

North Dakota State University

Graduate School

Title

ENHANCING WALKABILITY IN MEDORA
ANALYZING MOBILE PHONE DATA TO IMPROVE WALKABILITY AND IDENTIFY

CRITICAL INFRASTRUCTURE NEEDS FOR RAPID GROWTH IN MEDORA, ND.

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MASTER OF LANDSCAPE ARCHITECTURE

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A Thesis
Submitted to the Graduate Faculty
of the
North Dakota State University

By
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In Partial Fulfillment of the Requirements
for the Degree of
MASTER OF LANDSCAPE ARCHITECTURE

Major Department: Landscape Architecture
Department of Landscape Architecture

May 2024

Fargo, North Dakota

ABSTRACT

Medora, North Dakota, nestled in the heart of the Badlands. The town of Medora has grown to be a favorite among travelers looking for a genuine experience because of its distinctive combination of scenic natural beauty and cultural attractions. Currently, the Theodore Roosevelt Presidential Library is under construction, with an estimated cost of \$300 million. The project aims to create 100s of jobs and anticipates attracting thousands of monthly visitors upon completion. So, the town needs to enhance its walkability, amenities, and infrastructure to maintain the growing number of visitors. As urbanization continues to change the look and feel of cities across the United States, the concept of walkability has gained appeal to support healthier, more environmentally friendly, and vibrant communities.

This research uses mobile phone data i.e. Safe graph data to identify high-potential zones where most of the visitors are going and spending their time at Medora. This information enables us to pinpoint areas in Medora that are most frequented by tourists and, consequently, in need of infrastructure upgrades to enhance their walkability. The data obtained can then be analyzed by the software Grasshopper to dictate visitor movement patterns, preferences, the most appropriate forms and locations for open areas and development, paths and nodes, stormwater infrastructure and maximize pedestrian movement.

This study proposes a dynamic pedestrian routing model for maximizing efficiencies and uses when applied to prototypical small cities. The results suggest a new responsive model that can reduce walking distances between necessary uses, harness path prediction software, minimize disturbance, create safe pedestrian walking trails, and building systems in similar suburban cities. The results of this research offer valuable guidance for urban planners, local authorities, and

businesses in Medora seeking to optimize their investments in near future infrastructure development.

1.1 Keywords

Visitor movement patterns, Walkability, Geo-spatial and Digital Analytics, Human Informatics, Big Data Studies

ACKNOWLEDGMENTS

While completing this thesis, I came across several people who contributed in various ways to my field of research and design phase, and they deserve special recognition. It is a delight to express my appreciation to each of them.

First and foremost, I'd like to express my heartfelt gratitude and indebtedness to my primary advisor, Dominic Fischer, for his invaluable encouragement, suggestions, and support from the beginning of research to the design phase, as well as for providing me with extraordinary experiences throughout the project. Above all, his invaluable and rigorous monitoring at every stage of the project impressed me in numerous ways.

I would like to express my gratitude to my thesis coordinator Jason Kost for his guidance, support, and suggestions which helped to give shape and refine this thesis.

Finally, my sincere appreciation to my family and friends for their unwavering support and encouragement throughout this academic journey.

DEDICATION

This thesis is entirely devoted to my parents, who have been a source of inspiration and strength for me, and who continue to provide spiritual support, encouragement, and motivation throughout this academic path.

To my husband, friends, brothers, sisters, and mentors who advised and encouraged me to complete this thesis.

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1. CHAPTER 1 INTRODUCTION

1.1. Problem Statement

Medora, North Dakota, nestled in the heart of the Badlands. The town of Medora has grown to be a favorite among travelers looking for a genuine experience because of its distinctive combination of scenic natural beauty and cultural attractions. Currently, the Theodore Roosevelt Presidential Library is under construction, with an estimated cost of \$300 million. The project aims to create 100s of jobs and anticipates attracting 1,000's of monthly visitors upon completion.

Despite its historical value and thriving tourism, Medora has experienced recent urbanization. This growth, while positive, has brought some challenges. The walkability of Medora isn't well-documented, and there are no specific plans to make it better for pedestrians. It's also tough to figure out where essential things like amenities and utilities should go. So, there's a need to improve the town's walkability, amenities, and infrastructure to keep up with the increasing number of visitors.

As cities across the United States change due to urbanization, the idea of walkability has become important. It supports healthier, eco-friendly, and lively communities. To make Medora more walkable and improve amenities and infrastructure, we first need to know where visitors spend their time. Trying to improve everything in Medora without proper research isn't practical. Identifying places where most visitors go allows us to provide the right amenities there. Traditional ways of collecting and analyzing data might not catch the dynamic movements of people and how they use infrastructure in a changing town.

Mobile phones have become a big part of our daily lives, always with us wherever we go. This widespread use gives us a unique opportunity to collect data on how people move and what they do every day. Analyzing mobile phone data can help us understand foot traffic patterns,

popular routes, and areas that need better walkability. This information is crucial for pinpointing where important infrastructure improvements are needed the most.

1.2. Objective

This research endeavors to address existing gaps in Medora, North Dakota, through a comprehensive analysis of mobile phone data. The primary focus is on understanding visitor mobility patterns and pinpointing peak attendance hours, seasonal variations, and foot traffic along different routes. The goal is to identify hotspots, such as intersections, where essential services like eateries and restrooms are needed.

Additionally, the research aims to offer practical insights to urban planners and policymakers, promoting evidence-based decision-making in Medora. The objective is to optimize walkability and address significant infrastructure needs, ensuring that the town evolves in a manner that aligns with the requirements of both residents and visitors.

Following the research, the design phase concentrates on three key objectives: enhancing pedestrian walkability, identifying critical infrastructure needs, and actively involving the community in decision-making, shaping the project to align with their specific needs and preferences.

2. CHAPTER 2 LITERATURE REVIEW

2.1. Definition of Walkability

In a community where people of all ages and abilities have convenient access to their surroundings on foot, the reliance on automobiles for every trip is eliminated. This pedestrian-friendly environment encourages increased walking, fostering safer, healthier, and friendlier neighborhoods. Parents find reassurance in the safety of their children playing outdoors without the constant worry of motor vehicle threats. Consequently, children benefit from spending more time outside with peers, promoting physical activity, fitness, and overall well-being. Streets and highways are thoughtfully designed or reconstructed to provide secure facilities for pedestrians, ensuring easy and safe crossings for everyone. Priority is given to pedestrians in various areas, including neighborhoods, workplaces, schools, and shopping districts, with reduced motor vehicle speeds or, in some instances, complete elimination. Strict control over motor vehicle speeds is implemented to maintain compatibility with surrounding land uses and accommodate the routine presence of pedestrians. Drivers are held accountable for their actions, operating vehicles responsibly to prevent threats, injuries, or fatalities. Such conscientious measures contribute to a community where air and water quality thrive, creating an environment conducive to the health and happiness of its residents. (Creating Walkable Communities A Guide for Local Governments Mid-America Regional Council, n.d.)

2.2. Benefits of Safe Pedestrian Walking

The vision of a more active and healthier community is at the forefront of people- and family-oriented community development. This approach emphasizes the creation of environments that promote physical activity and well-being. By fostering various transportation choices, individuals

can opt for modes that suit their preferences and needs, contributing to a more inclusive and versatile community. A key element in this vision is ensuring independent mobility for children, allowing them the freedom to explore and play safely in their surroundings. The concept of accessibility for all is paramount, aiming to remove barriers that may hinder individuals with diverse abilities from fully participating in community life. In essence, the aspiration for a more active and healthier population is intricately woven into a comprehensive framework that prioritizes people and families, encourages diverse transportation options, empowers children with independent mobility, and ensures accessibility for everyone, creating a vibrant and inclusive community for all its residents.(Creating Walkable Communities A Guide for Local Governments Mid-America Regional Council, n.d.)

2.3. Definition and Types of Critical Infrastructure

Critical infrastructures are important structures and systems for society because they provide essential services and goods. The term "critical" means they play a decisive role during crises or important moments. To determine their significance, we look at how relevant and risky they are. Relevance is about how important the infrastructure is for a large part of society, while risk comes when the infrastructure could be a threat, like if it fails to supply the community. Criticality becomes apparent when infrastructures reach a certain size or importance, and it's measured by the negative impacts of any outages. Criticality can be access by looking at internal importance, external impacts, and the abilities needed to prevent or handle failures. In summary, critical infrastructures are crucial for society, and their importance and potential risks decide how critical they are.(Fekete, 2011)

Critical infrastructure is often categorized into various sectors, each representing a different aspect of societal functioning. Commonly recognized sectors include:

- Energy Sector
 - Includes power generation, transmission, and distribution systems.
- Water and wastewater system
 - Encompasses water supply and treatment facilities, as well as wastewater management.
- Transportation systems
 - Involves the movement of people and goods through various modes of transportation.
- Communication Systems
 - Involves the networks and technologies that enable communication.

2.4. GIS and Network Analysis

Geographic Information System (GIS) technology presents significant prospects for advancing contemporary tourism applications through map utilization. Travelers seeking to explore various attractions require detailed information and visual depictions of these locations, facilitated by GIS tools. This technology seamlessly combines standard database operations like querying with the distinctive advantages of visualization and geographic analysis provided by maps.(Gill & Bharath, 2013)

Facilitating efficient travel routes for tourists through GIS-enabled network analysis enhances planning and minimizes time and cost. This approach is pivotal in managing diverse network facilities, aiding utilities, transmissions, transport systems, retail planning, and tourism routes. GIS integration allows travel agencies to create informative, ready-to-print maps,

improving overall visitor experiences. GIS technology simplifies wayfinding and navigation, while online visualizations enable prospective visitors to plan trips meticulously, incorporating multimedia elements for a richer travel experience.(Gill & Bharath, 2013)

3. CHAPTER 3 RESEARCH METHOD AND METHODOLOGY

3.1. Data

Medora, North Dakota, one of the most visited destinations, was selected as the context of this research for one research; the authors have access to a visitor use survey, count data and mobile device data in Medora, ND at the same period. The dataset utilized for this investigation was Safe Graph mobile device data.

3.1.1. Safe Graph Data

Safe Graph is a commercial provider of Point of Interest (POI) and Location-Based Services (LBS) data in the United States, Canada, and the United Kingdom. The term POI refers to a specific helpful or interesting location. The POI data are gathered from a variety of sources, including mobile phone GPS data and open government data. After gaining opt-in agreement from users, Safe Graph can track anonymous whereabouts from mobile applications. These statistics do not include any personal information, such as usernames or mobile device MAC addresses. They only include the device's latitude and longitude at a specific location and time. Safe Graph uses geographic location information to calculate the number of visits to each POI.(Liang et al., 2022)

SafeGraph gathers POI data by collecting public location data on the web, using public APIs to collect updated locations from open web domains, processing, and modeling to infer additional attributes (e.g., POI category), and collaborating with third-party data sources to fill gaps. Safe Graph thoroughly cleans and incorporates all data sources to assure accuracy and currency.(Cessford & Muhar, 2003)

The data has been gathered using secure graph methods, spanning a period of one year. It encompasses the dynamics of visitor movement between various locations. The dataset provides

insights into the overall count of visitors across diverse categories such as accommodations, restaurants, parks, museums, and more.

Initially, the gathered data undergoes thorough analysis using GIS to pinpoint high-potential visitor destinations across diverse categories. A total of 15 strategic destination points were identified, spanning accommodations, museums, parks, restaurants, commentary sites, gasoline centers, and schools.

Table 1 High-Potential Destination

Location Name	Top Category	Total Visitors
Perception	Amusement Park	111642
Medora Musical	Musical Event	870357
Medora Uncork'd	Liquor Stores	284268
United States Postal Service	Postal Service	307
St Bernard's Church	Religious Organization	4005
Badlands Pizza & Saloon	Restaurant	275265
Cowboy Cafe	Restaurant	39960
Dollar General	Shopping Center	34930
Superpumper	Grocery Stores	1295867
Chasing Horses	Office Supplies, Stationery	269417
Elkhorn Quarter	Accommodation	47429
Rough Riders Hotel & Convention Center	Accommodation	128071
Medora Convenience Store	Gasoline Stations	159943
Theodore Roosevelt National Park	Museums, Historical Sites	372122

South Heart Elementary School	Elementary & Secondary School	46532
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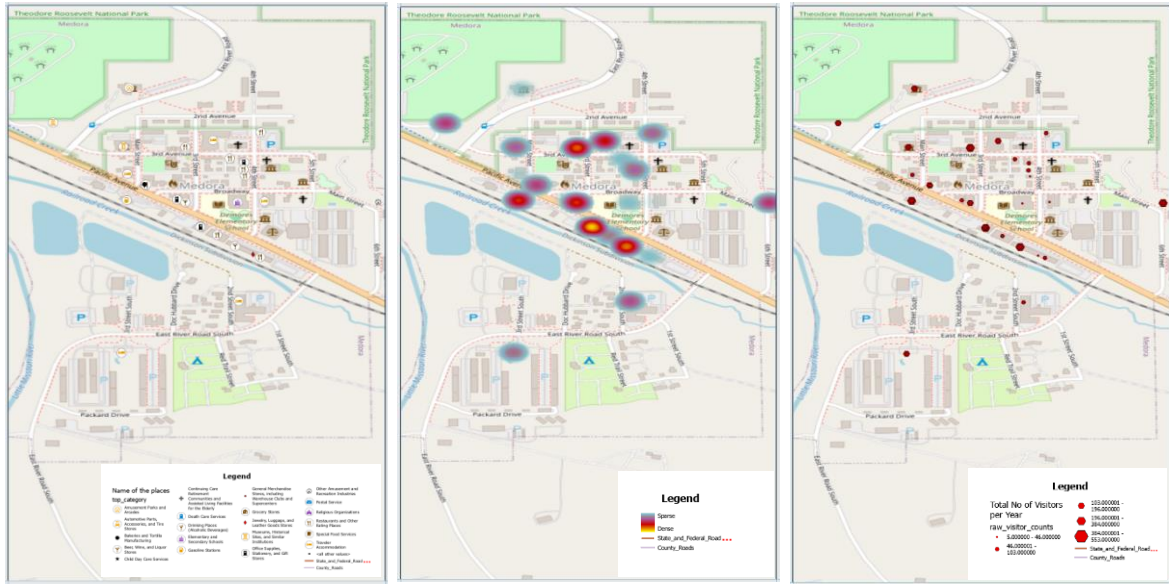


Figure 1 Map showing different categories with visitors density

3.2. Methodology

The road network and these high-potential points were then taken into consideration for route identification in the tourism route network analysis.

The analysis focused on estimated travel time and distance, utilizing network analysis capabilities. This methodology allows for the calculation of the shortest and most efficient routes between various tourist destinations, providing the ability to generate precise route directions for optimal travel planning.

The analysis was conducted multiple times, each time refining the approach by considering different numbers of high-potential locations to determine a consistent route. To illustrate, initially, all high-potential areas were included by making highway as a buffer, outlining one potential route.

Subsequently, the process was repeated, this time with a selection of only six points. Finally, the analysis was refined further, focusing on just four key points to pinpoint the most viable route.

Table 2 12 High-Potential Destination

Location Name	Top Category	Total Visitors
Superpumper	Grocery Stores	1295867
Medora Musical	Musical Amphitheatre	870357
Theodore Roosevelt National Park	Museums, Historical Sites	372122
Medora Uncork'd	Beer, Wine & Liquor Stores	284268
Badlands Pizza & Saloon	Restaurant	275265
Chasing Horses	Shopping Center	269417
Medora Convenience Store	Gasoline Stations	159943
Rough Riders Hotel & Convention Center	Accommodation	128071
Perception	Amusement Park	111642
Elkhorn Quarters	Accommodation	47429
Cowboy Cafe	Restaurant	39960
Dollar General	Shopping Center	34930

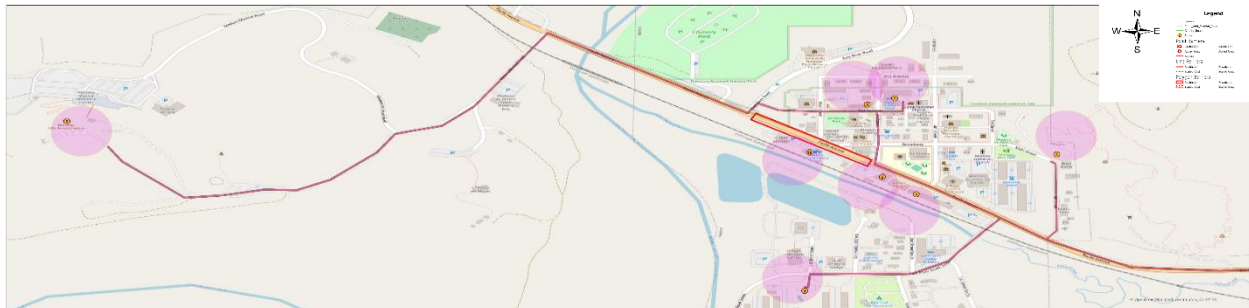


Figure 2 Map showing connecting trails for 12 high-potential point

Table 3 High Potential Destination with 6 points

Location Name	Top Category	Total Visitors
Medora Musical	Musical Amphitheatre	870357
Theodore Roosevelt National Park	Museums & Historical Sites	372122
Chasing Horses	Shopping Center	269417
Medora Convenience Store	Gasoline Stations	159943
Perception	Amusement Park	111642
Elkhorn Quarters	Traveler Accommodation	47429

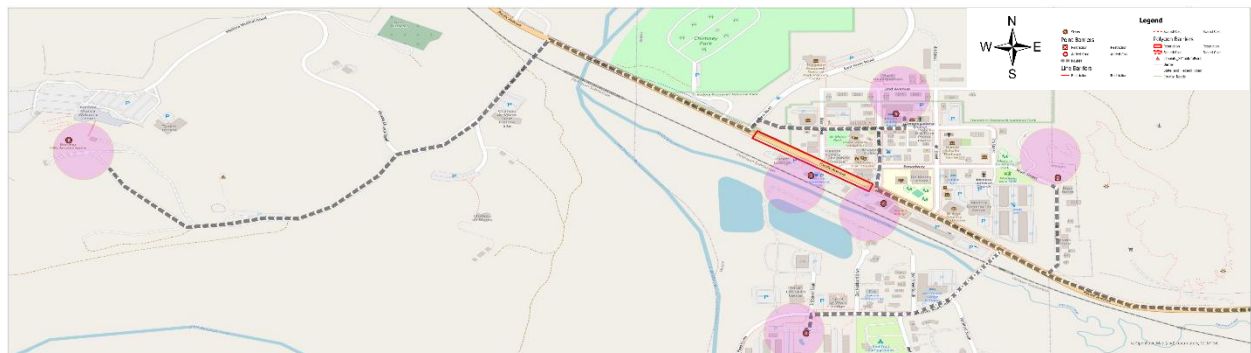


Figure 3 Map showing connecting trails with 6 points

Table 4 High Potential Destination with 4 Points

Location Name	Top Category	Total Visitors
Medora Musical	Musical Amphitheatre	870357
Medora Uncork'd	Beer, Wine & Liquor Stores	284268
Medora Convenience Store	Gasoline Stations	159943
Rough Riders Hotel & Convention Center	Accommodation	128071

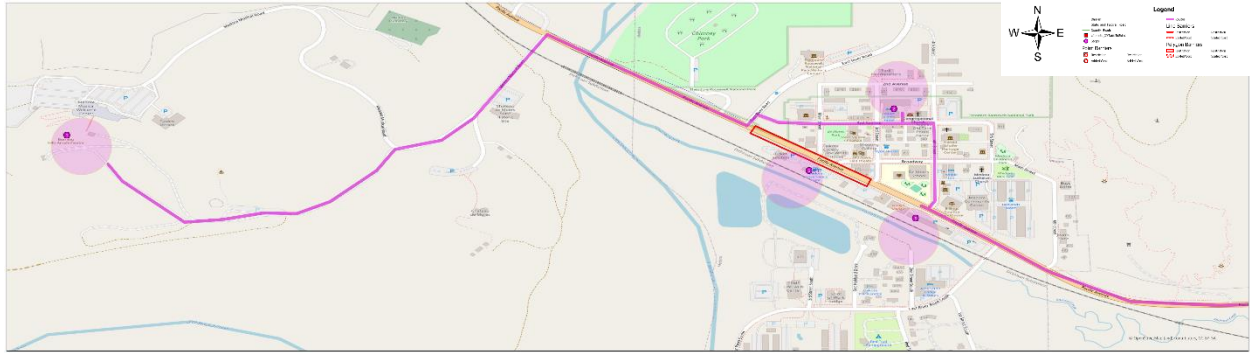


Figure 4 Map showing connecting trails for 4 points

4. CHAPTER 4 RESULTS

The analysis provides clear evidence that regardless of the scenario considered, there is a consistent pattern of trails linking all high-potential areas. The map visualizes this with a dotted line, highlighting the predominant route favored by the majority of tourists to access Medora's sought-after attractions in North Dakota. This trail, spanning approximately 1.91 miles in total distance, serves as the primary pathway for visitors exploring the region's famous destinations.

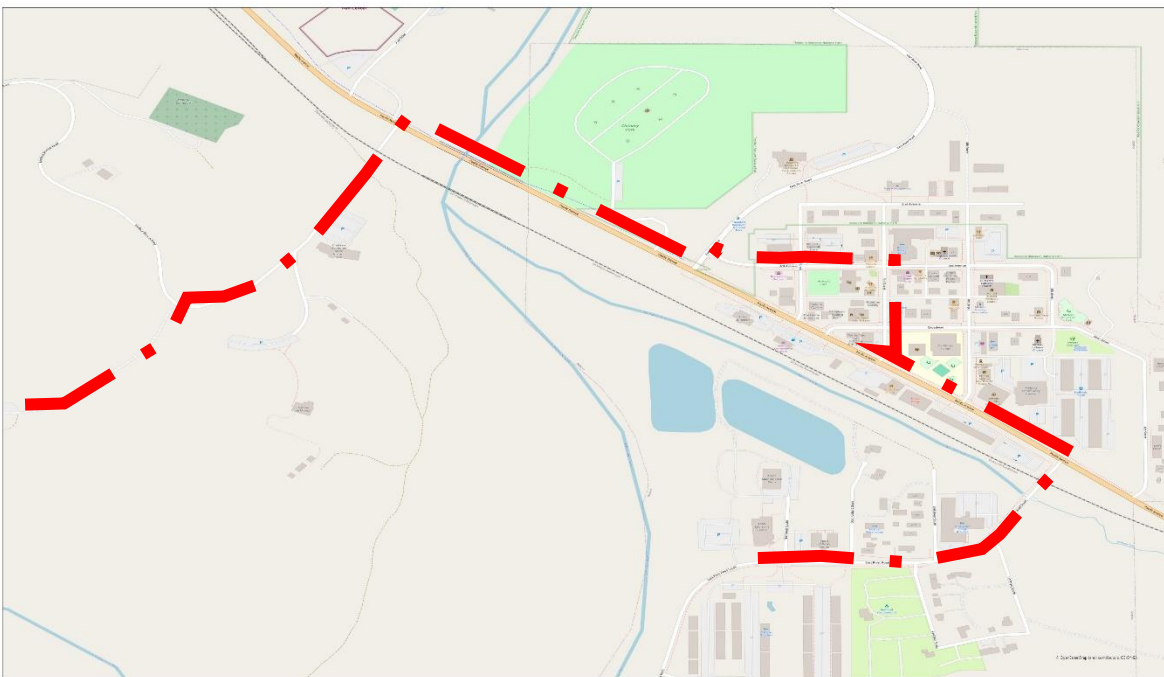
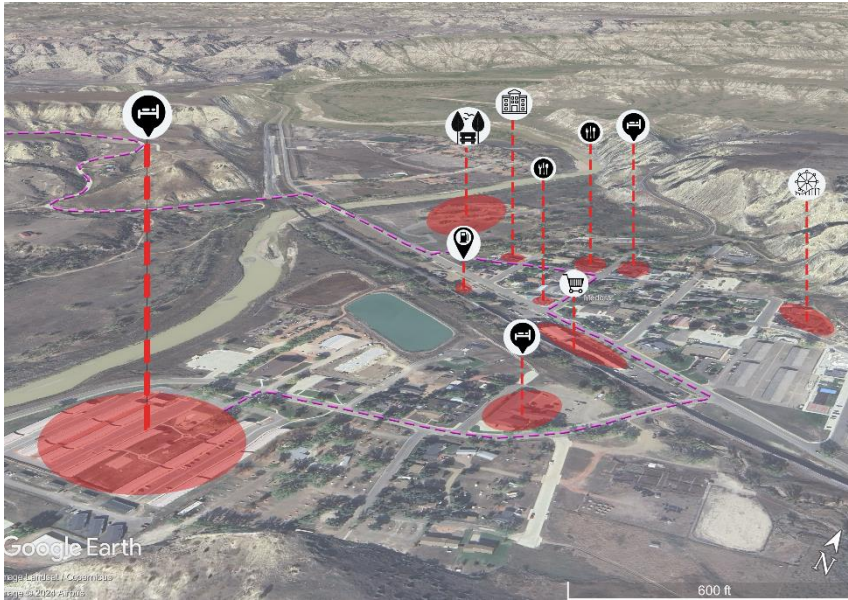


Figure 5 Map showing common trails.



- ⦿ Accommodation
- ⦿ Shopping/Grocery
- ⦿ Amusement Park
- ⦿ Park
- ⦿ Restaurant
- ⦿ Hall
- ⦿ Gasoline Stations

Figure 6 Research Results

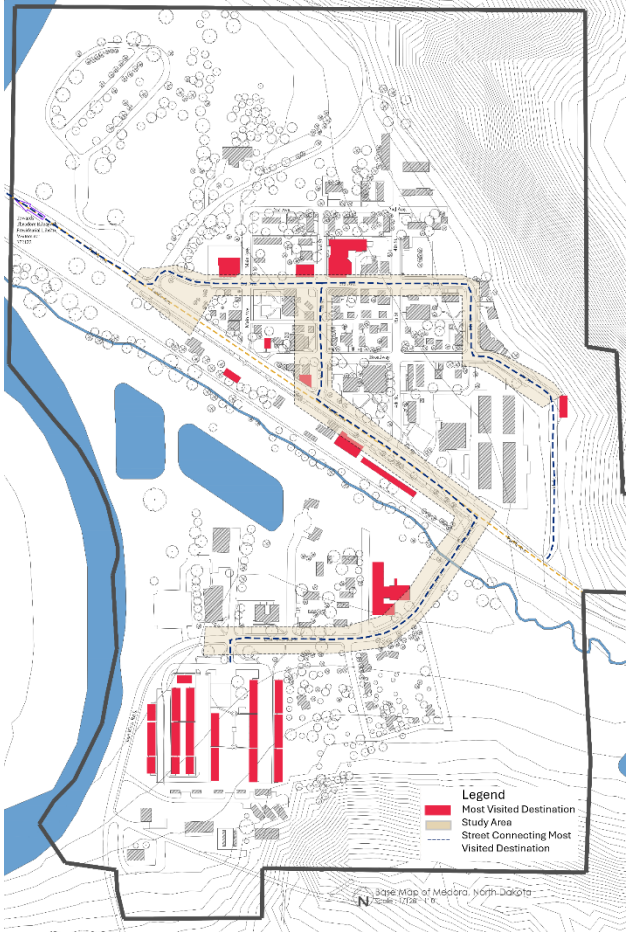
5. CHAPTER 5 RESEARCH CONCLUSION and APPLICATION TO THE PROFESSION

In conclusion, research has revealed insight into the travel patterns of visitors to various destinations. Through analysis, it has been determined that a significant majority of travelers tend to move toward certain accommodations, restaurants, bars, and other key points of interest. This discovery forms the foundation of our understanding, indicating that there are indeed specific locales that consistently capture the attention of visitors.

Going deeper into the data, our findings have pinpointed a remarkable exposure: there exist 15 destinations of particularly high

appeal, drawing in the bulk of travelers. This discovery not only sheds light on the preferences of our global audience but also paves the way for strategic planning and development initiatives.

Upon analyzing these high-potential destinations, a compelling narrative emerges. Through careful analysis and consideration, a series of common trails have been proposed. These trails, carefully crafted, offer a blend of efficiency and safety, ensuring that travelers can seamlessly navigate their way from one key destination to another. By connecting these prominent locales via the shortest and safest routes, we not only enhance the overall visitor experience but also foster a deeper sense of exploration and discovery within our destinations.



In essence, this comprehensive research not only shows the rhythm of traveler preferences but also serves as a guide to optimizing travel routes and experiences. It represents a collaboration between data-driven insights and the art of hospitality, promising to elevate the journey of every traveler who embarks on these carefully identified trails.

For application to the profession, the trails can be picked to improve things. The trails could be renovated to make sure that everything visitors need, especially to sustain the number of visitors in Medora.

6. CHAPTER 6 SITE

6.1. Site Context

Taking about the Medora, the Medora is located at the west corner of North Dakota. According to the United States Census Bureau, the city has a total area of 0.37 square miles (0.96 km²), of which 0.36 square miles (0.93 km²) is land and 0.01 square miles (0.03 km²) is water. According to the Köppen climate classification system, Medora has a cold semi-arid climate.



Figure 7 Site Context Map

The research helped to pinpoint the study area and understand why it's important to design it carefully. Now, focusing on analyzing the trails that link these top destinations will give a deeper understanding of the site and help to plan better.

So, after research, there is a problem statement “How can Medora effectively balance the provision of necessary amenities for its growing number of tourists while simultaneously enhancing the city’s walkability to sustain and potentially increase the visitors' number?”. To answer this question, the project identified the 3 objectives.

Those are:

- **Pedestrian Walkability**
- **Identifying Critical Infrastructure**
- **Community Involvement**

6.2. Site Inventory and Analysis



Figure 8 Site Inventory Map



Figure 9 Site Inventory with building Categories

The above figures show where the highways, roads, and other infrastructures are. After knowing all the infrastructure, roads, rivers, and existing buildings categories, further site analysis was done as per the identified project objectives.

OBJ 1:

- Pedestrian Walkability
- Pedestrian Pathway

01. INVENTORY | PEDESTRIAN PATHWAY

02. ANALYSIS | PEDESTRIAN PATHWAY

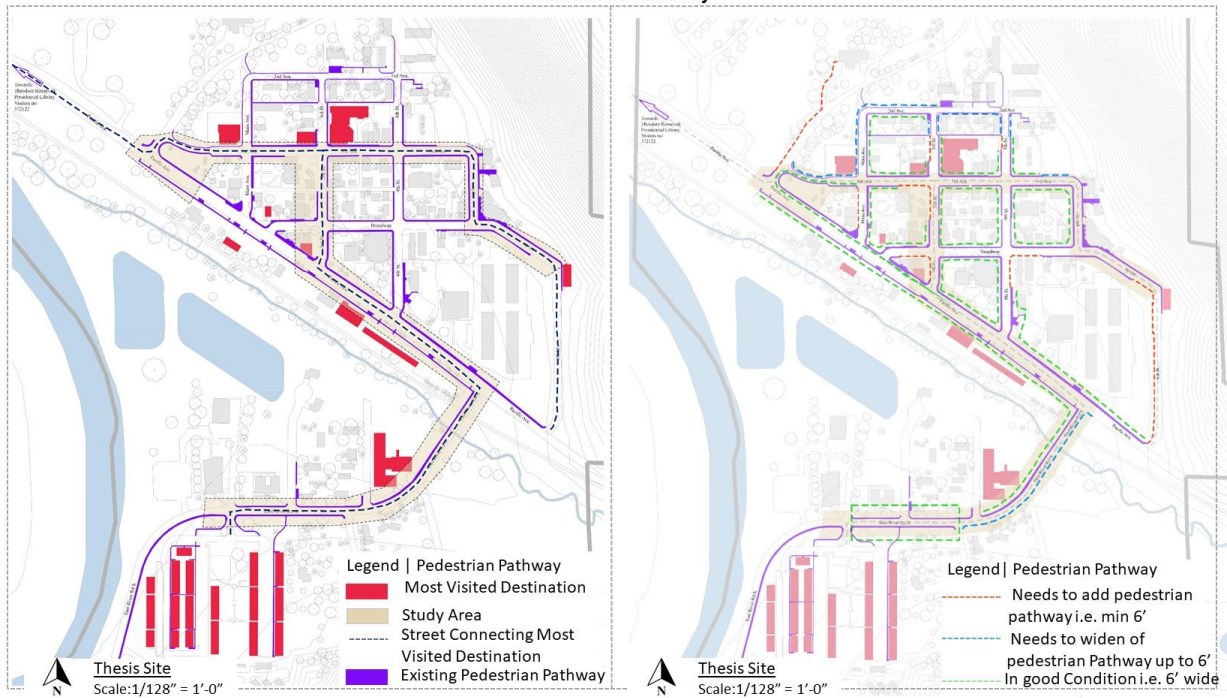


Figure 10 Site Analysis for Pedestrian Pathway

OBJ 1:

- Pedestrian Walkability
- Road Intersection

01. INVENTORY | ROAD INTERSECTION

02. ANALYSIS | ROAD INTERSECTION

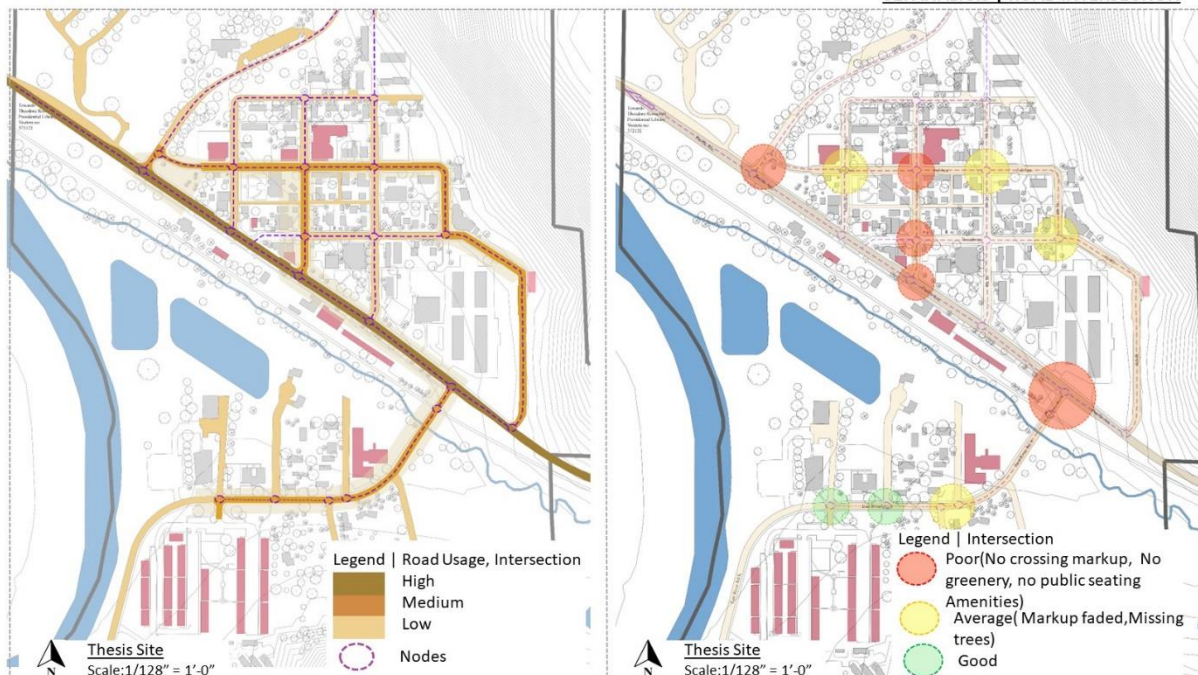


Figure 11 Site Analysis for road Intersection

OBJ 2:

☐ Identifying Critical Infrastructure Needs

01. INVENTORY | MANMADE STRUCTURE

✓ Manmade Structure

02. ANALYSIS | MANMADE STRUCTURE

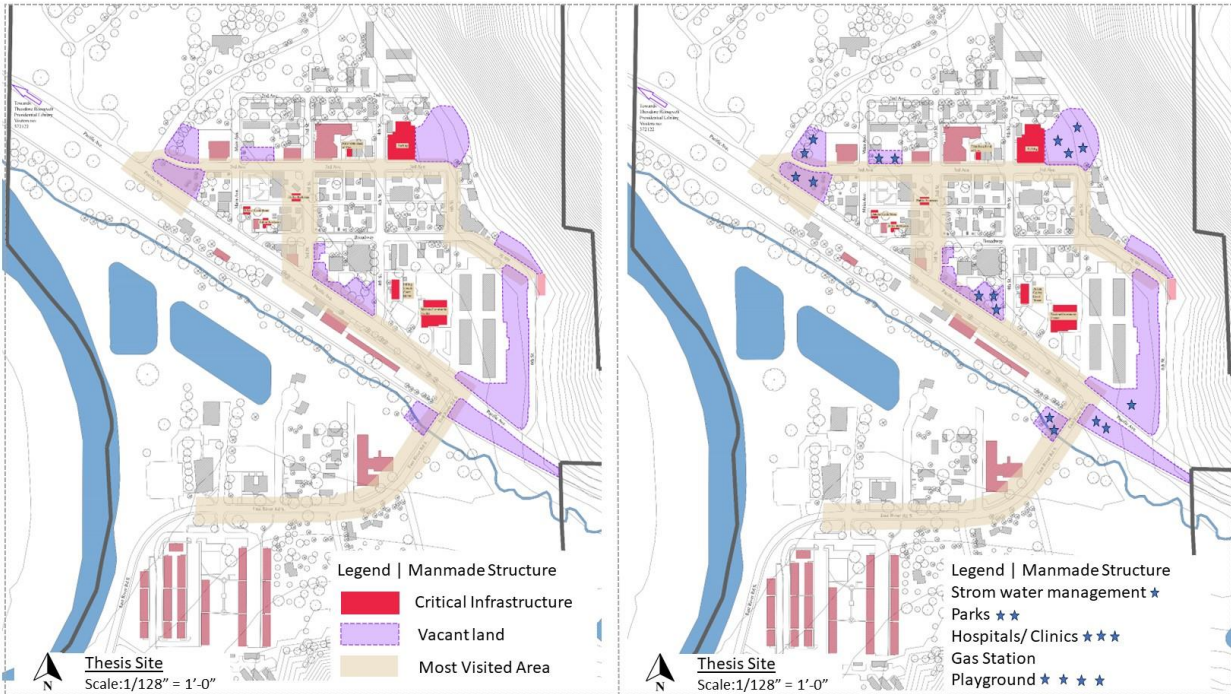


Figure 12 Site Analysis for Manmade Structure

OBJ 2:

☐ Identifying Critical Infrastructure Needs

01. INVENTORY | LANDSCAPE

✓ Landscape

02. ANALYSIS | LANDSCAPE

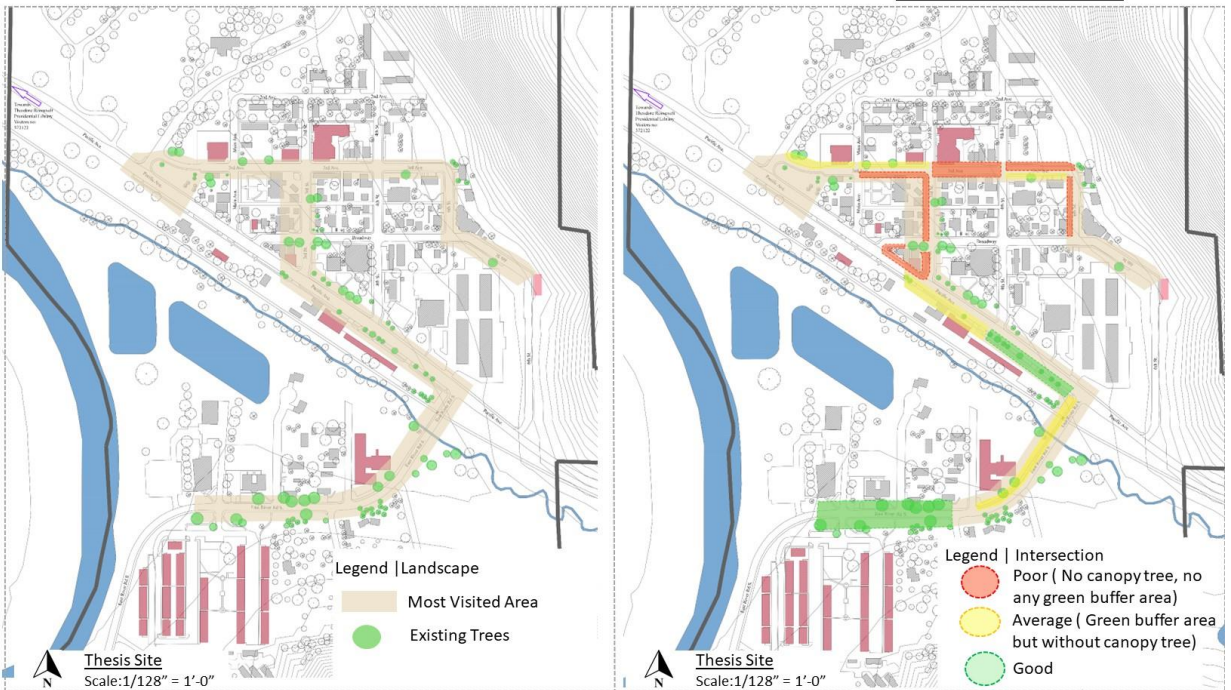


Figure 13 Site Analysis for Landscape

OBJ 3:

Community Involvement

01. INVENTORY | COMMUNITY INVOLVEMENT

02. ANALYSIS | COMMUNITY INVOLVEMENT

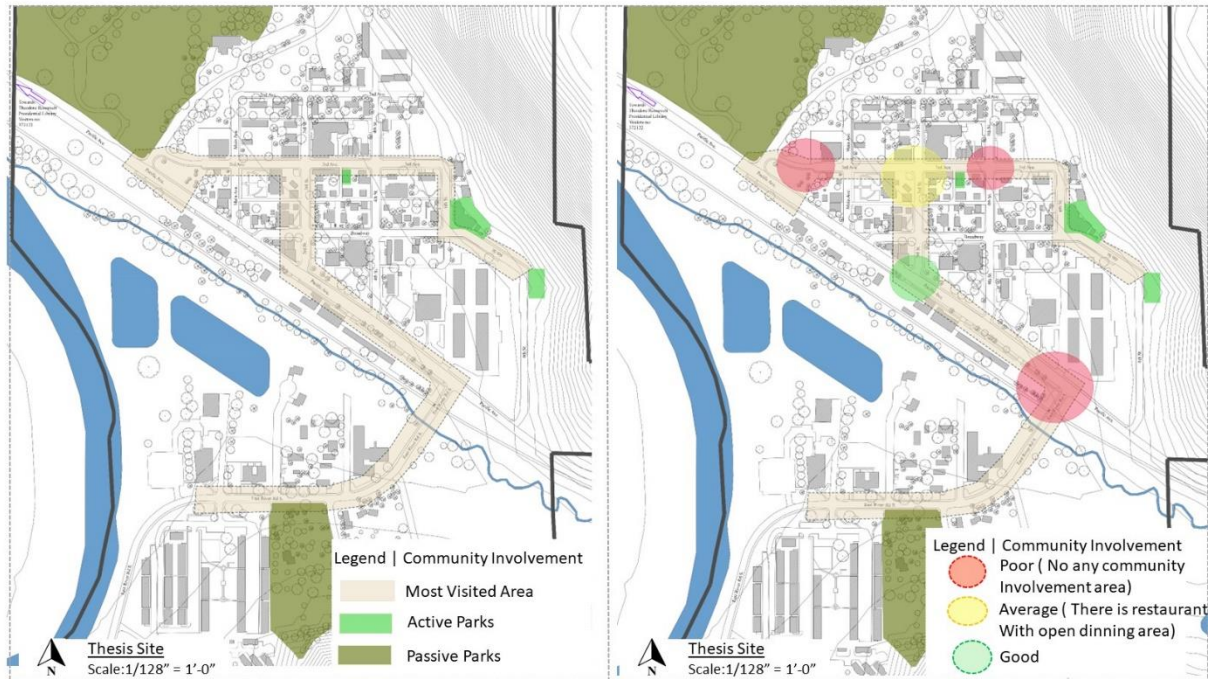


Figure 14 Site Analysis for Community Involvement

6.3. Site Analysis Summary

Following site analysis, several key objectives have emerged for enhancing the pedestrian experience and overall infrastructure of the area. Firstly, it has been observed that there is a significant discontinuity among pedestrian pathways, posing safety concerns. To address this issue, a dedicated walkway is proposed to ensure safe passage, along with widening existing pathways to a minimum of 6 feet for improved usability. Moreover, the lack of sufficient buffer between pedestrian pathways and streets necessitates the introduction of greenery for proper separation. Additionally, intersections lacking crossing markings require redesigning to enhance safety in high-traffic zones.

Secondly, critical infrastructure gaps, particularly in emergency services like hospitals, clinics, and training facilities, have been identified. Establishing these resources is crucial to provide the public with essential training on risk management. Furthermore, the streets are lacking an adequate number of canopy trees, which are essential for enhancing the overall street environment. Therefore, it is recommended to introduce additional canopy trees to improve the aesthetic and environmental quality of the area.

Lastly, while the existing parks offer amenities such as children's parks, golf playing areas, and memorial parks, there is a notable absence of community gathering spaces, playgrounds tailored for adults, and community libraries. Introducing these elements would enrich the diversity and inclusivity of recreational spaces in the area, offering to a broader range of age groups and interests. Addressing these objectives will not only enhance the functionality and safety of the area but also contribute to its overall livability and community well-being.

7. CHAPTER 7 PRE-DESIGN PROGRAMMING & DESIGN PRECEDENTS

After conducting a thorough site analysis and extensive research, it has become evident that Medora, North Dakota, requires significant improvements to provide for its growing number of visitors. The current amenities and facilities are insufficient to accommodate the increasing number of visitors.

To promote walkability in Medora, the city must ensure safety from every angle. This entails the provision of essential features on walkways, such as street furniture and adequate street lighting, to create a secure environment for pedestrians. Additionally, pedestrian intersections must be designed to facilitate safe crossing.

Moreover, establishing a proper drainage system is essential to mitigate any potential hazards caused by bad weather. Introducing a public plaza dedicated to pedestrians will further enhance the city's appeal and provide a public space for residents and visitors alike.

By addressing these crucial aspects, Medora can transform into a city where people can walk freely and safely. Thus, the proposed program elements outlined below are designed to achieve these objectives and advance a more vibrant and walkable urban environment.

Table 5 List of Program Elements

<p>OBJ 1</p> <p>Pedestrian</p> <p>Walkability</p>	<p>OBJ 2</p> <p>Identifying Critical</p> <p>Infrastructure Needs</p>	<p>OBJ 3</p> <p>Community</p> <p>Involvement</p>
<p>1.1 Proper Crossing</p> <p>Markup</p>	<p>2.1 Hospitals/ Clinic</p>	<p>3.1 Playground</p>

1.2 Increasing Side Walks Width (Min6')	2.2 Storm Water Management(Rainwater, Bioswale, Roofgarden)	3.2 Community Gathering Spaces
1.3 Street Furniture (Benches, Streetlights)	2.3 Gas Station	3.3 Communities Libraries
1.4 Street Signage	2.4 Bike Rent Area	3.4 Communities Garden
1.5 Bicycle Lane	2.5 Canopy Trees on the Sides of Streets	3.5 Flexible Communities Event Spaces
1.6 Curb Ramps	2.6 Water body(Water Fountain, Wastewater Treatment Pond)	3.6 Public Plazas
1.7 Elevated Crossing pathway for Pedestrian	2.7 Parking	
1.8 Entry Gate		
1.9 Green Buffer Between Streets and Sidewalks		

After identifying the necessary program elements, the site was analyzed to develop the vision plan. The map presented below illustrates the areas where deficiencies exist and where significant challenges are marked. Various color codes have been employed to portray the project's phase order, with each phase determined based on the issues established in each zone. Zones marked with a "+ High" indicate high impact and thus merit priority in the design process,

designated as phase 1. Conversely, zones marked with "- Low" signify lower impact areas that can be addressed in subsequent phases.

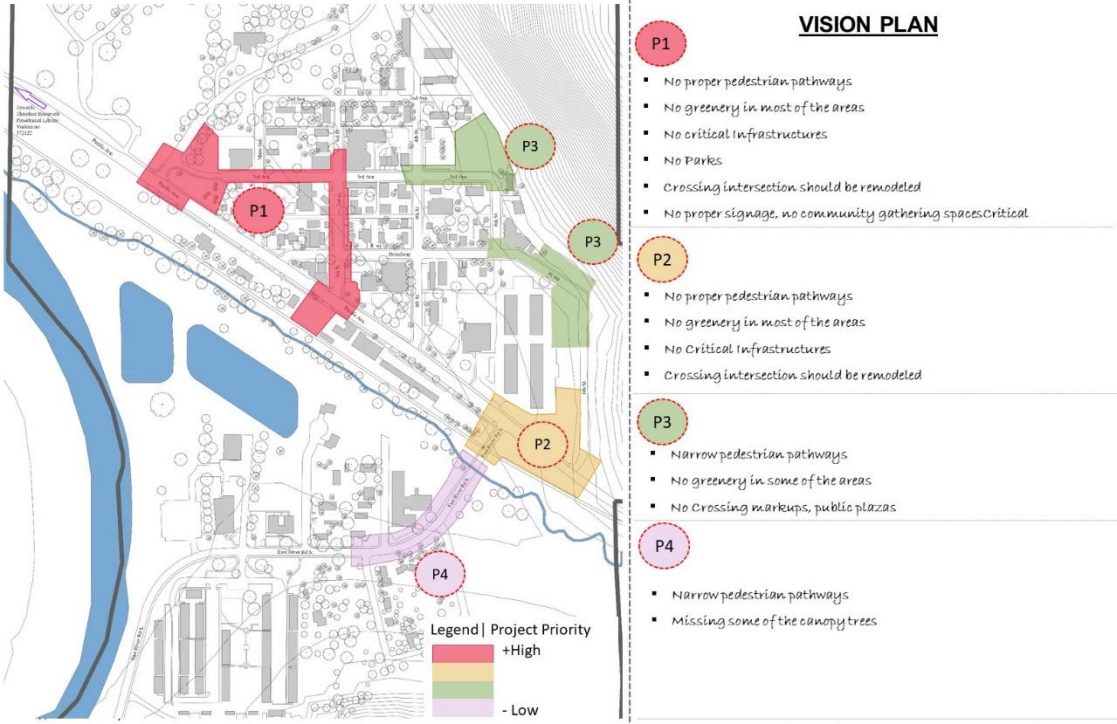


Figure 15 Map showing Vision Plan

After identifying the vision plan, due to time limitation this thesis is focused for Phase 1 i.e. P1 only. In this zone, the neighborhood faces several issues that impact daily life. There are no proper pedestrian pathways, making it challenging for people to walk safely. Most areas lack greenery, and there are no parks for residents to enjoy. The absence of critical infrastructures is noticeable, affecting the overall functioning of the community. Crossing intersections needs improvement for better safety and efficiency. Moreover, there is a lack of proper signage, making navigation difficult, and no designated community gathering spaces, hindering social interactions. Addressing these concerns is essential for creating a more comfortable and vibrant living environment.

8. CHAPTER 8 SCHEMATIC DESIGN

The site is divided into three zones based on their location and proposed functions.

P1, situated along the highway, specifically Pacific Ave, presents an ideal spot for entry gates to showcase Medora city and attract travelers passing through to make a stop. This zone also suffers from a lack of green spaces, public plazas, and proper drainage.

Similarly, P2 marks the intersection of 3rd Ave and 3rd Street. Research findings and site analysis reveal these roads to be among the busiest, necessitating the creation of a safe intersectional crossing area.

Lastly, P3 serves as the entry point to Theodore Roosevelt National Park. These areas contains sufficient vacant land, suitable for the creation of a Nature's Resilience Park.

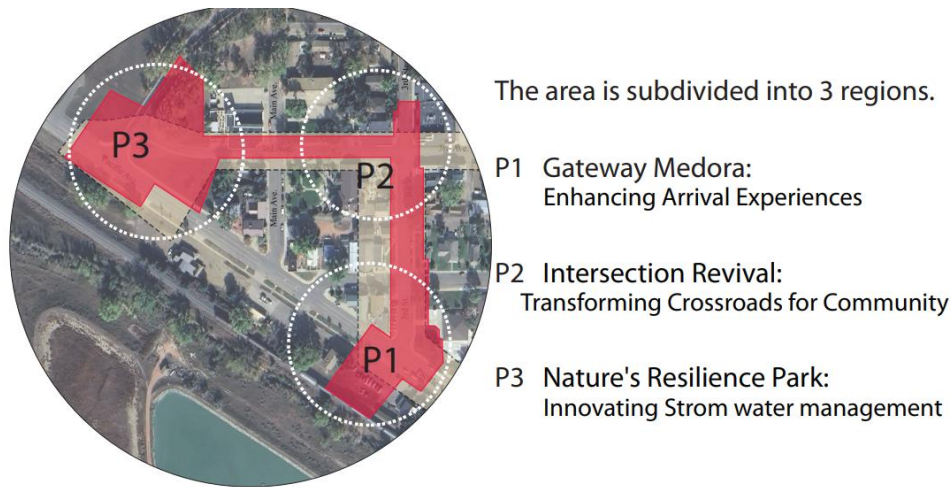


Figure 17 Zoning Plan

Following the completion of the zoning process, the project proceeded into the conceptual drawing phase, a fundamental stage in the design process. At this stage, the focus was on translating the identified zones and their specific requirements into visual representations. The bubble diagram represented in the figure below serves as a comprehensive illustration of how each site's needs and inherent features were considered during the planning process.

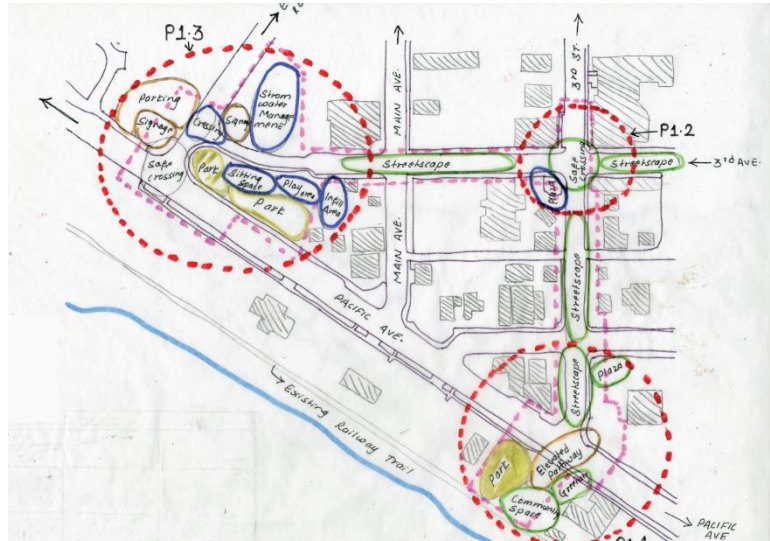
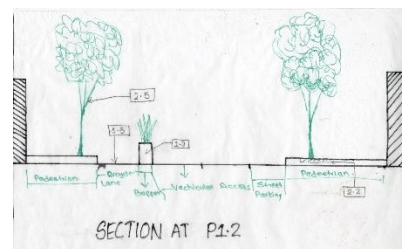
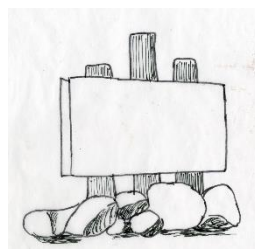
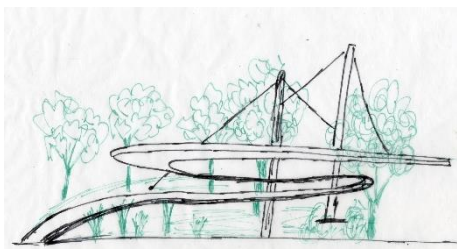


Figure 18 Bubble Diagram

The bubble diagram technique is an effective tool used by designers and urban planners to map out spatial relationships and functional requirements within a given area. Each bubble represents a distinct element or function, and their sizes and placements are indicative of their relative importance and spatial relationships. By carefully crafting this diagram, the design was able to create a visual roadmap that would guide the subsequent phases of the project, ensuring that the final design aligns closely with the identified goals and objectives for each site.



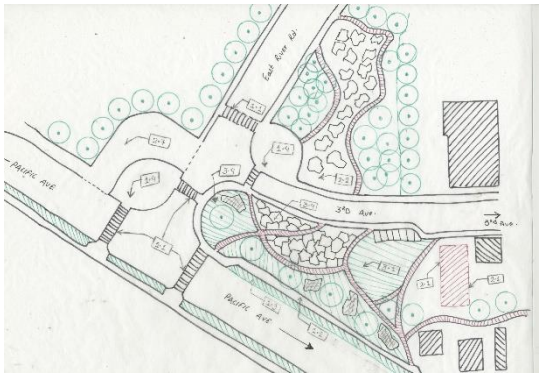
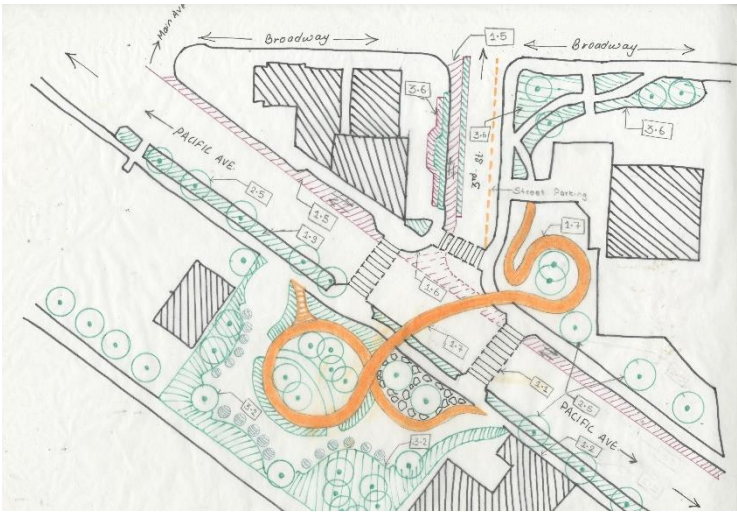
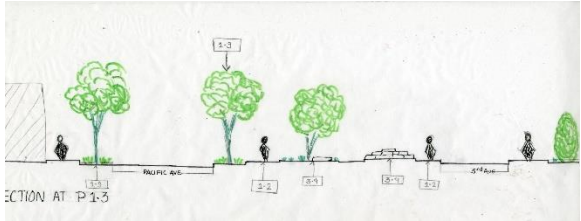
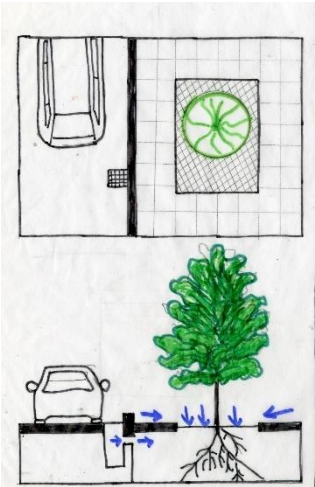
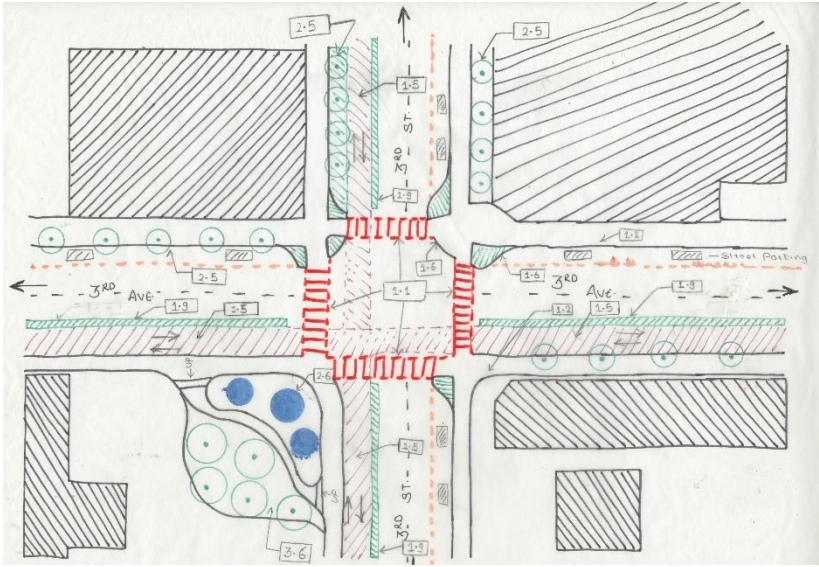


Figure 19 Conceptual Drawing for a better understanding of sites

9. CHAPTER 9 DESIGN DEVELOPMENT

9.1. Masterplan

The site analysis has revealed significant discontinuity among pedestrians, highlighting the need for dedicated walkways to ensure safe passage. Existing pathways are too narrow, necessitating a widening to a minimum of 6 feet for enhanced safety and usability. Furthermore, the current streets lack sufficient canopy trees, impacting the overall street environment. To address this, it is recommended to introduce additional canopy trees, aiming to enhance the aesthetic and environmental quality of the area. Moreover, the analysis has identified a lack of community gathering spaces and playgrounds designed for adults, as well as the absence of community libraries. To promote recreational activities, the proposal includes plans to incorporate these elements into the urban landscape, fostering a vibrant and engaging environment for residents and visitors alike.



Figure 20 Masterplan of site

The above figure explains the master planning of the whole site location. The three plans represent these areas and will look like this after the completion.

9.1.1. Site plan of P1 “Gateway Medora: Enhancing Arrival Experience.”

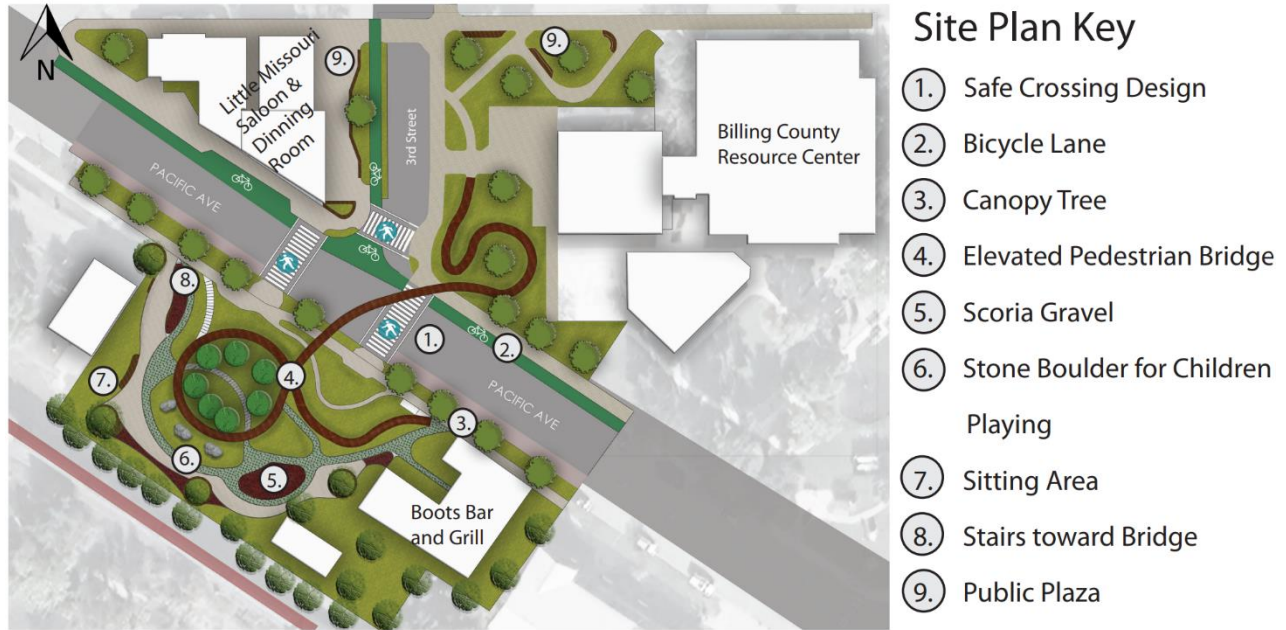


Figure 21 Site plan of P1 " Gateway Medora: Enhancing Arrival Experience."

In discussing the design of P1, known as "Gateway Medora," the focal point of this area is the elevated pedestrian bridge. The bridge's design takes inspiration from the twisting form of a snake, reflecting the symbol of nature. Crafted from steel, the bridge features a brown texture, echoing the color palette of a snake's skin. The bridge supports i.e columns designed to resemble trees, specifically cottonwood, symbolizing the natural environment. The bridge will stand at a clear height of 13 feet above road level and 12 feet above the pedestrian walkway, ensuring sufficient clearance for all users. Additionally, the slope of the bridge will maintain a gentle gradient of 5%, facilitating easy passage for individuals of all age groups.

Additionally, for individuals who may not want to use the bridge, a safe crossing markup is provided underneath, facilitating easy pedestrian movement between points. Furthermore, to enhance mobility within the city, a designated bicycle lane is added, extending to the Maah Daah

Hey Trail, offering an adventurous experience for cyclists. Between Pacific Avenue and the pedestrian walkway, street trees are planted to foster a healthy environment for walkers and mitigate pollution levels.

Talking on the design details, the circular loop formed by the bridge will be adorned with Medora Juniper and various evergreen plants, added by stone pavement walkways to suggest a natural ambiance. Surrounding this area, seating and designated play spaces for children is provided. Additionally, stone boulders are strategically placed to serve as playful features for children. Cottonwood trees offer shading, enhancing the comfort of visitors, while scoria gravel, native to Medora, is utilized for paving. Permeable pavements are provided for walkways within the park area, facilitating effective water drainage and promoting sustainability. Moreover, a public plaza is established in front of the Little Missouri Saloon & Dining Room, serving as a vibrant communal space for social gatherings and events.

9.1.1.1. Sectional Elevation

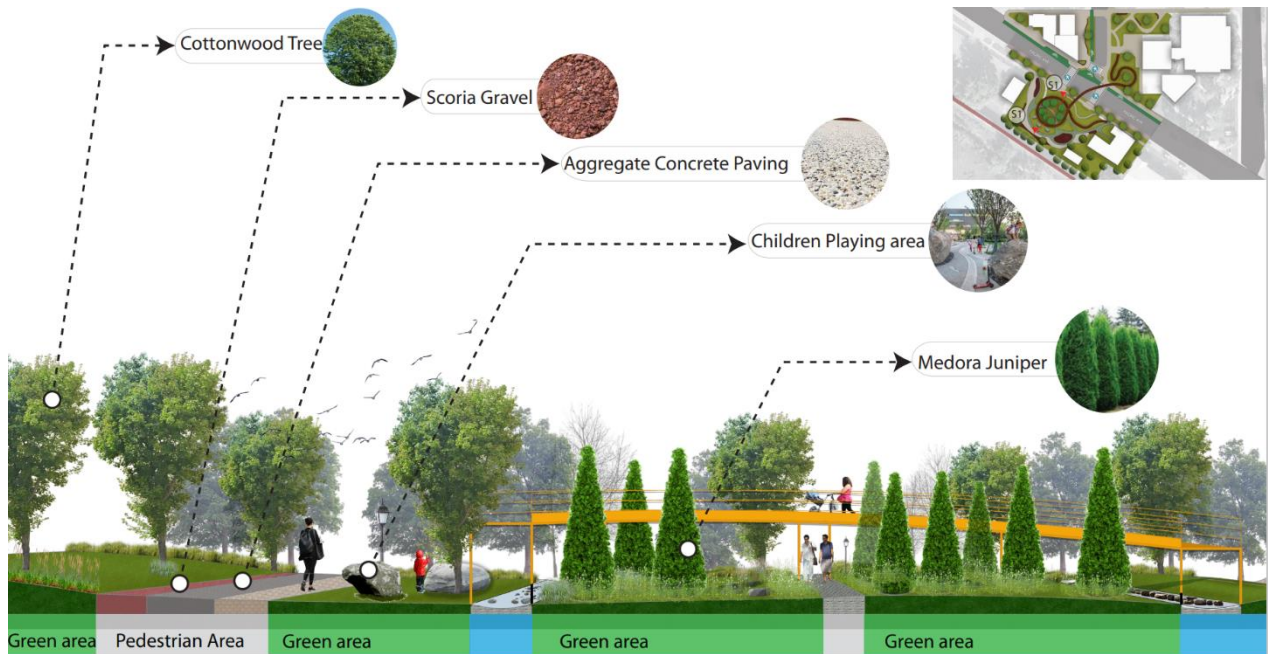


Figure 22 Sectional Elevation at S3/S3

This section shows what parks will look like. The center part of the bridge is covered with evergreen trees and shrubs. The section shows what types of trees will be planted.

9.1.1.2. Perspectives



Figure 23 Perspective view from seating space near Boots & Grill

The perspective shows how the bridge will look like. From this perspective, from the top view of the bridge, the view of badlands can be seen. From this perspective, the pavement materials are seen.



Figure 24 Aerial view of Elevated Bridge

9.1.1.3. Construction Details

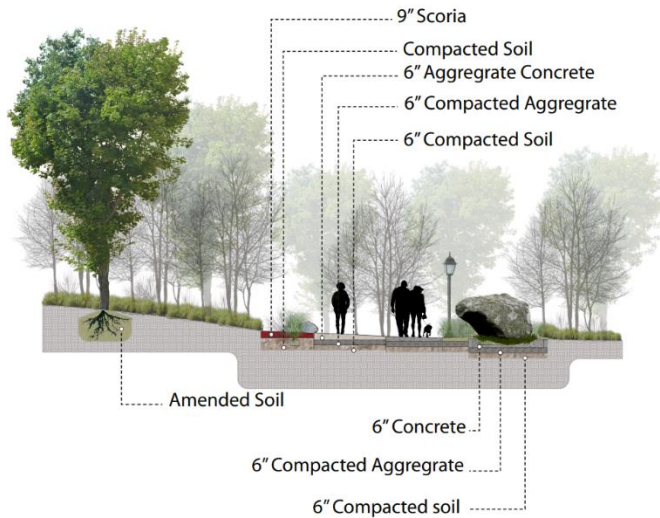


Figure 25 Drawing of Construction Detail of Paving

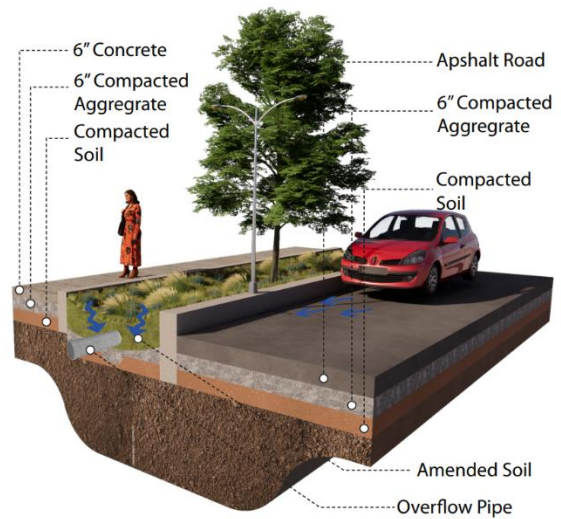


Figure 26 Drawing of Construction Detail of Bioswale Area

9.1.2. Site Plan of P2 “Intersection Revival: Transforming Crossroads for Community”



Figure 27 Site Plan of P2 Intersection Revival

P2's site plan is a model intersection, centered around the Town Square Show Hall. Open spaces in front of the hall have been turned into a welcoming plaza, complete with water features.

Visitors can relax in seating areas shaded by cottonwood trees, fostering a sense of calm and community amidst urban life.

In this thoughtfully designed site plan, the green areas indicate dedicated bicycle lanes, each 8 feet wide, with a excessive 3-foot buffer separating them from the road. Vehicular lanes, 10 feet wide, accommodate traffic in both directions. One side of the road features segregated street parking, while curb extensions optimize space usage. Traffic lights regulate vehicle flow, ensuring safe and orderly movement, while pedestrian lights enhance safety at crossings.

In this area, the pedestrian walkway was limited to just 8 feet, leaving no space for a green buffer zone. To address this challenge, tree pits were inventively incorporated. These pits not only serve as street canopy trees, mitigating air pollution, but also function as a clever drainage solution, contributing to the overall sustainability of the urban environment.

9.1.2.1. Axonometric Perspective

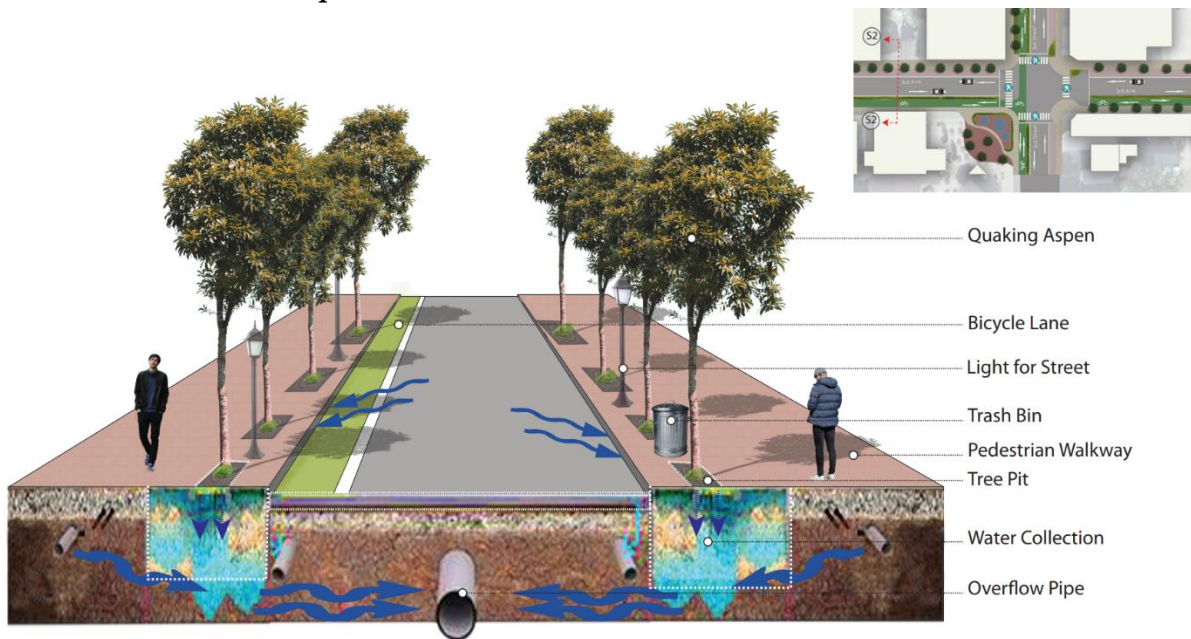


Figure 28 Axonometric Perspective View of Street

9.1.2.2. Perspective



Figure 29 Looking NW from 3rd Street to show Safe Crossing Design

9.1.3. Site Plan of P3 “Nature’s Resilience Park: Innovating Storm water Management”

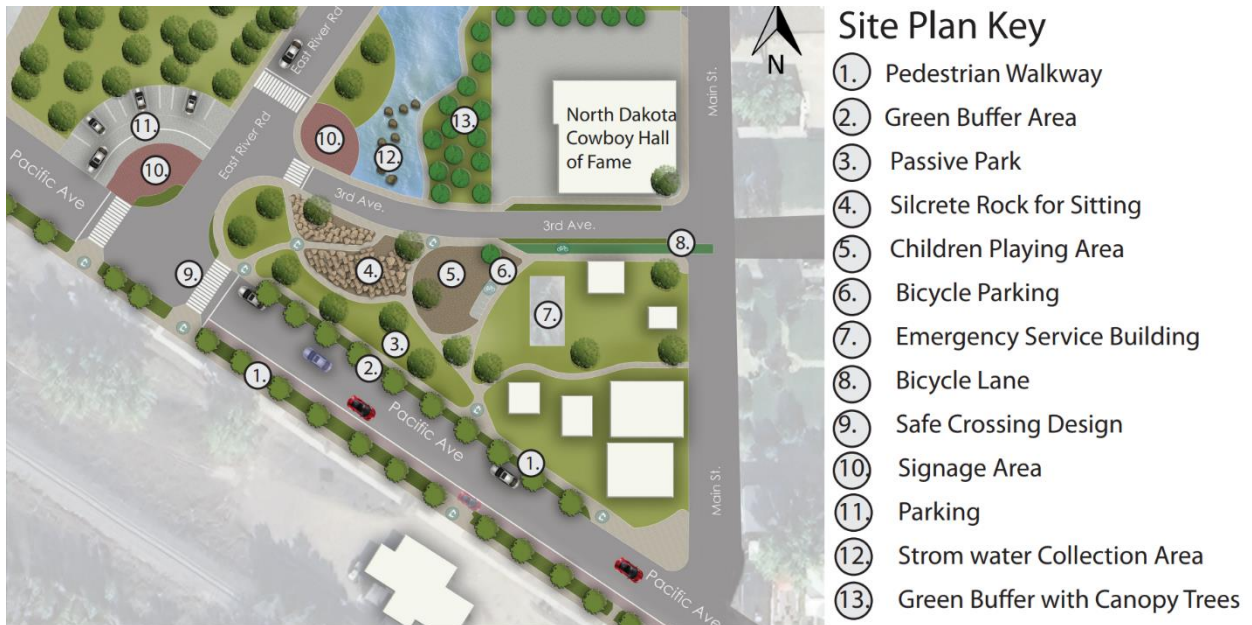


Figure 30 Site Plan of P3

When discussing the design of this area, most of it was vacant. Therefore, the vacant land has been utilized to create a passive park and a stormwater collection pond. Considering the

contour elevation of this area, it is located at a lower height, making it perfect for collecting drainage water. In the plan above, a pedestrian walkway is provided between Pacific Avenue and the proposed passive park. The pedestrian walkway is separated by the proposed buffer green area to prevent air pollution for pedestrians. Similarly, in this plan, there is an addition of an emergency care building. In front of the emergency care building, some green space is left, followed by the proposed children's park to provide a playing area for children.

In the passive park, there are cottonwood trees and Medora junipers to provide both winter and spring effects. Flat stones are arranged for visitors to sit on. On the other side, there is proposed parking to accommodate visitors who wish to visit the park. In the park's center, a mass of silcrete rock are present to create an OAT effect for visitors. This location will offer a perfect view of the badlands as well.

Additionally, just beside the North Dakota Cowboy Hall of Fame building, a stormwater collection pond is proposed. The pond's slope gradient is divided into two sections: one part, where the stone boulder is present, will be 3 to 4 feet deep, creating playing spaces for children, while the other end will be 5 to 6 feet deep, restricting entry for children. An area for signage direction is also selected in this space, providing guidance about the trails for visitors. The ponds and North Dakota Cowboy Hall building is separated by a green layer consisting of native trees. A walking path will surround the pond. Lastly, the road intersection is designed with safe crossing markings.

9.1.3.1. Sectional Elevation

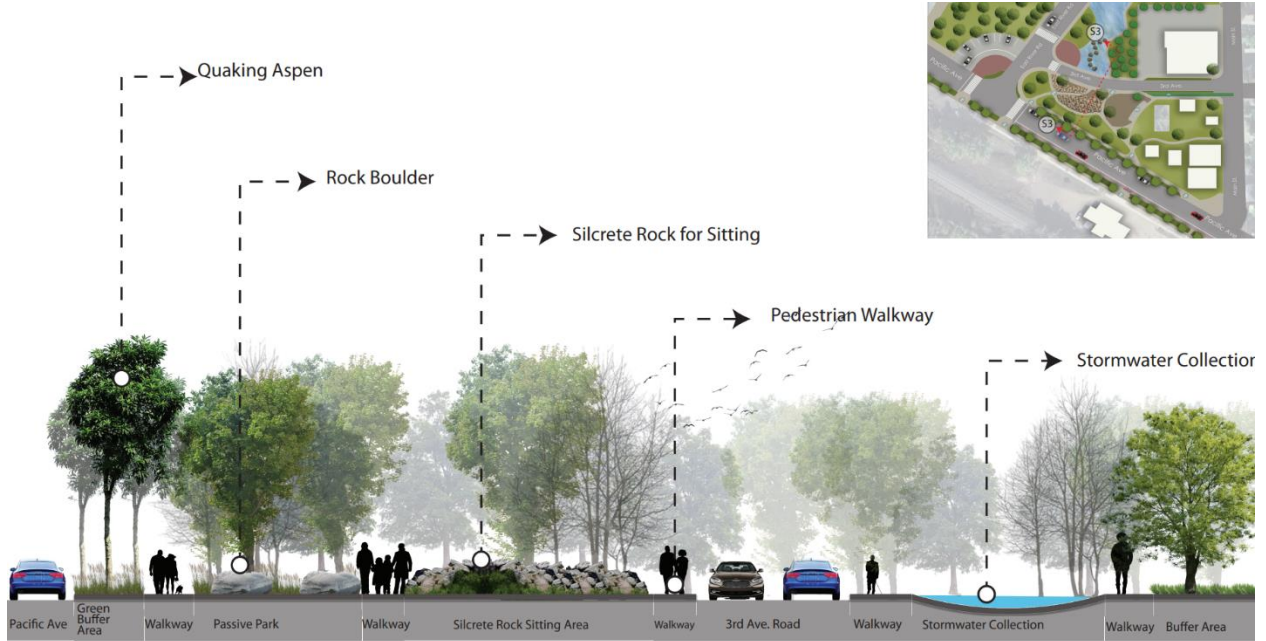


Figure 31 Sectional Elevation at S3/S3

9.1.3.2. Perspectives



Figure 32 Looking NW from the Sidewalk of Pacific Ave Showing Buffer between Street and Walkway



Figure 33 View at Stormwater Collection

10. CHAPTER 10 DESIGN CONCLUSION AND REFLECTION

In conclusion, the success of this design relies on the provision of all the amenities and facilities outlined above. This comprehensive approach will not only enhance air quality and improve stormwater management but also ensure safe crossings and provide communal gathering spaces. If these amenities are indeed implemented in Medora, they will undoubtedly contribute to sustaining the growing number of visitors to the area.

It's crucial to recognize that there's always room for improvement. When there was examination of the vision plan derived from research findings and site analysis, it becomes evident that there are several zones or areas that could be targeted to enhance walkability in Medora. According to the vision plan, phases 2 and 3 present significant potential for improving walkability for visitors. One suggestion is to incorporate an attractive entry gate design that draws visitors in from the entrance of Medora. Additionally, adding active parks would greatly enhance community interaction and engagement.

This project has been incredibly enlightening for me. One of the key takeaways has been learning how to integrate research findings into design and effectively narrow down vast areas to pinpoint high-impact zones through thorough research and analysis. This endeavor has not only honed my design skills but has also emphasized the importance of deeply understanding the site before initiating the design process. Additionally, I've acquired valuable knowledge in ArcGIS analysis techniques, particularly in network analysis.

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