ASSESSING ELEMENTS OF URBAN PUBLIC SPACE UNDER ELEVATED FREEWAYS: APPLICATION TO THE WEST END'S DALLAS ALLEY

by

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To all my professors, faculty, and fellow students that have helped me throughout this journey.

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Abstract

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This thesis investigates the revitalization of spaces found underneath elevated freeways into valued urban public spaces. These spaces are created when elevated freeways carve through dense city centers. Literature addressing the history of freeways, their sometimes-destructive impact on the urban fabric of cities and the unique role elevated freeways place in this destruction is reviewed. A brief review of an unintended consequence of elevated freeways as well as the impacts elevated freeways have had in Texas is also reviewed. The research employs three methods which rely on the collecting and synthesizing of data from literature reviews, case studies, site observation findings, and a supplementary interview. The data is used to identify optimal environmental conditions of obsolete and unproductive spaces found

underneath elevated freeways. These conditions are then used to identify design strategies that help mitigate the adverse conditions and impacts caused by elevated freeways. Two examples of redevelopment of spaces found underneath freeways, The Bentway and Underpass Park, are investigated. The fact that these spaces are located in the same city create a basis with which to compare and contrast design elements and strategies. A site observation of the Dallas Alley is conducted to understand existing conditions and how the space is used, and then incorporates the findings into a design concept of the Dallas Alley. The proposed concept employs the study's research methodology and subsequently applies the derived design strategies. The strategies include emphasizing the point of entry, multi-functional programming, defined path of pedestrian circulation, and the incorporation of public art. Possible design recommendations for similar sites, the relevance this research has for landscape architecture, and the scope of future research is also discussed.

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INTRODUCTION

Introduction

This chapter introduces the problem caused by freeway infrastructure carving through dense city centers. Also included is the purpose for this research, research objectives, research questions, and methods and data required to answer the research questions. A definition of terms is provided, and the significance and limitations of this research are also addressed.

1.1 Problem Statement

Freeways are designed and built using standards set by the Federal Highway Administration (FHA). These standards do little to accommodate different urban settings. As a result, when freeways are built through cities, the cities experience a disruption of their dense urban fabric (Trancik,1986). When placed within a city, freeways allow for large movements of traffic to flow to and from them, increasing the demand for faster speeds (Blas, 2010). Faster speeds require the elevation of freeway away from pedestrian traffic. As a result, empty spaces are created underneath the elevated freeways. Baron (2014) describes these often marginalized spaces surrounded or run through by freeways, as terrains

vagues, obsolete and unproductive spaces. In addition to the creation of terrains vagues, elevated freeways impact social, economic, and environmental conditions.

1.2 Research Purpose

The purpose of this research is to improve the utilization of terrain vague under freeways by mitigating adverse conditions through the application of specific design strategies to transform them into valued urban open spaces. Specifically, this research aims to revitalize the West End's Dallas Alley (heretofore referred to as the Dallas Alley) by suggesting a framework of design strategies to improve its utilization.

1.3 Research Objectives

Four research objectives outline an approach to construct a framework of design principles to aid in the transformation of Dallas Alley into a valued open public space:

Research Objective 1: Determine the positive and negative impacts of terrain vague under elevated freeways.

Research Objective 2: Identify strategies to remedy the negative impacts of terrain vague under elevated freeways

Research Objective 3: Analyze and outline existing site conditions of Dallas Alley

Research Objective 4: Propose a framework of specific design criteria to improve the utilization of the Dallas Alley

The first research objective aims to understand what the specific impacts are for terrain vague under elevated freeway and to understand the existing conditions found at Dallas Alley. The second objective aims to identify the specific strategies used to solve adverse impacts of elevated freeways and the specific design, programming, and goals of the strategies. The purpose of identifying these elements is to inform the researcher how they can be applied to the utilization of the Dallas Alley. The third objective is to determine the existing site conditions of Dallas Alley, at the economic, social, and environmental level. Once an understanding of site conditions is established, the fourth research objective is used to set up a framework of design principles that assist in the transformation of Dallas Alley into a valued public open space.

1.4 Research Questions

The research questions for this study are structured around the purpose of understanding how to transform Dallas Alley into a valued public open space.

The research questions for this study include:

What are the conditions of terrain vague spaces and what are the conditions of Dallas Alley?

What strategies can remedy these conditions and how can they be applied to Dallas Alley?

Which design strategies can help revitalize Dallas Alley into a valued open public space?

1.5 Research Methods

The researcher uses three research methods. The first method employs secondary descriptive research strategies to gather information about specific urban public spaces designed and built under freeways.

The second method relies on site observations documenting existing conditions of the Dallas Alley to gain insight into the character, use, and performance of the space.

The third and final method uses literature reviews, and cites current published information that encompasses the literature reviewed in Chapter 2 of this study.

A supplementary source of research includes an interview with a landscape architecture professional with experience related to freeway landscape design and management.

1.6 Definition of Terms

Terrains Vagues: Ambiguous, unresolved, and marginalized spaces in the urban landscape (Barron & Mariani, 2014)

Elevated Freeway: A classification of freeway that is separated from at grade intersections allowing for undisturbed flow of traffic (U.S. Department of Transportation, 2016)

Urban Fabric: Refers to the physical urban environment, social, cultural, ecological and economic structures (Hasan & Othman & Ismail, 2017)

Walkability: A measure of how capable an area is of being traveled, crossed, or covered by walking (Forsyth, 2015)

Urban Revitalization: Refers to a set of initiatives aimed at reorganizing an existing city structure, particularly in neighborhoods in decline due to economic or social reasons (Ramlee & Samadi, 2015)

Urban Open Space: Publicly accessible open places designed and built

for human activity and enjoyment including parks, neighborhood playgrounds, community gardens, downtown plazas, streets, and malls (Zube & Moore,1987)

Freeway Infrastructure: A transportation system moving the vast majority of the Nation's products and goods, and providing a link between all modes of transportation (Ge & Li, 2013)

Mobility: The whole of trips generated daily by the inhabitants of a city, and the methods and conditions associated with such trips (Foth, 2009)

Fragmentation: The inter-penetration of built-up areas of cities and open spaces in and around them (Angel & Civco, 2000)

Traffic Air Quality: The measure of pollutants produced by automobiles (North Central Texas Council of Governments, 2018)

Right of Way (R.O.W.): Coordinates the acquisition of land to build, widen or enhance highways and provides relocation assistance when needed (Texas Department of Transportation, 2018)

U.S. Highway Spur: A highway which usually begins on a U.S. Highway and ends on an off-system roadway (Texas Department of Transportation, 2018).

1.7 Significance and Limitations

This design research has significance for landscape architects and the evolving field of landscape architecture in three ways: First, the research helps expand on the variety of conditions in which terrains vagues under freeways are utilized. Second, the research aids in overcoming preconceived ideas that these spaces offer minimal to no value for communities. Lastly, the research suggests a framework of specific strategies to aid in the revitalization of these spaces.

Limitations for this research are defined as limits that occurred during the design research process. The collected data is limited in terms of available research regarding terrain vague under freeways. Research is available for many transit line related infrastructure projects; however it could not be used because these projects cause dissimilar impacts as compared to freeways.

Lastly, data from an interview, which is supplementary information, is limited to one participant who has over 28 years of experience with the Texas Department of Transportation, specifically working with landscape architecture related to freeways.

1.8 Chapter Summary

In summary, Chapter 1 introduces the problem of terrains vagues, created through the placement of elevated freeways in dense city centers.

The chapter also presents the purpose of this research which is to improve the utilization of these spaces under freeways into valued urban open spaces, specifically Dallas Alley. The research questions for this study and methods of literature review, secondary descriptive case studies, and site observation are introduced. The significance of this research to landscape architecture and the limitations of this research are briefly addressed.

Chapter 2 discusses the current literature regarding obsolete and unproductive spaces under elevated freeways, their history, definition and condition. It assigns the term terrains vagues to these spaces, and discusses the social, environmental, and economic impacts elevated freeways have on these spaces.

Chapter 3 introduces the research design methodology used for this study; provides an overview of the study population and study locations, reviews the data collection and data analysis methods

employed, and includes a discussion on bias and errors associated with the research methods.

Chapter 4 provides a summary of data and findings for two revitalization projects; The Bentway and Underpass Park. It also discusses the site observation conducted for Dallas Alley and provides findings from the site observation. Lastly, a synthesis of the findings and summary are discussed.

Chapter 5 presents site selection criteria and suggested design strategies for Dallas Alley derived from the synthesis of data from the literature review, secondary descriptive findings, and site observation findings. The chapter also offers a proposed design concept for Dallas Alley, incorporating the suggested design strategies.

Chapter 6 concludes the design study research by addressing the proposed research questions and recommending possible design recommendations for similar sites. It also discusses the relevance this research has for landscape architecture and the scope of future research.

Chapter 2

LITERATURE REVIEW

2.1 Freeway Beginnings

Methods of transportation are developing over time but the primary choice of transportation throughout American society has become the automobile (Robert, 2009). The car is an evolving commodity allowing people to travel farther distances with ease and comfort. This is due in part to the expansion of highways throughout the U.S.

A government act that helped start this expansion is the Federal Highway Act (FHA) signed by President Eisenhower in 1956. “Highways were intended to eliminate traffic congestion, provide cross country transportation, and quick access in-and-out of large metropolitan areas (Raymond, 2004, p.675).”

For many planning freeway constructions, it was common knowledge to build on existing road structure to keep the city’s existing circulation. In the 1960’s and 1970’s planners began to realize that highways were fracturing large areas of land and affecting the economy of city centers at the expense of booming suburbs. This trend continued into the twenty first century and continues today (Raymond, 2004).

2.2 Destruction of a City's Urban Fabric

Freeways not only move commuters about; they connect communities and help mold and shape the form of cities. However, they have also been a great destroyer of neighborhoods (Halprin, 1966).

Figure 2.1 Beginning construction of I-95
Source (CNU 2018)

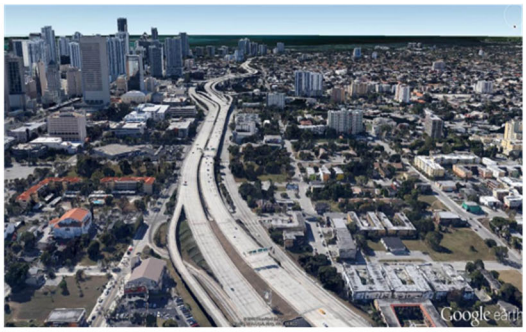


Figure 2.2 Current location of I-95
Source (CNU 2018)

An example of the kind of destruction that a freeway can cause is illustrated by the construction of I-95 in Miami, Florida (see Figures 2.1, 2.2). In the beginning stages of its construction I-95 was planned as a major artery for the eastern coast of Florida. The interstate would provide major access for not only its residents but also allow westward expansion for its central business district. The freeway's construction resulted in claiming twenty square blocks of the Overtown neighborhood, displacing 10,000 residents.

A second example is found in New Orleans, Louisiana. A thriving commercial district, North Claiborne Avenue, was once home to restaurants, music venues, cafes, and a variety of businesses. The area

was known for its large alley of oak trees lining its boulevard (see Figure 2.3). It was also inherently known as a connector for surrounding neighborhoods. Although rich in culture and community, Claiborne was not immune to the interstate expansion. An elevated freeway known as Interstate-10 or the Claiborne Expressway was built along North Claiborne Avenue. A 2.2 mile stretch of the expressway removed 200 oak trees and replaced 50 acres of greenery (see Figure 2.4) with an elevated concrete structure (CNU, 2018). Beyond the previously demonstrated destruction elevated freeways can cause, they create other unintended effects.

Figure 2.3 North Claiborne Avenue before freeway Source (CNU,2018)

Figure 2.4 North Claiborne during construction Source (CNU,2018)

2.3 Elevated Freeways and their Consequences

As the network of interstates began to spread rapidly after 1960, the interstates began to weave through the urban fabric of cities. To maintain a continuous flow of high-speed traffic, a key design element of this network became elevated freeways (Hormigo & Morita, 2004).

Consequently, interstates incorporated underpass or overpass conditions. Underground freeways were an option at the time, but elevating the roadways proved to be a more cost-effective approach. Although this relieved the congestion of vehicle traffic, elevated freeways created empty spaces underneath them that were relegated to parking lots, junk yards, and repositories for trash (Halprin, 1966).

These spaces under freeways are commonly perceived as unsafe due to limited pedestrian accessibility. In addition, they have poor lighting, noise pollution, and attract undesirables (Crisman, 2009).

2.4 Terrains Vagues

As elevated freeways cut through cities in the 1960s and 1970s (and still do today), they created empty spaces underneath them. Barron suggests these empty spaces are containers of a fragmented, shared history and refers to them as terrains vagues. The term “terrains vagues” is the plural of the word terrain vague. “Terrain” (from the Latin *terranum*,

or *land*) in English generally refers to a tract of land, and “Vague” (from the Latin *vacuus*, or empty).

Contrary to the perception that these spaces are empty and simply containers, many terrains vagues are inviting to people who can make creative, unintended, and originally unplanned use of them (Groth & Corijn, 2005).

2.5 Effects of Elevated Freeways in Texas

Elevated freeways impact their immediate surroundings. The major types of impacts from elevated freeways are categorized as economic, social, and environmental (Zimmer & Buffington, 1997). This study investigates the impacts of elevated, depressed, and at grade freeways specifically in Texas. Study areas include the cities of Dallas, Lubbock, Houston, and San Antonio. A total of 30 freeways in four Texas cities were identified and studied. Sources for this data come from literature, a national survey, The United states census Bureau, the Texas State Comptroller and Employment Commission, TxDOT, Environmental Impact statements, site surveys of business and residents, and traffic volumes. The following four sub-sections are a summary of studies and address the environmental, social, and economic impacts, as well as aesthetics.

2.5.1 Environmental Impacts

This section addresses environmental effects of noise pollution, drainage, and air quality associated with elevated freeways. Refer to Figure 2.5 for sub-categories of environmental impacts.

Figure 2.5 Environmental Impacts Sub-Categories

Freeway traffic noise is a problem for business and property owners, and residents in communities surrounding elevated freeways (Zimmer & Buffington,1997). Subsequently, with increasing traffic volumes, there is a demand to maintain lower levels of noise pollution. Elevated sections of freeways block noise near or under the freeway, if they are built at a height between 40 and 80 feet above the roadway (Singal, 2005).

Additionally, elevated sections produce less noise than the at-grade freeways up to 400 ft. from the right-of-way. Past that point, they are about the same. This is due to the shielding effect of the solid concrete guardrails on either side of the elevated freeway (Zimmer & Buffington, 1997).

Therefore, for areas underneath freeways to maintain lower levels of noise pollution, the freeway itself needs to be built a minimum of 40 feet and incorporate the use of concrete guardrails.

Elevated freeways pose a problem with drainage especially with the collection and transport of runoff. In some cases, in Texas, freeways have utilized curb-side gutters but have had difficulty with lateral slopes causing gutters to have low water collection efficiency (Buffington & McMully, 1997). “Wider pavements on these sections can be designed with sufficient cross fall and collector systems to assure adequate pavement drainage for safety (Buffington & McMully,1997, p.54).”

Therefore, by ensuring sufficient cross fall and collector systems, drainage problems are mitigated and a better environment for areas under freeways is provided.

There is an increased awareness of health effects linked to exposure to traffic-related air pollution near large freeways (Baldauf, 2017). The primary pollutants in traffic related air pollution are carbon

monoxide, nitrogen oxides, and lead (Nikolaou & Inkeuk, 1997). The levels at which these pollutants exist depend on a few factors. A study by Nikolaou and Inkeuk in 1997, measured factors such as freeway height, temperature, vehicle count, traffic mix, wind speed and direction to determine air quality under elevated freeways. It's important to note that the height of the freeway plays a key role in the level of air quality underneath the freeway. The higher the freeway, the lower the level of pollution found underneath it.

Therefore, after assessing elevated freeways in Houston, Dallas, and San Antonio, the study concluded that there are decreased levels of pollutants under elevated freeways, in agreement with what would be expected from elevated freeways, given the likely turbulent dispersion of pollutants and adequate height (Nikolaou & Inkeuk, 1997).

2.5.2 Social Impacts

This section discusses the social impacts of elevated freeways. In a study conducted by Buffington and Vadali in 1997, findings associated with the social impacts of elevated freeways found that the quality of neighborhood cohesion, community engagement, and safety and access, was moderate to poor. Refer to Figure 2.6 for sub-categories.

Figure 2.6 Social Impacts Sub-Categories

Report findings are based on data obtained through responses from personal contact surveys of residents in proximity to elevated freeways. Respondents in the study range from households of three to five members or more, and homeowners residing in neighborhoods adjacent to elevated freeways for a period longer than 15 years (Buffington and Vadali, 1997).

Respondents stated convenience, freeway access, work, and school to be factors in accepting a moderate to poor level of cohesion. Additional concerns from the participants included safety and access near

elevated freeways and a lack of neighborhood upkeep as major factors contributing to inhibiting community engagement.

Therefore, to increase community engagement for residents near elevated freeways, safety and access, and neighborhood upkeep are crucial.

2.5.3 Economic Impacts

This section discusses the economic impacts of elevated freeways. A study conducted by Buffington and Vadali (1997), obtained data for impacts such as business revenue, change in employment, and property value based on non-survey databases. Refer to Figure 2.7 for sub-categories.

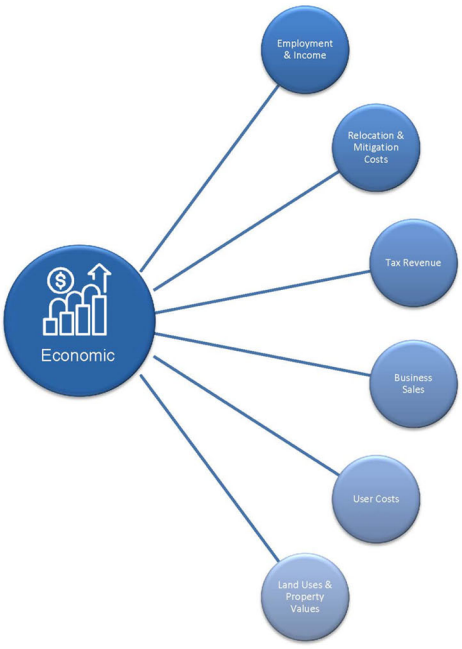


Figure 2.7 Economic Impacts Sub-Categories

The types of businesses surveyed for the Buffington and Vadali study included retail and commercial businesses located in rented buildings with an average length of stay of 8 years.

This study concluded that the elevated freeway is the preferred type of grade level for businesses. This is due in part to commercial business volumes improving near elevated sections of freeways due to travel safety, travel convenience, and travel time. There were concerns however from businesses involving accessibility and visibility. Additionally, businesses reported little to no impact of change in employment in relation to being located near elevated freeways. From a business perspective, they saw a positive impact on the neighborhood.

Land parcels next to elevated freeways experience an increase in property value compared to parcels next to at-grade or depressed freeways. However, residential parcels near elevated freeways have the greatest appreciation over time, compared to commercial property which has a moderate level of appreciation (Buffington and Vadali, 1997).

Therefore, impacts due to elevated freeways are positive for businesses and from a revenue and employment perspective, overall increase property values.

2.5.4 Aesthetics

This section discusses a study conducted by the Texas Transportation Institute (TTI), which evaluated the nature of aesthetic treatments, and elements used for application of Texas freeways. For this study the term aesthetic quality is defined as “the character of the visual scene of its qualities of beauty such as form, proportions, line, and mass (Schutt & Philips, 2001, p.30).” The main objective of the TTI study is to gain information on each tool regarding issues of, maintenance and durability.

The most commonly used aesthetic elements include sealer stains, colored concrete, public art, lighting, and site amenities such as furniture. The study suggests utilizing sealer stains on overpass structures to incorporate color and reduce required maintenance because the sealants exhibit minimal peeling and fading.

Additionally, the study suggests that incorporating street lighting, which adds distinctive, thought of design and can be used to accent or compliment the architecture of nearby buildings. Site amenities such as benches, tree grates and trash receptacles add convenience and visual interest for areas of high pedestrian use.

Public art is limited to the right-of-way in most areas but the use of murals is most common with TxDOT. An example is found within the

Dallas Arts District Art Park, in which TxDOT provided concrete surfaces to be painted by local artists. Most districts prefer to create a venue for the community to provide public art, which adds a distinctive character to that section or corridor of freeway. It also allows the community to express some aspects of its culture and provides a venue to build a positive relationship with the community (Schutt & Philips, 2001).

2.6 Chapter Summary

In summary, this chapter discusses the current literature regarding spaces under freeways, their history, definition and condition. The literature defines these spaces as terrains vagues: spaces surrounded or run through by what Marc Auge' (1995) calls "non-places', areas of transit or commerce in which he claims users experience a heightened sense of anonymity and a compulsion to adhere to codified behavior, such as freeways (Barron & Mariani, 2014). For this study, the term terrains vagues assigns spaces under elevated freeways a clear and concise definition

The chapter also discusses the impacts freeways have on these spaces. These impacts are arranged into environmental, social, and economic effects. This chapters illustrates that there are positive and negative impacts on terrains vagues under freeways. The purpose in

stating these impacts aids the study in identifying which factors can affect the utilization of urban space under freeways.

Chapter 3

METHODOLOGY

Introduction

This chapter introduces the research design methodology used for this study; an overview of the study population and study locations, data collection and data analysis methods employed, and includes a discussion on bias and errors associated with the research methods. A summary is also provided.

3.1 Research Design

This research study employs three qualitative research methods to assess terrain vague, specifically elements of urban space found under elevated freeways. The methods are then used to identify design strategies and conditions that help create optimal environments for these spaces. These strategies are then used to inform the Dallas Alley design (see Figure 3.1).

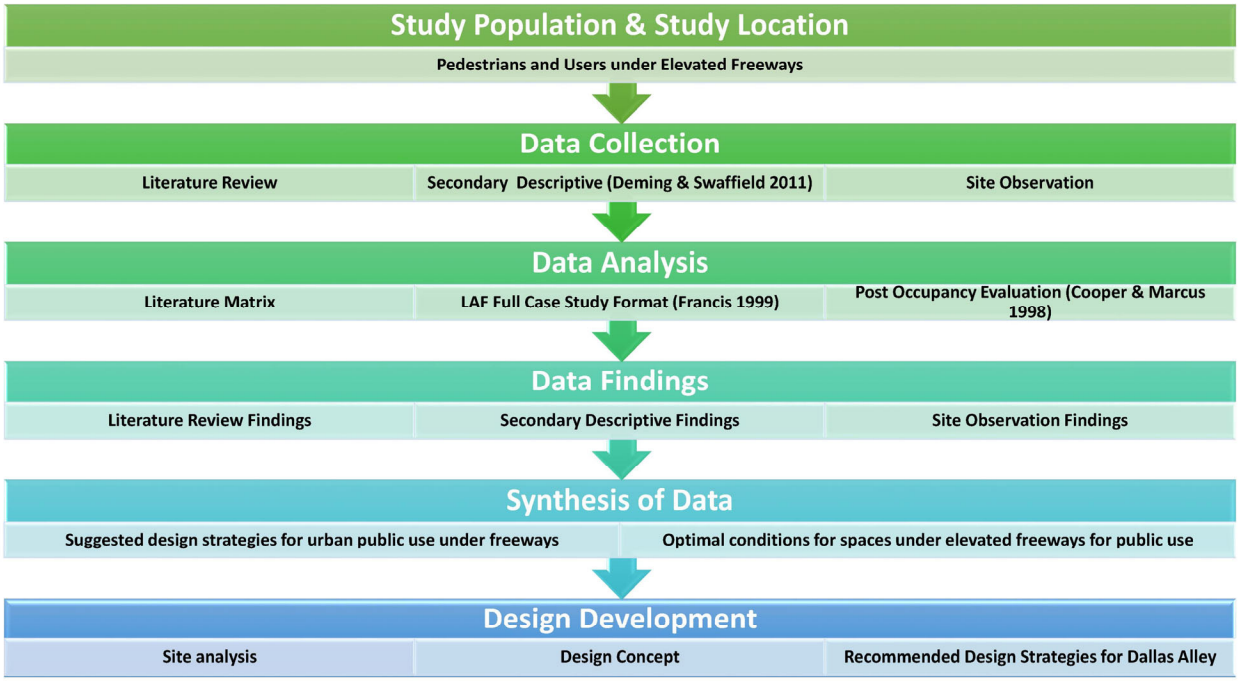


Figure 3.1 Research Design

3.2 Study Population and Study Location

This research looks at public space located under elevated freeways. The population includes pedestrians and users who either pass through or use space under elevated freeways. The study location is identified after the collection of data yields findings that are synthesized and produce a list of criteria for optimal conditions of spaces under freeways for public use. The list is then used to select the site for the study.

3.3 Three Methods

The researcher uses three methods. The first method employs secondary descriptive research strategies to gather and analyze

information about specific urban public spaces already designed and built under freeways.

The descriptive research strategies essentially create new knowledge through the collection and recording of existing information that is available to the investigator (Deming & Swaffield, 2011).

This research approach uses information that has been recorded by people other than the investigator (Deming & Swaffield, 2011). This information typically relies upon documentary sources and other descriptive artifacts that are “found”, which include, but are not limited to archival documents, maps, diaries, media reports, and previous studies. Appendix B contains a list of the types of secondary sources used.

The second method relies on non-existing and personally derived site observations which document existing conditions of the Dallas Alley to gain insight into the character, use, and performance of the space.

The third and final method uses literature reviews, citing current published information that encompasses the literature reviewed in Chapter 2 of this study.

An interview with an expert with the Texas Department of Transportation in landscape architecture around freeways is conducted as a supplemental method. Conclusions for the Institutional Review Board

(IRB) approved, face-to-face and digitally recorded interview, are cited as reference in Chapter 4. Refer to Appendix A for interview questions.

3.4 Data Analysis Methods

The researcher employs two data analysis methods. The first analysis method uses Cooper Marcus and Francis, post occupancy evaluation, to analyze data collected from the Dallas Alley site observation. The following are the categories used to analyze the existing conditions at Dallas Alley (see Figure 3.2).

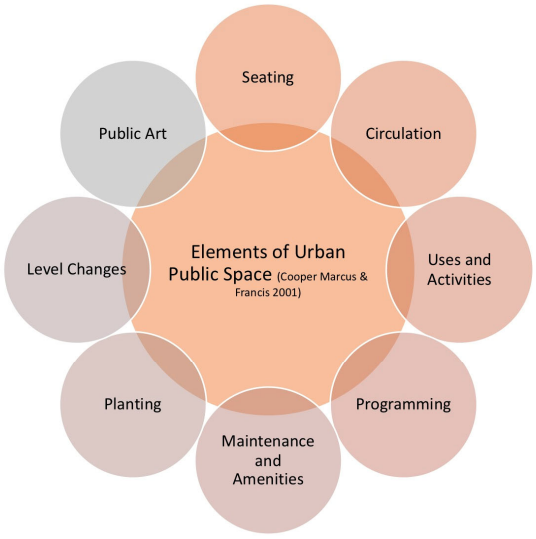


Figure 3.2 Elements of Urban Public Space,
Modified from Cooper and Marcus, 1998

The second method uses the full case study format commissioned by the Landscape Architecture Foundation (LAF) (Francis, 1999) to analyze two selected projects for previously obsolete and unproductive spaces located under elevated freeways: The Bentway and Underpass Park. The method has been widely used and adopted by ASLA's sustainable sites initiative, the American institute of architects, and the active learning program of the Robert Wood Johnson Foundation. The format for the full case study is *detailed* in Figure 3.3. This format is used to identify general information, challenges, surrounding context, and design elements for the projects mentioned above.

The researcher understands that there are values and limitations using this format especially in the field of landscape architecture but, notes that it is primarily used to develop a "strategic approach" regarding landscape architecture projects at both site and regional scale (Francis,1999).

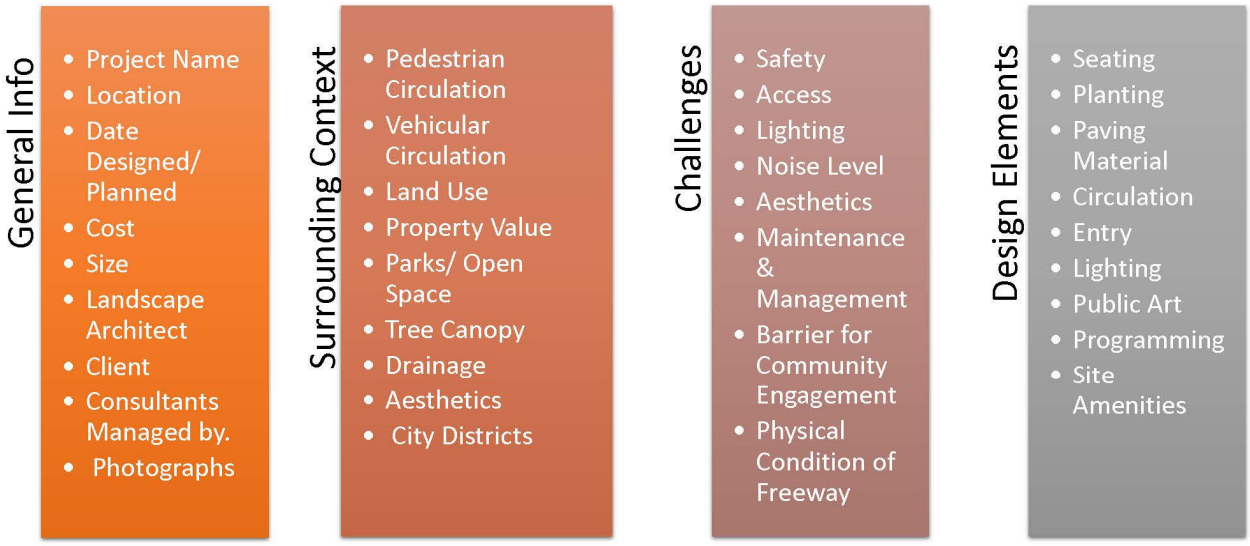


Figure 3.3 Landscape Architecture Foundation Full Case Study Format

3.5 Bias and Errors

The researcher is aware of the bias associated with site observations and sought to avoid these biases. There are also possible bias and errors with the data from secondary data. The researcher also acknowledges possible bias and errors associated with secondary sources such as news articles, architectural reviews, and critics. However, the researcher proposes that the scope and amount of data from multiple sources helps to reduce bias and errors.

3.6 Summary

This study's research design methodology first employs three data collection methods: descriptive secondary strategy, site observation

strategy, and literature review. It then analyzes the collected data using two methods" Cooper Marcus and Francis (1998) (see Figure 3.3) and the Landscape Architecture Foundation full case study format (see Figure 3.2). The collecting and synthesizing of the data is subsequently used to identify optimal environmental conditions of terrains vagues under elevated freeways. These conditions are then used to identify design strategies that help mitigate adverse conditions caused by elevated freeways, ultimately helping to design a revitalized Dallas Alley.

Chapter 4

ANALYSIS AND FINDINGS

Introduction

This chapter discusses data collected using the secondary descriptive method referenced in Chapter 3, for two projects; The Bentway and Underpass Park. The analysis follows the LAF full case study format (see Figure 3.3) to analyze the data and provides a summary of findings for both projects.

Additionally, with the collection of secondary descriptive data, site plans, site photos, and site sections are used for this analysis. A list of the types of secondary sources collected for this analysis is provided (see Appendix B).

This chapter also discusses the site observation conducted for Dallas Alley. Findings from the observation and how they inform which design strategies are needed are discussed. A finding for this observation is provided. Lastly, a synthesis of findings and summary are provided.

4.1 The Bentway

4.1.1 General Information

The first case study for this study is The Bentway, located in Toronto, Canada. The project occupies 10 acres, along 1.2 miles stretch of the Gardiner Expressway, and has an estimated cost of $49 million. The landscape architect commissioned for this project is the partnership of PUBLIC WORK and Greenberg Consultants, Inc.

The Bentway is a unique project that originated from the construction of the Gardiner Expressway. The Gardiner is an eight-lane elevated highway built in the 1940's as a core system for intercity circulation in Toronto (Doyle, 2015). The Gardiner was a response to the growing population in the 1950's and was planned to compete with other car centric North American cities. The Gardiner plays a major role in connecting the city to the western suburbs (Lorinc, 2018). The eastern section of the freeway carries about 120,000 vehicles a day from East to West of the city (Dilon Consulting, 2015).

The Bentway is a response to growing residential influx during the city's development (Bozikovic, 2018). With this influx of residents, the City of Toronto experienced a demand for more public space and The Bentway is a response to those demands.

4.1.2 Surrounding Context

The surrounding area of the project was formerly a high industrial area. Currently, the area has transitioned from a post-industrial area into residential developments. Specifically, the project is located in the Bathurst Quay District, just south of Old Downtown Toronto. The site is also located at the epicenter of four city parks: The Gore, Coronation Park, June Callwood Park, and the Garrison Commons (see Figure 4.1).

The most common businesses around the site are mixed, commercial businesses and some vacant industrial buildings open for leasing (Dilon Consulting, 2015). The CN Rail is parallel to the expressway with Western Channel waterfront south of the site. Storm drainage from the site discharges onto various locations including the Don River and Keating Channel but is discharged without any of quality or quantity control.

4.1.3 Challenges

There are two major challenges arising from this site. The first pertains to the condition of the Gardiner Expressway. Areas of the expressway have been deteriorating since the 1980's causing the city to spend millions annually on repairs. The second challenge is the Gardiner Expressway acting as a barrier. Along with Lake Shore Boulevard and the city rail line, the Gardiner separates many neighborhoods and districts

from the adjacent waterfront (see Figure 4.2) The Expressway also acts as a psychological barrier with “dead space” located underneath it (Keenan, 2018). There were only a few areas where a crossing could be made. “The elevated structure restricts views and creates a gap in the urban fabric between the city and the water front and between existing and planned communities (Lorinc, 2018).”

4.1.4 Design Elements

The project includes a continuous multi-use trail, a bridge over Fort York Boulevard for pedestrians and cyclists, a grand stair-case that doubles as seating for urban theatre, and a variety of flexible performance spaces intended for use by the community (see Figure 4.3 Photo B, Photo C). The design sought to create a series of rooms from the spaces between the column underneath the expressway (see Figure 4.4). In total the project contains 55 different ‘rooms’ under the expressway (Lorinc, 2018). Additional current amenities include gardens, public art, festivals, special exhibitions and musical performances.

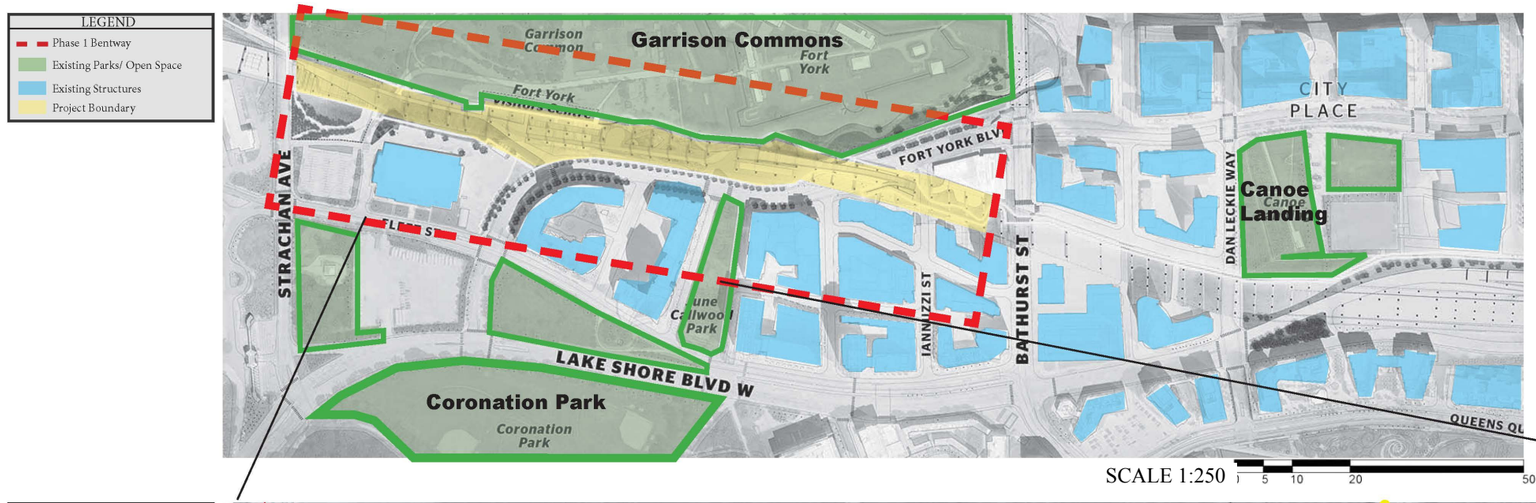
The Bentway Project sought to accomplish a few goals. The first, to reclaim and transform the underused space for active community use allowing for diverse variety of events (see Figure 4.4 & Figure 4.5). The second, to become a gateway to the waterfront while providing access to

important attractions and destinations. By repurposing the areas under the expressway into a usable space, this created a “new outdoor civic living room for the use of over 70,000 residents in nearby neighborhoods and for visitors (Carapetian, 2017, p.3).” A summary of these findings is given in Table. 4.1.

4.1.5 Site Analysis

The following is a site analysis utilizing secondary descriptive data including site plans and site photos. Refer to Figures 4.5 and Figure 4.6, sections of the project created by the researcher.

Figure 4.1 The Bentway Surrounding Context
(Source Public Work 2016)



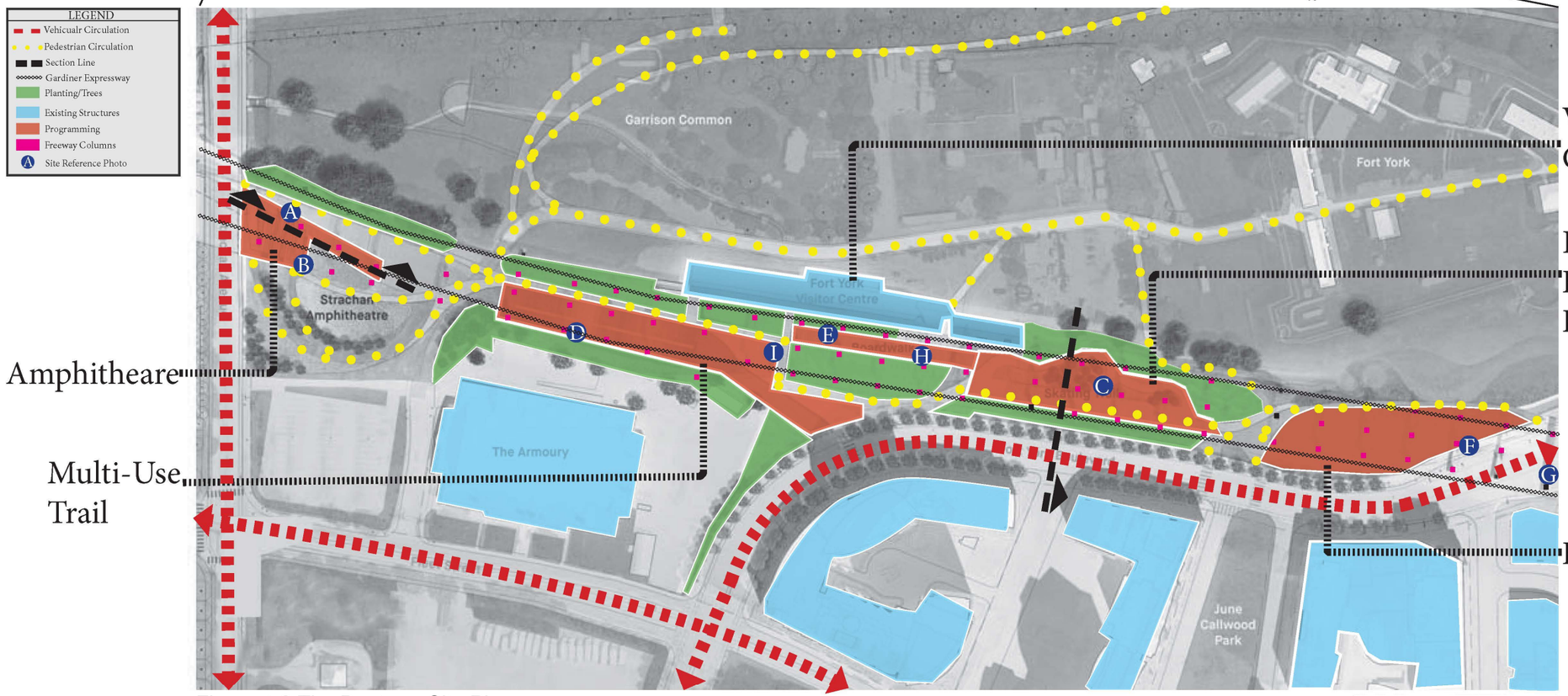


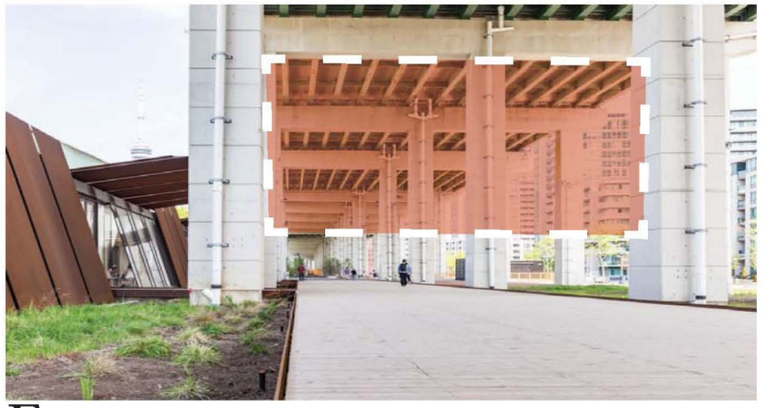
Figure 4.2 The Bentway Site Plan
Source (Public Work 2016)

A This graphic illustrates the use of elevation change for seating

B Covered seating shields from weather and space for viewing events

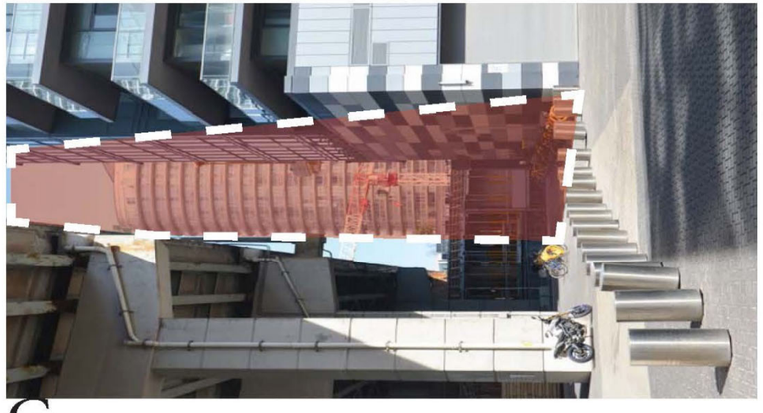
C Ice skating ring provides activities for winter conditions

D This graphic highlights the use of seating located along the edge of path



E This graphic illustrates the condition between columns determining circulation

F Pedestrian and cyclists utilize multi use trails



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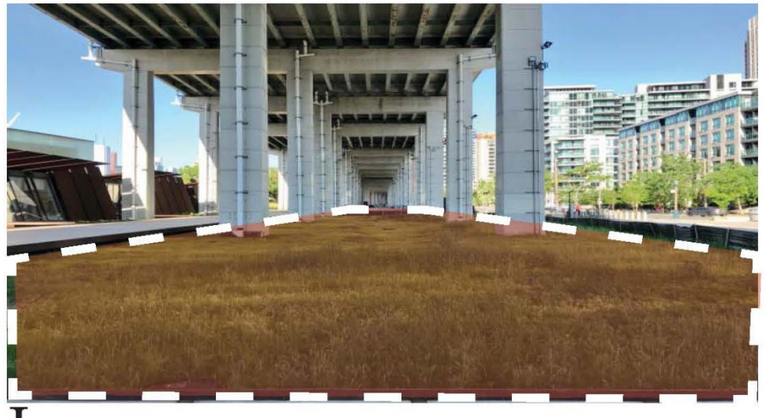


I

Figure 4.3
Existing Site Photos- The Bentway
(Source: Denise Militzer 2015)

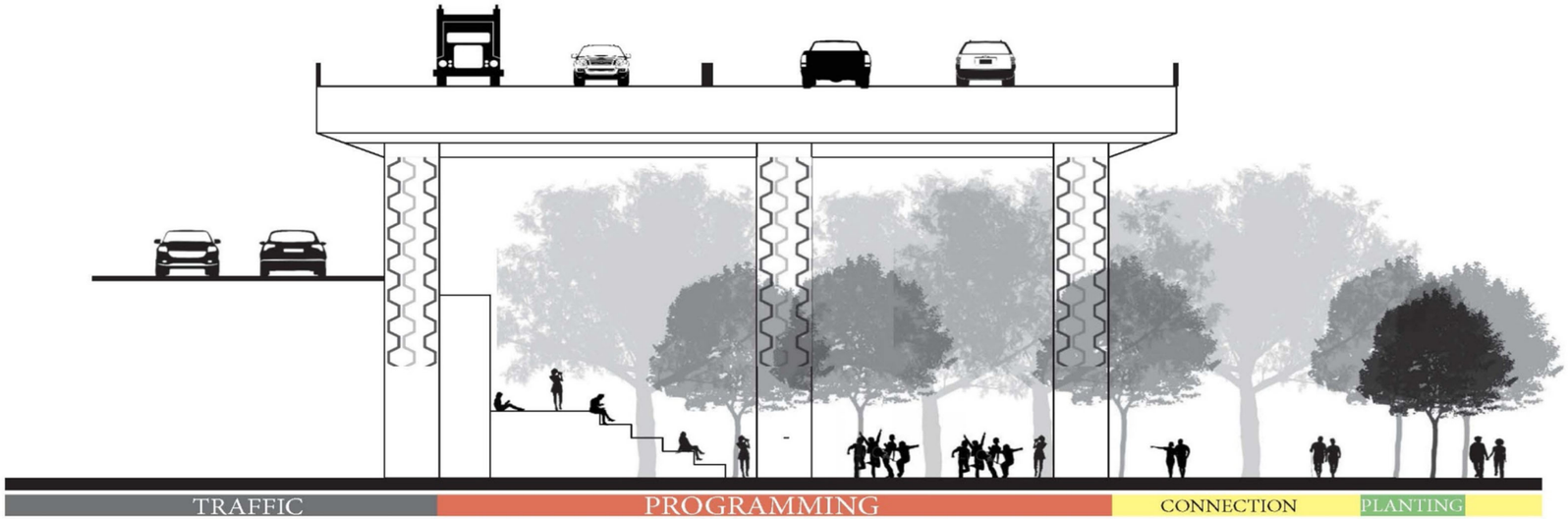


Figure 4.5
Section B – Ice Skating Plaza
Planting is located as a barrier between trails and vehicular traffic
Programmed spaces such as ice skating occurs directly under the freeway

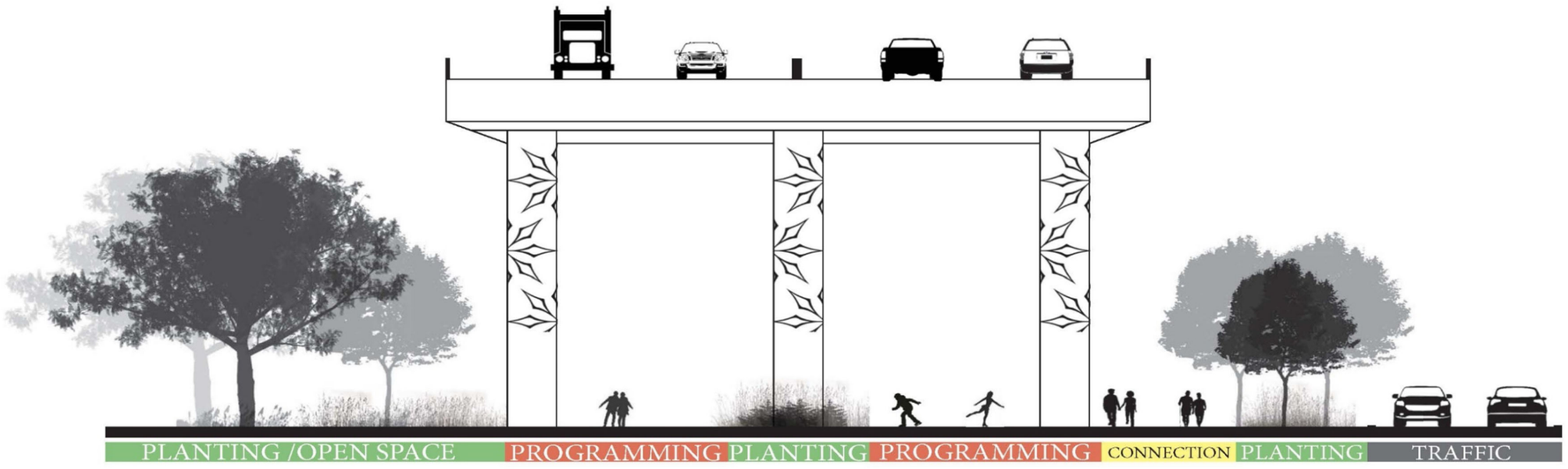


Figure 4.6- Ice Skating Plaza
Planting areas are placed as a barrier between trails and vehicular traffic
Programmed spaces such as ice skating occurs directly under the freeway

4.2 Underpass Park

4.2.1 General Information

Underpass Park is a 2.5 acre urban park built in partnership with Waterfront Toronto. The park is designed by Philips Farevagg Smallenberg (PFS Studio) and Planning Partnership. The park is a unique project for Toronto and is broken into two phases. Phase I is situated two blocks East of St. Lawrence St and Phase II includes Block 18 West of St. Lawrence St (see Figure 4.6). The park benefits from the elevated structure and its beams and columns which create creating unusual spaces (Agrell, 2012).

4.2.2 Surrounding Context

The park is located at the Eastern Avenue and Richmond/Adelaide overpasses, between Cherry Street and Bayview Avenue (see Figure 4.6) Two arterial streets, St. Lawrence Street and River Street intersect the site. Underpass Park has very similar development around the site, consisting of mixed use and commercial use. The waterfront is located south of the park with the CN Rail running parallel.

4.2.3 Challenges

Like the Bentway, the physical conditions of the freeway act as a barrier between the north and south parts of the West Don Lands

community. The freeway also creates areas with poor lighting which causes an influx of crime ridden incidents in the area (Hogan, 2016). Lighting is provided underneath the freeway, but pedestrian paths are poorly lit and poor maintenance of planting beds create unsafe conditions (Agrell, 2012).

4.2.4 Design Elements

Underpass Park has three distinct elements to its design. First the park is organized by covered and uncovered areas. Covered areas are populated with recreational spaces such as basketball courts, climbing structures, and open spaces areas for markets and festivals. (see Figure 4.10). The uncovered areas of the park are meant to include dense groves of trees and other plants adding to the much-needed greenery. Planting of the park is meant to create a gateway for the West Don Lands (see Figure 4.9).

Lighting and public art are two additionally design elements that help Underpass Park function as a successful public space. Lighting is a key feature for the park creating a safe and inviting environment. Underpass columns are lit with colorful LED spotlights and seating is lit with concrete ribbons (see Figure 4.8). The Park takes advantage of implementing public art. Waterfront Toronto identified the area a high

priority in public art and installed an interactive ceiling installation using reflectivity to draw people in (Aulak, 2012). The site itself presented a unique condition. It is sloped upwards towards the river to provide protection against flooding. This sloping helped to accentuate the sports courts installed on the east side of the project.

The design creates an engaging park for members of all ages to interact with not only the park but also the surrounding neighborhoods (Urban Toronto, 2012). "The design takes full advantage of the existing site's eccentricities and its free-for-the-taking weather protection, transforming something that might otherwise be incidental into a delightful urban park" (Green 2010, p.2).

4.2.5 Site Analysis

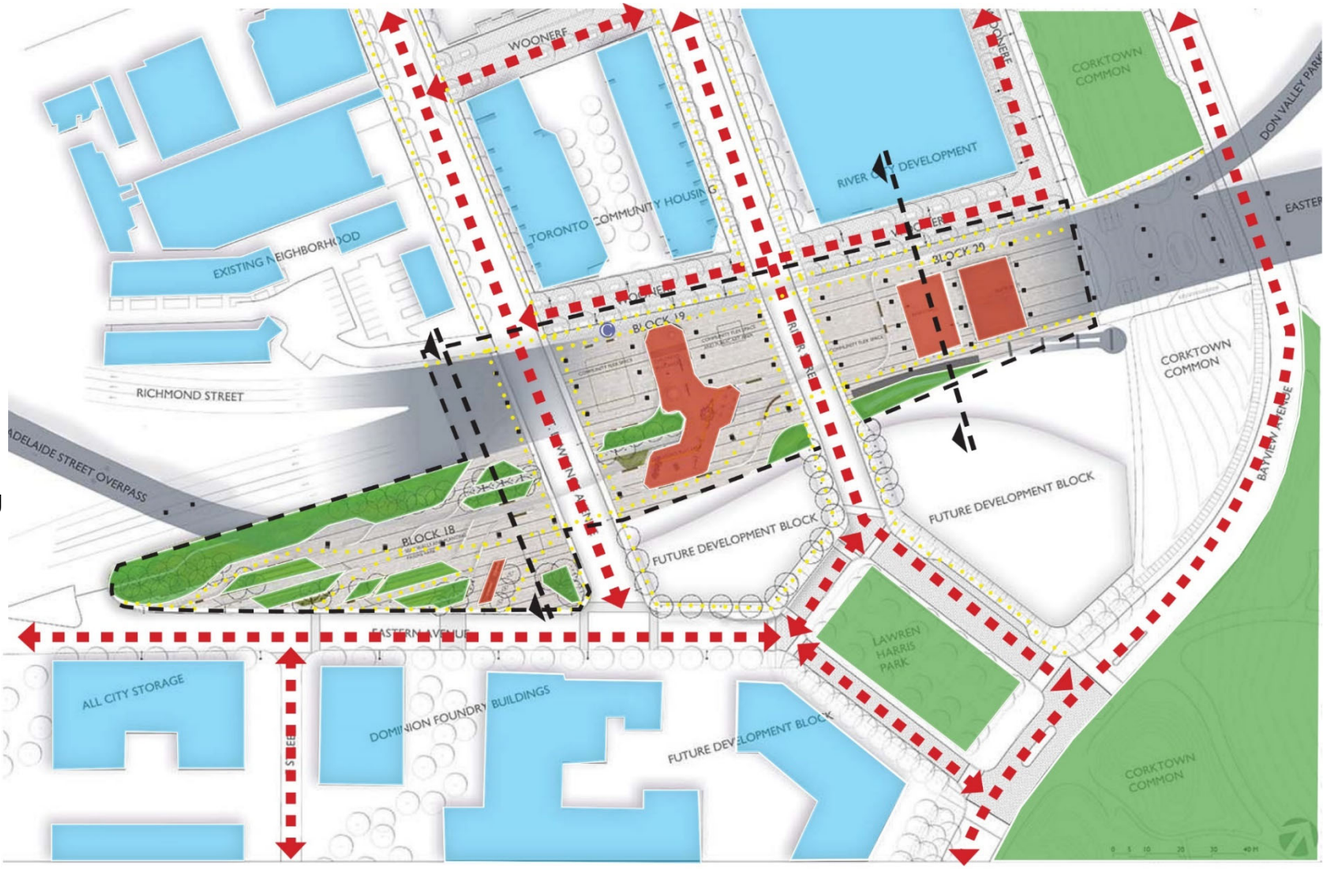
The following is a site analysis utilizing secondary descriptive data including site plans and site photos. Refer to Figures 4.9 and Figure 4.10, sections of the project created by the researcher.

Figure 4.7
Site Plan – Underpass Park

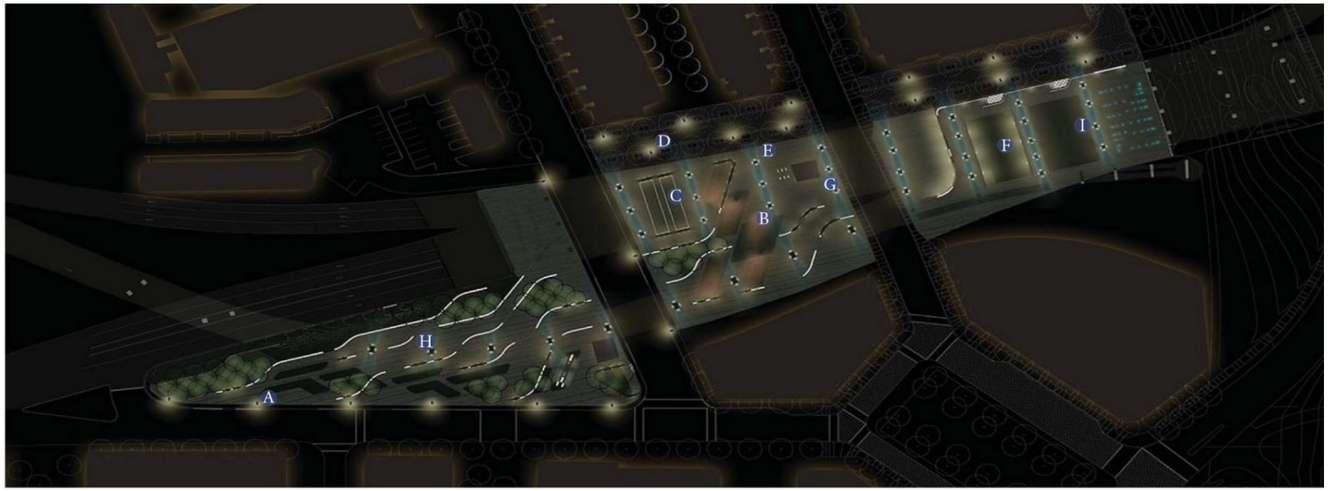
Underpass Park is located between commercial and residential land uses

Two major arterial roadways bisect the project creating three distinct program areas

Planting is found along the edging of the site and also in uncovered areas of the freeway



(Image Source PFS Studio 2016)



(Image Source PFS Studio 2016)

Figure 4.7
Site Plan B – Underpass at Night

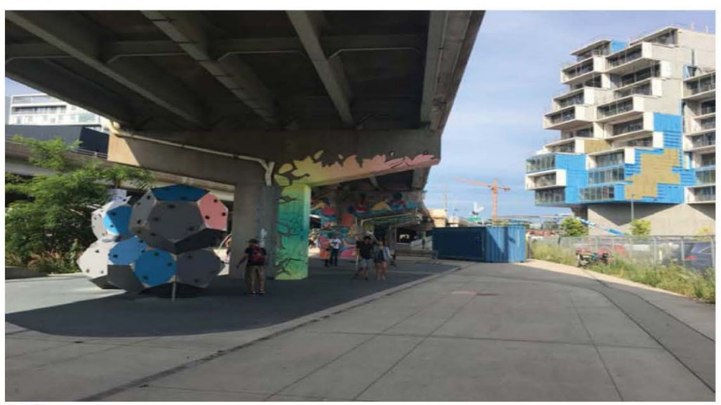
Underpass Park implements use of lighting throughout the site including trails found adjacent to the park

Lighting is a primary element for court space and the paved trails

A Pedestrian trails separate from vehicles traffic with the use of plantings

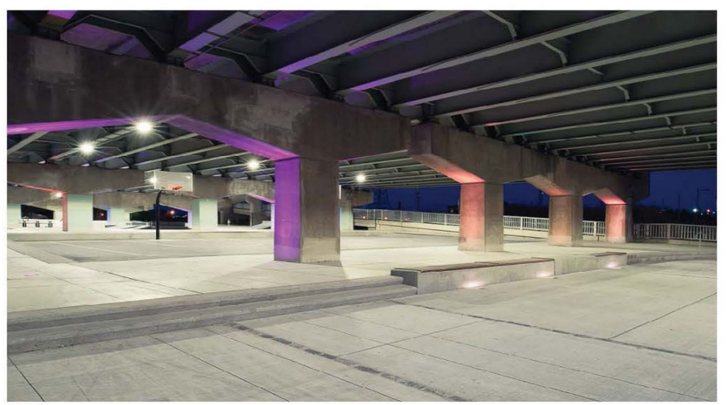
B Programming takes advantage of uncovered areas

C Art installations utilized not only columns but the ceiling conditions



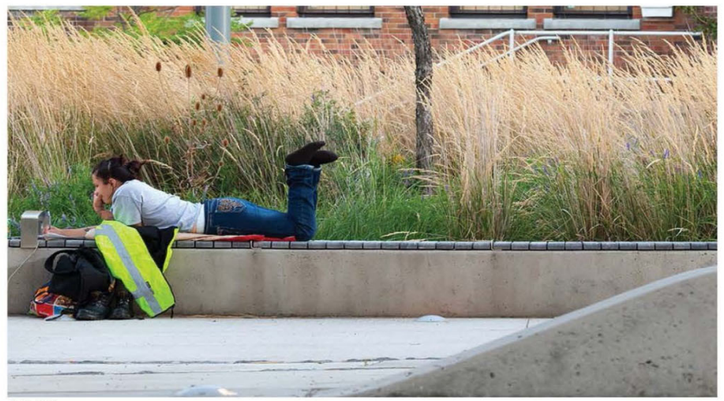
D Covered and uncovered areas of the site are utilized

E Openings in the freeway offer opportunities for optimate lighting

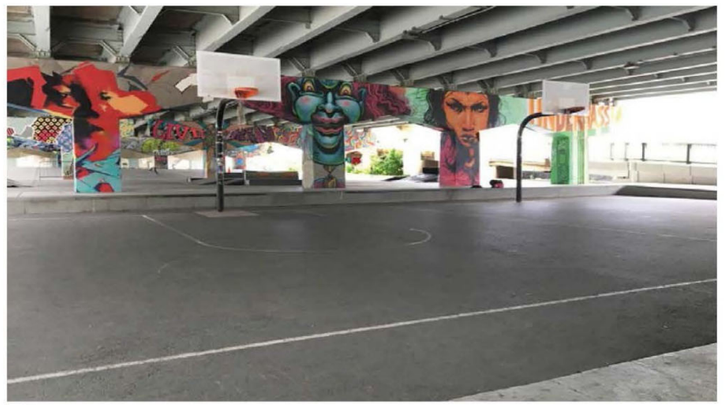


F Ample lighting is provided for nighttime use

G Planting provides a softer condition in relation to the concrete pavement



H Seating is found along planting edge conditions



I Minimal change in grade differentiate between program areas

Figure 4.8
Existing Site Photos
(Source PFS Studio 2016)

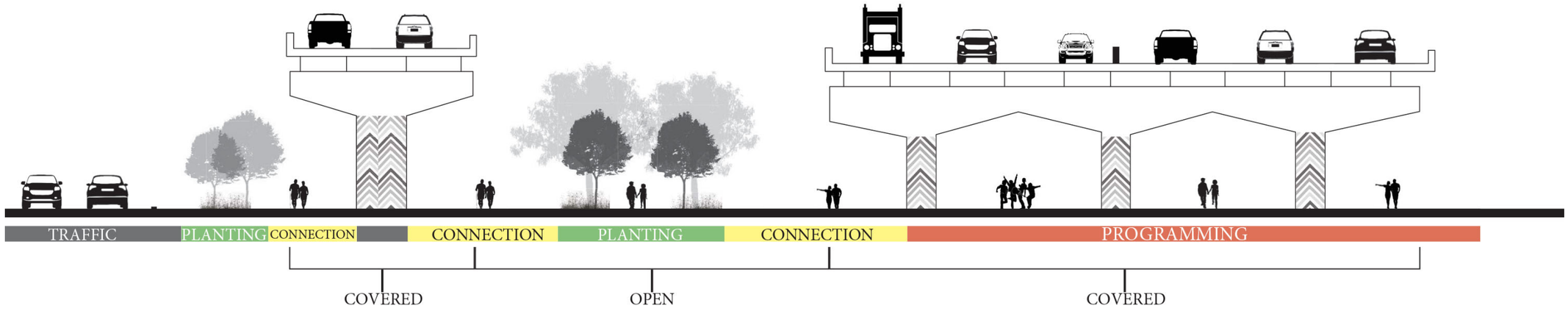


Figure 4.9
Section A – Trails and Connection

Planting is situated between the uncovered area of the project to provide seating and trail connections
Programming occurs both under and between the elevated structures

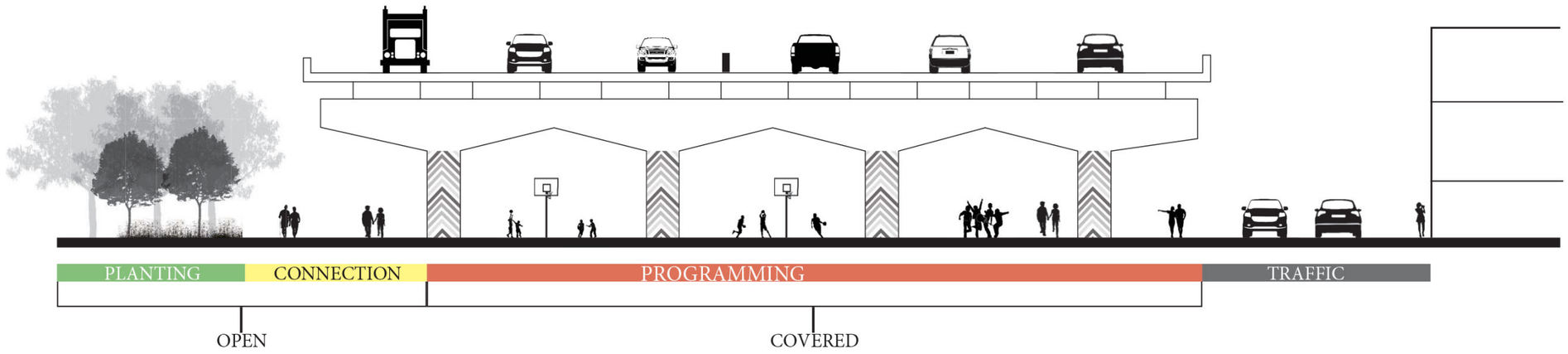


Figure 4.10
Section B – Sports Court

Planting is emphasized as a softer edge condition when the freeway abuts residential buildings
Sport courts are placed in close proximity to residential areas of the community

4.3 Secondary Descriptive Findings

This section discusses the overall findings from the analysis of full case study format. From the data, height plays an important factor for the future potential use of spaces under freeways. The analysis shows the freeways are a minimum of 40 feet or taller suggests the larger the gap between freeway and ground plane promotes potential for public use.

The analysis also indicates a few strategies for programming under freeways. First, primary programming is located directly under the freeway. Being directly under the freeway protects from weather and noise pollution. As stated in the literature, being located directly under the freeway does not promote a higher level of noise pollution. When the program is not directly under the freeway ample amounts of trees and plantings are provided for shade and forms of shelter. Second, programming for these spaces are designed to be multi-seasonal and multi-functional. Programs that can fluctuate and change to accommodate a variety of programs are found in this analysis and show how a multiplicity of the program encourages its use for a public space.

Planting is an additional strategy used in these spaces. Also found through the interview, establishing plant material is commonly found in uncovered parts of the projects or on the edge conditions. Plantings are primarily used to separate pedestrian traffic from vehicular traffic. Trees

and shrubs are placed adjacent to the curb or they are planted to direct pedestrians away from the roadway. Planting is also found parallel to the pathways of the projects. The trails and paved paths are designed to lead pedestrians through the site and provide options for seating. Along with planting, seating is also found directly on pathways and trails. Movable seating is more commonly found in large paved areas. The analysis also shows that there is an emphasis of pathways connecting to existing paths. When there is a condition of the roadway adjacent to the site, pedestrian entry points are emphasized with either lighting, plant material, or art installations.

Installation art is an additional strategy utilized for these spaces. Art is a common factor found in this analysis and used to encourage local talent and a sense of community. Art is found in forms of painting and installations taking advantage of the freeway structures such as the columns and ceiling. Art is primarily used to attract users to the site and offer a venue to express community identity.

A final design strategy found through analysis is changes in elevation. The study shows when either a drastic change in elevation to promote seating for public entertainment or differentiating between programs, elevation variation helps these spaces function for public use.

	Description	Project 1	Project 2
General Information		**The Bentway**	**Underpass Park**
	Location	Toronto, Canada	Toronto, Canada
	Date Designed/ Planned	Nov-15	May-12
	Cost	$49 Million	$6 Million
	Size	10 Acres, 1.2 Miles	2.5 Acres
	Landscape Architect	PUBLIC WORK, Greenberg Consultants, Inc	PFD Studio, The Planning Partnership
	Client/Managed By.	The City of Toronto	The City of Toronto, Waterfront Toronto
	Photographs	Refer Figure 4.3	Refer Figure 4.8
Surrounding Context	Pedestrian Circulation	Existing sidewalks and nature trail	Sidewalks
	Vehicular Circulation	Fort York Blvd major roadway next to site	Site is intersected by three major arterial streets
	Land Use	Mixed Use, Residential Commercial, Retail, Industrial	Residential, Commercial
	Parks/Open Space	Garrison Commons/ Coronation Park, Canoe Landing Park	Only one existing park- Corktown Common
	Tree Canopy	Street Trees, Surrounding Parks- Garrison Commons, Coronation Park, Canoe Landing	Street Trees & Corktown Commons Park
	Drainage	No use of filtering or collecting water besides storm drainage on roadways.	Sloped towards waterfront to protect against flood. No specific elements of storm water management for filtering or containing water.
	City Districts	Located in the Bathurst Quay District- experiencing urban development	West Don Lands- surrounding community

Challenges	Safety	There are no reports from the surrounding area of heightened crime.	Major concerns with safety. Communities expressed area as attracting crime.
	Access	Major access points require crossing street but also accessible from City Park, Garrison Commons.	Accessible but difficult due to the number of arterials crossing through site.
	Lighting	Minimal lighting only attached to freeway structure.	Freeway structure is lit but pedestrian sidewalks under freeway are not.
	Noise Level	Height of freeway allows for minimal issues of noise.	Surrounding residents expressed concerns with noise levels.
	Aesthetics	Expressway utilizes stained concrete for color. Use of concrete guardrails. Area is reported as minimal to no concerns for aesthetics.	Freeway utilizes metal guardrails and no stain or color of structure.
	Maintenance & Management	Maintenance for freeway structure. Minimal for surrounding area.	No reports of maintenance or management issues.
	Barrier for Community	Community and city expressed concerns about freeway fracturing neighborhood.	Community and city expressed concerns about freeway fracturing neighborhood.
	Physical Condition of Freeway	Reports indicated deterioration.	Only reports concern the physical appearance as a barrier for pedestrians.

Design Elements	Seating	Movable seating, seating at Amphitheatre, and seating found along edge of pedestrian paths.	Seating is found along main paths of circulation.
	Planting	Planting utilized between pedestrians' paths and roadways. Tall trees planted on the south end of the site and turf and shrubs used north end.	Planting beds and trees used to direct circulation, found along seating edges, also utilized as barrier between pedestrians and cars.
	Paving Material	Size of pavers used more predominately then color of pavers. Other materials used are wood for amphitheater.	Colored pavers used to indicate circulation. Use of different size and textures.
	Circulation	Major path of circulation is provided to access all areas of project, but secondary paths are also provided for choice. All points of circulation are accessible from roadway and city park.	There is not a direct path of circulation through the project but multiple options for circulation are provided. Paths are accessible from street.
	Entry	There is on major points of entry indicated by the visitor center otherwise points of entry are not emphasized.	Entry points are not highlighted or emphasized. Entries occur from cross walks and from the adjacent neighborhood.
	Lighting	Lighting for major areas such as the amphitheater, skating park, and skate park is provided. Paths are also lit.	Lighting is greatly highlighted to allow use of sports courts at all times. All pedestrian paths are lit along with seating also having ample lighting. The site infuses the use of art installations with lighting techniques.
	Public Art	Art is used for this project but not local artist. The columns exhibit art as markings to indicated a sense of place. The Bentway organization commissioned this art which does not circulate or change.	Public art is found on the structure itself. The columns are used as canvases. Local artist exhibit their work. Also, installation art such as sculptures and reflective mirrors are implemented.
	Programming	Ice Skating Ring, Movable Skate Park, Amphitheatre, Festival Gathering Area, Visitor Center	Playground, Sports Courts: Basket Ball Courts, Flex Space for Festival and Public Gathering Space.

Table 4.1 Summary of Findings for The Bentway & Underpass Park

4.4 Site Observation – Dallas Alley

The following discusses the site observation conducted for Dallas Alley. This observation was conducted on three separate days of the week at three different times of the day. The first visit was conducted on Saturday, October 13 from noon to 3 PM, Wednesday, October 17 from 5 PM to 7:30 PM, and Friday October 19 from 11 AM to 2 PM. Elements of public space including circulation, seating, planting, uses and activities, programming, maintenance and amenities, public art, and level change are used to analyze the site observation data.

4.4.1 Circulation, Programming, Uses and Activities

This section discusses circulation, programing, and uses and activities of Dallas Alley. First, the existing pedestrian paths are marked by differences in paving. The use of size, color, and texture are all utilized to mark the designated pedestrian paths of the site. As for the circulation of pedestrians, there are a few common behaviors that are observed. The site designates points of entry by using ramps to indicate entry points. The existing West End arches also indicate a point of entry (see Figure 5.8, Photo L). Indicating these points of entry does not necessarily mean pedestrians utilize them. As seen in Figure 4.11 and 4.12, pedestrians entered the site not only at marked entries but more often entered by

crossing adjacent streets at non-designated crosswalks. The observation noted that flow of vehicle traffic is moderate to heavy, which did not deter pedestrians from entering the site at non-entry points. The observation also noted groups of three or more are observed exhibiting this behavior as compared to two or less.

An interesting observation of pedestrians is found when comparing traffic on a weekday to traffic on the weekend. The observation noticed flows of pedestrian traffic became random and dispersed from the marked pedestrian paths on the weekend compared to direct use of sidewalks and pathways on weekdays (see Figure 4.11 & Figure 4.13). There are minimal obstacles for pedestrians as the pavement is clear of raised pavers or broken concrete. Subsequently, pedestrian speed did not vary. Except for a few users, the pedestrian speed was observed to be moderate to fast, implying a destination. This was found to be for all groups of users, ranging from individual to groups of three or more pedestrians. This observation is particularly interesting, in that it may pose the idea of how to slow down pedestrian flow.

Programming of the site was observed to be limited to either through traffic, seating, stationary use, and maintenance access. The site does not suggest or direct users to a specific use or program. The observation noted the frequent visits of maintenance crew for site and

freeway maintenance. As previously stated, the use and activities observed at the site are limited to through traffic and seating.

4.4.2 Seating, Public Art, Level Change

Dallas Alley has few options for public seating. As seen in Figure 5.7, the seating occurs in the uncovered space or the edge conditions of Woodall Rodgers. Concrete seat walls and steps are the primary options for seating. The observation found minimal to no use of seating throughout the site. All of the seating provided was constantly in shade. Users that were stationary for a period of time preferred to locate in sun lit areas and did not utilize the seating. Seating is also distant from any planting the only seating offered next to planting is near the street. The observation found no use of this seating option. Public seating is provided, but the location and choice of material seems to play a role in its use.

The one public art element observed at the site is the use of pavers (see Figure 5.7, Photo A). The pavers create a star shaped emblem located in the plaza space or the uncovered area of the site. Users could not interact with the element because it is used as visual markings for the plaza.

Level change is found when transitioning from the plaza area to under the freeway (see Figure 5.7, Photo F), Steps and an access ramp

are provided for pedestrians, which both experience the same level of pedestrian access. This observation concluded that level change is used to differentiate between spaces, specifically making the pedestrian aware when entering under the freeway. The observation did not ask users of this awareness, but observed when pedestrians transition from uncovered to covered spaces, their direction of paths and speed change. Some users immediately change their path of direction to the sidewalks when entering under the freeway and others increased their speed. This observation may imply the importance of safety for the site and identifying methods to achieve that safety.

4.4.3 Planting, Maintenance and Amenities

Planting at Dallas Alley is found primarily in the main plaza area not covered by the freeway as seen in Figure 25, Site Photo B. Tree planters are placed in a half semi-circle in the main plaza area depicted in Figure 25. All existing plantings are placed in the main plaza center of Dallas Alley and any existing turf is placed near the roadway or used near ramps to direct pedestrian circulation. There is no planting found directly under the freeway. Maintenance was observed at each observation visit. The maintenance pertained to the freeway columns, electrical boxes for lighting, and landscaping maintenance. Maintenance appears to be a

constant occurrence around this site and may suggest identifying ways to allow maintenance to occur without interrupting users.

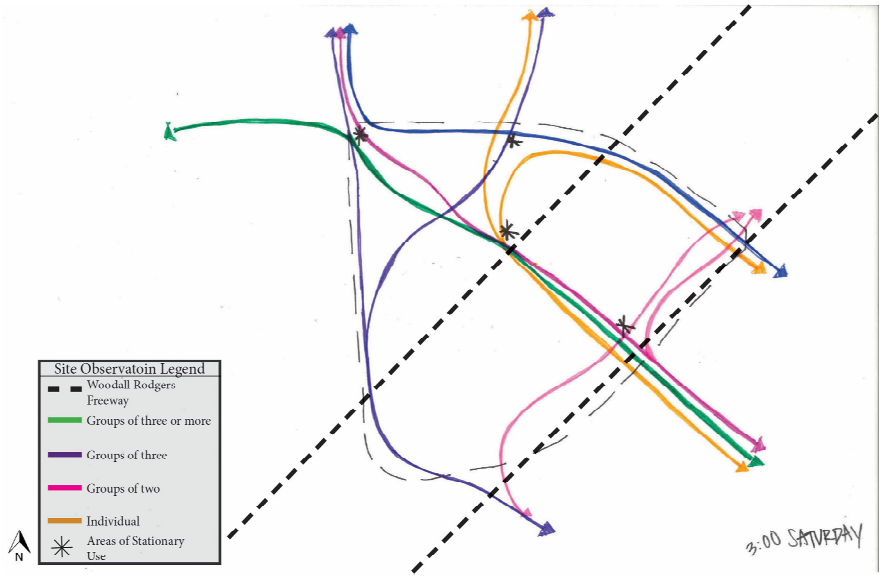


Figure 4.11 Site Observation Saturday at Noon
Pedestrians vary their paths during the more often on weekends

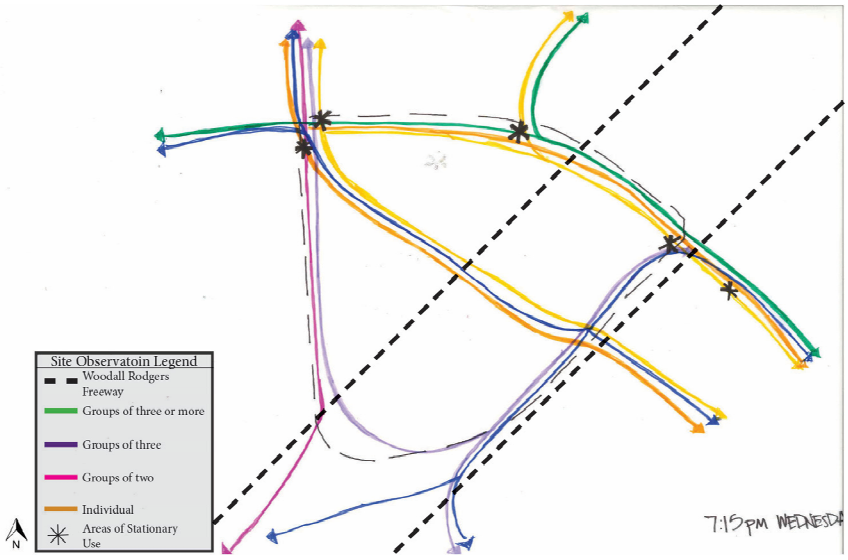


Figure 4.12 Site Observation Wednesday 7PM

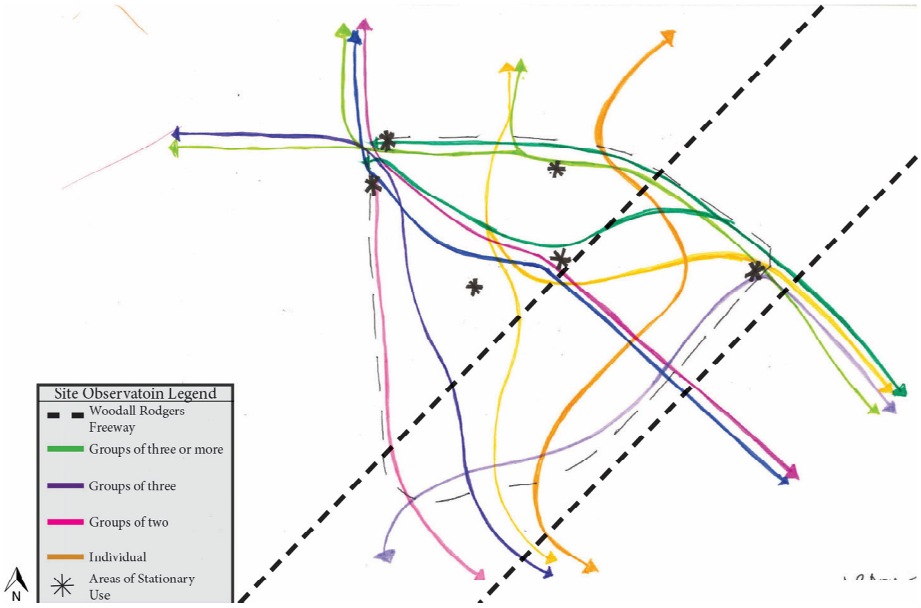


Figure 4.13 Site Observation Wednesday 11AM
There is a variety to circulation and less restrictive during earlier times of day

4.5 Site Observation & Interview Findings

This section discusses the overall findings from the site observation and interview. A summary of findings for the site observation are referenced in Figure 4.14. The site observation analysis revealed a variety of factors about Dallas Alley and its users. First, in reference to circulation, the time of day played a crucial factor in the method, direction, and type of use for pedestrians. For example, pedestrians avoided unmarked pathways during times later in the evening as compared to those who took random unmarked paths during the daytime. This suggests that users express freedom in circulation when safety and lighting are present.

Figure 4.14 A summary of findings from the site observation for Dallas Alley

The findings also revealed that entry points to the site need more than just changes in paving material. Users ignored marked entry points, but they constantly used the existing archways on the site. This suggests that an enhancement at all entry points of the site needs to take place to direct circulation. This does not rule out users entering at unmarked entries. By directing users through specific entries and paths through the site, the rate of use and stay can be improved.

This finding also shows that safety is also a significant factor for Dallas Alley. Observing the speeds of pedestrians, their length of stay,

and their direction of paths suggests a non-stationary use. Users did not want to be in the space for any lengthened period of time except for crossing through. This was found not only during the day but especially at night. Users of three or more passed through the site at night but individual users restricted their paths to sidewalks. This observation advocates that safety both directly under the freeway and plaza are concerns for the site.

Findings show that pedestrians rarely used seating. This may indicate how seating is used and why seating is offered. The findings show the environment in which the seating is offered does not advocate for its use. Changing that environment can improve seating, in turn improving the length of stay of users. Additionally, the lack of public art and planting material suggests an increase of these elements. Planting is restricted to the edges of Continental Ave. and N. Houston Street (see Figure 5.9, Photo R). Just from the observation, planting material dominated by pavers, concrete, and the aesthetic material of the freeway.

The interview and discussion provided multiple insights about the effect of Woodall Rodgers on its surrounding area. The problems discussed for Dallas Alley are traffic above and adjacent to Dallas Alley. The participant revealed that not only is noise above the elevated sometimes a problem, but the traffic adjacent to the site also contributes to

the noise pollution. Another issue is the establishment of plants. Providing water to the site is not a dilemma but establishing plant material with such minimal sunlight is a prime issue for this site.

The participant, Patrick Haigh RLA., discussed the need for these spaces to produce funds for maintenance which suggests why public paid parking is often found under elevated freeways. Generating money is a concern for the city and for developers that look into developing these spaces. A unique aspect of the discussion revealed that Dallas Alley was often used as spaces for basketball courts during the weekdays. The parking lots near Dallas Alley were converted between sports courts and public parking to allow for multiple use of the space.

4.6 Synthesis of Findings

This section discusses the process of synthesizing the data collected and analyzed in the preceding chapter. The purpose in synthesizing this data is to inform the optimal conditions of spaces for public use and the design strategies for urban space under freeways (see Figure 4.1). First, findings from Chapter 2, include the importance of social, environmental, and economic impacts of freeways for spaces underneath

Second, findings from secondary descriptive data suggest an abundant use of lighting, seating, and programming which aids safety, access, neighborhood cohesion and the overall improvement of spaces under freeways (see Table 4.1). Third, a site observation of Dallas Alley indicates the site deals with issues of programming, lack of planting, and safety concerns.

Through this synthesis, a suggested list of site conditions indicated the optimal environment for public space under freeways. These conditions inform the criteria used to create a framework for deciding on the chosen project site. The synthesis also suggests a recommended list of design strategies concerning access, safety, neighborhood cohesions, and maintenance and management (see Figure 4.15). The design strategies are utilized to inform the design development of Dallas Alley.

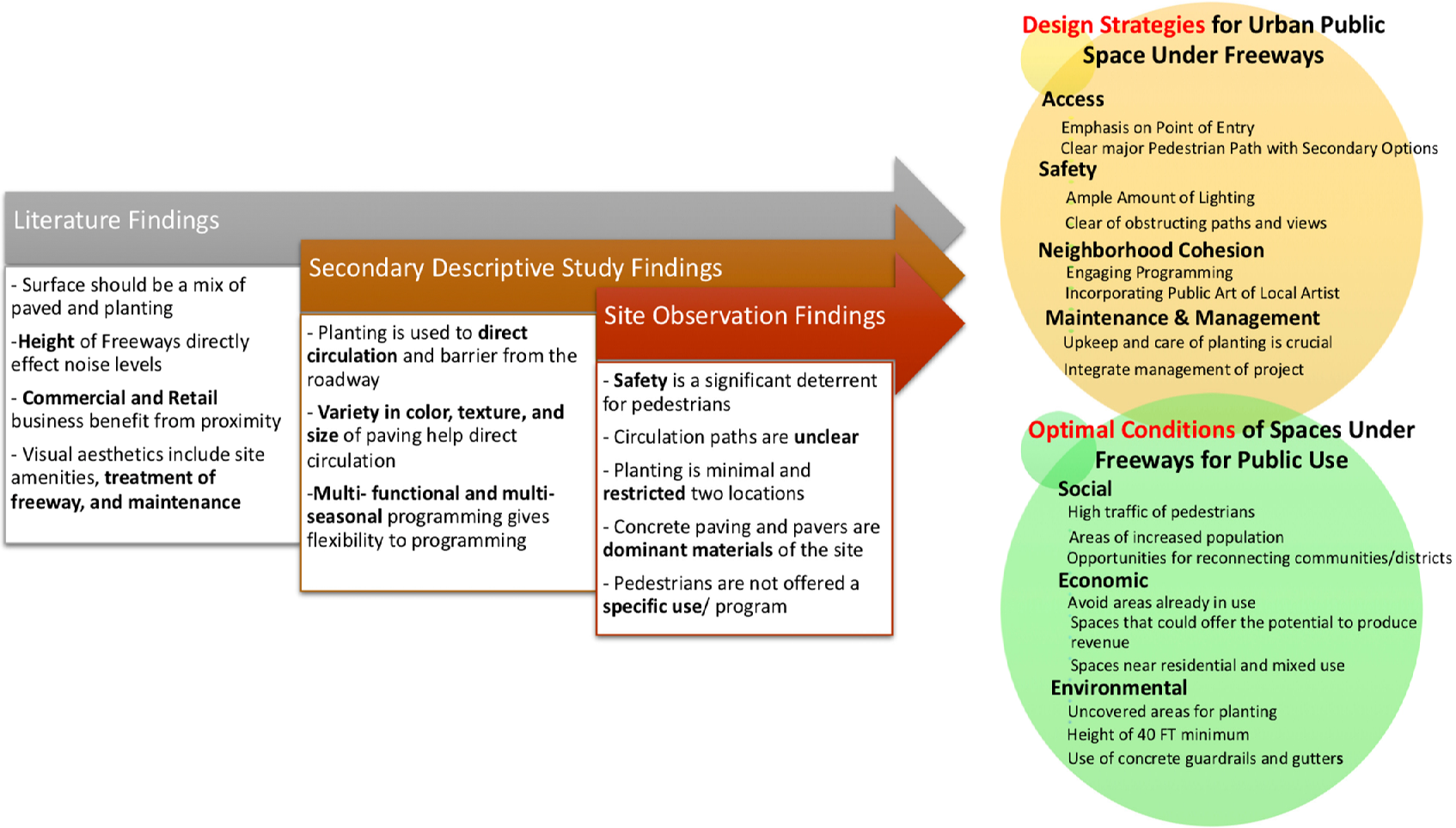


Figure 4.15 Synthesis of Analyzed Data for Optimal Conditions of Public Space and Design Strategies for Urban Public Space Under Freeways

4.7 Chapter Summary

In summary, this chapter discusses the data collected through two methods. The first is the secondary descriptive method collecting data from two projects: The Bentway and Underpass Park. The second is a site observation for Dallas Alley. This data is analyzed through methods of Cooper and Marcus, post occupancy evaluation. Findings from the literature review, secondary descriptive data, and the site observation are then synthesized to inform two frameworks of suggested data. The first, is a framework of optimal conditions for spaces under freeways intended for public use. The second are design strategies recommended for urban public space under freeways. These two frameworks are used to create a set list of criteria to use in determining a site and then applying the recommended design strategies to that determined site.

Chapter 5

DESIGN

Introduction

This chapter presents the site selection criteria and suggested design strategies for Dallas Alley derived from the synthesis of data from the literature review, secondary descriptive findings, and site observation findings in Chapter 4. Dallas Alley is located in the West End district, so a brief history of the area is provided. This chapter also presents a site analysis of Dallas Alley, documenting the existing conditions such as vehicle circulation, existing structures, and pedestrian circulation.

Additionally, a suggested concept and design scheme are given to demonstrate the recommended design strategies, derived from the research and applied to Dallas Alley.

5.1 Site Selection Criteria

The site selected for this project is derived from the synthesis of findings in Chapter 4.6 (see Figure 5.1). The framework of criteria is categorized into social, economic, environmental, and freeway conditions. This categorization is derived from the synthesis of data in Chapter 4. Using

this framework, a site known as Dallas Alley in the West End District of Downtown Dallas is chosen (see Table 5.1).

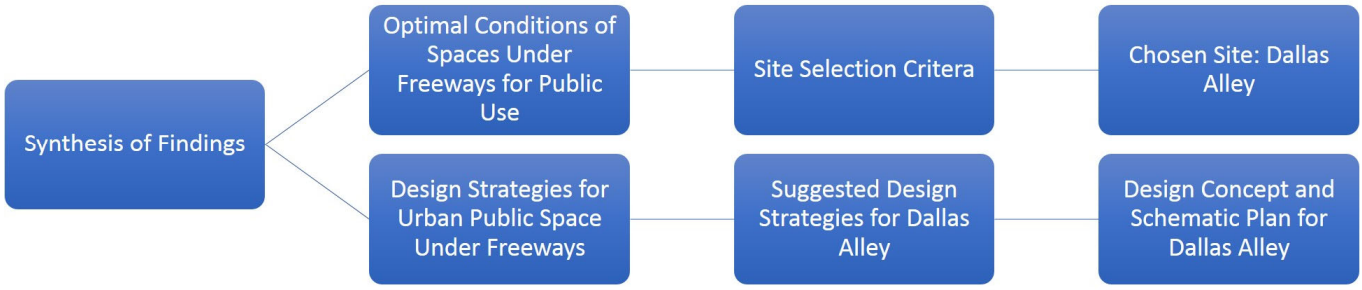


Figure 5.1 Synthesis of Findings Schema

Economic Conditions	Environmental Conditions	Social Conditions	Freeways Conditions
Surrounding land uses are primarily mixed used and residential	Areas with minimum noise pollution and opportunity for improved drainage	High volumes of pedestrian traffic	Freeways should be a minimum of 40 ft from the roadway
Avoid areas that are already in use i.e. Parking lots	Look for areas that provide uncovered areas for additional vegetation	Look for areas of increased residential population	Look for freeways that utilized concrete guard rails
Space for flex space that have potential to produce revenue	Look for areas with a mix of traffic that helps with low levels of air pollutants	Areas that offer opportunity for reconnecting neighborhoods/districts	Surface under freeways should be a mix of paving and plantings

Table 5.1 Suggested Criteria for Site Selection

5.2 Suggested Design Strategies

The following is a detailed list of the suggested design strategies implemented for Dallas Alley. The strategies recommended for this research are derived from the synthesis of findings from the literature review, secondary descriptive findings, and site observation. The findings suggest design elements of importance include seating, programming, circulation, public art, and entry.

Entry	Public Art	Circulation	Seating	Programs	Planting
Emphasis entry to site	Options for areas of art- interactive art utilizing structure of freeway i.e. Columns, ceiling spanning between columns	Pedestrians have a clear direction of path- utilizing paving colors and path width	Provide multiple levels of seating	Multi-functional programming	Utilize vegetation as a barrier between pedestrians and vehicle traffic
Repurpose any materials such as pavers, arches, light poles to points of entry- Emphasize identity to West End	Provide different options for canvases for local artist to display work	ADA accessible	Seating should be found along pedestrian paths	Take advantage of elevation change to create separation of space	Provide varying heights of trees and shrubs
Crossings for pedestrians are clear at roadway	Art that functions as marketing for the site and also incorporates opportunity for lighting	Circulation should provide main path and also options of secondary path	Seating should be open and clearly visible to avoid secluded areas- Safety concerns	Multi-seasonal programs that could possibly generate revenue	Provide more options between open lawn and paving

Table 5.2 Suggested Design Strategies for Dallas Alley

5.3 History of West End's Dallas Alley

Dallas Alley is an area Downtown Dallas located in a district known as the Historic West End. Dallas Alley has a rich history of ups and downs

starting from its beginning in 1986. The West End is known as one of the largest concentrations of historic buildings in Dallas. During the early 80's the area saw an influx of repurposing buildings with clubs, retail, and entertainment businesses (Perez, 2016). In its early stages, Dallas Alley was known for its various bars and restaurants that differed from country to hip-hop. In its' first year of business Dallas Alley earned about $10 million dollars in revenue (Patoski,1987).

Dallas Alley provided a new type of entertainment for the Downtown user and by doing so attracting a vast amount of people to the area. A staple of the area are the multi-color curving arches lighting up the West End Market Place. Due to economic conditions, however, the area fell victim to foreclosures and bankruptcy. In the beginning of 2016 the West End began to experience an influx of developers and new residents (Perez, 2016). Property in the West End was put up for sale and to promote the sale, city enticed developers with tax credits and incentives (Bunch, 2018). Companies such as Blue Cross, Corgan, and Factory Six03 began moving in and developers such as Granite Properties are renovating the historic buildings into modern co-working spaces. Developers stated the West End maintained the most unique quality in Downtown with high walkability and access to DART rail lines (Bunch, 2018).

5.4 Site Analysis for Dallas Alley

Dallas Alley is located under Woodall Rodgers Freeway between two major arterials, Lamar St. and N. Houston St. Secondary roadways adjacent to the site are Continental Avenue and McKinney Avenue. Lamar Street and N. Houston Street provide vehicular and pedestrian access to the West End district and Victory Park. The West End District is located south of the project site with Victory Park located just north of the site.

Figure 5.2 details both the vehicular and pedestrian traffic for Lamar and N. Houston Street, and shows existing roadways adjacent to the project site and points of intersections. The figure also shows bus stops and DART stations accessible from Dallas Alley. Figure 5.2 exhibits existing public open space within a quarter mile walking distance. Figure 5.6, also depicts the existing tree canopy.

Dallas Alley is bordered on all sides by roadways with three roadway intersections at the North, Southeast, and Southwest corners (see Figure 5.3). Portions of Dallas Alley are located directly under Woodall Rodgers with the North area of Dallas Alley not directly under the freeway, as seen in Figure 24. Pedestrians must cross Lamar St., N. Houston St., or McKinney Ave. to access the site (see Figure 5.5). ADA

access is found on McKinney Ave. with a ramp allowing access to the site (see Figure 5.8, Photo J).

The surrounding context of the site is a mix of commercial use buildings, public plazas, residential towers, and a mix of public and private parking (see Figure 5.4). Built structures line Dallas Alley both North and South whereas parking lots are situated East and West of the site. Parking under Woodall Rodgers is commonly found either directly underneath as designated public parking or along the side streets as parallel parking (see Figure 5.9, Photos Q & R). Directly south of the site is the West End District which includes a variety of repurposed industrial buildings leased for office space (see Figure 5.8, Photo L). Other uses include an abundant number of restaurants and residential buildings within a quarter mile walking distance.

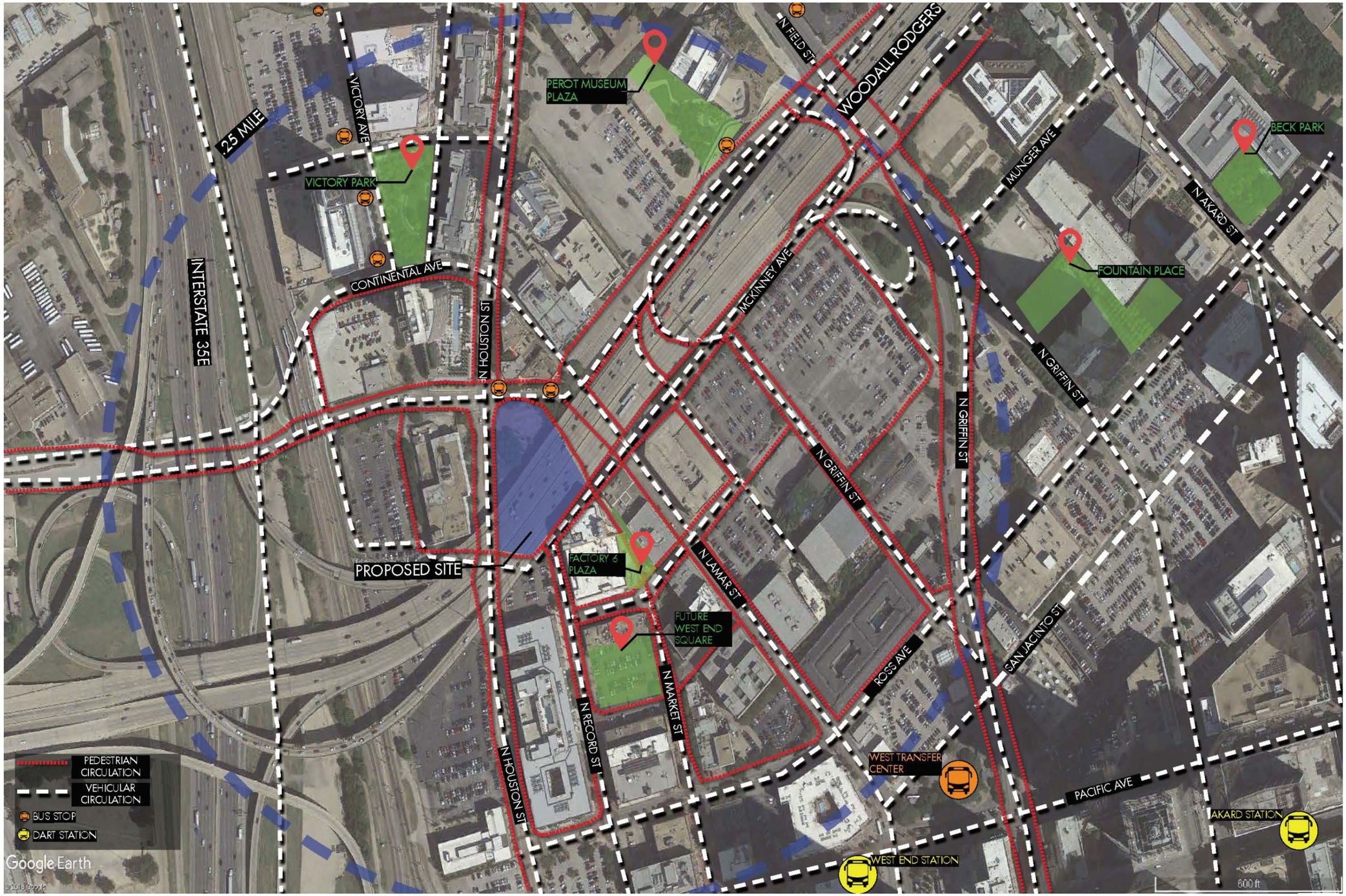


Figure 5.2
Surrounding Conditions of Dallas Alley at .25 Mile Walking Radius

Figure 5.3
Dallas Alley Vehicular Circulation and Major Intersections

N

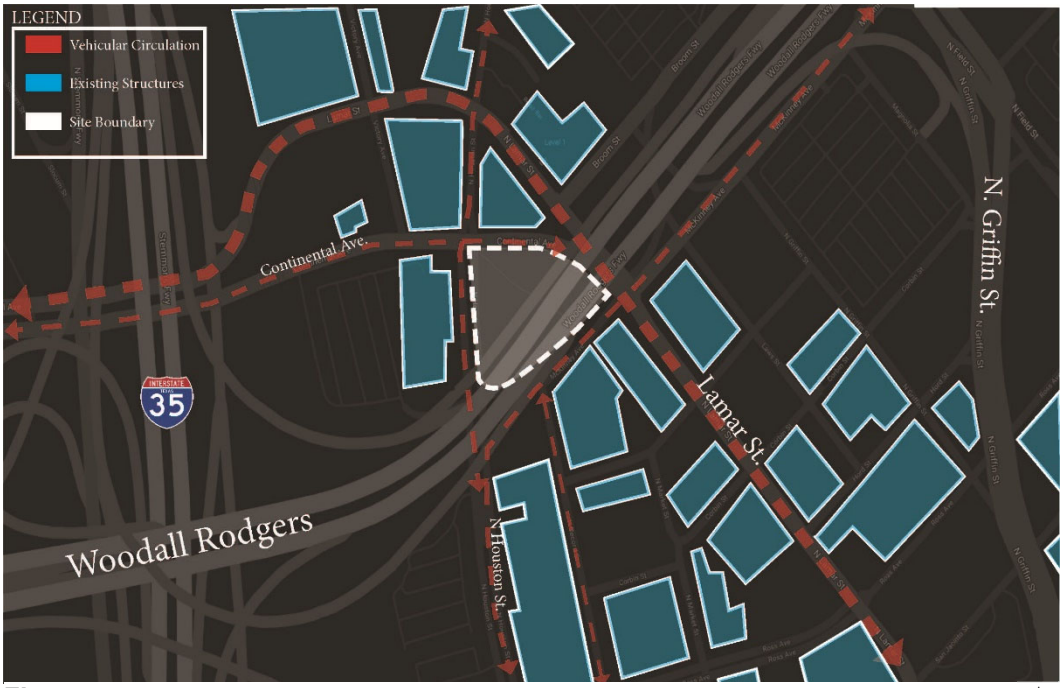


Figure 5.4
Dallas Alley Existing Structures

N

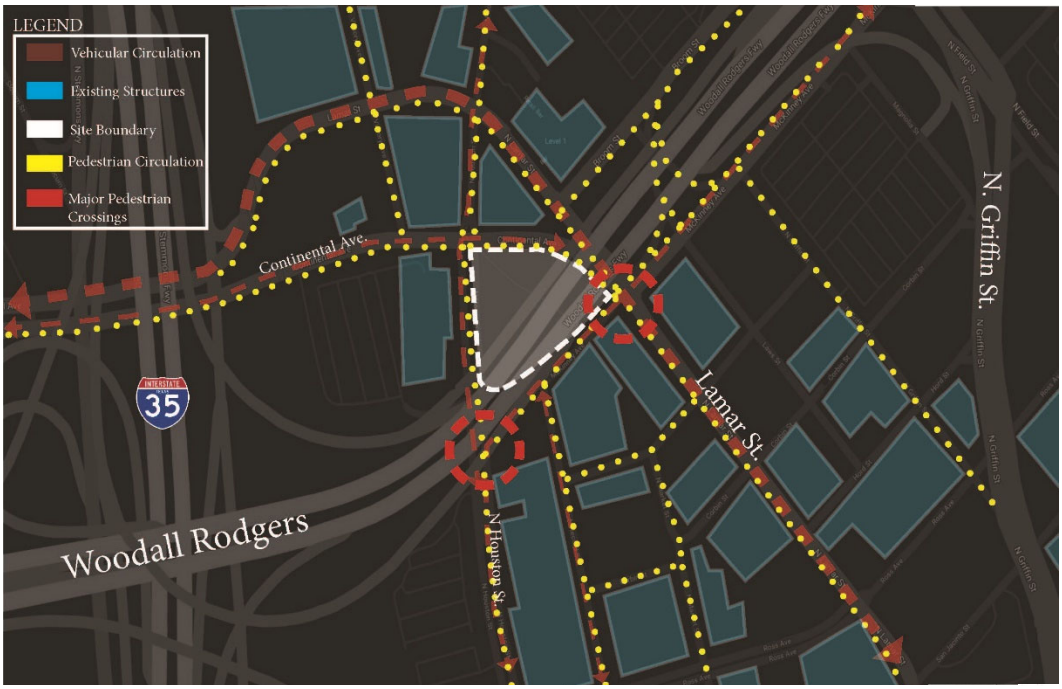


Figure 5.5
Dallas Alley Pedestrian Circulation and Crossings

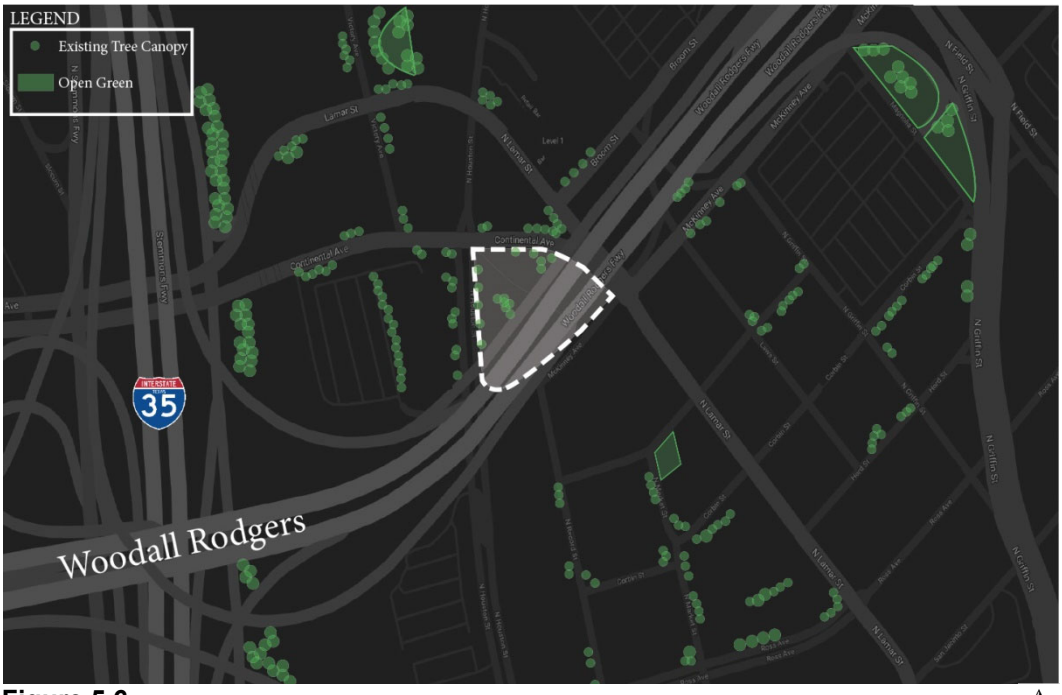


Figure 5.6
Surrounding Tree Canopy

E Seating is located near sidewalk and vegetation

F Pavers vary in size and color

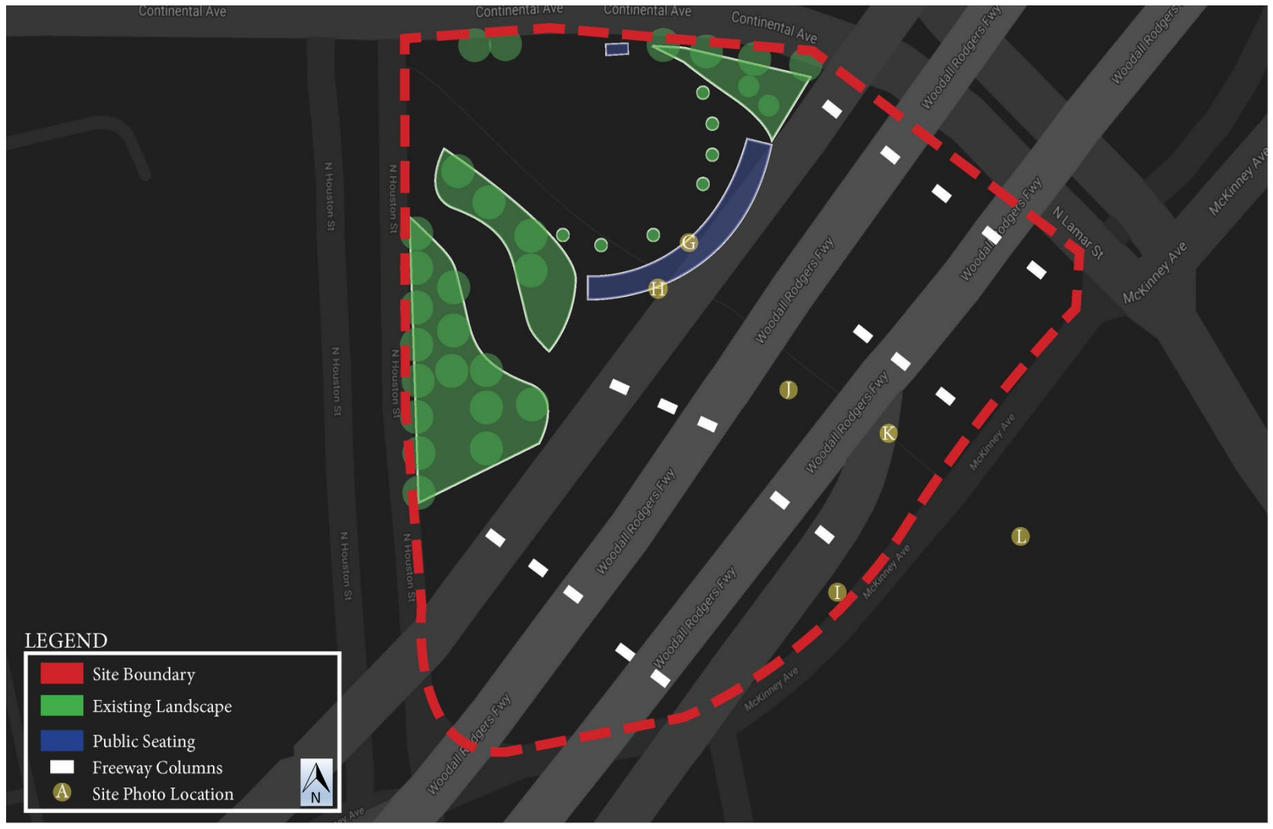
A Plaza area transitions into space under the freeway

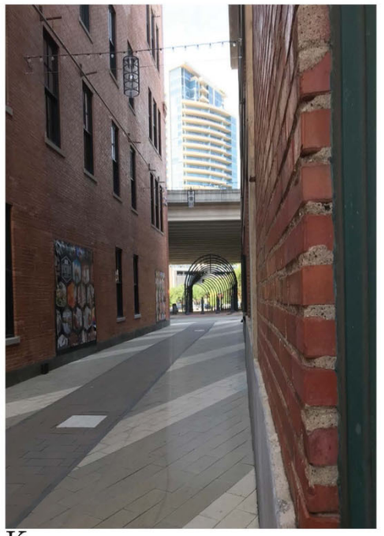
B A clear path of circulation is not indicated in paving

C Freeway columns are abundant in quantity

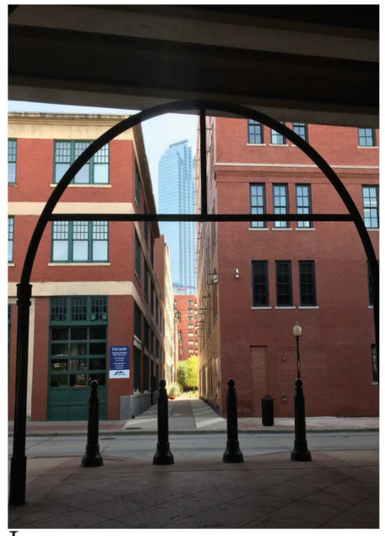
D Pedestrians are directly next to the roadway/ vehicle traffic

Figure 5.7
Dallas Alley Site Analysis Photos



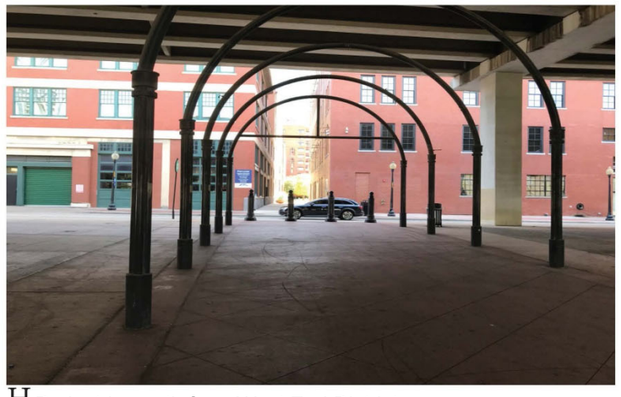


K Path leading directly into Dallas Alley



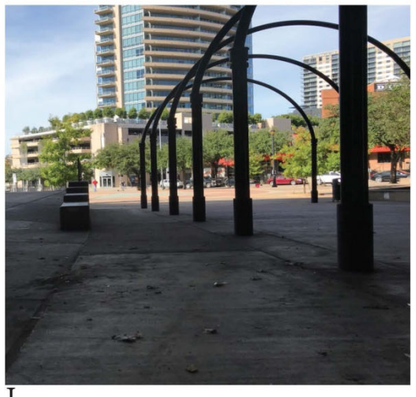
L Existing arches- identity of West End – View of entrance into West End

G Low wall seating offered near pedestrian paths



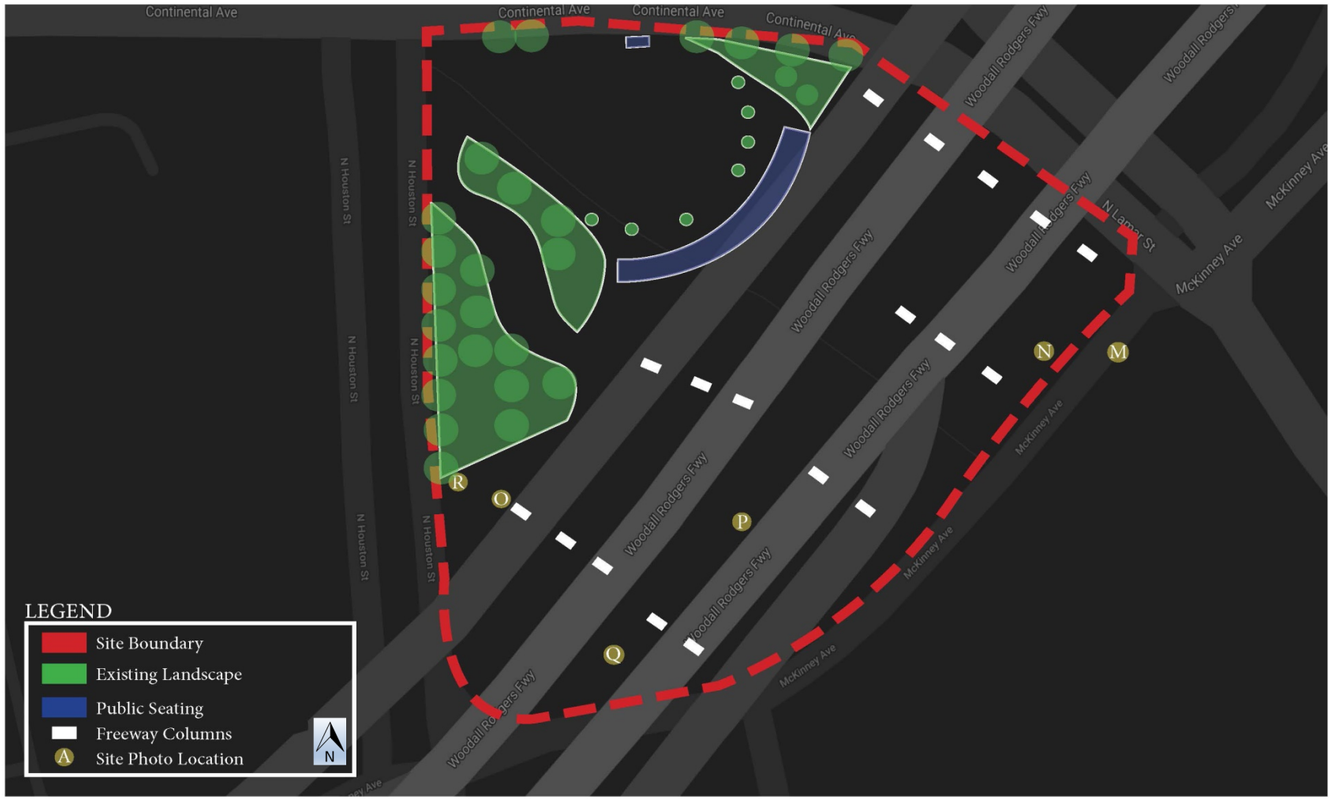
H Pedestrian path from West End District

I McKinney Ave. and N. Lamar St.

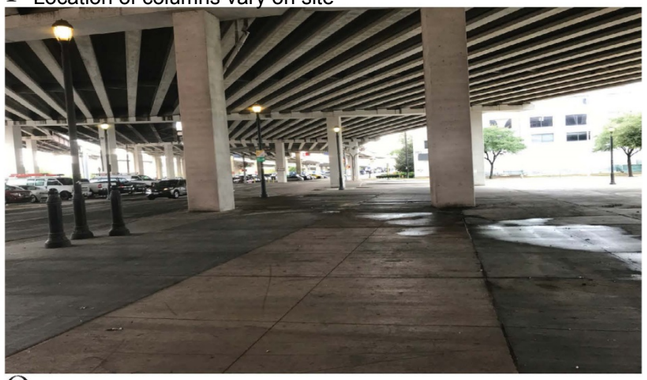


J Path into Dallas Alley Plaza

Figure 5.8
Dallas Alley Site Analysis Photos



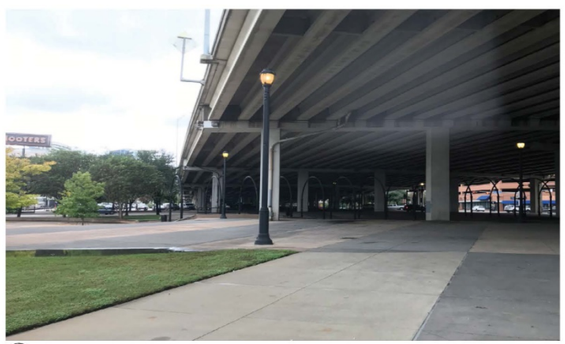
P Location of columns vary on site



Q Use of different color pavers and bollards for vehicle traffic

M View from McKinney Ave.

N View from McKinney Ave towards N. Houston St.



O View from N. Houston St.

R View towards N. Houston St.- Vegetation found on edge of roadway

Figure 5.9
Dallas Alley Site Analysis Photos

5.5 Site Analysis Findings

With the findings from the site observation in Chapter 4.4, the site analysis indicated similar findings. The flow of vehicular traffic impacts the accessibility of the site and also safety for pedestrians. Figure 5.5 shows that both pedestrian and vehicular paths intersect when accessing the site. Lighting for Dallas Alley is primarily found from street lamps and lighting directly attached to the freeway structure (see Figure 5.8, Photo I). As stated in the site observation findings, this seemed to affect the safety concerns for pedestrians, which in turn affected their length of stay and choice of circulation paths.

Figure 5.2 and 5.6 show a lack of green open space and tree canopy near Dallas Alley. The site incorporates a mix of plantings and paving but as seen in Figure 5.7, the amount of paving out numbers the quantity of vegetation.

5.6 Design Concept

The following is a description of the suggested concept for Dallas Alley. The suggested concept aims at transforming Dallas Alley into a public space that promotes connection, community interaction and safety and is open for urban public use. Figure 5.10 depicts the suggested concept Dallas Alley.

First, the investigator suggests entry to the site be emphasized at four specific points (see Figure 5.10). These four points of entry are derived from the findings of the Dallas Alley site observation. The observation indicated four primary points of entry commonly used. This suggestion also originates from case study findings. The Bentway and Underpass Park emphasized entries to their sites by utilizing either built structures, public art, and multiple paving colors and sizes. Highlighting entries contributed to the identity of these spaces and promoted their continued use throughout. The concept suggests highlighting points of entry to direct circulation and create an awareness of entering Dallas Alley.

Second, the investigator suggests a hierarchy of circulation. Based on findings from the site observation such as unclear pedestrian paths and undefined use of the site, the concept suggests a primary path through

programmed areas. Secondary paths are suggested to provide internal additional options of circulation.

Third, the investigator proposes placing active programs directly underneath the freeway and placing passive programs in uncovered areas of the freeway. Due to site observation findings suggesting little interaction between users, active programs such as multi-functional sports courts and amphitheaters are recommended to engage the community and its residents. The interview revealed that sports courts were once a popular and common use of adjacent sites similar to Dallas Alley. Keeping the area physically open provides opportunities for vendors, markets, and public gatherings.

Additionally, the investigator advises incorporating public art into Dallas Alley. Case study findings strongly show public art to be a major factor in contributing to the continued use of a site. Both case study projects allow for multiple artists to exhibit their work directly on the structure of the freeway, incorporate their work on the columns and ceiling. Public art is completely absent from Dallas Alley. Public art is suggested to engage the community to experience a greater sense of place and interaction.

Based on site conditions, lighting is suggested to be increased in areas of pedestrian paths and programmed areas, such as the sports

courts and amphitheater. The literature review discusses the importance of aesthetics of lighting related to freeways. Lack of lighting is a deterrent for users, and the suggested concept looks to incorporate lighting to enhance the use and safety of Dallas Alley.

Finally, the investigator suggests enhancing the amount of vegetation. Case study findings indicate the use of plantings and vegetation along pedestrian paths and along roadways. The concept suggests locating additional vegetation at edge conditions of the site to separate vehicular and pedestrian traffic. Literature findings discuss the use of increased vegetation contributing to increase air quality. In turn, additional vegetation such as open lawn and a variety of planting beds are to be located in uncovered areas of Dallas Alley. The recommended transitional lawn area is intended for community markets and festival areas. According to interview findings, programmed spaces should provide flex space that have potential to produce revenue.

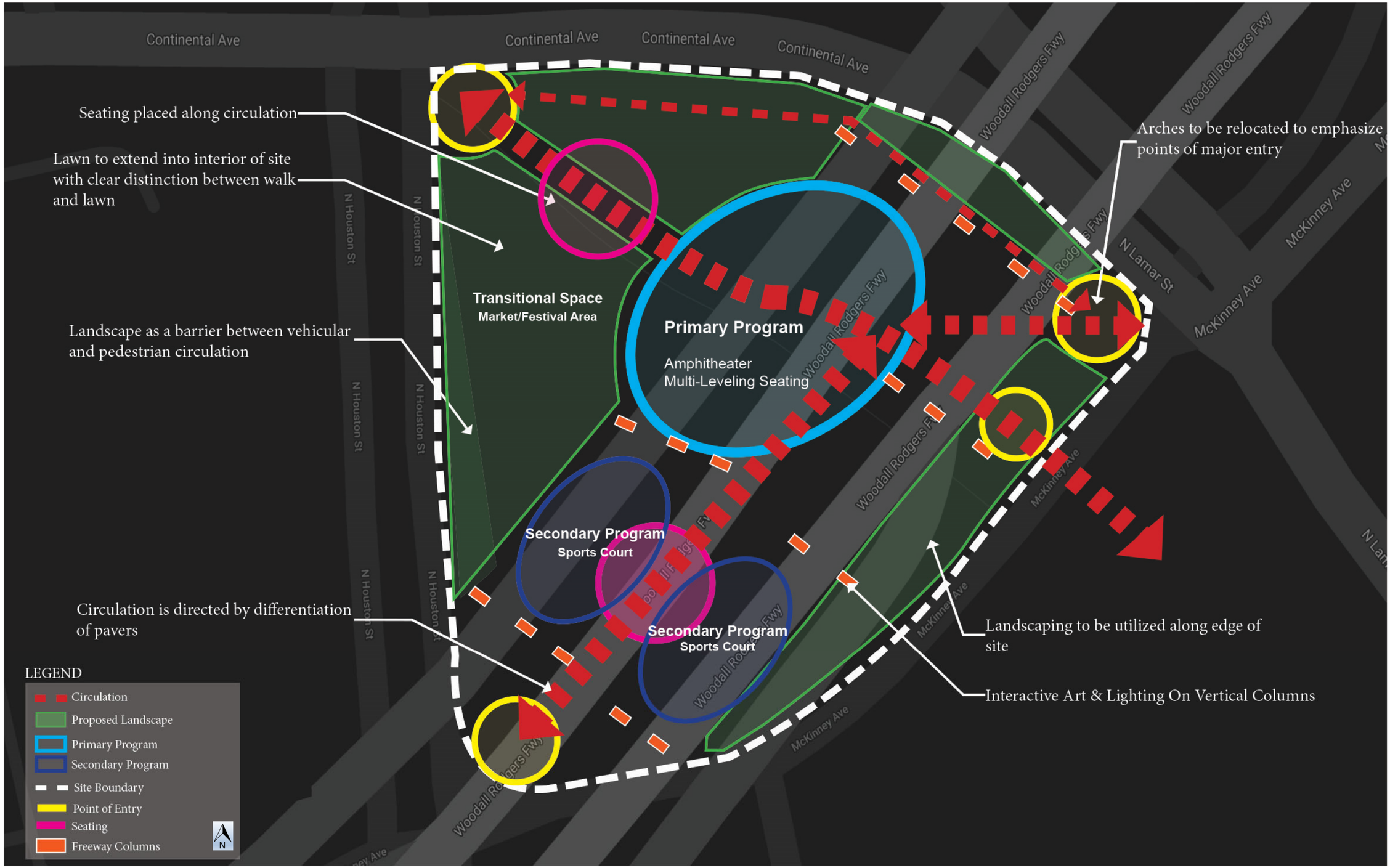


Figure 5.10
Dallas Alley Concept Plan

5.7 Design

The following is a description of the design strategies derived from findings and applied to Dallas Alley. The design strategies focus on factors such as accessibility and safety, neighborhood engagement and user interaction, maintenance, management and aesthetics. A list of these design strategies can be found in Figure 5.3.

5.7.1 Accessibility & Safety

Accessibility and safety are two primary factors that influence the potential of a space to be used by the public.

Findings from the case studies indicate that efficient accessibility and ample safety be provided, and that elements such as lighting and circulation be clear and abundant. Underpass Park specified lighting to be located at pathways, seating, underneath the freeway, edge of roadways, and incorporated into the paving system. The recommended design for Dallas Alley outlines additional lighting to be placed along pedestrian paths and along areas of the urban grove to highlight seating and vegetation. Lighting is also suggested to be placed along the edge of Lamar St., McKinney Ave., and N. Houston St. Along with vegetation, additional lighting is suggested to ensure safety at all times of the day.

Pedestrian circulation and entry points are also indicators of safety. Findings from the case studies show that pedestrians have a clear direction of path which utilizes paving colors and sizes. The design proposes all pedestrian paths are marked with clear colored pavers of varying sizes and entry from street crosswalks are ADA accessible. The design recommends all major paths give users access to all programs of the site: sports courts, urban grove, and public amphitheater (see Figure 5.11). Findings from the study show to increase community engagement all programs and use of the site should be readily accessible.

Additionally, the investigator suggests relocating the existing arches to emphasize entry points of the site (see Figure 5.12). The recommended relocation refers to the recommended design strategies, stating that emphasizing points of entry aid in use of spaces and provide a sense of place. Dallas Alley has previously benefited from a distinct identity, allowing for an abundance of commercial and night life businesses in the area. By relocating a few of the existing arches to entry points of the site, the design proposes this contributes to reinforcing the existing identity of the Dallas Alley.

5.7.2 Neighborhood Engagement & User Interaction

Neighborhood engagement and user interaction are factors that must be considered when designing for spaces under elevated freeways. Literature and findings show that freeways fracture surrounding communities and neighborhoods. Site observation findings showed pedestrians were not offered any specific program with which to engage. This in turn affected how they used the site. The primary use of the site was revealed to be transitory. Pedestrians walked through, past, and around the site; standing long enough to only cross roadways.

To promote greater interaction among users, the proposed programming for the site includes a multi-functional and sunlit urban grove since case studies showed an increase of users when spaces incorporate additional vegetation. In addition, the proposed programming includes a multi-functional public amphitheater and multi-functional sports courts. These multi-functional spaces provide options for the community and help to promote greater interaction (see Figure 5.13).

Additionally, the amount of seating is increased to provide users options and freedom (see Figure 5.14). From case study findings seating is suggested to promote continued of space. Both the Bentway and Underpass Park provided multiple options of seating along major paths and also seating for viewing public events. The design suggests locating

seating along the edge of the urban grove for users to view events such as festivals, urban markets, and vendors.

5.7.3 Maintenance and Management, and Aesthetics

Based on site conditions, maintenance and management of Dallas Alley and Woodall Rodgers was found to be frequent. The suggested sports courts and flex space are intended to allow this continued maintenance of Dallas Alley. The proposed design places additional trash and recycling receptacles adjacent to the sports courts, amphitheater, and urban grove. Placing additional trash bins are intended to aid in maintenance of the site through passive community involvement. The recommended design is meant to enable maintenance of the site since adding vegetation will increase required maintenance.

Findings from the site observation show a lack of pleasing aesthetics. Literature findings discuss the importance of aesthetics related to freeways such as public art, site amenities, lighting, and trash receptacles. These elements contribute to how the space is perceived by users. The following proposed design strategies are intended to improve existing aesthetics and maintenance.

The suggested design suggests taking advantage of the freeway structure by incorporating public art on the structure (see Figure 5.15,

5.16). The research has shown projects allowing local artist to display their work on the columns of the freeway engenders a greater sense of community and identity.

5.7 Chapter Summary

In summary, this chapter discusses the synthesis of data collected in Chapter 4, which are the site selection criteria and suggested design strategies for Dallas Alley. A brief history of the West End District is provided to inform the reader a background of Dallas Alley. This chapter also discusses the site analysis conducted for Dallas Alley, which illustrates the existing conditions such as vehicular and pedestrian circulation, tree canopy, and built structures. Providing this information is intended to inform how the suggested design strategies are incorporated and applied to the site. Additionally, a suggested concept and design are discussed in detail.

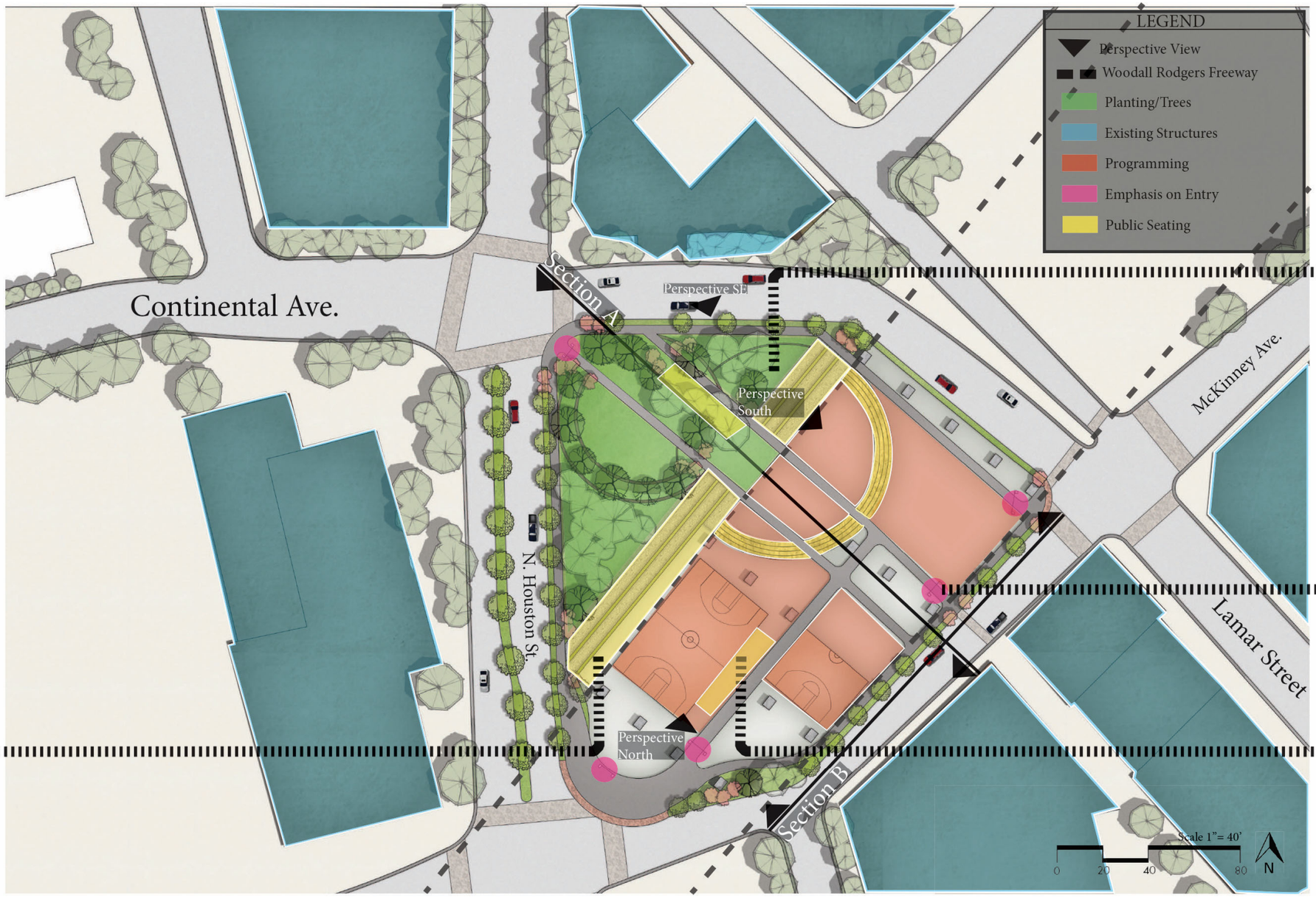


Figure 5.11
Dallas Alley Program Diagram

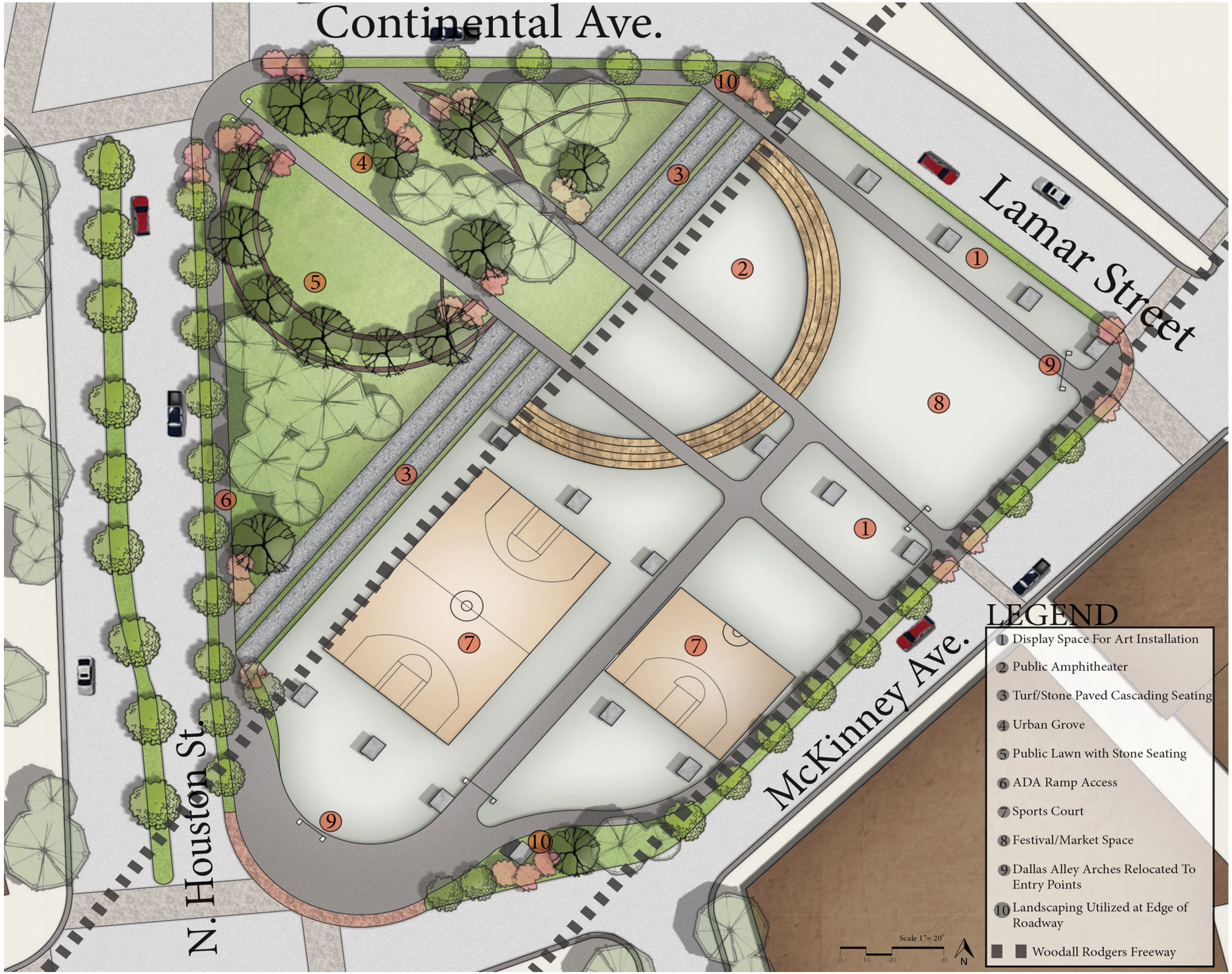


Figure 5.12
Dallas Alley Site Plan

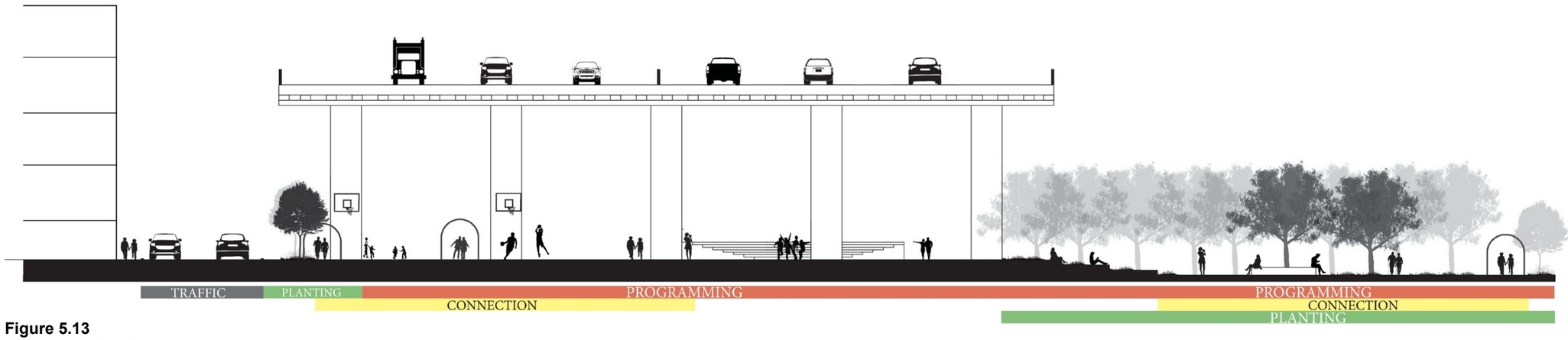


Figure 5.13
Dallas Alley Site Section A

Figure 5.14
Dallas Alley Site Section B

Figure 5.15
Dallas Alley Sports Court Perspective North

Figure 5.16
Dallas Alley Amphitheatre Perspective South

Figure 5.17
Dallas Alley Urban Grove Perspective South East

Chapter 6

CONCLUSION

Introduction

This chapter concludes the design study research by addressing the proposed research questions and recommending possible design recommendations for similar sites under elevated freeways. This chapter also discusses the relevance this research has for landscape architecture and the scope of future research.

6.1 Addressing Research Questions

This section addresses research questions in Chapter 1.6.

Research Question 1: What are the conditions of terrain vague spaces and what are the conditions of Dallas Alley?

Research found that terrain vague spaces are prone to high levels of noise, poor air quality, and minimal use of vegetation and planting. They also are commonly surrounded by mixed use, commercial, and industrial land. Additionally, the aesthetics of the spaces are found to be of poor quality and include minimal use of lighting, a lack of site amenities, and in need of maintenance. Research found conditions for Dallas Alley to have lack a lack of lighting, accessibility, and safety. The flow of vehicular traffic impacted the accessibility of the site and also safety for pedestrians.

There is a lack of green open space and tree canopy near Dallas Alley. The site incorporates a mix of plantings and paving but, the amount of paving out numbers the quantity of vegetation.

Research Question 2: What strategies can remedy these conditions and how can they be applied to Dallas Alley?

Research found that the following design strategies can be applied to Dallas Alley to remedy the adverse conditions referenced above.

- Entry to the site be emphasized at four specific points highlighting points of entry to direct circulation and create an awareness of entering Dallas Alley.
- Creating a primary path through programmed areas and, secondary paths to provide internal and additional options of circulation.
- Placing active programs directly underneath the freeway and placing passive programs in uncovered areas of the freeway. Keeping the area physically open provides opportunities for vendors, markets, and public gatherings.
- Incorporating public art into Dallas Alley to engage the community to experience a greater sense of place and interaction.

- Placing lighting in areas of pedestrian paths and programmed areas, such as the sports courts and amphitheater
- Increasing the amount of vegetation. Locating additional vegetation at edge conditions of the site to separate vehicular and pedestrian traffic.

Research Question 3: Which design strategies can revitalize Dallas Alley into a valued open public space?

This research study found there are three distinct design strategies that aid in revitalizing Dallas Alley into a valued open public space. The first strategy is the use of public art. Public art is installed in Dallas Alley to create an identity and sense of place that is currently lacking. The second strategy is increasing safety. Through the use of lighting and vegetation along roadways, safety is increased, not only underneath the freeway, but also along pathways, along roadways, and the urban grove.

The third design strategy that contributes to the revitalization of Dallas Alley is programming.

With the influx of residents and development in the West End, the demand for more public space will increase. To meet the community demand, specific programming such as sports courts and a public

amphitheater engages users to the site and transform it into a valued public space.

6.2 Design Recommendations for Similar Sites

The research indicates that there is a multitude of obsolete and unproductive spaces (terrains vagues) with varying conditions under elevated freeways that have the potential for revitalization. For these spaces to be revitalized, the following design strategies are crucial to transform them into valued open public space:

- **Accessibility and Safety**
    - Emphasize the most commonly used entry points of the site with signs, structures, lighting, vegetation etc.
    - Create a clear and defined path of pedestrian circulation with both a primary and secondary path
    - Provide ample amount of lighting which must be located to illuminate pathways, edge of roadways, and any programmed areas directly underneath the freeway
- **Neighborhood Integration and User Interaction**
    - Provide opportunities of public art and installations to promote neighborhood identity

    - Offer a variety of multi-functional and multi-seasonal programming for all types of users such as children, families, and large groups
    - Specify public seating to be located along pathways and clearly visible seating to avoid secluded areas
- **Maintenance and Management, and Aesthetics**
    - Utilize vegetation as a barrier between pedestrians and vehicular traffic
    - Provide ample amount of trash and recycling receptacles to aid in the maintenance of the site
    - Provide opportunity of space for individuals and groups to hold events that will produce revenue for the site, in turn producing funds for management

6.3 Relevance to Landscape Architecture & Future Research

This design has relevance to the field of landscape architecture in several ways. First, this research can inform landscape architecture designers and planners that the adverse conditions of spaces under elevated freeways have the potential to be mitigated.

Specifically, the research provides a framework of design strategies that landscape architecture designers and planners can use to revitalize

these obsolete spaces by improving accessibility and safety, promoting neighborhood engagement and user interaction, incorporating methods of maintenance and management, and improving aesthetics. Further research could be conducted in applying these design strategies to similar sites located near waterfronts, urban parks, design districts or residential neighborhoods. The recommended design strategies in Chapter 6.2 may have different implications based on surrounding conditions.

This design research can also aid in the negative perception of spaces under elevated freeways having little to no value for surrounding communities. It proposes that these spaces have potential value for communities and can be revitalized by employing the design strategies found in Section 6.2

Further research can investigate a method in quantifying benefits for communities and influence similar sites to take advantage of this potential value.

Future research may also imply the possibility of incorporating built structures in these spaces, which can lead to an expansion of programming. Structures can include shipping containers, utility sheds, greenhouses, glass enclosures, modular weatherproof retail and mobile public structures. Built structures would allow for multi-seasonal use of the spaces and further protect the area from weather conditions.

Other recommended strategies may include adding architectural elements to the structure of the freeway such as archways, beam structures, modular wall and ceiling panels, and elements for vaulted ceilings. Also, storm water management or other design strategies that allow vegetation, and incorporate lighting and plantings directly under the freeway, to improve the utilization of the spaces.

Appendix A

Interview Questions:

1. What is your Profession/Title?

2. How long have you been working in this field?

3. What is your role in the department?

4. Can we identify you in our publications for this research?

5. Freeways are considered an important part of DFW's identity. Do you think their presence can cause a disconnect for neighborhoods situated near freeways?

6. Are you familiar with any freeways in the DFW area that provide safe and usable space? If so what do you think makes them successful?

7. What are some common safety concerns for pedestrians when trails or sidewalks pass under freeways?

8. From your professional opinion, are there methods in utilizing this land to promote safe and usable areas?

9. Are you aware of any ecological complications at this site i.e. flooding, poor drainage, poor soil conditions, sun exposure, animal infestation, plant infestation?

10. What kind of benefits do you see for the neighborhood?
11. Are you aware of any research/ investigation/ planning done for this site in relation to using the land other than its current use?
12. Why do you think there are so few precedents/ projects for areas like this site?
13. Do you think their programs such as parks are feasible? For example, parks, recreation, trails etc.
14. Considering the site location, do you think a built structure could be an option for programming?

Appendix B

Secondary Resources for Case Studies:

Project Name	Source Titile	Classification	Year	Author
The Bentway	"Gardiner Expressway and Lake Shore Boulevard Reconfiguration"	City Funded Study	Jul-05	Waterfront Toronto and the City of Toronto
	"Gardiner Expressway East Planning Study Innovative Planning Techniques"	Planning Study	2015	Dilon Consulting Limited
	"Gardiner Expressway and Lake Shore Boulevard Reconfiguration: Environmental Assessment and Urban Design Study"	Urban Design Study	Jul-05	Perkins + Will, Dillon Conslutling, Morrison Hershfield, Harvreaves Associates
	"The Bentway"	Project Description	2016	Waterfront Toronto- Public advocate of waterfront revitalization. Created by the Governments of Canada and Ontario
	"The Bentway's surprising success shows Torontonians are hungry for unconventional public spaces"	Architectrual Review	2018	Alex Bozikovic (The Globe and Mail)
	"The Bentway, Toronto's Newest Attraction, Is a Model for Other Cities"	Travel Review	2018	Michael Kaminer (TPG)
	"The Bentway Makes Magic in a hostile urban space beneath the Gardiner"	News Column	2018	Edward Keenan (Columnist The Star)
	"Under the Expressway: The Bentway"	Architectural Review	2018	John Lorinc (Canidian Architect)
Underpass Park	"Underpass Park"	Project Description	2015	Waterfront Toronto
	"Underpass Park"	Review	2012	Urban Toronto
	"Toronto's Underpass Park aims to turn neglected space into community hub"	Urban Affairs Report	2012	Siri Agrell (The Globe and Mail)
	"Underpass Park in Toronto: Opens world of possibilites for Gardiner Expressway"	Review	2012	Raveena Aulakh (The Star)
	"Underpass Park"	Project Description	2016	American Society of Landscape Architects
	"Low Overhead"	Article Description	2017	Jane Margolies (Landscape Architecture Magazine)
	"Underpass Park"	Architecture Portofolio	2013	Lisa Rochon (Architectural Record)
	"Underpass Park"	Project Description	2015	Waterfront Toronto

Appendix C

Approved IRB Subject Research Form:

UNIVERSITY OF TEXAS ARLINGTON | OFFICE OF RESEARCH ADMINISTRATION
REGULATORY SERVICES

October 19, 2018

Adrianna Tobias
Dr. Joowon Im
School of Architecture
The University of Texas at Arlington
Box 19108

Protocol Number: 2019-0002
Protocol Title: *Remote Real Estate: A Study of Utilizing Vacant Land Under Interstate 35E to Reconnect Communities to the Trinity River*

APPROVAL OF MINIMAL RISK HUMAN SUBJECTS RESEARCH WITHOUT FEDERAL FUNDING

The University of Texas Arlington Institutional Review Board (UTA IRB) or designee has reviewed your protocol and made the determination that this research study involving human subjects is approved in accordance with UT Arlington's Standard Operating Procedures (SOPs) for minimal risk research. You are therefore authorized to begin the research as of **October 18, 2018**.

Note that this project is not covered by UTA's Federalwide Assurance (FWA) and the researcher has indicated it will not receive federal funding. You must inform Regulatory Services immediately if the project may or will receive federal funding in the future, as this will require that the protocol be re-reviewed in accordance with the federal regulations for the protection of human subjects.

As Principal Investigator of this IRB approved study, the following items are your responsibility throughout the life of the study:

UNANTICIPATED ADVERSE EVENTS
Please be advised that as the Principal Investigator, you are required to report local adverse (unanticipated) events to The UT Arlington Office of Research Administration; Regulatory Services within 24 hours of the occurrence or upon acknowledgement of the occurrence.

INFORMED CONSENT DOCUMENT
The IRB approved version of the informed consent document (ICD) must be used when prospectively enrolling volunteer participants into the study. Unless otherwise determined by the IRB, all signed consent forms must be securely maintained on the UT Arlington campus for the duration of the study plus a minimum of three years after the completion of all study procedures (including data analysis). The complete study record is subject to inspection and/or audit during this time period by entities including but not limited to the UT Arlington IRB, Regulatory Services staff, OHRP, FDA, and by study sponsors (as applicable).

REGULATORY SERVICES
SERVICES
The University of Texas at Arlington, Center for Innovation
202 E. Border Street, Ste. 300, Arlington, Texas 76010, Box#19188
(T) 817-272-3723 (F) 817-272-5808 (E) regulatoryservices@uta.edu (W) www.uta.edu/rs

MODIFICATIONS TO THE APPROVED PROTOCOL
All proposed changes must be submitted via the electronic submission system and approved prior to implementation, except when necessary to eliminate apparent immediate hazards to the subject. Modifications include but are not limited to: Changes in protocol personnel, changes in proposed study procedures, and/or updates to data collection instruments. Failure to obtain prior approval for modifications is considered an issue of non-compliance and will be subject to review and deliberation by the IRB which could result in the suspension/termination of the protocol.

ANNUAL CHECK-IN EMAIL / STUDY CLOSURE
Although annual continuing review is not required for this study, you will receive an email around the anniversary date of your initial approval date to remind you of these responsibilities. Please notify Regulatory Services once your study is completed to begin the required 3-year research record retention period.

HUMAN SUBJECTS TRAINING
All investigators and personnel identified in the protocol must have documented Human Subjects Protection (HSP) training on file prior to study approval. HSP completion certificates are valid for 3 years from completion date; the PI is responsible for ensuring that study personnel maintain all appropriate training(s) for the duration of the study.

CONTACT FOR QUESTIONS
The UT Arlington Office of Research Administration; Regulatory Services appreciates your continuing commitment to the protection of human research subjects. Should you have questions or require further assistance, please contact Regulatory Services at regulatoryservices@uta.edu or 817-272-3723.

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