CITY OF NORTHFIELD

Pedestrian + Bikeway Analyzation

DRAFT: AUGUST 2022

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alta

City Of Northfield Minnesota

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INTRODUCTION

Overview, Purpose, and Organization

Overview

The City of Northfield (City) adopted a Pedestrian, Bike, and Trail System Plan in 2019. The plan included strategies to help the City develop a more comfortable, safe, and connected network of trails, bikeways, and walkways throughout the city. The City is now in a position to implement a vision of attracting more people to walk and bike in Northfield and to pursue the following key goals:

- Bicycling: Provide a facility that helps people of all ages and abilities (AAA) feel comfortable and safe.
- Walking: In addition to sidewalks or paths to walk on with buffers from the street, have safe and comfortable places to cross the street.

This report explores what types of bikeway and pedestrian crossing improvements are possible and desirable in Northfield with a goal of expanding bike usage for people of all ages and abilities. This report explores bicycle facility options to move toward that goal.

The City installed several bikeway projects several bikeway projects since the adoption of the 2019 plan (see Figures 1 and 2 on the following page). Two-way buffered bikeways on one side of the street were a popular installation. This type of bikeway has several benefits in Northfield:

The City is now in a position to implement a vision of attracting more people to walk and bike in Northfield

- They provide a dedicated space for people to bike.
- The traffic volume on most streets owned by the City of Northfield is relatively low, but high enough that separation from motor vehicles will help people feel comfortable bicycling.
- Parking is retained on one side of the street.

Opportunities exist to improve the comfort level of these bikeways. This report explores opportunities to provide physical separation between moving motor vehicles and people biking.

Figure 1. Eighth Street W at Water Street S - facing west

Figure 2. Nevada Street and Fourth Street E - facing east

Purpose of This Report

The purpose of this report is to identify how projects identified in the 2022-2026 Capital Improvement Projects (CIP) can be organized to provide the most benefit to people walking and bicycling in Northfield. Construction projects are often the best opportunity to make a measurable impact on safety and comfort for people walking and biking. The CIP includes a variety of street project types, including: mill and overlays, reconstruction and reclamation, and sidewalk/trail improvements. Each of these project types has different implementation opportunities and challenges.

Organization

This document is organized into four sections:

Section 1: Review of Existing Plans and Conditions

This section includes a review of policies, plans, and documents that provide guidance to inform bikeway and pedestrian infrastructure improvements.

Section 2: Bikeway Design Concepts and Report

This section includes an analysis of seven proposed bikeway corridors–with an existing cross section and proposed cross sections.

Section 3: Pedestrian Design Concepts and Report

This section includes a map and analysis of pedestrian origins and destinations–with a list of locations to consider for pedestrian crossing improvements.

Section 4: CIP Analysis and Recommendations

This section provides recommendations to move forward with implementing pedestrian and bicycle projects in coordination with the CIP.

01

REVIEW OF EXISTING PLANS AND CONDITIONS

To understand prior work relevant to the ongoing project, including how adopted design and policy guidance can support and guide bicycle and pedestrian facility design, Alta Planning + Design completed a high-level review of previous plans adopted by the City of Northfield. While older plans such as the 2006 Greenway Corridor Plan were noted in this section, they didn't have as much of direct impact on the report. Others, including the 2012 Complete Streets Policy and the 2019 Pedestrian, Bike, and Trail System Plan, provided relevant technical guidance or offered insights into the City's vision for surface transportation systems.

Key Findings

- **Facilities should safely accommodate users of all ages and abilities (AAA):** The 2012 Complete Streets Policy clearly states that facilities should be "planned, funded, designed, constructed, operated and maintained to safely accommodate users of all ages and abilities." The 2019 Pedestrian, Bike, and Trail System Plan also specifies that facilities should serve "all ages and abilities."
- **Facility design should rely on the "latest and best" standards, principles, policies, and guidelines:** The 2012 Complete Streets Policy, rather than adopting explicit design guidelines, recognizes that best practices evolve over time and instead refers to contemporary best practices for complete streets design. The 2019 Pedestrian, Bike, and Trail System Plan provides some specific guidance; the Complete Streets Policy also provides flexibility for the City to leverage other state-of-the-art design guidelines, such as the National Association of City Transportation Officials (NACTO) Urban Street Design Guide, NACTO Don't Give Up at the Intersection guide, Federal Highway Administration (FHWA) Separated Bike Lane Planning and Design Guide, and the Minnesota Department of Transportation (MnDOT) Bicycle Facility Design Manual.
- **The City's updated street type table provides high-level facility guidance for different street segments:** The 2019 Pedestrian, Bike, and Trail System Plan updated the City's prior street type table to shift away from functional classifications and toward a framework focused on land use context. This process also incorporated the City's 2012 Complete Streets Policy into the street type table. While the street type table does not provide comprehensive guidance about facility selection and layouts applicable to all the corridors under analysis as part of this project, it does provide an important typology and example cross sections that can form the bases for more individualized design recommendations. A strategy listed in the plan clarifies that the City should develop a bicycle facility selection matrix to guide more specific decision making.
- **Separated bicycle facilities–including those with vertical separation (concrete curbs, flex posts, planter boxes), off-street facilities, and protected**

intersections–are recommended where there is high bicycle or vehicle traffic or where the City wants to expand the AAA network to increase bicycle usage: The *2019 Pedestrian, Bike, and Trail System Plan* lists as Strategy 2 "Implement Separated Bicycle Lanes in Select Locations." This includes the guidance that "Separated bicycle lanes should only be implemented… where there is a high demand for bicycle infrastructure [or] where the current facility does not provide a comfortable bicycling environment for people of all ages and abilities." Cross sections provided in the plan illustrate some of the situations and types of separated facilities that would be appropriate.

- **Improved water quality and stormwater management–by reducing impervious surfaces, narrowing streets, planting street trees, and leveraging green infrastructure–are key outcomes and design strategies for street projects:** The 2012 Complete Streets Policy identifies improved water quality and management outcomes as core goals of street design projects, and also establishes as a goal an "attractive surface transportation network." Accordingly, street design projects should seek to do the following:
  - Maintain existing green infrastructure (e.g., street trees)
  - Convert impermeable surfaces to new features (e.g., rain gardens, bioswales, planters) that achieve multiple City objectives:
    - Water purification
    - Water infiltration
    - User comfort (e.g., by reducing street-level temperatures, by mitigating vehicle noise and air pollution, and by enhancing the visual appeal of streetscapes)
    - User safety (e.g., by installing green elements as separation between vehicles and other road users)

Plan Reviews

2022–2026 Capital Improvement Projects

The current CIP provides details on programmed capital projects through 2026. Projects are broken down by department and by funding source, with programmed funding listed by year for each project. All pedestrian- and bicycle-related projects fall under the purview of the Engineering Division and have project codes of the format E-YEAR-PROJECT NUMBER. The CIP was reviewed at a high level, including the project-specific details for each engineering project in the CIP to identify relevant aspects of the City's current planning, funding, and implementation process for pedestrian- and bicycle-related capital projects. Engineering projects sum to $34,725,479 across the five years and account for 39% of the City's total capital expenditures ($90,069,517) over the five years. Each project sheet has a set of standard fields, including project name, project number, department, contact, type, useful life, category, priority, total project cost, description, justification, and tables of expenditures and funding sources. Most projects also include a supplementary image.

2019 Pedestrian, Bike, and Trail System Plan

This plan was complete in March 2019 and included an existing plan and policy review, community engagement, updates to the City's street type table, development of planned sidewalk and walking and bicycling networks, and other area- and route-specific multimodal planning tasks (e.g., Safe Routes to School recommendations). The review of existing plans and policies included six documents: the *Comprehensive Plan, Complete Streets Policy, Comprehensive Transportation Plan Update, Land Development Code and Street Type Table, Safe Routes to School Plan,* and Minnesota Department of Natural Resources *Trail Planning, Design, and Development Guidelines*.

For each reviewed document, the plan provides recommended revisions. Key recommended revisions include the following:

- Prioritize accessibility for people with disabilities (*Comprehensive Plan*)
- Clarify the importance of separated bicycle facilities for both comfort and safety (*Comprehensive Plan*)
- Where separated facilities are not present, implement traffic calming treatments to achieve speeds of 25 miles per hour (mph) or less (*Complete Streets Policy*)
- Design on-street bicycle routes to be comfortable for people with less experience bicycling (*Comprehensive Transportation Plan Update*)
- Emphasize connections and wayfinding between on- and off-street bicycle facilities, including regional trails (*Comprehensive Transportation Plan Update, Safe Routes to School Plan*)
- Require trails to be at least 10 feet in width, with a minimum of three-foot shoulders on each side (*Safe Routes to School Plan, Minnesota Department of Natural Resources Trail Planning, Design, and Development Guidelines*)

Key strategies building from the plan review included the following:

- Design streets based on land use context
- Implement separated bicycle lanes in select locations
- Improve accessibility for people with disabilities[1]
- Develop a bicycle facility selection matrix

Findings from community engagement highlight that:

- Downtown, schools, and local trails are major walking and biking origins/destinations.
- Bicycle and pedestrian infrastructure at dangerous intersections is limited or absent.
- Physical linkages and wayfinding to connect the street network to off-street facilities are needed.
- Gaps in the sidewalk network are problematic.

The plan's street type table updates also reflect a number of City goals around multimodal street design. Perhaps most significantly, the updates establish target

1 At the time of the plan review, only a draft version of the City's Americans with Disabilities Act Transition Plan was available. A final version of the plan has since been published

speeds for each street type and recognize that these speeds are not merely a function of posted speed limits; rather, "**Achieving target speeds depends on the selected *design speed*.**" (Italics added.) Design elements included in the cross sections include the following:

- No more than two travel lanes on most street types, and no more than two travel lanes plus a shared center turn lane on all streets with 15,000 annual average daily traffic (AADT) or less
- Travel lanes of no more than 12 feet on any street type, and travel lanes of 10 feet on almost any street type
- Traffic calming and crossing treatments such as curb extensions, protected intersections, pedestrian refuge islands, mini traffic circles, and speed humps

2019 Americans with Disabilities Act (ADA) Transition Plan

The City completed a self-evaluation in 2018 of its efforts to address the needs of people with disabilities and subsequently produced a final *ADA Transition Plan*. The plan specifies a number of relevant policies regarding accessibility in infrastructure projects, namely that all new construction projects, as well as all reconstruction projects–including mill and overlays–and all curb replacement projects, will be built to current Americans with Disabilities Act (ADA) standards *to the extent feasible*. The plan further establishes a schedule for updates, such that: by 2023, areas in the CIP would be ADA-compliant; by 2028, 50% of accessibility features within the City's jurisdictions would ADA-compliant; and by 2038, 80% of accessibility features within the City's jurisdictions would be ADA-compliant.

Although approximately 26% of adults in the US live with a disability[2]–and all children and adults benefit from accessible infrastructure design–the City's *ADA Transition Plan* only received one public comment. As the City continues to implement the plan, it should collaborate with the community, in particular with people with disabilities, to learn about their experiences accessing places in Northfield, and their needs for more accessible infrastructure and related policies. Findings should be used to inform updates to the plan and to other City policies relating to the built and natural environments and accessibility.

As it pertains to this project, the plan is clear that **all CIP projects will be designed to meet current ADA standards**. However, in many scenarios, there will be significant opportunities to exceed these standards to provide safer, more comfortable, and more convenient bicycle and pedestrian facilities for users of all ages and abilities.

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2 https://www.cdc.gov/ncbddd/disabilityandhealth/infographic-disability-impacts-all.html

2012 Complete Streets Policy

The City's 2012 *Complete Streets Policy* establishes high-level "directives" for all surface transportation projects and also specifies the City's motivations, vision, and goals for its surface transportation network. These include the following:

- "Long-term cost savings in improved public health, better environmental stewardship, reduced fuel consumption, and reduced demand for motor vehicle infrastructure"
- A preference for separated facilities for bicyclists and pedestrians and, when separated facilities are not possible, road designs that calm traffic to achieve a "safe, reliable, integrated, and interconnected" multimodal network
- Improved water quality and stormwater management by reducing impervious surfaces, narrowing streets, planting street trees, and leveraging green infrastructure design approaches
- Public transportation infrastructure that is designed to limit maintenance needs, and that is "maintained so that all users can travel safely, reliably, and independently"

The policy establishes a clear set of desired outcomes–and general approaches for achieving these outcomes–for which this project should design. Particularly relevant are the policy's emphases on reducing street widths and impervious surfaces, designing environmentally and fiscally sustainable transportation projects, and opting for separated bicycle and pedestrian facilities or traffic calming improvements.

2006 Greater Northfield Area Greenway System Action Plan

The City's 2006 *Greater Northfield Area Greenway System Action Plan* developed a proposed map of regional greenway corridors, which were defined as "a connected system of protected natural areas and cultural resources that is accessible for human use." These corridors are intended to "protect, preserve, and enhance natural areas and open spaces" and to balance the multiple functions of these areas (e.g., recreational and educational, as well as routes for active transportation) while connecting neighborhoods and communities within the region.

Given the vintage of this plan and the focus of the current project, the primary relevant consideration is to **ensure that design of projects facilitates connections to existing and planned segments of the regional greenway system**. This is reiterated in the 2019 *Pedestrian, Bike, and Trail System Plan* (described previously), which has a recommendation to "develop connections to existing and planned facilities in the regional trails system (as well existing and planned on-street facilities)."

02

BIKEWAY DESIGN CONCEPTS AND REPORT

Approach

Alta developed existing cross sections and recommended cross sections for the following City of Northfield proposed bikeway corridors (see map on the following page), each based on existing curb-to-curb, potential new curb-to-curb, and right-of-way (ROW) dimensions:

- Prairie Street
- Nevada Street/Maple Street
- Heritage Drive/Adams Street/Roosevelt Drive
- Lincoln Street N/Lincoln Parkway/Spring Street
- Armstrong Road
- Washington Street
- Eighth Street E

The goal of this effort was to identify how bikeways can fit into the existing curb-to-curb dimensions for each street, and to note options that may include a modified street section. There are notes for each corridor that identify technical challenges, trade-offs, and other applicable observations related to feasibility of installing bike lanes. Each proposed bikeway corridor has a context map, existing cross section or sections, and proposed cross section or sections.

There may be opportunities to enhance key intersections along the proposed bikeway corridors with pedestrian crossing improvements. Locations for these improvements should be based on the pedestrian origin and destination map in Section 3, and are contingent on identifying funding in the CIP.

Selecting a Preferred Bikeway Type in Northfield

A key goal of this report was to determine how to enhance bikeways for AAA to reduce barriers and increase bicycle usage:

- Policy guidance: including City of Northfield policies and plans, Minnesota State Aid Rules, the MnDOT Bicycle Facility Design Manual, and national guidance such as NACTO Urban Street Design Guide, NACTO Don't Give Up at the Intersection guide, and the FHWA Separated Bike Lane Planning and Design Guide
- Clear policy direction to safely accommodate users of all ages and abilities
- Street and ROW widths of proposed bikeway corridors
- Recent bikeway implementation

One of the key parts of the analysis came from "Contextual Guidance for Selecting All Ages & Abilities Bikeways" in the Urban Bikeway Design Guide. In June 2022, two-day traffic counts were conducted at 17 locations in the city, which largely overlapped with the proposed bikeway corridors in this report. A majority of the corridors were in the 1,000 to 3,000 range for AADT for the two-day sample.

Table 1: NACTO guidance applicable to City of Northfield streets

Roadway Context	All Ages and Abilities Bicycle Facility
Speed Limit	Greater than 26 mph
Target Motor Vehicle Volume (AADT)	Less than or equal to 6,000 AADT
Motor Vehicle Lanes	Single lane in each direction
Key Operational Considerations	Low curbside activity, or low congestion pressure
All Ages & Abilities (AAA) Facility (based on above features)	Separated bike lane, or reduce speed

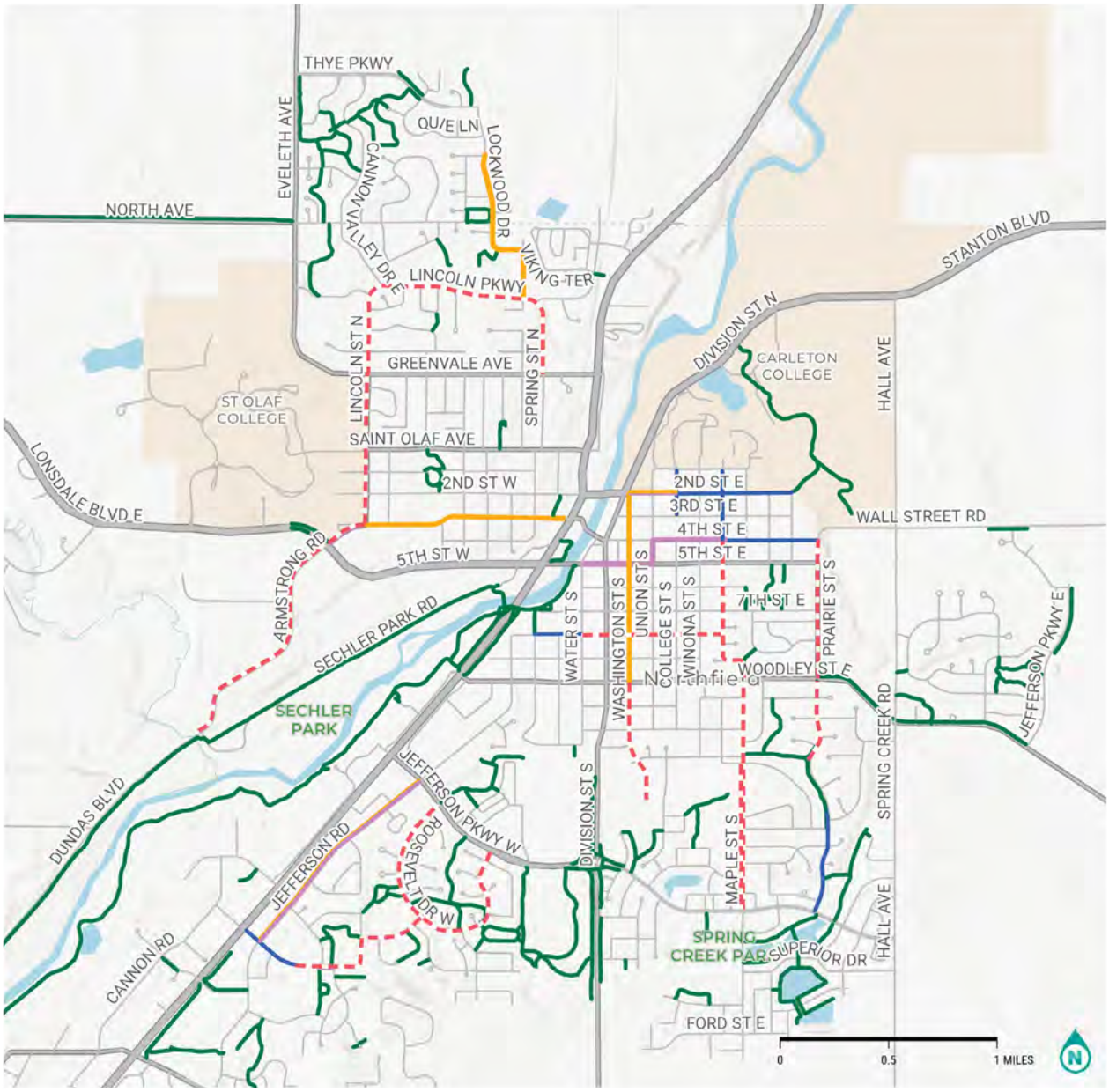
The NACTO guidance that applies to the City of Northfield streets reviewed as a part of this report is shown in Table 1.

Based on the analysis, Alta recommends the following preferred bikeway types based on project types identified in the CIP:

- For reconstruction and reclamation projects:
  - **The preferred bikeway in most contexts is a raised (sidewalk height, behind the curb), two-way separated bikeway that separates pedestrians and bicyclists where feasible.** Also consider other important pedestrian and bicycle features, including green boulevards, green stormwater infrastructure, trees, and intersection treatments.
- For mill and overlay projects and stand-alone bikeway projects (no underlying street maintenance project):
  - **The preferred bikeway in most contexts is an in-street, two-way separated bikeway, with a two-foot concrete bike buffer as a form of physical separation between the travel lanes and the bike lanes.** In cases where the concrete bike buffer is not feasible, a hatched buffer should be included (see Figure 2). This often includes retaining a travel lane in each direction and one side of street parking.
- In some contexts, a bike boulevard is a preferred option. This includes striping bike boulevard symbols in the street and including traffic calming features such as bumpouts, traffic circles, and raised crossings.

Prairie St, just north of Jefferson Parkway

Figure 3. Bicycle Network Map



BICYCLE NETWORK

NORTHFIELD, MN
Citywide

PROPOSED BIKEWAY CORRIDORS

- Proposed Bikeway Corridors

EXISTING BICYCLE NETWORK

- On-Street Bike Lane May use full lane
- On-Street Bike Lane One direction
- On-Street Bike Lane Two direction
- Trail

Prairie Street

From Fourth Street E to Just South of Pleasant View Court

Overview

Length: 0.7 miles

Existing Curb-to-Curb: 32 feet

Total Right-of-Way: 65 feet

Traffic Volumes (AADT, based on two full-day counts):

- Prairie Street north of Woodley Street E: 1,729
- Prairie Street south of Woodley Street E: 1,244

Connection to the CIP:

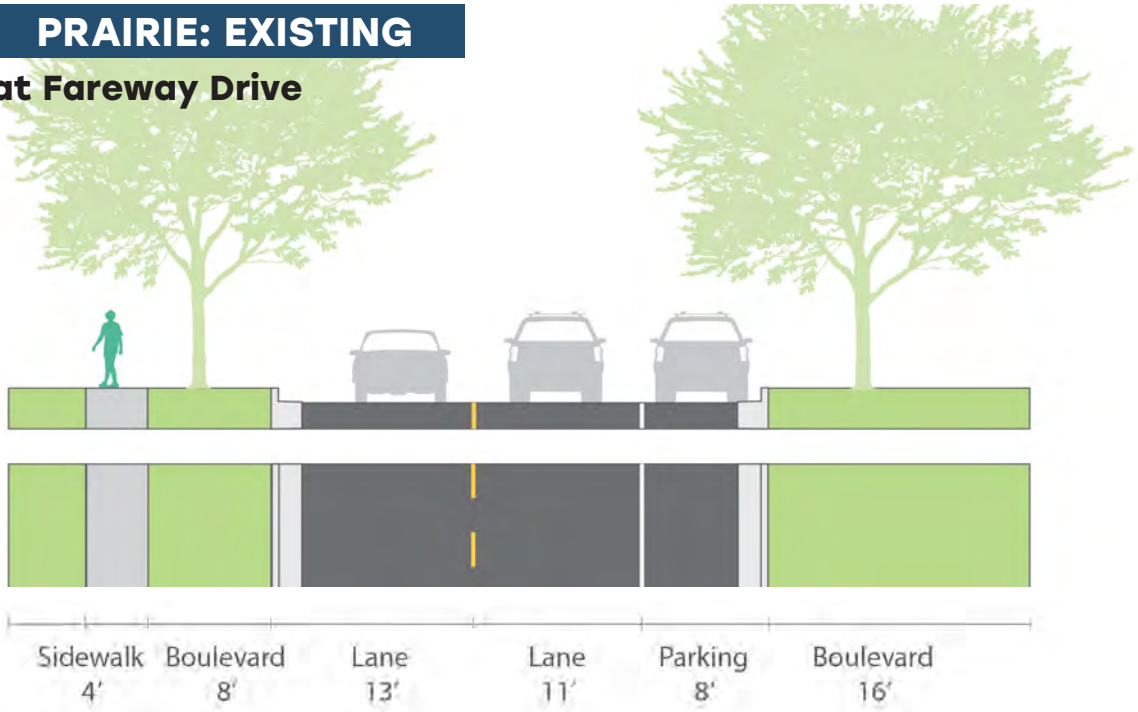
- Prairie Street from Fourth Street E to Woodley Street E: sidewalk/trail improvements (2023); mill and overlay (2023)

Notes on the Proposed Cross Sections

- Challenging corridor due to limited ROW and existing tree canopy on the west side–limited opportunities on the east side.
- Opportunity to implement a bicycle boulevard with the 2023 mill and overlay project and use the sidewalk/trail improvements CIP project to implement traffic calming elements that optimize pedestrian and bicycle comfort. Assumption for the bicycle boulevard is a stamped bike symbol with "BLVD" below it–one in each direction at the entrance of each block.
- Proposed cross sections focus on the section from Fourth Street E to Woodley Street E because there is an existing two-way buffered bikeway on Prairie Street south of Woodley Street E.
- Connections to the bikeway network: Prairie Street S connects to a two-way in-street bikeway on the south side of Fourth Street and then to an existing two-way bikeway south of Woodley Street E.
- Consider modification of curb lines to a a raised separated bikeway in a future reconstruction.

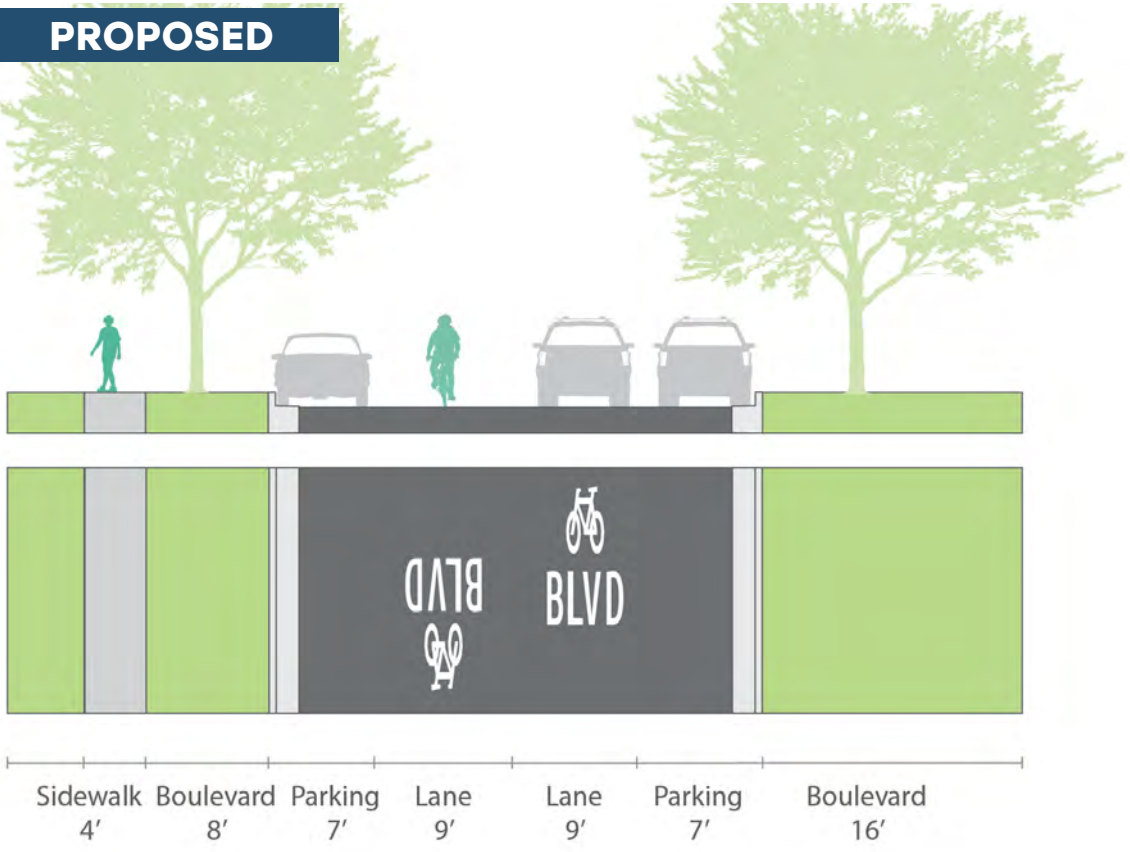
PRAIRIE: EXISTING

at Fareway Drive



Looking North

PROPOSED



Nevada Street/Maple Street
From Fourth Street E to Jefferson Parkway

Overview

Length: 1.4 miles

Existing Curb-to-Curb: 32 feet on Nevada Street and ranges from 36 to 44 feet on Maple Street

Total Right-of-Way: ranges from 76 to 80 feet

Traffic Volumes (AADT, based on two full-day counts):

- Maple Street north of Sibley Drive: 1,763
- Maple Street south of Sibley Drive: 1,551

Connection to the CIP:

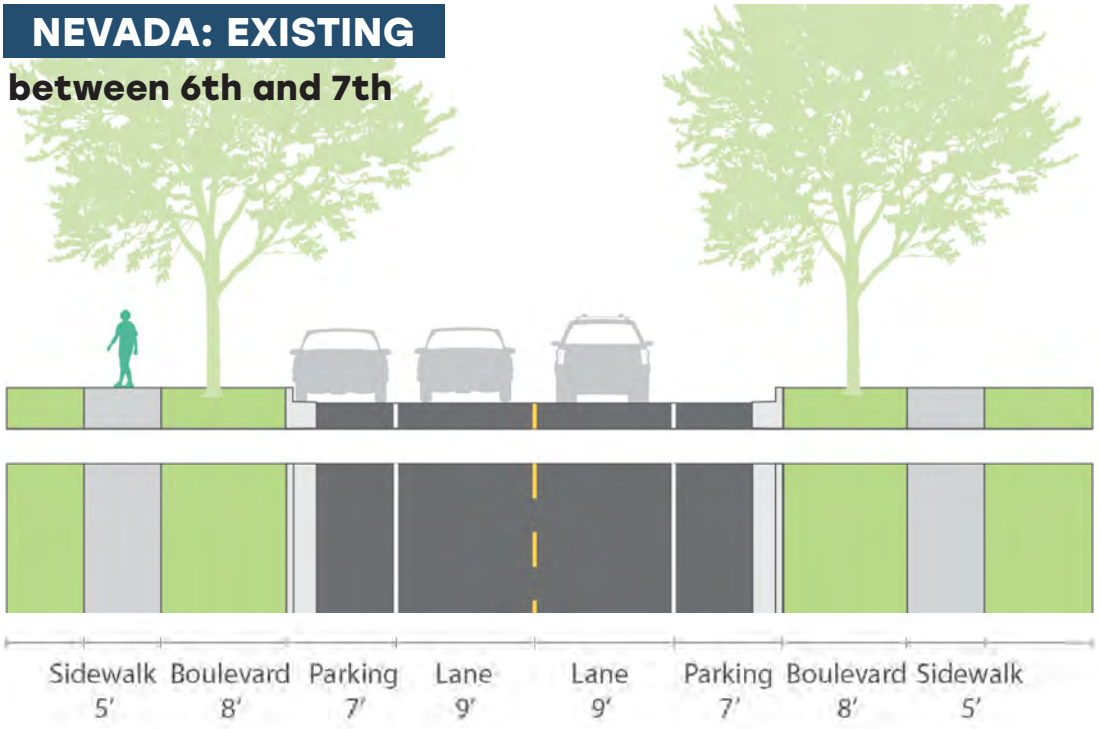
- Maple Street from Ames Street to Jefferson Parkway: sidewalk/trail improvements (2023); mill and overlay (2026)
- Maple Street from Elm Street to Woodley Street E: sidewalk/trail improvements (2023)
- Maple Street north of Woodley Street E to the intersection of Nevada Street and 4th Street E: No project identified

Notes on the Proposed Cross Sections

- Nevada Street recommendation: implement a bicycle boulevard from Fourth Street E to Ninth Street E. Nevada Street is 32 feet wide in this section, and a separated bikeway would be tight and require full parking removal.
- There is no CIP project associated with Nevada Street at this time. Assumption for the bicycle boulevard is a stamped bike symbol with “BLVD” below it–one in each directions at the entrance of each block.
- Maple Street recommendation: install a two-way separated bikeway from Ninth Street to Jefferson Parkway on the west side of the street and retain parking on the east side of the street. The separated bikeway would require striping and signage, and is an opportunity to install concrete bike buffers as a form of separation within a four-foot buffer.
- The street narrows from Maple Court to Jefferson Parkway, and parking would need to be removed from both sides of the street in this section.
- In the stretch between Sibley Street and Meadow View Drive, the recommendation is to bring the bikeway off street and provide a shared use path adjacent to Spring Creek Elementary.
- Consider an off-street shared-use path the full stretch of Maple Street if the budget could support it.
- The west side was chosen to connect to Spring Creek Elementary School.
- This project will connect to the existing bikeway on Fourth Street E and farther north on Nevada Street, as well as Eighth Street E planned and existing bikeways.

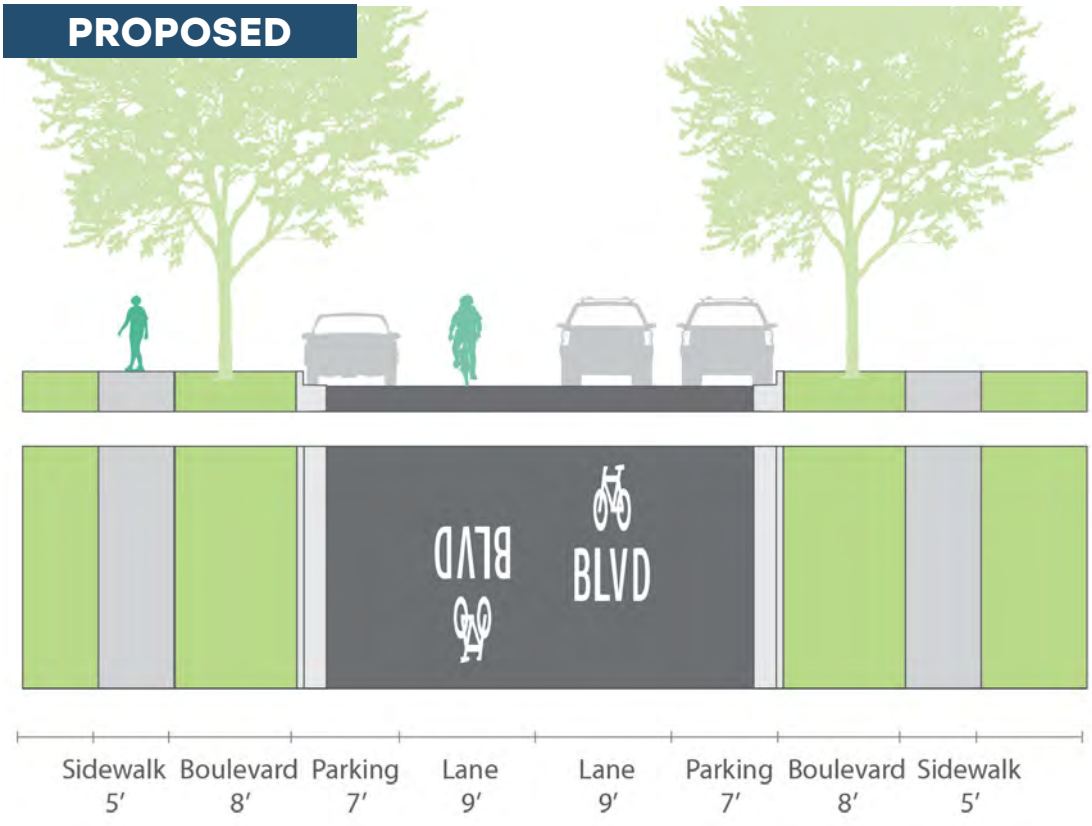
NEVADA: EXISTING

between 6th and 7th



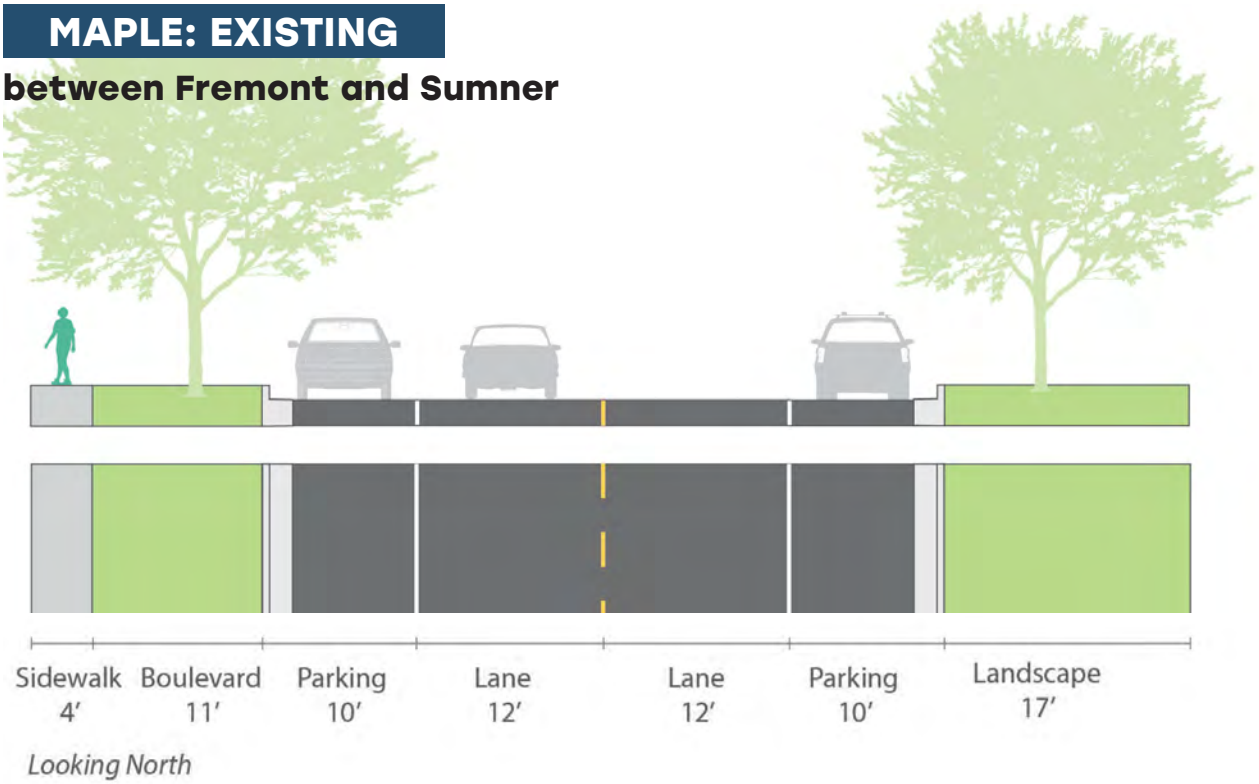
Looking North

PROPOSED



MAPLE: EXISTING

between Fremont and Sumner



Looking North

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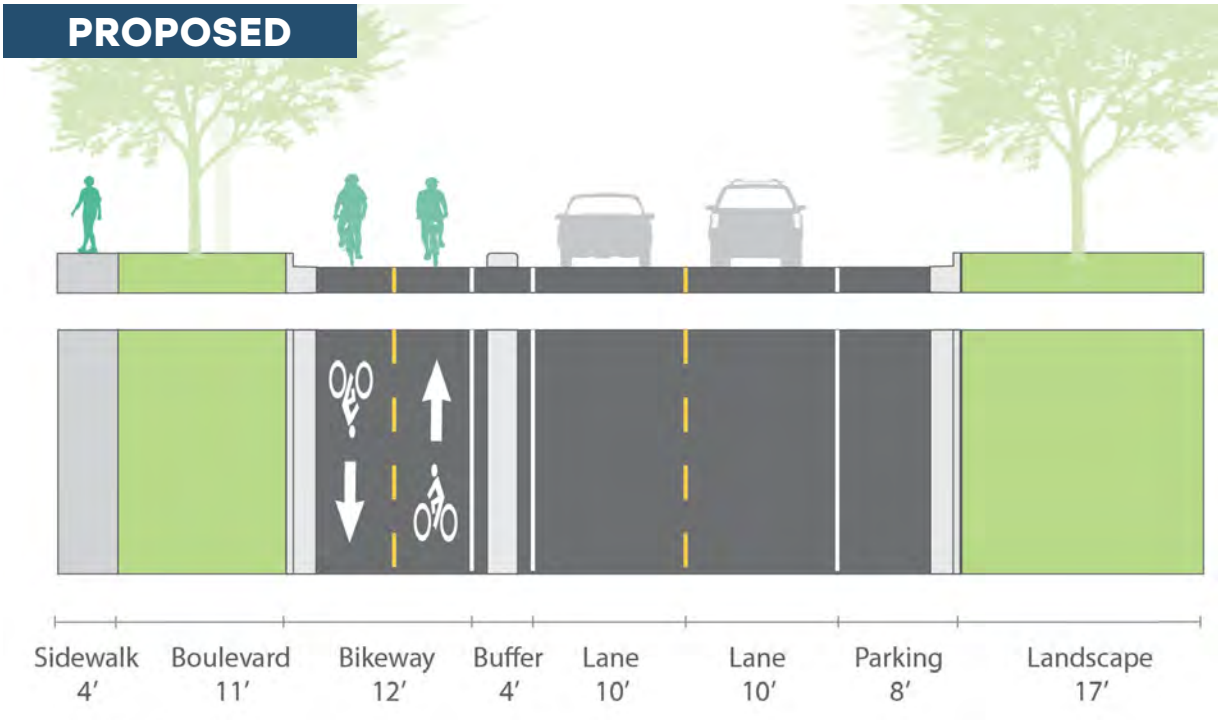

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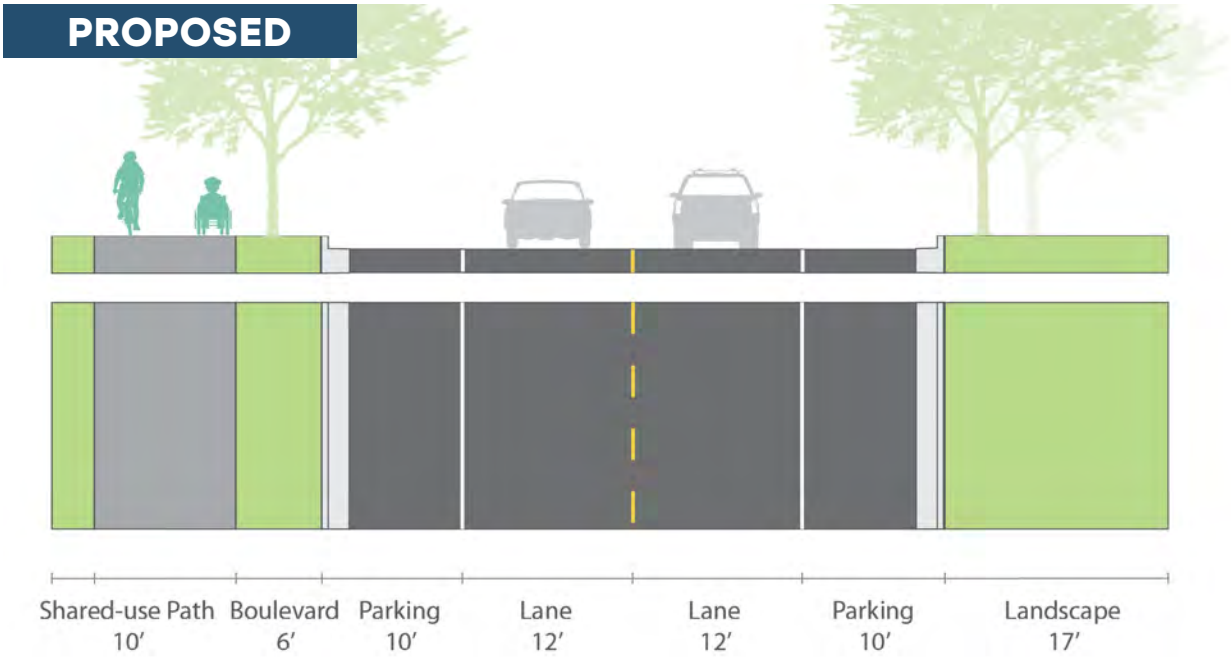

Shared-use Path
10′
Boulevard
6′
Parking
10′
Lane
12′
Lane
12′
Parking
10′
Landscape
17′


4th Street
Nevada Street
Woodley Street E
Maple Street
Jefferson Parkway
N
Proposed bikeway extents
Location of cross section

Heritage Drive/Adams Street/Roosevelt Drive:
From Just West of Hidden Valley Road on Heritage Drive to Jefferson Parkway

Overview

Length: 1.5 miles

Existing Curb-to-Curb: 40 feet on Heritage Drive, 36 feet on Adams Street, and 44 feet on Roosevelt Drive W

Total Right-of-Way: ranges from 70 to 80 feet

Traffic Volumes (AADT, based on two full-day counts):

- Heritage Drive east of Valley Drive: 1,192
- Roosevelt Drive between Jefferson Parkway and Humphrey Court/Jackson Court: 1,372
- Roosevelt Drive between Tyler Court and Van Buren Court: 889

Connection to the CIP:

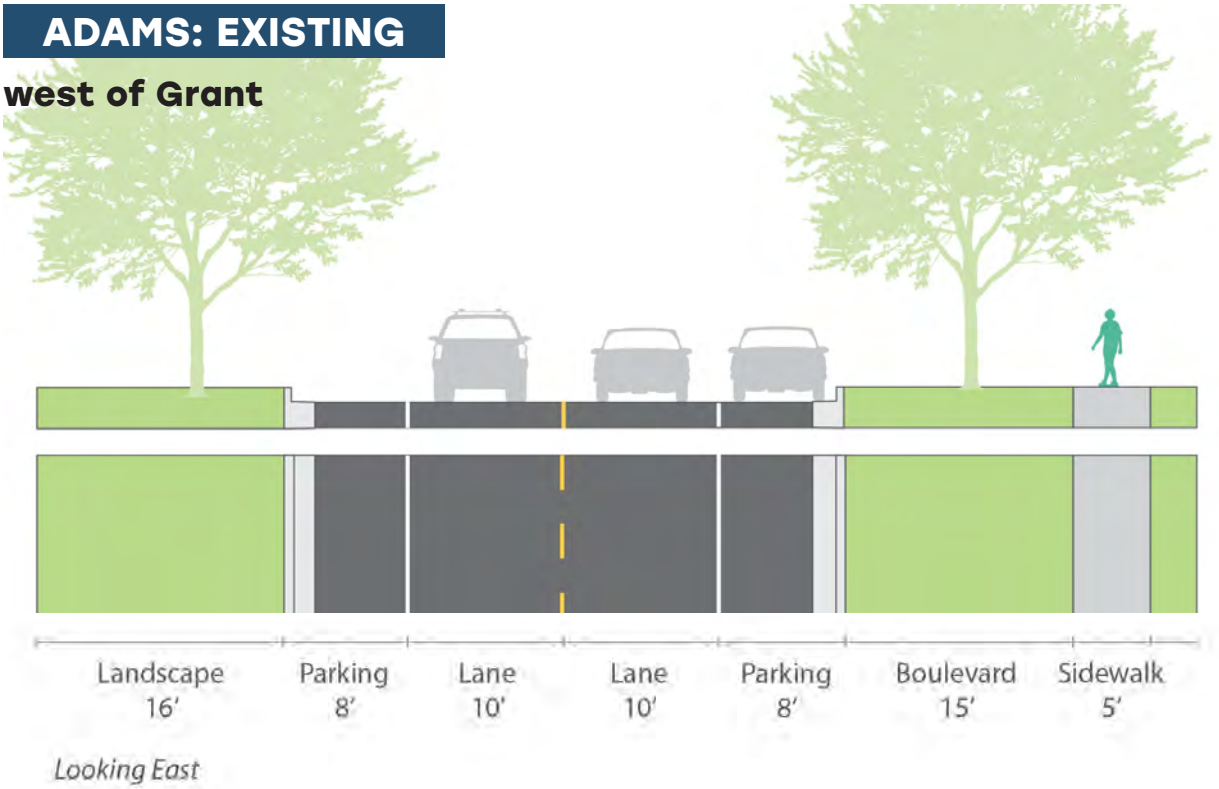
- Heritage Drive, Lincoln Street S, and Adams Street: Reclamation (2023)
- Roosevelt Drive: No project identified

Notes on the Proposed Cross Sections

- Heritage Drive, Lincoln Street S, and Adams Street recommendation: shift the street as a part of a reclamation project and construct a two-way, off-street separated bikeway on the north/west side of the street.
- Roosevelt Drive recommendation: implement a retrofit two-way, in-street separated bikeway on the outside of the loop. There is no CIP project associated with Roosevelt Drive at this time. The project would include striping, signage, and concrete bike buffers as a form of separation within a four-foot buffer.
- The proposed bikeway on Heritage Drive, Lincoln Street, and Adams Street is located on the north side of Heritage Drive in order to connect with the existing two-way bikeway to the west. This route will connect bicyclists to Jefferson Parkway, which is a planned bikeway and connects people to destinations and other bikeways to the east.

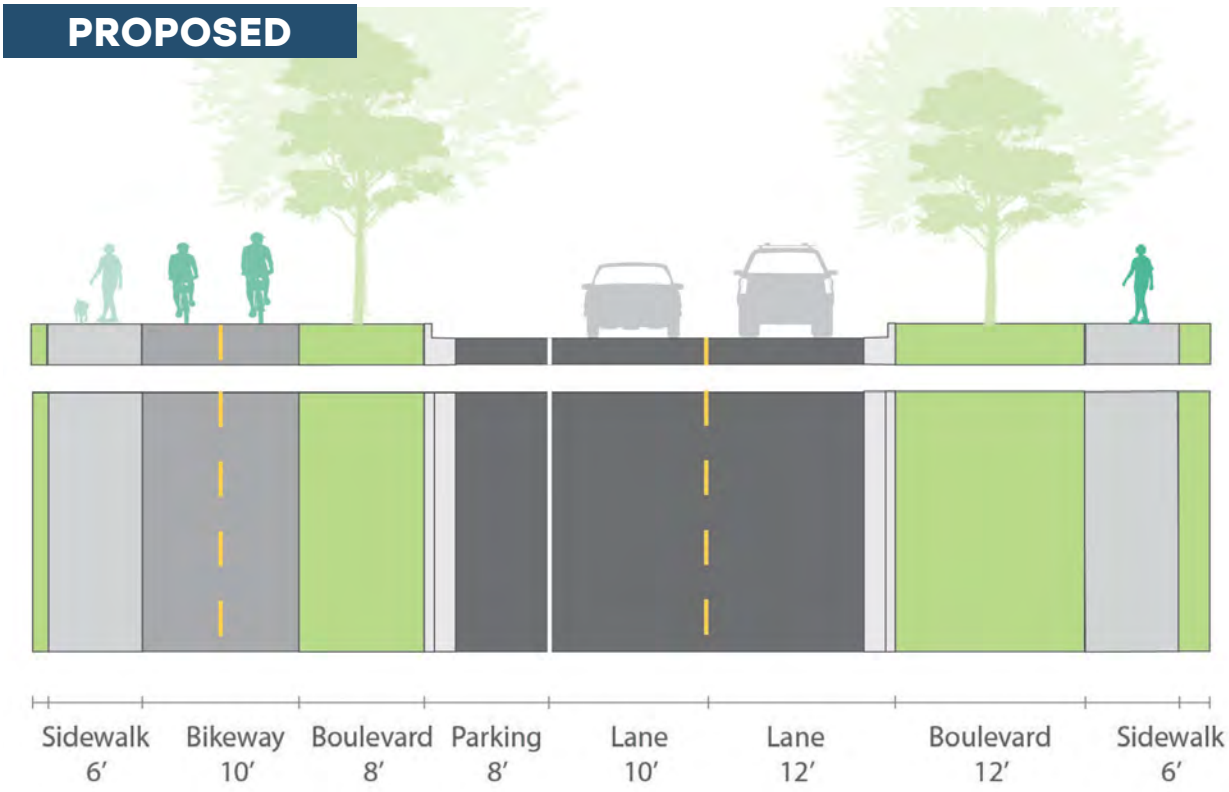
ADAMS: EXISTING

west of Grant



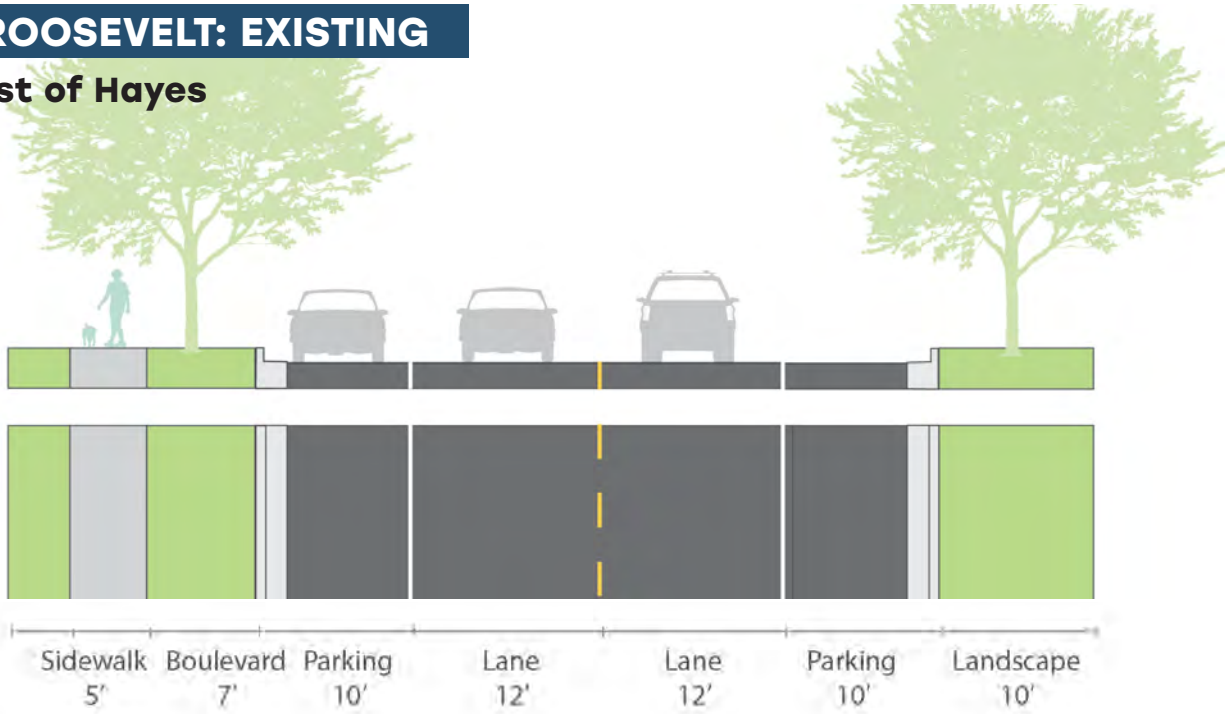
Looking East

PROPOSED



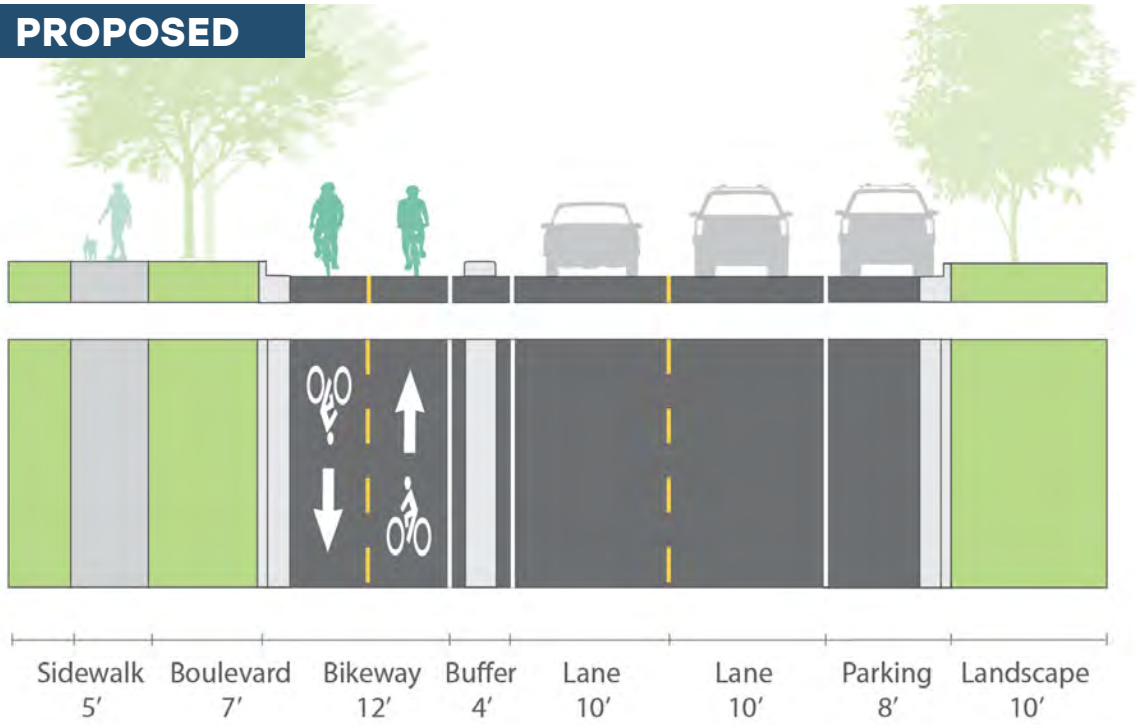
ROOSEVELT: EXISTING

west of Hayes



Looking East

PROPOSED



Lincoln Street N/Lincoln Parkway/Spring Street:

From Forest Avenue North to Lincoln Parkway, Looping East to Spring Street N and Then South to Greenvale Avenue W

Overview

Length: 1.6 miles

Existing Curb-to-Curb: 36 feet on Lincoln Street north to Greenvale Avenue W on the west side, and 44 feet on the loop ending at Spring Street N and Greenvale Avenue W on the east side

Total Right-of-Way: ranges from 65 to 78 feet

Traffic Volumes (AADT, based on two full-day counts):

- Lincoln Street N between Greenvale Avenue W and St. Olaf Avenue: 3,047
- Lincoln Street N north of First Street W: 3,124

Connection to the CIP:

- No project identified

Notes on the Proposed Cross Sections

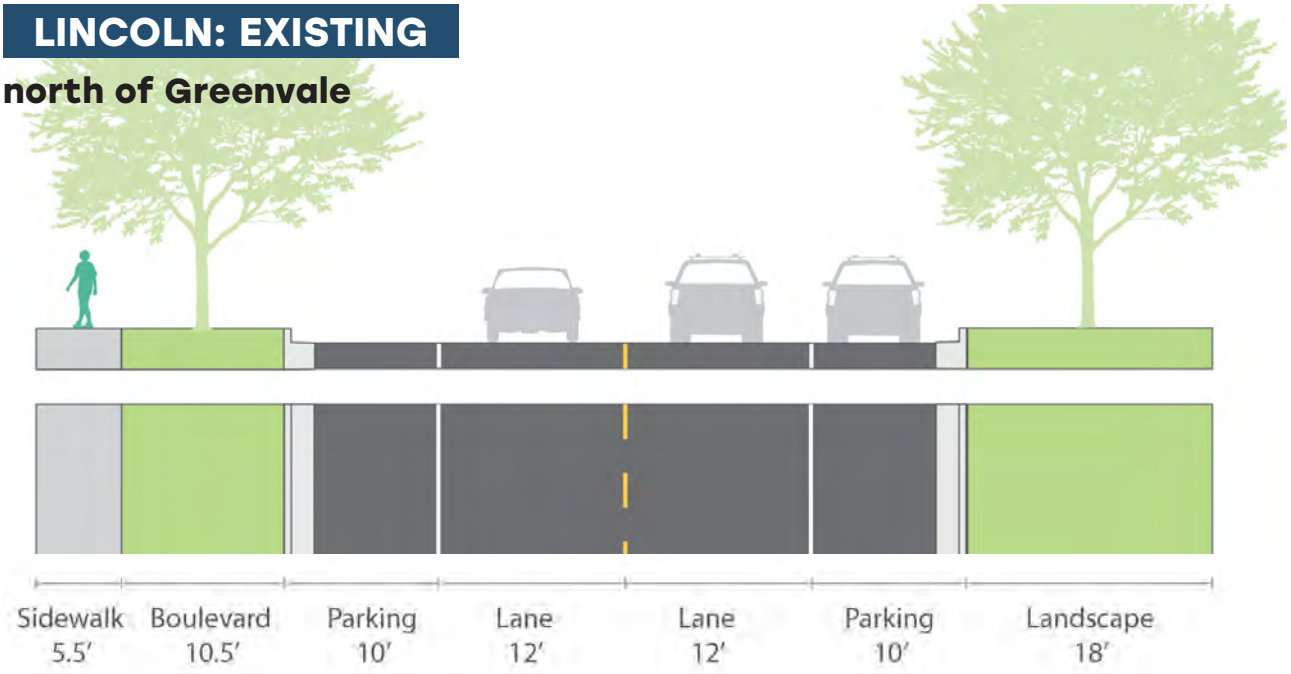
- Lincoln Street N/Lincoln Parkway/Spring Street recommendation: implement a two-way, in-street separated bikeway on the outside of the loop. The project would include striping, signage, and concrete bike buffers as a form of separation within a four-foot buffer.
- This route connects St. Olaf College, Greenvale Park Elementary School, Northfield Community Education Center, and indirectly connects to Longfellow District Office and Area Learning Center, and Open Door Preschool.
- The proposed bikeway is planned to connect to the Mill Town Trail at the intersection of Armstrong Road and Sechler Park Road.

Proposed bikeway extents

Location of cross section

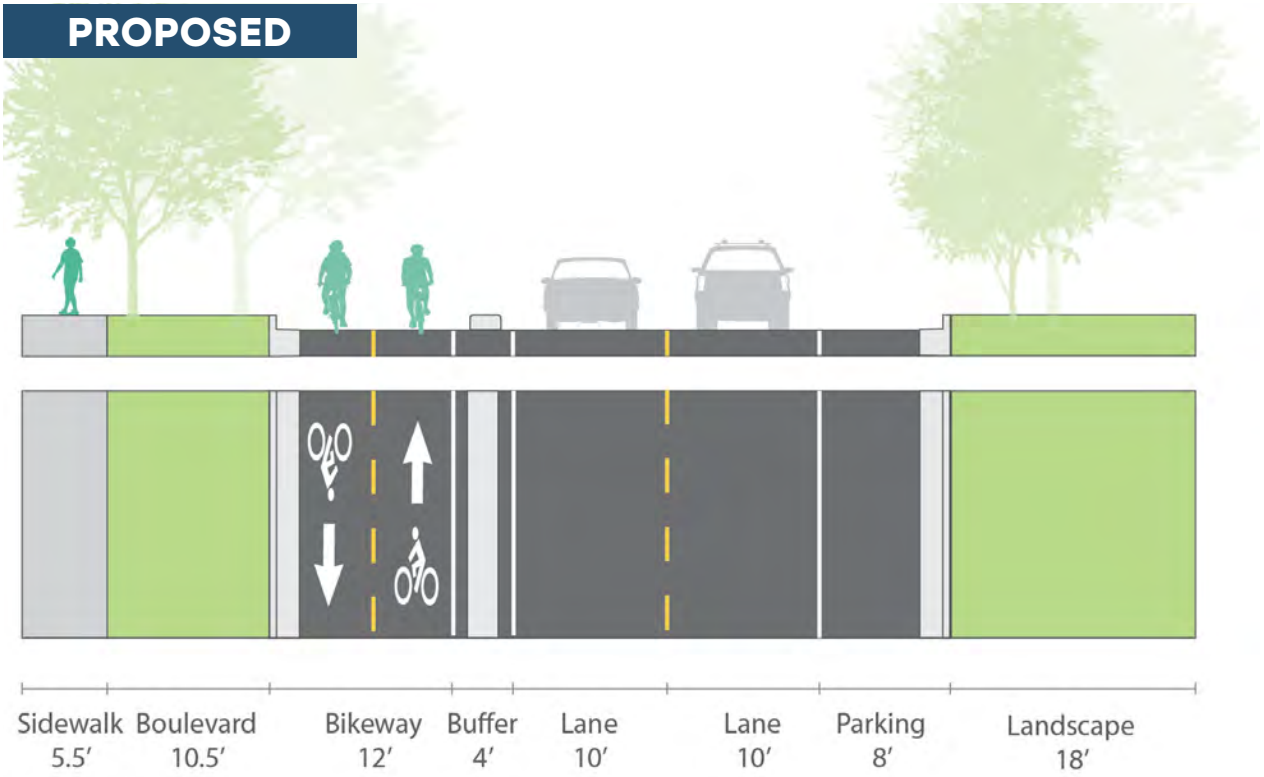
LINCOLN: EXISTING

north of Greenvale



Looking North

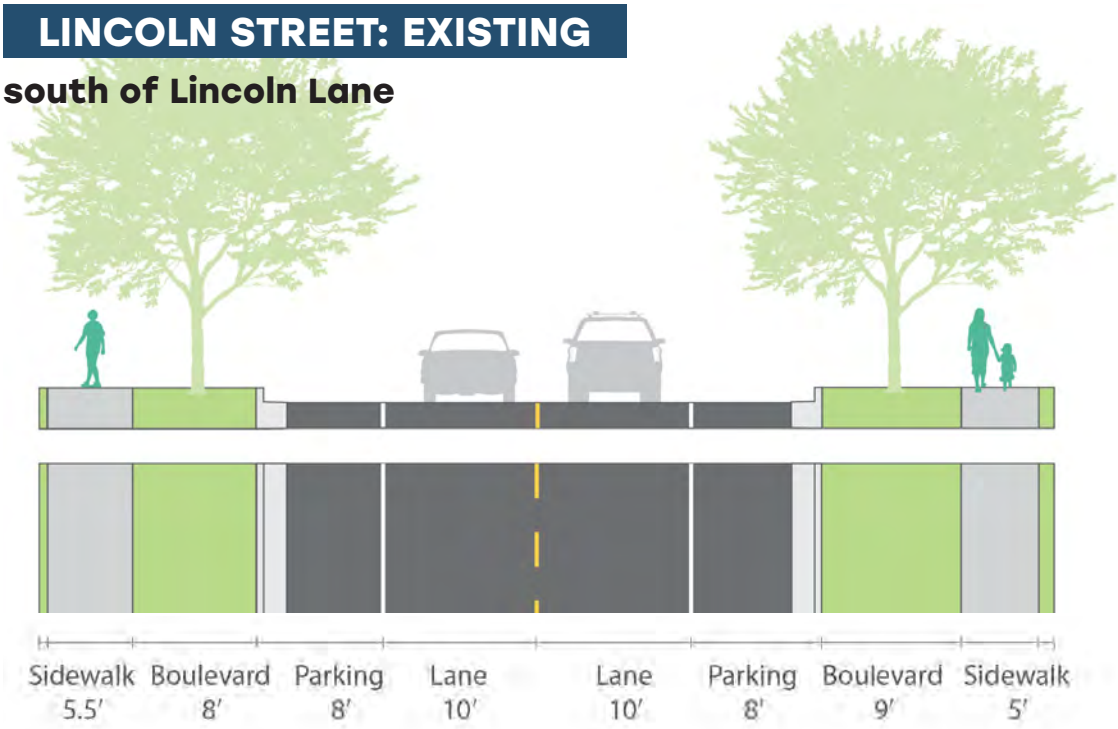
PROPOSED



Looking North

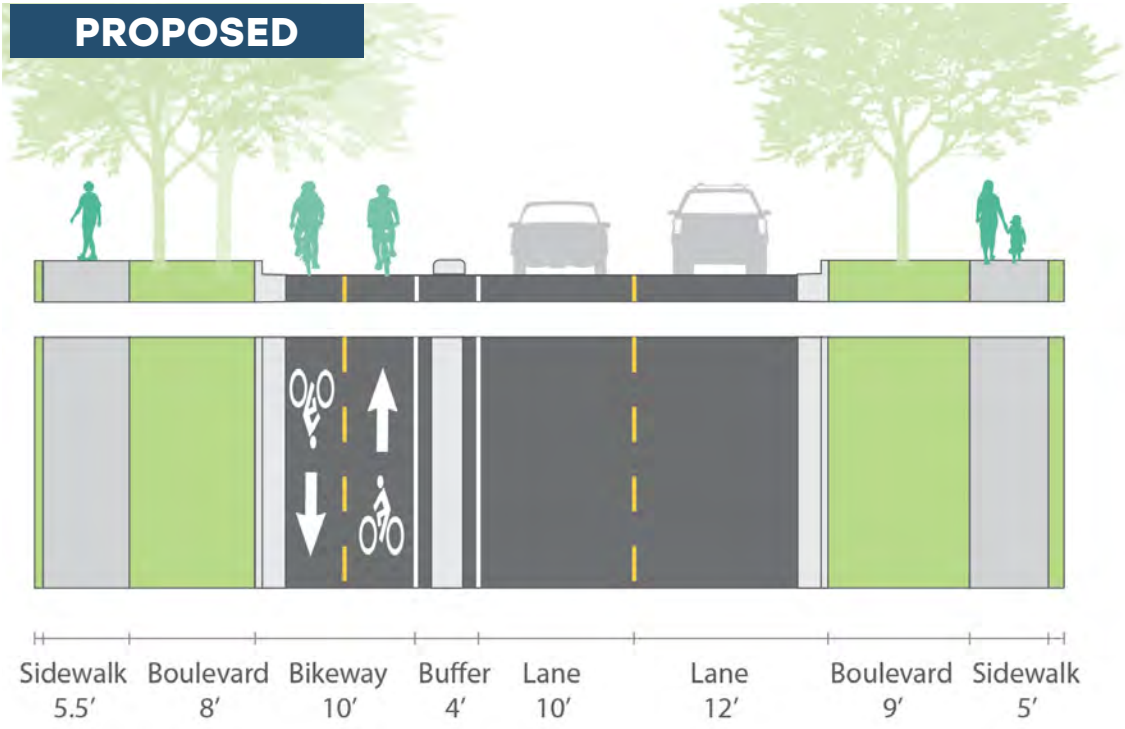
LINCOLN STREET: EXISTING

south of Lincoln Lane



Looking North

PROPOSED



Looking North

Armstrong Road:

From Sechler Park Road to Lincoln Street S

Overview

Length: 1 mile

Existing Curb-to-Curb: 24-foot street with no curb and gutter on the southern portion to just south of Industrial Drive, and 44 feet on the northern portion to Lincoln Street S

Total Right-of-Way: 80 feet

Traffic Volumes (AADT, based on two full-day counts):

- Armstrong Road between Industrial Drive and Sechler Park Road: 2,249
- Armstrong Road between Colville Memorial Highway and Industrial Drive: 2,754
- Armstrong Road west of Lincoln Street S: 2,480

Connection to the CIP:

- No project identified

Proposed bikeway extents

Location of cross section

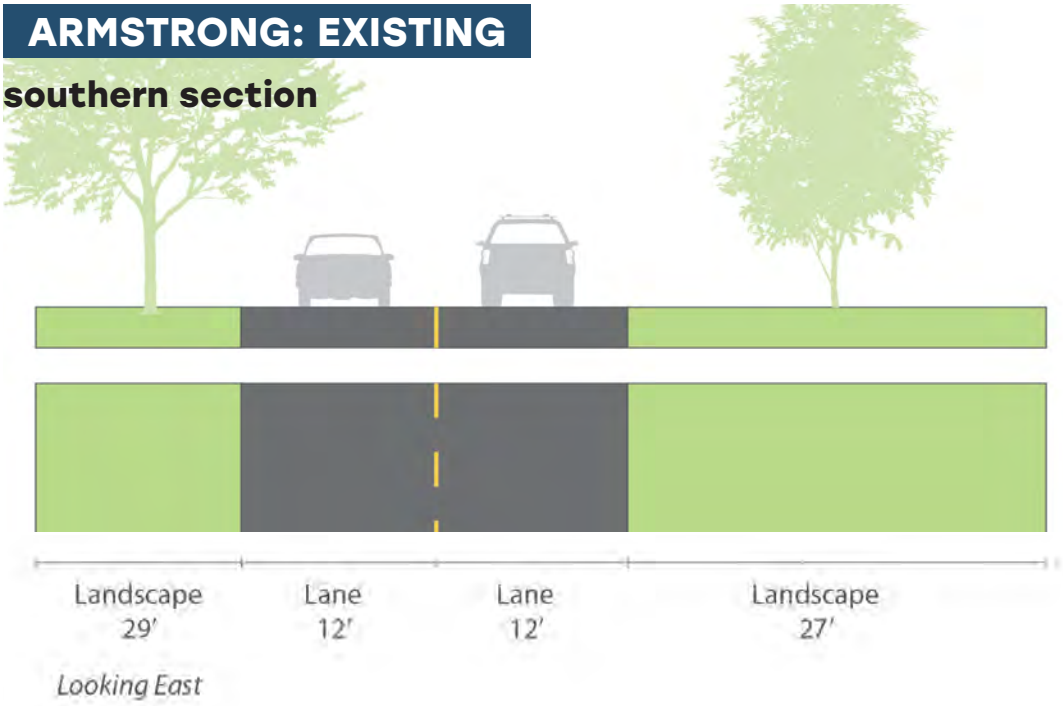
Notes on the Proposed Cross Sections

- Armstrong Road recommendation: construct an off-street shared-use path on Armstrong Road from Sechler Park Road to Highway 19. The proposed bikeway is planned to connect to the Mill Town Trail, where it terminates on Armstrong Road at Sechler Park Road, and to the planned bikeway on Lincoln Street S.
- There are existing one way in street bike lanes on Armstrong from Highway 10 to Lincoln Street S. Recommend a retrofit two way bikeway in the stretch. The assumption for a project would include striping, signage and concrete bike buffers as a form of separation within a 4-foot buffer.
- There are ROW constraints along the northern section of Armstrong Road, particularly near Industrial Drive. The City may need to explore an easement to get proper separation from the street, adequate trail width, and clear zones.
- There are also some grade challenges along the 24-foot street section in the southern portion of Armstrong Road. Further exploration of grading and slope issues will be required in concept and final design phases of a trail project.
- The MnDOT Bicycle Facility Design Manual notes a two-foot minimum horizontal clearance per State Aid Standards and five-foot minimum for steep slopes.[1]

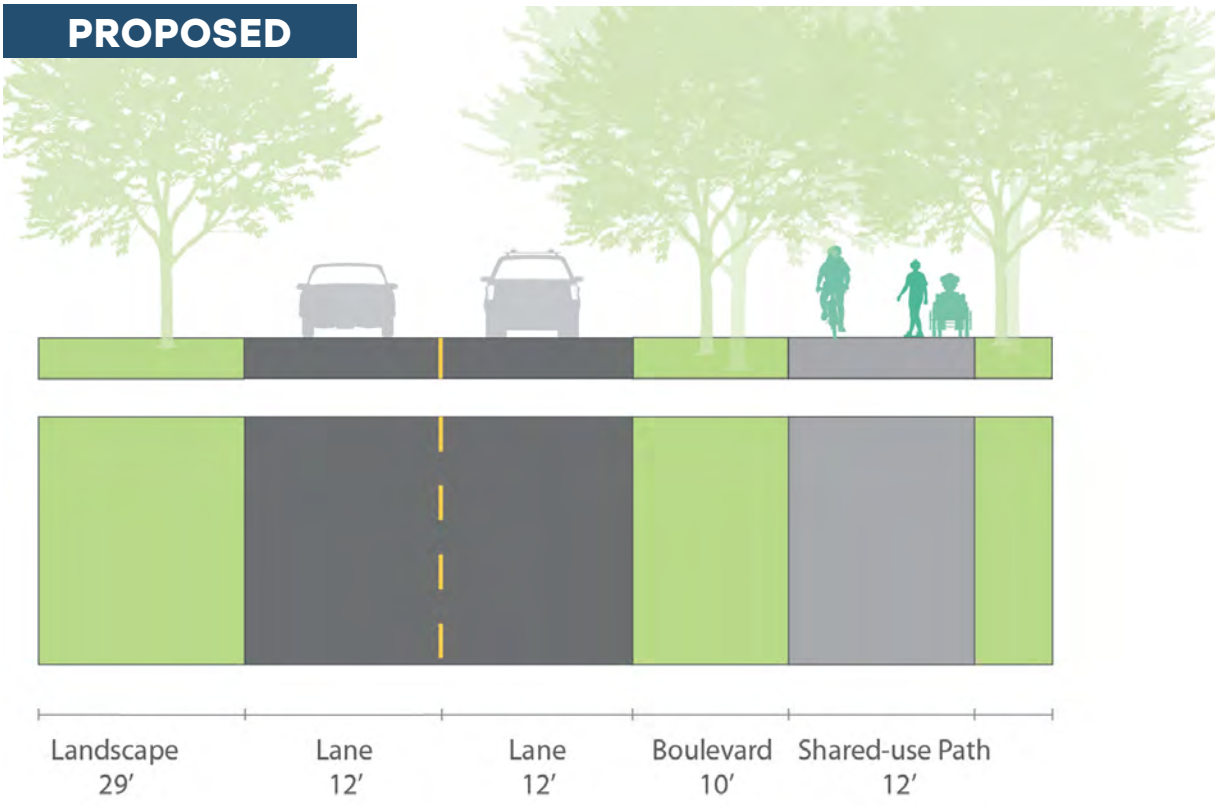
1 *https://www.dot.state.mn.us/bike/bicycle-facility-design-manual.html*

ARMSTRONG: EXISTING

southern section

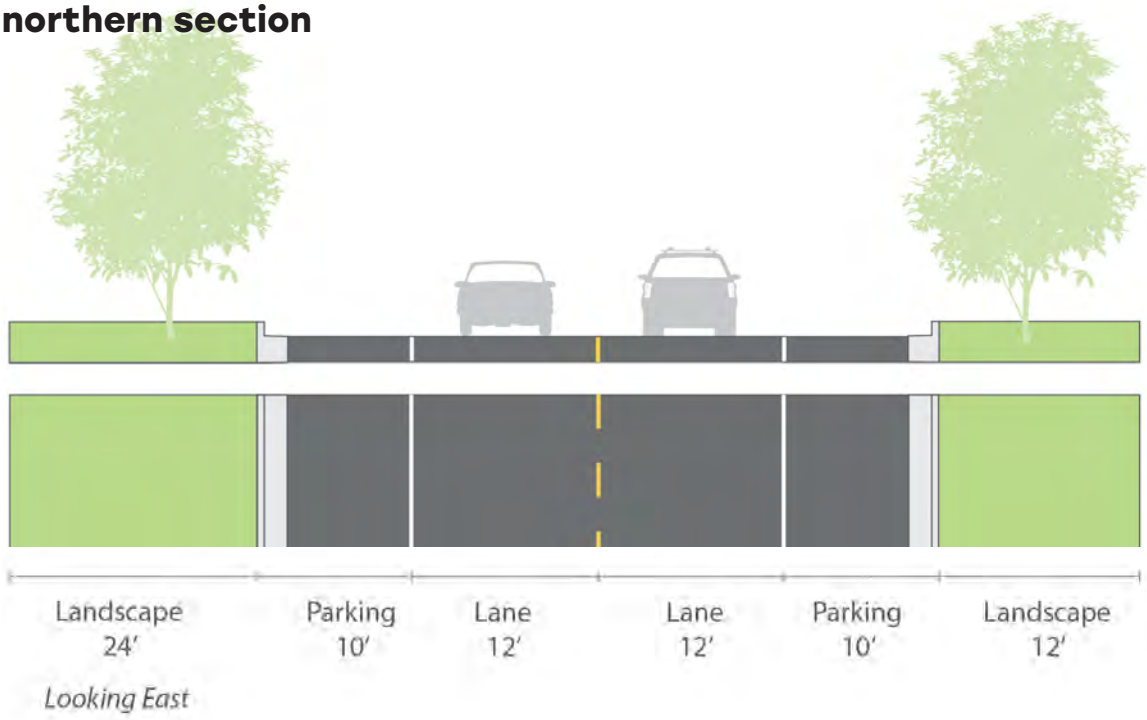


PROPOSED



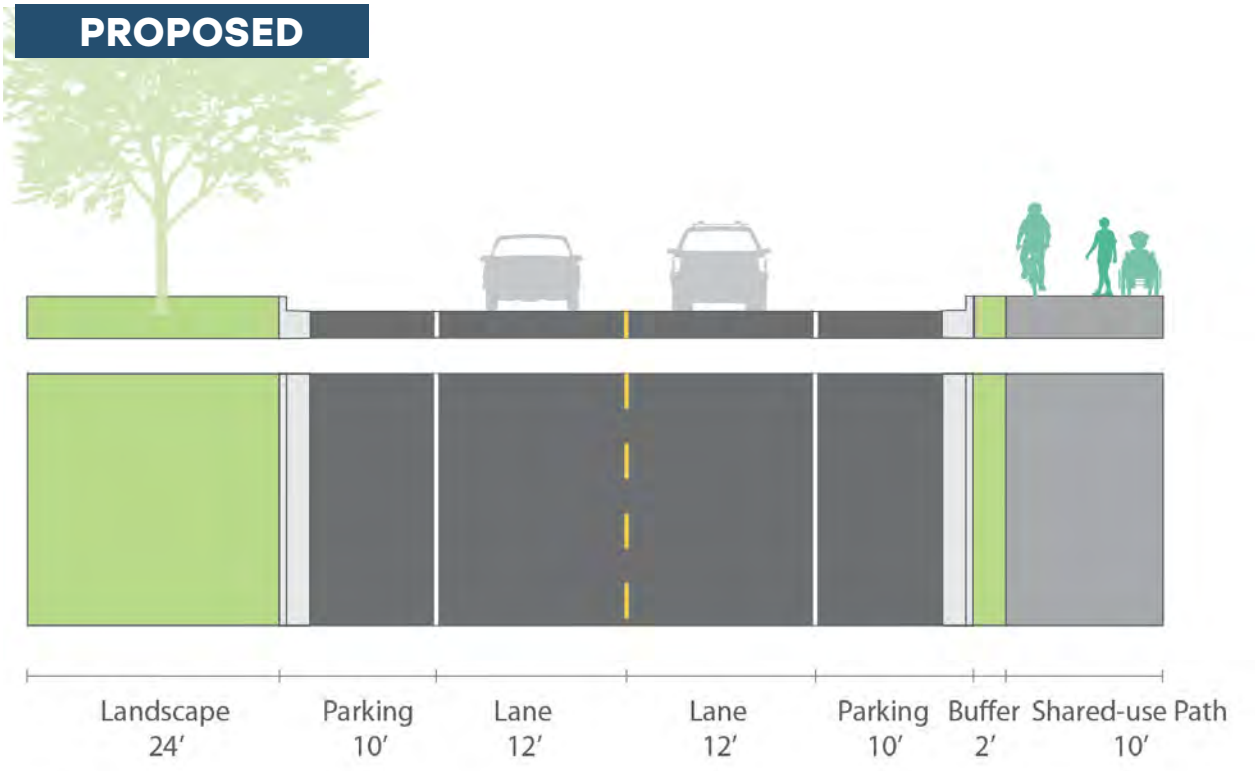
ARMSTRONG: EXISTING

northern section



Looking East

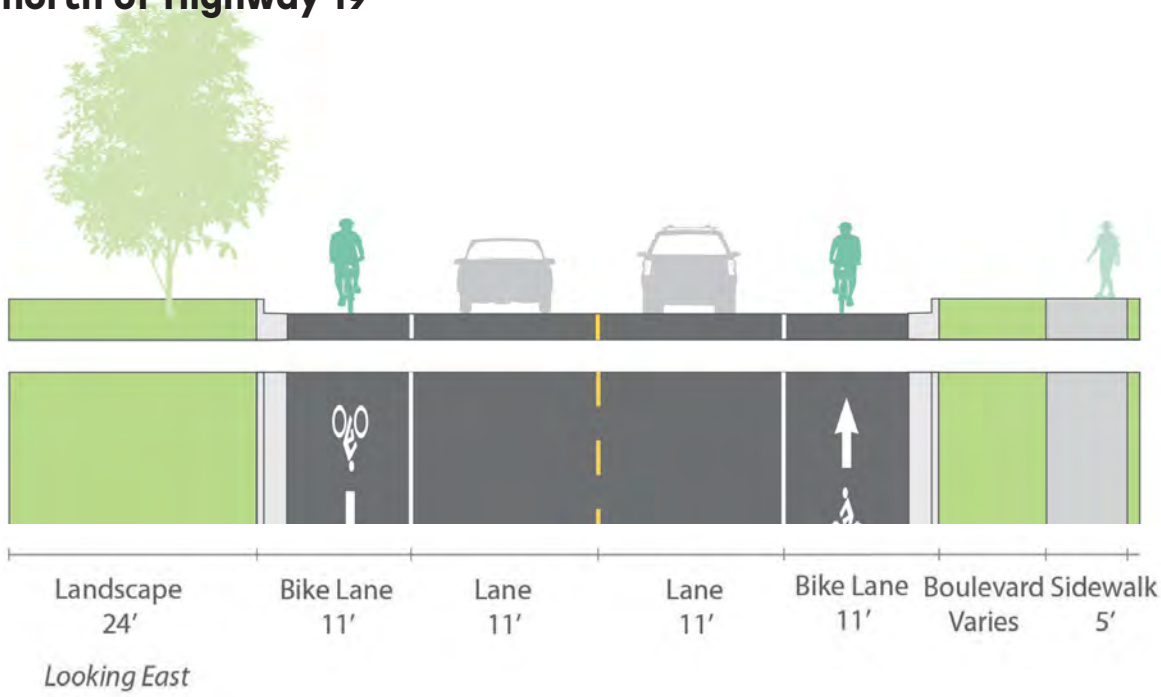
PROPOSED



Looking East

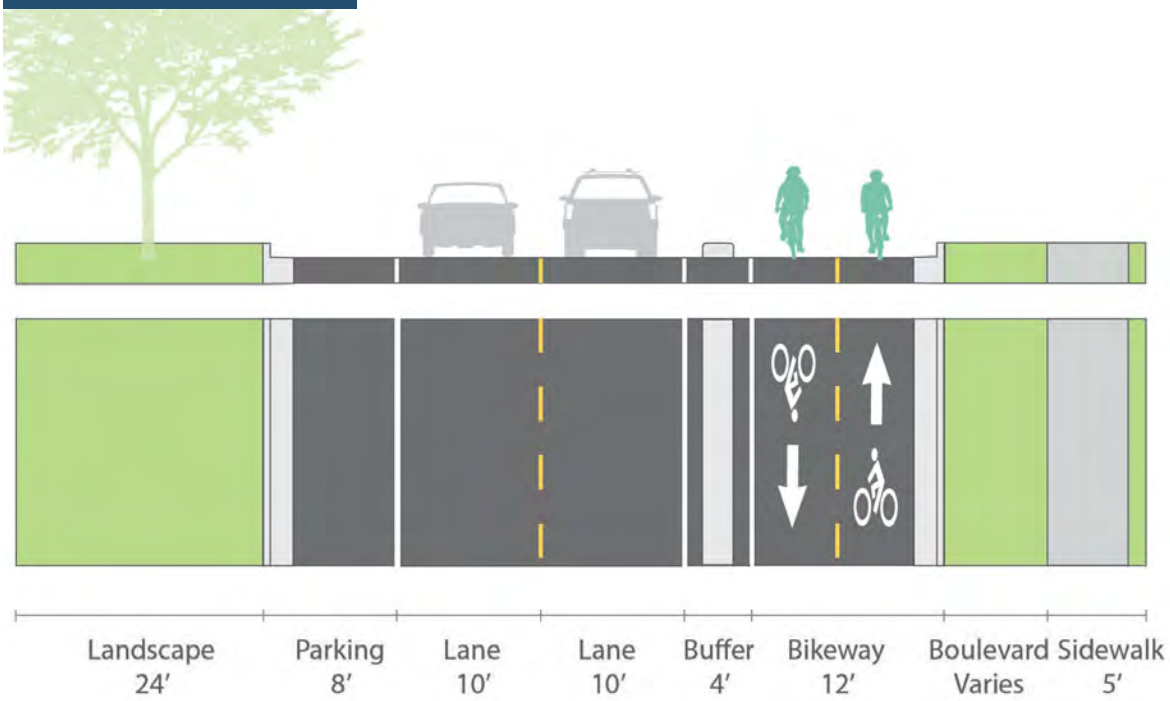
ARMSTRONG: EXISTING

north of Highway 19



Looking East

PROPOSED



Looking East

Washington Street:

From Woodley Street E South to the Cul-de-Sac

Overview

Length: 0.4 miles

Existing Curb-to-Curb: 36 feet from Woodley Street W to Ames Street, and 32 feet from Ames Street to the cul-de-sac

Total Right-of-Way: 80 feet from Woodley Street to Ames Street, and 66 feet from Ames Street to cul-de-sac

Traffic Volumes (AADT, based on two full-day counts):

- Washington Street south of Woodley Street E: 530

Connection to the CIP:

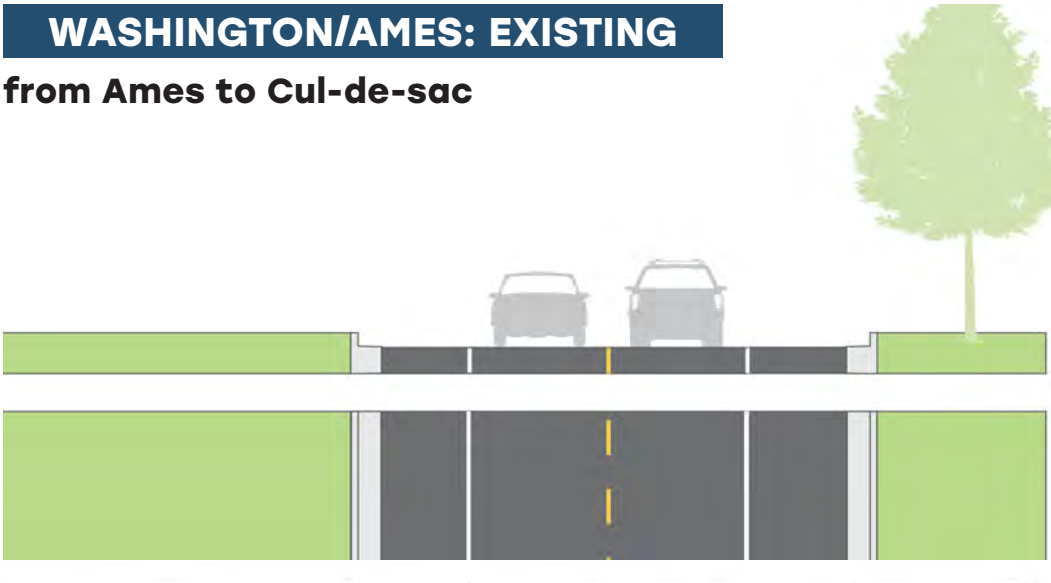
- Woodley Street E to Sumner Street E: No project identified
- Sumner Street E to cul-de-sac: reclamation and sidewalk/trail improvements (2025)

Notes on the Proposed Cross Sections

- Recommendation for Washington Street E from Sumner Street E to the cul-de-sac: construct a two-way shared-use path on the west side as a part of the reclamation project.
- Recommendation for Washington Street E from Woodley Street E to Sumner Street E: explore expanding the scope of the reclamation project two blocks north to Woodley Street E and match the two-way shared-use path recommendation. If expanding the scope is not feasible, the alternative recommendation is to include a two-way separated bikeway with a concrete bike buffer within the existing street section as a retrofit project to connect to Woodley Street E. This option would include removing parking from both sides of the street.
- This project connects to the existing bicycle boulevard on Washington Street and may include future connections to the south.

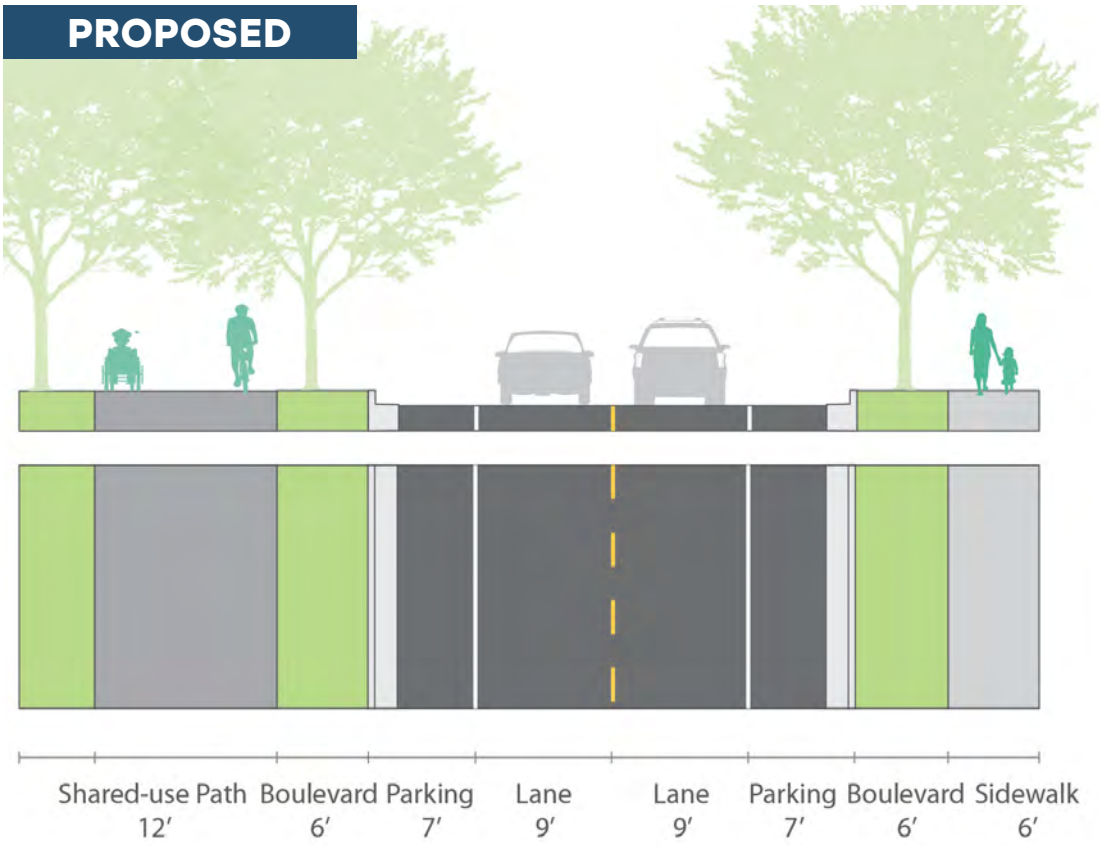
WASHINGTON/AMES: EXISTING

from Ames to Cul-de-sac



Looking North

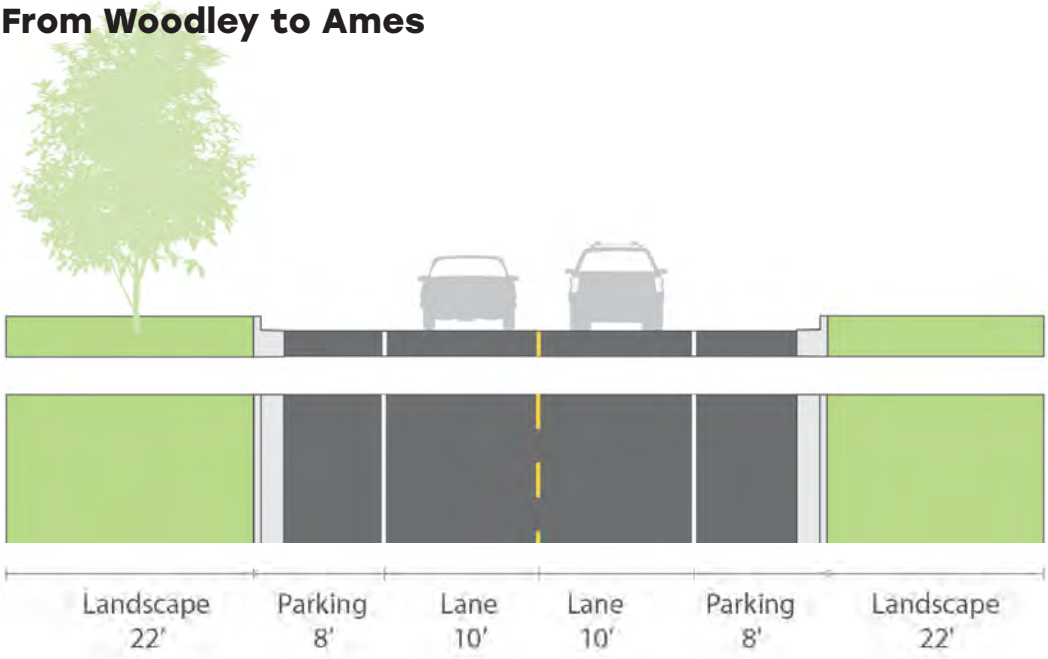
PROPOSED



Looking North

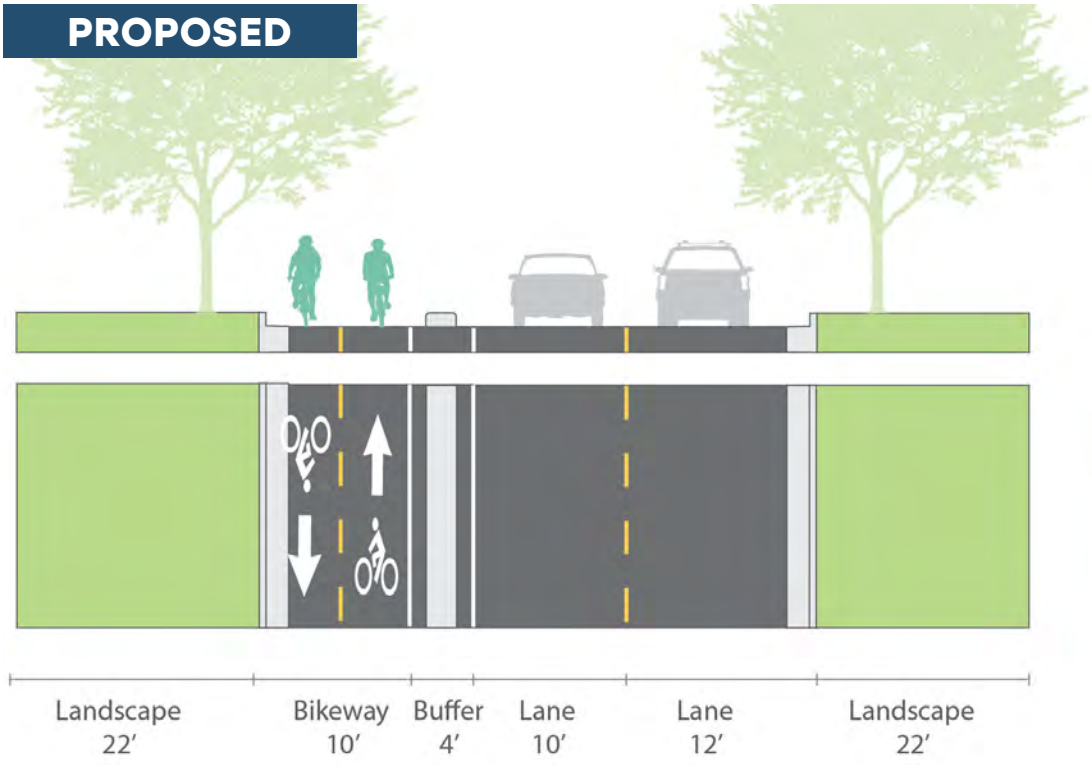
WASHINGTON/WOODLEY: EXISTING

From Woodley to Ames

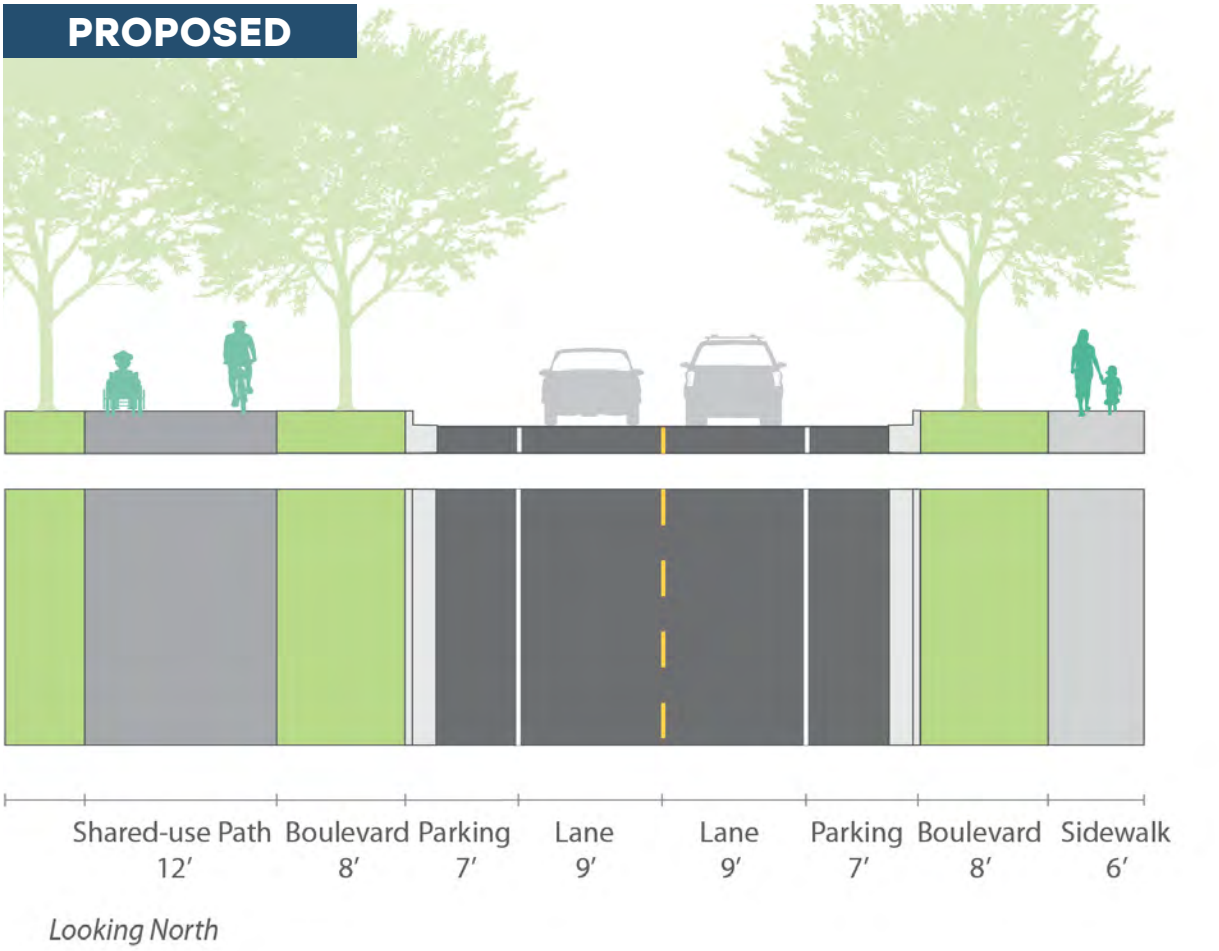


Looking North

PROPOSED



Looking North


PROPOSED
Shared-use Path 12′
Boulevard 8′
Parking 7′
Lane 9′
Lane 9′
Parking 7′
Boulevard 8′
Sidewalk 6′
Looking North

Eighth Street E:

from Water Street S to Nevada Street S

Overview

Length: 0.5 miles

Existing Curb-to-Curb: 38 feet from Water Street S to Washington Street S, 32 feet from Washington Street S to College Street S, and 40 feet from College Street S to Nevada Street S

Total Right-of-Way: 80 feet

Traffic Volumes (AADT, based on two full-day counts):

- No counts taken

Connection to the CIP:

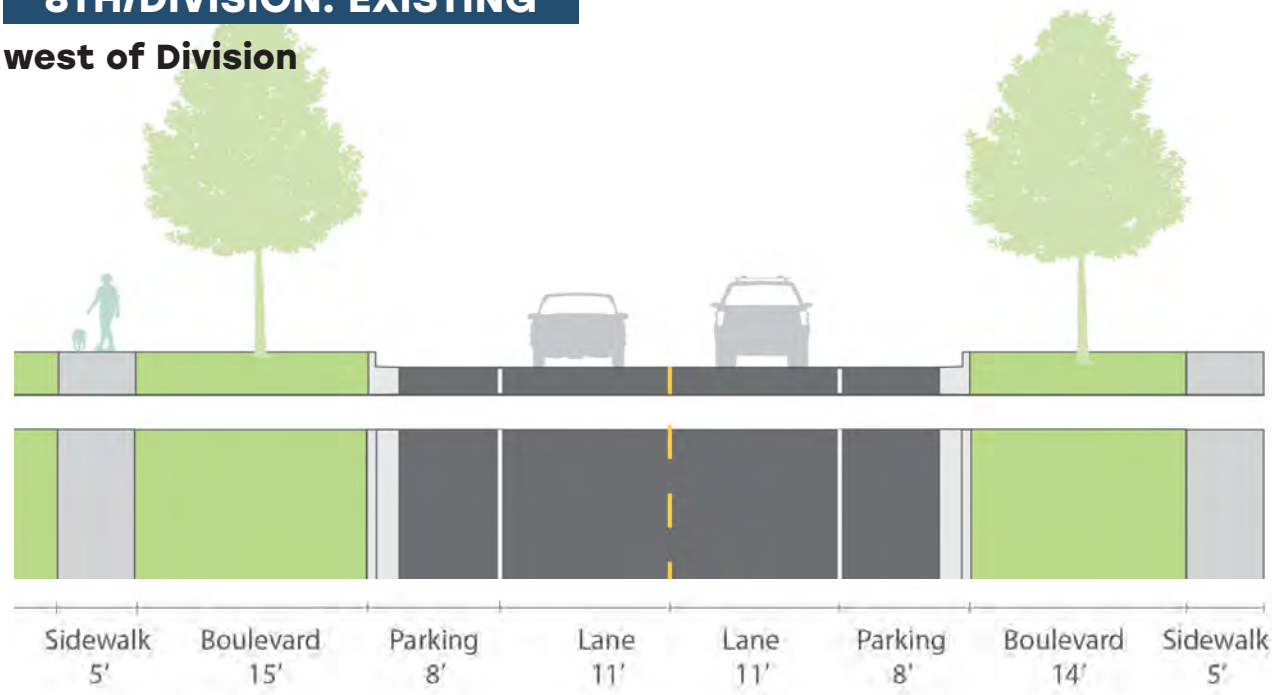
- College Street S to Nevada Street S: Sidewalk/Trail Improvements (2024)
- Water Street to College Street: No project identified

Notes on the Proposed Cross Sections

- Eighth Street E from Union Street S to Nevada Street recommendation: implement a two-way in-street separated bikeway on the north side of the street. This would include striping, signage, and some strategic use of a concrete bike buffer where the buffer width is 4 feet (College Street S to Nevada Street S).
- Recommend expanding the scope of the 2024 Sidewalk/Trail Improvements project to include the four blocks between Water Street S and College Street S. This section would require striping and signage. The width of the street changes every two blocks. Transitions through intersections will be important.
- Recommend connecting with the MnDOT State Aid Office regarding the recommended dimensions. A variance may be required due to minimum dimensions. Eighth Street E is a Municipal State Aid Route west of Washington Street S.
- Eighth St E is a critical east/west connector for the bikeway network in this part of the city. It connects to multiple north/south routes, including Nevada Street S and Washington Street S, as well as the East River Trail (via Linden Street S).

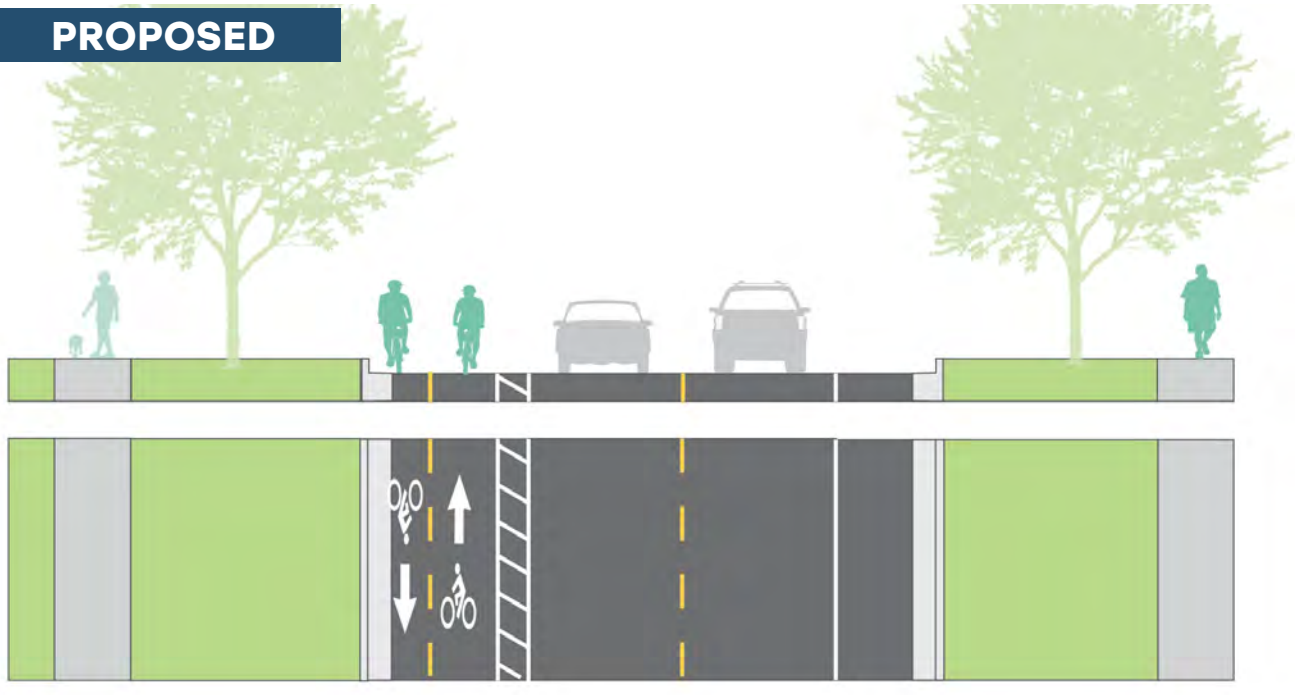
8TH/DIVISION: EXISTING

west of Division



Looking East

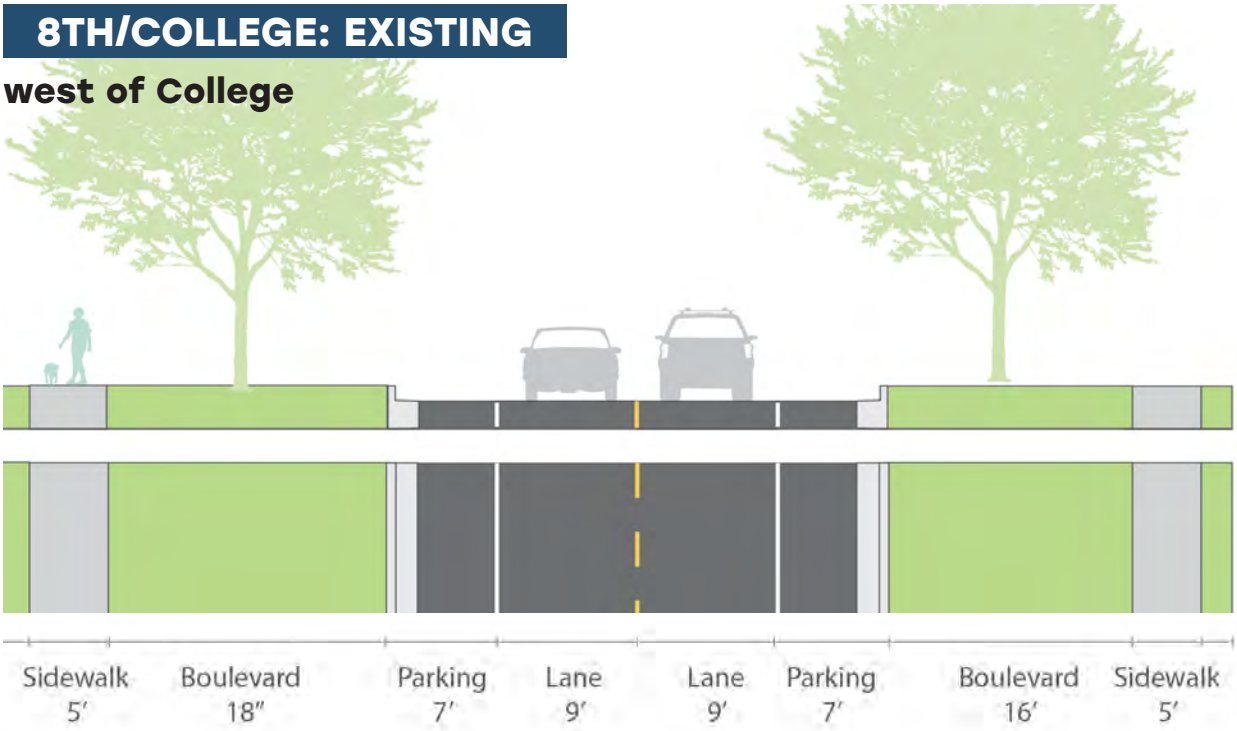
PROPOSED



Looking East

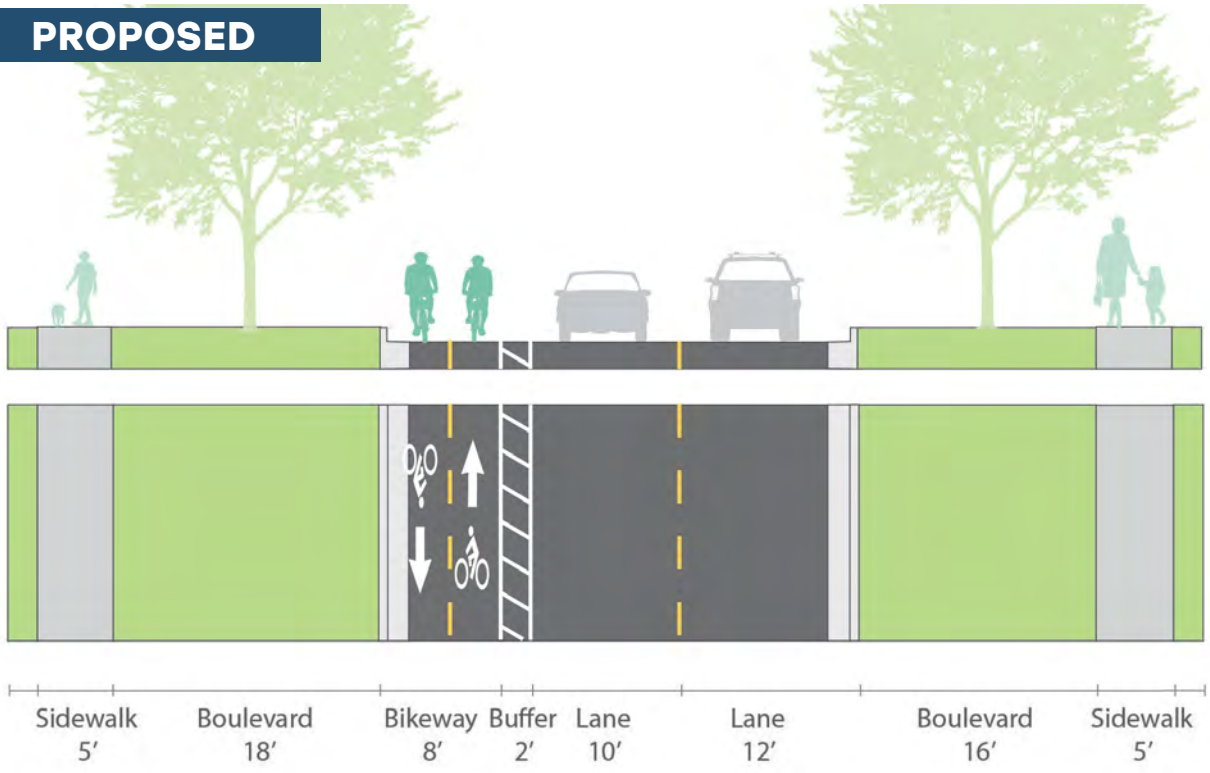
8TH/COLLEGE: EXISTING

west of College



Looking East

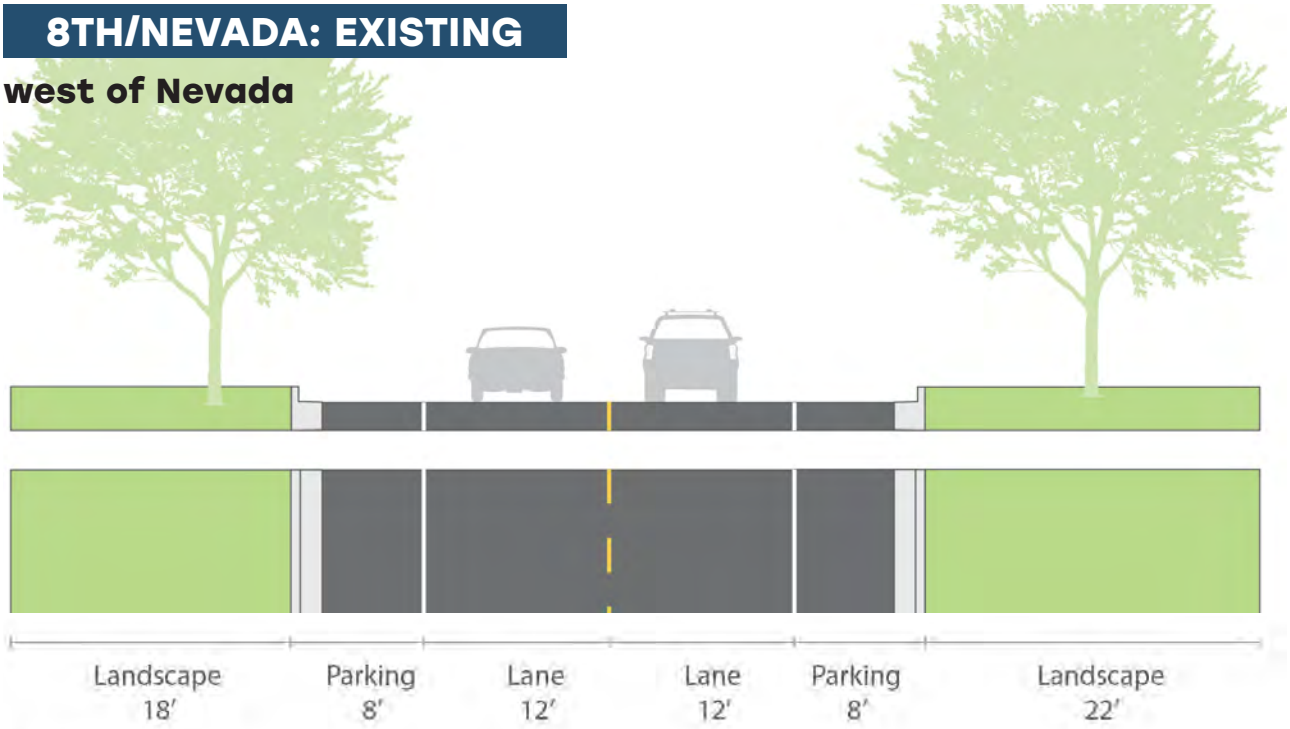
PROPOSED



Looking East

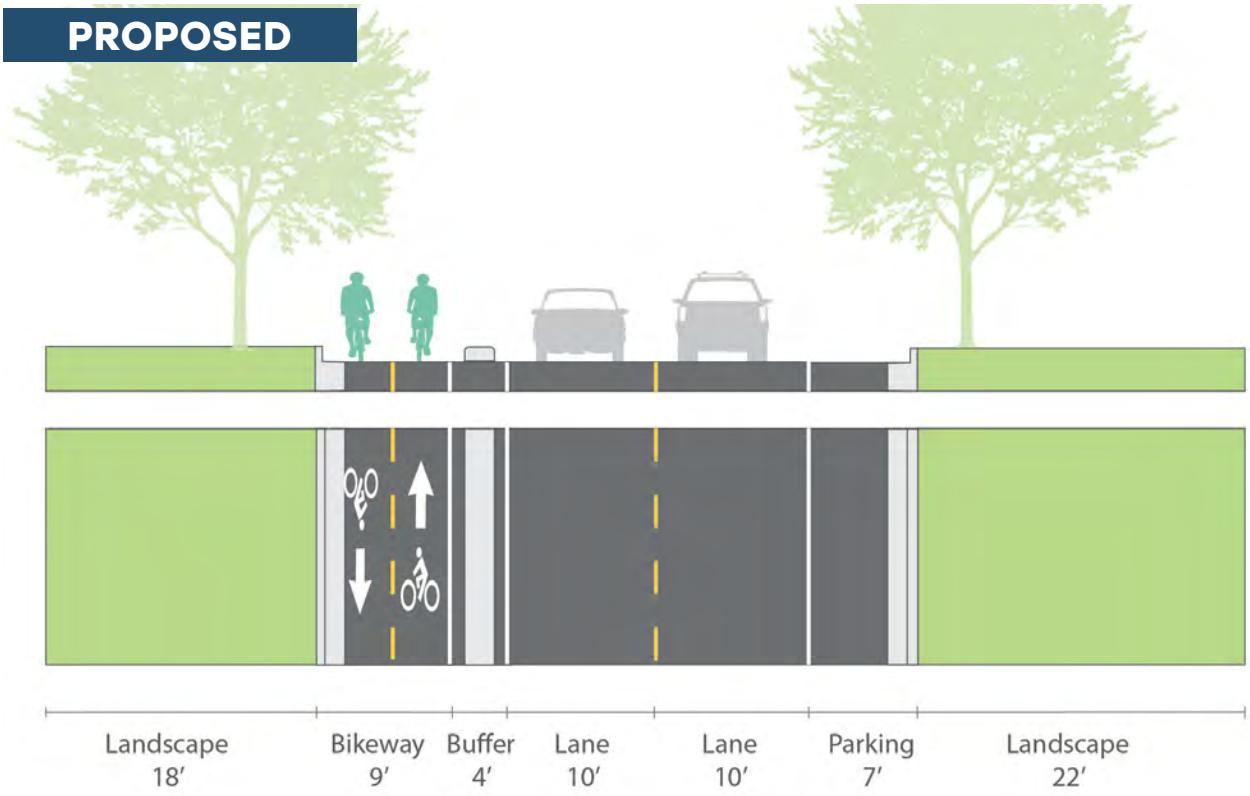
8TH/NEVADA: EXISTING

west of Nevada



Looking East

PROPOSED



Looking East

03

PEDESTRIAN DESIGN CONCEPTS AND REPORT

Approach

This section provides high-level recommendations for pedestrian safety countermeasures to consider for each of four crossing types–stop-controlled T-intersections, mid-block crossings, four-way stop-controlled intersections, and two-way stop controlled intersections–as well as a supporting Pedestrian Toolbox with more detailed countermeasure guidance. These materials are intended to serve as a reference for City of Northfield staff when moving into the conceptual design phase of projects in the CIP.

The primary goal of this section is to identify opportunities to reduce barriers for people walking. Walking in this context also includes people using mobility devices and wheelchairs. This includes focusing on the comfort of people walking along the street, such as providing buffers from the street, shade via trees in a boulevard, and other less visible benefits such as green stormwater infrastructure. It also includes a large focus on intersections and improving the street crossing experience, such as bumpouts, median refuge islands, protected intersections, and raised crossings.

Methodology

A pedestrian origin and destination analysis overlaid the CIP with pedestrian origins and destinations used to identify locations for pedestrian improvements. The origins and destinations included the following:

Community services

- Places of worship
- Hospital
- Library
- Schools
- Community Action Center and Senior Center
- Community Education Center
- Stores that accept SNAP benefits

Pedestrian generating land uses

- Recreational (parks and trails)
- City or State-owned property
- Commercial
- Housing with four or more units
- Low-income land or building
- Homesteads with people with disabilities
- Manufactured home park

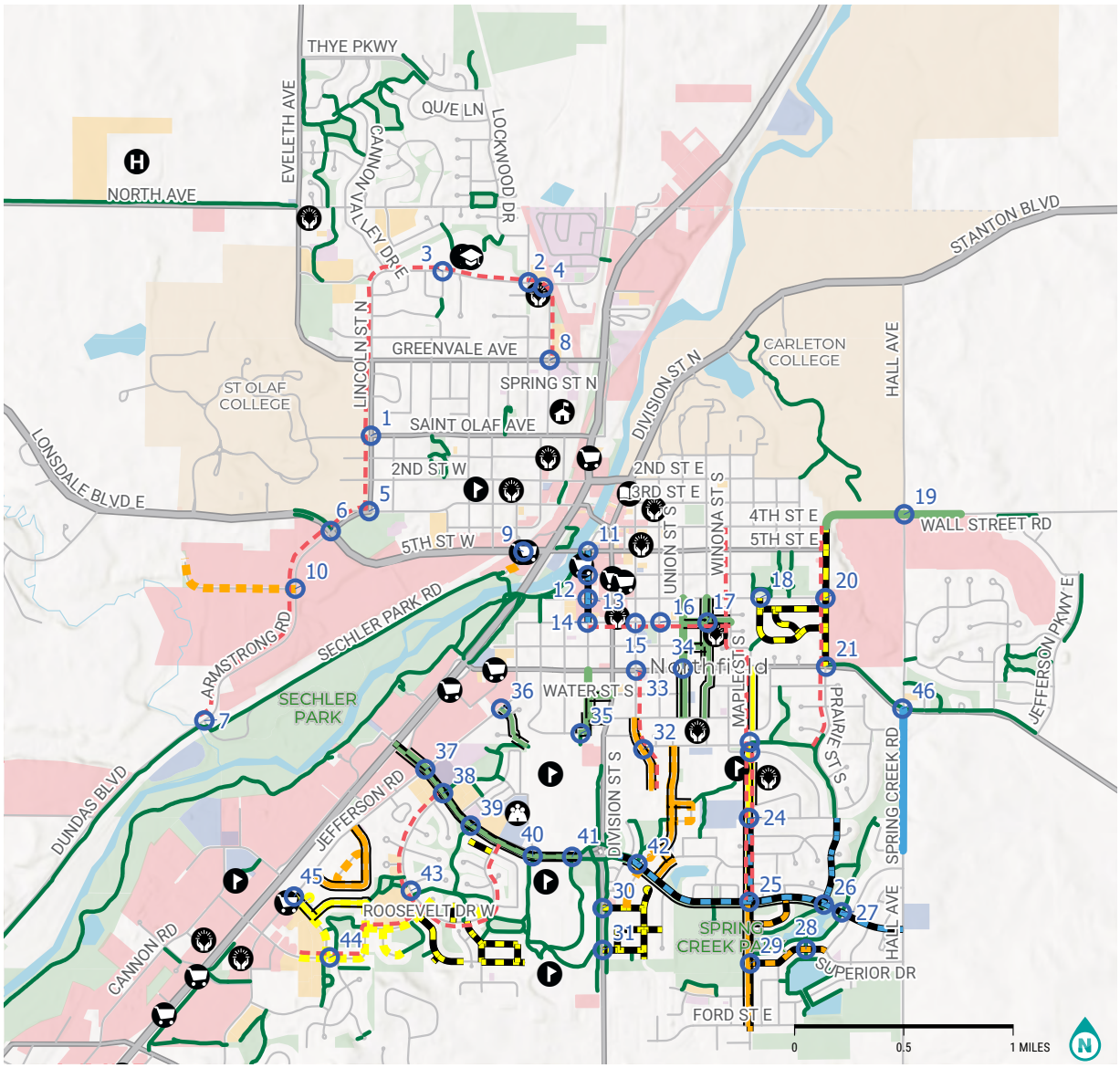
Analysis Results

Locations to consider for pedestrian crossing improvements while implementing projects in the CIP are shown in Table 2 and highlighted in Figure 3; 45 locations were identified as places where pedestrian crossing improvements would make walking to destinations safer and more appealing.

Table 2: Potential pedestrian crossing improvement locations

Location Number	Nearest Cross Street
1	St. Olaf Ave. & Lincoln St. N
2	Lincoln Pkwy. & Linden St N
3	Lincoln Pkwy. & Lathrop Dr.
4	Lincoln Pkwy. & Dresden Ave.
5	Forest Ave. & Lincoln St. S
6	Hwy. 19 & Armstrong Rd.
7	Armstrong Rd. & Sechler Park Rd.
8	Greenvale Ave. & Spring St. N
9	Hwy. 19 & Laurel Ct
10	Industrial Dr. & Armstrong Rd.
11	5th St. W & Water St. S
12	6th St. W & Water St. S
13	7th St. W & Water St. S
14	8th St. W & Water St. S
15	8th St. E & Washington St. S
16	8th St. E & Union St. S
17	8th St. E & Winona St. S
18	7th St. E & Fareway Dr.
19	Wall Street Rd. & Spring Creek Rd.
20	7th St. E & Prairie St. S
21	Woodley St. E & Prairie St. S
22	Ames St. & Maple St. S
23	Sibley Dr. & Maple St. S
24	Meadow View Dr. & Maple St. S
25	Jefferson Pkwy. E & Maple St. S
26	Jefferson Pkwy. E & Prairie St.
27	Jefferson Pkwy. E & Michigan Dr.
28	Superior Dr. & Michigan Dr.
29	Superior Dr. & Maple St. S
30	Anderson Dr. & Division St. S
31	Arbor St. & Division St.
32	Ames St. & Washington St. S
33	Woodley St. E & Washington St.
34	Woodley St. E & College St. S
35	Linden Pl S & Water St. S
36	Jefferson Rd. & Spruce Ct
37	Jefferson Pkwy. & Jefferson Rd.
38	Jefferson Pkwy. & Roosevelt Dr. W
39	Jefferson Pkwy. & Roosevelt Dr. E
40	Jefferson Pkwy. & Raider Dr.
41	Jefferson Pkwy. & Division St. S
42	Jefferson Pkwy. & Washington St. S
43	Roosevelt Dr. W & Truman Ct
44	Heritage Dr. & Hidden Valley Dr.
45	Jefferson Rd. & Hidden Valley Rd.

Figure 4. Bicycle Network Map



PEDESTRIAN ORIGINS & DESTINATIONS

NORTHFIELD, MN
Citywide

COMMUNITY SERVICES

- Places of Worship
- Hospital
- Library
- Preschool
- School
- Community Action Center and Senior Center
- Northfield Community Education Center
- SNAP Stores
- Trail

CAPITAL IMPROVEMENT PROJECTS (2023-2026)

- 2023 - Mill and Overlay
- 2023 - Reclamation
- 2023 - Sidewalk/Trail/Bike Construction
- 2024 - Mill and Overlay
- 2024 - Reconstruction
- 2024 - Sidewalk/Trail/Bike Construction
- 2025 - Mill and Overlay
- 2025 - Reclamation
- 2025 - Sidewalk/Trail/Bike Construction
- 2026 - Mill and Overlay
- 2026 - Reconstruction
- Proposed Bikeway Corridor
- Recommended Crossing Improvements

PEDESTRIAN GENERATING LAND USES

- Recreational
- City or State Owned Property
- Commercial
- Housing with 4+ Units
- Low-Income Land or Building; Homesteads with People with Disabilities; Manufactured Home Park

alta

The analysis revealed that all crossing locations that provide access to destinations are on streets with no more than one through travel lane in each direction, with relatively low traffic volumes. The roadway geometries of the crossing locations are limited to the following:

- Stop-controlled T-intersections
- Mid-block crossings
- Four-way stop-controlled intersections
- Two-way stop controlled intersections

Examples of these crossing types are shown in Figures 4 through 7. The toolbox included with this report is tailored to the roadway conditions found at these locations.

Figure 5. Stop-controlled T-intersection

Figure 6. Mid-block crossing

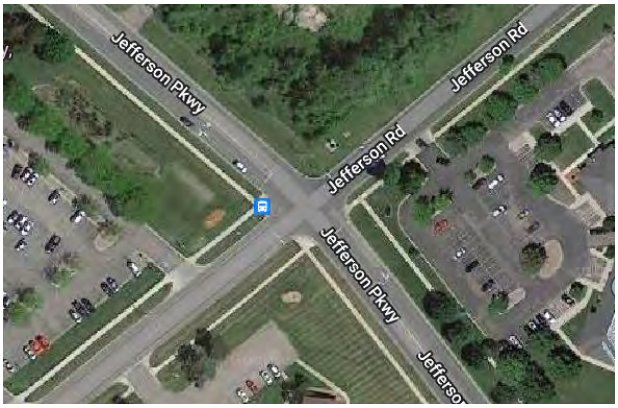


Figure 7. Four-way stop-controlled intersection

Figure 8. Two-way stop-controlled intersection

Pedestrian Toolbox

The tools in the Pedestrian Toolbox are intended to not only reduce the likelihood that collisions with vehicles result in the death or serious injury of people walking, but to also make walking more appealing, comfortable, and convenient. These pedestrian safety countermeasures can shorten crossing distances, slow vehicle speeds, simplify crossings, and prioritize pedestrian movements.

Table 5 provides guidance on how to use the tools on different types of CIP projects.

Potential Next Steps

For mill and overlay projects:

- Include the "standard" tools based on internal practices, and use the Pedestrian Origins and Destinations Map to determine which locations are suitable for opportunistic treatments. Bumpouts, median refuge islands, and rectangular rapid flashing beacons (RRFBs) are likely the most common tools to enhance pedestrian crossings for mill and overlay projects.

For reconstruction and reclamation projects:

- This is an opportunity to include all the "standard" tools, and determine if there are locations to include the "opportunistic" tools.

For stand-alone sidewalk/trail improvement projects:

- Include the "standard" tools based on internal practices, and use the Pedestrian Origins and Destinations Map to determine which locations are suitable for opportunistic treatment. Bumpouts, median refuge islands, and RRFBs are likely the most common tools to enhance pedestrian crossings for stand-alone or spot improvements.

Table 3: Pedestrian Toolbox tools relevant to Capital Improvement Projects

Tool	Mill and Overlay	Reconstruction and Reclamation	Sidewalk/Trail Improvements
Curb ramps	Standard	Standard	Standard (except bike lane striping/signing with no other associated project)
Corner treatments*	Opportunistic (especially curb extensions)	Standard	Opportunistic (especially curb extensions)
Crosswalks	Standard	Standard	Standard
Median refuge islands	Opportunistic	Opportunistic	Opportunistic
RRFBs	Opportunistic	Opportunistic	Opportunistic
Raised crossings	Opportunistic	Standard	Opportunistic (not applicable for sidewalk gap or bike lane striping projects)
Raised intersections	Limited	Opportunistic	Limited
Trees	Standard	Standard	Limited
Green stormwater infrastructure	Limited	Standard	Opportunistic
Roundabouts	Limited	Opportunistic	Limited
Other speed and volume control measures	Limited	Opportunistic	Opportunistic

**Curb extensions, corner radii, mountable truck aprons, and protected Intersections*

The Pedestrian Toolbox includes pedestrian-oriented infrastructure elements that create a more comfortable and safe pedestrian experience. This toolbox is important because it contains tools for creating a system that meets the needs of the community.

This toolbox will help city staff in addressing pedestrian needs and opportunities throughout the City of Northfield. It should be noted that the tools contained in this guide are not exhaustive and should be referenced along with NACTO's Urban Street Design Guide, as well as local guidance of Minnesota. Further, all pedestrian treatments should meet or exceed the minimums set by the Americans with Disabilities Act Accessible Design Guidelines (ADAAG) and the Public Right of Way Accessibility Guidelines (PROWAG).

Facility overview

Typical scenario

Component descriptions

Detailed information

Technical specifications

PEDESTRIAN REALM

Sidewalk Zones & Widths

Sidewalks are the most fundamental element of the walking network, as they provide an area for pedestrian travel separated from vehicle traffic. Providing adequate and accessible facilities can lead to increased numbers of people walking, improved accessibility, and the creation of social space.

Design Features

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

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

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

Typical Application

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

Materials and Maintenance

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

Emissions impacts of materials should be taken into account in material selection. For example, carbon-sequestering calcium carbonate aggregates are now available for use in concrete.

PEDESTRIAN REALM

Sidewalk Zones & Widths

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- Sidewalks should be continuous on both sides of urban commercial streets, and should be required in areas of moderate residential density (1-4 dwelling units per acre).
- When retrofitting gaps in the sidewalk network, locations near transit stops, schools, parks, public buildings, and other areas with high concentrations of pedestrians should be the highest priority.

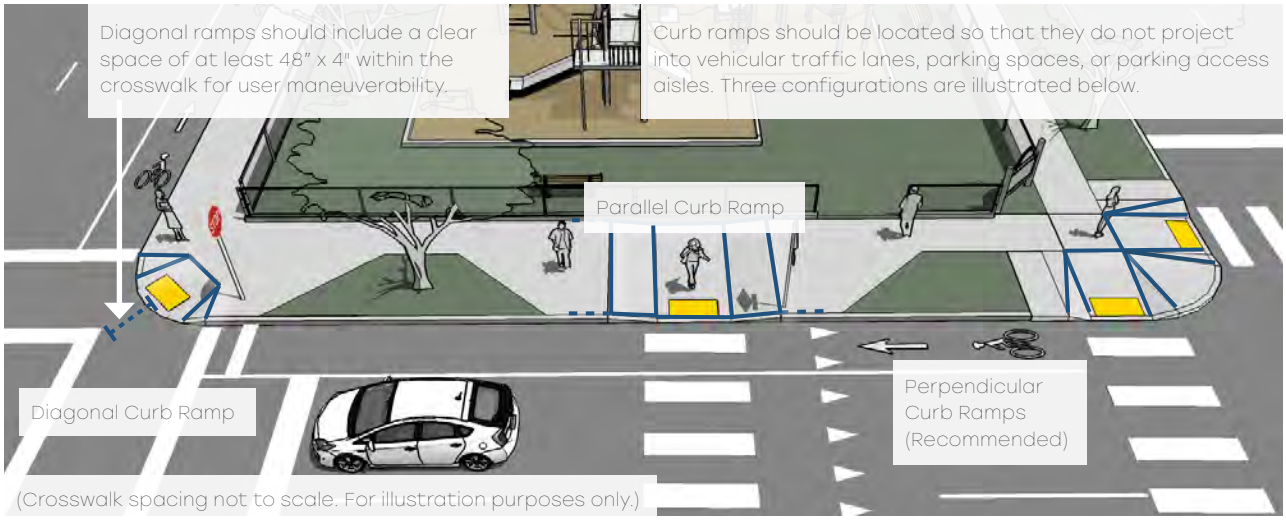
Materials and Maintenance

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

Emissions impacts of materials should be taken into account in material selection. For example, carbon-sequestering calcium carbonate aggregates are now available for use in concrete.

CURB RAMPS

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



Typical Application

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

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

Design Features

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

Not recommended: Diagonal curb ramp configuration.

Recommended: Directional curb ramps for crossing in both directions.

Further Considerations

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

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

Where feasible, design curb ramps in conjunction with sidewalk stormwater infrastructure and plantings such as bioswales and infiltration basins, as well as shade trees. In this context it is important to not interfere with pedestrian and vehicular sightlines, therefore close attention to these details is critical.

Materials and Maintenance

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

CORNER TREATMENTS

Corner Radii Design

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

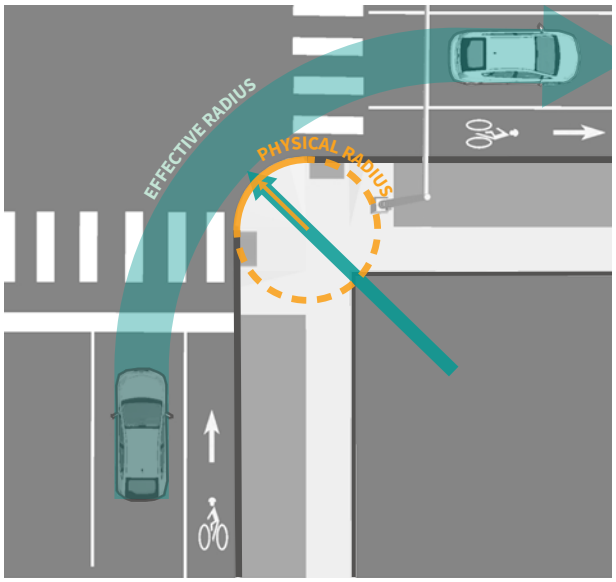
Typical Application

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

Design Features

Corners have two critical dimensions which must be considered together.

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



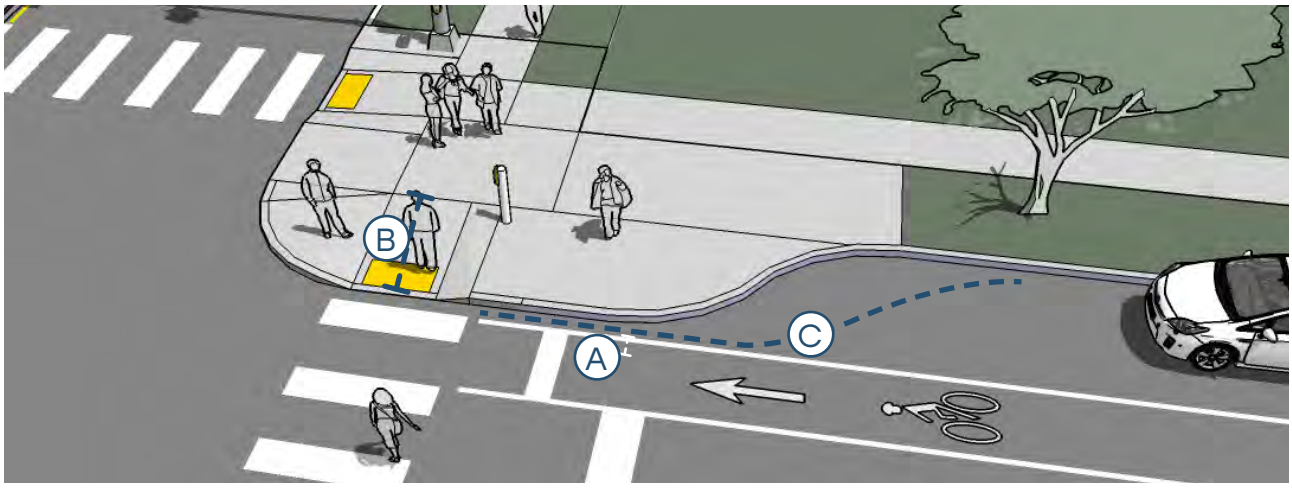
Recommended: Bidirectional curb ramps for crossing in both directions.

Further Considerations

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

Curb Extensions

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



Typical Application

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

Design Features

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

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

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

Further Considerations

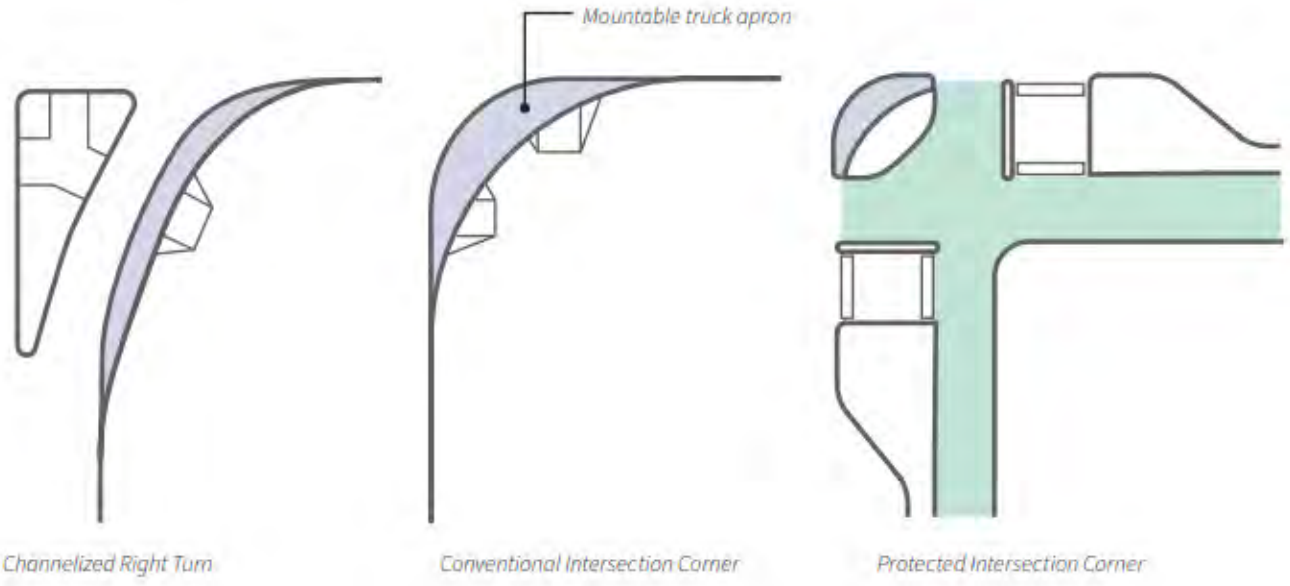
When adding curb extensions across a roadway shoulder with no parking lane, consider ways to facilitate bicycle travel (such as with a protected intersection design) and truck or bus turning movements (such as with a mountable curb apron).

Materials and Maintenance

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

Mountable Truck Aprons

Corner designs that limit turning speed for passenger vehicles while still allowing larger vehicles to complete the turn will likely have some form of a truck apron, which creates a tighter effective radius for smaller vehicles while still accommodating large trucks without endangering other road users.



Typical Application

Curb aprons with a single radius with mountable zone are designed to be usable for the vast majority of vehicles. Only very infrequent control vehicles (such as fire trucks) are expected to mount the curbs.

Curb aprons with a dual radius with defined apron area are intended for encroachment by larger design and control vehicles on a more frequent basis, while providing a tighter radius for managed vehicles.

Design Features

For a truck apron to be effective as a pedestrian safety measure, it must:

- Deter smaller vehicles from turning across it
- Clearly convey to drivers of larger control vehicles that it is traversable
- Be traversable by large vehicles without threatening stability
- Deter pedestrians and bicyclists from stopping or queuing on it

Further Considerations

The ability of the apron to function during and after snow events and its compatibility with snow removal equipment should be considered in design.

A surface material that is the same color as the sidewalk reinforces the distinction from the roadway for drivers, but may encourage pedestrians to dwell on it. A more aesthetically enhanced apron distinguishes it from both the roadway and sidewalk, but if the surface finish looks too “nice” it may be unclear that it is intended to be driven over.

Protected Intersections

A protected intersection is designed to make it safer for vulnerable road users, which includes people on bicycles and pedestrians, in the approach to and when crossing an intersection. This is achieved by shortening crossing distances, reducing exposure, increasing visibility, and improving yielding behavior by motor vehicle drivers.

Typical Application

Protected intersections can be implemented at signalized or stop-controlled intersections to create safe, comfortable conditions for people bicycling. Protected intersections are most commonly used with separated bike lanes, but can be used with conventional bike lanes, shoulders, or shared lanes.

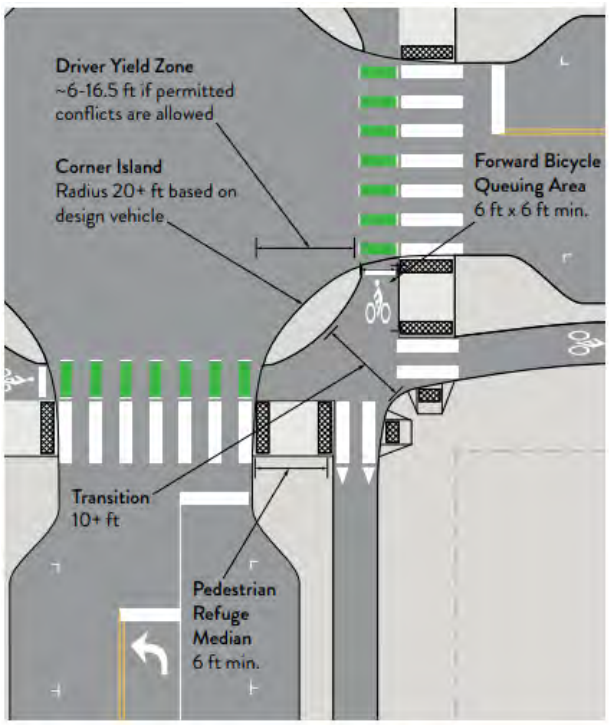
Design Features

Although a protected intersection consists of several interacting design elements, the most important are:

- Crossride setback, or the lateral offset from the motor vehicle lane to the bicycle crossride, which enables better sightlines and allows more time for drivers to stop for people walking and bicycling
- Forward stop bar, which places people on bicycles who are waiting further ahead than motor vehicles, improving visibility of people on bicycles and reducing potential for conflicts at the start of the signal phase
- Corner safety island, which separates and protects the bicycle and pedestrian space from the roadway at the corner
- Integrated accessibility features to facilitate safe crossing by vulnerable road users

Further Considerations

An intersection is made up of more than one corner, and depending on the context, each corner may or may not include all of the elements listed above.



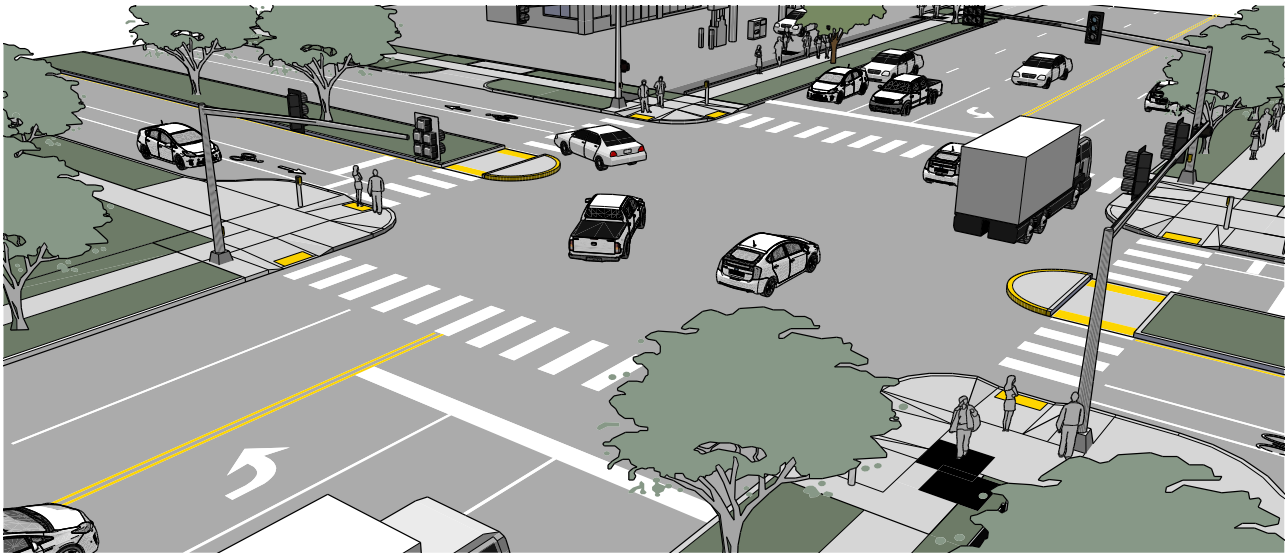
Consider access and legibility for pedestrians when designing a protected intersection. Align pedestrian refuge medians and crosswalks directly the extension of the PAR. Refuge medians that are 6-feet wide or more should have detectable warnings. Consider placement of APS buttons when designing the intersection. Wider medians and buffer areas make it easier to place required pedestrian elements.

Protected intersections may require additional right-of-way at intersection corners if parking lanes are not present. They may also require specialized snow removal equipment.

MARKED CROSSWALKS AT INTERSECTIONS

Marked crosswalks signal to motorists that they must stop for pedestrians and encourages pedestrians to cross at designated locations. Installing crosswalks alone will not necessarily make crossings safer, particularly on multi-lane roadways.

Marked crosswalks across the uncontrolled leg of unsignalized intersections should follow the design guidance of marked crosswalks at mid-block locations.



Typical Application

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

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

Design Features

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

Further Considerations

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

Materials and Maintenance

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

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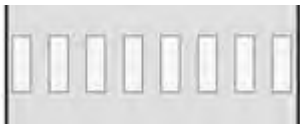
1 The appropriate marking material(s) should be determined on a project basis.

Crosswalk Examples

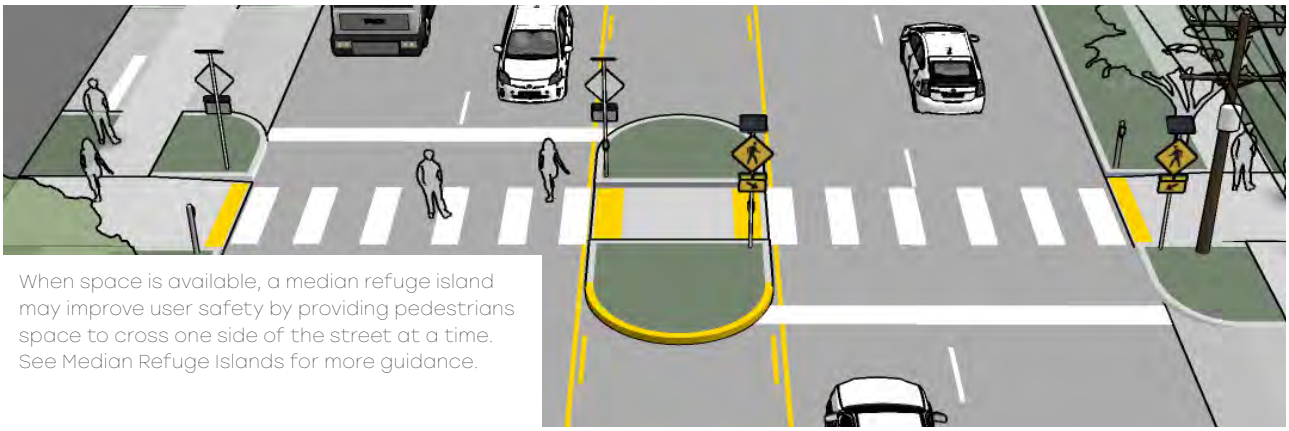
Transverse Markings

Continental Markings



MARKED CROSSWALKS AT MID-BLOCK

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



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

Typical Application

Locations where mid-block crossings should be considered include:

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

Design Features

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

Further Considerations

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

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

MEDIAN REFUGE ISLANDS

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

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

Typical Application

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

Design Features

- Cut-through median refuge islands are preferred over curb ramps to better accommodate wheel chairs users.
- Pedestrian warning signage should be placed at the crossing. Advanced warning signage should also be considered where site obstructions may be present on the approach.

Further Considerations

This treatment may be combined with Rectangular Rapid Flashing Beacons (RRFBs). See treatment description for more information.

Materials and Maintenance

Refuge islands may require frequent maintenance of road debris. Trees and plantings in a landscaped median must be maintained so as not to impair visibility, and should be no higher than 30 inches.

RAISED CROSSINGS

A raised crossing is a crosswalk or bicycle crossing that is combined with a speed table. In addition to slowing motor vehicle traffic, raised crosswalks can also improve visibility between drivers, bicyclists and pedestrians at crossing locations. They may eliminate the need for ADA curb ramps, although tactile warnings are still necessary. Raised crosswalks also make a good gateway treatment at the entrance to a bicycle boulevard or a downtown area. Raised crosswalks can reduce pedestrian crashes by 45%.

Typical Application

The FHWA Safe Transportation for Every Pedestrian guide suggests raised crosswalks as a candidate treatment for unsignalized intersections on roads with posted speeds of 30 mph or less and AADT of 9,000 vehicles per day or less. Raised crosswalks across driveways help indicate to drivers that sidewalk and trail users have the priority.

Design Features

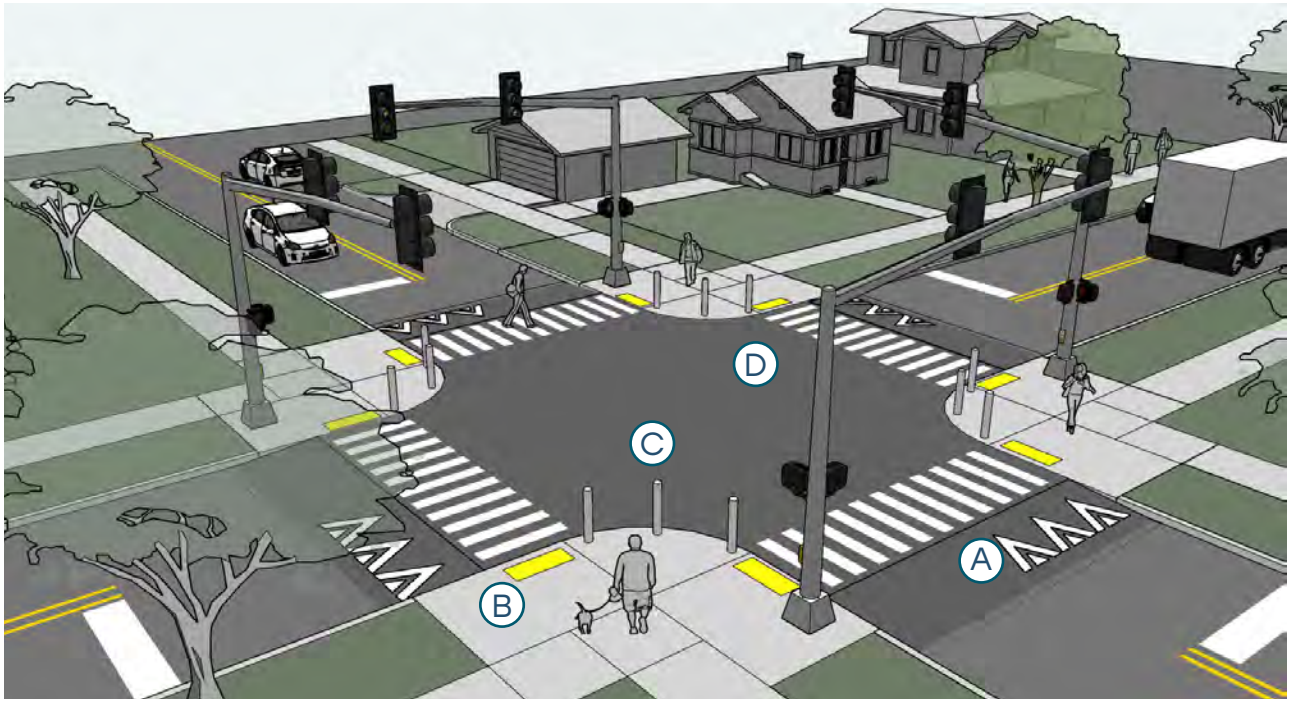
- Raised crosswalks are flush with the height of the sidewalk.
- The speed table is typically at least 10 feet wide.
- Truncated domes are installed at the edge of the sidewalk to alert people with low-vision that they are entering the roadway.

Further Considerations

Designers should consider drainage needs for all raised treatments to ensure the roadway still drains properly.

RAISED INTERSECTIONS

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



Typical Application

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

Design Features

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

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

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

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

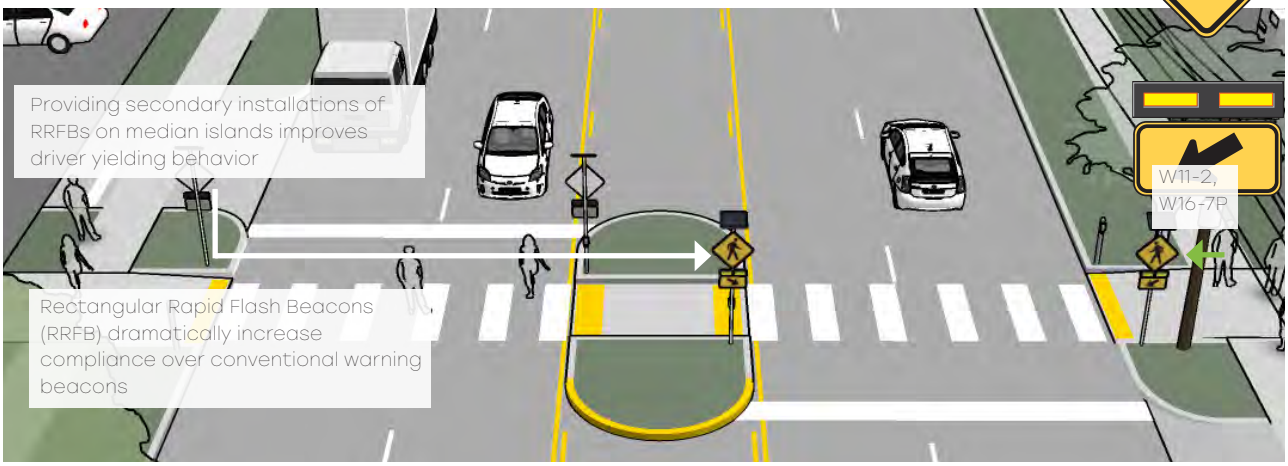
(D) The intersection can be constructed from special paving materials, emphasizing the pedestrian environment and public space. These materials can include asphalt, concrete, stamped concrete, or pavers. High visibility street materials will draw attention to the raised intersection.

Further Considerations

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

RECTANGULAR RAPID FLASH BEACONS

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



Typical Application

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

Design Features

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

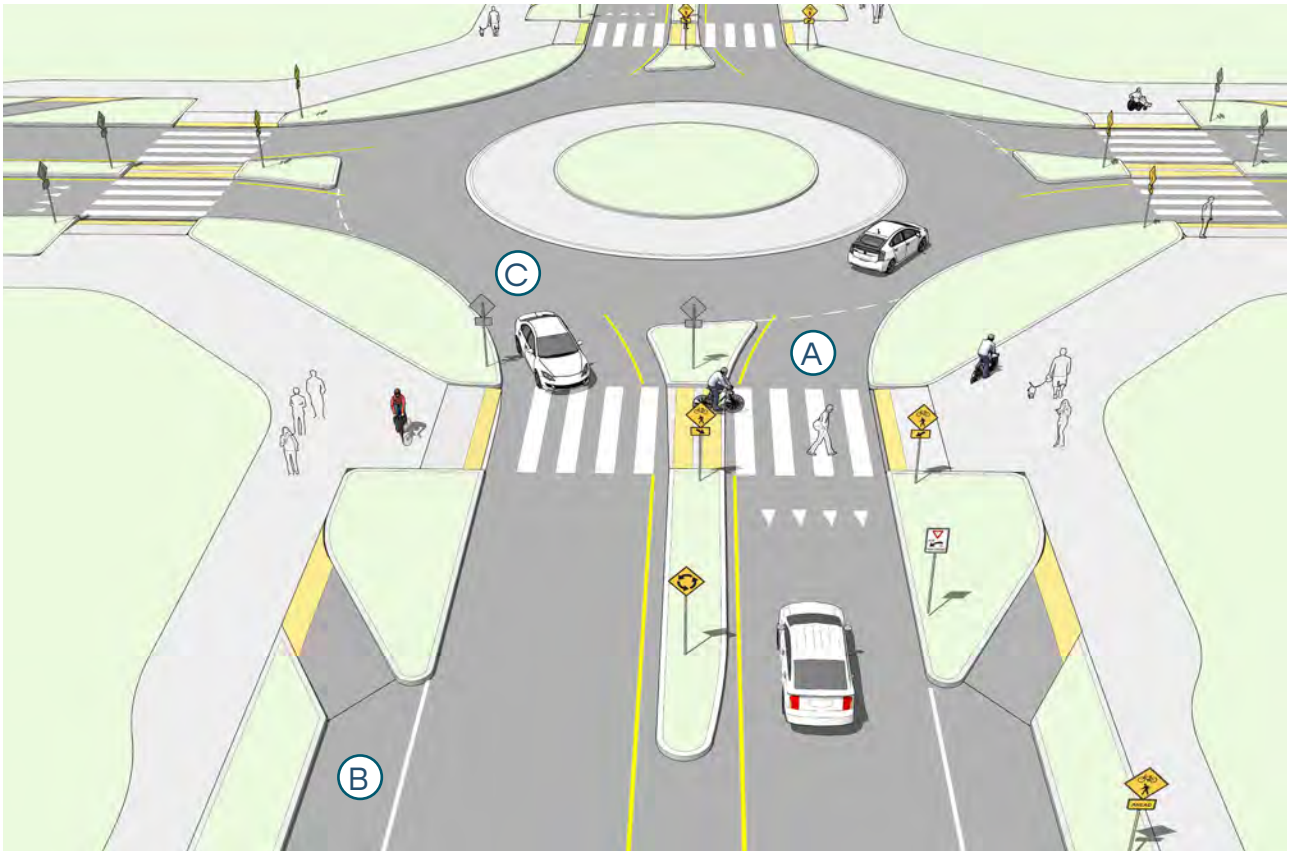
Further Considerations

Rectangular rapid flash beacons elicit the highest increase in compliance of all the amber warning beacon enhancement options.

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

Materials and Maintenance

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



ROUNDABOUTS

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

Typical Application

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

Design Features

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

Ⓑ Allow people bicycling to exit the roadway onto a separated bike lane or shared use trail that circulates around the roundabout.

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

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

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

Further Considerations

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

GREEN STORMWATER INFRASTRUCTURE

Green stormwater infrastructure (GSI) is a design approach to managing stormwater, the urban heat island effect, and air and water quality. GSI includes streetscape elements such as rain gardens, bioswales, and flow-through planters. These elements intercept stormwater before it reaches the gray water infrastructure systems, or sewers. GSI can help protect people walking from the impacts of flooding, and can enhance and beautify the walking environment.

Typical Application

GSI implemented along with pedestrian improvements is typically located between the back of curb and sidewalk, in curb extensions, or in median refuge islands.

Design Features

- Rain gardens are designed to capture, clean, and infiltrate stormwater. They have a curb inlet that diverts stormwater into the basin. When the basin is full, stormwater bypasses the inlet and continues down the gutter.
- Bioswales are usually designed to both infiltrate and clean stormwater runoff from a 'first flush' storm event. They typically have an inlet in the curb at the upstream end as well as an outlet at the downstream end.
- Flow-through planters are designed to clean stormwater before returning it to the municipal storm drain system. They are useful in areas where stormwater infiltration is not possible due to soil conditions.

Further Considerations

Including shrubs and other understory plants in GSI helps to filter and slow stormwater so it can infiltrate into soil or be cleaned before entering the storm drain system. GSI plantings are most successful using a native plants that can tolerate periods of drought and inundation, as well as high salinity.

Routine maintenance includes things like debris removal, ensuring water infiltrates at the required rate, inspecting and replacing any damaged plant material, inspecting for and repairing any erosion damage, weeding, accumulated sediment removal, and cleanout of inlets and outlets.

STREET TREES

Street trees can increase comfort for pedestrians and bicyclists by lowering temperatures, filtering air and water, and improving the quality of both. The presence of trees can make walking and biking facilities feel more comfortable and appealing, contributing to mode shift and reducing greenhouse gas emissions. On tree-lined streets people tend to drive more slowly, reducing the risk of collisions.

Continuous planting areas increase available soil volume, moisture holding capacity,a larger soil surface area for gas exchange, and the ability to capture and store more stormwater.

Typical Application

Trees may be planted in the right-of-way where they do not negatively impact sight lines and where adequate soil volume is available. Trees should ideally be spaced to provide a continuous canopy along bicycle and pedestrian routes.

Design Features

- Provide as much soil volume as feasible to extend the life and increase the health of street trees. As a rule of thumb, a small tree (20-30ft), medium tree (30-60ft), and large tree (60ft+), should be provided a minimum of 600, 900, and 1200 cubic feet respectively of high-quality rootable (loose, aerated, water storing) soil.
- Choose an appropriate species for the context. Future-proof tree planting by selecting species tolerant of warming temperatures.

Further Considerations

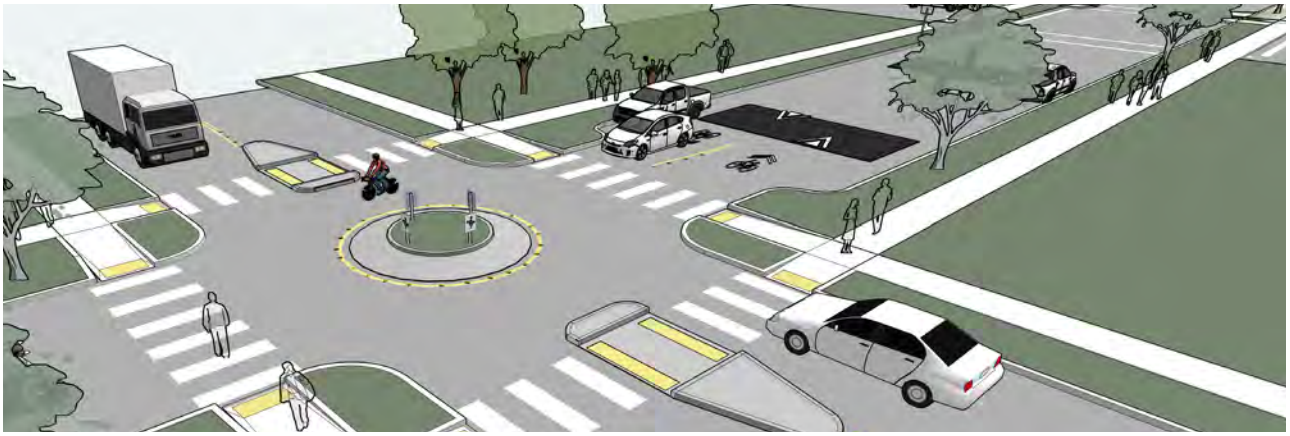
Irrigate whenever feasible to help trees survive periods of drought or extreme heat stress.

In areas where green space is constrained, consider using suspended pavement systems to increase the amount of rootable soil available for street trees.

Trees can be planted in bioswales if they are planted on the upslope portion of the swale. Tree species should be tolerant of periodic inundation and drought conditions if no supplemental irrigation is provided. Trees can be planted adjacent to more intensive green infrastructure features (which are subject to full inundation) If trees are planted in a separate dedicated soil volume.

OTHER SPEED & VOLUME CONTROL MEASURES

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



Typical Application

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

Design Features

- Measures that are meant to regulate, warn, inform, enforce, and educate motorists, cyclists, and pedestrians on the road include radar signs, pavement markings, turn restrictions, temporary speed bumps.
- Measures that are used primarily to reduce traffic speeds within residential areas can include, speed tables, chicanes, traffic circles, and tree planting.
- Measures that are implemented to discourage cut-through traffic from utilizing residential streets include diverters, partial street closures, and median barrier/forced turn islands.

Further Considerations

Traffic calming can slow or deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

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04

CIP ANALYSIS AND RECOMMENDATIONS

Analysis and Recommendations

This section includes five recommendations based on the findings of this report. They include recommended changes to the CIP, bikeway implementation options, and next steps for prioritizing and selecting treatments for pedestrian crossing improvements.

Changes to the CIP

Recommendation #1: Separate Sidewalk/Trail Improvements Category in the CIP

This is an important category to address walking and biking projects in the CIP. In the current 2022-2026 CIP, several pedestrian and bikeway project types fall under this one category. This category should be split into distinct topic areas and with language provided in the "Description" and "Justification" section of the new CIP programs. This category should be split into three programs: Sidewalk Construction, All Ages and Abilities (AAA) Bikeways, and Pedestrian Crossing Improvements.

For the All Ages and Abilities (AAA) Bikeways program, the proposed bikeways map, individual route maps, and cross sections could be included in the program description to help provide clarity on the priorities of the program. For the Pedestrian Crossing Improvements program, the Pedestrian Origins and Destinations Map could be included in the program description. As individual projects are identified, those locations could be included as well to provide the same level of clarity. It may also be necessary to reevaluate funding levels in the CIP and identify an annual budget allocation for the separate CIP programs.

Bikeway Implementation Options

Recommendation #2: Identify a Preferred Bikeway Type in Northfield

Two-way separated bikeways should be identified as the preferred bikeway type in Northfield. This includes raised separated bikeways when there is an opportunity for reconstruction that includes moving an existing curb. For retrofit projects, such as mill and overlays, and stand-alone projects, this includes installing two-way separated bikeways with a concrete bike buffer.

Recommendation #3: Implement Unprogrammed Bikeways Identified in the "Proposed Bikeway Corridors"

For the unprogrammed sections of the "proposed bikeway corridors," add to the scope and implement them with a quick build approach. This should include striping, signage, and concrete bikeway buffers. This recommendation is based on a goal of providing continuity and seamless connections between bikeways. These projects could be included in a new CIP program as identified in Recommendation #1.

Recommendation #4: Use Concrete Bike Buffers as a Form of Physical Bikeway Separation

Explore a demonstration of a concrete bike buffer as a form of bikeway separation. The dimensions of the barrier are roughly six to eight inches tall and two feet wide. The pavement is milled slightly and slip form concrete is placed within a buffer separating moving motor vehicles and people biking. This could be included in an existing bikeway that has a four-foot striped buffer or as part of a new bikeway project. A good first location should be highly visible for people bicycling and driving, leaving plenty of room for turning vehicles, and use bollards to add to the visibility. Demonstrating this technique could have several benefits, including determining construction techniques, evaluating how it holds up, and engaging residents about the treatment. Lessons learned from the demonstration can improve future installations.

Pedestrian Crossing Improvements

Recommendation #5: Prioritize Pedestrian Crossing Improvements

Use the Pedestrian Origins and Destinations Map to prioritize pedestrian crossing improvements in conjunction with reconstruction and reclamation projects, mill and overlay projects, and stand-alone projects. There may be opportunities to pair pedestrian crossing improvement projects with bikeway projects to increase the benefit of the project. These projects could be included in a new CIP program as identified in Recommendation #1.

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