supported internet services and data sharings are available. Specifically, WebGIS enables place and time-independent accessibility to a wide variety of information and spatial data. The use of interactive web mapping technology also realizes more effective services delivery based on place-specific spatial locations

In particular, in the practice of public services allocation, most accessibility decisions based on equity considerations are restrictedly related to physically fixed geographically referenced public services such as libraries, parks, hospitals, and recreation facilities. A GIS is an organized collection of computer hardware, software, and geographic data which efficiently stores, analyzes and displays various geographically- referenced information (Ormsby & Jonell 1999). As Chang (1997) argued, together with the advantages of the Internet, GIS could be useful in allowing many more grassroots organizations to have access to GIS functionality, and it may enhance public participation in the planning decision making process. It is entirely possible that a WebGIS will play an important part in the development of PPGIS (Public Participation GIS (Nyerges & Barndt 1997). Though discussed in a different term, 'resident-generated GIS', Talen (1999) also emphasized the future role of GIS as an important method of enhancing public participation in the planning process. Through an Internet-based project (i.e., Neighborhood Evaluation using GIS, Http://www.urban.uiuc.edu/faculty/talen/GISweb/main.html), she indicated the utility of WebGIS as a successful tool to survey neighborhood residents' evaluation of their local environment.

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APPENDIX 1

SURVEY BOOKLET

Survey on

Austin Public Parks Utilization &

Neighborhood Delineation

Department of Landscape Architecture and

Urban Planning

Texas A&M University

USE OF PUBLIC PARKS

How useful are the public parks in Austin? For as many locations as you usually visit, please answer how often you usually use the parks, and how good you think the services are. When answering each question, **you may wish to refer to the *PARKS INVENTORY* listed on pages 11-15**. Even if the list doesn't include the parks you use, please specify the names of your parks.

1. In general, how frequently per month do you visit public parks in Austin?

☐ more than 4 times / month ☐ 2 times / month
☐ 4 times / month ☐ 1 time / month
☐ 3 times / month ☐ less than 1 time / month

2. With Whom do you usually go to visit public parks?

☐ Friends ☐ Neighbors ☐ Family ☐ your child
☐ self (alone) ☐ Relatives ☐ Other (Specify : _______________)

3. How do you usually travel to public parks? (check one only)

☐ Drive ☐ Walk ☐ Jog ☐ Bicycle
☐ Public transportation ☐ Other (Specify: __________ *Never*

4. How long does it usually take you to travel to public parks? __________ Minutes

5. How long would be the maximum amount of time you would spend on traveling to public parks? ___________ Minutes

6. How much leisure time do you usually have? Do you feel that:

a. you usually have too many family obligations to spend on leisure activities?

None |——|——|——|——|——|——| *Very Much*

b. you usually have enough time available to spend on leisure activities?

None |——|——|——|——|——|——| *Very Much*

7. How many hours per month do you think you usually spend on leisure activities?

__________ hours / month

8. When you visit public parks, how safe do you feel from crimes like being attacked or held up? (Please mark an "**X**" on the following scale.)

Very Unsafe |——|——|——|——|——|——| *Very Safe*

9. When you visited the public parks, did fear of crime ever cause you to:

a. stop or change activities?

Never |——|——|——|——|——|——| *Very Often*

b. change park locations?

Never |—|—|—|—|—|—| *Very Often*

c. avoid certain areas of the park?

Never |—|—|—|—|—|—| *Very Often*

d. take any preventive measures? (such as to refrain from carrying excess cash or expensive jewelry)

Never |—|—|—|—|—|—| *Very Often*

e. feel that the park police has to be reinforced?

Never |—|—|—|—|—|—| *Very Often*

10. How much information do you have:

a. about the <u>Locations</u> of the parks in Austin?

None |—|—|—|—|—|—| *Very Much*

b. about the <u>Programs</u> the parks provide?

None |—|—|—|—|—|—| *Very Much*

c. about the <u>Activities</u> the parks provide.

None |—|—|—|—|—|—| *Very Much*

d. about the <u>Facilities & Equipment</u> the parks provide.

None |—|—|—|—|—|—| *Very Much*

11. How do you feel about other users when you visit the parks?

a. Are you happy sharing the parks with other users?

Never |—|—|—|—|—|—| *Very Often*

b. Do others make you feel comfortable?

Never |—|—|—|—|—|—| *Very Often*

c. Do others make you feel threatened?

|—|—|—|—|—|—| *Very Often*

d. How often do you witness inappropriate behavior of other users?

Never |—|—|—|—|—|—| *Very Often*

12. What activities do you usually enjoy at public parks in Austin? (<u>check all that apply</u>)

☐ Meet with people ☐ Observe Nature ☐ Walk or hike
☐ Walk dog ☐ Picnic ☐ Fish
☐ Swim ☐ Run or jog ☐ Bicycle
☐ Tennis ☐Attend concerts ☐ Relax and enjoy open space
☐ Children's play ☐ Other (specify: ____________, ______________)

13. What types of programs, or facilities would you like the public parks to provide more of? (ex: concerts, festivals, fitness center, etc.)

____

____

14. Overall, how satisfied are you with the public parks in Austin?

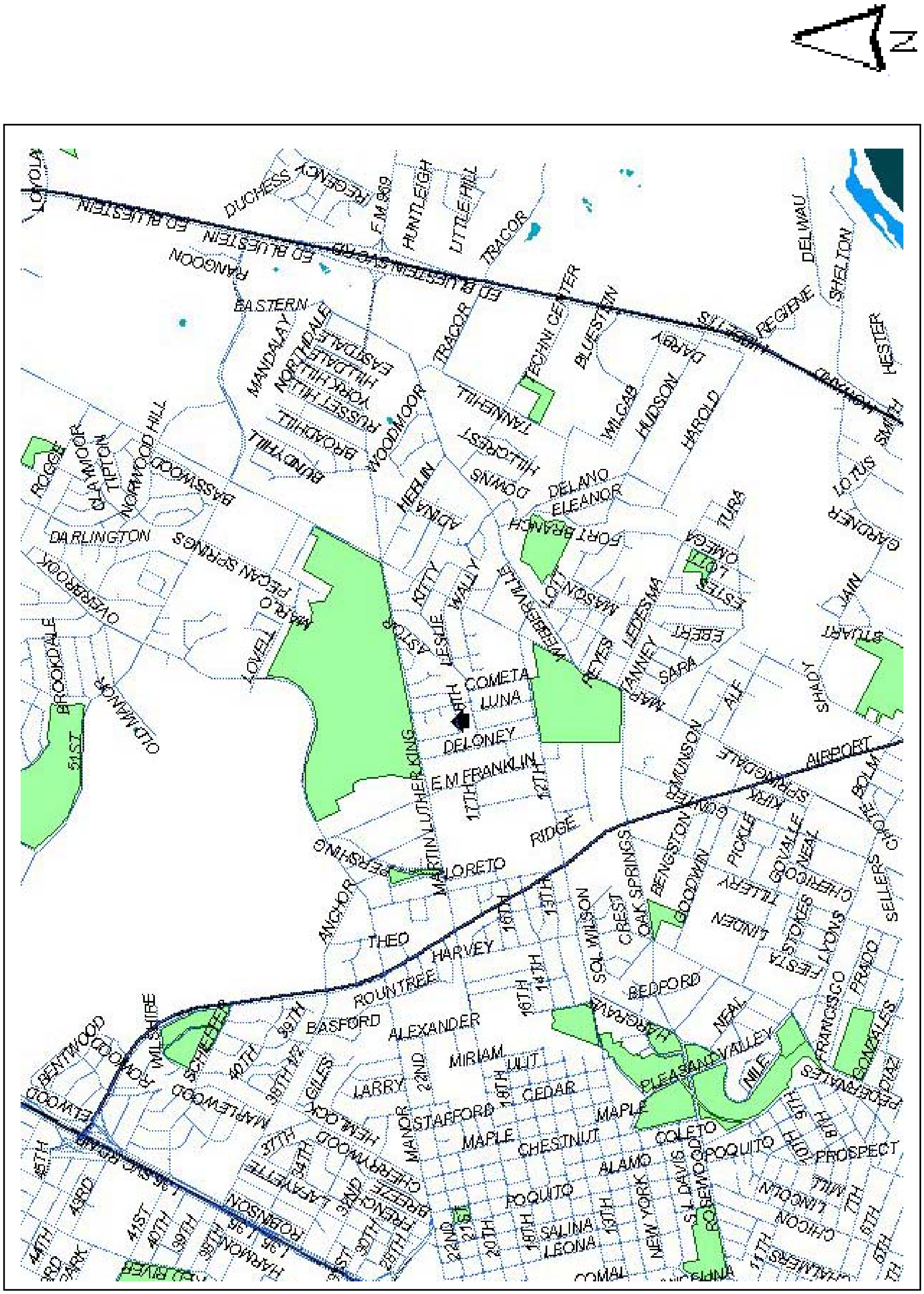
Very Unsatisfied |—|—|—|—|—|—| Very Satisfied

NEIGHBORHOOD DELINEATION 

15. In general, what words would you use to describe your neighborhood to total strangers? In other words, how is your neighborhood different from other neighborhoods?
(i.e. quiet, mostly older, all good neighbors, well-kept yards, safe, deteriorating, lots of kids, etc.)
____
____
____

16. What elements of your neighborhood do you think are the most distinctive or stand out the most? (i.e. buildings, public facilities, open space, roads, etc.)
(1) ____
(2) ____
(3) ____
(4) ____
(5) ____

17. [IMPORTANT] Please, draw a boundary around the specific edges of your neighborhood on the following map (next page). In other words, if you were going to show a total stranger around your neighborhood, what would be the Boundary of your Neighborhood on the map?
(Your perception of your neighborhood boundary is very important for the current survey. Please don't skip this process! Your residence is at the center of the map.)


N
LOYOLA
ED BLUESTEIN
DUCHESS
REGENCY
F.M. 969
HUNTLEIGH
LITTLE HILL
TRACOR
RANGOON
EASTERN
MANDALAY
NORTHDALE
TECHNI CENTER
BLUESTEIN
DELWAU
SHELTON
HESTER
DARBY
REGIENE
WILCAB
HUDSON
HAROLD
TANNEHILL
HILLCREST
WOODMOOR
BROADHILL
RUSSET HILL
YORK HILL
HILLDALE
EASTDALE
NORWOOD HILL
TIPTON
CLAYMOOR
ROGGE
BASSWOOD
BUNDYHILL
HEFLIN
ADINA
DOWNS
DELANO
ELEANOR
FORT BRANCH
TURA
LOTUS
SMITH
GARDNER
DARLINGTON
PECAN SPRINGS
OVERBROOK
KITTY
WALLY
MASON
LOTT
OMEGA
ESTES
JAIN
STUART
MARLO
LOWELL
BROOKDALE
OLD MANOR
ASTOR
LESLIE
LEDESMA
REYES
ERERT
SARA
JANNEY
ALF
SHADY
COMETA
LUNA
DELONEY
E M FRANKLIN
12TH
17TH
ROBINSON
SPRINGDALE
AIRPORT
BOLM
51ST
KIRK
PERSHING
MARTIN LUTHER KING
LORETO
RIDGE
BENGSTON
OAK SPRINGS
CREST
GOODWIN
PICKLE
TILLERY
GOVALLE
NEAL
CHERRYWOOD
SELLERS
ANCHOR
THEO
HARVEY
16TH
13TH
SOL WILSON
LINDEN
STOKES
LYONS
FIESTA
PRADO
ROUNTREE
14TH
BEDFORD
FRANCISCO
GONZALES
BASFORD
ALEXANDER
WILSHIRE
BRENTWOOD
HARGRAVE
NEAL
PLEASANT VALLEY
NILE
MIRIAM
LARRY
22ND
19TH
CEDAR
MAPLEWOOD
40TH
GILES
DIAZ
STARFORD
MAPLE
CHESTNUT
COLETO
PROSPECT
MANOR
ALAMO
POQUITO
ROSEWOOD
S.L. DAVIS
NEW YORK
LINCOLN
CHICON
ELMWOOD
45TH
43RD
41ST
LAFAYETTE
ROBINSON
HARMON
SALINA
LEONA
COMAL
CHALMERS
44TH
PARK
RED RIVER

18. [IMPORTANT] Please don't skip this process! What are the names of the public parks you usually visit in Austin in order of frequency? *[You may wish to refer to the PARKS INVENTORY enclosed.]*

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

19. Why do you like to use the public parks you listed above? (check all that apply)

☐ Operation times
☐ Low or no utilization cost
☐ Good Facilities / equipment
☐ Good maintenance
☐ Close to workplace
☐ Good promotion / marketing
☐ Good Programs
☐ Good natural environment
☐ Close to home
☐ Cleanliness
☐ Good at providing information on facilities/programs
☐ Facilitating Activities that meet my needs (i.e. jogging, fishing)
☐ Available public transportation
☐ Public safety (less or no fear of crime)
☐ Uniqueness (personally meaningful in memory)
☐ Good perception of other users
☐ Other (specify : ______________________________
____

20. What are the constraints that prevent you from using the public parks of Austin more frequently? (check all that apply)

☐ Fear of crime
☐ No one to go to the parks with
☐ Poor Programs
☐ My poor health
☐ Operation hours are limited
☐ Lack of facilities/equipment
☐ Too crowded
☐ The staff is unfriendly
☐ Poor Facilities / equipment
☐ Location is too far away
☐ Lack of activities/programs
☐ Poor maintenance
☐ Negative perception of other users
☐ No way to go to the facilities
☐ Lack of time to enjoy leisure activities
☐ Pursue recreation in areas other than parks facilities
☐ Lack of information about existing parks and facilities
☐ Lack of information about programs the facilities provide
☐ Public transportation is not easily available.
☐ Utilization cost is too much (i.e. fees are too much.)
☐ Overdeveloped (not enough natural environment)
☐ Only for children (no or few adult programs or facilities)
☐ Other (Specify: ______________________________)
____
____

BACKGROUND INFORMATION

21. What is your age? _________ years old

22. What is your gender? ☐ Female ☐ Male

23. What is your race? ☐ White ☐ Black ☐ Hispanic ☐ Asian ☐ Other
24. What is the total household income before taxes?
    ☐ Under $20,000 ☐ $40,001-$60,000 ☐ Greater than $80,000
    ☐ $20,001-$40,000 ☐ $60,001-$80,000

25. About how long have you lived at this residence? ______ Years ______ Months.

26. Do you own or rent this home? ☐ Own ☐ Rent ☐ Other

27. Do you own a car? ☐ Yes ☐ No

28. What is the highest level of education you have achieved?
    ☐ Less than high school ☐ Bachelor's degree
    ☐ High school / GED ☐ Masters' degree or higher
    ☐ Community college / Technical School

29. Do you have a child living at home? ☐ Yes ☐ No

30. What is the age of your youngest child living at home? ____ Years____ Months

31. How many people in your home are in the following age groups?
    0 – 5 years old: _________ 36-55 years old:_________
    6-17 years old: __________ 56-64 years old:__________
    18-25 years old: _________ 65 and older:_________
    26-35 years old:__________

32.What is your marital status?
    ☐ Married ☐ Widowed ☐ Divorced ☐ Separated ☐ Never married

33. Are you currently:
    ☐ Self-employed or employed by someone else (Full or part-time)
    ☐ Unemployed ☐ Retired ☐ Homemaker ☐ Student

34. If you are currently employed, how long have you been working at your workplace? _________ Years ________Months

35. If you are currently employed, working outside the home, and if you ever visited any park near your workplace, what are the names of those public parks? *[You may wish to refer to the PARKS INVENTORY enclosed.]*

____

____

APPENDIX 2

AUSTIN PUBLIC PARKS INVENTORY

Park Name	Type	Address	Town Area	Acres
Adams-Hemphill Park	neighborhood park	201 W. 30th Street	NE	8.96
Alamo Park	neighborhood park	2100 Alamo Street	NE	1.87
Andrews Playground	neighborhood park	6601 Northeast Drive	NE	3.27
Armadillo Park	neighborhood park	910 Armadillo Road	S	2.42
Austin's Colony Park	neighborhood park	14517 Lippincott Drive	NE	9.29
Bailey Park	neighborhood park	1101 W. 33rd Street	NW	2.3
Balcones District Park	district park	12017 Amherst Drive	NW	51.69
Barrington Playground	neighborhood park	400 Cooper Drive	NE	8.02
Barrow Preserve	preserve	7715 Longpoint Drive	NW	7.6
Bartholomew District Park	district park	5201 Berkman Drive	NE	57.21
Barton Creek Greenbelt	greenbelt	3755-B Capital of Texas Hwy.	TL	1,770.85
Barton Creek Wilderness Park	greenbelt	2631 S. Capitol of Texas Hwy.	TL	1021.85
Barton Hills Playground	neighborhood park	2108 Barton Hills Dr.	TL	4.76
Battlebend Park	neighborhood park	4600 Suburban Dr.	S	4.9
Bee Creek Nature Preserve	preserve	3602 Red Bud Trail	NW	30
Beverly S. Sheffield Northwest District Park	district park	7000 Ardath St.	NW	30.75
Big Stacy Park	neighborhood park	700 E. Live Oak St.	S	3.31
Big Walnut Creek Greenbelt-East	greenbelt	2611 Park Bend Rd.	NE	279.18
Big Walnut Creek Greenbelt-North	greenbelt	2611 Park Bend Rd.	NE	279.18
Big Walnut Creek Greenbelt-Northeast	greenbelt	2611 Park Bend Rd.	NE	279.18
Big Walnut Creek Preserve	preserve	11418 Sprinkle Cut-off Rd.	NE	46
Blowing Sink Preserve	preserve	3705 Deer Ln.	S	167.73
Blunn Creek Greenbelt	greenbelt	1901 East Side Dr.	S	12.9
Blunn Creek Preserve	preserve	1200 St. Edwards Dr.	S	38.52
Boggy Creek Greenbelt	greenbelt	1114 Nile St.	NE	89.8
Brentwood Park	neighborhood park	6710 Arroyo Seca	NW	9.26
Brush Square (O. Henry Museum)	special park	409 E. 5th St.	NE	5.76
Bull Creek Greenbelt Lower	greenbelt	7806 N. Capital of Texas Highway	NW	477.74
Bull Creek Greenbelt Upper	greenbelt	7806 N. Capital of Texas Highway	NW	477.74
Bull Creek District Park	district park	6701 Lakewood Dr.	NW	48.06
Buttermilk Branch Greenbelt	greenbelt	7500 Meador Dr.	NE	18.72
Cherry Creek Park	neighborhood park	3403 Silk Oak Drive	S	0.9
Circle C Ranch Metropolitan Park on Slaughter Creek	Metropolitan Park	507 West Slaughter Ln.	S	545.78
Civitan Park	neighborhood park	513 Vargas Rd.	NE	7.12
Clarksville Park	neighborhood park	1811 W. 11th St.	NW	1.42
Colony District Park	district park	8200 blk Loyola Ln.	NE	27.88
Colorado River Preserve	preserve	5827 Levander Loop	NE	43.33
Colorado/Walnut Greenbelt	greenbelt	8001 Delwau Ln.	NE	30.5
Comal Park	neighborhood park	300 Comal St.	NE	0.99
Commons Ford Ranch Metropolitan Park	Metropolitan Park	614 Commons Ford Rd.	NW	215
Convict Hill Quarry Park	neighborhood park	6511 Convict Hill Rd.	S	2.81

Cook Playground	neighborhood park	1511 Cripple Creek Dr.	NW	7.69
Cunningham Playground	neighborhood park	2200 Berkeley Ave.	S	3.55
Davis Hill Park	neighborhood park	3402 Davis Ln.	S	8.36
Dick Nichols District Park	district park	8011 Beckett Rd.	S	152.92
Dittmar Park	neighborhood park	1009 Dittmar	S	12.86
Doss Playground	neighborhood park	7005 Northledge Dr.	NW	6.2
Dottie Jordan Park	neighborhood park	2803 Loyola Ln.	NE	11.45
Dove Springs District Park	district park	5801 Ainez Dr.	S	59.01
Downs Mabson Fields	special park	2812 E. 12th St.	NE	9.97
Duncan Park	neighborhood park	900 W. 9th St.	NE	5.25
East Bouldin Creek Greenbelt	greenbelt	1202 S. 1st St.	S	1.16
Eastwoods Park	neighborhood park	3001 Harris Park Ave.	NE	9.9
Eilers (Deep Eddy) Park	neighborhood park	401 Deep Eddy Ave.	TL	8.96
Ellen Higgins Park	neighborhood park	2705 Cameron Loop	S	0.5
Emma Long Metropolitan Park	Metropolitan Park	1600 City Park Rd.	NW	1,147.02
Franklin Park	neighborhood park	4800 Copperbend Blvd.	S	5.3
Gaines Creek Greenbelt	greenbelt	-	TL	136.65
Gaines Creek Park	neighborhood park	4801 Republic of Texas Blvd.	S	37.92
Garrison District Park	district park	6001 Manchaca Rd.	S	40
Gillis Park	neighborhood park	2504 Durwood Ave.	S	7.8
Givens District Park	district park	3811 E. 12th St.	NE	35.75
Govalle Park	neighborhood park	5200 Bolm Rd.	NE	26.22
Gracywoods Park	neighborhood park	12133 Metric Blvd.	NW	10.22
Grand Meadow Park	neighborhood park	8022-8032 Thaxton Dr.	S	6.4
Great Hills Park	neighborhood park	10700 Floral Park Dr.	NW	59.36
Gullett Playground	neighborhood park	6310 Treadwell Blvd.	NW	17.86
Gus Garcia (Rundberg) Park	neighborhood park	1101 E. Rundberg Ln.	NE	47.27
Harris Branch Park	neighborhood park	11200 Farmhaven Rd.	NE	8.16
Hill Playground	neighborhood park	8601 Tallwood Dr.	NW	5.51
Houston Playground	neighborhood park	2107 Deadwood Dr.	S	8.74
J.J. Seabrook Greenbelt	greenbelt	2000 Pershing Dr.	NE	3.9
Johnson Creek Greenbelt	greenbelt	2100 Enfield Rd.	NW	59.47
Joslin Park	neighborhood park	4500 Manchaca Rd.	S	5.58
Karst Preserve	preserve	3900 Deer Ln.	S	7.9
Kealing Playground	neighborhood park	1500 Rosewood Ave.	NE	20.8
Kendra Page Park	neighborhood park	2203 Blue Meadow Dr.	S	15.23
Lakeline Park	neighborhood park	2701-2715 Lakeline Blvd.	NW	10.45
Latta Branch Greenbelt	greenbelt	7910 Beckett Rd.	NW	10.45
Legends Oaks Park	neighborhood park	7750-7830 Escarpment	S	36.12
Lewis Mountain Ranch Park	neighborhood park	8200-8300 blk. Young Ln.	S	6.06
Little Stacy Park	neighborhood park	1400 Alameda Dr.	S	6.73
Little Walnut Creek Greenbelt	greenbelt	1000 Block of Hermitage Dr.	NE	1.93
Longview Park	neighborhood park	7609 Longview Rd.	S	20.06
Lott Park	neighborhood park	1108 Curve St.	NE	0.73
Lucy Reed Playground	neighborhood park	2608 Richcreek Rd.	NW	5.14
Mabel Davis District Park	district park	3427 Parker Ln.	S	50.03
Marble Creek Greenbelt	greenbelt	6500-6800 William Cannon	S	12.53
Mary Dawson Park	neighborhood park	650 Dawson Rd.	S	0.92
Mary Moore Searight Metropolitan Park	Metropolitan Park	907 Slaughter Ln.	S	344.8

Mayfield Preserve	preserve	3505 West 35th St.	NW	22
Meadows at Trinity Crossing Park	neighborhood park	5900 Trinity Meadows Crossing	NE	16.36
Metz Park	neighborhood park	2407 Canterbury St.	TL	5.96
Montopolis Park	neighborhood park	1200 Montopolis	NE	7.61
Mount Bonnell	special park	3800 Mt. Bonnell Dr.	NW	5.36
Mountain View Park	neighborhood park	9000 Middlebie Rd.	NW	8.55
Nicholas Dawson Park	neighborhood park	614 Gibson St.	S	2.27
Norman Playground	neighborhood park	4101 Tannerhill St.	NE	6.9
North Cat Mountain Greenbelt	greenbelt	6704 Cat Creek Trail	NW	13.43
Norman Playground	neighborhood park	4101 Tannerhill St.	NE	6.9
North Oaks Park	neighborhood park	900 Plaza Dr.	NE	4.6
North Starr Greenbelt	greenbelt	-	NW	120.12
Northeast District Park	district park	5909 Crystalbrook Dr.	NE	110.8
Northwest Balcones Park	neighborhood park	10201 Tallyran Dr.	NW	6.5
Oak Springs Playground	neighborhood park	3601 Webberville Rd.	NE	6.13
Oakhill Park	neighborhood park	5400-5450 Southwest Pk.	S	14.5
Oakview Park	neighborhood park	.	S	6.98
Odom Playground	neighborhood park	1010 Turtle Creek Blvd.	S	4.3
Onion Creek Greenbelt	greenbelt	7001 Onion Creek Dr.	S	156.48
Onion Creek Metropolitan Park	Metropolitan Park	6900 Onion Creek Dr.	S	397.9
Onion Creek Preserve	preserve	4425 E. US HWY 71	S	172.85
Onion Creek Sports Complex	special park	-	S	120.27
Ortega Playground	neighborhood park	1135 Garland Ave.	NE	4.25
Palm Park	neighborhood park	200 N. IH-35	TL	2.4
Pan Am Park	neighborhood park	2100 E. 3rd St.	NE	4.83
Parque Zaragoza Park	neighborhood park	714 Pedernales St.	NE	15.27
Patterson Park	neighborhood park	4200 Brookview Rd.	NE	9.29
Pease District Park	district park	1100 Kingsbury St.	NW	42.26
Pecan Springs Playground	neighborhood park	3100 Rogg Ln.	NE	4.55
Perry Playground	neighborhood park	4900 Fairview Dr.	NW	6.6
Pickfair Park	neighborhood park	10904 Pickfair Dr.	NW	0.5
Pillow Playground	neighborhood park	3025 Crosscreek Dr.	NW	7.2
Piney Bend Park	neighborhood park	8600 West Gate Blvd.	S	0.5
Plaza Saltillo	special park	412 Comal St.	NE	0.88
Ponciana Park	neighborhood park	5101-5499 Fredrick St.	S	5.18
Quail Creek Park	neighborhood park	1101 Mearns Meadow Dr.	NW	16.62
Ramsey Park	neighborhood park	4301 N. Rosedale Ave.	NW	5.27
Red Bud Isle	special park	3401 Red Bud Trail Unit Cr.	TL	13.56
Reed Park	neighborhood park	2600 Pecos St.	NW	6.27
Reilly Playground	neighborhood park	405 Denson Dr.	NE	4.32
Republic Square	special park	422 Guadalupe St.	NE	1.75
Riata Park	neighborhood park	12401 Riata Trace	NW	7.97
Ricky Guerrero Park	neighborhood park	2006 S. 6th St.	S	2.01
Ron Rigsby Park	neighborhood park	1110 Little Elm Park	NW	1
Rosewood Park	neighborhood park	2300 Rosewood Ave.	NE	13.9
Roy G. Guerrero Colorado River Park	Metropolitan Park	6200 Grove Dr.	NE	362.59
Sanchez Playground	neighborhood park	1000 Holly St.	TL	1.3
Schroeter Park	neighborhood park	11701 Big Trail	NW	12.08
Scofield Farms Park	neighborhood park	12901 Scofield Farms Dr.	NW	13.93

Shipe Park	neighborhood park	4400 Ave. G	NE	2.45
Shoal Creek Greenbelt Upper	greenbelt	2600-2799 Lamar Blvd.	NW	76.72
Shoal Creek Greenbelt Lower	greenbelt	2600-2799 Lamar Blvd.	NW	76.72
Silk Oak Park	neighborhood park	3204 Silk Oak Dr.	S	4.5
Slaughter Creek Greenbelt	greenbelt	2328 Lavendale Court	S	6.58
South Austin Park	neighborhood park	1100 Cumberland Rd.	S	11.73
South Boggy Creek Greenbelt	greenbelt	7600 Blk. of Circle S. Rd.	S	4.07
Southland Oaks Park	neighborhood park	3501-3601 Green Emerald	S	18.5
Springbrook	special park	-	NE	56.33
Springdale	neighborhood park	-	NE	14.87
Springfield Park	neighborhood park	6300 E. William Cannon	S	18.12
St. Edwards Park	neighborhood park	7301 Spicewood Springs Rd.	NW	80
St. Elmo Playground	neighborhood park	4410 S. 1st St.	S	6.2
St. John's Park	neighborhood park	901 E. St. Johns Ave.	NE	6.09
Steck Valley Greenbelt	greenbelt	8403 Adriondack Trail Dr.	NW	37.99
Stephenson Preserve	preserve	7609 Longview Rd.	S	147.23
Stillhouse Hollow Nature		7810 Sterling Dr.	NW	19.83
Swede Hill Park	neighborhood park	907 E. 14th St.	NE	1
Symphony Square	special park	1101 Red River St.	NE	1.73
T.A. Brown Playground	neighborhood park	505 W. Anderson Ln.	NE	2.29
Tanglewood Park	neighborhood park	1406 Rustic Rock Rd.	NW	14.3
Tarrytown Park	neighborhood park	2106 Tower Dr.	NW	2.25
Town Lake-Auditorium Shores Metropolitan Park	Metropolitan Park	920 W. Riverside Dr.	TL	508.89
Town Lake-Butler Shores Metropolitan Park	Metropolitan Park	200 S. Lamar	TL	508.89
Town Lake-Festival Beach Metropolitan Park	Metropolitan Park	2101 Bergman St.	TL	508.89
Town Lake-Holly Shores Metropolitan Park	Metropolitan Park	2709 Canterbury	TL	508.89
Town Lake-Lakeshore Metropolitan Park	Metropolitan Park	1928 S. Lakeshore Blvd.	TL	508.89
Town Lake-Lamar Beach Metropolitan Park	Metropolitan Park	1200 W. Cesar Chavez St.	TL	508.89
Town Lake-Longhorn Shores Metropolitan Park	Metropolitan Park	200 S. Pleasant Valley Rd.	TL	508.89
Town Lake-Norwood Tract Metropolitan Park	Metropolitan Park	1009 Edgecliff Terrace	TL	508.89
Town Lake-Shoal Beach Metropolitan Park	Metropolitan Park	707 W. Cesar Chavez St.	TL	508.89
Town Lake-Waller Beach Metropolitan Park	Metropolitan Park	30 East Ave.	TL	508.89
Treaty Oak Square	special park	507 Baylor St.	NW	0.3
Umlauf Sculpture Garden	special park	605 Robert E. Lee Rd.	TL	7.43
Upper Bull Creek	greenbelt	6958 Old Spicewood Springs	NW	346.2
Upper Bull Creek Preserve	preserve	-	NW	150.74
Vireo Nature Preserve	preserve	1107 N. Capitol of Texas Hwy.	NW	212.32
Waller Creek Greenbelt	greenbelt	703 E. 6th St.	NE	15.9
Walnut Creek Metropolitan Park	Metropolitan Park	12138 N. Lamar Blvd.	NW	293.62
Walsh Boat Landing	special park	1600 Scenic Dr.	NW	4.06
Walter E. Long Metropolitan Park	Metropolitan Park	6614 Blue Bluff Rd.	NE	3,802.06
Waterloo Park	neighborhood park	403 E. 15th St.	NE	10.74
Wells Creek Greenbelt	greenbelt	13100 Block of Metric Blvd.	NW	14.9
West Austin Park	neighborhood park	1317 W. 10th St.	NW	3.27
West Bouldin Creek Greenbelt	greenbelt	1200 S. 6th St.	S	54.44
West Bull Creek Greenbelt	greenbelt	7810 RM RD 2222	NW	54.44
Westenfield Park	neighborhood park	2008 Enfield	NW	11.04
Williams Playground	neighborhood park	400 Blue Valley Dr.	S	9.89
Williamson Creek Central Greenbelt	greenbelt	5120 S. 1st St.	S	312.78

Williamson Creek East Greenbelt	greenbelt	4618 E. William Cannon Dr.	S	312.78
Williamson Creek West Greenbelt	greenbelt	6312 Brush Counry Rd.	S	312.78
Wooldridge Playground	neighborhood park	1412 Norseman Terrace	NW	10.38
Wooldridge Square	special park	900 Guadalupe St.	NE	1.77
Wooten Park	neighborhood park	1406 Dale Dr.	NW	6.28
Yates Park	neighborhood park	6200 Felix Ave.	NE	0.73
Yett Creek Park	neighborhood park	12520-12543 Huntsville Rd.	NW	40.55
Zilker Metropolitan Park	Metropolitan Park	2100 Barton Springs Rd.	TL	351.04
Zilker Neighborhood Park	neighborhood park	1900 Bluebonnet Ln.	TL	4.57

Source: Restructured from parks directory of Parks and Recreation Department website, Austin City Connection, 2001

APPENDIX 3

NEIGHBORHOOD DESCRIPTORS LIST

Neighborhood Descriptors	Census Tracts									Total
	16035	17473	18063	18123	18172	18281	20034	21092	24242	
Quiet	15	15	4	1	18	8	6	5	10	82
Safe / low crime	10	9		1	6	6	6	3	3	44
Good neighbors	4	7	1		6	9	6	5	5	43
Well-kept yards	4	12	2		9	5	4	2	2	40
Mostly older	11	9	1	1	4		5	2	1	34
Older houses	6	1	3		3	2	4	1	1	21
Lots of kids	5		1	1	1	4	1	1	1	15
Mix of ages	4	1			5	1	1			12
Busy streets / traffic	1	1			2	2	5			11
Deteriorating			6			1		1	3	11
Close to necessities	5	1				4				10
Friendly	5	1			2	1				9
Lots of trees / greenery	3	2	1		1	1	1			9
Middle class	1				2	5			1	9
New (young) families	2	3			1	1	2			9
Family-oriented	3				3	2				8
Kept-up houses	2				1	3			2	8
Noisy		1		1			1	1	2	6
Mix of races		1			2			1	2	6
Good location in city				1	3	2				6
Mostly (many) rented					1	3	1		1	6
Small houses		2				1			3	6
Low income / poor				1	1		1	1	1	5
Close to major roads	1	1			1	2				5
Good Neighborhood	2	1			1	1				5
Lots of older residents	1	1	1					1	1	5
Blue collars					1		4			5
Mostly (many) owned	1					1	1		1	4
Unsafe / Serious crime			1		1		1		1	4
Protective / loyal	2	1				1				4
Some kids					1	1			2	4
Mix of incomes		1			1				1	3
Mix of old/new houses	1				2					3
Good to walk / jog	1			1		1				3
Mix of own / rent						1	1		1	3
Neighborhood park	1				2					3
Established	1				1		1			3
Unsocial neighbors			1	1			1			3
Pleasant	1					1	1			3
Comfortable					1	1				2
High income / affluent	1					1				2
Longtime residents		2								2
Moderate (low) traffic	1	1								2
Nice homes / houses					2					2
No sidewalks		2								2
Clean					1	1				2

Not many children		2								2
Nasty/ill-kept/trashed			1		1					2
Elementary school						2				2
No permanent neighbor									1	1
Unique						1				1
Boring						1				1
Fairly Social						1				1
Lack of police	1									1
Mostly middle aged	1									1
No street life	1									1
Orderly					1					1
Quaint	1									1
Moms support network					1					1
All American									1	1
Beautifully landscaped	1									1
Good-size lots						1				1
Low population density	1									1
Lower-middle class						1				1
Mostly Hispanic							1			1
Close neighborhood	1									1
Peaceful						1				1
Small neighborhood									1	1
Wide streets		1								1

APPENDIX 4

NEIGHBORHOOD ELEMENTS LIST

Neighborhood Elements	Census Tracts									Total
	16035	17473	18063	18123	18172	18281	20034	21092	24242	
Trees / greenery	14	7	2		5	4	4	1	3	40
Streets / roads (minor)	1	6		1	7	4	6	2	3	30
Stores / Shopping centers	5	6	3		2	3	1		2	22
Major roads	2	2	3	1	4	5	1		2	20
Parks / creeks / greenbelts	2	1	1	2	2	9	2		1	20
Open spaces	2	2	1	1	2		2	4		14
(Large) Trees	4	2			1	2	2		1	12
Schools	3				1	4	1		1	10
Elementary Schools					2	6				8
Libraries	1					6				7
Public facilities(comm.ctr.)	1			2		1		1	1	6
Church buildings	1		1			3				5
Restaurants	1	1				1				3
Golf courses	1							2		3
Post offices	2									2
Garrison Park							1		1	2
Neighborhood Parks	1				1					2
Trash			1	1						2
Tree-lined streets	2									2
Willimson creek greenbelt							2			2
Balcones park						2				2
Swimming pools	1						1			2
Ball fields							2			2
Bus routes									2	2
Sidewalks	1				1	1				2
Daycare centers						1				1
Cars parked in yard			1							1
Cul-de-sac								1		1
Hospitals							1			1
Nice trees						1				1
Picnic areas							1			1
Car wash									1	1
Dead-end streets			1							1
Flowers	1									1
Moms' group						1				1
New streets	1									1
Playground									1	1
Speed bumps						1				1
Gas stations			1							1
Banks									1	1
Tarrytown park	1									1

APPENDIX 5

MULTIPLE RESPONSES ANALYSIS - NAMED PARKS

	Type	Area (mile)	Code	Count	Pct of Responses	Pct of Cases
Zilker Metropolitan Park	M	351.04	196	121	20.3	68.4
Balcones District Park	D	51.69	7	27	4.5	15.3
Town Lake-Auditorium Shores Metropolitan	M	508.89	162	26	4.4	14.7
Pease District Park	D	42.26	118	23	3.9	13
Mary Moore Searight Metropolitan Park	M	344.8	90	21	3.5	11.9
Tarrytown Park	N	2.25	161	21	3.5	11.9
Garrison District Park	D	40	60	19	3.2	10.7
Pillow Playground	N	7.2	122	19	3.2	10.7
Dittmar Park	N	12.86	46	18	3	10.2
Reed Park	N	6.27	129	17	2.8	9.6
Bull Creek District Park	D	48.06	30	16	2.7	9
Barton Creek Greenbelt	G	1,770.85	11	13	2.2	7.3
Walnut Creek Metropolitan Park	M	293.62	178	13	2.2	7.3
Westenfield Park	N	11.04	186	13	2.2	7.3
Emma Long Metropolitan Park	M	1,147.02	56	12	2	6.8
Town Lake-Lamar Beach Metropolitan Park	M	508.89	167	10	1.7	5.6
Dick Nichols District Park	D	152.92	45	9	1.5	5.1
Eilers (Deep Eddy) Park	N	8.96	54	9	1.5	5.1
Rosewood Park	N	13.9	135	9	1.5	5.1
Tanglewood Park	N	14.3	160	9	1.5	5.1
Beverly S. Sheffield Northwest District	D	30.75	16	8	1.3	4.5
Givens District Park	D	35.75	62	8	1.3	4.5
Mayfield Preserve	P	22	91	8	1.3	4.5
Mount Bonnell	S	5.36	95	8	1.3	4.5
Waterloo Park	N	10.74	181	8	1.3	4.5
Batholomew District Park	D	57.21	10	7	1.2	4
St. Elmo Playground	N	6.2	152	7	1.2	4
Town Lake-Butler Shores Metropolitan Par	M	508.89	163	7	1.2	4
Big Stacy Park	N	3.31	17	6	1	3.4
Northwest Balcones Park	N	6.5	104	6	1	3.4
Barton Creek Wilderness Park	G	1021.85	12	5	0.8	2.8
Ramsey Park	N	5.27	127	5	0.8	2.8
Shoal Creek Greenbelt Upper	G	76.72	141	5	0.8	2.8
Johnson Creek Greenbelt	G	59.47	73	4	0.7	2.3
Little Stacy Park	N	6.73	82	4	0.7	2.3

Patterson Park	N	9.29	117	4	0.7	2.3
Town Lake-Lakeshore Metropolitan Park	M	508.89	166	4	0.7	2.3
Bull Creek Greenbelt Upper	G	477.74	29	3	0.5	1.7
Joslin Park	N	5.58	74	3	0.5	1.7
St. Edwards Park	N	80	151	3	0.5	1.7
Symphony Square	S	1.73	158	3	0.5	1.7
Town Lake-Longhorn Shores Metropolitan P	M	508.89	168	3	0.5	1.7
Umlauf Sculpture Garden	S	7.43	173	3	0.5	1.7
Alamo Park	N	1.87	2	2	0.3	1.1
Brentwood Park	N	9.26	26	2	0.3	1.1
Buttermilk Branch Greenbelt	G	18.72	31	2	0.3	1.1
Govalle Park	N	26.22	63	2	0.3	1.1
J.J. Seabrook Greenbelt	G	3.9	72	2	0.3	1.1
Montopolis Park	N	7.61	94	2	0.3	1.1
Schroeter Park	N	12.08	138	2	0.3	1.1
Shipe Park	N	2.45	140	2	0.3	1.1
Slaughter Creek Greenbelt	G	6.58	144	2	0.3	1.1
South Austin Park	N	11.73	145	2	0.3	1.1
St. John's Park	G	6.09	153	2	0.3	1.1
Town Lake-Festival Beach Metropolitan Pa	M	508.89	164	2	0.3	1.1
Town Lake-Holly Shores Metropolitan Park	M	508.89	165	2	0.3	1.1
Williamson Creek Central Greenbelt	G	312.78	188	2	0.3	1.1
Barrington Playground	N	8.02	8	1	0.2	0.6
Blunn Creek Preserve	P	38.52	24	1	0.2	0.6
Colony District Park	D	27.88	36	1	0.2	0.6
Commons Ford Ranch Metropolitan Park	M	215	40	1	0.2	0.6
Davis Hill Park	N	8.36	44	1	0.2	0.6
Dove Springs District Park	D	59.01	49	1	0.2	0.6
Eastwoods Park	N	9.9	53	1	0.2	0.6
Gracywoods Park	N	10.22	64	1	0.2	0.6
Gullett Playground	N	17.86	67	1	0.2	0.6
Kealing Playground	N	20.8	76	1	0.2	0.6
Longview Park	N	20.06	84	1	0.2	0.6
Odom Playground	N	4.3	108	1	0.2	0.6
Red Bud Isle	S	13.56	128	1	0.2	0.6
Reilly Playground	N	4.32	130	1	0.2	0.6
Republic Square	S	1.75	131	1	0.2	0.6
Riata Park	N	7.97	132	1	0.2	0.6
Scofield Farms Park	N	13.93	139	1	0.2	0.6
T.A. Brown Playground	N	2.29	159	1	0.2	0.6
Vireo Nature Preserve	P	212.32	176	1	0.2	0.6
Walter E. Long Metropolitan Park	M	3,802.06	180	1	0.2	0.6

Wooten Park	N	6.28	193	1	0.2	0.6
Zilker Neighborhood Park	N	4.57	197	1	0.2	0.6
Total responses				597	100	337.3

VITA

Chun Man Cho

Educational Background

9. 1998 - 8. 2003	Texas A&M University, College Station, Texas, U.S.A. Degree: Ph.D. of Urban and Regional Science, 2003
3. 1994 - 2.1996	Seoul National University, Seoul, Korea Degree: M.S. of Urban Planning, 1996
3. 1987 - 2.1994	University of Seoul, Seoul, Korea Degree: B.S. of Urban Planning, 1994

Professional Experience

9. 2002 - 8, 2003	Graduate Research Assistant GIS Analyst / WebGIS Developer Environmental Management Lab TTI (Texas Transportation Institute)
6.1999 – 8, 2002	Graduate Non-Teaching Research Assistant GIS Analyst / WebGIS Developer GeoInformatics Studio Department of Landscape Architecture and Urban Planning Texas A&M University
8.1996 - 10.1997	GIS Researcher, GIS Team, Government Projects Division Information Technology Institute Hyundai Information Technology Co. Hyundai Group Seoul, Korea
4. 1996 - 6.1996	GIS Researcher, Construction Information Lab KICT (Korean Institute of Construction Technologies) Seoul, Korea

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