Visualizing walkability: exploring residents' preferences for complete street design and urban trails using immersive 360° videos

by

Chloe S. Gillespie

A REPORT

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Approved by:

Major Professor

Sara Hadavi, PhD

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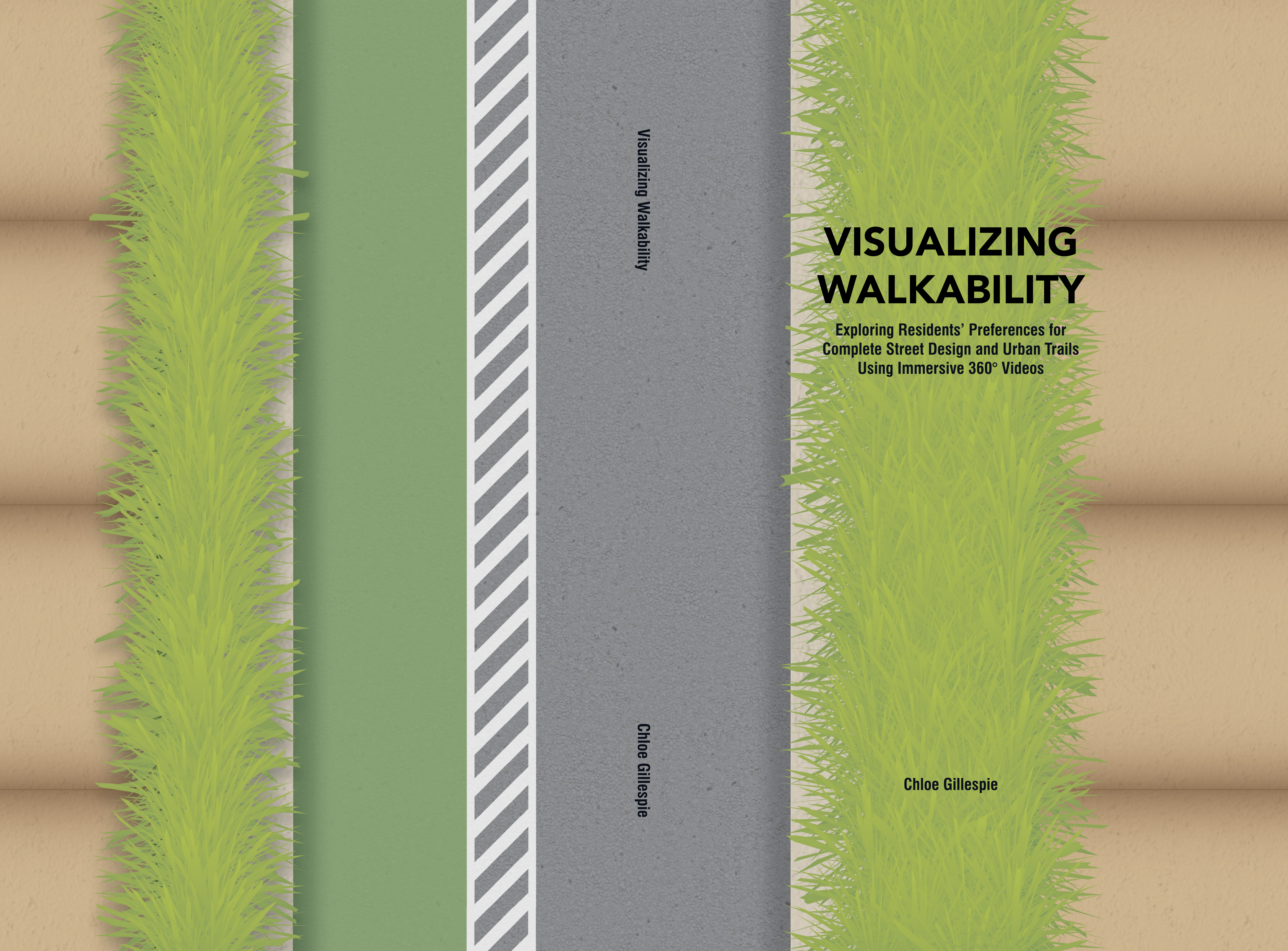
Abstract

Complete streets and pedestrian-oriented design have been a pressing issue in cities over the past 20 years. While the safety benefits of having complete streets have been explored widely (Burlacu & Tărîţă-cîmpeanu 2016; Litman 2015; Kwon et al. 2022), less attention has been paid to the role comfort level and aesthetic quality has in walkability. This study aims to address this issue by examining people's perceptions towards pedestrian-oriented street designs along an urban streetside interpretive trail. More specifically, this study investigates how sidewalk widths, plantings, and bike lanes influence people's comfort level, perceived safety, and aesthetic preference towards a space. Using a virtual reality experience with 360° video, data was collected from a population of 53 participants in a study area in eastern Kansas City, Missouri. In this study, participants viewed three focus areas each with three different interventions of added pedestrian-oriented complete street elements including sidewalk width, planting, and bike lane, and ranked their levels of comfort, safety, and attractiveness for the space on a five-point rating scale. The results indicate the extent to which complete street elements contribute to creating more walkable spaces from users' perspective. The statistical analysis results revealed that increased sidewalk width and flowered plantings had the greatest influence in increasing feelings of walkability. Building upon these findings planning and design interventions were proposed for each focus area type. The broader outcome of this study relates to its implications in highlighting the use of VR and 360° videos in understanding people's preferences for urban streetside interpretive trail design, and how 360° technology can be used as a research and design tool.



VISUALIZING WALKABILITY

Exploring Residents' Preferences for Complete Street Design and Urban Trails Using Immersive 360° Videos

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Visualizing Walkability:

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by Chloe Gillespie

Major Professor:

Sara Hadavi, Ph.D, Assistant Professor, Landscape Architecture & Regional and Community Planning

Committee:

Kutay Güler, Art.D, Associate Professor, Interior Architecture & Industrial Design
Gregory Newmark, Ph.D, Research Associate Professor, Civil Engineering

Kansas State University
College of Architecture, Planning, and Design
Department of Landscape Architecture and Regional & Community Planning

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Key Terms

Complete Street:

Streets that are designed to meet the needs of all users – pedestrians, cyclists, transit users, and motorists – regardless of age or ability, to ensure safe access to mobility
(Smart Growth America 2020)

Level-of-Service:

An evaluation method of measuring of how well a facility can meet the user demand of movement through the space
(Kingsbury et al. 2011)

Ordinance:

A local law put in place by a municipality
(Cornell Law School 2020)

Right of Way:

An area owned by the state, county, or local jurisdiction encompassing the street, curbs, sidewalks, parkways, and numerous utilities, while providing a safe space to travel through neighborhoods and cities
(Richardson 2017)

Virtual Reality:

A digitally enhanced experience that transports viewers into simulated alternatives to reality
(Milovanovic et al. 2017)

360° Video:

Videos taken using a special camera capturing a 360° field of vision

Head-mounted Display

Wearable device over one's head used to show immersive images, videos, and games in a digital setting.
Examples: Meta Quest, Oculus, Google Cardboard

Abstract

Complete streets and pedestrian-oriented design have been a pressing issue in cities over the past 20 years. While the safety benefits of having complete streets have been explored widely (Burlacu & Tărîţă-cîmpeanu 2016; Litman 2015; Kwon et al. 2022), less attention has been paid to the role comfort level and aesthetic quality has in walkability. This study aims to address this issue by examining people's perceptions towards pedestrian-oriented street designs along an urban streetside interpretive trail. More specifically, this study investigates how sidewalk widths, plantings, and bike lanes influence people's comfort level, perceived safety, and aesthetic preference towards a space. Using a virtual reality experience with 360° video, data was collected from a population of 53 participants in a study area in eastern Kansas City, Missouri. In this study, participants viewed three focus areas each with three different interventions of added pedestrian-oriented complete street elements including sidewalk width, planting, and bike lanes, and ranked their levels of comfort, safety, and attractiveness for the space on a five-point rating scale. The results indicate the extent to which complete street elements contribute to creating more walkable spaces from users' perspective. The statistical analysis results revealed that increased sidewalk width and flowered plantings had the greatest influence in increasing feelings of walkability. Building upon these findings, planning and design interventions were proposed for each focus area type. The broader outcome of this study relates to its implications in highlighting the use of VR and 360° videos in understanding people's preferences for urban streetside interpretive trail design, and how 360° technology can be used as a research and design tool.

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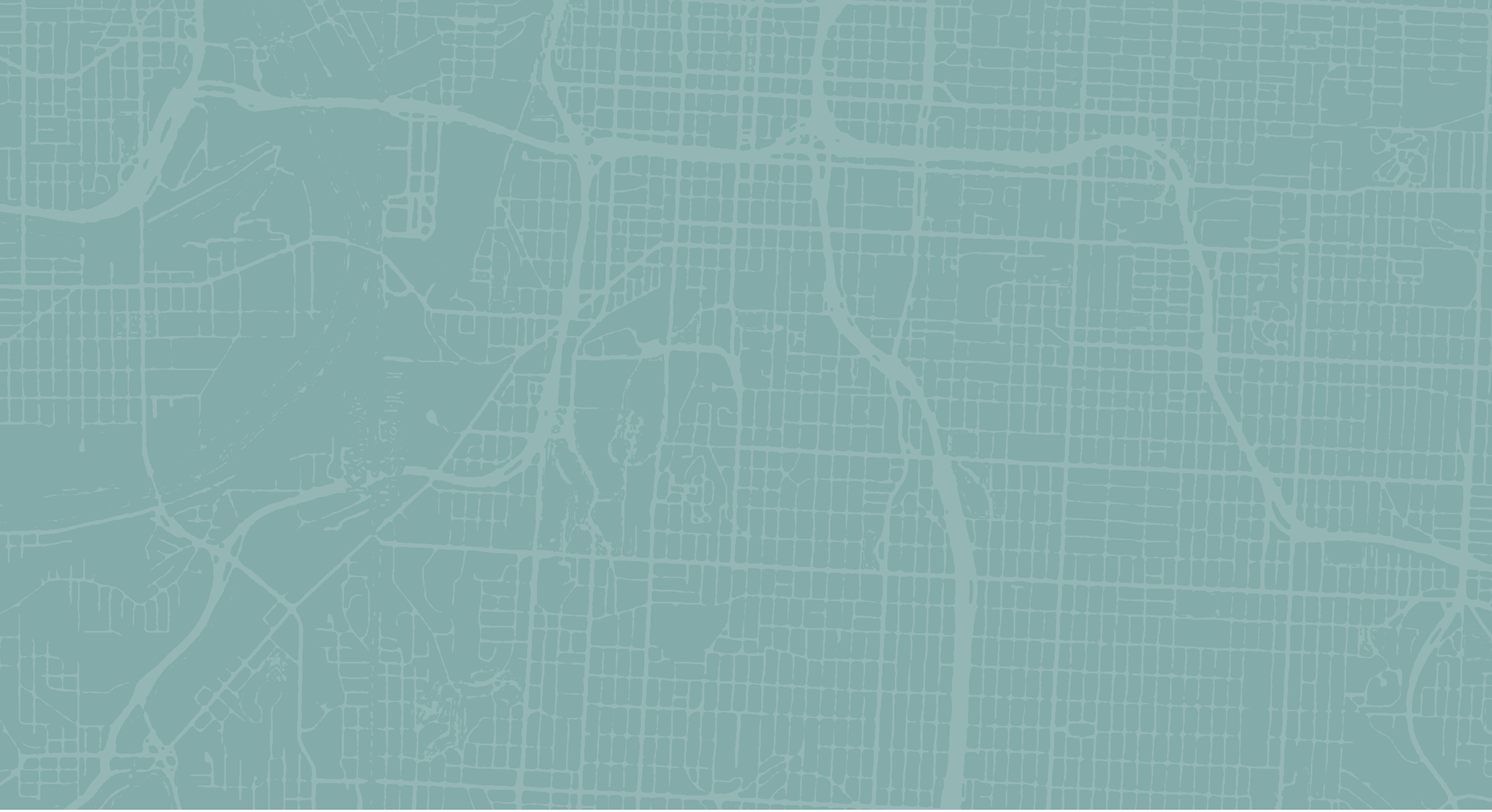


INTRODUCTION

Chapter One

Introduction

Transportation has been a part of human development since the very beginning (Herbst 2006). From walking to horseback to the modern car, people have always been on the move. When the modern car became widely available in the 1920s, many cities shifted the way the streets operated. Streets went from being open and accessible to all forms of transportation (including pedestrians) to being strictly car centric (Kumar et al. 2019; Schwartz 2015). This shift in street design seemed to make sense at the time, but as more research is coming to light about the harm cars are doing to cities, car-centered streets are falling out of fashion, and starting to be replaced with multimodal streetscapes (Kumar et al. 2019; Litman 2022; Schwartz 2015). In recent years, cities have started to adopt Complete Street Ordinances, which are designed to create safe, equitable streets for all modes of transportation. More than 1,600 complete street policies have been passed in the U.S. since 2000, with at least one in every state (Smart Growth America 2020). Pedestrians are a major part of complete street design, as 20% to 40% of residents in a typical U.S. community do not use driving as their main mode of transportation (Litman 2015). Having walkable spaces and connected pedestrian networks foster livable communities that are safer, healthier, and more sustainable (Burlacu & Tărîţă-cîmpeanu 2016; Corning-Padilla & Rowangould 2020; Gerike et al. 2021; Li et al. 2015; Mofolasayo 2019).

People walk for a multitude of reasons – as their main mode of transportation, for social or recreational activity, or as exercise (Saelens & Handy 2008; Sugiyama et al. 2012). Regardless of purpose, most walking trips take place on neighborhood streets and in public facilities (Lee & Moudon 2004; Saelens & Handy 2008; Sugiyama et al. 2012). The quality and character of the street, along with attractiveness, play a role in how comfortable and safe people feel to walk (Saelens & Handy 2008). Pedestrian signage has also shown to increase walking comfort levels and perceived safety (McCann 2013; Xu et al. 2022).

Focusing on the social and recreational aspect of walking, urban streetside trail systems can be integrated into neighborhoods, though utilizing complete street elements as a means to educate visitors about the history of a neighborhood and create a sense of pride for the community. Streetside trails are not yet a widespread practice, so the need for understanding the comfort levels, safety perceptions, and aesthetics qualities of the trails is an open area of research.

Currently, there are a few methods that are being used to understand how people view complete streets and trail designs. One way is through temporary mockups demonstrating how each element will function. Recent research has focused on this topic and has shown great success with temporary set ups leading to permanent installations of complete streets (Carlson et al. 2019; Downing 2013). However, this method takes a lot of time and resources to implement. Temporary mockups are great for seeing how the proposed elements will function through real-world tests, but they lack the aesthetic qualities of their permanent solutions.

A method better suited for visualizing aesthetics is using virtual reality (VR). VR allows users to view what an implemented complete street would look like, without the cost and hassle of temporary mockups. The immersive experience VR creates, allows people to move through a designed space and see each element, which then can be easily adjusted or changed based on people's preferences and feedback. A drawback to using VR is that the digital modeling often lacks the photorealistic quality of the real world, making it hard for people to truly imagine themselves in the space. Several studies have used VR to assess people's perception of safety on complete streets (Kwon et al. 2022; Maheshwari et al. 2016; Xu et al. 2022).

Another method, and the one this study will be using, is the use of immersive 360° videos. This method combines the digital aspect of creating visual implementations like VR with the photorealistic quality of the real world, as experienced in the temporary mockups. While this method does have its limitations, like potential motion sickness and static quality, it does provide users with a photorealistic experience of what a designed streetside trail or complete street could look like in their neighborhood. Using 360° videos instead of VR is plausible when studies focus on the pedestrian side of the complete streets, because pedestrians have the greater capability to observe their surroundings in detail, making the photorealistic quality of high importance. 360° videos also allow for a more immersive environment compared to traditional 2D videos or photos, creating a richer experience for the participants.

This study uses Kansas City, Missouri as a case to explore walkability in designing urban streetside interpretive trails using 360° videos as a tool to capture people's responses to design solutions and their effects on walkability.

Figure 1.1 shows the research map of this study.

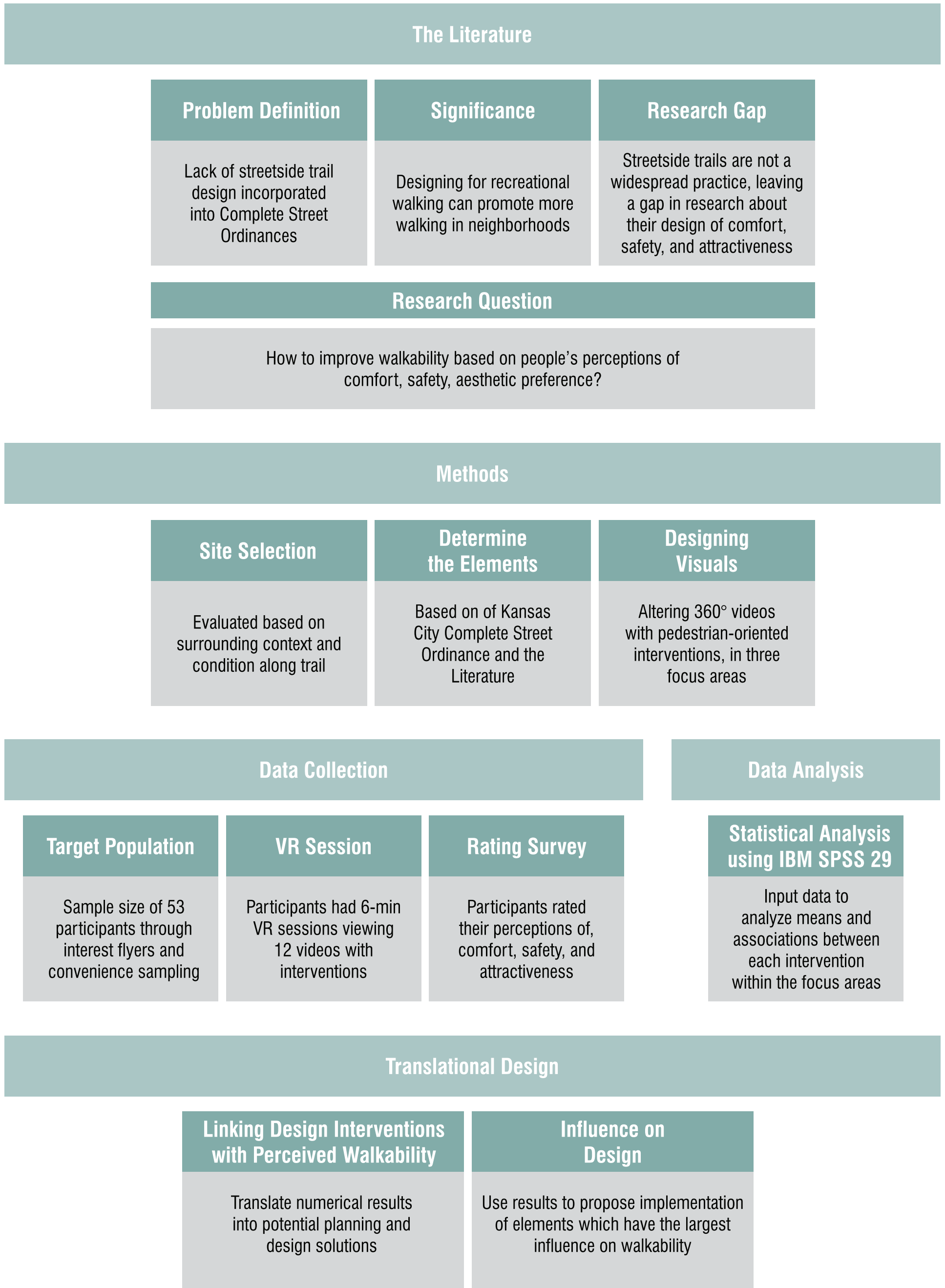


Figure 1.1: Research Map

Project Objective

Like many cities across the United States, Kansas City, Missouri has adopted a city-wide Complete Street Ordinance, which was passed in 2017. This ordinance outlines guidelines for implementing complete streets with suggestions on when and where they should be implemented (KC CSO 2017). Specifically stating in the ordinance that middle- and lower-income areas should be given priority, this study uses an area east of Troost Ave – the historic racial and economic dividing line – as a study area (Figure 1.2).

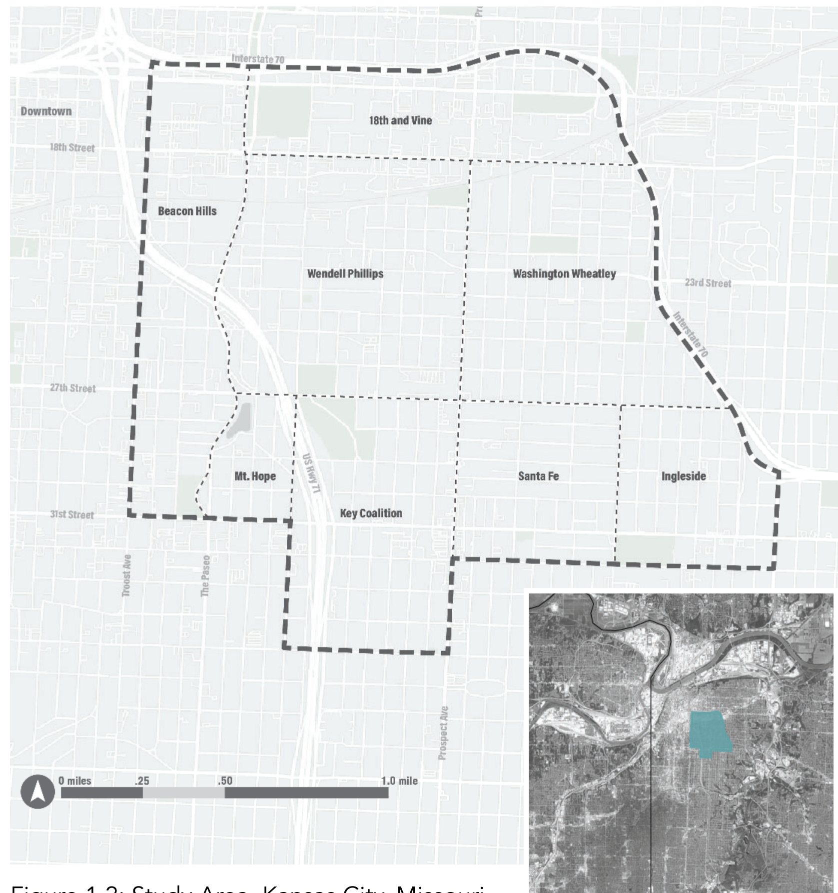
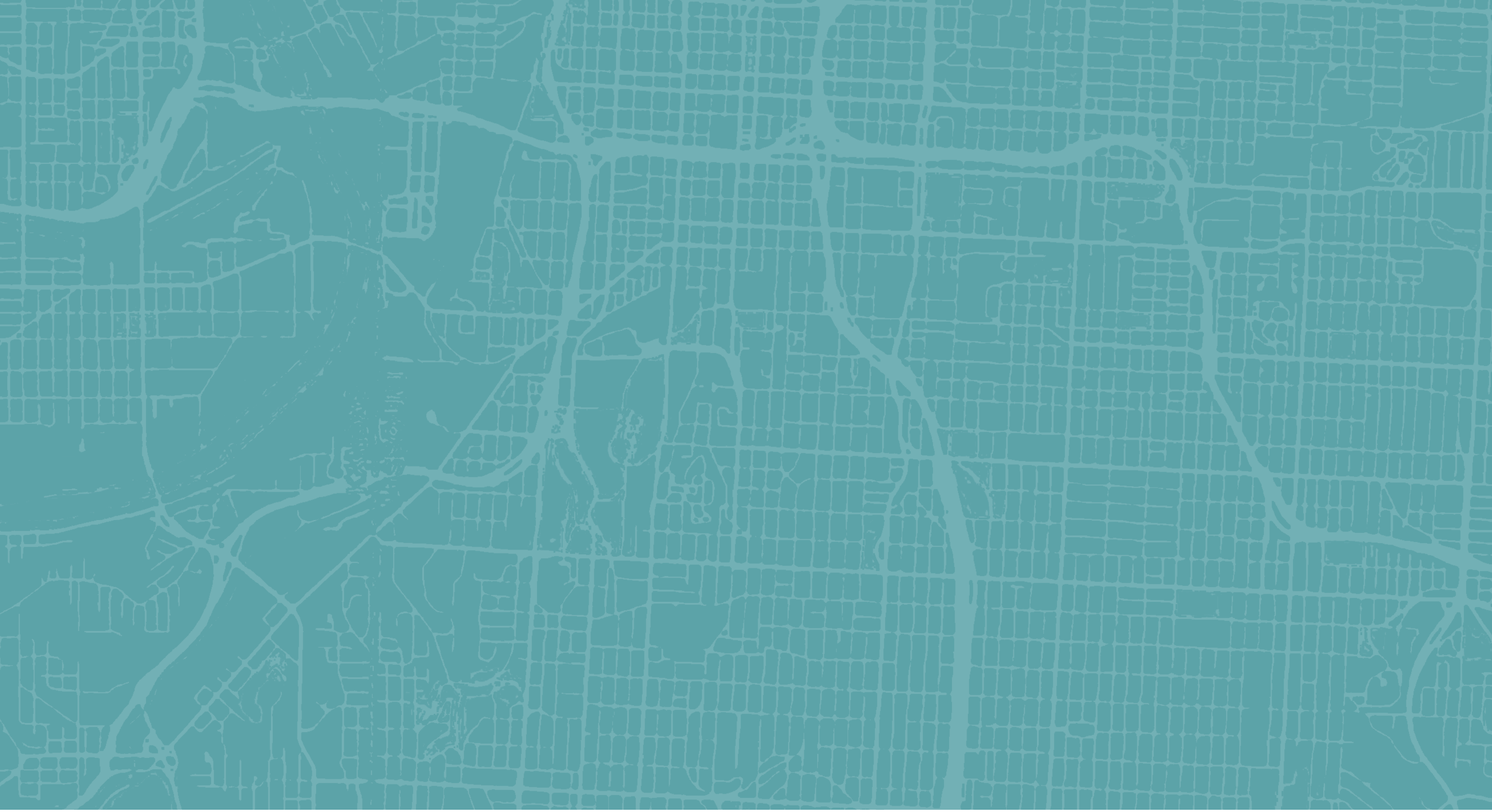


Figure 1.2: Study Area, Kansas City, Missouri

Research Question

This study aims to answer the question of *how to improve walkability based on people's perceptions of comfort, safety, and aesthetic preference*. This study uses a proposed streetside heritage trail in a culturally rich area of Kansas City, Missouri as a case, to address this question.

How to improve walkability based on people's perceptions of comfort, safety, and aesthetic preference?



INVESTIGATION

Chapter Two

Background

History of Complete Streets

Ever since cars became affordable to the middle class in the early 20th century, the American dependency on cars has grown at a rapid pace, leaving the other modes of transportation seemingly irrelevant (Burlacu & Tărîţă-cîmpeanu 2016; Richardson 2021; Tracz 2015). As car usage grew, so did the size of the street. The main goal of streets is moving cars as fast and efficiently as possible from one point to another, so wider streets became the proposed solution to meet that goal (Hanson 2017; Harvey et al. 2018; Litman 2015). However, wider streets make it more dangerous for walkers and cyclists as they get pushed aside to give as much space as possible to the car, leaving them vulnerable to higher risks of accidents (Harvey et al. 2018; Litman 2018). In 2003, Barbara McCann – an American Bikes staff member – coined the term "Complete Streets" leading to the rise of safer streets designed for all users, not just cars (Burlacu & Tărîţă-cîmpeanu 2016; Zavestoski & Agyeman 2015). Since then, the popularity of complete street design has taken cities by storm, with over 1,600 complete street policies implemented across the country, with no signs of slowing down (Bejleri et al. 2021; Smart Growth America 2020; Tracz 2015; Zavestoski & Agyeman 2015).

Defining a Complete Street

Defining exactly what a complete street looks like is difficult as each street has different needs for completeness (Kingsbury et al. 2011; Maisel et al. 2021; Ranahan et al. 2018; Tracz 2015), but the goal of complete streets is clear: "plan, design, build, operate, and maintain streets that enables safe access for all people who need to use them, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities" (Smart Growth America 2020). Having flexibility in the street design allows for each complete street to be tailored to meet the needs of the surrounding neighborhood (Kumar et al. 2019; Donais et al. 2019; Mofolasayo 2019). While the design differs from street to street, a few measures of success remain the same: increased safety, increased walkability and cyclability, increased transportation diversity, and healthier, happier communities (Richardson 2021; Tracz 2015).

Elements of a Complete Street. With the goal of designing streets for all types of users, there are a few elements of complete streets that are common across many designs: wider sidewalks, bike lanes and racks, bus lanes and shelters, crosswalks, street trees and other landscape elements, and signage (Burlacu & Tărîţă-cîmpeanu 2016; Hanson 2017; Kumar et al. 2019; Lenker et al., 2016; Litman 2015; Sukmana et al. 2019; Tracz 2015; Zavestoski & Agyeman 2015). The above list is not an exhaustive list of every complete street element, but a narrowed list of the common elements found in many complete street designs. Along with the above-mentioned elements, traffic calming design is used to help slow traffic, making roads safer (Laplante & McCann 2008). Some common traffic calming measures include narrower travel lanes, reducing the number of travel lanes, smaller corner curb radii, pedestrian refuge islands, center left turn lanes, and removing free-flow right turn lanes (Burlacu &Tărîţă-cîmpeanu 2016; Hanson 2017; Laplante & McCann 2008; Lenker et al., 2016; Litman 2015). All these elements and more are designed to meet the goals of complete streets by making the street safe and accessible to all users.

Selection for Complete Streets. Determining what streets should become complete streets and what elements should be implemented is a process unique to each ordinance. Prioritizing areas that lack safe walking spaces have proven successful in creating an equitable network of complete streets (Donais et al. 2018; Harvey et al. 2018; Hui et al. 2018; Li et al. 2015; McCann 2013). Many studies have used point ranking systems to help determine what areas should be targeted first (Donais et al. 2018; Hui et al. 2018; McCann 2013). The ranking factors and prioritization include multimodal qualities, surrounding context, and quality of walking spaces (Donais et al. 2018; Harvey et al. 2018; Hui et al. 2018; Li et al. 2015; Litman 2015; McCann 2013).

Evaluating a Complete Street. Currently there is no standard grading system for the "completeness" of a street as every street requires differing levels of "completeness" (Hanson 2017; Hui et al., 2018). However, a variety of studies have created their own 'score card' to evaluate complete streets based on their area of study (Dock et al. 2012; Gerike et al., 2021; Hanson 2017; Kumar et al., 2019; Lenker et al., 2016; Litman 2015; Xu et al., 2022). One of the main indicators of a successful complete street, or any design, is the level-of-service (LOS) provided to the users (Bejleri et al. 2021; Dock et al., 2012; Litman 2015). LOS is measured by how well a facility can accommodate the user demand of movement through the space (Kingsbury et al., 2011). Beyond just the LOS, the quality of the space is also an important measure of success (Dock et al. 2012; Kingsbury et al. 2011; Kumar et al., 2019). The LOS can be broken down into four user groups, each with different needs: pedestrians, cyclists, transit users, and motorists (Elias 2011). For pedestrians, wider sidewalks, marked crosswalks, and slower traffic speeds were cited as having a positive impact on pedestrian safety and usability of the complete street with an increased LOS (Gerike et al. 2021; Litman 2015).

Urban Trails

Walkability. Walkability comes from well-connected quality sidewalk networks, smaller distances between needs, and mixed street uses, along with other pedestrian focused design elements (Burlacu & Tărîţă-cîmpeanu 2016; Gerike et al. 2021; Li et al. 2015). Increased walkability provides a myriad of health benefits, from higher levels of activity leading to reduced obesity (Burlacu & Tărîţă-cîmpeanu 2016; Gerike et al. 2021; Li et al. 2015; Mofolasayo 2019), to healthier breathing because of the reduction of pollution from cars (Burlacu & Tărîţă-cîmpeanu 2016; Corning-Padilla & Rowangould 2020; Mofolasayo 2019). Prioritizing pedestrians and walkability measures have led to economic improvement in cities as it increases the ability for pedestrians to be able to comfortably walk to commercial areas (Gerike et al. 2021) and increasing property value in residential areas (Corning-Padilla & Rowangould 2020; Li et al. 2015). But walkability is more than just the benefits walking can provide, it is also about the experience for the pedestrian. People walk for utilitarian purposes to get to a destination, but they also walk for recreation purposes, however, this distinction is often not made when analyzing walkability (Cao et al. 2006). The built environment plays a large role in the pedestrian experience of walking, in terms of comfort, safety, and attractiveness (Alfonzo et al. 2008; Cao et al. 2006; Saelens & Handy 2008).

Comfort. Pedestrian comfort level when walking can be hard to quantify because comfort can be subjective. There are also various factors that impact one's feeling of comfort, from the weather to the familiarity of a place, to the traffic levels (Alfonzo 2005; Ma et al. 2021; Mehta 2008). However, there are a few street design elements that display higher comfort level ratings than others. The first of which is sidewalk width and condition. Kim et al. (2010) conducted a study to understand people's preferences for sidewalk widths to make them the most comfortable. While the study did not have a large enough sample size to be generalizable, the theory of the research is sound in proposing having a more balanced distribution of roadway space to allow for wider sidewalks (Kim et al. 2010). To complement Kim et al.'s (2010) study, Gerike et al. (2021) states pedestrians feel more comfortable in wider sidewalks that are clear of obstacles and have high quality pavement. The minimum sidewalk width Gerike et al. (2021) proposes to maintain comfort levels for pedestrians to pass one another, is 1.80 meters or about 6 feet. The Federal Highway Administration states 5ft as the bare minimum for a sidewalk width with a buffer between it and the road, and 6ft as the minimum if there is no buffer (FHWA n.d.). For Kansas City, the minimum sidewalk width on residential streets is 4ft, and 5ft if there is no buffer (KCMCAPWA 2016).

Beyond sidewalk width, other street design elements impacting pedestrian comfort level are traffic calming measures. These measures include narrowing street widths, lowering the speed limit, adding in speed bumps and crosswalks, and adding vegetated buffers between the sidewalk and street (Alfonzo 2005; Ma et al. 2021). These measures have shown to increase pedestrian activity in the neighborhoods they have been implemented (Alfonzo 2005). Higher aesthetic qualities of elements can also lead to a positive impact on people's comfort level when walking through a space (Xu et al. 2022).

Safety. With respect to walkability, feelings of safety take on two forms: (1) safety from traffic and (2) safety from crime. Pedestrians are the most vulnerable group on streets in terms of physical safety from traffic because they have the least amount of protection from vehicles (Laplante & McCann 2008; Mehta 2008; Mofolasayo 2019; Sukmana et al. 2019). The Governors Highway Safety Association (GHSA) reports an estimated 7,485 pedestrians were killed by vehicles in 2021 in the U.S. (Snider 2022). Many of the reported crashes occurred on streets that did not have sidewalks (Hanson 2017; Knoblauch et al., 2001; Snider 2022). Complete streets are used to help improve both actual and perceived pedestrian safety, through the use of pedestrian-oriented design elements (Apritasari 2021; Burlacu & Tărîţă-cîmpeanu 2016; Litman 2015; Kwon et al. 2022). These elements include raised crosswalks, refuge islands, narrower traffic lanes, pedestrian lighting, and separated sidewalks (Apritasari 2021; Burlacu & Tărîţă-cîmpeanu 2016; Forsyth 2015; Gårder 2004; Hanson 2017; Kwon et al. 2022; Mehta 2008; Tracz 2015). Complete streets are found to reduce pedestrian-involved crash risk by around 28% (Burlacu & Tărîţă-cîmpeanu 2016; Litman 2015). Vegetation was found to have mixed results on safety. From the pedestrian side, vegetation provided a separation from the cars making them feel safer, but from the driver's perspective, vegetation can block the pedestrian from view, making them harder to see when the driver is turning (Alfonzo 2005; Tracz 2015). Blocked views by vegetation have also shown to increase fear of crime (Alfonzo 2005).

In terms of the safety from crime, whether the threat of crime is real or perceived, surrounding context plays a major role in people's perceptions (Mehta 2008). Litter, graffiti, and abandoned lots or buildings are some of the cues of disorder which decrease the perceptions of safety when walking (Alfonzo 2005; Brown et al. 2007; Mehta 2008). When people do not feel safe in an area, they will likely choose not to walk (Alfonzo 2005; Brown et al. 2007), therefore decreasing the walkability of the area. Providing safety from both traffic and crime should be considered when designing streetscapes for walkable cities (Alfonzo 2005; Brown et. al 2007; Mehta 2008).

Attractiveness. Studies have explored the association of the visual quality of the build environment and the experience of walking (Alfonzo 2005; Alfonzo et al. 2008; Brown et al. 2007; Cao et al. 2006; Lee & Moudon 2004; Mehta 2008; Saelens & Handy 2008; Speck 2018; Sugiyama et al. 2012). The findings often concluded that people will be more inclined to walk in spaces that have high-quality and appealing scenery. Some of the elements that contribute to the high visual quality are wide paved sidewalks (Forsyth 2015; Mehta 2008; Reynolds et al. 2007), plantings (Forsyth 2015; Mehta 2008; Speck 2018), and wayfinding signage (Forsyth 2015; Mehta 2008). It was also noted that people will more likely walk to their desired destination if they have good, obstacle-free access (Brown et al 2007; Mehta 2008). Variables of litter and loud noises have shown to reduce the attractiveness of a trail, leading to decreased use (Reynolds et al. 2007). In contrast, having pleasant and attractive streets near people's homes help create activity-friendly neighborhoods, encouraging more people to walk (Lee & Moudon 2004). When walking for recreational purposes, the attractiveness of the street and surrounding context matter more to pedestrians than when they walk for utilitarian purposes (Sugiyama et al. 2012). Environmental aesthetics, like street trees and flowers, have been shown to increase walking for exercise and recreation (Alfonzo 2005; Lee & Moudon 2004; Saelens & Handy 2008). Street trees can increase the pleasurably walking in a space (Alfonzo et al. 2008) and provide comfort from the heat and safety from cars (Mehta 2008; Speck 2018).

Virtual Reality and 360° Video as Research Tools

Virtual Reality (VR). Although virtual reality is becoming more popular by the day, VR technology actually started nearly 200 years ago with the invention of the Stereoscope in 1838 (Güler 2022). While VR technology has come a long way since then, the original goal of transporting viewers into new environments from reality has remained the same throughout the years (Güler 2022; Milovanovic et al. 2017; Song & Huang 2018). The draw to using VR is the immersive technology makes it ideal for a wide range of applications, from entertainment purposes to designing landscapes in virtual reality (Froehlich & Azhar 2016; Song & Huang 2018). The immersiveness of VR ranges from being completely immersive with sight, sound, smell, taste, and touch (Froehlich & Azhar 2016) to being semi-immersive in a virtual reality theater, or immersive rooms, with projected images (George et al. 2017).

As the technology continues to advance, VR is starting to become adopted among designers and landscape architects as a tool to represent design ideas (Bejleri et al., 2021; George et al. 2017; Kwon et al., 2022; Xu et al. 2022) or show realistic 3D geovisualization to clients and stakeholders (Carbonella-Carrera et al. 2021). While the use on VR in the design professional world is still developing, the use of VR in academic and research settings is becoming increasingly popular (George et al. 2017; Milovanovic et al. 2017; Paes et al. 2017). For example, in one study, students were able to draw their design ideas while in virtual reality and were able to see their ideas come to life (George et al. 2017). The immersive, virtual spaces allow users to experience a variety of scenarios without the risk of being injured, which is specifically helpful in traffic studies (Bhagavathula et al. 2018; Kwon et al., 2022; Shonesy 2017; Xu et al. 2022). Studies have used VR to teach school children how to safely cross the street (Shonesy 2017), test out safety measures of complete streets (Bejleri et al. 2021), and evaluate people's perceptions of intersection design (Bhagavathula et al. 2018).

360° Videos. Like VR, 360° videos can be viewed through a head-mounted display to create a semi-immersive experience. One of the benefits of using 360° video is the photorealistic quality they provide as they are videos of the real world (Alamäki et al. 2021). However, 360° videos are limited in their immersiveness, as viewers are not able to move through the space, but rather can only turn their heads to view the space (Atwa et al. 2019). Determining what is more important for the study, the realism of the imagery or the interactiveness, will help researchers decide whether to use 360° videos or traditional VR (Atwa et al. 2019).

The use of 360° videos has had a great impact on the development of AR (augmented reality) and VR applications (Alamäki et al. 2021; Putra et al. 2016). Three-dimensional (3D) scans using 360º photos and videos can be used to develop virtual 3D models of buildings which can viewed in VR (Putra et al. 2016). Studies have also shown 360º videos can create emotional and physiological impacts on viewer because of their rich media effects, allowing more logical connections to be made (Alamäki et al. 2021; Hebbel-Seeger 2017; Toet et al. 2020). Studies have been conducted using 360° video for educational uses in classrooms (Alamäki et al. 2021; Pirker & Dengel 2021; Snelson & Hsu 2020), but there has been limited research into using 360° videos for designing. Nonetheless, there have been a few studies that use 360° videos to evaluate streetscapes after implementation (Kim & Lee 2022) and cultural heritage storytelling (Škola et al. 2020).

Figure 2.1 shows the connections of sources reviewed in the literature.

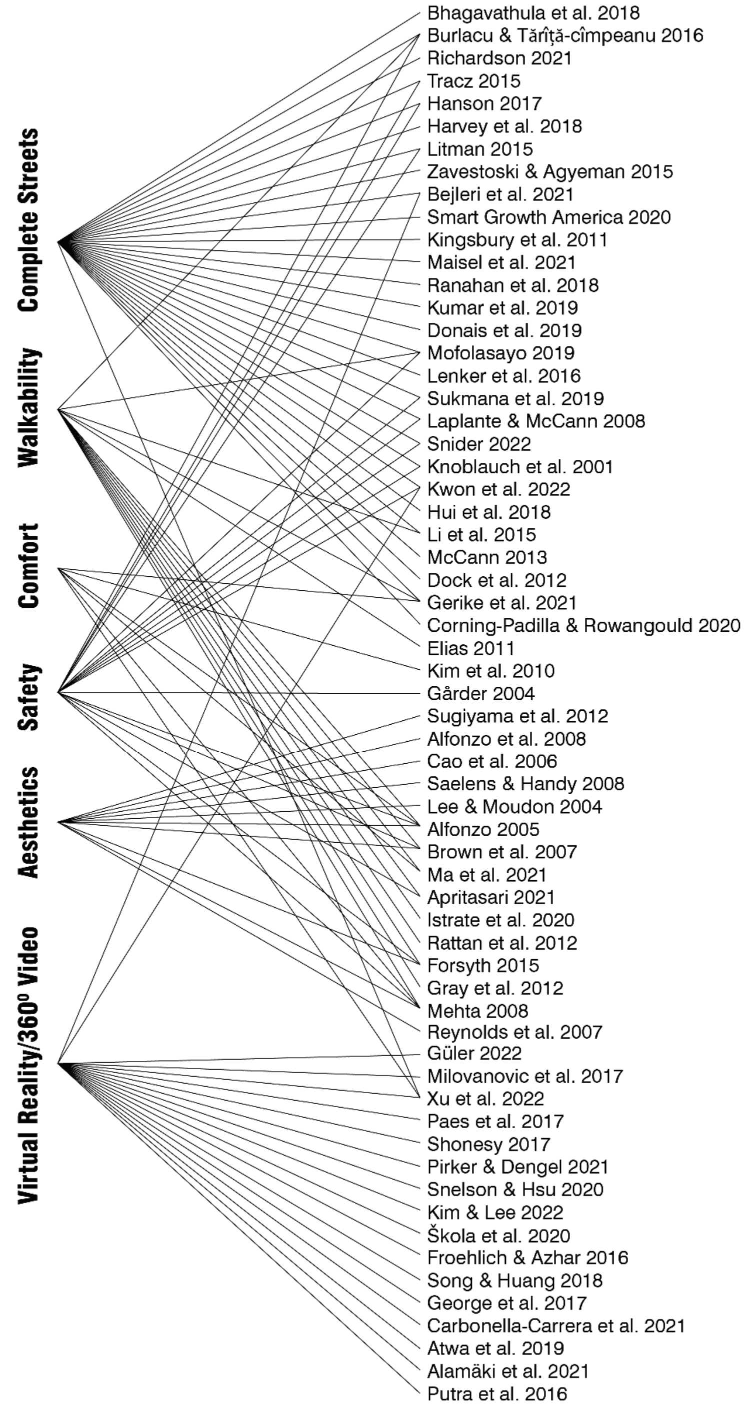


Figure 2.1: Literature Map

EXPLORATION

Chapter Three

Methods

Site Selection

This study focuses on a proposed heritage trail in eastern Kansas City, Missouri – The Historic Eight Heritage Trail (Figure 3.1). There is currently a virtual trail of 115 heritage sites identified by the African American Heritage Trail of Kansas City, but no physical trail connecting the sites as the distance between the sites was deemed too far (AAHTKC 2022). However, 60 heritage sites are within the selected study area with the potential to be connected by a three-mile trail, within a two-minute walking radius (Figure 3.1). This trail was purposed through a strategic plan created for the area. This study focuses on three segments of the trail (Figure 3.2) with different existing conditions and context to examine a variety of potential design solutions that would increase walkability through impacting people's sense of comfort, safety, and aesthetic preference.

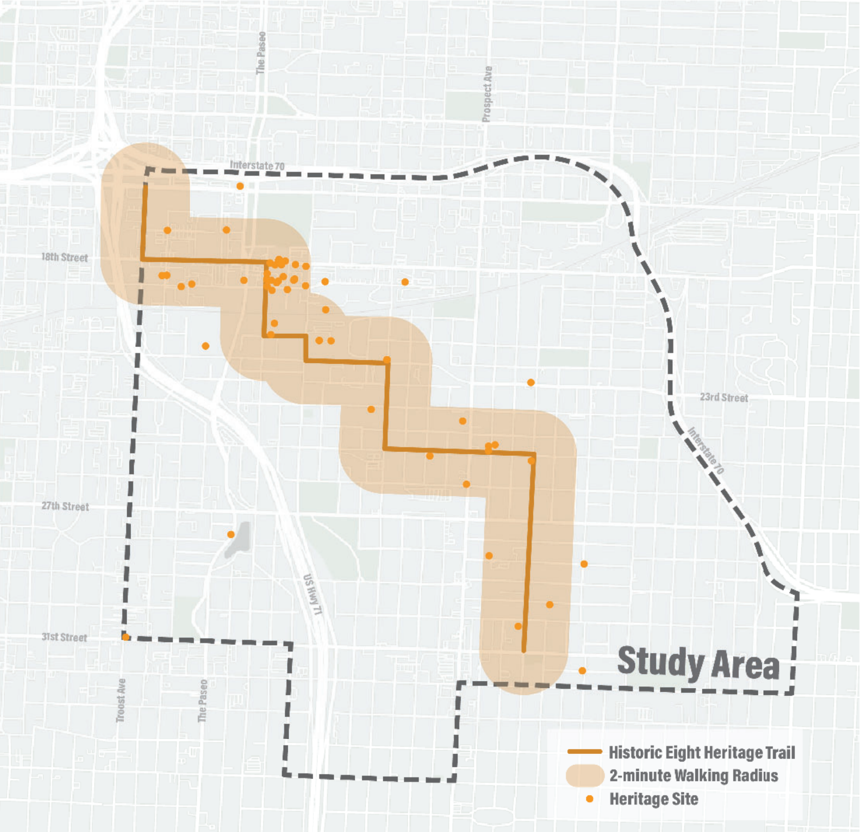


Figure 3.1: Historic Eight Heritage Trail

Each of the three focus areas are analyzed to understand their current visual quality and context. The condition of the houses and buildings are categorized into good condition – good curb appeal, no chipping paint or broken windows, maintained landscape; fair condition – fair curb appeal, some chipping paint or broken windows, unmaintained landscape; and poor condition – dilapidated, graffiti and boarded windows, overgrown landscape. The collected data of the condition of the surrounding context serves as a base to compare if the surrounding visual context impacts the feelings of walkability. The appearance of the houses and buildings were not altered for this experiment.

Figure 3.2: Focus Areas

Focus Area One: Brooklyn Avenue

The first focus area is at the north side of the trail on Brooklyn Avenue, between 22nd Street and 23rd Street (Figure 3.3). The surrounding context of this road suffers from vacancy. Along this stretch of Brooklyn Avenue, 7 parcels of the 15 lots on the block are vacant, three of them being vacant houses. The curb appeal of the surrounding houses is fairly good, with half of the houses ranking in good condition and the other half in fair condition (Figure 3.4). This section of trail was selected because of the lower quality sidewalks, but higher quality road. Brooklyn Ave is an exceptionally wide road with a width of 50ft, yet the sidewalks are 5ft wide with a 3ft setback only on one side, making up a combined 14% (13ft) of the 63ft right of way (Figure 3.5). Brooklyn Avenue is a two-lane road but has the width of a 5-lane road, leaving a lot of potential to redistribute some of the right of way towards multimodal transportation methods and giving space back to the residents. Overall, this focus area ranks as having fair surrounding context.

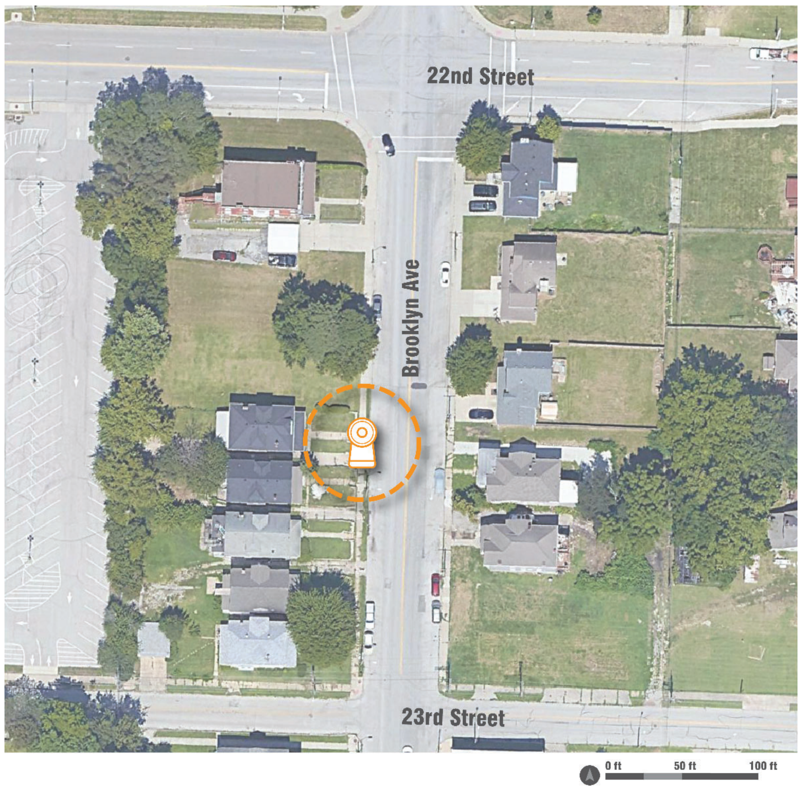


Figure 3.3: Focus Area One — Brooklyn Avenue with 360° viewpoint

Figure 3.4: Brooklyn Avenue Context Analysis

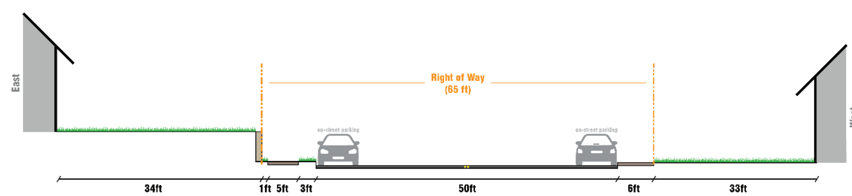


Figure 3.5: Brooklyn Avenue Section

Focus Area Two: 25th Street

The second focus area is on 25th Street between Prospect Avenue and Montgall Avenue (Figure 3.6). This section of trail was selected because of its proximity to a major arterial roadway and poor visual quality of surrounding buildings. Vacancy is high along this stretch as 4 of the 6 adjacent parcels are vacant, with one being an empty lot. The visual curb appeal of this focus area is suffering as most of the surrounding houses are in poor or fair condition (Figure 3.7). One of the vacant houses is identified as an African American Heritage Site, the home of Anna H. Jones, a former educator and principal. This area has fair quality sidewalks and a fair quality road. The road is 25 feet in width and has a 100ft stretch of a 10ft wide sidewalk with a 6ft setback along the north side of the road nearest Prospect Avenue, but the sidewalk narrows down to 5ft by the end of the block. The sidewalks and setbacks make up a combined 45% (22ft) of the 47ft right of way (Figure 3.8). Overall, this focus area ranks as having poor surrounding context.

Figure 3.6: Focus Area Two — 25th Street with 360° viewpoint

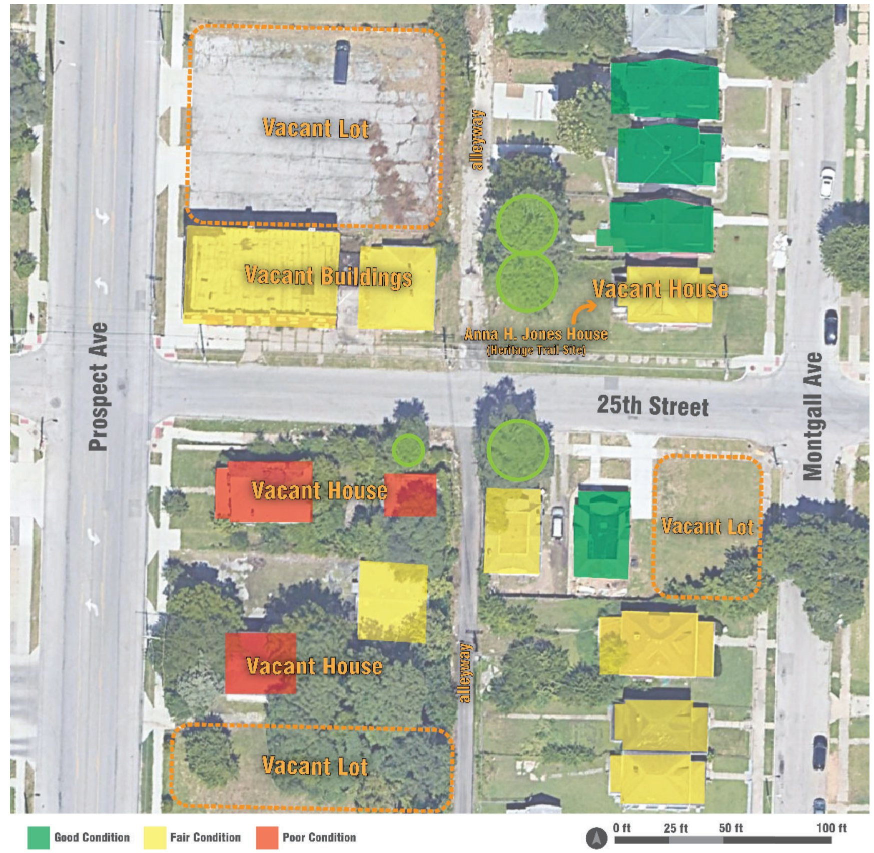


Figure 3.7: 25th Street Context Analysis

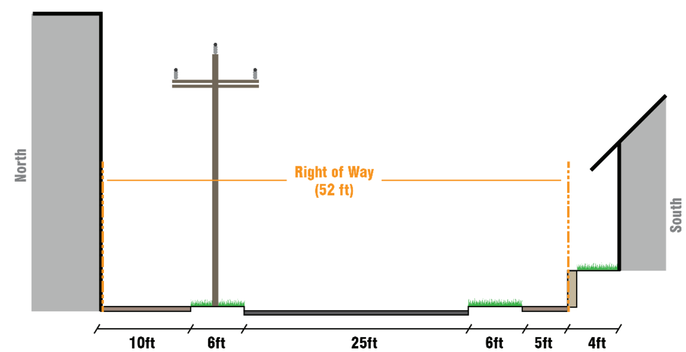


Figure 3.8: 25th Street Section

Focus Area Three: Benton Boulevard

The third focus area is at the southern side of the trail on Benton Boulevard, between 26th Street and 27th Street (Figure 3.9). There is less vacancy on the this stretch of road with 7 vacant lots of the 25 total parcels, two of which are vacant buildings. The curb appeal is higher in this area as 13 of the 18 houses are in good condition and the rest are in fair condition (Figure 3.10). This section of road differs greatly from the previous focus areas. This section has high-quality sidewalks and a high-quality road. The road is semi-wide at 40ft, but Benton Boulevard serves as a major collector, requiring a wider road size. The sidewalks are 8ft wide with a setback of 16ft on either side with a row of trees in between, establishing a combined 55% (48ft) of the 88ft right of way (Figure 3.11). Overall, this focus area has a good surrounding context.

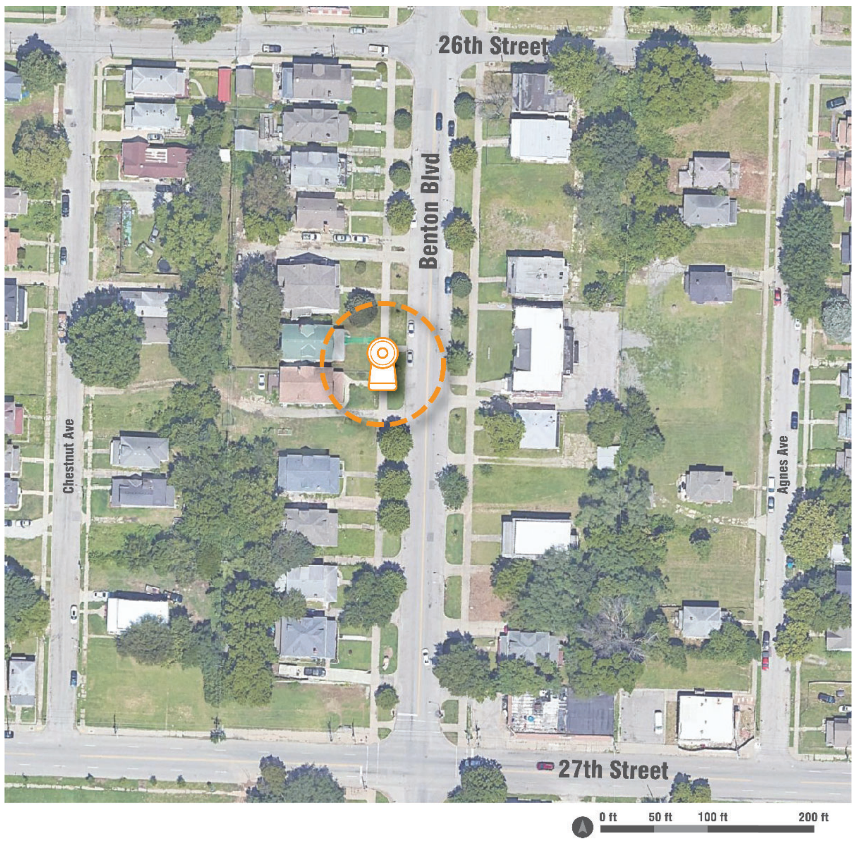


Figure 3.9: Focus Area Three — Benton Boulevard with 360° viewpoint

Figure 3.10: Benton Boulevard Context Analysis

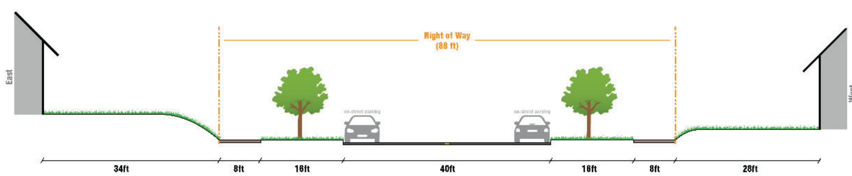


Figure 3.11: Benton Boulevard Section

Target Population

The target population for this study is the residents within the eight neighborhoods in the study area – Beacon Hills, 18th & Vine, Wendell Phillips, Washington Wheatley, Mt. Hope, Key Coalition, Santa Fe, and Ingleside (South Round Top). This population was chosen because of their desire and eagerness to implement a cultural heritage trail in their neighborhoods. The idea of this trail is important to the surrounding residents as it celebrates the identity and history of the neighborhoods and who came from them. Engaging residents who reside within the study area in the study allows the results to better reflect the preferences of the people who will be using the trail, in turn, increasing the trail's walkability.

Sample Size

A sample size of 53 participants was recruited for this study. The number is limited due to the narrow time constraints and feasibility to conduct this study. While this number may not allow the findings of this study to be generalizable, it still provides useful information that can be applied to this study area.

The sample size aimed to be representative of the study area with a diversity of ages and genders. However, due to the location of the convenience sampling and the participant's willingness, the sample population leaned more male dominated (approximately 39% females vs 56% males). The age range distribution was fairly diverse, with the majority being between 25 and 54 years old. Over 60% of the sampled population did not have any children living with them.

Figure 3.12 shows the demographic makeup of the participants.

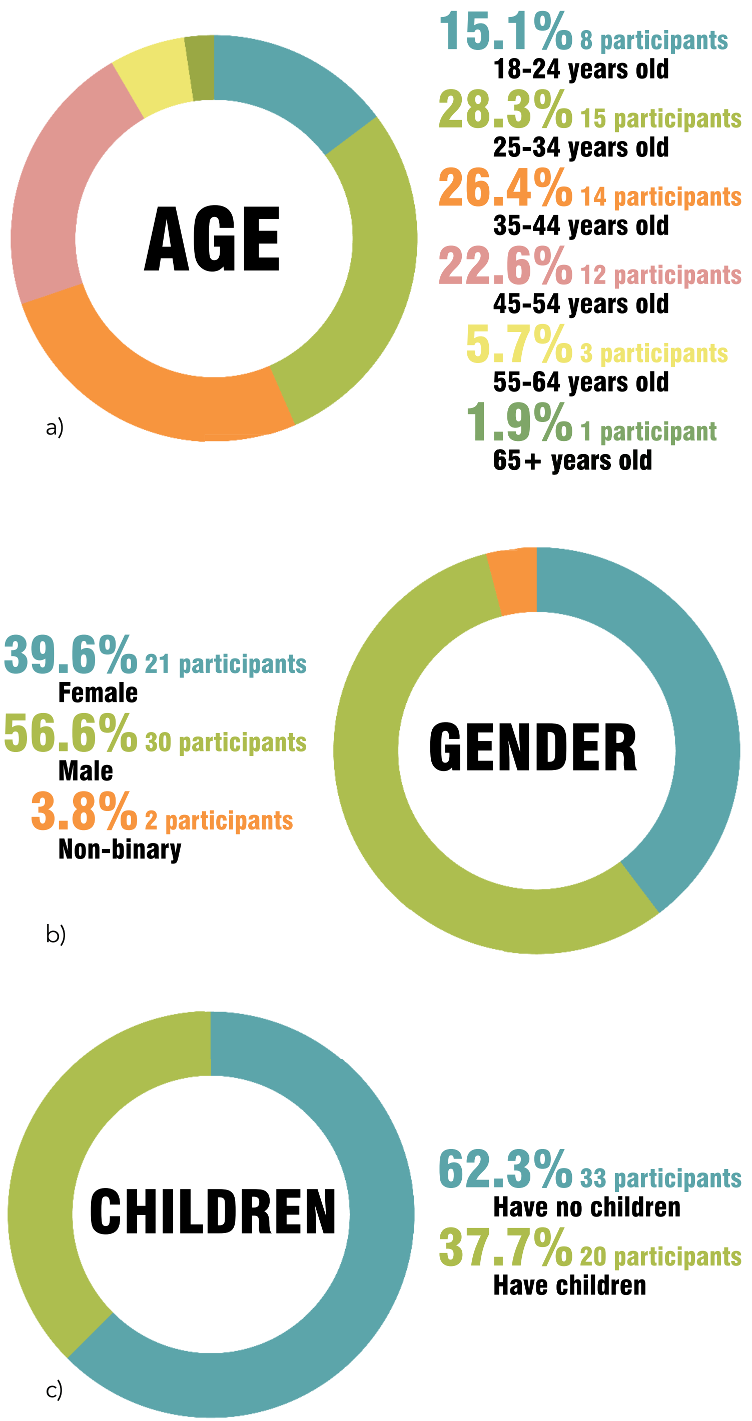


Figure 3.12: Demographic Makeup of Participants
a) Participant Age; b) Participant Gender; c) Participant Parental Status

Data Collection

This study collected social data on people's perceptions of complete street design through utilizing 360° videos with proposed design solutions. The process is explained below.

Designing the Visuals

Using a Samsung Gear 360 camera, videos of the existing conditions were taken from eye-level in three focus areas (refer to Figures 3.3, 3.6, and 3.9 for specific locations). Adobe After Effects was used to render the videos into the 360° format. A snapshot was taken from each video and used as a base to render individual interventions in Adobe Photoshop. Using Adobe Premiere Pro, the rendered intervention elements were overlayed back into the 360° video, for a total of nine videos with interventions, plus three without.

The intervention elements were inspired by the elements specifically mentioned in the Kansas City Complete Street Ordinance; increased sidewalk width, refuge islands, curb extensions, traffic calming measures, accessible curb ramps, bicycle lanes, separated bikeways, multi-use trails, bicycle parking facilities, signage, street trees, public transportation stops, and roadway re-channelization (KC CSO 2017). The selected intervention elements measured in this study are increased sidewalk width (or decreased if existing conditions are wide), plantings of trees, flowers, and shrubs, and green painted bike lanes. An additional element, signage for the Heritage Trail, is included in each intervention and remains consistent in each focus area.

Data Collection Procedure

The Kansas City Public Library Lucile H. Bluford Branch served as the location for most of the participant experiment sessions. The sessions were held at a small table in a quieter area near the back of the library. In addition to the library, sessions were also conducted at a local barbershop (on Brooklyn Avenue) and at the Habitat for Humanity of Kansas City office (on Linwood Boulevard).

Interest flyers (Appendix D) were emailed out to the neighborhood leaders, which were then sent out to the public. Flyers were also emailed to Habitat for Humanity of Kansas City to be distributed among their homeowners who live within the study area. Physical flyers were posted in public areas in the study area, including the library, community centers, and museums. Interested participants filled out a digital sign-up sheet on Sign-Up Genius to reserve a time slot. Of the 53 participants, nine participants used the sign-up sheet to schedule a time and the rest, n=44, were recruited through convenience sampling.

Data Collection Tool

Before the experiment, a consent statement was verbally read to participants, to which participants verbally replied to continue the study, or to decline (in Appendix C). After consenting, participants were briefed on how the study will work and the help they will be providing by participating in this study (in Appendix C). After the brief, participants completed a four-question questionnaire to determine their experience with VR headsets and their eligibility for the study (in Appendix C). Participants were asked if they would prefer to sit or stand during the experiment (standing, n=17; sitting, n=36). Participants then put on the Meta Quest 2 headset and were shown a series of 360° videos of three locations throughout the study area.

Twelve videos were shown to participants for 30 seconds each, totaling 6 minutes. During each video, participants were verbally asked three questions about their comfort level, their feelings of safety, and the attractiveness of the space on a five-point rating scale (See Appendix C). Some wording varied to help better explain the question when participants did not understand. Nine of the videos contained an intervention to measure the impact of a specific element, while the remaining three were unaltered to serve as the control (Table 3.1, see Appendix E for the visual elements). Participants view the videos in a selected random order determined by a random number generator, with a few manual adjustments to ensure no back-to-back viewing of the same location (Table 3.2). All the participants viewed the videos in the same randomized order.

After removing the headset, participants were asked which element(s) they felt had the greatest impact on the sense of walkability (See Appendix C). Participants then answered twelve questions about their experience with VR, familiarity with the area, and demographic information. Upon completion of the experiment, participants were given a printed debrief with contact information in case they had any follow up questions (in Appendix C). The average length of the experiment lasted around 12 minutes. Small snacks were provided to participants who completed the experiment as a token of appreciation.

Table 3.1: Matrix of Interventions

	Intervention				
	Sidewalk		Plantings		Bike Lane
Focus Area	Wide	Narrow	Trees	Flowers	
Brooklyn Ave #1	x				
Brooklyn Ave #2		o	x	x	
Brooklyn Ave #3		o			x
Brooklyn Ave #4		o			
25th Street #1		x			
25th Street #2	o			x	
25th Street #3	o				x
25th Street #4	o				
Benton Blvd #1		x	o		
Benton Blvd #2	o		x	x	
Benton Blvd #3	o		o		x
Benton Blvd #4	o		o		

x Added · o Existing · No Intervention (shaded rows: Brooklyn Ave #4, 25th Street #4, Benton Blvd #4)

Table 3.2: Matrix of Video Order

	Intervention				
	Sidewalk		Plantings		Bike Lane
Focus Area	Wide	Narrow	Trees	Flowers	
Benton Blvd #2	o		x	x	
25th Street #3	o				x
Brooklyn Ave #3		o			x
25th Street #4	o				
Benton Blvd #1		x	o		
Brooklyn Ave #4		o			
25th Street #2	o			x	
Brooklyn Ave #1	x				
Benton Blvd #4	o		o		
25th Street #1		x			
Benton Blvd #3	o		o		x
Brooklyn Ave #2		o	x	x	

x Added · o Existing · No Intervention (shaded rows: 25th Street #4, Brooklyn Ave #4, Benton Blvd #4)

DISCOVERY
Chapter Four

Data Analysis

IBM SPSS Statistics

The data collected from the experiment was entered into IBM SPSS Software, Version 29 to be analyzed. Shapiro-Wilk test of normality was conducted to determine if the data of comfort, safety, and attractiveness for each intervention is normally distributed. The results indicate that for each intervention, the data deviates from normal distribution ($p = < 0.001$). With this, the data analysis tests include descriptive means, correlations, nonparametric independent sample tests, and nonparametric related sample tests. The results of this analysis were used to inform design applications along the Historic Eight Heritage Trail, in Chapter Five.

Linear regression models were also conducted as examples of the tests to conduct if the residuals have normal distribution. Further steps were taken with the linear regression models to plot the residuals of the model to check if specific patterns were ditectable.

Refer to Appendix F for data analysis results.

Defining the Variables

There are three variables of walkability being measured: comfort, safety, and attractiveness. For the purposes of this study, comfort is defined as feeling relaxed and content in a space free from uneasiness. Safety is defined as the feeling of physical protection from harm or injury from vehicles or crime. Attractiveness is defined as the high visual quality of a space that is appealing to view. Together these three variables will be referred to as walkability measures.

What has the greatest impact on walkability measures?

Descriptive mean analysis were performed to find the highest and lowest means for comfort, safety, and attractiveness in each contextual setting with and without interventions. Nonparametric Related-Samples Friedman's Two-Way Analysis of Variance by Ranks tests were performed to find out the statistically significant differences between walkability measures before and after each intervention in each focus area. The videos with no interventions were used as the baseline to determine the influence each intervention had on the perceptions of the walkability measures.

In Focus Area One – Brooklyn Avenue, the mean values of the video with no intervention ranked the lowest for all three walkability measures (comfort: 3.42; safety: 3.28; attractiveness: 2.87). This implies that all three interventions created a positive influence on the perceptions of comfort, safety, and attractiveness. The nonparametric related sample tests confirm this implication by showing a statistical significance for a change in walkability measures for all the interventions (see Table 4.1). The highest means in this focus area all occur in the increased sidewalk width intervention (comfort: 4.11; safety: 4.04; attractiveness: 3.92). The planting intervention showed the next highest means for the focus area. While the planting intervention averaged higher means in comfort (3.92) and attractiveness (3.87), the bike lane intervention averaged a higher mean in safety (3.87) compared to the planting intervention safety mean of 3.75. One conclusion for this could be the added sense of separation from traffic a bike lane provides could increase the perceptions of safety. There could also be many other contributing factors, such as the flowers create perceptions of lack of maintenance or decreased line of sight, allowing for more hiding places, lowering the level of safety.

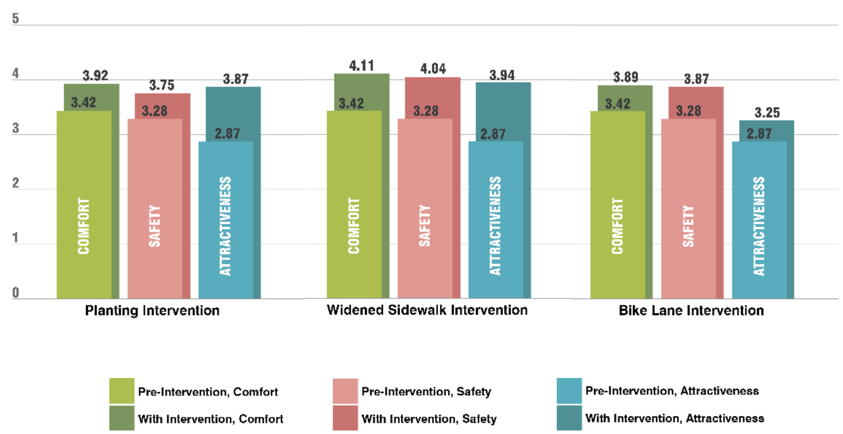


Figure 4.1: Results of Nonparametric Related Sample Tests for Brooklyn Avenue

Table 4.1: Difference of Mean Values from Nonparametric Related Sample Tests, Focus Area One – Brooklyn Avenue

Focus Area One - Brooklyn Avenue

Intervention	Comfort	Safety	Attractiveness
No Intervention	3.42	3.28	2.87
Planting Intervention	3.92	3.75	3.87
n = 53 Significance	p = < 0.001*	p = < 0.001*	p = < 0.001*

Intervention	Comfort	Safety	Attractiveness
No Intervention	3.42	3.28	2.87
Widened Sidewalk Intervention	4.11	4.04	3.94
n = 53 Significance	p = < 0.001*	p = < 0.001*	p = < 0.001*

Intervention	Comfort	Safety	Attractiveness
No Intervention	3.42	3.28	2.87
Bike Lane Intervention	3.89	3.87	3.25
n = 53 Significance	p = 0.001*	p = 0.002*	p = 0.009*

*significance level is 0.050
ns = not significant

In Focus Area Two – 25th Street, the mean values of the no interventions video are 2.92 for comfort, 2.77 for safety, and 2.04 for attractiveness. Similar to Focus Area One, these means were the lowest in the focus area. The nonparametric related sample tests showed statistical significance for changes in walkability measures for all interventions, except for the comfort and safety levels for the narrowed sidewalk intervention (see Table 4.2). The highest means for comfort (3.34) and attractiveness (2.96) occur with the planting intervention. For safety, the highest mean (3.26) appeared with the bike lane intervention, with the safety in the planting intervention (3.23) not far behind. For this focus area, since the existing sidewalk is already wide, 10ft, a narrowing sidewalk intervention was used to narrow the sidewalk to 5ft, while adding a 5ft buffer of grass between the building and sidewalk. The existing sidewalk extends to the face of a two-story building with no buffer. It is interesting to note the means for comfort, safety, and attractiveness all increased in the narrowed sidewalk intervention, but only the attractiveness proved significant. One theory is with the narrowing of the sidewalk, the green buffer that was created between the sidewalk and building could have potentially influenced the perceptions of comfort, safety, and attractiveness, but had the greatest influence on the attractiveness. Overall, the means in this focus area scored the lowest across all three focus areas. This might be related to the poor quality of the surrounding context – vacant houses in disrepair and adjacency to a busy street (Prospect Avenue).

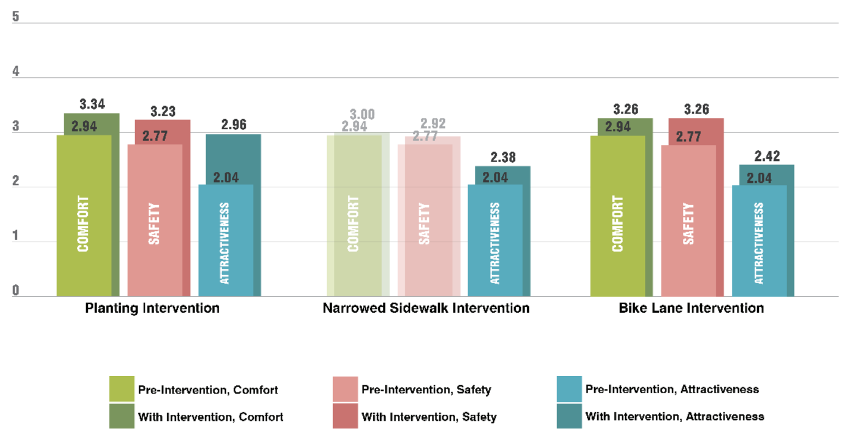


Figure 4.2: Results of Nonparametric Related Sample Tests for 25th Street

Table 4.2: Difference of Mean Values from Nonparametric Related Sample Tests, Focus Area Two – 25th Street

Focus Area Two - 25th Street

Intervention	Comfort	Safety	Attractiveness
No Intervention	2.94	2.77	2.04
Planting Intervention	3.34	3.23	2.96
n = 53 Significance	p = 0.003*	p = < 0.001*	p = < 0.001*

Intervention	Comfort	Safety	Attractiveness
No Intervention	2.94	2.77	2.04
Narrowed Sidewalk Intervention	3.00	2.92	2.38
n = 53 Significance	ns	ns	p = 0.003*

Intervention	Comfort	Safety	Attractiveness
No Intervention	2.94	2.77	2.04
Bike Lane Intervention	3.26	3.26	2.42
n = 53 Significance	p = 0.007*	p = < 0.001*	p = 0.006*

*significance level is 0.050
ns = not significant

In Focus Area Three – Benton Boulevard, the mean values for the no interventions video are 4.02 for comfort, 3.98 for safety, and 3.74 for attractiveness. Unlike the previous two focus areas, these were not the lowest mean values, except for the attractiveness mean value. The lowest mean value for comfort is 3.92 in the narrowed sidewalk intervention. Like the intervention in Focus Area Two, the sidewalks were narrowed from 8ft to 5ft in this intervention. The lowest mean value for safety is 3.96 in the bike lane intervention. The difference of these means are small and not statistically significant. According to the nonparametric related sample tests, the only significant mean differences were found in the planting intervention (see Table 4.3). The planting intervention exhibited the highest mean values for the focus area; comfort: 4.47, safety: 4.40, attractiveness: 4.30. Overall, the mean values in this focus area are the highest across all three focus areas. This might be related to the quality of the existing conditions of large setbacks from the road and the houses, and good condition sidewalks.

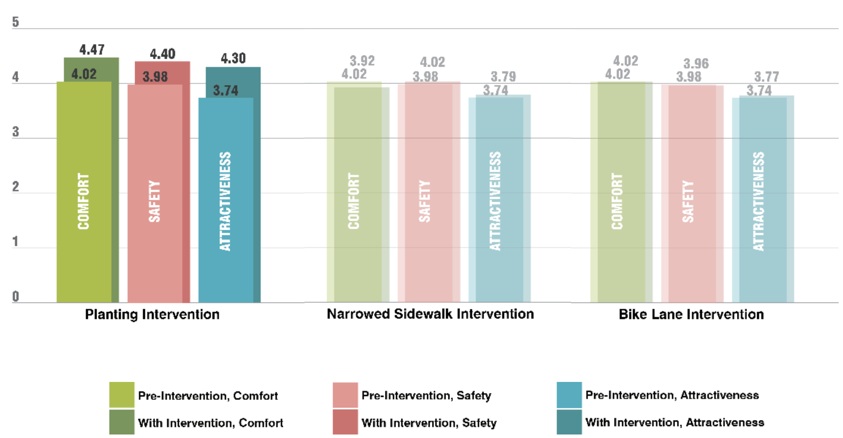


Figure 4.3: Results of Nonparametric Related Sample Tests for Benton Boulevard

Table 4.3: Difference of Mean Values from Nonparametric Related Sample Tests, Focus Area Three – Benton Boulevard

Focus Area Three - Benton Boulevard

Intervention	Comfort	Safety	Attractiveness
No Intervention	4.02	3.98	3.74
Planting Intervention	4.47	4.40	4.30
n = 53 Significance	p = 0.013*	p = 0.020*	p = 0.009*

Intervention	Comfort	Safety	Attractiveness
No Intervention	4.02	3.98	3.74
Narrowed Sidewalk Intervention	3.92	4.02	3.79
n = 53 Significance	ns	ns	ns

Intervention	Comfort	Safety	Attractiveness
No Intervention	4.02	3.98	3.74
Bike Lane Intervention	4.02	3.96	3.77
n = 53 Significance	ns	ns	ns

*significance level is 0.050
ns = not significant

Overall, the widened sidewalk intervention had the greatest influence in improving walkability, through the largest increases in comfort, safety, and attractiveness levels. The planting interventions were not too far behind by ranking high in improving comfort and attractiveness levels. The bike lane intervention showed significant improvement on walkability in the poor and fair surrounding conditions but showed little to no influence on walkability in good surrounding conditions.
The narrowed sidewalk intervention showed little influence on walkability (See Figure 4.4).

Figure 4.4: Summary of findings on the associations between design interventions and measures of walkability

Regression Models

Another method for analysis is linear regression models. This analysis is useful in predicting the extent of the relationship between the walkability measures as outcome variables, the tested interventions as independent variables or predictors, and the outside factors such as gender, age, and parental status as covariates. Linear regression models are used with the assumption of normal distribution of outcome variables as well as residuals, which is not the case in this study. However, linear regression models were still run using this data to be used as model examples for future research with normally distributed residuals. Shapiro-Wilk tests of normality were conducted on the residuals of the regression models to explore normal distribution. Scatter plots of the residuals were used to explore the relationship between the standardized predicted values and the standardized residuals. Ideally, the plots should show no discernible pattern to indicate that the results of the regression models are valid.

For these models, the data was reorganized with dummy-coded variables to increase the number of observations by 12 times from 53 to 636. The dummy variables were used to identify the presence of specific interventions in the three focus areas (coded as 0 and 1). The independent variables of the regression model are the dummy variables of three interventions (plantings, wide sidewalks, and bike lanes) and the focus area location (25th Street and Benton Boulevard), along with the demographic variables of gender, age, parental status, and neighborhood walking frequency. See Table 4.4 for the results of the model, and Figure 4.5 for the synthesized conclusions.

The regression models displayed significant increases in all three walkability measures with the presence of the planting intervention. Of the three walkability measures, the attractiveness rating showed the highest increase, followed by comfort, then safety. Wider sidewalks showed relatively similar significant increases in comfort and attractiveness, but the influence of the wider sidewalks was not as strong as with the planting interventions. The bike lane intervention did not show any significant changes in walkability measures.

Table 4.4: Linear Regression results for walkability measures tested against interventions, demographics, and fixed elements

		Comfort	Safety	Attractiveness
Plantings	Undstandardized B	0.306**	0.261*	0.547***
	Coefficients Std. Error	(0.104)	(0.109)	(0.105)
Wide Sidewalks	Undstandardized B	0.219*	0.173	0.226*
	Coefficients Std. Error	(0.098)	(0.103)	(0.100)
Bike Lanes	Undstandardized B	0.118	0.166	-0.019
	Coefficients Std. Error	(0.104)	(0.109)	(0.105)
Male	Undstandardized B	-0.117	0.038	0.127
	Coefficients Std. Error	(0.090)	(0.094)	(0.091)
Age	Undstandardized B	-0.066	-0.081*	-0.125***
	Coefficients Std. Error	(0.036)	(0.038)	(0.037)
Walking Frequency	Undstandardized B	-0.135***	0.145***	0.116***
	Coefficients Std. Error	(0.029)	(0.030)	(0.029)
Parental Status	Undstandardized B	-0.068	-0.080	-0.062
	Coefficients Std. Error	(0.096)	(0.106)	(0.098)
25th St	Undstandardized B	-0.808***	-0.775***	-1.146***
	Coefficients Std. Error	(0.113)	(0.119)	(0.115)
Benton Blvd	Undstandardized B	0.164	0.267*	0.307**
	Coefficients Std. Error	(0.113)	(0.119)	(0.115)
Overall Model	R Square	0.186	0.186	0.311
	F	15.920	15.872	31.441
	Significance	<0.001	<0.001	<0.001

*** significant at the <0.001 level
** significant at the 0.010 level
* significant at the 0.050 level

Figure 4.5: Summary of Linear Regression for Walkability Measures

The frequency of walking in the neighborhood showed significant positive association with perceived safety (β = 0.145) and attractiveness (β = 0.116), meaning the more often one walked in their neighborhood, the higher sense of safety and attractiveness was reported. Contrarily, the comfort level ratings showed significant negative association with walking frequency (β = -0.135). These results indicate that participants who frequently walk in their own neighborhood report higher levels of safety and attractiveness in the three focus areas, while at the same time, with relatively similar magnitude, report lower levels of comfort, leading to mixed conclusions on the influence walking frequency has on rating walkability. Further research should be conducted to explore this relationship.

Age showed a negative association with the walkability measures, indicating the older the participant the lower their walkability rating. While age did not show a significant association with comfort, it did show statistically significant assoiation with both perceived attractiveness (β = -0.125) and safety (β = -0.081).

As presented in Table 4.4, the regresstion results showed that gender and parental status did not have any significant association with towards the comfort, safety, or attractiveness ratings.

The focus areas were also used as independent variables to measure the influence of the varying conditions of the surrounding context. Focus Area Two – 25th Street, showed high negative associations with all the walkability measures. This result is not surprising as this focus area has poor surrounding context and scored the lowest walkability measure rankings of the three focus areas. The attractiveness ranking especially, displayed strong negative associations. Focus Area Three – Benton Boulevard, showed positive associations with the walkability measures, notably with the safety and attractiveness ratings.

Shapiro-Wilk tests of normality were conducted with the residuals of the three regression models of comfort, safety, and attractiveness, each of which concluded with non-normally distributed data. The normality tests were then conducted separately using the residuals from each focus area with each walkability measure. From this second round of tests, only residuals of the regression model for attractiveness in Focus Area Two – 25th Street showed normal distribution.

After identifying normality with the singular case, a linear regression model was conducted for that case (Table 4.5). From the model, the planting intervention displays high significant increases in attractiveness levels for Focus Area Two – 25th Street. Other significant associations include age – the older the participant, the less attractive they found the space – and walking frequency – the more often the participant walked in their neighborhood the higher they rated the attractiveness of the intersection.

These significant associations were taken into consideration when developing the design recommendations in Chapter Five.

Table 4.5: Linear Regression results for attractiveness of 25th Street tested against interventions and demographics

		Attractiveness
Plantings	Undstandardized B	0.925***
	Coefficients Std. Error	(0.205)
Wide Sidewalks	Undstandardized B	-0.340
	Coefficients Std. Error	(0.100)
Bike Lanes	Undstandardized B	0.377
	Coefficients Std. Error	(0.205)
Male	Undstandardized B	0.299
	Coefficients Std. Error	(0.155)
Age	Undstandardized B	-0.133*
	Coefficients Std. Error	(0.062)
Walking Frequency	Undstandardized B	0.163**
	Coefficients Std. Error	(0.029)
Parental Status	Undstandardized B	-0.102
	Coefficients Std. Error	(0.166)
Overall Model	R Square	0.181
	F	6.456
	Significance	<0.001

*** significant at the <0.001 level
** significant at the 0.010 level
* significant at the 0.050 level

Defining the Walkability Score

The walkability measures of comfort, safety, and attractiveness are correlated, which lead to conducting a reliability test showing the measures cluster together with high Cronbach's Alpha (Focus Area One – Brooklyn Avenue, $\alpha = 0.923$; Focus Area Two – 25th Street, $\alpha = 0.909$; Focus Area Three – Benton Boulevard, $\alpha = 0.888$).

From this, a walkability score was created for each intervention within the three focus areas. In the Walkability-Score, the walkability measure rankings were weighted based on the role of their significance in influencing participant's behavior as seen in this study with support from the literature (Alfonzo et al. 2008; Saelens & Handy 2008). Safety received a x1.5 weight, comfort received a x1.0 weight, and attractiveness received a x0.5 weight (Figure 4.6). These scores were then used to compare the means of each intervention in each focus area to observe the change in the walkability. See Tables 4.6, 4.7, and 4.8.

For Focus Area One – Brooklyn Avenue, all three interventions increased the walkability score from no intervention, with the widened sidewalk intervention having the largest increase. In Focus Area Two – 25th Street, all three interventions increased the Walkability-Score, with the planting intervention having the largest increase. For Focus Area Three – Benton Boulevard, the planting intervention was the only intervention to increase the walkability score from no intervention. The narrowing of the sidewalk and the addition of a bike lane slightly decreased the walkability score in this context.

$$\text{Walk-Score} = \frac{1.5\,\text{Safety} + 1.0\,\text{Comfort} + 0.5\,\text{Attractiveness}}{3}$$

Figure 4.6: Walkability-Score Weight Distribution Equation

Table 4.6: Walkability-Score Means for Focus Area One – Brooklyn Avenue

Focus Area One -- Brooklyn Avenue	Minimum	Maximum	Mean	Standard Deviation	Variance
No intervention	0.85	4.25	2.8277	1.02422	1.049
Planting intervention	1.20	4.25	3.2500	0.87681	0.769
Wide Sidewalk intervention	1.70	4.25	3.4557	0.72698	0.529
Bike Lane intervention	0.85	4.25	3.2836	0.79119	0.626

n=53

Table 4.7: Walkability-Score Means for Focus Area Two – 25th Street

Focus Area Two --25th Street	Minimum	Maximum	Mean	Standard Deviation	Variance
No intervention	0.85	4.25	2.4019	0.89454	0.800
Planting intervention	0.85	4.25	2.7758	0.98977	0.980
Narrow Sidewalk intervention	0.85	4.25	2.5019	1.05969	1.123
Bike Lane intervention	0.85	4.25	2.7604	1.03538	1.072

n=53

Table 4.8: Walkability-Score Means for Focus Area Three – Benton Boulevard

Focus Area Three -- Benton Boulevard	Minimum	Maximum	Mean	Standard Deviation	Variance
No intervention	1.00	5.00	3.9528	0.98405	0.968
Planting intervention	2.83	5.00	4.4057	0.56944	0.324
Narrow Sidewalk intervention	1.50	5.00	3.9497	0.88770	0.788
Bike Lane intervention	1.67	5.00	3.9497	0.86453	0.747

n=53

Can one's familiarity of an area be a predictor of walkability?

Pearson correlation was run for each focus area between the familiarity factors of proximity of residency and frequency of travel through the focus area, and the baseline comfort, safety, and attractiveness values of the focus area with no intervention.

Focus Area One, Brooklyn Avenue, showed strong negative correlations between the walkability measures and familiarity factors (Table 4.9). This suggests, if one lives close to or frequently travels through an area, they are more likely to be familiar with the space, therefore more likely ranking their levels of comfort, safety, and attractiveness lower, as they have experienced the shortcomings of the space through first-hand experience. The correlation between the familiarity factors showed strong positive correlations, implying if one lives close to an area, the more frequently they will travel through the area.

Neither Focus Area Two, 25th Street, nor Focus Area Three, Benton Boulevard, showed correlations between the walkability measures and the familiarity factors. They did, however, show positive correlations between the familiarity factors.

Table 4.9: Correlation between familiarity factors and walkability measures for Brooklyn Avenue

	How close do you live to Brooklyn Ave and 22nd St?	How often do you travel through Brooklyn Ave and 22nd St?	Comfort, No Intervention	Safety, No Intervention	Attractiveness, No Intervention
How close do you live to Brooklyn Ave and 22nd St?	1	0.578**	-0.372**	-0.323*	-2.66
		p = <0.001	p = 0.006	p = 0.018	p = 0.054
How often do you travel through Brooklyn Ave and 22nd St?		1	-0.316*	-0.364**	0.414**
			p = 0.021	p = 0.007	p = 0.002

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Does gender play a role in perceived walkability?

To explore whether female and male participants responded differently to these interventions in each setting in terms of feelings of comfort, safety, and attractiveness, a nonparametric independent sample test was used, with gender as the grouping variable. To further analyze how different genders responded to the interventions, nonparametric related sample tests were conducted for each gender to test the difference of responses with and without intervention. The sample included n=2 non-binary participants, they were excluded from these tests, as their group was too small to accurately be compared with the other two groups: female (n=21) and male (n=30).

Comfort. The only intervention that showed significant difference between male and female responses based on nonparametric independent sample tests, was the planting intervention in Focus Area Three — Benton Boulevard. It was found that females ranked their comfort levels higher (mean = 4.81, p = 0.007,) than males (mean = 4.30). Nonparametric related sample tests (Table 4.10) show that for females, the change in comfort level from no intervention (3.86) to the planting intervention (4.81) is also significant (p = 0.007), while the change for males was not statistically significant. This means, females felt significantly more comfortable than males in this space, and the plantings had a greater positive influence on females over males. However, for the other two focus areas the planting intervention showed statistical significance for increased comfort in males, but not females, suggesting that surrounding context plays a part in the difference in comfort levels between females and males.

For females, the other statistically significant changes in comfort were in Focus Area One — Brooklyn Avenue, with the increased sidewalk width and bike lane interventions, and the bike lane intervention in Focus Area Two — 25th Street. For males, all three interventions in Focus Area One — Brooklyn Avenue, and the planting intervention in Focus Area Two — 25th Street, showed significant increase in comfort from no intervention.

Table 4.10: Difference of Mean Values with from Nonparametric Related Sample Tests for Gender Differences in sense of Comfort across different conditions.

Focus Area One	Female	Male
No Intervention	3.38	3.37
Planting Intervention	3.67	4.03
n = 51		
Significance	ns	p = < 0.001*
Focus Area One	**Female**	**Male**
No Intervention	3.38	3.37
Widened Sidewalk Intervention	4.24	4.03
n = 51		
Significance	p = 0.003*	p = < 0.001*
Focus Area One	**Female**	**Male**
No Intervention	3.38	3.37
Bike Lane Intervention	4.05	3.77
n = 51		
Significance	p = 0.011*	p = 0.013*

*significance level is 0.050
ns = not significant

Table 4.10 (continued): Difference of Mean Values from Nonparametric Related Sample Tests for Gender Differences in sense of Comfort across different conditions.

Focus Area Two	Female	Male
No Intervention	3.00	2.83
Planting Intervention	3.38	3.27
n = 51		
Significance	ns	p = 0.002*

Focus Area Two	Female	Male
No Intervention	3.00	2.83
Narrowed Sidewalk Intervention	2.81	3.03
n = 51		
Significance	ns	ns

Focus Area Two	Female	Male
No Intervention	3.00	2.83
Bike Lane Intervention	3.38	3.10
n = 51		
Significance	p = 0.035*	ns

*significance level is 0.050
ns = not significant

Table 4.10 (continued): Difference of Mean Values from Nonparametric Related Sample Tests for Gender Differences in sense of Comfort across different conditions.

Focus Area Three	Female	Male
No Intervention	3.86	4.10
Planting Intervention	4.81	4.30
n = 51		
Significance	p = 0.001*	ns

Focus Area Three	Female	Male
No Intervention	3.86	4.10
Narrowed Sidewalk Intervention	3.90	3.97
n = 51		
Significance	ns	ns

Focus Area Three	Female	Male
No Intervention	3.86	4.10
Bike Lane Intervention	3.81	4.13
n = 51		
Significance	ns	ns

*significance level is 0.050
ns = not significant

Safety. None of the samples showed a statistically significant difference between male and female safety level means. Nonparametric independent sample tests showed that the planting intervention in Focus Area Two — 25th Street, was marginally significant (p = 0.061) with males ranking higher safety means (3.43) than females (2.76). It is interesting to note, while not statistically significant, females ranked their comfort level (mean = 3.38) of the 25th Street planting intervention higher than males (mean = 3.27), but as mentioned in the last paragraph, the change in comfort level for the males was significant, while not for females. This confirms that feelings of comfort and safety are not synonymous and should be considered as separate factors that may be highly correlated.

While comparing the means between the genders did not result in significant differences, comparing within the genders is a different story, using the nonparametric related sample tests (Table 4.11). For males, all three interventions in Focus Area One — Brooklyn Avenue, and the planting intervention and bike lane intervention in Focus Area Two — 25th Street, showed significant increase in safety levels. For females only the widened sidewalk intervention in Focus Area One — Brooklyn Avenue, and the bike lane intervention in Focus Areas Two — 25th Street, showed significant increases in safety levels. This suggests the widened sidewalk intervention in Focus Area One — Brooklyn Avenue, and the bike lane intervention in Focus Area Two — 25th Street, showed the greatest influence of safety levels regardless of gender. This also suggests that the proposed interventions have a greater influence on increasing male safety over female safety.

Table 4.11: Difference of Mean Values from Nonparametric Related Sample Tests for Gender Differences in sense of Safety across different conditions

Focus Area One	Female	Male
No Intervention	3.19	3.27
Planting Intervention	3.48	3.87
n = 51		
Significance	ns	p = < 0.001*

Focus Area One	Female	Male
No Intervention	3.19	3.27
Widened Sidewalk Intervention	4.19	3.90
n = 51		
Significance	p = 0.002*	p = < 0.001*

Focus Area One	Female	Male
No Intervention	3.19	3.27
Bike Lane Intervention	3.86	3.87
n = 51		
Significance	ns	p = 0.012*

*significance level is 0.050
ns = not significant

Table 4.11 (continued): Difference of Mean Values from Nonparametric Related Sample Tests for Gender Differences in sense of Safety across different conditions

Focus Area Two	Female	Male
No Intervention	2.43	2.97
Planting Intervention	2.76	3.43
n = 51		
Significance	ns	p = 0.005*

Focus Area Two	Female	Male
No Intervention	2.43	2.97
Narrowed Sidewalk Intervention	2.57	3.03
n = 51		
Significance	ns	ns

Focus Area Two	Female	Male
No Intervention	2.43	2.97
Bike Lane Intervention	3.05	3.33
n = 51		
Significance	p = 0.007*	p = 0.020*

*significance level is 0.050
ns = not significant

Table 4.11 (continued): Difference of Mean Values from Nonparametric Related Sample Tests for Gender Differences in sense of Safety across different conditions

Focus Area Three	Female	Male
No Intervention	3.90	3.97
Planting Intervention	4.52	4.33
n = 51		
Significance	ns	ns

Focus Area Three	Female	Male
No Intervention	3.90	3.97
Narrowed Sidewalk Intervention	3.81	4.10
n = 51		
Significance	ns	ns

Focus Area Three	Female	Male
No Intervention	3.90	3.97
Bike Lane Intervention	3.95	3.90
n = 51		
Significance	ns	ns

*significance level is 0.050
ns = not significant

Attractiveness. Nonparametric independent sample tests showed statistically significant differences between male and female responses in Focus Area Two — 25th Street, with no intervention. It was found that males ranked the attractiveness of the area (mean = 2.30, p = 0.040) higher than females (mean = 1.67). This non-intervened case had the lowest ranking means of all the interventions within their respective gender groups. This finding was not surprising, as this focus area has the poorest quality existing context. With these low starting rankings, all the interventions in focus area proved to statistically increase the level of attractiveness for females, but only the planting intervention significantly increased for males.

All the planting interventions showed a significant increase in attractiveness levels for both males and females, except for in Focus Area Three — Benton Boulevard for males. Nonparametric related sample tests (Table 4.12) showed the widened sidewalk intervention in Focus Area One — Brooklyn Avenue also increased in attractiveness levels regardless of gender. In Focus Area Two – 25th Street, females showed a statistically significant increase in attractiveness levels for the narrowed sidewalk intervention. For bike lanes, the males presented statistically significant increases in attractiveness in Focus Area One — Brooklyn Avenue, while females presented statistically significant increases in Focus Area Two — 25th Street.

Table 4.12: Difference of Mean Values from Nonparametric Related Sample Tests for Gender Differences in sense of Attractiveness across different conditions

Focus Area One	Female	Male
No Intervention	2.81	2.87
Planting Intervention	3.62	4.00
n = 51		
Significance	p = 0.004*	p = < 0.001*

Focus Area One	Female	Male
No Intervention	2.81	2.87
Widened Sidewalk Intervention	4.14	3.87
n = 51		
Significance	p = 0.002*	p = < 0.001*

Focus Area One	Female	Male
No Intervention	2.81	2.87
Bike Lane Intervention	3.19	3.3
n = 51		
Significance	ns	p = 0.005*

*significance level is 0.050
ns = not significant

Table 4.12 (continued): Difference of Mean Values from Nonparametric Related Sample Tests for Gender Differences in sense of Attractiveness across different conditions

Focus Area Two	Female	Male
No Intervention	1.67	2.30
Planting Intervention	3.00	2.97
n = 51		
Significance	p = < 0.001*	p = 0.002*

Focus Area Two	Female	Male
No Intervention	1.67	2.30
Narrowed Sidewalk Intervention	2.1	2.57
n = 51		
Significance	p = 0.020*	ns

Focus Area Two	Female	Male
No Intervention	1.67	2.30
Bike Lane Intervention	2.29	2.57
n = 51		
Significance	p = 0.011*	ns

*significance level is 0.050
ns = not significant

Table 4.12 (continued): Difference of Mean Values from Nonparametric Related Sample Tests for Gender Differences in sense of Attractiveness across different conditions

Focus Area Three	Female	Male
No Intervention	3.43	3.93
Planting Intervention	4.48	4.23
n = 51		
Significance	p = 0.020*	ns

Focus Area Three	Female	Male
No Intervention	3.43	3.93
Narrowed Sidewalk Intervention	3.86	3.70
n = 51		
Significance	ns	ns

Focus Area Three	Female	Male
No Intervention	3.43	3.93
Bike Lane Intervention	3.67	3.83
n = 51		
Significance	ns	ns

*significance level is 0.050
ns = not significant

Overall, there were few differences found between the perceptions of walkability between male and female. However, there are differences in how male and females perceive the walkability measures of specific interventions. The planting intervention increased comfort and safety for males more often than for females. Bike lanes increased comfort and safety levels for females in poor surrounding contexts. Refer to Figure 4.7.

Figure 4.7: Associations between interventions and walkability measures across gender types

What does the neighborhood want?

After viewing all the videos, participants were asked an open-ended question about what they felt had the greatest impact on their walkability. Of the 48 participants who answered, 25 mentioned wide, high-quality sidewalks as having the greatest impact on their feelings towards walkability, and 18 mentioned the plantings (Figure 4.8). Of those responses, 12 indicated both sidewalks and plantings as having the greatest impact on walkability. These indications correspond to quantified data collected, as the widened sidewalk interventions and planting interventions scored the highest mean rankings. Other notable answers were the quality of the surrounding houses and the cleanliness and litter-free surroundings which are mostly related to visual quality and attractiveness of the environment.

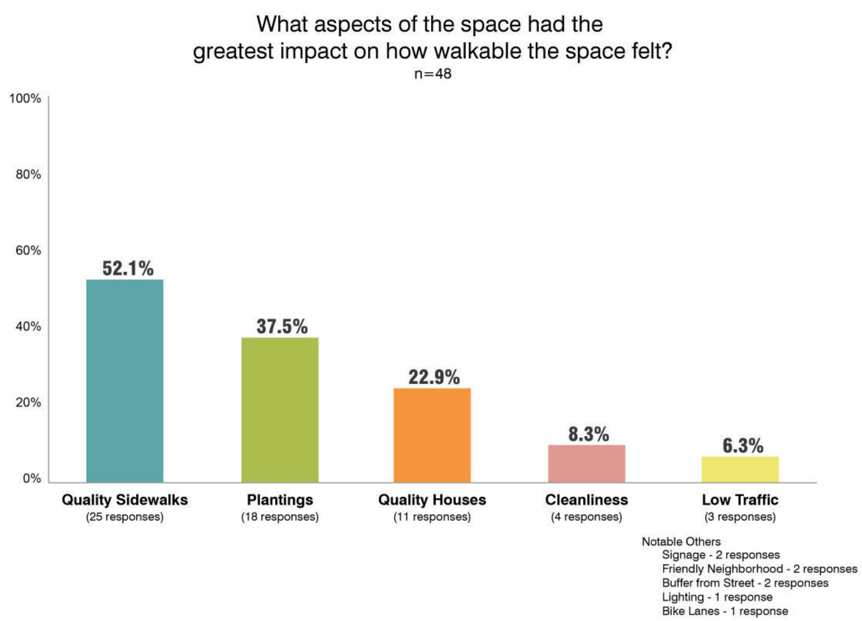


Figure 4.8: Perceived aspects of the space with the greatest impact on sense of walkability

Summary

After conducting the analyses and reviewing the results, the intervention that appears to have the greatest influence on walkability is the widening of the sidewalk. It was the only intervention that had statistically significant positive influence on all three walkability measures for both males and females. Wide sidewalks were also mentioned in more than half of the responses to the open-ended question about what aspect had the greatest influence on walkability. The planting interventions also had a great influence on walkability, specifically increasing comfort and attractiveness.

Surrounding context is important to note when measuring walkability. In poor surrounding context (Focus Area Two – 25th Street), it will take more than plantings, sidewalk repair and/or widening, and bike lanes to create comfortable, safe, and attractive spaces. While those interventions do help, people will still feel uncomfortable and unsafe if the surroundings look abandoned and in disrepair. In fair surrounding context (Focus Area One – Brooklyn Avenue), the interventions of planting, widened sidewalks, and bike lanes will have a greater influence on walkability. When the surrounding buildings are in nicer conditions, people are able to focus more on the changes of the sidewalk and street, as they are not as concerned for their safety. In good surrounding context (Focus Area Three – Benton Boulevard), the interventions do not have as large of influence on walkability, as the existing conditions are already highly ranked as walkable. Less work is needed in areas with good existing surrounding contexts to make the area have high perceived walkability, but an upkeep of maintenance is needed to ensure the area does not fall into disrepair.

DESIGN APPLICATION

Chapter Five

Design Implications

The findings presented in Chapter Four, were applied to create recommendations for the complete street design elements that should be implemented along the Historic Eight Heritage Trail to promote a walkable trail. The goal of the recommendations is to provide evidence-based design ideas to the City of Kansas City to use as rationale for implementation of the Historic Eight Heritage Trail, to enhance users' perceptions of comfort and safety, while also having an attractive trail. The findings can also be used as a base line that can be applied to similar urban streetside trail projects.

The three-mile Historic Eight Heritage Trail can be broken down into three segments that have similar context to the three focus areas defined in this study. A set of criteria was made to help find the similarity of each segment to each focus area (Figure 5.1), which was determined from the existing conditions present in each focus area. The curb appeal criterion used the same determining factors as explained in chapter three. To be considered as similar to a focus area, the segment conditions must match at least three of the four criteria. Google Street View was used to travel the length of the trail and assess the existing conditions. The street view images were taken in April 2022 and September 2022. Once the entire trail was categorized, it was found 0.67 miles were in poor surrounding context, similar to Focus Area Two – 25th Street, 1.20 miles were in fair surrounding context, similar to Focus Area One – Brooklyn Avenue, and 1.13 miles were in good surrounding context, similar to Focus Area Three – Benton Boulevard.

Figure 5.1: Historic Eight Heritage Trail Similarity Breakdown

Poor Surrounding Context

These segments make up less than a third of the trail length, however, these conditions are found throughout the majority of the study area. This context is defined by the poor curb appeal from surrounding houses, usually vacant, and poor-quality sidewalks (Figure 5.2). In this study, the visual shown to participants is with an existing wide sidewalk, which is not typical for the context, the recommendations take this into account and use knowledge from the literature and examples from the fair context intervention of a wider sidewalk to make informed recommendations for the typical poor surrounding context with a narrow sidewalk.

Poor Surrounding Context (Focus Area Two)
☐ Poor Quality Sidewalks
☐ Poor Surrounding Curb Appeal
☐ Narrow Road
☐ No to Little Setback from Road

Figure 5.2: Criteria for Poor Surrounding Context

Figure 5.3: Historic Eight Heritage Trail Segments in Poor Surrounding Context

chapter five

Translational Design Recommendations

Collectively, this context had the lowest scores of comfort, safety, and attractiveness. It was found that plantings and bike lanes can significantly increase feelings of comfort, safety, and attractiveness. Plantings were found to significantly increase male comfort and safety while in poor surrounding context. The comfort and safety levels for females with the planting intervention also increased, but not a significant amount. Bike lanes significantly increased levels of comfort, safety, and attractiveness for the female demographic, while for males, bike lanes only significantly increased their level of safety (Figure 5.4).

To help increase the walkability of this context, it is recommended that flowered plantings are installed as a buffer between the sidewalk and the road. This will add a layer of perceived protection from vehicles while also increasing the attractiveness of the space. For an additional layer of protection, bike lanes can be installed along the road. The bike lane will help decrease traffic speeds, as the driving lanes will be slightly narrowed, forcing drivers to be more alert (Nanayakkara et al. 2022). It is also recommended to repair and widen the sidewalks to at least 6ft, to allow pedestrians to pass one another comfortably (Gerike et al. 2021). If there is no buffer between a building (with no entrances) and the sidewalk, adding slight buffer of grass or plantings can help increase walkability and the attractiveness of the space.

These elements can also be implemented in phases (Figure 5.5) if cost of installation is a limiting factor. Figure 5.7 illustrates the potential of implementing all three interventions (wider sidewalks, flowered planting, and painted bike lanes) compared to the current conditions (Figure 5.6).

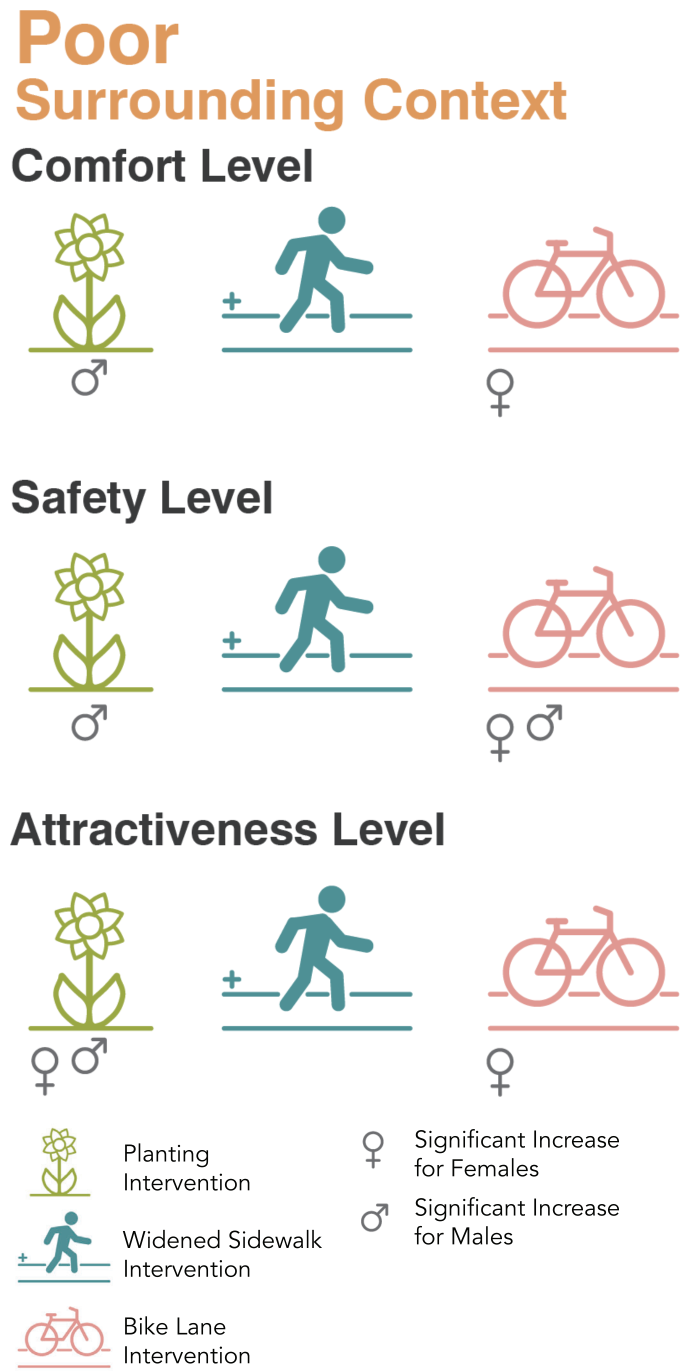


Figure 5.4: Translational Design Diagram for Poor Surrounding Context

Recommendation:
Widen Sidewalks

- At least 6ft wide
- At least 3 ft buffer from the road
- At least 2 ft buffer from buildings
- Free of obstacles

Recommendation:
Widen Sidewalks & Painted Bike Lane

- At least 6ft wide
- At least 3 ft buffer from the road
- Free of obstacles
- One-way bike lane at least 6 ft wide
- Small buffer between bike and drive lane

Recommendation:
Widen Sidewalks & Flowered Plantings

- At least 6ft wide
- At least 3 ft buffer from the road
- Free of obstacles
- Low vegetation to keep visibility from the road
- Native flowers reduce maintenance costs

Figure 5.5: Phased recommendations. a) widen sidewalks b) widen sidewalks & bike lanes c) widen sidewalk & flowers

Figure 5.6: Existing Condition of Poor Surrounding Context Historic Eight Heritage Trail Segments

Figure 5.7: Proposed Design Recommendations for Poor Surrounding Context Historic Eight Heritage Trail Segments

Fair Surrounding Context

The majority of the heritage trail has fair surrounding context. These segments were identified by the wide roads, average sidewalk conditions, and decent curb appeal (Figure 5.8). Along the trail, the sidewalk conditions in the fair surrounding context ranges from extremely poor (cracks, overgrown, narrow) to good (no cracks, clean edges, minor setback from road). In this study, the visual shown to participants show extremely poor sidewalk conditions. The recommendations are informed based on poor-quality sidewalks but should be applied to all sidewalk conditions in the fair surrounding context. Some areas will require more work than others.

Fair Surrounding Context (Focus Area One)
☐ Narrow Sidewalks
☐ Decent Surrounding Curb Appeal
☐ Wide Road
☐ No to Little Setback from Road

Figure 5.8: Criteria for Fair Surrounding Context

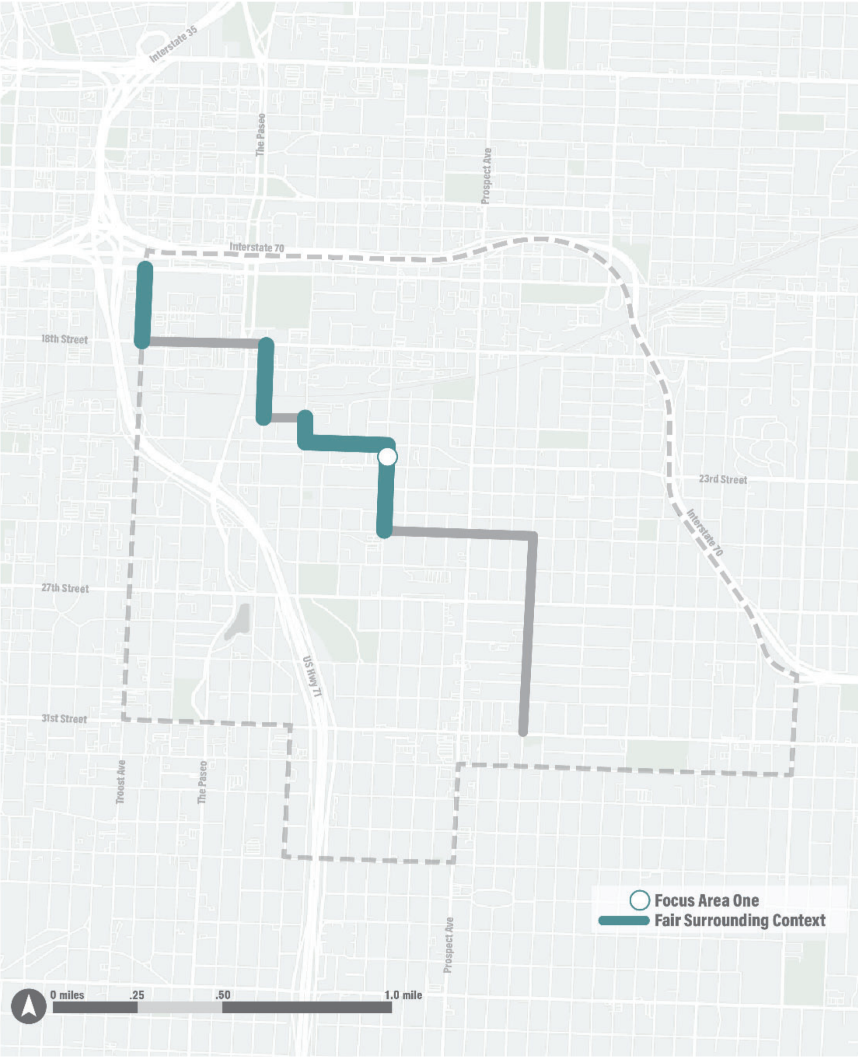


Figure 5.9: Historic Eight Heritage Trail Segments in Fair Surrounding Context

Translational Design Recommendations

The results of the experiment showed that all the interventions in this context had positive influence on the comfort, safety, and attractiveness perceptions of the participants. For males, each intervention significantly increased their feelings of comfort and safety, and their rating of attractiveness for the space. For females, the widened sidewalk and bike lane interventions significantly increased their perception of safety and comfort, but the planting intervention did not (Figure 5.10).

To increase the walkability of this context it is recommended to increase the sidewalk width to at least 6 feet. With increasing the width of the sidewalk it is also important to keep a buffer between the road and the sidewalk. Planting the buffer with flowers can help increase the comfort and safety levels of the space, but this intervention is not as significant with females. Like in the poor surrounding contexts, bike lanes can be added to create an additional layer of comfort and safety from vehicles.

Similarly to the poor surrounding context, implementing these elements in phases (Figure 5.11) can reduce large upfront cost of implementing all the elements at once, while also still having a positive influence on the walkability of the space. Figure 5.13 illustrates the potential of implementing all three interventions (wider sidewalks, flowered planting, and painted bike lanes) compared to the current conditions (Figure 5.12).

Figure 5.10: Translational Design Diagram for Fair Surrounding Context

Recommendation:

Widen Sidewalks

- At least 6ft wide
- At least 3 ft buffer from the road
- Free of obstacles

Recommendation:

Widen Sidewalks & Painted Bike Lane

- At least 6ft wide
- At least 3 ft buffer from the road
- Free of obstacles
- One-way bike lane at least 6 ft wide
- Small buffer between bike and drive lane

Recommendation:

Widen Sidewalks & Flowered Plantings

- At least 6ft wide
- At least 3 ft buffer from the road
- Free of obstacles
- Low vegetation to keep visibility from the road
- Native flowers reduce maintenance costs

Figure 5.11: Phased recommendations. a) widen sidewalks b) widen sidewalks & bike lanes c) widen sidewalk & flowers

Figure 5.12: Existing Condition of Fair Surrounding Context Historic Eight Heritage Trail Segments

Figure 5.13: Proposed Design Recommendations for Fair Surrounding Context Historic Eight Heritage Trail Segments

Good Surrounding Context

The condition of these segments are defined by their high quality of sidewalk conditions, with a buffer from the street, and high visual quality of the surrounding buildings (Figure 5.14). With the good existing conditions of these segments there is little intervention needed to improve the walkability.

Good Surrounding Context (Focus Area Three)
☐ Wide Sidewalks
☐ Good Surrounding Curb Appeal
☐ Average Road
☐ Setback from Road

Figure 5.14: Criteria for Good Surrounding Context

Figure 5.15: Historic Eight Heritage Trail Segments in Good Surrounding Context

Translational Design Recommendations

For this context, plantings can be used to help increase the walkability of the area. Females found plantings in this context to significantly increase their comfort levels. Bike lanes could be implemented, especially to create a well-connected bike lane along the historic trail, but they will not produce a positive influence on the walkability of the context. That is not to conclude that bike lanes should not be implemented for the safety and comfort of cyclists, but their implementation will have little impact on pedestrians walking in the space based on the participants' responses in this study. Maintaining at least 6ft to 8ft wide sidewalks will keep the feelings of comfort, safety, and attractiveness high, as there were slight negative changes to walkability when the sidewalk was narrowed (Figure 5.16).

Figure 5.18 depicts the image of what the sidewalk in this context would look like if flowered plantings were implemented, from the current condition (Figure 5.17).

Good
Surrounding Context

*faded signifies insignificant results

Figure 5.16: Translational Design Diagram for Good Surrounding Context

Recommendation:

Flowered Plantings

- Low vegetation to keep visibility from the road
- Native flowers reduce maintenance costs
- Sun/Shade plants should be placed under trees
- Mulch can be added for a more refined aesthetic, but will require extra maintenance

Figure 5.17: Existing Condition of Good Surrounding Context Historic Eight Heritage Trail Segments

Figure 5.18: Proposed Design Recommendations for Good Surrounding Context Historic Eight Heritage Trail Segments

CONCLUSION

Chapter Six

Conclusion

Overview. This study's objective was to gain a better understanding of how walkability can be improved by using people's perceptions towards comfort levels when walking, perceived safety, and aesthetic preferences along urban streetside interpretive trails. The use of 360° video VR allowed participants to experience three focus areas along a proposed heritage trail in Kansas City, Missouri. Participants used a head-mounted display to view each focus area in its existing condition and with three interventions of complete street elements and responded to questions about walkability. The results of this study found that increased sidewalk width and plantings had the greatest influence on how walkable a space felt.

Limitations. There were a few limitations that arose throughout this study. First was the visual sharpness, or lack thereof, in the 360° videos. The camera used to capture the 360° videos was about five years old, making the camera semi-outdated as technology has advanced rapidly over the last five years. The quality of the 360° video was a bit grainy, but participants were still able to be visually transported to the focus area. However, a better camera may have produced a higher quality video, increasing the photorealistic ability of the experiment.

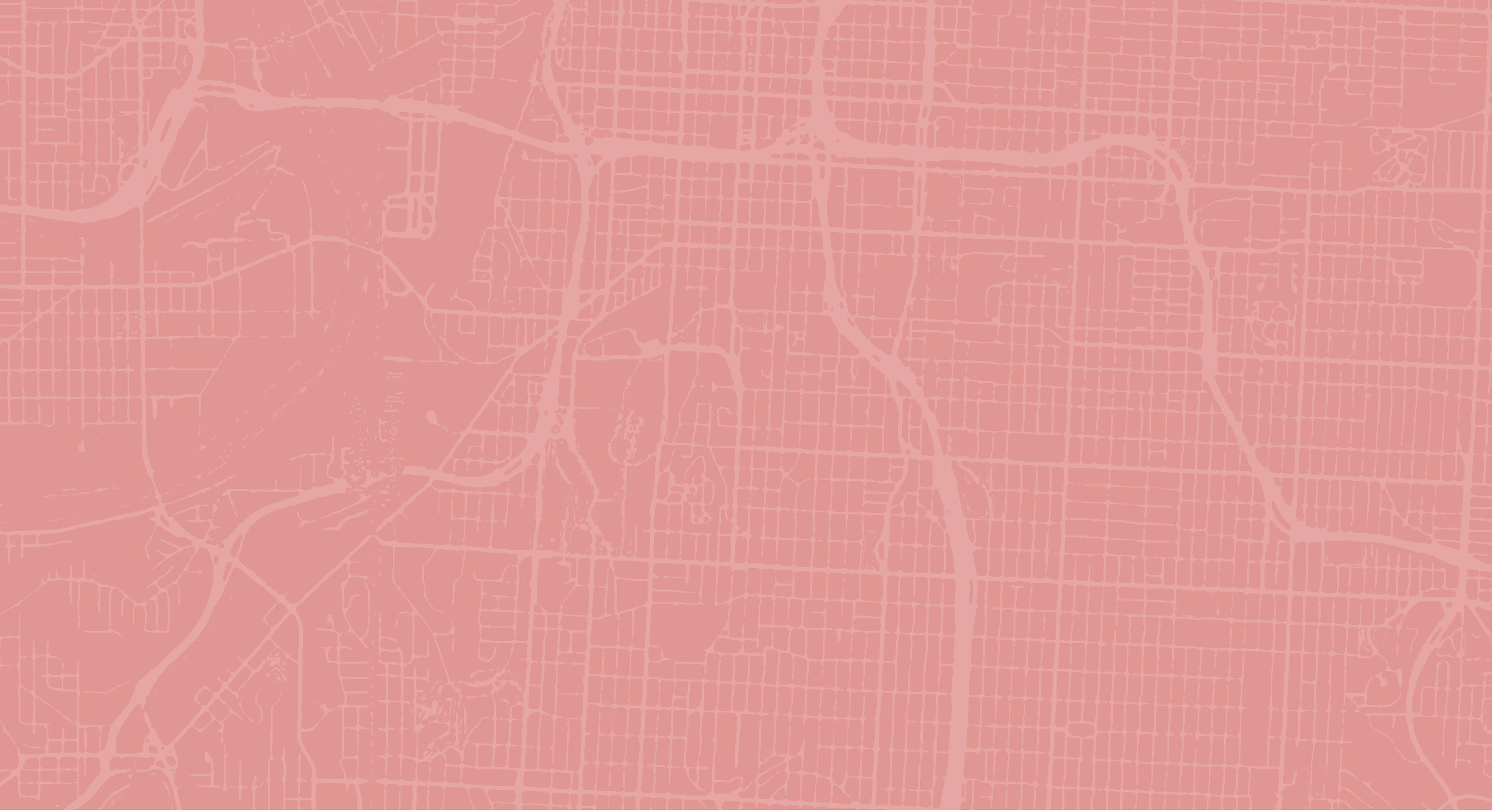
Another limitation of this study is the limited control of movement in the 360° videos. Participants were only able to move their head to view their surroundings but were unable to walk to move in the video. The decision to not have participants be able to move in the video was made to limit the likelihood of motion sickness – another limitation to this study – and to provide all participants the same experience, as sometimes movement in VR is difficult to navigate. Further, using 360° videos limits the manipulation of weather, lighting, and seasonality, as the participants are only able to view the segment of trail during the time the video was taken – mid-morning on a Sunday in mid-October. This limited the extent of what elements could be measured in this study, as elements like pedestrian lighting would not be measurable during daylight hours.

An additional limitation is related to the timeframe of the project. Given the limited time available for completing the project, the sample size was small (n=53) which reduced the generalizability of the results. Most of the participants were acquired through convenience sampling in public places, which potentially bias the results, as it does not represent a true depiction of the study area population. Another factor that could have biased the results of the study was the order in which the videos were viewed. Every participant viewed the twelve videos in the same order (Table 3.2). Although the video order was randomized initially, not randomizing across participants could have introduced bias, as the participants may be more fatigued towards the end of the experiment or understand the experiment differently after viewing more videos, thus biasing the results of the later shown videos. Creating a few different sets of randomized video orders and systematically revolving them through the participants will help to avoid this bias in the future.

Contribution. Despite the limitations, this study contributes to the existing literature through discovering how sidewalks, flowers, and bike lanes can influence comfort level, safety perceptions, and perceived aesthetic quality along urban streetside trails. Urban streetside interpretive trails are not yet well studied or utilized broadly in cities, but the hopes of this study are to build a base of how urban streetside interpretive trails could be designed to promote walkability. Specifically, this research will hopefully serve as the beginnings of community outreach and engagement with the neighborhoods to one day construct this trail.

Further, the methods applied in this study can serve as a reference for other landscape architects who aim to explore people's responses to their design solutions using 360° video renderings. With the rapid advancements in technology, it is important to adapt traditional ways of people-oriented design into modern practice to expand the reach and relevancy of design.

Future Research. As the sample size for this study was small, additional research will need to be conducted to confirm the results. This research can serve as the groundwork for measuring comfort, safety, and attractiveness levels for pedestrian-oriented complete street elements. Further research could expand on measuring the influence different combinations of intervention elements have on the walkability measures. Additionally, expanding the number of focus areas with a variety of existing conditions as well as using multiple randomized order of cases will create a more holistic representation of the study area with reduced bias, which would ultimately lead to more reliable findings.



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Figures

Figure 5.9: Gillespie, C. (2023). Historic Eight Heritage Trail Segments in Fair Surrounding Context. [diagram]. Base map from ArcGIS Earth.

Figure 5.10: Gillespie, C. (2023). Translational Design Diagram for Fair Surrounding Context. [diagram].

Figure 5.11: Gillespie, C. (2023). Phased Recommendations. a) widened sidewalks; b) widened sidewalks & bike lanes; c) widened sidewalks & flowers. [Photo Rendering].

Figure 5.12: Gillespie, C. (2023). Existing Condition of Fair Surrounding Context Historic Eight Heritage Trail Segments. [Photograph].

Figure 5.13: Gillespie, C. (2023). Proposed Design Recommendations of Fair Surrounding Context Historic Eight Heritage Trail Segments. [Photo Rendering].

Figure 5.14: Gillespie, C. (2023). Criteria for Good Surrounding Context. [diagram].

Figure 5.15: Gillespie, C. (2023). Historic Eight Heritage Trail Segments in Good Surrounding Context. [diagram]. Base map from ArcGIS Earth.

Figure 5.16: Gillespie, C. (2023). Translational Design Diagram for Good Surrounding Context. [diagram].

Figure 5.17: Gillespie, C. (2023). Existing Condition of Fair Surrounding Context Historic Eight Heritage Trail Segments. [Photograph].

Figure 5.18: Gillespie, C. (2023). Proposed Design Recommendations of Fair Surrounding Context Historic Eight Heritage Trail Segments. [Photo Rendering].

Tables

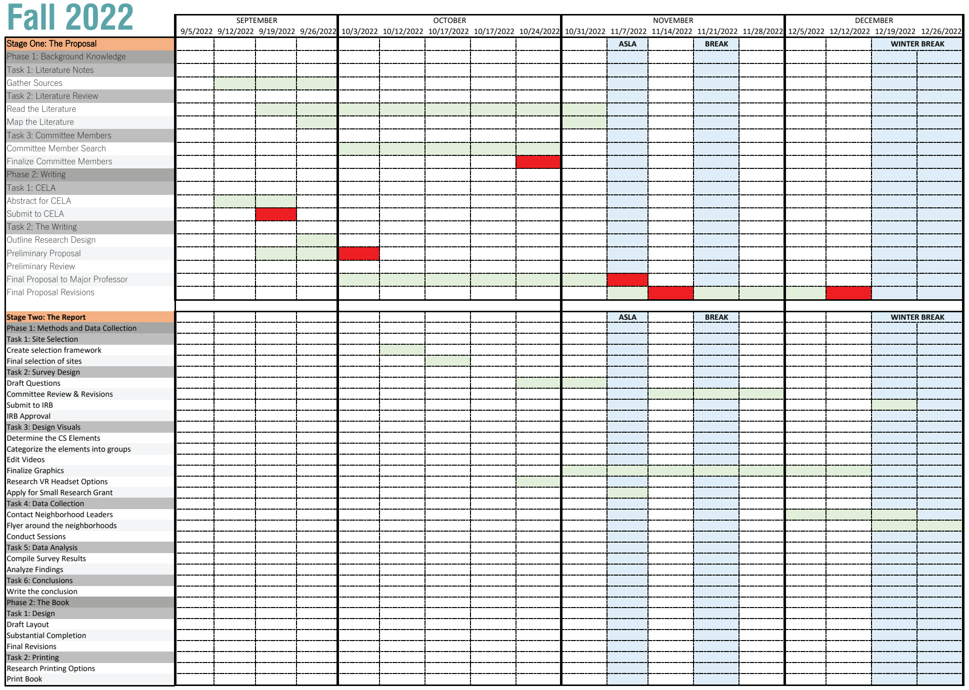
APPENDICES

PROJECT TIMELINE

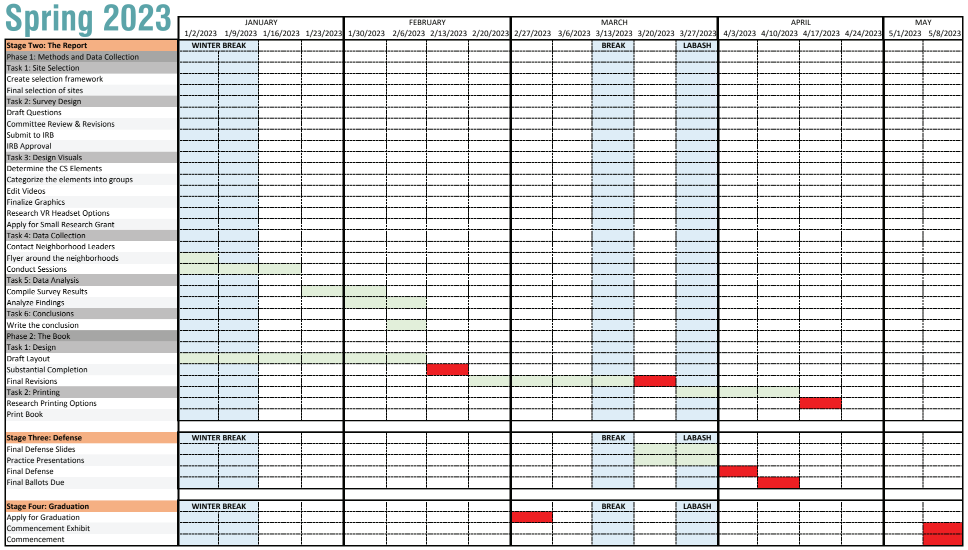
Appendix A

Project Timeline

Fall 2022



Spring 2023



IRB APPROVAL

Appendix B

IRB Exemption Letter

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Sara Hadavi
Landscape Archit & Comm Plan

Proposal Number: IRB-11456

FROM: Lisa Rubin, Chair
Committee on Research Involving Human Subjects

DATE: 12/20/2022

RE: Proposal Entitled, "Visualizing Walkability: Exploring residents' preferences for complete street design and urban trails using immersive 360° videos."

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §104(d), category:Exempt Category 2 Subsection ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

Electronically signed by Phill Vardiman on 12/22/2022 12:39 PM ET
On Behalf of IRB Chair

203 Fairchild Hall, Manhattan, KS 66502 | (785) 532-3224 | fax: (785) 532-3278

DATA COLLECTION TOOL

Appendix C

Verbal Introduction/Consent Statement

This research is part of a graduate student project. This experiment will involve viewing 360° videos through a head mounted display (VR headset) and answering questions about your perceptions. The purpose of the study will be explained at the completion of the experiment, as to not bias your answers before the experiment.

This experiment will take approximately 15 minutes, with 6 minutes being with the headset on. Your participation is voluntary, and you may decline to answer questions and/or withdraw from the experiment at any point, for any reason. Your answers will remain anonymous and stored on a password protected computer.

This study has been reviewed and approved by the Kansas State University Institutional Review Board.

Kansas State University IRB Chair—Lisa Rubin, (785) 532-3224

Any questions can be addressed to Graduate Student Chloe Gillespie, chloe98@ksu.edu or Assistant Professor Sara Hadavi, sarahadavi@ksu.edu

Do you consent to continue this study?

- ☐ Yes
- ☐ No

Brief

Read aloud to participants

Thank you for your willingness to participate in this study. My name is Chloe, and I am a graduate student at Kansas State University. This study is a part of my graduate studies, and your participation in this study will help me complete my work. This experiment will involve viewing 360° videos through a head mounted display (VR headset) and answering questions about your perceptions. No prior experience with VR headsets is needed. You will be shown a total of 12 videos for 30 seconds each, for a total time of 6 minutes with the headset on. During each video you will be verbally asked three questions and you will verbally answer based on a scale of 1 to 5, with 1 being the lowest and 5 being the highest. After viewing the videos in the head mounted display you will be asked a series of questions about your experience and familiarity with the area. If you have any health concerns, you believe may affect your experience with the headset, or have any questions about the study please notify me now.

All the data collected in this experiment is confidential and will only be viewed by the me and my supervisor. The information you provide will be anonymous and there is no way to identify you based on your responses. Your participation is voluntary, and you have the right to withdraw from the experiment anytime. You can also skip any question that you'd prefer not to answer.

Questionnaire (Google Forms)

Asked before wearing VR headset

What is your familiarity with using VR?

☐ Not familiar – Never experienced it
☐ Slightly familiar – Experienced it once or twice
☐ Somewhat familiar – Experienced just a few times
☐ Moderately familiar – Experienced several times
☐ Very familiar – Experienced quite a lot

Do you have any medical conditions that might affect your VR experience?

☐ Severe vision problems
☐ Heart condition (including pacemakers)
☐ Pregnant
☐ Seizures/Epilepsy
☐ Hearing aids
Other ____

Do you live within the neighborhoods of Beacon Hills, 18th and Vine, Wendell Phillips, Washington Wheatley, Mt. Hope, Key Coalition, Santa Fe, or Ingleside (South Round Top)?

☐ Yes
☐ No
If no, what neighborhood do you live in? ____________________

Asked while wearing VR headset - repeated for each video

On a scale of 1 to 5, How would you rate your comfort level for walking in this space?

1 - Very uncomfortable
2 - Uncomfortable
3 - Neutral
4 - Comfortable
5 - Very comfortable

On a scale of 1 to 5, How would you rate your level of safety for walking in this space?

1 - Very unsafe
2 - Unsafe
3 – Neutral
4 - Safe
5 - Very safe

On a scale of 1 to 5, How would you rate the attractiveness of this space?

1 – Very unattractive
2 – Unattractive
3 – Neutral
4 – Attractive
5 – Very attractive

Asked after wearing VR headset

After viewing all the videos, what aspects of the space had the greatest impact on how walkable the space felt to you?

____

Questionnaire cont. (Google Forms)

Asked at the end of the experiment

How was your experience with VR?

- ☐ Great – had no problems, enjoyed everything
- ☐ Good – had no problems
- ☐ Okay – had no or few problems
- ☐ Not good – had problems, do not want to experience it again
- ☐ Bad- had problems, felt dizzy, ended experiment early, will not do again

What is your main mode of transportation?

- ☐ Personal/Family vehicle
- ☐ Public Transportation (bus/streetcar)
- ☐ Walking
- ☐ Biking (Personal Bike)
- ☐ Biking (Ride KC Bike Share)
- ☐ Scooter Rental
- Other (please specify) ___________________

How close do you live to Brooklyn Ave & 22nd Street?

- ☐ Very Close – within 2 blocks
- ☐ Close – within a 10-minute walk
- ☐ Semi close – within a 20-minute walk (1-minute drive)
- ☐ Not close – 60-minute walk (5-minute drive)
- ☐ Not remotely close – farther than 3 miles

How often do you travel through the intersection mentioned above?

- ☐ Very often - Twice a day or more
- ☐ Regularly - Once a day
- ☐ Often - Three to four times a week
- ☐ Sometimes - Once a week
- ☐ Rarely - Once every two weeks or less

How close do you live to Prospect & 25th Street?

- ☐ Very Close – within 2 blocks
- ☐ Close – within a 10-minute walk
- ☐ Semi close – within a 20-minute walk (1-minute drive)
- ☐ Not close – 60-minute walk (5-minute drive)
- ☐ Not remotely close – farther than 3 miles

How often do you travel through the intersection mentioned above?

- ☐ Very often - Twice a day or more
- ☐ Regularly - Once a day
- ☐ Often - Three to four times a week
- ☐ Sometimes - Once a week
- ☐ Rarely - Once every two weeks or less

How close do you live to Benton Blvd & 27th Street?

- ☐ Very Close – within 2 blocks
- ☐ Close – within a 10-minute walk
- ☐ Semi close – within a 20-minute walk (1-minute drive)
- ☐ Not close – 60-minute walk (5-minute drive)
- ☐ Not remotely close – farther than 3 miles

How often do you travel through the intersection mentioned above?

- ☐ Very often - Twice a day or more
- ☐ Regularly - Once a day
- ☐ Often - Three to four times a week
- ☐ Sometimes - Once a week
- ☐ Rarely - Once every two weeks or less

How often do you walk in your neighborhood?

- ☐ Very often - Twice a day or more
- ☐ Regularly - Once a day
- ☐ Often - Three to four times a week
- ☐ Sometimes - Once a week
- ☐ Rarely - Once every two weeks or less

What age range do you fall in?

- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-65
- ☐ 65+

What is your gender identity?

- ☐ Female
- ☐ Male
- ☐ Non-Binary
- Other____________________

Do you have children who live with you?

- ☐ No
- ☐ Yes

Debrief

Printed, given to participants

Thank you for your participation in this study. The aim of this study was to investigate what elements have the greatest impact on comfort, safety, and attractiveness along streetside trails, to help improve walkability. You viewed three areas within east Kansas City with differing existing contexts and viewed three alternative scenarios for each area. The differing elements measured in this study was sidewalk width, plantings, and bike lanes. Each of these elements have been shown to improve walkability but are often measured together and not as individual. The results of this study will potentially provide insight into what elements have the greatest impact of walkability to then inform future development of a cultural streetside trail. The data from this experiment has the potential to be used in future publications and/or conference presentations, but your information will remain anonymous.

If you have any further questions about this study or topic, you can ask them now or email the me later with your questions, and I will be happy to answer your questions.

All the data collected in this experiment is confidential and anonymous, and will only be viewed by me and my project supervisor.

Experimenter
Chloe Gillespie: chloe98@ksu.edu

Project Supervisor
Sara Hadavi: sarahadavi@ksu.edu

This study has been reviewed and approved by the Kansas State University Institutional Review Board.

Kansas State University IRB Chair—Lisa Rubin, (785) 532-3224

PARTICIPANT INTEREST FLYER

Appendix D

Participant Interest Flyer

Digital

Interested in trying Virtual Reality? Volunteers Needed!

We are looking for residents of east Kansas City to participate in a study viewing simulated sidewalks through a head-mounted display to help a K-State graduate student complete their research.

Participant Eligibility:

- 18 years of age or older
- No experience in VR required

Click the link to sign up!
https://tinyurl.com/9jzsvmy4

Or scan the QR Code to sign up for a time!

The study will take place
January 4-14, 2023

Sessions take less than 15 minutes!

Snacks Provided

Participants will receive a small snack upon completion of the study

If you have questions please send them to Chloe at chloe98@ksu.edu

Participant Interest Flyer

Printed

Interested in trying Virtual Reality? Volunteers Needed!

We are looking for residents of east Kansas City to participate in a study viewing simulated sidewalks through a head-mounted display to help a K-State graduate student complete their research.

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VR Study: https://tinyurl.com/9jzsvmy4
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EXPERIMENT DESIGNED VISUALS

Appendix E

Figure e.1: Benton Boulevard, Planting Intervention; First Video

Figure e.2: 25th Street, Bike Lane Intervention; Second Video

Figure e.3: Brooklyn Avenue, Bike Lane Intervention; Third Video

Figure e.4: 25th Street, No Intervention; Fourth Video

Figure e.5: Benton Boulevard, Narrowed Sidewalk Intervention; Fifth Video

Figure e.6: Brooklyn Avenue, No Intervention; Sixth Video

Figure e.7: 25th Street, Planting Intervention; Seventh Video

Figure e.8: Brooklyn Avenue, Widened Sidewalk Intervention; Eighth Video

Figure e.9: Benton Boulevard, No Intervention; Ninth Video

Figure e.10: 25th Street, Narrowed Sidewalk Intervention; Tenth Video

Figure e.11: Benton Boulevard, Bike Lane Intervention; Eleventh Video

Figure e.12: Brooklyn Avenue, Planting Intervention; Twelfth Video

RAW DATA ANALYSIS RESULTS

Appendix F

Descriptive Means - Brooklyn Ave

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Brooklyn Ave, Comfort, Planting Intervention	53	1	5	3.92	1.089	1.187
Brooklyn Ave, Safety, Planting Intervention	53	1	5	3.75	1.090	1.189
Brooklyn Ave, Attractiveness, Planting Intervention	53	2	5	3.87	1.001	1.001
Brooklyn Ave, Comfort, Sidewalk Intervention	53	2	5	4.11	.824	.679
Brooklyn Ave, Safety, Sidewalk Intervention	53	2	5	4.04	.980	.960
Brooklyn Ave, Attractiveness, Sidewalk Intervention	53	2	5	3.94	.949	.901
Brooklyn Ave, Comfort, Bike Lane Intervention	53	1	5	3.89	.934	.872
Brooklyn Ave, Safety, Bike Lane Intervention	53	1	5	3.87	1.001	1.001
Brooklyn Ave, Attractiveness, Bike Lane Intervention	53	1	5	3.25	1.207	1.458
Brooklyn Ave, Comfort, No Intervention	53	1	5	3.42	1.184	1.401
Brooklyn Ave, Safety, No Intervention	53	1	5	3.28	1.336	1.784
Brooklyn Ave, Attractiveness, No Intervention	53	1	5	2.87	1.127	1.271
Valid N (listwise)	53					

```
DESCRIPTIVES VARIABLES=BrPCom BrPSaf BrPAtt BrSCom BrSSaf BrSAtt
BrBCom BrBSaf BrBAtt BrUCom BrUSaf
    BrUAtt
  /STATISTICS=MEAN STDDEV VARIANCE MIN MAX.
```

Descriptive Means - 25th St

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
25th Street, Comfort, Planting Intervention	53	1	5	3.34	1.192	1.421
25th Street, Safety, Planting Intervention	53	1	5	3.23	1.310	1.717
25th Street, Attractiveness, Planting Intervention	53	1	5	2.96	1.208	1.460
25th Street, Comfort, Sidewalk Intervention	53	1	5	3.00	1.271	1.615
25th Street, Safety, Sidewalk Intervention	53	1	5	2.92	1.299	1.687
25th Street, Attractiveness, Sidewalk Intervention	53	1	5	2.38	1.023	1.047
25th Street, Comfort, Bike Lane Intervention	53	1	5	3.26	1.288	1.660
25th Street, Safety, Bike Lane Intervention	53	1	5	3.26	1.347	1.813
25th Street, Attractiveness, Bike Lane Intervention	53	1	5	2.42	1.151	1.324
25th Street, Comfort, No Intervention	53	1	5	2.94	1.151	1.324
25th Street, Safety, No Intervention	53	1	5	2.77	1.235	1.525
25th Street, Attractiveness, No Intervention	53	1	5	2.04	1.018	1.037
Valid N (listwise)	53					

```
DESCRIPTIVES VARIABLES=@25PCom @25PSaf @25PAtt @25SCom @25SSaf @25SAtt
@25BCom @25BSaf @25BAtt
    @25UCom @25USaf @25UAtt
  /STATISTICS=MEAN STDDEV VARIANCE MIN MAX.
```

Descriptive Means - Benton Blvd

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Benton Blvd, Comfort, Planting Intervention	53	1	5	4.47	.799	.639
Benton Blvd, Safety, Planting Intervention	53	3	5	4.40	.716	.513
Benton Blvd, Attractiveness, Planting Intervention	53	2	5	4.30	.911	.830
Benton Blvd, Comfort, Sidewalk Intervention	53	1	5	3.92	.978	.956
Benton Blvd, Safety, Sidewalk Intervention	53	1	5	4.02	1.028	1.057
Benton Blvd, Attractiveness, Sidewalk Intervention	53	1	5	3.79	1.063	1.129
Benton Blvd, Comfort, Bike Lane Intervention	53	1	5	4.02	1.009	1.019
Benton Blvd, Safety, Bike Lane Intervention	53	2	5	3.96	.898	.806
Benton Blvd, Attractiveness, Bike Lane Intervention	53	1	5	3.77	1.068	1.140
Benton Blvd, Comfort, No Intervention	53	1	5	4.02	1.009	1.019
Benton Blvd, Safety, No Intervention	53	1	5	3.98	1.047	1.096
Benton Blvd, Attractiveness, No Intervention	53	1	5	3.74	1.195	1.429
Valid N (listwise)	53					

```
DESCRIPTIVES VARIABLES=BePCom BePSaf BePAtt BeSCom BeSSaf BeSAtt BeBCom
BeBSaf BeBAtt BeUCom BeUSaf
    BeUAtt
  /STATISTICS=MEAN STDDEV VARIANCE MIN MAX.
```

Nonparametric Related-Sample Test – Brooklyn Avenue

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Comfort, Planting Intervention and Brooklyn Ave, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Safety, Planting Intervention and Brooklyn Ave, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Attractiveness, Planting Intervention and Brooklyn Ave, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Comfort, Sidewalk Intervention and Brooklyn Ave, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Safety, Sidewalk Intervention and Brooklyn Ave, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Attractiveness, Sidewalk Intervention and Brooklyn Ave, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Comfort, Bike Lane Intervention and Brooklyn Ave, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Safety, Bike Lane Intervention and Brooklyn Ave, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.002	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Brooklyn Ave, Attractiveness, Bike Lane Intervention and Brooklyn Ave, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.009	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Nonparametric Related-Sample Test – 25th Street

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Comfort, Planting Intervention and 25th Street, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.003	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Safety, Planting Intervention and 25th Street, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Attractiveness, Planting Intervention and 25th Street, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Comfort, Sidewalk Intervention and 25th Street, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.117	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Safety, Sidewalk Intervention and 25th Street, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.201	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Attractiveness, Sidewalk Intervention and 25th Street, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.003	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Comfort, Bike Lane Intervention and 25th Street, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.007	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Safety, Bike Lane Intervention and 25th Street, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of 25th Street, Attractiveness, Bike Lane Intervention and 25th Street, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.006	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Nonparametric Related-Sample Test – Benton Boulevard

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Comfort, Planting Intervention and Benton Blvd, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.013	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Safety, Planting Intervention and Benton Blvd, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.020	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Attractiveness, Planting Intervention and Benton Blvd, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.009	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Comfort, Sidewalk Intervention and Benton Blvd, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.513	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Safety, Sidewalk Intervention and Benton Blvd, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.394	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Attractiveness, Sidewalk Intervention and Benton Blvd, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.480	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Comfort, Bike Lane Intervention and Benton Blvd, Comfort, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.796	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Safety, Bike Lane Intervention and Benton Blvd, Safety, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.593	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of Benton Blvd, Attractiveness, Bike Lane Intervention and Benton Blvd, Attractiveness, No Intervention are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	1.000	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Linear Regression – Comfort

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th[b]	.	Enter

a. Dependent Variable: Comfort

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.432[a]	.186	.175	1.053

a. Predictors: (Constant), Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th

b. Dependent Variable: Comfort

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	158.911	9	17.657	15.920	<.001[b]
	Residual	694.301	626	1.109		
	Total	853.212	635			

a. Dependent Variable: Comfort

b. Predictors: (Constant), Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th

Coefficients[a]

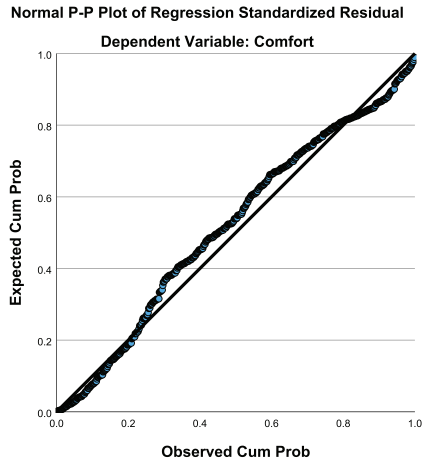
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.460	.202		17.146	<.001
	Planting	.306	.104	.114	2.956	.003
	Sidewalk	.219	.098	.093	2.230	.026
	Bike	.118	.104	.044	1.135	.257
	Male	-.117	.090	-.050	-1.306	.192
	How often do you walk in your neighborhood?	.135	.029	.174	4.677	<.001
	What age range do you fall in?	-.066	.036	-.069	-1.831	.068
	Children	-.068	.096	-.028	-.706	.480
	25th	-.808	.113	-.329	-7.117	<.001
	Benton	.164	.113	.067	1.445	.149

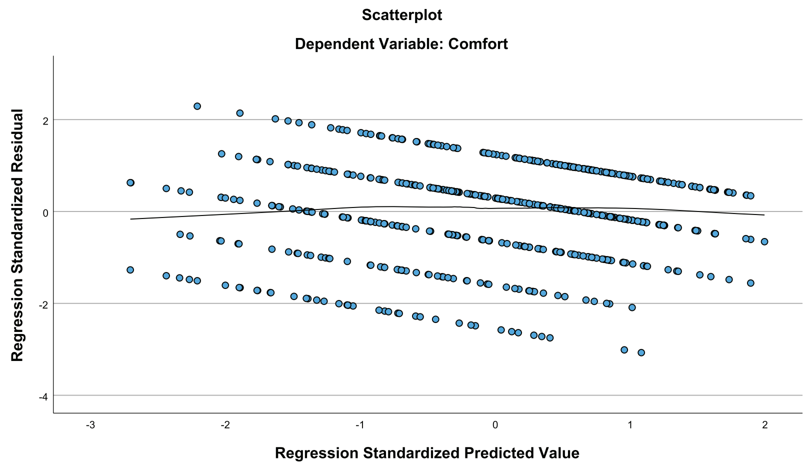
a. Dependent Variable: Comfort

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.34	4.69	3.69	.500	636
Residual	-3.235	2.412	.000	1.046	636
Std. Predicted Value	-2.707	1.996	.000	1.000	636
Std. Residual	-3.072	2.291	.000	.993	636

a. Dependent Variable: Comfort





appendix f

Linear Regression – Comfort
Normality of Residuals

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Comfort	636	100.0%	0	0.0%	636	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Comfort	.069	636	<.001	.973	636	<.001

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Com_Brook	212	100.0%	0	0.0%	212	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Com_Brook	.078	212	.003	.960	212	<.001

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Com_25th	212	100.0%	0	0.0%	212	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Com_25th	.076	212	.005	.978	212	.002

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Com_Bent	212	100.0%	0	0.0%	212	100.0%

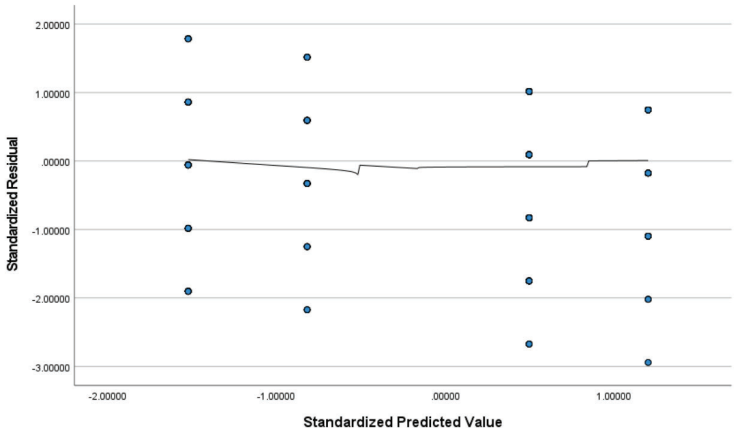
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Com_Bent	.123	212	<.001	.926	212	<.001

a. Lilliefors Significance Correction

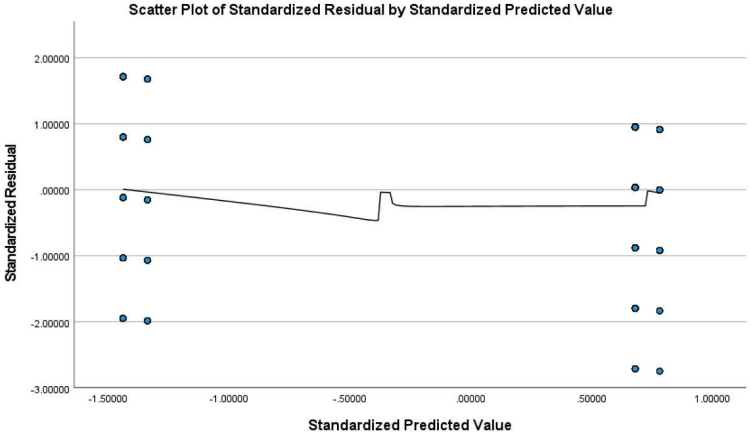
Linear Regression – Comfort Scatter Plots with LOESS

Com Plant



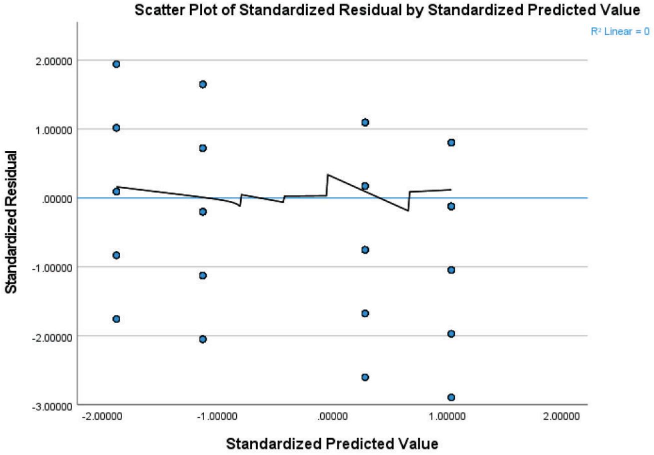
Com Bike

Scatter Plot of Standardized Residual by Standardized Predicted Value



Com Sidewalk

Scatter Plot of Standardized Residual by Standardized Predicted Value



Linear Regression – Safety

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th[b]	.	Enter

a. Dependent Variable: Safety
b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.431[a]	.186	.174	1.105

a. Predictors: (Constant), Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th
b. Dependent Variable: Safety

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	174.492	9	19.388	15.872	<.001[b]
	Residual	764.695	626	1.222		
	Total	939.187	635			

a. Dependent Variable: Safety
b. Predictors: (Constant), Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th

Coefficients[a]

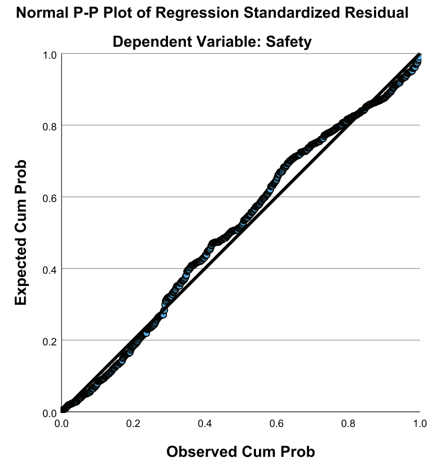
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.291	.212		15.542	<.001
	Planting	.261	.109	.093	2.396	.017
	Sidewalk	.173	.103	.070	1.675	.095
	Bike	.166	.109	.059	1.529	.127
	Male	.038	.094	.016	.405	.686
	How often do you walk in your neighborhood?	.145	.030	.179	4.808	<.001
	What age range do you fall in?	-.081	.038	-.081	-2.139	.033
	Children	-.080	.101	-.032	-.791	.430
	25th	-.775	.119	-.301	-6.508	<.001
	Benton	.267	.119	.104	2.245	.025

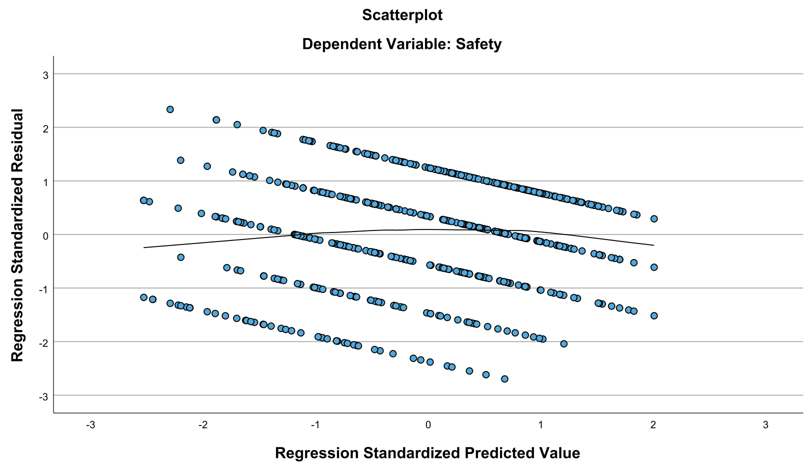
a. Dependent Variable: Safety

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.30	4.68	3.62	.524	636
Residual	-2.980	2.579	.000	1.097	636
Std. Predicted Value	-2.532	2.008	.000	1.000	636
Std. Residual	-2.697	2.334	.000	.993	636

a. Dependent Variable: Safety





Linear Regression – Safety
Normality of Residuals

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Safety	636	100.0%	0	0.0%	636	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Safety	.066	636	<.001	.982	636	<.001

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Saf_Brook	212	100.0%	0	0.0%	212	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Saf_Brook	.090	212	<.001	.968	212	<.001

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Sat_25th	212	100.0%	0	0.0%	212	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Sat_25th	.065	212	.029	.984	212	.017

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Saf_Bent	212	100.0%	0	0.0%	212	100.0%

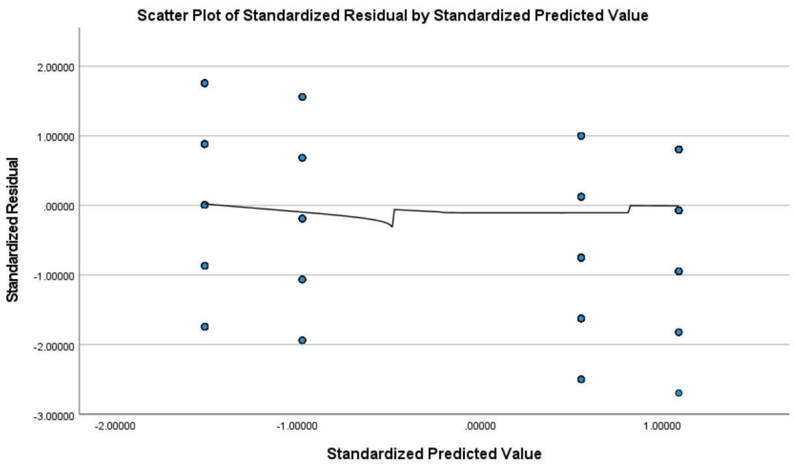
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Saf_Bent	.091	212	<.001	.944	212	<.001

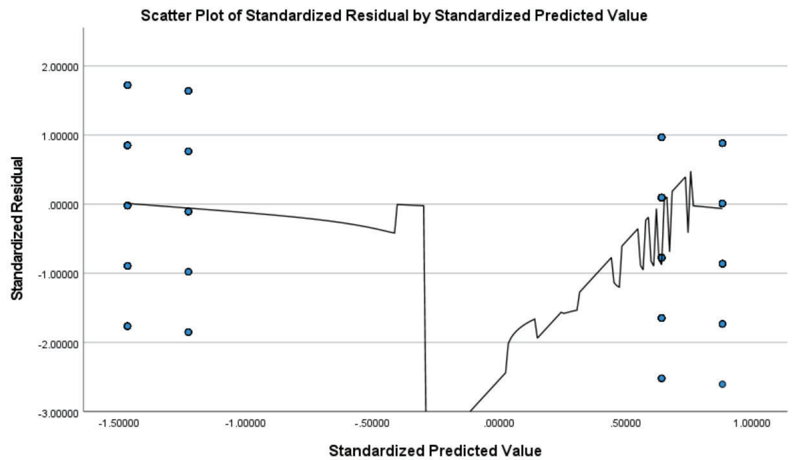
a. Lilliefors Significance Correction

Linear Regression – Safety Scatter Plots with LOESS

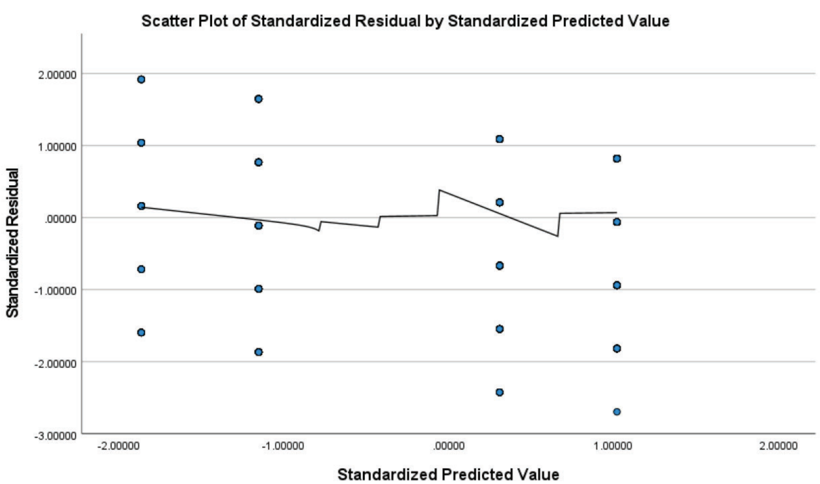
Saf Plant



Saf Bike



Saf Sidewalk



Linear Regression – Attractiveness

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th[b]	.	Enter

a. Dependent Variable: Attractiveness

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.558[a]	.311	.301	1.071

a. Predictors: (Constant), Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th

b. Dependent Variable: Attractiveness

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	324.784	9	36.087	31.441	<.001[b]
	Residual	718.512	626	1.148		
	Total	1043.296	635			

a. Dependent Variable: Attractiveness

b. Predictors: (Constant), Benton, Children, Bike, How often do you walk in your neighborhood?, Sidewalk, What age range do you fall in?, Male, Planting, 25th

Coefficients[a]

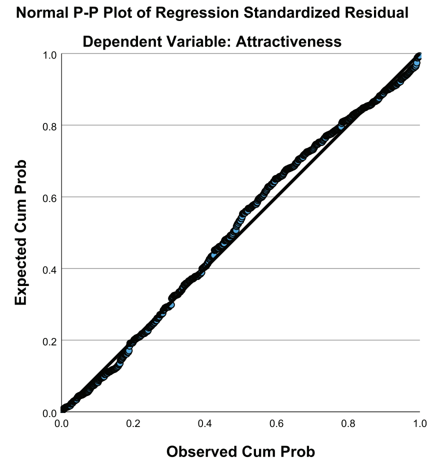
Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.174	.205		15.464	<.001
	Planting	.547	.105	.185	5.192	<.001
	Sidewalk	.226	.100	.087	2.265	.024
	Bike	-.019	.105	-.006	-.179	.858
	Male	.127	.091	.049	1.394	.164
	How often do you walk in your neighborhood?	.116	.029	.135	3.952	<.001
	What age range do you fall in?	-.125	.037	-.119	-3.435	<.001
	Children	-.062	.098	-.023	-.630	.529
	25th	-1.146	.115	-.422	-9.929	<.001
	Benton	.307	.115	.113	2.656	.008

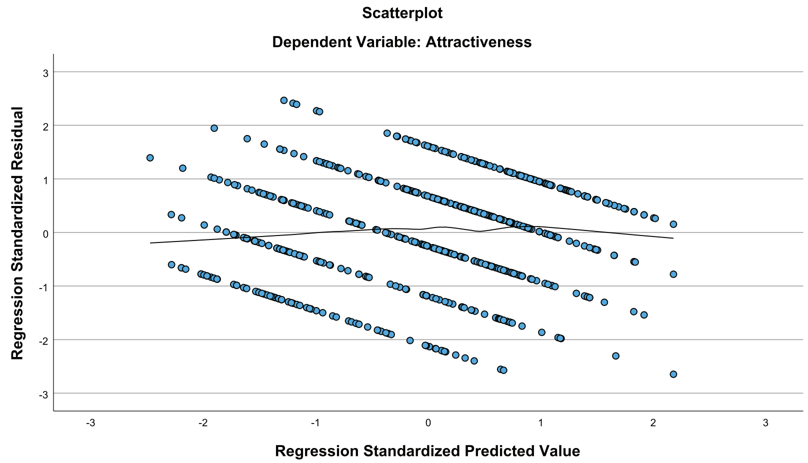
a. Dependent Variable: Attractiveness

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.51	4.84	3.28	.715	636
Residual	-2.836	2.642	.000	1.064	636
Std. Predicted Value	-2.474	2.180	.000	1.000	636
Std. Residual	-2.647	2.466	.000	.993	636

a. Dependent Variable: Attractiveness





Linear Regression – Attractiveness Normality of Residuals

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Attractiveness	636	100.0%	0	0.0%	636	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Attractiveness	.055	636	<.001	.987	636	<.001

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Att_Brook	212	100.0%	0	0.0%	212	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Att_Brook	.089	212	<.001	.964	212	<.001

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Att_25th	212	100.0%	0	0.0%	212	100.0%

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Att_25th	.061	212	.054	.990	212	.135

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Standardized Residual_Att_Bent	212	100.0%	0	0.0%	212	100.0%

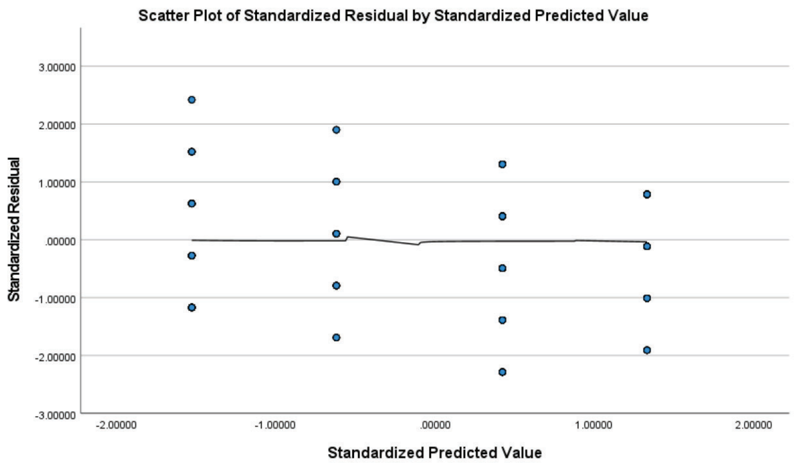
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual_Att_Bent	.113	212	<.001	.954	212	<.001

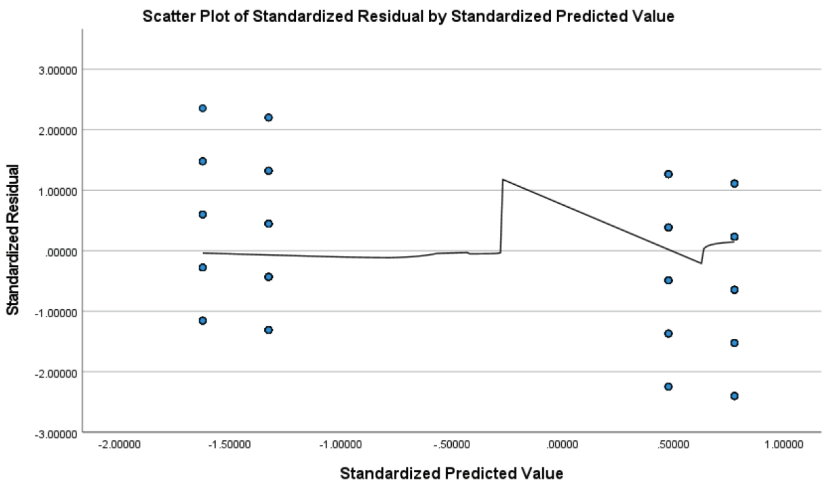
a. Lilliefors Significance Correction

Linear Regression – Attractiveness Scatter Plots with LOESS

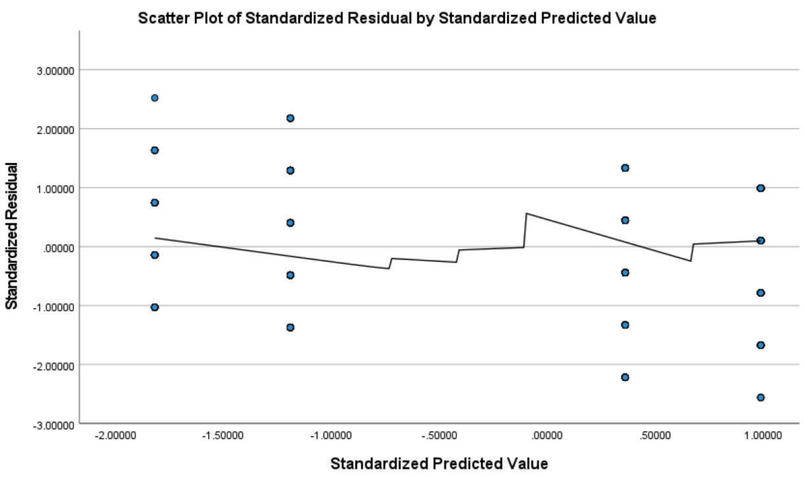
Att Plant



Att Bike



Att Sidewalk



Linear Regression – Attractiveness 25th Street

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Children, Bike, How often do you walk in your neighborhood?, What age range do you fall in?, Sidewalk, Male, Planting[b]	.	Enter

a. Dependent Variable: Attractiveness

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.426[a]	.181	.153	1.053

a. Predictors: (Constant), Children, Bike, How often do you walk in your neighborhood?, What age range do you fall in?, Sidewalk, Male, Planting

b. Dependent Variable: Attractiveness

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	50.134	7	7.162	6.456	<.001[b]
	Residual	226.295	204	1.109		
	Total	276.429	211			

a. Dependent Variable: Attractiveness

b. Predictors: (Constant), Children, Bike, How often do you walk in your neighborhood?, What age range do you fall in?, Sidewalk, Male, Planting

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	2.028	.348		5.822	<.001
	Planting	.925	.205	.351	4.519	<.001
	Sidewalk	-.340	.205	-.129	-1.660	.098
	Bike	.377	.205	.143	1.844	.067
	Male	.299	.155	.130	1.924	.056
	How often do you walk in your neighborhood?	.163	.050	.213	3.254	.001
	What age range do you fall in?	-.133	.062	-.141	-2.135	.034
	Children	-.102	.166	-.043	-.614	.540

a. Dependent Variable: Attractiveness

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.22	3.59	2.45	.487	212
Residual	-2.459	2.755	.000	1.036	212
Std. Predicted Value	-2.525	2.346	.000	1.000	212
Std. Residual	-2.335	2.616	.000	.983	212

a. Dependent Variable: Attractiveness

Reliability Analysis – Brooklyn Avenue

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.922	.923	12

ANOVA with Friedman's Test and Tukey's Test for Nonadditivity

			Sum of Squares	df	Mean Square	Friedman's Chi-Square	Sig
Between People			383.726	52	7.379		
Within People	Between Items		86.910[a]	11	7.901	121.873	.000
	Residual	Nonadditivity	4.609[b]	1	4.609	8.118	.005
		Balance	324.230	571	.568		
		Total	328.840	572	.575		
	Total		415.750	583	.713		
Total			799.476	635	1.259		

Grand Mean = 3.68

a. Kendall's coefficient of concordance W = .109.

b. Tukey's estimate of power to which observations must be raised to achieve additivity = 2.092.

```
RELIABILITY
  /VARIABLES=BrPCom BrPSaf BrPAtt BrSCom BrSSaf BrSAtt BrBCom BrBSaf BrBAtt BrU-
Com BrUSaf BrUAtt
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=DESCRIPTIVE SCALE CORR ANOVA FRIEDMAN TUKEY
  /SUMMARY=MEANS VARIANCE.
```


Walk-Score – Brooklyn Avenue

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
WalkScore_BrU	53	.85	4.25	2.8277	1.02422	1.049
WalkScore_BrP	53	1.20	4.25	3.2500	.87681	.769
WalkScore_BrS	53	1.70	4.25	3.4557	.72698	.529
WalkScore_BrB	53	.85	4.25	3.2836	.79119	.626
Valid N (listwise)	53					

```
COMPUTE WalkScore_BrU=(1.5 * BrUSaf + BrUCom + 0.5 * BrUAtt) / 3.
EXECUTE.
COMPUTE WalkScore_BrP=(1.5 * BrPSaf + BrPCom + 0.5 * BrPAtt) / 3.
EXECUTE.
COMPUTE WalkScore_BrS=(1.5 * BrSSaf + BrSCom + 0.5 * BrSAtt) / 3.
EXECUTE.
COMPUTE WalkScore_BrB=(1.5 * BrBSaf + BrBCom + 0.5 * BrBAtt) / 3.
EXECUTE.
DESCRIPTIVES VARIABLES=WalkScore_BrU WalkScore_BrP WalkScore_BrS WalkScore_BrB
  /STATISTICS=MEAN STDDEV VARIANCE MIN MAX.
```

Reliability Analysis – 25th Street

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.911	.909	12

ANOVA with Friedman's Test and Tukey's Test for Nonadditivity

			Sum of Squares	df	Mean Square	Friedman's Chi-Square	Sig
Between People			463.101	52	8.906		
Within People	Between Items		97.679[a]	11	8.880	103.290	.000
	Residual	Nonadditivity	12.035[b]	1	12.035	15.562	.000
		Balance	441.619	571	.773		
		Total	453.654	572	.793		
	Total		551.333	583	.946		
Total			1014.434	635	1.598		

Grand Mean = 2.88

a. Kendall's coefficient of concordance W = .096.

b. Tukey's estimate of power to which observations must be raised to achieve additivity = -.184.

```
RELIABILITY
  /VARIABLES=@25PCom @25PSaf @25PAtt @25SCom @25SSaf @25SAtt @25BCom
@25BSaf @25BAtt @25UCom
    @25USaf @25UAtt
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=DESCRIPTIVE SCALE CORR ANOVA FRIEDMAN TUKEY
  /SUMMARY=MEANS VARIANCE.
```

Walk-Score – 25th Street

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
WalkScore_25U	53	.85	4.25	2.4019	.89454	.800
WalkScore_25P	53	.85	4.25	2.7758	.98977	.980
WalkScore_25S	53	.85	4.25	2.5019	1.05969	1.123
WalkScore_25B	53	.85	4.25	2.7604	1.03538	1.072
Valid N (listwise)	53					

```
COMPUTE WalkScore_@25U=(1.5 * @25USaf + @25UCom + 0.5 * @25UAtt) / 3.
EXECUTE.
COMPUTE WalkScore_25P=(1.5 * @25PSaf + @25PCom + 0.5 * @25PAtt) / 3.
EXECUTE.
COMPUTE WalkScore_@25S=(1.5 * @25SSaf + @25SCom + 0.5 * @25SAtt) / 3.
EXECUTE.
COMPUTE WalkScore_@25B=(1.5 * @25BSaf + @25BCom + 0.5 * @25BAtt) / 3.
EXECUTE.
DESCRIPTIVES VARIABLES=WalkScore_@25U WalkScore_@25P WalkScore_@25S WalkS-
core_@25B
  /STATISTICS=MEAN STDDEV VARIANCE MIN MAX.
```

Reliability Analysis – Benton Boulevard

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.895	.888	12

ANOVA with Friedman's Test and Tukey's Test for Nonadditivity

			Sum of Squares	df	Mean Square	Friedman's Chi-Square	Sig
Between People			281.390	52	5.411		
Within People	Between Items		33.401[a]	11	3.036	54.558	.000
	Residual	Nonadditivity	30.287[b]	1	30.287	58.977	.000
		Balance	293.229	571	.514		
		Total	323.516	572	.566		
	Total		356.917	583	.612		
Total			638.307	635	1.005		

Grand Mean = 4.03

a. Kendall's coefficient of concordance W = .052.

b. Tukey's estimate of power to which observations must be raised to achieve additivity = 6.774.

```
RELIABILITY
  /VARIABLES=BePCom BePSaf BePAtt BeSCom BeSSaf BeSAtt BeBCom BeBSaf BeBAtt
BeUCom BeUSaf BeUAtt
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=DESCRIPTIVE SCALE CORR ANOVA FRIEDMAN TUKEY
  /SUMMARY=MEANS VARIANCE.
```


Walk-Score – Benton Boulevard

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
WalkScore_BeU	53	1.00	5.00	3.9528	.98405	.968
WalkScore_BeP	53	2.83	5.00	4.4057	.56944	.324
WalkScore_BeS	53	1.50	5.00	3.9497	.88770	.788
WalkScore_BeB	53	1.67	5.00	3.9497	.86453	.747
Valid N (listwise)	53					

```
COMPUTE WalkScore_BeU=(1.5 * BeUSaf + BeUCom + 0.5 * BeUAtt) / 3.
EXECUTE.
COMPUTE WalkScore_BeP=(1.5 * BePSaf + BePCom + 0.5 * BePAtt) / 3.
EXECUTE.
COMPUTE WalkScore_BeS=(1.5 * BeSSaf + BeSCom + 0.5 * BeSAtt) / 3.
EXECUTE.
COMPUTE WalkScore_BeB=(1.5 * BeBSaf + BeBCom + 0.5 * BeBAtt) / 3.
EXECUTE.
DESCRIPTIVES VARIABLES=WalkScore_BeU WalkScore_BeP WalkScore_BeS WalkScore_
BeB
  /STATISTICS=MEAN STDDEV VARIANCE MIN MAX.
```

Correlation – Brooklyn Avenue

Correlations

		How close do you live to Brooklyn Ave & 22nd Street?	How often do you travel through the intersection mentioned above?	Brooklyn Ave, Comfort, No Intervention	Brooklyn Ave, Safety, No Intervention	Brooklyn Ave, Attractiveness, No Intervention
How close do you live to Brooklyn Ave & 22nd Street?	Pearson Correlation	1	.578**	-.372**	-.323*	-.266
	Sig. (2-tailed)		<.001	.006	.018	.054
	N	53	53	53	53	53
How often do you travel through the intersection mentioned above?	Pearson Correlation	.578**	1	-.316*	-.364**	-.414**
	Sig. (2-tailed)	<.001		.021	.007	.002
	N	53	53	53	53	53
Brooklyn Ave, Comfort, No Intervention	Pearson Correlation	-.372**	-.316*	1	.800**	.590**
	Sig. (2-tailed)	.006	.021		<.001	<.001
	N	53	53	53	53	53
Brooklyn Ave, Safety, No Intervention	Pearson Correlation	-.323*	-.364**	.800**	1	.664**
	Sig. (2-tailed)	.018	.007	<.001		<.001
	N	53	53	53	53	53
Brooklyn Ave, Attractiveness, No Intervention	Pearson Correlation	-.266	-.414**	.590**	.664**	1
	Sig. (2-tailed)	.054	.002	<.001	<.001	
	N	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlation – 25th Street

Correlations

		How close do you live to Prospect Ave & 25th Street?	How often do you travel through the intersection mentioned above?	25th Street, Comfort, No Intervention	25th Street, Safety, No Intervention	25th Street, Attractiveness, No Intervention
How close do you live to Prospect Ave & 25th Street?	Pearson Correlation	1	.306*	.070	.002	.015
	Sig. (2-tailed)		.026	.619	.989	.915
	N	53	53	53	53	53
How often do you travel through the intersection mentioned above?	Pearson Correlation	.306*	1	-.031	.089	.231
	Sig. (2-tailed)	.026		.824	.525	.096
	N	53	53	53	53	53
25th Street, Comfort, No Intervention	Pearson Correlation	.070	-.031	1	.546**	.215
	Sig. (2-tailed)	.619	.824		<.001	.122
	N	53	53	53	53	53
25th Street, Safety, No Intervention	Pearson Correlation	.002	.089	.546**	1	.496**
	Sig. (2-tailed)	.989	.525	<.001		<.001
	N	53	53	53	53	53
25th Street, Attractiveness, No Intervention	Pearson Correlation	.015	.231	.215	.496**	1
	Sig. (2-tailed)	.915	.096	.122	<.001	
	N	53	53	53	53	53

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation – Benton Boulevard

Correlations

		How close do you live to Benton Blvd & 27th Street?	How often do you travel through the intersection mentioned above?	Benton Blvd, Comfort, No Intervention	Benton Blvd, Safety, No Intervention	Benton Blvd, Attractiveness, No Intervention
How close do you live to Benton Blvd & 27th Street?	Pearson Correlation	1	.508**	-.055	.035	-.101
	Sig. (2-tailed)		<.001	.695	.804	.471
	N	53	53	53	53	53
How often do you travel through the intersection mentioned above?	Pearson Correlation	.508**	1	-.083	-.128	-.172
	Sig. (2-tailed)	<.001		.553	.362	.217
	N	53	53	53	53	53
Benton Blvd, Comfort, No Intervention	Pearson Correlation	-.055	-.083	1	.801**	.721**
	Sig. (2-tailed)	.695	.553		<.001	<.001
	N	53	53	53	53	53
Benton Blvd, Safety, No Intervention	Pearson Correlation	.035	-.128	.801**	1	.780**
	Sig. (2-tailed)	.804	.362	<.001		<.001
	N	53	53	53	53	53
Benton Blvd, Attractiveness, No Intervention	Pearson Correlation	-.101	-.172	.721**	.780**	1
	Sig. (2-tailed)	.471	.217	<.001	<.001	
	N	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

Nonparametric Independent-Sample Test – Comfort

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of Benton Blvd, Comfort, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.007	Reject the null hypothesis.
2	The distribution of Benton Blvd, Comfort, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.936	Retain the null hypothesis.
3	The distribution of Benton Blvd, Comfort, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.445	Retain the null hypothesis.
4	The distribution of Benton Blvd, Comfort, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.515	Retain the null hypothesis.
5	The distribution of Brooklyn Ave, Comfort, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.226	Retain the null hypothesis.
6	The distribution of Brooklyn Ave, Comfort, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.641	Retain the null hypothesis.
7	The distribution of Brooklyn Ave, Comfort, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.309	Retain the null hypothesis.
8	The distribution of Brooklyn Ave, Comfort, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.913	Retain the null hypothesis.
9	The distribution of 25th Street, Comfort, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.844	Retain the null hypothesis.
10	The distribution of 25th Street, Comfort, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.515	Retain the null hypothesis.
11	The distribution of 25th Street, Comfort, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.404	Retain the null hypothesis.
12	The distribution of 25th Street, Comfort, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.566	Retain the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Nonparametric Independent-Sample Test – Safety

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of Benton Blvd, Safety, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.424	Retain the null hypothesis.
2	The distribution of Benton Blvd, Safety, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.449	Retain the null hypothesis.
3	The distribution of Benton Blvd, Safety, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.848	Retain the null hypothesis.
4	The distribution of Benton Blvd, Safety, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.770	Retain the null hypothesis.
5	The distribution of Brooklyn Ave, Safety, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.241	Retain the null hypothesis.
6	The distribution of Brooklyn Ave, Safety, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.368	Retain the null hypothesis.
7	The distribution of Brooklyn Ave, Safety, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	1.000	Retain the null hypothesis.
8	The distribution of Brooklyn Ave, Safety, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.937	Retain the null hypothesis.
9	The distribution of 25th Street, Safety, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.061	Retain the null hypothesis.
10	The distribution of 25th Street, Safety, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.214	Retain the null hypothesis.
11	The distribution of 25th Street, Safety, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.476	Retain the null hypothesis.
12	The distribution of 25th Street, Safety, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.152	Retain the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Nonparametric Independent-Sample Test – Attractiveness

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of Benton Blvd, Attractiveness, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.460	Retain the null hypothesis.
2	The distribution of Benton Blvd, Attractiveness, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.523	Retain the null hypothesis.
3	The distribution of Benton Blvd, Attractiveness, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.570	Retain the null hypothesis.
4	The distribution of Benton Blvd, Attractiveness, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.143	Retain the null hypothesis.
5	The distribution of Brooklyn Ave, Attractiveness, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.187	Retain the null hypothesis.
6	The distribution of Brooklyn Ave, Attractiveness, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.284	Retain the null hypothesis.
7	The distribution of Brooklyn Ave, Attractiveness, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.859	Retain the null hypothesis.
8	The distribution of Brooklyn Ave, Attractiveness, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.835	Retain the null hypothesis.
9	The distribution of 25th Street, Attractiveness, Planting Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.929	Retain the null hypothesis.
10	The distribution of 25th Street, Attractiveness, Sidewalk Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.128	Retain the null hypothesis.
11	The distribution of 25th Street, Attractiveness, Bike Lane Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.358	Retain the null hypothesis.
12	The distribution of 25th Street, Attractiveness, No Intervention is the same across categories of What is your gender identity?.	Independent-Samples Mann-Whitney U Test	.040	Reject the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Nonparametric Related-Sample Test – Brooklyn Avenue – Female

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrPCom and FBrUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.206	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrPSaf and FBrUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.248	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrPAtt and FBrUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.004	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrSCom and FBrUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.003	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrSSaf and FBrUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.002	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrSAtt and FBrUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.002	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrBCom and FBrUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.011	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrBSaf and FBrUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.083	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBrBAtt and FBrUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.317	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Nonparametric Related-Sample Test – Brooklyn Avenue – Male

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrPCom and MBrUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrPSaf and MBrUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrPAtt and MBrUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrSCom and MBrUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrSSaf and MBrUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrSAtt and MBrUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrBCom and MBrUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.013	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrBSaf and MBrUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.012	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBrBAtt and MBrUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.005	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Nonparametric Related-Sample Test – 25th Street – Female

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25PCom and F25UCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.248	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25PSaf and F25USaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.059	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25PAtt and F25UAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	<.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25SCom and F25UCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.782	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25SSaf and F25USaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.414	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25SAtt and F25UAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.020	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25BCom and F25UCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.035	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25BSaf and F25USaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.007	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of F25BAtt and F25UAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.011	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Nonparametric Related-Sample Test – 25th Street – Male

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25PCom and M25UCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.002	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25PSaf and M25USaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.005	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25PAtt and M25UAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.002	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25SCom and M25UCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.083	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25SSaf and M25USaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.593	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25SAtt and M25UAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.083	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25BCom and M25UCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.132	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25BSaf and M25USaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.020	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of M25BAtt and M25UAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.071	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Nonparametric Related-Sample Test – Benton Boulevard – Female

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBePCom and FBeUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.001	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBePSaf and FBeUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.071	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBePAtt and FBeUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.020	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBeSCom and FBeUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.739	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBeSSaf and FBeUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	1.000	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBeSAtt and FBeUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.134	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBeBCom and FBeUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.739	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBeBSaf and FBeUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.705	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distributions of FBeBAtt and FBeUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.366	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Nonparametric Related-Sample Test – Benton Boulevard – Male

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBePCom and MBeUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.317	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBePSaf and MBeUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.071	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBePAtt and MBeUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.090	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBeSCom and MBeUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.366	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBeSSaf and MBeUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.248	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBeSAtt and MBeUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.439	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBeBCom and MBeUCom are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	1.000	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBeBSaf and MBeUSaf are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.257	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.^{a,b}	Decision
1	The distributions of MBeBAtt and MBeUAtt are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.180	Retain the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.