Experiential Graphic Design

Generating Urban Renewal by Improving Safety and Connectivity in Bicycle Pathways

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by
Molly R. Lawrence
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Thesis written by

Molly R. Lawrence


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Approved by

______________________________
Ken Visocky O'Grady, M.F.A., Advisor
School of Visual Communication Design

______________________________
Jaime Kennedy, M.F.A., Director
School of Visual Communication Design

______________________________
Amy Reynolds, Ph.D., Dean
College of Communication and Information
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CHAPTER I

Problem Overview

Introduction

Cleveland, like many Rust Belt cities, experienced an economic boom during the industrial era that resulted in significant logistical and cultural transformations. Planning and implementation were contingent upon industry needs and infrastructure—canal, lake, and railway transportation—and not on habitable environments. The livability of these cities was poor due to the focus on production and consequential congestion; eventually people migrated out to the suburbs (Chapman, 1964). Globalization then led much of the manufacturing overseas, which perpetually diminished these working class communities (Florida, 2012, p. vii). After the fall of the industrial revolution, many of these cities in the Great Lakes region plunged into a steep decline. Once thriving factory towns now began to suffer from economic decline, population loss, and urban decay.

Suburbanization was a practical solution for people throughout the mid-twentieth century, but now, enormous demographic shifts are occurring as young innovative generations move into urban areas. Post-industrial cities are attractive to these new generations due to their forward-thinking transformative possibilities (Florida, 2012, p. vii). To quote Richard Florida, acclaimed American urban studies theorist, “These cities have the density and infrastructure, history and authenticity, the walkable neighborhoods and quality, affordable housing, the great universities and medical centers, the leading cultural complexes and cutting-edge music and cultural scenes that are the fuel of the creative economy” (p. vii). Florida argues that it is not the old top-down methods and approaches that our cities need, but the spirit from bottom-up: collaborative
and holistic community efforts from community organizations, entrepreneurs, programmers, architects, designers, and planners that really make contemporary and radical strides (p. viii). Industrial districts that once operated successfully in post-industrial Midwestern cities are commonly underutilized (Kapp & Armstrong, 2012, p. x). These post-industrial landscapes, in fact, have the capacity and potential for redevelopment and it is economically, environmentally, and socially responsible to do so in order to create more attractive destinations for the community to experience and celebrate (p. x).

Research shows that creative class citizens and millennials prefer communities with vibrant street culture as well as walkable downtowns and districts in which they can live, work, and play (Speck, 2012, p. 18). This is supported by the statistic that 77% of millennials desire to live in urban centers (p. 21). Since the late nineties the amount of automobile miles driven by Americans in their twenties has gone from 20.8% to 13.7%, which is surprising with today’s auto-centric cities and urban sprawl (p. 19). Along with the new generation, the boomers are seeking more walkable, accessible, and independent communities in place of their large homes in the suburbs (p. 21). With the rise of new and old generations moving into post-industrial cities like Cleveland, there is a greater demand for pedestrian and bicycle culture and a need to reintegrate street life into the current urban environment. In order for industrial cities to regenerate, the safety and connectivity of urban pedestrian and bicycle infrastructure must be improved so that communities can develop into more prosperous walkable and bikeable environments.
Walkable Environments

The Benefits of a Walkable City

A walkable city enhances the quality of life for its residents. The benefits of a pedestrian and bicycle-friendly community can be categorized into three parts; health, economy, and sustainability (Speck, 2012, p. 16). Whether it is the commute to work or school, a shopping trip, or purely recreational, walking and cycling gives people the opportunity to use transportation as a form of exercise and socialization (Southworth, 2005, p. 246). Walking and cycling also minimizes automobile congestion and has little environmental impact (p. 246). Further, walkable cities attract new residents and businesses which are necessary for urban regeneration (Speck, 2012, p. 35). Walkability allows members of the community to feel more closely connected to the people and places in their cities.

Behavior and Motivations

The degree of walkability and cyclability is directly related to the condition of the pedestrian environment. Due to the fact that the pedestrian and cyclist use their senses of sight, sound, smell, and touch to gauge their surroundings, the urban setting therefore affects the decision to walk or cycle (Southworth, 2005, p. 247). Three key challenges must be acknowledged when motivating people to increase their walking or cycling routine. Physical issues in the environment including urban design, shop locations, walking or biking destinations, street access and lighting are all motivations for people to walk or cycle instead of driving a car (Wright, 2003, p. 409). Structural factors such as street crossings and a reasonable road sharing system for cars, pedestrians, and bicycles are also important considerations. Lastly, social reasons like a sense of community and safety
encourage people to walk and cycle as well (p. 409).

Aside from the physical environment, the decision to walk or cycle may also be based upon the emotional connotation related to the benefits or risks involved. In regard to cycling, the benefits include convenience, low cost, speed, fun, and environmental kindness (Forward, 2003, p. 211). Contrary to the positive aspects, the disadvantages include the risk of a stolen bicycle, an uncomfortable or strenuous ride, the difficulty of large and heavy hauls, and the danger involved in riding, particularly in automobile-heavy areas (p. 211). Attitudes towards walking and cycling can change positively with a more desirable user experience (p. 220).

Criteria for a Walkable City

A certain criteria must exist for a walkable community to succeed, apart from utilitarian access (Southworth, 2005, p. 249). Educator and researcher of urban design and planning, Michael Southworth, outlines necessary attributes of a walkable network in his journal article, Designing the Walkable City (p. 249-252):

1. **Connectivity of path network, both locally and in the larger urban setting;**
   - Connectivity of the path network is determined by the presence of sidewalks and other pedestrian paths and by the degree of path continuity and absence of significant barriers.
   - Connectivity is best addressed when an area is being designed, and is much more difficult to remedy once a place is built.

2. **Linkage between transportation modes: bus, streetcar, subway, train;**
   - A small pedestrian district, no matter how well designed, cannot contribute to a reduction in automobile use if it is not well supported by transit and situated
within an accessible mix of land uses.

3. **Fine grained and varied land use patterns, especially for local serving uses;**
   - A walkable neighborhood or city has an accessible pattern of activities to serve daily needs.

4. **Safety, both from traffic and social crime;**
   - In most United States cities transportation and land use policies have made walking and bicycling inconvenient, unpleasant, and dangerous. Environments that support fast and efficient auto travel are not enjoyable, safe, or interesting for pedestrians and bicyclists.

5. **Quality of path including width, paving, landscaping, signing, and lighting;**
   - The ideal pedestrian path will provide for the comfort and safety of pedestrians of varied ages and physical abilities.

6. **Path context, including street design, visual interest of the built environment, transparency, spatial definition, landscape, and overall explorability;**
   - A transparent environment allows one to sense the social and natural life of a place through first hand observation. Such qualities are impossible to deal with at the macro level of most transportation analyses and planning, but require special attention to detail and design of the qualities of places.

By creating a greater quality of life through walkability, new residents and jobs will abound (Speck, 2012, p. 35).

*Defining Pathways, Districts, and Walkability*

Distinguished American architect and planner Kevin Lynch, defines the formal
elements of a city and organizes them into five categories: paths, landmarks, edges, nodes, and districts (Lynch, 1960, p. 8). His principles are widely studied and used today in fields relating to urban planning and design. The role of these forms, or design elements, is to work in unison to emphasize meaning and structure in the environmental appearance (p. 8).

Pathways are routes along which a user travels, and the most predominant element when navigating a city. In an urban environment pathways may be streets, sidewalks, bike lanes, transit lines, rivers, and railways (p. 47). Depending on the use of the path and its structural properties, some pathways are more useful, important, or appealing than others (p. 50). Pathways with a strong identity have clear beginnings and destinations, informing people where they are in relation to where they came from and where they are going (p. 54). As stated by Lynch, “people observe the city while moving through it, and along these paths the other environmental elements are arranged and related” (p. 47).

Cities, such as Cleveland, are primarily divided into progressive districts, or large areas in and surrounding the city, that transmit a distinct energetic character (p. 47). They are often an enjoyable aspect of living an urban lifestyle, usually as a result of their location and identity within the city image. Often in a city, the edges of a district are either strong or withered and counter a seamless transition from one district to another, causing the city to appear fragmented and disorderly (p. 65). Accordingly, the distinction and proximity of a district plays a significant role in its success (p. 72).

The condition of a city’s pathways and districts is directly related to the theory of walkability. Walkability may be defined as a measure of walking or cycling facilitated and encouraged by the built environment, connecting users with destinations
(Southworth, 2005, p. 247–248). A successful walkable environment encourages walking and cycling through an interconnected and accessible path network and aids walking for a variety of purposes including commuting, shopping, pleasure, recreation, and health (p. 248). In his book, Walkable City, Jeff Speck, Washington D.C. based city planner, outlines his General Theory of Walkability:

The General Theory of Walkability explains how, to be favored, a walk has to satisfy four main conditions: it must be useful, safe, comfortable, and interesting. Each of these qualities is essential and none alone is sufficient. Useful means that most aspects of daily life are located close at hand and organized in a way that walking serves them well. Safe means that the street has been designed to give pedestrians a fighting chance against being hit by automobiles; they must not only be safe, but feel safe, which is even tougher to satisfy. Comfortable means that buildings and landscape shape urban streets into “outdoor living rooms,” in contrast to wide-open spaces, which usually fail to attract pedestrians. Interesting means that sidewalks are lined by unique buildings with friendly faces and that signs of humanity abound (Speck, 2012, p. 11).

These four conditions for the pedestrian and cyclist are significant in improving walkability and advancing the overall sustainability of a city. The effort of increasing the walkability of a city therefore has the potential to create an interconnected community and to establish a prominent sense of place in an urban setting.

**Urban Bicycle Infrastructure**

Research proves that creating cities focused on pedestrians and cyclists over automobiles leads to the betterment of the community and the urban environment. The
primary obstacle in designing pedestrian and bicycle systems is the critical aspect of user safety. Bicycle infrastructure proves to be more complex than pedestrian due to the interrelation with busy urban roadways and shared use of traffic pathways. This investigation was narrowed to focus on bicycle infrastructure, specifically, to study the complexities of these systems and to uncover if design can offer a solution. Bicycle guidelines, particularly the Ohio Manual of Uniform Traffic Control Devices by the Federal Highway Administration (FHWA), were analyzed to initiate the investigation of the level of safety established in the bicycle infrastructure in Cleveland.

Dedicated and Shared Bicycle Facilities

Bicycle facilities can be defined as the design of bicycle pathways or treatments for roadway transportation that exist within the larger bicycle infrastructure, or network of facilities. Bicycle-specific facilities, such as dedicated bike lanes and trails, are commonly implemented as a means to increase cycling. Though evidence is varied surrounding the effectiveness of particular facilities, bicycle-specific facilities are proven to support existing bicyclists and encourage new non-riders to increase their cycling habits as well (Schoner & Levinson, 2014, p. 1189). The challenge with bicycle-specific facilities is that it is often not the most direct route for the cyclist. This is an issue considering bicycle commuters are confirmed to judge distance to be the most important factor when determining route choices (p. 1189–1190).

The newly revised Guide for the Development of Bicycle Facilities published by the American Association of State Highway and Transportation Officials (AASHTO) states that bicycle planning requires a complete qualitative and quantitative evaluation of roadway conditions, needs, and feasibility (p. 1190). This implies that each bicycle
plan and roadway is different and the design should meet the needs of the user and the roadway design accordingly. Regardless of the type of bicycle facility, it is recommended that the routes be as direct, safe, and comfortable for the user as possible (p.1190).

An interconnected network with minimal detour is essential for bicycle commuters. It is clear that the need is present for a system that combines both the safe and comfortable attributes of dedicated bike facilities, with the directness and efficiency of shared bicycle and automobile traffic lanes. Evidently, characteristics need to be addressed according to individualized roadways and bicycle paths as opposed to dismissing specific user needs by generalizing these types of facilities.

Bicycle facilities benefiting the needs and safety of a cyclist on shared roadways is severely unconsidered in many cities, including Cleveland. With cyclists being primarily classified as a vehicle on roadways, standard signage designed for cyclists is treated similarly to signage designed for motor vehicles. However, bicycle infrastructure and signage in United States cities are not as commonly comprehensive as the underlying vehicular road network (p.1188). In situations where accommodations for cyclists are not present, riders are often left to maneuver in automobile traffic on hazardous shared roadways.

*Standard Design for Bicycle Facilities and Traffic Control Devices*

Multiple organizations (both federal and state) are involved in the development of pedestrian and bicycle facilities across the United States. The Federal Highway Administration (FHWA) adopts several guidelines for pedestrian and bicycle facility design, including the *Guide for the Development of Bicycle Facilities* published by the American Association of State Highway and Transportation Officials (AASHTO), and the
Urban Bikeway Design Guide published by the National Association of City Transportation Officials (NACTO). Aside from design guidelines, traffic control manuals are another resource in use, particularly in city departments of traffic engineering. The City of Cleveland adheres to the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) that contains statewide standards for the design and use of traffic control devices for streets, highways, bikeways and private roads.

The Ohio Manual of Uniform Traffic Control Devices: Signs and Markings

Part nine of the OMUTCD is categorized into two parts including signs and pavement markings specifically related to bicycle travel on roadways and shared-use paths (ODOT, 2012, p. 895–925). It also contains information regarding placement authority, sign and plaque sizes, materials, and color-coding. Also noted in this chapter is that the absence of these signs or markings on any roadway does not mean that bicyclists are not permitted to travel on that particular road (p. 895). A survey of these sign types and pavement markings was organized in order to form an understanding of the regulated signage that is currently in use, and to address problems that negatively affect cyclist safety.

Signs

The post-mounted upright bicycle signs are divided into three groupings; regulatory signs and plaques for bicycle facilities, warning signs and plaques, and guide signs and plaques (ODOT, 2012, p. 895–925). They are required to be reflectorized on any shared-use path and bicycle facility. It is also noted that post-mounted signs on shared-use paths are required to be mounted at a minimum of four feet measured vertically from
Most significant to note about the regulatory signs and plaques is the lack of instruction inherent with these sign types (figure 1). They supply automobile drivers and bicycle riders with general rules, but to most drivers unaware of bicycle regulations, these signs would not provide them with a full understanding or guidance relating to bicycle traffic patterns. For example, the “bicycle lane” sign (R3-17) paired with the “ahead” or “ends” signs (R3-17aP and R3-17bP) informs cyclists and drivers that a bicycle lane is beginning or coming to an end (p. 901). This sign does bring awareness to both users. However, the disadvantage is that these signs do not provide the driver or cyclist with further instruction on how to interrelate beyond the end of the bike lane.
The cautionary signs and plaques for bicycle facilities can be easily confused with signs dedicated for automobiles, due to their use of identical symbols and color (figure 2). While both sign families serve a similar purpose, they do not articulate specific instruction for automobile drivers regarding bicycle riders. For example, the cautionary sign containing the bicycle symbol (W11-1) may bring awareness to drivers that cyclists are riding on the road, but they do not advise the driver of any specific location on the roadway where they could find a cyclist riding (p. 905). Another example of unclear information is the sign that reads “share the road” (W-16-1P). While the sign does provide awareness for both the driver and cyclist to ride together on the road, it informs neither user of how to do so. This may cause confusion regarding passing rules and where the
cyclist is permitted to ride in the shared lane.

**Figure 3. Guide Signs and Plaques for Bicycle Facilities**

(ODOT, 2012, p. 907–908)

The positive features of the guide signs in the O MUTCD are highlighted here, in support of the design criterion used in the design investigation section of this study (figure 3). Certain examples in the guide signs category illustrate a successful combination of destination, distance, and direction (p. 907–908). The bicycle symbol in combination with the allotted miles of travel distance encourages people to cycle to various destinations. The “bike route” sign (D11-1) acts as a route marker providing the rider with navigational assurance (p. 908). It also acts as a linkage if placed between the aforementioned signs, which contains the bicycle symbol, destination, arrow, or mileage number.
Markings

The OMUTCD specifies that pavement markings for bicycle facilities indicate lane separations, bicyclist travel paths, and provide information for turning and crossing maneuvers (p. 915). All markings are also required to be reflectorized while still providing traction in wet conditions. The markings for bicycle facilities may be categorized into four groupings; intersection markings, bicycle lane markings, detector markings, and shared lane markings (p. 915–925).

**Figure 4. Intersection Pavement Markings**

(ODOT, 2012, p. 916)

While the intersection markings depicted do provide the cyclist with guidance through an intersection, the optional dotted line is commonly unimplemented (figure...
4). These intersection markings also do not take into consideration situations in which a bicycle lane ends before the intersection. Another case in which the cyclist is left with an abrupt transition into a busy and dangerous crossing with automobiles traveling in diverging directions. Another common circumstance, not pictured, is when a cyclist needs to cross multiple lanes of traffic, from the rightmost lane to make a left hand turn without the accessibility of a bike lane. In this case there is no marking prevalent to guide them while transitioning through automobile traffic—unsettling to both drivers and bicyclists.

**Figure 5. Word, Symbol, and Arrow Pavement Markings for Bicycle Lanes**

(ODOT, 2012, p. 918)

The bicycle lane markings in the OMUTCD combine words, symbols, and arrows to mark the location of bicycle lanes on pavement (figure 5). Often bicycle lanes are unclear to automobile drivers when there are large, unmarked gaps in bike lanes,
between pavement markings; an observation made from personal experience and confirmed by secondary and primary research. If there are great lengths of unmarked bike lanes, they are commonly confused with vehicular roadway markings due to the identical white reflective paint used. This weak differentiation is distressing for both drivers and cyclists, and may cause automobiles to drive in bike lanes unknowingly.

**Figure 6. Bicycle Detector Pavement Marking and Shared Lane Marking**

(ODOT, 2012, p. 923–924)

Detector and shared lane markings are both useful in providing an awareness of bicycles to automobile drivers (figure 6). They are symbols widely understood to inform automobile drivers of frequently traveled bicycle pathways. Most importantly, they can be used in combination with other bicycle markings to keep drivers alert and to ultimately use caution while sharing the road with bicycle riders. While these markings do provide awareness, their broad meaning results in minimal effectiveness.
Summary

Considering that the *Ohio Manual of Uniform Traffic Control Devices* is the most critical and widely referenced set of guidelines for the Cleveland area, significant problems concerning their bicycle facilities remain, and are imperative to analyze. The overarching issue with the three categories of signs is that they are mounted upright on posts, making it difficult for the cyclist to detect. A cyclist’s line of sight is continually aimed at their path on the ground ahead, making readability of roadway markings more immediate. Additionally, the pavement markings exemplified in the OMUTCD are insufficient and generalized, causing difficulties in their application to varying roadway situations.

Conclusion

The pedestrian and bicycle environment is filled with numerous obstacles; drivers with little knowledge of pedestrian and bicycle laws, unsafe streets, and poor walking and cycling infrastructure. These issues often arise from a lack of communication and interdisciplinary collaboration between departments of transportation, urban designers, city planners, parks departments, and graphic designers (Southworth, 2005, p. 255). When these disconnected disciplines fail to work together the needs of the user are commonly forgotten. Automobile-centric cities leave little room for the pedestrian and bicyclist to navigate, and in circumstances such as these, streets are neither walking nor cycling friendly, leaving pedestrians and cyclists without a safe and functional user experience.

A macro approach to designing city transportation planning and engineering is data-driven and focuses on capacity, demand, volume, rate of flow, trip origin/destination
analysis, congestion patterns, and regional land use patterns. Alternatively, urban
designers and landscape architects address the micro factors including form and the use
of community sites (p. 247). While the macro view of an urban environment is important,
the micro view, which affects the livability of a city, should not be neglected. When these
two approaches are disconnected it can create divided neighborhoods or districts, damage

Therefore, both macro and micro approaches to the design of the urban landscape
should work harmoniously. Successful and functional cities should be planned by a
generalist, or a city planner, who maintains a broad view for the benefit of the city as
a whole (Speck, 2012, p. 15-16). Designers, planners, and engineers must work together
in a collaborative movement to overturn our automobile-centric cities and begin a new
revolution of vibrant urban street life. Undoubtedly, there is a need for a more adaptive
and flexible bicycle system meeting the more individualized needs of both automobile and
bicycle users to align with the goals outlined for a more bikeable city.
CHAPTER II
Experiential Graphic Design

Introduction

As notable urban planner Kevin Lynch states in his text, *The Image of the City*, “a legible city would be one whose districts or landmarks or pathways are easily identifiable and are easily grouped into an overall pattern” (Lynch, 1960, p. 3). This legibility, or understanding of the urban environment, is essential to its users and also to the restoration of our cities. Navigating is instinctual through using and organizing our senses in external environments so we can facilitate finding our way. Cities are permeated with signals, but when the feeling of disorientation occurs it causes distress. Wayfinding offers the individual aid through orientation in any given environment (p. 3–4). Regarding the urban streetscape, vehicular or bicycle wayfinding systems cannot function without an underlying system of cautionary signs and markings to ensure user safety. With a framework of safety established, wayfinding design can then provide the organization and clarity needed to create a legible city.

Experiential, or environmental, graphic design has origins that precede its realization as a defined discipline rooted in architectural practices (Calori, 200, p. 3). Notable environmental graphic designer, Chris Calori provides a clear translation: “Environmental graphic design, or EGD, can be defined as the graphic communication of information in the built environment” (Calori, 2007, p. 2). Over the past several decades EGD has been identified as a cross-disciplinary field of significance. Before it attained this recognition, signage was considered an afterthought in environmental conditions. Though as cities expanded and developed into more complex environments, a need for information in the environment to be organized emerged in a way that people
could better understand and navigate their surroundings. Consequently, efficient and systematic signage and wayfinding systems have materialized (p. 2–4). In her book, *Signage and Wayfinding Design* Chris Calori identifies three overlapping components of EGD as listed here (Calori, 2007, p. 4–9):

1. **Signage and Wayfinding, orients people to a site and helps them navigate it.**
   - Signage and wayfinding are most commonly expressed in unified sign programs that informationally and visually unify a site.
   - In the same way that well-designed sign programs unify a site, signage can perform a placemaking role by creating a unique identity and sense of place, thereby effectively creating a brand image within the environment.

2. **Interpretation, tells a story about a site.**
   - Interpretive information relays further information an object, a site, an event, a historical figure, a corporation and its products, and so on, providing deeper meaning.

3. **Placemaking, creates a distinctive image for a site.**
   - Placemaking can be expressed in several ways. What separates placemaking, in the EGD sense, from other forms of placemaking is the explicit communication of information (Calori 4–8).

The intent of experiential graphic design is to communicate information through a systematically organized combination of language, symbols, diagrams, and images, and thus plays a critical role in the user experience of the built environment. Not only does EGD have the capability of sharing information with the public, but also has the capacity to intimately connect people with places. Moreover, signage and wayfinding are gaining recognition in contributing to the order of high-stress environments by providing a sense
of wellbeing, safety, and security in places such as airports, hospitals, and cities (p. 9).

Ultimately, EGD has the power to humanize complex environments.

**Urban Wayfinding**

There is a wide spectrum of wayfinding project types and markets for customer experiences, as well as in urban areas (Gibson 2009, p. 18) People come together in public spaces for numerous reasons; work, entertainment, study, recreation, culture, art, and religion. To fully experience these spaces, people use wayfinding to orient themselves and to feel comfortable with their surroundings (p. 12). People must be able to navigate sprawling cities filled with information, without becoming overwhelmed and disoriented.

It is the wayfinding designer's duty to create this desired experience through organized and simple systems that are seamlessly integrated into the environment. A successful wayfinding system communicates information about places with efficiency and immediacy (p. 13).

Wayfinding systems are utilized in a diverse array of spaces, from small scale communities to large scale public centers. Small markets including sports and entertainment, hospitality, retail, corporations, and commercial real estate enhance the consumer experience, whereas larger centers for transportation, education, healthcare, culture, and government require extensive navigational systems. Urban wayfinding systems often become a dynamic image embedded into the “civic infrastructure and public narrative of the city” (p. 18). An adept signage system is unobtrusive to the environment and its necessity often goes unnoticed (Uebele, 2007, p.9).
Within the urban context, navigational signs for vehicular, bicycle, and pedestrian users are useful components of environmental, or experiential, graphic design. Urban wayfinding strategies are derived from urban planning concepts and can be grouped into four concepts: districts, streets, connectors, and landmarks (figure 7). Districts specifically are spread throughout a city and contained within them are individual destinations. Pathways, or streets, provide a network of corridors through a space. All four wayfinding strategies are capable of making places easier to interpret and navigate (p. 37). This study specifically involves pathways and districts that will be visually presented in the design investigation section.
Planning Wayfinding Systems

When planning a wayfinding system, the designer must first observe user movement patterns within the populated locales (Gibson, 2009, p. 36). On-location investigation and analysis also requires an understanding of the complexity of public space. Circulation patterns and plans, maps, or diagrams are reviewed to reveal necessary information for the user. Once pathways and locations are established, the designer can look for obstacles and opportunities within the environment. Additionally, user interviews provide the designer with more information that is unlikely discoverable by observational research alone. Findings from preliminary research investigation involving site observations and interviews can then be applied to the planning and strategy phase, and an overall framework for the wayfinding system can be developed. Frameworks are used in wayfinding design to organize and structure a system of signs that help people navigate from place to place, or specifically in this research investigation, from district to district (p. 40–44).

Each sign within a wayfinding system plays a specific role and exhibits graphic symbols, images, and/or words accordingly (Gibson, 2009, 46). Signs are can be categorized into varying classes: identification, directional, orientation, regulatory, and warning (p. 47). Identification signs signify transitions from one place to the next along a path by indicating entrances and exits. Directional signs function as signals for continuous movement throughout the route by guiding the user from one destination to the next. Message content often includes typography, symbols, and arrows, and must be simple, recognizable, and quickly readable. Orientational signage commonly includes maps and displays a broader scope of the space. Regulatory signs and messages communicate rules or warnings and are unobtrusive and immediately recognizable (p.
Lastly, warning signs alert people of hazardous situations or safety conduct in an environment (Calori, 2007, p. 72).

Sign programming is the final phase of planning wayfinding systems. This stage entails developing sign message content and planning sign locations using the preliminary research analysis. In the professional realm, most sign programs include a list of sign types, sign elevations, sign-location plans, and sign-message schedules. Simplicity is crucial in the planning process, especially when working with complex environments (Gibson, 2009, p. 65).

In his journal article *Principles of Urban Wayfinding Systems*, Craig Berger, notable EGD designer and scholar, outlines a method for developing urban sign routes according to Kevin Lynch’s influential urban elements from *Image of the City* (figure 8). Hierarchically, he describes it as an approach similar to the “peeling of the onion.” First, at the edge of the city directions should point inward to the large districts or the downtown area. Next, the district edge should direct to smaller subdistricts, major boulevards, and major landmarks and parks. Then inside the subdistrict to larger destinations and parking, and lastly, at the pedestrian level to all destinations (Berger, 2002, p. 32).
A traffic engineer plays an important role in the development of wayfinding systems, particularly with sign route and placement (Berger, 2002, p. 33). For the highest functioning system, the designer should rely on the traffic engineer’s quantitative data for planning purposes (p. 33). The Federal Highway Association’s *Manual of Uniform Traffic Control Devices* (MUTCD), the primary set of guidelines used by city traffic engineers, is applicable to wayfinding signage, however, the specifications in the manual are nationally uniform, whereas successful wayfinding is designed for individual needs and characteristics of each unique city (Berger & Trescott, 2007, p. 126). Concurrently, the traffic engineer and wayfinding designer are responsible for following the federal and state regulations outlined in this manual in the same manner that they are firmly applied to roadway systems.

**Conceptualizing Wayfinding Systems**

The schematic design phase follows research and analysis (Calori, 2007, p. 19).
These phases are exploratory in nature, and is the point at which the designer can generate a multitude of concepts and approaches to the problem, which will then be iterated and refined recurrently, and finally narrowed down to one solution. The designs at this phase are generally rough and informal prototypes that do not exhibit a large amount of detail (p. 19–21).

Following the schematic design phase the wayfinding designer transitions into development. This stage progresses the concept with further refinements and detail. A set of standards and professional recommendations are referenced when creating signs in the field of environmental graphic design. Human factors are considered in this phase including viewing angle and distance, as well as code-mandated factors such as typography and layout, color, symbols and maps, forms, materials, and media (p. 27).

**Typography**

Typefaces chosen for wayfinding projects must be both appropriate and communicative for each individual system (Gibson, 2009, p. 76). Form versus function is a key concept in choosing type that is suitable for a project. The typography determined by the designer must reflect an appropriate personality and it must be legible within its environment. Type size, weight, scale, and arrangement are also necessary in wayfinding design. In David Gibson’s book titled *The Wayfinding Handbook*, he suggests that wayfinding typography should be measured in accordance with four categories; reading, walking, driving, and environment (p. 82).

Regarding vehicular signage, a general pragmatism for typography size used on signage is the measure of one inch of character height, or cap height, for every fifty feet of viewing distance (Calori, 2007, p. 132). Though this criterion is a recommendation,
other authorities and codes require more rigorous measures. Calori’s more complex formula measures speed, setback, and message quantity (figure 9). This formula is used in practice initially, but further testing in individual situations is highly recommended (p. 133). State Departments of Transportation require a minimum of 4-in letter height on state roads, and 3 inches to 3.5 inches on non-state roads (Berger & Trescott, 2007, p. 126). The majority of State Departments of Transportation do not define requirements for fonts used on urban signs, though there are reliable fonts used for vehicular legibility such as Clearview, Futura, Franklin Gothic, and British Transport, among others (p. 126).

**Figure 9. Formula for Determining Letter Height on Vehicular Signage**

(Calori, 2007, p. 133)

\[
\frac{(N+6)S + D}{100} = H
\]

N: Number of Messages
S: Speed Limit
D: Setback Distance
H: Height of Letters

**Layout**

Regarding message guidelines, most states allow for a maximum of three to four destinations listed on one vehicular sign (Berger & Trescott, 2007, p. 126). There are
two options for the arrangement of typography, symbols, and arrows: side-by-side and stacked positioning (figure 10). Side-by-side positioning displays arrows and symbols in line with typography, and stacked positioning displays arrows and symbols above typography (Calori, 2007, p. 136). The order of destinations on directional signs may be divided into four categories; arrow direction, alphabetical order, proximity, and importance (figure 11). Regardless of the specificities, consistency in positioning the elements across the entire system is the most significant factor in regard to sign layout design (p. 143–144)

**Figure 10. Side-By-Side and Stacked Positioning Sign Examples**
(Calori, 2007, p. 137)

[left] Baggage Claim

[right]

↑ Ticketing

↑ Ticketing

**Figure 11. Destination Arrangement on Directional Sign Examples**
(Calori, 2007, p. 144)

[left] Aquarium

Sports Arena

City Hall

Library

Science Center

Zoo

[right] Aquarium

Sports Arena

City Hall

Library

Science Center

Zoo
Color

Color carries many meanings across all environments and demographics, and is used as a fundamental element of spatial organization through color-coding (Gibson, 2009, p. 87). It helps to establish identity, assist in navigation, and create emotional connections between people and places. In the early twentieth century American traffic engineers established a standardized color-signal vocabulary to create order on chaotic vehicular roadways (p. 87–88). The color palette consists of green (go), yellow (caution/yield), and red (stop) (figure 12). This palette is universally known and is the groundwork for the American traffic signage system, outlined in the Manual of Uniform Traffic Control Devices (p. 88). Meanings associated with color applies to drivers, bicycle riders, and pedestrians alike. Contrast and legibility are also imperative to choosing color combinations for wayfinding signage. Traditionally, colors approved by state Departments of Transportation were limited to green, blue, or brown (Berger & Trescott, 2007, p. 126). But more recently, at least fifteen states have expanded this, allowing for the use of broader color palettes in signage systems. The color contrast separating foreground letters from the background should be a minimum of 50%, though 70% is preferred. These guidelines are also comparable to the codes outlined in the Americans with Disabilities Act (ADA) (p. 126). Color can be utilized as a wayfinding tool in the form of color-coding, color as identity, and the scientific reasoning behind the meaning communicative properties of color (Gibson, 2009, p. 92).
Symbols

Symbols provide a minimal pictorial representation of places, services, and actions in public spaces (Gibson, 2009, p. 97). They are used to support words or can stand alone and ultimately enhance communication. AIGA, the American Institute of Graphic Arts and leading professional organization for design, developed a set of fifty pictographs for use in public facilities for the United States Department of Transportation (DOT) (figure 13). It is the standard family of symbols used in wayfinding design today. The Society of Environmental/Experiential Graphic Design (SEGD) has additionally designed a new set of recreational symbols to accompany the set of symbols designed by AIGA (figure 14) (p. 97–98). Specific arrows are not required by state Departments of Transportation, but they do prefer arrows with a wide head and long tail for visual contrast (Berger & Trescott, 2007, p. 126). Testing for the positioning of arrows is inconclusive, but some states instruct left-directing arrows to be on the left side of the sign and right-directing arrows placed on the right (p. 126–127).
Figure 13. AIGA/DOT Symbols for Transportation

Figure 14. SEGD Universal Symbols for Recreation
**Code Requirements**

Wayfinding designers are also required to comply with legal code requirements. In the sphere of this research, local and city sign codes as well as state mandated traffic guidelines are a primary consideration. Some municipalities have developed outdoor or exterior signage requirements to provide guidelines for sign locations, height and distance to other environmental elements, square footage, and illumination (Gibson, 2009, p. 137). Additionally, design for public spaces must comply with Americans with Disabilities Act (ADA) guidelines along with fire and life-safety regulations (p. 137).

**Conclusion**

Urban wayfinding systems are designed for cities that are constantly changing and evolving, and should therefore be adaptable and flexible while maintaining regulated design considerations. If the system remains adaptable and flexible, it allows the user to continue to explore and structure their environment independently. A flexible wayfinding system should be capable of modifications according to the changing environment, without oversaturating spaces. The critical measure of validity to State Departments of Transportation is a concise and efficient system with clear destination hierarchy (Berger & Trescott, 2007, p. 127). While maintaining their flexibility, these systems must provide safety, be truthful and readable, and should, above all, be clearly communicative. A legible, ordered city therefore would have numerous parts that are successfully interconnected and identifiable as a whole (Lynch, 1960, p. 3).
CHAPTER III
Design Case Studies

Introduction

A multitude of cities in the United States are highlighted in this section through the lens of three bicycle facility designs: colored bike facilities, shared lane markings, and bike route wayfinding. These three categories serve as the dominant areas of bicycle facility design where environmental graphic design elements can have the most impact. Successful attributes of these three categories are outlined to inform the design approach in the design investigation section of this study.

Bicycle signing and marking was examined during the investigation of successful bicycle-friendly communities across the United States. The National Association of City Transportation Officials (NACTO) is a non-profit association that represents large city transportation issues at local, regional, and national levels. The Urban Bikeway Design Guide, which is part of the Cities for Cycling Initiative, provides cities with best practices and solutions that help create safe and enjoyable complete streets for bicyclists. The treatments in this design guide meet nearly all the regulations established in the Manual of Uniform Traffic Control Devices (MUTCD), and are used both in the United States and internationally. The guide was created through a collaboration between traffic engineers, planners, and academics combining an extensive literature review with personal experiences. The Urban Bikeway Design Guide is broken down into six categories; bike lanes, intersection treatments, bikeway signing and marking, cycle tracks, bicycle signals, and bicycle boulevards. The section outlining bikeway signing and marking is used for the purposes of this study.

NACTO’s Urban Bikeway Design Guide defines bikeway signing and marking as
“any treatment or piece of infrastructure whose primary purpose is either to indicate the presence of a bicycle facility or to distinguish that facility for bicyclists, motorists, and pedestrians” (p. 117). Bicycle signing consists of wayfinding and route signage, regulatory signage, and warning signage. Bicycle markings refer to any mechanism adhered to the pavement surface and designed to distinguish right-of-ways, direction, conflict areas, and route options (p. 117). Markings may also be used to augment existing lanes, intersections, or signals. Important elements to consider are colors, materials, design, and legibility for cyclists, pedestrians, and motorists. The following bicycle signing and marking will be examined, showcasing examples in cities across the US: colored bike facilities, shared lane markings, and bike route wayfinding.

**Colored Bike Facilities**

Colored pavement increases the visibility of a bicycle facility and identifies potential areas of conflict (figure 15). Colored bike facilities can be designed either as a corridor treatment along the duration of a bike lane, or as a spot treatment in conflict areas. Consistency in the colored pavement treatments throughout a bikeway corridor is essential to providing clarity for cyclists and drivers (p. 119).

*The following benefits are listed to highlight the value of colored bike facilities (p. 120):*

- Promotes the multi-modal nature of a corridor.
- Increases the visibility of bicyclists. Discourages illegal parking in the bike lane.
- When used in conflict areas, raises motorists and bicyclist awareness to potential areas of conflict.
- Increases bicyclist comfort through clearly delineated space.
- Increases motorists yielding behavior.
- Helps reduce bicycle conflicts with turning motorists.

**Figure 15. Colored Bike Facilities**
(NACTO, 2014, p. 119–124)

The bike lanes in Boston, Long Beach, and Austin shown in Figure 15 are respectable examples of colored bike facilities. The bike lanes depicted in both images of Boston and Long Beach show the colored pavement applied to an entire bike facility, or bike lanes. The green color establishes the direct pathway for the bicyclist, ensuring both bike riders and automobile drivers are aware of cycling traffic areas. The image of the bike lane in Austin shows the colored bike facility applied as a spot treatment in an area of conflict. Each application shown provides an additional level of safety and awareness in individualized situations through the reinforcement of color.

**Shared Lane Markings**

Shared Lane Markings (SLMs) or “sharrows” are roadway markings designed to signify a shared lane pathway for bicycles and automobiles (figure 16). SLMs underline the validity of bicycle traffic on the road, suggest proper bicyclist positioning, and may
also be designed to offer directional and wayfinding navigation. A shared lane marking is not a definite facility, but rather a spot treatment intended for more flexible use in the entire bicycle network (p. 133).

The following benefits are listed to highlight the value of SLMs (p. 134):

- Encourages bicyclists to position themselves safely in lanes too narrow for a motor vehicle and a bicycle to comfortably travel side by side within the same traffic lane.
- Alerts motor vehicle drivers to the potential presence of bicyclists.
- Alerts road users of the lateral position bicyclists are expected to occupy within the travel lane.
- Indicates a proper path for bicyclists through difficult or potentially hazardous situations, such as railroad tracks.
- Advertises the presence of bikeway routes to all users.
- Provides a wayfinding element along bike routes.
- Demonstrated to increase the distance between bicyclists and parked cars, keeping bicyclists out of the “door zone.”
- Encourages safe passing by motorists.
- Requires no additional street space. Reduces the incidence of sidewalk riding.
- Reduces the incidence of wrong-way bicycling.
Each example presented in Figure 16 contrast in use and application, but benefit users on shared roadways. The shared lane marking shown in New York City is helpful to the cyclist due to its placement, showing a cyclist where to ride in the shared lane. The marking in Salt Lake City is combined with a colored bike facility, establishing prominent bicycle awareness in the shared lane. The SLMs shown in the last image that are unique to Portland are exceptionally impressive, and are found less often in other cities. They provide the cyclist with navigational guidance while also creating an awareness of the cyclist in a shared traffic lane.

**Bike Route Wayfinding**

A wayfinding system, specific to cyclists, consists of a network of signage and/or pavement markings customarily placed at decision points to guide users to their destinations along preferred routes (figure 17). Intersections of bike routes and other key locations leading to and along bicycle routes are additional locations for this type of signage (p. 139).
The following benefits are listed to highlight the value of bike route wayfinding (p. 139):

- Familiarizes users with the bicycle network.
- Identifies the best routes to destinations.
- Overcomes “barrier to entry” for infrequent bicyclists.
- Signage that includes mileage and travel time to destinations may help minimize the tendency to overestimate the amount of time it takes to travel by bicycle.
- Visually indicates to motorists that they are driving along a bicycle route and should use caution.
- Passively markets the bicycle network by providing unique and consistent imagery throughout the jurisdiction.

**Figure 17. Bike Route Wayfinding**  
(NACTO, 2014, p. 139–144)

NACTO categorizes bike route wayfinding signs into three groups: confirmation, turn signs, and decision signs (figure 18). Confirmation signs are used to inform cyclists that they are on a designated bicycle pathway, as well as display information including destinations, distance, and time. They are typically placed every two to three blocks along a bicycle route, as well as after turns for reassurance (p. 140). Turn signs are placed near intersections and used to guide a cyclist when a bike route turns from one
street to the next, depicting destinations and arrows (p. 140). Decision signs indicate the intersection of multiple bikeways. These signs list information including arrows, distances, and travel times. Decision signs are commonly placed ahead of a bike route junction and along bike routes to mark nearby destinations (p. 141). NACTO recommends destination signs to be placed up to five miles away from primary destinations, such as downtown areas. Secondary destination signs may be placed up to two miles away, and tertiary destination signs can be placed locally or up to one mile away (p. 140).

**Figure 18. Confirmation, Turn, and Decision Signs**
(NACTO, 2014, p. 140–141)

Pavement markings can also be used to confirm bike routes, recommend bicyclist positioning on the road, and support route branding (figure 19). Busy urban environments are most suitable for pavement markings due to the increased visibility available from the ground rather than post-mounted signs. This is also beneficial to a bicyclist maneuvering through difficult turns or high-traffic areas (p. 143).
The combination of confirmation, turn, and decision signs create a well-connected bikeway network in all of the examples presented. The confirmation signs in Berkeley stand out among the rest due to their vibrant change in color along with the identity mark, giving this system a unique and recognizable brand. All of the examples of turn signs and decision signs depicted with the consolidation of the arrow, bicycle symbol, and destination are useful to cyclists when navigating through multiple route options. Lastly, the pavement marker depicted in the photograph from New York is interesting in shape and gives the bicycle path an individualized mark while also providing cyclists with assurance and navigational guidance.

**Conclusion**

Each of these bikeway signs and markings are distinctly beneficial to the safety and navigation of the bicycle pathway. Colored bike facilities provide visibility of cyclists and the bike path, as well as deterring automobiles from intervening with the
bicycle facility. Shared lane markings benefit both cyclists and drivers in alerting users of the shared lane while also providing cyclists with guidance in some circumstances. Bike route wayfinding identifies a larger bicycle network through identification and navigational elements, along with encouraging ridership. Branding a bicycle network brings an overall awareness of bicycle culture to automobile drivers and the larger community. Clearly, all three of these styles of these bikeway signs and markings are most effective when designed collectively.
CHAPTER IV
Primary Research Investigation

Introduction

This primary research investigation is an effort to test and validate the theory that experiential graphic design elements can aid the design of bicycle signing and marking, and that wayfinding is capable of creating stronger connections within a city through bicycle pathways. It will provide a foundation of qualitative research reflecting the existing bicycle conditions in Cleveland, Ohio, along with the study and analysis of various perceptions from multiple stakeholders involved in Cleveland’s bike culture. This investigation will also exhibit a hybrid bicycle safety and wayfinding system that highlights the value of experiential graphic design, and lays the groundwork for future research.

The Design Research Process

A research-driven design process consisting of nonlinear and iterative analytical and creative phases was employed for this investigation. The design innovation process begins with real-world problems, and the designer’s role is to take these tangibles and shape them into frameworks in order to gain new insights by reframing the problem. This process therefore leads to higher value and a more successful solution (Kumar, 2013, p. 8–9).
Kumar’s Seven Modes of the Design Innovation Process explains the design research process used for this investigation. The diagram above visualizes Kumar’s Model of the Design Innovation Process, in accordance to his Four Core Principles of Successful Innovation, as described in his text, 101 Design Methods (figure 20). The objectives of the seven modes are listed below (p. 10–13):

1. **Sense Intent**: Start by using tactics that offer ways to reframe the initial problem and look for new innovation opportunities to help think of the initial intent and where to move next.

2. **Know Context**: Study the circumstances or events that affect the environment in which our innovation offerings exist or could exist, and pay attention to what is transforming our innovation context including society, environment, industry, technology, business, culture, politics, and economics.

3. **Know People**: Use observational and ethnographic research methods to learn about people, and then extract valuable insights, or interpret what is observed and ask
questions.

4. **Frame Insights**: Bring structure to what has been found and learned from the previous modes and organize the data gathered to find important patterns.

5. **Explore Concepts**: Use the insights and principles framed earlier as a starting place to generate concepts, and ensure that the concepts are defensible and grounded in reality.

6. **Frame Solutions**: Evaluate concepts and identify the ones that bring the most value to the users.

7. **Realize Offerings**: Once potential solutions are framed and prototypes tested, they need to be evaluated to move into implementation.

This model lends itself to an investigation like this due to its flexibility and a variety of methods. The tactics used for this research will be outlined in this chapter.

**Research Investigation**

*Method: Sense Intent*

In this initial phase of the process, the problem requires framing through an examination of the current situation. By reframing the problem, existing conditions are reconsidered and potential opportunities are identified. This sets the course in order for steps forward to be made with clear consideration and direction (Kumar, 2013, p. 15–16).

*Tactics: Focus Area and Observational Research*

*Focus Area*

With new generations being drawn to Cleveland and surrounding neighborhoods, and mediocre walk and bike scores barely above the national average, the city has
opportunity for connectivity and pathway improvement (Walk Score, 2016). This investigation initially began with a much broader scope in mind, with the question, “how can the Cleveland community be encouraged to walk and cycle more by way of interconnected pathways and experiential graphic design?” Due to the limitations of this graduate study, it was necessary for the breadth of this investigation to be narrowed and a small location was selected in the near west side area of downtown Cleveland as the area of focus (figure 21).

**Figure 21. Map of Focus Area in Downtown Cleveland, Ohio**

This area of focus was selected for several reasons. Many of Cleveland’s citizens reside in the neighborhoods on the west side of Cleveland and commute to work downtown, making this an active area. The Eastern side of the Cuyahoga River in the downtown area covers three neighboring districts; Gateway District, the Warehouse
District, and the Flats East Bank. On the opposite side west of the Cuyahoga River is the Ohio City neighborhood. The main connection in this area between the west side neighborhoods and the near west side of downtown is the Detroit-Superior Bridge, officially named the Veterans Memorial Bridge. The assumption is that each of these districts is flourishing—yet none of them are well connected through strong pedestrian or bicycle pathways.

**Observational Research**

Several site visits were made throughout the course of this investigation, but initial observations were predetermined as exploratory research to help identify and clarify the problem. Observational research generally allows the analyst to view and record subjects and the environment from a removed position so as not to influence what is being documented (Visocky O’Grady, 2006, p. 34). Photos of the environment were taken to record observations and are pictured below. This aided in establishing an analysis of the following districts and pathways.

**Districts**

**Figure 22. Warehouse District**
Photos taken while walking through the area of focus depict the two districts involved in this study on the near west side of downtown Cleveland. Documentation began in the center of the Historic Warehouse District, at the intersection of West 6th Street and West St. Clair Avenue (figure 22). Photos from this district depict orientation, identification, and directional signage in the area. Also noted are several pop-up retail shops and a bike share station. Cleveland’s Warehouse District is made up of commercial, residential, and entertainment venues, and is in close proximity to Public Square, a four-block area near the heart of downtown.

**Figure 23. The Flats**

The Flats East Bank lines the Cuyahoga River on the Western edge of downtown and is rejuvenating with emerging residential, dining, and entertainment venues. Photos taken during this stretch indicate that the Flats pathways along the East Bank
are walkable but underutilized (figure 23). There are pedestrian pathways connecting to RTA transit lines along the river surrounded by parks and grassy areas. Signs are also present, indicating that the Cleveland Metroparks and the Towpath Trail of the Ohio Erie Canalway are nearby, but directions are unclear due to the disconnected placement. This area is adjacent to the Warehouse District and lies below the Detroit-Superior Bridge, making it a potentially favorable point of connection.

**Figure 24. Ohio City Market District**

The Ohio City neighborhood is located just west of downtown near the West Bank of the Cuyahoga River (figure 24). The neighborhood is made up of residential streets, small businesses, bars and restaurants, and is home to the popular and historic West
Side Market. The district is highly walkable and bikeable for its community residents, and photos of the central Market District in Ohio City indicate that there are numerous pedestrian and bicycle friendly attributes. Many of the bars and restaurants in the area have accommodations for patio dining and outdoor seating, making the streetscape a friendly atmosphere. The sidewalks are vibrant, safe, and lined with bicycle racks and bike boxes, or bicycle storage huts. Most streets in Ohio City also have roadway markings or infrastructure for bicycles.

Pathways

**Figure 25. Detroit-Superior Bridge**
The Detroit-Superior Bridge runs over the Cuyahoga River linking Detroit Avenue on the west side and Superior Avenue on the east side (figure 25). Detroit Avenue intersects with West 25th Street on the west side of the bridge, while Superior Avenue intersects with West 9th Street and West Huron Road on the east end of the bridge. The bridge connects the west side Ohio City neighborhood to Warehouse District and the Flats East Bank on the east side of the river in downtown Cleveland. The top level of the bridge is primarily designed for automobile traffic. However, the rightmost lane heading eastbound into downtown does have a shared automobile and bike lane separated from lanes of traffic by the bridge supports, making the shared lane very narrow. There is a wide pedestrian sidewalk on the opposite side of the bridge, which is seemingly bare based on observations over time. Considering this bridge is the primary connection that links these three districts, it will serve as the main pathway of focus for this investigation.

**Outcome**

This initial research was helpful in solidifying the problem and looking for opportunities. Establishing an area of focus established a more feasible undertaking. Condensing the focus to a smaller area also allowed for more attention to be given to each pathway and district considered in this study. Observational research was another valuable tactic used in this phase. The photos show that both districts have sufficient walkability, but the spaces in between the districts are not well connected. In the case of the Flats district, many areas had potential but seemed uninhabited at the time. This analysis solidifies beneficial observations.
Method: Know Context

By studying conditions that affect the environment and identifying opportunities for innovation, further intent can be confirmed (Kumar, 2013, p. 51–52). In this mode, a greater understanding of the surrounding conditions, or context, is explored. The goal here is to gain insights about the context and prepare to take further direction in investigating opportunities. Coherent mental models and frameworks aid in this step (p. 51–52).

Tactics: SWOT Analysis and Expert Interviews

SWOT Analysis

Through writing a creative brief following the first phase, a SWOT framework was used to analyze strengths, weaknesses, opportunities, and threats associated with existing pedestrian and bicycle environments, wayfinding, and traffic control devices. The SWOT analysis creates a summary, provides guidance, identifies obstacles, reveals opportunities, and leads to a formal statement of the research objective and knowledge of context (Kumar, 2013, p. 81).

Strengths found using this tactic are that traffic control devices encourage automobile drivers to be cautious of pedestrians and cyclists, and advise all users to share the road while remaining alert of others. Weaknesses uncovered indicate that pedestrian and bicycle signs are commonly not well connected throughout the Cleveland area. Sharrows, or shared lane markings, and bike lanes often end abruptly, leaving a cyclist in dangerous situations without further accommodations. Most significantly, traffic control devices increase safety but do not address navigation, while pedestrian and bicycle wayfinding supports navigation but does not address issues of safety. Therein lies an
opportunity for a redesigned system to address both wayfinding and navigation, as well as traffic control and user safety. Thus, what prevails from this assessment is that both the liability and safety of roadway or pathway users are at risk.

*Expert Interviews*

Semi-structured interviews were conducted for this investigation to gather expert perspectives on the pedestrian and bicycle conditions in the Cleveland community. Interviews are a form of ethnographic research used to form associations between behavior and culture (Visocky O’Grady, 2006, p. 26). An interview style dialogue with experts in varied disciplines provides a broad understanding of their field and affirmative direction in the search for additional information, and allows for a deeper perspective to materialize (Kumar, 2013, p. 83). Six professionals were interviewed spanning a wide range of specialized disciplines. These areas include commuter cycling, bicycle advocacy, urban design, bike share design, sustainability, and traffic engineering.

*Interview with Josh Goran*

Josh Goran is the administrator at the Ohio City Bicycle Co-Op, located on the East Bank of The Flats in Cleveland. The OCBC is a non-profit organization providing community members with a bicycle education center, riding groups, volunteer opportunities, and a resale shop with refurbished bikes, used parts, and new and used bike accessories. Josh is an avid “necessity cyclist” by preference, meaning he chooses to use cycling as his main method of transportation, having sold his car upon moving to the west side of Cleveland two years ago.

Goran encounters many “necessity” or full-time cyclists through the OCBC,
but he believes there is a hesitation in the Cleveland community’s reasoning for not biking regularly throughout the year. The most common reason being automobile driver distraction, among others such as weather, obtaining the appropriate gear and equipment, and lack of pedestrian and bicycle infrastructure throughout the city.

Commuting to work in The Flats near the west side of downtown Cleveland from the Detroit Shoreway area where Goran lives is about a two and a half mile bike ride. He also held a position at a cycling company in downtown Cleveland before starting at the OCBC, making him thoroughly familiar with bicycle commuting in this area. When explaining various route options for his commute, he predominantly spoke of two bridges that connect the west side to downtown Cleveland stretching the Cuyahoga River; the Lorain-Carnegie bridge and the Detroit-Superior bridge. The Lorain-Carnegie bridge has two-direction bicycle and pedestrian paths, making it safer than the Detroit-Superior bridge which has its right-most lane shared by automobiles and bicycles going eastbound separated by bridge supports, and a large sidewalk outside of the bridge supports running westbound. Josh expressed his uneasy sense of assurance while riding on the Detroit-Superior bridge traveling eastbound because of the narrowness of the lane, and due to its positioning between the bridge supports on either side. In this case, Goran is forced to ride defensively in the center of the lane. Otherwise, drivers would attempt to pass him when there is realistically not enough room to safely pass. In fact, the bicycling community is hopeful that the local bicycle advocacy organizations are successfully pushing the State of Ohio to have a three-foot passing law in the near future.

Goran also explained the problem of exiting the bike route on the bridge and transitioning into regular street riding once the bridge has ended. Transitioning in general for a cyclist can be dangerous because of the change from one style of a bike
route to the next, often due to the differences in the infrastructure (or lack thereof) throughout the city. A cyclist riding from the west side to downtown would navigate through a variety of environments and traffic patterns from neighborhood communities and residential streets, through newly developing districts, industrial corridors, and into a grid of streets downtown dense with cars and buses. Oftentimes it is difficult to reintegrate with traffic once a bicycle facility has ended. Goran states, “Especially as a cyclist, I feel sometimes those transitions you just have to be particularly aware of.”

The lane markings through the streets of city districts can be inconsistent, causing unreliable and unsafe pathways for cyclists. Goran believes that sharrows help generate awareness, but he does not believe they are necessarily effective. Although current bicycle signs do create awareness for automobile drivers they are often not adequate. Alternatively, protected bike lanes and separated bicycle facilities have both positive and negative effects as well. A full bike path can help alleviate unsafe passing, but if drivers and riders are unfamiliar with lane markings it can be confusing and unrecognizable. In areas without the bicycle symbol, it is often difficult to discern where a bike lane is located, especially if it is painted with white paint rather than green.

Goran is passionate about his city and cycling. He encourages the community to overcome their hesitations around bicycling and supports anyone who is interested in using a bike for transportation. He hopes to see a more casual use of bikes in the community in Cleveland’s future.

**Interview with Jacob VanSickle**

Jacob VanSickle is the executive director of Bike Cleveland, a bicycle advocacy organization in the Cleveland community. VanSickle’s education and background is in
sociology and community development. Before forming Bike Cleveland, he was involved with a community development corporation, Slavic Village Development, frequently working with local bike groups. It was in that position when he realized that cycling is a way for people to experience their community in a unique and meaningful way, particularly when biking is tied in with community development.

VanSickle believes Cleveland has a good network of suburban bike trails that has led to a strong recreational cycling component in the region. He says he is beginning to see more on-street bike facilities connecting people to the larger networks outside of the city, in turn encouraging more people to commute by bike for everyday activities. He admits Cleveland’s bike facilities continue to advance, but he still believes there is a significant amount of room for improvement. A large part of the community’s hesitation to cycle comes from the lack of infrastructure in the city of Cleveland. VanSickle also agrees that people are skeptical of automobile drivers. He strongly trusts that if Cleveland would build more protective bike facilities, people would feel safer and more comfortable riding bikes, therefore increasing the amount of bikers in the community.

As a bicycle advocacy organization, VanSickle explains that Bike Cleveland’s largest obstacle is an organizational resistance to change. Some community residents do not want their streets to be narrowed, which would help to accommodate bike facilities, consequently making streets safer for cyclists, pedestrians and motorists. VanSickle also describes the resistance they encounter with the city of Cleveland. He explains that Cleveland has street networks built for over one million cars and a population under 400,000. Every expert in transportation planning and engineering brought in from larger cities, like New York and Chicago, affirm Cleveland has ample capacity and can accommodate bike facilities easily; the problem lies in the city’s prioritization.
Bike Cleveland works closely with a lot of city departments on a project-by-project basis. Within the City of Cleveland they work with the Office of Sustainability, the Traffic Engineering Department, and the City Planning Department. They also work with ODOT, the Ohio Department of Transportation. They closely monitor the city’s Bike Lane Implementation Plan and stay updated with all of these departments. When asked how willing they are to work with Bike Cleveland, VanSickle comments, “It’s hit or miss. Sometimes we have a very controversial relationship in how we get along.” He declares the Traffic Engineering Department are not fans of protected bike lanes for old-school engineering thinking and reasoning, which remains their most significant obstacle. Rob Thompson, Bike Cleveland’s Communications Manager, interjects that the FHWA (Federal Highway Administration) recently passed federal guidelines for protected bike lanes so they are hoping the old attitude will change in response to the protocol established at a level of higher authority.

In terms of building up Cleveland’s bicycle pathway network and encouraging the community to get out on bikes, VanSickle describes their approach as bottom-up. He illustrates this concept using “the chicken and the egg” analogy. They want more community members out on bikes, so they want to start a bike share program to influx the community with bikes. Infrastructure is needed to help support the bike share programs, in turn showing the city that if there are more people on bikes they need to be safely accommodated. He envisions a cohesive network of dense bicycle facilities so each district or neighborhood is connected, and for people to have easy access to bicycles through a bike share program reaching each community. He views this as a “utopia in Cleveland.”
Interview with Dawn Hancock

Dawn Hancock is the managing director and founder of Firebelly Design in Chicago. Motivate, an international bike share company, contracted IDEO, a global design company, to design the brand and to build out the bike share system for the city of Chicago. IDEO brought Firebelly on board as a collaborator on the DIVVY bike share project. IDEO led the naming and research end of the project, while Firebelly tackled the visual design and application across the system. Hancock spoke at the national SEGD (Society of Environmental Graphic Design) conference in Chicago in June 2015 with Josh Sikich from Alta Planning and Design, a transportation planner who also worked on the bike share project.

In his talk, Sikich describes the bike share system as a “transportation revolution,” providing the city of Chicago with a completely new and economical mode of transportation. For decades European cities have been the leaders in bicycle transportation. He states the “tipping point” for bike share programs occurred in Paris in 2007 when they launched a bike share system with a total of 8,000 bikes in their very first year of operation, quickly growing to 16,000 bikes in the second year. By 2014 over 600 cities worldwide have bike share systems that have doubled over the past five years, and today in the United States over 60 communities have bike share programs while it was formerly non-existent just five years ago (Sikich, 2015).

Hancock spoke about the ethnographic research gathered in the initial phases of the DIVVY bike share project to gain a better understanding of the community’s common interests and attitudes towards cycling. The team sought out “regular riders,” or bicycle owners and commuters, along with “would-be riders,” or interested individuals with a fear or hesitation of riding a bicycle. The team then analyzed the research gathered
in their intercepts with the public that revealed a tension lying between the fear of riding and the allure of riding. Ultimately, this information was then used to inform the branding and design of the DIVVY bike share system, with the goal of communicating safety, friendliness, and the joy of riding (Hancock, 2015).

In an interview with Hancock several months following the conference, she reported that she sees the DIVVY bike share program growing in Chicago and more people signing up for memberships. With the expansion of the bike share program and the addition of more bike share stations, Hancock notices the Chicago community’s growing interest in memberships as a result of the stations becoming more accessible and closer to home. She now hears DIVVY mentioned often in conversation as an option for people to get from one place to another in everyday city life.

Interview with Terry Schwarz

Terry Schwarz has been the director of the CUDC (Cleveland Urban Design Collaborative) for approximately 15 years. She works with community-based clients on a wide range of urban design and planning projects all around the region. The role of the urban designer in this sphere is to collaborate with civil engineers and transportation planners to design the bicycle and pedestrian experience. Schwarz explains that the role of the urban designer is to form an urban context where there are multiple modes of safe and comfortable transportation, and an ecological and human responsive streetscape throughout the community.

Similarly to Goran, Schwarz does not see diversity in the bicycle community of greater Cleveland. Aside from committed bicycle commuters, the majority of other types of riders do not have access to cars. Not only do perceptual barriers play a role in
the choice to ride a bike as a means of transportation, but physical barriers are apparent as well. Northeast Ohio’s weather is the other major reason Schwarz believes to be a significant barrier in choosing to ride a bicycle. She states that through inclement months during the winters the bicycle facilities are not well maintained. In addition, the overall bike culture in the Cleveland community is on the rise but still needs strengthened.

The CUDC is working closely with the Downtown Cleveland Alliance on the Step Up Downtown Plan to “complement all of the [city] project investments with good linkages—with the stitches that hold it together.” Schwarz explains that a well-connected city has districts that build and complement each other, and the way to do that is to create accessible links between them so the city can work as one unified network. She claims downtown Cleveland is not yet successful in this manner; “there are a lot of holes in the fabric.” She believes that seamless connections allowing people to move effortlessly from one place to the next would contribute to the revitalization of downtown Cleveland.

Schwarz agrees that the connections between the west side of downtown and the nearby west side neighborhoods could use improvements. Along with Goran, she also recognizes that bicyclists prefer the Lorain-Carnegie bridge over the Detroit-Superior bridge due to the infrastructure, but she expresses, “good cities offer options.” The more options people have, the easier it is for them to access their desired destination.

Personally, Schwarz has an entirely different view of bicycle road markings than most. She describes her aversion to bike lanes because of their lack of flexibility. Willingly, Schwarz prefers to ride on the road and to “function as a vehicle.” She describes for example, when approaching a complicated and intricate intersection, oftentimes bike lanes transition from a solid to dotted line, and then suddenly end. As an experienced cyclist, Schwarz prefers sharrows on the road. She believes bike lanes frequently
create a false sense of security, whereas sharrows leave a cyclist free to make their own decisions on the road. Contrarily, she also detects confusion among drivers when they are unfamiliar with the meaning of a sharrow, and suspects that if they become overused their significance will diminish.

The CUDC primarily works with NOACA (Northeast Ohio Areawide Coordinating Agency) and ODOT. Schwarz admits that in working with the Cleveland division of ODOT for the region, she has become aware that they are not progressive in regard to modernization. Comparable to Bike Cleveland, Schwarz reveals that the transportation specialists with the city and state are difficult to work with because they are overwhelmingly “by the book.” She voices, “I wouldn’t say that here in Cleveland in northeast Ohio our transportation partners are leading the way in terms of innovation.”

In time, Schwarz believes change in Cleveland’s bicycle culture will occur. For pedestrian and bicycle usage to grow she believes it’s a matter of safety, along with the combination of infrastructure investments and higher community participation. She proclaims, “I think it will happen. It just takes time. Everything takes time.”

*Interview with Andrew Cross and Jenita McGowan*

Lastly, for this investigation, a joint interview was conducted with Andrew Cross, Traffic Engineer, and Jenita McGowan, Chief of Sustainability, for the City of Cleveland. As Chief of Sustainability, McGowan operates in two overlapping realms; the green operations dealing with policies, programs and operations of city functions, and community work with the larger Sustainable Cleveland initiative helping outside sectors be more sustainable. Specifically on pedestrian and bicycle projects, McGowan works with internal and external stakeholders on the Complete and Green Streets initiatives
involving bikes, pedestrians, mobility, and transit. Cross has been the traffic engineer for the city for almost 15 years and is closely involved with the development of bikeway plans in Cleveland. The two strategize and develop various pedestrian and bikeway projects, focusing on how to get them funded, designed, and ultimately built. They both comment that Bike Cleveland is also heavily involved and deeply engaged in details at the planning level for bicycle projects. McGowan explains hierarchically, the city’s Planning Department designs high-level conceptual plans for streets, and then it is passed to engineering to design them granularly.

McGowan confirms that bikeability and walkability have been proven to economically benefit cities by attracting people, and therefore benefiting housing prices and local businesses. Along with health reasons, McGowan also comments on the notion of accessibility for the community: “about 30% of Clevelanders do not own cars.” She states that millennials for a number of reasons (more than any other demographic) are choosing not to own cars, and are one of the most rapidly growing population segments. She also claims that vibrant street environments are intangible so they are more difficult to measure, but growing neighborhoods in Cleveland all share a “good urban fabric” made up of smaller blocks and local retail, working together with progressive pedestrian and bicycle infrastructure.

Cross views Cleveland as a generally walkable city, comprised of short blocks and a strong network. He explains that as a result of pedestrian improvements being localized, they are usually low-cost and quick to implement. Alternatively, bikeway enhancements span a farther distance so they are typically more intricate and more expensive. Regarding bike facilities, if the enhancement is dealing with road construction, it is funded with state dollars and may take up to two years from design to construction. If it
were a project using local money and instead altering road striping, it could take as few as a couple of months or less.

Recall the Ohio Manual of Uniform Traffic Control Devices (OMUTCD), which contains over 900 pages of vehicular and bicycle traffic rules and serves as a guide for engineers to follow under federal law; the required, recommended, permitted, and prohibited traffic systems. An engineer is responsible for interpreting the guidelines of the manual and applying them to various types of roadways and intersections. Cross clarifies that if the manual is violated, which he believes to be unethical, the city and its pedestrians, drivers, and cyclists can potentially be put in danger and as a result, an engineer’s professional license could be at risk. A wayfinding section was recently added to the manual just three years ago. Surprisingly, the wayfinding guidelines are quite restrictive, but Cross believes, “wayfinding is probably the least important type of sign to a road user” in comparison to critical regulatory and warning signs. He considers vehicular and bicycle wayfinding “not a big need now with Maps, Google Maps, Bing, smart phones, and GPS.” Pedestrian wayfinding is not in the manual and has much more flexibility because it does not interfere with road safety or vehicular signage.

There are many kinds of urban pop-up projects, or temporary design interventions, used throughout city and neighborhood environments as a form of action-based research. From Cross’s engineering perspective and with his understanding of traffic operations, he believes pop-up projects do not help: “I don’t think we need to experiment because we know how certain things are going to operate.” He would rather see the city’s resources utilized on something with permanence that he is confident will work. Understandingly, pop-up projects intervening with road users are a major safety concern and require the same amount of time, perseverance, and set of standards as any
design that is permanent. McGowan believes pop-up projects in spaces such as vacant lots and pedestrian settings add vibrancy to the environment and are more appropriate in terms of time, expenses, and safety. Cross points out, “once you’re in the road, it’s never simple if you’re reorganizing what traffic is going to do.”

McGowan and Cross explain that every pedestrian and bicycle plan is decided on a case-by-case basis due to differences in individualized pathways and intersections. Commonly, people look to European cities for bicycle design solutions, where bike facilities like protected bike lanes and bike tracks are successful, but it is infrequently weighed that every city has a different structure and therefore different needs. They explain that the term “protected,” referring to bike lanes, is frequently overused and abused, creating a false sense of security for bicycle riders. McGowan explains a typological process they developed which categorized streets by width, land use, and traffic volumes. They were then color-coded by types of appropriate bike facilities and with the priority bike or pedestrian user. She defined it as a high-level approach or view that can then be narrowed to a smaller scope that focuses on the details required for each location. The process can be tedious but efficient. In these cases not all stakeholders can be satisfied, but their responsibility is to find a balance among the numerous groups.

Both experts acknowledge that there are many uncontrollable reasons behind people choosing not to use a bicycle as a form of transportation including climate, topography, lifestyle, time and comfort. Cross lists The Five E’s composed by the League of American Bicyclists while pointing out that it is possible for people to overcome their fear of riding by better understanding a safe way to do so (LAB, 2015):

- **Engineering**: creating safe and convenient places to ride and park
- **Education**: giving people of all ages and abilities the skills and confidence to ride
• Encouragement: creating a strong bike culture that welcomes and celebrates bicycling
• Enforcement: ensuring safe roads for all users
• Evaluation and Planning: planning for bicycling as a safe and viable transportation option

They argue that a lot of focus is put on enhancing engineering and infrastructure, but they agree that developing a solid bicycle friendly culture will break down a larger barrier. McGowan remarks, “culture eats strategy for breakfast.”

Interview Summary

Uniformly, all interviewees agree that a significant feeling of hesitation and negative attitudes toward bicycling are common throughout the Cleveland community. Reasons span from perceptual to physical barriers that lead many in the community toward these perspectives, but the professionals interviewed are optimistic that a more encouraging bicycle culture in Cleveland could begin to transform attitudes. Ethnographic research shows that bike share systems implemented in cities reassure residents to overcome their fear of riding. This bottom-up approach is one successful way of creating an influx of cyclists, and will then likely urge the city to prioritize plans for advancing infrastructure while simultaneously creating a more vibrant bicycle culture in the community. Subsequently, connections made by bicycle facilities will contribute to the improvement of the overall network of the city by connecting separated prospering nodes within the downtown and surrounding neighborhoods.

There are a multitude of differing views that remain, encompassing bicycle lanes and markings. Some feel that bicycle lanes, both protected and unprotected, do not
provide the flexibility that other types of markings do, such as sharrows. Bike lanes cause
unsafe, distressing, and often abrupt riding transitions in traffic. Conversely, sharrows
provide more flexibility and awareness but are not necessarily functional. Some believe
that the implementation of more bike facilities, specifically protected bike lanes, will
increase bike ridership. Comprehensively, every bicycle facility plan must be designed
specifically for the needs of the particular location.

A stark controversy exists between regulation and innovation. Bicycle advocacy
groups and urban designers alike concede that city departments and officials are resistant
to change. They criticize their lack of progressiveness and their methods that adhere to
strict policy and regulation. Transportation departments avoid innovative methods of
design research for this reason. They trust that their understanding of traffic systems
already in place are efficient, and experimenting with new approaches is a waste of their
time, funds, and resources. Yet, the city has another point of view. They are required by
law to follow restrictive guidelines and any violation of these rules may put people’s lives
at tremendous risk. Consequently, where can a middle ground be agreed upon so steps
forward can take place?

Outcome

The goal in this phase of the process is to visualize the knowledge gained so far
at a broad level to understand all of the components, relationships, and dynamics. This
method also allows for all stakeholders involved to be considered and exhibits their
motivations and interactions (Kumar, 2013, p. 51–52). The SWOT analysis provided a
clearer picture of the problem and confirmed the project intent. Through this tactic the
opportunity is recognized in which a system that provides navigation and safety for its
user is necessary. Expert interviews largely propose that a balance between current procedure and new opportunities is needed for change. It is also important to note that in this phase of the process the design direction shifted to focus more on bicycle wayfinding and safety alone. Qualitative data gathered from interviews suggest that pedestrian and bicycle environments have entirely separate treatments, and the safety and needs of the bicycle user are indispensable.

Method: Know People

This stage in the process is to acquire a better understanding of the user and their interactions with the environment. Again, observational and ethnographic methods are appropriate in this method, and insights are generated based on learning about the mental and physical behavior of the user (Kumar, 2013, p. 87–88). The tactics used in this method were to learn about the user on a more personal level for a better understanding of their mindset and experience.

Tactics: Experiential Research and User Experience Models

Experiential Research

Figure 26. Cycling North on West 25th Street in Ohio City
Experiential field research was conducted at this point for a deeper and more involved understanding of the user’s needs in the area of focus (figure 26). Most important to record are the points at which doubt or apprehension occur. Moments in which lane markings, or the transitions in-between lane markings, are unclear commonly make bicycle riders uncomfortable in regard to safety. Automobile drivers would likely feel the same uncertainty when driving behind or next to a bicycle rider when a lane transition is occurring. The most significant route transition appears to be when a cyclist is approaching an intersection. Often, a bicycle lane will either abruptly end without further accommodations for the cyclist, or the bike lane will quickly transition into a shared lane with a sharrow path marking. These end points and transitions do not leave an adequate amount of time for a cyclist to make a confident route decision unless they have previously traveled the route and are familiar with the conditions. Still, these disjointed transitions and dangerous pathways may cause unease with even the most skilled cyclist.

Cross Examining the 5E and POSTA User Experience Models

Two frameworks were cross-examined by organizing data into predefined categories in order to better understand and analyze the needs of the user. Frameworks such as the 5-E User Experience Model, POEMS, and POSTA are necessary to provide clarity and expose potential action to design researchers (Visocky O’Grady, 2013, p. 116). Gaps revealed in research frameworks present opportunities for design solutions. The 5-E User Experience Model assembles information by charting an event from the user’s perspective from the beginning of an experience to the end (p. 121). This model is broken down into five categories; Entice, Enter, Engage, Exit, and Extend. The POEMS
and POSTA frameworks were combined for this investigation to consist of elements including People, Objects, Environments, Messages, Situations, Time, and Actions. These frameworks are another method of organizing observational research and to provide a foundation for the analysis of user experience. In this investigation, a matrix combining the 5-E Experience Model, POEMS, and POSTA frameworks was utilized to organize existing user experiences, as well as for brainstorming and stating questions where gaps or opportunities were present. This cross-examination confirmed that design can have the most impact in communicating messages to the user involving safety and navigation during the experience of riding a bicycle (figure 27).

**Figure 27. Framework Matrix Summary**

<table>
<thead>
<tr>
<th>Existing</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entice</strong></td>
<td>People are discouraged to ride a bike due to their concern or worry for their comfort and safety while riding on the road.</td>
</tr>
<tr>
<td><strong>Enter</strong></td>
<td>Bicyclists often plan routes ahead of time to select bike-friendly roads for travel. If they prefer to be more spontaneous riders, they still need some form of navigation to return home if traveling in unfamiliar territory.</td>
</tr>
<tr>
<td><strong>Engage</strong></td>
<td>Cyclists encounter pedestrians, other bikes, automobiles, and buses in high traffic areas including intersections, bike lanes, and shared traffic lanes. Navigating through clustered environments may be difficult.</td>
</tr>
<tr>
<td><strong>Exit</strong></td>
<td>Once a cyclist has arrived at their destination they dismount their bike and are in need of a safe place to secure their bicycle. A cyclist must also plan their route to return to their starting point.</td>
</tr>
<tr>
<td><strong>Extend</strong></td>
<td>Cyclists may share their experience with others, encouraging others to ride.</td>
</tr>
</tbody>
</table>
**Outcome**

This phase of the design process was essential in humanizing the study. Gaining an empathic view of the needs of the user is critical in designing a valuable solution (Kumar, 2013, p. 87–88). The experiential research allowed for immersion into the environment and insight of the user’s perceptions. This method recognized uncomfortable situations for bicycle and automobile users on the road. The frameworks matrix using the 5-E User Experience Model crossed with the POEMSTA framework allowed for a better understanding of the progression of the user experience and challenges that users encounter. These findings led to questions involving how design can impact positive change for the user in the bicycle environment. These questions are important to reinstate during the design development in order to effectively address user needs and to create value in their experience.

**Implications**

**Method: Frame Insights**

Framing insights require the aggregation of research in order to bring structure to the collected data. This is a necessary measure conducive to searching for patterns and insights in the research, and the analysis of uncovered patterns present opportunities where design can be implemented (Kumar, 2013, p. 129–130). Through framing the research gathered thus far it is critical to address the gaps and opportunities that prevail in the overlapping topics of walkability, bicycle infrastructure, and experiential graphic design. In examining the primary research with the support of the secondary research in this study, there are several key points that are necessary to address. These key insights are important factors to analyze prior to moving into the design investigation.
Tactic: Implications

Post-industrial cities are increasingly populating, and both walkable and bikeable cities are essential to urban sustainability. Presently in Cleveland, it is apparent that districts are flourishing, yet they are not well connected through pedestrian and bicycle pathways. Creating an environment with a clear structure and identity is the beginning of defining strong symbols in a community, and if a city appears to be a unified place, people are more likely to partake in urban activity like walking and cycling (Lynch, 1960, p. 119). Introducing a bicycle system into an urban environment would promote the city’s walkability by encouraging residents to engage themselves in the community due to the sense of place a visual system would provide. Not only will a wayfinding system for cyclists connect people to place, but it will also form a community and create relationships by connecting people with people (Schneekloth & Shibley, 1). A successful environment furnishing both pedestrians and cyclists must be designed into a well-connected and well integrated-network. Undoubtedly, connectivity is best attempted when an environment is designed and more of a challenge to revise once the environment has been built (Southworth, 2005, p. 250). In ideal situations, bike and walking paths would be designed and well-connected in initial stages of urban development, but what if an existing environment needs remedied? Certainly, there is opportunity here for design to have an impact in resolving issues of connectivity in the built environment.

Undoubtedly, a successful bicycle wayfinding system cannot exist without a safe underlying network of bicycle facilities. Current bicycle infrastructure in Cleveland, and many other cities across the United States, is insensitive to the needs and safety of cyclists on the road. Controversy is clearly present in bicycle infrastructure classifications, including shared lane facilities and dedicated bike facilities. However, the need still
exists that signs and markings for bicycle facilities must be humanized in an effort to increase awareness for all users on the road. High traffic and conflict areas appear to be where signage and markings can create safer pathways and provide guidance for both cyclists and drivers. The examination of effective bicycle signage and markings in various cities has provided an overview of other successful design approaches that will inform this investigation. Thus, an additional opportunity is present for further ethnographic and design research methods to be employed in the development of bicycle signage and markings. A system combining navigation and safety is needed while maintaining a balance within current regulation, procedure, and design innovation.

Commonly, the graphic designer is not considered an essential contributor to urban design and planning. Yet, if a graphic designer is included in design development, they are often brought on late in the design process. Visual communication designers practice design research methods that are largely based upon ethnography and the needs of the user. Therefore, environmental graphic designers should be involved in the initial design stages as to interject a sense of empathy, contribute new ideas, and work more collaboratively and effectively alongside other design disciplines involved with the urban environment. This implementation of environmental graphic design will provide a more accessible way to provide direction, a sense of place, and a more functional overall experience for the user, especially in cases where urban renovation is underutilized. Furthermore, introducing pedestrian and bicycle wayfinding systems into the urban environment can connect segregated districts. The experiential qualities of the urban environment interact with users daily, and its appearance, information, comfort, and safety are all key factors in the design of a successful and interconnected urban network.
Outcome

The goal of this design phase is to form a clear understanding of the knowledge gained from this research by framing insights (Kumar, 2013, p. 129–130). Key insights have been extracted from this format of organization; issues regarding connectivity in the urban environment need to be addressed in Cleveland. A system designed to guide the bicycle pathway user navigationally while creating a safe experience is necessary; and the design approach must uphold the balance between current traffic regulation and design innovation to humanize the design solutions and maintain efficiency. By structuring this information these guidelines are created to drive deliberate concept generation in the next design phase.

Design Investigation

Method: Explore Concepts

In this mode of the design process the insights and opportunities from the previous phase are used to brainstorm and generate design concepts (Kumar, 2013, p. 195–196). The goal persists that a system designed to address issues of connectivity through the use of navigational elements is required while still meeting the safety needs of the bicycle user. It is important to note that the designs generated in this phase are largely based in the initial schematic, or conceptual, phase of the environmental graphic design process. Within the scope of this research, limitations prevent this investigation from advancing beyond the schematic design phase, and relevant specifications regarding vehicular signage were primarily considered. Vehicular signage requirements are of maximum importance due to the fact that bicycles on roadways are treated as vehicles. Integral factors are applied to vehicular signage including the viewer’s distance from
the sign and driving speed (Calori, 2007, p. 132). These measures are studied and tested during the design development process. Further cross-disciplinary collaboration would be necessary for the advancement of these design concepts. Accordingly, exploratory design concepts have been created for the urban bicycle environment with design decisions still grounded in research.

**Tactic: Design Prototypes**

The main challenge in creating the aforementioned bicycle network is combining both navigational and safety features into one unified wayfinding system. In order to approach this design problem the insights gained from this research were converted into design principles to visualize concepts. Sketching was used as a method of brainstorming and then remodeled to create design prototypes. Multiple iterations were generated before arriving at potential solutions. The concepts and directions chosen were then categorized into two separate groups, safety and wayfinding, which ultimately intend to be combined and integrated together.

**Graphic System**

A visual identity was created to brand the wayfinding system through the selection of typography, symbols, and color (figure 28). The typography selected for this system is the grotesque sans-serif typeface, Univers. This typeface has a strong consistency in its large versatile family of weights and styles, which is particularly important for wayfinding signage. Univers is notable for its distinct clarity and legibility at great distances, also making it suitable for transportation systems and wayfinding signage. The symbol chosen for this wayfinding system is the bicyclist selected from the
kit of SEGD’s Universal Symbols for Recreation (figure 14). This symbol combines the bicycle symbol and the symbol of the rider, humanizing the bicycle symbol as a whole. Arrows were also designed to complement the rounded forms present in the design of the bicycle symbol. The color green was selected for the safety roadway markings due to its international recognition for the association of the color with safety, and also the color green used in most bicycle facilities across the country. A series of colors has also been chosen to establish a system of color-coding in relation to the districts selected for the area of study. These colors were chosen based upon their strong contrast and visibility necessary for vehicular signage, and also not to be confused with the colors green, yellow, and red which signify meaning in the context of traffic signals.

**Figure 28.** Graphic System: Typography, Color, and Symbols

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm
Nn Oo Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz
1234567890
Univers LT Std, 55 Roman

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm
Nn Oo Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz
1234567890
Univers LT Std, 65 Bold

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm
Nn Oo Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz
1234567890
Univers LT Std, 75 Black
**Intersection Mapping**

To gain a better understanding of the street design in the area of study, all main intersections were diagramed based on satellite images (figure 29). Intersections prove to be main areas of traffic conflict, thus, these areas were studied in the preliminary phase of the design investigation. This process allowed for a broad overview of several types of intersections common in downtown Cleveland, and specific to the area of focus in Ohio City, the Warehouse District, and the Flats. Knowledge gained from this process indicates that an adaptable and versatile system is necessary to span various types of roadway intersections including two to five direction junctions along with differing left-hand and right-hand turn patterns.

**Figure 29. Initial Intersection Diagram Studies**

![Intersection Diagram 1](image1)

**W 25th St + Lorain Ave**

![Intersection Diagram 2](image2)

**W 25th St + Detroit Ave**

![Intersection Diagram 3](image3)

**W Huron Rd + W 9th St**

![Intersection Diagram 4](image4)

**W Superior Ave + Detroit Ave**
Cautionary Bicycle Markings

Three types of cautionary markings were developed for the safety portion of this design investigation: bike lane markings, lane transition markings, and intersection guidance markings. Noted from the experiential bike ride research, bike lanes often come to an abrupt end leaving the cyclist without further instruction or guidance. The bike lane markings that were developed for this research are a combination of a bicycle symbol or trail blazer, distance markers, and a symbol that marks the end of the bike lane (figure 30). These designs were created to inform a cyclist that they are approaching the end of a bike lane, allowing them to make preparations in advance to transition into different types of traffic patterns.
The lane transition markings consist of a continuous line of travel broken up by directional arrows (figure 31). This design is intended to guide cyclists while making traffic lane changes. The arrows are used at points of transition to reinforce direction, and these markings are recommended to begin and end with a shared lane bicycle symbol. This marking is also designed to bring awareness to automobile drivers to use caution while cyclists are maneuvering through lane change transitions.
The final cautionary making is the intersection guidance marking (figure 32). This marking consists of a continuous pathway used to guide cyclists while moving through a right turn lane, left turn lane, or straight lane and can be adapted to various intersections. Arrows are used throughout the line of travel to reinforce bicycle direction through the intersection. This marking is designed to bring awareness to automobile drivers through the use of cautionary bicycle pathway indicators. These markings are also recommended to begin and end with a shared lane bicycle symbol, or trail blazer.

**Figure 32. Cautionary Intersection Guidance Bicycle Markings**

*Bicycle Wayfinding Signs*

A concept for a bicycle wayfinding system applied to the roadway has also been explored (figure 33). Based upon primary ethnographic research, a cyclist’s line of sight generally falls from the front wheel of their bicycle up to 50 feet ahead of where they are riding. This line of sight on the ground ahead in combination with the horizon line slightly above the road are alternated and are the primary lines of sight for cyclists. A series of directional signs has been consequently developed to be adhered to the ground
with reflective paint similar to other roadway markings. This directional signage consists of a curved background shape color-coded to represent districts in Cleveland. Positioned on the background is the district name in combination with a directional arrow. This preliminary concept is the groundwork for a potentially adaptable wayfinding system. It is capable of being applied in different arrangements on various types of roadways and intersections. The goal of this wayfinding system is to encourage cyclists to explore new areas of the city that they would have previously not considered, through the placement of signage in otherwise unmarked areas to promote the connection of popular districts. A wayfinding system like this has the potential to link disconnected districts in Cleveland’s urban environment. Ultimately the goal of this system is to create a shared language among cyclists to strengthen the cycling community in Cleveland and to attract new members of the community to bicycling to increase ridership within the city.

**Figure 33. Bicycle Wayfinding System**

*Outcome*

These prototypes were designed based upon insights about the people and the context involved in this design problem. Possible solutions were explored to enhance the
user experience of bicycle pathways, so naturally an open frame of mind is imperative to this design phase. However progressive the design concepts are, they should still be human-centered and context-driven to drive innovation. Therefore, the designs created in this investigation are not definite solutions, but rather explorations that are meant to be tested and iterated in nonlinear and continuous cycles until an effective and valuable solution is reached (Kumar, 2013, p. 195–196).

Method: Frame Solutions

In this phase of the design process the concepts that have been developed must be evaluated to determine the solutions that hold the most value to the user (Kumar, 2013, p. 247–248). The modes of design and evaluation are iterative to realize the greatest design potential. In order to test the designed prototypes, four cyclists ranging in skill level were interviewed in an unstructured conversational format. The participants are all residents of the Cleveland community and were familiar with the locations of study. All participants also ranged in the level of comfort and feeling of safety when biking in the Cleveland area. The goal of this method was to gain qualitative data to judge whether or not the design solutions possess clarity, effectiveness, and potential value.

Tactic: Test Prototypes

In the preliminary phases of this research it was assumed that the designed prototypes would be tested physically in the environment. However, due to the limitations of time and resources involved, the prototypes were tested theoretically. In order to conduct a test in this manner the users were provided with a narrative regarding conditions and situations to stimulate the frame of mind they would have while riding a
bicycle on the road. They were then asked questions pertaining to the images provided depicting the prototype designs of the cautionary markings and wayfinding system (figures 30–33).

The participants unanimously agreed that the meaning of the cautionary bike lane markings was clear (figure 30). One participant commented, “it adds a nice layer of precaution, especially for people who are new to riding.” All participants agreed that these lane markings would likely alert them in advance that the bike lane would come to an end. However, this topic in each interview consistently led to question how they would transition into different traffic patterns once the lane had ended. These markings provide cautionary warning, but they do not provide guidance for any type of maneuver required after the end of the bike lane. Following an analysis of the feedback, a further recommendation can be contributed. The modified shared lane markings used in Portland would be an effective solution to the questions brought up regarding the end of the bike lane (figure 34). If these markings were adapted for bike lane use and placed before the end of the bike lane, they would provide guidance for the cyclist while transitioning into their next maneuver before the bike lane has ended.

**Figure 34.** Modified Shared Lane Markings, Portland, OR (NACTO, 2014, p. 136)
The cautionary lane transition bicycle markings caused confusion among all participants interviewed (figure 31). All participants described their process of crossing over lanes of traffic in a similar fashion; first looking over their left shoulder for cars they would then slow down, put out their left arm for the left-hand turn signal, and if the pathway is clear continue to cross into the far most left lane to make the turn. This indicates that while transitioning through lanes of traffic, cyclists generally have their line of sight directed at automobile traffic and not at the ground level. Therefore, timing and traffic were the most significant variables for cyclists while maneuvering through lane transitions, proving that this prototype design would not be effective in these situations. However, if the modified shared lane markings used in Portland were to be integrated on the roadway prior to the event of lane transitioning, this may help a cyclist prepare to navigate through an area of conflict (figure 34). The need for flexibility in regard to timing is present in lane transition situations. A roadway marking located prior to the point of lane transitioning and with more suggested direction, rather than restrictive direction, could be most effective in this situation. A post-mounted sign signaling a 'bike merging zone' may also provide further awareness and guidance for both drivers and cyclists in these occurrences.

The intersection guidance bicycle marking was the most well received prototype out of the cautionary bicycle markings category (figure 32). Based on the participants’ descriptions of their process of riding through intersections, it is indicated that left-hand turns may be the most intimidating in regard to their safety. All users explained that depending on the level of traffic and type of intersection, they generally make the decision to take up a full lane with assertiveness to make cars more aware in busy conflict areas. Participants agreed that these markings would be useful for both cars and bicycles,
conveying that this prototype would help cyclists to feel more confident due to the markings communicating their legitimacy on the road, and would also provoke drivers to use caution in areas of high traffic. One participant expressed the desire for these types of markings in large confusing intersections to minimize confusion for drivers and cyclists. Another participant confirmed the sense of security and stability these markings would provide cyclists in allowing them to take ownership of their route choice in busy intersections, especially in downtown areas. Certainly these markings would be adaptable to change positioning depending on the intersection circumstances. Further testing would be needed to determine the placement of markings based on specific roadway conditions.

All participants agreed that the bicycle wayfinding system developed specifically for cyclists would help them to successfully navigate a route while riding (figure 33). All interviews led to further recommendations and additional possibilities in regard to how the system can be improved, which is important criticism to consider in future stages of refinement. Participants’ processes vary in regard to route planning; when riding recreationally participants prefer either planning a route in advance or traveling with more spontaneity, and commuters tend to prefer the most direct route. Regardless of route planning preferences, all participants avoid busy and unsafe roads, generally choosing more bike friendly routes. One participant explained that it would be helpful in not requiring him to pause cycling in order to check a map on his mobile phone for directions. Participants also explained that they commonly ride on familiar roads, only occasionally venturing to places they have not previously traveled. Participants all acknowledged that this type of signage would still maintain a sense of spontaneity while riding, but would ultimately encourage them to explore new areas of the city while
providing reassurance. Participants also explained that this signage could potentially create more conversation regarding biking in Cleveland, encouraging new riders and creating a stronger bicycle culture in the city. Participants agreed that their general line of sight while riding alternates between the ground ahead of their front bicycle wheel and the horizon line. All participants believed the ground signage would be more visible for cyclists on the road, but would also like to see the wayfinding repeated on post-mounted signs. The ground signage is clear and directed at the cyclist, while post-mounted signage would reaffirm the system and may also target pedestrian users. More information about the system depicted on a website or other venues of communication with maps and explanations of the system as a whole would also provide the user with more background and context. A participant commented that a system like this is unified and would successfully function across multiple districts throughout the city.

**Outcome**

This mode of framing solutions is necessary in evaluating and determining which design concepts are valuable and worth pursuing (Kumar, 2013, p. 247–248). All participants agreed that the green color of the cautionary markings would make drivers more aware of cyclists, but the solid continuous line may be misunderstood as a bike lane. Further revisions are necessary for the cautionary markings in order to eliminate designs not suitable for the user, and to refine those that prove to be potentially effective based on user testing. The conversational style inherent with the unstructured interviews also led to new insights from the participants’ experiences, ultimately initiating ideas for revised concepts in regard to the wayfinding system. Establishing value in this mode leads to more actionable and systematic design solutions for future implementation (p. 247–248).
CHAPTER V
Conclusion

Method: Realize Offerings

Tactic: Reflection

This body of research identifies the growth of walkable and bikeable communities in evolving cities, and determines the need for safer and more interconnected bicycle infrastructure. It also supports the theory that environmental graphic design can contribute to the development of safer bicycle pathways, and that wayfinding can increase the connectivity of urban districts through bicycle networks. Through creating a robustly unified city, the identity of the urban culture can be strengthened, creating enriched user experiences and a more sustainable community.

The first series of design prototypes and user testing introduced new ideas and considerations. A final iteration for this investigation has been designed to further explore these new concepts based on the first round of prototype testing results, though this iteration itself has not yet been tested (figure 35). Further analysis of the initial round of designing and testing led to a more simplified system of cautionary markings and a dual layer wayfinding system encompassing both post-mounted signs and ground wayfinding. The arrows in the system have been altered to maintain a shape that contains both a wider head and longer tail for enhanced readability. The cautionary markings have been simplified to a series of three identical arrows so as not to confuse roadway users with an exact pathway. Therefore, these symbols provide more navigational flexibility and ultimately a safer pathway. The system has also been given a brand name (Cleveland Bikeway) to provide users and community members with more context about the system. Future development would likely include digital components such as an app
or website with maps and information about the bikeway system. The district names are listed on the post-mounted sign paired with an arrow in a color specific to that district. The wayfinding arrow has then been repeated on the ground using a color coded method to correspond with the post-mounted signage. This double layer of information provides the cyclist with directional information in more than one line of sight, ensuring ultimate readability. The ground wayfinding can also be implemented in places where a sign may not be applicable, creating a more connected system.

**Figure 35. Prospective Bicycle Wayfinding System**

The design prototypes developed for this study are best defined as the initial development of a hybrid system combining bicycle traffic signing and marking with bicycle wayfinding signage. This combined system addresses aforementioned issues of both safety and connectivity. While revisions and iterations may still be required for these design prototypes, based on user feedback and data generated in testing they could prove highly valuable and effective. The nature of this design approach is heavily based on the presented secondary research and remains in the initial conceptual and schematic
phase of the design process. Within this study are limitations of time, resources, and cross-disciplinary collaboration, which are all necessary for the progression and implementation of these design solutions, and which future research relies heavily upon.

Consequently, the development of these design concepts and the qualitative data gathered in the testing phase present new questions that are important to consider. In future iterative processes, how can users be tested to gather quantitative data regarding the speed of traffic, traffic volumes, traffic patterns, and visibility? On a larger geographic scale, how will districts, landmarks, and destinations be determined to design a more holistic wayfinding system for cyclists, and potentially pedestrians, across the city of Cleveland? Measuring this data will be imperative to determine the best routes and placement for these types of signs and markings. Additionally, what other forms of communication are necessary in building a brand around this hybrid system? Possible additions could include a website or mobile application, containing maps and information depicting how the system works as a whole. This would provide the community with more background information on the function and intention behind the system, encouraging usability.

These questions provide the foundation for the progression of a design solution built for the environment. Multiple community stakeholders must be involved for furthering a design solution of this kind. While the research and design process in this study is limited, it does provide a framework of concepts to continue the conversation around strengthening urban bicycle cultures, and ultimately creating more designful, innovative, and prosperous cities.
Appendices
Appendix A

Expert Interviews: Sample Questions
Appendix A

Expert Interviews: Sample Questions

Joshua Goran, Transportation Cyclist:

1. How long have you been living and cycling in Cleveland?
2. Do you cycle everyday? Describe your regular routine.
3. Describe your experience cycling in Cleveland.
4. What are the similarities and differences cycling on the west side as opposed to downtown?
5. Do you have any frustrations in regard to biking in Cleveland, or anything you wish were improved or different?
6. Do you think cycling is becoming a more popular mode of transportation in this city?
7. Would you say drivers are considerate of pedestrians and cyclists in Cleveland?
8. Do you think there are hesitations for people to bike between districts, for example, from the west side to downtown?
9. Are bike lanes and accommodations for cyclists consistent throughout the city?
10. Do you believe sharrows are an effective method of lane sharing?
11. What do you wish to see in Cleveland’s bike culture in the future?
Appendix A

Expert Interviews: Sample Questions

Jacob VanSickle, Director of Bike Cleveland:

1. Describe your position and at Bike Cleveland and what led you here.

2. You have a background in sociology and community development. How do you think a bicycle culture can enhance a community?

3. Do you think a bicycle network has the potential to link successful pockets or districts within a community?

4. Do you cycle primarily for recreation or for transportation?

5. Describe your personal experience biking in Cleveland.

6. What are some of the major challenges you face as a cyclist personally, and as a bicycle advocacy organization?

7. What do you think are the main hesitations in the Cleveland community regarding bicycling?

8. Do you believe sharrows are an effective method of lane sharing?

9. Do you work with the Department of Transportation? Is this a challenge?

10. Do you work closely with any other organizations?

11. What do you wish to see in Cleveland’s bike culture in the future?
Appendix A

Expert Interviews: Sample Questions

Dawn Hancock, Founder and Director of Firebelly Design:

1. Describe your design background and your role at Firebelly Design.

2. How was the DIVVY Bike Share design initiated with your firm by IDEO?

3. You mentioned in your talk at the SEGD Chicago Conference that in your research while interviewing community members you witnessed an emotional response; a tension present between the fear of riding and the allure of riding. How did this affect your design decisions and do you think the design of the bike share is helping people overcome their fear of riding?

4. Describe your process in working with the public and any other organizations that were involved in this design project.

5. You said in your conference talk that your design team was brought on very late in the process. Will you explain your experience in working with the Chicago Department of Transportation? Was it a positive or negative experience?

6. What are some of the most significant takeaways or things you have learned about bicycling and/or the community through your involvement with this project?

7. Have you seen a progression with this project over time in regard to the public and their response?

8. Can you describe Chicago’s bicycle infrastructure? Are there bike lanes, sharrows, or any other types of ground wayfinding? Do you think these methods are safe and effective?

9. Are there any existing signage systems or plans for environmental graphics to be
integrated into the bike share system throughout the city?

10. What do you see in the future for the DIVVY Bike Share?
Appendix A

Expert Interviews: Sample Questions

*Terry Schwarz, Director of the Cleveland Urban Design Collaborative (CUDC):*

1. How has your career path led you to your profession at the CUDC and what are the responsibilities involved in your position?

2. Describe the role of the urban designer in the pedestrian and bicycle environment.

3. The CUDC’s Step Up Downtown Plan depicts future plans for pedestrian and bicycle pathway connections in Cleveland. What do you think this will do for the community?

4. Do you think members of the community are hesitant to walk and cycle in Cleveland? Why?

5. Protected bike lanes appear to be the safest bicycle facility, but also the most difficult to implement. Do you believe bike lanes and sharrows are an effective and safe method of lane sharing?

6. What is the process like in working with the city and the Department of Transportation in regard to implementing bicycle plans?

7. The Step Up Downtown Plan mentions the need for signage. Do urban designers usually work with graphic designers on projects like this?

8. Are there standards for the types of signs or wayfinding that you are required to use for pedestrian and bicycle designs?

9. Jacob VanSickle of Bike Cleveland mentioned the CUDC has done a pop-up project downtown involving a bike lane. Can you explain this project further?

10. What do you see in the future pedestrian and bicycle environment in Cleveland?
Appendix A

Expert Interviews: Sample Questions

Andrew Cross and Jenita McGowan, Traffic Engineer and Chief of Sustainability for the City of Cleveland:

1. BOTH: Describe your positions and responsibilities working for the City of Cleveland.
2. BOTH: Do you commonly work on projects together? If so, what types of projects?
3. BOTH: What is the process like in working with outside community organizations, like Bike Cleveland or the CUDC, for example?
4. JENITA: How can a walkable and bikeable city help to improve the sustainability of a community?
5. JENITA: How do you think a more walkable and bikeable city could benefit the community of Cleveland specifically?
6. ANDY: What is the process like implementing new pedestrian and bicycle infrastructure?
7. ANDY: What are the standards and regulations required for pedestrian and bicycle wayfinding, signs, and markings?
8. BOTH: Do you believe sharrows are an effective method of lane sharing?
9. ANDY: Are bicycle facilities frequently improved or updated? How often is a new design introduced into pedestrian and bicycle infrastructure or sign standards? Is it difficult for something new to be implemented?
10. BOTH: Do either of you ever work with urban designers or environmental graphic designers? If so, can you describe that experience and process?
11. BOTH: What do you think are the hesitations, or even limitations, biking or walking in Cleveland?

12. BOTH: What are the city’s goals for the pedestrian and bicycle environment in Cleveland?

13. BOTH: What do you think are some similarities and differences in the way that the City of Cleveland approaches pedestrian and bicycle projects as opposed to the City of Lakewood? A downtown location versus a smaller community?

14. BOTH: What do you each envision or wish to see in the future pedestrian and bicycle environment within the city of Cleveland?
Appendix B

5E and POEMSTA User Experience Matrix
Appendix B

5E and POEMSTA User Experience Matrix

### Image 1. Full Framework Matrix

<table>
<thead>
<tr>
<th>People</th>
<th>Objects</th>
<th>Environments</th>
<th>Messages</th>
<th>Situations</th>
<th>Time</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entice</strong></td>
<td>- Motivated or discouraged to ride a bike - Concern and worry of comfort</td>
<td>- Weight to carry - Navigational elements - Stolen bike - Cars/unaware drivers</td>
<td>- Infrastructure - Weather - Safety - Landscape</td>
<td>- Concern of appearing to be lower-class - How can people be encouraged to ride a bike?</td>
<td>- Weather - Safety - Comfort</td>
<td>- Takes too much time - Too far - Traffic</td>
</tr>
<tr>
<td><strong>Enter</strong></td>
<td>- Plan Route</td>
<td>- Cycling gear</td>
<td>- Low traffic routes - Well maintained streets - Bike friendly roads</td>
<td>- How does a rider know where to begin? - How does a cyclist navigate while riding?</td>
<td>- Decision to ride or recreationally or for transportation</td>
<td>- Starting point</td>
</tr>
<tr>
<td><strong>Engage</strong></td>
<td>- Pedestrians - Cyclists - Automobiles - Transit users</td>
<td>- People - Cyclists - Cars - Buses</td>
<td>- Crosswalks - Intersections - Sharrows - Bike lanes - Bus lanes</td>
<td>- Share lanes - Watch for pedestrians and cyclists - What are high conflict areas?</td>
<td>- Lane transitions - Left-hand turns - Navigation</td>
<td>- Length of time to go - Where to go</td>
</tr>
<tr>
<td><strong>Exit</strong></td>
<td>- Arrive at destination</td>
<td>- Bike rack - Look bike</td>
<td>- Safe place to leave bike - End of ride to destination and beginning of ride home</td>
<td>- What informs the cyclist that the ride has ended? - How do they return?</td>
<td>- Arrive at destination</td>
<td>- Amount of miles ridden</td>
</tr>
<tr>
<td><strong>Extend</strong></td>
<td>- Tell others about ride - Physical feeling after a ride - What you encountered on the ride (recall)</td>
<td>- Photos of experience</td>
<td>- Discovered new places and wish to return</td>
<td>- How can you share your experience with others?</td>
<td>- Others ask about your experience</td>
<td>- Plan future routes based on past experiences relating to speed and distance</td>
</tr>
</tbody>
</table>
### Image 2. Framework Matrix Summary

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entice</td>
<td>People are discouraged to ride a bike due to their concern or worry for their comfort and safety while riding on the road.</td>
<td>How can people be encouraged to ride a bike?</td>
</tr>
<tr>
<td>Enter</td>
<td>Bicyclists often plan routes ahead of time to select bike-friendly roads for travel. If they prefer to be more spontaneous riders, they still need some form of navigation to return home if traveling in unfamiliar territory.</td>
<td>How does a cyclist know where to begin their ride? How does a cyclist make navigational decisions while physically riding a bicycle?</td>
</tr>
<tr>
<td>Engage</td>
<td>Cyclists encounter pedestrians, other bikes, automobiles, and buses in high traffic areas including intersections, bike lanes, and shared traffic lanes. Navigating through clustered environments may be difficult.</td>
<td>How can design create safer pathways and clear navigation for cyclists?</td>
</tr>
<tr>
<td>Exit</td>
<td>Once a cyclist has arrived at their destination they dismount their bike and are in need of a safe place to secure their bicycle. A cyclist must also plan their route to return to their starting point.</td>
<td>What informs a cyclist that their ride has ended and how do they navigate back to the beginning of their route?</td>
</tr>
<tr>
<td>Extend</td>
<td>Cyclists may share their experience with others, encouraging others to ride.</td>
<td>Why or how would a cyclist’s experience be shared with others in their community?</td>
</tr>
</tbody>
</table>
Appendix C

Design Prototypes
Appendix C
Design Prototypes

Cautionary Bike Lane Markings

Image 1. Scale Drawing of Cautionary Bike Lane Markings

Based on roadway conditions, the width measurements of bike lanes range from a minimum of 3 feet to a maximum desirable width of 6 feet (NACTO, 2014, p. 6). The standard measurement for a bicyclist symbol applied to a bike lane is 72 inches for the height of each segmented piece of the marking, and 44 inches in height for type treatment (ODOT, 2012, p. 918).

Scale: $\frac{1}{4''} = 1'-0''$
Appendix C

Design Prototypes

Cautionary Bike Lane Markings

Image 2. Plan View of Cautionary Bike Lane Markings

Plan view of cautionary bike lane markings applied to a dedicated bike lane.

Scale: NTS
Appendix C
Design Prototypes

Cautionary Bike Lane Markings

Image 3. Elevation View of Cautionary Bike Lane Markings

Elevation view of cautionary bike lane markings supported by ‘bike lane ends (R3-17 & R3-17bP)’ post-mounted regulatory sign (ODOT, 2012, p. 901). Roadway markings act as a more detailed and accurate layer of advanced precaution.

Scale: NTS
Appendix C
Design Prototypes

Cautionary Lane Transition Markings

Image 4. Scale Drawing of Cautionary Lane Transition Markings

The solid white line used to separate motor vehicle lanes from bike lanes is required to be 6–8 inches wide (NACTO, 2014, p. 6). Using this existing line width as a reference, the lane transition marking is thinner so as to not be confused with lane divider striping.

Scale: \(\frac{1}{4}" = 1'-0"\)
Appendix C

Design Prototypes

Cautionary Lane Transition Markings

**Image 5. Plan View of Cautionary Lane Transition Markings**

Plan view of lane transition markings applied to a dedicated bike lane and shared traffic lanes.

Scale: NTS
Appendix C
Design Prototypes

Cautionary Lane Transition Markings

Image 6: Elevation View of Cautionary Lane Transition Markings

Elevation view of lane transition markings applied to a dedicated bike lane and shared traffic lanes. Cyclist’s line of sight alternates between looking ahead at their pathway and over their left shoulder for oncoming traffic.

Scale: NTS
Appendix C
Design Prototypes

Cautionary Intersection Guidance Markings

Image 7: Scale Drawing of Cautionary Intersection Guidance Markings

Equal to the lane transition markings, the intersection guidance markings have the same width and arrow height measurement.

Scale: $\frac{1}{4}'' = 1' - 0''$
Appendix C
Design Prototypes

Cautionary Intersection Guidance Markings

**Image 8: Plan View of Cautionary Intersection Guidance Markings**

Plan view of intersection guidance markings applied to shared traffic lanes in an intersection.

Scale: NTS
Appendix C
Design Prototypes

Cautionary Intersection Guidance Markings

Image 9: Elevation View of Cautionary Intersection Guidance Markings

Elevation view of intersection guidance markings applied to shared traffic lanes in an intersection. Cyclist’s line of sight alternates between looking ahead at their pathway and over their left shoulder for oncoming traffic.

Scale: NTS
Appendix C

Design Prototypes

Bicycle Wayfinding System

Image 10. Scale Drawing of Bicycle Wayfinding System

The width of the directional signs in the bicycle wayfinding system measure 4 feet in width, making them adaptable for applications on dedicated bike lanes and shared use pathways. The minimum cap height for vehicular signage is generally 4 inches. The height of each directional sign in the system measures 8 inches, allowing for a 5-inch cap height for the district names. Therefore, cyclists traveling at speeds less than or equal to automobiles in these locations will be assured clear readability.

Scale: ¾"=1'-0"
Appendix C
Design Prototypes

Bicycle Wayfinding System

Image 11. Plan View of Bicycle Wayfinding System

Plan view of bicycle wayfinding system applied to shared traffic lanes in an intersection. Directional signage is placed at areas with high bicycle traffic at prominent points of decision.

Scale: NTS
Appendix C
Design Prototypes

Bicycle Wayfinding System

Image 12. Elevation View of Bicycle Wayfinding System

Elevation view of bicycle wayfinding system applied to shared traffic lanes in an intersection. Cyclist’s line of sight alternates between looking at the navigational cues on the directional signage in front of their bicycle and further ahead at their pathway.

Scale: NTS
Appendix C
Design Prototypes

Prospective Bicycle Wayfinding System

Image 13. Scale Drawing of Prospective Bicycle Wayfinding System

The post-mounted sign has maintained the type cap height of 5 inches for the vehicular size requirement. The brand name and bicycle symbol are positioned to read as the header of the sign in the top green portion, and the coordinating district names and directional arrows are placed underneath, closer to the cyclist for a more accurate viewing distance. The ground wayfinding system corresponds with the arrows on the post-mounted sign with the use of color-coding for the city districts. Cautionary pathway markers are smaller in size for more flexibility in pathway placement.

Scale: 3/4"=1'-0"

Post Mounted Directional Sign

Ground Wayfinding

Ground Pathway Marker

Bottom of sign is mounted on a post 4 feet above the ground level.
Appendix C

Design Prototypes

Prospective Bicycle Wayfinding System

**Image 14: Plan View of Prospective Bicycle Wayfinding System**

Plan view of prospective bicycle wayfinding system applied to shared traffic lanes in an intersection. Directional signage is placed at areas with high bicycle traffic at prominent points of decision.

Scale: NTS
Appendix C

Design Prototypes

Prospective Bicycle Wayfinding System

Image 15. Elevation View of Prospective Bicycle Wayfinding System

Elevation view of prospective bicycle wayfinding system applied to shared traffic lanes in an intersection. Cyclist’s line of sight alternates between looking at the navigational cues on the directional signage in front of their bicycle and on the post-mounted sign, as well as further ahead at their pathway.

Scale: NTS
Appendix D

Testing Participant Interviews: Sample Questions
Appendix D

Testing Participant Interviews: Sample Questions

Introduction:

1. Do you live in Cleveland, Ohio?
2. Are you familiar with this area? (show focus area map)
3. Do you ride a bicycle for transportation or recreation?
4. Can you describe your experience biking on the roads in Cleveland regarding your level of comfort and safety?

Prototype 1, Bike Lane Cautionary Marking:

1. Imagine you are riding your bike in a designated bike lane. If the lane were to end right before an intersection what would you do?
2. (show prototype 1) If these symbols were placed on the ground approaching the end of a bicycle lane what would they signify to you?
3. Do you believe these markings would help you in any way by warning you in advance that the bike lane is ending?
4. Would these markings make you feel safer?

Prototype 2, Lane Transition Cautionary Marking:

1. Imagine you are riding a bicycle in the right-most lane, but you need to cross over lanes of traffic to make a left hand turn. What would you do?
2. (show prototype 2) If you were to see these markings on the ground what would they signify to you?
3. Do you believe these markings would be helpful in crossing over lanes of traffic? How?

4. Would these markings make you feel safer?

5. If you were driving a car and saw these markings would you be more cautious of cyclists?

Prototype 3, Intersection Guidance Cautionary Marking:

1. Imagine you are riding your bicycle through an intersection. How would you maneuver through this situation?

2. (show prototype 3) If you were to see these markings on the ground what would they signify to you?

3. Do you believe these markings would be helpful in guiding you through an intersection?

4. Would these markings make you feel safer?

5. If you were driving a car and saw these markings would you be more cautious of cyclists?

Prototype 4, Bicycle Wayfinding System:

1. Imagine you are riding your bicycle for recreation. Would you plan your route before you ride? Would you choose roads that are bicycle friendly?

2. Would you ride in places you have been before or explore new areas?

3. (show prototype 4) If you were to see directional signage like this on the ground what would it signify to you?

4. Would wayfinding like this encourage you to bike to new places?
5. Do you believe wayfinding like this would encourage your friends and others to try cycling or ride a bike more often?

6. When you ride a bike where does your line of sight generally fall? Do you believe wayfinding signs on the ground like this would be easier to read while riding your bike rather than reading a sign on a post?
References


