CITY OF
ROCHESTER

Active Transportation Plan

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EXECUTIVE SUMMARY

Introduction

The active transportation plan examines the use of human-powered modes (focusing on walking and biking), and develops recommendations for improvements through future investments. It guides future investments for active transportation throughout Rochester.

The City of Rochester created this Active Transportation Plan to update the 2012 Rochester Area Bicycle Master Plan. Rochester has changed in terms of population, land use, and transportation options since the 2012 plan was adopted. Recognizing those changes and anticipating future change, this Active Transportation Plan identifies strategies and transportation improvements to foster a safe and healthy community with accessible connections between businesses, neighborhoods, schools, and other destinations.

Vision and Goals

The project steering committee (PSC), City staff, and project team worked together to create the plan's vision statement:

Active transportation provides equitable freedom of movement. Walking and bicycling in the City of Rochester are primary modes of transportation that are safe, convenient, and enjoyable.

The goals guiding the plan are:

- Health: Invest in comfortable and enjoyable places for people of all ages and abilities to walk and bike with dignity year-round, especially in equity priority areas.
- Equity: Invest in equity priority areas based on residents' needs and desires. Center equity in all parts of the project process and maintain a focus of rectifying current and present inequity.
- Safety: Center active transportation safety in all plans, policies, and investments.
- Connectivity: People walking and bicycling can access everyday destinations via low stress streets, sidewalks, and trails.
- Resiliency: Create streets and trails that make Rochester more resilient.
- Economy: Install walking and bicycling infrastructure as practical tools for community prosperity.

Public Engagement

Public outreach and engagement efforts for the Rochester Active Transportation Plan were designed to be inclusive and interactive. Outreach was structured in two phases, conducted at two separate times with two distinct purposes. Phase 1 of engagement intended to introduce the project, gather input on the community's needs and desires, and inform the plan vision and goals, and was conducted throughout the summer and fall of 2021. In Phase 2, the community was asked to review specific active transportation networks and inform programming recommendations.

Rochester residents said they want more transportation options. Many people want to drive less, and walk, bike, and take transit more often. People said that they would walk more if there were more nearby destinations, more comfortable crossings of busy streets, better lighting, clear sidewalks during the winter, more sidewalks, and more shade. People said they would bike more if there were more separation between bikeways and motor vehicles, better connected bikeways, more bikeways, and more comfortable crossings of busy streets.

Recommendations & Implementation Resources

The plan includes the following:

- A design resource guide was developed as part of the Active Transportation Plan (see Appendix D: Design Resource Guide). The document presents guidance for local planners, engineers, and advocates to improve the walkability and bikability of Rochester and create more comfortable streets for pedestrians and bicyclists of all ages and abilities.
- Every street and trail where people are permitted to walk is part of Rochester's walking network. To help Rochester direct our limited resources to improve conditions on the walking network, **priority areas for walking** were developed using a combination of five factors: demand, equity, land use, traffic conditions, and crashes. Streets in the downtown core generally have the highest priority ranking, as well as streets with higher speed limits carrying higher traffic volumes. (See Figure 1)
- The plan developed a vision for An All Ages and Abilities (AAA) bicycle network that would be designed to serve people of all ages and abilities, and come within ⅛ mile (a 2-3 minute walk) of major destinations. (See Figure 2) The AAA Bicycle Network will be designed to meet Rochester residents' desire for physical separation between people biking and people driving motorized vehicles on busier roadways. It also designs for separation between people biking and people walking where needed.
- Using a combination of the prioritization results, public input, and review of opportunities in the City's Capital Improvement Program, **ten potential near term gaps** were selected for further analysis to accelerate implementation of the AAA network. Cost estimates for these ten gaps, along with cross-sections showing further detail on three "do now" projects, can be found in Appendix C: Implementation Resources.
- **Key process and policy recommendations** around GIS and data collection, public engagement and communication, evaluation, and shared micromobility were developed in response to City team member ideas and needs.

Figure 1. Pedestrian Network Prioritization

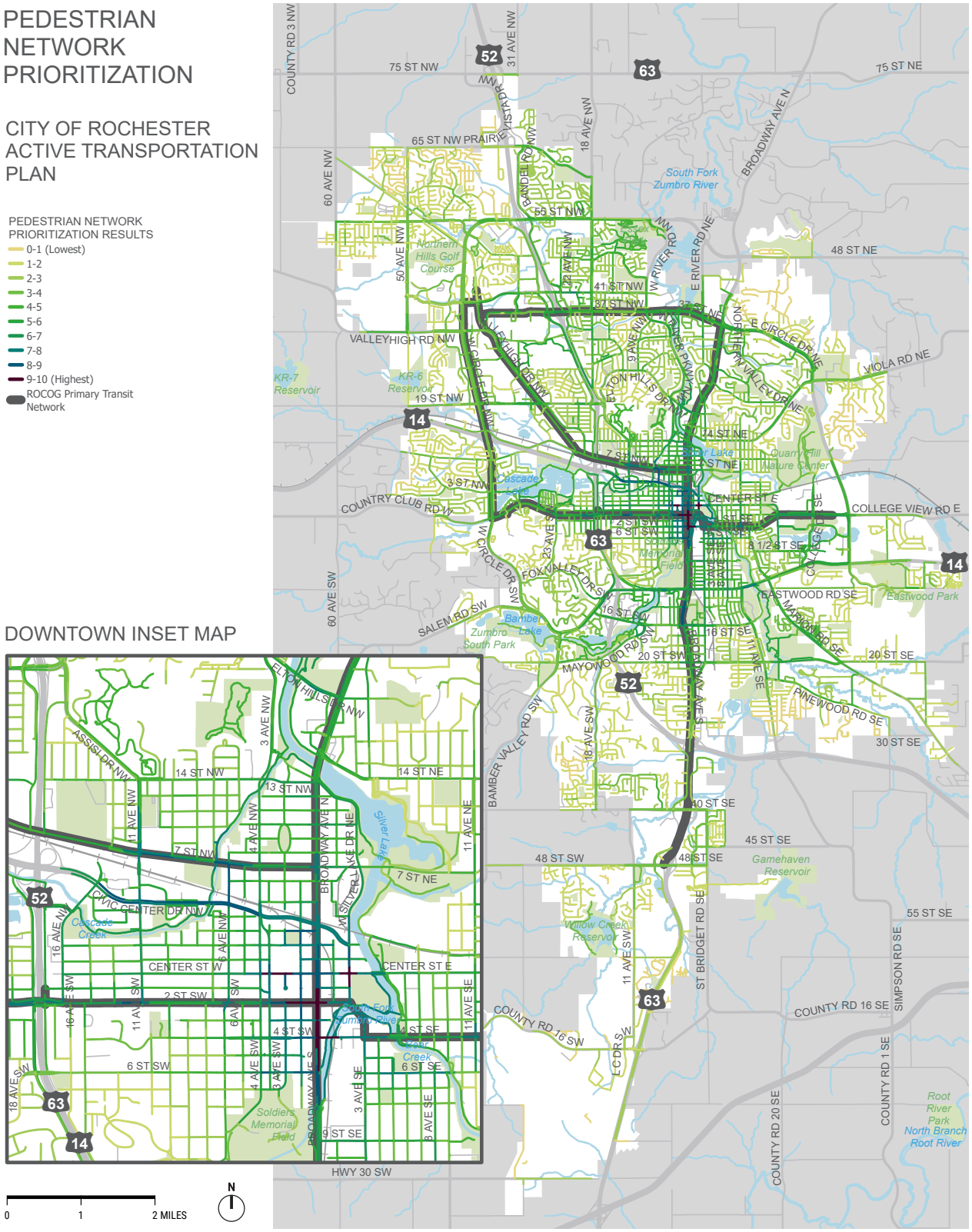


Figure 2. Vision for the All Ages and Abilities Bicycle Network

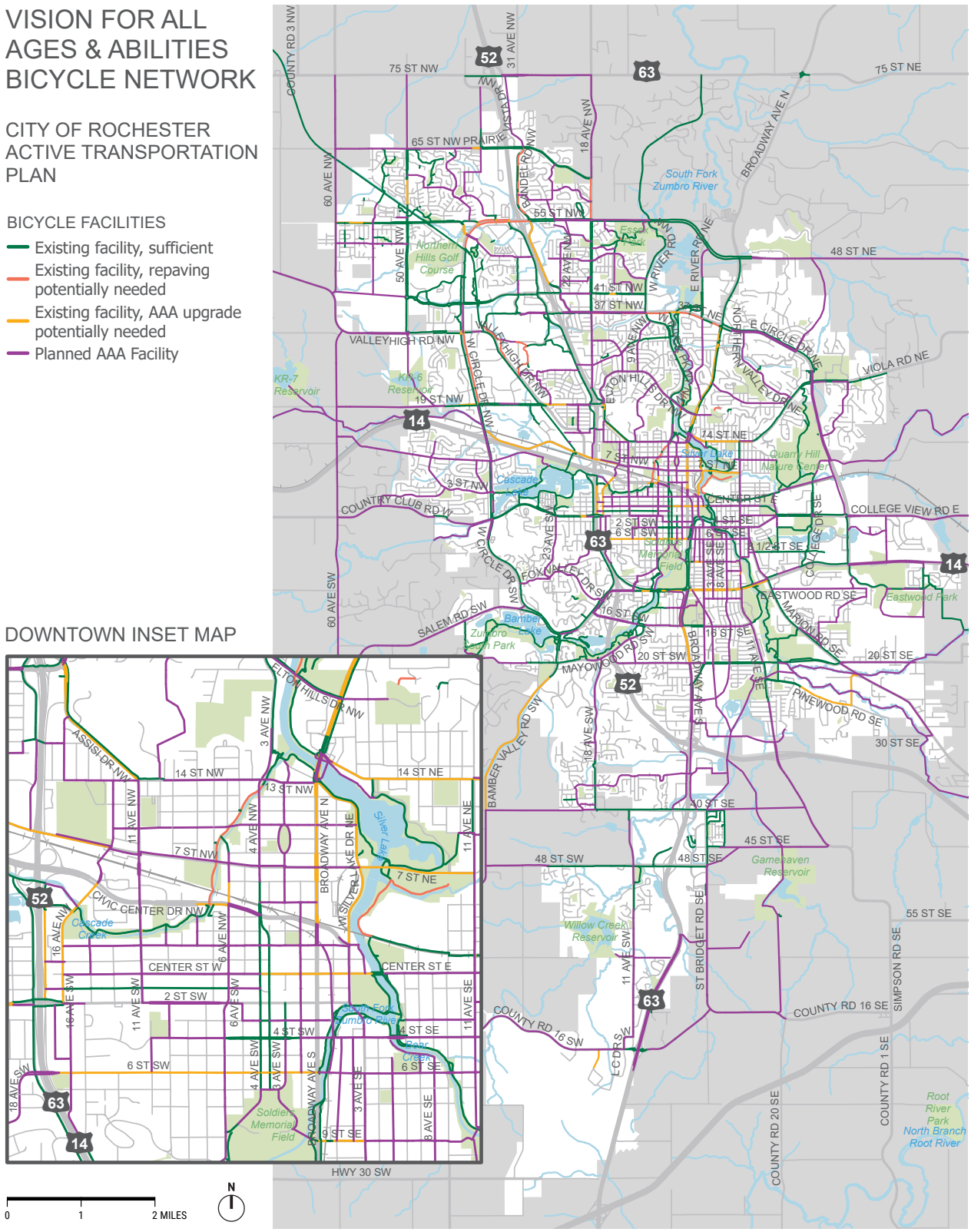
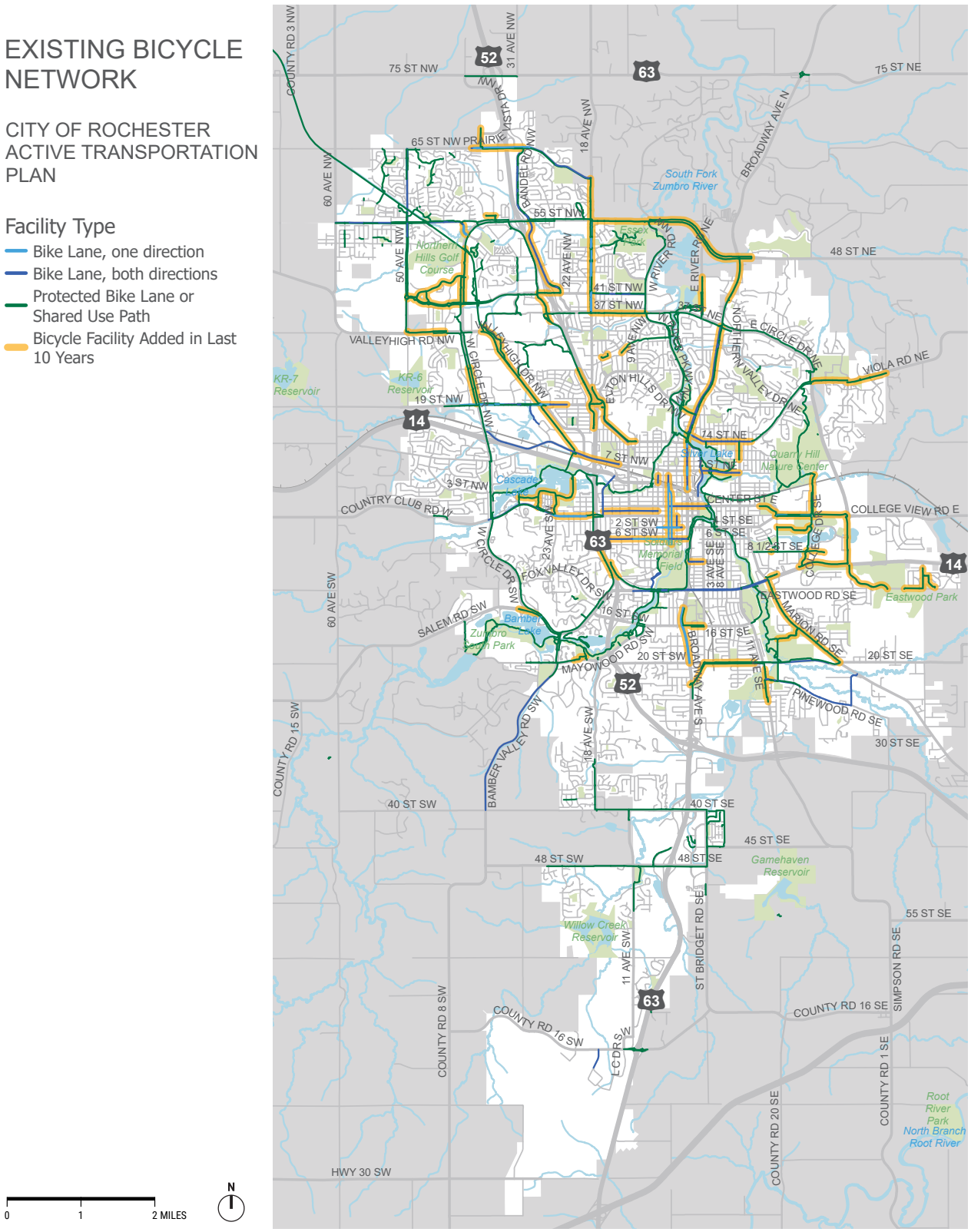


Figure 3. Existing Bicycle Network with Recent Additions Highlighted



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01

INTRODUCTION

WHY CREATE AN ACTIVE TRANSPORTATION PLAN?

This active transportation examines the use of human-powered modes of transportation (primarily walking and biking), and develops recommendations for improvement through future investments. It guides future investments in places to walk and bike.

An active transportation plan creates a opportunity for public agency staff to invite community members and elected officials to come together to answer questions like: How can we make streets safer? How can we make it easier for more people to walk or bike to get where they need to go? How can our transportation system support local businesses and adapt to changing technology and travel habits?

The City of Rochester created this Active Transportation Plan to update the 2012 Rochester Area Bicycle Master Plan. Rochester has changed in terms of population, land use, and transportation options since the 2012 plan was adopted. Recognizing those changes and anticipating future change, this Active Transportation Plan identifies strategies and transportation improvements to foster a safe and healthy community with accessible connections between businesses, neighborhoods, schools, and other destinations.

Planning 2 Succeed: Rochester Comprehensive Plan 2040 (P2S) estimates an increase in 55,000 new residents and 50,000 new jobs by 2040. Status quo projections show an increase in vehicle miles traveled of 50%; this plan aims to reduce or eliminate the additional vehicle miles traveled. Limitations such as adherence to compact growth patterns, and constraints to capacity for roadway expansions, as well as an expected 70% increase in downtown employment, will require new solutions and means by which people move about the city. Rochester cannot maintain current commute patterns—or meet climate, livability, and community goals—and accommodate city growth projections.

Historically, our roads have been designed to prioritize the efficient movement of automobiles, typically at the expense of all other users. Safe and convenient bicycle and pedestrian travel is vital to the community's quality of life, economy, public health, and resiliency. Active transportation facilities serve many users in the community—for many

Safe and convenient bicycle and pedestrian travel is vital to the community's quality of life, economy, public health, and resiliency.

(often underrepresented) groups, non-motorized travel is the sole means of daily transportation to primary destinations in the City. Within recent years, studies of access mobility and access gaps revealed limitations on travel choice primarily affecting low- and moderate-income neighborhoods, residents experiencing mobility impairments, the elderly, and workers of 2nd and 3rd shifts.

Safe, viable, and convenient transportation options that reduce dependency on auto ownership are crucial for reducing housing & transportation cost burdens. In 2018, approximately 40% of Rochester households spent over 45% of household income on the combined costs of housing and transportation. Availability of diverse and affordable housing options in the community are shrinking. A holistic active transportation framework increases the number of affordable transportation options available to accommodate the mobility needs of an aging population and adapt to the changing travel and dwelling preferences of younger generations.

In 2015, Southeast Minnesota Association of Realtors found that the majority of Rochester's current residents would prefer to live in a walkable neighborhood with a mix of houses, stores, and local businesses. To achieve these outcomes, **a safe and reliable transportation network must give residents walking and biking access to their daily destinations**. This means recognizing the primary purpose of a transportation network is to connect people to places where they want and need to go**.** Plans and projects developed by the City must support cohesive neighborhoods while retaining a mix of housing and transportation options. In short, transportation must be better integrated with land development patterns to reduce the dependency on personal automobile use.

An intentionally designed, well-planned active transportation system plays an essential role in supporting this objective. Additionally, it fulfills numerous core principles of the Rochester Comprehensive Plan: greater access to a wider range of commuting options will provide residents with increased flexibility, reduced car dependency, and the ability to pursue a healthier lifestyle. This Active Transportation Plan Update sets in motion a tangible, measurable, and achievable mission for non-motorized transportation.

A VISION FOR WALKING & BIKING IN ROCHESTER

The project steering committee (PSC), City staff, and project team worked together to create the plan's vision statement:

> Active transportation provides equitable freedom of movement. Walking and bicycling in the City of Rochester are primary modes of transportation that are safe, convenient, and enjoyable.

Goals and Objectives

The plan goals are presented in bold, and supporting objectives are shown in bullet points that follow. The project goals were shaped by:

- Project Steering Committee
- Pedestrian & Bicycle Advisory Committee (PBAC)
- We Bike Rochester
- Citizens Advisory on Transit
- Sustainability & Resiliency Action Plan
- Stakeholder Interviews
- Community Listening Sessions
- Community Development
- Public Works
- Parks and Recreation

Health: Invest in comfortable and enjoyable places for people of all ages and abilities to walk and bike with dignity year-round, especially in equity priority areas.

- Complete sidewalk gaps (especially on pedestrian priority corridors)
- Connect people to everyday destinations via low stress active transportation infrastructure
- Expand Safe Routes to School infrastructure and non-infrastructure projects to every public school in Rochester

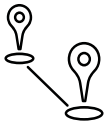
Equity: Invest in equity priority areas based on residents' needs and desires. Center equity in all parts of the project process and maintain a focus of rectifying current and present inequity.

- Study and eliminate existing disparities related to the ease and enjoyment of using active transportation in Rochester
- Use MnDOT tools for identifying walking and bicycling priority areas; focus investment on meeting the needs of people living in high priority areas for rectifying inequities

Safety: Center active transportation safety in all plans, policies, and investments.

- Create joyful places for people to walk and bike and that provide a sense of personal safety
- Eliminate all fatal and serious injury crashes involving people walking and bicycling
- Increase year-round usability of active transportation network

- Implement projects that center on active transportation safety; utilize the following principles:
  - » Separate people walking and bicycling from people driving and include appropriate signage
  - » Design roadways to lower motor vehicle speeds
  - » Reduce roadway right-of-way dedicated to driving
  - » Reconnect areas that have been disconnected by dangerous roadway crossings
  - » Increase signal timing to allow people more time to cross the street and priority over people driving
- Shorten pedestrian crossing distance and reduce roadway width
- Install demonstration projects that focus on safety improvements
- Safety education programs for motorists to help create a culture where active transportation is valued and supported
- Continuous education for elected officials and public agency staff promote buy-in for implementing the plan

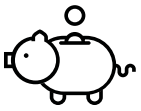


Connectivity: People walking and bicycling can access everyday destinations via low stress streets, sidewalks, and trails.

- Investment in vital infrastructure is led by residents living in priority equity areas. Vital infrastructure includes elements that make the experience of walking more comfortable and beautiful, such as green stormwater systems, shade trees, lighting, benches, and public artwork
- Implement high priority bicycle connections
- Create a continuous system of low-stress streets for active transportation. This system also includes placemaking opportunities and green stormwater infrastructure. These items particularly serve people using active and public transportation

Resiliency: Create streets and trails that make Rochester more resilient.

- Study all programmed reconstruction and resurfacing projects for opportunities to add infrastructure that mitigates climate change and its effects on people walking, bicycling, and taking transit
- Improve air quality for people walking, bicycling, and waiting for transit
- Study new mobility options for their ability to promote greater active transportation and less reliance on personal cars and single occupancy vehicle trips
- Reduce transportation-related greenhouse gas (GHG) emissions
- Reduce impermeable area of public streets; reduce right of way dedicated to driving



Economy: Install walking and bicycling infrastructure as practical tools for community prosperity.

- Demonstrate the benefits of active transportation to community members
- Educate the business community about the social, environmental, and economic return on investment from active transportation
- Complete the City Loop and other projects to strengthen active transportation use downtown
- Engage surrounding neighborhoods early in the implementation and design process for future street projects included in the active transportation network

Priority Performance Measures

The following priority performance measures will help the City of Rochester track plan progress over time.

1. Transportation-related greenhouse gas emission reductions
2. Miles of sidewalk installed; miles of bikeway installed
3. Percent of people who walk or bike to work
4. Pedestrian and bicycle involved collisions
5. Projects installed in potential high crash areas, as noted from the plan's systemic safety analysis found in Appendix B (paired with evaluation of these projects' performance over time)
6. Miles of sidewalk gaps on pedestrian priority mapped corridors; miles of arterial roadways without dedicated bicycling infrastructure
7. Number of new developments approved with no off-street parking spaces or fewer off-street parking spaces than minimum

Recommended Progress Tracking Tools:

- Annual report to City Council and City Engineer include important metrics such as annual active transportation funding shown as a percentage of the total City's transportation funding, and a comparison of annual active transportation funding compared to the City's overall budget figure
- Develop and maintain geographic databases for bicycling and walking infrastructure and key performance measure statistics

Table 1. Key Terms

Term	Meaning in this Plan
Walking	Walking is an inclusive term that includes both ambulatory and non-ambulatory modes. Walking encompasses all forms of mobility devices, including using a wheelchair, cane, walker, or other mobility device that allows the user to travel at human speed.
Equity priority areas	Areas with high concentrations of people who are not white, have limited English speaking ability, are seniors, lack a vehicle, identify as having a disability, and/or have low incomes
Active Transportation	Human-powered modes of transportation, primarily walking and bicycling
All Ages and Abilities bicycle facilities	Bicycle trails and on-street lanes designed to be comfortable to a range of bicyclists, including children, seniors, women, people with disabilities, people moving goods or cargo, people of color and low-income riders


ROCHESTER
ROCHESTER
Aloha
Hola
你好
Hello
Dia dhuit
Kon'nichiwa
czesc
nyob zoo
Merhaba
Olá
Ciao
مرحبا
Здравствуйте
xin chào
Sawubona
Ahoj
namaste
Салом
Hallo
Привет
Сайн уу
Sveiki
안녕하세요
Bonjour
Hej

02

CONTEXT

COMMUNITY ENGAGEMENT

Process

Public outreach and engagement efforts for the Rochester Active Transportation Plan were designed to be inclusive and interactive. Engagement was structured to inform the plan's understanding of community needs and opportunities, shape plan recommendations, and build support for the planning process and for plan implementation.

The main goals of public outreach were:

- Educate the public about the project goals and timeline
- Build relationships
- Create a community-informed vision and shared understanding of vision and goals
- Gather input on walking, biking, and rolling needs, opportunities, and expectations
- Solicit feedback on potential trade-offs, recommendations, and priorities

The goals early on for engagement were to introduce the project, inform the public on the plan's vision and goals, and gather input on the community needs and desires. Opportunities for public input included public events, listening sessions, a survey, and an online interactive map. Public input and the resulting recommendations from the Sustainability and Resiliency Plan were also considered.

Later in the project, public input sought feedback on draft recommendations and project prioritization. Opportunities to participate included an online survey and targeted listening sessions.

Figure 4. Opportunities for public input

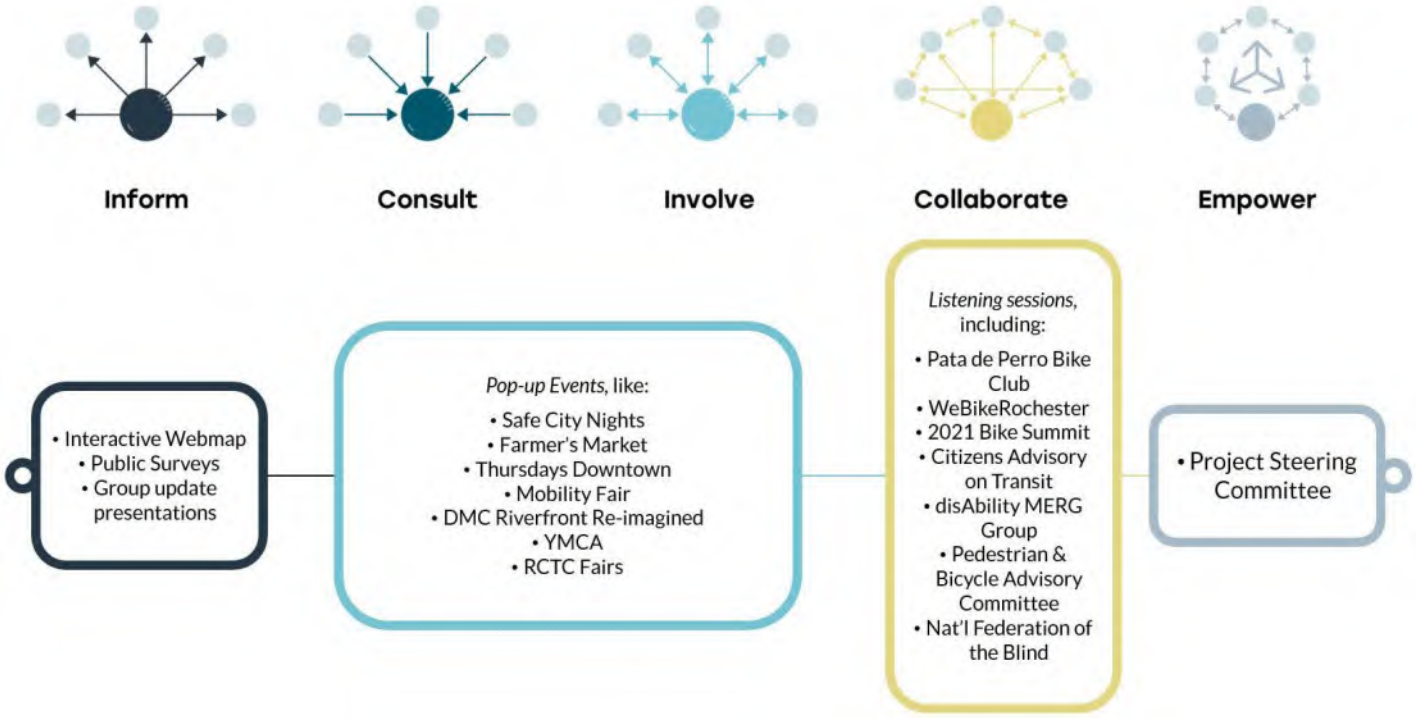


Figure 5. Outreach by the Numbers

395 **location and route-based suggestions** through interactive online map, with an additional 91 discussion comments

~1,300 **survey responses** received via Polco web survey

10+ **Community Events**

10+ **Stakeholder Sessions**

299 **suggestions and contributions** through **in-person outreach**

5+ **Media Spotlights**

Highlights

Three major themes emerged in public engagement: desire for more transportation options, tension over transitioning to a multimodal transportation system, and desire for comfort and safety in public spaces.

Rochester residents said they want more transportation options. Many people want to drive less, and walk, bike, and take transit more often. People said they would bike more if there were more separation between bikeways and motor vehicles, better connected bikeways, more bikeways, and more comfortable crossings of busy streets. People said that they would walk more if there were more nearby destinations, more comfortable crossings of busy streets, better lighting, clear sidewalks during the winter, more sidewalks, and more shade.

> "I hope for more street closures to car traffic for more pedestrian and bike use."

> "I'm so glad this is a priority!"

Members of the public were asked to review maps showing the draft walking network prioritization results, the draft Vision for an All Ages and Abilities (AAA) Bicycle Network, and the draft AAA network prioritization results. The majority of survey respondents felt that the prioritization results for both the Pedestrian and AAA Bicycle Networks definitely or mostly accurately reflected the areas that are most important for walking and bicycling improvements. Nearly 80% of those who bike or want to bike said they will be able to reach all or most places they want to go when the AAA Bicycle Network is fully built.

For more information on the public engagement process for this plan, refer to the engagement summaries in Appendix A: Engagement Summary.

EXISTING CONDITIONS

The Existing Conditions Memo in Appendix B: Technical Analysis documents changes to the physical and social environments that influence walking and bicycling in Rochester, highlighting demographic, land use, and active transportation network changes since the 2012 Bicycle Plan. Major findings from the analysis are summarized below.

What's Changed in Rochester

The population has increased and become more racially diverse. The median household income has risen at roughly the same rate as the cost of living.

Downtown neighborhoods have added several full block urban infill developments. Future mixed use transit-oriented centers and transit supportive neighborhoods have been added to the land use plan. Many miles of trails and bikeways have been built since the 2012 plan.

Geographic Differences in Access to Resources and Health

Based on demographic factors like income and race, Rochester residents have different levels of access to resources, political power, and mobility options. Some areas of the city have concentrations of people with higher access, while other areas have concentrations of people with lower access (Figure 6). Areas where people have lower access tend also to have higher rates of health issues like heart disease and poor mental health. The analysis of geographic differences in access to resources was overlaid on other analyses to plan an equitable active transportation system.

Where People Travel

More than half of Rochester's 510,000 daily trips are under 3 miles, making them good candidates for conversion from driving to active modes. The highest concentration of destinations for active trips is found around downtown, the Kutsky Park neighborhood, 41st St NW & 18th Ave NW, Graham Park, Mayo High School, Rochester Community and Technical College, Federal Medical Center, and the Rochester Recreation Center (Figure 7).

Barriers to Travel

Factors that restrict convenient and comfortable access to destinations include major multi-lane roadways, railroads, rivers, low intersection density, and high impermeable (paved) surfaces.

Pedestrian and bicycle crashes make up only 2% of crashes in Rochester, but account for 39% of fatal and 14% of serious injury crashes.

Lower stress bicycling facilities make up most of the transportation network, but in many cases riders on lower stress facilities must make stressful crossings of multilane roadways or travel significantly out of their way to lower stress crossings. These stressful crossings may discourage many people from riding at all.

Figure 6. Social Inequality by Census Block Group

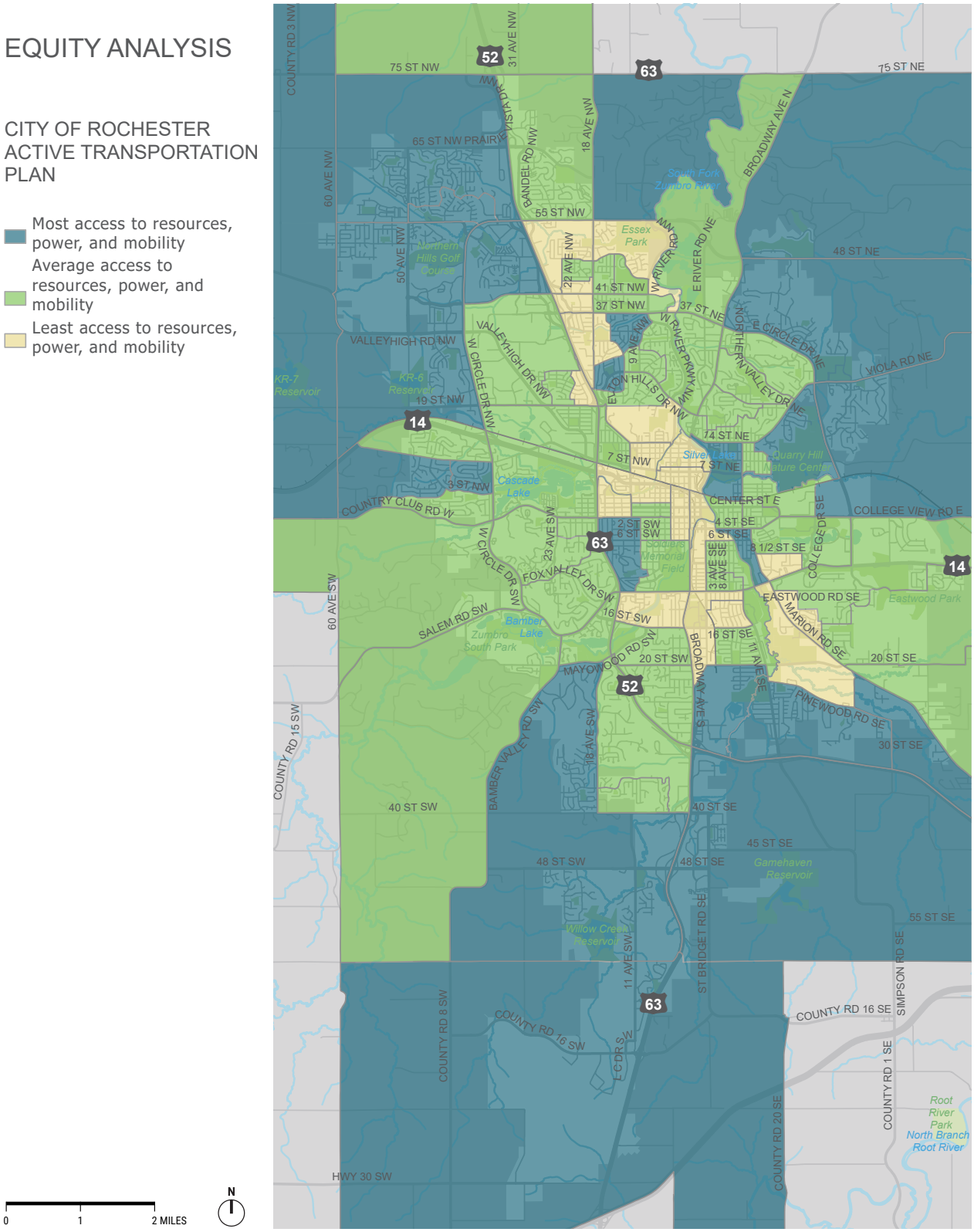
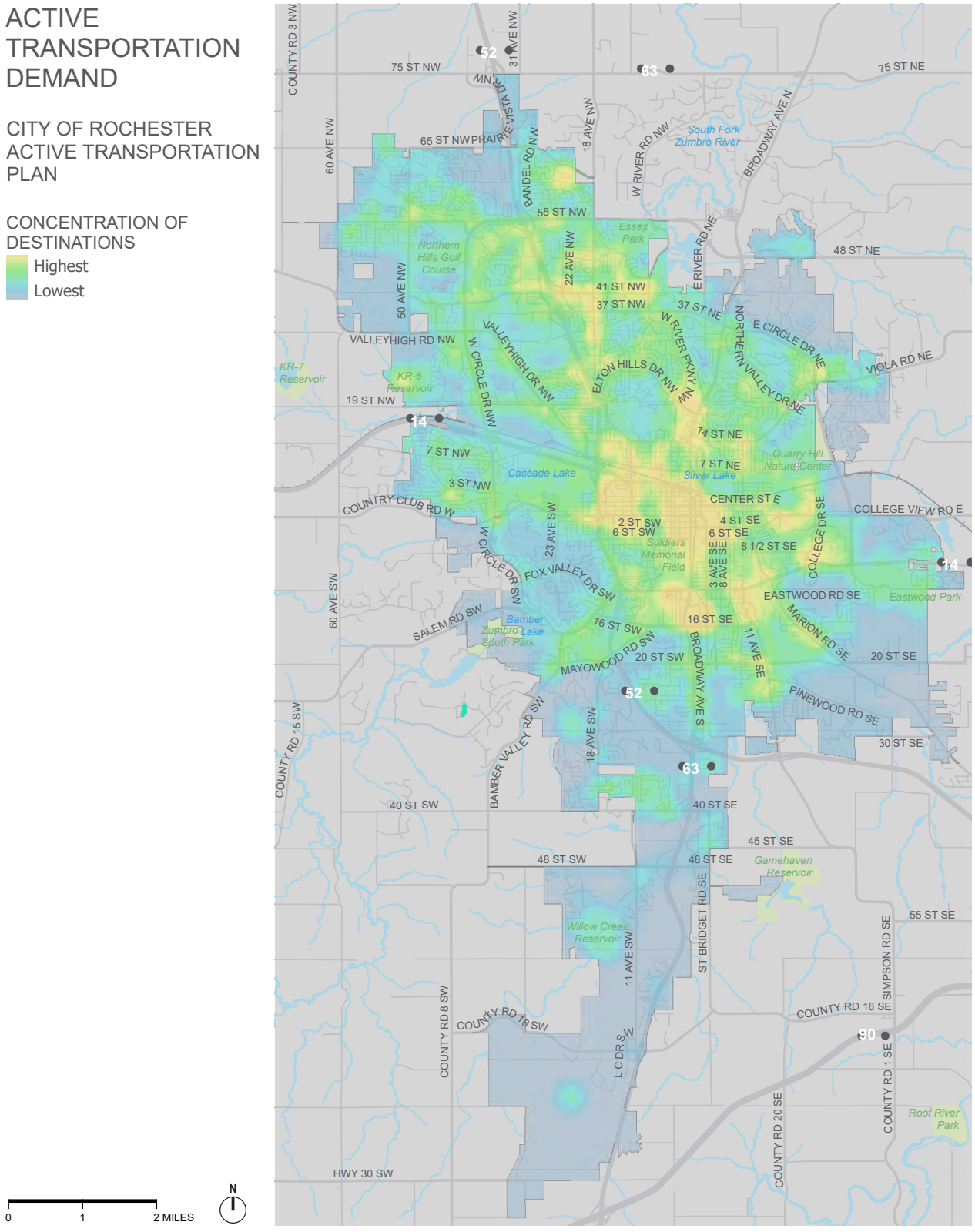


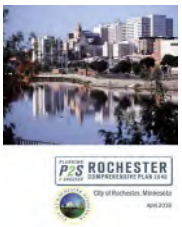
Figure 7. Concentration of Destinations



PLANNING & POLICY CONTEXT

Rochester-Olmsted Bicycle Master Plan

The Rochester-Olmsted Bicycle Master Plan (2012) was adopted by the City of Rochester in 2012 and identifies needed bicycling infrastructure for improving connectivity and usability of the bicycle environment for both recreation and transportation in the Rochester and Olmsted County area. The current Active Transportation Plan is a direct update to this plan, with a broadened scope of influence to include all forms of active transportation.



2040 Planning 2 Succeed Comprehensive Plan

The City of Rochester's Planning 2 Succeed: Comprehensive Plan 2040 (2018) conceptualizes a city-wide network of nodes and corridors—an integrated framework of mixed residential, commercial, retail, office, and industrial uses connected by high-quality transit and multi-modal systems, supportive of pedestrian-centered infrastructure and expanded transportation choices. A significant portion of this plan accentuates the importance of integrating land use with a complete transportation network, where a multi-modal street system should enhance the vitality of both private and public realms. The Active Transportation Plan Update is a direct response to several Core Strategies for implementation of P2S.

Parks and Recreation System Plan

The Parks and Recreation System Plan (2016) provides a comprehensive overview of Rochester parks, natural areas, and trails, and identifies system investments over the next twenty years. An interconnected network of trails is identified as essential for making the recreation system accessible for as many users as possible. This plan characterizes trails as essential for providing sustainable transportation options, and to maintain the City's commitment to active living and environmental sustainability.

2045 Long Range Transportation Plan

Chapter 12 of the ROCOG 2045 Long Range Transportation Plan (2020) focuses on active transportation recommendations: regional systems of trails, walking paths, and other features supporting pedestrians, bicyclists, and non-motorized travel. This plan addresses both Rochester city limits and the greater Olmsted County area, highlighting infrastructure projects along specific corridors and facilities for improved multi-modal connectivity to major regional destinations.

Downtown Integrated Transit Studies Reports

A series of five Integrated Transit Studies (ITS) Reports were prepared for the Destination Medical Center (DMC) Transportation & Infrastructure Program and the City of Rochester, supporting and embracing the vision presented in the Downtown Rochester Master Plan and the DMC Development Plan.

City Loop Study

The City Loop Study (2018) refines concepts described in the DMC Development Plan, recommending facility design, route alignment, and implementation of the downtown City Loop. The City Loop envisions a world-class pedestrian and bicycle trail in downtown Rochester, facilitating safe, enjoyable, and healthy access throughout the Development District for visitors and residents alike.

Street Use & Complete Streets Study Report

The Street Use & Complete Streets Study Report (2018) is a technical memo investigating the proposed multimodal elements of the downtown Rochester transportation system. This study identifies pedestrian, bicycle, and transit enhancements to downtown streets, and incorporates urban placemaking and Complete Streets principles into the design of a healthy, walkable, and sustainable downtown realm.

DMC District Design Guidelines

The DMC District Design Guidelines (2017) is a comprehensive set of architectural and placemaking guidelines to help shape the growth of the DMC District in a clear and consistent manner. Within these guidelines, design details are applied at three scales: the entire Downtown District, streets and corridors, and individual sites and buildings.

Non-Motorized Transportation Analysis

The Non-Motorized Transportation Analysis (2015) technical memo summarizes the existing conditions for active transportation modes in Rochester, and constructs a foundation for the recommendations of walk- and bike-supportive polices to be included within the updated Rochester Comprehensive Plan. This analysis focused on the infrastructure conditions affecting the amount of active transportation use and the quality of the experience.

ADA Transition Plan

The ADA Transition Plan (2013) identifies structural modifications necessary to public facilities to ensure programs, services, and activities are accessible to people with different abilities and compliant with ADA requirements. It specifically addresses pedestrian curb ramps, access to the right-of-way, and accessible pedestrian traffic signals. The plan establishes a prioritization system for the timeframe and location of facility upgrades, which is incorporated into annual capital improvement budget estimates.

Resolution Establishing a Complete Streets Policy

The Resolution Establishing a Complete Streets Policy (2009) is an adopted ordinance explicitly recognizing the needs of pedestrians, bicyclists, and transit riders. This ordinance prioritizes bicycle, pedestrian, and transit facility design in all roadway projects, and emphasizes the primacy of safety for all users of the roadway, regardless of age, ability, or mode of transportation.

03

RECOMMENDATIONS

Design Resource Guide

A design resource guide was developed as part of the Active Transportation Plan (see Appendix D: Design Resource Guide). The document presents guidance for local planners, engineers, and advocates to improve the walkability and bikability of Rochester and create more comfortable streets for pedestrians and bicyclists of all ages and abilities.

Planners and project designers should refer to this guide in developing the infrastructure projects recommended by this plan, but they are not a substitute for thorough project-by-project evaluation by a landscape architect or engineer upon implementation.

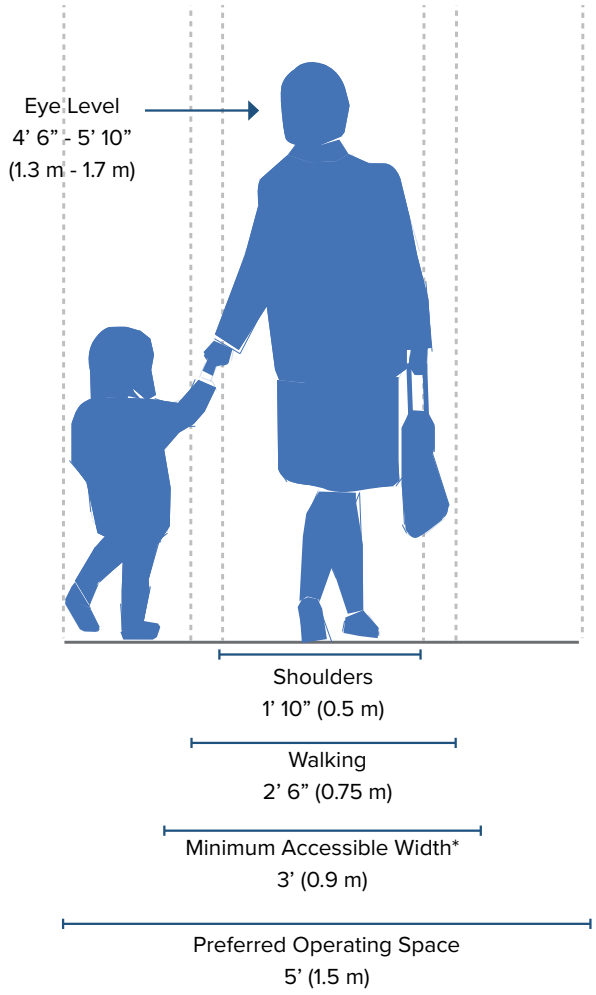
The design resource guide and recommendations in the document are for use on City of Rochester roadways. Projects must not only be planned for their physical aspects as facilities serving specific transportation objectives; they must also consider effects on the aesthetic, social, economic and environmental values, needs, constraints and opportunities in a larger community setting. This is commonly known as Context Sensitive Design, and should be employed when determining which standard is applicable in each scenario.

All walkway and bikeway design resource guide in the document meet or exceed the minimums set by the Americans with Disabilities Act Accessible Design Guidelines (ADAAG) and the Public Right of Way Accessibility Guidelines (PROWAG).

The design resource guide includes seven sections:

1. Introduction
2. Pedestrian Toolbox
3. Bicycle Toolbox
4. Shared Use Trails
5. Enhanced Crossing Treatments
6. Network Connections and Supporting Facilities
7. Pedestrian-Bicycle Operations and Maintenance

Figure 8. Example Graphic from Design Resource Guide



*At point of contact

STREET AND TRAIL IMPROVEMENTS

Pedestrian Network Priorities

Every street and trail where people are permitted to walk is part of Rochester's walking network. To help Rochester direct our limited resources to improve conditions on the walking network, priority areas for walking were developed using a combination of five factors:

- Demand: areas where people live, work, play, learn, shop, and take transit (weighted at 26%)
- Land use: areas where many people and destinations are close together (weighted at 13%)
- Traffic conditions: streets with higher speed limits and more lanes (weighted at 18%)
- Crashes: locations where people driving motor vehicles crashed into people walking, and the crash was reported to the police (weighted at 17%)
- Equity: primarily areas with higher percentages of people with disabilities and lack of access to vehicles (this factor also includes people with low incomes, people with limited English-speaking ability, people over age 65, and people who do not identify as white) (weighted at 26%)

Streets in the downtown core generally have the highest priority ranking, as well as streets with higher speed limits carrying higher traffic volumes.

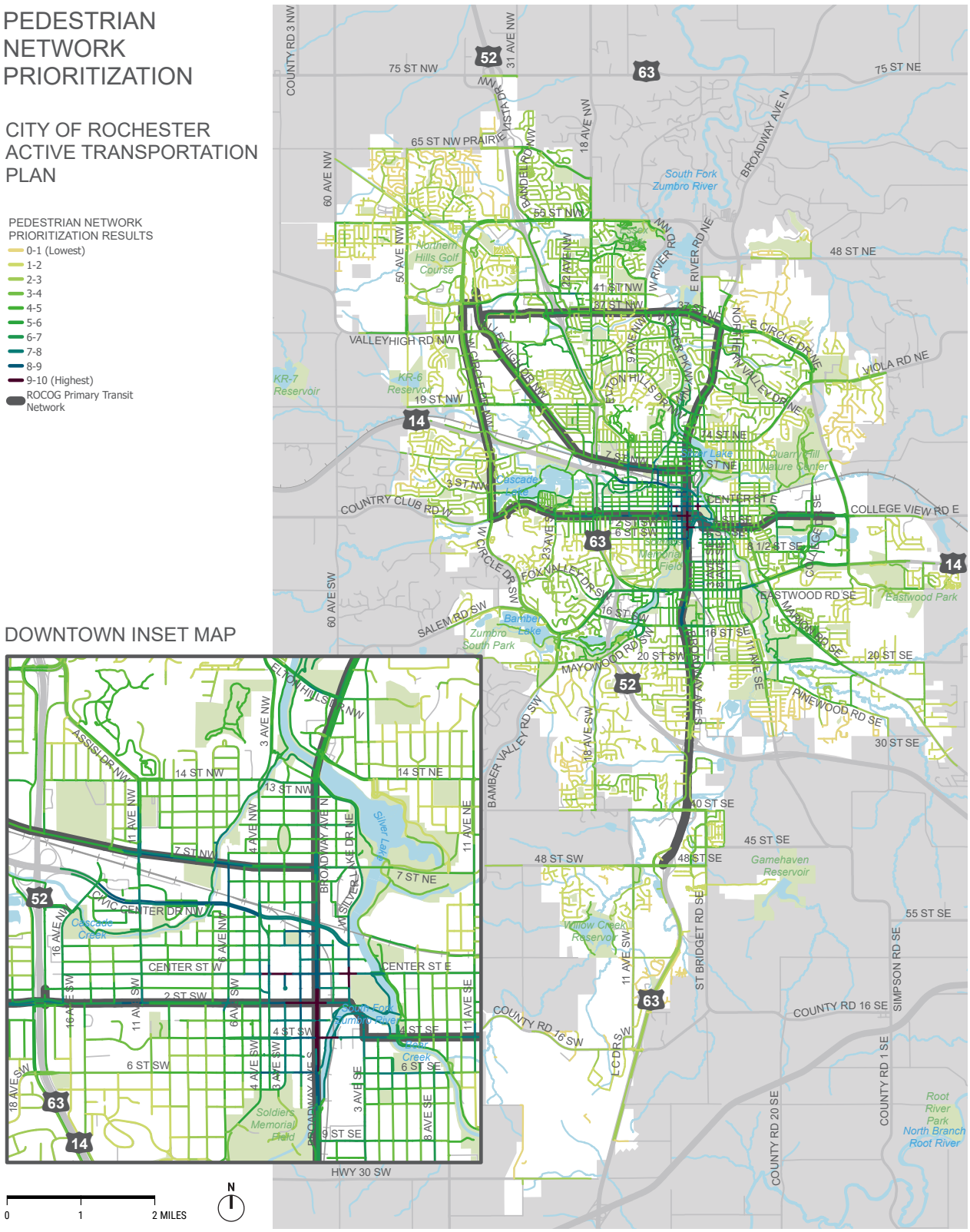
Members of the public were asked to review maps showing the draft walking network prioritization results. Over 70% of survey respondents (176 people) said that the walking network prioritization "definitely" or "mostly" accurately reflects the most important areas for walking.

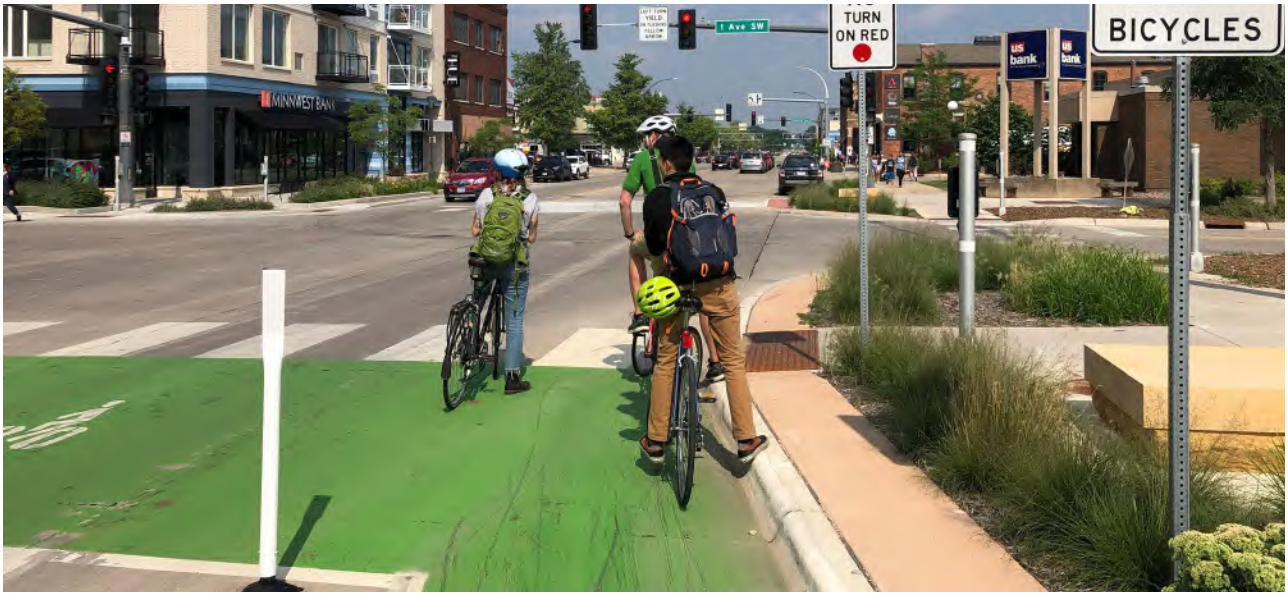
> "If I can walk to work, get groceries, go to a gym, etc. in downtown then my family can live with one vehicle, rather than two."

Improvements to the pedestrian network should include but go beyond what is required by the Americans with Disabilities Act (ADA) to achieve universal access. Universal access strives to do more than meet ADA requirements; it aims to incorporate accessibility into the core of the design, not as an afterthought. Universal design creates environments that function for everyone, where elements like lighting and decorative paving serve not only an aesthetic but functional purpose.

Many roadways with a higher priority score are also on the Primary Transit Network (PTN) and/or are classified as arterial or collector roads. The ROCOG 2045 plan identifies locations along the PTN where pedestrian facilities are needed to provide access to future transit stations as well as locations along other arterial and collector streets where gaps in the sidewalk network result in a lack of safe pedestrian travel options to serve existing development. Improvements along these roads should be coordinated with ROCOG.

Figure 9. Pedestrian Network Prioritization





All Ages and Abilities Bicycle Network

Existing Network

Rochester's bicycle network is composed of bike lanes and trails. Over the last ten years, approximately 20 miles of trails and bike lanes have been built in Rochester. These active transportation facilities have helped to close gaps in the network and improve access to destinations citywide.

While the bicycle network has grown, much work remains to make bicycling for daily transportation a viable option for more Rochester residents. In 2019, the median trip distance in the City of Rochester was 2.9 miles. During Fall 2019 specifically, about 510,000 trips per day started in the City of Rochester; 80% of those trips were made using a motor vehicle. Trips of three miles or less are considered to be potential candidates for conversion from driving to active modes. meaning that more than half of daily trips in Rochester can potentially be made by active modes.

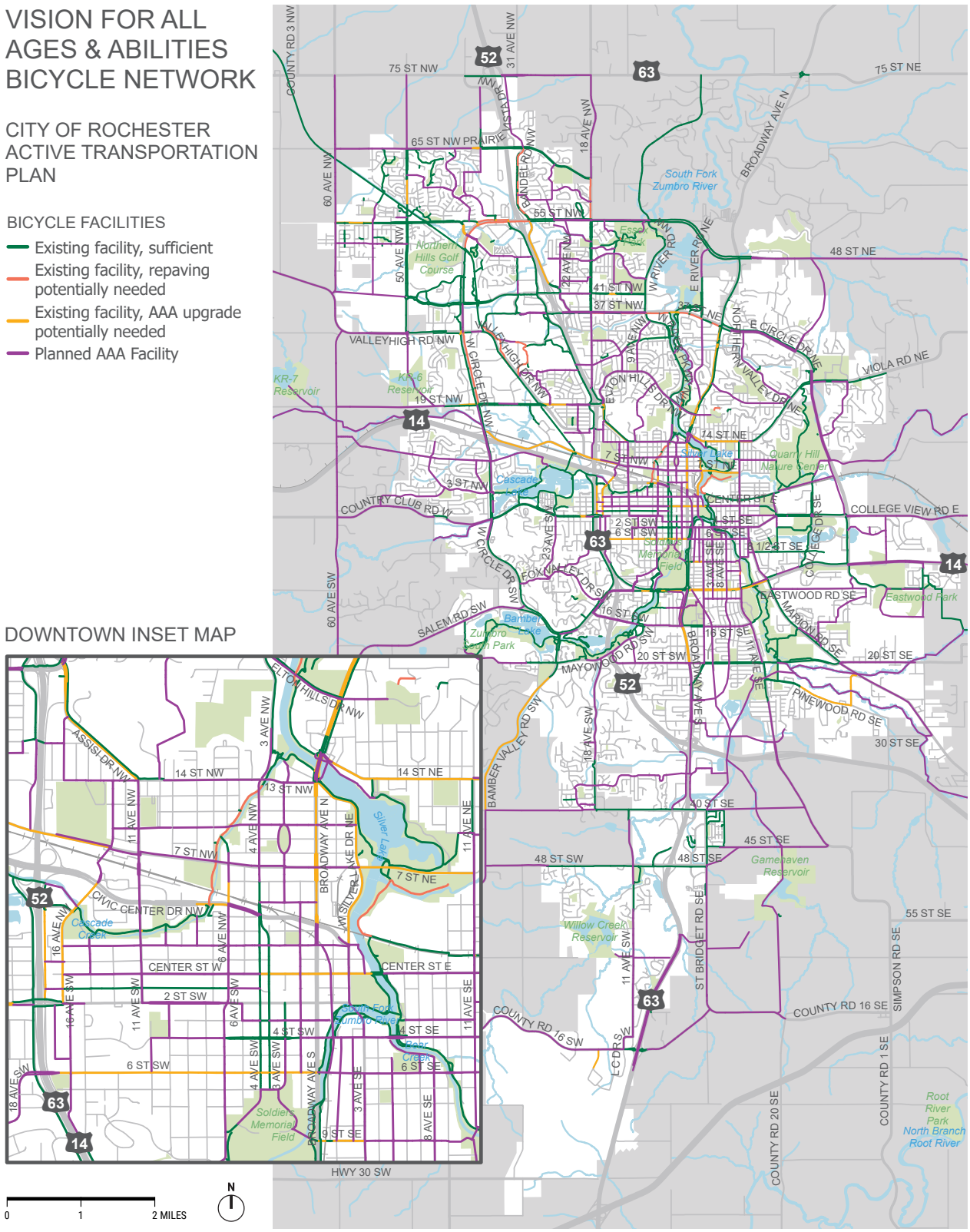
Vision for All Ages and Abilities Bicycle Network

The plan developed a vision for An All Ages and Abilities (AAA) bicycle network that would be designed to serve people of all ages and abilities, and come within ⅛ mile (a 2-3 minute walk) of major destinations.

In cases where the network does not directly connect to the destination, traversing the last 1/8 mile may mean riding on a quiet residential street, or walking with the bike along a sidewalk for 2-3 minutes.

More than half of Rochester's 510,000 daily trips could potentially be made by active modes.

Figure 10. Vision for the All Ages and Abilities Bicycle Network



Destinations connected by the network include schools, shopping/commercial centers, parks, recreational spaces, major employers, the downtown transit center, hospitals and medical centers, libraries, and community centers.

The distance between parallel bikeways is ¼ mile or less in areas with more residences and jobs, and ½ mile or less in areas with fewer residences and jobs.

The network is made up of existing bikeways, bikeways that were proposed in previous plans, and newly proposed bikeways based on public input, city staff input, and a review of the data on physical and social conditions for biking.

The AAA Bicycle Network will be designed to meet Rochester residents' desire for physical separation between people biking and people driving motorized vehicles on busier roadways. It also designs for separation between people biking and people walking where needed.

On some streets an AAA bikeway can fit in the existing roadway space, while on other streets, implementing an AAA bikeway may need to occur with street reconstruction.

In Phase 2 engagement for this plan, members of the public were presented with a map of the vision for the AAA Bicycle Network (Figure 10), and then asked how many of the places they want to go would be easy to reach by bicycling when the network is fully built. Nearly 80% of respondents who bike or want to bike said they will be able to easily reach all or most destinations. For more see Public Engagement Phase 2 public input in Appendix A.

Prioritization

With the plan's goals (health, equity, safety, connectivity, resiliency, and economy) in mind, planned facilities and existing facilities identified as potentially needing an upgrade or repaving were scored using a combination of five factors:

- Demand: areas where people live, work, play, learn, shop, and take transit (weighted at 30%)
- Land use: areas where many people and destinations are close together (weighted at 5%)
- Level of Traffic Stress: streets where speeds, number of travel lanes, and inadequate bicycling facilities make it uncomfortable to ride a bike (weighted at 30%)
- Crashes: locations where people driving motor vehicles crashed into people biking, and the crash was reported to the police (weighted at 5%)
- Equity: areas with higher percentages of people with disabilities, households without access to vehicles, people with low incomes, people with limited English-speaking ability, people over age 65, and people who do not identify as white (weighted at 30%)

The prioritization results (Figure 11) were shared with the public through the Phase 2 engagement process. Among those who bike or are interested in biking, over 75% of respondents (153 people) said that the network prioritization "definitely" or "mostly" accurately reflects the most important areas for bicycling.

"We need more businesses on bike routes for easy access"

Figure 11. Prioritization Results for the All Ages and Abilities Bicycle Network

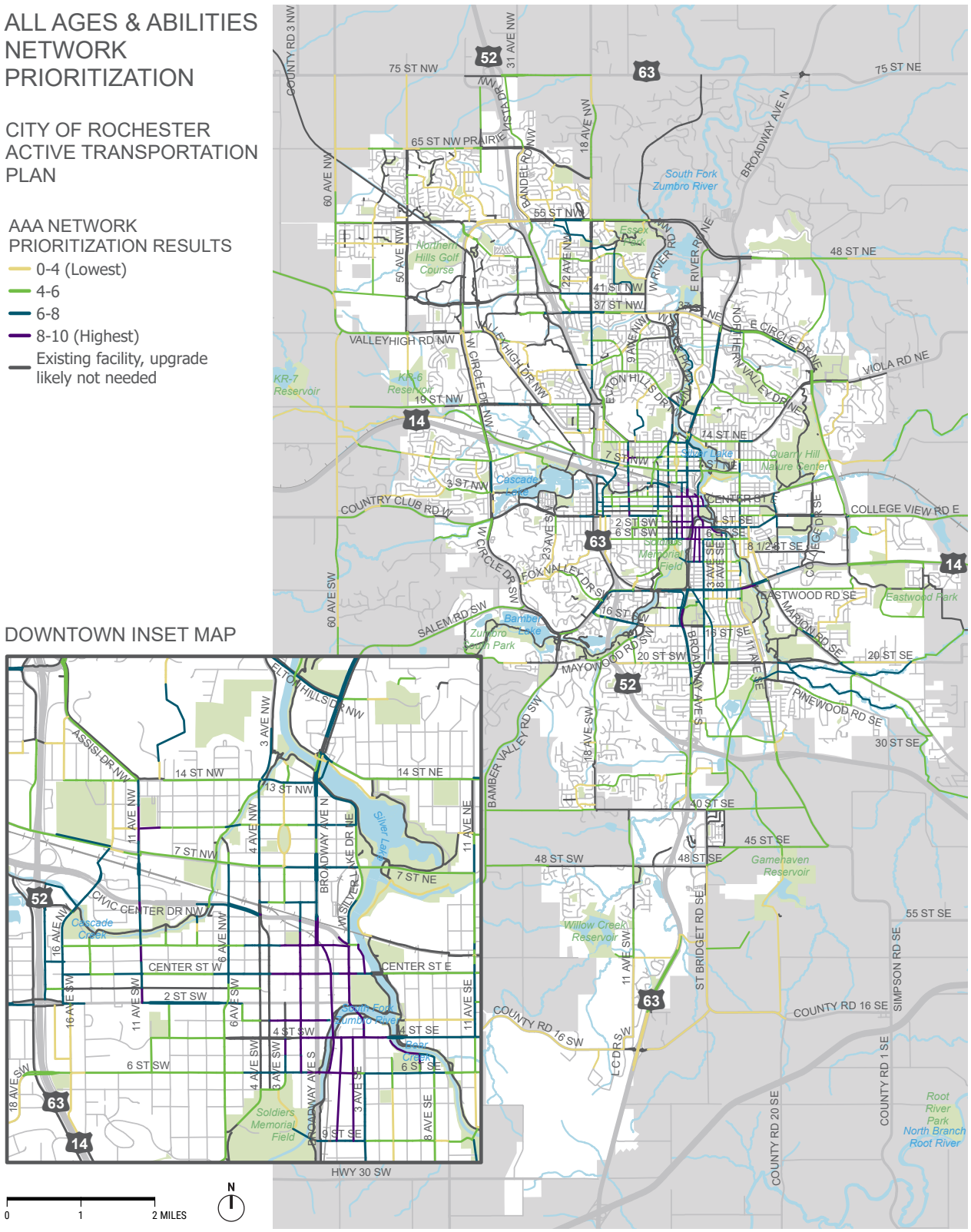
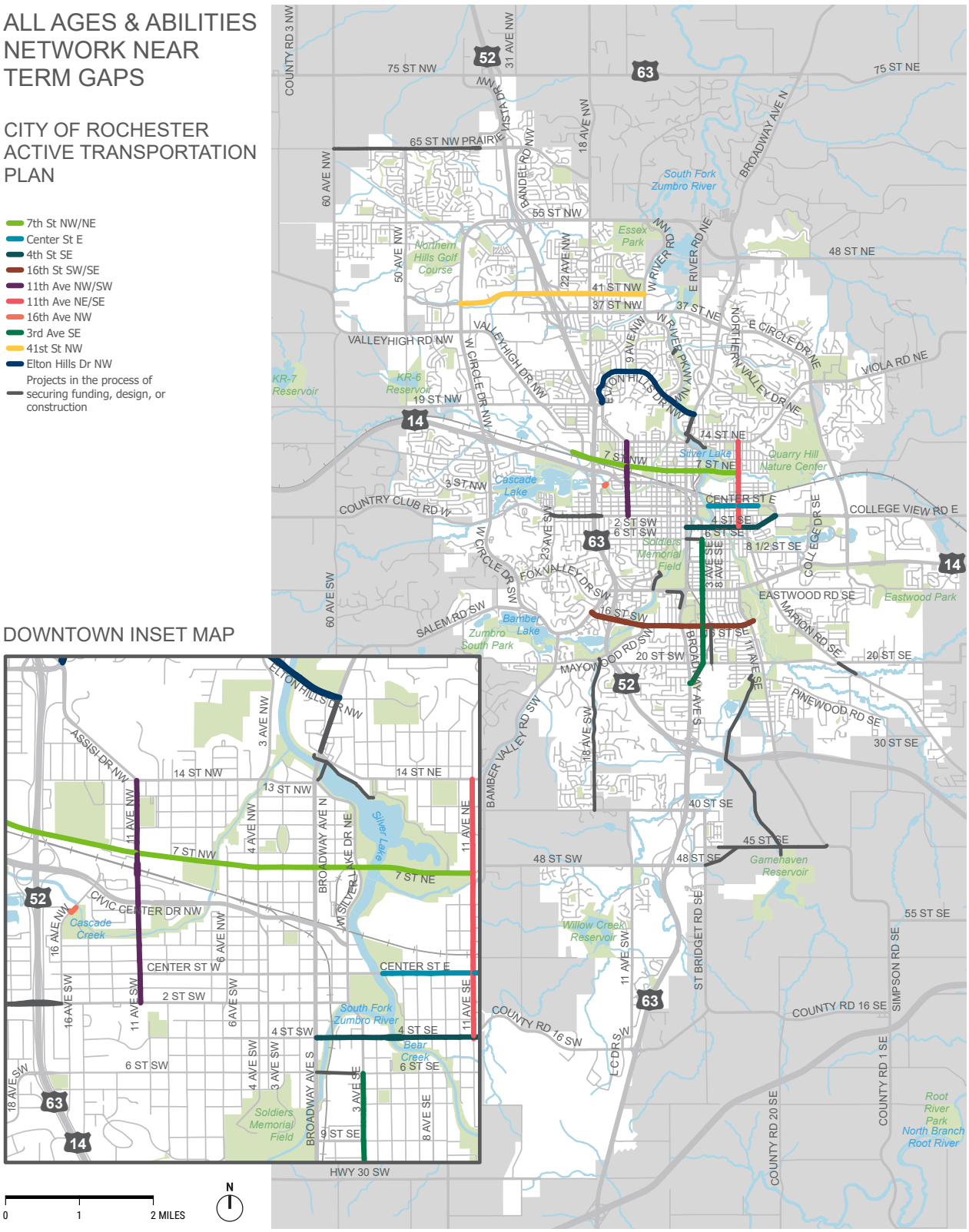


Figure 12. All Ages and Abilities Bicycle Network Near Term Gaps



Near Term Gaps

Using a combination of the prioritization results, public input, and review of opportunities in the City's Capital Improvement Program, ten potential near term gaps were selected for further analysis to accelerate implementation of the AAA network.

In no particular order, these projects are:

- 7th St NW/NE from Douglas Trail to 11th Ave NE
- Center St E from Zumbro River to 15th Ave SE
- 4th St SE from Broadway to 19th Ave SE
- 16th St SW/SE from Salem Rd SW to 11th Ave SE
- 11th Ave SW/NW from 14th St NW to 2nd St SW
- 11th Ave NE/SE from 4th St SE to 14th St NE
- 16th Ave NW connection along Cascade Creek
- 3rd Ave SE from 6th St SE to Broadway
- 41st St NW from W Circle Dr NW to W River Pkwy NW
- Elton Hills Dr from Assisi Dr NW to Broadway Ave N

See Figure 12 for a map of these ten near term gaps, as well as other projects in the process of securing funding, design, or construction.

Cost estimates for these ten gaps, along with cross-sections showing further detail on three "do now" projects, can be found in Appendix C: Implementation Resources.

Currently, the Rochester Transit Development Plan and the Rochester Middle Schools' Safe Routes To Schools (SRTS) Plan are ongoing efforts. The City will reference related documents when proposing future projects for the CIP and for City Council consideration

> The AAA Bicycle Network will be designed to meet Rochester residents' desire for physical separation between people biking and people driving on busier roadways and separation between people biking and people walking where needed.

PROCESS & POLICY RECOMMENDATIONS

Key process and policy recommendations around GIS and data collection, public engagement and communication, evaluation, and shared micromobility were developed in response to City team member ideas and needs.

ADA Transition Plan Recommendations

- Reframe accessibility improvements in terms of universal access. The plan must also clearly communicate that accessibility is a human rights issue. Go beyond ADA to think holistically about creating environments that work for all.
- Document all curb ramps, sidewalks, push buttons, and crosswalks within the City. This detailed inventory will give planners and engineers information about existing conditions and areas in need of accessibility enhancements.
- Enhance connections at bus stop transfer points throughout the system for people with disabilities. These connections include walking between forms of transit and walking to/from destinations during a transit trip.

GIS and Data Collection

GIS and data collection recommendations focus on improving the City's data availability over time.

- Dedicate funding within consultant project budgets and City staff time budgets toward developing new datasets AND maintaining existing datasets.
- Develop a data maintenance and management plan for data created as part of this planning initiative.
- Involve Public Works GIS staff in the creation of future plans. Schedule check-in meetings between GIS staff and the consultant team from the beginning of the project.
- Create a "wish list" of data that have not been created by the City or other agencies. Work through the list as interns or other staff are available for data collection work.
- Coordinate regularly with the County and ROCOG to facilitate data sharing and create more efficient data collection, maintenance, and distribution processes for the region.
- Develop a standardized set of characteristics to collect for pedestrian ramps, including characteristics needed to prioritize ramps for improvements.
- Dedicate funding to develop a comprehensive, up-to-date inventory of pedestrian ramps, either via staff field surveys, automated data collection and analysis (e.g., PathVu, StreetScan), or a combination of multiple approaches.

Public Engagement and Communication

Public engagement and communication recommendations seek to enhance relationships with community members and increase education about the benefits of active transportation infrastructure.

- Build time into project schedules to update City communications about project progress, benefits, and other information. Involve other City departments in this work to avoid capacity issues with any one group (e.g., Parks & Recreation, Public Works).
- Create a new staff role dedicated to community engagement and communication. Focus on proactively collaborating with community members, especially underrepresented communities (e.g., people with disabilities, people of color).

- Regularly report on transportation benefits and upcoming projects to City Council members and the public. Work with business owners and other community leaders to share their positive experiences with multi-modal transportation improvements.
- After completing the plan, host educational sessions for relevant agencies to support them in incorporating the plan in their work.

Evaluation

Coordinated approaches to evaluation would quantify the benefits of active transportation and make a strong case for continued investment of staff time and funding.

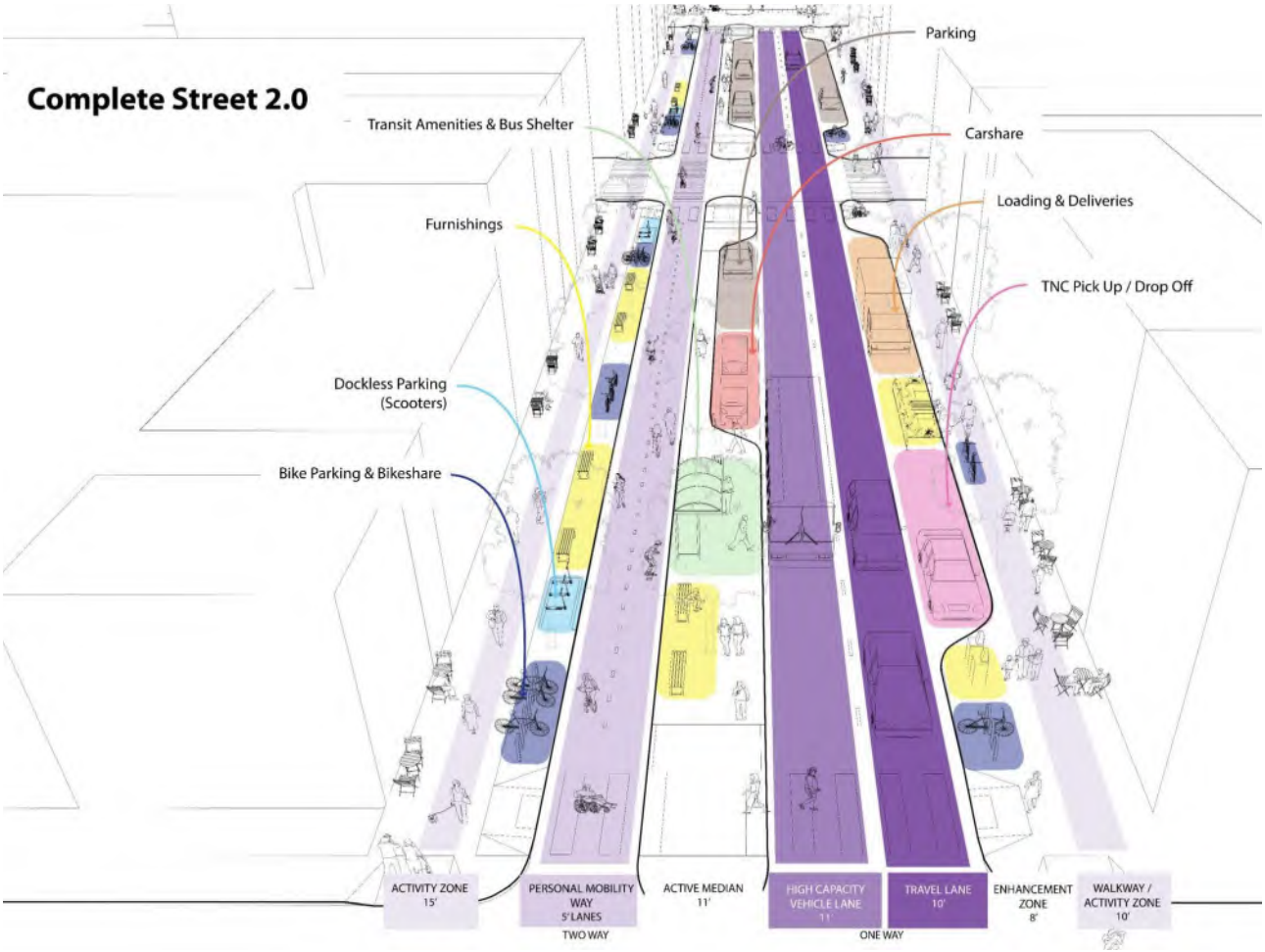
- Create an evaluation plan for Public Works projects that allows staff to measure and communicate the benefits of active transportation and transit improvements.
- Create an evaluation plan to help Parks & Recreation more systematically measure usage of and attendance at Parks facilities and programming, which could help to justify further investments in active transportation infrastructure and build resident support.
- Evaluate on- and off-street parking supply, demand, pricing, and policy history to identify potential parking surpluses throughout the city. Consider the potential for district parking plans and seek ways to disincentivize driving/parking.
- Expand bicycle and pedestrian data collection throughout the City to better characterize the need for implementing plan recommendations. Consider using Replica or another data service for this information. This could provide more information than expanding the network of physical bike counters throughout the city. Incorporate findings within City communications.

Network Development

Network development recommendations focus on improving physical infrastructure throughout the city and creating a connected network for walking and biking.

- Consider connections through and adjacent to parks when developing this plan's network recommendations. This would enhance access to park resources and contribute to a multi-functional network (e.g., one that serves utilitarian and recreational demand).
- Integrate green stormwater infrastructure within active transportation projects, especially in flood control areas and downtown.
- Explore future opportunities to apply flood control funding to on-street infrastructure projects that can improve green stormwater infrastructure.
- Consider options for the City taking a greater role in year-round maintenance of more active transportation facilities, perhaps by contracting to local small businesses for snow removal and other operations.
- Include year-round maintenance costs in project budgets.
- Prioritize the development of infrastructure that provides high quality active transportation travel in winter, including separated bike lanes.

"If I could get to and from my destination uninterrupted by car traffic is something that would immensely incentivize me to bike"



Shared Micromobility

Background

In 2016, Nice Ride opened a bike sharing service in Rochester, offering human-powered orange bicycles at two (and later, three) staffed docking stations in the city. But by 2018, these docking stations were closed: limited locations, hours, and ridership; a dearth of bike-friendly roads; a change in ownership of Nice Ride; and advances in dock-less bikes, electric bikes, and phone-based bike rental apps all contributed to the limited duration of the program.

Since Nice Ride's closure, Parks & Recreation has offered a bike share program that allows community members to check-out 8-12 conventional (and two electric-assist) bikes from the public library from May through October each year. In June 2020, Rochester entered a new phase of shared micromobility services when the City Council authorized Lime, a private shared micromobility service provider, to offer electric scooters and electric bikes. Lime has continued to provide electric scooters and electric bikes since, with approval from the City to continue operations (of up to 300 scooters and 50 electric bikes) through the end of the 2023 season.

As the City assesses existing shared micromobility offerings and plans for future services, there are a number of critical considerations that will help to inform the direction of shared micromobility services in the City:

1) Define Program Goals

What does Rochester want from shared micromobility? Establishing program goals can guide decision-making about how to design, fund, and implement a shared micromobility program.

Common goals include: improve access to key destinations; improve access to and from public transit; improve public health; improve transportation system safety; introduce new people to biking and other forms of non-vehicular travel; reduce congestion; and reduce greenhouse gas emissions and other types of pollution (e.g., noise, water, particulate).

Equity is an overarching priority for program design and should be incorporated into each specific program goal. Pricing structures, infrastructure siting, and other program design choices will influence the equity impacts of shared micromobility.

2) Evaluate Resource Availability

How much funding is available from public and non-public sources? While some early shared micromobility programs were funded entirely by private organizations, time has shown that public investment is critical to sustain an effective and equitable program. This aligns with other modes of transportation, where public investment complements user fees and other funding sources.

However, because shared micromobility can meet many private organizations' goals, opportunities for partnership abound. Sponsorship on bikes, scooters, or docking stations can drive brand awareness. Organizational memberships can serve as a perk for employees and can account for a large share of system ridership and revenue.

Public funding can come from the local, state, and federal levels. Local funding is often the most flexible and can fill in gaps not covered by other revenue sources. Local funding can also help address community-specific goals, such as improving equitable access to a local park or grocery store.

3) Review Laws and Regulations

An understanding of the legal landscape will also inform program design. Municipal counsel can provide insight on this front, and insurance and liability coverage can help to reduce risks.

4) Assess Existing Infrastructure and Infrastructure Needs

The existing conditions analyses conducted as part of this plan will form the basis for understanding bicycle and pedestrian infrastructure in Rochester. By leveraging these findings, Rochester can identify important infrastructure characteristics—e.g., network gaps, protected bike corridors, areas of high need—and use these to shape where shared micromobility services are offered, as well as areas where additional infrastructure is needed to support safe and comfortable trips for all users.

5) Identify Program Parameters

With clear program goals, an understanding of available resources, knowledge of the legal context, and data describing active transportation facilities, travel patterns, and related community characteristics, the City will be poised to make critical program design decisions. Who will own and operate the program? How much public funding will be used, and to what ends? Will the fleet comprise human-powered bikes, electric-assist bikes, electric scooters, or a mix of multiple device types? How will pricing, service location, and program seasonality promote equitable access and use?

Next Steps

The above considerations will help to shape a long-term vision for shared micromobility in Rochester and will inform actions needed to realize this vision. As the City begins this planning process, it will be critical to collaborate with communities and residents impacted by limited transportation access, as well as with relevant organizations (e.g., bike advocacy groups, health promotion non-profits, transportation safety advocates). Working with Lime and Rochester's Parks & Recreation department to identify successes, limitations, and unmet needs of existing shared micromobility programs will also be key. Short- and medium-term actions include:

- Convene a shared micromobility advisory committee.
- Solicit public input around existing and desired shared micromobility services.
- Integrate shared micromobility infrastructure needs (e.g., device parking spaces; protected on- and off-road facilities) into planned projects.
- Quantify existing use and estimate demand for shared micromobility services for the next 10-15 years.
- Develop an implementation plan for shared micromobility for adoption by the City Council.

Other Recommendations

- Hire a dedicated bike and pedestrian planner; participants identified this as critical to the plan's success.
- Continue collaboration between Public Works and Parks & Recreation.
- Explore opportunities for better coordinating work that involves multiple agencies or City departments.
- Require pedestrian facilities as part of the development approval process.
- Proactively identify grants to support bike and pedestrian projects that align with this plan.
- Use demonstration projects as a way to build momentum for long-term change.
- Encourage Parks & Recreation and other city departments to start piloting electric-assist cargo bikes as a way to reduce reliance on internal combustion engine vehicles.
- Enhance options for downtown bike repair and provide amenities for bicycle commuters.
- Implement consistent wayfinding signage for active transportation throughout networks; consider showing time in addition to distance.

Sidewalk Maintenance

The sidewalk is an essential space for people walking and using wheelchairs and other personal mobility devices, and it is also the location where many other important activities take place. Each of the zones described in 'Sidewalk Zones' needs to be maintained for the overall sidewalk space to function as intended.

Maintaining Sidewalk Zones

- The **Primary Pedestrian Zone** must remain free and clear of obstacles and impediments. This is the primary accessway for people traveling along streets and to and from adjacent properties, and must be maintained to ADA standards.
- Property owners are responsible for maintaining all sidewalk zones abutting their property, not just the Building Frontage Zone. The City shall enforce per City Ordinance/Policy.
    - Maintaining a firm, stable, and slip resistant surfaces is necessary for people walking or rolling to traverse this zone without risk of tripping, slipping or otherwise uneven footing.
    - Regular sweeping ensures the zone is kept free of natural debris and litter.
    - Routine maintenance of sidewalk damage due to tree roots, freeze-thaw, etc. is the responsibility of abutting property owners.
- The **Amenity Zone** is where street furnishing are located, where people are often picked up and dropped off, where mail is delivered, and where other loading/unloading happens. It's the space where trees and landscaping are planted, and where street lighting and other utilities are located. This zone must be maintained properly to ensure access to this area and all of these curbside uses are possible.
    - Vegetation in the Amenity zone should be regularly maintained by the City so as not to encroach on the primary pedestrian zone. Maintainance should be prioritized by plant species, high demand areas, and/or narrow sidewalk corridors. When not maintained, the primary pedestrian zones becomes constrained, creating bottlenecks, and may force pedestrians into the street.
    - During snow events, this zone may be designated for snow storage, but must not impact the Primary Pedestrian or Enhancement Zones.
- The **Building Frontage Zone** between the Primary Pedestrian Zone and the abutting property may be utilized by businesses for outdoor cafe seating by permit along commercial corridors, and occupied by landscaping or other natural screening in residential areas.
    - Outdoor seating shall not occupy the Primary Pedestrian Zone or inhibit travel along the sidewalk.
    - Landscaping in the Building Frontage Zone should be maintained in a manner similar to landscaping in the Amenity Zone. Landscaping should be maintained by property owners so as not to encroach on the Primary Pedestrian Zone.
- The **Enhancement Zone** must be maintained for the following uses: bike facilities, vehicle parking, curb extensions, and bike parking.
    - Street sweeping and snow/ice removal should be conducted per maintenance schedule and following significant weather events to help to ensure intended use of this space. Snow must not be stored in bikeways

Winter Maintenance Program

Prioritization and scheduling is a key component of a successful winter bikeway program. For most jurisdictions, keeping all bikeways completely clear during or immediately after a heavy snow event is infeasible. Clearing major city bikeways as soon as possible provides the best access to the greatest number of people possible following a heavy storm event.

The major bikeway network and winter maintenance program need to focus on major local destinations. If roadway clearing and de-icing begins first thing in the morning, primary routes leading to schools, commercial corridors and business districts, and other major destinations should be cleared first.

Snow storage spills out onto a separated bike lane reducing the path of travel along this block in Salt Lake City, Utah.

Coordination between agencies and departments responsible for on-street bikeways and shared use trails is necessary to ensure the major bikeway networks are plowed in an organized, complete, and timely matter.

In Järvenpää, Finland, Class A routes, the main bikeway routes from residential areas to the city center and through the city center, are cleared first. This is followed by Class B routes, bikeways along other major roads, and Class C routes, those along residential streets and through parks.

- Class A routes are plowed within 4 hours of 3 cm of snow accumulation and de-icing treatments are applied before 7am. Plowing is done before 7am when snowing at night.
- Class B routes are plowed within 4 hours of 5 cm of snow accumulation and de-icing treatments are applied as needed. Plowing is done before 7am when snowing at night.
- Class C routes are plowed after class B routes and plowing is done before 10 am.

Sand and road grit is cleared from Class A, B and C bikeways in Järvenpää every year before the 1st of May.

Wisconsin DOT offers guidance on the prioritization of snow removal from shared use trails (Wisconsin Bicycle Facility Design Handbook, 2009 p. A-4, A-5):

Winter use varies according to local conditions. In some communities (e.g. Eau Claire, Madison), trails are plowed regularly due to frequent use. Heavily-used trails that serve key destinations should be considered first for plowing. Trails that serve only occasional use should also considered for snow removal when the trail is the only means of making a key connection (e.g., crossing a bridge). Isolated trails serving recreational users who must travel long distances to use them may be given lower priority. In these cases, managers may want to allow use by cross country skiers or snowmobile operators as long as all applicable laws are followed.

To ensure that winter use is properly accommodated, agencies must clearly understand who will maintain what trail. For trails along state highways, a municipality will have the responsibility for maintenance. Winter use and snow removal frequency will be determined by the municipality after considering the following factors:

- Expected use by bicyclists and pedestrians;
- Parallel options for bicyclists and pedestrians if the trail is not passable

A good winter maintenance program requires a maintenance plan that prioritizes facilities, establishes a maintenance schedule for frequent clearing, and sets operational standards for maintenance relating to facility design, equipment, and materials.

As stated with the DMC, The City Loop should be identified as a priority route for winter maintenance, with the city (or another designated entity) assuming responsibility for snow and ice-clearing operations. In many cases, adjoining property owners maintain sidewalks and shared-use paths. On priority routes not maintained by the city, the city should work directly with property owners by encouraging/enforcing snow removal.

Additional consideration is required during design and operation to provide winter maintenance on separated bikeways. The City's Winter Maintenance Program should be updated to include these facilities.

Major bikeways prioritized for plowing provide direct, predictable, connections for people on bike and these routes may overlap with other designated transit, freight, or emergency service routes and should receive special attention.

In the situation where the main arterial or collector has curb-tight sidewalks and has not provided a specific snow storage location, the bike lane may be used for snow storage when a parallel off-street or parallel route is available and snow operations can keep that parallel facility ridable. Notification of bike lane closure and re-routing to the parallel facility should be provided. Temporary signage, media updates, and routable mapping notifications need to indicate the maintained route.

As discussed earlier in the use of the buffer of a buffered bike lane being used for snow storage, the melting from this pile will sheet flow across the parking protected bike lane and needs to be worked into the overall winter maintenance operation to ensure adequate traction in icy conditions.

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Active Transportation Plan

APPENDIX A: ENGAGEMENT SUMMARY

PUBLIC ENGAGEMENT PHASE 1

SUMMARY

Public outreach and engagement efforts for the Rochester Active Transportation Plan are inclusive, interactive, and structured to inform our team's understanding of community needs and opportunities, shape plan recommendations, and build support for the planning process and for plan implementation.

The principal goals of public outreach are:

- Educate the public about the project goals and timeline
- Build relationships
- Create a community-informed vision and shared understanding of vision and goals
- Gather input on walking, biking, and rolling needs, opportunities, and expectations
- Solicit feedback on potential trade-offs, draft recommendations, and priorities

Engagement activities are structured in two phases. The goals of Phase 1 engagement for the project are:

- Introduce the project
- Inform the public on the plan's vision and goals
- Gather input on the community needs and desires

This memo summarizes Phase 1, beginning by outlining opportunities for public input on the plan. These included public events, listening sessions, a survey, and an online interactive map. Public input and the resulting recommendations from the Sustainability and Resiliency Plan are also incorporated in the summary.

> "Biking is a terrific way to get around! I have really appreciated how much the City of Rochester has invested in creating bike lanes on major roads through downtown and maintaining the trail system."

Three major themes emerged in public engagement: desire for more transportation options, tension over transitioning to a multimodal transportation system, and desire for comfort and safety in public spaces.

The memo organizes community input into the following categories:

- Priorities For Pedestrians
- Bicycle Facility Needs
- Design
- Programs and Policies
- Maintenance and Operations

Phase 2 of public engagement invited feedback on draft recommendations, trade-offs, project prioritization, and implementation action steps.

OPPORTUNITIES FOR PUBLIC INPUT ON THE PLAN

The public engagement process is focused on achieving a broad audience and reaching diverse communities. A project steering committee made up of residents, public agency staff, and community group representatives provided input on public involvement strategies. In Phase 1, public engagement strategies included a survey, interactive web map, public events, and listening sessions. Community voices from previous and concurrent engagement efforts were also included in Phase 1.

Public Events

The project team partnered with the city and community organizations to engage members of the public at events throughout the summer of 2021, including:

- Safe City Nights
- Rochester Farmers Market
- Thursdays Downtown
- Pata de Perro Community Bike Shop
- RCTC Resource Fair
- Riverfront Reimagined
- Mobility Fair

Residents and visitors had the opportunity to share ideas via a post-it note board, bean counting game, and/or informal interviews, depending on the type of event. Regardless of the format, a central question was posed to individuals at each event: What would make you more likely to bike or walk somewhere in the city?

Listening Sessions

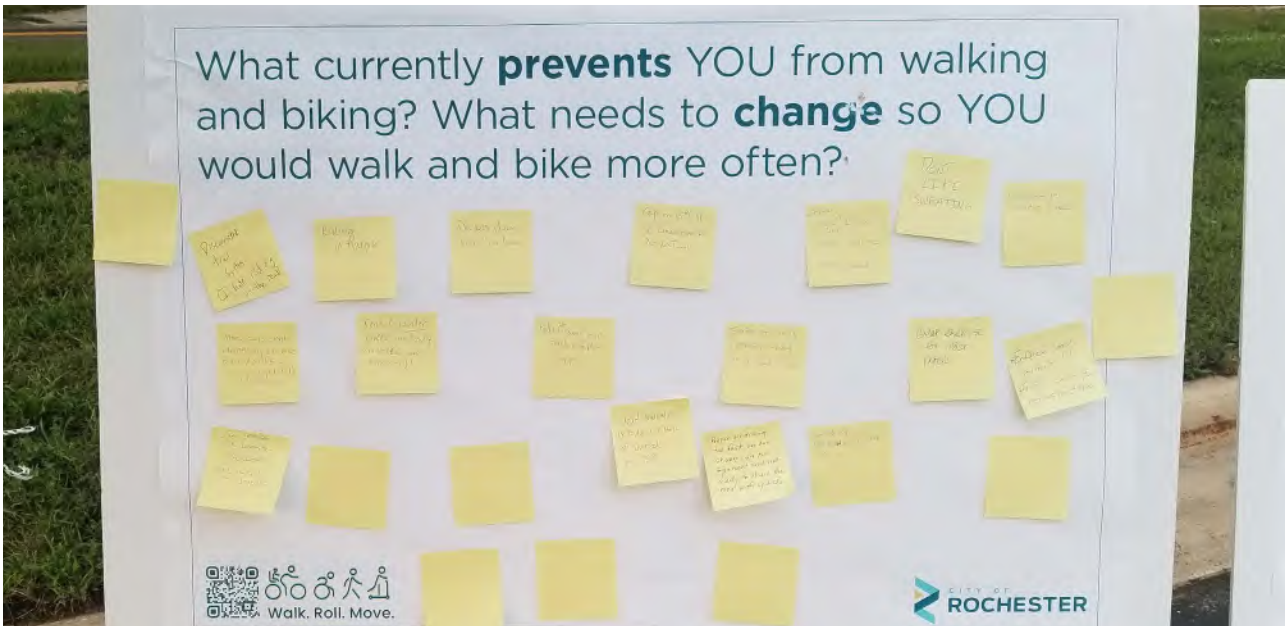
The project team met with community groups to discuss their ideas and concerns in depth. These groups included:

- National Federation for the Blind, Rochester Chapter
- disABILITY Mayo Employee Resource Group (MERG)
- Citizens Advisory for Transit
- We Bike Rochester
- Rochester Bike Summit
- Rochester Pedestrian and Bicycle Advisory Committee

Survey

Nearly 1,000 Rochester residents and visitors took the project's online survey. The survey included optional demographic questions that shed light on how closely the survey respondents represent the residents of Rochester:

- **Disability:** Of those who reported a disability status, 11% identified as having a disability.
- **Race and ethnicity:** Of those who reported a race or ethnicity, 87% of identified as White alone (not Hispanic or Latino) and 13% as a race other than White. People who identify as White alone were over-represented in the survey, as they make up 75% of Rochester's population.
- **Home ownership:** Of those who reported home ownership status, home owners were overrepresented in the survey, with 87% of respondents owning their home. 66% of homes in Rochester are owner occupied.
- **County of origin:** Of those who reported a country of origin, people who were born in the United States



were overrepresented in the survey, comprising 96% of survey respondents but 86% of Rochester's population.

- **Age:** People aged 18 to 24 were the most underrepresented age group, at 3% of survey respondents but 11% of Rochester's adult population. People aged 25-34 were also underrepresented, at 17% of respondents and 21% of Rochester adult residents. People over age 74 were underrepresented, at 4% of survey respondents but 9% of Rochester's adult population. People aged 35 to 44 were the most overrepresented group in the survey, at 25% of respondents and 17% of Rochester adult residents. People aged 45 to 74 were also overrepresented.
- **Gender:** Of those who reported a gender, 48% were female, 49% were male, and 3% were Trans, genderqueer/ gender non-conforming, or other. 51% of Rochester residents identify as female.
- **Sexual Identity:** Of those who reported a sexual identity, 84% were Heterosexual/Straight, and 16% were Asexual, Bisexual, Gay, Lesbian, Queer, Questioning, or preferred to self-identify.

Interactive Online Map

Rochester residents and visitors left 395 suggestions on the webmap, made 91 comments in response to the original suggestions, liked the suggestions 1,544 times, and disliked the suggestions 27 times.

Previous and Concurrent Engagement

The project team incorporated findings from the extensive engagement process for the Rochester Sustainability and Resiliency Plan. Engagement included nearly 40 in-depth listening sessions with community groups and individuals who reflect the diversity of Rochester, including elders, immigrants, black people, people of color, young adults, high school students, people with disabilities, and more. Members of the public also shared their perspectives through a survey available in English, Spanish, Somali, and Arabic.

SURVEY FINDINGS

Why People Walk

Health (73% of respondents) and recreation (67%) are the most common reasons survey respondents walk around the city. Shopping or errands (39%) and as past of a trip to work (24%) are also common reasons for walking. 15% selected "other." 20 of the 149 "other" responses mentioned dog walking. Many people noted that they walk when the distance to their destination is short or when parking is difficult.

Why People Bike

The most popular reason survey respondents bike around the city is for recreation on regional trails (59%), followed by health (53%), for recreation on paved roads (40%), for shopping or errands (24%), and as part of a trip to work (21%). 30% of respondents selected "other", with the majority noting that they do not bike.

Top Priorities

When asked what four priorities Rochester should prioritize in planning for the future of the City's active transportation system, 37% selected "transportation options that support a sustainable city (address climate change, resiliency, reduction in driving, etc.)." 34% selected "Improved safety for all modes." "Improved maintenance of existing transportation infrastructure", "Safer, more comfortable, and/or more connected options for walking and biking along roadways," and "Safer, more comfortable, and/or more connected options for shared-use paths/ trails" tied at 33%. 28% chose "Social equity, prioritizing historically-marginalized communities (including low-income households, people of color, older adults, people with disabilities, etc.)."

> "I walk or bike everywhere year-round - rain, snow or shine."

MAJOR THEMES

Three major themes emerged in public engagement for this plan and the Sustainability and Resiliency Plan: desire for more transportation options, tensions over transitioning to a multimodal transportation system, and desire for comfort and safety in public spaces. Further detail on community input that will inform the development of major pieces of this plan is found on the following pages.

Desire for More Transportation Options

While the majority of survey respondents are satisfied with how often they use each mode of transportation, a significant portion of respondents want to change how they move around. Thirty percent want to walk more frequently than they currently do, 40% want to bike more, and 42% want to take transit more (Figure 1). Thirty-five percent want to drive less frequently (Figure 2).

Figure 1. Percent of Survey Respondents Who Want to Travel by the Given Mode **More** Frequently Than They Currently Do

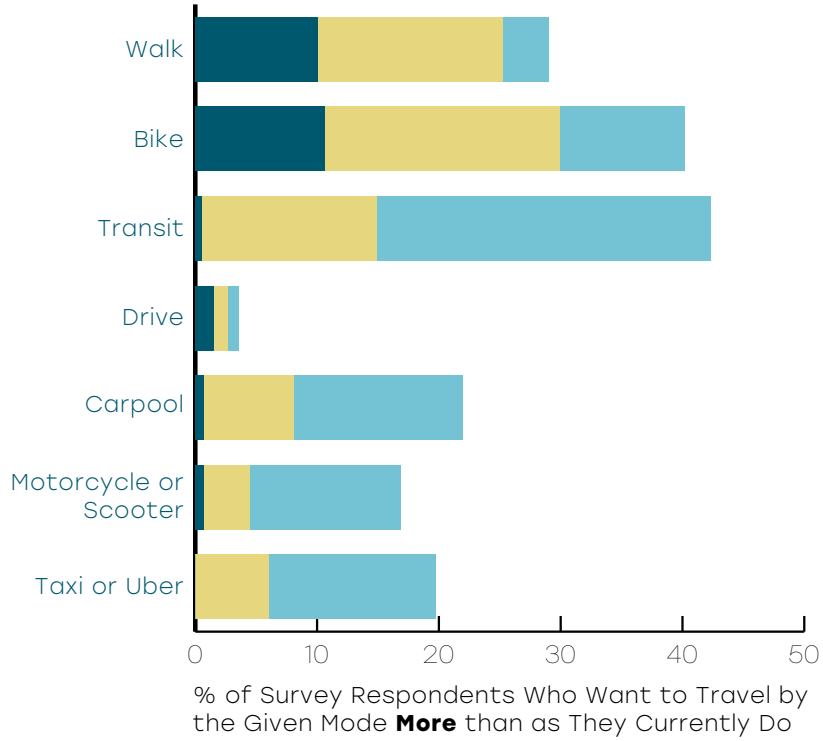
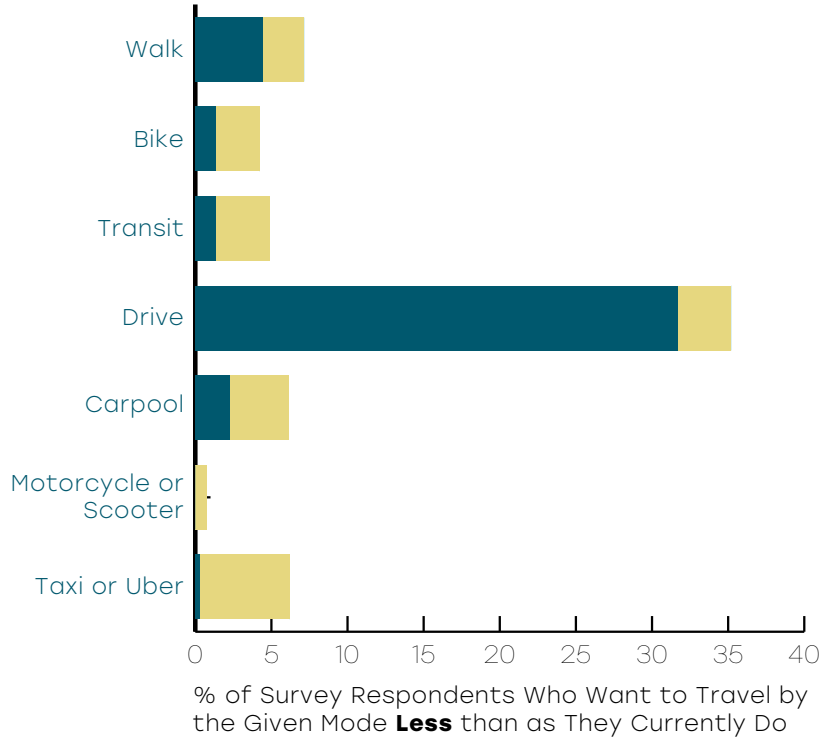


Figure 2. Percent of Survey Respondents Who Want to Travel by the Given Mode **Less** Frequently Than They Currently Do



Key

How Frequently Respondents Currently Travel by the Given Mode

- Daily or A Few Times Per Week
- Rarely or A Few Times Per Month
- Never

Thirty percent of survey respondents want to walk more frequently, 40% want to bike more, and 42% want to take transit more. Thirty-five percent want to drive less frequently.

During engagement for the Sustainability and Resiliency Plan, many people shared that they find it difficult to get around Rochester without a car, and that they feel more socially isolated when they travel by car. These sentiments were echoed in input on the Active Transportation Plan; as noted above, "Transportation options that support a sustainable city" was the most popular priority among survey respondents.

Tension Over Transitioning to a Multimodal System

People shared widely diverging views on whether the existing bicycle and walking network is sufficient. While some feel that bicycle facilities are taking up space that should be used to move and store motor vehicles, others feel that much more should be done to support bicycling. Some want people biking to share space with people walking, while others want them to be separated. Sharing space is of particular concern on downtown streets.

Some people voiced concern over the feasibility of traveling by modes other than driving during winter months, while others shared that they already travel by active modes year-round.

"I live one mile from my evening job but don't feel it is safe to walk alone in the dark."

"I don't bike - it is too dangerous to bike on major streets required to get a bike from my neighborhood to the places I visit."

Desire for Comfort and Safety in Public Spaces

People shared that they want to feel more connected to each other and more comfortable in public spaces (including while traveling along streets and trails). Many people biking have experienced harassment and aggression from people driving. Some people of color feel uncomfortable in public space because they fear mistreatment based on their race or ethnicity. Others feel more afraid of violent crime in Rochester than they once did. Poorly maintained active transportation facilities and environments contribute to a sense of discomfort.

There is general agreement about the possible improvements that would make people feel more comfortable bicycling in public spaces. Most people agree that bicycle facilities should be separated from vehicle traffic where possible to maximize comfort for all. To feel comfortable leaving their bikes while going inside to work or shop, many people would like to see more secure, covered bike parking that is publicly accessible, especially in the downtown area and near transit stops.

INPUT ON PRIORITIES FOR PEDESTRIANS

Desired Improvements

Nearly 30% of survey respondents want to walk more often than they currently do. One-third or more of these respondents said that the following changes would support them in walking more:

1. More destinations near me
2. More comfortable crossings of busy streets
3. Better lighting when it is dark outside
4. Sidewalks cleared after it snows
5. More sidewalks
6. More shade on my walking route

The top investment priorities among people who are frequent walkers or want to walk more are:

1. Improve safety of roadway crossings for people walking and biking
2. Improve safety for all road users
3. Improve winter maintenance of sidewalks and bikeways, including snow removal
4. Improve routine maintenance of streets, including repaving
5. Build more sidewalks that are fully accessible to people walking or including using a wheelchair, cane, walker, or other mobility device
6. Improve signal timing and coordination

Common Concerns

- There is not enough time to cross at signals.
- Pedestrian call buttons are unreliable.

> "I would walk more if there were more sidewalks, walking paths to places (not just around neighborhoods), and more protected crossings for pedestrians."

- People walking should have priority at intersections in the downtown area.
- Sidewalks are needed to access transit.
- People walking need access routes through construction zones.

A few streets came up repeatedly as major concerns for people walking:

- County Rd 22 (W Circle Dr NW)
- 11th Ave NW
- 7th St NW
- 65th St NW
- 2nd St SW and SE
- 14th Ave SW
- 20th St SW
- Broadway Ave S and N
- Viola Rd NE
- College View Rd E
- Highway 14

INPUT ON BICYCLE FACILITY NEEDS

Themes

Forty percent of survey respondents want to bike more often than they currently do. Two-fifths or more of these respondents said they would bike more if there were:

1. More separation between bikeways and motor vehicles
2. Better connected bikeways
3. More bikeways (bike lanes, trails, etc.)
4. More comfortable crossings of busy streets

Common concerns voiced in the survey, webmap, and at in-person events include:

- Transitions between bicycle facilities (from a trail to a bike lane, for example)
- Gaps in facilities, such as facilities ending before intersections, trails that turn into sidewalks, or missing links between trails and destinations
- Need for new facilities to access destinations like Quarry Park, Oxbow Park, the History Center, Crossroads Center, RCTC, and the Apache Mall
- Poor trail surface quality
- Narrow trails and sidewalks, especially on bridges
- Trail crossings of roadways, with a preference for grade separation
- Car/truck parking in downtown bikeways

Most Popular Webmap Suggestions

The most liked and commented-upon suggestions are highlighted in Figure 3.

Northwest

- A bicycle facility is needed on Valleyhigh Rd NW to Oxbow Park.
- A bridge to access the Douglas Trail from 14th Street NW is needed.
- There is an opportunity for a bicycle facility on Elton Hills Drive that could be a key east-west connection.
- Maintenance is needed on the trail on the east side of County Rd 22 (W Circle Dr NW). Safety improvements are needed at the intersection of County Rd 22 and Valleyhigh Rd NW.
- Trail crossings of 11th Ave NW and 16th Ave NW north of Cascade Creek need safety improvements.

Northeast

- The trail crossing of 11th Ave NE is uneven and not visible to people driving.
- There were multiple concerns about safety for people biking and walking in the area where Broadway Ave N crosses Silver Lake and intersects with 14th St NE. Commenters noted that there is a gap in the connection from the trail to on-street bike lanes on 14th St, as well as insufficient space for biking and walking on the bridge over Silver Lake.
- Repaving is needed along the path on the east side of the South Fork Zumbro River north of Elton Hills Drive NW.

Southeast

- The Hwy 52/Hwy 63 interchange area is a major barrier to biking and walking.
- The Southeast area is cut off from Soldiers Field.

Southwest

- Bicycle and pedestrian facilities are needed to support travel along and across 18th Ave SW from the City limits to Mayowood Road/Zumbro South Park.

Figure 3. Webmap Comments

WEBMAP COMMENTS

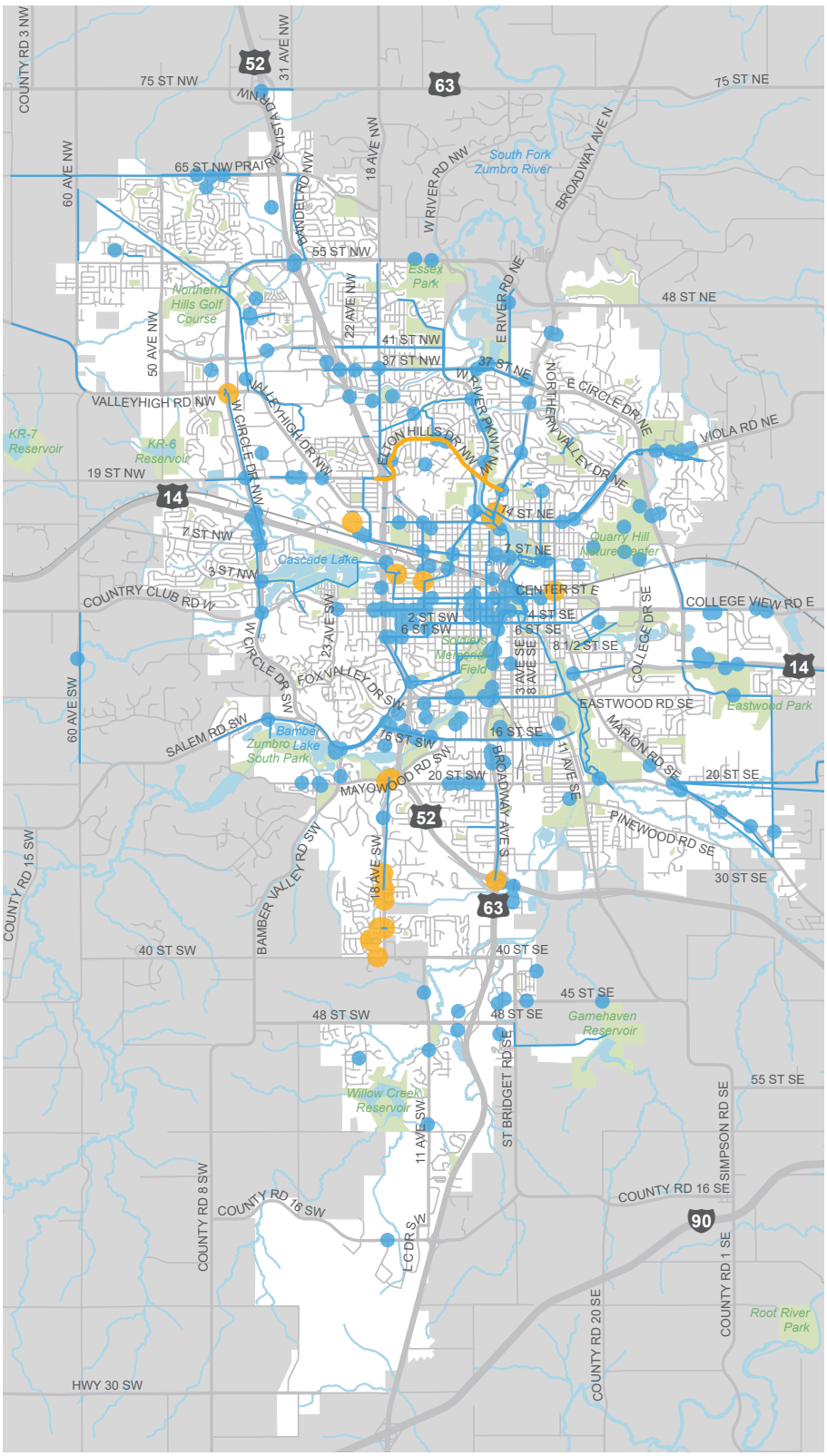
CITY OF ROCHESTER ACTIVE TRANSPORTATION PLAN

WEBMAP BARRIERS AND DESTINATIONS

- Suggestion with >20 likes or >1 response
- Other Suggestion

WEBMAP ROUTES

- Suggestion with >20 likes or >1 response
- Other Suggestion



INPUT ON DESIGN

Separation of Modes

Over 70% of survey respondents who want to bike daily or a few times per week said they would bike more if the bikeways provided more separation from motor vehicles. Separation from traffic was the most important factor for those who want to bike a few times per month or rarely.

Separation of people walking from people bicycling is important in areas with higher volumes of people walking or biking, such as downtown and on popular trails. Many existing trails and sidewalks were noted as being too narrow, especially on bridges.

Climate Change Resilience

During engagement for the Sustainability and Resiliency Plan, many Rochester residents said they want public spaces that are designed to be more resilient and usable all year round even during harsh weather. Members of the public want to see more trees, better management of stormwater and flooding in public spaces, food-producing plants included in public landscapes, and designs that support pollinator populations.

The Sustainability and Resiliency Plan recommends the following:

- Assess climate change vulnerability and evaluate risk and resilience by determining flood prone areas throughout the City and evaluate flood risk potential not only for current design standards but also for design standards reflective of predicted climate change scenarios.

> "Bike lanes need to be physically separated with hard barriers to prevent cars from driving or parking in them."

- Evaluate and implement alternatives to pesticides and fertilizers in landscaping practices.
- Prioritize the use of materials that are made to last, reducing the ongoing operation, maintenance, and eventual replacement of the materials. Further, as a means to reduce heat island effect, evaluate materials that have a higher solar reflectivity index.

Amenities

- Include public art that reflects diversity of community and promotes equity.
- Provide signage that is accessible in multiple languages and abilities.
- Develop and implement uniform waste and recycling stations across City facilities, including parks and outdoor spaces.

INPUT ON PROGRAMS AND POLICIES

Land Use

Sixty percent of survey respondents who want to walk more said they would walk more "if there were more destinations near me." The following recommendations from the Sustainability and Resiliency Plan align with this feedback:

- Evaluate zoning policy changes for new developments and require sidewalks for safe community service access.
- Evaluate and facilitate developments that prioritize living, working, shopping, entertainment, and food in centralized areas. Prioritize current childcare, food, and transportation deserts.
- Repurpose underused or vacant land to create complete, walkable communities.

Amenities

- Provide free covered bike parking in downtown garages by their entrance and at transit stops.
- Encourage bike parking at businesses, including City facilities.
- Encourage and fund more opportunities for public art in the community.

Encouragement

The following recommendations from the Sustainability and Resiliency Plan would encourage active transportation:

- Develop events and activities to increase support for local businesses.
- Provide an accessible transportation app and/or web based program with directions in multiple languages.

> "We need more mixed use neighborhoods and corner convenience stores so all people are within biking distance of milk, eggs, and bread."

- Create a bike/walk promotion campaign to encourage alternative transportation habits and healthy living.

Education

Half of survey respondents said that is somewhat important or very important to increase education about safe walking, biking, and driving behaviors.

The Sustainability and Resiliency Plan recommends creating an Accessible Transportation Education Campaign using trusted community connections and messengers to carry information into the broader community and lower dependence on single-occupancy vehicles. It also supports creating a Bike and Pedestrian Coordinator position at the City.

Workforce Development

The Sustainability and Resiliency Plan recommends evaluating opportunities to expand or create a local service learning program that would skill building for workforce development such as jobs in tree/lawn care, sustainability, renewable energy, stormwater infrastructure, etc.

INPUT ON MAINTENANCE AND OPERATIONS

One-third of survey respondents said that the city should prioritize maintenance of existing facilities in plans for the future of the City's active transportation system.

The Sustainability and Resiliency Plan recommends creating a tool to allow community members to share specific issues such as damaged sidewalks, maintenance problems, potholes, frost heaves, broken lights, etc.

Snow and Ice

Forty-four percent of survey respondents who want to walk or bike daily or multiple times per week said that they would walk more if the sidewalks were cleared after it snows.

Nearly 80% of survey respondents said that it is very important or somewhat important for the city to improve winter maintenance of sidewalks and bikeways, including snow removal.

Multiple webmap comments described areas with poor drainage that fill with debris and become icy in winter, leading to injuries.

Pavement Quality

Eighty-four percent of survey respondents said that it is very important or somewhat important for the city to improve routine maintenance of streets, including repaving.

> "Our trail system is wonderful, but some trails are in bad shape."

Pavement quality on trails was highlighted as a concern in multiple webmap comments, many of them in the Northwest quadrant of the city and in areas that experience flooding:

- Cascade Creek trail north of railroad tracks
- Trail connecting 10th St SE and 10 1/2 St SE west of Bear Creek
- Along 18th Ave NW north of 55th St NW
- Along Bandel Rd NW north of 55th St NW
- Along 55 St NW from Hwy 63 to Douglas Trail
- IBM campus east of Valleyhigh Dr NW
- East side of the South Fork Zumbro River north of Elton Hills Drive NW
- Trail to Kellogg Middle School
- East side of County Rd 22 between Valleyhigh Rd and 19th St NW
- Trail through Northern Heights Park
- Along 37th St NE/NW from 18th Ave NW to Broadway Ave N
- Near bridge across creek at Essex Park
- Along Silver Creek west of 11th Ave NE

Striping

Striping is worn down on the 41st St NW bike lanes.

Centerline or edge markings on trails would assist with navigation at night and are important to people with limited vision.

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PUBLIC ENGAGEMENT PHASE 2

SUMMARY

Public outreach and engagement efforts for the Rochester Active Transportation Plan are inclusive, interactive, and structured to inform our team's understanding of community needs and opportunities, shape plan recommendations, and build support for the planning process and for plan implementation.

The principal goals of public outreach are:

- Educate the public about the project goals and timeline
- Build relationships
- Create a community-informed vision and shared understanding of vision and goals
- Gather input on walking, biking, and rolling needs, opportunities, and expectations
- Solicit feedback on potential trade-offs, draft recommendations, and priorities

Engagement activities are structured in two phases. The goals of Phase 1 engagement for the project are to invite feedback on draft recommendations, trade-offs, project prioritization, and implementation action steps.

This memo summarizes Phase 2, beginning by outlining opportunities for public input on the plan. These included listening sessions and a survey with online interactive maps.

Members of the public were asked to review maps showing the draft walking network prioritization results, the draft Vision for an All Ages and Abilities (AAA) Bicycle Network, and the draft AAA network prioritization results. The majority of survey respondents felt that the prioritization results for both the Pedestrian and AAA Bicycle Networks definitely or mostly accurately reflected the areas that are most important for walking and bicycling improvements. Nearly 80% of those who bike or want to bike said they will be able to reach all or most places they want to go when the AAA Bicycle Network is fully built. Public feedback in listening sessions and at community events was also generally supportive of the Plan.

"I'm a very confident rider, but I don't like biking in some areas with my kids. Improving bike safety and access is wonderful!"

"To make walking safer, we need slower traffic in many places. Drivers aren't always careful."

OPPORTUNITIES FOR PUBLIC INPUT ON THE PLAN

The public engagement process is focused on achieving a broad audience and reaching diverse communities. A project steering committee made up of residents, public agency staff, and community group representatives provided input on public involvement strategies. In Phase 2, public engagement strategies included a survey with interactive web maps and listening sessions.

Listening Sessions

The project team met with community groups in listening sessions and at community events to discuss their ideas and concerns in depth. The listening sessions included Mayo disABILITY MERG and The National Federation of the Blind-Rochester Chapter. Events included the Transportation Fair and a Bikeable Community Workshop.

Survey

263 Rochester residents and visitors took the project's online survey. Of those who shared their relationship to Rochester, 95% of respondents live in Rochester, 63% work in Rochester, 6% own a business in Rochester, and 5% go to school in Rochester.

The survey included optional demographic questions that shed light on how closely the survey respondents represent the residents of Rochester:

- **Disability:** Of those who reported a disability status, 14% identified as having a disability.
- **Race and ethnicity:** Of those who reported a race or ethnicity, 89% of identified as White and 11% as a race other than White. People who identify as White alone were over-represented in the survey, as they make up 75% of Rochester's population.
- **Car/truck ownership:** Of those who reported car/truck ownership, 98% said their family owns a car or truck.
- **Income:** 54% of those who reported their income said their household income in 2021 was over $100,000. The median household income in Rochester is $76,034.
- **Age:** People aged 18 to 24 were the most underrepresented age group, at 8% of survey respondents but 11% of Rochester's adult population. People aged 25-34 were also underrepresented, at 9% of respondents and 21% of Rochester adult residents. People over age 74 were proportionately represented, at 9% of survey respondents and 9% of Rochester's adult population. People aged 35 to 44 were the most overrepresented group in the survey, at 27% of respondents and 17% of Rochester adult residents. People aged 45 to 74 were also overrepresented, at 46% of respondents and 41% of Rochester adults.
- **Gender:** Of those who reported a gender, 38% were female, 58% were male, and 4%identified another way. 51% of Rochester residents identify as female.

SURVEY FINDINGS

Members of the public were asked to review maps showing the draft walking network prioritization results, the draft Vision for an All Ages and Abilities (AAA) Bicycle Network, and the draft AAA network prioritization results. The maps were interactive, allowing users to zoom in and out (See Figure 5). About 5% of survey respondents said they had trouble understanding how to use the map. Text clarifying how to turn on the legend was added above the map to improve ease of use.

Walking Network

Over 70% of respondents (176 people) said that the walking network prioritization "definitely" or "mostly" accurately reflects the most important areas for walking (Figure 4). Those who answered anything other than "definitely" were prompted to share what doesn't look quite right. Themes from their responses are listed in Table 1.

Figure 4. Keeping in mind the plan's goals (health, equity, safety, connectivity, resiliency, and economy), do the prioritization results accurately reflect the most important areas for walking improvements in Rochester?

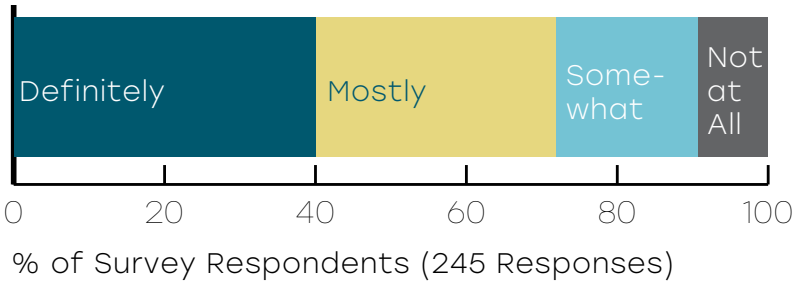
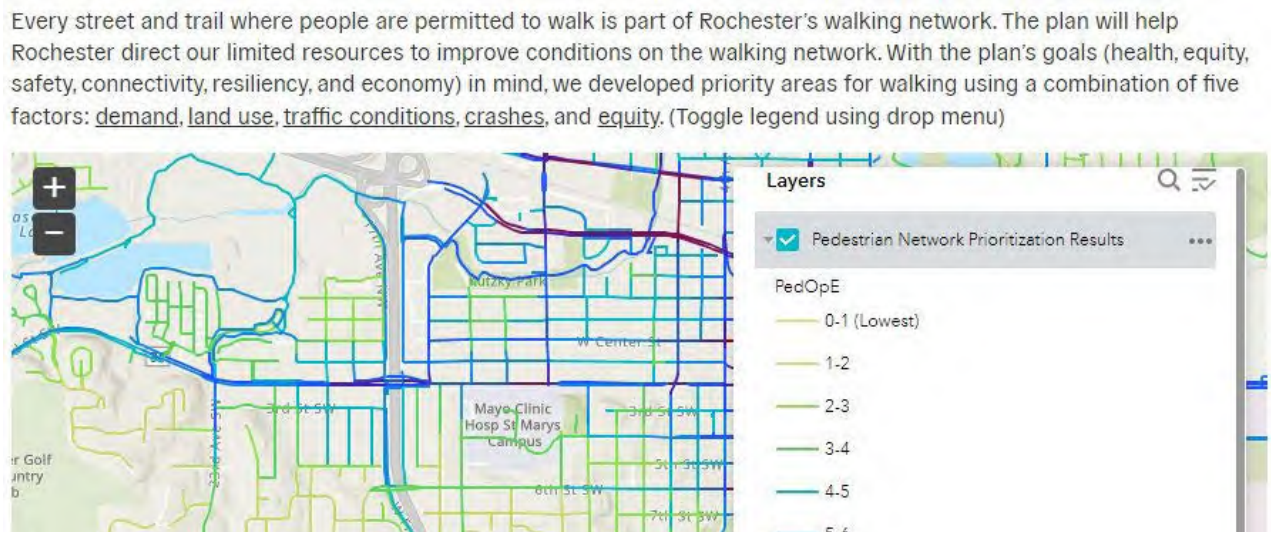


Table 1. Themes in comments by those who said the walking network prioritization looks mostly, somewhat, or not at all accurate

Theme (Number of Times Mentioned)
Downtown generally feels more accessible by walking than other areas of Rochester; there should be less emphasis on downtown (7)
Need for accessibility for people with disabilities (6)
Skeptical of the viability of walking in Rochester due to winter weather (6)
Major road crossings are an issue in general (5)
Car-free spaces (especially in downtown) would be a way to create safer and more comfortable places to walk and bike. (4)
More emphasis on parks (4)
Need for winter maintenance (4)
Need more sidewalks (4)
Focus on downtown-adjacent neighborhoods (3)
Need access to the Rochester Alternative Learning Center (3)
Improve connections to Apache Mall (3)
Highway 52 is a barrier (3)
Generally increase attention to SE (3) and NW (2) areas

Figure 5. Interactive Pedestrian Network Prioritization Map included in Phase 2 Survey



In addition to the ideas and locations mentioned by multiple people, the following were mentioned once:

- Northwest locations
  - 11th Ave NW crossing to Hyvee Barlows grocery store
  - Civic Center Dr at 1st Ave NW and 4th Ave NW
  - Elton Hills
  - 19th St NW & Valley High Drive
- Northeast locations
  - 31st Street NE between Broadway and East River Road
  - North Broadway to Zumbro River
  - Century Hills
  - Century High School
  - East side of Silver Lake
  - South side of Silver Lake
  - 7th St NE by Silver Lake
  - Crossing of Broadway by Silver Lake trails
  - Teton
  - Quarry Hill trail
- Southeast locations
  - 11th Ave SE near Mayo High School and Pinewood Elementary School
  - 3rd Ave SE from 14th to 16th
  - South Broadway and 16th
  - Broadway south of 52
  - Gamehaven Reservoir
  - 16 St SE between the Fair Grounds and Mayo High School
  - Mobile homes in SE
  - Woodlake Drive
  - Willow Creek trail south of Hwy 52
- Southwest locations
  - 4th St SW
  - 6th St SW and Memorial Parkway
  - Mobile homes in SW
- Ideas
  - Automatically include pedestrians in traffic signal phases
  - No right turn on red
  - Covered bike and walk ways
  - Eliminate the need to cross major streets when using trails

All Ages & Abilities Bicycle Network

Respondents were asked how often they bike. 23% bike at least once a week year-round; 37% bike at least once a week in warmer months; 12% bike occasionally; 11% don't currently bike but are interested in riding a bike; and 17% are not interested in riding a bike.

Those who bike or are interested in biking were asked how many of the places they want to go are easy to reach by bicycling. Of the 212 people who responded, only 20 (9%) said it is easy to reach all the places they want to go. 28% said it is easy to reach most places, 53% said it is easy to reach some places, and 9% said it is not easy to reach any place. Those who do not currently bike but are interested generally are able to reach fewer of the places they want to go by bike than those who currently bike (Figure 7).

Respondents were presented with a map of the vision for the AAA Bicycle Network (Figure 6), and then asked how many of the places they want to go would be easy to reach by bicycling when the network is fully built. Nearly 80% of respondents said they will be able to easily reach all or most destinations (Figure 8).

> Nearly 80% of those who bike or want to bike said they will be able to reach all or most places they want to go when the All Ages & Abilities Bicycle Network is fully built.

Figure 6. Interactive All Ages & Abilities Bicycle Network Map included in Phase 2 Survey

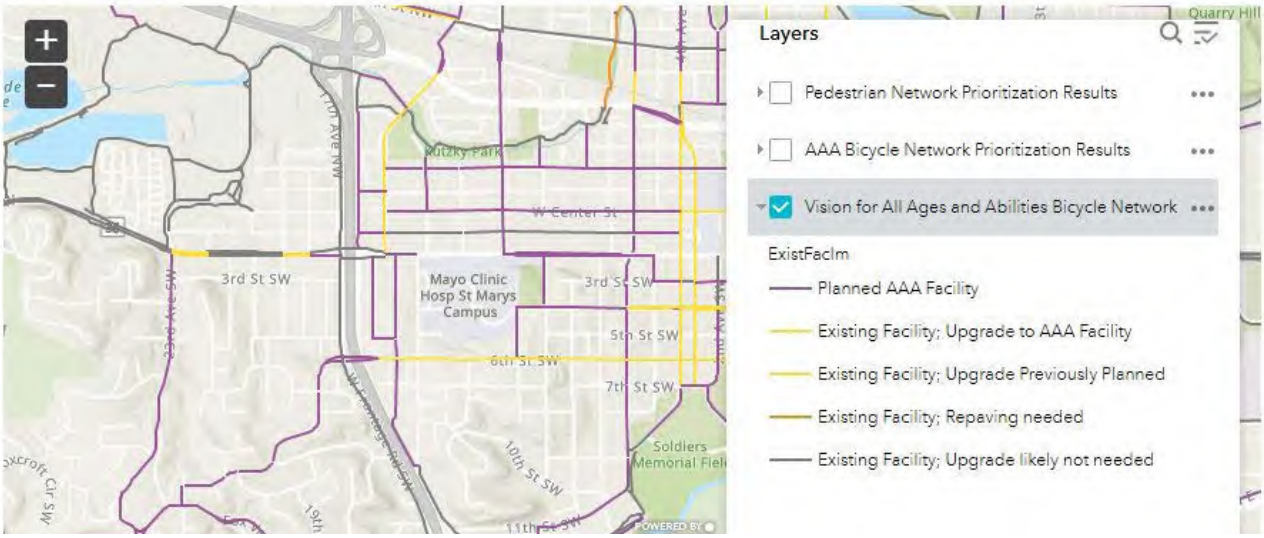


Figure 7. Access to destinations with current bicycle network

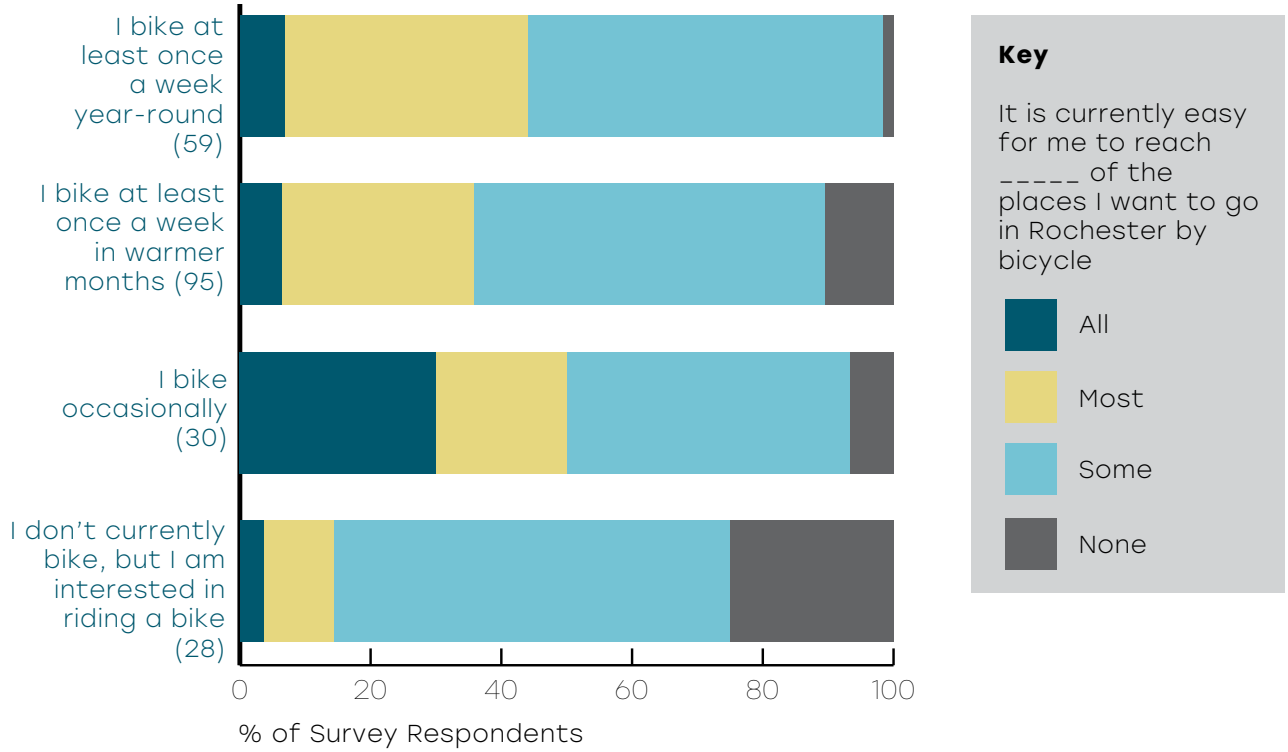
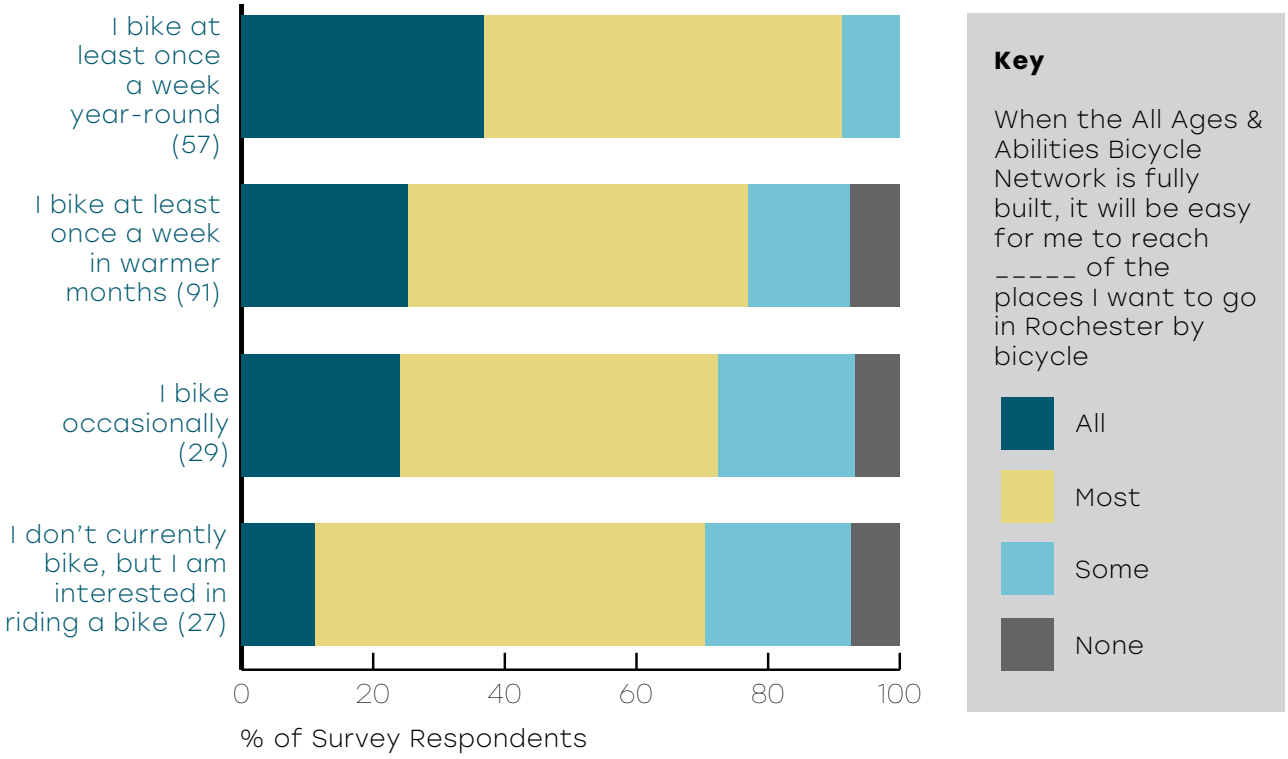


Figure 8. Access to destinations when the All Ages & Abilities Bicycle Network is fully built



Respondents were asked to review the prioritization results for the AAA Bicycle Network. Among those who bike or are interested in biking, over 75% of respondents (153 people) said that the network prioritization "definitely" or "mostly" accurately reflects the most important areas for bicycling (Figure 4). Those who answered anything other than "definitely" were prompted to share what doesn't look quite right. All respondents were asked for their suggestions for improving the AAA Network, and asked to share any additional thoughts about the network. Themes from these responses are listed in Table 2.

75% of those who bike or want to bike said that the network prioritization "definitely" or "mostly" accurately reflects the most important areas for bicycling.

Figure 9. Keeping in mind the plan's goals (health, equity, safety, connectivity, resiliency, and economy), do the prioritization results accurately reflect the most important areas for biking improvements in Rochester?

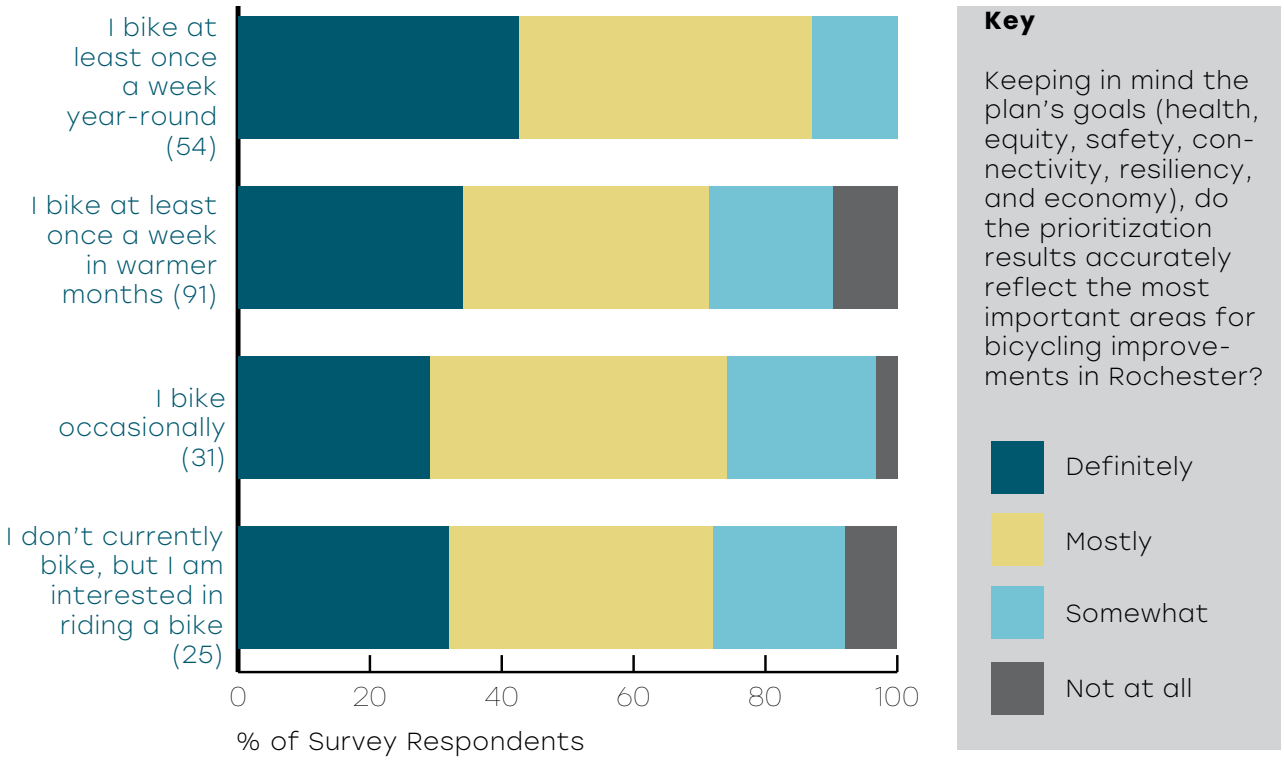


Table 2. Themes in comments about the All Ages & Abilities Bicycle Network

Theme (Number of Times Mentioned)
Desire for continuously connected bike facilities separated and physically protected from vehicles (34)
Hesitation about investing in bicycle infrastructure (30), including viability of bicycling in Rochester due to winter weather (6) and concern about on-street bike lanes (11)
Prioritize a trail connecting the Woodlake Drive Business Park (where the Rochester Alternative Learning Center and Channel One food bank are located) and Gamehaven Park to the rest of the city to the north (13)
Highway 52 is a key barrier (8). Overpasses of Hwy 52 at 19th St NW, 2nd St SW, 55th St NW, and 37th St NW were pointed out as in need of improvement
Broadway is a key barrier (8). Crossings at 14th St NE/Silver Lake Dam are an issue (3). North Broadway in general was noted as an issue, as well as Broadway at 16th St SW/SE and south of Highway 5
Maintenance (repaving, sweeping, snow clearance, etc) is important (6)
Design of bike facilities should seek to minimize steep grades (6)
Need better connections to the extreme southern part of Rochester (5)
Need a bridge over East Circle Dr NE connecting Century Point to Quarry Hil (3)
The parking-protected bikeway on 4th is not working well (3)

In addition to these themes, respondents shared locations where they would like to see better conditions for bicycling:

- Areas to increase priority generally:
  - » Crossings of major roadways (4)
  - » East-west pathways across city outside of the downtown core (2)
  - » Connect to downtown (2)
  - » Less downtown (2)
  - » Commuting corridors
  - » Non-community corridors
  - » Suburbs
  - » Neighborhoods near downtown
  - » New elementary and middle schools

> "I am looking at this from a powerchair seat and I can go where a bike goes around the city, except it needs to be smoother and no obstructions."

- Northwest locations
  - 19th St NW (2)
  - Civic Center Dr (2)
  - Elton Hills Dr (2)
  - Path on both sides of 55th St NW between Hwy 52 and 18th Ave NW (2)
  - Cascade Lake
  - Connection between 6th Ave NW and the Cascade Trail
  - Connection between 7th St NW and the Cascade Lake Trail
  - Connections to Barlow Plaza and Fresh Thyme
  - 18th Ave NW between 37th Ave NW and Elton Hills Dr
  - A bridge across Civic Center Drive NW, somewhere between 1st and 4th Ave NW
  - Connection to Douglas Trail at 14th St NW and/or 15th St NW
  - Repave the path on 37th St NW between Broadway and West River Road
  - Repave Riverwalk west of Recreation Center
- Northeast locations
  - Connect Circle Drive with Quarry Hill near the softball field
  - N Heights Dr NE
  - Repave trail on the east side of the Zumbro River near Oakwood Cemetery
  - Repave trail on 37th St NE near Hyvee
  - 11th Ave NE
  - E Center ST
- Southeast locations
  - 4th St SE (2)

"Right now I either have to bike on bike paths that feel like they take forever and do lots of winding/stopping and starting, or bike on busy roads with small bike lanes if I want to go the grocery store."

  - Hwy 14 crossings near RCTC
  - 18th Ave SE
  - Rochester Public Library
  - Intersections of 3rd Ave SE at 4th St SE, 7th St SE
  - 3rd Ave SE (1 supportive; 1 opposed)
  - A Meadow Park bridge from the Fairgrounds, north across Hwy 14 (follow the RR spur line) to Sunnyside
- Southwest
  - 16th St SW (2)
  - 18th Ave SW
  - 4th St SW
- Outside of Rochester
  - Chester Woods Park
  - Byron
  - Connect to neighboring cities

LISTENING SESSION RESULTS

In Phase 2, the project team reconnected with stakeholder groups engaged in Phase 1 to seek feedback on the plan. Two groups from Phase 1 participated in virtual Phase 2 listening sessions, disABILITY Mayo Employee Resource Group (MERG) and the National Federation of the Blind-Rochester Chapter.

The team also engaged stakeholders through the Transportation Fair and a Bikeable Community Workshop. The Bikeable Community Workshop was an independently planned event, but involved many of the project stakeholders, and frequently touched on the Active Transportation Plan as a next step in Rochester's advancement of bikeable infrastructure.

Key Themes

Phase 2 listening sessions revealed general support for the plan from the participants in each session. The same information was provided at the transportation fair and listening sessions, though responses and feedback varied significantly between the two virtual events and the one in-person event. The larger Bikeable Community Workshop had unique feedback as it took a much more comprehensive look at existing conditions and desired outcomes.

Key takeaways from all engagement sessions:

- The methodology used to determine which routes would be selected was seen favorably, with no negative comments about the priorities or the approach to weighting them.

- Overall, those presented with a map in person were very focused on whether the priority routes were accurate and were very focused on which projects would move forward.
- Those presented with the map virtually were less interested in routes and more interested in the design elements and features.

Transportation Fair

The Transportation Fair is an annual event put on by the city to introduce kids to different forms of transportation, and the vehicles and crew that run them. It is historically well-attended by families, with a number of interactive exhibits. The project team presented the prioritization maps for kids and parents to look at and started conversations by having kids find their home on the map, and discuss where they like to ride or walk. This often led to parent involvement in the discussion and spurred a number of conversations about routes that felt unsafe and needed upgrades or improvements.

Specific feedback of note:

- In nearly every case, safety concerns matched identified priorities for the city to address (Silver Lake/Broadway, 3rd Ave, Viola, Kutzky Park/16th Ave NW, Center St).

- Most comments were geographic, focusing on routes rather than what type of road treatment was installed.
- Kids were very focused on their neighborhood and short routes to parks & school, while adults noted their bike commute (typically to downtown).

Virtual Meetings with Groups from Phase I

The two virtual meetings were both with disability advocacy groups (disABILITY MERG and National Federation of the Blind – Rochester Chapter). Other groups involved in Phase I were unavailable for participation in Phase 2 during the window for the project. Both were encouraged by the All Ages and Abilities plan and added further context to specific treatments they felt were vital regardless of which route was considered. Both groups wanted safer intersections and wider pathways to provide enough room on trails for pedestrians and bikes to share space safely.

Specific feedback of note:

- Sidewalk and trail width is impacted by light poles, parking meters, and other features. This has an outsized impact on those who are mobility-limited. Sufficient width for mobility devices and bikes in shared corridors was cited as a challenge by multiple participants.
- Effective audible signals for crosswalks were cited multiple times as an important safety feature, along with high contrast paints and treatments to make crossings and routes more visible both to pedestrians and vehicles.
- The 1/8 mile assumption of acceptable walking distance between routes and destinations was a concern, with some noting that it can still create challenges for those who aren't able to easily navigate sidewalks.

Bikeable Community Workshop

BikeMN organized and hosted the workshop and took a comprehensive look at Rochester as a bikeable community, with a focus on engineering, engagement, equity, evaluation/planning, education, and encouragement. This was a two-part event with virtual and in-person components.

Specific feedback of note:

- The city seems to be effective in designing bike infrastructure, noting complete streets and bike lanes going in on recent projects, but little is done to connect with neighboring communities.
- Additional focus on education and encouragement identified as a gap to increase buy-in for active transportation. This was not a primary focus of the plan, and warrants consideration for future city efforts in parallel with infrastructure improvements.
- Protected bike infrastructure came up often as a preference for users. The top ten project list largely reflects this with separated bike lanes and trails.
- Discussion of "walksheds" and "bikesheds," focusing future routes on filling in pathways people want to use to access key destinations. This aligned well with the priorities of the plan, and the top 10 projects, which largely connect outlying areas with the downtown core or create new cross-town pathways.

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CITY OF
ROCHESTER

Active Transportation Plan

APPENDIX B: TECHNICAL ANALYSIS

EXISTING CONDITIONS

SUMMARY

This memo documents changes to the physical and social environments that influence walking and bicycling in Rochester, highlighting demographic, land use, and active transportation network changes since the 2012 Bicycle Master Plan. It provides context that will inform the development of the next phases of the plan, including information on travel patterns and barriers to travel.

What's Changed in Rochester

The population has increased and become more racially diverse. The median household income has risen at roughly the same rate as the cost of living.

Downtown neighborhoods have added several full block urban infill developments. Future mixed use transit-oriented centers and transit supportive neighborhoods have been added to the land use plan.

Many miles of trails and bikeways have been built since the 2012 plan.

Geographic Differences in Access to Resources and Health

Based on demographic factors like income and race, Rochester residents have different levels of access to resources, political power, and mobility options. Some areas of the city have concentrations of people with higher access, while other areas have concentrations of people with lower access. Areas where people have lower access tend also to have higher rates of health issues like heart disease and poor mental health. The analysis of geographic differences in access to resources will be overlaid on other analyses to plan an equitable active transportation system.

Where People Travel

More than half of Rochester's 510,000 daily trips are under 3 miles, making them good candidates for conversion from driving to active modes. The highest concentration of destinations for active trips is found around downtown, the Kutsky Park neighborhood, 41st St NW & 18th Ave NE, Graham Park, Mayo High School, Rochester Community and Technical College, Federal Medical Center, and the Rochester Recreation Center.

Barriers to Travel

Factors that restrict convenient and comfortable access to destinations include major multi-lane roadways, railroads, rivers, low intersection density, and high impermeable (paved) surfaces.

Pedestrian and bicycle crashes make up only 2% of crashes in Rochester, but account for 39% of fatal and 14% of serious injury crashes.

Lower stress bicycling facilities make up most of the transportation network, but in many cases riders on lower stress facilities must make stressful crossings of multilane roadways or travel significantly out of their way to lower stress crossings. These stressful crossings may discourage many people from riding at all.

WHAT'S CHANGED IN ROCHESTER?

Rochester's last bicycle plan was adopted in 2012. Rochester has changed in terms of population, land use, and transportation options since that time.

Demographics

The City of Rochester has had a total population increase of 14,626 people, or 14%, from 2010 to 2020.

All racial and ethnic groups have increased in population during this time. The number of people identifying as Black or African American alone has grown by 62%, the number of people identifying as Hispanic or Latino has grown by 45%, and the number of people identifying as Asian alone has grown by 31%. The number identifying as American Indian or Alaska Native alone has grown by 29%, Native Hawaiian or Pacific Islander alone by 47%, some other race alone by 102%, and two or more races by 125%. The number identifying as White alone has increased by 3%.

The median income for an individual living in Rochester has risen from $32,981 in 2010 to $38,635 in 2019, an increase of 17%. The median income for a household has risen from $63,428 to $73,106, an increase of 15%. Meanwhile, the average cost of living has gone up by 16%. The unemployment rate has decreased from 6% to 3.6%.

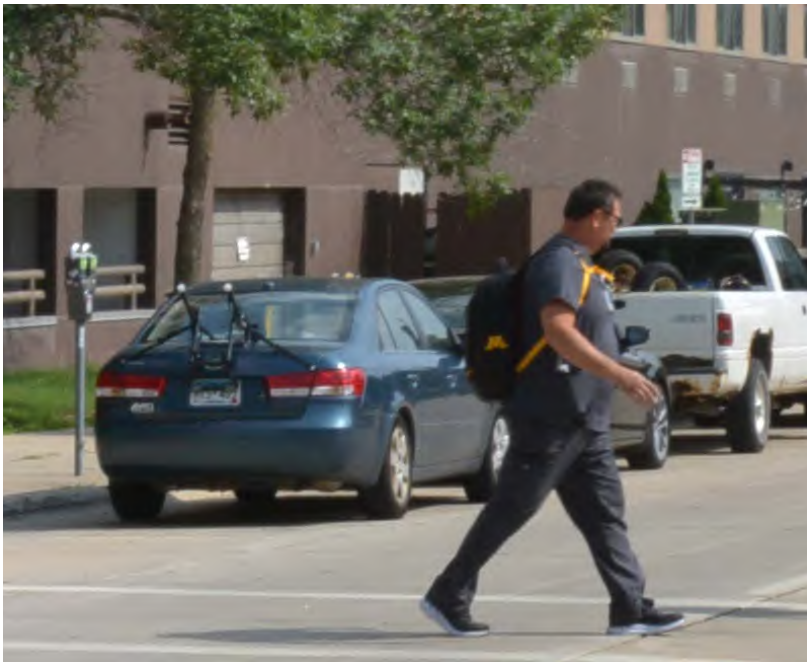
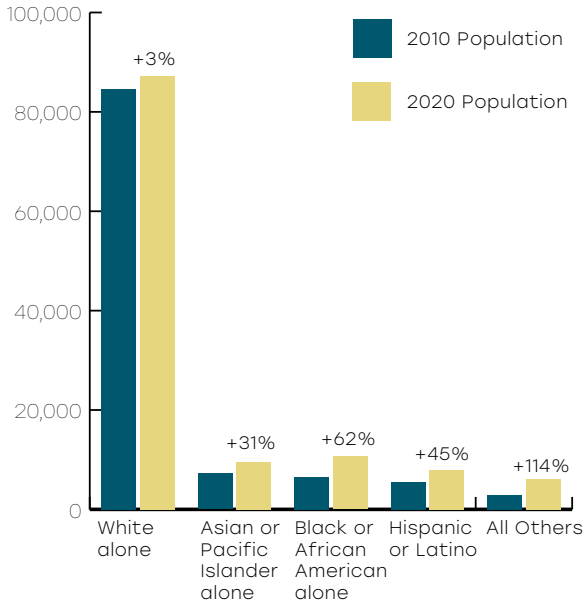


Figure 1. Population by Race and Ethnicity, 2010 to 2020



Source: 2010 and 2020 Decennial Census

Land Use

Since the last plan was adopted, most new single-family development has occurred on the north side of Rochester with the completion of the next phases of developments that were started in the pre-2008 economic downturn.

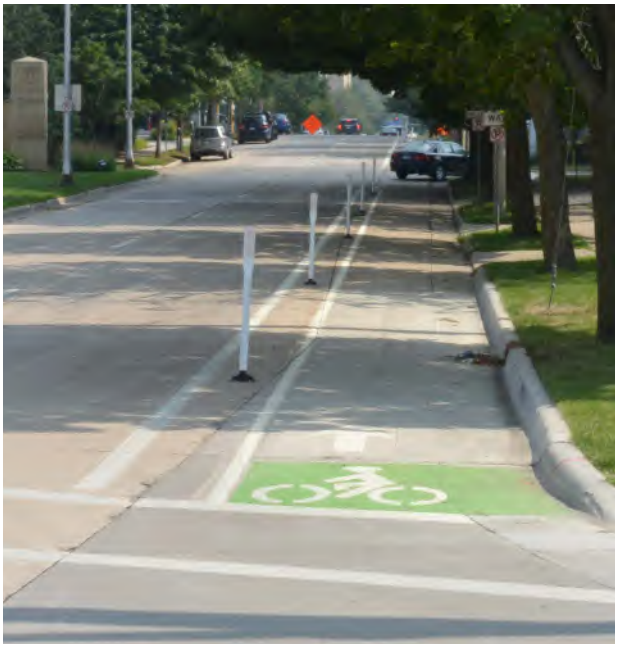
The downtown neighborhoods have added several full block urban infill developments, primarily apartment or hotel buildings with some including first floor commercial. There have been a few new office buildings added since 2012 with Discovery Square located on the north half of the block between 4th and 5th Street SW and 2nd and 3rd Ave SW being the most prominent. The University of Minnesota Rochester campus has also expanded in the downtown with student housing and a new student union.

Future mixed use transit-oriented centers and transit supportive neighborhoods have been added to the land use plan since 2012. There are also two future large transit village nodes that were identified as part of the Rochester Transit Oriented Development Plans, located around the Mayo Clinic West Parking Lot and Graham Park.

Active Transportation Infrastructure

Rochester's bicycle network is composed of bike lanes and trails (Figure 3). Over the last ten years, many miles of trails and bike lanes have been built in Rochester. These active transportation facilities have helped to close gaps in the network and improve access to destinations across the city.

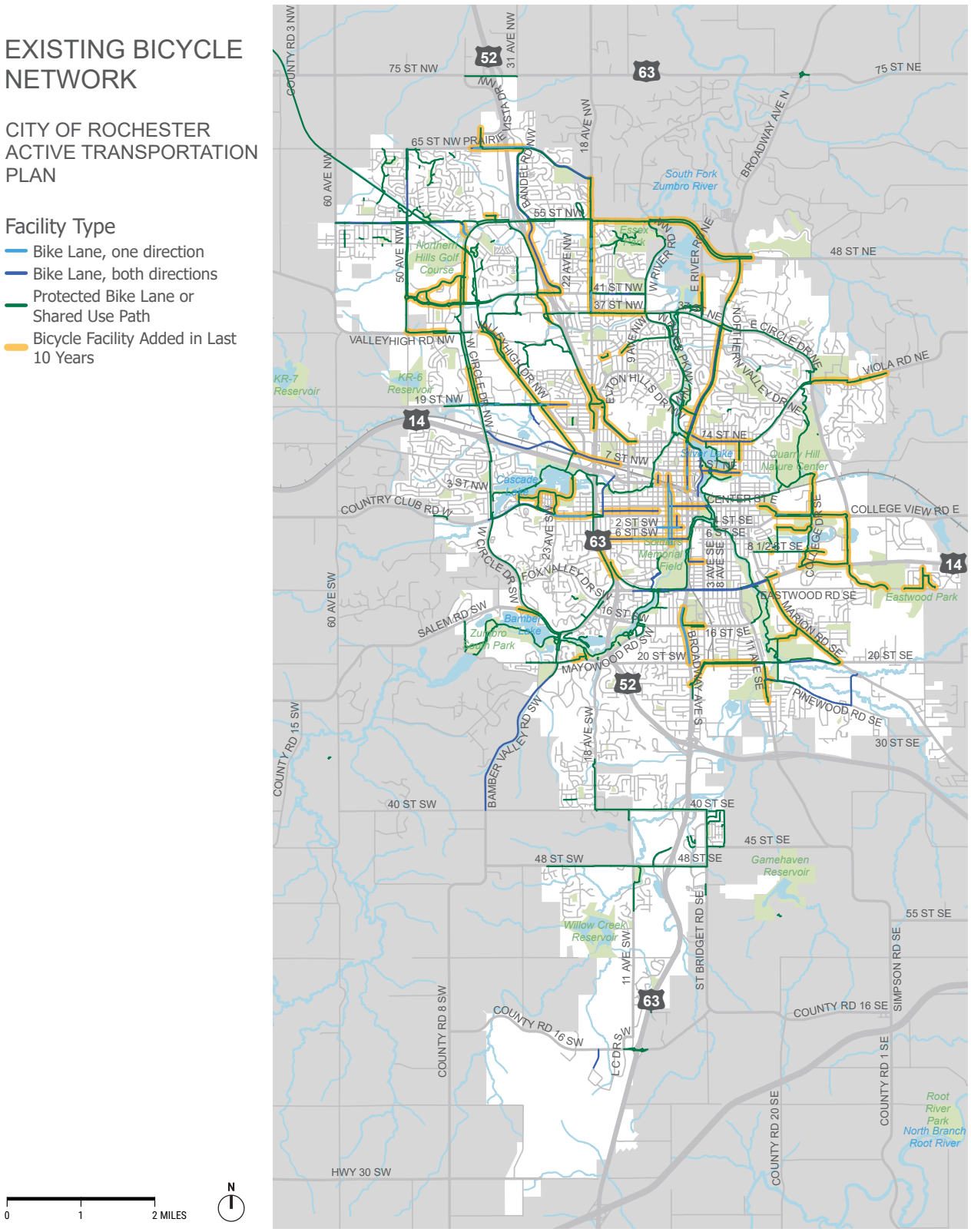
One of the most significant projects was the extension of the Douglas Trail to Cascade Lake. This project included the construction of a bicycle and pedestrian bridge over 7th St NW and over Valleyhigh Dr NW as shown below.



Bollard-Protected Bike Lane near Mayo Clinic

Bicycle and Pedestrian Bridge over Valleyhigh Dr NW

Figure 3. Existing Bicycle Network with Recent Additions Highlighted



WHO LIVES IN ROCHESTER?

Equity

Understanding equity is important for the development of multi-modal transportation plans. The historical, social, and political dynamics in the United States have produced transportation infrastructure that is not evenly distributed across communities. These dynamics have also caused segregation of housing by race and income. Housing that is affordable to people with lower incomes is often located close to high traffic roadways that increase levels of noise and pollution and restrict options for active transportation.

People with lower incomes are cost-burdened by car ownership and would benefit from access to transit and safer walking and biking facilities. People with higher incomes, privileges, and easier access to power, such as ability to speak English fluently and Whiteness, often have more transportation options, less exposure to high traffic roadways, and more access to green spaces.

Methodology

Equity was examined at the census block group level using 2019 American Community Survey data. The following equity indicators were included in the analysis:

- Percent of residents not identifying as white alone (not Latino or Hispanic)
- Percent of households with limited English speaking ability
- Percent of residents age 65 or older
- Percent of housing units with no vehicle available
- Percent of households with at least one person with a disability
- Percent of residents with income under 185% of the poverty level

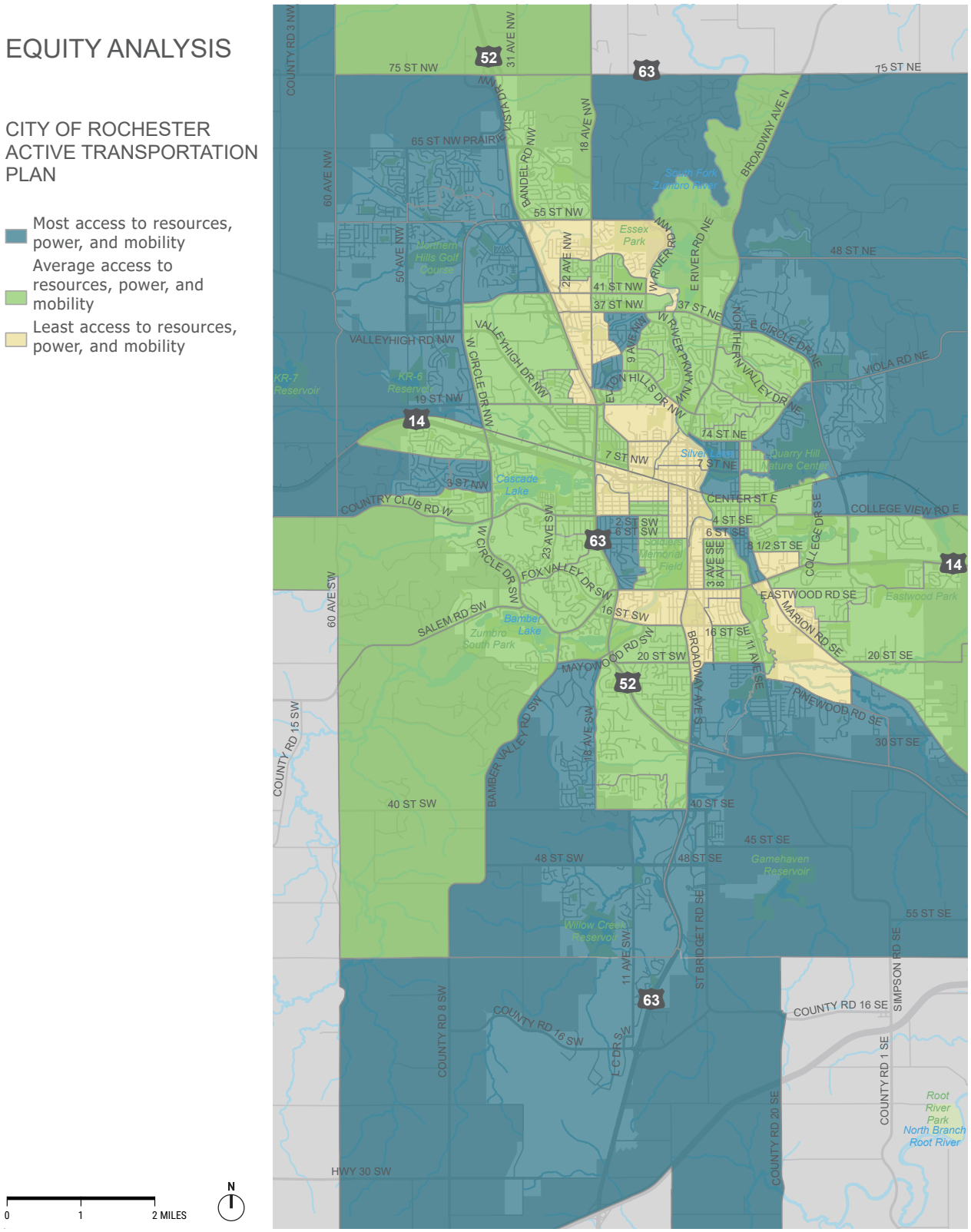
A percentile score for each census block group was created for each of the six equity indicators. (For example, a census block group with a very high percentage of residents over age 65 relative to the other census tracts in Rochester might score in the 90th percentile. A census block group with a very low percentage of residents over age 65 might score in the 10th percentile.)

Results

The percentile scores were averaged to determine an overall equity score. In Figure 4, the 25% of census block groups where the population generally is expected to have the least access to resources, power, and mobility options are shown in yellow. The 25% of census block groups where the population generally is expected to have the most access to resources, power, and mobility options are shown in blue. All other census block groups are considered to have average access.

This analysis of geographic differences in access to resources will be overlaid on other analyses to plan an equitable active transportation system.

Figure 4. Social Inequality by Census Block Group



Health

Determinants of health include clinical care, biology and genetics, social and economic factors, health behaviors, and the physical environment. Scientists do not know the precise contribution of each determinant, but together, health behaviors, the physical environment, and social and economic factors explain 60-75 percent of health outcomes. All of these factors can be impacted by physical activity.

Physical activity is an important way to reduce the risk of high blood pressure, diabetes, stroke, heart disease, certain types of cancers, depression, and anxiety. Communities designed to promote safe and connected active transportation and recreational opportunities are positively associated with greater levels of resident physical activity and consequently, with improved health.

Methodology

The health analysis conducted for the Rochester Active Transportation Plan uses the Centers for Disease Control and Prevention's PLACES 2018 data. Health indicators related to physical activity include crude prevalence of the following among adults aged 18+ years:

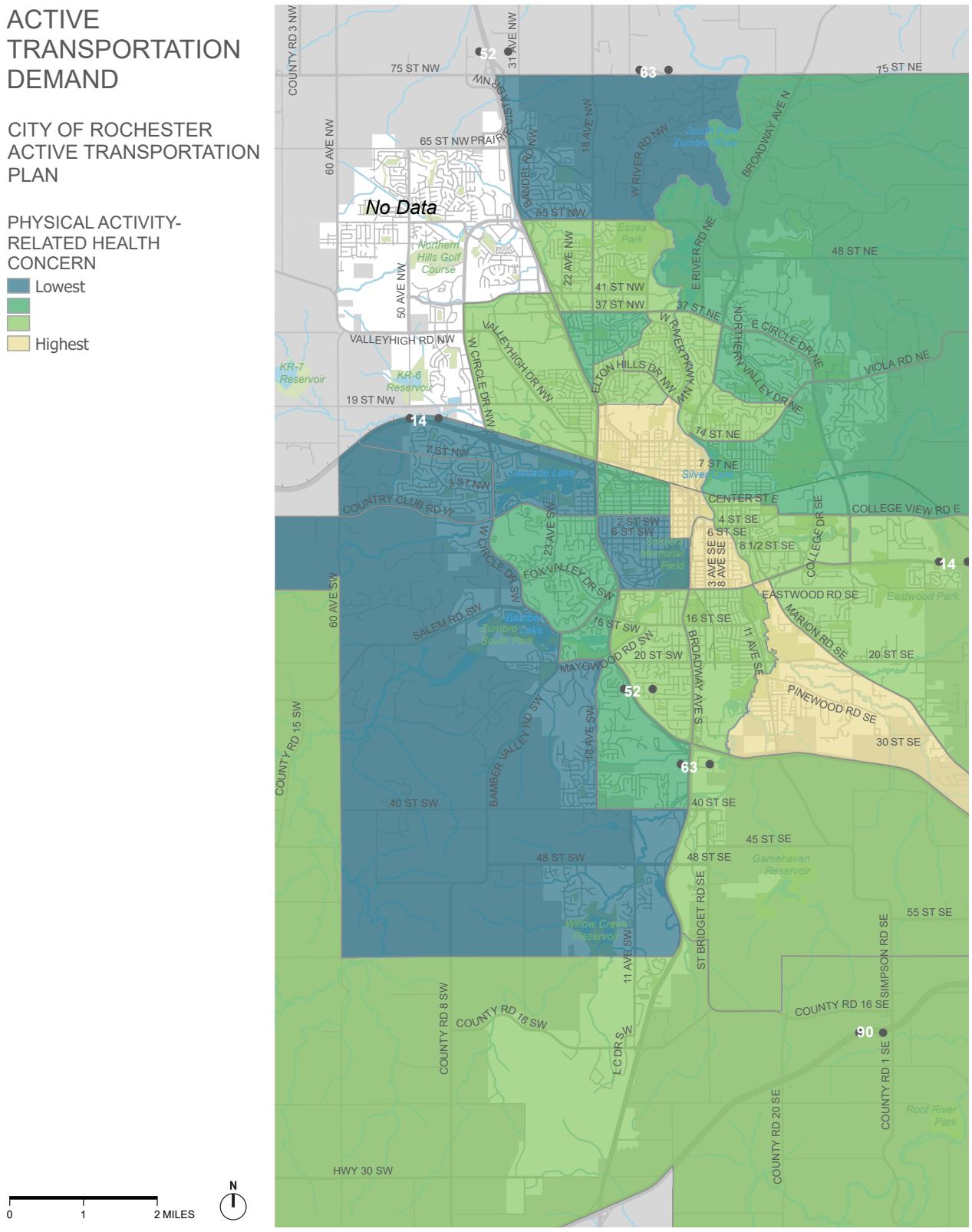
- High blood pressure
- Asthma
- Coronary heart disease
- Chronic obstructive pulmonary disease
- Diabetes
- High cholesterol
- No leisure time physical activity
- Mental health not good for >=14 days
- Physical health not good for >=14 days

A percentile score for each census tract was created for each of the nine physical activity-related health indicators. (For example, a census tract with a very high rate of asthma relative to the other census tracts in Rochester might score in the 90th percentile. A census tract with a very low rate of asthma might score in the 10th percentile.)

Results

The percentile scores were averaged to determine a health score. In Figure 5, the highest scoring census tracts (yellow) are in the top 25% of census tracts and have the highest rates of health concern. The lowest scoring census tracts (blue) are in the bottom 25% of census tracts and have the lowest rates of health concern. The areas with the highest rates of health concern generally align with the areas where residents have the lowest access to resources, power, and mobility options.

Figure 5. Physical Activity Related Health Concern by Census Tract



WHERE DO PEOPLE TRAVEL?

Destinations

Count data of people walking and biking alone typically do not reflect demand for walking and biking due to the lack of adequate facilities to support active transportation. A lack of people walking and biking does not necessarily indicate a lack of demand, so evaluation of the concentration of destinations is used to understand where people want to walk and bike.

Methodology

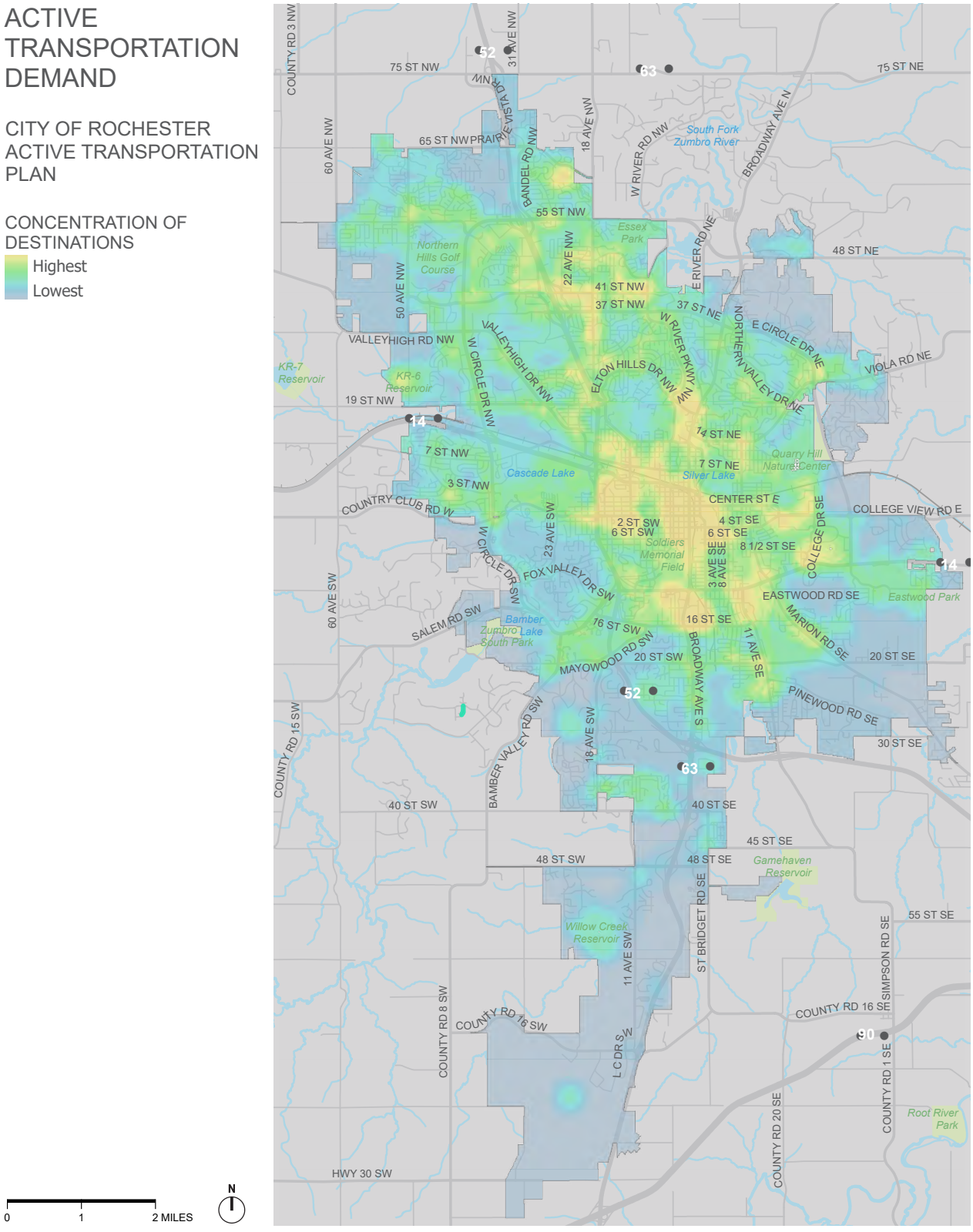
The composite Live Work Play analysis conducted for this Plan combines six factors to determine areas where demand for walking and biking is likely to be high:

- Live: Population density based on 2019 American Community Survey population data at the block group level
- Work: Concentration of jobs based on 2018 Longitudinal Employer-Household Dynamics (LEHD) data on all jobs at the block group level
- Shop: Concentration of shopping destinations based on 2018 LEHD data on retail jobs at the block group level
- Transit: Concentration of transit stops
- Parks and trails: Concentration of trail and park destinations, with parks given more weight than trails because of the greater variety of amenities available at parks
- Institutions: Concentration of institutional land uses, including destinations like schools, the library, post offices, hospitals, city hall, and fire stations

Results

As shown in Figure 6, the highest concentration of destinations is found around downtown, the Kutsky Park neighborhood, 41st St NW & 18th Ave NE, Graham Park, Mayo High School, Rochester Community and Technical College, Federal Medical Center, and the Rochester Recreation Center.

Figure 6. Concentration of Destinations



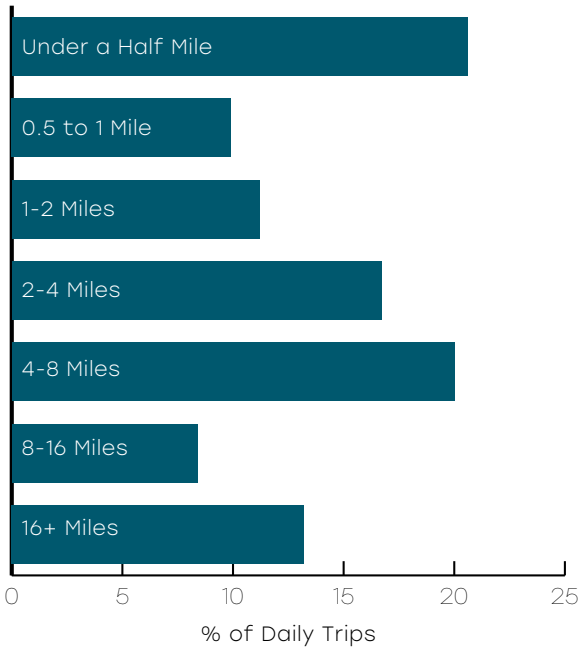
Active Trip Potential

Trips of three miles or less are considered to be potential candidates for conversion from driving to active modes. A casual cyclist can complete a three mile trip in about 15 to 20 minutes (or less, if using an electric bike). A half-mile walking trip takes about 10 minutes.

During Fall 2019, about 510,000 trips per day started in the City of Rochester. 80% of those trips were made using a motor vehicle. The median trip distance was 2.9 miles, meaning that more than half of daily trips could potentially be made by active modes. 21% of trips were under a half-mile (Figure 7).

Areas planned for high density and mixed-use land uses have high active trip potential because many origins (like apartments) and destinations (like grocery stores and restaurants) are located close together, and there are enough. In Rochester, these areas are mostly located in the center of the city, with additional areas along 2nd St SW, Broadway Ave N, College View Rd E, and parts of northwestern Rochester (Figure 8).

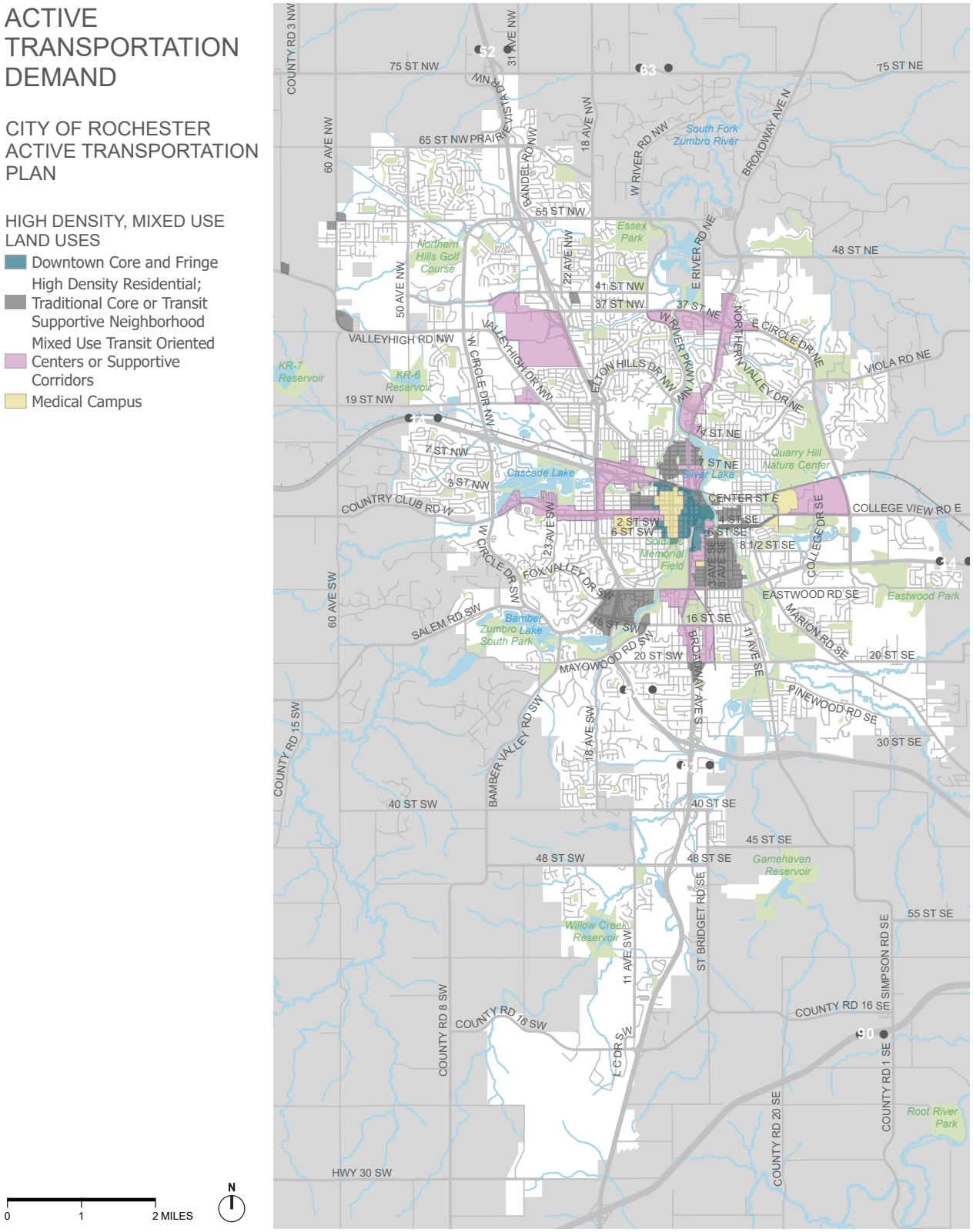
Figure 7. Number of daily trips by total distance traveled



Replica, September-November 2019

More than half of Rochester's 510,000 daily trips could potentially be made by active modes.

Figure 8. High density and mixed-use land uses



WHAT ARE THE BARRIERS TO TRAVEL?

Active Trip Barriers

There are several factors that restrict convenient and comfortable access to destinations via active transportation in Rochester, including major multi-lane roadways, railroads, rivers, low intersection density, and high impermeable land use. Figure 9 illustrates the barriers to active transportation, each of which are described below.

Highways/Major Vehicle Routes

The downtown core of Rochester is served by a traditional grid network of streets which provides frequent crossing opportunities for people walking and biking. Outside of the downtown area, the street network is characterized by a more suburban style pattern of development. This more circuitous street pattern presents a barrier to accessing destinations with fewer crossing opportunities. There are also limited crossings of major roadways and highways in locations across the City.

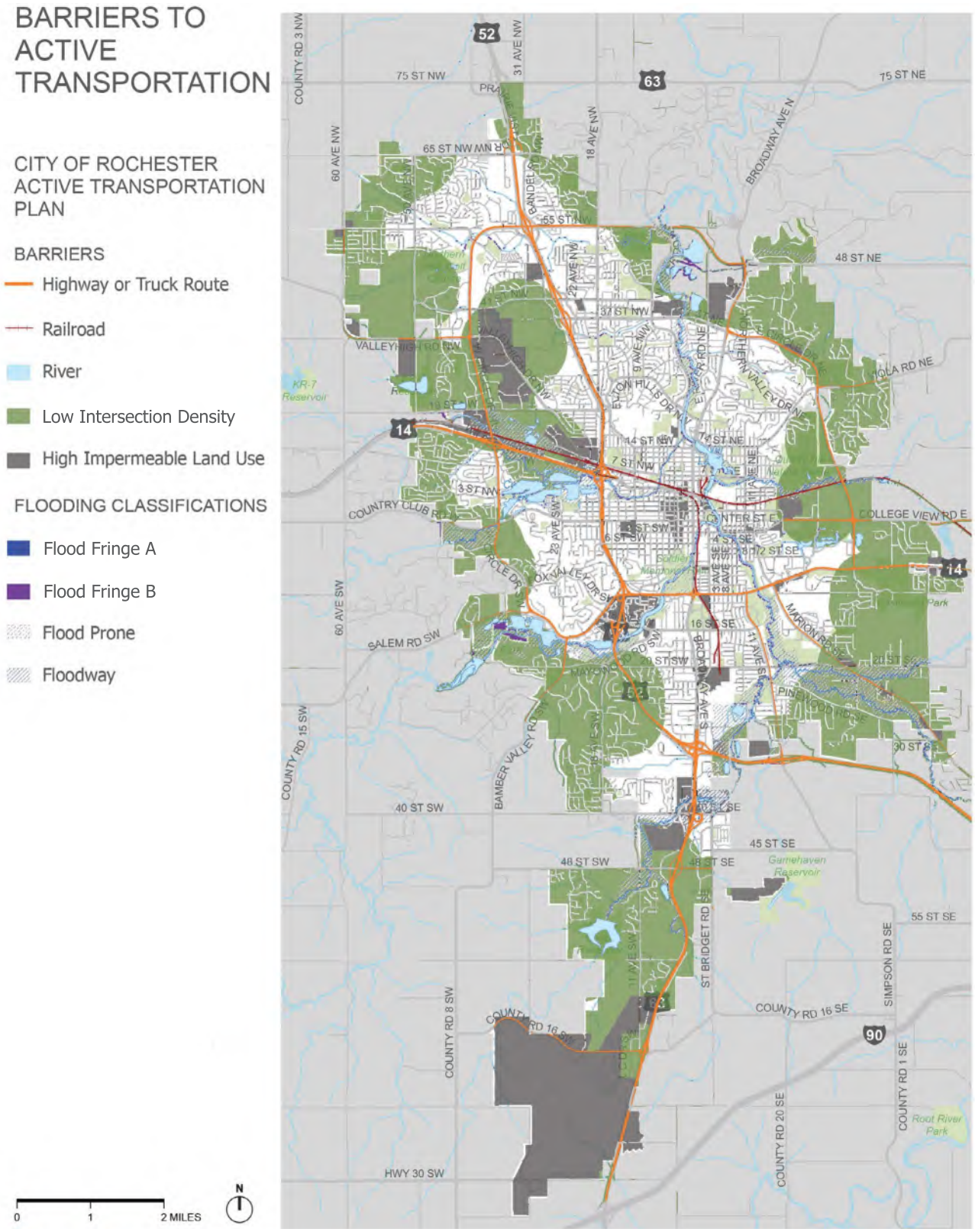
Three highways travel through Rochester. Highway 52 is the largest and most consistent barrier extending from the southeast quadrant to the north, generally bisecting the city as it runs north/south. Highway 63 enters Rochester from the south and then connects with Highway 52 on the south end of the City. These two roads run together until reaching 75th Street North where Highway 63 splits to the east. Highway 14 is the only east/west highway. In the eastern part of the city, it is a four lane road with an adjacent multi-use trail until it merges with Highway 52 before heading west at Civic Center Drive. These roads disconnect the urban core from the suburban style developments around Rochester.

Broadway Avenue and Civic Center Drive are the major north/south and east/west roads. These roadways carry higher volumes of traffic at speeds of 30 to 55mph depending upon the segment of roadway. They provide access to destinations, in particular closer to the downtown core, with continuous sidewalks, traffic signals and block spacing providing consistent facilities and frequent crossing opportunities. Broadway features bike lanes, sidewalks on both sides of the street and trails on certain portions of the road. Civic Center Drive does not have any bike lanes and does not consistently have a sidewalk. There are portions with sidewalk on the south side near the downtown but heading west it is inconsistent and disconnected. Outside of downtown the intersection spacing is wider. East Circle Dr and West Circle Dr form a loop road that travels around the City of Rochester. These are both high speed roads that typically have vehicles moving faster than the posted speed limits and reduced access.

Railroads

The City of Rochester has a main railroad line owned by Canadian Pacific that extends east/west through the city. This railroad line extends north of the main

Figure 9. Barriers to Active Transportation



downtown area running along Civic Center Drive to the northwest. To the east it passes by the Olmsted County Recycling Center but does not follow a specific roadway alignment. There are two main north/south spur lines that connect to industrial land uses within Rochester. Most of these industrial areas are no longer actively serviced by the railroad so the number of trains that use the north/south lines is limited.

Rivers

The Zumbro River is the largest river in the City of Rochester. It flows north and enters the city from the Southwest. Silver Lake is a centralized lake that was created by a dam on the Zumbro River. There are several smaller creeks in the city, but they are primarily located within parks with trails and often abut residential backyards. Most of the larger bodies of water are stormwater ponds that have been created for specific developments. There are three major areas with lakes. The Cascade Lake area to the west, the Mayowood Lake area to the southwest and Silver Lake just north of Downtown.

The Zumbro River is the main source of flooding in the City of Rochester. The Army Corps of Engineers oversee the large floodwalls that exist in Rochester's downtown. These walls serve to limit flooding from the Zumbro River to downtown. Bear Creek and Cascade Creek, and the trails and pedestrian bridges across them, were also a part of the same flood control project.

Low Intersection Density

The downtown and core downtown neighborhoods of Rochester are served by a street grid system that is more conducive for bicycle and pedestrian connectivity providing frequent crossing opportunities as noted above. The city has suburban type development surrounding the downtown core. An assessment of low intersection density was completed with low intersection density defined as less than 130 intersections per square mile.

High Impermeable Land Use

Areas with a high percentage of impermeable land typically have a limited amount of tree canopy, large surface parking areas and wide roadways. The lack of tree canopy and the high percent of surface covered by pavement contributes to a heat island effect in these areas. The heat island effect results in temperatures 1-7 degrees higher due to absorption and re-emitting the sun's energy, making these areas less comfortable for active transportation.

Crashes

A review of crash data provides some insight into existing safety conditions for people walking and biking, recognizing however, that these crashes only represent only those that are reported to law enforcement. Further, the data does not reflect near miss events. To understand the complete safety picture, it is necessary to obtain additional information from stakeholders about their experiences and perceived safety at locations across the city.

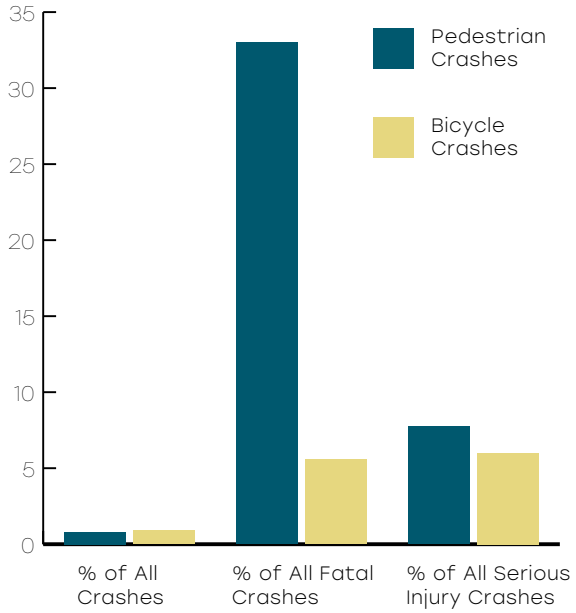
Methodology

Citywide crash information from January 1, 2016 through December 31, 2020 was analyzed using MnDOT's Crash Mapping Application (MnCMAT2). This data is based on information provided by the responding law enforcement officer, victims, and witnesses. It is important to recognize that each of these participants have their own unique perspective on the events that occurred which are impacted by the emotion and personal feelings of the individual. These elements should be considered when interpreting the data.

Results

There were a total of 9,628 reported crashes in Rochester during the last 5 years. Of those crashes, 79 involved pedestrians, 89 involved bicyclists, and the remaining 9,460 crashes were vehicle only crashes. Pedestrian and bicycle crashes make up a small percentage of the total crashes within the City of Rochester (approximately 2%) but account for 39% of fatal and 14% of serious injury crashes (Figure 10).

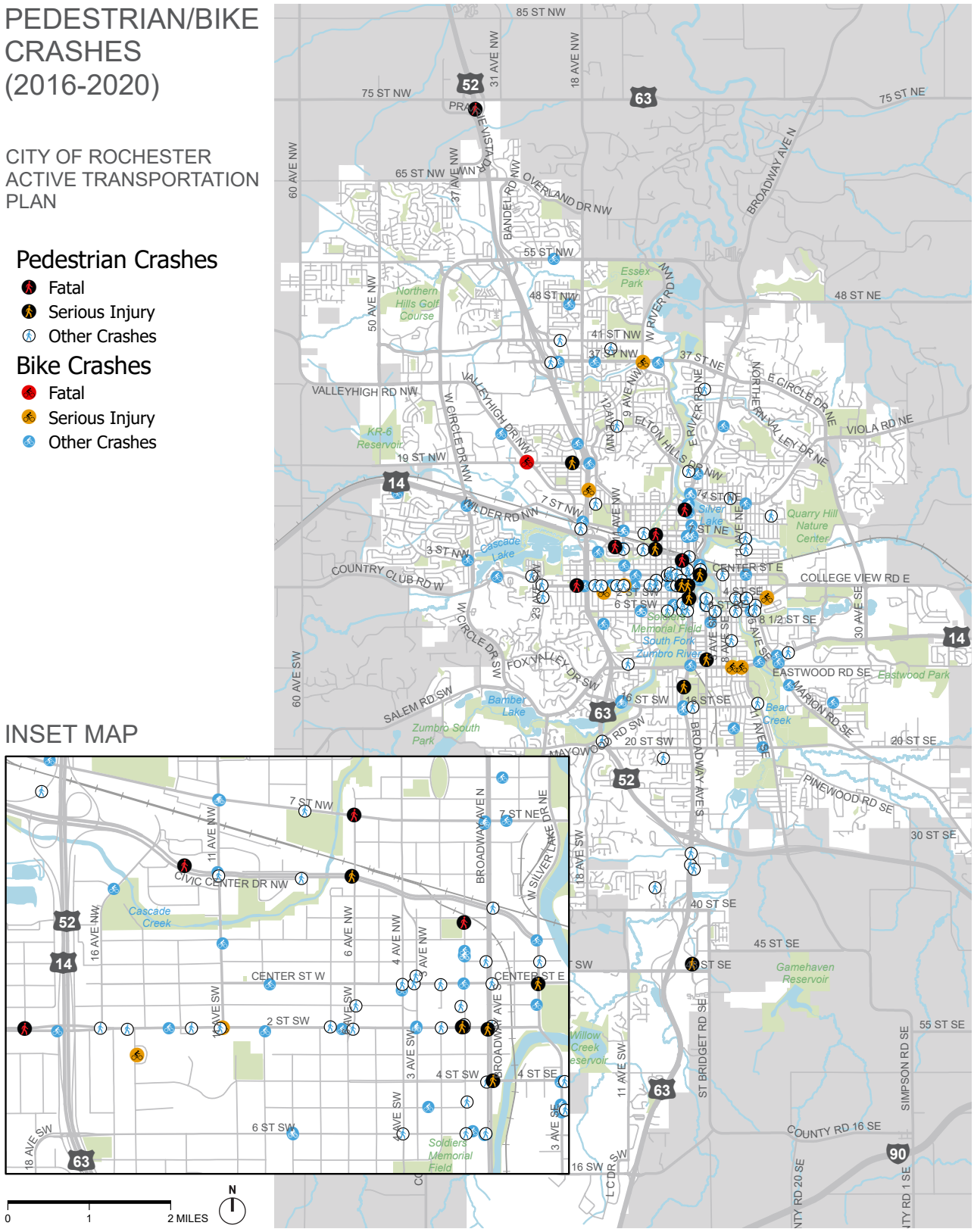
Figure 10. Pedestrian and Bicycle Crashes as a Percentage of Crashes for All Modes



Pedestrian and bicycle crashes are 2% of all crashes but account for 39% of fatal crashes and 14% of serious injury crashes.

Of the 168 pedestrian and bicycle crashes (shown in Figure 11), approximately 85% were coded as occurring on City streets, the other 15% of crashes occurred along the State, County, or other roadways.

Figure 11. Pedestrian and Bicycle Crashes, 2016-2020



All six of the fatal pedestrian crashes occurred when it was dark. Four of the 16 serious injury pedestrian and bicycle crashes occurred when it was dark.

Six of the 23 fatal and serious injury pedestrian and bicycle crashes involved a left turning vehicle failing to yield.

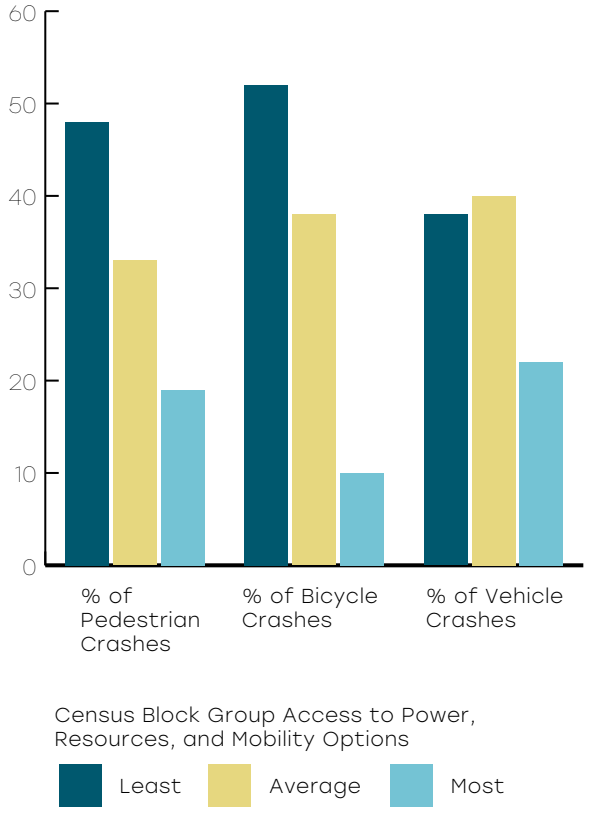
The relationship between crashes and equity status is shown in Figure 12. The areas where residents generally have the least access to power, resources, and mobility options experience a disproportionate number of crashes relative to their residential population. Some of the disparity may be explained by the high number of jobs and destinations in these areas (Table 1). The areas where resident have the least access to resources contain 19% of Rochester's population and 50% of its jobs, but 73% of all fatal and severe injury pedestrian crashes.

Twenty percent of pedestrian and bicycle crashes occurred in the 0.3 square mile downtown area near Mayo Clinic, which is also within an area where residents have the least access to resources, power, and mobility options.

Table 1. Population and Jobs by Equity Area

Access to Power, Resources, and Mobility Options	Percent of Population	Percent of Jobs
Least	19%	50%
Average	48%	29%
Most	33%	21%

Figure 12. Crashes by Equity Area



Level of Traffic Stress

A majority of the public would like to walk or ride bicycles more but are discouraged from doing so by perceived safety concerns, lack of facilities, or a lack of knowledge about where the appropriate facilities are located. Surveys nationally show that 50-60 percent of people say they would ride a bicycle more (or start riding) if they had access to facilities that provided more separation from traffic, lower traffic speeds, and/or lower traffic volumes (Figure 13). Additionally, evidence has shown that increasing the number of bicyclists on the road improves safety for all transportation modes. Cities with high bicycling rates tend to have lower crash rates.

Most people living in Rochester are likely to be interested in biking, but uncomfortable riding on busy streets.

The Bicycle Level of Traffic Stress (BLTS) analysis estimates the level of comfort for people biking on a given roadway segment. BLTS helps to identify where gaps or deficiencies in a bike network exist, and provides a measure of how likely different types of riders, based on ability and comfort level, are to use the facility.

Methodology

BLTS is determined by characteristics of a given roadway segment that affect a bicyclist's perception of safety and comfort, including posted speed limit, number of travel lanes, and the presence and character of bicycle lanes. The

Figure 13. Types of Bicyclists

combination of this criteria classifies a road segment into one of four levels of traffic stress as shown in Figure 14:

- BLTS 1 represents roadways where bicyclists of all ages and abilities would feel comfortable riding. These roadways are generally characterized by low volumes, low speeds, no more than two travel lanes, and traffic control measures at intersections. These roadways may have bicycle facilities; separated shared-use paths for bicycles also fall into this category.
- BLTS 2 represents slightly less comfortable roadways, where most adults would feel comfortable riding.
- BLTS 3 represents moderately uncomfortable roadways, where most experienced bicyclists would feel comfortable riding.
- BLTS 4 represents high-stress roadways where only strong and fearless bicyclists would feel comfortable riding. These roadways are generally characterized by high volumes, high speeds, several travel lanes, and complex transitions approaching and crossing intersections.

Results

The results of the BLTS analysis, shown in Figure 15, help identify existing areas that are low-stress for many bicyclists, and identifies the degree to which roadways must be improved in order to provide a comfortable experience for riders of all ages and abilities.

Approximately 65% of the street network within the City of Rochester is classified as BLTS 1, facilities on which people of all ages and abilities would feel comfortable riding. This low stress network is primarily

Figure 14. Bicycle Level of Traffic Stress and typical roadway conditions

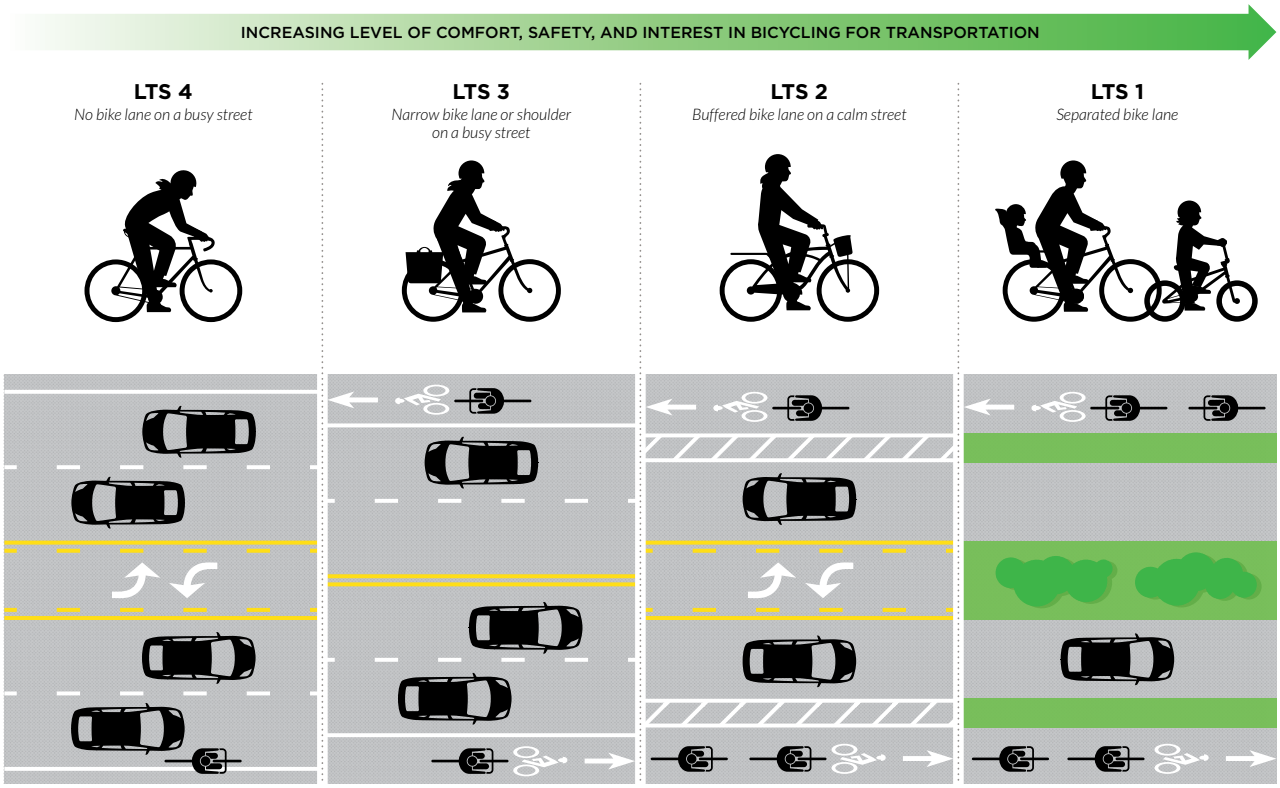
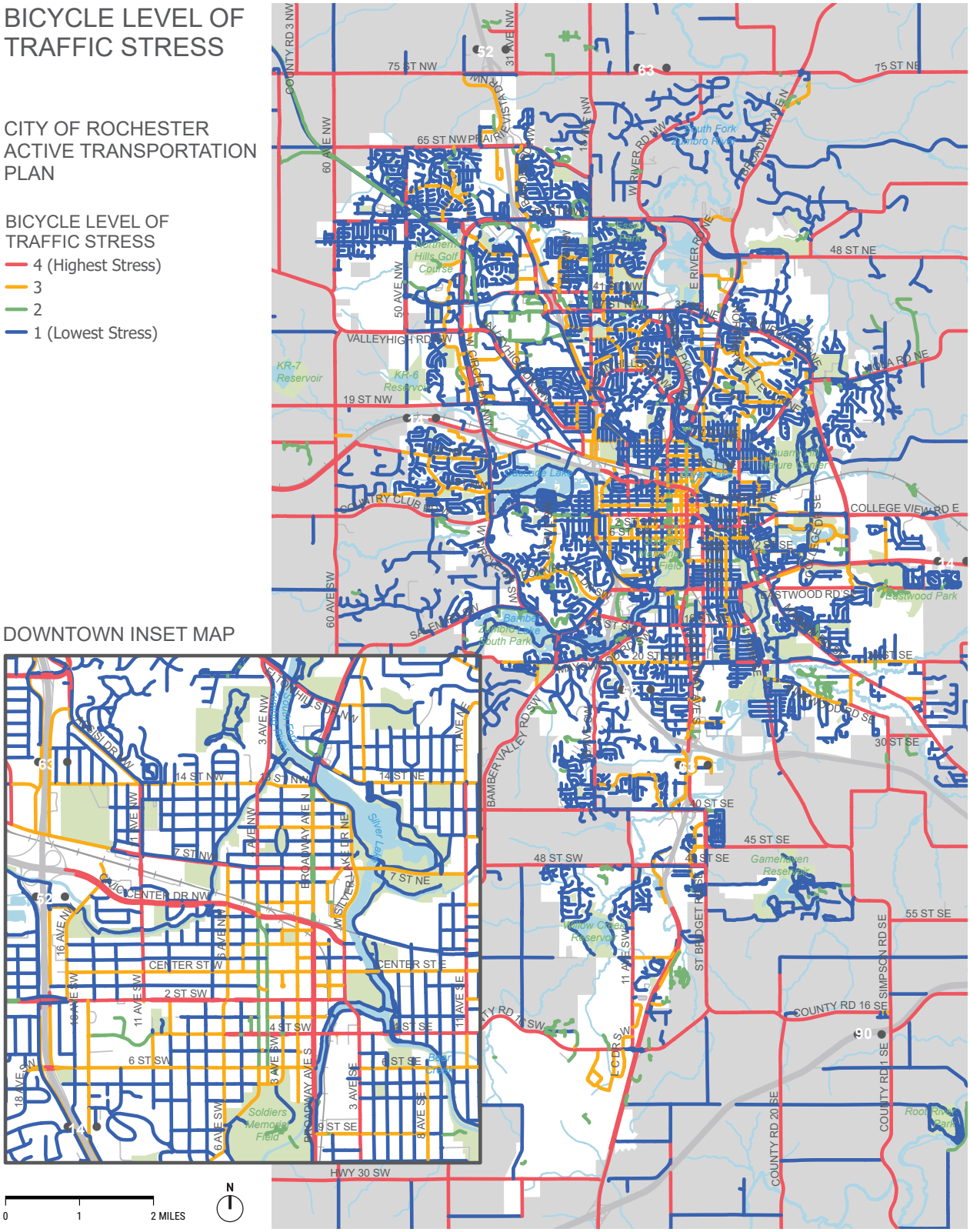
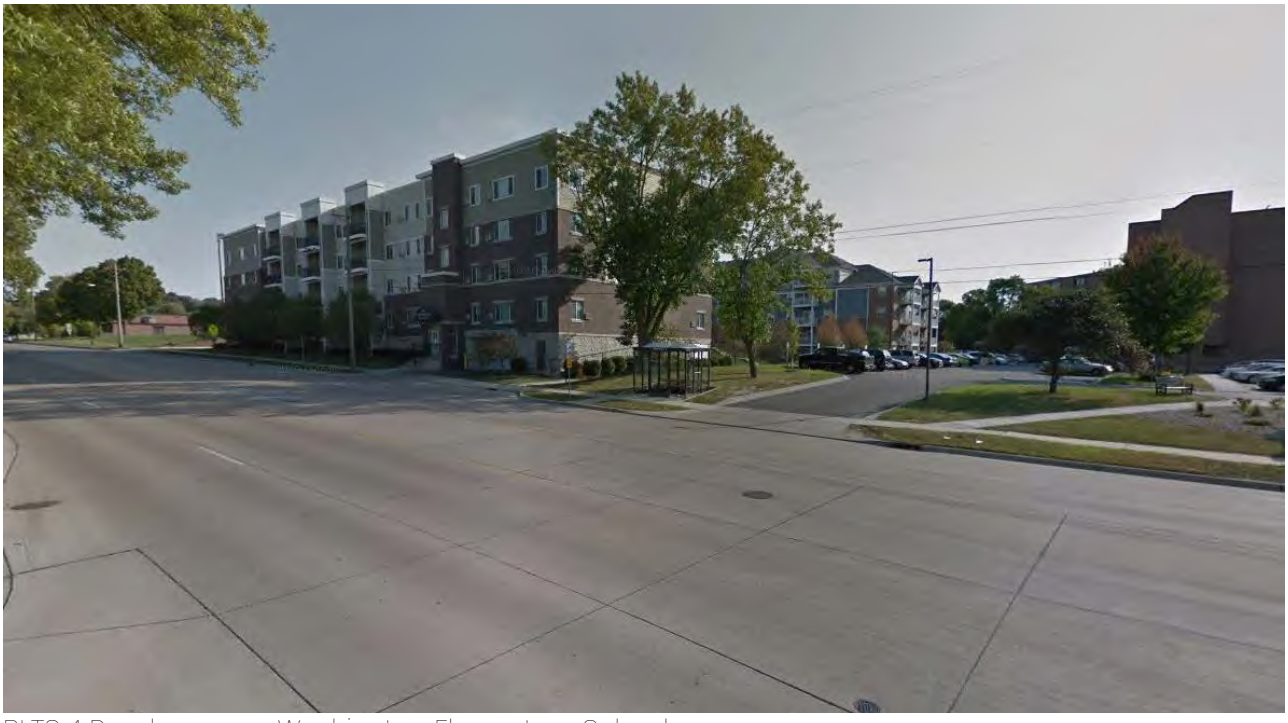


Figure 15. Bicycle Level of Traffic Stress





BLTS 4 Roadway near Washington Elementary School

comprised of low speed residential streets and trails.

Five percent of the network is classified as BLTS 2, comfortable for most adults. 12% is classified as BLTS 3, comfortable only for experienced riders, and 19% is classified as BLTS 4, high stress roadways where only strong and fearless bicyclists may be comfortable. Most BLTS 4 roadways are multilane, higher speed roadways like Circle Dr, Civic Center Dr, Broadway Ave, and 2nd St SE.

While BLTS 1 and 2 facilities make up most of the transportation network, in many cases riders on lower stress facilities must make stressful crossings of BLTS 3 and 4 roadways or travel significantly out of their way to lower stress crossings. These stressful crossings discourage many people from riding at all.

The areas where residents have the least access to resources, power, and mobility options make up 13% of the city's land area, but contain 21% of the city's BLTS 3 and 4 roadways. 34% of the network in these areas is higher stress.

The areas where residents have the most access to resources, power, and mobility options make up 45% of the city's land area but contain only 37% of the BLTS 3 and 4 roadways. 24% of the network in these areas is higher stress.

Building a Better World for All of Us®

MEMORANDUM

TO: Colin Harris, PE - Alta Planning + Design

FROM: Heather Kienitz, PE (MN)
Justin Anibas, PE (MN)

DATE: October 13, 2021

RE: Rochester Citywide Crash Analysis Memorandum
SEH No. ALTAP 160874

INTRODUCTION

The City of Rochester is developing an Active Transportation Plan. As part of this process, it is necessary to understand the existing safety conditions for people walking, rolling and biking across the community. A review of crash data provides some insight to this component, recognizing however, that these crashes only represent only those that are reported to law enforcement. Further, the data does not reflect near miss events. To understand the complete safety picture, it is necessary to obtain additional information from stakeholders about their experiences and perceived safety at locations across the city.

Citywide crash information from January 1, 2016 through December 31, 2020 was analyzed using MnDOT's Crash Mapping Application (MnCMAT2). This data is based on information provided by the responding law enforcement officer, victims, and witnesses. It is important to recognize that each of these participants have their own unique perspective on the events that occurred which are impacted by the emotion and personal feelings of the individual. These elements should be considered when interpreting the data.

KEY FINDINGS

Below are the key findings of the pedestrian, bicycles, and vehicle crash analysis.

- Pedestrian and bicycle crashes make up a small percentage of the total crashes within the City of Rochester (approximately 2%) but account for a considerable percentage of the fatal and serious injury crashes (approximately 17%).
- 20% of pedestrian and bicycle crashes occurred in the 0.3 square mile downtown area near Mayo Clinic, which is also within an area with the least access to resources, power, and mobility options.
- All six of the fatal pedestrian crashes occurred when it was dark. Four of the 16 serious injury pedestrian and bicycle crashes occurred when it was dark.
- Six of the 23 fatal and serious injury pedestrian and bicycle crashes involved a left turning vehicle failing to yield.
- Nearly ¾ of all fatal and serious injury pedestrian and bicycle crashes occurred in areas with the least access to resources, power, and mobility options.

PEDESTRIAN AND BICYCLE CRASHES

According the MnCMAT2, there was a total of 9,628 crashes in Rochester during the last 5 years. Of those crashes, 79 involved pedestrians, 89 involved bicyclists, and the remaining 9,460 crashes were vehicle only crashes. The pedestrian and bicycle related crashes make up a small percentage of the total crashes within the City of Rochester (approximately 2%) but account for a considerable percentage of the fatal and serious injury (severity A) crashes within in the City (approximately 17%), as displayed for bicycle and pedestrian crashes within the City of Rochester in **Figure 1**. The severity of pedestrian and bicycle crashes is summarized in **Table 1**.

Figure 1 – Pedestrian and Bicycle Crash Percentages of Total Crashes (2016-2020)

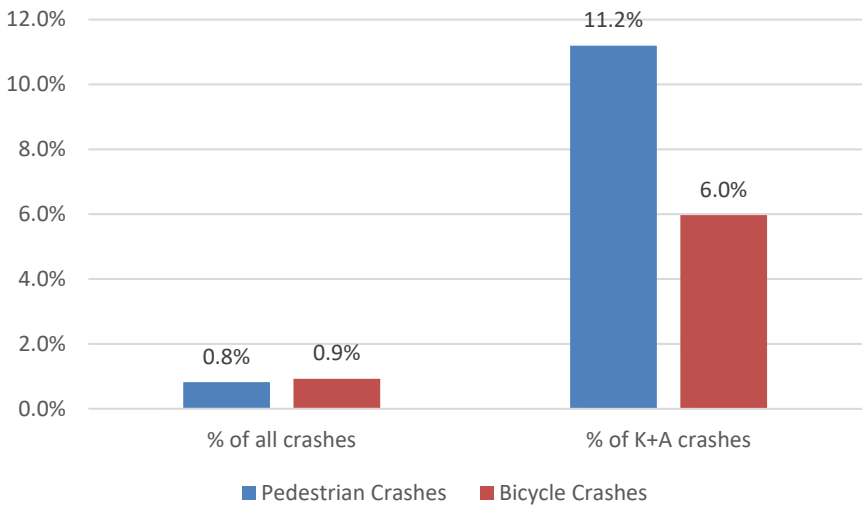


Table 1 – Pedestrian and Bicycle Crash Severity

Pedestrian/Bicycle	Crash Severity					Total
	Fatal	Serious Injury	Minor Injury	Possible Injury	Property Damage Only	
Pedestrian Crashes	6	9	35	23	6	79
Bicycle Crashes	1	7	45	24	12	89
Total	**7**	**16**	**80**	**47**	**18**	**168**

Pedestrian and Bicycle Crashes by Roadway Type

Of the 168 pedestrian and bicycle crashes, approximately 85% were coded as occurring on City streets, the other 15% of crashes occurred along the State, County, or other roadways. **Table 2** summarizes the pedestrian and bicycle crashes by roadway type.

Table 2 – Pedestrian and Bicycle Crashes by Roadway Type

Pedestrian/Bicycle	Roadway Type				Total
	US/MnDOT Highway	County Road	City Street	Other/ Unknown	
Pedestrian Crashes	6	1	70	2	79
Bicycle Crashes	7	7	73	2	89
Total	**13**	**8**	**143**	**4**	**168**

Summary of Pedestrian Crash Characteristics

There was a total of 79 crashes involving pedestrians in the City of Rochester between 2016 and 2020. Below are trends seen within those 79 crashes.

- 6 fatal crashes and 9 serious injury (severity A) crashes
  - 6 of the crashes involved pedestrians crossing the roadway at improper locations (i.e. mid-block or without a marked crosswalk)
  - 6 of the crashes involved vehicles failing to yield to pedestrians in a crosswalk. 4 of these involved left turning vehicles failing to yield.
  - All 6 of the fatal and 2 of the serious injury crashes occurred when it was dark.
- There is a concentration of pedestrian crashes through downtown Rochester in the area of Broadway Avenue/2nd Street NW/ 4th Street SW near the Mayo Clinic. 20 of 79 pedestrian crashes occurred in the approximately 0.3 square mile downtown area, including 3 of the serious injury pedestrian crashes.
- 52 of the 79 (66%) pedestrian crashes occurred at intersections, with the remaining 27 (34%) occurring along roadway segments, at business accesses, or in unspecified areas of the roadway.
- 45 of the 79 (57%) pedestrian crashes occurred after 3 PM, with 21 occurring between 3 and 6 PM and 24 occurring after 6 PM.
- 37 of the 79 (49%) pedestrian crashes occurred between May and October, the more pleasant weather months when pedestrian activity is expected to be higher.
- 30 of the 79 (38%) pedestrian crashes occurred when it was dark, with the remaining 49 (62%) crashes occurring during daylight. As noted above, all 6 of the fatal crashes occurred when it was dark.

Summary of Bicycle Crash Characteristics

There was a total of 89 crashes involving bicycles in the City of Rochester between 2016 and 2020. Below are trends seen within those 89 crashes.

- 1 fatal crash and 7 serious injury (severity A) crashes
  - 3 of the crashes involved vehicles failing to yield to bicyclists. 2 of these crashes involved left turning vehicles failing to yield.
  - 2 of the crashes involved bicyclists disregarding traffic signals and crossing the roadway without a walk signal.
- There is a concentration of bicycle crashes through downtown Rochester in the area of Broadway Avenue/2nd Street NW/ 4th Street SW near the Mayo Clinic. 13 of the 89 bicycle crashes occurred in the approximately 0.3 square mile downtown area.
- 63 of the 89 (71%) bicycle crashes occurred at intersections, with the remaining 26 (29%) occurring along roadway segments, at access points, in an interchange area, or in unspecified areas of the roadway.
- 50 of the 89 (56%) bicycle crashes occurred after 3 PM, with 22 occurring between 3 and 6 PM and 28 occurring after 6 PM.
- 73 of the 89 (82%) bicycle crashes occurred between May and October, the more pleasant weather months when bicycle activity is expected to be higher.
- 19 of the 89 (21%) bicycle crashes occurred when it was dark, with the remaining 70 (79%) crashes occurring during daylight.

Table 3 summarizes the provided information for the fatal and serious injury (severity A) crashes involving pedestrians and bicyclists. **Figure 2** shows all pedestrian and bicycle crash locations and highlights the fatal and severity A crash locations

Table 3 – Fatal and Serious Injury Pedestrian/Bicycle Crashes

Date	Location	Location Type	Light	Weather/ Surface Condition	Severity	Brief Description of Crash based on law enforcement narrative	Contributing Factor
Pedestrian Crashes							
4/8/2016	South of 1st Ave NW near Central Park	Segment	Dark (roadway lighting)	Clear / Dry	**Fatal**	Pedestrian crossed 1st Ave NW mid-block and was struck by a southbound vehicle	Alcohol / Improper Crossing
5/13/2017	South of 11th St SE/3rd Ave SE	Segment	Daylight	Clear / Dry	Serious Injury	Pedestrian crossed 3rd Ave SE mid-block and was struck by a northbound vehicle	Alcohol / Improper Crossing
5/28/2017	West of Civic Center Dr/11th Ave NW	Segment	Dark (roadway lighting)	Clear / Dry	**Fatal**	Pedestrian crossed Civic Center Dr near the right-in/right-out business access and was struck by a westbound vehicle	Improper Crossing
10/16/2017	2nd St SW/Broadway Ave S	Signalized Intersection	Daylight	Clear / Dry	Serious Injury	Northbound left turning vehicle failed to yield to a southbound through vehicle. After the collision, the northbound left turning vehicle spun into a pedestrian in the crosswalk on the west leg	Vehicle Failure to Yield
4/25/2018	Civic Center Dr/Center St	Signalized Intersection	Daylight	Clear / Dry	Serious Injury	Westbound left turning vehicle failed to yield to a pedestrian in the crosswalk on the south leg	Vehicle Failure to Yield
6/8/2018	Civic Center Dr/6th St NW	Signalized Intersection	Dark (roadway lighting)	Clear / Dry	Serious Injury	Pedestrian disregarded traffic control and crossed Civic Center Dr on the east leg; Pedestrian was struck by a westbound vehicle	Alcohol/ Pedestrian Disregard Traffic Control
9/17/20218	Alleyway near Broadway Ave/12th St NW intersection	Alleyway	Dark (no roadway lighting)	Clear / Dry	**Fatal**	Vehicle traveling eastbound struck a pedestrian in the alleyway	Unknown

Date	Location	Location Type	Light	Weather/ Surface Condition	Severity	Brief Description of Crash based on law enforcement narrative	Contributing Factor
11/2/2018	2nd St W/18th Ave SW	Unsignalized Intersection	Dark (roadway lighting)	Cloudy / Dry	**Fatal**	Pedestrian crossing 2nd St SW in the marked crosswalk was struck by an eastbound vehicle in the left lane; one vehicle had already stopped for the pedestrian in the right lane	Vehicle Failure to Yield
2/12/2019	2nd St SW/1st Ave SW	Signalized Intersection	Daylight	Snow / Snow	Serious Injury	Southbound vehicle attempted to a take a right turn on red and struck a pedestrian in the crosswalk on the west leg	Vehicle Failure to Yield
6/13/2019	Maine Ave SE/Target Access	Access	Daylight	Clear / Dry	Serious Injury	Pedestrian crossed Maine Ave SE at the intersection with no marked crosswalk and was struck by a southbound vehicle	Improper Crossing
9/29/2019	Broadway Ave S/14th St SW	Signalized Intersection	Daylight	Cloudy / Wet	Serious Injury	Westbound left turning vehicle failed to yield to a pedestrian in the crosswalk on the south leg	Vehicle Failure to Yield
3/3/2020	7th St NW/6th Ave NW	Unsignalized Intersection	Dark (roadway lighting)	Clear / Wet	**Fatal**	Pedestrian crossed 7th St NW at the intersection with no marked crosswalk and was struck by an eastbound vehicle	Unknown
4/13/2020	Broadway Ave S/4th St SW	Signalized Intersection	Daylight	Clear / Dry	Serious Injury	Westbound left turning vehicle failed to yield to a pedestrian in the crosswalk on the south leg	Vehicle Failure to Yield
8/7/2020	US 52 south of 75th St NW	Freeway	Dark (no roadway lighting)	Clear / Dry	**Fatal**	Pedestrian on US 52 improperly was struck by a southbound vehicle	Improper Crossing
12/18/2020	West of 19th St NW/18 ½ Ave NW	Segment	Dark (roadway lighting)	Clear / Dry	Serious Injury	Pedestrian crossed 7th St NW mid-block and was struck by a westbound vehicle	Improper Crossing

Date	Location	Location Type	Light	Weather/ Surface Condition	Severity	Brief Description of Crash based on law enforcement narrative	Contributing Factor
Bicycle Crashes							
8/1/2016	4th St SE/15th Ave SE	Unsignalized Intersection	Daylight	Clear / Dry	Serious Injury	Bicyclist crossed 4th St SE with no marked crosswalk and was struck by an eastbound vehicle	Improper Crossing
8/30/2016	Valleyhigh Dr NW/19th St	Signalized Intersection	Sunrise	Cloudy / Dry	**Fatal**	Northbound left turning vehicle struck a bicyclist in the crosswalk on the west leg	Unknown
9/26/2016	12th St SE/8th Ave SE	Signalized Intersection	Dark (roadway lighting)	Clear / Dry	Serious Injury	Bicycle crossing on the east leg of the intersection was struck by an eastbound vehicle	Unknown
11/12/2016	West River Pkwy/37th St NW	Signalized Intersection	Dark (roadway lighting)	Clear / Dry	Serious Injury	Bicyclist disregarded traffic control and crossed 37th St NW on the east leg; Bicyclist was struck by an eastbound vehicle	Bicyclist Disregard Traffic Control
1/27/2017	12th St SE/10th Ave SE	Unsignalized Intersection	Sunset	Clear / Dry	Serious Injury	Eastbound right turning vehicle struck an eastbound bicyclist crossing 10th Ave SE	Vehicle Failure to Yield
6/27/2018	2nd St SW/11th Ave SW	Signalized Intersection	Daylight	Clear / Dry	Serious Injury	Bicyclist disregarded traffic control and crossed 11th Ave SW on the north leg; Bicyclist was struck by a southbound vehicle	Bicyclist Disregard Traffic Control
6/12/2020	16th St NW/E Frontage Rd	Unsignalized Intersection	Daylight	Clear / Dry	Serious Injury	Westbound left turning vehicle failed to yield to a bicycle northbound on E Frontage Rd	Vehicle Failure to Yield
9/1/2020	14th St SW/St Mary's Hospital Pick-Up/Drop-off Access	Access	Daylight	Clear / Dry	Serious Injury	Southbound left turning vehicle failed to yield to a bicycle northbound on 14th Ave SW	Vehicle Failure to Yield

FIGURE 2 - PEDESTRIAN/BIKE CRASHES (2016-2020)

CITY OF ROCHESTER ACTIVE TRANSPORTATION PLAN

Pedestrian Crashes

- Fatal
- Serious Injury
- Other Crashes

Bike Crashes

- Fatal
- Serious Injury
- Other Crashes

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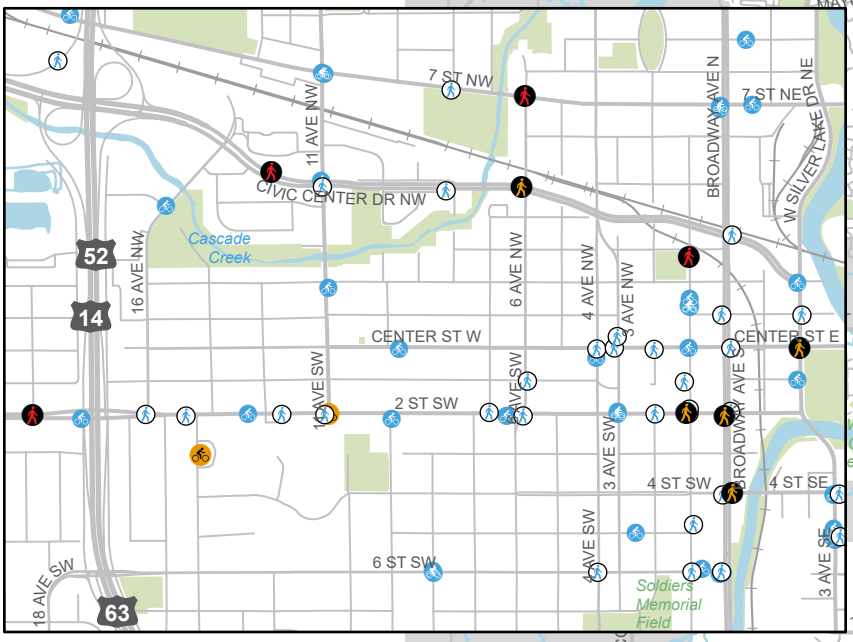
INSET MAP



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CITY OF ROCHESTER

AUTOMATED VEHICLE ONLY CRASHES

Of the 9,628 crashes in the City of Rochester between 2016 and 2020, 9,460 involved only vehicles. There were a total of 11 fatal and 100 serious injury (severity A) crashes. Property damage only crashes are the most common crash type and make up approximately 78% of vehicle crashes Citywide. **Table 4** summarizes the vehicle crashes by severity.

Of the 9,460 vehicle only crashes rear end crashes were the most common crash type with 32%, followed by right angle (25%) and single vehicle crashes (22%). **Table 5** summarizes the vehicle crashes by general crash diagram.

Table 4 – Vehicle Only Crash Severity

Crash Severity					Total
Fatal	Serious Injury	Minor Injury	Possible Injury	Property Damage Only	
11	**100**	**737**	**1,257**	**7,355**	**9,460**
0.1%	1%	8%	13%	78%	

Table 5 – Vehicle Only Crash Diagrams

Crash Severity						Total
Rear End	Right Angle	Sideswipe	Head On	Single Vehicle	Other	
3,061	**2,400**	**1,181**	**332**	**2,114**	**372**	**9,460**
32%	25%	12%	4%	22%	4%	

Auto Only Crashes by Roadway Type

Of the 9,640 vehicle crashes, approximately 64% were coded as occurring on City streets, the other 35% of crashes occurred along the State, County, or other roadways. **Table 6** summarizes the crashes by roadway type.

Table 6 – Vehicle Only Crashes by Roadway Type

Roadway Type				Total
US/MnDOT Highway	County Road	City Street	Other/ Unknown	
1,816	**1,282**	**5,882**	**146**	**9,460**
20%	14%	64%	2%	

Summary of Automated Vehicle Crash Characteristics

Below are additional trends seen within the 9,460 vehicle crashes.

- 11 fatal crashes
  - 4 were single vehicle crashes
  - 3 were right angle crashes
  - 4 occurred on City streets
  - 6 occurred at intersections
  - 9 occurred after 3 PM; 5 between 3 PM and 6 PM
- 100 serious injury crashes
  - 36 were right angle crashes
  - 33 were single vehicle crashes
  - 56 occurred on City streets
  - 53 occurred at intersections
  - 58 occurred after 3 PM; 25 between 3 PM and 6 PM
- 51% of the vehicle crashes occurred at intersections, with the remaining 49% occurring along roadway segments (38%), at access points (3%), in an interchange area (4%), or in unspecified areas of the roadway (4%).
- 47% of the vehicle crashes occurred after 3 PM, with 29% occurring between 3 and 6 PM and 18% occurring after 6 PM.
- 32% of the vehicle crashes occurred between December and February during the winter months when road conditions can be worse.
- 73% of vehicle crashes occurred during daylight
- 64% of vehicle crashes occurred when the roadway was dry, the next two highest roadway surface conditions were snowy/icy (21%) and wet (14%)

EQUITY CRASH ANALYSIS

Alta Planning + Design completed an *Equity Analysis* for the City of Rochester using census data and additional data from the city to identify areas with the most and least access to resources, power, and mobility options. SEH completed a crash analysis through an equity lens based on the determination of equity areas. It is important to note that this crash analysis only included the number of crashes in given census block groups and does not consider crash rates based on vehicle, pedestrian, or bicycle exposure/volume.

In the city there are 91 total census block groups and based on the equity framework, 23 census block groups were identified as having the most access and 22 identified as having the least access. The remaining 46 block groups were considered to have average access to resources, power, and mobility options.

Table 7 provides a summary of the block groups in each equity category based on population and land area. The block groups in the City with the least access include nearly 20% of the population and occupy 2.7% of the land area in the community. These are the most dense areas of the City which are typically the areas with the highest demand for walking, biking and rolling.

Table 6 – Vehicle Only Crashes by Roadway System

Access to Resources, Power, and Mobility Options	Number of Block Groups	Population	Percent of Population	Percent of Land Area
Most	23	43,244	33.5%	75.0%
Average	46	61,448	47.6%	22.3%
Least	22	24,425	18.9%	2.7%
Total	**91**	**129,117**	**100%**	**100%**

Comparisons were made between the crash analyses for people walking, biking, rolling and driving and the areas identified with the most, least and average access to resources, power and mobility. These comparisons provide a high-level review of the conditions related to safety based on crash data in these areas of the community. As with the previous analysis discussed in this memo, these analyses did not include the crash rate, daily traffic volume or vehicle miles traveled (VMT). These factors typically contribute to the raw number of total crashes. Some of those areas with the least access to resources for example also experience some of the highest daily traffic volumes on streets within the city.

Figure 3 shows the percentage of pedestrian, bicycle, and vehicle crashes occurring within the census block groups with the most, average, and least access to resources. This Figure shows that there are a higher percentage of pedestrian and bicycle crashes in areas with the least access to resources, power, and mobility options.

Figure 3 – Equity Crash Analysis – All Crashes

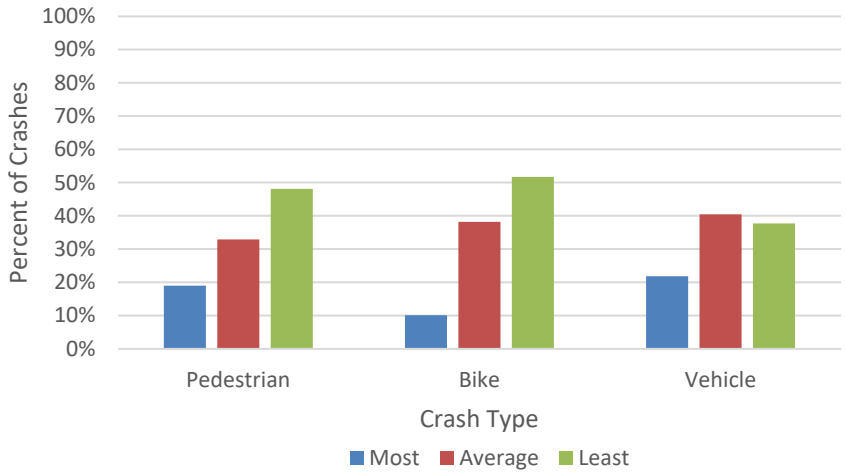
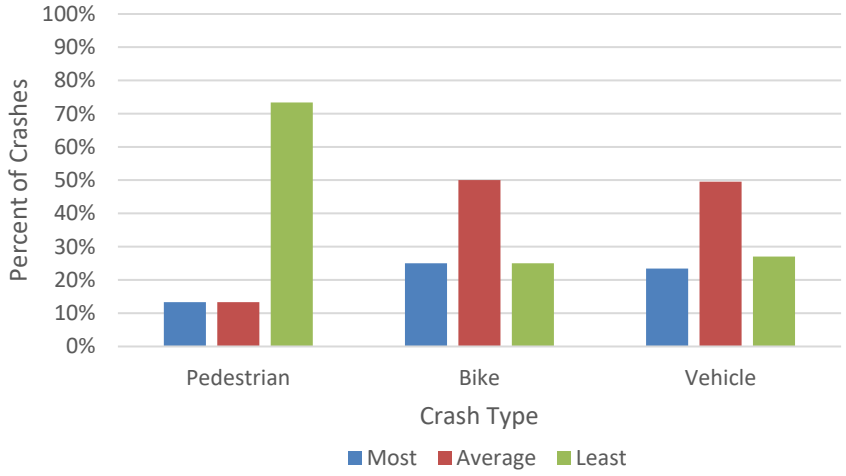


Figure 4 shows the percentage of fatal and serious injury crashes for pedestrians, bicycles, and vehicles occurring within the census block groups with the most, average, and least access to resources. This Figure shows that 73% of fatal and serious injury pedestrian crashes occurred in areas with the least access to resources, power, and mobility options.

Figure 4 – Equity Crash Analysis – Fatal & Serious Injury Crashes



Based on the equity crash analysis shown in Figures 3 and 4, the following observations were made about the areas with the **LEAST** access to resources, power, and mobility options.

- 48% of all pedestrian crashes occurred in these areas (38 total)
- 73% of all fatal and severe injury pedestrian crashes occurred in these areas (11 total)

- 52% of all bicycle crashes occurred in these areas (46 total)
- 25% of all fatal and severe injury bicycle crashes occurred in these areas (2 total)

- 38% of all vehicle crashes occurred in these areas (3,567 total)
- 25% of all fatal and severe injury vehicle crashes occurred in these areas (30 total)

Figure 5 identifies the areas with the most and least access to resources, power, and mobility options as well as the fatal and severity A crashes in Rochester.

FIGURE 5 - EQUITY CRASH ANALYSIS

CITY OF ROCHESTER
ACTIVE TRANSPORTATION PLAN

Pedestrian Crashes
- Fatal
- Serious Injury

Bike Crashes
- Fatal
- Serious Injury

Vehicle Crashes
- Fatal
- Serious Injury

EquityScore
- Most access to resources, power, and mobility options
- Least access to resources, power, and mobility options

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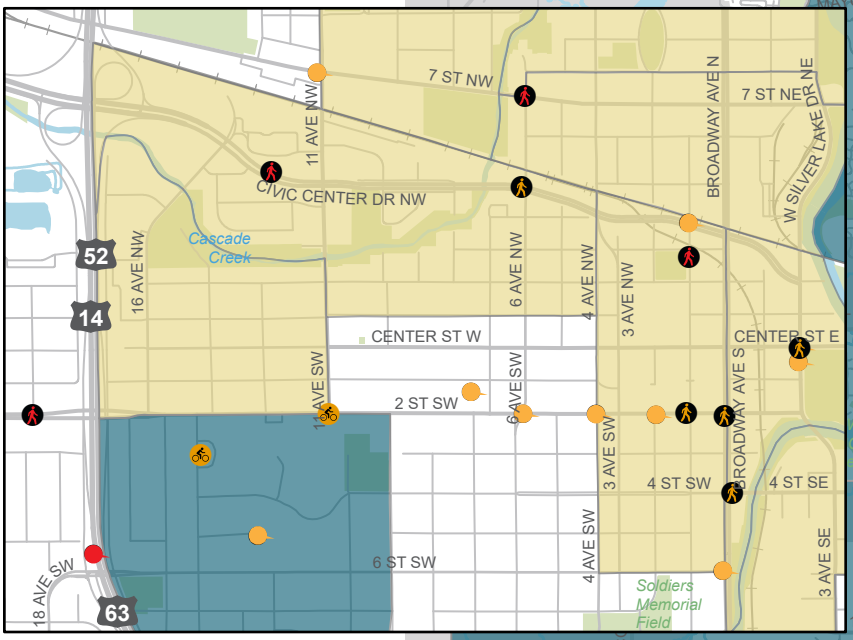
INSET MAP



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CITY OF ROCHESTER

CENSUS BLOCK GROUP ANALYSIS

In addition to general crash trends by equity areas, the three census block group areas that had the highest number of pedestrian and bicycle crashes were identified and analyzed in further detail. All three of the census block groups with the most pedestrian and bicycle crashes are within downtown Rochester, which is also likely have some of the highest amount of pedestrian and bicycle activity in the community. All three census blocks also fall within the group with the least access to resources, power, and mobility options.

Census Tract 000100 Block Group 1 – Downtown Rochester/Mayo Clinic Area – 27 Pedestrian/Bike Crashes

This census block group falls within the group identified as having the least access to resources, power, and mobility options. The area is bounded by Broadway Avenue on the east, 4th Avenue SW on the west, 6th Street SW on the south, and the railroad tracks just north of Civic Center Drive on the north. **Figure 6** shows the census block group area and the pedestrian and bicycle crashes in the area. Below is a summary of the crashes in this area.

- 16 pedestrian crashes
  - 1 fatal
  - 2 serious injury (severity A)
  - 10 minor injury (severity B)
  - 3 possible injury (severity C)
- 9 bicycle crashes
  - 5 minor injury (severity B)
  - 1 possible injury (severity C)
  - 3 property damage only
- 417 vehicle crashes
- 18 of the 27 pedestrian and bicycle crashes fall within the area between 2nd Street NW and 2nd Street SW, which is the Mayo Clinic campus. The Mayo Clinic generates a significant amount of pedestrian, bicycle, and vehicle activity daily.
- 3 of the pedestrian crashes occurred at or near the signalized intersection of 2nd Street SW at 1st Avenue SW.
- The fatal pedestrian crash occurred along 1st Avenue NW near Central Park and involved a pedestrian crossing 1st Avenue NW mid-block and being struck by a southbound vehicle.
- There were 2 serious injury pedestrian crashes.
  - The first occurred at the signalized intersection of 2nd Street SW at Broadway Avenue and involved a northbound left turning vehicle failing to yield to a southbound through vehicle and one of the vehicles striking a pedestrian after the crash.
  - The second occurred at the signalized intersection of 2nd Street SW at 1st Avenue SW and involved a southbound vehicle attempting to take a right turn on red failing to yield to a pedestrian in the crosswalk on the west leg of the intersection.

FIGURE 6 - CENSUS TRACT 000100 BLOCK GROUP 1

CITY OF ROCHESTER ACTIVE TRANSPORTATION PLAN

Pedestrian Crashes

- Fatal
- Serious Injury
- Other Crashes

Bike Crashes

- Fatal
- Serious Injury
- Other Crashes
- Census Block Group Boundary

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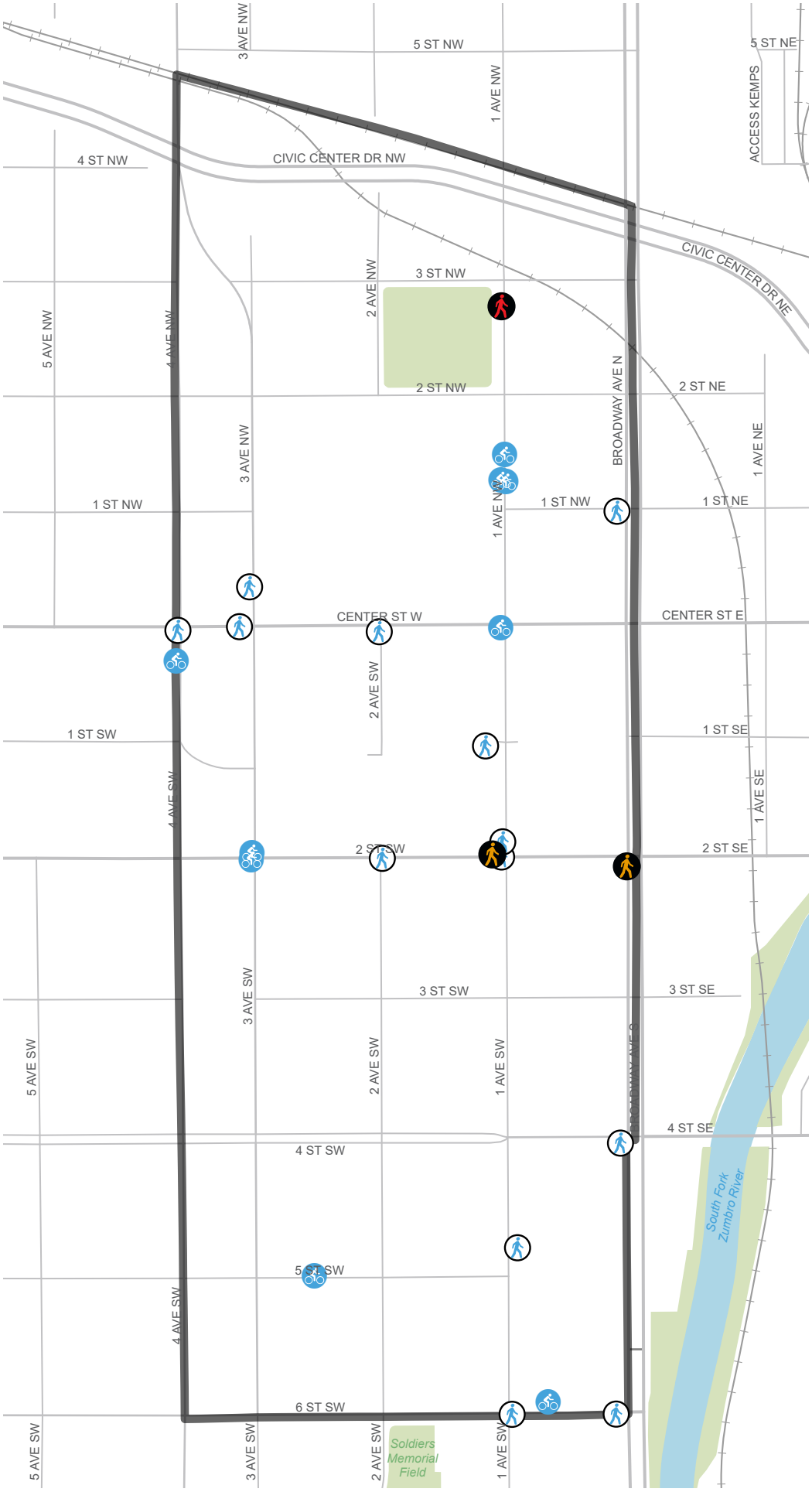

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CITY OF ROCHESTER

Census Tract 000300 Block Group 1 – Olmsted Government Center/Mayo Clinic East Area –

10 Pedestrian/Bike Crashes

This census block group falls within the group identified as having the least access to resources, power, and mobility options. This area is bounded by Broadway Avenue/the Zumbro River and 3rd Avenue SE north of Highway 14, then is bounded by 6th Street SE and Bear Creek east of 3rd Avenue SE. **Figure 7** shows the census block group area and the pedestrian and bicycle crashes in the area. Below is a summary of the crashes in this area.

- 3 pedestrian crashes
  - 1 minor injury (severity B)
  - 1 possible injury (severity C)
  - 1 property damage only
- 7 bicycle crashes
  - 3 minor injury (severity B)
  - 1 possible injury (severity C)
  - 1 property damage only
- 247 vehicle crashes
- 1 pedestrian and 3 bicycle crashes occurred at or near the unsignalized intersection of 3rd Avenue SE at 5th Street SE, which is located near one of the accesses to Mayo Clinic East Campus and has bus stops on either side of 3rd Avenue SE.
- 1 pedestrian and 2 bicycle crashes occurred at or near the signalized intersection of 3rd Avenue SE at 4th Street SE.
- 1 pedestrian and 1 bicycle crash occurred at or near the unsignalized intersection of 6th Street SE at 5th Avenue SE, which is adjacent to Riverside Central Elementary School.

FIGURE 6 - CENSUS TRACT 000300 BLOCK GROUP 1

CITY OF ROCHESTER ACTIVE TRANSPORTATION PLAN

Pedestrian Crashes

- Fatal
- Serious Injury
- Other Crashes

Bike Crashes

- Fatal
- Serious Injury
- Other Crashes

- Census Block Group Boundary

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CITY OF ROCHESTER

Census Tract 000100 Block Group 2 – Mayo Civic Center/Zumbro River Area – 9 Pedestrian/Bike Crashes

This census block group falls within the group identified as having the least access to resources, power, and mobility options. The area is bounded by Broadway Avenue on the west, the railroad tracks just north of Civic Center Drive on the north, and the Zumbro River on the south and east. **Figure 8** shows the census block group area and the pedestrian and bicycle crashes in the area. Below is a summary of the crashes in this area.

- 6 pedestrian crashes
  - 2 serious injury (severity A)
  - 2 minor injury (severity B)
  - 2 possible injury (severity C)
- 3 bicycle crashes
  - 1 minor injury (severity B)
  - 2 possible injury (severity C)
- 290 vehicle crashes
- The bicycle and pedestrian crashes in this area are concentrated along Broadway Avenue (4 pedestrian crashes) and Civic Center Drive NE (2 pedestrian, 1 bicycle).
- 1 pedestrian and 1 bicycle crash occurred at or near the signalized intersection of Center Street at Civic Center Driver NE, which is adjacent to the Rochester Civic Center.
- There were 2 serious injury pedestrian crashes
  - The first occurred at the signalized intersection of Center Street at Civic Center Driver NE and involved a westbound left turning vehicle failing to yield to a pedestrian in the crosswalk on the south leg of the intersection.
  - The second occurred at the signalized intersection of Broadway Avenue at 4th Street SE and involved a westbound left turning vehicle failing to yield to a pedestrian in the crosswalk on the south leg of the intersection.

c: Maria Wardoku, AICP – Alta Planning+ Design
Brian Morgan – SEH

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FIGURE 6 - CENSUS TRACT 000100 BLOCK GROUP 1

CITY OF ROCHESTER ACTIVE TRANSPORTATION PLAN

Pedestrian Crashes

- Fatal
- Serious Injury
- Other Crashes

Bike Crashes

- Fatal
- Serious Injury
- Other Crashes
- Census Block Group Boundary

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CITY OF ROCHESTER

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CITY OF
ROCHESTER

Active Transportation Plan

APPENDIX C: IMPLEMENTATION RESOURCES

SHARED MICROMOBILITY

DEFINE PROGRAM GOALS

Establishing a set of program goals established a foundation for subsequent decision-making about how to design, fund, and implement a shared micromobility program. Common program goals include:

- Improve access to key destinations
- Improve access to and from public transit
- Improve public health
- Improve transportation system safety
- Introduce new people to biking and other forms of non-vehicular travel
- Reduce congestion
- Reduce greenhouse gas (GHG) emissions and other types of pollution (e.g., noise, water, particulate)

Equity is an overarching priority for program design should and should be incorporated into each specific program goal. Thoughtful program design decisions can ensure that community members who have been most harmed by—and who have benefited the least from—auto-centric transportation systems are disproportionately benefit from shared micromobility. Pricing structures, infrastructure siting, and other program design choices will influence the equity impacts of shared micromobility.

EVALUATE RESOURCE AVAILABILITY

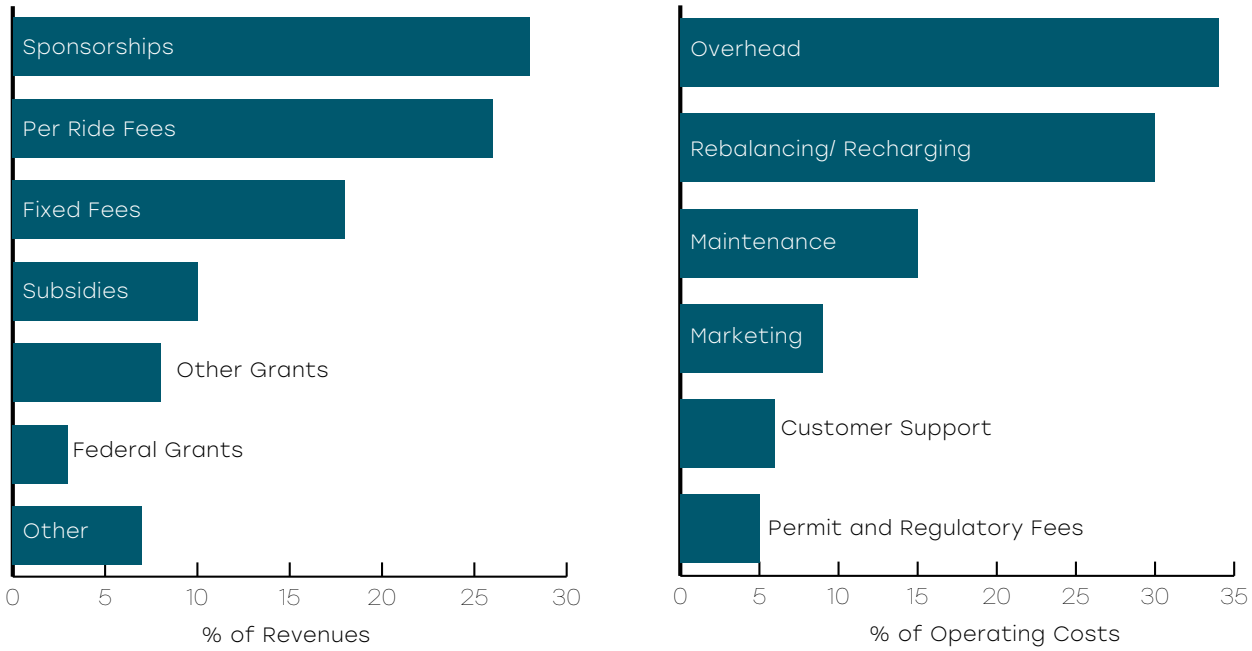
An accurate understanding of both financial and non-financial resources will contribute to successful and sustained program implementation. How much funding is available from public and non-public sources? What can private partners bring to the table? What is the balance between start-up costs (those that are incurred only once, at the beginning of the program) and ongoing operating costs, which are incurred annually?

While some early iterations of shared micromobility programs were funded entirely by private organizations, time has shown that public investment is critical to sustain an effective and equitable program. This aligns with other modes of transportation, where public investment—e.g., the costs for constructing and maintaining roadways and free public parking for private automobiles, or the cost of purchasing and operating buses as part of a transit system—supplements user fees and other funding systems.

But because shared micromobility can meet many private organizations' goals, opportunities for partnership abound. Sponsorship on bikes, scooters, or docking stations can drive brand awareness. Organizational memberships can serve as a perk for employees and comprise a large share of system ridership and revenue.

"Title" sponsorship, where a single entity is branded on all devices, infrastructure, and communications, can be a substantial

Figure 1. Composition of operating costs and revenues for shared micromobility



Source: NABSA 2020 State of the Industry Report

funding source for a program. New York City's "Citi Bike" program, where Citi Bank is the title sponsor, is an iconic example of how this type of partnership can work. Major local institutions, such as the Mayo Clinic, IBM, or institutions of higher education can be ideal partners, either for title sponsorship or other types of program support.

Public funding can come from the local, state, and federal levels. Federal funding sources include the Federal Transit Administration (FTA), Federal Highway Administration (FHWA), and Department of Energy (DOE). At the state level, the Transportation Alternatives Solicitation, operated by the Minnesota Department of Transportation (MnDOT), is a funding source that support bicycle-related projects and infrastructure. Local funding, meanwhile, is often the most flexible and can fill in gaps not covered by other revenue sources. Local funding can also help address community-specific goals, such as improving equitable access to a local park or grocery store.

Figure 1 describes the typical composition of operating costs and revenues for agency and nonprofit owned shared micromobility systems.

REVIEW LAWS & REGULATIONS

An understanding of the legal landscape—primarily the local ordinances and state statutes that relate to conventional bicycle, electric bicycle, and electric scooter use in Rochester—will inform program design as well. The successful operation of shared micromobility programs in communities across Minnesota suggests that municipalities such as Rochester can address any legal requirements or constraints and offer their community members important transportation benefits via shared micromobility. Municipal counsel can provide insight on this front, and insurance and liability coverage can help to reduce risks.

ASSESS EXISTING INFRASTRUCTURE & NEEDS

The existing conditions analyses conducted as part of this plan forms the basis for a fuller understanding of bicycle and pedestrian infrastructure in Rochester. By leveraging these data and findings, Rochester can identify important infrastructure characteristics—e.g., network gaps, protected bike corridors, areas of high need—and use these to shape where micromobility services are offered, as well as areas where additional infrastructure is needed to support safe and comfortable trips.

IDENTIFY PROGRAM PARAMETERS

With a clear set of program goals, an understanding of available resources, knowledge of the legal context, and socio-demographic data describing bicycle facilities and related community characteristics, the City will be poised to make critical program design decisions.

COST ESTIMATES

INTRODUCTION

The project team developed typical unit costs for a variety of bicycle treatments based on the Rochester Design Resource Guide. These per unit costs were then applied to the ten near-term gaps. This process involved the following elements:

- Identification of pedestrian and bicycle friendly treatments from the Rochester Design Resource Guide
- Research of associated costs for each treatment
- Compilation of per-unit costs
- Application of per-unit costs to the ten near term gaps

METHODOLOGY

First, the project team selected applicable pedestrian and bicycle treatments that could be implemented by the city from the City of Rochester Design Resource Guide. Three treatments were identified for the "pedestrian toolbox", 10 treatments for the "bicycle toolbox", 10 treatments for "crossing treatments" and two treatments for "supporting facilities". These 25 treatments and the assumptions associated with them are shown in Table 1, Table 2, Table 3, and Table 4. Assumptions were made at the discretion of the engineer.

Research was conducted on each of these treatments from a wide variety of sources explained later in this document. General per unit costs were gathered from these sources and recorded. This step was completed to gain a general idea of unit costs for each treatment. Per-unit costs were calculated using average bid prices and estimated quantities.

- MnDOT average bid prices and Rochester's average bid prices were recorded for bid items needed to complete each treatment.
- Applicable items were associated to each treatment and quantities for each were estimated.
- Typically, the higher bid price was used to complete cost calculations.

Calculated unit costs were then compared with the researched costs to ensure accuracy of estimated quantities and costs. The final "unit cost estimate" was achieved by selecting the greatest cost estimate (so long as it was not an outlier from the others) and increasing by 10%.

Recommended treatment types for near term gaps (shown in Figure 2) were developed assuming a retrofit (not a reconstruction where curbs could be moved) to show what could be possible without a full reconstruction and to demonstrate how the unit cost estimate table can be directly applied to planning-level project cost estimates. Treatment types are based on the Rochester Design Resource Guide and a desktop review of roadway conditions (widths, lane configurations, parking presence, bus stop presence, speed limit, traffic volumes, etc).

To develop near term gap cost estimates, the team selected the appropriate treatments to align with the recommendations, applied the appropriate quantities to each treatment, and calculated a projected cost to achieve an AAA facility and crossing improvements for each of the 10 near term gaps (Table 5).

Figure 2. All Ages and Abilities Bicycle Network Near Term Gaps

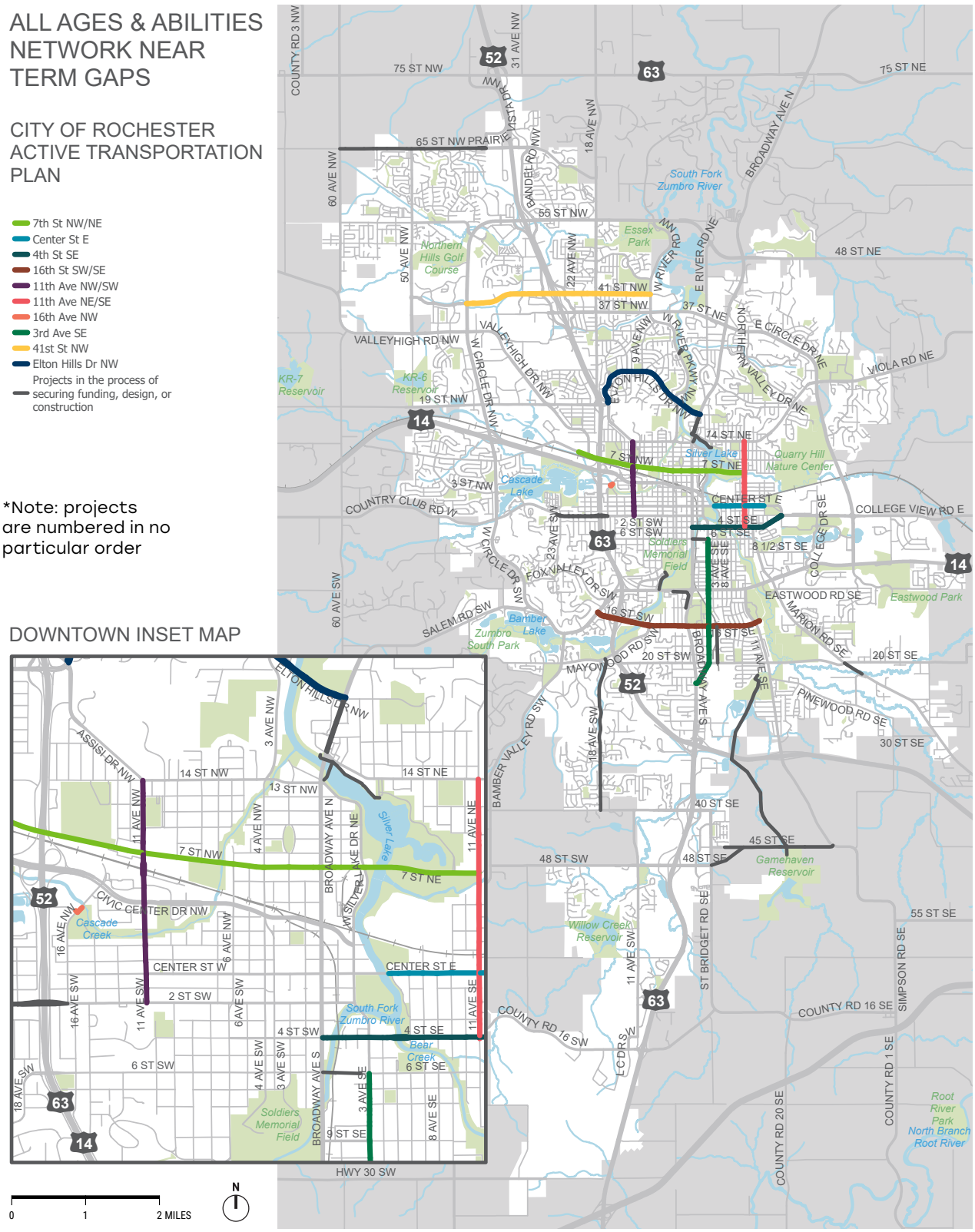


Table 1. Pedestrian Toolbox Unit Costs*

Treatment	Assumptions	Unit	Unit Cost Estimate
Directional Curb Ramp	Includes removal of diagonal curb ramp	EA	$8,000
Curb Extension	Assumed 8'x20' extension	EA	$16,500
Corner Radii	Assumed 30' radius to 5' radius	EA	$24,000

Table 2. Supporting Facility Unit Costs*

Treatment	Assumptions	Unit	Unit Cost Estimate
Short Term Bike Parking	Inverted U with concrete pad	EA	$750
Long Term Bike Parking	Bike locker	EA	$2,600

*Sources: Previous Projects (SEH, Rochester); 2020 Average Bid Prices for Awarded Contracts; Costs for Pedestrian and Bicyclist Infrastructure Improvements; Pedestrian Crosswalk Policy Development Guidelines; Texas Bicycle Tourism Trails Study

Table 3. Bicycle Toolbox Unit Costs*

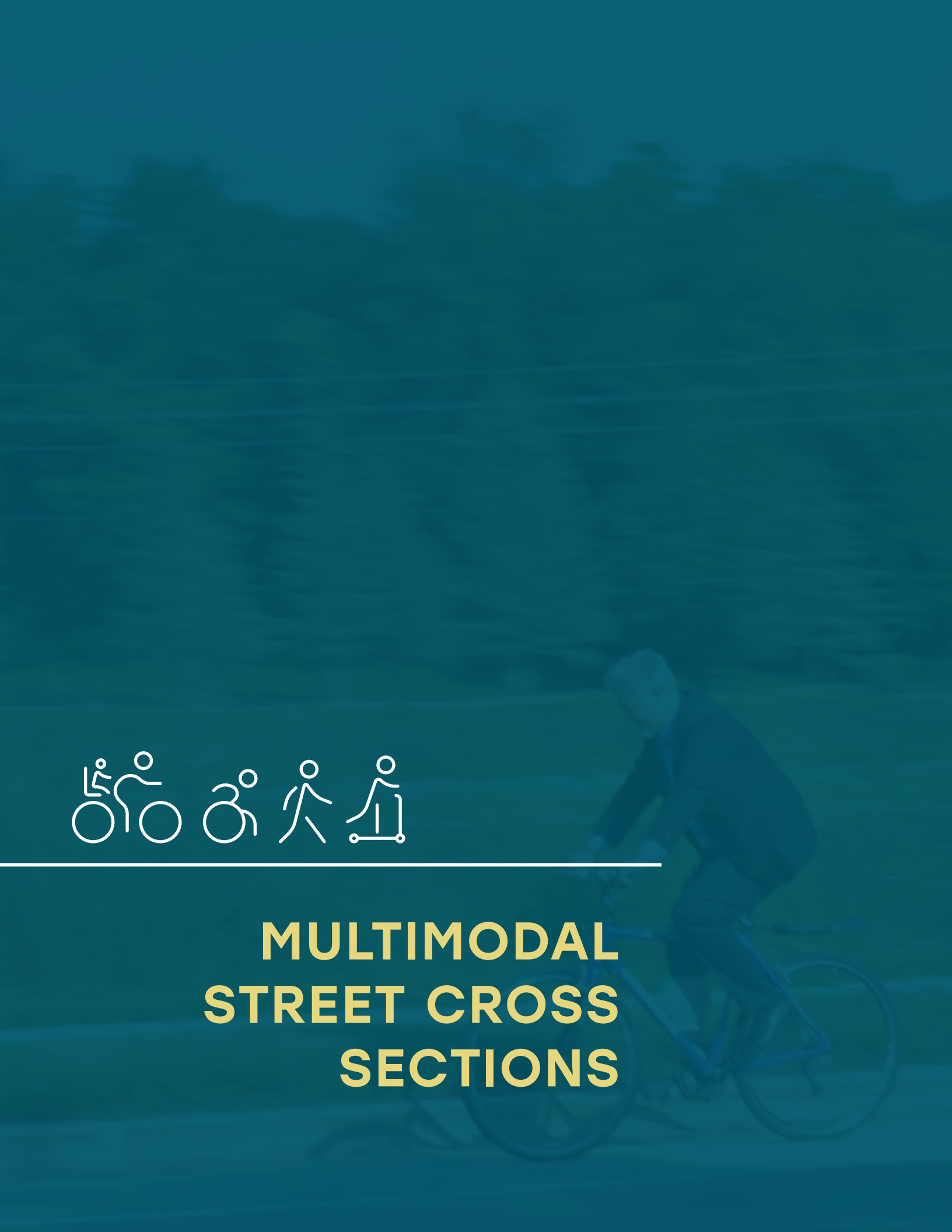
Treatment	Assumptions	Unit	Unit Cost Estimate
Bicycle Lanes	Striping changes to add lanes on both sides of street - no parking lanes	MI	$110,000
Bicycle Lanes	Striping changes to add lanes on both sides of street - with parking lanes	MI	$132,000
Buffered Bicycle Lanes	Striping changes to add lanes and buffers on both sides of street - no parking lanes	MI	$132,000
Buffered Bicycle Lanes	Striping changes to add lanes and buffers on both sides of street - with parking lanes	MI	$152,000
Separated Bike Lanes	One-way with traffic delineators on both sides of street	MI	$190,000
Separated Bike Lanes	Two-way with striped median and traffic delineators on one side of street	MI	$168,000
Separated Bike Lanes	One-way with concrete median and curb on both sides of street	MI	$1,880,000
Separated Bike Lanes	Two-way with concrete median and curb on one side of street	MI	$1,012,000
Bike Boulevard	Includes signage and painted symbols	MI	$14,000
Shared Use Trail		MI	$575,000

Table 4. Crossing Treatments Unit Costs*

Treatment	Assumptions	Unit	Unit Cost Estimate
Marked Crosswalks		EA/LEG	$3,300
Mid Block Crosswalk	Includes 8'x20' pedestrian refuge island	EA	$13,200
Rectangular Rapid Flashing Beacon (RRFB)		EA	$35,000
Ped Hybrid Beacon		EA	$125,000
Separated Bicycle Signal Phase		EA/ HEAD	$2,000
Bike Detection & Actuation	Loop detection system	EA	$2,000
Bicycle Box	Includes paint and 2 signs	EA	$12,500
Two-Stage Turn Box		EA	$2,200
Driveway & Minor Street Crossings		EA	$2,750
Roundabout	Upgrade existing roundabout to bicycle friendly	EA	$95,000

Table 5. Near Term AAA Project Planning Level Cost Estimates

Street	Length (mi)	Total Cost
1: Elton Hills Dr from Assisi Dr NW to Broadway Ave N	1.8	$2,005,300
2: 7th St NW/NE from Douglas Trail to 11th Ave NE	2.3	$1,990,100
3: Center St E from Zumbro River to 15th Ave SE	0.7	$164,300
4: 4th St SE from Broadway to 19th Ave SE	1.4	$2,027,400
5: 16th St SW/SE from Salem Rd SW to 11th Ave SE	2.2	$4,329,000
6: 11th Ave SW/NW from 14th St NW to 2nd St SW	1	$1,555,000
7: 11th Ave NE/SE from 4th St SE to 14th St NE	1.2	$2,438,000
8: 16th Ave NW connection from trail to 4th St NW	0.03	$20,000
9: 3rd Ave SE from 6th St SE to Broadway	2	$3,942,000
10: 41st St NW from W Circle Dr NW to W River Pkwy NW	2.5	$1,590,650



MULTIMODAL STREET CROSS SECTIONS

Figure 3, Figure 4, and Figure 5 show example cross sections for three near-term All Ages and Abilities bicycle projects. The cross-sections are meant to be planning-level suggestions of "short-range" retrofit ideas for high priority streets that would fit within the existing curb-to-curb width of the existing street. Note that other locations of the streets have varying cross sections and high-complexity intersections that would require more extensive analysis and development of assumptions—and may require curbs to change location and present potential right-of-way impacts.

Figure 3. 4th St SE from 7th Ave SE to 19th Ave SE

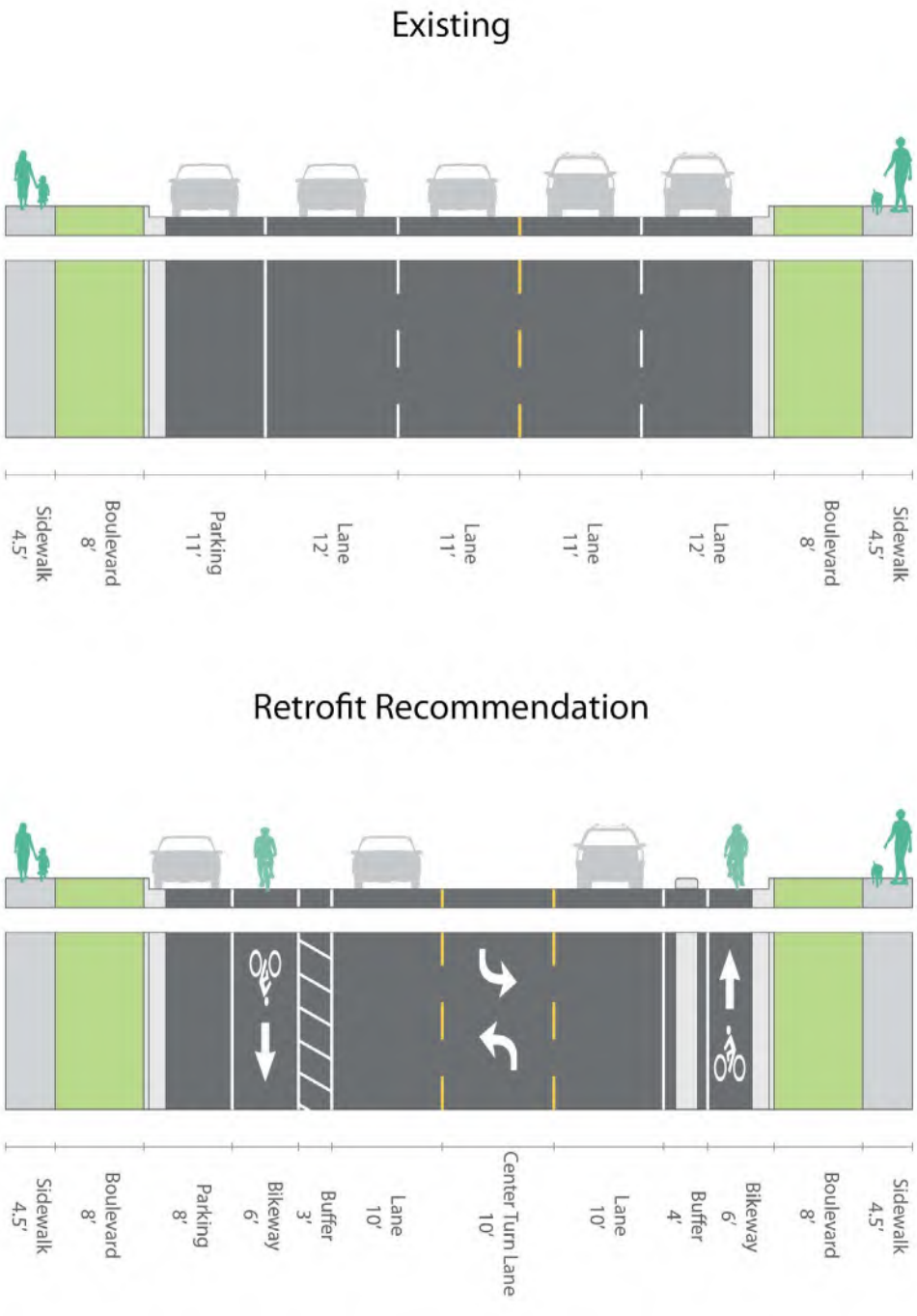


Figure 4. 11th Ave NW from 10th St NW to 14th St NW

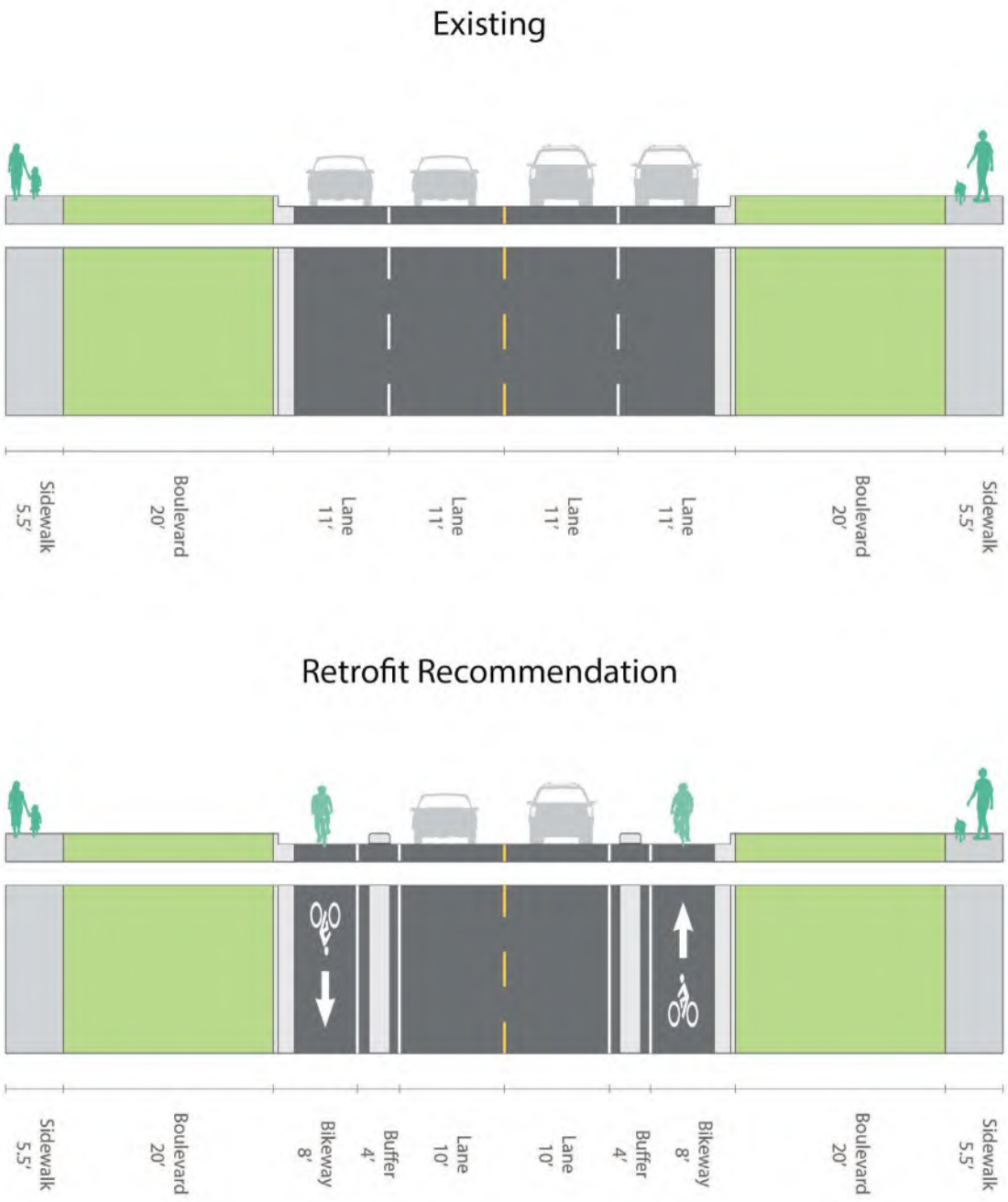
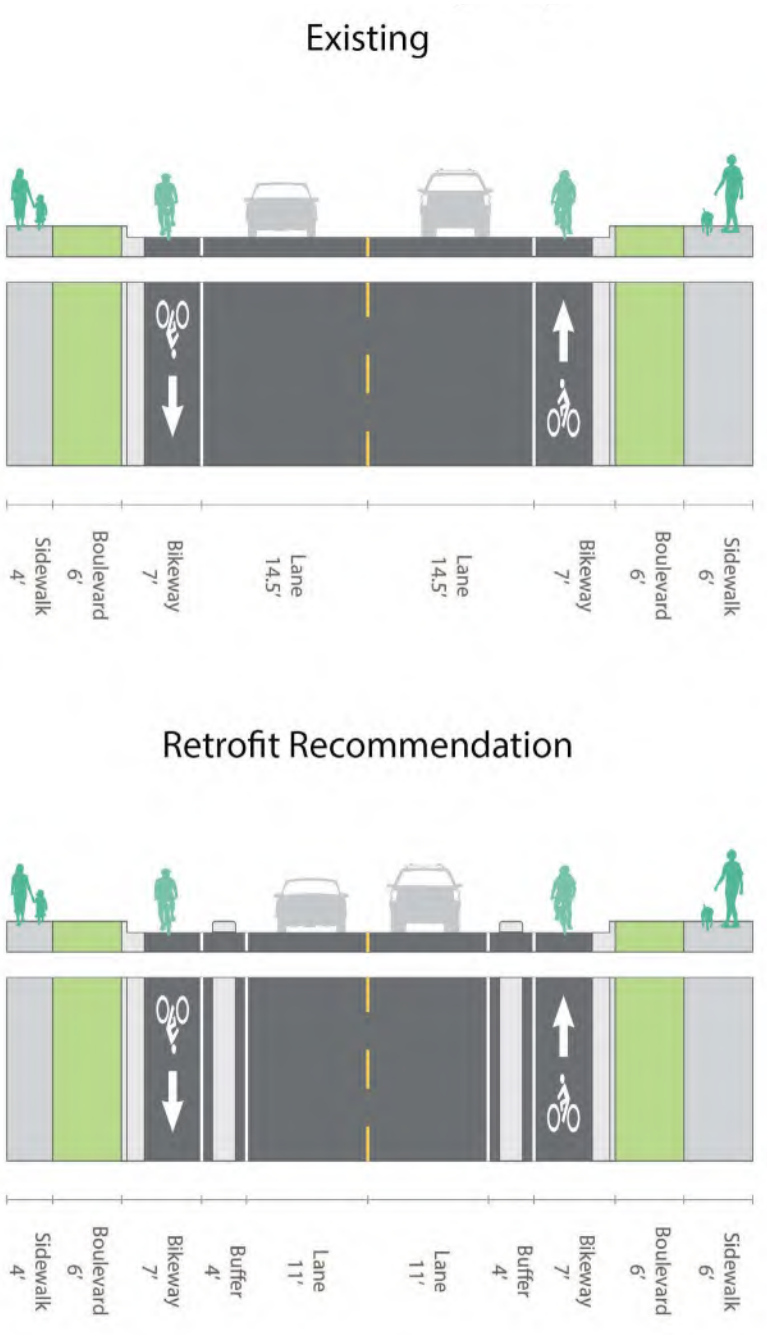


Figure 5. 7th St NW from Douglas Trail to 13th Ave NW



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CITY OF
ROCHESTER

Active Transportation Plan

APPENDIX D: DESIGN RESOURCE GUIDE

TABLE OF CONTENTS

01

INTRODUCTION

CONTEXT

Over the course of the last two decades, cities across the United States have altered the way streets and roads are built. Paradigms are shifting as street-space is no longer viewed as only for automobiles: place-making advocates have increasingly attempted to "reclaim" the streets; sidewalks are expanding to provide additional space for pedestrians; public right-of-way such as on-street parking stalls are converted to outdoor patios, bike parking, or urban landscape areas; and, the COVID-19 pandemic has fundamentally altered the way cities manage the curbside. Intentional design is critical to establishing a cost-effective and contextually appropriate multimodal transportation network within Rochester.

In 2009, Rochester became the first city in Minnesota to adopt a "Complete Streets" policy. Complete streets are designed to accommodate all users by enabling safe and convenient access for pedestrians, bicyclists, motorists, and transit riders of all ages and abilities. Complete streets improve community connectivity by providing travelers with options to access the places they need to go. Nonetheless, while the goal of complete streets is to better accommodate all users of all abilities, this does not mean all modes are equally prioritized on every street.

Between 2019 and 2021, Rochester conducted a city-wide Speed Limit Technical Evaluation and subsequent "Slower-is-Safer" Campaign. As a result, speed limits on all local streets were reduced to 25 mph. Speed limit reductions enforceable by law is one tactic to promote traffic safety: long-term changes to driving behavior often requires physical roadway design and construction with the goal to increase safety for all users. In the city, all new and reconstructed local streets will be designed for a 20 mph speed limit.

This design toolbox presents coordinated guidance for many audiences—local planners, engineers, elected officials, the development community, and community advocates—with the collective mission of improving the walkability and bikeability of Rochester. This toolkit specifically seeks to empower the community to aid city officials in advancing Rochester's 2009 Complete Streets Policy. By distributing ownership into the hands of invested residents, it intends to enhance collaboration between the City and the community during the design and engineering phases of road rehabilitation projects.

This toolkit is a mechanism by which local advocacy committees may measure City projects against its commitment to maintain safe and friendly neighborhoods, eliminate severe injuries and traffic deaths on City streets, and increase neighborhood vitality and livability. Finally, this toolkit is meant to inspire innovation in planning, designing, constructing, and maintaining Rochester's streets for pedestrians and bicyclists of all ages and abilities.

Planners and project designers should refer to these guidelines in developing the infrastructure projects recommended by this plan, but they are not a substitute for thorough project-by-project evaluation by a landscape architect or engineer upon implementation. Furthermore, this toolkit is not intended as a legal standard, but offers design and cost-estimate guidance, and should be integrated with local, state, and federal policies and resources to ensure compliance.

ADDITIONAL CONTEXTUAL NOTES

- Future roadway planning, engineering, design and construction will continue to strive for a balanced transportation system that includes a seamless, accessible bicycle and pedestrian network and encourages bicycle and pedestrian travel wherever possible
- Achieving the appropriate design for any project is not a simple process as designers are expected to balance many competing needs and constraints. In order to address public expectations, a community's needs, and the limitations of available funding and right-of-way, a project's broader context and its projected impacts needs to be considered when applying this design toolkit.
- There are many reasons to integrate bicycle and pedestrian facilities into typical roadway development policy. The goal of a transportation system is to better meet the needs of people - whether in vehicles, bicyclists or pedestrians - and to provide access to goods, services, and activities.
- Supporting active modes gives users important transportation choices, whether it is to make trips entirely by walking or bicycling, or to access public transit. Often in urban or suburban areas, walking and bicycling are the fastest and most efficient ways to perform short trips.
- Convenient non-motorized travel provides many benefits, including reduced traffic congestion, user savings, road and parking facility savings, economic development, and a better environment by helping reduce the greenhouse gases.
- Compatible design does more than help those who already walk or bicycle: it encourages greater use of non-motorized transportation.
- The design guidelines and recommendations in this document are for use on City of Rochester roadways. Projects must not only be planned for their physical aspects as facilities serving specific transportation objectives; they must also consider effects on the aesthetic, social, economic and environmental values, needs, constraints and opportunities in a larger community setting. This is commonly known as Context Sensitive Design, and should be employed when determining which standard is applicable in each scenario.
- All walkway and bikeway design guidelines in this document meet or exceed the minimums set by the Americans with Disabilities Act Accessible Design Guidelines (ADAAG) and the Public Right of Way Accessibility Guidelines (PROWAG).
- All traffic control devices, signs, pavement markings used and identified in this document must conform to the "Manual on Uniform Traffic Control Devices" (MUTCD).

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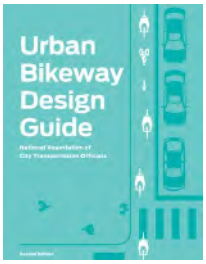
GUIDANCE BASIS

The sections that follow serve as an inventory of pedestrian and bicycle design treatments and provide guidelines for their development. These treatments and design guidelines are important because they represent the tools for creating a pedestrian- and bicycle-friendly, accessible community. The guidelines are not, however, a substitute for a more thorough evaluation by a professional engineer prior to implementation of facility improvements. The following guidelines are incorporated in this Design Guide.

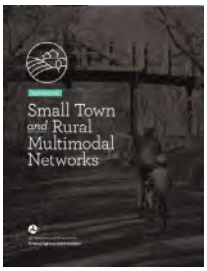
National Guidance

The National Association of City Transportation Officials' (NACTO) **Urban Bikeway Design Guide (2012)** *and* **Urban Street Design Guide (2013)** *are collections of nationally recognized street design standards, and offers guidance on the current state of the practice designs.*



The National Association of City Transportation Officials' (NACTO) **Urban Bikeway Design Guide (2012)** *provides cities with state-of-the-practice solutions that can help create complete streets that are safe and enjoyable for bicyclists. The designs were developed by cities for cities, since unique urban streets require innovative solutions. In August 2013, the Federal Highway Administration issued a memorandum officially supporting use of the document.*

Separated Bike Lane Planning and Design Guide (2015) *is the latest national guidance on the planning and design of separated bike lane facilities released by the Federal Highway Administration (FHWA). The resource documents best practices as demonstrated around the U.S., and offers ideas on future areas of research, evaluation and design flexibility.*



The Federal Highway Administration's **Small Town and Rural Multimodal Networks Report (2016)** *offers resources and ideas to help small towns and rural communities support safe, accessible, comfortable, and active travel for people of all ages and abilities. It connects existing guidance to rural practice and includes examples of peer communities.*

Minnesota Guidance

Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD) *defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public traffic.*

The Minnesota Department of Transportations's **Bicycle Facility Design Manual (2020)** *establishes uniform design criteria for Minnesota roadways. The manual should be used in conjunction with the current versions of the MnDOT Road Design Manual and the Minnesota Manual on Uniform Traffic Control Devices.*

The Minnesota Department of Transportations's **Minnesota's Best Practices for Pedestrian and Bicycle Safety (2021)** *identifies proven strategies and treatments. The manual should be used in conjunction with the current versions of the MnDOT Road Design Manual and the Minnesota MUTCD*

The City of Rochester's **DMC City Loop draft (2018)** *refines and advances the concepts described in the DMC Development Plan and puts forward recommendations for facility design, route alignment, and implementation of the City Loop.*

QUICK BUILD PROJECTS

Throughout this document quick build projects are identified with a shovel icon. Quick build projects will also be identified with a project timeframe of: “now,” “soon,” or “later” that depends on the design parameters, implementation feasibility, and funding availability of the particular project.

Quick build is a method to improve communities for walking, bicycling, and micromobility on a minimal budget and on a compressed timeline, as both planning and building are much less expensive.

Quick build works to meet mobility needs by helping people to choose active modes more often. Those mobility needs will vary depending on the community, and may include safer crossings, slower streets, an extended bikeway network, or safer routes to transit, schools, and essential workplaces. In every case, people require a safe, connected, and comfortable network for active transportation.

Quick Build Defined

Quick build puts bicycle, pedestrian or traffic safety improvements in place using low-cost materials that can be installed quickly. Quick build projects are flexible and designed to be easily changed or even removed if necessary. Most quick build projects can be constructed in mere days or weeks and can go from conception to reality within months. Quick build projects are not pop-up or demonstration projects that are intended to be removed after a short period.

Quick build allows the community to benefit immediately from walking and bicycling safety improvements, with

flexibility for public feedback to impact the design while building enthusiasm and support for more permanent infrastructure. Once a project is accepted by a community, quick builds can last for years if maintained, or rebuilt using more durable materials.

The goal is to offer a series of interim street improvements that create a complete, connected network of physically safe environments for people walking, bicycling, and using micromobility to get safely where they wish to go. Quick build infrastructure is usually more than a bike lane quickly striped; it should create the kind of comfortable, protected, connected bikeways that have been proven to enable people of all ages and abilities to use active transportation.

Ideally, quick build projects will build off of existing plans that have already been approved and were created with community input. Quick build becomes a way to implement previously recommended active transportation projects in a relatively short time frame. More extensive, and potentially permanent, improvements can be added in the future as the project evolves, based on public input, interest, and use.

Real Time Public Engagement

Traditional projects require long periods of outreach for projects that are planned for years in the future. Meetings typically attract more privileged stakeholders with the spare time to engage in the process. Stakeholders change as time passes, requiring more outreach when the project is built according to old plans that may not have the support of new stakeholders.

Quick build projects are intended to be community-led and, based on real-time feedback, iterative and adaptable. An inclusive planning process which consults and involves the community throughout is essential. While quick build leverages opportunities for speed and ease of installation, projects should not move forward without consultation, engagement, and open lines of communication with the community members who will be most impacted by a project's creation or by its removal. This is important during planning and implementation—and beyond, and planners should extend the public feedback period into a longer term period of project evaluation.

Re-Allocating Space is Easier

Sometimes it is necessary to reallocate road space within the existing cross-section to create safer crossings for pedestrians or a protected lane for people on bikes. With quick build, communities get to see and adjust what works on the ground, rather than in theory. Unlike concrete infrastructure, quick build street designs can be adapted by adding a planter box, moving bollards, restriping a lane, or even removing a project if necessary. During installation the City of Rochester can say "we are trying this." Evaluation and review becomes part of the process and feedback on a quick build design can become part of the public input for the eventual project, if the public supports making it permanent. This feedback is usually much more informed than traditional planning processes, where stakeholders are asked to imagine how it will feel to use a new street alignment based on modeled data, renderings and PowerPoint presentations.

Feedback from the community can include the need for curb access for delivery and passenger access. Business managers, delivery people, and other users can see the impact in real time, and planners can adjust the design to accommodate those needs.

Assemble the Team

Who needs to be at the table?

How does one assemble an administrative team or working group to get a quick build project off and running? The answer is not simple or formulaic, as the answer differs in as many ways as there are different agency departmental structures and administrations. Here are some key things to keep in mind and to effectively deliver quick build projects.

Some of these people need to be at every discussion, others don't. Some need to be consulted, others simply informed. Some are critical, while some are optional. Some may be staff while others are hired consultants. Build your team for what makes sense in your community for your project. If you cannot fill a role listed here due to budget or staffing constraints, pursue additional outreach to that department to ensure the project can be implemented smoothly with appropriate buy-in from the role outlined for the "missing seat."

Who's not at the table?

Meaningfully including everyone who needs to have a voice in the process is not easy. Continue to identify who is missing and to create new ways to expand engagement throughout the process. Take a close look at the "table" the team has set to see if the format, messaging, power dynamics, or other factors present unintentional barriers or biases. Leverage the trial period as an opportunity to call attention to the need for broad, inclusive assessment and encourage additional community members, leaders and organizations to participate.

Person	Role
Agency Staff	
Key Coordinator	• Champions the value of and need for quick-build facilities to the public and other municipal staff • Keeps project on track, problem solves issues as they arise, maintaining momentum and overall communication among the various stakeholders and participants • Identifies community partners and stakeholders who need to be at the table and helps to ensure they are engaged • Available for feedback and communication from stakeholders, including elected officials, other municipal staff, and community leaders • Stays aware of projects and best practices in other jurisdictions • Identifies opportunities and community needs as they arise • Should be adept at working with underrepresented and marginalized communities
Communications In some agencies, especially smaller ones, this person may be the same as the "key coordinator."	• Helps everyone stay "on message" about the quick-build strategy • Develops online tools for community feedback • Collects and reports on feedback received from the most representative group possible
Transportation Planners	• Understands the jurisdiction's goals, vision, opportunities and challenges when it comes to active transportation • Can interpret code, policy, and other crucial regulations • Can provide helpful information regarding the existing active transportation network and its gaps • Has access to planning tools, such as mapping software, that aid in decision-making
Transportation Engineers Engineering and planning roles may be held by the same staffer.	• Understands traffic patterns, street design, regulations, etc. • Can ensure that facilities meet standards and best practices so they are as safe and navigable as possible • Involved in approval of street plans
Representatives from other departments that will interface with the project	• Understands aspects of the project that others will not (e.g. how trash pickup will be impacted) • Contributes to the identification of important corridors to include from an equity and connectivity perspective (ex. Health, Economic, Parks, Housing, Planning Departments)

Person	Role
Representatives from other departments that will interface with the project	• Needs to be informed of projects to provide technical insight and avoid potential conflict once facilities are in place
Community Leaders	• May be tasked with formal review of street changes (e.g. Fire Department)
Neighborhood or Community Ambassador or Champion	• Believes in the project and ensures that the community is involved in its planning and installation • Has broad connections and rapport in the community and can bring a variety of voices to the table to speak to community needs and perspectives • Monitors the project after installation and relays feedback to the key coordinator, providing resident perspective and flagging issues • During public engagement you are likely to find this person advocating for a quick-build facility in their neighborhood • This person should receive compensation for their time and local expertise
Local Business Leaders	• Can help share information with local businesses • Will want to understand what types of improvements are planned and what the expected timeline is. • May be able to donate materials that could embellish the project area like picnic tables, chairs, flower pots, etc.
Representatives from community organizations, especially bicycle advocacy organizations	• Leaders of nonprofits, social services organizations, and religious institutions will help to support and improve the project if engaged. • Bicycle advocacy organizations will understand the needs and perspectives of pedestrians and bicyclists in the community and can offer insight as potential future users of these facilities • Can help disseminate information to the bicycle and pedestrian community, gather feedback, and improve future iterations of the project
Elected Officials	• Have the power to approve the use of funds or staff, often much more quickly than others can • In some jurisdictions, approve or deny street changes • Receives direct communication from their constituents about needs, challenges and complaints • Can raise the profile of these improvements among their constituents and beyond (or rally against them)

DESIGN NEEDS OF PEDESTRIANS

Types of Pedestrians

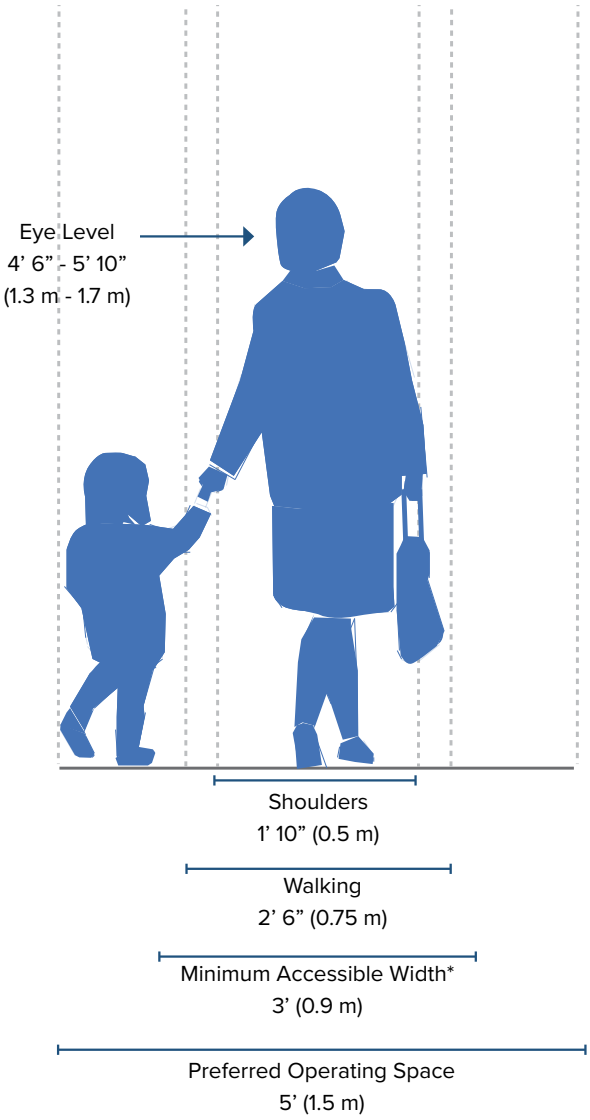
Pedestrians have a variety of characteristics and the transportation network should accommodate a variety of needs, abilities, and possible impairments. Age is one major factor that affects pedestrians' physical characteristics, walking speed, and environmental perception. Children have lower eye height and may walk slower than adults. They also perceive the environment differently at various stages of their cognitive development. Older adults walk more slowly and may require assistive devices for walking stability, sight, and hearing.

Disabled Pedestrian Design Considerations

The table below summarizes common physical and cognitive impairments, how they affect personal mobility, and recommendations for improved pedestrian-friendly design.

Disabled Pedestrian Design Considerations

Impairment	Effect on Mobility	Design Solution
Physical Impairment Necessitating Wheelchair and Scooter Use	Difficulty propelling over uneven or soft surfaces.	Firm, stable surfaces and structures, including ramps or beveled edges.
	Cross-slopes cause wheelchairs to veer downhill or tip sideways.	Cross-slopes of less than two percent.
	Require wider path of travel.	Sufficient width and maneuvering space.
Physical Impairment Necessitating Walking Aid Use	Difficulty negotiating steep grades and cross slopes; decreased stability and tripping hazard.	Cross-slopes of less than two percent. Smooth, non-slippery travel surface.
	Slower walking speed and reduced endurance; reduced ability to react.	Longer pedestrian signal cycles, shorter crossing distances, median refuges, and street furniture.
Hearing Impairment	Less able to detect oncoming hazards at locations with limited sight lines (e.g. driveways, angled intersections, channelized right turn lanes) and complex intersections.	Longer pedestrian signal cycles, clear sight distances, highly visible pedestrian signals and markings.
Vision Impairment	Limited perception of path ahead and obstacles; reliance on memory; reliance on non-visual indicators (e.g. sound and texture).	Accessible text (larger print and raised text), accessible pedestrian signals (APS), guide strips and detectable warning surfaces, safety barriers, and lighting.
Cognitive Impairment	Varies greatly. Can affect ability to perceive, recognize, understand, interpret, and respond to information.	Signs with pictures, universal symbols, and colors, rather than text.



*At point of contact

Pedestrian Characteristics by Age

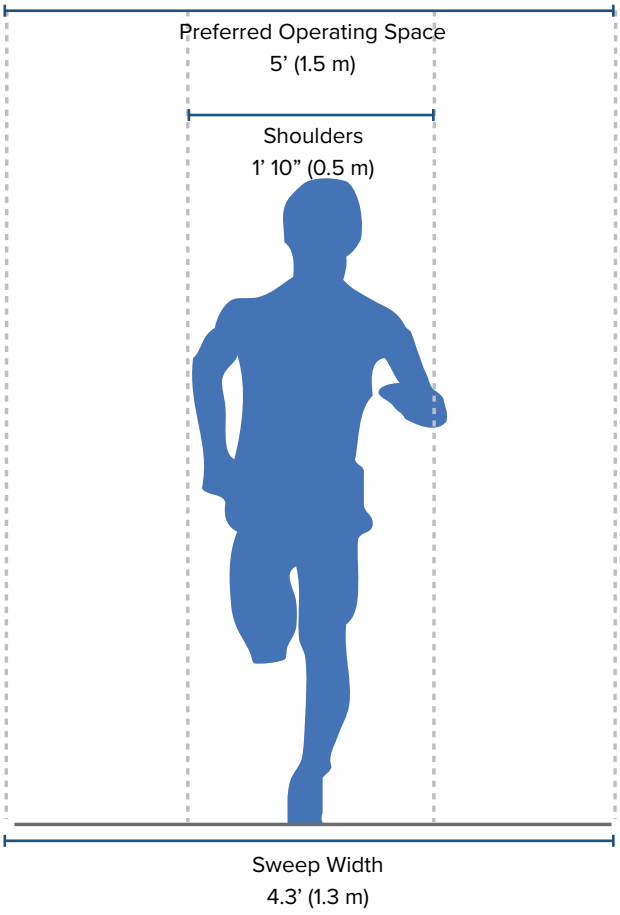
Age	Characteristics
0-4	Learning to walk
	Requires constant adult supervision
	Developing peripheral vision and depth perception
5-8	Increasing independence, but still requires supervision
	Poor depth perception
9-13	Susceptible to "darting out" in roadways
	Insufficient judgment
	Sense of invulnerability
14-18	Improved awareness of traffic environment
	Insufficient judgment
19-40	Active, aware of traffic environment
41-65	Slowing of reflexes
65+	Difficulty crossing street
	Vision loss
	Difficulty hearing vehicles approaching from behind

Source: AASHTO. Guide for the Planning, Design, and Operation of Pedestrian Facilities, Exhibit 2-1. 2004.

Design Needs of Runners

Running is an important recreation and fitness activity commonly performed on shared use paths. Many runners prefer softer surfaces (such as rubber, bare earth or crushed rock) to reduce impact. Runners can change their speed and direction frequently. If high volumes are expected, controlled interaction or separation of different types of users should be considered.

Runner Dimensions

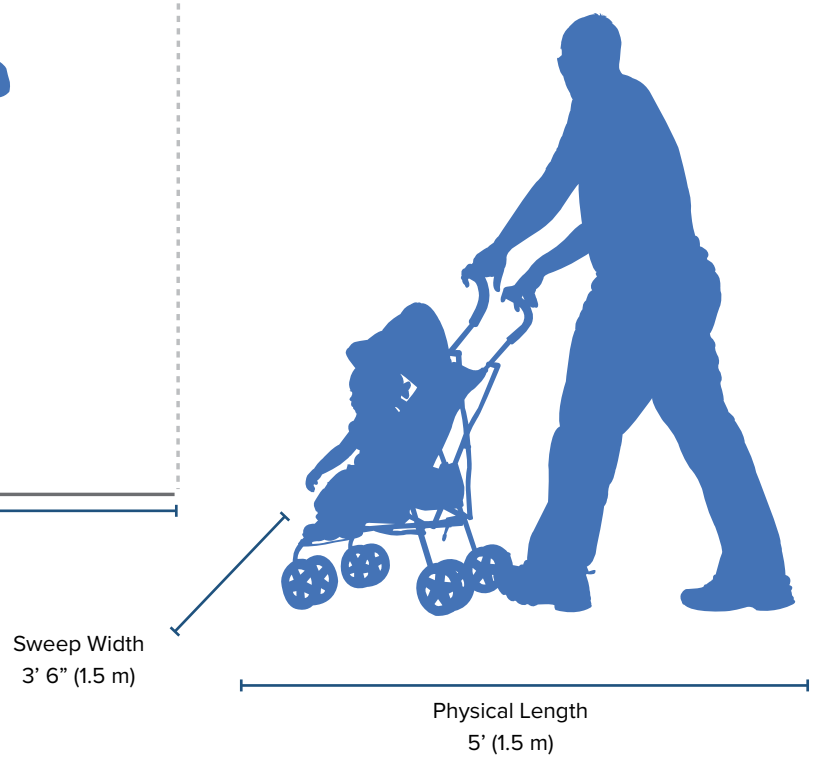


Design Needs of Strollers

Strollers are wheeled devices pushed by pedestrians to transport babies or small children. Stroller models vary greatly in their design and capacity. Some strollers are designed to accommodate a single child, others can carry 3 or more. Design needs of strollers depend on the wheel size, geometry and ability of the adult who is pushing the stroller.

Strollers commonly have small pivoting front wheels for easy maneuverability, but these wheels may limit their use on unpaved surfaces or rough pavement. Curb ramps are valuable to these users. Lateral overturning is one main safety concern for stroller users.

Stroller Dimensions



Design Needs of Wheelchair Users

As the American population ages, the age demographics in Rochester may also shift, and the number of people using mobility assistive devices (such as manual wheelchairs, powered wheelchairs) will increase.

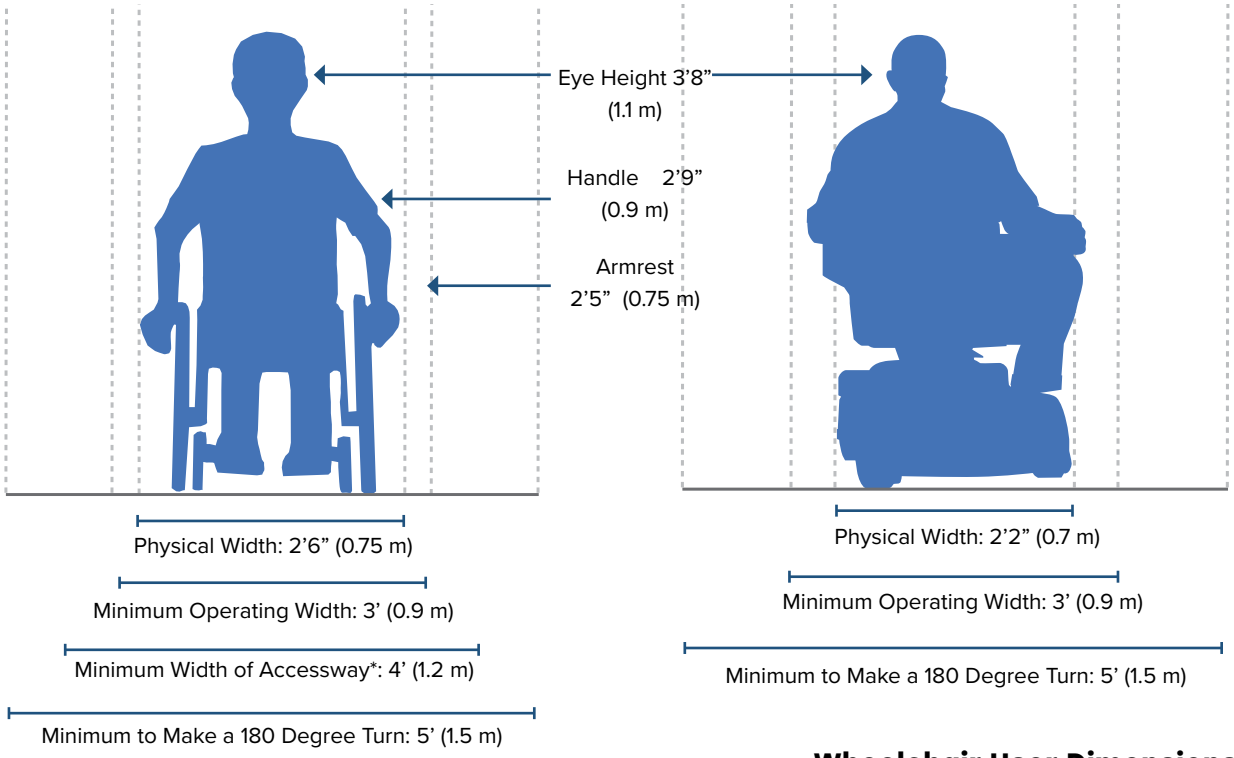
Manual wheelchairs are self-propelled devices. Users propel themselves using push rims attached to the rear wheels. Braking is done through resisting wheel movement with the hands or arm. A second individual can also control the wheelchair using handles attached to the back of the chair.

Power wheelchairs use battery power to move the wheelchair. The size and weight of power wheelchairs limit their ability to negotiate obstacles without a ramp. Various control units are available that enable users to control the wheelchair movement, based on their ability (e.g., joystick control, breath controlled, etc).

Turning maneuvers requires additional space for wheelchair devices. Providing adequate space for 180 degree turns at appropriate locations is an important element of accessible design.

Wheelchair User Design Considerations

Effect on Mobility	Design Solution
Difficulty propelling over uneven or soft surfaces.	Firm, stable surfaces and structures, including ramps or beveled edges.
Cross-slopes cause wheelchairs to veer downhill.	Cross-slopes of less than two percent.
Require wider path of travel.	Sufficient width and maneuvering space.



Provide 5' x 5' passing zone every 200' if travel way width is less than 5 feet.

Wheelchair User Dimensions

DESIGN NEEDS OF BICYCLISTS

The facility designer must have an understanding of how bicyclists operate and how their bicycle influences that operation. Bicyclists, by nature, are much more affected by poor facility design, construction and maintenance practices than motor vehicle drivers. By understanding the unique characteristics and needs of bicyclists, a facility designer can provide quality facilities and minimize user risk.

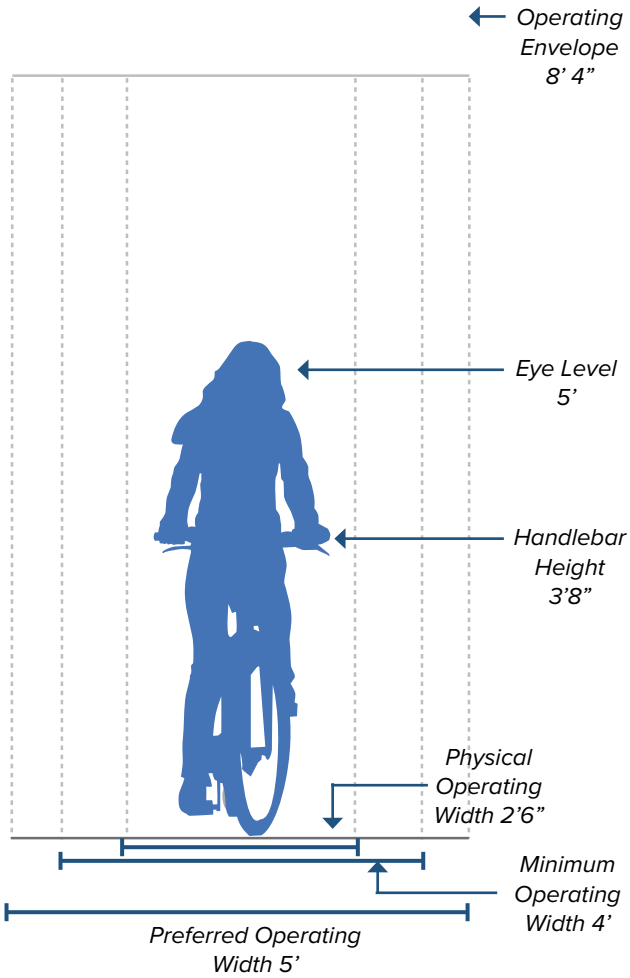
Bicycle as a Design Vehicle

Similar to motor vehicles, bicyclists and their bicycles exist in a variety of sizes and configurations. These variations occur in the types of vehicle (such as a conventional bicycle, a recumbent bicycle or a tricycle), and behavioral characteristics (such as the comfort level of the bicyclist). The design of a bikeway should consider reasonably expected bicycle types on the facility and utilize the appropriate dimensions.

The figure illustrates the operating space and physical dimensions of a typical adult bicyclist, which are the basis for typical facility design. Bicyclists require clear space to operate within a facility. This is why the minimum operating width is greater than the physical dimensions of the bicyclist. Bicyclists prefer five feet or more operating width, although four feet may be minimally acceptable if the pavement is continuous and there is no curbing present..

In addition to the design dimensions of a typical bicycle, there are many other commonly used pedal-driven cycles and accessories to consider when planning and designing bicycle facilities. The most common types include tandem bicycles, recumbent bicycles, and trailer accessories.

Bicycle Rider - Typical Dimensions



Bicycle as Design Vehicle - Design Speed Expectations

BICYCLE TYPE	FEATURE	TYPICAL SPEED
Upright Adult Bicyclist	Paved level surfacing	8-12 mph*
	Crossing Intersections	10 mph
	Downhill	30 mph
	Uphill	5 -12 mph
Recumbent Bicyclist	Paved level surfacing	18 mph

** Typical speed for causal riders per MnDOT Bicycle Facility Design Manual.*

02

PEDESTRIAN TOOLBOX

INTRODUCTION

The Pedestrian Toolbox includes pedestrian-oriented infrastructure elements that create a more comfortable and safe pedestrian experience. The toolbox provides design options for the identified locations of high need within the 2015 Rochester Comprehensive Plan 2040 Non-Motorized Transportation Analysis.

This toolbox will be helpful to city staff in addressing the pedestrian needs and opportunities as found within the Non-Motorized Transportation Analysis. Some of these critical findings included:

- Most crashes occur at intersections.
- Enhancing the visibility of marked crossings,as well as providing additional crossing enhancements for mid-block crossings of larger streets.
- Opportunities to incorporate innovative bikeway treatments to increase user comfort.

Additionally, the Pedestrian Environmental Quality Index (PEQI) analysis provided an assessment of the comfort of walking along and across arterial roadways in Rochester. Many arterials are wide and with high vehicles speeds, exposing 'vulnerable' non-motorized transportation users to risk in the event of a crash. Findings showed:

- The least comfortable areas include US 14, West Circle Drive north of US 14, and Hwy 63 south of US 52.
- The most comfortable areas for pedestrians include in and around the downtown area where speeds are lower and roads tend to have fewer lanes.
- Signalized crossing opportunities are also the highest in the downtown core while the distance between crossing opportunities increases on the periphery of town.

A walkable, pedestrian-friendly environment meets the overall goals of creating a healthy city (more walking, a sustainable city (less driving), and a vibrant public realm."

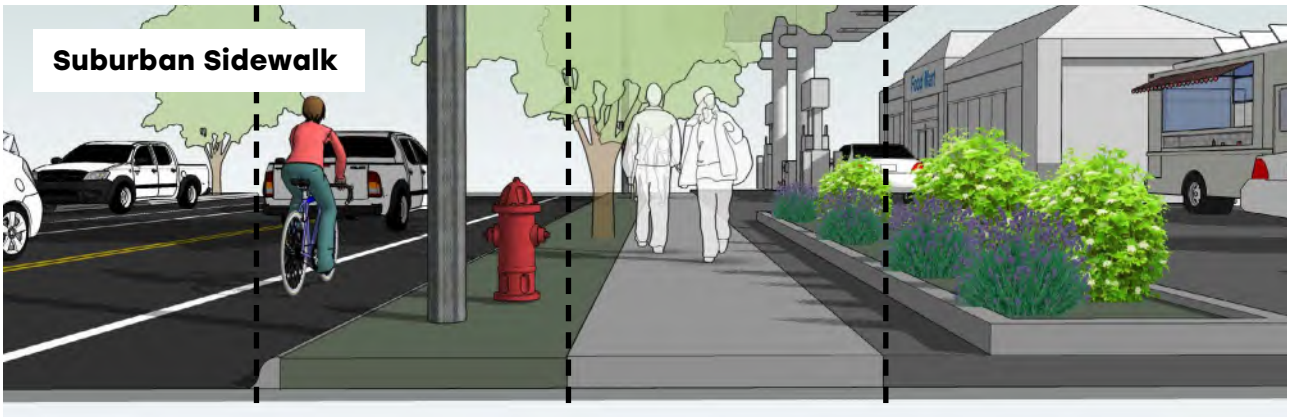
-Rochester Destination Medical Center (DMC) District Design Guidelines

SIDEWALKS

SIDEWALK ZONES & WIDTHS

Sidewalks are the most fundamental element of the walking network, as they provide an area for pedestrian travel separated from vehicle traffic. Providing adequate and accessible facilities can lead to increased numbers of people walking, improved accessibility, and the creation of social space. The following guidance is informed by the Rochester DMC City Loop Guidelines.

Design Features



Enhancement Zone	Amenity Zone	Primary Pedestrian Zone	Building Frontage Zone
The curbside lane can act as a flexible space to further buffer the sidewalk from moving traffic, and may be used for a bike facility. Curb extensions and bike corrals may occupy this space where appropriate.	The amenity zone, also called the furnishing or landscaping zone, buffers pedestrians from the adjacent roadway, and is also the area where elements such as street trees, signal poles, signs, and other street furniture are properly located.	The primary pedestrian zone is the area intended for pedestrian travel. This zone should be entirely free of permanent and temporary objects. Wide pedestrian zones are needed in areas or where pedestrian flows are high.	The building frontage zone allows pedestrians a comfortable “shy” distance from the building fronts, fencing, walls and vertical landscaping. It provides opportunities for window shopping, to place signs, planters, or chairs.

Street Classification	Parking Lane/ Enhancement Zone	Amenity Zone	Primary Pedestrian Zone	Building Frontage Zone*
Local Streets	Varies	4 - 6 ft	6 - 8 ft	2 ft
Pedestrian Priority Areas	Varies	6 - 10 ft	8 ft	2 - 8 ft
Arterials and Collectors	Varies	4 - 6 ft	6 - 8 ft	4 - 6 ft

**Indicates ideal frontage zone space. Actual frontage zone is contingent upon the City's development code and required set backs*

Typical Application

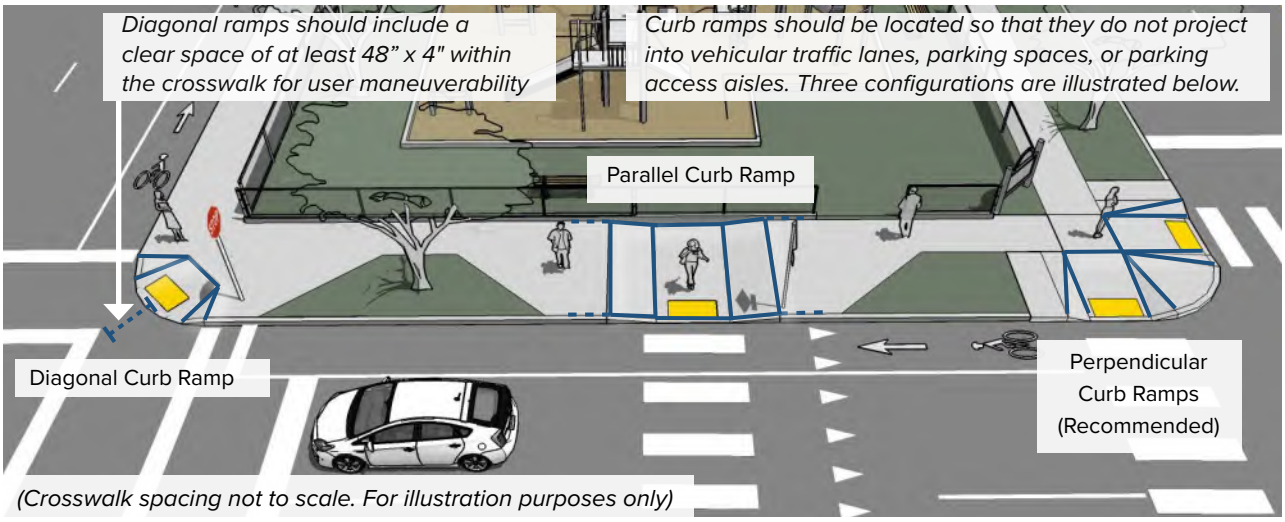
- Wider sidewalks should be installed near schools, at transit stops, or anywhere high concentrations of pedestrians exist.
- At transit stops, an 8 ft by 5 ft clear space is required for accessible passenger boarding/alighting at the front door location per ADA requirements.
- Sidewalks should be continuous on both sides of urban commercial streets, and should be required in areas of moderate residential density (1-4 dwelling units per acre).
- When retrofitting gaps in the sidewalk network, locations near transit stops, schools, parks, public buildings, and other areas with high concentrations of pedestrians should be the highest priority.

Materials and Maintenance

Sidewalks are typically constructed out of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped boulevard. Less expensive walkways constructed of asphalt, crushed stone, or other stabilized surfaces may be appropriate. Ensure accessibility and properly maintain all surfaces regularly. Surfaces must be firm, stable, and slip resistant. Colored, patterned, or stamped concrete can add distinctive visual appeal. See 'Sidewalk Maintenance' for more information.

CURB RAMPS

Curb ramps are the design elements that allow all users to make the transition from the street to the sidewalk. A sidewalk without a curb ramp can be useless to someone in a wheelchair, forcing them back to a driveway and out into the street for access. There are a number of factors to be considered in the design and placement of curb ramps.



(Crosswalk spacing not to scale. For illustration purposes only)

Typical Application

Curb ramps must be installed at all intersections and midblock locations where pedestrian crossings exist, as mandated by federal legislation (1973 Rehabilitation Act and ADA 1990). All newly constructed and altered roadway projects must include compliant curb ramps. In addition, existing facilities must be upgraded to current standards when appropriate.

The edge of an ADA compliant curb ramp should be marked with a detectable warning surface (also known as truncated domes) to alert people with visual impairments to changes in the pedestrian environment. Visual contrast between the raised tactile device and the surrounding infrastructure is important so that the change is readily evident to partially sighted pedestrians.

Design Features

- The level landing at the top of a ramp should be at least 4 feet long and at least the same width as the ramp itself. The slope of the ramp should be compliant to current standards.
- If the top landing is within the sidewalk or corner area where someone in a wheelchair may have to change direction, the landing must be a minimum of 4’-0” long (in the direction of the ramp run) and at least as wide as the ramp, although a width of 5’-0” is preferred.

Not recommended: Diagonal curb ramp configuration.

Recommended: Directional curb ramps for crossing in both directions.

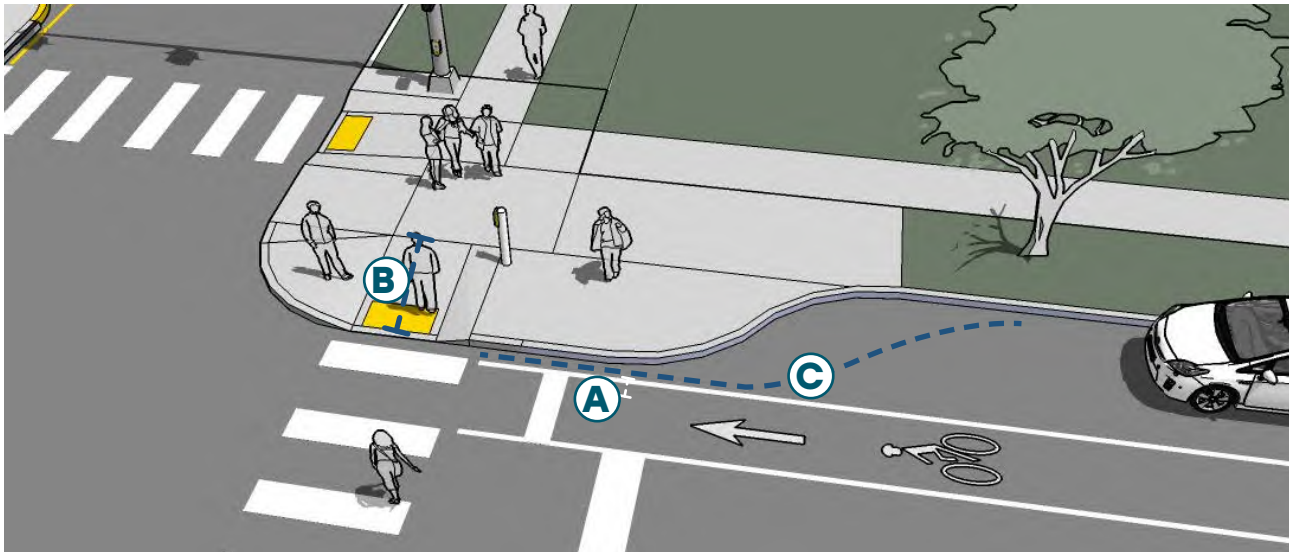
Further Considerations

Where feasible, separate directional curb ramps for each crosswalk at an intersection should be provided rather than having a single ramp at a corner for both crosswalks. Although diagonal curb ramps might save money, they orient pedestrians directly into the center of the intersection, which can be challenging for wheelchair users and pedestrians with visual impairments. Diagonal curb ramp configurations are not recommended.

Curb radii need to be considered when designing directional ramps. While curb ramps are needed for use on all types of streets, the highest priority locations are on streets near transit stops, schools, parks, medical facilities, shopping areas.

Materials and Maintenance

It is critical that the interface between a curb ramp and the street be maintained adequately. Asphalt street sections can develop vertical differentials where concrete meets asphalt at the foot of the ramp, which can catch the front wheels of a wheelchair.



CURB EXTENSIONS

Curb extensions, also called curb bulbouts and neckdowns, minimize pedestrian exposure during crossing by shortening the crossing distance and giving pedestrians a better chance to see and be seen before beginning to cross. Curb extensions are appropriate for any crosswalk where it is desirable to shorten the crossing distance and there is a parking lane adjacent to the curb.

Typical Application

- For purposes of efficient street sweeping and snow plowing, the minimum radius for the reverse curves of the transition is 10 ft and the two radii should be balanced to be nearly equal.
- The curb extension width should terminate one foot short of the parking lane to maximize bicyclist safety when bicycle lanes are not present. This buffer is also preferred when bicycle lanes are present.

Design Features

(A) Where a bike lane runs adjacent to the curb extension, design with a 1‘ buffer from edge of parking lane (preferred).

(B) Crossing distance is shortened by approximately 6-8 feet with a parallel parking lane or 15 feet or more with an angled parking lane.

(C) Curb extension length can be adjusted to accommodate bus stops or street furniture.

Further Considerations

If there is no parking lane, adding curb extensions across a roadway shoulder may be a problem for bicycle travel and truck or bus turning movements.

Materials and Maintenance

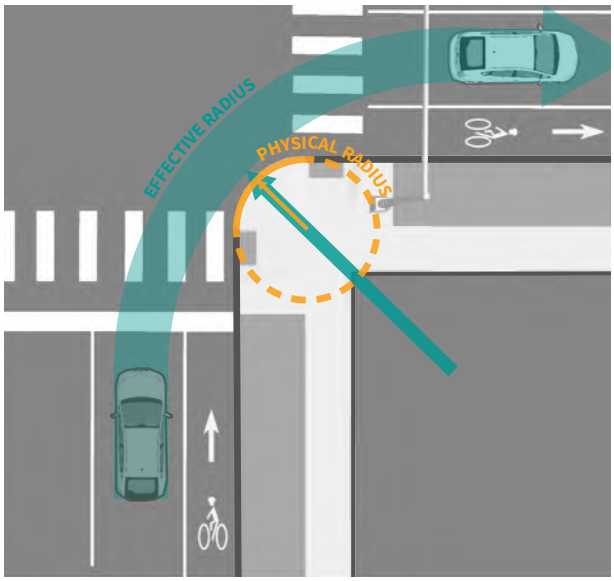
Planted curb extensions may be designed as a bioswale, a vegetated system for stormwater management. To maintain proper stormwater drainage, curb extensions can be constructed as refuge islands offset by a drainage channel or feature a covered trench drain.

CORNER RADII

The size of a curb's radius can have a significant impact on pedestrian comfort and safety. A smaller curb radius provides more pedestrian area at the corner, allows more flexibility in the placement of curb ramps, results in a shorter crossing distance and requires vehicles to slow more on the intersection approach. During the design phase, the chosen radius should be the smallest possible for the circumstances and consider the effective radius in any design vehicle turning calculations.

Typical Application

The curb radius may be as small as 3 ft where there are no turning movements, or 5 ft where there are turning movements and adequate street width. Wide outside travel lanes, on-street parking and bike lanes create a larger effective turning radius and can therefore allow a smaller physical curb radius.



Recommended: Bidirectional curb ramps for crossing in both directions.

Design Features

Corners have two critical dimensions which must be considered together.

- The physical radius controls the pedestrian experience.
- The effective radius is the widest turning arc that a vehicle can take through the corner and is larger than the physical radius.

Further Considerations

Several factors govern the choice of curb radius in any given location. These include the desired pedestrian area of the corner, traffic turning movements, street classifications, design vehicle turning radius, intersection geometry, and whether there is on-street parking or a bike lane (or both) between the travel lane and the curb.

03

BICYCLE TOOLBOX

INTRODUCTION
FACILITY SELECTION: BICYCLE USER TYPE

The current AASHTO Guide to the Development of Bicycle Facilities encourages designers to identify their rider type based on the trip purpose (Recreational vs Transportation) and on the level of comfort and skill of the rider (Causal vs Experienced). A user-type framework for understanding a potential rider's willingness to bike is illustrated in the figure below. Developed by planners in Portland, OR* and supported by research**, this classification identifies four distinct types of bicyclists.

Strong and Fearless – This group is willing to ride a bicycle on any roadway regardless of traffic conditions. Comfortable taking the lane and riding in a vehicular manner on major streets without designated bicycle facilities.

Enthused and Confident - This group of people riding bicycles who are riding in most roadway situations but prefer to have a designated facility. Comfortable riding on major streets with a bike lane.

Interested but Concerned – This group is more cautious and has some inclination towards bicycling, but are held back by concern over sharing the road with cars. Not very comfortable on major streets, even with a striped bike lane, and prefer separated pathways or low traffic neighborhood streets.

No Way, No How – This group comprises residents who simply aren't interested at all in bicycling and may be physically unable or don't know how to ride a bicycle, and they are unlikely to adopt bicycling in any way.

** Roger Geller, City of Portland Bureau of Transportation. Four Types of Cyclists. http://www.portlandonline.com/transportation/index.cfm?&a=237507. 2009.*
*** Dill, J., McNeil, N. Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential. 2012.*

Typical Distribution of Bicyclist Types

FACILITY SELECTION: COMFORT

In order to provide a bikeway network that meets the needs of the Rochester's "Interested but Concerned" residents (who comprise the majority of the population), bikeways must be low-stress and comfortable. By using a metric called Level of Traffic Stress (LTS), specific facility types can be matched to the needs of people who bicycle in Rochester. Generally, "Interested but Concerned," users will only bicycle on LTS 1 or LTS 2 facilities.

Levels of Traffic Stress (LTS)

LTS LEVEL	DESCRIPTION	WHAT TYPE OF BICYCLISTS WILL RIDE ON THIS LTS FACILITY?		
		STRONG & FEARLESS	ENTHUSIASTIC & CONFIDENT	INTERESTED BUT CONCERNED
LTS 1	Presents the lowest level of traffic stress; demands less attention from people riding bicycles, and attractive enough for a relaxing bicycle ride. Suitable for almost all people riding bicycles, including children trained to ride in the street and to safety cross intersections.	YES	YES	YES
LTS2	Presents little traffic stress and therefore suitable to most adults riding bicycles, but demandsmore attention than might be expected from children.	YES	YES	SOMETIMES
LTS3	More traffic stress than LTS2, yet significantly less than the stress of integrating with multilane traffic.	YES	SOMETIMES	NO
LTS4	A level of stress beyond LTS 3. Includes roadways that have no dedicated bicycle facilities and moderate to higher vehicle speeds and volumes OR high speed and high volume roadways WITH an exclusive riding zone (lane) where there is a significant speed differential with vehicles.	YES	NO	NO

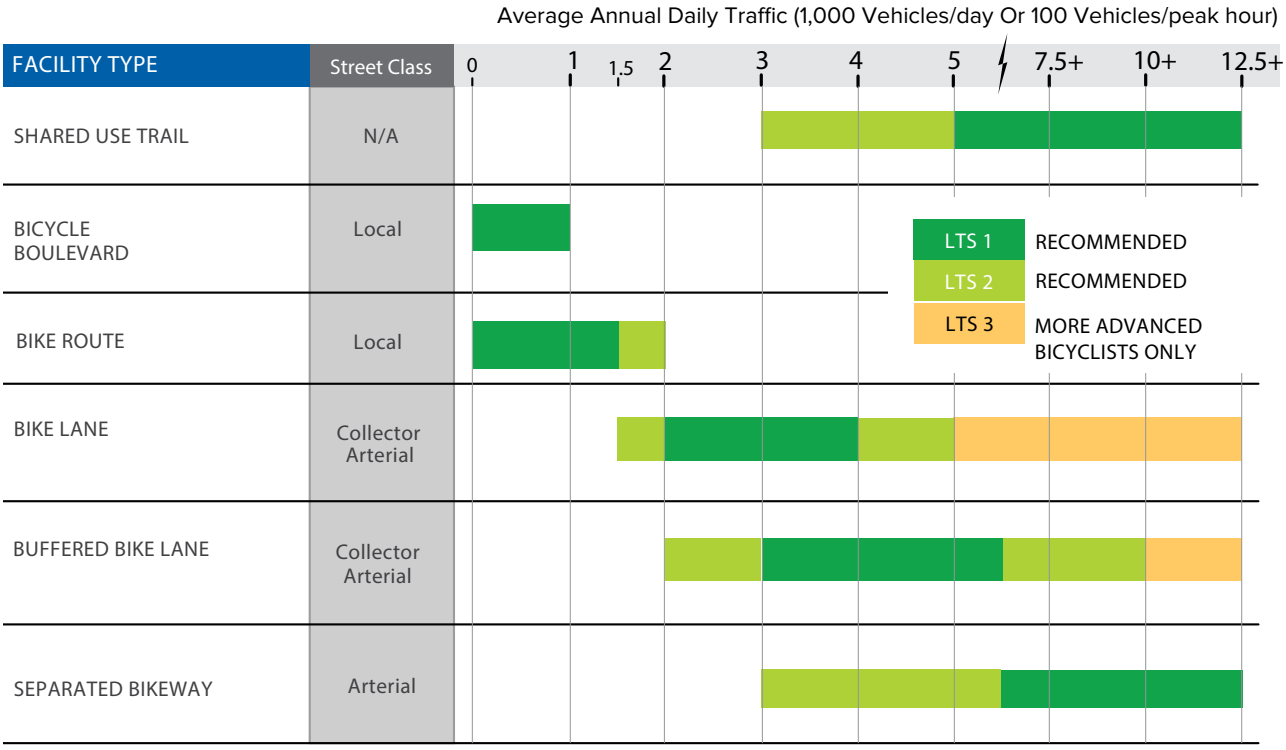
FACILITY SELECTION: BIKEWAYS

Selecting the best bikeway facility type for a given roadway can be challenging, due to the range of factors that influence bicycle users' comfort and safety. There is a significant impact on bicycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high. This page can help determine when a Separated Bikeway is most appropriate relative to other facility types.

Facility Selection Table

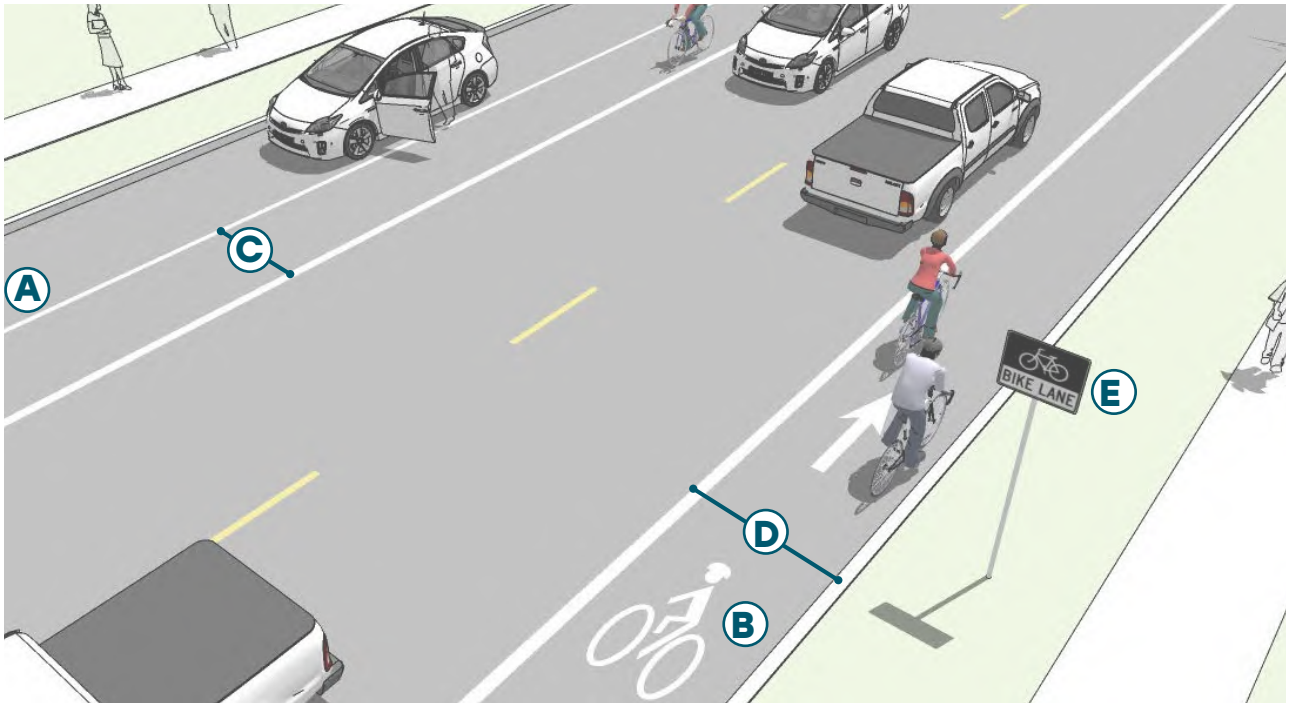
As a starting point to identify a preferred facility, the chart below can be used to determine the recommended type of bikeway to be provided in particular roadway speed and volume situations. To use this chart, identify the appropriate daily traffic volume on the existing or proposed roadway, and locate the facility types indicated by those key variables.

Other factors beyond volume which affect facility selection include traffic speed, traffic mix of automobiles and heavy vehicles, the presence of on-street parking, intersection density, surrounding land use, and roadway sight distance. These factors are not included in the facility selection chart below, but should always be considered in the facility selection and design process.



STANDARD BICYCLE LANES

On-street bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signs. The bike lane is located directly adjacent to motor vehicle travel lanes and is used in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge or parking lane.



Typical Application

- Bike lanes may be used on any street with adequate space, but are most effective on streets with moderate traffic volumes ≤ 6,000 ADT (≤ 4,000 preferred).
- Bike lanes are most appropriate on streets with lower to moderate speeds ≤ 30 mph.
- Appropriate for skilled adult riders on most streets.
- May be appropriate for children when configured as 6+ ft wide lanes on lower-speed, lower-volume streets with one lane in each direction.

Design Features

(A) Mark inside line with 6" stripe. (MN MUTCD 9C.04) Mark 4" parking lane line or "Ts".

(B) Include a bicycle lane marking (MN MUTCD Figure 9C-3) at the beginning of blocks and at regular intervals along the route. (MN MUTCD 9C.04)

(C) 6 foot width preferred adjacent to on-street parking, (5 foot min.). Buffer preferred when parking has high turnover, see Buffered Bike Lanes.

(D) 5–6 foot preferred adjacent to curb and gutter or 4 feet more than the gutter pan width.

(E) The R3-17 "Bike Lane" sign is optional, but recommended in most contexts.

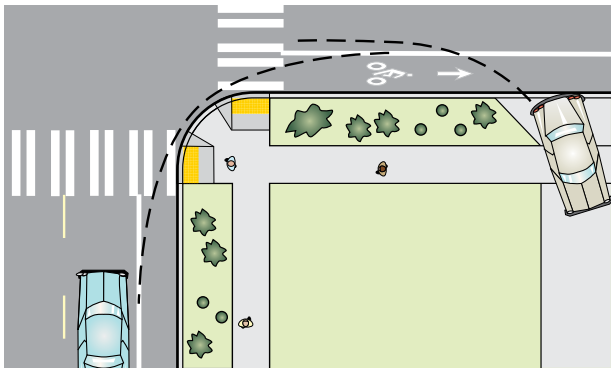
Further Considerations

- On high speed streets (≥ 40 mph) the minimum bike lane should be 6 feet.
- It may be desirable to reduce the width of general purpose travel lanes in order to add or widen bicycle lanes.
- On multi-lane streets, the most appropriate bicycle facility to provide for user comfort may be buffered bicycle lanes or physically separated bicycle lanes.
- Contraflow bike lanes are a special type of bike lane that can be implemented in specific locations where a dedicated bike lane is needed for a particular direction of travel, but the roadway is oriented for one-way travel in the opposite directioin, and/or when space constraints preclude a bike facility on nearby parallel routes that would otherwise serve this need. Contraflow bike lanes are effective in providing short, critical connections along bikeways, and special attention needs to be paid to facility transitions to other bikeway types.

Manhole Covers and Grates:

- Manhole surfaces should be manufactured with a shallow surface texture in the form of a tight, nonlinear pattern.
- If manholes or other utility access boxes are to be located in bike lanes within 50 ft. of intersections or within 20 ft. of driveways or other bicycle access points, special manufactured permanent nonstick surfaces ensure a controlled travel surface for bicyclists breaking or turning.
- Manholes, drainage grates, or other obstacles should be set flush with the paved roadway. Roadway surface inconsistencies pose a threat to safe riding conditions for bicyclists.

Bike lanes provided dedicated spaces for bicyclists to ride on the street.



Place Bike Lane Symbols to Reduce Wear

Bike lane word, symbol, and/or arrow markings (MN MUTCD Figure 9C-3) *should be placed outside of the motor vehicle tread path in order to minimize wear from the motor vehicle path.* (NACTO 2012)

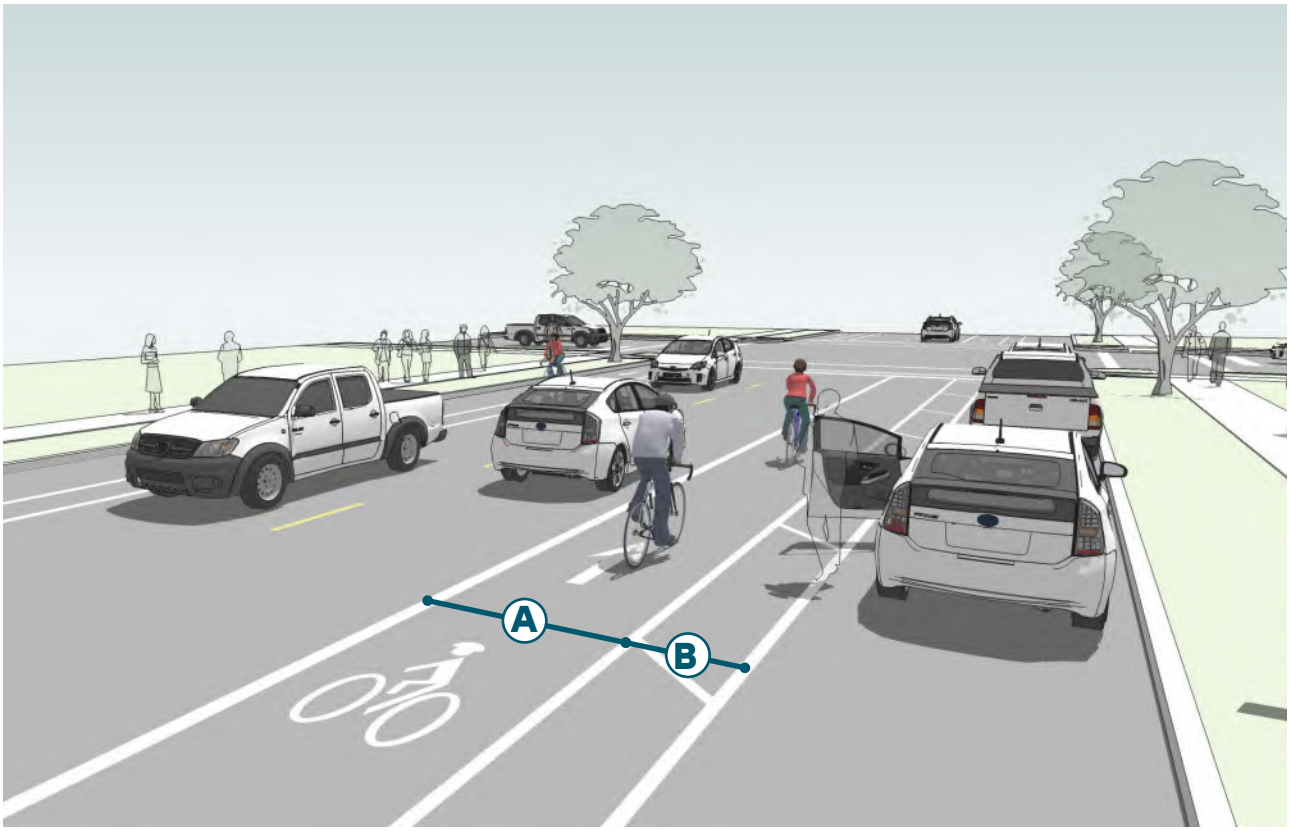
Construction of manholes, access panels or other drainage elements should be constructed with no variation in the surface. The maximum allowable tolerance in vertical roadway surface will be 1/4 of an inch.

Materials and Maintenance

Bike lane striping and markings will require higher maintenance where vehicles frequently traverse over them at intersections, driveways, parking lanes, and along curved or constrained segments of roadway. Bike lanes should also be maintained so that there are no pot holes, cracks, uneven surfaces or debris.

BUFFERED BICYCLE LANES

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane.



Typical Application

- Anywhere a conventional bike lane is being considered.
- While conventional bike lanes are most appropriate on streets with lower to moderate speeds (≤ 30 mph), buffered bike lanes provide additional value on streets with higher speeds (+30 mph) and high volumes or high truck volumes (up to 6,000 ADT).
- On streets with extra lanes or lane width.
- Appropriate for skilled adult riders on most streets.

Design Features

(A) The minimum bicycle travel area (not including buffer) is 5 feet wide.

(B) Buffers should be at least 2 feet wide. If buffer area is 4 feet or wider, white chevron or diagonal markings should be used.

- For clarity at driveways or minor street crossings, consider a dotted line.
- Buffers may be applied on the parking side, the travel side, both or alternating depending on the main source of concern.

Buffered bike lanes should consider both vehicular traffic and parked cars.

The use of additional pavement markings delineates space between vehicles and bicyclists.

Further Considerations

- Color may be used within the lane to discourage motorists from entering the buffered lane.
- On multi-lane streets with high vehicles speeds, the most appropriate bicycle facility to provide for user comfort may be physically separated bike lanes.
- NCHRP Report #766 recommends, when space is limited, installing a buffer space between the parking lane and bicycle lane where on-street parking is permitted rather than between the bicycle lane and vehicle travel lane.[1] This buffer is particularly useful in commercial areas where parking turnover is higher.

Materials and Maintenance

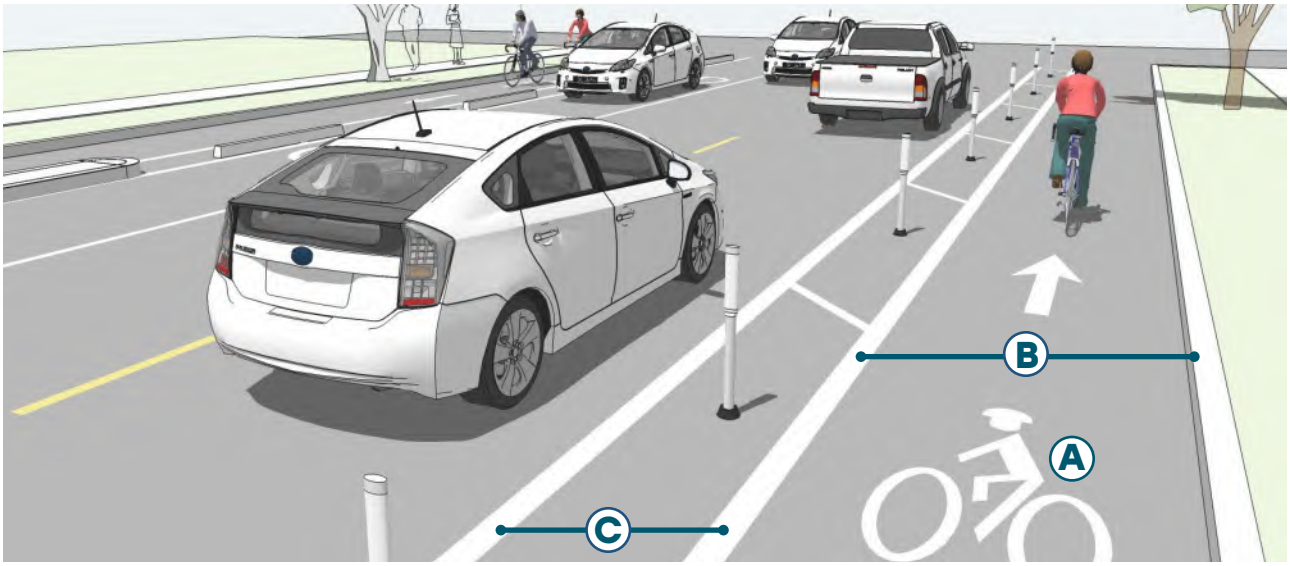
Bike lane striping and markings will require higher maintenance where vehicles frequently traverse over them at intersections, driveways, parking lanes, and along curved or constrained segments of roadway.

Bike lanes should be maintained so that there are no pot holes, cracks, uneven surfaces or debris. Additionally, the bike lane buffer presents an opportunity to be used for snow storage in winter months.

1 National Cooperative Highway Research Program. Report #766: Recommended Bicycle Lane Widths for Various Roadway Characteristics.

SEPARATED BIKE LANES - ONE-WAY

One-way separated bike lanes, also known as protected bikeways or cycle tracks, are on-street bikeway facilities that are separated from vehicle traffic. Physical separation is provided by a barrier between the bikeway and the vehicular travel lane. These barriers can include flexible posts, bollards, parking, planter strips, extruded curbs, or on-street parking. Separated bikeways using these barrier elements typically share the same elevation as adjacent travel lanes, but the bikeway could also be raised above street level, either below or equivalent to sidewalk level.



Typical Use

- Along streets on which conventional bicycle lanes would cause many bicyclists to feel stress because of factors such as multiple lanes, high bicycle volumes, high motor traffic volumes (9,000-30,000 ADT), higher traffic speeds (35+ mph), high incidence of double parking, higher truck traffic (10% of total ADT) and high parking turnover.
- Along streets for which conflicts at intersections can be effectively mitigated using parking lane setbacks, bicycle markings through the intersection, and other signalized intersection treatments.

Design Features

(A) Pavement markings, symbols and/or arrow markings must be placed at the beginning of the separated bikeway and at intervals along the facility based on engineering judgment to define the bike direction. (MN MUTCD 9C.04)

(B) 6'-7' foot width preferred in areas with high bicycle volumes or uphill sections to facilitate safe passing behavior.

(C) When placed adjacent to parking, the parking buffer should be 3 ft wide to allow for passenger loading and to prevent door collisions. When no buffer is present, buffers as narrow as 18 inches may still provide value.

- When placed adjacent to a travel lane, one-way raised cycle tracks may be configured with a mountable curb to

Parked cars serve as a barrier between bicyclists and the vehicle lane. Barriers could also include flexible posts, bollards, planters, or other design elements. Source: Alta

allow entry and exit from the bicycle lane for passing other bicyclists or to access vehicular turn lanes.

Further Considerations

- If the buffer area is 4 feet or wider, white chevron or diagonal markings should be used.
- Curbs may be used as a channeling device. Grade-separation provides an enhanced level of separation in addition to buffers and other barrier types.
- Where possible, physical barriers such as removable curbs should be oriented towards the edge of the buffer so as to maximize lane width for bicycle use.
- A retrofit separated bikeway has a relatively low implementation cost compared to road reconstruction by making use of existing pavement and drainage and using a parking lane as a barrier.
- Gutters, drainage outlets and utility covers should be designed and configured as not to impact bike travel.
- For clarity at major or minor street crossings, consider a dotted line for the buffer boundary where cars are expected to cross.
- Special consideration should be given at transit stops to manage bicycle and pedestrian interactions.

Materials and Maintenance

Bikeway striping and markings will require higher maintenance where vehicles frequently traverse over them at intersections, driveways, parking lanes, and along curved or constrained segments of roadway. Green conflict striping (if used) will also generally require higher maintenance due to vehicle wear.

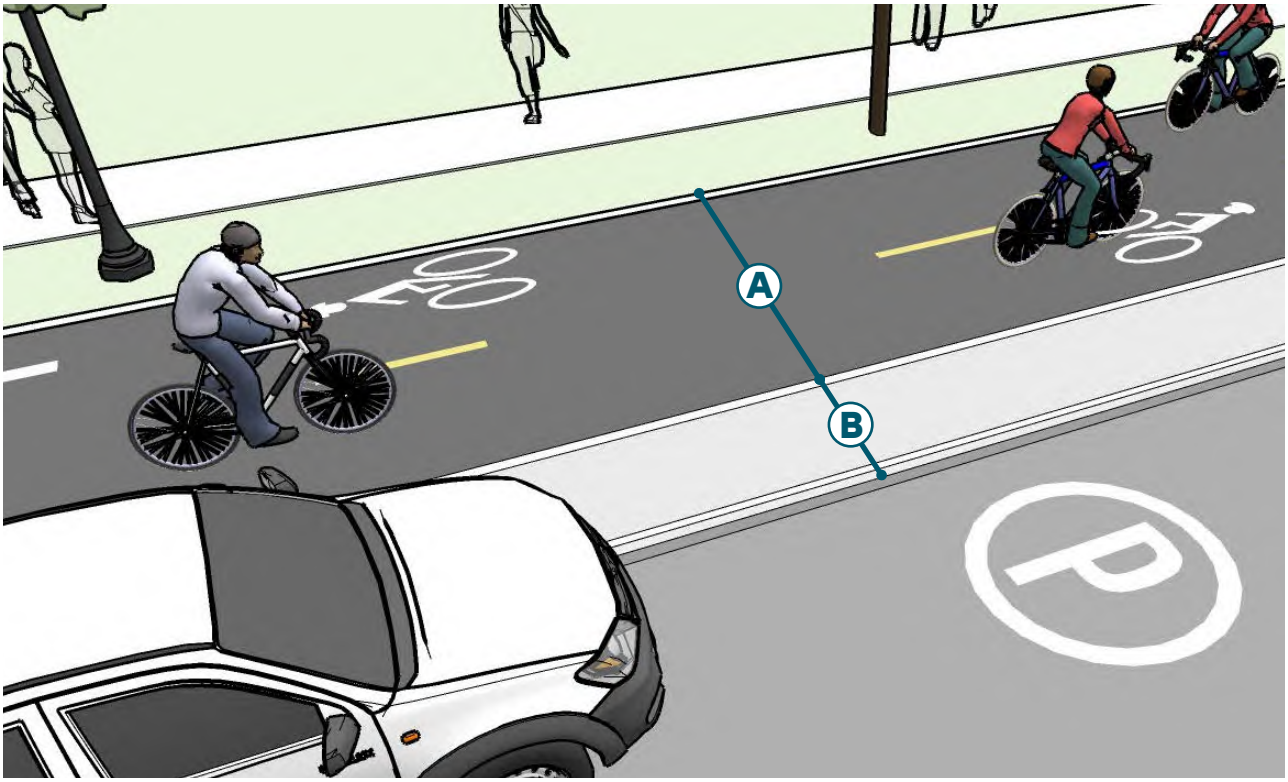
Bikeways should be maintained so that there are no pot holes, cracks, uneven surfaces or debris.

Access points along the facility should be provided for street sweeper vehicles to enter/exit the separated bikeway.

Composite and reboundable delineator systems, offer more durability and may withstand winter conditions better. If not used, delineators should be removed during winter for plowing operations as the buffer area can be used for snow storage.

SEPARATED BIKE LANES - TWO-WAY

Two-Way separated bike lanes are bicycle facilities that allow bicycle movement in both directions on one side of the road. Two-way separated bikeways share some of the same design characteristics as one-way separated bikeways, but often require additional considerations at driveway and side-street crossings, and intersections with other bikeways.



Typical Application

Works best on the left side of one-way streets.

- Streets with high motor vehicle volumes and/or speeds
- Streets with high bicycle volumes.
- Streets with a high incidence of wrong-way bicycle riding.
- Streets with few conflicts such as driveways or cross-streets on one side of the street.
- Streets that connect to shared use trails.

Design Features

(A) 12 foot operating width preferred (10 ft minimum) width for two-way facility.

(B) In constrained locations an 8 foot minimum operating width may be considered.

- Adjacent to on-street parking a 3 foot minimum width channelized buffer or island should be provided to accommodate opening doors. (NACTO, 2012).
- Additional signalization and signs may be necessary to manage conflicts.

A two-way facility can accommodate bicyclists in two directions of travel.

Further Considerations

- A two-way separated bikeway on one way street should be located on the left side.
- A two-way separated bikeway may be configured at street level or as a raised separated bikeway with vertical separation from the adjacent travel lane.
- Two-way separated bikeways should ideally be placed along streets with long blocks and few driveways or mid-block access points for motor vehicles.
- Two-way separated bikeways may have implications for signalized and unsignalized intersections that put contra-flow bicyclists in increased levels of risk. This should be strongly considered with any project. Bicycle exclusive signals and other control elements are often recommended with two-way separated bikeways.

Materials and Maintenance

Bikeway striping and markings will require higher maintenance where vehicles frequently traverse over them at intersections, driveways, parking lanes, and along curved or constrained segments of roadway. Green conflict striping (if used) will also generally require higher maintenance due to vehicle wear.

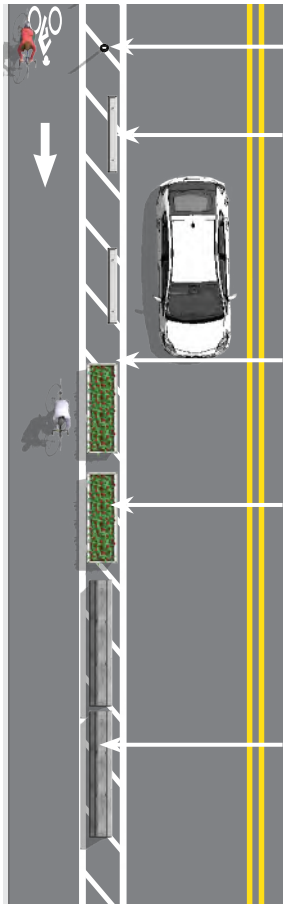
Bikeways should be maintained so that there are no pot holes, cracks, uneven surfaces or debris.

Access points along the facility should be provided for street sweeper vehicles to enter/exit the separated bikeway.

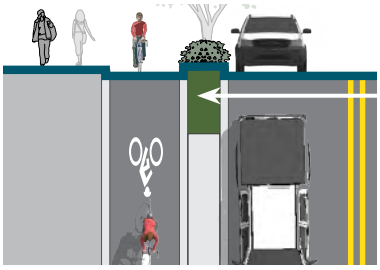
SEPARATED BIKE LANE BARRIERS

Separated bike lanes may use a variety of vertical elements to physically separate the bikeway from adjacent travel lanes. Barriers may be robust constructed elements such as curbs, or may be more interim in nature, such as flexible delineator posts.

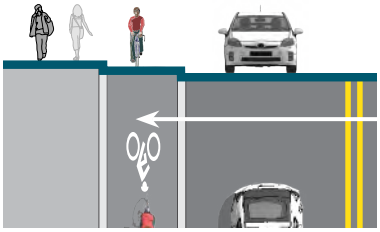
Barrier Separation



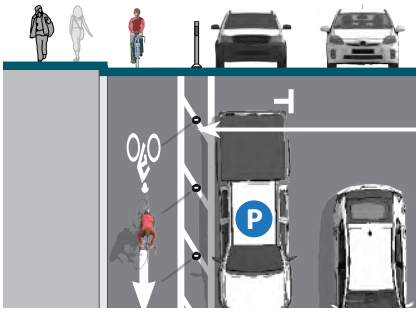
Media Separation



Elevation Separation



Parking Separation



Typical Application

Appropriate barriers for retrofit projects:

- Parked cars
- Flexible delineators
- Bollards
- Planters
- Parking stops (for use in areas where winter maintenance is not an issue)

Appropriate barriers for reconstruction projects:

- Curb separation
- Medians
- Landscaped medians
- Raised protected bike lane with vertical or mountable curb
- Pedestrian Refuge Islands

Raised separated bikeways are bicycle facilities that are vertically separated from motor vehicle traffic.

Design Features

- Maximize effective operating space by placing curbs or delineator posts as far from the through bikeway space as practicable.
- Allow for adequate shy distance of 1 to 5 feet from vertical elements to maximize useful space.
- When next to parking allow for 3 feet of space in the buffer space to allow for opening doors and passenger unloading.
- The presences of landscaping in medians, planters and safety islands increases comfort for users and enhances the streetscape environment.

Further Considerations

- With new roadway construction, a raised separated bikeway can be less expensive to construct than a wide or buffered bicycle lane because of shouldower trenching and sub base requirements.
- Parking should be prohibited within 30 feet of intersections and driveways to improve visibility.

Materials and Maintenance

Separated bikeways protected by concrete islands or other permanent physical separation, can be swept and plowed by smaller street sweeper vehicles.

Access points along the facility should be provided for street sweeper vehicles to enter/exit the separated bikeway.

BIKE BOULEVARDS

BIKE BOULEVARD OVERVIEW

A Bike Boulevard is a low-speed, low-volume roadway that is designed to enhance comfort and convenience for people bicycling. It provides better conditions for bicycling while improving the neighborhood character and maintaining emergency vehicle access. Bike Boulevards are intended to serve as a low-stress bikeway network, providing direct, and convenient routes across Rochester. Key elements of Bike Boulevards are unique signage and pavement markings, traffic calming and diversion features to maintain low vehicle volumes, and convenient major street crossings.

Treatments depicted may vary per roadway segment or location.

Typical Use

- Parallel with and in close proximity to major thoroughfares (1/4 mile or less) on low-volume, low-speed streets.
- Follow a desire line for bicycle travel that is ideally long and relatively continuous (2-5 miles).
- Avoid alignments with excessive zigzag or circuitous routing. The bikeway should have less than 10% out of direction travel compared to shortest path of primary corridor.
- Local streets with traffic volumes of fewer than 3,000 vehicles per day and with average operating speeds below 30 mph. Utilize traffic calming to maintain or establish low volumes and discourage vehicle cut through / speeding.

Design Features

- Signs and pavement markings are the minimum treatments necessary to designate a street as a bike boulevard.
- Implement volume control treatments based on the context of the bike boulevard, using engineering judgment. While motor vehicle volumes should not exceed 3,000 vehicles per day, ideal conditions are 1,500 vehicles per day or less.

A painted intersection, planters, and curb extensions to reinforce that the street is intended for local, slow-speed use instead of cut-through vehicle traffic.

An example of an large pavement marking to reinforce that the street is a Bike Boulevard.

- Intersection crossings should be designed to enhance comfort and minimize delay for bicyclists of diverse skills and abilities.

Further Considerations

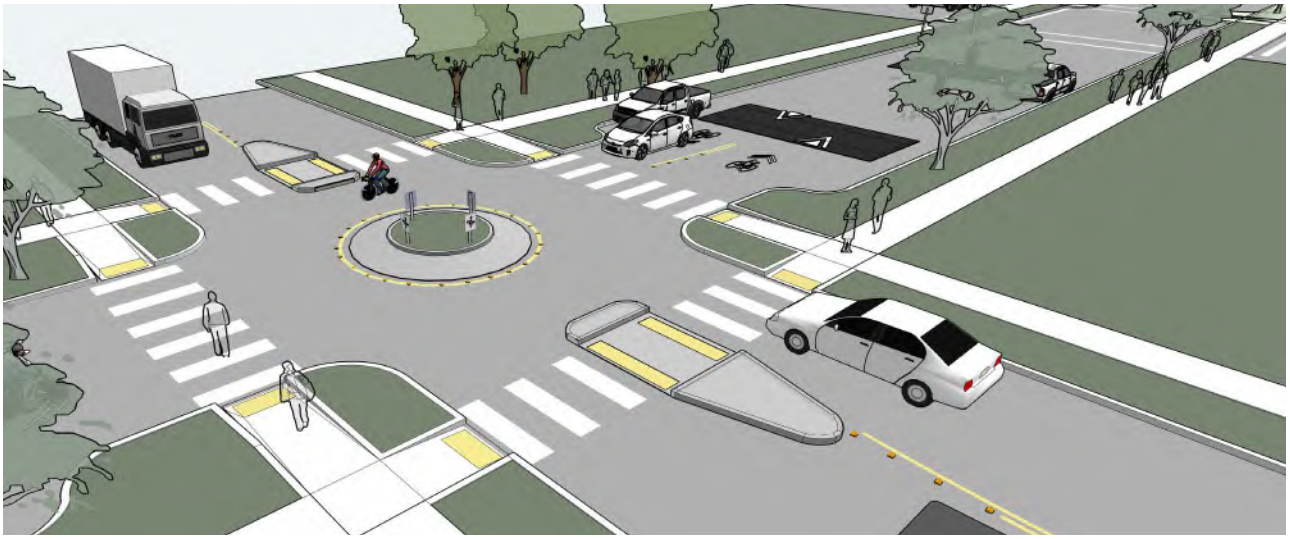
- Bike Boulevards are established on streets that improve connectivity to key destinations and provide a direct, low-stress route for bicyclists, with low motorized traffic volumes and speeds, designated and designed to give bicycle travel priority over other modes.
- Bike Boulevard retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers along the Bike Boulevard.
- Traffic calming can deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Materials and Maintenance

Bike Boulevards require few additional maintenance requirements to local roadways. Signage, signals, and other traffic calming elements should be inspected and maintained according to local standards.

TRAFFIC CALMING

Traffic calming devices can help mitigate speeding and cut-through traffic by changing driver behavior through a variety of visual or physical changes to the road environment. Such measures may reduce the design speed of a street and can be used in conjunction with reduced speed limits to reinforce the expectation of lowered speeds.



Typical Application

- Traffic calming measures should be limited to local or minor collector streets, typically with a maximum posted speed of 35 mph.
- Traffic calming measures should be implemented when the safety of all roadway users, especially pedestrians and bicyclists, is at risk due to high vehicular speeds. The risk can be determined by an engineering study.
- Traffic calming measures can be more applicable in areas with high potential for conflict between pedestrian/bicyclist and motor vehicles.
- Traffic calming measures may be most appropriate in areas with predominantly residential or mixed-use land use.
- If applicable, traffic calming measures should not infringe on bicycle space. Where possible, provide a bicycle route outside of the element so bicyclists can avoid having to merge into traffic at a narrow pinch point.
- Traffic calming measures should always consider emergency vehicle response times and turning abilities.

Design Features

- There are a variety of treatments and combinations of treatments that can be used for traffic calming. Reference City of Rochester Neighborhood Traffic Management Program Handbook for a list of Level 1, Level 2, and level 3 traffic calming measures. This handbook should be used as the primary tool for developing traffic calming plans.
- Level 1 traffic calming measures include strategies and devices that are primarily focus on safety. They are meant to regulate, warn, inform, enforce, and educate motorists,

cyclists, and pedestrians on the road. Examples include, radar signs, pavement markings, turn restrictions, temporary speed bumps.

- Level 2 traffic calming devices and roadway design features are used primarily to reduce traffic speeds within residential areas. Level 2 devices are used when Level 1 calming devices have not been effective. Examples include, speed tables, chicanes, traffic circles, and tree planting.
- Level 3 traffic calming measures are implemented to discourage cut-through traffic from utilizing residential streets. Level 3 devices are used when traffic volumes in a particular area have been found to be significantly higher compared to similar streets in other areas. Examples include, diverters, partial street closures, and median barrier/forced turn islands.

Further Consideration

Benefits of speed management include:

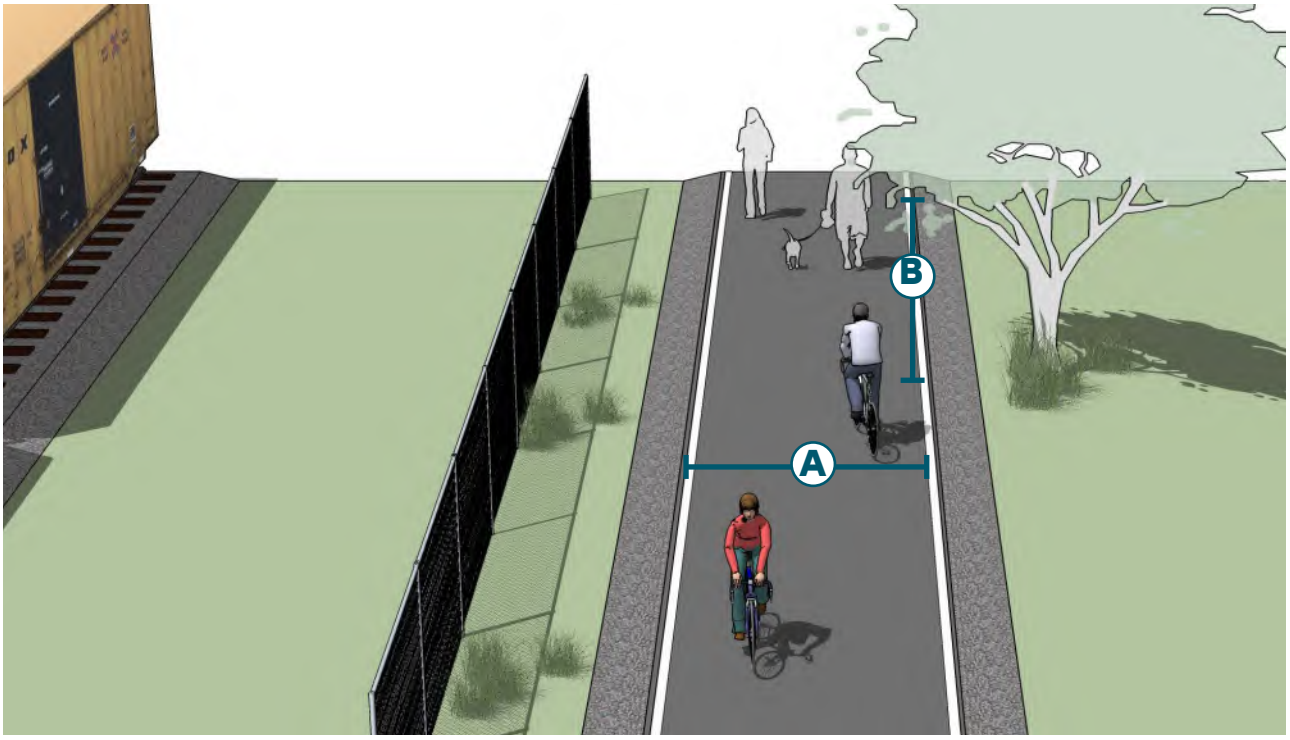
- Improves conditions for bicyclists, pedestrians, and residents on local and minor collector streets.
- Reduced travel speeds decreases the exposure risks between bicyclists/ pedestrians and motor vehicles.
- Reduced travel speeds result in reduced injury severity in the event of a collision.
- Helps achieve a safer and more livable neighborhood while balancing the transportation needs of the roadway.

04

SHARED USE TRAILS

SHARED USE TRAILS

A shared use trail provides a travel area separate from motorized traffic for bicyclists, pedestrians, skaters, wheelchair users, joggers, and other users. Shared use trails are desirable for bicyclists of all skill levels preferring separation from traffic. Bicycle trails should generally provide directional travel opportunities not provided by existing roadways. Most shared use trails are designed for two-way travel.



Typical Use

- In waterway corridors, such as along canals, drainage ditches, rivers, and creeks.
- In abandoned rail corridors (commonly referred to as Rails-to-Trails or Rail-Trails.)
- In active rail corridors, trails can be built adjacent to active railroads (referred to as Rails-with-Trails.)
- In utility corridors, such as power line and sewer corridors.
- Along roadways.

Design Features

Ⓐ 12 ft is recommended for heavy use situations with high concentrations of multiple users. A separate track (5' minimum) can be provided for pedestrian use.

- 10 ft is recommended in most situations and will be adequate for moderate to heavy use.
- 8 ft is the minimum width (with 2' ft shoulders) allowed for a two-way bicycle trail and is only recommended for low traffic situations. (Caltrans Design Manual)

Lateral Clearance

- A 2 ft or greater shoulder on both sides of the trail should be provided.

Overhead Clearance

Ⓑ Clearance to overhead obstructions should be 8 ft minimum, with 10 ft recommended.

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.
- Solid centerlines can be provided on tight or blind corners and transitions, and on the approaches to roadway crossings.

Further Considerations

Under most conditions, centerline markings are not necessary. Centerline markings should only be used if necessary for clarifying user positioning or preferred operating procedure: Solid line = No Passing; Dashed line = Lane placement

Trails with a high volume of bidirectional traffic should include a centerline. This can help communicate that users should expect traffic in both directions and encourage users to travel on the right and pass on the left.

Where there is a sharp blind curve, painting a solid yellow line with directional arrows reduces the risk of head-on collisions.

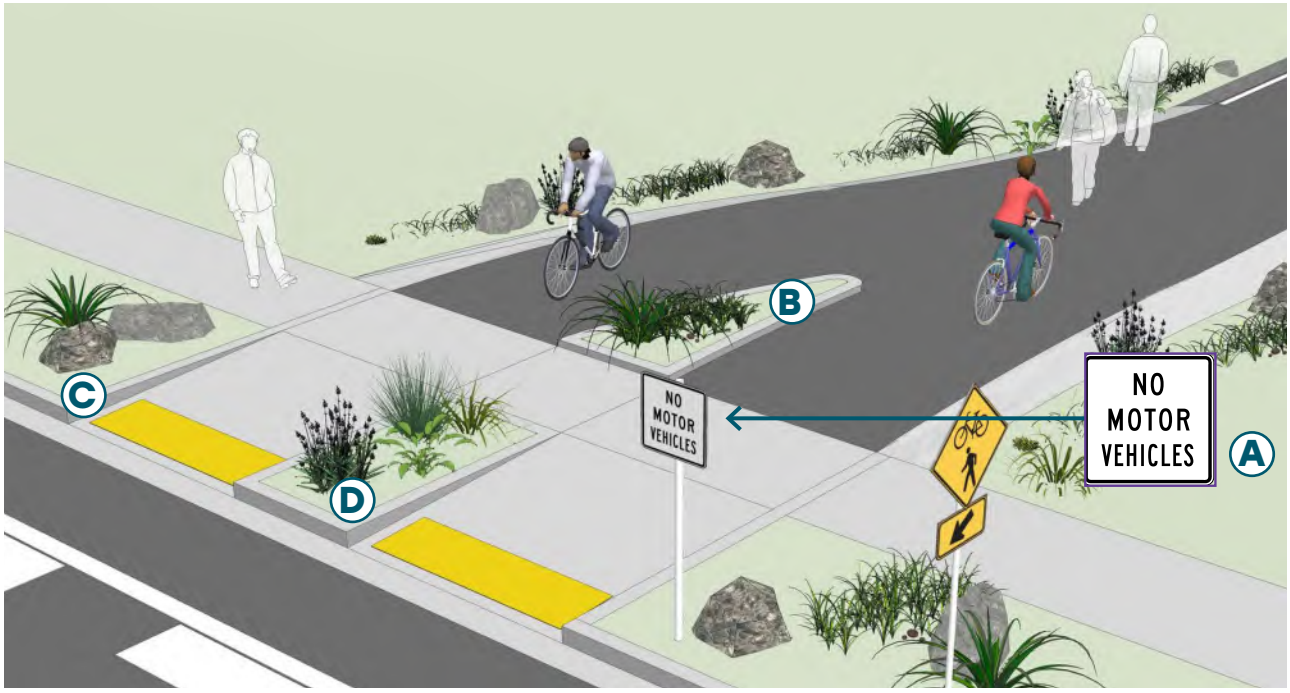
Small scale signs should be used in trail environments.

Terminate the trail where it is easily accessible to and from the street system, preferably at a trailhead, controlled intersection or at the beginning of a dead-end street.

Use of bollards should be avoided when possible. If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

BOLLARD ALTERNATIVES

Bollards are physical barriers designed to restrict motor vehicle access to the shared use trail. Unfortunately, physical barriers are often ineffective at preventing access, and create obstacles to legitimate trail users. Alternative design strategies use signage, landscaping and curb cut design to reduce the likelihood of motor vehicle access.



Typical Application

- Bollards or other barriers should not be used unless there is a documented history of unauthorized intrusion by motor vehicles.
- If unauthorized use persists, assess whether the problems posed by unauthorized access exceed the risks and issues posed by bollards and other barriers.

Design Features

(A) "No Motor Vehicles" signage (R5-3) may be used to reinforce access rules.

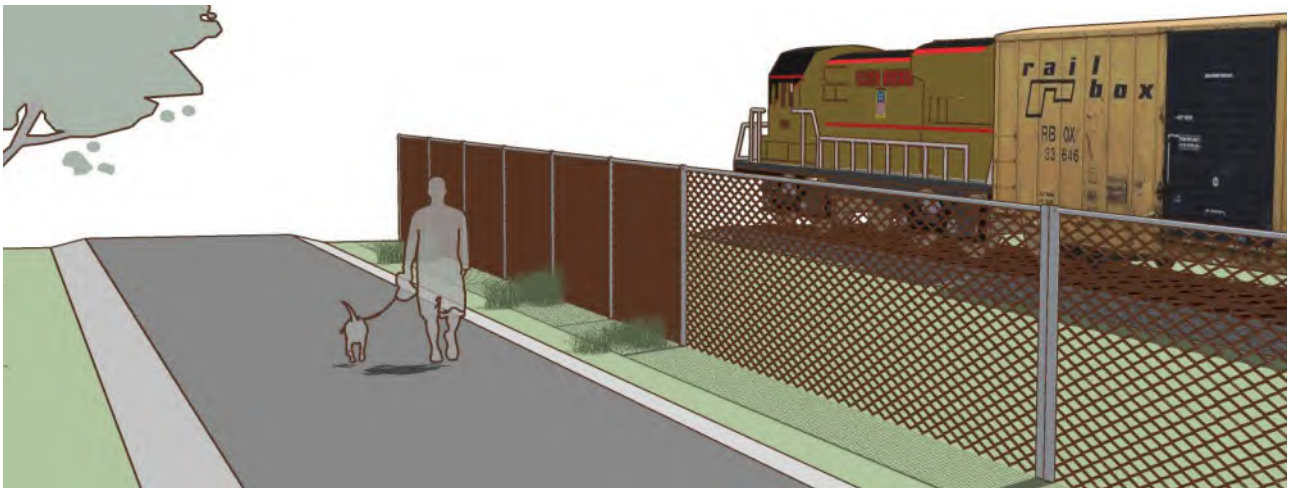
(B) At intersections, split the trail tread into two sections separated by low landscaping.

(C) Vertical curb cuts should be used to discourage motor vehicle access.

(D) Low landscaping preserves visibility and emergency access.

SCREENING/BARRIER SEPARATION TYPES

Urban trails typically transverse through a range of channel configurations, trail types, and adjacent land uses. As a result, a toolkit of options is required in order to apply appropriate edge conditions to the unique circumstances along the trail. Edge conditions comprise the range of treatments used to transition from the path of travel to space adjacent to the trail. Edge conditions include shoulder buffers, screening, barriers, railing, and other visual and tactile cues to indicate the path of travel.[1] These treatments keep users from venturing off the trail, protect users from hazards, delineate the path of travel where users are separated by direction, mode or speed, and enhance the comfort and attractiveness of the trail.



Design Features

Shoulders should be a minimum of 2 feet wide 3 feet preferred) and constructed of the same material as the trail or another durable surface. Shoulders should be sloped at 2% to 5% away to reduce ponding and minimize debris on the trail. Three feet minimum is required where signage or other furnishings will be installed. A shoulder of at least 1 foot should be provided between the trail and any fencing or barrier. Where the shoulder serves as a pedestrian path, a maximum cross slope of 2% is required to remain compliant with ADA regulations.

Barriers and Railings

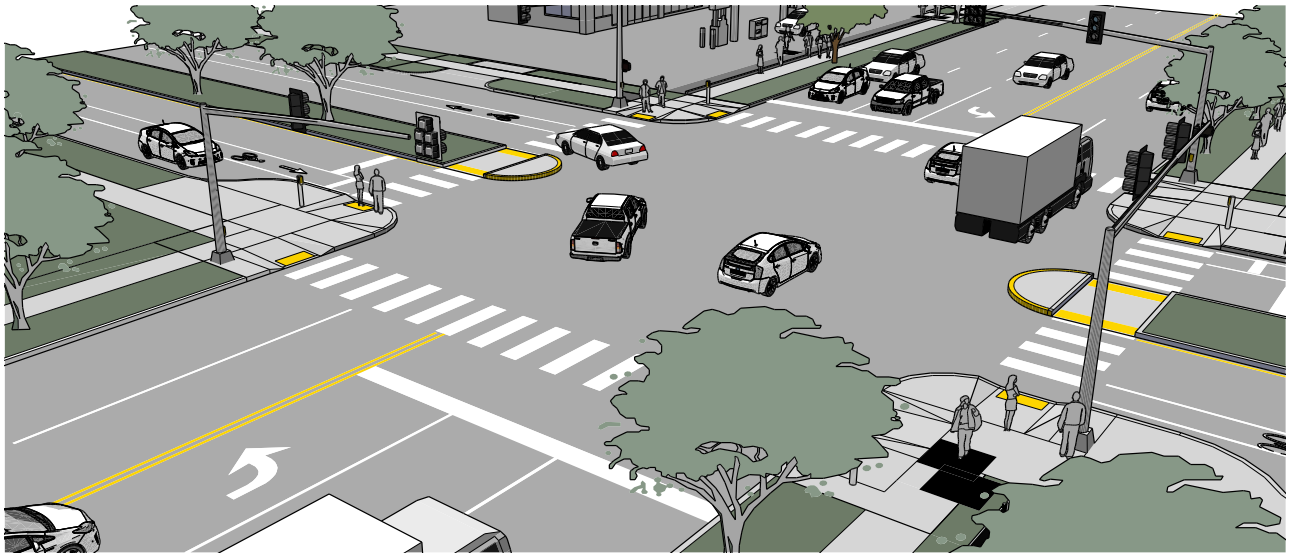
Fences, walls, and railings will likely be a recurring element along the trail to provide separation between the trail and the channel edge, rail lines, and private property. In some areas, railings and/ or security fences will be on both sides of the trail.

05

ENHANCED CROSSING TREATMENTS

MARKED CROSSWALKS AT INTERSECTIONS

Marked crosswalks signal to motorists that they must stop for pedestrians and encourages pedestrians to cross at designated locations. Installing crosswalks alone will not necessarily make crossings safer, particularly on multi-lane roadways. Marked crosswalks across the uncontrolled leg of unsignalized intersections should follow the design guidance of marked crosswalks at mid-block locations.



Typical Application

At signalized intersections, all crosswalks should be marked. At unsignalized intersections, crosswalks may be marked under the following conditions:

- At an intersection within a school zone or on a walking route, trail crossings, and at parks, libraries, or community centers.
- At a complex intersection, to orient pedestrians in finding their way across.
- At an offset intersection, to show pedestrians the preferred route across traffic with the least exposure to vehicular traffic and traffic conflicts.
- At an intersection with visibility constraints, to position pedestrians where they can best be seen by oncoming traffic.

Design Features

- The crosswalk should be located to align as closely as possible with the through pedestrian zone of the sidewalk corridor.
- Transverse markings are the most basic crosswalk marking type, but may wear faster as every vehicle drives over the markings.
- Continental markings provide improved visibility and can be located outside of vehicle wheel paths.
- Local climate can present unique challenges for pavement markings due to extreme heat/ cold, snow plows, and de-icing techniques.

Further Considerations

Continental crosswalk markings should be used at crossings with high pedestrian use, particularly where the crossing is not controlled by signals or stop signs, such as a local street crossing of a multi-lane arterial. These type of markings should also be used where vulnerable pedestrians are expected, including crossings near schools. Continental crosswalk marking also requires less ongoing maintenance and lasts longer than other marking techniques.

Materials and Maintenance

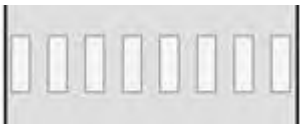
The effectiveness of marked crossings depends entirely on their visibility; maintaining marked crossings should be a high priority. Thermoplastic markings offer increased durability when compared to conventional paint.[1]

1 The appropriate marking material(s) should be determined on a project basis.

Crosswalk Examples

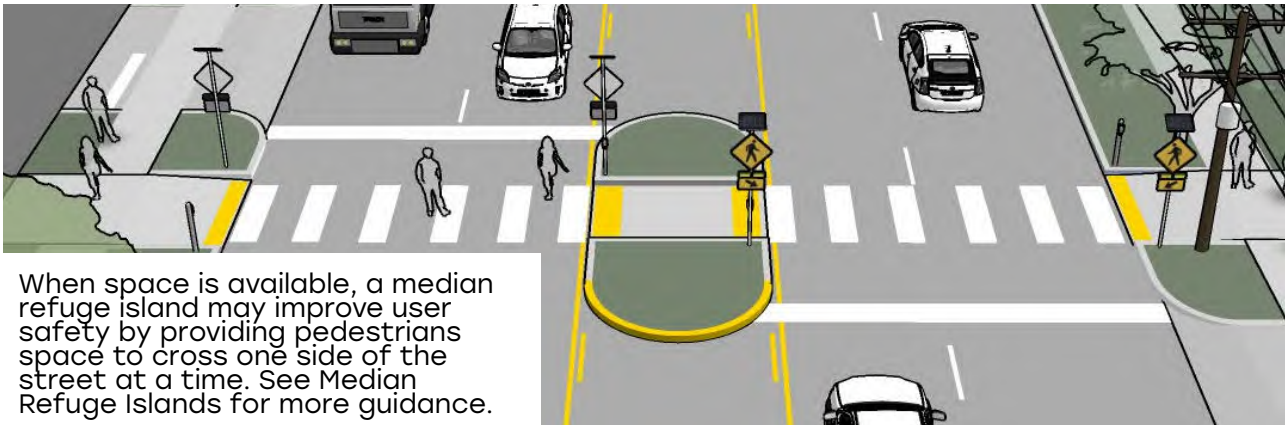
Transverse Markings

Continental Markings



MARKED CROSSWALKS AT MID-BLOCK

An effective pedestrian crossing at an uncontrolled location consists of a marked crosswalk, appropriate pavement markings, warning signage, and other treatments to slow or stop traffic such as curb extensions, median refuges, beacons, hybrid beacons, and signals. Designing crossings at mid-block locations depends on an evaluation of motor vehicle traffic volumes, sight distance, pedestrian traffic volumes, land use patterns, vehicle speed, and road type and width.



When space is available, a median refuge island may improve user safety by providing pedestrians space to cross one side of the street at a time. See Median Refuge Islands for more guidance.

Typical Application

Locations where mid-block crossings should be considered include:

- Long blocks (longer than 600 ft.) with destinations on both sides of the street.
- Locations with heavy pedestrian traffic, such as schools, shopping centers, and shared use trail crossings.
- At transit stops, where transit riders must cross the street on one leg of their journey.

Design Features

- Detectable warning strips are required to help visually impaired pedestrians identify the edge of the street and are required through ADA
- Advance stop lines should be placed 20-50 feet in advance of multi-lane uncontrolled mid-block crossings
- Crosswalk markings legally establish mid-block pedestrian crossing
- Pedestrian and stop warning signage (W11-2 and R1-5C) should be installed at the crossing to alert drivers of the potential presence of pedestrians in the roadway

Further Considerations

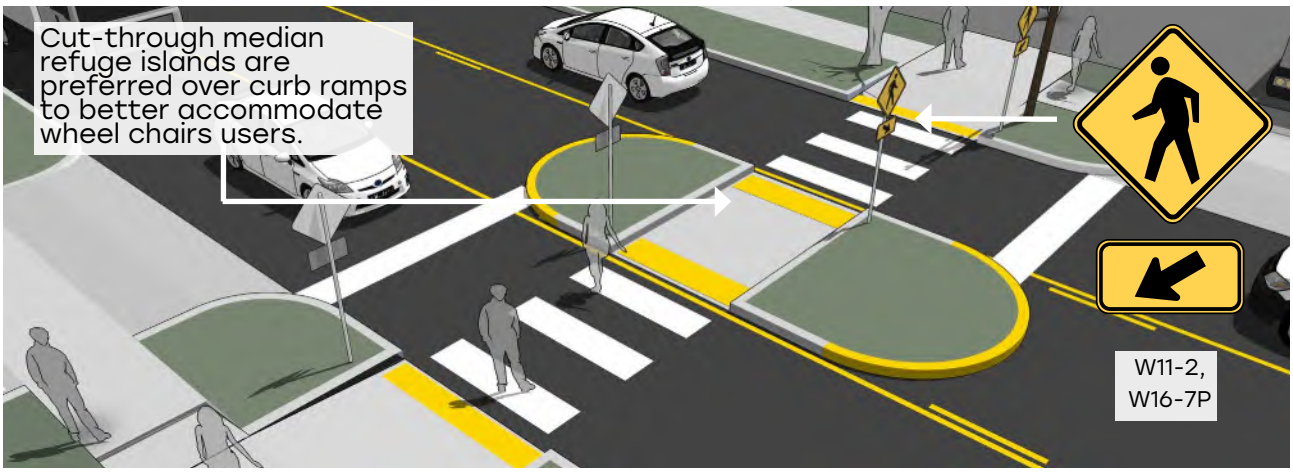
Uncontrolled crossings of multi-lane roadways with over 15,000 ADT may be possible with features such as sufficient crossing gaps in vehicular traffic (more than 60 per hour), median refuges, or beacons, and good sight distance.

On roadways with low to moderate traffic volumes and posted speeds at or below 30 mph, a raised crosswalk may be the most appropriate crossing design to improve pedestrian visibility and safety.

MEDIAN REFUGE ISLANDS

Median refuge islands are located at the mid-point of a marked crossing and help improve safety by increasing visibility and allowing pedestrians to cross one direction of traffic at a time. Refuge islands minimize pedestrian exposure at mid-block crossings by shortening the crossing distance and increasing the number of available gaps for crossing.

Median refuge islands can also be configured as an off-set crossing. This requires pedestrians to change their direction of travel while in the median - to face on-coming vehicles - before crossing. Here, pedestrians are more likely to see, and establish eye contact with on-coming motorists before stepping into the roadway.



Typical Application

- Refuge islands can be applied on any roadway with a left turn center lane or median that is at least 6’ wide.
- Islands are appropriate at signalized or unsignalized crosswalks.
- The refuge island must be accessible, preferably with an at-grade passage through the island rather than ramps and landings.
- The island should be at least 6’ wide between travel lanes and at least 20’ long (40’ minimum preferred).
- Provide double centerline marking, reflectors, and “KEEP RIGHT” signage in the island on streets with posted speeds above 30 mph.

Design Features

- Cut-through median refuge islands are preferred over curb ramps to better accommodate wheel chairs users.
- Pedestrian warning signage should be placed at the crossing. Advanced warning signage should also be considered where site obstructions may be present on the approach.
- This treatment may be combined with Rectangular Rapid Flashing Beacons (RRFBs). See treatment description for more information.

Materials and Maintenance

Refuge islands may require frequent maintenance of road debris. Trees and plantings in a landscaped median must be maintained so as not to impair visibility.

SIGNALS AND BEACONS

PEDESTRIAN SIGNALIZATION IMPROVEMENTS

Typical Application

Pedestrian signal heads indicate to pedestrians when to cross at a signalized crosswalk. Pedestrian signal indications are recommended at all traffic signals except where pedestrian crossing is prohibited by signage. Countdown signals should be used at all new and rehabbed signalized intersections.

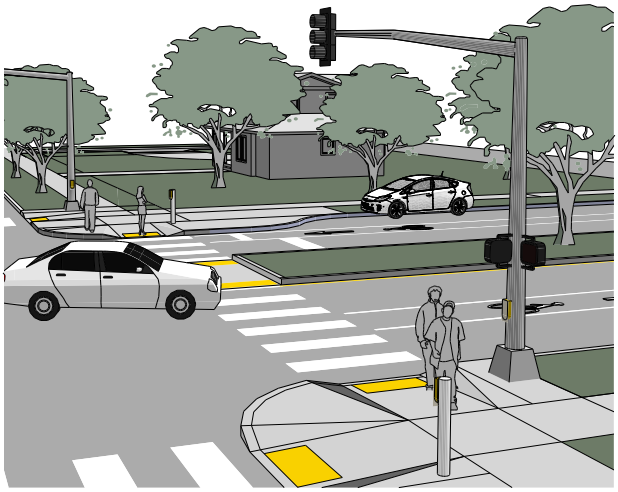
Design Features

Adequate pedestrian crossing time is a critical consideration at signalized intersections. The length of a signal phase with parallel pedestrian movements should provide sufficient time for a pedestrian to safely cross the adjacent street. The MN MUTCD recommends a walking speed of 3.5 ft per second.

At crossings where older pedestrians or pedestrians with disabilities are expected, crossing speeds as low as 3 ft per second should be assumed. Special pedestrian phases can be used to provide greater visibility or more crossing time for pedestrians at certain intersections.

Large pedestrian crossing distances can be broken up with medians islands into multiple stages. If the crossing is multi-stage, pedestrian push buttons must be provided. This ensures that pedestrians are not stranded on the median, and is especially applicable on large, multi-lane roadways with high vehicle volumes, where providing sufficient pedestrian crossing time for a single stage crossing may be an issue.

Consider the use of a Leading Pedestrian Interval (LPI) a headstart for pedestrians.



Accessible Pedestrian Signals (APS) provide crossing assistance to pedestrians with various types of disabilities

Further Considerations

Pushbuttons should be located so that someone in a wheelchair can reach the button from a level area of the sidewalk without deviating significantly from the natural line of travel into the crosswalk. Pushbuttons should be marked (for example, with arrows) so that it is clear which signal is affected.

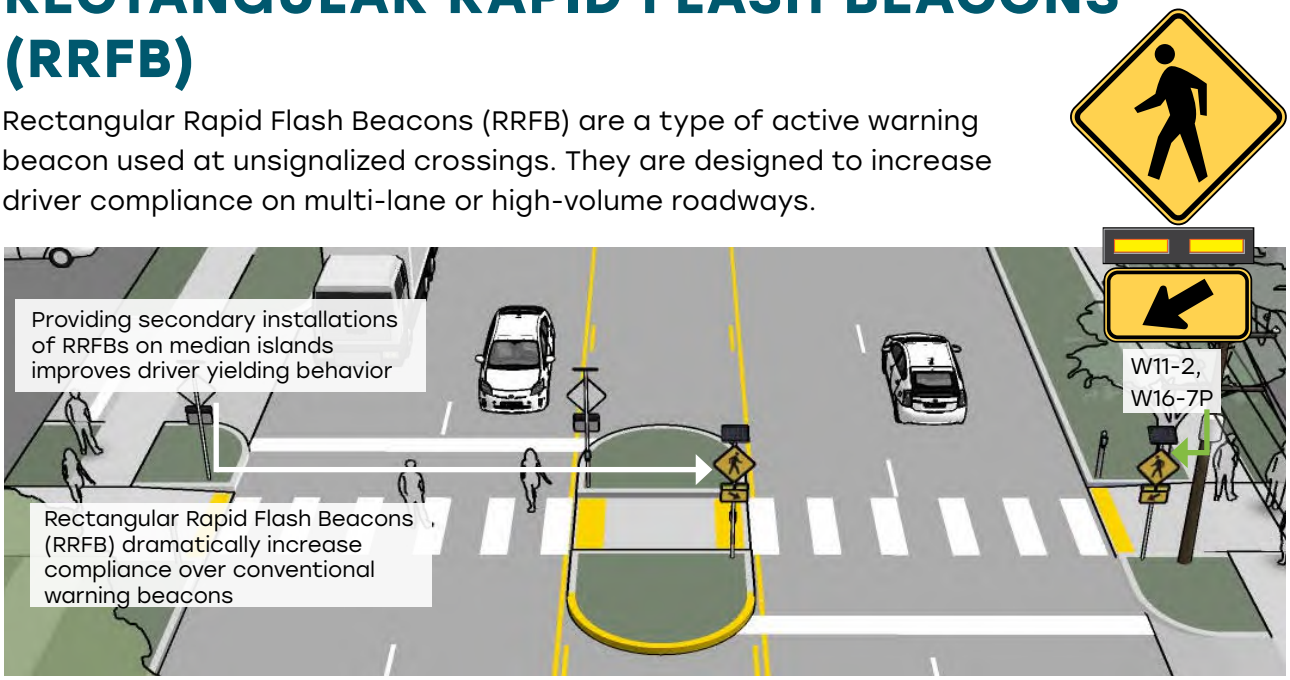
In areas with very heavy pedestrian traffic, consider an all-pedestrian signal phase to give pedestrians free passage in the intersection when all motor vehicle traffic movements are stopped. This may provide operational benefits as vehicle turning movements are then unimpeded.

Materials and Maintenance

It is important to perform ongoing maintenance of traffic control equipment. Consider semi-annual inspections of controller and signal equipment, intersection hardware, and detectors.

RECTANGULAR RAPID FLASH BEACONS (RRFB)

Rectangular Rapid Flash Beacons (RRFB) are a type of active warning beacon used at unsignalized crossings. They are designed to increase driver compliance on multi-lane or high-volume roadways.



Typical Application

- Guidance for marked/unsignalized crossings applies.
- RRFBs should not be used at crosswalks controlled by YIELD signs, STOP signs, Pedestrian Hybrid Beacons (HAWKs), or traffic control signals.
- RRFBs should initiate operation based on user actuation and should cease operation at a predetermined time after the user actuation or, with passive detection, after the user clears the crosswalk.

Design Features

- RRFBs are typically activated by pedestrians manually with a push button, or can be actuated automatically with passive detection systems. See Enhanced Crossing Treatment Selection page for more details on appropriate applications.
- Providing secondary installations of RRFBs on median islands improves conspicuity and driver stopping behavior.
- Must be used in conjunction with W11-2, S1-1, or W11-15, (and W16-7P if post-mounted). See FHWA Interim Approval 21 for more information.
- Beacons may be installed as side mounted or in overhead installations.

Further Considerations

RRFBs elicit the highest increase in compliance of all the amber warning beacon enhancement options.

One study found that going from no beacons to a two-beacon RRFB installation increased yielding from 18 percent to 81 percent. A four-beacon arrangement raised compliance to 88%. Additional studies of long term installations show little to no decrease in yielding behavior over time.

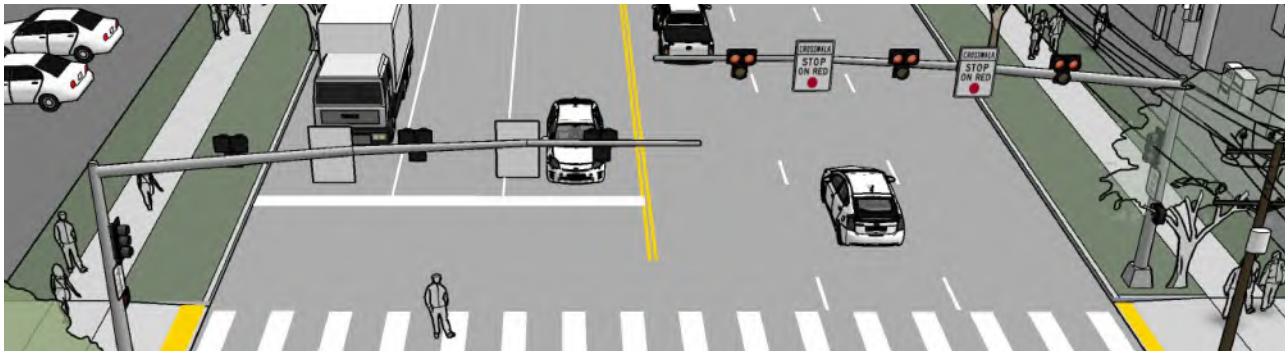
See FHWA Interim Approval 21 (IA-21) for more information on RRFBs.

Materials and Maintenance

RRFBs should be regularly maintained to ensure that all lights and detection hardware are functional.

PEDESTRIAN HYBRID BEACON (PHB)

Pedestrian Hybrid Beacons (PHB) or High-Intensity Activated Crosswalks (HAWK) are used to improve non-motorized crossings of major streets. A hybrid beacon consists of a signal head with two red lenses over a single yellow lens on the major street, and a pedestrian signal head for the crosswalk. Hybrid beacons are only used at marked mid-block crossings or unsignalized intersections. They are activated with a pedestrian pushbutton at each end. If a median refuge island is used at the crossing, another pedestrian pushbutton can be located on the island to create a two-stage crossing.



Typical Application

- Suitable for arterial streets where speeds are above 30-45 mph and there are three or more lanes of traffic (or two lanes with a median refuge).
- Where off-street bicycle facilities intersect major streets without signalized intersections.
- At intersections or midblock crossings where there are high pedestrian volumes.

Design Features

- PHBs may be installed without meeting traffic signal control warrants based on engineering judgment if roadway speed and volumes are excessive for comfortable pedestrian crossings.
- If installed within a signal system, signal engineers should evaluate the need for the hybrid beacon to be coordinated with other signals.
- Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk to provide adequate sight distance.

Further Considerations

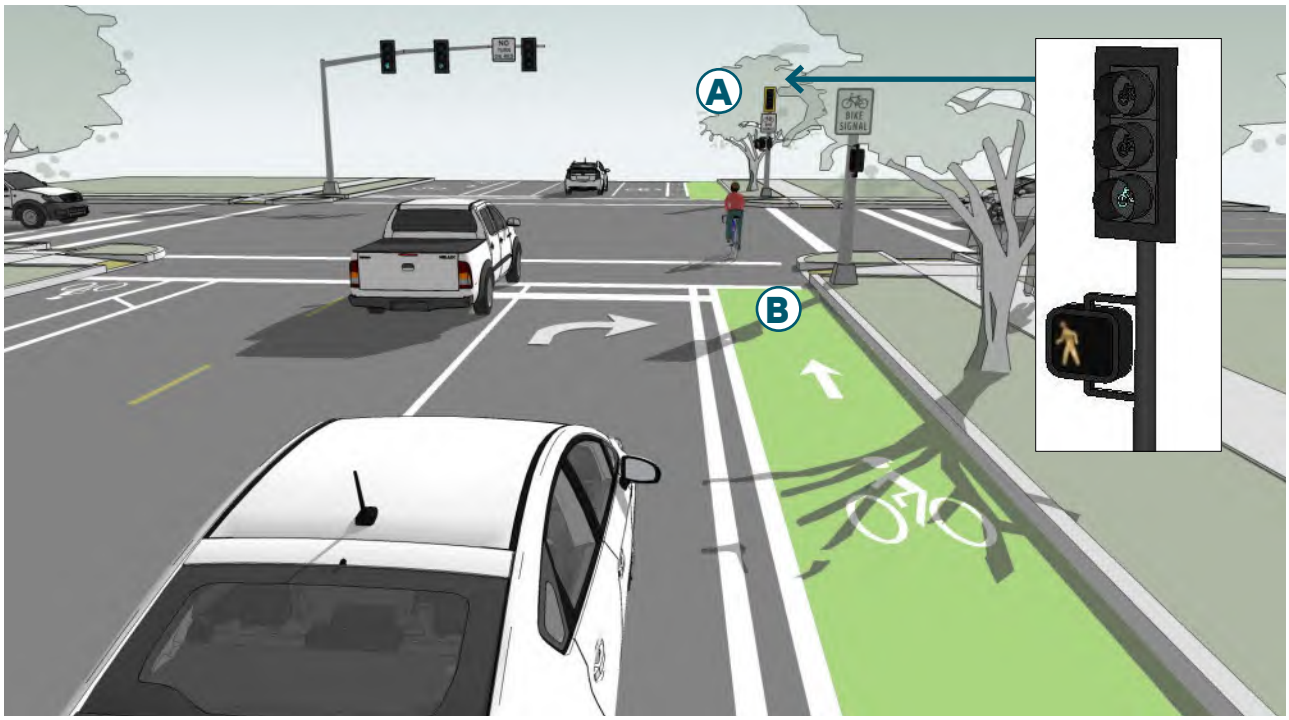
- PHBs are normally activated by push buttons, but may also be triggered by infrared, microwave, or video detectors. If not on-demand, the maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street, but a much shorter delay is strongly preferred.
- Each crossing, regardless of traffic speed or volume, requires review to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety.
- The installation of hybrid beacons should also include public education and enforcement campaigns to ensure proper use and compliance.

Materials and Maintenance

PHBs are subject to the same maintenance needs and requirements as standard traffic signals. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

SEPARATED BICYCLE SIGNAL PHASE

Separated bicycle lane crossings of signalized intersections can be accomplished through the use of a bicycle signal phase which reduces conflicts with motor vehicles by separating bicycle movements from any conflicting motor vehicle movements. Bicycle signals are traditional three lens signal heads with green, yellow and red bicycle stenciled lenses.



Typical Use

- Two-way protected bikeways where contraflow bicycle movement or increased conflict points warrant protected operation.
- Bicyclists moving on a green or yellow signal indication in a bicycle signal shall not be in conflict with any simultaneous motor vehicle movement at the signalized location
- Right (or left) turns on red should be prohibited in locations where such operation would conflict with a green bicycle signal indication.

Design Features

(A) An additional “Bicycle Signal” sign should be installed below the bicycle signal head.

(B) Designs for bicycles at signalized crossings should allow bicyclists to trigger signals via pushbutton, loop detectors, or other passive detection, to navigate the crossing.

- On bikeways, signal timing and actuation shall be reviewed and adjusted to consider the needs of bicyclists.

A bicycle signal head at a signalized crossing creates a protected phase for cyclists to safely navigate an intersection.

A bicycle detection system triggers a change in the traffic signal when a bicycle is detected.

Further Considerations

- A bicycle signal should be considered for use only when the volume/collision or volume/geometric warrants have been met.
- The Federal Highway Administration (FHWA) has approved bicycle signals for use, if they comply with requirements from Interim Approval 16 (I.A. 16). Bicycle Signals are not approved for use in conjunction with Pedestrian Hybrid Beacons.
- Bicyclists typically need more time to travel through an intersection than motor vehicles. Green light times should be determined using the bicycle crossing time for standing bicycles.
- Bicycle detection and actuation systems include user-activated buttons mounted on a pole, loop detectors that trigger a change in the traffic signal when a bicycle is detected and video detection cameras, that use digital image processing to detect a change in the image at a location.

Materials and Maintenance

Bicycle signal detection equipment should be inspected and maintained regularly, especially if detection relies on manual actuation. Pushbuttons and loop detectors will tend to have higher maintenance needs than other passive detection equipment.

BIKE DETECTION AND ACTUATION

Bicycle detection and actuation is used to alert the signal controller of bicycle crossing demand on a particular approach. Proper bicycle detection should meet two primary criteria: accurately detects bicyclists and provides clear guidance to bicyclists on how to actuate detection (e.g., what button to push, where to stand).

Typical Application

- At signalized intersections within bicycle lanes or general purpose travel lanes.
- At signalized intersections within left turn lanes used by bicyclists.
- At signalized intersections within separated bike lanes.
- In conjunction with active warning beacons and pedestrian hybrid beacons.

Design Features

Push Button Actuation

- User-activated button mounted on a pole facing the street.
- The location of the device should not require bicyclists to dismount or be rerouted out of the way or onto the sidewalk to activate the phase. Signage should supplement the signal to alert bicyclists of the required activation to prompt the green phase.

Loop Detectors

- Loop detectors are bicycle-activated and installed within the roadway to allow the presence of a bicycle to be detected by the signal. This allows the bicyclist to stay within the lane of travel without having to maneuver to the side of the road to a pedestrian push button.
- Loops should be sensitive enough to detect bicycles should be supplemented with pavement markings to instruct bicyclists how to trip them.
- The MN MUTCD provides guidance on stencil markings and signage related to signal detection.

Video Detection

- Video detection systems use digital image processing to detect a change in the image at a location. These systems can be calibrated to detect bicycle, although there may be detection issues during poor lighting and weather conditions.

Thermal Detection

- Infrared detection systems typically consist of one or more thermal cameras, a microprocessor to process the thermal imagery, and software to interpret the traffic flow data and communicate with the traffic signal controller. These systems are typically able to extract a significant amount of data from the thermal imagery.

Microwave Detection

- Remote Traffic Microwave Sensor Detection (RTMS)
- RTMS is a system which uses frequency modulated continuous wave radio signals to detect objects in the roadway. This method marks the detected object with a time code to determine its distance from the sensor.
- The RTMS system is unaffected by temperature and lighting, which can affect standard video detection.

User-activated button mounted on a pole

Bicycle loop detection

Further Considerations

- Bicycle loops and other detection mechanisms can also provide bicyclists with an extended green time before the light turns yellow so that bicyclists of all abilities can reach the far side of the intersection.
- User comprehension of the bicycle detector Pavement markings is low, although some treatments show promise in increasing proper usage. Researchers at Portland State University found that 23.5% of bicyclists correctly positioned themselves over the stand-alone marking, use increased to 34.8% when the marking was paired with a R10-22 sign, and increased further to 48.4% when installed over a green background.

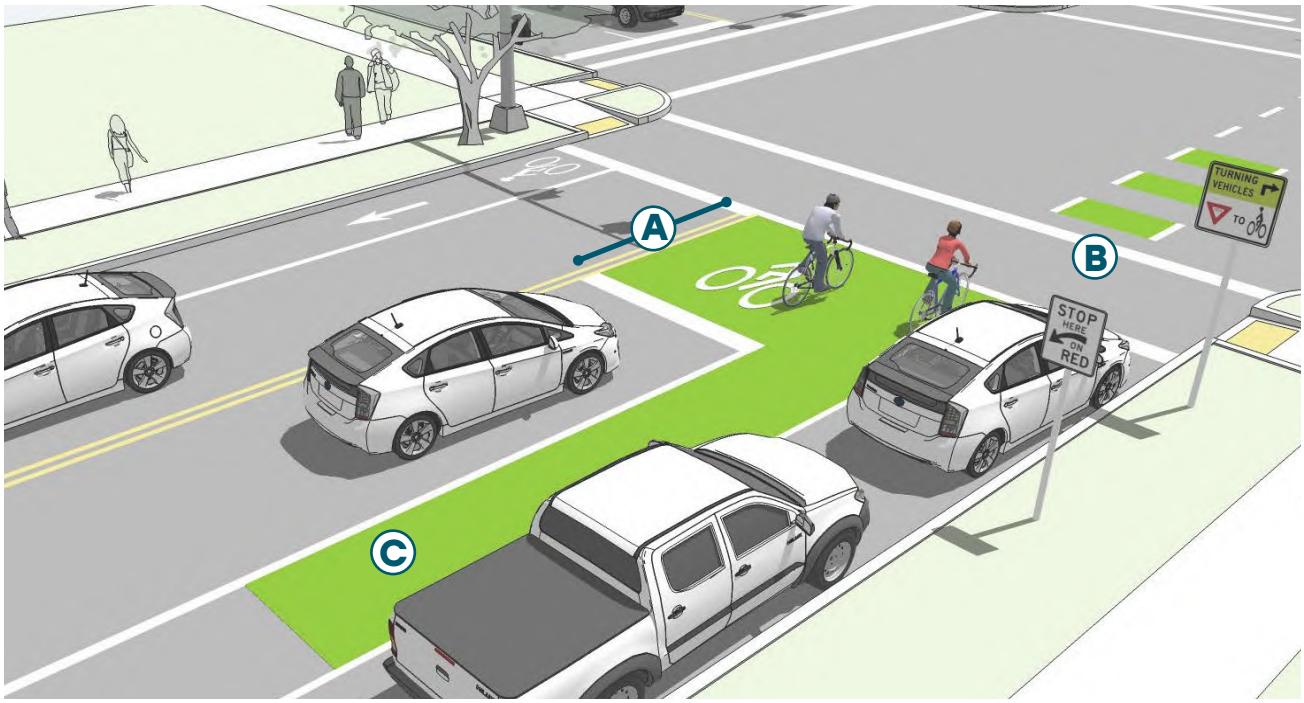
Materials and Maintenance

It is important to perform ongoing maintenance of traffic control equipment. Consider semi-annual inspections of controller and signal equipment, intersection hardware, and detectors.

INTERSECTION TREATMENTS

BICYCLE BOX

A bicycle box is designed to provide bicyclists with a safe and visible space to get in front of queuing traffic during the red signal phase. Motor vehicles must queue behind the white stop line at the rear of the bike box. On a green signal, all bicyclists can quickly clear the intersection. This treatment received Interim Approval from the FHWA in 2016 (IA-18).



Typical Use

- At potential areas of conflict between bicyclists and turning vehicles, such as a right or left turn locations.
- At signalized intersections with high bicycle volumes.
- At signalized intersections with high vehicle volumes.
- Not to be used on downhill approaches to minimize the right hook threat potential during the extended green signal phase.

Design Features

(A) 14 foot minimum depth from back of crosswalk to motor vehicle stop bar. (NACTO, 2012)

(B) A “No Turn on Red” (MN MUTCD R10-11) sign should be installed overhead to prevent vehicles from entering the Bike Box. A “Stop Here on Red” (MN MUTCD R10-6) sign should be post mounted at the stop line to reinforce observance of the stop line.

(C) A 50 foot ingress lane should be used to provide access to the box.

- Use of green colored pavement is recommended.

A bike box allows for bicyclists to wait in front of queuing traffic, providing high visibility and a head start over motor vehicle traffic.

Further Considerations

- This treatment positions bicycles together and on a green signal, all bicyclists can quickly clear the intersection, minimizing conflict and delay to transit or other traffic.
- Pedestrian also benefit from bike boxes, as they experience reduced vehicle encroachment into the crosswalk.
- Bike boxes require permission from the FHWA to implement, and jurisdictions must receive approval prior to implementation. A State may request Interim Approval for all jurisdictions in that State.[1]
- Bike boxes should not be used to accommodate bicyclist turns at intersections that have substantial parallel green time as bicyclists cannot safely occupy the box when arriving on green.

Materials and Maintenance

Bike boxes are subject to high vehicle wear, especially turning passenger vehicles, buses, and heavy trucks. As a result, bike boxes with green coloring will require more frequent replacement over time. The life of the green coloring will depend on vehicle volumes and turning movements, but thermoplastic is generally a more durable material than paint.

1 FHWA. Interim Approval for Optional Use of an Intersection Bicycle Box (IA-18). 2016.

TWO-STAGE TURN BOXES

Two-stage turn boxes offer bicyclists a safe way to make turns at multi-lane signalized intersections from a physically separated or conventional bike lane. On separated bike lanes, bicyclists are often unable to merge into traffic to turn due to physical separation, making the two-stage turning critical. This treatment received Interim Approval from FHWA in 2017 (IA-20).

Typical Application

- Streets with high vehicle speeds and/or traffic volumes.
- At intersections of multi-lane roads with signalized intersections.
- At signalized intersections with a high number of bicyclists making a left turn from a right side facility.
- Preferred treatment to assist turning maneuvers on bike lanes, instead of requiring bicyclists to merge to make a vehicular left turn, and are required for separated bikeways to assist left turns from a right side facility, or right turns from a left side facility.

Design Features

- The two-stage turn box should be placed in a protected area. Typically this is within the shadow of an on-street parking lane or protected bike lane buffer area and should be placed in front of the crosswalk to avoid conflict with pedestrians.
- 10 foot x 6.5 foot preferred dimensions of bicycle storage area (6 foot x 3 foot minimum).
- Bicycle stencil and turn arrow pavement markings should be used to indicate proper bicycle direction and positioning. (NACTO, 2012)

Further Considerations

- Consider providing a “No Turn on Red” (MN MUTCD R10-11) on the cross street

to prevent motor vehicles from entering the turn box.

- This design formalizes a maneuver called a “box turn” or “pedestrian style turn.”
- Two-stage turn boxes reduce conflicts by keeping bicyclists from queuing in a bike lane or crosswalk and by separating turning bicyclists from through bicyclists.
- Bicyclist capacity of a two-stage turn box is influenced by physical dimension (how many bicyclists it can fit) and signal phasing (how frequently the box clears).

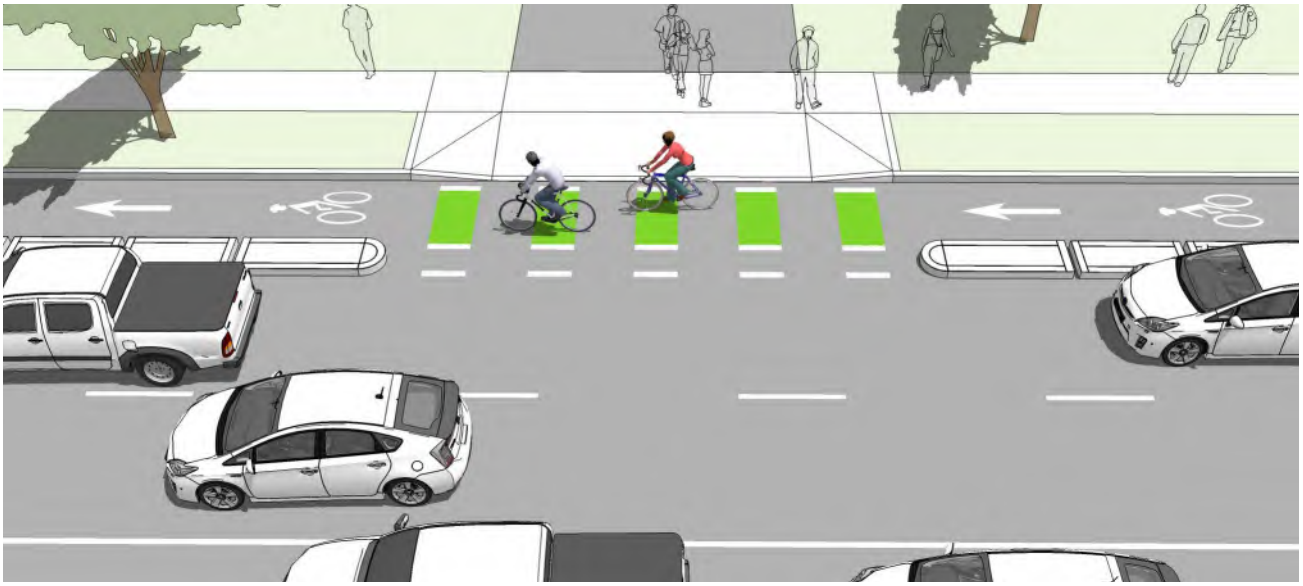
Materials and Maintenance

Turn boxes may subject to high vehicle wear, especially turning passenger vehicles, buses, and heavy trucks, so, bike boxes with green coloring will require more frequent replacement over time. The life of the green coloring will depend on vehicle volumes and turning movements, but Thermoplastic or MMA are generally more durable material than paint.

DRIVEWAY & MINOR STREET CROSSINGS

The added separation provided by separated bikeways creates additional considerations at intersections and driveways when compared to conventional bicycle lanes. Special design guidelines are necessary to preserve sightlines and denote potential conflict areas between modes, especially when motorists turning into or out of driveways may not be expecting bicycle travel opposite to the main flow of traffic.

At driveways and crossings of minor streets, bicyclists should not be expected to stop if the major street traffic does not stop.

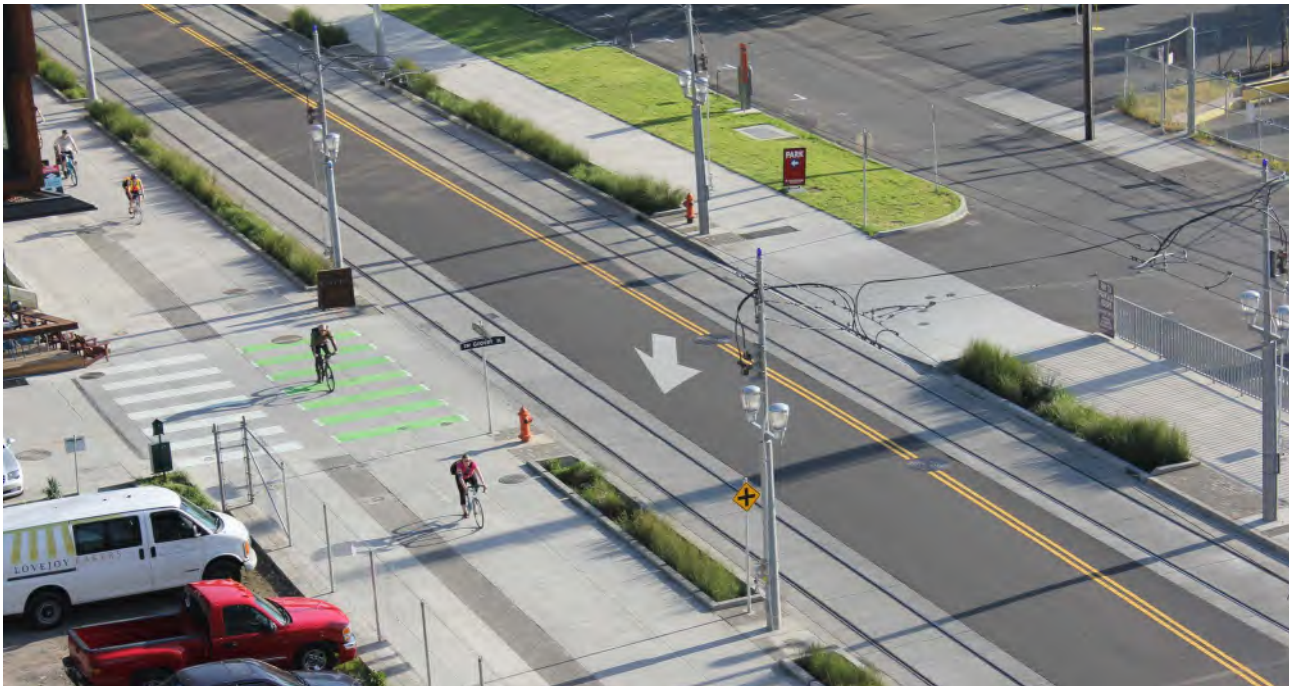


Typical Use

- Along streets with separated bikeway where there are intersections and driveways.
- Higher frequency driveways or crossings may require additional treatment such as conflict markings and signs.

Design Features

- Remove parking to allow for the appropriate clear sight distance before driveways or intersections to improve visibility. The desirable no-parking area is at least 30 feet from each side of the crossing.
- Use colored pavement markings and/or shared line markings through conflict areas at intersections.
- If a raised bikeway is used, the height of the lane should be maintained through the crossing, requiring automobiles to cross over.



Intersection crossing markings can be used at high volume driveway and minor street crossings, as illustrated above.

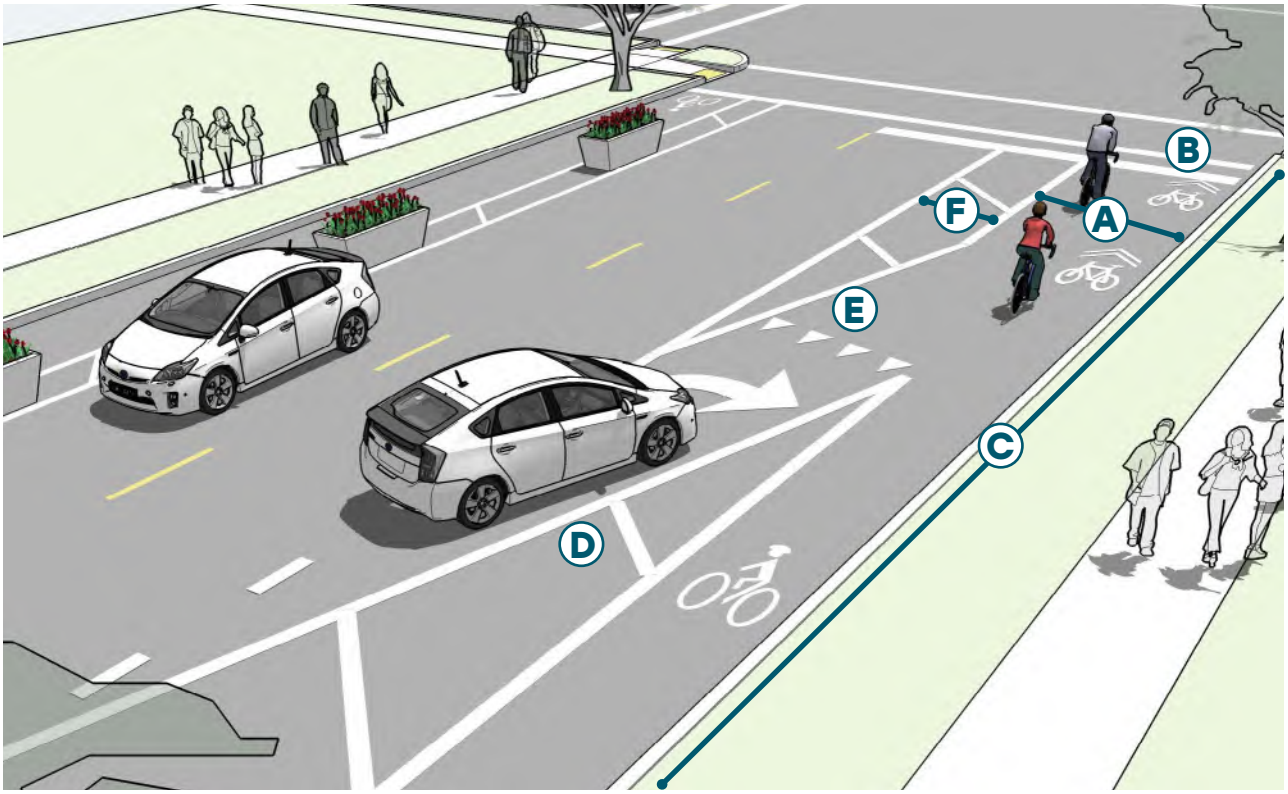
- Motor vehicle traffic crossing the bikeway should be constrained or channelized to make turns at sharp angles to reduce travel speed prior to the crossing.
- Driveway crossings may be configured as raised crossings to slow turning cars and assert physical priority of traveling bicyclists.
- Motor vehicle stop bar on cross-streets and driveways is setback from the intersection to ensure that drivers slow down and scan for pedestrians and bicyclists before turning.

Further Considerations

- Removing obstructions and providing clear sight distance at crossings increases visibility of bicyclists.
- Treatments designed to constrain and slow turning motor vehicle traffic will slow drivers to bicycle-compatible travel speeds prior to crossing the separated bikeway.

Materials and Maintenance

Green conflict striping and markings, will require higher maintenance where vehicles frequently traverse over them at driveways and minor intersection. Green conflict striping (if used) will also generally require higher maintenance due to vehicle wear.



BIKE MIXING ZONES

A mixing zone creates a shared-space travel lane where turning motor vehicles yield to people on bikes. Geometric design of the mixing zone is intended to slow motor vehicles to bicycle travel speeds, provide regulatory guidance to people driving, and enable all roadway users to negotiate conflicts upstream of the intersection.

Typical Application

- Used with wide buffered or protected bikeways to provide enough room to establish a formal "yield" area for motor vehicles.
- Potential option when there is a presence or need for a right turn only lane.
- Most appropriate in areas with low to moderate right-turn volumes (typically less than 100 per hour).

Design Features

(A) Shared lane dimensions: 13 feet maximum width. Creates clear expectations of in-line operations.

(B) Shared lane bicycle marking ("Sharrow") used to clarify bike positioning in the mixing zone.

(C) Transition to mixing zone: 75 feet preferred length. The travel lane transition should begin a minimum of 70 feet and a maximum of 100 feet in advance of the intersection. The objective is to limit vehicle storage within the mixing zone, thus slowing operating speeds during merging.

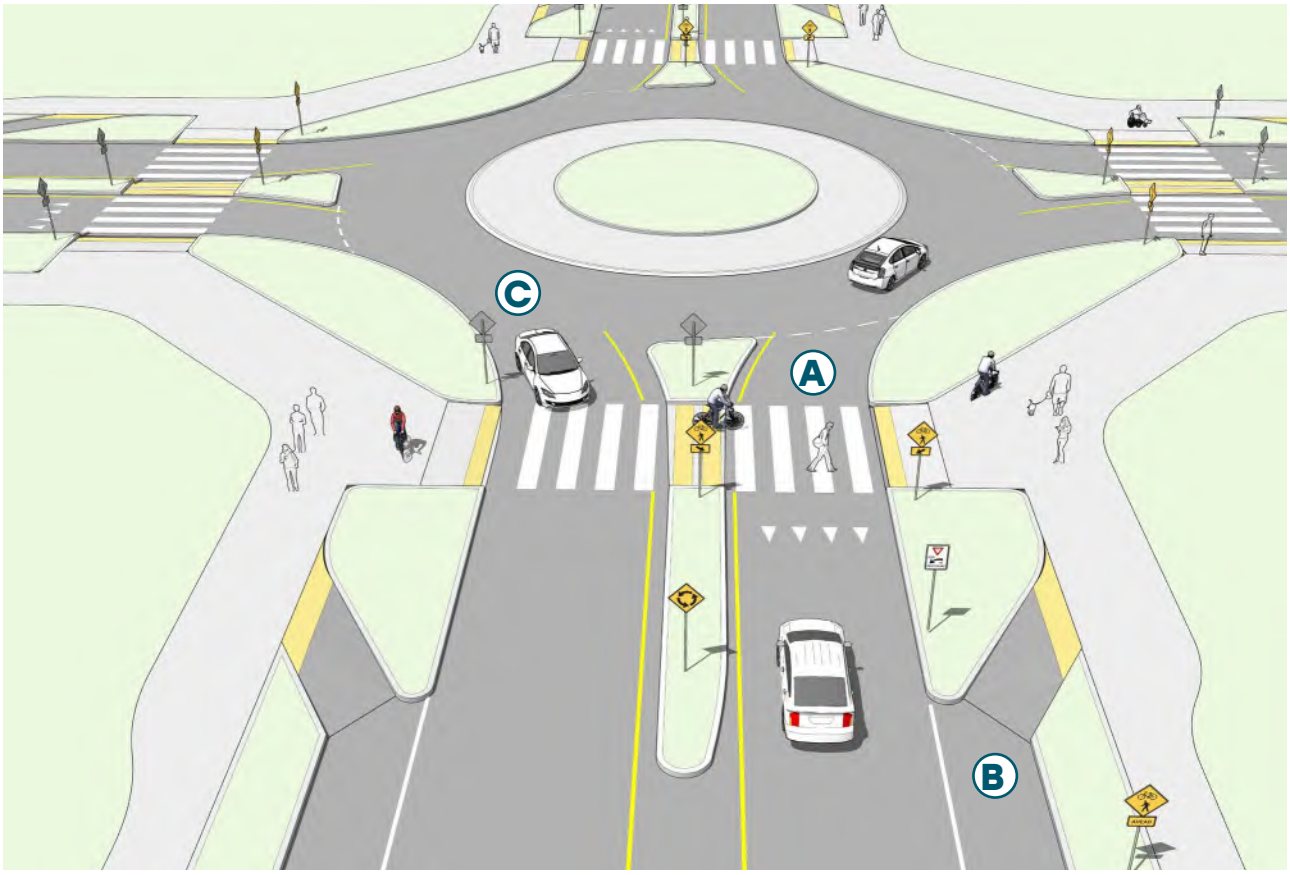
Ⓓ Entrance to mixing zone: 7:1 recommended taper with 20 mph entry speed for vehicles.

Ⓔ Yield line indicates bike priority in mixing zone

Ⓕ The mixing zone should be buffered 2-6 feet from the through travel lane.

Further Considerations

- Flex posts may be installed in the buffer between the mixing zone and the adjacent through travel lane. However, this may result in more abrupt motor vehicle transitions and is most appropriate in slow-speed conditions (20 mph or less).
- Use agressive transition taper dimensions and short storage length to promote slow motor vehicle travel speeds
- Ensure clear sight lines in advance of mixing zone, i.e. adequate parking setback in the case of a parking protected bike lane.



ROUNDABOUTS

Single lane roundabouts can provide high intersection throughput and reduced delay while reducing points of conflict between people driving, walking, and riding bikes. Multilane roundabouts can offer similar benefits, but introduce more complexity to the intersection and require special design considerations. At roundabouts, it is important to provide clear right-of-way rules to all people traveling through and guidance through use of appropriately designed signage, pavement markings, and geometric design elements.

Typical Application

- Where a bike lane or separated bikeway approaches a single-lane roundabout.
- Reduce vehicular speeds at crossings to 20 mph or less.
- Support high yield-compliance behaviors by motorists at crossings.
- Provide smooth transitions between on-street bicycle facilities and off-street trails.
- Ensure off-street trail users can see approaching traffic before initiating crossing maneuvers.

Design Features

(A) Design approaches/exits to the lowest speeds possible. Use effective radius of curvature less than or equal to 130' for speeds of up to 20 MPH.

(B) Allow people bicycling to exit the roadway onto a separated bike lane or

shared use trail that circulates around the roundabout.

- Also allow people bicycling the choice to navigate the roundabout like motor vehicles to "take the lane."

© Maximize yielding rate of motorists to people walking and people bicycling at crosswalks with small corner radii and reduced crossing distance.

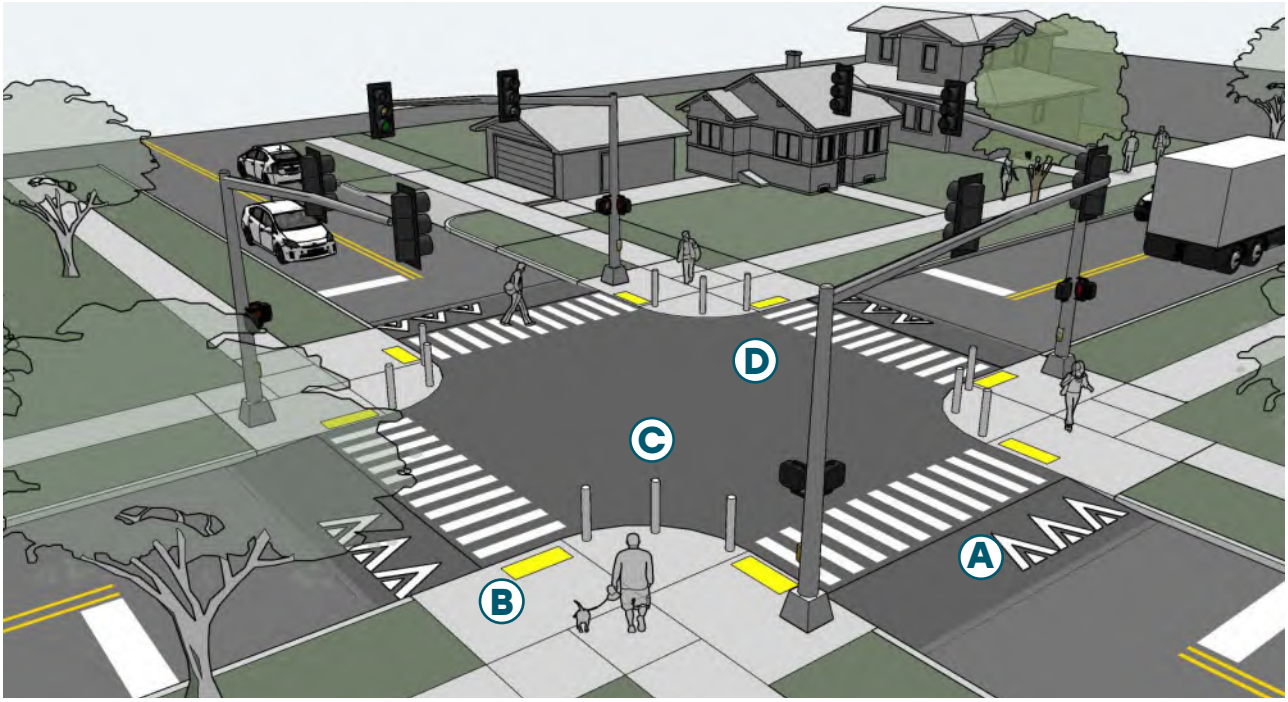
- Ensure good sightlines at crossings, provide lighting at a point immediately upstream of the crosswalk so that drivers on both approaches to the crosswalk have ample time to see and react to those in the crosswalk.
- Use mountable aprons/ramps at roundabout entries, exits and the central island to accommodate larger vehicles while keeping passenger vehicle speeds low.
- Detectable directional indicators can be used at bike ramps entrances and exits to prevent people with vision disabilities from entering the roadway at these locations.

Further Considerations

- Consider using speed tables, or raised crosswalks to increase motorist yielding at crossings.
- The publication Roundabouts: Informational Guide states, "... it is important not to select a multilane roundabout over a single-lane roundabout in the short term, even when long-term traffic predictions eventually warrant a higher capacity intersection design" (NCHRP 2010 p 6-71). The purpose of this is to prevent crashes in the interim time period. When intersections have more lanes and are wider than necessary to safely and comfortably accommodate near term traffic, a higher crash rate and more frequent injury crashes occur.
- Other circulatory intersection designs exist but they function differently than the modern roundabout. These include traffic circles (also known as "Rotaries," and neighborhood traffic circles.
- Multilane roundabouts support higher traffic volumes and higher stress levels for people on bikes. People on bikes should not be encouraged to take the lane while traveling through a multilane roundabout.
- At multilane roundabout crossings, consider a jog in the median to enhance intersection awareness and judgement for those crossing.

RAISED INTERSECTIONS

A raised intersection is a vertical speed control treatment that elevates the entire intersection and its crosswalks to the level of the sidewalk. The intersection operates as a large speed table with ramps on each approach, reinforcing slower vehicle speeds and increasing awareness of pedestrian crossing activity. Crosswalks flush with the sidewalk create a smoother travel path for pedestrians and reduces the need for curb ramps, although detectable warning strips at the edges should still be provided.



Typical Application

- Minor intersections with a high volume of pedestrian crossings.
- Roads with speed limits under 30 mph and annual average daily traffic (AADT) less than 9,000.
- Reduce vehicle speeds through pedestrian-oriented zones such as commercial areas, campus settings, and pick-up/drop-off locations.
- Support high yield-compliance behaviors by motorists at crossings.

Design Features

(A) Chevrons, or diagonal solid white lines meeting at an angle should be used to indicate ramps to vehicular traffic.

(B) If crosswalks are at-grade with the sidewalk, they do not need to be marked, but ADA-compliant detectable warning stips are always required.

(C) Include bollards on corners or along other pedestrian areas that are level with the street and where crossings are not desired. Bollards protect and delineate pedestrian spaces.

Unique crosswalk markings can be used to draw attention to the raised intersection, as demonstrated above on an offset residential intersection.

D The intersection can be constructed from special paving materials, emphasizng the pedestrian environment and public space. These materials can include asphalt, concrete, stamped concrete, or pavers. High visibility street materials will draw attention to the raised intersection.

Further Considerations

- If the intersection consists of two 1-way streets, there will be two corners with no vehicle turning movements. These corners should be designed with the smallest radius possible (approximately 2 ft).
- Consider how the color of the detectable warning strips will contrast with the colors of the raised intersection, sidewalk, and roadway. Detectable warning strips with higher constrast will improve the delineation of the spaces, such as red when adjoining light-colored sidewalks, or bright white/ yellow when adjoining dark colored pavements.
- Avoid applying this treatment to major bus transit routes or primary emergency vehicle routes. These vehicles may experience issues with vertical speed control elements.
- Avoid applying this treatment to areas with sharp curves, limited sight distances, or steep roadway grades.
- Raised intersections may impact street drainage or require catch basin relocation.
- Include appropriate warning signs and roadway markings to prepare motorists for the raised crossings and alert snow plow operators to the location of the ramps.

06

NETWORK CONNECTIONS AND SUPPORTING FACILITIES

SHORT-TERM BICYCLE PARKING

People need a safe, convenient place to secure their bicycle when they reach their destination. This may be short-term parking of 2 hours or less, or long-term parking for employees, students, residents, and commuters.

Information on short- and long-term bike parking has been informed by the Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guide, which is updated frequently and is available online at www.apbp.org.

Application

Bike Racks

- Bike racks provide short-term bicycle parking and are meant to accommodate visitors, customers, and others expected to depart within two hours. It should be an approved standard rack, appropriate location and placement.

Bike Corrals

- On-street bike corrals (also known as on-street bicycle parking) consist of bicycle racks grouped together in a common area within the street traditionally used for automobile parking.
- Bicycle corrals are reserved exclusively for bicycle parking and provide a relatively inexpensive solution to providing high-volume bicycle parking. Bicycle corrals can be implemented by converting one or two on-street motor vehicle parking spaces into on-street bicycle parking.
- Each motor vehicle parking space can be replaced with approximately 6-10 bicycle parking spaces.

Design Features

Bike Racks

- When placed on sidewalks, 2 feet minimum from the curb face to avoid 'dooring.'
- 4 feet between racks to provide maneuvering room.
- Locate close to destinations; 50 feet maximum distance from main building entrance.
- Minimum clear distance of 6 feet should be provided between the bicycle rack and the property line.
- While bike racks could be installed perpendicular or parallel to the curb, it is important to ensure there is sufficient room for pedestrian traffic, even when a bike is locked to the rack.

Bike Corrals

- Bicyclists should have an entrance width from the roadway of 5-6 feet.
- Can be used with parallel or angled parking.
- Parking stalls adjacent to curb extensions are good candidates for bicycle corrals since the concrete extension serves as delimitation on one side.

Further Considerations

- Where the placement of racks on sidewalks is not possible (due to narrow sidewalk width, sidewalk obstructions, street trees, etc.), bicycle parking can be provided in the street where on-street vehicle parking is allowed in the form of on-street bicycle corrals.
- Some types of bicycle racks may meet design criteria, but are discouraged except in limited situations. This includes undulating "wave" racks, schoolyard racks, and spiral racks. These discouraged racks are illustrated on the following page.
- Bike racks should be made of thick stainless steel to reduce the chance of thieves cutting through the racks to take bicycles. Square tubing can provide further protection from cutting, as well.
- If a bike rack is installed as surface mount, countersink bolts or expansion bolts should be used to keep the rack in place. Covering the bolts with putty or epoxy can provide additional protection.

Inverted-U racks provide two points of contact.

Racks with square tubing, good spacing, and a concrete base likewise offer two points of contact.

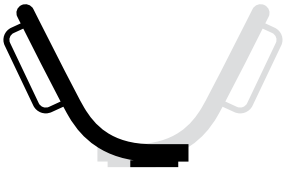
References

MnDOT Bicycle Facility Design Manual.
APBP Bicycle Parking Guide 2015.

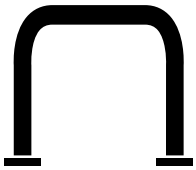
Types of Bike Racks to Use

These racks provide two points of contact with the bicycle, accommodate varying styles of bike, allow for the frame of a bicycle and at least one wheel to be secured by most U-locks, and are intuitive to use.

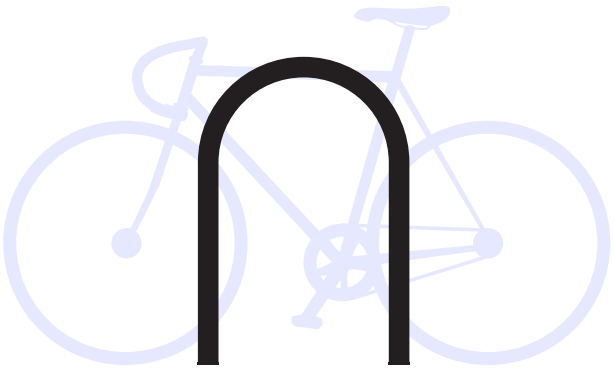
POST & RING



WHEELWELL SECURE



INVERTED-U

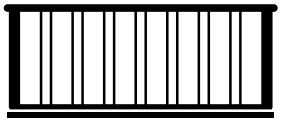


Communities may consider purchasing branded U-racks for installation on sidewalks.

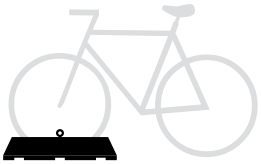
Types of Bike Racks to Avoid

These racks do not provide support at two places on the bike, can damage the wheel, do not provide an opportunity for the user to lock the frame of their bicycle easily, and are not intuitive to use. Because of performance concerns, the APBP Essentials of Bike Parking Report recommends selecting other racks instead of these.

WAVE



COMB



WHEELWELL

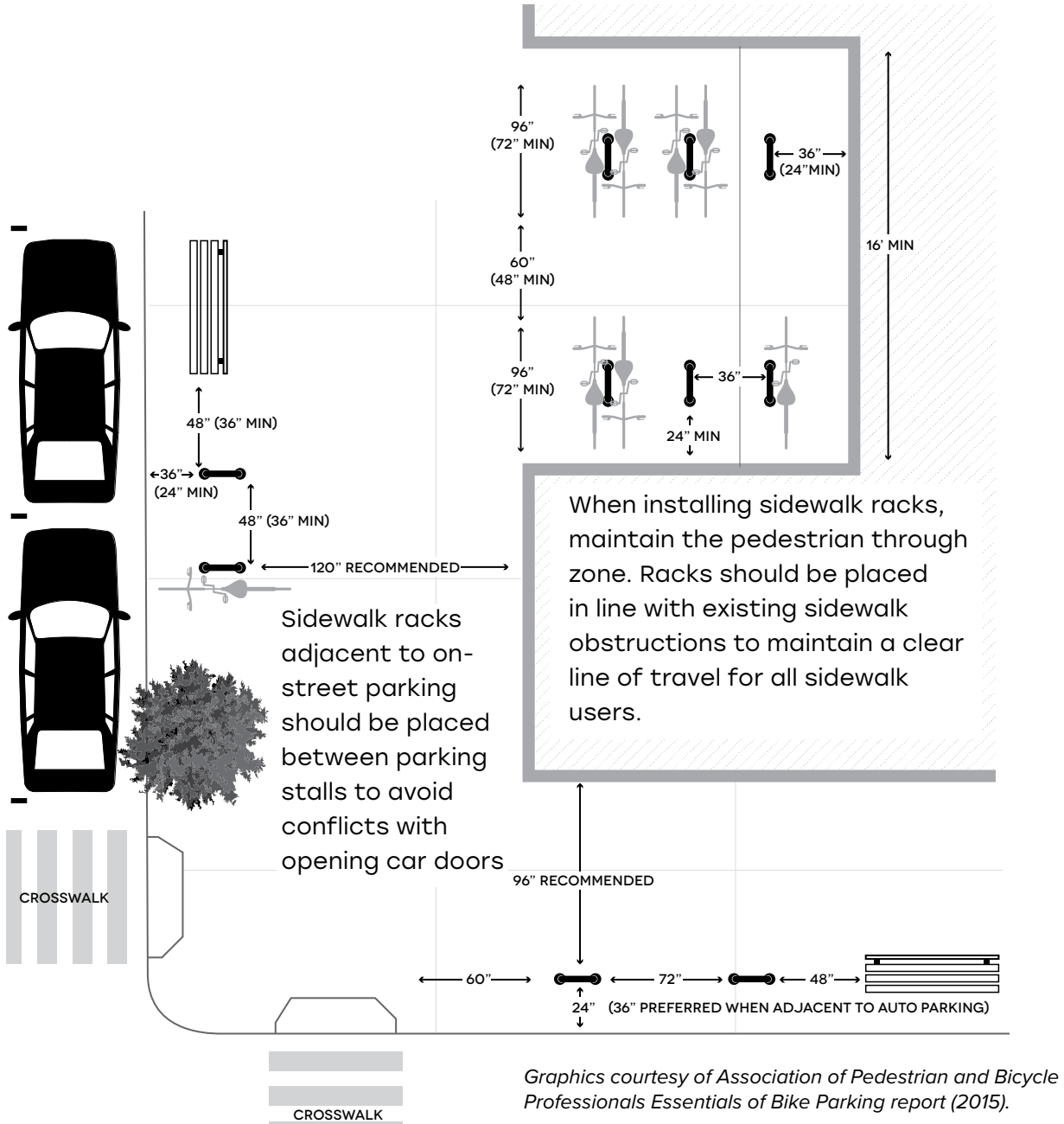
COATHANGER

BOLLARD

Graphics courtesy of Association of Pedestrian and Bicycle Professionals Essentials of Bike Parking report (2015).

Space Requirements

The following minimum spacing requirements apply to some common installations of fixtures like inverted U or post and ring racks that park one bicycle roughly centered on each side of the rack. Recommended clearances are given first, with minimums in parentheses where appropriate. In areas with tight clearances, consider wheelwell-secure racks, which can be placed closer to walls and constrain the bicycle footprint more reliably than inverted U and post and ring racks. The footprint of a typical bicycle is approximately 6' x2'. Cargo bikes and bikes with trailers can extend to 10' or longer.



Graphics courtesy of Association of Pedestrian and Bicycle Professionals Essentials of Bike Parking report (2015).

LONG-TERM BICYCLE PARKING

Users of long-term parking generally place high value on security and weather protection. Long-term parking is designed to meet the needs of employees, residents, public transit users, and others with similar needs.

Information on short and long term bike parking has been obtained from the APBP Bicycle Parking Guide, which is updated frequently and is available online at www.apbp.org.

Application

- At transit stops, bike lockers or a sheltered secure enclosure may be appropriate long term solutions.
- On public or private property where secure, long-term bike parking is desired.
- Near routine destinations, such as workplaces, universities, hospitals, etc.

Design Features

Bike Lockers

- Minimum dimensions: width (opening) 2.5 feet; height 4 feet; depth 6 feet.
- 4 foot side clearance and 6 foot end clearance. 7 foot minimum distance between facing lockers.

Secure Parking Area

- Closed-circuit television monitoring or on-site staff with secure access for users.
- Double high racks & cargo bike spaces.
- Bike repair station with bench and bike tube and maintenance item vending machine.
- Bike lock “hitching post” – allows people to leave bike locks.

Further Considerations

- As the APBP Bike Parking Guide notes, increasing density of bike racks in a long-term facility without careful attention to user needs can exclude users with less-common types of bicycles which may be essential due to age, ability, or bicycle type.
- To accommodate trailers and long bikes, a portion of the racks should be on the ground and should have an additional 36” of in-line clearance.

References

MnDOT Bicycle Facility Design Manual
APBP Bicycle Parking Guide 2015.

High Density Bike Racks

Racks may be used that increase bike parking density, like the ones below. While these types of racks provide more spaces, racks that require lifting should not be used exclusively. People with heavier bikes (i.e. cargo bikes) or people with disabilities or people who are simply small in stature may be unable to lift their bikes easily.

STAGGERED WHEELWELL-SECURE

VERTICAL

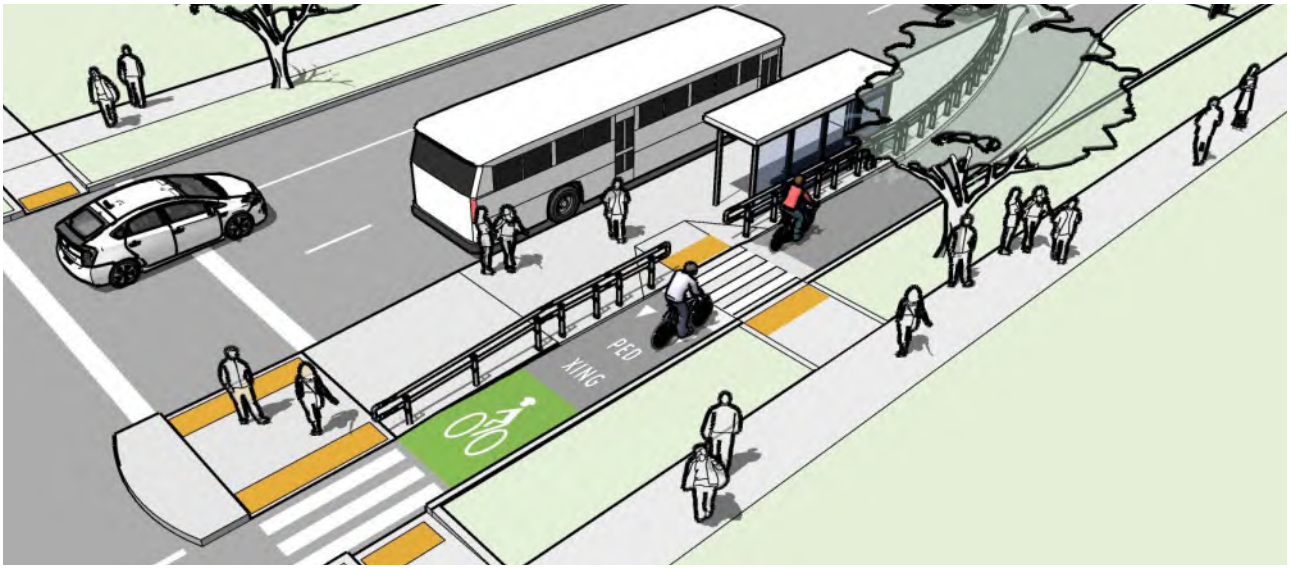
TWO-TIER

Bike Parking Rooms

Long term bike parking may be available in dedicated rooms in residential and commercial buildings. Bicycle parking can be accommodated in 15 square feet per space or less.

Bike lockers

Secured parking areas



TRANSIT STOP DESIGN

Bus platforms or waiting areas serve as the critical transition point for pedestrians as transit passengers. As such, bus platforms, shelters, and shelter amenities need to be designed to the benefit of people boarding, alighting, waiting, and passing through. Transit platforms and shelters should be designed to be comfortable and safe, accessible for people with disabilities, sized appropriately based on ridership and demand, use space efficiently, and to minimize delay and conflicts with other modes such as bicycles, and competing sidewalk uses.

Typical Application

- Bus stops can range from simple curbside stops with a pole and seating, to in-roadway platforms with shelters and other shelter amenities depending on demand, adjacent land use, and available right of way.
- Typically, bus stop shelters and amenities occupy an area of the sidewalk, either in the furnishing zone, or a reserved space in the frontage zone. They can also be located on transit islands which accommodates bicycle through traffic, or in medians for center running alignments.
- Shelters can face toward the roadway or away from the roadway. Shelters facing toward the roadway provide better sightlines, but may compete with other sidewalk uses and adjacent property access and circulation.

Design Features

- Bus shelters should be designed to minimize potential for conflicts between the bus, and people walking and bicycling through the area.
- Site visibility is a critical safety and security factor. The bus operator needs to be able to see waiting passengers, and waiting passengers need to be able to see approaching buses. The shelter, street trees, and other vertical elements must not obstruct visibility. The stop and shelter should be adequately illuminated at night for safety and security.
- The shelter canopy should be sized to provide sufficient coverage based on stop demand.

SHARED USE TRAILS AND ON-STREET TRANSITIONS

Transitions occur where the trail meets a roadway or railway, where one trail typology meets another, such as when an elevated trail transitions into an at-grade trail or where separated trail segments transition into shared environments. Transitions may also include horizontal shifts to avoid physical obstacles such as utility towers or other structures. Trail access means providing a formalized way for people to arrive and depart from the trail network by a variety of travel modes.

Typical Application

- Regional trail access points can take several different forms ranging from major trailheads, minor trailheads, and neighborhood entryways. These vary in the level of infrastructure and facility amenities.
- These access points are multimodal transition points; they serve as the transition between the on-street network and the off-street network for people walking, biking, riding transit, and driving.
- All trailheads should be open to the public.

Design Features

- Major trailheads feature convenient access to transit, parking for 10 or more vehicles, (including accessible spaces), short- and long-term bicycle parking, restrooms, trash/recycling facilities, wayfinding/interpretive kiosks, benches/ picnic tables, and other day use amenities.
- Minor trailheads include similar facilities as major trailheads but a lower provision of vehicle and bike parking and day use amenities, and may be further from major transit and bike connection points.
- Neighborhood entrypoints are the most basic form of local accessways that do not provide many of the amenities of trailheads due to space constraints, neighborhood context, and/or proximity to other trailheads.

Typology Transitions

Design elements used to alert trail users include pavement markings such as optical speed bars, zebra stripe crosswalks with yield/stop markings, and "LOOK" legends and arrows. Other visual indications include bike and pedestrian directional markings, centerlane striping, and the use of colored pavement to visually narrow or indicate a change in environment.

Tactile indications include speed humps, tactile speed bars, and the use of multiple surface types, such as concrete, asphalt, and pavers.

Advisory, regulatory, and/or wayfinding signage are should be considered at transition points. Physical treatments to alert and guide trail users include traffic calming measures such as vertical and horizontal deflection.

Trail illumination is an important design element that must be considered along the trail, but is especially important in transition zones.

Mixing Zones

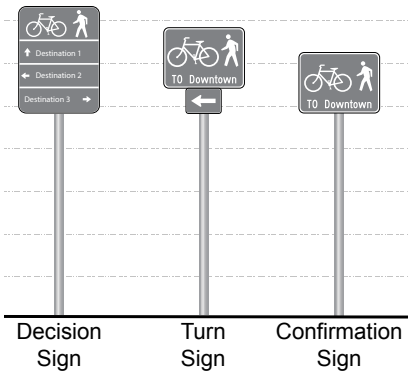
Mixing zones are necessary where physical space constraints do not allow for separated modes, or at locations along the trail where a high level of cross-traffic is expected. Mixing zones need to provide clear indication to all users that a transition is occurring in advance of the change, so that trail users can adjust their speeds and awareness appropriately to proceed carefully into the mixing zone.

Advanced warning can be accomplished with advisory signage, pavement markings, and the use of contrasting surface treatments (e.g. pavers/inlays with contrasting tones/textures, striping, or a combination of these treatments). These design elements help to guide trail users safely through the mixing zone by alerting users to the change in conditions and thus reducing the speed differential.

WAYFINDING

The ability to navigate across an urbanized area is informed by landmarks, natural features, and other visual cues. Signs throughout the city should indicate the direction of travel, the locations and travel time distances to those destinations. A pedestrian wayfinding system is similar to a transit, vehicular, or bike facility wayfinding system, in that it consists of comprehensive signing and/or pavement markings to guide pedestrians to their destination along routes that are safe, comfortable and attractive.

Sign types



Decision sign

Typical Application

Wayfinding signs will increase users' comfort and accessibility to the pedestrian system in denser urbanized areas and connections to other destinations across the larger region.

Signage can serve both wayfinding and safety purposes including:

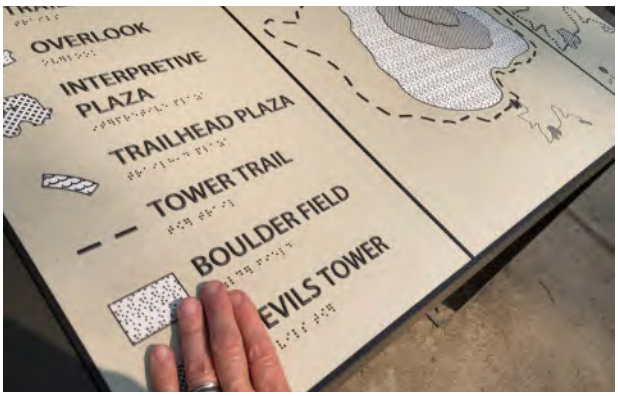
- Helping to familiarize users with the pedestrian network
- Helping users identify the best routes to destinations within walking distance or connections to other modes.
- Helping to address misperceptions about time and distance.
- Helping overcome a "barrier to entry" for people who are not frequent walkers.

Design Features

- Confirmation signs indicate to pedestrians that they are on the right trail to their destinations. They include destinations and distance/time, but not arrows
- Turn signs indicate where a route turns from one street onto another street.
- Decision signs indicate the junction of two or more pedestrian routes to access key destinations. These include destinations, arrows and distances. Travel times are optional but recommended.
- A regional wayfinding sign plan would identify sign locations, sign type, destinations, and approximate distance and travel time to destinations, and highlight connections between urban and non-urbanized areas.

Further Considerations

- Bicycle wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes.
- Too many road signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists rather than per vehicle signage standards.
- Green is the color used for directional guidance and is the most common color of bicycle wayfinding signage in the US, including those in the MNMUTCD.
- Check wayfinding signage along bikeways for signs of vandalism, graffiti, or normal wear and replace signage along the bikeway network as-needed.



Tactile navigation sign

07

PEDESTRIAN-BICYCLE OPERATIONS AND MAINTENANCE

SIDEWALK MAINTENANCE

The sidewalk is an essential space for people walking and using wheelchairs and other personal mobility devices, and it is also the location where many other important activities take place. Each of the zones described in 'Sidewalk Zones' needs to be maintained for the overall sidewalk space to function as intended.

Maintaining Sidewalk Zones

- The **Primary Pedestrian Zone** must remain free and clear of obstacles and impediments. This is the primary accessway for people traveling along streets and to and from adjacent properties, and must be maintained to ADA standards.
- Property owners are responsible for maintaining all sidewalk zones abutting their property, not just the Building Frontage Zone. The City shall enforce per City Ordinance/Policy.
    - Maintaining a firm, stable, and slip resistant surfaces is necessary for people walking or rolling to traverse this zone without risk of tripping, slipping or otherwise uneven footing.
    - Regular sweeping ensures the zone is kept free of natural debris and litter.
    - Routine maintenance of sidewalk damage due to tree roots, freeze-thaw, etc. is the responsibility of abutting property owners.
- The **Amenity Zone** is where street furnishing are located, where people are often picked up and dropped off, where mail is delivered, and where other loading/unloading happens. It's the space where trees and landscaping are planted, and where street lighting and other utilities are located. This zone must be maintained properly to ensure access to this area and all of these curbside uses are possible.
    - Vegetation in the Amenity zone should be regularly maintained by the City so as not to encroach on the primary pedestrian zone. Maintainance should be prioritized by plant species, high demand areas, and/or narrow sidewalk corridors. When not maintained, the primary pedestrian zones becomes constrained, creating bottlenecks, and may force pedestrians into the street.
    - During snow events, this zone may be designated for snow storage, but must not impact the Primary Pedestrian or Enhancement Zones.
- The **Building Frontage Zone** between the Primary Pedestrian Zone and the abutting property may be utilized by businesses for outdoor cafe seating by permit along commercial corridors, and occupied by landscaping or other natural screening in residential areas.
    - Outdoor seating shall not occupy the Primary Pedestrian Zone or inhibit travel along the sidewalk.
    - Landscaping in the Building Frontage Zone should be maintained in a manner similar to landscaping in the Amenity Zone. Landscaping should be maintained by property owners so as not to encroach on the Primary Pedestrian Zone.
- The **Enhancement Zone** must be maintained for the following uses: bike facilities, vehicle parking, curb extensions, and bike parking.
    - Street sweeping and snow/ice removal should be conducted per maintenance schedule and following significant weather events to help to ensure intended use of this space. Snow must not be stored in bikeways

PARKING, LOADING, AND GARBAGE ACCESS

Where separated bikeways are adjacent to on-street parking, drop-off locations, freight loading zones, or designated garbage pick-up areas, the design of the separation at those locations should provide an accessible aisle and adequate landing area to allow for travel from the vehicle to the curb ramp.

Colored pavement within a bicycle lane may be used to increase the visibility of the bicycle facility, raise awareness of the potential to encounter bicyclists, and reinforce priority of bicyclists in conflict areas. In 2021, MnDOT received statewide Interim Approval from FHWA for the use of green-colored pavement for bike lanes (IA-14). MnDOT must maintains a list of locations using the green colored pavement.

Typical Application

- Streets with on-street parking and a separated bikeway along the same block face.
- Where ADA-accessible spaces are desired, either due to proximity to nearby building entrances, street grades, or other factors.
- Where loading and garbage pick-up zones are desired along the same side of the street as a separated bikeway due to adjacent commercial users such as retail or hotels, and cannot be relocated to adjacent block faces or alleys.

Colored Pavement Treatment

Within a weaving or conflict area to identify the potential for bicyclist and motorist interactions and assert bicyclist priority.

Green colored conflict striping indicates the path of travel of people on bicycles, and alerts people intending to turn across the bike lane to yield when bicyclists are present.

A passenger loading zone allows pedestrians to cross the separated bike lane to access the loading island. These designs should also incorporate truncated domes to alert people walking with vision disabilities of the crossing.

- Across intersections, driveways and Stop or Yield-controlled cross-streets.
- At bike boxes and two-stage turn boxes

Design Features

- Accessible spaces should be located adjacent to intersections to simplify access to curb ramps.
- Accessible spaces must comply with all ADA requirements.
- To connect between the sidewalk and parking spaces, a crosswalk across the separated bikeway and curb ramp (6' minimum width) must be provided.
- Place a YIELD HERE TO PEDESTRIANS **(MUTCD R1-5)** sign where the separated bikeway crosses the parking access route to clearly establish a right-of-way. Yield line pavement marking may be placed prior to the crosswalk.

(A) Typical white bike lane striping (solid or dotted 6" stripe) is used to outline the green colored pavement.

(B) In weaving or turning conflict areas, preferred striping is dashed, to match the bicycle lane line extensions.

- The colored surface should be skid resistant and retro-reflective (MnMUTCD Section 3G.01).
- In exclusive use areas, such as bike boxes, color application should be solid green.

Further Considerations

- Garbage pick-up, freight loading, and drop-off hours should be restricted to hours of the day when less bicycle traffic is expected, to minimize potential interactions.
- The City can provide guidance to both waste management operators and customers on desirable recycling/trash can and bin placement with respect to both walkways and bikeways to improve safety and use of these facilities.
- Removing obstructions and providing clear sight distance at crossings increases visibility of bicyclists.
- Driveway and intersection designs shall provide appropriate sight lines, radii, and other features that deliver a turning movement speed that provides the calculated time needed for turning motor vehicle drivers to see and react to bikeway users.

BICYCLE ACCESS THROUGH CONSTRUCTION AREAS

When construction work zones overflow into the right of way, or into an on- or off-street bicycle facility, care must be taken to avoid conflicts with people walking and approaching on bikes. If the work zone obstructs an existing bike facility, every effort should be made to provide a facility of the same, or higher level of access and safety through the area. It is unsafe to force people who are bicycling slowly into a shared lane situation, unless posted speeds are 20 or 25 mph. At higher speeds, the speed differential is a potential deadly combination and is an unacceptable option for how to allocate space along higher speed roadways with construction zones.

Typical Applications

- People on bicycles should not be led into conflicts with work site vehicles, equipment, moving vehicles, open trenches, or temporary construction signage.
- Whenever people area allowed to ride bikes through an exclusive work zone area, measures should be taken to provide a continuous path of travel for bikes.
- Construction warning signage guides people on bikes through construction work zones, and/or along route detours.
- Debris should be swept to maintain a reasonably clean riding surface in the provisional bike facility. Allow temporary use of sidewalk in suburban areas (lower walk/bike volumes) by requiring temporary ramps up to sidewalk and down from sidewalk for short zones. Proper shared use signs on sidewalk are needed as well as “bikes yield to people walking signs.”

Design Features

(A) Advanced signage alerts people on bicycles to the changes ahead. Construction warning signage at the site should be located in the furnishing zone of the sidewalk, or in a location

In this poor example, the existing bike lane ends abruptly and forces people to ride in the adjacent vehicle travel lane. The existing bike lane is also covered in gravel and debris, increasing the likelihood of crashes. Options for accommodating bike riding through the construction zone include: strictly limiting the encroachment into the bike lane so it can still be used; requiring daily sweeping; narrowing the travel lanes so the bike lane can continue. If the posted speeds are 20 - 25 mph, another option would be to create a shared lane by providing merge pavement markings and signage, shared lane pavement markings, and signage.

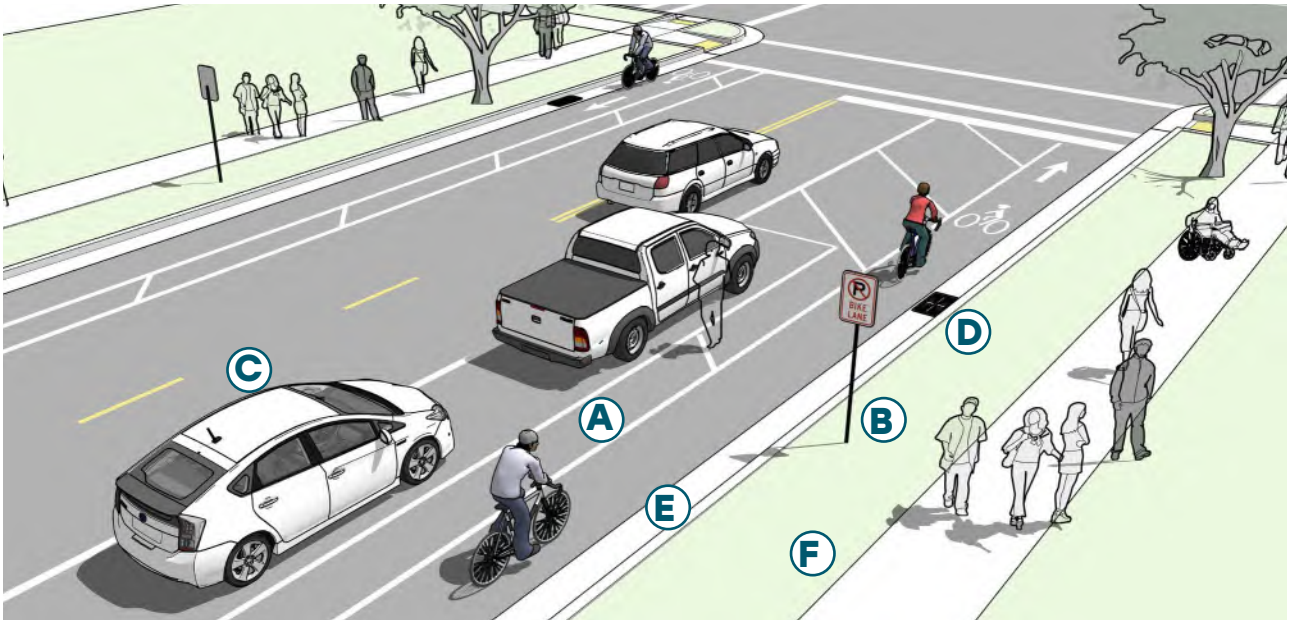
that does not obstruct the designated path of travel for people walking and bicycling. Signage mounts and footings should not pose a hazard for bicycle wheels nor a tripping hazard for anyone walking, caning, or traveling in a wheelchair.

- Steel plates used to cover trenches tend to have a 1”-2” vertical raised lip over the roadway surface. Because the plate is not flush, it can cause a person on a bicycle to lose control as they come into contact with it. Require temporary asphalt (cold mix) around steel plates to create a smooth transition. Require steel plate in use signs.
- Use steel plates only as a temporary measure during construction, not for extended periods.

This existing bike lane was repurposed as a pedestrian travelway, but people riding are forced to merge into the adjacent travel lane. Options for accommodating bike riding through the area could include: widening the pedestrian travelway sufficiently (8-10’, depending on the number of expected users) to create a shared use path of travel; tapering to a single travel lane while providing a bike lane; providing a well-routed bike only detour. If the roadway travel lanes are posted 20 or 25 mph, another option would be to add proper merge areas, signing, and temporary retro-reflective sharrows. Setting a construction speed limit may help to reduce roadway travel speeds and create a safer transition.

Further Considerations

- Contractors should be made aware of the needs of people on bikes, and be properly trained in how to safely route bicyclists through or around work zones.
- Detour paths of travel and routing, detour signage, and path of travel and closure signage should be included on all bikeways where construction activities occur. Signage should also be provided on all other roadways.
- Require both temporary and final repaving to provide a smooth surface without abrupt edges
- Use warning signs where steel plates are in use. These plates can be slippery, particularly when wet. Applying traction to the surface of the plate can reduce the likelihood of slips.



BIKE FACILITY MAINTENANCE

Regular bicycle facility maintenance includes sweeping, snow plowing, maintaining a smooth roadway, trimming encroaching vegetation, ensuring that the gutter-to-pavement transition remains relatively flush, and installing bicycle friendly grates. Pavement overlays are a good opportunity to improve bicycling facilities. The following recommendations provide a menu of options to consider to enhance a maintenance regimen.

(A) Sweeping

The City of Rochester Sweeping Operations Plan will identify debris management to ensure safe surface conditions in bikeways. Debris that is allowed to accumulate can become a hazard due to loss of control, inner tube blow outs, as well as service dog safety.

The following are recommended items to include in the City's Sweeping Operations Plan.

- Cover both on-road and off-road bikeways under the jurisdiction of the city. Can establish a seasonal sweeping schedule that allows for prioritization of routes. The schedule could prioritize facilities designated as major bikeways, before roadways designated as minor bikeways.
- Sweep bikeways periodically to minimize accumulation on the facility to maintain safe surface conditions.
- Identify winter traction material removal protocols to ensure traction materials are removed from bike ways in a timely manner.

(B) Signage

- Include bikeway regulatory and wayfinding signing as part of the roadway sign maintenance program, regularly checking for vandalism, graffiti, and wear. Schedule replacement/repair as needed.

Ⓒ Roadway Surface

- Smooth pothole-free surfaces are especially critical for people on bikes.
- The finished surface on bikeways does not vary more than 1/4" for new roadway construction.
- Pavement should be maintained so ridge buildup does not occur at the gutter-to-pavement transition or adjacent to railway crossings.
- Ensure pavement inspections occur after trenching activities are completed and if excessive settlement has occurred to require mitigation prior to the expiration of the project's warranty period.
- To the extent possible, pavement markings and green-colored areas should be placed out of the vehicle path of travel to minimize wear. In general, striping, pavement markings, and green colored areas should be well maintained especially areas in the path of vehicle travel, and where high-turning movements occur.

Ⓓ Drainage Grates

- New drainage grates should be bicycle-friendly. Grates should have horizontal slats on them so that bicycle tires and assistive devices do not fall through any vertical slats.
- Create a program to inventory all existing drainage grates, and replace hazardous grates as necessary - temporary modifications such as installing rebar horizontally across the grate should not be an acceptable alternative to replacement.

Ⓔ Gutter-to-Pavement Transition

- Gutter-to-pavement transitions should have no more than a 1/4" vertical transition.
- Pavement transitions should be examined during every roadway project for new construction, maintenance activities, and construction project activities that occur in streets.

Ⓕ Landscaping

- Vegetation on the edge of the roadway should not hang into or impede passage along bikeways.
- After storm events, remove fallen trees or other debris from bikeways as quickly as possible.

Coordination With Emergency Responders

- General roadway maintenance should be coordinated and prioritized on emergency response routes that overlap with major and minor bikeways.
- Provide fire, police, and EMS services with a map of major and minor bikeway routes.

Recommended Bikeway Maintenance Activities

The following table summarizes maintenance activities. The City should ensure that each of these activities is addressed in City requirements, various operations plans, or emergency response plans. The frequency of each activity is at the discretion of the City Engineer. However, the activity should be done in a timely enough manner to ensure bikeways are operated in a safe manner for all users.

WINTER MAINTENANCE BEST PRACTICES

Many considerations factor into how to provide safe, ridable bikeway surface conditions and sight lines in the winter. These factors are the bikeway type and the presence and type of vertical protection or separation along a bikeway.

Snow Storage and Roadway Design

There are several roadway planning and design considerations that can be taken to avoid the situation where there is no snow storage provisions.

Plan Roadways with Sufficient ROW

On new roadways, or in roadway re-engineering projects that include bike lanes (or may include them in the future), design the street to provide space within the right of way for snow storage space. Ensure that the snow storage space is of adequate width to accommodate typical snowfall accumulations, allows plows to clear the roadway and bike lane of snow, and allows sidewalks to also be kept clear of snow storage.

Best practice for bike lanes or buffered bike lanes is to plow snow onto the parking strip/snow storage strip as this practice most closely matches that of typical snow plowing operations.

The City standard is to always provide a parkstrip between sidewalk and curb. Calculating the width of the parkstrip is an exercise in right-of-way width available less width allocation to motor vehicle and

A parking protected bike lane in Salt Lake City, UT after a snow plow operation. Photo Credit: Travis Jensen

bike facilities. Additionally, identifying a minimum parkstrip width based on snow storage requirements also needs to be taken into consideration. The width of the snow storage space will depend on equipment capabilities, width of roadway and typical snowfall conditions.

When right of way is restricted to such an extent that only curb-tight sidewalk without snow storage space is available, one of the following techniques needs to be deployed for that segment of the corridor.

Use the Wide Bike Lane Buffer

By providing a wide, painted bike lane buffer, snow plow operations may be able to store snow in the buffer between motor vehicle lane and the bike lane. This requires the roadway plow to plow snow to the right, and the bike lane plow to plow snow to the left. This method may be useful where there is insufficient snow storage area between the bike lane and the sidewalk. Considerations for this method include snow melt. During the day, the stored snow can melt and sheet flow across the bike lane, resulting in a very icy bikeway surface condition. This needs to be countered with a deicing operation.

A recessed thermoplastic bike lane marking in Minneapolis, MN.

Vertical delineators help inform snow plow drivers of obstacles such as cycletracks, raised medians and bulb-outs in Bozeman, MT.

Recessed Thermoplastic Pavement Markings

Milling the area of pavement 3mm in depth where thermoplastic pavement markings are applied has shown to be effective in reducing damage as a result of snowplows in a 2010 study.[1] Minneapolis, MN, mills the area of pavement where thermoplastic bike lane indicators are placed to help reduce damage as a result of snowplows. While this method increases the cost of installation, it may save in long-term maintenance costs (and help preserve safety conditions along the roadway).

Edge-of-roadway Visual Cues

Pavement markings, striping, sidewalks curbs, and other types of travel delineators installed at ground-level serve as good indicators of the bicycle travel way when they the ground is clear, but after a snow event, these lose their utility, and in some cases can become hazards, making the travelway be difficult to navigate.

For this reason it is important to provide other visual cues to indicate the bicycle travelway for those riding and snow plow vehicles. Possible locations for snow storage include the buffer area of protected bikeways, in the place of parked cars in parking protected bike lanes, and along the furnishing zone of the sidewalk. Piling snow in these locations all help to visually define the path of travel and help snow plows operators identify curblines. This becomes especially critical when the bike facility bends in or out around curb extensions, median islands or other transitions.

[1] *Development of Recessed Pavement Markings that Incorporate Rumble Strips. http://www.easts.info/publications/journal_proceedings/journal2010/100292.pdf*

A small snow plow vehicle clears sidewalks in Vancouver, BC.

Small Snow Plow Vehicles

When typical snow plows are too wide to fit, the City can consider using smaller, more specialized vehicles. These specialized small snow plows are becoming particularly important for bikeways that have confined travelways, such as separated bike lanes and trails.[1]

Many cities that experience harsh winter climates maintain a fleet of these specialized small snow plows, which are sometimes referred to as 'downsized street maintenance vehicles' due to the fact that they can be repurposed for other uses throughout the year.

Where used, cities have found that smaller vehicles are effective for cleaning and plowing protected bike lanes, sidewalks and multiuse paths.[2] They can also supplement maintenance activities on other public facilities, such as narrow streets, parking lots, garages, basketball courts, and pedestrian malls.

In addition to making the transportation network more accessible during the winter, cities report operating cost savings and reduced emissions stemming from the

[1] *Andersen, M., & Golly, T. (2016, February 11). How cities clear snow from Protected Bike Lanes: A starter guide. Streetsblog USA.*

[2] *Downsized Street Maintenance Vehicles Case Studies. 2018. NACTO.*

greater fuel efficiency of smaller vehicles.[3] On the other hand, utilizing existing maintenance vehicles such as pickup trucks with mounted snow blades may prove to be much more cost-effective and time-efficient than purchasing smaller vehicles which operate at slower speeds and have smaller plow blades. Regardless, the design of shared use trails and bicycle facilities will need to consider how the snow removal vehicles will access the facility.

Small Snow Plow Vehicle Classes

Due to their wide ranging application, downsized street maintenance vehicles come in many different shapes and sizes. Many small utility vehicles such as pick-up trucks, tractors, ATVs, mini-loaders, bombardiers, skid-steers, and even lawn mowers can be equipped with snow removal devices.

Typically these small vehicles are either equipped with snow plows, snow brushes (effective for removing light snow) or snow blowers (effective for heavy snow). Many small snow removal vehicles can also be equipped with de-icing applicators as well, such as briners and drop spreader salters. Even more specialized attachments can include rotary sweepers and power washers, which extend the vehicle's utility year round.

The combination of vehicle and attachment will change the clearance width and turning radius of the unit, affecting where it can be used. Among the options currently available on the market, clearance widths range from 4 ft - 12 ft with many vehicles being approximately 5 - 5.5 ft. NACTO reports a good rule of thumb for estimating the right size plow for a bike lane: the biggest one that isn't too big.[4]

Fleet Size and Composition

The downsized street maintenance vehicle fleet size and composition are different for every city and depend on climate, use cases, and existing (and planned) active transportation network size. Boston, for example, owns 21 compact sweeping and plowing vehicles from 6 different vendors (each providing unique functions and utility) - in large part because of the number of pedestrian plazas in the city combined with its bike network. Salt Lake City however, needs only one sweeper for its protected bike lanes (3 miles) and 2 compact plows and for the rest of its bike network. The City of Waterloo, which is similar in size to Rochester, maintains its network of sidewalks, trails, and raised cycle tracks with 8 trackless compact plows (in addition to other larger vehicles).

Recommendations

When procuring downsized street maintenance vehicles, the City should consider the following factors.

[3] *Downsized Street Maintenance Vehicles Case Studies. 2018. NACTO.*

[4] *Ibid.*

Test

- A "try before you buy" strategy is recommended to make sure the vehicles meet particular needs, including size, maneuverability, traction, capacity, reliability, and attachment customization and modification.
- Before the acquisition process begins, it is important that maintenance staff demo the equipment personally in order to familiarize themselves with the new vehicles and gain understanding for the benefits of compact equipment. Other cities report that staff buy-in is particularly important for a smooth deployment of a winter maintenance program.

Comfort

- The City should consider features that make using the vehicles safer and more comfortable, such as heated cabs, windshield wipers, and larger cab interiors to accommodate larger drivers as this will help staff complete longer shifts.

Timing

- The City should time the purchase and delivery of the vehicles (which may take a significant amount of time) so that they can be used immediately in the upcoming winter in order to maximize their value (i.e., avoid a springtime delivery).

Training

- The City should provide annual vehicle training for operators, and work to both share the vehicles with other departments to maximize their utility. This will require sustained and robust coordination, as some departments struggle to handle an increased volume of clearing work without a corresponding increase of resources.

Vehicle Class Examples

This page describes generic vehicle classes and names used by most vendors. The actual models and names may differ depending on the manufacturer. They are loosely organized from smallest to largest clearance widths.

See reference table on the following page for details and source information.

Manual Snow Blower

Small ATV

Converted Mower

Mini-loader

Tracked Snow Vehicle

Trackless Tractor

Skid Steer Loader

Large ATV/UV

Pick-up Truck

Tractor

Vehicle Class Examples (cont.)

Reference Table (see previous page)

Category	Approximate Clearance Width	Generic Name
SMALL	1 - 3FT	MANUAL SNOW BLOWER
SMALL	4 FT	SMALL ATV
SMALL	4 FT	MINIATURE TRACTOR/CONVERTED MOWER
SMALL	3 - 4.5FT	MINI-LOADER
MEDIUM	4.5 - 5.5FT	TRACKED SNOW REMOVAL VEHICLE
MEDIUM	5 - 6 FT	TRACKLESS TRACTOR/VEHICLE
MEDIUM	5 - 6 FT	SKID STEER LOADER
LARGE	5 - 6 FT	LARGE ATV/UTILITY VEHICLE
LARGE	7 - 8.5 FT	PICK-UP TRUCK
LARGE	8 - 12 FT	TRACTOR

(Photo location) Sources from top to bottom:

- *Manual Snow Blower, (Philadelphia, PA) Ben Hasty/MediaNews Group/Reading Eagle via Getty Images*
- *Small ATV, (Philadelphia, PA) Will Cowan, Greater Philiadelphia Bicycle Coalition*
- *Converted Mower, (Boulder, CO) John Deere 1500 Series TerrainCut, (Location unknown, used in Boulder Colorado)*
- *Mini-Loader, (Cambridge, MA) City of Cambridge, MA. MassDOT Separated Bike Lane Planning & Design Guide: Chapter 7*
- *Tracked Snow Removal Vehicle, (Location Unknown) Prinoth SW4S Publiquip*
- *Trackless Tractor, (Waterloo, ON) City of Waterloo, Alta Planning + Design*
- *Skid Steer Loader, (Seattle, WA) City of Seattle*
- *Large ATV/UV, (Waterloo, ON) City of Waterloo, Alta Planning + Design*
- *Pick-up Truck, (Waterloo, ON) City of Waterloo, Alta Planning + Design*
- *Tractor, (Boothbay Harbor, ME) Boothbay Register*

WINTER MAINTENANCE PROGRAM

Prioritization and scheduling is a key component of a successful winter bikeway program. For most jurisdictions, keeping all bikeways completely clear during or immediately after a heavy snow event is infeasible. Clearing major city bikeways as soon as possible provides the best access to the greatest number of people possible following a heavy storm event.

The major bikeway network and winter maintenance program need to focus on major local destinations. If roadway clearing and de-icing begins first thing in the morning, primary routes leading to schools, commercial corridors and business districts, and other major destinations should be cleared first.

Snow storage spills out onto a separated bike lane reducing the path of travel along this block in Salt Lake City, Utah.

Coordination between agencies and departments responsible for on-street bikeways and shared use trails is necessary to ensure the major bikeway networks are plowed in an organized, complete, and timely matter.

In Järvenpää, Finland, Class A routes, the main bikeway routes from residential areas to the city center and through the city center, are cleared first. This is followed by Class B routes, bikeways along other major roads, and Class C routes, those along residential streets and through parks.

- Class A routes are plowed within 4 hours of 3 cm of snow accumulation and de-icing treatments are applied before 7am. Plowing is done before 7am when snowing at night.
- Class B routes are plowed within 4 hours of 5 cm of snow accumulation and de-icing treatments are applied as needed. Plowing is done before 7am when snowing at night.
- Class C routes are plowed after class B routes and plowing is done before 10 am.

Sand and road grit is cleared from Class A, B and C bikeways in Järvenpää every year before the 1st of May.

Wisconsin DOT offers guidance on the prioritization of snow removal from shared use trails (Wisconsin Bicycle Facility Design Handbook, 2009 p. A-4, A-5):

Winter use varies according to local conditions. In some communities (e.g. Eau Claire, Madison), trails are plowed regularly due to frequent use. Heavily-used trails that serve key destinations should be considered first for plowing. Trails that serve only occasional use should also considered for snow removal when the trail is the only means of making a key connection (e.g., crossing a bridge). Isolated trails serving recreational users who must travel long distances to use them may be given lower priority. In these cases, managers may want to allow use by cross country skiers or snowmobile operators as long as all applicable laws are followed.

To ensure that winter use is properly accommodated, agencies must clearly understand who will maintain what trail. For trails along state highways, a municipality will have the responsibility for maintenance. Winter use and snow removal frequency will be determined by the municipality after considering the following factors:

- Expected use by bicyclists and pedestrians;
- Parallel options for bicyclists and pedestrians if the trail is not passable

A good winter maintenance program requires a maintenance plan that prioritizes facilities, establishes a maintenance schedule for frequent clearing, and sets operational standards for maintenance relating to facility design, equipment, and materials.

As stated with the DMC, The City Loop should be identified as a priority route for winter maintenance, with the city (or another designated entity) assuming responsibility for snow and ice-clearing operations. In many cases, adjoining property owners maintain sidewalks and shared-use paths. On priority routes not maintained by the city, the city should work directly with property owners by encouraging/enforcing snow removal.

Additional consideration is required during design and operation to provide winter maintenance on separated bikeways. The City's Winter Maintenance Program should be updated to include these facilities.

Major bikeways prioritized for plowing provide direct, predictable, connections for people on bike and these routes may overlap with other designated transit, freight, or emergency service routes and should receive special attention.

In the situation where the main arterial or collector has curb-tight sidewalks and has not provided a specific snow storage location, the bike lane may be used for snow storage when a parallel off-street or parallel route is available and snow operations can keep that parallel facility ridable. Notification of bike lane closure and re-routing to the parallel facility should be provided. Temporary signage, media updates, and routable mapping notifications need to indicate the maintained route.

As discussed earlier in the use of the buffer of a buffered bike lane being used for snow storage, the melting from this pile will sheet flow across the parking protected bike lane and needs to be worked into the overall winter maintenance operation to ensure adequate traction in icy conditions.

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