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Investigating Environmental Factors that Contribute to Disparities in Utilization Across Different Sections of a 10-mile Urban Trail

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Investigating Environmental Factors that Contribute to Disparities in Utilization Across Different Sections of a 10-mile Urban Trail

by

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Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Education

The University of Texas at Austin

May 2014

Dedication

I dedicate this effort to my father, who - through his expression on canvas - inspired within me both a blessing and a curse: embrace the process and your purpose will emerge. And to my mother, who - steadfast in my corner - revealed that devotion is nothing more than stamina with grace.

Acknowledgements

This work would not have been accomplished without the help of several people. First and foremost, many thanks to my advisor, Dr. John Bartholomew, whose patience and encouragement kept the wheels turning when they would have otherwise fallen off the bus. In addition, I am extremely appreciative of the time and effort of my volunteers on the trail: Christy Coward, Jeff DeLargy, Jeff Fletcher, Jason Golod, Lara Latimer, James McMullen, Jon Michelson, Melinda Mount, Julie Pomerantz, Chad Simpson, Whitney Nelson, and Nishi Whitely. I also want to thank Susan Rankin and The Trail Foundation for connecting me with resources, but also for their passion and commitment to the Ann & Roy Butler Trail. To my committee: Dr. Chandra Bhat, Dr. Darla Castelli, Dr. Esbelle Jowers, and Dr. Fred Peterson – thank you for the time and patience you have invested in improving my research skills. And the accolade for the most patient person on the planet, my best friend and rock star ally - Miss Julie Pomerantz – for you, I am immeasurably grateful.

"It ain't what you don't know that gets you into trouble.
It's what you know for sure that just ain't so."
- Mark Twain

Investigating Environmental Factors that Contribute to Disparities in Utilization Across Different Sections of a 10-mile Urban Trail

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The purpose of this study was to identify barriers that contribute to a disparity in utilization across different segments of an urban trail. To achieve this aim, subjective ratings of trail characteristics for high-use areas (western sections of the trail) were compared to subjective ratings of lower-use areas (eastern sections of the trail). These ratings were compared between those who reported primarily traveling the western, high-use sections vs. those who primarily travel the eastern, low-use sections. Data were collected through self-report and a cross-sectional analysis based on sections of primary use. Ratings for each trail characteristic from an online survey were compared for different trail segments as a function of these groups. Comparisons were conducted through ANOVA and showed that perceptions of trail characteristics varied strongly as a function of which sections of the trail were used most by the respondents. Users of the high-traffic, western sections held significantly more negative views of the eastern sections. In contrast, users of the low-traffic, eastern sections held similar views of the eastern and western sections.

Objective measurements of trail characteristics were conducted on all six segments of trail to compare to user perceptions. A trail count and researcher evaluation/audit of all trail characteristics provided data for comparison. A descriptive analysis of the differences between trail user perceptions and objective measures was reported. The trail count and survey results showed similar patterns of usage. The western sections exhibited the highest number of trail users representing 80% of the

people on the trail. The central sections contained 14% and the eastern sections 6%. Mode of travel observed was 94% walking or running and 6% cycling. In addition, these numbers are similar to those of the earlier, pilot study (TEMBA, 2011). Given the similarities between the online survey, and both the objective trail count for usage and the earlier TEMBA study, it is hoped that the online sample is representative of the population of regular trail users.

A comparison of subjective and objective ratings revealed different patterns of agreement depending on east vs. west group membership. Overall, west users are misinformed about crime and amenities on the east side but are in general agreement on other characteristics. This suggests that their concerns about trail continuity, directional clarity, and loop options may be warranted. Overall, east users showed general agreement with objective measures on the west side except for exposure to traffic, which they rated more poorly than objective measures.

Table of Contents

List of Tables

List of Figures

CHAPTER 1: INTRODUCTION

Purpose

The purpose of this study was to identify barriers that contribute to a disparity in utilization across different segments of an urban trail.

Background

Physical activity (PA) is a vital part of an overall wellness plan to increase quality of life and prevent chronic diseases associated with obesity (CDC, 2008). Researchers have identified lack of physical activity as the fourth strongest risk factor for mortality worldwide (WHO, 2009). Lack of physical activity can lead to obesity which is linked to serious health problems such as high blood pressure, type 2 diabetes, fatty liver disease, sleep apnea, and orthopedic issues (Lieb, Snow, & DoBoer, 2009; Slusser, Cumberland, Browdy, Winham, & Neumann, 2005). In addition to the physical outcomes, there are psychological consequences associated with obesity that include low self-esteem, social isolation and rejection, eating disorders, depression, and suicidal behaviors (Puhl & Latner, 2007).

The highest rates of obesity are most prevalent among disadvantaged groups, those with little education and high rates of poverty (CDC, 2008). The groups with the highest rates of obesity also report the lowest commitment to physical activity. According to the Center for Disease Control & Prevention, 15% of individuals who did not finish high school report engaging in regular exercise compared to 22% with a high school diploma and 38% with a college education (CDC, 2008). One explanation is that communities with more college-educated residents have more facilities for physical activity and are 32% less likely to be overweight (Shishehbor, Lauer, Gordon-Larson, Kiefe, & Litaker, 2007).

Physical activity is commonly divided into two categories by public health and urban planning researchers. *Leisure-time physical activity* (LTPA) or *recreational physical activity* involves exercise or recreation during one's free time. *Utilitarian* physical activity is viewed as a means to an end such as walking to school or the grocery store (TRB, 2005). The distinction between recreational and utilitarian PA is important because a person's decision to be active may differ depending on whether their purpose is utilitarian or leisure (Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003). For example, access is considered important for leisure activities (Bedimo-Rung, 2005) while distance to destination predicts utilitarian physical activity (Adams et al. 2011; Wong, 2011).

The minimum recommendation for adult physical activity is 150 minutes of moderately intense aerobic activity each week accompanied by strength work two or more days per week (CDC, 2008). Utilitarian PA is usually a lower intensity effort than recreational PA (Frank, Andresen, & Schmid, 2004), which makes recreational PA especially important for combating the health conditions associated with obesity as higher intensity exercise provides greater caloric expenditure (ACSM, 2006). People that engage in regular utilitarian and leisure-time physical activity lower their risk for acquiring disorders and disease (Lieb, Snow, & DoBoer, 2009). However, changing behavior is no easy task. Attempting to modify the behavior of others through education alone is not always a strong enough intervention to motivate the inactive individual to become active (King, 1998). A wide-angle examination of the problem must occur before education can be effective.

Social change, through education or other means, is challenging because individual and community behavior is entwined with other facets of the municipal system. A *systems thinking* approach to the problem of inactivity is necessary in order to identify the underlying factors in the environment that are influencing behavior. Systems thinking is a big picture examination of a system that illustrates a phenomenon

or problem that has multiple interacting factors (Senge & Kim, 1997). A system is defined as an interconnected set of elements that is organized in a way that achieves something (Meadows, Randers, & Meadows 2004). System dynamics refers to the interplay within a system whether organized, self-organized, or unorganized (Parsons, Jessup & Moore, 2013).

Relevant to the proposed study, a systems thinking model is based on the notion that perceptions shape behavior (Senge, 1990), which interacts with our environment and all of the processes within it. Systems thinking asserts that a factor examined in isolation does not behave the same way as when part of a system (Johnson, 1997). A systems thinking model is closely tied to the social-ecological model (Bronfenbrenner, 1977) which is a common theoretical framework for health behavior research. An ecological or *social-ecological model* (Bronfenbrenner, 1977) describes a multi-layered interaction between the individual, community, and environment. This model assumes three constructs are at play: a) a health issue likely has many causes b) health issues are influenced by a combination of factors and c) small changes in these factors can positively influence health (Lounsbury, 2009). The unique qualities of a systems thinking model, along with the lens of the social-ecological model, will guide this study.

The design of cities, neighborhoods, recreational facilities, and transportation systems can discourage or facilitate PA (Sallis, 1997). These environmental factors are often categorized as social, natural, or built (Norman, 2010). The *social environment* is made up of "cultures, institutions and networks of individuals and groups, both formal and informal" (Innes & Booher, 2000), while *social capital* refers to "the forms of social cohesion or 'social glue' that enable people to work together civilly, in formal and informal groupings". The *natural environment* is defined as "land, water, atmosphere, and the many natural resources they contain" (Johnson, et al., 1997). The *built environment* encompasses all structures, spaces, and objects that have been designed or modified by people (Sallis, 1997). Examples of factors affecting physical activity in

each of these environmental dimensions include: frequency of seeing others exercise and social connections (social environment) (Kaczynski & Glover, 2012), pleasant scenery (natural environment) (Humpel, Owen, & Leslie, 2002), and access to facilities and satisfaction with those facilities (built environment) (Brownson, Baker, Housemann, Brennan & Bacak, 2001; Wilcox, Castro, King, Housemann & Brownson, 2000).

Neighborhoods are often the focus of active living research (Badland, Keem, Witten, & Kearns, 2010; Adams, et al., 2011; Evenson, Murray, Birnbaum, & Cohen, 2010; Kaczynski & Glover, 2010). This is achieved by examining the design of communities, active transportation, parks, and schools (Ewing, Schmid, Killingsworth, Zlot, & Raudenbush, 2010; Ewing, Schroeer & Greene, 2004). The constructs of density, diversity, design and access were originally established as major contributors to travel pattern transportation research (Cervero & Kockelman, 1997) and more recently were linked to the association between neighborhoods and physical activity (Kligerman, Sallis, Ryan, Frank, & Nader, 2007). This research focus kept the application of these constructs to utilitarian physical activity. However, one common avenue for the pursuit recreational PA in cities is the availability of multi-use paths for walking, running, and cycling. The terminology "density, diversity, design, and access" are less common in recreational studies, and specifically trail research, but the constructs might be helpful in framing the variables that affect behavior in a recreational physical activity setting.

For instance, in an urban neighborhood setting, *density* refers to the amount of activity found in a specified area (Handy, 2002) such as population density per acre (Cervero & Kockelman, 1997) or residential density, which represents the number of housing parcels per acre of land (Norman, 2010). Urba*n diversity* examines land use and the way it is utilized within a given area (Handy, 2002). High diversity indicates a wide variety of possible destinations between residence and retail, work, or recreation (Handy, 2002). *Design* includes all of the elements that contribute to creating space (Cervero & Kockelman, 1997). Urban *design* might be the proportion of blocks with

sidewalks, streetlights and the distance between them, bike lanes, sidewalk width, and pedestrian crossing signals (Cervero & Kockelman, 1997). Aesthetic design qualities are those that increase the appeal of a particular space such as landscaping, lighting, benches, and architectural design (Cervero & Kockelman,1997). *Access* is examined in two ways. *Individual access* refers to the distance an individual must travel to desired destination (Bedimo-Rung, Mowen, Cohen, 2005). *Equitable access* refers to equal distribution across different types of neighborhoods (Bedimo-Rung, Mowen, Cohen, 2005). These definitions of access deviate from the common conception that access refers to an access point, such as a trailhead. For example, a heavily wooded urban trail may have many *access points* but the distance an individual must travel to reach the closest trailhead, or the socio-economic census path through which the trail meanders, can vary greatly. Both may impact individual and/or equitable access.

An "active community" includes a combination of density of development and mix of land use, diverse destinations, connectivity of the street network, and aesthetic qualities (Saelens & Handy, 2008). Communities that demonstrate these characteristics are often considered "walkable communities" (Burden, 2004). Many studies have shown that residents of communities with high scores of walkability make more walking, bicycling and public transportation trips than residents of automobile-oriented neighborhoods (Ewing, 2005; Saelens, Sallis, & Frank, 2003).

Many studies have replicated the finding that people who live closest to recreational facilities may be the most likely to visit and be physically active (Sallis, Johnson, Calfas, Caparosa, & Nichols, 1997; Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Troped , Saunders & Pate, 2001; Giles-Corti & Donovan, 2002). One study revealed that 80% of park visitors come from within three blocks of the park (Bedimo-Rung, 2005). However, according to the pilot data on a 10-mile community trail in Austin, Texas, sections of trail with the highest residential density show the lowest rates of use. Furthermore, 60% of these users drive to the trail and indicate that they live or

work an average of 6 miles from the trail (TEMBA, 2011). These results suggest that lack of access may not be a barrier in this community.

The purpose of this study was to identify trail user perceptions of barriers that contribute to a disparity in utilization across different segments of an urban trail. This study will investigate built environment factors (trail design characteristics), social environment factors (perceived safety, population density), natural environment factors (aesthetics) and individual factors (demographics).

Research Questions

1. How many users are on The Ann & Roy Butler Trail during peak hours and what are the differences in utilization across different sections of the trail?
2. What are the demographic characteristics and patterns of use of people on the trail?
3. What trail characteristics do users value most?
4. How do users perceive and rate characteristics on different sections of the trail?
5. Are perceptions of trail characteristics in agreement with objective measurements?

Potential Impact

1. Trickle down effect – if regular users increase utilization on segments in lower SES neighborhoods, role modeling and vicarious reinforcement might take effect for those living in neighborhoods adjacent to the trail. This in turn might improve physical activity rates for those most at risk while improving social capital in the community.
2. If perceptions don't match reality, interventions to inform the community of misconceptions can be developed.

3. If perceptions do match reality, trail improvements can be made and future trail designs can incorporate trail features that are most desirable to users.

Limitations

Participants were asked to rely on recall when evaluating trail segments. A map of each segment was provided on the survey to help orient them to the segment they rated. There was a risk that they would rate the sections based on reputation rather than experience. However, knowledge through the opinions of others is not uncommon (Siemens, 2003) and frequently expressed as perception. Although this is difficult to control, participants will be asked to report how many times they have traveled the segment they are rating in order to measure degree of experience. In order to acquire accurate subjective ratings, respondents must be able to visualize each segment of the trail under examination. In other words, they must geographically know the trail well regardless of whether what they know to be true is accurate.

An online survey was chosen over an intercept survey due to the time involved to answer all questions and rate all segments. It was estimated that the average time to complete the survey was 15 minutes. This was too long a time period to interrupt a runner or cyclist on the trail and might impact response rate. The limitation with an online survey is the inability to capture survey data immediately and the reliance instead on the responders to initiate participation.

Another limitation was lack of incentive or the burden involved in completing the survey. Social Exchange Theory claims, “the actions of individuals are motivated by the reward from these actions” (Smith, 2012). Not offering an incentive requires respondents to be motivated to participate for other reasons. This may have reduced the number of respondents. The reward that the participant received may have been expressing dissatisfaction with facilities or amenities. On the other hand, commitment or allegiance to place, or feeling that they are part of the system, can drive individuals to

reciprocate as well (Smith, 2012). As a result, the make-up of respondents could include those that love the trail and possess a strong attachment to place or those that have negative feedback to share which leaves the neutral users less represented.

Delimitations

The trail count observed all users on the trail during one weekday from 7-9am and 5-7pm and on one Saturday from 9-11am on six different sections of the trail. The online survey recruited active trail users 18 years of age and older on all sections of the trail during early morning, noon, and evening hours on both weekdays and weekends.

Definitions

access point – place of entry to destination.

aesthetics – characteristics that are pleasing in appearance.

built environment - all structures, spaces, and objects that have been designed or modified by people.

density (population) - the number of people in a given area.

design - the elements that contribute to creating space.

greenway - A natural or landscaped path for pedestrian or bicycle use.

natural environment - land, water, atmosphere, and the many natural resources they contain.

perception - the identification and interpretation of sensory information in order to understand the environment.

perspective - world views and purpose within a system.

physical activity (recreational) - physical activity during free time

physical activity (utilitarian) – physical activity that is a means to an end such as walking to school.

relationships – connections and exchanges that occur within the boundaries of a system.

social capital - information sharing that occurs between residents of a community, the mutual aid that they provide each other, and their ability to act collectively

system – interconnected set of elements that is organized in a way that achieves something.

system dynamics – the interplay within a system whether organized, self-organized, or unorganized. These three different types of systems can transform into the other.

system thinking - a big picture examination of a phenomenon or problem that has multiple interacting factors.

walkability - a combination of variables that influence walking behavior and measured by the number of destinations present (density), the variety of those destinations (diversity), and how well the streets are connected (design).

CHAPTER 2: REVIEW OF LITERATURE

Physical activity (PA) on a regular basis helps to lower the risk of obesity, heart disease, diabetes, and osteoporosis and can improve overall physical and cognitive functioning (U.S. Department of Health & Human Services, 2008). Psychological health benefits of physical activity include stress relief, mood improvement, and a reduction in symptoms of depression (U.S. Department of Health & Human Services, 2008). Despite the known benefits of activity, only 30% of adult Americans report regular physical activity during leisure time while 40% report no physical activity at all (CDC, 2008).

There are a variety of factors that influence physical activity. Identifying these factors is important since few people meet the national recommendations for physical activity, which is defined as 150 minutes of moderately intense aerobic activity each week accompanied by strength work two or more days per week (U.S. Department of Health & Human Services, 2008). Demographics, socioeconomic status, attitudes, beliefs, self-efficacy, motivation, and skills are some of the factors that researchers report to explain the difference between those that are physically active and those that are not (TRB, 2005). Facets of the social, natural, and built environments influence physical activity as well (Norman, 2010). This literature review will present the physical and social environments that are hypothesized to function as part of an ecological model in explaining factors that affect leisure-time physical activity. Research from the fields of urban planning, public health, and physical activity have contributed to the expanding body of knowledge on how various aspects of the built environment influence physical activity.

Researchers have gained a better understanding of the impact of the physical and social environments on physical activity and obesity over the last ten years. A large portion of this work comes from the fields of transportation and urban planning. The focus of this research usually revolves around active commuting. This is the promotion of active modes of travel, such as walking and cycling to and from work or utilitarian physical activity such as walking to school or stores (Saelens, Sallis, & Frank, 2003).

There is less research on the impact of the environment on recreational physical activity. Research findings on how the built environment impacts walking for transport in a dense urban setting cannot simply be applied to a recreational walker on an urban trail. Physical activity occurs in a defined context and the interaction between the individual, the context, and other social variables are constantly changing (Giles-Corti, 2005). Few studies have successfully developed a model that reflects the effect and interplay of the individual, community, and the environment on physical activity (Sugiyama et al. 2012). The following review of the literature surveys both individual and environmental characteristics that influence physical activity. To my knowledge, there are no studies that isolate regular users to determine patterns of trail use that examine perceptions of trail characteristics on different segments of the same trail in the social, natural, and built environment domains.

Benefits of Physical Activity & Trails

Physical activity is a vital part of an overall wellness plan to increase quality of life and prevent chronic diseases associated with obesity (CDC, 2010). A lifestyle void of physical activity is a major determinant of obesity. People that engage in regular physical activity lower their risk for developing the health disorders associated with obesity (CDC, 2008). Physical activity is a protective factor against heart disease and stroke, colon and breast cancer, type 2 diabetes, osteoporosis, depression, and weight gain; it also improves sleep, mood, cognitive function, and cardiovascular and muscular fitness (Owen, Healy, Matthews & Dunstan, 2010; Dishman, Washburn & Heath, 2004; Heath & Brown, 2009).

Walking to improve health is a popular activity across the world (Kaczynski & Glover, 2012) and among a variety of demographic groups (Cordell, Betz & Green, 2002). Urban trails provide communities with a walking and running venue and are a major draw for individuals with active lifestyles (Gobster, 2002). The presence of a trail in a community is associated with higher rates of individuals meeting recommended physical

activity levels (Wilhelm, Schneider, & Russell, 2009, Brownson, Housemann, Brown, Jackson-Thompson & King, 2000; Sharpe, Granner, Hutto & Ainsworth, 2004). Furthermore, urban trails that are close to home increase the likelihood of use (Kaczynski & Henderson, 2007; Zoellner, Hill, Zynda, Sample, & Yadrick, 2012). Some greenways are located outside the community such as those established by the Rails-to-Trails Conservancy (RTC, 2013). Trails located within the urban center offer additional benefits such as proximity to people and the ability to connect diverse populations (Coutts & Miles, 2011). Diversity of land use on urban trails also provides more destinations, which promotes utilitarian and leisure-time PA (Coutts & Miles, 2011). Trail systems are identified as important outlets for P.A. because in addition to providing opportunity for PA close to where people live and work, they also require little equipment or organization (Abildso, et al., 2007). A national survey of 3,700 U.S. adults found that 34% of active adults use trails at least once per week (Librett, Yore & Schmid, 2008), and parks with trails are 26 times as likely to be used for PA than parks without trails (Kaczynski & Henderson, 2007).

Environment & Physical Activity

The environmental factors that influence PA are often categorized as social, natural, or built. Each of these plays a different role in how they influence physical activity. There is a growing body of evidence that the *built environment* impacts human behavior. The built environment encompasses all structures, spaces, and objects that have been designed or modified by people (Sallis, 2009). Research from a variety of fields such as urban planning, public health, and physical activity have contributed to the growing body of knowledge on how factors in the built environment specifically influences physical activity (Norman, 2010*).*

Neighborhoods are often the focus of this research as they provide information about leisure and utilitarian activity around the home (Wong, 2011). Studies show that exercise facilities are associated with recreational PA if conveniently located (Sallis,

1997), accessible (Bedimo-Rung, 2005), exhibit satisfactory condition, and possess reasonable amenities (Sallis, 1997; Sallis & Saelens, 2000). Research has also demonstrated that people living in *walkable* neighborhoods report more PA than residents in neighborhoods with low walkability (Sallis, 2009). In terms of equitable access, lack of access to health promoting resources in low socio-economic neighborhoods promotes poor health and obesity (Kawakami, 2011), and higher crime rates reduce the amount of activity outdoors (Loukaitou-Sideris, 2007).

Adams and colleagues (2011) tested the relationship between a variety of built environment factors and adult physical activity levels. A total of 916 participants from the Seattle and Baltimore regions participated in the study. Participants were recruited from 16 neighborhoods in each region. Neighborhoods were measured on 11 built environment characteristics and labeled by their degree of walkability and transit and recreation density (low walkability/transit and recreation sparse, low walkability/recreation sparse, moderate walkability/recreation dense, high walkability/recreation dense). Built environment elements that were measured included residential density, land use diversity/access, street connectivity, walking/cycling facilities, aesthetics, traffic and crime safety, transit stops, nearest parks, and nearest fitness facility. Results showed that the high-walkability/recreation dense neighborhood had the highest values for residential density, land use diversity/access, intersection density, and access to fitness facilities and parks (Adams, et al., 2011). As hypothesized, individuals in the high-walkability/recreation dense neighborhood reported the highest levels of physical activity with 9 minutes more MVPA per day compared to the low walkability/transit and recreation sparse neighborhood in Seattle. In Baltimore, the difference between the high-walkability/recreation dense neighborhood and the low walkability/transit and recreation sparse neighborhood differed by 13 minutes (Adams, et al., 2011). The total MVPA difference per week between these two neighborhoods equates to approximately 60 – 75 minutes per week which accounts for roughly 50% of the national guidelines of 150 minutes of moderately

intense physical activity per week (CDC, 2008). These are significant findings with implications that could greatly influence the future designs of urban settings. Less research has been conducted on how the constructs of density, diversity, and access express themselves outside the neighborhood in a recreational activity. There is a need for context-specific examination of these factors in other contexts such as urban trails (Giles-Corti, 2005). Researchers report that general trail use is greater in areas of high urban population density, retail activity, and greenness (Lindsey, 2006). Trail characteristics (i.e. quality of surface) and amenities (i.e. restrooms, street lights, water fountains) can increase utilization by 35-73% (Reynolds et al., 2007). In regards to individual access, for every .25-mile increase in distance from home to trail, trail use decreases by 42% (Krizek, El-Geneidy, and Thompson 2007). The design construct was not explicitly examined in the Adams study (2011) but has been empirically established as a predictor of walkability (Cervero & Kockelman, 1997; Kligerman, Sallis, Ryan, Frank, & Nader, 2007; Reynolds et al., 2007). In the proposed study, the specific design function of connectivity, as it relates to *continuity*, will be explored.

Connectivity in the field of transportation and urban design is defined as the ability to link destinations (Cervero & Kockelman, 1997). More specifically, urban planners define connectivity as the ability to travel directly from point A to point B within a street network which is measured by the number of intersections per square mile along with average block length (Handy et al., 2002). Studies show that improving connectivity can increase physical activity but most of this research is focused on utilitarian activity in urban environments rather than recreational physical activity on trails. In contrast, Fitzhugh et al. (2010) conducted a prospective study to determine the impact of a new urban trail on walking behavior. A 2.9-mile, 8-foot wide greenway was built to link destinations from the intervention neighborhood to retail and school destinations. Observational data of walking behavior was collected before trail construction began in 2005 and after completion in 2007. The three groups were matched based on socioeconomic characteristics. At baseline, there were no significant

differences in physical activity between the intervention and control groups in 2005. However, post-intervention data collected in 2007 showed significantly higher physical activity counts in the experimental neighborhood compared to baseline and control neighborhoods (Fitzhugh et al., 2010). Although this study was about connecting residents to desired destinations, the construct of connectivity was not specifically defined.

The construct of connectivity is identified as a factor in neighborhood walkability, but data on connectivity in trail studies is lacking (Adams et al. 2011; Fitzhugh, Bassett, & Evans, 2010; Vorhees et al., 2010). This may be because many trails are used for recreation or leisure rather than utilitarian purposes (Cromley, Troped, Melly, & Huffman, 2008), and connectivity implies reaching a desired destination from a place of origin (Cervero & Kockelman, 1997). However, when the purpose is recreation, the process rather than the destination may be what matters. Thus, continuity of a trail, rather than connectivity to a destination, may be a more appropriate construct for trail research. For the purpose of this study, continuity will be defined as a trail segment with no deviations from the primary path that might expose users to sidewalks, street crossings, or traffic.

Much of what we know about the impact of the built environment on human behavior stems from studies in the field of transportation (Saelens, Sallis & Frank, 2003). Thus, the lack of literature on the effect of parking on recreational physical activity is not a reflection of a gap in the field of transportation literature; it's simply not as relevant. Public health researchers have examined access to recreational resources but research on parking availability, which may moderate access, is lacking. What we know from urban studies is that the design of parking near destinations affects behavior. For example, parking that is on the side or behind a grocery store encourages walking for travel (Cervero & Kockelman, 1997). However, these results do not generalize to people who wish to utilize urban trails. Perhaps it is because of the assumption that people walk or ride bicycles to the trail rather than drive, because research shows that the

further one lives from the trail the less likely they are to use it (Krizek et al., 2007; Kaczynski & Henderson, 2007; Zoellner et al., 2012). However, in the proposed study on the *Anne & Roy Butler Trail at Lady Bird Lake*, it is reported that 60% of users drive to the trail. Thus, perceptions of parking availability and actual parking capacity are important to measure because a lack of parking may impact usage.

Urban trails are often viewed as attractive to the public (Reynolds et al., 2007) while using them for recreation is associated with a reduction in stress (Kahn, 2011) and an improvement in the health of communities (Clarke, 1996). The study of aesthetics in urban environments is often limited to the absence or presence of garbage and graffiti (Bedimo-Rung, 2005) and few studies have found aesthetics to have a significant association with utilitarian walking (Sugiyama et al. 2012). However, research on aesthetics for recreational physical activity is more broadly defined and may play a more important role in creating positive perceptions. Chon and Shafer (2009) attempted to better understand perception of aesthetics on two urban trails in Texas. The purpose of their study was to examine aesthetic responses to trail characteristics to determine if aesthetics were related to the "likeability" of these trails. The researchers used Nasar's (1997) definition of aesthetic quality, which is described as an evaluation that includes both a cognitive and emotional response that can interact and influence behavior (Chon & Shafer, 2009) as suggested in a social-ecological model. This separation of cognition from emotion is an interesting framework, because many theorists from the fields of psychology to quantum physics assert the belief that cognitive appraisal triggers an emotional response (Pert, 2002; Green, 1970; Davidson & Van Reekum, 2005; Paivio, 1985; Wolf, 2011). Conversely, the model for this study hypothesized that individual perceptions of two urban trails would represent as either cognitive or affective and that these responses would predict likeability.

One of the two trails examined in this study is the same setting for this dissertation: The Anne & Roy Butler Trail in Austin, Texas. The second trail was The Buffalo Bayou Trail in Houston. The researchers were interested in individual

perceptions in three environmental categories: natural features, human-made features, and background infrastructure (Chon & Shafer, 2009). Natural features included elements such as vegetation and water. Human-made features included facilities such as benches, water fountains, and bathrooms. Background infrastructure features included skylines, exposure to traffic, and other structures built close to the trail. Participants were students at Texas A&M University who participated through virtual tours of the trails in a computer lab (Chon & Shafer, 2009). Participants were shown images for each one of the environmental categories (natural features, human-made features, background infrastructure) and asked to evaluate them with adjective pairs scored on a continuum from 1 (messy) to 5 (tidy). These adjective pair ratings revealed the participants' cognitive response. The adjective pairs designed to solicit an emotional response included scales such as 1 (hostile) to 5 (friendly).

The cognitive evaluations focused on "maintenance", "distinctiveness" and "naturalness" while the affective responses focused on "pleasantness" and "arousal" (Chon & Shafer, 2009). Results showed that pleasantness and distinctiveness accounted for the most variance in explaining likeability followed by arousal and naturalness. Maintenance accounted for the least among the five variables. In other words, one cognitive variable (distinctiveness) and one emotional variable (pleasantness) contributed the most variance in explaining trail feature likeability. Unfortunately, It is difficult to ascertain what trail characteristics led to the emotional response of "hostile" or "friendly". Separating the cognitive and affective dimension negates the possibility that a cognitive appraisal could be mediating an affective response. For example, it is interesting that maintenance (messy, tidy) accounted for little variance and yet pleasantness did. It is possible that although the participant didn't attribute tidiness to likeability, the tidy environment led to a pleasant emotional response. This dissertation assumed a more direct approach and had participants rate various trail segments on a variety of characteristics after determining the importance and desirability of those characteristics for the rater. Another limitation of the Chon &

Shafer study (2009) is that participants were college students and not necessarily trail users. The proposed study will include active trail users in order to acquire well-informed responses. Finally, although a virtual tour may be a novel way to examine an environment, the ability to solicit an emotional response through a static image on a computer screen is much less salient than placing the participant in nature where the capacity to perceive and evaluate with all five senses is critical.

Environment & Perception

Bronfenbrenner (1977) emphasized the importance of individual perception in the social-ecological model. The socio-ecological model defines the individual as "motivating change in individual behavior by increasing knowledge, or influencing attitudes or challenging beliefs" (Bronfenbrenner, 1977). Individual perception of the environment may be just as powerful a predictor of physical activity as the actual environment (Sallis, Johnson, Calfas, Caparosa, & Nichols, 1997; Wong, 2011). Some researchers question whether perception of the environment is *more* explanatory than the actual environment (Wong, 2011).

For example, perceived crime is cited as a reason for using modes of transport other than cycling or walking (Lovasi et al., 2009). Although perceived crime is not an aspect of the built environment, it is a social characteristic that may explain the effect of built environment factors on physical activity. Incivilities such as graffiti and garbage influence aesthetics and thereby influence perceived safety, which can lead to less time walking outdoors (Bedimo-Rung, 2005). Vorhees et al. (2010) selected a random sample of 60 girls from 36 schools in six cities to investigate the relationship between perceived and objective neighborhood variables. The perceived environment data was gathered from a survey that inquired about crime and traffic safety, aesthetics, and access to facilities. Demographic, street connectivity, land use diversity, block size, population density, and destinations were objectively measured. Results showed that 56% of the 890 girls living within 1.5 miles from school reported walking to or from school at least

once during the week. Girls who perceived that their neighborhood was safe were almost twice as likely to walk to or from school (Vorhees et al., 2010). This study did not objectively measure crime. This present study asked participants to report their perceived level of safety on various segments of the trail, which will be compared to city crime statistics for that area. Subjective ratings of safety will also be compared to current rates of use to see if an association exists between perceived safety and overall utilization for each segment.

Zoellner et al. (2012) conducted a survey with trail walkers to determined if perceived and objective audit variables predict meeting the recommendations for physical activity. Participants reported their physical activity over the past seven days including numbers of days of activity, time spent daily, and level of intensity. Perceptions of neighborhood and walking trails were surveyed to identify "barriers and enablers for physical activity" (Zoellner, Hill, Zynda, Sample, & Yadrick, 2012). The neighborhood variables included presence of sidewalks and maintenance, lighting, dogs, traffic speed, and safety from traffic. Trail variables related to safety included feeling of safety on trail, crime on trail, lighting, trail surface, and presence of animals. Trail variables regarding amenities included aesthetics, fitness equipment, restrooms, and benches (Zoellner, Hill, Zynda, Sample, & Yadrick, 2012). Objective ratings were acquired using the Path Environmental Audit Tool (PEAT) (Troped, et al., 2006). The researchers identified 21 trails in the city of Hattiesburg, Mississippi to include in the study. Results of the PEAT revealed high (positive) scores for safety features, 52% of trails had good or excellent surface conditions, benches were common, but aesthetics and restrooms were lacking (Zoellner, Hill, Zynda, Sample, & Yadrick, 2012). None of the objectively rated variables predicted physical activity or meeting recommended guidelines for activity. Likewise, none of the perception variables predicted meeting recommended guidelines for physical activity. However, the frequency of trail use was correlated with higher perceptions of trail safety and trail amenities. Although this study was ambitious in its effort to objectively audit 21 trails, it did not report whether

individual perceptions were in agreement with objective ratings. It is not clear whether the results would have been different if they only included variables in the model that were in subjective/objective agreement. The present study on The Anne & Roy Butler Trail is different in that the outcome variable was trail characteristic ratings rather than meeting recommended physical activity guidelines. An important additional component was to compare subjective and objective ratings of trail characteristics to determine agreement. If ratings are in agreement then recommendations for trail improvements are in order. If ratings disagree then education about the actual environment on the trail is warranted in order to encourage utilization across all sections of trail.

Case Study: The Trail at Lady Bird Lake

The urban trail of interest in this study is a recreational resource for the community of Austin, Texas and is utilized by walkers, runners, and cyclists. Lady Bird Lake runs through the city center of Austin and is surrounded by an urban trail nearly 10 miles in length (TTF, 2012). This body of water is a dammed section of the lower Colorado River. The Anne & Roy Butler Trail challenges some of the findings of prior research (TEMBA, 2011; TLTF, 2007). These discrepancies include the number of people that drive to the trail, the lack of use in lower socioeconomic neighborhoods adjacent to the trail despite ample access, and the notion that the further one lives from the trail the less likely they are to use it (Krizek et al., 2007; Kaczynski & Henderson, 2007; Zoellner et al., 2012)

Historically, Interstate 35 in Austin has represented a cultural and socioeconomic divide with ethnic minorities and low-income families residing east of the highway (CAPCOG, 2011). Contrary to research that suggests lower income neighborhoods lack access to recreational resources (Kawakami, 2011), this trail offers ample access along the entire 10-mile loop regardless of socio-economic status adjacent to the trail. Interestingly, 75% of trail users also report doing their activity west of the Congress Bridge (TEMBA, 2011) where a variety of loops can be made ranging from one

to five miles. The trail east of I35 is less traveled as 11% of all users report using the eastern section of the trail (TEMBA, 2011). It is important to understand why trail users are avoiding certain sections of the trail in order to better understand trail use in general. In order for urban trails to positively impact the physical activity of all populations, all sections of the trail need to be perceived as traversable without barriers (Coutts & Miles, 2011). It is the aim of this study to examine possible reasons for this disparity in utilization. The implications for this research could lead to trail improvements or education to address misconceptions that in turn could result in greater usage in areas that are currently under-utilized. Ideally, this would lead to greater social capital and increased PA among residents in these areas, which could ultimately reduce the prevalence of obesity.

Prior research on The Anne & Roy Butler Trail shows that 60% of users drive to the trail rather than walk or ride bicycles (TEMBA, 2011). Thus, the majority of users are driving to the trail and choosing to access it west of the I35 highway. There are 15 common access points to the trail (Riverside, 2003). However, over 75% of all users enter at one of four locations, all of which are West of Interstate 35.

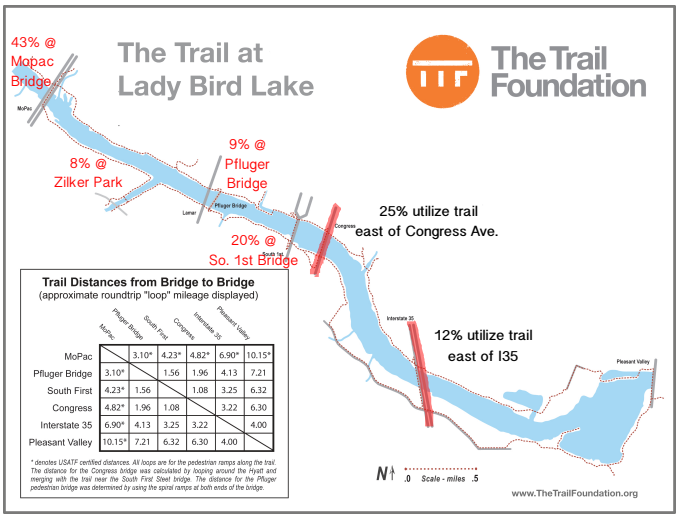


Figure 2.2 Common *Access Points*

The outcome of the TEMBA study (2011) that deserves further investigation to help to explain the disparities in use across the trail are the characteristics that the 3 most utilized routes have in common:

1. The three most popular routes include the Mopac Bridge where 43% of users access the trail.
2. The three most common routes avoid a 1-mile gap on the south side of the lake that requires trail users to use a sidewalk which crosses I-35 and more than 35 driveways, curb cuts, and intersections with high exposure to traffic (TTF, 2012).
3. The three most common routes are west of the Congress Bridge (and I35).
4. The three most common routes are loops.

It is tempting to draw conclusions based on these statistics, however there were several limitations in this study that leave unanswered questions regarding possible reasons for the disparity in utilization on this trail. The TEMBA study (2011) analyzed 150 surveys collected through intercept and online methods. The participants were approached at random with no specific methodology concerning day of week, time of

day, or location on trail. Recruitment took place both on and off the trail so it can't be assumed that responders were regular users on the trail. Prior research has shown that users and non-users often report opposing perceptions. For instance, a study on park use showed that park users rated the park as safe while non-users rated the park as unsafe (Nager & Wentworth, 1976). It is important to survey current trail users to acquire the most accurate and meaningful evaluations from well-informed participants.

Most of the studies reviewed in the physical activity and environment literature approach their research questions within a social-ecological framework. The methods and outcomes of the TEMBA study (2011) offer descriptive data concerning trends of utilization but did not assess the environmental factors that may also influence patterns of use. The present study conducted a trail count to confirm that a disparity in usage exists and then collected subjective ratings of trail characteristics to identify perceived barriers.

Overview of Study

The 10-mile crushed granite loop that winds its way through the city of Austin is formally known as *The Ann and Roy Butler Hike and Bike Trail at Lady Bird Lake* (TTF, 2012). The purpose of this study was to identify environmental characteristics that may influence differences in utilization across different sections of this urban trail. According to pilot data, the typical user drives to the trail. If most users are driving to the trail, it is evident that they are choosing a different section of the trail than what is adjacent to lower SES neighborhoods. It is important to identify the perceived barriers in these sections in order to promote a trail that is considered traversable through all neighborhoods thereby connecting people of varying demographics in an effort to improve social capital.

A trail count and online survey will be used to collect usage patterns, perceived ratings of trail characteristics, and demographic information. Participants for this study will include adult pedestrians and bicyclists over the age of 18 that are utilizing the trail. Understanding socio-demographic user characteristics such as age, race/ethnicity,

distance traveled to access trail will provide useful information for future urban planning of recreational resources and policy design.

Research Questions

1. How many users are on The Trail at Lady Bird Lake during peak hours and what are the differences in utilization across different sections of the trail?
2. What are the demographic characteristics and patterns of use of people on the trail?
3. What trail characteristics do users value most?
4. How do users perceive and rate characteristics on different sections the trail?
5. Are perceptions of trail characteristics in agreement with objective measurements?

CHAPTER 3: METHODOLOGY

Setting

The Anne & Roy Butler Trail easily subdivides into routes of varying distances via bridges and was divided into six segments for evaluation. For the purpose of this study, three segments north of Lady Bird Lake and three segments south of Lady Bird Lake were observed. These included northwest (NW), north central (NC), and northeast (NE). The three segments south of Lady Bird Lake will include: southwest (SW), south central (SC), and southeast (SE). Bridges across the lake offer a convenient boundary line for each segment and were not used for observation.

The dividing line between the West, Central, and East zones was chosen based on rates of utilization according to a study conducted during the summer of 2011 (TEMBA, 2011). The TEMBA study collected a combination of 150 trail-intercept and online surveys. Results showed that 75% of those who took the survey reported using the western portion of the trail between the Mopac Bridge and So. Congress Bridge. For the purpose of this study, these segments were labeled Northwest (NW) and Southwest (SW). The remaining 25% of users reported using the section of trail east of the So. Congress Bridge extending to the Pleasant Valley Bridge (TEMBA, 2011). This area was divided into two segments both north and south. The area was segmented where utilization drops to 12% (TEMBA, 2011), which is at the I35 Bridge. North Central (NC) and South Central (SC) will extend from the Congress Bridge to I35. Northeast (NE) and Southeast (SE) will extend from I35 to the Pleasant Valley Bridge. The reason for subdividing the West, Central, and East zones into North and South segments was to attain an accurate portrayal of environmental characteristics that may differ between the north and south sides of the lake. Figure 3.1 shows the six segments chosen for this study.

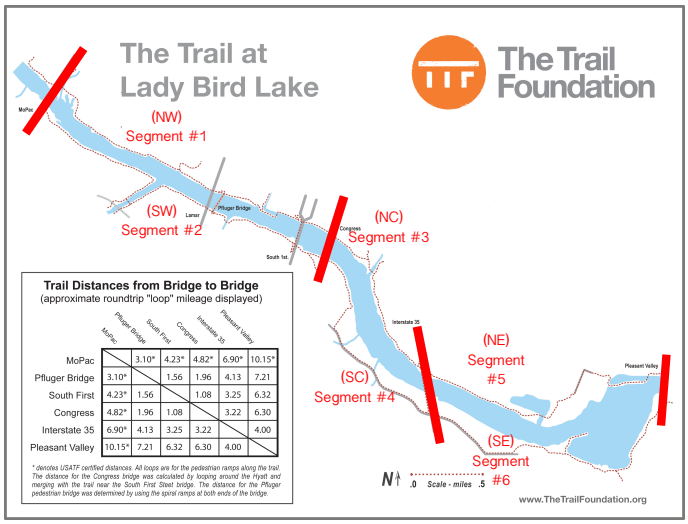


Figure 3.1 Study Segments

Participants: Trail User Count

Researchers observed trail users on six segments of the trail during one weekday from 7-9am, one weekday from 5-7pm, and on one Saturday from 9-11am.

Participants: Online Survey

Two different methods were used to recruit trail users to participate in an online survey. The first method briefly intercepted trail users to offer a small card that directed users to an online survey. A QR code was printed on the card to encourage timely response through use of a handheld device. Trail users were recruited while at rest on the trail, such as water stations or access points. The cards were distributed during the week and weekend during peak hours. The second recruitment method utilized an email newsletter produced by a local non-profit trail advocacy organization. A link to the survey was listed in the free monthly newsletter.

Procedures

To measure users, Krizek et al. (2009) suggests three general strategies. 1) Self-reporting, which involves asking users to provide details about trail behavior 2) Observation, which requires researchers to observe individual activity through manual or digital methods and 3) Tracking devices such as pedometers or GPS units. This study employed the first two methods using a self-reported online survey and a manual trail count. Many studies conduct user counts but they do not often query people's choice of route or environmental preferences (Dill, 2008). This study aims to illuminate the individual perceptions association with usage and compare this data to objective ratings.

Trail User Count

An observer trail count was conducted on all six segments of the trail to seek replication of earlier findings (TEMBA, 2008) that indicate disparity in usage across different segments of trail. Results from the trail count will also be compared to self-reported data collected in current study. Volunteer observers were trained on proper count procedures consistent with the protocol established by the National Bicycle & Pedestrian Documentation Project (Jones, Buckland & Cheng, 2005). Specifically, observers were assigned to a segment for two hours. Trail users were counted by marking tallies on a count recording form. These observations occurred on all segments of the trail as users passed the observer's station, which is within 1/8 mile from an access point (MTC, 2003). Trail users were counted in 15-minute intervals for a 2-hr period (Schweizer, 2005). Trail users were observed and coded for 1) mode of activity 2) traveling solo or with others and 3) gender. A cell phone alarm clock was set with 8 alarms to alert observer to use a new count sheet for every 15-minute segment. Temperature and overall weather was recorded throughout the observation period.

During peak hours (5-7pm on weekdays and 9-11am on Saturday) two observers were assigned to segments that were anticipated to be busier (NW and SW) based on the TEMBA study (2011). In the two-observer segments, one observer counted

eastbound users while the other counted westbound users. Observers recorded gender of user and mode of travel, which the TEMBA study reported as 80% walkers and runners and 20% cyclists (TEMBA, 2008). The count sheet includes an "other" category that might include baby strollers, wheelchairs, or scooters. For example, a baby in a stroller is considered a user whose mode is reported under "other" while the adult pushing the stroller is counted as a walker or runner. Observers also recorded whether the user is traveling alone or in a group. Training emphasized the importance of an accurate count. To this end, volunteers were told: "If you spend more than a second or two trying to determine a user's gender or whether the user is part of a group, make your best guess and move on." Observers were also advised not to "count ahead" down the trail but to only count those users who cross the "invisible line" in front of observer station (Jones, Buckland & Cheng, 2005).

The trail user count occurred on two weekdays (Wednesday and Thursday) during peak morning and evening hours and one weekend day (Saturday) during peak morning hours. On Wednesday, three southern segments were counted in the morning from 7:00-9:00am and the three northern segments were counted Wednesday evening from 5:00-7:00pm. The same schedule was applied on Thursday except the segments switched from a morning count to an evening count and vice versa (Table 3.1). The southern sections were counted at the same time to maintain consistency in the event that an uncontrollable variable affects count (i.e. construction, traffic, special event). Six counters covered all segments on Saturday simultaneously from 9-11:00am. In order to maintain consistency, counting adjacent segments occurred on weekdays as well.

Table 3.1
Trail Count Schedule

	Wednesday	**Thursday**	**Saturday**
7-9am	SW, SC, SE	NW, NC, NE	
5-7pm	NW, NC, NE	SW, SC, SE	
9-11am			NW, NC, NE, SW, SC,SE

Online Survey

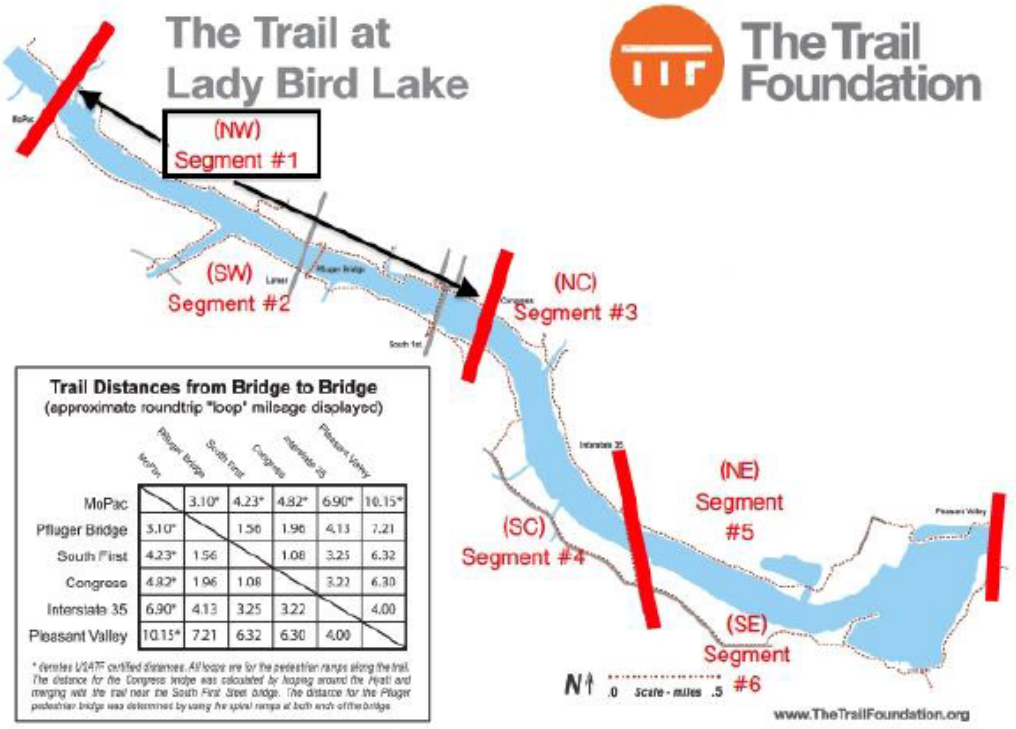
An *online survey* was conducted to acquire individual perceptions about trail characteristics that may contribute to trail utilization disparities. The survey serves 3 purposes: 1) collect subjective ratings of trail characteristics from users on all six segments 2) collect individual patterns of use and 3) obtain demographic information.

Trail users in each of the six segments were invited to take a card small enough to fit in the pocket of running shorts. The card directed users to an online survey. Each segment had a different card with a slightly different survey URL address to identify which zone the user was in when approached by the researcher. Users were recruited while at rest on the trail, such as water stations or access points, and asked to complete the survey in the next couple of days. The cards were distributed during weekdays and Saturdays during peak hours, which included morning, noon, and evening hours.

The online survey asked 44 questions with an estimated completion time of 15 minutes. A 6-point Likert-scale (1- “strongly disagree, 2- “moderately disagree”, 3- “mildly disagree”, 4- “mildly agree”, 5- “moderately agree”, 6- “strongly agree”) was used to measure subjective ratings of safety, parking, crowding, trail continuity, trail direction clarity, drinking water, shade, bathroom availability, litter, and separation from traffic on all six segments. Patterns of trail utilization were obtained through survey questions that included mode of travel to trail, distance traveled to access trail, access point, mode of recreational activity on trail, most common route on trail, route type (loop, out & back, one-way & exit), and frequency of use. The survey question that provided the data for analyzing subjective ratings of trail segments is illustrated in Figure 3.2.

Please examine the map before answering the following question.

MOPAC BRIDGE to CONGRESS BRIDGE (North of lake)
Landmarks along this section: Austin High School, Texas Rowing Center, Cesar Chavez Rd., Lamar Bridge, So. 1st Street to Congress Ave.



19. For (NW) Segment #1, to what extent do you agree with the following statements about this segment?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Safe to be on trail alone.	◯	◯	◯	◯	◯	◯
Plenty of areas to park throughout segment.	◯	◯	◯	◯	◯	◯
Too crowded.	◯	◯	◯	◯	◯	◯
Can do a loop of desired distance.	◯	◯	◯	◯	◯	◯
Trail is continuous - no need to use streets or sidewalks.	◯	◯	◯	◯	◯	◯
Trail direction is clear.	◯	◯	◯	◯	◯	◯
Plenty of public drinking water.	◯	◯	◯	◯	◯	◯
Plenty of shade.	◯	◯	◯	◯	◯	◯
Adequate number of bathrooms available.	◯	◯	◯	◯	◯	◯
Very little litter or glass on trail.	◯	◯	◯	◯	◯	◯
Separated from cars and noise.	◯	◯	◯	◯	◯	◯

Figure 3.2 *Survey question to examine perception of trail characteristics*

The following survey question provided data on individual preferences:

"How much do the following characteristics influence your choice of route?

Personal safety
Ability to make a loop
Preference to be around people
Access to parking
Trail direction is clearly marked
Limited exposure to traffic while on trail
Continuous path (unbroken route)
Access to amenities such as drinking water and bathrooms

Objective Measures

A researcher audit of trail characteristics was conducted to obtain descriptive data for comparison to subjective ratings. Trail characteristics were measured for all six segments using computer-aided design (CAD) software, Google maps, *The Trail Foundation* maps, and researcher audit. CAD was used to measure segments for exposure to traffic, distance from traffic to trail, and shade. There are two *Trail Foundation* maps that will be used for objective assessment. One map outlines the trail with distance between bridges and includes total distance for a variety of loops. The other map is an online interactive map that reveals the location of facilities and resources, which includes water stations and bathrooms. The researcher conducted a trail audit to confirm the data provided by *The Trail Foundation* maps. Table 3.2 outlines the subjective survey prompts and corresponding objective measures.

Safety. Census blocks adjacent to the trail were identified and examined for crime statistics. The number of incidents of aggravated assault that occurred during 2012 in each segment was used for analysis.

Parking. On street and lot parking adjacent to the trail was identified by research audit and calculated using CAD software and Google Maps. One parking stall is 20 linear feet (lf). A Google Maps layer was used with CAD software to graphically

represent the trail. After determining segment length in linear feet, the number of parking stalls per linear foot (20ft x #stalls/segment lf) was used as the objective measure.

Continuity. Linear feet of broken trail per segment (e.g. quality of path diminished by interruption of sidewalk, street, or park space for more than 10 yards) were identified and calculated using researcher audit and CAD software as previously described.

Route options (loops). The Trail Foundation map was used to determine the number of loops that are contained within each segment.

Clarity of trail direction. Ambiguous junctions that warrant directional signage were given a score of 1 if signage was posted and 0 if there was no sign present.

Shade. CAD software and Google Maps were used to trace tree canopy over the trail. This allowed for a calculation of linear feet of tree canopy/segment, which is displayed in Appendix A. The % tree canopy ranged from 85% (NW) to 30% (SE).

Litter. Researchers walked the trail and counted pieces of litter on the crushed granite pathway for each segment and reported ratio of trash to linear feet.

Exposure to traffic. CAD software and Google Maps were used to calculate linear feet of trail within 10ft of road. This was used to calculate exposure/segment, which was expressed as the % exposure per segment.

Bathrooms. The Trail Foundation interactive map was used to identify # of bathrooms per segment.

Drinking Fountains. The Trail Foundation interactive map was used to identify # of drinking fountains per segment.

Crowding. Trail count data provided # of users per segment in 15-minute blocks over two hours.

Table 3.2 *Subjective Rating Prompts and Measures*

Trail Construct	Subjective ratings	Objective Measurement	Source
Safety	"Safe to be on trail alone"	# aggravated assaults	Census block crime statistics (Austin, 2012)
Parking	"Plenty of areas to park throughout segment"	# spaces per lf	Google map with CAD software
Continuity	"The trail is continuous - no need to use urban streets or sidewalks"	% segment lacking continuity	Researcher audit Google map with CAD software
Route diversity	"Can do a loop of desired distance"	# loops within segment	*The Trail Foundation* Map
Trail clarity	"Trail direction is clear"	# signs/# junctions	Researcher audit
Aesthetics	"Very little litter or glass on trail" "Plenty of shade" 'Separated cars/noise"	% trash to lf # lf tree canopy # linear feet within 10ft road	Researcher Audit Google map with CAD software
Amenities	"Plenty of public drinking water" "Adequate number of bathrooms available"	# fountains per segment # bathrooms per segment	*The Trail Foundation* interactive map and researcher audit
Pop. density	"Too crowded"	# users per 15 minute block	Trail user count

Analysis

Descriptive statistics were used to analyze patterns of use and demographics. Survey participants were divided into two groups of trail users (west users, east users) based on the trail route they reported as traveling most often. A logistic regression was performed to determine the effect of trail preferences (personal safety, ability to make a loop, preference to be around people, access to parking, trail direction clearly marked, limited exposure to traffic, continuous path, and access to amenities such as drinking water and bathrooms) on frequency of use (occasional, frequent). Frequent users were

defined as those who use the trail one or more times per week. An Anova was conducted to determine if there were differences in trail characteristic preferences between east and west users. A multivariate analysis of variance was performed to determine the effect of group (East, West) on all ratings of the two segments chosen for comparison (NW, NE). This was followed by a 2x2 mixed design ANOVA with one between- subjects factor and one within-subjects factor. A simple effects analysis was conducted for each of the significant interaction effects to identify where the differences occurred. Qualitative analysis was used to confirm user preferences and perceptions of trail characteristics. Comparison of subjective ratings and objective measurements were made by plotting values on a graph with x-axis representing Likert 1-6 scale and y-axis representing objective measurement. Concordance was assessed by the degree to which subjective ratings increased as objective measures improved or decreased as objective measures deteriorated.

CHAPTER 4: RESULTS

Patterns of Use

Trail Count. Table 4.1 shows the results of the Saturday trail count. Five thousand eight hundred and twenty-one (n=5,821) adults (44% male) were counted between 9:00-11:00am on Saturday May 18, 2013. Weather conditions during the count varied from mostly cloudy and 73 degrees to mostly sunny and 84 degrees. The busiest 15-minute block was 10:00-10:15am with 786 people observed on the trail across all segments. The NW and SW segments accounted for most of these people with 665 users combined. The western sections (NW, SW) exhibited the highest number of people over the two-hour count with 4,680 trail users representing 80% of the people on the trail. The central sections (NC, SC) reported 813 people representing 14% of all users. The eastern sections (NE, SE) had the lowest number of people with 327 trail users representing 6% of the people on the trail. Mode of travel observed was 94% walking or running and 6% cycling. 48% were traveling alone.

Table 4.1
Saturday Trail Count Results

	NW	SW	NC	SC	NE	SE	Total
9:00am	262	288	87	39	23	23	722
9:15am	278	292	64	38	20	15	707
9:30am	275	274	52	45	29	17	692
9:45am	310	299	50	54	26	29	768
10:00am	328	337	63	34	14	10	786
10:15am	313	317	54	23	22	26	755
10:30am	265	300	87	44	24	19	739
10:45am	241	302	40	39	13	17	652
Total	2,272	2,408	497	316	171	156	5,821

The weekday trail user count was conducted on two weekdays (Wednesday and Thursday) during peak morning and evening hours on Wednesday February 27, 2013 and Thursday February 28, 2013. Morning temperatures ranged from 42-52 degrees

and evening temperatures ranged from 57-73 degrees. On Wednesday, three southern segments were counted in the morning from 7:00-9:00am and the three northern segments were counted that evening from 5:00-7:00pm. The same schedule was applied on Thursday except the segments that were counted in the morning, were counted in the evening, and vice versa.

Self-report. Two hundred and fifty-eight (n=258) adults (aged 20-73, 46% male) participated in the online survey. Response rate was 16% for participants who were recruited on the trail. Response rate for the online survey via *The Trail Foundation* newsletter is approximate. Each month the newsletter is sent to about 7,000 subscribers and roughly 2,000 people open the newsletter. The newsletter method of recruitment yielded 204 participants, which is approximately 10% of the people that opened the newsletter.

Trail users reported their primary route as being in west sections (74%), with 11% primarily using the central and 15% primarily using the east sections. Users reported their primary mode of recreation on the trail as running (68%), walking (27%), and cycling (5%). These results mirror the objective trail count, suggesting that this sample was representative of normal users on the trail (Table 4.2).

Table 4.2

	Trail Count			Survey
	Saturday N (%)	Weekday AM N (%)	Weekday PM N (%)	N (%)
Sex				
Male	2,567 (44%)	626 (51%)	1,594 (53%)	93 (46%)
Female	3,253 (56%)	611 (49%)	1,398 (47%)	108 (54%)
Activity				
Walkers/Runners	4,943 (94%)	1,199 (97%)	2791 (93%)	240 (96%)
Bicyclists	337 (6%)	38 (3%)	201 (7%)	11 (4%)
Segment usage				
West	4,680 (80%)	924 (75%)	2287 (76%)	163 (74%)
Central	813 (14%)	169 (14%)	432 (15%)	25 (11%)
East	327 (6%)	144 (11%)	273 (9%)	33 (15%)

The self-report survey provided a wider array of information than was observable during the trail count. Specifically, 95% of participants reported using the trail for recreational purposes while 5% reported utilitarian / commuting purposes. The types of routes users chose include loops (85%) and out-and-back (15%). Users reported mode of transportation to the trail as automobiles (66%), walking or running (28%), and bicycling (6%). Trail users originated their trip to the trail from home (80%) and work (20%). Distance traveled to access trail from home showed some traveling more than 5 miles (32%), others 2-5 miles (36%), or less than two miles (32%). Only 9% of trail users travel less than .25 miles from home to access the trail. Distance traveled to access the trail from work showed that most (55%) traveled less than two miles and 24% travel less than .25 miles to access the trail from work. Other trail users travel more than 5 miles (24%) from work and some 2-5 miles (21%).

Based on these responses, and given the interest in examining strong differences in utilization, participants were divided into those who primarily use the west (n=163) and those who primarily used the east (n=33) sections of the trail. Participants who reported their most common route as including the central (n=25) sections were removed from the segment rating analysis in order to focus on users who mainly use western sections. Because the usage drops from 80% to 14% at the west/central boundary, removing these "in-between" users helped separate east and west users more distinctly. Table 4.3 shows the demographic differences between east and west users.

Table 4.3

Demographic Characteristic for East and West Trail Users

Characteristic	West Users	East Users	All Users
Sex			
Male	42%	57%	46%
Female	58%	43%	54%
Race			
White	95%	97%	95%
Black/African American	0%	0%	.50%
Asian	4%	0%	3%
Native Hawaiian	0%	0%	1%
American Indian	1%	3%	.50%
Hispanic			
Hispanic	8%	17%	10%
Non-Hispanic	92%	83%	90%
Age			
Mean	44	43	44
Median	44	40	44
Mode	42	35	39
Annual household income			
< $30,000	3%	22%	7%
$31,000 - $70,000	26%	19%	25%
$71,000 - $100,000	13%	15%	14%
> $100,000	57%	44%	54%
Education			
Some high school	0%	0%	0%
Completed high school	1%	0%	.05%
Some college/vocational	4%	10%	5%
Completed college degree	46%	38%	43%
Some graduate school	10%	17%	10%
Completed graduate degree	39%	35%	41%
Resident			
< 2 years	4%	13%	5%
2-4 years	9%	17%	10%
5-9 years	14%	17%	15%
> 10 years	73%	53%	70%

Trail User Preferences

A logistic regression was performed to determine the effect of trail preferences (personal safety, ability to make a loop, preference to be around people, access to parking, trail direction clearly marked, limited exposure to traffic, continuous path, and access to amenities such as drinking water and bathrooms) on frequency of use (occasional, frequent). Table 4.4 shows the results the eight predictor variables. Only loops and parking were significant. Frequent users were 1.52 times more likely to prefer loops than occasional users and 0.71 times more likely to prefer easy access to parking.

Table 4.4
Logistic Regression Predicting Frequency of Trail Use from Trail Characteristic Preferences

	B	Wald $\chi 2$	*p*	OR
Safety	0.18	2.03	.15	1.19
Loops	0.42	4.79	.02	1.52
More People	-0.14	0.78	.38	0.87
Less People	0.14	0.79	.37	1.15
Parking	-0.34	4.66	.03	0.71
Trail Clarity	-0.01	0.00	.93	1.00
Exposure to Traffic	-0.04	0.06	.81	1.04
Trail Continuity	0.18	0.93	.34	0.84
Amenities	-0.02	0.01	.91	0.99

General trail preferences were attained through the survey question: *"How much do the following characteristics influence your choice of route?"* A 6-point Likert-scale (1- "strongly disagree, 2- "moderately disagree", 3- "mildly disagree", 4- "mildly agree", 5- "moderately agree", 6- "strongly agree") was used to rate preferences for personal safety, ability to make a loop, preference to be around people, access to parking, trail direction clearly marked, limited exposure to traffic, continuous path (unbroken route – no need to use urban streets or sidewalks), and access to amenities such as drinking water and bathrooms. Figures 4.1 and 4.2 show the preference ratings of west and east users, respectively.

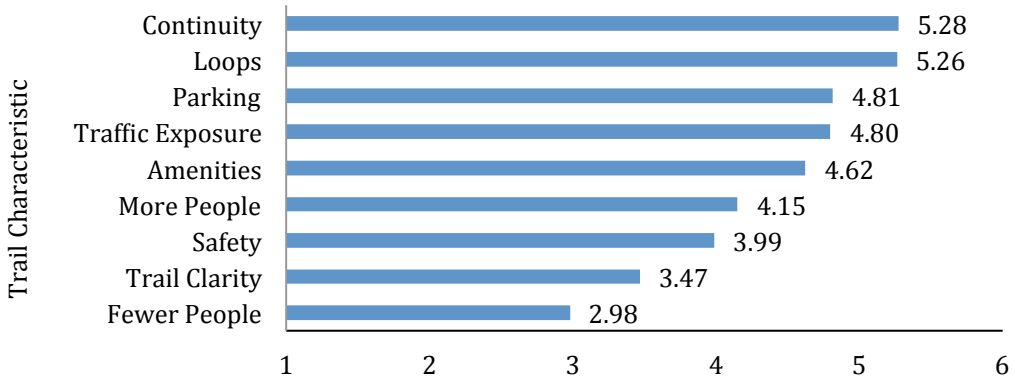


Figure 4.1 West Users Mean Preference Rating

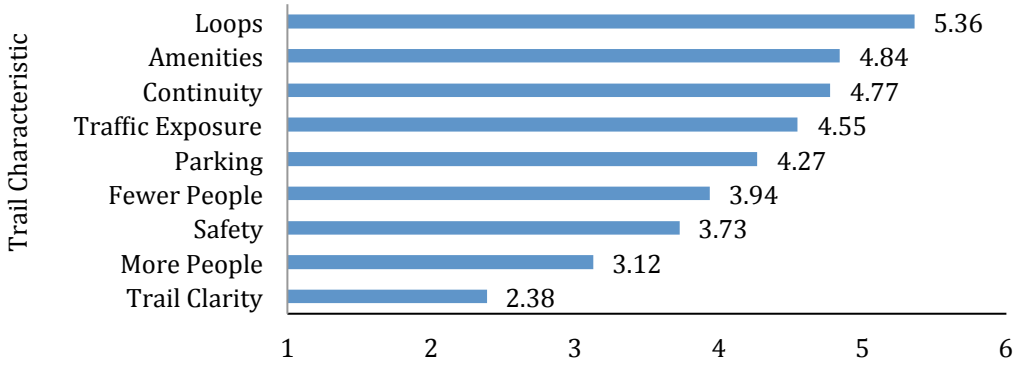


Figure 4.2 East Users Mean Preference Rating

A one-way ANOVA was run to determine if there were differences in preference ratings between east and west users. Significant differences were found for *preference to be around people*, $F(1,184) = 14.14$, $p < .05$, *preference to be around less people*, $F(1,183) = 12.93$, $p < .05$, *preference for trail direction is clearly marked* $F(1,180) = 12.96$ $p < .05$, and *preference for a continuous path* $F(1,185) = 4.57$, $p < .05$. There were no significant differences between groups for *safety, ability to make a loop, parking access,*

exposure to traffic, and *access to amenities* (p > .05). Figure 4.3 illustrates the significant differences between east and west user groups.

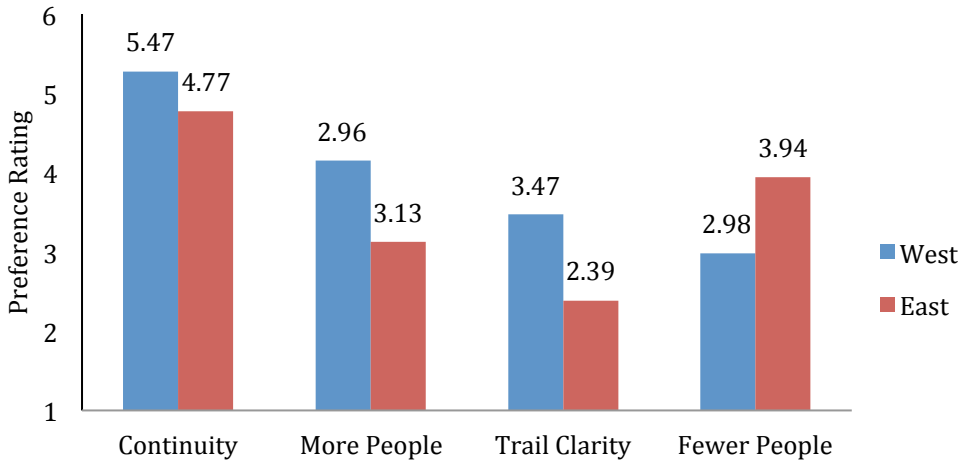


Figure 4.3 Trail Prerences

Subjective Ratings of Trail Segments

East and west users rated trail characteristics for all six segments of the trail. To ease the subjective rating analysis, two segments were selected for further analysis based on usage: NW vs. NE. This allowed for a clear comparison of the east and west sides of the trail, focused on those sections with high utilization as indicated by trail count results (Table 4.2). Ratings of NW and NE segments were compared between east and west users on all trail characteristics: safety, parking, continuity, clarity of trail direction, bathrooms, drinking water, shade, litter, exposure to traffic, loop options, and crowding. A multivariate analysis of variance was performed to determine how the east and west users might differ in their ratings of the NW and NE segments. There was a significant effect of user group on the combined dependent variables, $F(20, 74) = 2.890$, $p < .000$; Pillai's Trace = .439; partial $\eta 2 = .439$.

A series of ANOVAs were performed to test for interactions between the groups (west users, east users) and segments (NW and NE) on the dependent variables (segment rating). There was no significant group x segment interaction for bathroom availability, drinking water availability, or shade. Main effects for each of these were tested and showed varying results.

There were main effects of segment for *bathroom*, $F(1,112) = 44.10$, $p<.05$, partial $\eta 2 = .28$, *drinking water availability*, $F(1,113) = 77.05$, $p<.05$, partial $\eta 2 = .40$, and shade, $F(1,110) = 41.81$, $p<.05$, partial $\eta 2 = .27$. Pairwise comparisons showed all three variables received higher ratings in the NW segment: bathroom availability (+1.06), drinking water (+1.53), and shade (+0.898).

There were main effects of group for bathrooms, $F(1,112) = 5.35$, $p<.05$, partial $\eta 2 = .04$, and drinking water, $F(1,113) = 6.22$, $p<.05$, partial $\eta 2 = .05$. The main effect of group did not show a significant difference in shade ratings between east and west users, $F(1,110) = .15$, $p<.05$, partial $\eta 2 = .001$. Pairwise comparisons showed that the east users rated bathrooms (+0.783) and drinking water (+0.629) higher than west users.

There were significant interaction effects for trail user group on *safety* $F(1,120) = 16.32$, $p=.00$, partial $\eta 2 = .12$, *parking* $F(1,120) = 4.86$, $p=.03$, partial $\eta 2 = .04$, *continuity* $F(1,120) = 6.24$, $p=.01$, partial $\eta 2 = .05$, *clarity of trail direction* $F(1,120) = 7.17$, $p=.0$, partial $\eta 2 = .06$, *litter* $F(1,120) = 4.54$, $p=.03$, partial $\eta 2 = .04$, *exposure to traffic* $F(1,120) = 10.03$, $p=.00$, partial $\eta 2 = .08$, *ability to make a loop of desired distance* $F(1,120) = 18.86$, $p=.00$, partial $\eta 2 = .14$, and *crowding* $F(1,120) = 6.30$, $p=.01$, partial $\eta 2 = .05$. These results show that east and west users rated segments differently on 8 out of 11 trail characteristics.

A simple effects analysis was conducted for each of the significant interaction effects to identify where the differences occurred. Greenhouse-Geisser correction was used for violations of sphericity.

Most of the significant effects pertained to the NE segment where the mean ratings on trail characteristics were higher among east users than west users. These included: *safety* $F(1, 120) = 14.71$, $p<.05$, partial $\eta 2 = .10$, *trail continuity* $F(1 ,113) = 9.06$, $p<.05$, partial $\eta 2 = .07$, *trail direction clarity* $F(1 ,107) = 5.64$, $p<.05$, partial $\eta 2 = .05$, and *loops* $F(1 ,109) = 20.00$, $p<.05$, partial $\eta 2 = .15$.

Significant simple effects pertaining to the NW segment showed that mean ratings were higher among west users than east users. These included: *crowding* $F(1,116) = 8.72$, $p<.05$, partial $\eta 2 = .07$ and *exposure to traffic* $F(1 ,111) = 5.91$, $p<.05$, partial $\eta 2 = .05$.

Although there were significant interactions between user group and trail segment for parking rating (p=.03) and litter rating (p=.03), none of the east vs. west user simple effects for either trail segment was significant. In this case, simple effects analysis tests whether west - east = 0 for the NW segment and/or west - east = 0 for the NE segment. However, with a significant interaction, although neither of these differences is significantly different from 0, it is possible that these differences are significantly different from each other (Sweet & Martin, 2011).

Within-group and simple effects analysis showed that east and west users agreed that the NW deserves higher ratings on safety, continuity, bathroom availability, water, clarity of trail direction, and shade. West users: *safety* $F(1,93) = 267.03$, $p < .05$, partial $\eta 2 = 0.742$, *continuity* $F(1,88) = 149.19$, $p < .05$, partial $\eta 2 =0.629$, *bathroom availability* $F(1,87) = 76.09$, $p < .05$, partial $\eta 2 =0.467$, *water* $F(1,87) = 94.39$, $p < .05$, partial $\eta 2 =0.520$, *clarity of direction* $F(1,85) = 152.41$, $p < .05$, partial $\eta 2 =0.642$, *shade* $F(1,85) = 61.92$, $p < .05$, partial $\eta 2 =0.421$. East users: *safety* $F(1,25) = 14.42$, $p < .05$, partial $\eta 2 = 0.417$, *continuity* $F(1,25) = 14.42$, $p < .05$, partial $\eta 2 =0.366$, *bathroom availability* $F(1,25) = 7.11$, $p < .05$, partial $\eta 2 =0.222$, *water* $F(1,26) = 19.08$, $p < .05$, partial $\eta 2 =0.423$, *clarity of direction* $F(1,22) = 8.44$, $p < .05$, partial $\eta 2 =0.277$, and *shade* $F(1,25) = 12.19$, $p < .05$, partial $\eta 2 =0.328$.

The only NE trail characteristic that east and west users agreed deserves a higher rating than the NW is *crowding*. West users, $F(1,86) = 31.95$, $p < .05$, partial $\eta 2 = 0.271$. East users, $F(1,24) = 4.92$, $p < .05$, partial $\eta 2 = 0.170$.

West users also rated the NW segment higher for *parking* $F(1,85) = 27$, $p < .05$, partial $\eta 2 = 0.241$, *loops* $F(1,83) = 93.83$, $p < .05$, partial $\eta 2 = 0.531$, *litter* $F(1,85) = 75.29$, $p < .05$, partial $\eta 2 = 0.470$, and *exposure to traffic* $F(1,85) = 75.29$, $p < .05$, partial $\eta 2 = 0.470$. East users showed no difference between NW and NE ratings for parking, loops, litter, and exposure to traffic ($p = >.05$).

Qualitative analysis was used to identify reasons why trail users preferred using the east or west side of the trail. Perceptions of population density, safety, aesthetics, and familiarity were common themes derived from the responses.

Reasons for using the west side of the trail included:

"Safest, usually has a lot of other people on it."

"Prefer to be around more people, unbroken loop."

"I like the social aspect of running, so I find that there are far more people on the trail when going [west]."

"I know this part best. Safe. Nice views. More people."

"It's scenic and shady."

"There's more raw nature and shade on the [west] side."

"East is a confusing path, and it takes you onto the street quite a bit."

"East is more scenic but fewer people and probably the reason I would run west first."

"I am not familiar with the east route at all."

"East side is not very safe."

"East side is a little scary."

Reasons for using the east side of the trail included:

"Less foot and bike traffic. No walking near car traffic. Pleasant scenery."

"Scenery. Not crowded. No traffic."

"Fewer people, pleasant path."

“Prettiest trail.”

“Less people, wider paths, less buildings, more greenery.”

“Prefer to "run" with the "runners" vs. the mix of walkers, bikes, strollers, etc.”

Summary of Subjective Ratings

East and west users reported different preferences when choosing their route. Specifically, west users are concerned about safety and prefer to be around people and use continuous trails with clear direction more so than east users, who prefer to be around less people.

A comparison of how east and west users rated the NW and NE segments shows west users rating the NW segment significantly higher than east users on crowding and exposure to traffic. This was suggested by east users who said they prefer the east side for “less foot and bike traffic and no walking near car traffic”. There were no trail characteristics on the NW segment that east users rated higher than west users, but there were many on which they generally agreed: safety, continuity, directional clarity, bathrooms, drinking water, loops, shade, parking, and litter. Similarly, east users rated the NE segment higher on safety, continuity, trail direction clarity, and loops. This is reinforced by west users who commented that the east side is a confusing path and “not very safe”.

There were no trail characteristics on the NE segment that west users rated higher than east users, but they generally agreed on bathrooms, drinking water, shade, parking, litter, exposure to traffic, and crowding.

A comparison between segments within each group, rather than between groups, showed that east and west users agreed that the NW segment deserves higher ratings for safety, continuity, bathrooms, drinking water, shade, and clarity of trail direction. West users also rate the NW segment higher than NE for parking, loops, litter,

and exposure to traffic while east users reported no difference in their NW/NE ratings of these variables. The only NE trail characteristic that east and west users agreed deserves a higher rating is crowding.

Objective Measures

The trail count and researcher audit of trail characteristics provided descriptive data for comparison to subjective ratings. Trail characteristics were objectively measured for all six segments using computer-aided design (CAD) software, Google Earth, The Trail Foundation maps, and researcher audit. Observations are reported in Table 4.5.

Safety. Census blocks adjacent to the trail were identified and examined for crime statistics. The number of incidents of aggravated assault that occurred during 2012 in each segment was used for analysis. The NC segment had the highest number of aggravated assaults (139) and the NW segment had the least (0).

Parking. On street and lot parking adjacent to the trail was identified by research audit and calculated using CAD software and Google Maps. One parking stall is 20 linear feet (lf). A Google Earth layer was used with CAD software to graphically represent the trail. After determining segment length in linear feet, the number of parking stalls per linear foot (20ft x #stalls/segment lf) was used as the objective measure. The distribution of parking spaces, along with total numbers per segment, is illustrated in Appendix A. The SE segment had the highest number of parking spaces (825), which calculated as 1.87 parking spaces per linear foot of trail. The SC segment had the least parking spaces (0). The average number of parking spaces available per linear foot across all segments is 0.81. These spaces are noted in Appendix C.

Continuity. Linear feet of broken trail per segment (e.g. quality of path diminished by interruption of sidewalk, street, or park space for more than 10 yards) were identified and calculated using researcher audit and CAD software as previously described. The sections of trail that lack continuity and the proportion of segment that

is continuous are highlighted Appendix D. The SC segment is the least continuous segment with 4,641 feet of trail interrupted, which leaves 26% of the trail continuous. The NW, SW, and NC segments are the most continuous (100%).

Route options (loops). The Trail Foundation map was used to determine the number of loops that are contained within each segment. The NW and SW segments offer the greatest number of loops (6) and the four remaining segments offer the least (1).

Clarity of trail direction. Ambiguous junctions that warrant directional signage were given a score of 1 if signage was posted and 0 if there was no sign present. Thus, the score presented in Table 4.4 reflects the proportion of ambiguous junctions that contain signage. An ambiguous junction was defined as a split in the trail at which more than one travel option was viable and similar in form and design as existing trail. All segments scored poorly on this measure. The scores ranged from 1:4 (NE) to 0/5 (SE).

Shade. CAD software and Google Maps were used to trace tree canopy over the trail. This allowed for a calculation of linear feet of tree canopy/segment, which is displayed in Appendix E. The % tree canopy ranged from 85% (NW) to 30% (SE).

Litter. Researchers walked the trail and counted pieces of litter on the crushed granite pathway for each segment and reported ratio of trash to linear feet. The SE segment had the least amount of litter (1:276) and the SC segment had the most (1:71).

Exposure to traffic. CAD software and Google Maps were used to calculate linear feet of trail within 10ft of road. This was used to calculate exposure/segment, which was expressed as the % exposure per segment. Most segments showed a high percentage of separation from the road (91-99%) while the SC and SE segments showed the least (27%, 57%).

Bathrooms. The Trail Foundation interactive map was used to identify # of bathrooms per segment which ranged from 3 (NW, NE) to 0 (SC).

Drinking Fountains. The Trail Foundation interactive map was used to identify # of drinking fountains per segment which ranged from 4 (NW) to 0 (SC).

Crowding. Trail count data provided # of users per segment in 15-minute blocks over two hours which is presented in Table 4.1. The NW and SW segment showed the highest levels of crowding (310, 299) and the NE and SE segments showed the least (26, 29).

Table 4.5
Objective Measurement Results

Variable	NW	SW	NC	SC	NE	SE	Measure
Safety	0	16	139	7	2	41	# aggravated assaults in 2012
Parking	.84	1.1	.34	0	.71	1.87	# spaces per lf per segment
Continuity	100	100	100	26	84	72	% of segment continuous
Direction	0/1	0/3	0/1	0/2	1/4	0/5	# signs/# junctions req. signage
Bathrooms	3	1	1	0	3	1	# bathrooms per segment
Water	4	3	2	0	5	1	# per segment
Shade	85	70	67	30	60	24	% of segment with tree canopy
Litter	1:229	1:103	1:211	1:71	1:91	1:276	trash to lf
Traffic	91	99	95	27	93	57	% of segment > 10ft from road
Loops	6	6	1	1	1	1	# loops per segment
Crowding	310	299	50	54	26	29	# users in 15 minutes

Comparing Subjective and Objective Trail Characteristic Ratings

Figures 4.4 thru 4.14 illustrate the concordance, or lack there of, between subjective and objective ratings. Agreement was assessed by the degree to which subjective ratings increased as objective measures improved or decreased as objective measures deteriorated. Not all subjective ratings and objective measurements fell neatly in this manner. As a result, the vague alignments were reported as *approaching* agreement or disagreement and are not highlighted in the graph.

Safety. Both east and west user ratings seem to align with the objective safety measurements for the NW and SW segments. East users are also in agreement for the SC and SE segment. Both east and west users do not display objective agreement for the NC and NE segments. West users do not agree on SE and SC.

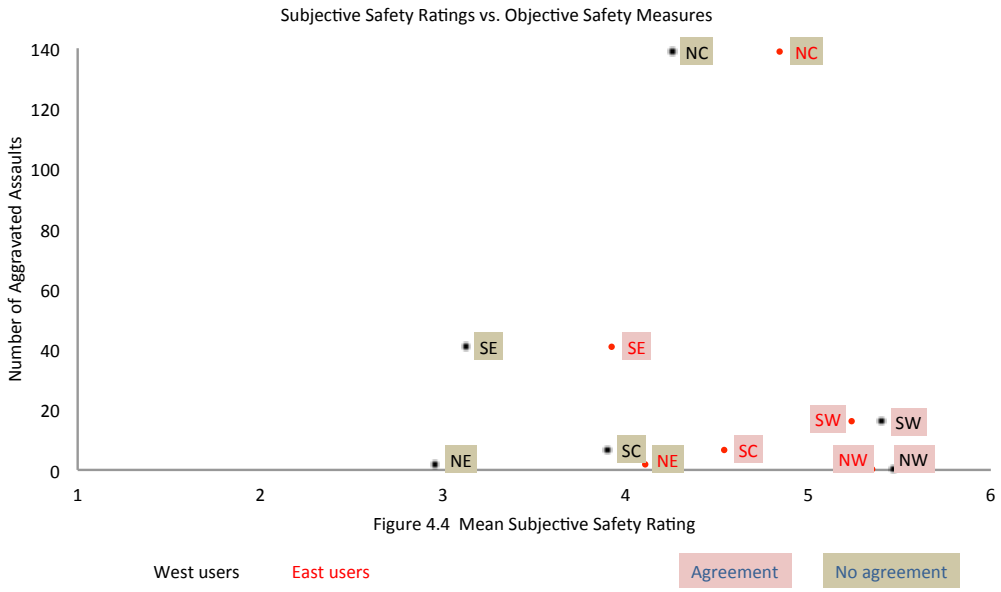


Figure 4.4 Mean Subjective Safety Rating

Parking. East and west users do not match objective ratings for parking in the SE and SC segments and are close to mismatch in the NC segment with east users appearing slightly closer to the objective measure than west users. The remaining segments (NW, SW, NE) do not clearly agree nor disagree given the available observable data but display a trend that suggests possible agreement with objective ratings.

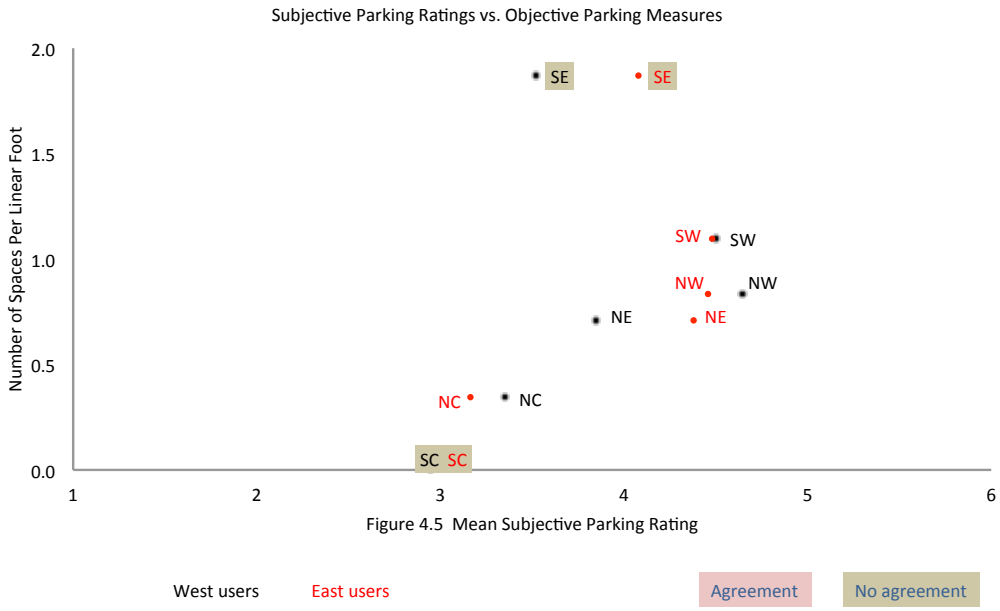


Figure 4.5 Mean Subjective Parking Rating

Continuity. Both east and west users are well aligned with objective ratings of continuity in the NW, SW, and SC segments but do not clearly align with SE. West users do not clearly match NE ratings while east users do. Both user groups appear to be approaching objective agreement in the NC segment.

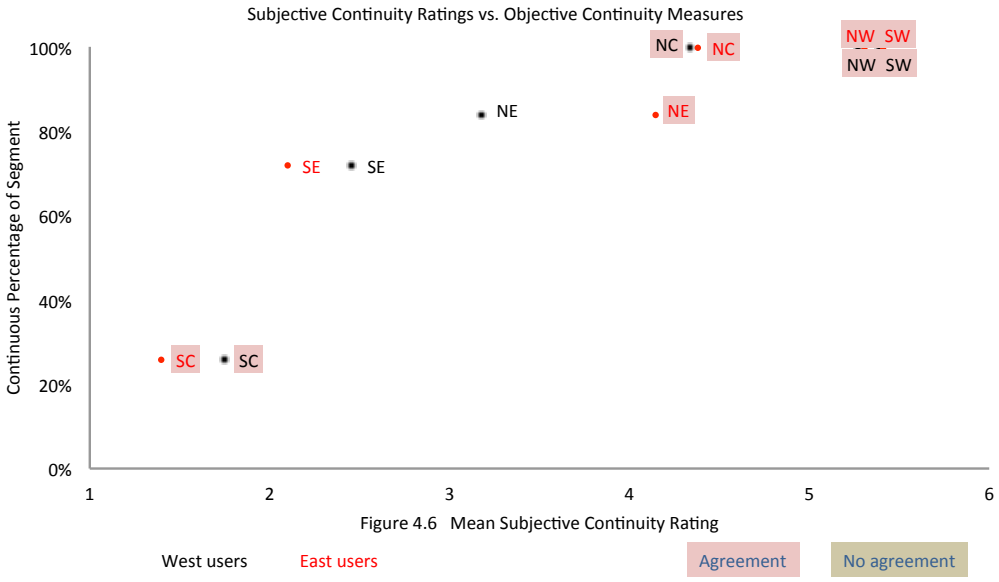


Figure 4.6 Mean Subjective Continuity Rating

Trail Clarity. Both east and west users appear to be in range of objective ratings for the SC and SE segments. It is not clear whether east or west users agree with objective ratings in the NC and NE segment based on the data collected. Both east and west users rated the NW and SW segments highly despite low objective ratings.

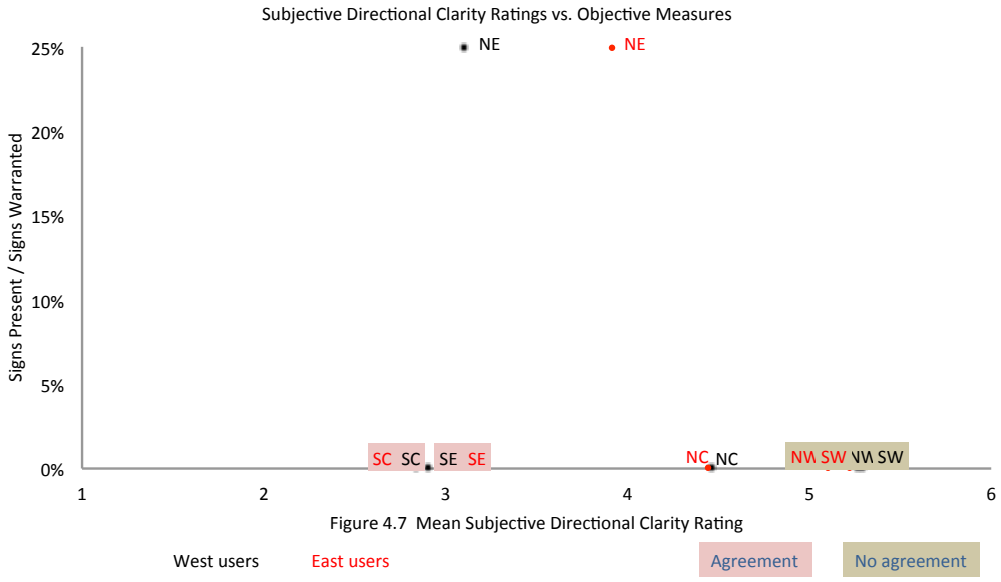


Figure 4.7 Mean Subjective Directional Clarity Rating

Bathrooms. East and west users are well aligned with objective ratings in the SC, SE, and NW segments. Less agreement is displayed in the NC and SW segments for both groups. West users do not match in the NE segment while east users approach agreement.

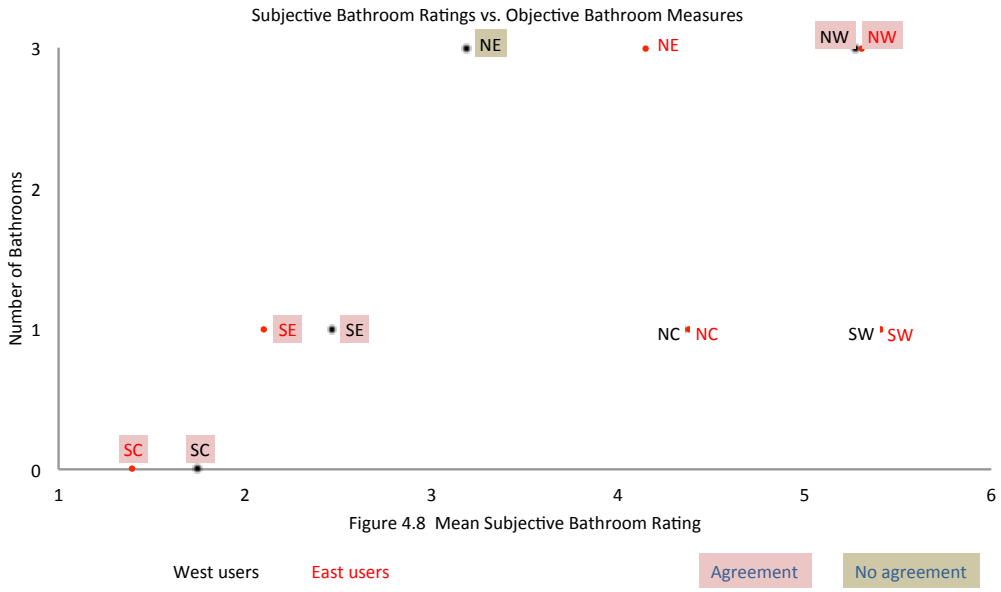


Figure 4.8 Mean Subjective Bathroom Rating

Water. East and west users display agreement with objective ratings of drinking water availability in the SC, SE, NC, SW, and NW segments. Conversely, both groups disagreed with objective measurements in the NE segment.

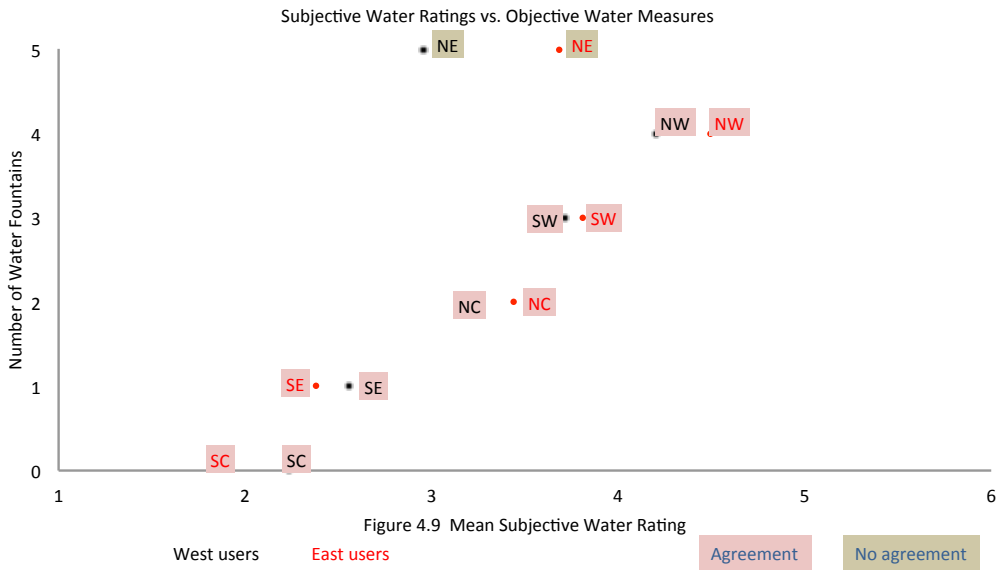


Figure 4.9 Mean Subjective Water Rating

Shade. To the best of the researcher's assessment, east and west users match objective ratings of shade on all six segments.

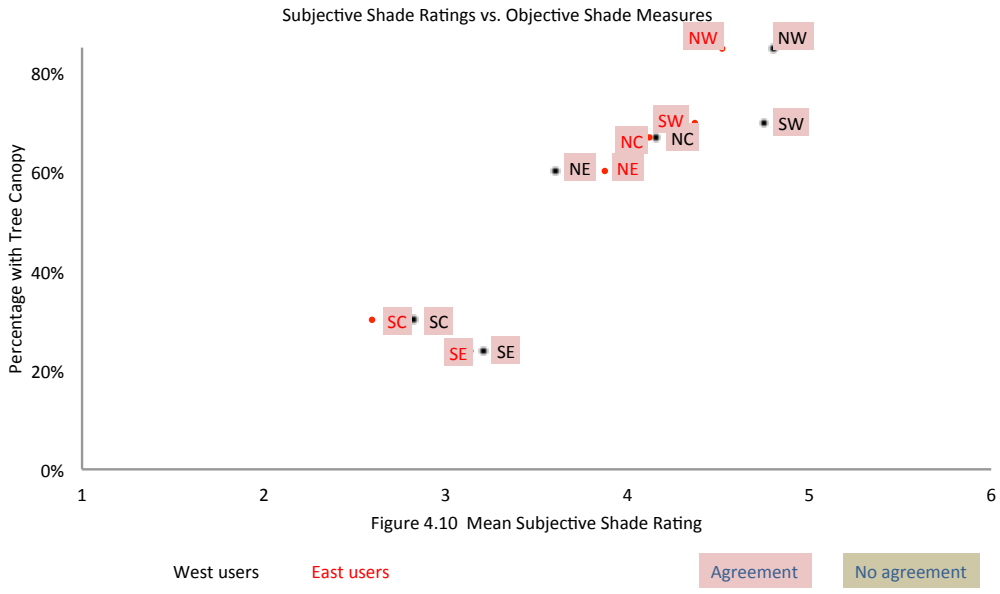


Figure 4.10 Mean Subjective Shade Rating

Litter. East and west users agreed with objective ratings of litter in the NW and NC segments but do not match objective ratings in the SE segment. East users align with objective ratings in the SC segment and approach agreement in the NE segment while west users align with the NE segment and approach agreement in the SC segment. The SW segment performed well on the objective measure but both east and west users did not agree.

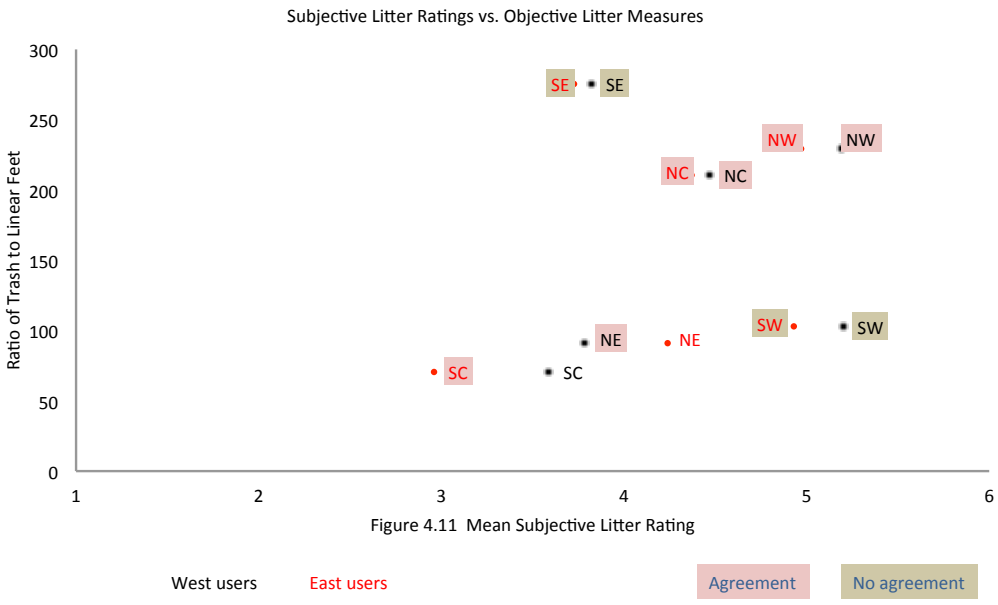


Figure 4.11 Mean Subjective Litter Rating

Traffic Exposure. Both east and west user groups match objective ratings for exposure to traffic in the SC and SW segments. They split on the remaining segments with west users matching objective ratings in the NW, SE, and NC segments while east users match the NE segment rating.

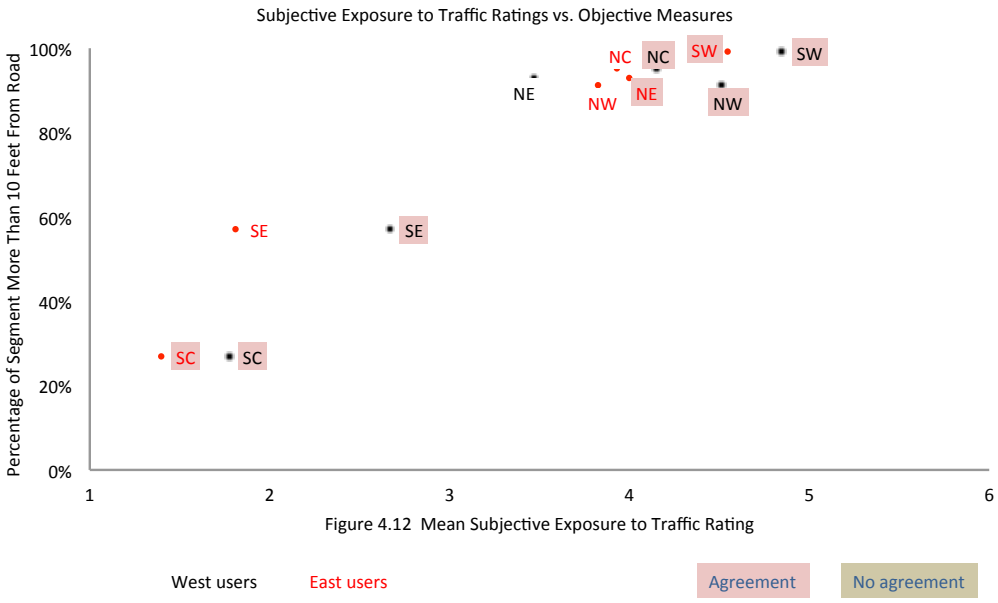


Figure 4.12 Mean Subjective Exposure to Traffic Rating

Loops. The only observable outcome to interpret with reasonable confidence, given the display of data, is east and west user agreement in the NW and SW segments.

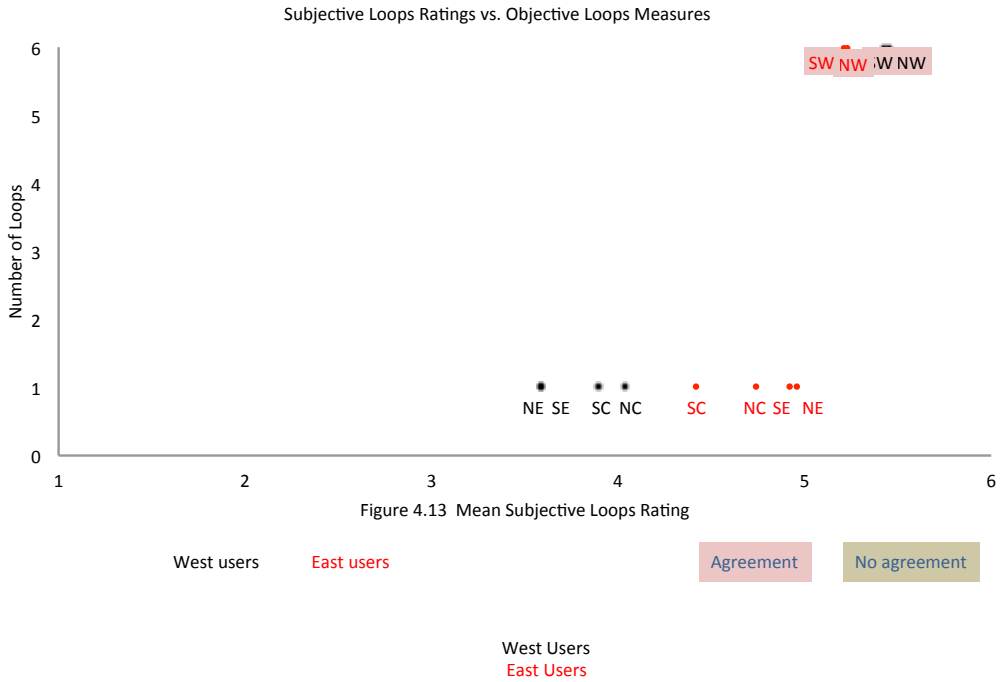


Figure 4.13 Mean Subjective Loops Rating

Crowding. East and west users are aligned with objective measures of crowding in the SC, SE, and NE segments. West users did not agree with objective measures in the NW and SW segments while east users displayed agreement. East users did not match ratings for the NC segment.

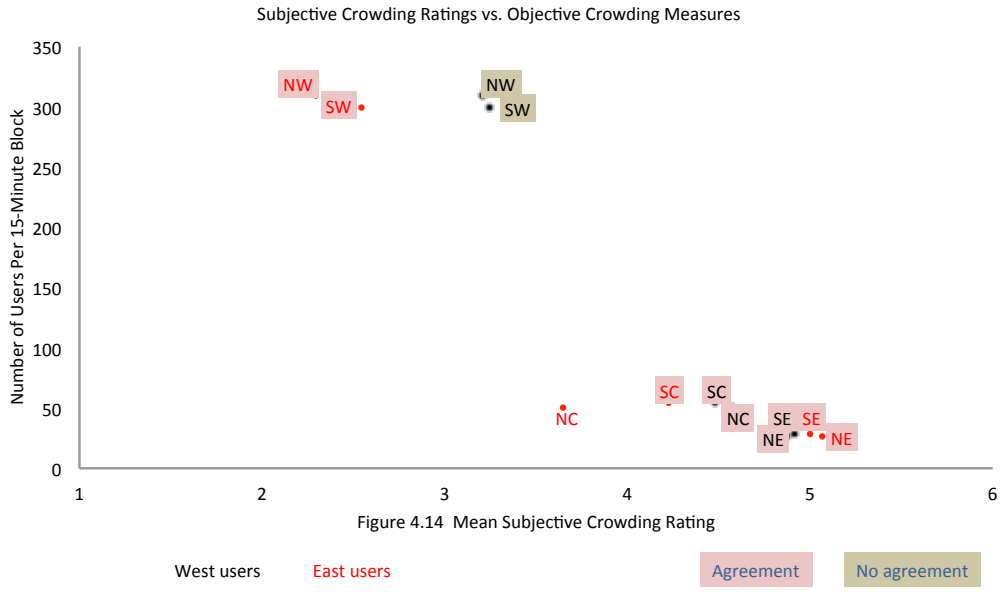


Figure 4.14 Mean Subjective Crowding Rating

Summary of Subjective and Objective Comparisons

One pattern that emerged from examining the graphs is the consistent subjective rating of the SC segment as the lowest scoring segment for both east and west users across all trail characteristics except for safety, crowding, and loops. Additionally, all eight of the remaining subjective ratings pertaining to the SC segment (parking, continuity, trail direction clarity, bathrooms, water, shade, litter, and exposure to traffic) were in agreement with objective measures.

Overall, west users are in agreement with objective safety ratings on western segments, parking ratings across all segments, continuity ratings for western and central segments, water and bathroom ratings for most segments, shade ratings across all segments, litter ratings on most segments, exposure to traffic ratings across all segments, loop ratings for western segments, and crowding ratings for central and eastern segments. West users were not in agreement with objective ratings for safety on central and eastern segments, litter on SE and SW segments, bathroom rating on NE segment, nor trail direction clarity on western segments (NW, SW).

East users, similar to west users, agreed with objective safety ratings on western segments and parking ratings across all segments. East users are in agreement with most continuity measures except the SE segment and show agreement for trail clarity on SC and SE segments. East users are in line with bathroom and water measures, except for the NE segment, and show complete agreement across all segments for shade. Agreement also exists for litter on the NW, NC, SC, and NE segments. Exposure to traffic agreement is well aligned among east users for SW, NE, and SC. East users agree with loop measures on western segments, but agreement with central and eastern segments are vague. Similar to west users, agreement did not occur for safety on central and eastern segments nor trail clarity on western segments (NW, SW). East users also did not agree with litter measures on eastern segments (NE, SE) and did not align with exposure to traffic for NC, NW, and SE.

CHAPTER 5: DISCUSSION

The purpose of this study was to identify barriers that contribute to a disparity in utilization across different segments of an urban trail. To achieve this aim, subjective ratings of trail characteristics for high-use areas (western sections of the trail) were compared to subjective ratings of lower-use areas (eastern sections of the trail). These ratings were compared between those who reported primarily traveling the western, high-use sections vs. those who primarily travel the eastern, low-use sections. Data were collected through self-report and a cross-sectional analysis based on sections of primary use. Ratings for each trail characteristic from an online survey were compared for different trail segments as a function of these groups. Comparisons were conducted through ANOVA and showed that perceptions of trail characteristics varied strongly as a function of which sections of the trail were used most by the respondents. Users of the high-traffic, western sections held significantly more negative views of the eastern sections. In contrast, users of the low-traffic, eastern sections held similar views of the eastern and western sections.

Objective measurements of trail characteristics were conducted on all six segments of trail to compare to user perceptions. A trail count and researcher evaluation/audit of all trail characteristics provided data for comparison. A descriptive analysis of the differences between trail user perceptions and objective measures was reported. The trail count and survey results showed similar patterns of usage. The western sections exhibited the highest number of trail users representing 80% of the people on the trail. The central sections contained 14% and the eastern sections 6%. Mode of travel observed was 94% walking or running and 6% cycling. In addition, these numbers are similar to those of the earlier, pilot study (TEMBA, 2011). Given the similarities between the online survey, and both the objective trail count for usage and the earlier TEMBA study, it is hoped that the online sample is representative of the population of regular trail users.

A comparison of subjective and objective ratings revealed different patterns of agreement depending on east vs. west group membership. Overall, west users are misinformed about crime and amenities on the east side but are in general agreement on other characteristics. This suggests that their concerns about trail continuity, directional clarity, and loop options may be warranted. Overall, east users showed general agreement with objective measures on the west side except for exposure to traffic, which they rated more poorly than objective measures.

Social-Ecological/Systems Thinking Framework

This study used a social-ecological framework to identify the factors in a domain-specific environment that impact purpose-specific physical activity. Research findings that describe the impact of the environment on recreational physical activity in an urban neighborhood cannot be generalized to other recreational domains. Physical activity occurs in a defined context and the interaction between the individual, the environment, and other social variables are constantly changing (Giles-Corti, 2005). This study offered numerous examples of the interplay between individual perceptions and environmental variables and the difficulty in isolating one factor for scrutiny. For example, research has shown that safety may be moderated by such factors as tree canopy, population density, litter, and streetlights (Reynolds, 2007). Consequently, the results of the present study should be interpreted with caution and more research is needed to understand how trail perceptions operate in this recreational context. That said, there is potentially useful information gathered from the differences in perceptions as a function of trail usage.

Demographics and Patterns of Use

Some of the most curious findings were not directly related to subjective ratings and objective measurements. For example, 85% of trail users reported using loops as their most common route and regarded it as the most important (east users) or second

most important (west users) characteristic when choosing a route. Although the lay of the land may not be conducive to developing looped trails in many dense urban cities, if there is a way to design it then this study shows that users will value it.

The TEMBA study showed that most users drive to the trail and the present study replicated those results showing that 66% of trail users drive to the trail. What adds to the uniqueness of this finding is the distance that people are willing to drive to reach the trail. Over a third of users travel more than five miles and less than one in ten users travel less than .25 miles. This is unusual because many studies show that distance from home to trail has a negative relationship with trail use (Troped & Saunders, 2001; Moore, 1998; Starnes et al., 2011).

In 2010, census data showed Austin, Texas to be 45% White, 34% Hispanic, 8% Black, and 6.5% Asian. The trail users in this study self-reported as 85% White, 10% Hispanic, 05% Black and 3% Asian. Clearly the demographics of this city are not represented on the trail. This lack of representation is not out of the norm as other studies report that a disproportionate number of trail users are white (Gobster, 2002; Starnes, 2011).

Frequent trail users have a greater preference for loops and parking than occasional trail users. In addition, both the objective and the perceptual ratings indicate that the west side has a variety of loops, while the east has very few. However, the objective and perceptual ratings differ on parking. Trail users perceived a significantly higher number of parking options in the western segments regardless of whether they were east or west users. Thus, it might logically follow that so many people would use the west side. However, objective measurement showed ample parking on the east side. The east segments combined offer more parking spaces (1,135) than the west segments combined (1,071). It is possible that there is an association between perception of safety and parking. That is, users may seek *safe* parking and, if perceived as unavailable, concerns for safety may drive behavior and distort perceptions about parking availability if not also considered safe.

Perception Differences Among Trail Users

In general, west users' ratings showed larger differences in favor of their areas of use, as they rated the NW segment very high and the NE segment very low. Although east users typically followed the trend of rating the NW segment higher than the NE segment, the mean differences were considerably less than that of west users. This suggests that east users do not view the two segments to be as extreme in their differences as do the west users. Specifically, comparison of east and west users indicate that west users perceive the eastern sections of the trail as less safe, difficult to navigate, and lacking route options. East users see the western sections of trail as more crowded and exposed to traffic than west users. In addition, while both groups rated the NE segment as scoring lower than the NW segment safety, continuity, clarity of trail direction, and desirable loop distance, the magnitude of this difference was far greater for the west users vs the east users.

The difference in perception between groups was analyzed to uncover why west users do not use the east side. For safety, east users "moderately agreed" that the NE segment was safe to travel alone, which is more closely aligned to the objective measure (2 incidents of aggravated assault in 2012), than west users who "mildly disagreed". Some trail characteristics can influence an individual's perception of safety. For example, the literature suggests that areas with low population density, extensive tree canopy, or presence of litter may be associated with a perceived risk of personal safety (Reynolds, 2007). It would be beneficial for future trail studies to examine the role of these variables as moderators in the perception of safety.

West users "mildly disagreed" that the NE trail is continuous with no need to use streets or sidewalks. This was significantly lower than east users rating of "mildly agree". Both ratings are within relative range of the objective evaluation, which found the trail to be 84% continuous. Studies show that improving connectivity can increase physical activity (Cromley, Troped, Melly, & Huffman, 2008). Most of this research is focused on utilitarian activity in urban environments rather than leisure-time physical activity on

trails. It is possible that the west user continuity rating is associated with other trail characteristics such as trail direction clarity. Specifically, objective assessment of trail direction clarity was poor for all segments including the NE segment which offered one directional sign out of four ambiguous trail junctions. The west users' "mild disagreement" that trail direction is clear and the east users' "mild agreement" both are more favorable than the objective score. It is a practical time to clarify that a subjective rating that is higher or lower than objective measures are not what researchers hypothesize predicts behavior. Research studies suggest that perception alone, regardless of what drives perspective, can influence behavior (Senge, 1990). It is plausible that there is an association between continuity ratings and directional clarity ratings and that lack of experience on the eastern section contributes to a correlation between trail direction clarity and continuity among west users. Lack of trail direction clarity may be related to poor signage at points on the trail that lack continuity, which leaves unfamiliar users uncertain about direction of travel. Experienced users on the eastern section who have greater familiarity with direction may not notice lack of signage, and thereby rate it leniently, but are able to visualize points on trail that lack continuity more easily. Thus, east users might show a weaker association between continuity and trail direction clarity than west users. Thus, signage should be explored as a possible moderator for perceptions of continuity as adequate signage might alleviate the impact of poor continuity.

The disagreement between east and west users' ratings of loops on the NE segment is not easily resolved by examining objective measures. The loop rating was based on "can do a loop of desired distance" which showed less than satisfactory results among west users. The NE segment, when combined with the SE segment, offers only one loop option with a distance of four miles. The NW segment offers a variety of loop options from 1.5 to 4.8 miles. It is unknown whether the availability of shorter loops in the NW segment is what yields more favorable ratings among west users. However,

descriptive analysis shows that 32% of west users are walkers compared to 17% of east users. Loops shorter than 4 miles might be preferable to some walkers.

Crowding ratings on the NW segment showed a significant result for both between-group and within-group comparisons among east users. This may indicate a perceived barrier for these users. This aligns with the previous finding of east users' preference to "be around less people on the trail" that was significantly lower than west users. West users rated the NW segment more favorably than the NE segment on all variables except crowding, thereby acknowledging the significant difference in population density between east and west sides. Given their group preference to "be around people on the trail", the lack of people on the east side may play a role in their route choice. West users commented: "I like the social aspect of running, so I find that there are far more people on the trail when going [west]" while east users said they preferred the east side because there were "less people" and "less crowding". Future research should investigate individual or demographic correlates that are associated with a desire to be around more or less people while controlling for personality differences.

Group Membership

The trail count reported number of users per segment while the survey reported route traveled most often. Thus, a true comparison was not possible. For the survey, user group was determined by route traveled most often and was based on the furthest east one traveled. Trail users that *only traveled west of I35* were identified as west users and those who traveled *east of I35 at any time in their route* were identified as east users. Therefore, some east users reported traveling a route that included both east and west segments. This categorization creates the possibility that east users may be familiar with more parts of the trail than west users. This may explain why east users were more in-line with objective measures than were west users. However, this was not viewed as a limitation because the purpose of the study was to identify barriers to

traveling on the eastern sections of trail, and while west users may hold misperceptions due to lack of familiarity they are likely acting on these misperceptions.

The carryover for east users to the west side does make a direct comparison between the survey counts and the trail count difficult. The trail count reported 95% of users on the western most segments whereas the online survey and prior TEMBA survey reported 85% and 86%, respectively. Although this is not a large discrepancy in reports, it is worthy of scrutiny since the two measures that are closely aligned are self-report and the other is observation. one possible reason for this mismatch in utilization is the distance between trail count observation stations and the possibility of double counting. There were 4 observers on the western sections covering 7 miles of trail, one trail counter approximately every 1.75 miles. Despite the effort to space them 15 minutes apart from each other, a cyclist or moderately fast runner could be counted twice. This would be slightly less likely to occur on the eastern segments. There were 2 observers on the east side covering 4 miles of trail, or one trail counter every 2.0 miles. To explore this further, the results of the 15-minute blocks were examined to compare two segments that would be difficult to connect in 15 minutes. In this case NE (n=171) and SW (n=2,408) reflected 6% and 94% of users, respectively. This falls in line with the total trail count, which lessens the concerns about double counting. The reason for the difference in reported utilization may be linked to the self-reported profile of the typical east and west user. As previously mentioned, some "east" users include western sections in their route. In fact, 68% of east users travel loops that extend west of I35 and 50% of all east users travel the entire 10-mile loop as their most common route. A closer look at the survey participants who were recruited on the trail vs. the trail organization newsletter shows that only 33% east users recruited on the trail travel west of I35 compared to 84% of newsletter subscribers. Furthermore, 63% of newsletter respondents reported that their most common route was the entire 10-mile loop. Thus, there appears to be relationship between newsletter participants and traveling the entire 10-mile trail. This confirms the possibility that east users may be more familiar

with all sections of the trail. This, again, might explain the high level of agreement with objective measures in the western segments. This pattern of utilization among east users also means that they travel loops of longer distances since the loop contained within the NE/SE segment is 4 miles and the next shortest loop option is 6.3 miles. Because bicycling on the trail only accounts for 4-6% of travel on the trail, this pattern suggests that east users may be running longer distances. Future research should examine whether or not different levels of intensity and/or distance traveled predicts choice of route on an urban trail. Route choice for more serious exercisers might also be associated with population density and a desire to be on less crowded sections of the trail.

Summary

It was the aim of this study to contribute to a growing body of literature that examines the relationship between physical activity and environmental characteristics by specifically investigating recreational physical activity on an urban trail. The findings demonstrate that negative perceptions of safety, trail continuity, and route options may prevent trail users from utilizing segments of trail that present unsatisfactory expression of these characteristics.

Limitations

There are several limitations to this study. Participants were required to rely on recall when evaluating trail segments. Even though a map of each segment was provided to orient participants to the segment they were rating, this required them to visualize each segment in the context of the trail characteristic. This opens the possibility of errors in memory. There is also a risk that they rated the sections based on reputation rather than experience. However, as users were making decisions regarding which area of the trail to use, these perceptions – whether accurate or not – were important. This study clearly shows that a difference in perception among users may be

contributing to different patterns of utilization. Thus, errors in perception are less of a limitation than a basis for behavior.

A major limitation of this study is unequal sample sizes between east (n = 33) and west users (n = 163). Inherent to the phenomenon under study, it was expected that the east group would be much smaller than the west group as 85% of trail users reported that their activity occurs on the western section of trail. Another limitation that affected sample size was the effect of participant mortality. Unfortunately, the west segments were presented prior to the east segments. As participants progressed through the survey - rating segments from west to east - some quit the survey before completing all ratings. This disproportionately impacted the eastern segments. Although these respondents were eliminated from the study, this weakened the ability to analyze the primary segments of interest.

This study focused on existing trail users in an effort to understand why certain sections of the trail are avoided. Consequently, it is prudent to assume that non-users of the trail hold similar perceptions. The barriers for non-users may be different as indicated in a study that showed perceived safety of trail use was more troubling for new users than regular users (Gordon, Zizzi, & Pauline, 2004).

As such, the generalizability of this study extends to urban trails that are primarily used for recreational purposes by regular users. The ability to generalize to other trail settings might also require trails that are comprised of loops, such as in the present study, rather than linear trails.

There were many limitations associated with objective measurements. The greatest challenge was comparing subjective ratings on a Likert scale to objective measures on a much larger and varied scale. The objective measurements that were conducted don't map onto Likert items, e.g. safety - # incidents of aggravated assault, parking - # parking spaces per linear foot of trail. In addition, given only one trail there was no means to statistically compare variations in subjective to variations in objective ratings. This limitation affected the validity of certain measures. For example, if the

measure for bathrooms had been for users to predict the number of bathrooms in each segment, that would provide a fairly just comparison. However, the survey prompt asked if there were an "adequate number of bathrooms available". It is difficult to gage what is adequate for an urban trail and the researcher failed to find relevant justification in a review of the literature. Thus, it makes it difficult to interpret when each segment varies from no bathrooms (SC) to three bathrooms (NW, NE) on segments ranging from .96 miles to 2.2 miles long, which is more than adequate since this is an average of one bathroom for every mile on the trail.

Some objective measures are problematic because they are not a direct reflection of what is happening on the trail. For example, safety was assessed by the number of aggravated assaults that occurred in the census block adjacent to each segment in 2012 (Figure 5.1). The NC segment showed the highest rate of crime with 139 incidents of assault. This segment is largely made up of the downtown area which includes an avenue that is a destination for both locals and tourists due to it's high number of bars and music venues. Thus, this crime statistic is far from a clear reflection of crime on the trail.

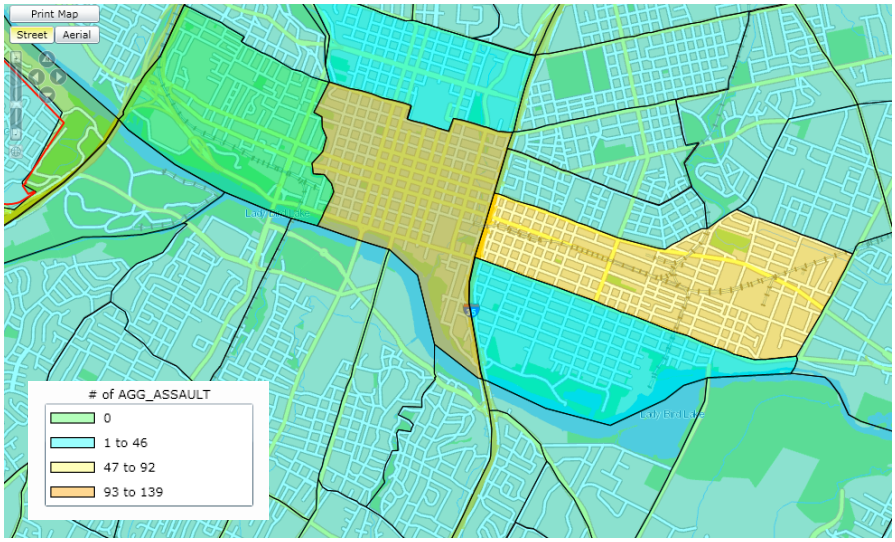


Figure 5.1 *Incidence of aggravated assault by census tract*

The objective measurement for shade was calculated by measuring the number of feet on which tree canopy covered the trail. This provided an estimate of shade rather than an actual value because neither time of day nor tree canopy density were taken into account. Although this might overestimate true values for shade, the same methods were performed on all segments. Thus, the findings are considered to be relatively valid in that they show how each segment performed compared to the others.

Implications for Trail Development

It is important to understand why trail users are avoiding certain sections of the trail in order to illuminate the barriers that impact utilization. Identifying these characteristics can guide local efforts to maximize use of existing trails and provide direction for future trail development. In order for urban trails to positively impact the physical activity of all populations, all sections of trail need to be perceived as traversable and without perceived barriers (Coutts & Miles, 2011).

Collective agreement provides useful information for trail developers because it is a strong indicator of what is not working in the community. One pattern that emerged from examining the graphs is the consistent subjective rating of the SC as the lowest scoring segment for both east and west users across all trail characteristics except for safety, crowding, and loops. Additionally, all eight of the remaining subjective ratings pertaining to the SC segment (parking, continuity, trail direction clarity, bathrooms, water, shade, litter, and exposure to traffic) were in agreement with objective measures. Most of these ratings are negative. The SC segment was objectively scored the lowest of all segments on parking, bathrooms, drinking water, litter, and exposure to traffic. This segment of trail is 1.19 miles long and includes a 1-mile gap on the south side that requires trail users to use a sidewalk which crosses Interstate 35 and more than 35 driveways, curb cuts, and intersections with high exposure to traffic (TTF, 2012). This gap in the trail is likely responsible for the low subjective continuity ratings reported by both east and west users. This assessment by

participants accurately portrays a segment that is only 26% continuous. An intervention to remedy this is already underway with the construction of a boardwalk that closes the gap by extending the trail over the lake and under Interstate 35. The project will be completed by summer 2014. This trail improvement may positively affect some of the other characteristics that received low scores. Litter ratings and exposure to traffic ratings are likely to improve when the main path moves from the sidewalk - that is next to a busy urban road - to the lakeshore. These factors are considerable detractors of trail use on their own as research has shown that litter and noise is associated with 20%-33% less usage (Starnes et al., 2011).

Not all of the trail characteristics that were poorly rated can be improved by the new boardwalk. Adding a water fountain may be feasible but parking may not be due to the land use surrounding the segment, which consists largely of commercial and multi-family properties. Appendix F shows a map of land use distribution around the trail. Bathrooms on a short segment such as this may not be a priority issue at this time. There are no issues on the SC segment that require educating the public about existing trail conditions because all of the subjective ratings are valid and match objective measurement.

The NE segment provides an opportunity to educate trail users because the objective safety measurement was higher than the subjective assessment for west users. This segment earned the second highest objective ranking for safety with only two incidents of aggravated assault. Other major issues concerning east users include trail continuity, clarity of trail direction, and ability to make a loop of a desirable distance. As previously discussed, there is only one loop on this section of the trail. If the 4-mile distance deters users it is unlikely that any other trail improvement will matter. If the 4-mile distance is acceptable, then increasing the number of signs at ambiguous intersections could make an improvement in clarity of trail direction. Trail continuity could be improved by making the path more evident as it winds through parks and

baseball fields. The Trail Foundation website indicates that there is a plan for making this improvement in the future.

Implications for Community

Urban trails provide communities with walking, running, and biking opportunities and are associated with higher rates of individuals meeting recommended physical activity guidelines (Wilhelm, Schneider, & Russell, 2009, Brownson, Housemann, Brown, Jackson-Thompson & King, 2000; Sharpe, Granner, Hutto & Ainsworth, 2004).

The increasing popularity of virtual realities, suburbanization, two career families, and indoor media entertainment has compromised the social cohesion or 'social glue' that enables people to work together civilly within the *social environment* (Putnam et al., 2000). Researchers suspect that this migration to life indoors is a contributing factor in the decline and loss of social capital (Louv, 2005; Putnam et al., 2000). Social capital is defined as "information sharing that occurs between residents of a community, the mutual aid that they provide each other, and their ability to act collectively" (Putnam et al., 2000). One way to improve social capital is through opportunities for recreation in a community (Eicher & Kawachi, 2011).

Urban trails provide places for people to meet and socialize with others and can build pride among communities (Kaczynski & Henderson, 2008). Urban trails are described in the United States as the new "front porches of many communities" (Moore & Ross, 1998). A possible explanation for how recreation can improve the social environment is the phenomenon that occurs when people vicariously experience the positive health behavior of others which increases the observer's self efficacy for initiating the desired behavior (Bandura, 2002). This role modeling makes a favorable imprint on the inactive observer, which collectively builds social capital over time (Kaczynski & Glover, 2012). If regular trail users expand their travel to less utilized sections that are adjacent to lower socioeconomic neighborhoods, it is possible that such vicarious observations could occur. This is important because the highest rates of

obesity are most prevalent among disadvantaged groups, those with the least education, and highest poverty rates (CDC, 2010).

Trust is considered an important protective social factor and contributes to building social capital (Kaczynski & Glover, 2012). One way community trust is broken is through crime. Perceptions of safety are strongly correlated with levels of neighborhood and trail activity as demonstrated by Brennan et al. (2003), who reported that as perceptions of "protective social factors" grew, the probability of meeting physical activity guidelines increased, especially among lower SES groups. Historically, Interstate 35 in Austin has represented a socioeconomic divide with ethnic minorities and low-income families residing east of the highway (CAPCOG, 2011). It is possible that this cultural divide is related to the disparity in utilization between east and west sections of the trail. The NE segment has the highest residential density within .25 miles of the trail yet shows the lowest rate of use. Expanding usage to this part of the trail could ultimately improve the health of individuals living nearby.

Future Directions

Many researchers hypothesize that poorer health in low socioeconomic neighborhoods is explained by lack of access to health promoting resources (Kawakami, Winkleby, Skog, Szulkin, & Sundquist, 2011). Contrary to prior research that suggests lower income neighborhoods lack access to recreational resources (Kawakami, 2011), the Ann & Roy Butler Trail offers ample access along the entire 10-mile loop regardless of socio-economic status adjacent to the trail. Future research should examine perceived barriers to trail use for those that live close to the trail.

The trail improvements currently underway offer an excellent opportunity to conduct a natural experiment to see if these improvements affect usage on sections of trail that are currently under-utilized. If usage increases after the completion of the boardwalk, it would suggest that continuity of trail is a significant construct that impacts the choices people make about physical activity.

Appendix A: Trail Count Instructions

General Instructions:

Please arrive 15 minutes prior to your scheduled count time.

- Do your best and don't worry if you think you've missed a trail user. Don't try to make up a missed count, just keep going and describe any complications in the notes section on your count sheet.
- When you arrive please establish your station and take 3 photos from your chair (one facing forward, one looking left, and one looking right). *Your chair should face the lake.* **Text these photos to me at (512) 239-9104**. This will let me know you arrived and are in the right place. Also, feel free to text/call with any questions.
- You will use a new form every 15 minutes. Thus, a total of 8 count sheets will be provided. If you have an alarm clock on your phone, set multiple alarms to alert you that it is time to use a new form (i.e. set alarms at 7:15am, 7:30am, 7:45am, 8:00am, etc…).

Counting Instructions:

- Please fill in your name, count location, time, date, time period and weather (approx. temp and conditions: sunny, rainy, foggy, wind, etc.). You only need to do this on the first sheet. Low priority as I will track weather.
- Only count users that cross the imaginary counter line that is directly in front of you on trail.
- Use single lines in groups of five to tally each pedestrian or cyclist (4 = I I I I, 5 = ~~I I I I~~).
- If someone passes you twice, count them twice.
- Count all adult users crossing your trail line under "male" or "female" and "alone" or "group" categories (see example count sheet). Count children (appearing under 16) separately under "child". A "group" is considered more than one individual.
- "Other" is considered anything other than a walker, runner, or cyclist (note that a cyclist may include a unicyclist or a recumbent bike) such as a wheelchair, scooter, etc… Please indicate mode of "other" on count sheet.
- Every individual on the trail receives a tally with associated characteristics. For example, if there is a family of two adults walking with one child on a bike then each adult would receive a tally under "pedestrian", "group", and respective "gender". The child would receive a tally under "child", "group", and respective "gender".
- If two observers are assigned to your segment it is because of expected high volume. In this case, one observer can focus on counting users traveling east while the other observer counts users traveling west.

Field Notes:

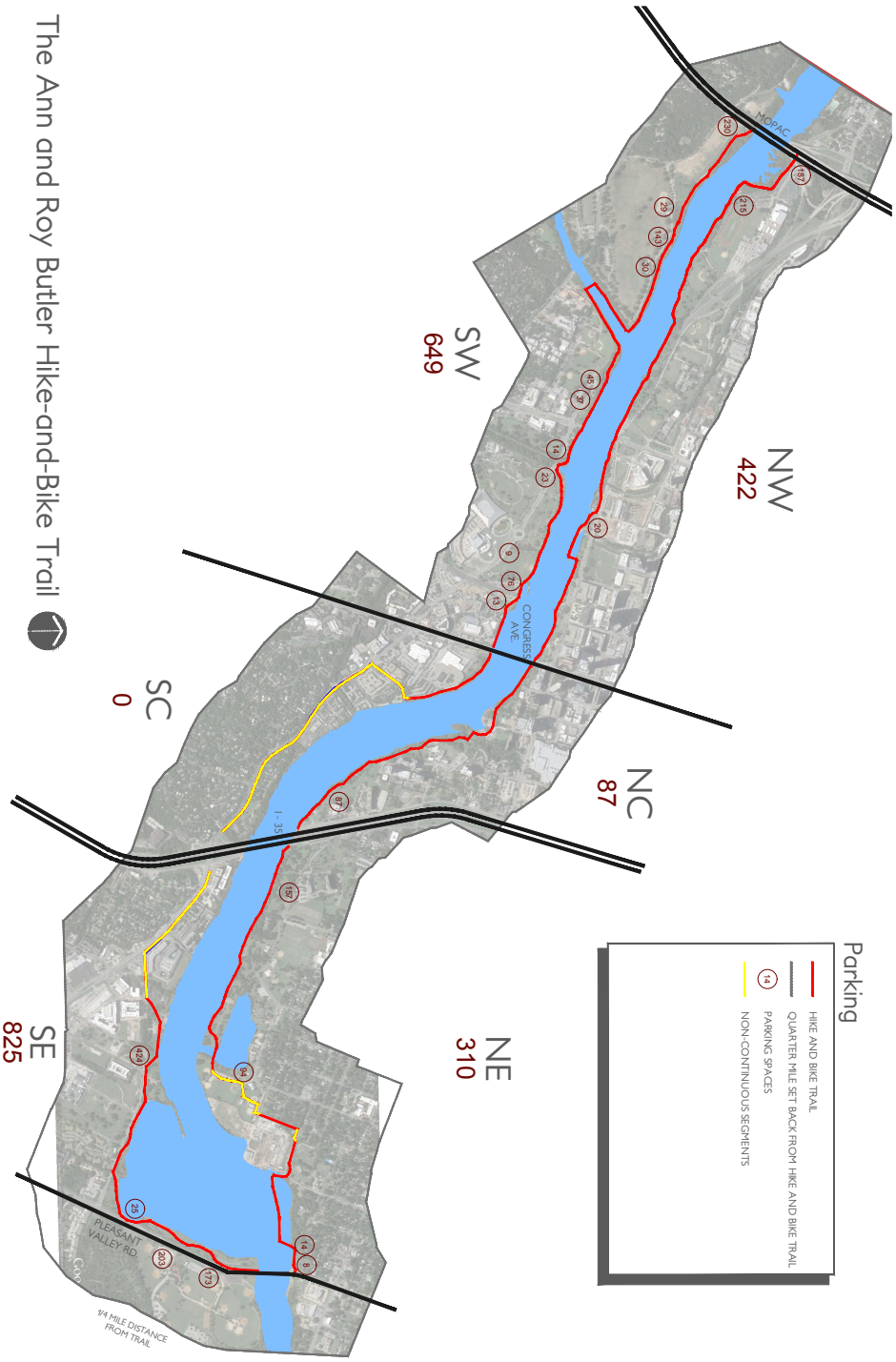
- Comments/observations: Describe any visible problems trail users have negotiating the trail. Also note any close calls, conflicts, or inappropriate trail behavior. In addition, **note any factors that may have affected your count (accident, road construction, tour group, event nearby, etc.)**

North Central location (22 East Ave) is located between the So. Congress Bridge and the I35 bridge on the north side of the lake. It is closer to I35 than the Congress bridge. There is parking along the street as well as at the boat dock nearby. The purple pins & the "A" pin in the photos below represent your observation point. Please note that you are just east of a small footbridge and west of an informal "Y" in the trail (see pics 2 & 3). Feel free to move yourself to shade or sun (ideally only a few yards off this location and without crossing any trail intersections). If you have a folding/camping chair you may want to bring it. If you do not have one, let me know so that I can try to provide one for you. You should have the following items at the start of your count: 1) 8 counting forms 2) this instruction sheet 3) phone for alarm/camera 4) 2 pencils/pens. Optional items: chair, water, sunscreen. Morning shift: it's cold – bring hat, gloves, layers, even a blanket.

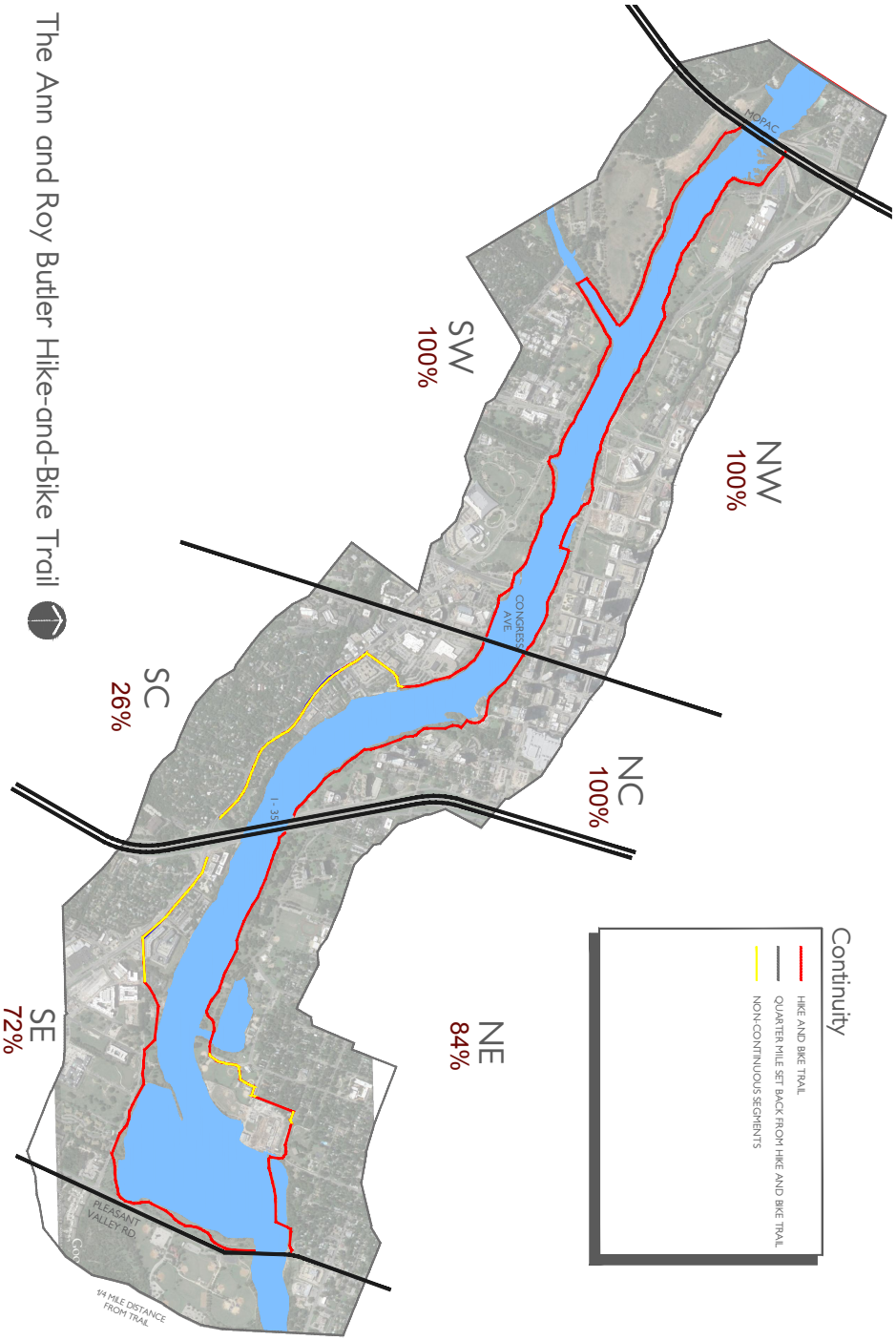
Appendix B: Trail Count Form

North Central Segment				
Date: _____ Time _____-_____ AM PM Observer: _____ Temp: _____ Skies: _____ Wind: _____				
Users		Alone	Group	Total
Pedestrians	Male			
	Female			
	Child			
Bicyclists	Male			
	Female			
	Child			
Other (describe here)	Male			
	Female			
	Child			
Total				

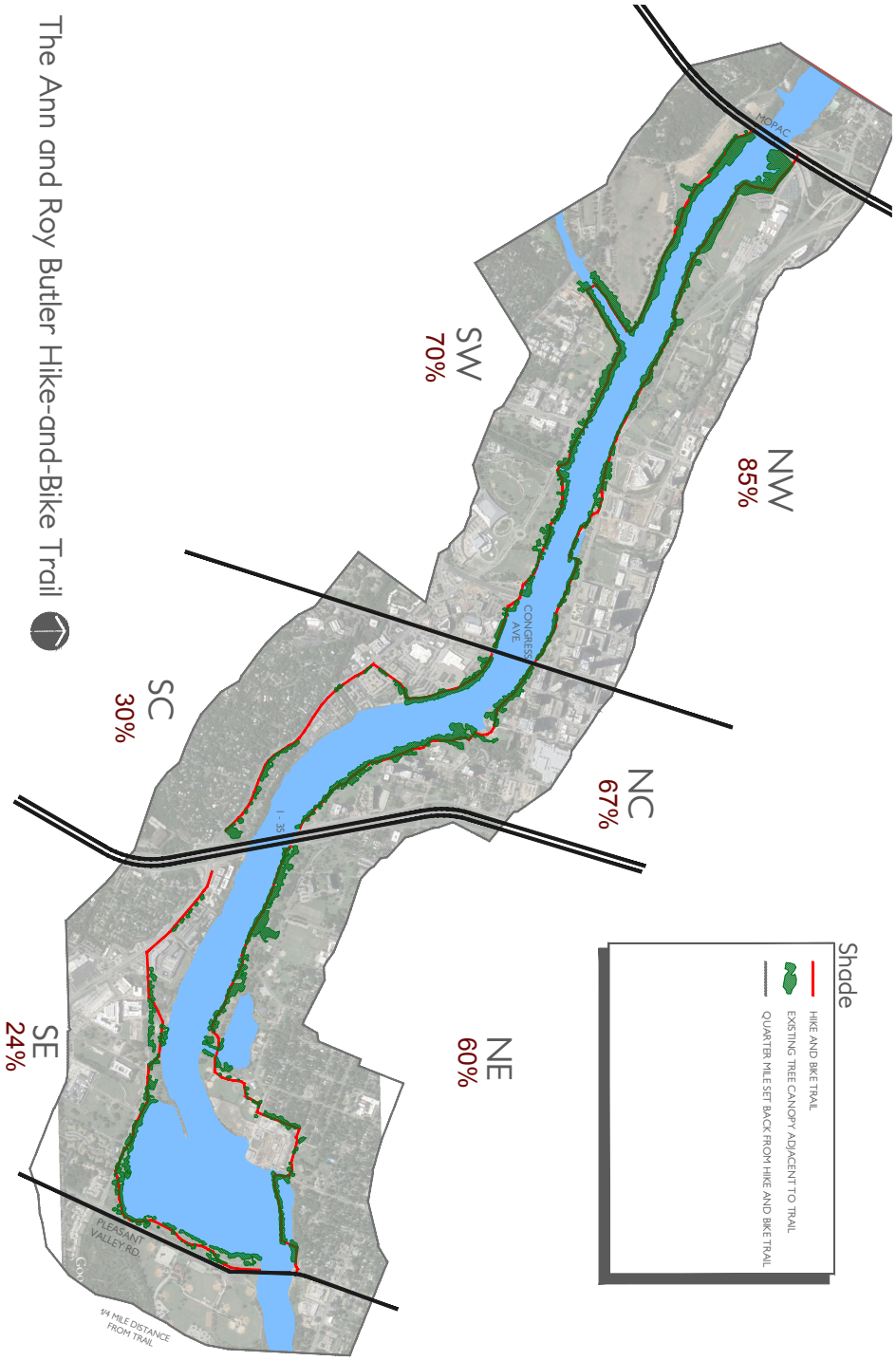
Appendix C: Objective Measure - Parking



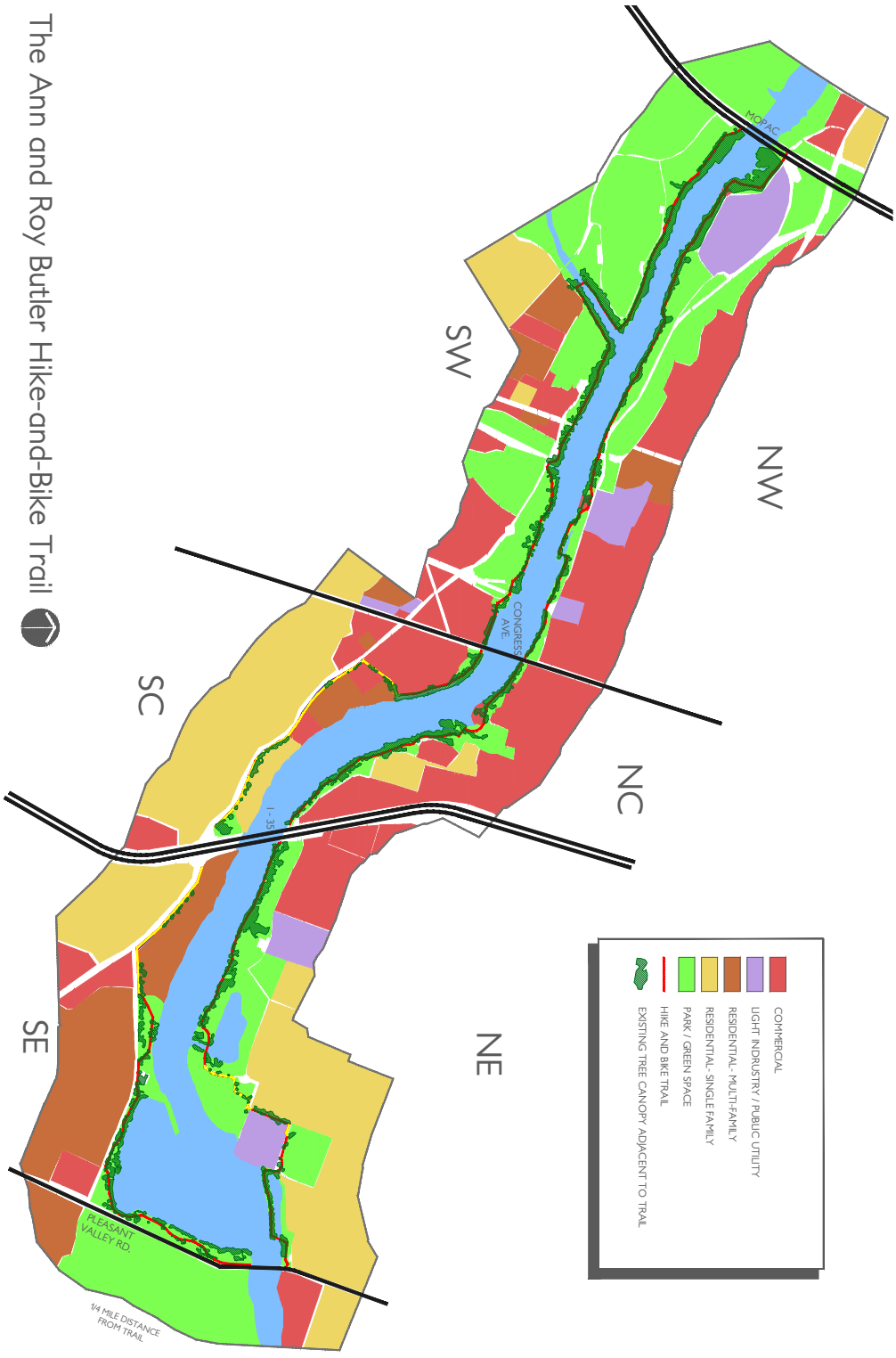
Appendix D: Objective Measure - Continuity



Appendix E: Objective Measure - Shade



Appendix F: Map - Land Use



Appendix G: Online Survey

You are invited to participate in a research study, entitled "The Butler Trail at Lady Bird Lake." The study is being conducted by Sarah Mount of The University of Texas at Austin, 1 University Station-D3700 Austin, TX 78712. For more details please contact sarahmount@utexas.edu

The purpose of this study is to examine the relationship between individual perceptions of trail characteristics and route choice. Your participation in the survey will contribute to a better understanding of how our community perceives the trail which will help city planners design future trails. You must be at least 18 years old to participate.

If you agree to participate:
- The survey will take approximately 15 minutes of your time.
- You will complete a survey about your use of The Trail at Lady Bird Lake.
- You will not be compensated.

The potential risk to the participants is no greater than everyday life. There will be no costs for participating, nor will you benefit from participating. The survey will not ask for your name. However, you may opt to provide your email address at the end of the survey if you would like to be contacted for a follow-up study. The primary researcher is the only individual that will have access to the data during data collection. The optional e-mail address will be deleted and replaced with a code number so that no identifying information will be kept with your responses. The email addresses will then be encrypted and stored separately on a password protected external hard drive and destroyed at the conclusion of the study. All responses will be stored on a password protected computer.

Your participation in this survey is voluntary. You may decline to answer any question and you have the right to withdraw from participation at any time. Withdrawal will not affect your relationship with The University of Texas in anyway. If you do not want to participate either simply stop participating or close the browser window.

If you have any questions about the study or need to update your email address contact the researcher: sarahmount@utexas.edu. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact – anonymously, if you wish – the Office of Research Support by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

IRB Number: 2013-04-0086.

If you agree to participate please press the "next" button at the bottom right of the screen otherwise use the "exit" button at the upper right corner to close this window and disconnect.

Thank you. Your time is greatly appreciated!

1. How were you invited to take this survey?

- ◯ I was given a card while on the trail.
- ◯ Someone gave me the card away from the trail.
- ◯ I subscribe to TTF newsletter.
- ◯ Someone forwarded TTF newsletter to me.
- ◯ Someone sent me the survey link.

Other (please specify)

2. How long have you lived in the Austin area?

- ◯ 10 years or more
- ◯ 5-9 years
- ◯ 2-4 years
- ◯ less than 2 years
- ◯ I don't live in Austin

3. For what purpose do you mostly use the Trail?

- ◯ Pleasure/exercise/recreation
- ◯ Commuting to work/school/errands

4. On average, how often do you use the Trail for this purpose?

- ◯ 3 or more times per week
- ◯ 1-2 times per week
- ◯ 2-3 times per month
- ◯ every couple of months
- ◯ 1-2 times per year
- ◯ this is my first time on trail

5. What is your most common activity on the Trail?

- ◯ Walking
- ◯ Running
- ◯ Biking
- ◯ Other (please specify)

6. What is your most common mode of transportation to the Trail?

- ◯ Car
- ◯ Bike
- ◯ Walk/Run
- ◯ Public transportation

Other (please specify)

7. Approximately, where is your most common access point?

- [ ] Mopac bridge (north side) i.e Austin High School
- [ ] Mopac bridge (south side) i.e. Stratford Dr.
- [ ] Barton Springs & Robert E. Lee
- [ ] Pfluger bridge/Lamar (north side) i.e. Cesar Chavez
- [ ] Pfluger bridge/Lamar (south side) i.e. Barton Springs Rd.
- [ ] So. 1st bridge (north side) i.e. Cesar Chavez
- [ ] So. 1st bridge (south side) i.e. Auditorium Shores
- [ ] Congress bridge (north side) i.e. Cesar Chavez
- [ ] Congress bridge (south side) i.e. Austin Statesman
- [ ] I35 bridge (north side) i.e. Festival Beach
- [ ] I35 bridge (south side) i.e. Riverside Dr.
- [ ] Longhorn dam (north side) i.e. Holly Shores/Canterbury St.
- [ ] Longhorn dam (south side) i.e. Lakeshore Blvd.
- [ ] Longhorn dam (east side) i.e. Pleasant Valley Rd.

Other (please specify)

8. To what degree do the following characteristics influence your access point?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Safety	◯	◯	◯	◯	◯	◯
Access to parking	◯	◯	◯	◯	◯	◯
Proximity to home/work	◯	◯	◯	◯	◯	◯

Other (please specify)

9. How would you describe the route you use most often?

- ◯ Loop
- ◯ Out & back same way
- ◯ One-way & exit trail

10. If you answered "loop" as your most common route, which of the following two bridges complete your loop?

- ◯ Mopac bridge & Pfluger/Lamar bridge
- ◯ Mopac bridge & So. 1st bridge
- ◯ Mopac bridge & Congress bridge
- ◯ Mopac bridge & I35 bridge
- ◯ Mopac bridge & Longhorn dam
- ◯ Pfluger/Lamar bridge & So. 1st bridge
- ◯ Pfluger bridge & Congress bridge
- ◯ Pfluger bridge & I35 bridge
- ◯ Pfluger bridge & Longhorn dam
- ◯ So. 1st bridge & Congress bridge
- ◯ So. 1st bridge & I35 bridge
- ◯ So. 1st bridge & Longhorn dam
- ◯ Congress bridge & I35 bridge
- ◯ Congress bridge & Pleasant Valley bridge
- ◯ I35 bridge & Pleasant Valley bridge

11. If you answered "out-and-back" as your most common route, what are the start and turn around points you utilize most often?

Start _____

Turn around _____

12. If you answered "one-way and exit trail" as your most common route, what are your start and exit points?

Start _____

Exit _____

13. How much do the following characteristics influence your choice of route?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Personal safety	◯	◯	◯	◯	◯	◯
Ability to make a loop	◯	◯	◯	◯	◯	◯
Preference to be around people	◯	◯	◯	◯	◯	◯
Preference to be around less people	◯	◯	◯	◯	◯	◯
Access to parking	◯	◯	◯	◯	◯	◯
Trail direction is clearly marked	◯	◯	◯	◯	◯	◯
Limited exposure to traffic while on trail	◯	◯	◯	◯	◯	◯
Feeling of being in nature	◯	◯	◯	◯	◯	◯
Continuous path (unbroken route - no need to use urban streets or sidewalks)	◯	◯	◯	◯	◯	◯
Access to amenities such as drinking water and bathrooms	◯	◯	◯	◯	◯	◯

Other:

14. Suppose you wanted to complete a 3-mile course and only had the following three options. Which would be your 1st, 2nd, & 3rd choice? Note: all options begin and end at the Congress Bridge. DRAG AND DROP to arrange your choices.

- ☐ Congress bridge heading West for OUT & BACK - turn around @ Austin High
- ☐ Congress bridge heading East for OUT & BACK - turn around @ Festival Beach boat dock
- ☐ Congress bridge to I35 LOOP

15. What are your reasons for ranking #1?

16. What are your reasons for ranking #2?

17. What are your reasons for ranking #3?

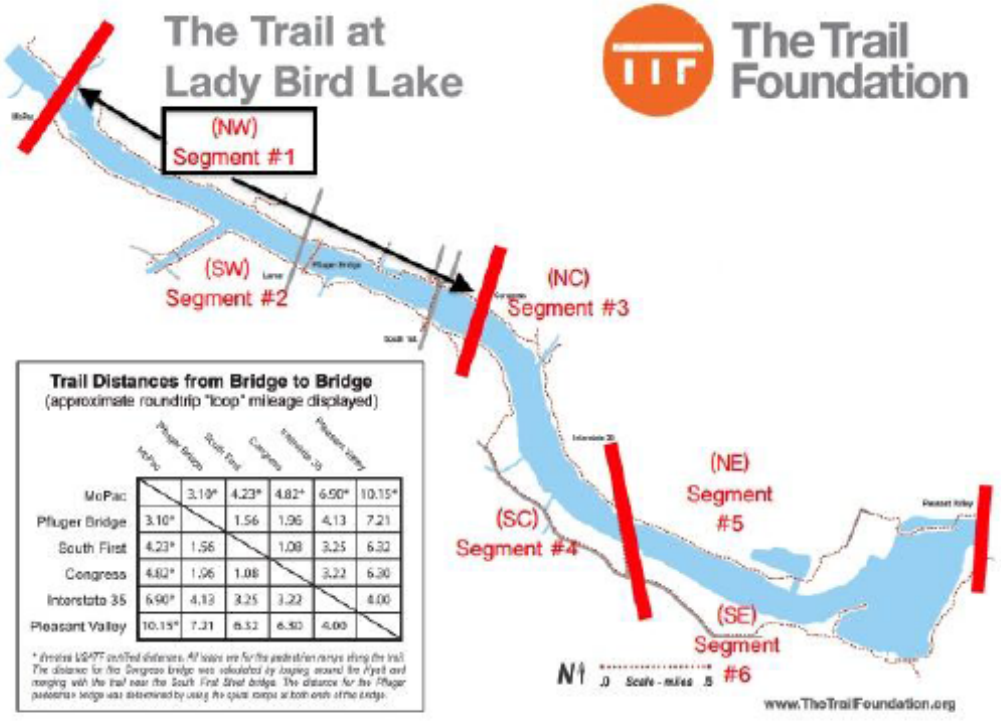
18. Rate the degree to which you agree with the following statements based on your involvement/relationship with the Butler Trail at Lady Bird Lake.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
This trail means a lot to me.	◯	◯	◯	◯	◯
This trail is a special place.	◯	◯	◯	◯	◯
I identify strongly with this trail.	◯	◯	◯	◯	◯
I feel no commitment to this trail.	◯	◯	◯	◯	◯

Please examine the map before answering the following question.

MOPAC BRIDGE to CONGRESS BRIDGE (North of lake)

Landmarks along this section: Austin High School, Texas Rowing Center, Cesar Chavez Rd., Lamar Bridge, So. 1st Street to Congress Ave.



Trail Distances from Bridge to Bridge
(approximate roundtrip "loop" mileage displayed)

	MoPac	Pfluger Bridge	South First	Congress	Interstate 35	Pleasant Valley
MoPac		3.10*	4.23*	4.82*	6.90*	10.15*
Pfluger Bridge	3.10*		1.56	1.96	4.13	7.21
South First	4.23*	1.56		1.08	3.25	6.32
Congress	4.82*	1.96	1.08		3.22	6.30
Interstate 35	6.90*	4.13	3.25	3.22		4.00
Pleasant Valley	10.15*	7.21	6.32	6.30	4.00	

* Omitted USATT certified distances. All values are for the pedestrian ramps along the trail. The distance for the Congress bridge was calculated by looping around the Hyatt and merging with the trail near the South First Street bridge. The distance for the Pfluger pedestrian bridge was determined by using the same ramps at both ends of the bridge.

19. For (NW) Segment #1, to what extent do you agree with the following statements about this segment?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Safe to be on trail alone.	◯	◯	◯	◯	◯	◯
Low crime neighborhood.	◯	◯	◯	◯	◯	◯
Plenty of areas to park throughout segment.	◯	◯	◯	◯	◯	◯
Easy to find parking space.	◯	◯	◯	◯	◯	◯
Too crowded.	◯	◯	◯	◯	◯	◯
Too isolated.	◯	◯	◯	◯	◯	◯
Can do a loop of desired distance.	◯	◯	◯	◯	◯	◯
Trail is continuous - no need to use streets or sidewalks.	◯	◯	◯	◯	◯	◯
Trail direction is clear.	◯	◯	◯	◯	◯	◯
Plenty of public drinking water.	◯	◯	◯	◯	◯	◯
Plenty of shade.	◯	◯	◯	◯	◯	◯
Adequate number of bathrooms available.	◯	◯	◯	◯	◯	◯
Feeling of being in nature.	◯	◯	◯	◯	◯	◯
Very little litter or glass on trail.	◯	◯	◯	◯	◯	◯
Separated from cars and noise.	◯	◯	◯	◯	◯	◯

20. How many times have you traveled this section of trail in the last year?

◯ 0

◯ 1-5

◯ 6-10

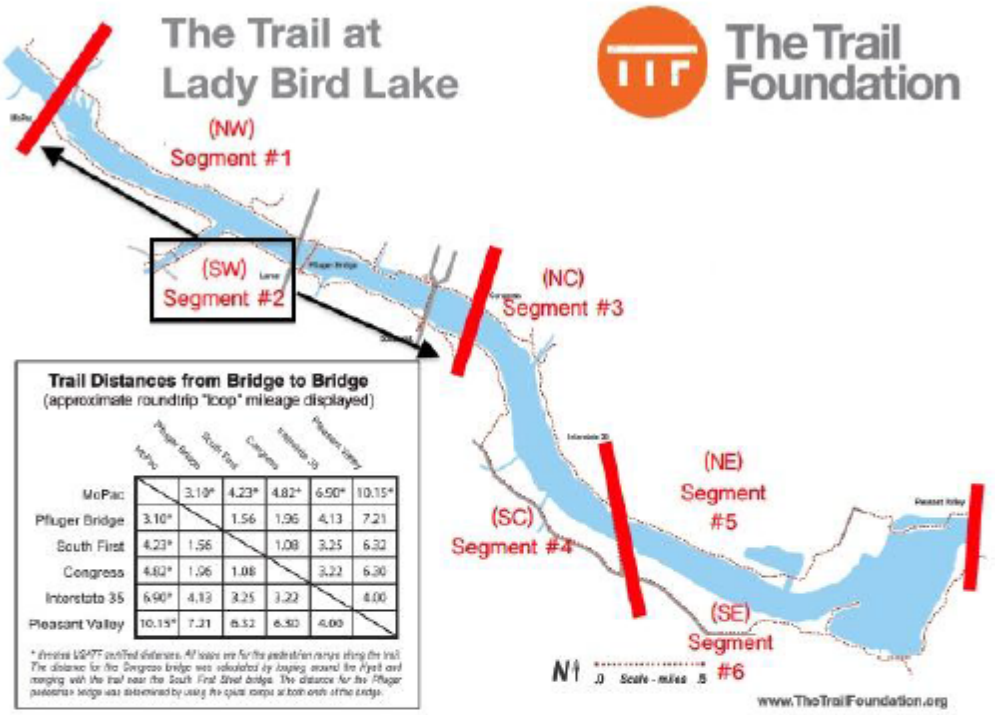
◯ 10-20

◯ 20 or more

Please examine the map before answering the following question.

MOPAC BRIDGE to CONGRESS BRIDGE (South of Lake)

Landmarks along this section: Zilker Park, Pedestrian bridge across Barton Springs Creek, Lamar Bridge, Auditorium Shores, So. 1st Bridge, Hyatt Hotel.



Trail Distances from Bridge to Bridge
(approximate roundtrip "loop" mileage displayed)

	McPac	Pfluger Bridge	South First	Congress	Interstate 35	Pleasant Valley
McPac		3.10*	4.23*	4.82*	6.90*	10.15*
Pfluger Bridge	3.10*		1.56	1.96	4.13	7.21
South First	4.23*	1.56		1.08	3.25	6.32
Congress	4.82*	1.96	1.08		3.22	6.30
Interstate 35	6.90*	4.13	3.25	3.22		4.00
Pleasant Valley	10.15*	7.21	6.32	6.30	4.00	

* Approx USATF certified distances. All loops are for the pedestrian ramps along the trail. The distance for the Congress bridge was calculated by looping around the Hyatt and merging with the trail near the South First Street bridge. The distance for the Pfluger pedestrian bridge was determined by using the ramps at both ends of the bridge.

21. For (SW) Segment #2, to what extent do you agree with the following statements about this segment?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Safe to be on trail alone.	◯	◯	◯	◯	◯	◯
Low crime neighborhood.	◯	◯	◯	◯	◯	◯
Plenty of areas to park throughout segment.	◯	◯	◯	◯	◯	◯
Easy to find parking space.	◯	◯	◯	◯	◯	◯
Too crowded.	◯	◯	◯	◯	◯	◯
Too isolated.	◯	◯	◯	◯	◯	◯
Can do a loop of desired distance.	◯	◯	◯	◯	◯	◯
Trail is continuous - no need to use streets or sidewalks.	◯	◯	◯	◯	◯	◯
Trail direction is clear.	◯	◯	◯	◯	◯	◯
Plenty of public drinking water.	◯	◯	◯	◯	◯	◯
Plenty of shade.	◯	◯	◯	◯	◯	◯
Adequate number of bathrooms available.	◯	◯	◯	◯	◯	◯
Feeling of being in nature.	◯	◯	◯	◯	◯	◯
Very little litter or glass on trail.	◯	◯	◯	◯	◯	◯
Separated from cars and noise.	◯	◯	◯	◯	◯	◯

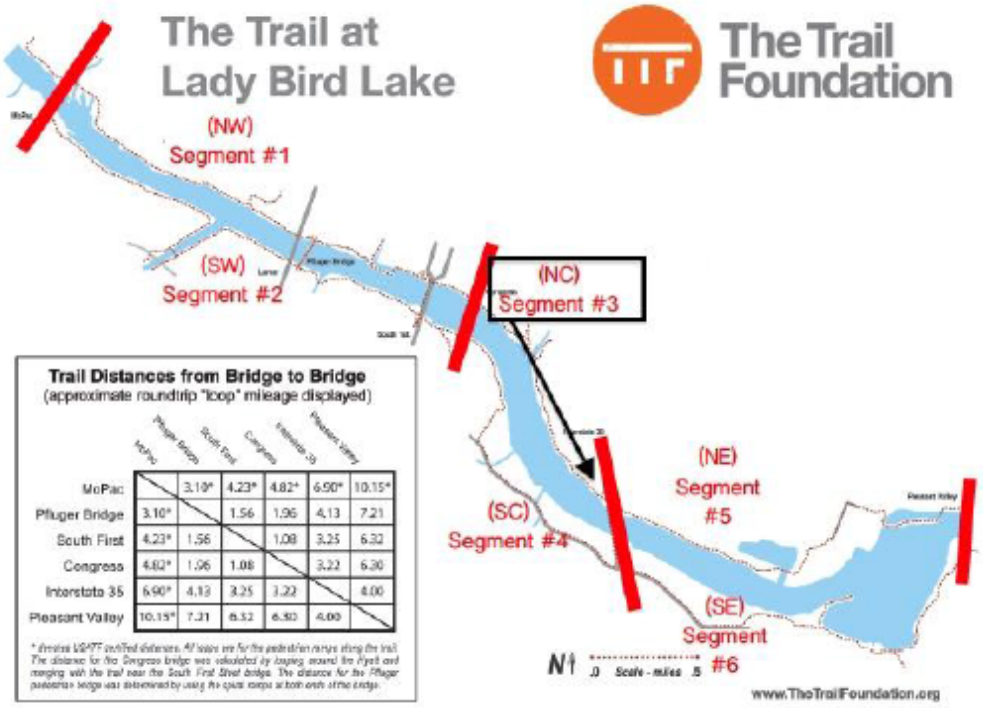
22. How many times have you traveled this section of trail in the last year?

- ◯ 0
- ◯ 1-5
- ◯ 6-10
- ◯ 10-20
- ◯ 20 or more

Please examine the map before answering the following question.

CONGRESS BRIDGE to I35 BRIDGE (North of lake)

Landmarks along this section: Congress Ave, Four Seasons, East Ave, Holiday Inn boat ramp.



Trail Distances from Bridge to Bridge
(approximate roundtrip "loop" mileage displayed)

	McPac	Pfluger Bridge	South First	Congress	Interstate 35	Pleasant Valley
McPac		3.10*	4.23*	4.82*	6.90*	10.15*
Pfluger Bridge	3.10*		1.56	1.96	4.13	7.21
South First	4.23*	1.56		1.08	3.25	6.32
Congress	4.82*	1.96	1.08		3.22	6.30
Interstate 35	6.90*	4.13	3.25	3.22		4.00
Pleasant Valley	10.15*	7.21	6.32	6.30	4.00	

* Denotes USATT certified distances. All trails are for the pedestrian ramps along the trail. The distance for the Congress bridge was calculated by looping around the Hyatt and merging with the trail near the South First Street bridge. The distance for the Pfluger pedestrian bridge was determined by using the quiet ramps at both ends of the bridge.

23. For (NC) Segment #3, to what extent do you agree with the following statements about this segment?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Safe to be on trail alone.	◯	◯	◯	◯	◯	◯
Low crime neighborhood.	◯	◯	◯	◯	◯	◯
Plenty of areas to park throughout segment.	◯	◯	◯	◯	◯	◯
Easy to find parking space.	◯	◯	◯	◯	◯	◯
Too crowded.	◯	◯	◯	◯	◯	◯
Too isolated.	◯	◯	◯	◯	◯	◯
Can do a loop of desired distance.	◯	◯	◯	◯	◯	◯
Trail is continuous - no need to use streets or sidewalks.	◯	◯	◯	◯	◯	◯
Trail direction is clear.	◯	◯	◯	◯	◯	◯
Plenty of public drinking water.	◯	◯	◯	◯	◯	◯
Plenty of shade.	◯	◯	◯	◯	◯	◯
Adequate number of bathrooms available.	◯	◯	◯	◯	◯	◯
Feeling of being in nature.	◯	◯	◯	◯	◯	◯
Very little litter or glass on trail.	◯	◯	◯	◯	◯	◯
Separated from cars and noise.	◯	◯	◯	◯	◯	◯

24. How many times have you traveled this section of trail in the last year?

◯ 0

◯ 1-5

◯ 6-10

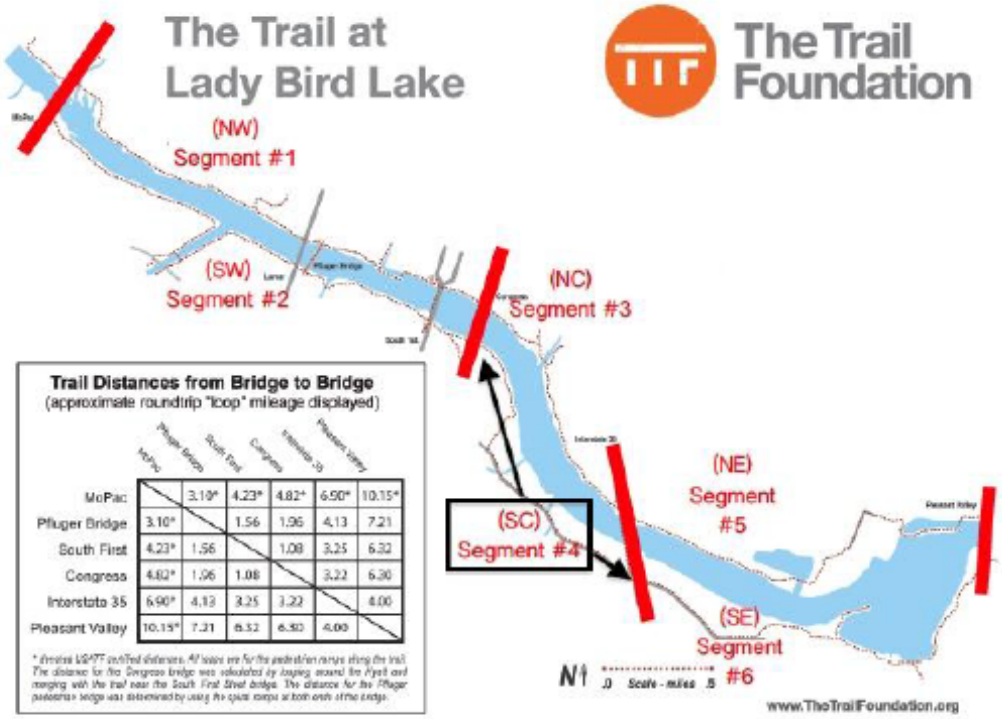
◯ 10-20

◯ 20 or more

Please examine the map before answering the following question.

CONGRESS BRIDGE to I35 BRIDGE (South of lake)

Landmarks along this section: Austin American-Statesman Newspaper, Thundercloud Subs, Riverside Drive to I35.



25. For (SC) Segment #4, to what extent do you agree with the following statements about this segment?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Safe to be on trail alone.	◯	◯	◯	◯	◯	◯
Low crime neighborhood.	◯	◯	◯	◯	◯	◯
Plenty of areas to park throughout segment.	◯	◯	◯	◯	◯	◯
Easy to find parking space.	◯	◯	◯	◯	◯	◯
Too crowded.	◯	◯	◯	◯	◯	◯
Too isolated.	◯	◯	◯	◯	◯	◯
Can do a loop of desired distance.	◯	◯	◯	◯	◯	◯
Trail is continuous - no need to use streets or sidewalks.	◯	◯	◯	◯	◯	◯
Trail direction is clear.	◯	◯	◯	◯	◯	◯
Plenty of public drinking water.	◯	◯	◯	◯	◯	◯
Plenty of shade.	◯	◯	◯	◯	◯	◯
Adequate number of bathrooms available.	◯	◯	◯	◯	◯	◯
Feeling of being in nature.	◯	◯	◯	◯	◯	◯
Very little litter or glass on trail.	◯	◯	◯	◯	◯	◯
Separated from cars and noise.	◯	◯	◯	◯	◯	◯

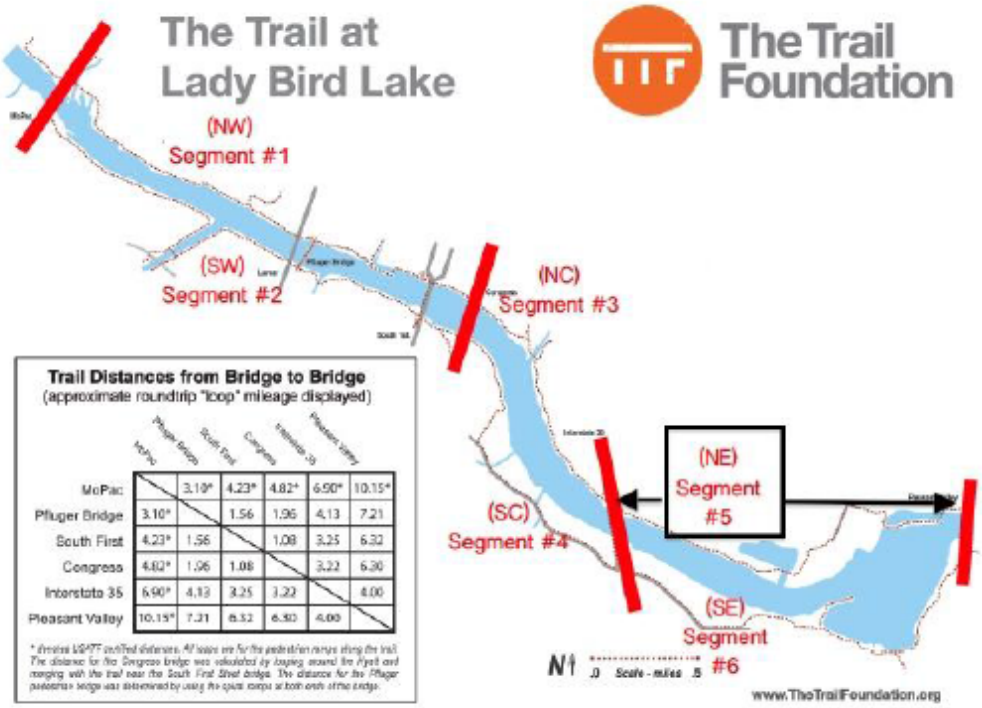
26. How many times have you traveled this section of trail in the last year?

- ◯ 0
- ◯ 1-5
- ◯ 6-10
- ◯ 10-20
- ◯ 20 or more

Please examine the map before answering the following question.

I35 BRIDGE to PLEASANT VALLEY RD. (North of lake)

Landmarks along this section: Festival Beach, Holly St. Power Plant, Holly Shores Peninsula & Overlook.



Trail Distances from Bridge to Bridge
(approximate roundtrip "loop" mileage displayed)

	McPac	Pfluger Bridge	South First	Congress	Interstate 35	Pleasant Valley
McPac		3.10*	4.23*	4.82*	6.90*	10.15*
Pfluger Bridge	3.10*		1.56	1.96	4.13	7.21
South First	4.23*	1.56		1.08	3.25	6.32
Congress	4.82*	1.96	1.08		3.22	6.30
Interstate 35	6.90*	4.13	3.25	3.22		4.00
Pleasant Valley	10.15*	7.21	6.32	6.30	4.00	

* denotes USATT unofficial distances. All trails are for the pedestrian ramps along the trail. The distance for the Congress bridge was calculated by looping around the Hyatt and merging with the trail near the South First Street bridge. The distance for the Pfluger pedestrian bridge was determined by using the spiral ramps at both ends of the bridge.

27. For (NE) Segment #5, to what extent do you agree with the following statements about this segment?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Safe to be on trail alone.	◯	◯	◯	◯	◯	◯
Low crime neighborhood.	◯	◯	◯	◯	◯	◯
Plenty of areas to park throughout segment.	◯	◯	◯	◯	◯	◯
Easy to find parking space.	◯	◯	◯	◯	◯	◯
Too crowded.	◯	◯	◯	◯	◯	◯
Too isolated.	◯	◯	◯	◯	◯	◯
Can do a loop of desired distance.	◯	◯	◯	◯	◯	◯
Trail is continuous - no need to use streets or sidewalks.	◯	◯	◯	◯	◯	◯
Trail direction is clear.	◯	◯	◯	◯	◯	◯
Plenty of public drinking water.	◯	◯	◯	◯	◯	◯
Plenty of shade.	◯	◯	◯	◯	◯	◯
Adequate number of bathrooms available.	◯	◯	◯	◯	◯	◯
Feeling of being in nature.	◯	◯	◯	◯	◯	◯
Very little litter or glass on trail.	◯	◯	◯	◯	◯	◯
Separated from cars and noise.	◯	◯	◯	◯	◯	◯

28. How many times have you traveled this section of trail in the last year?

◯ 0

◯ 1-5

◯ 6-10

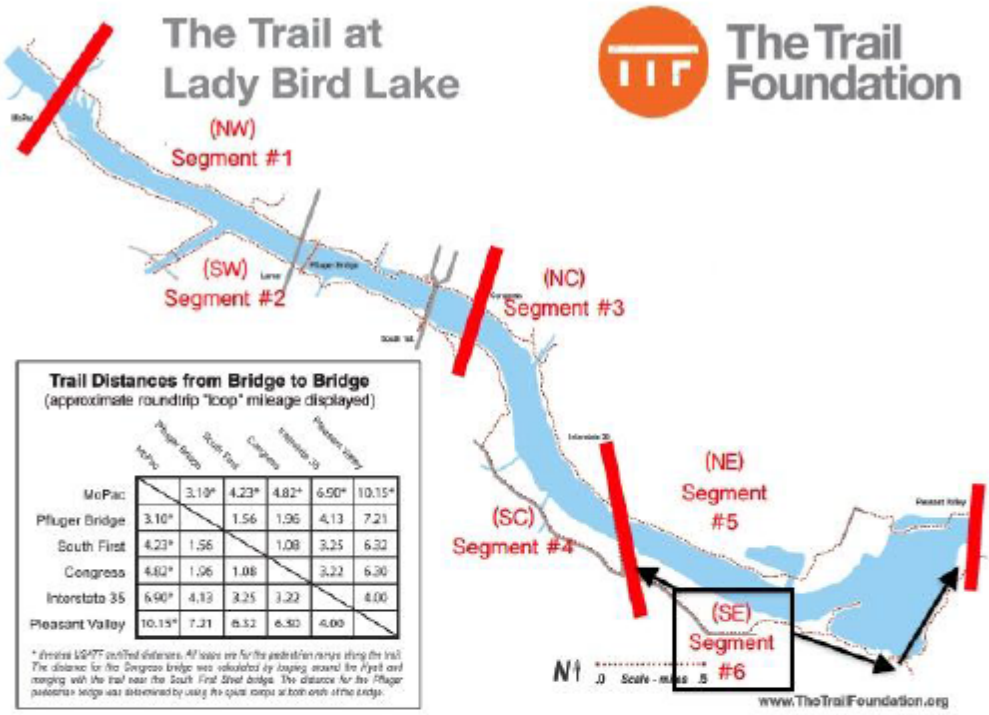
◯ 10-20

◯ 20 or more

Please examine the map before answering the following question.

I35 BRIDGE to PLEASANT VALLEY RD. (South of lake)

Landmarks along this section: East Riverside Drive, Lakeshore Blvd, Hostel Austin.



Trail Distances from Bridge to Bridge
(approximate roundtrip "loop" mileage displayed)

	MoPac	Pfluger Bridge	South First	Congress	Interstate 35	Pleasant Valley
MoPac		3.10*	4.23*	4.82*	6.90*	10.15*
Pfluger Bridge	3.10*		1.56	1.96	4.13	7.21
South First	4.23*	1.56		1.08	3.25	6.32
Congress	4.82*	1.96	1.08		3.22	6.30
Interstate 35	6.90*	4.13	3.25	3.22		4.00
Pleasant Valley	10.15*	7.21	6.32	6.30	4.00	

* denotes MAPS method distances. All trails are for the pedestrian ramps along the trail. The distance for the Congress bridge was calculated by looping around the Hyatt and merging with the trail near the South First Street bridge. The distance for the Pfluger pedestrian bridge was determined by using the quick maps at both ends of the bridge.

29. For (SE) Segment #6, to what extent do you agree with the following statements about this segment?

	Strongly Disagree	Moderately Disagree	Mildly Disagree	Mildly Agree	Moderately Agree	Strongly Agree
Safe to be on trail alone.	◯	◯	◯	◯	◯	◯
Low crime neighborhood.	◯	◯	◯	◯	◯	◯
Plenty of areas to park throughout segment.	◯	◯	◯	◯	◯	◯
Easy to find parking space.	◯	◯	◯	◯	◯	◯
Too crowded.	◯	◯	◯	◯	◯	◯
Too isolated.	◯	◯	◯	◯	◯	◯
Can do a loop of desired distance.	◯	◯	◯	◯	◯	◯
Trail is continuous - no need to use streets or sidewalks.	◯	◯	◯	◯	◯	◯
Trail direction is clear.	◯	◯	◯	◯	◯	◯
Plenty of public drinking water.	◯	◯	◯	◯	◯	◯
Plenty of shade.	◯	◯	◯	◯	◯	◯
Adequate number of bathrooms available.	◯	◯	◯	◯	◯	◯
Feeling of being in nature.	◯	◯	◯	◯	◯	◯
Very little litter or glass on trail.	◯	◯	◯	◯	◯	◯
Separated from cars and noise.	◯	◯	◯	◯	◯	◯

30. How many times have you traveled this section of trail in the last year?

- ◯ 0
- ◯ 1-5
- ◯ 6-10
- ◯ 10-20
- ◯ 20 or more

31. Have you traveled the complete loop around the lake (10 miles) in one outing?

- ◯ Yes
- ◯ No

32. In what ZIP code is your HOME located?

33. In what ZIP code is your WORK located?

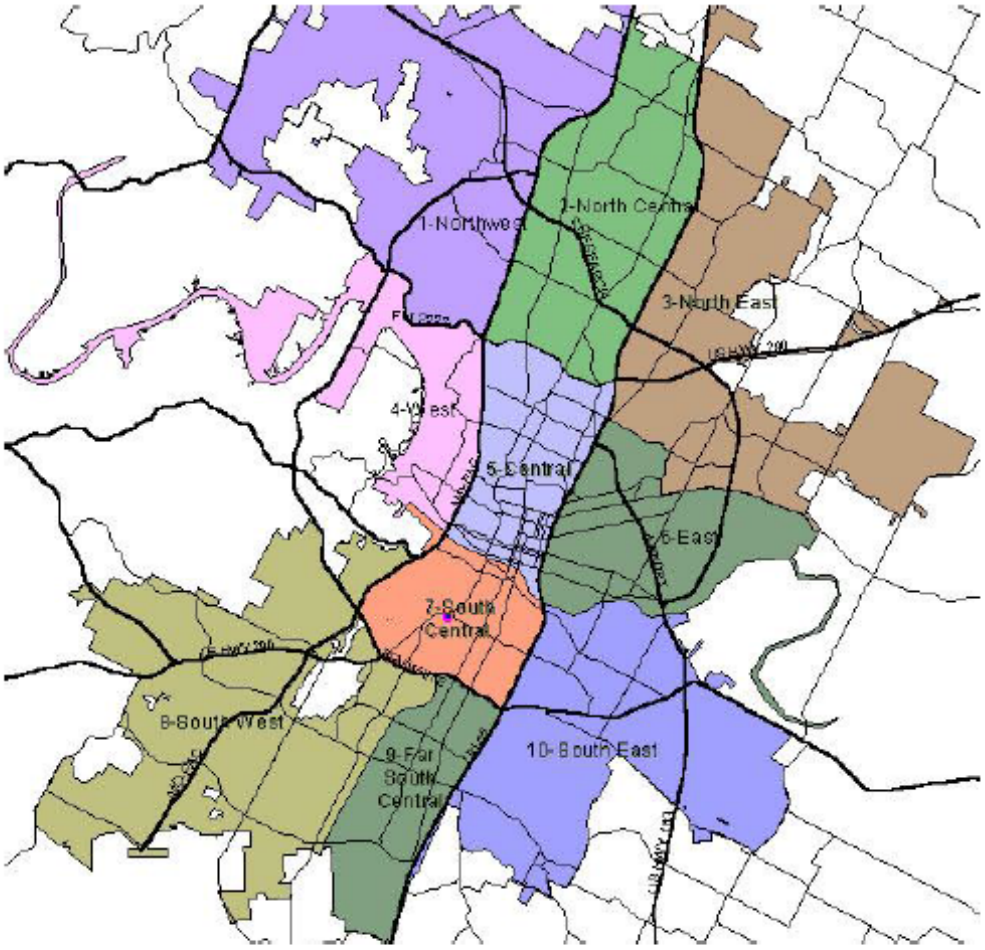
34. Do you mostly access the Trail from home or work?

- ◯ Home
- ◯ Work

35. Approximately how many miles do you travel to access the Trail from WORK?

- ◯ Less than .25 mile
- ◯ .25-.50 mile
- ◯ .50-1.0 mile
- ◯ 2-5 miles
- ◯ More than 5 miles

Please examine the map below.



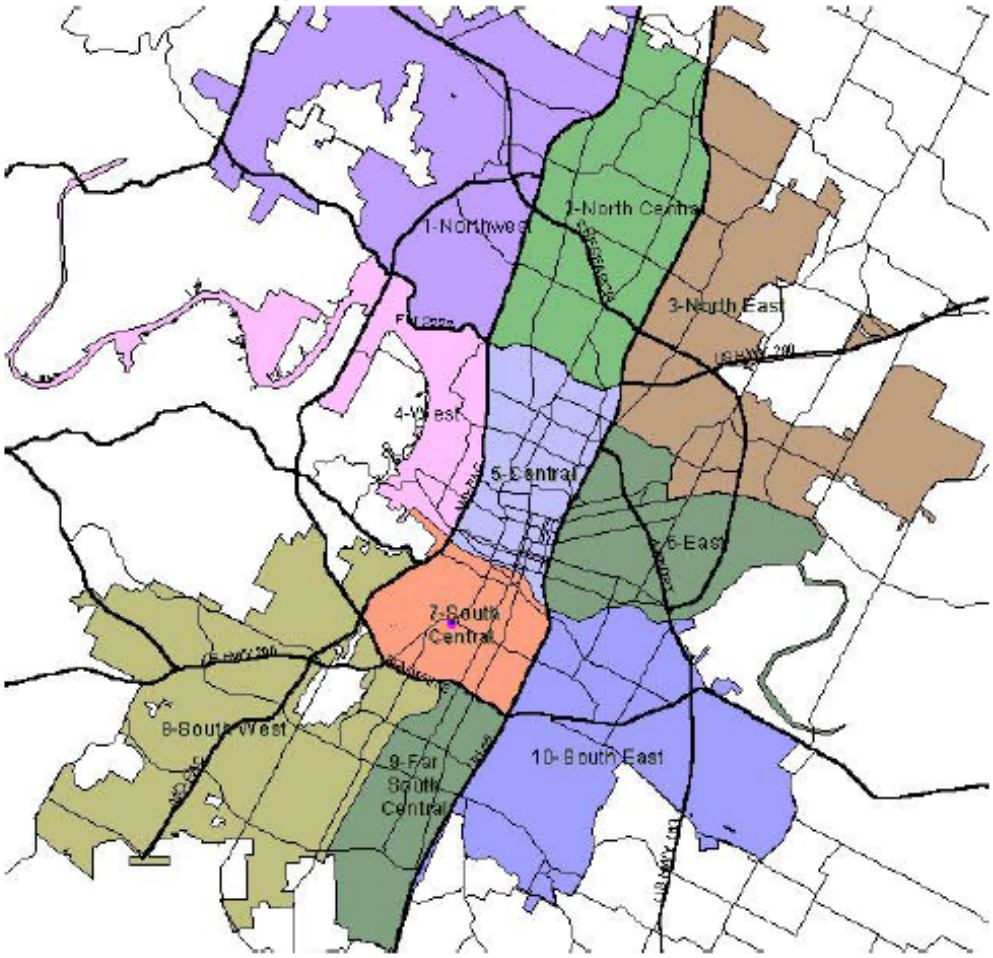
36. Which shaded area represents the location where you work?

- ◯ 1 - Northwest
- ◯ 2 - North Central
- ◯ 3 - North East
- ◯ 4 - West
- ◯ 5 - Central
- ◯ 6 - East
- ◯ 7 - South Central
- ◯ 8 - South West
- ◯ 9 - Far South Central
- ◯ 10 - South East
- ◯ 11 - None of these

37. Approximately how many miles do you travel to access Trail from HOME?

- ◯ Less than .25 mile
- ◯ .25-.50 mile
- ◯ .50-1.0 mile
- ◯ 2-5 miles
- ◯ More than 5 miles

Please examine the map below.



38. Which shaded area represents the location of HOME?

- ◯ 1 - Northwest
- ◯ 2 - North Central
- ◯ 3 - North East
- ◯ 4 - West
- ◯ 5 - Central
- ◯ 6 - East
- ◯ 7 - South Central
- ◯ 8 - South West
- ◯ 9 - Far South Central
- ◯ 10 - South East
- ◯ 11 - None of these

39. How old are you?

40. What is your gender?

- ◯ Female
- ◯ Male

41. Are you of Hispanic or Latino origin or descent?

- ◯ Yes, Hispanic or Latino
- ◯ No, not Hispanic or Latino

42. What is your race? Mark one or more.

- ◯ White
- ◯ Black or African American
- ◯ Asian
- ◯ Native Hawaiian or Other Pacific Islander
- ◯ American Indian or Alaska Native
- ◯ Other

Other (please specify)

43. What is the highest level of education you have completed?

- ◯ Some high school
- ◯ Completed high school
- ◯ Some college or vocational school
- ◯ Completed college degree
- ◯ Some graduate school
- ◯ Completed graduate degree

44. What is your approximate average household income?

- ◯ Less than $30,000
- ◯ $31,000 - $70,000
- ◯ $71,000 - $100,000
- ◯ More than $100,000

45. Thank you for participating in this survey! You're input on the trail is greatly appreciated and your responses are confidential. Please provide an email address so that we may invite you to participate in a future follow-up study (optional).

Email address for future follow-up study (confidential):

REFERENCES

Abildso, C., Zizzi, S., Abildso, L., Steele, J., & Gordon, P. (2007). Built environment and psychosocial factors associated with trail proximity and use. *American Journal Of Health Behavior*, *31*(4), 374-383.

Adams, M., Sallis, J., Kerr, J., Conway, T., Saelens, B., Frank, L., & Cain, K. (2011). Neighborhood environment profiles related to physical activity and weight status: a latent profile analysis. *Preventive Medicine*, 52(5), 326-331.

Ainsworth B., Haskell W., Whitt M., Irwin M., Swartz A., Strath S., O'Brien WL, Bassett DR, Schmitz K., Emplaincourt P., Jacobs D., & Leon A. (2000). Compendium of Physical Activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc* 32: 498–516.

American College of Sports Medicine (2006). *ACSM Guidelines for Exercise Testing and Prescription*. 7th ed. Philadelphia (PA): Lippincott,Williams and Wilkins.

Badland, H. M., Keam, R., Witten, K., & Kearns, R. (2010). Examining public open spaces by neighborhood-level walkability and deprivation. *J Phys Act Health, 7*(6), 818-824.

Bandura, A. (2002). Social cognitive theory in cultural context. *Applied Psychology* 51(2): 269- 290.

Bedimo-Rung, A., Mowen, A., & Cohen, D. (2005). The significance of parks to physical activity and public health: a conceptual model. *American Journal Of Preventive Medicine*, 28(2 Suppl 2), 159-168.

Boarnet, M., Day, K., Anderson, C., McMillan, T., & Alfonzo M. (2005). California's safe routes to school program. *Journal of the American Planning Association*, 71(3), 301-317.

Booth, M.L., Owen, N., Bauman, A., Clavisi, O., & Leslie, E. (2000). Social-cognitive and perceived environmental influences associated with physical activity in older Australians. *Preventive Medicine, 31*(1), 15-22.

Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist, 32*, 513-531.

Brosse, A., Sheets, E., Lett, H., Blumenthal, J. (2002). Exercise and the treatment of clinical depression in adults. *Sports Medicine*. 32 (12), 741-760.

Brownson R., Baker, E., Housemann, R., Brennan, L., and Bacak, S. (2001). Environmental and Policy Determinants of Physical Activity in the United States. *American Journal of Public Health*, 91(12), 1995-2003.

Brownson, R. C, Housemann, R. A., Brown, D. R., Jackson-Thompson, J., & King, A. C. (2000). Promoting physical activity in rural communities: Walking trail access, use, and effects. *American Journal of Preventive Medicine*, 18(3), 235-241.

Burden, D. (2004). *Ten Keys to Walkable/Liveable Communities*: Local Government Commission.

Capital Area Council of Governments (2011). *U.S. Census Bureau*. Austin, Tx.

Centers for Disease Control (2010). www.cdc.gov. Information retrieved March 16, 2011.

Centers for Disease Control and Prevention (2008). *National Center for Health Statistics*. http://www.cdc.gov/nchs

Cervero, R. & Kockelman, K. (1997). Travel demand and the 3Ds: Density, diversity, and design. *Transportation Research Design*, 2(3), 199–219.

Chon, J. & Shafer, S. (2009): Aesthetic Responses to Urban Greenway Trail Environments, *Landscape Research*, 34:1, 83-104.

Clarke, A. (1996). Beyond recreation: Trails for transportation and livable communities. *Trends*, 33(2), 25–28.

Cohen, D., Ashwood, S., Scott, M., Overton, A., Evenson, K., Voorhees, C., Bedimo-Rung, A., & McKenzie, T. (2006). Proximity to school and physical activity among middle school girls: the Trial of Activity in Adolescent Girls. Study, *Journal of Physical Activity & Health,* 3(1), S129–138.

Cohen, D., Golinell, D., Williamson, S., Sehgal, A., Marsh, T., McKenzie, T. (2009). Effects of park improvements on park use and physical activity. *American Journal of Preventative Medicine*, 37(6), 475-480.

Cordell, H., Betz, C, & Green, G. (2002). Recreation and the environment as cultural dimensions in contemporary American society. *Leisure Sciences*, 24, 13-41.

Coutts, C. & Miles, R. (2011). Greenways as Green Magnets: The relationship between the race of greenway users and race in proximal neighborhoods. *Journal of Leisure Research*, 43(3), 317-333.

Cromley, E., Troped, P., Melly, S., & Huffman, F. (2008). Community Trails in Community Context: GIS Analysis of Associations between Trail and Neighborhood Characteristics. *Uccgia papers and Proceedings, Paper 4.*

Davidson, R. & Van Reekum, C. (2005). Emotion is not one thing. Psychological Inquiry, 16-18.

Dill, J. & Glebe, J. (2008). *Understanding and Measuring Bicycling Behavior: A Focus on Travel Time and Route* Choice. Oregon Transportation Research and Education Consortium (ORTEC), Final Report.

Dishman, R., Washburn, R., & Heath, G. (2004). Mental Health. Physical Activity Epidemiology. Champaign: Human Kinetics.

Dorwart, C., Moore, R., & Leung, Y.(2010). Visitors' perceptions of a trail environment and effects on experiences: a model for nature-based recreation experiences. *Leisure Sciences*, *32*(1), 33-54.

Dove, J. (1997). Perceptual geography through urban trails. *Journal Of Geography In Higher Education*, *21*(1), 79.

Eicher, C. & Kawachi, I. (2011). *Social capital and community design*. In: Dannenberg, A., Frumkin, H., Jackson, R. Making healthy places: designing and building for health, well-being, and sustainability. Washington DC: Island Press.

Evenson, K., Murray, D., Birnbaum, A., & Cohen, D. (2010). Examination of perceived neighborhood characteristics and transportation on changes in physical activity and sedentary behavior: The Trial of Activity in Adolescent Girls. *Health & Place*, 16(5), 977-985.

Ewing, R. (2005). Can the Physical Environment Determine Physical Activity Levels? *Exercise Sport Science Review*, 33(2), 69-75.

Ewing, R., Schroeer, W., & Greene, W. (2004). School location and student travel analysis of factors affecting mode choice. *Trans Res Rec*, 1895, 55– 63.

Ewing, R., Schmid, T., Killingsworth, R., Zlot, A., & Raudenbush, S. (2003). Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity. *American Journal of Health Promotion*, 18(1), 47-57.

Finkelstein, E. A., Fiebelkorn, I. C., & Wang, G. J. (2003). National medical spending attributable to overweight and obesity: How much, and who's paying? *Health Affairs, 22*(4), W219-W226.

Fitzhugh, E., Bassett, D., & Evans, M. (2010). Urban Trails and Physical Activity: A Natural Experiment. *American Journal of Preventive Medicine, 39*(3), 259-262.

Frank, L., Andresen, M., & Schmid, T. (2004). Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars. *American Journal of Preventive Medicine*, 27(2), 87-96.

Giles-Corti, B., & Donovan, R. (2002). The relative influence of individual, social and physical environment determinants of physical activity. *Social Science & Medicine*, 54, 1793-1812.

Giles-Corti, B., Timperio, A., Bull, F., & Pikora, T. (2005). Understanding physical activity environmental correlates: increased specificity for ecological models. *Exercise And Sport Sciences Reviews*, *33*(4), 175-181.

Gobster, P. (2002). Managing urban parks for a racially and ethnically diverse clientele. *Leisure Sciences*, 24{2), 143-159.

Gordon, P., Zizzi, S., Pauline, J. (2004). Use of a community trail among new and habitual exercisers: a preliminary assessment. Prevention of Chronic Disease, 1(4), A11

Green, E. (1970). Voluntary control of internal states: Psychological and physicological. *Journal of Transpersonal Psychology*, (2) 1-26.

Handy, S.L. (2005). Critical Assessment of the Literature on the Relationships Among Transportation, Land-Use, and Physical Activity. *Transportation Research Board Special Report 282: Prepared for the Transportation Research Board and the Institute of Medicine Committee on Physical Activity, Health, Transportation, and Land Use.*

Handy, S., Boarnet, M., Ewing, R., & Killingsworth, R. (2002). How the built environment affects physical activity: Views from urban planning. *American Journal of Preventive Medicine*, 23(2,Suppl), 64-73.

Hartig, T. (2006). *Using greenways to amplify the health benefits of physical activity*. Paper presented at the Technical Conference Greenways in Europe, Girona, Spain.

Heath, G., & Brown, D. (2009).Recommended levels of physical activity and health related quality of life among overweight and obese adults in the United States, 2005. *Journal of Physical Activity and Health*, 6, 403-411.

Humpel, N., Owen, N., & Leslie, E. (2002). Environmental factors associated with adults' participation in physical activity: A review. *American Journal of Preventive Medicine*, 22, 188-199.

Innes, J. & Booher, D. (2000). Indicators for sustainable communities: a strategy building on complexity theory and distributed intelligence. Planning Theory & Practice, 1(2), 173-186.

Johnson, L. (1997). Organizations as living systems. *The Systems Thinker*, 7(10), 9-11.

Johnson, D., Ambrose, S., Bassett, T., Bowen, M., Crummey, D., Isaacson, J., Johnson, D. N, Lamb, P. ET AL (1997). "Meanings of Environmental Terms". *Journal of Environmental Quality* 26 (3): 581–589.

Jones, M., Ryan, S., Donlon, J., Ledbetter, L., Ragland, D., Arnold, L. (2010). *Seamless Travel: Measuring Bicycle and Pedestrian Activity in San Diego County and its Relationship to Land Use, Transportation, Safety, and Facility Type.* UC Berkeley Safe Transportation Research & Education Center, University of California, Berkeley.

Jones, M., Buckland, L., Cheng, A. (2005). *National Bicycle and Pedestrian Documentation Project*. Transportation Research Board.

Kaczynski, K. & Glover, T. (2012). Talking the talk, walking the walk: examining the effect of neighborhood walkability and social connectedness on physical activity, *J Public Health 34(3): 382-389.*

Kaczynski, A.T., & Henderson, K.A. (2007). Environmental correlates of physical activity: A review of evidence about parks and recreation. *Leisure Sciences*, 29, 315–354.

Kawakami, N., Winkleby, M., Skog, L., Szulkin, R., Sundquist, K. (2011). Differences in neighborhood accessibility to health-related resources: A nationwide comparison between deprived and affluent neighborhoods in Sweden. *Health & Place*, 17, 132-139.

Khan, F. (2011). Combating Obesity through the Built Environment: Is There a Clear Path to Success? *Journal Of Law, Medicine & Ethics*, *39*(3), 387-393.

King, A. (1998). How to promote physical activity in a community: research experiences from the US highlighting different community approaches. *Patient education and counseling*, 33, S3-S12.

Kligerman, M., Sallis, J., Ryan, S., Frank, L., & Nader, P. (2007). Association of neighborhood design and recreational environment variables with physical activity and body mass index in adolescents. American Journal of Health Promotion, 21, 274-277.

Krizek, K.J., El-Geneidy, A., and Thompson, K. (2007). A detailed analysis of how an urban trail system affects cyclists' travel. *Transportation*. 34(5), 611-624.

Krizek, K., Handy, S., Forsyth, A. (2009). Explaining Changes in Walking and Bicycling Behavior: Challenges for transportation research. Environmental Plan. B: Plan. Design, 36, 725-740.

Librett J., Yore M., & Schmid T., (2008). Characteristics of physical activity levels among trail users in a U.S. national sample. *American Journal of Preventive Medicine*, 31(5): 399–405.

Lindsey, G., Han, Y., Wilson, J., & Yuang, J. (2006). Neighborhood correlates of urban trail use. Journal of Physical Activity and Health, 3 (Suppl 1): S139-S157.

Lieb, D. C., Snow, R. E., & DeBoer, M. D. (2009). Socioeconomic Factors in the Development of Childhood Obesity and Diabetes. *Clinics in Sports Medicine, 28*(3), 349.

Locke, L., Silverman, S., Spirduso W.(2004). *Reading and Understanding Research*. Thousand Oaks: Sage.

Loukaitou-Sideris, A., & Eck, J. E. (2007). Crime prevention and active living. *American Journal of Health Promotion, 21*(4), 380-389.

Lounsbury, D., Mitchell, S. (2009). Introduction to Special Issue on Social Ecological Approaches to Community Health Research and Action. *American Journal of Community Psychology*, 44, 213-220.

Louv, R. (2005). *Last Child in the Woods: saving our children from nature-deficit disorder.* Chapel Hill, Algonquin books.

Lovasi, G., Neckerman, K., Quinn, J., Weiss, C., & Rundle, A. (2009). Effect of individual or neighborhood disadvantage on the association between neighborhood walkability and body mass index. *American Journal Of Public Health*, 99(2), 279-284.

Meadows, D.H., Randers, J. and Meadows, D.L. (2004). *Limits to Growth: The 30-Year Update.* White River Junction, Vermont: Chelsea Green Publishing Co.

Metropolitan Transportation Commission (2003). *Handbook for Bicyclist and Pedestrian Counts.*

Moore, R. & Ross, T. (1998). Trails and Recreational Greenways: Corridors of Benefits. *Parks & Recreation*, 33(1).

Mundet, L. & Coenders, G. (2010). Greenways: a sustainable leisure experience concept for both communities and tourists. *Journal Of Sustainable Tourism*, *18*(5), 657-674.

Nager, A., Wentworth, W. (1976). *Bryant Park: A comprehensive evaluation of its image and use with implications for urban open space design*. New York: CUNY Center for Human Environments.

Nasar, J. L. (1997). New developments in aesthetics for urban design, in : *G. T. Moore & R.W. Marans Advances in Envrionment, Behavior, and Design* (New York, Plenum Press).

Norman, G. J., Adams, M. A., Kerr, J., Ryan, S., Frank, L. D., & Roesch, S. C. (2010). A Latent Profile Analysis of Neighborhood Recreation Environments in Relation to Adolescent Physical Activity, Sedentary Time, and Obesity. *Journal of Public Health Management and Practice, 16*(5), 411-419.

Nulty, D. (2008). The adequacy of response rates to online and paper surveys: what can be done? Assessment & Evaluation in Higher Education, 33(3) 301–314.

Owen, N., Humpel, N., Leslie, E., Bauman, A., and Sallis, J. (2004). Understanding environmental influences on walking; Review and research agenda. *Am. J. Prev. Med*, 27:67–76.

Owen, N., Healy, G.N., Matthews, C.E., & Dunstan, D.W. (2010). Too much sitting: The population health science of sedentary behavior. *Exercise and Sport Sciences Reviews, 38*(3), 105-113.

Paivio, A. (1985). Cognitive and motivation funcitons of imagery in human performance. *Candadian Journal of Applied Sport Sciences*, 10(4).

Parsons, B., Jessup, P., & Moore, M. (2013*). Using the visibility and depth iceberg diagram to understand complex systems.* Ft. Collins, CO: InSites.

Pert, C. (2002). The Wisdom of the Receptors: Neuropeptides, the Emotions, and Bodymind.

Pikora, T., B. Giles-Corti, F. Bull, K. Jamrozik, and R. Donovan. Developing a framework for assessment of the environmental determinants of walking and cycling. *Soc. Sci. Med.* 56:1693–1793.

Pomerantz, James R. (2003): "Perception: Overview". In: Lynn Nadel (Ed.), *Encyclopedia of Cognitive Science*, Vol. 3, London: Nature Publishing Group, pp. 527–537

Price, A. E., Reed, J. A., & Muthukrishnan, S. (2012). Trail user demographics, physical activity behaviors, and perceptions of a newly constructed greenway trail. *Journal Of Community Health: The Publication For Health Promotion And Disease Prevention*, *37*(5), 949-956.

Puhl, R. M. & Latner, J. D. (2007). Stigma, obesity, and the health of the nation's children. *Psychological Bulletin, 133*(4), 557-580.

Putnam, R. (2000). Bowling alone: America's declining social capital. *Journal of Democracy, 6*, 65-78.

Rails-to-Trails Conservancy, (2013). Retrieved April 10, 2013 from http://www.railstotrails.org/index.html.

Reynolds, K. D., Wolch, J., Byrne, J., Chih-Ping, C., Guanjun, F., Weaver, S., & Jerrett, M. (2007). Trail Characteristics as Correlates of Urban Trail Use. *American Journal Of Health Promotion*, *21*335-345.

Rodríguez, D. A., Khattak, A. J., & Evenson, K. R. (2006). Can New Urbanism Encourage Physical Activity?. *Journal of the American Planning Association*, 72(1), 43-54.

Saelens, B. E. & Handy, S. L. (2008). Built environment correlates of walking: A review. *Medicine and Science in Sports and Exercise*, 40(7), S550–S566.

Saelens, B., Sallis, J., & Frank, L. (2003). Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. *Ann. Behav. Med*. 25, 80 –91.

Sallis, J. (2009). Measuring physical activity environments: a brief history. *American Journal of Preventative Medicine*, 36(4 Suppl): S86–S92.

Sallis, J.F., Johnson, M.F., Calfas, K.J., Caparosa, S., and Nichols, J. (1997). Assessing perceived physical environment variables that may influence physical activity. *Research Quarterly for Exercise and Sport*, 68, 345-351.

Sallis, J.F. & Saelens, B.E. (2000). Assessment of physical activity by self-report: Status, limitations, and future directions. *Research Quarterly for Exercise and Sport*, 71 , S1-S14.

Sander, T. H. (2002). Social Capital and New Urbanism: Leading a Civic Horse to Water. *National Civic Review*, 91(3), 213.

Schweizer, T. (2005). *Methods for Counting Pedestrians*. Paper presented at Walk21-VI 6th International Conference on Walking in the 21st Century, Zurich, Switzerland.

Senge, Peter M. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York, Doubleday/Currency, 1990.

Senge, P., Kim, D. (1997). From fragmentation to integration: Building learning communities. *The Systems Thinker*, 8(4), 1-5.

Sevenant, M., & Antrop, M. (2009). Cognitive attributes and aesthetic preferences in assessment and differentiation of landscapes. *Journal Of Environmental Management*, *90*(9), 2889-2899.

Shafer, C., Bong Koo, L., & Turner, S. (2000). A tale of three greenway trails: user perceptions related to quality of life. *Landscape & Urban Planning*, *49*(3/4), 163.

Sharpe, P., Granner, M., Hutto, B., & Ainsworth, B. (2004). Association of environmental factors to meet physical activity recommendations in two South Carolina counties. *American Journal of Health Promotion*, 18(3), 251-257.

Shishehbor, M., Lauer, M. S., Gordon-Larson, P., Kiefe, C. I., & Litaker, D. (2007). Association of neighborhood socioeconomic status with physical fitness in healthy young adults: The CARDIA study. *Journal of the American College of Cardiology, 49*(9), 176A-176A.

Siemens, G. (2003). *Knowing Knowledge*. Retrieved March 17, 2013 from http://www.elearnspace.org/

Slusser, W. M., Cumberland, W. G., Browdy, B. L., Winham, D. M., & Neumann, C. G. (2005). Overweight in urban, low-income, African American and Hispanic children attending Los Angeles elementary schools: research stimulating action. *Public Health Nutrition, 8*(2), 141-148.

Smith, S. (2012). *Why do People Participate as Respondents in a Survey?* Retrieved March 21, 2013 from http://www.qualtrics.com/blog/why-do-people-participate-as-respondents-in-a-survey/

Starnes, H., Troped, P., Klenosky, D. Doehring, (2011). Trails and Physical Activity: A Review". *Journal of Physical Activity and Health*, 8, 1160-11174.

Sugiyama, T., Neuhaus, M., Cole, R., Giles-Corti, B., and Owen, N. (2012). Destination and Route Attributes Associated with Adults' Walking: A Review. *Med. Sci. Sports Exerc*., 44(7), 1275–1286.

Texas Evening Master of Business Administration (2011). *Trail Survey*.

The Trail Foundation (2012). Retrieved Oct 10, 2012 from http://www.thetrailfoundation.org.

Town Lake Trail Foundation, (2007). *Riverside Boardwalk Investment Study: Completing the Town Lake Trail.* Austin, Tx.

Troped, P. J., Cromley, E. K., Fragala, M. S., Melly, S. J., Hasbrouck, H. H., Gortmaker, S. L., & Brownson, R. C. (2006). Development and Reliability and Validity Testing of an Audit Tool for Trail/Path Characteristics: The Path Environment Audit Tool (PEAT). *Journal Of Physical Activity & Health*, *3*S158-S175.

Troped P., Saunders R., Pate R., (2001). Associations between self-reported and objective physical environmental factors and use of a community rail-trail. *Preventive Medicine*, 32(2): 191–200.

Troped, P., Whitcomb, H., Hutto, B., Reed, J., & Hooker, S. (2009). Reliability of a brief intercept survey for trail use behaviors. Journal of Physical Activity and Health, 6(6), 775–780.

Transportation Research Board (2005). Does the Built Environment Influence Physical Activity: Examining the Evidence. *Transportation Research Board Special Report*, 282.

U.S. Department of Health and Human Services. (2008). 2008 Physical Activity Guideleines for Americans. http://www.health.gov/paguidelines/guidelines/summary.aspx

Voorhees, C., Ashwood, S., Evenson, S., Sirard, J., Rung, A., Dowda, M., & Mckenzie, T. (2010). Neighborhood design and perceptions: Relationship with active commuting. *Medicine and Science in Sports and Exercise*, 42(7), 1253-1260.

Wilcox, S., Castro, C., King, A., Housemann, R., and Brownson, R. (2000). Determinants of leisure time physical activity in rural compared with urban older and ethnically diverse women in the United States. *Journal of Epidemiology and Community Health*, 54, 667–672.

Wilhelm Stanis, S. A., Schneider, I. E., & Russell, K. C. (2009). Leisure Time Physical Activity of Park Visitors: Retesting Constraint Models in Adoption and Maintenance Stages. *Leisure Sciences*, 31(3), 287-304.

Wolf, F. (2011). Towards a Quantum Field Theory of Mind. *Neuroquantology*, *9*(3), 442-458.

Wong, B., Faulkner, G., & Buliung, R. (2011). GIS measured environmental correlates of active school transport: a systematic review of 14 studies. *The International Journal Of Behavioral Nutrition And Physical Activity*, 839.

World Health Organization (2009). *WHO Handbook for guideline development*, Geneva.

Zoellner, J., Hill, J., Zynda, K., Sample, A., & Yadrick, K. (2012). Environmental perceptions and objective walking trail audits inform a community-based participatory research walking intervention. *The International Journal Of Behavioral Nutrition And Physical Activity*, 9(6), 1-11.