Repurposing Minnesota State Highway 65

A Multimodal Urban Cyclist Corridor

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Repurposing Central Avenue SE:
A Multimodal Urban Cyclist Corridor

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By

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Thesis Booklet Disclaimer

This thesis booklet was prepared by Keith M. Dahl as an undergrad assignment at North Dakota State University for academic purposes. The content expressed in the thesis booklet was developed over two semesters, LA 563 and LA 572. Throughout these two semesters the project scope has changed slightly due to further project development and design. As of present, the final solution is a reflection of the project development and design. Therefore, this thesis booklet outlines the process used to derive at the final solution.

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Introduction

Abstract

Many countries, cities, and communities have recently set out new policy frameworks to support growth of non-motorized transportation, creating a multimodal environment. This paper examines the repurpose and redesign of Minnesota State Highway 65 as a primary route for cyclists into downtown Minneapolis. Focusing on safety of the cyclists, the research presented looks at the cyclist in a multimodal environment – more specifically, road design and connection characteristics, through a discursive approach. The research indicates that with effective design treatments cycling can be a safe transportation system as demonstrated through application of a design solution along Minnesota State Highway 65 in downtown Minneapolis thereby increasing public health benefits.

Statement of Intent

Cycling is an active, environmentally friendly means of travel. Many advocacy groups, organizations, and government agencies have promoted the use of non-motorized transportation. Policies, such as the Intermodal Surface Transportation Efficiency Act and Transportation Equity Act of the 21st Century, have increased funding and awareness for innovative improvements. This movement is promoting cultures and communities to take to their bikes. They're finding health benefits, low-cost, transportation, and having a positive impact to the environment. Until recently, the increase in non-motorized transportation hasn't been associated with safety of supportive cycling infrastructures. However, the way our environment is constructed has the potential to positively impact public health. To continue the increased use of non-motorized transportation, cycling must be a safe transportation option and perceived as such for health benefits to be realized.

Research, perceived and actual, pertaining to cycling safety will be gathered through qualitative and quantitative research methods. Initially, in order to investigate and explore qualitative research an administered public survey will gather information on the public's experiences, reactions, beliefs, and ideas about cycling. A survey will be beneficial to understand current perceptions of bike facilities and improvements that can be made. Subsequently, the next step in collecting research will be gather quantitative research already published – ejournals, books, and academic articles. These quantitative researches will form statistical data that can be analyzed to support a design solution for Minnesota State Highway 65 in Minneapolis.

Repurposing Minnesota State Highway 65 through Minneapolis into a bike boulevard will have a positive impact on perceived safety and comfortability of non-motorized transportation in and out of the downtown area. The created multimodal environment will create traffic calming design elements to promote low-volume and low-speed transportation. Many of the design solutions will promote and prioritize non-motorized transportation over motorized transportation.

Problem Statement

What infrastructural bike improvements can be implemented to increase the number of cyclists in the area of downtown Minneapolis?

Literature Review

Project Typology

Multimodal Corridor

Critical Evaluation of Cited Papers

The bicycle could become an important part of the twenty-first century transportation system. Since 40 percent of US trips are two miles or less, a bike can often substitute for a car. Bikes have been under appreciated for so many years that motorists never have learned to drive with them, which in turn has made cycling more dangerous and discourages their use for even short trips. Cycling advocates have been relentless in putting pressure on governments to create multimodal environments, policies that would accommodate all users: motorists, pedestrians, transit users, and bikes. Cyclists have also joined with health professionals as well to help figure out how to entice people to incorporate walking and cycling into their everyday lives.

Increasing the role of the cyclist gets us into some much tougher issues. How do we integrate two very different modes of transportation into our road system? Do we allow cyclists to operate as much as possible as a motor vehicle with all the rights and responsibilities? Or do we give cyclists a variety of special facilities? Does it only involve some paint on the roads creating bike lanes or do we physically separate the cyclist from the road system? However we incorporate the cyclist into our road systems, it's evident that cyclists will have a major impact on the streetscape.

N. Tilahun, D. Levinson, and K. Krizek in a 2006 study evaluated individual preferences for five different cycling environments by trading off a better facility with a higher travel time against a less attractive facility at a lower travel time. They found that respondents are willing to travel up to twenty minutes more to switch from an unmarked on-road facility with side parking to an off-road bicycle trail.

Safety is probably the biggest barrier that discourages people who would otherwise be willing to cycle. One component of safety is the bicycle infrastructure which makes bicycling safer by two means: first, by making cycling a more attractive and comfortable choice and secondly by providing a physical protection to reduce the chance of being hit by a car.

Gulsah Akar, Kelly J. Clifton in a 2008 study formed a survey to understand the travel patterns and the specific issues regarding bicyclists. Transportation infrastructure on and around campus is automobile oriented, people drive their cars even for short distances. Respondents of the survey commented that the lack of bike lanes and safety are the two factors that keep them from bicycling. This reveals the importance of a connected bicycle network for a successful bicycle program.

Good bike streets don't always have bike lanes and barriers. Every type of street has its own needs. The busier the street, the greater the intervention required to make it comfortable to bicyclists. And also creating infrastructure that better serves the cyclists needs must be addressed as well. When you are given an option to go the wrong way for a block or travel eight blocks out of your way and cross several intersections, more often than not, a cyclist will take the route more convenient and dangerous.

The cycling rate in the U.S. is rising quickly1 and you might assume that the crashes would be directly increasing as well. When in reality, as the numbers of cyclists rise, crashes between cyclists and vehicles stay flat or decrease. Bikes, in sufficient numbers, can have traffic calming effects; cyclists themselves are also safer just by having numbers on the road
(Peter Jacobson, 2008).

Several surveys have shown that a sizeable percentage of the population is willing to consider using a bicycle for some transportation purposes, if the circumstances are right. Safety fears are the biggest factor keeping people off bikes. As long ago as 1996, the U.S. surgeon general, in a report on physical activity, said that 53 percent of people who had cycled in the previous year said they would commute to work by bike if they could on safe, separated systems. This tells planners, designers, and health professionals that people would like to make cycling part of their everyday lives but until we address safety they will remain in their vehicle.

The issue is to push for street changes that have been seen in European countries where bikes are given their own protected lanes, special traffic signals, and even special routes that allow them to travel through the inner city more quickly than cars. Motorists have their space, pedestrians have their space on the sidewalk, and cyclists need their space too. A question that arises from precedents set in Europe is whether or not they can be effectively implemented in America.

There is no doubt that unsafe riding causes many cyclists injuries and deaths. A 1996 study by the University of North Carolina Highway Safety Research Center found that as many as a third of all bike accidents involved riding against traffic. In addition, although many cyclists think they are safer on sidewalks, sidewalk can be more dangerous because cyclists can be hit by drivers in both intersections and driveways who don't expect to see anyone moving faster than walking speed. A study of 803 cyclists' crashes in the Orlando, Florida area in 2003 and 2004 found that nearly two thirds involved riding on a sidewalk or another unsafe choice by the cyclist.

Cyclists are picking it up as they go, and that doesn't always include following the traffic laws or even knowing that they should follow the rules set forth. David Glowacz spends much of his time educating cyclists how to ride with traffic, to stay far enough left of parked cars to avoid "dooring" by a motorist exiting a vehicle and to be careful of right turning vehicles moving into the cyclists line of travel.

1) The number of bicycle trips more than doubled between 2001 and 2009. They went from 1.7 billion to 4 billion. U.S. Department of Transportation and Federal Highway Administration, 2009 National Household Travel Survey Between 1998 and 2008, cycling fatalities didn't go up, they fell from by 21%. Pucher, J., et al., Bicycling renaissance in North America? An update and reappraisal of cycling trends and policies, Transportation Research A, 2011

One reason why European countries often use yield signs rather than stop signs is to reduce the loss of kinetic energy of coming to a stop cycling. Joel Fajans, a physics professor at the University of California at Berkeley, has calculated that a cyclist who rolls through a stop sign at just five mph uses 25 percent less energy to get back up to 10 mph than a cyclist who comes to a full stop. Fajans expanded on this by using two paths of travel, one along a low traffic street recommended for bikes that had twenty one stop signs and one stop light over a distance of about two miles. The second was a busy four lane street with eight stop lights. He obeyed the traffic rules and found that his average speed on the busy path of travel was 14.2 mph while the average speed he sustained on the low traffic path of travel was 10.9 mph. Fajans noted that this may not sound like a big difference but compared to a motor vehicle it is driving at 45 mph rather than 60 mph.

Cyclists feel they have enough visibility to go slowly through stop signs if they don't see any traffic, just as motorists feel they can safely speed by at least a few miles per hour. There are strict rules however; there are also social rules that allow motorists and cyclists as well to think they are doing nothing wrong.

Peter Jacobson explained, "If the motorist expects to see someone walking or cycling, they will behaver accordingly." Fred Wegman who runs the Netherlands traffic safety research institute, calls it "awareness in numbers" because there can still be unsafe conditions that need to be addressed. Safety in numbers has been studied a lot as of recent in part to the counter intuitiveness of what the results present.

A 2003 study by Jennifer Dill and Theresa Carr at Portland State University found that cities with the most miles of bike systems had the highest ridership. The data reinforces that increasing bike systems will create a continuous cycle: more riders demand more facilities, which bring more riders who demand more facilities.

Several studies have given some indication that bike lanes do increase safety to some extent. Davis, Eugene, and Corvallis all documented lower bike crash levels along streets after bike lanes had been installed. New York City has released a 2006 safety report that found that just one cyclist of the 225 cyclist deaths over the previous decade had been in a bike lane. Bike lanes don't solve many of the toughest safety programs but, it does provide an invitation for cyclists to take to the roads and create safety in numbers.

At the same time bike lanes can be a false invitation to cyclists. Much or all of a bike lane can be inside the "dooring" zone of a parked car. Cyclists can be particularly vulnerable at intersections as well. One of the most common crashes is the "right hook," where drivers cross into the path of riders in bike lanes to take a right as cyclists are going straight through the intersection. Left turns can also pose a problem to cyclists who are moving from the right to make a left hand turn. These issues plague our streets and need to be addressed. Many bike activists are gaining public and private attention. It's clear that bike lanes have taken on a momentum of their own. Another way to accommodate for the cyclists in our inner cities is by introducing bike boulevards.

Bike boulevards are increasingly gaining favor among bike planners and activists because they give cyclists a corridor. These corridors typically work best in areas where there is a good grid system of streets. The best bike boulevards are low traffic streets that discourage all but some auto travel while providing a good through route for cyclists.

Peter Jacobson also has been an activist in another debate over bike safety. He has argued against helmets as they discourage cycling by building the impression that cycling is dangerous and risky.2 This may or may not be true, but however we accomplish bicycling safety, it does not lie in whether or not we wear helmets but it is in the design, speed, and use of the roads.

If you expand your definition of safety to include living a long and healthy life, there is no comparison. Staying physically active is good for your health and well-being. When we think of health, we usually associate it with sicknesses and diseases. Our society works hard to take preventive care to find cures for diseases that pose problems for our society. And we have been relatively successful; however, an epidemic we must face is chronic disease. Chronic diseases are related to Americans sedentary lifestyles: cancer, heart disease, diabetes, depression, and anxiety issues. There is no medication in the world that can cure these chronic diseases. However, increased bike systems and connections may very well be the antibiotics of the twenty-first century.

The health community has adopted the view that the only way to get Americans to exercise regularly is to incorporate exercise into their daily lives. Staying physically active affects physical and mental health. There have been many grim studies done about the inactive lifestyles many Americans are choosing to live. The obesity epidemic was referred to as the "terror within" by Surgeon General Richard Carmona in 2006. The report also pointed to cycling as one alternative to short car trips that would physical activity of our sedentary lifestyles.

Safety risks of cycling are outweighed by the personal health benefits that we would receive. Mayer Hillman's study for the British Medical Association, "Cycling Towards Health and Safety," published in 1993, concluded that regular cycling added twenty years of life for every year lost to fatal crashes.

John Pucher, a professor at Rutgers University, views Americans dependency on the car as a disease. "It is an addiction, it is such a strong habit that people don't even think of doing it another way."

2) Ian Walker, a researcher in Cambridge England who electronically measured how close drivers came when they passed as he cycled. He found that drivers gave him more leeway when he wasn't wearing a helmet and even more when we was wearing a long blonde wig. The point is that cycling safety sometimes has to do with the actions of the motorists around the rider.

We have a very large cultural blind spot when it comes to cars. Using the roads by any means is one of the most dangerous things you can do on a daily basis; in a car you become a tremendous danger to yourselves and others.

When everybody drives, the perceived cost of not driving is too high to be an attractive choice. Changes are needed at once in order to overcome the safety obstacles that deter cyclists from using the bike systems. We can start with improving the bicycle infrastructure, bike boulevards, and slower traffic speeds. For cycling to work, cyclists must be viewed as herds of sheep rather than lone wolves.

Research Questions

How to incorporate bikes onto Nicollet Mall?

What pavement treatments should be used?

What intersection improvements can be made?

How to connect Nicollet Mall to an already existing bike system?

How many bikes can Nicollet Mall accommodate?

Where can cyclists park their bikes along Nicollet Mall?

Should there be a speed limit set for cyclists?

What should the posted speed limit be for motorized vehicles?

Should there be a posted speed limit for non-motorized transportation?

How will biking be designated along MN State Highway 65?

How to transition the cyclist from a cycling corridor into a street with motorized vehicles?

How will stop lights acknowledge a cyclists presence?

How wide should the bike lane be?

What is a reasonable buffer distance between cyclists and other users?

How does biking along MN State Highway 65 improve one's health?

Does safety increase for cyclists when cycling in general increases?

Research Hypothesis

Minnesota State Highway 65 in Minneapolis can be repurposed to emphasize cyclist safety as one component of a multimodal network to increase non-motorized transportation to and from the central business district.

Case Study

Project Name North Williams Traffic Operations Safety Project

Location North Williams Avenue – From N. Weidler Street to N. Killingsworth Street, Portland, Oregon

Date Designed/ planned April of 2012 after 16-month planning process

Construction Completed September 2014

Construction Cost Street Improvements $1,471,000

Size Two mile stretch of road with 34 intersections

Landscape Architect(s) N/A

Client/ Developer City of Portland Bureau of Transportation

Consultants/ Architects Alta Planning and Design and Kittelson & Associates Inc. Transportation Engineering and Planning

Managed By City of Portland Bureau of Transportation

Context

North Williams Avenue is a northbound one-way street and an existing multimodal corridor with a bikeway. The street runs through the heart of the historic community, one of Portland's oldest neighborhoods and once an independent city. North Williams Avenue is a historic "main street" for Portland's African-American community. The project focused on an approximately two-mile stretch from North Weidler Way to Killingsworth Street accommodating 34 intersections in the corridor.

Bicycling - North Williams is one of the busiest bikeways in Portland. Its popularity is partially due to the directness of the route in comparison to alternate streets. Adjacent north-south streets do not go straight through and often require difficult crossings at major east-west streets.

Walking - The corridor contains several attractors for people walking, with high crossing demands in a number of locations.

Transit - The corridor offers frequent transit service with TriMet bus routes.

Motor Vehicle – North Williams is designated as a Neighborhood Collector in the City's Transportation System Plan. Neighborhood Collectors generally have higher traffic volumes than local service streets. Motor vehicle volumes vary along the corridor. Motor vehicle volumes range from 700 to 1,100 vehicles per hour during the evening peak.

Site Analysis Left

Side Buffered Bike Lane: The preferred concept for the majority of the corridor is a left-side buffered bike lane with strategically placed pedestrian crossing improvements (see Figure 5). This concept involves converting the westside motor vehicle travel lane into a buffered bike lane. The advantages of this concept include:

Traffic Calming: The buffered bike lane is created by eliminating a motor vehicle travel lane. This reduction in capacity has a slowing effect on motor vehicles.

Eliminates bus/bike conflict: Under this concept bicyclists and transit operators will only be required to navigate the same roadway space at Fremont Street, where the #4 bus turns left.

Safe passing: The left-side buffered bike lane provides space for bicyclists to safely pass one another without needing to enter the adjacent motor vehicle lane.

Increased separation of bicyclists and motorists: As the speed differential between bicyclists and motor vehicles increases, the comfort of bicyclists decreases. The threefoot buffer that separates the bike lane from the motor vehicle lane helps to mitigate this problem and creates a more comfortable environment for all road users.

Reduced threat of "dooring" incidents: The buffered bike lane concept provides a twofoot painted buffer between the parking lane and the bike lane and a three-foot buffer between the bike lane and adjacent travel lane. This creates greater distance between the space where car doors are opening and the area where bicyclists are riding, as well as greater navigating area on the through lane side, should the bicyclist have to swerve to avoid an opening door. In addition, having the bike lane on the left side moves the conflict zone between the car door and the cyclist to the passenger side rather than the driver side. Passenger-side doors open less frequently than driver's-side doors.

Emergency service vehicle access: A buffered bike lane does not create a hard barrier between the motor vehicle and bicycle travel lane. Bikes and motor vehicles alike can move to the sides of the street to allow enough room for emergency vehicles to pass in the middle of the roadway.

Shared Left-Side Bikeway and Left-Turn Lane: In the commercial corridor between Fremont Street and Skidmore Street, approximately five city blocks, the Committee wanted to maintain two motor vehicle travel lanes and on-street parking. To provide a low-stress bikeway under these conditions it recommended an innovative approach: the left-hand lane will be for bicycles and for cars that are parking, unparking or making a left turn within one block.

The shared left-side bikeway and left-turn lane utilizes a traffic diverter at the end of each block that allows bicyclists to pass through and continue straight on North Williams, but prevents motorists from continuing straight (see Figure 6). This design is intended to create a lowvolume and low-speed shared bike and motor vehicle lane. The City will use ample and thoughtful pavement markings, signs and educational campaigns to teach travelers on North Williams how to bike and drive in the new lane.

Project Background/ History

The typical street had a curb-to-curb width of 40' that included parking on both sides of the street, two travel lanes, and a five-foot – six-foot wide bike lane. The existing bike lanes were added to North Williams Avenue in 1999 by narrowing the two motor vehicle travel lanes. This project was also influenced by previous planning work conducted in 2006 as part of the Vancouver-Williams Transportation Project. In that 2006 project, a committee recommended pedestrian safety improvements. City staff for the North Williams Traffic Operations Safety Project expanded on this work by approaching the re-design of the streetscape with seven initial project goals that were later expanded to address specific desirable project outcomes. The North Williams Traffic Operations Safety Project relied heavily on input from a Stakeholder Advisory Committee, comprised of local residents, small business owners, religious leaders and transportation advocates, to design alternative concepts for the street.

Genesis of Project

Major changes were needed to improve safety for all travelers along North Williams Avenue, a corridor that serves a growing neighborhood as well as being a popular commuting route for vehicles, bicycles and transit to downtown Portland. The purpose of the North Williams Traffic Operations Safety Project was to conduct an open, community-driven planning process to identify strategies for making travel on North Williams Avenue safer and more comfortable for all roadway users.

Design, Development and Decision-Making Process

Public outreach began with City staff and consultants going door-to-door on North Williams, conducting interviews and inviting neighbors to join the project's Stakeholder Advisory Committee. The first Committee meeting was held in February, 2011. Early planning for this project focused on technical transportation issues. Committee members and the public were concerned, however, that the City was ignoring and exacerbating issues of race, gentrification, and equity. In response to their concerns and requests, the project team extended the public process, broadened the topics the Advisory Committee would address, and emphasized outreach to the older residents, people of color and low-income neighbors who often do not have access to transportation planning processes.

Role of Landscape Architects N/A

Program Elements

- Increase convenient opportunities for pedestrians to safely cross North Williams
- Mitigate conflicts between all modes of transportation
- Reduce motor vehicle speeds
- Improve the visibility of pedestrians
- Reduce the risk of cyclists being struck by opening car doors
- Create opportunities for people bicycling to pass one another without entering the motor vehicle travel lane
- Manage conflicts between bus and bicycle lane operations
- Reduce all crashes in the North Williams corridor
- Maintain or improve the ease with which people bicycling can turn on and off of Williams
- Maintain access and operability for TriMet LIFT vehicles and private lift-equipped vans

Maintenance and Management

The city of Portland's Bureau of Transportation is responsible for all maintenance and management of North Williams, as well as all the other streets and corridors in Portland. In order for them to know which roads need repair, or reconstruction, bureau staff rate the condition of the streets. The staff utilizes a rating tool called the Pavement Condition Index (PCI). This pavement management system calculates costs and prioritizes maintenance work based on the rating level of the street. All streets receive a visual inspection that results in a numerical rating between 0 and 100, placing them between "Very Poor" to "Very Good".

Peer Reviews N/A

Criticism

North Williams Ave. safety project has been under criticism from locals for the lack of a landscape architect to help guide and direct the safety project. Design starts with client needs, researching the site, identifying possible uses, and gathering community feedback. Landscape architects focus on the inventory, analysis, planning and the stewardship of the land before any design begins. Landscape architects offer a valuable service in projects, such as North Williams by understanding the full site and surroundings.

Significance and Uniqueness of Project

As part of developing a balanced multimodal transportation system, the City of Portland is a leader in providing bicycle and pedestrian facilities. Improved safety for all modes is the primary objective of the project. The recommended design accomplishes this generally by:

Slowing traffic speeds – Through a 'road diet' of N. Williams Ave. this will eliminate one of the two travel lanes forcing motorists to slow down

Creating better separation between users – Left side buffered bicycle lanes are designed to remove the cyclist from bus traffic (pulling into and away from bus stops) and substantially reduce motorists driver-side, door opening accidents with cyclists

Spot improvements that reduce conflicts at intersections – By increasing line of sight distance and crossing gaps at intersections

Limitations

North Williams Ave. is a multimodal corridor accommodating safety for all users, regardless of age, ability, or mode of transportation. This means that the corridor will make the street safer for motorists, public transportation, pedestrians, and bicyclists. There is no singular design prescription for North Williams Ave. as every street is unique and responds to communities' context in a different way. The main limitations for North Williams Ave. were community heritage and historical significance of the neighborhoods as they were not considered in the beginning phase of the project.

Generalizable Features and Lessons

The lack of community involvement and outreach that lead to many stakeholders vocalizing their concerns is a lesson for all future multimodal projects. This project demonstrates that Portland has to use extreme care to ensure that all stakeholders are represented from the start of a project, and that the city must allow opportunity for all perspectives when making decisions. Along with this, planners and city staff must make efforts to understand the social context of neighborhoods with additional efforts being made to bring historical significance to projects.

Future Issues/ Plans

Like most other multimodal corridors, North Williams Ave. will continue to evolve and become a precedent for other multimodal corridors. Due to the recent completion of improvements to North Williams Ave., no plans, as of yet, have been assessed to further improve upon the safety operations. However, with the complete street and multimodal movement continually building momentum, further safety improvement and innovative ideas are to come. North Williams Ave. will change and evolve, as for now its essential qualities will be examined for future projects.

Methodology

Approach to Research

The bicycle could become an important part of the twenty-first century transportation system. Minneapolis, MN, has more than doubled the number of bike facilities offered throughout the city for cyclists. Safety is one concern that discourages individuals to choose two-wheel transportation over four-wheel means. Creating a bike boulevard along State Highway 65 would create safer travel in and out of the business district in downtown Minneapolis. As part of the greening initiative the Downtown Council of Minneapolis is supporting, understanding the external and internal factors to increase cycling in Minneapolis will have a positive impact on public health. In order to increase the number of cyclists several quantitative and qualitative research questions must be analyzed:

- What bike facilities should be adopted?
- What is the maximum number of cyclists that MN State Highway 65 can accommodate?
- How are health benefits related to the increased safety of cyclists?
- What improvements to safety conditions will increase the number of cyclists?
- How will different user's effect design considerations at intersections?
- What connections can be made to existing bike facilities?

Site Introduction

My thesis project focuses on the development of a bike boulevard along State Highway 65 in Minneapolis, MN; my proposed plan encompasses a cyclist corridor integrating urban bicycling as one component to promote non-motorized transportation. Minneapolis has been ranked as one of the best biking cities in the nation by numerous organizations and magazines. With more than 92 miles of on-street bikeways and lanes and 85 miles of off-street paths the city has the bike infrastructure to support those who live and work in the city to use bicycles as a healthy and low-cost way to travel. Minnesota State Highway 65, which runs through downtown Minneapolis, Minnesota, serves as a south–north route between Minneapolis and surrounding suburbs of Fridley, Blaine, Cambridge, Mora, McGregor, Nashwauk, and Littlefork in east–central and northeast Minnesota. In this project, I propose to repurpose the eight-block stretch from the intersection of East Hennepin Avenue to the intersection of South Fourth Street. This stretch offers a secondary connection across the Mississippi River with the primary connection a few blocks north connecting cyclists, pedestrians, public transportation, and motorists to the downtown area. Currently, State Highway 65 is a four-lane expressway with bike lanes on either side of the road, but there is support from both public and private sectors of Minneapolis to green downtown Minneapolis and make the area vibrant for the community and the central business district. This is not the first time that downtown Minneapolis has been re-envisioned spurring infrastructural change in the central business district but, was once re-envisioned with the movement known today as suburbanization.

Downtowns may be perceived as dirty, dangerous and chaotic which resulted in businesses movement out to suburbs following consumers. The central business district has been the heart of downtown Minneapolis' for a century before it was re-designed with the loss of business associated with suburbanization. The revitalization movement was in response by the Downtown Council of Minneapolis to preserve the business district as a destination for people moving out to the suburbs. The intuitive optimism in the redesign project of the area gained Minneapolis a reputation as a city willing to take big risks (Martin and Goddard 1989). Further, strengthening the infrastructural redesigns by creating a bike boulevard will continue to reshape the vibrant atmosphere of downtown Minneapolis.

Client / User Description

For those who Love cities, and believe that they must endure if civilization as we know it is to be perpetuated, Minneapolis offers more than a model. It offers hope (Minneapolis Collection).

The client for this project would be the Downtown Council of Minneapolis. Founded in 1955, the Downtown Council of Minneapolis is a membership-based organization that helps to create a vibrant Minneapolis. The DCM goals are to create a greener, cleaner and a safer Downtown. Greening is a core value for the Downtown Council's vision for new plans that call for increased greening efforts in the public realm. A bike boulevard along Minnesota State Highway 65 would be considered a downtown asset that would attract people and fortify Minneapolis as a model city offering hope for the future.

Users of the site would be Minneapolis community members, including commuters to and from the downtown area. Means of non-motorized transportation means include but not
limited to:

- Cyclists
- Pedestrians
- Other non-motorized vehicles
- Public transportation

The bike boulevard would stimulate street changes creating a safer route for users to travel through the inner city more quickly than cars.

Data Measures

Initially, improving the safety of State Highway 65 for non-motorized transportation requires qualitative and quantitative research methods. These data measures will be used to further understand the issues pertaining to the safety and public health. Two administered public surveys will gather information relevant to the public's experiences, reactions, beliefs, and ideas about how cycling is perceived. A survey approach is beneficial here to evaluate the public's perception of the safety that the bike facilities currently create and what safety improvements must be made to increase non-motorized transportation.

A preference survey based on people's views of bicycle facilities will be administered to measure how much additional travel time people are willing to spend to use safer, more enhanced cycling facilities rather than Minneapolis' current bike facility systems. This survey will gauge the community's preferences for bike facilities to determine the appropriate application for the proposed bike boulevard.

The second administered public survey will focus on the connectivity to other bike facilities, to evaluate what will encourage individuals to take non-motorized trips rather than trips in a car. It is important to understand commuter's trends and trips to effectively incorporate a bike facility that will promote safe cycling through Minneapolis.

Subsequently, the next step in gathering relevant data would be to analyze ejournals, books, and academic articles to assist in gathering relative information about improving safety of bike facilities, this will act as a source and a guide to create statistical data for a more conclusive analysis. The research collected will establish the recommended improvements that will positively impact public health and safety of cycling in Minneapolis.

The first quantitative measure would be evaluating demographics around State Highway 65 and the connection it makes with the business district. Collected through census data, understanding the potential users of the bike boulevard will determine the amount of traffic the bike boulevard will have to account for on a daily basis and identify the potential users of the bike facility.

The next quantitative measure will focus on health benefits associated with the safety of the bike boulevard. As for a direct outcome on health benefits it is hard to measure however, I looked at existing data from scientific studies and evaluating the relative risks of mortality for commuters who use bicycles compared to other transportation modes, will present quantifiable statistics that then can be related to health benefits.

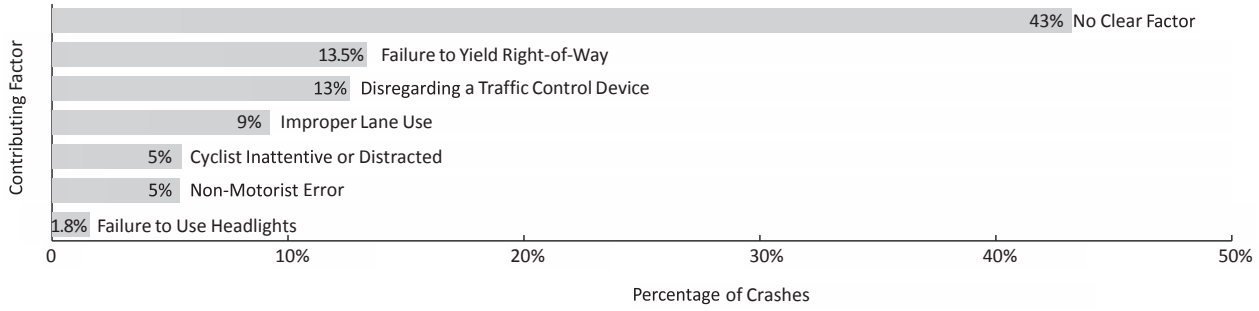
The final quantitative measure focuses in on the design of the intersections. Designing multimodal intersections must accommodate cyclists, pedestrians, cars, buses, and sometime other transportation modes. Therefore, design of the intersections bisecting the bike boulevard need to be on a case-by-case basis. The design encompasses the approaches, medians, streetscapes, and adjacent land uses. Through collecting literature already proven and analyzed identifying the treatments for each intersection will be based on extenuating circumstances.

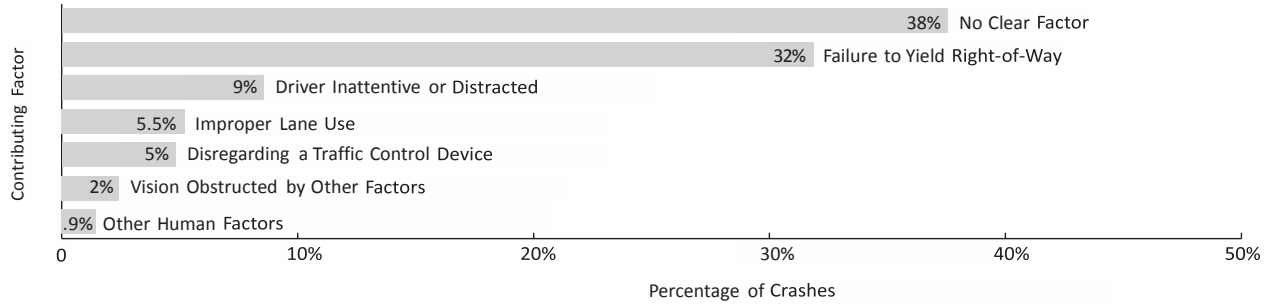
Results

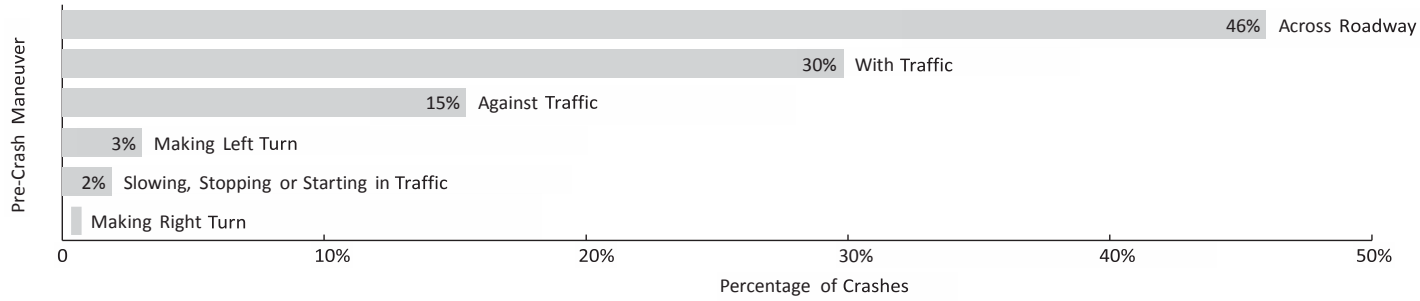
Research Findings

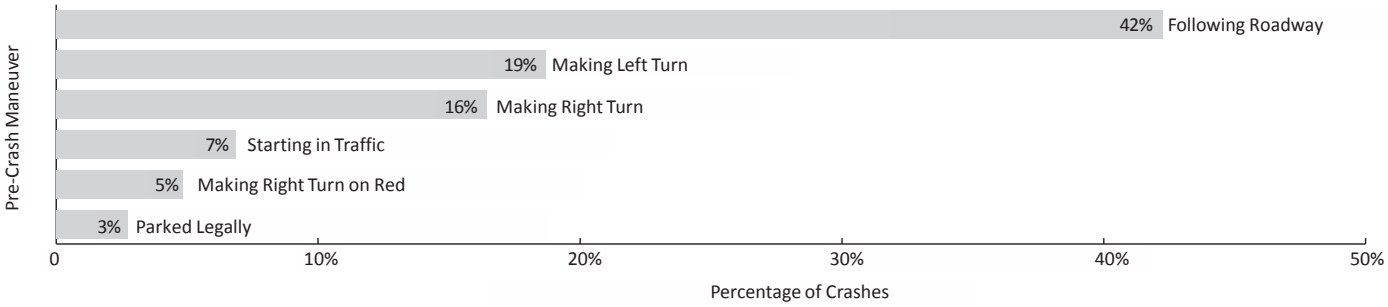
What is causing crashes?

Safety is the number one factor discouraging people from cycling. Bicycle infrastructure impacts the safety of cycling by two means; by making cycling a more attractive and comfortable choice and secondly by providing a physical protection against other means of traffic. To understand safety at its core analyzing crash causes will help determine design features that can positively impact urban cyclist's safety. Using this data set, contributing factors and pre-crash maneuvers are the best indicators of the cause of a crash. This section outlines the top contributing factors and pre-crash maneuvers for both bicyclists and motorists.

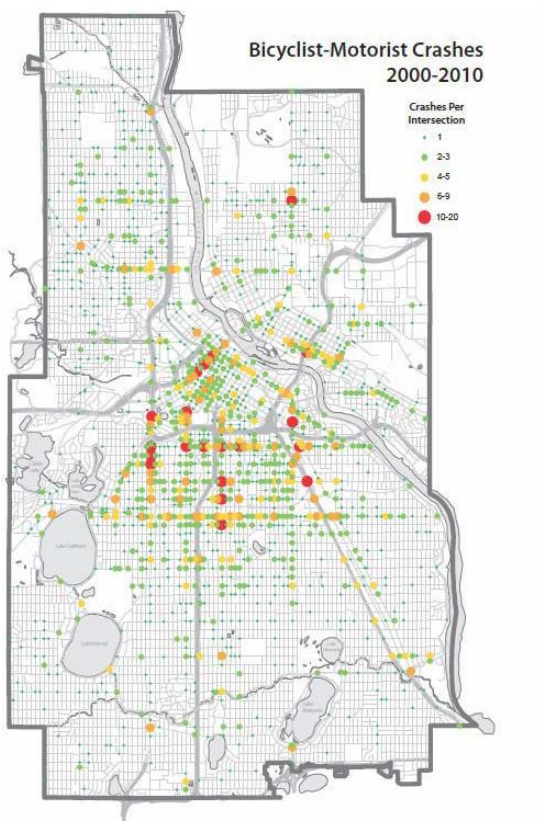


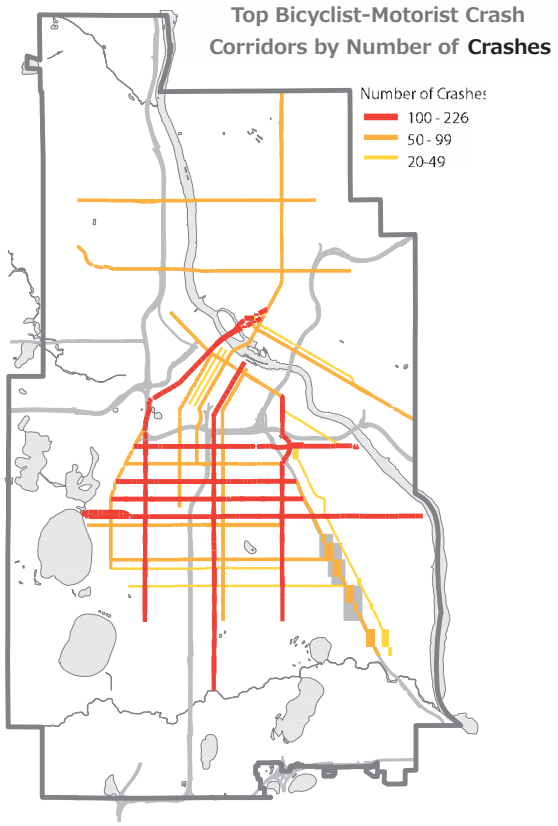

Contributing Factor
38% No Clear Factor
32% Failure to Yield Right-of-Way
9% Driver Inattentive or Distracted
5.5% Improper Lane Use
5% Disregarding a Traffic Control Device
2% Vision Obstructed by Other Factors
.9% Other Human Factors
0
10%
20%
30%
40%
50%
Percentage of Crashes


Pre-Crash Maneuver
46% Across Roadway
30% With Traffic
15% Against Traffic
3% Making Left Turn
2% Slowing, Stopping or Starting in Traffic
Making Right Turn
0
10%
20%
30%
40%
50%
Percentage of Crashes


Pre-Crash Maneuver
42% Following Roadway
19% Making Left Turn
16% Making Right Turn
7% Starting in Traffic
5% Making Right Turn on Red
3% Parked Legally
0
10%
20%
30%
40%
50%
Percentage of Crashes

Where are bicyclist-motorist crashes happening in Minneapolis?





Minneapolis conducted a city wide cyclist study on crashes from 2000 – 2010 analyzing cyclistmotorist accidents. The figures above represent a comparison of crash density and crashes along corridors. Crashes are complex events as many factors contribute to them. However, the study determined that three primary crash instances were occurring:

- Most crashes are occurring at intersections along major arterials.
- Motorists are not seeing or yielding to bicyclists.
- Bicyclists are not riding in a predictable manner.

What types of cyclists will utilize an implemented bike facility on MN State Highway 65?

Commonly, we associate users of the road to include public transportation, motorists, cyclists, and pedestrians. These road users are generalized and can be separated further within their groupings. For instance, cyclists are a highly diverse, highly segmentable population as they can be broken down into age groups – children or adults. Another way in which cyclists have been segmented is based on whether their cycling for leisure, fitness, or commuting.

So what is the best way to segment the cycling population?

What types of cyclist will utilize Minnesota State Highway 65?

The answer may not be as simple as some may like because segmentation exists and the cycling population will depend on who is attracted to the area. For the true answer we must look to the demographics and the amenities of downtown Minneapolis in the inventory to understand what types of cyclist will be utilizing the bike boulevard. As for now we can assume that segmentation for the area is likely to involve some or all of the following variables:

- Age
- Gender
- Reasons to cycle
- Cycling patterns
- Cycling approaches used

It is also important to remember that individuals may belong to more than one group: for example, a single person may commute to work, use cycling as an escape activity with their family, and sometimes cycle with their children to the shops.

How health benefits are related to the increased safety of cyclists?

To be fit and healthy you need to be physically active. Cycling is a healthy, low-impact exercise that can be used for physical activity. To be physically active through cycling, research shows that safety conditions have to increase to encourage people to utilize the facilities offered. Regular physical activity can help protect you from serious diseases such as obesity, heart disease, stroke, diabetes, and high blood pressure. Riding your bicycle regularly is one of the best ways to reduce your risk of health problems associated with a sedentary lifestyle.

Cycling is a healthy, low-impact exercise that can be enjoyed by people of all ages, from young children to older adults. It gives your heart, blood vessels and lungs a good workout. It is also fun, cheap and good for the environment.

Riding to work or the shops is one of the most time-efficient ways to combine regular exercise with your everyday routine. An estimated one billion people ride bicycles every day – for transport, recreation and sport.

*Low impact exercise – it causes less strain and injuries on the joints than most other forms of exercise

What improvements to safety conditions will increase the number of cyclists?

Direct –
The term "separated bicycle facility" is generally used to refer to bicycle facilities that follow street alignments but where there is a physical separation between the bicycle travel area and the motor vehicle travel area, often through barriers or grade separation. They are referred to as buffered bike lanes, raised bike lanes, cycle tracks, or one-way bike paths. They incorporate the convenience of riding on the street with the advantages of physical separation from motor vehicle traffic.

Separated bicycle facilities also provide the necessary support for a greater range of people, including children and those who are handicapped to choose to ride a bicycle.

Indirect –
There is evidence that one of the main factors influencing the individual safety of cyclists is the number of cyclists using the roads, commonly called the safety in numbers effect. Cycling increases on routes with cycling facilities. With greater numbers of cyclists in relation to motorists, the safety in number effect is seen.

A wide ranging study by P L Jacobsen found that as cycling and walking increase, the chance that a given cyclist will be struck by a motor vehicle actually decreases. This pattern is consistent across communities of varying size, from specific intersections to cities and countries, and across time periods. Jacobsen found that doubling the number of cyclists on the road tends to bring about a 1/3 drop in the per-cyclist frequency of a crash with a motor vehicle.

How the different users impact the design considerations at intersections?

Physical protection was one safety element that people would like to see improve for them to take to their two wheels. What a protected bike lane needs is a protected intersection. Modeled after Dutch intersection designs, the Protected Intersection brings the physical protection of a separated bike lane along through with you as you navigate the intersection. A collection of design elements makes left turns simple and secure, right turns protected and fast, and provides straight through movements that minimize or eliminate conflicts from turning cars. There are four main elements to protected intersection designs:

- Corner Refuge Island
- Forward Stop Bar for Bicyclists
- Setback bike and pedestrian crossing
- Bicycle Friendly Signal phasing

The Corner Refuge Island -
The corner refuge island brings the protective barrier from the bike lane far into the intersection. The island physically separates bicyclists as they make right turns, and provide a secure refuge for those waiting at a red signal protected from moving cars.

IThe Forward Stop Bar -
While people driving must stop back behind the crosswalk, people on bikes may yield to pedestrians, and stop at a bicycle waiting area farther ahead in the intersection. Bicyclists turning left also use this space to wait when making a left turn.

The Setback Crossing -
The bike lane bends away from the intersection to create a setback bicycle and pedestrian crossing. The setback provides all users the space and time to react to each other. Typically, one car length is given for the setback distance.

Bicycle-Friendly Signal Phasing -
The last, element of a protected intersection is the use of bicycle specific. Just like cars have designated lights, cyclists should have signal lights of their own to control when different users should precede through the intersection.

Applicable Site Values

Connectivity, Public Health, Bridge River Crossing, Safety

Plan for Proceeding

Week 1, December 28th – January 3rd : Prepare a detailed/ polished AutoCAD basemap and start working on a Sketchup model of existing infrastructural buildings, sidewalks, roads, and bridges

Week 2, January 4th – January 10th : Develop a Conceptual Plan of the bike boulevard

Week 3, January 11th – January 17th : Finalize the Conceptual Plan of the bike boulevard

Week 4, January 18th – January 24th : Develop a Schematic Plan of the bike boulevard

Week 5, January 25th – January 31st : Finalize a Schematic Plan of the bike boulevard

Week 6, February 1st – February 7th : Develop a detailed Master Plan for the bike boulevard

Week 7, February 8th – February 14th : Finalize the detailed Master Plan of the Bike boulevard

Week 8, February 15th – February 21st : Finish Sketchup model of existing infrastructure

Week 9, February 22nd – February 28th : Begin creating the proposed Sketchup model of the site

Week 10, March 1st – March 7th : Finalize the proposed Sketchup model of the bike boulevard

Week 11, March 8th – March 14th : Begin developing renderings and perspective of essential elements and programs along the bike boulevard

Week 12, March 15th – March 21st : Continue working on renderings and perspectives

Week 13, March 22nd – March 28th : Finish renderings and perspectives

Week 14, March 29th – April 4th : Prepare text that will accompany all presentation images

Week 15, April 5th – April 11th : Start laying out of presentation boards

Week 16, April 12th – April 18th : Finish laying out of presentation boards

Week 17, April 19th – April 25th : Create final booklet from the thesis project/ Plot presentation

Week 18, April 26th – May 2nd : Practice and present thesis presentation

Design Goals

Theoretical –
Create a safe multimodal environment that encourages bicycling as a safe and convenient means of transportation in Minneapolis, MN for all segmented cyclist groups.

Improve the safety of non-motorized transportation by increasing the number of cyclists using bike facilities offered throughout the city, a theory called safety in numbers.

Reduce conflicts between public transportation, motorists, cyclists, and pedestrians by implementing treatments applicable to a street and/or intersection.

Physical –
Develop a bike boulevard supporting current on-street and off-street bike facilities, as well as form a bridge connection over the Mississippi River to the Minneapolis business district.

Develop a low-stress bicycle route that connects important destinations in the city and promotes safe travel in and between city neighborhoods into downtown Minneapolis.

Provide wayfinding maps and well-designed transitions at intersections along MN State Highway 65 to current on-street bike facilities.

Social –
Promoting air quality benefits, fossil fuel savings, and public health benefits from physical activity in Minneapolis, MN.

Encourage bicycling as a low-impact exercise for sedentary people to become physically active to improve chronic health conditions.

- Obesity
- Diabetes
- High blood pressure
- Stroke
- Heart Disease

Inventory

Site Elements

Physiography -
Minneapolis, a city by nature; an ecosystem by urban life reminds city dwellers of their place in an evolving atmosphere. Cities are often thought to be separate from nature, but recent trends demand that we consider them as part of the environment. Understanding urban life and culture are crucial to analyze the ever changing cities that we live in.

Climate -
Minneapolis is subjected to many temperatures ranging from, on average, 15.6 °F in January to 73.8 °F in July. Throughout the winter months Minneapolis experiences many arctic air masses. These arctic air masses bring with them very cold temperatures and sometimes strong winds, resulting in dangerous wind advisories. Summer month temperatures can be subject to very hot temperatures from May to August, and very high humidity as well.

Hydrology -
During the spring and summer month's precipitation is a common occurrence, while snow, sleet, and freezing rain during the winter. The summer months of June, July and August account for nearly half of the annual precipitation total across the Twin Cities. The average annual snowfall in the Twin Cities is 45.3 inches.

Land Use -
This section will display the existing and future land use GIS maps for Minneapolis and describes their features. These maps are graphic depictions of the growth and development in the City of Minneapolis.

- Urban Neighborhood - Residential areas range in denseness, with highest dense neighborhoods concentrated around identified nodes and corridors closer to Downtown Minneapolis. While less dense neighborhoods are scattered further out from the business district and the main growth center of Minneapolis.

- General Commercial - Includes a broad range of commercial uses that focus on consumer needs and wants.

- Mixed Use - Mixed use may include either a mix of retail, office or residential uses within a building or within a district. There is no requirement that every building be mixed use.

- Public and Institutional - Accommodates public and semi-public uses, including museums, hospitals, civic uses, stadiums, airport related uses, and college and university campuses.

- Open Space and Parks - Applies to land or water areas generally free from development. Primarily used for park and recreation purposes, natural resource conservation, or historic or scenic purposes.

- Industrial - Includes areas suited for industrial development and limited supporting commercial uses.

- Transitional Industrial - Industrial areas located outside of Industrial Employment Districts may eventually evolve to other uses compatible with surrounding development.

Zoning -

- B4 – Downtown Business District
- B4S – Downtown Service District
- B4C – Downtown Commercial District
- B4N – Downtown Neighborhood District
- C2 – Neighborhood Corridor Commercial District
- C3A – Community Activity Center District
- I1 – Light Industrial District
- R5 – Multiple-family District
- R1 – Single-family District
- R2 – Two-family District

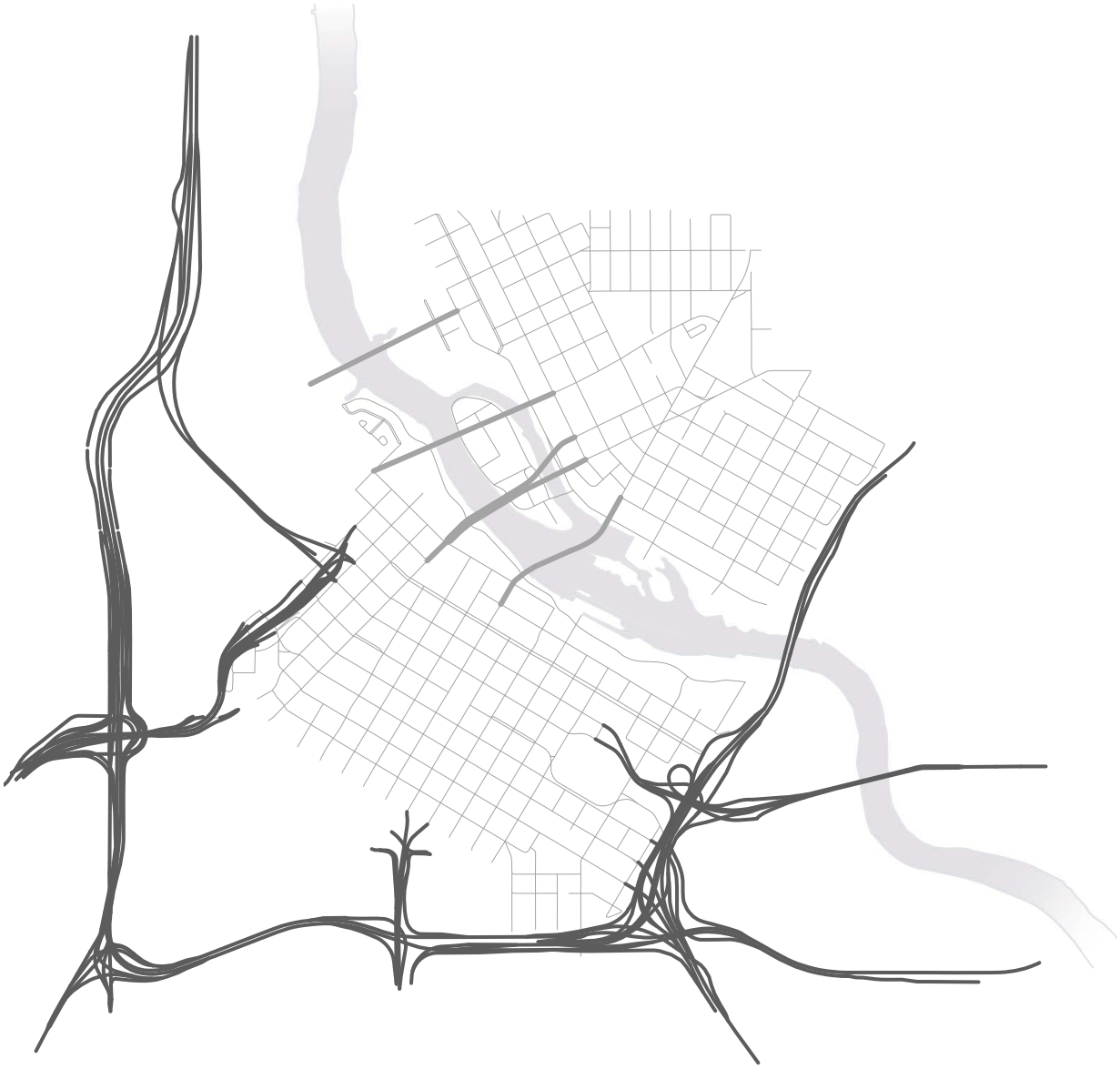
Culture/ Arts -
Throughout Minneapolis public artworks contribute to livability and vibrancy of public places in the City. They build pride in community and cultural heritage while inspiring discussion about issues affecting quality of life and future aspirations. The process of developing public artworks builds the capacity of artists and community leaders to shape City spaces and neighborhoods. For over 30 years, the City of Minneapolis has enriched the lives of citizens and visitors by integrating public art into city planning, services design and infrastructure. The City's Public Art Program features:

- New Commissions through the Art in Public Places program
- The conservation and maintenance of the City's collection of over 60 works located in all parts of Minneapolis
- Support to other departments and agencies developing public facilities, infrastructure, and public art projects
- Permits to neighborhoods and community groups for art projects in the public realm

Bus Routes -

Traffic Volumes -

Bridge Crossings -

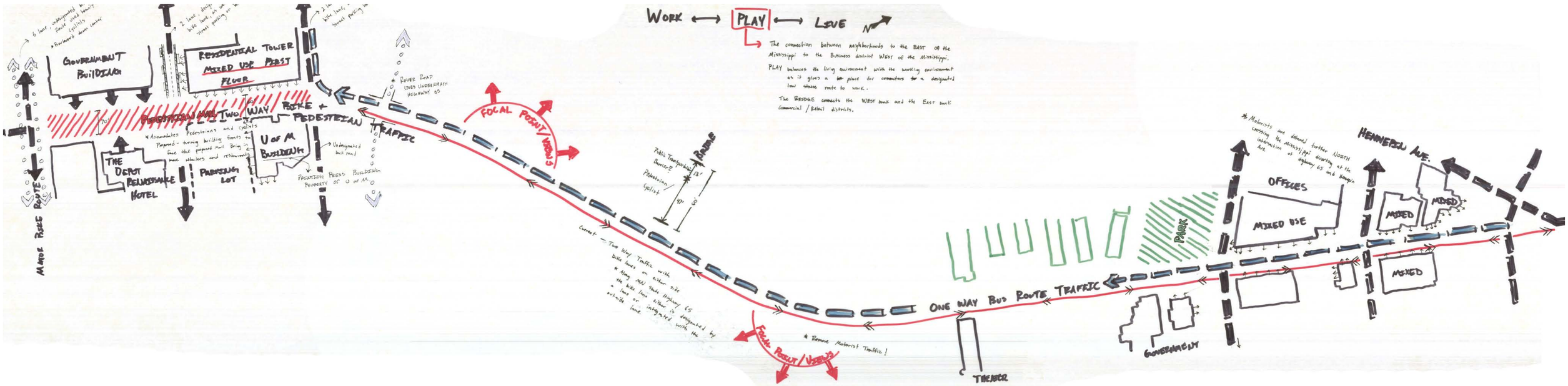


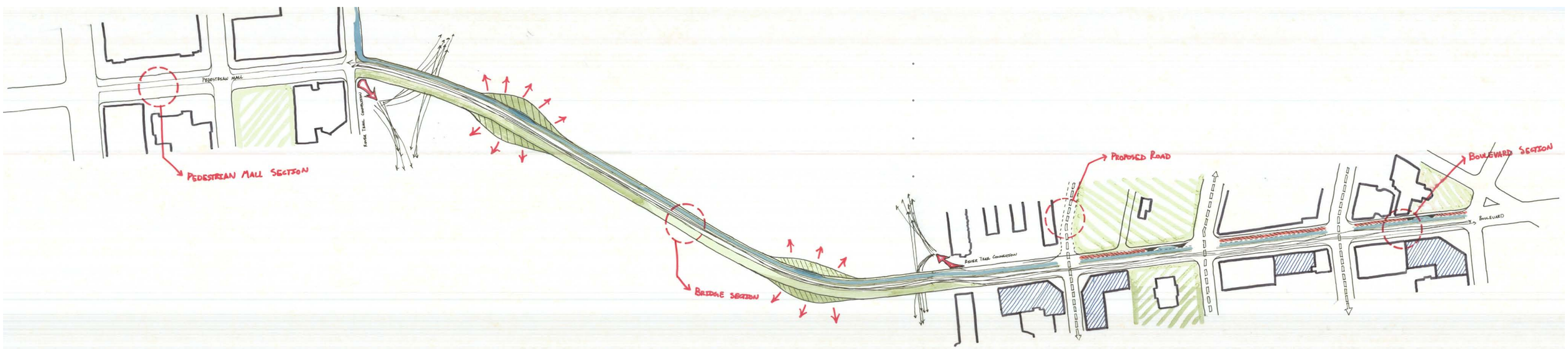
Proximity to Bike Lanes and Trails -

Site Location -

Design Development

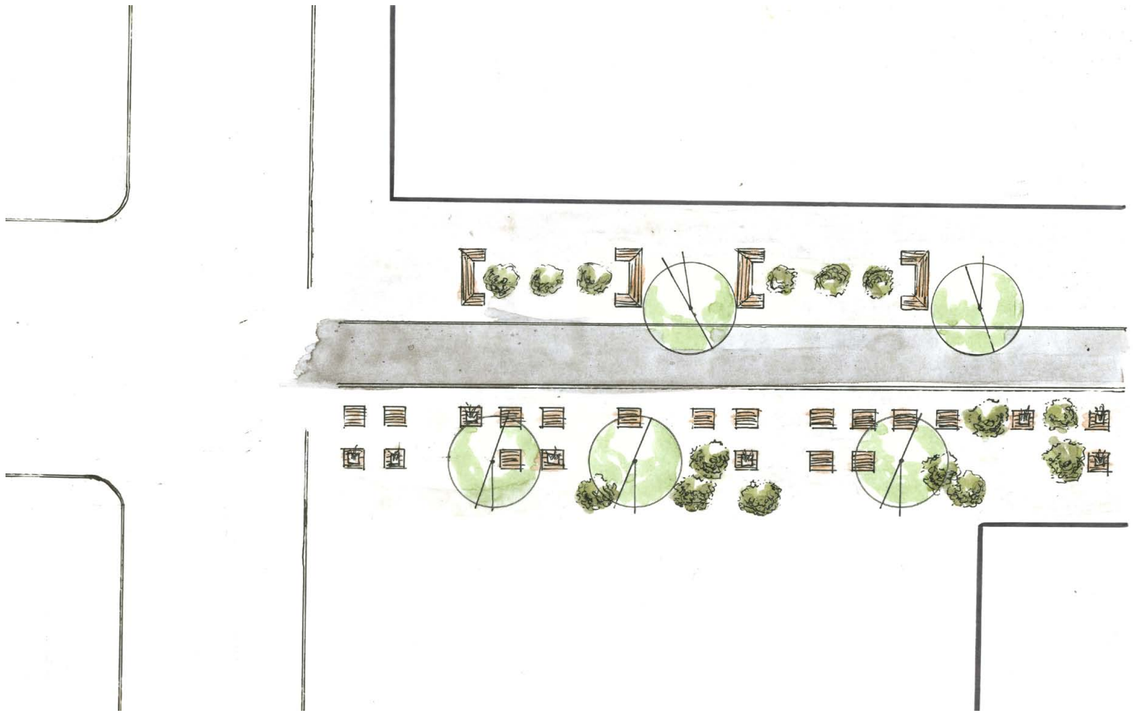
Schematic Development



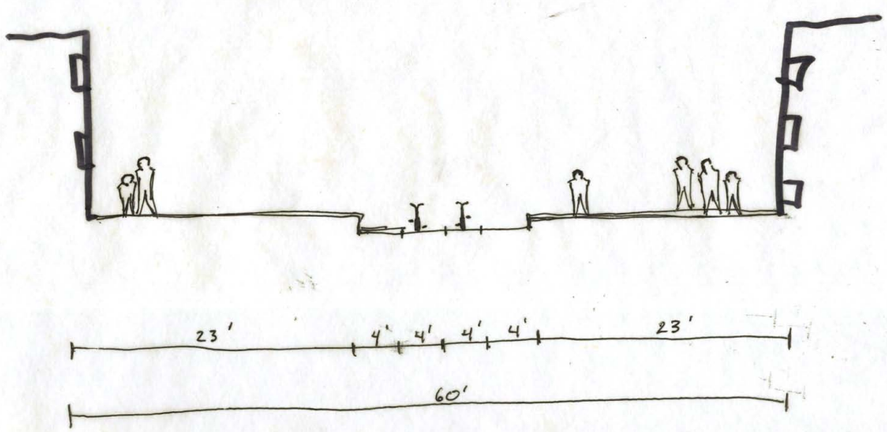


Repurposing Central Avenue SE: A Multimodal Urban Cyclist Corridor

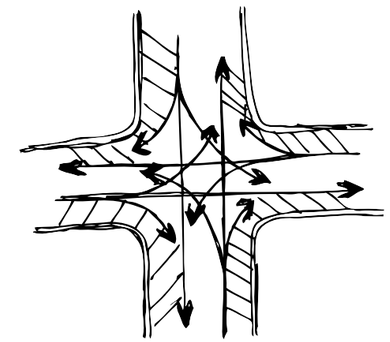
Pedestrian Mall Schematic Development



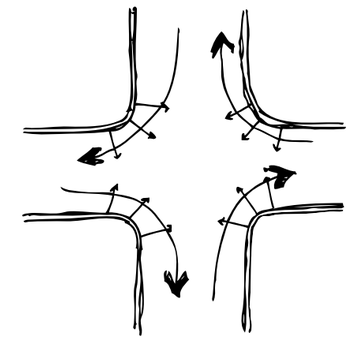
Pedestrian Mall Section



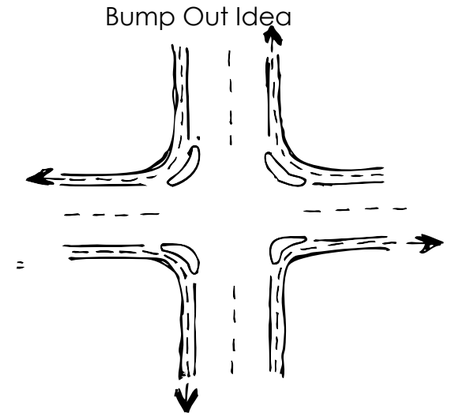
Ways Through Intersection



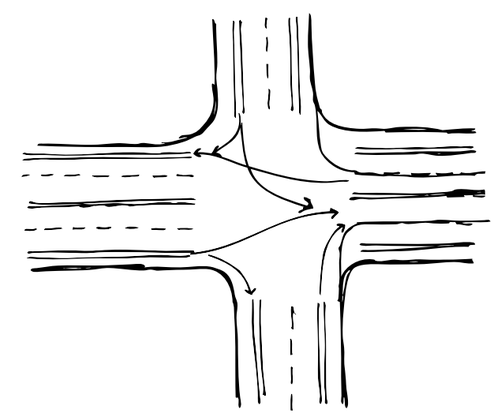
Bump Out



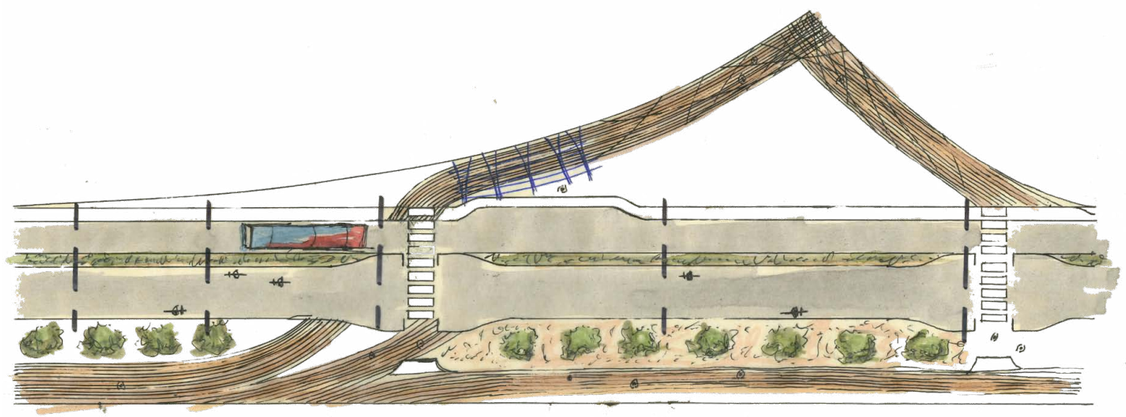
Bump Out Idea



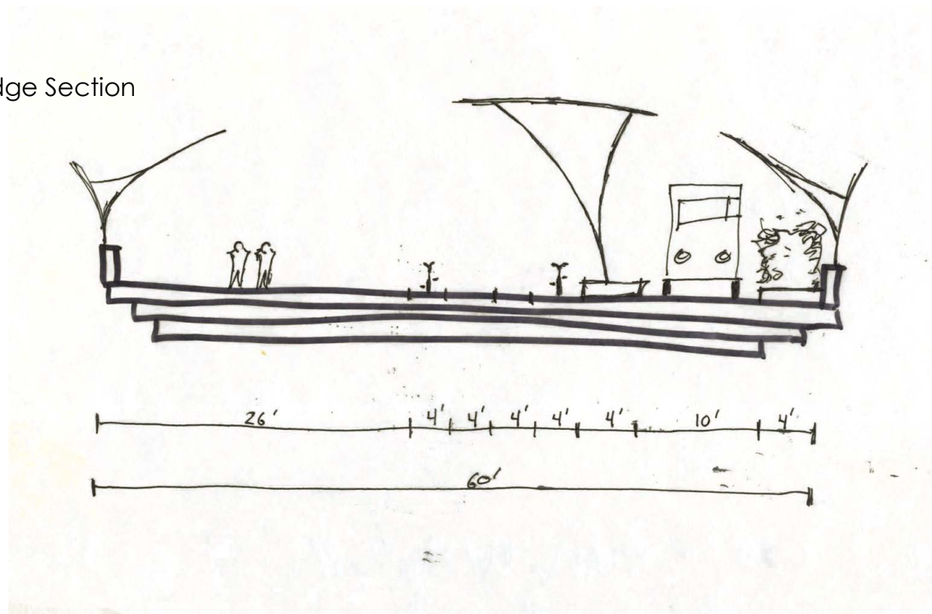
Bike Positioning



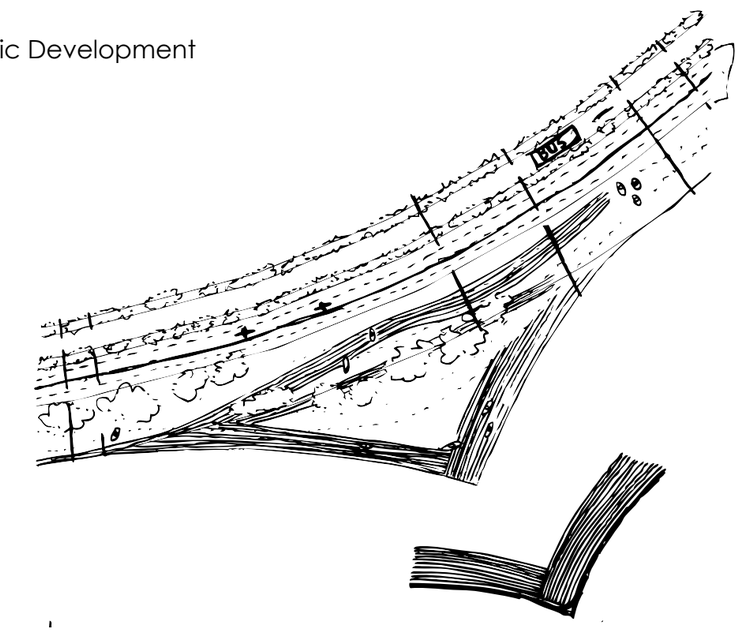
Bridge Schematic Development



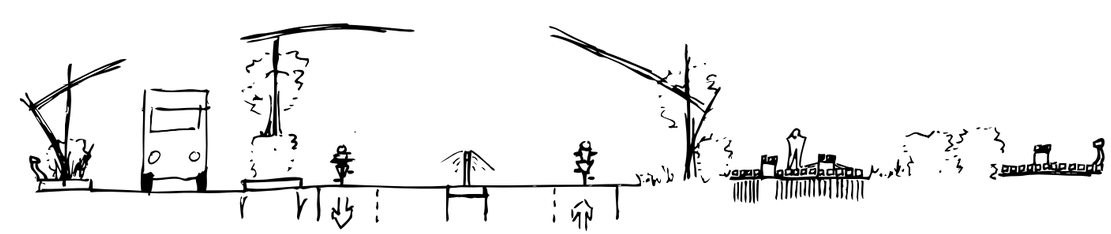
Bridge Section



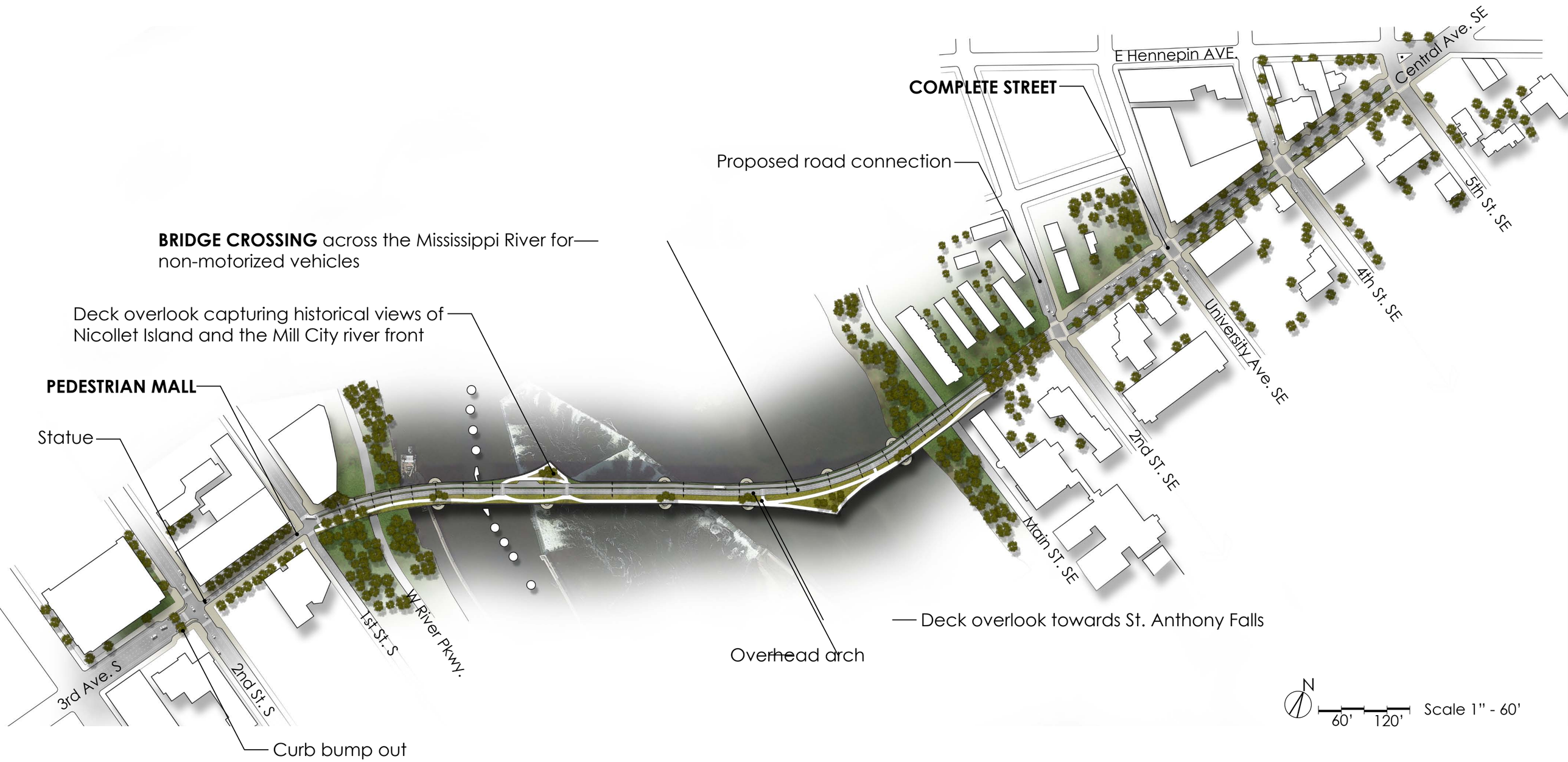
Bridge Schematic Development



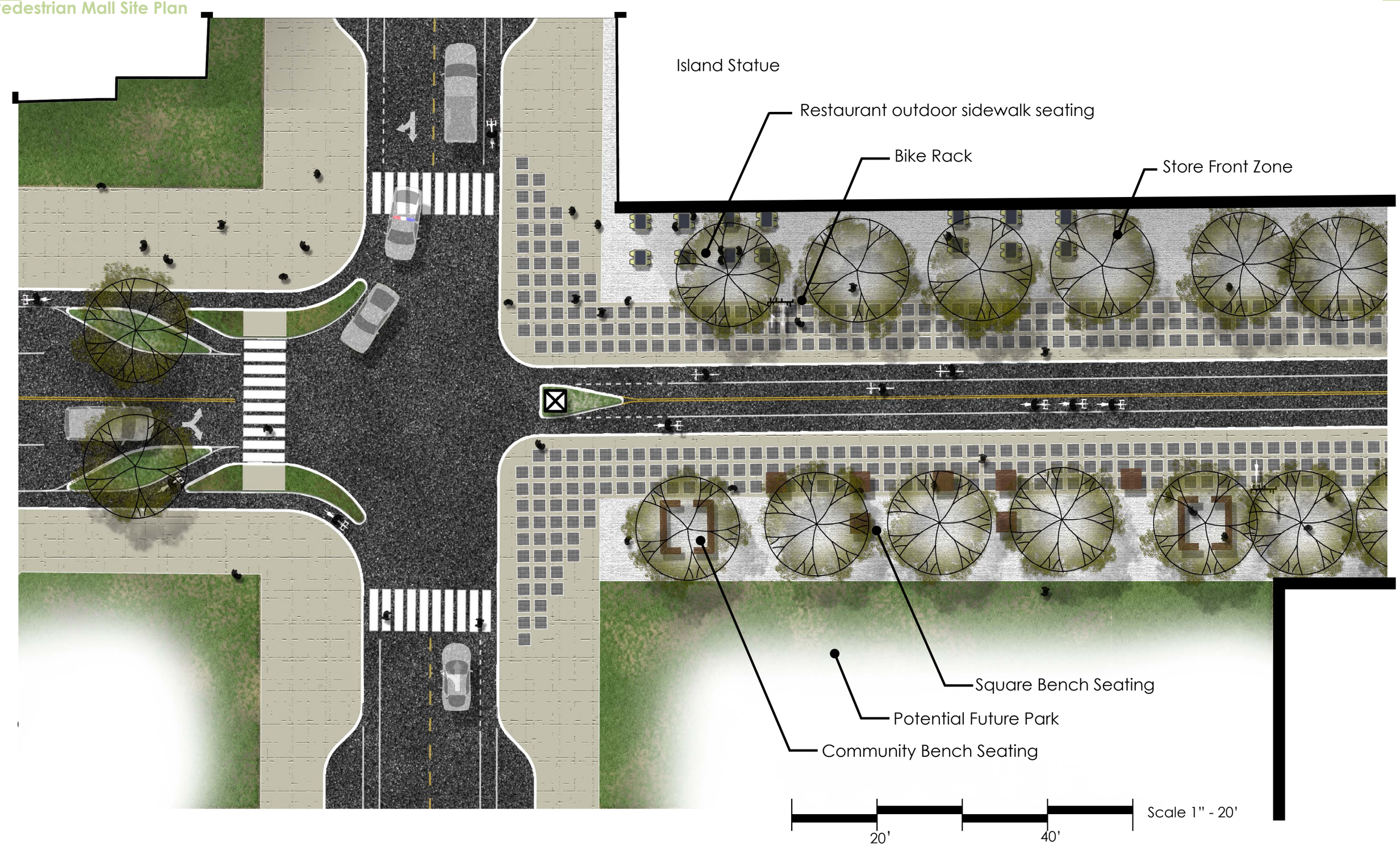
Bridge Section



Final Design


E Hennepin AVE.
Central Ave. SE
COMPLETE STREET
Proposed road connection
5th St. SE
BRIDGE CROSSING across the Mississippi River for non-motorized vehicles
4th St. SE
Deck overlook capturing historical views of Nicollet Island and the Mill City river front
University Ave. SE
PEDESTRIAN MALL
Statue
2nd ST. SE
Main ST. SE
W River Pkwy.
1st St. S
Deck overlook towards St. Anthony Falls
Overhead arch
3rd Ave. S
2nd St. S
Curb bump out
N
60'
120'
Scale 1" - 60'

Pedestrian Mall Site Plan

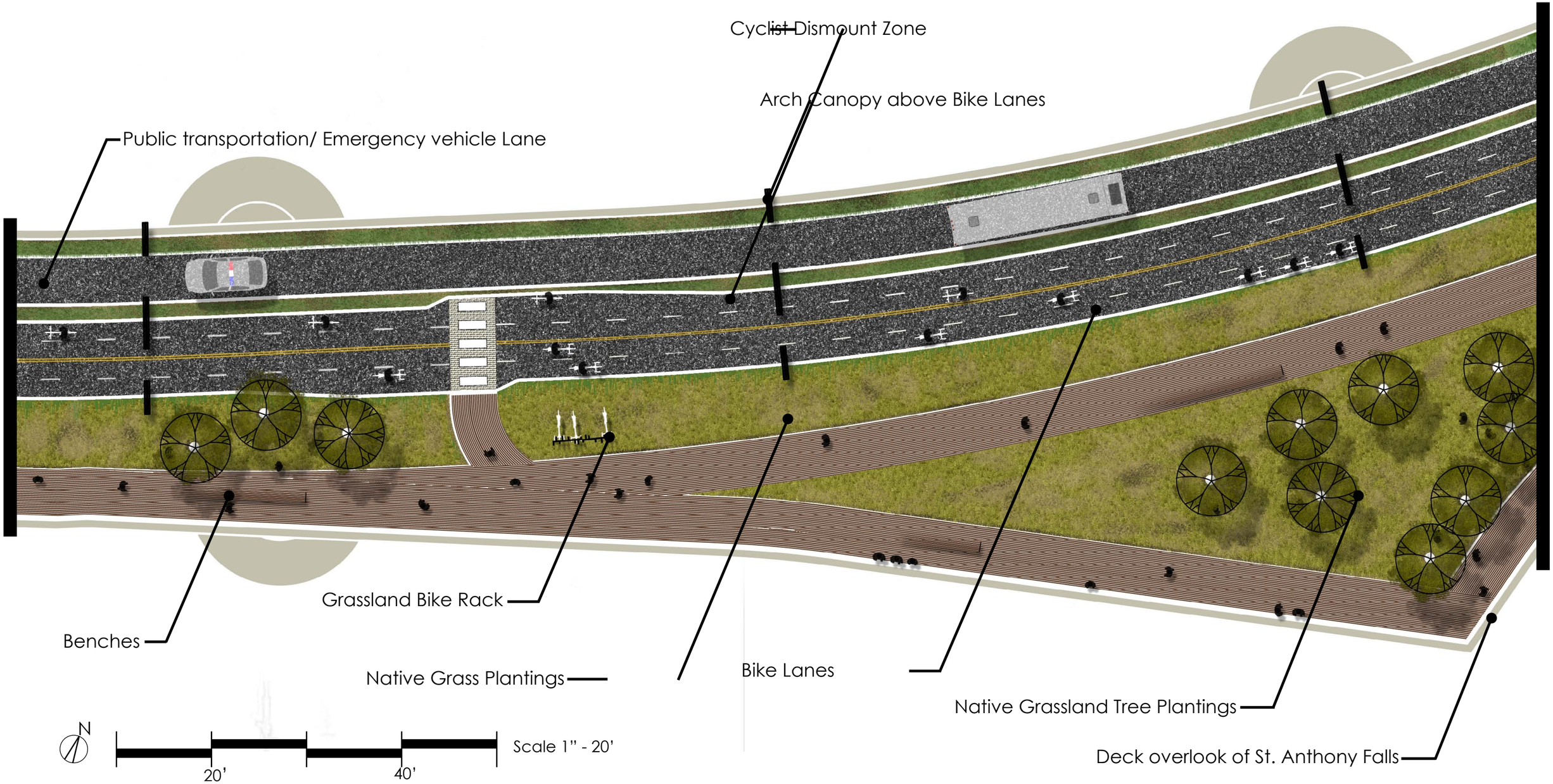


Repurposing Central Avenue SE: A Multimodal Urban Cyclist Corridor

Pedestrian Mall Perspective

Repurposing Central Avenue SE: A Multimodal Urban Cyclist Corridor

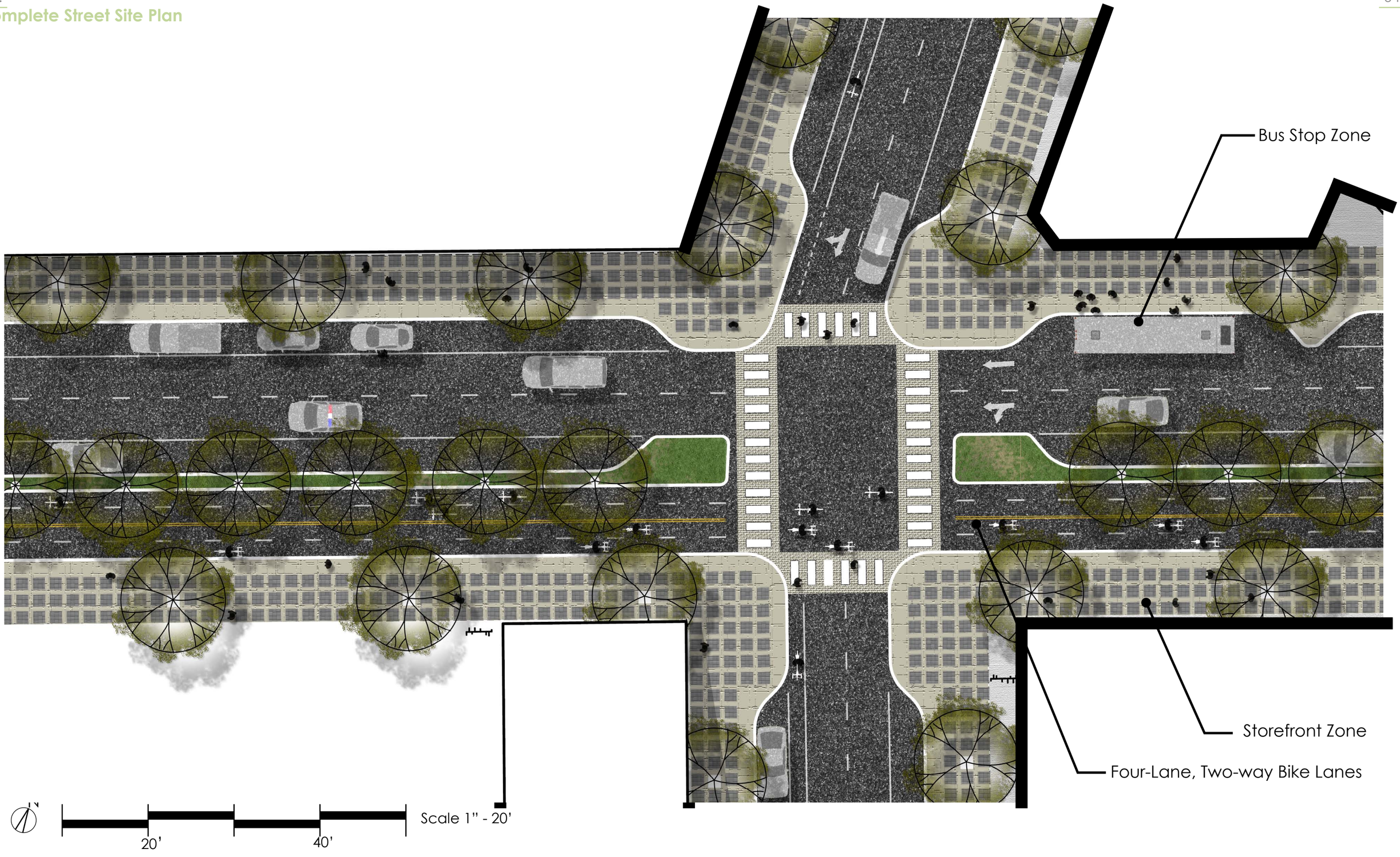
Bridge Site Plan



Bridge Perspective

Repurposing Central Avenue SE: A Multimodal Urban Cyclist Corridor

Complete Street Site Plan



Repurposing Central Avenue SE: A Multimodal Urban Cyclist Corridor

Complete Street Perspective

Repurposing Central Avenue SE: A Multimodal Urban Cyclist Corridor

Discussion

Research Summary

To summarize the data presented in the previous chapters:

Bicyclists and motorists are generally not impaired at the time of crashes.

Bicyclists and motorists appear to be equally contributing to crashes.

Motorists are often inattentive or are distracted at the time of crashes, or are failing to yield the right-of-way to bicyclists.

Bicyclists are often failing to the yield right of - way, disregarding traffic control devices and riding against traffic.

Bicyclists sustain injuries in most crashes. No motorists appear to have sustained injuries.

The circumstances of bicyclist fatalities adhere to a clear pattern involving large motor vehicles, inclement weather or aggressive or impaired motorists.

Most crashes are occurring at or near roadway intersections.

There is an apparent safety in numbers – crash rates tend to be lower on streets with more bicycle traffic.

Reducing these findings further, three primary conclusions emerge:

1. Most crashes are occurring at intersections along major arterials

2. Motorists are not seeing or yielding to bicyclists

3. Bicyclists are not riding in a predictable manner

These three conclusions help simplify the complex nature of crashes. However, translating the findings into effective improvements for cyclist's safety is the next step. While posed with good intentions, this discussion for cyclist safety can quickly become detailed and itemized. Safety is a moving target as conditions are constantly changing. Minneapolis has been heading in the right direction with improvements in non-motorized transportation. The steps the city has taken have been on the smaller scale to effectively, in the short term, reduce incident rates and encourage the public to consider non-motorized transportation. To continue the improvements already made, larger scale efforts should be considered in the city's infrastructure to encourage further increased bike facility use. This draws the need for a physically separated bike facility that can increase cyclist's safety in and between downtown Minneapolis. Designing a bike boulevard that eliminates motorists from the picture will continue to increase publics use of non-motorized transportation on a larger scale, as cycling will be perceived as a healthy, safe, and practicable transportation option.

Conclusion

Safety is a moving target as conditions are constantly changing. Minneapolis has been heading in the right direction with continual improvements towards non-motorized transportation. The steps the city has taken have been on the smaller scale to effectively, in the short term, reduce incident rates and encourage the public use. To continue the cycling revolution improvements must be made at a larger scale in redeveloping and/or repurposing the city's infrastructure to encourage further non-motorized transportation use. This draws the need for physically separated bike facilities that accommodate the cyclist's safety and convenience needs. The solution proposed will increase the publics use of non-motorized transportation as cycling would be perceived as a healthy, safe, and practicable transportation option into downtown Minneapolis.

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