Technical Memorandum 1

DMC Project No. J8620 _TM_ City Loop 1

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Subject: Revised Interim Deliverable 1 for City Loop

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This interim project deliverable describes work efforts undertaken by SEH and ALTA Planning and Design team members as outlined in the approved Work task and Person- Hour Estimates spread sheet under task 4.0. Precedents and Preliminary Guidance.

Project Precedents

The City Loop team has been investigating additional project precedents including expanding upon those such as the Indianapolis Cultural Trail described in the DMC Development Plan. Precedent investigation will continue throughout the City Loop Study as it is plays an important role in substantiating and proving up the City Loop concept. Precedents covering the following topic areas were selected for review:

- Separated bike and pedestrian facilities
- Integrated, cohesive design aesthetic
- Supportive cycling furnishing/facilities
- High level of streetscape materials and finishes
- Cohesive signing and wayfinding
- Green infrastructure/rainwater management
- Bike share

Project precedents explored are described in Attachment 1 at the end of this Technical Memorandum.

Project Specific Design Guide

The City Loop team has developed a draft project-specific design guide as a resource for further planning and design of the City Loop. The design guide focuses on separated bikeway design considerations because of the vision of the City Loop established in the DMC plan. The guide highlights information from the NACTO Urban Bikeway Design Guide and precedent guidance that is most relevant to the design of the City Loop. The guidance addresses separated bikeway design details, safety measures to address conflict points between bicyclists and drivers, and design considerations for amenities.

The guide is presented on the following pages in draft form and will be updated as the project continues to address additional details relevant to the design of the City Loop.

See Attachment 2 for Project Specific Design Guide at the end of this Technical Memorandum.

Winter Usage

In cities across the northern part of the world, riding in winter is a fast-growing segment of cycling.

Winter and the treacheries it can bring to all travelers has, until recently, been a forgotten season when it comes to riding bikes. Everyone used to put their bikes away in November. Now it's changing. Respondents in each of the last three Winter Cycling Congress surveys were asked, "What would be more likely to take you off of the bike in the winter; bitterly cold temperatures or poorly maintained infrastructure. 76% said poorly maintained infrastructure. It will be critical to ensure that the Rochester City Loop be safe for riding and walking in winter. To keep the pathways ready for riding and walking, we recommend that Rochester consider the following areas of interest to prepare infrastructure for winter:

- Design
- Maintenance (timing)
- Signage

Proper design will allow for ease of maintenance and enough storage for snow to be adequately cleared off of the pathways and adjacent roadways. Effective maintenance plans will insure that the pathways are cleared quickly and effectively.

Rochester sees an average yearly snowfall of 48 inches. Good planning is required to ensure safe travel. Thus, emphasis should be placed on insuring that the bikeways and walkways remain free of snow or ice.

Snow events can leave up to 18" of snow in their wake. Snow storage for these events will be necessary if bikeways, walkways, and roads are to be kept clear from snow. Typically 6 feet of width should be dedicated to storing snow (and planting during the spring, summer, and fall). If the snow storage area fills with snow, it may be necessary to remove the snow from the storage area.

There are two schools of thought relative to managing pathways in the winter:

- Clearing the bikeways and walkways. Preparing the surfaces with brine before events and clearing the snow and ice with snow removal equipment and chemicals (usually salt) after the event has occurred.
- "Groom" the bikeways and walkways such that a packed snow surface is the walking/riding surface of choice. With this method, treatment during freeze/thaw periods will be equally, if not more important. After the freeze, gravel or crushed rock must be spread over the pathway surface. Crushed rock with sharp "corners" can present problems to riders. The crushed rock must be "rounded" to prevent bicycle flat tires.

Clearing Bikeways and Walkways

Plow and/or Salt

Clearing pathways completely is the least expensive and most environmentally damaging of the two strategies. However, the resulting dry pathways are often thought to be the safest. When moving a significant amount of snow off the pathways, it's important to include snow storage space into the design so that both roadways and bikeways and walkways can be clear of snow. When the possibility of creating adequate storage doesn't exist, the timing of maintenance will be important. It will be critical that one operation (pathways or roads clearing) does not push snow or ice onto the other surface after it has been cleared. Almost everyone who rides a bike or walks in winter has experienced the attempt to clear the pathway first for the safety of bike riders, is subsequently negated by adjacent roadway plowing that pushes snow back onto the bikeways and walkways.

If the bikeways and walkways are wide enough to accept pickup trucks with plows, they should work fine. Even where the pathways are 12 feet wide, winter maintenance which leaves an 8-foot pathway will be adequate in winter.

Up to twenty-four hours before snow or freezing rain events, it is helpful to apply salt brine to the pathway surfaces to reduce the amount of snow clearing during or after the event.

Grooming

Many cities in Northern Europe, in part as a response to the undesirability of using chemicals and the resultant pollution to rivers and lakes, are beginning to groom their pathways for bicycles. This entails allowing as much as five inches of snow to accumulate then grooming the bikeway and walkway with specially designed plows which leave the five inches on the ground then "comb" it with the specially designed bucket or blade.

Before the snow reaches the five-inch depth, plows can "comb" the surfaces instead of plowing. This results leave about a quarter inch of soft snow on top of the snow pack. One can ride on these surfaces safely and comfortable without snow or studded tires. Oulu, Finland has groomed its extensive network in just this way

When conditions are icy from freeze thaw or freezing rainfall, the best solution is to liberally spread crushed rock - granite or limestone on the surface. The gravel must be rounded so as to not cause flat tires. In the spring, the rock can be swept and re-used the next season.

Signs

Most protected bike lanes are identified, in part, by paint markings in the lane. When it snows or in the aftermath, these signs are often covered for days at a time. It will be important to create a signage system that identifies the facilities. This signage can be integrated with wayfinding signs.

Pathway Conditions – Crowd Sourcing

Ideally, pathways will be cleared or groomed by as early as 6:00 AM after a storm or snow event. If this is not possible, it can be a deterrent to riders who would otherwise use the system for their commute. If pathway maintenance work becomes inconsistent across the network, it will be important for Rochester to keep riders informed as to pathway conditions. Social media can help people keep informed through crowd sourcing of the information. We recommend the creation of Facebook and Twitter accounts where riders can post information about the condition of pathways. This will mitigate the adverse effects of parts of the network being unsafe or worse, impassable.

Bike Share in Rochester

Cities all over the world are trying to attract younger workers in the wake of the demographic shift that is changing the way that cities are competing. Communities are using bike share to attract younger workers and residents. In this way, bike share should be seen as a tool for community development and not solely as a recreational activity.

Bike share is a fast-growing phenomenon around the United States and the world. Most bike share programs are locally based with a few exceptions outside the United States. The opportunity to create a bike share program in Rochester will offer a myriad of opportunities to the city; its residents and visitors to the city.

What Is Bike Share?

The history of bike share goes back decades. The first bike share "systems" were the so-called yellow bikes. Cities deployed yellow bikes around town and anyone could ride one and leave it where they wanted for the next person to ride. Maintenance and theft plagued those systems until, one by one, they were abandoned. In the last 20 years, beginning in Europe, bike share systems became

automated. A customer could, through the use of a credit card, take out a bike for trips of limited times and distances. Cities had service areas within which bikes were placed. The concept spread to North America with Montreal, Washington D.C. and Minneapolis leading the way. Now dozens of cities with systems of all kinds are in operation. They are:

Smart Dock Systems

- Bikes all reside at a station.
- Each station has docks for bikes and a kiosk for the transaction to get a bike.
- Bikes are returned to any station with the system.
  - Advantages: Rebalancing (keepings bikes where customers are) is simplified; Customers can identify bike share stations; opportunities to promote brand through station ads.
  - Disadvantages: Capital costs are highest in this form of bike share programming; Lack of flexibility for future technologies.

Smart bike systems

- Bikes can located anywhere in a defined service area.
- Bikes can be rented through on-bike technology.
- Bikes can be left anywhere in the service area.
  - Advantages: Capital costs lower; system flexibility allows for more customer options.
  - Disadvantages: Tracking bikes dependent on battery life; Re-balancing is more complex and expensive.

Hybrid systems

- Bikes can be located at designated stations or anywhere in the service area.
- Once a ride is complete, the bike can be left anywhere within the service area or returned to a station. Usually financial incentives are used to encourage customers to return the bikes to stations.
- Both smart dock and smart bike providers are increasingly moving to this scheme.
  - Advantages: Capital costs approach the smart bike systems; different areas of the city can be served in different and appropriate ways; flexibility will allow changes in the future; Manufacturers and suppliers are increasingly moving to this technology.
  - Disadvantages: Rebalancing can be more cumbersome and expensive.

Bike share systems operate in different sized markets. Some examples are:

- Large City – New York City – Smart Dock System
  - 10,000 bikes
  - 600 stations
  - Annual membership - $155.00

  - Day pass - $12.00 for unlimited 30 minute trips within 24 hours
  - Open year-round
  - Title sponsor – Citibank
- Mid-sized City – Portland, OR – Hybrid System
  - 1,000 bikes
  - 100 stations
  - Annual membership - $144.00 per year for 90 minutes of ride time per day
  - Casual use - $12.00 per day for 180 minutes of ride time
  - Open year-round
  - Title sponsor – Nike
  - Riders are charged $2.00 to leave a bike within the service area but NOT at a station and $20 for leaving the bike outside of the service area
- Mid-sized City – Minneapolis/St. Paul – Smart Dock System
  - 2,000 bikes
  - 200 stations
  - Annual membership - $85.00
  - Casual use - $4.00 per half hour
  - Open April through October
  - Title sponsor – Blue Cross Blue Shield of MN Center for Prevention
- Small city – Fargo, ND – Smart Dock System
  - 101 bikes
  - 11 Stations
  - Annual membership - $75.00 – North Dakota State University students ride as part of their student fees – unlimited 30 minute rides.
  - Casual use - $4.00 per hour
  - Open 6:00 – midnight
  - Closed for winter
- Very Small City – Bemidji, MN (pop. 13,000) – No-tech System
  - 200 bikes
  - 4 staffed locations
  - Market rate rental rates ($6/hour)
  - Monday – Thursday free for local residents
  - Open 8:00 AM – 8:00 PM
  - Program sponsor - Blue Cross Blue Shield of MN Center for Prevention

  (NOTE: The current program in Rochester, operated by Nice Ride Minnesota is configured similar to Bemidji)

What Are Bike Share Key Success Factors?

The answers to this question are varied. There are several measurements. The most successful programs will benefit from several of the following:

- The number of bike share trips taken.
  - New York and Fargo lead this measurement in the US for different reasons. New York has a high-density service area and Fargo offers service free to students. Both have among the highest trips per bike per day in North America.
- How well all of the city's and town's inhabitants are served?
  - If a city of town is a tourist destination, bike share use will differ from cities or towns where the bikes will be used as transportation.
- Revenue
  - Revenue will help municipalities improve the customer experience.
  - Revenue will ease the need for sponsorships.
  - Revenue will fuel bike share as a more attractive partner in the shared mobility ecosystem.
- Integration with other modes of transportation
  - Using bike share as an adjunct to other modes of transportation will enhance its contribution to communities. Local transit organizations should be able to integrate their ID and payment systems with bike share so that transit and bike share customers can have a seamless trip experience. Metro Bike Share in Los Angeles comes close by allowing TAP card users to ride transit and take a bike. Payment systems, however, remain separate.
  - There are models, particularly Helsinki, Finland for how to integrate transit successfully into bike share operations.
- Effects of biking – mode share, new cyclists, equity.
  - Does having bike share in a community increase the number of cyclists?
  - Does bike share add to other measurable community outcomes?
- Positive environmental, health and economic outcomes
  - Does bike share create a positive environmental impact?
  - Will bike share improve health outcomes?
  - Will bike share stimulate the local economy by delivering customers directly to local businesses?
- Positive experience for all customers/users.

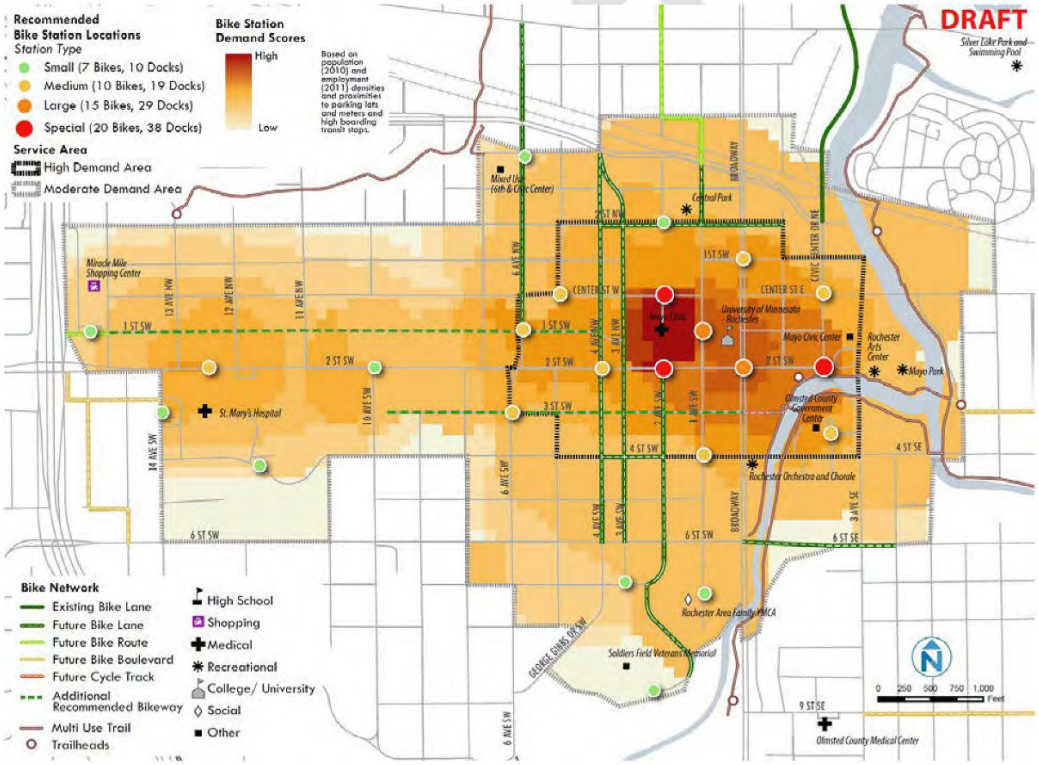
Success is measured, as much by which measurements are important to cities and towns. Each might have their own objectives that bike share will help them realize.

Bike Share in Rochester

In 2013, Nice Ride Minnesota and Blue Cross Blue Shield Center for Prevention commissioned Nelson Nygaard to conduct a bike share study to determine if bike share would be feasible in Rochester. In part, the study considered population density, potential use, and the extent to which the Mayo Clinic would influence the location of stations. After studying bike share programs in three comparable cities, Madison, WI, St. Paul, and Chattanooga, TN, the study found that operations would cover just 7% of operations costs. This is due in large part, to the lack of bicycle facilities in and near Downtown Rochester. In the Twin Cities, Nice Ride sees one trip in Downtown St. Paul for every ten trips in Downtown Minneapolis. For bike share to be successful, people need to feel safe riding.

The development of the City Loop and bike infrastructure along 2nd Street SW bodes well for bike share in Rochester. The study recommended placement of 22 locations in and around the center of Rochester. These locations would consist of docks or racks of varying numbers of bikes. The Nelson\Nygaard report identified 22 stations shown on their Figure 2, Recommended Initial Service Area and Station Locations. The system described by Nelson\Nygaard primarily served the Mayo Clinic, St. Mary's campus, and Methodist Hospital. Other locations were placed at destinations or

Figure 2 Recommended Initial Service Area and Station Locations



higher density areas within the city. The service area is quite compact. It is a 10-12 minute bike ride from one edge of the service area to another. Given the number of trips between St. Mary's and the Mayo Clinic, we believe the stations located near St. Mary's Hospital might be too small. Since the

report was completed, advances in smart bike technology have made it a better choice for some communities that need more flexibility in serving the community.

The study found that, with current conditions including the number of miles and quality of safe bicycle infrastructure Downtown Rochester, an urban automated bike share was not feasible and could not be financially sustained. The study did not consider the feasibility of a bike share system in Rochester that included safe and efficient biking and walking infrastructure such as the DMC City Loop. The DMC Development Plan introduced the concept of expanding bike share in support of DMC investments and in support of the City Loop. Figure 7.5-41 from the plan illustrates possible locations for bike share stations along the proposed City Loop route.

There is an opportunity to serve the DMC Development Districts as they come online. All of the DMC Development District locations are close enough to one another to allow for bicycling or walking from place to place. With the completion of the City Loop and other Downtown bike facilities, riding will be safer. Higher density, long a key success factor of bike share, will also come as a result of the new DMC development.

Based on the envisioned DMC development, Alta recommends changes to the Nelson Nygaard map of station locations. As shown in Attachment 3, we recommend shifting the location at 1st Avenue SW and 4th Street SW to 2nd Avenue SW and 5th Street SW to better serve Discovery Square. We also added a station at 1st Street SW and 6th Avenue SW at the Peoples' Coop block to serve the people who are currently using Nice Ride at this location.



FIGURE 7.5-41 - RECOMMENDED BIKE SHARE SYSTEM INTEGRATED WITH CITY LOOP

Once the City Loop and other Downtown bike infrastructure is complete, we recommend that hybrid system be implemented. This would allow flexibility for customers and for the bike share operator. The Nelson Nygaard study assumed that a smart dock system would be the best alternative but developments in bike share allow for a viable alternative that could better serve the city. The "stations" shown on the map would be the racks. It's to these locations that customers would have the incentive to return the bikes. As explained above they could leave them anywhere.

Nice Ride Minnesota, working with a stakeholder group that included: The Mayo Clinic, The City of Rochester, DMC, Rochester Parks and Recreation Department, Rochester Convention and Visitors Bureau, and others, met many times over two years to determine the configuration of a bike program that would be best for the city under current circumstances.

As a result, Nice Ride Minnesota began, in the summer of 2016, a non-automated bike program with two staffed locations (Peace Plaza and the People's Coop) and a service center where bikes are maintained and stored. They provided 180 bikes for the rental program as well as future ancillary programs.

Customers rent the bikes at market rates for rides around town and along the many trails in the city and surrounding area. In addition, Nice Ride Minnesota arranges and attends events to encourage people to ride. The program is designed to appeal primarily to tourists, family members of Mayo Clinic patients, and residents who live or work downtown.

In 2017, Nice Ride plans to expand the number of locations based on research conducted this season and requests from locals. There are plans to engage the Mayo Clinic with a program to provide bikes for long term patients who are receiving longer term care, are able to ride, and need something healthy to occupy their time. At some point Nice Ride plans to convert the program to a technology driven urban bike share program.

In fall 2016, Nice Ride offered free rides from St. Mary's to and from the Dan Abraham Healthy Living Center. As part of an intercept survey, riders were asked a number of questions about their experience. Parking limitations, rush-hour congestion, the expense, and health implications all point to riding a bike for transportation as a viable alternative to driving, especially within the Rochester city limits. The survey reinforced this assumption.

The survey accounted for only two locations but both were popular destinations in Rochester and one can expect that surveys at any future DMC Development District locations would see similar results. As the DMC Development Districts are built, more opportunities for active transportation from one place to another in the center of Rochester will be realized and bike share can support this.

The landscape for bike share has changed in Rochester. Things have changed both in planning and in projects recently built. Downtown developments are signaling a greater density in the center of Rochester. This together with the DMC Development Districts suggest that bike share will be more

feasible in the few years to come. The success of bike share depends largely on density and on the availability of safe places to ride. As both come to Rochester, expect bike share to be a success.

Community Partners

Existing community groups active in Olmsted County and the City of Rochester with knowledge, skill and potential interest in partnering coming together to support the expansion of a bike share program include:

Rochester Bike Coalition (We Bike Rochester)

This is an active group bringing people together to support biking in Rochester. They host several annual events with the goal of getting more people on bikes. They lobby at city hall for biking and walking policy. They will be a strong supporter of the Downtown City Loop implementation.

Mayo Clinic Community Fund

The fund supports, among other things, active living and active transportation. They are one of the large local funders of Nice Ride Minnesota in Rochester.

The People's Coop

Coops and bikes go well together. The Peoples Coop Downtown Rochester is a Gold League of American Cyclists Bike Friendly Business. They were awarded the Bike Friendliest Business for 2016 by the Bike Alliance of Minnesota. They have been a strong supporter of bike events in the city and will be a strong participant in helping to realize the City Loop.

Olmsted County

Through the administration of SHIP (State Health Improvement Program) funding, the County is an active supporter of active transportation.

Review of Current Guidance

The following represents a review and summary of design guidance from the DMC Draft Development Plan: Section 7 - Transportation Plan and Appendix 10 – Active Transportation. More detailed, in-depth consideration of design guidance is planned within the City Loop team's scope of work in Task 5.

Pedestrian Components:

- Wide walkway to accommodate all mobility levels
- Minimum width: 5 feet

- Preferred width: 10 feet
- Street furnishings are important
- Materials: concrete, granite pavers, bricks
- Alternating bands of brick on the approach to intersections: to alert pedestrians of the intersection
- Contrast in colors to assist pedestrians with low-vision

Interaction with Bikeway:

- Separated from the bikeway with a landscaped furnishing zone
- Brick bands used to identify pedestrian crossings of the bikeway

Comment: Concern about using a mix of materials such as unit paving with beveled profiles and numerous joints – this will create problems for people using mobility devices and also pushes recommendations of ADA.

Protected Bikeway:

Separation from motorized traffic using a landscaped buffer, grade-separation, and parking buffers in some areas.

- Minimum width of separation: 2.5 feet
- Raised 6" from street level
- Two-way facility
- Minimum width: 10 feet
- Desired width: 12 feet

Two-way traffic separated by yellow dashed striped and pavement markings showing the direction of travel.

Materials: different from the asphalt roadway and the pedestrian walkway

Recommended locations:

- 6th St SW
- 11th Ave SW
- 2nd St SW
- 4th Ave NW/SW

Comment: Concern about using a mix of materials such as unit paving with beveled profiles and numerous joints – this will create vibrations and increase possibility for tire catching. Uniform, moderately smooth surfaces provide the safest and most pleasing riding experience.

Bikeway Multi-Use Trails:

DMC plan says it is not necessary to have separated bicycle and pedestrian facilities at every location on the City Loop.

- Multi-use facility design:
  - Desired width: 12 feet
  - Minimum width: 10 feet
  - 2-3 foot buffer on both sides of trail
- Recommended locations:
  - 7th Ave SW
  - 5th Ave NW
  - 4th St SW
  - 3rd St NW
  - Cultural Crescent
  - Kutzky Park trail
  - South Zumbro trail

Comment: Concern about mixing and matching separated facilities with multi-use paths. This will create confusion for users, particularly people who are visiting.

- Shared Street
  - Minimum 18 foot wide shared space
  - Chicanes and other design features to slow vehicle speeds
  - Paver materials consistent with other parts of the City Loop
- Recommended intersection treatments:
  - Curb extensions
  - Median refuge islands
  - Leading pedestrian intervals
  - Separate signal phases for bicycles: use loop or video detection to initiate a separate bike phase for through movements
  - Bike pavement markings at intersections and driveways
  - Transit stops should always be on the inside of the City Loop, with the bicycle facility wrapping around the outside of the transit stop
- Design considerations for universal access:
  - Solid surfaces
  - ADA compliant curb ramps
  - Maximum cross slope of 2 percent
  - Non-slip travel surfaces
  - Increased pedestrian signal cycle time
  - Leading pedestrian intervals at signalized intersections
  - Clear sight distance

  - Visual-tactile strips at crossings
  - Accessible text on signage
  - Accessible pedestrian signals
  - Signs with universal symbols/icons
- Other design considerations:
  - Street trees are an important component; provide shade, create more human scale
  - Desire for green street elements: bio-swales, pervious pavement, etc.

High Level ADA Assessment

In preparing an assessment of existing conditions including ADA requirements, team members walked and cycled the City Loop alignment (including several adjacent streets adjacent streets) as described in the DMC Development Plan on three separate occasions between July and October. Conditions were recorded using digital photography and noted on 1":100' scale aerial photos (north loop and south loop) with embedded 2 foot contour interval mapping.

The proposed City Loop routes appear to meet ADA requirements for centerline gradient (less than 5%) and cross sectional gradient (2% or less) with the exception of two areas:

- Existing multiuse trail connection from Kutzky Park to the sidewalk along the south side of Civic Center Drive includes a short segment of approximately 12.5%.
- The gradient of 7th Avenue SW ranges from 5% up to 12.8%.

The 7th Avenue corridor includes several other constraints such as numerous large street trees, stone retaining walls and tree lawns of varying widths and continuous overhead utility lines. Existing buildings appear to be a mix of single and two family residences. In total, these conditions make it difficult for this route segment to support the type of high quality pedestrian walkway and cycling facilities envisioned for the City Loop.

6th Avenue SW was also reviewed as an alternate to 7th Avenue and was found to also exceed ADA gradients over several blocks. With the ADA accessible 4th Avenue lying three blocks to the east it may be more practical to use it instead of 7th Avenue.












STOP



Additional ADA constraints occur along the Cultural Crescent segment between 2nd St NW and 3rd St. NW in relation to crossing the existing rail spur.

Figures 1.1 and 1.2 High Level ADA Assessment North and South Segments illustrate the team's comments along with an assessment of pedestrian ramps. A variety of pedestrian ramp treatments were found. Ramp treatments included weathered steel detectable warnings and drop curbs, exposed aggregate dateable warning areas with drop curbs and detectable warning with a drop curb. Intersections were rated using a rating of 8 out 8 for a fully compliant 4-way intersection. It appears that the City is in the process of upgrading pedestrian curb ramps throughout the project area on an ongoing basis.

DMC Development Plan Route Assessment

In addition to ADA parameters, the City Loop's proposed route and proposed design typologies (protected bike lanes, multiuse paths, etc.) were reviewed with respect to existing potential physical constraints such as overhead utilities, significant street trees, street width, on-street parking, driveway curb cuts, integration with or addition to existing trails and adjacent supportive land use and visual quality or urban design character. While additional analysis and discussion are warranted, Figure 1.3 illustrates the team's initial suggestions for route refinement.

Utilizing the western segments of the existing riverfront Downtown Loop, at least initially provides a convenient and attractive alignment for the waterfront portion of the City Loop. Connections to the east side of the river can easily be made using the existing riverfront rail's bike/ped. bridges. As multi-use pathway in the range of 10 feet wide, the riverfront trails are limited in their ability to fully provide the low stress, high safety, uniquely branded user experience ultimately envisioned for the City Loop. Making improvements to some of these trails such as adding width, adding separate walking paths, and adding signature pavement treatments, lighting, signing and furnishings would help to create and reinforce the City Loop brand.

Utilizing 1st Ave. SW from 2nd St. SE (Cultural Crescent segment) up to the City paint shop (proposed for future redevelopment) at Civic center Drive allows for the repurposing of on-street angled parking as City Loop and avoids a variety of issues related to the rail spur.

Extending the Central Station segment westward along 3rd Street NW to 8th Ave. NW provides for a more direct and efficient route to enter Kutzky Park via a new bike/ped. bridge over the creek. The elevation of the land as one moves from the street end into the park, aligns well with the elevation of the existing trail. Alternatively, the route could be extended westward to utilize the existing creek bridge crossing at 9th Ave. NW however this further reduces the length of City Loop within the park.

Avoiding the Pill Hill neighborhood and extending the use of 2nd Street SW (St. Mary's Place segment) eliminates ADA issues however, it also modifies the user experience emphasizing efficiency over diversity of visual character and charm.

A spatial analysis of existing street designated as the initial DMC Development Plan City Loop route was conducted using the provided GIS data and aerial photography. The analysis examined street widths and presence of street trees and the potential tradeoffs required for implementing a protected bike facility. Findings are described in Table 1.

The City Loop team anticipates undertaking another more detailed route assessment using the evaluation criteria currently being prepared. This will include application of system typologies and phasing.

Land Use

Land uses along the DMC Development Plan City Loop route were reviewed with respect to interpreted influences on supporting and or boosting the City Loop's user population. As identified in the DMC Development Plan, each Loop Experience (route segment) includes a mix of uses. These are described in Table 2 as an attachment to this Technical Memorandum.

Table 1. Land Use Review

LOOP EXPERIENCES / ROUTE SEGMENTS	LAND USE ANLAYSIS
Central Station	Mix of civic/park open space, institutional physical plant and employee surface parking, social service, and high density residential. Residential and park provide a pool of potential riders/users as well as an attraction/destination along the City Loop. The future transit center represents a significant investment in multimodal connectivity and could be highly supportive of the City Loop by serving and potentially adding users.
Cultural Crescent / Waterfront	Mix of commercial / retail, high density residential, social service/residential, high rise lodging, office/industrial, structured parking and civic uses (library, event center and open space trails). The diversity of uses provides a supply of employees, residents and visitors to potentially use the City Loop users. Existing users of the existing Downtown Loop multi-use trail within the river corridor provide an initial City Loop user group.
Soldier's Memorial Field and University of Minnesota	Mix of civic / park and open space, institutional, social service, commercial, lodging, surface parking and moderate density residential. This segment includes a number of community assets that serve as attractions and destinations for residents, employees and visitors. The City Loop could help increase walking and cycling as a preferred transportation mode for accessing these altercations. The area's moderate job and housing densities may not significantly boost the number of City Loop users in the

LOOP EXPERIENCES / ROUTE SEGMENTS	LAND USE ANLAYSIS
	near term however, redevelopment of surface parking lost could contribute new users over the long term.
Saint Mary's Place and Historic Pill Hill	Mix of healthcare, institutional, commercial and moderate to low density residential. Current job density is concentrated at Saint Mary's Place. Future expansion plans could further boost users of the City Loop. Residential densities are highest along 2nd Street SW and taper off within the Historic Pill Hill neighborhood. Future residential and or mixed use redevelopment could help increase City Loop's user base.
Kutzky Park	Mix of low to moderate density residential, day care, and park-open space. Current job and housing densities could add a modest number of City Loop users. If future redevelopment includes medium density residential and or commercial mixed use, the City Loop could see a boost in users. Kutzky Park and its trail system serve as a local attraction and would provide an attractive, low stress environment for City Loop users.
The Heart of the City	Mix of healthcare, educational, office/commercial, lodging, institutional-worship, structured and surface parking. Job density and visitor levels provide the strongest potential for supporting City Loop investments from the outset. Future Mayo expansion and DMC redevelopment will help build user base over the long term.

Attachments to Technical Memorandum 1

Figures 1.1 and 1.2 - High Level ADA Assessment North and South Segments

Figure 1.3 - Suggested Route Refinement

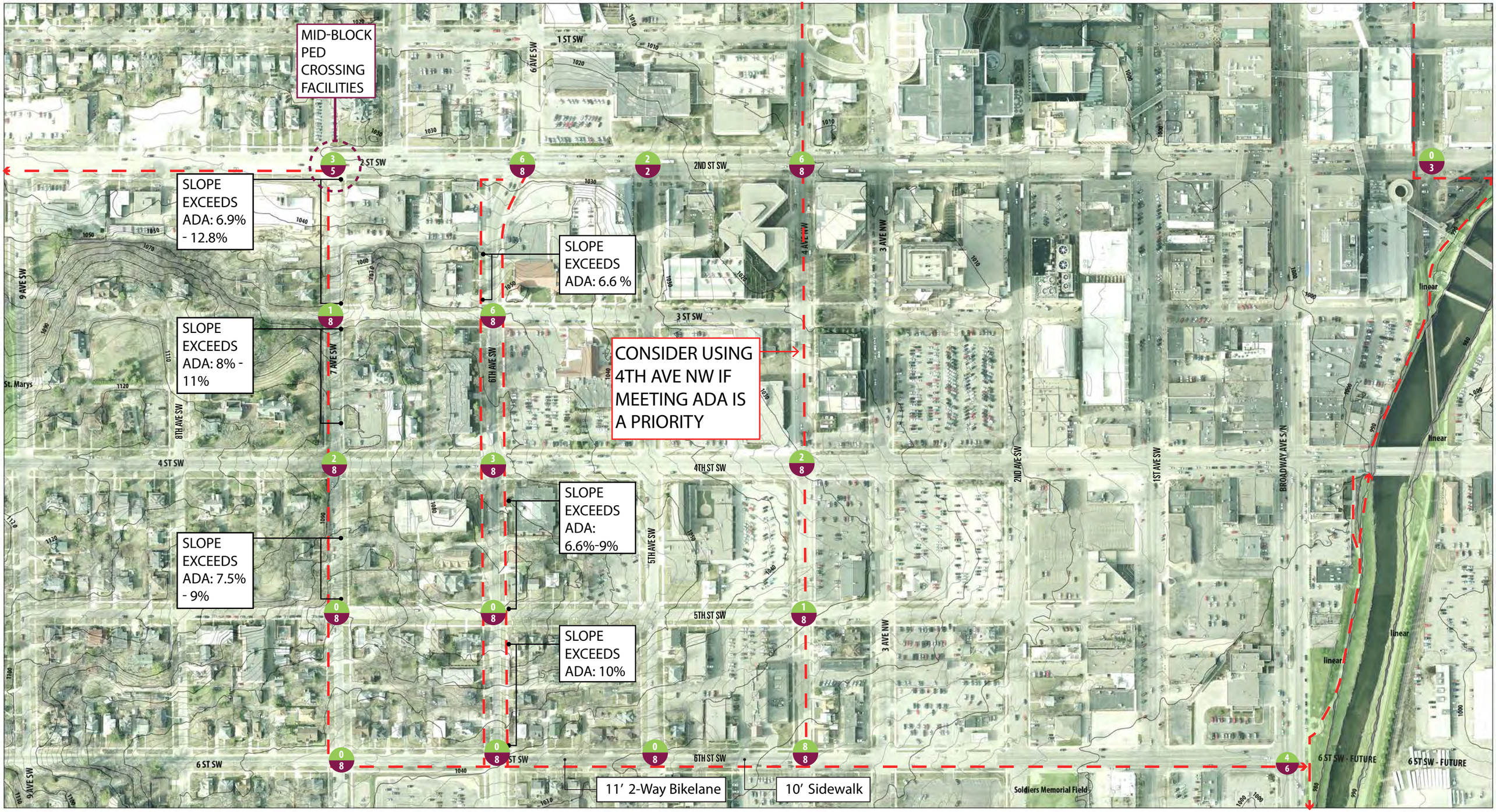
Table 2 - City Loop Spatial Analysis

Attachment 1 - Project Precedents

Attachment 2 - Bikeway Design Guide

Attachment 3- Bikeshare Map

Figure 1.1



SEH SEH TEAM 12.12.16

HIGH LEVEL ADA ASSESSMENT

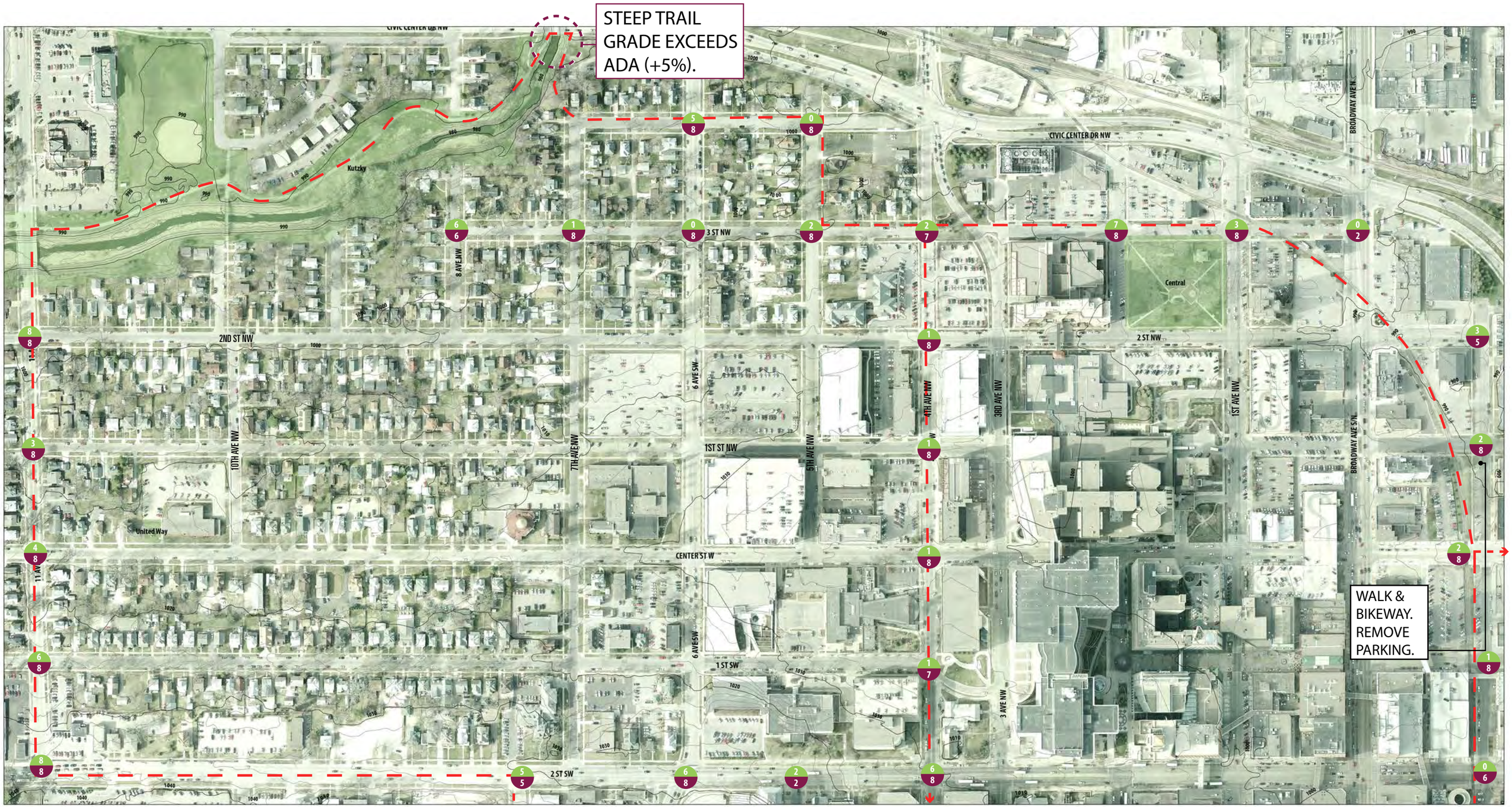
City Loop South Segments

DMC City Loop Proposed Route

# of adequate pedestrian ramps.
Total ADA pedestrian ramps needed.

100 Feet

Figure 1.2



SEH SEH TEAM 12.12.16

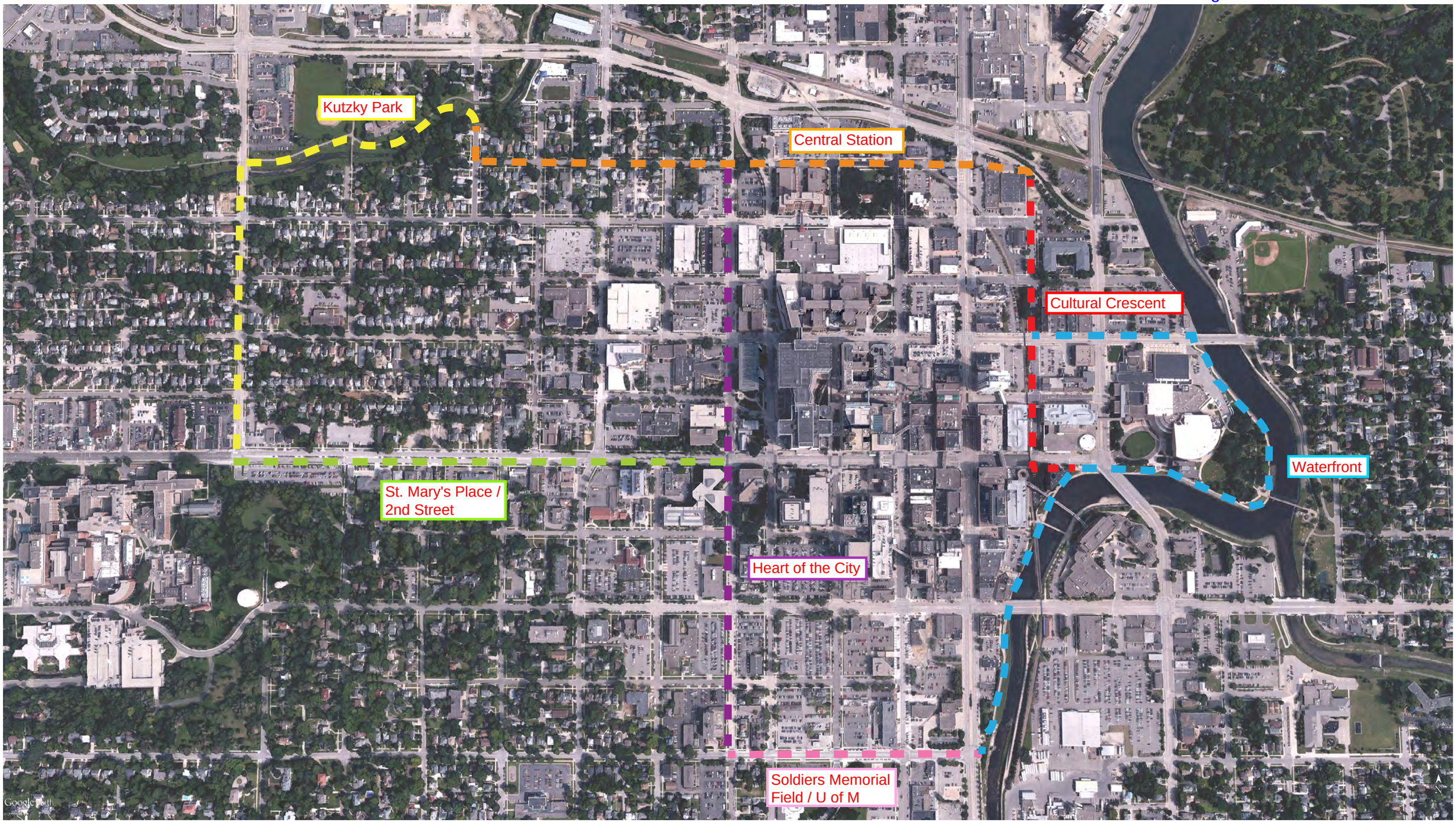
HIGH LEVEL ADA ASSESSMENT

City Loop North Segments

DMC City Loop Proposed Route

# of adequate pedestrian ramps.
Total ADA pedestrian ramps needed.

100 Feet


Kutzky Park
Central Station
Cultural Crescent
Waterfront
St. Mary's Place / 2nd Street
Heart of the City
Soldiers Memorial Field / U of M
Google Earth

City Loop Spatial Analysis

STREET	TERMINI	ROW WIDTH	STREET WIDTH 1	STREET WIDTH 2	Recommended Bikeway Design	Tradeoffs	Bike Share Facility Locations
Central Park and Transit Terrace							
3RD STREET NW	1ST AVE NW TO 2ND AVE NW	75	31.15		Two-way raised separated bikeway - south side of street	The City Loop would be adjacent to Central Park, which provides some flexibility behind the curb. The City Loop could be built in place of the existing sidewalk, with the sidewalk shifted further south. This would limit impacts to mature trees, utilities, and parking, but it would have some impacts to the park (including to what appear to be horseshoe pits). An alternative would be to repurpose the existing angle parking for the City Loop.	
3RD STREET NW	2ND AVE NW TO 3RD AVE NW	75	33.28	40.41	Two-way raised separated bikeway - south side of street	On-street parking would need to be removed to accommodate the City Loop.	
Cultural Crescent / Waterfront							
RAIL SPUR		12.56 to 25					
1ST STREET NE	RIVER TO CIVIC CENTER DR NE	75	49.55		Two-way raised separated bikeway - north side of street	Impacts to on-street parking on one side of the street. It is recommended to repurpose existing street space to avoid impacts to street trees and the Riverview Suites driveway.	
1ST STREET NE	CIVIC CENTER DR NE TO 3RD AVE NW	75	40.93	50.23	Two-way raised separated bikeway	Impacts to on-street parking on one side of the street. It is recommended to repurpose existing street space to avoid impacts to mature street trees.	
Soldier's Memorial Field & U of M							
6TH STREET SW	BROADWAY AVE S TO 1ST AVE SW	70.93	60.76		Two-way raised separated bikeway - north side of street	Requires removal of one travel or turn lane, or impacts to street trees and possible acquisition of ROW.	
6TH STREET SW	1ST AVE SW TO 2ND AVE SW	75	44.18	59.2	Two-way raised separated bikeway - north side of street	Impacts to on-street parking on one side of the street. It is recommended to repurpose existing street space to avoid impacts to new streetscaping as part of the recent street reconstruction and redevelopment. There would be some impacts to bump-outs.	
6TH STREET SW	2ND AVE SW TO 3RD AVE SW	75	45.47		Two-way raised separated bikeway - north side of street	Recommend shifting sidewalk slightly north and constructing City Loop in place of the existing bike lane and boulevard. There do not appear to be right of way impacts.	
6TH STREET SW	3RD AVE SW TO 4TH AVE SW	75	45.6		Two-way raised separated bikeway - north side of street	The City Loop could be constructed in place of the existing turn and bike lanes without impacts behind the curb. If turn lanes remain, there will be impacts to a mature tree on the north side of the street and possible private property impacts (to an apartment driveway and steps to a home). It is not clear whether the apartment driveway and steps are within or outside existing ROW.	NN Study recommended at 7th St and 3rd Ave S. Recommend shifting location to 6st St and 3rd Ave S.
4TH AVENUE SW	6TH AVE SW TO 7TH ST SW	75	37.56		Two-way raised separated bikeway - west side of street	Requires removal of on-street parking on one side of the street.	
4TH AVENUE SW	7TH ST SW TO 6TH ST SW	75	33.2		Two-way raised separated bikeway - west side of street	Requires removal of on-street parking on one side of the street.	
Saint Mary's Place & Historic Pill Hill							
6TH STREET SW	4TH AVE SW TO 5TH AVE SW	75	33.03	44.69	Two-way raised separated bikeway - north side of street	Recommend removing on-street parking on one side of the street in order to preserve mature street trees. The City Loop would impact bump-outs at 5th Ave SW.	
6TH STREET SW	5TH AVE SW TO 6TH AVE SW	75	36.4		Two-way raised separated bikeway - north side of street	Impacts to on-street parking on one side of the street. Recommend constructing City Loop in place of parking to preserve mature street trees.	
6TH STREET SW	6TH AVE SW TO 7TH AVE SW	75	32.52		Two-way raised separated bikeway - north side of street	No parking is currently allowed on this block, but it is possible the street is used for school bus queuing. Recommend repurposing roadway space to avoid impacts to mature street trees and utilities.	
7TH AVENUE SW	6TH ST SW TO 5TH ST SW	75	27.95		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking to avoid impacts to mature street trees. The west side would better connect with the 2nd St portion of the City loop. The east side has more flexibility (wider boulevard space) and would connect better to the 6th St segment of the City Loop, but there would likely be utility impacts.	
7TH AVENUE SW	5TH ST SW TO 4TH ST SW	75	27.82		Two-way raised separated bikeway - west side of street	This block of 7th Ave is very narrow. Parking would need to be removed and there would not be enough roadway space to maintain two-way traffic operations without shifting the curb line on the east side of the street. Retaining walls are at the back of the sidewalk on the west side of the street.	
7TH AVENUE SW	4TH ST SW TO 3RD ST SW	75	24.57		Two-way raised separated bikeway - west side of street	This block of 7th Ave is also very narrow. Parking would need to be removed and there would not be enough roadway space to maintain two-way traffic operations without shifting the curb line on the east side of the street. Slopes on the west side of the street would create design challenges.	

City Loop Spatial Analysis

STREET	TERMINI	ROW WIDTH	STREET WIDTH 1	STREET WIDTH 2	Recommended Bikeway Design	Tradeoffs	Bike Share Facility Locations
7TH AVENUE SW	3RD ST SW TO 2ND ST SW	75	24.44		Two-way raised separated bikeway - west side of street	This block of 7th Ave is also very narrow. Parking would need to be removed and there would not be enough roadway space to maintain two-way traffic operations without shifting the curb line on the east side of the street.	
2ND STREET SW	7TH AVE SW TO 9TH AVE SW	100	26.42 TO 34.(	28.37 (EB)	Two-way raised separated bikeway - north side of street	Impacts to on-street parking and/or newly installed streetscaping. South side is better from a connectivity standpoint: higher density of land uses and connection to St. Mary's. However, there is less room between and behind the curbs on the south side.	
2ND STREET SW	9TH AVE SW TO 11TH AVE SW	100	27.07 TO 35.2	28.11 (EB)	Two-way raised separated bikeway - south side of street	Impacts to on-street parking and/or newly installed streetscaping.	NN Study: recommended at 10th Street
Kutzky Park							
11TH AVENUE SW	2ND ST SW TO 1ST ST SW	66	49.27		Two-way raised separated bikeway - west side of street	Could possibly require removal of one lane or acquisition of a small amount of additional ROW.	
11TH AVENUE SW	1ST ST SW TO CENTER ST W	66	37.05		Two-way raised separated bikeway - west side of street	Recommend repurposing existing street space for the City Loop. No parking is currently allowed on 11th Ave. If the City Loop is constructed behind the existing curb it would impact mature trees.	
11TH AVENUE SW	CENTER ST W TO 1ST ST NW	66	37.17		Two-way raised separated bikeway - west side of street	Recommend repurposing existing street space for the City Loop. No parking is currently allowed on 11th Ave. If the City Loop is constructed behind the existing curb it would impact mature trees.	
11TH AVENUE SW	1ST ST NW TO 2ND ST NW	66	37.05		Two-way raised separated bikeway - west side of street	Recommend repurposing existing street space for the City Loop. No parking is currently allowed on 11th Ave. If the City Loop is constructed behind the existing curb it would impact mature trees.	
11TH AVENUE SW	2ND ST NW TO RIVER	66	44.19		Two-way raised separated bikeway - west side of street	None identified	
3RD STREET NW	3RD AVE NW TO 4TH AVE NW	75	20.9		Two-way raised separated bikeway - south side of street	Impacts to landscaping on both sides of 3rd Ave NW.	
3RD STREET NW	4TH AVE NW TO 5TH AVE NW	75	26.4	34.33	Two-way raised separated bikeway - south side of street	Recommend removing parking on one side of the street. If the City Loop is constructed behind the existing curb it would impact mature street trees.	
5TH AVE NW	3RD ST NW TO 4TH ST NW	75	40.41		Two-way raised separated bikeway - east or west side of street	Recommend removing parking on one side of the street. If the City Loop is constructed behind the existing curb it would impact mature street trees.	
4TH STREET NW	5TH AVE NW TO 6TH AVE NW	75	34.42		Two-way raised separated bikeway - north side of street	Recommend removing parking on one side of the street, possibly both sides in order to avoid impacts to street trees.	
4TH STREET NW	6TH AVE NW TO 7TH AVE NW	66	24.96	35.76	Two-way raised separated bikeway - north side of street	Recommend removing parking on the north side of the street. The city loop would impact newly constructed bump-outs at 6th Ave.	NN Study: recommended at 6th Ave
Heart of the City							
4TH AVENUE SW	6TH ST SW TO 5TH ST SW	75	36.39		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking and parking bay on west side of street.	
4TH AVENUE SW	5TH ST SW TO 4TH ST SW	75	40.58		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE SW	4TH ST SW TO 3RD ST SW	75	44.1		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE SW	3RD ST SW TO 2ND ST SW	75	33.2	45.11	Two-way raised separated bikeway - west side of street	Recommend removing on-street parking on west side of street.	NN Study: recommended at 2nd St
4TH AVENUE SW	2ND ST SW TO 1ST ST SW	75	36.72		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE SW	1ST ST SW TO CENTER ST W	75	33.37		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE NW	CENTER ST W TO 1ST ST NW	75	41.25		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE NW	1ST ST NW TO 2ND ST NW	75	41.42		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE NW	2ND ST NW TO 3RD ST NW	75	40.24		Two-way raised separated bikeway - west side of street	Recommend removing on-street parking on west side of street.	

Project Precedents











An 8 mile bike trail in and around downtown Indianapolis, IN with extensive streetscape, identity, and wayfinding elements. Called "The biggiest and boldest step by any American City." This $62.5 million dollar investment put Indianapolis on the map for its focus on stylish paving features for cyclists, pedestrians and $2 million allocation on public art. The City Loop could become a nationally renown facility for supporting health and wellness through active transportation.

Firm: Rundell Ernstberger Associates.
Date of Completion: 2013.
Cost: $62.5 Million







DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

FIGURE 2
INDIANAPOLIS CULTURAL TRAIL









Two trails connect to the Indianapolis Cultural Trail and add connection to more rural locations in the area. Monon trail adds 18.1 miles of pedestrian and bike trails to the city; created from an unused railroad track. The Canal Walk gives user access to the river cutting through downtown. Both connectors add experiential value to the Indy Cultural Trail by highlighting the water front cutting through town and the history of industry and transport in the city. These elements can be highlighted through the City Loop as well by adding connection to the River and reusing rail lines that cit through the city now.

Firm:Rundell Er nstberger Associates.
Date of Completion: 2003.
Cost: $42 Million



1



2



3



4

New York City has undergone a major bike infrastructure enhancements since 2008, filling in miles long connectivity gaps present since the 2980's. Now NYC claims 1,000+ miles throughout the 5 buroughs, with 311 lanes in Manhattan alone. These statistics and well as user friendly bike wayfinding gives international acuity to NYC cycling.

Firm: NYC Gov. and Consultants.
Date of Completion: Ongoing
Cost: $355 Million since 2008.

1 Eastern parkway NYC

2 Bike path. Brooklyn

3 Shared path. Brooklyn

4 Bike and pedestrian only streets. Central Park NYC











5 Hudson river greenway. Manhattan

6 Ocean parkway. Long island

7 9th ave. cycle track. Manhattan

8 high bridge. bronx to washington heights

9 painted pathway. Brooklyn











Bogota's "CicloRuta" has become a leader in multimodal transit and of providing infrastructure to support alterative modes of transit. This provides 211 miles of connected protected bike ways and connects to major BRT lines, parks, and community centers. System improvements were introduced through a series of programmed events and public education including temporary street closures.

Firm: Institute of Urban Development.
Date of Completion: 2016.
Cost: $147,000/km. $2 million in maintence 2010.




© Andrew Bain


Sistema CicloRuta de Bogotá D.C.
PORTAL NORTE
PORTAL BOSA
PORTAL TUNAL
PORTAL AMERICAS
Zona Sur
Zona Centro
Zona Occidente
Zona Norte
CicloRuta
CicloRuta Conectante
Canal o Río
TransMilenio
TransMilenio en Construcción
Vías Principales
Portales
Bogotá sin indiferencia
¡Cambia tu Vía!
Descubre la CicloRuta





1



2



3



4

1 "POP UP"EXCERISE PLAZA, PLAZA BOGOTA COLOMBIA.
FIRM: UNKNOWN
DATE: 2012 - CURRENT
COST: N/A

2 EXERCISE PARK AT COFFMAN PARK, OHIO.
FIRM: MSI DESIGN
DATE: 2003
COST: $ 7MILLION PARKS EXPANSION PLAN

3 TARGET STATION PLAZA, MINNEAPOLIS, MN.
FIRM: SEH INC. + PERKINS EASTMAN
DATE: 2014
COST: UNKNOWN

4 TIANJIN BRIDGED GARDENS
FIRM: TURENSCAPE
DATE: 2011
COST: UNKNOWN









Streetscape elements help cities effectively and efficiently create safe and healthier public spaces (often using public right of ways) for pedestrians, cyclists, businesses, and even pets. These methods are typically associated with "complete streets" programs and are gaining popularity throughout the United States.

5 HANDICAPABLE CROSSING US DOT EXAMPLE.
DATE: 2015
COST: VARIES

6 LUCKY LAB BEER GARDEN PORTLAND, OR.
DATE: 2010

7 RIVA SPLIT WATERFRONT, CROATIA.
FIRM: 3LHD
DATE: 2005
COST: 9 MILLION EURO

8 JAMISON PARK, PORTLAND OREGON.
FIRM: PWP. LA
DATE: 2006
COST: $3.6 MILLION



1



2



3



4



5

Biking and Multimodal transit has increased access and equity to shopping, food and jobs for milllions of people. In addition, with no rent costs, new businesses are more likely to be truck or bicycle based. With new businesses comes the need for increased public spaces, bike lanes, parking, and venues for them to become successful. Bicycle infrastructure investments increase economic development for the city, developers, business owners, homeowners and investors. These investments attract new residents and help support strong, diverse communities.

1 HANGZHOU BIKESHARE CHINA

2 CITI BIKESHARE NYC

3 PARKING STATION UTRECHT, AMSTERDAM

4 BIKE DELIVERY BUSINESS PORTLAND

5 MOBILE BIKE CAFE



5



6



7



8



9

Bike fix stations and other conviniences enforce multimodal transit and active, healthy living. These conviniences are also small in upfront costs, create vibrant communities, safer streets, and advocate use of alternative methods of transportation.

5 BIKE CHANNEL

6 WINTER BIKE RACES / TRAILS

7 MOBILE BIKE STORE

8 BIKE ON BUS

9 BIKE FIX STATION









Green infrastructure is essential to any urban environment to ease issues with heat indices, water allocation, storage and use, flooding, air quality, carbom sequestration, public health, access to green space and ease of movement for pedestrians. The green infrastructure technques also pay off for urban settings economically after some years with lower energy costs and fewer repairs.

1 GREEN ALLEYS PROJECT, DETROIT MI.
FIRM: MDI, GREEN GARAGE
DATE: 2016-ONGOING
COST: $50,000 RAISED FROM CROWDFUNDING

2 RICHMOND GREENWAY
FIRM: BDG, LSA
DATE: 2010
COST: $1.2 MILLION

3 LIVING WALL CHICAGO
FIRM: SAGE VERTICAL GARDENS
DATE: 2010

4 MEDIAN RAIN CHANNEL, BROOKLYN CENTER, MN
FIRM: SEH INC.
DATE: 2014
COST:$$??









Rain water management and green infrastructure techniques have evolved over the past decade and have been found to be an effective means of reducing the impacts of urban run off, reducing urban heat island effects, enhancing the health of urban forests while simultaneously adding beauty, vitality, and strength to communities.

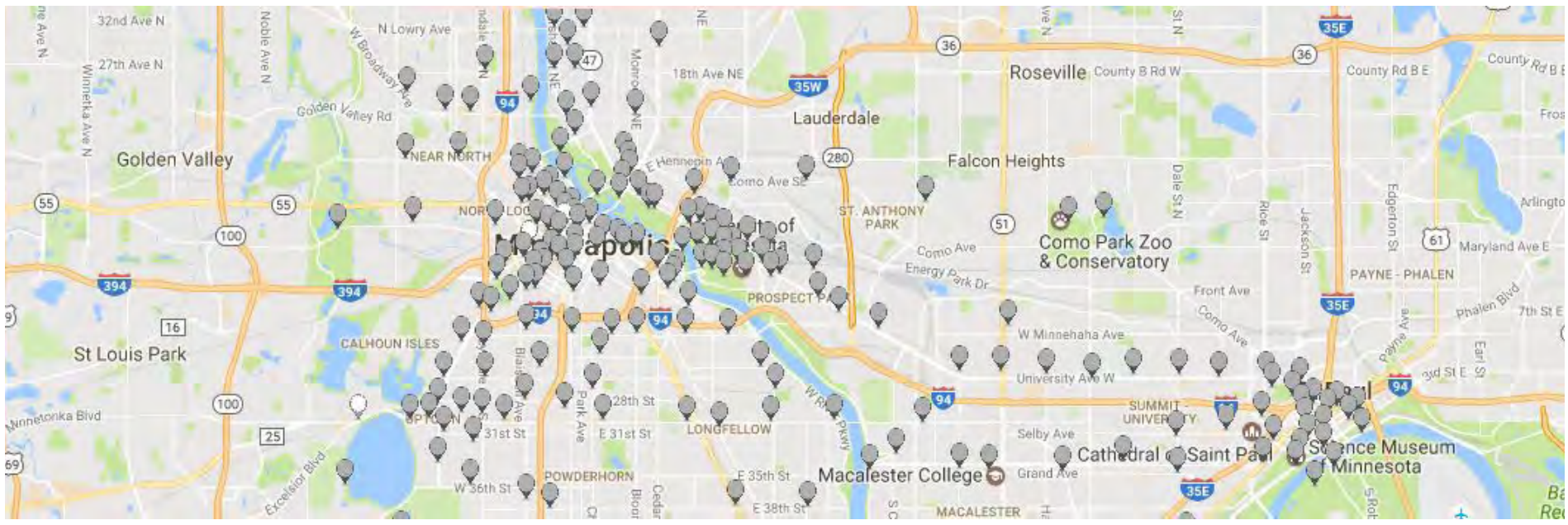
5 GREEN ALLEYS PROJECT, CHICAGO, IL.
FIRM: CDOT, HITCHCOCK DESIGN GROUP, HEY AND ASSOCIATES.
DATE: 2006-2010
COST: VARIES BY IMPLMENTATION TECHNIQUE

6 VACANT LOTS PROJECT, PHILADELPHIA

7 STORMWATER INLET, PORTLAND
FIRM: ODOT, GREEN STREET STEWARD PROGRAM.
DATE: ONGOING
COST: $1.2 MILLION APPROX.

8 GLOWING PAVEMENT, POLAND





Are bike share stations associated with local economic activity?

- **Yes** — • **Station activity model** of retail destinations and controls
- **Probably** — • **Business Perceptions** of Nice Ride users and value of stations
- **Yes** — • **User Survey** of expenditure patterns on trips made using Nice Ride



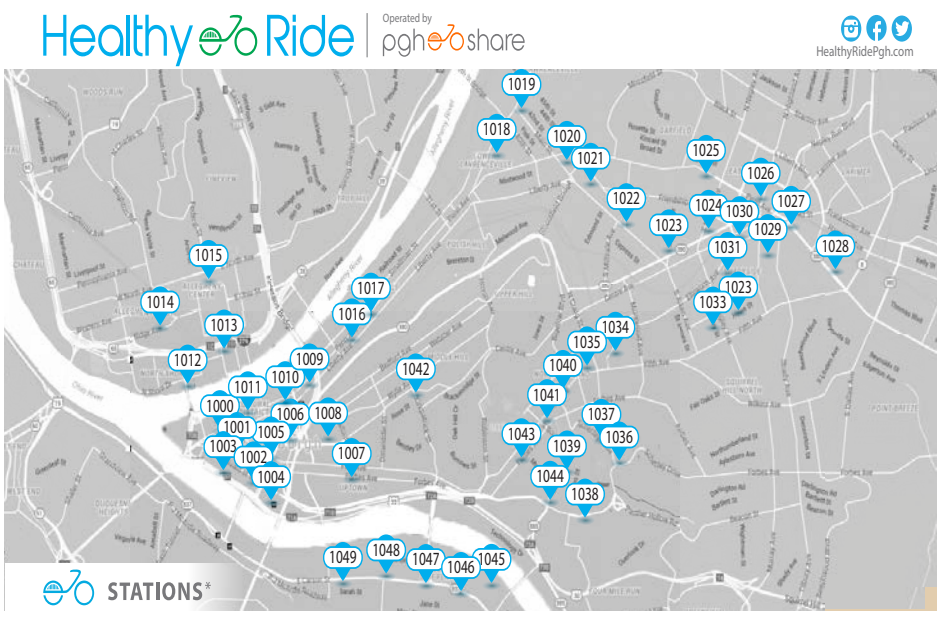
Bicycling has an extensive and comprehensive impact on the local and regional economy. According to a recent study by the University of Minnesota, as the number of Nice Ride bike-sharing stations in the Twin Cities has grown, so has the economic activity in the areas surrounding them. The study estimated that cyclists spent $150,000 more annually near bike sharing stations as a result of the Nice Ride program.[1] More directly, bicycling supports local Saint Paul bike shops, manufacturers and distributors, rental outlets, wholesalers, and non-profit organizations. These impacts are wholly positive, and represent a bicycling-specific local economy.

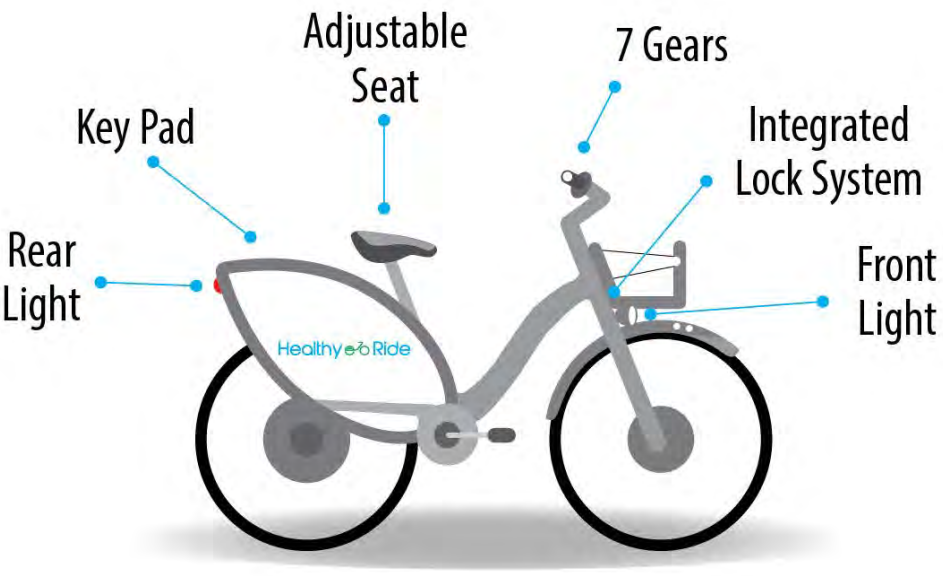
1. Schoner, Jessica; Harrison, R. Andrew; Wang, Xize. (2012). Sharing to Grow: Economic Activity Associated with Nice Ride Bike Share Stations. Hubert H. Humphrey School of Public Affairs. Retrieved from the University of Minnesota Digital Conservancy, http://hdl.handle.net/11299/135470.



PHOTO: BOB DONALDSON/POST-GAZETTE







Pittsburgh hosts over 50 bike share rental stations since its city wide debut in 2015. In the first two months they had more than 20,000 riders. The bike share keeps costs low, at just $2 every 30 mins, but also have membership discounts; like $12 / month unlimited rentals. Each station has space for 37 bikes, but bikes may be rented from one station and returned to another. The stations are solar and renters can use a mobile app or telephone to first register thier memberships. These bikes have been said to be “great for the less experienced” rider or anyone who has minor issues with bike mobility.

Walsh, Lawrence. “Pedal Pushers: New Bike-sharing Initiative Makes for an Easy Ride.” Pittsburgh Post-Gazette, 31 July 2015. Web. 12 Jan. 2017.

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Bikeway Design Guide

December 2016

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INTRODUCTION

INTRODUCTION

BICYCLIST USER TYPE

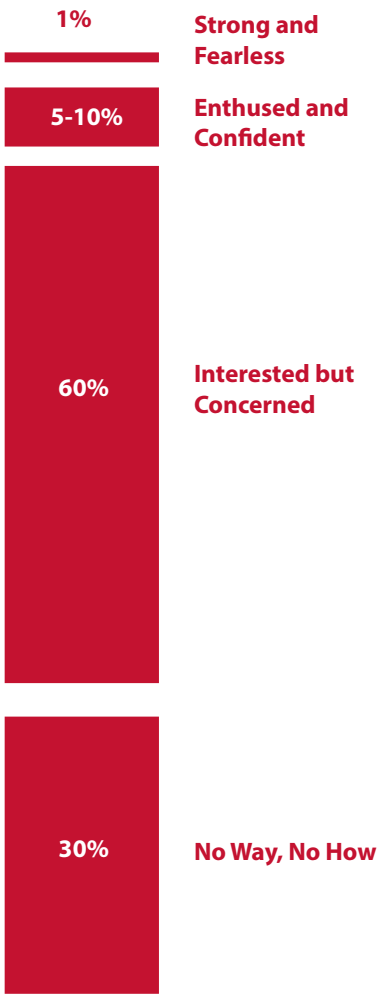
The current AASHTO Guide to the Development of Bicycle Facilities encourages designers to identify their rider type based on the trip purpose (Recreational vs Transportation) and on the level of comfort and skill of the rider (Causal vs Experienced). An alternate framework for understanding the US population's relationship to transportation focused bicycling is illustrated in the figure below. Developed by planners in Portland, OR* and supported by research**, this classification identifies four categories to address varying attitudes towards bicycling in the US.

Strong and Fearless (approximately 1% of population) – Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections -- even if shared with vehicles -- over separate bicycle facilities such as shared-use paths.

Enthused and Confident (5-10% of population) - This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared-use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.

Interested but Concerned (approximately 60% of population) – This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or shared-use paths under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience.

No Way, No How (approximately 30% of population) – Persons in this category are not bicyclists, and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances and may not be physically able to do so.



Typical Distribution of Bicyclist Types

* 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.

INTRODUCTION

USER DESIGN DIMENSIONS

The purpose of this section is to provide the facility designer with 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.

Bicyclists lack the protection from the elements and roadway hazards provided by an automobile's structure and safety features. By understanding the unique characteristics and needs of bicyclists, a facility designer can provide quality facilities and minimize user risk.

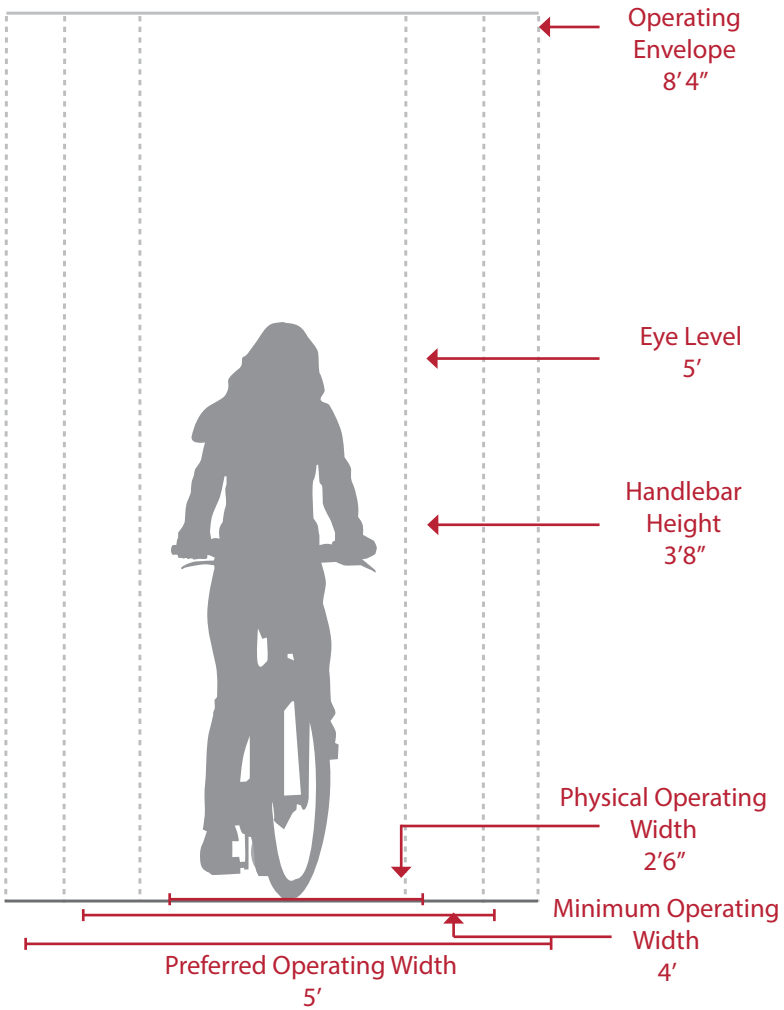
Bicycle as a Design Vehicle

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.

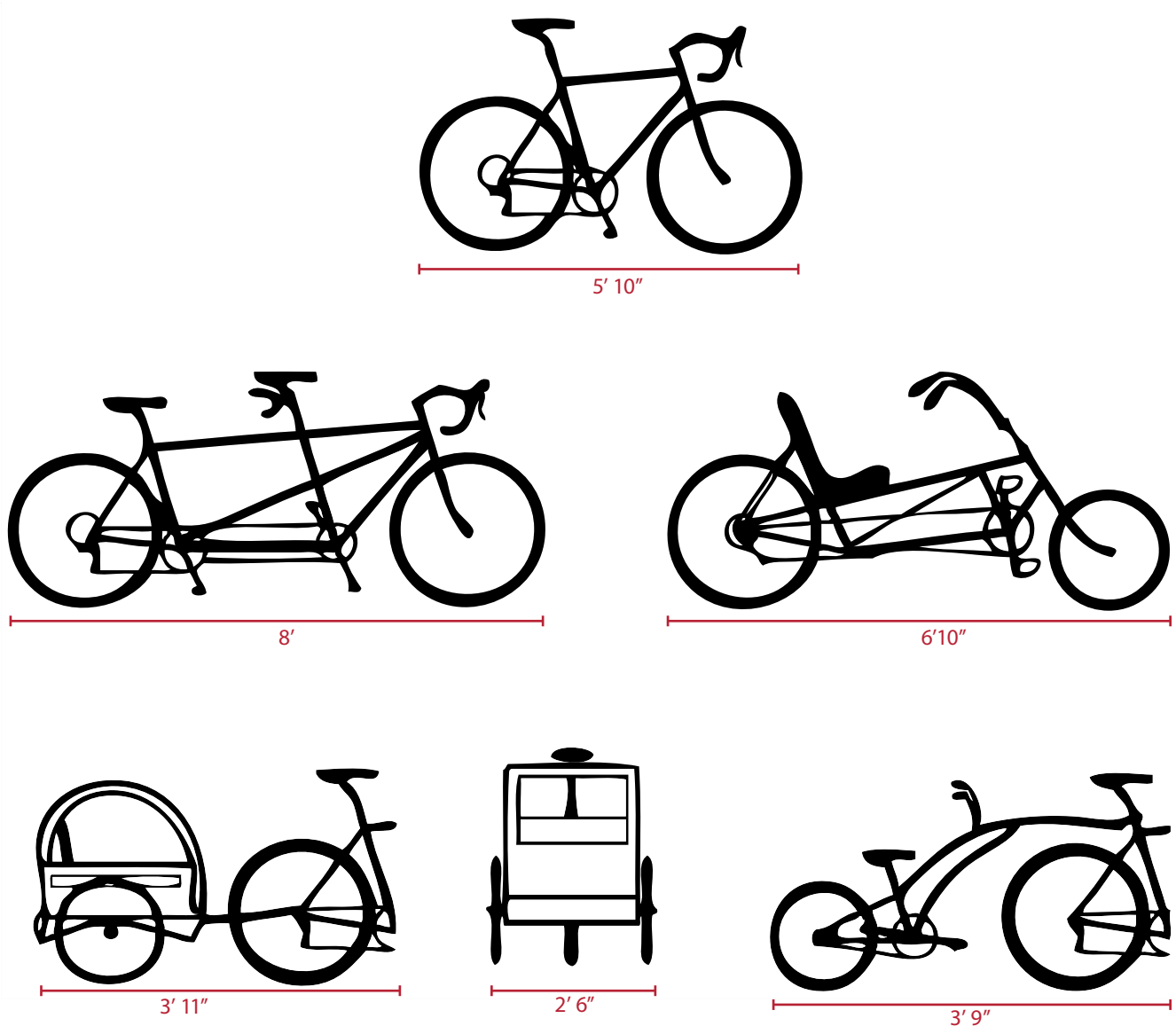
The figure to the right illustrates the operating space and physical dimensions of a typical adult bicyclist, which are the basis for typical facility design. Bicyclists require clear space to operate within a facility. This is why the minimum operating width is greater than the physical dimensions of the bicyclist. Bicyclists prefer five feet or more operating width, although four feet may be minimally acceptable.

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. The figure to the left summarizes the typical dimensions for bicycle types.

Bicycle Rider - Typical Dimensions



Bicycle Design Vehicle - Typical Dimensions



Source: AASHTO *Guide for the Development of Bicycle Facilities*, 4th Edition

Design Speed Expectations

The expected speed that different types of bicyclists can maintain under various conditions also influences the design of facilities such as shared use paths. The table to the right provides typical bicyclist speeds for a variety of conditions.

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 AASHTO 2013.

FACILITY TYPES



FACILITY TYPES

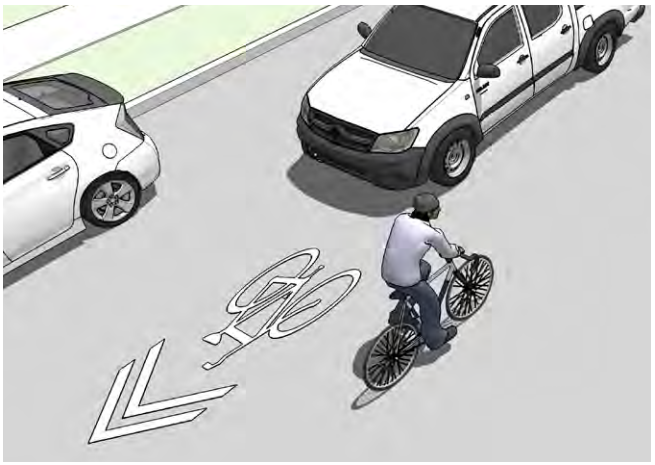
BICYCLE FACILITY CLASSIFICATION

Bicycle facilities can be identified by the degree of separation from motor vehicle traffic. These are generally classified into three categories: shared roadways, on-street striped bikeways, and protected bikeways.

SHARED ROADWAYS

Bicyclists and cars operate in the same travel lane, either side by side or in single file depending on roadway configuration.

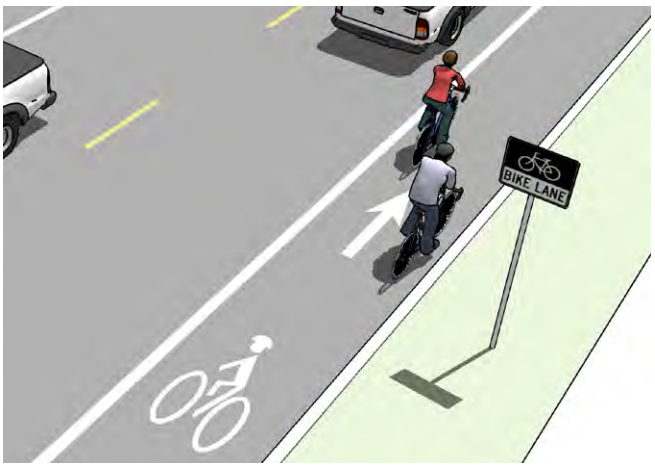
- Signed Routes simply provide wayfinding navigation between designated bicycle routes.
- Bicycle Boulevards designate bicycle routes with signs, pavement markings, and include speed and volume controls (traffic calming and diversion) to optimize the roadway for bicycle travel.



ON-STREET STRIPED BIKEWAYS

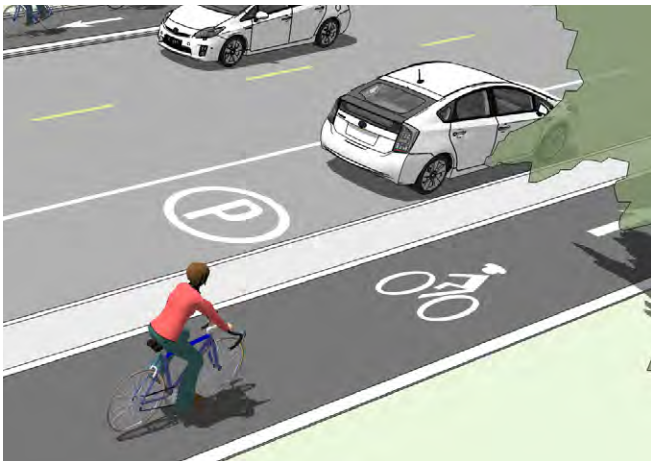
Bicyclists operate in a portion of the right of way delineated by striping and signage.

- Bicycle lanes are dedicated space for bicyclist travel adjacent to and distinct from travel lanes, either adjacent to a curb or parking lane.
- Buffered bicycle lanes provide an additional painted buffer between the bicycle lane and the travel lane.



PROTECTED BIKEWAYS

Exclusive bicycle facilities that combines the user experience of a separated path with the on street infrastructure of bike lanes. Protected bike lanes can be at street level, raised to the level of the sidewalk or set at an intermediate level between the roadway and the sidewalk. They may be one directional or bi-directional depending on available width and other design considerations.



FACILITY TYPES

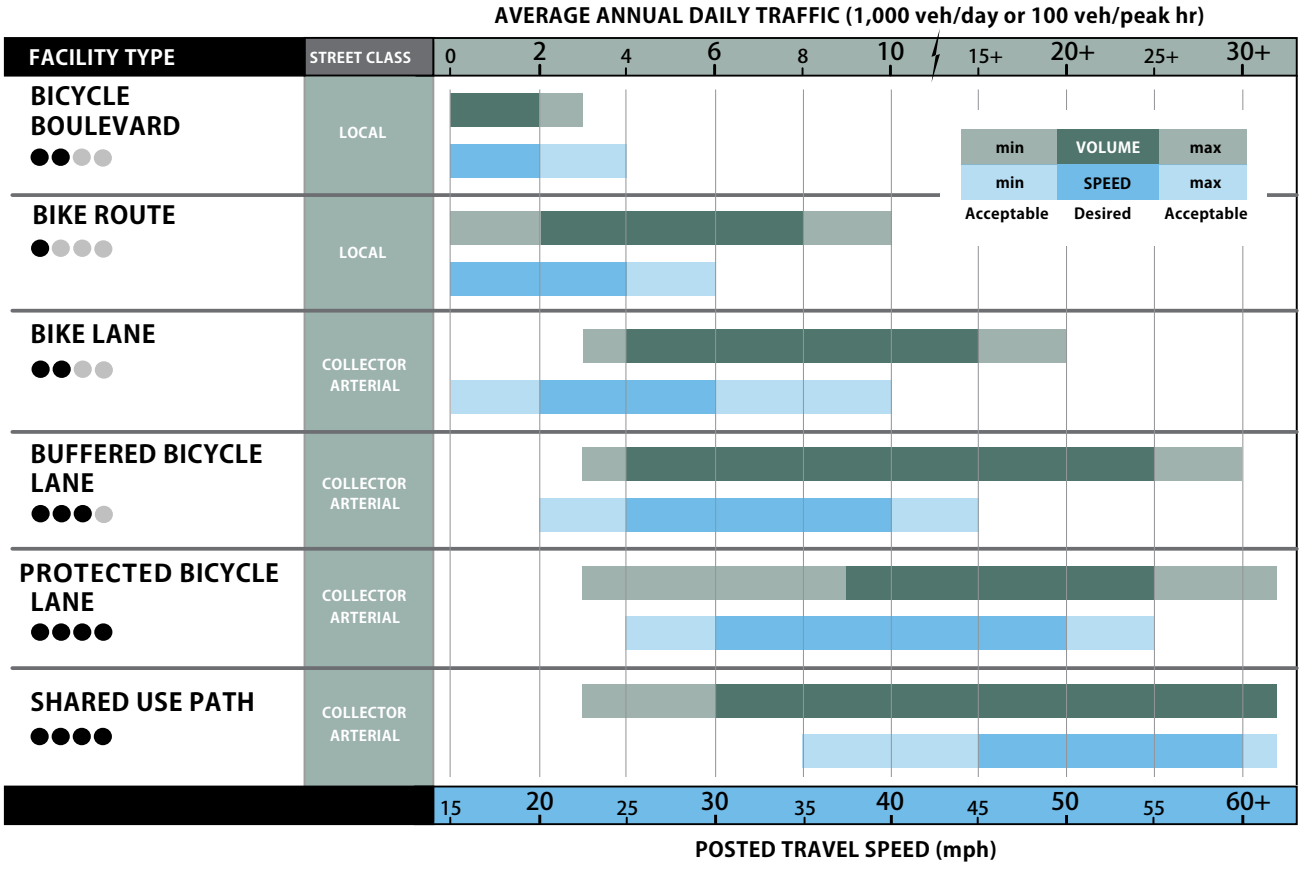
FACILITY SELECTION

Selecting the best bikeway facility type for a given roadway should be based on the range of factors that influence bicycle users' comfort and safety. There is a significant impact on cycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high. The information below supports the vision of the DMC City Loop as a protected bikeway.

Facility Selection Table

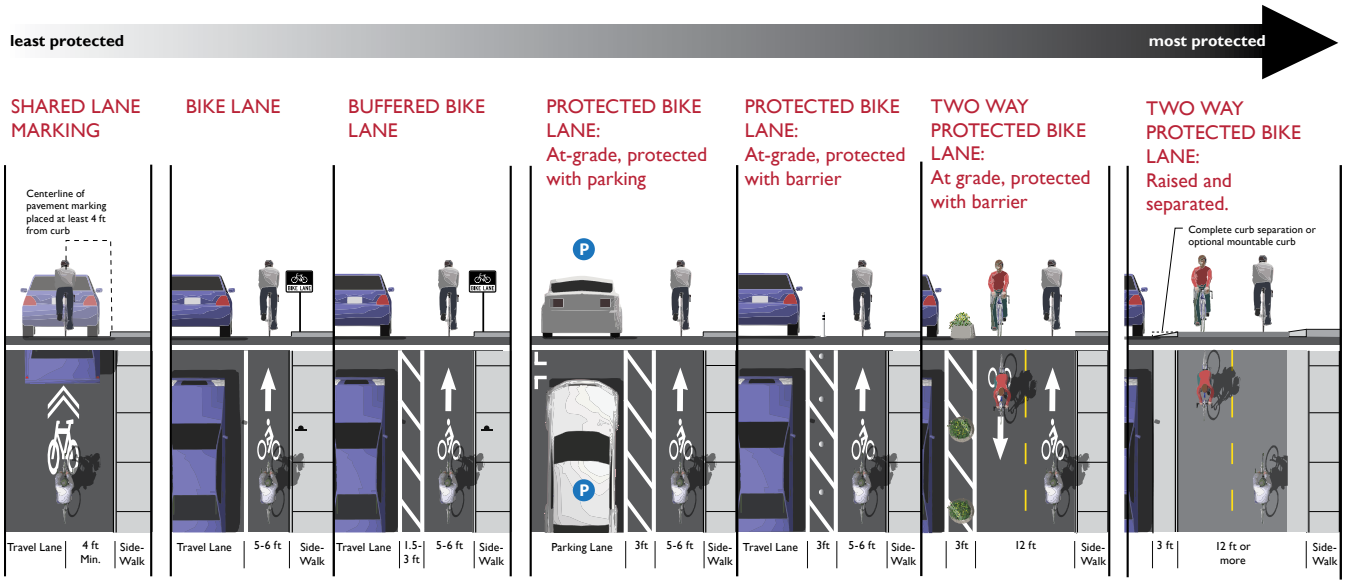
As a starting point to identify a preferred facility, the chart below can be used to determine the recommended type of bikeway to be provided in particular roadway speed and volume situations. To use this chart, identify the appropriate daily traffic volume and travel speed on or the existing or proposed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

Other factors beyond speed and volume which affect facility selection include 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.



BIKEWAY FACILITY CONTINUUM

The diagram below illustrates the spectrum of on street bikeway facilities from the least to greatest amount of separation between bicyclists and motor vehicle traffic. Typically, the higher degree of user separation results in a more comfortable facility accessible to a broader category of people interested in bicycling. The DMC City Loop is proposed as a two-way raised protected bike lane in order to provide the greatest level of comfort for users.



Further Considerations

Engineering judgment, traffic studies, previous planning efforts, community input, and local context should be used to refine criteria when developing bicycle facility recommendations for a particular street. In some corridors, it may be desirable to construct facilities to a higher degree of protection in order to appeal to a wider range of potential users. The DMC City Loop is envisioned as a raised protected bikeway for this exact reason. A protected bikeway is the most appropriate facility to appeal to the range of residents and visitors that the city wishes to attract to the City Loop. It is also important to develop consistent designs along a roadway or as part of a unified system (such as the City Loop). Users will feel more comfortable and have an easier time navigating a bikeway that is consistently protected rather than varying between on-street and protected facilities. Consistency in facility design also makes it easier for people driving to understand how to safely interact with people using the bikeway.

PROTECTED BIKEWAY DESIGN

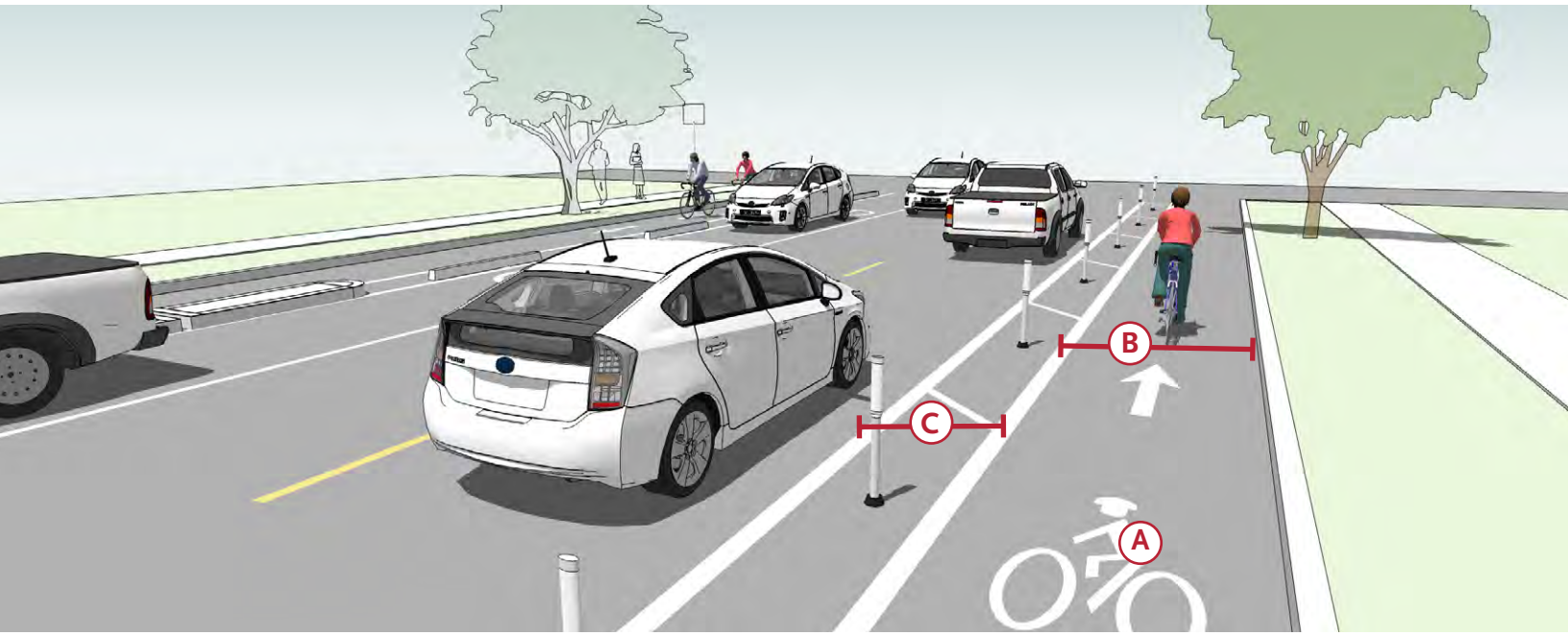


A protected bicycle lane is an exclusive bike facility that combines the user experience of an off-street path with the on-street infrastructure of a on-street bike lane. A protected bicycle lane is physically protected from motor traffic by a vertical element and distinct from the sidewalk. In situations where on-street parking is allowed, protected bicycle lanes are located between the parking and the sidewalk.

PROTECTED BIKEWAY DESIGN

STREET LEVEL PROTECTED BICYCLE LANES

Street-level protected bicycle lanes could be considered for pilot or interim implementation of the City Loop. This design provides protection through physical barriers and can include flexible delineators, planters, curbs, on-street parking or other barriers. A street level protected bike lane shares the same elevation as adjacent travel lanes.The primary advantage of street-level protected bike lanes is their lower cost and shorter time frame for implementation. However, street-level protected facilities are generally not as desirable from an urban design perspective, and are not as comfortable for users as raised protected bike lanes.



Typical Application

- Street retrofit projects with limited funds for relating curbs and drainage.
- Streets with high motor vehicle volumes and/or speeds and high bicycle volumes.
- Streets for which conflicts at intersections can be effectively mitigated using parking lane setbacks, bicycle markings through the intersection, and other signalized intersection treatments.
- Appropriate for most riders on most streets, although caution should be used when approaching intersections or other conflict areas.

Design Features

(A) Pavement markings, symbols and/or arrow markings must be placed at the beginning of the separated bike lane and at intervals along the facility.

(B) 7 foot width preferred (5 foot minimum).

(C) 3 foot minimum buffer width adjacent to parking. 18 inch minimum adjacent to travel lanes**.** Channelizing devices should be placed in the buffer area.

If buffer area is 4 feet or wider, white chevron or diagonal markings should be used.

Street Level Protected Bicycle Lanes



Street Level Protected Bicycle Lanes can be protected from the street with parking, planters, bollards or other design elements.

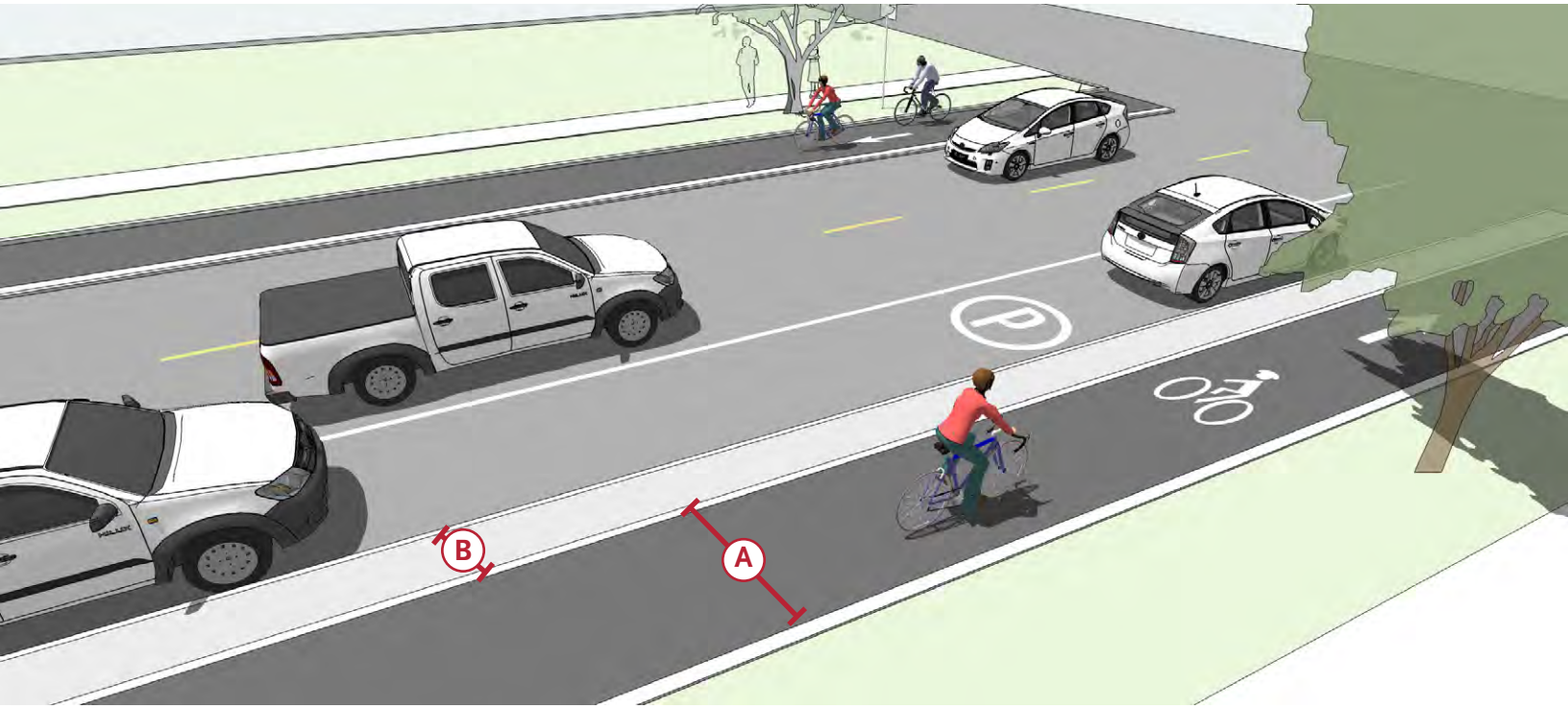
Further Considerations

- A retrofit protected bike lane has a relatively low implementation cost compared to a raised protected bike lane by making use of existing pavement and drainage and by using parking lane as a barrier.
- Gutters, drainage outlets and utility covers should be designed and configured as not to impact bicycle travel.
- Special consideration should be given at transit stops to manage bicycle & pedestrian interactions. (see page 34)
- Several different types of physical barriers can be considered for street-level protected bicycle lanes. Options include flexible delineators, planters, curbs, on-street parking, or other vertical elements that can be placed in the buffer between the bike lane and the vehicle lanes.
- Consider the minimum width needed to operate snow removal equipment when designing a street-level protected bike lane. The width of the facility will be constrained by the equipment that will be used for snow removal. The minimum width of a one-way protected bike lane is not adequate for most snow removal equipment.

PROTECTED BIKEWAY DESIGN

RAISED ONE-WAY SEPARATED BICYCLE LANES

Raised one-way protected bicycle lanes could be considered in some locations of the City Loop. Raised protected bicycle lanes may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk to separate the bike lane from the pedestrian. The guidance in this section is specific to raised protected bike lanes intended for one-way travel.



Typical Application

- On street reconstruction projects where road widening or curb reconstruction is planned.
- Along streets with multiple lanes, high traffic volumes, high speed traffic, high demand for double parking, and high parking turnover.
- On streets with numerous curves where vehicle encroachment into bike lanes may be a concern.

Design Features

(A) Preferred width is 7 feet wide exclusive of the buffer to allow side-by-side riding or passing. The minimum width is 5 feet.

(B) When a separated bike lane is adjacent to on-street parking, provided a minimum buffer of 3 feet.

If designed with a mountable curb, the curb should slope of 4:1 to allow for safe entry and exit of the roadway.

Raised One-Way Protected Bicycle Lanes





Raised protected bike lanes are bicycle facilities that are vertically protected from motor vehicle traffic.

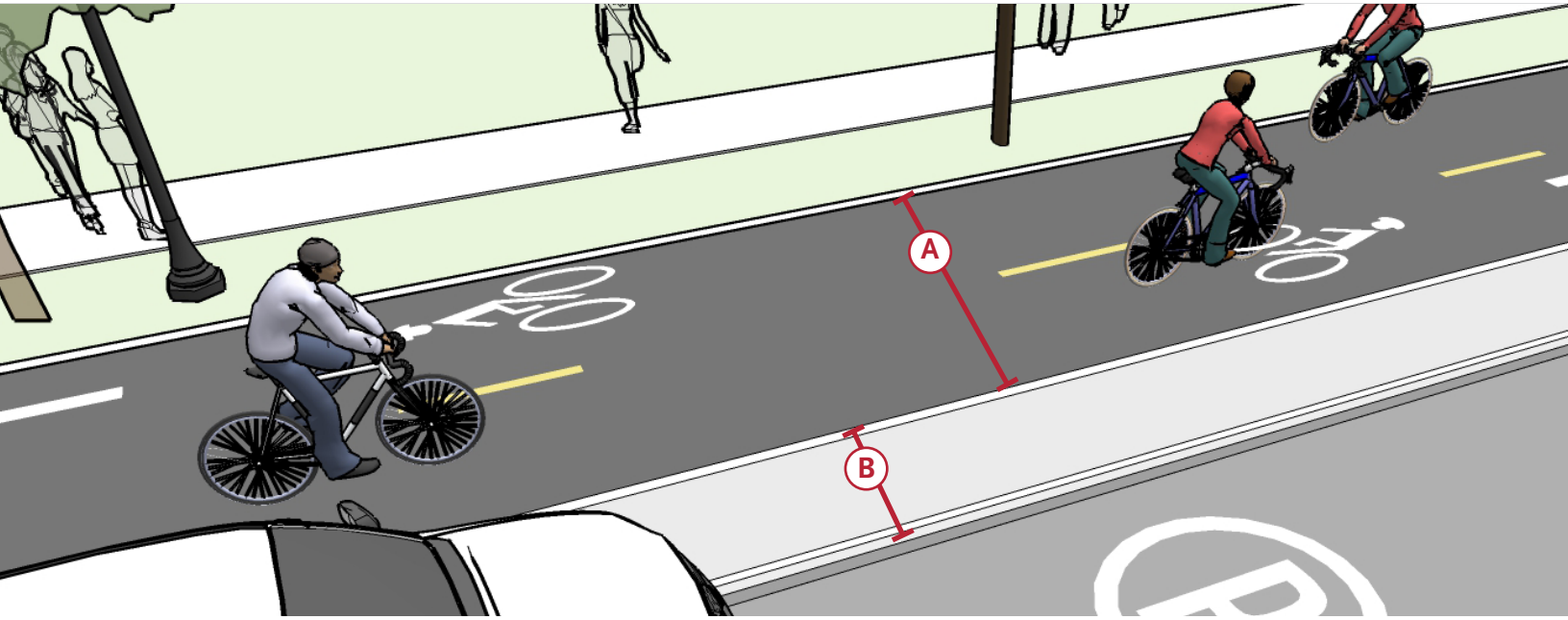
Further Considerations

- With new roadway construction a raised separated bike lane can be less expensive to construct than a wide or buffered bicycle lane.
- Parking should be prohibited within 30 ft of the intersection to improve visibility.
- Consider the minimum width needed to operate snow removal equipment when designing a raised one-way protected bike lane. The width of the facility will be constrained by the equipment that will be used for snow removal. The minimum width of a one-way protected bike lane is not adequate for most snow removal equipment.

PROTECTED BIKEWAY DESIGN

RAISED TWO-WAY SEPARATED BICYCLE LANES

The DMC Plan envisions the City Loop as a network of raised two-way protected bicycle lanes. Two-Way Protected Bicycle Lanes are bicycle facilities that allow bicycle movement in both directions on one side of the road. The facility may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk. Two-way protected bicycle lanes share some of the same design characteristics as one-way protected bicycle lanes, but may require additional considerations at driveway and side-street crossings.



Typical Application

- 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 paths.
- Streets with a concentration of destinations on only one side.
- Streets with fewer driveways, intersections, or conflict points on one side.

Design Features

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

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

Adjacent to on-street parking a 3 foot minimum width channelized buffer or island shall be provided to accommodate opening doors.

Separation may be narrower than 5 foot separation may be permitted if physical barrier separation is present.

Additional signalization and signs may be necessary to manage conflicts.

Raised Two-Way Protected Bicycle Lanes



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

Further Considerations

- A two-way separated bike lane on one way street should be located on the left side.
- Two-way separated bike lanes should ideally be placed along streets with long blocks and few driveways or mid-block access points for motor vehicles.
- Consider the minimum width needed to operate snow removal equipment when designing a raised protected bike lane. The width of the facility will be constrained by the equipment that will be used for snow removal. A two-way protected bicycle lane is typically wide enough for most snow removal equipment.

PROTECTED BIKEWAY DESIGN

MATERIALS

When determining surface type for paved trails, consider topography, surrounding landscape, underlying soils, and user needs. All surfaces have advantages and disadvantages, and each must be analyzed to determine which surface is appropriate in any given location. American Disabilities Act Accessibility Guidelines (ADAAG) compliant trails require firm, stable, slip resistant surfaces, which in most instances is a paved surface for access and ease of use.







Paved Surface Materials

A proper foundation will increase the longevity of the trail surface. Two inches of surfacing material over six inches of base course gravel over geotextile fabric is recommended for construction.

Asphalt is a common surface for bikeways, offering substantial durability for the cost of installation and maintenance. Asphalt is popular with users for its smooth, continuous surface and has the benefit of lower cost, but requires more upkeep than concrete. As a flexible pavement, asphalt can also be considered for installing a paved trail on grades steeper than 3%. If constructed properly on suitable sub-grade, asphalt has a life span of about half that of concrete, or 10 to 15 years.

Concrete can last twenty five years or more when properly constructed and maintained on a regular basis. The high cost of concrete is often the most limiting factor since it is one of the most expensive surfaces to install. It is recommended that concrete be used for its superior durability and lower maintenance requirements in areas prone to frequent flooding, and for intensive urban applications. To prevent expansion joints from jarring cyclists or in line skaters, 1/4 inch saw cut concrete joints (rather than troweled) improve user experience.

Permeable paving is twice the cost of asphalt to install and is only recommended in very special bikeway applications. Permeable paving should only be used areas with proper drainage, and is not suitable in floodplain or areas with ponding or sedimentation. Permeable paving also requires a maintenance schedule for vacuuming debris after storm events to retain permeability.

Pavers are not recommended for bikeways because it is very difficult to provide a surface that is smooth enough to meet the expectations of bicyclists. Freeze-thaw cycles can further diminish the ride quality for bicyclists, as individual pavers shift over the years.

SAFETY MEASURES: INTERSECTION TREATMENTS

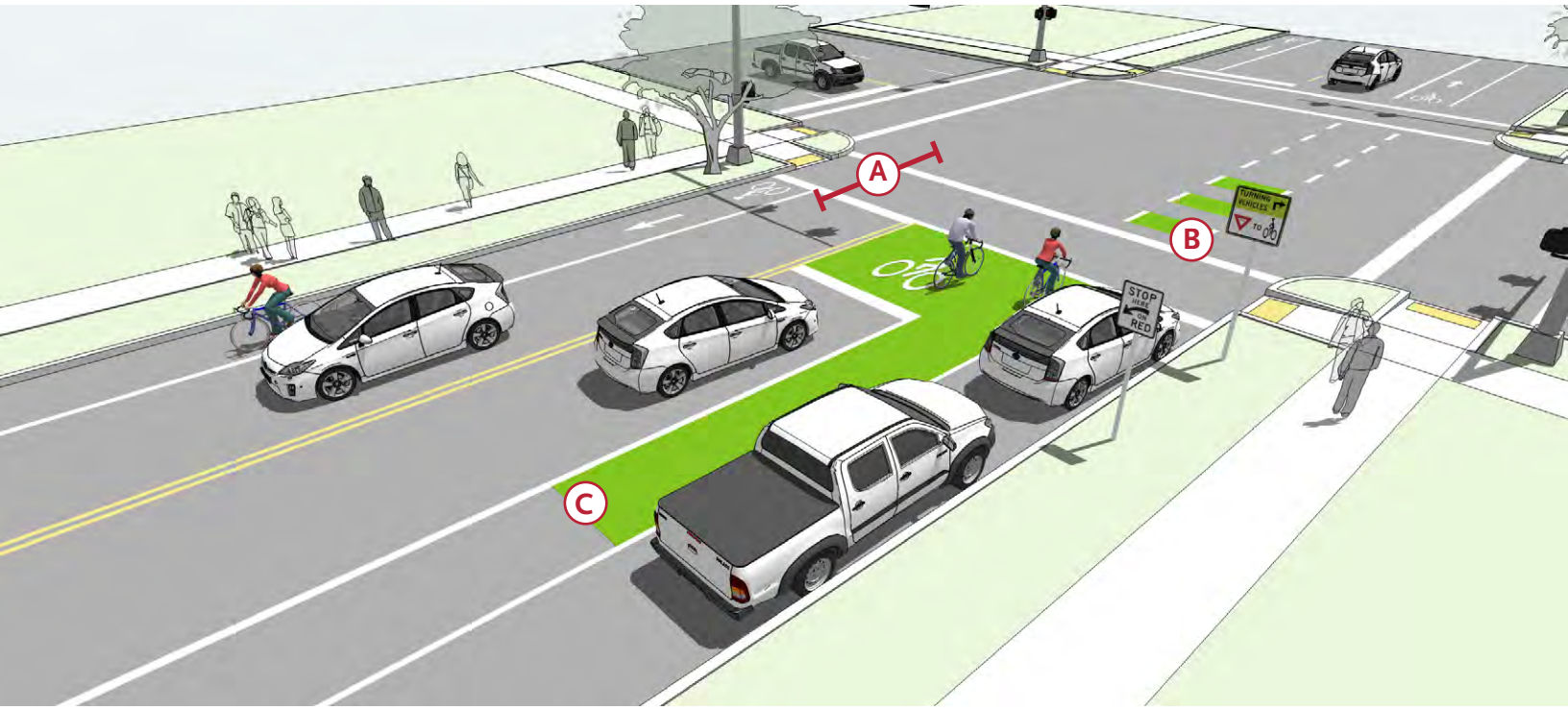


Intersections are junctions at which different modes of transportation meet and facilities overlap. An intersection facilitates the interchange between bicyclists, motorists, pedestrians and other modes in order to advance traffic flow in a safe and efficient manner. Designs for intersections with protected bicycle facilities should reduce conflict between bicyclists and motor vehicles by heightening the level of visibility, denoting clear right-of-way and facilitating eye contact and awareness with other modes.

SAFETY MEASURES: INTERSECTION TREATMENTS

BIKE BOX

A bike box is a designated area located at the head of a traffic lane at a signalized intersection that provides 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. Bike boxes are most appropriate at intersections with street-level protected bikeways are implemented on a pilot or interim basis.



Typical Application

- 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
- At intersections with street-level protected bikeways or on-street striped bike lanes.

Design Features

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

(B) A “No Turn on Red” or “No Right Turn on Red” sign shall be installed overhead to prevent vehicles from entering the Bike Box. A “Stop Here on Red” 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 optional.

Bike Box



A bike box allows for cyclists 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.

Crash Reduction

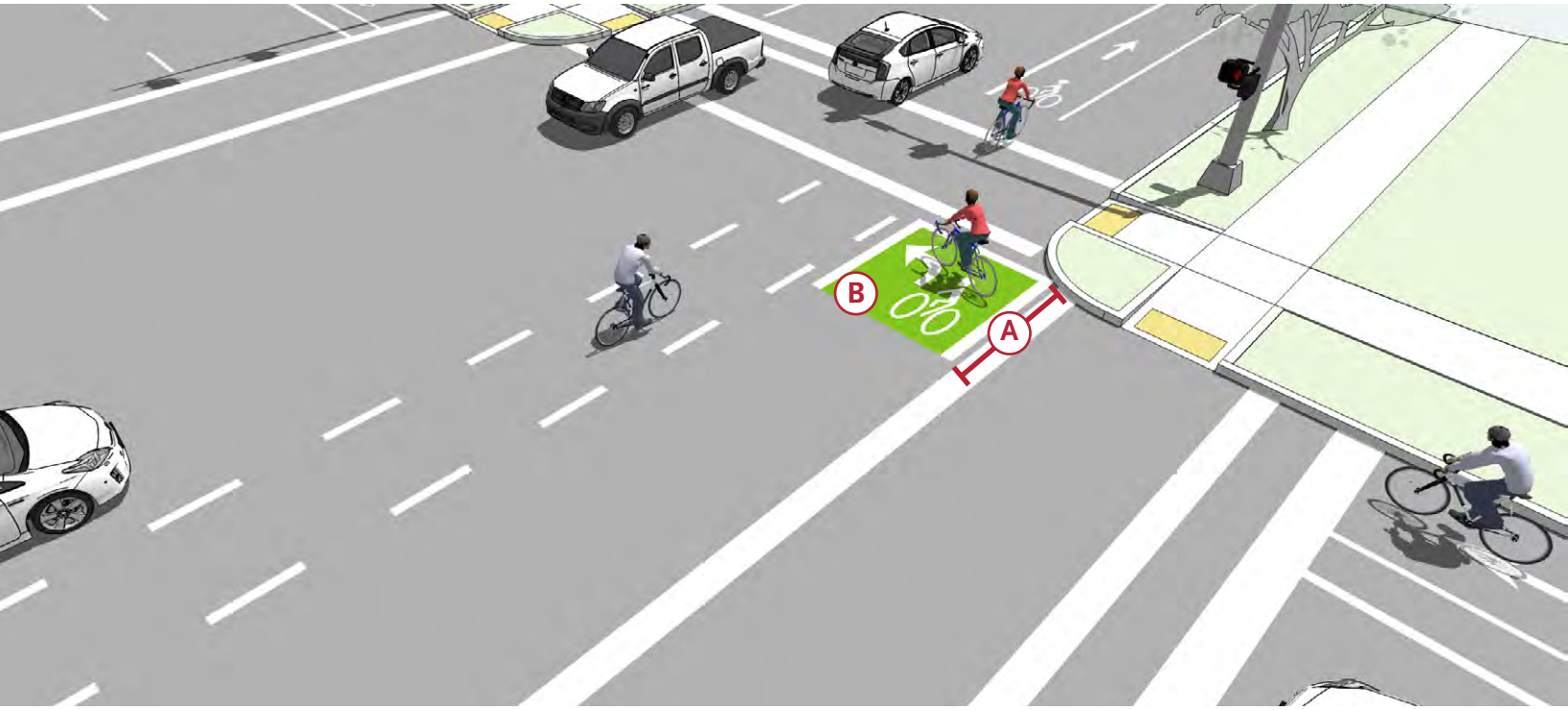
A study of motorist/bicyclist conflicts at bike boxes indicate a 35% decrease in conflicts. (CMF ID: 1718) A study done in Portland in 2010 found that 77% of bicyclists felt bicycling through intersections was safer with the bike boxes. *

* Monsere, C. & Dill, J. (2010). Evaluation of Bike Boxes at Signalized Intersections. Final Draft. Oregon Transportation Research and education Consortium.

SAFETY MEASURES: INTERSECTION TREATMENTS

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 physically separated bike lanes, bicyclists are often unable to merge into traffic to turn due to physical separation, making the provision of two-stage turn boxes critical. Two-stage left-turn boxes can be considered at signalized intersections where the City Loop makes a 90 degree turn onto an intersecting street, or where the City Loop intersects with another bikeway.



Typical Application

- Streets with high vehicle speeds and/or traffic volumes.
- At intersections with multi-lane roads with signalized intersections.
- At signalized intersections with a high number of bicyclists making a left turn from a right side facility.
- At intersections with protected bike lanes.

Design Features

The two-stage turn box shall 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.

(A) 8 foot x 6 foot preferred depth of bicycle storage area (6 foot x 3 foot minimum).

(B) Bicycle stencil and turn arrow pavement markings shall be used to indicate proper bicycle direction and positioning.

Jughandle Turn Box



This MUTCD compliant design carves a jughandle out of the sidewalk to provide space for waiting bicyclists. This design is generally used at T-intersections.

Protected Bike Lane Turn Box



On protected bike lanes, the two-stage turn box can be located in the protected buffer/parking area.

Further Considerations

- Consider providing a "No Turn on Red" 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."
- Design guidance for two-stage turns apply to both bike lanes and separated bike lanes.
- Two-stage turn boxes reduce conflicts in multiple ways; from 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 contain) and signal phasing (how frequently the box clears.)

SAFETY MEASURES: INTERSECTION TREATMENTS

INTERSECTION CROSSING MARKINGS

Bicycle pavement markings through intersections guide bicyclists on a safe and direct path through the intersection and provide a clear boundary between the paths of through bicyclists and vehicles in the adjacent lane. Intersection crossing markings enhance the visibility of the protected bike lane and improve safety and comfort for people bicycling.



Typical Application

- Where potential conflicts exist between through bicyclist and adjacent traffic: at signalized intersections, unsignalized intersections, and driveways.

Design Features

Intersection markings should be the same width and in line with leading bike lane.

(A) Dotted lines should be a minimum of 6 inches wide and 4 feet long, spaced every 12 feet.

All markings should be white, skid resistant and retro reflective

(B) Green pavement markings may also be used.

Intersection Crossing Markings



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

Further Considerations

When designing a facility, it is important to develop a hierarchy or intersection marking styles for different types of bikeway crossings. For example, signalized intersections should have the highest visibility type crossing markings and markings should be consistent across signalized intersections. Markings at driveways are often a more minimal style.

The National Committee on Uniform Traffic Control Devices has submitted a request to include additional options bicycle lanes extensions through intersections as a part of future MUTCD updates*. Their proposal includes the following options for striping elements within the crossing:

- Bicycle lane markings
- Double chevron markings, indicating the direction of travel.
- Green colored pavement.

* Letter to FHWA from the Bicycle Technical Committee for the NUTCD. Bicycle Lane Extensions through Intersections. June 2014.

Crash Reduction

A study on the safety effects of intersection crossing markings found a reduction in accidents by 10% and injuries by 19%**

A study in Portland, OR found that significantly more motorists yielded to bicyclists after the colored pavement had been installed (92 percent in the after period versus 72 percent in the before period.)***

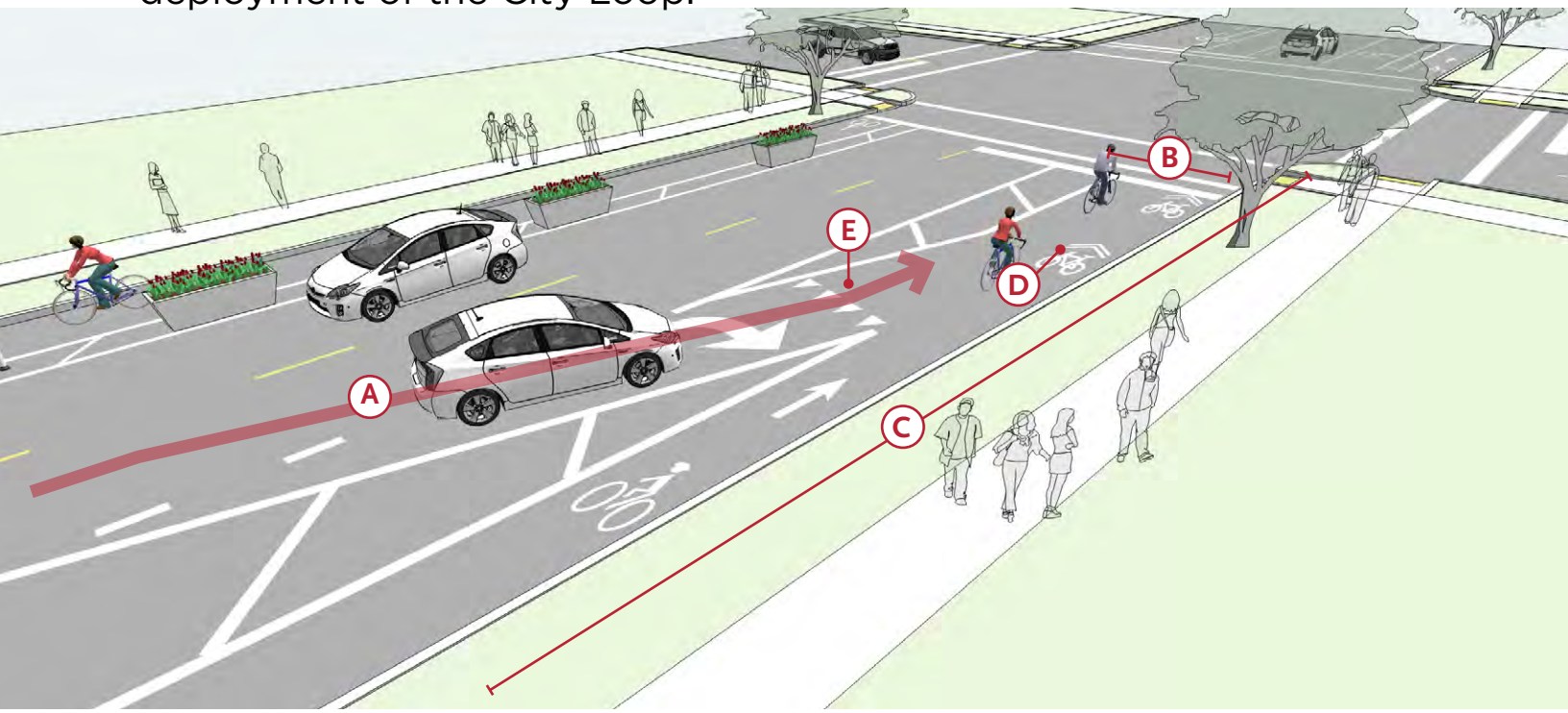
** Jensen, S.U. (2008). Safety effects of blue cycle crossings: A before-after study. Accident Analysis & Prevention, 40(2), 742-750.

*** Hunter, W.W. et al. (2000). Evaluation of Blue Bike-Lane Treatment in Portland, Oregon. Transportation Research Record, 1705, 107-115.

SAFETY MEASURES: INTERSECTION TREATMENTS

MIXING ZONE

A mixing zone creates a shared travel lane where turning motor vehicles yield to through traveling bicyclists. Geometric design is intended to slow motor vehicles to bicycle speed, provide regulatory guidance to people driving, and require all users to negotiate conflicts upstream of the intersection. Mixing zones are generally used on street-level protected bikeways and can be considered as part of pilot or interim deployment of the City Loop.



Typical Application

- Most appropriate in areas with low to moderate right-turn volumes
- Streets with a right turn lane but not enough width to have a standard width bicycle lane at the intersection.
- At signalized intersections.
- On street-level protected bike lanes.

Design Features

(A) Use short transition taper dimensions and short storage length to promote slow motor vehicle travel speeds.

(B) The width of the mixing zone should be 9 feet minimum and 13 feet maximum.

(C) The transition to the mixing zone should begin 70 feet in advance of the intersection.

(D) Shared lane markings should be used to illustrate the bicyclist's position within the lane.

(E) A yield line should be used in advance of the intersection.

Mixing Zone (New York City, NY)



Mixing Zone (Photo via NACTO)

Further Considerations

- Not recommended at intersections with high peak motor vehicle right turn movements.
- The reduces conflicts at intersections by having the mixing zone upstream of the intersection conflict area.

Crash Reduction

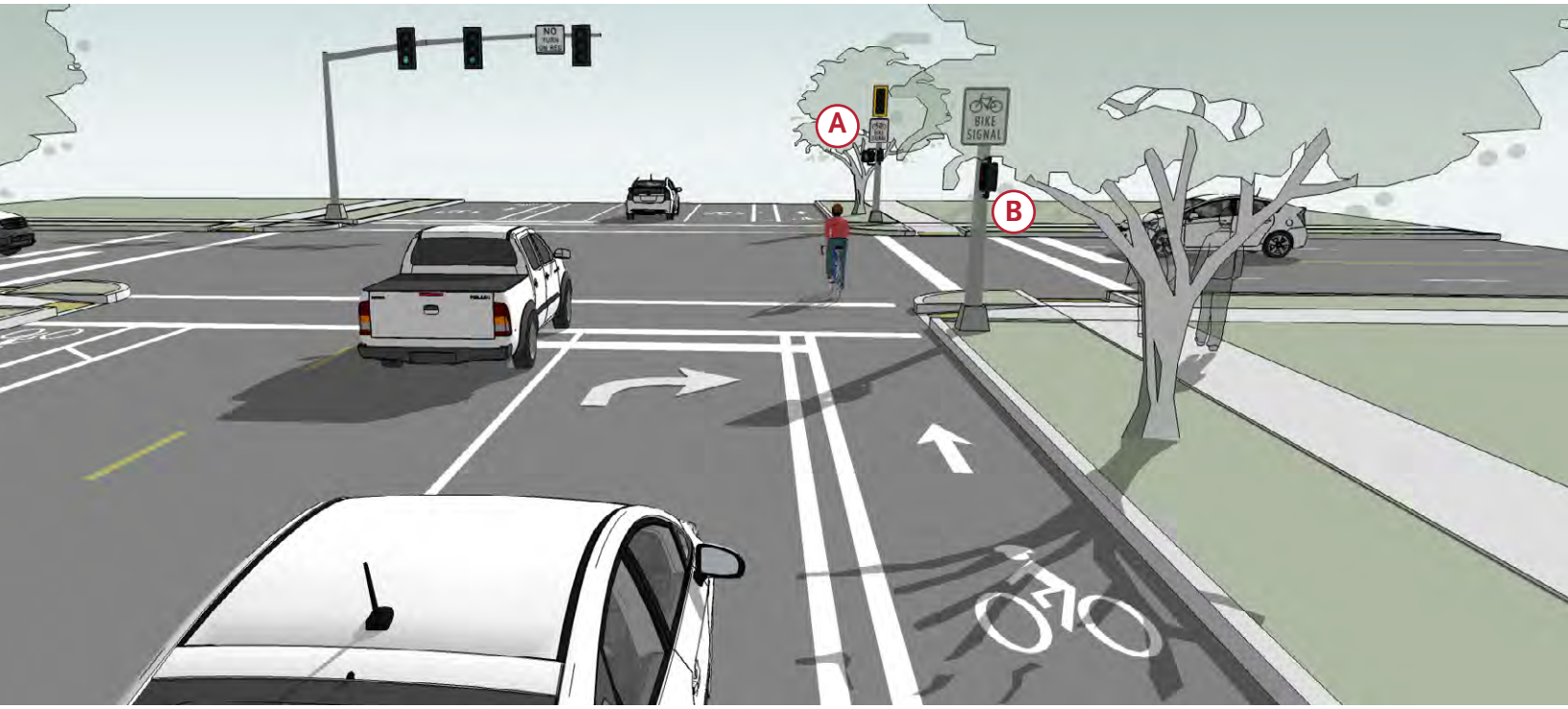
A survey of separated bike lane users in the United States found the 60-80% of respondents agreed with the statement "I generally feel safe when bicycling through the intersections" when asked about intersections with mixing zone approaches.*

* NITC. Lessons from the Green Lanes. 2014.

SAFETY MEASURES: INTERSECTION TREATMENTS

PROTECTED BICYCLE SIGNAL PHASE

Protected 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 Application

- Two-way protected bike lanes 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 and safely maneuver the crossing.

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

Protected Bicycle Signal Phase





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. **(CAMUTCD 4C.102)**
- FHWA has approved bicycle signals for use, if they comply with requirements from F.C. Interaction Approval 16 (I.A. 16).
- 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.
- A leading bicycle and pedestrian interval can be considered as a way to reduce conflicts between bicyclist and turning vehicles. Bicyclists and pedestrians are given a 3-4 second head start so that they can establish themselves in the intersection before vehicles are able to begin making turns across the bicycle/pedestrian crossing.

Crash Reduction

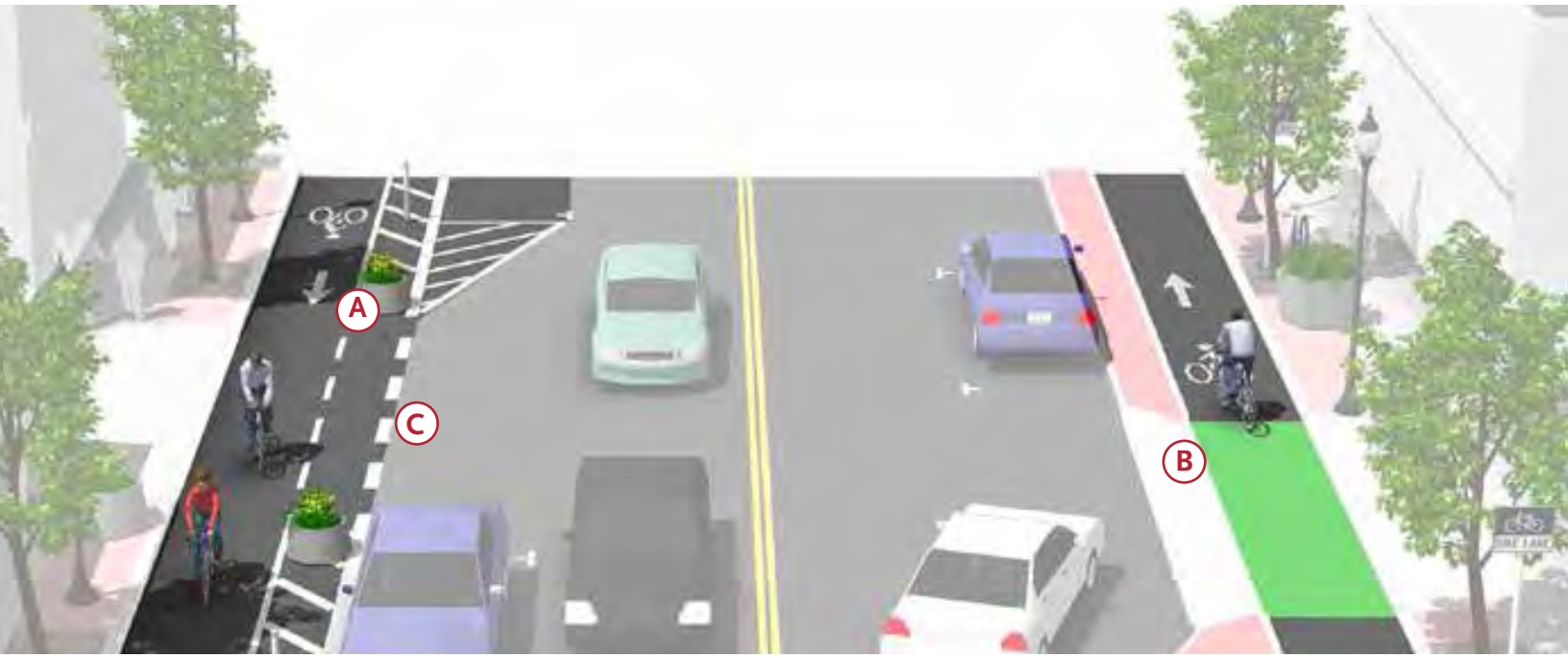
A survey of separated bike lane users in the United States found the 92% of respondents agreed with the statement “I generally feel safe when bicycling through the intersections” when asked about an intersection with a protected bicycle signal phase.*

* NITC. Lessons from the Green Lanes. 2014.

SAFETY MEASURES: INTERSECTION TREATMENTS

CONSIDERATIONS FOR DRIVEWAYS AND MINOR STREET CROSSINGS

The added separation provided by protected bike lanes creates additional considerations at minor street intersections and driveways that should be addressed. At driveways and crossings of minor streets a smaller fraction of automobiles will cross the protected bikeway. Bicyclists should not be expected to stop at these minor intersections if the major street does not stop.



Typical Application

- At intersections of driveways and bikeways.
- At side street stop sign controlled intersections.

Design Features

(A) Furnishings and other features should accommodate sight lines to ensure safe crossing.

(B) Openings in the barrier or curb are needed at intersections and driveways to allow vehicle crossing. Driveway crossings of the protected bikeway should be raised so that the height of the protected bikeway is consistent across the driveway.

(C) Street level protected bikeways should indicate potential conflict areas with dotted lane lines.

Bikeway crossing driveways



A protected bikeway crossing a series of driveways. Notice the yield sign (MUTCD R10-15 variant) directed towards turning vehicles.

Further Considerations

- At these locations, bicycle visibility is important. A buffer of parked cars or vegetation can reduce the visibility of a bicyclist traveling in the bikeway. Consider removing parking 30 ft prior to the intersection or driveway.
- Marking and signage should be present that make it easy to understand where bicyclists should be traveling.
- If raised, maintain the height of the protected bike lane through the crossing, requiring automobiles to cross over. Raised crossing encourage drivers to use slow speeds when crossing the protected bike lane, and reinforce the priority of bicyclists traveling across the intersection or driveway.
- Use colored pavement and/or shared lane markings through the conflict area.
- Access management should be used to reduce the number of crossings of driveways on a protected bike lane. Driveway consolidations and restrictions on motorized traffic movements reduce the potential for conflict.

SAFETY MEASURES: INTERSECTION TREATMENTS

RECTANGULAR RAPID FLASH BEACON (RRFB)

Active warning beacons, such as an RRFB are user actuated illuminated devices designed to increase motor vehicle yielding compliance at crossings of multi-lane or high volume roadways. RRFB may be appropriate at unsignalized locations where the City Loop route makes a 90 degree turn onto an intersecting street.



Typical Application

- Crossing of streets with high volumes and speeds and/or multilane roads.

Design Features

Ⓐ Consider installing a Bicycle Waning Sign in combination with the RRFB.

Should not be used at crossings controlled by YIELD or STOP signs, or traffic signals

Rectangular Rapid Flash Beacon (RRFB)





Further Considerations

- Rectangular rapid flash beacons (RRFB) dramatically increase driver compliance over conventional warning beacons.
- RRFB should initiate operation based on pedestrian or bicyclist actuation and cease operation at a predetermined time after actuation or, with passive detection, after the pedestrian or bicyclist clears the crosswalk.

Crash Reduction

Rectangular rapid flash beacons have the highest compliance of all the warning beacon enhancement options.

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

SAFETY MEASURES: INTERSECTION TREATMENTS

HIGH INTENSITY ACTIVATED CROSSWALK (HAWK) SIGNAL

A HAWK signal consists of a signal-head with two red lenses over a signal yellow lens on the major street, ad pedestrian and/or bicycle signal heads for the minor street approaches. A HAWK signal may be appropriate at unsignalized locations where the City Loop route makes a 90 degree turn onto an intersecting street or crosses a high-volume street at an unsignalized location.



Typical Application

- Used to improve non-motorized crossings of major streets in locations where side street volumes do not support installation of a conventional traffic signal.
- Where there are concerns that a conventional signal will encourage additional motor vehicle traffic on the minor street.
- May be used at mid-block crossings.

Design Features

(A) Consider installing a Bicycle Warning Sign in combination with the RRFB.

(B) Push button actuation along protected bikeway to facilitate crossing.

HAWK signal



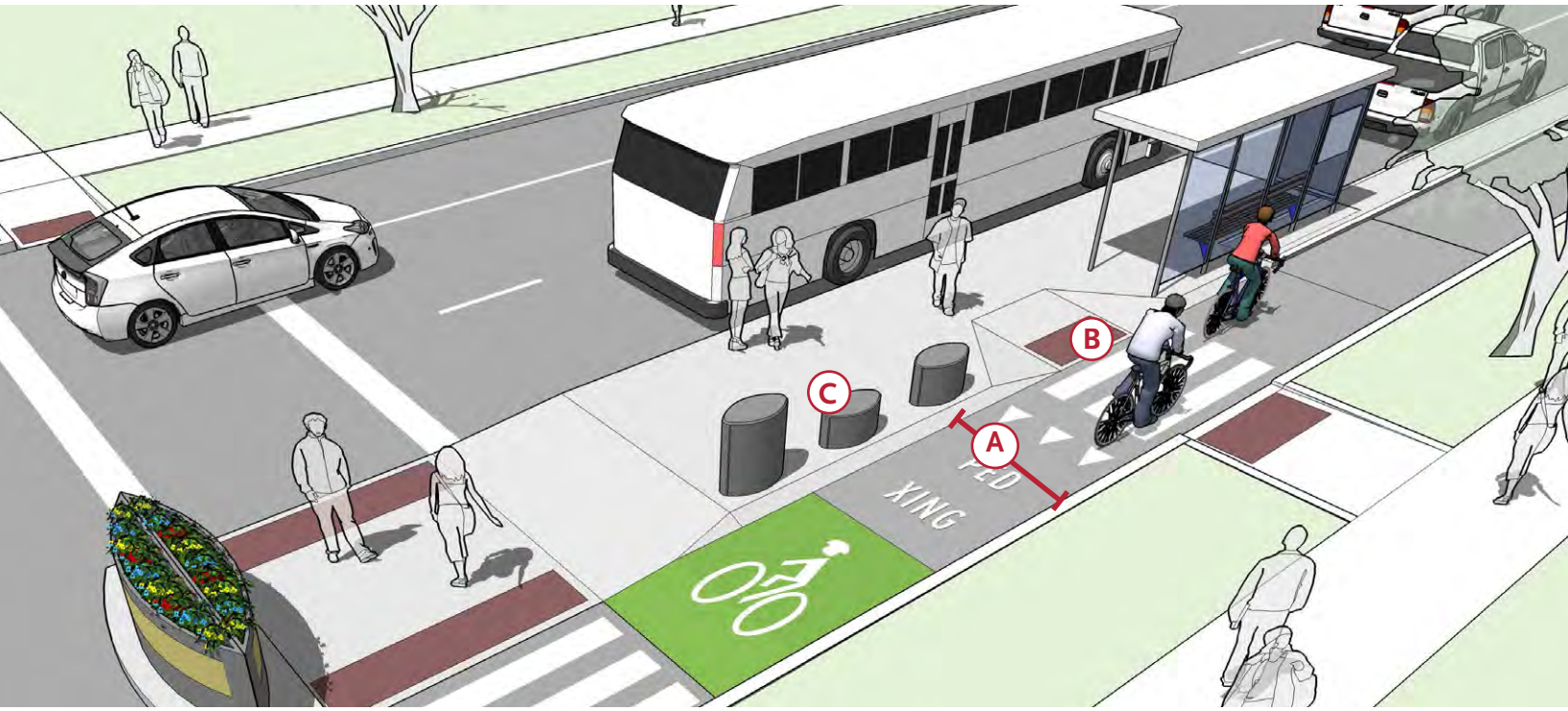
Further Considerations

- HAWK signals may be installed without meeting traffic control signal warrants if roadway speed and volumes are excessive for comfortable user crossing.
- Parking and other sight obstructions should be prohibited for at least 100 ft in advance of and at least 20 feet beyond the marked crosswalk to provide adequate sight distance.
- The HAWK signal can significantly improve the operation of a bicycle route, particular along neighborhood protected bikeway corridors. Because of the low traffic volumes of these facilities, intersections with major roadways are often unsignalized, creating difficult and potentially unsafe crossing conditions for bicyclists.
- Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts onon traffic progression , timing with adjacent signals, capacity and safety.

SAFETY MEASURES: INTERSECTION TREATMENTS

TRANSIT STOP INTEGRATION

Where transit routes and protected bikeways overlap, space may be provided to bicyclists between a transit boarding island and the pedestrian space. Where space for a transit island is not available, the sidewalk, bikeway, and transit boarding zone share space and more mixing is expected. It will be important to carefully address transit stop design at locations of existing and planned transit stops along the City Loop.



Typical Application

- Routes where protected bike lanes and transit operations overlap.

Design Features

(A) Bicycle bypass lane, minimum of 6 ft

(B) Marked pedestrian crossing and accompanying shark teeth indicating appropriate stopping distance.

(C) Railing or bollards to direct transit users to marked crossing of bikeway.

Bikeway passing transit lanes, in street and protected





Further Considerations

- Transit islands should be wide enough to accommodate mobility devices.
- Ensure an adequate width bike lane where the bypass lanes rejoins the roadway so that bicyclists do not encroach into adjacent lanes.
- Conflicts with pedestrians may be increased over conventional bus stop designs. Consider railings to direct pedestrians to a single location where they may cross to the sidewalk.
- Consider elevating the bike bypass lane 3-4 inches from the adjacent roadway to reduce the height of curbface. A curb <3 inches in height will minimize conflict with bicycle pedals and maximize ridable space.

SAFETY MEASURES: INTERSECTION TREATMENTS

AT-GRADE RAILROAD CROSSING

Bikeways that cross railroad tracks at a diagonal may cause steering difficulties or loss of control for bicyclists due to slippery surfaces, degraded, rough materials, and the size of the flangeway gaps.



Typical Application

- Where bike lanes, shoulders or physically protected bike lanes across railroad tracks.
- Provide extra design attentions to angled track crossings.
- Crossing design and implementation is a collaboration between the railroad company and transportation agency. The railroad company is responsible for the crossbucks, flashing lights and gate mechanisms. The transportation agency is responsible for advance warning markings and signs.

Design Features

- 6 ft minimum bikeway width.
- Consider posting a grade crossing advance warning sign.
- Sight triangles of 50 ft by 100 ft will be provided at the railroad and street right of way (sight triangles are measured from the center line to the railroad track).
- Angled track crossings also limit sight triangles, impacting the ability to see oncoming trains. If the skew angle is less than 45 degrees, special attention should be given to the sidewalk and bicycle alignment to improve the approach angle to at least 60 degrees (90 degrees preferred where possible).

At-grade railroad crossing



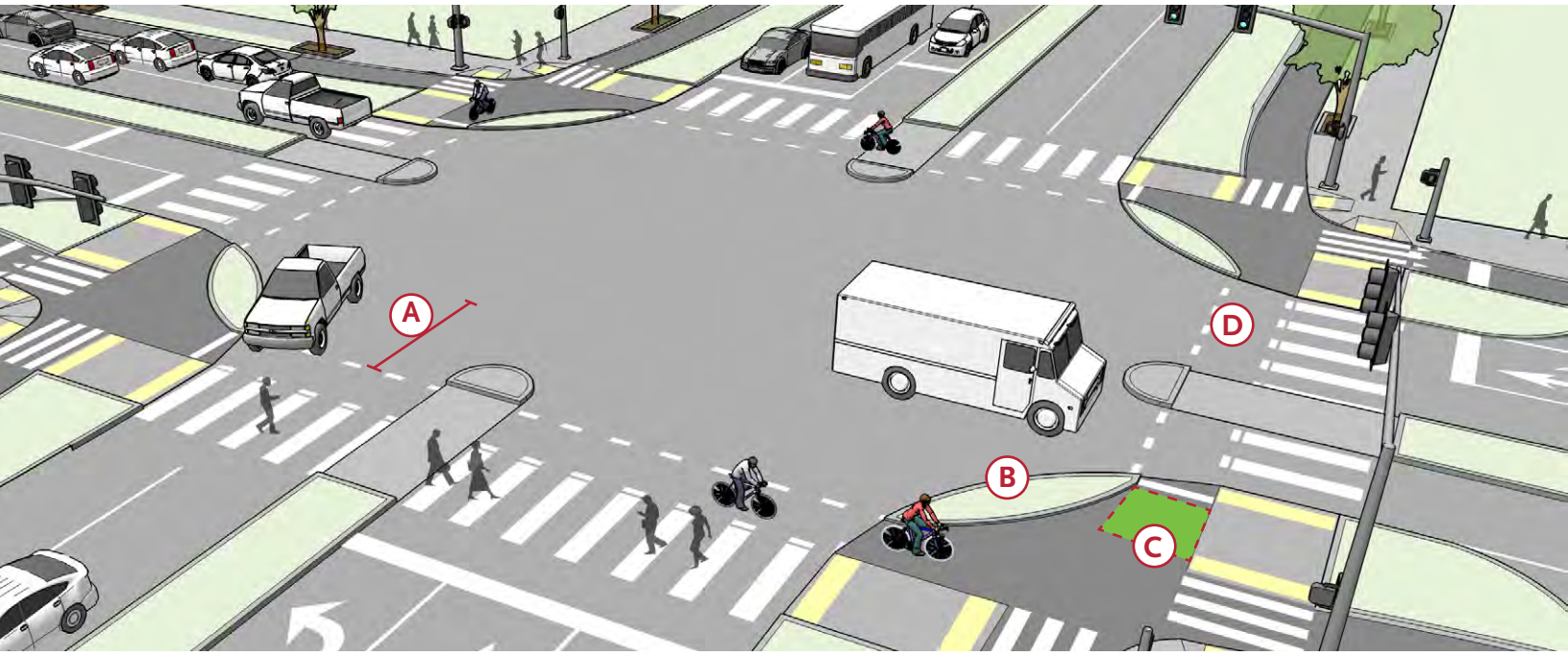
Further Considerations

- Allow bicyclists access to the full widened pavement area to allow them to choose the path that suits their needs best.
- Warning devices should be recommended for each specific situation by a qualified engineer based on various factors including train frequency and speed, path and trail usage, and sign distances.
- Concrete is the preferred material for use at bikeway railroad crossings. Rubber crossings are ridable when new and dry, but become slippery when wet, and degrade over time.

SAFETY MEASURES: INTERSECTION TREATMENTS

PROTECTED INTERSECTION

A protected intersection, or "bend-out" intersection approach, maintains physical separation within the intersection to define the turning paths of motor vehicles, slow vehicle turning speed, and offers a comfortable place for people bicycling to wait at a red signal. Protected intersections will be important to consider on the City Loop to enhance bicyclist safety and comfort.



Typical Application

- Streets with a protected bikeway separated by wide buffer or on-street parking.
- Where two protected bikeways intersect and two-stage left-turn movements must be provided for bicycle riders.
- Helps reduce conflicts between right-turning motorists and bicycle riders by reducing turning speeds and providing space for vehicles to queue out of the way of through traffic and before the protected bikeway.
- Where it is desirable to create a safety island at intersections to reduce pedestrian crossing distance.

Design Features

(A) Set back bicycle crossing of 16.5 ft allows for one passenger car to queue while yielding. Smaller setback distance is possible in slow-speed, space constrained conditions. A reduced separation width as low as 6.5 ft may be used in low-speed environments.

(B) Corner safety island with a 15-20 ft corner radius slows motor vehicle speeds. Larger radius designs may be possible when paired with a deeper setback, or small mountable aprons.

(C) Two stage turning boxes are provided for queuing bicyclists adjacent to corner islands.

(D) Intersection crossing markings should be used.



Further Considerations

- Pedestrians crosswalks may need to be set back from intersection in order to make room for two-stage turning queue boxes.
- Colored pavement may be used within corner refuge area to clarify use by people bicycling and discourage use by people walking or driving.
- Protected intersections are designed to mitigate conflicts where traffic is controlled by standard circular green traffic signal indicators. Under these conditions, drivers must yield to bicyclists and pedestrians before completing the turning maneuver. Consider prohibiting right turn on red to promote safety of users in the intersection.
- Intersection approaches with high volumes of right turning vehicles should provide a dedicated right turn only lane paired with a protected right turn signal phase. Protected signal phasing may allow different design dimensions than are described here.
- If a protected right turn signal phase is used to manage conflicts, right turn on red should be prohibited to ensure compliance to protected signal phases.

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AMENITIES



The ability to navigate through a city is informed by landmarks, natural features and other visual cues. Bicycle wayfinding can assist in navigation to guide bicyclists to their destinations along preferred bicycle routes. Signs are typically placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes.

AMENITIES

WAYFINDING SIGN TYPES

The ability to navigate through a city is informed by landmarks, natural features and other visual cues. Signs throughout the city should indicate to bicyclists the direction of travel, the locations of destinations and the travel time/distance to those destinations. A bicycle wayfinding system consists of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes. Wayfinding signs are also an opportunity to brand the City Loop as a unique facility.



D11-1c



D1-1



D11-1/D1-3a

Typical Application

- Wayfinding signs will increase users' comfort and accessibility to the bicycle systems.
- Signage can serve both wayfinding and safety purposes including:
    - Helping to familiarize users with the bicycle network
    - Helping users identify the best routes to destinations
    - Helping to address misconceptions about time and distance
    - Helping overcome a "barrier to entry" for people who are not frequent bicyclists (e.g., "interested but concerned" bicyclists)

Design Features

(A) Confirmation signs indicate to bicyclists that they are on a designated bikeway. Make motorists aware of the bicycle route. Can include destinations and distance/time but do not include arrows.

(B) Turn signs indicate where a bikeway turns from one street onto another street. These can be used with pavement markings and include destinations and arrows.

(C) Decisions signs indicate the junction of two or more bikeways and inform bicyclists of the designated bike route to access key destinations. These include destinations, arrows and distances. Travel times are optional but recommended.

Community Logos on Signs



Wayfinding signs can include a local community identification logo, as this example from Oakland, CA.

Custom Street Signs (Berkeley, CA)



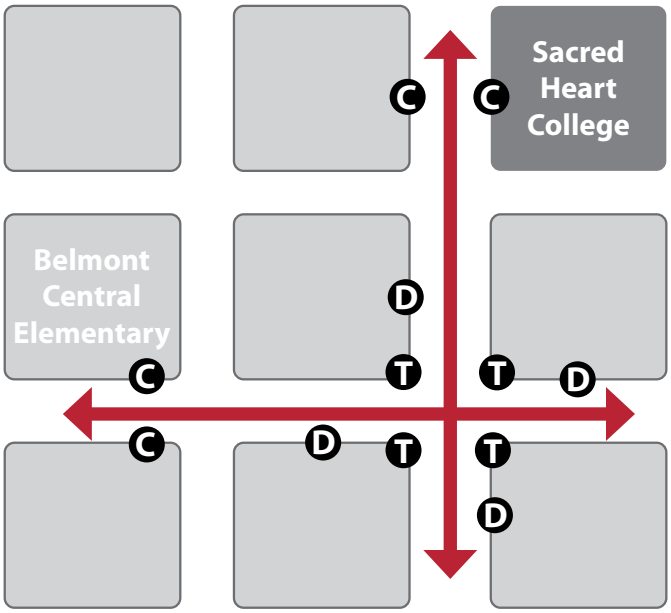
Custom street signs can also act as a type of confirmation sign, to let all users know the street is prioritized for bicyclists.

- 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.
- A community-wide bicycle wayfinding signage plan would identify:
    - Sign locations
    - Sign type – what information should be included and design features
    - Destinations to be highlighted on each sign – key destinations for bicyclists
    - Approximate distance and travel time to each destination
- 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 MUTCD.
- Check wayfinding signage along bikeways for signs of vandalism, graffiti, or normal wear and replace signage along the bikeway network as-needed.

AMENITIES

WAYFINDING SIGN PLACEMENT

Signs are placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes.









Typical Application

Confirmation Signs

- Placed every ¼ to ½ mile on off-street facilities and every 2 to 3 blocks along on-street bicycle facilities, unless another type of sign is used (e.g., within 150 ft of a turn or decision sign).
- Should be placed soon after turns to confirm destination(s). Pavement markings can also act as confirmation that a bicyclist is on a preferred route.

Turn Signs

- Near-side of intersections where bike routes turn (e.g., where the street ceases to be a bicycle route or does not go through).
- Pavement markings can also indicate the need to turn to the bicyclist.

Decision Signs

- Near-side of intersections in advance of a junction with another bicycle route.
- Along a route to indicate a nearby destination.

Design Features

- MUTCD guidelines should be followed for wayfinding sign placement, which includes mounting height and lateral placement from edge of path or roadway.
- Pavement markings can be used to reinforce routes and directional signage.

Wayfinding Pavement Markings



Some cities use custom pavement markings to indicate required turns or jogs along the bicycle route. Note these are not MUTCD approved and would not be able to be installed with federal funds.

Further Considerations

It can be useful to classify a list of destinations for inclusion on the signs based on their relative importance to users throughout the area. A particular destination's ranking in the hierarchy can be used to determine the physical distance from which the locations are signed. For example, primary destination's (such as the downtown area) may be included on signage up to 5 miles away. Secondary destinations (such as a transit station) may be included on signage up to 2 miles away. Tertiary destinations (such as a park) may be included on signage up to one mile away.

AMENITIES

BIKE PARKING

Bicyclists expect 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.



Typical Application

- Bike racks provide short-term bicycle parking and is meant to accommodate visitors, customers, and others expected to depart within two hours. It should be an approved standard rack, appropriate location and placement, and weather protection.
- 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.
- Bicycle lockers are intended to provide long-term bicycle storage for employees, students, residents, commuters, and others expected to park more than two hours. Long-term facilities protect the entire bicycle, its components and accessories against theft and against inclement weather, including snow and wind-driven rain.
- A Secure parking Area for bicycles, also known as a BikeSPA or Bike & Ride (when located at transit stations), is a semi-enclosed space that offers a higher level of security than ordinary bike racks. Accessible via key-card, combination locks, or keys, BikeSPAs provide high-capacity parking for 10 to 100 or more bicycles. Increased security measures create an additional transportation option for those whose biggest concern is theft and vulnerability.

Design Features

Bike Racks

- (A) 2 feet minimum from the curb face to avoid 'dooring.'
- (B) 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.

Bike Corrals

- (C) 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.

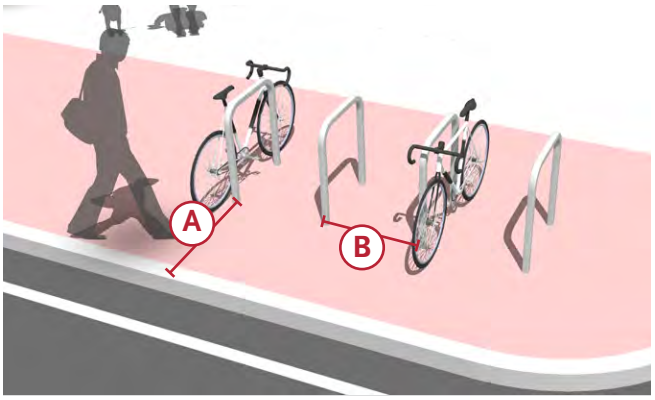
Bike Lockers

- (D) 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.

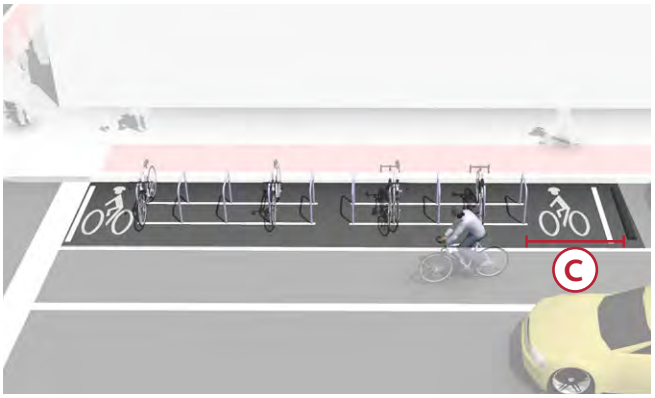
Secure Parking Area

- (E) Closed-circuit television monitoring 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.

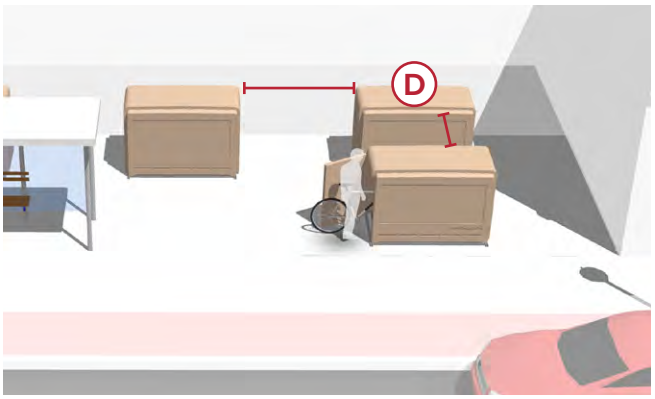
Perpendicular Bike Racks



Bike Corral



Bike Locker



Secure Parking Area



GUIDANCE BASIS

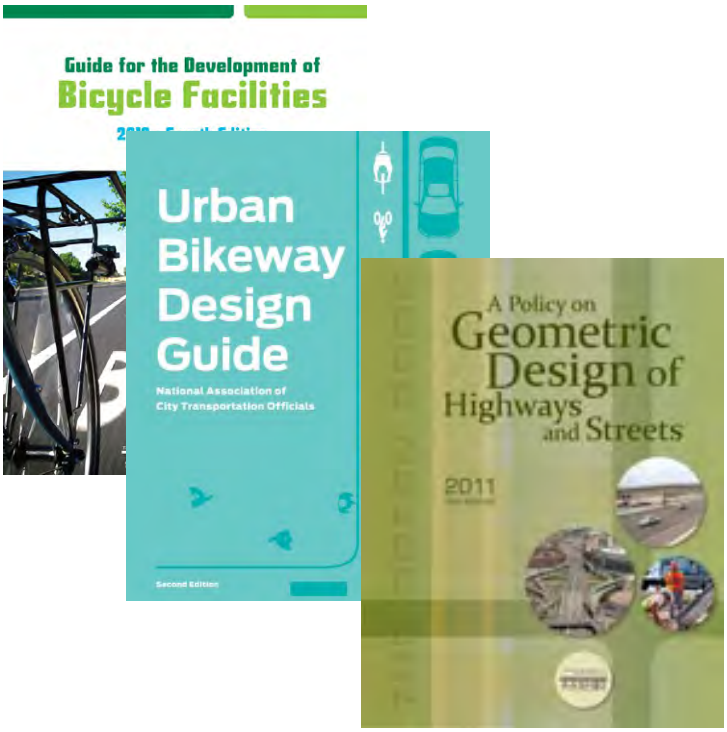
The preceding sections serve as an inventory of bicycle design treatments and provide guidelines for their development. These treatments and design guidelines are important because they represent the tools for creating a bicycle-friendly, safe, accessible community. The guidelines are not, however, a substitute for a more thorough evaluation by a landscape architect or engineer upon implementation of facility improvements. The following standards and guidelines are referred to in this guide.

National Guidance

American Association of State Highway and Transportation Officials **(AASHTO) Guide for the Development of Bicycle Facilities (2013)**, updated in June 2012 provides guidance on dimensions, use, and layout of specific bicycle facilities.

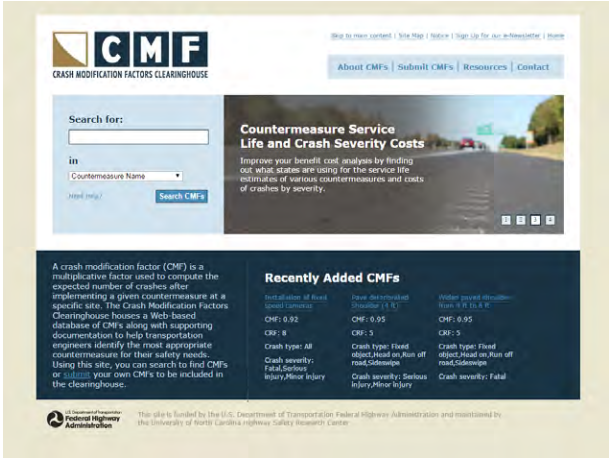
The National Association of City Transportation Officials' **(NACTO) Urban Bikeway Design Guide (2012)** is the newest publication of nationally recognized bikeway design standards, and offers guidance on the current state of the practice designs.

The 2011 **AASHTO A Policy on Geometric Design of Highways and Streets (2011)** commonly referred to as the "Green Book," contains the current design research and practices for highway and street geometric design.



Impact on Safety and Crashes

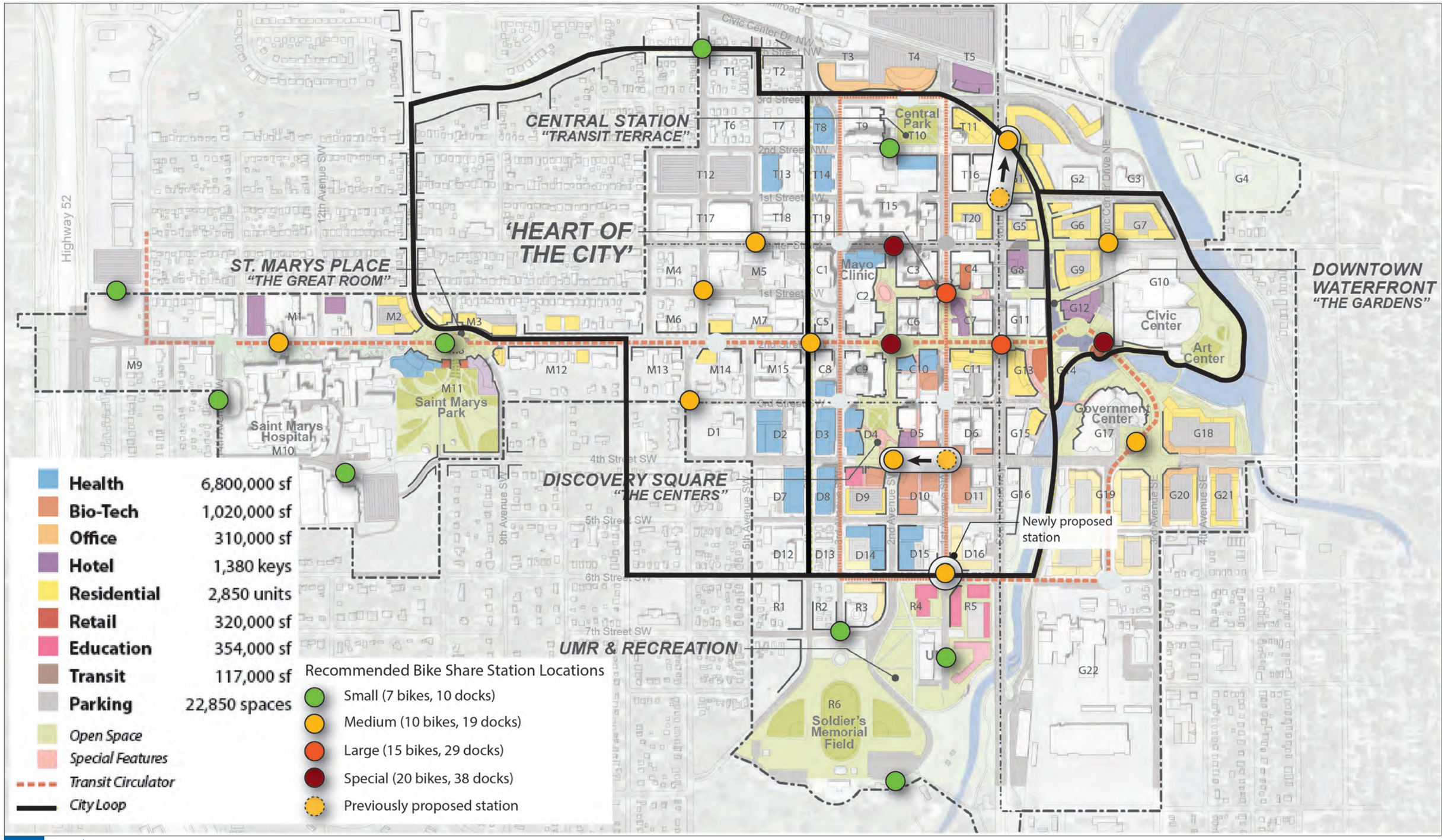
Bicycle facilities can have a significant influence on user safety. The Federal Highway Administration's (FHWA) **Crash Modification Factor Clearinghouse (http://www.cmfclearinghouse.org/)** is a web-based database of Crash Modification Factors (CMF) to help transportation engineers identify the most appropriate countermeasure for their safety needs. Where available and appropriate, CMFs or similar study results are included for each treatment.



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Bikeshare Map



DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

PROPOSED BIKE SHARE LOCATIONS UPDATED WITH CITY LOOP ALIGNMENT
DMC, ROCHESTER, MINNESOTA
Attachment 3
JANUARY 2017

Technical Memorandum 2

DMC Project No. J8620 _TM_ City Loop 2

To: Joni Giese, Principal
SRF Consulting Group

From: Bob Kost, Project Manager
SEH
bkost@sehinc.com
952-912-2604

Date: April 26, 2017

Subject: Interim Deliverable 2 for City Loop

Cc: Colin Harris, Alta Planning and Design
Rose Ryan, Alta Planning and Design
Tom Brennan, Nelson Nygaard

Introduction

This memo describes outcomes of work undertaken in Task 5, Baseline Conditions and Validation of DMC City Loop Vision while also building upon Precedence and Preliminary Design Guidance work presented in Tech Memo One:

- City Loop Precedents
- High Level ADA assessment
- Preliminary Route Assessment
- Land Use Review
- Preliminary Spatial Assessment
- Rochester Bike Share Program Assessment
- Protected Bikeway Design Guide

DMC City Loop Vision

"Develop a World-Class Urban Trail Amenity in Downtown Rochester – The City Loop Trail. Designed to put Rochester on the map for visitors around the world, this facility will be a reason people will want to come to Rochester and help catalyze and organize land use development. The City Loop will create a safe, enjoyable, healthy way to move about the Development District to experience sites, visit local shops, and dine in local restaurants and eateries." *DMC Development Plan*

Baseline Conditions

City Loop baseline conditions pertain to the route proposed in the DMC Development Plan as illustrated in **Figure 1**. This examination focuses on a set of interrelated components that when considered in total, provide insights for validating the DMC City Loop vision including:

- Connectivity to community assets and activity generators (cultural, civic, commercial uses)
- Connectivity to existing and planned on-street bike and multi-use trails network
- Connectivity to existing enhanced streetscapes
- Rail spur right of way, short and, or long-term repurposing for City Loop
- Identification of traffic control facilities
- Identification of spatial pinch points (if any)
- Assessment of bike/pedestrian user groups
- Preliminary projected bike share use
- Public health conditions
- Level of stress analysis for pedestrians and cyclists

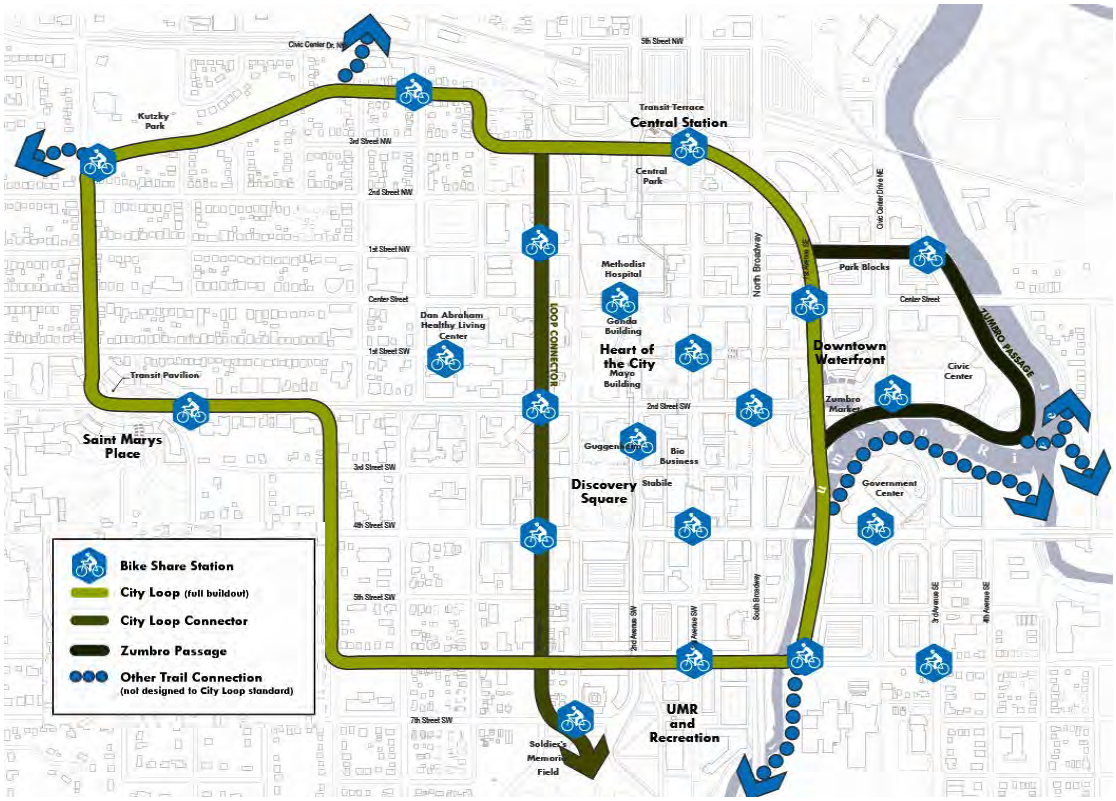


Figure 1. DMC Development Plan City Loop Route and Bike Share Stations

Connectivity to Existing and Planned Community Assets and Activity Generators, Figure 2

Examining the City Loop in a counter clock wise direction starting on 6th Street SW, the City Loop will provide easy access to downtown commercial, dining, entertainment and lodging facilities as it intersects with 1st Ave. SW and South Broadway. The City Loop also connects directly with the People's Food Coop grocery, bistro, bakery and deli located within the ground floor of a new, 5-story residential building. With Soldiers Field Veterans Memorial one block to the south, City Loop users have convenient access to a one the City's most significant park and open spaces. The central route segment running along 4th Ave. NW and 4th Ave. SW provides access to Central Park, several hotels, the Graham Parking Ramp and Mayo Clinic. The 4th Ave. SW segment provides access to additional Mayo Clinic facilities, Mayo gardens and plazas, and structured and surface parking facilities as it runs between Center and 6th Streets. Future Discovery Square district development and U of M campus expansion will also be easily accessed by this route segment.

The Zumbro riverfront is directly accessed as the City Loop follows the existing downtown River Loop northward to the Rochester Public Library, Mayo Civic Center, Rochester Civic Theater Company, Rochester Art Center and Mayo Park. As the City Loop moves on to Center Street additional downtown office and commercial properties and University of MN Rochester facilities are accessible.

The 3rd Street NW segment provides connections to Central Park and Charter House residential development as well as potential future development within the proposed Central Station area. This leg also provides access to Kutzky Park via a shift up to 4th Street NW.

Saint Marys Place campus and park and are the most significant activity generators and community assets accessible along the City Loop's western segment. DMC Development plans indicate considerable new mixed use development within this area which will be conveniently accessible from the City Loop. The City Loop also provides connections to commercial shops and eateries locate along the north side of 2nd St. SW between 11th and 13th Ave. SW.



The City Loop will reconfigure Kutzky Park's multi use trail as a two-way bikeway along with a separate pedestrian walkway.

Connectivity to Existing and Planned On-Street Bike and Multi-Use Trails Network, Figure 3

The City Loop route directly corresponds with several existing and planned trail facilities. The eastern most segments will repurpose several lengths of the existing Downtown Loop bike, Zumbro South Trail and walking pathways while a length of the northern segment will repurpose a length of the existing multiuse pathway within Kutzky Park. **Figure 3** further illustrates other intersections and overlaps with multiuse trails and planned bikeway improvements including those in downtown at 4th Ave. SW. and 6th St SW.



City Loop will replace a length of the existing bike lane on 6th St. with a 2-way protected bikeway.

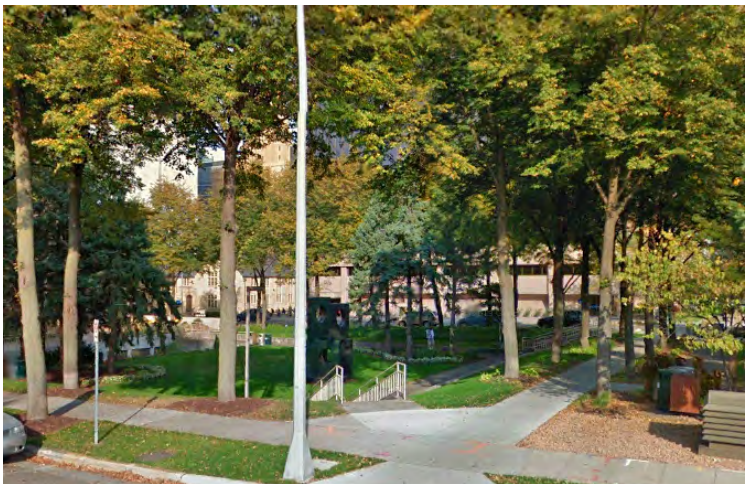
Connectivity to Existing Enhanced Streetscapes, Figure 4

2nd Str. SW is the most prominently streetscaped corridor within downtown Rochester. Enhancements reflect Mayo Clinic's site design program seen in other areas of downtown with low height, native limestone walls, black steel fencing, linear plantings of street trees and lushly planted boulevards. The corridor also includes enhanced bus shelters and extensive planting within the center median. The City Loop is proposed to run within the north side of this corridor.



Example of existing streetscape enhancements along 2nd St. SW

Building upon the City Loop's vision of a distinct identity and recognizable aesthetic requires exploration of streetscape amenities and furnishings that are different than those currently in use throughout the downtown. Recommendations for bike and distinctive pedestrian and bike system furnishings and materials will be proposed in the upcoming Design Vocabularies developed as a part of work in Task 6.



City Loop will connect to enhanced streetscape elements and Mayo Clinic semipublic green spaces as it runs within the 4th Avenue SW corridor.

CP Rail Spur

The City Loop is planned to run within the former right of way of the Canadian Pacific Railway spur line as a part of the proposed Cultural Crescent area within the Downtown Waterfront district. Situated within a variable width ROW, the line runs through the east side of downtown providing rail service for several industries located south of the downtown. Recently Seneca Foods, one of the primary users has shifted its hauling to trucks to better accommodate its frozen food business. Rail traffic is slow moving and variable in frequency ranging from several trips per day to several trips per month.

Locating the City Loop within the rail spur strengthens development of Cultural Crescent and Waterfront District by providing safe, convenient and attractive active transportation alternatives to



View of CP Rail spur line looking south.

cars and trucks. Given the current high levels of mixed and multi-use development occurring within downtown Rochester it would be prudent for the City to begin pursuing acquisition of spur line right of way in order to set the stage for implementation of the City Loop and DMC Waterfront District.

Traffic Control Facilities, Figure 5

Figure 5 illustrates locations along the City Loop route where users' movements will be effected by stop signs or traffic signals. Of greatest concern to bike safety is the ability for motorists to execute right-on-red turning movements at signalized intersections. The unpredictability of these movements create multiple opportunities for bicycle / vehicle conflicts with parallel and perpendicular bike travel. Additionally, vehicles queuing for right-on-red movements typically occupy / block the adjacent bike lane, this often results in bikers weaving around queuing vehicles further increasing opportunities for conflicts and accidents. Implementation of the City Loop will require further, detailed analysis of traffic control facilities including restrictions (where applicable) of right turning movements.



Spatial Pinch Points, Table 1

The spatial analysis introduced in Tech Memo 1 was been updated using additional information provided by the Streets Use study group and field reconnaissance. ROW widths are sufficient for accommodating the introduction of the City Loop's anticipated 28 - 32 ft. width within the majority of the proposed route. Five pinch points resulting from narrow ROW, steep slopes and or narrow bridge facilities have been identified:

1. Downtown River Loop trail between 6th St. SW and 2nd St. SW
2. The multi-use trail area along the east side of Cascade Creek between the existing trail and adjacent child care facility.
3. The Cascade Creek bridge sidewalk along the south side of Civic Center Dr.
4. A segment of the Kutzky Park multi-use trail just south of Civic Center Dr. and the Cascade Creek Bridge.
5. 7 Ave SW between 2nd St SW and 6th St SW (previously identified as exceeding ADA gradient parameters)

Bike and Pedestrian User Groups

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). An alternate framework for understanding the US population's relationship to transportation focused bicycling is illustrated in the figure below. This classification identifies four categories to address varying attitudes towards bicycling in the US.

- **Strong and Fearless** (approximately 1% of population) – Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections -- even if shared with vehicles -- over separate bicycle facilities such as shared-use paths.
- **Enthused and Confident** (5-10% of population) - This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared-use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.
- **Interested but Concerned** (approximately 60% of population) – This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or shared-use paths under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience.
- **No Way, No How** (approximately 30% of population) – Persons in this category are not bicyclists, and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances and may not be physically able to do so.

Pedestrian users are identified in the DMC Development Plan as:

- **Residents**: people living in Rochester who will help transform downtown into a 24-hour mixed use neighborhood.
- **Commuters**: people traveling in and out of the City for employment who will have convenient access to fast and reliable multimodal transit, and an update bicycle and pedestrian network.
- Businesses: physicians, researchers, scientists, professional service enterprises, commercial and personal service providers.
- Patients / Patient Companions: people receiving medical services and those who accompany them during their visits.
- Visitors: people coming to downtown Rochester for a wide range of purposes from family gatherings to regional and seasonal activities, sporting events, arts and cultural performances, conferences and conventions.

These user groups include people of all ages, activity levels and abilities ranging from independently mobile to mobility device assisted. The City Loop's pedestrian facilities will be planned, designed and maintained to support the full range of users.

Bike Share

In 2013, Nice Ride Minnesota and Blue Cross Blue Shield Center for Prevention commissioned Nelson\Nygaard to conduct a bike share study to determine if bike share would be feasible in Rochester. In part, the study considered population density, potential use, and the extent to which the Mayo Clinic would influence the location of stations. The study compared potential bike share in Rochester with existing bike share programs in three comparable cities, Madison, WI, St. Paul, and Chattanooga, TN.

Based upon a review of comparable cities and existing and planned conditions in Rochester, the study forecast the number of annual trips that could be expected were between 21,200 and 26,500. These numbers assumed the completion of bike lanes on 2nd, 3rd, and 4th Avenues, the installation of a protected bike lane (cycle track) along 3rd Street SE and several bike boulevards.

Since 2013, the vision of the DMC has become more clear, and the concept of the City Loop has been introduced. Bike share use would be impacted by the envisioned growth and increased residential and worker density within the DMC Development District. More residents, workers, and visitors are likely to reach the DMC via expanded public transportation options. It is assumed that some of these people would be interested in using bike share to complete short trips within the DMC development district. The development of the City Loop would further encourage bike share use, as people would have a comfortable and attractive bike facility to use to connect to destinations throughout the DMC.

With the development of DMC centers of resident and worker density, further improvement of the bike network, and increased access to transit, we believe bike share use could be increased by as much as 10% above the projections completed in 2013. This would bring the total to 23,320-29,150 annual trips on bike share.

Public Health

Why health is relevant to DMC City Loop

The City of Rochester aspires to be a city of health. In order to holistically achieve this goal, investment in active transportation infrastructure and programming is an essential part of the equation. The physical, mental, and social health benefits of active travel, as well as the reduction in localized road network congestion and conflicts will help propel Rochester into the next generation of healthy living. Residents throughout the city will be able to actively commute to work, and visitors and patients alike will be able to easily and safely walk or bike from their accommodations to the medical center, services, and amenities. The DMC City Loop presents an unprecedented opportunity for the City of Rochester to transform their transportation network and improve the overall health and wellness of the city.

Chronic disease is the leading cause of death and disability in the United States, which results in approximately 70% of deaths each year[i]. It is well understood that increasing physical activity levels

is one of the most effective ways to reduce the risk of chronic diseases and related risk factors. Specifically, physical activity is associated with reductions in the risk of overweight/obesity, high blood pressure, abnormal cholesterol, diabetes, coronary heart disease, some cancers, depression, and all-cause mortality.[ii, iii, iv, v, vi, vii, viii]

However, in order to realize the benefits that physical activity can have for Rochester residents, people who work in Rochester, and those visiting the city, the city's active transportation infrastructure must be designed to meet a high level of safety and comfort to encourage walking and biking.

It is well documented that roadway safety is one of the biggest barriers to increasing the rate of walking and biking. This is one of the reasons that the DMC City Loop will offer bicycle and pedestrian facilities that are separated from road traffic. Studies have shown that bicycling may increase by as much as 75 percent after implementing separated bike lanes, and pedestrian safety is also shown to benefit. The DMC City Loop will specifically target the 60 percent of people who are interested in biking and walking throughout the city, but who are concerned about their safety. The DMC City Loop will also provide accessible infrastructure to ensure that all ages and abilities can benefit from active transportation.

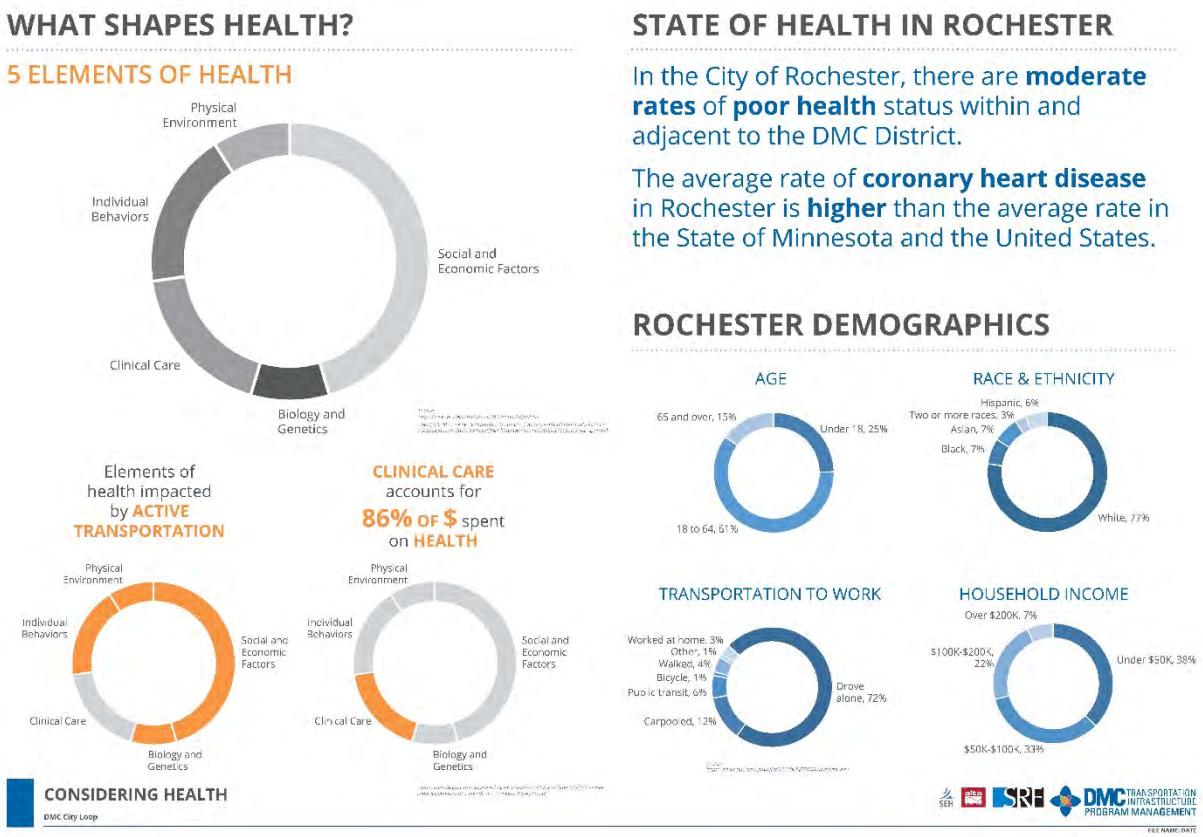
The following analysis includes a background of the factors that shape human and community health; the benchmarking methodology used for Rochester's health conditions assessment; and findings from the health conditions assessment for Rochester, inclusive of an explanation of how active transportation can have a positive impact on chronic disease indicators.

What Shapes Health

Determinants of health are factors that contribute to a person's current state of health. These determinants are clinical care, biology and genetics, social and economic factors, health behaviors, physical environment. Scientists do not know the precise contribution of each determinant, but health behaviors, the physical environment, and social and economic factors account for approximately 60-75% of the health factors that contribute to shaping health outcomes, which are all factors that can be impacted by physical activity.

Physical activity is one of the best ways to reduce the risk of overweight/obesity, high blood pressure, and abnormal cholesterol, all risk factors for diabetes. For example, thirty minutes of moderate-intensity physical activity has also been shown to directly reduce the risk of diabetes up to 30-50 percent [ix].

Through the following analysis, we found that in the City of Rochester there are moderate rates of poor health within the DMC District and in adjacent neighborhoods. Most concerning is that there are higher rates of coronary heart disease in Rochester as compared to the average rate in the State of Minnesota and the United States.



Benchmarking Methodology

The benchmarking process used in this analysis compared health measures for the City of Rochester to the State of Minnesota and the United States. This process also mapped the geographic distribution of specific chronic diseases within the city. As a starting point, we performed a cursory analysis of the health conditions in the City of Rochester and found evidence of a number of health concerns. While limited in scope, four chronic disease indicators including obesity prevalence, diabetes prevalence, coronary heart disease, and mental health were selected as a focus for this analysis due to their rates within the city and the potential impact that increased physical activity can have on improving these specific health outcomes. This initial analysis provides a snapshot of Rochester's health status, but it is recommended that additional chronic disease indicators, social demographic data, collision data, and travel behavior be evaluated to provide a more complete picture of the overall state of health in the city. Additionally, supplemental research and geographic mapping of social demographic data, such as age, race, income, and education is recommended to further understand the geographic correlations between social demographics and health outcome measures.

The analysis was conducted using census tract data from the Centers for Disease Control and Prevention's (CDC) 500 Cities project, a dataset inclusive of city and census tract-level data,

obtained using small area estimation methods, for 27 chronic disease measures for the 500 largest American cities.[x] Using this data, we established the average prevalence rate for each indicator and then generated choropleth maps that graphically illustrate the distribution of the average, above average, and below average prevalence rate for each indicator. The analysis also included a comparative analysis for each indicator at the state and national level.

Findings

Overall the rate of chronic disease in Rochester is better than compared to the state of Minnesota the country as a whole. Yet, there are higher rates of NCD in neighborhoods within and adjacent to the DMC district. Below is a sampling of health status measures in the City of Rochester.

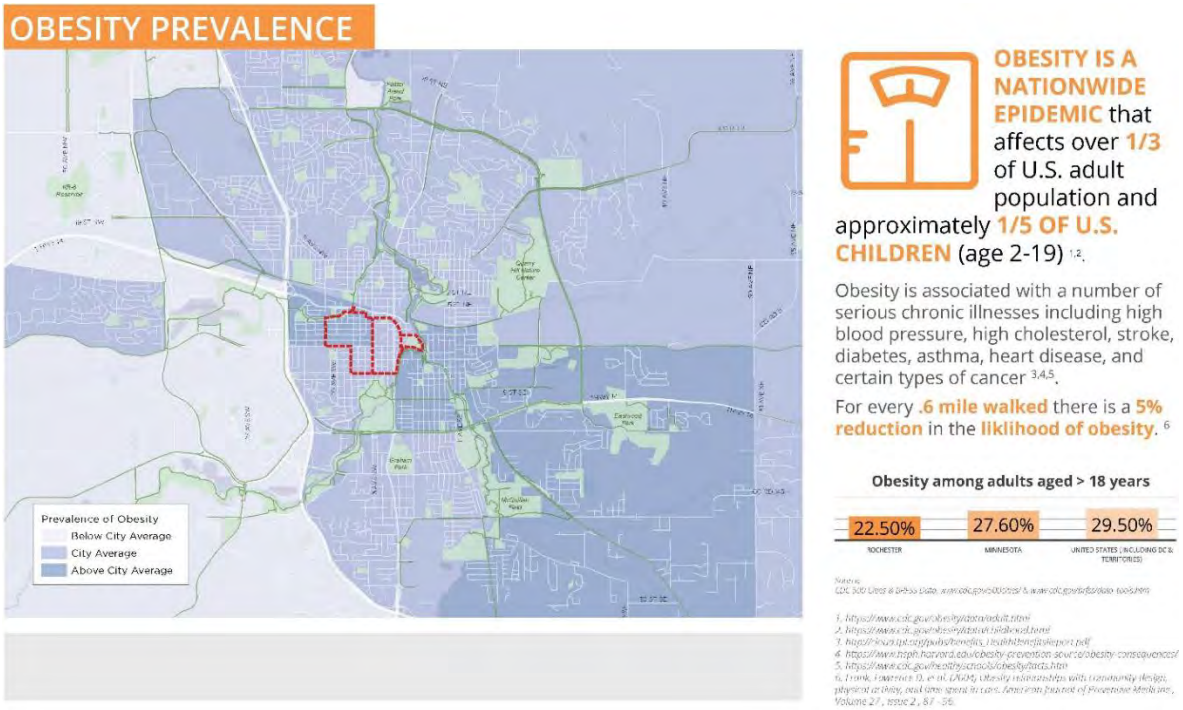
- 22.5% of adult residents are obese
- 7.1% of adult residents have been diagnosed with diabetes
- 5% of adult residents have coronary heart disease
- 8.4% of adult residents have reported that during the past 30 days, their mental health, which includes stress, depression, and problems with emotions, was not good for at least 14 days

Obesity Prevalence

Obesity is a nationwide epidemic that affects over one third of the U.S. adult population and approximately one fifth of U.S. children (age 2-19)[xi, xii]. Obesity impacts individuals emotionally and socially, and is associated with a number of serious chronic illnesses including high blood pressure, high cholesterol, stroke, diabetes, asthma, heart disease, and certain types of cancer [xiii,xiv,xv]. Of the ten leading causes of death in the United States, obesity is linked to seven of these conditions. [xvi].

Active transportation presents an important opportunity to begin to reduce the incidence of obesity in an area and improve overall resident health. Active transportation allows people to incorporate physical activity into their daily routines and is associated with greater rates of walking and cycling, physical activity, and lower rates of obesity.[xvii] For example, for every 0.62 mile walked per day, there is an associated 5 percent reduction in the likelihood of obesity.[xviii]

The analysis found that the City of Rochester has lower prevalence rates (22.5%) of obesity as compared to 27.6% for the State of Minnesota, and 29.5% for the United States. However, within the city there are higher rates of obesity showing up on the west side of the DMC District and the southeast sector of the city.



Note: The dotted-red line on the map represents the proposed route for the DMC City Loop.

Diabetes Prevalence

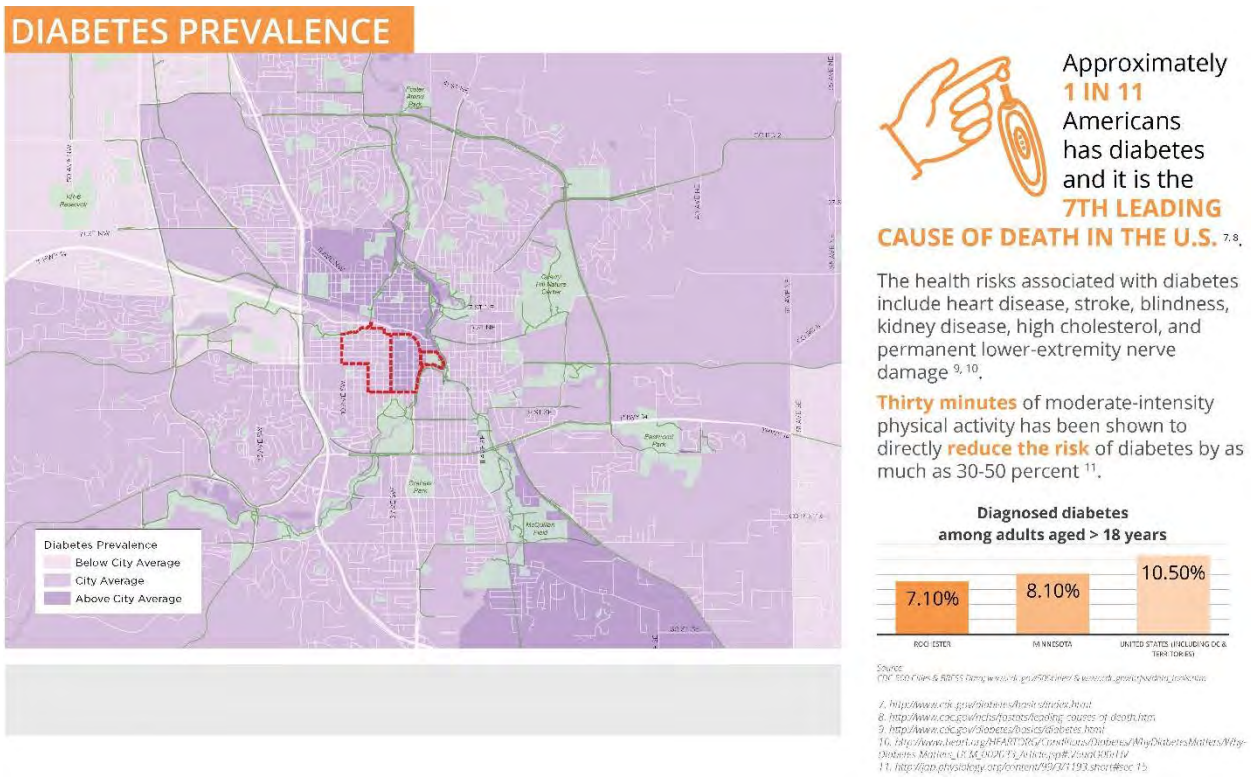
The diabetes prevalence indicator reports the percentage of adults in Rochester, MN who have ever been told by a doctor that they have diabetes [xix]. As of 2015, approximately one in eleven Americans has diabetes and it is the seventh leading cause of death in the United States [xx,xxi].

The health risks associated with diabetes include heart disease, stroke, blindness, kidney disease, high cholesterol, and permanent lower-extremity nerve damage [xxii, xxiii]. Risk factors associated with diabetes that can be controlled for prevention include overweight/obesity, physical inactivity, high blood pressure, and abnormal cholesterol [xxiv].

Active transportation has a direct and positive impact on numerous risk factors associated with diabetes. Specifically, active transportation, inclusive of walking and bicycling, as well as taking public transportation is inextricably linked with increased rates of physical activity and evidence-based reductions in rates of overweight and obesity. It has been found that thirty minutes of

moderate-intensity physical activity can directly reduce the risk of diabetes by as much as 30-50 percent.[xxv]

The analysis found that the City of Rochester has a lower prevalence (7.1%) of obesity as compared to 8.1% for the State of Minnesota, and 10.5% for the United States. Within the city, the highest rates of CHD show up in the east side of the DMC District and north of the DMC.



Note: The dotted-red line on the map represents the proposed route for the DMC City Loop.

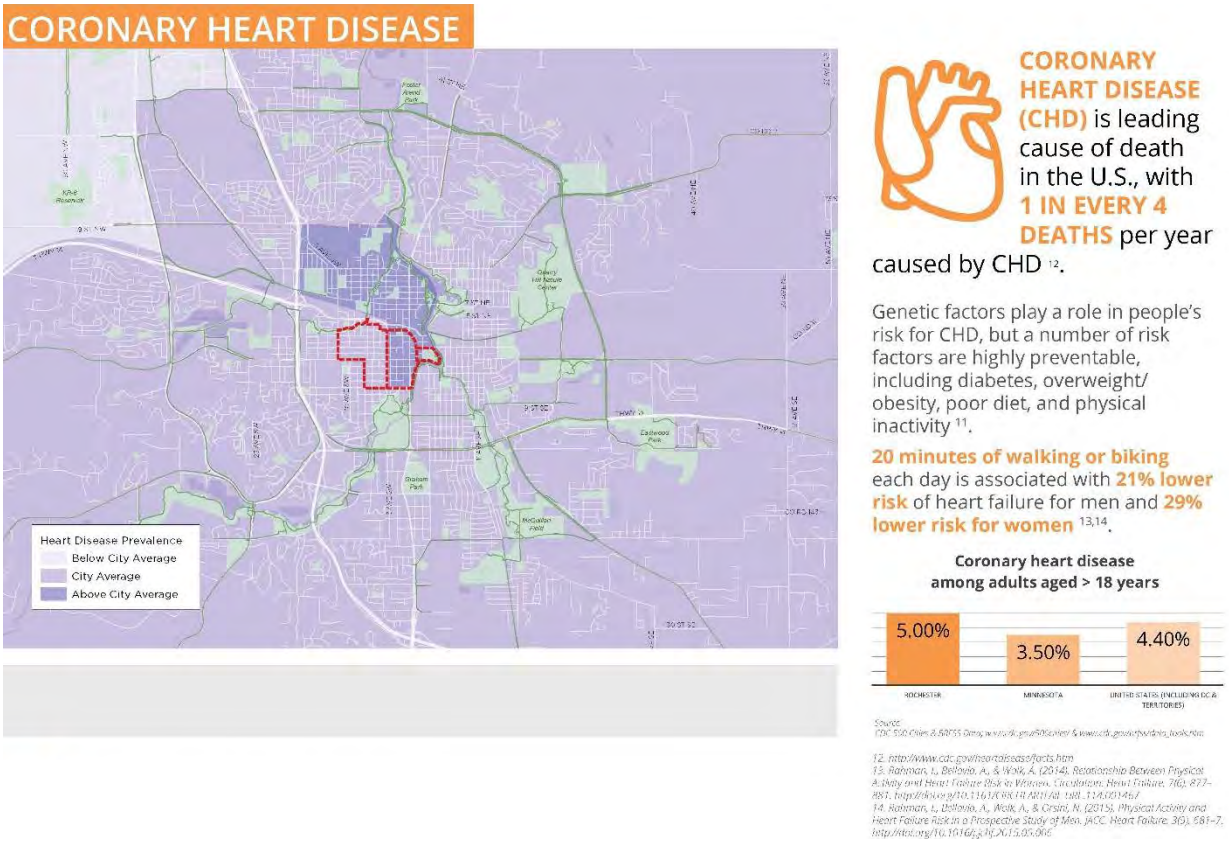
Coronary Heart Disease

Coronary Heart Disease (CHD) is leading cause of death for both men and women in the United States, with one in every four deaths per year caused by coronary heart disease [xxvi]. The heart disease indicator reports the percentage of adults (18+) in Rochester, MN that has ever been told by a doctor that they have CHD or angina [xxvii]. Genetic factors play a role in people's risk for CHD, but a number of risk factors are highly preventable, including diabetes, overweight/obesity, poor diet, and physical inactivity [xxviii].

The analysis found that the City of Rochester has a higher prevalence rate (5.0%) of CHD as compared to 3.5% for the State of Minnesota, and 4.4% for the United States. Within the city, the highest rates of CHD show up in the east side of the DMC District and north of the DMC. At the January 24th public outreach meeting, there was feedback from the public that this may be due to

higher concentration of older residents in these areas, particularly in the neighborhood to the north of the DMC District.

Active transportation is an important tool for creating a balanced transportation system designed to meet everyone's needs and abilities, regardless of age. Creating a network that encourages safe walking, biking, and access to transit allows residents to incorporate low-impact physical activity into their everyday routines, as well as encourages long-term positive health behaviors. These behaviors in turn, have been shown to be positively associated with reduced risk of coronary heart disease. [xxix]



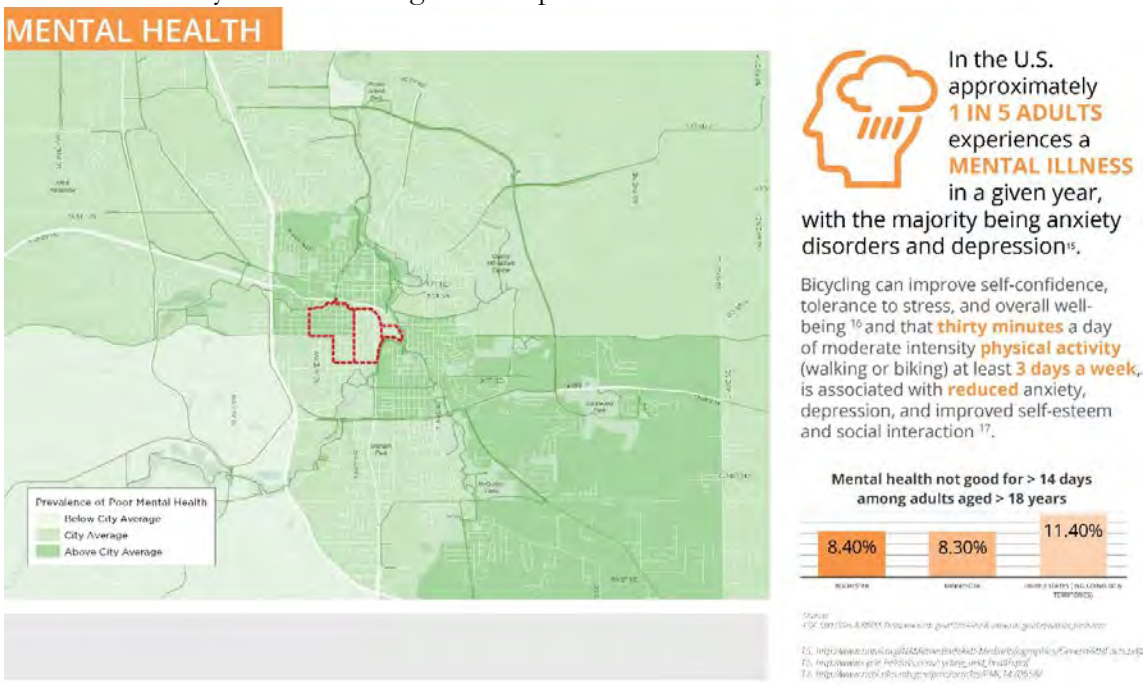
Note: The dotted-red line on the map represents the proposed route for the DMC City Loop.

Mental Health

In the United States, approximately one in five adults experiences a mental illness in a given year, with the majority being anxiety disorders and depression [xxx]. The mental illness indicator reports the percentage of adults (18+) reporting any mental illness in the past year (61). A mental illness is defined by the National Alliance on Mental Illness as a condition that affects a person's thinking, feeling, or mood [xxxi].

Many protective factors for mental illness are positively associated with walking and bicycling, including individual self-esteem, confidence, stress management, fitness, and social support.[xxxii] Evidence has shown that walking and/or cycling for even short periods throughout the day can lead to reduced anxiety, stress, and depression, and improved self-esteem and social interaction.[xxxiii, xxxiv] One study in particular, found that thirty minutes a day of moderate intensity physical activity (walking or biking) at least 3 days a week, is associated with reduced anxiety, depression, and improved self-esteem and social interaction [xxxv].

The analysis found that the City of Rochester has a higher prevalence (8.4%) of poor mental health as compared to 8.3% for the State of Minnesota, but lower than the United States which is 11.4%. Within the city there are higher rates of poor mental health showing up on the west side of the DMC District, the adjacent neighborhoods to the north, and the southeast sector of the city. Similar to the other health indicators, we recommend further investigation into census demographic data in these areas and to discuss findings with public health and community stakeholders to better understand what may be contributing to these patterns.



Note: The dotted-red line on the map represents the proposed route for the DMC City Loop.

Conclusion

The DMC City Loop presents a unique opportunity for the City of Rochester to achieve its aspiration of a city of health. Not only will Rochester be known for its world-class medical facilities and services, but also for its exemplary active transportation facilities that promote physical activity and overall wellness for city residents, employees, and visitors. Active transportation is one of the easiest ways to reduce the prevalence of obesity and overweight, diabetes, cardiovascular and mental health, among other risk factors and health concerns. The DMC City Loop will offer a safe and

comfortable separated facility for active transportation users of all ages and abilities and will be a destination location within the city.

Bicycle Level of Traffic Stress, Figures 6-11

Introduction

As part of the Destination Medical Center (DMC) City Loop planning and concept development, an investigation of existing bicycle comfort was completed using a Bicycle Level of Traffic Stress (LTS) Analysis. This analysis uses street characteristics to rate the roadway from 1 – 4, from most to least comfortable for bicyclists. This analysis acknowledges that comfort and perceived safety are strongly tied to bicycle use. If people do not feel comfortable or safe biking on city streets, they are unlikely to choose to bike for transportation or recreation.

As the City of Rochester considers bicycle improvements that make up the proposed City Loop, the LTS analysis performed and detailed below will help highlight locations where potential improvements could have the biggest effect on a safe, comfortable, and connected bicycle network.

The methods used for the Level of Traffic Stress Analysis were adapted from the 2016 Oregon Department of Transportation (ODOT) *Analysis Procedure Manual*[1]. The approach outlined in the ODOT report uses roadway network data, including posted speed limit, the number of travel lanes, and the presence and character of bicycle lanes, as a proxy for bicyclist comfort level. Road segments are classified into one of four levels of traffic stress based on these factors.

The lowest level of traffic stress, LTS 1, is assigned to low-traffic residential roads that would be suitable for bicycle use by people of all ages and abilities, including children, and also to multi-use paths that are separated from motorized traffic. LTS 2 roads are those that could be comfortably ridden by the most adults. These roads typically have moderate traffic volumes but low speeds.

The higher levels of traffic stress, LTS 3 and 4, correspond to types of cyclists characterized by Portland's bicycle coordinator Roger Geller in his *Four Types of Cyclists* report[2]. This categorization of cyclist types is accepted throughout the bicycling planning practice across the U.S. LTS 3 is the level assigned to roads that would be acceptable to current "enthused and confident" cyclists, who are typically comfortable bicycling in striped bike lanes and on low to moderate traffic roads with no dedicated bicycle facilities. LTS 4 is assigned to segments that are only acceptable to "strong and

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[1] *Analysis Procedure Manual* methodology relies heavily on the 2012 Mineta Transportation Institute *Report 11-19: Low-Stress Bicycling and Network Connectivity*

[2] Source: Roger Geller. *Four Types of Cyclists*.
http://www.portlandoregon.gov/transportation/article/237507

fearless" bicyclists, who will tolerate riding on roadways with higher motorized traffic volumes and speeds, with our without dedicated bicycle facilities. The definitions for each level of traffic stress are shown in **Table 2**. **Figure 6** shows existing Rochester streets at each LTS level.

A route consisting of stretches of connected low stress streets may be interrupted by needing to cross a high stress intersecting street. Because of this, a trip along a comfortable route might be avoided altogether by a person on a bike – just because of a single uncomfortable crossing. It is critical to acknowledge that stressful streets in an otherwise low stress network will often discourage a person from making a trip by bicycle.

Table 2. Levels of Traffic Stress Definitions Source: ODOT Analysis Procedure Manual, Version 2

LTS 1	Represents little traffic stress and requires less attention, so is suitable for all cyclists. This includes children that are trained to safely cross intersections (around 10 yrs. old/5th grade) alone and supervising riding parents of younger children. Generally, the age of 10 is the earliest age that children can adequately understand traffic and make safe decisions which is also the reason that many youth bike safety programs target this age level. Traffic speeds are low and there is no more than one lane in each direction. Intersections are easy to cross by children and adults. Typical locations include residential local streets and separated bike paths/cycle tracks.
LTS 2	Represents little traffic stress but requires more attention than young children can handle, so is suitable for teen and adult cyclists with adequate bike handling skills. Traffic speeds are slightly higher but speed differentials are still low and roadways can be up to three lanes wide in total for both directions. Intersections are not difficult to cross for most teenagers and adults. Typical locations include collector-level streets with bike lanes and local streets that might intersect arterials.
LTS 3	Represents moderate stress and suitable for most observant adult cyclists. Traffic speeds are moderate but can be on roadways up to five lanes wide in both directions. Intersections are still perceived to be safe by most adults. Typical locations include low-speed arterials without bike lanes.
LTS 4	Represents high stress and suitable for experienced and skilled cyclists. Traffic speeds are moderate to high and can be on roadways from two to over five lanes wide in both directions. Intersections can be complex, wide, and or high volume/speed that can be perceived as unsafe by adults and are difficult to cross. Typical locations include high-speed or multilane roadways with narrow or no bike lanes or shoulders.



Figure 6. Four LTS levels existing in Rochester

Bikeways of the City Loop are recommended to be designed for All Ages and Abilities (often referred to as AAA). An AAA network invites more of the population to ride because improved safety and comfort. Because of this, priority should be given to projects that upgrade roadways and network connections to LTS 1.

Methodology

The categorization of roadways in and around the proposed DMC Development District was completed through an analysis of street segments, intersections, and approaches using spatial (GIS) data and aerial imagery. Where GIS data was unavailable, spot checks were completed using a combination of high-resolution aerial imagery, on site field review by the project team, and Google Streetview. The extent of the study area is based on the DMC Development District boundary. Because the proposed City Loop alignment extends outside of the DMC Development District, the LTS analysis study area was expanded to include the City Loop alignment. The existing trail system of off street facilities that supplements the street network was analyzed and was considered separately from the on-street network.

Broadly, every street link (a section of roadway) received *up to* three scores based on its characteristics: one score for its segment, the space of roadway between intersecting streets; one score for its approach, the area of the segment with turn lanes, where present; and one score for its intersection, where one segment crosses another, where present. **Figure 7** helps illustrate the three possible sections of a roadway that were scored.

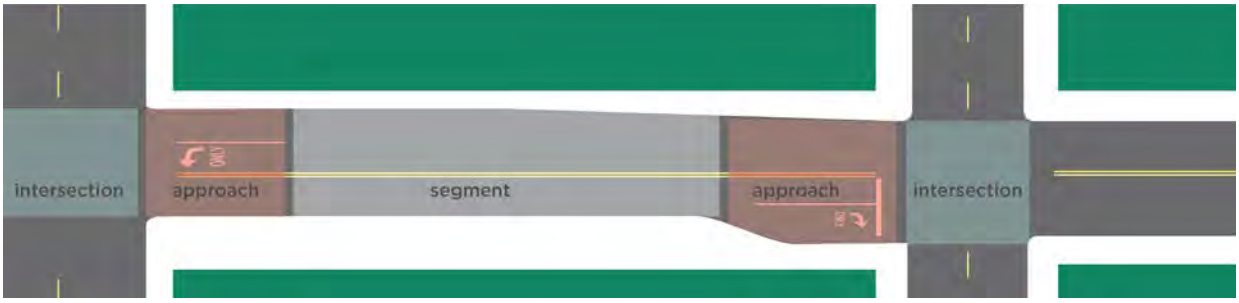


Figure 7. A street link showing the three possible scores it could receive. Because not all links have these three sections, some links may instead receive a single score for segment level of traffic stress.

The three scores assigned were based on a link's characteristics that affect a bicyclist's feeling of safety and comfort. The scores ranged from 1 to 4, where 1 represents the lowest stress, and 4 represents highest stress and discomfort. These three scores, (when all were assigned), determined the overall LTS score. The overall LTS score a link received was based on a "weakest link" methodology. That is, if a link received a segment score of 2, an approach score of 4, and an intersection score of 3, the overall link score assigned was LTS 4.

The following list is a summary of street characteristics that affect the LTS score assigned to a segment, approach, and intersection, thereby affecting the overall LTS score assigned. **Tables 3-10** include detailed descriptions of how street characteristics affected LTS.

Segment

- Bike lane or mixed traffic
- Width of bike lane, if present
- Bike lane along parking lane or curb, if present
- Posted speed limit
- Number of travel lanes
- Frequent lane blockage (commercial vehicles, transit vehicles, etc)
- Presence of centerline
- Presence of sharrow markings

Table 3. Scoring criteria for bike lane segments without adjacent parking lane (ODOT)

1 Lane per direction					**≥2 lanes per direction**	
Prevailing or Posted Speed	≥ 7' (Buffered bike lane)	5.5' – 7' Bike lane	≤ 5.5' Bike lane	Frequent bike lane blockage1	≥ 7' (Buffered bike lane)	<7' bike lane or frequent blockage[1]
≤30 mph	LTS 1	LTS 1	LTS 2	LTS 3	LTS 1	LTS 3
35 mph	LTS 2	LTS 3	LTS 3	LTS 3	LTS 2	LTS 3
≥40 mph	LTS 3	LTS 4	LTS 4	LTS 4	LTS 3	LTS 4

[1]Typically occurs in urban areas (i.e. delivery trucks, parking maneuvers, stopped buses).

Table 4. Scoring criteria for bike lane segments with adjacent parking lane

	1 Lane per direction			≥2 lanes per direction	
Prevailing or Posted Speed	**≥ 15' bike lane + parking**	**14' – 14.5' bike lane + parking**	**≤ 13' bike lane + parking or Frequent blockage**	**≥ 15' bike lane + parking**	**≤ 14.5' bike lane + parking or Frequent blockage[1]**
≤25 mph	LTS 1	LTS 2	LTS 3	LTS 2	LTS 3
30 mph	LTS 1	LTS 2	LTS 3	LTS 2	LTS 3
35 mph	LTS 2	LTS 3	LTS 3	LTS 3	LTS 3
≥40 mph	LTS 2	LTS 4	LTS 4	LTS 3	LTS 4

[1]Typically occurs in urban areas (i.e. delivery trucks, parking maneuvers, stopped buses).

Table 5. Scoring criteria for urban/suburban mixed traffic

Prevailing Speed or Speed Limit (mph)	**Unmarked Centerline**	**1 lane per direction**	**2 lanes per direction**	**3+ lanes per direction**
≤ 25[1]	**LTS 1**	**LTS 2**	**LTS 3**	**LTS 4**
30	**LTS 2**	**LTS 3**	**LTS 4**	**LTS 4**
≥ 35	**LTS 3**	**LTS 4**	**LTS 4**	**LTS 4**

[1]Presesence of "sharrow" markings may reduce the LTS by a level for 25 mph or less sections depending on overall area context.

Approach

- Presence of right turn lanes (where bikes and cars might mix)
- Presence of left turn lanes (where a bike must merge/cross to reach left turn lane to make left turn)
- Length of turn lane
- Posted speed limit

Table 6. Scoring criteria for approaches with right turn lanes. This measures the level of stress a person on a bicycle would experience while sharing a right turn lane with a vehicle.

Right-turn lane configuration	**Right-turn lane length (ft)**	**Bike Lane Approach Alignment**	**Vehicle Turning Speed (mph)[2]**	**LTS**
Single	≤ 150	Straight	≤ 15	2
Single	>150	Straight	≤ 20	3
Single	Any	Left	≤ 15	3

Single[1] or Dual Exclusive/ Shared	Any	Any	Any	4

[1]Any other single right turn lane configuration not shown above.

[2]This is vehicle speed at the corner, not the speed crossing the bike lane. Corner radius can also be used as a proxy for turning speeds.

On approaches without exclusive left turn lanes, a person on a bicycle would be riding in close proximity to the space from which a left turn is made, and there is little lateral maneuvering that must be made. However, on street approaches where there is a separate left turn lane, a person on a bicycle must merge from the right side of the road across lanes to reach the left turn lane. This can be a stressful maneuver, especially where vehicle speeds are greater or where multiple lanes must be crossed by a person on a bicycle. In **Table 7** below, the columns indicate the Level of Traffic Stress scoring based upon the number of lanes that a person would need to cross to make a left turn on their bicycle.

Table 7. Scoring criteria for approaches with left turn lanes. This measures the level of stress a person on a bicycle would experience while merging to make a left turn.

Left Turn Lane Criteria Prevailing Speed or Speed Limit (mph)	**No lane crossed[1]**	**1 lane crossed**	**2+ lanes crossed**	**Dual shared or exclusive left turn lane[2]**
≤25	LTS 2	LTS 2	LTS 3	LTS 4
30	LTS 2	LTS 3	LTS 4	LTS 4
≥ 35	LTS 3	LTS 4	LTS 4	LTS 4

[1]For shared through left lanes or where mixed traffic conditions occur (no bike lanes)

[2]Any other single left turn lane configuration not shown above.

Intersection

- Presence of traffic signal
- Number of lanes that must be crossed on intersecting street
- Posted speed limit on intersecting street
- Presence of median island

Signalized intersections do not create a barrier to people on bicycles because of the protected signal phase for crossing. Because of this, all intersections with signalized crossings were given an LTS 1 intersection score in this analysis. However, intersection approaches could be assigned lower scores than the intersection itself due to the presence of right and/or left turn lanes on the approach to the signalized intersection.

Table 8. Scoring criteria for unsignalized intersection crossing without median refuge

Prevailing Speed or Speed Limit (mph)	**Total Lanes Crossed (Both Directions)**		
	≤ 3 Lanes	**4 -5 Lanes**	**≥ 6 Lanes**
≤ 25	LTS 1	LTS 2	LTS 4
30	LTS 1	LTS 2	LTS 4

35	LTS 2	LTS 3	LTS 4
≥ 40	LTS 3	LTS 4	LTS 4

Table 9. Scoring criteria for unsignalized intersection crossing with median refuge

Prevailing Speed or Speed Limit (mph)	Maximum Through/Turn Lanes Crossed per Direction		
	1-2 Lanes	**2-3 Lanes**	4+ **Lanes**
≤ 25	LTS 1[1]	LTS 1[1]	LTS 2
30	LTS 1[1]	LTS 2	LTS 3
35	LTS 2	LTS 3	LTS 4
≥ 40	LTS 3	LTS 4	LTS 4

[1]Refuge should be at least 10 feet to accommodate a wide range of bicyclists (i.e. bicycle with a trailer) for LTS 1, otherwise LTS=2 for refuges 6 to <10 feet.

Results

Figure 8 shows the results of the LTS analysis in and around the DMC Development District. The proposed City Loop alignment is shown in gray. **Table 10** shows the percentage of analyzed roadway that was categorized at each LTS level.

Table 10. Amount of analyzed roadway in each LTS level

LTS	Length of analyzed roadway[2]	Percentage of analyzed roadway [2]
1[1]	0.9 mi	2 %
2	19.7 mi	47 %
3	11.3 mi	27 %
4	10.3 mi	24 %

[1]this does not include the off street trail network along Cascade Creek and the Zumbro River

[2]double carriage way roads were considered redundant in terms of mileage. Civic Center Drive and Broadway roadway miles were counted only once, the redundant travelways were not counted.

LTS 1 roadways, shown in dark green in **Figure 8**, made up a small portion of the study area. The majority of these LTS 1 links existed on roadways that do not have an intersection or an approach – often as dead end streets.

LTS 2 roadways, shown in lighter green, made up a significant portion of the study area on local residential streets where the street network often had lower speeds, no centerline, and intersections that were comfortable to cross.

LTS 3 roadways, shown in orange, were those that typically had a marked centerline, indicating space enough for two way travel. Often, posted speed limits were 30 miles per hour, or had intersection approaches that required people on bicycles to share travel lanes with turning vehicles.

LTS 4 roadways, shown in red, were those roadways that had higher traffic speeds, mixed intersection approaches, and difficult intersection crossings.

Trail Network

The off street trail network along the Zumbro River and Cascade Creek offers a comfortable riding experience for people on bicycles in the area. Indeed, when scoring the trail segments and intersections with the street network, all trails in the area received an overall LTS score of 1. **Figure 9** shows the trails in the area as LTS 1, in dark green. This existing trail network is an important asset and was used when considering the low stress bicycling in Rochester.

Cluster Analysis

Figure 10 shows connected LTS 1 or LTS 2 roadways. Each differently colored cluster represents the extent a person on a bicycle could ride and remain on an LTS 1 or 2 roadway. Where each colored cluster ends, a rider would encounter a roadway exceeding LTS 2. This analysis considered the existing trail system, shown in dark green. The trail system plays an important role in connecting LTS 1 and 2 roadways to extend the distance that a person could travel under LTS 1 and 2 conditions.

The cluster shown in blue displays the network of LTS 1 and 2 roadways in and around the northwest portion of the DMC Development District. The LTS 1 and 2 network is supported by the trails along Cascade Creek (through Kutzky Park), which provides a low-stress connection across Civic Center Drive NW.

The connected clusters in purple show the network of LTS 1 and 2 roadways connected by existing trails in Soldiers Memorial Field, along the Zumbro River, and through Silver Lake Park. These trails provide crossings of the river on low stress bicycle and pedestrian-only bridges.

The clusters that are not purple or blue are disconnected from each other, regardless of the existing trail. Before being able to connect to another cluster, a person riding a bicycle on these streets would encounter a roadway exceeding LTS 1 or 2.

Discussion

As part of DMC planning, Rochester aims to create quality and safe bicycle infrastructure in order to make bicycling comfortable and attractive for people of all ages and abilities, and therefore increase the number of people using bicycles for transportation as the DMC grows. LTS 1 roadways are considered comfortable for

adults and many children. Projects that improve safety and comfort to a level of LTS 1 on existing roadways, intersections and connections should be prioritized in order to reach the bicycle mode share targets established by the DMC.

The Cluster Analysis provided insight into improvements that might yield the highest benefit to people on bicycles. These improvements are those that connect existing and separated LTS 1 or 2 roadways, shown as colored clusters in **Figure 10**. Making a connection between two clusters would allow a person on a bike access to additional safe and comfortable streets. For example, an improvement made along 2nd St SW at 7th Ave SW to facilitate safe and comfortable crossing of the street would connect two very large clusters currently separated, shown in blue and purple in Figure 5.

It is important to note that a connection from south of 2nd St SW to the north of 2nd St SW must upgrade the existing crossing from its current LTS level to an LTS 1 or 2, in order to make the connection comfortable for all ages and abilities. Referring to **Figure 8**, we see that 2nd St SW is currently an LTS 4. A half block connection along and across 2nd St SW would connect two clusters. However, this connection must be safe and comfortable enough to achieve LTS 1 or 2. The proposed alignment of the City Loop falls on this important section of 2nd St SW. It is critical that improvements address the existing uncomfortable conditions along this roadway.



The proposed City Loop alignment would serve to connect several clusters of LTS 1 and 2 roadways isolated from one another. Considering the connections provided by the existing trail network, there are currently 16 separate clusters. If the City Loop were constructed at a level of LTS 1 or 2, it would connect three additional clusters with the LTS 1 or 2 network currently connected by the existing trail system. **Figure 11** shows LTS 1 and 2 clusters in purple that would be connected by the proposed City Loop alignment. With the City Loop in place, a person would be able to bicycle on 17.91 miles[3] of connected LTS 1 or 2 roads. This network is shown in **Figure 11** in purple. Currently, the largest extent of LTS 1 or 2 roads is 11.65 miles[3] – shown in Figure 5 in purple. The addition of the City Loop at the level of LTS 1 or 2 would more than double the largest existing cluster and open more destinations to people on bicycles.



It is important to point out the lack of LTS 1 and 2 roadways in the downtown area – between 4th Ave NW and the River, and between Civic Center Drive and 4th St SW. This section of the City contains a large number of jobs and some of the most stressful and uncomfortable roadways on which to bicycle. While the

[3] These mileages do not include the length of the City Loop itself (roughly 4 miles), or the existing trail network (9.84 miles)

proposed City Loop would construct safe and comfortable bicycle facilities around the downtown core, the City Loop would need to be supplemented by additional LTS 1 or 2 bicycle facilities for downtown to be truly inviting to most people on bikes. Physically protected bike facilities would be the most appropriate LTS 1 and 2 facilities in downtown Rochester, given the existing traffic speeds and volumes.

Conclusion

The LTS analysis performed and discussed above highlights the need for safe and comfortable connections in and around the DMC Development District. While there are existing roadways comfortable enough for adults and most children, they are limited to off street trails and the residential areas of the city and have limited connections to destinations within the DMC Development District. The proposed City Loop alignment provides significant benefits in terms of network connectivity and leverages places that are already safe and rideable, such as low stress city streets. Prioritizing improvements that make connections between existing low stress clusters will be critical to expanding areas that are comfortable for people on bikes.

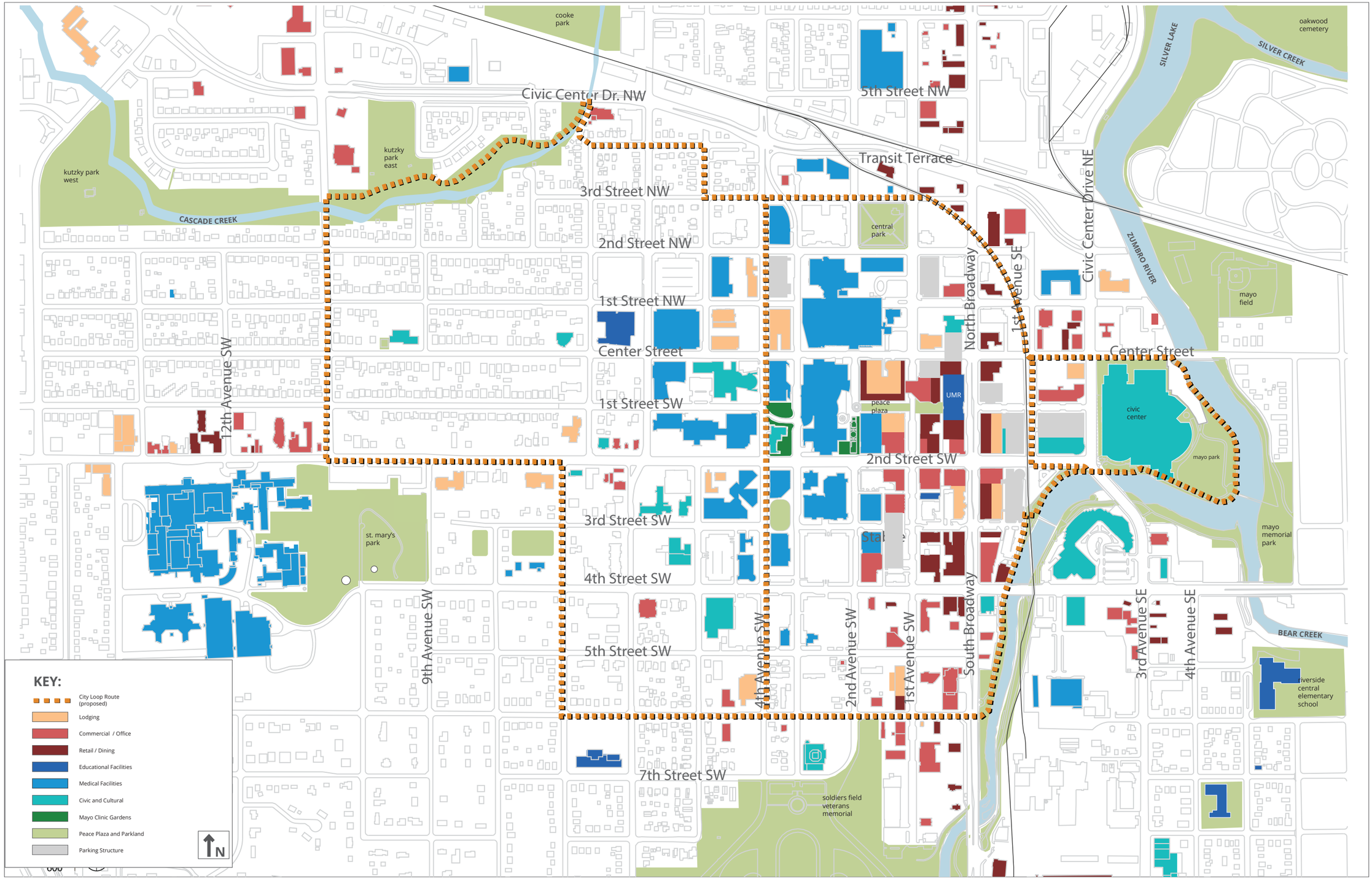
As proposed, the City Loop does not address the lack of safe and comfortable roadways in the downtown area. Further projects should consider addressing this gap. Although the distance of uncomfortable roadways in this area is relatively low, even the shortest gap will discourage the vast majority of people from choosing to ride a bicycle. The proposed City Loop alignment provides a skeleton off which a comfortable downtown network can be built.

Attachments to Technical Memorandum 2

Figures 2,3,4,5,8,9,10,11

Table 1- City Loop Spatial Analysis Update and Pinch Points

[i] https://www.healthypeople.gov/2020/about/foundation-health-measures/General-Health-Status#chronic
[ii] http://atvb.ahajournals.org/content/early/2013/04/04/ATVBAHA.112.300878.abstract
[iii] http://jap.physiology.org/content/99/3/1193.short#sec-15
[iv] http://cebp.aacrjournals.org/content/22/10/1906.short
[v] http://www.c3health.org/wp-content/uploads/2009/09/C3-report-on-walking-v-1-20120911. pdf
[vi] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1470658/
[vii] http://www.peopleforbikes.org/statistics/category/health-statistics
[viii] https://ubcmedicaljournal.files.wordpress.com/2015/11/ubcmj_3_2_2012_6-11.pdf
[ix] http://jap.physiology.org/content/99/3/1193.short#sec-15
[x] https://www.cdc.gov/500cities/about.htm
[xi] https://www.cdc.gov/obesity/data/adult.html
[xii] https://www.cdc.gov/obesity/data/childhood.html
[xiii] http://cloud.tpl.org/pubs/benefits_HealthBenefitsReport.pdf
[xiv] https://www.hsph.harvard.edu/obesity-prevention-source/obesity-consequences/
[xv] https://www.cdc.gov/healthyschools/obesity/facts.htm
[xvi] http://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm
[xvii] http://activelivingresearch.org/sites/default/files/ALR_Brief_ActiveTransportation_0.pdf
[xviii] http://americawalks.org/learning-center/benefits-of-walking-2/health/
[xix] http://kff.org/other/state-indicator/adults-with-diabetes/
[xx] http://www.cdc.gov/diabetes/basics/index.html
[xxi] http://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm
[xxii] http://www.cdc.gov/diabetes/basics/diabetes.html
[xxiii] http://www.heart.org/HEARTORG/Conditions/Diabetes/WhyDiabetesMatters/Why-Dia-betes-Matters_UCM_002033_Article.jsp#.V6uaO00rLIV
[xxiv] http://www.heart.org/HEARTORG/Conditions/Diabetes/UnderstandYourRiskforDiabe-tes/Understand-Your-Risk-for-Diabetes_UCM_002034_Article.jsp#.V6ucIE0rLIW
[xxv] http://jap.physiology.org/content/99/3/1193.short#sec-15
[xxvi] http://www.cdc.gov/heartdisease/facts
[xxvii] http://assessment.communitycommons.org/CHNA/report?page=6&id=609&reporttype=li-braryCHNA
[xxviii] http://www.cdc.gov/heartdisease/facts.htm
[xxix] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2736383/
[xxx] http://www.nami.org/NAMI/media/NAMI-Media/Infographics/GeneralMHFacts.pdf
[xxxi] http://www.nami.org/Learn-More/Mental-Health-Conditions
[xxxii] http://www.who.int/mental_health/mhgap/risks_to_mental_health_EN_27_08_12.pdf
[xxxiii] http://www.cycle-helmets.com/cycling_and_health.pdf
[xxxiv] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1470658/
[xxxv] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1470658/

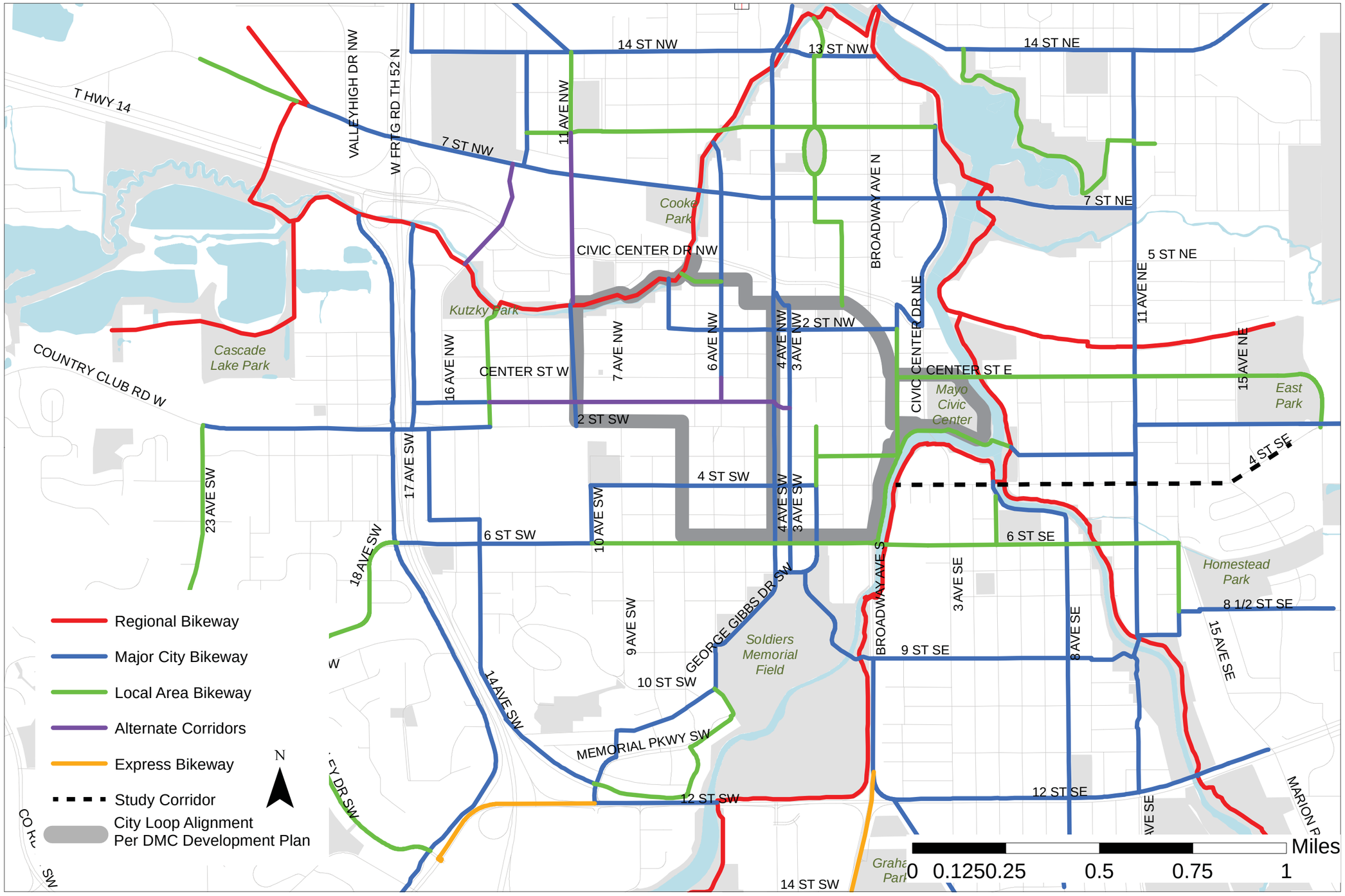


CITY LOOP COMMUNITY ASSETS & ACTIVITY GENERATORS

J8620 dmc city loop

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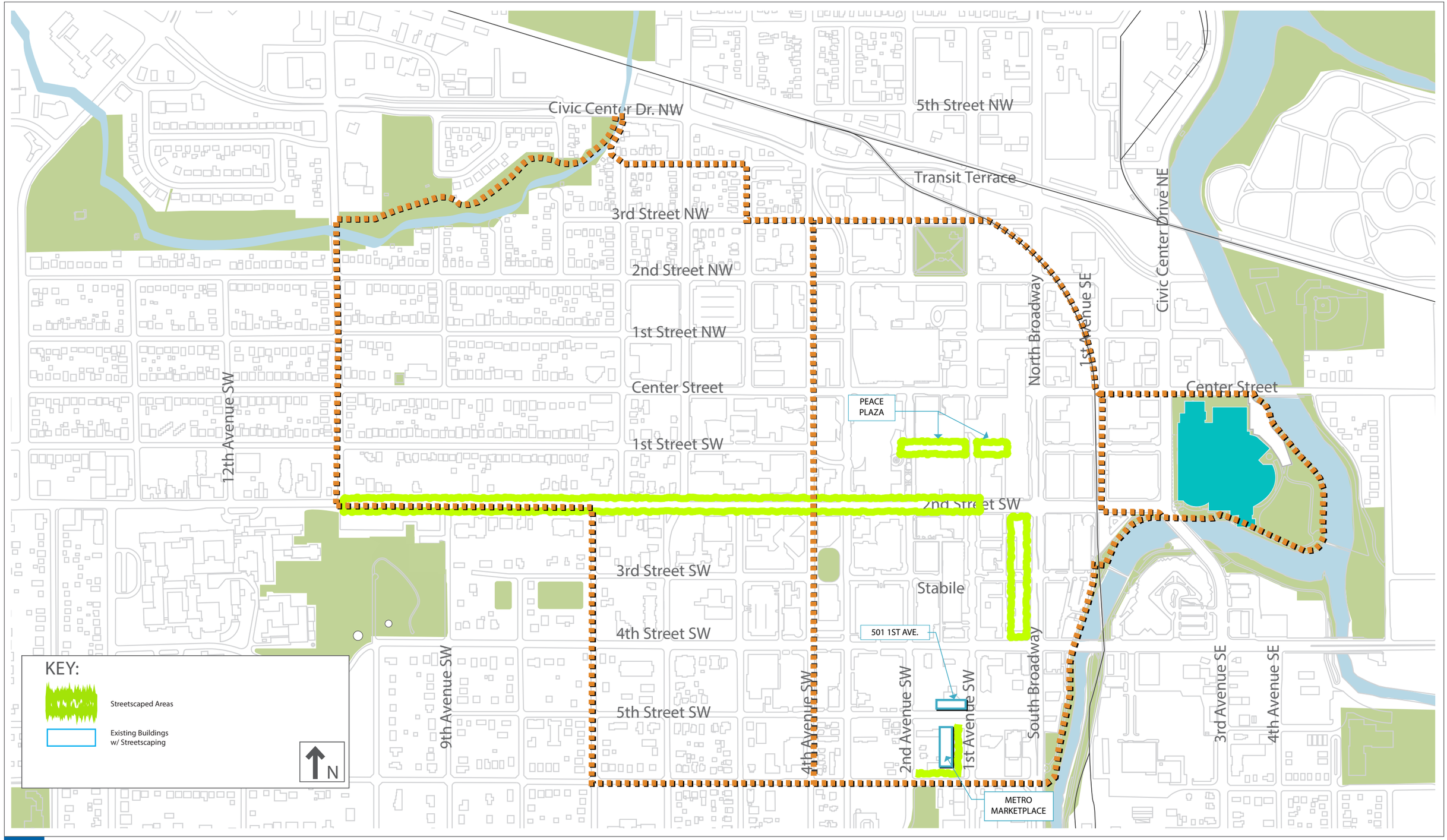
Figure 2.



Existing and Planned Bicycle Facilities
Per 2012 Rochester Area Bicycle Master Plan
DMC City Loop

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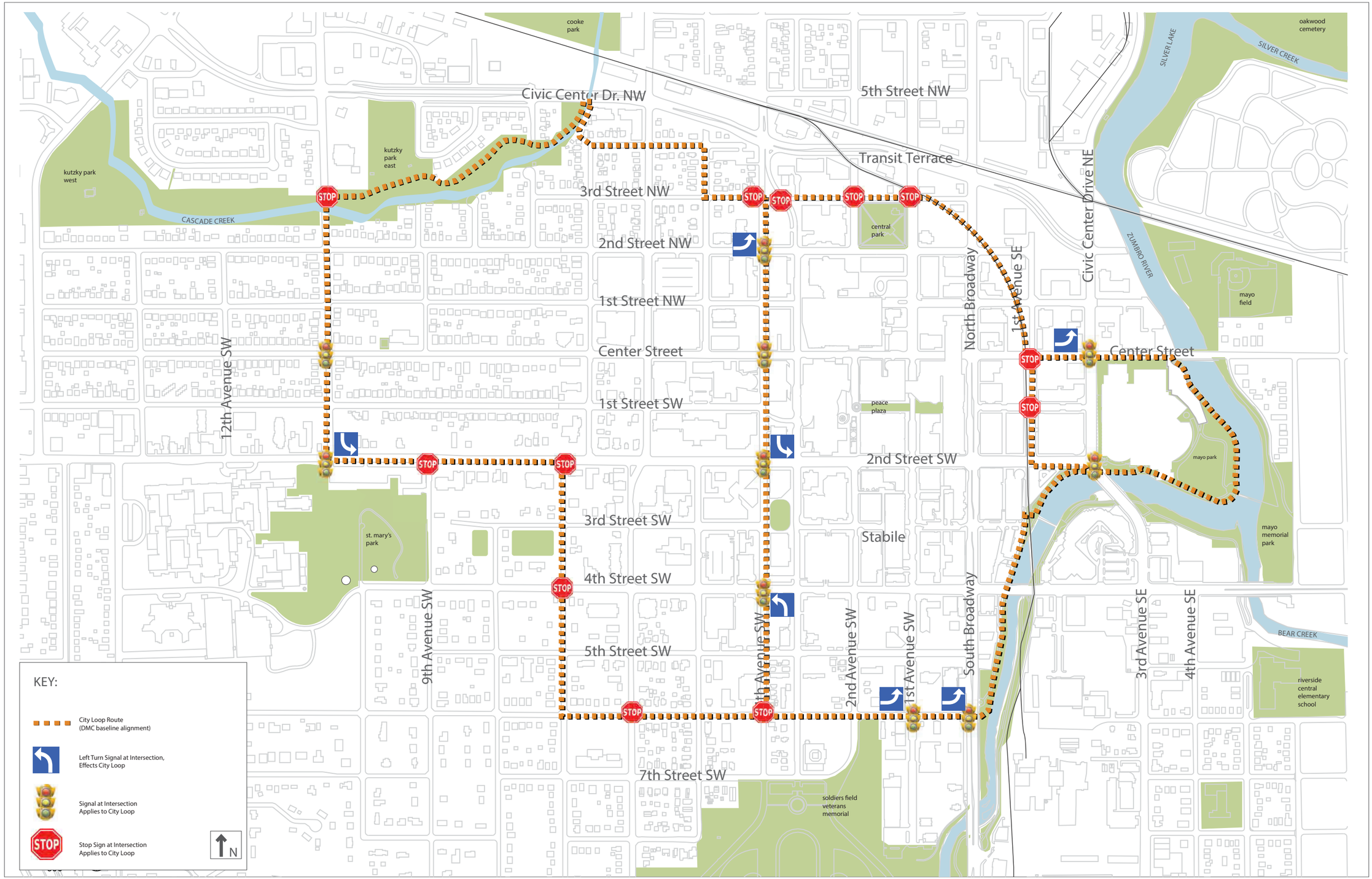
Figure 3.



DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

CONNECTIVITY TO EXISTING ENHANCED STREETSCAPES

Figure 4.



CITY LOOP TRAFFIC CONTROL INVENTORY

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SEH alta

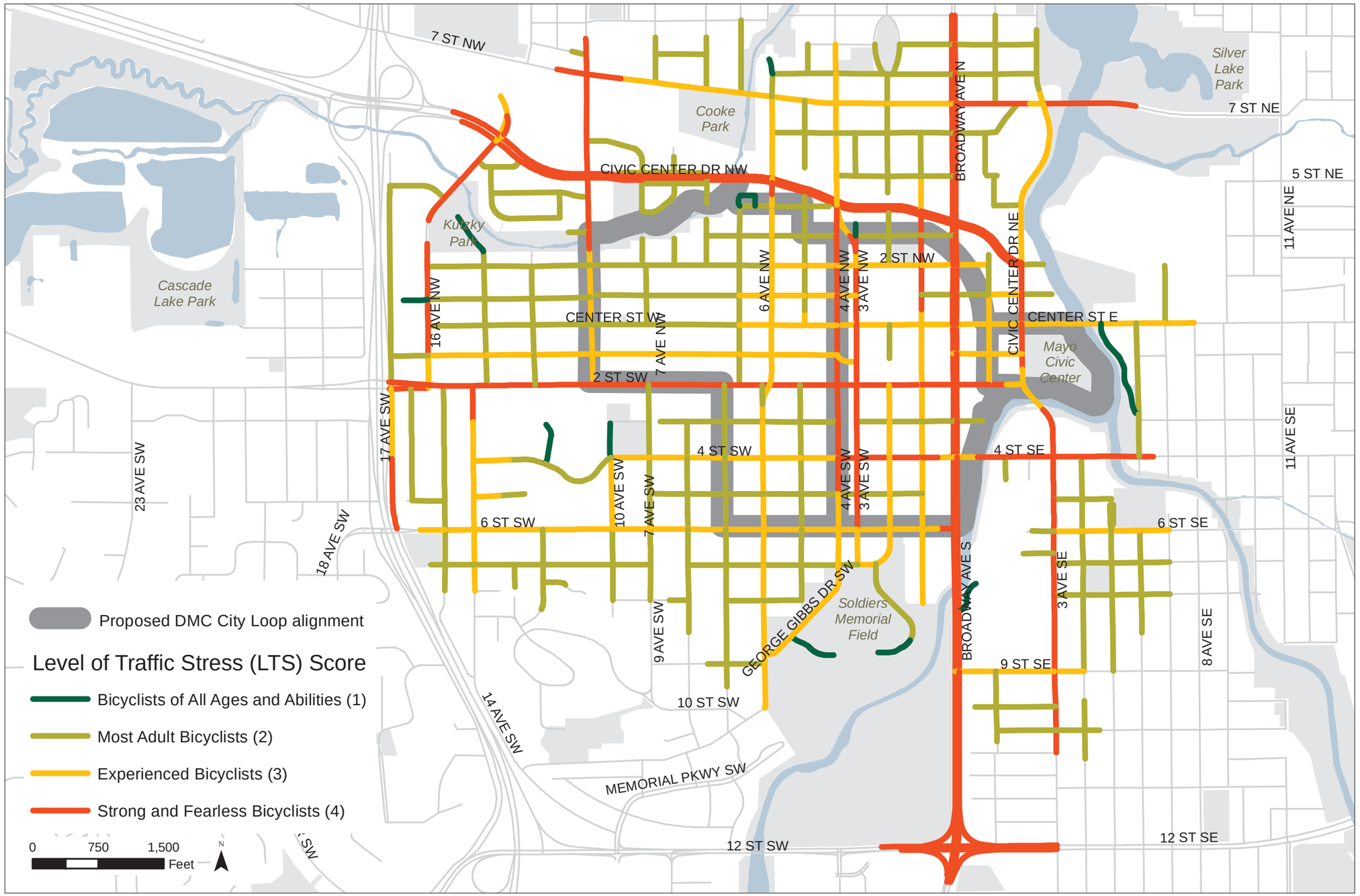
DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

Figure 5.

Table 1. DMC City Loop Corridor Spatial Analysis and Pinch Points - 3/23/17

Street	Termini	ROW Width	Pavement Width 1	Pavement Width 2	Recommended Design	Comments / Trade Offs	Bike Share Locations
Central Park and Transit Terrace							
3RD STREET NW	1ST AVE NW TO 2ND AVE NW	75	31		Decorative walkway and two-way raised separated bikeway - south side of street	The City Loop could be adjacent to Central Park, which provides flexibility for placement. The walkway could be widened and enhanced, existing street trees could remain in place and angled parking could be repurposed as a 2-way bikeway. If on-street parking is required then it could be converted to run parallel, street trees would need to be removed for the bikeway, and the walkway would be pushed southward into park. This would also require relocating several horse shoe pits and benches.	
3RD STREET NW	2ND AVE NW TO 3RD AVE NW	75	33	40	Decorative walkway and two-way raised separated bikeway - south side of street	On-street parking would need to be removed to accommodate the City Loop.	
Cultural Crescent / Waterfront							
RAIL SPUR		12.50 to 25			Decorative walkway and two-way raised separated bikeway - south side of street - long-term design once spur is abandoned	Requires either short-to medium term implementation of temporary City Loop in another corridor OR waiting and implementing as later, future phase.	
1ST STREET NE	RIVER TO CIVIC CENTER DR NE	75	50		Decorative walkway and two-way raised separated bikeway - north side	Impacts to on-street parking on one side of the street. It is recommended to repurpose existing street space to avoid impacts to street trees and the Riverview Suites driveway.	
1ST STREET NE	CIVIC CENTER DR NE TO 3RD AVE NW	75	41	50	Decorative walkway and two-way raised separated bikeway-north side	Impacts to on-street parking on one side of the street. It is recommended to repurpose existing street space to avoid impacts to mature street trees.	
1s AVE SE	CENTER TO 1ST STREET SE	75	24		Decorative walkway and two-way raised separated bikeway-east side	Traffic will need to be removed in the long-term to accommodate City Loop, future phase once rail spur is abandoned	
1st AVE SE	1ST TO 2ND STREET SE	75	29		Decorative walkway and two-way raised separated bikeway-east side	Traffic will need to be removed in the long-term to accommodate City Loop, future phase once rail spur is abandoned	
Downtown River Loop Tail	BROADWAY AVE S TO 2nd St SW	Varies	10		2-way bikeway on west bank, decorative pedestrian path on east bank - short term.	Narrow paths, variable ROW's and variable slopes, overhead bridges and multiple concrete retaining walls create several signifcant PINCH POINTS and suggest need for decoupling the joint facility. Redesign reconstruction of existing west bank trail facility as a conjoined walking and biking facility is recommended in the long-term.	
Soldier's Memorial Field & U of M							
6TH STREET SW	BROADWAY AVE S TO 1ST AVE SW	70	61		Decorative walkway and two-way raised separated bikeway - north side	Requires removal of one travel or turn lane, or impacts to street trees and possible acquisition of ROW.	
6TH STREET SW	1ST AVE SW TO 2ND AVE SW	75	44	59	Decorative walkway and two-way raised separated bikeway - north side	Impacts to on-street parking on one side of the street. It is recommended to repurpose existing street space to avoid impacts to new streetscaping as part of the recent street reconstruction and redevelopment. There would be some impacts to bump-outs.	
6TH STREET SW	2ND AVE SW TO 3RD AVE SW	75	45		Decorative walkway and two-way raised separated bikeway - north side	Recommend shifting sidewalk slightly north and constructing City Loop in place of the existing bike lane and boulevard. There do not appear to be right of way impacts.	
6TH STREET SW	3RD AVE SW TO 4TH AVE SW	75	46		Decorative walkway and two-way raised separated bikeway - north side	The City Loop could be constructed in place of the existing turn and bike lanes without impacts behind the curb. If turn lanes remain, there will be impacts to a mature tree on the north side of the street and possible private property impacts (to an apartment driveway and steps to a home). It is not clear whether the apartment driveway and steps are within or outside existing ROW.	NN Study recommended at 7th St and 3rd Ave S. Recommend shifting location to 6st St and 3rd Ave S.
4TH AVENUE SW	6TH AVE SW TO 7TH ST SW	75	38		Decorative walkway and two-way raised separated bikeway - west side	Requires removal of on-street parking on one side of the street.	
4TH AVENUE SW	7TH ST SW TO 6TH ST SW	75	33		Decorative walkway and two-way raised separated bikeway - west side	Requires removal of on-street parking on one side of the street.	
Saint Mary's Place & Historic Pill Hill							
6TH STREET SW	4TH AVE SW TO 5TH AVE SW	75	33	45	Decorative walkway and two-way raised separated bikeway - north side	Recommend removing on-street parking on one side of the street in order to preserve mature street trees. The City Loop would impact bump-outs at 5th Ave SW.	
6TH STREET SW	5TH AVE SW TO 6TH AVE SW	75	36		Decorative walkway and two-way raised separated bikeway - north side	Impacts to on-street parking on one side of the street. Recommend constructing City Loop in place of parking to preserve mature street trees.	
6TH STREET SW	6TH AVE SW TO 7TH AVE SW	75	33		Decorative walkway and two-way raised separated bikeway - north side	No parking is currently allowed on this block, but it is possible the street is used for school bus queuing. Recommend repurposing roadway space to avoid impacts to mature street trees and utilities.	
7TH AVENUE SW	6TH ST SW TO 5TH ST SW	75	28		NA	Doesn't meet ADA gradient requirements- not recommended for City Loop route.	
7TH AVENUE SW	5TH ST SW TO 4TH ST SW	75	28		NA	Doesn't meet ADA gradient requirements- not recommended for City Loop route.	
7TH AVENUE SW	4TH ST SW TO 3RD ST SW	75	25		NA	Doesn't meet ADA gradient requirements- not recommended for City Loop route.	
7TH AVENUE SW	3RD ST SW TO 2ND ST SW	75	24		NA	Doesn't meet ADA gradient requirements- not recommended for City Loop route.	
2ND STREET SW	7TH AVE SW TO 9TH AVE SW	100	26.5 TO 34 (WB	28 (EB)	Decorative walkway and two-way raised separated bikeway - north side	Impacts to on-street parking and/or newly installed streetscaping.	
2ND STREET SW	9TH AVE SW TO 11TH AVE SW	100	27 TO 35 (WB)	28 (EB)	Decorative walkway and two-way raised separated bikeway - south side	Impacts to on-street parking and/or newly installed streetscaping.	NN Study: recommended at 10th Street

Street	Termini	ROW Width	Pavement Width 1	Pavement Width 2	Recommended Design	Comments / Trade Offs	Bike Share Locations
Kutzky Park							
11TH AVENUE SW	2ND ST SW TO 1ST ST SW	66	49		Decorative walkway and two-way raised separated bikeway - west side	Could possibly require removal of one lane or acquisition of a small amount of additional ROW.	narrow ROW restricts placement
11TH AVENUE SW	1ST ST SW TO CENTER ST W	66	37		Decorative walkway and two-way raised separated bikeway - west side	Recommend repurposing existing street space for the City Loop. No parking is currently allowed on 11th Ave. If the City Loop is constructed behind the existing curb it would impact mature trees.	narrow ROW restricts placement
11TH AVENUE SW	CENTER ST W TO 1ST ST NW	66	37		Decorative walkway and two-way raised separated bikeway - west side	Recommend repurposing existing street space for the City Loop. No parking is currently allowed on 11th Ave. If the City Loop is constructed behind the existing curb it would impact mature trees.	narrow ROW restricts placement
11TH AVENUE SW	1ST ST NW TO 2ND ST NW	66	37		Decorative walkway and two-way raised separated bikeway - west side	Recommend repurposing existing street space for the City Loop. No parking is currently allowed on 11th Ave. If the City Loop is constructed behind the existing curb it would impact mature trees.	narrow ROW restricts placement
11TH AVENUE SW	2ND ST NW TO RIVER	66	44		Decorative walkway and two-way raised separated bikeway - west side	None identified	narrow ROW restricts placement
MULTIUSE TRAIL AND BRIDGE SIDEWALK	4TH ST NW, CIVIC CENTER DRIVE to KUTZKY PARK	Varies	10		Decorative walkway and two-way separated bikeway - north side of Cascade Creek	Area bewteen the existing multiuse trail and adjacent child care facility retaining wall is narrow. Adjacent land slopes steeply towards the creek and precludes introduction of a decoratyive walkway. This area is a significant PINCH POINT. 8 Ft. wide walkway on Civic Center DRr. bridge is a PINCH POINT. PINCH POINT condidions also ocurr west of the creek as the trail enters the park. Recommend approaching Kutzky Park from 8th Ave. NW.	
4TH STREET NW	6TH AVE NW TO 7TH AVE NW	63	25	36	Decorative walkway and two-way raised separated bikeway - north side	Recommend removing parking on the north side of the street. The city loop would impact newly constructed bump-outs at 6th Ave. ROW width creates pinch pint for City loop.	NN Study: recommended at 6th Ave, narrow ROW restricts placement
4TH STREET NW	5TH AVE NW TO 6TH AVE NW	75	34		Decorative walkway and two-way raised separated bikeway - north side	Recommend removing parking on one side of the street, possibly both sides in order to avoid impacts to street trees.	
5TH AVE NW	3RD ST NW TO 4TH ST NW	75	40		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing parking on one side of the street. If the City Loop is constructed behind the existing curb it would impact mature street trees.	
3RD STREET NW	4TH AVE NW TO 5TH AVE NW	75	26	34	Decorative walkway and two-way raised separated bikeway - south side	Recommend removing parking on one side of the street. If the City Loop is constructed behind the existing curb it would impact mature street trees.	
3RD STREET NW	3RD AVE NW TO 4TH AVE NW	75	21		Decorative walkway and two-way raised separated bikeway - south side	Impacts to landscaping on both sides of 3rd Ave NW.	
Heart of the City							
4TH AVENUE SW	6TH ST SW TO 5TH ST SW	75	36		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking and parking bay on west side of street.	
4TH AVENUE SW	5TH ST SW TO 4TH ST SW	75	41		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE SW	4TH ST SW TO 3RD ST SW	75	44		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE SW	3RD ST SW TO 2ND ST SW	75	33	45	Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking on west side of street.	NN Study: recommended at 2nd St
4TH AVENUE SW	2ND ST SW TO 1ST ST SW	75	37		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE SW	1ST ST SW TO CENTER ST W	75	33		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE NW	CENTER ST W TO 1ST ST NW	75	41		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE NW	1ST ST NW TO 2ND ST NW	75	41		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking on west side of street.	
4TH AVENUE NW	2ND ST NW TO 3RD ST NW	75	40		Decorative walkway and two-way raised separated bikeway - east or west side of street	Recommend removing on-street parking on west side of street.	

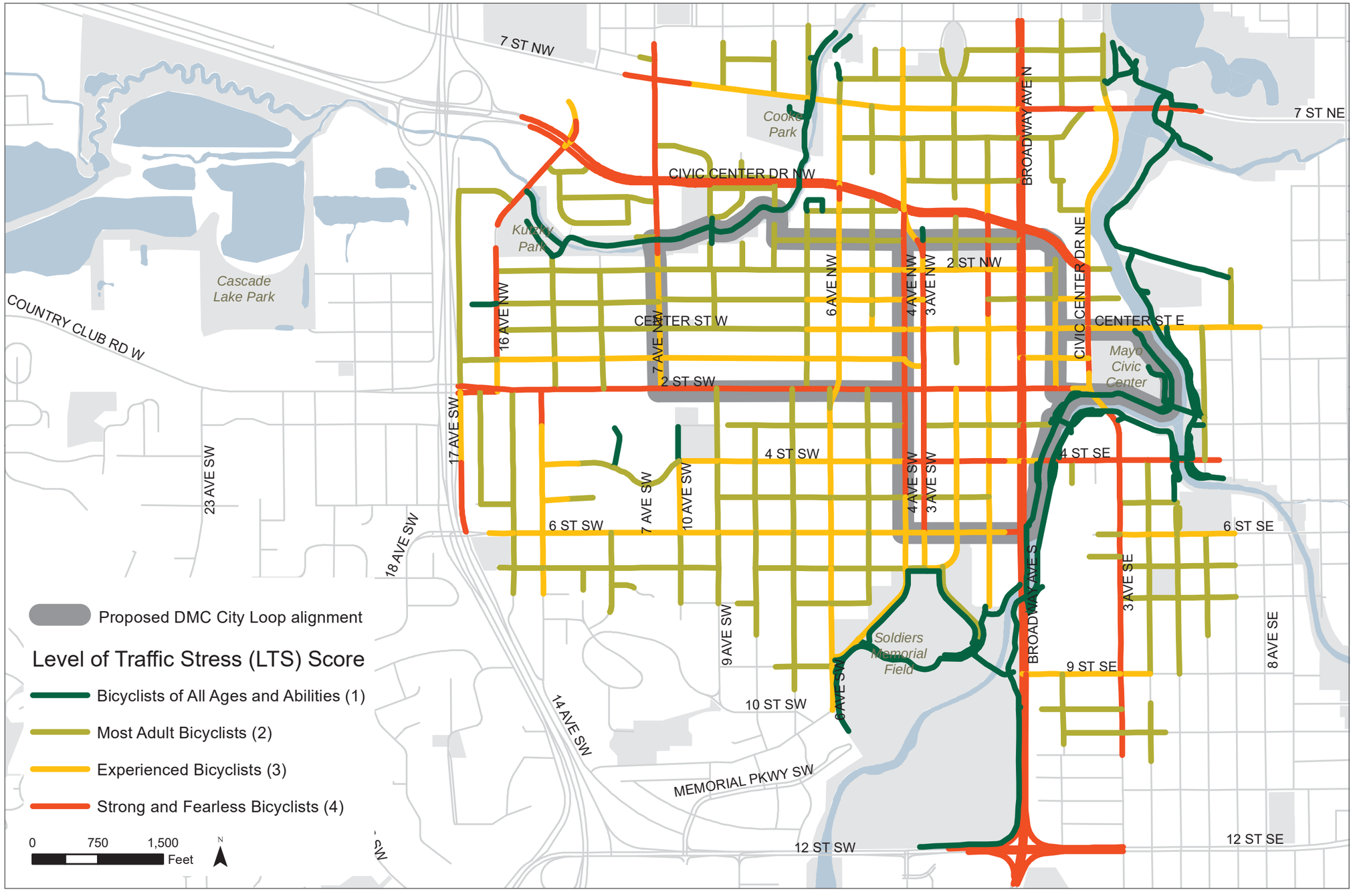


Street Network

BICYCLE LEVEL OF TRAFFIC STRESS

DMC City Loop

Figure 8.

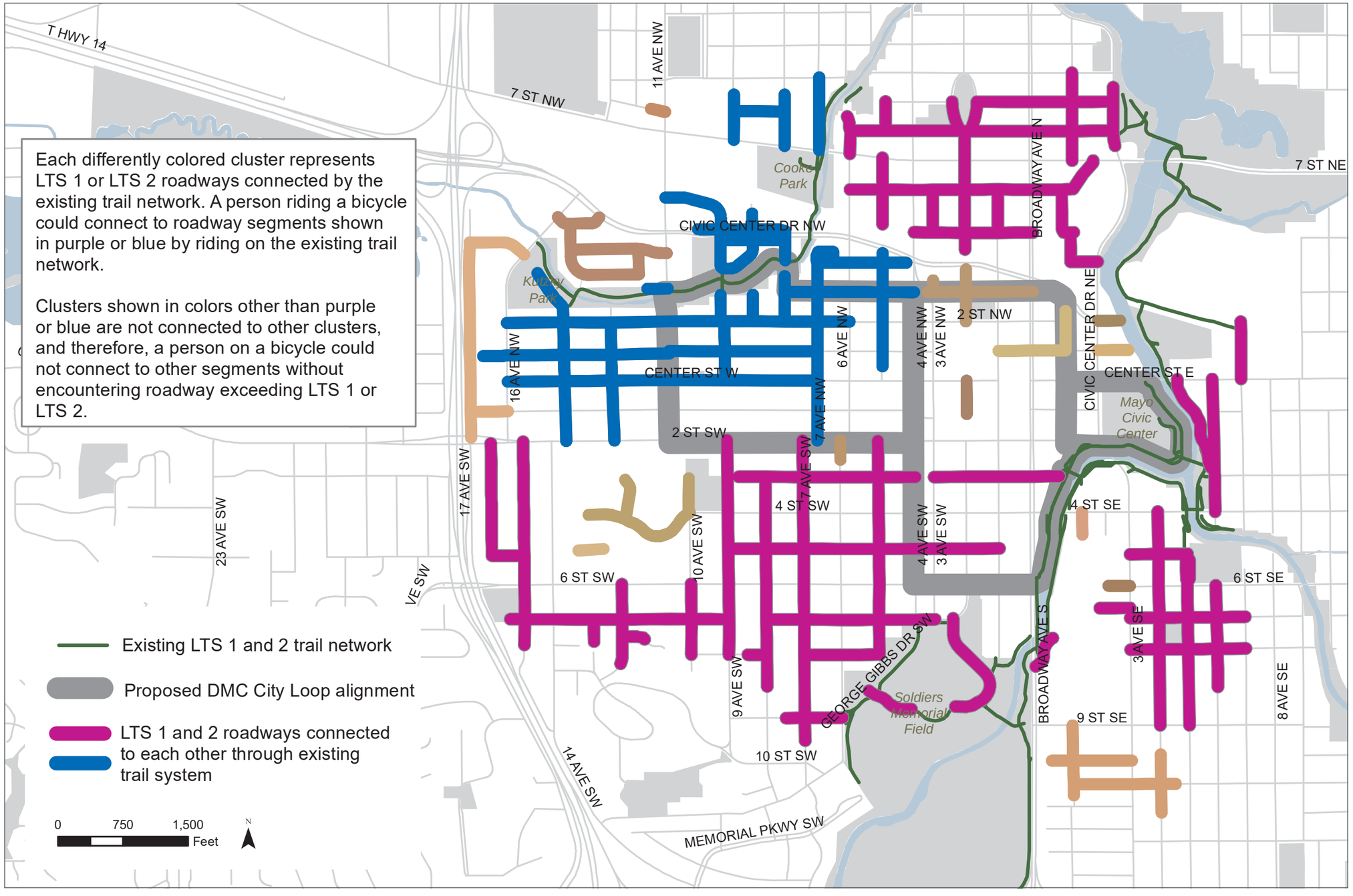


Street Network and Trails

BICYCLE LEVEL OF TRAFFIC STRESS

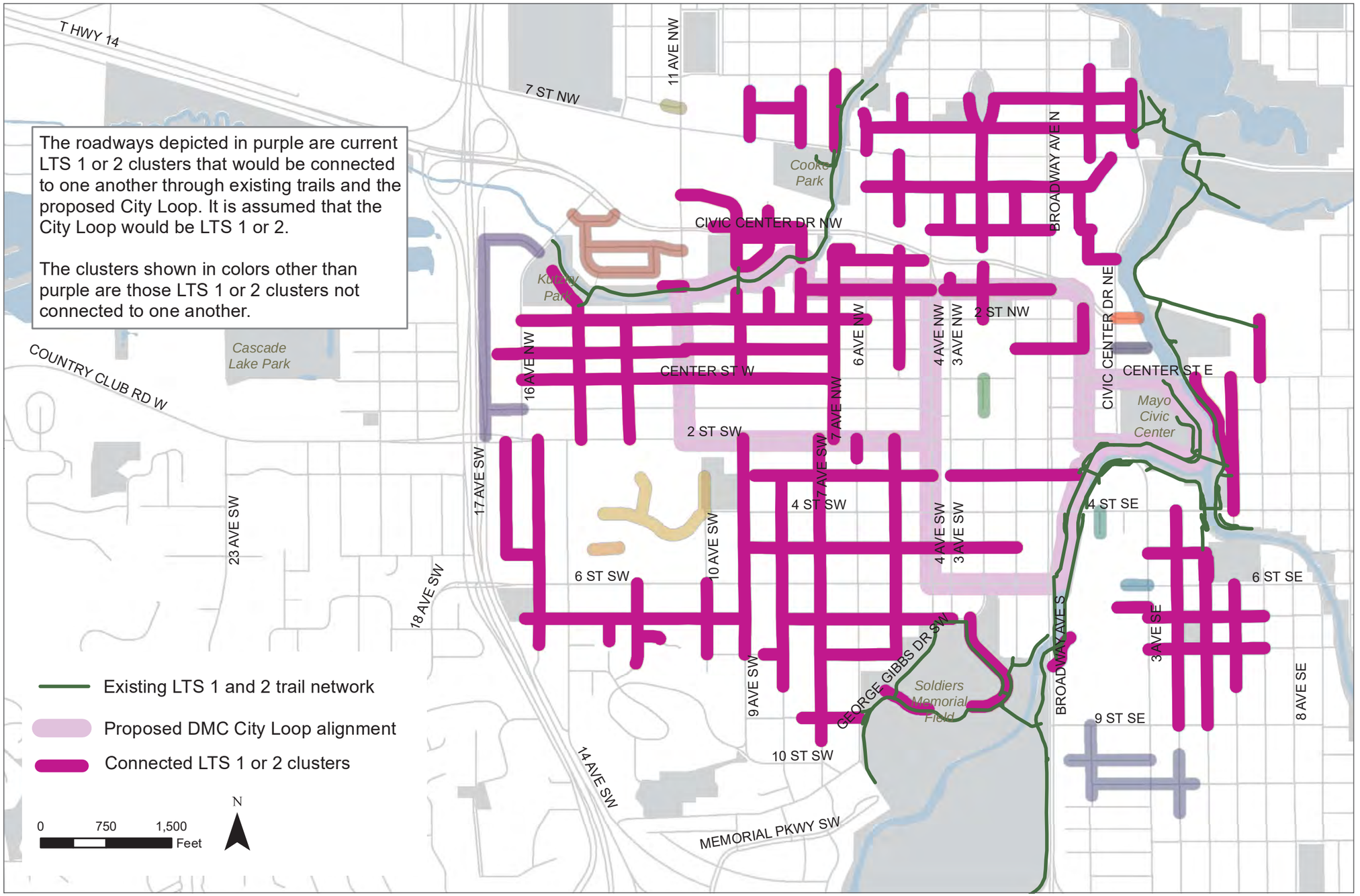
DMC City Loop

Figure 9.



LTS 1 & 2 Clusters Connected by Existing Trails
BICYCLE LEVEL OF TRAFFIC STRESS
DMC City Loop

Figure 10.



LTS 1 & 2 Clusters Connected by City Loop and Trails

BICYCLE LEVEL OF TRAFFIC STRESS

DMC City Loop

SEH alta DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

Technical Memorandum 3

DMC Project No. J8620 City Loop

To: Joni Giese, Principal
SRF Consulting Group

From: Bob Kost, ASLA, AICP, LEED-AP
SEH
bkost@sehinc.com
952-912-2604

Date: November 16, 2017

Subject: Interim Deiverable 3 for City Loop

Cc: Colin Harris, Alta Planning and Design, Antonio Rosell, Community Design Group

Introduction

This documents summarizes activities undertaken in Task 6, which identifies development of purpose and need, evaluation criteria and a comprehensive set of integrated project elements which validate the vision and advance the design of the City Loop. Design elements include:

- A design vocabulary for establishing pedestrian and bicycle pathways including proposed cross sections illustrating the arrangement and widths of walking and biking facilities.
- Recommended surface materials and furnishings.
- Identification and description of green infrastructure opportunities.
- Recommendations for operations and maintenance.

Purpose and Need

The Purpose and Need statement is the foundation of any transportation improvement project. It establishes the issues to be addressed and the means for judging the potential value of alternative solutions. It includes an assessment of travel and development markets, the findings of previous studies, a review of existing conditions, and public / stakeholder input. The Purpose and Need then translates into project goals and objectives that then help in defining the criteria by which transportation solutions are evaluated.

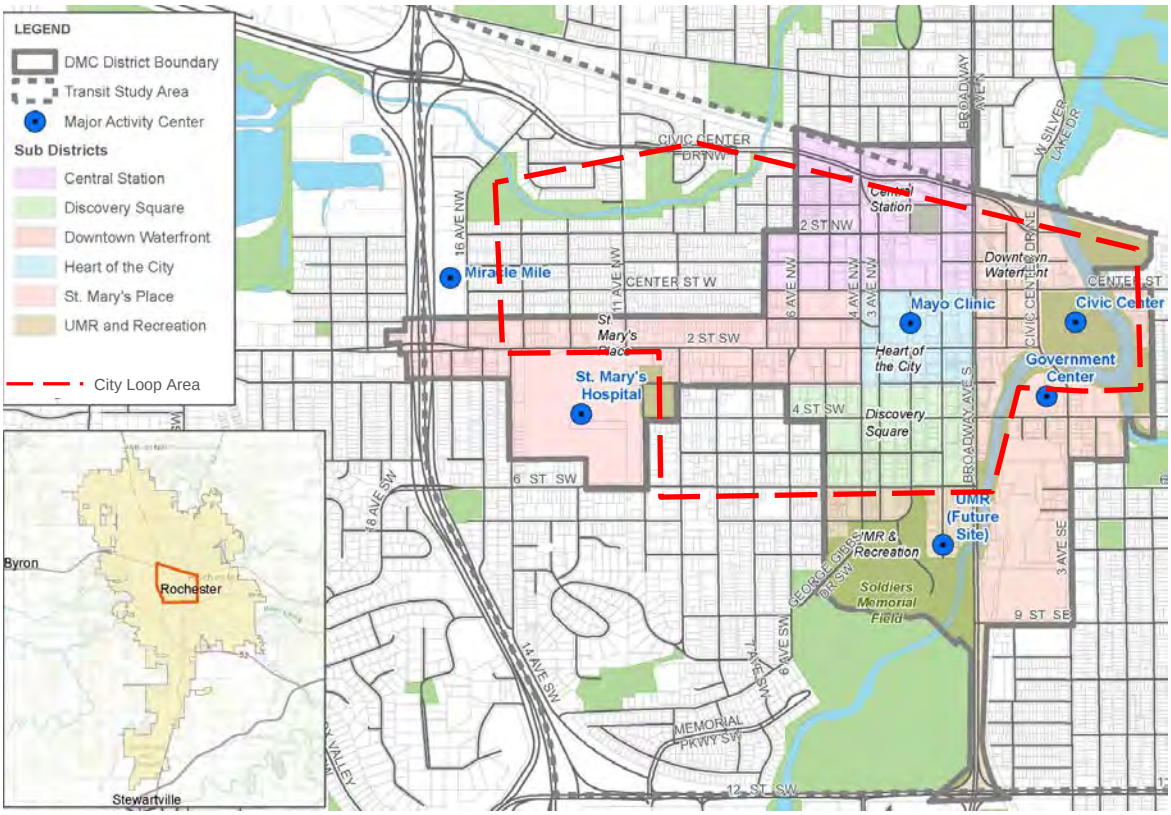
In the case of a non-motorized, active transportation facility such as the City Loop the development of a Purpose and Need statement is based on a combination of qualitative and quantitative information due to the limitation of available cycling and walking travel market and user data. Where possible, relevant data developed for the Transit Circulator and Street Use studies was utilized.

The purpose of this Memo is to lay out an outline or structure for the development of a formal Purpose and Need statement for the City Loop facility.
The Purpose and Need statement comprises the following six key elements:

1. **Study area:** identifies the geographic location in which the problem and potential solutions occur.
2. **Planning context:** review and analysis of relevant past plans and policies establishing the foundation for the proposed project.
3. **Project purpose:** statement of the fundamental reason for the project.
4. **Needs:** description of the transportation problems in the corridor that the project is intended to address.
5. **Goals and objectives:** desired outcomes of the project, and the framework to identify and evaluate the performance of a proposed transit alternative.
6. **Evaluation criteria:** qualitative and quantitative measures used to assess an alternative's ability to address the project goals and objectives.

1. Study Area: The area covered by the City Loop study is described in Figure 1.

Figure 1. Study Area



2. Planning Context: Documents and studies reviewed in development of this Purpose and Need include:

a. Rochester Downtown Mater Plan Report, 08/2010
b. DMC Development Plan, 01/2015
c. Rochester 2nd St Corridor Framework Plan, 02/2009
d. Mayo Special Service District Plan Five Year Update, 11/2016
e. Rochester Area Bicycle Master Plan, 03/2012
f. Rochester Comprehensive Plan 2040 (Draft), 03/2017
g. DMC Integrated Transit Studies - Transit Circulator and Street Use Studies, 2017

3. Purpose: Provide a uniquely identifiable low stress, attractive, high quality walking and biking facility providing a connective greenway throughout the DMC District that encourages private investment and enhances the quality of life.

For Whom:

DMC area employees, businesses, customers, residents, visitors, Civic Center patrons, medical patients, and patient companions.
These groups have different needs:

- Patients/companions – quiet, contemplative spaces, access to nature
- Customers / Civic Center Patrons - business access, social gathering
- Residents / Employees – active transportation, social gathering, access to nature

City loop can address these needs by providing convenient, safe, high quality connections:

- To landscaped plazas, parks, and natural areas.
- To work places, shops, restaurants and other activity centers.
- To city-wide and regional trail network

Bicycle users are a subgroup of targeted users of special concern due to the lack of adequate infrastructure in the downtown area of Rochester that provides safe connections to key destinations. Bicyclists can generally be organized into four categories (and percentages):

1. Strong and Fearless: 1%
2. Enthused and Confident: 5-10%
3. **Interested but Concerned: 60%**
4. No way, No how: 30%

City loop will focus on addressing needs of the 60%
Top 2 user groups are accustomed and comfortable using mixed traffic / bike facilities.

Why:

- Supports the DMC Vision by improving year-round active transportation and recreation options
- Improve community health and wellness through walking and biking instead of driving.
- Support environmental sustainability by improving air quality, reducing Rochester's carbon footprint.

- Walking and biking support Mayo strategic initiatives such as the Healthy Living Program.
- Strengthen walking and biking connections to each DMC sub-district, linking visitors, patients/companions, residents and workers to nature, arts, culture, and entertainment – serving users of all abilities.

4. Needs:

Transportation Related Needs

As described in the DMC Development Plan, the City is expected to experience significant growth in travel demand in the next 20 years resulting from growth including

- Approximately 310,000 square feet of new office/professional space
- Approximately 1, 020,000 square feet of Bio-Med-Tech related space
- Approximately 8,900,000 square feet of Health care related space
- Approximately 1,380 new hotel rooms
- Approximately 3,800 new housing units
- Approximately 680,000 square feet of new Retail/Dining/Entertainment space
- Approximately 26,000 – 28,000 new jobs

- Current capacity of the street network cannot accommodate additional peak period traffic volumes if the current mode split is maintained.
- Need to move more people towards transit, walking and biking to alleviate anticipated congestion.
- There is a current lack of bicycle facilities in the DMC area.
- Currently, numerous existing sidewalk facilities within the DMC area are do not meet requirements of the Americans with Disabilities Act (ADA) (see High Level ADA Assessment, Tech Memo 2.)
- Need to improve connections to broader city bikeway and trail network

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Health Related Needs

- The rate of Coronary Heart Disease (CHD) in Rochester is 5%, compared to 3.5% in the State of Minnesota and 4.4% in the United States.
- In the City of Rochester there are higher rates of CHD, poor mental health, obesity, and diabetes within DMC district and in adjacent neighborhoods compared to other neighborhoods in Rochester.
- Obesity effects 22.50% of adults (18 years and older) within and adjacent to the DMC district.
- The number of Mayo Clinic patients who have special mobility needs are expected to increase threefold over the next 20 years, many with physical, visual or cognitive impairment that would benefit enhanced accessibility the City Loop would provide.

Benefits

- Increasing walking and biking will reduce motor vehicle trips, contributing to air quality improvements.
- A minimum of 20 minutes of physical activity such as walking or biking 3 times a week strengthens the lungs, including those with asthma.
- For every 0.6 miles walked there is a 5% reduction in the likelihood of obesity.
- 20 minutes of walking or biking each day is associated with a 26% lower risk of heart failure in women and 21% in men.
- Walking and biking is significantly less expensive than driving, improving economic well-being.
- Low stress, protected bicycle and pedestrian facilities improve safety for all road users, reducing injury crashes among road users by up to 40% as measured in some studies.

5. Goals:

1. Create an exceptional public realm for healthy, human-powered, transportation that is, attractive, distinctive, accessible and inclusive to people of all ages, abilities, and states of wellness.
2. Increase walking and biking in Rochester and increase the number and percentage of commuter bike/walk trips to downtown Rochester from an existing bike/walk mode split of 7% (2008) to 13% by 2035.
3. Improve public health
4. Reduce motor vehicle trips
5. Strengthen connections to passive and active places and spaces, improve connectivity within downtown and thoughtfully connect downtown to its adjacent neighborhoods
6. Support DMC economic development initiatives
7. Boost business vitality at the street level
8. Reduce the ecological footprint of the city

6. Evaluation Criteria:

Four criteria categories (A-D) were developed for use by all of the DMC Transportation Studies (Transit, Street Use, Parking, etc.). Detailed, City Loop-specific criteria were developed within each criteria category for evaluating alternative City Loop route scenarios.

users:	R-Resident, C-Commuter, B-Business, P/C-Patient and Companion, V-Visitor, A-All			
	A	B	C	D
DMC EC "Accounts"	**Economy-Economic Development**	**Community + Experience**	**Health + Wellness + Safety**	**Delivery**
1	Connects to DMC Districts. Rate the level of accessibility for people and jobs (adjacent land use - higher density of residential/commercial = higher score) (A,R,C,B)	Maximizes connections to public and semi-public social spaces, natural areas and quiet spaces. (A)	**Potential to increase physical activity and reduce injuries (A) (As a proxy for increasing physical activity, evaluate safety of the city loop alternatives as a way to measure the potential increased usage by multiple age and ability)	Fundable total project capital cost, describe in per mile terms (A)
2	Connections with existing and planned regional transit hub, regional bus, circulator stations and PTN crossings (A)	Quantify: Maximizes connections to existing and planned parking to support a park-once environment (A,C,P/C,V)	Provides direct connections with Mayo facilities for patients, visitors, and wellness retreat participants (P/C, V)	Transition Plans / ability to be phased in a logical and useful manner (A)
3	Connections to existing surface parking lots and proximity to future redevelopment sites whereby City Loop may serve as a catalyst for private development (measure # of block faces). (A)	Meets the principles of walkability: useful, comfortable, direct, safe, and interesting routes. (A)	Minimizes reliance on wayfinding for navigation and legibility: follows existing street grid, minimizes changes/shifts in route (V,P/C)	Connections to existing surface parking facilities. Catalyst and likelihood for financial partnership w/ future redevelopment, private development, and partnership for funding. (A)
4			Length of Loops	

Design Vocabulary

See attached 1

Green Infrastructure Design Guide

See attached 2

Operations and Maintenance

See attached 3

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Design Vocabulary

November 2017

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INTRODUCTION

Best Practice

The City Loop is a signature bicycle and pedestrian facility in the heart of Rochester. It is designed to encourage movement and physical activity, provide access to parks for therapeutic respite, and connect DMC districts to regional trails and local destinations for residents, businesses, patients and their companions, and visitors of all ages and abilities. The City Loop is comprised of a bikeway, buffers, and enhanced walkways with pedestrian amenity zones *(see below)*.

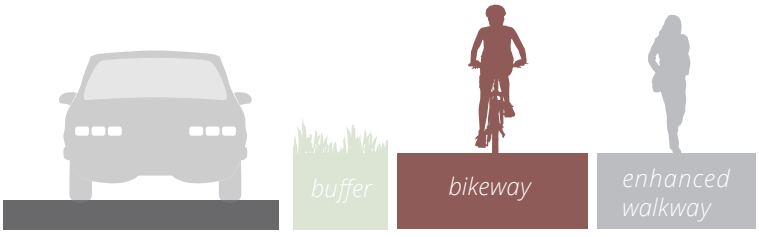
An all ages and abilities facility means that it feels safe and comfortable to someone who is 8 years old or 80 years old. From a design perspective, this means providing clear physical separation between people walking and riding bikes from those in motor vehicles, and further separating people riding bikes from those walking. Raised, protected bike lanes, separate from the adjacent roadway are the gold standard for increasing user comfort and improving safety. In this document the raised protected bike lanes will be referred to as a bikeway. The enhanced walkway refers to a wide pedestrian space with amenities such as plantings, decorative lighting, benches, etc.

An Elevated Experience

The City Loop will prioritize walking and biking by physically separating the City Loop from vehicles with a six inch tall curb and where possible, a planted buffer. The experience of being removed from the flow of vehicular traffic will give people confidence to walk and bike at their own pace without the concern of potential conflicts with vehicles. At intersections the City Loop could remain elevated above the street grade via raised crosswalks or table intersections to allow for a seamless user experience that would not require people on foot or on bike to use curb ramps or negotiate with vehicular traffic. Elevated crosswalks and intersections could also play a significant role in calming traffic by slowing vehicular speeds when crossing with the City Loop. This approach would require intersection reconstruction including modifications to existing stormwater drainage infrastructure. Where intersection reconstruction is impractical the City Loop would need to transition to meet existing grades.

The key benefits of a raised City Loop are:

- Maximized safety
- Increased user comfort
- Traffic Calming
- Reduced conflicts between all modes
- Legible route through the city
- Unique and distinct facility



City Loop Composition

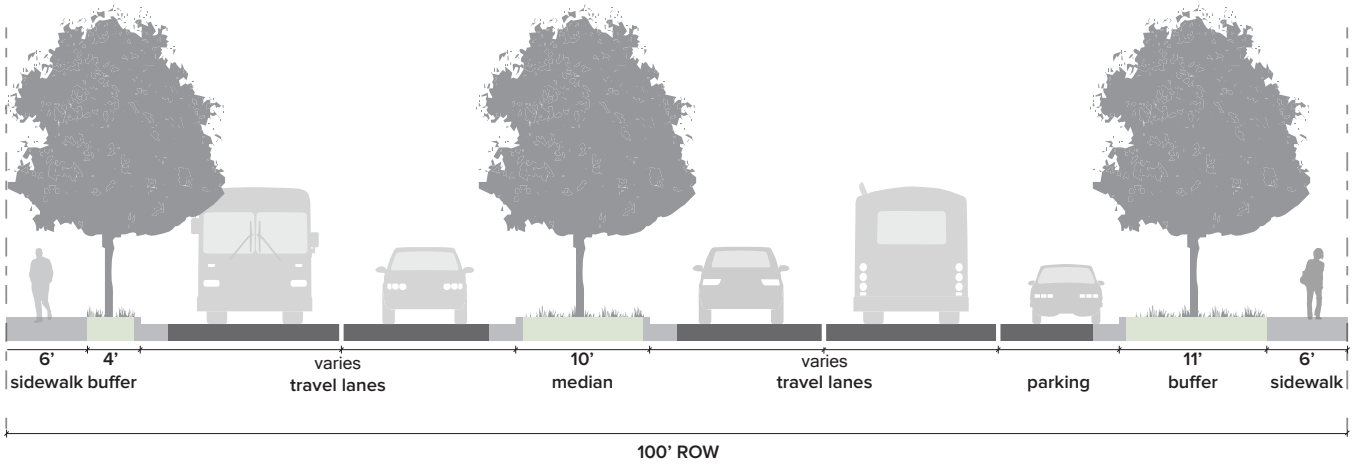
The following sections in this document describe typical cross sections, intersection configurations, pedestrian spaces, and materials that will be used as the design vocabulary for the City Loop.

CITY LOOP DESIGN

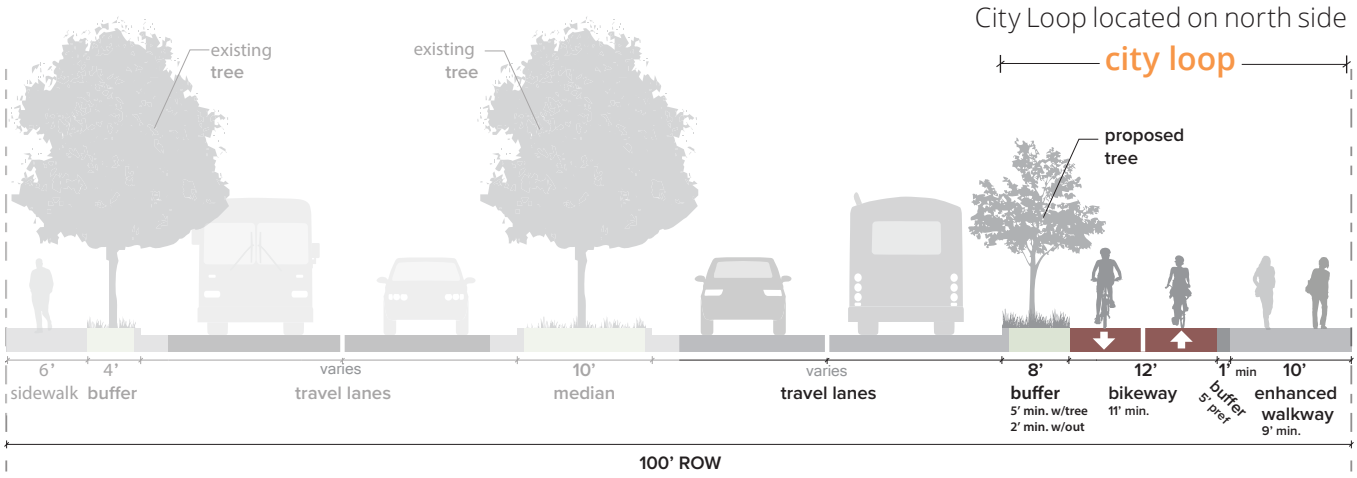
Typical Sections

The City Loop is proposed to be retrofitted into existing streets within the City of Rochester. The initial route illustrated in the DMC Development Plan has been used for the development of this Design Vocabulary.

Existing 100' ROW along 2nd St. SW - west facing

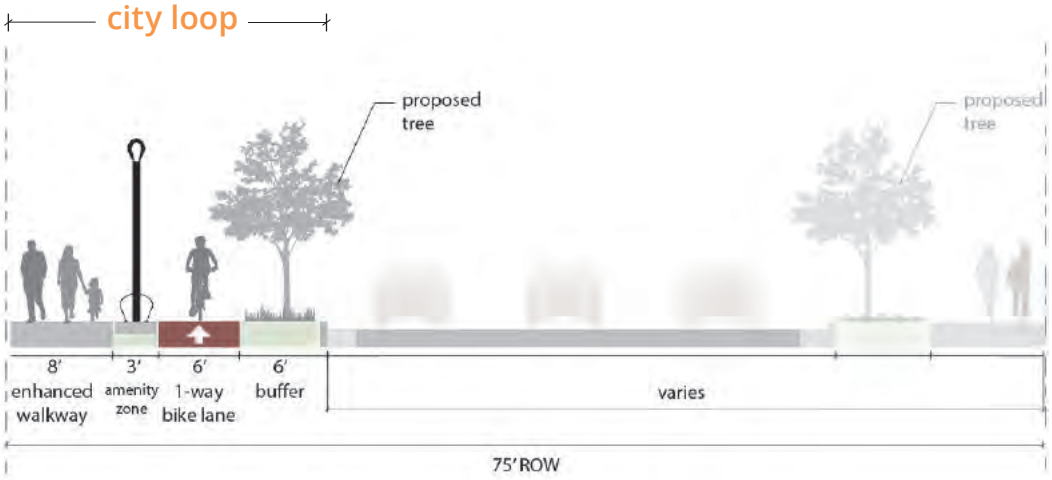


Potential 100' ROW for 2nd St. SW - west facing



2nd St. SW has a 100 ft. right of way (ROW) along the proposed City Loop route. The City Loop could fit into the existing right-of-way if compromises to the cross section are made along with removing on-street parking and narrowing of travel lanes. The center median is intended to remain after the implementation of the City Loop, as well as existing trees when possible. Thus, the corridor will be reconfigured to accommodate the City Loop between the existing curb and gutter of median to the north ROW line, which is approximately 50 ft. The bikeway is 11 ft. wide and is separated from vehicles by a five ft. planted buffer. There is a nine ft. enhanced walkway with a one ft. paved buffer (i.e., unit pavers) between the enhanced walkway and the bikeway. It is recommended that additional right of way be secured on the north side of the street between 4th Ave and 11th Ave to provide more flexibility in accommodating all the modes including the City Loop and a future Downtown Transit Circulator.

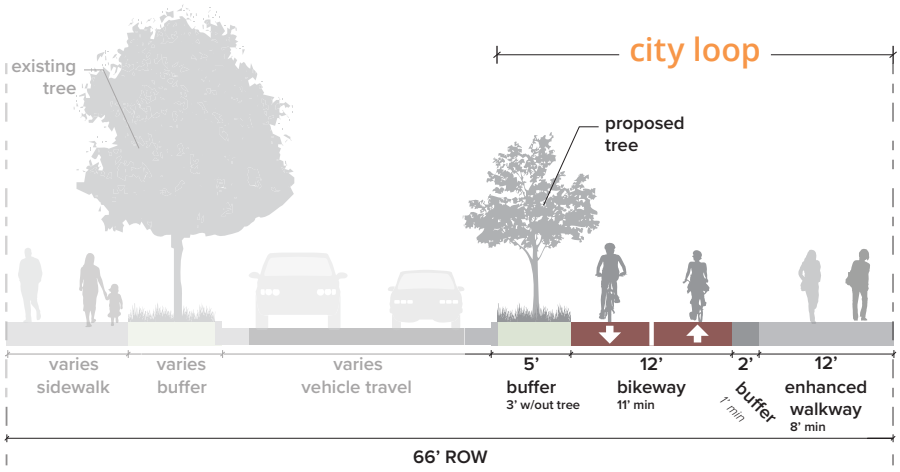
Proposed 75' ROW Section



The 75 ft. ROW section shown above is a fairly common condition for streets on the City Loop alignment. The 75 ft. ROW has a 6 ft. bikeway and is separated from vehicles by a six ft. planted buffer. There is a 12 ft. enhanced walkway with a 3 ft. buffer. This 3 ft. buffer could be used for plantings, green stormwater infrastructure, pedestrian seating, or a bike share station. See page 17 for enlargements of possible configurations of this area. Streets along the proposed City Loop where this section could be applied:

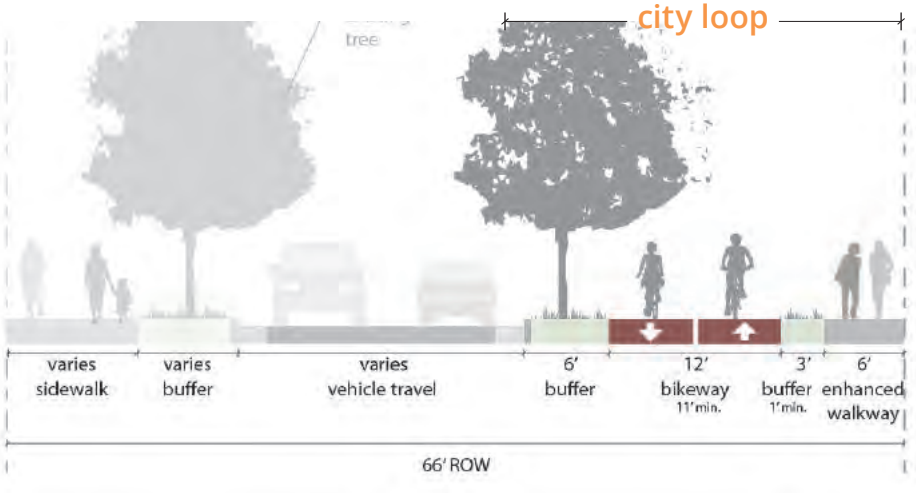
- 3rd St NW, north side
- 1st Ave NE, west side
- 6th St SW, north side
- 4th Ave SW, east side
- 5th Ave NW, east side
- 4th St NW, east side

Potential 66' ROW Section in a Commercial Zone



The section shown above illustrates how the City Loop could be integrated into existing urban streets with a 66 ft. ROW. This section has a 12 ft. bikeway and is separated from vehicles by a five ft. planted buffer. The bikeway and enhanced walkway are separated by a 2 ft. paved buffer. Streets along the proposed City Loop where this section could apply include 4th St NW on the north side, and 11th Ave SW on the west side. Where space is constrained, a set of minimum dimensions are identified.

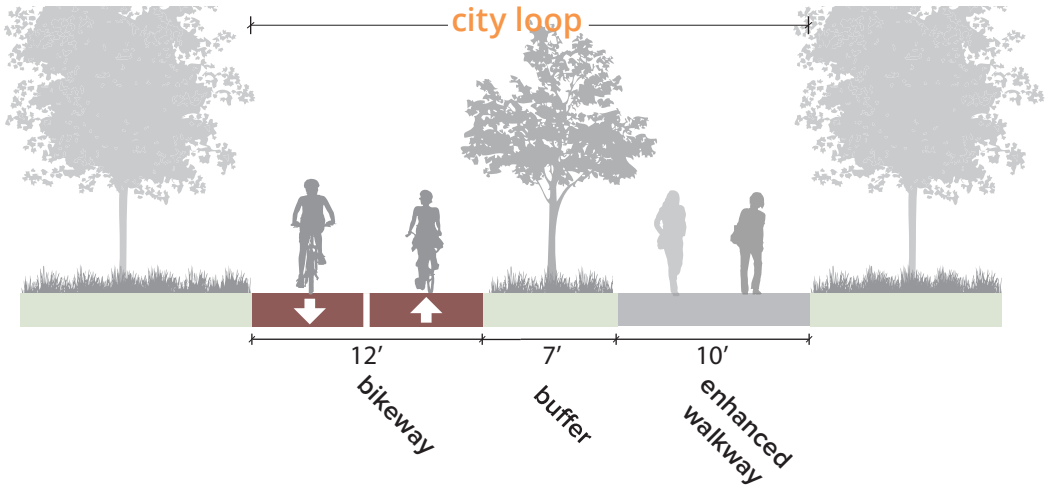
Typical 66' ROW Section in a Residential Neighborhood



Along residential streets with a varying. ROW it is critical to minimize impact to existing mature neighborhood street trees. To accommodate the existing trees, the City Loop will need to be configured with at least an eight ft. buffer between the bikeway and enhanced walkway. A street along the proposed City Loop where this section could apply is 11th Ave SW, 3rd St NW, and 13th Ave NW. Where space is constrained, a set of minimum dimensions are identified.

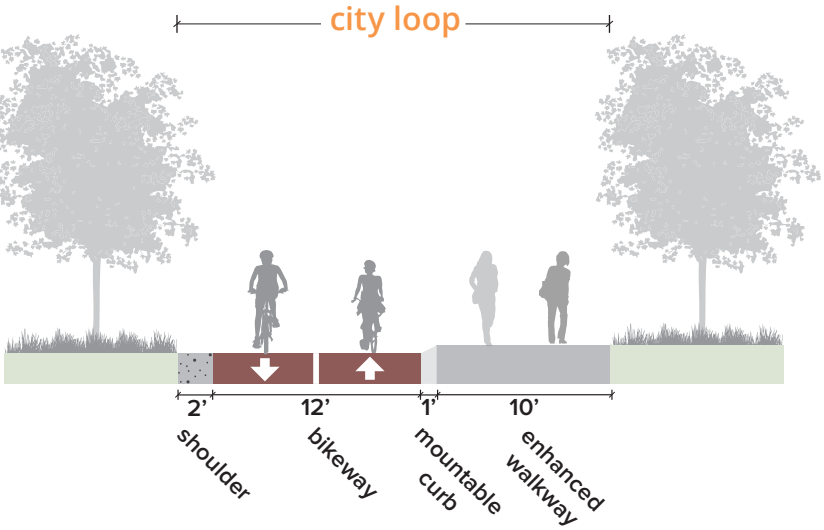
- 11th Ave SW, west side
- 3rd St NW, north side
- 13th Ave NW, east side

Trail with Buffer



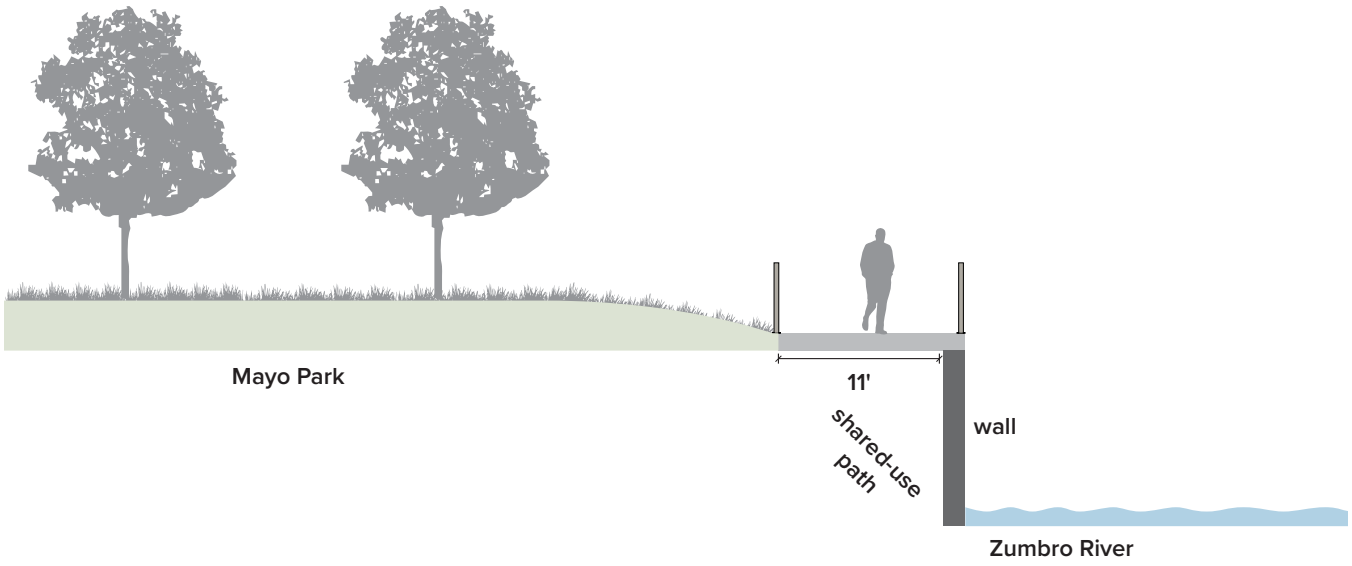
The off-street trail segments of the City Loop will be rebuilt with the same design vocabulary to provide a seamless, high quality experience as the on-street segments. There is a 12 ft. bikeway with two ft. compacted gravel shoulders on each side. Where space permits, a vegetated buffer for green stormwater infrastructure separates the enhanced walkway and bikeway.

Trail without Buffer

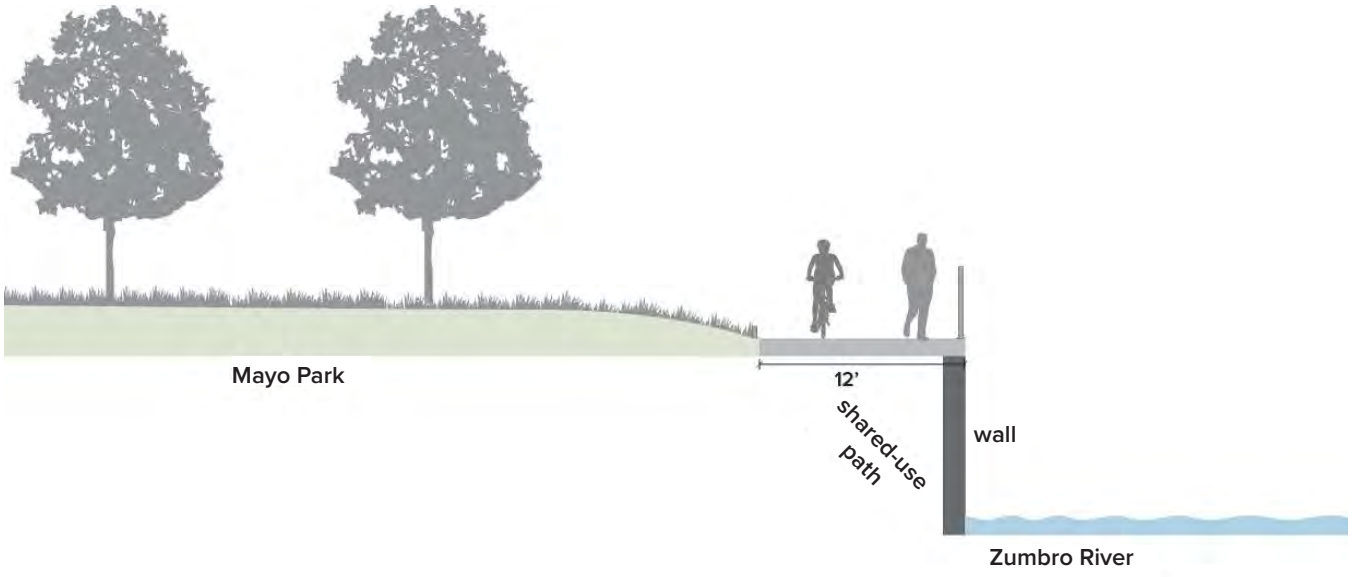


In constrained areas, the buffer will be reduced and the enhanced walkway will be elevated above the bikeway with a mountable curb.

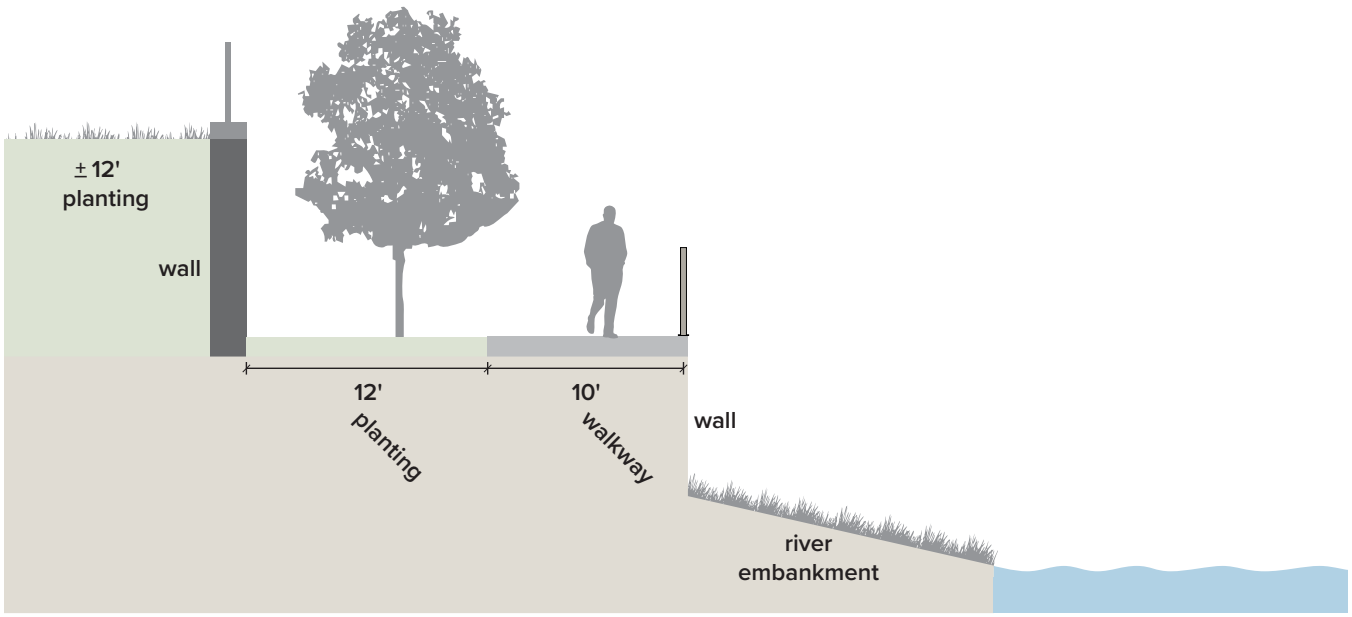
Existing Section within Mayo Civic Center Park-Interim Route as Shared Use Path



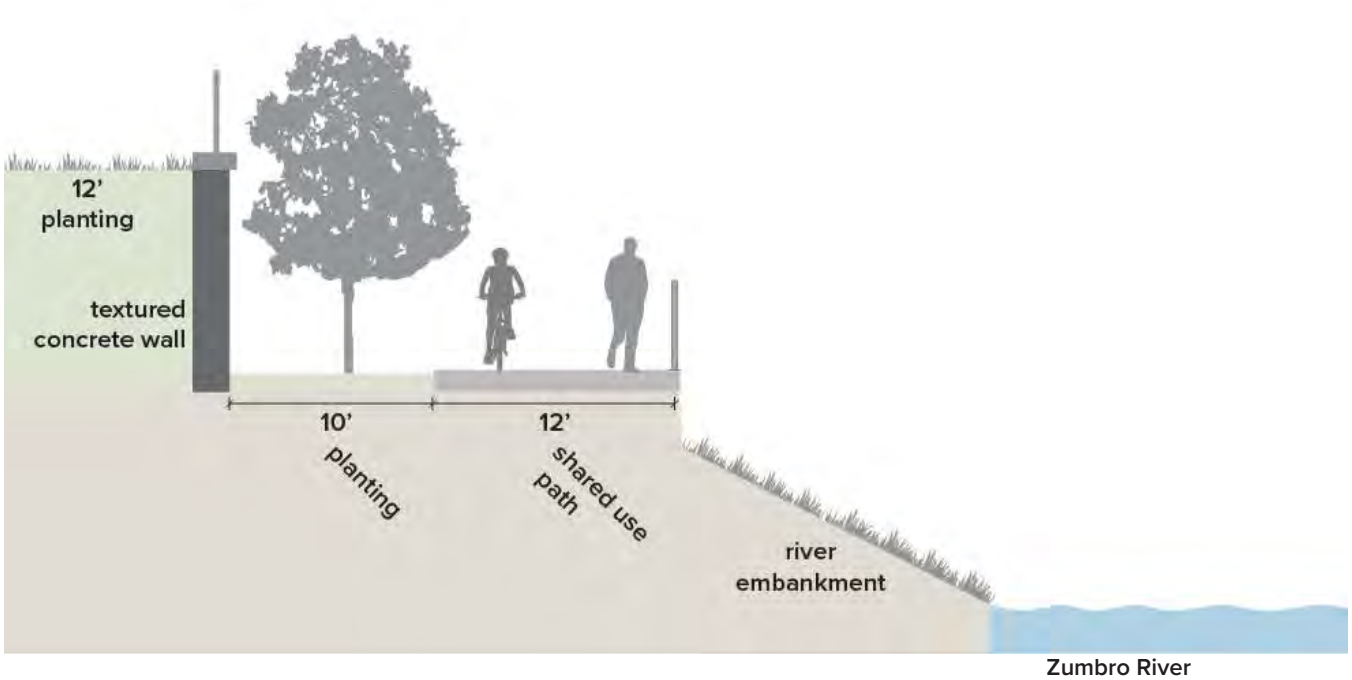
Proposed Section within Mayo Civic Center Park- Shared Use Path



Existing Section along Riverfront between 5th St & 6th St SE - Interim Route

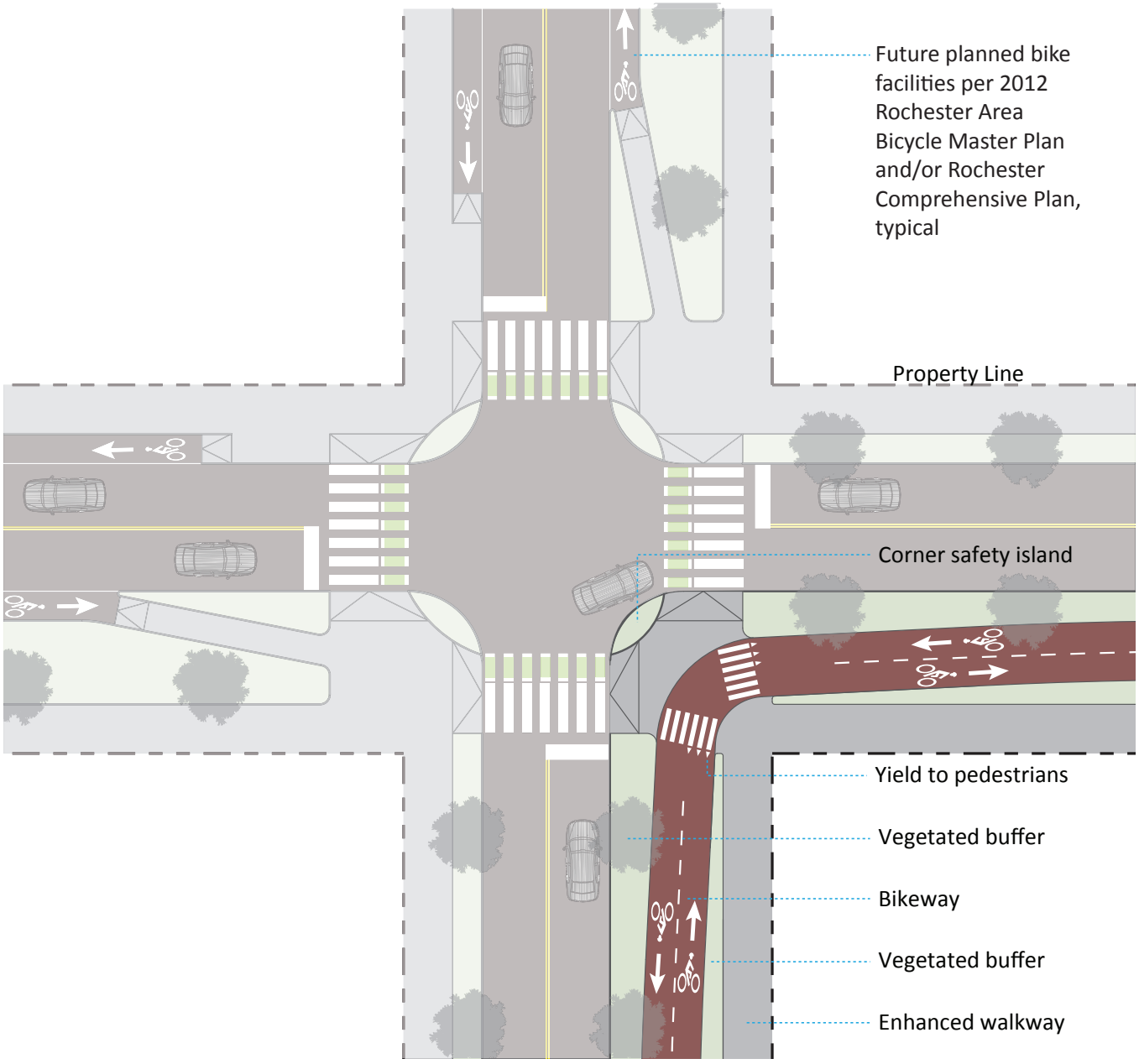


Proposed Section along Riverfront between 5th St & 6th St SE- Shared Use Path



Typical Plans

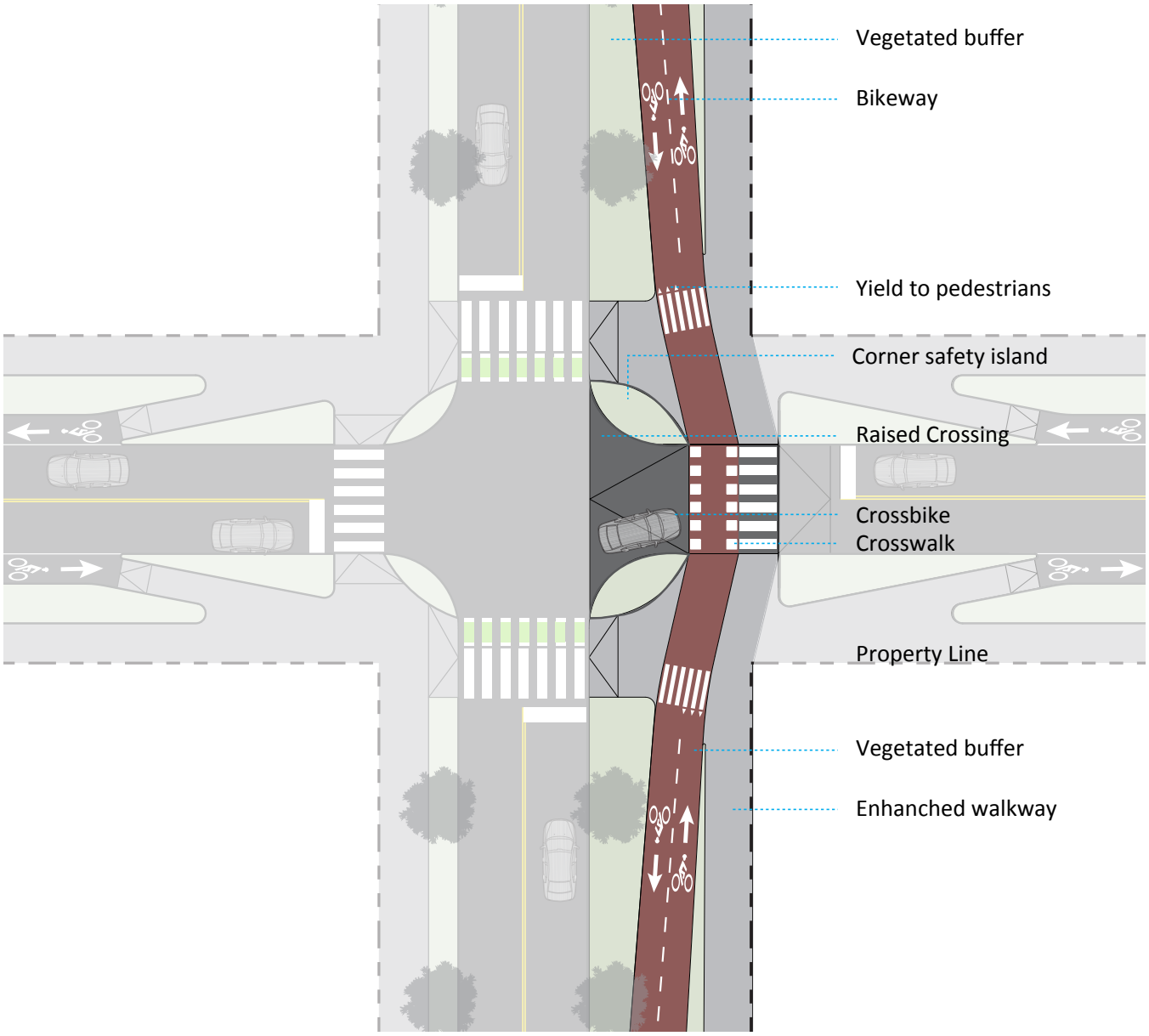
Turn at Intersection



Protected intersections will be used throughout the loop at all crossings to maintain a safe and comfortable experience for all users. Key protected intersection features include an approach taper for the bikeway, setback crossbike, yield to pedestrian markings, and corner safety islands that are raised six inches above the roadway.

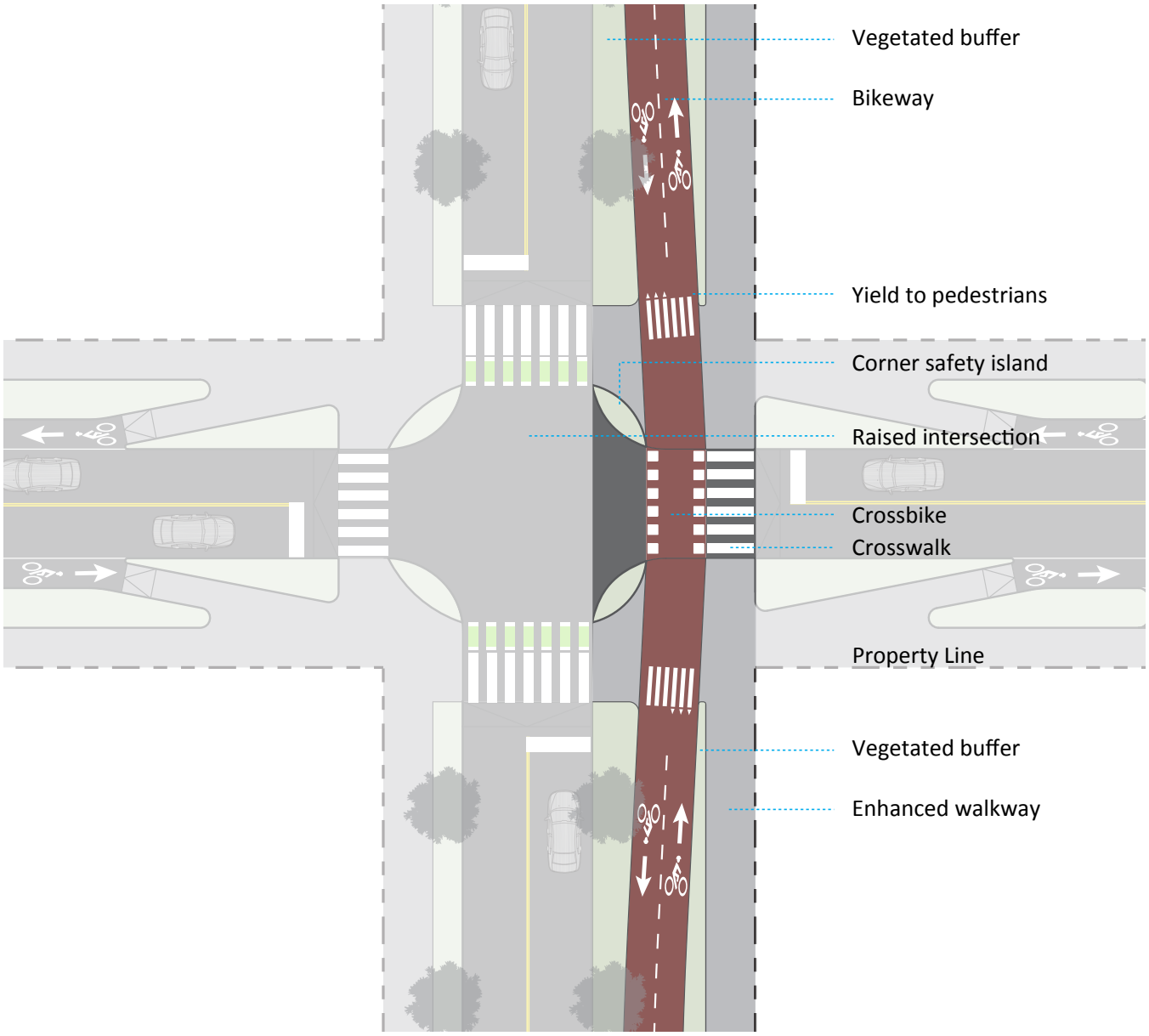
Where the City Loop alignment turns at an intersection, the bikeway tapers towards the enhanced walkway to allow buffer space for curb ramps and to indicate to cyclists that a change in direction is upcoming. Crosswalks from the intersection should continue across the bikeway to indicate to bicyclists that pedestrians crossing the bikeway have priority. Yield line markings can also supplement the crosswalk marking across the bikeway to reinforce that people riding bikes must yield to those walking.

Crossing at Minor Intersection



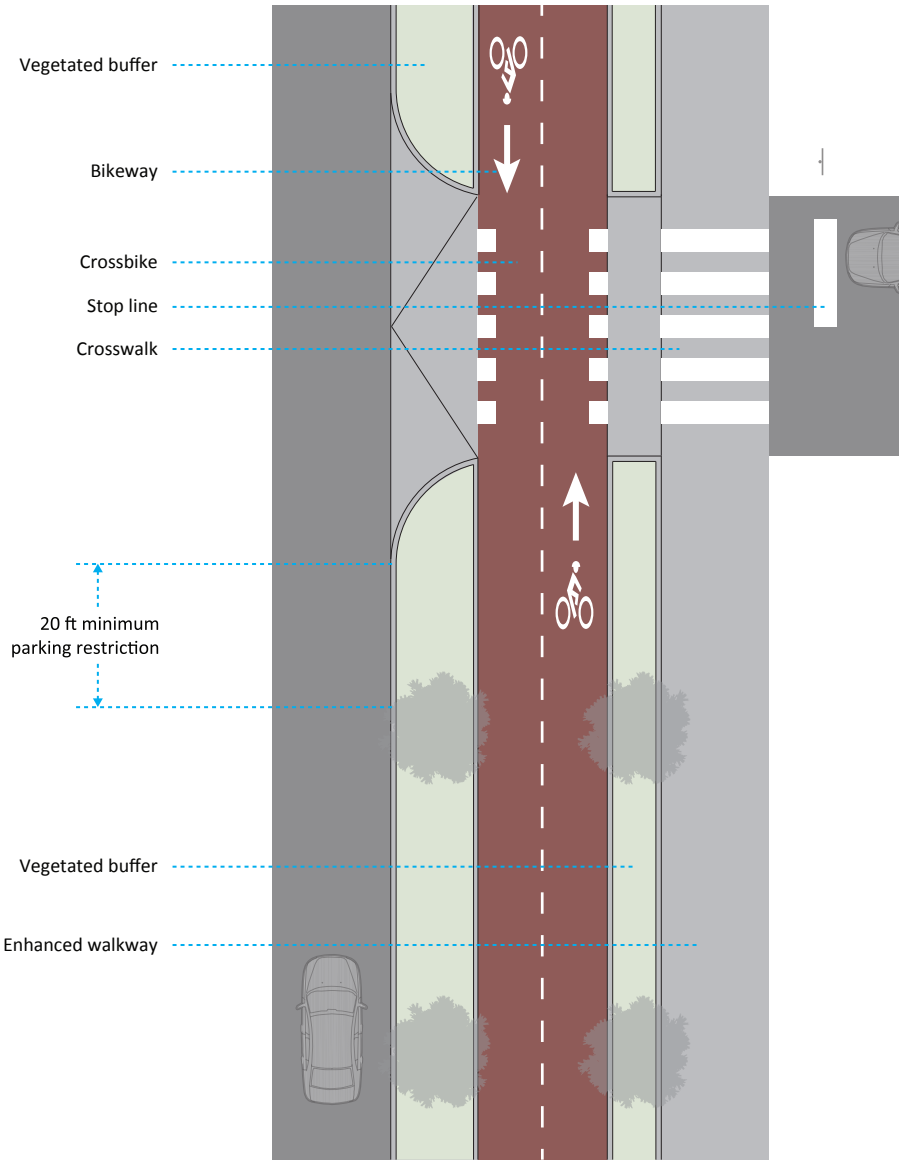
At minor intersections, such as a low volume side streets, the City Loop should have priority over the roadway. An elevated crossbike and crosswalk maintains a continuous experience for City Loop users and slows approaching vehicles that will cross the City Loop. Similar to the turn plan, the bikeway should taper towards the enhanced walkway in advance of the crossing. This taper allows a buffer to be maintained between the roadway and the bikeway by a corner safety island. This buffer space allows a turning vehicle to turn, then queue before crossing the City Loop. This focuses the driver's attention on people walking and biking through the intersection separately from the turning movement.

Crossing at Major Signalized Intersection



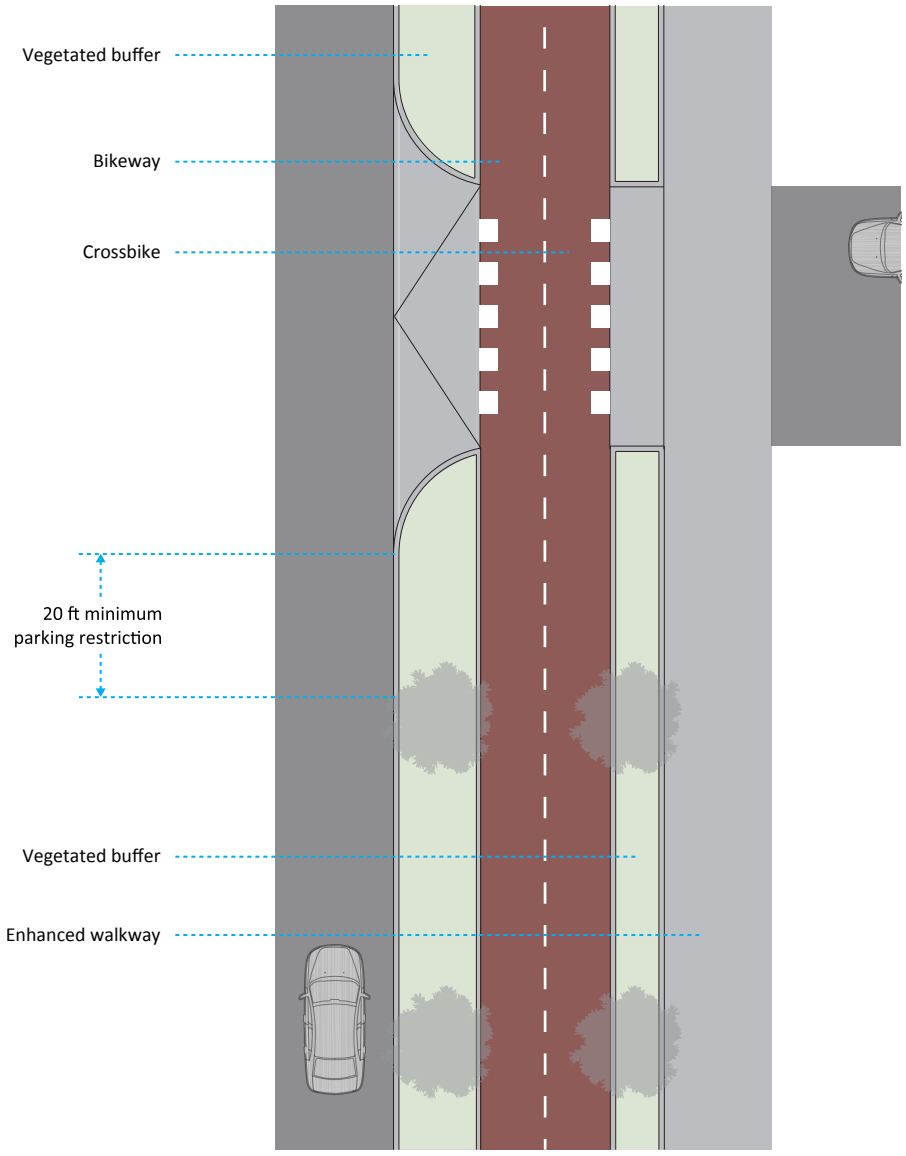
At major intersections with high vehicle volumes and buses, it is not practical to have one leg of an intersection raised. To provide a continuous experience for City Loop users while also minimizing disruption to traffic flow, the entire intersection can be elevated as a table with gradual transitions. The geometry of the City Loop is the similar to the layout of a minor intersection shown on the previous page, with a bikeway taper and corner safety islands to minimize turning conflicts. Crosswalk markings should continue across the bikeway to the sidewalk.

Commercial Driveway Crossing



Along the City Loop, walking and biking is prioritized at driveway crossings by continuing the bikeway and enhanced walkway through the driveway intersection. White elephant feet markings and high visibility crosswalk markings are used to demarcate the bike and pedestrian crossings. Bicycle symbols may be used to add extra visibility to the driveway crossing. Vehicles approaching from driveways must stop and yield to City Loop users.

Residential Driveway Crossing

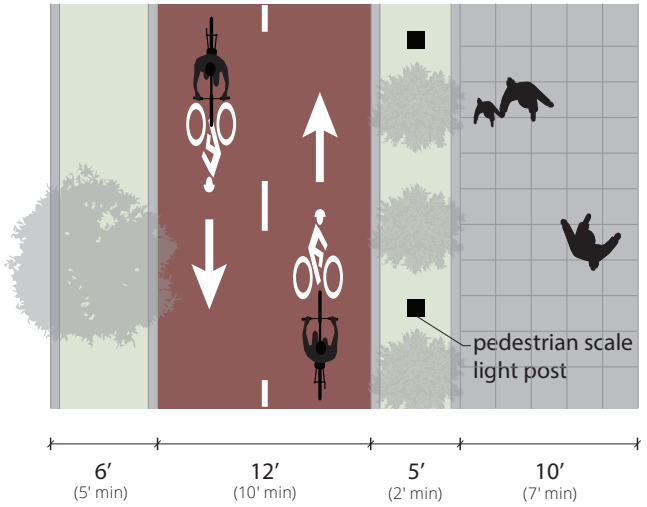


At residential driveways, the number of pavement markings can be reduced to a center skip line on the bikeway to indicate bidirectional flows, and elephant feet markings to alert both people biking on the City Loop and the driver of a potential conflict.

BIKE AND PEDESTRIAN ZONES

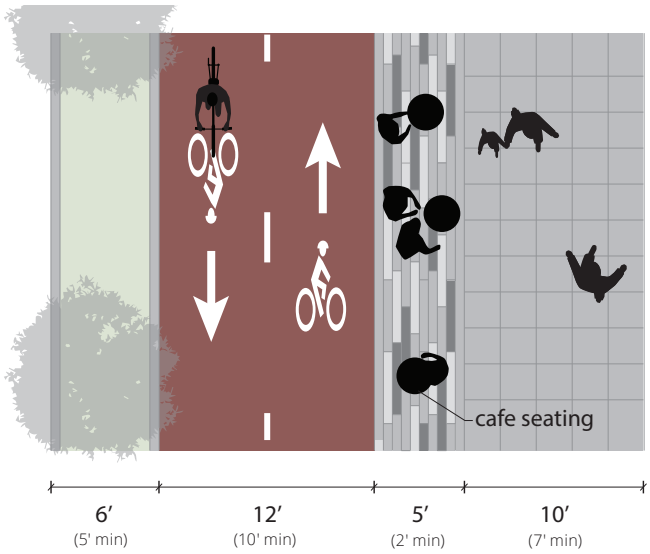
Planted Buffer

In a typical 75 ft. ROW City Loop section, the buffer between the bikeway and the enhanced walkway can be used as an area for turf grass, ornamental planting or stormwater infrastructure. Pedestrian scaled lighting should also be provided in this buffer, spaced adequately to provide illumination to both the bikeway and the walkway.



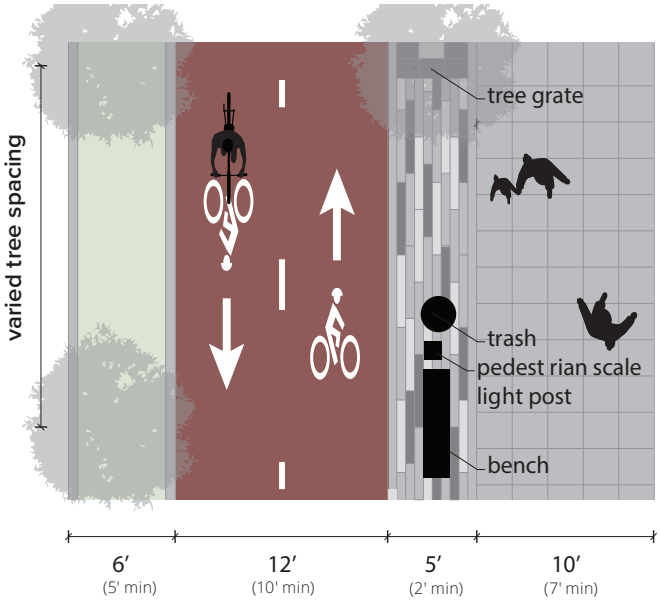
Pedestrian Amenity Zone | Cafe

In particularly urban contexts, the buffer between the bikeway and the enhanced walkway can be utilized as an extension of the sidewalk with cafe seating and tables. However, this area should be distinguished from the through walkway with a different paving type, such as elongated pavers. See examples of unit pavers for this area on page 24.



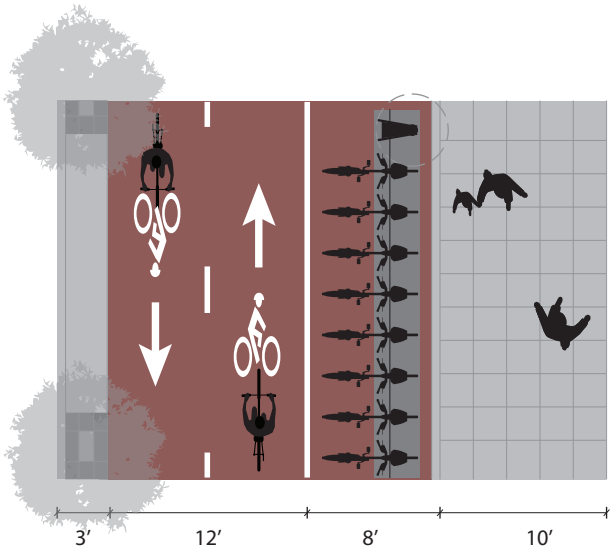
Pedestrian Amenity Zone

Similar to the previous examples, the buffer space can also be used in a conventional streetscape manner, with benches, trash receptacles, lighting, and tree pits. Tree grates should be given careful consideration to avoid hazards for bike wheels that may pass over them. Some examples of tree grates are provided on page 37.



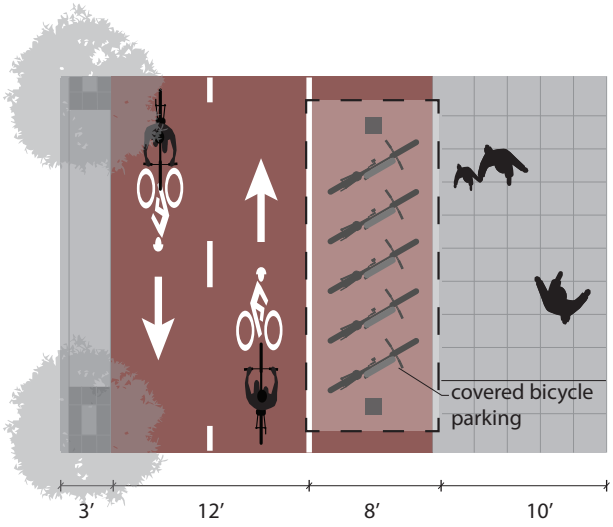
Bikeshare Station

The buffer can also become an extension of the bikeway. This would be appropriate to locate a bikeshare station, for example. A simple stripe can delineate the through bikeway from the bikeshare station. Bikeshare bikes should be oriented towards the bikeway to reduce the likelihood of bikeshare users riding on the walkway to access the station. In order to widen the buffer to accommodate a bikeshare station, three ft. would be removed from the vegetated buffer between the roadway and bikeway and reallocated to the buffer between the bikeway and enhanced walkway.



Covered Bike Parking

Similar to the previous example, the buffer space can also function as a designated area for bicycle parking. Bike racks should be covered wherever possible for protection from sun, rain, and snow. Self bike repair stations can also be included as part of these parking areas. See page 32 for examples of bike parking.



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MATERIALS AND FURNISHINGS

Paving Materials

Bike lane



Bike lanes will be constructed with asphalt to provide a smooth, uniform surface.

A surface material incorporating EVIzero or a similar ecological binder for coloring asphalt surfaces should be applied to create a distinctive and defined bikeway. This is easily replaced (average 12 yr life span), and repairs can be done when refreshing surfaces is needed.

Pedestrian walkways should be enhanced with integrally colored concrete organized in curving patterns to further reinforce the City Loop identity. Saw cutting contraction joints is recommended for improving surface uniformity and reducing chatter or rumble for users employing mobility devices such as walkers or scooters. Markings and color will continue over intersections to make vehicular traffic aware of a major crossing. Additional signage and wayfinding at major intersections may be added as needed.

Pedestrian Walkway - Enhanced



Buffer Areas

Buffer areas serve as a pedestrian amenity zone. In areas where the buffer between the bikeway and the enhanced walkway is used as a seating area or pedestrian amenity, paving materials similar to the images below can distinguish this area from the through walkway. This paving has a fine grain detail appropriate for pedestrian areas, and visually provides interest.



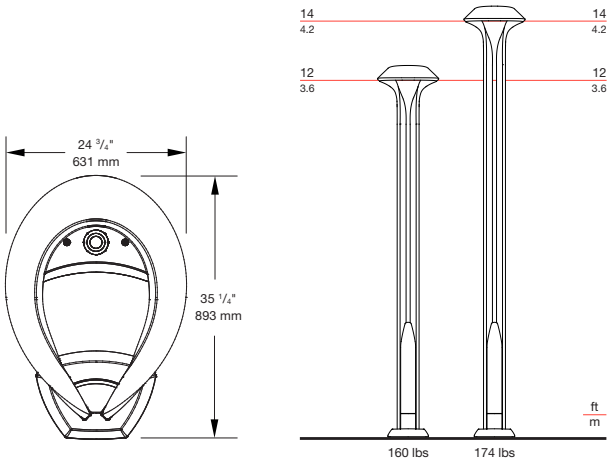


Lighting

Landscape Forms - Metro 40 Hi-Glo

Lighting along the City Loop can provide 24 hour access to walking and bicycling and provides a sense of safety to users after sundown. Pedestrian scaled lights should be installed at frequent intervals. Shorter bollard type lighting can be added in key locations such as at seating nodes (see page 26). The Metro-Glo fixtures are recommended for their loop-like design which will reinforce the City Loop brand. Light columns are included for further enhancements within the downtown core (see page 27).



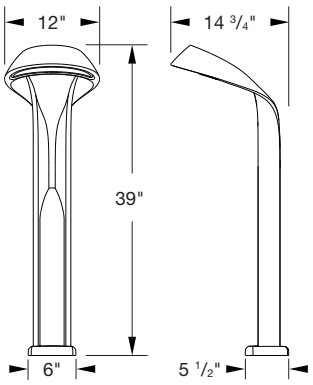


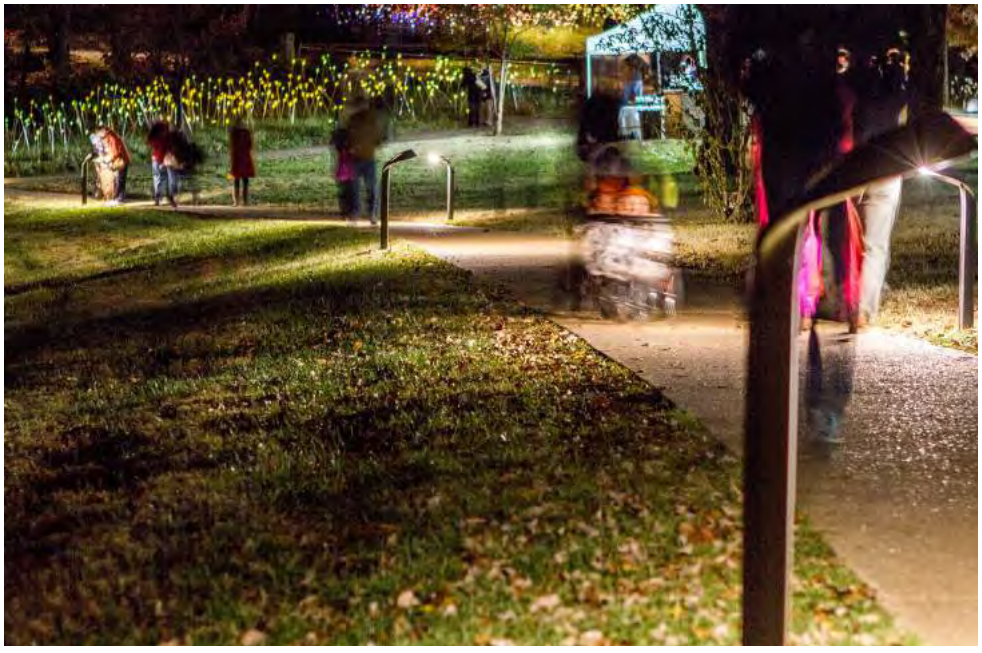


Landscape Forms- Metro40 Lo-Glo





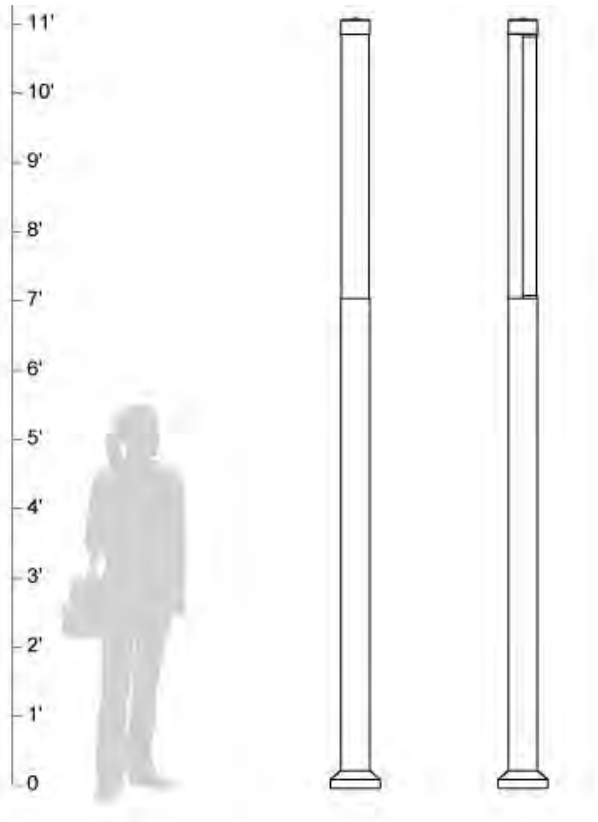




Forms and Surfaces - Column Pedestrian Light









Wayfinding

The main principles of a wayfinding system are to connect places, be predictable, be inclusive, and keep information simple. Good wayfinding makes it easier to walk, bike and take transit; reduces the risk of getting lost or disoriented; improves access to destinations; and can create a community identity. The City Loop should have a distinct wayfinding family specific to the City Loop brand to clearly indicate to users when they are on the loop as well as provide orientation and direction to nearby destinations. Key components of a bicycle and pedestrian wayfinding family for the City Loop could include information kiosks, area maps, directional signs, confirmation signs, mile markers, gateway markers, pavement markings and other route identifiers such as sign toppers and distinctive crosswalk markings.

Using time (minutes to destination) of trip instead of distance is a more useful way of informing users regarding access to key destinations and connections while using the City Loop.

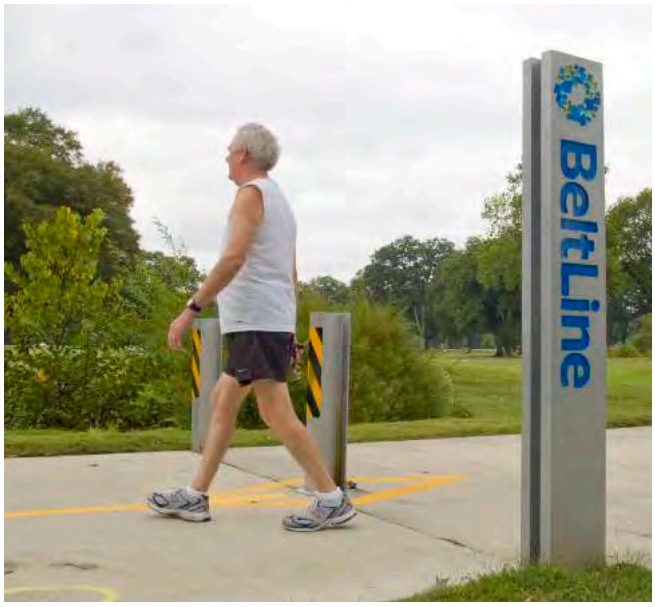






Wayfinding and branding should be designed as a comprehensive system using a range of sign/message types to adequately inform users.







Branding and Identity

The City Loop will be a world-class pedestrian and bicycle urban trail that creates safe, enjoyable, and healthy ways to move about the Development District to experience the sites, visit local shops, and dine in local restaurants and eateries. With such a large and diverse route, the objective is to create a distinct and instantly recognizable identity that connects the entire route. The identity needs to be simple and intuitive to serve as a quick, consistent reassurance to the City Loop user that they are on the right path. With that in mind, it also needs to be flexible enough to be able to integrate across the City's other wayfinding systems. Finally, the brand needs to distinctly reflect Rochester's character as defined by community input, as well as the vision for the Destination Medical Center.



For St. Paul, MN's Grand Round pathway system, designers developed a system of logo variations to respond to a range of conditions and applications such as the web, site signage and printed materials.

INDIANAPOLIS CULTURAL TRAIL®
A Legacy of Gene & Marilyn Glick



Public Art Opportunities

Integrating public art prepared by local, regional and national artists into the City Loop provides opportunities for supporting health and wellbeing, reinforcing identity, sense of place and beauty.

Multiple opportunities are available including:

- Artist designed / constructed furnishings such as benches, bike racks, railings, drinking fountains, etc.
- Separate artworks such as paving designs, mosaics, sculpture, lightworks, banners, murals or soundworks.
- Programmed activities / events such as music, dance and or theater performance.
- Artist prepared planting designs



River Monolith, Andy Kincaid & Rob Neilson



symbol of happiness, speed & purity



symbol of hope



symbol of courage, wisdom & strength

Examples of native American symbols



Sentient Beings, Cliff Gartner



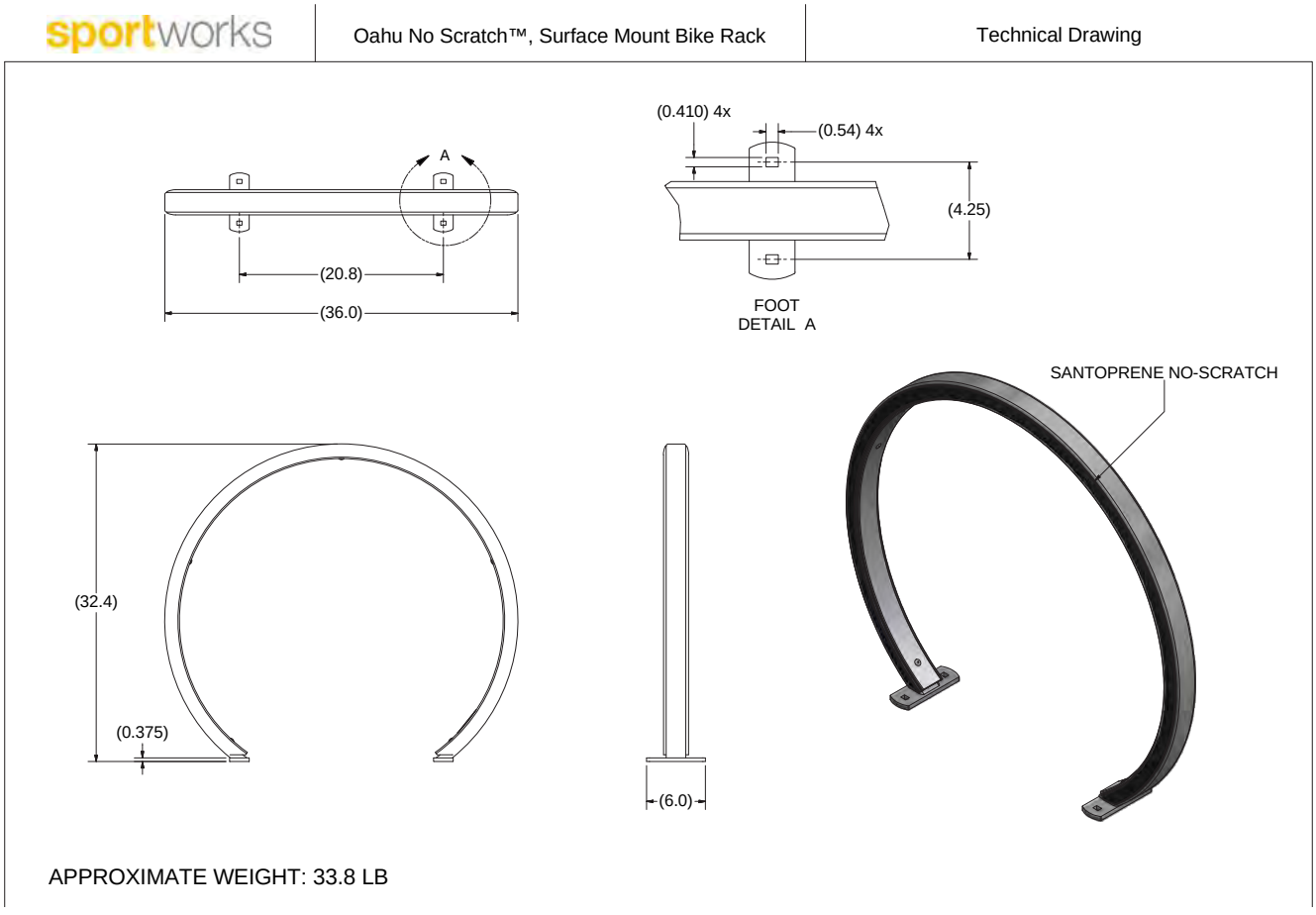
Stone Boat, Stanton Sears

Bike Parking

A bike rack provides a convenient and secure location for a City Loop rider to leave their bicycle. Racks should provide two points of support on a bicycle frame. This ensures that a bicycle is not damaged while it is parked on the rack, and is not susceptible to falling over in wind or from other users accessing the rack. An ideal rack type for the City Loop is a circular bike rack. The photo on the right shows a no-scratch rack manufactured by Sportworks. This rack provides adequate support to a parked bicycle, and the rubber coating on the face of the rack does not scratch the bicycle frame or components. This rack is a high end amenity which values a bicycle rider and their bicycle.



Where possible, bike racks should be provided under shelter. Shelters provide protection from sun, rain, and snow and can be lit at night for safety. Shelters can be conventional, or custom designed to fit the City Loop brand. The images on the following page present a series of different styles of sheltered bike parking.








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Bike Repair Station





Publicly accessible bicycle repair stations allow people to perform minor repairs on their bikes while travelling on the City Loop. This simple amenity allows users to self-repair flats or adjust seats where a bike shop is too far or not open. These repair stations typically have a stand to hold up a bicycle, an air pump, and a set of basic tools. This is a useful amenity that can be combined with wayfinding elements such as a map or information kiosk, or a rest area with seating. These repair stands are ideally located with bike racks under shelters to protect the tools from rust and to allow City Loop users to make repairs in a comfortable dry location in inclement weather.

Seating and Gathering

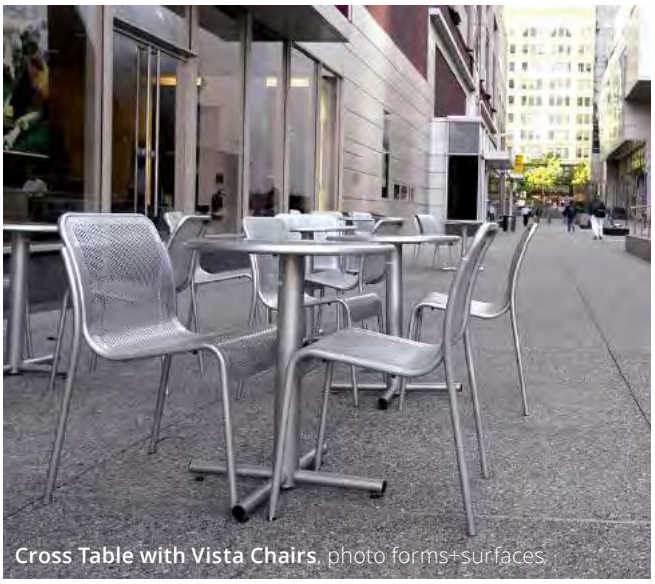
A diversity of public seating options should be provided on the City Loop to provide opportunities for group and individual resting areas, places to eat, and places to meet. Conventional tables and benches as well as unique block or terraced seating should be considered.



Trio Bench, photo forms+surfaces



Charlie Table, photo landscape forms



Cross Table with Vista Chairs, photo forms+surfaces



Trio Bench, photo forms+surfaces



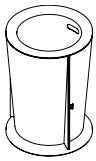
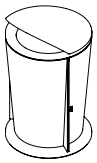
Union Concrete, photo Jangir Maddadi Design Bureau

Trash and Recycling

Landscape Forms Austin Litter Receptacle





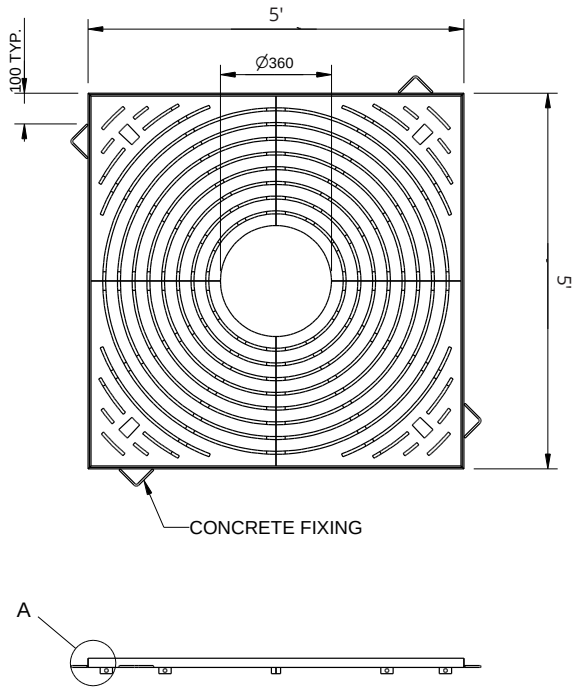
	STYLE	DIAMETER	HEIGHT	PRODUCT WEIGHT
	Top-Opening	24"	35"	172 lb
	Side-Opening	24"	42"	186 lb

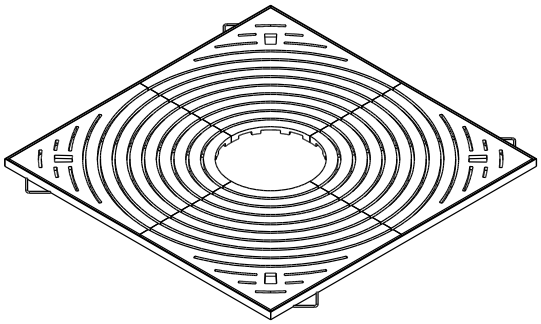
The Austin litter receptacle by Forms and Surfaces provides a distinctive look and will contribute to branding the City loop. The smooth steel product provides opportunities for applying enhancements such as a City Loop identity graphic, and or location map. The top cover keeps litter or recycling dry while the side opening provides for easy, stress free maintenance.

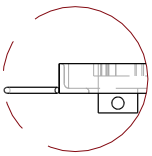
Tree Grates



The distinctive design of this radiating circle patterned tree grate reinforces the City Loop brand/identity.







Detail A
LUG PLACEMENT
HIDDEN LINES SHOWN

SPECIFICATION:

MATERIALS:
Grate - Recycled Aluminum
Frame - Mild Steel

DIMENSIONS:
All in mm unless otherwise stated

FINISH:
Frame - Galvanised & Optional Powder Coat
Grate - Mill or Optional Powder Coat

Certified System
Quality
ISO 9001
SAI GLOBAL

© copyright

Planters

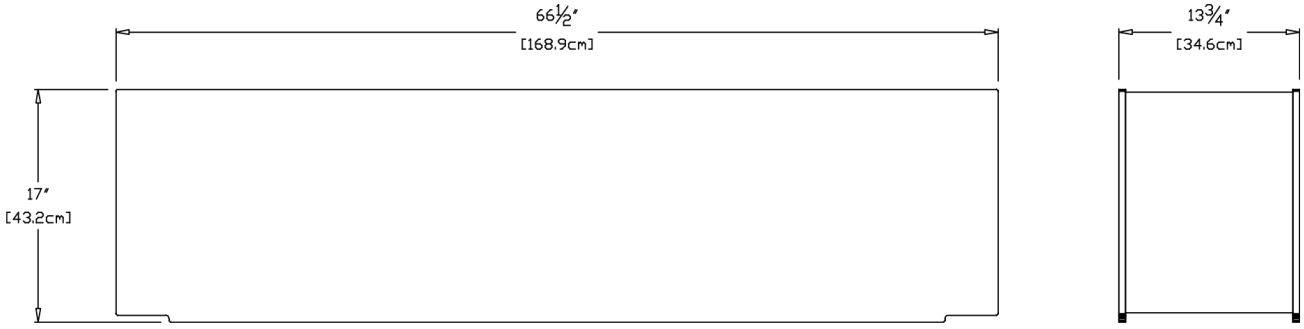


The Skinny Planter by Loll Designs of Duluth, MN provides a clean, modern product for introducing seasonal plantings while simultaneously providing vertical separation between pedestrians, bikes and or motor vehicles. Constructed of 100 percent recycled plastic, it is moveable and made to withstand the test of time and extreme weather. In addition, the containers allow for an addition of irrigation service and slow, seeping drainage, and holes can easily be drilled in the bottom if desired.





Opportunity areas for applying City Loop identity/logo.



Plantings

Planting that reinforce comfort, identity and ecological performance help create places that are welcoming and nurturing for people and urban wildlife. For example, incorporating tree plantings and mixed beds not only provide practical microclimate benefits (i.e. shade in summer) but also fulfill cognitive needs for connecting with the 'natural' environment. The aesthetic aspects of landscape plantings in built environments also provide restorative mental and physical health benefits, especially as people become more disconnected with nature in general. Additionally, focusing plant selection and design to support local and migratory pollinators strengthens the local and national agricultural economy.



Prairie Dropseed (Sporobolis heterolepis) - native grass attractive to the endangered rusty patched bumblebee



Rough Blazing Star (Liatris aspera) - native forb attractive to butterflies



Swamp White Oak (Quercus bicolor) - native shade tree with proven performance in urban conditions often hold its leaves in winter.

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Green Infrastructure Design Guide

November 2017

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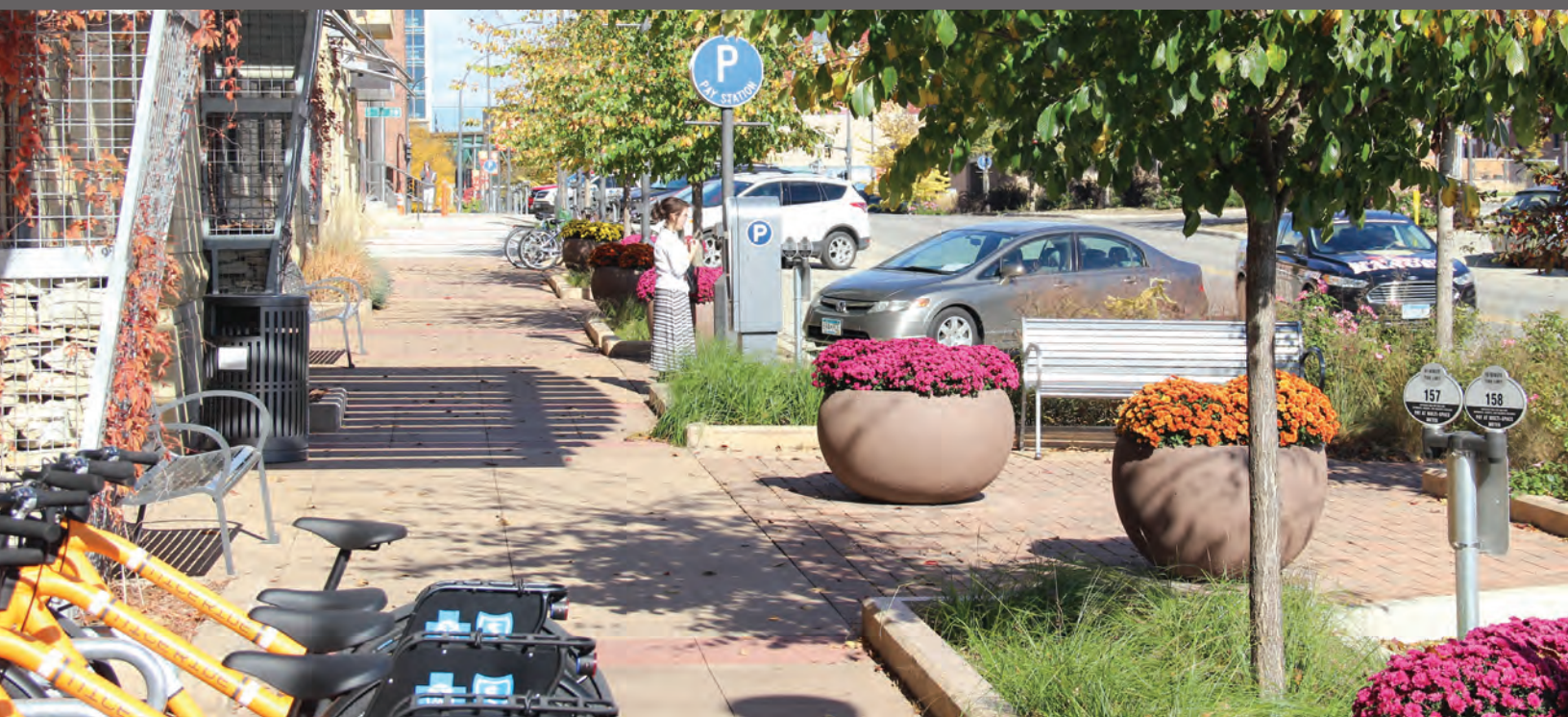
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DMC City Loop
GREEN INFRASTRUCTURE

Green infrastructure enhances sustainability and helps create more healthy places. Integrating green infrastructure with human-powered transportation facilities such as the City Loop promotes environmental, social and economic progress within the DMC area and the City of Rochester.



GREEN INFRASTRUCTURE

INTRODUCTION

What is Green Infrastructure?

For the purpose of this transportation study green infrastructure is defined as sustainable practices, tools, or techniques that may be applied to the design, construction, and the on-going maintenance of the City Loop facility. These sustainable practices may or may not be readily visible to the everyday user but are integral part of the facility.

Green Infrastructure Design Guide

The overarching goal is to build green infrastructure into the City Loop as this will support several of the principles defined by the Destination Medical Center (DMC) Transportation Study. Green infrastructure provides environmental sustainability and creates healthy places for people.

The following green infrastructure design guide provides explanations of green infrastructure strategy types including detailed information for employing sustainable stormwater management strategies along the proposed City Loop. This design guide provides a focus on sustainable stormwater management as these quantifiable practices have in-place regulations and guidelines at the state level that have proven beneficial in similar applications. The stormwater practices should not preclude the consideration of other sustainable practices included in this design guide. It is recommended to apply several sustainable practices as appropriate to maximize the benefit outcomes for the City Loop. Other sustainable practices (in addition to green infrastructure) are worthy of consideration as well.

In addition, at a city-wide and DMC view, the integration of sustainability-focused infrastructure with human-powered mobility infrastructure provides a district approach for the City Loop. A district systems approach produces inhabitable (often contiguous and networked) environments that fully function on an individual level, yet together create a heightened and more meaningful experience for a diverse set of users. This approach for the City Loop will uniquely promote environmental, economic, and social progress for the City of Rochester.



GREEN INFRASTRUCTURE

INTRODUCTION

Goals

Specific goals and benefit outcomes for the City Loop are defined further in the Summary section of this design guide. However, overarching goals for the City Loop related to green infrastructure include the following:



- Improve community health and wellness

  (Inherently through the City Loop human-powered mobility opportunities and sustainable environments/ materials)



- Support environmental sustainability by improving air quality and reducing Rochester's carbon footprint

  (Inherently through the City Loop human-powered mobility opportunities reducing vehicular carbon dioxide emissions)



- Reduce the ecological footprint of the City

  (Through implementation of City Loop green infrastructure strategies)

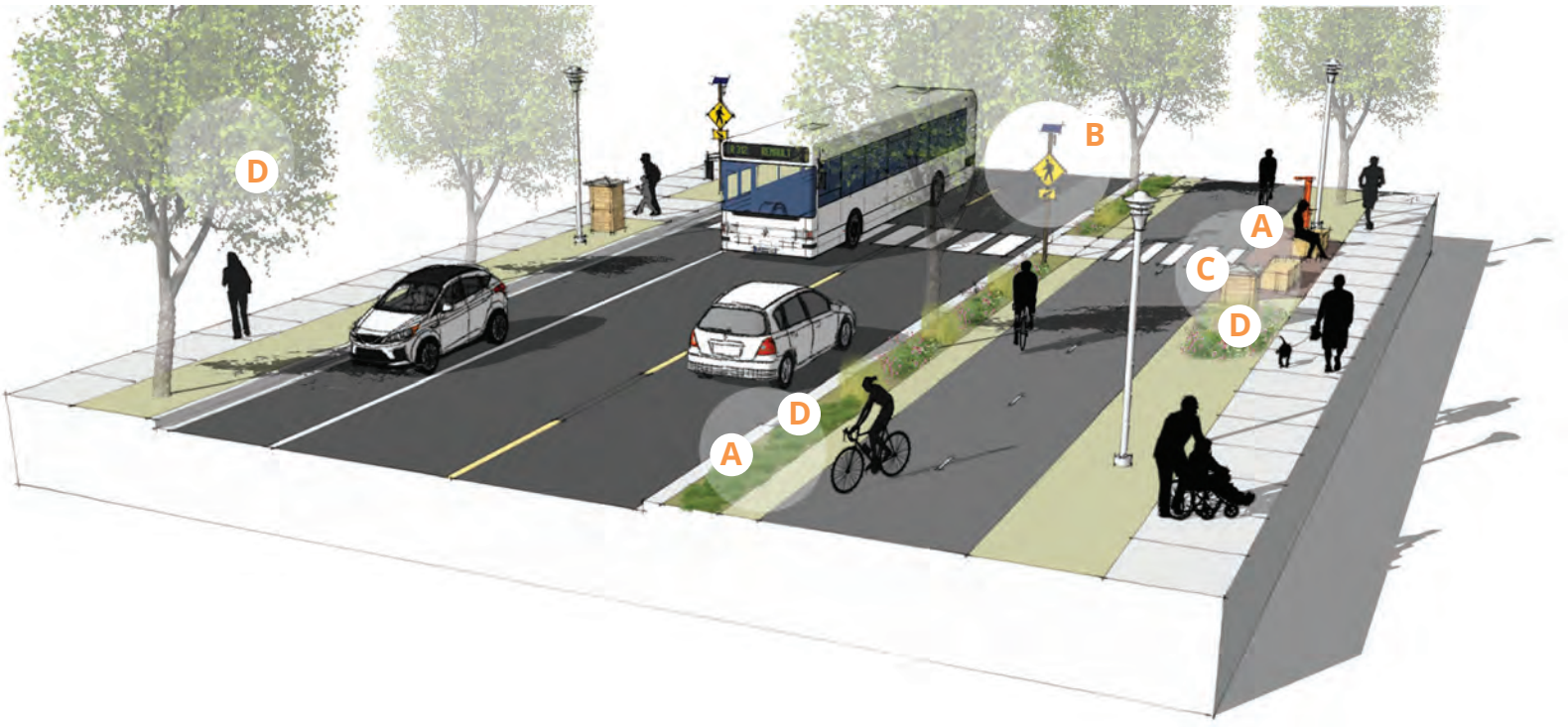
GREEN INFRASTRUCTURE

INTRODUCTION

A Layered Approach

Green infrastructure for the City Loop employs a layering methodology, which applies green infrastructure strategy types at different levels of intensity for maximizing benefits at multiple scales. These green infrastructure strategy types include:

- **A** Stormwater Management
- **B** Active Solar Applications
- **C** Materials Sustainability
- **D** Trees and Vegetation



This overall strategy for the City Loop pro-actively addresses the future quality of living conditions for people as connected to the quality of the surrounding environment. As public health and wellness continue to pose challenges for subsequent generations, now is the time to plan for maximizing the return on investment from building healthy, vibrant, and sustainable places. The specific strategies, combination of strategies, and resulting benefit outcomes are described further in the following green infrastructure design guide sections.

GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE: STRATEGIES

The green infrastructure strategies discussed in these design guidelines include Stormwater Management, Solar Applications, Materials Sustainability, and Vegetation.

Stormwater Management

Stormwater Management as a green infrastructure strategy plays a key role for sustainability and is a measurable benefit outcome. In an effort to minimize impacts of stormwater to downstream systems and be better armored against disaster-scale rainfall events the approach to stormwater management has shifted to promote capture and infiltration at the point of rainfall. Methods for mitigating stormwater runoff:

Infiltration and Filtration -

- Bioswales, infiltration beds, subsurface filtration/ treatment trenches, and Silva Cells for trees – Vegetated swales, raingardens, and specially engineered tree root spaces under pavements.
- Permeable pavements – Special pavements such as porous pavers or porous asphalt allowing for traversable pavement surfaces and infiltration of rainwater.
- Underground stormwater detention and infiltration – Engineered systems collect stormwater runoff, detain in underground storage systems and infiltrate into subsoils or hold excessive volumes of runoff for release after large rain events.
- Greywater catchment for infiltration or reuse – Collection of rainwater from impervious surfaces (i.e. roof tops) and storage for infiltration or reuse such as rain barrels/ cisterns and reusing greywater for irrigation.

Other Methods/ Opportunities -

- Plantings and street trees – Vegetation provides more surface area for rainwater to be captured, naturally evaporated, and less overall runoff.



As the approach to stormwater management has changed so have the metrics defining the quantifiable design standards and outcome benefits. The Minimal Impact Development Standards (MIDS), as issued by the Minnesota Pollution Control Agency (MPCA), provides design goals and calculators for stormwater management that focus on stormwater volume, stormwater quality, and stormwater rate control. This process is further explored and applied to the City Loop in the Project Approach, Stormwater Analysis Methodology section of these guidelines.

GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE: STRATEGIES

Solar Applications

Applications of active solar voltaic panels as a forward-thinking green infrastructure strategy provides renewable resource opportunities within the City Loop. Solar technology may be used to power wayfinding signage for the City Loop, assisting pedestrians, recreational bicyclists, and commuting bicyclists. Bike share programs, such as Nice Ride, employ solar powered self-service kiosks. Solar applications may also assist with powering special safety features such as in-ground flashing lights at pedestrian- bicycle transition zones. Solar Applications also provide economic benefits in lowered electrical utility loads for the City Loop, especially as up-front costs are reduced due to increased market prevalence.





Materials Sustainability

Materials Sustainability includes a green infrastructure approach that employs locally derived, repurposed, or recycled materials within the City Loop. For example, site furniture and amenities may originate from local resources or be manufactured from recycled materials. These site amenities may include benches, columns, landscape garden features, edging materials, mile markers, or signage.

Using locally or regionally sourced materials and products within the City Loop promotes sustainability (and is likely more economical). This is achieved by reducing hauling distances of products. The longer the hauling distances the greater the negative impact to the environment through use of non-renewable resources (i.e. fossil fuels) and greater the potential for vehicle emissions detrimental to air quality.

Specifically for the City Loop project, Minnesota offers many opportunities for quality, durable and local products such as Minnesota River Valley dolomitic limestone. This natural stone material derived from local sources can provide high-quality and aesthetically pleasing site elements. As this material is presently used in building and site materials throughout the City of Rochester, it will reinforce the visual and experiential connection between the City Loop and the surrounding context.

There may be opportunities to incorporate materials that not only provide repurposing but may evoke a deeper meaning through the inherent historic quality. For example, cities may have resources of historic materials such as granite pavers or granite curbs that were removed as the city infrastructure has been upgraded over time. These types of materials can be reused and repurposed in creative ways within an amenity such as the City Loop. (*Continued*)

GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE: STRATEGIES

Materials Sustainability

Another sustainable consideration is the specific chemical composition of products and materials to be used within the City Loop. Selecting products that minimize the presence of chemical hazards and off-gassing will reduce the risks of exposure to the public and promote public health.

In addition, it is recommended to consider companies supplying materials and products for the City Loop to have incorporated sustainable practices or follow Leadership in Energy and Environmental Design (LEED) requirements. These sustainable practices at the manufacturing level may include using recycled materials, using energy-efficient processes, or reducing amounts of polluted and harmful by-products.

Reduction of Heat Island Effect

The reduction of Urban Heat Island Effect may be achieved by planting trees, shrubs and perennial grasses and forbs along the City Loop. Heat island effect, an overall increase of ambient temperatures within a certain area, is mainly caused by the prevalence of buildings, pavements and other surfaces in urban environments that retain the sun's energy by heating up. Other factors such as material thermal properties, solar aspect and orientation, air pollution, and loss of evapotranspiration can contribute to the heat island-effect. Canopy trees provide shade and physical relief for people during the summer months. In addition, shade/ street trees have been shown to lower the surrounding ambient air temperatures through evapotranspiration.

Trees also absorb harmful air pollutants and release oxygen into the environment. Replacing building surfaces with groups of plantings may help reduce ambient temperatures as vegetative materials have lower thermal capacity than most building materials. Also, plants may retain more moisture promoting cooler microclimates.

Combining Strategies

The four distinct green infrastructure strategy types as outlined above, can be applied in a multi-layered approach to help promote the maximum benefit outcomes for the City Loop. How these strategy types are combined may be a factor of the contextual or site conditions at a particular point or segment along the City Loop. However, we can look at applying these strategies in general by qualifying number of strategies used, defined here as Tier 1, Tier 2 and Tier 3:

- Tier 1: One Strategy Type
- Tier 2: Two Strategy Types
- Tier 3: Three (or more) Strategy Types

***Benefit Outcome** is defined as a resultant, positive, quantitative (or qualitative) impact to the DMC user groups, stakeholders, and community at large that meets the project goals and objectives.*

GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE: STRATEGIES

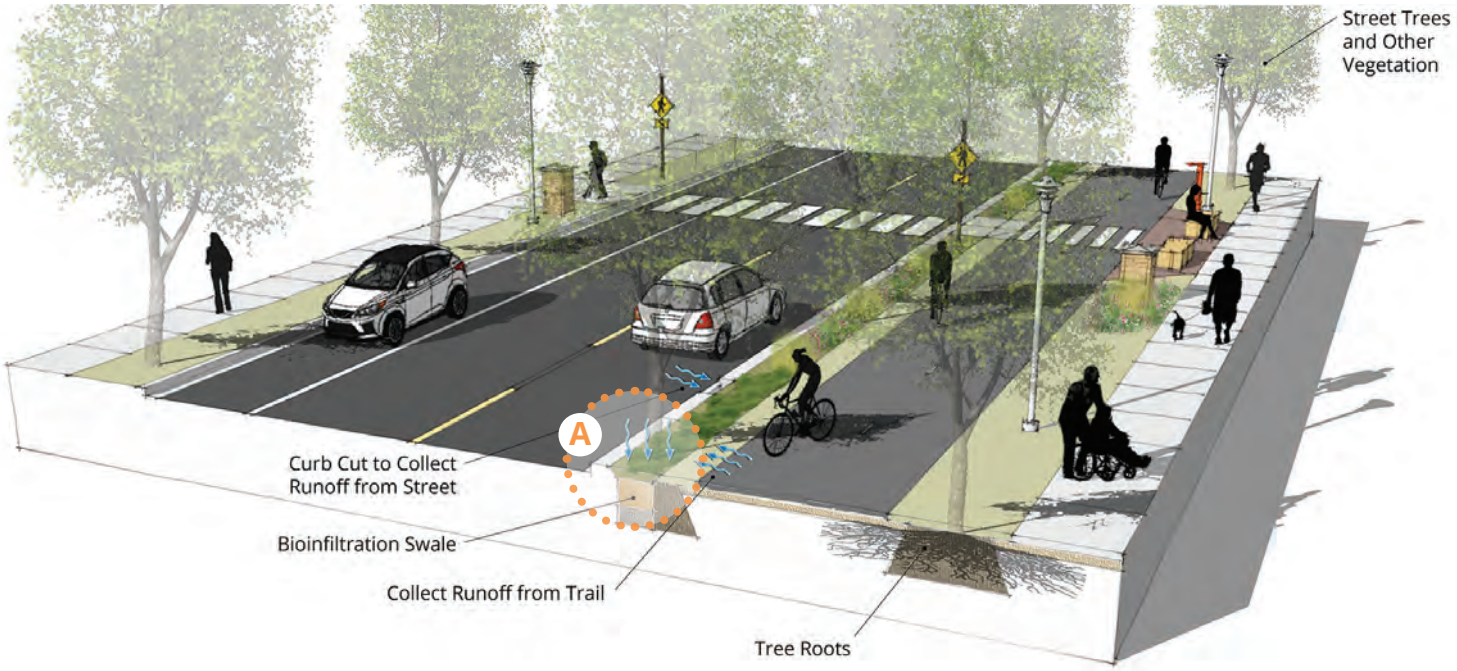
Combining Strategies

Tier 1: One Strategy Type

Examples of applying Tier 1:

A Stormwater infiltration

- Solar-powered signage
- Permeable pavers
- Street trees
- Other



GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE: STRATEGIES

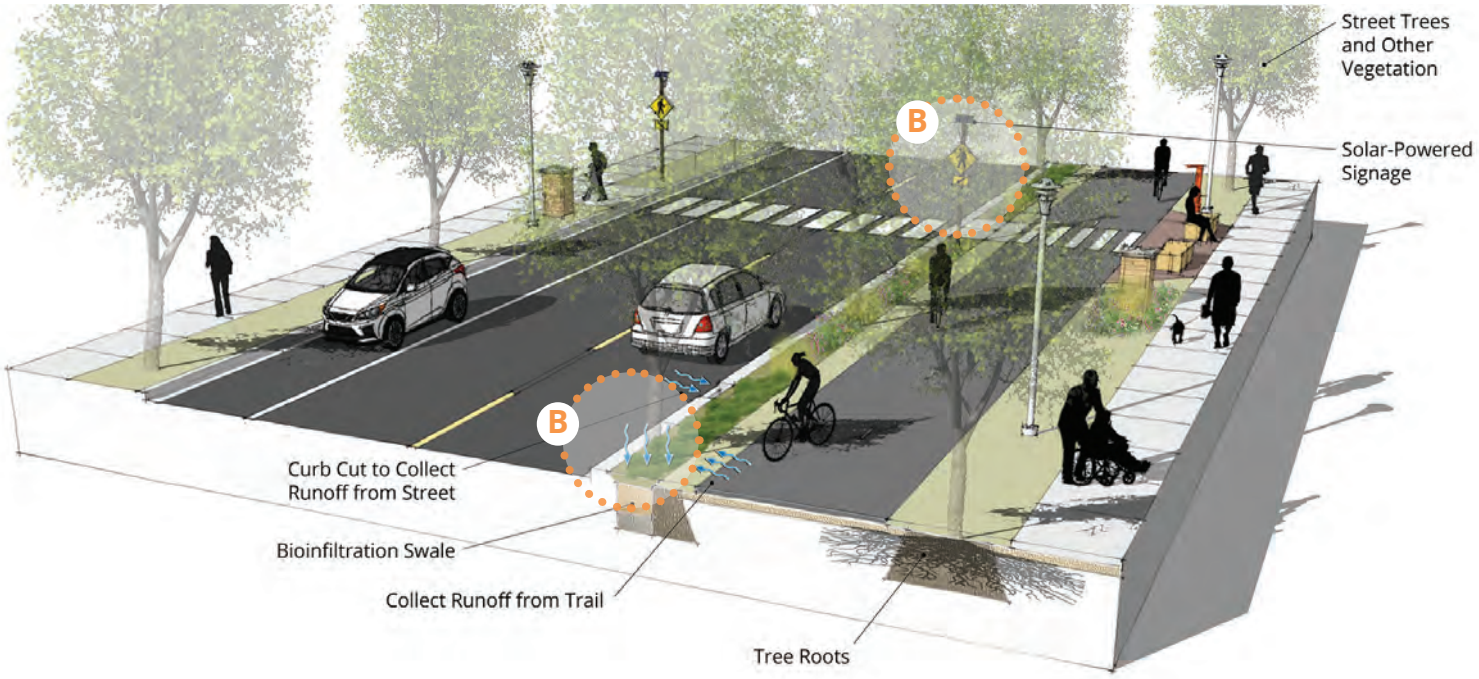
Combining Strategies

Tier 2: Two Strategy Types

Examples of applying Tier 2:

B Stormwater infiltration + Solar-powered signage

- Stormwater infiltration + Permeable pavers
- Bioswales + Recycled site furniture
- Other



GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE: STRATEGIES

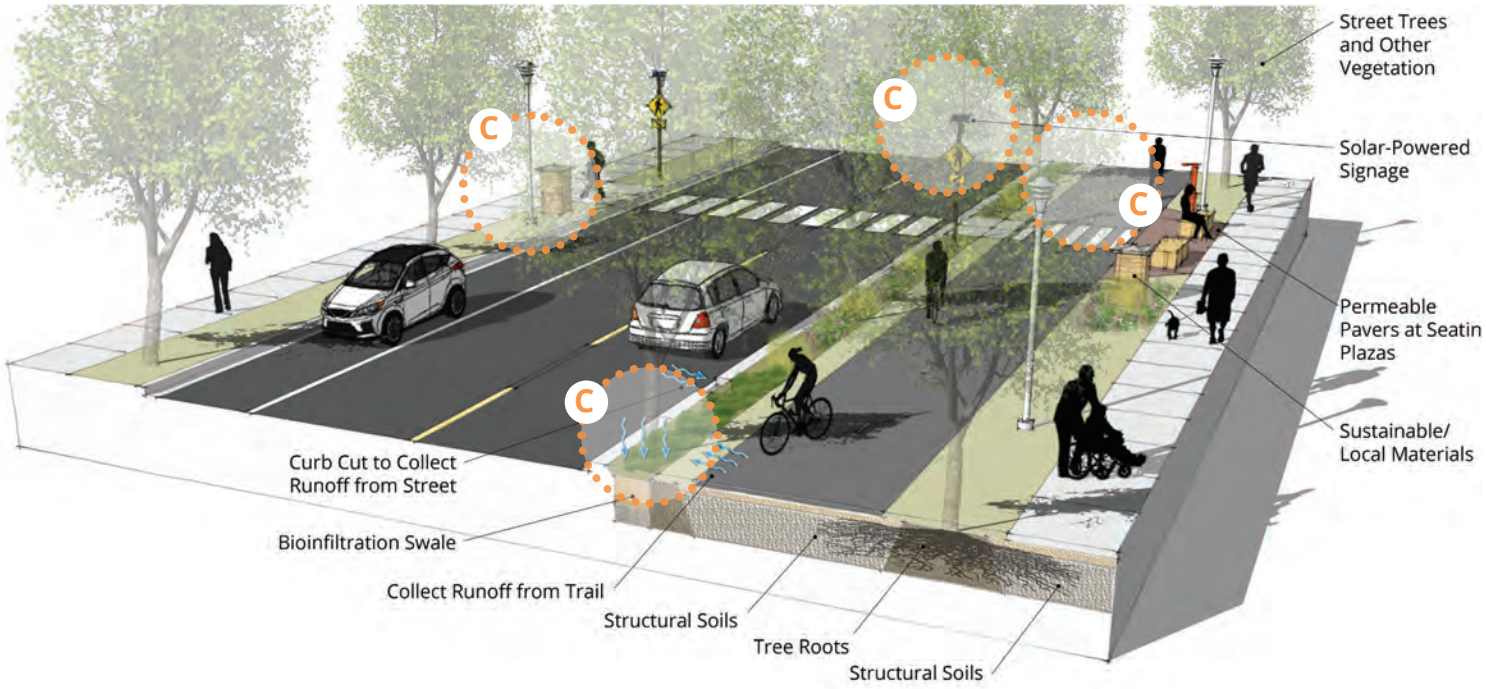
Combining Strategies

Tier 3: Three (or more) Strategy Types

Examples of applying Tier 3:

C Stormwater infiltration + Solar-powered signage + Permeable pavers + Locally sourced materials

- Other



GREEN INFRASTRUCTURE

GREEN INFRASTRUCTURE: STRATEGIES

Combining Strategies

In revisiting the Destination Medical Center (DMC) 10 Transportation Principles, there are key words to consider: affordable, convenient, people, healthy, sustainable, inclusive, streets, ecological footprint, economic development, shared, and human-powered. These meaningful words intend to guide the decision-making at all scales for the city's future transportation network goals, including the City Loop.

The City Loop, as part of this district-wide, multi-modal transportation network, must meet the needs of multiple city departments, investors, and user groups. Traditional approaches to infrastructure will not achieve this nor address the principles as set by the DMC. Embracing the application of multiple green infrastructure strategies at finite points along the City Loop will reinforce, enhance, and enrich the overarching systems and networks. Not unlike a drop of water falling into a pool creating a ripple that grows larger over time and distance. The greater number of applied green infrastructure building blocks along the City Loop, the greater overall benefit outcomes for the entire DMC transportation network system.

The goal of green infrastructure within the City Loop is to create a healthy and vibrant community defined by next generation design and goals for stormwater management, solar technologies, heat island effect reduction, and sustainable and healthy materials. In recognizing the City Loop is an integral part of larger systems, from district-wide to regional to global, green infrastructure strategies can be applied to reduce ecological footprints, pollutant migration, and waste generation effectively at multiple scales of time and space.

The next generation application of layering multiple green infrastructure strategies along the City Loop means addressing the 'needs' at that given locale and point in time. These strategies do not defer treatments downstream nor defer treatments later in time. For example, the fall of a raindrop is not carried across multiple pavements, into a pipe, and ultimately into an already overflowing, unstable river (traditional approach for stormwater management). Instead, that raindrop is immediately captured to infiltrate the ground for plant growth or replenishing groundwater resources. That raindrop no longer carves an erosive path across pavements and earth. A balance is now struck between the built and natural environment allowing for a more stable coexistence for both those systems and longevity of the built environment.

This balance also improves the connection between people and the environment. By integrating green infrastructure strategies within the City Loop, such as stormwater treatment and solar technologies, people better understand these systems and form a deeper engagement with their surrounding environment. Engagement leads to familiarity of these integrated systems, which will in turn encourage year-round and higher usage of that environment (i.e. City Loop). This is shown through specific realized benefits of green infrastructure. For example, pervious asphalt pavement used for bike trails in the upper Midwest is advantageous in late fall, winter, and early spring as moisture still seeps through the pavement reducing ice accumulation on the surface. Less sand and salt needs to be applied and paved trail surfaces remain bikeable throughout the cold season.

Green infrastructure strategies provide a balance of environmental sustainability and healthy places for people and urban wildlife. The City Loop provides an opportunity to integrate layered green infrastructure strategies that will promote public health, improve the environment, spur economic growth, and foster social progress of the city as a whole.

GREEN INFRASTRUCTURE

PROJECT APPROACH

Precedents: National and Regional

Precedents for implementation of multi-modal networks that include both green and bicycle infrastructure can be found at national and regional levels. These precedents are informative for understanding the components of multi-modal transportation networks and provide visual imagery of the outcomes. Here are a few example precedents that may provide inspiration for the City Loop.

National

Portland, Oregon:

Portland Bicycle Plan for 2030 (https://nacto.org/wp-content/uploads/2012/06/City-of-Portland-2010-2030-Plan.pdf)

In February 2010 the City of Portland, Oregon adopted a comprehensive bicycle plan through the year 2030. Portland, Oregon is nationally known for its smart-growth policies, citywide sustainable practices, and extensive bicycle infrastructure. This document covers an array of information on bicycle planning including vision, policy framework, transportation system, programming, and implementation. Specifically, as a precedent for the City Loop, Section 3.5.6 Green Streets provides information on integrating bicycle infrastructure with alternative stormwater management practices to not only connect people to nature, but also to provide opportunities to educate the public about these sustainable systems.



Photo credit: Kevin Perry, Bureau of Environmental Services, City of Portland

Regional

Saint Paul, Minnesota:

Capital City Bikeway, Jackson Street, Saint Paul, Minnesota (https://www.stpaul.gov/departments/public-works/bicycles/capital-city-bikeway)

The City of Saint Paul in March 2015 adopted as an addendum to the city's comprehensive plan, the Saint Paul Bicycle Plan. This plan recommended expanding the bicycle network in the downtown area. In 2016, as part of the downtown Jackson Street reconstruction, a separated, two-way bikeway, called the Capital City Bikeway, was implemented to provide additional bicycling resources downtown, connect regional trails, and spur economic growth.

The Capital City Bikeway: Network Study and Design Guide (see https://www.stpaul.gov/departments/public-works/bicycles/capital-city-bikeway for link to document) provides detailed information on design recommendations and the integration of stormwater best management practices (BMPs) for the bikeway. The Jackson Street segment of the Capital City Bikeway constructed in 2016-2017 includes both porous asphalt pavements for the bikeway and bioinfiltration basins as alternative stormwater management techniques. This regional project precedent is an exceptional model for the City Loop, especially for the urban segments traversing the downtown Rochester areas.



GREEN INFRASTRUCTURE

PROJECT APPROACH

Precedents: Local

Observing local green infrastructure prototypes is also informative to the design process. These prototypes may provide measurable and transferrable outcome benefits to the City Loop project. Another advantage is providing relevant post-occupancy evaluation of what did and did not work in the implementation phase. Here are a few examples of stormwater management prototypes that may be worth exploring:

Metropolitan Market Place
519 1st Ave SW
Downtown Rochester



Uptown Neighborhood
2nd St SW
City of Rochester



These two local precedents may inform the green infrastructure design of the City Loop as they both incorporate alternative stormwater management techniques. In both of these examples, the functional aspects of the green infrastructure are considered with creating vibrant spaces for people and dynamic landscapes.

Specifically, the Metropolitan Market Place located in downtown Rochester on 1st Avenue SW integrates a mixed-use development with public space, amenities for people, and alternative stormwater management. Implementation of this urban village project necessitated private-public partnerships as the development included a food co-op at street level (People's Food Co-op), apartment living above, updated street and street parking, and new urban public space within the Right-of-Way under the purview of the City of Rochester's Public Works Department. This is a model example for the City Loop on how to seamlessly and elegantly integrate green infrastructure, such as raingardens and porous pavers, within the urban core and in locations where privately-owned developments would be adjacent to the public City Loop.

The Uptown Neighborhood along 2nd Street SW located west of downtown Rochester provides examples of alternative stormwater management techniques in the city's neighborhoods beyond the urban core. Bioinfiltration basins within the street medians are aesthetically pleasing with the integration of functional stormwater management, plant materials, and structured stone elements. These types of green infrastructure stormwater management systems may be incorporated into the City Loop along segments that fall outside of the urban core and in areas that provide enough space to accommodate these types of features.

GREEN INFRASTRUCTURE

PROJECT APPROACH

Additional Case Studies

In addition to the national, regional, and local precedents for green infrastructure described previously, there are a host of other case studies that may offer next-generation green infrastructure solutions applicable to the City Loop. The following list provides a summary of these case studies that may be worth investigating further:

Chicago Green Alleys

handbook: nacto.org/docs/usdg/green_alley_handbook_chicago.pdf

source:

https://www.cityofchicago.org/city/en/depts/cdot/provdrs/street/.../green_alleys.html

An Action Guide to Create a Greener, Environmentally. Sustainable Chicago.

ReFresh Milwaukee

source:

http://www.refreshmke.com

In July 2013, Mayor Barrett launched ReFresh Milwaukee, a citywide strategic plan to develop a sound environmental, economic and social sustainable future for the community. The plan aims to implement sustainable projects and encourage citizens and businesses to engage in solutions that are economically, environmentally, and socially smart for our community.

Stafford County Virginia; stormwater drainage system design

source:

http://staffordcountyva.gov/documentCenter/View/107

Design Manual 2014

Green Infrastructure: Ontario Coalition

source:

http://greeninfrastructureontario.org/

Topics and case studies addressed:

- *Urban Forests*
- *Storm Water Systems*
- *Green Roofs*
- *Parks and Open Spaces*
- *Ag & Urban Agriculture*
- *Natural Heritage*

Naturally Resilient Communities

source:

nrcsolutions.org

Nature offers a powerful set of tools for addressing hazards like flooding and erosion. Nature-based solutions use natural systems, mimic natural processes, or work in tandem with traditional approaches to address these specific hazards. Communities across the country— along rivers or coasts, large or small, rural or urban— can incorporate nature-based solutions in local planning, zoning, regulations, and built projects to help reduce their exposure to flood and erosion impacts.

GREEN INFRASTRUCTURE

PROJECT APPROACH

Types of Places: City Loop

The types of places vary along the City Loop and may be characterized in general by the following: Downtown Core, Downtown along River, Residential, Neighborhood Commercial Node, and Park. Exactly how and what combinations of green infrastructure are applied along the City Loop may depend in part on the locale and the characteristics of the place.

However, even though these places may offer unique opportunities for sustainable applications, bringing a sense of continuity throughout the City Loop is an important design consideration that may be supported by the green infrastructure design vocabulary.



Existing Conditions: 4th St NW & 6th Ave NW



Existing Conditions: Kutzky Park



Existing Conditions: Downtown Riverfront Trail



Existing Conditions: 2nd St SW by Saint Marys Campus



Existing Conditions: Downtown Civic Center



Existing Conditions: 6th St SW & 3rd Ave SW



Existing Conditions: Downtown



Existing Conditions: Metropolitan Market Place at 6th St SW

GREEN INFRASTRUCTURE

PROJECT APPROACH

Benefit Outcomes

Benefit outcomes exist on several levels, which may be directly quantifiable (i.e. stormwater quality) or others not readily measurable (i.e. social benefits). Benefit outcomes also may be immediate or span years, depending on the type. For this discussion, we focus on the 10 DMC Transportation Principles for guidance on potential benefit outcomes of green infrastructure strategies that may be applied to the City Loop.

Besides addressing ecological and environmental sustainability, these guiding design principles indicate a level of equity for the human component of transportation infrastructure. The inclusion of people-powered mobility and people in general is now recognized as equally important for transportation infrastructure planning. The healthy environments derived from City Loop green infrastructure systems will provide direct benefits to the people of Rochester, including residents, business owners, visitors, patients, and patient companions. In general benefit outcomes of green infrastructure include the following:

- Improved Stormwater Quality
- Renewable Energy Resources through Solar Power
- Materials Sustainability and Durability
- Heat Island Effect Reduction
- Social and Economic Benefits

Green infrastructure strategies can create places that are welcoming to people from a physical and mental capacity. For example, incorporating tree plantings and planting beds not only provide practical microclimate benefits (i.e. shade in summer) but also fulfill cognitive needs to reconnect with the 'natural' environment. Landscape plantings in built environments go beyond mere aesthetics as these systems provide restorative mental and physical health benefits, especially as people become more disconnected with nature in general.

Applying green infrastructure provides opportunities to educate the public on processes and importance of these systems. Interpretive signage, art, or interactive features can create another human-scaled experience within the City Loop. These experiences start to build a foundation of accepted practices for the good of the community, economics, environment, and public health. In addition, specialized training for construction, maintenance and inspection can provide new workforce opportunities, such as the National Green Infrastructure Certification Program and public-private partnerships.

By creating a City Loop that is people-focused, businesses will also realize economic benefits. As residents, visitors, patients and companions are drawn to the City Loop public amenities, people will look to private entities to fill their other subsequent needs: cafes, dining, shopping and entertainment, as examples, will follow suit. Quality spaces will also increase adjacent property values. According to an assessment conducted for the Indianapolis Cultural Trail (*Assessment of the Impact of the Indianapolis Cultural Trail: A Legacy of Gene and Marilyn Glick, March 2015*) between the years of 2008 to 2014 property values of parcels adjacent to this trail increased an overall amount of 148 percent[1]. The cooperative relationship between public and private entities will help establish the City Loop as a vibrant, safe, populated, and healthy resource opportunity in the city.

[1] http://indyculturaltrail.org.s3.amazonaws.com/wp-content/uploads/2015/07/15-C02-CulturalTrail-Assessment.pdf

GREEN INFRASTRUCTURE

SUSTAINABLE STORMWATER MANAGEMENT

Sustainable stormwater management practices or stormwater best management practices (BMPs) are readily understood and measurable as a green infrastructure strategy. The following sections focus on potential applications of several stormwater BMPs for the City Loop.

City Loop Typologies

Two Typologies have been defined for exploring sustainable stormwater management opportunities for the City Loop trail. These typologies include the trail within the street section and the trail in off-street areas, such as Kutzky Park. The ROW sections listed below are used as examples in applying stormwater management and analysis methodology for the City Loop. Actual Right-of-Way (ROW) dimensions and conditions will vary along the City Loop alignment and should be appropriately defined and applied for any final stormwater analysis.

- **Two-Way Protected Bike Lanes within Street ROW**
  - Section #1: 100' ROW
  - Section #2: 75' ROW
  - Section #3: 66' ROW
- **Off-Street Elevated Walkway and Separated Trails**

Examples of this application is further described in the next section, Stormwater Analysis Methodology. Currently the City of Rochester is exempt from Stormwater Utility improvement requirements. However, as noted in the previous Green Infrastructure: Strategies, Stormwater Management section, stormwater management is at an important environmental critical pass and can play a large defining role in green infrastructure strategies.

Criteria Review and Assumptions

Due to lack of current City of Rochester stormwater ordinances pertaining to treatment of linear projects, we will utilize the Minimal Impact Design Standards (MIDS) criteria established by the Minnesota Pollution Control Agency (MPCA, https://www.pca.state.mn.us/water/enhancing-stormwater-management-minnesota).

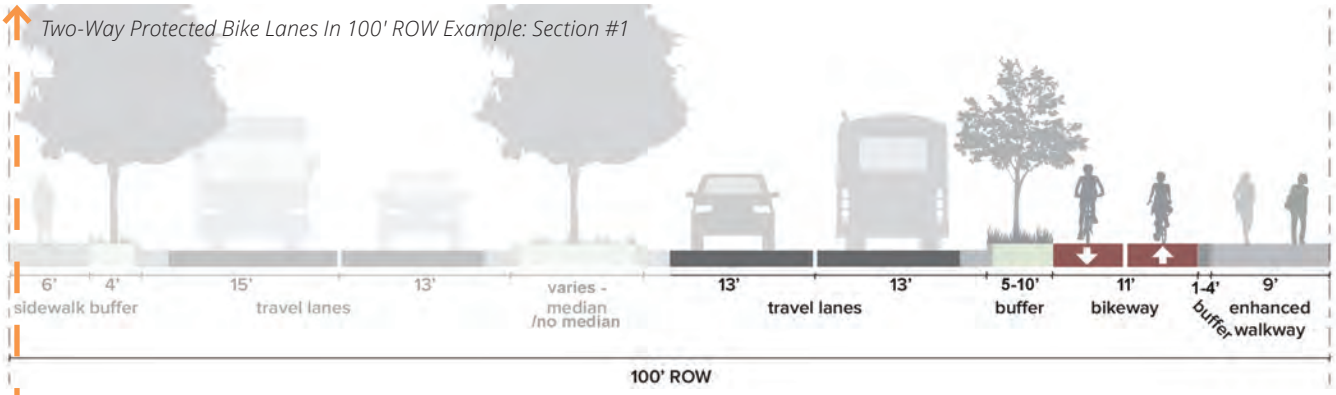
- Use treatment volume criteria for linear projects:
  - 1.1 inches over net new impervious
  - 0.55 inches over reconstructed impervious surface
- The total treatment volume must be retained and infiltrated
- MIDS assumes that if you can meet criteria for volume retention/infiltration, Total Suspended Solids (TSS) and Total Phosphorus (TP) removal have been met.
  - If utilizing filtration BMPs or retention BMPs that do no infiltrate (ex. Wet ponds or underground retention), then must evaluate TSS and TP removal
  - At this stage, will assume City Loop project can meet MIDS criteria through volume retention/infiltration
- Even if MIDS or additional stormwater volume reduction requirements are not adopted by Rochester, if more than 1.0 acre of net new impervious surface (proposed impervious surface minus the existing impervious surface) is created by the project, then have to comply with Permanent Stormwater Management requirements of MPCA Construction General permit.
  - 1.0" over net new impervious retained

GREEN INFRASTRUCTURE

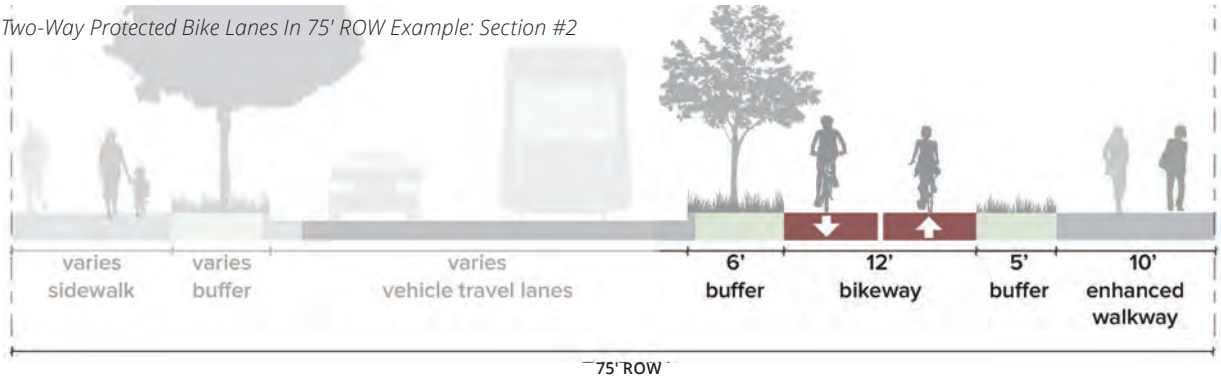
SUSTAINABLE STORMWATER MANAGEMENT

Within Street ROW

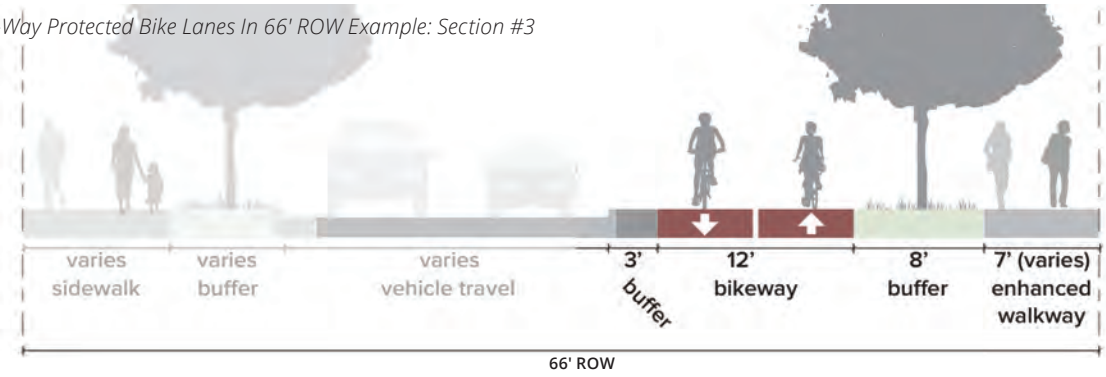
Two-Way Protected Bike Lanes In 100' ROW Example: Section #1



Two-Way Protected Bike Lanes In 75' ROW Example: Section #2

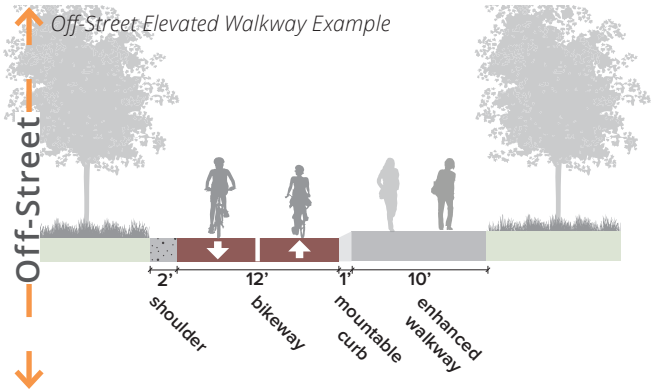


Two-Way Protected Bike Lanes In 66' ROW Example: Section #3



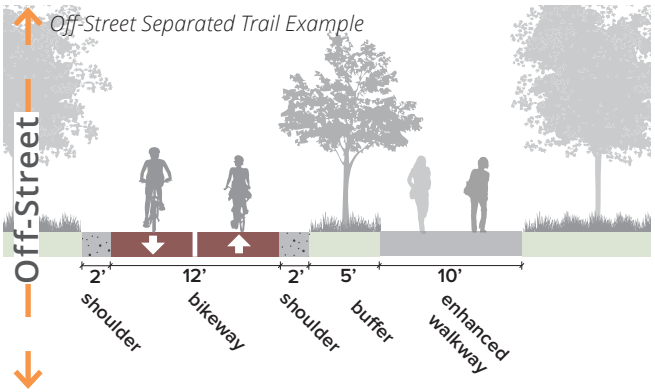
Off-Street

Off-Street Elevated Walkway Example



Off-Street

Off-Street Separated Trail Example



GREEN INFRASTRUCTURE

STORMWATER ANALYSIS METHODOLOGY

Prototypical Analysis: Street Sections

The following summarizes the model treatment required for a 350' long block segment of each prototypical street cross section in the City Loop, defined as:

- Use Sections #1 (100' ROW), #2 (75' ROW), and #3 (66' ROW)

The model treatment was performed under these assumptions:

- Assume no new net impervious
  - Only the 0.55 inches of impervious applies to the proposed impervious surfaces (street, sidewalk, and trail)
  - See Table below for required treatment volumes:

	Reconstructed Impervious Surface along 350' Block (ft^2)	Required Treatment Volume for 0.55" Storm Event (ft^3)
Section #1	25,550	1,283
Section #2	20,300	930
Section #3	18,200	834

- Assume all soils along the corridor are Hydrologic Soil Group B
  - 0.45 in/hr infiltration rate
- Assume linear BMPs (tree trench, bioinfiltration basin) can only be placed along right offset (within City Loop project area)
- Assume the entire impervious area along the length of the block is capable of being directed to infiltration BMPs
  - Not necessarily applicable for disconnected impervious area
- Assume no areas outside the public ROW are directed to BMP
- Applicability of proposed BMPs must be assessed on a site-by-site basis in-field for:
  - In-situ soil infiltration rate
  - Ground water elevation
- Physical and environmental constraints (contamination, karst, well areas, etc.)

GREEN INFRASTRUCTURE

STORMWATER ANALYSIS METHODOLOGY

Prototypical Analysis: Street Sections

The technical procedure for evaluating the 'typical block scenarios' based on the identified Typology Cross Sections) is outlined below:

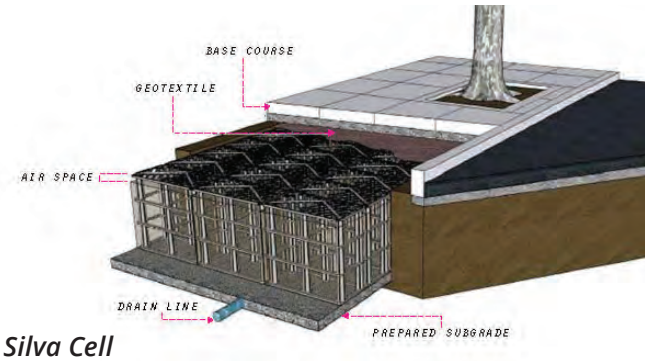
- Use methods established in the MPCA Stormwater Manual or the MIDS Calculator to evaluate treatment credits
- ALL BMPS DESIGNED TO DRAW DOWN WITHIN 48 HOURS
- Only Right Offset considered for BMP placement due to greater impervious surface area from path and sidewalk, and to preserve the existing conditions of the Left Offset and/or median
  - *Stormwater treatment opportunities may be limited*

Tree Trench

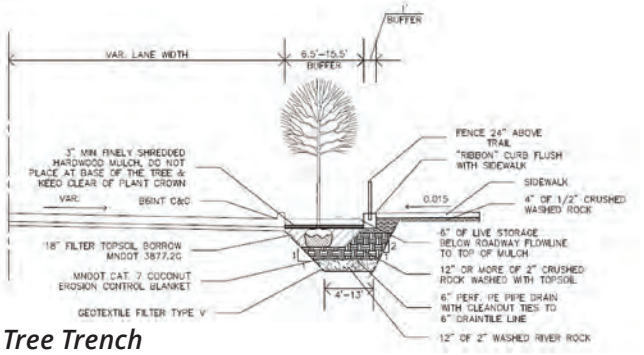
- Would utilize curb cut to capture runoff from roadway in addition to overland flow from sidewalk, trail, and other buffer sections
- Often used throughout project servicing small to medium sized catchments
- Only applicable for 8' buffer widths (i.e. Right Offsets of Section #3 and where applicable for Section #1)
  - Assume average 8' buffer width for Section #1
- Assume 50% of a 350' length of block available for BMP
- Assume 3' depth of structural soil or soil with Silva cells
- Assume two trees per trench in order to meet ideal soil volume requirements for medium trees (2 ft^3 of soil per 1 ft^3 of tree canopy area)
- Can incorporate elevated underdrain if in-situ soils are poorly draining
- Utilizing one 175' long tree trench (or two 87.5' trenches) within the 8' buffer along Right Offset of Section #1 or #3 would provide an estimated 560 cubic feet of storage. This volume does not meet the treatment requirements of Section #1 or #3.
  - Would need to combine with other smaller BMPs to meet requirements



Tree Trench



Silva Cell



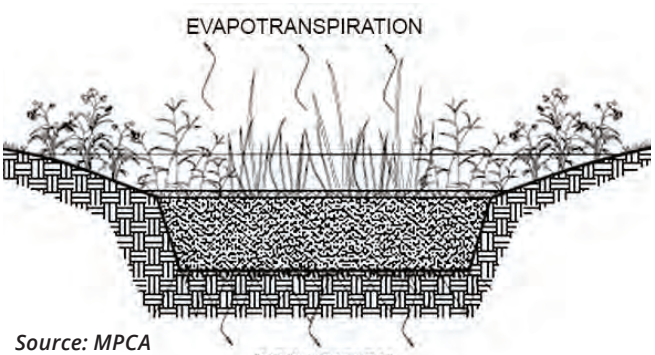
Tree Trench

GREEN INFRASTRUCTURE

STORMWATER ANALYSIS METHODOLOGY

Bioinfiltration Basin (Raingarden)

- Provides storage for runoff above media to allow it to infiltrate
- Can incorporate ornamental plantings, native vegetation, gravel, etc.
- Often used throughout project servicing small to medium sized catchments
- Would utilize curb cut to capture runoff from roadway in addition to overland flow from sidewalk, trail, and other buffer sections
- Applicable to 6'-10' buffer widths alongside roadway (Sections #1, #2, and #3)
- Assume 50% of 350' length of block available for BMP
- Assume 0.5' of live storage (depth from curb cut to top of media)
    - May need railings along trail-side of BMP for safety of cyclists or pedestrians
- Receive volume credit for live storage above media
    - Typically have 2.5' depth of infiltration media mix
- Can incorporate elevated underdrain if in-situ soils are poorly draining
    - Smaller scale version is often referred to as "Urban bioswale" or "infiltration planter"
    - Small, often only 10-20' in length
    - Need many of these through to achieve sizable volume reduction



Source: MPCA Stormwater Manual



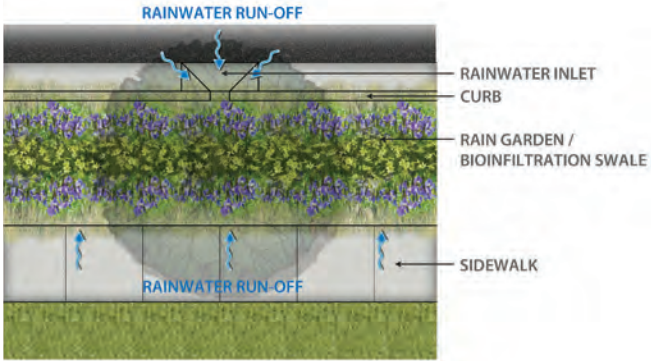


GREEN INFRASTRUCTURE

STORMWATER ANALYSIS METHODOLOGY

Bioinfiltration Basin (Raingarden)

- Bioinfiltration can be used to achieve the volume reduction of every Section block using criteria described above
- Section #1 can achieve 438 cubic feet of volume reduction in 5' buffer along Right Offset if half of block length is utilized. Other BMPs would be necessary to meet treatment goals for this section. Otherwise BMPs could be considered in the existing 10' median.
- Section #2 can achieve 525 cubic feet of volume reduction with 175' long bioinfiltration basins (or several smaller basins that add up to this length) in the 6′ buffer along the Right Offset. This does not meet the MIDS performance goal.
    - Could also use some basin lengths in 4′ buffer between path and sidewalk, but likely would not be able to do this to get entirety of treatment volume as the road runoff could not reach here (unless impervious areas out of the ROW were directed)
- Section #3 can achieve 525 cubic feet volume reduction with 175' long bioinfiltration basins (or several smaller basins that add up to this length) in the 6′ buffer along the Right Offset. This does not meet the MIDS performance goal.







GREEN INFRASTRUCTURE

STORMWATER ANALYSIS METHODOLOGY

Underground Infiltration

- Perforated underground chambers or pipe to allow stormwater to infiltrate after it has entered storm sewer system
- Typically used in centralized manner to service large drainage areas
  - Tend to be large and expensive
  - Can be placed anywhere within the right-of-way
- However, must be located and designed to avoid subsurface utility conflicts and provide 3' of groundwater separation from bottom of BMP
- Many are proprietary designs (Stormtech® chambers), but can also use corrugated pipes with holes drilled in them
- Receive volume credit for chamber/pipe volume as well as void space in surrounding crushed rock
- Height of infiltration pipe/chamber and underlying media determined by infiltration rate of underlying soils
  - For Group B soils, approximately 1.8'
  - Example, Storm tech SC-160LP (height of chamber 11.7")
- When used beneath public roads, must be designed to accommodate traffic loads
- Required to design system for regular access for inspection and maintenance
  - Inspected semi-annually
  - Inspections and maintenance may require confined space entry
- Using low-profile StormTech® chambers (1' high chambers, underlain by 0.8' of crushed rock media), can achieve volume reduction goal of Section #1's block with a chamber gallery with the approximate dimensions of 46' long and 28 feet wide
  - However, HIGHLY recommend this BMP not implemented on a block-by-block basis as it would be very expensive, but rather used at centralized locations servicing several blocks
  - Also highly recommend additional soil infiltration tests be performed as larger chambers are more economical



Source: Stormtech.com



Target Field Station Plaza
Minneapolis, Minnesota

GREEN INFRASTRUCTURE

STORMWATER ANALYSIS METHODOLOGY

Prototypical Analysis: Off-Street Sections

The following summarizes the model treatment required for off-street sections such as the City Loop portions through Kutzky Park.

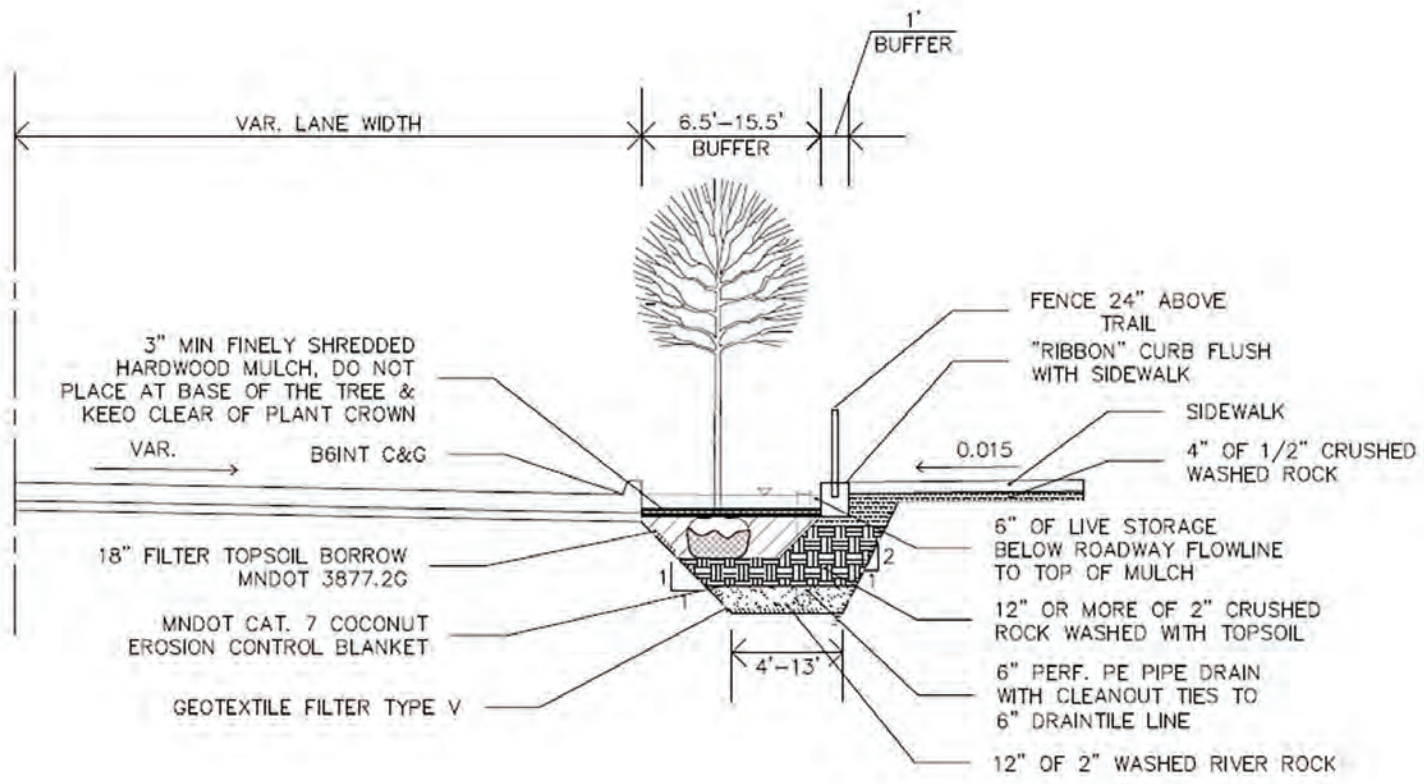
- Widening of existing trail will increase impervious
- Approximately double the amount of impervious along off-street section
- If more than One acre of net new impervious is created, then project is subject to NPDES permanent stormwater management
  - Trail will have rural drainage and will drain to turf or vegetated swales (no curb and gutter)
  - Best to use linear BMPs to meet MIDS stormwater treatment criteria
  - Swales with check dams
- Check dams allow for infiltration of water along length of swale along with pollutant removal
- Spacing of check dams and subsequent volume retained for infiltration dependent upon longitudinal slope along trail
  - Disconnected Impervious
- Utilize surrounding pervious area for stormwater treatment
- Not eligible for volume credit for NPDES permit, but can be used to meet MIDS volume criteria
- Does not require any swales or specially constructed BMPs
- Even if max length of 100' feet buffer of downstream pervious is used, only 60% of volume requirement for full 25' width trail can be met if all drains to one side
- Even if trail crowned at center, only 63% of volume retention can be met
- Would likely need additional BMPs to meet full volume requirement unless Group A soils are present
  - Can utilize swale alongside to direct water to central BMPs (rain garden, infiltration basin, etc.)
- Larger BMP can be sized to accommodate runoff volume

GREEN INFRASTRUCTURE

STORMWATER MANAGEMENT EXAMPLES

Tree Trenches

Cross Section of tree trench for Jackson Street, Saint Paul. Note, this basin is lined and has an underdrain due to utility and building foundation concerns associated with infiltrated stormwater. (Source: SEH, Inc.). For reference only.

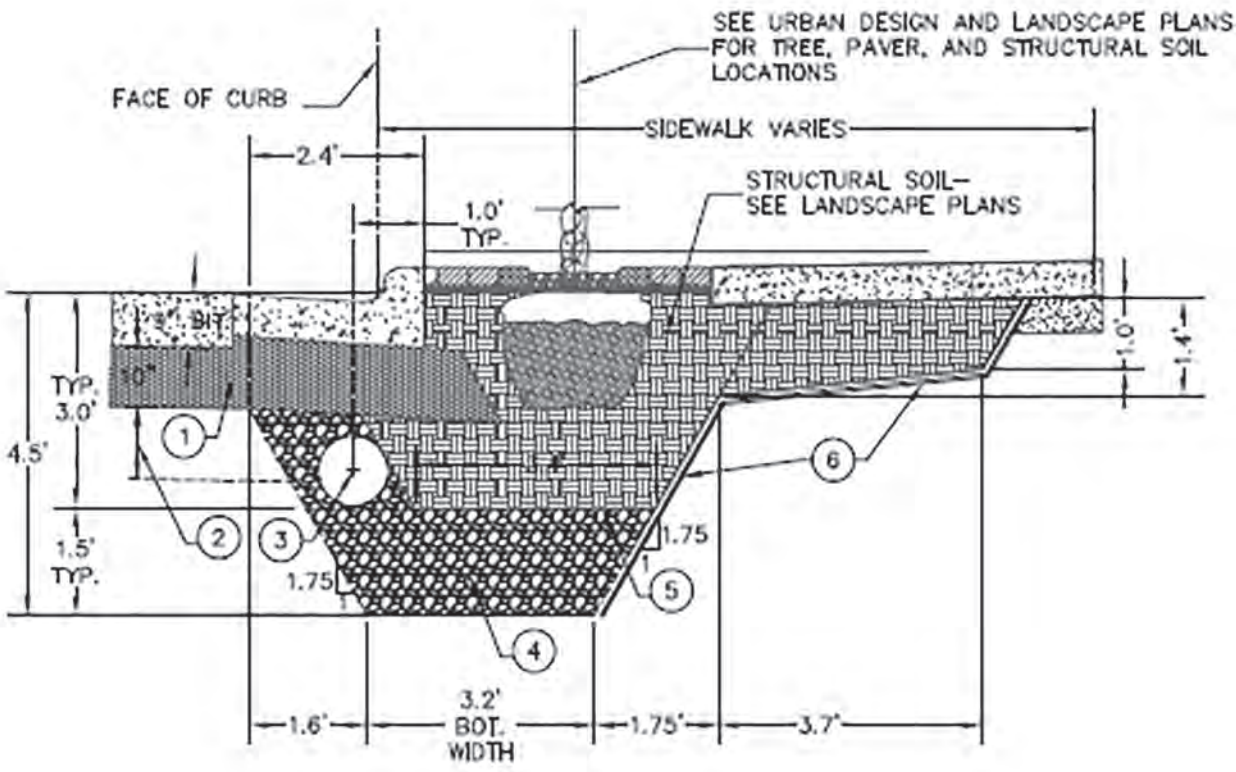


GREEN INFRASTRUCTURE

STORMWATER MANAGEMENT EXAMPLES

Tree Trenches

Tree trench section for University Avenue light rail system, Saint Paul (Source: City of Saint Paul). For reference only.



1. CL-6 ROADWAY BASE
2. SELECT GRANULAR SUBGRADE
3. 12" PERFORATED SDR 26 PIPE, CENTERED IN CATCH BASIN, CONTINUOUS LENGTH OF TRENCH, INVERT = 3.0' TYP.
4. ¾" – 1 ½" WASHED, CRUSHED ANGULAR GRANITE. MN/DOT SPEC 3149
5. NON-WOVEN GEOTEXTILE FABRIC ENVELOPE (NOT COVERING TRENCH BOTTOM)
6. PVC IMPERMEABLE MEMBRANE EXTENDS FROM CONCRETE WALK TO TRENCH FLOOR. WHEN PVC LINER IS PUNCTURED FOR WATERMAIN, SANITARY, OR OTHER CROSSINGS, PATCH AROUND HOLE WITH ADDITIONAL PVC LINER AND TAPE TO MAINTAIN IMPERMEABILITY

GREEN INFRASTRUCTURE

STORMWATER MANAGEMENT EXAMPLES

Tree Trenches

Tree Trenches along trailway by Minneapolis Community and Technical College (Source: City of St. Paul)

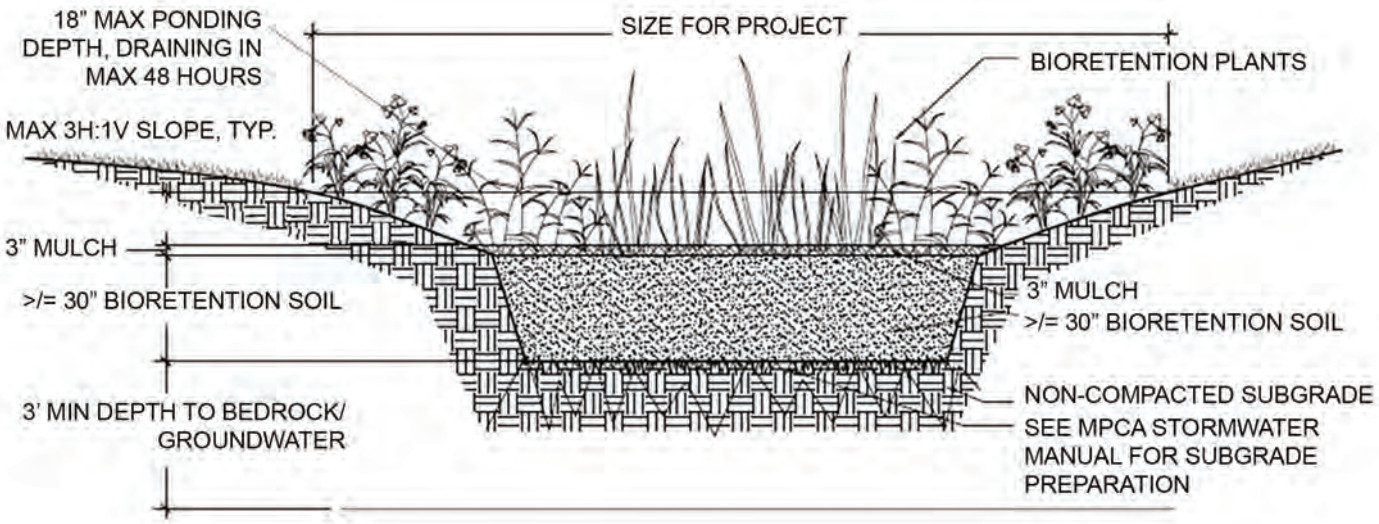


GREEN INFRASTRUCTURE

STORMWATER MANAGEMENT EXAMPLES

Bioinfiltration Basin

Typical Section, note, we can use a "cellular" version of this between the curb back and trail (Source: MPCA Stormwater Manual). For reference only.





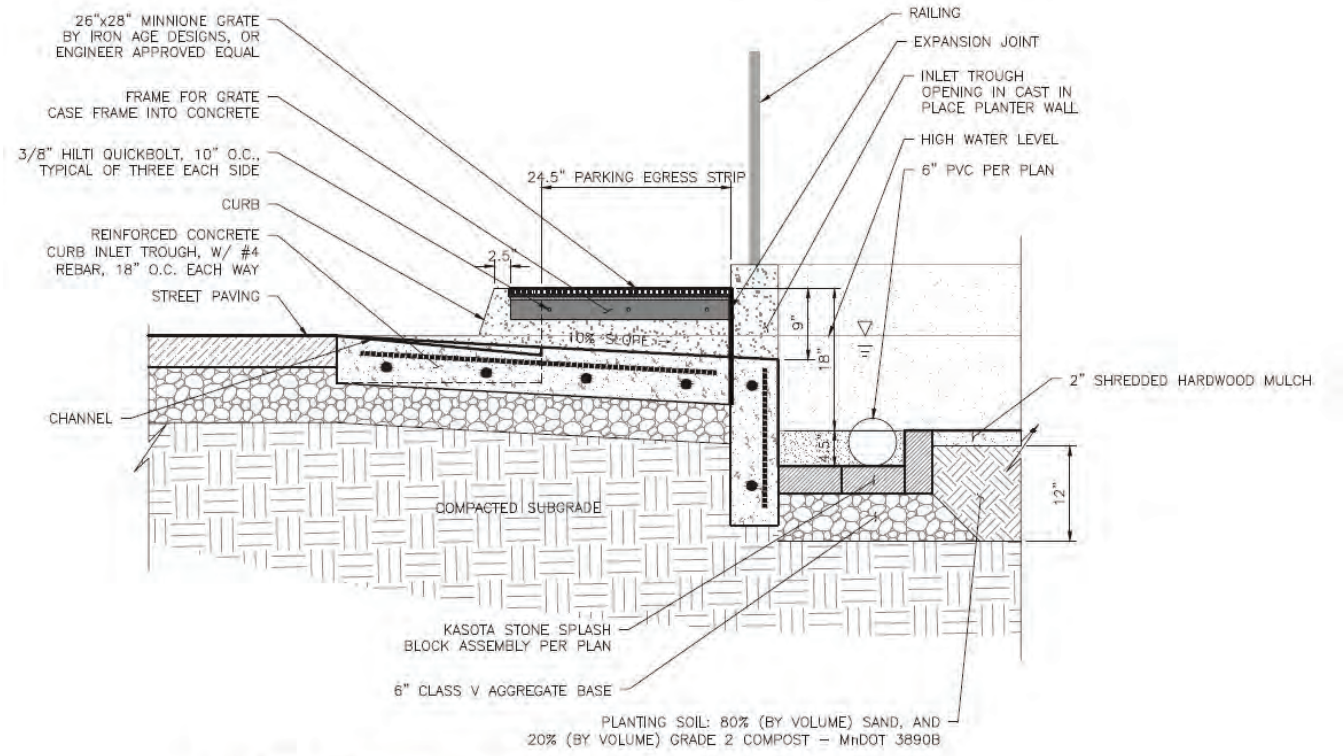
Bioinfiltration Basin at The Pond at Tartan Crossing, Oakdale, Minnesota (Source: City of Oakdale)

GREEN INFRASTRUCTURE

STORMWATER MANAGEMENT EXAMPLES

Bioinfiltration Basin

Section and detail for Capitol Region Watershed District urban bioinfiltration basin (Source: Capitol Region Watershed District and City of Saint Paul). For reference only.



SECTION: STORMWATER PLANTER CURB INLET
NOT TO SCALE



GREEN INFRASTRUCTURE

STORMWATER MANAGEMENT EXAMPLES

Bioinfiltration Basin

Curb cut entrance to urban bioinfiltration basin (Source: Capitol Region Watershed District)



An urban bioinfiltration basin



A smaller urban bioswale or infiltration planter

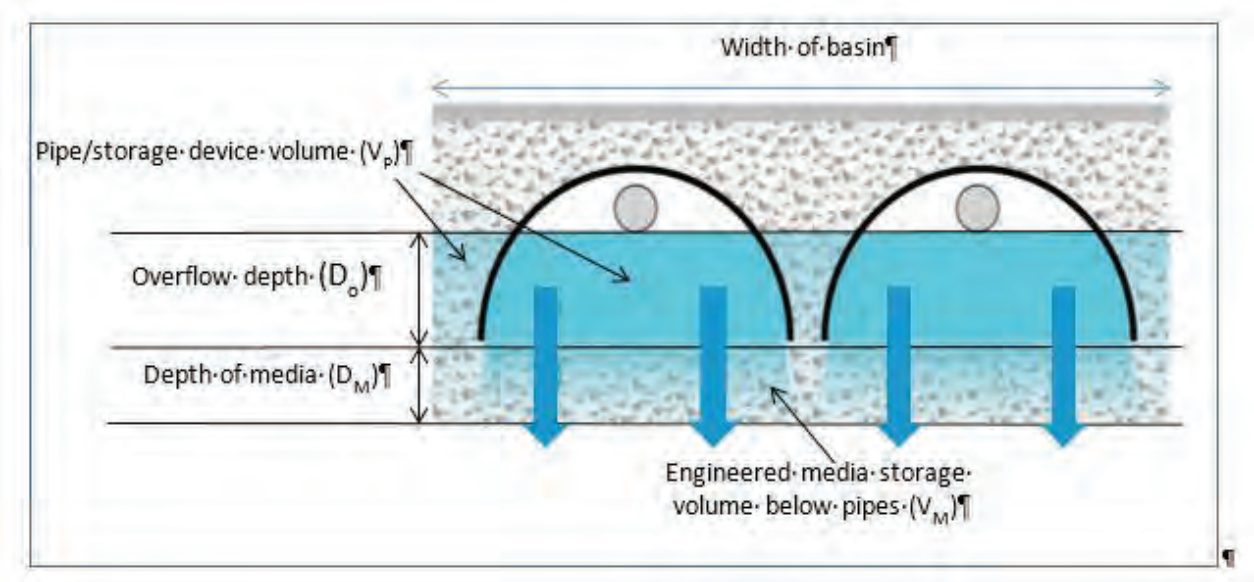


GREEN INFRASTRUCTURE

STORMWATER MANAGEMENT EXAMPLES

Underground Infiltration

Typical Section (Source: MPCA)



Underground Infiltration

Underground Infiltration Chambers (Source: MPCA)



GREEN INFRASTRUCTURE

STORMWATER MANAGEMENT EXAMPLES

Permeable Pavements

Permeable Paver Sections in Boulevard along Walkway



Uptown Neighborhood, 2nd Street SW, Rochester, Minnesota

Permeable Asphalt Bikeway



Capital City Bikeway, Downtown Saint Paul, Minnesota

GREEN INFRASTRUCTURE
SUMMARY

Projected Outcomes

Projected benefit outcomes for green infrastructure may exist on several levels such as environmental, economic, and social depending on the green infrastructure strategy type. Stormwater outcomes may be directly measured. However, the social benefits may be more difficult to quantify. In addition, there may be shared benefits between combined strategy types. The following provides a summary of potential benefit outcomes for the City Loop:

- **Stormwater Management Outcomes**
  - Improved water quality
  - Reduction in stormwater volumes
  - Proper stormwater rate control
  - Functional integration of natural/ cultural elements such as plants and art
  - Stormwater BMPs implemented as part of the project can be reported in the City's Annual Municipal Separate Storm Sewer System (MS4) Report
  - Informational placards near the BMP, information on City website, tours of BMP areas with school children can count towards education outreach requirements
  - Can report volume reductions and pollutant removals achieved by infiltration BMPs
- **Solar Applications Outcomes**
  - Renewable resource
  - Reduction in utility and maintenance costs
  - Public safety
- **Materials Sustainability Outcomes**
  - Reduction in environmental impacts
  - Reduction in up front/ replacement costs
  - Reduction maintenance costs
  - Social connection/ history
  - Public health
- **Heat Island Effect Reduction**
  - Improved air quality
  - Public health
  - Improved microclimate
  - Energy conservation
  - Cooling efficiencies/ reduction in utility costs
- **Social and Economic Outcomes**
  - Human equity
  - Educational
  - Public/ private cooperative relationships
  - Increased property values
  - Green infrastructure workforce opportunities (ngicp.org)
  - Economic growth
  - Public Art

Building green infrastructure into the City Loop will support several of the principles defined by the Destination Medical Center (DMC) Transportation Study as well as the DMC Master Plan. Green infrastructure provides environmental sustainability and creates healthy places for people. By applying these principles and next-generation green infrastructure policies to the City Loop, this vibrant, sustainable, safe, populated, and healthy resource opportunity will directly benefit the people of Rochester, including residents, businesses, visitors, patients, and companions.

In turn, the integration of sustainability-focused infrastructure and human-powered mobility infrastructure is a district-wide systems approach that will promote environmental, economic, and social progress of the city as a whole.

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Operations and Maintenance

November 2017

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LEFT
RIGHT
YIELD TO

INTRODUCTION



A protected bicycle lane is an exclusive bike facility that combines the user experience of an off-street path with the on-street infrastructure of a on-street bike lane. A protected bicycle lane is physically protected from motor traffic by a vertical element and distinct from the sidewalk. In situations where on-street parking is allowed, protected bicycle lanes are located between the parking and the sidewalk.

INTRODUCTION

A WORLD-CLASS URBAN TRAIL

The DMC City Loop will bring a world-class pedestrian and bicycle urban trail connecting the heart of the city. Its design characteristics, layout, location, landscape, wayfinding and intersection treatments will create a safe, enjoyable, healthy way for residents, visitors and workers to move about the DMC Development District, experience the sights, visit local shops, and dine in local restaurants and eateries. It will be a national and international precedent for how an exceptional walking and biking experience stimulates private investment while supporting healthy living.

Beyond the facility and design choices, the maintenance and operation policies and practices that are applied to the City Loop will mark the quality of experience available to its users. From how pavement markings and wayfinding signs are kept up, how vegetation is maintained, to how it is maintained during winter. These operations and maintenance measures will ensure the City Loop is an asset that can be accessed and enjoyed year-round. Over the long term, the operations and maintenance practices that are applied to the City Loop are what will determine whether or not this important investment lives up to its city-changing potential.

This document summarizes a set of best practices from maintenance and operations leaders operating pedestrian and bicycle assets in Minnesota and other locations. It also brings in the experience and recommendation of leaders at the Indianapolis Cultural Trail, a source of inspiration for the City Loop.





EXPERT INTERVIEWS AND RECOMMENDATIONS



Information provided in this section was obtained from interviews, project documents and presentations on best maintenance practices provided by operations and maintenance experts.

EXPERT REVIEWS AND RECOMMENDATIONS

JORDAN KINGDON :: INDIANAPOLIS CULTURAL TRAIL

The Indianapolis Cultural Trail is an 8-mile long bike and pedestrian path that runs through downtown Indianapolis, Indiana. It was completed in 2013, and serves as a hub for Indiana's greenway system, connecting all six of the city's cultural districts. The trail is a national model and serves as one of the main sources of inspiration for the Rochester City Loop.







The trail is managed by Indianapolis Cultural Trail, Inc (ICT, Inc.), a nonprofit organization. ICT is responsible for all management and maintenance activities.

Riders stop and visit many amenities along the trail, including downtown shops, landscape features, and public art. Green Infrastructure such as bioswales provided along trail segments, (totaling 25,000 sq ft) capture and filter storm water, reduce runoff to the city's water supply, and remove silt and pollution. The bioswales are estimated to capture and treat approximately four million gallons of water per year. A "Spring Clean" event is hosted along the trail every year. During nighttime, sensors are used to activate LED trail lighting, increasing safety and visibility while reducing electrical consumption.

Bikeshare stations and bicycle parking racks are provided along the trail.

The trail is maintained during winter to encourage use by people walking, biking and running. A "Winter Warmup" helps to raise funds for snow and ice removal. Snow events of 2 inches or more are plowed, with environmentally-friendly de-icer salts applied if necessary. City ordinances require that adjacent property owners shovel the sidewalks and pedestrian paths that are adjacent to their property or buildings (ICT will seek damages if plant material is damaged as a result of adjacent property owners application of excessive salts). The remainder of the path is plowed by ICT.

ICT is also responsible for hardscape and electrical maintenance along the trail. Users of the trail can use an online form to request maintenance or suggest areas of improvement.

Jordan Kingdon serves as the Operations and Maintenance Manager for the Indianapolis Cultural Trail. He stated that ICT is currently developing a Maintenance Plan / Maintenance Program for the trail. He also stated that ICT is currently operating in a "reactive" mode, addressing problems or issues as they come up, but sees the Maintenance Plan as a tool that will help ICT to move into a more proactive mode, with set guidelines, routines, and procedures for maintenance activities.

KEVIN OSBURN :: INDIANAPOLIS CULTURAL TRAIL

Kevin Osburn was the principal designer of the Indianapolis Cultural Trail, currently serves on the board of the ICT, Inc. and provides a unique perspective on post-occupancy performance of the Trail system and considerations for future similar projects.

Planning for Long Term Success

When planning for funding and implementation of the Indianapolis Cultural Trail, an endowment was established to develop a new non-profit organization, the ICT, Inc., to provide for long-term programming, operations, maintenance and management of the trail system. The ICT, Inc supplements the City's standard maintenance and operations procedures to ensure the high quality infrastructure of the ICT is maintained over the long term. The City provides standard maintenance activities such as snow-clearing and litter removal; the ICT contracts with vendors to provide additional maintenance activities such as landscape pruning and replacements, snow plowing and removal, light fixture repair and replacements, signage and site furnishing repair and replacements in keeping with project specifications. The ICT, Inc. also manages a bikeshare system which provides numerous stations within 1/2 block of or directly on the Trail.

Ensuring A Good Fit

The ICT, Inc. is a one-stop-shop and point of contact for all new development that occurs adjacent to the Trail system in order to protect, preserve and improve the integrity of the Trail system. The ICT, Inc partners with the City to review all private landowner plans and gives recommendations to the City to ensure adjacent land uses and modifications to those sites do not negatively impact the success of the Trail in the short and long-term. Any proposed changes to adjoining land uses, pavements, landscape plantings, stormwater drainage and other impactful components of new developments are closely reviewed and monitored.

Looking Ahead

The currently successful management of the ICT is made possible by the existence of the ICT, Inc and those who serve on the board that have long been involved with the project. But with time, staffing will evolve an those who have been involved with the project since it's inception will no longer be present to carry the mission forward. Long-term management and protection of this asset could perhaps best be accomplished with a formalized governance plan. Operations/maintenance protocols and processes could be formalized and adopted into City Code to clarify who is responsible for what and ensure a high-level of maintenance/protection for this amenity in keeping with the designer's specified vision long-term.

Observations

The ICT has been highly successful due to the skilled design team and a careful planning process. Vandalism and crime remain low and trail infrastructure has held up well. While the ICT is more than spacious enough to accommodate both pedestrians and cyclists, it has been observed that often users don't adhere to the trail assigned to their mode of travel. Significant signage exists at block-end points of entry as well as mid-block though users tend to walk and bike where they please. This is likely due to user behavior patterns and no further action is planned at this time.

When damages occur to Trail infrastructure due to vehicular impacts, the ICT files police reports and insurance claims to document and recover damages. This has worked well to recoup high repair and replacements costs for this spectacular public asset.

EXPERT REVIEWS AND RECOMMENDATIONS

DOUG LAUER :: UNIVERSITY OF MINNESOTA

Doug Lauer is the Supervisor of the University of Minnesota's Landcare Division.

The Landcare Division is responsible for the year-round maintenance and operations (including winter) of the University of Minnesota's 900 acre Twin Cities campus. This includes maintaining year-round safe sidewalk access (maintained to a "dry pavement" standard) to 265 buildings in both campuses, maintenance for 46 miles of sidewalk and plazas (7 ft equivalent) and 16 miles of streets and roadways.

User Demand

When class is in session, the University of Minnesota Twin Cities campus is accessed by approximately 50,000 students and staff per day, with the addition of another 20,000 visitors for campus events. Once they are in the campus, all students, staff and visitors circulate as pedestrians. The total number of pedestrians does not change during winter.

The Landcare Division also estimates that there are normally around 6,000 bicycle riders on campus at any one time, with a daily total of 7,500 riders (the variation in number is due to class schedules). Bicycle-use volume drops in winter, decreasing to an estimated 2,000 year-round bicycle riders after the first snow event. This number has been steadily increasing over recent years.



Goals

The University of Minnesota Landcare Division is a national leader in proactive, low impact winter maintenance methods to maintain year-round safe access to the campus.

Maintenance goals include:

- Provide safe access for students, staff and visitors
- Employ cost-effective and fruitful methods
- Keep environment as pollution-free as possible

Characteristics

Some characteristics of the University of Minnesota's operations include:

- Maintenance obligation: 46 miles of sidewalks and plazas (7 ft eq)
- Staffing: 21 FT staff and part time student staff
- Salt supplies and brine mixing and storage equipment on site
- Equipment:
- Smaller equipment (Toro, Bobcat and similar) is used for sidewalk and plaza maintenance
- Most equipment is adaptable for year-round use (can use attachments for mowing from spring through fall, and brooming and brine attachments in winter)

Practices and Recommendations

Among the principal recommendations shared by Doug are:

- Start maintenance before snow events
- Pre-wet sidewalk surfaces using brine solution ahead of snow events to avoid adhesion
- Broom whenever possible
- Pre-treatment is key to decrease adhesion of ice / snow and prevent snowpack
- Ice is expensive (in terms of staff cost and environmental impact) to break up
- Pre-treatment of sidewalks and pedestrian areas with brine solution
- Decreased overall salt use by 40%
- Decreased incidence of snowpack from 20-30% to 10-15%
- Pay attention to air temperature and surface temperature
- Temp >15F: use NaCl / Temp <15F: use MgCl2
- Use sand in extreme cold
- Wheelchair access is a priority - focus includes keeping curb cuts clean
- Keep records tracking snow events, response and results
- Prioritize maintenance efforts
- First: Roads, sidewalks, bike parking with most use
- Redundant / low use plazas, stairs not maintained
- User-reporting / slippery spots reported to call center

EXPERT REVIEWS AND RECOMMENDATIONS

CITY OF EDMONTON :: WINTER DESIGN GUIDELINES

The City of Edmonton, in Alberta, Canada, has recently developed a Winter Design Guide that aims to guide development and maintenance practices in that city:

Winter is a core part of Edmonton's identity and needs to be fully considered as our city grows and matures. In order to realize the full return on our investments, development and public infrastructure projects should work year-round, not just for our summer conditions.

Given that Edmonton's winter climate is similar to that of Minnesota cities, some of those recommendations may be applicable to the Rochester City Loop - not only as they pertain to maintenance of the trail facilities themselves, but also to the type of development that will be encouraged along and around the City Loop, as this development will impact the quality of users' experience while on the trail, including:

Incorporating design strategies - for both the trail and adjoining potential future development - to:

- Block wind
- Maximize exposure to sunshine
- Enlivening visual interest and the cityscape overall through the use of color and lighting
- Providing supporting infrastructure that provides year-round interest, user comfort, and supports the desired year-round life and activity of the City Loop

Strategies

By blocking wind, path users will feel warmer and will not have to work to fight against walking or biking into the wind. Blocking of wind can be accomplished through building design, location of public art pieces, and landscaping.

Providing breaks in store frontage can provide shelter from the wind. Evergreen trees can be used to block wind. Deciduous trees are best placed on the southern side to allow for light to pass through the branches in the winter. Trees placed along blank walls will reduce wind. Large snow mounds from cleared snow can also be used to block wind in open spaces and along boulevards.

When combined with blocking wind, maximizing sun exposure of the trail can help increase the perceived temperature by nearly 20 degrees Fahrenheit. Using deciduous trees that allow for sunlight to pass through, angling streets or trails to run at an angle, and incorporating setbacks in upper stories of potential adjacent buildings can help maximize solar exposure.

Color and light can be used to brighten the landscape and make winter walking and biking more enjoyable. Bright colors in adjoining buildings and trail elements can create visual interest.

Art pieces both large and small can create destinations along the trail, and can also:

- Incorporate lighting
- Invite new users to the trail
- Larger art pieces can also be used to block wind

Landscaping, and even snow storage along the trail, can be used to block wind. Vegetation species placed along the trail should be able to withstand moderate amounts of sand, salt, and other types of deicing treatments. Overall, native plants are usually better adapted to withstand winter conditions and are recommended for use in the City Loop. When intentionally planned, bioswales and other linear landscape spaces can also serve as winter snow storage areas.

Additional elements to consider include providing awnings or canopies on adjacent buildings to prevent falling snow or ice from landing on trails and sidewalks. Fire pits and warming huts can provide outdoor seating and invite year-round use. Splashing ice and water from road spray can be decreased through incorporation of planted boulevards and thoughtful street design and buffers.



EXPERT REVIEWS AND RECOMMENDATIONS

MICHAEL NIGBUR :: THE CITY LOOP URBAN TRAIL

The following content has been developed based on conversation with Michael Nigbur, Park and Forestry Division Head, Rochester Minnesota Parks & Recreation.

The City Loop multi-use urban trail is envisioned to be a world class public amenity serving residents and visitors to the City of Rochester. Trail amenities will include enhanced paving materials, landscape plantings, wayfinding signage and intersection treatments which will provide a memorable and high quality experience for users.

Maintenance of the City Loop trail system should be considered separately from other City paths, trails and walks. The trail's prominent downtown location and anticipated high-density use will necessitate maintenance activities are of upmost priority and should include inspections, sweeping, litter removal, vegetation pruning, repair of defective pavements and infrastructure, drainage deficiencies and winter snow clearing/removal at high frequency intervals.

Snow clearing and removal will be of highest priority. Snow clearing is expected to be completed during and immediately following snow events. A snow removal plan should be implemented where lack of open space prohibits long term snow storage.

A formalized approach to maintenance of the City Loop should include tools such as a schedule of tasks to guide annual preventative and routine maintenance activities, implementation of an asset management program and budget planning. Careful coordination amongst City departments responsible for trails management and maintenance will ensure a successful maintenance program and result in a safe and pleasant experience for users.

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OPERATIONS AND MAINTENANCE GUIDELINES



Walking and biking facilities should receive adequate maintenance to protect the investments made by the City of Rochester and its partners, and to ensure that they continue to serve the needs of residents and visitors well into the future.

OPERATIONS AND MAINTENANCE GUIDELINES

USER NEEDS

Pedestrians

Pedestrians and wheelchair users depend on having a level, slip-resistant surface for their travel. Walking surfaces that are free from unexpected bumps, holes or cracks, and free from ice or other slippery materials, are paramount for their safety and comfort.

Bicycle Riders

A cyclist rides on two very narrow, high-pressure tires. What may be an adequate roadway surface for automobiles (which have suspension and shock-absorbing systems and travel on four wide, low-pressure tires) can be treacherous for cyclists: small rocks can deflect a bicycle wheel; a crack in the pavement or a poorly-placed drainage grate can trap a wheel; wet leaves, ice, and the gravel that gets blown off the travel lane are slippery and can cause a fall.

Dual Use

Both pedestrians and bicycle riders depend on the ability of motorists to anticipate and respond to their presence while crossing streets or when otherwise exposed to motor vehicle traffic; therefore, signs, signals and markings should be maintained and kept in good working condition.

This is especially important in locations in and around intersections where the City Loop crosses active roadways. One of advantages of the City Loop concept is that it will provide much improved sense of security and comfort to users. However, this enhanced sense of comfort may make users less vigilant at intersection locations, and will likely also invite less experienced users who are less able to anticipate potential conflicts with motor vehicles.







GENERAL CONSIDERATIONS

Maintenance Budget

Preventive maintenance reduces hazards and future repair costs. Maintenance costs and responsibility for maintenance should be assigned when projects are planned and budgets developed. Typical annual maintenance costs range from 3 to 5 percent of infrastructure replacement costs - for example, a $100,000 facility should include a $5,000 annual maintenance budget. Life-cycle cost analysis is recommended to determine the net value of using longer-lasting, higher-quality materials during construction if they reduce yearly maintenance expenditures.

Asset Management

The trail system should be managed under a central authority with maintenance and operations activities centralized to ensure the high-level of service needed to maintain the trail system in keeping with the design vision for the City Loop can be accommodated consistently and over the long-term. Critical components of an asset management system should include funding to accommodate the needed level of service and clear identification of responsibilities.

Management Plan

A management plan is a tool to identify maintenance needs and responsible parties. A management plan that includes the maintenance component for a proposed facility should be in place before construction. Additionally, a management plan should include a means for users of the system to report maintenance and related issues and to promptly address them.

A facility's management plan answers basic operational and staffing questions such as frequency of maintenance tasks and who is responsible for the following issues:

- Filling potholes
- Removing downed or dangerous trees
- Responding to vandalism and trespassing
- Removing litter
- Replacing stolen or damaged signs/site furnishings
- Watering and weeding landscaping
- Vegetation pruning and replacement
- Acting as the main contact
- Paying bills and expenses
- Pavement preservation tasks and schedule
- Snow clearing and removal
- Green infrastructure maintenance
- Pavement marking maintenance
- Tasks listed later in this section

OPERATIONS AND MAINTENANCE GUIDELINES

User-initiated Maintenance Requests

Users of Rochester's City Loop will likely be the first to notice hazards, maintenance issues, and opportunities to improve the system. A formal mechanism for receiving requests for maintenance can help focus and prioritize investments, avert deterioration of the city's infrastructure investments, provide effective management, and reinforce resident-ownership of the city's non-motorized network assets.

Currently, RochesterSeeClickFix (https://en.seeclickfix.com/rochester) and the city's Service Request mechanism (https://www.rochestermn.gov/i-want-to-/submit-a/service-request) are two tools that may be used by residents to report non-emergency issues to the city.

Rochester should consider updating its Service Request mechanism to increase its user-friendliness and streamline reporting by app, phone, or online. Develop a public marketing campaign to increase public awareness and use of the tools when available, as well as inclusion (using QR code on City Loop wayfinding) are also recommended.

WINTER MAINTENANCE

Snow and Ice Removal

Snow removal is a critical component of pedestrian and bicycle safety. The presence of snow or ice on sidewalks, curb ramps, or bikeways will deter pedestrian and cyclist use of those facilities to a much higher degree than cold temperature alone.

Seniors and other vulnerable adults will avoid walking in locations where ice or snow accumulation creates slippery conditions that may cause a fall. Curb ramps that are blocked by ice or snow effectively sever access to pedestrian facilities for wheelchair users and seniors. Additionally, inadequately maintained facilities may force people walking or biking to take a route that is unsafe, uncomfortable or inconvenient.

When the surface of a road is covered by snow, the pavement markings that guide and warn people walking, biking, or driving may be difficult to see. The trail system should be treated as a transportation facility and snow and ice removed from the entire trail surface within 24 hours so pavement is accessible and markings are identifiable.



Snow and ice removal during Minnesota winters is critical for extending the use of pedestrian and bicycle facilities throughout the year.

A Year-round Approach

Snow and ice removal should be planned with the expectation that walking and bicycle facilities will continue to be used during winter months. Snow and ice should be cleared from the City Loop and from connecting sidewalks, bike lanes and shoulders used by pedestrians and bicyclists. Pedestrian and bicycle facilities including sidewalks, gutters, and curb ramps should not be used to store snow removed from streets.

Prioritizing Snow Clearing Operations

A useful approach for maximizing the efficiency of maintenance investments is to identify locations where accumulation of snow or ice would significantly impede pedestrian and bicycling access and safety so that these locations are prioritized for clearing immediately after a storm event.

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 to encourage and/or enforce snow removal.

ROUTINE MAINTENANCE

Trail and Street Sweeping

Loose gravel, sand, leaves, and other debris on the surface of bicycle lanes, paved shoulders, and paved sections of shared use paths should be removed twice a year by machine, normally in the spring and fall. When needed, additional spot sweeping should be swept by hand or with blowers.

Markings

Signs and pavement markings are important features of walkways, bikeways and roadways, and help ensure continued safe and convenient use of these facilities. It is critical that bikeway signs, striping, and legends be kept in a legible condition.





Maintain trail and intersection walkways/bikeways clear of debris and with visible markings.

OPERATIONS AND MAINTENANCE GUIDELINES

Recommendations to address these infrastructure elements include:

- Annual inspection of bikeway signs and legends, including an inventory of signs to account for missing or damaged signs;
- Prompt replacement of defective or obsolete signs;
- Annual inspection of markings, trail striping, street crossing markings and materials, and prompt reapplication/replacement as needed.
- Consider durable cold plastic for skip-striping bike lanes across right turn lanes.

Surface Repairs

People walking and biking are more sensitive and more vulnerable to problems with paved surfaces than people driving. A smooth surface, free of potholes, cracks and other major surface irregularities, should be provided and maintained. are should be taken to eliminate other physical problems. Surface condition inspections should be done annually. Requests for surface improvements could be made through the user-initiated maintenance request program described above.

Potholes should be patched with in-kind paving materials. Bituminous portions of trail can be temporarily repaired with a cold mix; permanent repair should consist of saw-cutting the damaged area and infilling with new bituminous. Loose asphalt materials from patching operations on bituminous trails can adhere to the existing surfacing, creating a very rough surface for biking. Fresh loose materials should be swept off the trail before they have a chance to adhere to the pavement.

Concrete repairs should be saw cut and infilled with new concrete to match the existing condition. Pavers should be removed and reset as needed; replacements should match the existing condition.

Cracks should be filled and sealed and root barriers should be placed where vegetation roots are encroaching upon the trail section.

Utility Cuts

Utility cuts can leave a rough surface for people biking if not back-filled with care. Cuts should be backfilled and compacted so that the cut will be flush with the existing surface when completed. Extra care should be used when cuts are made parallel to bicycle traffic to avoid a ridge or groove in the bicycle wheel track. Considerations should be given to adding the above specifications to utility permit requirements.

Vegetation

Vegetation encroaching into and under a sidewalk, shared-use path, or trail crossing creates a nuisance and a hazard for people walking (especially for those with sight or mobility impairments) and biking. To provide long-term control of vegetation, its management should be considered during design and construction of the City Loop.

Vegetation management helps to maintain smooth pavement surface, as well as clear zones, sightlines, and sight corners to promote pedestrian and cyclist safety. City maintenance staff are generally responsible for vegetation management and should inspect the trail system monthly during the growing season. Regular seasonal maintenance activities should include weekly mowing of turf areas within the trail ROW, annual trimming of vegetation, weed control, raingarden maintenance and sweeping and blowing of vegetation and turf debris from the trail surface and root cutting as needed.

Vegetation management issues identified by users (e.g. tree roots causing heaving of sidewalk surfaces, encroachment and maintenance issues) may be reported through the user-initiated maintenance request program.





Vegetation should be trimmed to minimize walkway/bikeway encroachment.

Amenities

Biannual inspections of trail system amenities should take place in the spring and fall to ensure furnishings are properly functioning and are not posing safety hazards. Inspections should include but are not limited to benches, bike racks, litter receptacles, picnic tables, kiosks, site lighting and bollards. Repairs and/or replacements should be made as soon as possible when a need is identified.

Litter removal

Litter removal from the trail corridor is important for both a safety and aesthetics and includes removing loose debris from the ground and emptying litter receptacles. Trash removal should take place on a weekly basis.

Stormwater Management

Effective stormwater management conveyance and removal collects and dissipates stormwater runoff in an efficient and sustainable manner, utilizing natural topography and vegetation to aid in sediment control as well as water filtration and infiltration. Raingardens and similar BMPs such as infiltration basins, vegetated filter strips, bioswales, etc. should be well-designed and maintained in working order to ensure successful functioning.

Drainage facilities may change grades and deteriorate over time. Ensuring bicycle-safe drainage grates are located at the proper height greatly improves cyclist safety; it is sometimes necessary to adjust or replace catch basins to ensure continued safe operations and improve drainage. The small asphalt dams that are sometimes constructed on roadway shoulders to divert storm-water into catch basins are a hazard to people biking, and their use should be avoided.

Drainage systems should be inspected monthly during the growing season for erosion, invasive plant materials, litter, standing water and blockages. Annually, plants should be trimmed or removed as needed, and leaf removal, mulching, plant replacements and erosion stabilization activities should be completed.

Event-related drainage issues (e.g. backed-up grates) and long-term drainage hazards (unsafe grates) can be reported through the user-initiated maintenance request program, and should be proactively addressed whenever street improvements are made.




DMC
TRANSPORTATION
INFRASTRUCTURE
PROGRAM MANAGEMENT


community
design
group


alta
PLANNING + DESIGN


SEH

Technical Memorandum

DMC Project No. J8620 City Loop

To: Joni Giese, Principal
SRF Consulting Group

From: Bob Kost, ASLA, AICP, LEED-AP
SEH
bkost@sehinc.com
952-912-2604

Date: March 19, 2018 – Updated with Hybrid Scenario

Subject: Draft Interim Deiverable for City Loop - Evalutation of Alternative Route Scenarios

Cc: Colin Harris and Rose Ryan, Alta Planning and Design

Introduction

The DMC Development Plan described an initial route for the City Loop which was reviewed and analyzed under Tasks 2, 3 and 4. This review of the initial route examined application of ADA requirements and potential pinch points or ability to fit within existing rights of way. Following the outcome of this work, a number of alternative alignment scenarios were developed and refined while working together with the other DMC transportation study teams. Initially, three alternatives were developed for evaluation:

1. DMC Modified Scenario
2. Scenario A
3. Scenario D

As illustrated in the attached composite scenario plan, all three of the City Loop scenarios share five route segments:

1. 2nd Street NW between 5th Ave. NW and North Broadway
2. Downtown River Loop between 2nd St. SW and 6th Street SW
3. 6th St. SW between South Broadway and 4th Ave. SW
4. 4th Avenue SW between 6th St SW and 2nd St. NW
5. 2nd Street SW between 9th Ave. SW and 4th Ave. SW

The recommendation for including these five route segments emerged from work previously undertaken and described in Technical Memos1, 2 and 3 as a part of the overall City Loop study. Consequently, these shared routes were not subject further evaluation using the scenario criteria.

Evaluation Grading System:

Score: Each criteria will be assigned a rating of "Poor", "Good", or "Best" for each scenario. The ratings will correspond to a score of 0 for NOT APPLICABLE or NONE, 1 for POOR, 5 for GOOD, and 9 for BEST in the score boxes.

Scoring Style: A criteria can be averaged or quantified as a summation of total items present. These criteria are defined in the score card's first column.

The total will appear at the bottom of the score sheet once all score boxes have been evaluated.

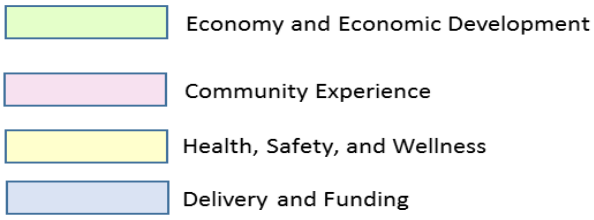


Figure 1 Evaluation Grading System

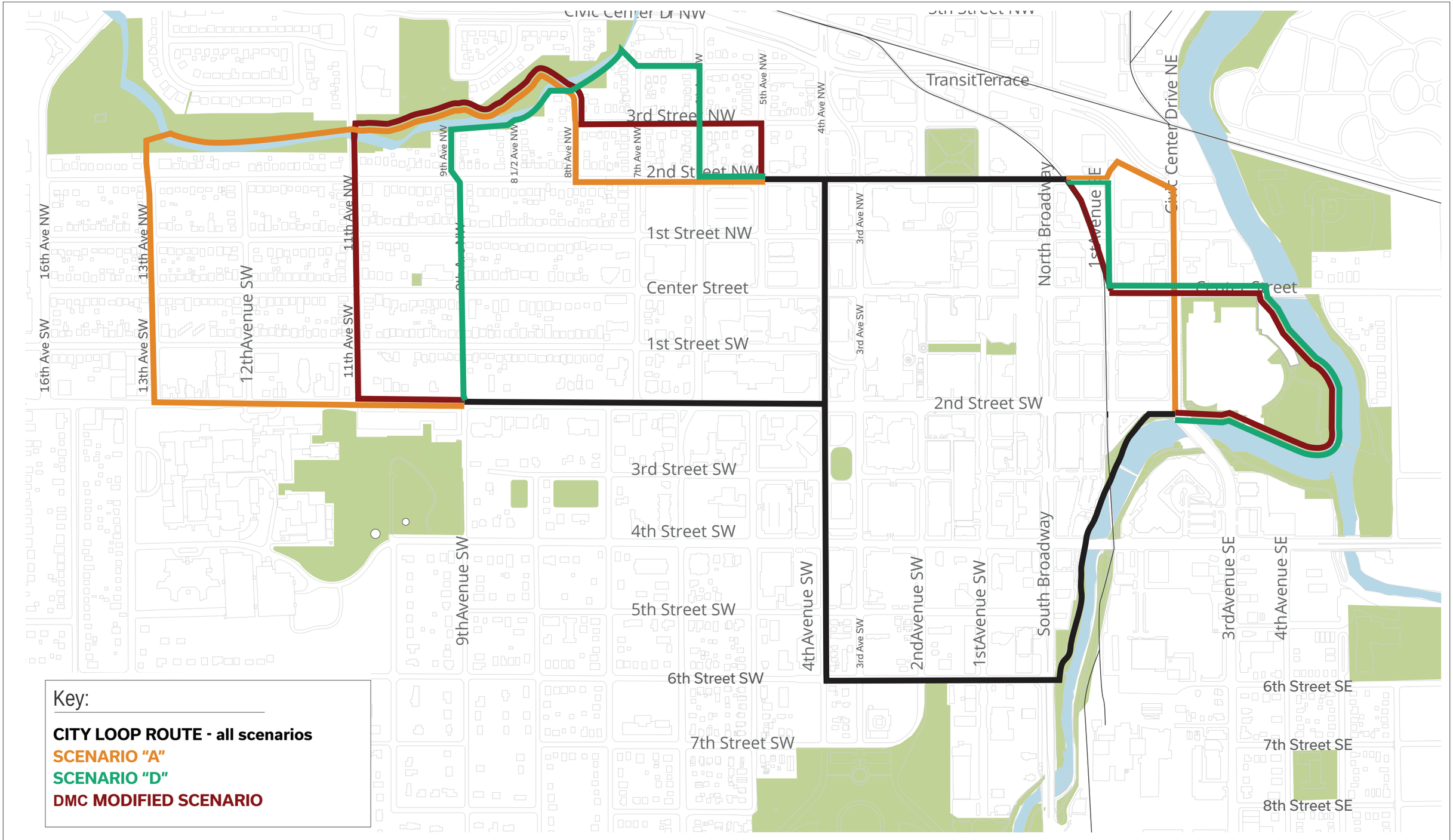
In addition to developing alternative route scenarios, an extensive process of developing draft and final evaluation criteria was also undertaken by the study team. The City Loop team established draft evaluation criteria based on guidance provided by DMC Transportation Study team member, Nelson Nygaard. Criteria are organized into four categories shown in the Figure 1. Application of the criteria included use of a number of documents and data sources including but not limited to: DMC Development Plan, Draft Rochester Comprehensive Plan, Analysis of Redevelopment Potential along City Loop Alternative Routes, Google Earth, and field reconnaissance. The final version of these criteria are provided in each of the attached scenario score sheets.

Based upon the application of the evaluation criteria, Scenario A scored the highest and was recommended for inclusion with the final composite scenario, comprised of the highest ranking scenarios from the other studies (Transit, Parking, etc.).

Following the review and consideration of the high scoring transit, parking and streets scenarios, a Hybrid City Loop scenario was developed and evaluated. The outcome of this evaluation is also included in this memo.

Attachments:

- Composite Scenario Plan
- Hybrid Scenario Plan
- Evaluation Score Sheets (4)



Key:

CITY LOOP ROUTE - all scenarios

SCENARIO "A"

SCENARIO "D"

DMC MODIFIED SCENARIO

DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

COMPOSITE SCENARIOS

08-10-2017

REPORT NAME:



DRAFT Proposed Hybrid DMC City Loop Alignment

SEH

alta PLANNING + DESIGN

DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

October 2017

Evaluation Criteria for DMC City Loop

R-Resident, C-Commuter, B-Business, P/C-Patient and Companion, V-Visitor, A-All

Scoring Style	Scenario A	**2nd street sw** from 13th ave sw to 9th ave sw	**civic center drive** from 2nd st sw to 2nd st nw	**2nd street ne** from civic center dr to north broadway	**2nd street nw** from 5th ave to 8th ave nw	**8th ave nw** to cascade creek crossing (new)	**kutzky park trail** (north side)	**13th avenue** from kutzky park to 2nd st sw	Score
average	1. Rate the level of accessibility for people and jobs (adjacent land use - higher density of residential/commercial = higher score) (A,R,C,B)	9	9	5	5	1	5	5	**5.6**
average	2. Connections with existing and planned regional transit hub, regional bus, circulator stations and PTN crossings (A)	9	9	5	1	0	0	9	**4.7**
average	3. Maximizes connections to public and semi-public social spaces, natural areas and quiet spaces. (A)	5	5	5	1	5	9	5	**5.0**
quantify	4. Maximizes connections to existing and planned parking to support a park-once environment (A,C,P/C,V)	2	4	0	0	0	0	0	**6.0**
average	5. Meets the principles of walkability: useful, comfortable, direct, safe, and interesting routes. (A)	9	9	5	5	5	5	9	**6.7**
average	6. Potential to increase physical activity and reduce injuries (A) (As a proxy for increasing physical activity, evaluate safety of the city loop alternatives as a way to measure the potential increased usage by multiple age and ability)	5	1	9	9	9	9	9	**7.3**
average	7. Provides direct connections with Mayo facilities for patients, visitors, and wellness retreat participants (P/C, V)	9	0	0	5	0	0	5	**2.7**
average	8. Minimizes reliance on wayfinding for navigation and legibility: follows existing street grid, minimizes changes/shifts in route (V,P/C)	9	9	5	5	1	5	9	**6.1**
average	9. Length of Loops	9	9	9	9	9	9	9	**9.0**
average	10. Fundable total project capital cost, describe in per mile terms (A)	5	5	9	5	1	9	5	**5.6**
average	11. Transition Plans / ability to be phased in a logical and useful manner (A)	5	9	9	5	5	9	5	**6.7**
quantify	12. Connections to existing surface parking facilities and proximity to future redevelopment sites whereby City Loop may serve as a catalyst for private development, and partnership. (measure of block faces) (A)	3	5	3	1	0	0	1	**13.0**
	Average Score	6.6	6.2	5.3	4.3	3.0	5.0	5.9	

TOTAL	**78.4**

08/21/17 by S. Sularz

Evaluation Criteria for DMC City Loop

R-Resident, C-Commuter, B-Business, P/C-Patient and Companion, V-Visitor, A-All

Scoring Style	Scenario D	mayo park loop	**center street** from the zumbro bridge to 1st ave ne	**1st avenue ne** from center st to2nd street ne	**2nd street ne** from 1st ave to north broadway	**2nd street nw** from 5th to 6th ave nw	**6th avenue nw** to 4th st nw	**4th street nw** to kutzky park	**NEW** kutzky park trail (south side)	**9th avenue** from kutzky park to 2nd st.	Score
average	1. Rate the level of accessibility for people and jobs (adjacent land use - higher density of residential/commercial = higher score) (A,R,C,B)	5	5	5	5	5	5	9	9	5	**5.9**
average	2. Connections with existing and planned regional transit hub, regional bus, circulator stations and PTN crossings (A)	1	5	1	5	1	9	5	0	5	**3.6**
average	3. Maximizes connections to public and semi-public social spaces, natural areas and quiet spaces. (A)	9	5	0	0	1	1	5	9	5	**3.9**
quantify	4. Maximizes connections to existing and planned parking to support a park-once environment (A,C,P/C,V)	0	5	1	1	0	0	0	0	0	**7.0**
average	5. Meets the principles of walkability: useful, comfortable, direct, safe, and interesting routes. (A)	5	5	5	5	5	5	5	5	9	**5.4**
average	6. Potential to increase physical activity and reduce injuries (A) (As a proxy for increasing physical activity, evaluate safety of the city loop alternatives as a way to measure the potential increased usage by multiple age and ability)	9	5	9	5	9	5	5	9	1	**6.3**
average	7. Provides direct connections with Mayo facilities for patients, visitors, and wellness retreat participants (P/C, V)	0	0	0	0	5	5	1	1	1	**1.4**
average	8. Minimizes reliance on wayfinding for navigation and legibility: follows existing street grid, minimizes changes/shifts in route (V,P/C)	5	9	9	5	5	5	1	1	0	**4.4**
average	9. Length of Loops	1	1	1	1	1	1	1	1	1	**1.0**
average	10. Fundable total project capital cost, describe in per mile terms (A)	5	9	9	5	5	5	5	0	1	**4.9**
average	11. Transition Plans / ability to be phased in a logical and useful manner (A)	9	5	5	5	9	5	5	5	1	**5.4**
quantify	12. Connections to existing surface parking facilities and proximity to future redevelopment sites whereby City Loop may serve as a catalyst for private development, and partnership. (measure of block faces) (A)	0	3	3	1	2	1	0	0	2	**12.0**
	Average Score	4.1	4.8	4.0	3.2	4.0	3.9	3.5	3.3	2.6	

TOTAL	**61.3**

08/21/17 by S. Sularz

Evaluation Criteria for DMC City Loop

R-Resident, C-Commuter, B-Business, P/C-Patient and Companion, V-Visitor, A-All

Scoring Style	Scenario MOD	**2nd st sw** from 11th ave sw to 9th ave sw	mayo park loop	**Center st** from the zumbro bridge to the BM&E railline	**BM&E railroad line** from center street to 2nd st nw	**5th ave nw** from 2nd st nw to 3rd st nw	**3rd st nw** from 5th ave nw to 8th ave nw	**8th ave nw**; north of 3rd st to kutzky park trail	kutzky park trail (north side)	**11th ave nw / sw** from kutzky park to 2nd st.	Score
average	1. Rate the level of accessibility for people and jobs (adjacent land use - higher density of residential/commercial = higher score) (A,R,C,B)	5	5	5	9	1	1	1	5	5	4.1
average	2. Connections with existing and planned regional transit hub, regional bus, circulator stations and PTN crossings (A)	9	1	5	1	1	5	1	0	5	3.1
average	3. Maximizes connections to public and semi-public social spaces, natural areas and quiet spaces. (A)	5	9	5	5	5	5	9	9	5	6.3
quantify	4. Maximizes connections to existing and planned parking to support a park-once environment (A,C,P/C,V)	2	0	5	2	1	0	0	0	0	10.0
average	5. Meets the principles of walkability: useful, comfortable, direct, safe, and interesting routes. (A)	9	5	5	9	5	1	5	5	5	5.4
average	6. Potential to increase physical activity and reduce injuries (A) (As a proxy for increasing physical activity, evaluate safety of the city loop alternatives as a way to measure the potential increased usage by multiple age and ability)	9	9	5	5	5	5	9	9	5	6.8
average	7. Provides direct connections with Mayo facilities for patients, visitors, and wellness retreat participants (P/C, V)	9	0	0	0	1	0	0	0	5	1.7
average	8. Minimizes reliance on wayfinding for navigation and legibility: follows existing street grid, minimizes changes/shifts in route (V,P/C)	9	5	9	1	5	5	1	5	9	5.4
average	9. Length of Loops	5	5	5	5	5	5	5	5	5	5.0
average	10. Fundable total project capital cost, describe in per mile terms (A)	1	9	5	1	9	1	1	9	9	5.0
average	11. Transition Plans / ability to be phased in a logical and useful manner (A)	5	9	5	1	9	5	1	9	1	5.0
quantify	12. Connections to existing surface parking facilities and proximity to future redevelopment sites whereby City Loop may serve as a catalyst for private development, and partnership. (measure of block faces) (A)	1	0	3	2	2	1	0	0	2	11
	Average Score	5.8	4.8	4.8	3.4	4.1	2.8	2.8	4.7	4.7	

TOTAL	**68.9**

08/21/17 by S. Sularz

Evaluation Criteria for DMC City Loop

R-Resident, C-Commuter, B-Business, P/C-Patient and Companion, V-Visitor, A-All

Scoring Style	Scenario Hybrid	**2nd st sw** from 11th ave sw to 9th ave sw	5th Ave SW/3rd St SW to 4th Ave SW	Soldier's Memorial Field	BM&E Railroad Line from 6th St SW to Center St E	**BM&E railroad line** from center street to 2nd st nw	**2nd street nw** from 5th ave to 8th ave nw	**8th ave nw** to cascade creek crossing	kutzky park trail (north side)	**11th ave nw / sw** from kutzky park to 2nd st.	Score
average	1. Rate the level of accessibility for people and jobs (adjacent land use - higher density of residential/commercial = higher score) (A,R,C,B)	5	5	5	9	9	5	1	5	5	5.4
average	2. Connections with existing and planned regional transit hub, regional bus, circulator stations and PTN crossings (A)	9	9	9	9	1	1	0	0	5	4.8
average	3. Maximizes connections to public and semi-public social spaces, natural areas and quiet spaces. (A)	5	1	9	5	5	1	5	9	5	5.0
quantify	4. Maximizes connections to existing and planned parking to support a park-once environment (A,C,P/C,V)	2	2	2	4	2	0	0	0	0	12.0
average	5. Meets the principles of walkability: useful, comfortable, direct, safe, and interesting routes. (A)	9	5	5	9	9	5	5	5	5	6.3
average	6. Potential to increase physical activity and reduce injuries (A) (As a proxy for increasing physical activity, evaluate safety of the city loop alternatives as a way to measure the potential increased usage by multiple age and ability)	9	5	9	9	5	9	9	9	5	7.7
average	7. Provides direct connections with Mayo facilities for patients, visitors, and wellness retreat participants (P/C, V)	9	5	5	0	0	5	0	0	5	3.2
average	8. Minimizes reliance on wayfinding for navigation and legibility: follows existing street grid, minimizes changes/shifts in route (V,P/C)	9	5	5	9	9	5	1	5	9	6.3
average	9. Length of Loops	5	5	5	5	5	9	9	5	5	5.9
average	10. Fundable total project capital cost, describe in per mile terms (A)	1	5	9	1	1	5	1	9	9	4.6
average	11. Transition Plans / ability to be phased in a logical and useful manner (A)	5	5	9	1	1	5	5	9	1	4.6
quantify	12. Connections to existing surface parking facilities and proximity to future redevelopment sites whereby City Loop may serve as a catalyst for private development, and partnership. (measure of block faces) (A)	1	1	2	5	2	1	0	0	2	14
	Average Score	5.8	4.4	6.2	5.5	4.1	4.3	3.0	4.7	4.7	

TOTAL	**79.8**

Produced 1/08/18