URBAN STREETSCAPE:
Activating the Public Realm and Increasing Safety Through Multifunctional User-Oriented Spaces

by

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A REPORT

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Abstract

Colorado Springs' downtown streets are primarily automobile-oriented, which has lead to a deficiency of multi-modal transportation networks and user-oriented environments. The streets lack engaging public space, pedestrian and bicyclist amenities, native landscaping, and stormwater management systems. The auto-centric design presents significant physical and perceived safety issues concerning pedestrians and bicyclists in the right-of-way. The aim of this study is to redesign the downtown core of Colorado Springs to foster multifunctional user-oriented spaces which enhance overall environmental, social, and economic benefits. In order to complete this study, background literature research and a series of case studies were conducted. The ultimate goal of this masters project is to create a retrofit streetscape design for Colorado Springs that can be used as a model for other planners and designers. The results of this project will be significant to designers because it will provide them with information regarding the best practices for designing urban streetscapes that activate the public realm and promotes safety.

Urban Streetscape

Activating the Public Realm and Increasing Safety Through Multifunctional User-Oriented Spaces

Katherine A. Whitford - Kansas State University Year 2013 - Master of Landscape Architecture

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Table of Contents

(1) Preface

(3) Chapter 1: Definition

(27) Chapter 2: Exploration

(53) Chapter 3: Inventory and Analysis

(73) Chapter 4: Design

(113) Chapter 5: Conclusion

(119) References

(129) Appendices

List of Figures

Chapter 1: Definition

Figure 1-1: Wide sidewalk on Pikes Peak Avenue lacks pedestrian amenities and street trees (5)

Figure 1-2: View of long pedestrian crossings and lack of streetscape amenities (5)

Figure 1-3: View of the wide, automobile-oriented street of Pikes Peak Avenue. While the entire right-of-way measures approximately 140 feet, vehicular lanes and parking take up 100 feet of space (6)

Figure 1-4: Pedestrian realm on Pikes Peak Avenue lacks seating, vegetation, and shade trees (7)

Figure 1-5: Former tree grates are filled with rocks and planter pots, creating an unattractive streetscape (8)

Figure 1-6: View of parking island on Pikes Peak Avenue between Tejon Street and Nevada Avenue (9)

Figure 1-7: 1895 Panorama of Colorado Springs (12)

Figure 1-8: Pikes Peak Avenue and Antlers Hotel with Pikes Peak in the distance (12)

Figure 1-9: 1882 Historical view of downtown Colorado Springs (13)

Figure 1-10: Present day view of downtown along Pikes Peak Avenue (15)

Figure 1-11: Aerial view of downtown Colorado Springs (17)

Figure 1-12: View of historical cowboy statue on Pikes Peak Avenue (18)

Figure 1-13: Downtown district scale (20)

Figure 1-14: 6-Block Pikes Peak Avenue corridor (22)

Figure 1-15: Urban Renewal Block (22)

Figure 1-16: Site scale block (23)

Figure 1-17: Trailways parking lot on north side of Pikes Peak Avenue's site scale block (24)

Figure 1-18: Sidewalk lacks pedestrian amenities and street trees (24)

Figure 1-19: Wide underutilized sidewalk space (24)

Figure 1-20: Unattractive rock and landscape area near intersection of Pikes Peak Avenue and Weber Street (24)

Figure 1-21: Vehicular lanes and diagonal parking on Pikes Peak Avenue (25)

Figure 1-22: Peak Theater on Pikes Peak Avenue (25)

Figure 1-23: Median parking on Pikes Peak Avenue between Tejon Street and Nevada Avenue (25)

Figure 1-24: Curb bump out with seating area on Pikes Peak Avenue between Tejon Street and Nevada Avenue (26)

Figure 1-25: Directional signage with downtown map located on Pikes Peak Avenue (26)

Figure 1-26: View of pedestrian bump out at Pikes Peak and Nevada Avenues (26)

Chapter 2: Exploration

Figure 2-1: Fillmore Plaza as a pedestrian-only street before redesign (40)
Figure 2-2: View of curb bump out (40)
Figure 2-3: Fillmore Plaza as a shared-use street after redesign (40)
Figure 2-4: Wide sidewalks with pedestrian lighting and amenities (40)
Figure 2-5: Sidewalk amenity zone with bike racks, landscaping, benches, art, and lighting (41)
Figure 2-6: View of pedestrian zone and parallel parking buffer (41)
Figure 2-7: Unique bench design (42)
Figure 2-8: LED lighting strips in pedestrian zone (42)
Figure 2-9: Pedestrian realm and outdoor cafe (43)
Figure 2-10: Bollards separate the pedestrian zone from the vehicular zone (43)
Figure 2-11: Colored brick pavers and limestone planters (44)
Figure 2-12: Iconic structure with awning (44)
Figure 2-13: View of curb chase (46)
Figure 2-14: View of parking egress zone (46)
Figure 2-15: View of stormwater planter (46)
Figure 2-16: View of main sidewalk zone, stormwater planters, and the parking egress zone (47)
Figure 2-17: Narrow curb cut directs runoff from the sidewalk into the planter (47)
Figure 2-18: Mature shrubs border the stormwater planters (48)
Figure 2-19: Enhanced pedestrian realm (50)
Figure 2-20: Designated bike lane (50)
Figure 2-21: Valencia street post (50)
Figure 2-22: Valencia Street lane configuration (52)
Figure 2-23: Bike lane and parallel parking (52)

Chapter 3: Inventory and Analysis

Figure 3-1: General map (57)

Figure 3-2: Land use (57)

Figure 3-3: Population density (58)

Figure 3-4: Existing bus routes (59)

Figure 3-5: Traffic volume (59)

Figure 3-6: Street width (60)

Figure 3-7: Existing bike lanes (60)

Figure 3-8: Street Hierarchy Master Plan (61)

Figure 3-9: General map (63)

Figure 3-10: Land use (63)

Figure 3-11: Utilities infrastructure (64)

Figure 3-12: Utilities infrastructure 2 (64)

Figure 3-13: Parking garages and surface lots (65)

Figure 3-14: On-street parking (65)

Figure 3-15: Vehicular circulation (66)

Figure 3-16: Existing bike sharrows and parking (67)

Figure 3-17: Bike sharrow in the center of the vehicular lane(67)

Figure 3-18: Typical bike rack in sidewalk amenity zone (67)

Figure 3-19: Temporary bike rack in front of Post Office (67)

Figure 3-20: Existing pedestrian amenities (68)

Figure 3-21: Pedestrian amenities and outdoor dining at the corner of Pikes Peak and Cascade Avenues (68)

Figure 3-22: Pedestrian bump out with seating, lighting, street trees and public art (68)

Figure 3-23: Public art displays (69)

Figure 3-24: Pikes Peak Range Riders Memorial, located at the corner of Pikes Peak and Cascade Avenues (69)

Figure 3-25: Pikes Peak or Bust Rodeo statue, located at Pikes Peak Avenue and Tejon Street (69)

Figure 3-26: Spencer Penrose statue, located at Pikes Peak Avenue and Tejon Street (69)

Figure 3-27: Existing street trees (70)

Figure 3-28: Street trees are absent on block between Nevada Avenue and Weber Street (70)

Figure 3-29: Mature trees located on the block East of Wahsatch Avenue (70)

Figure 3-30: Topography (71)

Figure 3-31: Drainage flow and stormwater inlets (71)

Chapter 4: Design

Figure 4-1: Project framework (77)
Figure 4-2: Existing program elements (79)
Figure 4-3: Proposed gateways (80)
Figure 4-4: Proposed street car routes (80)
Figure 4-5: Proposed pedestrian spines (81)
Figure 4-6: Existing bike lanes (81)
Figure 4-7: Proposed bike lanes (82)
Figure 4-8: Composite bike lane network (82)
Figure 4-9: Composite framework plan (84)
Figure 4-10: 6-block Pikes Peak Avenue design (85)
Figure 4-11: Pikes Peak Avenue site scale design (89)
Figure 4-12: Section A-A (91)
Figure 4-13: Section B-B (91)
Figure 4-14: Section C-C (92)
Figure 4-15: Section D-D (92)
Figure 4-16: West portion of Pikes Peak Avenue's site scale block (103)
Figure 4-17: East portion of Pikes Peak Avenue's site scale block (105)
Figure 4-18: View of plaza space in front of future mixed use building, facing west (107)
Figure 4-19: View of stormwater planters in front of Post Office, facing west (109)
Figure 4-20: View of mid-block crossing with church in background, facing south (111)

Appendices

Figure A-1: Flow chart concept map (131)
Figure A-2: Topic exploration concept map (132)
Figure A-3: Project timeline (133)
Figure A-4: Methodology diagram (135)
Figure A-5: Preliminary design process diagram (135)
Figure A-6: Final design process diagram (135)
Figure A-7: Literature map (136)
Figure A-8: Site visit chart (139)
Figure A-9: Site visit chart 2 (140)
Figure A-10: Existing section cut locations (141)
Figure A-11: Section1-1 (143)
Figure A-12: Section 2-2 (143)
Figure A-13: Section 3-3 (144)
Figure A-14: Section 4-4 (144)
Figure A-15: Section 5-5 (145)
Figure A-16: Section 6-6 (145)
Figure A-17: Section 7-7 (146)
Figure A-18: Section 8-8 (146)
Figure A-19: Section 9-9 (147)
Figure A-20: Section 10-10 (147)
Figure A-21: Section 11-11 (148)
Figure A-22: Colorado Springs suitable street trees (149)

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Lastly, I am forever grateful to my family and friends who have supported and encouraged me throughout my college education. I am particularly thankful to my parents for their love, patience, and enthusiasm.

To

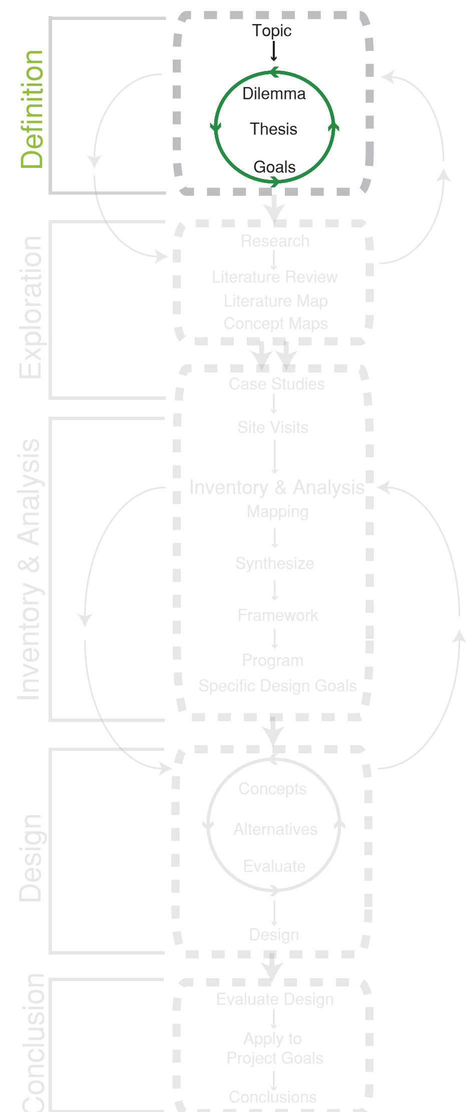
My grandfather, Richard Waite IV.

I love you.

Preface

Throughout my academic career at Kansas State University, I have had the opportunity to work on a range of project types and scales. I have learned that I am highly intrigued by urban design and the meshing of social, environmental, and economic issues. Prior to the start of fifth year, I knew that I wanted to pursue an urban design revitalization project for my master's report. After considering various options and conducting preliminary research, I decided to focus the topic to urban streetscapes. My interest in urban streetscapes stems from the idea that the right-of-way should support multiple modes of transportation, as well as spaces for shared activities and community engagement. I am intrigued by the complex nature of street design, which includes the functionality of various transportation modes, the opportunity for social interaction in the pedestrian realm, and the need for environmentally conscious stormwater management systems.

Chapter 1: Definition



Dilemma

The downtown streets of Colorado Springs were historically dimensioned wide to capture views of the mountains and to ensure convenient travel for carriages, street trolleys, and pedestrians. Today the city's streets are primarily automobile-oriented, which has lead to a deficiency of multi-modal transportation networks and user-oriented environments. The streets lack sufficient public space, pedestrian and bicyclist amenities, native landscaping and stormwater management systems.

Furthermore, Colorado Springs presents significant safety issues concerning pedestrians and bicyclists in the right-of-way. Since the downtown streets are oversized at 90-plus feet, pedestrian crossing distances are long. Many streets do not include pedestrian crossing safety features, such as median refuge islands and curb bump-outs, which shorten crossing distances and increase driver visibility of the pedestrian. The downtown district also lacks a comprehensive bike lane network. The few existing bike lanes end abruptly at intersections, leaving bicyclists to navigate streets within the vehicular traffic lanes. However, these issues can be addressed through a series of retrofitting strategies.

Figure 1-1. Wide sidewalk on Pikes Peak Avenue lacks pedestrian amenities and street trees (photo by Devin Ash)

Figure 1-2. View of long pedestrian crossings and lack of streetscape amenities (photo by Devin Ash)

Figure 1-3. View of the wide, automobile-oriented street of Pikes Peak Avenue. While the entire right-of-way measures approximately 140 feet, vehicular lanes and parking take up 100 feet of space (photo by Devin Ash)

Thesis

Retrofitting the downtown streets of Colorado Springs with multifunctional user-oriented spaces will enhance overall environmental, social, and economic benefits, while improving safety concerns. Adding green infrastructure and streetscape amenities will attract people to the street, activate the public realm, improve stormwater management, and help improve the economic vitality of the district.

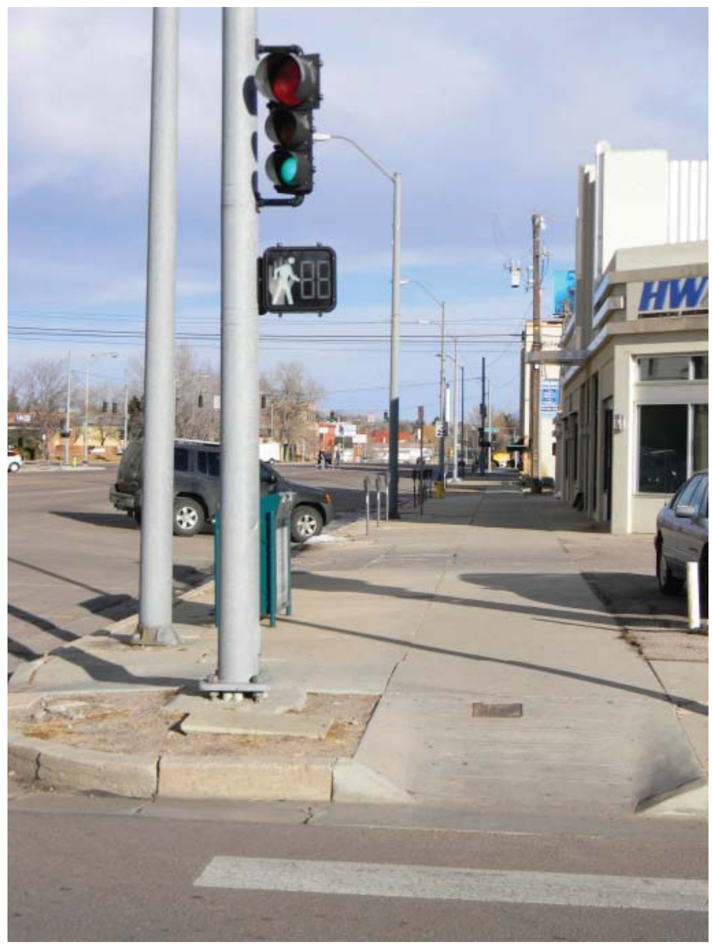


Figure 1-4. Pedestrian realm on Pikes Peak Avenue lacks seating, vegetation, and shade trees (photo by Devin Ash)

Research Questions:

- How can implementing multifunctional user-oriented spaces activate the public realm and increase safety in the downtown core of Colorado Springs?
- How can pedestrian safety be improved?
- How can bicyclist safety be improved?
- What public space improvements and amenities should be included to enhance overall social benefits?
- In what ways can green infrastructure and stormwater management systems be introduced into the right-of-way?

Figure 1-5. Former tree grates are filled with rocks and planter pots, creating an unattractive streetscape (photo by Devin Ash)

Program Factors to Consider:

- a comprehensive transportation system (mass transit, motorists, bicyclists, pedestrians)
- useable public space (multifunctional plazas and parks)
- pedestrian amenities (crosswalks, lighting, site furniture)
- accommodating parking facilities
- stormwater management systems
- connection to ecology, natural habitat of the region
- connection to city's history
- creating an identity for a place
- improved economic vitality (access to businesses)

Project Goals

Overall Project Goals:

• Understand the history of streetscape design in the American West, and how it can be retrofitted to better respond to all users, instead of a primary focus on vehicles.
• Develop specific criteria and a protocol to evaluate the design elements of streetscape precedents and the final design proposal.
• Create a framework plan and a detailed site design for the downtown core of Colorado Springs.

District Scale Goals:

• Identify opportunities for multimodal transportation in downtown Colorado Springs.
• Design a framework plan that will highlight street hierarchies and propose locations for: public street car routes, gateways into downtown, bicycle lanes, and main pedestrian realms.

Site Scale Goals:

• Using the framework plan and 6-block Pikes Peak Avenue corridor design as a guide, create a detailed site design for the one-block site.
• Develop design strategies to enhance social, environmental, and economic factors, while improving pedestrian and bicyclist safety issues.
• Design a streetscape environment that will capture and enhance the historical values of Colorado Springs, as well as propel the city towards a new and vibrant future.

Figure 1-6. View of parking island on Pikes Peak Avenue between Tejon Street and Nevada Avenue (photo by Devin Ash)

The City's Goals

The city of Colorado Springs has established a set of goals for the future of its downtown district, many of which are related to streetscape design. The Imagine Downtown Master Plan, completed in 2008, provides a set of goals, objectives, and strategies that aim to enhance downtown Colorado Springs, and propel it towards becoming a more vibrant cultural and historical urban district. The 2008 Master Plan outlines the following broad goals and strategies regarding streetscape improvements:

• Ensure efficient transit into and out of downtown while also striving for pedestrian orientation.
• Provide for multiple modes of transportation and increase public transit options.
• Incorporate pedestrian-friendly design and streetscape improvements, including wider sidewalks, more trees, art, and architectural texture.
• Increase pedestrian safety throughout downtown through the use of bump outs and other crosswalk improvements.
• Implement comprehensive public space improvements and develop unique street character block by block.
• Maintain historic block patterns in the downtown district.
• Encourage green infrastructure in development projects and use native landscaping and construction materials.
(Imagine Downtown Master Plan, 2008)

The Urban Land Institute Advisory Services Panel conducted a study of downtown Colorado Springs in June 2012. The ULI team created a report summarizing the study's findings and recommendations for creating a "New Renaissance in Downtown." The recommendations related to streetscape design clearly overlap with some of the city's goals outlined in the Imagine Downtown Master Plan. The ULI Report discusses the following strategies for revitalizing the downtown streets:

• Encourage alternate modes of transportation, such as a shuttle or street trolley system and a bicycle network.
• Emphasize the gateways into the downtown district through architectural features, signage, and landscaping.
• Encourage bicycling as both a commuter option and a recreational activity by integrating bike lanes and bike racks throughout downtown.
• Transform Tejon, Bijou, and Kiowa Streets into complete streets by reducing traffic lanes from three to two and introducing bike lanes and cafe platforms.
• Strengthen major urban connector streets, such as Nevada and Pikes Peak Avenues, with landscaping and hardscape improvements. (ULI, 2012)

Site Information

Context and History:

The project site is located in Colorado Springs, which is situated in south-central Colorado on the eastern edge of the Rocky Mountains. Colorado Springs is the state's second-largest city with a population of more than 416,000 people (United States Census, 2010). The city was founded in 1871 by General William Jackson Palmer and was intended to be a high-quality resort town. Palmer envisioned the new settlement as a "garden town" in the midst of the wild west. One of Palmer's original goals was to capture the beauty of the surrounding landscape, particularly Pikes Peak, and he wanted to ensure that views to the mountains would be preserved in the downtown area. In 1871, Palmer's survey crew drove the first stake for Pikes Peak Avenue directly in line with the summit of Pikes Peak (Imagine Downtown Master Plan, 2008). The city was then organized around a street grid system and the Denver and Rio Grande Railways (Figure 1-7).

General Palmer and other town founders decided to construct wide streets (Figure 1-8). The plat of the original town specified street right-of-ways of 100 feet for streets and 140 feet for avenues (springsgov.com). There was typically one street between every avenue when running north and south, and two streets between every avenue when running east and west (City of Colorado Springs). Streets were dimensioned wide not only to capture picturesque views, but also to avoid potential traffic congestion, a common issue in East Coast and European cities at the time. Palmer wanted to allow for multiple horse carriages to turn around easily, without having to back up (City of Colorado Springs). The roads, which were originally dirt, began growing weeds and other vegetation in their centers where no carriages (and later cars) travelled. These center areas were eventually transformed into "parkways" or landscaped medians, which further developed Palmer's idea of a "garden city" (City of Colorado Springs). Palmer and city members saw these parkways as a way to encourage and enhance an outdoor lifestyle, bringing people out of their homes to enjoy the scenery (City of Colorado Springs).

By 1918, with both the Antlers and Broadmoor Hotels, Colorado Springs had become a well- known tourist destination. Over time, however, the city transformed from a resort community into a center of commerce for the railroad and mining industry (ULI, 2012). As the city evolved, citizens began settling in areas outside of the downtown core, and in the 1960's and 1970's, suburban sprawl was moving the city center away from the historic downtown. In 1971, the first downtown plan was issued in efforts to sustain downtown's prominence (Imagine Downtown Master Plan, 2008). Since the 1970's, the city of Colorado Springs has been working to revitalize the downtown core into the city's historic and cultural heart.

Figure 1-7. 1895 Panorama of Colorado Springs (Colorado Springs Pioneer's Museum)

Figure 1-8. Pikes Peak Avenue and Antlers Hotel with Pikes Peak in the distance (postcard image ca. 1910) (Colorado Springs Pioneer's Museum)

Figure 1-9. 1882 Historical view of downtown Colorado Springs (Colorado Springs Pioneer's Museum)

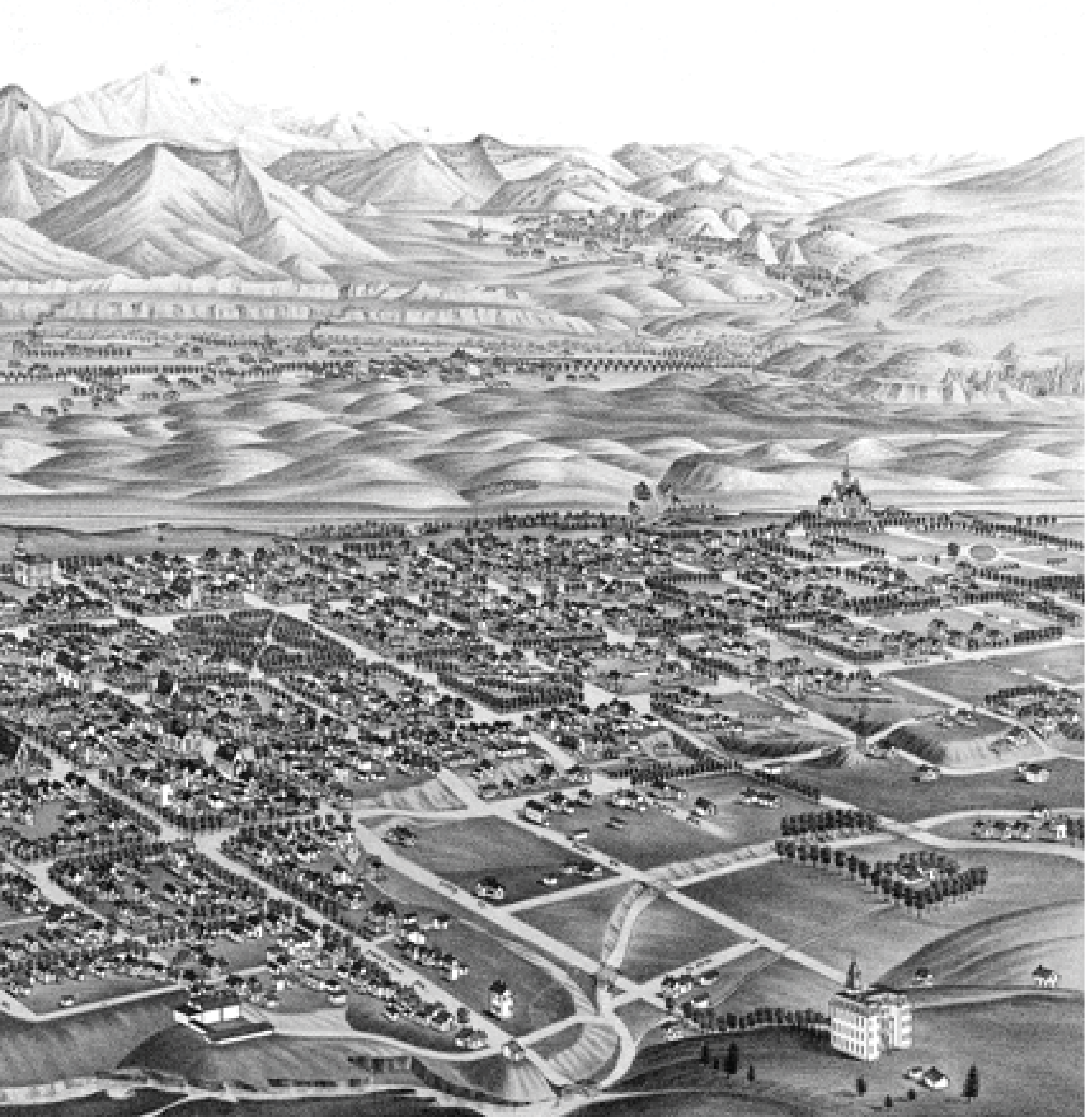


Figure 1-10. Present day view of downtown along Pikes Peak Avenue (VisitCOS.com)

Since its founding, Colorado Springs has grown significantly in population and overall land area, but it has remained a tourist destination due to its surrounding natural beauty and other attractions. Some of the most frequented attractions in Colorado Springs include, Pikes Peak, Garden of the Gods, the United States Air Force Academy, the United States Olympic Training Center, and the Broadmoor Hotel.

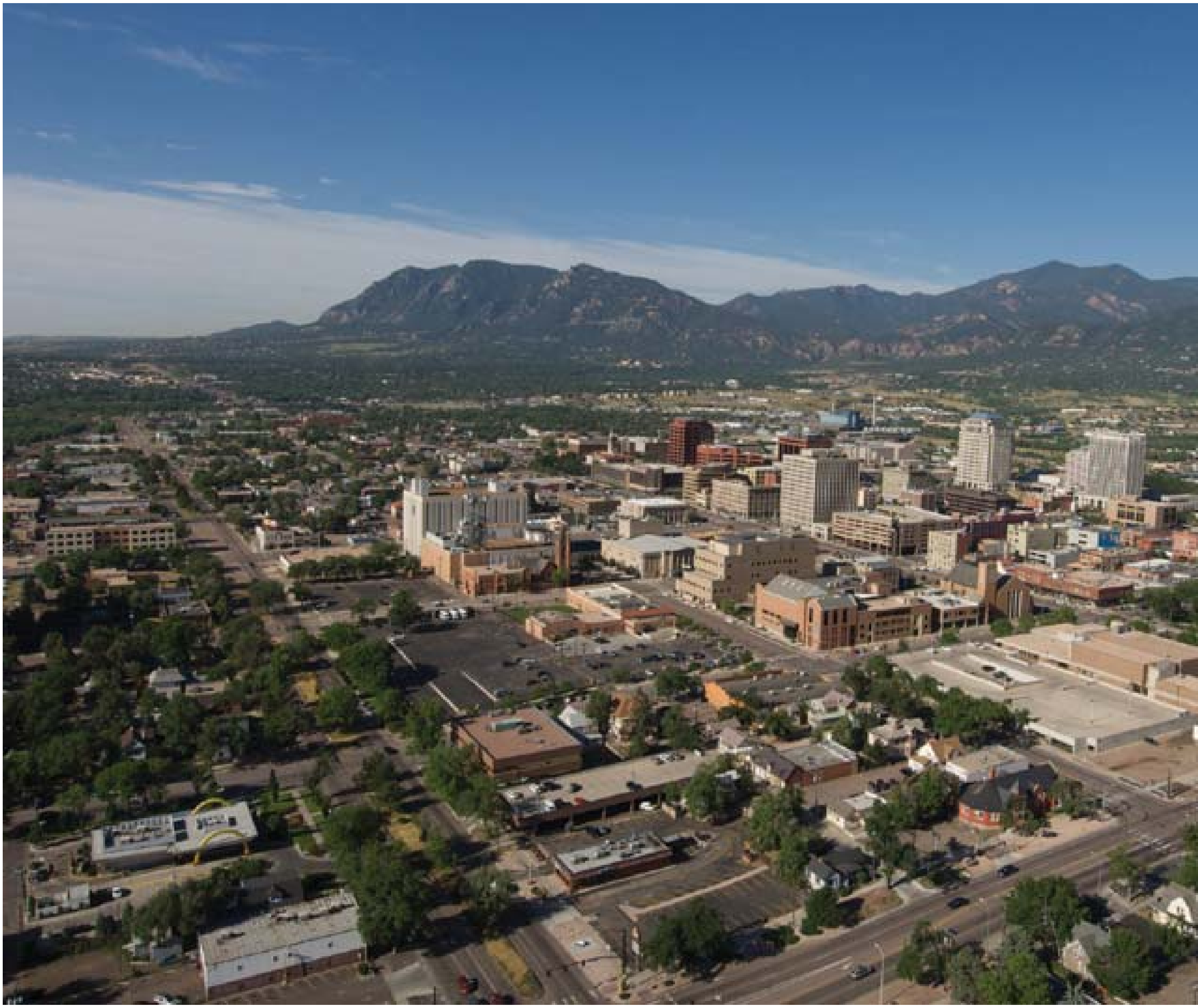


Figure 1-11. Aerial view of downtown Colorado Springs (VisitCOS.com)

Figure 1-12. View of historical cowboy statue on Pikes Peak Avenue (VisitCOS.com)

Current Conditions of Downtown

Office

The downtown district has relatively low density for a city of its size and population, and there are large amounts of vacant land ready for development. Downtown office development represents only about 12 percent of the entire city's collective office space. If overall density is increased in future years, opportunities for increased office space will emerge (ULI, 2012).

Retail

Downtown Colorado Springs is a major employment center with a strong retail presence, but it is vulnerable to changing economic conditions and ongoing suburban competition (ULI, 2012). Existing retail uses include a diverse mix of specialty boutiques and restaurants not found elsewhere in the city. However, some businesses have reportedly struggled due to difficulties in attracting enough clientele, as suburban dwellers shop closer to their neighborhoods. Currently, one of downtown's strongest attractors is its cultural and arts venues.

Residenial

There are significant single-family housing options in the broader downtown district, however, housing options within the core are mostly limited to expensive high-end lofts. The ULI Panel advises implementing lower-cost multifamily housing that caters to a younger demographic (ULI, 2012). Greater housing density in the downtown area will increase market demand on retail and restaurant businesses (ULI, 2012).

Economy

Today, Colorado Springs' economy is primarily driven by military bases, the high-tech industry, and tourism. There are five military bases in Colorado Springs, including, Fort Carson, Cheyenne Mountain Station, the Air Force Academy, and Peterson and Schriever Air Force Bases, which collectively represent over twenty percent of the region's employment (ULI, 2012). Other industries that largely support the economy include, health care providers, universities, and local government (ULI, 2012).

Boundaries

In order to address the greater context of downtown Colorado Springs, as well as a specific street corridor, and site scale block, this project operates at three different scales. The larger project site is focused on the downtown core, bounded by Uintah Street on the North, Interstate-25 on the South and West, and Shooks Run Trail and Park system on the East (Figure 1-13). This boundary was selected based on the greenway loop that surrounds downtown Colorado Springs. The greenway loop, also known as the Emerald Necklace, is comprised of a system of parks and trails and is considered an important organizing element for downtown. The northern boundary of the project site was positioned to include the Colorado College campus. There are opportunities to connect the campus to the downtown core through both the greenway and the implementation of a complete street along a North to South corridor. Colorado College campus also serves as the northern- most piece of the Emerald Necklace.

The second scale is focused on the six- block stretch of Pikes Peak Avenue from Cascade Avenue on the West to Shooks Run Trail on the East (Figure 1-14). This corridor was chosen because the city's Imagine Downtown Master Plan identified Tejon Street and Pikes Peak Avenue as the two "pedestrian spines" within the larger downtown area. These "pedestrian spines" are defined as major pedestrian corridors or attractors, with strong pedestrian activities and streetscape amenities

Figure 1-13. Downtown district scale (created by author, adapted from CS Utilities GIS data)

(Imagine Downtown Master Plan). The Imagine Downtown Master Plan also states that while the entirety of Tejon Street qualifies at a pedestrian spine, only sections of Pikes Peak Avenue meet the desired criteria. The city has also identified the need to develop more street level activity along Pikes Peak Avenue. Furthermore, there is currently an unnecessary amount of space designated for vehicular traffic and parking, causing portions of the street to lack safe pedestrian and bicyclist crossings and amenities. Pikes Peak Avenue also does not celebrate the views to the mountains as was originally intended by town planners. There is no remaining evidence of Palmer's central parkway, which takes away from his idea of creating a city that embraces nature. Overall, the six-block stretch of Pikes Peak Avenue presents a significant opportunity for improvement because of its historical background and insufficient existing conditions.

The third and smallest scale is a one block area within the six block Pikes Peak Avenue corridor. This block is located between Nevada Avenue and Weber Street, and currently lacks pedestrian and bicyclist amenities (Figure 1-16). This block was selected because the City of Colorado Springs has deemed the northern portion an "Urban Renewal Block" (Figure 1-15). The northern block currently contains the City Auditorium, a few other businesses, and a parking lot directly adjacent to the project site. Future plans contain a hotel and mixed use center, with residential, offices, services, and retail. The future urban renewal project is intended to eliminate blight and stimulate growth and reinvestment on the surrounding blocks and throughout downtown (Colorado Springs Urban Renewal Authority). The goal for this scale is to create a detailed streetscape design that will help revitalize the block and serve as a catalyst and design model for the remaining blocks of Pikes Peak Avenue and other downtown streets.

The final goal for this masters project is to create a framework plan and a detailed site design for downtown Colorado Springs. The larger scale design will focus on the entire downtown core in order to show a network of multimodal transportation. The smaller scale narrows in to a one- block area for a detailed streetscape design. The primary reason for looking at these different scales is to understand the entire context of the downtown area of Colorado Springs and to apply streetscape design strategies at different levels of detail.

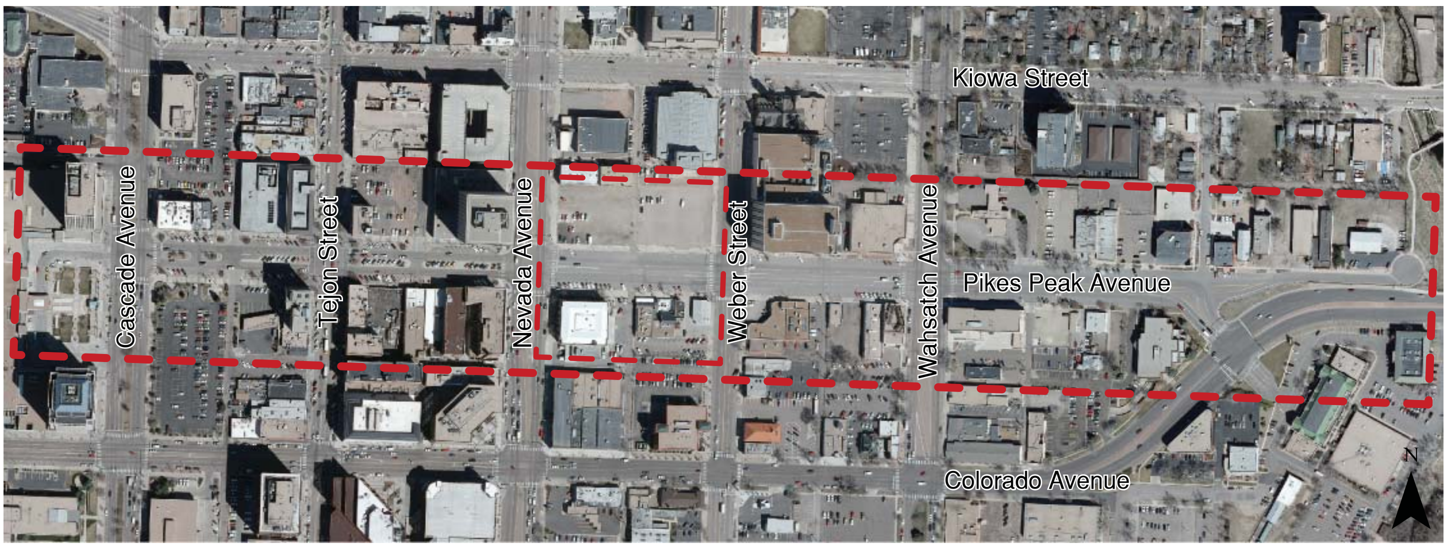


Figure 1-14. 6-block Pikes Peak Avenue corridor (created by author, adapted from CS Utilities GIS data)

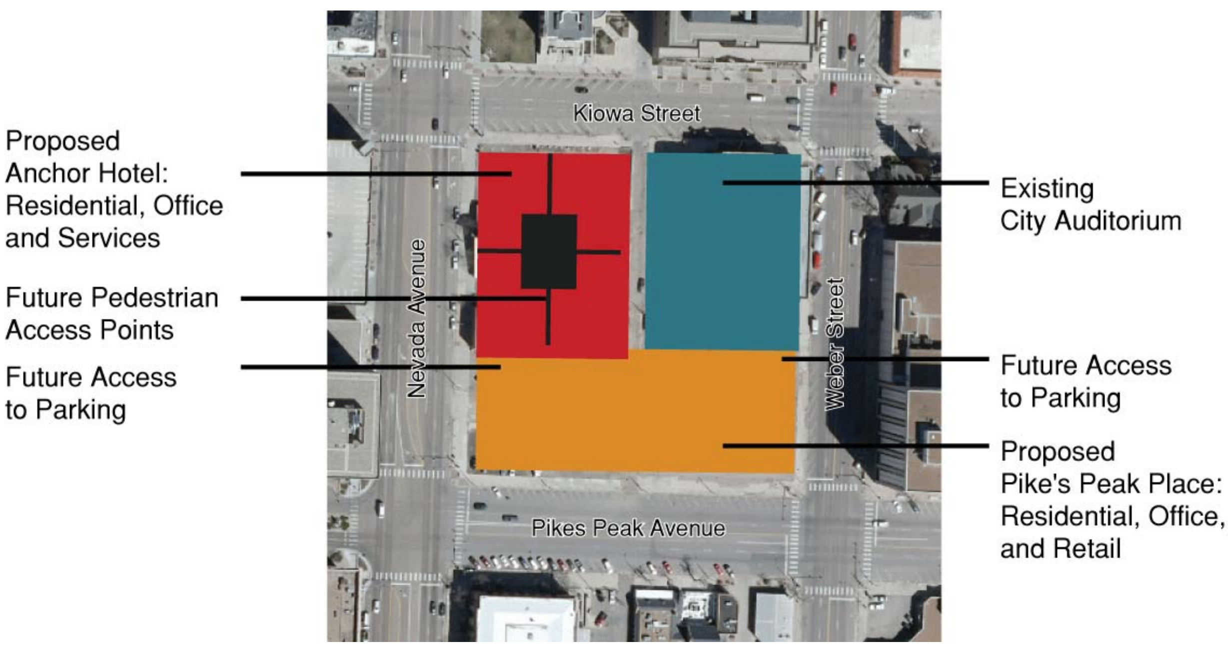


Figure 1-15. Urban Renewal Block (adapted from Colorado Springs Urban Renewal Authority City Auditorium Block)

Figure 1-16. Site scale block (created by author, adapted from CS Utilities GIS data)

Site Scale Block's Existing Conditions:

Figure 1-17. Trailways parking lot on north side of Pikes Peak Avenue's site scale block (photo by Devin Ash)

Figure 1-18. Sidewalk lacks pedestrian amenities and street trees (photo by Devin Ash)

Figure 1-19. Wide underutilized sidewalk space in front of the Post Office (photo by Devin Ash)

Figure 1-20 . Unattractive rock and landscape area near intersection of Pikes Peak Avenue and Weber Street (photo by Devin Ash)

Pikes Peak Avenue between Cascade and Nevada Avenues:

Figure 1-21. Vehicular lanes and diagonal parking on Pikes Peak Avenue (photo by author)

Figure 1-22. Peak Theater on Pikes Peak Avenue (photo by author)

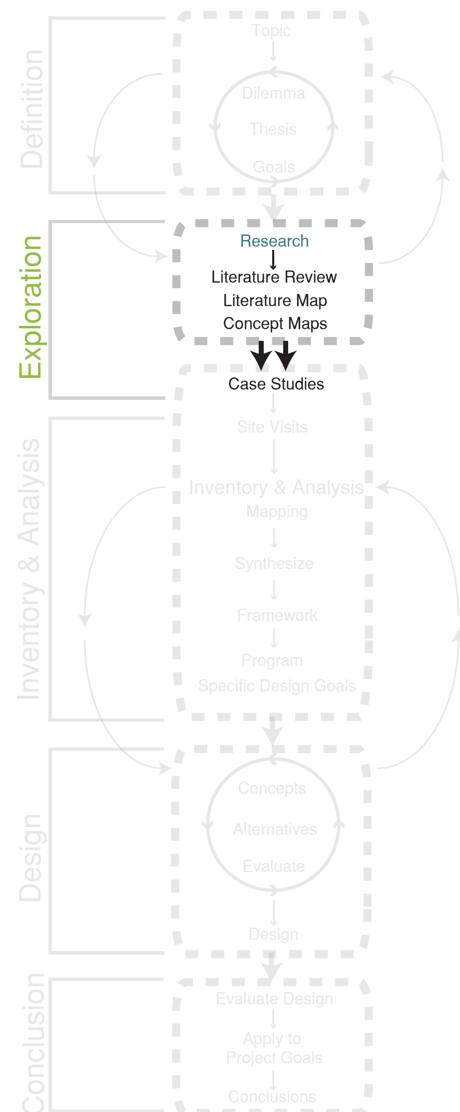
Figure 1-23. Median parking on Pikes Peak Avenue between Tejon Street and Nevada Avenue (photo by author)

Figure 1-24. Curb bump out with seating area on Pikes Peak Avenue between Tejon Street and Nevada Avenue (photo by author)

Figure 1-25. Directional signage with downtown map located on Pikes Peak Avenue (photo by author)

Figure 1-26. View of pedestrian bump out at Pikes Peak and Nevada Avenues (photo by Devin Ash)

Chapter 2: Exploration



Literature Review

In recent years, American planners and landscape architects have realized that streets are more than just places to drive; streets are spaces themselves, and a valuable part of the public realm. In the past, mobility for traffic has been viewed as the main function of the American street and right-of-way, however there has been a shift of thinking and today streets are seen as opportunities for multi-use spaces for people. The right-of-way can now be considered as a network of spaces with a mix of uses and users that enhance communities (Bain, 2012). According to Lesley Bain's Living Streets, there are five major reasons to invest in the public realm: to create places to live, work, and play, to strengthen community interaction, to encourage healthier lifestyles, to develop local economies, and to promote urban patterns less dependent on fossil fuels (Bain, 2012). These are strong reasons for why designers should be taking a closer look at streetscapes and considering how to make the urban right-of-way more multifunctional. This literature review will discuss the following topics related to urban streetscapes: social factors of placemaking, mobility, safety, and complete streets; environmental factors of natural systems and green streets; and economic factors and impacts.

Social Factors

Placemaking:

According to the NACTO Urban Street Design Guide, "streets are often the most vital, yet underutilized public spaces in cities (NACTO, 2012)." Streets can increase social benefits through: placemaking, mobility, and natural systems (Bain, 2012). In terms of successful placemaking, the design needs to take advantage of the opportunities specific to a particular site and the potential of each site to contribute to the public realm. Depending on the needs of the area, that may mean creating new spaces for community activities, bringing out the identity of a neighborhood, or making enticing places that encourage people to walk from place to place (Bain, 2012). Streets and sidewalks are often limited by existing conditions however, there are design treatments that can transform underutilized roadbeds into vibrant public spaces. Among these design strategies are, moving the curb, low impact design (stormwater management), parklets, pop-ups and street seats (NACTO, 2012).

American street curbs are traditionally designed to collect stormwater, and divide the pedestrian and vehicular zones. Designers today view the curb as a flexible space that can be moved to create larger sidewalks, outdoor cafes, and other amenities. Low impact design refers to stormwater management systems in the form of bioswales and rain gardens along the street. The LID concept not only manages stormwater in a more ecologically progressive manner, but it can also calm traffic, as drivers slow down near areas with trees and landscaping, which act as a buffer between the street and the sidewalk (Dumbaugh, 2005). Another way streets can be used to create vibrant public spaces is through temporary treatments such as, parklets, pop-ups, and street seats, which can transform one or two parking spaces into 200 to 400 square feet of public space. These design elements may be temporary, lasting a few days to a whole year, or they may be a permanent part of the street scene depending on the intent (NACTO, 2012).

In general, better public spaces bring more people outside into shared activities which in turn builds stronger communities and creates a sense of pride (Bain, 2012). Additionally, in order to encourage the use of public space, the area must feel safe and comfortable. Spaces can become safer by increasing visibility and attracting different user groups at different times of day. Both Lesley Bain in her book Living Streets, and Jane Jacobs in her book The Death and Life of Great American Cities, discuss the ideas of "eyes on the street" and creating a twenty-four hour place or city. They both argue that by increasing activity levels during all times of the day in any place, there will be a decrease in crime and an increase in overall perceived safety (Bain, 2012, Jacobs, 1961).

Mobility:

In Living Streets, the chapter on mobility explains that the auto-oriented street forces other modes of transportation, such as walking and bicycling to be squeezed into the remaining space, with little design consideration (Bain, 2012). Since cities are moving towards the concept of multi-modal transportation, all types of transportation must be considered, including, cars, trucks, emergency vehicles, transit, bicycles, and pedestrians. Reasons for this movement include desires for walkable, bikeable communities in order to create better places to live and stronger communities, promote better individual health, reduce transportation costs, reduce time spent in the car, offer mobility options for everyone, and increase property values (Bain, 2012). Planners and designers have also been in debate over the idea of transforming downtown vehicular streets to non-vehicular pedestrian streets. However, there are problems with eliminating all traffic on downtown streets, including diminished ease of access and reduction of on street parking. Overall, in order to encourage people to make trips on foot or by bicycle, there need to be streets and places that have a high quality of experience with interesting diversions and unique destinations.

Safety:

As previously stated, urban streets have the potential to be both thoroughfares for vehicles and public spaces for people. Well-designed urban streets provide places for people to walk, shop, and engage in various social activities. Beyond these benefits, pedestrian-friendly urban streets have been increasingly linked to many desirable social outcomes, including economic growth, improvements in air quality, and increased physical health (Bain, 2012). Many of the sources referenced for this literature review have agreed on the basic characteristics that create a livable street; the consensus is that livable streets provide a continuous pedestrian realm with design features that minimize negative impacts of vehicular traffic on pedestrians. Among the design characteristics that buffer the pedestrian realm from traffic lanes, are street trees and on-street parking. While it is typically agreed that trees and other streetscape features enhance the aesthetic quality of a street, there is some debate concerning their safety effects for both drivers, bicyclists, and pedestrians (Dumbaugh, 2005).

According to Eric Dumbaugh and J.L. Gattis in "Safe Streets, Livable Streets," there is significant evidence suggesting that the inclusion of trees and other streetscape features along an urban road may actually reduce crashes and injuries. There have been multiple studies showing that various streetscape elements reduce mid-block and intersection crashes (Dumbaugh, 2005). For example, a study conducted in downtown Toronto showed that elements such as trees and concrete planters resulted in a five to twenty percent decrease in number of crashes (Dumbaugh, 2005). There are also findings that conclude that wider lanes and shoulders are associated with statistically significant increases in crash frequencies (Dumbaugh, 2005). In fact, it has been reported that crash frequencies increase as lanes are widened to twelve or more feet (Dumbaugh, 2005). On urban streets the impact of driver error is greater, making it important to manage speed. Therefore it is recommended to have 10-foot wide lanes for speeds of 40 miles per hour or less (NACTO, 2012).

Furthermore, Dumbaugh completed a study that examined a five year span of crash data for Colonial Drive in downtown Orlando, Florida (Dumbaugh, 2005). The ten mile street includes both segments of livable street and segments without livable street elements. The results showed that the livable street section is safer in all respects. Additionally, pedestrian and bicyclist injuries were lower in the livable street section, which could be attributed to the fact that the livable street provides parked cars and fixed objects to buffer pedestrians from oncoming traffic. The most likely explanation for enhanced safety on livable streets is that drivers are "reading" the potential hazards of the road and adjusting their behavior in response (Dumbaugh, 2005). It has been found that traffic calming implementations result in a 74 to 82 percent decrease in crash occurrences (Dumbaugh, 2005).

Complete Streets:

Complete streets are safe, comfortable, and convenient streets designed for everyone, regardless of age or ability. They are designed for people using all modes of transportation, including, motorists, pedestrians, bicyclists, and public transportation riders. The complete streets concept focuses not just on individual roads but also on changing the design process so that all users are considered during the planning phase. The complete street has become a policy movement and has instigated institutional change in many cities in the United States (Laplante, McCann, 2008). The National Complete Streets Coalition has been working for several years to promote policy and procedural changes at the federal, state, and local levels. The coalition has succeeded in gaining national attention and policy adoption across the country. In 2007, several cities adopted new policies, including, Salt Lake City, Utah, Seattle, Washington, and Charlotte, North Carolina. Whereas other places have been implementing complete streets for much longer, including Oregon, Florida, Arlington, Virginia, and Boulder, Colorado (Laplante, McCann, 2008).

There are useful traffic calming measures that contribute to creating complete streets. Based on results of a recent National Cooperative Highway Research Program study, 10 or 11 foot lanes in urban areas are just as safe as 12 foot lanes for posted speeds of 45 miles per hour or less. Other traffic calming measures include, road diets (lessening number of traffic lanes), raised medians, roadway landscaping, curb parking and curb bulb-outs. The complete streets concept is an important step in the revolutionary process of transforming transportation design thinking and greatly increasing travel options, flexibility, and usability of American streets (Laplante, McCann, 2008).

Environmental Factors

Natural Systems:

In recent years, planners and designers have recognized that cities should not be isolated from nature, but should be connected with it in order to create healthy and sustainable places to live (Bain, 2012). There are multiple benefits to reconnecting the city and nature, including, improved water and air quality, improved habitat, reduction in urban heat island effect, improved well-being of city residents, and economic benefits (Bain, 2012).

Until recently, green infrastructure systems were not considered an integral component of the street and drainage ways were buried below ground and out of sight (Bain, 2012). Today, the right-of-way is seen as an opportunity for stormwater management systems, a method to restore habitats, and clean the air (Bain, 2012). The Environmental Protection Agency discusses the major benefits of green infrastructure, the first of which is improved water quality and quantity. In urban areas, stormwater collected in underground sewers is lead to other bodies of water and often carries pollutants, such as pathogens, nutrients, sediment, heavy metals, and sometimes untreated sewage (EPA, 2013). Furthermore, in a large storm event, underground drainage pipes quickly move urban stormwater to external bodies of water, increasing the flood risk. Green infrastructure can help slow, filter, and infiltrate stormwater, thereby reducing the amount of stormwater runoff sent to rivers and lakes downstream. Green infrastructure has the ability to mitigate flood risk as well. Water collected through green infrastructure can also be used for irrigation or be infiltrated into the ground to recharge groundwater supplies (EPA, 2013). In terms of economics, green infrastructure promotes lower costs for site grading, paving, landscaping, and smaller or eliminated piping and detention facilities (EPA, 2013).

In addition to the benefits of improved water quality and quantity, green infrastructure also improves air quality. Smog, or ground level ozone, is formed when nitrogen oxides and organic compounds interact with heat and sunlight, often causing health problems for humans. Vegetation can reduce ground level ozone and dangerous air particles by lowering air temperatures and absorbing and filtering air pollutants (EPA, 2013). Green infrastructure, trees, and vegetated surfaces cool urban areas by reducing the amount of land area covered with pavement and buildings, therefore diminishing urban heat island effect (EPA, 2013). Another benefit of green infrastructure is habitat improvement and connectivity. Urban vegetation provides small areas of habitat, while larger scale green infrastructure, such as parks and urban forests, provide connections between natural habitats and paths for animals to travel along (EPA, 2013). As an example, tree lined streets act as habitat connectors between city parks and other natural areas (Bain, 2012).

Trees are considered a form of green infrastructure, and individually, they provide many benefits to an urban setting. Urban trees and forests can be viewed as a "living technology" that helps maintain a healthy environment for urban dwellers (Dwyer, 1992). Trees can significantly contribute to energy conservation because they help reduce the cost of heating and cooling buildings. Projections from computer studies indicate that 100 million mature trees in American cities (the equivalent to three trees for every other single family home) could reduce annual energy use by 30 billion kwh, saving approximately 2 billion dollars in energy costs (Dwyer, 1992). As mentioned previously, vegetation exchanges gases with the atmosphere and absorbs particles that are potentially harmful to humans. Results from another computer simulated study infer that one mature tree can absorb up to 50 pounds of particles a year (Dwyer, 1992). There are also many social benefits associated with urban trees, such as reduced stress and improved physical health for urban dwellers and a greater sense of community and environmental awareness (Dwyer, 1992). Studies show that urban trees have also been associated with increased real estate values, and therefore have produced local economic gains through property taxes (Dwyer, 1992). Seattle has a 30 year goal to increase urban forest cover from 18 percent to 30 percent and it is projected to increase economic benefits from stormwater management, cleaner air, and carbon storage, from 15 million to 44 million dollars (Bain, 2012).

There are multiple opportunities in the street right-of-way to introduce natural systems. For example, simply implementing trees and vegetation will help reduce heat island effect, sequester carbon, and reduce green house gases. Furthermore, natural drainage systems, such as bioswales and rain gardens, slow and treat water, while creating aesthetically pleasing environments (Bain, 2012).

Green Streets:

The concept of the green street is currently widely used throughout the United States as a design strategy to capture and treat stormwater. Green streets are intended to transform impervious street surfaces into landscaped green spaces that capture stormwater and filter pollutants. Green streets capture stormwater that would typically be directed to an underground storm drain and converts it into a resource that replenishes groundwater supplies. They also create attractive streetscapes capable of providing natural habitat and connecting amenities (Environmental Services City of Portland, 2008). The city of Portland, Oregon is one of the leaders in green street technology and implementation, with its constructs many different types and scales of stormwater management systems. A few examples include, stormwater curb extensions, stormwater street planters, and rain gardens (Environmental Services City of Portland, 2008).

Economic Factors

Economic Impacts:

People-oriented rather than car-oriented business districts help support local economies. Studies show that for local business districts to thrive, there needs to be a mix of uses, diversity of types of businesses, and well-designed public space (Bain, 2012, Jacobs, 1961). Furthermore, a pleasant walking environment and well-managed parking facilities are helpful to retail success (Bain, 2012). The general idea is that a complete urban street that fosters multifunctional spaces will ultimately enhance business success and local economic vitality. According to the NACTO Urban Street Design Guide, "cities have realized that streets are an economic asset as much as a functional element. Well-designed streets generate higher revenues for businesses and higher values for homeowners (NACTO, 2012)."

Central business districts are intended to be places where people can enjoy an appealing atmosphere and have a memorable experience. A commercial district that is designed with landscaping and trees can enhance a customer's experience and further strengthen its edge against strip mall competitors. The University of Washington conducted a series of research studies to evaluate consumer response to urban forest conditions along main streets and in central business districts (Wolf, 2009). Surveys of shoppers were assessed to determine if trees influenced visual quality, place perceptions, shopper patronage, and pricing perceptions. The surveys asked participants to rate their preferences for images that depicted streetscapes with varying forest character. In terms of visual quality, preferences were lower for places without trees and much higher for places with trees, particularly when large trees formed a canopy over the sidewalk and street. Furthermore, potential shoppers claim they are willing to travel more often, longer, and over greater distances, and once they arrive there, will spend more time in a retail district that has trees. This is important because once shoppers arrive in a central business district, they will stay longer, which could mean greater sales revenue. Lastly, the study determined the impact of streetscape trees on local economies. The results showed that consumers were willing to pay 12 percent more in large cities for equivalent goods and services in business districts having trees. Additionally, participants claimed they will pay more to park on streets with trees. Overall, this study argues that business districts can use trees and landscaping to enhance a sense of place and identity for the area while boosting foot traffic and sales revenue (Wolf, 2009). Kathleen Wolf in Trees Mean Business: City Trees and the Retail Streetscape, also outlines strategies for implementing street trees that will thrive over time and will enhance the character of a district (Wolf, 2009).

There have been several recent studies conducted on the impact that streetscape conditions have on business districts. One of the studies examined the Estes Park Riverwalk and Streetscape. The driving force behind this project was the prevalence of severe flooding and a need for mitigation. The project initially invested twenty million dollars to create the riverwalk and streetscape, without raising taxes (Sorvig, 2009). Yet, in the years after implementatoin it has increased local revenue by more than fifty million dollars (Sorvig, 2009). According to visitor surveys, people began stopping and spending time at the riverwalk, rather than just passing through to reach the National Park. By creating a useable, attractive space where people wanted to be, the street and riverscape project produced a remarkable economic return (Sorvig, 2009).

Case Studies

Case studies were conducted in order to further explore the body of related literature, to understand various strategies for urban streetscape design, and to inform specific design practices as part of the overall project framework. The selected case studies were evaluated to determine best design practices for urban streetscapes, which in turn informed the design decisions for the Colorado Springs site. Each project was studied to understand prior site conditions, how the sites were transformed, design strategies used, and the resulting outcomes of the implemented designs.

The literature review revealed a wide range of urban streetscape precedents, many of which demonstrated multi-beneficial design strategies and outcomes. Though all these projects were initially considered, only three were selected for further case study analysis. Projects selected included: a comprehensive streetscape project (that directly benefited local businesses and the economy); a green street project (that reclaimed underused sidewalk space for capturing and infiltrating stormwater runoff); and a complete street project (that reallocated area within the right-of-way to improve bicyclist and pedestrian safety). The selected sites included:

Cherry Creek North/ Fillmore Plaza in Denver Colorado; SW 12th Avenue Green Street in Portland, Oregon; and Valencia Street in San Francisco, California. Cherry Creek North/ Fillmore Plaza was selected because it is an example of a streetscape project that revitalized a business and shopping district. The SW 12th Avenue site was chosen because it was the first implemented green street in Portland, and has since served as an archetype and model for many other green streets throughout the country. Lastly, Valencia Street in San Francisco was selected because of its innovative techniques of transforming a major traffic thoroughfare into a complete street, with focus on bicyclist and pedestrian amenities. These projects are relevant examples of urban streetscape improvements that ultimately helped guide the programming and design for the Colorado Springs site.

Next, a set of criteria were developed to assess each case study in a consistent manner. The criteria are: function, safety, user-oriented spaces, ecology, and identity. The selected criteria were identified in the literature review as being the most important aspects to examine in order to understand the range of potential functions of the right-of-way. The criteria address the opportunities of the right-of-way to enhance social, environmental, and economic benefits of an urban streetscape.

Evaluating Criteria

Function

- the street's ability to transport people and traffic from one destination to another
    - context (surrounding land uses)
    - size, length, width (pedestrian zone, bike zone, vehicular zone)

Safety

- the street's ability to provide a safe environment for all users, including motorists, bicyclist, and pedestrians
    - crosswalks
    - bike amenities (bike lanes, sharrows, parking)
    - traffic calming measures

User-oriented spaces

- the street's provision of multifunctional public spaces and pedestrian and bicyclist amenities
    - amenities (furnishings)
    - public space (plazas, parks)

Ecology

- the street's inclusion of ecological features and stormwater management systems
    - landscaping (natural habitat)
    - stormwater management systems

Identity

- the street's ability to create a strong identity for the place
    - connection to history (signage)
    - details (bollards, lighting, paving)

Cherry Creek North and Fillmore Plaza, Denver, Colorado

Reason for Selection:

Cherry Creek North is a retail district that was originally designed to be Denver's premier outdoor shopping center. However, deteriorating infrastructure, outdated aesthetics, and competition from the adjacent indoor mall lead to its decline. The district was suffering because the indoor mall was attracting shoppers and draining activity from the pedestrian realm. The retrofit project included streetscape improvements such as, new landscaping, lighting, signage, and art and garden places. Fillmore Plaza, located near the center of the 16-block site, was transformed from an underused pedestrian street to a vibrant shared-use street. Today, Fillmore Plaza is a hybrid two-way street and a popular shopping destination, closed to vehicular traffic only during planned pedestrian events (Yang, 2012). Cherry Creek North was selected because it is an example of a streetscape project that revitalized a business and shopping district and enhanced overall social, environmental, and economic benefits.

General Information:

Location: 16-block area between University Blvd on the West, Steele St on the East, 3rd Ave on the North, and 1st Ave on the South, Denver, Colorado

Project Type: mixed- use retail district, streetscape revitalization

Designer: Design Workshop, Inc.

Client: Cherry Creek North Business Improvement District

Completion Date: 2011

Figure 2-1. Fillmore Plaza as a pedestrian-only street before redesign (www.lafoundation.org) D. A. Horchner/Design Workshop, Inc.

Figure 2-3. Fillmore Plaza as a shared-use street after redesign (www.lafoundation.org) D. A. Horchner/Design Workshop, Inc.

Figure 2-2. View of curb bump-out (www.lafoundation.org) D. A. Horchner/Design Workshop, Inc.

Figure 2-4. Wide sidewalks with pedestrian lighting and amenities (www.lafoundation.org) D. A. Horchner/Design Workshop, Inc.

Figure 2-5. Sidewalk amenity zone with bike racks, landscaping, benches, art, and lighting (photo by author)

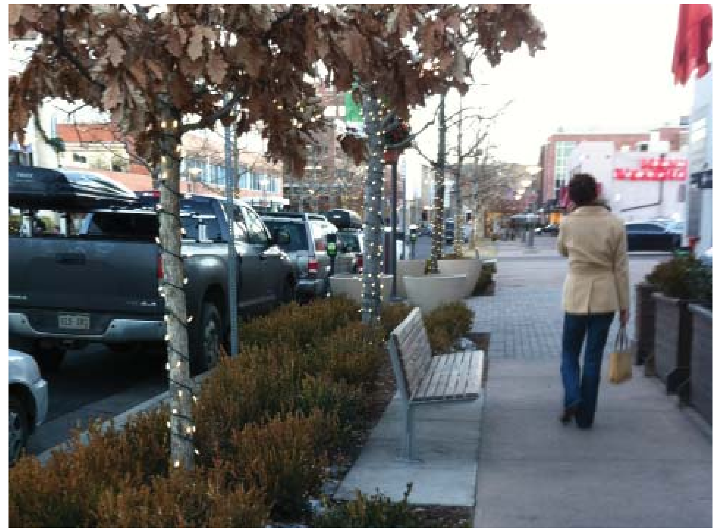


Figure 2-6. View of pedestrian zone and parallel parking buffer (photo by author)

Overall District:

Function:

Most of the streets within the Cherry Creek North district are comprised of two-lanes of traffic, one in each direction, parallel parking on one or both sides of the street, and curbed pedestrian space. The intersections are controlled by four-way stop signs, instead of signal lights. Additionally, all intersections have curb bump-outs, which serve to both slow traffic and lessen the crossing distance for pedestrians. This project gives only the necessary, and therefore minimal, amount of space for the automobile, preserving much of the right-of-way for the pedestrian realm. On average, the vehicular lanes are dimensioned at 11 feet wide, with 7 foot wide spaces for parallel parking. Therefore, on streets with two lanes of traffic and parking on either side, the dimension from curb to curb is approximately 36 feet. Furthermore, the pedestrian realm on either side of the street, typically measures around 30 feet wide. Therefore, there is roughly twice the amount of pedestrian space versus vehicular space, allowing for a walkable and vibrant pedestrian shopping district.

Safety:

The implementation of streetscape improvements throughout the district resulted in a 39 percent decrease in crime, from 180 incidents in 2009 to 110 in 2011 (Yang, 2012). The updated infrastructure and new lighting system create a safer environment for pedestrians, ultimately attracting more people and creating a vibrant shopping destination. The lighting system is comprised of LED full-cutoff lights, which are designed to direct light to the ground instead of letting it escape into the atmosphere. These light fixtures allow for lower wattage lamps, and each light pole has reduced the number of lamps from three to one. Overall, these LED lights reduces annual energy consumption for outdoor lighting by 223,000 kilowatts, saving 12,700 dollars in energy costs each year (Yang, 2012).

User-Oriented Spaces:

One of the primary goals for the Cherry Creek North improvements project was to increase pedestrian activity and enliven the outdoor shopping realm. To achieve this goal, the project design 20 new "Art and Garden Spaces," which contain art, benches, tables and chairs, lighting and landscaping. These spaces are meant to enrich the pedestrian experience and encourage shoppers to relax and linger (Yang, 2012). In addition, there are bike racks throughout the site and two B-cycle

Figure 2-7. Unique bench design (photo by author)

Figure 2-8. LED lighting strips in pedestrian zone (photo by author)

stations located in the district as part of Denver's bicycle sharing program (Yang, 2012).

Ecology:

The Cherry Creek North shopping district planted 21,700 new plants, including 196 new trees, significantly increasing vegetative cover and contributing to the ecological health of the site (Yang, 2012). A study shows that the overall increase in tree canopy is projected to decrease mid-day air temperatures by about 11 degrees Fahrenheit. Prior to the streetscape project, there were 528 existing trees, and 258 new shade trees were installed, accounting for a 49 percent increase in tree canopy (Yang, 2012). Additionally, the project replaced over half of the spray-irrigated turf with drip-irrigated, water-wise perennials and shrubs. This design change, along with a centralized computer-controlled irrigation system, allowed for a reduction in annual landscape water consumption by 3,376,000 gallons, saving approximately 17,600 dollars annually (Yang, 2012).

Identity:

The district has a strong sense of identity with its wide sidewalks, varying materials, and unique art and garden spaces. The revitalization project also implemented new street signs, street identification banners, and directory map structures, which enhance pedestrian navigation and walkability. Overall, the street character and furnishing contribute to a unified sense of place that is unique to the Cherry Creek district.

Economic Impacts:

The Cherry Creek North and Fillmore Plaza revitalization project proved to enhance local economics, by increased the district sales tax revenues by 16 percent (over 1 million dollars) in the first year after construction (Yang, 2012). Furthermore, the project helped to decrease retail vacancies from 13.6 percent in 2009 to 7.2 percent in 2012. This project is an important example of how a streetscape revitalization project can enhance the social, environmental, and economic benefits of the site. The improvements reactivated the public realm by attracting more pedestrians, increased overall vegetation and sustainable stormwater management, and increased the district's economic viability.

Figure 2-9. Pedestrian realm and outdoor cafe (photo by author)

Figure 2-10. Bollards separate the pedestrian zone from the vehicular zone (photo by author)

Fillmore Plaza:

Function:

Fillmore Plaza is a shared-use street, with space for vehicles, bicyclists, and pedestrians. For planned pedestrian events, the street can be closed off to vehicular traffic with retractable stainless steel bollards located at both intersections. The northern half of the plaza is curbless and has no on-street parking, creating a large and level area for events. The southern half has a 4 inch rolled curb and ten on-street metered parallel parking spaces, allowing for large tents and event staging. The two-way drive lane, which is brick, is approximately 20 feet wide, while the parallel parking spaces are approximately 6.3 feet wide. The pedestrian zones on either side of the drive lane vary in width, however, are at minimum 30 feet wide.

Safety:

The plaza seems to provide a safe environment for all users, including motorists, bicyclists and pedestrians. On the northern half of the street, where there is no curb, there are bollards that physically and visually separate the vehicular zone from the pedestrian zone. Furthermore, the East side of the plaza, which is raised to meet storefronts, includes ADA ramps and railings to accommodate handicapped users.

User-Oriented Spaces:

Fillmore Plaza itself is a multifunctional public space which includes amenities for all types of users. Aside from the fact that the entire street is a transformative plaza space, there are smaller plaza-like spaces on either side of the drive lane. These spaces include street amenities and furnishings such as, benches, tables and chairs, trash receptacles, and landscaping features. There are limestone retaining walls and raised planter edges that also serve as seat walls throughout the site. Additional user-oriented elements include bike racks and lighted directories.

Ecology:

Fillmore Plaza contains two linear trench drains located on either side of the drive lane that capture runoff and move it to an underground stormwater treatment vault where it is filtered before being released into Denver's storm sewer system. This underground treatment vault, capable of capturing water from a 5-year storm event, removes up to 80 percent of solids in the stormwater runoff (Yang, 2012). In addition to this stormwater system, there are in-ground planters and raised planters with low maintenance and water-wise plantings and trees.

Figure 2-11. Colored brick pavers and limestone planters (photo by author)

Identity:

In the center of Fillmore Plaza, there is a large structure with an awning that spans the drive lane. This awning is iconic in appearance and it has a visible sign reading "Cherry Creek North." In addition, there are unique LED lighting fixtures that line both sides of the plaza and change colors at night. To further create a sense of identity, the design incorporates various materials and textures to create a pedestrian scaled environment. Various colors and patterns of bricks are used for the pavement creating visual interest, while retaining walls and planters are constructed from textured limestone blocks. The richness of materiality in tandem with the aesthetically modern steel structures creates a unique identity for the street.

Figure 2-12. Iconic structure with awning (photo by author)

SW 12th Avenue Green Street, Portland, Oregon

Reason for Selection:

The city of Portland is a national leader in the movement towards sustainable stormwater management practices. According to Portland Metro, the design and construction of green streets is an important component in the larger watershed approach to improving the region's water quality (Portland Metro). The SW 12th Avenue Green Street project received a National Award of Honor from the American Society of Landscape Architects for its innovative strategies of reclaiming underused sidewalk space for capturing and infiltrating street stormwater runoff. The project has become an important example and precedent of how a green street can be introduced and integrated into a highly urban setting to provide environmental and aesthetic benefits. While the functional aspect of the stormwater planters is certainly noteworthy, much of the public attention has been placed on the unique integration of the system into the existing urban streetscape.

General Information:

Location: SW 12th Avenue between SW Mill Street and SW Montgomery Street, adjacent to Portland State University, Portland, Oregon

Project Type: green street implementation

Designer: Kevin Robert Perry, Bureau of Environmental Services

Client: City of Portland, Oregon

Completion Date: 2005

Figure 2-13. View of curb chase (photo by author)

Figure 2-14. View of parking egress zone adjacent to planter (photo by Katherine Leise)

Figure 2-15. View of stormwater planter (photo by author)

Figure 2-16. View of main sidewalk zone, stormwater planters, and parking egress zone (photo by Glen Jarrett)

Figure 2-17. Narrow curb cut directs runoff from the sidewalk into the planter (photo by Glen Jarrett)

Function:

According to the Portland Bureau of Environmental Services, there was a list of site selection criteria for this green street project. The criteria called for a site that would allow for no traffic or on-street parking impacts, minimal utility conflicts, a moderate street slope, available space, and a location for a flow monitor and rain gage (Hohlfeld, Hunstiger, 2008). SW 12th Avenue fit the criteria with a street slope of two percent and necessary space for the stormwater planters to avoid impeding traffic or existing parking spaces. The only utility conflict was an existing gas service line intersecting the planters and running to the adjacent building. The shut-off valve was located and preserved with a plastic standpipe for easy access (Hohlfeld, Hunstiger, 2008). In order to maintain existing street traffic and the number of parking spaces, the four stormwater planters were located in an existing landscaped zone between the pedestrian sidewalk and the street curb, where parallel parking spaces are located.

Safety:

The functionality and safety of the site was actually improved through the implementation of a three foot wide parking egress zone adjacent to the curb. Prior to the installation, the existing landscaped zone nearly reached the edge of the curb, leaving minimal space for passengers to get in and out of their parked vehicles. In addition to the parking egress zone, there is a three foot wide walkway between each of the four planters to allow pedestrians to easily access the main sidewalk. Furthermore, a two foot wide landscape buffer was located at each end of the planters to help direct pedestrians safely around the curbed stormwater planters. These design additions create a greater pedestrian connection from the main sidewalk to the parking area and street.

Each planter measures 18 feet by 4 feet, creating a total landscaped area of 72 square feet. There is a 6 inch wide and 4 inch high curb enclosing the perimeter of each planter, which helps accommodate various water volumes (www.asla.org). The 4 inch curb was implemented to indicate to the pedestrian that there is a drop in grade (www.asla.org).

User-Oriented Spaces:

The project includes some user-oriented elements, such as effective pedestrian circulation, street lighting, and informational signage. However, the site does not include any seating options. Being adjacent to Portland State University, it seems that benches may be a necessary program element. Additionally, providing seating may further encourage users to observe the stormwater planters and engage in the site character. It is important to take into

Figure 2-18. Mature shrubs border the stormwater planters (photo by Glen Jarrett)

consideration the lack of space on this site, and how that impacted design decisions.

Ecology:

This green street project disconnects street runoff from the storm sewer that drains straight to the Willamette River. Four landscape planters were implemented to capture, slow, cleanse, and infiltrate approximately 7,500 square feet of runoff. Runoff from the street flows downhill along the curb until it reaches the first planter, where it enters a one-foot wide curb cut, that channels the water under the parking egress zone and into the first planter. In order to facilitate the water making a 90 degree turn into the curb cut, the asphalt below the curb was raised one-inch to redirect the runoff. After flowing through the drain, the runoff moves over a concrete slab, where sediment is deposited, and then flows into the vegetated planter. Each planter is capable of holding 7 inches of water before it is infiltrated into the ground. In an event where water ponds to more than 7 inches, the runoff exits a second curb cut, flows back into the street, and enters the next planter. This process continues to the third and forth planter, and if the last planter fills to capacity, the remaining water flows into the underground sewer system. Furthermore, drainage from the sidewalk flows into the planters through curb cuts (Hohlfeld, Hunstiger, 2008).

Each planter was excavated to a depth of 24 inches below grade, and filled with 6 to 9 inches of a mix of sand, topsoil, and compost (Hohlfeld, Hunstiger, 2008). Plant species, including grasses and trees that are tolerant of both wet and dry soil conditions were planted closely together to help infiltrate water, increase aesthetic benefits, and reduce maintenance requirements (Hohlfeld, Hunstiger, 2008). Overall, the system has managed stormwater effectively, and based on a simulated test, the planters have the ability to reduce the runoff intensity of a 25-year storm event by at least 70 percent (www.asla.org).

Identity:

In order to create a sense of place and identity, particular attention was placed on materiality and design detail. Sand-set concrete unit pavers were used for all of the pathways in order to create an aesthetic separation from the primary sidewalk zone (www.asla.org). These pavers also help create a pedestrian scaled environment, with varying colors and textures. The ornamental curb cut grates add to the aesthetic benefits of the project further creates an identity for the street. The attractive grates also draw user attention to the true purpose of the planters, which can potentially facilitate education about urban stormwater conveyance.

Valencia Street, San Francisco, California

Reason for Selection:

San Francisco is not only a national leader for innovative streetscape design, but is also responsible for implementing a high number of road diets on city streets (sfstreetsblog.org). Valencia Street, which underwent a road diet and streetscape improvement project, has become a well-known model for traffic engineers and landscape architects. The street was reduced from a four lane road, to a two lane road with a center median, left-hand turn bays, and bike lanes. Due to concerns that the road diet would worsen traffic for drivers, the city agreed to a one-year trial and detailed study of the changed conditions. After a year, if the configuration did not work, it would be removed. However, traffic data and public opinion surveys declared that the project was a success and that the road diet would become permanent (www.bikesbelong.org). This project was selected as a case study because there are detailed reports on how the design positively affected the social, environmental, and economic issues on Valencia Street.

General Information:

Location: Valencia Street between 15th and 19th Streets, San Francisco, California

Project Type: road diet, complete street, streetscape improvement

Designer: Department of Public Works, Municipal Transportation Agency

Client: City of San Francisco

Completion Date: Phase 1 completed 1999, Phase 2 completed 2010

Figure 2-19. Enhanced pedestrian realm (www.sfdpw.org)

Figure 2-21. Valencia street post. (www.sfdpw.org)

Figure 2-20. Designated bike lane (www.peninsulartransportation.org

Function:

Valencia Street runs through a mixed-use corridor consisting of two and three story high buildings with commercial uses at street level and residential on upper levels (Sallaberry, 2000). The street, which is part of a grid system, runs parallel to four other North-South arterials. Before the road diet was implemented, Valencia Street was a 4 lane road, with an Average Daily Traffic (ADT) of approximately 22,000 vehicles per day (Sallaberry, 2000). Furthermore, a public transit line travels along the road. Valencia is also a popular bicycle thoroughfare and shopping destination. The idea of a road diet was extremely controversial at first, with bicycle advocates in favor, and transportation officials in opposition. A compromise was made to install the road diet on a one-year trial basis; 1.8 miles of Valencia were transformed to a two lane road with left turn bays and bike lanes.

The effects of the road diet were studied and compared to baseline data taken before the implementation. The results showed that vehicular traffic dropped approximately 10 percent, diverting to other parallel arterials (Sallaberry, 2000). Furthermore, bicycle ridership increased by 144 percent, making Valencia Street the second busiest bike route in San Francisco (bikesbelong.org).

Safety:

Collision data was also collected for a few years after the installation to determine if the new design improved street safety. The total number of collisions decreased by 20 percent, although that is partially attributed to the decrease in traffic volume. Bicycle collisions increased by about 50 percent, however, that increase can be related to the 144 percent increase in ridership. Therefore, taking into account these statistics, collisions involving bicyclists actually decreased. Collisions involving pedestrians declined by 36 percent, which is in part due to the traffic calming design features (Sallaberry, 2000).

User-Oriented Spaces:

In the second phase of the project, efforts were focused on the improvement of the pedestrian realm in order to make it more of a destination than a through arterial. The project included the addition of 76,000 square feet of sidewalk and the installation of pedestrian bump-outs, to further provide traffic calming, shorter crossing distances, and places to gather (www.sfdpw.org). Other new pedestrian amenities included, wheel chair accessible curb ramps, bike racks, pedestrian scaled lighting, and trash receptacles (www.sfdpw.org). The road diet, along with these user-oriented design additions received positive input from local store owners, many claiming that business had improved (bikesbelong.org).

Ecology:

Although the focus of this project was not to address ecological concerns, the second phase planted 106 new trees along the sidewalks to create an enhanced pedestrian realm (www.sfdpw.org). This additional vegetation contributes to a denser tree canopy, and therefore, helps reduce heat island effect on the street.

Identity:

A public art project was introduced into the pedestrian realm, creating a stronger sense of identity and place. "Valencia Street Posts" are poles with Victorian-inspired crowns that are located at various pedestrian bump-outs. The posts are intended to foster community interaction, where people are invited to post bulletin information, notices, and advertisements. The Victorian themed crown is meant to represent the site's architectural history (www.arcega.us/artwork).

Figure 2-22. Valencia Street lane configuration (Google Earth Imagery)

Figure 2-23. Bike lane and parallel parking (Google Earth Imagery)

Chapter 3: Inventory and Analysis

Site Visits

Site visits were conducted in downtown Colorado Springs. It was important to study both the physical and social functions of the site. Physical conditions and typical dimensions of streetscape elements were documented through notes and photographs. Social functions and user interactions were observed in order to understand the various activities occurring at the site. A method known as "tracking and tracing" was used to determine how motorists, bicyclists, and pedestrians move through the streets and use the public spaces.

The "tracking" method is observing how people move through the space for a set duration, while "tracing" is observing what evidence is left behind indicating how people use the space. The tracking approach is to record the arrival and departure of the subject, the location where they were observed, the time, and any activities that they were participating in. Tracing is conducted by looking for leftover clues, such as pavement erosions, trash piles, or cigarette butts. The ultimate goal of this method was to understand how the space influences users and how they impact the space through their use. Through observation I was able to see first-hand the condition of the streets, the activities that occurred there, and the amenities present. It was also important to visit the site at different times of day in order to record data for day time and night time uses.
In order to make site visits more efficient and beneficial, a chart was devised to display the case study and site criteria into categories and sub questions that were considered in the field.

A specific protocol was followed for the site visits and tracking and tracing method. During site visits, observations were recorded in a designated chart that was organized into an "observations" column and a "comments" column. The two columns separated objective observations from viewer interpretations. The chart also has the case study and site evaluation criteria listed in the rows so that observations could be recorded under the according category. There is an additional chart that is organized into two columns, one for tracking and one for tracing. Both the tracking and tracing columns are divided into categories that were suggested by John Zeisel in Inquiry by Design: Tools for Environment- Behavior Research, along with sub-questions listed at the bottom. Throughout site visits, observations about physical settings and social behavior were recorded into these charts, allowing for efficient compilation of the data.

Inventory and Analysis

Site inventory and analysis maps and data collected from the case studies helped inform the project framework and the final design outcome. In order to understand existing conditions at the district and site scale, a site inventory and analysis was conducted at two different scales, including the entire downtown area and the 6-block Pikes Peak Avenue corridor. The first step was to use GIS data, acquired from the Colorado Springs Utilities, to create a series of maps, that illustrate relevant site conditions including: land use and zoning, population density, utilities infrastructure, street lighting, parking facilities and lots, and topography. Since Utilities data does not include many detailed site characteristics, Google Earth Imagery and site visit photographs were used to locate, and map, specific program elements. Existing street features such as, vehicular circulation, parking spaces, bike lanes and racks, pedestrian amenities, street trees, public art, and stormwater inlets were identified, counted, and located by using Google Earth Imagery.

Downtown Scale

General Map

The downtown district is defined by a greenway boundary, comprised of a park and trail system. The streets within this district are shown in gray, with the thicker lines representing arterials and higher levels of traffic.

Land Use

The core district, as well as the length of Tejon Street, is a mixed use center, with land uses including, commercial, office, institutional, and residential. Large industrial areas mostly lie along the southern district boundaries. Residential neighborhoods are located primarily in the northwestern and southeastern portions of the site.

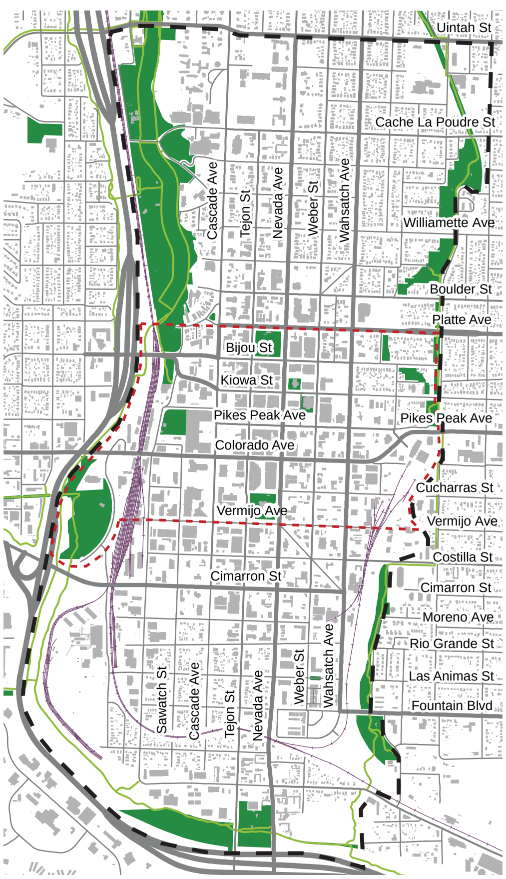


Figure 3-1. General map (created by author, adapted from CS Utilities GIS data)

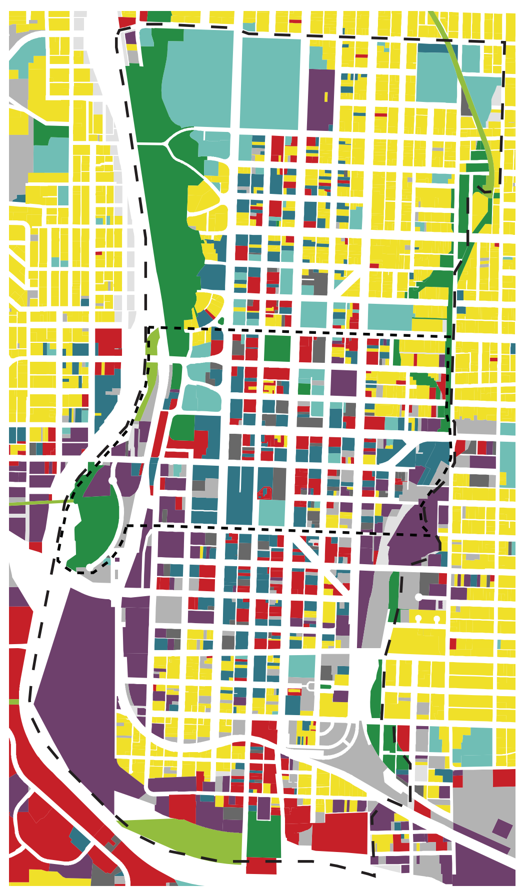


Figure 3-2. Land use (created by author, adapted from CS Utilities GIS data)

Population Density

The most densely populated area is located on the Colorado College campus, which includes student dormitories. The neighborhoods located in the northwestern part of the site also have higher densities. The city of Colorado Springs has expressed a future goal to increase residential density in the downtown core.

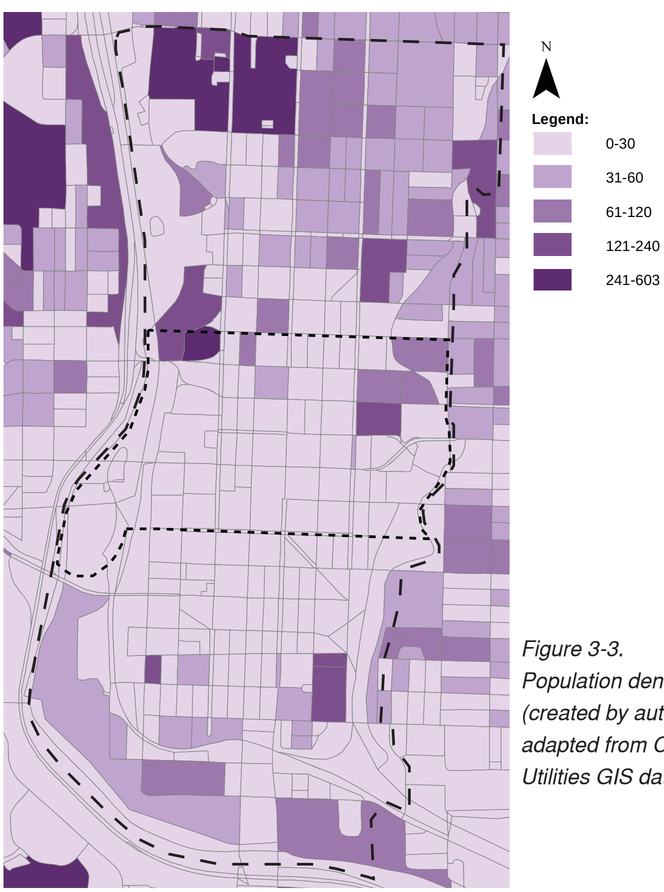


Figure 3-3. Population density (created by author, adapted from CS Utilities GIS data)

Bus Routes

Colorado Springs' primary transit stop and bus station is located at the corner of Nevada Avenue and Kiowa Street. Buses depart from the station every 30 minutes on weekdays, and every hour on weekends. The circles with bus route numbers are not indicative of secondary stops; all other stops are located outside of the district.

Traffic Volume

The high traffic streets are either major thoroughfares through the district, or important entryways into downtown. Colorado Avenue is the main East/West traffic way through the core district, while Nevada is the primary North/South traffic way through the entire district.

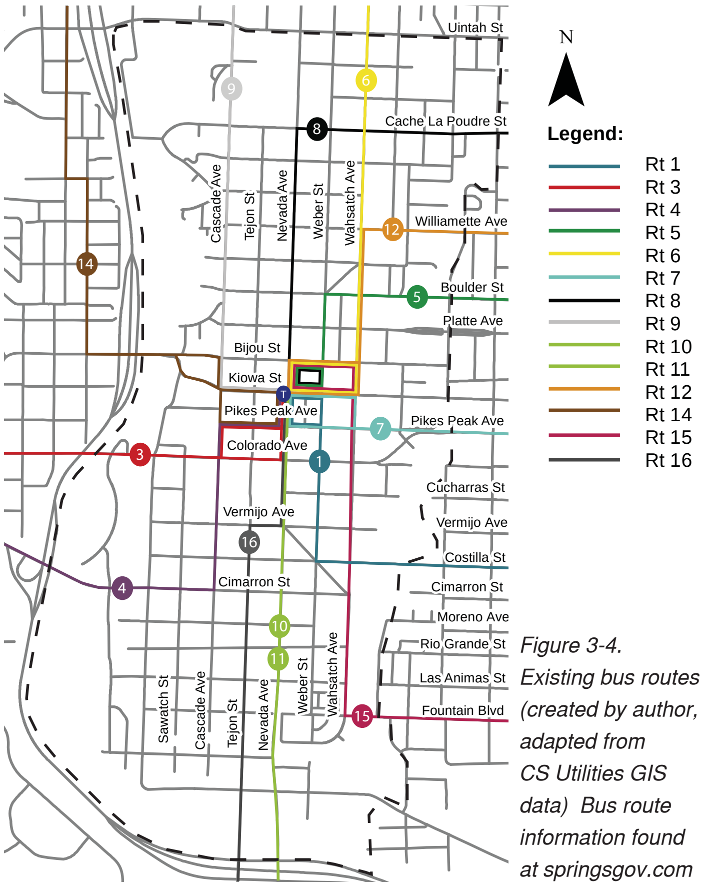


Figure 3-4. Existing bus routes (created by author, adapted from CS Utilities GIS data) Bus route information found at springsgov.com

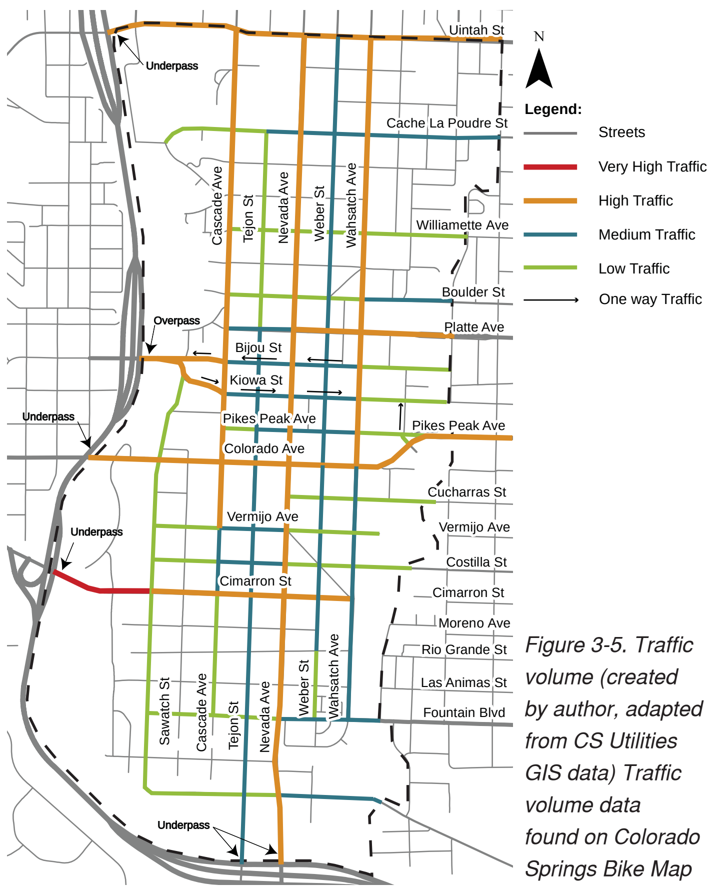


Figure 3-5. Traffic volume (created by author, adapted from CS Utilities GIS data) Traffic volume data found on Colorado Springs Bike Map

Street Width

This map shows the general widths of downtown streets. The measurements are not exact; they are based on the city's original plans to have 140-foot wide avenues, and 100-foot wide streets. The plan specified one street between every avenue when running north and south, and two streets between every avenue when running east and west (springsgov.com).

Bike Lanes and Sharrows

This map indicates the district's fragmented bike infrastructure system. The city has implemented sharrows along Colorado and Pikes Peak Avenues, making these streets the only complete bike connectors through the district. However, these streets are wide enough to install designated bike lanes, resulting in increased safety.

Figure 3-6. Street width (created by author, adapted from CS Utilities GIS data)

Figure 3-7. Existing bike lanes (created by author, adapted from CS Utilities GIS data)

Street Hierarchy Master Plan

This map, adapted from the Imagine Downtown Master Plan Street Hierarchy Map, conveys a vision for future street types and uses. The Imagine Downtown Master Plan defines the following street types:

• Gateway streets are the key entryways into downtown and should provide a sense of arrival and departure. The blue circles indicate locations that should have entry signage to help create a sense of place.

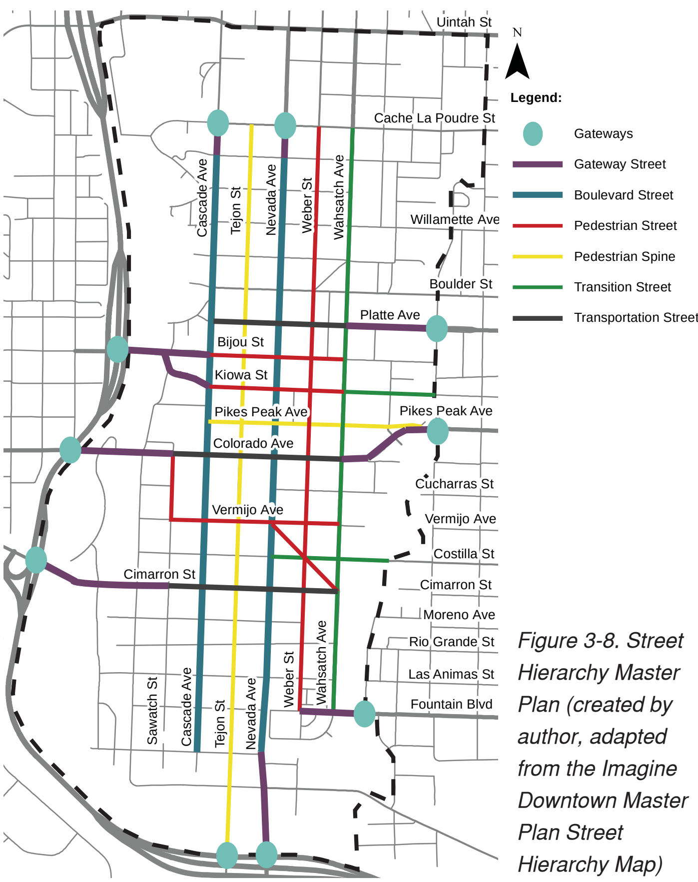


Figure 3-8. Street Hierarchy Master Plan (created by author, adapted from the Imagine Downtown Master Plan Street Hierarchy Map)

• Boulevard streets are wide streets, with landscaped center medians.

• Pedestrian spines are major pedestrian corridors with streetscape amenities. These streets are characterized by wide sidewalks, street cafes, adjacent retail and entertainment activities, patterned street crossings, low level pedestrian lighting, ornamental landscaping, pedestrian seating, and public art.

• Pedestrian streets support considerable commercial and residential uses, but generally have less concentrated retail and entertainment activities in comparison to pedestrian spines.

• Transition streets are streets linking areas of varying land uses, such as areas transitioning from primarily commercial to residential buildings.

• Transportation streets are the main traffic thoroughfares through the downtown district, which often provide access to Interstate-25. In addition to efficient traffic flow, transit, bicyclist, and pedestrian mobility should also be integrated (Imagine Downtown Master Plan, 2008).

Goals for Pedestrian Spines (as identified in the Imagine Downtown Master Plan)

Streetscape Elements

R	Street Trees
	Landscaped Medians
R	Ornamental Planters
E	Cluster Landscaping/ Massing/ Mix of Inorganic Materials
E	Transit Shelters and/or Turn-Outs
E	Information Kiosks
E	Public Art Displays
E	Benches
E	Bicycle Storage Racks or Facilities
R	Pedestrian Lighting
R	Ornamental Overhead Streetlights
R	Underground Utilities
R	Use of Pavers

Parking Elements

E	On Street Diagonal Parking
E	On Street Parallel Parking
E	On Street Median Parking
R	Surface Parking Lots (Behind Buildings)
R	Parking Structures (With First Level Retail)
P	Parking Structures (100% Parking)

Signage

R	Uniform Public and Directional Signage
R	Pedestrian Oriented Private Signage
P	Auto Oriented Private Signage
	Gateway or Downtown Entry Signage

Pedestrian Circulation

E	Pedestrian Plazas
R	Pedestrian Connectivity/ Public Space Connections
R	Wide Sidewalks
E	Street Cafes/ Tables
E	All-Way Pedestrian Crossings/ Pavement Design
R	Traffic Calming Design/ Pedestrian Bump-Outs
E	Designated Bicycle Lanes
R	Alley Pedestrian Improvements
E	Public Transit/ Downtown Circulator Facilities

Form and Building Scale

R	Height to Street Width Pedestrian Scale (Building Step-Backs)
R	Adherance to Build-to Lines
R	Transparency/ Glazing Requirements (Street Level Windows)
R	Enhanced Architecture/ Building Form/ Architectural Detail
R	Identified Palate of Acceptable Facade Materials/ Facade Treatment
R	Pedestrian Well-Defined Entry Considerations
R	Skyline/ Roof and Parapet Design Considerations
R	Sun and Shadow Considerations
R	Historic Preservation Considerations/ Conversion Guidelines
R	Public View Preservation Considerations
R	Neighborhood and Land Use Transitioning/ Transition Considerations
R	Listing of Discouraged or Prohibited Land Uses

R	Required
E	Encouraged
P	Prohibited
	Unclassified/ Not Applicable

Pikes Peak Avenue

General Map

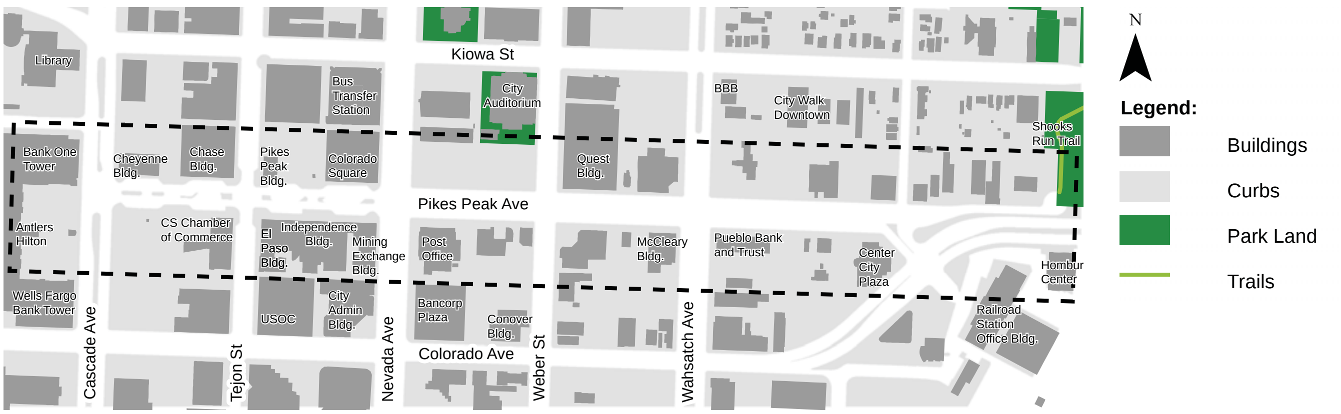


Figure 3-9. General map (created by author, adapted from CS Utilities GIS data)

Land Use

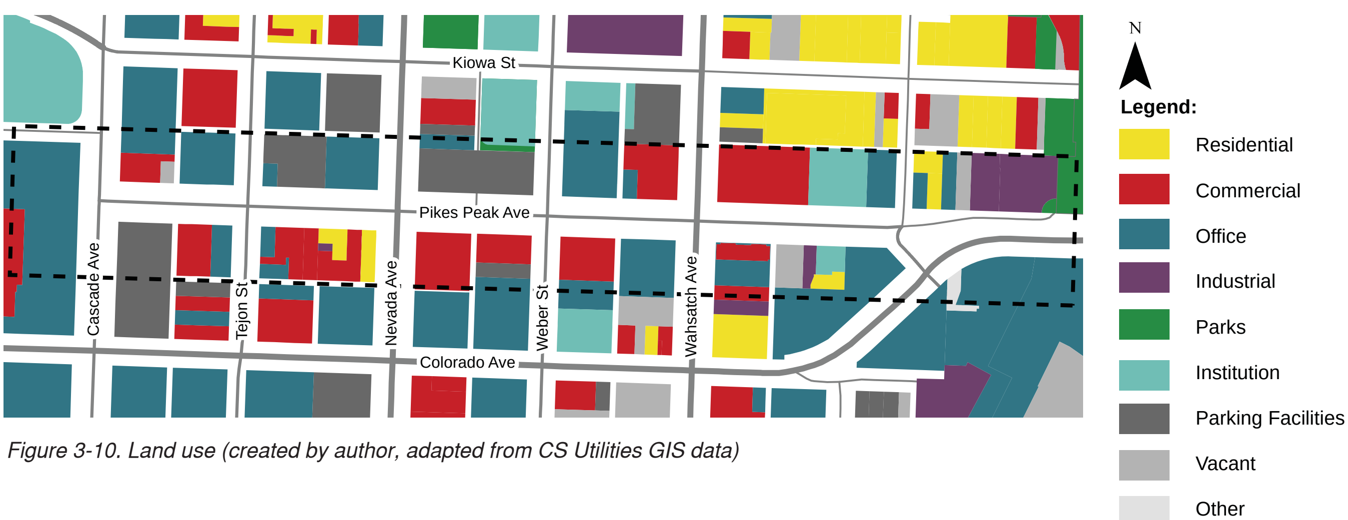


Figure 3-10. Land use (created by author, adapted from CS Utilities GIS data)

Utilities Infrastructure

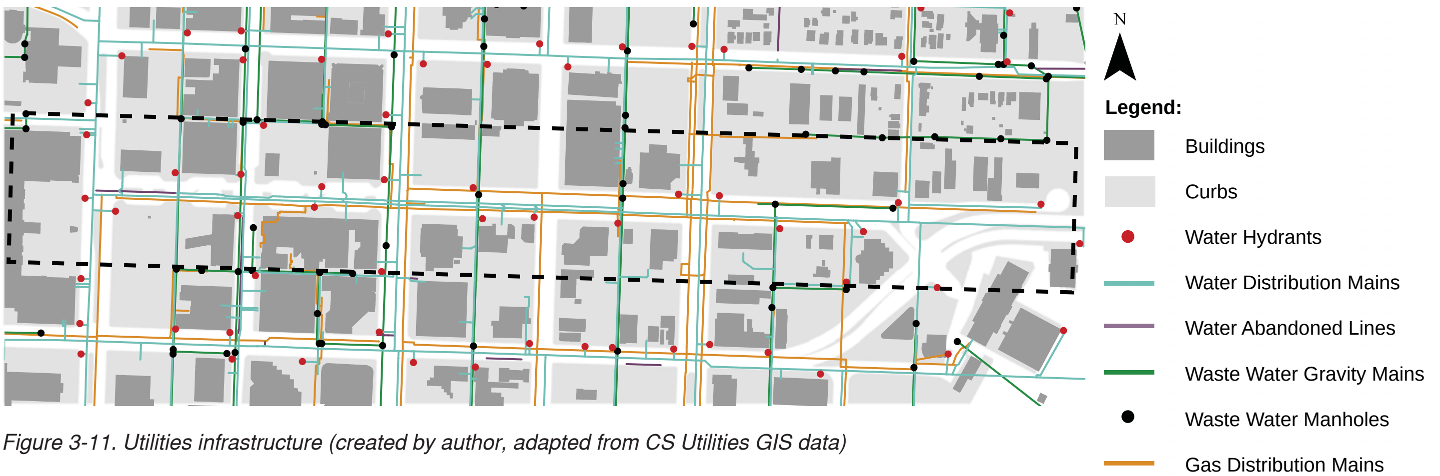


Figure 3-11. Utilities infrastructure (created by author, adapted from CS Utilities GIS data)

Utilities Infrastructure 2

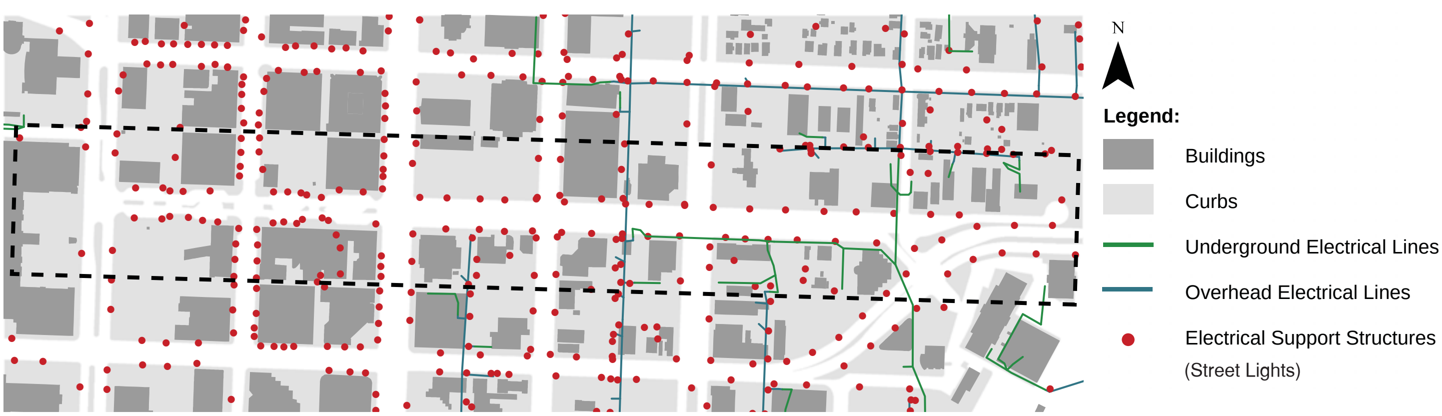


Figure 3-12. Utilities infrastructure 2 (created by author, adapted from CS Utilities GIS data)

Parking Garages and Surface Lots

Figure 3-13. Parking garages and surface lots (created by author, adapted from CS Utilities GIS data)

The ULI Advisory Board states that downtown has more than 10,000 public and private parking spaces. Approximately 2,400 are metered parking spaces (ULI, 2012). Easy Park is a program that provides pre-purchased cards which can be used at all parking meters in downtown Colorado Springs. Easy Park is intended to eliminate the need for change and make parking downtown more convenient and economical.

On-Street Parking

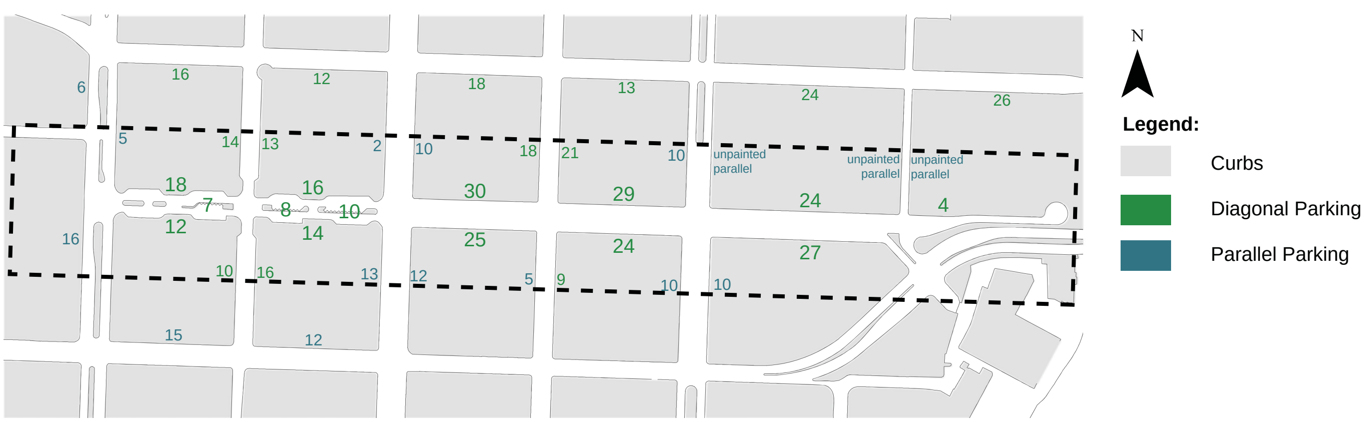


Figure 3-14. On-street parking (SOURCE)

Vehicular Circulation

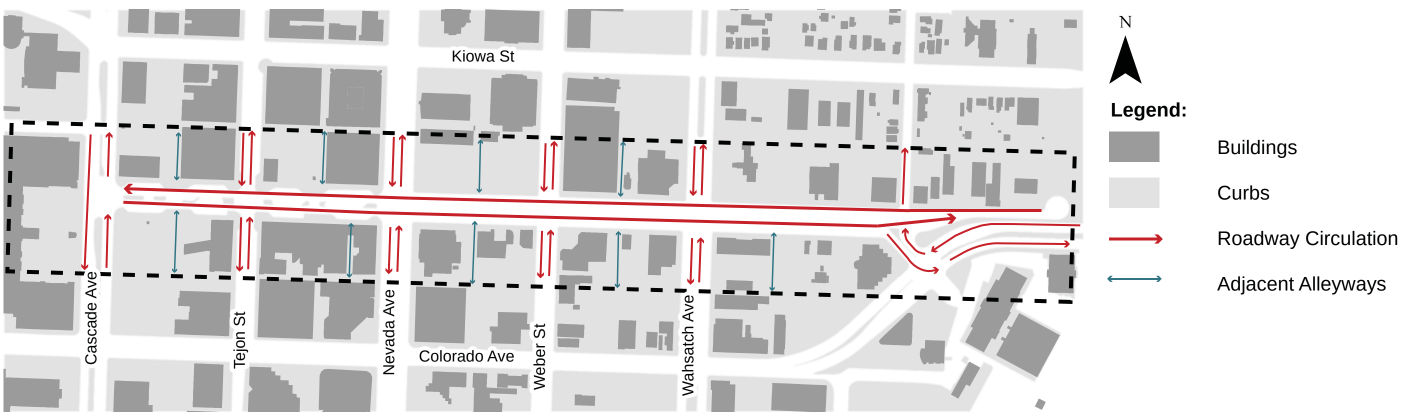


Figure 3-15. Vehicular circulation (created by author, adapted from CS Utilities GIS data)

There are currently two vehicular lanes travelling in each direction along Pikes Peak Avenue. The two blocks between Cascade and Nevada Avenues include a center parking island. The four blocks to the east include a continuous center turn lane. Alleyways that run perpendicular to Pikes Peak Avenue are located on each block.

Unnamed Parking Lot: 144 spaces

Colorado Square Lot: 90 spaces

US Bank Lot: 220 spaces

Kiowa St Garage: 650 spaces

Trailways Lot: 174 spaces

Total: 1,278

Metered Parking Spaces:

Diagonal: 458 spaces

Parallel: 126 spaces

Total: 584 spaces

Total for site area: 1,862 spaces

Existing Bike Sharrows and Parking

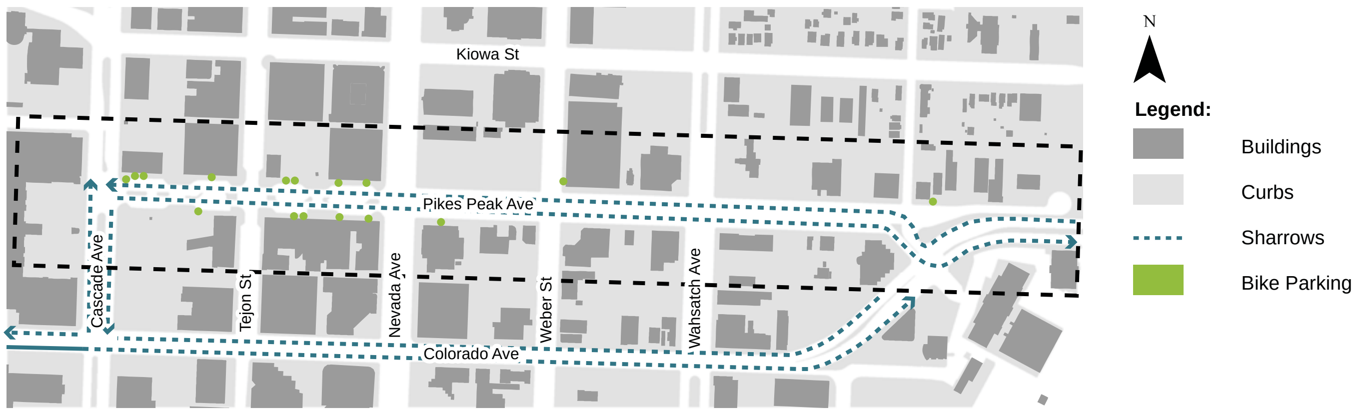


Figure 3-16. Existing bike sharrows and parking (created by author, adapted from CS Utilities GIS data)

The 6-block length of Pikes Peak Avenue includes bike sharrows on both sides of the street. Bike parking is limited mainly to the two blocks between Cascade and Nevada Avenues. Additionally, some of the bike racks, such as the one in front of the Post Office are temporary bike racks, not fully integrated into the streetscape.

Figure 3-17. Bike sharrow in the center of the vehicular lane (photo by author)

Figure 3-18. Typical bike rack in sidewalk amenity zone (photo by author)

Figure 3-19. Temporary bike rack in front of Post Office (photo by Devin Ash)

Existing Pedestrian Amenities

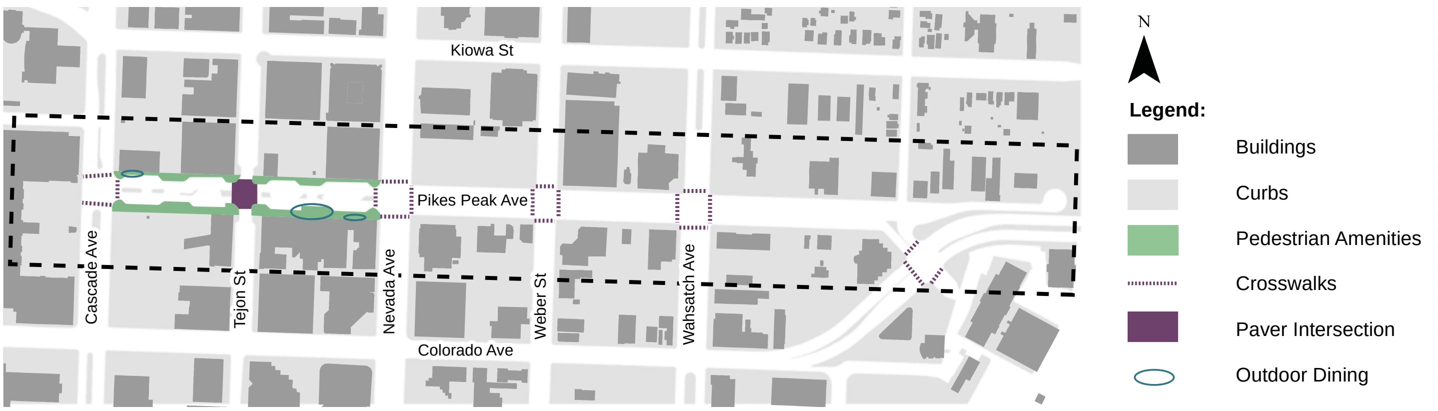


Figure 3-20. Existing pedestrian amenities (created by author, adapted from CS Utilities GIS data)

Existing pedestrian amenties are located on the two blocks between Cascade and Nevada Avenues. These amenities include, benches, tables and chairs, pedestrian scaled lighting, informational signage, newspaper stands, trash and recycling receptacles, and paver patterns. The remaining four blocks are deficient of pedestrian amenties.

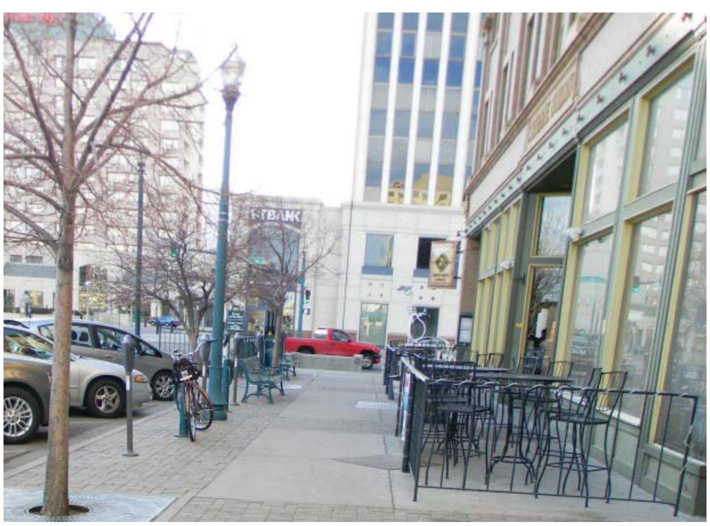


Figure 3-21. Pedestrian amenities and outdoor dining at the corner of Pikes Peak and Cascade Avenues (photo by Devin Ash)

Figure 3-22. Pedestrian bump out with seating, lighting, street trees and public art (photo by Devin Ash)

Public Art Displays

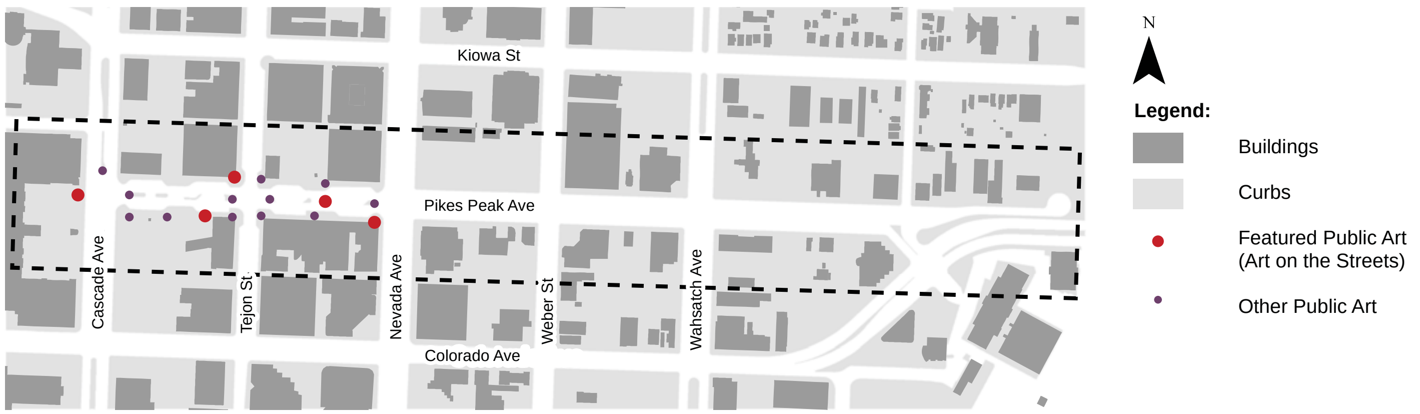


Figure 3-23. Public art displays (created by author, adapted from CS Utilities GIS data)

There are many public art displays on Pikes Peak Avenue between Cascade and Nevada Avenues. Several of these art displays are memorials and statues of historic figures important to the founding and development of Colorado Springs. The four eastern blocks lack public art displays and a connection to the historic past.

Figure 3-24. Pikes Peak Range Riders Memorial, located at the corner of Pikes Peak and Cascade Avenues (photo by Devin Ash)

Figure 3-25. Pikes Peak or Bust Rodeo statue, located at Pikes Peak Avenue and Tejon Street (photo by Devin Ash)

Figure 3-26. Spencer Penrose statue, located at Pikes Peak Avenue and Tejon Street (photo by Devin Ash)

Existing Street Trees

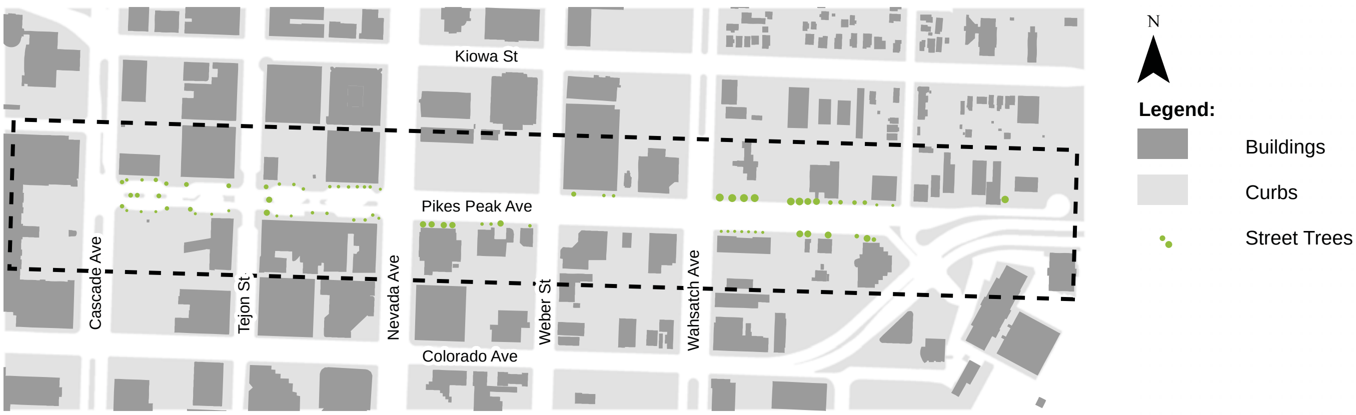


Figure 3-27. Existing Street Trees (created by author, adapted from CS Utilities GIS data)

There are smaller, less established street trees between Cascade and Nevada. The blocks between Nevada and Wahsatch are mostly devoid of street trees. Lastly, there are mature trees on the block East of Wahsatch Avenue.

Figure 3-28. Street trees are absent on block between Nevada Avenue and Weber Street (photo by Devin Ash)

Figure 3-29. Mature trees located on the block East of Wahsatch Avenue (photo by Devin Ash)

Topography

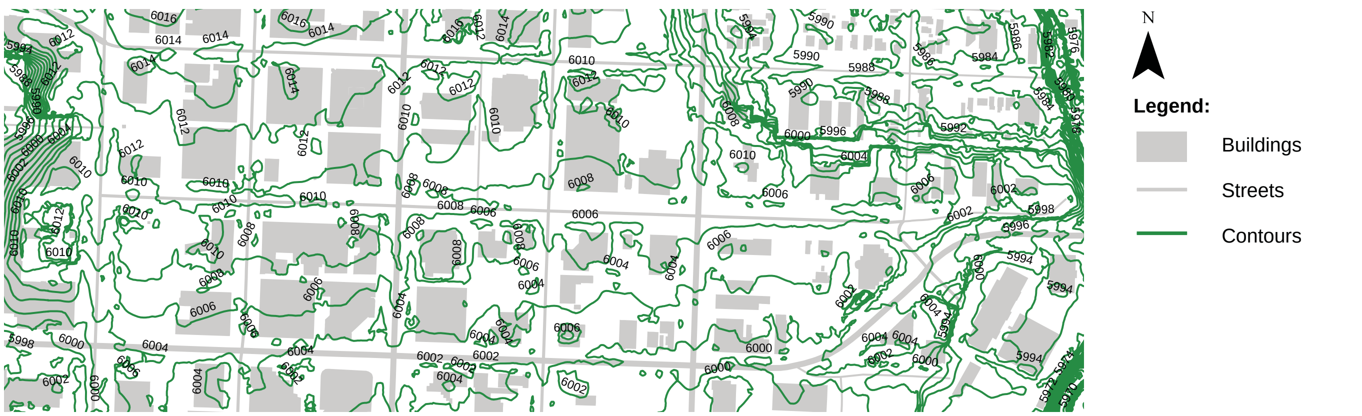


Figure 3-30. Topography (created by author, adapted from CS Utilities GIS data)

The general flow of drainage along Pikes Peak Avenue is from West to East. Stormwater inlets are often located at street corners in order to capture water before it travels across intersections.

Drainage Flow and Stormwater Inlets

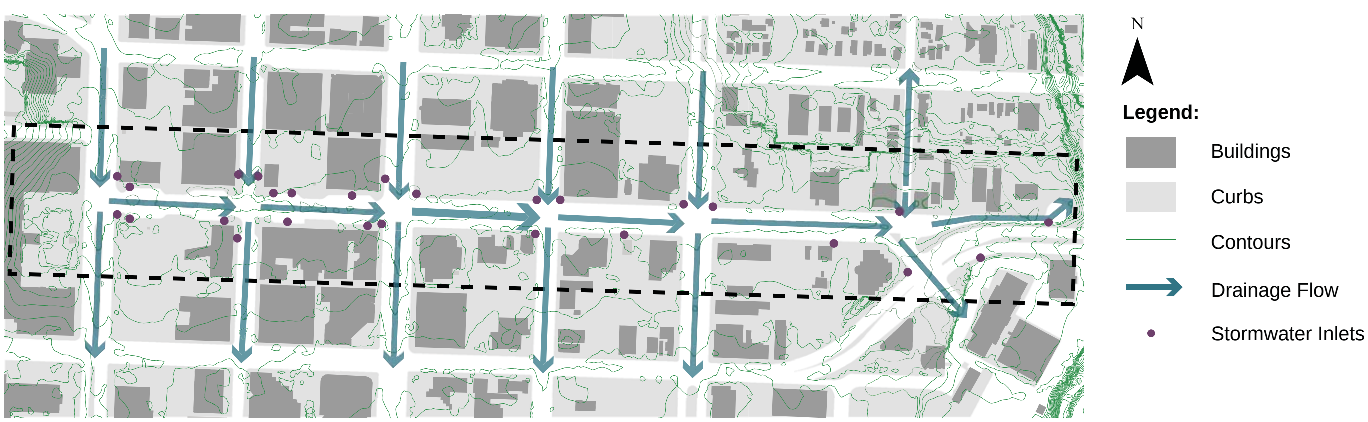


Figure 3-31. Drainage flow and stormwater inlets (created by author, adapted from CS Utilities GIS data)

6-Block Pikes Peak Avenue Site Analysis Synthesis

Function

The 6-block length of Pikes Peak Avenue currently dedicates an excessive amount of space to vehicular use; 100 feet of a 140 foot right-of-way is entirely consumed by asphalt traffic lanes and diagonal parking spaces. There are two lanes of traffic in each direction and a center turn lane (the two blocks between Cascade and Nevada Avenues include center parking islands). Since Pikes Peak Avenue has low to medium traffic volumes, it is not necessary to consume such a large amount of space for automobile traffic. Although the street efficiently transports automobiles from one block to the next, it does not include efficient or safe pedestrian crossings.

Safety

There are safety issues concerning pedestrians and bicyclists in the right-of-way along Pikes Peak Avenue. There is a lack of traffic calming design features to increase visibility of the pedestrian and decrease crossing distances. Furthermore, the street does not include designated bicycle lanes; instead there are sharrows, which indicate that vehicles and bicycles must share the lane.

User-Oriented Spaces

The two blocks between Cascade and Nevada Avenues include pedestrian amenities such as, outdoor dining areas, benches, lighting, informational signage, newspaper stands, and recycling and trash receptacles. In general, these two blocks offer a cohesive pedestrian environment that is intended for a range of potential users. Furthermore, these two blocks contain a high number of public art pieces, many of which are statues and plaques that connect to the historical past. In contrast, the remaining four blocks significantly lack useable public space and pedestrian and bicyclist amenities. Sidewalks are entirely devoid of pedestrian amenities and community spaces.

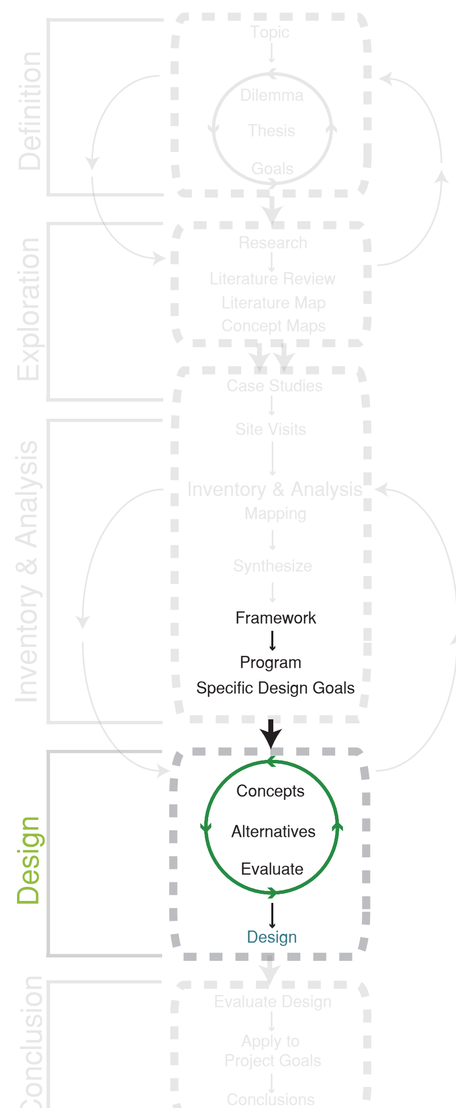
Ecology

Pikes Peak Avenue has a deficiency of sustainable stormwater management systems as street runoff is currently directed to storm sewer inlets. Furthermore, there is a general lack of street trees, particularly on the blocks between Nevada Avenue and Wahsatch Avenue. There are some mature trees on the block east of Wahsatch Avenue; this is partially attributed to the fact that the trees are planted in continuous planting beds, allowing more space for root growth.

Identity

Partially due to the automobile-oriented streetscape, Pikes Peak Avenue currently fails to create a strong sense of place and identity. Considering the city's rich history, there is a significant opportunity to connect to embrace the historical past. Although he two western blocks contain historical statues and signage, there is still potential for improvement.

Chapter 4: Design



Synthesize and Design

After conducting the case studies and mapping and analyzing the project site, the design process for downtown Colorado Springs began. The first step in the design process was to synthesize all of the information collected through the literature review, case studies, and site inventory to create a project framework. The project framework aims to connect research and design by combining the most important ideas and design methods in order to inform the Colorado Springs site design goals and outcomes. Next, after developing the project framework, design began at the large downtown network scale in order to create a contextual framework that influenced more specific design decisions for the 6- block street corridor and one block site scale.

Framework: Connecting Research and Design

EXPLORATION

LITERATURE

Social
Placemaking
Mobility
Safety
Complete Streets

Environmental
Natural Systems
Green Streets

Economic Factors
Design Elements

CASE STUDIES

Valencia Street
San Francisco,California

SW 12th Avenue Green Street
Portland, Oregon

Cherry Creek North/ Fillmore Plaza
Denver, Colorado

SITE VISITS

EVALUATING CRITERIA

Function
• the street's ability to transport people and traffic from one destination to another

Safety
• the street's ability to provide a safe environment for all users, including motorists, bicyclist, and pedestrians

User-oriented spaces
• the street's provision of multifunctional public spaces and pedestrian and bicyclist amenities

Ecology
• the street's inclusion of ecological features and stormwater management systems

Identity
• the street's ability to create a strong identity for the place

DESIGN PRACTICES

Road diet
Narrow lane width (11' wide)
Center turn bays

Traffic calming
Curb bump outs
Median refuge islands
Buffered bike lanes (6' wide)

Wide sidewalks
Pedestrian/ bicyclist amenities
Lighting and seating
Plaza spaces

Stormwater planters, bioswales
Pervious surfaces
Native landscaping

Detailed design elements
Art, signage, paving
Connection to history

Figure 4-1. Project framework (created by author)

APPLICATION

CITY'S GOALS

• Maintain historic block pattern in the downtown district
• Provide multiple modes of transportation and increase public transit options
• Incorporate pedestrian-friendly design
• Increase pedestrian safety through the use of bump outs and other crosswalk improvements
• Implement comprehensive public space improvements and develop unique street character block by block
• Encourage green infrastructure

INVENTORY & ANALYSIS → **PROJECT GOALS**

Excessive amount of space dedicated to vehicular use and parking

Safety issues concerning pedestrian crossings and comprehensive bicycle network

Lack of useable public space and pedestrian and bicyclist amenities

Deficiency of stormwater infrastructure and native landscaping

Absence of ww identity and connection to city's history

SITE SCALE

• Decrease area dedicated to vehicular traffic
• Provide bicycle lanes and parking facilities
• Create an enhanced pedestrian realm
• Create a multifunctional plaza space
• Provide stormwater management solutions
• Increase native landscaping and habitat

DESIGN OUTCOME

Downtown Framework Plan

Existing Program Elements

The city of Colorado Springs currently lacks a comprehensive framework plan for the downtown streets. Though many different sources identify future design ideas for the downtown streets, the city does not have a cohesive vision for how all these ideas come together. Therefore, as previously stated, the goal for the larger downtown scale was to create a cohesive framework plan that identifies opportunities for multimodal transportation and proposes locations for: public street car routes, gateways into downtown, bicycle lanes, and main pedestrian realms.

The design strategies from Colorado Springs' various visioning plans were identified, extracted, and combined together into one cohesive framework plan. The information contained in this plan includes: existing program elements such as, park land, trails, and the existing bus station; existing bike lanes; proposed gateways into downtown; proposed street car routes; and proposed pedestrian spines.

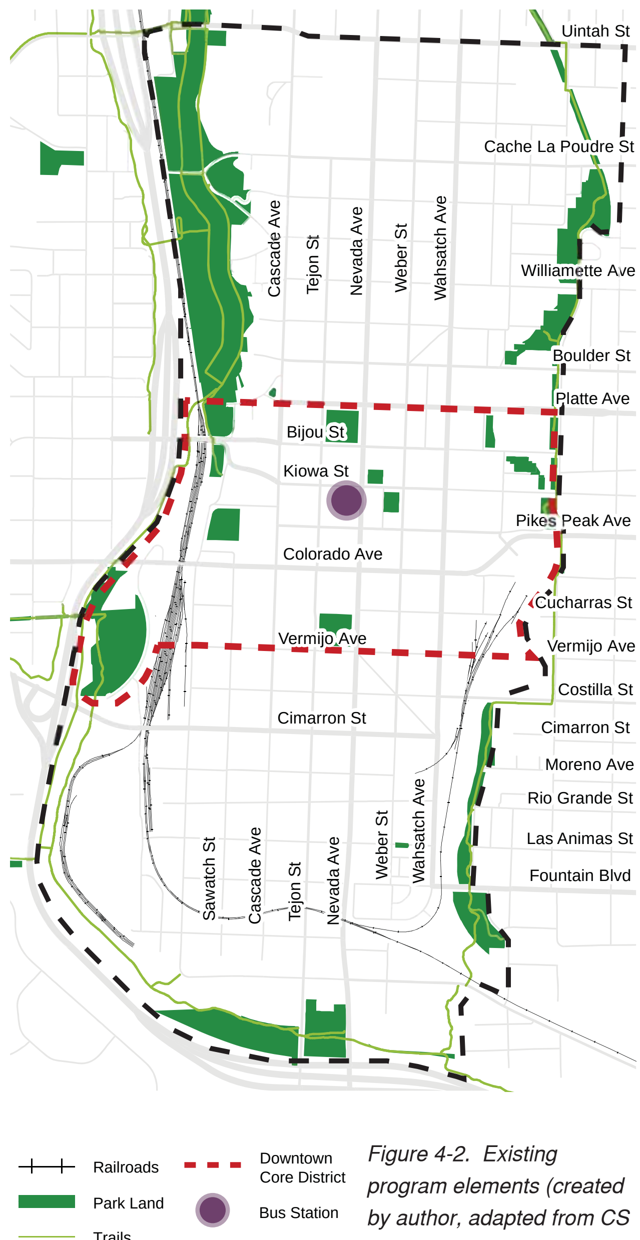


Figure 4-2. Existing program elements (created by author, adapted from CS Utilities GIS data)

Proposed Gateways

(as identified in the Imagine Downtown Master Plan)

Figure 4-3. Proposed gateways (created by author, adapted from CS Utilities GIS data) Proposed gateways identified in the Imagine Downtown Master Plan

Proposed Street Car Route

(as identified in the Street Car Feasibility Study)

Figure 4-4. Proposed street car routes (created by author, adapted from CS Utilities GIS data) Street car routes identified in the Colorado Springs Street Car Feasibility Study, 2010

Proposed Pedestrian Spines

(as identified in the Imagine Downtown Master Plan)

Figure 4-5. Proposed pedestrian spines (created by author, adapted from CS Utilities GIS data) Pedestrian spines identified in the Imagine Downtown Master Plan

Existing Bike Lanes

(as identified in the Colorado Springs Bike Map)

Figure 4-6. Existing bike lanes (created by author, adapted from CS Utilities GIS data) Bike lanes identified in Colorado Spring Bike Map

Proposed Bike Lanes

(as identified in this project)

Figure 4-7. Proposed bike lanes (created by author, adapted from CS Utilities GIS data)

Proposed Composite Bike Lane Network

(as identified in this project)

Figure 4-8. Composite bike lane network (created by author, adapted from CS Utilites GIS data)

The city does not have a plan for a future downtown bike lane system. Therefore, in order to complete a truely multimodal transportation framework plan, this project proposes adding a comprehensive bike lane network. Four criteria were developed for locating bike lanes in the downtown core:

• necessary connection
• vehicular traffic volume
• available space
• presence of bus routes or stops

These criteria were used to identify the most suitable streets for bike lanes. It was important to determine if a street was in need of a bike lane to connect segmented bike lanes or to connect various land uses, such as parks or the greenway loop. It was also crucial to consider vehicular traffic volumes, since it is less safe to propose bike lanes on streets with high traffic volumes and speeds. Furthermore, available space was studied to ensure that selected streets have the ability to accommodate designated bike lanes. Lastly, the location of bus routes and stops was considered to avoid proposing bicycle lanes on streets with frequent bus travel.

The layers from outside sources, as well as the proposed bike lane layer, were then compiled and overlaid to create the composite framework plan for downtown Colorado Springs.

Proposed Composite Framework Plan

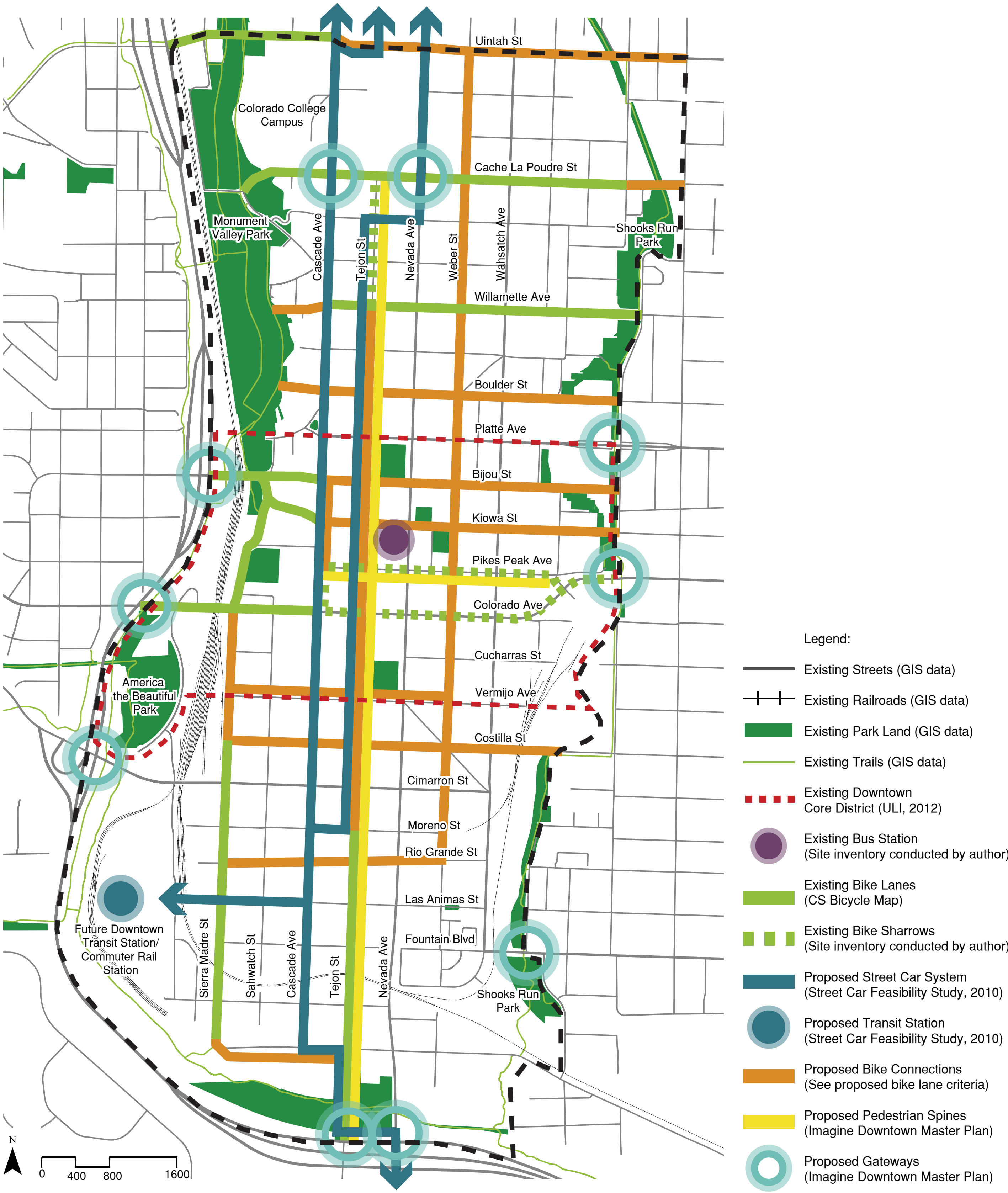


Figure 4-9. Composite framework plan (created by author, adapted from CS Utilities GIS data)

6-Block Pikes Peak Avenue

It was necessary to develop a schematic design for the 6-block corridor of Pikes Peak Avenue, in order to later create a feasible design strategy for the one-block site. It was critical to ensure that the proposed lane configuration would fit into the right-of-way and function properly at each adjoining intersection. The 6-block Pikes Peak Avenue design is a diagrammatic representation of the proposed lane arrangement from curb to curb. The gray lines represent diagonal parking; the green lines represent designated bike lanes; the red lines represent vehicular lanes; and the blue lines represent center medians with left-hand turn bays for vehicles.

The schematic design proposes a road diet, or a reduction in the number of vehicular lanes, from two in each direction to one in each direction. It also proposes the addition of bicycle lanes and center medians with left-hand turn bays, while maintaining as much on-street diagonal parking as possible. These design decisions are discussed in more detail in the following pages.

Figure 4-10. 6-block Pikes Peak Avenue design (created by author, adapted from CS Utilities GIS data)


N
0
160
320
Diagonal Parking
Vehicular Lanes
Bicycle Lanes
Center Median with
Left Turn Lanes

Site Scale Pikes Peak Avenue

In order to address the thesis and overall project goals, the Pikes Peak Avenue site scale design proposal uniquely responds to each of the five urban streetscape evaluation criteria. These criteria, developed from the literature review, were also used to evaluate the selected case studies and existing site conditions. Therefore, it is logical to analyze and evaluate the final design proposal through the same set of criteria. The design proposal aims to meet the specific design goals outlined in the project framework (Figure 4-1). The following description discusses how these goals were met through various design strategies. The intent is for many of the concepts and strategies from earlier stages of the project to inform and relate to the design decisions for Pikes Peak Avenue.

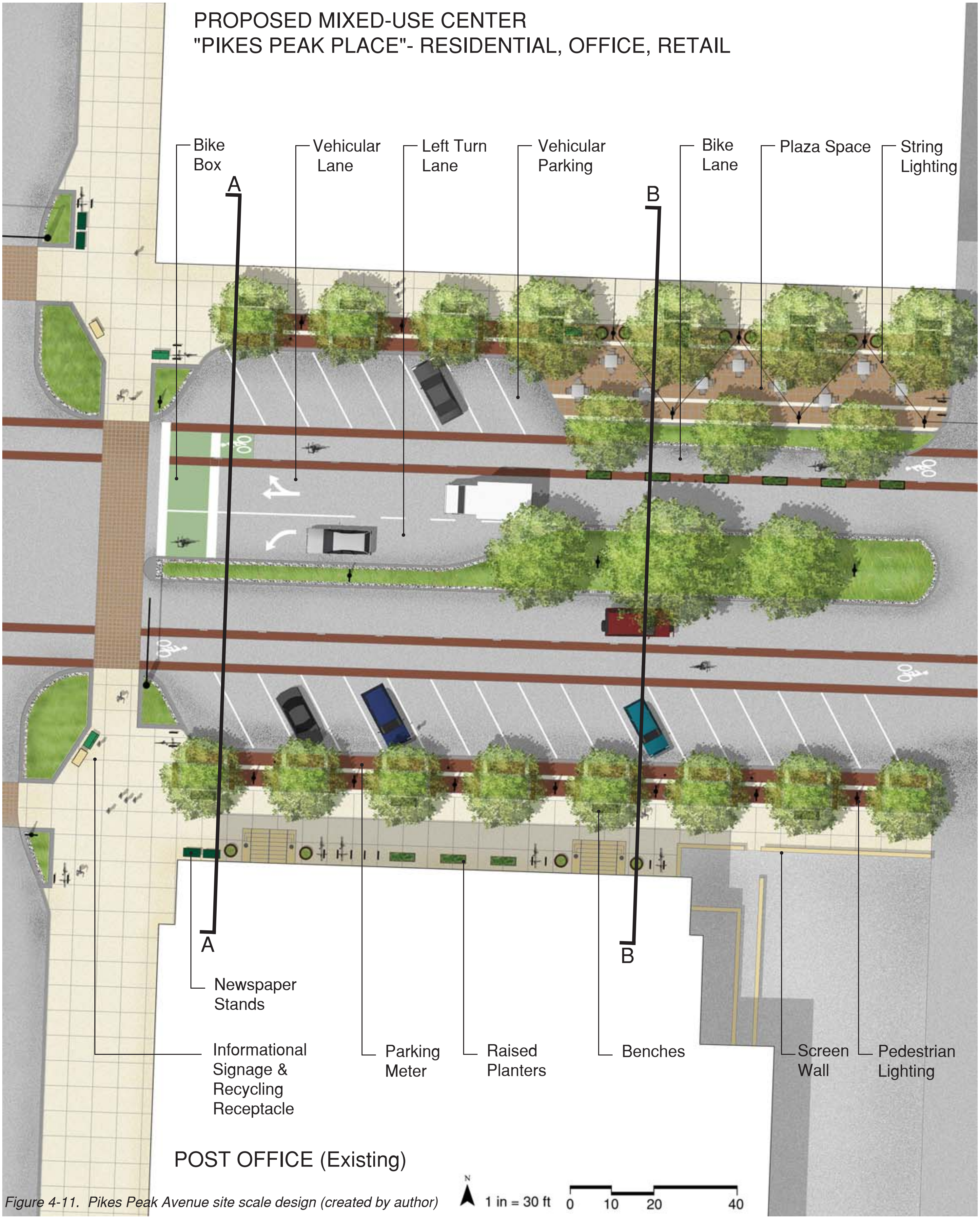
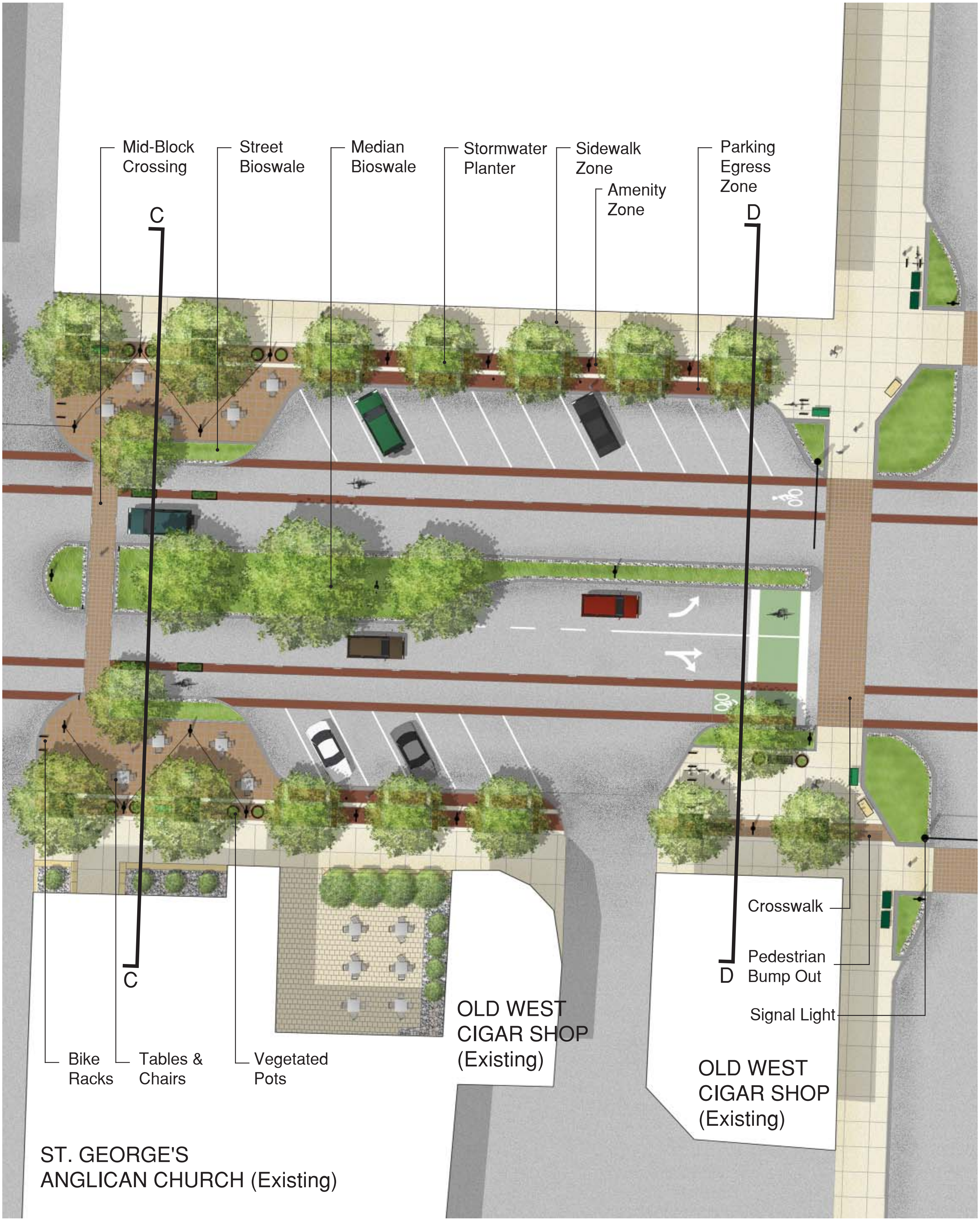


Figure 4-11. Pikes Peak Avenue site scale design (created by author)


Mid-Block Crossing
Street Bioswale
Median Bioswale
Stormwater Planter
Sidewalk Zone
Amenity Zone
Parking Egress Zone
C
D
C
D
Crosswalk
Pedestrian Bump Out
Signal Light
Bike Racks
Tables & Chairs
Vegetated Pots
OLD WEST CIGAR SHOP (Existing)
OLD WEST CIGAR SHOP (Existing)
ST. GEORGE'S ANGLICAN CHURCH (Existing)

Section A-A

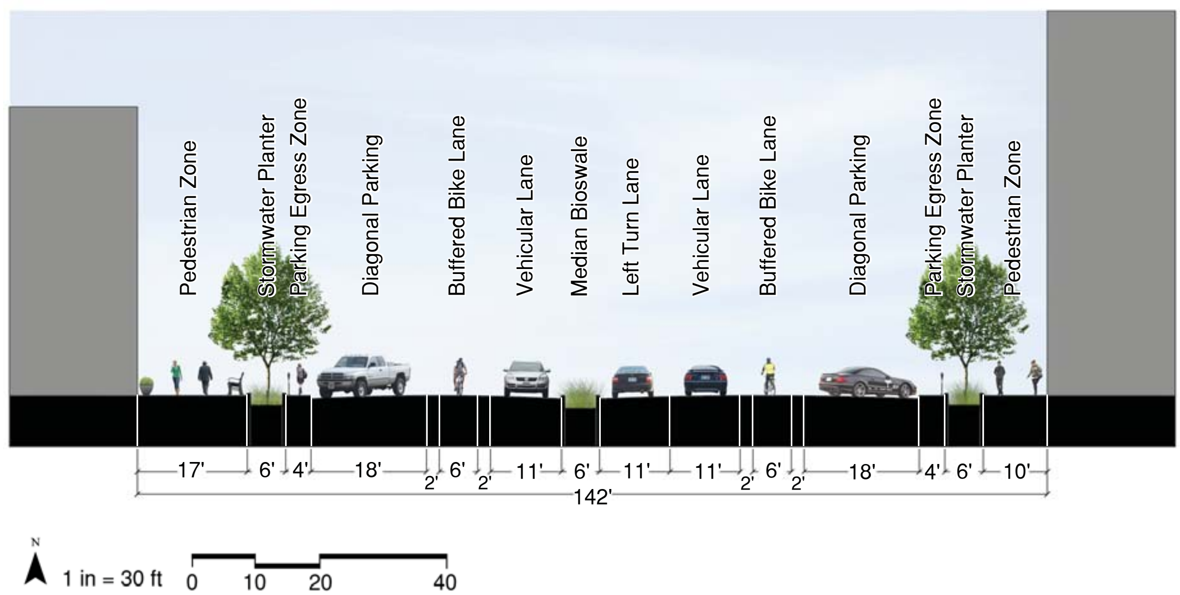


Figure 4-12. Section A-A (created by author)

Section B-B

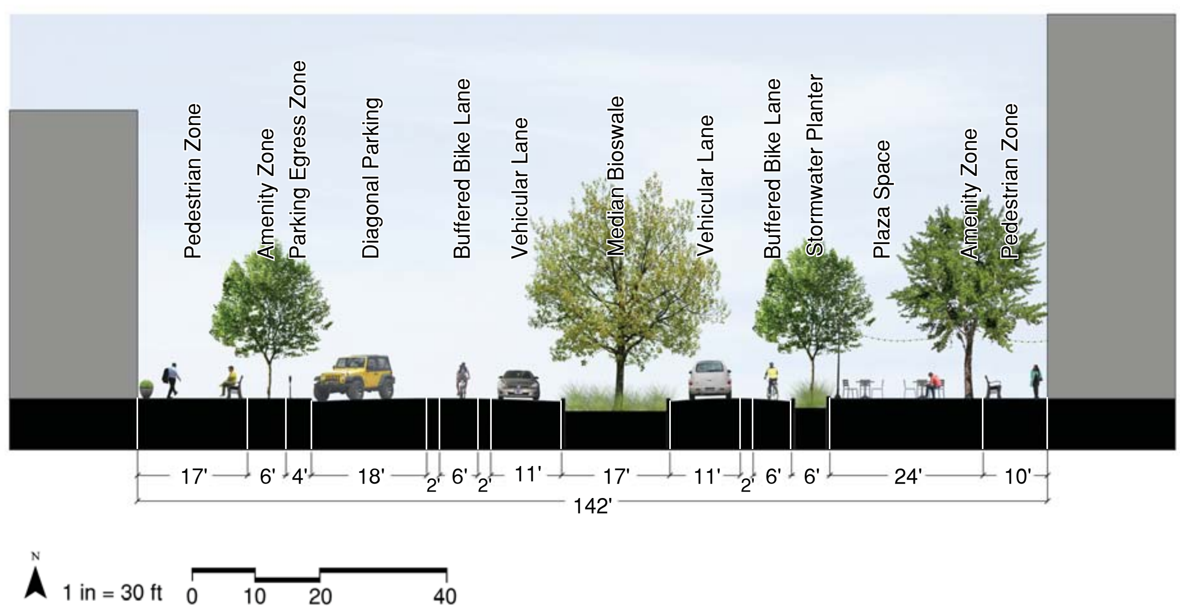


Figure 4-13. Section B-B (created by author)

Section C-C

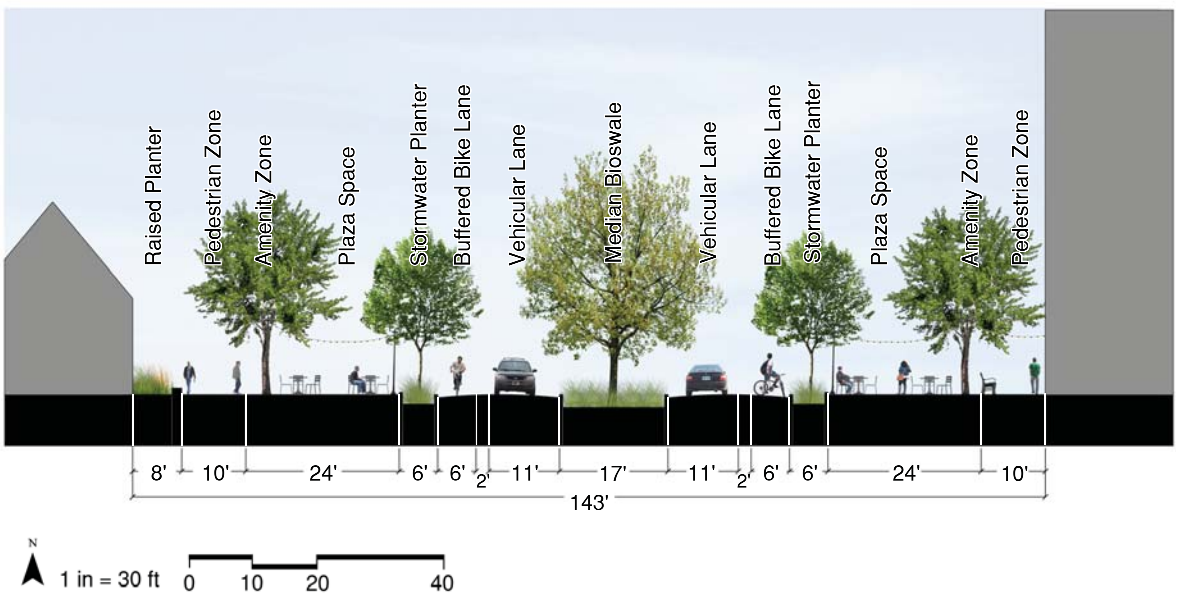


Figure 4-14. Section C-C (created by author)

Section D-D

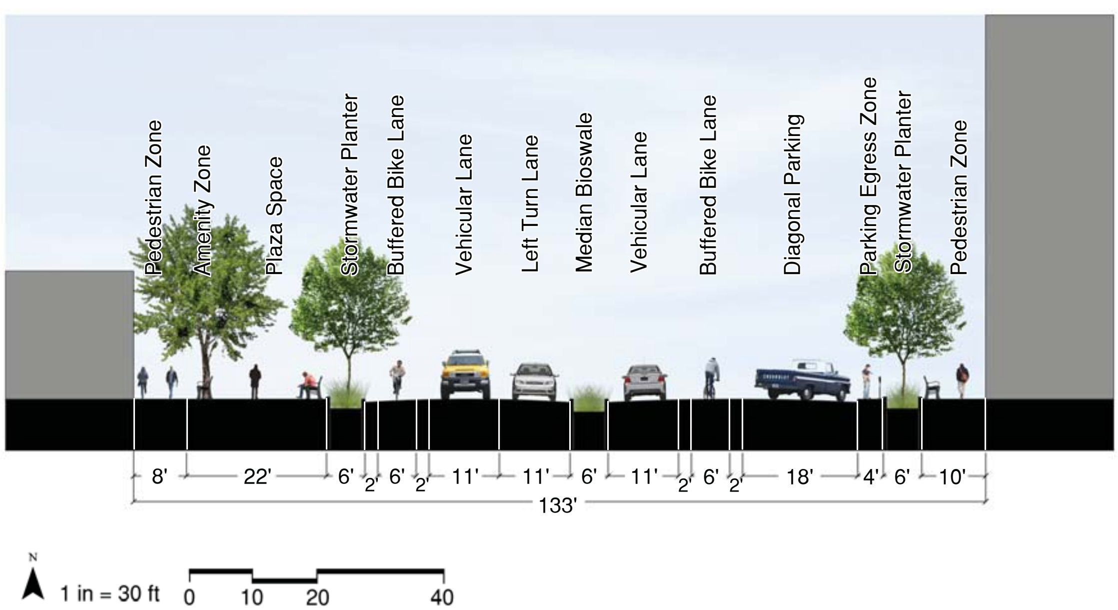


Figure 4-15. Section D-D (created by author)

Function

The first criterion, function, addresses the street's ability to transport people and traffic from one destination to another. As discussed in previous chapters, Pikes Peak Avenue currently includes two vehicular lanes in each direction, a center turn lane, and diagonal parking along both sides of the street. These vehicular lanes and parking spaces account for approximately 100 feet of a 140 foot wide right-of-way. One of the site design goals is to decrease the oversized area dedicated to vehicular traffic. Therefore, the main functional design change is to implement a road diet along the 6-block length of Pikes Peak Avenue. Two traffic lanes in either direction are removed, while a center median with left-hand turn bays is implemented and designated bike lanes are introduced.

There are two significant arguments available to support implementing a road diet on Pikes Peak Avenue. First, in September of 2012, the city of Colorado Springs facilitated a temporary project called "Better Block Pikes Peak." The purpose of BBPP was to experiment with the street layout in order to test new ideas for creating a stronger pedestrian environment. The two-day intervention transformed Pikes Peak Avenue, between Nevada Avenue and Tejon Street, into a pedestrian-oriented street (Olson, 2012). This block of Pikes Peak Avenue, one block west of the project site, currently contains 4 lanes of traffic, a median parking island, and diagonal parking on both sides of the street. The temporary installment removed two lanes, maintained parking on the outer sides of the street, and transformed the center median into a pedestrian realm (Olson, 2012). As part of this experiment, vehicular traffic data was tracked and analyzed to evaluate the consequences of a road diet. Traffic measurements were taken for a few days before the experiment to establish a control set to compare data against. Ultimately, the data showed that the road diet resulted in increased traffic volumes and decreased traffic velocities (Olson, 2012). Better Block Pikes Peak was viewed as a success because vehicular traffic was not impeded by anymore than it is in its present condition, as traffic still made it through the block in one street light cycle (Olson, 2012). Furthermore, time lapse videos show an increase in pedestrian traffic and interaction during the intervention (Olson, 2012).

Second, in the inventory and analysis section, there is a map depicting vehicular traffic volumes (Figure 3-5). This map shows that the 6 block stretch of Pikes Peak Avenue contains medium to low traffic volumes. Although this data is not quantifiable, it suggests that implementing a road diet along Pikes Peak Avenue would not be detrimental to the function of the street nor the ability for cars to travel easily and efficiently from one block to the next.

Furthermore, the design proposes extending the northern curb five feet into the street. Currently the sidewalk on this side of the street measures approximately fifteen feet wide. The curb extension is intended to ensure that all sidewalks are a minimum of twenty feet wide. It is necessary to have a minimum sidewalk width of twenty feet in order to include the proposed stormwater planters and pedestrian amenities.

Safety

The design increases overall safety for motorists, bicyclists, and pedestrians through the use of several design strategies. Various traffic calming measures are proposed to slow vehicular speeds and increase driver awareness of bicyclists and pedestrians. In addressing vehicular safety, the design proposes narrower vehicular lanes. As articulated in the literature review, crash frequencies increase when traffic lanes are widened to 12 or more feet, therefore, this design proposes 11 foot wide vehicular lanes.

In order to improve bicyclist safety, the design proposes designated bike lanes on either side of the street. The NACTO Urban Bikeway Design Guide presents different options for bike lane configuration dependent on existing conditions, constraints, and opportunities. The guide states that a desirable bike lane width adjacent to a curb is 6 feet, therefore, the proposed bike lanes are 6 feet wide. Furthermore, the design proposes buffered bike lanes, which are conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and parking lane (NACTO, 2011). The design proposes 2 foot buffers on either side of the bike lanes in order to create a visual separation between areas intended for vehicles and areas intended for bicycles. These brick buffer zones also include in-ground LED lights that will help distinguish vehicular and bike lanes during the night. The buffer strips continue through the street intersections in order to create a connected bike lane system. The intersection strips will also be a visual indication to drivers that bicyclists are sharing the street. In addition, there are moveable planters creating a physical separation between the vehicular lanes and bike lanes. These planters are located in the buffer zones adjacent to the plaza spaces; they are not continuous through the length of the block since vehicles must be able to cross the bike lane to reach the diagonal parking spaces. It is important to note that these planters are moveable to allow for street maintenance, particularly during winter months when snow will require removal.

Additionally, the design proposes bike boxes, which are designated areas at signalized intersections that provide bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase (NACTO, 2011). The bike boxes, which are 10 feet deep (as recommended by the Urban Bikeway Design Guide), are located at the beginning of each of the traffic lanes. Colored pavement is used as a background color within the bike box to further encourage motorists to stop before the bicycle area (NACTO, 2011). The design proposal extends the bike box across all lanes of traffic, including the bike lane itself, the main vehicular lane and the left-turn vehicular lane. This configuration will increase visibility of bicyclists and prevent intersection collisions with turning vehicles.

The design significantly increases pedestrian safety through intersection bump-outs, paver crosswalks, and a mid-block crossing. The intersection bump-outs reduce roadway width curb to curb, creating shorter crossing distances for pedestrians. Bump-outs also improve driver visibility of pedestrians, slow vehicular traffic speeds, and provide space for enhanced pedestrian amenities. The design proposal also includes a mid block crossing, which is beneficial to Pikes Peak Avenue since block lengths are particularly long and intersection crosswalks spaced far apart. A mid-block crossing will provide a designated location for pedestrians to cross the street without jaywalking. The crossing, strategically located to connect the church plaza space with the future mixed-use center, also includes bump-outs to increase safety for pedestrians. To create uniformity and to signal drivers of potential pedestrian use, the mid-block crossing is paved the same as the intersection crossings. To further enhance safety, the design includes crosswalk buttons that when activated, will light up crosswalk signs to let drivers know that pedestrians are in the street. In-ground LED lights, similar to those used in the bike buffer zones, will line the mid-block crossing, enhancing nighttime visibility. The posted speed limit along Pikes Peak Avenue is 25 miles per hour, the same as residential neighborhood speed limits. Through implementing this design proposal, vehicular speeds will most likely decrease due to the described traffic calming measures, which further indicates the viability of a mid-block crossing.

User-Oriented Spaces

The third criterion, user-oriented spaces, involves the street's inclusion of multifunctional public spaces and pedestrian and bicyclist amenities. As is represented in the graphics, the design intends to create a highly pedestrian-oriented environment. Among the site design goals for Pikes Peak Avenue was to create a multifunctional plaza space. The design proposes a large plaza space adjacent to the future mixed-use center. Additionally, there are two smaller plaza spaces that also serve as pedestrian bump-outs for the mid-block crossing. The larger plaza space is intended to enhance the future mixed-use center and to create a vibrant urban setting, where people can gather, enjoy outdoor dining, or simply sit and people-watch. The smaller plaza spaces are located directly across the street from one another to form the mid-block crossing connection. The southern plaza space is located in front of the church entrance to create a small streetscape gathering location. These plaza spaces contain pedestrian amenities, such as, tables and chairs, benches, pedestrian-scaled lighting, overhead string lighting, street trees, flower pots, and trash and recycling receptacles. Other proposed streetscape amenities include, public art, informational signage, and newspaper stands.

Bike parking is proposed to further encourage bicycle ridership in the downtown district of Colorado Springs. There is currently one moveable bike rack on this block, located in front of the post office, in between the two entrances to the building. The design proposal adds an additional 42 permanent U-shaped bike racks, which could potentially accommodate over 84 bikes, if two bikes are locked to each rack.

By proposing curb bump-outs and extended plaza areas, some parking spaces are lost. Currently there are 30 diagonal parking spaces on the north side, and 25 spaces on the south side, for a total of 55 parking spaces along the block. The design proposal contains 40 diagonal parking spaces, accounting for a total loss of 15 spaces. The loss of parking spaces can be justified in two ways. First, it is feasible to argue that with the addition of 84 bike parking spaces, the overall parking availability of the site significantly increases, even with the loss of 15 vehicular parking spaces. Second, as stated in the inventory and analysis chapter, the ULI Panel reported that the downtown district of Colorado Springs has over 10,000 parking spaces, which is a sufficient supply for the current demand. Therefore, it is not a concerning issue if small amounts of parking are removed in efforts to improve the overall social, environmental, and economic status of downtown. Furthermore, the literature review revealed that limited on-street parking often leads to the use of other transportation options, such as bicycling or mass transit.

Ecology

The ecology criterion addresses the street's inclusion of natural landscaping and stormwater management systems. The design for Pikes Peak Avenue proposes a green infrastructure system, with median bioswales and stormwater planters. The bioswales are located in the pedestrian bump outs, along the plaza edges, and in the center median. The stormwater planters, which are located along the sidewalk edges, are significantly influenced by the SW 12th Avenue Green Street case study from Portland, Oregon.

It is proposed that the street be graded so that there are two crowns, one on either side of the center median, so that water drains towards the center median and towards the sidewalks. Furthermore, as explained in the site inventory chapter, the street has a general drainage flow from west to east. The functional design of the stormwater planters is notably similar to that of the Portland case study. Stormwater runoff from the street enters the first planter through a 1 foot wide curb cut, flows under the parking egress zone, and into the stormwater planter. Upon entering the stormwater planter, the runoff passes over a concrete slab that captures large debris and sediment carried by the water. Each stormwater planter is capable of holding several inches of water (the exact amount of storage needs further study based on soil infiltration rates and vegetation density). If the stormwater planter reaches capacity, the runoff will exit through the second curb cut, flow back into the street and travel east towards the next planter. In the case of a large storm event, and all planters reach capacity, runoff will enter the existing storm sewer system.

Each planter measures 12 feet by 6 feet, with a 4 inch high safety curb around the perimeter. The curb is intended to create a physical and visual barrier between the pedestrian zone and the stormwater planter. Additionally there are in-ground planters on both ends of each stormwater planter, which serve as buffers for pedestrians walking around the planters. In addition to the two curb cuts that collect runoff from the street, there are two 6 inch wide curb cuts on each planter that collect water from the sidewalks.

The aesthetic design of the planters is slightly different from the SW 12th Avenue Green Street. For instance, different species are selected for Pikes Peak Avenue due to the differing climate and precipitation rates in Colorado Springs. In a semi-arid environment, plants must be able to thrive in both dry and wet conditions. Recommended tree species include Rocky Mountain Maple, Rock Mountain Birch, and Paper Birch. Grass species include, Little Bluestem, Butterfly Milkweed, and Aromatic Aster. In order to establish healthy vegetation, the plants may require drip irrigation in the first several months after planting.

In addition to the stormwater planters, there are bioswales in the pedestrian bump outs, along the plaza edges, and in the center median. These bioswales function in the same way as the sidewalk stormwater planters: runoff from the street enters the bioswale through curb cuts and is then filtered and infiltrated into the ground. The proposal includes an edging of rocks along the perimeter of the median bioswale, as well as along the street side of the bioswales located on the plaza edges. The intention of the rock border is to prevent significant erosion and to stop dirt and mud from entering the street through the curb cuts. Furthermore, the rocks will help to create an aesthetic quality fit for the region.

Through a series of estimated calculations, it was determined that the proposed green infrastructure system is capable of capturing 100 percent of a 100 year- 1 hour storm event, and approximately 70 percent of a 100 year-24 hour storm event.

To further address the criterion of ecology, the one-block design proposal introduces 41 new trees to the streetscape. The Littleleaf Linden tree is the recommended species for the tree grates because they are suitable and adaptable street trees. Additionally, permeable paving is located in the parking egress zones, the sidewalk amenity zones, and in the plaza spaces. Permeable paving will allow for further stormwater infiltration.

Identity

The design for Pikes Peak Avenue aims to create a strong identity and a distinct sense of place along the street. One of the preliminary design goals for this site scale was to create a streetscape environment that would convey the essence of Colorado Springs and its historical values, as well as propel the city towards a new and vibrant future. There are multiple proposed design elements that contribute to the identity and atmosphere of the streetscape.

The design embraces the historically wide right-of-way and includes the city's original plans of including landscaped medians. The center parkways help to revive Palmer's vision of creating a "garden city" within the wild west, linking the streetscape to historic values and further creating an identity for the street. Additionally, in efforts to promote modern and future sustainable practices, the median and sidewalks are designed to include bioswales and stormwater planters. The green infrastructure component helps create an identity for the street and has the potential to educate the public about sustainable stormwater management practices.

To further create a strong sense of place, the design proposes implementing informational and historical signage. Informational signage includes map directories, as well as educational signage about the purpose and function of the stormwater planters. The historical signage is suggested as an addition to the various signs and statues located along Pikes Peak Avenue between Cascade and Nevada Avenues. Furthermore, it is suggested to implement additional public art along the length of Pikes Peak Avenue in order to enhance the pedestrian experience and create visual interest.

The identity for a place often lies within the site's details and the uniformity of furnishings, materials, and colors. For instance, the proposed light fixtures (as shown in the perspectives and sections) are consistent with the existing pedestrian-scaled light fixtures along other streets in downtown; such as along the two blocks of Pikes Peak Avenue between Cascade and Nevada Avenues, and along the length of Tejon Street. Consistency in furnishings helps create a uniform design. Furthermore, the string lights included in the plaza areas will create a unique and identifiable atmosphere. The paving materials, also suggested to be uniform along the length of Pikes Peak Avenue, are a combination of poured colored concrete, colored concrete pavers, and brick. The poured colored concrete is located along the sidewalk zones and, as shown on the plan, is a light limestone color. The colored concrete pavers are located in the plaza spaces and along the crosswalks. These permeable pavers are suggested as brown. Colored concrete was selected because it is a relatively affordable and durable paving option. Many of the remaining historical buildings in downtown Colorado Springs are constructed of brick, therefore, the design proposes using red permeable brick in both the parking egress zones and along the amenity zones in order to create a uniform aesthetic in the downtown core.

City Codes and Standards

In order to develop a feasible design proposal for Pikes Peak Avenue, it was necessary to consider both the City Codes as well as the Colorado Springs Traffic Criteria Manual. The site scale design adheres to city standards in order to create a practical and safe streetscape. The following standards were followed:

- Sight line triangles at intersections
- Minimum width of center median
- Minimum curb radii
- Diagonal parking space dimensions
- Drive lane paint standards
- Alleyway access

The design proposal does not follow a couple of the city standards in order to increase safety within the right-of-way and increase potential social and environmental benefits. The following standards were not followed:

- Minimum lane with of 12 feet
- Turn lane design standards (deceleration length and storage length)

The minimum lane with of 12 feet was not followed because studies show that crash frequencies are decreased with narrower lane widths; the recommended width for traffic lanes of vehicular speeds less than 40 miles an hour is 11 feet. Furthermore, the Traffic Criteria Manual outlines a set of guidelines for the design of left turn lanes, with minimum deceleration and storage lengths.

Deceleration and storage lengths are simply measurements of minimum length widths in order to safely accomodate slowing and stopped vehicles at signalized intersections. The standards require extremely long deceleration and storage lengths; for streets with posted speed limits of 25 miles per hour, the required total turn lane length is 235 feet. This measurement is over half of the length of the entire block, which is unnecessary for this site. Therefore, the design proposes left turn lane lengths of 100 feet, with the first 10 feet designated to bike boxes.

The Proposed Design

west portion of Pikes Peak Avenue's site scale block

east portion of Pikes Peak Avenue's site scale block

view of plaza space in front of future mixed use building

view of stormwater planters in front of existing post office

view of mid-block crossing in front of existing church

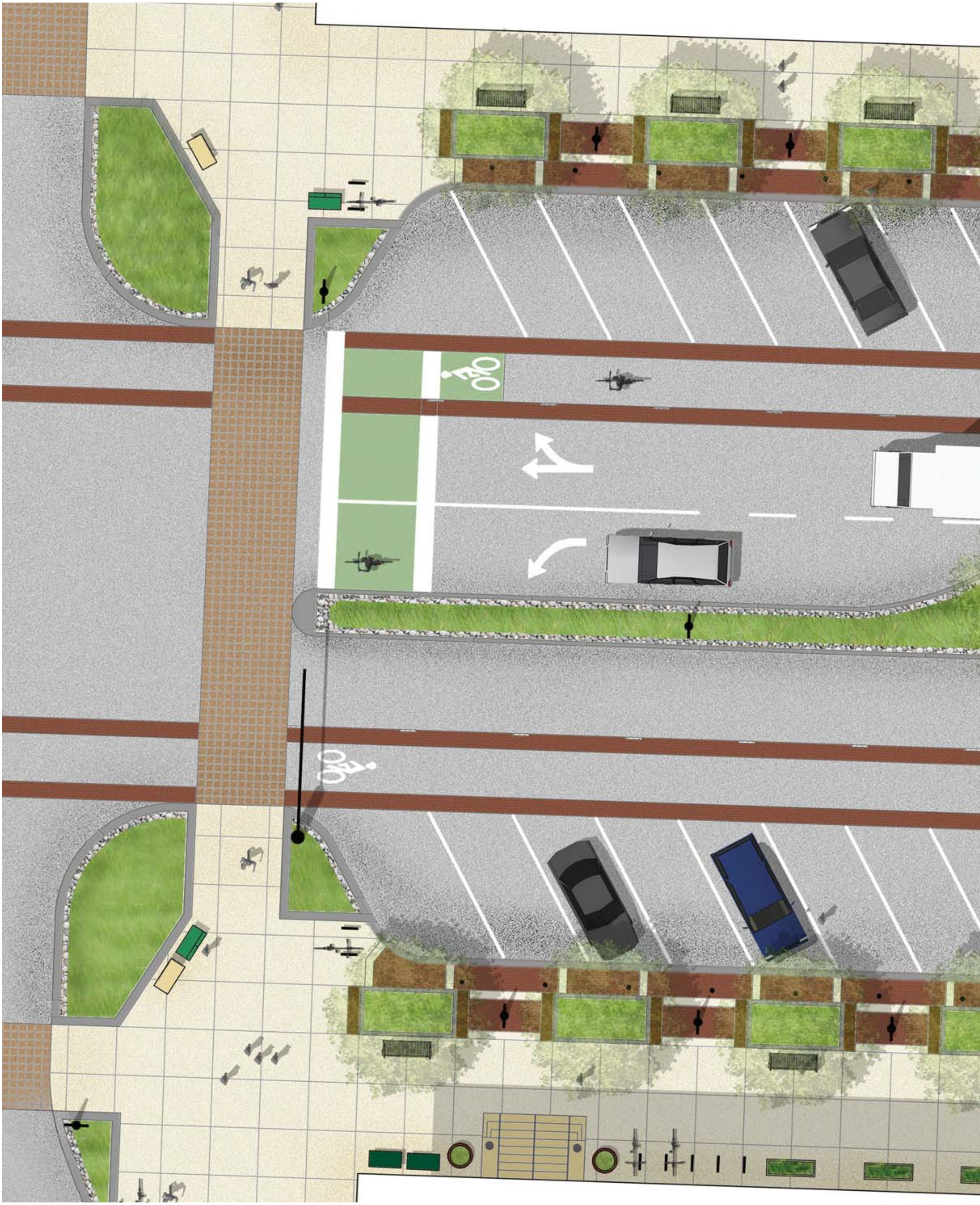
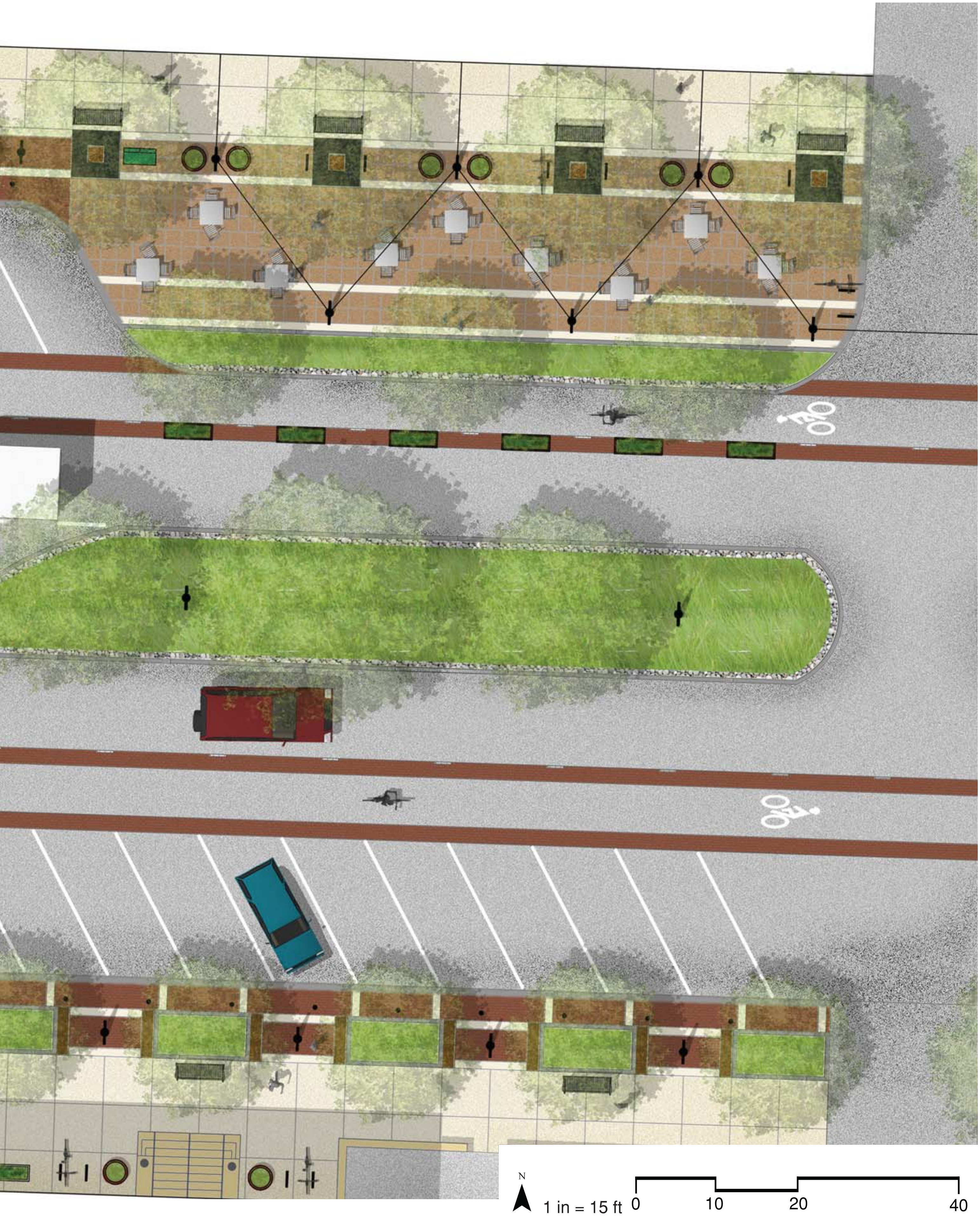


Figure 4-16. West portion of Pikes Peak Avenue's site scale block (created by author)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1 in = 15 ft
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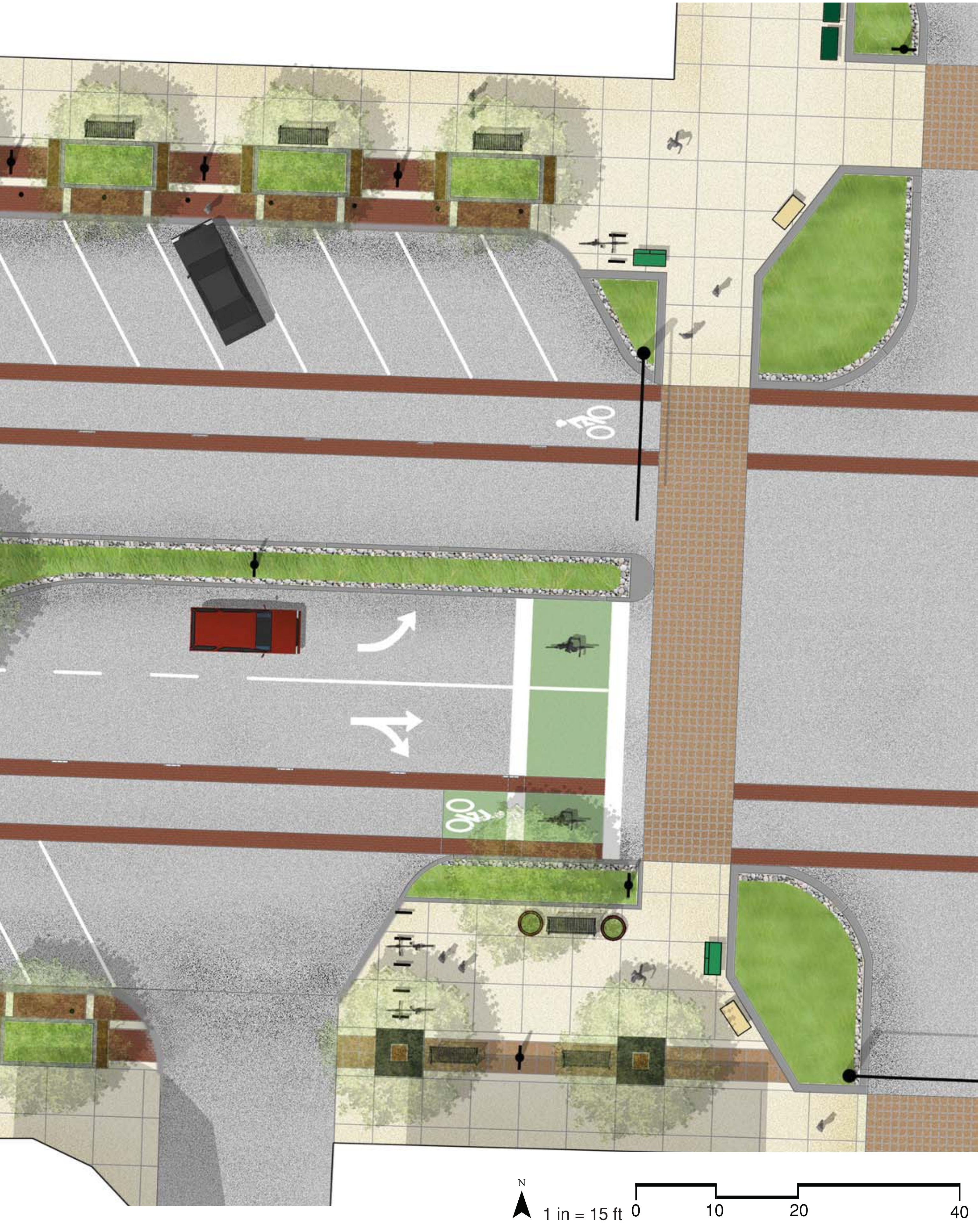
Figure 4-17. East portion of Pikes Peak Avenue's site scale block (created by author)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1 in = 15 ft
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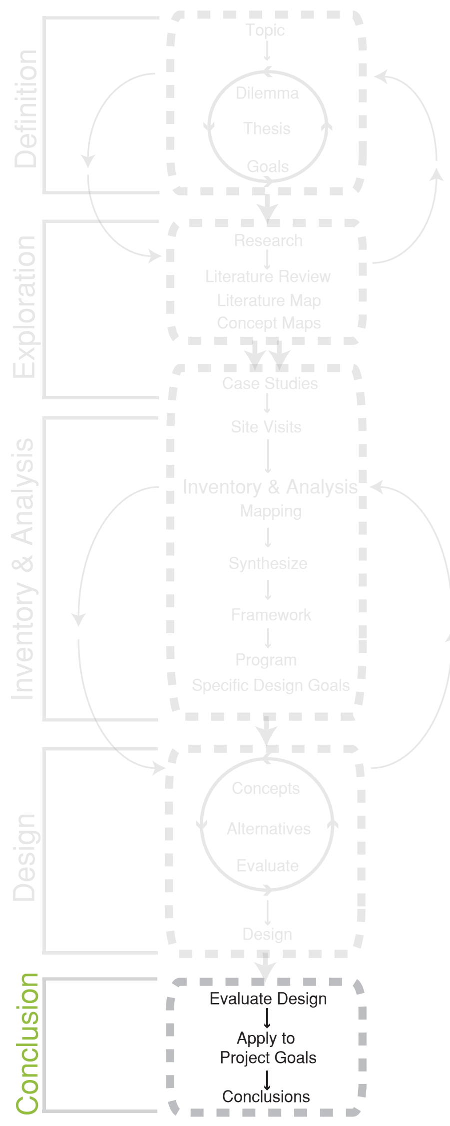
Figure 4-18. View of plaza space in front of future mixed use building, facing west (created by author)

Figure 4-19. View of stormwater planters in front of Post Office, facing west (created by author)


PIKES PEAK

Figure 4-20. View of mid-bock crossing with church in background, facing south (created by author)

Chapter 5: Conclusion



Conclusion

Project Summary

This project presents a potential framework and design solutions for retrofitting the downtown streets of Colorado Springs into multifunctional user-oriented environments. Through the process of conducting a literature review, case studies, and site inventory and analysis, a synthesized framework was developed to help guide and inform design strategies for the Colorado Springs site. The three site scale designs aim to provide a comprehensive approach to addressing the city's goals and exploring potential social, ecological, and economic benefits. The findings of this report and the final design may be useful to the city of Colorado Springs as a visionary model for their downtown streets.

Although the process was applied strictly to the downtown core of Colorado Springs, the literature, design strategies, and project framework could be adapted and applied to other cities and streets around the United States. This project explored and expanded the existing body of research and design application regarding the concepts of complete streets and green streets. The research and project framework provide a method for evaluating and applying streetscape design in order to create enhanced public realms and increase overall social, environmental, and economic benefits.

Considerations

The Pikes Peak Avenue site scale design was conducted for the City Auditorium Urban Renewal Block, where future plans include a mixed-use center and hotel. In order for the design proposal to be successfully strategized and implemented, it is crucial for the streetscape design to respond to the future adjacent land uses and to the design of future buildings. Therefore, the redevelopment of the Urban Renewal Block should coincide with the redevelopment of Pikes Peak Avenue's right-of-way. Furthermore, it will be important to illicit public involvement and input regarding the design strategies for Pikes Peak Avenue in order to create a community approach to revitalizing the downtown core of Colorado Springs.

Limitations and Future Research

Although there is a growing body of research regarding sustainable urban streetscape design, there is a lack of information and precedent projects pertaining to green infrastructure in arid climates. There is currently an insufficient amount of literature discussing the feasibility and functionality of implementing a green stormwater infrastructure system into a semi-arid environment. Although the site scale design for Pikes Peak Avenue proposes a tested sustainable method for stormwater conveyence, further research is necessary to ensure that the system would function properly in the given climate. For instance, although approximate stormwater volume calculations were conducted, variations in precipitation rates and typical drought periods were not taken into consideration. Therefore, before implementing such a strategy, it is necessary to conduct further research about the feasibility of stormwater planters in Colorado Springs and more importantly, about the species selection for the planters and bioswales.

It is important to consider maintenance strategies for the proposed streetscape design. Therefore, it is crucial to consider the effects of snow and ice of the street. Currently, the city of Colorado Springs uses salt to de-ice city streets in winter months. Studies show that salt has negative environmental impacts, such as decreasing the health and survival of vegetation, decreasing water quality, and on the larger scale, decreasing fresh groundwater supply and biodiversity. Some cities have transitioned to using de-icing alternatives, therefore it is feasible to suggest that Colorado Springs switch to using an alternative, such as gravel. In addition, the proposed stormwater planters and curb cuts would need routine maintenance to ensure their proper function. Through researching precedent studies, it was found that similar planters were cleaned out from two to four times a year in order to avoid debris collection. Overall, it is necessary to devise a maintenance plan along with the future design in order to ensure its functional and aesthetic success.

In addition to the previously mentioned topics for further research, there are some related research questions that could be explored in the future.

- How can the surrounding land uses and buildings support the future redevelopment of the downtown streets of Colorado Springs?
- How can the redesign of Colorado Springs' downtown streets enhance business success and overall economic vitality of the city?
- How can proposed streetscape design anticipate and respond to growing populations, increased density, and changing economic markets?

Personal Reflections

This master's report represents the capstone piece of my academic career at Kansas State University. I have not only established an in-depth comprehension of historic and modern urban streetscape design strategies, but have also learned about the entire process of developing and executing research and evidence based design. The process allowed me to explore my individual interests, design process, and goals regarding the future of my career in landscape architecture. An initial interest in streetscape design has transitioned into a greater passion for urban design and the field of landscape architecture.

References

References

ASLA. (2006) ASLA 2006 Professional Awards. Accessed at <http://www.asla.org/awards/2006/06winners/341.html>

ASLA. (2012) 2012 ASLA Professional Awards. Powell Street Promenade. Accessed at < http://www.asla.org/2012awards/349.html>

Bain, L., Gray, B., Rodgers, D. 2012. Living Streets: Strategies for Crafting Public Space. Hoboken, New Jersey: John Wiley and Sons, Inc.

Bertolini Luca, Clercq, Frank le. (2003) Urban development without more mobility by car? Lessons from Amsterdam, a multimodal urban region. Environment and Planning A(4) 575-589

Bikes Belong. Valencia Street Redesign, San Francisco, CA. Accessed at < http://www.bikesbelong.org/what-we-do/federal-policy-funding/why-invest-in-bicycling/valencia-street-redesign-ca/>

Buehler, Ralph, Pucher, John. (2011) Cycling to work in 90 large American cities: new evidence on the role of bike paths and lanes. Springer Science and Business Media, LLC. Accessed at <http://download.springer.com/static/pdf/478/art%253A10.1007%252Fs11116-011-9355-8.pdf?auth66=1354770051_391ba19204771b89d51ca61f57a4c34a&ext=.pdf>

Burden, Dan. (2006) 22 Benefits of Urban Street Trees. Accessed at <http://northlandnemo.org/images/22BenefitsofUrbanStreetTrees.pdf>

City of Colorado Springs. Land Use Review/ Historic Preservation/ Available Documents. Historic Medians. Accessed at < http://www.springsgov.com/Files/HistoricMedians.pdf>

City of Colorado Springs. Traffic Criteria Manual. Accessed at < http://www.springsgov.com/Files/Traffic%20Criteria%20Manual.pdf>

City and County of San Francisco Department of Public Works. Valencia Streetscape Project. Accessed at < http://www.sfdpw.org/index.aspx?page=1174>

Colorado Springs Urban Intervention. Better Block Pikes Peak Vehicular Traffic Data. Accessed at < http://springsurbanintervention.wordpress.com/2012/11/20/better-block-pikes-peak-vehicular-traffic-data/>

Colorado Springs Urban Renewal Authority. City Auditorium Block. Accessed at <http://www.csurbanrenewal.org/csuracityauditor.html>

City of Fort Collins. (2011) Pedestrian Plan Fort Collins. Accessed at <http://www.fcgov.com/planfortcollins/pdf/ped-plan.pdf>

City of Portland. SW 12th Avenue Green Street Project. Accessed at <http://www.portlandonline.com/bes/index.cfm?a=167503&c=45386>

Downtown Development Authority. (2008) Fort Collins Downtown Alleys Master Plan Report. Accessed at < http://www.downtownfortcollins.org/docs/alley-plan.pdf>

Dumbaugh, Eric and Gattis, J.L. (2005) Safe Streets, Livable Streets, Journal of the American Planning Association, 71:3, 283-300. Accessed at <http://www.tandfonline.com/doi/pdf/10.1080/01944360508976699>

Dumbaugh, Eric and Rae, Robert. (2009) Safe Urban Form: Revisiting the Relationship Between Community Design and Traffic Safety, Journal of the American Planning Association, 75:3, 309-329. Accessed at <http://www.tandfonline.com/doi/pdf/10.1080/01944360902950349>

Dwyer, John. F., McPherson, E. Gregory, Schroeder, Herbert W. and Rowntree, Rowan A. (1992) Assesing the Benefits and Costs of the Urban Forest. Journal of Arboriculture 18 (5): September 1992.

Green Streets. (2008) Environmental Services City of Portland. Accessed at < http://www.portlandonline.com/bes/index.cfm?c=45379&a=209685>

Hohlfeld, Ro, Hunstiger, Selina. Portland's Green Streets, SW 12th Avenue. Accessed at <http://courses.washington.edu/gehlstud/WEBSITE_CONTENT/Autumn2008/Portland_Green_Streets.pdf>

Jacobs, Jane. 1961. The Death and Life of Great American Cities. New York: Random House.

Landgren, S., and Costello, S. (2004) Streetscape Restoration Spurs Economic Growth. Urban Land, 63 (11-12), 76-77.

Laplante, John, N., McCann, Barbara. (2008) Complete Streets: We Can Get There from Here. ITE Journal. Accessed at < http://www.smartgrowthamerica.org/documents/cs/resources/cs-ite-may08.pdf>

Lee, Alison and March, Alan. (2010) Recognizing the economic role of bikes: sharing parking in Lygon Street, Carlton, Australian Planner, 47:2, 85-93. Accessed at <http://www.tandfonline.com/doi/pdf/10.1080/07293681003767785>

Lief, J.S. (1994) The Traditionally Styled Streetscape: 35 Design Tips for Revitalizing Downtown. Clem Labine's Traditional Building, 7 (4), 12, 14, 16.

Maloney, Michael K. Imagine Downtown Colorado Springs Master Plan. The City of Colorado Springs. Accessed at < http://www.springsgov.com/Files/Imagine%20Downtown%20Master%20Plan%206-12-09%20Final%20Web.pdf>

McCann, B. and Rynne, S. (2010) Complete Streets: Best Policy and Implementation Practices. American Planning Association: Planning Advisory Service. Report Number 559. Accessed at < http://www.planning.org/pas/brochure/pdf/report.pdf> and at <http://www.smartgrowthamerica.org/documents/cs/resources/cs-bestpractices-chapter5.pdf>

National Association of City Transportation Officials. (2012) Urban Street Design Guide. Accessed at < http://nacto.org/wp-content/uploads/2012/10/NACTOUrbanStreetDesignGuide_Highrez.pdf>

Pegler, Martin M. 1998. Streetscapes. New York: Retail Reporting Corp.

Peninsula Transportation Alternatives. (2012). New Buffered Bike Lanes Benefit Everyone. Accessed at <http://peninsulatransportation.org/page/5/>

Reinvestment Statistics: The Main Street Program's Economic Success. (2012) National Trust for Historic Preservation. Accessed at <http://www.preservationnation.org/main-street/about-main-street/reinvestment-statistics-1.html>

Schellinger, D. and Priest, S. (2006) Getting Streetscape Design Right. Planning, 72 (6), 44-49.

Ronkin, Michael. Road Diets: Designing Streets for Pedestrians and Bicyclists. (2007) Accessed at < http://www.smartgrowthonlineaudio.org/np2007/310c.pdf>

Roth, Matthew. San Francisco Planners Proud of Long List of Road Diets. SF.StreetsBlog.org. Accessed at < http://sf.streetsblog.org/2010/03/31/san-francisco-planners-proud-of-long-list-of-road-diets/>

Sallaberry, Michael. (2000) Valencia Street Bicycle Lanes: A One Year Evaluation. Accessed at < http://industrializedcyclist.com/Valencia_bikelanes.pdf>

Sorvig, K. (2009) Return on Investment: A Colorado Project Proves the Economic Value of Public Landscapes. [Estes Park]. Landscape Architecture, 99 (4), 32-36, 38, 40-41.

Sustainable Artwork Revitalizes Streetscape. (2010) Architecture +Design, 27(6), 92-94.

Trees for Colorado Springs: Suitable as Street Trees. Accessed at <http://www.springsgov.com/units/parksrec/SuitableStreetTrees.pdf>

Tyrvainen, Liisa, Pauleit, Stephan, Seeland, Klaus, and de Vries, Sjerp. Chapter 4: Benefits and Uses of Urban Forests and Trees. Accessed at <http://www.ncsu.edu/biosucceed/biomass/pdf/trees-biosucceed.pdf>

Urban Land Institute Advisory Services Panel Report. (2012) Downtown Colorado Springs Colorado: Strategies for a New Renaissance in Downtown. (Courtesy of Susan Edmondson of the Bee Vradenburg Foundation)

United States Environmental Protection Agency (EPA). Green Infrastructure in Arid and Semi-Arid Climates. Accessed at < http://www.epa.gov/npdes/pubs/arid_climates_casestudy.pdf>

United States Environmental Protection Agency (EPA) Low Impact Development and Green Infrastructure in the Semi-Arid West. Accessed at <http://www.epa.gov/region8/greeninfrastructure.html>

United States Environmental Protection Agency (EPA). Why Green Infrastructure? Accessed at <http://water.epa.gov/infrastructure/greeninfrastructure/gi_why.cfm#WaterQuality>

US 2010 Census data. Accessed at <http://2010.census.gov/2010census/popmap/ipmtext.php?fl=08>

Wolf, Kathleen L. (2009) Trees Mean Business: City Trees and the Retail Streetscape. The Monthly Journal of the National Trust. Accessed at <http://www.fs.fed.us/pnw/research/gcra/pdfs/pnw_2009_wolf003.pdf>

Wolf, Kathleen L. (2004)Nature in the Retail Environment: Comparing Consumer and Business Response to Urban Forest Conditions. Landscape Journal 23: 1-04.

Yang, Bo. (2012) Cherry Creek North Improvements and Fillmore Plaza. Case Study Briefs. Landscape Architecture Foundation. Accessed at < http://lafoundation.org/research/landscape-performance-series/case-studies/case-study/502/>

Zeisel, John. (1984) Inquiry By Design: Tools for Environment- Behavior Research. Cambridge: Cambridge University Press.

Image Citations

Figure 1-7: Panorama of Colorado Springs. 1895. Drawing. Courtesy of the Colorado Springs Pioneer's Museum.

Figure 1-8: Pikes Peak Avenue and Antlers Hotel with Pikes Peak in the distance. 1910. Drawing. Courtesy of the Colorado Springs Pioneer's Museum.

Figure 1-9: Historical view of downtown Colorado Springs. 1882. Drawing. Courtesy of the Colorado Springs Pioneer's Museum.

Figure 1-10: Present day view of downtown along Pikes Peak Avenue. n.d. Courtesy of the Colorado Springs Convention and Visitors Bureau.

Figure 1-11: Aerial view of downtown Colorado Springs. n.d. Courtesy of the Colorado Springs Convention and Visitors Bureau.

Figure 1-12: View of historical cowboy statue on Pikes Peak Avenue. n.d. Courtesy of the Colorado Springs Convention and Visitors Bureau.

Figure 1-13: Whitford, Katie. 2013. Downtown district scale. Source data: Colorado Springs Utilities. "RGB20104," "RGB20103".

Figure 1-14: Whitford, Katie. 2013. 6-block Pikes Peak Avenue corridor. Source data: Colorado Springs Utilities. "RGB20104," "RGB20103".

Figure 1-15: Whitford, Katie. 2013. Urban Renewal Block. Adapted from the City Auditorium Block image from the Colorado Springs Urban Renewal Authority. Original accessed at <http://www.csurbanrenewal.org/csuracityauditor.html>

Figure 1-16: Whitford, Katie. 2013. Site scale block. Source data: Colorado Springs Utilities. "RGB20104," "RGB20103".

Figure 2-1: Fillmore Plaza as a pedestrian-only street before redesign. n.d. Photograph. Courtesy of Landscape Architecture Foundation. Accessed January 2013. Reproduced from "Cherry Creek North Improvements and Fillmore Plaza," http://www.lafoundation.org/research/landscape-performance-series/case-studies/case-study/502/.

Figure 2-2: Fillmore Plaza as a shared-use street after redesign. n.d. Photograph. Courtesy of Landscape Architecture Foundation. Accessed January 2013. Reproduced from "Cherry Creek North Improvements and Fillmore Plaza," http://www.lafoundation.org/research/landscape-performance-series/case-studies/case-study/502/.

Figure 2-3: View of curb bump out. n.d. Photograph. Courtesy of Landscape Architecture Foundation. Accessed January 2013. Reproduced from "Cherry Creek North Improvements and Fillmore Plaza," http://www.lafoundation.org/research/landscape-performance-series/case-studies/case-study/502/.

Figure 2-4: Wide sidewalks with pedestrian lighting and amenities. n.d. Photograph. Courtesy of Landscape Architecture Foundation. Accessed January 2013. Reproduced from "Cherry Creek North Improvements and Fillmore Plaza," http://www.lafoundation.org/research/landscape-performance-series/case-studies/case-study/502/.

Figure 2-16: Enhanced pedestrian realm. n.d. Photograph. Courtesy of City and County of San Francisco Department of Public Works. Accessed March 2013. Reproduced from "Valencia Streetscape Project," http://www.sfdpw.org/index.aspx?page=1174.

Figure 2-17: Designated bike lane. n.d. Photograph. Courtesy of Peninsula Transportation Alternatives. Accessed March 2013. Reproduced from "New Buffered Bike Lanes Benefit Everyone," http://peninsulatransportation.org/page/5/.

Figure 2-18: Valencia street post. n.d. Photograph. Courtesy of City and County of San Francisco Department of Public Works. Accessed March 2013. Reproduced from "Valencia Streetscape Project," http://www.sfdpw.org/index.aspx?page=1174.

Figure 2-19: Valencia Street lane configuration. Courtesy of Google Earth Imagery.

Figure 2-20: Bike lane and parallel parking. Courtesy of Google Earth Imagery.

Figure 3-1: Whitford, Katie. 2013. General map. Source data: Colorado Springs Utilities. "Roadway," "Buildings," "Park Land," "Urban Trails," "Railroad."

Figure 3-2: Whitford, Katie. 2013. Land use. Source data: Colorado Springs Utilities. "Land use."

Figure 3-3: Whitford, Katie. 2013. Population density. Source data: Colorado Springs Utilities. "CensusBlocks2010."

Figure 3-4: Whitford, Katie. 2013. Existing bus routes. Source data: Colorado Springs Utilities. "Roadway".

Figure 3-5: Whitford, Katie. 2013. Traffic volume. Source data: Colorado Springs Utilities. "Roadway."

Figure 3-6: Whitford, Katie. 2013. Street width. Source data: Colorado Springs Utilities. "Roadway."

Figure 3-7: Whitford, Katie. 2013. Existing bike lanes. Source data: Colorado Springs Utilities. "Roadway."

Figure 3-8: Whitford, Katie. 2013. Street Hierarchy Master Plan. Source data: Colorado Springs Utilities. "Roadway."

Figure 3-9: Whitford, Katie. 2013. General map. Source data: Colorado Springs Utilities. "Buildings," "Streets," "ParkLand."

Figure 3-10: Whitford, Katie. 2013. Land use. Source data: Colorado Springs Utilities. "Land use," "Roadway."

Figure 3-11: Whitford, Katie. 2013. Utilities infrastructure. Source data: Colorado Springs Utilities. "whydrant," "wmains," "wabadondl," wwgmain," "wwmanhl," gmain."

Figure 3-12: Whitford, Katie. 2013. Utilities infrastructure 2. Source data: Colorado Springs Utilities. "priug125," "prioh125," "supprtst."

Figure 3-13: Whitford, Katie. 2013. Parking garages and surface lots. Source data: Colorado Springs Utilities. "Buildings," "Streets."

Figure 3-14: Whitford, Katie. 2013. On-street parking. Source data: Colorado Springs Utilities. "Buildings," "Streets."

Figure 3-15: Whitford, Katie. 2013. Vehicular Circulation. Source data: Colorado Springs Utilities. "Buildings," "Streets."

Figure 3-16: Whitford, Katie. 2013. Existing bike sharrows and parking. Source data: Colorado Springs Utilities. "Buildings," "Streets."

Figure 3-20: Whitford, Katie. 2013. Existing pedestrian amenities. Source data: Colorado Springs Utilities. "Buildings," "Streets."

Figure 3-23: Whitford, Katie. 2013. Public art displays. Source data: Colorado Springs Utilities. "Buildings," "Streets."

Figure 3-27: Whitford, Katie. 2013. Existing street trees. Source data: Colorado Springs Utilities. "Buildings," "Streets."

Figure 3-30: Whitford, Katie. 2013. Topography. Source data: Colorado Springs Utilities. "Buildings," "Streets," "Contours."

Figure 3-31: Whitford, Katie. 2013. Drainage flow and stormwater inlets. Source data: Colorado Springs Utilities. "Buildings," "Streets," "Contours."

Figure 4-2: Whitford, Katie. 2013. Existing program elements. Source data: Colorado Springs Utilities. "Roadway," ParkLand," "UrbanTrails."

Figure 4-3: Whitford, Katie. 2013. Proposed gateways. Source data: Colorado Springs Utilities. "Roadway."

Figure 4-4: Whitford, Katie. 2013. Proposed street car routes. Source data: Colorado Springs Utilities. "Roadway."

Figure 4-5: Whitford, Katie. 2013. Proposed pedestrian spines. Source data: Colorado Springs Utilities. "Roadway."

Figure 4-6: Whitford, Katie. 2013. Existing bike lanes. Source data: Colorado Springs Utilities. "Roadway."

Figure 4-7: Whitford, Katie. 2013. Proposed bike lanes. Source data: Colorado Springs Utilities. "Roadway."

Figure 4-8: Whitford, Katie. 2013. Composite bike lane network. Source data: Colorado Springs Utilities. "Roadway," ParkLand," "UrbanTrails."

Figure 4-9: Whitford, Katie. 2013. Composite framework plan. Source data: Colorado Springs Utilities. "Roadway," "ParkLand," "UrbanTrails."

Figure 4-10: Whitford, Katie. 2013. 6-block Pikes Peak Avenue design. Source data: Colorado Springs Utilities. "Buildings," "Streets," "ParkLand."

Figure A-10. Whitford, Katie. 2013. Existing section cut locations. Source data: Colorado Springs Utilities. "RGB20104," "RGB20103".

Appendices

Concept Maps

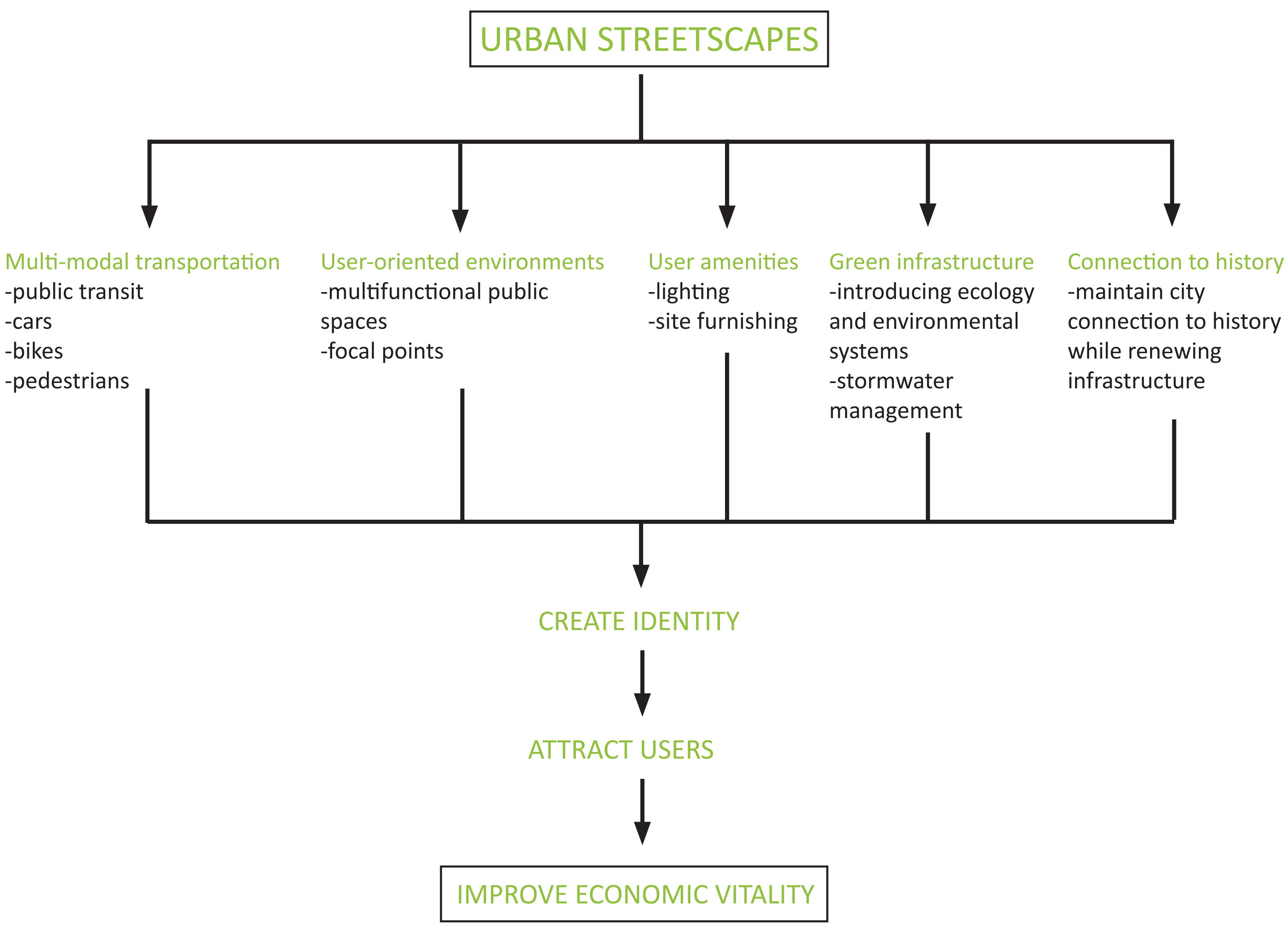


Figure A-1. Flow chart concept map (created by author)

Project Timeline

(See next page)

In order to complete required tasks by assigned deadlines, it was essential to create a work plan and timeline for the academic school year. As shown in the timeline graphic on the following pages, the fall semester is dedicated to defining and researching the topic, while the spring semester is dedicated to analysis and design of the site in Colorado Springs (Figure #). The allotted amount of time for each task is represented with solid green blocks, while secondary tasks are represented in lighter green blocks. Many of the blocks overlap horizontally, showing that certain tasks were conducted simultaneously, representing a non-linear design process. The vertical lines indicate project deadlines, reviews, and presentations. The bolder lines represent the most important deadlines. Several tasks were also completed during scheduled school breaks. Most importantly, winter and spring breaks allowed time to conduct site visits to the Colorado-located case studies as well as to my project site in Colorado Springs.

Figure A-2. Topic exploration concept map (created by author)

Project Timeline

1st Semester

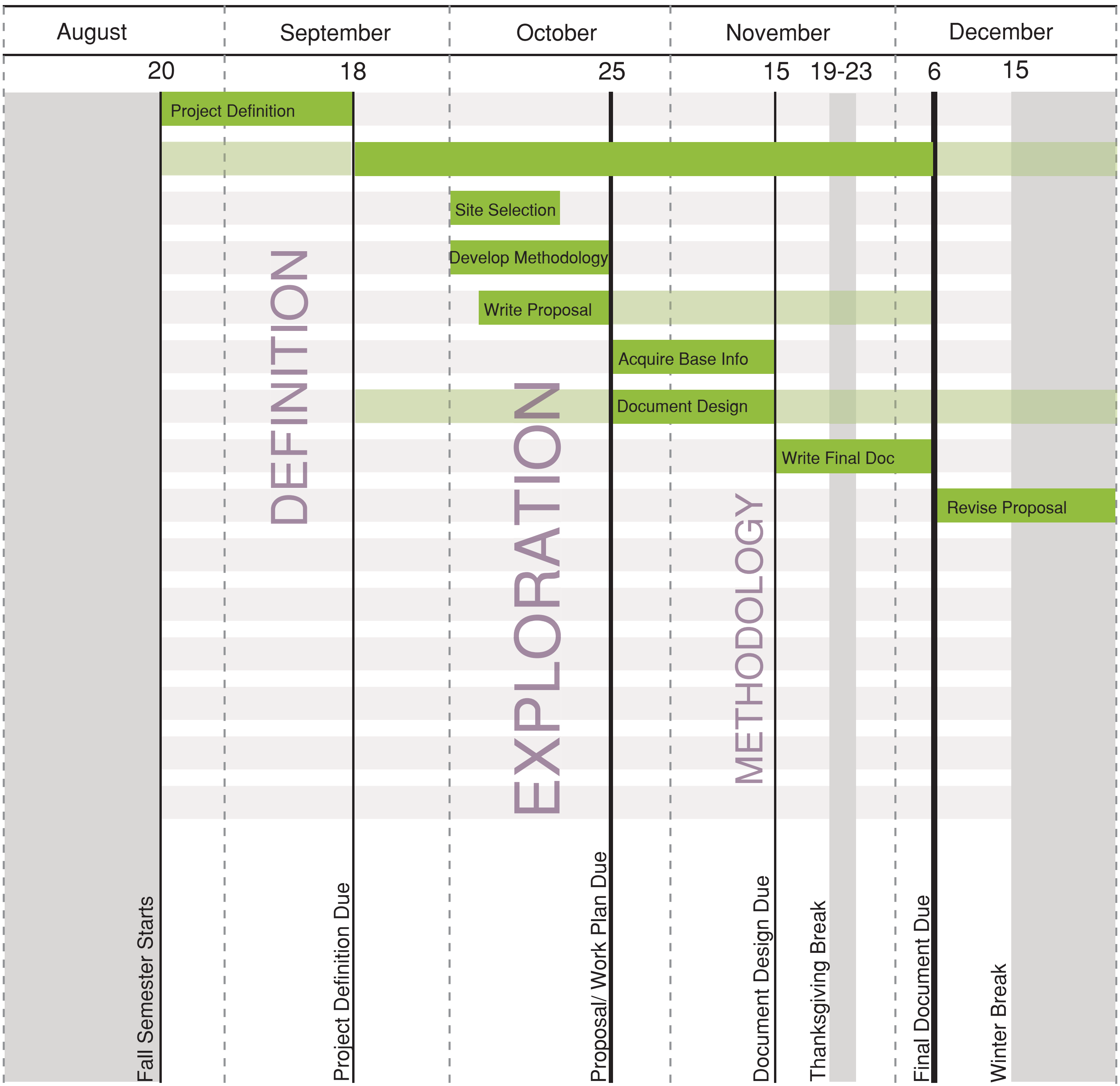
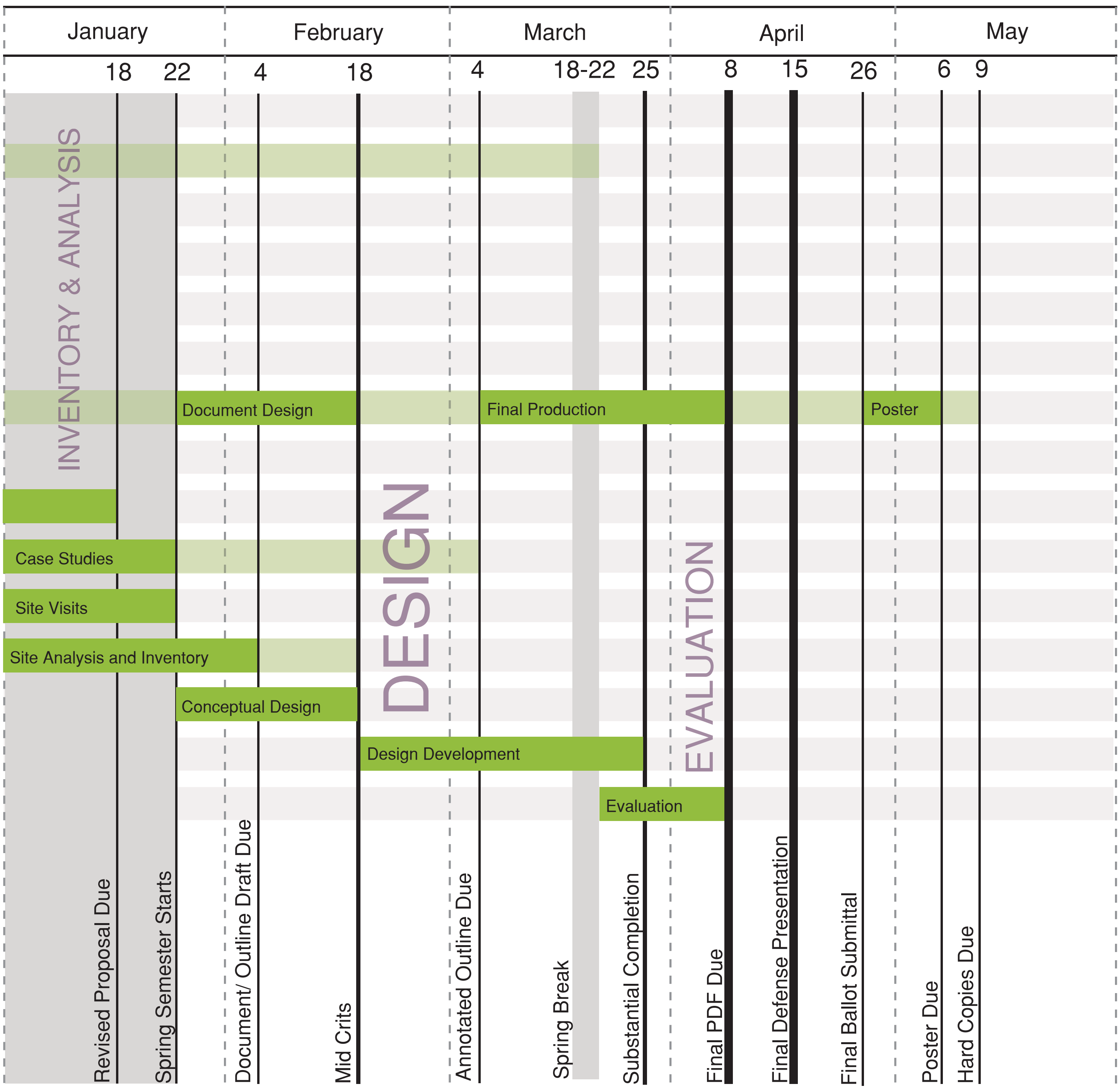


Figure A-3. Project timeline (created by author)

2nd Semester



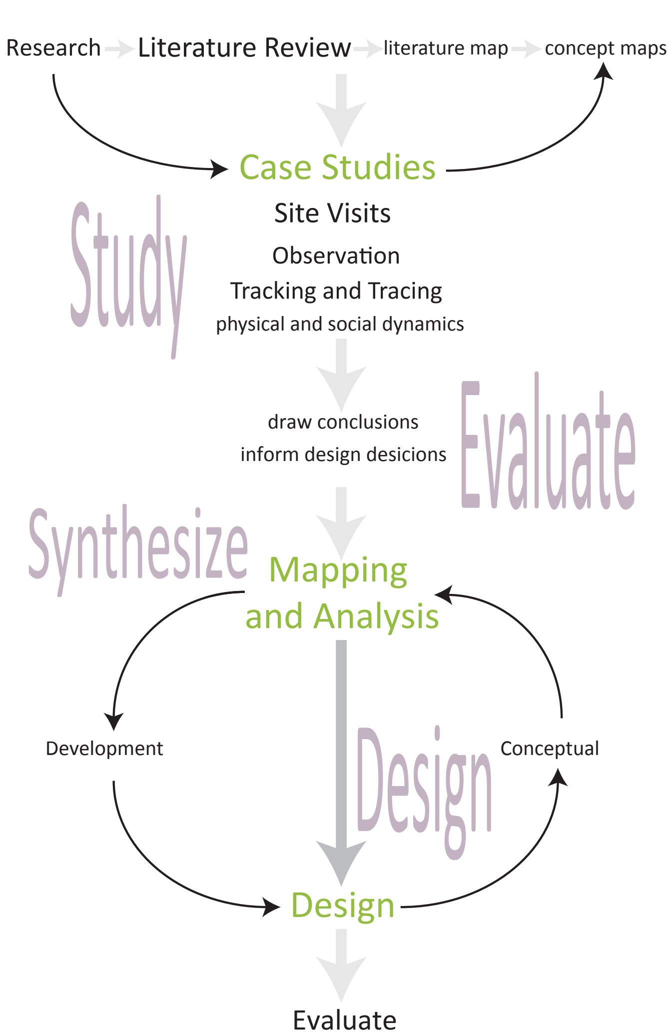


Figure A-4. Methodology diagram (created by author)

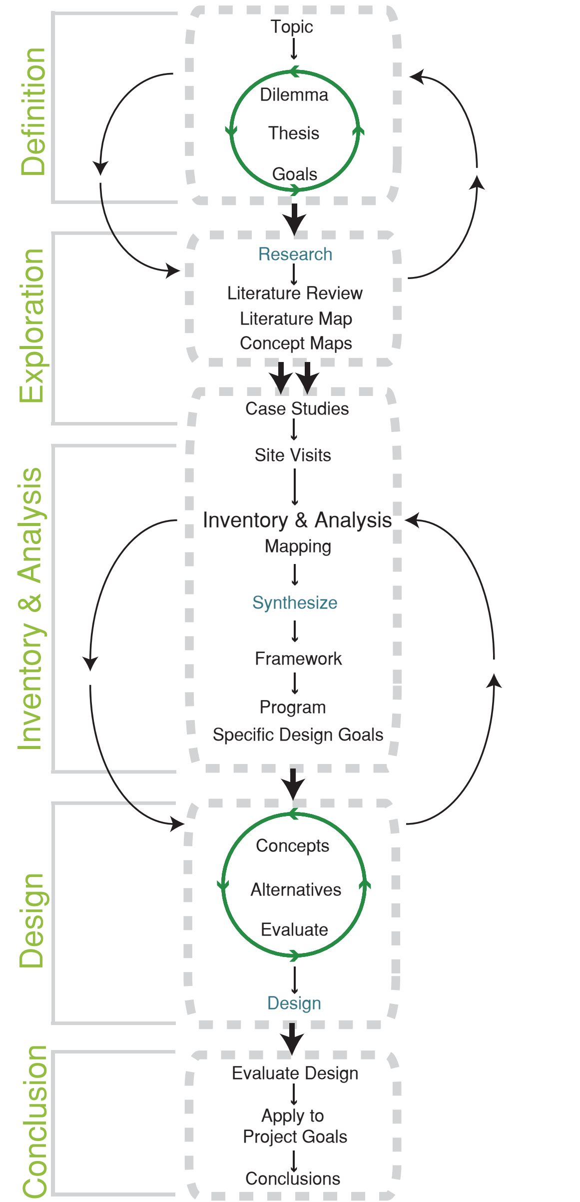


Figure A-6. Final design process diagram (created by author)

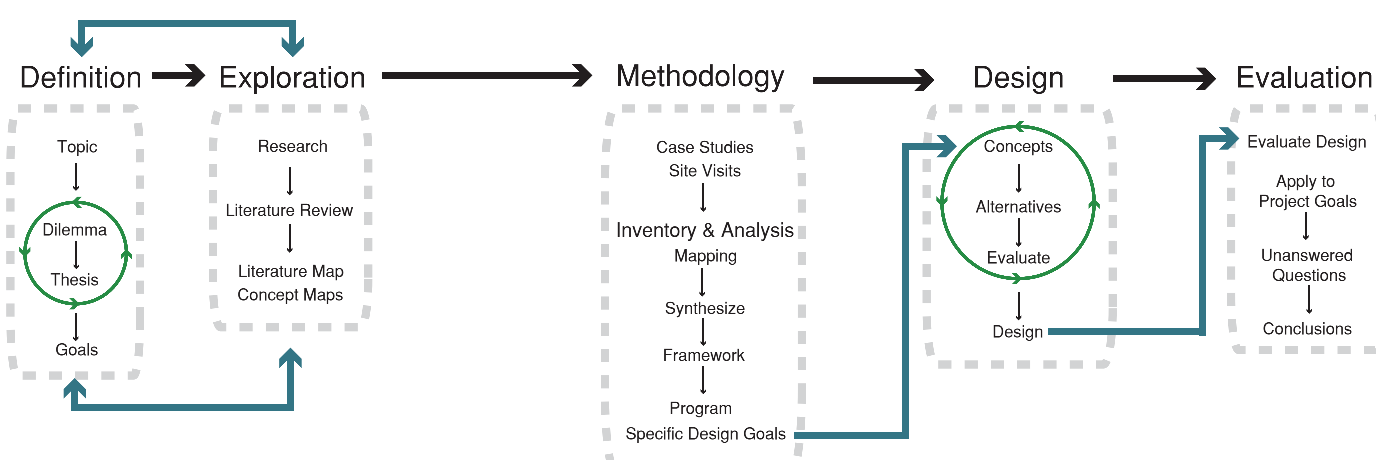


Figure A-5. Preliminary design process diagram (created by author)

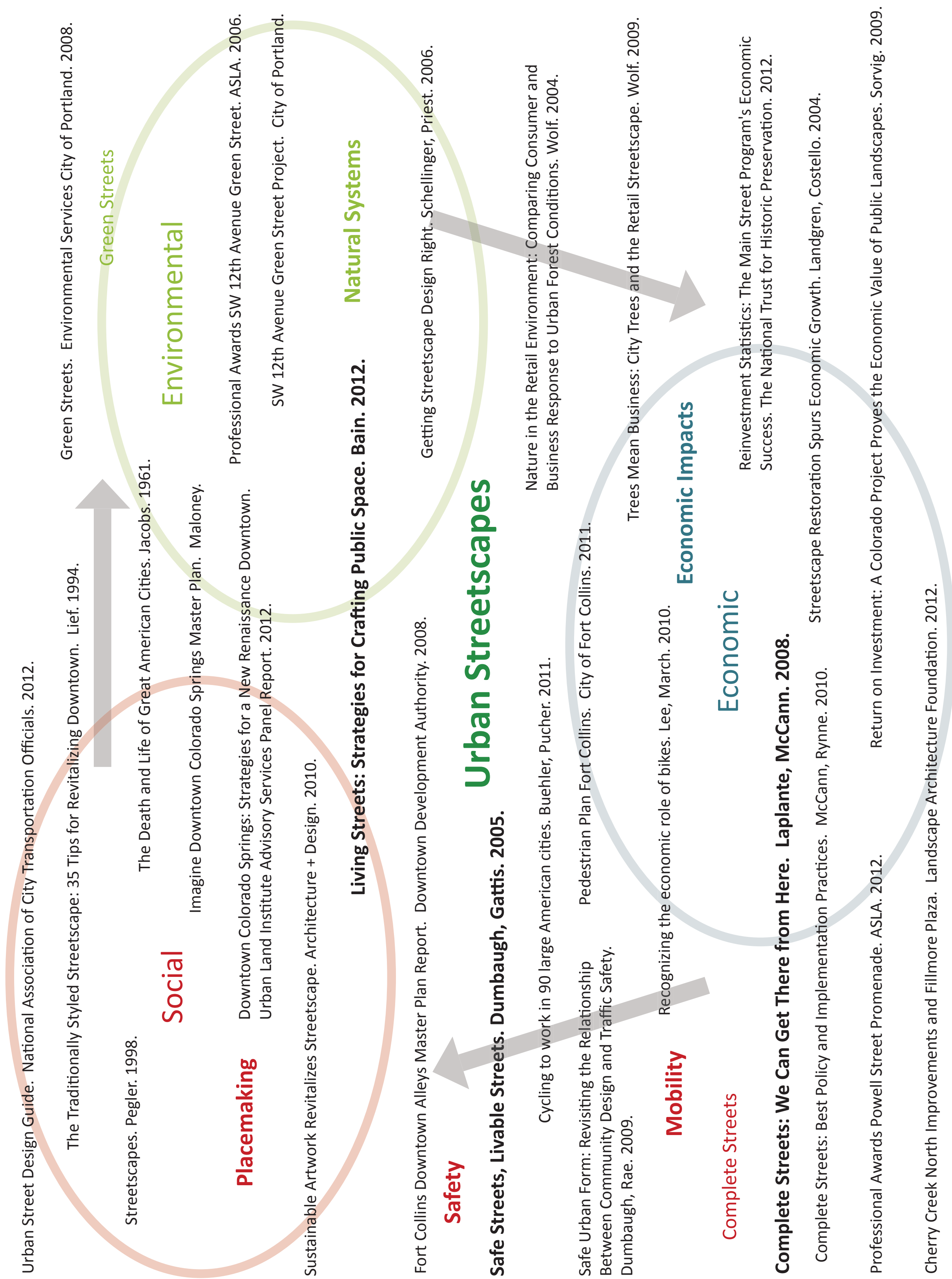


Figure A-7. Literature map (created by author)

Research Methods

Tracking and Tracing

John Zeisel, the author of Inquiry By Design: Tools for Environment- Behavior Research, discusses both tracking and tracing methods, although he does not use those terms to describe the act of observation. Instead, he uses the phrases "observing environmental behavior" and "observing physical traces" (Zeisel, 1984). According to Zeisel, observing behavior is the process of systematically watching people use their environments. Furthermore, observing behavior in a particular environment generates data about people's activities and the relationships needed to sustain them. There are several useful methods for recording observations, including, notations, pre-coded checklists for counting, floor plans or maps, photographs, and video recordings. Notes should be taken in two separate columns, one for observation and one for comments, so that analyses are kept separate from objective observations. If a researcher needs to know how often an activity occurs, they can use qualitative observation data to develop a pre-coded checklist for counting. Maps are also useful to record sequences of behavior in places where people have a choice of several paths. In order to simplify behavioral observation, Zeisel breaks it down into elements: actor, act, significant others, relationships, socio-cultural context, and physical setting. In other words, "who is doing what with whom? In what relationship, in what context, and where? (Zeisel, 1984)." Observing physical traces is a process of systematically looking at physical surroundings to find evidence of previous activity (Zeisel, 1984). After discovering a piece of evidence, researchers ask questions about what caused it, what the person who created it intended, and what sequence of events led to it. It is also extremely important to observe traces that do not stand out or traces that are missing because the researcher will begin to see what is and is not there. Similarly to the tracking method discussed above, there are various devices used to record observations of physical traces. Annotated diagrams and drawings are helpful to show the organization of spaces, the location of certain elements, and numbers of people using specific spaces. Additionally, photographs are helpful in capturing existing conditions and can be used for later revision and analysis. Zeisel devised a list of physical traces to look for when observing a site (shown below). Under by-products of use, he suggests looking for erosions, such as trampled grass or worn paving. However, since most environments sustain wear and tear, observers must distinguish erosion traces that show bad design, those that reflect uses designers planned for, and traces left when certain activities occurred (Zeisel, 1984). Observers should also look for leftovers, or evidence left behind to indicate what kinds of activities happened in a specific space. Furthermore, erosions and leftovers indicate what people do and when neither of these are seen, it indicates what people do not do- missing traces. Zeisel discusses adaptations for use, which is when people add or remove things from a setting, and create physical or visual separations and connections. Overall, Zeisel's tracking and tracing methods are a useful way to understand how people use their environments and how the environment affects the user's behavior (Zeisel, 1984).

Observing Environmental Behavior	Observing Physical Traces
Qualities of the Method	*Qualities of the Method*
Empathetic	Imageable
Direct	Unobtrusive
Dynamic	Durable
Variably intrusive	Easy
Observer's Vantage Points	*Recording Devices*
Secret outsider	Annotated diagrams
Recognized outsider	Drawings
Marginal participant	Photographs
Full participant	Counting
Recording Devices	*What to Look For*
Notation	By-products of use
Pre-coded checklists	Adaptations for use
Maps	Displays of self
Photographs	Public messages
Videotapes and movies	Context
What to Observe	
Who: actor	
Doing what: Act	
With whom: significant others	
Relationships	
Context	
Setting	

Elements in Environmental Behavior		Physical Traces to Look for
Who is	Actor	*By-products of Use*
doing *what*	Act	Erosions
with *whom*?	Significant Others	Leftovers
In what *relationship*,	Relationships	Missing Traces
	aural, visual, tactile,	*Adaptations for Use*
	olfactory, symbolic	Props
in what *context,*	Sociocultural Context	Separations
	situation	Connections
	culture	*Displays of Self*
and *where*?	Physical Setting	Personalization
		Identification
		Group Membership
		Public Messages
		Official
		Unofficial
		Illegitimate

(Zeisel, 1984).

Colorado Springs- Pikes Peak Avenue

OBSERVATIONS	COMMENTS
Function context (surrounding land uses) size, length, width (pedestrian zone, bike zone, vehicular zone)	**Function** the street's ability to transport people and traffic from one destination to another
Safety crosswalks bike amenities (bike lanes, sharrows, parking)	**Safety** the street's ability to provide a safe environment for all users: motorists, bicyclists, and pedestrians
User-oriented spaces amenities (furnishings) public space (plazas, parks)	**User-oriented spaces** the street's success in providing multifunctional public spaces and pedestrian and bicyclist amenities
Ecology landscaping (natural habitat) stormwater management systems	**Ecology** the street's inclusion of ecological features and stormwater management systems
Identity connection to history (signage) details (bollards, lighting, paving)	**Identity** the street's success in creating a strong identity for the place

Figure A-8. Site visit chart (created by author)

Behavior Observation (Tracking)	**Physical Traces (Tracing)**
Who is doing what with whom? In what relationship, in what context, and where?	Erosions Leftovers Missing traces Props Separations Connections
What are people doing? How do activities relate to one another spatially? How does the space influence users?	What activities take place in particular settings? How do environments create opportunities for people? How do users impact the space through their use?
Notes:	

Figure A-9. site visit chart 2 (created by author)

Existing Sections Along Pikes Peak Avenue

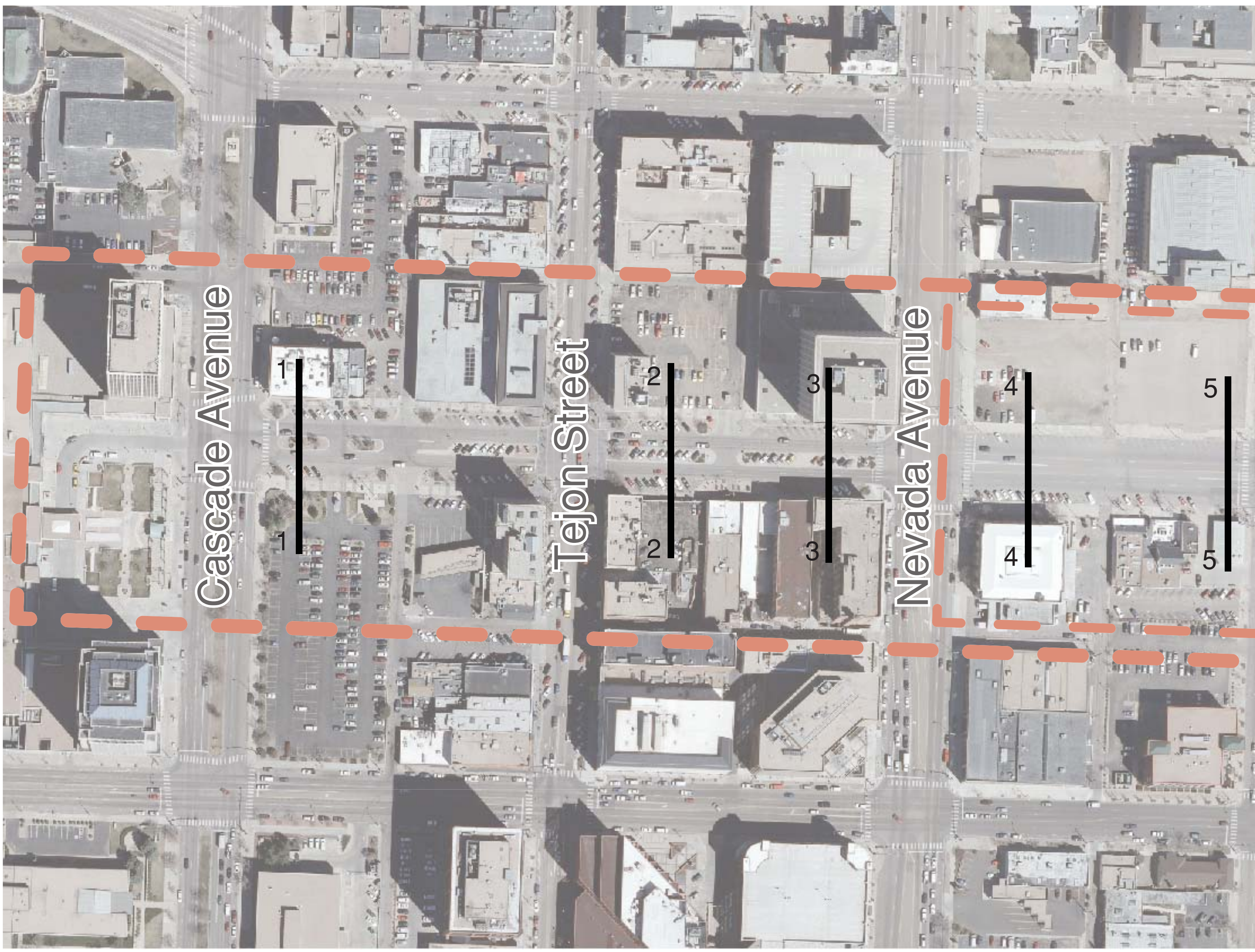


Figure A-10. Existing section cut locations (created by author, adapted from CS Utilities GIS data)


Kiowa Street
Weber Street
Wahsatch Avenue
Pikes Peak Avenue
Colorado Avenue
6
6
7
7
8
8
9
9
10
10
11
11

Section 1-1

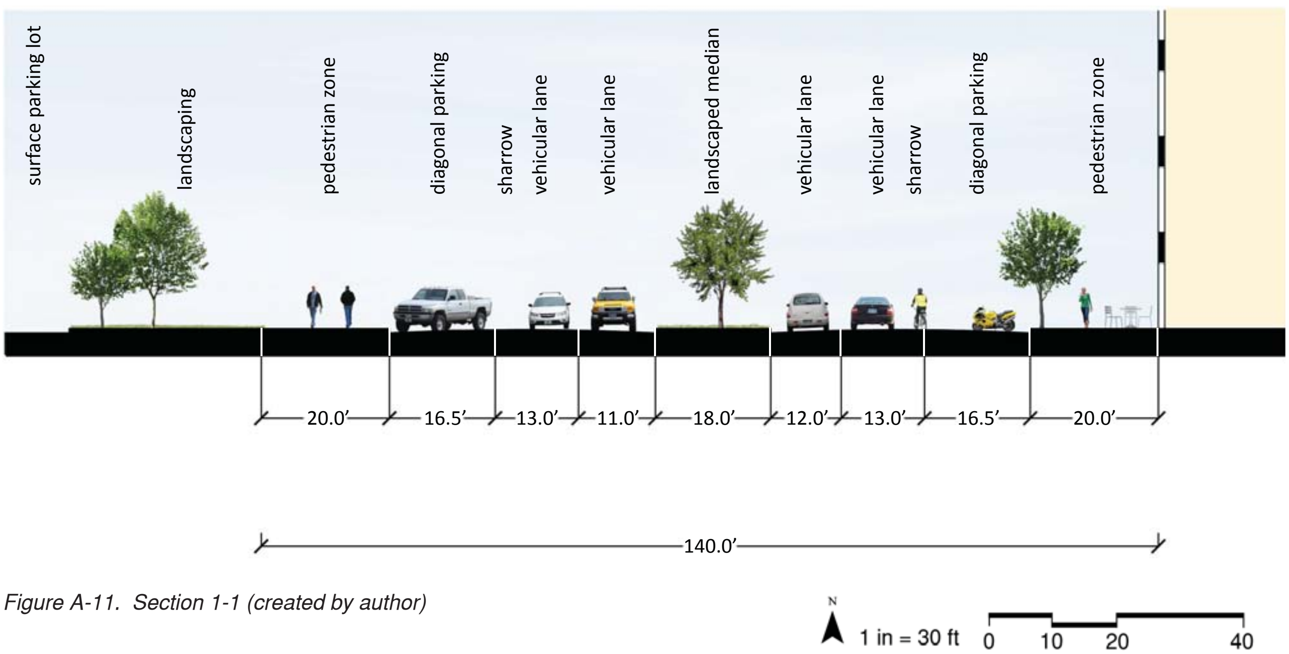


Figure A-11. Section 1-1 (created by author)

Section 2-2

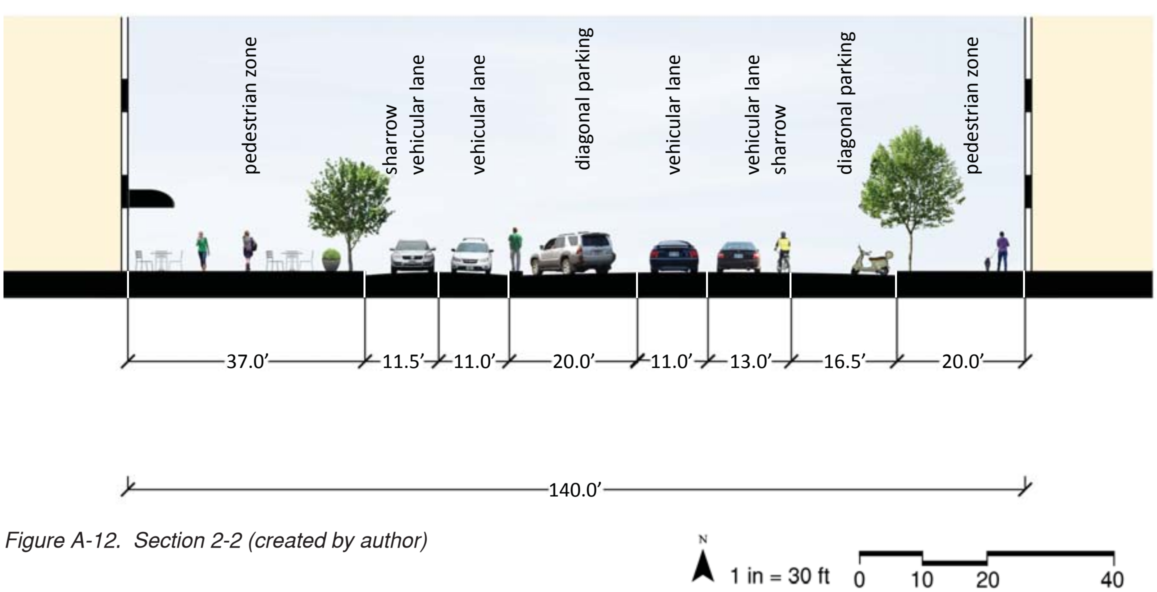


Figure A-12. Section 2-2 (created by author)

Section 3-3

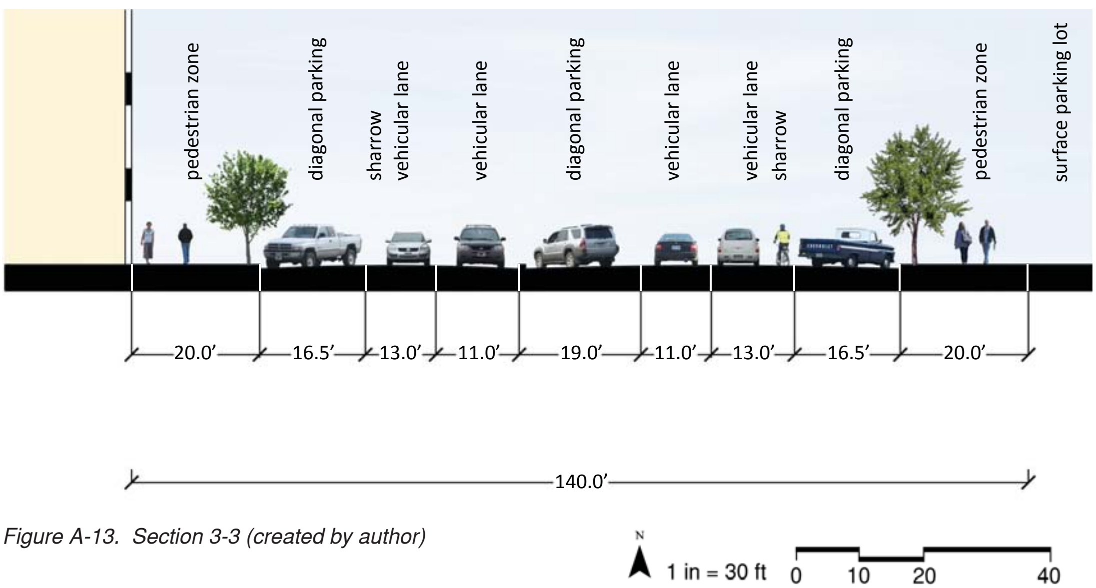


Figure A-13. Section 3-3 (created by author)

Section 4-4

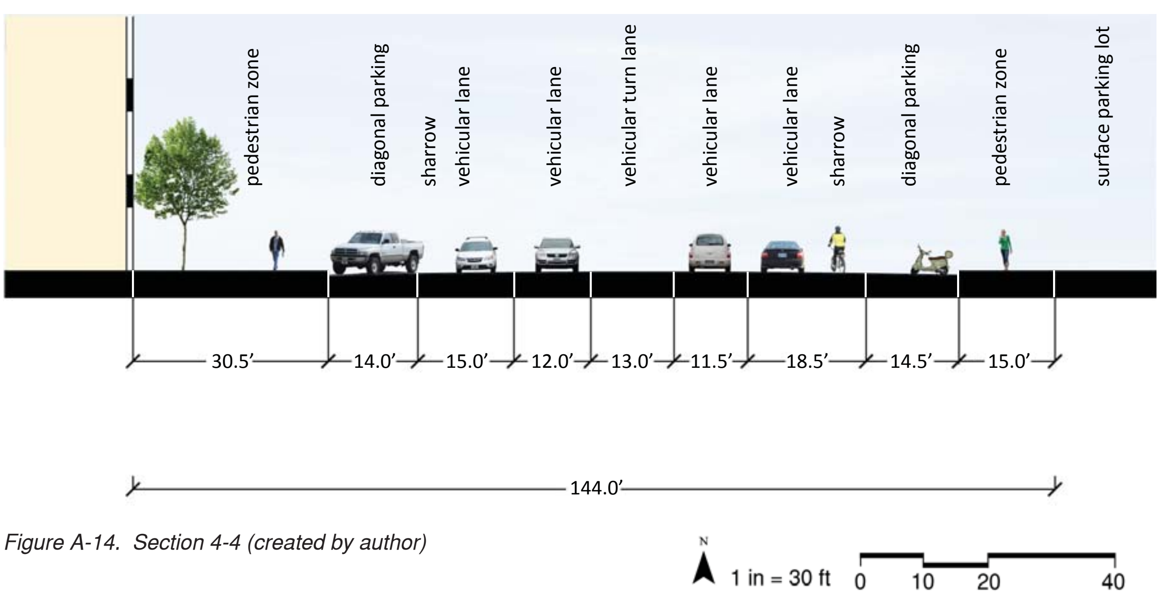


Figure A-14. Section 4-4 (created by author)

Section 5-5

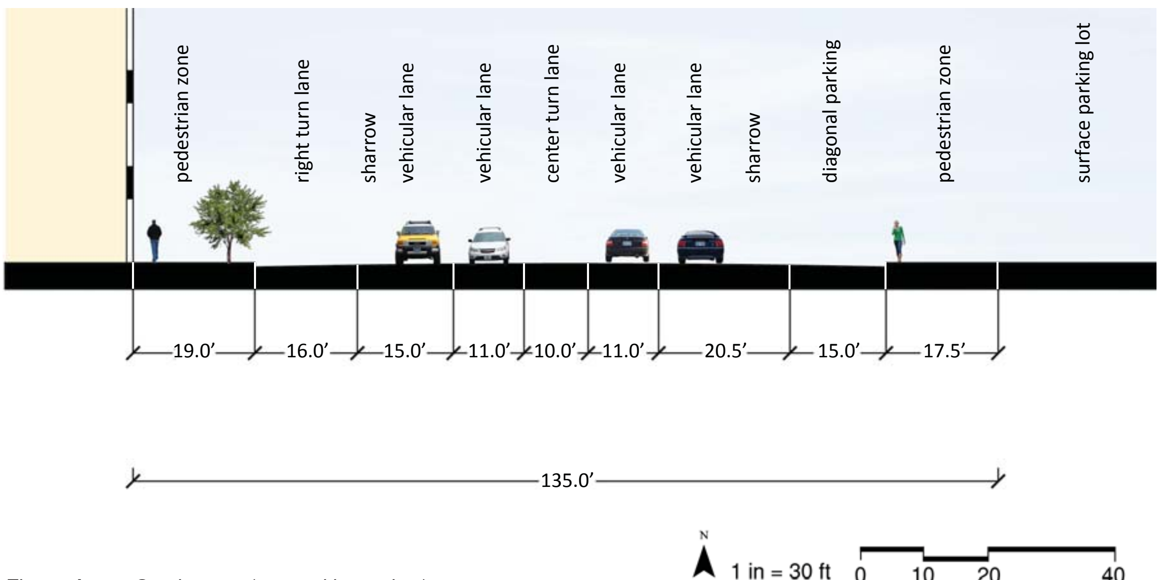


Figure A-15. Section 5-5 (created by author)

Section 6-6

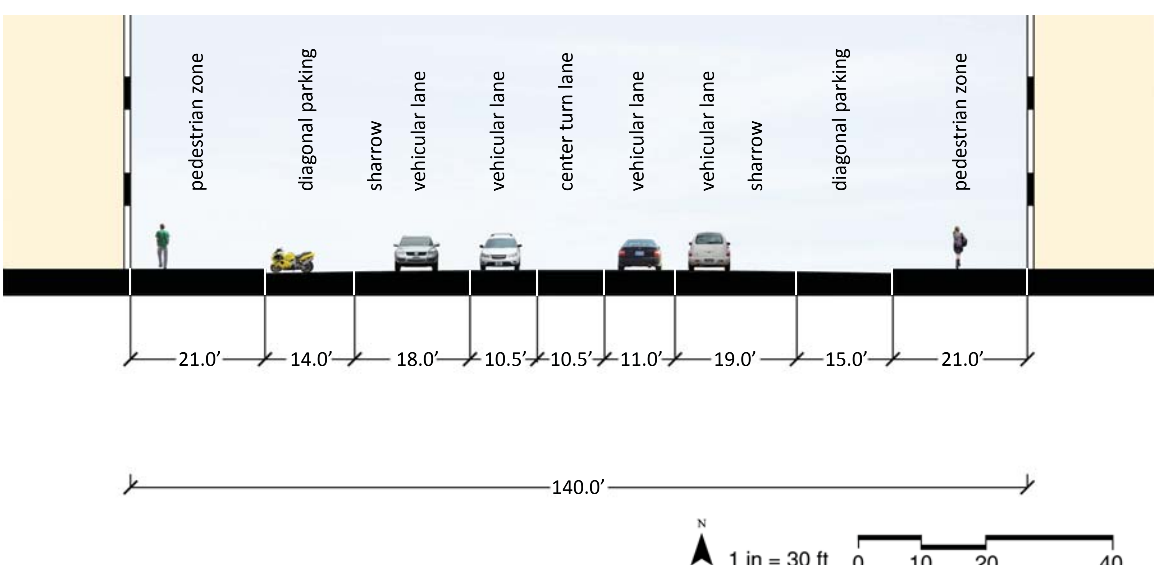


Figure A-16. Section 6-6 (created by author)

Section 7-7

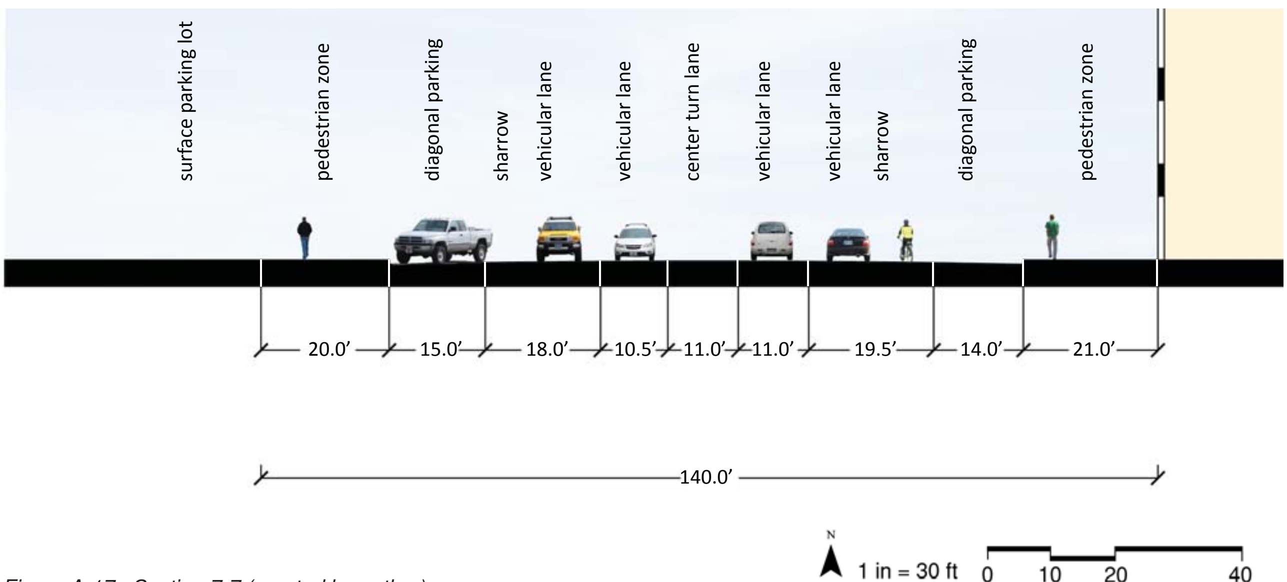


Figure A-17. Section 7-7 (created by author)

Section 8-8

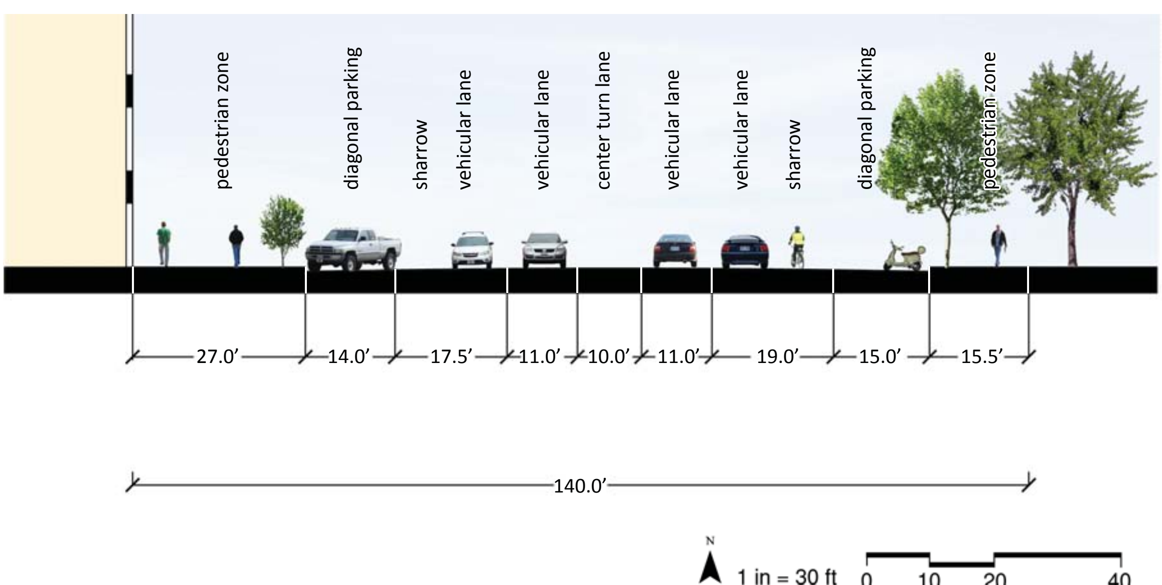


Figure A-18. Section 8-8 (created by author)

Section 9-9

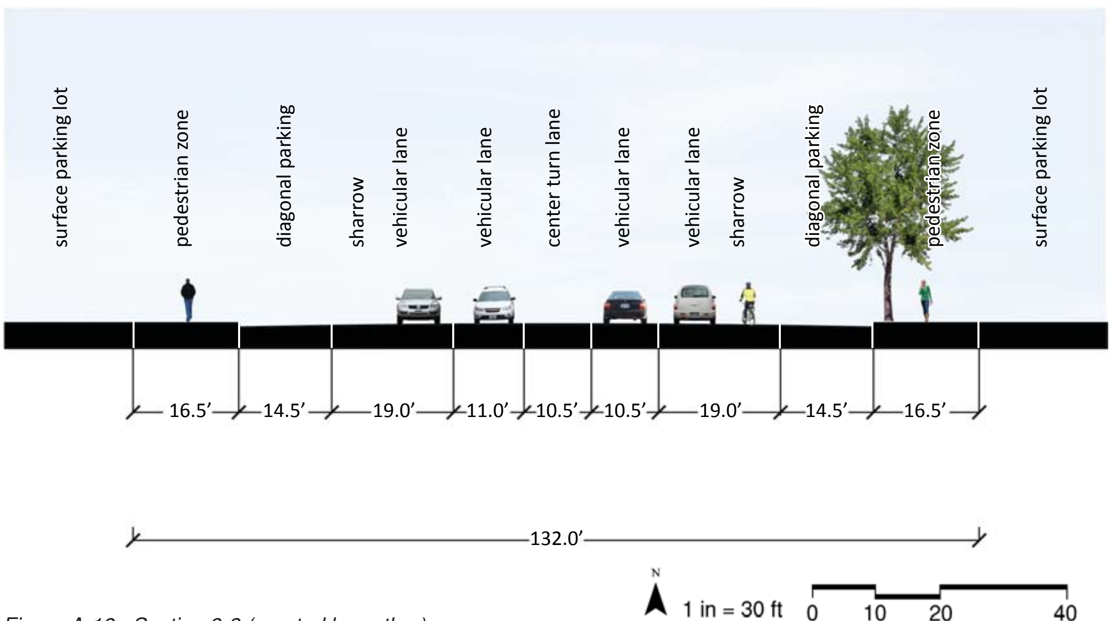


Figure A-19. Section 9-9 (created by author)

Section 10-10

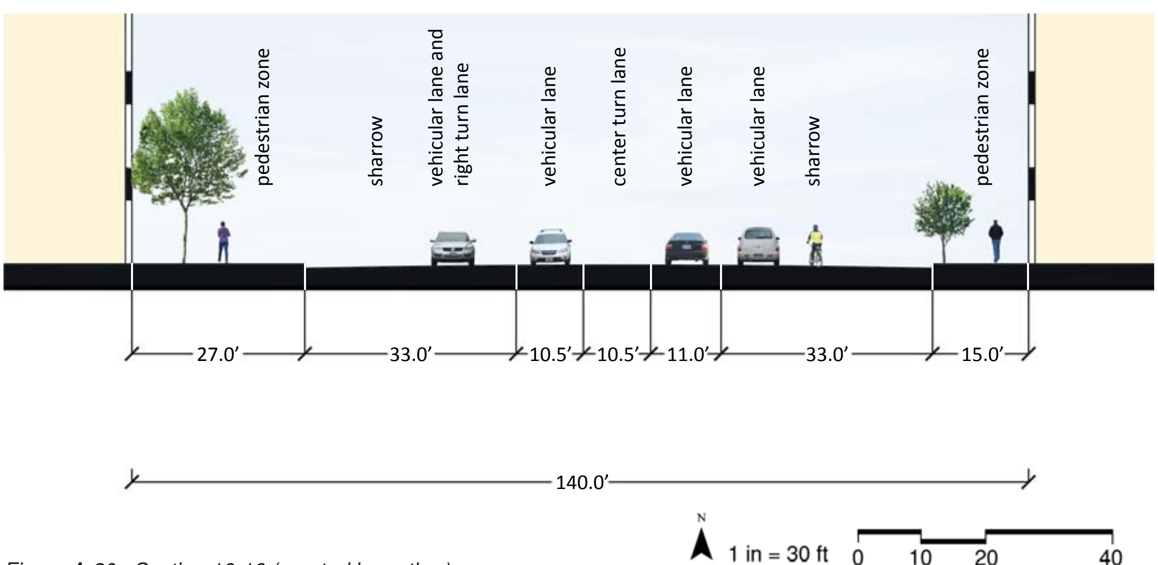


Figure A-20. Section 10-10 (created by author)

Section 11-11

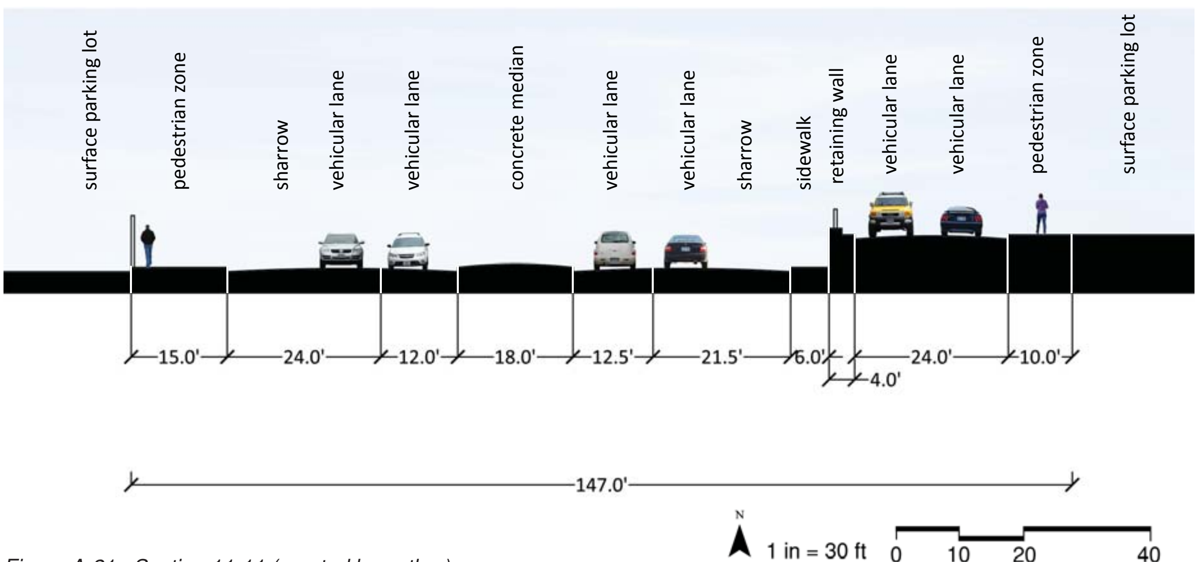


Figure A-21. Section 11-11 (created by author)

Trees for Colorado Springs

TREE		PHYSICAL CHARACTERISTICS					HABITAT REQUIREMENTS	M CHA
Common Name - ***Botanical name****	**Hard-iness Zone**	**Tree Shape**	**Spread (feet)**	**Canopy Density**	**Rate of Growth**	**Longevity ****	**Soil Type**	**Irrigation Need**
SUITABLE AS STREET TREES - (Approved street trees by City Forestry.)								
Large (over 49') 40' Spacing								
❖**Hackberry** - *Celtis occidentalis*	4	broad	30	med.	med.	long	dry soils, very adaptable	low
White Ash - *Fraxinus americana*	3	broad, oval	30	med.	med.	med.	somewhat adaptable	med.
❖**Green Ash** - *Fraxinus pennsylvanica*	3	irregular, oval	30	med.	med.	med.	very adaptable	low
❖**Thornless Honeylocust** - *Gleditsia triacanthos var. inermis*	4	broad, irregular	40	open	med.	med.	very adaptable to urban sites	low
❖**Black Walnut** - *Juglans nigra*	4	irregular	40	open	med.	long	adaptable	med.
American Sycamore - *Platanus occidentalis*	4	open spreading	50	open	med.	med.	prefers moist well-drained	med.
Swamp White Oak - *Quercus bicolor*	4	round	40	med.	slow	long	prefers fine clay, adaptable	med.
❖**Bur Oak** - *Quercus macrocarpa*	4	broad, round	40	med.	slow	long	adaptable, sensitive to compaction	low
English Oak - *Quercus robur*	5	large, broad	40	med.	slow	long	prefers loam, adaptable	med.
Northern Red Oak - *Quercus rubra*	5	broad, round	40	med.	slow	long	prefers loam, adaptable	med.
American Linden - *Tilia americana*	3	broad, pyramidal	25	dense	med.	med.	adaptable	med.
Medium (31 - 49') 30' Spacing								
Norway Maple - *Acer platanoides*	4	broad, round	30	dense	med.	med.	adaptable	med.
Ohio Buckeye - *Aesculus glabra*	4	round	20	dense	slow	med.	moist, not in clay	med.
Horsechestnut - *Aesculus hippocastanum*	3	oblong	25	dense	slow	med.	moist well-drained	med.
❖**Western Catalpa** - *Catalpa speciosa*	4	broad, oval	30	med.	slow	long	adaptable	low
Littleleaf Linden - *Tilia cordata*	4	pyramidal	20	dense	med.	low	adaptable	low
Crimean Linden - *Tilia x euchlora*	6 (5)	upright, pyramidal	25	dense	med.	med.	adaptable	med.
Small (up to 30') 25' Spacing								
❖**Amur Maple** - *Acer ginnala*	2	round, shrubby	15	med.	slow	med.	adaptable	low
Tatarian Maple - *Acer tataricum*	5	shrubby	10	med.	slow	med.	adaptable, tolerant of alkaline	low
❖**Hawthorn** - *Crataegus spp.*	4	irreg. horiz. branches	15	dense	slow	short	adaptable	low
❖**Goldenrain tree** -- *Koelrueteria paniculata*	5 (6)	round	20	med.	slow	med.	adaptable, tolerant of alkaline	low
Japanese Tree Lilac - *Syringa reticulata*	4	irregular	15	dense	med.	med.	adaptable	med.
SUITABLE AS STREET TREES - "Trees to Try"								
Large (over 49') 40' Spacing								
Black Ash – *Fraxinus nigra*	3	upright, oval	20	med.	med.	med.	adaptable to wide range	med.
Chestnut Oak - *Quercus montana*	5	round	40	med.	slow	long	prefers acid, adaptable	med.
Silverleaf Linden - *Tilia tommentosa*	4	pyramidal, elliptical	30	dense	med.	med.	adaptable	med.
Japanese Zelkova - *Zelkova serrata*	3	vase-shape	40	med.	med.	med.		med.
Medium (31 - 49') 30' Spacing								
Yellow Buckeye - *Aesculus octandra*	4	oblong	30	dense	slow	med.	prefers moist	med.
Yellowwood - *Cladrastis kentukea (lutea)*	3	broad, oval	30	open	slow	long	sensitive to compaction, tolerant of alkaline	high
Blue Ash - *Fraxinus quadrangulata*	5	irregular	30	med.	slow	med.		med.
Ginkgo - *Ginkgo biloba*	5	pyramidal	20	med.	slow	long	adaptable to urban sites	med.
❖**Kentucky Coffeetree** - *Gymnocladus dioicus*	5	irregular	25	open	slow	med.	prefers sandy loam, adaptable	med.
Lacebark Elm - *Ulmus parvifolia*	6 (5)	upright vase-shape	25	med.	med.	med.	adaptable, tolerant of alkaline	med.
Small (up to 30') 25' Spacing								
❖**Bigtooth Maple** - *Acer grandidentatum*	4	shrubby	20	med.	slow	med.	tolerant, dry and alkaline	low
HedgeMaple - *Acer campestre*	5	oval, shrubby	20	med.	slow	med.	adaptable, tolerant of alkaline	low
American Hornbeam - *Carpinus caroliniana*	2	round	30	dense	slow	long	deep, rich, moist	med.
Turkish Filbert - *Corylus colurna*	4	broad pyramidal	20	dense	slow	med.	adaptable	low
Amur Corktree - *Phellodendron amurense*	5	elliptical to broad	20	med.	slow	short	adaptable	med.
❖**Amur Chokecherry** - *Prunus maacki*	4	round	15	dense	med.	short	adaptable, dry sites	low

*The reference used for tree names is the *Manual of Woody Landscape Plants* by Michael A. Dirr

**LONGEVITY: Short 0-50 yrs./Medium 50-100 yrs.; Long 100+ yrs.

Figure A-22. Colorado Spring suitable street trees (City of Colorado Springs)

MAINTENANCE ARACTERISTICS	ORNAMENTAL CHARACTERISTICS					
Insect and Disease Problems	Flowers	Fruit	Bark	Foliage	Objectionable Features	Comments
nipple gall on leaf (aesthetic only)		hard “drupe”	corky gray	f.c. yellow	seed litter	gall psyllid food for migrating birds
ash borer (stressed sites)		samara	smooth	f.c.purple	sunscald, canker problem, borers	autumn purple ash most common
oyster shell scale, sawfly, borers		samara	furrowed light gray	f.c. yellow	overplanted in Colorado Springs	seedless variety, many varieties
thyronectria canker, plant bug, pod gall midge		pod, seedless variety	platey gray	compound, f.c. yellow	occasional uplift of sidewalks, canker	many varieties
aphids sometimes		nut	rough black	f.c. yellow, compound	honeydew from aphids	difficult to transplant, wildlife
anthracnose sometimes		1” globular	mottled green, white	large leaf	twig/fruit litter	
		acorn	furrowed gray-brown	f.c. dull yellow		tolerates poor drainage
		acorn	furrowed gray-brown	f.c. dull yellow		good drought tolerant tree
		acorn	furrowed, gray-black	f.c. brown		fastigate (upright) variety
		acorn	smooth gray	f.c. deep red-burgundy		late leaf drop
		hard nut-like	gray-black	heart-shape leaf (3”)	seed litter	‘Redmond’ a variety
aphids (nuisance insect)	pannicle	winged samara	gray to black	dark green	honeydew, sunscald when young	many varieties
	yellow spikes	large nut	platey white	f.c. yellow to orange	fruit litter	
	white spikes	large nut	platey white	f.c. orange red	fruit litter	slow to establish
	white in June	long pod	brown	large leaf	fruit and leaf litter	leafs out late
	fragrant	hard nut-like	smooth gray black	heart-shape leaf (1-2”)	included branching, seed litter	many varieties
	fragrant	hard nut-like	smooth furrowed	heart-shape leaf (2”)	seed litter	
		winged samara	white	f.c. red orange		
		winged samara		f.c. yellow		samara red in summer
fireblight sometimes		berry		f.c. red orange	thorns in some varieties	many varieties
		capsule		f.c. yellow	hard to establish	decorative seed pods
	white	capsule				
		seedless	f.c. golden yellow			naturally found on wet sites ‘Fall Gold’ a variety
		acorn	furrowed brown-black	f.c. dark crimson red		late leaf drop
	fragrant	hard nut-like	gray-brown	silver underneath	seed litter	
elm leaf beetle		berry	mottled	f.c. reddish		
	yellow spikes	large nut	platey	f.c. orange red	fruit litter	
	white pendant spike	long narrow pod	smooth light gray	compound	sensitive to heat, seed litter	
		samara	platey	f.c. yellow		
				f.c. yellow	female seed smells	plant male tree only!
		leathery pod	scaley gray	compound		leafs out late, ornamental winter form
resistant to Dutch elm disease & elm leaf beetle		samara in fall	mottled shedding	f.c. brown to orange		holds leafs late
				f.c. yellow orange, red		Rocky Mtn. native
		winged samara	gray	f.c. yellow	low branching	
	red catkins	large nut	smooth gray	f.c. yellow to red		shade tolerant
	catkin	nut	flaky brown			
		black drupe	corky gray-brown	compound, leather	fruit litter	
	white	small black cherries	orangish brown	reddish purple		don’t overwater!

❖ = Xeriscape Colorado!