# CLASSIFYING DESIRE PATHS UTILIZING A CAMPUS MASTER PLAN STUDY:

# A METHOD FOR RECOGNIZING URBAN DESIGN FLAWS

by

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## Abstract

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FLAWS

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Desire paths are the informal pathways created from the erosional effect of repeated foot traffic. These footpaths come in many shapes and sizes and can occur in spaces where there are no formal pathways for pedestrians. However, in many developed urban and natural areas, desire paths may appear within a landscape that has been intentionally designed. In some perspectives, desire paths can represent user dissatisfaction with the pedestrian landscape, as well as a failure of the urban design process.

Recent literature on this topic considers the environmental, economic, and social impacts caused by desire path occurrences. However, desire paths are a pedestrian's response to the surrounding environment and are a symptom of larger urban planning decisions. According to

Lang (2017), urban design is often treated as cosmetic, when in fact its role in city planning considers the relationship between the networks of public streets and open spaces, as well as the overall quality of the public realm. When the holistic considerations of urban design are neglected in planning efforts, there are unintended consequences that can impact pedestrian experience (Lang, 2017). The objective of this research is to study desire path occurrences on a university campus master plan in the Dallas Fort Worth metroplex. This study includes a record of desire paths, as well as their surrounding environments (street networks and public spaces) at multiple scales, to better understand the planning decisions that led to their creation and how to improve them. This research aims to consider how desire paths can relate to a larger urban design context, rather than simply an isolated landscape design issue.

The methodology used was a combination of descriptive research strategies including qualitative and quantitative methods. The University of North Texas campus master plan was studied as an urban form assimilating open spaces and street networks. The site was selected based on high pedestrian population, desire path occurrences, walkable scale, and similar urban design structure. Qualitative methods included field observation/inventory of desire paths and their surrounding conditions, as well as a modified case study for each campus using the Landscape Architecture Foundation Case Study Guide (2020). Analysis methods drew on mapping techniques, descriptive statistics outlined by Sommer and Sommer (2001), and a typology classification scheme defined by Deming and Swaffield (2011).

The products of this research contain desire path typologies, including a transect and plan diagram of their surrounding conditions. The typology coincides with design implications for landscape architects, urban planners, and designers, to better recognize design flaws during the design process. The significance of this research explores how a stronger understanding of desire paths and pedestrian behavior, can lead to better design quality of urban landscapes.

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# CHAPTER 1: INTRODUCTION

## 1.1 Research Background

Desire paths are the informal pathways that occur from repeated foot traffic in the landscape (Foster and Newell, 2019). These pathways are known by many names including desire lines, foot paths, social trails, elephant paths, and many more (Luckert, 2013). A review of the literature on the topic of desire paths suggests that there are environmental, social, and economic costs that occur when these pathways take form. Recreation ecologists and morphologists study the impacts of foot path erosion on environmentally sensitive areas, and how human pressures should be mitigated. The authors of one study found that erosion from foot traffic in natural environments can cause sediment pollution and affect the health of downstream ecosystems (Ramos-Scharron, et. al. 2014).

Social impacts of desire paths include a decline in the aesthetic value of a landscape, as well as threatened pedestrian safety from tripping on uneven ground (Foster & Newell, 2019). According to survey data of pedestrians, certain desire paths have the potential to reduce the perceived sense of pedestrian safety at night (Coutts, et al, 2019).

Finally, there are maintenance costs of materials and labor for either obstructing the pathway or paving the desire paths into a formal pathway. According to Kullhavy, et al. (2018), facilities or other grounds management professionals typically employ four solutions to mitigate desire paths; physical barriers, vegetated barriers, formalizing a new sidewalk, or consolidating constructed sidewalks based on desire paths.

Still, other research into the topic of desire paths notes their positive character and ability

to enhance pedestrian mobility. Urban design theorists such as Furman (2012), and Smith and Walters (2018) discuss the development of vehicle-centric environments and how desire paths are a method for pedestrians to expand their ownership of the city. While desire paths are dissected for their ability to be empowering for citizens or as examples of social deviancy, their potential to provide insight for designers to improve the quality of the human landscape has been explored but not sufficiently defined.

## 1.2 Problem Statement

Previous research into the topic of desire paths is focused on how to best learn from them to improve pedestrian infrastructure. However, many of these studies are exploratory, focus on the larger urban scale, and offer solutions to mitigate desire paths only after they are made. Desire paths have environmental, social, and economic costs and there is still a lack of research that emphasizes how designers could understand desire paths at the urban design scale as well as the landscape design scale. It could be highly beneficial to designers to then recognize flaws during the design process, and then to prevent desire paths from occurring in the landscape.

Literature in the landscape architecture profession contains tools in the form of foundational design concepts, including design form typologies. Design Form, or the spatial organization of landscape elements, could be used to mitigate desire paths by facilitating better pedestrian movement (Booth, 2011). Some of these design form typologies are even modeled after desire path forms themselves. However, despite the comprehensive design and site analysis tools available to designers, desire paths still occur frequently in urban environments. According to Marcus and Francis in their book *People Places* second edition, (1998) the texts on campus

planning prioritize building structure aesthetics, while there is little written on the design of open spaces.

> Frequently ignored in the texts on campus planning and design, these outdoor spaces - their use of circulation, study, relaxation, and aesthetic pleasure - deserve far greater attention than they have yet received… Though potentially useful for formal ideas to the architect of a new building, such books contain little that is helpful to the landscape architect or any professional concerned with the use and design of spaces between buildings. (Francis and Marcus, 1998; p.175).

According to Holmes, Huynh & Millard-Ball (2018), there is a distinct lack of research regarding planning for pedestrian circulation and found that the walkability, wayfinding, and overall mobility for pedestrians suffers in college campuses across North America. Desire paths are just one symptom resulting from the poor design quality of outdoor landscapes. This phenomenon occurring on campuses illustrates the need for the improved design quality of open spaces at the landscape scale.

Desire paths could also reveal a need for design improvement at the urban design scale when they enhance mobility for pedestrians to traverse large distances in place of formal pedestrian infrastructure (Foster & Newell, 2019). In cases where desire paths impact pedestrians at the urban design scale, their occurrence can be explained through poor transportation design and planning. Though the urban environment is densely populated, its infrastructure is not always pedestrian-centric, but rather tends to favor automotive transportation (Furman, 2012). According to Lang (2011), when urban planning disregards urban design due to a lack of perceived value, there is the potential for unintended consequences. In the case of Detroit, Michigan, desire paths are often the only option for pedestrians to be able to traverse the city

where there is a lack of sidewalks and formal infrastructure (Foster and Newell, 2019). Desire paths have also been noted to improve walkability in cities where vehicular transportation dominates development growth (Smith and Walters, 2018). In both scenarios, pedestrians could benefit from improved urban design quality that increases mobility as well as safety. Desire paths are a physical response to the conditions in the surrounding landscape, and while they have been studied for their impact and potential, they can be better utilized for improving the design of outdoor spaces.

### 1.3 Purpose Statement

The purpose of this research is to understand desire paths through a lens of landscape design and their relation to the larger urban design systems of open spaces and street networks. This is done by studying where desire paths occur in relation to the surrounding landscape types. The goal of this research is to develop and classify common desire paths into recognizable typologies and then to provide clear landscape design recommendations that can be used to improve the quality of pedestrian experiences at the street scale and ultimately to improve connected street networks. The desire path typology in this research is a multi-functional tool that could be used both in predicting desire path locations in new landscape projects, as well as providing solutions for desire paths in existing landscapes. According to Lang (2011), typologies are a reliable tool for urban designers and planners who often utilize classifications of principles guidelines for urban design projects.

This research synthesizes site analysis methods, design concepts, pedestrian behavior, and survey information to develop a new tool geared towards designers. The analysis methods

used in this thesis can be duplicated to offer landscape architects a better understanding of a project site, while the findings can be built upon and developed as desire paths are further understood.

### 1.4 Research Objectives

This research aims to take an in-depth inventory of desire path occurrences in the urban landscape. The University of North Texas is used as a study site and as a substitute for an urban city. Universities and other forms of institutions are pedestrian-centric environments, and essentially microscale versions of the urban city. The density of college campus infrastructure, and high frequency of desire path occurrences, also allows for an efficient way to collect much more data.

Inventory data on the physical characteristics of desire paths as well as their surrounding landscape elements were mapped and analyzed to understand the commonalities between their occurrences. The collected data and secondary data from the literature review were then synthesized to create a desire path typology geared towards designers. The typology contains desire paths defined by pedestrian motivations for their use, as well as the common landscape design flaws that encourage their occurrence. Designers could then refer to this typology during the site design process and potentially identify design conflicts.

A secondary objective of this research was to develop clear design implications tailored to each desire path typology. The goal of this objective is to provide simple solutions that could be applied after designers recognize potential landscape design conflicts. This research combined findings from social surveys of designers, maintenance professionals, as well as observation data

to develop in-depth design implications. These design solutions are developed to not impact the unique qualities of an individual design, while still enhancing pedestrian experience within an open space or streetscape.

Lastly, the third objective of this research was to explore the relationship that desire paths have at the landscape scale as well as the urban design scale. Much of the research on desire paths differentiates the phenomenon based on its local impacts and response to a landscape design. This thesis aims to explain how designers (landscape architects, urban planners, urban designers) could be better informed and aware of the impact of their designs at multiple scales. through inventory and analysis of desire paths in open spaces and street networks.

### 1.5 Research Questions

The questions posed by this study are an attempt to address the wishes of pedestrians to move freely within their built environment, and how urban planners and designers can best learn from this desire to create more pedestrian-centric landscapes. The research questions are also informed by the gap in the literature on the topic of desire paths.

1. Are desire paths isolated incidents in a landscape design, or a symptom of larger urban design and planning decisions?
2. What landscape design elements and patterns contribute to desire path occurrences in urban environments?
3. How can desire paths be utilized and understood to help designers identify and resolve potential conflicts in future design proposals?

## 1.6 Definition of Terms

**Circulation** often refers to the movement of some object or system, in this paper, it refers specifically to the movement of people through a site.

**Codified** is a term that means that an object or policy is a part of an agreed-upon standard. Often referring to infrastructure and development standards (Couttes, et. al., 2019).

**Dallas/Fort Worth Area or Dallas/Fort Worth Metroplex (DFW)** is referring to the large urban and suburban sprawl of the greater North Central Texas Council of Governments (NCTCOG) (US Census Bureau, 2017).

**Foundational Design Concepts** are techniques and devices used to create space from landscape elements and have been passed down as working knowledge from academic and professional circles to students of design disciplines (Booth, 2011).

**Design Guidelines** is a term to refer to how a specific concept or element can be best utilized based on evidence and precedence (Booth, 2011).

**Desire paths** are informal pathways created in the landscape by the erosional effect of repeated foot traffic. Often, they arise from the pedestrian's desire for more efficient routes to get from point A to B. (Foster & Newell, 2019).

**Ethnography** type of qualitative research involving the description and study of specific people and places (Sommer and Sommer, 2001).

**Form** is one of many *design concepts* that refers to the spatial organization of a landscape based on design elements such as pathways, structures, and vegetation, across vertical planes from the ground to overhead. The form is considered the foundation for space in the landscape because it is

the armature for framing all other elements. Form is a combination of primary shapes and geometries such as squares, circles, ovals, etc. (Booth, 2011).

**Landscape Morphology** are seven parts that make up every designed landscape space. These seven parts include Landscape Fabric, Spaces, Paths, Edges, Foci, Thresholds, and Details. Each of those parts is comprised of individual landscape elements (Dee, 2001).

**Landscape Elements** are the physical materials with which landscape designers assemble and arrange within a space. The four broad categories of landscape elements are topography, vegetation, water, and built structures. (Dee, 2001).

**North Central Texas Council of Governments (NCTCOG)** A governmental grouping of 16 individual counties of the North Texas region.

**Post-Path Mitigation Methods** is the umbrella category for methods that mitigate and repair desire path damage after it is made in the landscape. These methods include obstructing the desire paths with physical barriers as well as adding the desire path into the formal path network by paving it.

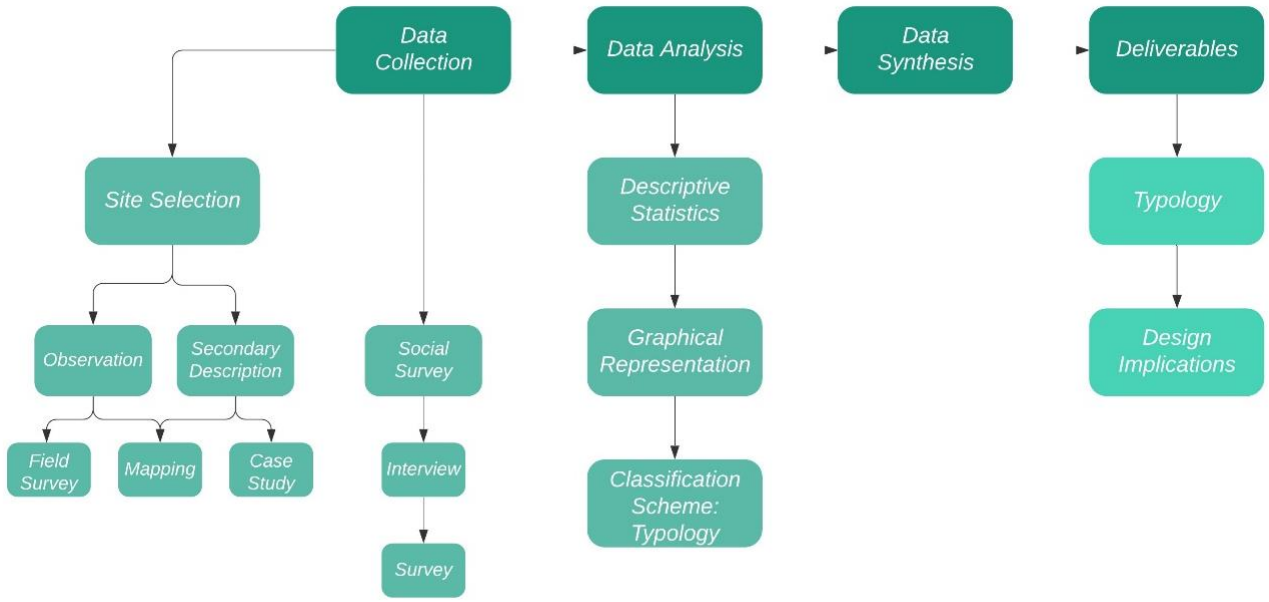
**Pre-Path Mitigation Methods** is a term describing the category for methods that mitigate desire path occurrences before they occur in the landscape. Typically, they are predictive measures made by designers, planners, and transportation experts in the site planning process.

### 1.7 Research Methods

This research examined multiple aspects of desire paths, pedestrian movement, and design principles, and required a multi-method approach to be achieved (Sommer & Sommer, 2001). The site selection process was a sampling of the largest university (by surface area) in the

DFW Metroplex. A purposive sampling approach was used to increase the potential for more desire path data to be collected by sampling from a desire population (Sommer and Sommer, 2001). Data collection methods in this thesis follow a theory-building model by combining secondary description, multiple observation strategies, as well as a social survey to enhance and strengthen the evidence and findings resulting from this research (Deming & Swaffield, 2011). Lastly, analysis methods include strategies defined by Deming & Swaffield (2011), such as graphical representation through mapping, descriptive statistics, and a typology classification scheme for desire paths, to describe and organize the data collected. A detailed description of the research methods utilized in this thesis is illustrated below (Figure 1).

*Figure 1- Methodology Flow Chart*




## 1.8 Significance and Limitations

The significance of this research is the development of a new tool for designers to

understand how to improve the quality of outdoor landscapes. The desire path typology can be used to identify circulation issues during the site design process. However, not only does this research have the potential to identify design conflicts but also offer simple design solutions that can be applied to some types of landscape projects at multiple scales.

While the findings of this research fill a gap in the literature for designers, there are some limitations to the extent of this thesis. One limitation exists in the study location defined for this research. While university campuses are similar to cities, they are a specific type of urban design project known as precincts and are not perfect substitutes (Lang, 2011). Desire paths studied in this research from the University of North Texas campus may not reveal every type of desire path that exists in urban environments. Additionally, conclusions drawn about urban design quality in this study are conditional to campuses and cannot be generalizable to all urban design scenarios in cities.

Purposive sampling poses another limitation in the site selection process. While it offers a strategy for selecting a site with desired characteristics, it is not a representative sampling process (Sommer and Sommer, 2001). The University of North Texas, Denton, Texas was selected as a study site because it is the largest University in the DFW area by surface area and has the potential for containing more desire paths. However, the data is circumstantial to UNT and some conclusions may not generalizable.

Lastly, while the design implications are tailored to specific desire path typologies and are bolstered by an evidence-based multi-method approach, they are untested in the field through a designed experiment. Each implication for design solutions should be taken into considerations for design projects because all landscape sites are unique and require a unique set of analyses to

be responsibly designed. The typologies and design implications presented in this thesis are only some of the possible design solutions. The typology developed in this thesis is not an exhaustive list of possible desire paths but can be built upon with future research.

## 1.9 Chapter Summary

Chapter One provides the organization of the central research questions and outlines the purpose, objectives, and methods to fulfill those goals. The purpose of this study is the development of a tool for designers to understand desire paths as recognizable flaws in proposed landscape and urban designs. The findings from this research also outline design implications to improve the quality of pedestrian spaces and prevent the need for desire paths in open spaces and streetscapes at multiple scales.

While desire paths have been dissected in the literature for their ability to improve pedestrian connections they come at environmental, social, and economic costs for stakeholders. The multi-method approach in this study is described to illustrate how desire paths can be better understood through a lens of design improvement.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 Introduction

The goal of this literature review chapter is to examine previous studies on the topic of desire paths and to synthesize the implications and findings into the field of landscape architecture. This review focuses on current perspectives, impacts, and common mitigation methods for desire paths. Lastly, two case studies in which desire paths have been the focus in landscape design, are examined concerning the topics in the literature. The gaps in the research are compared and inform the methodology for this thesis.

## 2.2 What are Desire Paths? – The Many Names of Desire

Desire paths are the informal pedestrian trails created by the erosional effects of repeated foot traffic. These pathways are known by many names and studied by nearly as many disciplines. Desire paths or desire lines are sometimes called cow paths, social trails, elephant trails, or simply foot paths (Luckert, 2013). Some of the oldest examples of desire paths exist in Europe and the Middle East, known as “Holloways”, where these semi-tunnels were formed over hundreds of years of footpath erosion (Kohlstedt, 2016). These pathways are created as a response to the state of the environment at a particular time, and the success of any changes to encourage or to mitigate the use of a desire path is considered unpredictable (Kohlstedt, 2016).

## 2.3 The Perspectives of Desire

The motivation for forming desire paths seems to be the result of the different needs of pedestrians in the landscape. Efficiency, deviancy, exploration, and forging new connections where there are none, are all possible reasons for why a particular desire path exists. Planners, architects, and other urban designers may either view a desire path as a disregard for

rationalizing urban spaces or as a novel efficiency (Foster & Newell, 2019). However, "usability designers", aim to take advantage of the concept to create more appealing and pedestrian-friendly designs (Kohlstedt, 2016). In every case, whether perceived as human ingenuity or deviancy, desire paths are a response to the landscape with an outstanding geographical physical feature that can be mapped and learned from (Luckert, 2013). The varying perspectives in the literature range based on the discipline studying the phenomenon and these perspectives are analyzed in the following sections.

### 2.3.1 Desire Paths as Citizen Empowerment

*Detroit's lines of desire: Footpaths and vacant land in the motor city*, Foster, and Newell (2019) is one of the few articles that attempts to quantify the social impact desire paths have by recording their physical character at the city scale. The authors also note the differences in methodology and perspective that different disciplines have towards desire paths and attempt to bridge the gap through empirical data. According to Foster and Newell's findings, urban planners tend to view desire paths and human travel behavior as a phenomenon to be learned from. Urban theorists and cultural geographers tend to view the desire paths as a tool for pedestrians to resist strict urban development that attempts to control space (Foster & Newell, 2019).

Smith and Walters (2017) note that the concept of "defensive architecture" is an example illustrating the control of public urban spaces into an increasingly transactional and exclusive one. This concept is often used in urban environments to reduce the numbers of homeless people in public spaces through strategic design interventions. The impacts of defensive architecture in tandem with urban policies have the potential to create a disenfranchised population (Smith & Walters, 2017). According to Smith and Walters "The governance of these public spaces appears

in multiple ways through mechanisms such as zero-tolerance policing, anti-social conduct by-laws, privatization, pervasive surveillance, and exclusionary design" (2018; p.2982). The authors suggest that desire paths could be one tool for disenfranchised populations to resist exclusionary urban development, by forging new paths to create permeable fringe spaces in urban environments.

In the case of the city of Detroit, Michigan, Foster & Newell (2019) found that the disenfranchised population does exist in the impoverished minority demographics of the city. Detroit faces economic challenges and as a result, their city infrastructure lacks basic pedestrian connectivity in the form of sidewalks and roads. The majority low-income population was found to use the extensive 150-mile desire path network to travel throughout the city and circumvent their lack of vehicle ownership, a finding that begins lending evidence to the empowering perspective of desire paths (Foster & Newell, 2019; p. 262).

According to Furman (2012), desire paths could potentially promote the walkability of a city, by contributing to what he calls the "Urban Filament" (p. 25). Increasing the walkability of the city is beneficial in motivating people to travel on foot, for a healthier city population (Furman, 2012). Like Smith and Walters (2017), Furman notes that public spaces may tend to demotivate public exploration of urban environments and favor vehicular traffic (2012). Desire paths/urban filaments are again, listed as a tool for breaking down boundaries of public spaces and inspiring walkability within an increasingly vehicular urban entity.

Furman (2012), states that the consequences of poorly designed pedestrian spaces are potentially harmful to public health and that using desire paths in terms of design as well as user experience could be a potential solution:

> "Urban Filaments are the physical manifestation of desire lines… If we believe cities are both destinations and events, we will need to revisit the staid pattern of street face design… Otherwise,

> with automobile ownership growing, the pedestrian experience will continue to be turned into relic spaces, cautioning whose only chance of survival is in enclosed private shopping and entertainment venues (pp. 31-32)."

Desire paths have been theorized to empower pedestrians, and with recent studies, they are also empirically shown in certain urban situations based on the research from Foster and Newell (2019).

### 2.3.2 Desire Paths as Social Deviancy

The planning of urban spaces requires some level of rationalization, prioritization, and function. Whether the urban landscape is becoming more commercial according to Smith and Walters (2017), or vehicle-centric (Furman, 2012), desire paths are not rational and serve the function of deviating from the codified pathways.

Designers and urban planners are not the only professions interested in manipulating space for pedestrians. Unlike Smith and Walters (2017), where defensive architecture is observed as a strategy to exclude certain demographics from spaces, there is a form of defensive architecture that has been observed to manipulate pedestrian flow for security planning in public spaces. According to the research done by Nikolopoulou, Martin & Dalton (2016), social interaction and the public use of space is at risk when extensive obstructions are presented in the landscape. This is especially true during emergencies when large crowds of panicked people need to exit an area quickly and safely. Planning safe, formal pathways that indicate direction is critical during emergencies such as terrorist acts, and knowledge in keeping pedestrians on the formal path helps prevent unnecessary risk or injury (Nikolopoulou, et al., 2016).

The authors provide evidence through experimentation, that engaging, non-obstructive interventions, can alter the pedestrian flow and engage a positive emotional state without

dampening the public social experience. “Such playfulness can be regarded as a key strength in amplifying desired disruption effects in public spaces” (Nikolopoulou, et. al., p.101, 2016). After experimenting with what could be described as multiple types of public art pieces, the authors found that altering pedestrian flow could be achieved without the use of obstructive objects such as fences or walls.

A result of designing playful interventions in public spaces was what Nikolopoulou, et. al. (2016) described as “zones of attraction and exclusion” (p.84). These zones pushed/pulled pedestrians through space as the desired effect of the interventions used in the experiment. In the case of Nikolopooulou et al. (2016), interventions experimented with included, floor tape, mirrors, text, and digital screens. Landscape architects and other designers have used similar interventions with substitutes in things like paving patterns, sculptures, landmarks, water features, overhead structures, and ornamental planting patterns. (Booth, 1983).

### 2.4 The Impacts of Desire Paths

Desire paths are both citizen empowerment and at the same time, a form of social deviancy (Luckert, 2013). The two perspectives on the topic can be debated, however, the impacts of desire paths remain the same. Apparent positive impacts are obvious geographical connectivity (Foster & Newell, 2017), as well as increased connectivity that pedestrians gain with nature (Fuda, et. al., 2015). The literature also discusses the negative impacts of informal foot paths and is synthesized in this paper into two distinct categories. Environmental and social costs associated with desire paths, and other unsanctioned footpaths, in the following sections.

#### 2.4.1 Environmental Impacts

unsanctioned foot traffic can go by many names, and in the case of erosion and

environmental studies, Robert-Scharron, et. al. (2014) label this form of desire paths as a type of "Anthropogenic disturbance" (p. 1764). A result of erosion is the movement of terrestrial sediment towards bodies of water, and with that, a potential pollution source.

According to Robert-Scharron et al., unpaved footpaths have the potential to erode and deposit three to 120 times more sediment in downstream marine ecosystems, than normal background levels (2014). Sediment pollution, depending on the severity, has the potential to impact downstream wildlife by disturbing water and habitat quality (Robert-Scharron, et al., 2014). This study is very specific in its context when measuring the impact of unpaved foot paths. More specifically the environmental conditions in the study were in the dry-subtropical climate of the Caribbean, and the marine ecology in danger from sediment pollution was the adjacent coral reefs. A site-specific study of erosion would be necessary to evaluate the whole impact of footpath erosion on any downstream water resources. This is due to the varying geographic conditions of climate, latitude, organic matter, slope relief, parent material, and terrain (Robert-Sharron et al., 2014). For this thesis, the environmental impact of erosion and sediment pollution of desire paths can only be speculated for the Dallas-Fort Worth (DFW) area. However, the literature offers methodology and findings that can offer clearer insight into what the potential sediment pollution impacts could be in urban areas.

Research towards footpath erosion typically observes the impact of sediment towards off-site, downstream ecosystems. One study from Rodway-Dyer & Walling (2010), used sediment catchments in protected nature parks to estimate erosion rates from foot traffic and found that the literature surrounding footpath erosion is mostly on the degradation of the environment by soil compaction, incision, and sediment pollution due to short-term erosion. These studies are typically done in natural areas or environmentally protected spaces for purposes in the field of

recreation ecology. The consensus among researchers is that increased pedestrian pressure causes higher erosion rates and sediment pollution. (Rodway-Dyer & Walling, 2010).

Drawing on research from recreation ecology, and empirical data from studies like Foster and Newell (2019), it is possible to speculate as to the potential for the environmental damage that could be caused by desire paths in urban areas such as the DFW Metroplex. This impact in urban environments could be argued to be equal to, or greater than the impact from desire paths in natural areas.

Urban sediment pollution sources were measured in one study, and include vehicle exhaust emissions, heavy metals, hydrocarbons, and fertilizers (Morgan, et al. 2017). The authors found that sediment builds up in urban environments during dry periods, collecting pollution loads, and wash into local streams with stormwater during rain events. The authors speculated the sediment to have come from all over the urban catchment zone, and that the finer the sediment, the higher potential it had to carry more chemical pollution with it (Morgan, et al. 2017). In this study, Morgan et al. (2017), found that sediment deposition rates resulting from the study were consistent with studies done in urban catchments elsewhere. In other words, the sediment from erosion on desire paths is also likely to contribute as a source for sediment deposition and pollution delivery to local watersheds.

### 2.4.2 Social Impacts of Desire Paths

Other aspects of desire paths that get little attention from urban theorists, but are of particular interest to landscape architecture, is the pedestrian perception of safety when using these paths. In the landscape architecture discipline, “sense of safety” is considered a design concept related to user experience, and pathways are often used as a design element that encourages safe, aesthetic movements (Booth, 1983). According to interviews conducted in the

city of Detroit by Foster and Newell (2019), citizens who reported avoiding desire paths cited safety and aesthetic concerns. In the large-scale city of Detroit, desire paths were often created through vacant land, where trespassing, unknown actors, or other dangers could cause personal threats to those unsuspecting.

At a smaller scale, desire paths were studied by Florida State University researchers by interviewing the users of those paths to study their travel behavior (Coutts, et al. 2019). This study was conducted to illustrate how observing pedestrian behavior when using desire paths could be a useful tool to design more accommodating pedestrian infrastructure.

When surveyed, only 25% of respondents indicated a willingness to traverse a particular desire path with low visibility at night (Coutts et al. 2019). In the study conducted by Coutts, et. al, the primary reason noted for taking desire paths over formal pathways was for expedient travel, but not at the expense of user safety at night (2019). Visibility is one part of a pedestrian's perception of their safety. The uneven ground of desire paths could cause tripping and risk of injury, while densely vegetated areas could provide habitat for snakes or other animals (Coutts, et al. 2019). Coutts et al. make note that the designers and planners can take cues from pedestrian behavior and install infrastructure that is more amenable to the efficient route but is critical of some approaches that designers use to develop pedestrian infrastructure. "…design professionals continue to produce pedestrian infrastructure networks that conform to some neat geometric pattern, observable only to a hovering drone" (2019, p.8).

Other problems inhibiting campus outdoor use are the crime or the anticipated fear of crime. According to Marcus and Francis (1998), interviews with sampled students from various universities revealed that students believed the most unsafe areas on campus were heavily planted areas, dense landscaping, and infrequently used pathways. The places cited as the most

unsafe for students due to the higher potential for crime are also consistent with some desire path locations. Crime and fear of crime increase in places where the design of the landscaping creates hiding places for criminals where there is a lack of visibility. However, when a separate sample of students was asked to describe improvements to these areas, the most frequently described improvement was better lighting, while there were no suggestions to remove the vegetation (Marcus and Francis, 1998). According to Marcus and Francis (2018), a potential reason for this phenomenon is the same reason people are most likely to use desire paths, which is they are drawn to natural elements.

While they are at times dangerous to navigate, desire paths seem to retain an attractive quality for people regardless of the risk to their safety. These mentioned social issues remain true across any landscape, not just within campus environments.

### 2.4.3 Other Unintended Consequences

While desire paths have a direct consequence to the environment, pedestrians' sense of safety, and aesthetic value of the landscape, they are only one possible result of design flaws. According to Lang (2011), urban planning projects that decline the use of urban design guidelines often result in unintended consequences. The disciplines responsible for city development are similar in objective but different in professional processes and design emphasis (Figure 2).

*Figure 2 - Urban Design Relationship Diagram*

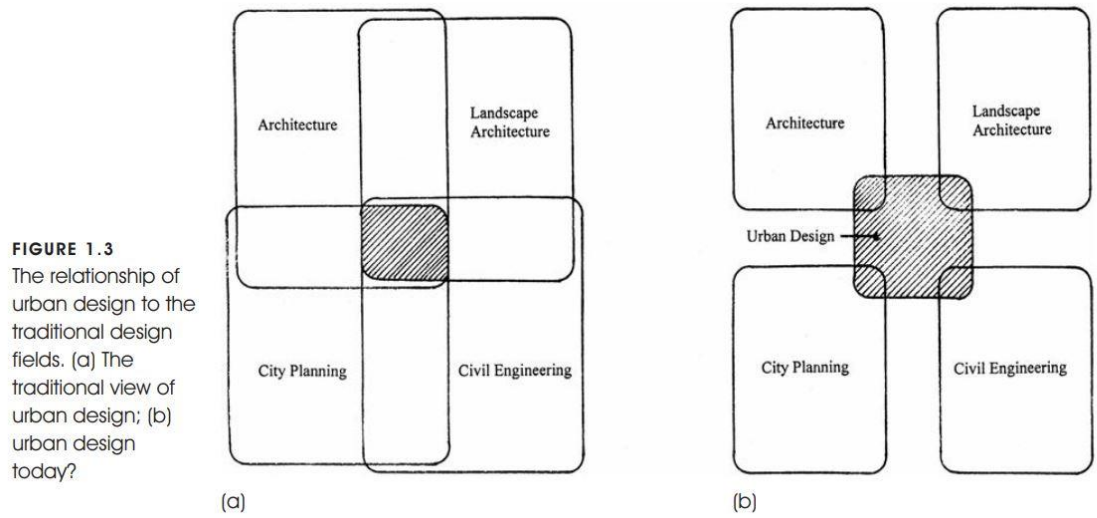


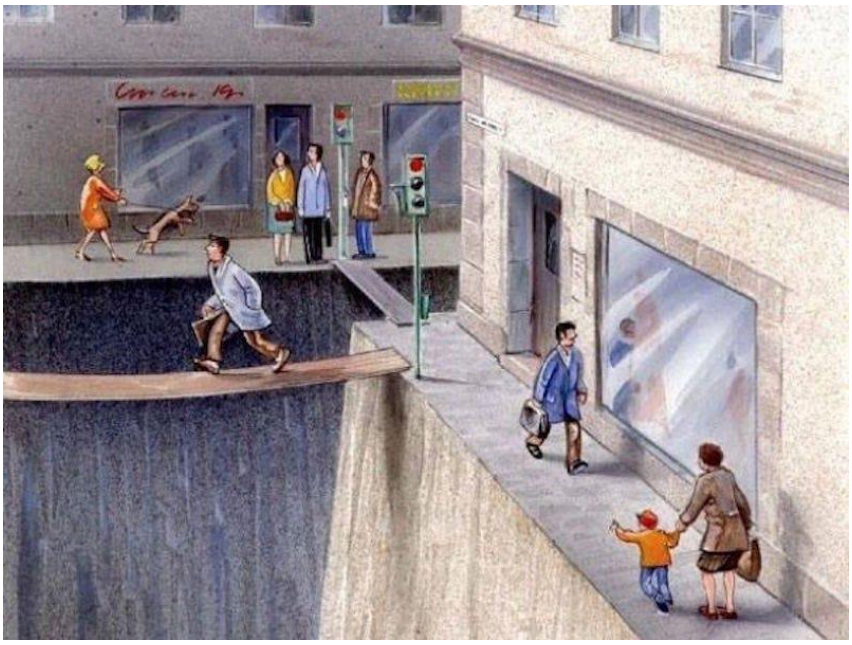

**FIGURE 1.3**
The relationship of urban design to the traditional design fields. (a) The traditional view of urban design; (b) urban design today?

*Source: Lang, (2017)*

In some city development cases, urban design is observed as an expensive luxury contributing only to aesthetic quality and can be disregarded when calculating costs of planning projects (Lang, 2011). However, it is the combined relationship of the planning professions that provides a holistic urban environment free of unintended consequences of poor design. In one study, researchers found that while transportation planning typically engineers safe sidewalks, the lack of place-making in their design directly reduces the overall quality of the pedestrian experience (Steven & Salmon, 2019). According to Steven & Salmon (2019), better pedestrian paths (sidewalks) come from using the local environment/context to inform sidewalk design and creating opportunities for place-making attachment for pedestrians. The authors cite that in many transportation planning scenarios, the engineering of sidewalks often leaves out design guidelines for a sense of place-making, while urban design relies heavily on such principles without practical evidence (Steven & Salmon, 2019). The pedestrian experience of both safe pathways, and experiential pathways, can be achieved with a strong relationship between design

guidelines and evidence-based methodology. The result of an imbalance in urban design could create unintended consequences such as the strictly controlled urban environment noted by Smith & Walters (2018) (Figure 3).

*Figure 3 - Commissioned Art for the Swedish Road Administration Illustrating Vehicular Dominated Cities*



*Source: Karl Jilg. Swedish Road Administration*

## 2.5 Urban Design and Urban Desire Paths

According to Lang (2011), the goal of urban design is to create a unified vision for an urban entity given the resources available. Urban design projects examine the context of larger systems including open spaces and existing and proposed street networks to develop a consistent character. The implications of urban design quality are examined in this thesis due to its ability to impact people, their behavior, and their way of life. Depending on how urban design projects are managed, the outcome could result in impressive geometric qualities, that lack essential elements to support ecosystem services (Lang, 2011). This relationship to design and its potential for encouraging desire paths at the urban scale is examined in the following sections.

### 2.5.1 Street Network Design

Transportation Planning is mostly thought of in terms of vehicular transportation, however, the street network system is an influencer of pedestrian wayfinding and travel behavior. According to Li & Tsukaguchi (2005), pedestrian route behavior is impacted directly by route distance, and that pedestrians are willing to travel only so far on foot. The authors note that route distance is effectively determined by the design of the street network topology which can vary depending on factors such as network grid degree, the total number of intersections, and network density (Li & Tsukaguchi, 2005). When the street network design impacts distance of travel, pedestrians make decisions on their travel behavior and their route options increase depending on the street topology (Li & Tsukaguchi, 2005) (Figure 4).

*Figure 4 - Route Options based on Origin-Destination.*

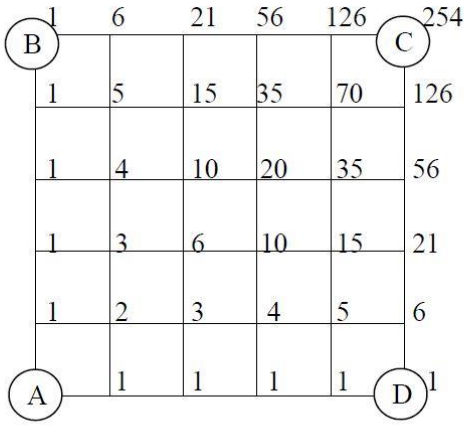


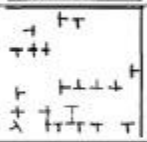
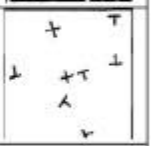

Figure 7 Alternative route numbers from A to other destinations

*Source: Li & Tsukaguchi (2005)*

Street topology has been classified in many ways including by geometric qualities, intersection characteristics, or urban design project type (Figure 5). According to Ben-Joseph & Southward (2003), the topology and design quality of the street network not only determines pedestrian travel behavior, but also the quality of pedestrian experience. When the street network

is designed as part of the seams of community life rather than as a boundary, the quality of the pedestrian network improves (Ben-Joseph & Southward, 2003).

*Figure 5 - Street Network Topologies*

| | Gridiron (c.1900) | Fragmented Parallel (c. 1950) | Warped Parallel (c. 1960) | Loops and Lollipops (c. 1970) | Lollipops on a Stick (c. 1980) |
|---|---|---|---|---|---|
| Street patterns |  |  |  |  |  |
| Intersections |  |  |  |  |  |
| Lineal Feet of Streets | 20800 | 19000 | 16500 | 15300 | 15600 |
| # of Blocks | 26 | 19 | 14 | 12 | 8 |
| # of Intersections | 26 | 22 | 14 | 12 | 8 |
| # of Access Points | 19 | 10 | 7 | 6 | 8 |
| # of Loops & Cul-de-Sacs | 0 | 1 | 2 | 8 | 24 |
| Variable Name | Netp1 | Netp2 | Netp3 | Netp4 | Net5 |

*Source: Ben-Joseph & Southward (2003)*

### 2.5.2 Open Space Design

Just as the design of a street network can impact pedestrian travel behavior, the spatial design of open spaces does as well. Catherine Dee is a senior lecturer in Landscape Design, at the University of Sheffield, UK. In her book *Form and Fabric in Landscape Architecture,* an entire chapter is dedicated to the construct of paths and the variety of design elements associated with them. Dee describes paths as having a "…key role, they are considered – together with spaces – part of the fundamental structure of landscapes" (Dee, 2001; p. 83). The author notes that landscape architects have the responsibility of creating connections in the landscape for pedestrians and that this connection facilitates their direct experience with their environment.

Like most landscape architects, Dee is aware of the phenomenon of desire paths that form in the landscape. Due to that responsibility of creating an experience for pedestrians, Dee urges

landscape architects to be sensitive to their needs. She outlines how paths can create those experiences when different path typologies are used in combination with vegetation, topography, water, and physical forms to keep people engaged with the landscape (Dee, 2001).

Francis and Marcus in their book, *People Places,* refer to desire paths as "shortcuts" and make the distinction between desire paths that are the fault of the "lazy" pedestrians and those that are created from "the result of poor design" (Francis and Marcus, 1998; p. 197). They also cite findings consistent with the social issues discussed by Coutts et al (2019), where desire paths create problems at night and with muddy terrain yet are ultimately favored by pedestrians for their efficiency and natural feel.

Stevens and Salmon (2015) also found that the various elements surrounding the footpaths contributed to the actual use of the pathway. Essentially everyday objects like awnings, trees, sculptures, light poles, garden beds, etc.… influence pedestrian movements because they contribute to the atmosphere of the footpath (sidewalk) environment and thus how they are used (Stevens and Salmon, pp. 343-346, 2015).

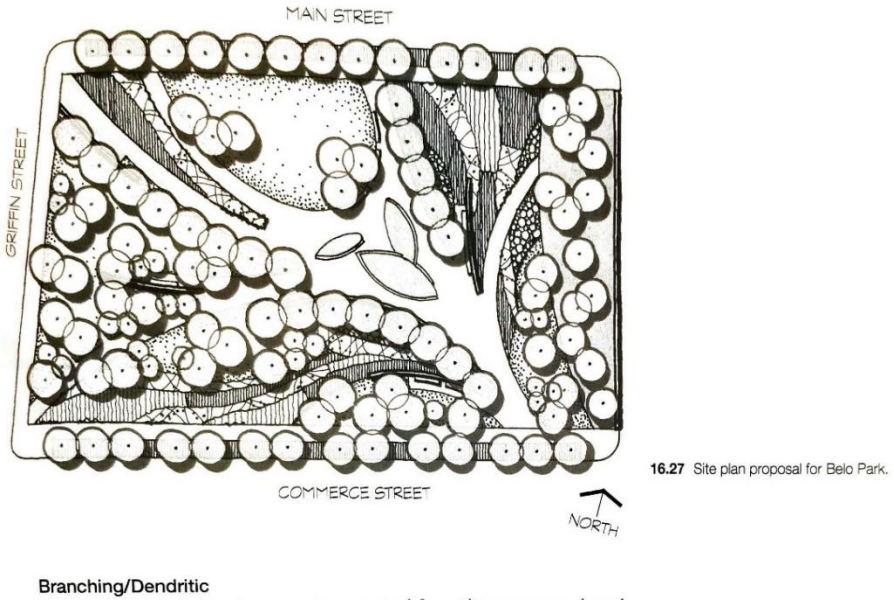
These various elements and their impact on pedestrian behavior are confirmed in landscape architecture literature when considering the placement and use of these design elements. According to Zacharias (2001), laypeople can interpret and react differently to these design elements, however "people notice differences in design and layout and can even express preferences about these aspects of the environment" (pp.4-5). Partly what controls pedestrian movements are the many micro-decisions from pedestrians in response to local stimulus, and this could explain where exactly desire lines emerge within the formalized network of pathways. The control and manipulation of these design elements are part of the foundational design concepts in landscape architecture.

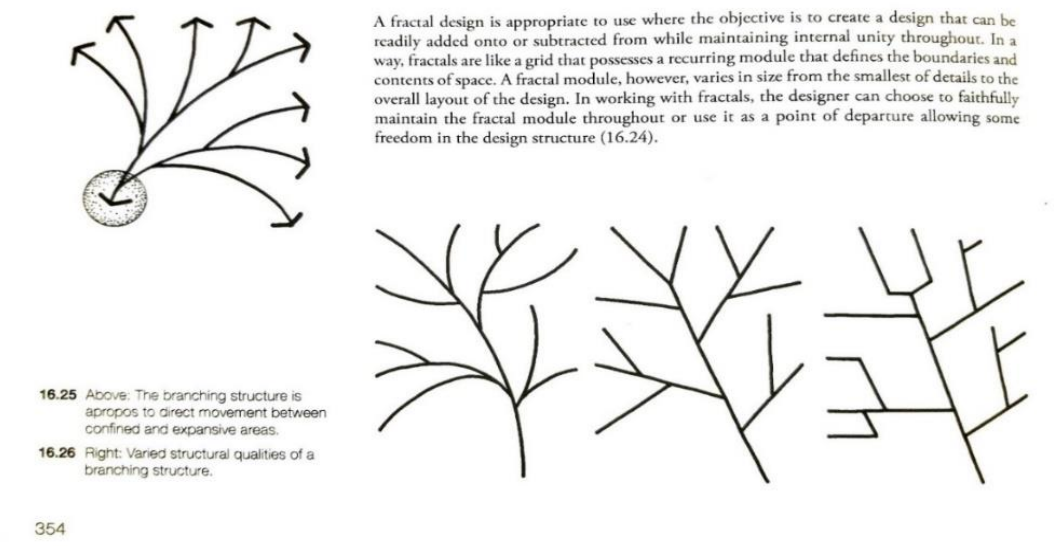
Norman K. Booth describes desire paths as random and not aligned compositionally, mostly appearing in urban landscapes (Booth, 2011). Like Dee, Booth outlines design elements that facilitate pedestrian movements for sites with specific purposes such as campuses, urban plazas, or parks. However, with Booth, a deeper focus on the spatial composition of the landscape is noted concerning circulation patterns. Unlike Dee (2001) and Francis (1998), Booth (2011) focuses on the form or the spatial organization of elements in the landscape. These forms are common geometries found in landscape design, such as radial, angular, and organic forms. In his book, *The Foundations of Landscape Architecture* Booth (2011) describes over 14 different form typologies, each with its own recommended landscape uses.

Three form typologies described by Booth (2011) specifically facilitate better pedestrian movement and even are modeled after desire paths (Figure 6).

1. The Diagonal (An Angular Form)
2. The Triangle (An Angular Form)
3. The Branching/Dendritic (An Organic Form)

*Figure 6 - Dendritic Design Form*





A fractal design is appropriate to use where the objective is to create a design that can be readily added onto or subtracted from while maintaining internal unity throughout. In a way, fractals are like a grid that possesses a recurring module that defines the boundaries and contents of space. A fractal module, however, varies in size from the smallest of details to the overall layout of the design. In working with fractals, the designer can choose to faithfully maintain the fractal module throughout or use it as a point of departure allowing some freedom in the design structure (16.24).

**16.25** Above: The branching structure is apropos to direct movement between confined and expansive areas.

**16.26** Right: Varied structural qualities of a branching structure.

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*Source: Booth (2011).*

The Woolwich Squares redevelopment of the General Gordon Square in Woolwich, South London by landscape architects Gustafson Porter & Bowman, is one real-world example of how to design form dramatically impacts pedestrian circulation According to Dorato & Lobosco (2017), Gustafson Porter & Bowman used an innovative analytical process that illustrates how well-informed design could eliminate desire paths.

The 2.5-acre project site is surrounded by residential and commercial land use at the center of a dense urban area and needed redevelopment due to a large amount of foot traffic and lack of pedestrian connection to local amenities and retail opportunities (Landezine, 2014). According to the Landezine online magazine, the landscape architects, Gustafson Porter & Bowman, used pedestrian movement studies to identify key patterns that ultimately influenced their design for the new square (Figure 7).

According to the authors Dorato and Lobosco, "… the analysis of accessibility was used for creating multiple scenarios and considering, according to possible design features, the various solutions, and their overall repercussions" (p. 3, 2017). The landscape architects who designed

Woolwich Squares used a particular modeling software known as Space Syntax, which describes their product as a powerful tool that can "…create compelling visions of the future that enhance the lives of the people that use them" (Space Syntax, 2020). The final design, while being informed by analysis tools, closely matches that of the Dendritic form typology described by Booth (2011) (Figure 8).

*Figure 7 - WhoolWhich Squares Plan*


*Source: Gustafson Porter + Bowman (2011).*

*Figure 8 - Whoolwhich Squares New Design*

*Source: Gustafson Porter + Bowman (2011).*

The significance of this case study is shown in how modern analysis techniques, reinforce the concept that certain design forms in the landscape are more appropriate in some places than others. According to Booth, the Dendritic form "… is most suited for guiding movement through the landscape… apropos for large green spaces like parks, arboreta, campuses and so forth" (P. 355, Booth, 2011). This thesis research aims to understand how the combination of design for both street networks and open spaces impacts pedestrian circulation and desire path occurrences. Examining the context of design at multiple scales including the landscape design scale, like Whoolwhich Square, and the urban design scale is important for understanding how desire paths can best be utilized and understood by designers.

## 2.6 Mitigation Methods for Desire Paths

According to the literature, there have been multiple approaches identified to mitigate the occurrence and use of desire paths in the landscape. Designers and planners have some strategies that attempt to predict the location of desirable pedestrian pathways with site analysis, community engagement, and new technologies. These approaches are referred to as Pre-Path Mitigation Methods in this thesis. When desire paths do occur in the landscape, maintenance crews and landscape professionals must respond with what is referred to in this paper, as Post-Path Mitigation Methods.

These broad categories of mitigation methods each contain multiple strategies and are discussed in the next sections. Their specific strategies and success are analyzed based on their use in the literature.

### 2.6.1 Post-Path Mitigation

When desire paths are created in the landscape, they may remain for some time before being mitigated. Pathways that are more frequently used tend to exhibit more hazardous erosional effects, which in turn renders the pathway less aesthetically appealing in the landscape (Kulhavy, Unger & Hung, 2018). These desire paths are eventually deemed problematic by maintenance professionals at different thresholds depending on the entity. Facilities managers at universities may mitigate desire paths earlier or later in the erosion process than facilities managers for parks and recreation departments at the city scale. Despite the differences in when desire paths are mitigated in public spaces and by which maintenance professionals, there remain only a few solutions for mitigating desire paths. According to Kulhavy, Unger, and Hung (2018), four solutions are possible for maintenance remedies and can be applied based on the category of a specific desire path. The four solutions defined by the authors are to either use a physical barrier, vegetative barrier, to pave the desire path, or to consolidate formal sidewalks and use desire paths as templates for new formal sidewalks (Kulhavy, Unger, & Hung, 2018).

Formalizing a desire path by paving it over is one satisfactory method by maintenance professionals as well as pedestrians. This paving method can be done to construction standards and serve American Disability Act 1990 (ADA) populations. The desire paths can also be haphazardly installed with a variety of paving types to offset economic costs. Visual evidence supports this claim at university campuses where frequently used desire paths are often paved over with cheap paving, including gravel or stone pavers, and not to ADA standards (Figure 9).

*Figure 9 - Differing Quality of Paving Add Desire Paths into Formal Path Network*

*Source: Reddit.com/r/desirepath (2020).*

One example of formalizing desire paths after they occur is illustrated by Disneyworld and some universities, including Michigan State University, which has used the novel idea of leaving the pedestrian pathways to be decided by the pedestrians. According to Coutts, et al. 2019),

> "Disneyland visitors expressed where they wanted to travel, and the subsequently codified infrastructure allowed them to efficiently (and likely more profitably for Disney) reach the offered attractions… At Michigan State University, instead of trying to predict in a geometrically predictable fashion where pedestrians were going to walk, the campus planners allowed students to express, in physical form where they wanted to go" (p. 3).

In these cases, some infrastructure such as buildings was developed, while pathways were

not. The subsequent desire paths, in these cases, were then formalized as the original pathways. This concept has the potential to eradicate the creation of new desire paths from the formal pathways. Campus designers and planners could then continue phasing development around the formalized pathways as planned. While this application has only been used at universities and theme parks in the United States, this idea has been used for residential land use in other countries. This strategy has also been nicknamed the "Scandinavian sidewalk" where in places such as Malmö, Sweden, housing settlements allow citizens to forge their desire paths which are then paved later (Ungvarai & Kisgyorgy, p. 1175, 2016). Unfortunately, the downside of this method is that the delay of construction of formal paths reduces accessibility for ADA, as well as having all the associated environmental impacts of desire paths.

While formalizing the pedestrian pathways may be a preferred method to immediately improve pedestrian mobility, "Relatively few constraints exist to installing a concrete pathway to replace an earthen desire path on a university campus" (Coutts et al., p.9, 2019), hardscape alone does not solve a circulation issue in the landscape. For a landscape to accommodate all the needs of the pedestrian, it must provide more than a walkable path, but also provide to a pedestrian's sense of safety with lighting and other design elements. At the same time, a desire path could be through a planting bed or private property, and formalizing the pathway with concrete or pavers may not be a possible solution.

Another issue with adding the desire paths to the formal pathway network is the subsequent patchwork of distinctly different aesthetic qualities. Coleman (1981), in his article studying footpath erosion in the English Lake District, stated that "It is also apparent that with suitable management and routing of the paths, high levels of recreational use can be accommodated with relatively slight detrimental effects on the paths" (p. 130). In terms of

landscape architecture, these management methods observed by Coleman (1981), such as delineating boundaries for the path may work to reduce environmental impact, but it does little in the way of aesthetics, user experience, and perception of personal safety.

Not only does formalizing desire paths potentially affect the visual aesthetic quality of the original design, but it also has the potential to alter the experiential aesthetic quality for users of the site. One example of this can be observed when examining the differences between pedestrians' perceptions of change in pathway materials.

According to Fuda, Aletta, Kang, and Astolfi (2015), it was observed through laboratory experiments that people have significant opinions on the sounds of walking over different materials. Four common ground materials were tested for soundscape quality including grass, gravel, stone, and wood. The results were divided between satisfaction with the resulting soundscape and annoyance with the soundscape, with sounds of walking over gravel receiving the highest annoyance level, while walking over the grass was the most pleasing (Fuda et. al. 2015).

When formalizing desire paths with different paving material, there is the potential to change the satisfaction of user experience and possibly the desirability of that path. More than likely the most economically efficient paving material, such as gravel, would be chosen to formalize desire paths in campus environments.

The use of obstruction mitigation methods is the practice of creating barriers between people and their path of desire. These barriers vary in level of visual and physical obstruction, from planting material and other natural features to physical fences and walls. "Examples of physical barriers designed specifically to prohibit pedestrian access abound in the urban environment, but a regular evaluation of how these barriers have been modified (i.e. vandalized)

by pedestrians to create access may reveal opportunities to remove outdated barriers or consider ways that they can be overcome" (Coutts, et al., 2019; p. 9). Just as formalizing the pathways could result in landscape issues, the obstruction could succeed in some instances and not others. Often, physical barriers are considered solutions to desire paths but at cost of reducing the permeability of urban environments for pedestrians. In the case of desire paths, if a path has a high level of desirability and usage, the barrier has the potential to be vandalized or a new path could be created around it (Figure 10).

*Figure 10 - Obstruction used to deter use of Desire Path, Encourages separate Desire Path*

*Source: Reddit.com/r/desirepath.com*

In one campus study of desire paths conducted at the Stephen F. Austin University in Nacogdoches, TX, students recommended obstruction of desire paths more commonly than any other mitigation method, as a solution for desire paths on their campus. According to Kulhavy, Unger, & Hung (2018), 61% of the desire paths recorded in their study were recommended to be mitigated with an obstructive mitigation method of either a physical or vegetated barrier. A smaller portion of desire paths, 32% of desire paths, were recommended to

be mitigated by being paved (Kulhavy, Unger, & Hung, 2018). The researcher's criteria for recommending solutions were based on the erosional hazard of a specific pathway and the economic cost of the method. The issue with this strategy is that it does not account for the desirability that a pathway contains, the motivations of pedestrians for using the pathway, or the context of the entire landscape design. While obstructing the desired path may prevent further erosional hazard, the root of the problem remains in that there is an unsatisfactory design of pedestrian open spaces and street networks.

### 2.6.2 Pre-Path Mitigation

Pre-Path Mitigation Methods are strategies in the literature that have been noted to either predict desire path locations in the design process or to use them as templates for formal pathway networks before they are formed in the landscape. Designers and planners have powerful analysis tools at hand when researching a site for suitable development. Geographic Information Systems (GIS) now offers the ability to map multiple layers of geographic, demographic, or other information. Such tools as GIS and other mapping software, have the potential to create more thoughtful design through the synthesis of that information, including determining good pedestrian connections. In terms of desire paths, these tools could potentially manage their frequency and location before they are made.

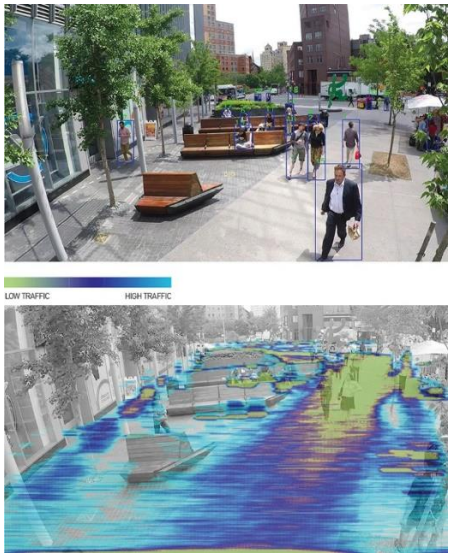
A relatively new form of technology to predict pedestrian movement in the public realm, such as the previously mentioned Space Syntax, is being explored as another method for mitigating desire paths. Other pedestrian traffic models, such as the finite-element-method, have been used with success to predict pedestrian movement in relatively simple landscapes by observing pedestrian patterns over long periods (Ungvarai & Kisgyorgy, 2016).

More sophisticated approaches include using parametric design models with Artificial

intelligence (AI). AI is often used as an umbrella term for many kinds of computer-driven tasks, including machine learning and deep learning, which are ways in which computers recognize patterns and complete tasks from repeated exposure. According to Li, Liu, Wang, Zhang, & Cui (2016), Computers can use these AI tools to differentiate pedestrians from other objects through repeated manual exposure to captured video, and then use a deep learning framework algorithm to accurately predict pedestrian's future movement. Pedestrian tracking has multiple applications and uses, including in planning and transportation, where machine learning can process these video sequences of people to lessen traffic congestion (Li, 2016).

In the field of Landscape Architecture, machine learning is being used for similar applications, such as determining the use of public spaces after they are constructed. Anya Domlesky, ASLA, and Emily Schlickman, ASLA used a machine learning program called Darkflow to track pedestrian movements in small urban plazas (Zeiger, 2019). The resulting video sequences were used to create heat maps of where people spent the most time in these urban environments. These applications can be useful to future designs in evaluating what were successful amenities and what was not (Figure 11).

*Figure 11 - Pedestrian Movement Heat Mapping with Machine Learning*




*Source: (Article "Live and Learn", in Landscape Architecture Magazine, by Mimi Zeiger, 2019) (Photo by SWA)*

Although less sophisticated than AI, a more common mitigation tool currently utilized by landscape architects are various types of community engagement practices. This is when the community is involved in the process of designing new development and treating them as partners. The goal of interacting with the stakeholders of a design proposal is that getting the community and the future users involved through engagement, reduces the chance of poor design quality, and unintended consequences. The benefits of community engagement are obvious when proposing designs for a neighborhood master plan or urban revitalization where amenities are intended for the local demographics.

According to Malone (2018), community engagement at any level can be helpful, but there are various levels of quality in its framework and effectiveness when put to practice. She argues that community engagement should be treated like research, where quantitative or qualitative data can be collected and analyzed just as geographic information could be. Though Malone (2018), uses the concept of desire paths symbolically and does not aim to mitigate them directly, her research finds that community involvement creates more people-centered designs.

Just as Smith and Walters (2017), and Furman (2012), have attributed desire paths as the natural recourse to the loss of pedestrian spaces to automotive travel, Malone (2018) aims to recapture the public, back into public space. “Desire lines can show the mismatch between what a designer thinks best and what people actually prefer…The symbolism seems apt for a book about putting local people at the center of the design process and allowing their needs and wishes to shape development” (Malone, 2018; p.4). The book goes on to describe an evidence-based methodology for designing strong community engagement programs, and analysis tools for that information.

Whether designers and planners use one or more methods of site analysis, their designs should be evidence-based and well-informed. Desire paths could be mitigated simply by paving or obstructing their use, however, using analysis tools to predict human uses of the landscape should be improved and utilized more heavily. The quality of landscape design and thus pedestrian experience can always be improved upon, and the development of more tools for the design professions could be beneficial in eliminating the need for pedestrian desire paths.

## 2.7 Literature Review Comparison

Two studies noted in the literature review share common elements in scope and methodology when researching desire paths. Both studies contained methods that are commonly used in landscape architecture, and other design professions. Were these two studies adapted, they could provide insight into how to utilize knowledge gained from desire paths for improving the quality of urban landscapes through design. Both studies use university campuses as study sites for their research and conclude how to relate an understanding of desire paths to improving pedestrian infrastructure.

Universities and other forms of institutions are pedestrian-centric environments, and

essentially microscale versions of the urban city. According to Lang (2011), campuses are a special type of urban design project that often act as separate and distinct entities from the city they reside in. In addition to classroom buildings and laboratories, college campuses contain, dining, housing, and employment locales, all within walking distance, making them ideal grounds for study and interpolation of pedestrian behaviors to the larger urban scale (Coutts et al., 2019). The density of college campus infrastructure, and high frequency of desire path occurrences, also allows for an efficient way to collect much more data.

According to Kullhavy, et al. (2018), desire paths should be mitigated for landscape beautification and to reduce the hazard to pedestrian safety. The authors used aerial imagery software to take inventory of desire paths at the Stephen F. Austin State University, and then classified them based on their level of hazard (Figure 12). The five classifications the researchers used were 1. Hazardous Conditions, 2. Erosive, 3. Tracking Issues, 4. Lost Sidewalk, and 5. Unsightly. Depending on the classification a desire path received, a maintenance solution was selected to mitigate that pathway.

*Figure 12 - Stephen F. Austin State University Campus Aerial Image*

*Source: Stephen F. Austin State University*

According to the authors, 61% of the desire paths were recommended to be mitigated by

using obstruction methods, while 32% of the desire paths recorded were recommended to be mitigated by being paved (Kullhavy, et al, 2018). While these methods may reduce the hazard to pedestrians, the recommendations do not consider the pedestrians' travel behavior or the context of the surrounding landscape. Obstructing a desire path is likely to encourage pedestrians to produce a new one (Coutts, et al. 2019). Furthermore, it is questionable that paving desire paths restore the beautification of the landscape when pedestrians sought a natural trail in the first place (Francis and Marcus, 1998). Lastly, both solutions recommended by the researchers only work to mitigate desire paths after they occur, when the thoughtful design of the pedestrian landscape could be utilized to eliminate pedestrians' needs for desire paths before they occur.

A similar study conducted at Florida State University found that males are most likely to use desire paths and that while pedestrians create desire paths mostly for efficiency, the value of those benefits is reduced with safety concerns at night (Coutts, et al. 2019). The authors of this study focused on the demographics of pedestrians that use desire paths, and their motivations for doing so. Inventory of desire paths on campus was taken through aerial imagery and classified into (3) categories based on level of desire, and the usage of that desire path over time. The authors also conducted a survey that was aimed at pedestrians who used desire paths to reveal their reasoning for using those paths, and their willingness to travel them in certain conditions. The focus of the study was to understand pedestrians’ motivations more clearly so that planning professions would reflect more efficient infrastructures in their designs (Figure 13).

*Figure 13 - Stephen F. Austin State University Campus Aerial Image*

*Source: Florida State University*

While both studies take inventory of desire paths and classify them, they view desire paths differently and their research objectives prioritize different findings. (Table 1). Both Kullhavy, et al. (2018) and Coutts et al. (2019) evaluate desire paths on their campuses through direct observation, for improving pedestrian infrastructure. However, one study offers solutions without considering pedestrians, and the other considers pedestrians without offering solutions.

*Table 1 - Literature Review Matrix*

| Case Studies | Student Led Campus Desire Path Evaluation Using Pictometry Neighborhood Imagery **(Case Study 1)** | Exploratory Analysis of Revealed Pedestrian Paths as Cues for Designing pedestrian Infrastructure **(Case Study 2)** |
|---|---|---|
| **Problem** | Desire paths pose hazard to pedestrians and need mitigation for "beautification". | Desire paths could reveal how to improve pedestrian networks. |
| **Objective** | • Evaluate desire paths based on level of conflict (hazard, erosion, aesthetics)<br>• Recommend Mitigation method for "beautification" | • Understand the extent of desire path usage on FSU<br>• Understand primary motivations for using desire paths |
| **Methods** | • Taking inventory of DP with aerial imagery<br>• Classification system | • Taking inventory of DP with aerial imagery<br>• Classification system<br>• Social Survey |
| **Analysis** | • Measuring hazard based on erosion<br>• Descriptive statistics of classifications used | • Descriptive Statistics of survey answers<br>• Measuring desirability based on usage/time in the landscape |
| **Conclusion** | Mitigation recommendations for obstructing the path or formalizing it. | Clear insight into pedestrian motivations for using desire paths. |
| **Research Gap** | • Recommendations don't prevent desire paths<br>• Recommendations don't consider pedestrians | • Unclear how to improve circulation<br>• Classification system does not reveal what landscape elements contributed to the location of the desire path |

The gaps in these two researcher studies reveal the need for a comprehensive typology of desire paths that considers both the pedestrians' motivations, as well as the design context of the surrounding landscape where they occur. This comprehensive typology would be aimed towards the design professions to reveal why desire paths are likely made, and where they are likely to occur so that they are prevented with better design.

## 2.8 Chapter Summary

The literature review revealed that desire paths are one of many potential consequences of design decisions for landscapes such as open spaces and streetscapes. Desire paths have many negative consequences associated with them including environmental and social impacts. While there are maintenance solutions for mitigating desire paths, there is a lack of comprehensive tools for designers to recognize conflicts in their landscape plans where desire paths may occur and then creatively solve that issue.

# CHAPTER 3: METHODOLOGY

## 3.1 Introduction

This research contains mixed methods of both qualitative and quantitative, to explore the connection between desire paths, landscape site design issues, and larger urban design conflicts. Desire paths and where they occur in the landscape, are classified to provide a working typology for designers to recognize potential design conflicts in future proposals. This research then used statistical and contextual evidence, to prescribe design implications for each of the classified desire path types found in this thesis. The methods for this research are framed by common site inventory and analysis procedures in the landscape architecture profession. To strengthen the legitimacy of the design implications, this research conducted a multi-method approach with three different methods of data collection. This chapter contains a descriptive account of methods utilized for site selection, data collection, analysis, and synthesis.

## 3.2 Research Design

To answer the research questions posed in this thesis, a multi-method approach is utilized.

**Research Question 1:** Are desire paths isolated incidents in the landscape, or a symptom of larger urban design and planning decisions?

**Research Question 2:** What landscape design elements and patterns contribute to desire path occurrences?

**Research Question 3:** How can desire paths be utilized and understood, to help designers identify and resolve potential conflicts in future design proposals?

A series of Descriptive Research Strategies, outlined by Deming and Swaffield (2011), are combined. These inductive (theory building) strategies enable the researcher to descriptively

analyze the relationship between human activities and site design (Deming and Swaffield, 2011). By studying sites where desire paths occur, and the conditions surrounding their occurrence, a detailed record could be synthesized for predicting future likely desire path occurrences in design proposals. At the same time, a detailed understanding of desire path locations and design flaws in the planning and urban design systems could provide evidence for strong design implications.

There are four general data collection methods used to answer the research questions, which are described in detail in the following sections. The methods include:

1. Study Site Selection

   Select sites to study for this thesis research. Sites were selected based on their opportunity for desire path observation.

2. Secondary Description

   Secondary data on the study site was collected, analyzed, and synthesized into an abstract-level case study template formed by the Landscape Architecture Foundation and Marc Francis (2020). This is to organize the background context of the development of the site to be included in the evidence for desire path typologies and design implications.

3. Site Observation

   Site visits followed to create a detailed inventory of the desire path characteristics present, as well as the surrounding environmental conditions. Typical observation and mapping techniques in the landscape architecture profession and outlined by Deming and Swaffield (2011) were used to conduct site observations.

4. Social Survey

   Pedestrians, Designers, and Maintenance Professionals are the three stakeholders in the occurrences of desire paths. Designers and Maintenance professionals were interviewed

for their in-depth perspectives and expert knowledge on the topic, while pedestrians were surveyed through an online tool "QuestionPro".

The Site Observation techniques are used to analyze patterns in desire path occurrences to form a working desire path typology. However, the objective of the social survey is to provide qualitative evidence to understand the success or failures of certain design strategies, and pedestrians' views towards the landscape, to develop design implications to coincide with the desire path typology. All previously listed data collection methods are descriptive research strategies, yet their use in combination creates a multi-method approach that is mutually strengthening (Sommer & Sommer, 2001). The objective of the multi-method approach in this thesis is to provide the varying evidence needed for forming a new desire path classification system as well as working design implications.

### 3.3 Rationale for Site Selection: University Campuses

For this thesis, university campuses are used as a substitution for larger urban entities such as cities, for study locations. Multiple reasons led to the decision for sampling university campuses for study sites. According to Lang (2017), there are four types of urban design projects "(1) new towns, (2) urban precincts of which there are many types and (3) elements of infrastructure, and possibly (4) individual items within the city that add luster to it: clock towers, monuments, works of art…" (22). University campuses contain residences, social buildings, and many other structures of cities that sustain urban lifestyles. According to Coutts et., al. (2019), universities are essentially dense urban environments that simulate city environments with a higher degree of pedestrian activity. While university campuses are not a perfect substitution for cities, they are part of the urban precincts category and many are separate entities from the city they reside in (Lang, 2017).

A secondary reason for using university campuses as study locations for this thesis is that they are frequently associated with desire paths as a normal part of campus wear and tear (Marcus and Francis, 1998). Desire paths are to be expected in the landscape of universities, of which, there are multiple in a relatively close range in the DFW area. This large number of potential study sites, combined with the walkable scale of a university campus, makes them a favorable study location.

Lastly, many urban design project types fall under the typology of "Total Design" development, meaning that the entire project is designed under one vision or design team, like how many universities are initially planned (Lang, 2017). However, according to Lang (2017), while Total Design projects may be admired for their geometric aesthetics, they lack thoughtful design of human spaces between buildings. A similar criticism is made by Marcus and Francis (1998), where they describe how buildings receive more attention to design and less is given to landscapes (p.175).

### 3.4 Site Selection Criteria

The site selection process began with a purposive sampling process by sorting universities in the DFW area based on the surface area. "A purposive sample targets the individuals thought to be most central to the research question" (Sommer & Sommer, 2002). This process samples larger universities because they are likely to contain more open/green spaces to study compared to smaller universities or community colleges. More open/green spaces present for study increases the odds of desire path occurrences and potentially more data to collect. The Dallas – Fort Worth area was chosen due to its urbanized nature and high amount of university campuses available to select from. College campuses contain similar urban elements to the average city (Coutts et al., 2019), but are much more dense urban environments, and for

that reason make suitable study sites due to their walkable scale and reportedly high number of desire path occurrences.

Using Esri's ArcMap GIS and available open-source data, the top three largest universities (by surface area) within the DFW boundary were sampled for the study. The GIS data source containing polygon data of all universities within the United States came from Koordinates.com (2021). The specific shapefile's original source containing the polygon data of universities is from the U.S. Census Bureau, updated 27 June 2019.

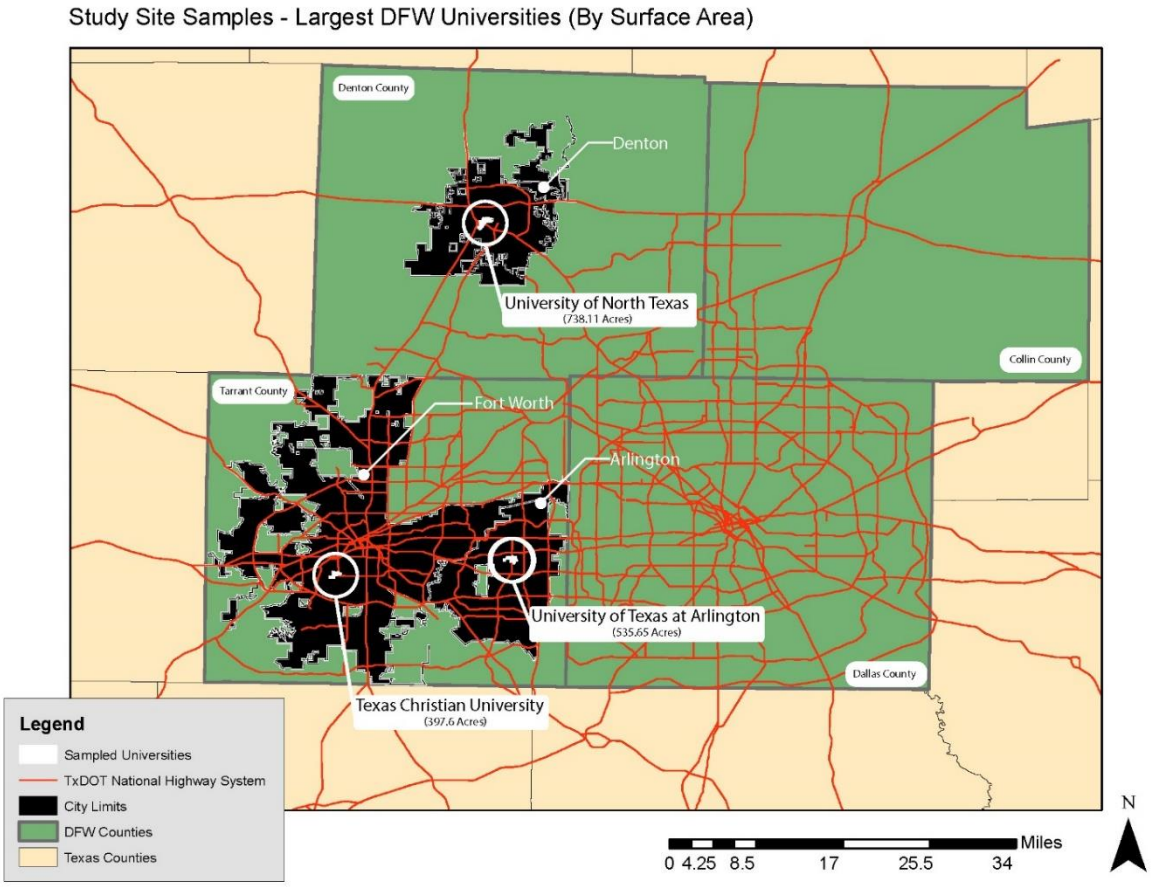
To determine the site selection boundary, the DFW Metroplex is defined by the updated Metropolitan Statistical Areas and Metropolitan Divisions list from the Federal Census (Mulvaney, 2017). The DFW metropolitan area is constantly urbanizing and changing in size, the boundary of which is not singularly defined. According to the Mulvaney federal report (2017), the principal cities of the Dallas-Fort Worth -Arlington, TX Metropolitan Statistical Area are Dallas, Fort Worth, Arlington, Plano, Irving, Denton, and Richardson (p. 77). For this study, the DFW area is defined by the counties to which those principal cities belong including, Dallas, Tarrant, Denton, and Collin Counties. The Texas County shapefile data was sourced from TNRIS.com (2017). In ArcMap, the layer containing university locations is clipped by the DFW boundary determined previously, leaving only those universities in the DFW area. Using available information in the attribute table, the remaining universities are ordered based on the surface area from largest to smallest. Lastly, the top three largest universities by surface area were sampled for the study.

As a result of the site sampling, this methodology revealed the three universities sampled for this research study as The University of North Texas (738.11 acres), The University of Texas at Arlington (533.65 acres), and Texas Christian University (397.6 acres) (Figure 14). Of the

three sampled sites, the University of North Texas was selected as the study site for this thesis research.

The surface area was calculated from ArcGIS geometry calculations of the available polygons in the attribute table. While the GIS calculated surface, the area does not align with each of the sampled universities' reporting of their total surface area, the calculations are within an acceptable range for this study. The error may be due to the polygon shapefile being two years old, or from the WGS_1984_Web_Mercator projection from which the polygon data source uses.

*Figure 14 - Largest Universities (by surface area) in the DFW area*




*Sources: (GIS Shapefiles from Koordinates.com, U.S. Census Bureau (2019), TNRIS.com (2019)*

## 3.5 Data Collection Methods

The data collection methods for each of the study sites are a combination of various

inductive research strategies outlined by Deming and Swaffield (2011). The objective of combining multiple methods is to achieve a multi-method approach of strengthening evidence and synthesis of findings. All methods used are forms of "Descriptive Research Strategies" which has three general types of strategies common in landscape architecture, including secondary description, observation, and descriptive social surveys (Deming and Swaffield, 2011, 65). These descriptive research strategies are explained in detail in the following sections.

### 3.5.1 Secondary Description

Case studies are considered complex descriptions and an in-depth investigation into a particular site (Deming and Swaffield, 2011). By building a case study on the study site (University of North Texas), comparisons can be drawn, and patterns can be identified in the differing landscape systems of each of the study sites. Understanding the differences and similarities in the urban design elements and layout of the campuses, in combination with desire path locations, could shed light on how urban design and planning strategies impact desire path occurrences.

A second reason for utilizing the case study strategy is that "… there are many examples where several comparative case studies are used to build a typology or working classification of situations that can generate further, more precise research questions" (Deming and Swaffield, 2011). In other words, generating detailed case studies for each of the sampled universities can contribute evidence to the products of this thesis (desire path typology and design implications).

The design of the case studies follows a well-known Case Study Method for Landscape Architecture, developed by Mark Francis and the Landscape Architecture Foundation (LAF) (2019). This template is updated and released frequently and contains various case study types based on the depth of research needed, as well as methods and case study examples. For this

thesis, the case study design is a modified version of the LAF case study method by taking parts of the Abstract Fact/Sheet and Full Case Study (Francis, 2019).

The final case study product includes sections such as background information, context, site history, development, and design, as well as a synthesis of the background knowledge into a "lessons Learned" section (Francis, 2019). The case study was informed by secondary description sources including previously packaged masterplan reports for the study sites. The objective of the case study is to build a base knowledge of the larger context of the study site and the relationship that desire path occurrences have with the larger landscape systems (circulation, street network, building orientation, environmental). Understanding the urban design context of the campus development through previous masterplans, sheds light on Research Question 1 "Are desire paths isolated incidents in the landscape, or are they symptoms of larger urban design and planning decisions?".

### 3.5.2 Observation Strategies

Observation strategies are an effective way to gain knowledge on the character of a particular place (Deming and Swaffield, 2011). For this research, multiple types of observation strategies were used in combination on the study site as follows.

#### 3.5.2.1 Field Survey

While evaluating the master plan of the sampled university was used in the campus-scale analysis of design features and landscape systems, field survey of desire paths present in each study site (open/green spaces), revealed more in-depth knowledge of the design elements that contributed to their occurrences. To achieve the later goal, the study site was visited to record the location and number of desire paths present in a data table. Every open/green space was systematically surveyed on foot to ensure as many desire paths could be recorded.

All data collected during this research, including the master plan evaluations, and field surveys, were gathered into a single data table. The data table was modeled after a combination of methods identified in the literature and will be referred to as the modified site design evaluation matrix. This matrix method uses elements from post-occupancy evaluation methods defined by Marcus and Francis (1998), with a combination of additional elements from Booth (2011) and "landscape morphology" aspects from Dee (2001). (Table 2).

*Table 2 - Modified Site Design Evaluation Matrix Example*

| University Name | Site Label | Local Name (AKA) | Location | Location Description | Site Description | Site Images | Plan View | Site Form | # of Desire Paths | Number of Formal Paths |
|---|---|---|---|---|---|---|---|---|---|---|
| University of Texas at Arlington | UTA - 1 | The Green at College Park | W. Mitchell Street, Arlington, TX | Campus park amenity near campus convention center and residential area. | Ovular pathway with central lawn area and planting masses on the edge conditions. | | | The Oval | 0 | 6 |

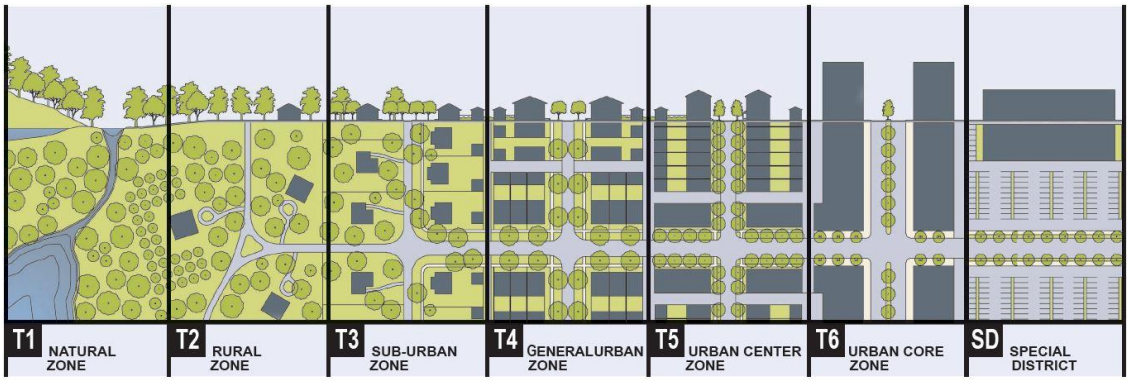
The purpose of the Modified Site Design Evaluative Matrix is to provide structure for data recording supported by the literature. There are many variations of this structure used in landscape architecture, however, The Evaluative Method from Marcus and Francis (1998), is a procedure in design criticism based on human needs, informed by simple observational methods. The original intent of the Evaluative Method is to synthesize observations of a site, including human behaviors, features, and other elements, to provide an evaluation of a site's design performance to function successfully for its users. The Evaluative method also outlines how researchers can offer evidence-based design implications to improve the performance of a landscape for its intended users. This procedure provides the framework for the structure of the matrix for this research, with its structure from Marcus and Francis (1998), "Structure of Report" (p.347). The data collected from the field survey in the modified site design matrix is the foundation of the research collected for this thesis. Design criteria for landscape architects are also added to this data collection matrix from literature including Booth (2011) and Dee (2001), to include landscape design in measuring desire path occurrences.

### 3.5.2.2 Transects

The second observation method includes creating transects of the landscapes where desire paths occur in the campus study site. The objective of the transects is to describe the relationship of various landscape elements in section graphics (Deming and Swaffield, 2011). Transects were created for representing geographical cross-sections of an area to reveal environmental relationships, however, they have been adapted to create transect-based codes for the planning of urban environments (SmartCode 9.2, 2009).

Diagrammatic plans and sections for chosen landscape sites with desire paths would be made as transects. This method closely resembles the SmartCode Version 9.2 framework for that process as seen in Figure (15).

*Figure 15 - Diagrammatic Transect Zones (Transect Examples)*




A Typical Rural-Urban Transect, with Transect Zones

*Source: (SmartCode Version 9.2)*

### 3.5.3 Social Survey

The use of descriptive social surveys is to provide information on landscapes, through the perspectives of stakeholders of that site. For this research, it is necessary to understand what

professional designers think the issues are relating to desire paths so that those considerations can influence new design implications. Additionally, maintenance professionals have insight on mitigation methods, as well as environmental and economic costs associated with desire paths that could impact the implications for design as well. Lastly, pedestrians who create desire paths are surveyed for their preferences in aspects of walkability, which contributes to a holistic set of design implications for mitigating desire paths.

#### 3.5.3.1 Social Survey Design

The purpose of this exploratory preliminary study was to understand the most relevant issues related to desire paths in terms of the landscape architecture profession whereas much of the academic literature concerning informal footpaths is within the range of impacts, and mitigation methods. This study was achieved by using interviews of experts and a survey of landscape users (three groups including landscape designers, maintenance professionals, and pedestrians). The collected interview and survey data were synthesized into main points for potential viable research questions about the topic of desire paths through the scope of landscape architecture. The data also structured the design implications for the developed desire path typology. The interviews and surveys adopted an open-ended questionnaire to reveal critical information of human interaction with the landscape only acknowledgeable through a survey (Deming and Swaffield, 2011).

*The Preliminary Interview Study on the Topic of Desire Paths* was structured around two key stakeholder groups (Experts, and Pedestrians/landscape users) and was conducted over two semesters from Spring 2020 – Fall 2020 to narrow a thesis topic into research questions. The data is repurposed for this thesis to strengthen the evidence for valid design implications for mitigating desire paths. This section summarizes the research organization through those two

stakeholder groups.

1. **Expert Interviews**

Expert interviews were conducted with landscape architect professionals, whose knowledge informs the urban landscape and thus directly impacts the use of that landscape. Their role has a direct impact on the occurrence of desire paths. The designer group was chosen for interviews on their thoughts and opinions over the topic of desire paths. This group was comprised of two landscape architects from different backgrounds.

The second group of experts interviewed would include Maintenance professionals or those that oversee the repair, or maintenance of desire paths after they are created in the landscape. Their perspective was sought out for their knowledge of the economic costs of maintenance, and the successful mitigation methods for desire paths. This group was initially planned to contain maintenance professionals from all scales, universities through city-level parks and recreation departments. This group would be interviewed as well for a fuller description of their perspectives on the topic of desire paths.

The University of Texas at Arlington has established an Institutional Review Board (IRB), to review human subject research conducted by members of the University community. The purpose of the board is to ensure that the rights of the human subjects are protected during the length of the research study. For the preliminary study discussed in this section, the interview/survey questions and processes were thoroughly examined by UTA IRB members, deemed “minimal risk” and was approved to be conducted (Reference Appendix A).

Interview questions were formed during Research Methods Course in Spring 2020, following the research guidelines defined by (Sommer & Sommer, 2002). Examples of these guidelines included interview questions that would remain open-ended to ensure that answers

would be more thoughtful and descriptive. Other guidelines for survey questions, would contain Liker Scales to accurately measure respondents' level of opinions on certain subjects.

During the unfortunate COVID-19 pandemic of 2020-2021, safety precautions had to be met, and all the interviews were conducted virtually, or by phone. The interviews were recorded for data in the aggregate, while the human subjects remained anonymous. The voice recordings were transcribed and deleted, with the transcriptions stored on the UTA Onedrive cloud extension in compliance with IRB protocol.

**2. Pedestrian/User Survey**

The pedestrian group would be defined for their direct creation of desire paths. To gather a larger number of respondents and resulting data, this group would be surveyed rather than interviewed. To ensure more thoughtful survey answers, the pedestrian group chosen would consist of desire path enthusiasts, or members of an online forum called "r/desirepath" (Reddit.com, 2013). These members would potentially harbor stronger opinions about desire paths than the random passersby on the street, however, they may not represent the larger population of pedestrians due to their higher-than-normal interest in the topic. The online forum has over 200k members, with about one hundred members online at any given time. These desire path enthusiasts have been mentioned in online media but have largely been untapped as a resource for collecting public opinion on the topic. The online survey link was posted on the forum page, and participation for survey respondents is voluntary.

Survey questions were formed using similar guidelines extracted from research methods outlined by Sommer & Sommer (2002). QuestionPro was used as an online tool designed to help researchers develop online survey instruments and analyze them efficiently. This tool was used to format the survey questions for the "Pedestrian" study group and was approved by IRB as an

acceptable method for storing the human subject data through its UTA extension.

#### 3.5.3.2 Social Survey Questions (Appendix C)

The research questions were designed for the three unique study groups to discern opinions and perspectives each group may have over the use, mitigation, and design of desire paths. The questions were worded so that open-ended responses would be given by the subjects and as much information about the topic could be discussed. The questions for the interviews and the survey acted as probes for the subjects by exploring the topic of desire paths. The unpublished data is repurposed for this thesis to add evidence for developing design implications to mitigate desire paths by considering pedestrian preferences and professional designers' experiences.

## 3.6 Data Analysis Methods

The collected data introduced in the previous sections contains a mix of qualitative and quantitative data, which is analyzed by a combination of descriptive statistics, context analysis, and graphical representation of maps and key figures. The data analysis methods are described in the following sections.

### 3.6.1 Mapping Analysis

The secondary data compiled from university masterplans for the study site study is combined with the observation data collected and analyzed through qualitative mapping analysis. These mapping graphics are the principal resource for illustrating desire path locations and their relationship to land use, circulation, and other landscape systems. The qualitative analysis describes the similarities and differences between the study sites, revealed in the map

illustrations.

Since desire paths are traces of human interactions with the landscape, the behavioral mapping technique ethnography, was applied to understand the behavioral motivations pedestrians have for utilizing desire paths (Sommer & Sommer, 2002).

### 3.6.2 Descriptive Statistics Analysis

The raw data collected from the secondary description and field observation was categorized into nominal or categorical variables to be analyzed through descriptive statistics. Design elements, such as ground plane material, site design form, the height of plant material, open space typology are categorical data that is synthesized into a contingency table from its original data table (modified site evaluation matrix). The resulting table reveals the "…frequencies of occurrence (counts)", for the sampled campuses, and its subsequent data reveals the patterns among sites where desire paths occur (Sommer & Sommer, 2002). The contingency table was then further summarized into measures of central tendencies and illustrated in figures.

### 3.6.3 Classification Schemes – Typology

To summarize raw data taken through survey and observation of desire path occurrences, a comparison between the character of recorded desire paths across the study site is made. The sites with similar conditions were placed into categories, and their resulting desire paths were compared to develop a more specific desire path typology (Deming and Swaffield, 2011). According to Deming and Swaffield (2011), classification schemes, including typology, are an excellent way to build theories or new organizational structures, typically employed in landscape architecture and design professions. According to Lang (2017), typologies are a reliable tool for

urban designers to express design principles and guidelines in urban planning projects.

### 3.6.4 Social Survey Qualitative Content Analysis

The social survey data of stakeholders in the occurrences of desire paths are analyzed into considerations for design implications. Some portion of the social survey results is analyzed through descriptive statistics based on the type of question answered in the online survey. However, the interview data and some of the open-ended survey questions are analyzed through qualitative content analysis (Sommer and Sommer, 2001). The objective of utilizing qualitative content analysis techniques on the open-ended questions of the social survey is to analyze for trends in perspectives stakeholders have on desire paths. The voice recorded interview data is transcribed and illustrated through categories into tables. The simple tables of key points from the interviews grant easy review for developing design implications to mitigate specific desire path typologies.

## 3.7 Data Synthesis

Synthesis of all analyzed data consists of a summarization of findings, into a “Lessons Learned” format based on A Case Study Method (Francis 2019). The literature review as well as the analysis and findings from this thesis, contribute to the summarized design considerations. (Figure 16).

Those design considerations are then graphically represented in a table of design implications for landscape plans at multiple scales, to mitigate desire paths. Each desire path typology defined from the data analysis has design implications tailored through alternative plan diagrams and transects, as well as a descriptive list of design considerations.

*Figure 16 - Data Synthesis Diagram*


## 3.8 Chapter Summary

Chapter 3 outlines the methods of data collection, analysis, and synthesis to answer the research questions posed by this thesis. The significance of this research is the provision of a typology of common desire paths so that designers to identify and recognize potential conflicts in future design proposals. This research explores the role of larger urban design and planning decisions on the occurrences of desire paths. This is achieved by expanding the analysis of the study sites to encompass both the open space and street network designs at multiple scales. All

data collection, analysis, and synthesis methods are sourced from traditional landscape architecture practice, and in landscape architecture research including Sommer and Sommer (2001), and Deming and Swaffield (2011). This chapter also contains elements of the outlines for Chapter 4 Analysis and Findings and Conclusions in Chapter 5.

# CHAPTER 4: ANALYSIS AND FINDINGS

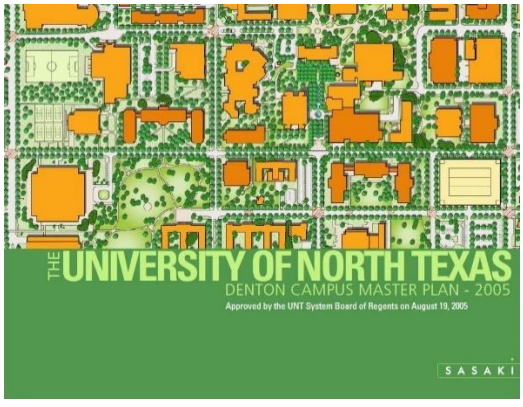
## 4.1 Introduction

The findings in this research study resulted from a combination of qualitative and quantitative analysis to assess the diverse data collected from a multi-method approach. The data collection methods followed the descriptive research strategies outlined by Deming and Swaffield (2011) and included field observation, secondary description, and social survey of stakeholders accountable for desire paths (landscape architects, maintenance professionals, and pedestrians). This chapter discusses the analysis and findings resulting from the various data collected.

## 4.2 Master Plan Analysis

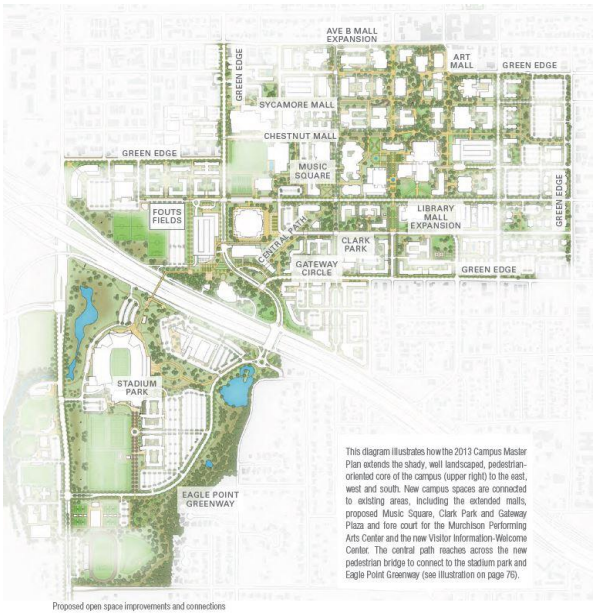
Two master plan reports for the University of North Texas (UNT) were used to provide background information on this history, development, and design of the campus (Figure 17 and Figure 18). Understanding the values, goals, and objectives of the design and development of UNT is important in revealing design decisions that potentially led to the occurrence of certain desire paths.

*Figure 17 - University of North Texas Master Plan Report - 2005*




*Source: Sasaki Associates (2005).*

*Figure 18 - University of North Texas Master Plan Report (2013)*




*Source: Ayer-Saint Gross (2013).*

This information is also useful in providing background for the design implications provided at the end of this thesis, based on historical evidence and lessons learned. The master plan reports are analyzed and organized by using the Case Study method developed by the Landscape Architecture Foundation and Mark Francis (2019). Three levels of the Case Study template exist (Abstract, Full, and In-Depth), based on specificity and amount of research. This study utilizes a modified version between the Abstract and Full Case Study templates (Section 4.2.1-4.2.5). Both the UNT Master Plan 2005 by Sasaki (2005) and The UNT Master Plan (2013 Update) by Ayer-Saint Gross (2013), are analyzed and organized in the modified case study template in the following sections.

### 4.2.1 Background Context

According to Ayer-Saint Gross (2013), UNT was originally known as the Texas Normal College started in Denton, TX in 1890. The campus was directly connected to Downtown

Denton by trolly. Over time, the college boundaries became more defined, and expansion of the campus core separated the city of Denton, TX, from the university. Most of the expansion was directed North and South to encompass parts of historic neighborhood districts (Ayer-Saint Gross, 2013).

In 2005 Sasaki was hired to develop a master plan that could take inventory and analysis of the current conditions of the campus and provide a planning and urban design report that could accommodate the future growth of the University. According to the Sasaki master plan (2005), many of the objectives emphasized were for UNT to improve the student experience through enhanced design for open spaces and pedestrian networks.

### 4.2.2 Design Development

In 2013, UNT hired Landscape Architects Ayer-Saint Gross to develop an updated Master Plan for the campus (Table 3). The purpose of this updated plan was to continue developing upon the 2005 Master Plan but to update the vision for the campus to accommodate the growth in the student body population. According to the 2013 Master Plan, in addition to the previous goals of the 2005 Master Plan, the updated plan established new goals for sustainable design, developing the university into a separate urban district from the city of Denton, and establishing stronger boundaries of the campus with a cohesive design. (Ayer-Saint Gross, 2013).

*Table 3 - Case Study Abstract Table for UNT 2013 Master Plan*

| | |
|---|---|
| Project Name | University of North Texas |
| Project Type | University Campus |
| Location | Denton, TX |
| Date Designed | (2013 Master Plan Update) |
| Size | 738.11 Acres (US Census Bureau 2010) |
| Landscape Architects | Ayer Saint Gross |
| Campus Planners | Master Planning Group & The City of Denton |

The updated master plan phased its objectives into achievable goals for the university to roll out over different timetables. At the time of this thesis, some objectives stated in the 2013 Master plan such as sustainable design have been achieved on the UNT Campus through native plantings, green roofs, and sustainable energy harvesting at sites like the Environmental Science building and the Business Leadership Building (Figure 19).

*Figure 19 - Low Water Planting Beds Outside Parking Garage at UNT Campus*

*Source: Ayer-Saint Gross (2013).*

However, many objectives stated in the 2013 Master Plan are still in progress on the university campus (Figure 20). Objectives such as defining a unified character throughout campus are a design task that must be met for every open space and streetscape and takes time to

develop (Ayer-Saint Gross, 2013). Defining strong campus boundaries is achieved by designing entrances and pedestrian nodes that reflect similar design characteristics found throughout the rest of the campus (Figure 21).

*Figure 20 - Construction at Terrill Hall at UNT Campus*

*Figure 21 - Enhanced Signage at the University of North Texas Welcome Center*


*Source: The University of North Texas (2021).*

### 4.2.3 Role of Landscape Architects

While the 2005 Master Plan (Sasaki, 2005) emphasized the enhancement of open spaces and plazas, the 2013 Master Plan Update, (Ayer-Saint Gross, 2013), emphasized circulation, formal entrances, and a standard design guideline to reinforce an aesthetic character at UNT. Both masterplans conducted standard inventory and analysis of demographics, land use, circulation, and environmental factors, common in the landscape architecture profession.

However, the large differences in objectives of the landscape architect's master plans, are the needs of the university at that time.

According to the 2005 Master Plan, the objectives for design were partly a response to the rapid expansion exhibited in the 2002 Master Plan (Sasaki, 2005). The large student population growth in the late 1990s required quick development of the campus through land acquisition. Many roads were closed to facilitate the construction of more buildings for academics and housing, however, the pedestrian landscape suffered without quality spaces and a new lack of transportation infrastructure (Sasaki, 2005). The 2005 Master Plan worked to improve student spaces with design recommendations for a Library Mall (Figure 22) and other open spaces.

*Figure 22 - UNT Library Mall*

*Source: Ayer-Saint Gross (2013).*

The needs of the UNT campus changed again shortly after the 2005 Master Plan, and the landscape architects from Ayer-Saint Gross expanded the vision for the campus to encompass both the quality of open spaces and the campus boundaries. According to Ayer-Saint Gross (2013), while many objectives from the 2005 Master Plan improved the aesthetic quality of the landscapes, the focus could shift to making sure that the individual landscapes sustained a unified character and standard.

### 4.2.4 Generalizable Features

In many ways, the UNT campus is an attractive campus due to its dense, natural tree canopy, the walkable campus core, and commitment to sustainable development practices (Ayer-Saint Gross, 2013). Some of the generalizable features that stand out from UNT's development and could be utilized more in other campuses are:

1. Emphasis on protecting mature native tree canopy.
2. Native or water-wise naturalistic plating palette.
3. Quality Facilities for academic programs.
4. Being progressive in sustainable architecture.

According to Ayer-Saint Gross (2013), UNT was the first public university in Texas to sign American College and University Presidents Climate Commitment, shortly after earning LEED platinum ratings on new campus buildings.

### 4.2.5 Lessons Learned

While many goals were met from both the 2002 and 2005 UNT Master Plans, still there are many goals in progress at the time of this thesis. These planning and urban design goals were outlined in the latest UNT Master plan report from Ayer-Saint Gross (2013) in the form of continued goals, as well as design criticisms revealed from inventory and analysis, and design implications based on that evidence.

1. Better define attractive campus edges and gateways.
2. Continue to enhance open spaces with more pedestrian connections.
3. Surface parking area being slowly removed and not replaced with more efficient infrastructure.
4. Pedestrian Malls outside of campus core suffer from varying path qualities and lack of

tree canopy.

5. “City code is misunderstood” as preventing the development of sites with mature trees.
6. W Highland St should be converted to a limited-access transit mall.

The goal of the lessons learned section is to organize the criticisms and successes of the previous master plan development to understand the context of the UNT campus design. This case study analysis informs that the latest goals of the master plans are to improve the campus with design standards that enhances university entrances, circulation/connections for pedestrians, and a unified character. It also reveals that the UNT development can be described as an “All-of-a-piece” urban design project, defined by Lang (2017). This means that an urban design project was designed in phases, by different groups, and can easily result in “loss of character” over time as well as contain unintended design consequences.

### 4.3 Observation Analysis

This section focuses on the observation analysis strategies for the field observation data collection methods. The data collection methods included behavior mapping, inventory of desire path occurrences recorded in the field, and field notes of the surrounding conditions of the landscape where the desired path occurred.

#### 4.3.1 Behavior Mapping

The second data collection method included field observation of pedestrians and desire path users. One strategy of field observation is known as Ethnography or an ethnogram in map form. Ethnography is the study of the behavior of people within a landscape (Sommer and Sommer, 2001). The goal of the behavior mapping and casual observation is to build a base understanding of what the demographics of the desire path users look like. On March 2nd, 2021, a

campus open space at UNT was observed from 10:30 AM – 12:15 PM. The open space was on the corner of West Highland Street and Avenue A between the Business Leadership Building (BLB) on the West and the Parking Garage on the East (Figure 4.3.1.1).

The open space contained 2 observable desire paths, one directed towards the BLB (Desire Path A indicated in red), one directed away from the BLB (Desire Path B, indicated in blue), and other desire paths in the periphery of the opens space (indicated in yellow). The design form typology of the pathways resembles Booth's (2011), angular design. According to Booth (2011), angular design forms enhance pedestrian circulation and efficiency due to the directness of the pathways. However, the terminus of the angular pathways did not meet at pedestrian nodes (building entrances and crosswalks) but instead avoided mature trees. A Desire path (Desire Path A) is formed in the space between where the pathway starts and the pedestrian nodes to improve efficiency. Desire Path B followed the angular pathways set in the open space but created a new terminus that overcame the planting obstruction preventing pedestrians from crossing the street. The W Highland Street and adjacent planting buffers acted as a boundary that prevented students from crossing to a visible entrance across the street, that was in line with the angular pathway of the open space.

Of the 323 pedestrians observed using the open space, the 40 individual pedestrians used Desire Path A and 7 (3 couples and 1 individual) pedestrians used Desire Path B. From this casual observation, 14.55% of pedestrians were found to take desire paths. Observation revealed that people are likely to enter desire paths on the right (following traffic behavior in North America), and would risk vehicular traffic and muddy conditions to improve efficiency (Figure 23).

*Figure 23 - Ethnogram Behavior Mapping of Pedestrians Using Desire Paths at UNT Campus*


| USERS | PATH | GROUPING | DIRECTION | LOCATION |
|---|---|---|---|---|
| 323 | Formal | Individuals | Left and Right | Entrances on all sides of the open space |
| 40 | Desire Path "A" | Individuals | Right | Open Space Entrance |
| 7 | Desire Path "B" | Group of 2 | Right | Streetscape on W Highland St |

### 4.3.2 Desire Path Analysis

After a casual observation exercise to understand the demographics of desire path users and their general behaviors, a detailed inventory of desire paths at the UNT campus was taken through a two-day site visit. The campus was traversed in a grid from block to block, starting from the upper northwest corner on Eagle Drive, moving east towards Fry Street. After each block along the northern campus boundary was walked, the process was repeated in reverse moving from East to West. When a desire path was encountered, its physical characteristics were recorded in the modified site evaluation matrix, and its location was marked on a physical copy of an aerial imagery printout.

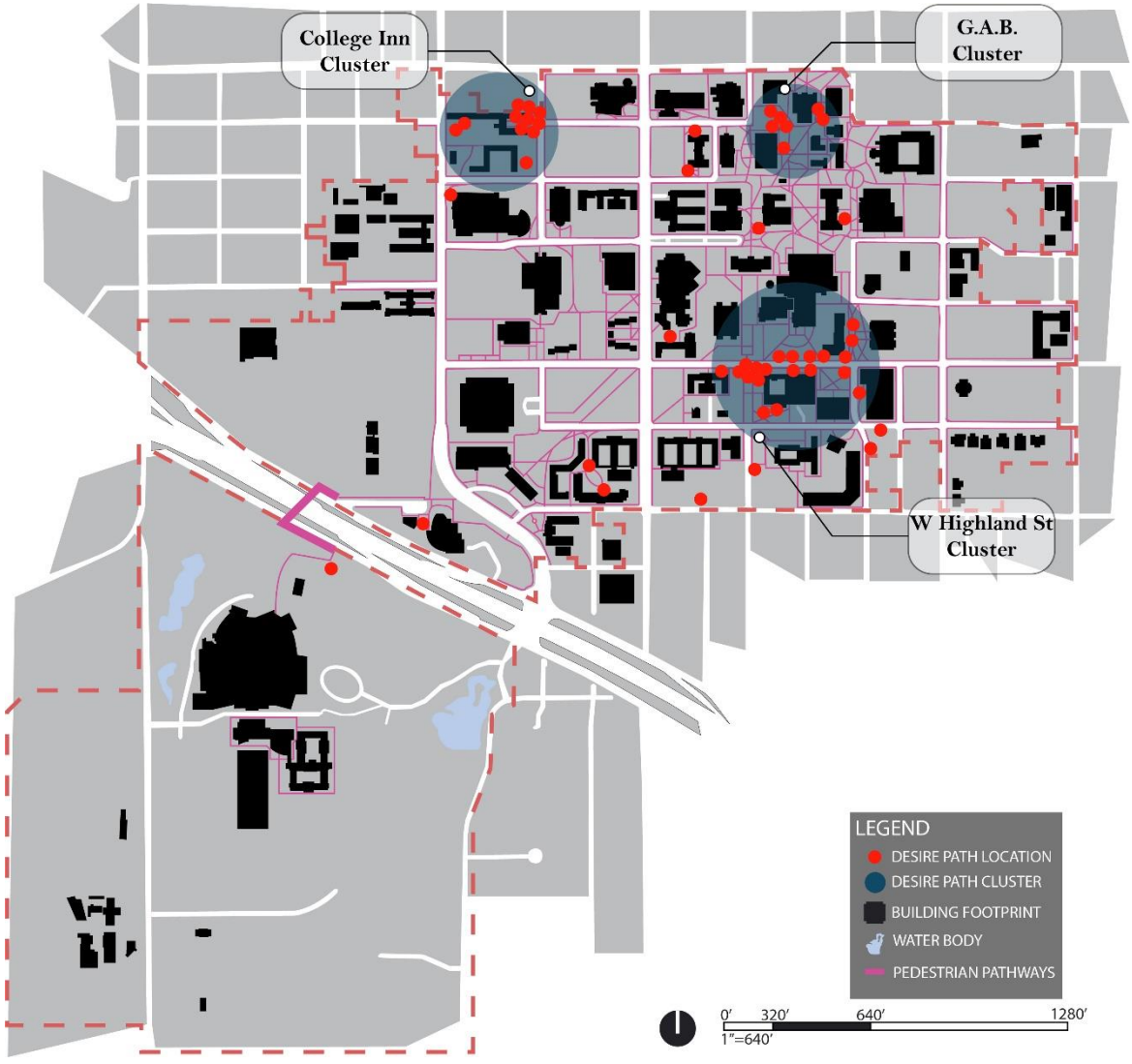
A total of fifty-two desire paths were recorded on the UNT campus (Figure 24), with a total length of 0.76 linear miles. The length of the desire paths ranged from 2 feet to 682 feet, with an average width being 4.5 feet wide. Immediately after mapping the desire paths on the campus, 3 distinct clusters of desire paths could be formed where desire path occurrences were densely located.

1. “College Inn Cluster”
2. “General Academic Building (GAB) Cluster”
3. “W Highland Street Cluster”

The differences in the clusters were largely due to the surrounding land use, and open space typology (Streetscape, Plaza, Malls-Quads, Grassy Area). However, other factors remained similar between the clusters such as the plant material, ground plane of the desired path, and design form typology of the pathways. The visual representation of the clusters became the organizing armature for comparing desire path locations and answering **Research Question 1** (“Are desire paths an isolated incident in the landscape, or a symptom of larger urban design and

planning decisions?") and **Research Question 2** ("What landscape design elements & patterns contribute to desire path occurrences in urban environments?").

*Figure 24 - Desire Path Location Map UNT Campus*




### *"College Inn Cluster"*

The College Inn cluster (Figure 25) contains a total of 11 desire paths. Due to the data analyzed from the ethnogram, the direction of the desired path was assumed, and marked in the plan diagram. The surrounding land use of the cluster was "housing" in the form of student

dormitories, which are typically on the boundary of the university property lines. The ground material was a lawn in every case of the 11 desire paths, and where the landscape was intentionally designed space, the design form typology was rectilinear. Two desire paths were made at a diagonal where no formal sidewalk existed, while most of the desire paths were formed at the entrance of the College Inn residence hall courtyard. While three of the desire paths create new connections to enter campus more efficiently, most of the desire paths made were a response to the poor design of the residence hall courtyard entrance. The pathways and pedestrian nodes (bike racks, seating areas) are narrow and obstructed (Figure 26).

*Figure 25 - "College Inn Cluster"*

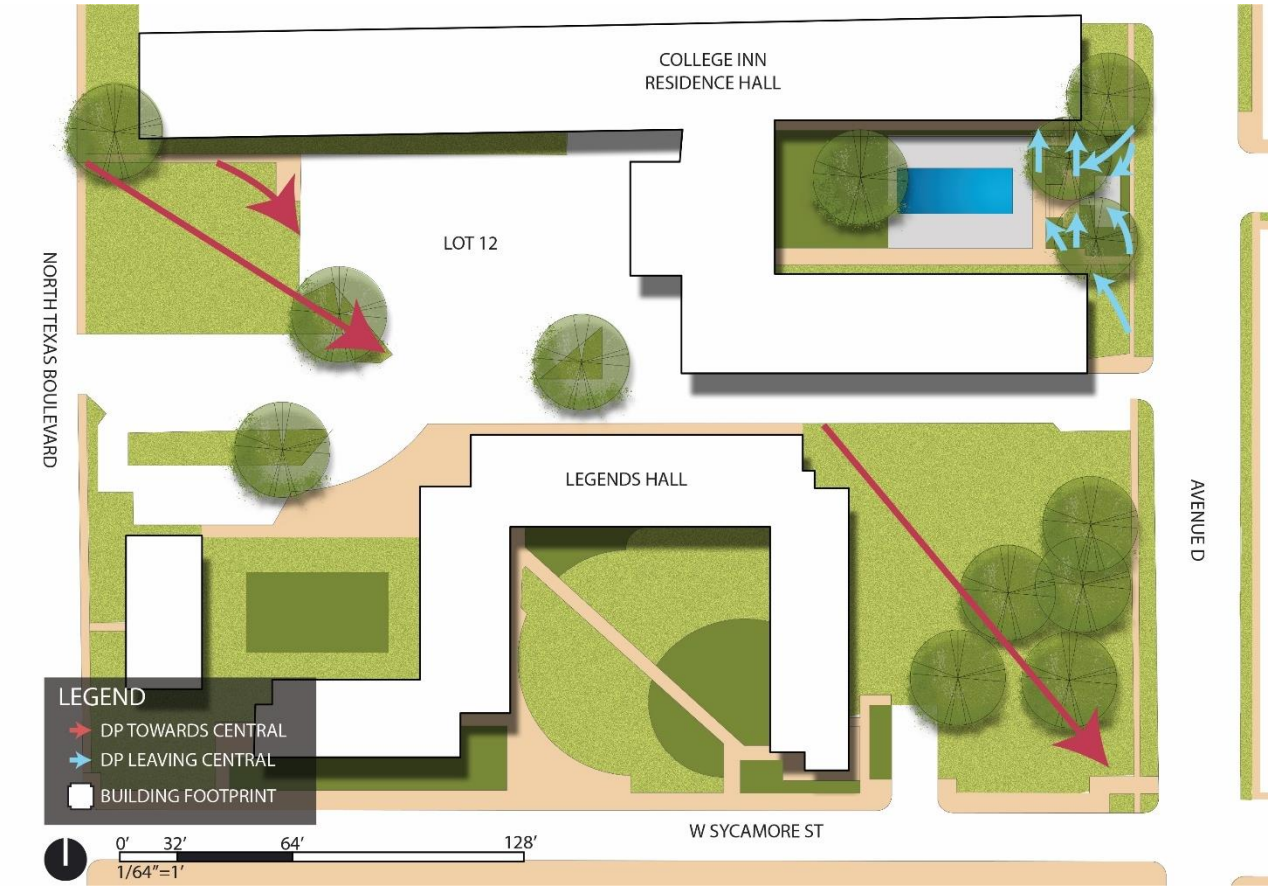
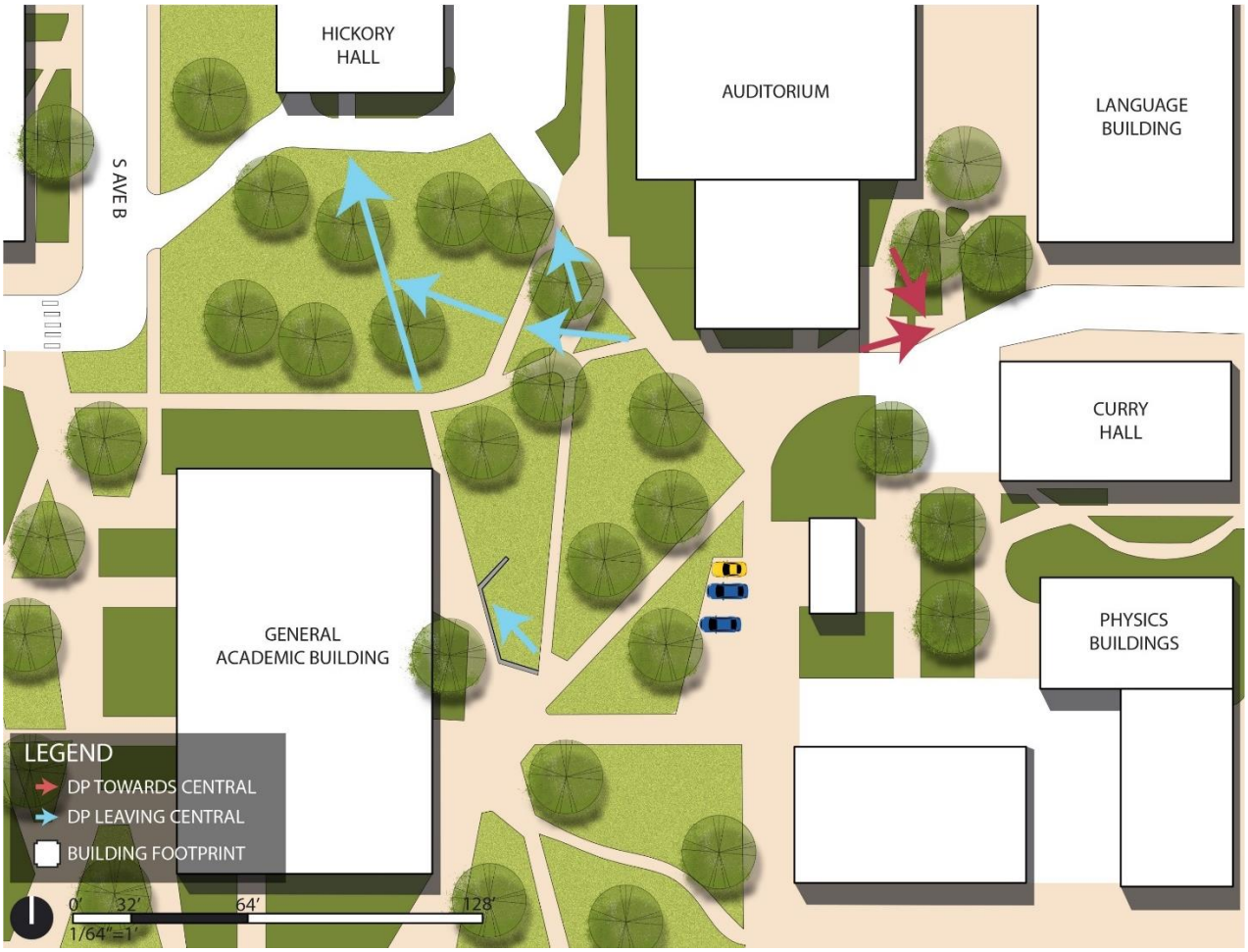


*Figure 26 - College Inn Cluster Site Photos (Desir paths are marked with orange masks)*

***"GAB Cluster"***

The desire paths in this area exist in the northernmost portion of the academic core of the campus and contained seven desire paths in total (Figure 27). The desire paths appear within the quads of the surrounding academic land use. Five of the seven desire paths are through lawn ground plane and are in a direction leaving campus, while two desire paths formed through a poorly placed planting bed that obstructs a bike rack.

*Figure 27 - "GAB Cluster" Plan Diagram*



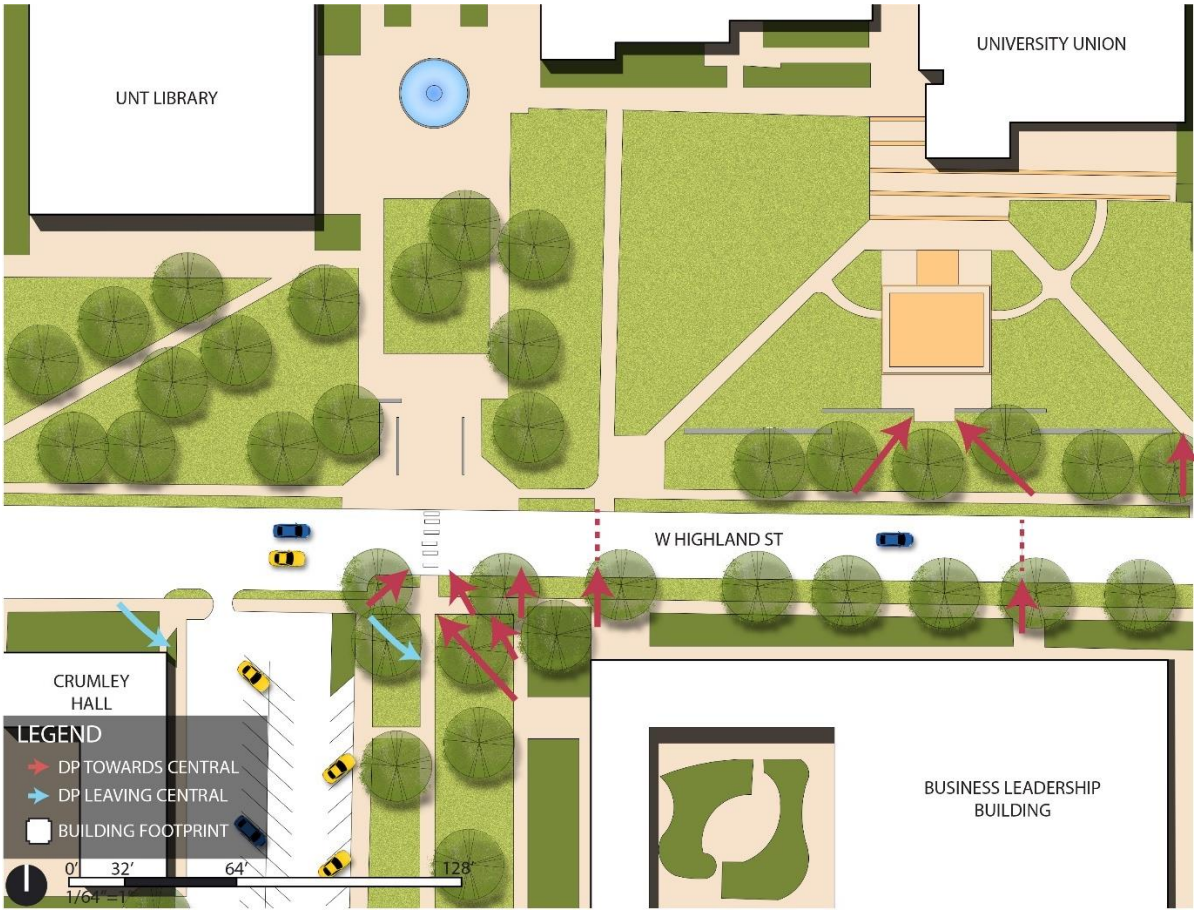

The desire paths directed away from the central campus follow the angular pathway design of the formal sidewalks, but similar to what was observed in the Ethnogram, the terminus of the pathway is obstructed by the native trees (Figure 28). Angular design forms in the landscape are meant to facilitate more efficient movement, however, in this case, the terminus of the pathways does not align with pedestrian nodes or building entrances. This phenomenon of over-protecting tree canopy was a criticism of the 2013 Master Plan. A pattern is also forming around certain landscape objects such as bike racks and seating areas, where they are either floating in open lawns with no sidewalk access, or they are enclosed on multiple sides with planting material.

*Figure 28 - "GAB Cluster" Site Photos*

***"W Highland Cluster"***

West Highland Street is now the only street that transverses the entire campus from West to East. All other streets that had previously done so were divided to provide space for more academic buildings. West Highland Street now divides the academic core from most of the housing buildings on the southern boundary of campus. Most of the desire paths that appear in this cluster occur within the streetscape of West Highland Street at natural crossing points that align with pedestrian nodes (building entrances, plazas, quads) (Figure 29). There are only two formal cross walks for pedestrians in the West Highland Street Cluster, resulting in many desire paths that lead pedestrians to unsafely cross from south to north in the academic core.

*Figure 29 - "W Highland St Cluster" UNT Campus*

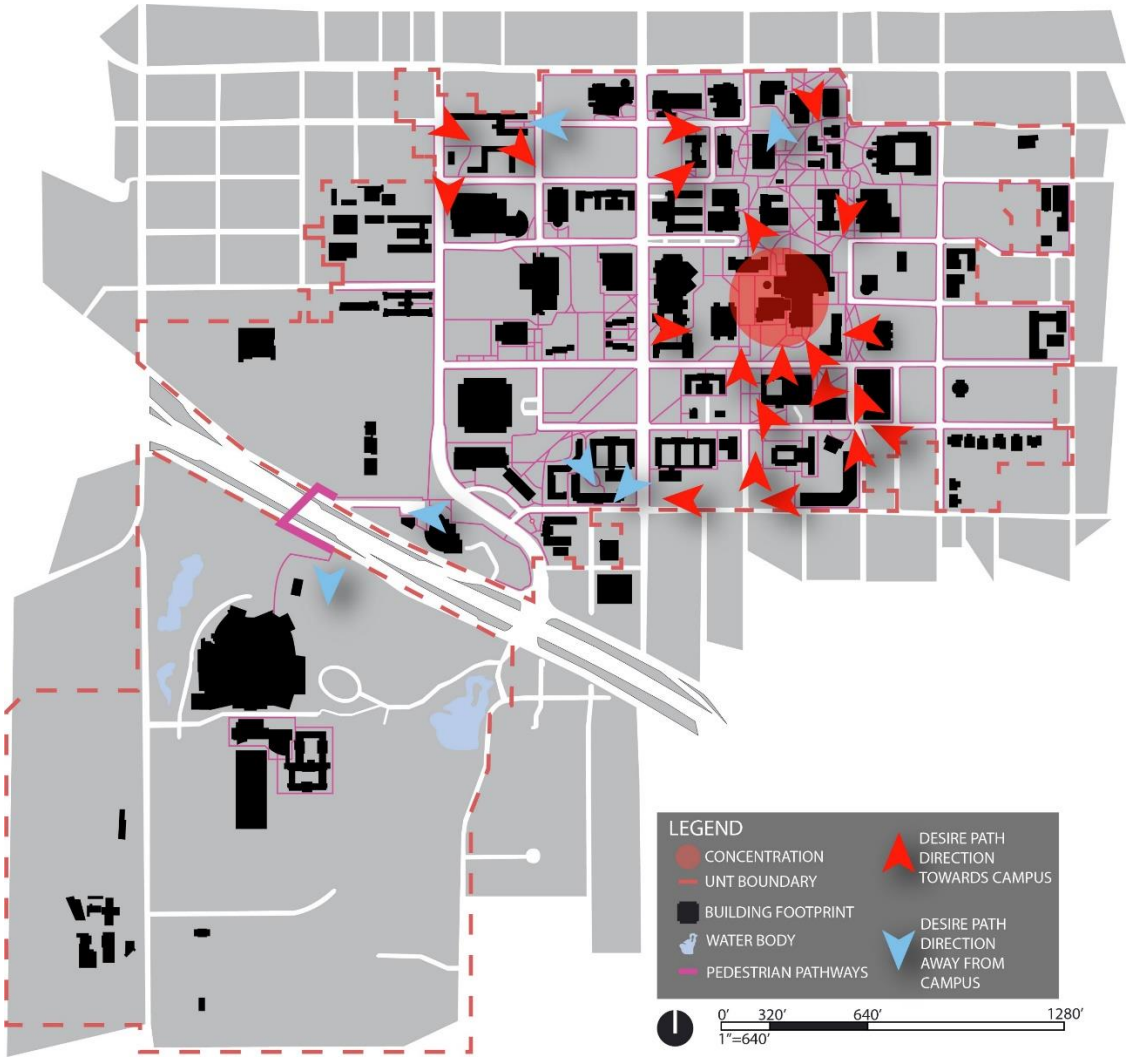



Common characteristics of the streetscape in this cluster are narrow sidewalks, rectilinear design forms, planting bed buffers that line the entire length of the streets, and few crossing points at heavy pedestrian traffic nodes (Figure 30). Gravel is commonly used as a mitigation method, where the plant material was eroded.

*Figure 30 - "West Highland Street Cluster" UNT Campus*

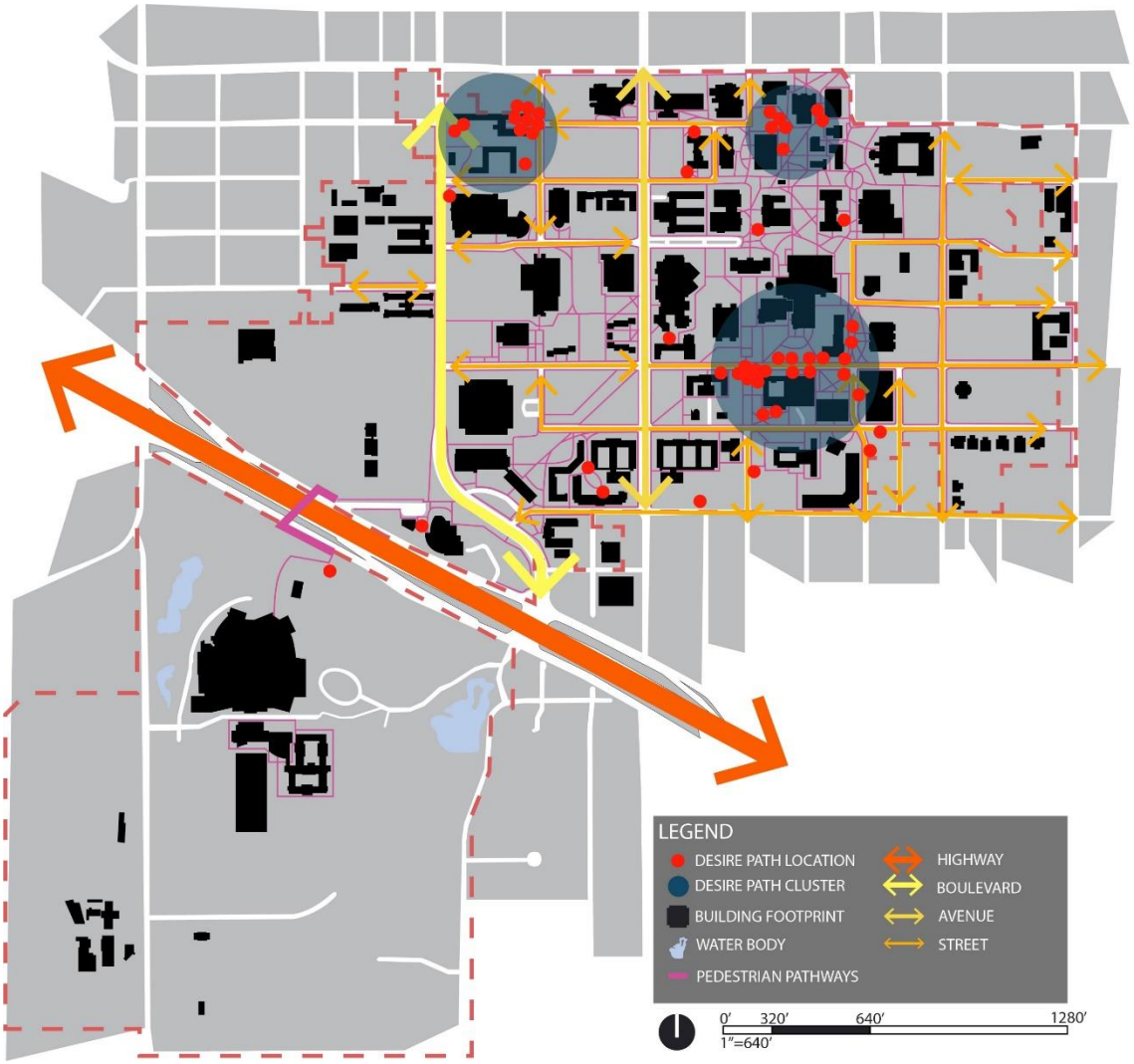
While field observation revealed strong data about how the landscape design contributed to the desire path locations, graphical representation through mapping analysis revealed the relationship that the desire path clusters had with the urban design of the entire campus. Secondary description data from the UNT master plan described the “Campus Core” as the central campus, where most of the academic buildings are. The ethnogram revealed how people use desire paths and from this data, the direction of desire paths can be assumed (Figure 31).

*Figure 31 - Desire Path Directions on UNT Campus*




Most of the desire paths recorded were directed towards the campus core, while desire paths leading away from campus were located at the periphery. Many of the desire paths that were directed at the campus core were located south of W Highland St. No other street on the UNT campus acted as a boundary for pedestrians like W Highland St did (Figure 32). Even streets that were classified as higher traffic, using the American Institute of Architecture (AIA) street classifications, such as Avenue C and Eagle Drive, did not prevent as much pedestrian circulation as W Highland St did.

*Figure 32 - Desire Paths and Street Network on UNT Campus*

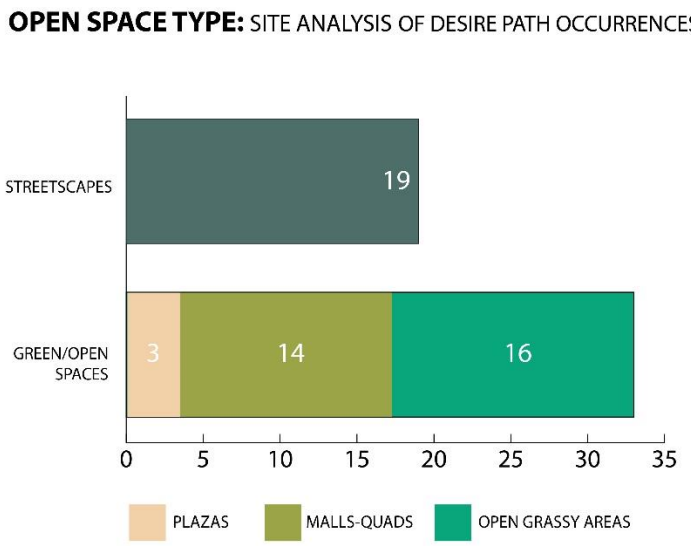



The campus core is an isolated island that is separated from the rest of the university due to the surrounding street network. A common characteristic of the streetscapes in the central campus is the high density of pedestrian pathways. However, there is a lack of pedestrian pathways on the periphery of the campus along the property boundaries, resulting in the desire paths along the campus edges. Another finding of note from this analysis is that the street network design typology for the campus had originally been developed as a grid. However, when the campus had started to expand by replacing sections of streets with buildings, much of the

East-West connections were lost. This development history places pressure on W Highland Street to provide East-West connection for vehicular traffic and contributes to making the street a conflict zone for pedestrians. The grid typology

Another common phenomenon of the desire paths across campus is that they tend to occur equally within streetscapes (W Highland St and Eagle Drive), designed open spaces (Plazas and Malls/Quads), and open grassy areas (lawn spaces that have yet to be developed) (Table 4). 19 of the desire paths recorded on campus occurred in streetscapes, 17 desire paths occurred in an intentionally design open space and 16 desire paths occurred within an open grass area.

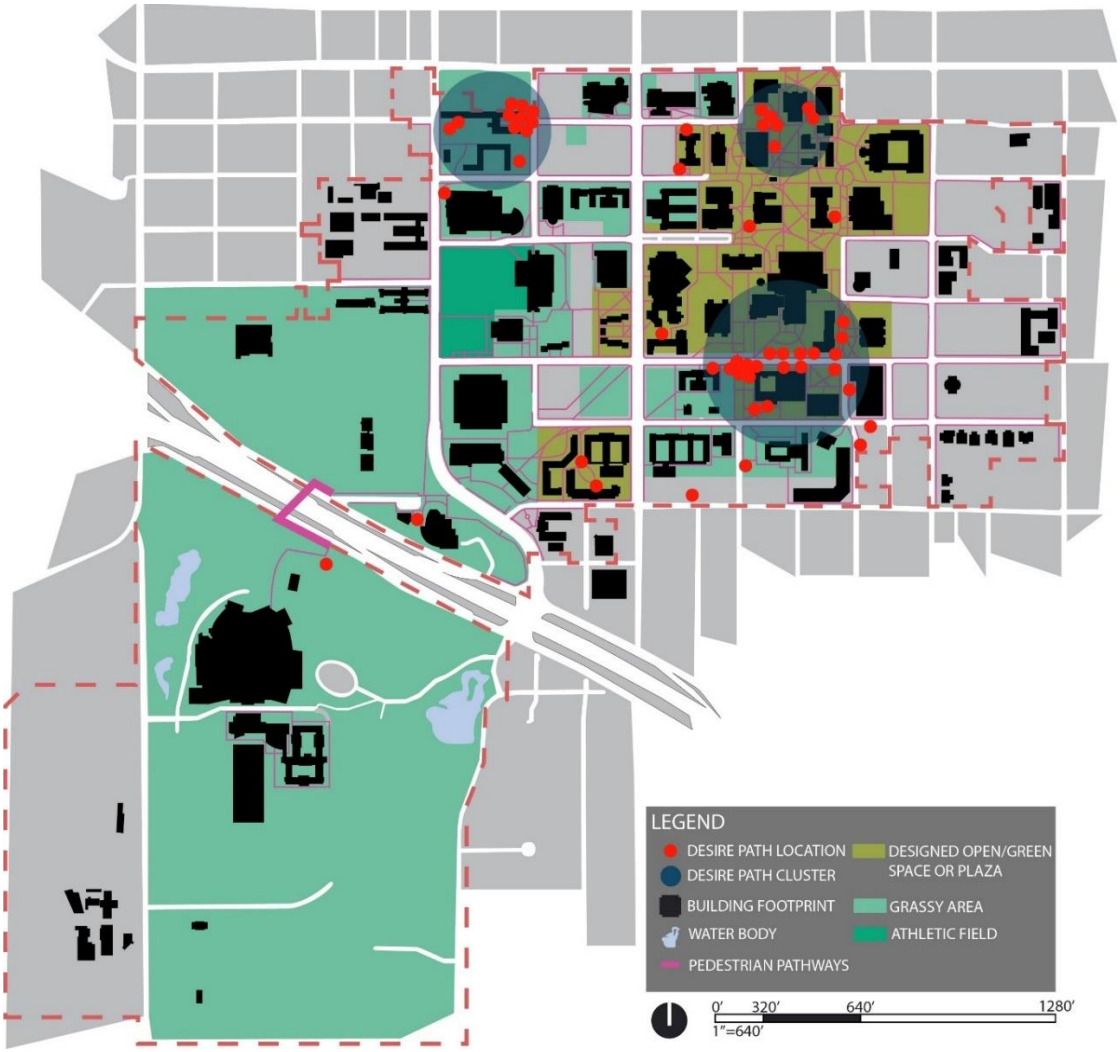
*Table 4 - Open Space Typology and Desire Path Occurrences*




The desire paths that occurred within the streetscapes typology almost exclusively came from the West Highland Street cluster (Figure 33). This data analysis confirms that the W highland street contains design conflicts present nowhere else on the campus. Secondly, this analysis shows that grassy lawns with no design are equally as likely to contain desire paths as designed opens spaces (malls and quads). Lastly, the open space map shows that most Malls/Quads and plazas are located centrally within the campus core, while the grass lawn areas

that have yet to be developed are mostly located on the campus periphery.

*Figure 33 - Open Space Typology and Desire Path Occurrences*




While the campus core is where most open spaces are, it is also where most of the academic buildings are on campus (Figure 34). Most of the desire paths recorded occurred within the academic zones with a total of 63% of desire paths appearing near academic buildings (Table 5). 23% of desire paths occurred within housing land use zones on campus which are mostly located on the periphery of the campus edges.

*Figure 34 - Land Use Map and Desire Path Occurrences*

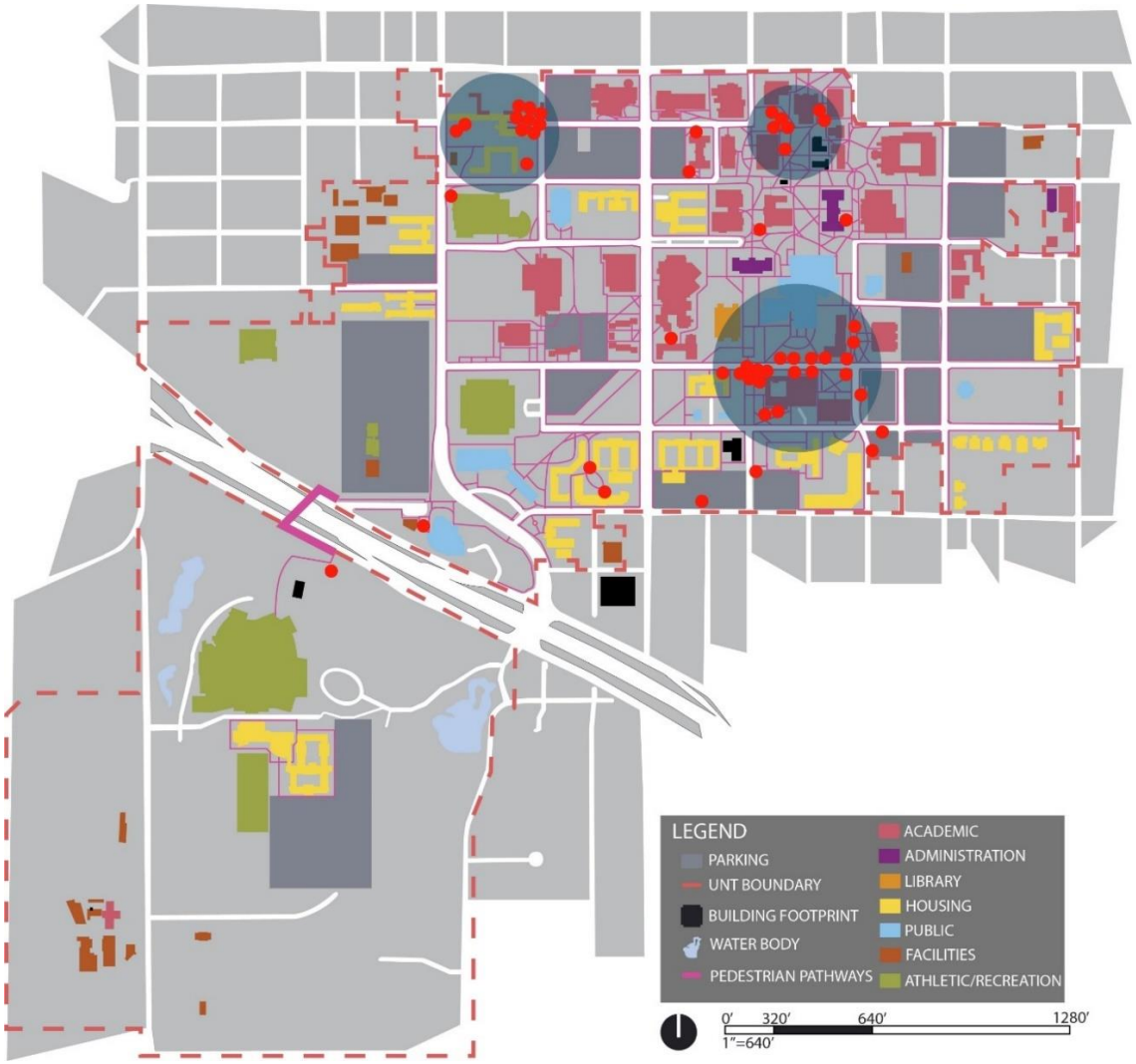
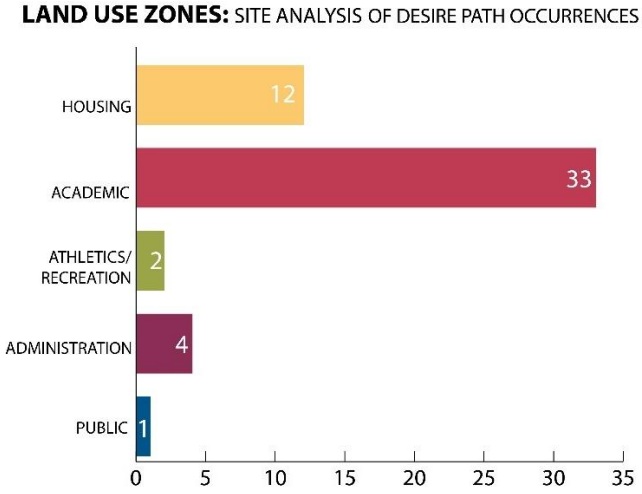



*Table 5 - Land Use Zones*



### 4.4 Research Question 1 Finding

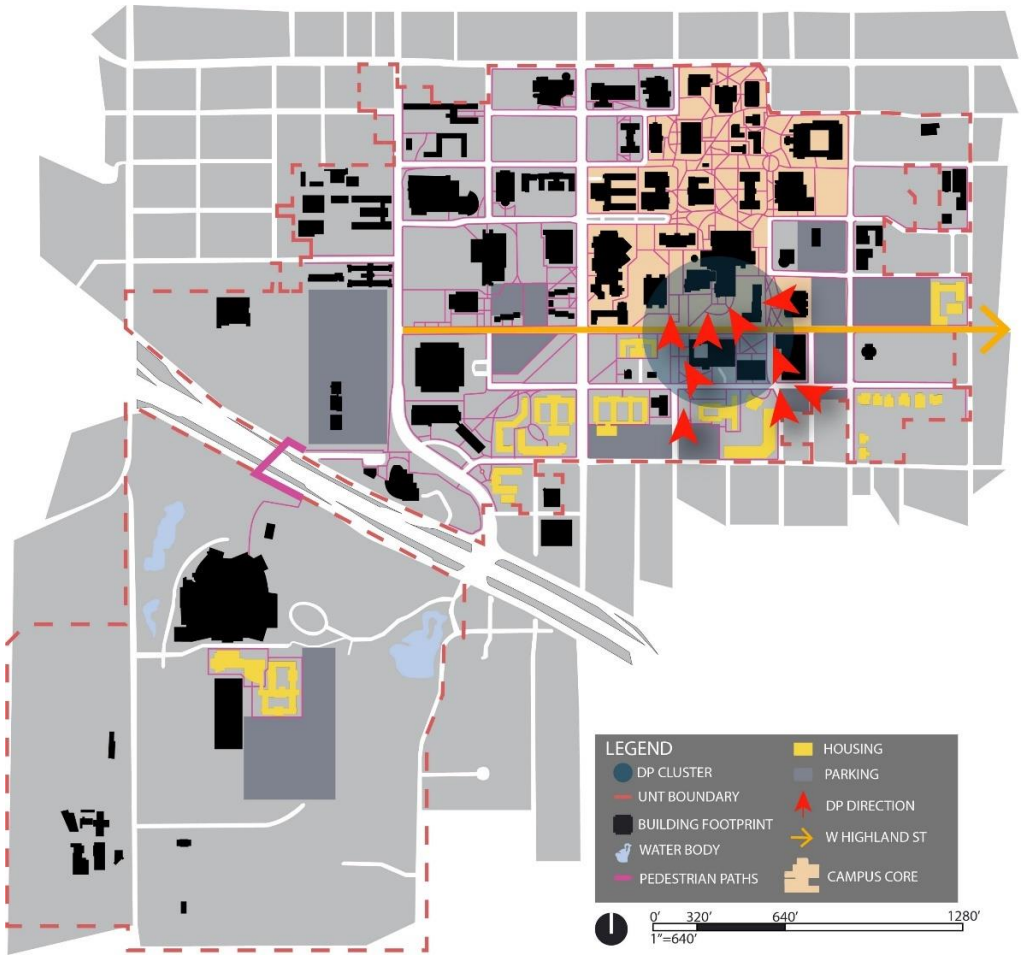
The mapping and descriptive statistical analysis of the field observation data confirm many of the design criticisms noted in the 2013 Master Plan and work to answer **Research Question 1** ("Are desire paths an isolated incident in the landscape or are they a symptom of larger urban design and planning decisions?"). While the University is committed to sustainable development, much of the infrastructure has been planned based on the topography of the site and the location of mature trees. Sidewalks that are angular and more efficient, terminate too early, or are not aligned with pedestrian nodes (building entrances, cross walks, etc…) to avoid trees, and create opportunities for desire paths to form. Secondly, W Highland St was noted for being a major zone of vehicular-pedestrian conflict in the 2013 Master Plan. Desire path analysis of the campus revealed that W Highland St acts as a boundary preventing a strong North-South connection for students who are entering the campus core from their dormitories or commuter parking lots (Figure 35).

Mapping analysis reveals that desire paths do occur from poor design decisions in the landscape as shown in all three desire path clusters. The "College Inn Cluster" had many desire paths form due to the rectilinear shapes of the courtyard sidewalks, and planting beds that obstructed amenities. The "GAB Cluster" had multiple desire paths form between the webbing of angular sidewalks that terminated too early because of the mature trees. Lastly, the streetscape on West Highland Street observed many design issues including limited cross walks, narrow sidewalks, obstructive plant material, and rectilinear sidewalk forms that created many opportunities for pedestrians to cut corners.

While these landscape design issues can be observed to encourage desire paths as isolated incidents, an urban design conflict arises when they happen multiple times throughout the urban project (a university campus in this case). Just as the 2013 Master Plan noted that UNT should

focus on developing a unified character of urban design standards, it should be noted that desire paths could be eliminated with such an effort.

*Figure 35 - Urban Design and Urban Desire Paths (DP) Map*




## 4.5 Research Question 2 Findings - Desire Path Typology

Typology classification systems are a reliable tool for organizing theory-building research (Deming and Swaffield, 2011), and are heavily utilized in the urban design professions to relate design principles to site planning projects (Lang, 2017). Desire path typologies have also been previously developed in the literature for specific purposes such as defining the level of hazard to pedestrians or rating the desirability of a particular pathway. This research attempts to create a new typology of desire paths that can be used by designers to recognize where desire

paths may occur in their proposals and resolve them before they appear in the landscape. The new typology developed in this thesis was structured by desire paths described in the literature review and later defined by analysis done in the previous sections (Table 6).

*Table 6 - General Desire Path Typology from the Literature*

| Typology – From Literature | Description |
|---|---|
| A. Efficiency – Motive Landscapes (Francis & Marcus, 1998), (Coutts, et al., 2019), (Booth, 2011) | Desire paths created to transport pedestrians from Point A to Point B faster. May or may not lead to an identifiable destination. |
| B. Discovery– Relaxing Landscapes (Luckert, 2013), (Furman, 2012) | Created by pedestrians to explore an area more closely. May be a natural area/park. There is usually a defined destination. The foot path typically winds in direction more and is not as direct. |
| C. Necessity – Any Landscape Type (Foster & Newell, 2019) | These Desire paths are created from necessity. There is typically no existing formal pathway, and pedestrians have had to make their own. |

Sources from the literature review revealed three general types of desire path typologies that can be organized by pedestrian motivation and the surrounding landscape they occur in. Pedestrian motivations for using desire paths and landscape design are two variables used to define the desire path typology because they help to provide a holistic understanding for designers. All three of the general desire path typologies are organized by those two variables and come from a combination of multiple sources in the literature. Efficiency desire paths appear to help move pedestrians from Point A to Point B as quickly as possible. Typically, these efficient desire paths appear in landscapes that are more motive and pedestrian dense such as cities and campuses. Discovery desire paths help create connections for pedestrians who are not trying to move efficiently within a landscape, but who wander from the formal trails to discover hidden objects or views. Lastly, Necessity desire paths are formed to create connections for pedestrians where no formal sidewalks exist. These types of desire paths are typically more dangerous due to the landscape potentially being private property or too close to vehicular traffic. From these three general desire path typologies structured by the literature review, visual observation data analysis from the research begins to fill in more defined sub-typologies as

follows.

**A1. Efficiency – Corner Cutting** (Figure 36)

*Figure 36 - Corner Cutting Desire Path on UNT Campus*

"Corner Cutting" desire paths were the second most observed desire paths (21% of all recorded desire paths) on the UNT campus. These desire paths appeared purely for increasing pedestrian travel efficiency at sidewalk intersections that formed right angles. Typical landscape design conflicts that contributed to the occurrences of "Corner Cutting" desire paths include right angle intersections, narrow sidewalks, lack of boundary between sidewalk and lawn material as the ground plane. In some examples, there are landscape objects such as lighting details and trees that don't necessarily encourage desire path occurrences but help guide where they are located. These landscape objects can act as gates or entrances at the start or end of the desired path. Lastly, it can be noted that this desire path does not always have a known destination.

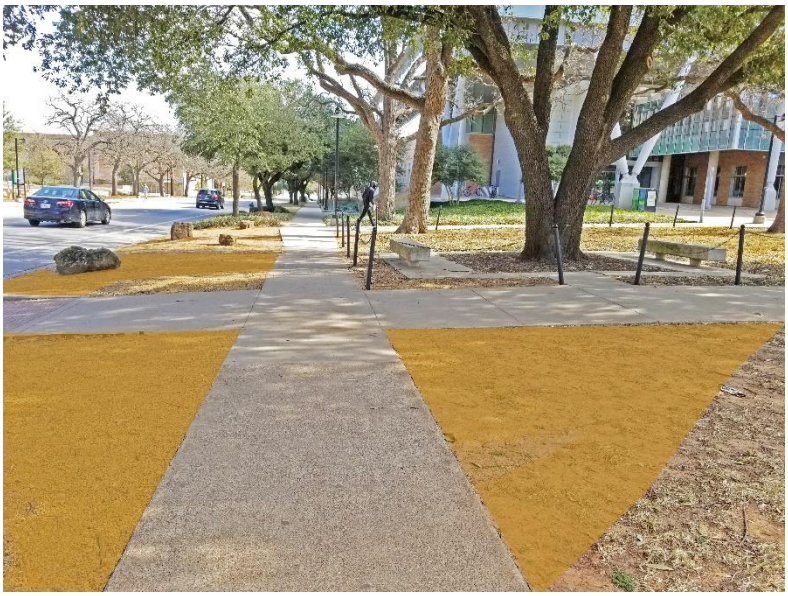
**A2. Efficiency – Direction Alignment** (Figure 37)

*Figure 37 - Direction Alignment Desire Path on UNT Campus*

"Direction Alignment" desire paths are a response to sidewalks that dramatically change direction away from the pathway starting point. From the case study analysis on the UNT Master Plans, we know this to happen because the university had prioritized mature trees over pedestrian experience during its expansion development. Instead of following the sidewalk, pedestrians would rather align their direction with their original walking path and forge their trail. This desire path occurs to increase travel efficiency, and in the case of UNT, happens in landscapes with design conflicts similar to where "Corner Cutting" Desire Paths occur. A total of 23% of desire paths recorded are classified as "Direction Alignment" desire paths.

**A3. Efficiency – Pedestrian Node** (Figure 38)

*Figure 38 - Pedestrian Node Desire Paths on UNT Campus*



"Pedestrian Node" desire paths are not a single type of desire path, but rather a space in the landscape that experiences multiple desire paths in a small area. These pedestrian node desire paths are also made to increase pedestrian travel efficiency, and can be both "Direction Alignment", and "Corner Cutting". However, in this case, the travel destination is known, unlike the previous typologies. Pedestrian nodes can be crosswalks, seating areas, building entrances, or other spaces of interest. The design conflicts in the example illustrated (Figure 38) are the narrow sidewalks that intersect at right angles, obstructive fences, and only one available crosswalk at a major North-South intersection point. Lastly, a planting buffer of low ground cover between the street and sidewalks was provided for pedestrian safety, however, they also act as a buffer to connection when only one crossing point is available.

**B1. Discovery – Recreation Destination** (Figure 39)

*Figure 39 - Recreation Destination Desire Path on UNT Campus*

"Recreation Destination" desire paths occur to connect pedestrians to landscape objects and other amenities. These desire paths are similar to "Pedestrian Node", in that they both have known destinations. However, "Recreation Destination" desire paths are not primarily meant to increase pedestrian travel efficiency, but rather serve as a connection to landscape recreation or amenities. Common landscape design issues associated with these desire paths are mainly that the landscape amenity is floating in an open lawn, with no formal connection to it. In the example illustrated (Figure 39), the seating areas are centrally located in a lawn area, with gravel and flagstone pavers added later to mitigate the desire path erosion. A total of 17% of the desire paths found on campus were classified as a "Recreation Destination" desire path type.

**C1. Necessity – Forgotten Spaces** (Figure 40)

*Figure 40 - Forgotten Spaces Desire Paths on UNT Campus*

"Forgotten Spaces" desire paths occur in any landscape type that lacks formal sidewalks. Both open spaces and streetscapes are subject to the "Forgotten spaces" typology of desire paths. Typically, these spaces lack formal infrastructure because they are on the boundary of two adjacent properties (Figure 40) or are undeveloped property. These pathways are typically shorter in length (an average of 267.8'), and with some sort of identifiable destination such as a utility or landscape object. However, there are some cases in which these pathways do not have identifiable destinations and are simply necessary for pedestrians to traverse a part of their city. Common landscape design issues surrounding these desire path types are grassy lawn areas and opposing land-use types that are too close in proximity to locate a formal sidewalk. When these desire paths appear in streetscapes vehicles can be especially dangerous for pedestrians. In other cases where this typology of path exists in undeveloped open spaces, dangers can be present in the form of hidden people or animals.

**C2. Necessity – Urban Connections** (Figure 41)

*Figure 41 - Urban Connections Desire Path on UNT Campus*

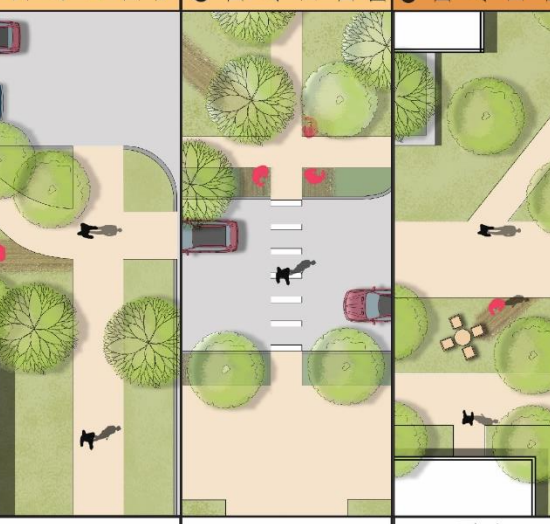
The last classification of desire paths recorded on the UNT campus include "Urban Connections" desire paths. These pathways are very similar to the previous "Forgotten Spaces" typology. However, this typology appears exclusively in streetscapes, not open spaces, and is much longer than the previous typologies (Average length of 441'). In the example illustrated (Figure 41) and elsewhere on the UNT campus, these pathways exist where there is no formal pedestrian infrastructure. These pathways were commonly found at the campus boundaries where parking lots advanced to the street edges, and pedestrian spaces were deprioritized. These pathways can be dangerous for pedestrians due to their proximity to vehicular traffic, lack of lighting, and other standard public safety amenities.

The use of a desire path typology as an analysis tool for the data collected has been useful in answering **Research Question 2** ("What landscape design elements and patterns contribute to desire path occurrences in urban environments?") of this thesis. By organizing the field observation data, case study analysis, and literature review into one typology system (Table 7),

designers can recognize the landscape elements that could contribute to desire path occurrences in their landscape design proposals.

While the desire path typology may be a helpful tool for designers to recognize certain design flaws in master plan proposals, it cannot alone provide evidence-based solutions. As noted in the literature review, some previous studies have outlined other classifications for desire paths, yet they have stopped short of providing recommendations that prevent desire paths from occurring. This thesis attempts to use the multi-method approach of data collection to develop a series of design implications to mitigate the desired path. These implications are tailored to specific desire path typologies and can be adopted as a design standard or implemented in single landscape design scenarios.

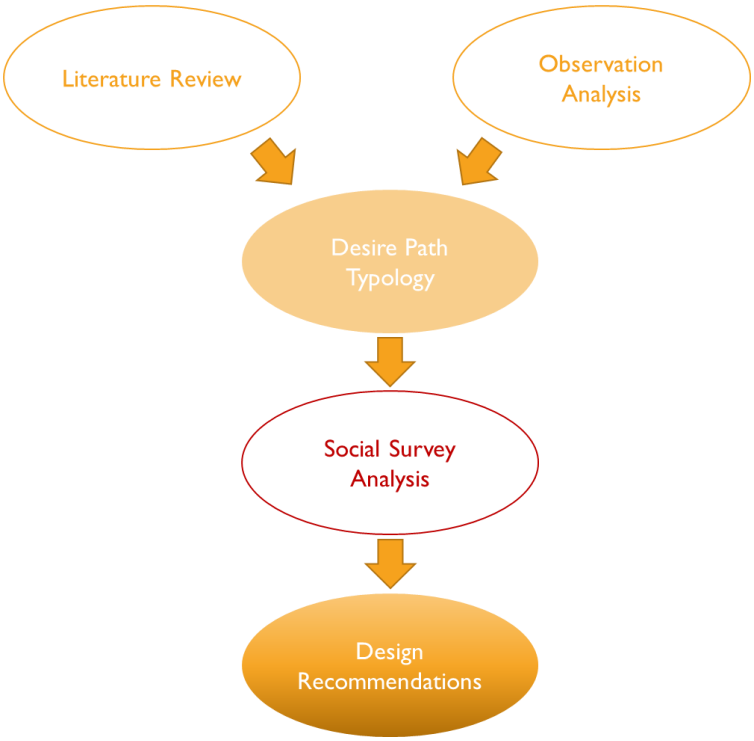
*Table 7 - Desire Path Typology Chart*

| | | |
|---|---|---|
| **A1. Efficiency - Corner Cutting**<br>A desire path type created to increase route efficiency. Typically, a diagonal that cuts through lawn or planting beds, at perpendicular intersections. Most common path type, and shortest in length. |  | **Character:** Diagonal cut in lawn or plantings<br>**Direction:** Typically on right side of sidewalk<br>**Avg. Length:** 20.8'<br>**Landscape Types:** Appears in any landscape<br>**Landscape Elements:** Trash cans, light poles, trees, signage will mark start/end points |
| **A2. Efficiency - Direction Alignment**<br>Desire path type inteded to align with original pedestrain direction, when formal pathways exhibit a direction change. Tends to happen where sidewalks curve to avoid objects (mature trees, utilities, etc...). |  | **Character:** Continuation of orignal path<br>**Direction:** Straight<br>**Avg. Length:** 38.5'<br>**Landscape Types:** Appears in any landscape<br>**Landscape Elements:** Sidewalk avoids large trees, utilities, or landmarks |
| **A3. Efficiency - Pedestrian Node**<br>Path intended to increase route efficiency towards a ***known*** destination. Can be combination of other path types. Potentially multiple paths in one space. (crosswalk, bike rack, fountain, etc...). |  | **Character:** Traffic dense space<br>**Direction:** Multiple directions<br>**Avg. Length:** 48'<br>**Landscape Types:** Any, but mostly *streetscapes*<br>**Landscape Elements:** Adjacent street, narrow pedestrian transition zone, rectilinear forms, plantings |
| **B1. Discovery - Recreation Destination**<br>While this path leads to a known destination, it is not inteded to increase efficiency. Rather, this path leads to recreation, or passive activity of some kind. Appeals to pedestrians' sense of discovery and exploration. |  | **Character:** Through lawn or planting beds<br>**Direction:** Can be winding, curved, or straight<br>**Avg. Length:** 24.2'<br>**Landscape Types:** Restful, relaxing, contemplative<br>**Landscape Elements:** Scattered seating, planting beds |
| **C1. Necessity - Forgotten Spaces**<br>A desire path made from necessity for pedestrians, because there is no formal sidewalks that exist. These pathways typically have a known destination, are shorter in length, and exist in forgotten spaces of designed landscapes. |  | **Character:** Open spaces with no sidewalks<br>**Direction:** Straight<br>**Avg. Length:** 22.5'<br>**Landscape Types:** open spaces, grassy areas<br>**Landscape Elements:** Utilities, lack of sidewalks, planting beds with low ground cover |
| **C2. Necessity - Urban Connections**<br>A desire path type that occurs in areas that lack formal sidewalks for pedestrians. These paths typically have no single destination, but are formed to transverse large areas. |  | **Character:** Substitutes for sidewalks in urban streets<br>**Direction:** Straight<br>**Avg. Length:** 441'<br>**Landscape Types:** Streetscapes<br>**Landscape Elements:** Busy streetscape, narrow lawn buffer and lack of sidewalks for pedestrians |

## 4.6 Social Survey Analysis

In this section, previously conducted social surveys implemented by the researcher are analyzed with qualitative content analysis and repurposed. The combination of data collection methods, the literature review, and the social survey of desire path stakeholders provides stronger evidence for design implications that could work well to mitigate desire path with better design quality (Figure 42).

*Figure 42 - Design Implications Flow Chart*




### 4.6.1 Interview Analysis

Two landscape architects were interviewed for their perspectives on desire paths in the landscape. The main points of the interviews have been summarized in Table 8 and illustrate the differences in approach towards mitigating desire paths. All interview questions can be found in Appendix C.

*Table 8 - Designer Interview Table*

| Subject 1 – Landscape Architect | Subject 2 – Landscape Architect |
|---|---|
| Over 15 years at "Boutique" firms and "Multi-Disciplinary" Firms. | Parks Manager for the city government Parks and Recreation Management |
| Focus clearly on "purity of design" | Focus on public safety |
| Form informs design | Analysis/Engagement informs design |
| Prioritizes clients | Prioritizes public |
| Works with mostly urban projects | Works with mostly nature/park projects |
| Desire Paths are a result of lazy people | Desire paths are a result of disregard of safety |
| Desire paths should not inform design because it is "chaotic" and "not designed". | Desire paths should not "100%" inform design because there are some places that people should not go. |

The interviews with the landscape architects revealed that even with different design projects (city parks, and urban open spaces) and design priorities (public safety and client requirements), both landscape architects agreed that desire paths should not inform where sidewalks should be located. Subject 1 described desire paths as "chaotic" and using them to inform sidewalk locations would create conflicts in the overall quality/aesthetics of the design. Subject 2 noted that public safety is put at risk when desire paths appear and are used as templates for sidewalks because they can lead to dangerous settings.

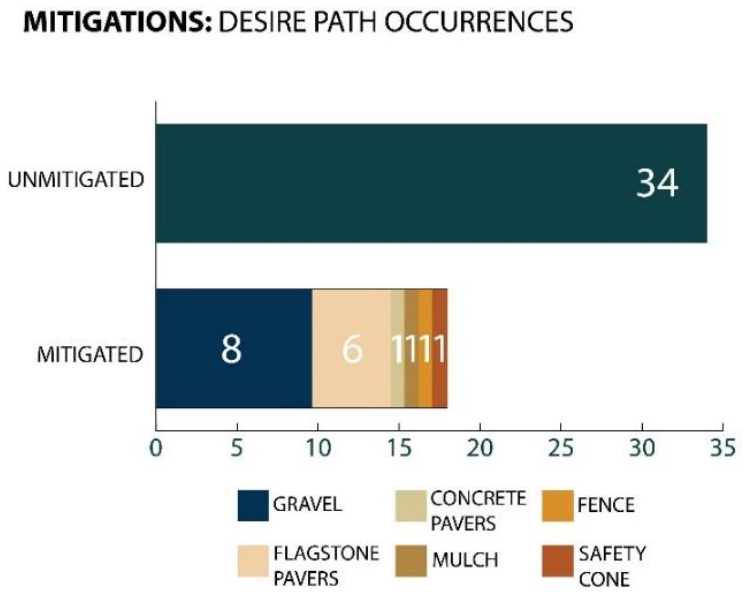
One maintenance professional was interviewed for this study and the resulting data is summarized in Table 9. Subject 3 revealed that while desire paths occur frequently in campus landscapes, they are considered to contribute positively to the landscape by offering a "natural feel". According to Subject 3, this "natural feel" guides the decisions they make for how they mitigate desire paths.

*Table 9 - Maintenance Professional Interview*

| Subject 3 – Maintenance Professionals |
| --- |
| Grounds Manager at local university |
| Best solution for mitigating desire paths are paving with flagstone pavers. "Keeps it natural". |
| Obstructing the pathway means everyone loses. More expensive solution, and it prevents circulation. Obstruction efforts are often disregarded anyway. |
| Desire paths are only mitigated when safety is a concern. When erosion becomes hazardous, or the pathway leads to a dangerous setting. |
| Desire paths are of little economic concern. $2-6 Thousand a year spent on mitigating desire paths. |

From subject 3's experience, most of the desire paths encountered are mitigated by being paved with either flagstone pavers or gravel. According to Subject 3, obstruction only works to create more desire paths and temporarily prevents connections for pedestrians. Subject 3 also revealed that the economic cost of labor and materials to mitigate desire paths can run a university anywhere between $2-6000 a year. In the case of UNT, only 34% of all desire paths recorded were mitigated (Table 10). The price of labor and maintenance of desire paths could potentially be 3 times more depending on the maintenance plan for UNT.

*Table 10 - Mitigation Methods of Desire Paths on UNT Campus*




### 4.6.2 Online Survey Analysis

211 volunteers from the online forum for desire path enthusiasts “r/desirepath”, on reddit.com took the social survey for this study. Many of the questions were open-ended to allow for survey respondents to guide the conversation about their opinions on desire paths. Those questions are qualitatively analyzed while the other questions in the survey are analyzed through descriptive statistics.

The most surprising information from the social survey was that while pedestrians view desire paths as the result of a flaw in the landscape design (Table 11), they still tend to view the desired path as a positive influence on the character of the landscape (Table 12). Many social survey respondents that viewed desire paths positively cited how they feel comfortable knowing people had been there before (Table 13). Pedestrians who viewed desire paths neutrally tended to believe that it was the type of landscape that determined if the desired path had a positive impact on the character.

*Table 11 - Desire Paths as Design Flaws Chart*

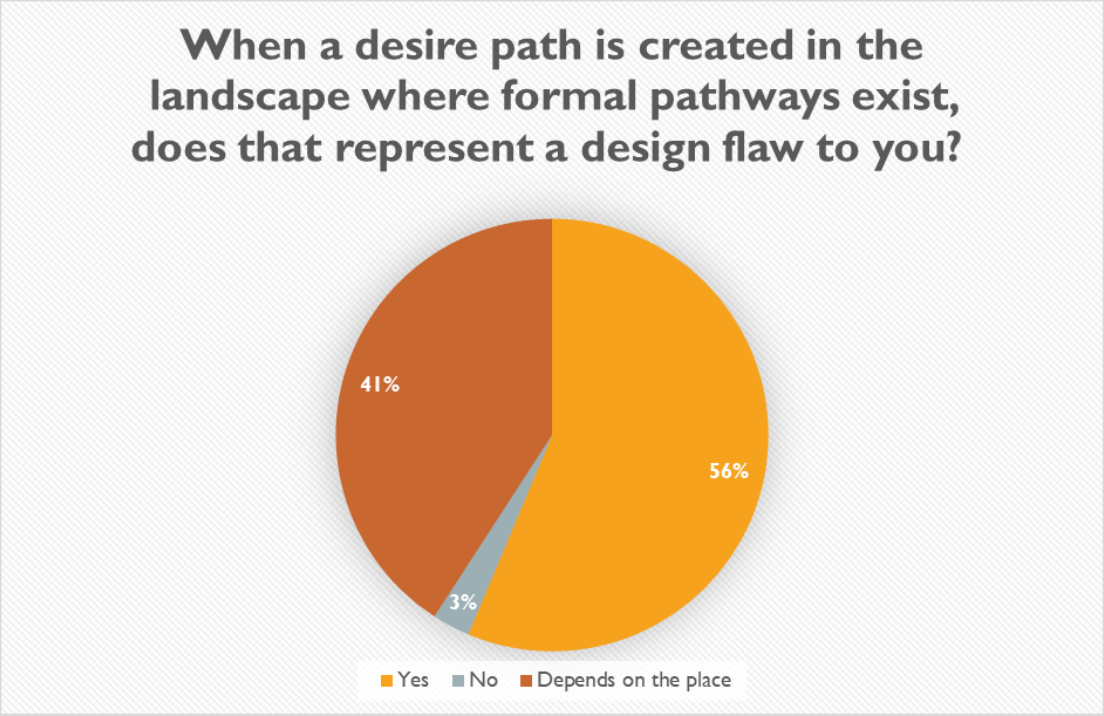



*Table 12 - Desire Paths and the Character of the Landscape*

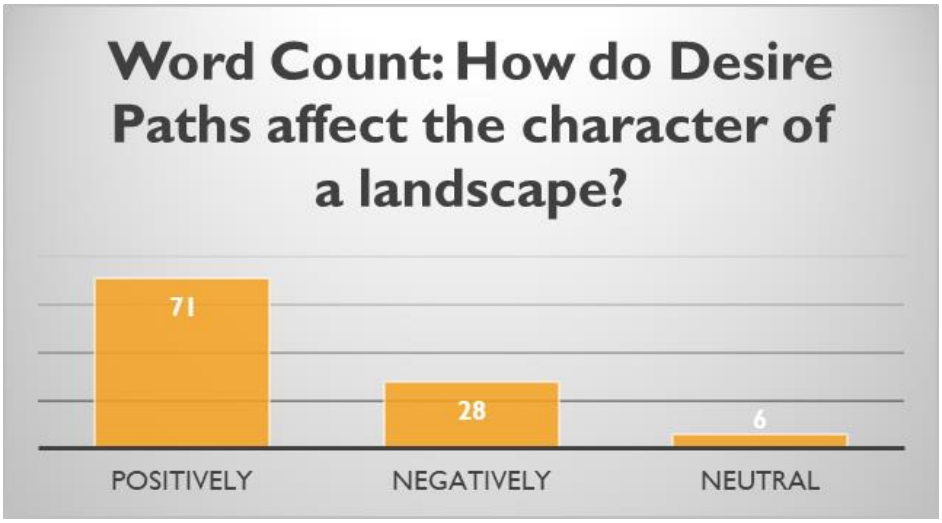


*Table 13 - Desire Paths and the Character of the Landscape Response*

| | |
|---|---|
| 86195306 | **Positively. They are artefacts of how civilians succeed at problem solving where designers fail. They represent chaotic good but are efficient nonetheless** |
| 86176637 | Negatively, especially if blocked. The presence of a desire path is a clear indication that the designer valued form over function. Blocking a path or signage show disdain for users of the space. One exception is signage in nature preserves that may contain fragile plants in the ecosystem. Totally justified then |
| 86175233 | Positively! It brings a sense of comfort knowing that many people have been through the same path as you before. When there's a preferred path that people have chosen in unison, over and over, there's a sense of collective togetherness that I find very comforting. |
| 86160874 | Not at all. Character is more defined by the point A and B of the path and not effected by the path itself. Consider a desire path at a university vs a desire path in an urban low income housing area. Is it really the small path that changes the character? |

Another key finding from the social survey analysis was the pedestrians' perspectives on mitigation methods. According to the survey, the only satisfactory method of mitigation for desire paths is to have them paved over (Table 14). All other methods of desire path mitigation were met with dissatisfaction. "Fenced Off" was the least acceptable method of mitigation with 64.81% of respondents stating they would be "very dissatisfied" (Table 15).

*Table 14 - Pedestrian Satisfaction with Paving Desire Paths*

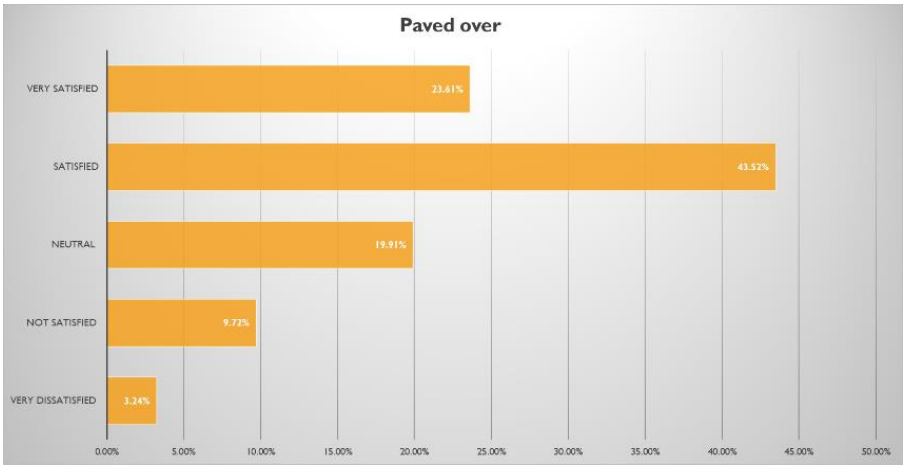
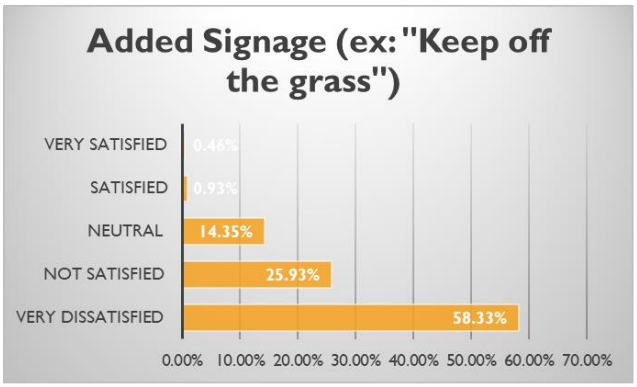
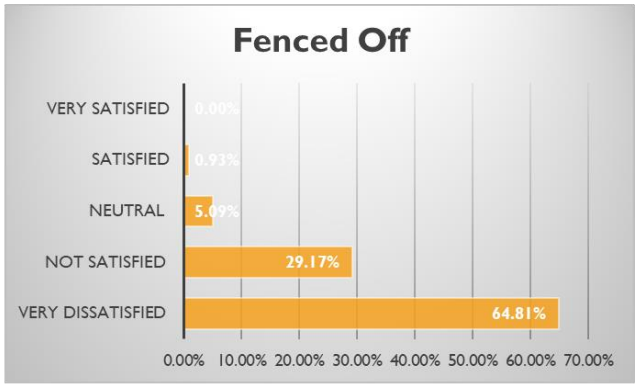
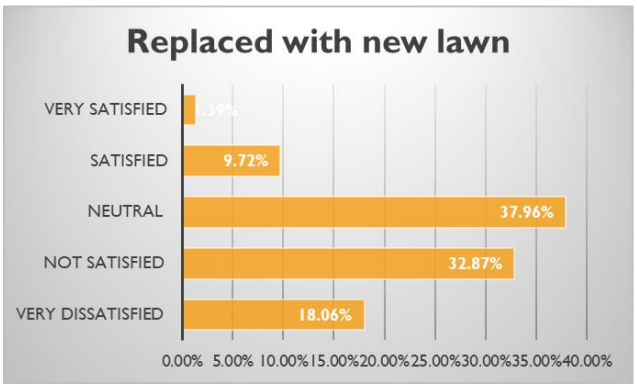
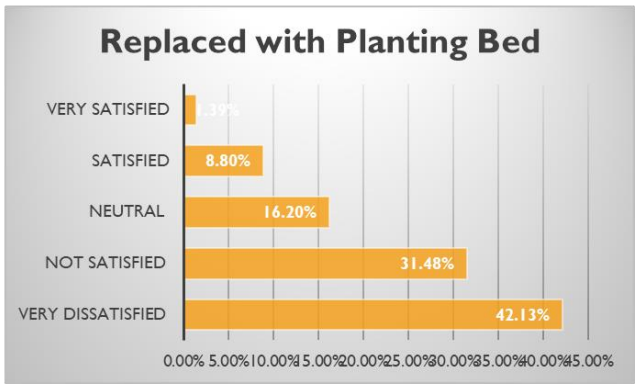


*Table 15 - Pedestrian Satisfaction with Mitigation Methods*




### 4.6.3 Social Survey Summary

The purpose of the social survey is to provide a well-rounded review of desire paths from multiple perspectives. Descriptive statistics and qualitative content analysis of the social survey data revealed some key points that influence the outcome of the design implications provided at the end of this thesis. These key points could be viewed as design considerations when exploring options for resolving desire paths in design proposals.

1. Most survey subjects consider desire paths a positive influence on the character of a landscape but also a result of design flaws.
2. There are economic costs of mitigating desire paths for maintenance professionals.
3. Obstructing desire paths, or natural pathways in the landscape is highly dissatisfying to pedestrians, more expensive as a maintenance solution, and only a temporary fix.

4. Designers believe that pathways should not conform to every desire due to public safety and the aesthetic quality of the landscape design. Instead, there should be better ways to keep people on the sidewalk and interested in the landscape experience provided for them by the designers.

### 4.7 Research Question 3 Findings

While the desire path typology may be a helpful tool for designers to recognize certain design flaws in master plan proposals, it cannot alone provide evidence-based solutions. The social survey data, in combination with the literature review, and field observation data, works to provide a well-rounded list of design considerations when examining how to creatively solve conflicts in landscape plans. The social survey analysis helped determine what mitigation methods would work best for desire paths. The field observation data on the UNT campus revealed where desire paths are most likely to occur in the landscape (Table 16), and what some common characteristics of those landscapes were (Table 17). The synthesis of these different data types into tailored design implications is what answers **Research Question 3** ("How can desire paths be utilized and understood, to help designers identify and resolve potential conflicts in future design proposals?") as follows.

*Table 16 - Open Space Design Forms and Desire Path Occurrences on UNT Campus*

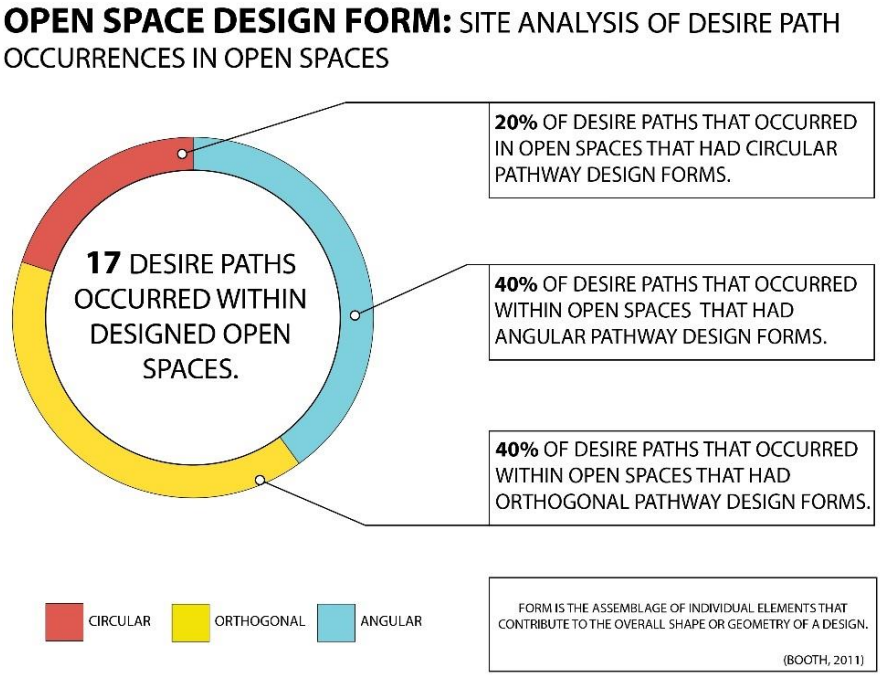
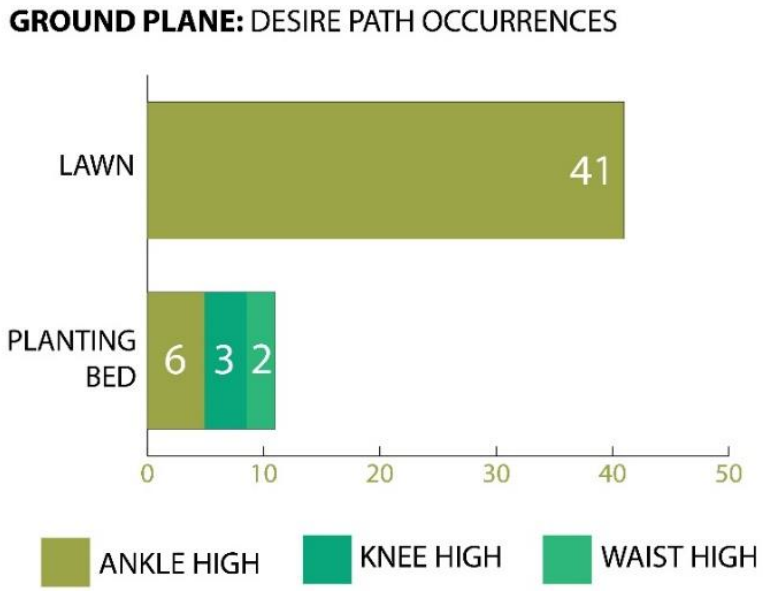



*Table 17 - Ground Plane and Desire Path Occurrences on UNT Campus*



# CHAPTER 5: CONCLUSION

## 5.1 Introduction

The object of this research was to explore how desire paths can be better understood and utilized by designers to prevent them from occurring in landscape planning. A critical look at the literature surrounding desire paths revealed a need for a simple and effective tool that could be used to recognize where desire paths may occur. This thesis used a multi-method approach to explore the relationship between desire paths and urban environments at multiple scales. This included utilizing descriptive research techniques to examine where desire paths occur in the landscape, why pedestrians are motivated to create them in that exact location and to classify recognizable desire path typologies. This research also used social survey results to inform design implications as creative steps for planners, landscape architects, and urban designers to adopt into their future design proposals.

## 5.2 Summary of Findings

The University of North Texas campus was selected as a study location for this thesis to substitute for cities as urban entities. This is because campuses are dense, pedestrian-centric environments, that contain similar elements to cities in a more walkable space (Coutts, et al. 2019). Universities, which are developed with pedestrians in mind, also could provide more opportunity for desire path encounters, and thus more data for collection.

52 desire paths were discovered on the University of North Texas campus, their physical characteristics and the character of the surrounding landscape were recorded. Mapping analysis revealed the relationship that desire paths had in the context of the urban open space and street network systems. Descriptive statistics analysis examined the common characteristics of desire

path locations to be mostly through lawn material, in open spaces with rectilinear design forms, as well as to be equally dispersed between streetscapes, Malls/Quads, and undeveloped lawn spaces.

### 5.2.1 Research Question 1 Discussion

Mapping analysis of the 52 recorded desire paths on the UNT campus showed the context around where desire paths were located within the open space and street network systems. Three clusters of densely located desire paths were identified (College Inn, GAB, and W Highland St) and with further examination were used to explain the similarities in the landscape design that contributed to the desire path occurrences.

Analysis revealed two key findings in an exploratory answer for **Research Question 1** ("Are desire paths an isolated incident in the landscape, or a symptom of larger urban design and planning decisions?").

1. While the open space type and landscape design of the three clusters differed, the same desire path types were observed in each of them.

The three clusters of desire paths occurred in different open space types, land use zones, and even had different form typologies describe by Booth (2011). The differing landscape scenarios should have created an opportunity for multiple different types of desire paths to occur. Instead, the same desire path types were recorded in each of these clusters across campus. This means that there are some urban design guidelines used throughout the campus that contributes to creating the same desire paths in multiple places.

2. The urban design and layout of the campus influenced where the desire path clusters formed.

Overlaying the mapping analysis found that the spatial organization of the land use and street

network contributed to the desire path cluster on W Highland St. Most of the academic buildings on UNT campus were developed in the campus core, while most of the housing and parking areas were placed on the southern border of campus. This causes many pedestrians (commuters and housing residents) to require a strong North-South connection into the campus core. Unfortunately, the poor design of the West Highland Street acts as a boundary between the two spaces and encourages multiple desire paths to accommodate the heavy traffic.

These two key findings show that while the exact location of a desire path is in response to the specific landscape design surroundings, desire paths are also influenced by the urban design and planning decisions of land use locations and street network typology. Both findings are confirmed as conflicts with the overall urban design of the campus as stated in the UNT Master Plan Update (Ayer-Saint Gross, 2013).

### 5.2.2 Research Question 2 Discussion

Field observation of desire path characteristics and using descriptive statistics as an analysis tool, helped to inform the answer to **Research Question 2** ("What landscape elements & patterns contribute to desire path occurrences in urban environments?"). Three key findings from the analysis can be summarized.

1. 79% of desire paths recorded happened through lawn spaces and 90% of desire path occurrences happened in planting material that was ankle height or lower.
2. Desire paths occurred almost equally between streetscapes (37%), designed open spaces (33%), and undeveloped grassy areas (30%).
3. Of the desire paths that occurred in designed open spaces (Malls/Quads, Plazas) only 20% were in open spaces that had a circular design form.

These findings were ultimately used to synthesize a list of common desire path typologies for

designers to recognize where desire paths may occur in their landscape designs. Additionally, these findings revealed that closer attention to detail and more extensive use of landscape architecture design principles could prevent many of the desire paths on UNT. According to Booth (2011), the form of landscape design can impact how people move in the landscape, with different form typologies that can encourage or discourage efficient circulation. Many of the desire paths on campus were in open spaces that used limited plant material such as lawn spaces or used a rectilinear design form typology.

The use of more Circular, or Dendritic design forms in campus open spaces, may reduce the amount of "Corner Cutting" at right angle sidewalks. Also, the use of more diverse planting species and heights may discourage pedestrians from trampling through plant material.

### 5.2.3 Research Question 3 Discussion

The use of the multi-method approach in this research study was key in developing the end products of this thesis. Secondary description, field observation, and social survey data were analyzed and synthesized to create both a typology of desire paths, as well as implications to prevent them through creative design. The end products of this thesis are the answer to **Research Question 3** ("How can desire paths be utilized and understood, to help designers identify and resolve potential conflicts in future design proposals?"), as informed by the need for such products in the literature review.

A typology classification scheme is a reliable tool for urban designers to express design guidelines and principles in planning projects (Lang, 2017). Previous studies similar to this research have developed classifications for desire paths yet fall short when accounting for the travel behavior of pedestrians, or the context of the surrounding landscape. Using the descriptions of pedestrian motivations and desire paths from the literature review three broad

categories were defined as Efficiency, Discovery, and Necessity. With the analysis from this research, sub-categories become more developed to include the context of the landscape they exist in.

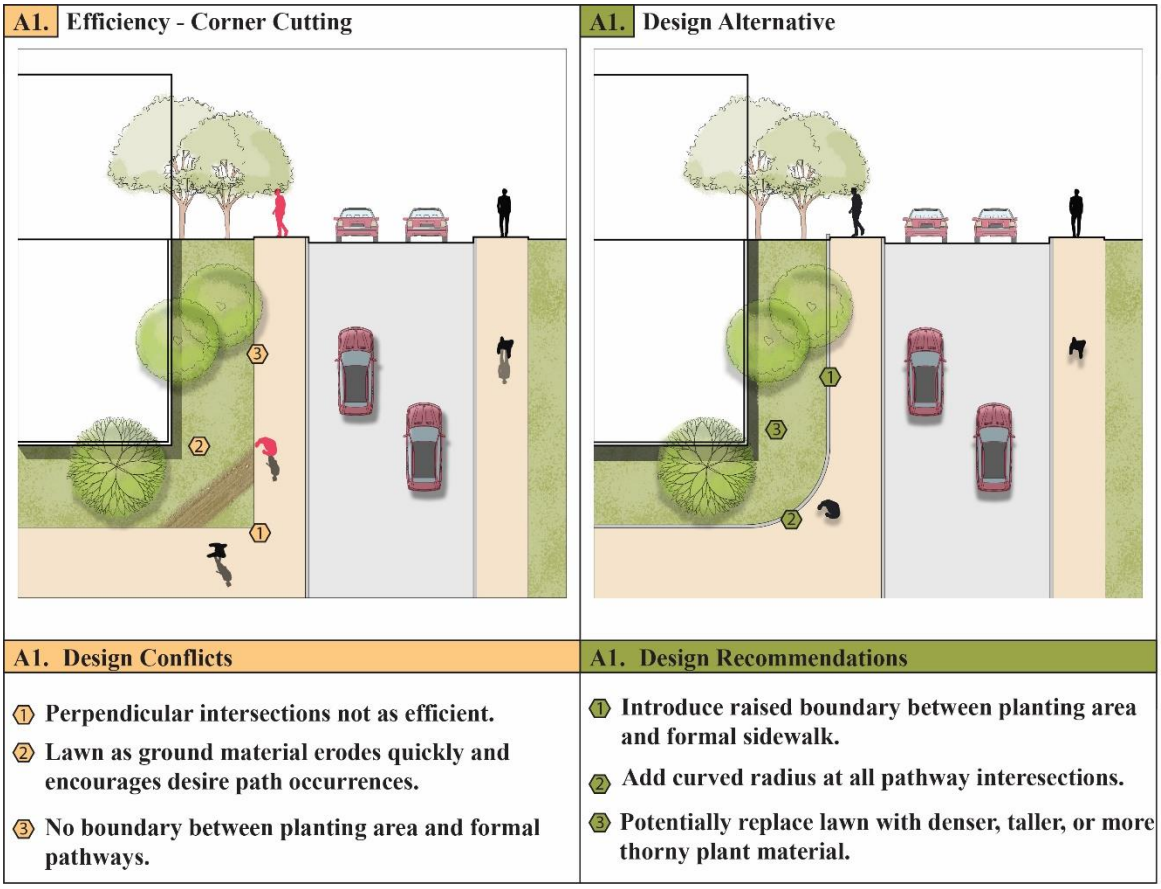
Secondly, desire paths can be further understood to then prevent them from happening in the landscape through more pedestrian accommodating design. Desire paths have been previously classified based on level of hazard to pedestrian safety and recommended to be obstructed more often than any other mitigation solution (Kullhavey, et al 2018). The design implications in this thesis for resolving desire paths include considerations from pedestrians as well as the landscape design context to provide a holistic understanding of how to improve pedestrian accommodating infrastructure.

## 5.3 Design Implications

Based on the findings, design implications are discussed in this section using the analysis on desire paths recorded on the UNT campus.

### *Type A1. Efficiency – Corner Cutting (Figure 43)*

*Figure 43 - Type A1 Desire Path*

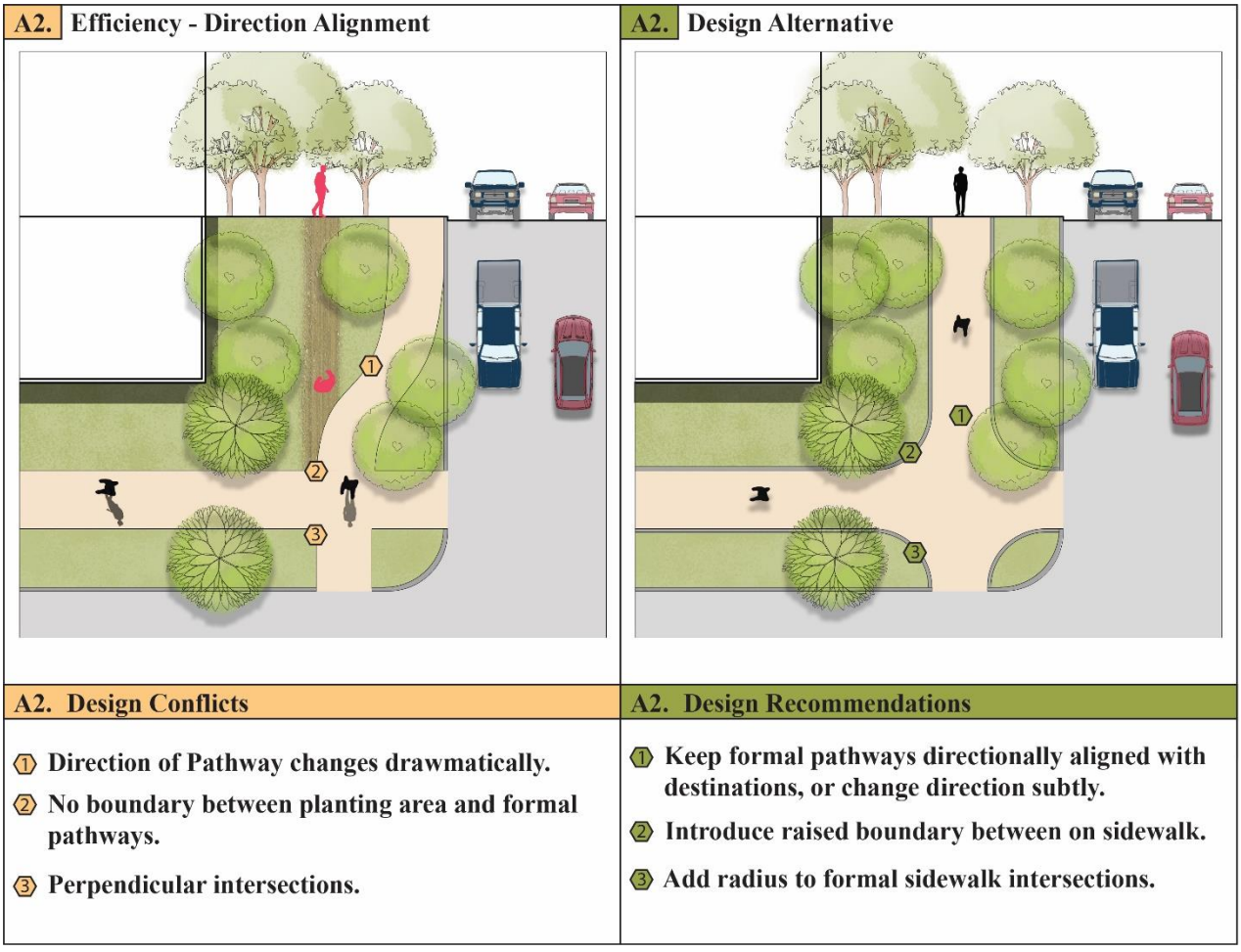



After recognizing where “Corner Cutting” desire paths may appear in a landscape design proposal, there are some design solutions that can be used individually or in combination to prevent this type of desire path from occurring (Figure 43). The most important change to make for “Corner Cutting” desire paths would be to flare sidewalk intersections with a curved radius. Field observation showed that rectilinear forms and right-angle pathways encourage pedestrians

to seek a more efficient route. Secondly, an obstruction can be used to discourage the use of these desire path types, however, social survey analysis and literature review data show that obstruction is not always effective. In the A1 recommendation chart (Figure 4.8.1.1), a raised boundary between the sidewalk and adjacent planting area can be a subtle obstruction, while dense planting material can be a more obvious obstruction.

***Type A2. Efficiency – Direction Alignment (Figure 44)***

*Figure 44 - Type A2 Desire Path*

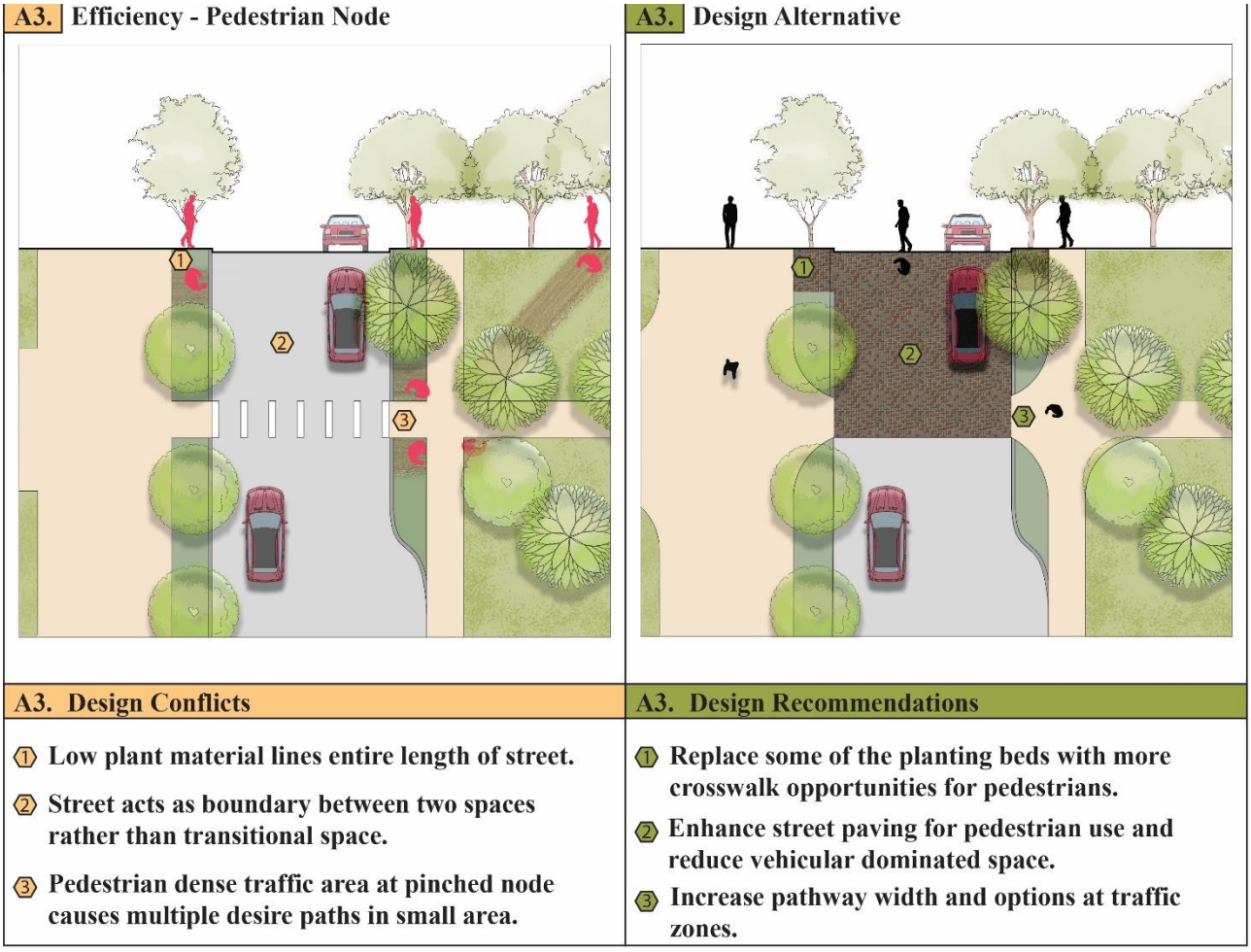



Solutions for the “Direction Alignment” desire path are simply to retain path direction from start point to endpoint (Figure 44). Rather than create a dramatic change in sidewalk direction to avoid trees or utilities, it would be best to continue in one direction or to subtly

change direction over a longer distance. If the sidewalk requires the removal of existing trees, new planting are always be available to replace what was removed. All previous implications, including the curved radius at sidewalk intersections and raised edges, should apply as a standard for every desire path typology.

***Type A3. Efficiency – Pedestrian Node (Figure 45)***

*Figure 45 - Type A3 Desire Path*




Implications for the “Pedestrian Node” desire path typology could vary widely based on the circumstances of the landscape in question. This is due to there being multiple desire path types in a small area that could change depending on the location. In the example illustrated in Figure 45, the pedestrian node that is creating desire path conflicts is the crosswalk with narrow

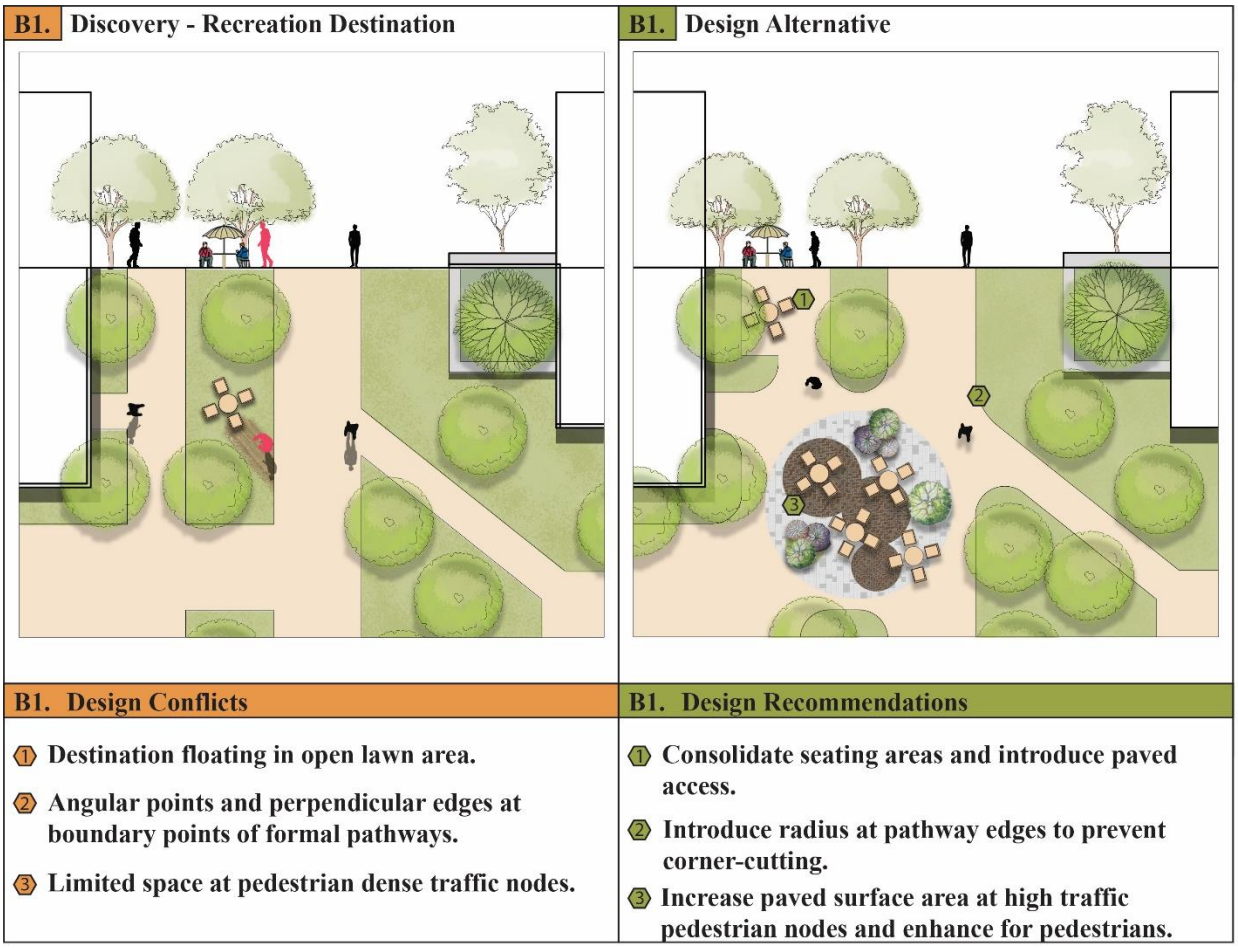
sidewalks leading to it. The existing sidewalks are rectilinear and narrow, and the street has planting beds along its borders causing obstructions for pedestrians needing to cross.

The largest factor contributing to the multiple desire paths in the example is the limited crossing points on this busy streetscape. Changing the paving materials of the street in the pedestrian-dominated spaces may indicate a change for vehicles to slow down. Replacing some of the planting buffers with that same paving material could mark where it is safe for pedestrians to cross, while other parts of the planting beds can be saved. While a planting buffer between the road and the sidewalks provides pedestrian safety from vehicles, it can act as an obstruction when it lines the entire length of the street.

The next most important recommendation for A3-type paths is to increase the width of the sidewalks. Pedestrian nodes attract more people which requires more space to accommodate the increased traffic demands. Lastly, all previous design implications for other desire path types could apply in this scenario as well.

### *Type B1. Discovery – Recreation Destination (Figure 46)*

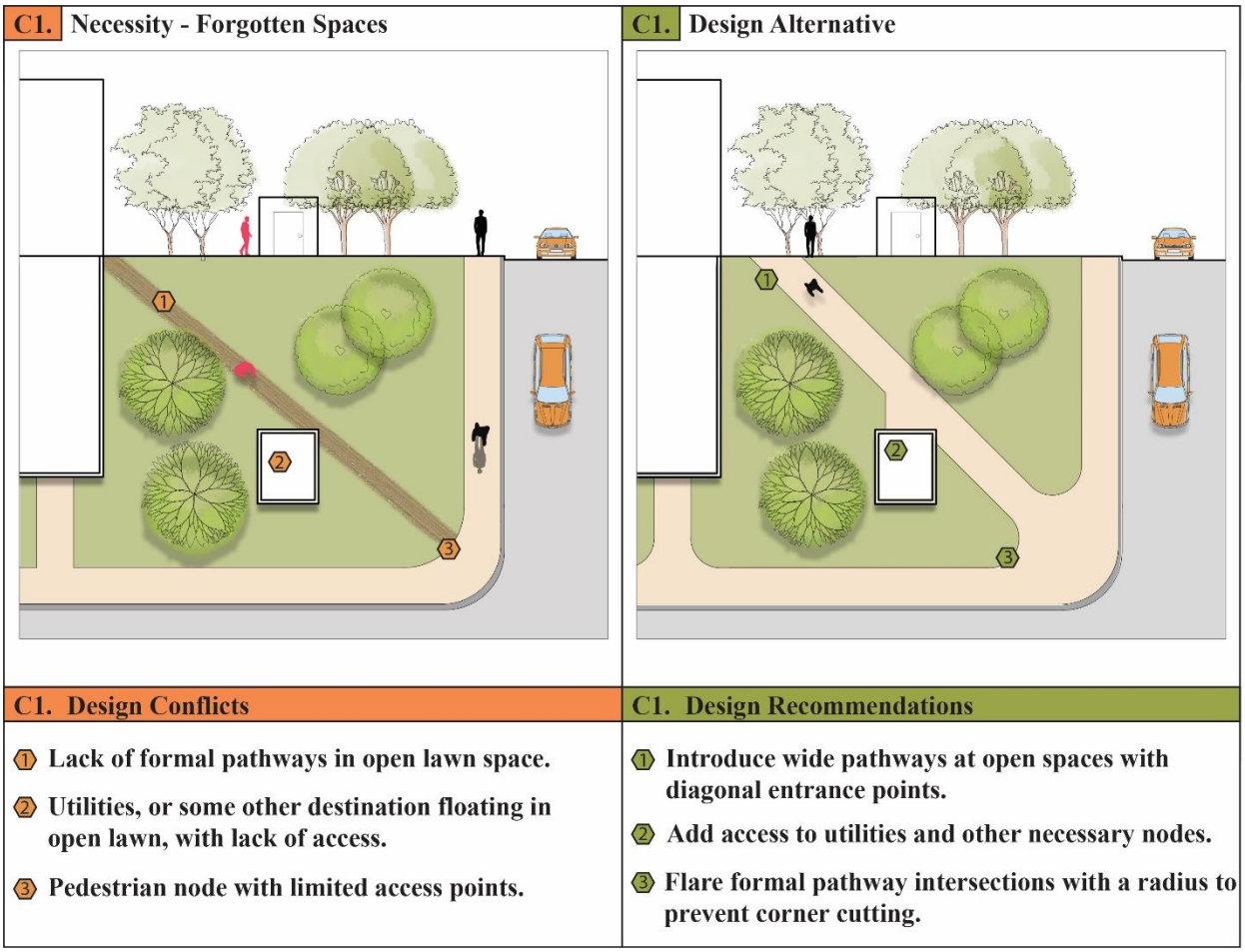
*Figure 46 - Type B1 Desire Path*




B1 Type or "Recreation Destination" pathways can be solved by controlling the location of landscape amenities more strategically. In the example (Figure 46), seating areas that are floating in open lawn spaces can be consolidated closer to buildings or centrally located within a more defined space. These recreation destinations could simply use paved connections to be accessed, however, enhancing seating areas with a plaza or creative planting design and use of paving patterns will improve more than just the pathways for pedestrians. Improved social spaces will increase the benefits it provides to its users and the value of the overall landscape.

### *Type C1. Necessity – Forgotten Spaces (Figure 47)*

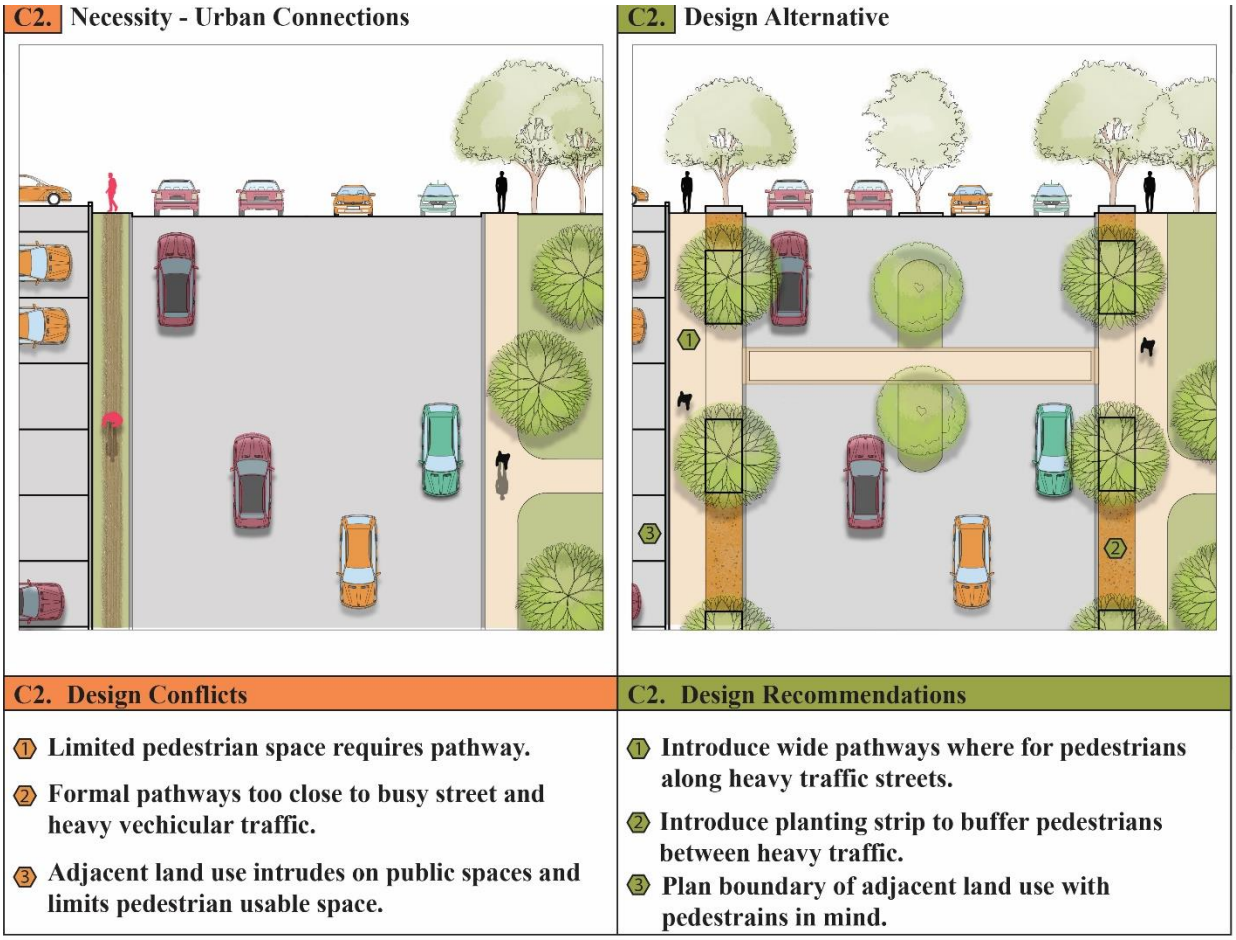
*Figure 47 - Type C1 Desire Path*




C1 Type desire paths can exist in multiple scenarios such as in streetscapes and open spaces. However, the biggest design recommendation that could mitigate this desire path type in multiple scenarios, is to simply add sidewalks to where pedestrians or maintenances services may need to access. In the example (Figure 47), adding a sidewalk in an angular form to give access to both the utilities and the street corner will improve pedestrian circulation. An angular path form will also work to increase pedestrian travel efficiency.

### *Type C2. Necessity – Urban Connections (Figure 48)*

*Figure 48 - Type C2 Desire Path*




The C2 type desire path occurs for pedestrians to overcome a lack of sidewalks in streetscapes. To resolve this pedestrian safety issue, sidewalks need to be incorporated into a streetscape that follows extensively studied design guidelines from multiple existing sources in the literature on transportation and engineering. Solutions to resolve C2 type desire paths can be a combination of design solutions from previous implications such as creating multiple safe crosswalk points and planting buffers to provide shade (Figure 48). Simply adding a sidewalk where one could fit along the street does not work to enhance the pedestrian experience in the

urban landscape. Instead, public safety and landscape quality can be achieved with more thoughtful designs implemented along streetscapes.

### 5.4 Applications to Landscape Architecture

This research study contributes to the profession of landscape architecture by examining analysis tools, research methods, foundational design principles, and real-world applications commonly used in the landscape architecture profession. The unique combination of methods in this study could be replicated and improved upon by landscape architects to understand future project sites in a new way. By overlaying common mapping analysis with desire path typologies, previously hidden urban design flaws can be revealed and creatively solved. This research also relates how landscape architecture design concepts such as form typology, and street network design work at the urban design scale to influence pedestrian travel behavior.

The final product of this thesis provides a starting point for developing and building a more in-depth tool for designers to recognize conflicts in landscape design projects. This typology tool and design implications are multi-functional as they can be used by designers to both predict where desire paths may occur in new projects while offering design solutions for desire paths in existing landscapes. The literature review examined multiple tools that exist currently for landscape architects that can identify pedestrian travel behavior and potential desire paths. The desire path typology is not meant to compete with these tools but to be used together in a unified goal of improving the human landscape.

### 5.5 Suggestions of Future Research

Future research on this subject could involve expanding the desire path typology by improving the current sub-categories or including new ones. This could be done by examining

larger urban design projects such as cities and comparing data across multiple cities. While university campuses are a distinct urban entity, they are not a perfect substitute for cities that could reveal new types of desire paths not present on campuses.

Lastly, future research could test the design implications listed in this thesis in the field through a controlled experiment to see how well they work to prevent desire paths. More research is needed to understand the environmental psychology and relationship between design and pedestrian decisions in terms of desire paths. Combinations of planting materials, paving, and other design interventions could be meticulously tested as methods for deterring the use of desire paths in the landscape.

# Appendix A Internal Review Board

UNIVERSITY OF TEXAS ARLINGTON | OFFICE OF RESEARCH ADMINISTRATION
REGULATORY SERVICES

10/12/2020

**IRB Approval of Minimal Risk (MR) Protocol**

**PI:** Michael Shuey
**Faculty Advisor:** Joowon Im
**Department:** Architecture
**IRB Protocol #:** 2021-0046
**Study Title:** *Preliminary Interview/Survey study for Thesis data on the Topic of Desire Paths*

**Effective Approval: 10/12/2020**
In-person interactions with human subjects must comply with UTA's list of permitted research activities and the related requirements under COVID-19 limitations: https://resources.uta.edu/research/regulatory-services/human-subjects/news-and-announcements.php.

The IRB has approved the above referenced submission in accordance with applicable regulations and/or UTA's IRB Standard Operating Procedures.

**Principal Investigator and Faculty Advisor Responsibilities**

All personnel conducting human subject research must comply with UTA's IRB Standard Operating Procedures and RA-PO4, Statement of Principles and Policies Regarding Human Subjects in Research. Important items for PIs and Faculty Advisors are as follows:

- **Notify Regulatory Services of proposed, new, or changing funding source**
- Fulfill research oversight responsibilities, IV.F and IV.G.
- Obtain approval prior to initiating changes in research or personnel, IX.B.
- Report Serious Adverse Events (SAEs) and Unanticipated Problems (UPs), IX.C.
- Fulfill Continuing Review requirements, if applicable, IX.A.
- Protect human subject data (XV.) and maintain records (XXI.C.).
- Maintain HSP (3 years), GCP (3 years), and RCR (4 years) training as applicable.

REGULATORY SERVICES | The University of Texas at Arlington, Center for Innovation
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(Phone) 817-272-3723 (Email) regulatoryservices@uta.edu (Web) www.uta.edu/rs

## Appendix B Social Survey Cover Letter

Desire Path Research Study for Thesis

Recruitment Example

Medium: Email

Hello [Potential Participant Name Here],

I am a graduate student at the University of Texas at Arlington, studying Landscape Architecture. I am reaching out to you to see if you would be interested in participating in a short survey as part of my thesis research.

My topic is over the concept of "Desire Paths", which are the informal pathways created from the erosional effect of repeated foot traffic. These marks have environmental, social, and aesthetic costs associated with them and I would like to record your opinion on the matter because you are a professional designer of public spaces. I am recruiting a panel of professional designers to weigh in on my research findings by confirming or denying my categorization of design forms of open/green spaces. Your input would help me to understand more about how purposeful use of design forms commonly used in landscape architecture (Booth, 2011) could encourage efficient pedestrian circulation and prevent desire paths on college campuses.

The potential outcome of this study is to provide evidence that campus site planning should integrate the purposeful use of the landscape architecture design concept of "form" to control desire paths. The social impacts would be increased walkability in urban spaces, reduced watershed pollution from sedimentation, and positive contributions to the character of public spaces.

Attached to this email are the list of survey questions, and informed consent form. Please fully read and understand the consent form before agreeing to take part in the survey. Answering the survey concludes you've read and understood the scope of the study and agree to the conditions of consent. Please note that your identity will remain anonymous in the final thesis product. If you are interested in participating in this study, please respond to my email and I will send a link to a survey site (QuestionPro) approved by the IRB of the University of Texas at Arlington, to being your survey. The survey will take approximately 20-30 minutes of your time.

Looking forward to hearing back from you.

Much appreciated,

Michael Shuey

# Appendix C Social Survey Questions

# Interview Questions for Thesis Research Study

**Thesis Research Topic:**

Desire paths are informal pathways that are created from repeated foot traffic through an area. In some views, they represent pedestrian dissatisfaction with the existing sidewalks and pathways offered from the current designed space. I want to study how designers could take advantage of this information to modify their design process and make more efficient/satisfying pathways for pedestrians.

**Goals and Objectives:**

To begin developing a stronger research question, I intend on interviewing professionals, facility crews, and laypeople (users, pedestrians, people interested in desire paths) to understand current thoughts on the concept of desire paths from different perspectives. The goal is to identify the significant aspects of desire paths and follow that towards a significant research question.

**Expectations:**

I expect that designers will hold little thought towards desire paths in the design process but will find existing desire paths a significant issue or failure from designers. I also assume that laypeople and maintenance people will find desire paths significant for reasons of cost and inconvenience, but not so much aesthetically or environmentally. The disconnect between designers and users may mean there is a need for developing guidelines for reducing desire paths. Or research could show that designers do pay attention to desire paths and use a pre-existing body of literature or criteria that is not working and could require editing.

## Interview

**Designers (Faculty from College of Planning, Architecture and Public Affairs at UTA)**

- Landscape Architects
- Planners
- Possibly architects

**Maintenance (Facilities Employees at UTA and other Universities)**

- Parks and Rec. City Officials
- Campus facilities crews

**Lay People (Pedestrians)**

- An online forum for people interested in desire paths. Reddit.com/r/DesirePaths

**Questions Should Cover**

1. **Significance** – how many people are aware of Desire paths as a phenomenon? Is there a problem with desire paths? Is it worth researching? How should the site design process be modified to avoid the possible occurrence of desire paths? Who is investigating and researching desire paths and what is driving this interest? Is there a disconnect between the users and the designers?
2. **Moving Forward** - What are the current ways of mitigation? Are there existing guidelines for dealing with desire paths? Is there a need for new guidelines?

**Questions for Designers and Planners (To start the interview I will remind the participant that they have the option to choose to remain anonymous in the final thesis product and will be unidentifiable based on their answers. They will also be reminded that they will be voice recorded for future reference as was stated in the consent form)**

1. **Do you wish to be quoted, or to remain anonymous in my thesis product?**

2. As an expert in site design, what are your current thoughts/opinions towards desire paths? And what seems to cause them?
3. When desire paths occur, should any fault land on the designer?
4. Where do you think desire paths are most prevalent at different scales? The site, Neighborhood, District, City Scale?
5. What should be added to the site design process to minimize the occurrence of desire paths?
6. To what extent is user circulation/movement a significant factor driving your design process? How significant is it compared to other design elements?
7. what guidelines or design principles do you personally follow if any when designing pedestrian circulation? Do you follow any official guidelines or evidence from the literature?
8. In your design process, to what extent is the ease of maintenance of sidewalks and pathways considered?
9. To what extent do you consider the client cost of maintenance for sidewalks and pathways?
10. What is the most limiting factor in the design process that prevents the most efficient route from being realized?
11. What are the possible positive factors of desire paths?
12. In site design, to what extent should designers be concerned with the possibility of the following consequences of desire paths?

- Environmental
- Personal Safety (tripping/falling, hidden animals/people, lack of lighting)
- Maintenance/Cost
- Overall lack of efficient pedestrian routes in urban areas
- Aesthetic
- All the above
- No concerning aspects of desire paths

13. How does your design team collect information about user satisfaction for installed designs?
14. What is your extent of post evaluations?
15. How could community engagement be utilized to help reduce the occurrence of desire paths?
16. Do you believe there will there always be a desire path no matter what designers do?
17. How could desire paths contribute to the character of a place?

**Example of Questions for Maintenance/Facilities (To start the interview I will remind the participant that they have the option to choose to remain anonymous in the final thesis product and will be unidentifiable based on their answers. They will also be reminded that they will be voice recorded for future reference as was stated in the consent form)**

1. Do you wish to be quoted or to remain anonymous in my thesis?
2. What are your current thoughts/opinions towards desire paths?
3. What is an appropriate level of concern for different consequences of desire paths?

- Environmental
- Personal Safety
- Maintenance/Cost
- Overall lack of efficient pedestrian routes in urban areas
- Aesthetic
- No concerning aspects of desire paths

4. What are the different ways to mitigate desire paths?
5. At what point does the path have to be mitigated on-site?
6. Which solutions for mitigating desire paths are most effective?
7. What are the costs of each of these mitigation methods?

8. Why do desire paths occur?
9. Where are desire paths most prevalent at different scales? Site, neighborhood, district, city?
10. How effective would community engagement in the design process be a solution for reducing desire paths?
11. Are desire paths guaranteed no matter how well space is designed?

**Example of Questions for laypeople**

1. Describe desire paths in your own words?
2. How often do you use desire paths/come across them in the world?
3. How significant a role do desire paths play as part of your sense of wayfinding in your city or area?
4. How would desire paths contribute to the character of a place? Either positively or negatively? Or not at all?
5. What is an appropriate level of concern for different consequences of desire paths?

- Environmental
- Personal Safety (tripping, visibility, hidden animals/people)
- Maintenance/Cost
- Overall lack of efficient pedestrian routes in urban areas
- All the above
- Other
- No concerning aspects of desire paths

6. When desire paths occur are designers are at some fault?
7. Where do you believe desire paths are most prevalent in an urban area?
8. Why do desire paths occur?
9. Compared to other design elements (plant material, seating placement, programming…etc.) how much consideration should go to pedestrian sidewalks and pathways in the site design?
10. Do you believe designers take the appropriate level of consideration for pedestrian routes (movement) during the design process compared to other design elements?
11. What are your thoughts/feelings towards desire paths that have been changed? Those pathways have been fenced off or paved over.
12. How effective would community engagement in the design process be as a method for reducing desire paths?
13. Will there always be desire paths no matter how well space is designed?

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