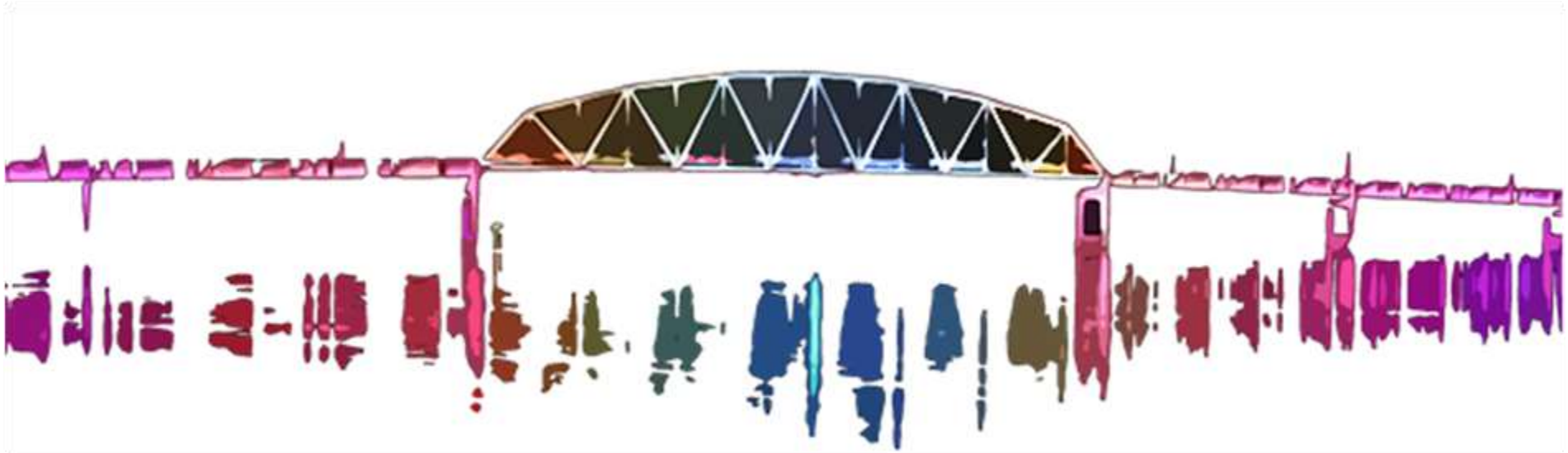

MUSCATINE PEDESTRIAN & BICYCLE MASTER PLAN

University of Iowa: The Iowa Initiative for Sustainable Communities

Connecting Muscatine to its People, Culture, and Livelihood. Connecting to a healthier lifestyle. Connecting to the Future.

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Executive Summary

This Bike and Pedestrian Plan was created by Graduate Students from the University of Iowa as part of the Iowa Initiative for Sustainable Communities. The City of Muscatine committed itself to increasing the ease of alternative transportation through its comprehensive plan and designation as a Blue Zone community. To achieve this goal, the authors of this plan, with the assistance of project partners in Muscatine and faculty advisors from the University of Iowa, developed a plan for the City of Muscatine, using a comprehensive approach to improve biking and walking within the city.

This plan adheres to the 5 E (Engineering, Education, Encouragement, Enforcement, and Evaluation) structure commonly found in nationally recognized bike and pedestrian plans, and is endorsed by the League of American Bicyclists and Walk Friendly Communities for its holistic approach to transportation planning. Sidewalk and trail facility construction projects were located and ranked, from most to least important, by a cutting-edge GIS model that compares the current infrastructure to an ideal network of sidewalks and trails. Where the two differ, the model determines the gap's relationship to destinations that attract high amounts of traffic within Muscatine. The attractive and common travel destinations include schools, parks, businesses, the downtown riverfront area, and bus-stops. The model then compares the gaps using their proximity, via walking along sidewalks or trails to give scores for each based on how many destinations it might reasonably serve. Considerations also included safety concerns by including pedestrian vehicle conflicts in the modeling process.

Potential infrastructure projects, in this plan, are broken up into three different time horizons (immediate, middle, and long term), depending on their rank, providing the City with a prioritized implementation strategy. Areas around schools were deemed the most crucial concern by community input, while bus stops were deemed the least. The highest ranked projects, as determined by the model, are concentrated around Franklin Elementary, the northern Park Avenue corridor, and the proposed trails along Mad Creek and Cedar Street connecting to the riverfront. Accompanying these physical projects, are way-finding signage recommendations to increase the ease of navigation and information available to people using the trails to traverse Muscatine; signs will go along existing trails, near trailheads, at intersections, and near parks.

Emphasizing the natural wonders that Muscatine has to offer, like the Mississippi Riverfront, the regional Mississippi River Trail, or the many parks in town (including a world class Soccer Complex), is another hope of this plan. By connecting the many parks and trails in Muscatine to its history, culture, and economy, this plan hopes to help grow awareness and usage of these facilities. To do this, the plan also provides a promotional smartphone application using virtual signage to help people see, in real time, what is around them and how to get there. This app will include destinations of schools, parks, businesses, and more!

This plan is not the final answer to Muscatine's alternative transportation needs. Instead, this plan provides a framework for analyzing the current bike and pedestrian network, along with gathering community input to come up with a plan of action that is consistent with the vision of the city. The authors of this plan have gone through that process and provided the city with implementation strategies, funding opportunities, and target goals. However, the process will have to be duplicated and the plan updated as the vision of Muscatine continues to grow and change over time. It is our belief that if this plan of action is carried out, that Muscatine could be recognized by the League of American Bicyclists, Walk Friendly Communities, or Blue Zones for their considerable efforts towards livability and transportation, in the very near future.

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Introduction

The City of Muscatine has partnered with the University of Iowa and the Iowa Initiative for Sustainability to increase livability within the city through policy projects. The recent comprehensive plan update and the accompanying public input identified bicycle and pedestrian facilities as a key area of improvement for the City and non-motorized vehicle opportunity a major concern. Non-motorized transportation is a vital part of public health (via walk-ability and bike-ability), safety in terms of pedestrian-vehicle conflicts, and welfare through economic vitality. In response to this desire, graduate students from the University of Iowa have developed this bicycle and pedestrian plan to address these opportunities for improvement and concerns of the community.

The development of a bicycle and pedestrian plan is the foundation for creating a community conducive to walking and cycling. This plan identifies key gaps in the cycling and walking infrastructure within the city of Muscatine, as well as prioritizing short, medium and long term projects in accordance with the needs of the community. Guidance for programs related to the complex and multi-faceted approach to Bike and Pedestrian planning is also be provided in the form of the Traditional 5E's which will receive their own section.

Muscatine

Muscatine has a rich cultural history and stands as a hub of industry situated on the Mississippi River. The city has a number of interesting facets within both its history and its people. In the early 20th century, Muscatine produced nearly 37% of the world's pearl buttons, making the town the undisputed Pearl Button Capital of the World. The city's population is aging, has a significant pocket of Hispanics/Latinos, and a robust and growing Liberian population.

Prior to the drafting of this Pedestrian and Bike Plan the city had outlined a number of policy and action goals regarding sidewalks and alternative transportation in response to the interests of its population and to emphasize its rich history; the plan will both respect those goals and ground recommendations in them. In order to craft a plan that is both meaningful and effective for Muscatine this plan seeks to complement and enhance the established projects, connect to the history and vitality of the community, while incorporating the comprehensive plan's objectives and working within current legal statutes.

Why a Bike and Pedestrian Plan?

Traditionally, Planning, as an institution, is used to improve the built environment, increase the efficiency of systems, promote health safety and convenience, and work towards social interests over individual desires. Sidewalks and trails fall squarely within the realm of planning, due to their very nature. These facilities improve the transportation efficiency in an urban community, making the streets safer by reducing vehicle and pedestrian/bicycle conflicts and more connected by offering more route options. Lastly, municipal sidewalks and trails are a public good. This means that if a facility is to provide for public transportation needs, then no one person may own them nor can a person be excluded from them (because they are located in the public right-of-way), making them difficult to provide without direct intervention of local

government. The cost of implementing these projects requires the coordination of planning and construction services to deliver the connections the community itself wants.

Legally, The Federal Aid highway Act of 1962 requires urbanized areas to have transportation master plans and a Transportation Improvement Plan (TIP) in order to receive federal funds for transportation related projects. In 1991, with the passage of the Intermodal Surface Transportation Equity Act (ISTEA), additional requirements were made to consider alternative "non-motorized" transportation in the planning process, as well as offered funds specifically for non-motorized commuter trails. ISTEA has expired, but many of the alternative transportation encouragements within it have lived through the other program regulations such as Transportation Equity Act for the 21st Century (TEA-21), Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), and Moving Ahead for Progress in the 21st Century (MAP-21). Formula grants to pay for trails and sidewalks are no longer offered through MAP-21 but instead have been included as part of the Transportation Alternatives funds. As such, utilizing money effectively to maximize the impact to the community will require strategic and well-thought out plans.

Vision:

The City of Muscatine outlines its vision for walking and cycling in the transportation section of their new comprehensive plan:

"Members of the community should have the opportunity to travel safely to their destination by foot, bike or other non-motorized means. Children should be able walk or bike to their school safely. To achieve this goal critical routes for non-motorized travel, linking all schools, parks, bus stops, most major employment and shopping centers, and are located within 400 feet of most residences in Muscatine will be identified. These routes will be made safe and attractive for travel by foot, bike, wheelchair, and all other forms of legal non-motorized travel."

The vision of the comprehensive plan has been distilled and developed with the input of advisory groups, stakeholder input, and public input, into a vision for city of Muscatine to be achieved through the implementation of this bike and pedestrian plan.

The important elements of the vision for the bike and pedestrian plan, as determined by comprehensive plan and stakeholder input, are:

- Walking and bicycling will provide *safe* and *convenient* access to all destinations within the city, with particular focus on securing access to schools.
- Greater connectivity is achieved within the sidewalk and trails network by adding infrastructure to make a *continuous network*.
- Way-finding will make the city of Muscatine easily accessible for residents and visitors alike while providing a link to historic Muscatine.

University of Iowa

History

The creation of a Pedestrian and Bike Plan for the City of Muscatine is not a stand-alone project. Recently, there has been much activity by both the city and community groups to improve access to non-automotive modes of transportation. The most comprehensive projects to date addressing alternative transportation are the Comprehensive Plan and the Blue Zones Project. It is not the goal of this plan to rewrite these documents, or speak for the organizations behind them, but to complement the ideas behind them and create an implementation plan and provide a wealth of information to help accomplish their ends. By understanding what they entail this plan enhances these works and focuses them towards the Pedestrian and Bike transportation needs of Muscatine.

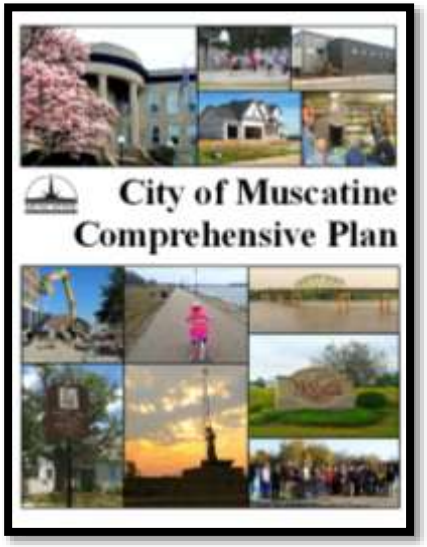

Figure 1: Muscatine Comprehensive Plan cover

In 2013 the City of Muscatine adopted a new Comprehensive Plan. The purpose of this plan is to lay out a vision of what community members desire Muscatine to become over the next decade. The current and future transportation needs of Muscatine were targeted as critical components of maintaining and improving the quality of life in the city. Through a development process, relying on input from community members and stakeholders, Muscatine identified its network of trails and sidewalks as an important resource which should be built upon to secure a vibrant future. In particular, the Comprehensive Plan emphasized the importance of children having the ability to walk to and from school. To achieve its goal of residential and school connectivity, the comprehensive plan proposes multiple trail and sidewalk projects.

On January 30, 2013, *Wellmark Blue Cross and Blue Shield, Blue Zones and Healthways* announced Muscatine as a Blue Zones Project™ demonstration site in Iowa. The Blue Zones project is a global initiative to improve community well-being and make healthy choices easier through permanent changes to environment, policy, and social networks. By becoming a Blue Zones community, Muscatine has pledged to make a number of improvements to the pedestrian and bike networks. For starters, Blue Zone designation calls for the adoption of both a bike and pedestrian plan. The Blue Zones project also calls for an ordinance to make every transportation project compliant with complete streets goals, which aim to make the street network better and safer for drivers, transit users, pedestrians, and cyclists.

Benefits of Bicycle and Pedestrian Networks:

Communities enjoy many benefits from a complete and connected system of trails and sidewalks. These benefits come in a number of forms, including but not limited to: Health benefits and Healthcare savings; comprehensive access to recreation facilities; Increased safety for travelers and possibly the community as a whole; increased equity of employment and shopping opportunities; localized increases in property values or retail sales; and reduced pollution.

Health:

The benefits to health from increased connectivity are not limited to qualitative descriptions. There are an estimated 149,916 recreational bike riders in Iowa who are estimated to have saved the state of Iowa $73,942,511 in health care costs (Bowles, 2011). Exercising reduces stress and improves overall wellness which can be promoted through increased sidewalk and biking networks that provide an affordable exercise and recreation opportunity within Muscatine

Recreation and Quality of Life:

It's more than just for fun. Increased sidewalk and trail infrastructure increases the community's connectedness to neighbors, parks, schools, and shopping centers. This serves to link cultural and historically important elements in Muscatine. People's lives can be improved through having a bike and pedestrian friendly city, since it increases transportation equity. With the annual cost of owning and operating a car estimated at over $7,000, walking and biking represent affordable alternatives (Bowles, 2011).

Crime Reduction:

More non-motorized transportation in a city reduces crime risk through increased pedestrian traffic - "more eyes on the street" as promoted by the International Crime Prevention and The Environmental Design Association. (Bowles, 2011)

Economic Prosperity:

Trails and sidewalks next to houses can increase their property value. A study by the Urban Land Institute shows home buyers are willing to pay more for homes in walkable neighborhoods (Bowles, 2011). In addition to private property gains, making a city bike and pedestrian friendly can increase the traffic to local businesses.

Environmental Health:

Promoting connectivity, provides alternative routes to get to school, parks, work, and recreation and shopping centers, as well as additional emergency routes. By choosing alternative transportation a community contributes to the reduction of greenhouses gases and reduces congestion during peak travel times by shifting traffic into alternative modes of travel. Young children have few means to get around, particularly to school. A study of the California Safe Routes to School Program has shown that providing sidewalks is one of the most effective engineering measures for getting children to walk to school (Bowles, 2011).

Planning Process

Plan Reviews

As a starting point, this plan reviewed the Bike, Trail, Pedestrian, and Transportation plans of over 40 communities from all over the United States. Each of these Communities had been recognized for their excellence in providing Pedestrian or Bicycle Services. These accolades came in the form of awards from the League of American Bicyclists (LAB), Walk Friendly Communities (WFC is affiliated with the Federal Highway Administration- FHWA), American Wheelmen, and Blue Zones. From these plans we took the tools and practices most suited to the City of Muscatine's needs.

It is this plan's findings that the typical Bike and/or Pedestrian Plan is structured with the "5E's of Transportation Planning," which refer to: Engineering, Education, Encouragement, Enforcement, and Evaluation. By following this structure, Muscatine can take advantage of years of Bicycle and Pedestrian planning knowledge.

5E's

The 5E's were originally adopted as a method for evaluating Safe Routes to Schools Programs first instituted by SAFETEA-LU in 2009. Since then, it has been adopted as evaluation criteria by numerous institutions and programs such as: FHWA, Transportation Research Board- National Cooperative Highway Research Program (TRB-NCHRP), WFC, LAB, Blue Zones, AASHTO research, and others. They represent the major facets of a transportation plan to address all levels of programmatic efforts. It is intended to not only build new infrastructure but make the alternative transportation lifestyle viable, requiring little investment from the user.

Engineering

Engineering does not mean calculations and designs for roads, instead Engineering represents the physical infrastructure projects to be implemented. This Bicycle and Pedestrian Plan focuses primarily on these physical projects. The main objective of doing this plan is to identify potential project locations and then provide a prioritization process and list for the future facilities. These facilities will include both sidewalks and trails.

Education

Education refers to informing the public about the alternative transportation network and how it should be used. Typically done by schools, advocacy groups, and non-profit organizations, this category attempts to teach people things like bicycle etiquette, and road safety. Other ways to educate may include publishing trail maps and brochures. This plan provides some material on potential programs but does not intend to directly implement them, as the schools and Blue-Zones committees are already dedicated to these ideals.

Encouragement

Encouragement is designed to get people excited about using the bicycle and pedestrian network and attract those that would not be utilizing it otherwise. Public Relations campaigns like a "bike to work week" or promotional materials about an upcoming project could serve in this capacity. Making the network a user-friendly, safe, and comfortable way to get around, as well as informing people about these capacities can lead to a growing healthy community. This plan provides ideas on how to do this, without making specific recommendations on their implementation, and additionally offers its own promotional application for smart phones to help connect Muscatine to its culture, history, and destinations.

Enforcement

Enforcement is defined as the legal political implementation of policy relating to the use of Pedestrian and Bicycle Facilities. This may refer to signage or striping to indicate where it is okay or expected for bicycles to travel, or perhaps law enforcement officers policing inappropriate cycling behavior/jay-walking. It is difficult for a plan to be successful if people do not behave in the expected manner; sometimes bicyclists do not heed stop signs because it is too much trouble, but this type of behavior can lead to an unsafe environment for both cyclists and motorists. This plan will not recommend any new laws, but it will outline potential programs for consideration in the future.

Evaluation

Evaluation asks that the adopters of the plan pay attention to the impacts and progress that the plan achieves throughout time. This can be done through surveys, data collection, progress reports, milestones, benchmarks …etc. This plan will propose a set of standards to judge the success of the plan, as well as recommend that the plan be revisited in the future to ensure that it remains a relevant and effective tool for the community.

Community Input

The American Institute of Certified Planners' Code of Ethics requires practitioners to consider the Public when making decisions. In fact, the first section is specifically "Our Overall Responsibility to the Public." Section 1.E dictates an obligation to ensure that the public have an opportunity to have meaningful contributions to the content and direction of planning decisions, as they are the primary stakeholders. In addition to this, Iowa State Code Chapter 18B states that municipalities must consider collaboration with community stakeholders in all planning, zoning, development and resource management decisions. To this effect, this plan utilizes two methods (focus groups and steering committee) to receive input from the community of Muscatine.

Comprehensive Plan

The comprehensive plan in Muscatine received a recent update. Rather than have this Pedestrian and Bicycle Plan retread, reinvent, or rescind the efforts of the City's Planning Department, this plan uses the comprehensive plan as the primary basis for all of its decisions. Public input is not only strong recommended for

comprehensive plans, but is a necessity for a quality policy document. Muscatine's input for the comprehensive plan is still very recent and relevant to this endeavor as well. The Comprehensive plan identified a few very important elements for the plan; namely, trail/sidewalk connectivity, and school zone safety. In fact, Safe Routes to School has just become the number one priority in Muscatine.

Focus Groups

This plan used the existing Muscatine Trails Committee as a focus group since they already have a stake in the biking and walking community and specific local knowledge regarding trails and sidewalk issues. A focus group, like this, is best utilized in a situation when a large portion of the population does not already use the facilities or have knowledge of issues, let alone have vested interests in the matter, such as in Muscatine users do not comprise the largest majority of the population. By targeting early adopters (or representatives of early adopters such as the Melon City Bicycle Club), this plan benefits from a dramatic increase in the quality of input, because they are very much aware of potential problems and have opinions on what they believe should happen. The community already has a vision for trails, particularly in regards to the Mississippi River Trail and it would not serve to ignore their tremendous efforts to this point in time, so this plan integrates them into its process.

Steering Committee

For decision-making and input directly on methods a steering committee was formed. Their local knowledge of the community and its political climate is invaluable. Since the plan drafters are technical experts but not locals it does not serve for them to make decisions without consulting with community members. In this regard, meetings and correspondence with a steering community allows the authors to combine their technical knowledge with the local knowledge of community members. Their input is the primary justification for many of the more subjective decisions about the prioritization process and the application of a "reasonableness check." The check refers to a process to ensure that the recommendations herein are grounded in reality for Muscatine, and make sense.

Members on the committee:

- *Andrew Fangman:* project partner, planner
- *John Sayles* - project partner, retired planner
- *Sarah Lande* - project partner, community activist
- *Randy Hill* – Public Works Director
- *Peg Heither* – Tourism-board member
- *Donald Krings* - School bus driver
- *Greg Harper* - Owns a bike shop
- *Dave Cooney* - Melon City Bike Club member

Destination Selections

Before determining which infrastructure projects were most important or what parts of Muscatine needed to be connected to the way-finding system, the reasons for trip making were analyzed. To prioritize projects, this plan identified the key destinations in town to use as references for all travel, assuming that if someone wanted to walk or bike these places are the primary destinations. These locations also serve as the inputs to the way-finding application/signage, and were split into different categories, both for analysis and way-finding. The categories for destinations and locations of interest were selected using guidance from the Chamber of Commerce's website regarding important facets of the community, focus group input, steering committee guidance, project partners' prompts, and based on socio-economic data. Analysis categories for infrastructure projects included:

- Schools
- Parks
- Downtown
- Major Employment Centers
- Bus Stops
- Pedestrian and Bicycle Crash Incidences

When making decisions for prioritizing sidewalk and trail projects, these identified locations served as the primary inputs. In addition to these locations other promotional items such as landmarks, historical buildings, local restaurants, healthcare and shopping opportunities were included for use in the final way-finding system recommendations.

Figure 2: Steering Committee Meeting

The local planning department already had GIS shape-files identifying the schools, parks, bus stops, downtown limits, and some major employment centers. The Chamber of Commerce website was the primary input for what local businesses and landmarks the community wanted to emphasize in marketing Muscatine. Additionally data was garnered from local authorities on crashes, the Department of Transportation for road/trail inventories, healthcare websites for providers in the area, and Longitudinal Employer-Household Dynamics Survey for employment purposes. The "major employment centers" were

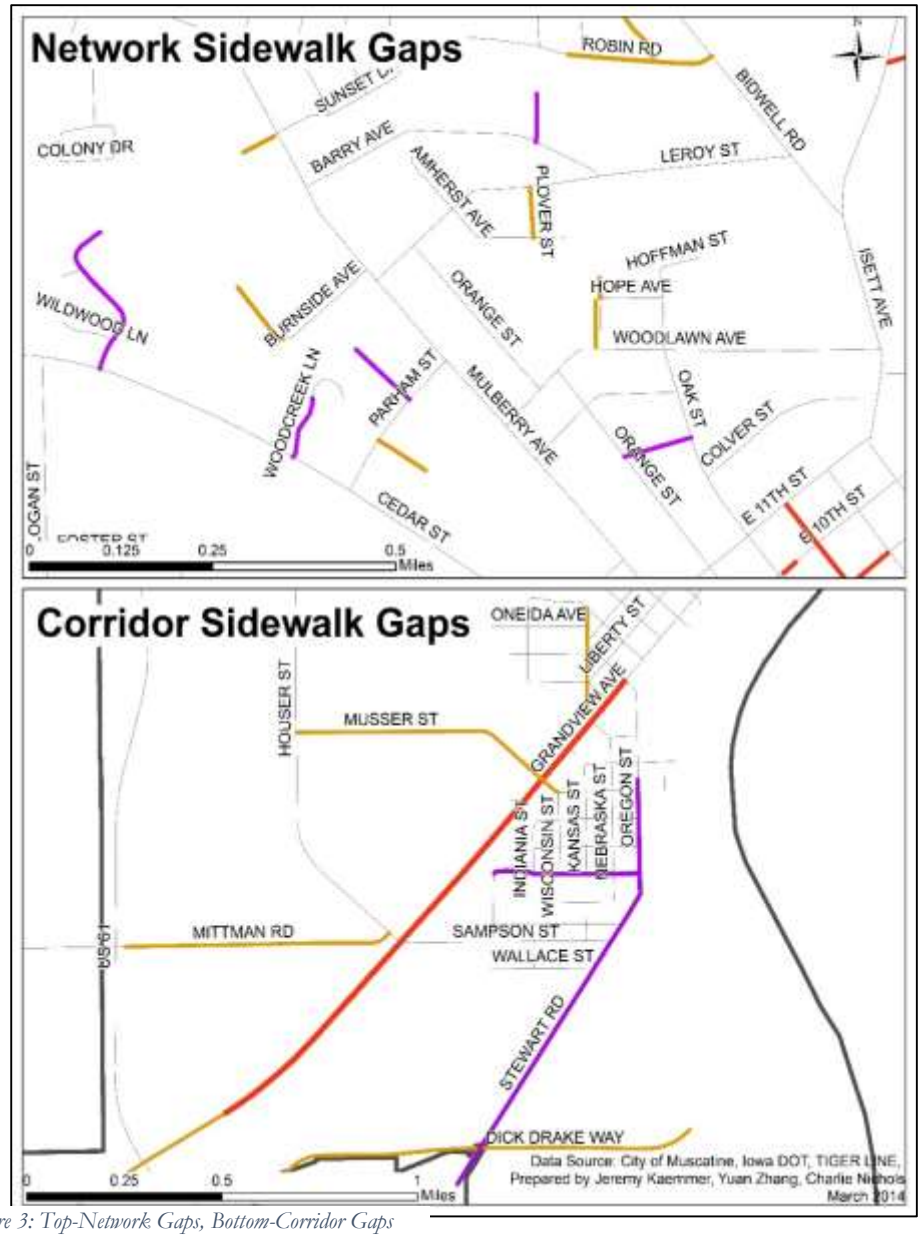

Figure 3: Top-Network Gaps, Bottom-Corridor Gaps

identified as the 30 largest employers in town (who made for >95% of total employment) as well as any business identified as important by the Chamber of Commerce.

Selection of Projects - Trail Proposals

Potential projects were identified through a GIS application that identified gaps in the sidewalk network, and trails that were either already proposed by the city in the comprehensive plan or where they could go to logically close extensive sidewalk gaps and connect existing trail systems. Where possible, the trails cleaved to existing right of way to minimize acquisition. The GIS application first assumed that the ideal city would have sidewalk fronting every property, every road, and on both sides of the road. The road network was then used to compare to the existing sidewalk file provided by the city. The road file was broken into smaller pieces (no larger than a city block) to ensure a fine level of detail, then roads where there are sidewalks on both sides were identified. Those sections that were found to have sidewalk were then removed. Everything else was considered to be a "gap." Gaps were then divided up into 2 different categories based on the physical characteristics: network and corridor.

The two categories are important because their funding sources and the way they would be implemented are very (different. Network gaps were considered to be those less than a ¼ mile. This is identified by the FHWA as the upper end of "walkable" distances that people would be willing to travel. It also represents a short gap where a pedestrian can likely see where they want to

go but cannot because they are lacking a direct connection to their destination and must go out of their way significantly. Typically network gaps are paid for by the property owners, developers, and business owners immediately adjacent. Corridor gaps, on the other hand, were identified as those extending greater than a ¼ mile in a single direction. These are major failures of the sidewalk network because they are prohibitive of nearly all travel in a given direction. Due to the scale of these projects, the funding for them usually requires government assistance and needs to be implemented as a major improvement project such as the Cedar Street or Colorado Street projects that are already underway. A third category is also used in this plan for trails. Multi-use recreational trails are oftentimes located off of the street network, needing separate analysis, and also are built using different funds- usually in the form of grants.

Each project was then evaluated to check for accuracy and feasibility. In the case that the model provided an output for a section that is actually served by sidewalk, the section was removed. Gaps were also added in certain areas that were not properly identified due to some unique topography of the area. Projects that were one side of the street and two-sides of the street were differentiated, and areas with prohibitive slopes along the road were given adjustments to represent the issues that would be experienced relative to their completion.

Figure 4:3rd St Stub that was flagged- is actually a driveway. Courtesy Google Maps

Ranking Process

After the potential projects were identified they were mapped along with the destination data. Each destination was then compared spatially to each gap. This utilized a "service area" approach. Every destination was given an area of influence based on network distance. This represents how far an individual could travel from a destination walking along a street, comfortably. This approach was used for a few reasons. The first reason was that it acknowledged the fact that urban travel is rarely in a direct line and needs to account for the shape of the travel network. The second is that it prioritized projects based on proximity to places important to the community (as identified through community input). Proximity was set as either near (within ½ mile) and immediate (< ¼ mile) to separate out things that serve a

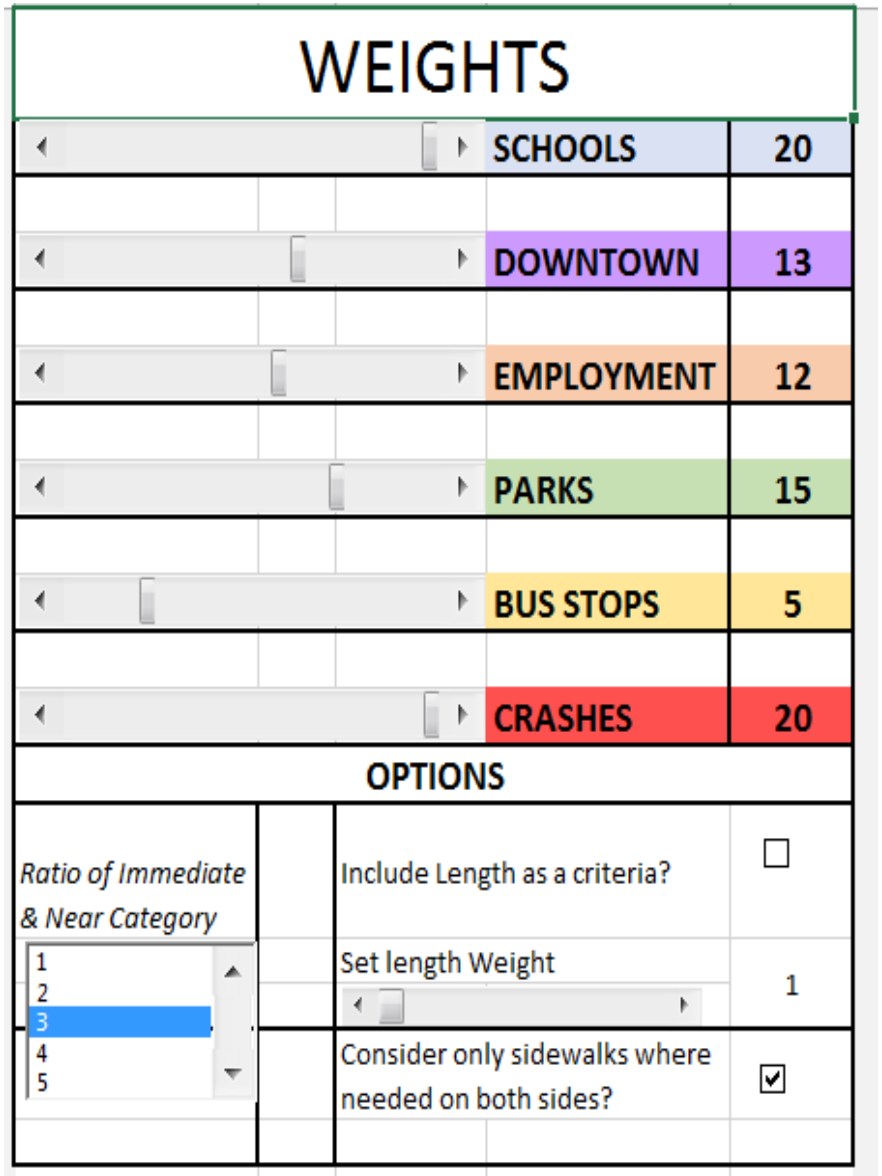

Figure 5: Graphic Interface for the Model

destination versus representing a likely route. Ideal projects will be located in the nexus of multiple service areas, essentially where the maximum number of people would need it. This helps this plan to achieve easy-wins and gain community support by implementing the most useful projects first and gain political support or momentum.

Each gap tallied the number of service areas it fell within for each of the destination types which was then converted into a project score and then translated to a ranking. To do this a dynamic spreadsheet plugin for GIS was created from Excel. The model offers a graphical interface (figure 5) to assist in weighting the destinations as evaluation criteria relative to each other. Other options such as cost (using length as a proxy) and the power of proximity can be adjusted within the model. Length is included in the model to account for the real world cost difference in constructing different lengths of sidewalk and trail. The Length costs were then compared logarithmically, so that the difference between a shorter gap and long one were significant, while the difference between 2 larger gaps was less influential than the difference between 2 smaller ones. This was done to simulate human decision making regarding magnitudes and perceptions.

The ranking process is meant to ensure that the projects selected fit the community well, and serve the places that are most important. Steering committee input was used to fix the weighting values in the interface. The interface then updated the GIS model, delivering a list of project rankings from most to least important and showing the value of each gap using a thematic color map. This is a very useful tool because future iterations of this plan can

use the exact same model and adjust values to suit the current climate and see what new projects are the most important.

The thematic map displaying the projects is broken into 3 color categories representing the different time horizons for each project. Time horizons were chosen because it is impossible to know exact funding, land acquisition, and political support factors that go into completing infrastructure projects. So rather than give specific dates or project times, the projects were given short, medium, and long term goal statuses. Short terms are influential and potentially cheaper projects that should have more impact than the others, and as such, be done first. Network gap projects had some options available that did not receive any scores or were not significant. These projects were categorized as "Does not qualify," referring to the fact they may not be worth accomplishing, because they will not add much in the way of connectivity or transportation opportunity to the community.

A reasonableness check and some adjustments were made to remove non-existent projects. Some areas were identified that should not have been because they are private drives or had atypical alignments that the model failed to address appropriately. Additional notes were made for projects that were redundant and where terrain may be problematic for sidewalks to be put in.

Way-finding Signage

In addition to sidewalks and trails new signs are recommended to be placed to assist in navigation and encouragement for Bicyclists and Pedestrians. Locations for signs are recommended based on intersections of trail systems and placements at regular ¼ mile increments. The signs will indicate other trail/park complexes as well as major landmarks and destinations such as downtown and the mall. Informational signage was selected to mark the areas around trail heads. These are located along major roads where they come near a trailhead, in order to increase awareness.

Implementation Strategies

This plan does not intend to just leave the City of Muscatine with a mere list of projects that they need to complete. Included in this plans are recommendations for an incremental approach to achieving a goal of complete connectivity in Muscatine and how to make the biggest difference in the community via the fastest route. One of the major barriers for infrastructure projects is money, and this plan also includes research into a variety of funding models and sources available for sidewalk and trail projects. Establishing a set of prioritized projects and identifying potential funding sources for those projects will be one of the biggest achievements of this plan.

Figure 6: Signage Examples

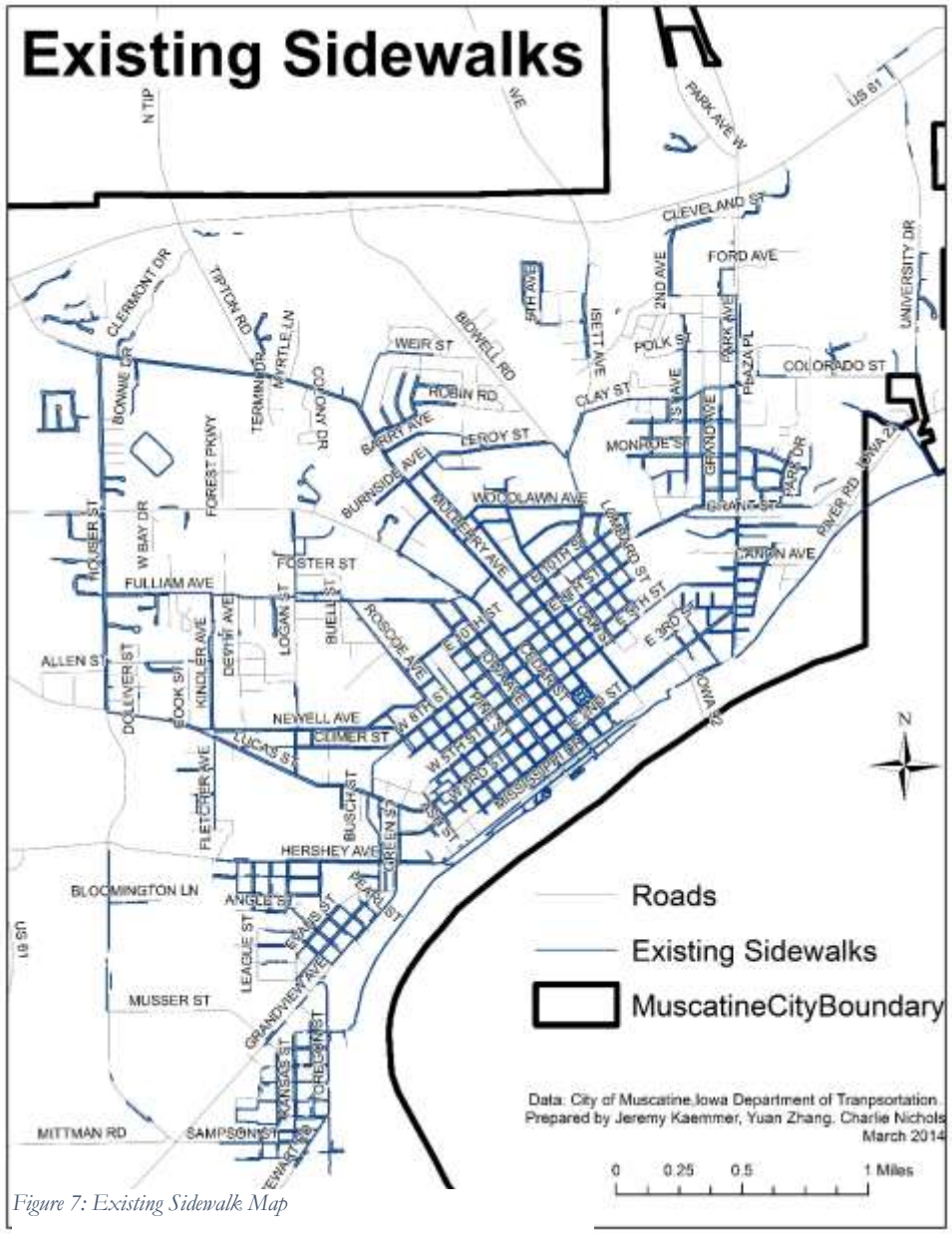

Figure 7: Existing Sidewalk Map

Existing Conditions

This section of the plan provides an overview of the existing conditions of the bicycle and pedestrian network in the City of Muscatine. It will describe the background of bike and pedestrian planning in Muscatine and set the basis for the development of the Bicycle and Pedestrian Plan. Efforts of this plan to improve the trail and sidewalk network with new infrastructure are rooted in knowledge and understanding of the current state of the network and major issues pertaining to it, as well as an understanding of the relationship between the network and the citizens of Muscatine.

Current Sidewalk and Trail Network

Trails and sidewalks in Muscatine are meant to serve as safe routes for non-motorized travel throughout the city. The comprehensive plan states that trails are meant to function in a manner similar to arterial streets in the road network, moving large volumes of bike and pedestrian traffic across long distances, while sidewalks have a role similar to collector and local streets.

Sidewalk Network

Outside of the downtown area, Muscatine's sidewalk network is incomplete (figure 7). Many residential areas were constructed during a period of time before the current ordinances requiring sidewalks to be installed in new subdivisions. This has led to the development of an inconsistent sidewalk network with gaps in the network

scattered throughout the city. In order to easily represent and perform analysis of the existing sidewalk infrastructure in Muscatine, a map of the current sidewalk network was transformed into a file in ArcGIS. (Figure 7)

Trail Network

Muscatine sits at the junction of two federally recognized trail systems, The American Discovery Trail, which crosses the nation from San Francisco to Delaware; and the Mississippi River Trail, which runs along the Mississippi River from Minnesota to Louisiana. The trail system in Muscatine is meant to serve as the backbone for non-motorized travel, and a number of trails have been built by the City to fulfill the goal of having a comprehensive and connected trail network. Trails, in Muscatine, specifically refer to 10 ft. wide multi-use facilities paved with either concrete or asphalt. The current trails in Muscatine are listed following this section and may be seen in figure 8.

Riverfront Trail:

- A recognized component of both "Mississippi Riverfront Trail" and "American Discovery Trail".
- Runs from Musser Park to the intersection of Solomon Road and Keener Road.
- 5.27 miles in length
- Off street multi-use trail.
- 1.9 miles of the trail is lighted, running from Musser Park to the River View Park (Boat Harbor).
- In the vicinity of: Musser Park, Riverside Park, Mark Twin Overlook, Downtown, Historic areas, southern end of industrial area, Weed Park, Muscatine Community College, Colorado Elementary School, Muscatine Aquatic Center, and Franklin Elementary School.

Musser Park to Kent-Stein Park Trail

- Connects Riverfront Trail and Kent-Stein Park Trail along Warren Street.
- 0.15 miles in length
- Shared road multi-use trail.
- In the vicinity of: Kent-Stein Park, Musser Park, Muscatine Soccer Complex, and Riverfront area.

Hershey Avenue Trail

- Runs along the Hershey Avenue, crossing Hwy 61 Bypass.
- 0.49 mile length
- Off street multi-use trail.

University of Iowa

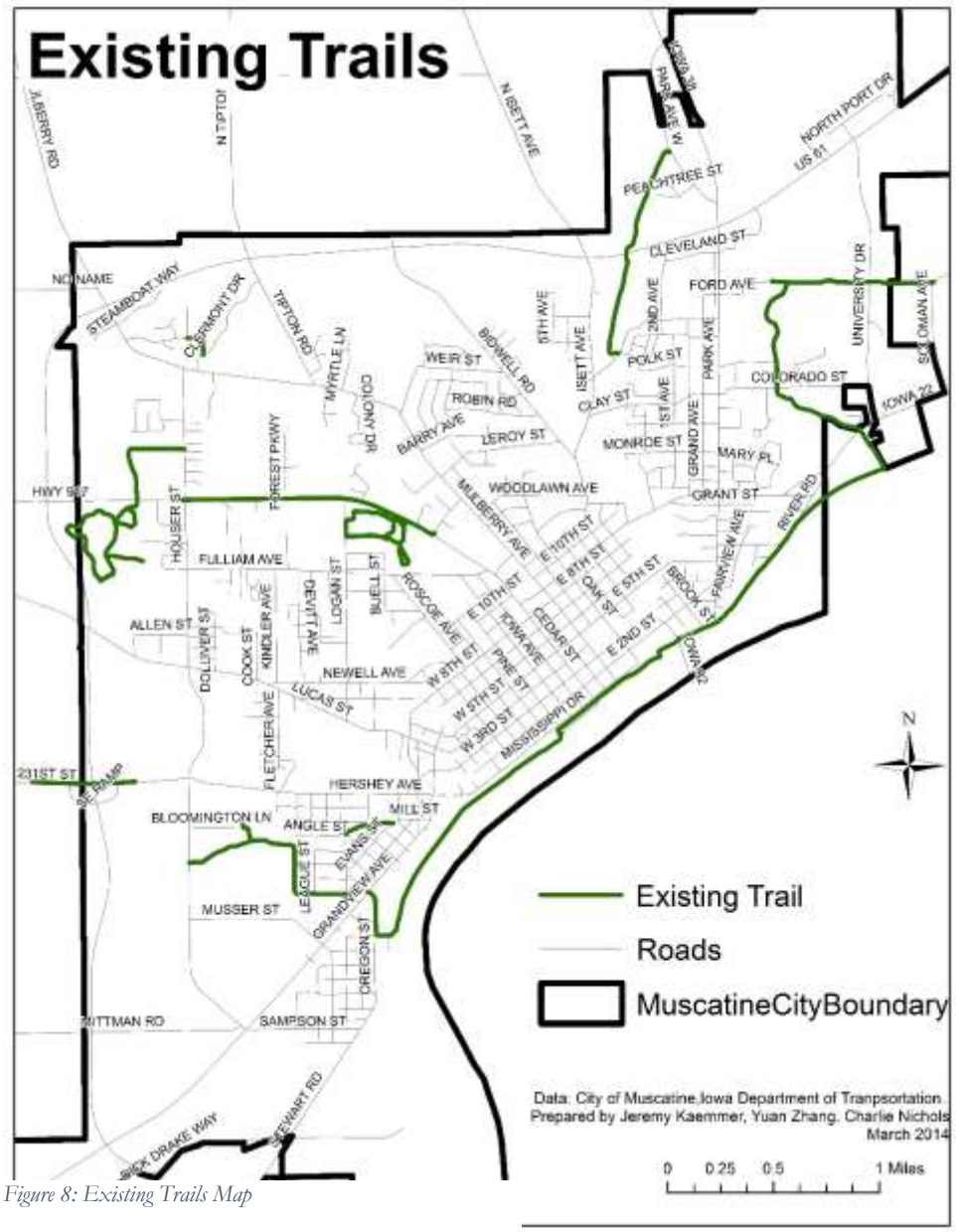

Figure 8: Existing Trails Map

Kent-Stein Park Trail

- Runs from Houser Street to Roby Avenue.
- 0.98 mile length
- Off street multi-use trail...
- In the vicinity of: Kent-Stein Park, Muscatine Soccer Complex, Water Pollution Control Plant, Transfer Station & Recycling Center, and Franklin Elementary School.

Taylor Trail

- Runs from intersection of Bond Street and Angle Street to Evans Street, passing through Taylor Park
- 0.23 miles in length
- Off street multi-use...
- In the vicinity of: Taylor Park, Franklin Elementary School, Kent-Stein Park, and Muscatine Soccer Complex.

Cedar Street Trail:

- Runs from Houser Street to Parham Street.
- 1.2 miles in length.
- Shared road multi-use trail.
- In the vicinity of: Muscatine High School, Jefferson Elementary School, Central Middle School, Post Office, Muscatine Medical Center, Art Center, clinics, and YMCA Trail.

Discovery Park Trail Complex

- Consists of Discovery Park Trail, Fuller Park Trail, and Arboretum Trail.
- 2.3 miles in length.
- Off road multi-use trail.
- Part asphalt and part compacted soil.

Mad Creek Greenbelt Trail

- Runs from Park Avenue to Lake Park Blvd.
- 2 miles in length.
- Off street multi-use trail.
- In the vicinity of: McKee Park, Mad Creek Greenbelt Park, and Oak Park.

YMCA Trails

- Runs from Logan Street to Cedar Street.
- 1.13 miles in length.
- Off street multi-use trail.
- In the vicinity of: Longview Park, Iowa Field, Cedar Street Trail Art Center, Hayes Elementary School, and Muscatine Medical Center.

Clermont Drive Trail

- Runs from Baton Rouge Road to Clermont Drive.
- 0.2 miles in length

Similar to the treatment of the sidewalk network in Muscatine, a map was created in ArcGIS of all existing trails (Figure 8) and proposed trails may be seen in Figure 9.

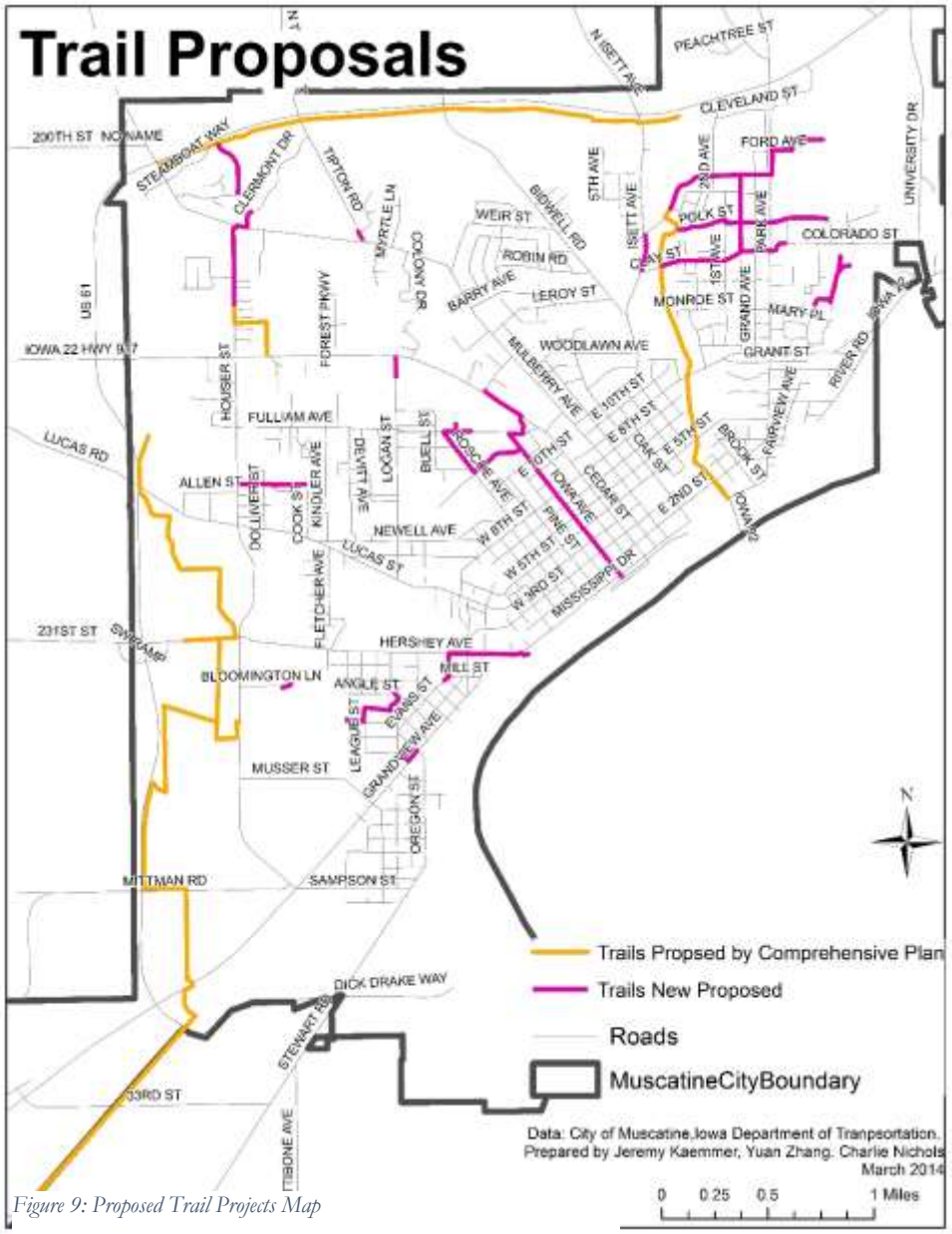

Figure 9: Proposed Trail Projects Map

Existing Bicycle and Pedestrian Regulations

Construction

First, every owner of property fronting the street shall be responsible for keeping, maintaining, and repairing sidewalks. The City Engineer shall issue a notice to exercise duties such as replacement and reconstruction. Additionally, the City Engineer may order a reconstruction of nonconforming sidewalks (City of Muscatine City Code, 2013).

The sidewalk specifications are found in section 3-7-(6, 7, 8, 9) of the City Code.

Figure 10: sidewalk construction

Section 3-7-6: Concrete sidewalks must be constructed with an excavation, which shall be made to the full width of the sidewalk to a depth of 4 inches below the finished grade of the walk. Subgrade shall be compacted rolling or hand tamping, and in such excavation shall be placed a concrete mix. Further, the base may be surfaced with nonporous bricks. A construct permit is required under the City Code (City of Muscatine City Code, 2013).

Second, under Section 3-7-7 of the city Code, no concrete sidewalk shall be constructed without first procuring the street and grade lines, but shall then to be constructed in accordance with such lines.

The width shall be 4 feet unless any other specifically requirement directed by the Council (City of Muscatine City Code, 2013).

Third, under Section 3-7-9 and new subdivisions section Title 11 of the City Code, new sidewalks shall be installed on both sides of streets as well as cul-de-sacs according to specifications prescribed by the city. For other areas, the City Council shall determine the necessity of installing sidewalks after holding a public hearing. The City of Muscatine and property owners shall share the installation cost (City of Muscatine City Code, 2013).

Operation

Under Section 7-3-8 of the City Code, bicycles are allowed to operate and park on sidewalks in the majority of city areas. However, area that is bounded by the downtown business area and by Mississippi Drive, Mulberry Avenue, Fourth Street and Pine Street is forbidden (City of Muscatine City Code, 2013).

Summary of Major Issues

The summary of major issues pertaining to the bike and pedestrian network in Muscatine comes from two resources that make up the backbone of this plan: the 2013 Comprehensive Plan and focus group/steering committee input.

Comprehensive Plan

The 2013 Muscatine Comprehensive Plan describes the vision of what community members in Muscatine wish the city to become over the course of the next decade, as well as identifying obstacles to that vision and specific steps that need to be taken to overcome those obstacles. In accordance with the Iowa Smart Planning Principles stated in Chapter 18B of Iowa State Code, Muscatine has devoted a section of the comprehensive plan to transportation issues, including alternative forms of transportation such as biking and walking. The following are issues pertaining to the bike and pedestrian network identified by the comprehensive plan.

Comprehensive Plan Notes:

1. Schools are a major traffic generator and the cause of some of the most significant traffic congestion issues in Muscatine. Most daily trips to and from schools occur within a narrow window of time and these surges in traffic often exceed the amount of traffic that the street serving a school can handle effectively.
2. The Muscatine Soccer Complex and Kent-Stein Park experience similar traffic congestion issues caused by large numbers of vehicles entering and exiting in a short period of time during events.
3. University Drive and Mulberry Avenue as it approaches U.S. 61, are the two street segments that have shown the greatest increase in traffic between 1998 and 2010. Both have the potential for the amount of traffic traveling of them to increase as development in these areas continues. This is also true for Houser Street, but to a lesser degree.
4. Not all schools are connected to the residential areas they serve by a complete network of trails and sidewalks, making it difficult and potentially dangerous to walk or bike to school.
5. Many gaps in the sidewalk network exist, especially outside of the downtown district.
6. The trail network is made up of isolated segments of trail not connected to each other.
7. The area northeast of Highway 38/U.S. 61 has become one of the most important employment centers in the city. Currently there are no safe routes for pedestrians to access this area.

Focus Group and Steering Committee

In addition to the 2013 Comprehensive Plan, a focus group and steering committee were consulted on major issues affecting the bike and pedestrian network. The focus group was made up of members of the trails committee which was a preexisting group which had been working on the development of trails in Muscatine prior to the creation of this plan. The steering committee consisted of community stakeholders with an interest in the bike and pedestrian network including: active and retired urban planners, community activists, engineers, school bus drivers, small business owners, and members of other community development boards. The following are issues pertaining to the bike and pedestrian network identified by the focus group and steering committee:

Results of Committee and Focus Group Input:

1. Safe routes to school for children walking or biking are a community priority.
2. The cost and ease of constructing a segment of trail or sidewalks are both important things to take into consideration. Limited resources are a reality faced by the city and this fact should be accounted for when recommending new infrastructure.
3. The trails which see the most use (riverfront trail, trail near Weed Park, Discovery Center trail) are those which are close to other destinations of interest.
4. Parks are a major destination for those using the trail system.
5. Vehicle-pedestrian crashes, while not numerous, are a large concern.
6. Building sidewalk on a street with sidewalk already on one side of the street shouldn't be as high of a priority as building sidewalk on a street without sidewalk on either side.
7. The topography of Muscatine presents a challenge when constructing trails and sidewalks. There are areas within the city where it is unreasonable to construct trails and sidewalks due to steep slopes on the side of roadways.

Destinations List

As part of the 5 E process of bicycle and pedestrian planning, this plan will be recommending the placement of trail and sidewalk infrastructure. A crucial component of making meaningful and effective recommendations is knowledge of destinations in Muscatine people want to be able to reach by bike or by foot. Using information from the Comprehensive Plan, our project partners, the trails committee, and the steering committee, a set of destinations were identified and mapped. An area of service was created for each destination, with sidewalks and trails within a quarter mile of the destination based on road network length considered as being in the immediate vicinity while sidewalks and trails between a half and quarter mile of the destinations are considered to be near.

Schools

Schools were identified by the Comprehensive Plan as well as the focus group and steering committee as being high priority for access by non-motorized travel. Community members stated that trails and sidewalks should radiate out from schools, creating school-centric networks.

	Name	Type
1	MUSCATINE COMMUNITY COLLEGE	COLLEGE
2	COLORADO ELEMENTRY SCHOOL	SCHOOL
3	MADISON ELEMENTRY SCHOOL	SCHOOL
4	GRANT ELEMENTRY SCHOOL	SCHOOL
5	MULBERRY ELEMENTRY SCHOOL	SCHOOL
6	MUSCATINE COMM HIGH SCHOOL	SCHOOL
7	MCKINELY ELEMENTRY SCHOOL	SCHOOL
8	WEST MIDDLE SCHOOL	SCHOOL
9	BISHOP HAYES ELEMENTRY SCHOOL	SCHOOL
10	FRANKLIN ELEMENTRY SCHOOL	SCHOOL
11	LUTHERAN CHRISTIAN PRESCHOOL	SCHOOL
12	WILTON COMMNITY JR/SR HIGH SCHOOL	SCHOOL
13	WILTON COMMUNITY GRADE SCHOOL	SCHOOL
14	CENTRAL MIDDLE SCHOOL	SCHOOL
15	JEFFERSON ELEMENTRY	SCHOOL
16	WASHINGTON ELEMENTRY SCHOOL	SCHOOL
17	WEST LIBERTY SCHOOL	SCHOOL
18	GARFIELD ELEMENTARY SCHOOL	SCHOOL

Figure 11: School Listing

University of Iowa

Downtown Area

The downtown area, consisting of many business and cultural attractions, was itself identified as a destination people want to be able to reach by bike and foot. Because the downtown area already has a very complete sidewalk network, trails and sidewalks which provide access to the downtown area also serve as points of entry to the built-up downtown sidewalk network.

Parks

Muscatine has many high quality parks which serve as a major generator/attractor of non-motorized recreational trips. Parks were identified in the comprehensive plan as very important to Muscatine.

	Name	Type
1	MUSCATINE AQUATIC CENTER	MUSCATINE AQUATIC CENTER WITHIN WEED PARK
2	WEED PARK	WEED PARK
3	MUSCATINE SOCCER COMPLEX	SOCCER COMPLEX
4	KENT-STEIN PARK	BASBALL/SOFTBALL COMPLEX
5	MUSC MUNICIPLE GOLF COURSE	MUNICIPLE GOLG COURSE/CLUBHOUSE/DRIVING RANGE
6	RIVER FRONT PARK	RIVERFRONT PARK
7	OVERLOOK PARK	OVERLOOK PARK
8	BROOK ST. PARK	CITY PARK
9	OAK PARK	CITY PARK
10	EVERSMEYER PARK	CITY PARK ON ORANGE ST
11	LINCOLNSHIRE VILLAGE CITY PARK	CITY PARK
12	MCKEE PARK	CITY PARK
13	FULLER PARK	CITY PARK
14	DISCOVERY PARK	COUNTY PARK
15	4TH ST. PARK	CITY PARK

Figure 12: Park Listing

Major Employment Centers

The need for non-motorized access to major employment centers was identified by the comprehensive plan and our project partners. The major employment centers were identified from a list of locations from the planning department and those listed on the chamber of commerce website. Inputs were amended to include points based on employment data taken from LEHD, in order to identify other concentrations of employment, not captured by the other sources (these points do not have business names attached to them, for security purposes).

	Name	Type
1	Muscatine Power& Water Utility A/O Center	Community
2	Unity Hospital	Community
3	Frodley Theatre	Commercial
4	Fareway	Commercial
5	Menards	Commercial
6	Walmart	Commercial
7	Blain's Farm & Fleet	Commercial
8	HY-VEE	Commercial
9	Mustine Mall	Commercial
10	HON	Major
11	G.P.C	Major
12	Musco Sport Lighting	Major
13	Union Tank Car	Major
14	Allsteel:	Major
15	Carver Pump	Major
16	HNI	Major
17	Bridgestone Bandag Learning Center	Major
18	Kent Corp.	Major
19	Raymond Manufacturing	Major
20	Heinz	Major
21	Stanley Consultants	Major
22	City Hall	Community
23	Letica	Major
24	Mckee Button	Major
25	HNI	Major

Figure 13: Employment Listing

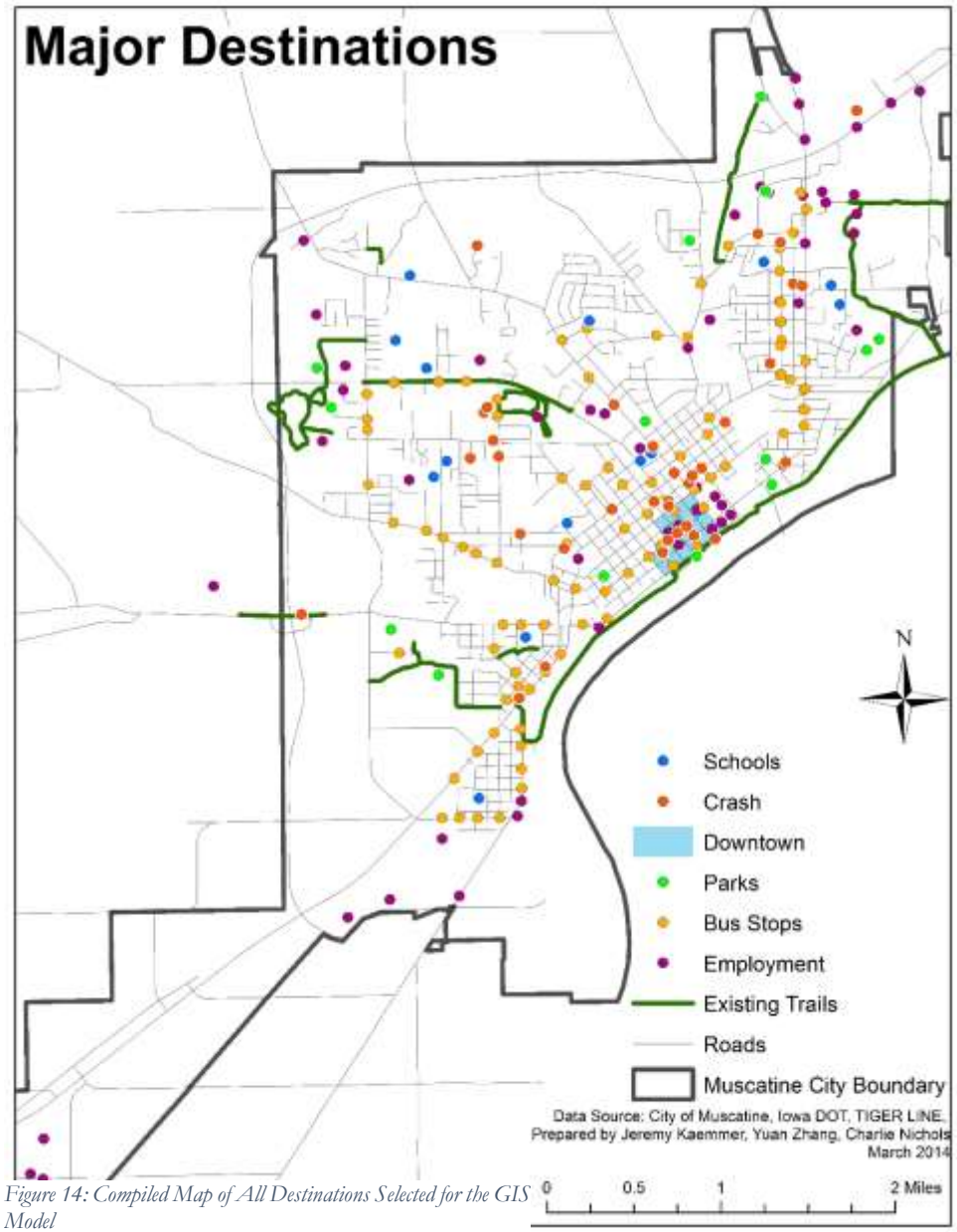

Figure 14: Compiled Map of All Destinations Selected for the GIS Model

Bus Stops

Public transit, along with non-motorized transit, is an important piece in providing citizens of Muscatine a comprehensive set of transportation options which suit their diverse needs. Building trails and sidewalks near bus stops will help increase the efficiency of transportation in the City.

Figure 14 provides a map displaying all of the destinations used in the modeling process. Bus stops may be seen in a shade of orange, for reference. They are the most numerous category, and displaying them via map is the most concise way to show where they are.

Pedestrian and Bicycle Crashes

Both the trails committee and the steering committee stressed the importance of safety when using the trail and sidewalk network. Identifying and fixing sidewalk gaps near crash sites is an important part of making Muscatine attractive for non-motorized travel. Information was taken from the local police department crash report from 2006 to 2013. (Figures 15&16)

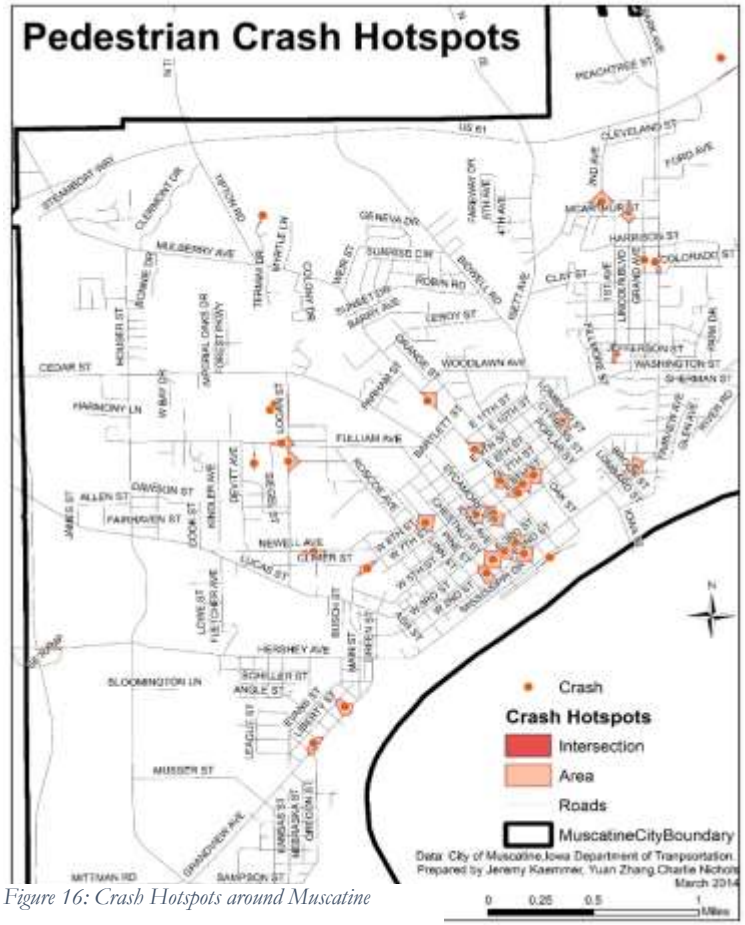

Figure 16: Crash Hotspots around Muscatine

	Location	Type	Year
1	Drugtown pkg lot	Accident MV-Property Damage	2006
2	3000 Provence Lane	Accident MV-Property Damage	2006
3	Sycamore Estimates	accident MV-PI	2006
4	Jefferson Elementary School	accident MV-PI	2006
5	Mullbery Ave	accident MV-PI	2007
6	West 8th Street	accident MV-PI	2007
7	700-Blk Lombard Street	accident MV-PI	2007
8	Walmart Pkg lot	accident MV-PI	2011
9	Sand Run Rd/Summerfield	accident MV-PI	2007
10	705 Grandview Ave	accident MV-PI	2007
11	Chestnut Street Alley	accident MV-HIT & Run PI	2007
12	Hwy 61 S	accident MV-HIT & Run PI	2007
13	1601 Grand Ave	accident MV-PI	2007
14	1816 Logan St	accident MV-PI	2008
15	900 Newell Ave	accident MV-PI	2008
16	501 Cedar Street & #5 Alley	accident MV-HIT & Run PI	2008
17	200 E 3rd St	accident MV-PI	2008
18	1st ave	accident MV-PI	2008
19	1907 W Fulliam Ave	accident MV	2008
20	Pearlview Ct	accident MV-HIT & Run PI	2008
21	Walmart Pkg lot	accident MV-PI	2008
22	300 W 8th St	accident MV	2009
23	Cedar St /E 2nd St	accident MV-PI	2009
24	Cedar Hills & Cedar Park around	accident MV-HIT & Run PI	2009
25	E 6th St & Oak St	accident MV-PI	2009
26	Reed St	accident MV-PI	2009
27	1000 Mullbery Ave	accident MV-PI	2009
28	Cedar Street & 3rd st	accident MV-PI	2009
29	Orange Street & 6th St	accident MV-PI	2010
30	500 Cedar Street	accident MV-PI	2010
31	2109 Lincoln Blvd,	accident MV-PI	2010
32	1800 Logan Street,	accident MV-PI	2010
33	700 Mulberry Avenue	accident MV-PI	2010
34	Park Ave	accident MV-PI	2011
35	E 2nd St & Smalley St	accident MV-PI	2011
36	E 2nd St & Parmalee St	accident MV-PI	2012
37	E 10th St & Mulberry	accident MV-PI	2012
38	Cedar Street & 3rd st	accident MV-HIT & Run PI	2012
39	300 Iowa Ave.	accident MV-PI	2012
40	Dillaway St & Logan St	accident MV-HIT & Run PI	2013
41	600 E Harbor Drive	accident MV-PI	2013
42	2nd ave & Lake Park Ave	accident MV-PI	2013
	MV: Moving Vehicle	PI: Pedestrian	

Figure 15: Pedestrian/Bike Crash Listing

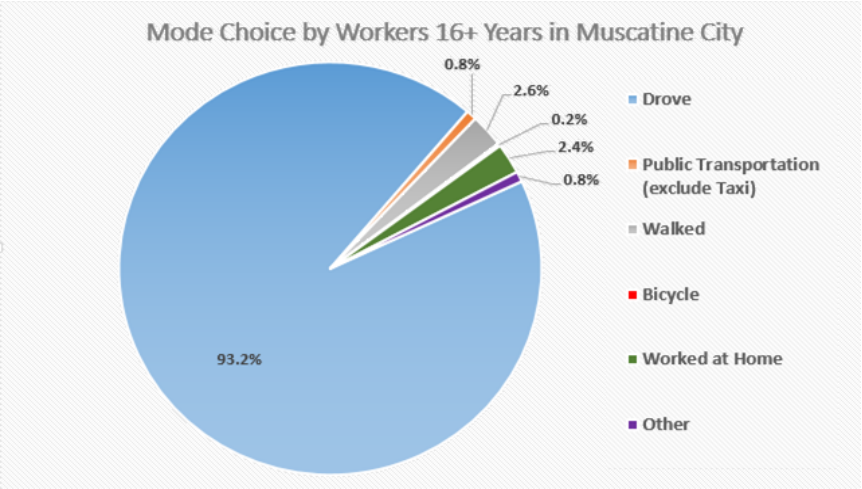

Figure 17: Means of Transportation for Wok for 16-years and older workers (Data source: 2007 to 2011 American Community Survey 5-Year Estimate)

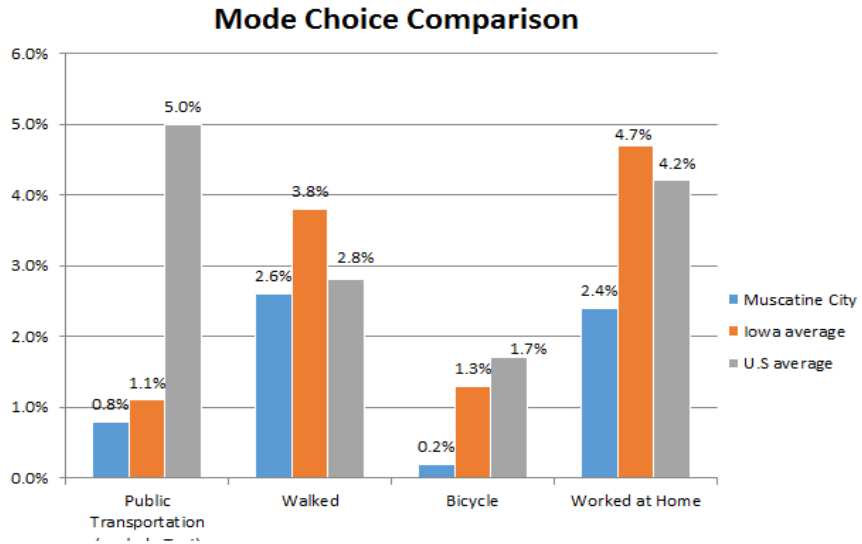

Figure 18: Mode choice comparison between Muscatine city, Iowa State, and the national average. (Data source: 2007 to 2011 American Community Survey 5-Year Estimate)

Relevant Statistics

Demographics are important when planning for the future. There are many sources of secondary data, such as the U.S. Census, which can provide a current picture of Muscatine and its citizens. Not only does this give base conditions within Muscatine, but it allows this plan to try and make predictions about the future of the city.

Mode Choice

Sidewalks, multi-use trails and bike paths can be used for both working and recreational purposes. A better understanding of the share of each mode for work trips is useful when evaluating the current usage of non-automobile transportation infrastructure.

Data about the commuting habits for the working population of Muscatine was taken from the 2007 to 2011 American Community Survey 5-Year Estimates. As shown in Figure 17, 93.2% of workers 16-years and older drove to work, 0.8% of them used public transit, and 2.6% workers walked to work. Only 0.2% workers (19 workers) used bicycles, which was less than 0.1% of the city population.

Figure 18 and Figure 19 demonstrate that the percent of workers who commute by non-automobile means were lower than both the Iowa average and the national average. The data is based on the American Community Survey 5-year estimation from 2007 to 2011, however, and is an estimation based on samples instead of population. It is meant to only be representative. Recreational travel data for trails and sidewalk are not available, which means there is a limited picture of how trails and sidewalks in Muscatine are used.

While it appears that Muscatine is underachieving in the standard non-motorized modes (Bicycle and Walking) the Bike data from the ACS did not have a large enough sample to make conclusive judgments based solely on their estimated proportion (Figure 19). When a hypothesis test was performed on the data, to determine if the statistics taken from ACS were significantly different (Z-score was equal to the difference divided by the square root of the standard errors squared and summed), it was determined that the error of the walking data was too large to make any assumptions based off of the national data. The data on walking in Iowa and biking in General, however, **was** significant at greater than the 90% confidence level. This level of confidence was chosen because it is the operating confidence level of the source data, and the way the ACS's educational tools describe the process. With this result it can be said with 90% confidence that Muscatine walk and bikes less than the state average and the national biking average.

Population Projection

Population increases result in subsequent growth in demand for both motorized and non-motorized modes of transportation. A population predication can help predict the future transportation needs of a city.

As part of this report, a population projection using the linear method was done (Figure 20). The linear method, which uses linear regression, was chosen because the population growth in Muscatine has been very stable over the past few decades. Using alternative methods such as the cohort component method (which relies on local age demographics and birth rates) are not

COMMUTING TO WORK						
	Muscatine City		Iowa		U.S.	
Workers 16 Years and Over	10,769	100%	1,524,370	100%	139,488,206	100%
Drove	10,123	93.2%	1,357,642	89.0%	120,315,446	86.3%
Drove Alone	8,991	82.7%	1,206,343	79.1%	106,138,652	76.1%
Carpooled	1,132	10.5%	151,299	9.9%	14,176,794	10.2%
Public Transportation (exclude	86	0.80%	17,239	1.1%	6,915,130	5.0%
Walked	276	2.6%	57,258	3.8%	3,948,202	2.8%
Bicycle	19	0.1%	20,448	1.3%	2,419,660	1.7%
Worked at Home	258	2.4%	71,783	4.7%	5,889,768	4.2%

Figure 19: Mode choice comparison between Muscatine city, Iowa State, and the national average (Data source: 2007 to 2011 American Community Survey 5-Year Estimate)

appropriate for a small city in Iowa because it will exaggerate small discrepancies and, typically, significant error is encountered in these models because a community like Muscatine sees changes in population more on migration than birth rates- the model cannot internalize this well without very detailed data. The data used for the projection was provided by the U.S. decennial Censuses from 1980 to 2010. This projection allows this plan to assume that the population growth rate will continue to remain steady.

The population projection predicts no new growth by 2030. This means that demand for sidewalks and trails will, likely, not increase due to an increase in population. However, as shown in the Mode Choice section, estimates from the American Community Survey show that people in Muscatine use trails and sidewalks for work trips less than people in Iowa and people in the U.S. This means there is potential room for increased demand for sidewalk and trails as Muscatine catches up to the Iowa and U.S. averages.

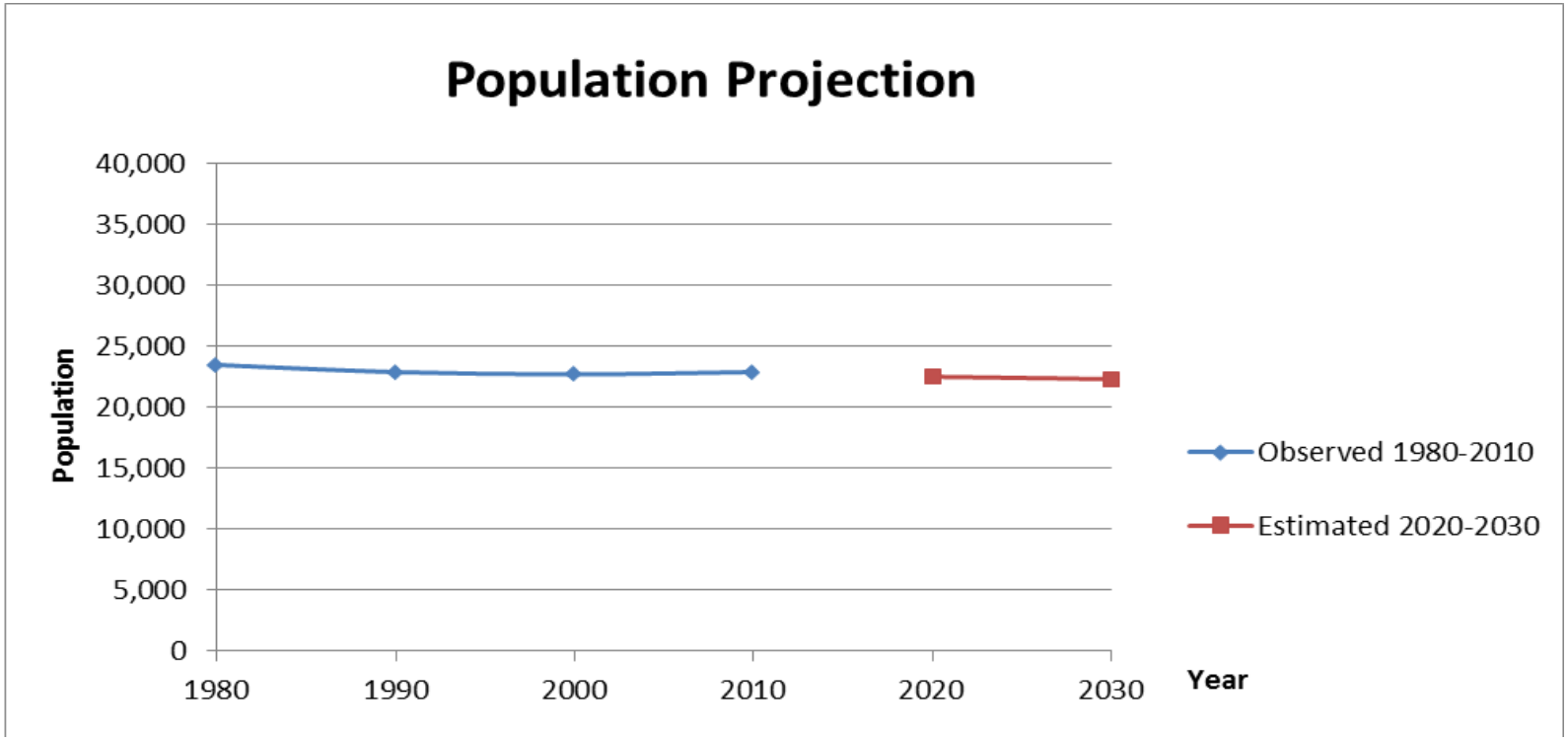

Figure 20: Linear-Based Population Projection

Best Management Practices

The 5E's of transportation planning have many ways that they can be implemented. This section details best management practices related to pedestrian/bicycle safety and convenience. These are offered as potential practices for the city of Muscatine to consider for future use. Executing every one of these ideas is outside the scope and power of this plan, and this section of the plan is intended to provide the full extent of information on the subject of transportation planning, via the 5E's. This plan relies on the 5 E structure to make non-automotive transportation a common mode for social, recreational and commuting purposes by:

- Improving pedestrian and bicycling safety.
- Improving the quantity and quality of the pedestrian and bicycling network.
- Increasing the percentage of pedestrian and bicycling trips to work or school.
- Enhancing public perception of walking and biking (Bicyclist Account Guidelines, 2013).

Design practices were taken from the League of American Bicyclists (LAB), Iowa DOT's Local Community Planning for Bicyclists and Pedestrians (Iowa DOT, 2000), the Pedestrian and Bicycle Information Center, and plan investigations from more than 40 cities with Bronze or higher level awards from the LAB, Blue Zones, or Walk Friendly Communities. All proposed best management practices and related traffic designs will need to be in accordance with specified standards found in the Manual on Uniform Traffic Control Devices.

Engineering

1. Shared-Use Paths
2. Pedestrian Infrastructure
3. Pedestrian crossing and traffic signals
4. On-Road Biking and Shared-Use Roads
5. Other Related Infrastructure

Enforcement

1. Way-finding signage
2. Identify Unsafe Behaviors

Encouragement

1. Use Media as a tool in Encouragement
2. Walk to School Day
3. Bike to School Day
4. National Bike Month and Events

Education:

1. Pedestrian Education Guides
2. Education Campaigns

Evaluation:

1. Bicycle Account Guidelines
2. Purpose and principles
3. Factors to consider

Engineering

Shared-Use Paths:

As one of the most common pathway types, a shared-use path typically has stabilized shoulders, as well as firm, smooth paved surfaces for bicyclists, pedestrians, line-skaters and other non-motorized users. Shared-use paths are designed to accommodate pedestrians, as well, though the primary users may be bicyclists (Evaluation of Safety, Design, and Operation of Shared-use Paths Final Report, 2006).

Pedestrian Infrastructure

Trail lighting: Trail lighting is an effective way to guide trail users along their trip while increasing safety and security. Solar lights are widely used in cities for cost-efficiency and sustainability purposes. LED lighting is another new tool used for continuous pathway lighting and signage marking. This may not, however, be a possibility in environmentally-sensitive, private residential, or remote areas (Landscape Lighting, 2013).

Trail crossings: Users may change directions, encounter other user groups, experience a narrower or wider trail width trail, or encounter automobile traffic at a trail crossing. A crossing should be constructed to maximize visibility and accessibility by full range of trail users, including pedestrian, bicyclists, and wheel chairs (Designing Sidewalks and Trails for Access: Best Practice Design Guide, 2001). Detectible warning tiles, clear sight lines and signage, pedestrian hybrid beacons, and median refuge islands could be provided to reduce the conflicts between multiple user groups (Designing Sidewalks and Trails for Access: Best Practice Design Guide, 2001).

Figure 21: Trail crossing. Image Source: City of La Crosse Bicycle and Pedestrian Master Plan, 2012.

Pedestrian crossing and traffic signals

Pedestrian Refuge Island: Pedestrian refuge islands are raised islands in the center of the roadway, separating opposing lanes of traffic and slotting along the pedestrian path; usually, refuge islands have a minimum area requirement; 1.2 to 1.8 meter wide and 2.4 to 3.6 meter long (Safety Toolbox: Engineering, 2014). Sometimes referred to as a "pork chop island", a triangular refuge island is often implemented to provide pedestrians the ability to cross "free-right" turn lanes before having to cross the through lanes. Generally, the islands are placed adjacent to free-right turn lanes and also serve to separate right-turning automobiles from the through lanes (Safety Toolbox: Engineering, 2014). Pedestrian refuge islands of all kinds have shown to be useful practices, making pedestrian crossings safer and easier (City of La Crosse Bicycle and Pedestrian Master Plan, 2012).

Pedestrian Pushbutton: Pedestrian pushbuttons are electronic devices attached to traffic signals or as stand-alone lights that adjust the intersection timing, when activated. Pushbuttons should be applied to areas where pedestrian traffic is infrequent (City of La Crosse Bicycle and Pedestrian Master Plan, 2012). Once installed, they should be clearly visible and within easy reach for people in wheelchairs (MUTCD, 2009). These devices are sometimes referred to as Hawk-Signals or Actuated Pedestrian Intersections.

Fixed Time Signal: A fixed time signal provides a pedestrian phase during each signal cycle by default. It uses the same time intervals within light cycles, and should be applied to intersections where pedestrian traffic is routine (*Traffic Signals 101*, 2012). The

Figure 22: Top: Pork Chop Island in the City of La Crosse. Image source: City of La Crosse Bicycle and Pedestrian Master Plan, 2012. Bottom: Grandview Avenue, Muscatine. Photo source: author

Figure 23: Top: Pedestrian Pushbutton. Image source: City of La Crosse Bicycle and Pedestrian Master Plan, 2012. Bottom: Pedestrian Countdown Signal. Image Source: Best Design Practices for Walking and Bicycling in Michigan

pedestrian cycle will tend to be concurrent with the phase that offers through traffic in the same direction, to reduce conflict. When determining the signal timing for a pedestrian crossing, a proper walking speed must be considered.

Pedestrian Countdown Signal: A countdown signal indicates to pedestrians how much time is left to cross the intersection (City of La Crosse Bicycle and Pedestrian Master Plan, 2012). A flashing "Do Not Walk" warning may accompany the end of the pedestrian walking phase. This has been implemented using LED light displays, beepers, and sometimes electronic time call outs. The use of beepers is becoming more standard since they serve elderly and blind citizens better than the LED displays.

Pedestrian-only Phase: A pedestrian-only phase (sometimes referred to as a Barne's Dance) allows pedestrians to cross the intersections, walking in any direction, without fear of vehicles. 34% of pedestrian crashes are reduced by applying pedestrian-only phases (City of La Crosse Bicycle and Pedestrian Master Plan, 2012). However, this treatment should be applied in intersections where pedestrian volumes are significantly higher than vehicular volumes, slow speed-limits are already in place, or in school zones during loading/unloading periods, as it can cause a substantial increase in vehicle and pedestrian delay (City of La Crosse Bicycle and Pedestrian Master Plan, 2012).

Shared-Use Roads:

On-road biking is one of the most widespread forms of cycling activity, for both recreational and commuting purposes. Paved shoulders, bike lanes, wide curbs, signage, pavement markings, and traffic signals are required to build an idyllic bicycle-friendly environment, which makes the non-automotive network safer for everyone (City of Baton Rouge Bicycle Routes Maps and Facilities, 2014).

Shared lane markings: Share-lanes are an easy way to expand bicycle network. The shared-lane road markings indicate to vehicle drivers and bicyclists that the road is for bicycle usage but there is no separate bike lane. It reassures the bicyclists of their right to the road, while increasing driver-awareness of potential cyclists. "Share-rows" (pronounced like arrows) are becoming very common in many cities, due to the ease of implementation and the encouragement it offers.

Protected bike lanes: Protected bike lanes boomed in past years, particularly when formula grants were still offered for pedestrian and bicycle specific infrastructure projects. While a physically separate alignment is the most common, newer applications have used parked vehicles along the edge of a road, or plastic poles to separate bicyclists from traffic flows (Graham, 2014). Protected bike lanes help reduce the vehicle-bicycle and bicycle- pedestrian crashes.

Figure 25: Shared lane marking. Image Source: City of La Crosse Bicycle and Pedestrian Master Plan, 2012.

Figure 25: Protected bike lanes. Image Source: City of Evanston Bicycle Plan Update; separated by parking

Figure 26: Top: Protected bike lanes. Image Source: City of Evanston Bicycle Plan Update. Uses poles in addition to parking. Bottom: Bike Parking. Left- Indoor Bike Racks, Image Source: Transportation Alternatives. Right: Typical storage. Image Source: City of La

Bicycle parking facilities: Bike racks are a modest way to provide convenient bicycle parking spaces in the public right-of-way (Best Design Practices for Walking and Bicycling in Michigan, 2012). The city of Muscatine has regulated that business district sidewalks are not legal places to park bicycles, which may be problematic for Bike Rack Implementation in that area. However, other bike storage options are available for business to install inside their facilities, or for the parks to put in.

Traffic signals for bicyclists: bicycle signals are helpful in clarifying vehicle and bicycle traffic, providing bicyclists a head of starting in mixed traffic conditions (Best Design Practices for Walking and Bicycling in Michigan, 2012). They should be placed in areas where bicycle volumes are higher (City of La Crosse Bicycle and Pedestrian Master Plan, 2012).

Other Infrastructure

Handicapped Access: Handicapped accessibility is always something that needs to be kept in mind during public infrastructure projects. ADA ramps, sidewalk widths, slopes are all regulated by the Federal government.

Recreational infrastructure: Some infrastructure provide services that complement cycling and walking practices, may encourage increased use, and help develop a community's perception of bicycle friendliness. Such projects may include restrooms, benches, drinking fountains, showers, and information kiosks. Recreational Infrastructure can improve users' convenience and comfort while requiring minimal maintenance.

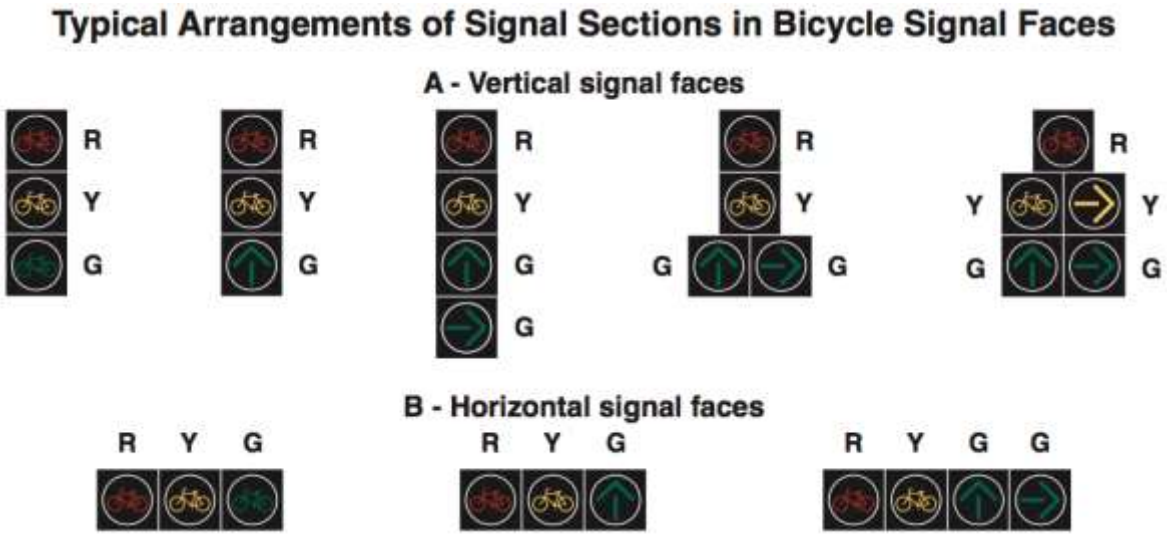

Figure 28: Signal Arrangements for Bicycle Lanes or mixed traffic. Image Source: FHWA Design Guide

Figure 27: Bicycle Signals. Image Source: Best Design Practice for Walking and Bicycling in Michigan, 2012.

Education:

Pedestrian Education Guides:

Identify characteristics of child pedestrians: Children can be impulsive as they "do not stop to think about safety when moving about" (Educating Child Pedestrians, 2014). From the Pedestrian and Bicycle Information Center, some of the major differences between adult and child pedestrians were identified for educational purposes. First, unlike adults, children do not have a strong sense of danger while walking or biking. Second, children are gradually learning to judge the speed and time of approaching vehicles. Third, some children may even be unable to judge if a vehicle is moving or not (Educating Child Pedestrians, 2014). Educational practices seeking safety for children, need to address these factors- particularly in regards to Safe Routes to School programs.

Educating College-aged Pedestrian: the Pedestrian and Bicycle Information Center has listed tips for college-age pedestrian safety education, such as crossing the street by following the traffic signals at marked crosswalks, facing traffic when walking or jogging in areas without sidewalks, and staying to the right of multi-use facilities to avoid walking in "bike only" lanes (Educating College-aged Pedestrians, 2014).

Driver Education: Drivers should be educated because they may "encounter pedestrians anytime and anywhere, even places where pedestrians are not supposed to be found" (Educating Drivers, 2014). Therefore, automobile drivers should be informed on the importance of slowing down under undesirable driving conditions, such as bad weather or at night (Educating Drivers, 2014). More importantly, drivers should be educated to assume that pedestrians cannot always see vehicles and act predictably (Pedestrian and Bicycle Information Center, 2014). Obstructions limit sight frequently in residential areas. Drivers need to be aware of their surroundings and look far ahead, while driving at reasonable speeds in these areas. Most residential neighborhoods do not post speeds because they are assumed. Signing may help keep people accountable and safe while giving the opportunity to reduce speeds further (typically, residential areas are 25, but 15 could be implemented in areas with a higher percentage of children).

Educational campaigns (taken from Pedestrian and Bicycle Information Center, 2014) aim to inform bicyclists, pedestrians and drivers of the safest ways to travel by:

(1) Defining education-related problems and goals. Education programs should target community-specific problems, such as children's unsafe crossing behaviors on their way to school. Educational programs should also identify specific, measureable and realistic goals to further programs related to their establishment, development and evaluation.

(2) Targeting specific audiences. There are major differences between road users, such as mode (drivers, pedestrians, and bicyclists), age group, and trip purpose. Different features of each audience should be considered for better allocation of educational resources.

(3) Relaying important messages. Unsafe behaviors should be identified specifically and corrected either through education or enforcement.

(4) Measuring program effectiveness. Related objectives should be measured, such as number of crashes, unsafe pedestrian and bicyclist behaviors, and traffic count for bicycle or walking trips.

(5) Creating viable partnerships. Bicycle and pedestrian education should be a team effort that different agencies and organizations cooperate and coordinate to achieve.

(6) Finding program support. Long term funding strategies and financial support will have positive impacts on educational activities (Education Campaigns, 2014).

Encouragement

Walk to School Day

Started in 1997 as a one-day event, the Walk to School Day focuses on "building awareness for the need for walkable communities" (Walk to School Day, 2014). Since 2000, it has become an international event. Based on data from the League of American Bicyclists, more than forty countries joined the United States to walk or bike to school on the same day (Walk to School Day, 2014). Walk to School Day has become a cultural celebration every October with a series of events to promote safe routes to school (Bike Month Dates and Events, 2014).

In 2013, there were 4,462 Walk to School Day events across the country during October (Who Walked in 2013, 2014). 71 of these events were hosted by 41 Iowan cities, including 4 elementary schools in Mason City (Who Walked in 2013 Iowa, 2014). Batavia in Illinois, a League of American Bicyclists Bronze Award Community with a population of 26,045, hosted Walk to School events for 5 elementary schools (Who Walked in 2013 Illinois, 2014).

Walk to School Day is now held every October 8th (About Walk to School Day, 2014).

Bike to School Day

The first National Bike to School Day took place May 9th, 2012, as one of the additional events for the League of American Bicyclists' National Bike Month (About Bike to School Day, 2014). About 1000 local communities and schools, nationwide, participated, aiming to encourage children to safely bike to school (Bike Month Dates and Events, 2014).

In 2013, more than 1700 schools in the U.S. participated in the Bike to School events on May 8th. 27 events were hosted by 20 Iowa cities. Bike to School will be on May 7th this year (About Bike to School Day, 2014).

National Bike Month and Events

National Bike Month includes a series of nationwide events. One of its biggest events is the Bike to Work Day, which will be May 16 in 2014, while the Bike to Work Week will be May 12 to 16, 2014 (Bike Month Dates and Events, 2014). Since 2010, hundreds of communities have hosted Bike to Work Week and Bike to Work Day, thereby increasing their bicycle commuting. Diversified events, such as group rides and fashion shows, were provided by local communities, aimed at making the bike culture a part of their community pride (Bike Month Dates and Events, 2014).

Media as a tool in Encouragement

A successful campaign needs to "provide information before the enforcement events occur, in order to encourage community support and facilitate positive coverage" (Media's Role in Enforcement, 2014). Examples of ways to use media to enhance the enforcement campaigns include:

- Hold press conferences to inform the general public about pedestrian safety.
- Providing pedestrian safety statistical information in press publications.
- Publishing articles in the local newspaper about projects related to pedestrians and bicyclists.
- Sending emails to residents about future projects and campaigns.
- Setting up a website with information and maps pertaining to the trail and sidewalk networks (Media's Role in Enforcement, 2014).

Figure 29: Press Conference ofr National Bike to School Day

Enforcement

Way-finding Signage

Directional signs should feature major destinations for vehicles, bicyclists, and pedestrians. Pedestrian directional signage should be placed along trails at starting points, midpoints or endpoints. Way-finding signage should serve to direct pedestrian and bicyclists to trailheads, from major roads (Princeton University, 2008). Locating these signs along arterial roads in front of trails, parks and landmarks increases the awareness and navigability of infrastructure that does not parallel the road network. Signage along arterial roads should be located in the right of way and be inside of sidewalks, if any. As such, signage design and construction are regulated and should conform to standards from the American Association of State Highway and Transportation Officials (AASHTO). Signage along trails (Figure 30) should list destination names, the direction the destination is located in, and estimated travel time (by walking or biking). Trail signage is not regulated and may be applied as the city sees fit. Muscatine has already started placing mile markers along a few of the major trails in town, so design consistency will be the main factor when creating way-finding signage.

Trail and Bike Route Signage

Occasionally trails need to use portions of roads or cross busy streets. In either case it is imperative that drivers expect and yield to bicyclists. Warning signs and trail route markers help build consistency in bike behavior and help keep drivers aware of potential conflict. If extended stretches of a trail need to use a road alignment, a bike lane or share-row is best, but signage helps to keep the rider assured that they are, in fact, going in the right direction. They will then spend less time flustered and more time focused on their surroundings.

Identifying Unsafe Behaviors

There are many common actions taken by pedestrians, bicyclists, and motorists of all types that need to be curbed to ensure a safe transportation environment. Many cities have spent time researching the behaviors of their constituents and passing policy to regulate/prevent these habits from creating problems. Educational campaigns may inform bicyclists, but bike officers tend to have the largest impact. Motorists need to be held accountable by traffic enforcers or cameras. In corridors where speeding is common speed capture devices, such as those with the digitally displayed speed signs, may reduce hazardous behavior, and make the road safer for pedestrians and bicyclists.

The following list is a series of unsafe behaviors that were identified by the Pedestrian and Bicycle Information Center for further policy purposes to improve pedestrian and bicycle safety (Implementing Enforcement Campaigns, 2014):

Figure 30: Trails signage. Data Source: Town of Jackson Bike Network and Way-finding

Figure 31: Examples of Jaywalking and misuse of bike lane

Unsafe Pedestrian Behaviors:

- Crossing a street at an undesirable location.
- Not following the directions of traffic signals or crossing guards.
- Entering a stream of traffic and disrupting the flow.

Unsafe Bicyclist Behaviors:

- Biking at night without lights or required reflectors and not wearing visible clothing.
- Biking in the wrong direction or against the flow of traffic.
- Biking through stop signs and/or red lights.
- Making unpredictable turns and/or failing to signal.
- Not yielding the right-of-way when required.

Unsafe Motorist Behaviors:

- Speeding through residential streets and school zones.
- Failing to yield to pedestrians.
- Running red lights or STOP signs.
- Passing stopped cars (especially ones stopped at crosswalks) and school buses.
- Driving while distracted by cell phones or eating, and so on.

Evaluation

Bicycle Account Guidelines

Bike Accounts are a tool to apply in cities to monitor the development of bicycle and pedestrian activity in a community to assess if a community is achieving its objectives by measuring, tracking, and reporting progress to inspire a better biking and walking community (Bicycle Account Guidelines, 2013).

The purposes and principles behind this are to evaluate the implementation of plans on how they achieve their goals. Goals that can be assessed include: increasing the share of bike and/or pedestrian trips to work and school; improving non-motorized users' safety; enhancing public perception of bike and pedestrian safety; increasing comfort, and convenience; and improving quantity and quality of the network (Bicycle Account Guidelines, 2013). Usually the network is evaluated using length of paths, sidewalks, trails, bike lanes, shared lanes, amount of bike parking, and sometimes pavement surface quality measurements (Bicycle Account Guidelines, 2013).

Evaluation factors: From the Bicycle Account Guidelines, bicycle accounts are recommended to consider four basic factors: bicycle traffic data, cycling quality, infrastructure development, and theme studies.

Bicycle traffic data, such as walking and bicycle's respective mode shares, traffic counts, and average trip distances, are fundamental for evaluating the existing bike and pedestrian environment of the community. Other desired data may also be cyclist age, gender, trip purpose, income, profession, and home location. Infrastructure development includes parameters such as the development of the bicycle network in miles, surface, and pavements (Bicycle Account Guidelines, 2013). Cycling quality refers to the general public's perception of the bike and pedestrian experience regarding safety, comfort and travel time, as well as collision locations (Bicycle Account Guidelines, 2013). Citizen feedback is a valuable asset for bike and pedestrian network development. Theme studies can help evaluate the bike and pedestrian environment, such as "the health effects of promoting non-motorized mode share among youth and children and how improved bicycle conditions can increase flexibility and life quality" or "the potential effects for the tourism industry" (Bicycle Account Guidelines, 2013).

Building momentum: The evaluation processes should be enhanced continually by assessing if the current state of the network has reached the goals and objectives outlined in the community's vision. Community organizations can seek bike and pedestrian related improvements, while residents can see the community impacts by the public investment in bicycling (Bicycle Account Guidelines, 2013).

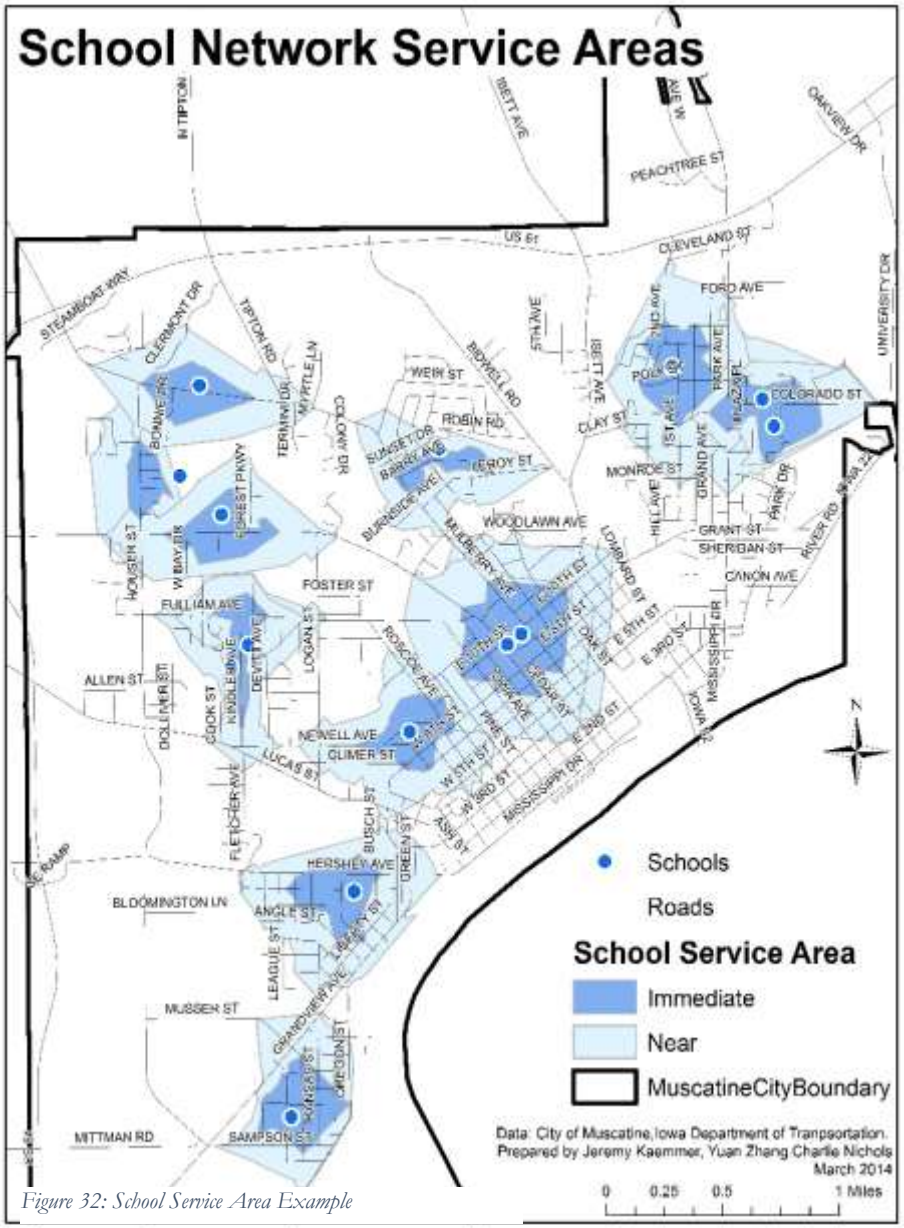

Figure 32: School Service Area Example

Recommendations

As with the rest of this plan the recommendations follow the structure and intent of the 5E's of bicycle and pedestrian planning. Projects and policies will be divided up and explained in each of the E categories.

Engineering

Trails and Sidewalks

Scores were generated using a simple scoring method where each destination type was given a maximum score based on input from the steering committee. Each sidewalk gap and trail was then given points for each destination with a service area that overlapped with it (figure 32); full points for being immediately adjacent (within ¼ mile) to the destination and half points for only being near (between ¼ and ½ miles). The service area maps for each of the destination types are included in Appendix B and an example is provided here.

No points were awarded when a potential project did not serve any destination. Only network gap projects had any segments with no scores or scores that were extremely low. These projects were categorized in a "does not qualify" state. They are still included in the model for awareness' sake but will not be prioritized any time in the near future. The remaining projects were separated into short, medium, and long term time horizons

Network Gaps

The primary concentration of Network Gaps (Figure 33) ranked highly is around the edges of the downtown area and the northeast corner of town. This is because of the schools in the area. Safe Routes to School (SRTS) is the number one priority and facilitating the ease of a home-to-school trip for children was the most important thing for this plan to internalize, and the results of the model are consistent with that priority. The schools in these areas also have proximity to parks, major employment centers, and lie along the major bus routes, which is why they were ranked higher than others. Any school not addressed by small network gaps has been captured one the corridor gap analysis. In south west the Grandview corridor has a great many high priority network gaps due to Franklin elementary, Musser Park, and a number of businesses in the area. The existence of the rail line has isolated the area and discouraged sidewalk and trail connectivity. Using the MRT, this area could have finally solve its isolation and become a fully walkable area.

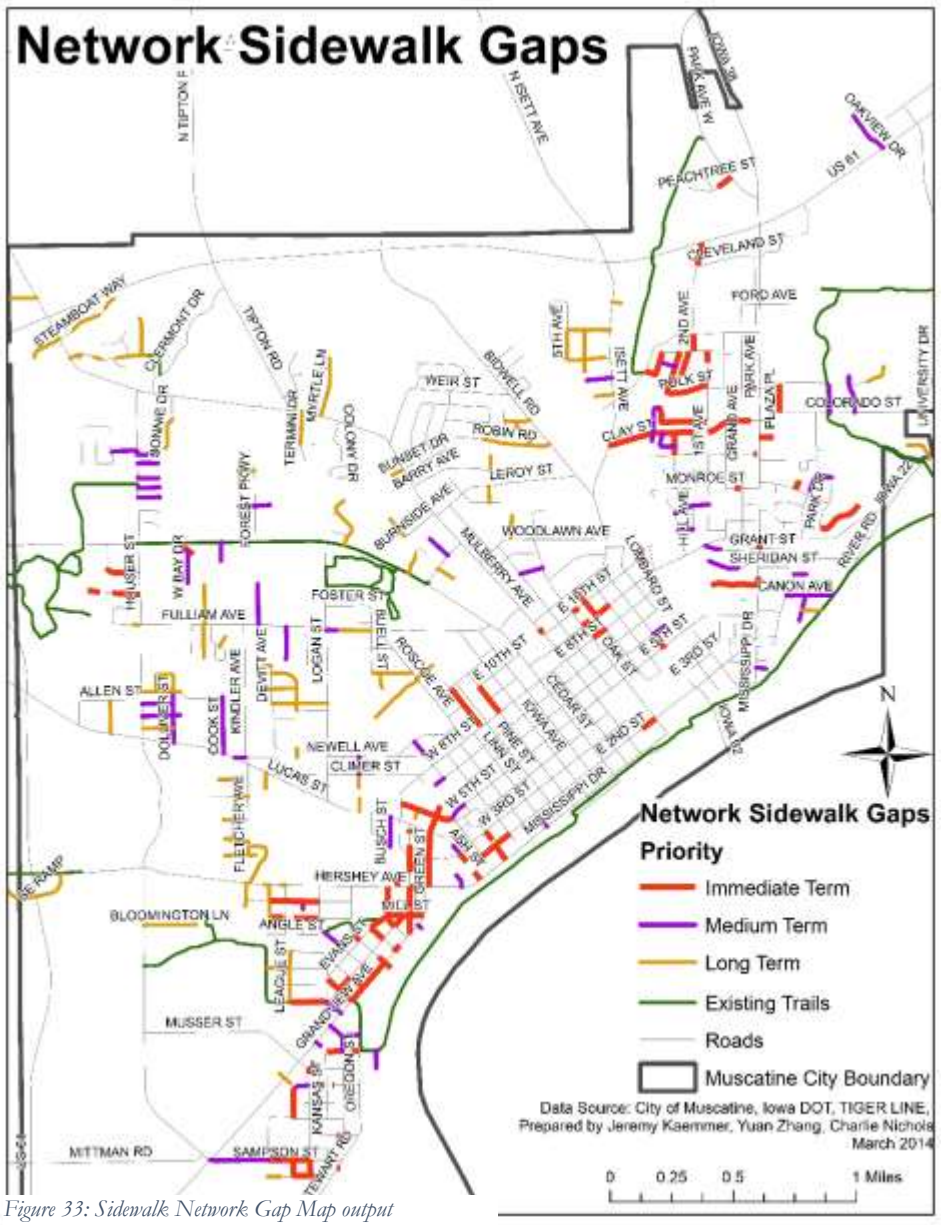

Figure 33: Sidewalk Network Gap Map output

University of Iowa

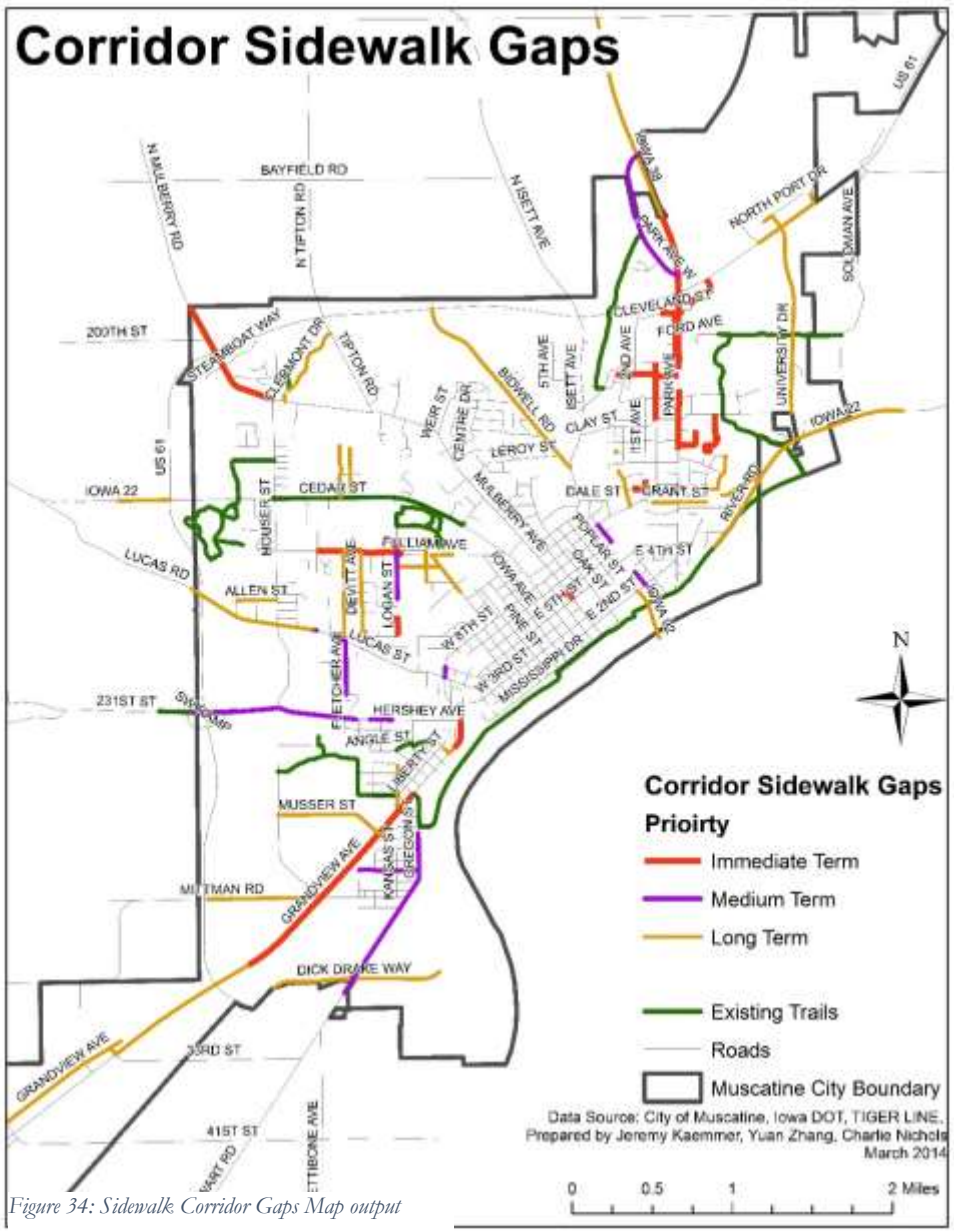

Figure 34: Sidewalk Corridor Gaps Map output

Corridors

West Middle School, Grant Elementary, and Colorado Elementary have very strong influences on their surrounding corridors (corridor projects may be seen figure 34). The Colorado St Improvement project due to be completed later this year will be a massive benefit to the community and was the highest ranked corridor in the test model. Other notable corridors include the Park Avenue area, Grandview Avenue, major arterials near the bypass, and the northwest corner of town that has recently received significant growth.

Recommendations

Trails

The most impactful Trails (Figure 35) in town are those that connect the Downtown and Mississippi River Trail to the other major corridors in town. Namely: Cedar St, Mad Creek, and Hershey. Mad Creek is a very important corridor that can only be addressed via Multi-use trail. The Trail is the only existing underpass in town that can get people north of the bypass. Significant business growth has been experienced at the US 61/IA 38 intersection and is expected to continue. Opening up Mad Creek provides access north of the bypass, to multiple major employers (such as the Heinz Corporation), offers great north south mobility in the community, and is a great recreational resource itself.

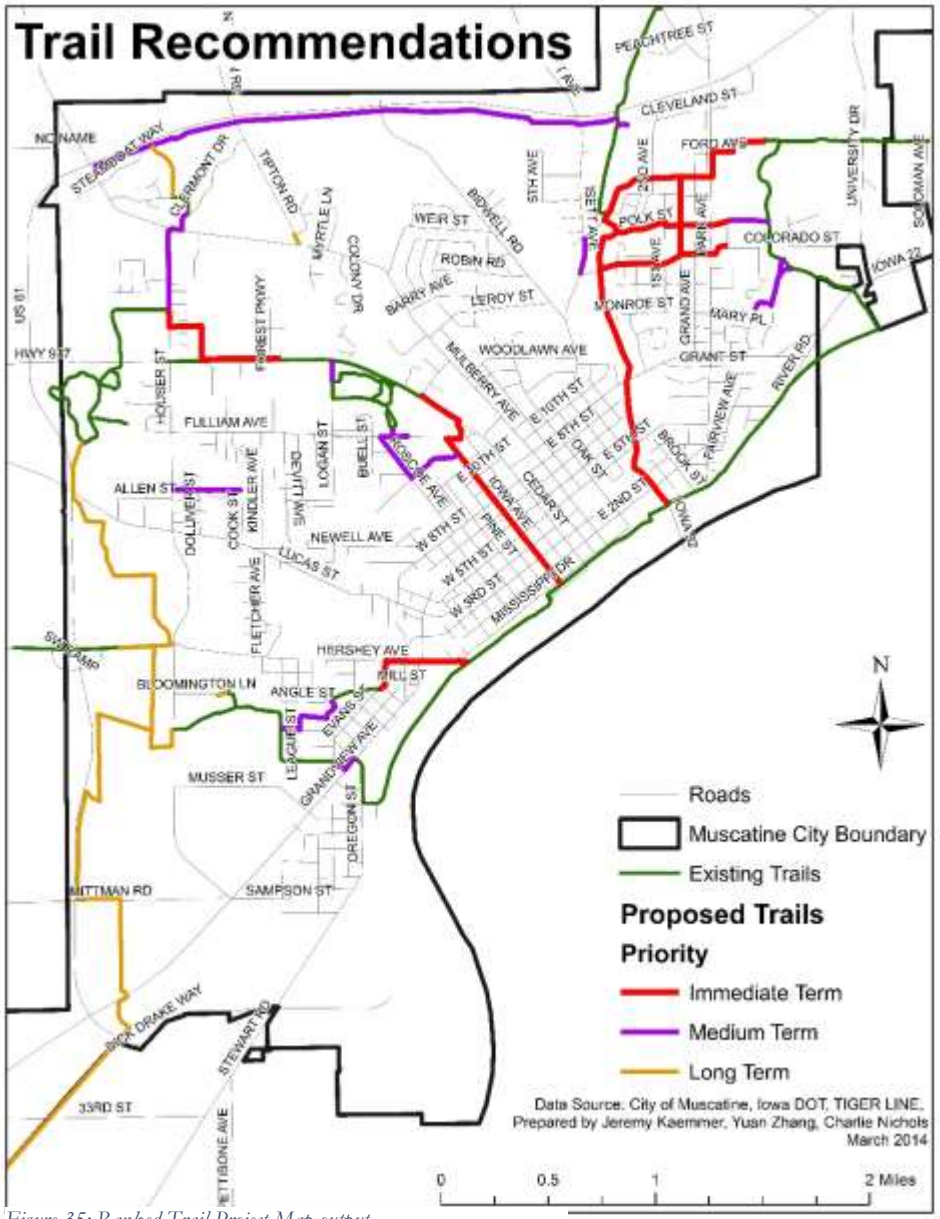

Figure 35: Ranked Trail Project Map output

Top 10-need new list

For reference, the top 10 projects for each project category along with their aggregate scores are shown in Figure 36. When brought before the steering committee these projects were deemed "very reasonable" and represented those projects in town that they themselves thought to be most important. The top 10 projects are also shown spatially in Figure 37 for reference. Additionally, maps for all of the ranked projects are provided and the ranked list for each type is provided in Appendix A.

Regarding the Lincoln/Grand and Park Avenue corridor projects; all of these lie along the same north-south corridor on the eastern side of Muscatine. Not only is Park Ave one of the major egress-ingress routes for Muscatine but it also is home to a multitude of shopping and employment options. The corridor received points from most every category, including schools, parks, bus-stops, and parks. Sidewalk is not provided effectively the entire length of Park Avenue. However, parking lots and existing structures may not make Park Avenue the best place to implement the sidewalks.

Rank	TRAILS	Scores	Network Gaps	Scores	Corridor Gaps	Scores
1	Cedar-Riverfront park cnx	1076	MULBERRY AVE	814	PARK AVE	1178
2	Ford ave	896	2ND AVE	532	MULBERRY AVE	727
3	Lincoln/Grand	684	PARK AVE	510	LINCOLN BLVD	699
4	Mall-Mad Creek cnx (CLAY)	633	E 2ND ST	486	FRONTAGE RD	597
5	cedar st improvement	568	CLAY ST	446	MCARTHUR ST	576
6	Mall -Mad Creek cnx (POLK)	555	SPRING ST	444	GRANDVIEW AVE	554
7	Cedar-Fuller cnx	496	SPRING ST	425	FORD AVE	521
8	mad creek southern	440	LAKE PARK BLVD	421	CLEVELAND ST	473
9	N river shortcut to KStein	366	PLAZA PL	404	COLORADO ST	471
10	mad creek central	319	CHERRY ST	403	LOGAN ST	440

Figure 36: Top 10 Infrastructure Projects

This plan recommends that a multi-use trail be built along Lincoln Boulevard to substitute for all three of Lincoln, Grand and Park. This alignment is ideal because there is ample room on both sides of the street in this residential area. Lincoln also serves as the major bus-route for the area rather than congesting Park-Avenue. The choice of Lincoln is ideal because the traffic counts indicate it is safer, the direct access to bus-stops creates excellent transit accessibility, and the land use make it a safe and easy to implement option. Grand shares many of the same characteristics but is slightly busier in traffic and does not have direct access to the bus stops. Either location, when chosen should not discount the other location. The corridor is a very high priority and while implementing the trail can alleviate the issue, we recommend that sidewalks be implemented in the other locations where the trail was not chosen to go. So if the Lincoln trail is built as recommended, Grand and Park should still receive sidewalk enhancements at a later date.

Additional mobility in the area can also be added by east west connections to the mall area and the trail system behind it. These connections are recommended at Ford Avenue, Polk, and Clay; Ford being the most impactful.

Most of the alignments are straightforward. All of the sidewalk projects follow along their respective streets, and their exact location may be identified from the maps. The trails, however, require clarification. The top ranked project for all of Muscatine, besides Park Ave, is the Cedar St connection to the riverfront. There has been a programmed trail going from the soon to be constructed roundabout and improvement project on Cedar St for some time. The trail will end around Partham St, but the ideal

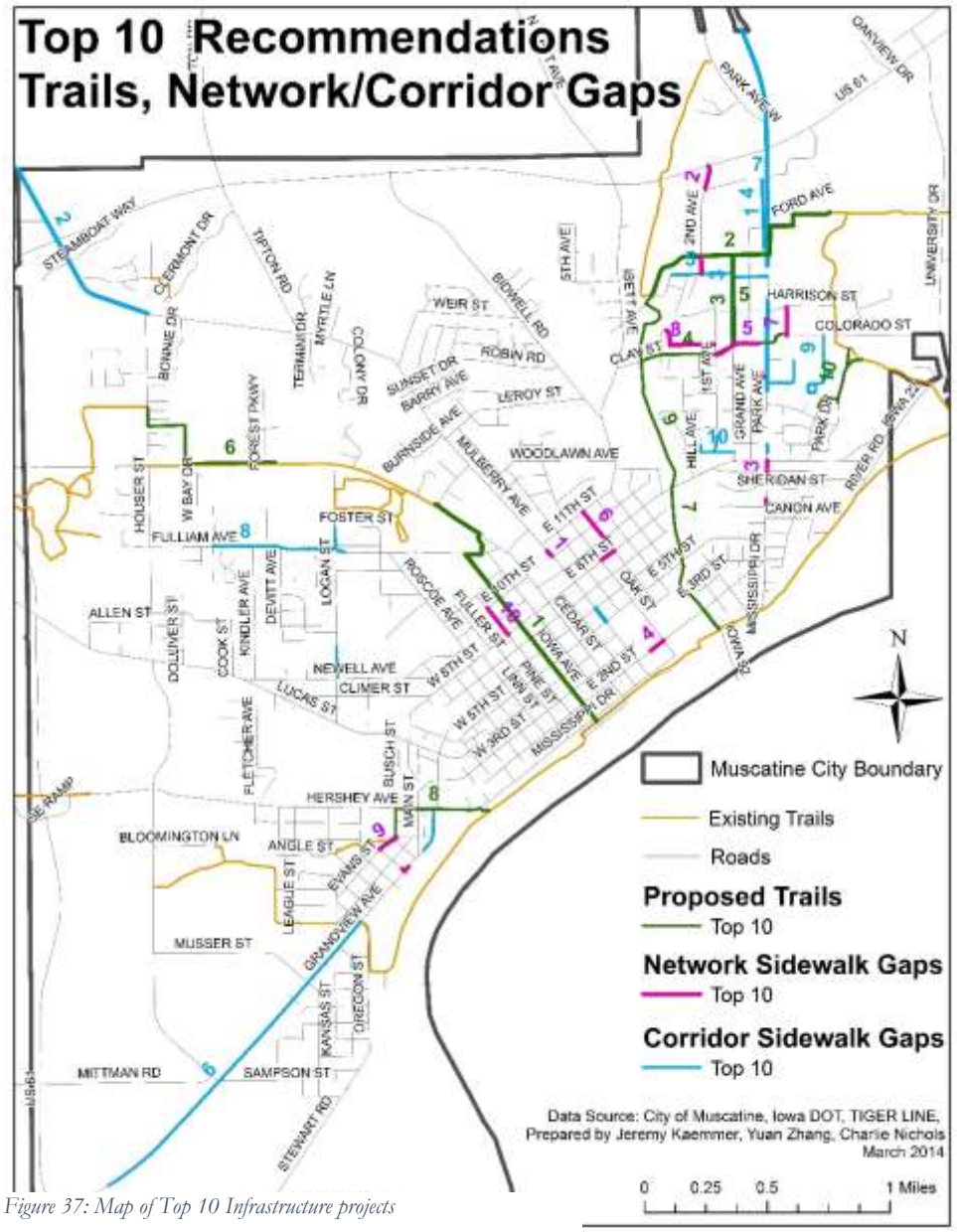

Figure 37: Map of Top 10 Infrastructure projects

version of this project stretches all the way to the riverfront trail and downtown, providing much needed bicycle access to the core of Muscatine. This plan recommends cutting across the corner of Fulliam Ave and Cedar St to move the trail alignment to Iowa rather than Cedar St. Cedar St is busy and does not possess an ample amount of right-of-way space to provide the connection. Many buildings, as the street nears downtown, are built all the way to the sidewalk, and since reducing parking is a very controversial issue it would not be advisable to take the short-direct route. Instead, by using Iowa Ave, the construction process may take advantage of copious right-of way, and the existing need to remove a number of compromised trees. Iowa Ave, also provides a signalized intersection to cross over the very busy Mississippi Drive. Sycamore was considered for much the same reasons but it has less right-of-way, and although there is room for the trail, it would require the acquisition of more property. Sycamore also does not provide a natural access to the Mississippi River Trail, there is a railroad crossing but it is small and un-signalized.

The Cedar-Fuller connection mentioned is a proposed project to use the YMCA trail complex as an alternative way to bypass the busy Y-shaped intersection at Fulliam and Cedar. It was originally intended to use Fuller as an outlet from the Iowa Field but the final alignment uses the YMCA to jump over to Fulliam, and heads west to Roscoe where it moves down and takes Amy Drive to use the publicly owned space of Iowa Field to end up on Iowa Ave, the preferred alignment of the Cedar St connection. This project would also have the opportunity to please a number of property owners around Iowa Field that have been lobbying to turn the Field into something more communal. It also provides easy access to the very popular YMCA and its trail complex. Future projects could take advantage of this off-road alignment and parks to provide additional connections to the West Middle School and its neighbors.

Signage

Potential signage locations were identified through the ArcGIS application. Directional information for parks, trails, and landmarks will be provided by placing signage throughout the city. There are two types of signage with different selection methods and placement standards: navigational signage and informative signage for pedestrians and bicyclists.

The purposes of placing nagivational signage are to boost public awareness of trails, parks and land marks, enhance the "sense of place", and to further connect the signage and way-finding system with the community's story as well as promoting bicycle and pedestrian.

Signage along road segments with higher traffic volume will be navigational tools for vehicle drivers. Motorists will be able to navigate to multiple destinations using this type of signage. Road segments were selected using ArcGIS based on the state functional road classification as principal arterials, minor arterials, major collectors and minor collectors. Buffers with a 500 foot distance were created around parks, trails, and landmarks. Then, intersections of selected road segments and buffers were generated, which provided potential signage locations. Based on the selection

results, aerial imagery, and local knowledge the locations for navigational signage were further modified. The Trailhead parking areas and major road intersections that were chosen are shown in Figure 38. Among the navigational signs, multiple-destination signage was assigned in locations that have multiple options in their vicinity. Navigational signs will identify destination names, directions to those destinations, as well as distances. The Manual on Uniform Traffic Control Devices (MUTCD) specifies the standards for signage design, installation and usage, when located within the public right-of-way. Since all of navigational signage will be placed between the sidewalk and the road, this will be the case.

Signage along trails will serve as informative tools for bicyclists and pedestrians while they are using the trail network. Proposed informational signage are recommended at major trail entrances, trailhead parking areas, trail midpoints, and trail and park intersecions (figure 38). Destination names, directions, and distances will be provided by the informative signage. The purpose of placing informative signage is to provide directional information for bicyclists and pedestrians, provide connectivity with the overall trail network, and to create opportunities for trail user to connect with the community's history.

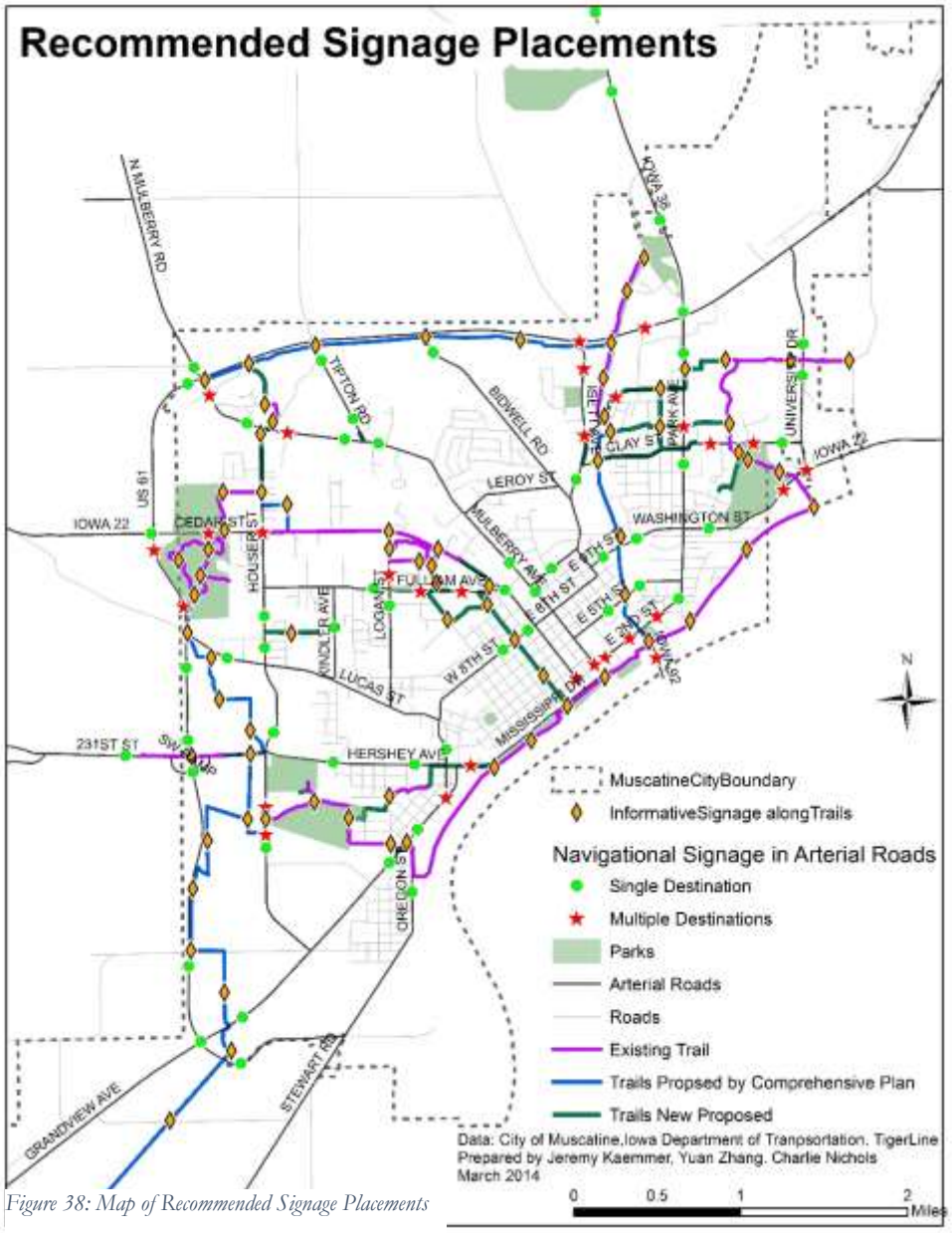

Figure 38: Map of Recommended Signage Placements

Figure 39: Safe Routes to school Educational Demo. Image Source: Safe Routes to School National Partnership

Education

SRTS programs are already beginning to be put in place by the city of Muscatine and "walking school busses" have already been established at a handful of schools. The Blue Zones program that Muscatine is participating in offers a wealth of educational options for communities and recommends their use. This plan recommends that the educational tenets adopted by Blue Zones be implemented by the city's Blue Zones Committee and initiative rather than through increased policy at the Master-Plan level.

In addition, this plan recommends the expansion of the Safe Routes to School program to include all schools within the city. This is consistent with Muscatine's goal of making schools easily accessible to children by bike or foot to both reduce congestion during peak hours and increase their health and welfare. The SRTS program has a website with a wealth of resources municipalities can utilize to effectively implement the program. One of the most impactful changes Muscatine can make in regards to the adoption of SRTS programs in every school is to designate a SRTS coordinator who can oversee citywide efforts.

Encouragement

Media can be a powerful tool in getting people excited over something as well as helping people be well informed about current projects and events. With the advent of smartphones it has become increasingly easy for users to obtain cartographic information and even have routes chosen for their use by their devices. In 2011 smartphones made up 62% of the mobile market and were projected to easily surpass 70% by 2013 (Nielson, 2011)

This plan has provided a Virtual Way-Finding channel through the Junaio smartphone application. Users in Muscatine can download the app onto their mobile devices either directly from the app-store, or by scanning the channel code provided here. In both cases, the Junaio app is free. This plan has created a channel in the app, specific to Muscatine to help connect its users to the culture and economy of city while informing them about its history. It provides a real time view of potential destinations around the user as well a list and a map function to help the user navigate and make choices in the city. By providing more information and a survey view of the city this will increase the ease and functionality of way-finding.

Locations of interest were identified in the planning process with the assistance of the steering committee and focus groups. These locations all have data attached to them and are located virtually by using a smartphone. Users may select a destination and a picture with a brief description will appear. The user will then have the option to learn more about the place or object by looking at provided websites, videos, picture galleries…etc. If the User is then interested they may select the directions button and it will navigate the user to the location of interest.

Currently, the app channel is in a state of testing. Appendix D provides instructions on how to change the scripting. The process has been simplified and the directions make it possible for someone with no previous experience with virtual way-finding to use the app. This plan recommends that the channel content be moved to and hosted on a city server, then the city should apply for Junaio to officially publish the app, so that any Junaio user may access the channel, not just those who have had a chance to scan the Quick-Response (QR) code provided (Figure 40). The QR code could be distributed around town or placed on the Tourism Board website for storage, but once the application has been published anybody can search the Junaio app for Muscatine, or Muscatine related items.

In addition to the channel scripted for Muscatine a version was done to show the smartphone application's ability to work in other languages. The number of Chinese visitors for business purposes is quite high, and Muscatine is very proud of this fact.

Figure 40: Top/Bottom- App being used in Muscatine, Real-Time Points of Interest Display. Middle- QR CODE for channel

University of Iowa

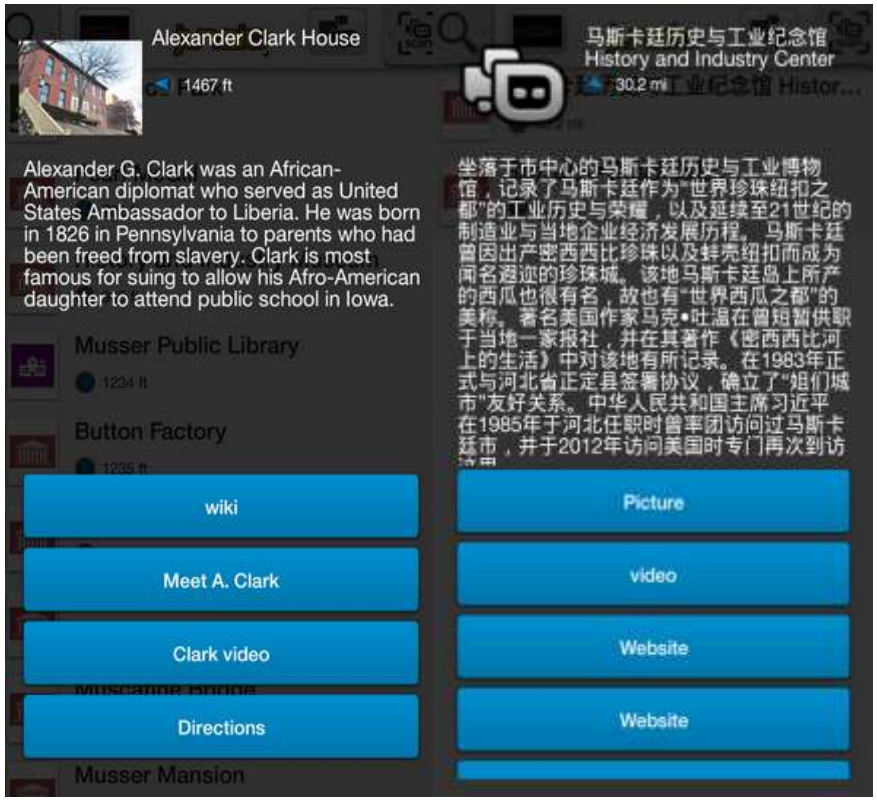

Figure 41: Example Point of Interest Page, English and Chinese

To help potential Chinese visitors navigate and learn about the community an additional Chinese language channel was scripted, as this plan feels they would be one of the most benefitted categories of people. The app is an excellent way to sell the city and inform about history/culture, all the while its medium allows language barriers to be bypassed, easily.

Enforcement

This plan does not recommend the adoption of any new laws or policy enforcement programs for bicyclists or pedestrians. Efforts should be focused on providing safe facilities and creating increased awareness for drivers to expect and respect bicyclists and pedestrians. Grade separated trails and a liberal bike usage policy already serve to reduce vehicle conflicts. This plan recommends that any shared lanes, bike lanes, or crossings be adequately striped and signed so that vehicles behave appropriately towards non-motorized travelers.

Evaluation

This plan is not the end of Bicycle and Pedestrian Planning in Muscatine. This plan recommends that constant scrutiny be applied. If adopted by the City Council, benchmarks and goals for the community should be set and adhered to. Just as with the Long Range Transportation Plan requirements from the FHWA, this plan should also be revisited at least every 4-5 years, in order to ensure this plans relevance and impact is maintained. This plan should conform to the ideals and vision of community at any given time, and that will require consistent upkeep. An example table of benchmarks and goals is provided on page57 with suggestions for intermittent assessments to ensure that this plan actually comes to fruition

The primary input of this plan is to implement engineering solutions for connectivity and way-finding in Muscatine, but there

are issues that have to be addressed or even identified in the community. This plan used Network and Corridor gaps as its main target but there are 3 other types of gaps that may exist: Area, Condition, and Crossing.

Area gaps are addressed somewhat by this plan, because they represent small contiguous 2 dimensional spaces where there are absolutely no sidewalks. These usually occur in residential neighborhoods and as such are captured in this model but put into the "does not qualify" category because they do not serve any destinations, but instead are trip generators. These areas should be evaluated and their impact assessed at some point in time so that appropriate policy may be made to address them.

Figure 42: People Trying the App at IISC event (courtesy of Adnya Sarasmita)

Goal	Benchmark	Completion
Gain Recognition	☐ Adopt a B&P Master Plan ☐ Apply for WFC ☐ Apply for LAB ☐ Apply for BZ	☐ Become a Bronze (or higher) WFC ☐ Awarded Bronze or Higher by LAB ☐ Become a BZ Community
Close Gaps	☐ Adopt a sidewalk construction and implementation policy ☐ Complete Immediate Term Projects ☐ Start an inventory of sidewalks and intersections	☐ Upgrade existing sidewalks to ADA compliance ☐ Complete all Immediate and Mid-Term Projects ☐ Complete inventories and pass policy based on assessment
Comprehensive Recreational Trail Network	☐ Construct the Immediate Term Projects ☐ Connect the Major Parks via trails ☐ Hook into the MRT regional trail	☐ Ensure Every home in Muscatine is no more than 400ft from a sidewalk or trail ☐ Complete all programmed projects ☐ Connect all major parks and destinations via multi-use trails
Grow the Network	☐ Complete the Mad Creek Trail, Cedar St Connection, and Park Avenue Sections ☐ Complete Immediate Term Corridor Projects ☐ Begin adding Shareways/Bike-lanes to the road network where possible	☐ Provide multiple safe crossings of the bypass ☐ Increase Trail Mileage by 25% ☐ Add one-side sidewalk projects to the list of priority projects ☐ Complete at least 5 Bike Lane/Shareway projects
Evaluate	☐ Provide Schools Parent Surveys about SRTS ☐ Set-up GIS model for future plan adaptations and progress ☐ Resolve to measure non-motorized traffic somehow	☐ Improve SRTS responses from survey ☐ Update Plan once ☐ Monitor non-motorized travel for changes
Connect	☐ Publish the AR App ☐ Distribute information about the app ☐ Place Navigational Signage	☐ Create new content for the app: websites, new locations, or enhance program usability. ☐ Get people using the app (>50 users) ☐ Place Informational Signage
Educate	☐ Adopt BZ educational programs ☐ Promote Biking and Walking in Schools	☐ Increase Awareness and Perception of Recreational Network (survey) ☐ Increase the number of Children walking/biking to school

Figure 43: Goals, Benchmarks, and Completion Standards- suggested

Condition and Crossing gaps are difficult and time consuming to assess. Condition refers to sections of sidewalk in such ill repair that it effectively does not exist. Crossing gaps are intersections where signalization or crosswalks either are not effective or non-existent, so people cannot cross safely. This plan recommends that a comprehensive sidewalk inventory and a status report be made to evaluate the condition of each sidewalk network. The city has already inventoried the ADA ramps in Muscatine, a similar approach to the sidewalk inventory would be ideal. This plan also recommends an inventory of intersections be taken and assessment made of traffic, signal timing, and crosswalks. The information from these two can then be aggregated and added to the spreadsheet model provided with this plan to rank the condition and crossing issues with the same criteria as the gaps.

Since school areas are the most critical areas for biking and walking in Muscatine, and SRTS are the top priority for the community enhanced information will help refine the implementation process. A sample Parent Survey, taken from the National Center for Safe Routes to School, has been provided in Appendix F. This plan recommends the distribution of this survey to schools at least once per 4 years. Online survey options are also available from the Center's website.

When updates to this plan are made (and there should be) the ranking model may also need to be revisited, in a manner more intensively than simple rescoring or adjustments. Instructions to perform the analysis from square one, are provided in Appendices D and E. Doing so will not require a GIS expert, but some level of professional expertise is recommended to ensure that the model is executed and translated well. Updates like this should be performed if Muscatine experiences significant growth, adds a number of proposed trail projects, or community vision calls for the addition or modification of the destination types.

Figure 34: Top: Example of a Muscatine Condition Gap-Sidewalk Section missing and not at road grade. Muscatine Bottom: Crossing Gap example Multiple Sidewalk Sections meet at this complex intersection. There is no striping or signage, crossing here would be very

Implementation

The first step of making non-motorized travel safer and more efficient in Muscatine, is the official adoption of the Pedestrian and Bicycle Master Plan in order to improve biking and pedestrian environment in Muscatine. Additional policies should be considered at the time of adoption, such as those that relate to the construction ordinances on sidewalks, or the use of bicycles in the downtown area. This plan recommends beginning evaluation programs to take regular inventory of the sidewalks in town, continue Blue Zones' educational programs, and integrate the virtual way-finding application into the way the community works in the future.

Prioritization

The Plan recommends far more trail and sidewalk improvement projects than the City of Muscatine can afford in a single fiscal year. Thus, to assess the impact and efficiency of proposed trails and sidewalks, the prioritization strategy considers the following critical destination by ranking their importance based on public input and GIS model analysis:

- Schools
- Downtown and its attractions
- Pedestrian Major employment centers
- Parks
- Bus stops
- Length
- Hot crash spots

New trail and sidewalk placements are scored by proximity to the above destinations. The higher the score the greater the impact a project will have. Proposed projects will be categorized under *Immediate Term* (within the first year of adoption), *Medium Term* (2 to 3 years) and *Long Term* (4 years or longer).

Immediate Term: Projects will start construction within the first year of plan adoption, and the construction durations are projected to be short (one year or less). Projects should be the most functional and meaningful connections for walking and biking.

Medium Term: Projects that are scored highly by the Prioritization Strategy, though the construction durations may or may not be short. Two to three years are generally acceptable. Medium Term Projects are trails or sidewalks that are planned to start construction within two to three years after plan adoption.

Long Term: Projects that scored in the bottom third or require longer construction durations may be grouped into this category.

Opportunity

The purpose of the prioritization strategy is to provide a rational method for choosing to build one sidewalk or trail over another in a manner that is consistent with the vision of the community. However, it is a reality in cities that many things get done on an incremental basis as opportunities arise. For example, Muscatine currently has three major capital improvement projects underway: Cedar Street from Parham to Houser is being completely reconstructed, Colorado Street is being reconstructed into a three land roadway, and the roads in the West Hill area are being torn up and reconstructed to replace the older combined sewer system

with a separated one. As part of the Colorado Street project, a new sidewalk will be built. As part of the Cedar Street project, a 10 foot wide multi-use trail will be constructed. The reconstruction of roads in the West Hill Sewer Separation Project provides many opportunities for building sidewalks.

These sidewalks and trails may not be prioritized in the immediate term category, but instead already have a built-up momentum. This plan recognizes the role that opportunism plays in completing infrastructure projects. Projects which already have strong public, political, and financial support should be built, even if they are not ranked in the immediate term category.

Funding

Cities have many financial obligations, and securing the funds necessary for expanding and maintaining the sidewalk and trail network is a large obstacle for many cities. As part of the implementation strategies section of this plan, six commonly used funding sources for trails and sidewalks have been analyzed on the basis of the level of cost to the citizens, the difficulty in implementing the funding, and the persistence of the funding source (is it available for a short time only or is it available indefinitely).

	Cost to Citizens	Implementation Difficulty	Persistence
Grants	Low	Low	Low
Road Use Tax Funds	Medium	Low	High
Local Option Sales Tax	Medium	High	Medium
Tax Increment Financing	Medium	Medium	Medium
General Obligation Bonds	Medium	Medium	High
Special Assessments	High	Low	High

Figure 445: Funding Strategies Comparison Table

Grants

Grants pose a relatively low cost to the citizens of Muscatine because they are provided by either the state of the federal government, which draws its funds from a wider tax base. For this reasons grants have become the funding source of choice for many cities. Many of the trails in Muscatine were built with grants, and Muscatine's Capital Improvement Plan currently lists state grants as the funding source for trail projects. However, grant funding is intermittent and cannot be fully relied on to fund a long term project. In addition to this, there are few grants to fund sidewalk construction and almost no grants cover the cost of maintenance for sidewalks and trails. The Moving Ahead for Progress in the

21st Century Act (MAP-21) consolidated many of the existing federal and state grants, including Safe Routes to School Grants, under one initiative called the Transportation Alternative Program (TAP). TAP provides funding for nine categories related to surface transportation, and of these three directly pertain to sidewalks and trails: pedestrian and bike facilities, safe routes for non-drivers, and conversion of abandoned railway corridors to trails. In addition to TAP funding, the Department of Transportation provides funds to the states for projects that reduce transportation-related air pollution.

Road Use Tax Funds

Road use tax funds are given to the city by the state based on population. Muscatine has set aside $50,000 from this year's road tax fund for sidewalk construction. Road tax funds impose a low cost burden on the citizen of Muscatine because they are gathered from the state tax base. They can also be relied upon to be distributed every year, and they are relatively easy to implement. However, road use tax funds are what cities rely upon to keep their streets in good condition. Sidewalks and trails will always be a lower priority than streets for road use tax fund monies, making it an unreliable funding source.

Local Option Sales Tax (LOST)

Local option sales taxes are appended onto a state's base rate. In Iowa, the base rate is 6% and the local option sales tax can be no more than 1%, so a local option sales tax would result in a sales tax of 7%, or 7 cents for every dollar. The cost burden to the citizens is higher than for road use tax funds or grants, since only the citizens within Muscatine are paying the LOST, although splitting the cost among the entire population of the city still results in a marginal cost burden. Implementing a LOST is difficult; over 50% of the population must vote in its favor.

Tax Increment Financing (TIF)

Tax increment financing is a method of reallocating property tax revenues which are produced as a result of an increase in taxable valuation above a "base valuation" figure within a tax increment area. This is essentially a bond to redevelop a "blighted" area and use the increased tax revenue from the higher property values to pay back the bond. In theory, the cost burden to the citizens will be low because the taxes are being levied on property value that would not have existed if not for the TIF redevelopment. TIF districts are easier to establish than local option sales districts, because a city-wide vote is not required. TIF funds are also fairly reliable, since TIF districts established for economic development can collect revenue for 20 years and TIF districts established to restore a blighted area can operate indefinitely. TIF may look like an attractive option for funding bicycle and pedestrian network improvement, but they also pose a great deal of risk. If the TIF district fails to increase in property value, either due to market fluctuations or factors inherent in the specific area, then the city will be left with a large amount of debt and no way to repay it.

General Obligation Bonds

General obligation bonds secured by the city are paid using legally available resources, including property taxes. General obligation bonds have a cost burden similar to the LOST, because the cost of paying off the bond plus interest is dispersed among the entire population. Similar to TIF districts, general obligation bonds do

not require a majority vote and can be approved by city council. In Iowa, cities and counties can only levy property taxes up to $8.10 for every $1,000 in assessed property value. This puts a limit on the amount of general obligation bond funds a city can incur, because it must be able to pay interest while maintaining a property tax levy below $8.10 for every $1,000 of assessed value. Muscatine is already at the $8.10 limit, and so its ability to take on general obligation bonds is limited.

Special Assessments

A special assessment is a charge that may be levied against parcels of real estate which have been identified as having received a direct and unique benefit from a public project. For example, a property owner could be charged for the construction of a sidewalk in the right of way on their property because that sidewalk will increase the value of their real estate. Special assessments have a high cost burden on those directly impacted by them, because they are required to pay the full value of the cost of construction. Special assessments are very easy to implement and will continue to be a tool cities can utilize for the foreseeable future. It should be noted that cities and counties should exercise caution when issuing special assessments, and that the cost of the assessment should be roughly proportional to the benefits gained. For example, it is legal to assess the construction of a 5 foot sidewalk (standard ADA width) to a property owner. However, if a sidewalk is wider than 5 feet, the cost of the extra width must be paid for by the city because the property owner does not directly benefit from the extra width.

Conclusions

Muscatine has committed itself to increasing the ease of alternative transportation network as well as the number of people who use alternative transportation through its comprehensive plan and its designation as a Blue Zones community. The City has partnered with the University of Iowa and the Iowa Initiative for Sustainable Communities to help fulfill these commitments. The authors of this plan, along with their project partners in Muscatine and faculty advisors at the University of Iowa, have developed a bicycle and pedestrian plan for the City of Muscatine in order to take a comprehensive approach to improve alternative transportation within the city.

Following the 5 E structure, adhered to by nationally recognized bike and pedestrian plans, this plan identifies current best management practices for each "E". Building off a foundation of base conditions within Muscatine, this plan makes recommendations of programs or infrastructure which should be implemented for each E. In regards to building trails and filling in sidewalk gaps, the authors of this plan consulted stakeholders within the community to create a scoring method which scores and ranks each gap and trail based on proximity to destinations of importance as selected by community members. A list of prioritized projects was generated, with projects scoring in the top third classified as immediate term projects, while projects in the middle third are medium term and projects in the bottom third are long term.

This approach allows the City of Muscatine to combine rational planning and incrementalism to address the issue of alternative transportation. The destination list and scoring method attempt to quantify community values to yield an objective ranking of projects, adhering to the rational planning method. Breaking the ranked projects up into three separate time horizons recognizes the reality that trail and sidewalk building in cities often occurs in bits and pieces. Combining these two methods allows the City of Muscatine to keep long term goals in mind while acknowledging the incremental nature of infrastructure construction.

This plan is not a stand-alone document that will detail the state of pedestrian and bike planning within Muscatine, forever. Instead, this plan provides a framework for analyzing the current bike and pedestrian network, along with gathering community input to come up with a plan of action that is consistent with the vision of the city. The authors of the plan have gone through that process and provided the city with recommendations for what to do now, and in the immediate future. However, the process will have to be duplicated and the plan updated as the vision of Muscatine continues to grow and change over time.

APPENDICES

APPENDIX A: Project Rankings

Rank	TRAILS	Score
1	Cedar-Riverfront park cnx	1076
2	Ford Ave	896
3	Lincoln/Grand	684
4	Mall-Mad Creek cnx (CLAY)	633
5	Cedar St improvement	568
6	Mall -Mad Creek cnx (POLK)	555
7	Cedar-Fuller cnx	496
8	mad creek southern	440
9	N river shortcut to KStein	366
10	mad creek central	319
11	Weed Park-Park Dr	313
12	N Hauser-Bypass cnx	253
13	YMCA-Iowa field shortcut	243
14	navigation gap-grand & white	215
15	KStein cnx	215
16	Isett gap (clay-lake)	176
17	Bypass trail	147
18	Dawson	143
19	mall rear cnx-Harrison	126
20	YMCA shortcut	123
21	s MRT cnx	80
22	Proj t.13.e	66
23	steamboat shortcut -Hauser	32
24	Bloomington	20
25	Tipton corner	20

Rank	Corridor Gaps	Score
1	PARK AVE	1178
2	MULBERRY AVE	727
3	LINCOLN BLVD	699
4	FRONTAGE RD	597
5	MCARTHUR ST	576
6	GRANDVIEW AVE	554
7	FORD AVE	521
8	CLEVELAND ST	473
9	COLORADO ST	471
10	LOGAN ST	440
11	MUSCATINE COMM COLL	439
12	JEFFERSON ST	389
13	LOMBARD ST	385
14	WASHINGTON ST	364
15	SCHLEY AVE	333
16	HERSHEY AVE	332
17	PARK AVE W	316
18	LUCAS ST	289
19	STEWART RD	288
20	LOGAN ST	274
21	OREGON ST	261
22	GRANT ST	260
23	KINDLER AVE	260
24	IOWA 92	259
25	DILLAWAY ST	258
26	GRANDVIEW AVE	247
27	DIVISION ST	220
28	FILLMORE ST	206
29	IMPERIAL OAKS DR	198
30	PARK DR	193
31	IOWA 22	190
32	IOWA 38	183
33	DEVITT AVE	182
34	MUSSER ST	179
35	ROSCOE AVE	163

Projects in Red are Immediate Term

Projects in Orange are Middle Term

Projects in Yellow are Long Term

Projects in Gray Do Not Qualify

Rank	Corridor Gaps	Scores
36	RIVER RD	147
37	UNIVERSITY DR	147
38	DICK DRAKE WAY	144
39	BIDWELL RD	140
40	LUCAS ST	132
41	US 61	120
42	UNIVERSITY DR	108
43	BUELL ST	98
44	MITTMAN RD	83
45	CLERMONT DR	80
46	JAMES ST	67
47	FOREST PKWY	67
48	WEST ACRE DR	65
49	SOLOMAN AVE	63
50	NORTH PORT DR	60
51	WEIR ST	50
52	N ISETT AVE	30
53	SUNRISE CIR	30
54	TIPTON RD	20
55	200TH ST	12
56	N MULBERRY RD	12
57	COLONY DR	5
58	GENEVA DR	5
59	57TH ST	1
60	67TH ST	1
61	BARRY AVE	0
62	CEDAR ST	0
63	CHERYL AVE	0
64	W 8TH ST	0
65	CEDAR ST	0
66	FAREWAY DR	0
67	GRAND AVE	0
68	HOUSER ST	0
69	ISETT AVE	0
70	LUCAS RD	0
71	MISSISSIPPI DR	0
72	N TIPTON RD	0

Rank	Network Gaps	Scores
1	MULBERRY AVE	814
2	2ND AVE	532
3	PARK AVE	510
4	E 2ND ST	486
5	CLAY ST	446
6	SPRING ST	444
7	SPRING ST	425
8	LAKE PARK BLVD	421
9	PLAZA PL	404
10	CHERRY ST	403
11	OAK ST	392
12	SUB VAN BUREN ST	385
13	REED ST	372
14	CHESTNUT ST	366
15	MUSCATINE ARMORY	356
16	HARRISON ST	350
17	WISCONSIN ST	348
18	LOCUST ST	346
19	GREEN ST	345
20	BRYAN AVE	330
21	FRANKLIN ST	325
22	E 10TH ST	319
23	INDIANIA ST	318
24	E 9TH ST	315
25	BUSCH ST	297
26	MCARTHUR ST	295
27	POLK ST	286
28	MAIN ST	280
29	FULLER ST	277
30	REED ST	277
31	MCCLELLEN ST	276
32	FRANKLIN ST	270
33	SAMPSON ST	268
34	WARREN ST	265
35	KING AVE	264
36	MONROE ST	262
37	BROADWAY ST	259
38	MAIN ST	258
39	CHESTNUT ST	235
40	CEDAR PLAZA DR	234
41	W 2ND ST	233

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Rank	Network Gaps	Scores	Rank	Network Gaps	Scores
42	HOWARD AVE	227	83	COBBLESTONE DR	160
43	ASH ST	223	84	BUSCH ST	159
44	GREEN ST	222	85	BIRCH DR	159
45	CLAY ST	218	86	GOBBLE ST	159
46	CLARABECK LN	216	87	VIRGINIA DR	159
47	WHICHER ST	214	88	NEWELL AVE	157
48	HERSHEY AVE	213	89	DOUGLAS ST	153
49	E 5TH ST	212	90	BANK ST	152
50	MILL ST	212	91	MAIDEN LN	151
51	HARMONY LN	210	92	SUNRISE LN	150
52	BENHAM AVE	209	93	SMITH ST	149
53	MILES AVE	209	94	COTTAGE ST	148
54	PARK DR	208	95	GILBERT ST	145
55	WISCONSIN ST	205	96	CANON AVE	145
56	SUMMIT AVE	204	97	OHIO ST	145
57	KEMPER AVE	203	98	BAKER AVE	144
58	NEW HAMPSHIRE ST	200	99	ALLEYNE DR	144
59	BLEEKER ST	195	100	CANAL ST	142
60	SCHILLER ST	195	101	PEARLVIEW CT	142
61	MAGNOLIA ST	195	102	JACQUELINE DR	141
62	LIBERTY ST	192	103	KAREN DR	141
63	ROBY AVE	190	104	ASH ST	140
64	EARL AVE	189	105	OAKLAND DR	136
65	PEACHTREE ST	185	106	ELM ST	136
66	JAMES PL	180	107	FAIRVIEW AVE	135
67	INDIANIA ST	176	108	E 6TH ST	134
68	HALSTEAD ST	175	109	MARIAN DR	134
69	TANGLEFOOT LN	175	110	BROADLAWN AVE	133
70	WHITE ST	175	111	DOLLIVER ST	133
71	CEDARWOOD DR	174	112	HILLCREST AVE	133
72	BANDAG DR	174	113	VAN BUREN ST	132
73	W BAY DR	174	114	BRIARWOOD LN	131
74	HILL AVE	172	115	COOK ST	130
75	W 7TH ST	171	116	JEFFERSON ST	130
76	DAY ST	167	117	FULLIAM AVE CONN	125
77	GRANT ST	165	118	HAMMAN ST	122
78	LINN ST	165	119	W GROVE BLVD	122
79	SAMPSON ST	165	120	SCOTT ST	121
80	NEBRASKA ST	164	121	ELFERS ST	120
81	W 5TH ST	162	122	GLEN AVE	120
82	BOND ST	160	123	OAKVIEW DR	120

Rank	Network Gaps	Scores	Rank	Network Gaps	Scores
124	ILLINOIS ST	119	165	WESTWOOD LN	62
125	ALLEN ST	118	166	BEACH CIR	60
126	NEWELL AVE	115	167	GROVER ST	55
127	DAWSON ST	113	168	LOWE ST	55
128	HIGHLAND CT	113	169	PINE RIDGE CT	51
129	AMY DR	112	170	KEMBLE ST	50
130	W FULLIAM AVE	111	171	4TH AVE	50
131	QUINCE ST	107	172	5TH AVE	50
132	WALLACE ST	106	173	WEBSTER ST	50
133	GREEN ACRES DR	105	174	BATON ROUGE RD	48
134	LEAGUE ST	105	175	STEAMBOAT WAY	48
135	STONEBROOK DR	103	176	NO NAME	48
136	WOODCREEK LN	102	177	SUNSET DR	45
137	CIRCLE DR	102	178	COBBLESTONE DR	40
138	#N/A	100	179	DEVITT AVE	40
139	FAIRHAVEN ST	97	180	LONGHURST LN	40
140	HAGERMAN DR	97	181	HOPE AVE	37
141	HANCOCK ST	96	182	DELTA QUEEN CIR	36
142	CHARLES ST	95	183	PALMS DR	36
143	CLIFFORD ST	93	184	BLOOMINGTON LN	35
144	LORENZ ST	92	185	KEMBLE ST	35
145	LEAGUE ST	90	186	SE RAMP	35
146	BRIER ST	90	187	BATON ROUGE RD	32
147	HWY 917	84	188	DIANA QUEEN DR	32
148	FULLIAM AVE	83	189	TERRACE HTS DR	32
149	PLOVER ST	82	190	FLETCHER AVE	30
150	WEBSTER ST	82	191	LONG MEADOW LN	30
151	BONNIE DR	80	192	NYENHUIS ST	30
152	HIGH ST	77	193	SIEGEL ST	30
153	KNOTT ST	75	194	WARFIELD ST	30
154	GROVER ST	75	195	SW RAMP	27
155	HIGH ST	75	196	FAIR ACRES DR	22
156	PALM ST	75	197	ROBIN RD	22
157	BRIDGMAN ST	70	198	SHADY LN	22
158	POND ST	70	199	TERMINI DR	20
159	FLETCHER AVE	65	200	AMERICANA AVE	20
160	BLAINE ST	65	201	MYRTLE LN	20
161	MEADOW LN	65	202	PINEFIELD ST	20
162	W CLEVELAND ST	65	203	RIDGEWOOD AVE	20
163	SHAMROCK DR	63	204	ROBIN RD	17
164	BURNSIDE DR	62	205	CRESTLINE DR	17

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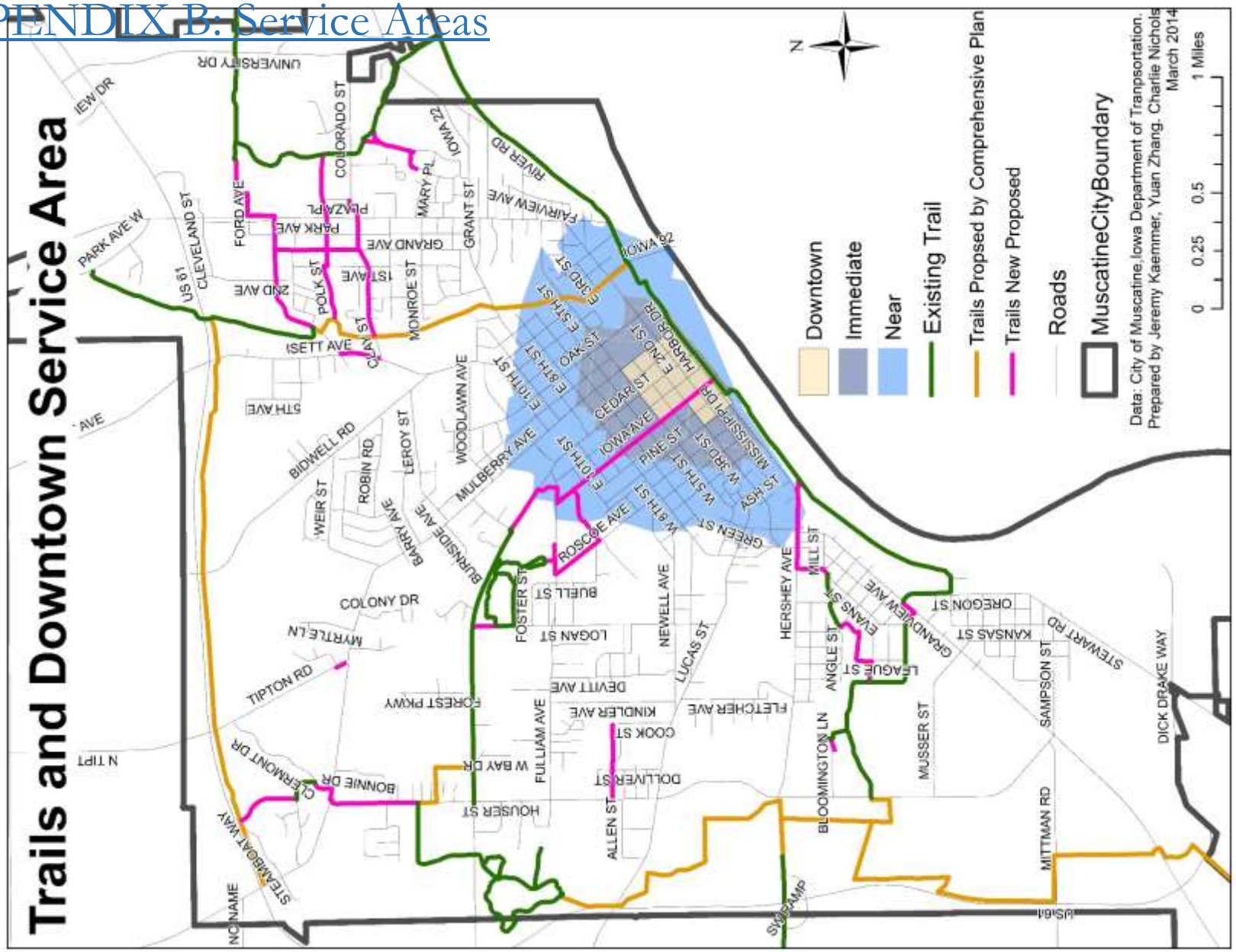
Rank	Network Gaps	Scores
206	EISENHOWER ST	15
207	MACKINAC CT	12
208	ANASTASIA PL	12
209	MAJESTIC DR	12
210	CEMETERY LN	10
211	JAMES ST	10
212	CENTER DR	5
213	WOODLAND WAY	5
214	65TH AVE W	1
215	ACORN LN	1
216	ANGLE ST	0
217	BROADWAY ST	0
218	BROOK ST	0
219	CLIMER ST	0
220	CLINTON ST	0
221	DEMOREST AVE	0
222	DEWEY AVE	0
223	E 4TH ST	0
224	EVANS ST	0
225	FOSTER ST	0
226	GRAND AVE	0
227	ISETT AVE	0
228	KANSAS ST	0
229	MCINTIRE RD	0
230	MISSISSIPPI DR	0
231	POPLAR ST	0
232	SHERIDAN ST	0
233	SHERMAN ST	0
234	SPRUCE ST	0
235	STEEPLE LN	0
236	STERNEMAN BLVD	0
237	TAYLOR ST	0
238	WASHINGTON ST	0
239	AMHERST AVE	0
240	ANGLE ST	0
241	BREESE AVE	0
242	CENTRE DR	0
243	DEERPATH LN	0
244	E 4TH ST	0
245	FOSTER ST	0
246	GEORGE ST	0
247	GLENWOOD LN	0
248	HOFFMAN ST	0
249	IOWA AVE	0
250	MARQUETTE ST	0
251	MIDDLE RD	0
252	NO NAME ST	0
253	NORTHWOOD LN	0
254	PINE ST	0

APPENDIX B: Service Areas



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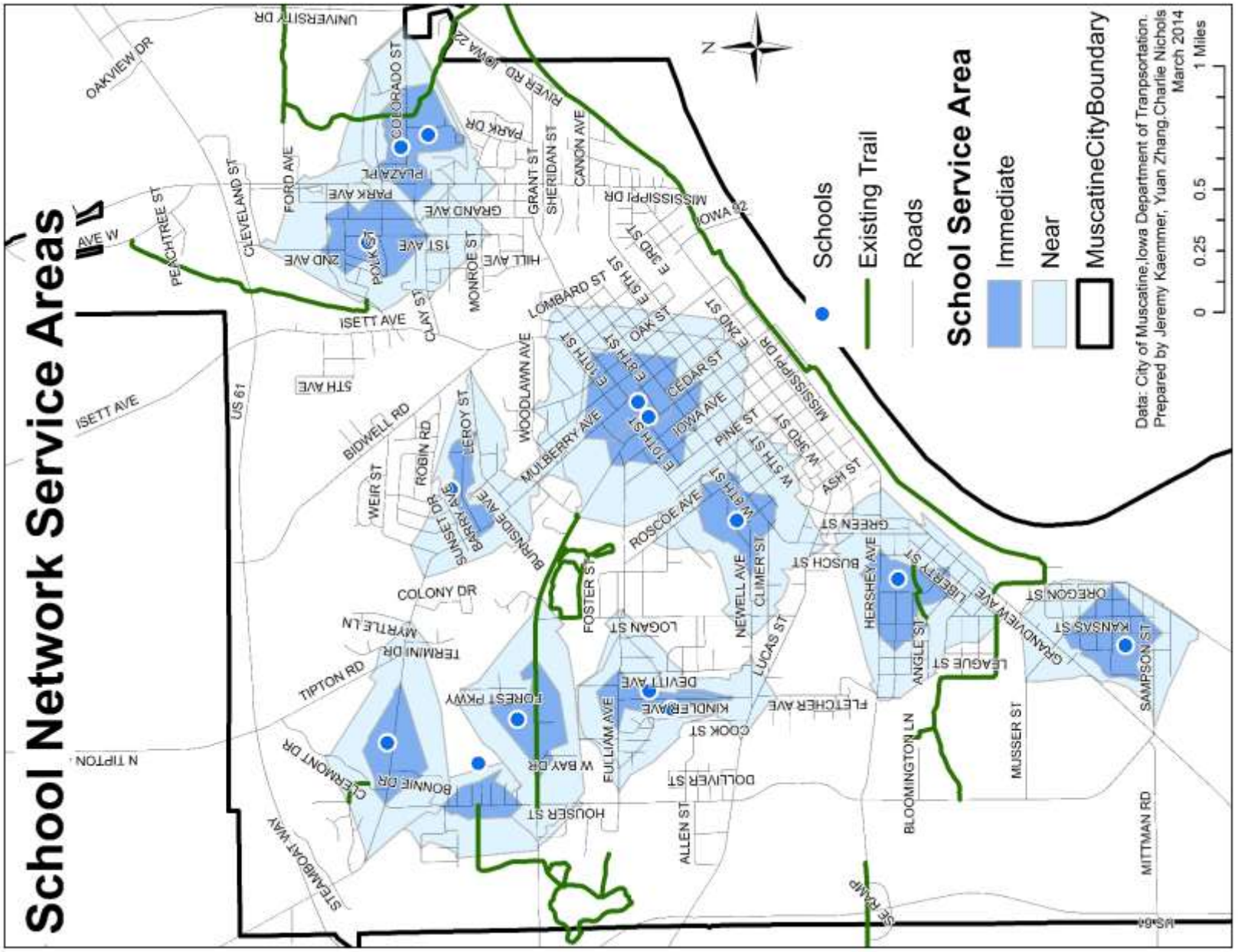
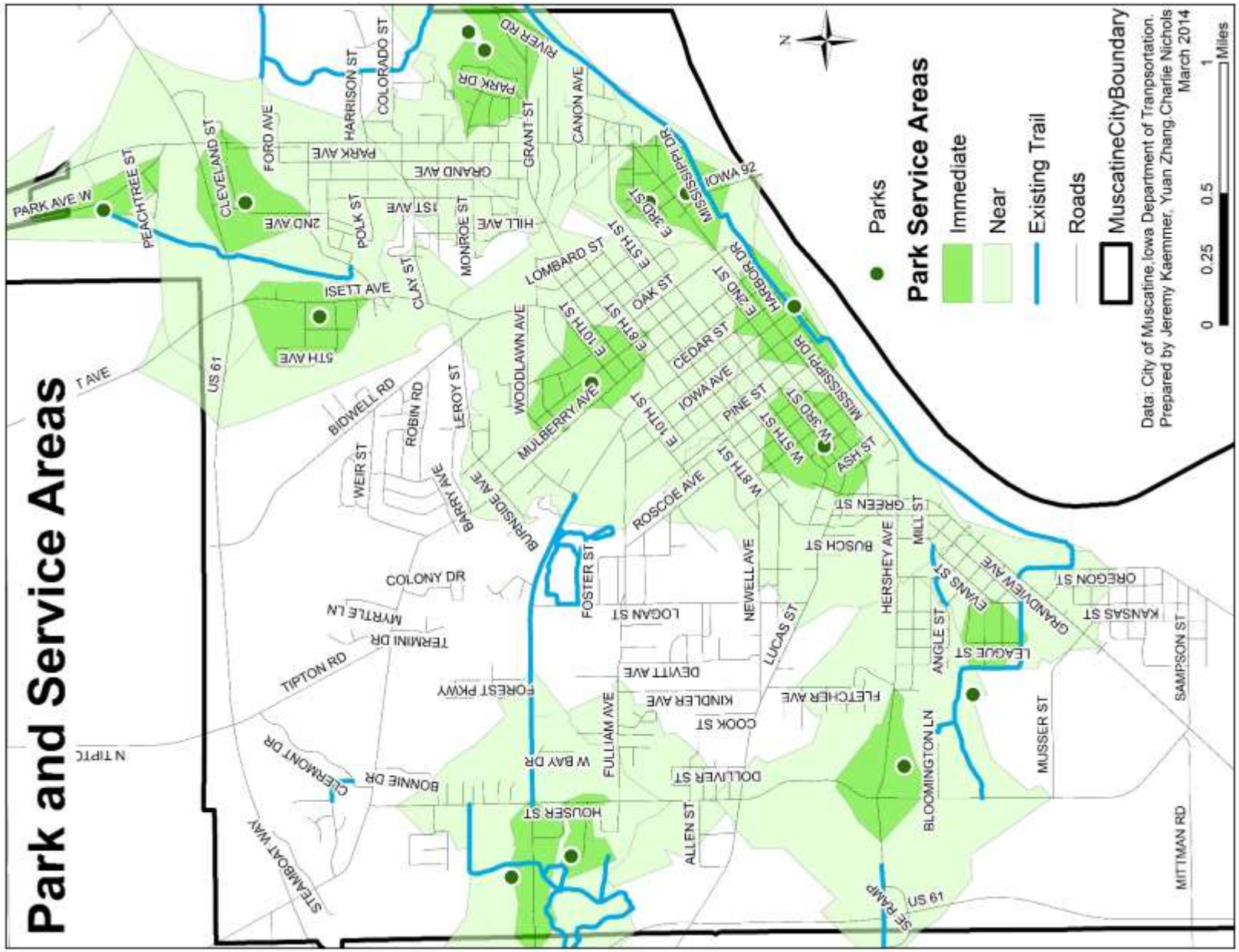
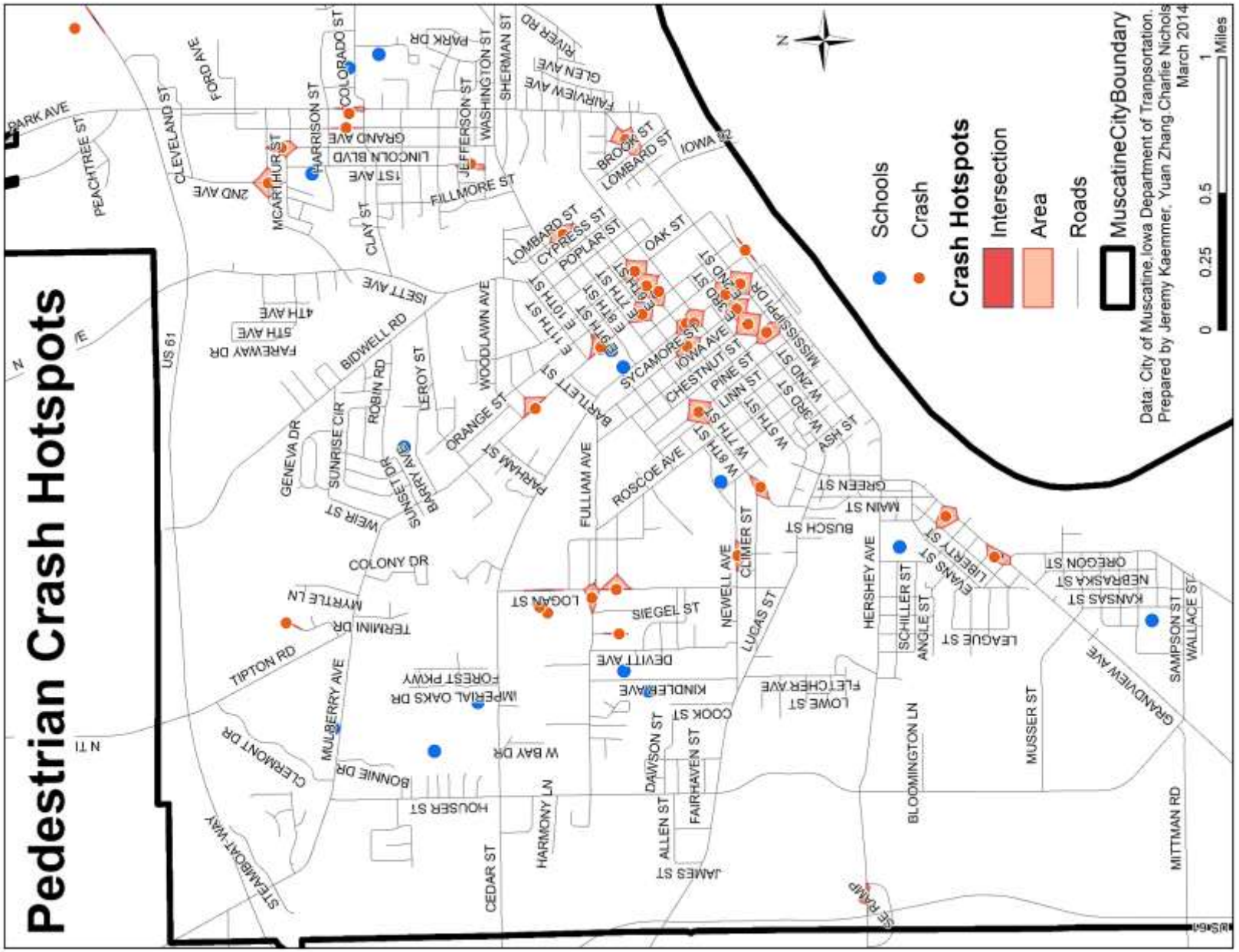


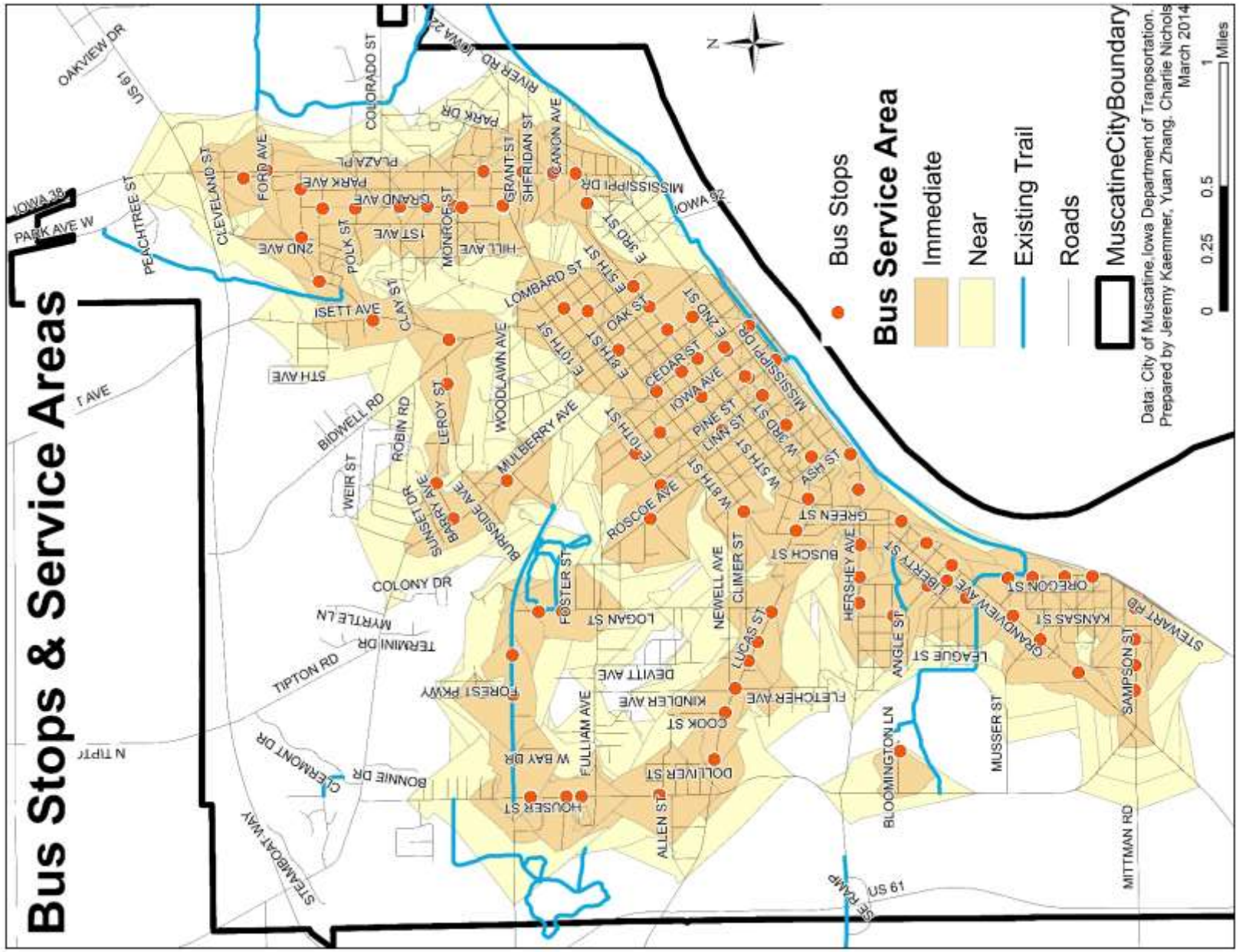
APPENDIX B: Service Areas



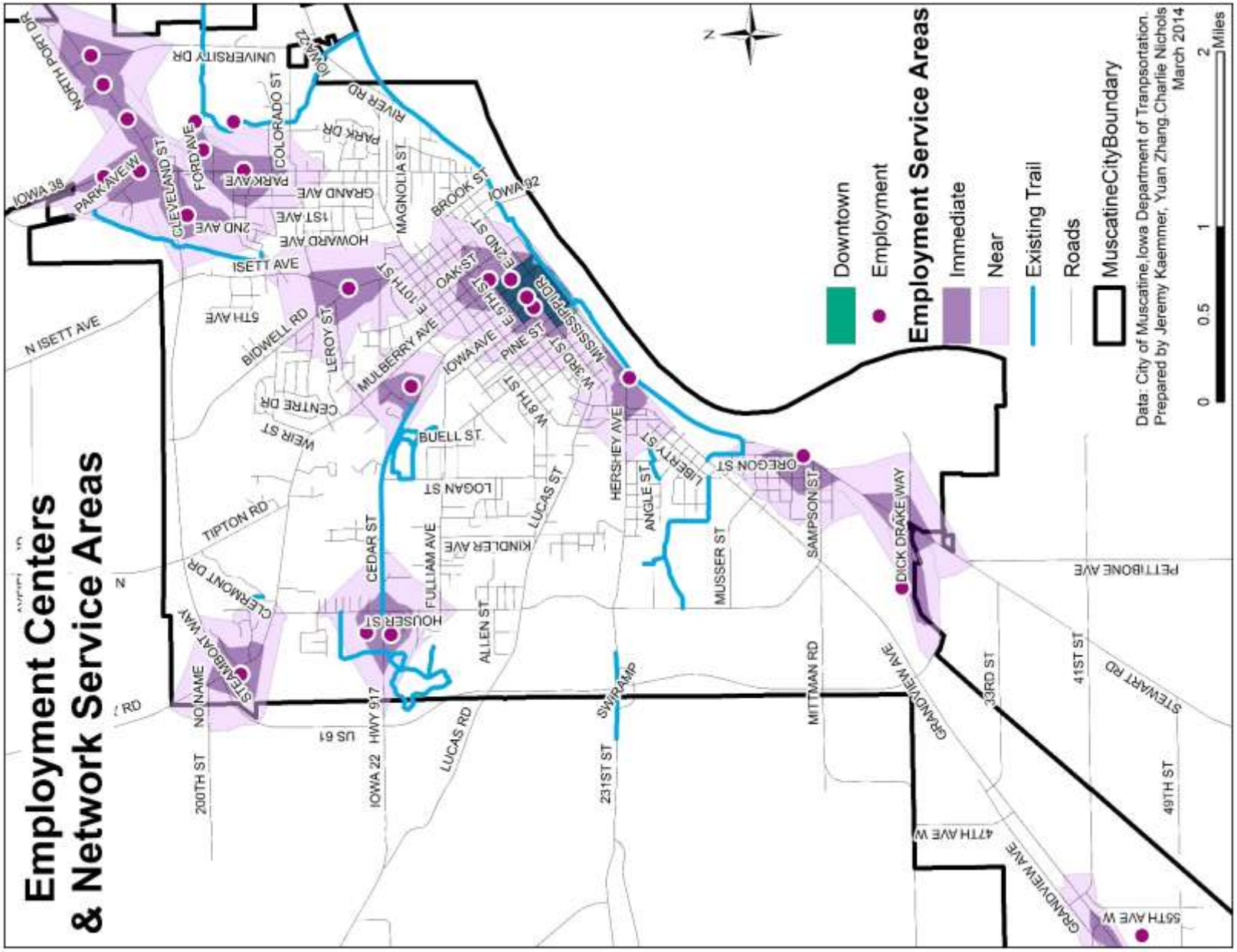
Iowa Initiative for Sustainable Communities



APPENDIX B: Service Areas



Iowa Initiative for Sustainable Communities



APPENDIX B: Service Areas

APPENDIX C: App Editing Instructions

Editing the code for the AR app does not need to be difficult. A few examples and a breakdown of each useful line of code will be provided along with a description of how it can be changed.

```
<object id="5">
        <title><![CDATA[Schaeffer Hall]]></title>
        <thumbnail><![CDATA[http://www.jkaemmer.byethost17.com/resources/schaeffer.png]]></thumbnail>
        <icon><![CDATA[http://www.jkaemmer.byethost17.com/resources/uoicon.png]]></icon>
        <location>
                <lat>41.660876</lat>
                <lon>-91.535705</lon>
                <alt>0</alt>
        </location>
        <popup>
                <description><![CDATA[schaeffer hall blah blah blah directions attempt]]></description>
                <buttons>
                        <button id="Directions" name="Directions"><![CDATA[route:daddr=41.660876,-91.535705]]></button>
                </buttons>
        </popup>
</object>
```

This code snippet represents a single point in the AR program. To start a new point, just copy and paste everything from "<object id="5">" to "<\object>". Now you have a new location point added.

```
<object id="5">
```

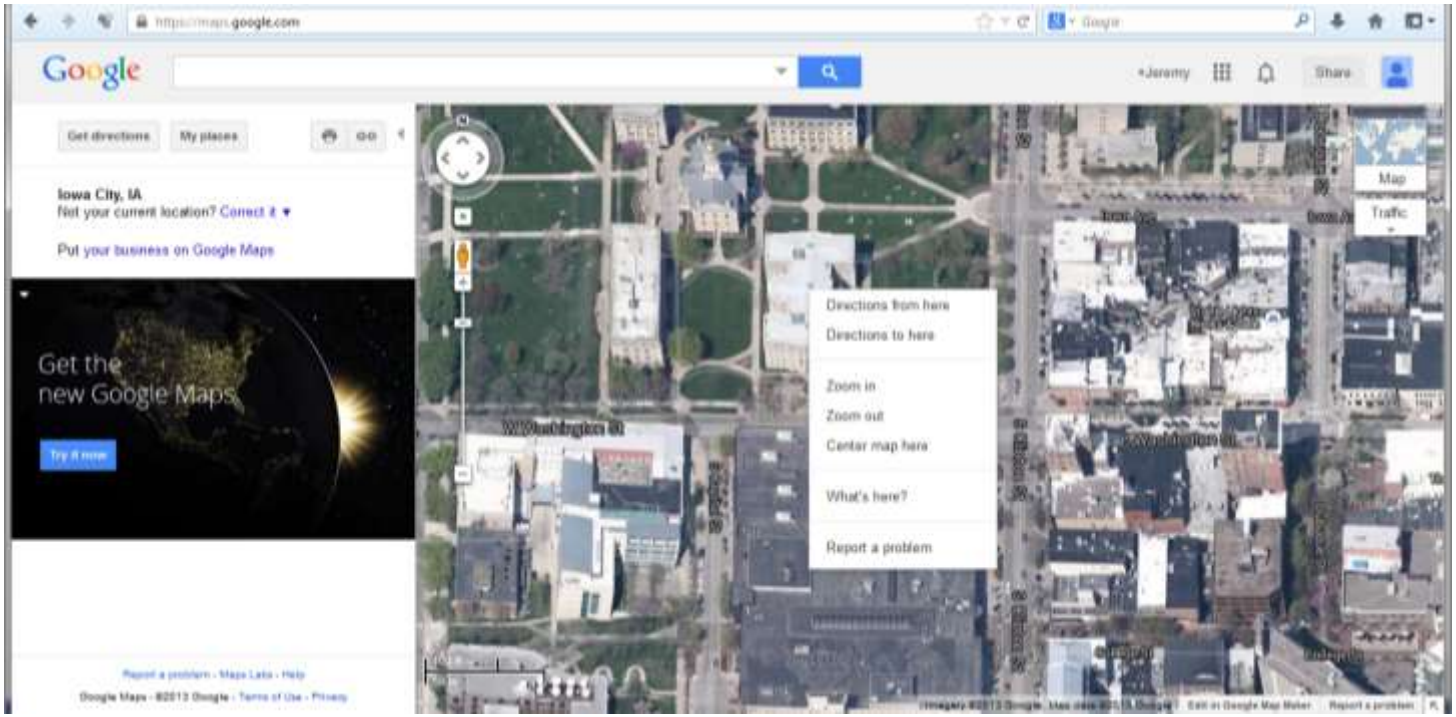
Change the number ("5" in this code) to be one more than the current number of points. This is so the point is unique and does not mix the data with another.

```
<title><![CDATA[Schaeffer Hall]]></title>
```

This is the name of the point. Leave everything alone except the words inside the "CDATA []" part. In this case, that would be Schaeffer Hall. Whatever you put inside of the brackets will be what is shown on the live AR feed, or on the list form of the app.

```
<thumbnail><![CDATA[http://www.jkaemmer.byethost17.com/resources/schaeffer.png]]></thumbnail>
```

This line of code is for the thumbnail. Just like the title the picture file provided will be shown in live feed and list portions of the app. The same thing applies here. Change the line inside of "CDATA []" to be the address of the picture you want to use. Note: smaller pictures sizes keep the app running smoother, and it is the best practice to store the pictures on your server rather than on a host site. It takes up space but keeps the computing/retrieval time low. In this case a file named "schaeffer.png" is being stored in the "resources" folder on the host server which is shown as a web address: www.jkaemmer.byethost17.com




```
<icon><![CDATA[http://www.jkaemmer.byethost17.com/resources/uoicon.png]]></icon>
```

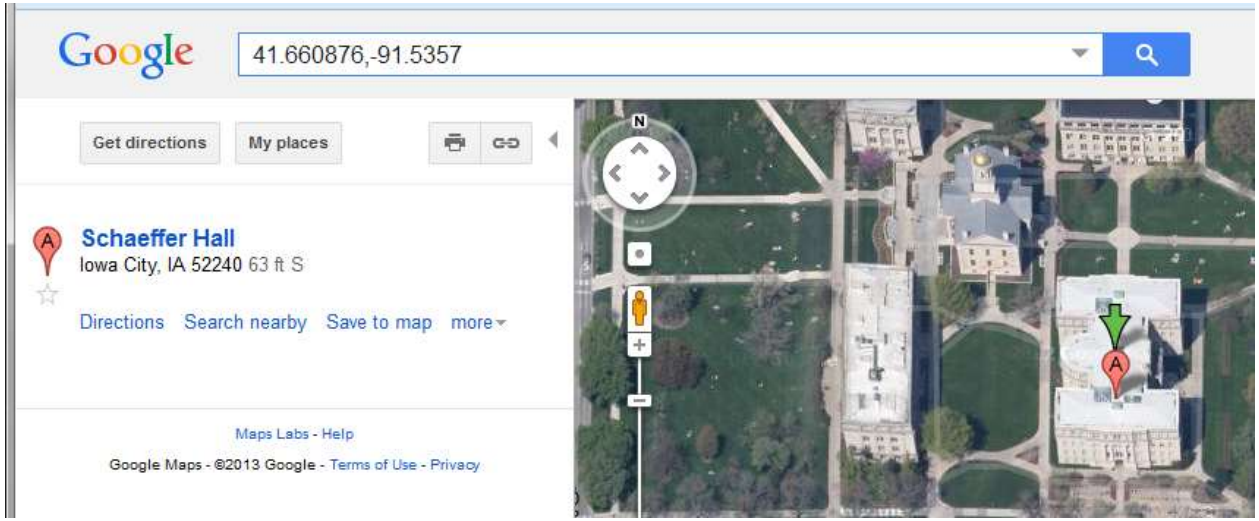
The icon is the picture displayed when the location point is opened in the app. All the same rules of changing and storage apply here.

```
<location>
        <lat>41.660876</lat>
        <lon>-91.535705</lon>
        <alt>0</alt>
</location>
```

Next up is very important part: Where the point is displayed. These are the GPS coordinates of where the object is. For the purpose of this AR app, the altitude is not important because the height of the object will be determined by the distance, anyways.

Lat and Lon can be obtained through google maps.

Find the location in google maps and right click on the location (not LEFT, use the RIGHT mouse button to select). A menu pops up after right-clicking. Select "What's here?"



The numbers in the search bar are the coordinates you will want to use. First is Lat, the second is Lon. Put those numbers between the ">" symbol and the "<" where the current numbers are.

This section of code represents the interactive part of the AR app. What is in between the 2 "<popup>" designators are the content of the point. When an individual selects the point using the live feed or list form of the APP this content will become available.

```
<popup>
        <description><![CDATA[schaeffer hall blah blah blah directions attempt]]></description>
        <buttons>
                <button id="Directions" name="Directions"><![CDATA[route:daddr=41.660876,-91.535705]]></button>
        </buttons>
</popup>
```

<Description> is exactly what it sounds like: a description of the point. Change what is in "CDATA []" to have that display as text in the main body of the point's app page. Short descriptions are best as there is a character limit. Longer descriptions ought to be included as an attached pdf or linked to via an outside webpage.

The <buttons> are where you can link to outside information, utilize web features, call on other apps, submit tweets, or view attached files.

```
<button id="Directions" name="Directions"><![CDATA[route:daddr=41.660876,-91.535705]]></button>
```

"Button ID" is just to keep track of what it does. Change what is in the quotation marks to what it is you want to add. Try and keep the ID to the basics: URL, directions, picture, file, sound, video, animation…etc. (for more information please see the Junaio quickstarts page).

"Name" is what the button will have on it as a label when it is displayed within the app. Again, change the word in the quotation marks. Try to limit the name to a single word or short phrase. If the name is too long the program will not display the page correctly and may close unexpectedly.

The last change should be the "CDATA []" section, again. Inside of the brackets should be the address for where the file is stored, the URL you want to visit, or one of the advanced commands Junaio offers.

An example of an advanced command is shown here. "Route:daddr=#, #" is the command to give directions using google maps. Change the 2 number positions to be the GPS coordinates of the location of interest. Google maps should open automatically and begin navigation for the user. The default google maps will open vehicle directions but will save the user's preference for non-motorized travel and use any known sidewalks and trails to navigate them there.

Junaio supports up to 5 buttons per location of interest page. You can simply copy the previous button line and paste it (making sure it is still before the closing statement "<\button>" then massage the contents the same way described previously (ID, name, CDATA[]). We suggest a website about the location, directions, and a social media outlet as three standard options. However, YouTube videos, sound files stored on the host server, or other files are perfect addition, too.

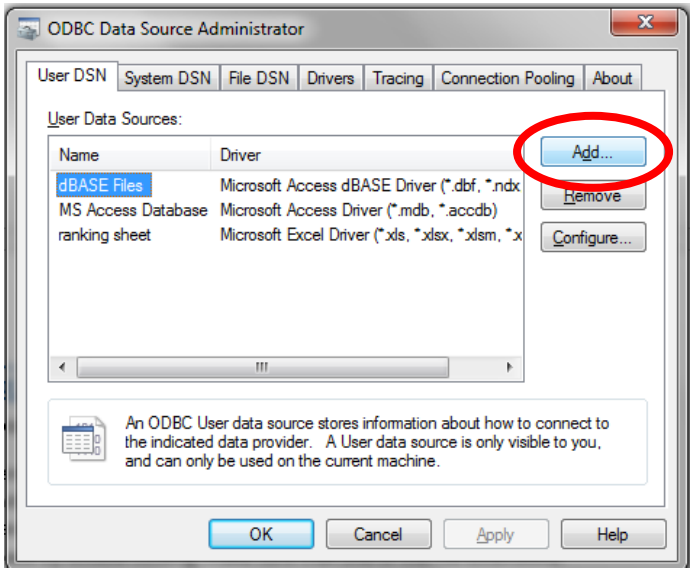
APPENDIX C: App Editing Instructions

There it is, a brand new point in the AR app! Save the new version of the app code and upload the file to the host server using an FTP program. This should replace the old file stored there. Finally, fire up the Junaio Channel on your phone and check out your handiwork!

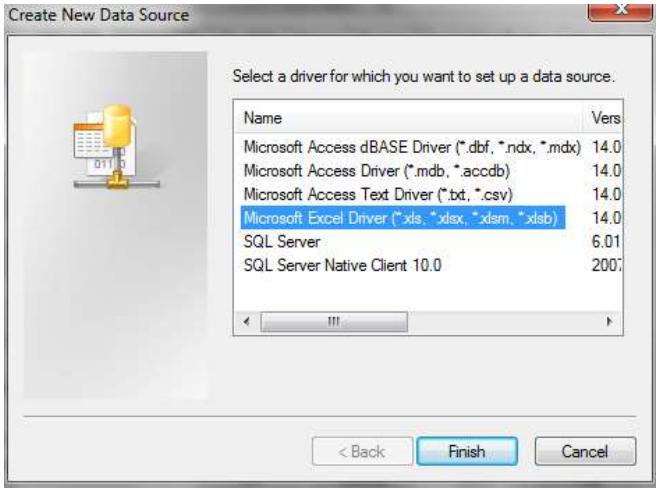
APPENDIX D: Using the GIS Model

To set up the spreadsheet and GIS connection you will need to do the following.

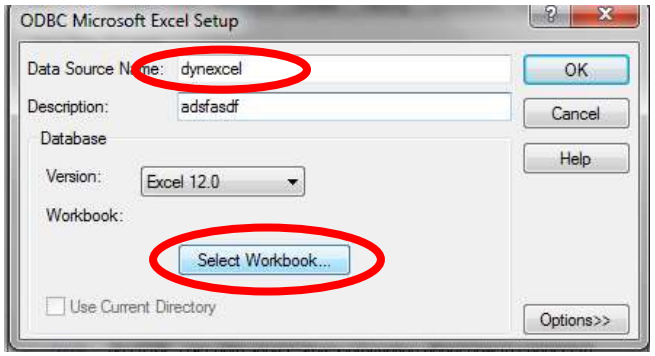
1. Download the Zip-file with the map package and spreadsheet
2. Use your computer search function to find Data Sources (ODBC), and open the program
3. Click Add, to begin setting up a database



4. Select a Microsoft Excel Database by double clicking, make sure that one of the file extensions is .xlsm
    a. Now there is a chance your computer may not have the appropriate excel drivers by default, this is common with Windows 2007 due to some registry issues. Just go to the Microsoft driver website and re-download the ODBC drivers- using the most updated version of course.



5. Name your database ‘dynexcel’ and then select your “workbook”



6. Select the excel spreadsheet you downloaded

7. Click OK twice to exit- You have just set up a dynamic database for your local computer that will update as you make changes to the connected file.
8. The next step is to get it into GIS; Open Arc-Catalogue
9. Go to “Customize” on the top toolbar and select “Mode”
10. Search for arc-catalogue specific add-ons- the top response is “add OLE DBC database,” drag the icon somewhere on your toolbars
11. Click the icon
12. This open a dialogue from here select the bottom option: set up database connection and the only option in the dropdown menu should be dynexcel- select it
13. Go to the connection settings tab and turn on ReadWrite, go back to the first tab and click “Test connection”. Click OK. Your database is now ready to be imported to GIS.
14. Open the provided map package
15. Open the sources option in your layer display and you will see a set of spreadsheets at the bottom. All of them will have red exclamation marks indicating they are pointing to a location that does not exist. Double click one of them.
16. Now it will ask you to find where the file is located. Use the dropdown menu to Databases and then click on dynexcel, then select the spreadsheet with the corresponding name as the one you double clicked.
17. The model should activate! You should only need to do this whole process once for a given computer!
18. From here you can adjust data in the spreadsheet and it will be directly reflected in the model output. NOTE: you cannot have both open at the same time so we suggest you keep them somewhere together and easy to access as there will be much back-and-forth work.

APPENDIX E: Duplicating/Changing the Model

If this model were desired to be used for other applications or other towns, we have provided a description of the steps required to adapt the files used for use. Use of Arc-GIS software as well as the spatial and network analysis toolboxes is required.

Establish destinations of interest

This step does not need to be the first and may be revisited if need be. This step is independent of the gap findings and is used to generate service areas. It is recommended that you set up a single file of destination with a matrix based on your types of destinations you want to use to analyze your network service. In this example the categories are School, Park, Employer, Bus-Stop, Crash Hotspot, and Downtown, so you would need a point to represent a location, such as a school, that has a value of 1 in the school column and zeroes in the rest. Points may be generated from available data such as LEHD employment databases, but for the most part will require manual location or address lookups to place the point. For maximum accuracy of analysis points ought to be near the street that provides the location's primary access.

For complex locations such as districts this plan recommends the use of shape corners and segment midpoints- which may be generated from the Vertices-to-Point tool in Arc-GIS. Locations with multiple access points to the street network and should not be simplified to one may require an additional point near the other access. This is not recommended if the two access points are less than $1/8^{th}$ of a mile a part, because it will unbalance the decision making process by double counting a single destination.

Identify Gaps

Gap identification begins with the assumption that all streets should have sidewalk on both sides. Download a road centerline file from the DOT and obtain a sidewalk network file for your city. In the case where one is not available it may need to be hand-drawn. There are raster analysis tools that could possibly be used on LIDAR and aerial photography to identify sidewalks should the need arise. If the sidewalk shape is not a line or polygon file, it will need to be converted it to one. Before moving to analysis, use Arc-GIS toolboxes to automatically split and clean the road network into smaller section to allow for fine detail analysis. At the very least split the network at every intersection. However, it is preferable that you split all along any curve and at regular intervals along straight sections.

The main part of this analysis relies on the Merge-Centerline tool in Arc-GIS. The tool draws a line between 2 relatively parallel line elements in the same shape-file and can have width requirements. Set those requirements within the regular tolerance of your sidewalk network. The low value being the smallest allowable street-width and the maximum being the width of widest right-of-way section owned by the city. This will only draw lines where sidewalk exists on both sides (they have merge value of 1, values of 2 and 3 generated by the tool may be deleted).

Using the centerlines created by the tool identify every segment of the network that does not have dual sidewalks. The way this plan performed this step was to generate midpoints for every dual sidewalk section and remove any roads that were within 10ft of a dual sidewalk mid-point. Assuming that the road was reasonably symmetrical and the network was cleaned appropriately this should avoid confusion from intersections or small sections of sidewalk.

Last, create projects and separate into corridor and network projects. Using the Arc-GIS tool "create route" you can merge any relatively parallel line segment, but merging by value is another option. If you pulled the network file from the DOT, every road will have a unique identification code NINEONEONE and works great. This plan split the routes into short (less than ¼ mile) and long (greater than ¼ mile) calling those network and corridor gaps, respectively. Their natures require different analysis based on their size.

Additional routes may be drawn in or selected from existing sections of sidewalk as well. These will need to be addressed by hand.

Generate Service Areas

Use the generate service area tool in Arc-GIS and use the destination points as the seeds. You should use at least 2 service area distance. This plan uses ¼ and ½ mile as those are the established "comfortable" walking distances and the majority of trips tend to be less than those lengths. In larger urban areas, additional or larger buffer distances may be used.

If the data did not transfer, join the service areas to the destination points, they should share ID's and can be joined easily from there. Separate distance requirements can be set for different types of destinations by using the selection tool and multiple "generate service area" commands (for example, this plan uses 100 and 400 ft. buffers around crash hot-spots). We recommend that the end results are merged together, however, to make the rest of the analysis easier.

Use Spatial Join

Select the gap layer(s) and use the join command. Check "spatial" join and select the service areas as the "from" object. Check the box saying that anything that intersects, or falls within the shape is joined and select the SUM option from how the data is stored. This will give a value that is the sum of all of the destination service areas, by type, that each gap serves.

Use the scoring spreadsheet

This is the easy part. If you follow the formatting of the model provided and pay close attention to the way the DATA tables in the spreadsheet are formed you can see that you can simply copy and paste the entire data table from GIS into excel and the model will work. If you added

destination categories, they will need their own columns, inputs, and the equation will need to be adjusted. Just make sure that the ranking updates appropriately and is able to be easily indexed for ranking purposes.

Use Appendix D to set up a connection

Just as this section title says, use appendix D to set up the connection and the tables may be freely joined back to the Gap shape-file.

Parent Survey About Walking and Biking to School

Dear Parent or Caregiver,

Your child's school wants to learn your thoughts about children walking and biking to school. This survey will take about 5 - 10 minutes to complete. We ask that each family complete only one survey per school your children attend. If more than one child from a school brings a survey home, please fill out the survey for the child with the next birthday from today's date.

After you have completed this survey, send it back to the school with your child or give it to the teacher. Your responses will be kept confidential and neither your name nor your child's name will be associated with any results.

Thank you for participating in this survey!

+ CAPITAL LETTERS ONLY – BLUE OR BLACK INK ONLY +

School Name:

1. What is the grade of the child who brought home this survey? ☐☐ Grade (PK,K,1,2,3...)

2. Is the child who brought home this survey male or female? ☐ Male ☐ Female

3. How many children do you have in Kindergarten through 8th grade? ☐☐

4. What is the street intersection nearest your home? (Provide the names of two intersecting streets)

and

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box.

5. How far does your child live from school?

☐ Less than ¼ mile ☐ ½ mile up to 1 mile ☐ More than 2 miles

☐ ¼ mile up to ½ mile ☐ 1 mile up to 2 miles ☐ Don't know

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box. +

6. On most days, how does your child arrive and leave for school? (Select one choice per column, mark box with X)

Arrive at school	**Leave from school**
☐ Walk	☐ Walk
☐ Bike	☐ Bike
☐ School Bus	☐ School Bus
☐ Family vehicle (only children in your family)	☐ Family vehicle (only children in your family)
☐ Carpool (Children from other families)	☐ Carpool (Children from other families)
☐ Transit (city bus, subway, etc.)	☐ Transit (city bus, subway, etc.)
☐ Other (skateboard, scooter, inline skates, etc.)	☐ Other (skateboard, scooter, inline skates, etc.)

+ Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box +

7. How long does it normally take your child to get to/from school? (Select one choice per column, mark box with X)

Travel time to school	**Travel time from school**
☐ Less than 5 minutes	☐ Less than 5 minutes
☐ 5 – 10 minutes	☐ 5 – 10 minutes
☐ 11 – 20 minutes	☐ 11 – 20 minutes
☐ More than 20 minutes	☐ More than 20 minutes
☐ Don't know / Not sure	☐ Don't know / Not sure

8. Has your child asked you for permission to walk or bike to/from school in the last year? ☐ Yes ☐ No

9. At what grade would you allow your child to walk or bike to/from school without an adult?

(Select a grade between PK,K,1,2,3...) ☐☐ grade **(or)** ☐ I would not feel comfortable at any grade

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

10. What of the following issues affected your decision to allow, or not allow, your child to walk or bike to/from school? (Select ALL that apply)

11. Would you probably let your child walk or bike to/from school if this problem were changed or improved? (Select one choice per line, mark box with X)

	My child already walks or bikes to/from school		
☐ Distance	☐ Yes	☐ No	☐ Not Sure
☐ Convenience of driving	☐ Yes	☐ No	☐ Not Sure
☐ Time	☐ Yes	☐ No	☐ Not Sure
☐ Child's before or after-school activities	☐ Yes	☐ No	☐ Not Sure
☐ Speed of traffic along route	☐ Yes	☐ No	☐ Not Sure
☐ Amount of traffic along route	☐ Yes	☐ No	☐ Not Sure
☐ Adults to walk or bike with	☐ Yes	☐ No	☐ Not Sure
☐ Sidewalks or pathways	☐ Yes	☐ No	☐ Not Sure
☐ Safety of intersections and crossings	☐ Yes	☐ No	☐ Not Sure
☐ Crossing guards	☐ Yes	☐ No	☐ Not Sure
☐ Violence or crime	☐ Yes	☐ No	☐ Not Sure
☐ Weather or climate	☐ Yes	☐ No	☐ Not Sure

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

12. In your opinion, how much does your child's school encourage or discourage walking and biking to/from school?

☐ Strongly Encourages ☐ Encourages ☐ Neither ☐ Discourages ☐ Strongly Discourages

13. How much fun is walking or biking to/from school for your child?

☐ Very Fun ☐ Fun ☐ Neutral ☐ Boring ☐ Very Boring

14. How healthy is walking or biking to/from school for your child?

☐ Very Healthy ☐ Healthy ☐ Neutral ☐ Unhealthy ☐ Very Unhealthy

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

15. What is the highest grade or year of school you completed?

☐ Grades 1 through 8 (Elementary)
☐ Grades 9 through 11 (Some high school)
☐ Grade 12 or GED (High school graduate)
☐ College 1 to 3 years (Some college or technical school)
☐ College 4 years or more (College graduate)
☐ Prefer not to answer

16. Please provide any additional comments below.

University of Iowa

Appendix G: AR App Usage Instructions

Direction for using Junaio for virtual way-finding

Step 1: Scan the Code and download Junaio.

OR

Step 1: Download Junaio directly from the IPhone or Android App Store.

Step 2: Open Junaio.

Step 3: Click "Scan" in the upper right corner and re-scan the code.

Step 4: Tap the Muscatine Bridge Icon and then the Channel name "Muscatine AR Way finding."

Step 5: Select "Add to Desktop" or "Add to Favorites".

Step 6: Explore!

Direction for using Junaio for virtual way-finding (Simplified Chinese Version)

"魔眼"增强现实浏览器使用指南

步骤一：请直接扫描 QR 码，然后依据链接免费下载、安装"魔眼"（Junaio）应用软件。

或

步骤一：请直接在 IPhone 或安卓的 App 商店搜索"魔眼"（Junaio）应用软件,并进行下载、安装。

步骤二：点开"魔眼"（Junaio）。

步骤三：请对准 QR 码，点击屏幕右上方的"扫描键"（Scan），进行再次扫描。

步骤四：扫描完成时会有一个名为"马斯卡廷 Muscatine"的应用频道出现，请点击该频道的标识： 马斯卡廷大桥。

步骤五：进入"马斯卡廷 Muscatine"频道后，请点击"添加至桌面"（Add to Desktop）或"添加至最爱/收藏夹"（Add to Favorite）。

步骤六：请开始使用! 敬请大家分享这个"马斯卡廷 Muscatine"频道。

APPENDIX H: References

American Planning Association. (2005). AICP code of ethics and professional conduct.

Ana Aizcorbe and Martha Starr-McCluer, (1997) "Vehicle Ownership, Purchases, and Leasing: Consumer Survey Data" Monthly Labor Review, June 1997 Ed., Retrieved From:

http://www.bls.gov/mlr/1997/06/art4full.pdf

Bowles, Brian; et al… (2011) "Economic and Health Benefits of Bicycling in Iowa," Iowa Bicycle Coalition. Retrieved from:

http://www.peoplepoweredmovement.org/site/images/uploads/Economic_and_Health_Benefits_of_Bicycling_in_Iowa.pdf

Census 1990, U.S. Census Bureau

Census 2000, U.S. Census Bureau

Census 2010, U.S. Census Bureau;

The Center for Disease Control and Prevention Life Tables Total Population: Life table for the male population: Iowa 1989-1991. Retrieved from:

http://www.cdc.gov/nchs/data/lifetables/life89ia.pdf

City of Austin, 2013. Walking Paths and Biking Trails. Retrieved From:

http://www.ci.austin.mn.us/Parkandrec/Parks/park.html

City of Muscatine. (2013). Muscatine City Code. Retrieved from:

http://www.muscatineiowa.gov/index.aspx?NID=103

City of Muscatine (2013). Muscatine Comprehensive Plan. Retrieved From:

http://www.muscatineiowa.gov/index.aspx?NID=518

Dahlstrom, Katie. (2013). "Ways to make Clinton More Bike-Friendly-Eyed," The Clinton Herald. Retrieved from:

http://www.clintonherald.com/clinton/x937527443/Wheels-Turning/print

.J, Dill, N McNeil. *Four Types of Cyclists?* 2012. Retrieved from:

http://web.pdx.edu/~jdill/Types_of_Cyclists_PSUWorkingPaper.pdf.

Don Pickrell and Paul Schimek, (1998) "Trends in Personal Motor Vehicle Ownership and Use: Evidence from the Nationwide Personal Transportation Survey," Retrieved From: http://nhts.ornl.gov/1995/Doc/Envecon.pdf

Eno Transportation Foundation, Inc., (2003) "Socioeconomics of Urban Travel: Evidence from the 2001 NHTS," Transportation Quarterly, Vol. 57, No. 3, summer (49–77),

"Background of Flint River Trail," (2013). Flint River Trail: Home, Flint River Trail Communications Committee. Retrieved from:

http://www.flintrivertrail.org/

Matt McClelland, (2011), "Naismith's Rule," Wildwalks: Handy Info, Retrieved from:

http://www.wildwalks.com/bushcraft/technical-stuff/naismith-s-rule-estimate-walking-time.html

"Mississippi River Trail," (2012). Mississippi river Trail, Inc.. Retrieved from:

http://www.mississippirivertrail.org/trails.html

Nhora Murphy and Richard Knoblauch, (2004) "Report of Focus Group Discussions in Washington, New York, Miami, and Los Angeles," Hispanic Pedestrian and Bicycle Safety, Retrieved From:

http://safety.fhwa.dot.gov/ped_bike/hispanic/fhwanhtsa/fhwahtsa.pdf

Nielson, (2011). "Generation App 62% of Mobile Users, 25-24 Own Smartphones". The Nielsen Company. Retrieved from:

http://www.nielsen.com/us/en/newswire/2011/generation-app-62-of-mobile-users-25-34-own-smartphones.html

Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *Journal of the American Medical Association* 2012; 307(5):483-490.

Schwanen, T., Dijst, M. and Dieleman, F. M. (2001), Leisure trips of senior citizens: determinants of modal choice. Tijdschrift voor economische en sociale geografie, 92: 347–360. doi: 10.1111/1467-9663.00161

Skipper. J. (2013). "Trail planner wants biking to be 'normal, not weird.'" Global Gazette. Retrieved from:

http://globegazette.com/news/local/trail-planner-wants-biking-to-be-normal-not-weird/article_f9ffdce8-c1c7-11e2-a115-0019bb2963f4.html

Things to Do, (n.d.) .Explore Minnesota: Trails. Retrieved from:

http://www.exploreminnesota.com/things-to-do/3036/jc-hormel-nature-center/details.aspx

Todd Litman. Short and Sweet: Analysis of Shorter Trips Using National Personal Travel Survey Data. Victoria Transport Policy Institute. 2012U.S. Census Bureau, 2007-2011 American Community Survey 5-Year Estimate

The U.S. Hispanic Community: Promoting Diversity of Thought in the Public Sector by Octavio A. Hinojosa Mier-2010. Retrieved From:

http://www.hispanicvista.com/HVC/Columnist/HVC/Opinion/Guest_Columns/08152010_Octavio_Hinojosa_Mier.htm

U.S. Census, (2009): A Compass for Understanding and Using American Community Survey Data

U.S. Census. (2012). Instructions for Applying Statistical Testing to ACS 2007 Data. Retrieved From:

http://www.census.gov/acs/www/Downloads/data_documentation/Statistical_Testing/ACS_2007_Statistical_Testing.pdf

Vital Statistics Iowa 2010, Table 9 Retrieved from:

http://www.idph.state.ia.us/apl/common/pdf/health_statistics/2010/vital_stats_2010.pdf

Walsh K. (2013). USA Today. Typical Climate of the Midwestern United State. Retrieved from:

http://traveltips.usatoday.com/typical-climate-midwestern-united-states-103926.html

U.S. Department of Transportation Federal Highway Administration. (2013*). Designing Sidewalks and Trails for Access: Best Practice Design Guide*.

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/sidewalks214.cfm

Federal Highway Administration. (2013). Trail Crossings.

https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/pdf/17chapter16.pdf

Graham, M. (2014). TreeHugger: The rise of curbs: Protected bike lanes in the U.S. are growing up!

http://www.treehugger.com/bikes/rise-curbs-bike-lanes-us-are-growing.html

National Transportation Operations Coalition. (2012). *Traffic Signals 101*.

http://www.ite.org/reportcard/TrafficSignals101.pdf

National Transportation Operations Coalition. (2012). *Safe Toolbox: Engineering Pedestrian Refuge Island*

http://www.mtc.ca.gov/planning/bicyclespedestrians/tools/pedRefugeIsland/#

Town of Jackson Bicycle Improvement Plan. (2013). *Town of Jackson Bike Network and Way-finding*

http://www.tetonwyo.org/cc/docs/StaffReports/2013-JIM/06-03/6-3-IVG-BikeWayfinding.pdf

Pedestrian and Bicycle Information Center. (2014). Media's Role in Enforcement.

http://www.pedbikeinfo.org/programs/enforcement_mediarole.cfm

Pedestrian and Bicycle Information Center. (2014). Education Campaigns.

http://www.pedbikeinfo.org/programs/education_campaigns.cfm

City of Evanston 2014 Bicycle Plan Update. (2014).

https://cityofevanston.org/public-works/bikeability/

U.S. Department of Transportation. (2006). Evaluation of Safety, Design, and Operation of Shared-use Paths Final Report.

http://www.fhwa.dot.gov/publications/research/safety/pedbike/05137/05137.pdf

Federal Highway Administration. (2013). Designing Sidewalks and Trails for Access: Best Practice Design Guide.

https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/sidewalks206.cfm

City of La Crosse Bicycle and Pedestrian Master Plan. (2012).

League of American Bicyclists. (2013). *Bicycle Account Guidelines.*

http://bikeleague.org/sites/default/files/Bicycle_Account_Guidelines.pdf

The Trail Foundation. (2013). *Landscape Lighting.*

http://www.thetrailfoundation.org/portfolio/landscape-lighting/

Federal Highway Administration (2001). Designing Sidewalks and Trails for Access Part II of II: Best Pratice Design Guide.

http://nacto.org/docs/usdg/designing_sidewalks_and_trails_access_kirschbaum.pdf

San Francisco Bay Area Metropolitan Transportation Commission. (2014). *Safety Toolbox: Engineering.*

http://www.mtc.ca.gov/planning/bicyclespedestrians/tools/pedRefugeIsland/

Manual on Uniform Traffic Control Devices (MUTCD. (2009).

http://mutcd.fhwa.dot.gov/pdfs/2009/part4.pdf

City of Baton Rouge. (2014). Bicycle Routes, Maps, and Facilities

https://brgov.com/dept/planning/bike/routes.htm

Michigan Department of Transportation. (2012). Best Design Practice fot Walking and Bicycling in Michigan.

https://www.michigan.gov/documents/mdot/MDOT_Research_Report_RC1572_Part6_387521_7.pdf

Pedestrian and Bicycle Information Center. (2014). How to Educate Bicyclists and Pedestrians

http://www.pedbikeinfo.org/programs/education.cfm

Pedestrian and Bicycle Information Center. (2014). Educating Child Pedestrians

http://www.pedbikeinfo.org/programs/education_ped_child.cfm

Pedestrian and Bicycle Information Center. (2014). How to Educate Bicyclists and Pedestrians

http://www.pedbikeinfo.org/programs/education.cfm

Pedestrian and Bicycle Information Center. (2014). Educating Collage-aged Pedestrians

http://www.pedbikeinfo.org/programs/education_ped_college.cfm

Pedestrian and Bicycle Information Center. (2014). Implementing enforcement campaigns

http://www.pedbikeinfo.org/programs/enforcement_campaigns.cfm

Pedestrian and Bicycle Information Center. (2014). Educating Drivers

http://www.pedbikeinfo.org/programs/education_ped_driver.cfm

League of American Bicyclists. (2014).*The 5 E's*

http://www.bikeleague.org/content/5-es

League of American Bicyclists. (2014). *Bike Month Dates and Events*.

http://www.bikeleague.org/content/bike-month-dates-events-0

Walk Bike to School Organization. (2014). *About Bike to School Day*.

http://walkbiketoschool.org/ready/about-the-events/bike-to-school-day

Walk Bike to School Organization. (2014). *Walk to School Day*

http://www.walkbiketoschool.org/ready/about-the-events/walk-to-school-day

Walk Bike to School Organization. (2014). *Who walked 2013*

http://www.walkbiketoschool.org/go/who-walked/2013

Walk Bike to School Organization. (2014). *Who biked 2013*

http://www.walkbiketoschool.org/go/who-biked/2013/IA

City of Castle Rock, *Colorado*, *Parks and Recreation Master Plan*

http://www.crgov.com/DocumentCenter/Home/View/36

City of Evanston, Illinois, City of Evanston Bicycle Plan Update

https://cityofevanston.org/public-works/bikeability/

City of Evanston, Illinois, Evanston Multi-Modal Transportation Plan

http://www.cityofevanston.org/pdf/EvanstonMulti-ModalTransportationPlan.pdf

City of Crested Butte, *Colorado*, *Crested Butte Transportation Plan 1998*

http://www.crestedbutte-co.gov/vertical/Sites/%7B6058FFBB-CB06-4864-B42F-B476F794BE07%7D/uploads/%7B7A47C4DE-79C4-4763-BC3E-3FAE06CECE8E%7D.PDF

City of Urbana, Illinois. *Urbana Bicycle Master Plan*

http://www.ccrpc.org/bike/report.php

City of Batavia, Illinois. *CITY OF BATAVIA BICYCLE PLAN*

http://www.cityofbatavia.net/content/articlefiles/2690-07-44BikePlan.pdf

City of Elmhurst, Illinois. *ELMHURST BICYCLE PLAN*

http://www.elmhurst.org/DocumentCenter/Home/View/1886

Bloomington, Indiana. Bicycle and Pedestrian Transportation & Greenways System Plan

http://bloomington.in.gov/media/media/application/pdf/57.pdf

City of Sturgeon Bay, Wisconsin. City of Sturgeon Bay Bicycle Master Plan

http://www.sturgeonbaywi.org/wp-content/uploads/2013/11/Sturgeon-Bay-Bicycle-Master-Plan_Feb-2011.pdf

Houghton, Michigan. Non-Motorized Transportation Plan 2013

http://www.cityofhoughton.com/documents/Houghton_Non-motorized_Plan_2013.pdf

TART Trails Inc. Traverse City Pedestrian and Bicycle Safety.

http://traversetrails.org/wp-content/uploads/2012/04/About-Strategic-Plan1.pdf

Clayton, MO. Brentwood, Clayton, Maplewood and Richmond Heights Bikeable Walkable Communities Plan

http://www.claytonmo.gov/Assets/Planning+and+Development/PDF+Files/Trail+Study.pdf

Cedarburg, WI. Bicycle & Pedestrian Route Plan.

http://www.town.cedarburg.wi.us/cm/pdfs/Bicycle%20&%20Pedestrian%20Route%20Plan.pdf

Oregon Department of Transportation. *Bicycle and Pedestrian Design Guide*.

ftp://ftp.odot.state.or.us/techserv/roadway/web_drawings/HDM/2011%20HDM%20Rewrite/2012%20Appendix%20L%20Bike%20Ped%20Design%20Guide.pdf