GLENWOOD SPRINGS

Long Range Transportation Plan

2015-2035

CONTENTS

1 Executive Summary

Vision

Create a multi-modal transportation system that safely and efficiently moves people and goods, enhances the quality of life, promotes economic vitality, and exemplifies the historic community character that is Glenwood Springs.

Goals

The success of the transportation system is dependent on the interaction of many factors. Every project the City undertakes will consider each of the following goals:

Revisit the Plan
Revisit the LRTP every year to evaluate project implementation progress and to review project prioritization and applicability of programs under the current financial environment.

Connectivity
Improve multi-modal transportation network connectivity in Glenwood Springs.

Safety
Promote system safety for all modes of transportation.

Accessibility
Enhance the existing multi-modal system to offer better choices for all users.

Convenience
Provide efficient and convenient multi-modal travel throughout Glenwood Springs.

Sustainability
Consider the economic costs, benefits, and partnerships for each identified project.

Accountability
Consider the environmental and health costs and benefits for each identified project.

Livability
Improve quality of life for residents and visitors in Glenwood Springs.

Adaptability
Identify measurable strategies for each project.

Complete Transportation Networks
The completeness of a transportation network is judged on its ability to facilitate different modes of transport that result in higher individual mobility than networks that serve mainly one mode. A complete network is also one that strengthens connections between those different modes making travel more convenient for users at all levels of service.

Community Engagement

Ongoing input was gathered throughout the planning process, from data gathering to final recommendations. Approximately 400 members of the public participated in the planning process (not including the final public event or second round of wikimapping). The following are a summary of the engagement tools used to solicit feedback:

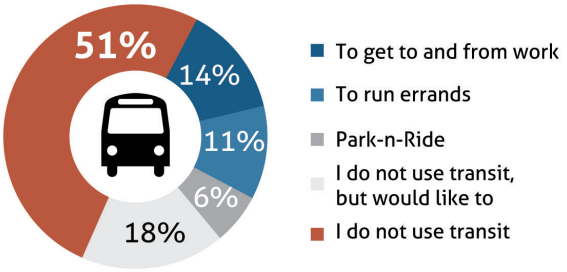
- Meetings with the Internal Review Team, City Council, Transportation Commission and River Commission
- Engagement with community members through:
  - 1 public open house (September 2014)
  - 2 public events (September 2014, August 2015)
  - Project website (Entire Planning Process)
  - 1 Online survey (August-November 2014)
  - 2 Wikimaps (August 2014, August 2015)
  - Multiple stakeholder meetings

Glenwood's Downtown Market public event

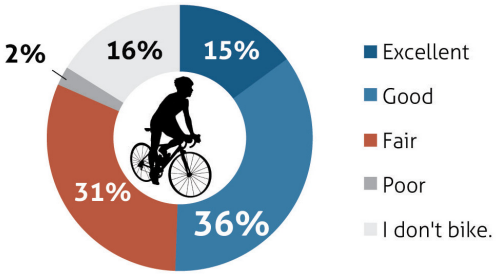
Key Themes

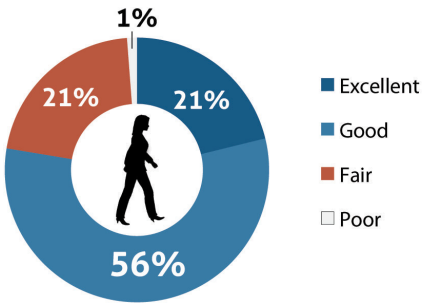
A number of key themes emerged from the public survey (99 respondents):

- The overall quality of the transportation system, including roads, bicycle and pedestrian facilities and transit, is generally good
- The reconstruction of the Grand Avenue Bridge is a concern, but the need is apparent
- Addressing congestion on SH-82 is a high priority
- Although over half of all respondents do not use transit, many indicated that they would like to use transit. Of the respondents who do use transit, most use it to get to and from work



- While gaps in networks were identified, most respondents rated the overall experience of bicycling and walking as good to excellent.





- Improving the bicycle and pedestrian environment is very important.

Infrastructure Recommendations

Based on existing conditions analysis and public input, this plan outlines recommendations to establish a complete and balanced multi-modal transportation network that safely and efficiently meets the needs of all users, regardless of age, ability, or mode of transportation.

Bicycles and Pedestrians

Glenwood Springs offers residents and visitors easy access to a sound sidewalk network and numerous shared-use pathways for both transportation and recreational purposes. The compact nature of the City is a result of the surrounding natural features and existing topography that translates into short intra-city trips for its residents and visitors with a diversity of available mobility options.

The plan recommends on- and off-street projects that enhance and expand pedestrian and bicycle networks. Recommendations include shared-use paths, on-street bicycle facilities, sidewalk connections, wayfinding signs, intersection improvements, and new bridge connections.

Roads

Within the neighborhoods in and around downtown, roads form a grid system, which is traditional for an urban area, and encourages more pedestrian and bicycle usage. In the newer areas of Glenwood Springs, however, the residential developments lack this connectivity, primarily due to the topographic challenges. Consequently, streets are typically curvilinear and connectivity is more circuitous.

The recommendations focus on improving vehicular circulation, connectivity, providing additional capacity by either expanding existing facilities or adding new facilities and completing system gaps.

Bridges

The Colorado River, Roaring Fork River, SH-82, and I-70 bisect Glenwood Springs and create barriers to and challenges in increasing the overall connectivity of the City's transportation network. Enhanced connectivity through the construction of additional bridges was identified as a high priority throughout the planning process.

The plan recommends both multi-modal and pedestrian/bicycle bridges to improve connectivity and fill gaps in the transportation network.

Glenwood Springs' 2015 Bike to Work Day

Programs

The plan recommends programs that benefit multiple user groups and have an education, encouragement or enforcement focus.

Priority programs include expanded Bike to Work Day programming, Safe Routes to School and enhanced pedestrian and bike counts and data collection.

Other programs recommended are geared toward encouraging people to bike around Glenwood Springs by making their experience safer and more comfortable. These programs include:

- Bicycle training
- Bicycle parking request forms
- Biking and walking summer events
- Group bike rides and walks for older adults
- Mayor's bike ride
- Continuing education for City staff

Why Invest in Walking and Bicycling Facilities

Health Benefits

This plan recommends new and enhanced pedestrian and bicycle facilities for recreation and daily trips. Walking and bicycling helps people meet recommended physical activity levels and cultivates a healthier community.

Economic Benefits

Investing in bicycling and pedestrian facilities stimulates the local economy by supporting local businesses, generating tourism revenue, and creating jobs.

2 Background

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The Glenwood Hot Springs Pool is a major destination for visitors and residents.

Purpose of the Plan

The Glenwood Long Range Transportation Master Plan builds upon the success of the City's 2003 Long Range Transportation Master Plan, the City and CDOT's 2010 Corridor Optimization Plan, and the City's 1991 River Trail Master Plan. Based on existing conditions and input from the community, this plan establishes objectives for Glenwood Springs to focus on and prioritized recommendations to develop a complete multi-modal transportation network.

Glenwood Springs sits at the confluence of the Colorado and Roaring Fork Rivers

Regional Context

The City of Glenwood Springs is located at the confluence of the Colorado and Roaring Fork Rivers 180 miles west of Denver along I-70. Incorporated in 1885, the city is both the county seat as well as the most populated city in Garfield County. From 2000 to 2010, the City population increased by roughly 24%, with additional growth slowing to two percent from 9,614 in 2010 to 9,837 in 2013. Within the city, the topography is generally flat and rolling, and distances are generally short. Both of these characteristics are indicative of high potential for active transportation modes such as bicycling and walking.

The City stretches north-south following the Roaring Fork River and SH-82. At the north end of the city, Interstate 70 moves east-west along the Colorado River. Glenwood Springs has a total area of 4.8 square miles (12km²) and a population density of 2,049 people per square mile. It has historically been known for its medicinal hot springs, scenic beauty and access to abundant outdoor recreational opportunities. Glenwood Springs welcomes large numbers of tourists throughout the year for multi-season sports and leisure within and surrounding the city

limits.

The City was recognized for its accessibility as it was named among America's Most Walkable Communities by the Public Broadcasting Service and Walking Magazine in 2002. This plan builds upon those successes and lays out the basis for future development of a complete transportation network.

Relevant Plans

Current and recent plans offer strong support for making multi-modal improvements that benefit all forms of mobility throughout the City of Glenwood Springs. The following plans have had implications for mobility in Glenwood Springs.

Long Range Transportation Master Plan (2003)

The *2003 Long Range Transportation Master Plan* discussed and considered all forms of transportation systems; from Streets and Bridges to a transportation demand management program. It also included a robust section on values and vision, and goals and strategies that strongly recommend provision of mobility and safety infrastructure improvements. This document has guided improvements to the transportation network over the last decade.

River Trail System Plan (1991)

As stated in the *2003 Long Range Transportation Master Plan*, the main component of the *River Trail System Plan* as it relates to mobility is the trails system. More specifically, the trail system should play a significant role in connecting key destinations such as, parks, schools, neighborhoods and that it needs to be separated from existing roadways.

Parks and Recreation Comprehensive Master Plan (2006)

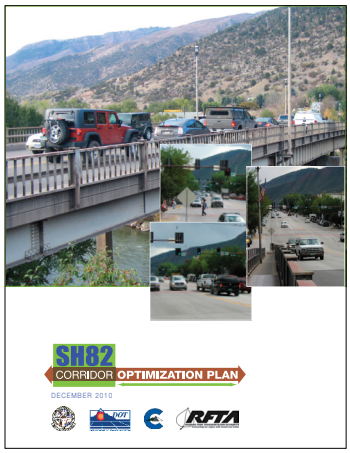
The purpose of the *Park and Recreation Comprehensive Master Plan* is to provide a framework document for decision-making as it relates to Parks and Recreation, Trails, and Open Space in Glenwood Springs. Recommendations from the plan were described in terms of short-term and long-term goals that explored various funding mechanisms and prioritized spending. One of the five primary themes that emerged from the plan was development of additional trails to provide better connectivity to desired destinations.

Corridor Optimization Plan (2010)

The *Corridor Optimization Plan* (COP) was part of a larger corridor optimization process designed to identify and assess programs and projects to reduce congestion on SH-82 through Glenwood Springs. The State Highway 82 COP identified and evaluated ten strategies for addressing future transportation demand within Glenwood Springs that ranged from no action to SH-82 relocation.

Comprehensive Plan (2011)

A family uses a high visibility crosswalk



The Corridor Optimization Plan informed the development of this plan's infrastructure and network recommendations.

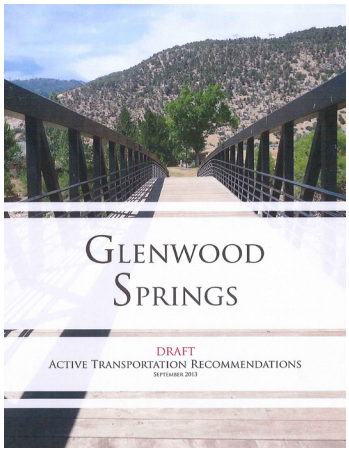
The *2011 Comprehensive Plan* identifies the current challenges and goals related to vitality, growth and many others facing Glenwood Springs. Related to transportation, the Comprehensive Plan establishes the goal of addressing transportation needs and providing multiple convenient travel choices. See the Comprehensive Plan for more specific transportation objectives and strategies.

State Highway 82 Access Control Plan (2013)

The State Highway *82 Access Control Plan* was adopted by the City of Glenwood Springs in July 2013. It was developed to define future property access points, reduce congestion, and improve safety along the SH-82 corridor.

Glenwood Springs Active Transportation Recommendations (2013)

The purpose of the *2013 Active Transportation Recommendations* was to evaluate and provide recommendations to improve the pedestrian and bicycle network on and around the State Highway 82 (Grand Avenue) vehicular, and pedestrian bridge improvements by the Colorado Department of Transportation (CDOT). If incorporated into the final design, residents and visitors alike will experience a more connected Downtown that is safe, functional and easy to navigate.



The Glenwood Springs Active Transportation Recommendations outlined on- and off-street projects that informed this plan's priorities.

Glenwood Ridge Traffic Impact Study (2014)

The *Glenwood Ridge Traffic Impact Study (March, 2014)* was developed to analyze the traffic impacts associated with the Glenwood Ridge Development on Four Mile Road. The study looks at existing roadway network, existing peak hour traffic conditions, and future volume forecasts in order to make recommendations for improvements to the road system. Data was collected in February 2012 and resulting data is presented as a LOS rating.

Downtown Vehicular and Pedestrian Circulation Study (2014)

The *Downtown Vehicular and Pedestrian Circulation Study* captured traffic patterns related to vehicular, bicycle and pedestrian volume. It also evaluated existing and future circulation opportunities and challenges within the transportation network of Glenwood Springs. While the boundaries of this study area were restricted to the downtown area alone, the findings at key intersections are significant to the City's transportation network as a whole.

Vision

Glenwood Springs recognizes the importance of transportation and mobility for citizens of Glenwood Springs. The City understands that a complete transportation system is essential for active living, quality of life, and the economic vitality of the City and its business community. A vision statement outlines what the city wants to be. It concentrates on the future and is a source of inspiration. The following vision statement, developed in coordination with the Internal Review Team, City Council, and the Commissions, guides the Glenwood Springs Long Range Transportation Master Plan:

Create a multi-modal transportation system that safely and efficiently moves people and goods, enhances the quality of life, promotes economic vitality, and exemplifies the historic community character that is Glenwood Springs.

Goals

The success of the transportation system within a community is dependent on the interaction of many factors. To develop a transportation system that works to preserve our historic community character, we must consider all of these issues and develop long-range solutions.

Every project the City undertakes will consider each of the following goals and objectives:

1. **Connectivity.** Improve multi-modal transportation network connectivity in Glenwood Springs.

Covered bicycle parking at VelociRFTA transit stop at SH-82 and 27th Street is an example of good bicycle support facilities.

A) Objective: Prioritize implementation projects that will close transportation gaps in the system.

B) Objective: Connect bicycle and pedestrian facilities to transit.

C) Objective: Prioritize implementation of the multi-modal transportation system with a focus on connecting neighborhoods with parks, trails, schools, commercial areas, and other neighborhoods.

2. Safety. Promote system safety for all modes of transportation.

Bozeman, MT Safe Routes to School program.

A) Objective: Improve communication and cooperation between government agencies, transportation agencies, law enforcement, public schools, emergency services and transportation users to support an interconnected transportation network.

B) Objective: Improve safety for pedestrians and bicyclists of all levels of ability through best practices based facility design. Foster safe interactions between users of all modes through programmatic development.

C) Objective: Improve the ability to identify high crash locations, and evaluate their impacts in LRTP project prioritization.

D) Objective: Establish a unified set of design guidelines for transportation system safety, comfort, and positive user interaction.

3. **Accessibility.** Expand multi-modal system to offer better choices for all users.

Kiosks and signage along Centennial Way in San Bruno, CA orients users and promotes awareness of the trail bicycle and pedestrian network.

A) Objective: Implement a wayfinding signage program to promote awareness of the system as a travel choice for residents and visitors.

B) Objective: Provide an easy-to-use electronic map and trip planner; include parking, route length, and rules.

C) Objective: Promote non-automobile transportation alternatives and create efficient connections between all transportation modes.

D) Objective: Ensure that through public outreach, transportation needs are met for all populations, especially for the youth and elderly, the mobility impaired, and the economically disadvantaged.

E) Objective: Provide hard copy maps, directional signage, and information about the multi-modal system at transit hubs and key transit stops.

4. **Convenience.** Provide efficient and convenient multi-modal travel throughout Glenwood Springs.

Bike racks on RFTA busses

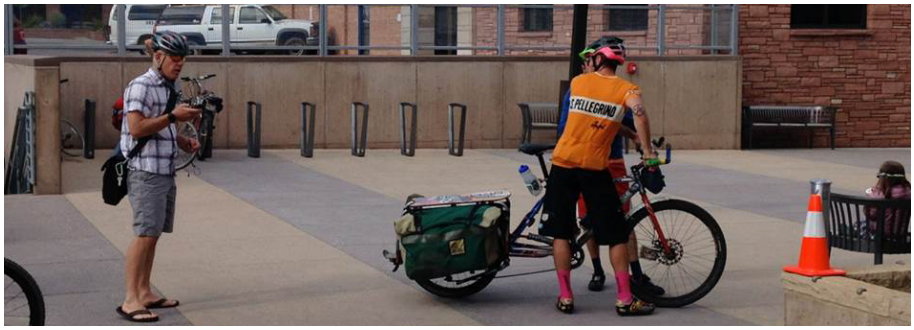
A) Objective: Maximize transportation system efficiency by creating multi-modal street designs that: encourage safe pedestrian, bicycle, and vehicular travel; provide access to public transportation; and ensure connectivity.

B) Objective: Establish performance standards that will measure the effectiveness of the urban area's overall transportation system in supporting access to goods, services, activities, and destinations.

C) Objective: Develop cooperative TDM strategies with area employers and RFTA to reduce congestion and increase the efficiency of the transportation system.

5. **Sustainability.** Consider the economic costs, benefits, and partnerships for each identified project.

Recommended as an early action in the LRTP planning process, Glenwood Springs' Bike to Work Day was implemented in June 2015.



A) Objective: Promote health and economic benefits of walking and bicycling as practical modes of transportation.

B) Objective: Enhance and expand services for alternative modes of transportation including but not limited to transit, walking and bicycling through increased funding and cooperative regional planning.

C) Objective: Outline a maintenance policy to protect local and regional investments in transportation and to foster the upgrade of select facilities over time.

6. **Accountability.** Consider the environmental and health costs and benefits for each identified project.

The Rio Grande Trail is an existing recreation and transportation facility that provides locals and visitors alike with a sustainable transportation option throughout the city.

A) Objective: Conserve natural resources and reduce energy consumption.

B) Objective: Establish performance standards and report on transportation impacts on the public health, natural environment, cultural resources, and social systems.

C) Objective: Identify and protect environmentally sensitive areas early in the planning process.

D) Objective: Modify the transportation system to reduce pollutants in highway runoff and vehicle emissions in accordance with best practices and federal, state and local clean air and water legislation.

E) Objective: Develop and implement a transportation system that supports and is coordinated with local greenhouse gas and carbon reduction plans.

F) Objective: Develop and implement modifications to the transportation system that reduce the rate of growth in vehicle miles traveled (VMT).

7. **Livability.** Improve quality of life for residents and visitors in Glenwood Springs.

The recently installed streetscape on 7th Street has added vitality to the Downtown Core.

A) Objective: Include considerations of pedestrian lighting, parking lot layout, short-term and long-term bicycle parking, location relative to buildings, and strong aesthetics in core or high-activity areas of town.

B) Objective: In addition to infrastructure recommendations, provide programmatic elements such as wayfinding, kiosks, public art, and events on open streets and along sidewalks such as walking tours, street festivals, and markets.

C) Objective: Determine which elements of the Transportation Plan would support or detract from the public's desired lifestyle.

D) Objective: Identify and recommend land use patterns, parking requirements, and development policies that increase overall mobility and that improve and support compact, mixed-use, transit-friendly, and walkable development.

8. **Adaptability.** Identify measurable strategies for each project.

Grand Avenue enhancements successfully integrate land use patterns and transportation needs to preserve Glenwood Springs' character.

A) Objective: Establish an annual review of this plan by City staff, the Transportation Commission, and City Council over the first half of each year, prior to the mid-summer City budget process.

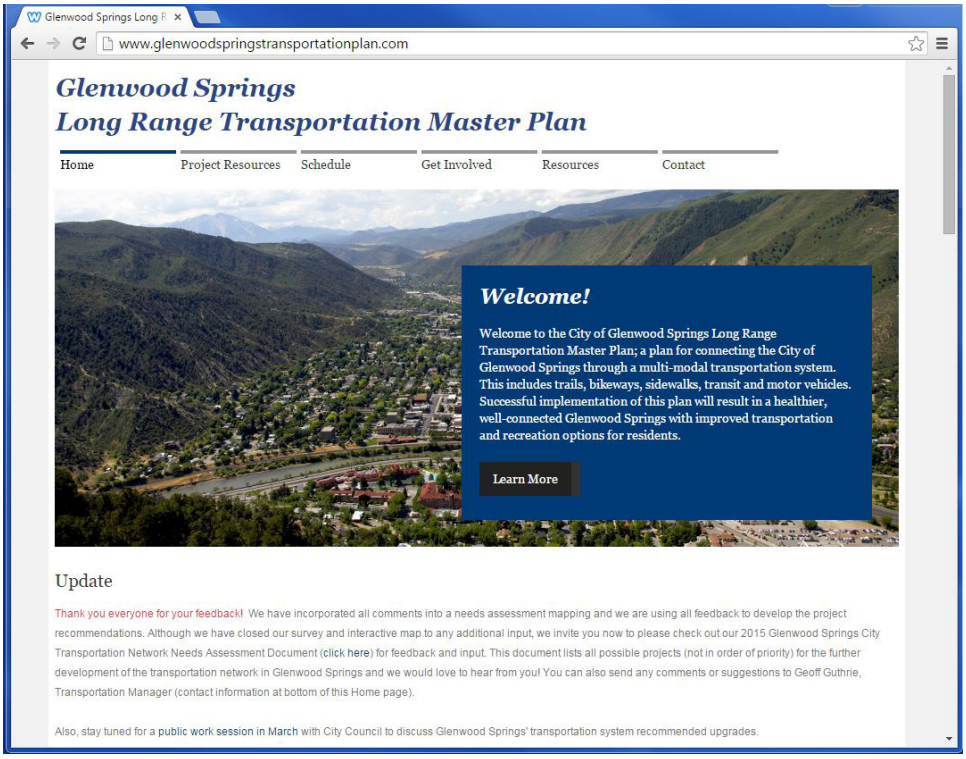
B) Objective: Implement an annual review of transportation system capital improvement prioritization by City staff and the Transportation Commission over the first half of each year, prior to the mid-summer budget process with City Council.

Community Engagement Activities

Community engagement plays a key role in developing a master plan. Through the creation of a public involvement and outreach strategy (described in Appendix C), an approach was developed that included multiple methods of public involvement and encouraged cooperation among agency stakeholders, community members, and public officials. Opportunities for input were provided throughout the planning process, from data gathering to final recommendations.

Project Website

A project website (http://www.glenwoodspringstransportationplan.com) was used throughout the master plan development process to announce workshops, provide project resources, collect input, and direct the public to an online survey and interactive mapping exercises.



Wikimap

Two interactive, online mapping exercises were conducted using the wikimaps platform. The first mapping exercise enabled members of the public to contribute information on existing conditions. Participants were asked to add lines representing:

- Desirable bike routes
- Gaps in biking/walking networks
- Destinations for bikers/walkers
- Routes that are taken but could be improved for biking and walking
- Routes that are desired for biking and walking but not taken
- Locations where bike parking is needed
- Intersection crossing conflicts
- Roadway bottlenecks
- Locations where transit stops are needed

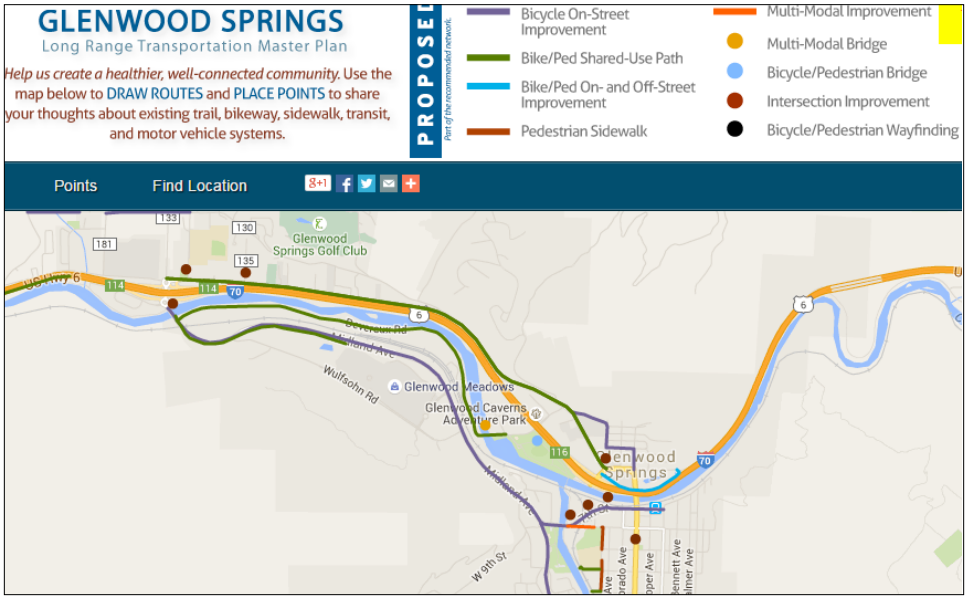
Information from this mapping exercise was incorporated into the infrastructure and network recommendations.

The second mapping exercise collected feedback on the infrastructure and network recommendations. Participants were asked to add lines representing:

- Great route, great facility
- Great route, with a different facility
- Gap in the network
- Route addition
- Route deletion

Information from this exercise was considered and incorporated into the final network recommendations, as appropriate.

The wikimap shows publicly generated recommendations for the multi-modal system



Community Survey

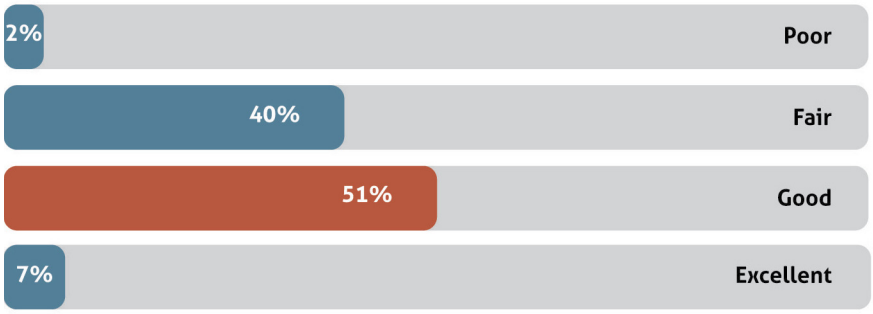
The Glenwood Springs Long Range Transportation Plan Survey was developed to gain feedback from the community on transportation, bicycling and walking. The survey, which was open from September to December 2014, was distributed at the first public workshop and was also available on the project website. In total, the survey generated feedback from over one hundred participants.

Survey respondents indicated the overall quality of the transportation system is good and expressed a desire for expanded and safer bike and pedestrian facilities. Although gaps in these networks were identified, most respondents rated the overall experience of bicycling and walking as good to excellent. A summary of the questions asked and responses received is included in the following pages.

Overall Transit System

Q. What is the overall quality of transportation in Glenwood Springs?

Survey respondents indicated that the overall quality of the transportation system, including roads, bicycles, pedestrians and transit, is good.



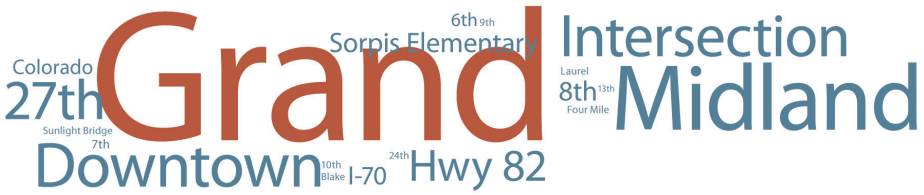
Q. How can the system be improved?

48% of respondents indicated a need for more/safer bike lanes and trails

42% of respondents expressed a desire for more bus stops within their neighborhoods

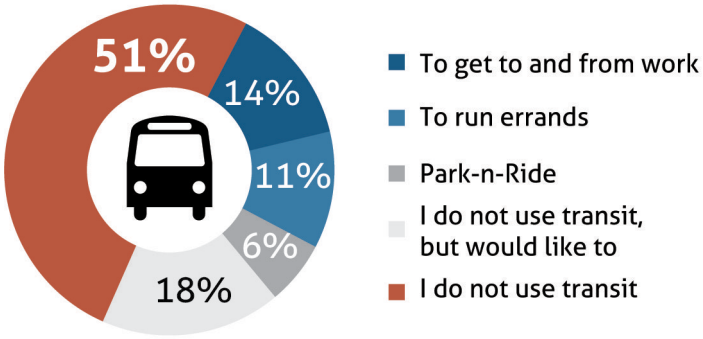
61% of respondents said that improving the bicycle and pedestrian environment in Glenwood Springs is VERY IMPORTANT.

Q. Where have you experienced traffic congestion?



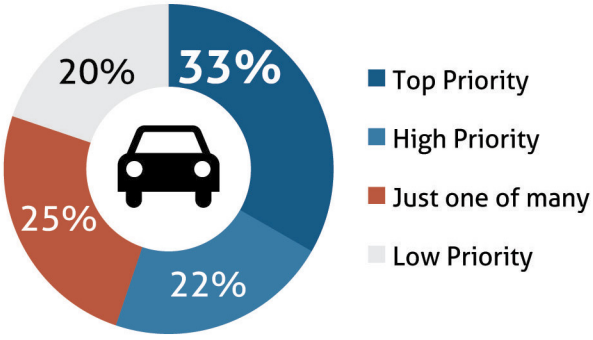
Q. How do you use transit?

Although over half of all respondents do not use transit, many indicated that they would like to use transit. Of the respondents who do use transit, most use it to get to and from work.



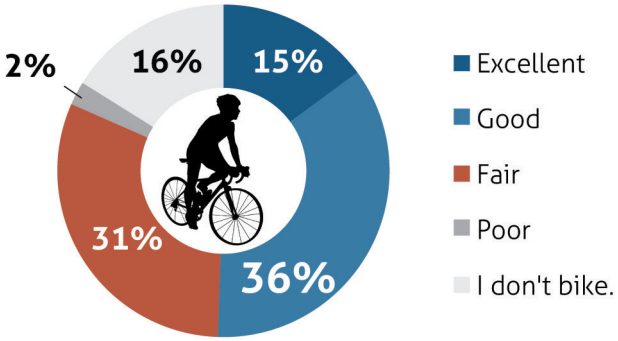
Q. What level of priority is a north-south bypass route for Grand Ave to SH-82?

The response for a north-south bypass route was largely split with a slightly higher percentage of respondents indicating the route as a top priority.



Bicycling and Walking System

Q. What is the overall bicycling experience in Glenwood Springs?
Half of respondents indicated that bicycling is good to excellent.



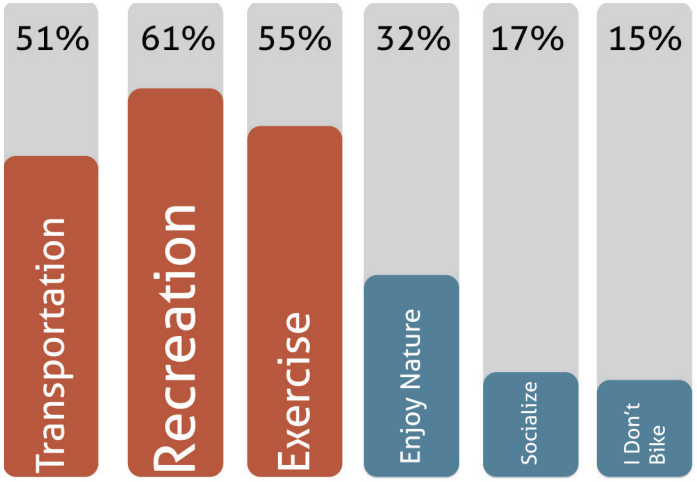
Q. What are the top bicycling destinations in Glenwood Springs?

75% of people said they would like to be able to reach PARKS or TRAILS.

58% of people said they would like to be able to reach DOWNTOWN.

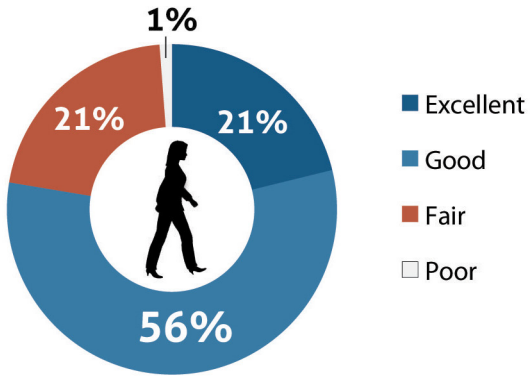
46% of people said they would like to be able to reach WORK.

Q. Why are people in Glenwood Springs choosing to bike?



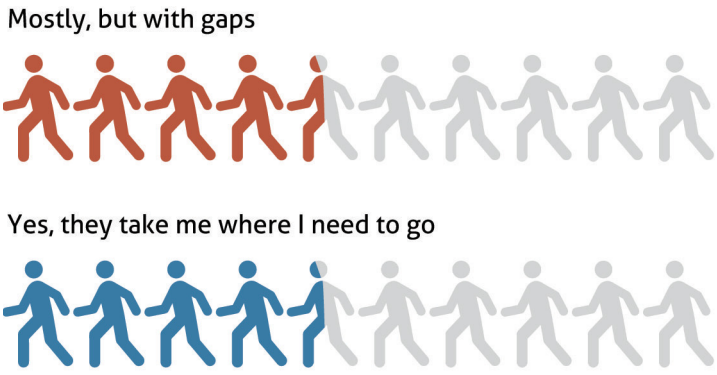
Q. What is the overall walking experience in Glenwood Springs?

Over 75% of respondents rated the walking experience as good to excellent.

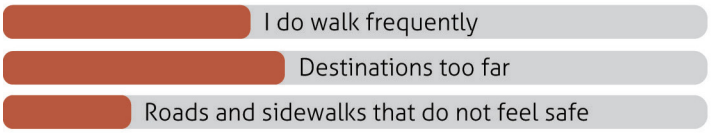


Q. Are city sidewalk complete?

Less than half of respondents indicated that Glenwood Springs' sidewalk network is complete and takes them where they need to go.



Q. What are local obstacles or concerns related to walking?



Event/Public Workshop

Two public events were held as part of the master plan process. The events occurred on September 2nd and 3rd, 2014 at the existing conditions and needs stage of the process. Over 100 community members participated in the public events described below.

Public Event

The September 2nd meeting was held at Glenwood's Downtown Market to encourage participation from a variety of demographics within the local community and visitors alike, with the goal of getting input from a wider range of potential Glenwood Springs users. The event was designed to allow the public to provide input on the gaps in the existing system, identify desired destinations, help identify opportunities and constraints, and provide input for the survey (same interface as online survey).

Public Workshop

The purpose of the September 3rd workshop was to solicit public feedback on the gaps in the existing system, identify desired destinations, help identify opportunities and constraints, and provide input for the survey (same interface as online survey). Flyers were distributed and advertisements placed in the Glenwood Springs Post Independent to notify the public of the workshop.

A variety of community members provide feedback on the transportation system at the Downtown Farmer's Market

Commission Engagement

Commissions

Throughout the planning process the project team engaged the City Council and Transportation and River Commissions numerous times to provide updates and opportunities to provide input and feedback on draft memos and documents. In addition, both commissions were significantly involved in the prioritization of the identified multi-modal infrastructure projects.

Internal Review Team (IRT)

A steering committee with representation from a variety of city departments met regularly to review draft documents and generally guide development of the Glenwood Springs Long Range Transportation Master Plan. The committee met bi-monthly during the course of the project.

City Council and the commissions attend a meeting during the data gathering phase of the project

3 Existing Transportation System

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EXISTING TRANSPORTATION SYSTEM

Introduction

The existing transportation conditions were assessed though review of related plans, meetings with city staff, Parks and Recreation, River and Transportation Commissions, stakeholders, data collection, field work, and the public involvement process. The following summarizes the current transportation network within Glenwood Springs city limits and is divided into the following sections:

- Overall Network Description
- Existing Bicycle Facilities
- Existing Off-Street Shared-Use Paths
- Existing Pedestrian Facilities
- Existing Vehicular Conditions
- Bridges
- Circulation Conditions
- Needs Assessment

A more extensive review of Glenwood's existing transportation conditions is found in Appendix A and includes the following:

- **Overall Network Description**- Analyzes the transportation network as a whole.
- **Existing Bicycle Facilities** - Provides an outline of existing bicycle facilities in Glenwood Springs with descriptions of facility types and local examples.
- **Existing Pedestrian Facilities** - Identifies existing pedestrian facilities and describes typical sidewalk design, connectivity, and the use of crosswalks.
- **Existing Vehicular Conditions** - Discusses existing vehicular conditions.
- **Bridges** - Reviews existing bridges and the access they offer.
- **Circulation Conditions** - Summarizes a circulation report used to identify vehicular, bicycle and pedestrian counts at key intersections in Glenwood Springs.
- **Needs Assessment** - Highlights a list of needs and concerns in the City.

Overall Network Description

Glenwood Springs' vehicular, bicycle and pedestrian networks are part of a larger transportation network that includes communities within and beyond the Roaring Fork Valley. The City's transportation network generally offers convenient and safe connections to other communities and neighborhoods and destinations within the city.

While the existing street network works well, the main north-south highway through Glenwood Springs, SH-82, is becoming increasingly congested with vehicles. Additionally, the city's most important southern arterial, South Midland from 27th Street to Four Mile Road faces its own challenges of access and increasing congestion.

The city's internal bicycle and pedestrian infrastructure generally allows convenient and safe access throughout the city. Regional paths draw tourists to Glenwood Springs and connect the city south to Aspen and east to the eastern entrance of Glenwood Canyon. However, on-street network gaps and multi-use conflict zones exist and need to be addressed.

The completeness of a transportation network is judged on its ability to facilitate different modes of transport to result in higher individual mobility than networks that serve mainly one mode. A complete network is also one that strengthens connections between those different modes making travel more convenient for users at all levels of service.

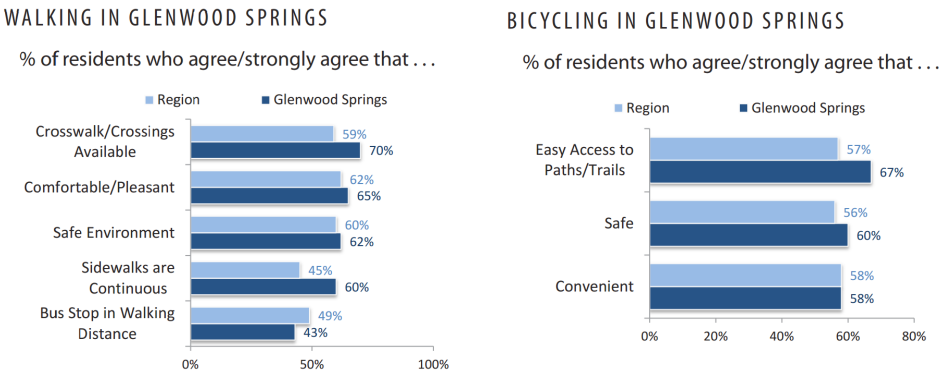


Figure 3.1: Glenwood Springs Travel Patterns

The RFTA 2014 Regional Travel Patterns Update study examined current and future multi-modal needs. Residents largely responded that crosswalks, sidewalks, paths and trails are convenient and safe.

Glenwood Springs has a highly functional bus system served by two different service providers. Operated by RFTA, Ride Glenwood Springs (RGS) is a year-round public bus service with stops along Grand Avenue, 6th Street, Highway 6 and Midland Avenue. RGS offers connections to regional Roaring Fork Transportation Authority (RFTA) transit services, Greyhound Bus Lines, Amtrak and two free Park-'n-Ride locations within Glenwood Springs. Presently, Ride Glenwood Springs does not allow bikes on their busses nor does it offer exterior bike racks. RFTA busses are equipped during the summer season with external bicycle storage. Two types of external bike racks can hold either two or four bikes.

One of the Ride Glenwood Springs bus stop along Hwy 6

Existing Bicycle Facilities

Glenwood Springs' existing bicycle facilities generally allow for convenient and safe access throughout the city. Bicycle facilities include approximately 2.5 miles of on-street bike lanes, 13 miles of bike routes, 4 miles of on-sidewalk bike routes, 7.5 miles of paved and 10 miles of unpaved off-street trails.

While bike routes represent a large proportion of the existing bike facilities, most of the bike routes in the City are not designated with wayfinding signage or route information.

Blake Street bike lanes

Existing Off-Street Shared-Use Paths

Glenwood Springs' network of paved and unpaved shared-use paths allow movement across the city and to neighboring towns and cities. The most popular shared-use paths include the Glenwood Canyon Recreation Trail and the Rio Grande Trail/River Trail which connects commuter and recreational bicyclists and pedestrians to destinations throughout the Valley.

While the Rio Grande Trail/River Trail traverses the city, there are limited access points from the existing roadway network.

River Trail shared-use path

Existing Pedestrian Facilities

Although recognized as a pedestrian friendly and walkable city, Glenwood Springs has an incomplete sidewalk network. Sidewalks are present on the majority of the Glenwood Spring's downtown streets but are less common in residential areas. Where present, sidewalks range from 3 to 10 feet in width and are part of a hierarchical system of crosswalks throughout the city.

Existing Vehicular Facilities

The City's street system is comprised of over 135 roads of various lengths and widths and has five functional classifications for its streets. In the neighborhoods in and around downtown, local streets form a grid system, which is traditional for an historic urban area, and encourages more pedestrian and bicycle usage. In the newer areas of Glenwood Springs residential developments reflect more of a suburban form due to the steep canyon topography and two major rivers. As a result, streets in these areas are typically curvilinear and connectivity is more circuitous.

Much of the City's congestion is caused by the lack of a grid network outside the downtown area which typically helps disperse traffic throughout the system. Consequently, there is more reliance on the limited number of major streets such as SH-82, 7th Street, and 27th Street, which contributes to the congestion along these facilities.

Currently, there are three congested corridors where traffic volumes are either at or over the capacity. SH-82, the primary north – south street, accommodates both travel passing through the City and local traffic. SH-82 operates at capacity with significant delays at select intersections. The City, in conjunction with the Colorado Department of Transportation, completed the 2010 Corridor Optimization Plan that identified improvements intended to strike a balance between mobility and access so the functional intent of the state highway is maintained but access is adequate to accommodate both existing land uses and potential development opportunities.

The other congested corridors include 7th Street, 27th Street and South Midland Ave. 7th Street and 27th Street provide the only two east/west vehicular connections across the Roaring Fork River. Seventh Street is currently operating at close to capacity and 27th Street at South Midland Ave is operating over capacity during peak periods.

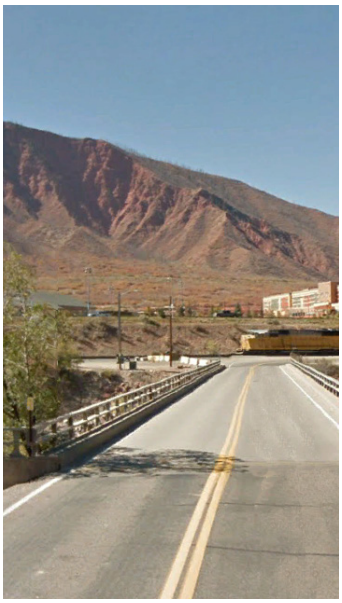
Streetscape on 7th Street (installed 2014)

Incomplete sidewalk at Glenwood Hot Springs, along N. River Street

High visibility crosswalk

Bridges

There are ten bridges in Glenwood Springs. Five bridges cross the Colorado River, three cross the Roaring Fork River, and two cross I-70 via Devereux Rd. Five of the ten total bridges are exclusively dedicated for bicycle and pedestrian use. The busiest vehicular bridges are the Grand Avenue Bridge with an AADT (Annual Average Daily Traffic) of 25,000 vpd (vehicles per day), the 27th Street Bridge with 9,500 vpd and the 7th Street Bridge with 8,300 vpd. The busiest pedestrian bridge, the Grand Avenue Pedestrian and Bicycle Bridge has combined bicycle and pedestrian volumes that can reach approximately 4,000 users per day during seasonal peaks (CDOT).



Devereux Bridge

Grand Ave. Pedestrian Bridge

Cardiff Bicycle and Pedestrian Bridge

Two Rivers Park Trail Bridge

Circulation Conditions

Four studies were considered in the development of circulation conditions data. The studies included:

- *Downtown Vehicular and Pedestrian Circulation Study* (Draft) - The draft study captured traffic patterns related to vehicular, bicycle and pedestrian volumes and was helpful in evaluating the existing and future circulation opportunities and challenges within the transportation network. While the study area was limited to the downtown area, the findings at key intersections are significant to the City's transportation network as a whole.
- SH-82 Access Control Plan (2013) - Adopted by City of Glenwood Springs in 2013, the plan identifies future property access points along the SH-82 corridor.
- Glenwood Ridge Traffic Impact Study (March, 2014) - The study analyzed the traffic impacts associated with the Glenwood Ridge Development on Four Mile Road to make recommendations to the road system.
- Traffic Assessment State Highway Access Permit Application for Iron Mountain Hot Springs (July, 2014) - The study estimated peak hour traffic generation for the Iron Mountain Hot Springs and examined existing movements on turn lanes along US 6 to determine whether or not they meet CDOT requirements under future conditions.

Twenty-seven intersections were analyzed for vehicular, bicycle, pedestrian and trail count volumes during the peak hours (see Figure 3.2). Trail count information was considered alongside vehicular, pedestrian and bicycle data as major Glenwood Springs trails are considered a significant part of the City's overall transportation network. Trail counts were collected by the Glenwood Springs Parks and Cemetery Department in 2013-2014 from automatic counters placed at each trail.

Vehicular Conditions: Existing Traffic Operations

The City's twenty-seven significant intersections were broken down into signalized and unsignalized groups for the sake of comparison as each condition presents its own issues. Table 3.1 describes each signalized intersection's LOS as well as its deficiency condition. Table 3.2 describes each unsignalized intersection through AM, PM, overall LOS, and volume-to-capacity ratio (v/c) for the worst performing movement (typically this is the left-turn approach at the stop-sign controlled intersection.) The prioritization of vehicular travel on Grand Avenue at some intersections results in longer green times on Grand Avenue and less on east-west travel. This reduced green time allocated to side streets increases vehicular (and pedestrian) wait time if crossing Grand Avenue.

27. US Highway 6 and Devereux St

26. Four Mile Rd and Midland/Airport

25. Mount Sopris Dr and Midland Ave

21. CR 115 and Hwy 82

22. Orrison d/w and Hwy 82

Figure 3.2: Downtown Intersections Key Map

Note: The above key map is a graphical reference for Tables 3.1 and 3.2

Table 3.1: Vehicular Level of Service: Signalized Intersections

Intersection	Level Of Service (LOS)			
	Control	Period	Overall	Deficient Approaches
1. 8th St. and Grand Ave.	Signal	AM PM Sat	B C B	EB - E, WB - E EB - F, WB - E EB - D, WB - D
2. 9th St. and Grand Ave.	Signal	AM PM Sat	A B B	WB - E EB - E, WB - F WB - E
3. 10th St. and Grand Ave.	Signal	AM PM Sat	A A A	EB - D, WB - D EB - E, WB - E EB - D, WB - D
4. 11th St. and Grand Ave.	Signal	AM PM Sat	A A A	EB - D, WB - D EB - E, WB - E EB - D, WB - D
5. 14th St. and Grand Ave.	Signal	AM PM Sat	A B A	EB - D, WB - D EB - E, WB - F EB - D, WB - D
7. 27th St. and Hwy 82	Signal	AM PM	C B	N/A N/A
23. 27th St. and Grand Ave	Signal	AM PM	A A	N/A N/A

Table 3.2: Vehicular Level of Service: Unsignalized Intersections

Intersection	Level Of Service (LOS)			
	Control	Period	Overall	(v/c)
6. 7th Street and Colorado Ave	Side-Street Stop	AM PM Sat	A B B	N/A
8. 7th Street and Cooper Ave	4-way stop sign	AM PM Sat	A A A	N/A
9. 8th Street and Cooper Ave	4-way stop sign	AM PM Sat	A A A	N/A
10. 9th Street and Cooper Ave	Side-Street Stop	AM PM Sat	A B B	N/A
11. Maple Street and Hwy 82	Side-Street Stop	AM PM	F C	0.05 0.04
12. 13th Street and Hwy 82	Side-Street Stop	AM PM	E F	0.27 0.39
13. D Street and Hwy 82	Side-Street Stop	AM PM	F F	0.54 0.41
14. Park Drive North and Hwy 82	Side-Street Stop	AM PM	C F	0.05 0.02

Table 3.2: Vehicular Level of Service: Unsignalized Intersections (continued)

Intersection	Level Of Service (LOS)			
	Control	Period	Overall	(v/c)
15. Park Drive South and Hwy 82	Side-Street Stop	AM PM	F F	0.02 0.06
16. 19th Street and Hwy 82	Side-Street Stop	AM PM	F F	0.16 0.76
17. Bradley d/w and Hwy 82	Driveway	AM PM	B F	0.04 0.30
18. 22nd Street and Hwy 82	Side-Street Stop	AM PM	E F	0.32 0.80
19. 24th Street and Hwy 82	Side-Street Stop	AM PM	D F	0.05 0.07
20. 29th Street and Hwy 82	Side-Street Stop	AM PM	F F	0.02 0.21
21. CR 115 and Hwy 82	Side-Street Stop	AM PM	E F	0.18 0.33
22. Orrison d/w and Hwy 82	Driveway	AM PM	E F	0.01 0.06
24. 27th Street and Midland Ave	Round-a-bout	AM PM	A A	N/A
25. Mount Sopris Drive and Midland Ave	Side-Street Stop	AM PM	C C	N/A
26. Four Mile Road and Midland/Airport	Side-Street Stop	AM PM	A A	N/A
27. US Highway 6 and Devereux St*	Side-Street Stop	AM PM	B C	N/A

*Overall LOS grade for US Highway 6 and Devereux Street intersection data is sourced from the Traffic Assessment State Highway Access Permit Application. The numbers here reflect future projection of volumes based on Synchro and SimTraffic traffic analysis software used to analyze year 2035 traffic volumes per Option #3 suggesting the installation of a signal, the relocation and widening of Traver Trail and the restriping of Devereux Road

Corridors were also evaluated in the *Downtown Vehicular and Pedestrian Circulation Study* for their performance as a whole using delay per vehicle, number of unserved vehicles, and the average speed along the highway (compared to posted speed limits). Segments along SH-82 were considered in the study and included I-70 to Pine Street, 8th Street to 13th Street, 14th Street to Blake Avenue and CR 154 to Orrison. The study of those highway segments revealed that drivers experience the greatest delays between I-70 and 14th Street. The study also showed that traffic demands exceeded capacity for some specific movements between 14th Street and Blake Ave. However, no intersection included in that segment has a calculated volume-to-capacity ratio greater than 1, suggesting that there may be an opportunity to improve signal operations for those specific delays. Traffic speed summaries showed that of the studied corridor segments along SH-82, drivers in the I-70 to Pine Street and 8th Street to 13th Street areas drove an average of almost 9 miles below the posted speed limit of 25 miles per hour. This is typical for urbanized areas with closely spaced traffic signals.

Bicycle and Pedestrian Conditions

Bicycle and pedestrian count data from the non-peak month of October 2012 was analyzed to identify downtown intersections that experience the most significant levels of bicycle and foot traffic. While most downtown intersections count less than six bicycle movements during any peak hour, increased bicycle traffic was observed at 8th and Cooper and 9th and Cooper during PM peak and Saturday.

Saturday midday generally has the highest pedestrian volume with many of the intersections counting over 100 pedestrians per hour. The intersections with the largest pedestrian volumes are 8th Street and Grand Avenue, 9th Street and Grand Avenue and 7th Street and Cooper Avenue (see Table 3.3).

Table 3.3: Pedestrian and Bicycle Counts

Intersection	Control	Ped Peak Period			Bike Peak Period		
		AM	PM	Sat	AM	PM	Sat
1. 8th St. and Grand Ave.	*Signal*	*55*	*134*	*373*	*0*	*2*	*0*
2. 9th St. and Grand Ave.	*Signal*	*35*	*57*	*173*	*0*	*0*	*0*
3. 10th St. and Grand Ave.	*Signal*	*18*	*40*	*70*	*0*	*0*	*0*
4. 11th St. and Grand Ave.	*Signal*	*7*	*13*	*30*	*0*	*1*	*1*
5. 14th St. and Grand Ave.	*Signal*	*22*	*25*	*24*	*0*	*2*	*3*
6. 7th St. and Cooper Ave.	*Stop*	*17*	*75*	*176*	*1*	*6*	*2*
7. 8th St. and Cooper Ave.	*4-Stop*	*38*	*105*	*130*	*1*	*5*	*7*
8. 9th St. and Cooper Ave.	*Stop*	*22*	*62*	*60*	*1*	*3*	*5*

Trail count data was collected by Glenwood Springs Parks Department with infrared trail counters at all major trails. This data reflects both pedestrian and bicycle numbers and is displayed in Table 3.4 in weekly and monthly amounts. The full trail count report includes hourly, daily, weekly, monthly and yearly numbers.

Table 3.4: Trail Counts - Average Bicycle and Pedestrian

Trail	Weekly	Monthly
1. Linwood Cemetery	*863*	*3,746*
2. Red Mountain - Golay Trail	*604*	*2,620*
3. Atkinson Trail - North	*653*	*2,775*
4. Atkinson Trail - South	*350*	*1,503*
5. River Trail at Two Rivers	*2,164*	*-*
6. Wulfsohn Trail - East	*662*	*2,873*

4 Infrastructure & Network Recommendations

CHAPTER CONTENTS

INFRASTRUCTURE & NETWORK RECOMMENDATIONS

Introduction

Glenwood Springs offers a scenic natural setting that makes the City a desirable place to live and visit. This setting allows easy access to a variety of hiking and road and mountain biking trails, river sports and the famous hot springs. The compact nature of the City is a direct result of the surrounding natural features and existing topography. This compactness translates into short intra-city trips for its residents and visitors with a diversity of available mobility options. However, the City's size also limits usable space for expansion, both through development and for transportation improvements. Due to the varied type of development in Glenwood Springs, each area has specific needs and concerns that will shape future multi-modal transportation facilities.

Recommended vehicular infrastructure was identified based on a review of previous studies and reports, information provided by City staff, commissions feedback, public input, and assessment of existing conditions. The recommendations focus on improving connectivity, providing additional capacity via either expanding existing facilities or adding new facilities and completing system gaps. In addition, many of the streets in the City are one-dimensional in nature, primarily designed to serve vehicular traffic. The new model for streets is to safely and efficiently meet the needs of all users, regardless of age, ability, or chosen mode of transportation.

Table 4.1 presents a list of recommended Infrastructure and Network Improvements to establish a multi-modal transportation network. Figures 4.1 and 4.2 illustrate the locations of these recommendations.

Recommended Infrastructure and Network Improvements

Table 4.1: Recommended Infrastructure and Network Improvements

Project Type	Project Rank	Project Name	Description
	On-Street Bicycle Facilities		
	1	8th Street on-street bicycle facilities	Install bicycle shared lane markings along both travel lanes of 8th Street from Vogelaar Park to Blake Avenue. Work elements include installing pavement markings and signing.
	6	Midland Avenue on-street bicycle facilities	Install bicycle lanes on Midland Avenue from 8th Street to 27th Street. Work elements for this project would include removal and replacement of striping as well as signing improvements. Widening of midland would need to occur, where current pavement width would not accommodate all modes.
	16	Bike Boulevard through North Glenwood Springs neighborhood	Designate and mark a bicycle boulevard between 6th and Pine and 6th and Linden intersections through north Glenwood Springs neighborhood. Work elements would include installing shared lane markings and signing.
	18	Donegan Road (GarCo) pedestrian (sidewalk) and bicycle (bike lanes) improvements	Install bike lanes on the north and south side of the Donegan Road. Add sidewalk on one side of Donegan Road. Work elements include widening existing roadway bench, adding pavement, adding curb and gutter, and adding 5' sidewalk.
	19	7th Street on-street bicycle facilities	Install bicycle shared lane markings along both travel lanes of 7th Street from Midland Avenue to Blake Avenue. Work elements include installing pavement markings and signing.
	21	6th Street on-street bicycle facilities	This project would add on-street bike lanes (buffered bike lanes) on 6th Street from Laurel Street to Olive Street. Work elements for this project would include removal and replacement of striping as well as signing improvements. Some widening may need to occur, where current pavement width would not accommodate the new facilities.
	34	Four Mile Road on-street bike facilities	Construct 6' shoulders to both travel lanes; add bicycle warning signs per MUTCD guidance. This project would require roadway reconstruction (clearing, major grading, and paving), signing and striping.
	39	Midland on-street bike facilities 27th - Four Mile Rd	This project would add on-street bike lanes on Midland Ave from 27th Street to Four Mile Road. Work elements for this project would include removal and replacement of striping as well as signing improvements. Widening of midland would need to occur, where current pavement width would not accommodate all modes.
	45	Midland Avenue on-street bike facilities	This project would add on-street bike lanes on Midland Ave from I-70 to 8th Street. Work elements for this project would include removal and replacement of striping as well as signing improvements. Some widening may need to occur, where current pavement width would not accommodate all modes.
	NA	10th Street on-street bicycle facilities	Install bicycle shared lane markings along both travel lanes of 10th Street from School Street to Blake Avenue. Work elements include installing pavement markings and signing.

Table 4.1: Recommended Infrastructure and Network Improvements

Project Type	Project Rank	Project Name	Description
	NA	Pitkin Avenue on-street bicycle facilities	Install bicycle lanes Pitkin Avenue from 8th Street to 14th Street. Work elements include installing pavement markings and signing.
	NA	14th Street on-street bicycle facilities	Install bicycle shared lane markings on 14th Street from Blake Avenue to Coach Miller Drive. Work elements include installing pavement markings and signing.
	NA	Coach Miller Drive on-street bicycle facilities	Install bicycle shared lane markings on Coach Miller Drive from 14th Street to and along Park Drive. Work elements include installing pavement markings and signing
	Bicycle/Pedestrian On- and Off-Street Improvement		
	15	South Blake Ave sidewalk improvements and bike facilities	Add 5' sidewalk on north and south side of Blake Ave from 23rd to 27th; add 5' sidewalk from BRT station to Walmart on north and south side of Blake Ave (City to complete this project in 2015); add 5' sidewalk on south side of Blake Ave: add shared lane markings from on Blake Ave from 23rd St to SH-82.
	23	Enhance connection: Two Rivers Park to Glenwood Canyon Recreation Trail	Install wayfinding signs along entire corridor per MUTCD; widen sidewalk underneath I-70 bridge at exit 116 to 8'; add shared lane markings along N. River Street to Glenwood Canyon Recreation Trail Trailhead.
	Bicycle/Pedestrian Shared-use Path		
	3	Midland Avenue shared-use path Lowes-Devereux	Install 10' share-use path adjacent to Midland Avenue from Lowes to I-70 interchange. Work elements would include clearing, removals, grading, and path paving.
	7	Hwy-6 Corridor shared-use path Laurel - Mel Ray	Design and construct a 10' wide shared-use path on the north side of Highway-6. The project would include improving the existing sidewalk (typically 6') from Donegan Rd to Mel Ray Rd, removal and replacement of the old asphalt shared-use path from Linden St. to Mel Ray Rd. Work elements include removal and replacement of sidewalk, signing, and asphalt shared-use path.
	26	27th St side-path	Install 10' wide attached shared-use path to south side of 27th Street from S. Grand Ave to SH-82. Work elements would include clearing and grubbing, removals, installing a retaining wall (Average 6.5' high), and installing pedestrian curb ramps.
	27	LoVa Trail	Install 10' shared-use path from West Glenwood Sanitation District plant to New Castle. Refer to existing construction drawings for alignment and cost implications.
	28	Atkinson Trail connection to Park East Trail	Install 10' wide detached share-use path from Atkinson Trail to Mountain Drive. Work items include removals, sub-base preparation, and path paving.
	29	Rio Grande Trail connection at 10th Street	Install 10' wide shared-use path from 10th Street to Rio Grande Trail. This project would include coordination with RFTA, school district, and property owners. Work elements would include, removals, clearing, grading, and path paving.

Table 4.1: Recommended Infrastructure and Network Improvements

Project Type	Project Rank	Project Name	Description
	33	Rio Grande Trail and 11th St connection	Install a 10’ wide shared-use pathway from 11th Street to the Rio Grande Trail. This project would include coordination with RFTA and property owners. Work elements would include, removals, clearing, grading, and path paving.
	35	Colorado River shared-use path (Rivertrail segment)	Install 10' wide shared-use along the Colorado River, from Two Rivers Park to White water Activity Area. Work elements would include clearing, grading, retaining walls, path paving, and placing a bicycle and pedestrian bridge.
	37	Rio Grande Trail connection at 14th St	Install a 10’ wide shared-use pathway from 14th Street to the Rio Grande Trail. This project would include coordination with RFTA and property owners. Work elements would include, removals, clearing, grading, and path paving.
	40	Atkinson Trail to Rio Grande Trail, "22nd St" bridge connection	Install 10’ shared-use path on the west side of the Roaring Fork from 27th Street north to a new bridge across the river vicinity of 22nd Street (City Property) along the ditch alignment. This project would include clearing, removals, grading, retaining walls, path paving, and a new bridge across the river.
	44	SH-82 shared-use path to commercial areas	Install new 10’ shared-use path along SH-82 from South Blake Ave to commercial center (Thrifty Thrills area).
	Pedestrian Sidewalk		
	12	Blake Ave sidewalk improvements	Add 5' sidewalk where missing and add 5' sidewalk where existing segments are substandard along east side of Blake Avenue.
	24	School Street sidewalks	Install 6' wide sidewalks on the west side of School Street from 8th Street to 9th Street and from 10th Street to 11th Street. Work elements include clearing and grubbing, removals, adding concrete sidewalk and pedestrian curb ramps.
	41	Coach Miller Dr sidewalk	Install 6' wide sidewalks on the west side of Coach Miller Drive. This project would include clearing, minor grading, and sidewalk paving.
	43	Midland sidewalk 27th to Park West Drive	Install new 6’ sidewalk along Midland Ave from end-of-path near Terraces/Hager Lane to end-of-path at Park West Drive.
	Intersection Improvement		
	9	7th Street Rectangular Rapid Flashing Beacons (RRFB’s)	Install RRFB’s at pedestrian crosswalks along 7th Street.
	11	Hwy 6 Rectangular Rapid Flashing Beacon (RRFB) at Soccer Field Road bus stop	Install RRFB on US-6 to access the transit stop opposite Soccer Field Rd.

Table 4.1: Recommended Infrastructure and Network Improvements

Project Type	Project Rank	Project Name	Description
	13	Mt. Sopris Drive Rectangular Rapid Flashing Beacon (RRFB's) at Midland Ave	Install RRFB's on Midland Ave at Mt. Sopris Dr. intersection. Work elements would include a signing and striping.
	14	RRFB's Crossing Hwy-6 and 135 Road bus stop	Install an RRFB activated pedestrian crosswalk across Hwy-6 to access the transit stop opposite 135 Rd. Work elements would include signing and striping.
	17	27th Street and S Grand Ave traffic operations	Compare and evaluate signal timing of current intersection and operations of a roundabout to mitigate traffic congestion.
	22	RRFB crossing Midland Ave at 4 Mile Road	Install RRFB's across Midland Avenue at the Four Mile and Airport Roads intersection. This project would include adding signing, striping and RRFB equipment.
	25	Grade-separated bicycle and pedestrian crossing of SH-82 and 27th Street	Evaluate underpass/overpass for both a north-south crossing of 27th Street (align with Rio Grande Trail) and a east-west crossing of SH-82.
	30	Grade-separated pedestrian crossing of SH-82 at 15th	Evaluate a new pedestrian overpass that connects High School to east side of SH-82.
	31	6th and Laurel pedestrian and bicycle improvements (in conjunction with the Grand Avenue Bridge improvements)	Facilitate safe and comfortable movement of pedestrians and bicyclists through this intersection via wayfinding signage, shared lane markings, bicycle lanes, shared-use pathways (or sidewalks) in conjunction with Grand Avenue Bridge improvements.
	32	12th St ditch underpass	Install 14' wide (min.) underpass beneath SH-82 along 12th Street ditch alignment. Work elements would include excavation, retaining walls, grading, clearing, working with property owners, and traffic control.
	36	Grade-separated bicycle and pedestrian crossing of Grand at 23rd	Evaluate underpass/overpass for an east-west crossing of SH-82 on the north side of the intersection.
	42	23rd St and SH-82 intersection improvements	Install pedestrian refuge island in SH-82 to facilitate shorter pedestrian crossing distances. This would include removals, removal and replacement of striping, and refuge installation.
	46	Grade-separated pedestrian crossing of SH-82 at 9th Street	Install a new grade-separated bicycle/pedestrian crossing of Grand Ave SH-82 at 9th Street. Evaluate underpass and overpass options.
	47	Whitewater Activity Area underpasses	Construct an underpass under Midland Avenue on one side of the Colorado River for watersport users to reduce at grade conflict with vehicles.

Table 4.1: Recommended Infrastructure and Network Improvements

Project Type	Project Rank	Project Name	Description
	Bicycle/**Pedestrian Bridge**		
	4	Relocate Grand Avenue pedestrian bridge to 15th St over the Roaring Fork River	Dismantle and relocate the existing (1985) Grand Avenue pedestrian bridge to 15th Street over the Roaring Fork River.
	Bridge and Multi-Modal Infrastructure Improvement Projects		
	2	South Bridge	Implement South Bridge project per the preferred alternative in the EA. The improvements would be from Four Mile Road/Airport Road to new interchange with SH-82 and would include 2 vehicle travel lanes, landscape buffers and 8' shared-use pathways.
	5	Sunlight Bridge replacement	Design and construct a new multi-modal bridge over Roaring Fork to connect Midland and South Grand Ave at 27th Street. This project would include widening the existing bridge to a three lane section to include a left turn lane and the additions of 8' shared-use sidewalks on both sides.
	10	14th Street Multi-modal bridge	Construct multi-modal bridge across Roaring Fork Bridge connecting 14th Street and Midland Avenue.
	20	Devereux Road multi-modal bridge	Construct multi-modal bridge across Colorado Bridge connecting Devereux Road to Midland Avenue. This project would include 2 vehicle travel lanes, 8' shared-use paths on both sides of the bridge, and all structural elements to span the Colorado River and Railroad ROW. In addition, a complete environmental assessment (EA) would be necessary.
	38	Roaring Fork Bridge Mt Sopris Dr - CR 154	Install a new multi-modal bridge over Roaring Fork to connect Mt. Sopris Drive to CR 154. This project would include two vehicle travel lanes, shared-use sidewalks, and bridge structure. In addition, property acquisition would be necessary.
	Multi-Modal Improvement		
	1	8th St Extension	This project will include extending 8th Street from Vogelaar Park to Roaring Fork River. It will include the following improvements, 2 vehicle travel lanes and 8' shared-use pathways.

Glenwood Springs
Long Range Transportation Master Plan

Figure 4.1: Recommended Infrastructure and Network Improvements - North Map

PARSONS BRINCKERHOFF

alta PLANNING + DESIGN

CITY OF GLENWOOD SPRINGS

On-street bike facilities
Pedestrian crosswalk
Pedestrian crosswalk
LoVA Trail
Below-grade pedestrian crossing
Midland shared-use path
On-street bike facilities
Laurel to Mel Ray shared-use path
On-street bike facilities
CO River Rivertrail segment
On-street bike facilities
Signage and marking improvements
Sidewalk improvements/bike facilities/wayfinding
Multimodal bridge
Sidewalk improvements/bike facilities/wayfinding
Pedestrian crosswalk
Pedestrian crosswalk
Street extension
Rio Grande trail connection
Rio Grande trail connection
Multimodal bridge
Rio Grande trail connection
New sidewalk
Dismantle/relocate bridge
On-street bike facilities
On-street bike facilities
On-street bike facilities
Pedestrian crosswalks
Grade-separated crossing
On-street bike facilities
New sidewalk
Grade-separated crossing
On-street bike facilities
New sidewalk
Grade-separated crossing
Atkinson to Rio Grande Trail bridge

Legend

- Bicycle On-Street Improvement
- Bicycle/Pedestrian On- and Off-Street Improvement
- Bicycle/Pedestrian Shared-use Path
- Pedestrian Sidewalk
- Intersection Improvement
- Bicycle/Pedestrian Bridge
- Multi-Modal Bridge
- Multi-Modal Improvement

N

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 500 feet

Glenwood Springs
Long Range Transportation Master Plan

Figure 4.2: Recommended Infrastructure and Network Improvements - South Map

PARSONS BRINCKERHOFF

alta PLANNING + DESIGN

Multimodal bridge
Rio Grand trail connection
Coach Miller sidewalk
Dismantle/relocate bridge
On-street bike facilities
Grade-separated bicyle/pedestrian crossing
Signal timing modifications or roundabout
Multimodal Bridge
On-street bike facilities
New sidewalk
On-street bike facilities
Atkinson Trail connection
Pedestrian crosswalk
Pedestrian crosswalk
Grade-separated crossing
On-street bike facilities
Sidewalk improvements
Grade-separated crossing
Atkinson to Rio Grande Trail bridge
Pedestrian refuge island
Sidewalk improvements/bike facilities
Grade-separated bicyle/pedestrian crossing
27th sidepath
New sidewalk
Multimodal Bridge
2 | Multimodal bridge

Legend

- Bicycle On-Street Improvement
- Bicycle/Pedestrian On- and Off-Street Improvement
- Bicycle/Pedestrian Shared-use Path
- Pedestrian Sidewalk
- Intersection Improvement
- Bicycle/Pedestrian Bridge
- Multi-Modal Bridge
- Multi-Modal Improvement

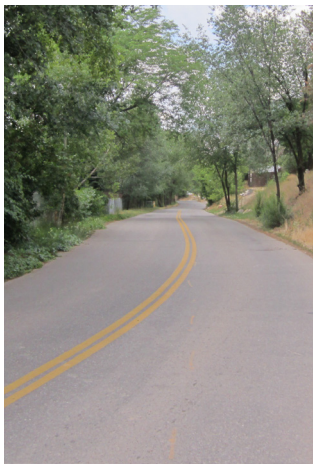
N

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 500 feet

5 Implementation Plan

CHAPTER CONTENTS



Linden Street: potential advisory bike lane

LOW-HANGING FRUIT PROJECTS

"Low Hanging Fruit" projects are those that are relatively easy or inexpensive to implement. Although some are not listed on the top priority projects list, low hanging fruit projects should be considered for implementation as soon as funding is available to continue momentum and make progress on network implementation.

IMPLEMENTATION PLAN

Implementation Strategies

The projects, programs, and policies recommended in Chapter 4 of this document, if implemented, detail the improvements and changes that will benefit the city over the next 10 to 15 years. This chapter provides guidance on how to make the facility improvements, programs and policies in this document a reality. Not all of these improvements can be made quickly; it will take many years of steady, incremental progress to achieve this vision. This chapter will be a tool to further Glenwood Springs evolution as a multi-modal community by identifying 'low hanging fruit' costs and funding opportunities. Implementation of this plan will take place in small steps over many years. The following strategies will guide the city toward developing and implementing the projects identified in the plan.

Implement inexpensive "**low-hanging fruit**" projects first to gain a more connected bicycle and pedestrian network. Such projects could include:

- Bicycle boulevards in North Glenwood Springs (such as Pine Street, 5th Street, Laurel Street, and Linden Street)
- Bike lanes that require *only* striping to complete (such as Pitkin Avenue, and Midland Avenue from I-70 to 8th Street)

Opportunistically pursue projects such as bike lanes or shoulder bikeways in conjunction with **roadway resurfacing or other maintenance projects** as they occur.

Strategically pursue high-priority projects and programs with local or grant funding.

Incrementally pursue projects based on **available resources** with the goal of eventually completing the project in full.

Incrementally pursue projects based on opportunities associated with **new development.**

Revisit the Long Range Transportation Master Plan every year to evaluate project implementation progress and to review project prioritization and applicability of programs under the current financial environment. Elevate implementation priority for projects that will significantly enhance the transportation network as it matures.

Federal Sources

Federal Formula Grants

The Federal Transit Administration (FTA) apportions certain federal funds based on formulas stipulated in the Moving Ahead for Progress in the 21st Century Act (MAP-21). These formula funds are used only for transit projects. For Glenwood Springs, FTA formula funds flow through CDOT. A locally-based transit program is eligible under the following federal formula grant programs:

- **Surface Transportation Program Funds.** Surface Transportation Program (STP) funds could be an eligible funding source for the City. These funds are referred to as "flexible" because they may be used for an array of eligible projects, including transit. Aside from its highway uses, the STP program can be applied to the capital cost of any public transportation project eligible for grant assistance under the transit title of the U.S. Code (49 U.S.C. Chapter 53 - Public Transportation).

- **Formula Grants for Other than Urbanized Areas (5311)**. Administered through CDOT, eligible recipients may use the funding for capital, operating, administrative expenses for public transportation projects that meet the needs of rural communities; capital projects; operating costs of equipment and facilities for use in public transportation; and the acquisition of public transportation services, including service agreements with private providers of public transportation services.

- **Alternatives Analysis (5339)**. Funds may be used to assist the City in conducting alternatives analyses when at least one of the alternatives is a new fixed guideway systems or an extensions to an existing fixed guideway system.

Federal Discretionary Grants

The federal government awards discretionary grants to states and other eligible recipients through competitive application processes. Unlike formula grants, there is no set allotment for a given geographic area and individual projects compete against other projects nationwide. These programs typically allow for a federal share of up to 80 percent of the project capital cost and require a local match for the remaining 20 percent.

- **National Infrastructure Investments (TIGER).** The Transportation Investment Generating Economic Recovery (TIGER) grant program is a discretionary grant program established under the American Recovery and Reinvestment Act. In theory, TIGER funds may be used for virtually any transportation infrastructure investment that would have a significant impact on the nation, a region, or a metropolitan area. Eligible projects include transit, highways, airports, and freight facilities.

The U.S. Department of Transportation (DOT) administers the TIGER program and may award grants covering up to 80 percent of a project's construction costs, although successful applications in urban areas generally request no more than $20 million and less than 35 percent of project costs from this program. Funds are required to be obligated within two years of award and are typically allocated to projects that have completed the National Environmental Policy Act (NEPA) process.

TIGER is not a statutory program, but given the overwhelming demand for the funding program to date, it is probable that future rounds of funding will be made available. To date there have been six rounds of TIGER funding with announcements on awards for the seventh round expected son. Most TIGER grant projects have been large ($10 million+) projects with a national or interstate commerce benefit.

HUD Discretionary Grants

- **Sustainable Communities Regional Planning (SCRP) Grant Program.** The US Department of Housing and Urban Development offers discretionary grants to local efforts to target housing, economic and workforce development, and infrastructure investments to create more jobs and regional economic activity. These HUD grants have been used for infrastructure projects in the past; however, grants through this program have not been awarded since FY 2011.

State Sources

- **Highway Users Tax Fund (HUTF).** Colorado's Highway Users Tax Fund collects revenues from motor fuel excise taxes, annual vehicle license and registration fees, and passenger-mile taxes on vehicles. Revenues from the fund are disbursed to recipients, including Glenwood Springs, based on a formula prescribed by statute.

- **State Highway Fund (SHF).** The State Highway fund is a subset of the HUTF that is administered by CDOT for the maintenance of the state's highway system. The fund also generates revenue through interest earnings on the fund balance. The SHF can also be used for matching available federal highway construction funding.

- **State General Fund.** The State General Assembly has provided mechanisms that can be used to allocate General Fund revenues for transportation projects, including direct transfers. Another mechanism, passed in 2009 by the General Assembly, creates a trigger of transfers from the General Fund to the HUTF when Colorado personal income grows 5 percent or more in a calendar year.

- **FASTER Transit Grants (Fund transit, safety, and bridge enterprise).** FASTER Transit Grants are awarded by the CDOT Division of Transit and Rail for the purchase of transit vehicles; construction of multimodal stations, and acquisition of equipment for consolidated call centers. Local recipients are required to provide a minimum 20% local match.

- Department of Local Affairs (DOLA). The Local Government Financial Assistance section manages a number of grant and loan programs within the Department of Local Affairs specifically designed to address public facility and service needs. Through coordination and outreach with the department's field offices, grant and loan resources are distributed on both a formula and discretionary basis depending upon applicable state statutory provisions, federal requirements and/or program guidelines.

Local Sources

At the local level, Glenwood Springs could fund the program through existing revenue streams or a variety of other local sources. Options include:

- **City General Fund.** The City could choose to earmark funds from its general fund sources to allocate towards transportation projects.

- **1/2 Cent Street Tax Fund.** Glenwood Springs receives a 1/2 cent sales tax to maintain the City's transportation facilities and plan new transportation initiatives for both vehicles and pedestrians. The tax was raised from 1/4 cent to 1/2 cent in 2006, and is effective until December 31, 2026.

- **2/10 Cent Bus Tax Fund.** The City collects a voter-approved 2/10 cent sales tax with no sunset date to support administration, operations, and capital improvements of the Ride Glenwood Springs transit system.

- **Other Special Sales Taxes.** Revenue from temporary or permanent sales taxes dedicated to transportation uses is increasingly utilized for transportation investments. Special purpose sales taxes can provide funding streams for a variety of programs, and since they are implemented at a city level, they would apply only within the City. This of course would require a public vote. As and example, the City currently has an Acquisitions & Improvements 1 cent sales tax that sunsets on 13-31-18 and will be going to the voters with a reauthorization request next year.

- **Special Assessments.** Special assessments are additional property taxes that are self- imposed on properties close to a new transportation facility or service. They can be used as a dedicated annual revenue stream for funding operations or bonded against under the right set of circumstances. The assessment is levied against parcels in an area that receive a special benefit that can be clearly identified and measured. Implementation of special tax districts can be challenging and before this mechanism can be considered an option, affected local landowners and businesses would need to buy into the premise that the tax is worth the value that the infrastructure or service improvement provides. Nationally, special tax districts are one of the most common forms of value capture for transportation projects.

- **Joint Development.** This refers to the development of a transportation facility and/or adjacent private real estate development, in which a private sector partner: (1) with respect to the transportation facility either provides the facility or makes a financial contribution to offset its costs; and/or (2) incorporates a profit sharing mechanism into the private portion of the project that enables the public sector to share in the private returns. Joint development is more commonly used to provide upfront capital funding, but operations funding based on a lease revenue stream could be considered. There are shopping centers and other large land owners that could donate land or station area amenities to help promote the rider experience at their station stops.

- **Transportation Demand Management Strategies.** Transportation Demand Management (TDM) is the application of strategies and policies to reduce travel demand (particularly, that of the solo-occupant auto) or to redistribute this demand in space or time. There are a number of strategies in the TDM field. Hypothetical TDM strategies include the imposition of parking charges in downtown street locations and parking lots and time limits on downtown parking to ensure more frequent turnover of close-in spaces for shoppers and to encourage all-day parkers to utilize transit instead. Of course, the City would need to weigh the advantages and disadvantages of these programs in the larger context of downtown commercial activity.

- **Private contributions.** These include donations from private entities in exchange for a specific benefit (i.e. advertising). An example would be advertising by local merchants on the outside of a bus. Like naming rights, private sector contributions could potentially be structured to provide a predictable annual revenue stream for funding operations but the magnitude of these payments is likely to be relatively small. Local civic or cultural organizations often contribute funding for sidewalk or park improvements in situations where the organization can be recognized for its contributions with an engraving or placard.

- **Service Purchase Agreements.** Under this approach, an institution or private entity agrees to directly reimburse the transit system for provision or use of the service.

- **Parking Revenues.** The City can use revenues from parking to fund transportation projects. Like naming rights and private contributions, the magnitude of these revenues is likely to be small and unlikely to cover a large portion of costs.

- **SIDs and BIDs.** Special Improvement Districts (SIDs) and Business Improvement Districts (BIDs) are special assessment districts within a city, formed by property and/or business owners as a means of funding and implementing local improvement projects. Establishment of a LID/BID offers low-interest financing, funded through the sale of bonds, for district-wide improvement projects. Incremental assessments are collected over several years for the collective costs of projects in the district. Projects are typically infrastructural and can include construction and maintenance of sidewalks, street lighting, roads, and utility lines. The benefits of SIDs/BIDs are that they provide a means of funding public projects that the City can't fund, they offer project financing for property owners, they spread the costs of projects over all affected property owners, and the owner assessments directly reflect the costs of the projects. The drawbacks of SIDs/BIDs are that they take a significant amount of time to establish and the project approval process can be tedious.

- **Tax Increment Financing (TIF).** A method to use future gains in taxes to subsidize current improvements, which are projected to create the conditions for said gains. The completion of a public project often results in an increase in the value of surrounding real estate, which generates additional tax revenue. Sidewalk and other streetscape improvements are typically popular uses of TIF funding.

Table 5.1: Summary of Preliminary Funding Assessment Sources

Funding Source/Title	Project Types	Eligible Recipients	Funding Approval
Federal Sources			
Rural FTA (§ 5311)	Capital and Operations	CDOT	CDOT
Bus and Bus Facilities (§ 5339)	Capital	Transit Agencies	CDOT
Surface Transportation Program Funds	Capital	CDOT	CDOT
National Infrastructure Investments (TIGER)	Capital	Infrastructure projects with National benefit	U.S. DOT
HUD Sustainable Communities Planning Grants	City Discretion	Projects that spur economic development	HUD
State Sources			
Highway Users Tax Fund (HUTF)	Capital and Operations	Counties, Municipalities, CDOT	Glenwood Springs
State Highway Fund (SHF)	Operations	CDOT	CDOT
State General Fund	Capital	CDOT	CDOT
Local Sources			
City General Fund	City Discretion	City projects if determined eligible	Glenwood Springs
1/2 Cent Street Tax Fund	City Discretion	All city transportation related projects	Glenwood Springs
2/10 Cent Bus Tax Fund	City Discretion	Bus related projects	Glenwood Springs
Other Special Sales Taxes	City Discretion	Determined based on tax measure provisions	Glenwood Springs
Special Assessments	Case by Case - Dependent	Case by Case - Dependent	Glenwood Springs and Assessed Property Owners
Joint Development	Case by Case - Dependent	Case by Case - Dependent	Glenwood Springs and Partnering Property Owners
New Development Assessment Fees	Case by Case - Dependent	Case by Case - Dependent	Glenwood Springs and Assessed Property Owners
Transportation Demand Management Strategies	Case by Case - Dependent	Case by Case - Dependent	Glenwood Springs
Naming Rights	Capital and Operations	Glenwood Springs	Glenwood Springs
Private Contributions/ Support	Capital and Operations	Glenwood Springs	Glenwood Springs
Service Purchase Agreements	Operations	Glenwood Springs	Glenwood Springs
Business Improvement District	Case by Case - Dependent	Case by Case - Dependent	Glenwood Springs
Parking Revenues	Case by Case - Dependent	Case by Case - Dependent	Glenwood Springs

Project Prioritization

A project team composed of the City's Parks & Recreation, Planning & Zoning, River, and Transportation Commissions along with the internal review team completed a prioritization process to help identify infrastructure projects that benefit the Glenwood Springs transportation system the most and best achieve project goals and objectives. Priority projects are those that have a significant value to the community and will have a larger impact to the overall network than simply developing an isolated bike lane or pathway.

Ranking Methodology

The ranking methodology and rating was developed by the project team in conjunction with city staff and the city commissions using a "weight 'em and rate 'em" process of developing ranking criteria, assigning weights to each criteria, and rating each project in relation to the developed criteria.

Scoring and Ranking

The criteria included in Table 5.2 were applied to each project. The project either met or failed to meet the criteria requirements. If the project met the criteria requirements, it was multiplied by the criteria's weight which was established by the review team with commissions input. Then the project's weighted scores for each criteria were added up to give a total score. These total scores were compared, and the projects ranked according to total score. This tool can be used and modified as necessary by the city as additional projects are desired or as criteria emphasis preferences change. It should be noted that this process is a tool to be considered when determining next project priorities, but is not the determining factor in which projects will be constructed in what order. Opportunities to develop projects through any means as they arise should not be wasted even if the project in question does not rate highly in the scoring.

Table 5.2: Summary of Evaluation Criteria and Scoring

Criteria	Description	Weighted Score[1]
Improves safety	Assesses the extent to which the project addresses identified safety problems for any or all modes of travel in Glenwood Springs' transportation system. This criteria would also assess whether a project improves the response time for emergency vehicles and provides alternate evacuation routes.	4.82
Improves connectivity	The project provides a new or improves upon an existing access to job centers, activity centers, neighborhoods, schools, or transit stops, public parks, open spaces and trails, other recreational destinations within and outside Glenwood Springs.	4.82
Transportation efficiency	The project improves the ability of people and goods to travel within and through Glenwood Springs (by auto, by bike or by walking)	4.18
Cost Effectiveness	The project benefits are weighed against the projects costs (including maintenance costs)	4.09
Expands multi-modal options	Assesses the extent to which a project provides transportation alternatives to vehicular travel and the extent to which a project has the ability to improve public health	4.00
Enhances Quality of Life	Assess whether the project preserves or enhances Glenwood's character, whether the project preserves or enhances historic resources, whether the project provides new or enhanced access to parks, open space and lifestyle amenities.	4.00
Reduces congestion	Assesses the extent to which the project helps reduce vehicular congestion on the street system in the short-term or long-term.	3.73
Minimizes impacts to the environment	Assess whether the project minimizes environmental impact, reduces carbon based vehicle miles traveled by reducing the distance between common destinations (by car) or includes facilities for bicycling, walking or transit. The project could also provide infrastructure for alternative or smaller vehicles.	3.64
Ease of implementation	The project is "shovel ready," requires little road reconfiguration or has an existing funding source/project that it can be implemented under.	3.55
Integrates land use goals and plans	Assesses how well the project integrates local and regional land use goals and adopted City and regional planning documents.	3.36
Public Input	The project has gone through a public input process	3.27
Improves Access to Schools	To encourage more students to walk and bicycle to school, proposed facilities that directly connect to or travel within ¼ mile of any school (public, private, primary, secondary, CMC) would qualify for this prioritization criteria.	3.00

[1]Criteria and weighting developed by city council, city commissions, city staff and project team.

Prioritized Improvements

Table 5.3: Prioritized Infrastructure and Network Improvements

Priority	Project Name	Commission Ranking						
		Parks & Rec.	P &Z	River	Trans-portation	Total Score	Total Responses	Average Score
1	8th St Extension	317.67	624.95	822.91	878.51	2,644.04	14	188.86
2	South Bridge	240.65	580.76	743.88	949.32	2,514.61	14	179.62
3	Midland Avenue shared-use path Lowes-Devereux	401.50	486.58	794.11	777.65	2,459.84	14	175.70
4	Relocate Grand Avenue pedestrian bridge to 15th St over the Roaring Fork River	362.58	329.20	800.80	777.87	2,270.45	13	174.65
5	Sunlight Bridge replacement	318.83	508.23	717.44	773.72	2,318.22	14	165.59

Table 5.3: Prioritized Infrastructure and Network Improvements (continued)

Priority	Project Name	Commission Ranking						
		Parks & Rec.	P &Z	River	Trans-portation	Total Score	Total Responses	Average Score
6	Midland Avenue on-street bike facilities	395.95	458.32	812.20	642.11	2,308.58	14	164.90
7	Hwy-6 Corridor shared-use path Laurel - Mel Ray	331.03	426.22	743.99	786.19	2,287.43	14	163.39
8	Wayfinding Map at Two Rivers Park	374.13	451.15	679.88	781.31	2,286.47	14	163.32
9	7th Street Rectangular Rapid Flashing Beacons (RRFB's)	343.57	367.66	709.36	526.73	1,947.32	12	162.28
10	14th Street Multi-modal bridge	171.91	537.68	768.89	788.08	2,266.56	14	161.90
11	Hwy 6 Rectangular Rapid Flashing Beacon (RRFB) at Soccer Field Road bus stop	377.49	459.06	681.10	584.56	2,102.21	13	161.71
12	Blake Ave sidewalk improvements	311.21	411.95	677.71	755.28	2,156.15	14	154.01
13	Mt. Sopris Drive Rectangular Rapid Flashing Beacon (RRFB's) at Midlane Ave	317.85	455.32	669.81	549.55	1,992.53	13	153.27
14	RRFB's Crossing Hwy-6 and 135 Road bus stop	352.21	451.79	636.72	546.38	1,987.10	13	152.85
15	South Blake Ave sidewalk improvements and bike facilities	289.20	481.97	706.28	649.37	2,126.82	14	151.92
16	Bike Boulevard through North Glenwood Springs neighborhood	353.94	220.30	693.30	668.02	1,935.56	13	148.89
17	27th Street and S Grand Ave traffic operations	278.20	419.32	648.42	734.30	2,080.24	14	148.59
18	Donegan Road (GarCo) pedestrian (sidewalk) and bicycle (bike lanes) improvements	331.30	447.96	738.83	552.43	2,070.52	14	147.89
19	7th Street shared roadway	328.30	465.12	763.29	497.20	2,053.91	14	146.71
20	Devereux Road multi-modal bridge	196.09	459.50	712.52	672.53	2,040.64	14	145.76
21	Hwy 6 on-street bike facilities	305.58	427.50	651.92	631.45	2,016.45	14	144.03
22	RRFB crossing Midland Ave at 4 Mile Road	280.03	427.15	646.91	517.37	1,871.46	13	143.96
23	Enhance connection: Two Rivers Park - Glenwood Canyon Recreation Trail	317.56	442.14	733.00	519.12	2,011.82	14	143.70
24	School Street sidewalks	356.67	439.05	690.71	519.35	2,005.78	14	143.27
25	Grade-separated bicycle and pedestrian crossing of SH-82 and 27th Street	330.75	438.86	636.61	551.42	1,957.64	14	139.83
26	27th St side-path	289.39	438.77	647.71	554.18	1,930.05	14	137.86
27	LoVa Trail	210.90	492.04	692.87	521.21	1,917.02	14	136.93

Table 5.3: Prioritized Infrastructure and Network Improvements (continued)

Priority	Project Name	Commission Ranking						
		Parks & Rec.	P &Z	River	Trans-portation	Total Score	Total Responses	Average Score
28	Atkinson Trail connection to Park East Trail	276.00	372.94	707.44	479.87	1,836.25	14	131.16
29	Rio Grande Trail connection at 10th Street	248.73	402.47	695.27	352.33	1,698.80	13	130.68
30	Grade-separated pedestrian crossing of SH-82 at 15th	387.41	384.85	565.42	486.17	1,823.85	14	130.28
31	6th and Laurel pedestrian and bicycle improvements (in conjunction with the Grand Avenue Bridge improvements)	296.02	211.01	685.90	350.78	1,543.71	12	128.64
32	12th St ditch underpass	243.19	315.57	629.24	597.79	1,785.79	14	127.56
33	Rio Grande Trail and 11th St connection	248.73	354.29	662.08	373.68	1,638.78	13	126.06
34	Four Mile Road on-street bike facilities	213.74	363.32	558.98	627.56	1,763.60	14	125.97
35	Colorado River shared-use path (Rivertrail segment)	191.54	343.03	693.98	480.69	1,709.24	14	122.09
36	Grade-separated pedestrian crossing of Grand at 23rd	366.04	284.93	602.70	444.69	1,698.36	14	121.31
37	Rio Grande Trail connection at 14th St	261.64	336.68	655.18	440.96	1,694.46	14	121.03
38	Roaring Fork Bridge Mt Sopris Dr - CR 154	191.46	417.40	597.87	485.15	1,691.88	14	120.85
39	Midland on-street bike facilities 27th - Four Mile Rd	220.45	316.01	727.62	407.12	1,671.20	14	119.37
40	Atkinson Trail to Rio Grande Trail, "22nd St" bridge connection	253.63	276.83	717.24	401.43	1,649.13	14	117.80
41	Coach Miller Dr sidewalk	258.28	336.75	623.81	415.86	1,634.70	14	116.76
42	23rd St and SH-82 intersection improvements	83.27	345.96	694.00	364.05	1,487.28	13	114.41
43	Midland sidewalk 27th to Park West Drive	195.91	330.84	638.89	431.31	1,596.95	14	114.07
44	SH-82 shared-use path to commercial areas	230.20	311.85	657.74	352.14	1,551.93	14	110.85
45	Midland Avenue on-street bicycle facilities	236.92	298.39	631.98	384.58	1,551.87	14	110.85
46	Grade-separated pedestrian crossing of SH-82 at 9th Street	145.09	400.66	599.16	381.21	1,526.12	14	109.01
47	Whitewater Activity Area underpasses	220.11	266.31	644.20	391.35	1,521.97	14	108.71

Cost Estimate Summary

Planning level cost estimates were prepared for 20 ranked on-street and off-street projects resulting from the prioritization process are listed below. The 20 projects were selected by the City as no design data or cost estimates currently exists. Table 5.3 shows a summary of the total opinion of probable cost for each project included in Table 5.3. To assist Glenwood Springs in moving forward quickly with their highest ranking and with additional "low hanging fruit" projects, project information for these projects including costs, notes, distances, and type are found in Appendix G.

Table 5.4: Planning Level Cost Estimates of Staff Selected Projects

Priority	Project	Total Cost
3	Devereux Road Multi-modal bridge	$23,950,000
7	US-6 Corridor East Shared Use Path	$1,930,000
10	14th Street Multi-modal Bridge	$7,578,000
12	Blake Ave. Sidewalk Improvements	$148,000
15	South Blake Ave. Sidewalk Improvements & Bicycle Facilities	$454,000
18	Donegan Road Ped/Bike Improvements	$483,000
23	Enhance Connection Two Rivers Park – Glenwood Canyon Trail	$288,000
24	School Street Sidewalk	$128,000
25	Grade Separated Bicycle and Pedestrian Crossing of SH-82 and 27th St.	$7,240,000
26	27th St. Side Path Connection	$1,248,000
28	Atkinson Trail to Park East Connection	$108,000
30	Grade Separated Pedestrian Crossing of SH-82 at 15th St.	$4,639,000
32	12th Street Ditch Underpass	$1,739,000
34	Four Mile Road On-street Bike Facilities	$11,844,000
35	Colorado River Shared Use Path – River Trail Segment	$2,849,000
36	Grade Separated Pedestrian Crossing of Grand Avenue at 23rd St.	$4,592,000
37	Rio Grande Trail and 14th St. Connection	$35,000
38	Roaring Fork Bridge Mt Sopris Dr - CR 154	$8,339,000
40	Atkinson Trail – Rio Grande Trail Bridge	$1,874,000
41	Coach Miller Drive Sidewalk	$512,000

Planning level cost estimates include likely construction bid items, a 30 percent contingency, construction start-up items, construction engineering, and design. Costs for right-of-way and/or easements (if applicable) are not included. Unit costs for the construction bid items were based on recent actual construction bids, cost data from CDOT and the City of Glenwood Springs, and professional engineering experience. The construction bid item quantities represent planning level assumptions and are not based on design plans.

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GLENWOOD SPRINGS

Long Range Transportation Plan

Appendices

CONTENTS

A Existing Transportation Conditions

CHAPTER CONTENTS

EXISTING CONDITIONS REPORT

This summary gives an overview of the current transportation network within Glenwood Springs city limits. Information presented here has been gathered from meetings with city staff, Parks and Recreation, River and Transportation Commissions, stakeholders, data collection and field work, as well as the public involvement process which includes surveys, events and workshops, and online tools. This document is divided into the following sections:

Setting

Describes the City of Glenwood Springs in terms of its location, layout and development.

Overall Network Description

Analyzes the transportation network as a whole.

Existing Bicycle Facilities

Provides an outline of existing bicycle facilities in Glenwood Springs with descriptions of facility types and local examples.

Existing Pedestrian Facilities

Identifies existing pedestrian facilities and describes typical sidewalk design, connectivity, and the use of crosswalks.

Existing Vehicular Conditions

Discusses existing vehicular conditions.

Bridges

Reviews existing bridges and the access they offer.

Circulation Conditions

Summarizes a circulation report used to identify vehicular, bicycle and pedestrian counts at key intersections in Glenwood Springs.

Needs Assessment

Highlights a list of needs and concerns in the City.

Setting

The City of Glenwood Springs is located at the confluence of the Colorado and Roaring Fork Rivers 180 miles west of Denver along I-70. Incorporated in 1885, Glenwood Springs is the county seat and most populated city in Garfield county. In recent years, the City population increased by roughly 24% from 2000 to 2010, with additional growth slowing to two percent from 9,614 in 2010 to 9,837 in 2013. Within the city, the topography is generally flat and rolling, and distances are generally short. Both of these characteristics are indicative of high potential for active transportation such as bicycling and walking.

The City stretches north-south following the Roaring Fork River and SH-82. At the north end of the city, Interstate 70 moves east-west along the Colorado River. Glenwood Springs has a total area of 4.8 square miles (12 km²) and a population density of 2,049 people per square mile. It has historically been known for its medicinal hot springs, scenic beauty and access to extensive outdoor recreational opportunities. Glenwood Springs welcomes large numbers of tourists throughout the year for multi-season sports and leisure within and surrounding the city limits.

The City was recognized for its accessibility as it was named among America's Most Walkable Communities by the Public Broadcasting Service and Walking Magazine in 2002. This plan builds upon those successes and lays out the basis for future development of a continually cohesive and integrated transportation network.

Glenwood Springs sits at the confluence of the Colorado and Roaring Fork Rivers

Amtrak Station

Bike storage on RFTA Bike Express busses (Sat & Sun) holds 12 bikes

Two types of racks on RFTA busses can hold either two or four bikes

Downtown bike racks

Overall Network Description

Glenwood Springs' vehicular, bicycle and pedestrian networks are part of a larger transportation network that includes other communities in the Roaring Fork Valley and beyond. The completeness of a transportation network is judged on its ability to facilitate different modes of transport resulting in higher individual mobility than networks that serve mainly one mode. A complete network is also one that strengthens connections between those different modes making travel more convenient for users at all levels of service. The Glenwood Springs' transportation network generally offers convenient and safe connections to other communities as well as to neighborhoods and destinations within the city. However, while the street network in place works well, it is recognized that SH-82, the main north-south highway through Glenwood Springs is becoming increasingly congested with vehicles. Additionally, the city's most important southern arterial, South Midland from 27th Street to Four Mile Canyon faces its own challenges of access and increasing congestion.

Covered bicycle parking at VelociRFTA transit stop at SH-82 and 27th Ave.

The city's internal bicycle and pedestrian infrastructure also generally allows convenient and safe access throughout the city. Regional paths draw many tourists to Glenwood Springs and currently connect the city south to Aspen and east to the eastern entrance of Glenwood Canyon. However, some gaps exist in the on-street network and some multi-use conflict zones still need to be addressed.

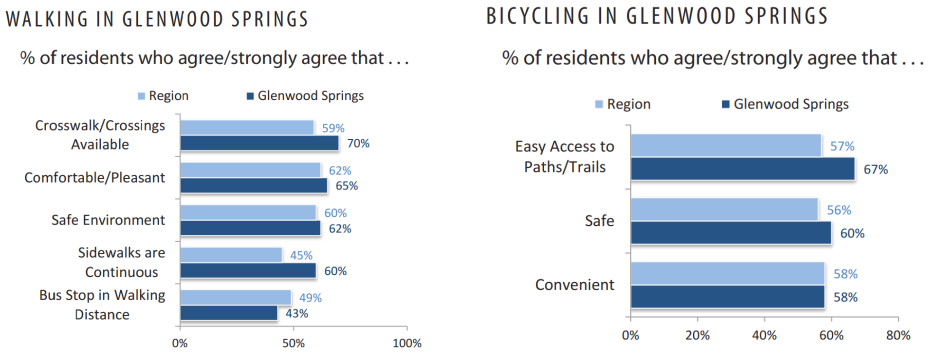
Glenwood Springs has a highly functional bus system served by two different service providers. Ride Glenwood Springs (RGS) is a year-round fixed-route public bus service that stops along Grand Avenue, Highway 6, and Midland Avenue. RGS offers connections to regional Roaring Fork Transportation Authority (RFTA) transit services, Greyhound Bus Lines, Amtrak and two free Park-'n-Ride locations within Glenwood Springs. Presently, Ride Glenwood Springs does not allow bikes on their busses nor does it offer exterior bike racks.

RFTA busses are equipped during the summer season with external bicycle storage. Two types of external bike racks can hold either two or four bikes.

The Roaring Fork Transportation Authority (RFTA) conducted a regional travel patterns study in 2014 of the Colorado River Valley and the Roaring Fork Valley. The study entitled *RFTA 2014 Regional Travel Patterns Update* includes communities from Parachute to Aspen and was conducted in order to provide local jurisdictions and planning agencies with relevant information on travel demand within the study area. Information gathered in the report reflects current and future needs related to motor vehicles, public transit as well as pedestrian and bicycle use. Studies examining the same data were completed in 1998 and 2004 and are used for comparison in the 2014 study to determine trends and changes in demand. Data for the 2014 study was gathered twice during the year and targeted different groups. The winter survey targeted employers and employees while the summer survey focused on residents within the study area. A total of 1,679 surveys were collected.

Of the surveys collected, the study shows that between 2004 and 2014 while people in the region as a whole commuting by car decreased by 6%, people commuting by bus in the same season increased by 60%. In the City of Glenwood Springs, data shows 68% of residents live and work in the same community, 67% drive alone to work in the winter and 50% drive alone to work in the summer. Only 6% say that their employers provide bus passes (part or all) and 99% said that their employers offer free parking at work. Responses related to pedestrian and bicycle facilities and trends show that for the most part, residents agree that the availability and safety of crosswalks, sidewalks, paths and trails are convenient and safe. This response data is displayed in Figure 1.

Figure 1: Glenwood Springs Travel Patterns



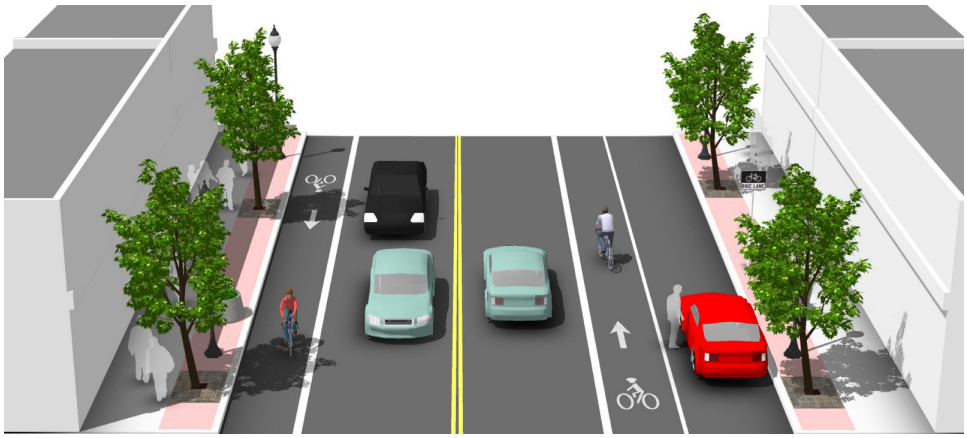
Existing Bicycle Facilities

Glenwood Springs' existing bicycle facilities include approximately 2.5 miles of on-street bike lanes, 13 miles of bike routes, 4 miles of on-sidewalk bike routes, 7.5 miles of paved and 10 miles of unpaved off-street trails. The following narrative, images and diagrams describe these varying facility types and where they can be found in Glenwood Springs. See pages A-23 and A-24 for existing conditions maps.

Bike Lanes

Bike lanes are a separate and delineated space designated for the exclusive use of bicycles on a roadway. Bike lanes are typically used on collector and arterial streets that have an annual average daily traffic (AADT) count of 3,000 or more.

Figure 2: Typical bike lane section



Blake Avenue bike lanes

Glenwood Springs presently has two existing bike lanes. Blake Avenue provides north-south travel and generally good conditions for cyclists with the exception of a section near Valley View Hospital where lane-widths become deficient and do not meet minimum widths recommended by the American Association of State Highway Transportation Officials (AASHTO). The second and more recently implemented bike lane runs along Donegan Roadand meets the minimum 5' stnadard with paving symbols and signage suggested by AASHTO. Figure 3 provides a list of existing bicycle lanes in Glenwood Springs.

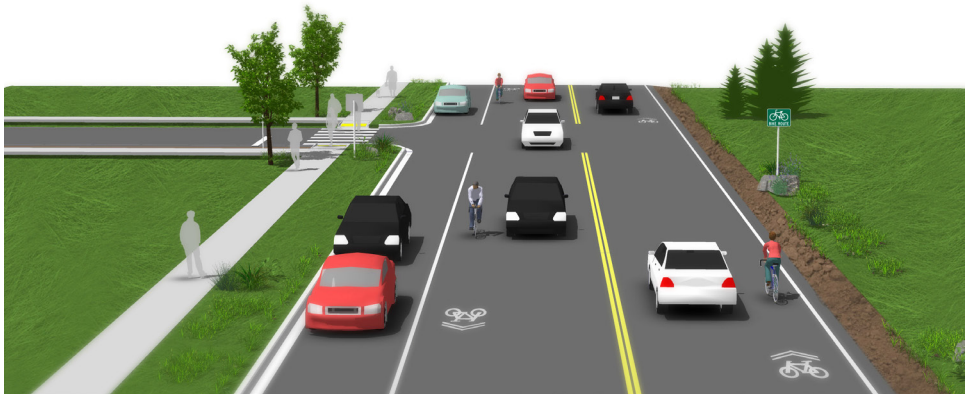
Figure 3: Existing Bicycle Lanes

Bicycle Lane	From	To
Donegan Road	Soccer Field Rd	US 6
Blake Avenue	7th Street	23rd St

Bike Routes/Sidepaths

Bike routes are signed or otherwise designated routes on roads, streets, or sidewalks that do not assign space exclusively to bicyclists but rather suggest a shared road, street or sidewalk. They are typically found on streets with lower volumes than those that would require a separated bike lane. Routes are designated as a shared sidewalk only when there are environmental or physical constraints, or when existing AADT is high enough that bicyclists would not feel comfortable sharing the road. This type of facility is defined as a 'sidepath' by AASHTO. The guide for the Development of Bicycle Facilities notes a number of design challenges and recommends the minimum width be 10 feet.

Figure 4: Marked and signed bike route



Existing bike route signage

On-sidewalk bike route

Bike routes are the most represented facility type in Glenwood Springs with 13 miles of signed roads and streets and sidewalks. Several major bike routes include along Midland, along Devereux Road and along Grand Ave. However, most of the bike routes in the City are not designated with wayfinding signage or route

information. See Figures 5 and 6 for a list and location of Glenwood's Bike Routes.

Figure 5: Bike Route On-Street

Bike Route On-Street	From	To
US 6	Center Dr.	Mitchell Creek
Mitchell Creek	US 6	Donegan Rd.
Donegan Rd.	Mitchell Creek	Soccer Field Rd.
Soccer Field Rd.	Donegan Rd.	US 6
Midland	US 6	Veltus Park
Devereux Rd.	Collision Repair	US 6
raver Trail	Harvard Dr.	US 6
Linden St.	US 6	Laurel St.
5th St.	Laurel St.	Olive St.
Olive St.	5th St.	6th St.
6th St.	N. River St.	Pine St.
North River St.	E. 6th St.	Laurel St.
Grand Ave.	6th St.	7th St.
7th St.	Midland Ave.	Lincoln Ave.
Red Mountain Dr.	Midland Ave.	W. 9th St.
Veltus Park	8th St.	Loop
8th St.	Grand Ave.	Cleveland Ave.
11th St.	Pitkin Ave.	School St.
23rd St.	Blake Ave.	Grand Ave.
South Grand Ave.	23rd St.	Old Cardiff Bridge Rd.
Old Cardiff Bridge Rd.	Grand Ave.	Midland Ave.
Midland Ave.	Old Cardiff Bridge Rd.	Airport
Blake Ave.	23rd St.	27th St.
27th St.	Blake Ave.	Grand Ave.
Mountain Dr.	Brush Creek Ln.	Mount Sopris Dr.
Mount Sopris Dr.	Midland Ave.	Mountain Dr.

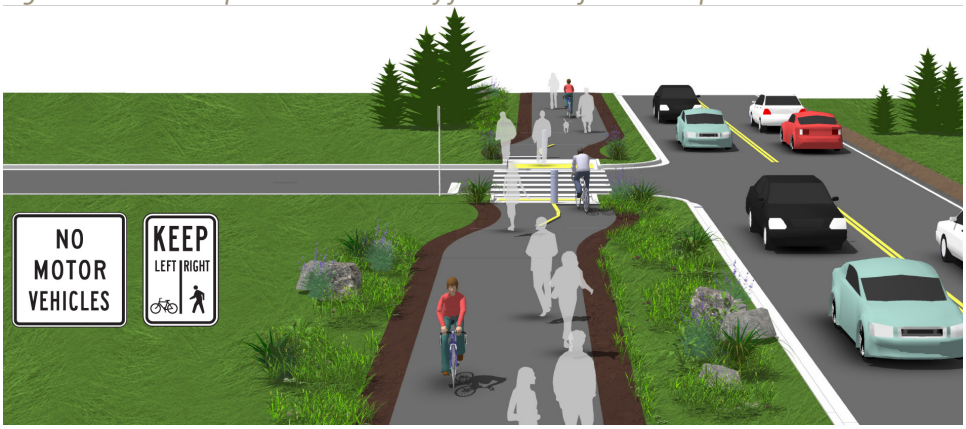
Figure 6: Bike Route On-Sidewalk

Bike Route On-Sidewalk	From	To
US 6	Center Dr.	Donegan Rd
Devereux Rd.	Midland Ave.	Collision Repair
Midland Ave.	Veltus Park	27th St.

Off-Street Shared-Use Paths

Shared-use paths are an off-street facility type that allows for two-way travel for the shared use of bicycles and pedestrians (can also include skateboarders, segways, wheelchairs and joggers). In addition to being used along roadways and highways, shared-use paths are commonly used where wide utility or railroad right-of-way exists and are designed to minimize cross-flow traffic. They offer non-motorized transportation opportunities not provided by the road system and are generally considered the most comfortable bicycle facility type for users.

Figure 7: Shared-use paths are exclusively for the use of bikes and peds



River Trail shared-use path

Atkinson Trail shared-use path

Glenwood Springs has paved shared-use paths that allow movement both across the city as well as out of town to other neighboring towns and cities. A few of the most popular shared-use paths include the Glenwood Canyon Recreation Trail and the Rio Grande Trail/River Trail. Figures 8 lists existing paved shared-use paths in Glenwood Springs. The Rio Grande Trail/ River Trail offers off-street north/south travel along the Roaring Fork River for commuting and recreational bicyclists and pedestrians with destinations throughout the Valley south all the way to Aspen. Within Glenwood Springs there are limited access points to the trail from the existing

Boy Scout Trail

Doc Holliday Trail

Red Mountain Trail

8th St. underpass has substandard sidewalk

South Blake Ave. near Walmart has sidewalks on one side of the street

Blake Ave. missing sidewalk and through street connection

roadway network. Together these facilities allow off-street corridor travel options for bicyclists and pedestrians who both live in and visit Glenwood Springs.

Glenwood Springs also offers an assortment of unpaved shared-use paths and trails. These are listed in Figure 9 The most popular trails include Boy Scout Trail, Red Mountain Trail, and the Wulfsohn Ranch Area Park.

Figure 8: Shared-Use Path Paved

Shared-Use Paved	From	To
Rio Grande Trail	Two Rivers Park	City of Aspen
Atkinson Trail	Glenwood Park	27th St.
Glenwood Canyon Path	Glenwood Springs	Dotsero
Connection	N. Traver Trail	W. Princeton Cir.
Connection	Glenwood Meadows	Red Mountain Dr.
Two Rivers Park	Loop	

Figure 9: Shared-Use Path Unpaved

Shared-Use Unpaved	From	To
Midland Ave.	Wulfsohn	The Meadows
Social Pathway	West 8th St.	7th St.
12th St. Ditch Trail (Not ADA)	Pitkin Ave.	Bennett Ave.
Doc Holiday Trail	12th St.	0.5 Miles
Boy Scout Trail	Cleveland Ave.	2.4 Miles
Red Mountain Trail	W 9th St.	7 Miles
Wulfsohn Mountain Park	Loops	1-4 Miles
Connector	Red Mountain	Com. Ctr./Wulfsohn

Existing Pedestrian Facilities

Sidewalk Design

Sidewalks are present on the majority of the downtown streets in Glenwood Springs but are less common in residential areas. Where present, sidewalks range from 3 to 10 feet in width. The sidewalk configuration is either attached or detached depending on the land-use. Attached sidewalks are typically found in commercial and retail zones, while residential zones have detached walks with a small landscape strip buffer. Five feet in width is the industry standard for a sidewalk which is enough room for two pedestrians to walk side by side. Additionally, downtown sidewalks offer pedestrian scale amenities including lighting, landscaping, seating and trash bins.

Streetscape on 7th Street (installed 2014)

Sidewalk Connectivity

An inventory of sidewalks was conducted by field reconnaissance and aerial photo review to determine the locations of gaps in the sidewalk network on both sides of the street. Though recognized as a very pedestrian friendly and walkable city, Glenwood Springs has an incomplete sidewalk network. Substantial sidewalk gaps are present in the neighborhood north of 6th Street, in town along Minter Ave, Lincoln Ave and School Street, in neighborhoods on the west side of the Roaring Fork River along Midland Ave, and in scattered parts of the central and southern parts of the City. See needs assessment maps page A-35 and A-36. Major system gaps in the City sidewalk network are more present in residential areas where there are lower traffic volumes.

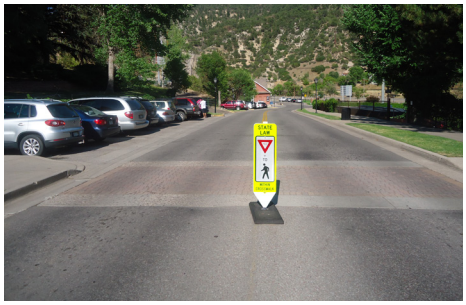
Incomplete sidewalk at Glenwood Hot Springs, along N. River Street

Sidewalk gap at 7th St. and RR Wye

Crosswalks and Intersections

Glenwood Springs has a hierarchical system of crosswalks throughout the city. Most major intersections have colored concrete crosswalks while collector and local streets may be marked with continental crosswalks or none at all. Along Grand Avenue, intersections have high quality pedestrian sidewalks with red-colored concrete crosswalks. Outside of Grand Avenue, other major intersections such as 8th and Midland, 6th and Laurel, and the I-70 collector have similar markings.

High visibility crosswalk



MUTCD "yield to pedestrians" sign

Other pedestrian facility enhancements are used at some intersections in downtown Glenwood Springs including "Yield to Pedestrians" signs in the middle of the crosswalk, pedestrian signals with push buttons and countdown timers, as well as audible devices for disabled pedestrians at Grand Avenue and 8th and 9th Streets.

Local streets that see lower traffic volumes typically don't need designated crosswalks. However local streets acting as the preferred route for Safe Routes to School (SRTS) should be identified and designed for safety and efficiency. There are nine schools in Glenwood Springs including Glenwood Springs Elementary School, Glenwood Springs Middle School, Glenwood Springs High

School, Two Rivers Community School, Colorado Mountain College, St. Stephen's School, Columbine Christian School, Our School Preschool, and Sopris Elementary School. These campuses are spread out across the city and attract pedestrians and bicyclists at intersections that cross arterial, collector and local streets. These routes often justify pedestrian scale improvements like bulbouts, pedestrian refuge islands, pedestrian signals, and high visibility crosswalks depending on context.

Continental crosswalk

Wayfinding signage for sidewalk underpass

6th St. and Pine traffic volume

Grand Ave and 27th Street

Cyclist on sidewalk

Existing Vehicular Conditions

The City's street system is comprised of over 135 roads of various lengths and widths. Each road is assigned a class according to the character of service they are intended to provide. The City has five functional classifications for its street system. They include principal arterial, minor arterial, commercial collector, residential collector, and local.

Principal arterials are intended to serve the major traffic movements within the City where focus is on providing mobility over access to abutting land uses. Minor arterials are streets that provide important connections between geographic areas of the City and are intended to augment the principal arterials where more emphasis is placed on land access. Commercial collectors are streets that provide both land access and traffic circulation within the commercial and industrial areas of the City. Residential collectors provide both land access and traffic circulation within the residential areas of the City. Finally, local streets are those that provide direct access to abutting land uses. They offer the lowest level of mobility and service to through traffic is usually deliberately discouraged.

The local street system in Glenwood Springs comprises all facilities not listed on one of the higher systems. In the neighborhoods in and around downtown, these local streets form a grid system, which is traditional for an urban area, and encourages more pedestrian and bicycle usage. In the newer areas of Glenwood Springs, however, the residential developments reflect more of a suburban approach to accommodate the topographic challenges. Consequently, the streets are typically curvilinear and connectivity is more circuitous.

Figure 10: Existing Vehicular Conditions per Street Type

Street Classification Class	Local Examples
1. Principal Arterial	*• SH-82* *• Midland from I-70 to 8th Street* *• 27th Street*
2. Minor Arterial	*• US-6 from Mel Ray to Laurel* *• 7th Street from Midland to Colorado* *• Midland from 8th Street to the south City limits*
3. Commercial Collector	*• Mel Ray* *• US-6 west of Mel Ray* *• Devereux Road* *• Wulfsohn except for segment between East Meadows and West Meadows* *• 7th Street from Colorado to Blake* *• 8th Street from School to Blake* *• South Grand Avenue*
4. Residential Collector	*• Donegan Road* *• Blake from 7th Street to Palmer* *• Pitkin from 8th Street to 14th Street* *• Four Mile Road*
5. Local	*• Small-scale traffic volume, residential local streets*

Currently, there are three congested corridors in the City where the traffic volumes are either at or over the capacity of the street. SH-82 is the primary north – south street in the City and must accommodate both travel passing through the City and local traffic. Traffic volumes range from 25,000 to slightly over 30,000 vehicles per day through the corridor. With this level of volume, the street is operating at capacity with problems at select intersections. The City, in conjunction with the Colorado Department of Transportation, completed the Corridor Optimization Plan in 2010. These improvements identified in the study are intended to strike a balance between mobility and access so the functional intent of the state highway is maintained but access is adequate to accommodate both existing land uses and potential development opportunities.

The other two congested corridors include 7th and 27th Streets. 7th Street and 27th Street provide the only two east/west vehicular connections across the Roaring Fork River. Seventh Street is currently operating at close to capacity and 27th Street at South Midland Ave is operating over capacity in the peak periods.

Much of the congestion in the City is caused by the lack of a grid network outside downtown which typically helps disperse traffic throughout the system. In Glenwood Springs, there is a limited grid network of streets due to the steep canyon topography and two major rivers. Consequently, there is more reliance on the limited number of major streets such as SH-82, 7th Street, and 27th Street. This reliance contributes to the congestion and delay at these key City connections.

Bridges

There are ten bridges in Glenwood Springs. Five bridges cross the Colorado River north/south and three cross the Roaring Fork River east/west. Two cross I-70 via Devereux Rd. Five of the ten total bridges are exclusively dedicated for bicycle and pedestrian use. The busiest vehicular bridges are the Grand Avenue Bridge with an AADT of 25,000 vpd (vehicles per day), the 27th Street Bridge with 9,500 vpd and the 7th Street Bridge with 8,300 vpd. The busiest pedestrian bridge, the Grand Avenue Pedestrian and Bicycle Bridge has combined bicycle and pedestrian volumes that can reach approximately 4,000 users per day during seasonal peaks (CDOT).

Devereux Bridge

Grand Ave. Pedestrian Bridge

Cardiff Bicycle and Pedestrian Bridge

Two Rivers Park Trail Bridge

Circulation Conditions

Four studies were considered in the development of circulation conditions data. They are the *Downtown Vehicular and Pedestrian Circulation Study,* the *SH-82 Access Control Plan, Glenwood Ridge Traffic Impact Study (March, 2014)* and the *Traffic Assessment State Highway Access Permit Application for Iron Mountain Hot Springs (July, 2014).* Data referenced from these four plans is presented in ways specific to each study but has been organized for overall comparison in the following tables. However, for each intersection that is being considered significant to this study, available information regardless of format has been incorporated here to determine the efficiencies (or lack of) for operations along major routes in Glenwood Springs. Traffic data is commonly measured and described using a grading system called level-of-service (LOS). This grading relies on average stopped delay in seconds per vehicle and characterizes the operational conditions of traffic flow at an intersection ranging from LOS A (indicating free flow traffic conditions with little or no delay) to LOS F (indicating an over-saturated intersection condition where traffic flows exceed the design capacity, resulting in long queues and delays). LOS D is commonly used as the minimum acceptable performance level grade. Other data such as pedestrian and bicycle use can present itself in the form of counts or volumes such as Annual Average Daily Traffic (AADT), vehicles per day (vpd) or Volume to Capacity Ratio (v/c).

The *Downtown Vehicular and Pedestrian Circulation Study* is presently being conducted for Glenwood Springs in order to capture traffic patterns related to vehicular, bicycle and pedestrian volume. Data for the study was gathered by All Traffic Data using the Synchro 7/0 software program during the week of October 14-19, 2013. It should be noted that mid-October is not considered peak season for tourism or bike and pedestrian traffic. However, according to historic CDOT data, traffic volumes in October typically represent the average along the Grand Avenue Corridor for the entire year. Regardless, the study is helpful in evaluating the existing and future circulation opportunities and challenges within the transportation network of Glenwood Springs. While the boundaries of this study area were restricted to the downtown area alone, the findings at key intersections are significant to the City's transportation network as a whole.

The *SH-82 Access Control Plan* was adopted by the City of Glenwood Springs in July, 2013 and was created to define future property access points along the SH-82 corridor. Reference stations were set up to determine directionality and counts. The *Glenwood Ridge Traffic Impact Study (March, 2014)* was developed to analyze the

traffic impacts associated with the Glenwood Ridge Development on Four Mile Road. The study looks at existing roadway network, existing peak hour traffic conditions, and future volume forecasts in order to make recommendations to the road system. Data was collected in February 2012 and resulting data is presented as a LOS rating. The *Traffic Assessment State Highway Access Permit Application* was prepared for the city by SGM and was completed in late 2014. The study was developed in order to provide estimated peak hour traffic generation for the Iron Mountain Hot Springs. The plan also looks at existing movements on turn lanes along US 6 to determine whether or not they meet CDOT requirements under future conditions. Traffic analysis data is presented in AADT format.

Twenty-seven intersections were analyzed for vehicular volumes, pedestrian crossing volumes and bicycle volumes during the AM (7:00-9:00 AM), PM (4:00 - 6:00 PM), and Saturday Midday (12:00-2:00 PM) peak hours. For signalized intersections, LOS is reported for the intersection as a whole, receiving an overall grade. For unsignalized intersections, only the worst performing movements are reported with a grade. At most unsignalized intersections, left turning and through movements experience lower LOS grading. At other unsignalized intersections, left turning vehicles from the minor street experience excessive delays (LOS F). However, for the city, the left turn movements cause significant delay and congestion on the minor approaches.

Figure 11 shows the location of the twenty-seven intersections being considered in this report for reasons of their outstanding numbers in all categories as they relate to this report. Figures 12 through 15 describe volumes for the downtown area in vehicular, bicycle, pedestrian and trail count volumes. Trail count information is being considered alongside vehicular, pedestrian and bicycle data as major Glenwood Springs trails are considered a significant part of the City's overall transportation network. Trail counts were collected by the Glenwood Springs Parks and Cemetery Department in 2013-2014 from counters placed at each trail.

Figure 11: Downtown Intersections Key Map

27. US Highway 6 and Devereux St

26. Four Mile Rd and Midland/Airport

25. Mount Sopris Dr and Midland Ave

21. CR 115 and Hwy 82

22. Orrison d/w and Hwy 82

Note: The above key map is a graphical reference for Figures 12 and 13

Vehicular Conditions: Existing Traffic Operations

The twenty-seven significant intersections are broken down into signalized and unsignalized groups for the sake of comparison as each condition presents it's own issues. Figure 12 describes *signalized* intersection's LOS as well as its deficiency condition. Figure 13 describes each *unsignalized* intersection through AM, PM, overall LOS, and volume-to-capacity ratio (v/c) for the worst performing movement (typically this is the left-turn approach at the stop-sign controlled intersection.) The prioritization of vehicular travel on Grand Avenue at some intersections results in longer green times on Grand Avenue and less on east-west travel. This reduced green time allocated to side streets increases vehicular (and pedestrian) wait time if crossing Grand Avenue.

Figure 12: Vehicular Volumes

VEHICULAR VOLUMES: Signalized Intersections

Intersection	Control	Level of Service (LOS) Period	Overall	Deficient Approaches
1. 8th St. and Grand Ave.	*Signal*	*AM*	*B*	*EB - E, WB - E*
		PM	*C*	*EB - F, WB - E*
		Sat	*B*	*EB - D, WB - D*
2. 9th St. and Grand Ave.	*Signal*	*AM*	*A*	*WB - E*
		PM	*B*	*EB - E, WB - F*
		Sat	*B*	*WB - E*
3. 10th St. and Grand Ave.	*Signal*	*AM*	*A*	*EB - D, WB - D*
		PM	*A*	*EB - E, WB - E*
		Sat	*A*	*EB - D, WB - D*
4. 11th St. and Grand Ave.	*Signal*	*AM*	*A*	*EB - D, WB - D*
		PM	*A*	*EB - E, WB - E*
		Sat	*A*	*EB - D, WB - D*
5. 14th St. and Grand Ave.	*Signal*	*AM*	*A*	*EB - D, WB - D*
		PM	*B*	*EB - E, WB - F*
		Sat	*A*	*EB - D, WB - D*
7. 27th St. and Hwy 82	*Signal*	*AM*	*C*	*N/P*
		PM	*B*	*N/P*
23. 27th St. and Grand Ave	*Signal*	*AM*	*A*	*N/P*
		PM	*A*	*N/P*

Figure 13: Vehicular Volumes

VEHICULAR VOLUMES: Unsignalized Intersections

Intersection	Control	Period	Level of Service (LOS) Overall	(v/c)
6. 7th Street and Colorado Ave	Side-Street Stop	AM PM Sat	A B B	N/P
8. 7th Street and Cooper Ave	4-way stop sign	AM PM Sat	A A A	N/P
9. 8th Street and Cooper Ave	4-way stop sign	AM PM Sat	A A A	N/P
10. 9th Street and Cooper Ave	Side-Street Stop	AM PM Sat	A B B	N/P
11. Maple Street and Hwy 82	Side-Street Stop	AM PM	F C	0.05 0.04
12. 13th Street and Hwy 82	Side-Street Stop	AM PM	E F	0.27 0.39
13. D Street and Hwy 82	Side-Street Stop	AM PM	F F	0.54 0.41
14. Park Drive North and Hwy 82	Side-Street Stop	AM PM	C F	0.05 0.02
15. Park Drive South and Hwy 82	Side-Street Stop	AM PM	F F	0.02 0.06
16. 19th Street and Hwy 82	Side-Street Stop	AM PM	F F	0.16 0.76
17. Bradley d/w and Hwy 82	Driveway	AM PM	B F	0.04 0.30
18. 22nd Street and Hwy 82	Side-Street Stop	AM PM	E F	0.32 0.80
19. 24th Street and Hwy 82	Side-Street Stop	AM PM	D F	0.05 0.07
20. 29th Street and Hwy 82	Side-Street Stop	AM PM	F F	0.02 0.21
21. CR 115 and Hwy 82	Side-Street Stop	AM PM	E F	0.18 0.33

Grand Ave and 9th Street

Grand Ave and 27th Street

Grand Ave and Pine Street

Grand Ave and 14th Street

22. Orrison d/w and Hwy 82	*Driveway*	*AM* *PM*	*E* *F*	*0.01* *0.06*
24. 27th Street and Midland Ave	*Round-a-bout*	*AM* *PM*	*A* *A*	*N/P*
25. Mount Sopris Drive and Midland Ave	*Side-Street Stop*	*AM* *PM*	*C* *C*	*N/P*
26. Four Mile Road and Midland/Airport	*Side-Street Stop*	*AM* *PM*	*A* *A*	*N/P*
*27. US Highway 6 and Devereux St**	*Side-Street Stop*	*AM* *PM*	*B* *C*	*N/P*

*Overall LOS grade for US Highway 6 and Devereux Street intersection data is sourced from the Traffic Assessment State Highway Access Permit Application. The numbers here reflect future projection of volumes based on Synchro and SimTraffic traffic analysis software used to analyze year 2035 traffic volumes per Option #3 suggesting the installation of a signal, the relocation and widening of Traver Trail and the restriping of Devereux Rd.

In addition to intersections, corridors were also evaluated in the *Downtown Vehicular and Pedestrian Circulation Study* for their performance as a whole using delay per vehicle, number of unserved vehicles, and the average speed along the highway (compared to posted speed limits). Segments along SH-82 were considered in the study and include I-70 to Pine Street, 8th Street to 13th Street, 14th Street to Blake Ave. and CR 154 to Orrison. The study of those highway segments revealed that drivers experience the greatest delays between I-70 and 14th Street. The study also showed that traffic demands exceeded capacity for some specific movements between 14th Street and Blake Ave. However, no intersection included in that segment has a calculated volume-to-capacity ratio greater than 1, suggesting that there may be an opportunity to improve signal operations for those specific delays. Traffic speed summaries showed that of the studied corridor segments along SH-82, drivers in the I-70 to Pine Street and 8th Street to 13th Street areas drove an average of almost 9 miles below the speed limit posted at 25 miles per hour. This is typical for urbanized areas with closely spaced traffic signals.

Bicycle and Pedestrian Conditions

Bicycle and pedestrian count data from the non-peak month of October 2012 was also analyzed to identify downtown intersections that experience the most amount of bike and foot traffic. Most downtown intersections see less than six bicycle movements during any peak hour. However, increased bicycle traffic was observed at 8th and Cooper and 9th and Cooper during PM peak and Saturday

The Study found that Saturday midday generally has the highest pedestrian volume with many of the intersections seeing over 100 pedestrians per hour. The intersections with the largest pedestrian volumes are 8th Street and Grand Avenue, 9th Street and Grand Avenue and 7th Street and Cooper Avenue (see Figure 14).

Figure 14: Pedestrian and Bicycle Counts

PEDESTRIAN AND BICYCLE COUNTS

Intersection		Ped Peak Period			Bike Peak Period		
	Control	AM	PM	Sat	AM	PM	Sat
1. 8th St. and Grand Ave.	*Signal*	*55*	*134*	*373*	*0*	*2*	*0*
2. 9th St. and Grand Ave.	*Signal*	*35*	*57*	*173*	*0*	*0*	*0*
3. 10th St. and Grand Ave.	*Signal*	*18*	*40*	*70*	*0*	*0*	*0*
4. 11th St. and Grand Ave.	*Signal*	*7*	*13*	*30*	*0*	*1*	*1*
5. 14th St. and Grand Ave.	*Signal*	*22*	*25*	*24*	*0*	*2*	*3*
6. 7th St. and Cooper Ave.	*Stop*	*17*	*75*	*176*	*1*	*6*	*2*
7. 8th St. and Cooper Ave.	*4-Stop*	*38*	*105*	*130*	*1*	*5*	*7*
8. 9th St. and Cooper Ave.	*Stop*	*22*	*62*	*60*	*1*	*3*	*5*

Trail count data was collected by Glenwood Springs Parks Department with infrared trail counters at all major trails. This data reflects both pedestrian and bicycle numbers and is displayed in Figure 15 in weekly and monthly amounts. The full trail count report includes hourly, daily, weekly, monthly and yearly numbers.

Figure 15: Trail Pedestrian and Bicycle Counts

TRAIL COUNTS - AVERAGE BIKE AND PED

Trail	Weekly	Monthly
1. Linwood Cemetery	*863*	*3,746*
2. Red Mountain - Golay Trail	*604*	*2,620*
3. Atkinson Trail - North	*653*	*2,775*
4. Atkinson Trail - South	*350*	*1,503*
5. River Trail at Two Rivers	*2,164*	*-*
5. Wulfsohn Trail - East	*662*	*2,873*
7. Wulfsohn Trail - West	*89*	*389*

Glenwood Springs
Long Range Transportation Master Plan

Multi-modal Existing Conditions - North Map

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CITY OF GLENWOOD SPRINGS

Legend

- Traffic Signals
- Bus Stops
- Bridges
- Trailheads
- Railroad Track
- Bike Lanes
- Bike Routes
- Off-Street Trail
- On Sidewalk Bike Routes
- Unpaved Trails
- RFTS SH 82 Valley
- RGWS Bus Routes
- RFTA Rio Grande Trail ROW
- Rio Grande Trail
- COGS Boundary
- Schools
- Destinations
- Parks

Street Classifications

- Local Streets
- Residential Collector
- Commercial Collector
- Minor Arterial
- Principal Arterial
- Interstate
- Private
- Future Roads
- Future Trails

N

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 500 feet

Upper Transfer Trail Parking

Glenwood Caverns Adventure Park

Horseshoe Bend Park

Glenwood Canyon Recreation Path

Transfer Trail Lower Trailhead +Parking

Glenwood Caverns Adventure Park Tram Parking

Glenwood Springs Public Golf Course

Glenwood Springs Mall

Two Rivers Community School

New Creation Preschool

Gregory Park

Glenwood Springs Middle School

Holy Cross Preschool

Sister Lucy Downey Park

Greyhound Bus Stop

West Glenwood Spring Park-N-Ride

The Meadows

Wulfsohn Mountain Park

Recreation Center

Two Rivers Park

Glenwood Hot Springs Pools

Amtrak Station

Yampah Mountain School

Jeanne Golay Trail

Vogelaar Park

Veltus Park

Centennial Park

Glenwood Springs Elementary School

Axtell Park

Boy Scout Trail No Parking

Doc Holliday Trail

Linwood Cemetery

Colorado Mountain College

Glenwood Springs High School

Grocery Store

Sayre Park

Dog Park

O'Leary Park

St. Stephens School

Grocery Store

Red Mountain Recreation Area

Red Mountain

Glenwood Ditch Trail

Glenwood Springs
Long Range Transportation Master Plan

Multi-modal Existing Conditions - South Map

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Legend

- Traffic Signals
- Bridges
- Bus Stops
- Trailheads
- Railroad Track
- Bike Lanes
- On Road Bike Routes
- Paved Trails
- On Sidewalk Bike Routes
- Unpaved Trails
- RFTA Rio Grande Trail ROW
- Rio Grande Trail
- COGS Boundary
- Schools
- Destinations
- Parks

Street Classifications

- Local Streets
- Residential Collector
- Commercial Collector
- Minor Arterial
- Principal Arterial
- Interstate
- Private
- Future Roads
- Future Trails

N

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 500 feet

Linwood Cemetery

Grocery Store

Glenwood Springs High School

Colorado Mountain College

Sayre Park

Dog Park

O'Leary Park

St. Stephens School

Grocery Store

Columbine Christian School

BRT/Park-N-Ride

Glenwood Ditch Trail

Roaring Fork Market Place

Our School Preschool

Rosebud Cemetery

Rio Grande Trail

Glenwood Park Recreation Area

Atkinson Trailhead Parking

Sopris Elementary School

Airport Office

Airport

Needs Assessment

Glenwood Springs offers a beautiful natural environment that makes the City a desirable place to live and visit. This setting allows easy access to hiking and road and mountain biking trails, river sports and the famous hot springs. The compact nature of the City is a direct result of the surrounding natural features and existing topography. This compactness translates into short intra-city trips for its residents and visitors with a diversity of available mobility options. However, the City's size also limits usable space for expansion, both through development and for transportation improvements. Due to the varied type of development in Glenwood Springs, each area has specific needs and concerns that will shape future multi-modal transportation facilities.

The vehicular needs were identified based on a review of previous studies and reports, information provided by City staff, public input, and a planning-level assessment of existing conditions. The identified needs focus on improving connectivity, providing additional capacity via either expanding existing facilities or adding new facilities, and completing system gaps. In addition, many of the streets in the City are one-dimensional in nature, primarily designed to serve vehicular traffic. The new model for urban streets is to safely and efficiently meet the needs of all users, regardless of age, ability, or mode of transportation.

Figure 15 presents an unprioritized list of those needs and concerns to be considered in the development of future multi-modal transportation facilities. Figures 17 and 18 represent mappings of those same needs and concerns. These needs and concerns take into consideration existing conditions, circulation conditions and public feedback.

Figure 15: Needs Assessment

Transportation Network Needs		
Project #	*Need*	*Notes*
Citywide Planning and Implementation Projects		
1	*Develop City Traffic Origins and Destinations Study*	
2	*Develop City-wide Traffic Model*	
3	*Develop and implement City TDM program*	
4	*Update 5-year Transit Operations Plan*	*Scheduled for 2015*
5	*Develop City-wide sidewalk plan*	*LRTP Wiki Map input as foundation*
6	*Develop City-wide Wayfinding and Signage Plan*	*See framework plan*
7	*Complete implementation of the 1991 RiverTrail Master Plan*	*See plan*
8	*Install and maintain pylon signs (Ped Xing) at all major crosswalks. Also develop policy to maintain striping at all crosswalks.*	*LRTP Design Guidelines to address this*
Midland Avenue Multi-Modal Improvements		
9	*Midland Avenue needs a consistent on-street bicycle facility from I-70 to Airport Road*	*ROW width and space limitations; environmental impacts*
10	*Implement pedestrian facility on Midland Ave between I-70 and the Meadows Mall*	*Design for section from Lowes to RFTA property will be completed in 2015. RFTA will construct the portion on their park and ride property in 2015. Coordination with the UPRR will be required to go under the existing rail bridge.*
11	*Widen Midland Ave from Exit 114/I-70 to 8th street*	*MOU transferred responsibility for widening to the City*
12	*Midland Ave - add lanes/widen from 8th to 27th*	*Future Study, roadway is close to capacity per city street classification*
13	*South Midland Avenue -Reconstruction from 27th to Four Mile Road*	*Design of the project is budgeted in 2015*
14	*Construct a new vehicular/bike/ped bridge from Midland Ave to Devereux Rd; trail connection to Community Center*	*Cost of implementation; environmental feasibility; engineering feasibility*
15	*Designate Midland avenue from 8th to 27th as a "share the road" avenue: mark it with signs/street painting, etc.*	*ADT for this street may be too high for sharrows*
16	*Add sidewalks along Midland Ave at Hagar Lane and the Terraces for school kids*	
17	*Improve safety for all modes at Mt. Sopris and Midland Intersection*	
18	*Install raised crossing and pedestrian activated signals on Midland near Sopris Elementary for school crossings*	
19	*Improve intersection safety for all modes of travel at Midland Ave and Four Mile Road (evaluate a roundabout)*	*Cost of implementation; funding source; may be completed with future development of South Bridge Project*
20	*Add a sidewalk along Midland from 27th to Four Mile Road*	

21	*Pedestrian underpass at Midland Ave bridge over CO River: from Dairy Queen area to Whitewater Activity Park*	*Help make this safer for river recreationists crossing Midland to return to the Wave from downstream*
SH-82 Corridor Multi-Modal Improvements		
22	*Provide access control measures along SH-82 to improve safety and operational efficiency per access control plan*	*see SH-82 Access Control Plan*
23	*Corridor timing analysis- ITS system to improve travel efficiency across the City*	*CDOT plans to re-time the corridor upon completion of the Grand Ave Bridge project*
24	*Relocation of SH-82*	*Very expensive project- would require State and federal participation and funding*
25	*Remove vehicular parking along Grand Ave from 8th St to 10th St and add bicycle facilities*	*On-street parking demand; residential/commercial concerns over loss of on-street parking*
26	*Grade-separated ped crossing of SH-82 at 9th Street*	*Engineering feasibility; space constraints; cost of implementation*
27	*Grade-separated ped crossing of SH-82 at 15th Street*	*Engineering feasibility; space constraints; cost of implementation*
28	*Grade-separated ped crossing of SH-82 at 23rd Street*	*Engineering feasibility; space constraints; cost of implementation*
29	*Improve safety for all modes at SH-82 and 23rd intersection*	*CDOT coordination; RFTA collaboration; ROW exchange in progress; refer to ACP Sheet 4 for possible configurations*
30	*Install a pedestrian refuge island on SH-82 for 23rd St crossing to allow bikes/peds more safe crossing times- the hwy is too wide for many to complete crossing in one signal cycle*	*Could be a good alternative to more expensive grade-separated project; ACP 23rd and SH-82; Coordination with CDOT is key as they have standard ped crossing speed for signal timing*
31	*Improve the safety of 27th Street and SH 82 intersection. Poor sight distances cause many conflicts with Rio Grande Trail users. Create a bike/ped trail along the south side of 27th to provide an alternate route back to Grand Avenue*	
32	*Grade-separated ped/bike crossing of SH-82 at 27th St to connect Rio Grande Trail and BRT Station*	*RFTA Coordination (Regional Bicycle, Pedestrian, and Transit Access Plan)*
33	*Provide a sidewalk connection along Hwy 82 from South Blake Ave to Glenwood Commercial/Retail center (Thrifty Thrills, First Class Trash)*	*CDOT coordination; ROW acquisition, private property coordination*
US-6 Corridor Multi-Modal Improvements		
34	*US-6 and Traver Trail, US-6 and Devereux Rd intersection improvements*	*CDOT coordination; cost of implementation; existing safety issues. City responsible for this improvement through 2002 Access Permit with State. Improvement trigger is 150 DHV*
35	*Provide on-street bicycle facilities along Hwy 6 from Mel Ray to Devereux*	*ROW and CDOT coordination*
36	*Provide enhanced mid-block pedestrian crossing (RRFB's) along Hwy 6 to bus stops on the south side of roadway*	*CDOT coordination; operations and maintenance*

37	*Provide a safe crossing of US-6 from Soccer Field Road to bus shelter on south side of hwy for Middle School kids and Greyhound patrons*	
38	*US-6 & Devereux intersection: provide east/west ped crosswalk with ped refuge island; provide north/south ped crosswalk across US-6 (consider ped refuge island here); extend sidewalk along east side of Devereux to US-6*	*Could be completed with intersection improvements based on MOU with CDOT*
39	*Build new shared-use path along Hwy 6 from Laurel to Donegan*	*CDOT coordination; roadway feasibility*
40	*Provide on-street bicycle facilities along Hwy 6 from Mel Ray to Devereux*	*ROW, CDOT coordination*
41	*Add a new bike lane, buffered bike lane, protected bike lane on one or both sides of US-6 from Devereux Rd to Center for the Arts (through the proposed 6th/Laurel roundabout)*	
Devereux Road Multi-Modal Improvements		
42	*Construct a new vehicular/bike/ped bridge from Midland Ave to Devereux Rd; trail connection to Community Center*	*Cost of implementation; environmental feasibility; engineering feasibility; crossing of UPRR*
43	*Sidewalk completion on Devereux Rd from existing ped bridge over I-70 to Centennial/Two Rivers Plaza Rd and from ped bridge north along east side of Devereux to intersection with US-6*	*Cost of implementation; environmental feasibility; engineering feasibility*
44	*Install a way finding map on the Two Rivers/ Devereux crossing to facilitate a bicycle connection through the Two Rivers parking lot back onto Devereux Rd.*	
45	*Design and implement a bike/ped connection between the Devereux/I-70 crossover and continuing along Devereux Road*	
46	*Consider marking Devereux Rd with "share the road" or bike lanes to facilitate bikers*	*CDOT maintenance facility on this road makes this a dangerous condition for a shared road designation; evaluate actual truck traffic*
47	*Finish sidewalk on Devereux Road from Colorado River Bridge westward to existing sidewalk on north side of roadway*	
48	*Add shared lane markings along Devereux Rd from Two Rivers Plaza Rd to US-6*	*Evaluate based on AADT and posted speed limit*
Citywide Bridge Projects		
49	*Implement South Bridge project, with improvements from Four Mile Road/Airport Road to new interchange with SH-82*	*Cost of implementation; public support; preliminary design complete; EA nearly complete; RFTA Coordination and Rio Grande Corridor ACP pending*
50	*Extension of 14th Street across Roaring Fork River to Midland: vehicle, bike/ped bridge*	*Cost of implementation; ROW acquisition; private property approval; environmental feasibility; engineering feasibility; RFTA coordination*

51	*Replace the 27th St. Sunlight Bridge*	*42.2 sufficiency rating; Operational issues at 23rd/S. Grand; CML grant for $1.7M has been awarded for design of replacement bridge*
52	*New vehicle/bike/ped bridge from Mt. Sopris Drive to CR 154*	*Could not be constructed in advance of South Bridge project #*
53	*Consider new bicycle and pedestrian bridge across CO River connecting South River Street to North River Street, vicinity of Vapor Caves and Palmer or Bennett*	*Cost of implementation; CDOT coordination; environmental feasibility*
54	*Relocate existing Grand Ave CO River ped bridge to new location in GWS. Consider across CO River from existing western end of LoVa trail by W GWS Sanitation District to City property on south side of river by WWTP*	
55	*New ped trail connection from Two Rivers Park west along the CO River to the Whitewater Park- this includes a new shared-use bridge across river from Iron Springs development to just west of UPRR yard*	
56	*Provide new ped/bike bridge connecting Atkinson Trail to Rio Grande trail in vicinity of 22nd Street*	*Depending on extending Atkinson Trail north from Sunlight Bridge; Cost of implementation; environmental concerns along Roaring Fork River*
Vehicular Improvements within City Limits		
57	*Wulfsohn Rd signalization @ east & west intersections w/ Midland Ave*	*Associated with Meadows development*
58	*Improve overall circulation and intersection operations in the downtown area*	*Downtown Circulation Study nearly complete; CDOT coordination for SH-82 intersections and signal timing*
59	*New north-south arterial street, west of Rio Grande trail from 8th St to 23rd St (Riverside Dr)*	*Environmental feasibility; engineering feasibility; public and elected official approval; RFTA Coordination*
60	*Open Blake Ave at gate between BRT parking lot and Walmart*	*Budgeted for construction in 2015; provides continuous travel to southern GWS commercial center*
61	*Straighten Blake Ave from 21st St to 23rd St*	*Corridor Optimization Plan; Cost; ROW acquisition; private property acquisition; public and elected official approval*
62	*Traffic congestion mitigation at S Grand Ave & 27th St Sunlight Bridge- signal modification*	*Signal and geometry are an issue- evaluate all three intersections along 27th St; $1.7M CML grant awarded for bridge design. IGA in process for grant award. Potential for additional funding sources through development proposals and Garfield County participation*
Pedestrian and Bicycle Connections and Safety Improvements within City Limits		
63	*8th Street Extension and Confluence Area ped/bike improvements; Pedestrian crossing on 8th Street*	*reviewing three alternate 8th St Extension proposals; Confluence parking was added with Lift Station project*
64	*Safety enhancements for pedestrians at west Wulfsohn Rd and Midland Ave intersection*	*Associated with Meadows development; RFTA building new trail from W GWS P-and-R*

65	*Add signs instructing "Do Not Block Crosswalk" at appropriate intersections. Some examples mentioned are:*	*6th St & Laurel; 7th St & Blake; 8th St & Grand Ave; 9th St & Grand Ave; 23rd St & Rio Grande trail; 27th St & Rio Grande trail; Rio Grande trail & CR 154 at Buffalo Valley* (outside of COGS Limits)*
66	*Move funeral home sign back from 8th St about 5'. Where it is now blocks visibility of oncoming westbound traffic for peds and cyclists coming up from RiverTrail until they reach the edge of 8th St*	*City Street or streetscape standards issue?*
67	*Enhance 7th St under DRGW RR wye bridge for cyclists: street too narrow and full of potholes where bikes SHOULD be ridden. Clearly mark 7th/8th St from Midland to Blake as "share the road" opportunity with appropriate signage and vehicle speed restrictions. Keep those potholes filled.*	*ADT for this street may be too high for sharrows; however, this problem could be addressed by new 8th St connection/pedestrian box culvert*
68	*Install ped-activated signal by ped crossing on 7th St where the east-leg RR wye tracks cross- this x-ing can be very dangerous during winter months when drivers are facing the low sun*	*RRFB rectangular rapid flashing beacon*
69	*Make the existing 8th St ad-hoc trail from the church across RR west wye track to City Hall parking lot usable for bikes by placing fill between the rails*	*Requires RFTA agreement and CO PUC-approved crossing*
70	*Add the following shared lane projects: -Linden St from Devereux Rd to Laurel -5th Street from Laurel to Pine -Pine Street from 5th Street to 6th Street -North River Street from Grand Avenue to 6th Street -7th Street from Midland Ave to Blake Ave -10th Street from School Street to Blake Ave -14th Street from Coach Miller Drive to Blake Ave -8th Street from School Street to Garfield -Pitkin Avenue from 8th Street to 14th Street -Laurel Street from 5th Street to the roundabout -Colorado Ave from 7th Street to 8th Street*	*Each project needs to be evaluated on AADT and posted speed limits*
71	*Commit to maintaining the Blake Ave bike lane-markings are not being maintained properly*	*Fix substandard section near hospital; use thermoplastic symbols and striping as an alternate; finish the bike lane loop from Blake Ave and 23rd St back down to Grand Ave*
72	*Formalize the 12th St & Grand Ave tunnel: add box culvert, clean out the mud, remove the cottonwood fuzz from the lights, mark it with signs at both ends*	
73	*Complete sidewalks on Blake Ave from Hyland Park Drive north to City Market/CMC*	
74	*Provide standard bicycle lanes or sharrows along Blake Ave from Hyland Park to 19th St*	*Street retrofit; existing space constraints and possible on-street parking loss*
75	*Provide sidewalks and bicycle facilities along S Blake Ave*	*Budgeted in 2015*

76	*Provide sidewalks on at least one side of the street in north Glenwood Springs (6th to 2nd, Laurel to Olive)*	*Cost of implementation; ROW acquisition; private property approval*
77	*Reconstruct shared-use trail along CO River/I-70 corridor from Two Rivers Park to No Name Tunnels (enhance the existing not-so-pleasant user experience)*	
78	*Provide enhanced connection from Two Rivers Park to Glenwood Canyon Recreation Trail along River Road*	*ROW acquisition; corrdination with Glenwood Hot Springs; CDOT coordination*
79	*Include bicycle ramps and pavement markings to allow for bicycle movement through the new Grand Ave Bridge project roundabout*	
80	*Need longer pedestrian signal timing at 6th and Pine intersection*	*Will likely be resolved with the Grand Avenue Bridge project*
81	*Modify the ped-activated light at Exit 116 to complement the traffic signal- currently the ped signal activates with traffic turning onto eastbound on-ramp- dangerous*	*Peds currently must cross while looking over their right shoulder for vehicles turning from SH-82 onto the I-70E on ramp*
82	*Improved signage is needed around the entire 6th/ Laurel/Hotel Colorado/Hot Springs area to assist visitors- area is confusing to navigate on foot or bike for them*	
83	*Mark the road in front of the Hot Springs Pool as "share the road" to make it easier for two-way bicycling, and provide adequate signage to guide peds/bikes and warn vehicles of oncoming bike traffic*	*6th St may be revised based on an upcoming DDA project and/or the Grand Ave Bridge replacement; should this also be done on N River St?*
84	*Designate a bicycle boulevard or bicycle route between 6th&Pine and 6th&Linden intersections through N GWS neighborhood. Mark route with signage and pavement markings and add to bike route maps*	
85	*Establish policy for bikes on downtown sidewalks and clearly mark them to reduce ped/bike conflicts*	*Consider using a dismount pavement marking (Ft Collins has good example for review)*
86	*Provide bicycle and ped facilities on W 9th St*	*ROW constraints; feasibility issues*
87	*Provide shared-use path along east leg of RR wye track to connect Rio grande trail from 7th St and downtown*	*UPRR coordination; RFTA coordination; elevation change*
88	*Provide more bicycle parking downtown*	*Bike racks; on-street bike corrals*
89	*Provide bicycle parking at Glenwood Springs Elementary School*	*District/School coordination; funding source*
90	*Provide bicycle parking at Veltus Park*	*Maintenance; funding source*
91	*Provide sidewalks along School Street to enhance safe routes to school*	*ROW constraints; neighborhood coordination*

92	*Add a sidewalk along Coach Miller Drive to the High School*	
93	*Add a sidewalk east of the recycling center along School Street*	
94	*Provide trail connections to the Rio Grande Trail at 10th, 11th, 12th, 14th Streets*	*ROW acquisition, RFTA coordination and access constraints; private property approval*
95	*Provide sidewalks on at least one side of the neighborhood streets along Minter Ave, Lincoln Ave, Garfield Ave*	*Cost of implementation; ROW constraints; private property approval*
93	*Provide bicycle parking at Doc Holiday Trailhead*	*Space constraints*
97	*Add mid-block crossing of Cooper Ave between 8th/9th to access public parking lot across from Colorado Mountain College*	*Safety demand*
98	*Fix curb ramps on side path along S. Grand Ave from 23rd St to 27th St*	*Improve sight distance at Atkinson Trail intersection*
99	*Extend Atkinson Trail north from 27th St (Cottonwood Landing) to approximately 22nd St (Rose Property) and provide a new bicycle and pedestrian bridge connecting to the Rio Grande Trail*	*Cost implementation; environmental concerns along Roaring Fork River*
100	*Extend Atkinson Trail south from reach to Park East Trail*	*ROW acquisition; environmental feasibility; engineering feasibility; cost of implementation*
101	*Enhance transition from Atkinson Trail to Midland Ave*	*ROW; private property approval; tree removal*
102	*Formalize connection to Rio Grande Trail from 32nd St*	*ROW acquisition; private property coordination*
Multi-Modal Improvements outside City Limits		
103	*Construct LoVa Trail from New Castle to Glenwood Springs through South Canyon*	*Environmental concerns along CO River; ROW acquisition; funding source coordination with Garfield County*
104	*New trail connecting west Glenwood Springs to South Canyon Trail*	*Environmental concerns along CO River; ROW acquisition; funding source coordination with Garfield County*
105	*Continue bike lanes and sidewalks along Donegan Rd from Soccer Field Rd to Mitchell Creek Rd*	*ROW; coordination with Garfield County; property owner approval; Each intersection needs crosswalk markings*
106	*Provide bicycle facilities along Mitchell Creek Rd from US-6 to Donegan Rd*	*ROW; property owner approval; coordination with Garfield County*
107	*Provide shared-use path along Four Mile Rd up to Sunlight Ski Area*	*Space constraints; ROW acquisition; environmental feasibility; coordination with Garfield County*

Glenwood Springs
Long Range Transportation Master Plan

Figure A.3: Bicycle and Pedestrian Needs Assessment - North Map

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Bike lanes and sidewalks to connect to schools

Bike/ped path

Bike lane/bike path down to Donegan Rd

Road shoulder is only path for peds

Pedestrian crossing signage on Midland to social trail

Improve social trail that connects River to Wulfsohn Mountain Park single track system

Bike/ped path along Wulfsohn ends

Bike lane/path

Trail connection to W. Glenwood interchange

Rework bike path tunnels

Extend sidewalk or bike path

Bike/ped bridge to connect Glenwood Meadows and the residential areas of West Glenwood

Existing path in poor condition; add 'no parking' signs for overnight semi-trucks and should be some type of buffer between path and traffic

Challenging intersection, limited sight distance and signage

Lengthen timing pedestrian crossings and add signage

Limited visibility, alternate westbound route needed

Connect Two Rivers to Glenwood Recreation Trail Access need

Erosion on trail

Mid-block crosswalk to access public parking across from CMC

Replace on-street parking on Grand from 8th to 10th and add bike lanes, transit-only outside lane

Bike path along railroad to connect Rio Grande Trail and 7th St Promenade

Bike lanes, sidewalks, signage

Clean up 12th Street Ditch culvert and improve lighting

Improve road to sidewalk transitions

Better connection to on-street bike lanes from the Rio Grande Trail. Improve Grand underpass

Improve bike lane

Legend

- Traffic Signal
- Bridges
- Trailheads
- Railroad Track
- Bike Lanes
- On Road Bike Routes
- Paved Trails
- On Sidewalk Bike Routes
- Unpaved Trails
- RFTA Rio Grande Trail ROW
- Rio Grande Trail
- COGS Boundary
- Schools
- Destinations
- Parks

Needs, Gaps and Barriers

- Bike Parking Need
- Spot Gap
- Challenging Intersection (size reflects number of public comments on WikiMap site)
- Bike Network Area Gap
- Corridor Needs
- Sidewalk Gap
- Barrier

N

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 500 feet

Glenwood Springs
Long Range Transportation Master Plan

Figure A.4: Bicycle and Pedestrian Needs Assessment - South Map

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Substandard bike lanes

Challenging Railroad Corridor Crossing

Uneven-bumpy surfacing on Grand from 23rd to 27th

Bike lanes, sidewalks, signage

Consider a mini round-a-bout

Improve sight distance at Atkinson Trail intersection

Challenging Railroad Corridor Crossing

Improve access for vehicles and pedestrians

Better signage linking Rio Grande Trail and Cardiff / South Glenwood

Conflicts for entering traffic and the sidewalk/bike path

Improve trail to street transition

Challenging intersection

Gap in vehicular/bike/ped access to/from Glenwood Park area connecting Mt. Sopris Drive to CR 154.

Provide South Glenwood Springs connection to Highway 82

Legend

- Traffic Signal
- Bridges
- Trailheads
- Railroad Track
- Bike Lanes
- On Road Bike Routes
- Paved Trails
- On Sidewalk Bike Routes
- Unpaved Trails
- RFTA Rio Grande Trail ROW
- Rio Grande Trail
- COGS Boundary
- Schools
- Destinations
- Parks

Needs, Gaps and Barriers

- Bike Parking Need
- Spot Gap
- Challenging Intersection (size reflects number of public comments on WikiMap site)
- Bike Network Area Gap
- Corridor Needs
- Sidewalk Gap
- Barrier

N

0 750 1,500 3,000 4,500 6,000 Feet

1 inch = 750 feet

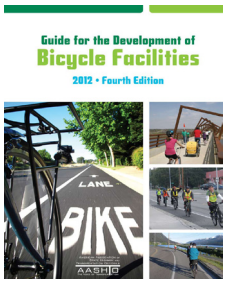
B Pedestrian and Bicycle Facility Design Guidelines

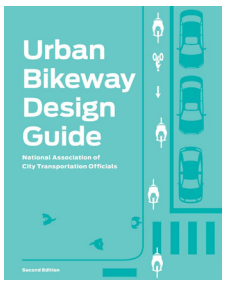
OVERVIEW

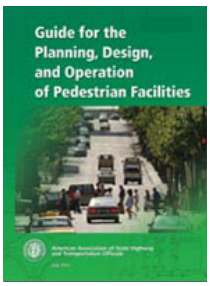
The sections that follow serve as an inventory of pedestrian and bicycle design treatments and provide guidelines for their development. These treatments and design guidelines are important because they represent the tools for creating a bicycle and pedestrian-friendly, safe, accessible community. The guidelines are not, however, a substitute for a more thorough evaluation by a landscape architect or engineer upon implementation of facility improvements. Some improvements may also require cooperation with the Colorado DOT for specific design solutions. The following standards and guidlines are referred to in this guide.

- The Federal Highway Administration's **Manual on Uniform Traffic Control Devices** (MUTCD) is the primary source for guidance on lane striping requirements, signal warrants, and recommended signage and pavement markings.
- American Association of State Highway and Transportation Officials (AASHTO) **Guide for the Development of Bicycle Facilities**, updated in June 2012 provides guidance on dimensions, use, and layout of specific bicycle facilities.
- Offering similar guidance for pedestrian design, the 2004 AASHTO **Guide for the Planning, Design and Operation of Pedestrian Facilities** provides comprehensive guidance on planning and designing for people on foot.
- The National Association of City Transportation Officials' (NACTO) 2012 **Urban Bikeway Design Guide** is the newest publication of nationally recognized bikeway design standards, and offers guidance on the current state of the practice designs.
- Meeting the requirements of the Americans with Disabilities Act (ADA) is an important part of any bicycle facility project. The United States Access Board's proposed **Public Rights-of-Way Accessibility Guidelines** (PROWAG) and the **2010 ADA Standards for Accessible Design**(2010 Standards) contain standards and guidance for the construction of accessible facilities.

Should the national standards be revised in the future and result in discrepancies with this chapter, the national standards should prevail for all design decisions.







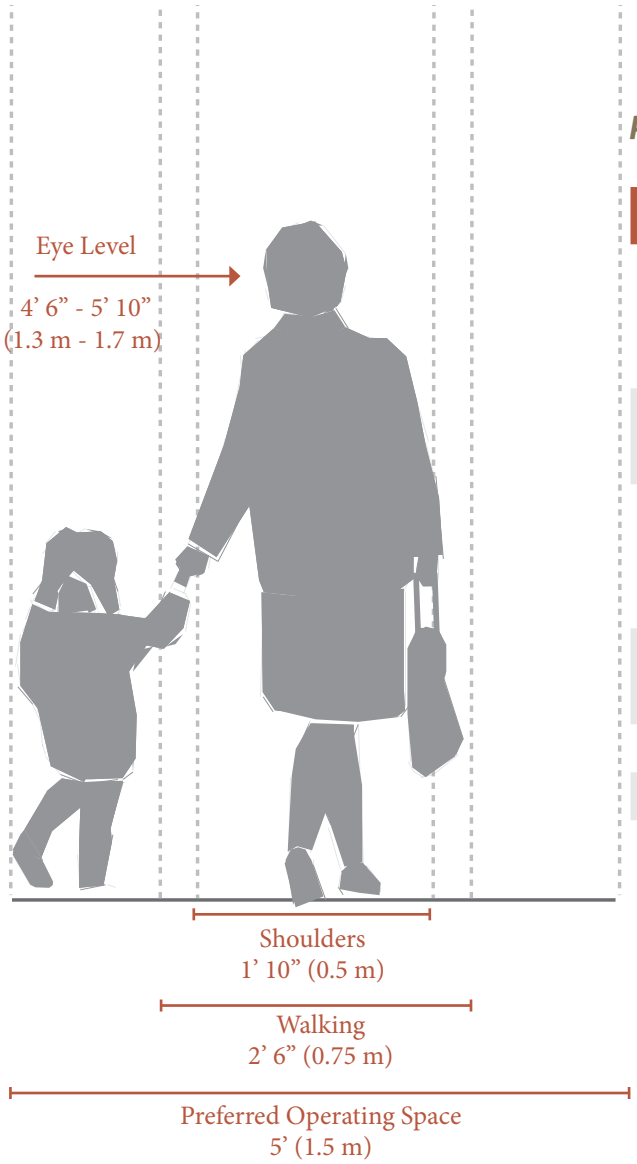
The Pedestrian and Bicyle Information Center, NACTO, AASHTO, the MUTCD, nationally recognized bikeway standards, and other sources have all informed the content of this appendix.

DESIGN NEEDS OF PEDESTRIANS

Types of Pedestrians

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

The MUTCD recommends a normal walking speed of 3.5 feet per second when calculating the pedestrian clearance interval at traffic signals. The walking speed can drop to 3 feet per second for areas with older populations and persons with mobility impairments. While the type and degree of mobility impairment varies greatly across the population, the transportation system should accommodate these users to the greatest reasonable extent.



Pedestrian Characteristics by Age

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

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

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

Disabled Pedestrian Design Considerations

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

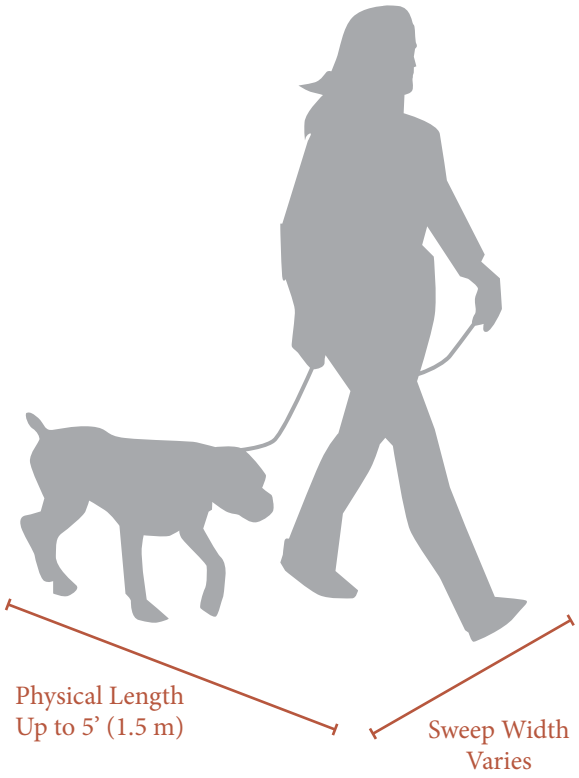
Design Needs of Dog Walkers

Dog walking is a common and anticipated use on shared use paths. Dog sizes vary largely, as does leash length and walking style, leading to wide variation in possible design dimensions.

Shared use paths designed to accommodate wheelchair users are likely to provide the necessary dimensions for the average dog walker. Amenities such as dog waste stations may enhance conditions for dog walkers.

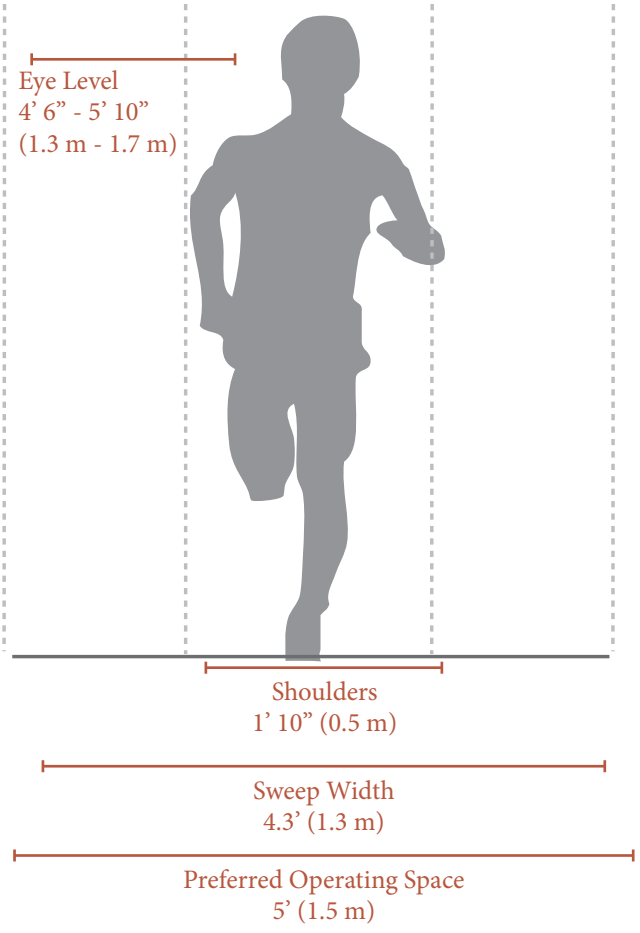
Design Needs of Runners

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



Typical Speed

User	Typical Speed
Runner	6.2 mph



Source: FHWA. *Characteristics of Emerging Road and Trail Users and Their Safety.* (2004).

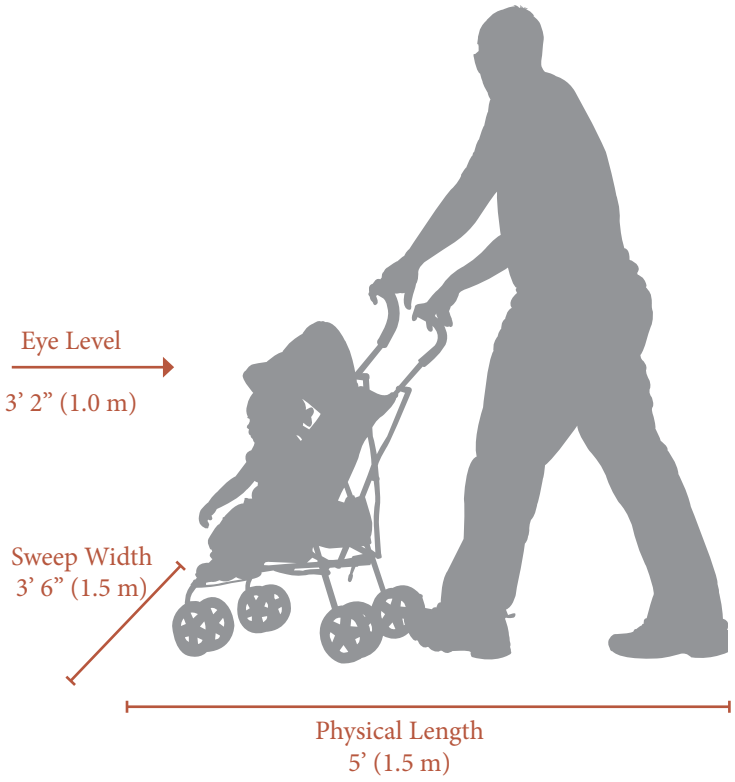
Design Needs of Strollers

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

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

Typical Speed

User	Typical Speed
Stroller	3.7 mph



Source: FHWA. *Characteristics of Emerging Road and Trail Users and Their Safety.* (2004).

Design Needs of Wheelchair Users

As the American population ages, the number of people using mobility assistive devices (such as manual wheelchairs, powered wheelchairs) increases.

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

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

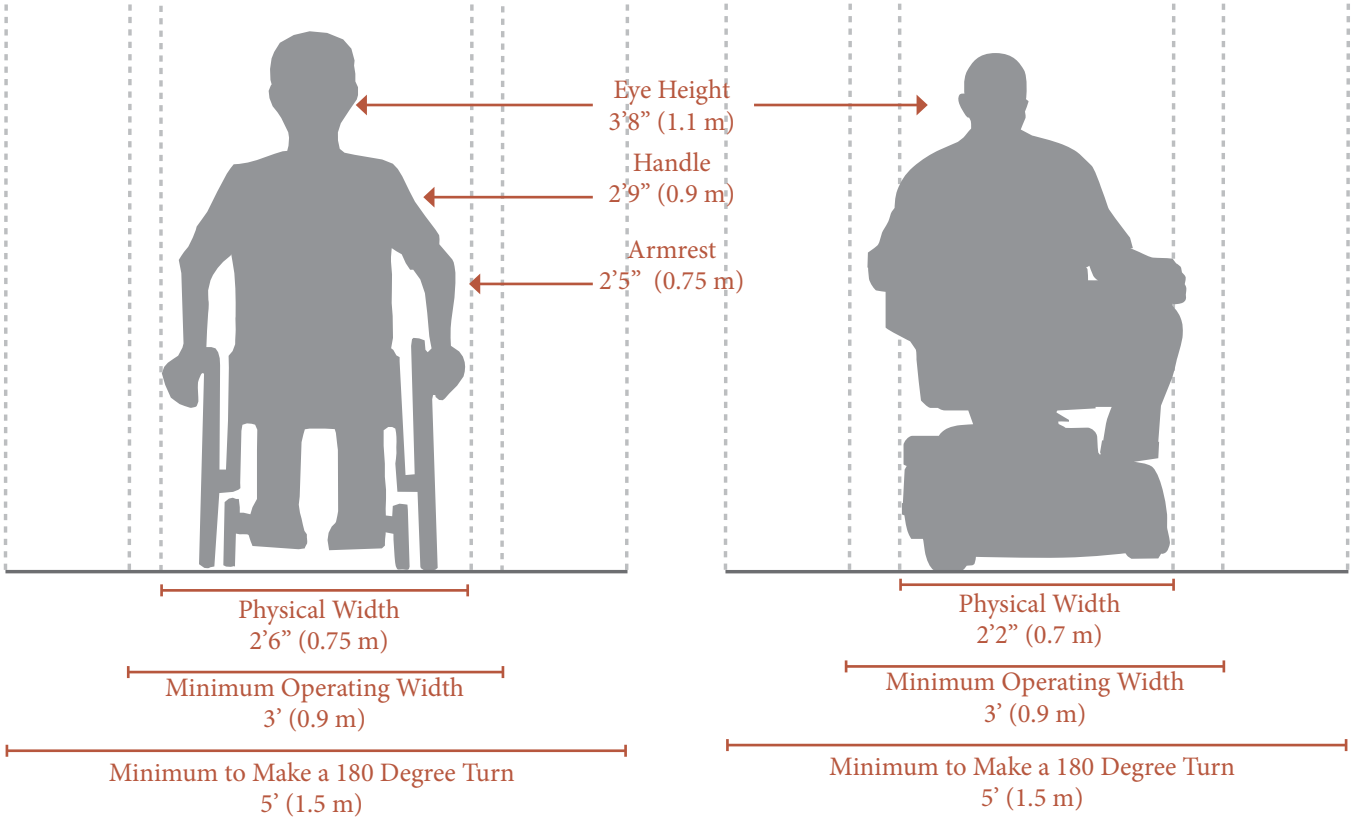
Maneuvering around a turn requires additional space for wheelchair devices. Providing adequate space for 180 degree turns at appropriate locations is an important element for accessible design.

Wheelchair User Typical Speed

User	Typical Speed
Manual Wheelchair	3.6 mph
Power Wheelchair	6.8 mph

Wheelchair User Design Considerations

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



Source: FHWA. *Characteristics of Emerging Road and Trail Users and Their Safety.* 2004. USDOJ. *2010 ADA Standards for Accessible Design.* 2010.

Design Needs of Skaters

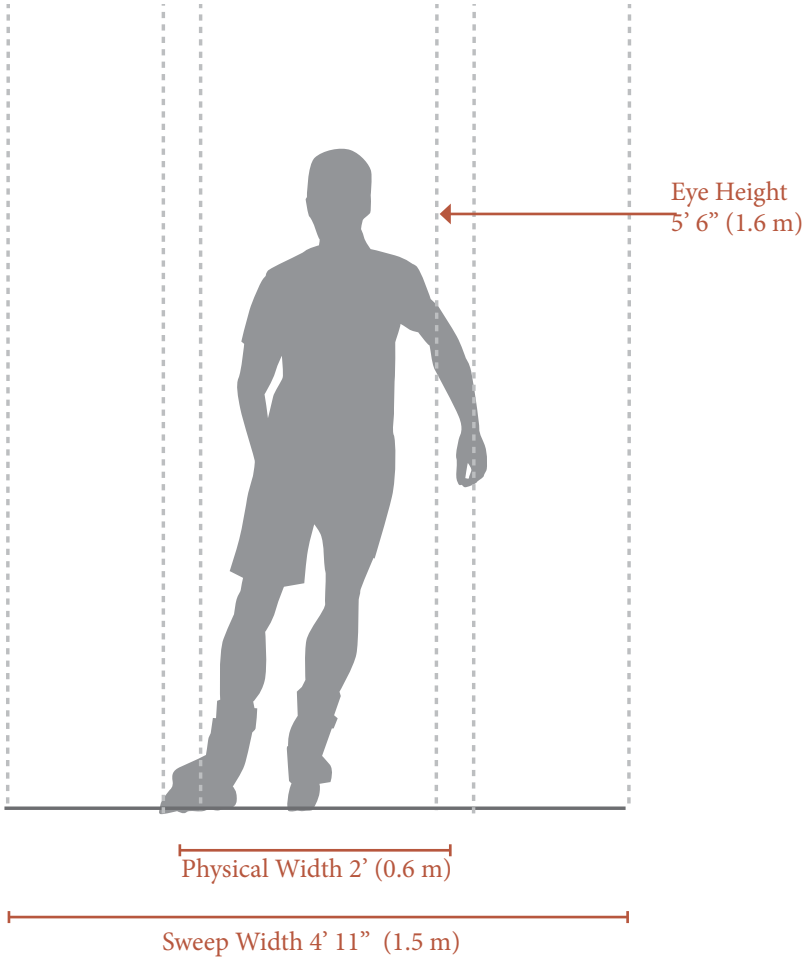
Inline skates are commonly used for recreational and transportation purposes. They typically have three to five wheels of 3 to 4 inches diameter, aligned in a straight line. Inline skate design allows for more efficient and high speed travel than quad wheel skates.

Operational characteristics vary by skill level of the operator. Novice skaters travel more slowly and have a narrower sweep width from advanced skaters. Novice users may also have trouble making sharp turns and stopping quickly, particularly on speed grades.

Inline skates are nearly impossible to use on unpaved surfaces and can be uncomfortable and difficult to operate on rough pavements such as chip seal and asphalt with large aggregate.

Typical Speed

User	Typical Speed
Inline Skates	9.9 mph



Source: FHWA. *Characteristics of Emerging Road and Trail Users and Their Safety.* 2004.

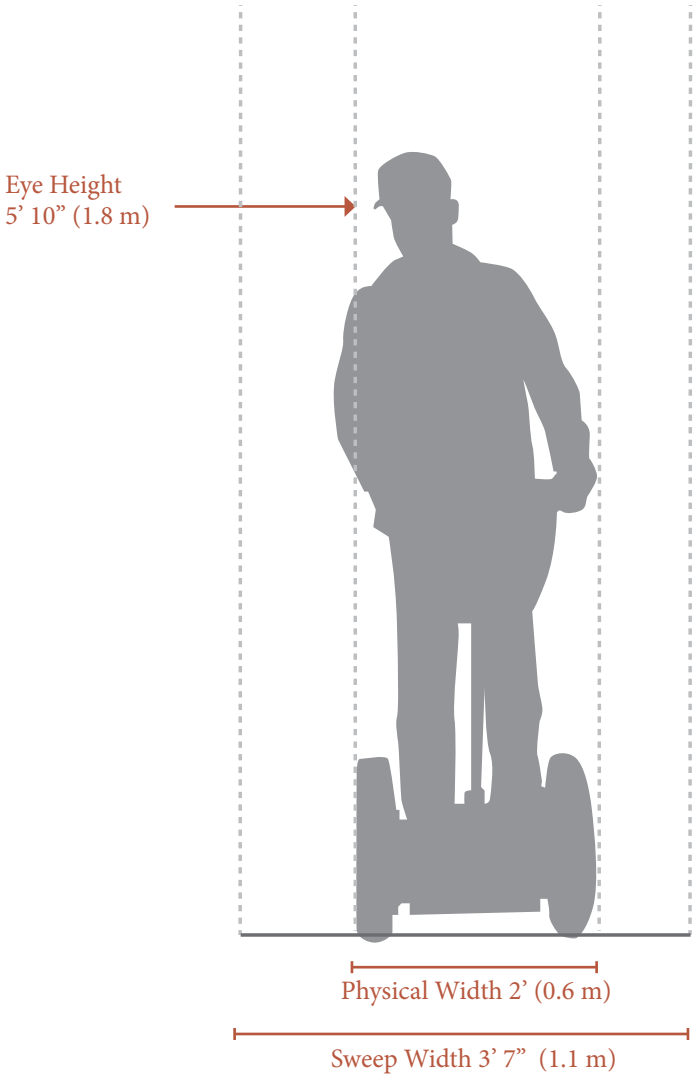
Design Needs of Electric Personal Mobility Devices (e.g., the Segway)

Electric personal mobility devices (EPMDs) such as the Segway, are appearing on paths and roadways around the country. North Carolina legislation has classified EPMDs as pedestrians, offering them all of the same rights and responsibilities.

The Segway is a self-balancing, electric-powered transportation device. Its footprint is not much larger than the human body's and has two wheels side by side next to the user's feet. The Segway uses gyroscopes and tilt sensors to monitor the body's movements and balance the device on the single axle. When a person leans forward, the Segway moves forward; leaning backward causes it to move back. The Segway has no brakes; to stop the device, users simply straighten up from their leaning position. Turning is accomplished with a twisting motion on the handlebar. Because both wheels are on one axle, it can turn in place with no turning radius.

Typical Speed

User	Typical Speed
Segway	10.5 mph



Source: FHWA. *Characteristics of Emerging Road and Trail Users and Their Safety.* 2004.
Roaring Fork Transportation Authority. Rio Grande Corridor Rules on the Use of Other Power Driven Mobility Devices. 2011.

PEDESTRIAN CROSSING LOCATION AND FACILITY SELECTION

Midblock Crossings

Midblock crossings are an important street design element for pedestrians. They can provide a legal crossing at locations where pedestrians want to travel, and can be safer than crossings at intersections because traffic is only moving in two directions. Locations where midblock 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.
- at midblock transit stops, where transit riders must cross the street on one leg of their journey.

Crossing Treatment Selection

The specific type of treatment at a crossing may range from a simple marked crosswalk to full traffic signals or grade separated crossings. Crosswalk lines should not be used indiscriminately, and appropriate selection of crossing treatments should be evaluated in an engineering study should be performed before a marked crosswalk is installed. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

PEDESTRIAN CROSSING CONTEXTUAL GUIDANCE
At unsignalized locations

	FACILITY TYPE	Local Streets 15-25 mph		Collector Streets 25-30 mph			Arterial Streets 30-45 mph							
		2 lane	3 lane	2 lane	2 lane with median refuge	3 lane	2 lane	2 lane with median refuge	3 lane	4 lane	4 lane with median refuge	5 lane	6 lane	6 lane with median refuge
1	Crosswalk Only (high visibility)	✓	✓	EJ	EJ	X	EJ	EJ	X	X	X	X	X	X
2	Crosswalk with warning signage and yield lines	EJ	✓	✓	✓	✓	EJ	EJ	EJ	X	X	X	X	X
3	Active Warning Beacon (RRFB)	X	EJ	✓	✓	✓	✓	✓	✓	X	✓	X	X	X
4	Hybrid Beacon	X	X	EJ	EJ	EJ	EJ	✓	✓	✓	✓	✓	✓	✓
5	Full Traffic Signal	X	X	EJ	EJ	EJ	EJ	EJ	EJ	✓	✓	✓	✓	✓
6	Grade separation	X	X	EJ	EJ	EJ	X	EJ	EJ	EJ	EJ	EJ	✓	✓

LEGEND	
Most Desirable	✓
Engineering Judgement	EJ
Not Recommended	X


1 Marked Crosswalks


2 Crosswalk with Warning Signage


3 Active Warning Beacon (RRFB)

4 Pedestrian Hybrid Beacon


5 Full Traffic Signal

6 Grade Separation

SIDEWALKS

Sidewalks are the most fundamental element of the walking network, as they provide an area for pedestrian travel that is separated from vehicle traffic. Sidewalks are typically constructed out of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped planting strip area. Sidewalks are a common application in both urban and suburban environments.

Attributes of well-designed sidewalks include the following:

Accessibility: A network of sidewalks should be accessible to all users.

Adequate width: Two people should be able to walk side-by-side and pass a third comfortably. Different walking speeds should be possible. In areas of intense pedestrian use, sidewalks should accommodate the high volume of walkers.

Safety: Design features of the sidewalk should allow pedestrians to have a sense of security and predictability. Sidewalk users should not feel they are at risk due to the presence of adjacent traffic.

Continuity: Walking routes should be obvious and should not require pedestrians to travel out of their way unnecessarily.

Landscaping: Plantings and street trees should contribute to the overall psychological and visual comfort of sidewalk users, and be designed in a manner that contributes to the safety of people.

Drainage: Sidewalks should be well graded to minimize standing water.

Social space: There should be places for standing, visiting, and sitting. The sidewalk area should be a place where adults and children can safely participate in public life.

Quality of place: Sidewalks should contribute to the character of neighborhoods and business districts.


Zones in the Sidewalk Corridor


Sidewalk Widths

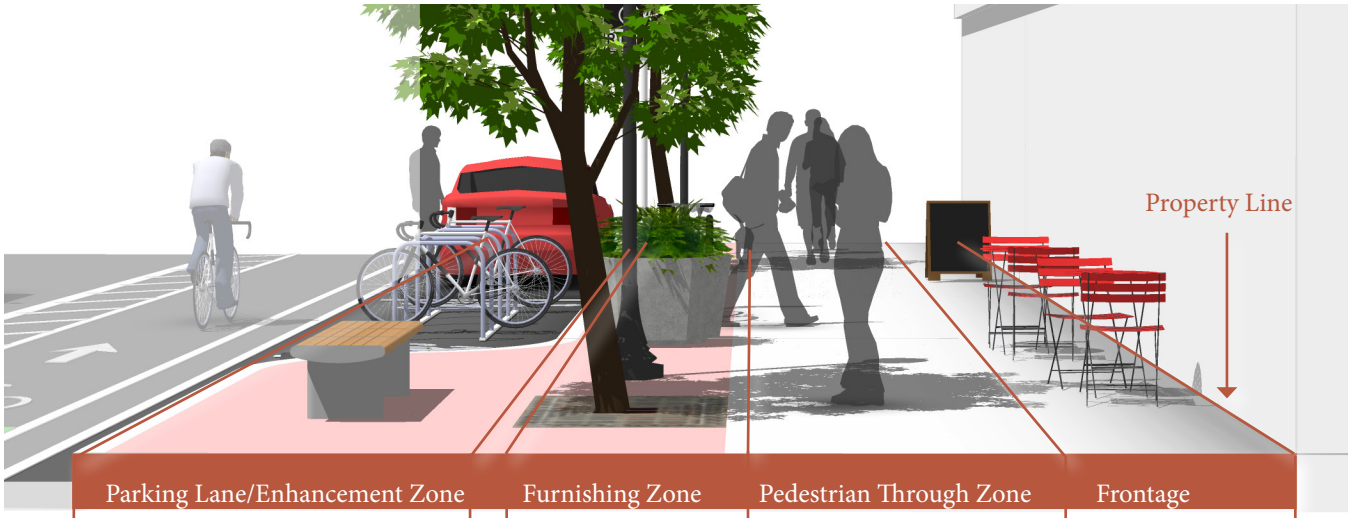

Sidewalk Obstructions and Driveway Ramps


Pedestrian Access in Construction Areas

Zones in the Sidewalk Corridor

Description

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



Parking Lane/Enhancement Zone

The parking lane can act as a flexible space to further buffer the sidewalk from moving traffic. Curb extensions and bike corrals may occupy this space where appropriate.

In the edge zone there should be a 6 inch wide curb.

Edge Zone

Furnishing Zone

The furnishing zone buffers pedestrians from the adjacent roadway, and is also the area where elements such as street trees, signal poles, signs, and other street furniture are properly located.

Pedestrian Through Zone

The through zone is the area intended for pedestrian travel. This zone should be entirely free of permanent and temporary objects.

Wide through zones are needed in downtown areas or where pedestrian flows are high.

Frontage

The Frontage Zone allows pedestrians a comfortable "shy" distance from the building fronts. It provides opportunities for window shopping, to place signs, planters, or chairs. Not applicable if adjacent to a landscaped space.

Discussion

Sidewalks should be more than areas to travel; they should provide places for people to interact. There should be places for standing, visiting, and sitting. Sidewalks should contribute to the character of neighborhoods and business districts, strengthen their identity, and be an area where adults and children can safely participate in public life.

Additional References and Guidelines

USDOJ. *ADA Standards for Accessible Design.* 2010.
United States Access Board. *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public-Right-of-Way (PROWAG).* 2011.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.
NACTO. *Urban Street Design Guide.* 2013.

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 space. Colored, patterned, or stamped concrete can add distinctive visual appeal.

Sidewalk Widths

Description

The width and design of sidewalks will vary depending on street context, functional classification, and pedestrian demand. Below are preferred widths of each sidewalk zone according to general street type. Standardizing sidewalk guidelines for different areas of the city, dependent on the above listed factors, ensures a minimum level of quality for all sidewalks.

Street Classification	Parking Lane/ Enhancement Zone	Furnishing Zone	Pedestrian Through Zone	Frontage Zone	Total
Local Streets	Varies	2 - 5 feet	4 - 6 feet	N/A	6 - 11 feet
Commercial Areas	Varies	4 - 6 feet	6 - 12 feet	2.5 - 10 feet	11 - 28 feet
Arterials and Collectors	Varies	2 - 6 feet	4 - 8 feet	2.5 - 5 feet	8 -19 feet

Areas that have significant accumulations of snow during the winter may prefer a wider furnishing zone for snow storage.

Six feet enables two pedestrians (including wheelchair users) to walk side-by-side, or to pass each other comfortably

Discussion

It is important to provide adequate width along a sidewalk corridor. Two people should be able to walk side-by-side and pass a third comfortably. In areas of high demand, sidewalks should contain adequate width to accommodate the high volumes and different walking speeds of pedestrians. The Americans with Disabilities Act requires a 4 foot clear width in the pedestrian zone plus 5 foot passing areas every 200 feet.

Additional References and Guidelines

USDOJ. *ADA Standards for Accessible Design.* 2010. United States Access Board. *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public-Right-of-Way (PROWAG).* 2011. AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004. NACTO *Urban Street Design Guide.* 2013.

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. Surfaces must be firm, stable, and slip resistant. Colored, patterned, or stamped concrete can add distinctive visual appeal.

Sidewalk Obstructions and Driveway Ramps

Description

Obstructions to pedestrian travel in the sidewalk corridor typically include driveway ramps, curb ramps, sign posts, utility and signal poles, mailboxes, fire hydrants and street furniture.

Guidance

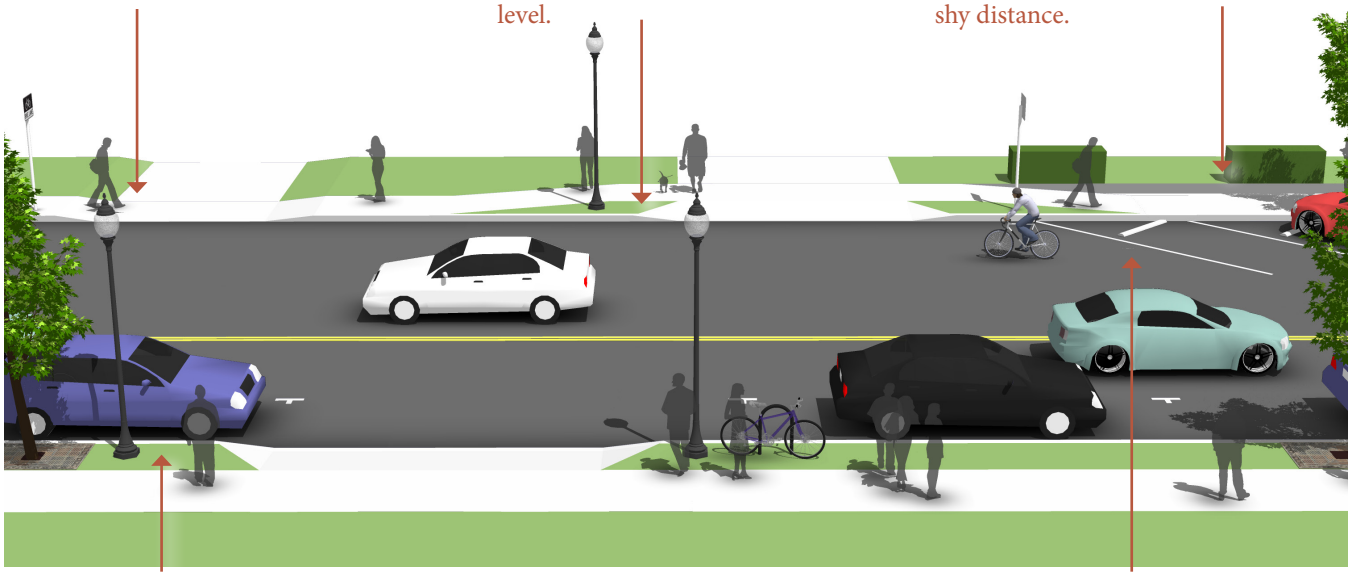
Reducing the number of accesses reduces the need for special provisions. This strategy should be pursued first.

Obstructions should be placed between the sidewalk and the roadway to create a buffer for increased pedestrian comfort.

Dipping the entire sidewalk at the driveway approaches keeps the cross-slope at a constant grade. This is the least-preferred driveway option.

Where constraints preclude a planter strip, wrapping the sidewalk around the driveway allows the sidewalk to still remain level.

When sidewalks abut hedges, fences, or buildings, an additional two feet of lateral clearance should be added to provide appropriate shy distance.



Planter strips allow sidewalks to remain level, with the driveway grade change occurring within the planter strip.

When sidewalks abut angled on-street parking, wheel stops should be used to prevent vehicles from overhanging in the sidewalk.

Discussion

Driveways are a common sidewalk obstruction, especially for wheelchair users. When constraints only allow curb-tight sidewalks, dipping the entire sidewalk at the driveway approaches keeps the cross-slope at a constant grade. However, this may be uncomfortable for pedestrians and could create drainage problems behind the sidewalk.

Additional References and Guidelines

USDOJ. *ADA Standards for Accessible Design.* 2010.
United States Access Board. *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public-Right-of-Way (PROWAG).* 2011.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

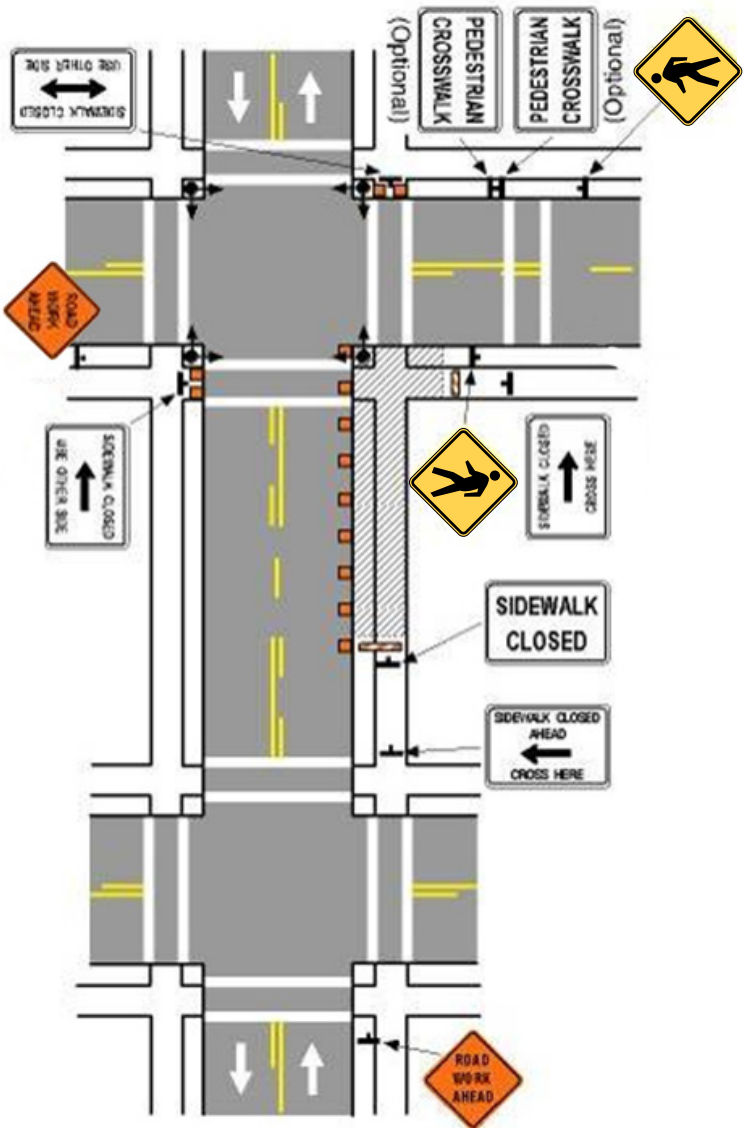
Materials and Maintenance

Sidewalks are typically constructed out of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped space. Surfaces must be firm, stable, and slip resistant.

Pedestrian Access Through Construction Areas

Description

Measures should be taken to provide for the continuity of a pedestrian's trip through a construction closure. Only in rare cases should pedestrians be detoured to another street when travel lanes remain open.



Guidance

- Pedestrians should be provided with a safe, accessible, convenient path that replicates as nearly as practical the most desirable characteristics of the existing sidewalks. The alternate circulation path should be parallel to the disrupted pedestrian access route, be located on the same side of the street, and accommodate the disabled.
- The alternate route should have a width of 5 feet minimum, and an additional foot of width for each vertical element along the route.
- In rare cases where access is not available on the same side of the street, the alternate pedestrian route may be located on the opposite side of the street as long as the distance of the disrupted pedestrian route does not exceed 300 feet.
- Signage related to construction activities shall be placed in a location that does not obstruct the path of bicycles or pedestrians, including bicycle lanes, wide curb lanes, or sidewalks.

Discussion

The removal of a pedestrian access route, curb ramp, or pedestrian street crossing, even for a short time, may severely limit or totally preclude pedestrians, especially those with a disability, from navigating in the public right-of-way. It might also preclude access to buildings, facilities, or sites on adjacent properties.

Additional References and Guidelines

FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

Materials and Maintenance

The alternate route should include sidewalks and pedestrian access routes, curb ramps, pedestrian crossings, lighting, and all other elements included in these standards.

PEDESTRIANS AT INTERSECTIONS

Attributes of pedestrian-friendly intersection design include:

Clear Space: Corners should be clear of obstructions. They should also have enough room for curb ramps, for transit stops where appropriate, and for street conversations where pedestrians might congregate.

Visibility: It is critical that pedestrians on the corner have a good view of vehicle travel lanes and that motorists in the travel lanes can easily see waiting pedestrians.

Legibility: Symbols, markings, and signs used at corners should clearly indicate what actions the pedestrian should take.

Accessibility: All corner features, such as curb ramps, landings, call buttons, signs, symbols, markings, and textures, should meet accessibility standards and follow universal design principles.

Separation from Traffic: Corner design and construction should be effective in discouraging turning vehicles from driving over the pedestrian area. Crossing distances should be minimized.

Lighting: Adequate lighting is an important aspect of visibility, legibility, and accessibility.

These attributes will vary with context but should be considered in all design processes. For example, suburban and rural intersections may have limited or no signing. However, legibility regarding appropriate pedestrian movements should still be taken into account during design.


Raised Crosswalks


Median Refuge Islands


Curb Extensions


Advance Stop Bar

Parking Control


Marked Crosswalks


ADA Compliant Curb Ramps

Marked Crosswalks

Description

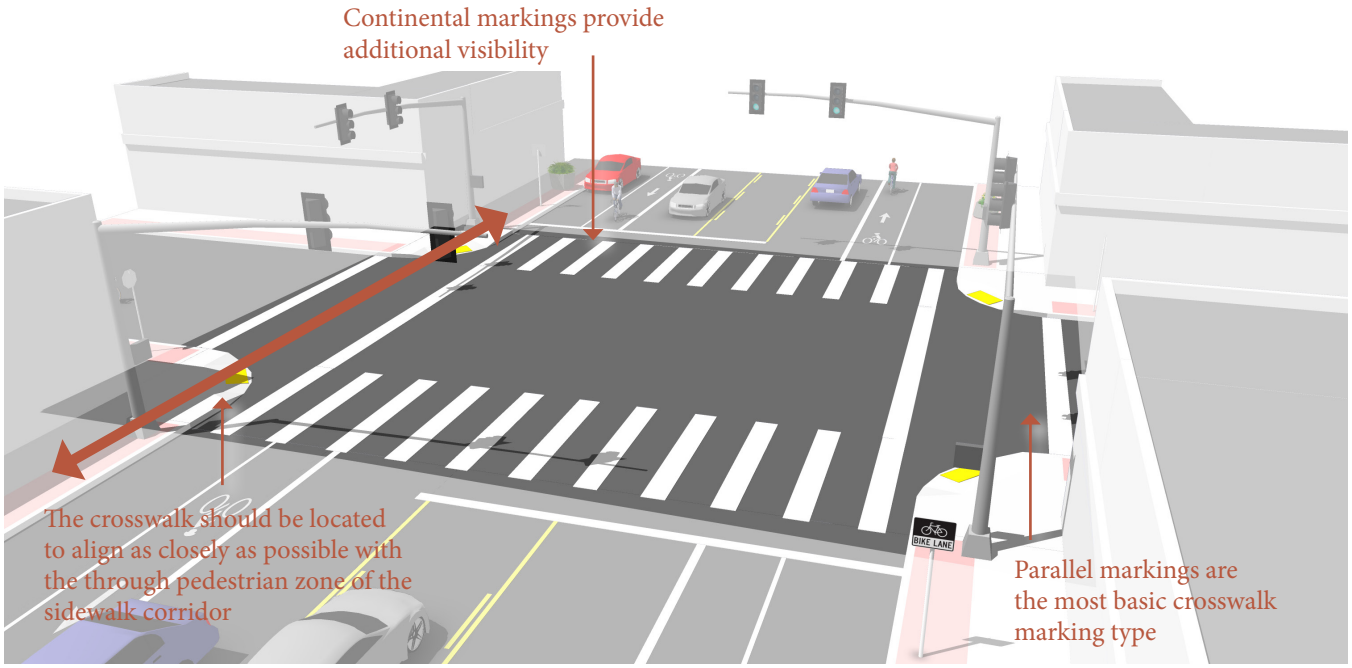
A marked crosswalk signals to motorists that they must stop for pedestrians and encourages pedestrians to cross at designated locations. Installing crosswalks alone will not necessarily make crossings safer especially on multi-lane roadways.

At mid-block locations, crosswalks can be marked where there is a demand for crossing and there are no nearby marked crosswalks.

Guidance

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

- At a complex intersection, to orient pedestrians in finding their way across.
- At an offset intersection, to show pedestrians the shortest 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.
- At an intersection within a school zone on a walking route.



Discussion

Continental crosswalk markings should be used at crossings with high pedestrian use or where vulnerable pedestrians are expected, including: school crossings, across arterial streets for pedestrian-only signals, at mid-block crosswalks, and at intersections where there is expected high pedestrian use and the crossing is not controlled by signals or stop signs. See intersection signalization for a discussion of enhancing pedestrian crossings.

Additional References and Guidelines

FHWA. *Manual on Uniform Traffic Control Devices. (3B.18). 2009.*
AASHTO. Guide for the Planning, Design, and Operation of Pedestrian Facilities. 2004.
FHWA. *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations.* 2005.
FHWA. *Crosswalk Marking Field Visibility Study.* 2010.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority. Thermoplastic markings offer increased durability than conventional paint.

Raised Crosswalks

Description

A raised crosswalk or intersection can eliminate grade changes from the pedestrian path and give pedestrians greater prominence as they cross the street. Raised crosswalks should be used only in very limited cases where a special emphasis on pedestrians is desired; review on case-by-case basis.

Guidance

- Use detectable warnings at the curb edges to alert vision-impaired pedestrians that they are entering the roadway.
- Approaches to the raised crosswalk may be designed to be similar to speed humps.
- Raised crosswalks can also be used as a traffic calming treatment.

Discussion

Like a speed hump, raised crosswalks have a traffic slowing effect which may be unsuitable on emergency response routes.

Additional References and Guidelines

FHWA. *Manual on Uniform Traffic Control Devices. (3B.18).* 2009.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.
USDOJ. *ADA Standards for Accessible Design.* 2010.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority.

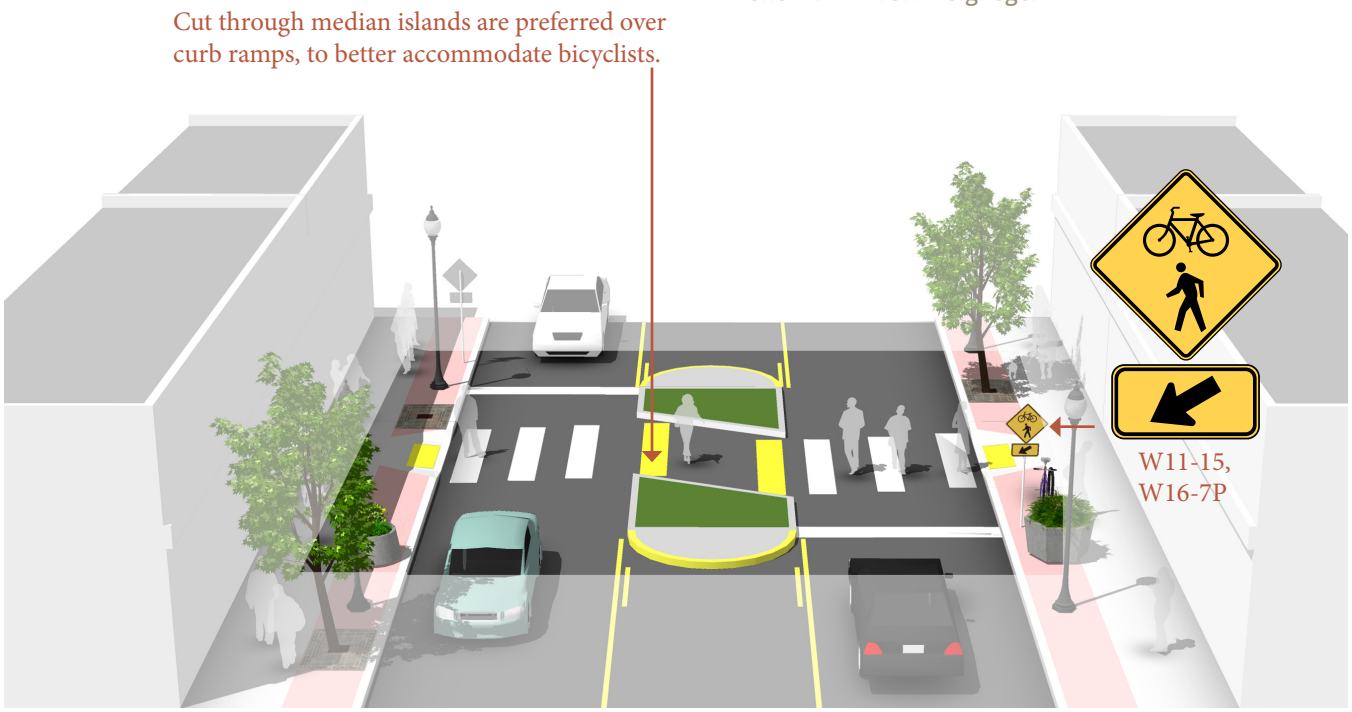
Median Refuge Islands

Description

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

Guidance

- Can be applied on any roadway with a left turn center lane or median that is at least 6' wide.
- 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 (to accommodate bikes with path and wheelchair users) and at least 20' long.
- On streets with speeds higher than 25 mph there should also be double centerline marking, reflectors, and "KEEP RIGHT" signage.



Discussion

If a refuge island is landscaped, the landscaping should not compromise the visibility of pedestrians crossing in the crosswalk. Shrubs and ground plantings should be no higher than 1 ft 6 in.

On multi-lane roadways, consider configuration with active warning beacons for improved yielding compliance.

Additional References and Guidelines

FHWA. Manual on Uniform Traffic Control Devices. 2009.
AASHTO. Guide for the Planning, Design, and Operation of Pedestrian Facilities. 2004.
NACTO. Urban Bikeway Design Guide. 2012.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Refuge islands may collect road debris and may require somewhat frequent maintenance. Refuge islands should be visible to snow plow crews and should be kept free of snow berms that block access.

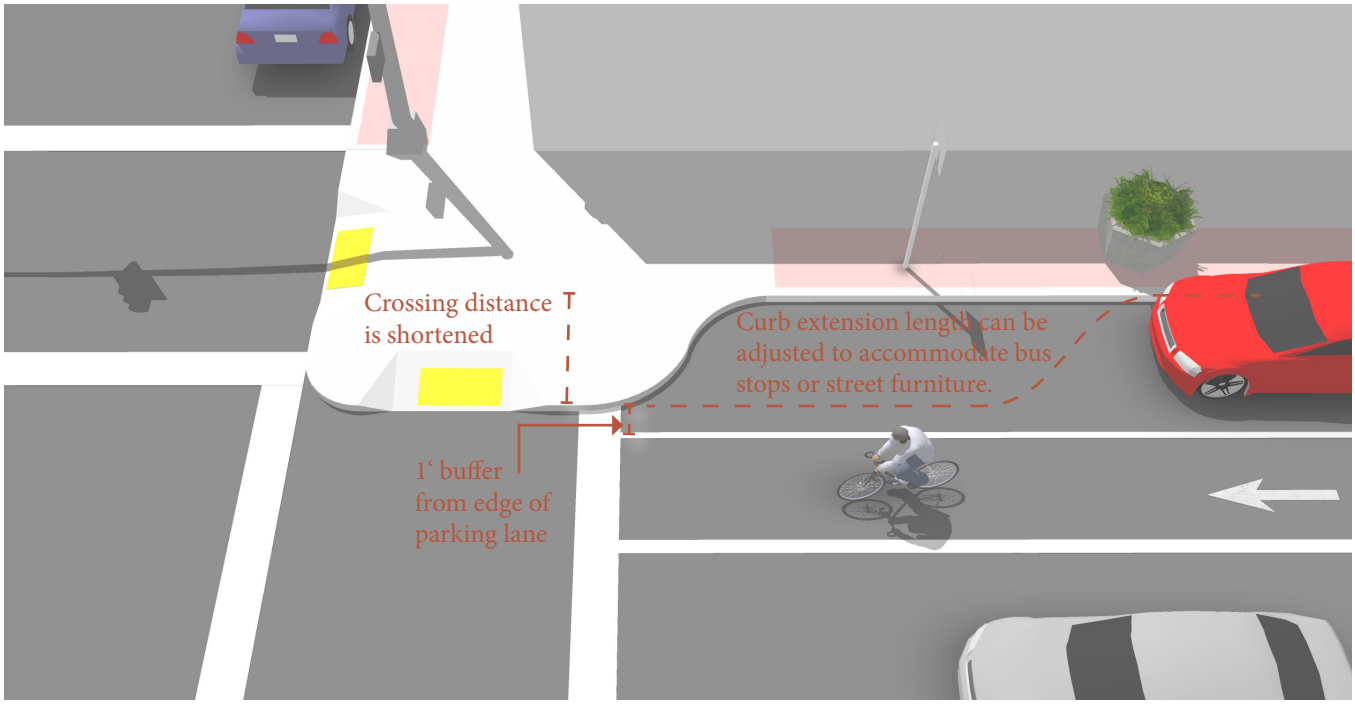
Curb Extensions

Description

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

Guidance

- In most cases, the curb extensions should be designed to transition between the extended curb and the running curb in the shortest practicable distance.
- For purposes of efficient street sweeping, the minimum radius for the reverse curves of the transition is 10 ft and the two radii should be balanced to be nearly equal.
- Curb extensions should terminate one foot short of the parking lane to maximize bicyclist safety.



Discussion

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

Additional References and Guidelines

AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004. AASHTO. *A Policy on Geometric Design of Highways and Streets.* 2004. NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Planted curb extensions may be designed as a bioswale, a vegetated system for stormwater management.

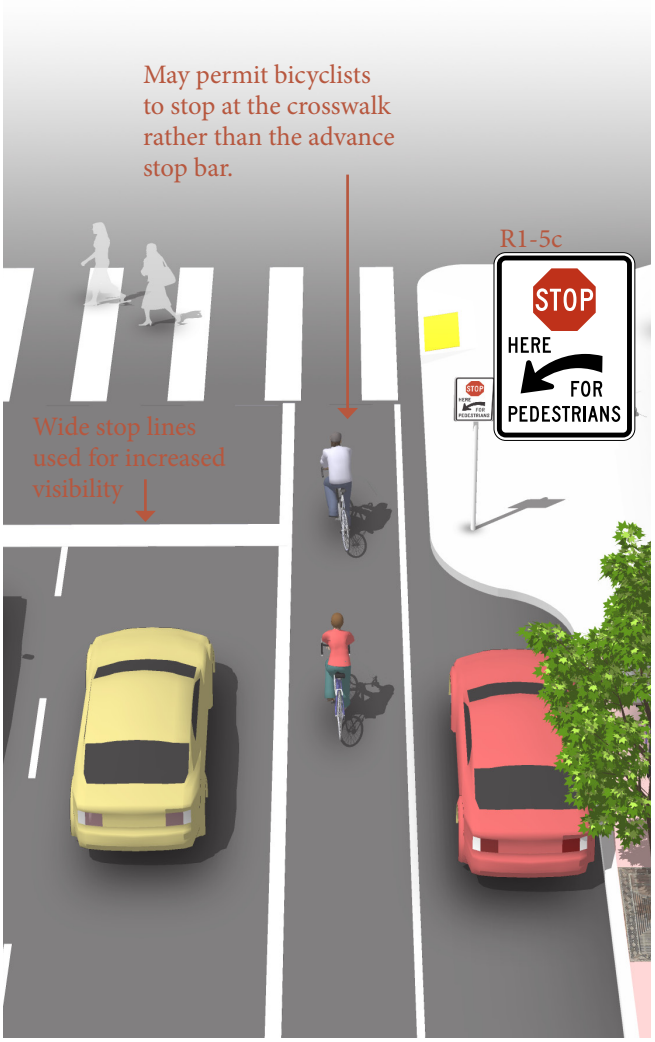
Advance Stop Bar

Description

Advance stop bars increase pedestrian comfort and safety by stopping motor vehicles well in advance of marked crosswalks, allowing vehicle operators a better line of sight of pedestrians and giving inner lane motor vehicle traffic time to stop for pedestrians.

Guidance

- On streets with at least two travel lanes in each direction.
- Prior to a marked crosswalk
- In one or both directions of motor vehicle travel
- Recommended 15-50 feet or more in advance of the crosswalk
- A "Stop Here for Pedestrians" sign should accompany the advance stop bar



Discussion

If a bicycle lane is present, mark the advance stop bar to permit bicyclists to stop at the crosswalk ahead of the stop bar.

If the State law requires drivers to YIELD to pedestrians in crosswalks, a Yield Line marking must be used rather than a stop line in these cases.

Additional References and Guidelines

FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Parking Control

Description

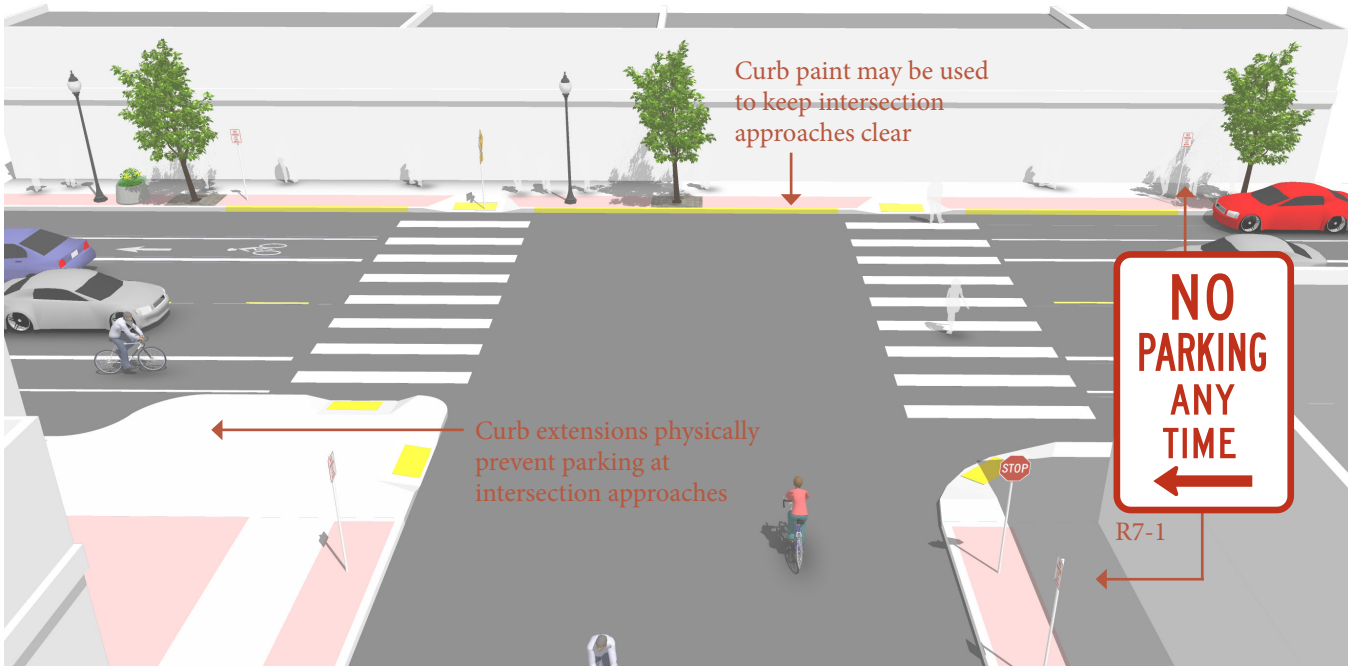
Parking control involves restricting or reducing on-street parking near intersections with high pedestrian activity. Locating parking away from the intersection improves motorist's visibility on the approach to the intersection and crosswalk. Improved sight lines at intersections reduces conflicts between motorists and pedestrians.

Guidance

Curb extensions, NO PARKING signage, or curb paint can be used to keep the approach to intersections clear of parked vehicles.

At "T" and offset intersections, where the boundaries of the intersection may not be obvious, this prohibition should be made clear with signage.

Parking should not be allowed within any type of intersection adjacent to schools, school crosswalks, and parks. This includes "T" and offset intersections.



Discussion

In areas where there is high parking demand parking compact vehicles may be allowed within "T" or offset intersections and on either side of the crosswalk. At these locations, signs will be placed to prohibit parking within the designated crosswalk areas, and additional enforcement should be provided, particularly when the treatment is new.

Additional References and Guidelines

AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.
AASHTO. *A Policy on Geometric Design of Highways and Streets.* 2004.

Materials and Maintenance

Signage and striping require routine maintenance.

ADA Compliant Curb Ramps

Description

Curb ramps are the design elements that allow all users to make the transition from the street to the sidewalk. There are a number of factors to be considered in the design and placement of curb ramps at corners. Properly designed curb ramps ensure that the sidewalk is accessible from the roadway. 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.

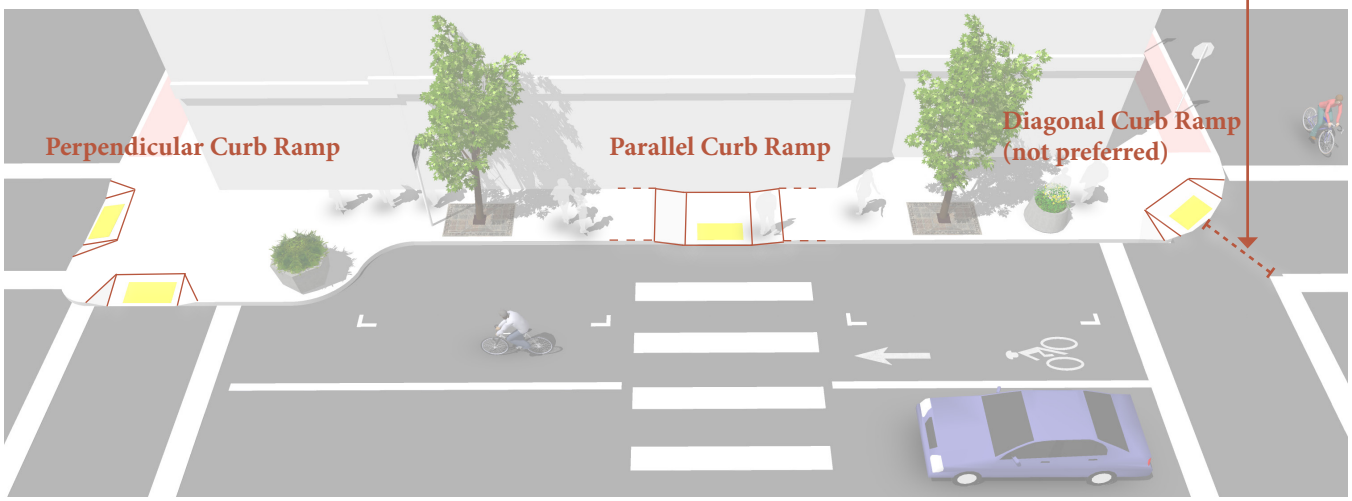
Although diagonal curb ramps might save money, they create potential safety and mobility problems for pedestrians,including reduced maneuverability and increased interaction with turning vehicles, particularly in areas with high traffic volumes. Diagonal curb ramp configurations are the least preferred of all options.

Guidance

- The landing at the top of a ramp shall be at least 4 feet long and at least the same width as the ramp itself.
- The ramp shall slope no more than 1:12 , with a maximum cross slope of 2.0%.
- If the ramp runs directly into a crosswalk, the landing at the bottom will be in the roadway.
- If the ramp lands on a dropped landing within the sidewalk or corner area where someone in a wheelchair may have to change direction, the landing must be a minimum of 5'-0" long and at least as wide as the ramp, although a width of 5'-0" is preferred.

Curb ramps shall be located so that they do not project into vehicular traffic lanes, parking spaces, or parking access aisles. Three configurations are illustrated below.

Diagonal ramps shall include a clear space of at least 48" within the crosswalk for user maneuverability



Crosswalk spacing not to scale. For illustration purposes only.

Discussion

The edge of an ADA compliant curb ramp may be marked with a tactile warning device (also known as truncated domes) to alert people with visual impairments to changes in the pedestrian environment. Contrast between the raised tactile device and the surrounding infrastructure is important so that the change is readily evident. These devices are most effective when adjacent to smooth pavement so the difference is easily detected. The devices should provide color contrast so partially sighted people can see them.

Additional References and Guidelines

United States Access Board. *Accessibility Guidelines for Buildings and Facilities.* 2002.
United States Access Board. *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public-Right-of-Way (PROWAG).* 2011.
USDOJ. *ADA Standards for Accessible Design.* 2010.

Materials and Maintenance

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

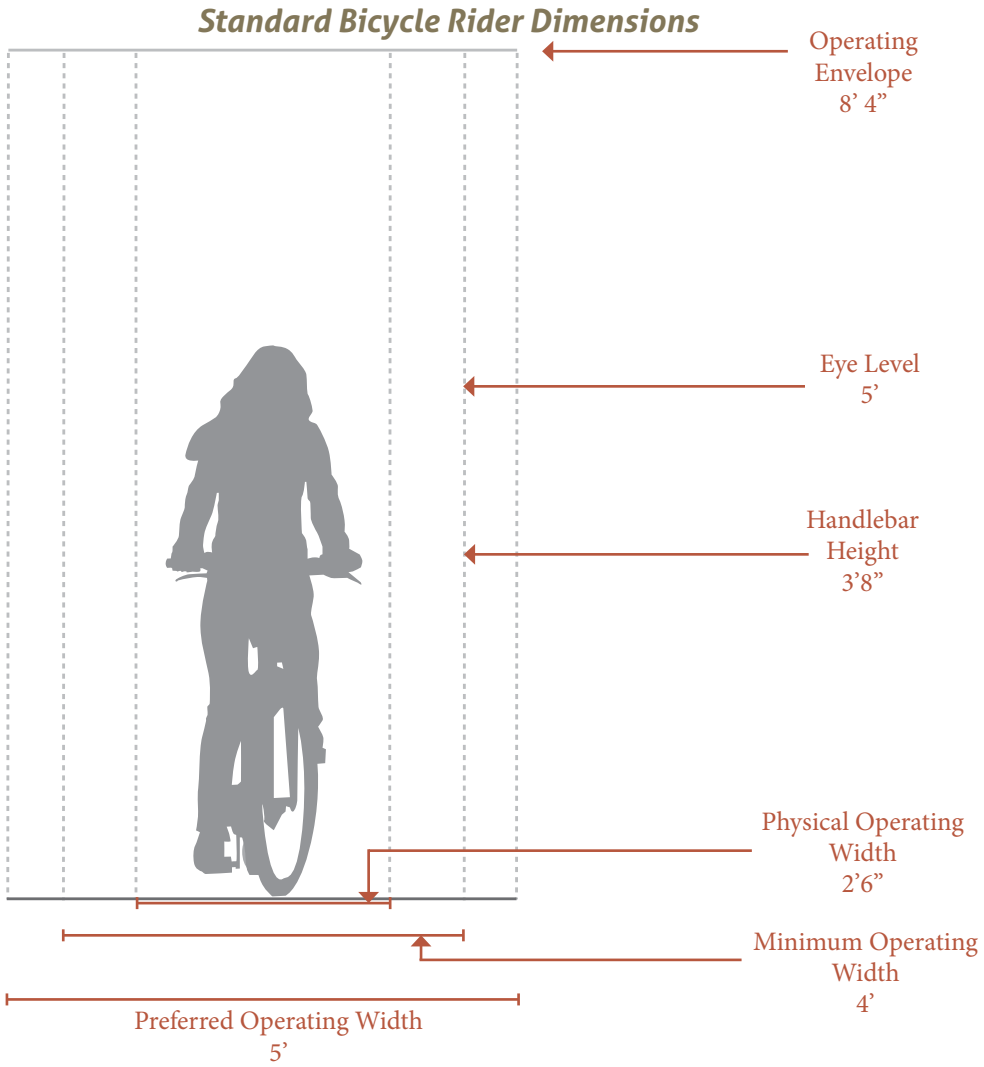
DESIGN NEEDS OF BICYCLISTS

The purpose of this section is to provide the facility designer with an understanding of how bicyclists operate and how their bicycle influences that operation. Bicyclists, by nature, are much more affected by poor facility design, construction and maintenance practices than motor vehicle drivers. Bicyclists lack the protection from the elements and roadway hazards provided by an automobile's structure and safety features. By understanding the unique characteristics and needs of bicyclists, a facility designer can provide quality facilities and minimize user risk.

Bicycle as a Design Vehicle

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

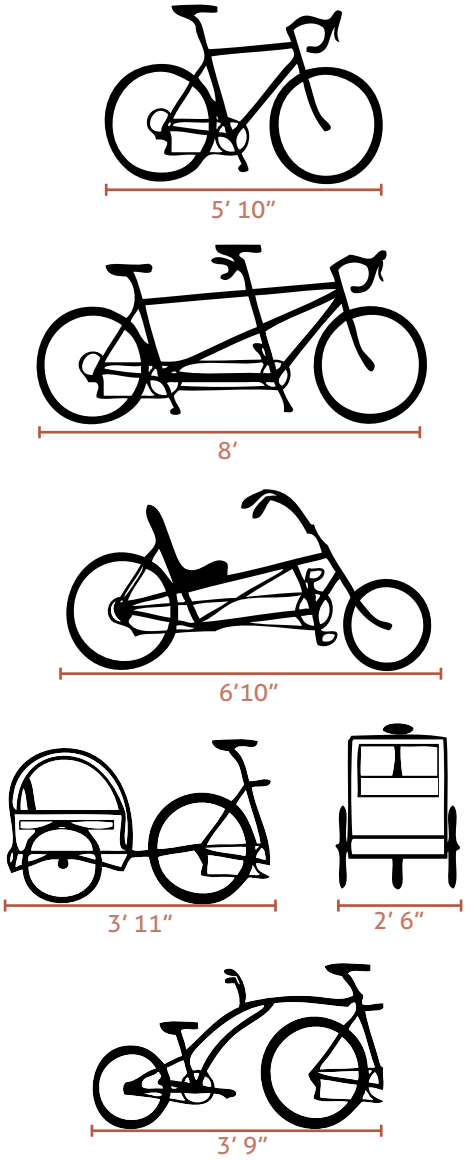
The figure below illustrates the operating space and physical dimensions of a typical adult bicyclist, which are the basis for typical facility design. Bicyclists require clear space to operate within a facility. This is why the minimum operating width is greater than the physical dimensions of the bicyclist.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



Source: AASHTO Guide for the Development of Bicycle Facilities, 4th Edition. 2012.

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

DESIGN SPEED EXPECTATIONS



Bicycle as Design Vehicle - Typical Dimensions

Source: AASHTO *Guide for the Development of Bicycle Facilities*, 4th Edition *AASHTO does not provide typical dimensions for tricycles.

Bicycle as Design Vehicle - Typical Dimensions

Bicycle Type	Feature	Typical Dimensions
Upright Adult Bicyclist	Physical width	2 ft 6 in
	Operating width (Minimum)	4 ft
	Operating width (Preferred)	5 ft
	Physical length	5 ft 10 in
	Physical height of handlebars	3 ft 8 in
	Operating height	8 ft 4 in
	Eye height	5 ft
	Vertical clearance to obstructions (tunnel height, lighting, etc)	10 ft
	Approximate center of gravity	2 ft 9 in - 3 ft 4 in
Recumbent Bicyclist	Physical length	8 ft
	Eye height	3 ft 10 in
Tandem Bicyclist	Physical length	8 ft
Bicyclist with child shared use path	Physical length	10 ft
	Physical width	2 ft 6 in

Bicycle as Design Vehicle - Design Speed Expectations

Bicycle Type	Feature	Typical Speed
Upright Adult Bicyclist	Paved level surfacing	15 mph
	Crossing Intersections	10 mph
	Downhill	30 mph
	Uphill	5 -12 mph
Recumbent Bicyclist	Paved level surfacing	18 mph

*Tandem bicycles and bicyclists with trailers have typical speeds equal to or less than upright adult bicyclists.

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

TYPES OF BICYCLISTS

It is important to consider bicyclists of all skill levels when creating a non-motorized plan or project. Bicyclist skill level greatly influences expected speeds and behavior, both in separated bikeways and on shared roadways. Bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people.

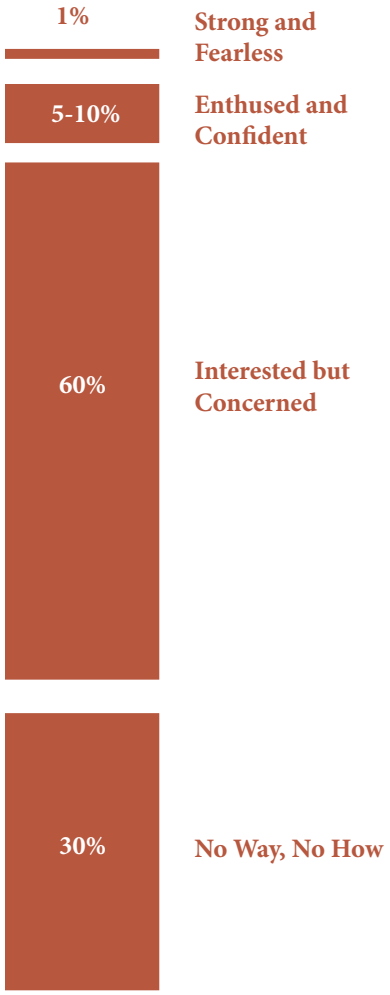
The bicycle planning and engineering professions currently use several systems to classify the population which can assist in understanding the characteristics and infrastructure preferences of different bicyclists. The current AASHTO Guide to the Development of Bicycle Facilities encourages designers to identify their rider type based on the trip purpose (Recreational vs Transportation) and on the level of comfort and skill of the rider (Causal vs Experienced). A more detailed framework for understanding of the US population's relationship to transportation focused bicycling is illustrated in the figure below. Developed by planners in Portland, OR[1] and supported by research[2], this classification provides the following alternative categories to address varying attitudes towards bicycling in the US:

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

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

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

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



Typical Distribution of Bicyclist Types

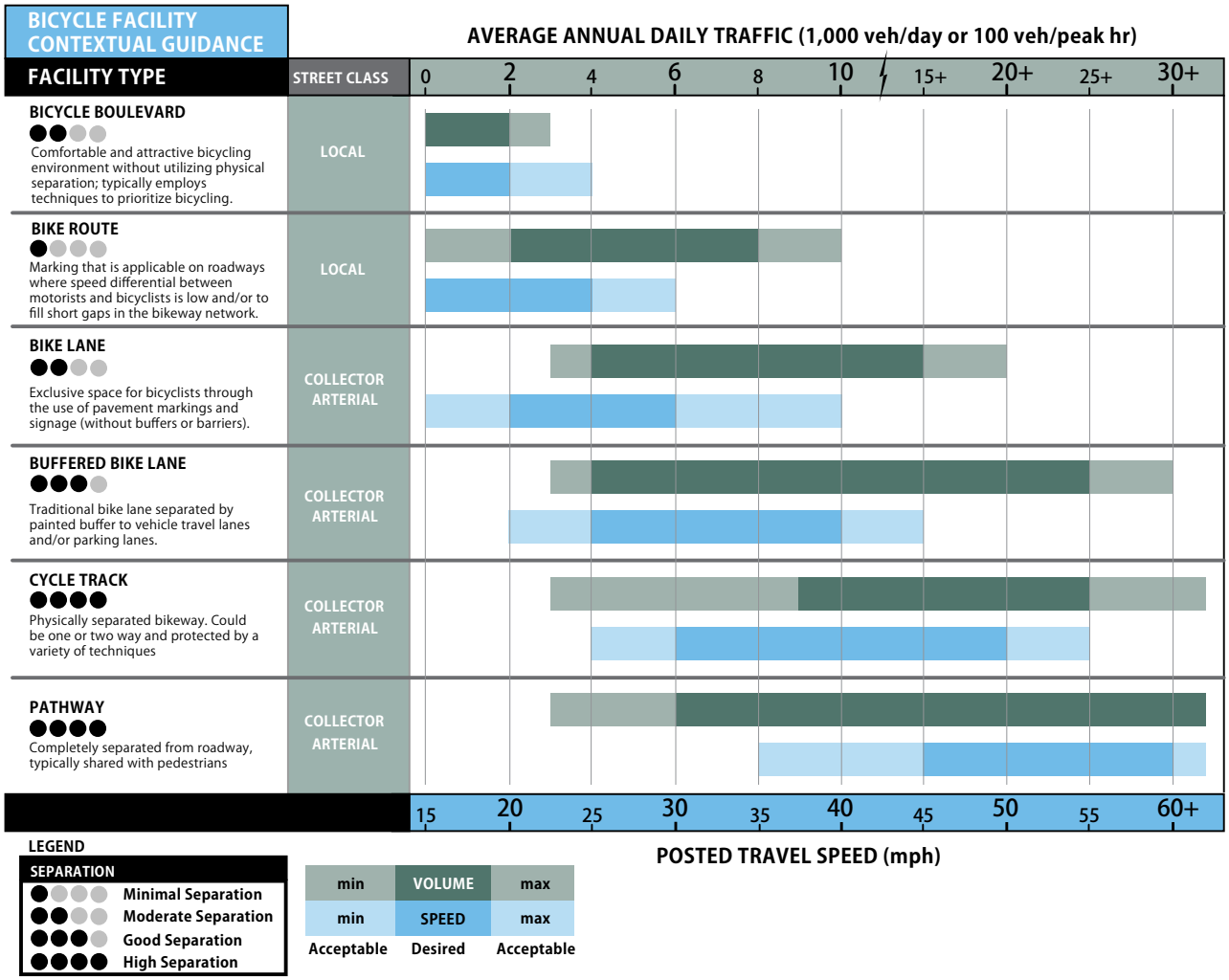
1 Roger Geller, City of Portland Bureau of Transportation. Four Types of Cyclists. http://www.portlandonline.com/transportation/index.cfm?&a=237507. 2009.

2 Dill, J., McNeil, N. Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential. 2012.

BICYCLE FACILITY CONTEXTUAL GUIDANCE

Selecting the best bikeway facility type for a given roadway can be challenging, due to the range of factors that influence bicycle users' comfort and safety. There is a significant impact on cycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high. As a starting point to identify a preferred facility, the chart below can be used to determine the recommended type of bikeway to be provided in particular roadway speed and volume situations. To use this chart, identify the appropriate daily traffic volume and travel speed on or the existing or proposed roadway, and locate the facility types indicated by those key variables.

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



SHARED ROADWAYS

On shared roadways, bicyclists and motor vehicles use the same roadway space. These facilities are typically used on roads with low speeds and traffic volumes, however they can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Shared roadways employ a large variety of treatments from simple signage and shared lane markings to more complex treatments including directional signage, traffic diverters, chicanes, chokers, and/or other traffic calming devices to reduce vehicle speeds or volumes.

Bike boulevards are a special class of shared roadways designed for a broad spectrum of bicyclists. They are low-volume local streets where motorists and bicyclists share the same travel lane. Treatments for bike boulevards are selected as necessary to create appropriate automobile volumes and speeds, and to provide safe crossing opportunities of busy streets.

Signed Shared Roadway


Marked Shared Roadway


Shared Roadways with Diagonal Parking


Bike Boulevards

Signed Shared Roadway

Description

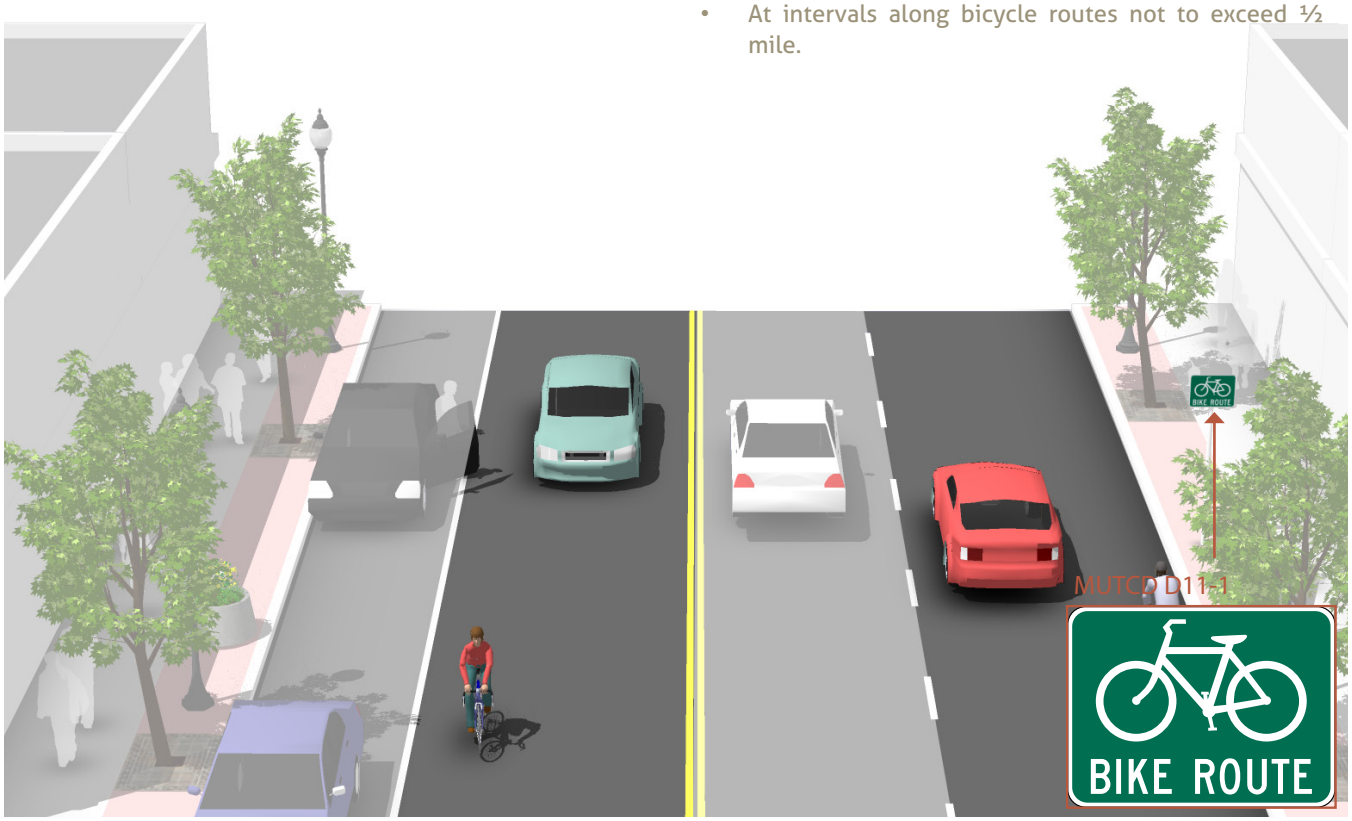
Signed shared roadways are facilities shared with motor vehicles. They are typically used on roads with low speeds and traffic volumes, however can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Guidance

Lane width varies depending on roadway configuration.

Bike route signage (D11-1) should be applied at intervals frequent enough to keep bicyclists informed of changes in route direction and to remind motorists of the presence of bicyclists. Commonly, this includes placement at:

- Beginning or end of Bicycle Route.
- At major changes in direction or at intersections with other bicycle routes.
- At intervals along bicycle routes not to exceed ½ mile.



Discussion

Signed Shared Roadways serve either to provide continuity with other bicycle facilities (usually bike lanes) or to designate preferred routes through high-demand corridors. This configuration differs from a bike boulevard due to a lack of traffic calming, wayfinding, pavement markings and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

Materials and Maintenance

Maintenance needs for bicycle wayfinding signs are similar to other signs, and will need periodic replacement due to wear.

Marked Shared Roadway

Description

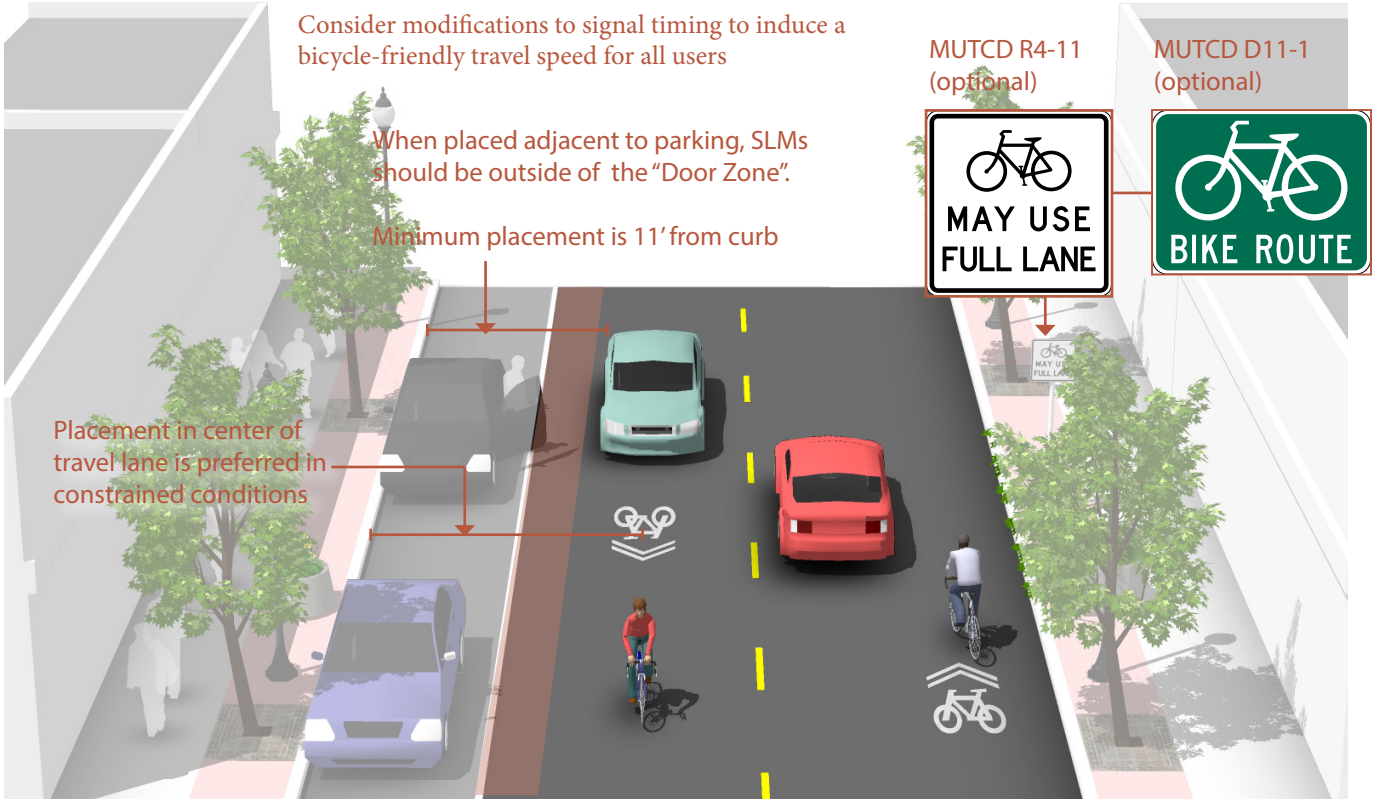
A marked shared roadway is a general purpose travel lane marked with shared lane markings (SLM) used to encourage bicycle travel and proper positioning within the lane.

In constrained conditions, the SLMs are placed in the middle of the lane. On a wide outside lane, the SLMs can be used to promote bicycle travel to the right of motor vehicles.

In all conditions, SLMs should be placed outside of the door zone of parked cars.

Guidance

- May be used on streets with a speed limit of 35 mph or under. Lower than 30 mph speed limit preferred.
- In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- Minimum placement of SLM marking centerline is 11 feet from edge of curb where on-street parking is present, 4 feet from edge of curb with no parking. If parking lane is wider than 7.5 feet, the SLM should be moved further out accordingly.



Discussion

If collector or arterial, this should not be a substitute for dedicated bicycle facilities if space is available.

Bike Lanes should be considered on roadways with outside travel lanes wider than 15 feet, or where other lane narrowing or removal strategies may provide adequate road space. SLMs shall not be used on shoulders, in designated bike lanes, or to designate bicycle detection at signalized intersections. (MUTCD 9C.07)

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Placing SLMs between vehicle tire tracks will increase the life of the markings and minimize the long-term cost of the treatment.

Shared Roadway Adjacent to Diagonal Parking

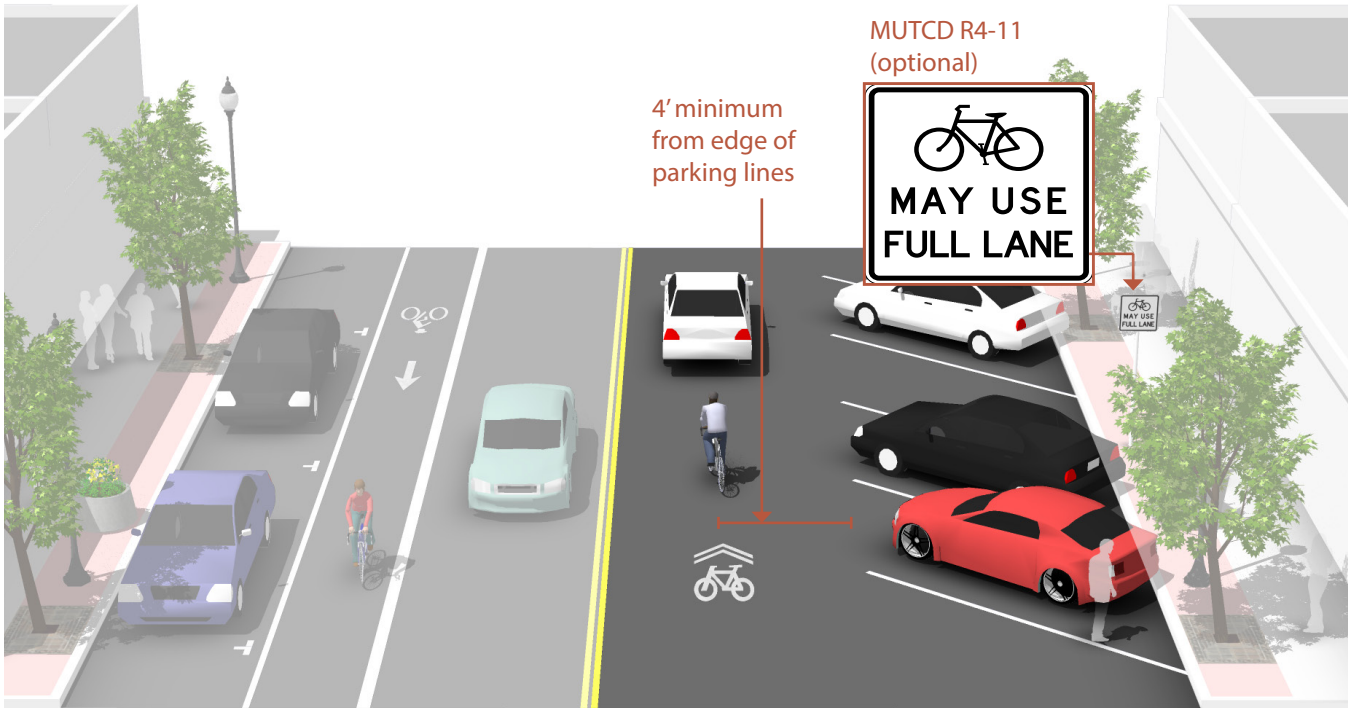
Description

In certain areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply.

Back-in diagonal parking improves sight distance between drivers and bicyclists when compared to conventional head-in diagonal parking. Back-in diagonal parking provides additional benefits to vehicles including loading and unloading of the trunk at the curb rather than in the street, passengers (including children) are directed by open doors towards the curb; there is also no door conflict with bicyclists.

Guidance

- In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- Minimum placement of SLM marking centerline is 4 feet from the edge of parking lines.



Discussion

Conventional front-in diagonal parking is not compatible or recommended in conjunction with high levels of bicycle traffic as drivers backing out of conventional diagonal parking have poor visibility of approaching bicyclists.

While there may be a learning curve for some drivers, using back-in diagonal parking is typically an easier maneuver than conventional parallel parking.

Additional References and Guidelines

There is no currently adopted Federal or State guidance for this treatment.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates.

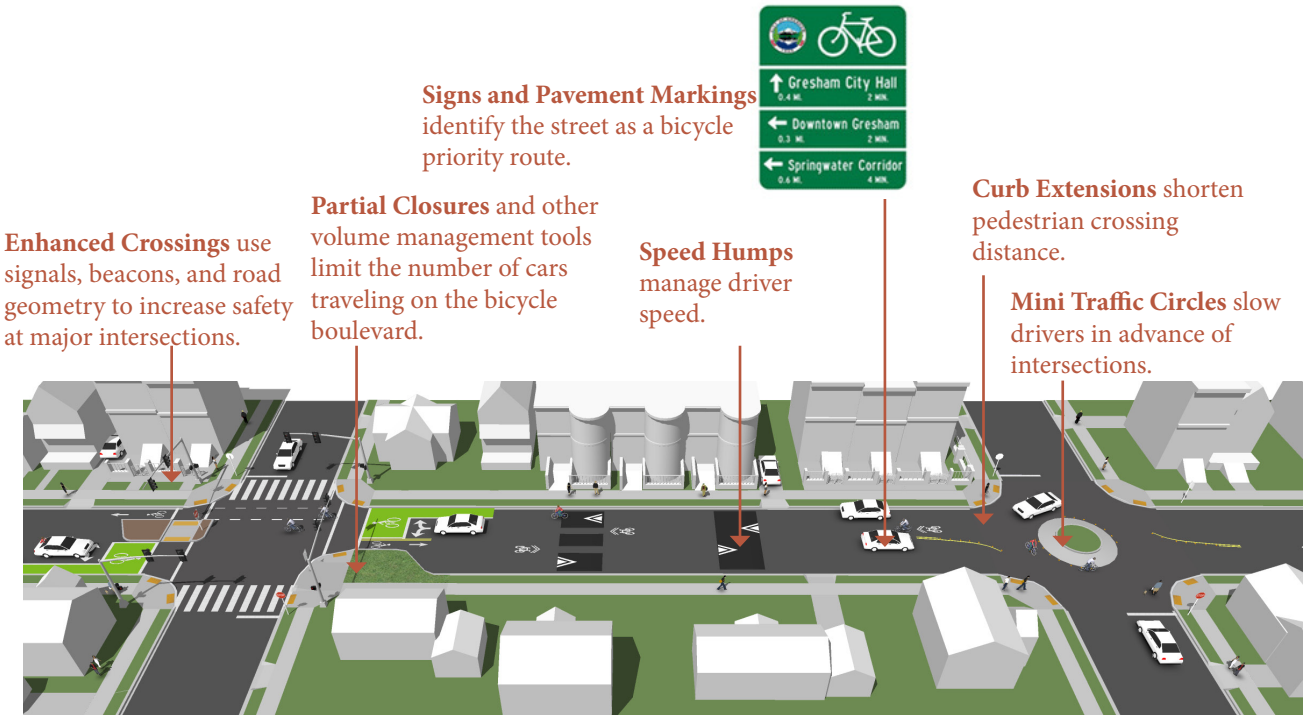
Bike Boulevard

Description

Bicycle boulevards are low-volume, low-speed streets modified to enhance bicyclist comfort by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through-trips by non-local motorized traffic.

Guidance

- Signs and pavement markings are the minimum treatments necessary to designate a street as a bicycle boulevard.
- Bicycle boulevards should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Implement volume control treatments based on the context of the bicycle boulevard, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day.
- Intersection crossings should be designed to enhance safety and minimize delay for bicyclists.



Discussion

Bicycle boulevard retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers along the bicycle boulevard and compromise safety. Traffic calming can deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Additional References and Guidelines

Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* 2009.
BikeSafe. *Bicycle countermeasure selection system.*
Ewing, Reid. *Traffic Calming: State of the Practice.* 1999.
Ewing, Reid and Brown, Steven. *U.S. Traffic Calming Manual.* 2009.

Materials and Maintenance

Vegetation should be regularly trimmed to maintain visibility and attractiveness.

SEPARATED BIKEWAYS

Designated exclusively for bicycle travel, separated bikeways are segregated from vehicle travel lanes by simple striping or robust physical barriers, and can include pavement stencils and other treatments. Separated bikeways are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation.

Separated bikeways can increase safety and promote proper riding by:

- Defining road space for bicyclists and motorists, reducing the possibility that motorists will stray into the bicyclists' path.
- Discouraging bicyclists from riding on the sidewalk.
- Reducing the incidence of wrong way riding.
- Reminding motorists that bicyclists have a right to the road.


Shoulder Bikeways


Conventional Bicycle Lanes


Contra-Flow Bike Lanes


Buffered Bike Lanes


Uphill Bike Lane Treatments


Protected Bike Lanes

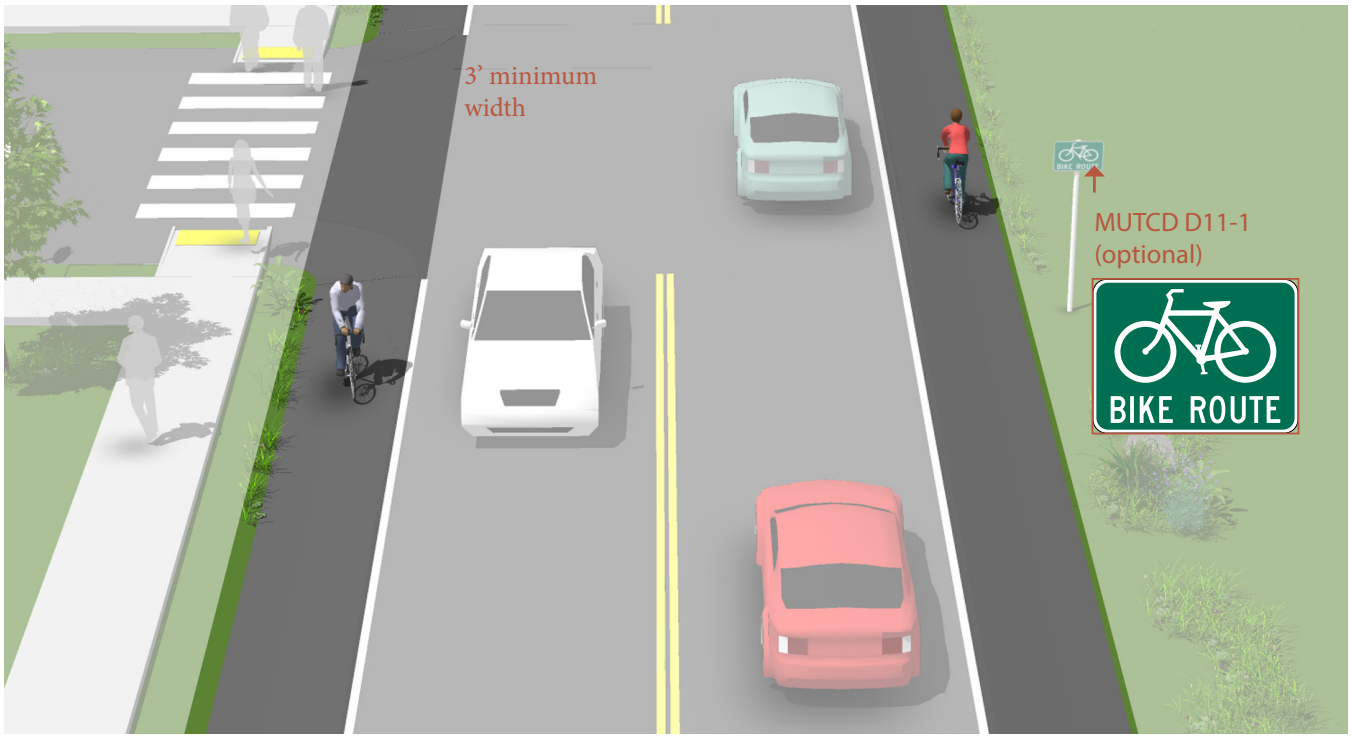
Shoulder Bikeways

Description

Typically found in less-dense areas, shoulder bikeways are paved roadways with striped shoulders (4'+) wide enough for bicycle travel. Shoulder bikeways often, but not always, include signage alerting motorists to expect bicycle travel along the roadway. Shoulder bikeways should be considered a temporary treatment, with full bike lanes planned for construction when the roadway is widened or completed with curb and gutter. This type of treatment is not typical in urban areas and should only be used where constraints exist.

Guidance

- If 4 feet or more is available for bicycle travel, the full bike lane treatment of signs, legends, and an 8" bike lane line would be provided.
- If it is not possible to meet minimum bicycle lane dimensions, a reduced width paved shoulder can still improve conditions for bicyclists on constrained roadways. In these situations, a minimum of 3 feet of operating space should be provided.
- Rumble strips are not recommended on shoulders used by bicyclists unless there is a minimum 4 foot clear path. 12 foot gaps every 40-60 feet should be provided to allow access as needed.



Discussion

A wide outside lane may be sufficient accommodation for bicyclists on streets with insufficient width for bike lanes but which do have space available to provide a wider (14'-16') outside travel lane. Consider configuring as a marked shared roadway in these locations.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Shoulder bikeways should be cleared of snow through routine snow removal operations.

Bike Lane without On-Street Parking

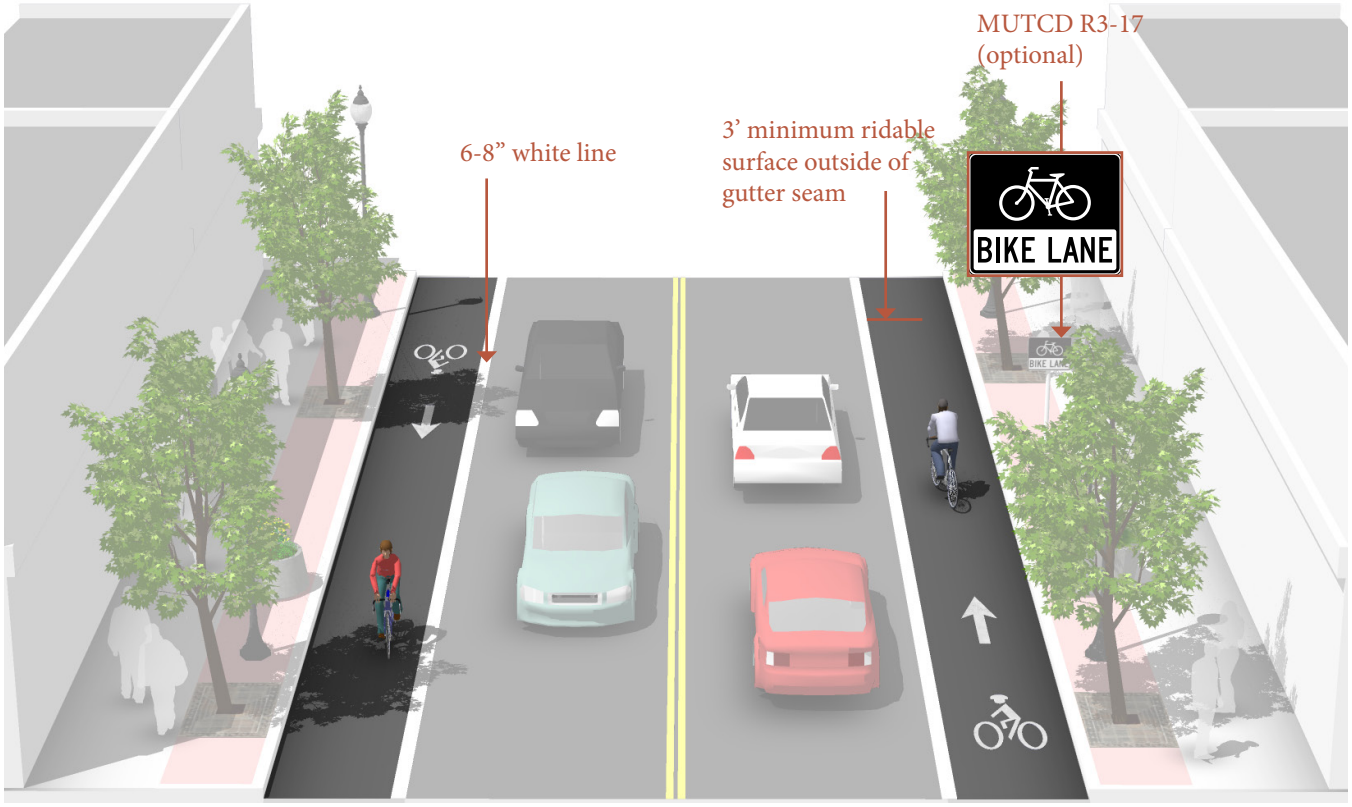
Description

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is typically located on the right side of the street, between the adjacent travel lane and curb, and is used in the same direction as motor vehicle traffic.

A bike lane width of 7 feet makes it possible for bicyclists to ride side-by-side or pass each other without leaving the bike lane, thereby increasing the capacity of the lane.

Guidance

- 4 foot minimum when no curb and gutter is present.
- 5 foot minimum when adjacent to curb and gutter or 3 feet more than the gutter pan width if the gutter pan is wider than 2 feet.
- 7 foot maximum width for use adjacent to arterials with high travel speeds. Greater widths may encourage motor vehicle use of bike lane. Configure as buffered bicycle lanes when a wider facility is desired.



Discussion

Wider bicycle lanes are desirable in certain situations such as on higher speed arterials (45 mph+) where use of a wider bicycle lane would increase separation between passing vehicles and bicyclists. Appropriate signing and stenciling is important with wide bicycle lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane. Consider buffered bicycle lanes when further separation is desired.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.

Bike Lane Adjacent to On-Street Parallel Parking

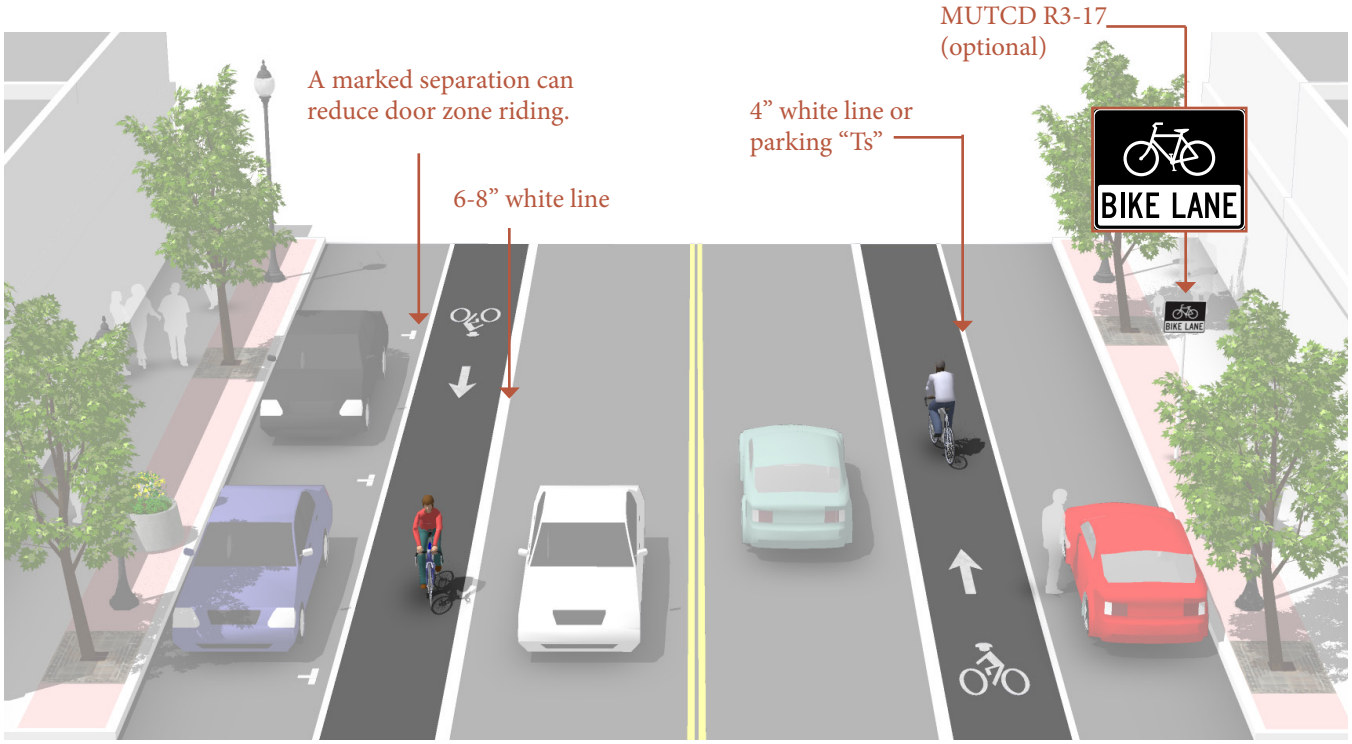
Description

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

Many bicyclists, particularly less experienced riders, are more comfortable riding on a busy street if it has a striped and signed bikeway than if they are expected to share a lane with vehicles.

Guidance

- 12 foot minimum from curb face to edge of bike lane.
- 14.5 foot preferred from curb face to edge of bike lane.
- 7 foot maximum for marked width of bike lane. Greater widths may encourage vehicle loading in bike lane. Configure as buffered bicycle lanes when a wider facility is desired.



Discussion

Bike lanes adjacent to on-street parallel parking require special treatment in order to avoid crashes caused by an open vehicle door. The bike lane should have sufficient width to allow bicyclists to stay out of the door zone while not encroaching into the adjacent vehicular lane. Parking stall markings, such as parking "Ts" and double white lines create a parking side buffer that encourages bicyclists to ride farther away from the door zone.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.

Bike Lanes and Diagonal Parking

Description

In certain areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply.

Back-in diagonal parking improves sight distances between drivers and bicyclists when compared to conventional head-in diagonal parking. Back-in parking is best paired with a dedicated bicycle lane.

Conventional front-in diagonal parking is not compatible or recommended with the provision of bike lanes, as drivers backing out of conventional diagonal parking have limited visibility of approaching bicyclists. Under these conditions, shared lane markings should be used to guide bicyclists away from reversing automobiles.

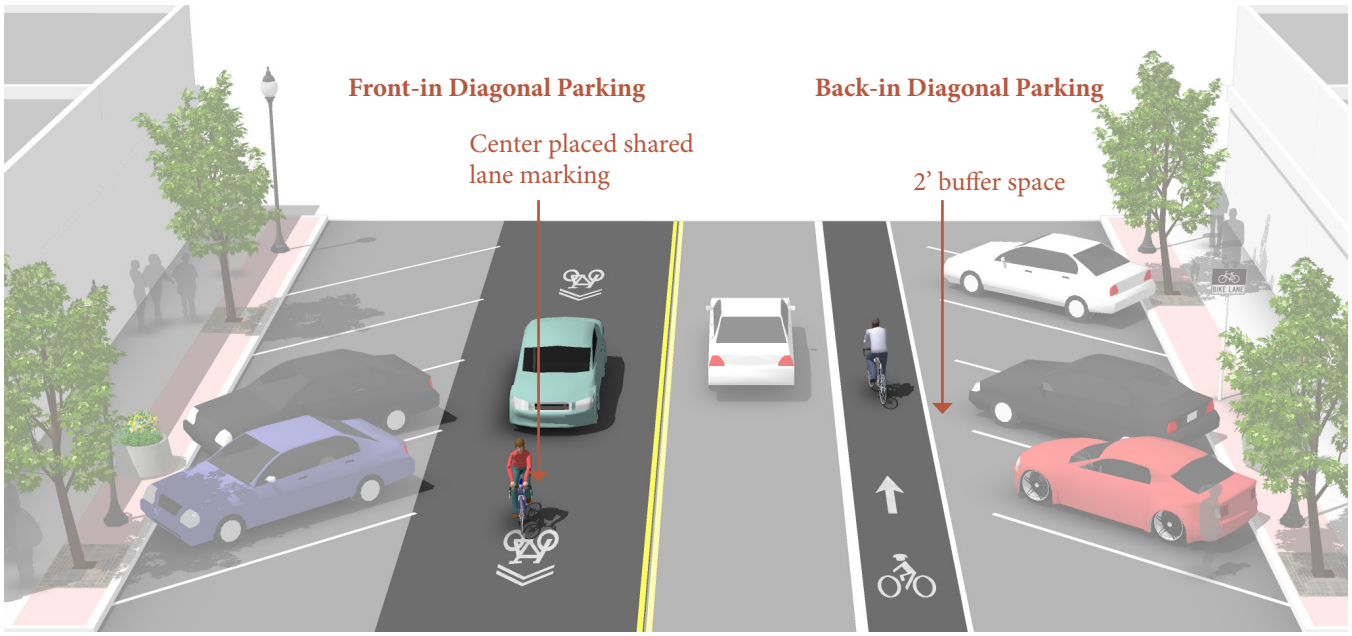
Guidance

Front-in Diagonal Parking

- Shared lane markings are the preferred facility with front-in diagonal parking

Back-in Diagonal Parking

- 5 foot minimum marked width of bike lane
- Parking bays are sufficiently long to accommodate most vehicles (so vehicles do not block bike lane)



Discussion

Conventional front-in diagonal parking is not compatible or recommended in conjunction with high levels of bicycle traffic or with the provision of bike lanes, as drivers backing out of conventional diagonal parking have limited visibility of approaching bicyclists.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.

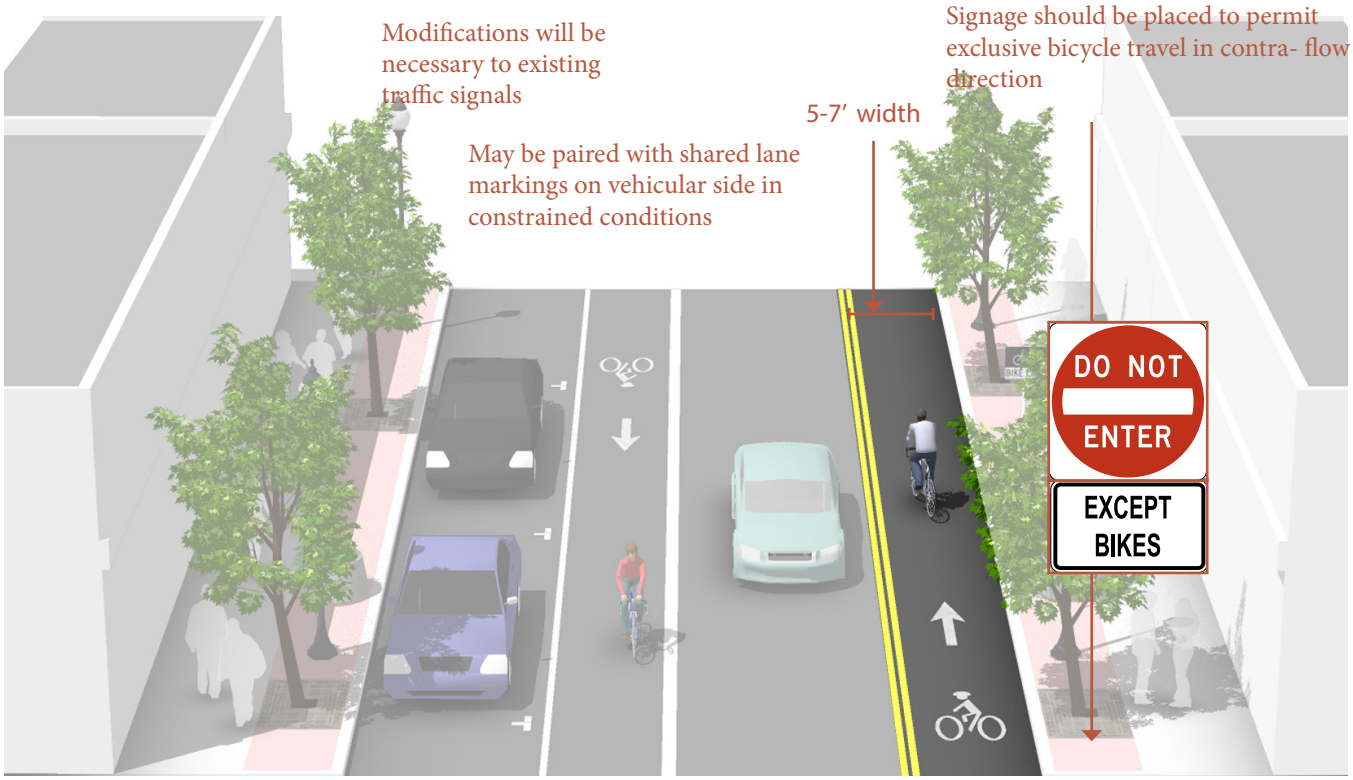
Contra-flow Bike Lane on One-way Street

Description

Contra-flow bike lanes provide bidirectional bicycle access on a roadway that is one-way for motor vehicle traffic. This treatment can provide direct access and connectivity for bicyclists and reducing travel distances. Contra-flow bike lanes can also be used to convert two-way motor vehicle traffic to one-way to reduce traffic volumes where desired.

Guidance

- The contra-flow bike lane should be 5-7 feet wide and marked with a solid double yellow line and appropriate signage. Bike lane markings should be clearly visible to ensure that the contra-flow lane is exclusively for bicycles. Coloration should be considered in the bike lane.
- Signage specifically allowing bicycles at the entrance of the contra flow lane is recommended.



Discussion

Because of the opposing direction of travel, contra-flow bike lanes increase the speed differential between bicyclists and motor vehicles in the adjacent travel lane. If space permits consider a buffered bike lane or protected bike lane configuration to provide additional separation.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.

Buffered Bike Lane

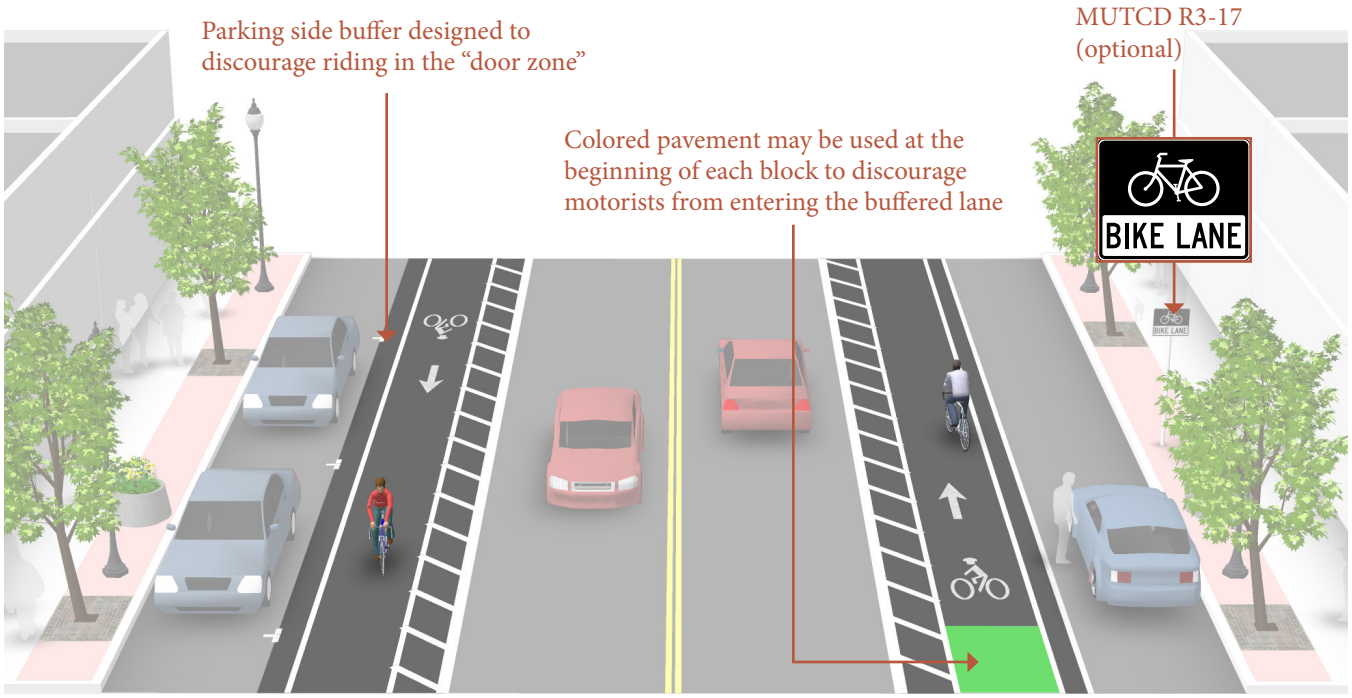
Description

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. Buffered bike lanes follow general guidance for buffered preferential vehicle lanes as per MUTCD guidelines (section 3D-01).

Buffered bike lanes are designed to increase the space between the bike lane and the travel lane and/or parked cars. This treatment is appropriate for bike lanes on roadways with high motor vehicle traffic volumes and speed, adjacent to parking lanes, or a high volume of truck or oversized vehicle traffic.

Guidance

- The minimum bicycle travel area (not including buffer) is 5 feet wide.
- Buffers should be at least 2 feet wide. If 3 feet or wider, mark with diagonal or chevron hatching. For clarity at driveways or minor street crossings, consider a dotted line for the inside buffer boundary where cars are expected to cross.
- Buffered bike lanes can buffer the travel lane only, or parking lane only depending on available space and the objectives of the design.



Discussion

Frequency of right turns by motor vehicles at major intersections should determine whether continuous or truncated buffer striping should be used approaching the intersection. Commonly configured as a buffer between the bicycle lane and motor vehicle travel lane, a parking side buffer may also be provided to help bicyclists avoid the 'door zone' of parked cars.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices. (3D-01).* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.

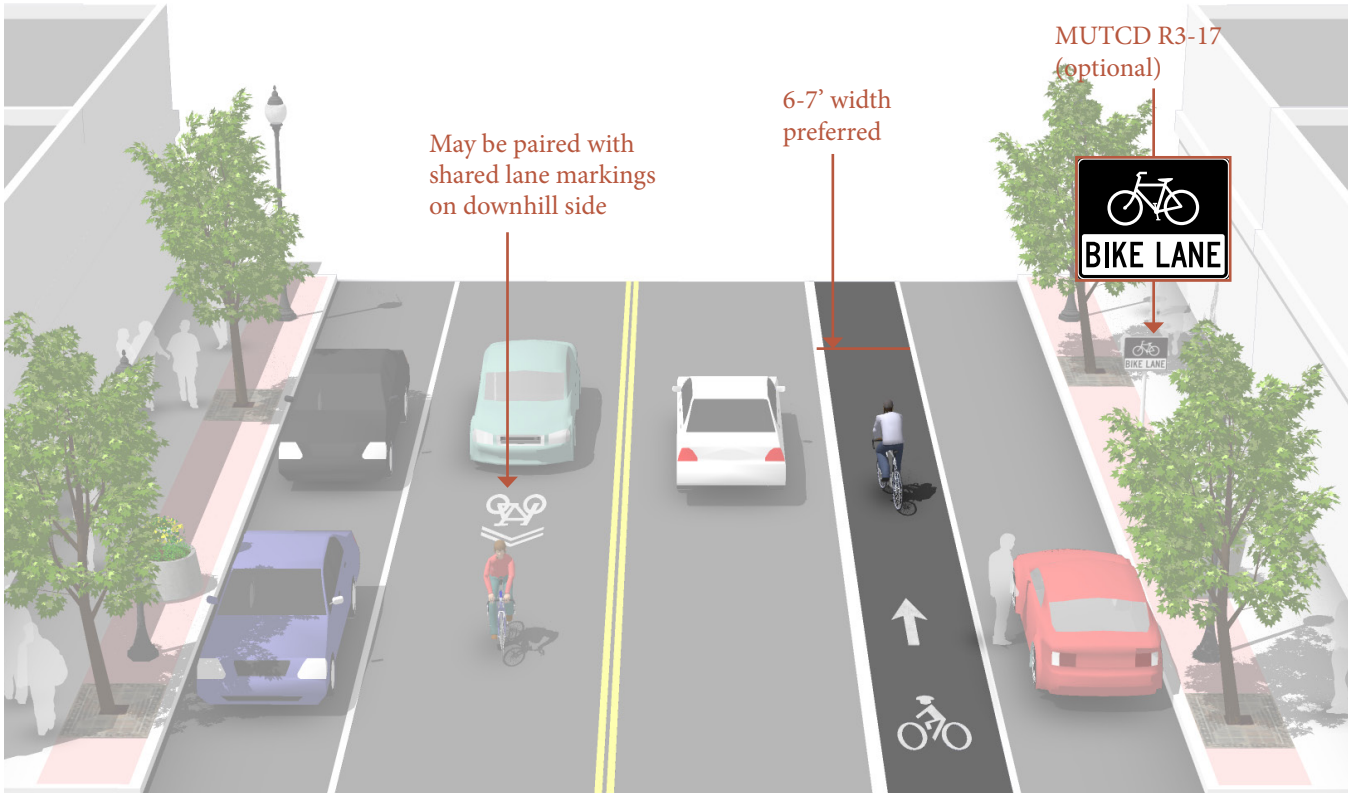
Uphill Bicycle Climbing Lane

Description

Uphill bike lanes (also known as "climbing lanes") enable motorists to safely pass slower-speed bicyclists, thereby improving conditions for both travel modes.

Guidance

- Uphill bike lanes should be 6-7 feet wide (wider lanes are preferred because extra maneuvering room on steep grades can benefit bicyclists).
- Can be combined with shared lane markings for downhill bicyclists who can more closely match prevailing traffic speeds.



Discussion

This treatment is typically found on retrofit projects as newly constructed roads should provide adequate space for bicycle lanes in both directions of travel. Accommodating an uphill bicycle lane often includes delineating on-street parking (if provided), narrowing travel lanes and/or shifting the centerline if necessary.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.
AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow through routine snow removal operations.

Protected Bike Lanes (Cycle Tracks)

Description

A [rotected bike lane (also called a cycle track) is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A protected bike lane is physically separated from motor traffic and distinct from the sidewalk. Potected bike lanes have different forms but all share common elements—they provide space that is intended to be exclusively or primarily used by bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks.

Raised protected bike lanes may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk to separate the bike lane from the pedestrian area.

Guidance

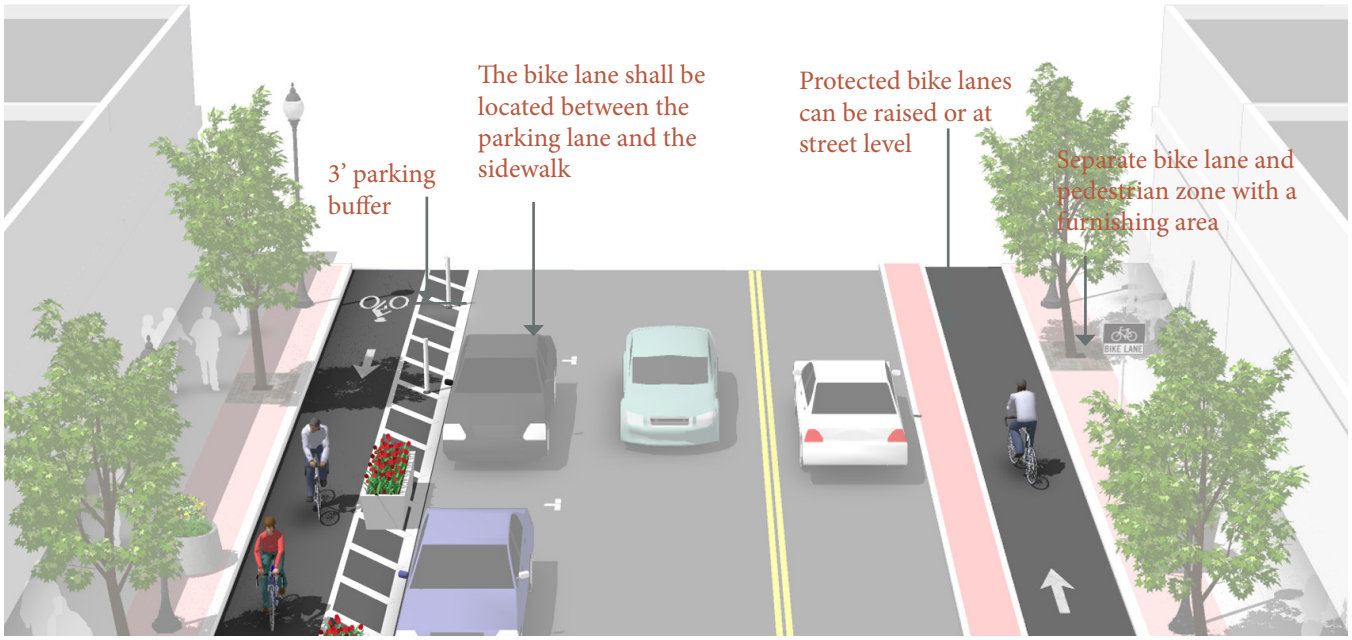
Protected bike lanes should ideally be placed along streets with long blocks and few driveways or mid-block access points for motor vehicles.

One-Way Protected Bike Lanes

- 7 foot recommended minimum to allow passing. 5 foot minimum width in constrained locations.

Two-Way Protected Bike Lanes

- Protected bike lanes located on one-way streets have fewer potential conflict areas than those on two-way streets.
- 12 foot recommended minimum for two-way facility. 8 foot minimum in constrained locations



Discussion

Special consideration should be given at transit stops to manage bicycle and pedestrian interactions. Driveways and minor street crossings are unique challenges to protected bike lane design. Parking should be prohibited within 30 feet of the intersection to improve visibility. Color, yield markings and "Yield to Bikes" signage should be used to identify the conflict area and make it clear that the protected bike lane has priority over entering and exiting traffic. If configured as a raised protected bike lane, the crossing should be raised so that the sidewalk and protected bike lane maintain their elevation through the crossing.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

In cities with winter climates, barrier separated and raised protected bike lanes may require special equipment for snow removal.

SEPARATED BIKEWAYS AT INTERSECTIONS

Intersections are junctions at which different modes of transportation meet and facilities overlap. An intersection facilitates the interchange between bicyclists, motorists, pedestrians and other modes in order to advance traffic flow in a safe and efficient manner. Designs for intersections with bicycle facilities should reduce conflict between bicyclists (and other vulnerable road users) and vehicles by heightening the level of visibility, denoting clear right-of-way and facilitating eye contact and awareness with other modes. Intersection treatments can improve both queuing and merging maneuvers for bicyclists, and are often coordinated with timed or specialized signals.

The configuration of a safe intersection for bicyclists may include elements such as color, signage, medians, signal detection and pavement markings. Intersection design should take into consideration existing and anticipated bicyclist, pedestrian and motorist movements. In all cases, the degree of mixing or separation between bicyclists and other modes is intended to reduce the risk of crashes and increase bicyclist comfort. The level of treatment required for bicyclists at an intersection will depend on the bicycle facility type used, whether bicycle facilities are intersecting, and the adjacent street function and land use.


Colored Bike Lanes in Conflict Areas

Shared Bicycle/Right Turn Lane


Intersection Crossing Markings


Two Stage Turn Boxes


Bike Boxes


Bicyclists at Roundabouts


Bike Lanes at Right Turn Only Lanes


Bikes at Diverging Lane Ramps

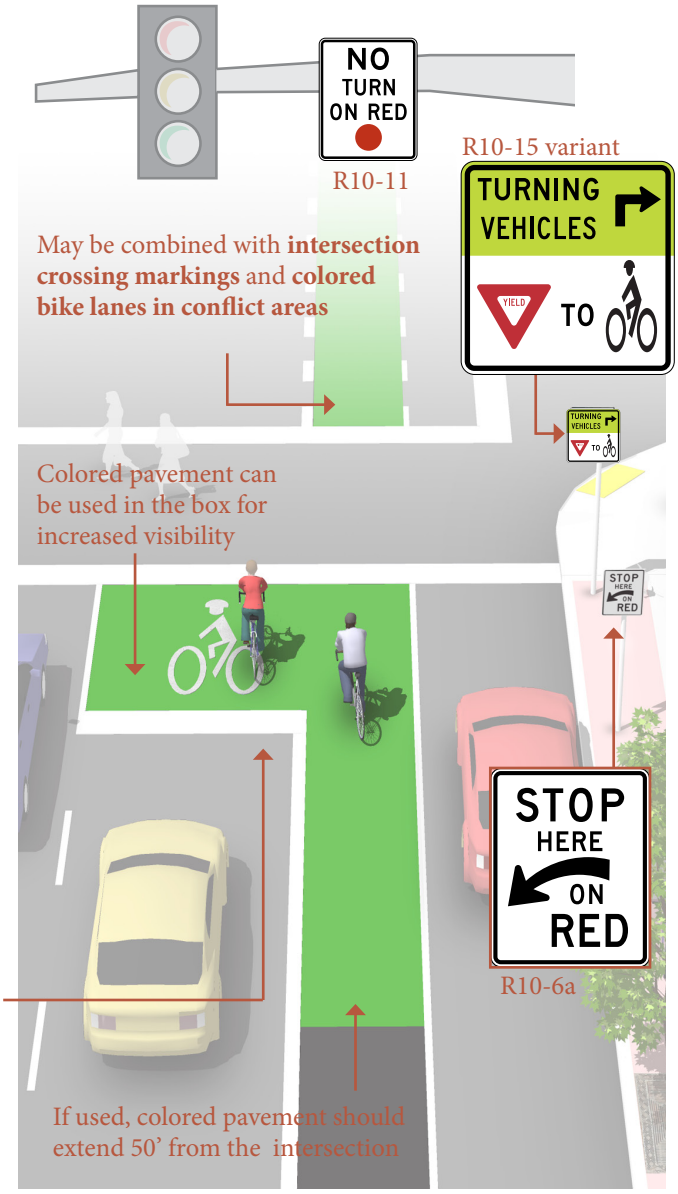
Bike Box

Description

A bike box is a designated area located at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible space to get in front of queuing motorized traffic during the red signal phase. Motor vehicles must queue behind the white stop line at the rear of the bike box.

Guidance

- 14' minimum depth
- A "No Turn on Red" (MUTCD R10-11) sign shall be installed overhead to prevent vehicles from entering the Bike Box.
- A "Stop Here on Red" sign should be post-mounted at the stop line to reinforce observance of the stop line.
- A "Yield to Bikes" sign should be post-mounted in advance of and in conjunction with an egress lane to reinforce that bicyclists have the right-of-way going through the intersection.
- An ingress lane should be used to provide access to the box.
- A supplemental "Wait Here" legend can be provided in advance of the stop bar to increase clarity to motorists.



Discussion

Bike boxes are considered experimental by the FHWA. Bike boxes should be placed only at signalized intersections, and right turns on red shall be prohibited for motor vehicles. Bike boxes should be used in locations that have a large volume of bicyclists and are best utilized in central areas where traffic is usually moving more slowly. Prohibiting right turns on red improves safety for bicyclists yet does not significantly impede motor vehicle travel.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012. FHWA. Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011.

Materials and Maintenance

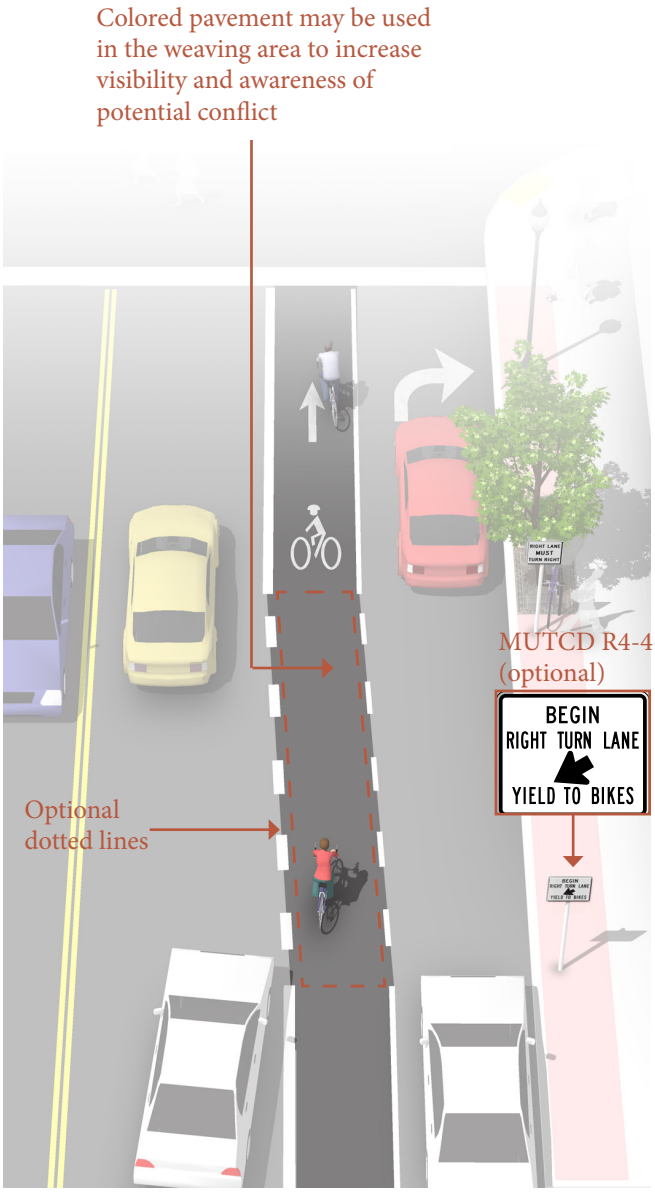
Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Bike Lanes at Right Turn Only Lanes

Description

The appropriate treatment at right-turn lanes is to place the bike lane between the right-turn lane and the right-most through lane or, where right-of-way is insufficient, to use a shared bike lane/turn lane.

The design (right) illustrates a bike lane pocket, with signage indicating that motorists should yield to bicyclists through the conflict area.



Guidance

At auxiliary right turn only lanes (add lane):

- Continue existing bike lane width; standard width of 5 to 6 feet or 4 feet in constrained locations.
- Use signage to indicate that motorists should yield to bicyclists through the conflict area.
- Consider using colored conflict areas to promote visibility of the mixing zone.

Where a through lane becomes a right turn only lane:

- Do not define a dotted line merging path for bicyclists.
- Drop the bicycle lane in advance of the merge area.
- Use shared lane markings to indicate shared use of the lane in the merging zone.

Discussion

For other potential approaches to providing accommodations for bicyclists at intersections with turn lanes, please see guidance on shared bike lane/turn lane, bicycle signals, and colored bike facilities.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Colored Bike Lanes in Conflict Areas

Description

Colored pavement within a bicycle lane increases the visibility of the facility and reinforces priority of bicyclists in conflict areas.

Guidance

- Green colored pavement was given interim approval by the Federal Highways Administration in March 2011. See interim approval for specific colored pavement standards.
- The colored surface should be skid resistant and retro-reflective.
- A "Yield to Bikes" sign should be used at intersections or driveway crossings to reinforce that bicyclists have the right-of-way in colored bike lane areas.

Discussion

Evaluations performed in Portland, OR, St. Petersburg, FL and Austin, TX found that significantly more motorists yielded to bicyclists and slowed or stopped before entering the conflict area after the application of the colored pavement when compared with an uncolored treatment.

Additional References and Guidelines

FHWA. Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011.

NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

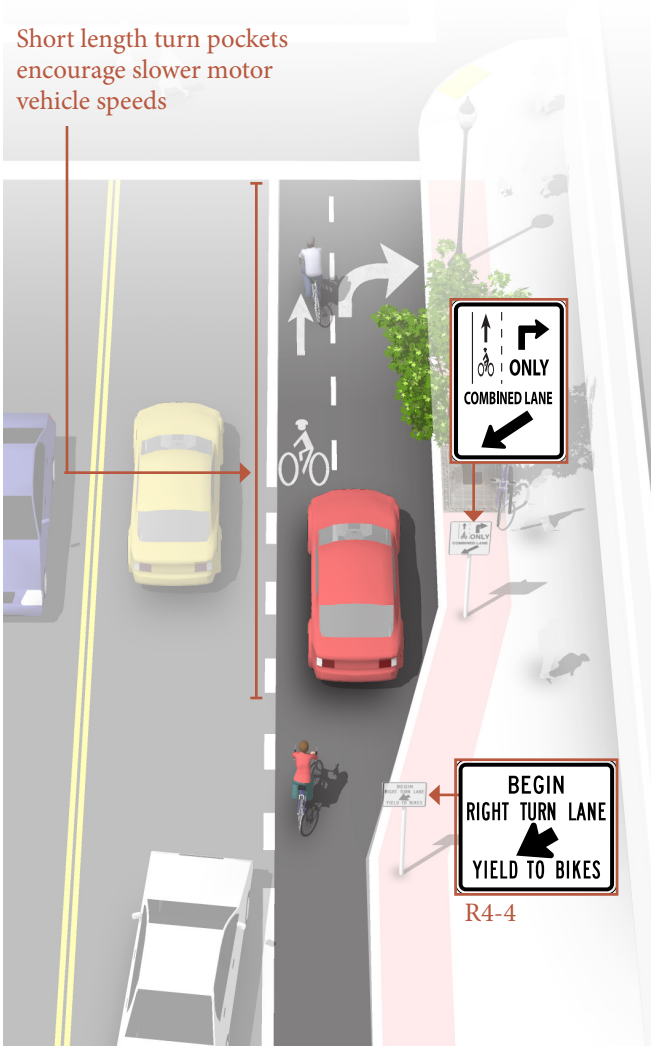
Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Shared Bicycle/Right Turn Lane

Description

The combined bike lane/turn lane places a standard-width bike lane on the left side of a dedicated right turn lane. A dotted line delineates the space for bicyclists and motorists within the shared lane. This treatment includes signage advising motorists and bicyclists of proper positioning within the lane.

This treatment is recommended at intersections lacking sufficient space to accommodate both a standard through bike lane and right turn lane.



Guidance

- Maximum shared turn lane width is 13 feet; narrower is preferable.
- Bike Lane pocket should have a minimum width of 4 feet with 5 feet preferred.
- A dotted 4 inch line and bicycle lane marking should be used to clarify bicyclist positioning within the combined lane, without excluding cars from the suggested bicycle area.
- A "Right Turn Only" sign with an "Except Bicycles" plaque may be needed to make it legal for through bicyclists to use a right turn lane.

Discussion

Case studies cited by the Pedestrian and Bicycle Information Center indicate that this treatment works best on streets with lower posted speeds (30 MPH or less) and with lower traffic volumes (10,000 ADT or less). May not be appropriate for high-speed arterials or intersections with long right turn lanes. May not be appropriate for intersections with large percentages of right-turning heavy vehicles.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Locate markings out of tire tread to minimize wear. Because the effectiveness of markings depends on their visibility, maintaining markings should be a high priority.

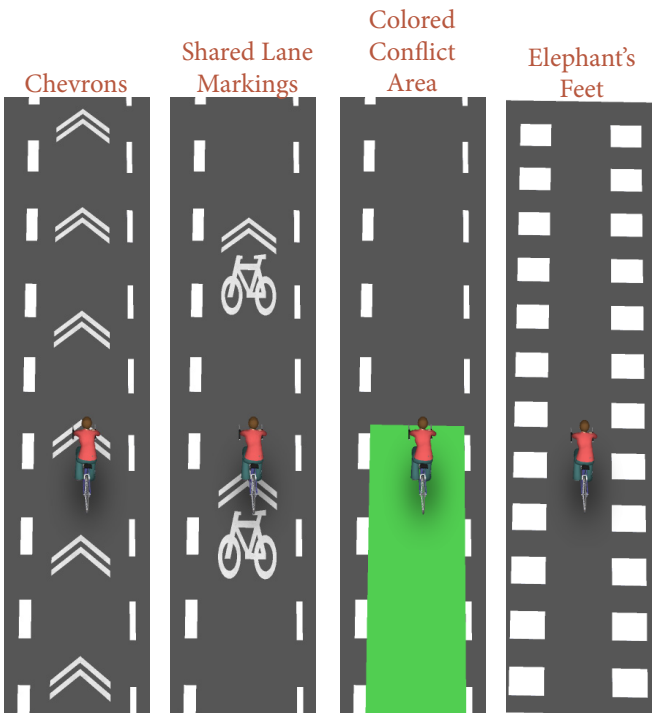
Intersection Crossing Markings

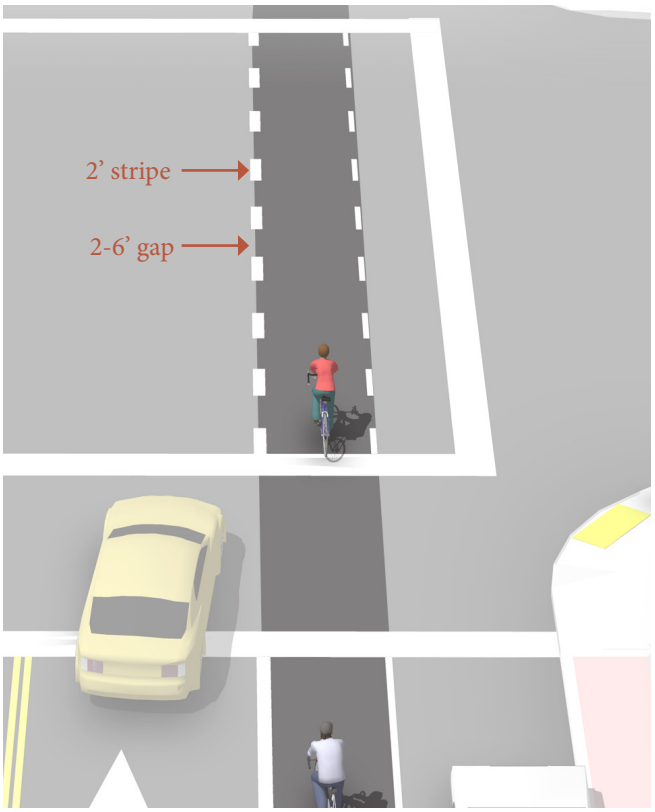
Description

Bicycle pavement markings through intersections indicate the intended path of bicyclists through an intersection or across a driveway or ramp. They guide bicyclists on a safe and direct path through the intersection and provide a clear boundary between the paths of through bicyclists and either through or crossing motor vehicles in the adjacent lane.

Guidance

- See MUTCD Section 3B.08: "dotted line extensions"
- Crossing striping shall be at least six inches wide when adjacent to motor vehicle travel lanes. Dotted lines should be two-foot lines spaced two to six feet apart.
- Chevrons, shared lane markings, or colored bike lanes in conflict areas may be used to increase visibility within conflict areas or across entire intersections. Elephant's Feet markings are common in Europe and Canada.





Discussion

Additional markings such as chevrons, shared lane markings, or colored bike lanes in conflict areas are strategies currently in use in the United States and Canada. Cities considering the implementation of markings through intersections should standardize future designs to avoid confusion.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices. (3A.06).* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority.

Two-Stage Turn Boxes

Description

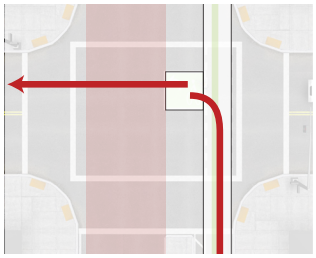
Two-stage turn queue boxes offer bicyclists a safe way to make left turns at multi-lane signalized intersections from a right side bike lane.

On right side protected bike lanes, bicyclists are often unable to merge into traffic to turn left due to physical separation, making the provision of two-stage left turn boxes critical. Design guidance for two-stage turns apply to both bike lanes and protected bike lanes.

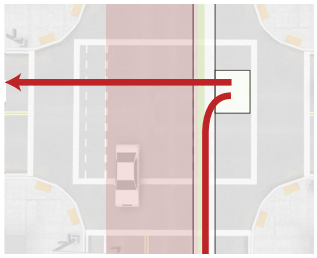
Guidance

- The queue box shall be placed in a protected area. Typically this is within an on-street parking lane or protected bike lane buffer area.
- 6' minimum depth of bicycle storage area
- Bicycle stencil and turn arrow pavement markings shall be used to indicate proper bicycle direction and positioning.
- A "No Turn on Red" (MUTCD R10-11) sign shall be installed on the cross street to prevent vehicles from entering the turn box.

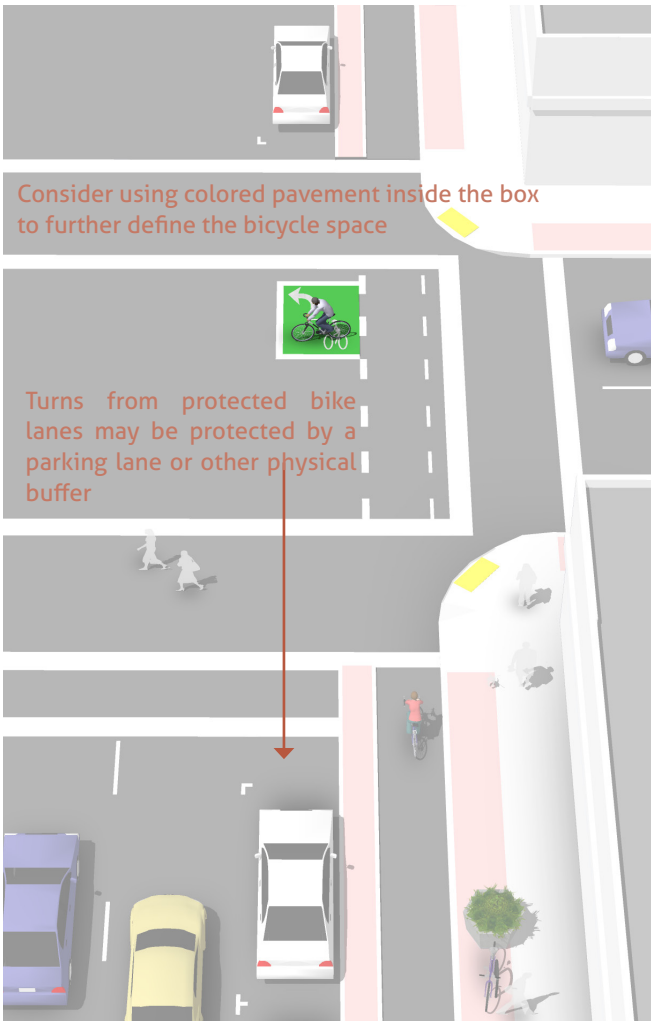
Protected bike lane turn box protected by physical buffer:



Bike lane turn box protected by parking lane:



Turns from a bicycle lane may be protected by an adjacent parking lane or crosswalk setback space



Discussion

Two-Stage Turn boxes are considered experimental by FHWA.

While two stage turns may increase bicyclist comfort in many locations, this configuration will typically result in higher average signal delay for bicyclists due to the need to receive two separate green signal indications (one for the through street, followed by one for the cross street) before proceeding.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates.

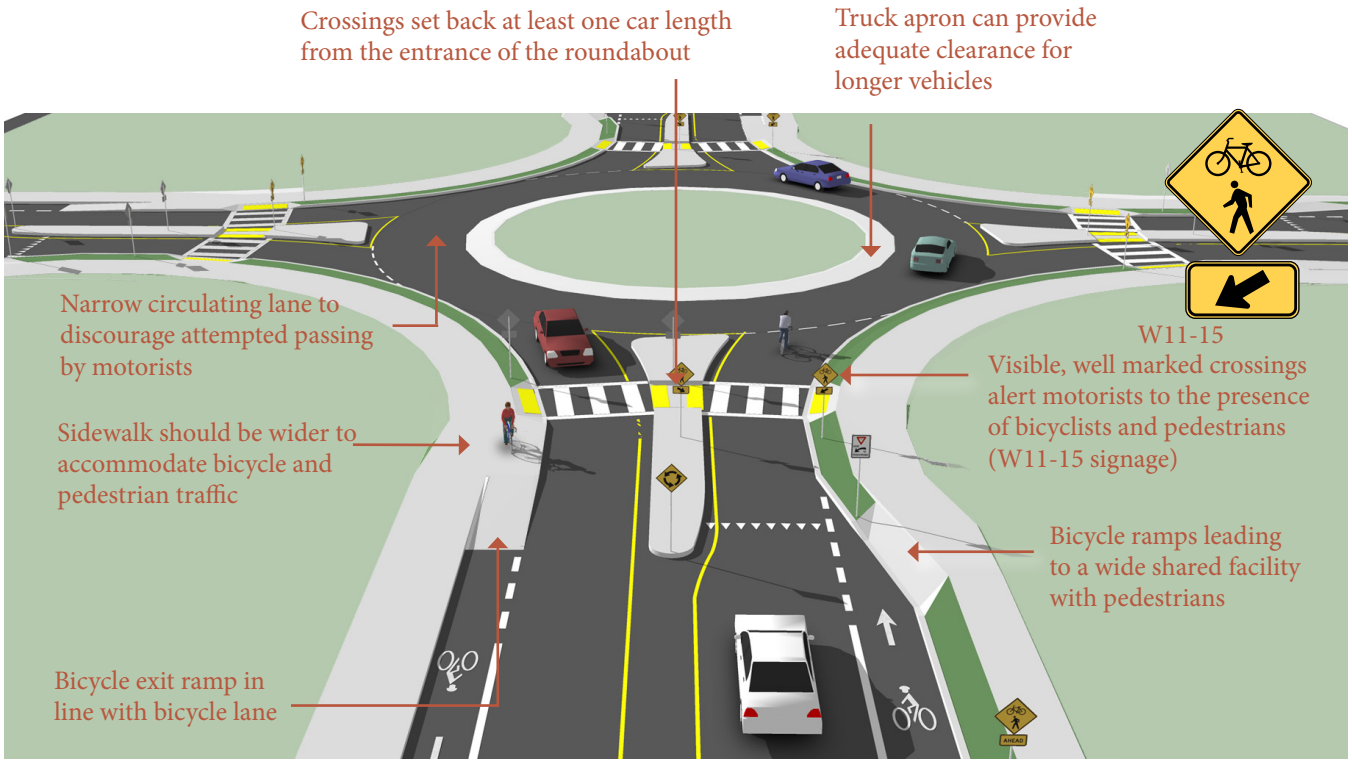
Bicyclists at Single Lane Roundabouts

Description

In single lane roundabouts it is important to indicate to motorists, bicyclists and pedestrians the right-of-way rules and correct way for them to circulate, using appropriately designed signage, pavement markings, and geometric design elements.

Guidelines

- 25 mph maximum circulating design speed.
- Design approaches/exits to the lowest speeds possible.
- Encourage bicyclists navigating the roundabout like motor vehicles to "take the lane."
- Maximize yielding rate of motorists to pedestrians and bicyclists at crosswalks.
- Provide separated facilities for bicyclists who prefer not to navigate the roundabout on the roadway.



Discussion

Research indicates that while single-lane roundabouts may benefit bicyclists and pedestrians by slowing traffic, multi-lane roundabouts may present greater challenges and significantly increase safety problems for these users.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.

FHWA. *Roundabouts: An Informational Guide.* 2000.
TRB. *Roundabouts: An Informational Guide, Second Edition.* NCHRP 672. 2010.

Materials and Maintenance

Signage and striping require routine maintenance.

Bike Lanes at Diverging Ramp Lanes

Description

Some arterials may contain high speed freeway-style designs such as merge lanes and exit ramps, which can create difficulties for bicyclists. The entrance and exit lanes typically have intrinsic visibility problems because of low approach angles and feature high speed differentials between bicyclists and motor vehicles.

Strategies to improve safety focus on increasing sight distances, creating formal crossings, and minimizing crossing distances.

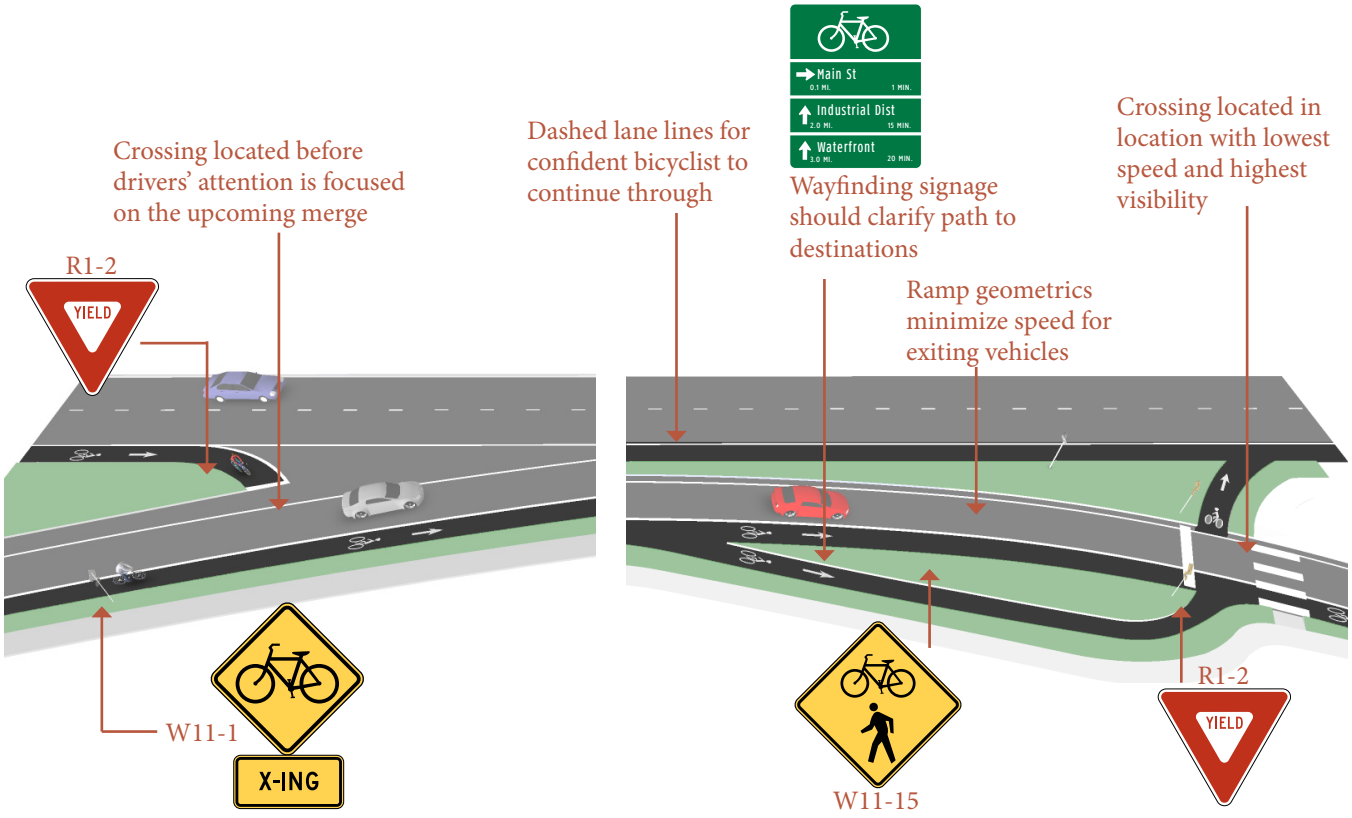
Guidance

Entrance Ramps:

Angle the bike lane to increase the approach angle with entering traffic. Position crossing before drivers' attention is focused on the upcoming merge.

Exit Ramps:

Use a jug handle turn to bring bicyclists to increase the approach angle with exiting traffic, and add yield striping and signage to the bicycle approach.



Discussion

While the jug-handle approach is the preferred configuration at exit ramps, provide the option for through bicyclists to perform a vehicular merge and proceed straight through under safe conditions.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.

FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

FHWA. *Bicycle and Pedestrian Transportation. Lesson 15: Bicycle Lanes.* 2006.

Materials and Maintenance

Locate crossing markings out of wheel tread when possible to minimize wear and maintenance costs.

BIKEWAY SIGNING

The ability to navigate through a city is informed by landmarks, natural features and other visual cues. Signs throughout the city should indicate to bicyclists:

- Direction of travel
- Location of destinations
- Travel time/distance to those destinations

These signs will increase users' comfort and accessibility to the bicycle systems.

Signage can serve both wayfinding and safety purposes including:

- Helping to familiarize users with the bicycle network
- Helping users identify the best routes to destinations
- Helping to address misperceptions about time and distance
- Helping overcome a "barrier to entry" for people who are not frequent bicyclists (e.g., "interested but concerned" bicyclists)

A community-wide bicycle wayfinding signage plan would identify:

- Sign locations
- Sign type – what information should be included and design features
- Destinations to be highlighted on each sign – key destinations for bicyclists
- Approximate distance and travel time to each destination

Bicycle wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes. Too many road signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists rather than per vehicle signage standards.

Wayfinding Sign Types


Wayfinding Sign Placement

Wayfinding Sign Types

Description

A bicycle wayfinding system consists of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes. There are three functional types of wayfinding signs:

Confirmation Signs

Alternative Bike Route Guide (D11-1c) signs are used to Indicate to bicyclists that they are on a designated bikeway and make motorists aware of the bicycle route. The use of the D11-1c sign (which includes a destination or route name) is preferred whenever practical, as it provides the reader with more useful information than the D11-1.

Turn Signs

A Bicycle Destination Sign (D1-1) with one or more destination in a single direction indicates where a bike route turns from one street onto another street. This signage can be used with pavement markings, and includes destinations and arrows.

Decisions Signs

Decision sign assemblies are a combination of D11-1c and D1-3a signs used to mark the junction of two or more bikeways and inform bicyclists of the designated bike route to access key destinations. Commonly includes destinations and arrows and distances.

Numbered Bicycle Route Signs

Numbered Bicycle Route (M1-8, M1-8a) signs are used to establish a unique identification of state or local bicycle routes. U.S. Bicycle Route (M1-9) signs shall contain the AASHTO designated route number.

D11-1c

D1-1

D11-1/D1-3a

M1-8

M1-9

Discussion

Green is the color used for directional guidance and is the most common color of bicycle wayfinding signage in the US, including those in the MUTCD.

While not included in the MUTCD, some jurisdictions include travel time on Bicycle Destination Signs to help communicate and inform users of realistic bicycle travel times based on a 10 mph travel speed.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Maintenance needs for bicycle wayfinding signs are similar to other signs and will need periodic replacement due to wear.

Wayfinding Sign Placement

Guidance

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

Decisions Signs

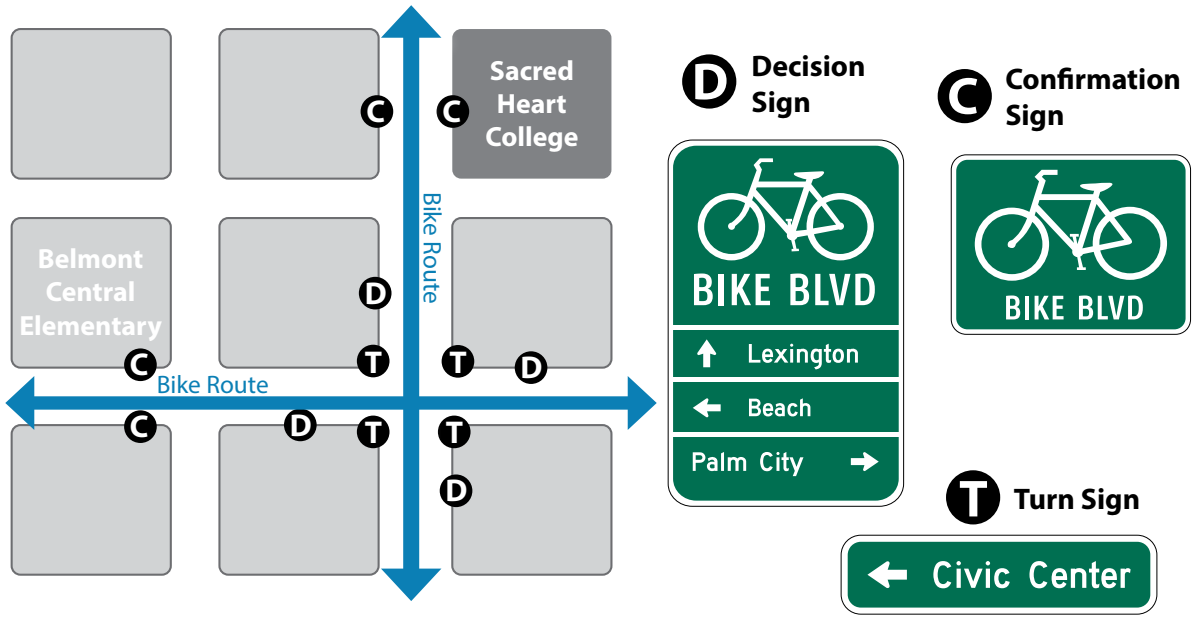
- Near-side of intersections in advance of a junction with another bicycle route.
- Along a route to indicate a nearby destination.

Confirmation Signs

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

Turn Signs

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



Discussion

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

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

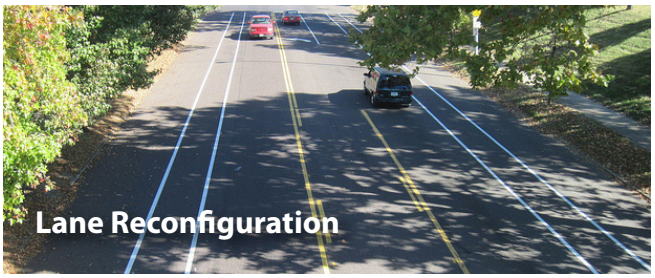
Materials and Maintenance

Maintenance needs for bicycle wayfinding signs are similar to other signs and will need periodic replacement due to wear.

RETROFITTING EXISTING STREETS TO ADD BIKEWAYS

Most major streets are characterized by conditions (e.g., high vehicle speeds and/or volumes) for which dedicated bike lanes are the most appropriate facility to accommodate safe and comfortable riding. Although opportunities to add bike lanes through roadway widening may exist in some locations, many major streets have physical and other constraints that would require street retrofit measures within existing curb-to-curb widths. As a result, much of the guidance provided in this section focuses on effectively reallocating existing street width through striping modifications to accommodate dedicated bike lanes.

Although largely intended for major streets, these measures may be appropriate for any roadway where bike lanes would be the best accommodation for bicyclists.



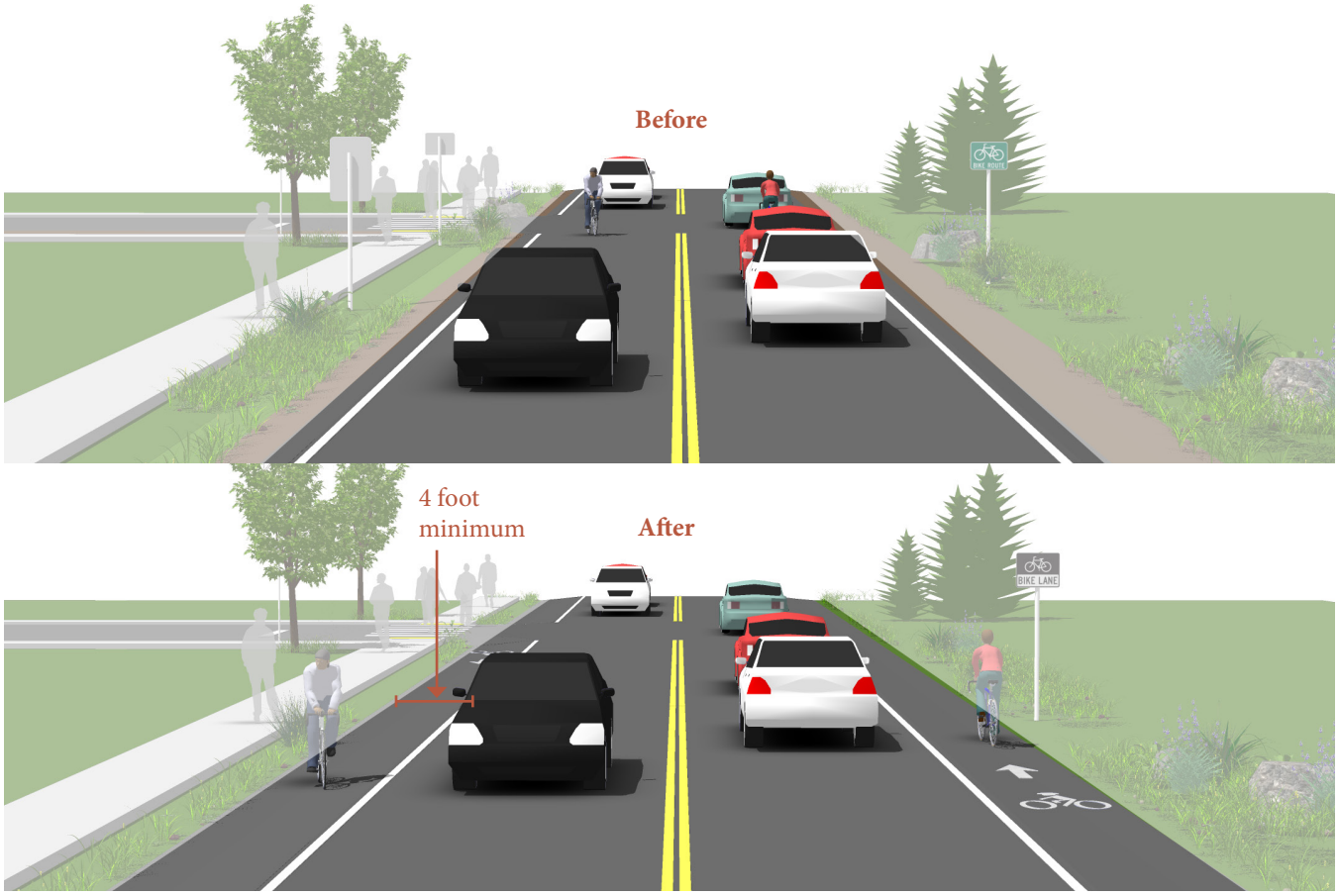
Roadway Widening

Description

Bike lanes can be accommodated on streets with excess right-of-way through shoulder widening. Although roadway widening incurs higher expenses compared with re-striping projects, bike lanes can be added to streets currently lacking curbs, gutters and sidewalks without the high costs of major infrastructure reconstruction.

Guidance

- Guidance on bicycle lanes applies to this treatment.
- 4 foot minimum width when no curb and gutter is present.
- 6 foot width preferred.



Discussion

Roadway widening is most appropriate on roads lacking curbs, gutters and sidewalks.

If it is not possible to meet minimum bicycle lane dimensions, a reduced width paved shoulder can still improve conditions for bicyclists on constrained roadways. In these situations, a minimum of 3 feet of operating space should be provided.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.

Materials and Maintenance

The extended bicycle area should not contain any rough joints where bicyclists ride. Saw or grind a clean cut at the edge of the travel lane, or feather with a fine mix in a non-ridable area of the roadway.

Lane Narrowing

Description

Lane narrowing utilizes roadway space that exceeds minimum standards to provide the needed space for bike lanes. Many roadways have existing travel lanes that are wider than those prescribed in local and national roadway design standards, or which are not marked. Most standards allow for the use of 11 foot and sometimes 10 foot wide travel lanes to create space for bike lanes.

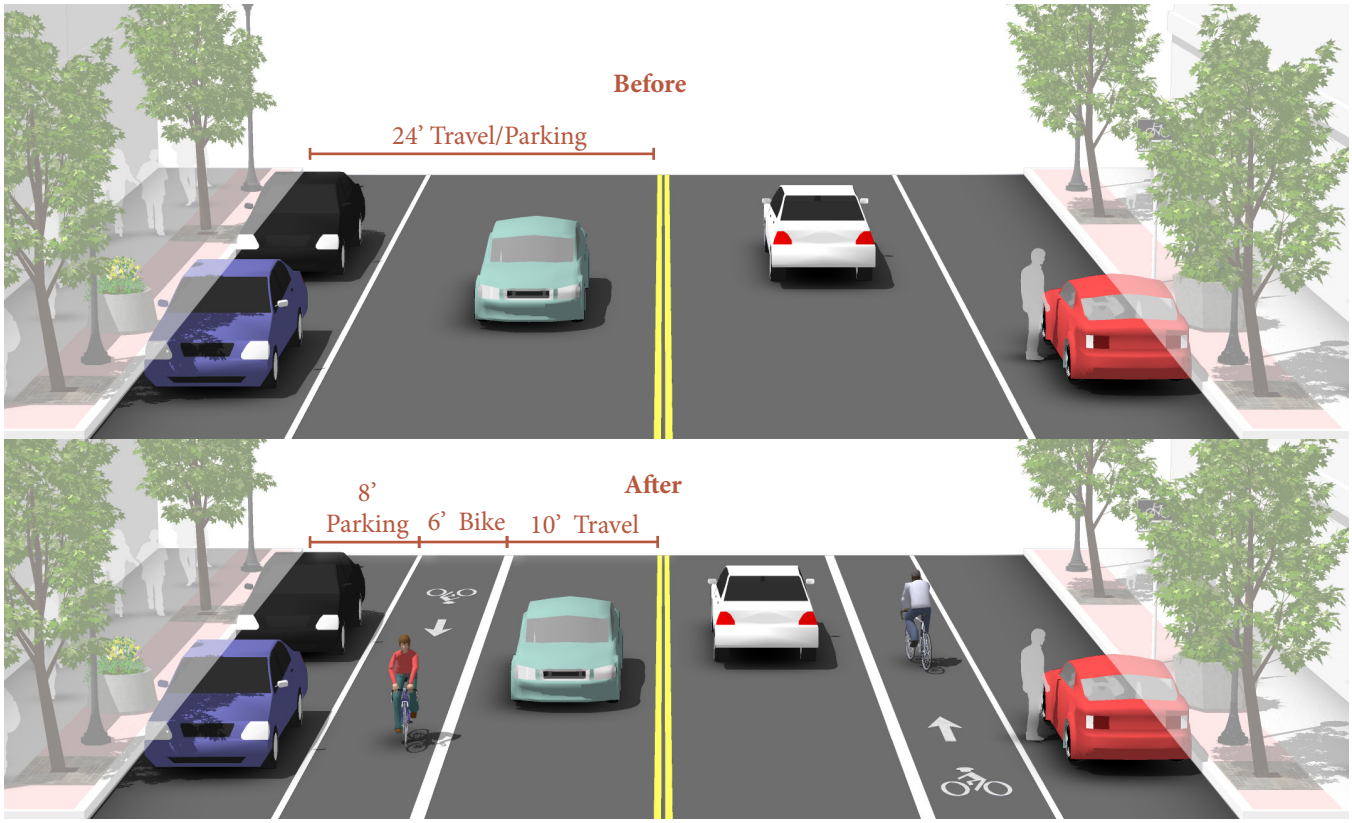
Guidance

Vehicle lane width:

- Before: 10-15 feet
- After: 10-11 feet

Bicycle lane width:

- Guidance on bicycle lanes applies to this treatment.



Discussion

Special consideration should be given to the amount of heavy vehicle traffic and horizontal curvature before the decision is made to narrow travel lanes. Center turn lanes can also be narrowed in some situations to free up pavement space for bike lanes. AASHTO supports reduced width lanes in *A Policy on Geometric Design of Highways and Streets*: *"On interrupted-flow operation conditions at low speeds (45 mph or less), narrow lane widths are normally adequate and have some advantages."*

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *A Policy on Geometric Design of Highways and Streets.* 2004.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.

Lane Reconfiguration

Description

The removal of a single travel lane will generally provide sufficient space for bike lanes on both sides of a street. Streets with excess vehicle capacity provide opportunities for bike lane retrofit projects.

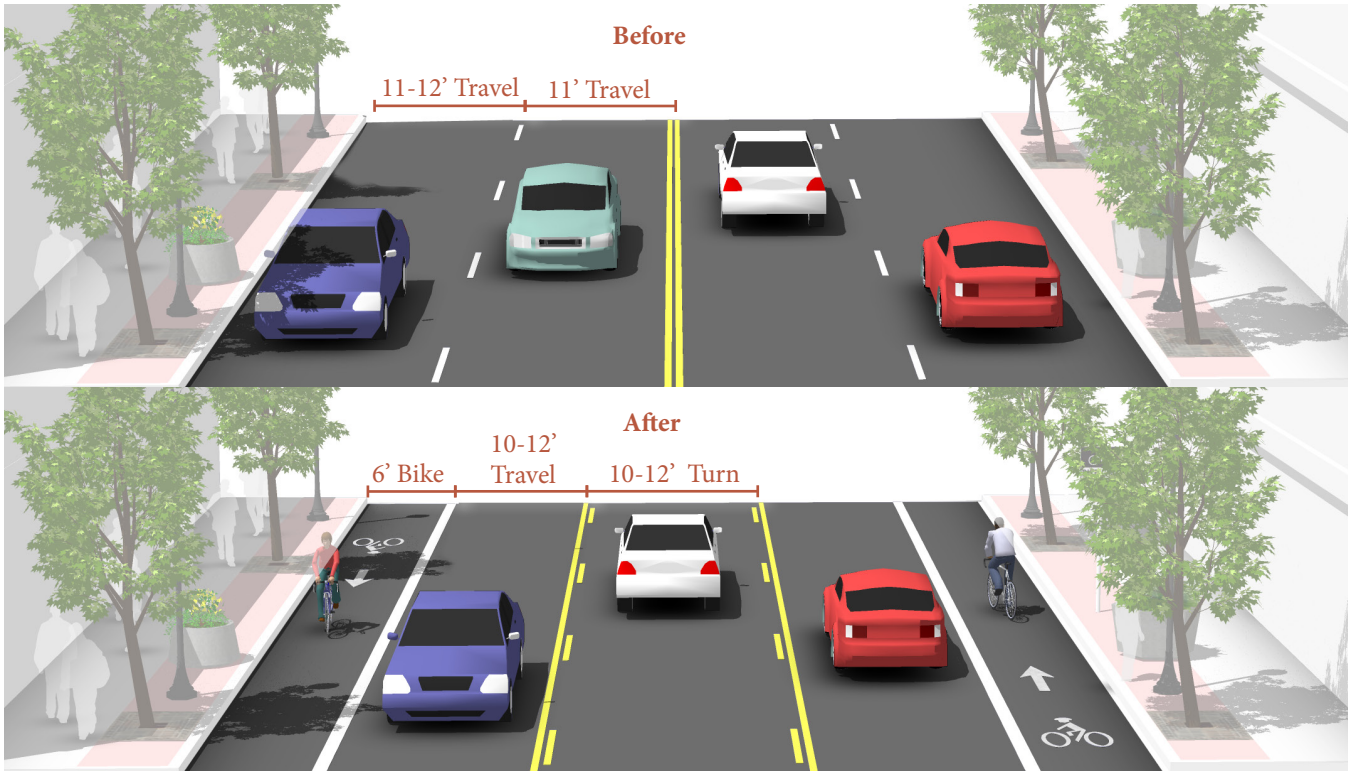
Guidance

Vehicle lane width:

- Width depends on project. No narrowing may be needed if a lane is removed.

Bicycle lane width:

- Guidance on bicycle lanes applies to this treatment.



Discussion

Depending on a street's existing configuration, traffic operations, user needs and safety concerns, various lane reduction configurations may apply. For instance, a four-lane street (with two travel lanes in each direction) could be modified to provide one travel lane in each direction, a center turn lane, and bike lanes. Prior to implementing this measure, a traffic analysis should identify potential impacts.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Evaluation of Lane Reduction "Road Diet" Measures on Crashes.* Publication Number: FHWA-HRT-10-053. 2010.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.

Parking Reduction

Description

Bike lanes can replace one or more on-street parking lanes on streets where excess parking exists and/or the importance of bike lanes outweighs parking needs. For example, parking may be needed on only one side of a street. Eliminating or reducing on-street parking also improves sight distance for bicyclists in bike lanes and for motorists on approaching side streets and driveways.

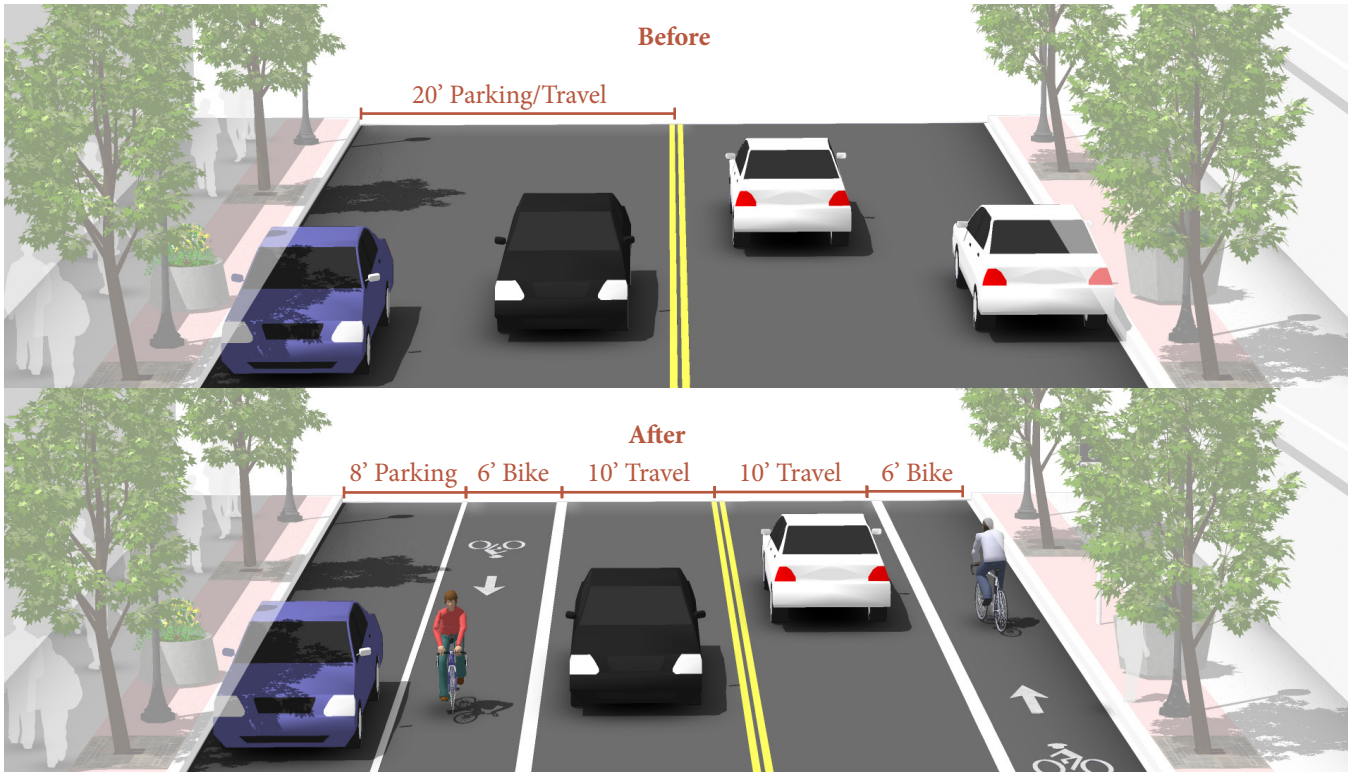
Guidance

Vehicle lane width:

- Parking lane width depends on project. No travel lane narrowing may be required depending on the width of the parking lanes.

Bicycle lane width:

- Guidance on bicycle lanes applies to this treatment.



Discussion

Removing or reducing on-street parking to install bike lanes requires comprehensive outreach to the affected businesses and residents. Prior to reallocating on-street parking for other uses, a parking study should be performed to gauge demand and to evaluate impacts to people with disabilities.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *A Policy on Geometric Design of Highways and Streets.* 2004.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement

BICYCLE SUPPORT FACILITIES

Bicycle Parking

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

Access to Transit

Safe and easy access to bicycle parking facilities is necessary to encourage commuters to access transit via bicycle. Providing bicycle access to transit and space for bicycles on buses and rail vehicles can increase the feasibility of transit in lower-density areas, where transit stops are beyond walking distance of many residences. People are often willing to walk only a quarter- to half-mile to a bus stop, while they might bike as much as two or more miles to reach a transit station.

Bicycle Racks


On-Street Bike Corral


Secure Parking Areas

Bicycle Access to Transit

Bicycle Racks

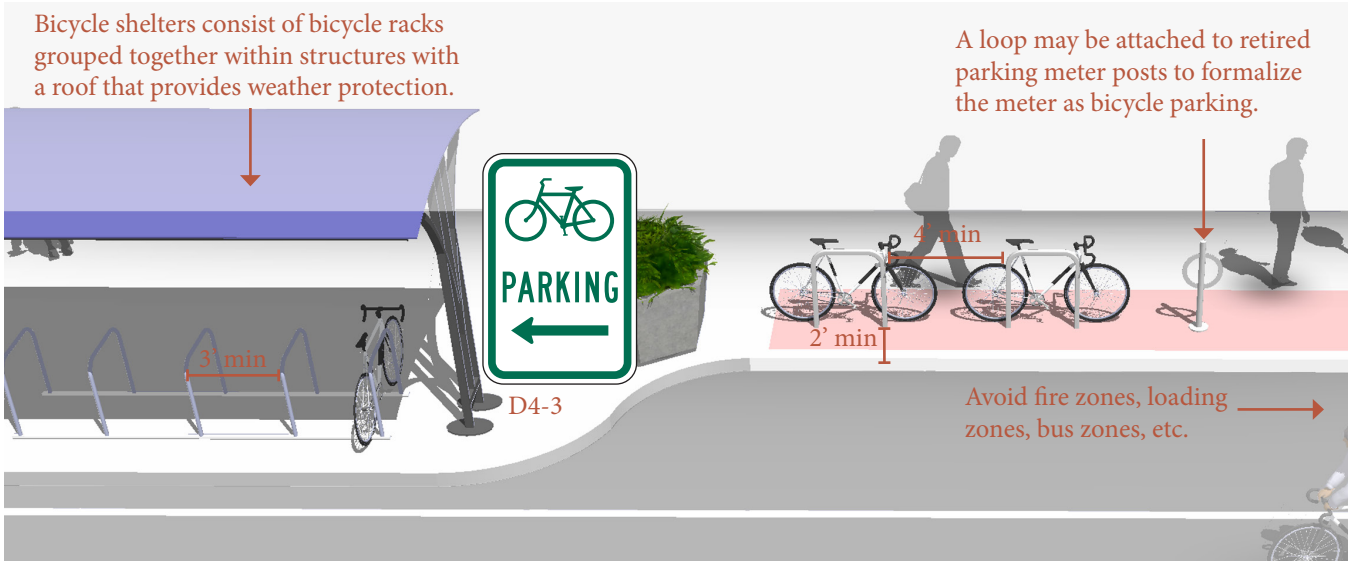
Description

Short-term bicycle parking is meant to accommodate visitors, customers, and others expected to depart within two hours. It should have an approved standard rack, appropriate location and placement, and weather protection. The Association for Pedestrian and Bicycle Professionals (APBP) recommends selecting a bicycle rack that:

- Supports the bicycle in at least two places, preventing it from falling over.
- Allows locking of the frame and one or both wheels with a U-lock.
- Is securely anchored to ground.
- Resists cutting, rusting and bending or deformation.

Guidance

- 2' minimum from the curb face to avoid 'dooring.'
- Close to destinations; 50' maximum distance from main building entrance.
- Minimum clear distance of 6' should be provided between the bicycle rack and the property line.
- Should be highly visible from adjacent bicycle routes and pedestrian traffic.
- Locate racks in areas that cyclists are most likely to travel.



Discussion

Where the placement of racks on sidewalks is not possible (due to narrow sidewalk width, sidewalk obstructions, street trees, etc.), bicycle parking can be provided in the street where on-street vehicle parking is allowed in the form of on-street bicycle corrals. Some types of bicycle racks may meet design criteria, but are discouraged except in limited situations. This includes undulating "wave" racks, schoolyard "wheel bender" racks, and spiral racks.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
APBP. *Bicycle Parking Guide 2nd Edition.* 2010.

Materials and Maintenance

Use of proper anchors will prevent vandalism and theft. Racks and anchors should be regularly inspected for damage. Educate snow removal crews to avoid burying racks during winter months.

On-Street Bicycle Corral

Description

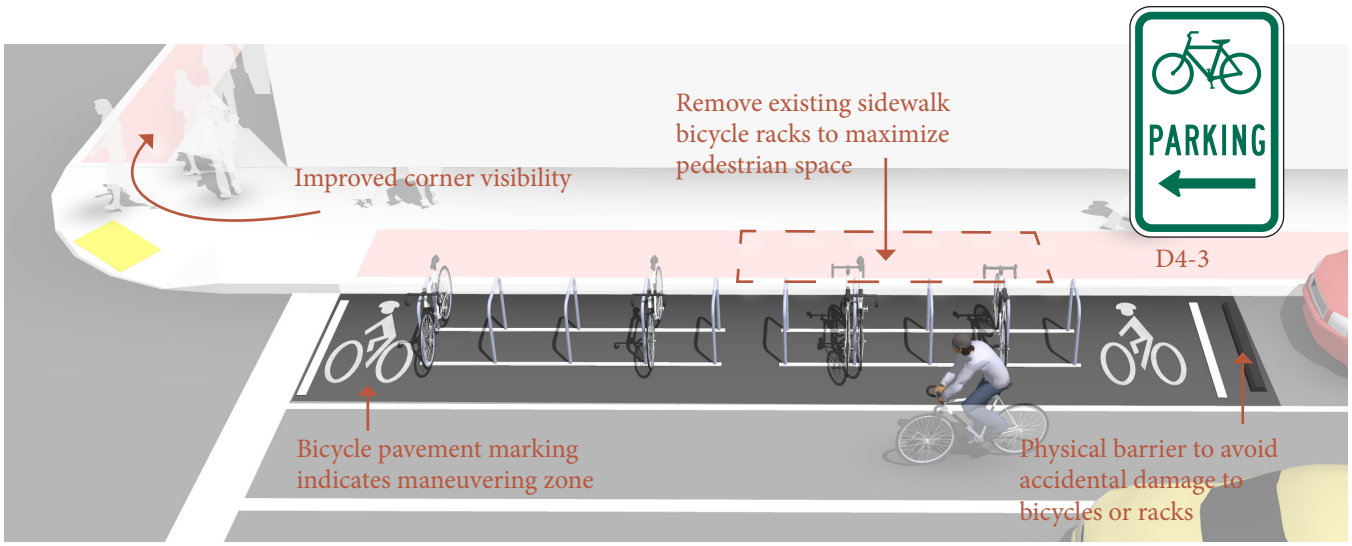
Bicycle corrals (also known as on-street bicycle parking) consist of bicycle racks grouped together in a common area within the street traditionally used for automobile parking. Bicycle corrals are reserved exclusively for bicycle parking and provide a relatively inexpensive solution to providing high-volume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

Bicycle corrals move bicycles off the sidewalks, leaving more space for pedestrians, sidewalk café tables, etc. Because bicycle parking does not block sightlines (as large motor vehicles would do), it may be possible to locate bicycle parking in 'no-parking' zones near intersections and crosswalks.

Guidance

See guidelines for sidewalk bicycle rack placement and clear zones.

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



Discussion

In many communities, the installation of bicycle corrals is driven by requests from adjacent businesses, and is not a city-driven initiative. In such cases, the city does not remove motor vehicle parking unless it is explicitly requested. In other areas, the city provides the facility and business associations take responsibility for the maintenance of the facility. Communities can establish maintenance agreements with the requesting business. Bicycle corrals can be especially effective in areas with high bicycle parking demand or along street frontages with narrow sidewalks where parked bicycles would be detrimental to the pedestrian environment.

Additional References and Guidelines

APBP. *Bicycle Parking Guide 2nd Edition.* 2010.

Materials and Maintenance

Physical barriers may obstruct drainage and collect debris. Establish a maintenance agreement with neighboring businesses. In snowy climates the bicycle corral may need to be removed during the winter months.

Secure Parking Areas (SPA)

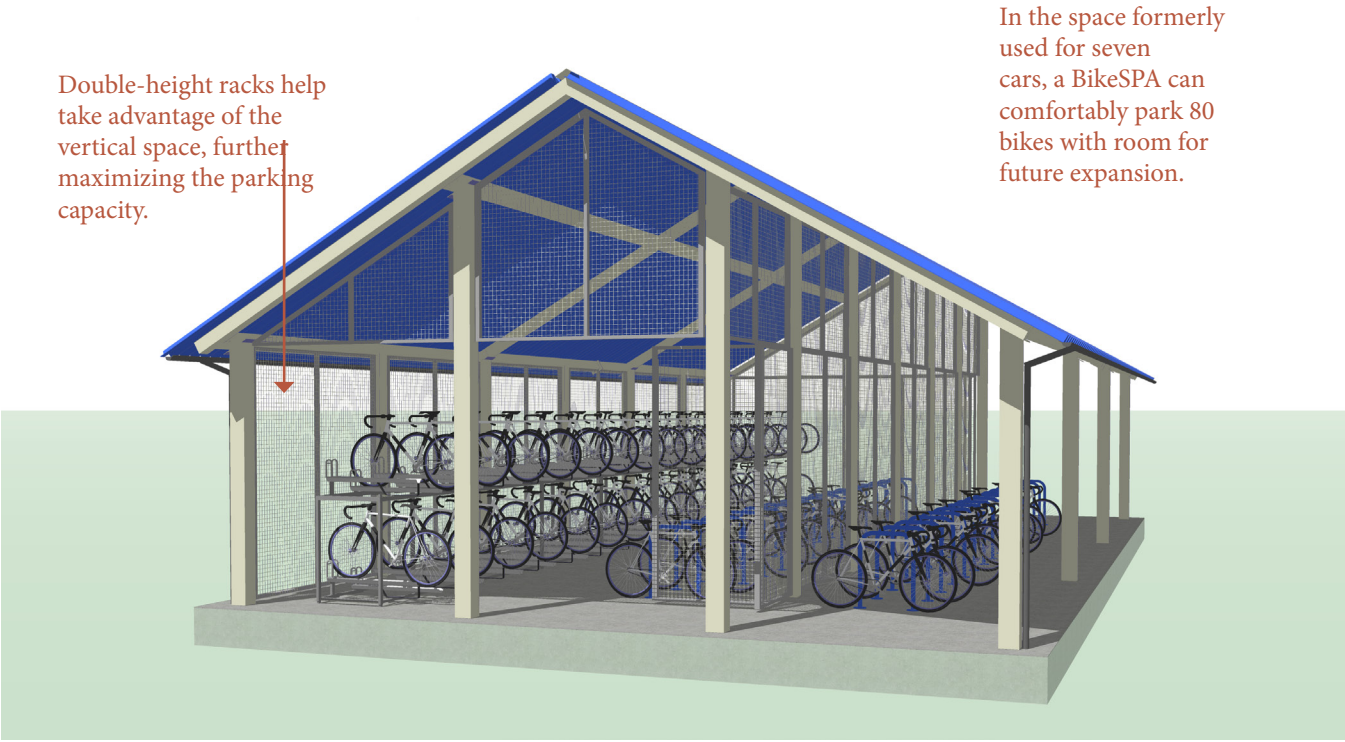
Description

A Secure Parking Area for bicycles, also known as a BikeSPA or Bike & Ride (when located at transit stations), is a semi-enclosed space that offers a higher level of security than ordinary bike racks. Accessible via key-card, combination locks, or keys, BikeSPAs provide high-capacity parking for 10 to 100 or more bicycles. Increased security measures create an additional transportation option for those whose biggest concern is theft and vulnerability.

Guidance

Key features may include:

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



Discussion

Long-term parking facilities are more expensive to provide than short-term facilities, but are also significantly more secure. Although many bicycle commuters would be willing to pay a nominal fee to guarantee the safety of their bicycle, long-term bicycle parking should be free wherever automobile parking is free. BikeSPAs are ideal for transit centers, airports, train stations, or wherever large numbers of people might arrive by bicycle and need a secure place to park while away.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
APBP. *Bicycle Parking Guide 2nd Edition.* 2010.

Materials and Maintenance

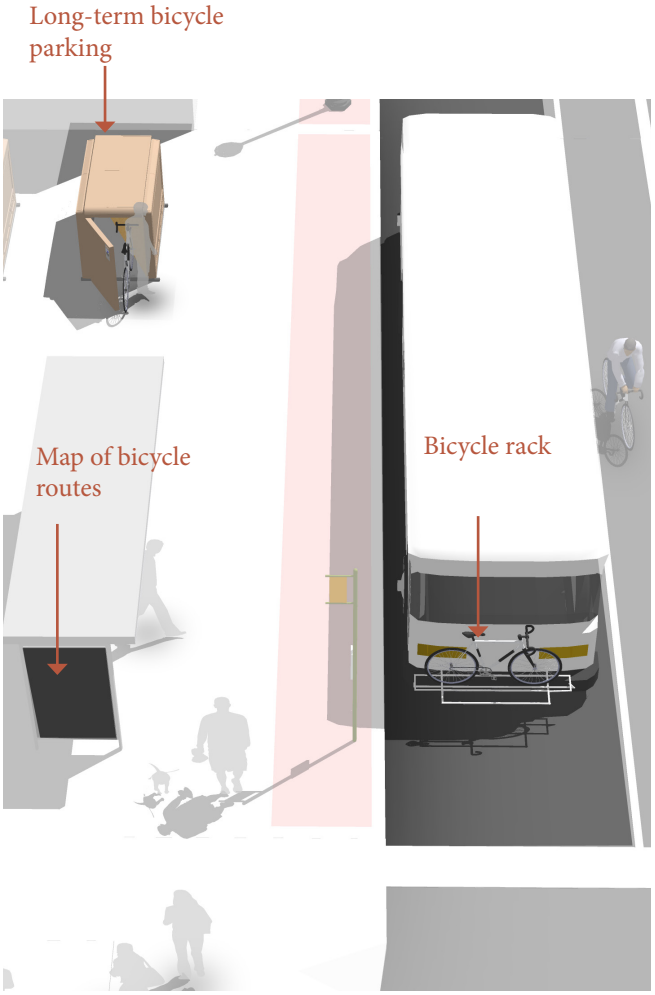
Regularly inspect the functioning of moving parts and enclosures. Change keys and access codes periodically to prevent access to unapproved users.

Bicycle Access to Transit

Description

Safe and easy access to transit stations and secure bicycle parking facilities is necessary to encourage commuters to access transit via bicycle. Bicycling to transit reduces the need to provide expensive and space consuming car parking spaces.

Many people who ride to a transit stop will want to bring their bicycle with them on the transit portion of their trip, so buses and other transit vehicles should be equipped accordingly.



Guidance

Access

- Provide direct and convenient access to transit stations and stops from the bicycle and pedestrian networks.
- Provide maps at major stops and stations showing nearby bicycle routes.
- Provide wayfinding signage and pavement markings from the bicycle network to transit stations.
- Ensure that connecting bikeways offer proper bicycle actuation and detection.

Bicycle Parking

- The route from bicycle parking locations to station/stop platforms should be well-lit and visible.
- Signing should note the location of bicycle parking, rules for use, and instructions as needed.
- Provide safe and secure long-term parking such as bicycle lockers at transit hubs. Parking should be easy to use and well maintained.

Discussion

Providing bicycle routes to transit helps combine the long-distance coverage of bus and rail travel with the door-to-door service of bicycle riding. Transit use can overcome large obstacles to bicycling, including distance, hills, riding on busy streets, night riding, inclement weather, and breakdowns. High-visibility crosswalks and mid-block crossings are often appropriate treatments to provide safer bicycle and pedestrian access to bus stops, particularly at high-usage transit stops. If a bus stop is located mid-block, adequate crossing treatments should be provided, based on the level of traffic on the roadway. All transit riders will need to cross the street to access or leave the bus stop.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
APBP. *Bicycle Parking Guide 2nd Edition.* 2010.
FHWA. *Federal Highway Administration University Course on Bicycle and Pedestrian Transportation. Lesson 18: Bicycle and Pedestrian Connections to Transit.* 2006.

Materials and Maintenance

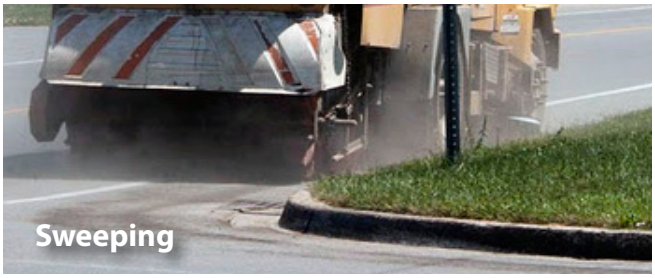
Regularly inspect the functioning of long-term parking moving parts and enclosures. Change keys and access codes periodically to prevent access to unapproved users.

BIKEWAY MAINTENANCE

Regular bicycle facility maintenance includes sweeping, maintaining a smooth roadway, ensuring that the gutter-to-pavement transition remains relatively flush, and installing bicycle-friendly drainage grates. Pavement overlays are a good opportunity to improve bicycle facilities. The following recommendations provide a menu of options to consider to enhance a maintenance regimen.

Recommended Walkway and Bikeway Maintenance Activities

Maintenance Activity	Frequency
Inspections	Seasonal – at beginning and end of Summer
Pavement sweeping/ blowing	As needed, with higher frequency in the early Spring and Fall
Pavement sealing	5 - 15 years
Pothole repair	1 week – 1 month after report
Culvert and drainage grate inspection	Before Winter and after major storms
Pavement markings replacement	As needed
Signage replacement	As needed
Shoulder plant trimming (weeds, trees, brambles)	Twice a year; middle of growing season and early Fall
Tree and shrub plantings, trimming	1 – 3 years
Major damage response (washouts, fallen trees, flooding)	As soon as possible


Sweeping


Roadway Surface


Gutter to Pavement Transition

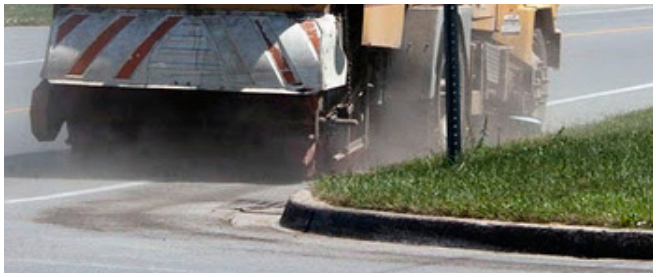

Drainage Grates


Maintenance Management Plan

Sweeping

Description

Bicyclists often avoid shoulders and bike lanes filled with gravel, broken glass and other debris; they will ride in the roadway to avoid these hazards, potentially causing conflicts with motorists. Debris from the roadway should not be swept onto sidewalks (pedestrians need a clean walking surface), nor should debris be swept from the sidewalk onto the roadway. A regularly scheduled inspection and maintenance program helps ensure that roadway debris is regularly picked up or swept.



Guidance

- Establish a seasonal sweeping schedule that prioritizes roadways with major bicycle routes.
- Sweep walkways and bikeways whenever there is an accumulation of debris on the facility.
- In curbed sections, sweepers should pick up debris; on open shoulders, debris can be swept onto gravel shoulders.
- Pave gravel driveway approaches to minimize loose gravel on paved roadway shoulders.
- Perform additional sweeping in the Spring to remove debris from the Winter.
- Perform additional sweeping in the Fall in areas where leaves accumulate .

Roadway Surface

Description

Bicycles are much more sensitive to subtle changes in roadway surface than are motor vehicles. Various materials are used to pave roadways, and some are smoother than others. Compaction is also an important issue after trenches and other construction holes are filled. Uneven settlement after trenching can affect the roadway surface nearest the curb where bicycles travel. Sometimes compaction is not achieved to a satisfactory level, and an uneven pavement surface can result due to settling over the course of days or weeks. When resurfacing streets, use the smallest chip size and ensure that the surface is as smooth as possible to improve safety and comfort for bicyclists.

Guidance

- Maintain a smooth pothole-free surface.
- Ensure that on new roadway construction, the finished surface on bikeways does not vary more than ¼".
- Maintain pavement so ridge buildup does not occur at the gutter-to-pavement transition or adjacent to railway crossings.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- If chip sealing is to be performed, use the smallest possible chip on bike lanes and shoulders. Sweep loose chips regularly following application.
- During chip seal maintenance projects, if the pavement condition of the bike lane is satisfactory, it may be appropriate to chip seal the travel lanes only. However, use caution when doing this so as not to create an unacceptable ridge between the bike lane and travel lane.

Pavement Overlays

Description

Pavement overlays represent good opportunities to improve conditions for bicyclists if done carefully. A ridge should not be left in the area where bicyclists ride (this occurs where an overlay extends part-way into a shoulder bikeway or bike lane). Overlay projects also offer opportunities to widen a roadway, or to re-stripe a roadway with bike lanes.

Guidance

- Extend the overlay over the entire roadway surface to avoid leaving an abrupt edge.
- If the shoulder or bike lane pavement is of good quality, it may be appropriate to end the overlay at the shoulder or bike lane stripe provided no abrupt ridge remains.
- Ensure that inlet grates, manhole and valve covers are within ¼ inch of the finished pavement surface and are made or treated with slip resistant materials.
- Pave gravel driveways to property lines to prevent gravel from being tracked onto shoulders or bike lanes.

Gutter to Pavement Transition

Description

On streets with concrete curbs and gutters, 1 to 2 feet of the curbside area is typically devoted to the gutter pan, where water collects and drains into catch basins. On many streets, the bikeway is situated near the transition between the gutter pan and the pavement edge. This transition can be susceptible to erosion, creating potholes and a rough surface for travel.

The pavement on many streets is not flush with the gutter, creating a vertical transition between these segments. This area can buckle over time, creating a hazardous condition for bicyclists.

Guidance

- Ensure that gutter-to-pavement transitions have no more than a ¼" vertical transition.
- Examine pavement transitions during every roadway project for new construction, maintenance activities, and construction project activities that occur in streets.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- Provide at least 3 feet of pavement outside of the gutter seam.

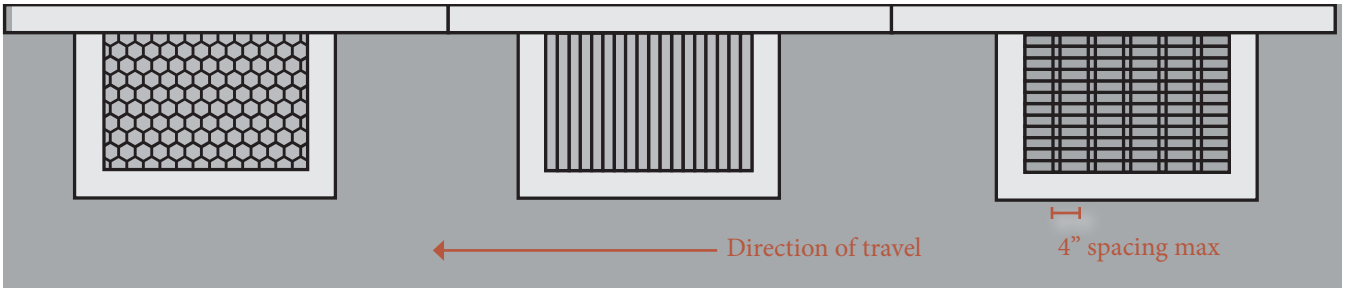
Drainage Grates

Description

Drainage grates are typically located in the gutter area near the curb of a roadway. Drainage grates typically have slots through which water drains into the municipal storm sewer system. Many older grates were designed with linear parallel bars spread wide enough for a tire to become caught so that if a bicyclist were to ride on them, the front tire could become caught in the slot. This would cause the bicyclist to tumble over the handlebars and sustain potentially serious injuries.

Guidance

- Require all new drainage grates be bicycle-friendly, including grates that have horizontal slats on them so that bicycle tires and assistive devices do not fall through the vertical slats.
- Create a program to inventory all existing drainage grates, and replace hazardous grates as necessary – temporary modifications such as installing rebar horizontally across the grate should not be an acceptable alternative to replacement.



Maintenance Management Plan

Description

Bikeway users need accommodation during construction and maintenance activities when bikeways may be closed or unavailable. Users must be warned of bikeway closures and given adequate detour information to bypass the closed section. Users should be warned through the use of standard signing approaching each affected section (e.g., "Bike Lane Closed," "Shared use path Closed"), including information on alternate routes and dates of closure. Alternate routes should provide reasonable directness, equivalent traffic characteristics, and be signed.

Guidance

- Provide fire and police departments with map of system, along with access points to gates/bollards
- Enforce speed limits and other rules of the road
- Enforce all trespassing laws for people attempting to enter adjacent private properties

SIGNALIZED CROSSINGS FOR BICYCLISTS AND PEDESTRIANS

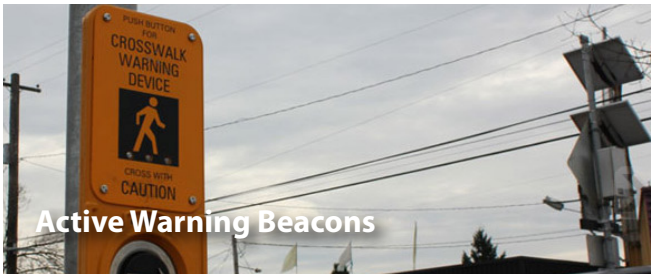
Crossing beacons and signals facilitate crossings of roadways for bicyclists and pedestrians. Beacons make crossing intersections safer by clarifying when to enter an intersection and by alerting motorists to the presence of pedestrians and bicyclists.

Flashing amber warning beacons can be utilized at unsignalized intersection crossings. Push buttons, signage, and pavement markings may be used to highlight these facilities for pedestrians, bicyclists and motorists.

Determining which type of signal or beacon to use for a particular intersection depends on a variety of factors. These include speed limits, traffic volumes, and the anticipated levels of pedestrian and bicycle crossing traffic.

Signals may be necessary as part of the construction of a protected bicycle facility such as a protected bike lane with potential turning conflicts, or to decrease vehicle or pedestrian conflicts at major crossings. An intersection with bicycle signals may reduce stress and delays for a crossing bicyclist, and discourage illegal and unsafe crossing maneuvers.

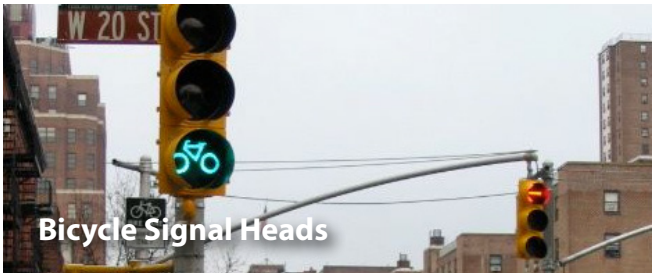

Pedestrians at Signalized Crossings



Active Warning Beacons


Hybrid Beacon (HAWK)


Bicycle Detection and Actuation



Bicycle Signal Heads

Pedestrians at Signalized Crossings

Description

Pedestrian Signal Head

Pedestrian signal indicators demonstrate to pedestrians when to cross at a signalized crosswalk. All traffic signals should be equipped with pedestrian signal indications except where pedestrian crossing is prohibited by signage.

Countdown pedestrian signals are particularly valuable for pedestrians, as they indicate whether a pedestrian has time to cross the street before the signal phase ends. Countdown signals should be used at all signalized intersections.

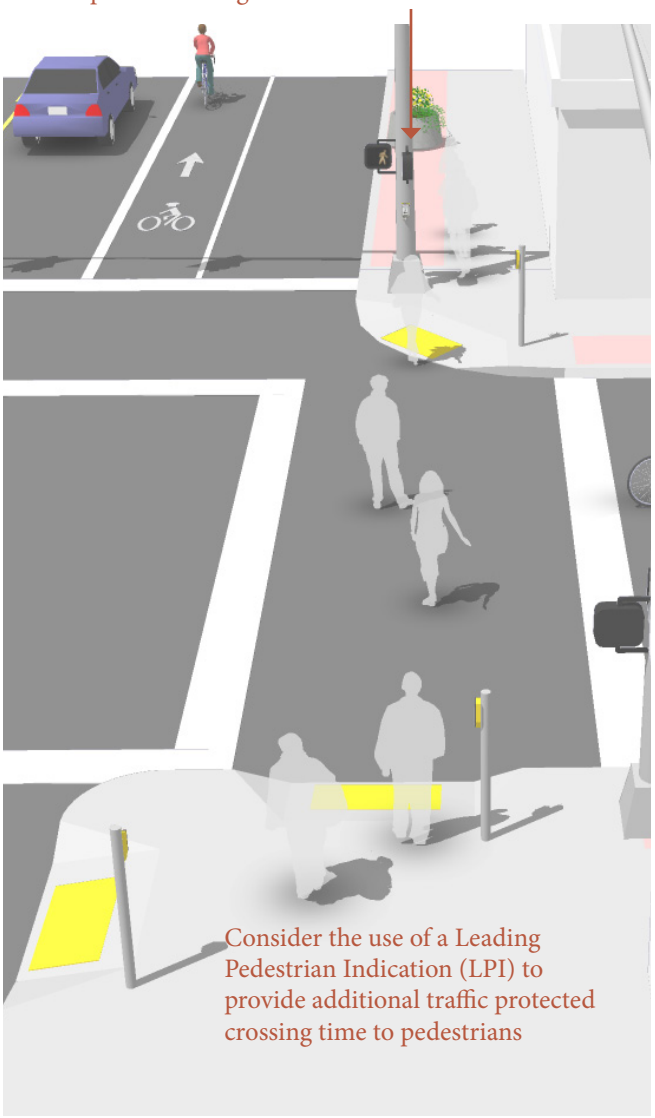
Signal Timing

Providing adequate pedestrian crossing time is a critical element of the walking environment at signalized intersections. The MUTCD recommends traffic signal timing to assume a pedestrian walking speed of 4' per second, meaning that the length of a signal phase with parallel pedestrian movements should provide sufficient time for a pedestrian to safely cross the adjacent street.

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

In busy pedestrian areas such as downtowns, the pedestrian signal indication should be built into each signal phase, eliminating the requirement for a pedestrian to actuate the signal by pushing a button.

Audible pedestrian traffic signals provide crossing assistance to pedestrians with vision impairment at signalized intersections



Consider the use of a Leading Pedestrian Indication (LPI) to provide additional traffic protected crossing time to pedestrians

Discussion

When push buttons are used, they should be located so that someone in a wheelchair can reach the button from a level area of the sidewalk without deviating significantly from the natural line of travel into the crosswalk, and marked (for example, with arrows) so that it is clear which signal is affected. In areas with very heavy pedestrian traffic, consider an all-pedestrian signal phase to give pedestrians free passage in the intersection when all motor vehicle traffic movements are stopped.

Additional References and Guidelines

United States Access Board. *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public-Right-of-Way (PROWAG).* 2011.

AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

It is important to repair or replace traffic control equipment before it fails. Consider semi-annual inspections of controller and signal equipment, intersection hardware, and loop detectors.

Active Warning Beacons

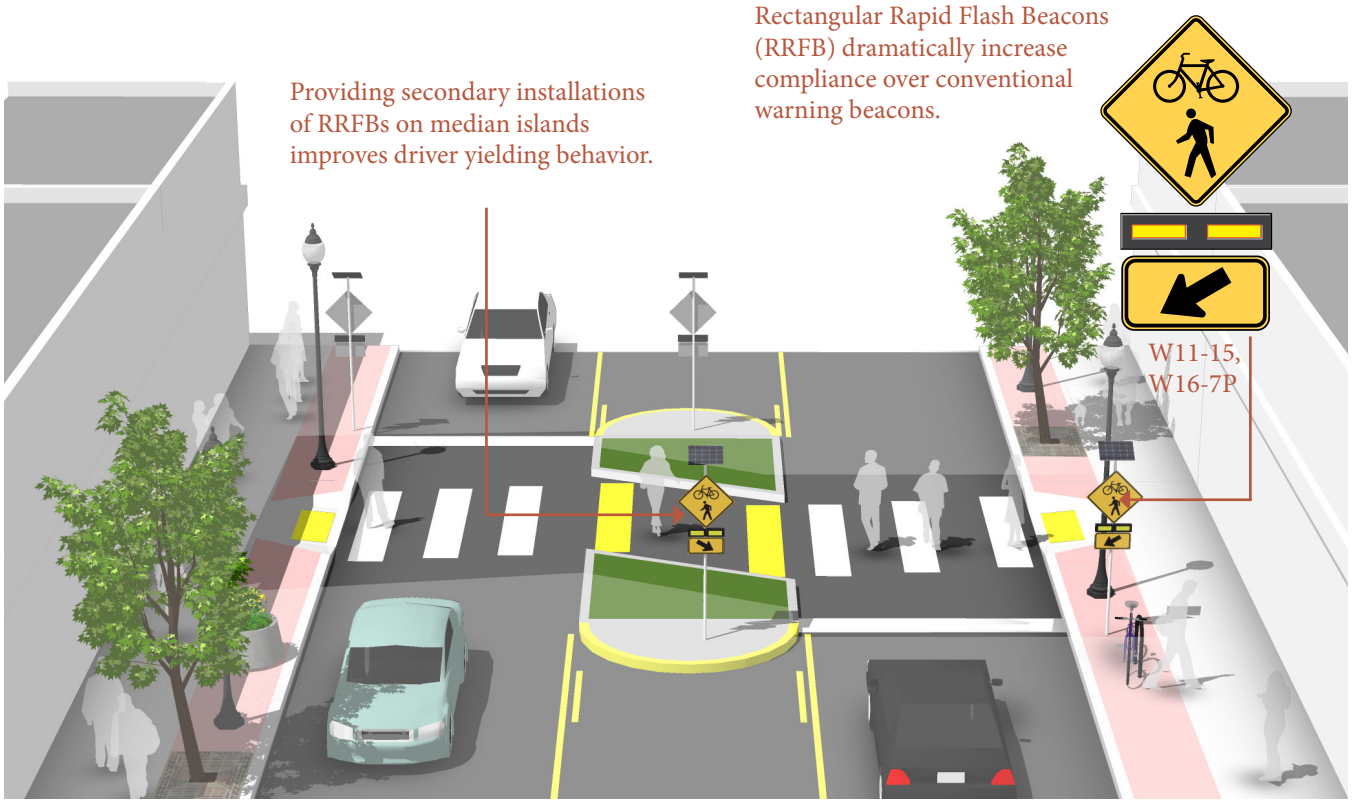
Description

Active warning beacons are user actuated illuminated devices designed to increase motor vehicle yielding compliance at crossings of multi lane or high volume roadways.

Types of active warning beacons include conventional circular yellow flashing beacons, in-roadway warning lights, or Rectangular Rapid Flash Beacons (RRFB).

Guidance

- Warning beacons shall not be used at crosswalks controlled by YIELD signs, STOP signs, or traffic signals.
- Warning beacons shall initiate operation based on pedestrian or bicyclist actuation and shall cease operation at a predetermined time after actuation or, with passive detection, after the pedestrian or bicyclist clears the crosswalk.



Discussion

Rectangular rapid flash beacons have the most increased compliance of all the warning beacon enhancement options. A study of the effectiveness of going from a no-beacon arrangement to a two-beacon RRFB installation increased yielding from 18 percent to 81 percent. A four-beacon arrangement raised compliance to 88 percent. Additional studies over long term installations show little to no decrease in yielding behavior over time.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
FHWA. *MUTCD - Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11).* 2008.

Materials and Maintenance

Depending on power supply, maintenance can be minimal. If solar power is used, RRFBs should run for years without issue.

Hybrid Beacon for Bicycle Route Crossing

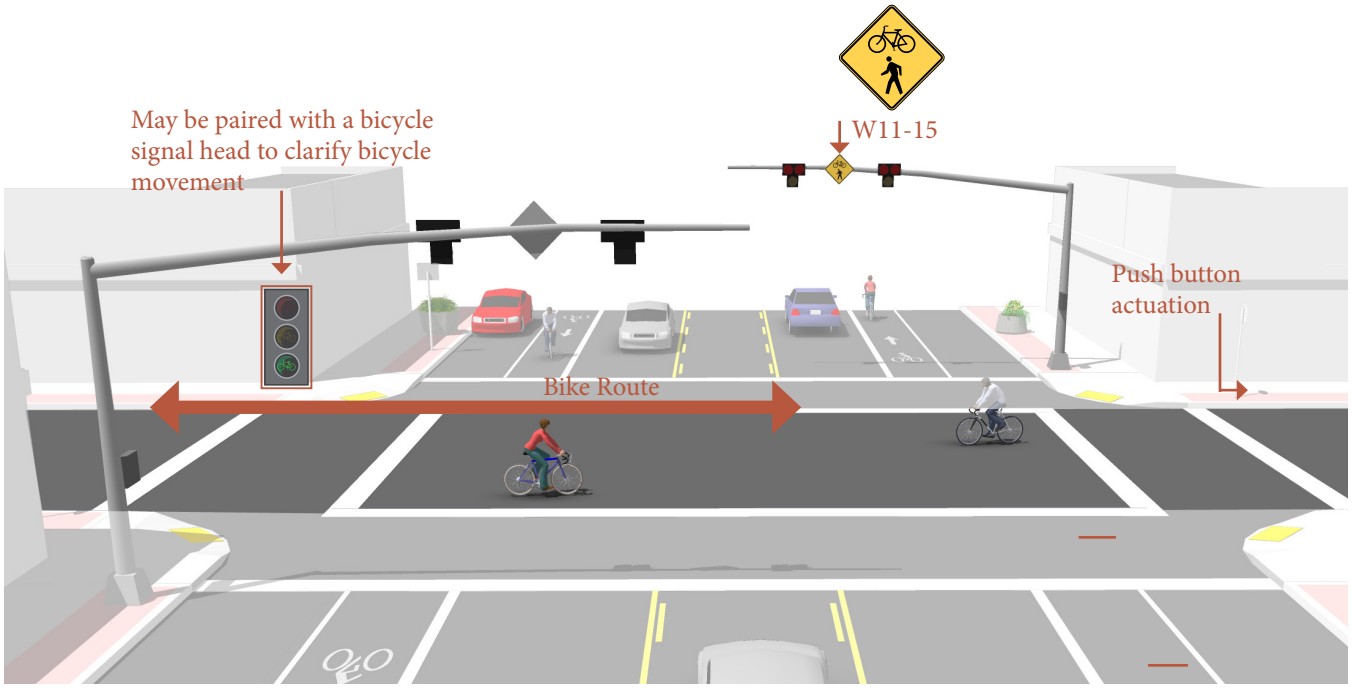
Description

A hybrid beacon, previously known as a High-intensity Activated CrosswalK (HAWK), consists of a signal-head with two red lenses over a single yellow lens on the major street, and pedestrian and/or bicycle signal heads for the minor street. There are no signal indications for motor vehicles on the minor street approaches.

Hybrid beacons are used to improve non-motorized crossings of major streets in locations where side-street volumes do not support installation of a conventional traffic signal (or where there are concerns that a conventional signal will encourage additional motor vehicle traffic on the minor street). Hybrid beacons may also be used at mid-block crossing locations.

Guidance

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



Discussion

The hybrid beacon can significantly improve the operation of a bicycle route, particularly along bicycle boulevard corridors. Because of the low traffic volumes on these facilities, intersections with major roadways are often unsignalized, creating difficult and potentially unsafe crossing conditions for bicyclists. Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety.

Additional References and Guidelines

FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

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

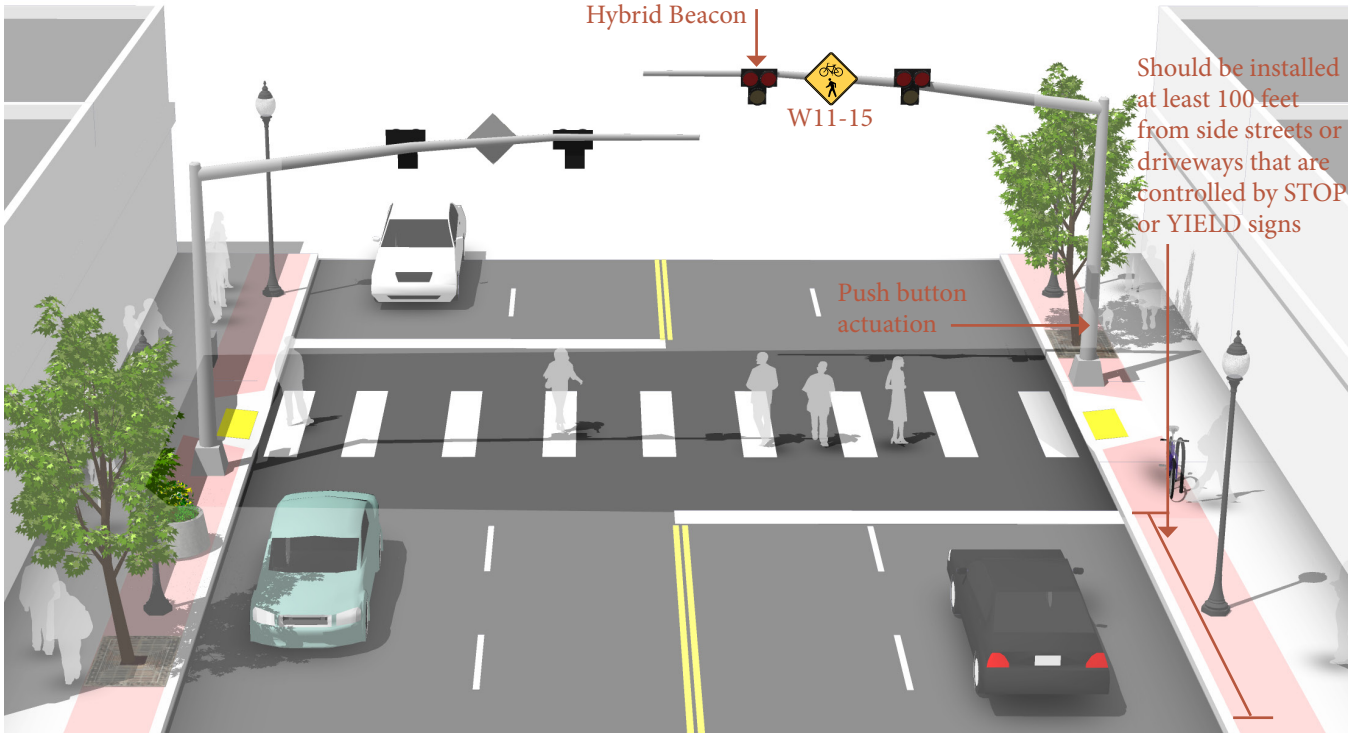
Hybrid Beacon for Mid-Block Crossing

Description

Hybrid beacons are used to improve non-motorized crossings of major streets. A hybrid beacon consists of a signal-head with two red lenses over a single yellow lens on the major street, and a pedestrian signal head for the crosswalk

Guidance

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



Discussion

Hybrid beacon signals are normally activated by push buttons, but may also be triggered by infrared, microwave or video detectors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street. Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety.

Additional References and Guidelines

FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

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

Bicycle Detection and Actuation

Description

Push Button Actuation

User-activated button mounted on a pole facing the street.

Loop Detectors

Bicycle-activated loop detectors are installed within the roadway to allow the presence of a bicycle to trigger a change in the traffic signal. This allows the bicyclist to stay within the lane of travel without having to maneuver to the side of the road to trigger a push button.

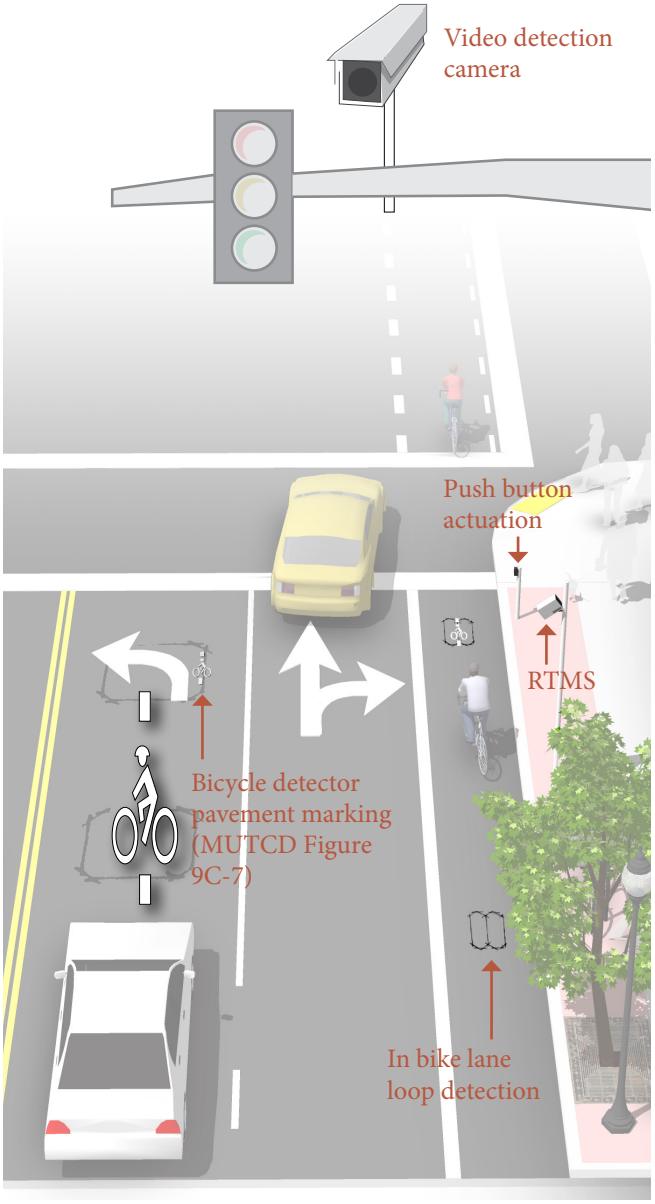
Loops that are sensitive enough to detect bicycles should be supplemented with pavement markings to instruct bicyclists how to trip them.

Video Detection Cameras

Video detection systems use digital image processing to detect a change in the image at a location. These systems can be calibrated to detect bicycles. Video camera system costs range from $20,000 to $25,000 per intersection.

Remote Traffic Microwave Sensor Detection (RTMS)

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



Discussion

Proper bicycle detection should meet two primary criteria: 1) accurately detects bicyclists and 2) provides clear guidance to bicyclists on how to actuate detection (e.g., what button to push, where to stand).

Bicycle loops and other detection mechanisms can also provide bicyclists with an extended green time before the light turns yellow so that bicyclists of all abilities can reach the far side of the intersection.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

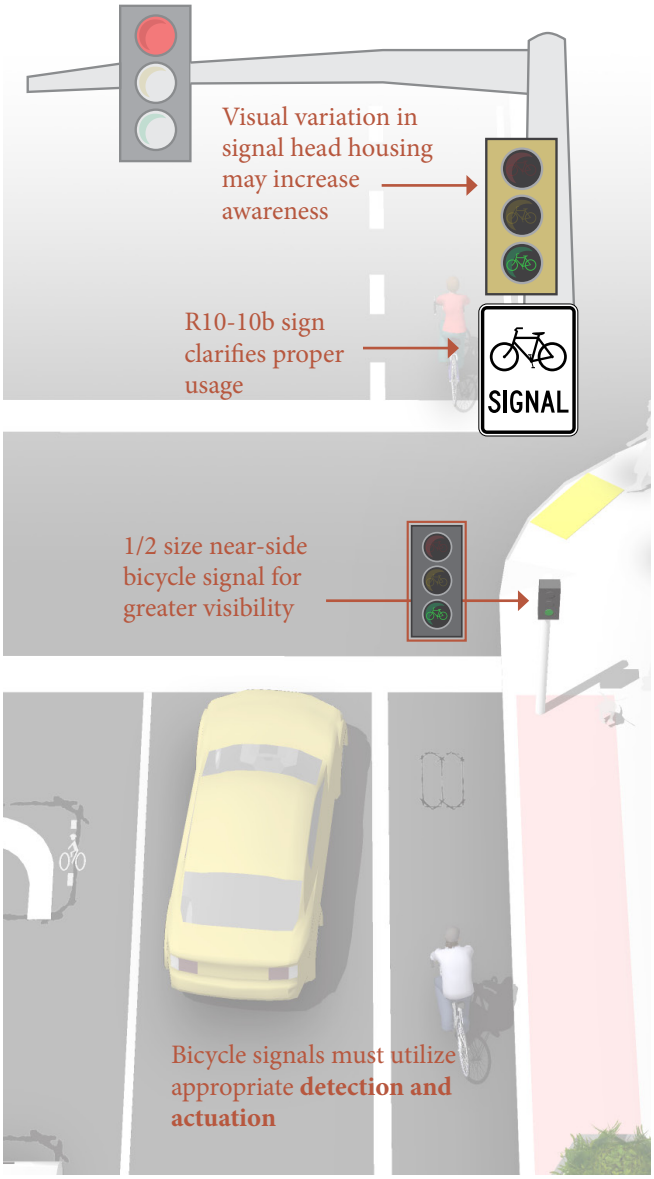
Signal detection and actuation for bicyclists should be maintained with other traffic signal detection and roadway pavement markings.

Bicycle Signal Heads

Description

A bicycle signal is an electrically powered traffic control device that should only be used in combination with an existing traffic signal. Bicycle signals are typically used to improve identified safety or operational problems involving bicycle facilities. Bicycle signal heads may be installed at signalized intersections to indicate bicycle signal phases and other bicycle-specific timing strategies. Bicycle signals can be actuated with bicycle sensitive loop detectors, video detection, or push buttons.

Bicycle signals are typically used to provide guidance for bicyclists at intersections where they may have different needs from other road users (e.g., bicycle-only movements).



Guidance

Specific locations where bicycle signals have had a demonstrated positive effect include:

- Those with high volume of bicyclists at peak hours
- Those with high numbers of bicycle/motor vehicle crashes, especially those caused by turning vehicle movements
- At T-intersections with major bicycle movement along the top of the "T."
- At the confluence of an off-street bike path and a roadway intersection
- Where separated bike paths run parallel to arterial streets

Discussion

Local municipal code should be checked or modified to clarify that at intersections with bicycle signals, bicyclists should only obey the bicycle signal heads. For improved visibility, smaller (4 inch lens) near-sided bicycle signals should be considered to supplement far-side signals.

Additional References and Guidelines

FHWA. *MUTCD - Interim Approval for Optional Use of a Bicycle Signal Face (IA-16).* 2013.

NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Bicycle signal heads require the same maintenance as standard traffic signal heads, such as replacing bulbs and responding to power outages.

SHARED USE PATHS

A shared use path allows for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. These facilities are frequently found in parks, along rivers, beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles. Path facilities can also include amenities such as lighting, signage, and fencing (where appropriate).

Key features of shared use paths include:

- Frequent access points from the local road network.
- Directional signs to direct users to and from the path.
- A limited number of at-grade crossings with streets or driveways.
- Terminating the path where it is easily accessible to and from the street system.
- Separate treads for pedestrians and bicyclists when heavy use is expected.


General Design Practices


Shared Use Paths in River and Utility Corridors


Shared Use Paths in Abandoned Rail Corridors


Local Neighborhood Accessways

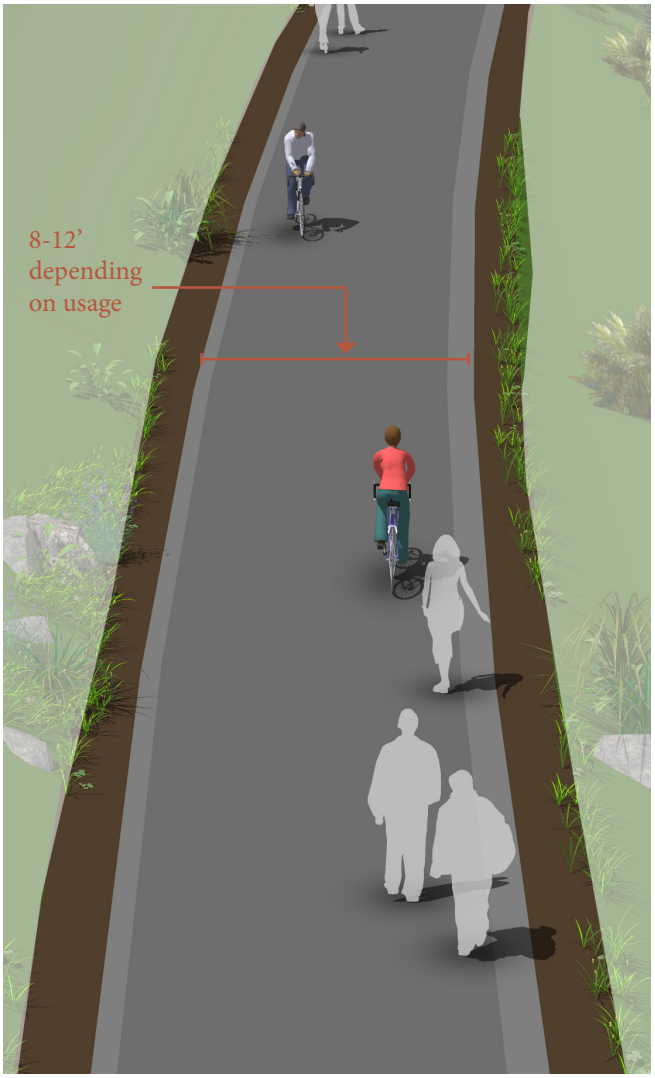

Shared Use Paths Along Roadways


Natural Surface Shared Use Paths

General Design Practices

Description

Shared use paths can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle paths should generally provide directional travel opportunities not provided by existing roadways.



Guidance

Width

- 8 feet is the minimum allowed for a two-way bicycle path and is only recommended for low traffic situations.
- 10 feet is recommended in most situations and will be adequate for moderate to heavy use.
- 12 feet is recommended for heavy use situations with high concentrations of multiple users. A separate track (5' minimum) can be provided for pedestrian use.

Lateral Clearance

- A 2 foot or greater shoulder on both sides of the path should be provided. An additional foot of lateral clearance (total of 3') is required by the MUTCD for the installation of signage or other furnishings.
- If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

Overhead Clearance

- Clearance to overhead obstructions should be 8 feet minimum, with 10 feet recommended.

Striping

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

Discussion

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

Additional References and Guidelines

Roaring Fork Transportation Authority. Rail Corridor and Trails Rules and Regulations. Undated.
AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
Flink, C. *Greenways: A Guide To Planning Design And Development.* 1993.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Shared Use Paths in River and Utility Corridors

Description

Utility and waterway corridors often offer excellent shared use path development and bikeway gap closure opportunities. Utility corridors typically include powerline and sewer corridors, while waterway corridors include canals, drainage ditches, rivers, and beaches. These corridors offer excellent transportation and recreation opportunities for bicyclists of all ages and skills.

Guidance

Shared use paths in utility corridors should meet or exceed general design practices. If additional width allows, wider paths, and landscaping are desirable.

Access Points

Any access point to the path should be well-defined with appropriate signage designating the pathway as a bicycle facility and prohibiting motor vehicles.

Path Closure

Public access to the shared use path may be prohibited during the following events:

- Canal/flood control channel or other utility maintenance activities
- Inclement weather or the prediction of storm conditions

Discussion

Similar to railroads, public access to flood control channels or canals may be undesirable. Hazardous materials, deep water or swift current, steep, slippery slopes, and debris all may constitute risks for public access. Appropriate fencing may be desired to keep path users within the designated travel way. Creative design of fencing is encouraged to make the path facility feel welcoming to the user.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.

FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

Flink, C. *Greenways: A Guide To Planning Design And Development.* 1993.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Shared Use Paths in Abandoned Rail Corridors

Description

Commonly referred to as Rails-to-Trails or Rail-Trail, these projects convert vacated rail corridors into off-street, shared use paths. Rail corridors offer several advantages, including relatively direct routes between major destinations and generally flat terrain.

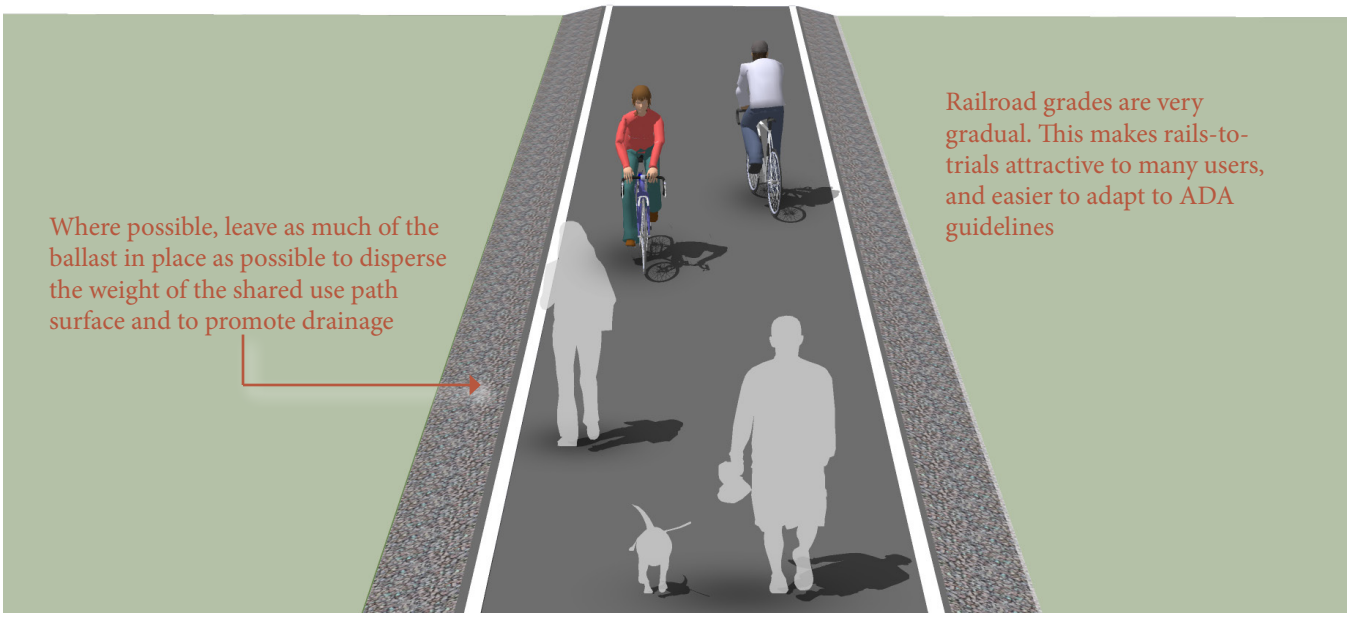
In some cases, rail owners may rail-bank their corridors as an alternative to a complete abandonment of the line, thus preserving the rail corridor for possible future use.

The railroad may form an agreement with any person, public or private, who would like to use the banked rail line as a shared use path or linear park until it is again needed for rail use. Municipalities should acquire abandoned rail rights-of-way whenever possible to preserve the opportunity for shared use path development.

Guidance

Shared use paths in abandoned rail corridors should meet or exceed general design practices. If additional width allows, wider paths, and landscaping are desirable.

In full conversions of abandoned rail corridors, the sub-base, superstructure, drainage, bridges, and crossings are already established. Design becomes a matter of working with the existing infrastructure to meet the needs of a rail-trail, or shared use path.



Discussion

It is often impractical and costly to add material to existing railroad bed fill slopes. This results in shared use paths that meet minimum path widths, but often lack preferred shoulder and lateral clearance widths.

Rail-to-Trails can involve many challenges including the acquisition of the right of way, cleanup and removal of toxic substances, and rehabilitation of tunnels, trestles and culverts. A structural engineer should evaluate existing railroad bridges for structural integrity to ensure they are capable of carrying the appropriate design loads.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
Flink, C. *Greenways: A Guide To Planning Design And Development.* 1993.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Local Neighborhood Accessways

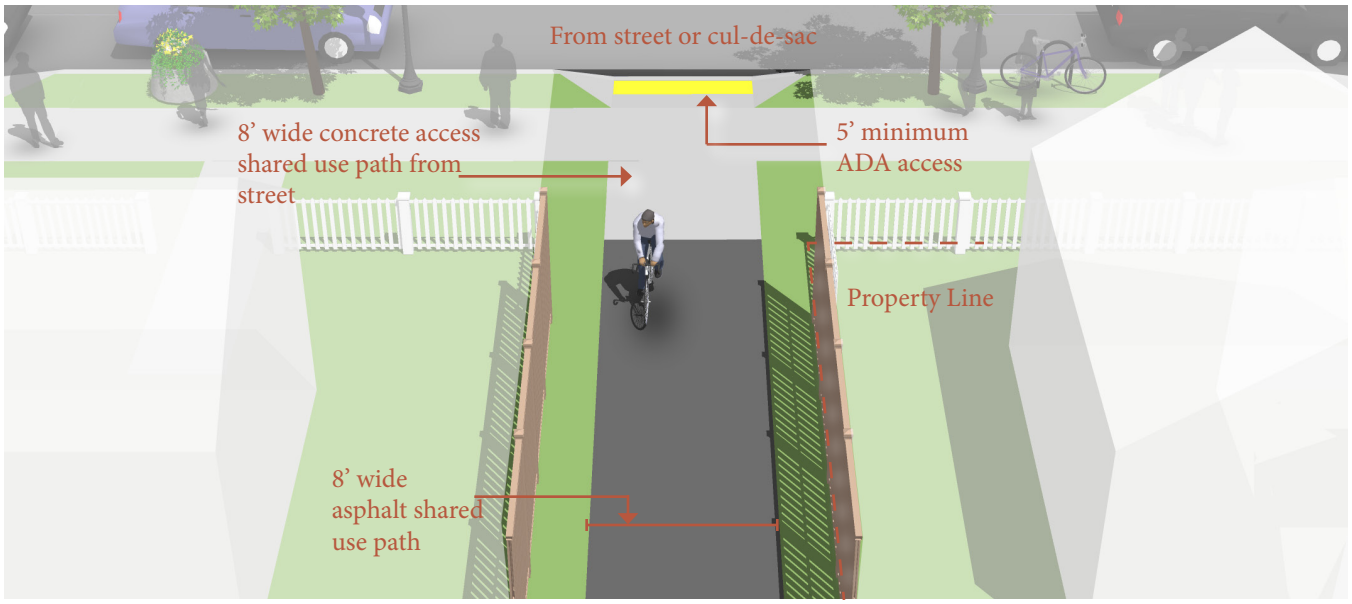
Description

Neighborhood accessways provide residential areas with direct bicycle and pedestrian access to parks, shared use paths, greenspaces, and other recreational areas. They most often serve as small shared use path connections to and from the larger shared use path network, typically having their own rights-of-way and easements.

Additionally, these smaller shared use paths can be used to provide bicycle and pedestrian connections between dead-end streets, cul-de-sacs, and access to nearby destinations not provided by the street network.

Guidance

- Neighborhood accessways should remain open to the public.
- Shared use path pavement shall be at least 8' wide to accommodate emergency and maintenance vehicles, meet ADA requirements and be considered suitable for multi-use.
- Shared use path widths should be designed to be less than 8' wide only when necessary to protect large mature native trees over 18" in caliper, wetlands or other ecologically sensitive areas.
- Access paths should slightly meander whenever possible.



Discussion

Neighborhood accessways should be designed into new subdivisions at every opportunity and should be required by City/County subdivision regulations.

For existing subdivisions, Neighborhood and homeowner association groups are encouraged to identify locations where such connects would be desirable. Nearby residents and adjacent property owners should be invited to provide landscape design input.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
FHWA. *University Course on Bicycle and Pedestrian Transportation. Lesson 19: Greenways and Shared Use Paths.* 2006.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Shared Use Paths Along Roadways

Description

Shared Use Paths along roadways, also called Sidepaths, are a type of path that run adjacent to a street.

Because of operational concerns it is generally preferable to place paths within independent rights-of-way away from roadways. However, there are situations where existing roads provide the only corridors available.

Along roadways, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding where bicyclists enter or leave the path.

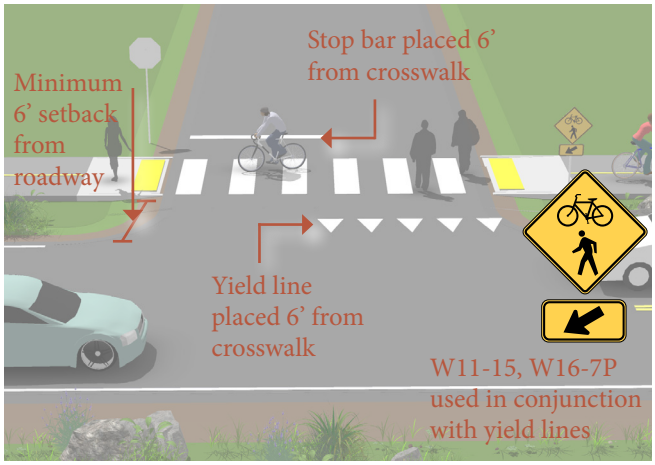
The AASHTO Guide for the Development of Bicycle Facilities cautions practitioners of the use of two-way sidepaths on urban or suburban streets with many driveways and street crossings.

In general, there are two approaches to crossings: adjacent crossings and setback crossings, illustrated below.

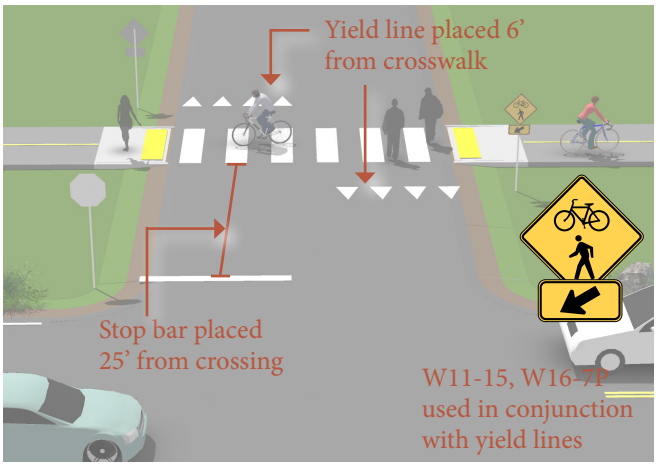
Guidance

- Guidance for sidepaths should follow that for general design practises of shared use paths.
- A high number of driveway crossings and intersections create potential conflicts with turning traffic. Consider alternatives to sidepaths on streets with a high frequency of intersections or heavily used driveways.
- Where a sidepath terminates special consideration should be given to transitions so as not to encourage unsafe wrong-way riding by bicyclists.
- Crossing design should emphasize visibility of users and clarity of expected yielding behavior. Crossings may be STOP or YIELD controlled depending on sight lines and bicycle motor vehicle volumes and speeds.

Adjacent Crossing - A separation of 6 feet emphasizes the conspicuity of riders at the approach to the crossing.



Setback Crossing - A set back of 25 feet separates the path crossing from merging/turning movements that may be competing for a driver's attention.



Discussion

The provision of a shared use path adjacent to a road is not a substitute for the provision of on-road accommodation such as paved shoulders or bike lanes, but may be considered in some locations in addition to on-road bicycle facilities.

To reduce potential conflicts in some situations, it may be better to place one-way sidepaths on both sides of the street.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
NACTO. *Urban Bikeway Design Guide.* See entry on Raised Cycle Tracks. 2012.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Natural Surface Shared Use Paths

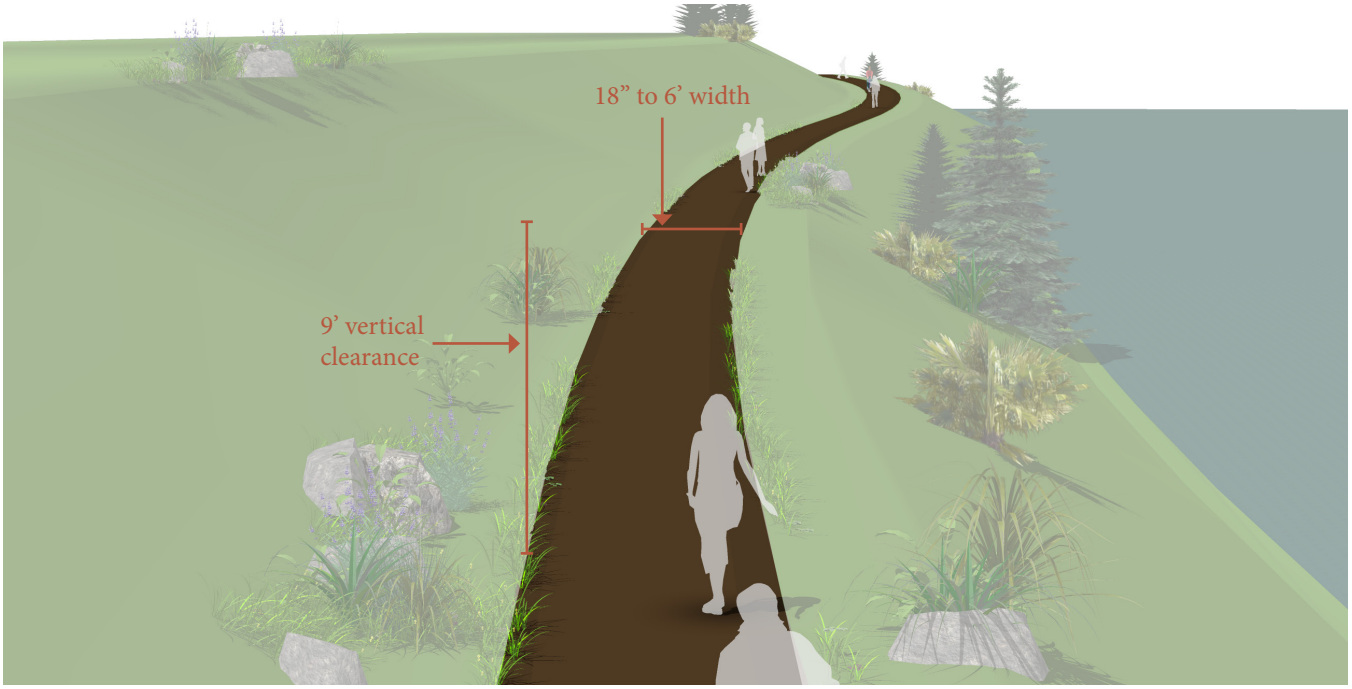
Description

Sometimes referred to as footpaths or hiking trails, the natural surface shared use path is used along corridors that are environmentally-sensitive but can support bare earth, wood chip, or boardwalk shared use paths. Natural surface shared use paths are a low-impact solution and found in areas with limited development or where a more primitive experience is desired.

Guidance presented in this section does not include considerations for bicycles. Natural surface shared use paths designed for bicycles are typically known as single track shared use paths.

Guidance

- Shared use paths can vary in width from 18 inches to 6 feet or greater; vertical clearance should be maintained at nine-feet above grade.
- Base preparation varies from machine-worked surfaces to those worn only by usage.
- Natural Surface Shared use path's can be made of dirt, rock, soil, forest litter, or other native materials. Some shared use paths use crushed stone (a.k.a. "crush and run") that contains about 4% fines by weight, and compacts with use.
- Provide positive drainage for shared use path tread without extensive removal of existing vegetation; maximum slope is five percent (typical).



Discussion

Shared use path erosion control measures include edging along the low side of the shared use path, steps and terraces to contain surface material, and water bars to direct surface water off the shared use path; use bedrock surface where possible to reduce erosion.

Additional References and Guidelines

Flink, C. *Greenways: A Guide To Planning Design And Development.* 1993.

Materials and Maintenance

Consider implications for accessibility when weighing options for surface treatments.

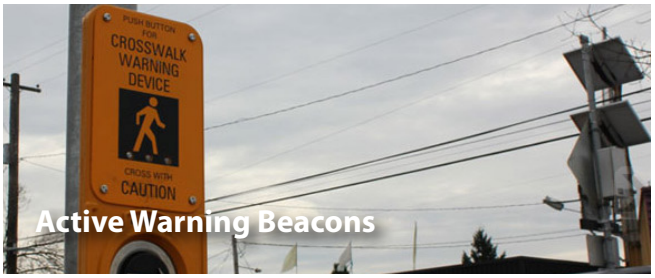
SHARED USE PATH/ROADWAY CROSSINGS

At-grade roadway crossings can create potential conflicts between path users and motorists, however, well-designed crossings can mitigate many operational issues and provide a higher degree of safety and comfort for path users. This is evidenced by the thousands of successful facilities around the United States with at-grade crossings. In most cases, at-grade path crossings can be properly designed to provide a reasonable degree of safety and can meet existing traffic and safety standards. Path facilities that cater to bicyclists can require additional considerations due to the higher travel speed of bicyclists versus pedestrians.

Consideration must be given to adequate warning distance based on vehicle speeds and line of sight, with the visibility of any signs absolutely critical. Directing the active attention of motorists to roadway signs may require additional alerting devices such as a flashing beacon, roadway striping or changes in pavement texture. Signing for path users may include a standard "STOP" or "YIELD" sign and pavement markings, possibly combined with other features such as bollards or a bend in the pathway to slow bicyclists. Care must be taken not to place too many signs at crossings lest they begin to lose their visual impact.

A number of striping patterns have emerged over the years to delineate path crossings. A median stripe on the path approach will help to organize and warn path users. Crosswalk striping is typically a matter of local and State preference, and may be accompanied by pavement treatments to help warn and slow motorists. In areas where motorists do not typically yield to crosswalk users, additional measures may be required to increase compliance.


Marked/Unsignalized Crossings



Active Warning Beacons


Route Users to Existing Signals


Signalized/Controlled Crossings

Undercrossings


Overcrossings

Marked/Unsignalized Crossings

Description

A marked/unsignalized crossing typically consists of a marked crossing area, signage and other markings to slow or stop traffic. The approach to designing crossings at mid-block locations depends on an evaluation of vehicular traffic, line of sight, pathway traffic, use patterns, vehicle speed, road type, road width, and other safety issues such as proximity to major attractions.

When space is available, using a median refuge island can improve user safety by providing pedestrians and bicyclists space to perform the safe crossing of one side of the street at a time.

Guidance

Maximum traffic volumes

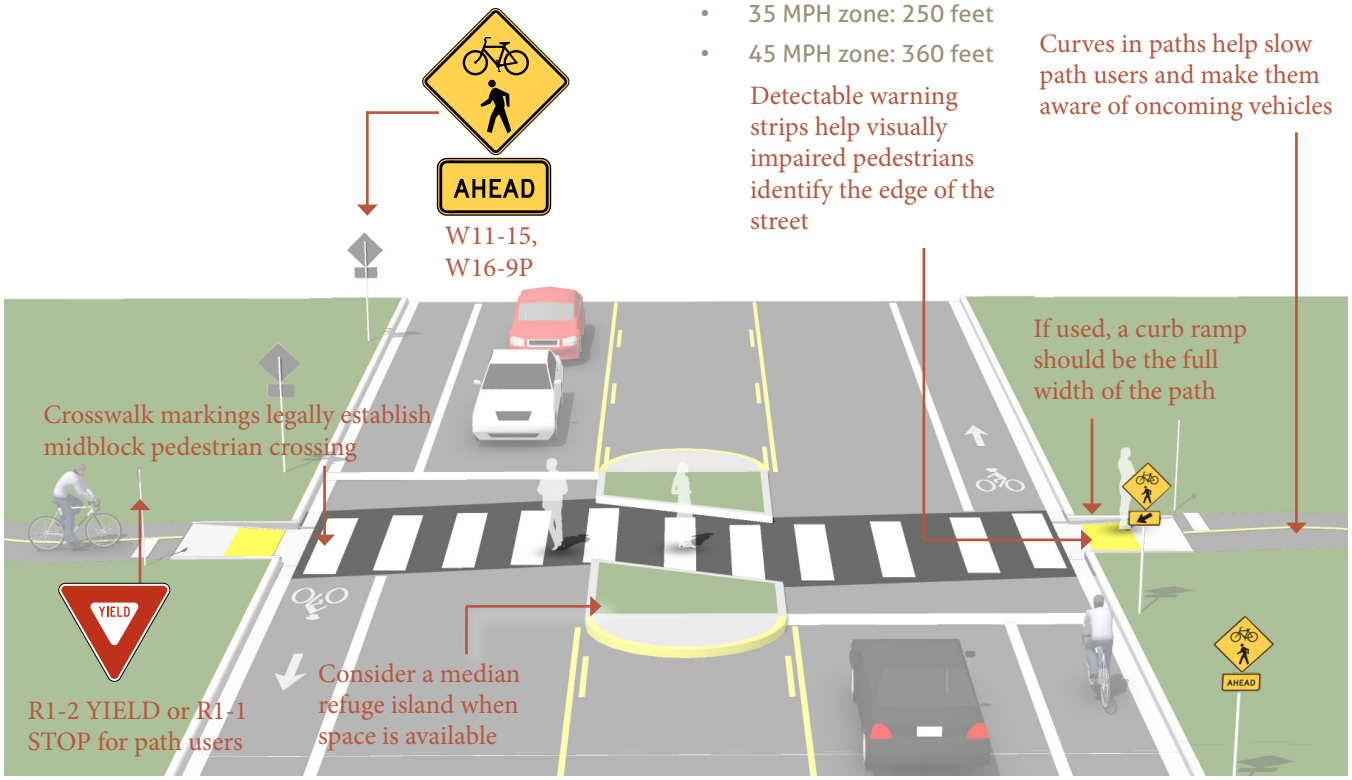
- ≤9,000-12,000 Average Daily Traffic (ADT) volume
- Up to 15,000 ADT on two-lane roads, preferably with a median
- Up to 12,000 ADT on four-lane roads with median

Maximum travel speed

- 35 MPH

Minimum line of sight

- 25 MPH zone: 155 feet
- 35 MPH zone: 250 feet
- 45 MPH zone: 360 feet



Discussion

Unsignalized crossings of multi-lane arterials over 15,000 ADT may be possible with features such as sufficient crossing gaps (more than 60 per hour), median refuges, and/or active warning devices like rectangular rapid flash beacons or in-pavement flashers, and excellent sight distance. For more information see the discussion of active warning beacons.

On roadways with low to moderate traffic volumes (<12,000 ADT) and a need to control traffic speeds, a raised crosswalk may be the most appropriate crossing design to improve pedestrian visibility and safety.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

Materials and Maintenance

Locate markings out of wheel tread when possible to minimize wear and maintenance costs.

Active Warning Beacons

Description

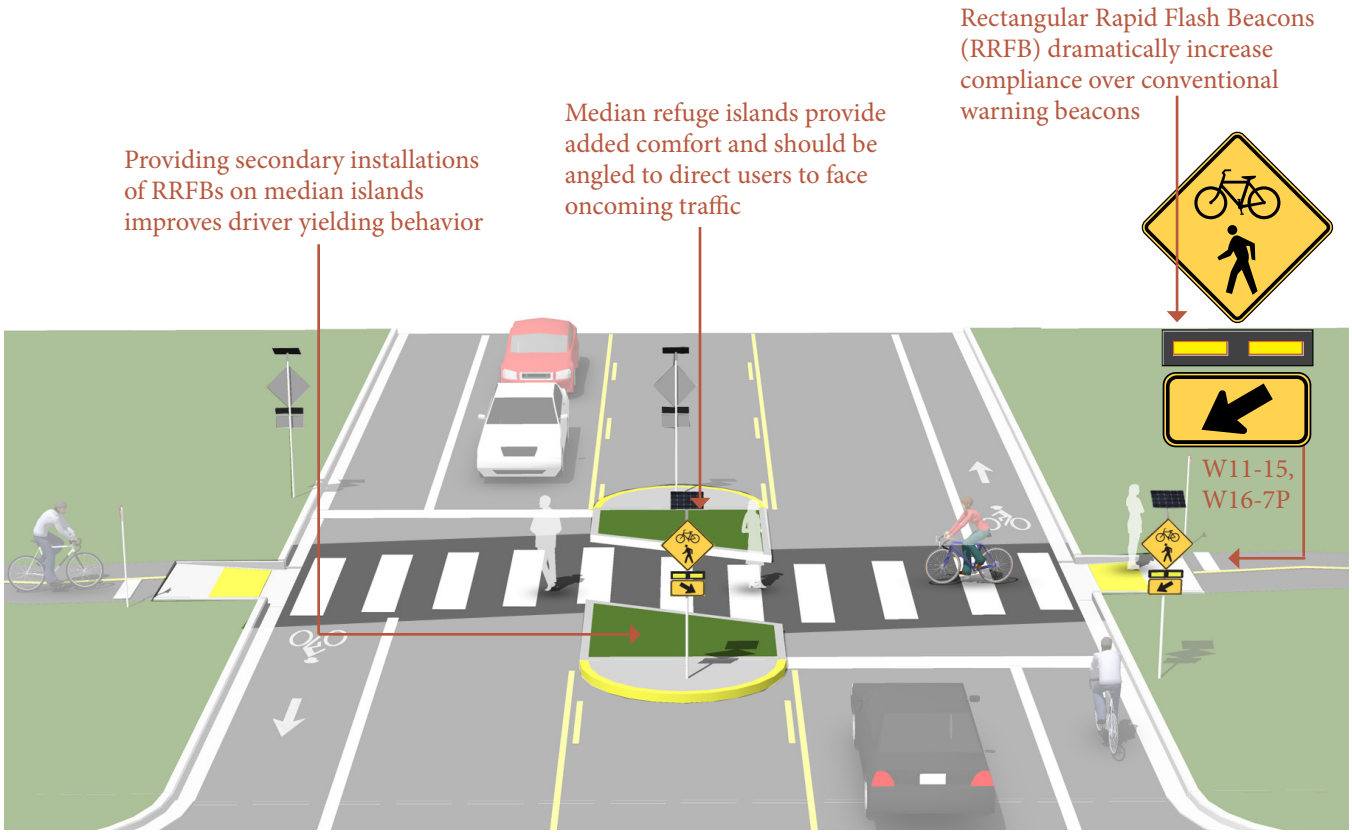
Enhanced marked crossings are unsignalized crossings with additional treatments designed to increase motor vehicle yielding compliance on multi-lane or high volume roadways.

These enhancements include pathway user or sensor actuated warning beacons, Rectangular Rapid Flash Beacons (RRFB) shown below, or in-roadway warning lights.

Guidance

Guidance for marked/unsignalized crossings applies.

- Warning beacons shall not be used at crosswalks controlled by YIELD signs, STOP signs, or traffic control signals.
- Warning beacons shall initiate operation based on user actuation and shall cease operation at a predetermined time after the user actuation or, with passive detection, after the user clears the crosswalk.



Discussion

Rectangular rapid flash beacons show the most increased compliance of all the warning beacon enhancement options.

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

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
FHWA. *MUTCD - Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11).* 2008.

Materials and Maintenance

Locate markings out of wheel tread when possible to minimize wear and maintenance costs. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

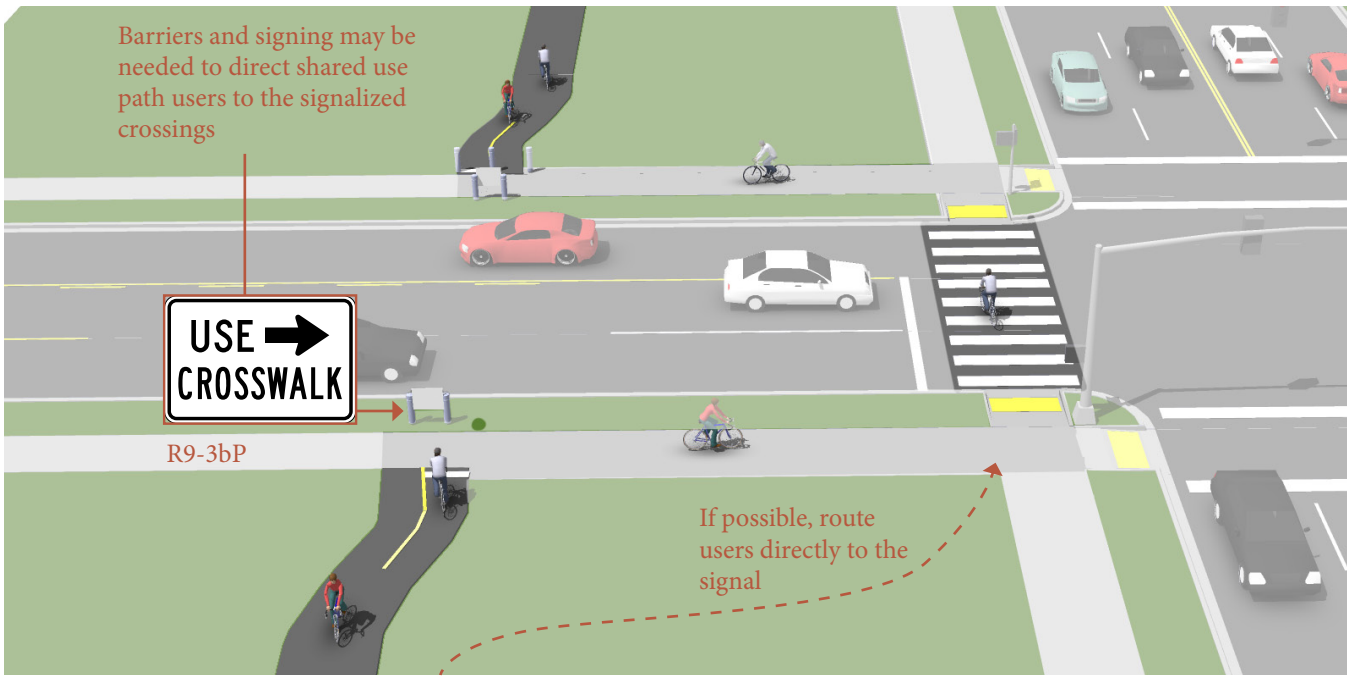
Route Users to Signalized Crossings

Description

Path crossings within approximately 400 feet of an existing signalized intersection with pedestrian crosswalks are typically diverted to the signalized intersection to avoid traffic operation problems when located so close to an existing signal. For this restriction to be effective, barriers and signing may be needed to direct path users to the signalized crossing. If no pedestrian crossing exists at the signal, modifications should be made.

Guidance

Path crossings should not be provided within approximately 400 feet of an existing signalized intersection. If possible, route path directly to the signal.



Discussion

In the US, the minimum distance a marked crossing can be from an existing signalized intersection varies from approximately 250 to 660 feet. Engineering judgement and the context of the location should be taken into account when choosing the appropriate allowable setback. Pedestrians are particularly sensitive to out of direction travel and undesired mid-block crossing may become prevalent if the distance is too great.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

Materials and Maintenance

If a sidewalk is used for crossing access, it should be kept clear of snow and debris and the surface should be level for wheeled users.

Pedestrian Hybrid Beacon Crossings

Description

Pedestrian hybrid beacons provide a high level of comfort for crossing users through the use of a red-signal indication to stop conflicting motor vehicle traffic.

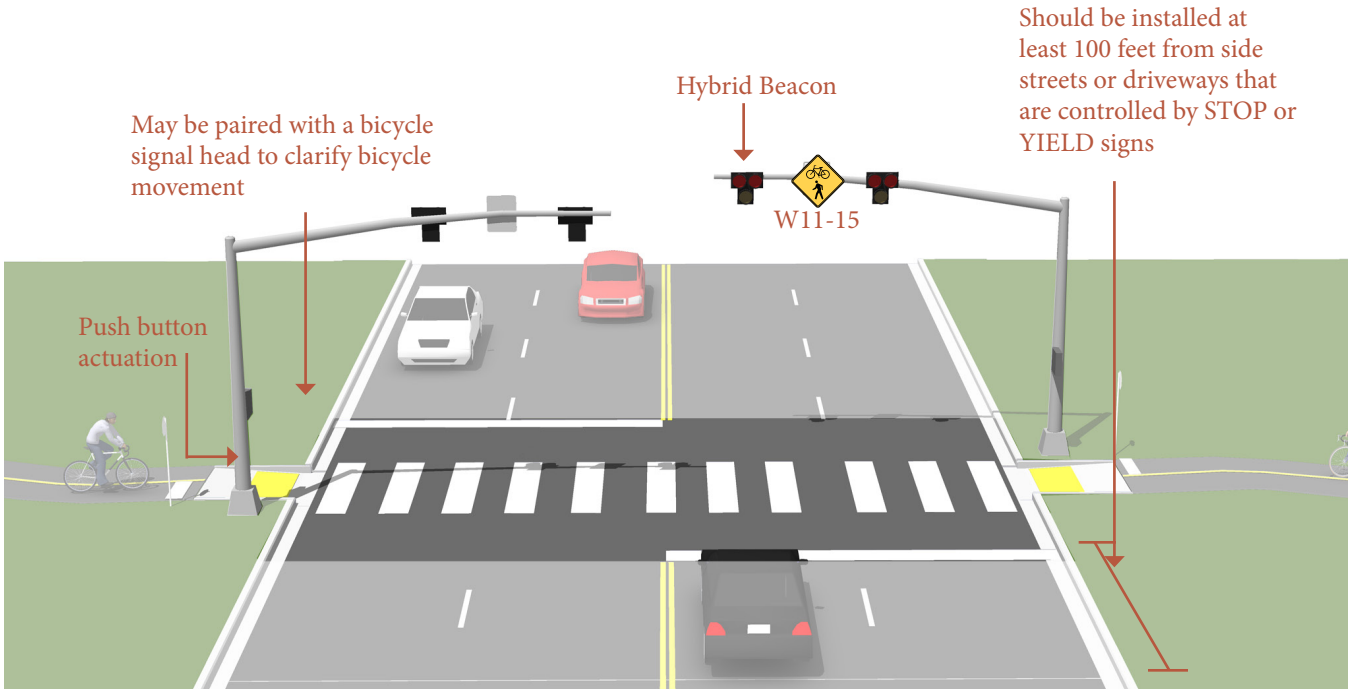
Hybrid beacon installation faces only cross motor vehicle traffic, stays dark when inactive, and uses a unique 'wig-wag' signal phase to indicate activation. Vehicles have the option to proceed after stopping during the final flashing red phase, which can reduce motor vehicle delay when compared to a full signal installation.

Guidance

Hybrid beacons (illustrated here) may be installed without meeting traffic signal control warrants if roadway speed and volumes are excessive for comfortable path crossings.

FHWA does not allow bicycle signals to be used with Hybrid beacons, though some cities have done so successfully.

To maximize safety when used for bicycle crossings, the flashing 'wig-wag' phase should be very short and occur after the pedestrian signal head has changed to a solid "DON'T WALK" indication as bicyclists can enter an intersection quickly.



Discussion

Shared use path signals are normally activated by push buttons but may also be triggered by embedded loop, infrared, microwave or video detectors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street.

Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity and safety.

Additional References and Guidelines

FHWA. *Pedestrian Hybrid Beacon Guide - Recommendations and Case Study.* 2014.
NACTO. *Urban Bikeway Design Guide.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

Materials and Maintenance

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

Full Traffic Signal Crossings

Description

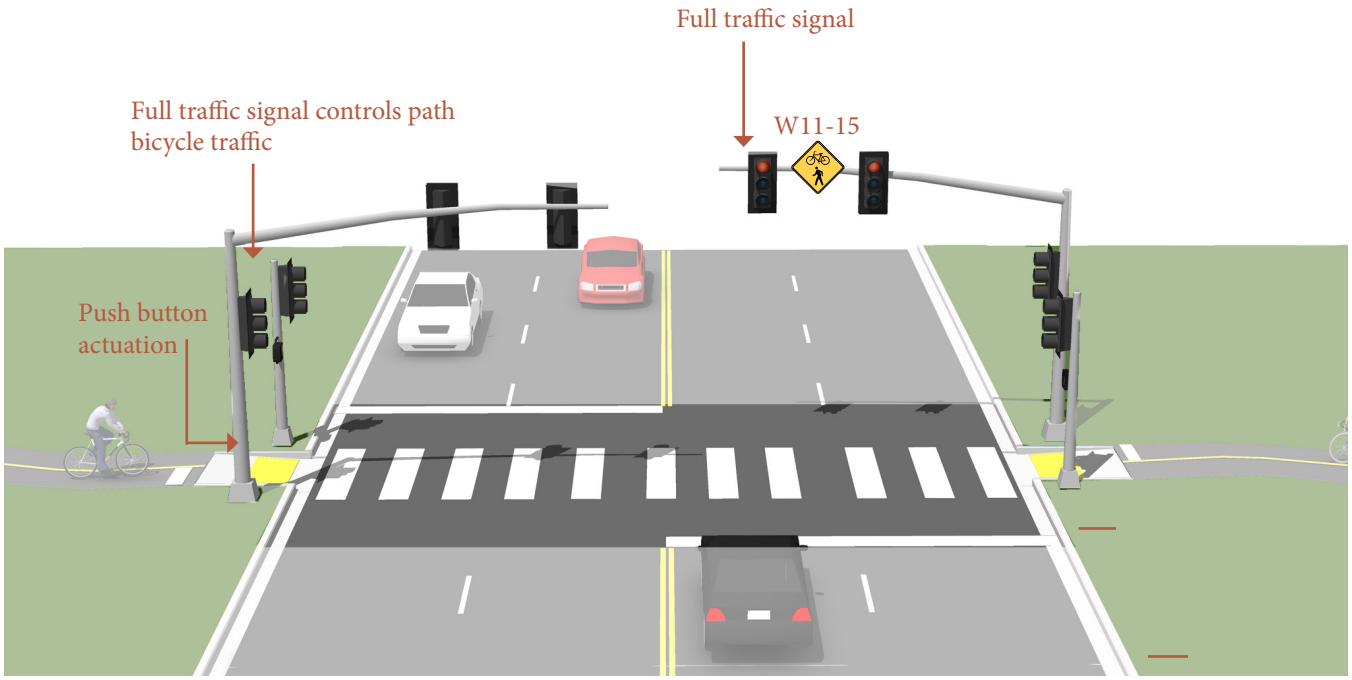
Signalized crossings provide the most protection for crossing path users through the use of a red-signal indication to stop conflicting motor vehicle traffic.

A full traffic signal installation treats the path crossing as a conventional 4-way intersection and provides standard red-yellow-green traffic signal heads for all legs of the intersection.

Guidance

Full traffic signal installations must meet MUTCD pedestrian, school or modified warrants. Additional guidance for signalized crossings:

- Located more than 300 feet from an existing signalized intersection
- Roadway travel speeds of 40 MPH and above
- Roadway ADT exceeds 15,000 vehicles



Discussion

Shared use path signals are normally activated by push buttons but may also be triggered by embedded loop, infrared, microwave or video detectors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street. Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity and safety.

Additional References and Guidelines

FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Traffic signals require routine maintenance. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

Undercrossings

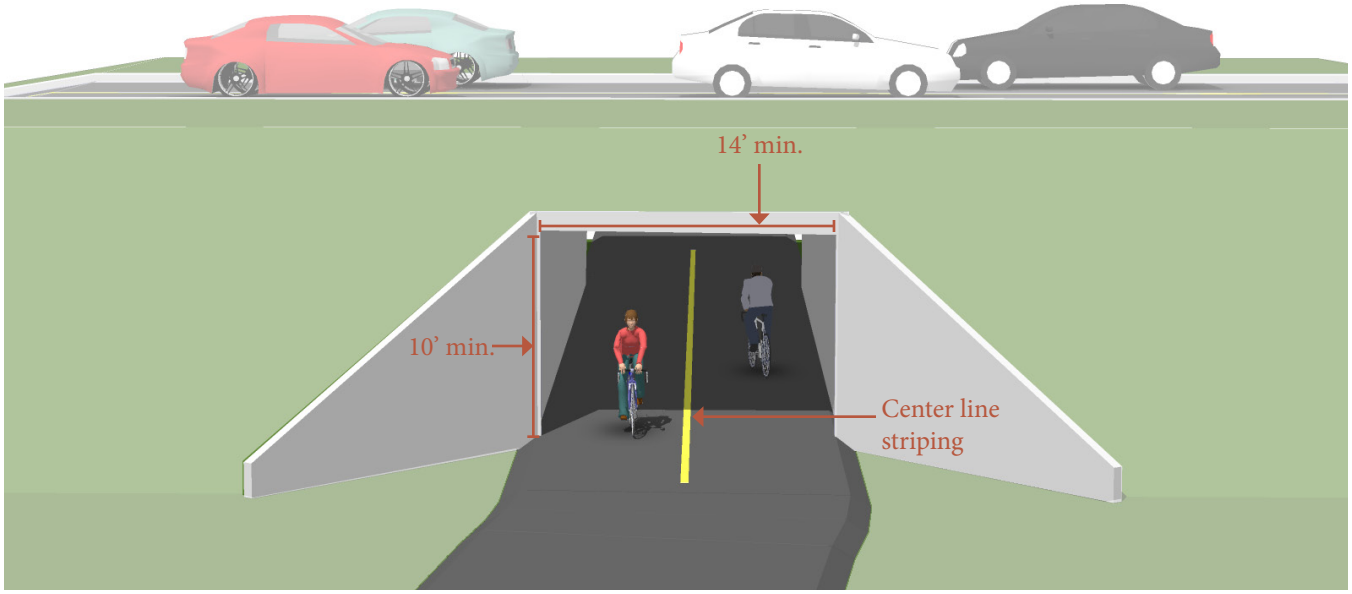
Description

Bicycle/pedestrian undercrossings provide critical non-motorized system links by joining areas separated by barriers such as railroads and highway corridors. In most cases, these structures are built in response to user demand for safe crossings where they previously did not exist.

There are no minimum roadway characteristics for considering grade separation. Depending on the type of facility or the desired user group grade separation may be considered in many types of projects.

Guidance

- 14 foot minimum width, greater widths preferred for lengths over 60 feet.
- 10 foot minimum height.
- The undercrossing should have a centerline stripe even if the rest of the path does not have one.
- Lighting should be considered during the design process for any undercrossing with high anticipated use or in culverts and tunnels.



Discussion

Safety is a major concern with undercrossings. Shared use path users may be temporarily out of sight from public view and may experience poor visibility themselves. To mitigate safety concerns, an undercrossing should be designed to be spacious, well-lit, equipped with emergency cell phones at each end and completely visible for its entire length from end to end.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

Materials and Maintenance

14 foot width allows for maintenance vehicle access.

Potential problems include conflicts with utilities, drainage, flood control and vandalism.

Overcrossings

Description

Bicycle/pedestrian overcrossings provide critical non-motorized system links by joining areas separated by barriers such as deep canyons, waterways or major transportation corridors. In most cases, these structures are built in response to user demand for safe crossings where they previously did not exist.

There are no minimum roadway characteristics for considering grade separation. Depending on the type of facility or the desired user group grade separation may be considered in many types of projects.

Overcrossings require a minimum of 17 feet of vertical clearance to the roadway below versus a minimum elevation differential of around 12 feet for an undercrossing. This results in potentially greater elevation differences and much longer ramps for bicycles and pedestrians to negotiate.

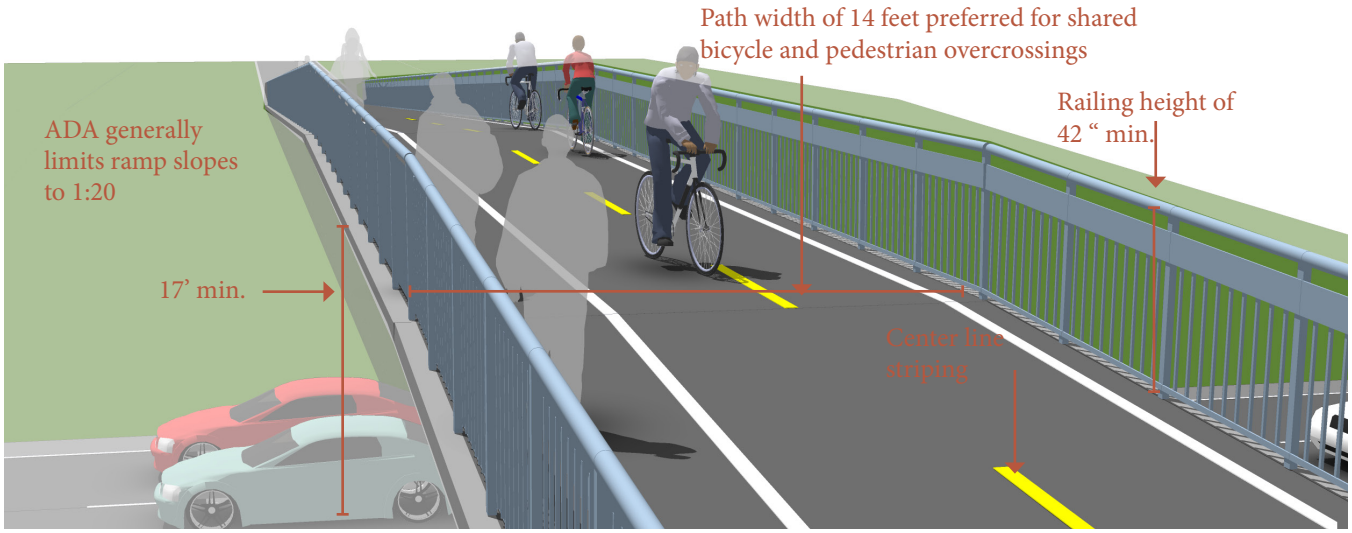
Guidance

8 foot minimum width, 14 feet preferred. If overcrossing has any scenic vistas additional width should be provided to allow for stopping. A separate 5 foot pedestrian area may be provided for facilities with high bicycle and pedestrian use.

10 foot headroom on overcrossing; clearance below will vary depending on feature being crossed.

Roadway:	17	feet
Freeway:	18.5	feet
Heavy Rail Line:	23 feet	

The overcrossing should have a centerline stripe even if the rest of the path does not have one.



Discussion

Overcrossings for bicycles and pedestrians typically fall under the Americans with Disabilities Act (ADA), which strictly limits ramp slopes to 5% (1:20) with landings at 400 foot intervals, or 8.33% (1:12) with landings every 30 feet.

Overcrossings pose potential concerns about visual impact and functional appeal, as well as space requirements necessary to meet ADA guidelines for slope.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

Materials and Maintenance

Potential issues with vandalism.

Overcrossings can be more difficult to clear of snow than undercrossings.

C Public Involvement

CHAPTER CONTENTS

PUBLIC INVOLVEMENT

Introduction

The following outlines the public involvement and outreach strategy developed for the Glenwood Springs Long Range Transportation Master Plan process. The public involvement and outreach strategy identified outreach methods, participants, dates, formats, and purposes for each meeting. The Public Involvement (PI) Plan was developed by Alta and included input from the Internal Review Team (IRT). The public outreach approach was designed to accommodate multiple methods of public involvement and encourage cooperation among agency stakeholders, community members, and public officials. The plan's goal was to facilitate a shared vision of the transportation system and programs in Glenwood Springs, as community endorsement of another Long Range Transportation Master Plan (multi-modal master plan) is critical to the long-term success of the resulting system and programs as well as of the ability of the City of Glenwood Springs to implement the plan. Strategies used to engage the agencies, stakeholders, and general public in the Long Range Transportation Master Planning process included:

1. Internal Review Team,
2. Stakeholder meetings,
3. Public/community workshops,
4. Website/survey/interactive mapping
5. Planning Commission and City Council workshops and presentations.

Outreach Method 1: Internal Review Team

Alta met with the Internal Review Team (IRT) approximately once a month throughout the master planning process to collect information, review technical data, discuss schedule and progress, develop project vision and goals, and aid in the development of criteria for ranking recommendations.

Roles

City Staff – Developed IRT participant list, sent meeting invitations, scheduled rooms/locations

Alta Team – Scheduled meetings with City, prepared meeting discussion and minutes

IRT Meetings

July 16 and 17, 2014 (Glenwood):

- Kickoff meeting in Glenwood Springs (included field work with City Staff)

August 6, 2014 (call/webinar):

- Existing conditions review, project coordination
- Preparation for public event/meeting #1

August 20, 2014 (call/webinar):

- Project coordination, reviewed agenda and materials for public event/meeting #1

September 2 and 4, 2014 (Glenwood):

- Public event/meeting #1
- City Council study session
- Vision and Goals working meeting (Alta and Staff)

September 17, 2014 (call/webinar):

- Discussion of public involvement and when to meet with City Council to discuss background and existing conditions
- Discussion of draft project prioritization criteria
- Discussion of infographic for economic and health benefits of bicycling and walking

October 1, 15 and 29, 2014 (call/webinar):

- Project coordination
- Needs assessment discussion
- Discussed of draft project prioritization criteria
- Discussed wikimap
- Reviewed commission's (Transportation and River) input on the project needs assessment list
- Commission's thought criteria should be weighted
- Need to get another public meeting for recommendations (farmer's market was a big success)
- Simplify criteria descriptions

November 19, 2014 (call/webinar):

- Final comments for existing conditions report
- Reviewed City Council agenda and presentation
- Coordinated programs and education strategies
- Reviewed updated needs assessment list

December 3 and 17, 2014 (call/webinar):

- Programs and education strategies call with Kristen and Jessica
- Discussed ideas developed in programs memo
- Reviewed updated needs assessment list
- Discussed content of upcoming wayfinding and signage framework memo

January 14, 28, 2015 (call/webinar):

- Discussed final content for programs and education chapter
- Reviewed wayfinding and signage framework memo
- Discussed minor edits on design guidelines
- Need to reduce and refine number of projects on needs assessment list
- Discussed maintenance costs memo - city to provide background information
- Discussed project cost estimating and when this should begin

February 11 and 25, 2015 (call/webinar):

- City decided to have the commissions prioritize all projects
- Cost estimates will be done after public meeting and project prioritization
- Discussed public meeting dates?
- Schedule for overall project shifted based on extensive involvement with commissions and PMT

March 11 and 25, 2015 (call/commissions meeting in Glenwood):

- Preparation and coordination for Project prioritization meeting
- Discussed wayfinding framework memo
- Discussed maintenance memo - City to provide background information
- Discussed dates for next public meeting
- Reviewed ground rules for commission's meeting
- Prepared and participated in project prioritization meeting in Glenwood Springs with commission's

April 15, 2015 (Glenwood):

- Project coordination and discussion of project prioritization meeting
- Discussed development of wayfinding design scope of work to implement priority routes identified in framework plan

May 20, 2015 (call/webinar):

- Discussed project schedule and completion dates
- Discussed cost estimates and the approach to this facet of the project
- Discussed maintenance memo - City to provide background information before Alta is to get started
- Discussed Draft and Final Plan submission Dates

Outreach Method 2: Stakeholder Meetings

Stakeholder meetings gathered input from critical groups and organizations within the City that have close ties to the transportation community (and therefore were able to provide information otherwise not acquired), were underrepresented populations within the City, were critical components to implementing the plan, or were most impacted by plan results and improvements. The stakeholders list was developed by the City in coordination with the Alta Team and included Colorado Mountain College, Law Enforcement Personnel, Neighborhood Organizations, School District, Downtown Development Authority, and River and Transportation Commissions. The Alta team and City staff met with numerous groups of stakeholders throughout the project.

Roles

City Staff – Developed stakeholder list, sent meeting invitations, scheduled rooms/locations and met with key stakeholders

Alta Team – Scheduled meetings with City, prepared meeting discussion and minutes

Stakeholder Meetings

- Kick-off meeting with commission's
- Vision and Goals meeting with commission's
- Background and existing conditions meeting with council and commission's
- School District meetings

The project team discusses existing conditions and the needs assessment list with the Transportation and River Commission's

Glenwood's Downtown Market public event

Outreach Method 3: Public/Community Workshops/Events

The Alta team prepared materials and facilitated two public workshops. The first workshop was open house style and was held at Glenwood's Downtown Market (Centennial Park). Alta and City staff managed the booth and received comments from over 75 community members.

Farmer's Market Event #1

The September 2nd meeting was held at Glenwood's Downtown Farmer's Market to encourage participation from a variety of demographics within the local community and visitors alike, with the goal of getting input from a wider range of potential Glenwood Springs users. The event was designed to allow the public to provide input on the gaps in the existing system, identify desired destinations, help identify opportunities and constraints, and provide input for the needs & attitudes survey (same interface as online survey). The City of Glenwood Springs provided a high level of support for meeting logistics and prepared specific elements. The Alta team provided content and support for the preparation of notices for the open houses, including one flyer per open house/event and other minor items as necessary for the City to use in advertising the workshop.

Public Open House #1

The September 2nd public open house meeting was held at Glenwood's Recreation Center to allow community members another opportunity to provide input on the gaps in the existing system, identify desired destinations, help identify opportunities and constraints, and provide input for the needs & attitudes survey (same interface as online survey). The City of Glenwood Springs provided a high level of support for meeting logistics and prepared specific elements. The

Advertising

Advertising for the public workshops was coordinated by the City of Glenwood Springs with the Alta team's help. Possible advertising strategies included:

- Flyer distribution occurred at strategic locations and events around the City, as noted below. At venues that had a counter, stacks of flyers were placed for the public to take.
  - Glenwood's Downtown Market (Tuesday's 4-8 PM, Centennial Park)
  - Glenwood Springs City Offices
  - Libraries
  - Community Centers
  - Bike shops
  - Colorado Mountain College Student Centers
  - Cafes and Coffee Shops
  - Hotels
- E-mail notices were sent to key groups that could easily forward the notice to distribution lists they have access to, including:
  - IRT
  - Neighborhood Committees and Groups (coordinated through community contacts)
  - Chamber of Commerce and Downtown Development Authority
  - Colorado Mountain College
- Information was posted on the project website. Other agencies were encouraged to post notices on their own websites. Information were posted to the following sites:
  - City of Glenwood Springs
- The Alta team provided information/graphics to the City for the initial press release and article in the paper announcing the Long Range Transportation Master Plan process.

Roles

City Staff – Secured workshop locations, advertised meetings

Alta Team – Scheduled workshops with City, prepared advertisement flyer, prepared meeting boards, prepared meeting discussion topics and minutes

Outreach Method 4: Website/Survey/Interactive Mapping/Social Media

Communication materials, such as the project website, were essential tools in maintaining the dialogue regarding the status of the project among City staff, the project team, decision-makers, stakeholders and especially the public. The web page provided an outlet for the public and interested stakeholders to receive updated project information, review relevant documents, and review project materials. The web page allowed the project team to collect information from the public and access contact information. The project website contained key public involvement components including a gateway to the online user needs and attitudes survey and an interactive map where members of the public could contribute information on existing conditions and review project recommendations. The project website was launched at the beginning of August and remained live throughout the project.

Roles

City Staff – Reviewed website and provided content, as needed

Alta Team – Developed and launched website, updated and maintained website with new information throughout the project

Outreach Method 5: Planning Commission and City Council Work Sessions and Presentations

The Alta team attended three to four City Council and three Transportation and River Commission meetings (as necessary). At the meetings, the Alta team provided an overview presentation of the project process and resulting Draft Long Range Transportation Master Plan. During the project, the Alta team provided materials and information for two City-led work sessions with the City Council to update the Commissioners on the status and progress of the project and solicit input. The intent was to involve the City Council and the Commissioners throughout the length of the project so that the elected officials were given the opportunity to provide input and create buy-in. Additionally, the City Council and Commissioners were specifically invited to all of the public meetings outlined above to provide additional interaction and engagement.

Roles

City Staff – Led work sessions with Council and Transportation and River Commission's, participated in draft plan presentations to Council and the Transportation and River Commission's, coordinated presentation and work session scheduled with respective groups

Alta Team – Scheduled presentations with City, presented at up to two Transportation and River Commission's and three City Council meetings, prepared boards and materials.

Proposed Transportation and River Commission and City Council Presentations

September 4, 2014 (council study session) – Discussed project process/expectations and vision/goals with City Council. Led by City.

September 4, 2014 (Transportation and River commission study session) – Discussed project process/expectations and vision/goals with both commissions. Led by City.

August 6, 2014 – Presented the draft recommended multi-modal transportation network map and programmatic strategies.

September 2015 – Presentation of final plan to City Council and the Transportation and River Commission's

D Economic and Health Benefits

CHAPTER CONTENTS

ECONOMIC AND HEALTH BENEFITS

Introduction

While the recreational and environmental benefits of bike and pedestrian facilities are commonly recognized, these facilities also benefit the economy, public health and the larger transportation network. The following highlights compelling research into the benefits of bicycling and pedestrian facilities.

Economic Benefits

Investing in bicycling and walking stimulates the local economy by supporting local businesses, generating tourism revenue, and creating jobs:

$75.66
per month

People who travel to a business on a bike spend less per visit but visit a business more often, spending more money per month on average than those who drive.

$61.03
per month

Ten customers who arrive by bike fit in the parking space of one customer who arrives by car.

24% ↑

The average young person is driving 23% less, biking 24% more, and taking transit 40% more.

23% ↓

$21,038
vehicle cost savings/3 days

Bicycling saves money. In the 2014 Garfield County Clean Energy Bike and Walk to School Challenge, *participants saved $21,038 over three days* on vehicle costs, which included automobile wear, gasoline, and emissions expenses. Eight schools participated in the challenge.

Bicycle facilities promote tourism and encourage return visits in Colorado. *The total revenue from cycling tourists at resorts is between $141 million and $193 million.* Half of all summer visitors at Colorado ski resorts spend time bicycling; of those 699,000 people, 70 percent are from out of state.

Following the restriping project that was implemented along West 38th Avenue in Wheat Ridge, CO:

- Bicyclists counts increased 45%
- Pedestrians counts increased 38%
- Sales tax revenues increased 16% since 2011
- Average traffic speed along West 38th Avenue decreased from 42 to 36 mph.
- Traffic accidents decreased by 11%

HEALTH BENEFITS

Physical activity is a key health objective that can be advanced through a transportation system that supports safe bicycling and walking.

For every $1.00 invested in bicycle and pedestrian trails, there is a $3.00 cost savings in direct medical expenses for users.

2 Years Longer

An adult cyclist typically has a level of fitness equivalent to someone 10 years younger and a life expectancy two years longer than average.

10 Years Younger

Currently, 42% of adults in Garfield County are considered overweight and 21% are obese. 24% of children are overweight and 13% of children in Garfield County are obese.

In a study of Garfield County residents, the top concerns regarding physical activity in the community were: not making enough time for physical activity, and having limited access to active facilities.

Active Transportation: Pathway to Health

References

NYC DOT, "Measuring the Street: New Metrics for 21st Century Streets," 2012. http://on.nyc.gov/1hdCIMY Kelly J. Clifton, Sara Morrissey, and Chloe Ritter, "Business Cycles: Catering to the Bicycling Market," TR News 280, 2012: 26-32. http://bit.ly/16WKfe3; T Fleming, S Turner, and L Tarjomi, "Reallocation of road space," NZ Transport Agency research report 530,2013. http://bit.ly/167iGlQ; Clean Air Partnership, "Bike Lanes, On-Street Parking and Business: A Study of Bloor Street in Toronto's Annex Neighbourhood," 2009. http://bit.ly/18hToAY

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E Programs & Policies

CHAPTER CONTENTS

PROGRAMS & POLICIES

Expanded Bike to Work Day Programming

Existing Conditions

Glenwood Springs has successfully sponsored past Bike to Work Day events. Past celebrations have met in Centennial Park for free breakfast and the chance to win prizes. Nearby communities have also hosted events. The State recognizes Bike Month in June and holds a variety of events and promotions throughout the month.

Recommendations

Bike to Work Day 2015 Booth

Program expansion could include a Mayor's Bike Ride. The ride would show the Mayor's support of bicycling in Glenwood Springs and introduce the Mayor to members of the local community. Extending the annual day to a week of festivities would build on the momentum already begun by past years' efforts. Coinciding the events with National Bike Month in May could further expand commute-related bicycle promotions and happenings. The League of American Bicyclists (LAB) and CDOT provide free print and downloadable resources for distribution during Bike Month and year-round. Numerous towns, cities, and counties across the state already participate. Additional ideas for future programming include:

- Breakfast on the bikeways or energizer stations
- Trail maintenance service days
- Bike-in movies
- Parades and family rides
- Commute challenge contests
- Bike transportation seminars and workshops
- Bike recognition days with discounts or a small gift for participants
- Bike swaps

Potential Partners

LiveWell Garfield County; Glenwood Springs Chamber; Surrounding communities (i.e.- Aspen, Basalt, New Castle, Rifle); Roaring Fork Transportation Authority (RFTA)

References

Colorado Bike Month: http://www.codot.gov/programs/bikeped/information-for-bicyclists/colorado-bike-month; LAB: http://bikeleague.org/content/plan-bike-month-event

Safe Routes to School (SRTS)

Existing Conditions

Elementary and middle schools within Glenwood Springs already participate in Safe Routes to School (SRTS) programming. SRTS non-infrastructure education and encouragement campaigns incentivize school travel beyond car-based trips. Due to grant program restructuring, Colorado's fiscal year 2015 grants are not available for infrastructure projects. Awards during this time period are 100% state funded.

Glenwood Springs' school walking and biking audits, conducted in 2007, examine physical non-motorized infrastructure near schools and their suitability for comfortable and safe travel. Regional efforts have produced a bilingual Safe Routes to School Bicycle & Trail Guide. Garfield Clean Energy Collaborative, an environmental efficiency organization composed of local governmental partners, leads a Bike & Walk to School Challenge. The annual event draws participating schools throughout Garfield County.

Recommendations

Ensure the program is up-to-date by undertaking walk and bike audits for local elementary and middle schools. Although all schools were included in the 2007 report, updating the findings would ensure the audit accounts for new infrastructure.

Launching an evaluation program would help organizers understand the program's outcomes. The program would build upon existing statistics gathered through the Bike & Walk to School Challenge. The Challenge website lists students' calories burned, fuel costs saved, and CO2 emissions reduced.

SRTS efforts come in all shapes and sizes. Other potential SRTS non-infrastructure programming ideas include:

- Updating the SRTS plan
- In-school bicycle and pedestrian training
- After school clubs
- Walking School Bus and/or Bike Train programs
- Student mileage tracking program and free giveaways/prizes

Given the broad array of program options, City staff should identify one or two priority programs to tackle first, based partly on partner availability and interest.

Potential Partners

Roaring Fork School District; Garfield Clean Energy Collaborative; Garfield County; Roaring Fork Transportation Authority (RFTA)

References

CDOT Safe Routes to School: https://www.codot.gov/programs/bikeped/safe-routes

TIPS FOR KIDS

BIKE SAFE!

WEAR YOUR HELMET:
It models good behavior. Helmets should fit snug, be level on your head and should always be buckled firmly under your chin.

RIDE PREDICTABLY:
Look for vehicles and signal to drivers which direction you plan to go before making turns. Ride in a straight line. Avoid the door zone, about five feet away from parked cars.

RIDE WITH TRAFFIC:
Ride on the right, in the direction of traffic. Obey all signs and signals.

LOCK YOUR BIKE:
When you get to school, lock your bike to a bike rack inside the campus. Lock both your front wheel and the bike frame to the rack.

RIDING ON SIDEWALKS:
In Austin, bicyclists are permitted on sidewalks except in the downtown business district. Discuss with your parents whether to ride on the street or sidewalk for your school route.

Ideas for enhanced SRTS programs

Enhanced Bicycle & Pedestrian Counts and Data Collection

Existing Conditions

Manual counts use volunteers or staff to count people passing on bikes or on foot. Automatic counters use technology (such as video detection, pneumatic tubes, inductive loops, piezoelectric sensors, among others) to count bicyclists and pedestrians. Past efforts in Glenwood Springs have used both methods. A part-time employee conducts manual counts. The City has also used video devices, which are later analyzed by a third party. CDOT references two Glenwood Springs count locations, one on the Rio Grande Trail and the other on South Grand, within their report on statewide data collection.

Recommendations

Data collection methods are divided between manual and automatic counting. Based on the City's population, 3-6 counters—automatic and/or manual—may be enough to collect useful data that describes biking and walking levels. Additional counters will help ensure the data's statistical accuracy. Short-term counting sites are usually chosen based on high ridership or walking levels. Continuous data collection sites should represent the area's overall ridership/walking levels, but selected sites should also have moderate activity levels.

Manual Counters:

Continue following National Bicycle & Pedestrian Documentation (NBPD) project guidance to conduct manual counts on standardized days. Conduct counts during two hour peak periods (7-9am; 4-6pm). The NBPD website includes free counter training resources and calculators to extrapolate data. Extrapolation enables counters to estimate annual average daily bicyclists (AADB) and annual average daily pedestrians (AADP).

Automatic Counters:

More research is needed to understand potential money saved by purchasing the City's own counters versus hiring a data collection company to study video-captured data. Automated efforts should include short duration as well as continuous counts. Short duration bike counters often consist of pneumatic tubes. Infrared sensors count pedestrians. Short duration counts should be no shorter than seven days and preferably 14 days. Continuous counters collect data over 365 days. Glenwood Springs should use at least two continuous automatic counters--one for pedestrians and one for bicyclists. Continuous bike counters are often inductive loops installed in the pavement or thermal sensors placed overhead. Continuous pedestrian counters use passive infrared ("pyroelectric") technology.

Enhanced counting may require manual counts on an annual basis

Potential Partners

Garfield County; Colorado Department of Transportation (CDOT)

References

NBPD: http://www.bikepeddocumentation.org

OTHER ITEMS OF INTEREST

Walking and Biking Summer Events

Glenwood Spring's plethora of summer events mean plenty of opportunities to hold free community walks and bike rides. Events can leave from a central location, preferably near transit, and travel to outdoor concerts at Two Rivers Park or to other attractions. The walks and rides will show residents the proximity of these locations to the downtown area. Residents who are offered fun opportunities to see their city on foot or by bicycle may be more likely to use these modes of transportation in other situations.

Noteworthy Examples:

Bike Denver Summer Solstice: (http://www.bikedenver.org/rides-events/other-rides/summer-solstice/); Portland By Cycle: (https://www.portlandoregon.gov/transportation/44099)

Bicycle Training for the Glenwood Springs Community

Bicycle trainings introduce new or would-be bicycle users to safe bicycling skills and low stress routes. Educational opportunities can use a wide range of formats from traditional courses to themed workshops. The City can host or support courses applicable for a variety of learners including:

- League Certified Instructor (LCI) training
- Women-focused/women-led courses
- Elderly riders
- Adaptive bicycle riders
- Commuting
- Families
- Law enforcement officers

Noteworthy Examples:

Bicycle Colorado Safety Education for Adults: (http://bicyclecolorado.org/learn/adult-bike-safety/); League of American Bicyclists LCI Program: (http://bikeleague.org/content/become-instructor)

Continuing Education for City Staff

City staff who have access to the latest in innovative non-motorized planning theories and methods become better equipped to serve their city. Free and paid webinars offer participants a chance to exchange ideas and learn about others' best practices without needing to travel. Inter-agency webinars or in-person brown bag lunch series allow City departments a chance to brainstorm and learn about partnership opportunities.

Noteworthy Examples:

The Initiative for Bicycle & Pedestrian Innovation from Portland State University (IBPI): (http://www.pdx.edu/ibpi/); Association for Pedestrian & Bicycle Professionals (APBP): (http://www.apbp.org/?page=Webinars); FHWA: (http://safety.fhwa.dot.gov/ped_bike/ped_focus/webinar.cfm); Portland Bureau of Transportation (PBOT) Lunch and Learn Series: (https://www.portlandoregon.gov/transportation/article/144945)

Bicycle Parking Request Form

Bicycle rack request forms let private citizens and businesses ask their city for new or replacement bicycle parking facilities. End-of-trip facilities are an important factor in encouraging bicycle trips, since secure parking areas can deter thieves. Bicycle-friendly cities respond to bicycle parking requests in a timely fashion. Installing additional facilities shows the city's support for bicycling. These cities add additional parking based on latent and existing demand. Popular locations for bicycle rack siting include:

- Commercial areas
- Elementary, middle, and high schools
- Colleges and universities
- Civic places (i.e.- library, post office)
- Parks and recreational spaces

Noteworthy Examples:

City of Chicago Bicycle Parking Request Interactive Map: (http://bikeparking.chicagocompletestreets.org/page/about)

Group Walks and Rides for Older Adults

Bicycle and pedestrian networks allow seniors to experience more independent mobility rather than relying on paratransit and family members for rides. Tricycles, adaptive bikes, and electric-assisted bicycles can make bicycle riding accessible and more efficient.

Senior specific bicycle courses offered through community centers, senior living centers, park districts, townships or some other source introduce seniors to bicycling for fitness or transport in a low-stress, controlled and personable setting. Guided walks let Seniors explore their neighborhood or revisit well-loved routes. Walks and rides should begin and end near public transit or paratransit facilities for greater accessibility.

Noteworthy Examples:

Sacramento "Neighborhood Walks" Program: (http://www.nhtsa.gov/PEOPLE/injury/olddrive/FromTheField-ActiveAging/pages/Sacramento.htm); Walk Kit: How to Start a Walking Program: A Guide for Local Program Coordinators: (http://www.caactivecommunities.org/wp-content/uploads/2011/03/walk_kit_v4.pdf)

F Wayfinding Framework Plan

CHAPTER CONTENTS

WAYFINDING AND FRAMEWORK PLAN

Framework Mapping

The Glenwood Springs Long Range Transportation Plan team developed a list of destinations ranging from large scale city-wide destinations to smaller scale local destinations during the existing conditions phase of the project to be included in the identification of wayfinding signage. This list includes landmarks and features that are considered significant to the local community and to the interest of visitors and tourists. The primary goal was to determine which features residents or visitors might orient themselves by at each scale. Maps illustrating prioritized routes and destinations are included at the end of Appendix F.

City and Pathways

Through the development of the existing conditions report, the Glenwood Springs Long Range Transportation Plan team identified major city bicycle and pedestrian routes and city-wide and local destinations. Routes and destinations were mapped to understand spatial relationships and develop a framework for the logic and placement behind wayfinding signage .

Selecting and Prioritizing Routes for Wayfinding

Candidates for implementation of wayfinding signage included pathways and on-street routes which are open to public use, provide a safe user experience, connect destinations, and are maintained on a regular basis. Pilot installations will be sited along popular routes that are well-maintained. Local paths that provide connections between neighborhoods, schools, parks, and places of work may also benefit from wayfinding to clarify connections and meet specific local needs.

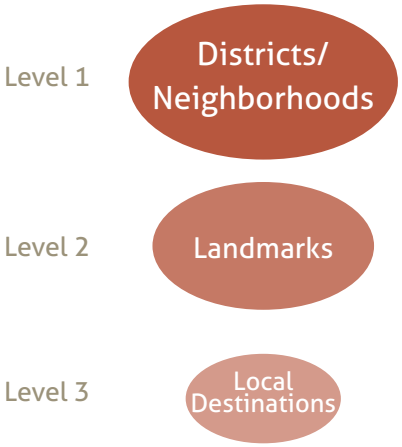
Destination Hierarchy

Following the first principle, "connect places," these guidelines describe an approach for selecting and prioritizing potential destinations to which cyclists and pedestrians may want to travel. As signs only allow for three slots of information or destinations per sign, a consistent approach to select destinations to be included on wayfinding elements is necessary given the multitude of potential destinations possible. Signs should follow the same approach throughout the City so that the system is clear and predictable. Destinations and their names should be referred to consistently until they are reached.

Potential destinations to be included on wayfinding elements were generated from discussions between the City and design team. The list of destinations for inclusion on signs were categorized within a range of three levels. Level 1 destinations should receive first priority on wayfinding signs on City pathways and on-street facilities, followed by level 2 and then 3.

For the purpose of the Glenwood Springs Long Range Transportation Plan Wayfinding Guide, these levels have been broadly organized as follows.

- Level 1 – Districts and Neighborhoods
- Level 2 – Landmarks
- Level 3 – Local Destinations



Community and local pathways typically serve shorter trips within their immediate community. Signs on such facilities may prioritize level 3 destinations recognizing that longer, city-wide trips are more likely to occur via the city-wide pathway network. Also, destinations that are smaller in scale and a regional significance are less likely to have direct connections from the off-street bicycle network than higher level destinations. The on-street bicycle wayfinding system will typically need to work in conjunction with the off-street bicycle navigational information to provide direction at all levels of one's journey in order to reach the front door of destinations.

The table below categorizes destinations within the City of Glenwood Springs.

Level 1 - Districts and Neighborhoods
Level 1 navigational information is used to direct users to comprehendible district and neighborhood scale destinations. These may be city centers, historic, commercial, cultural, or educational districts, or neighborhoods with a distinct name and character. Emphasis should be placed on districts providing a mix of services. Neighborhoods not offering services or attractions, need not be included. Level 1 destinations should be included on signs up to 2 miles away.
Level 2 - Landmarks
Level 2 destinations are more detailed than those in level 1. They are specific landmarks or major attractions which generate a high amount of pedestrian or bicycle travel. Landmarks include transit stations, major tourist venues, and regional parks. Level 2 destinations should be signed up to 1 miles away.
Level 3 – Local Destinations
Level 3 destinations are local destinations such as civic buildings, parks, high schools, shopping centers, and healthcare facilities. They typically occur on signs in low density areas where few other destinations are present or along pathways not connecting higher priority level 1-2 destinations. Level 3 destinations may be signed up to 1 mile away.

Signing Distances

Signing distances suggest the maximum distance that destinations should appear on directional signs. This process ensures that information is spread along the journey in manageable amounts according to a cyclist's or pedestrians immediate needs.

Level 1 destinations provide navigational guidance to the widest spectrum of system users and thus should be prioritized on signs. As a priority, level 1 destinations should appear on signs up to 2 miles away. Level 2 and 3 destinations appeal to a broad spectrum of users with local interest and should be included on signs up to one mile away.

The closest destination lying straight ahead should be at the top of the sign or assembly, and below it the closest destinations to the left and to the right, in that order. If more than one destination is displayed in the same direction, the name of a nearer destination shall be displayed above the name of a destination that is further away.

Signing Distances Based on Hierarchy

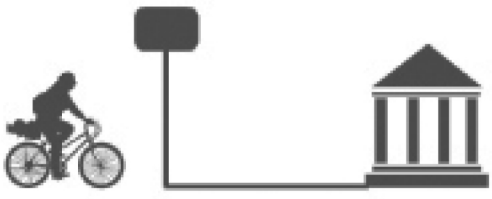
Distances may be measured either to a destination boundary or center, as long as the approach is consistent throughout the City. Cities typically have a well-defined edge and thus should be measured to their boundary lines. Districts or neighborhoods (level 1 destinations) are less defined in terms of their boundaries and thus should be measured to their centers. Level 2 and 3 destinations may have specific addresses and thus distances should be measured to the main entrance of their specific location. If a level 3 destination is large or has several access points, distance should be measured to the point at which the cyclist will arrive at the destination.

Level 1

Districts /
Neighborhoods
1-2 mile

Levels 2 + 3

Landmarks
Local Destinations
0.25-1 mile



Destination Selection Criteria

Listed below are the inclusion criteria for determining where a specific destination may fall in the destination hierarchy and whether the destination will be considered for inclusion on wayfinding elements within the City of Glenwood Springs. All destinations to be signed should be open and accessible to the public.

LEVEL 1 – DISTRICTS AND NEIGHBORHOODS

Districts and neighborhoods may be included on signs if the area has been formally established by resolution or ordinance of the appropriate local agency or if the district has developed and implemented its own internal wayfinding sign plan. Examples of districts include: city centers and surrounding neighborhoods. Neighborhoods having historic character or otherwise significantly contributing to the culture and vibrancy of a city may also be signed.

LEVEL 2 - LANDMARKS

Through the Glenwood Springs Long Range Transportation Plan team discussions, destinations included within the inventory of Landmarks have been sorted between levels 2 and 3. Level 2 landmarks have regional and city-wide significance and can reasonably be expected to be in operation for years to come. Level 2 destinations include:

Businesses and Services

- ***Medical facility*** - Hospitals, veterans services providers, and clinics may be considered if the facilities meet all of the following criteria:
  - Service is provided 24 hours a day, 7 days a week.
  - Emergency department facilities and services are provided.
  - The facility is licensed or approved for definitive medical care by an appropriate State authority.
- ***Shopping center*** - A group of thirty or more shops, retail stores, and/or restaurants with at least one major department store functioning as an anchor.
- ***Visitor Accommodation*** – Resorts or hotels having a satisfactory or three star rating or better and offering a minimum of seventy-five guest rooms.
- ***Visitor Center*** - A facility having the primary purpose of providing information and tourist support services. Must be approved by the State Department of Community and Economic Development.

Education

- ***College/University*** - An educational institution that is nationally accredited and grants degrees.
- ***Public 2 Year College*** - An educational institution that is nationally accredited and grants degrees.

Entertainment and Culture

- ***Historic Site*** - A structure or place of historical, archaeological, or architectural significance listed on the National Register of Historic Places.
- ***Museum*** – A facility of national or regional significance exhibiting works of artistic, historic, or scientific value.
- ***Performing Arts Venue*** – A facility focused on the enjoyment of the performing arts and providing a minimum capacity of two hundred seats.

Public Facility

- ***Airport*** – A facility licensed for landing and takeoff of aircraft.
- ***Recreation or Community Center*** – Publically owned buildings offering places to recreate, learn, and/or gather.
- ***Library*** - A repository for literary and multi-media materials, such as books, periodicals, newspapers, recordings, films, and electronic media, kept and systemically arranged for use and reference.
- ***Park*** – Publically owned National, State, and Regional parks.
- ***Pathway*** – Named regional facilities built for transportation and recreation purposes and used by both cyclists and pedestrians.
- ***Transit Center*** – Passenger terminals facilitating access to light rail, passenger train, or multiple bus lines.

Sports Facility

- ***Golf Course*** - A facility open to the public and offering at least eighteen holes of play. Miniature golf courses and driving ranges are not considered a level 3 landmark.
- ***Stadium or Arena*** – A permanent facility used for the primary purpose of presenting organized sporting events. Includes county and state fairgrounds.

LEVEL 3 - LOCAL DESTINATIONS

A city may wish to extend its wayfinding system to include local destinations. This may be useful in lower density areas or on more rural routes where Level 1-2 destinations are not present. Each city is unique but generally larger civic institutions such as libraries, museums, or community centers will take precedent over specific local services and visitor accommodations.

Businesses and Services

- ***Medical Facility*** - Licensed facilities that provide emergency or urgent care services. Need not be open 24 hours per day, seven days per week.
- ***Shopping Center*** - A group of at least five, but less than thirty shops, retail stores, and/or restaurants.

- ***Visitor Accommodation*** – Resorts or hotels having a satisfactory or three star rating or better and having fewer than seventy-five rooms but more than ten.

Community Facilities

- ***Cemetery*** - A large public park or ground laid out expressly for the interment of the dead.

Education

- ***Secondary School*** – Public schools providing high school level education to students generally aged eleven through eighteen.

Entertainment and Culture

- ***Movie Theater*** - A permanent indoor entertainment facility with capacity for at least two hundred seats which is focused on entertainment through film for visitors of all ages.
- ***Museum*** – A facility of local recognition exhibiting works of artistic, historic, or scientific value to the general public.
- ***Performing Arts Venue*** - A facility focused on the public's enjoyment of the performing arts and having a capacity of less than two hundred seats.
- ***Amusement Park*** - A permanent facility having multiple devices for entertainment, including rides, booths for the conduct of games, or sale of items, buildings for shows and entertainment, and restaurants and souvenir sales.

Public Facility

- ***Civic Building*** - City hall, court house, fire or police station.
- ***Local Park*** - Publically owned local parks.
- ***Post Office*** – Official federal postal service center.

Sports Facility

- ***Golf Course*** - A facility open to the public and offering fewer than eighteen holes of play. Miniature golf courses and driving ranges may be considered.
- ***Sports Field*** – A permanent facility used for the primary purpose of presenting and practicing local organized sports.

In situations where two destinations of equal significance and distance may be properly designated and the two destinations cannot appear on the same sign, the two names may be alternated on successive signs.

Abbreviations

In general, when placing destination names on signs, the use of abbreviations should be kept to a minimum whenever possible. When insufficient space is available for full wording, abbreviations may be used. A list of accepted abbreviations per the MUTCD is included in the table below. Unless necessary to avoid confusion, periods, commas, apostrophes, question marks, ampersands, and other punctuation marks or characters that are not letters or numerals should not be used in any abbreviation.

Word Message	Abbreviation
Alternate	ALT
Avenue	AVE
Bicycle	BIKE
Boulevard	BLVD
Bridge	BR
Center (as part of a place name)	CTR
Circle	CIR
Court	CT
Crossing (other than highway)	X-ING
Drive	DR
East	E
Hospital	HOSP
Information	INFO
International	INTL
Junction / Intersection	JCT
Mile(s)	MI
Miles Per Hour	MPH

Word Message	Abbreviation
Minute(s)	MIN
Mount	MT
Mountain	MTN
National	NATL
North	N
Parkway	PKWY
Pedestrian	PED
Place	PL
Road	RD
Saint	ST
South	S
Street	ST
Telephone	PHONE
Terrace	TER
Trail	TR
West	W

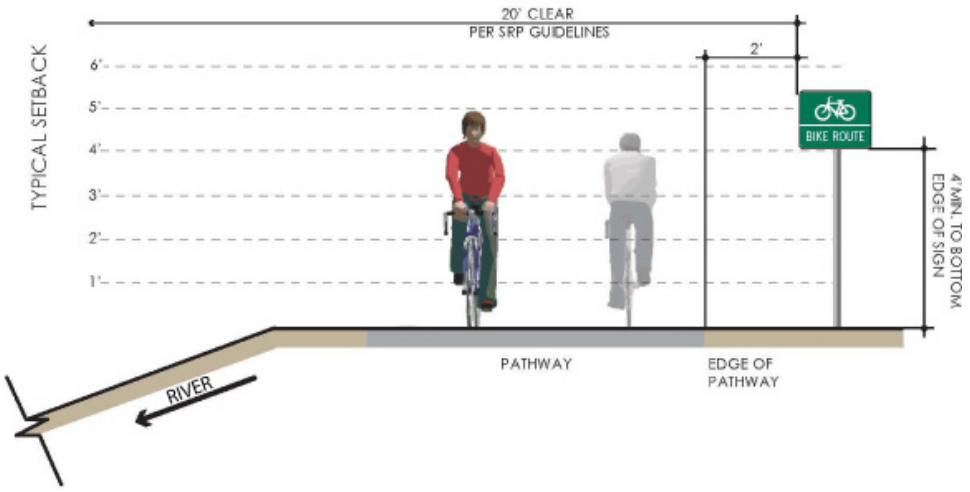
Function and Placement of Wayfinding Elements

Based on field reconnaissance, best practices review, public input, and discussions with project team members regarding wayfinding needs in the City of Glenwood Springs, the following sign typologies are recommended for the Glenwood Springs bicycle and pedestrian network family. All wayfinding elements are oriented and scaled towards the bicyclist and pedestrian unless noted otherwise.

Bicycle Elements

Bicycle oriented wayfinding elements include decision, confirmation, and turn signs as well as mile markers. Each element is designed to be legible by the pedestrian or the cyclist while in motion. The design speed of a path should not be confused with the assumed travel speed used to project distance based on travel time on wayfinding signs. When adding travel time to signs, a no sweat pace of 10 mph or six minutes per mile is typically used.

Per both the MUTCD and AASHTO, the nearest edge of any sign should be a minimum of two feet from the edge of the pathway. The lowest edge of post mounted signs should be no less than four feet above finish grade. The lowest sign edge of on-street bicycle signs should be seven feet.



In general, regulatory and warning signs are a higher priority than wayfinding signs. Care should be taken to not obscure priority information. This includes providing a typical spacing of no less than 75 feet between signs along off-street pathways. This distance is based on travel speeds and thus is generally greater for on-street systems.

Decision Sign

Function and Content: Decision signs clarify route options when more than one potential route is available. System brand mark, space for up to three destinations, distance in miles and time (based on 10 mph or 6 minute per mile travel speed). May include specific path name.

Placement: Placed prior to decision making points or intersections with routes having bicycle facilities. Sufficient distance prior to the intersection should be provided to allow for safe recognition and response to information provided. Care should be taken so that the turn or options the sign refers to are obvious. Decisions signs should not be placed near side or access paths that could be confused with the primary route.

Confirmation Sign

Function and Content: Placed after a turn movement or intersection to reassure cyclists that they are on the correct route. System brand mark, pathway name.

Placement: Signs should be placed 50 – 100 feet after turns. Confirmation signs need not occur after every intersection. They should be prioritized at locations where a designated route is not linear as well as after complex intersections. Complex intersections include those having more than four approaches, non-right angle turns, round-abouts, or in-direct routing.

Turn Sign

Function and Content: Used to clarify a specific route at changes in direction when only one route option is available. System brand mark, pathway name, directional arrow.

Placement: Placed at turns prior to the turning action to provide pedestrians and cyclists advance notice of a change in direction. Also may be used in conjunction with a decision sign at complex intersections warranting additional information.

Mile Markers

Function and Content: Aids pathway users with measuring distance travelled. Also provides pathway managers and emergency response personnel points of reference to identify field issues such as maintenance needs or locations of emergency events. System brand mark, distance in whole number miles or decimal miles when less than one mile. Path name and jurisdiction may be included.

Placement: To be placed every ¼ to ½ mile along the pathway network. Point zero should begin at the southern and westernmost terminus points of a pathway. Mile numbering should be reset at zero as a pathway crosses a jurisdictional boundary.

Distances along on-street routes should be included within mile measurements. Mile markers may be installed on one side of a pathway, back-to-back.

Supplemental Elements

Primary Pathway Identity Sign

Function and Content: Serves as the initial welcome and identification of primary pathway access points for vehicle drivers. System brand mark, pathway name, and local jurisdiction identity/logo.

Placement: Vehicle oriented and scaled identity signs should be located at trailheads or regional pathway access points. Care should be taken to maintain site triangles so as to not obstruct site lines between roadways and entries at trailhead locations.

Secondary Pathway Identity Sign

Function and Content: Serves as the initial welcome and identification of secondary pathway access points. Oriented and scaled towards pedestrian and bicycle network users. System brand mark, pathway name, local jurisdiction identity/logo.

Placement: Pedestrian and bicycle oriented and scaled monument sign located at pathway access points. Should be visible from adjacent bicycle facilities.

Information Kiosk

Function and Content: A clearing house of information for pathway users at a more detailed level than other elements. Includes space for orientation map graphics indicating the off-street route, on-street connections, major geographic features and area destinations to be included. Space shall be available for network rules and responsibilities as well as emergency and pathway manager contact information and jurisdiction logo.

Placement: Located at major pathway system access points. Should be set back from the edge of the path travelway in order to provide areas to dwell and consider the information. Not locating the signs within the first three feet of a pathway edge would remove a potential physical obstacle from the bicycle travelway as well as provide clear circulation area per accessibility guidelines.

System Identifiers

Function and Content: System identifiers include opportunities to add the system brand mark or logo to existing features to expand visibility at an affordable rate. Identifiers may include vinyl wraps, adhesive graphics, sign toppers, and pavement markings with system name or brand mark.

Placement: May be placed at each jurisdiction's discretion based on need for augmented system visibility.

On-street Support Elements

Function and Content: Support elements to facilitate connections via the on-street bicycle network. Includes brand toppers or directional plaques.

Placement: May be mounted to existing or new on-street wayfinding sign posts.

Placement Scenarios

Elements of the wayfinding family should be located in a consistent and logical manner across all of Glenwood Springs.

The following typical placement scenarios are typical navigational issues that most need clarification in relation to the pedestrian and bicycle network:

- Gaps in path network,
- Path-path intersections,
- Path-roadway intersections,
- Off-street and on-street transitions,
- Pathway access points,
- Typical setback and frequency.

Note: in the diagrams below, generic wayfinding elements are used as placeholders until final designs are approved.

Pathway Access Points

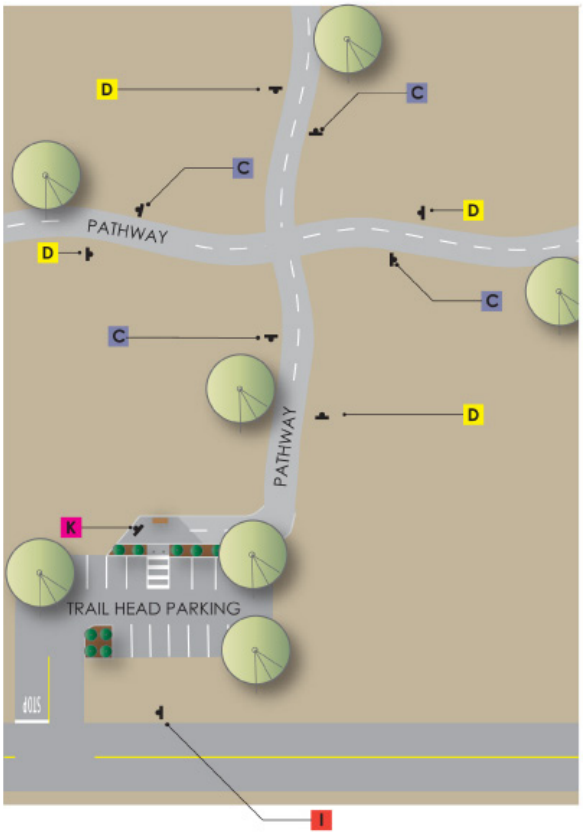
Major pathway access points or trailheads should be identified via primary identity signs. Primary identity signs should be placed oriented towards the approaching vehicle. Care should be taken to not obstruct site lines between the roadway and entry points or driveways.

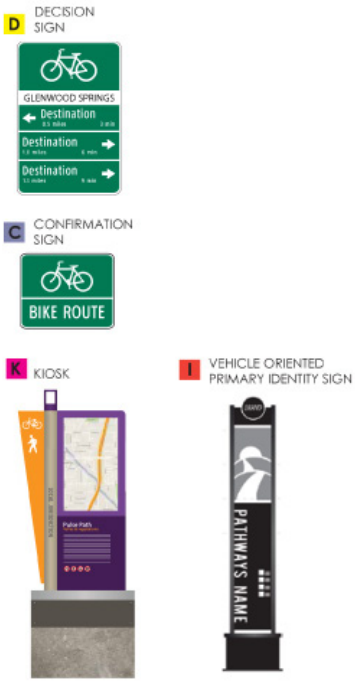
Pathway system access points not providing vehicle parking should utilize the secondary bicycle and pedestrian scaled identity sign.

As an option, kiosk signs with orientation maps may be placed at developed trailheads or access points.

Path-Path Intersection

When pathways intersect each other, multiple destinations are likely. Thus, decision signs should be placed prior to the intersection. As an option, confirmation signs may be placed after intersections to reinforce that the user did indeed make the correct movement.

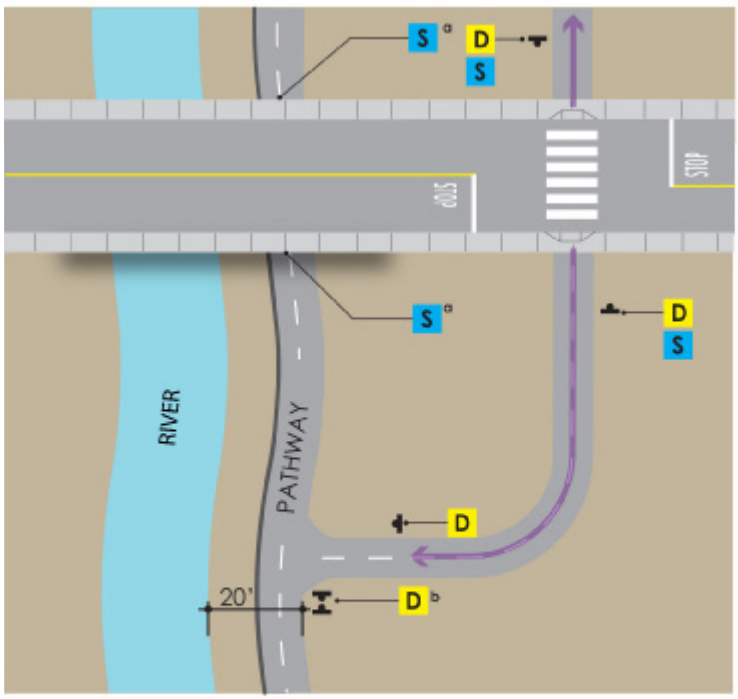




Pathway Bifurcations

Connections and access points between the off-street and on-street network may result in path bifurcations. At such junctions, it is important to inform pedestrians and cyclists of where the alternative route option goes. This may be done via decision signs located at junctions. Flood control facilities may limit the opportunity to place signs on both sides of the pathway. Although not ideal, decision signs may be placed on the opposite side of the pathway.

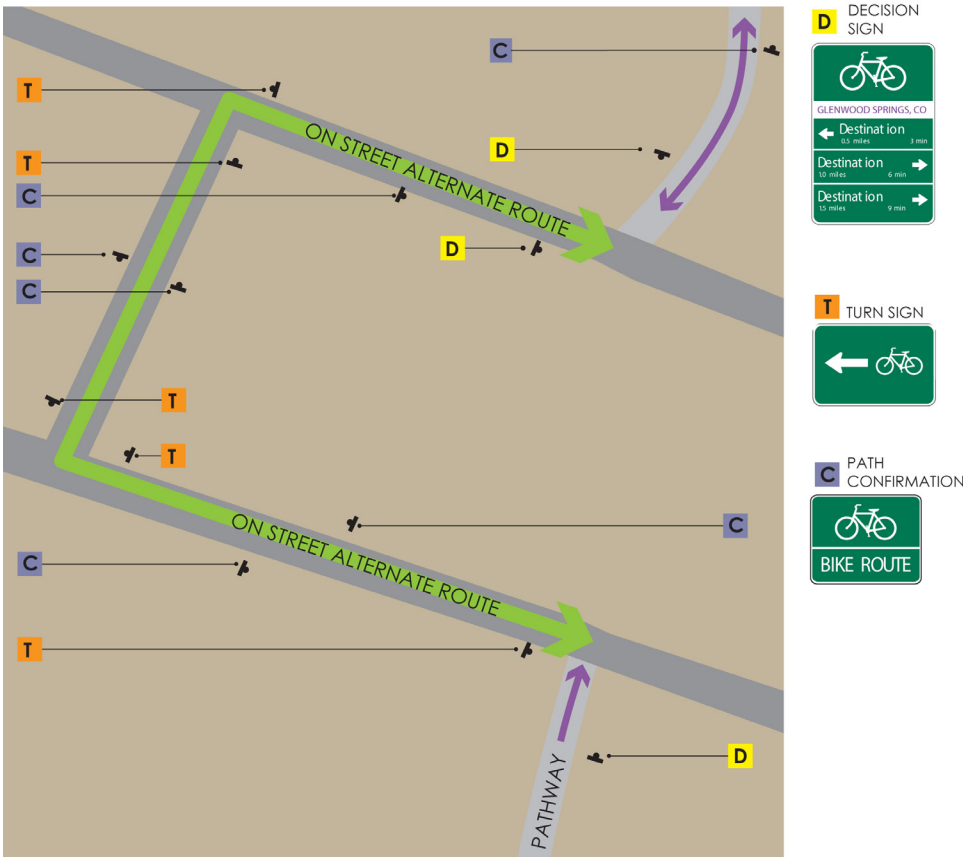
Grade separated roadway crossings would benefit from applying street name sign blades to crossing improvements such as bridge infrastructure.



NOTES:
a. MOUNT TO UNDERSIDE OF BRIDGE
b. OK TO MOUNT TWO SIGNS PER POLE. SIGNS TO BE PLACED PERPENDICULAR TO DIRECTION OF TRAVEL.

Gap in Path Network

Where gaps in the bicycle network exist, pathway users may be routed to another bicycle facilities to provide improved connectivity. The typical pattern for wayfinding signs includes a decision sign prior to the intersection of route options, followed by an optional confirmation sign. Turn signs should be placed to reinforce the route in locations where only one route option exists.



Off-street / On-street Transition

When transitioning from an off-street facility to an on-street facility, it is important to advise travelers of their route options. In this scenario, decision signs direct cyclists to their destination choices while confirmation signs reinforce that the user is on a designated facility after a turn movement is made.

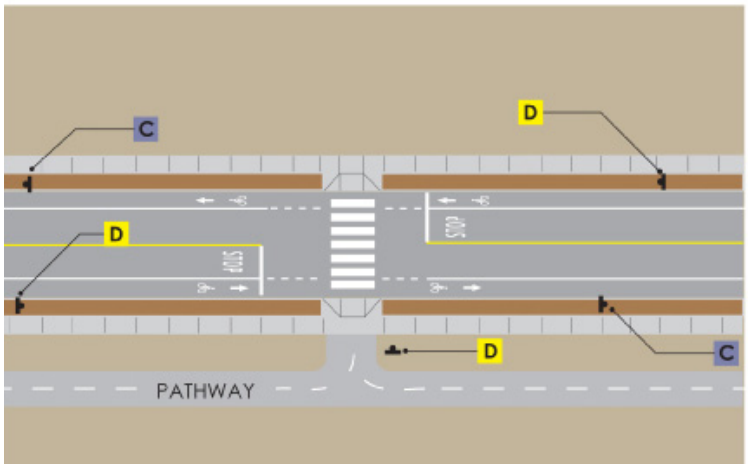
Decision signs should also be placed at the entry to the off-street bicycle network. Once on the off-street bicycle network, confirmation signs are optional.

Vehicle oriented bicycle and pedestrian crossing warning signs should be placed in advance of crosswalks. In more urbanized areas, signs should not be placed within four feet of a crosswalk in order to maintain visibility of those intending to cross the roadway.

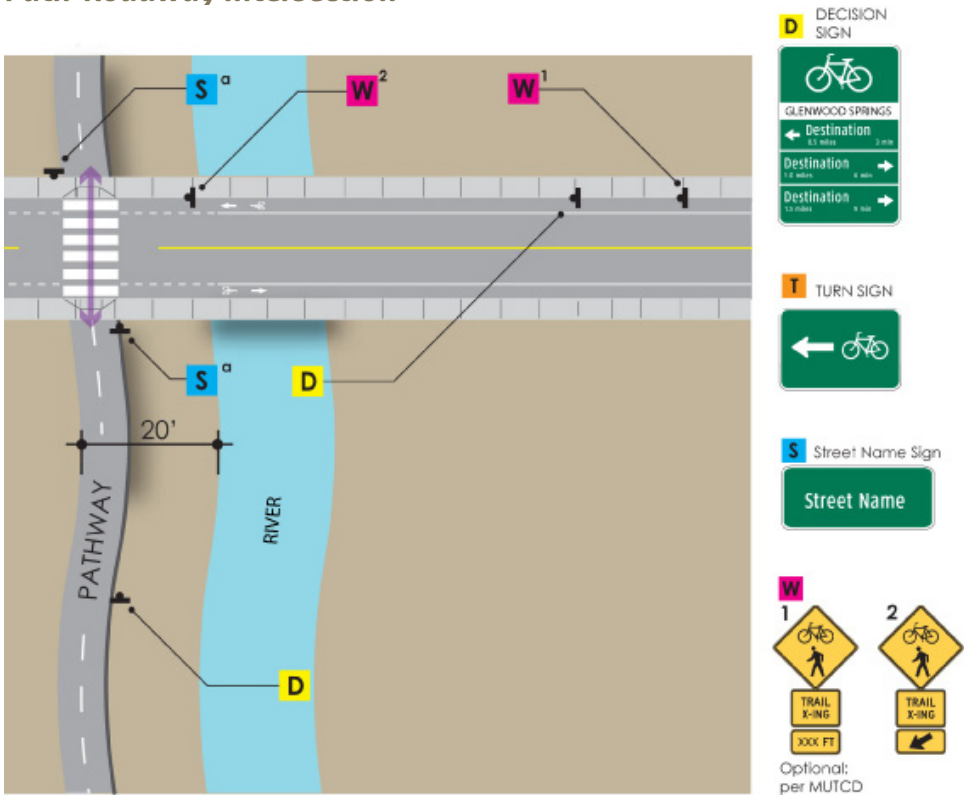
Advance warning signs are optional per the MUTCD. If they are used, their placement should provide needed time for dectection, recognition, decision, and

reaction. Table 2C-4 within the MUTCD provides guidance for advance warning sign placement based on vehicle speeds.

On-street directional signs leading to the pathway network should not obscure other roadway signs including warning signs. They should be spaced according to roadway travel speeds with faster roadways warranting wider spacing. Guidelines for the placement of advance warning signs based on perception-response time may be found within Table 2C-4 of the MUTCD.



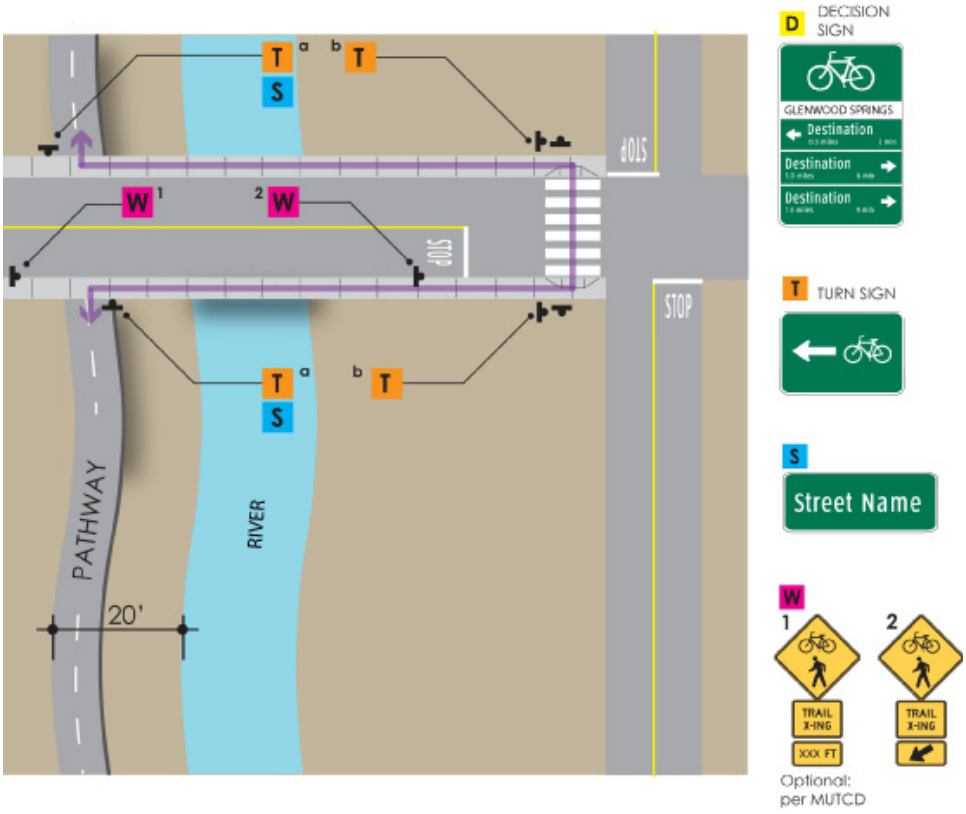
Path-Roadway Intersection



Pathway users should be directed to cross roadways only where improvements such as curb ramps, crosswalk striping, and warning signs exists. If the cross

street has bicycle facilities such as bike lanes, a bicycle boulevard, or cycletrack, a decision sign should be placed prior to the intersection to inform cyclists of their route options. If a cyclist oriented stop sign is present, it should not be obscured by the wayfinding sign. Decision signs may be topped with street name sign blades to enhance one's awareness of their location. As an option, confirmation signs may be placed at pathway entries to assure cyclists that they are on a bicycle facility.

Along Colorado River or Roaring Fork River facilities, a twenty foot wide clear area should be maintained from the edge of the river. It is preferred that signs not be placed in this area. Opportunities to mount wayfinding signs within the road right-of-way or to existing features within RFTA and Colorado River right-of-way such as sign posts and bridge railings, should be sought prior to the installation of signs on new posts.



Oftentimes, direct travel via mid-block roadway crossings is not provided for. Instead pathway users are expected to divert to the nearest improved or signalized intersection. In this scenario, turn signs should be used to direct cyclists to the intersection with safety improvements. Again street name blades may be mounted above decision signs to reinforce location.

G Cost Summary

Blake Avenue Sidewalk Improvements (Ranking 12)

Length of Improvement: 1,740'
Width of Sidewalk: 5'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.2	$1,000
Removals	SY	$25	967	$24,200
6" Concrete	SY	$61	967	$59,000
Ped Curb Ramps	EA	$5,000	2	$10,000
Total				**$94,200**

Total Opinion of Probable Cost*

Construction Items	$94,200
Contingency – 30%	$28,300
Construction Costs – 8% (1)	$7,500
Construction Engineering – 4% (2)	$4,900
Design -10% (3)	$12,700
Total	**$147,600**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

School Street Sidewalk (Ranking 24)

Length of Improvement: 1,060'
Width of Sidewalk: 6'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.15	$800
Removals	SY	$25	707	$17,700
6" Concrete	SY	$61	707	$43,100
Ped Curb Ramps	EA	$5,000	4	$20,000
Total				**$81,600**

Total Opinion of Probable Cost*

Construction Items	$81,600
Contingency – 30%	$24,500
Construction Costs – 8% (1)	$6,500
Construction Engineering – 4% (2)	$4,200
Design -10% (3)	$11,000
Total	**$127,800**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

Coach Miller Drive Sidewalk (Ranking 41)

Length of Improvement: 1,320'
Retaining Wall: 3' high and 400' long
Width of Sidewalk: 6'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.18	$900
Removals	SY	$25	880	$22,000
6" Concrete	SY	$61	880	$53,700
Retaining Wall	SF	$200	1,200	$240,000
Ped Curb Ramps	EA	$5,000	2	$10,000
Total				**$326,600**

Total Opinion of Probable Cost*

Construction Items	$326,600
Contingency – 30%	$98,000
Construction Costs – 8% (1)	$26,100
Construction Engineering – 4% (2)	$17,000
Design -10% (3)	$44,200
Total	**$511,900**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

27th Street Side Path Connection (Ranking 26)

Length of Improvement: 530'
Retaining Wall: Average 6.5' high and 530' long
Width of Path: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.12	$900
Removals	SY	$25	590	$14,800
Unclassified Excavation	CY	$10	10,600	$106,000
Sub-Grade Preparation	SY	$5	590	$3,000
4" Concrete	SY	$61	590	$36,000
Seeding/Mulching	AC	$3,500	0.10	$400
Retaining Wall	SF	$200	3,445	$689,000
Ped Curb Ramps	EA	$5,000	2	$10,000
Total				**$860,100**

Total Opinion of Probable Cost*

Construction Items	$860,100
Contingency – 30%	$258,000
Construction Costs – 8% (1)	$68,800
Construction Engineering – 4% (2)	$44,700
Design -10% (3)	$16,300
Total	**$1,247,900**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

Donegan Road Ped/Bike Improvements (Ranking 18)

Length of Improvement: 3,700'
Length of Bike Lane (both Directions): 7,400'
Width of Sidewalk: 6'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.51	$2,600
Removals	SY	$25	2,467	$61,700
6" Concrete	SY	$61	2,467	$150,500
Striping	LF	$0.15	7,400	$1,100
Signing	EA	$700	30	$21,000
Pavement Markings	EA	$50	30	$1,500
Ped Curb Ramps	EA	$5,000	14	$70,000
Total				**$308,400**

Total Opinion of Probable Cost*

Construction Items	$308,400
Contingency – 30%	$92,500
Construction Costs – 8% (1)	$24,700
Construction Engineering – 4% (2)	$16,000
Design -10% (3)	$41,700
Total	**$483,300**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

South Blake Avenue Sidewalk Improvements & Bicycle Facilities (Ranking 15)

Length of Improvement: 3,000'
Length of Bike Lane (both Directions): 8,340'
Width of Sidewalk: 5'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.51	$2,600
Removals	SY	$25	2,470	$61,800
6" Concrete	SY	$61	2,470	$150,700
Pavement Markings	EA	$250	18	$4,500
Ped Curb Ramps	EA	$5,000	14	$70,000
Total				**$289,600**

Total Opinion of Probable Cost*

Construction Items	$289,600
Contingency – 30%	$86,900
Construction Costs – 8% (1)	$23,200
Construction Engineering – 4% (2)	$15,100
Design -10% (3)	$39,200
Total	**$454,000**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

US-6 Corridor East Shared Use Path from Laurel Ave. to Mel Ray Rd. (Ranking 7)

Length of Improvement: 10,560'
Width of Path: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	2.4	$12,000
Removals	SY	$25	11,730	$293,300
Unclassified Excavation	CY	$10	7,820	$78,200
Sub-Grade Preparation	SY	$5	11,730	$58,700
4" Concrete	SY	$61	11,730	$715,500
Seeding/Mulching	AC	$3,500	1.9	$6,700
Ped Curb Ramps	EA	$5,000	26	$70,000
Total				**$1,234,400**

Total Opinion of Probable Cost*

Construction Items	$1,234,400
Contingency – 30%	$370,300
Construction Costs – 8% (1)	$98,800
Construction Engineering – 4% (2)	$64,200
Design -10% (3)	$166,900
Total	**$1,934,600**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Atkinson Trail to Park East Trail Connection (Ranking 28)

Length of Improvement: 530'
Width of Path: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.12	$600
Removals	SY	$25	590	$14,800
Unclassified Excavation	CY	$10	390	$3,900
Sub-Grade Preparation	SY	$5	590	$3,000
4" Concrete	SY	$61	590	$36,000
Seeding/Mulching	AC	$3,500	0.10	$400
Ped Curb Ramps	EA	$5,000	2	$10,000
Total				**$68,700**

Total Opinion of Probable Cost*

Construction Items	$68,700
Contingency – 30%	$20,600
Construction Costs – 8% (1)	$5,500
Construction Engineering – 4% (2)	$3,600
Design -10% (3)	$9,300
Total	**$107,700**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

Rio Grande Trail and 14th Street Connection (Ranking 37)

Length of Improvement: 200'
Width of Path: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.05	$300
Removals	SY	$25	220	$5,500
Unclassified Excavation	CY	$10	150	$1,500
Sub-Grade Preparation	SY	$5	220	$1,100
4" Concrete	SY	$61	220	$13,400
Seeding/Mulching	AC	$3,500	0.05	$200
Total				**$22,000**

Total Opinion of Probable Cost*

Construction Items	$22,000
Contingency – 30%	$6,600
Construction Costs – 8% (1)	$1,800
Construction Engineering – 4% (2)	$1,100
Design -10% (3)	$3,000
Total	**$34,500**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Atkinson Trail – Rio Grande Trail Bridge (Ranking 40)

Length of Improvement: 1,850'
Length of Bridge: 200'
Width of Path: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.38	$1,900
Removals	SY	$25	1,830	$45,800
Unclassified Excavation	CY	$10	1,220	$12,200
Sub-Grade Preparation	SY	$5	1,830	$9,200
4" Concrete	SY	$61	2,060	$125,700
Seeding/Mulching	AC	$3,500	0.30	$1,100
Structure	SF	$500	2,000	$1,000,000
Total				**$1,195,900**

Total Opinion of Probable Cost*

Construction Items	$1,195,900
Contingency – 30%	$358,800
Construction Costs – 8% (1)	$95,700
Construction Engineering – 4% (2)	$62,200
Design -10% (3)	$161,700
Total	**$1,874,300**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

Colorado River Shared Use Path – River Trail Segment (Ranking 35)

Length of Improvement: 2,100'
Length of Bridge: 320'
Width of Path: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.41	$2,100
Removals	SY	$25	1,980	$49,500
Unclassified Excavation	CY	$10	1,320	$13,200
Sub-Grade Preparation	SY	$5	1,980	$9,900
4" Concrete	SY	$61	2,330	$142,100
Seeding/Mulching	AC	$3,500	0.33	$1,200
Structure	SF	$500	3,200	$1,600,000
Total				**$1,818,000**

Total Opinion of Probable Cost*

Construction Items	$1,818,000
Contingency – 30%	$545,400
Construction Costs – 8% (1)	$145,400
Construction Engineering – 4% (2)	$94,500
Design -10% (3)	$245,800
Total	**$2,849,100**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Grade Separated Pedestrian Crossing of SH-82 and 27th St. (Ranking 25)

Length of Bridge over SH-82: 170'
Length of Bridge over 27th St.: 110'
Width of Bridges: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Structure over SH-82	SF	$500	1,700	$850,000
Structure over 27th St.	SF	$500	1,100	$550,000
Ramps	EA	$1,040,000	3	$3,120,000
Landscaping	SF	$100	1,000	$100,000
Total				**$4,620,000**

Total Opinion of Probable Cost*

Construction Items	$4,620,000
Contingency – 30%	$1,386,000
Construction Costs – 8% (1)	$369,600
Construction Engineering – 4% (2)	$240,200
Design -10% (3)	$624,600
Total	**$7,240,400**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

Grade Separated Pedestrian Crossing of Grand Avenue at 15th St. (Ranking 30)

Length of Bridge: 150'
Width of Bridge: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Structure	SF	$500	1,500	$750,000
Stairs	EA	$830,000	2	$1,660,000
Elevators	EA	$250,000	2	$500,000
Landscaping	SF	$100	500	$50,000
Total				**$2,960,000**

Total Opinion of Probable Cost*

Construction Items	$2,960,000
Contingency – 30%	$888,000
Construction Costs – 8% (1)	$236,800
Construction Engineering – 4% (2)	$153,900
Design -10% (3)	$400,200
Total	**$4,638,900**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Grade Separated Pedestrian Crossing of Grand Avenue at 23rd St. (Ranking 36)

Length of Bridge: 160'
Width of Bridge: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Structure	SF	$500	1,600	$800,000
Ramps	EA	$1,040,000	2	$2,080,000
Landscaping	SF	$100	500	$50,000
Total				**$2,930,000**

Total Opinion of Probable Cost*

Construction Items	$2,930,000
Contingency – 30%	$879,000
Construction Costs – 8% (1)	$234,400
Construction Engineering – 4% (2)	$152,400
Design -10% (3)	$396,100
Total	**$4,591,900**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

12th Street Ditch Tunnel (Ranking 32)

Length of Tunnel: 80'
Width of Path: 10'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Box Culvert	EA	$1,100,000	1	$1,100,000
Unclassified Excavation	CY	$10	90	$900
Sub-Grade Preparation	SY	$5	130	$650
4" Concrete	SY	$61	130	$7,930
Total				**$1,109,500**

Total Opinion of Probable Cost*

Construction Items	$1,109,500
Contingency – 30%	$332,900
Construction Costs – 8% (1)	$88,800
Construction Engineering – 4% (2)	$57,700
Design -10% (3)	$150,000
Total	**$1,738,900**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Roaring Fork Bridge Mt. Sopris Dr. to CR 154 (Ranking 38)

Length of Improvement: 420'
Length of Bridge: 330'
Width of Bridge: 46'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.10	$500
Unclassified Excavation	CY	$10	150	$1,500
Sub-Grade Preparation	SY	$5	460	$2,300
Structure	SF	$340	15,180	$5,161,200
Curb and Gutter	LF	$28	840	$23,500
8" Full Depth Asphalt	SY	$54	1,030	$55,600
Sidewalk	SY	$61	930	$56,700
Guardrail	LF	$25	660	$16,500
Signing	EA	$700	4	$2,800
Striping	LF	$0.15	420	$100
Seeding/Mulch	AC	$3,500	0.02	$100
Total				**$5,320,800**

Total Opinion of Probable Cost*

Construction Items	$5,320,800
Contingency – 30%	$1,596,200
Construction Costs – 8% (1)	$425,700
Construction Engineering – 4% (2)	$276,700
Design -10% (3)	$719,400
Total	**$8,338,800**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

14th Street Bridge over the Roaring Fork River (Ranking 10)
Length of Improvement: 780'
Length of Bridge: 290'
Width of Bridge: 46'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	0.52	$2,600
Unclassified Excavation	CY	$10	830	$8,300
Sub-Grade Preparation	SY	$5	2,500	$12,500
Structure	SF	$340	13,340	$4,535,600
Curb and Gutter	LF	$28	1,560	$43,700
8" Full Depth Asphalt	SY	$54	1,910	$103,100
Sidewalk	SY	$61	1,730	$105,500
Guardrail	LF	$25	580	$14,500
Signing	EA	$700	4	$2,800
Striping	LF	$0.15	780	$200
Seeding/Mulch	AC	$3,500	0.90	$300
Total				**$4,829,100**

Total Opinion of Probable Cost*

Construction Items	$4,829,100
Contingency – 30%	$1,448,700
Construction Costs – 8% (1)	$386,300
Construction Engineering – 4% (2)	$251,100
Design -10% (3)	$652,900
Total	**$7,568,100**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Devereux – Midland Bridge (Ranking 20)
Length of Improvement: 1,200'
Length of Bridge: 800'
Width of Bridge: 46'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Structure	SF	$340	36,800	$12,512,000
Retaining Wall	SF	$200	8,000	$1,600,000
Curb and Gutter	LF	$28	2,400	$67,200
8" Full Depth Asphalt	SY	$54	6,130	$331,000
Sidewalk	SY	$61	2,670	$162,900
Guardrail	LF	$25	2,400	$60,000
Signing	EA	$700	4	$2,800
Striping	LF	$0.15	1,200	$400
Total				**$14,736,300**

Total Opinion of Probable Cost*

Construction Items	$14,736,300
Contingency – 30%	$4,420,900
Construction Costs – 8% (1)	$1,178,900
Construction Engineering – 4% (2)	$766,300
Design -10% (3)	$1,992,400
Total	**$23,094,800**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

Four Mile Road On-Street Bike Facilities (Ranking 34)

Length of Improvement: 12 Miles
Width of Improvements: 12' (Two 6' Shoulders)

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Clear and Grub	AC	$5,000	17.45	$87,300
Removals	SY	$25	84,480	$2,112,000
Unclassified Excavation	CY	$10	28,160	$281,600
Sub-Grade Preparation	SY	$5	84,480	$422,400
8" Full Depth Asphalt	SY	$54	84,480	$4,561,900
Seeding/Mulching	AC	$3,500	11.65	$40,800
Striping	LF	$0.15	126,720	$19,000
Signs	EA	$700	12	$8,400
Culvert Extensions	EA	$4,000	6	$24,000
Total				**$7,557,400**

Total Opinion of Probable Cost*

Construction Items	$7,557,400
Contingency – 30%	$2,267,200
Construction Costs – 8% (1)	$604,600
Construction Engineering – 4% (2)	$393,000
Design -10% (3)	$1,021,800
Total	**$11,844,000**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Enhance Connection Two Rivers Park – Glenwood Canyon Trail (Ranking 23)

Length of Improvement: 120'
Width of Path: 8'

Construction Opinion of Probable Cost

Construction items	Unit	Unit Price	Quantity	Hard Cost
Removals	SY	$25	113	$2,800
Unclassified Excavation	CY	$10	36	$400
Sub-Grade Preparation	SY	$5	110	$600
4" Concrete	SY	$61	110	$6,700
Retaining Wall	SF	$200	720	$144,000
Ped Curb Ramps	EA	$5,000	2	$10,000
Signs	EA	$700	20	$14,000
Pavement Markings	EA	$250	20	$5,000
Total				**$183,500**

Total Opinion of Probable Cost*

Construction Items	$183,500
Contingency – 30%	$55,100
Construction Costs – 8% (1)	$14,700
Construction Engineering – 4% (2)	$9,500
Design -10% (3)	$24,800
Total	**$287,600**

(1) Includes General Conditions (4%), Mobilization (3%), and Construction Surveying/Staking/Inspection (1%)
(2) Includes Construction Traffic Control (2%), Materials Testing (1%), and Erosion Control (1%)
(3) Includes Design (8%), Surveying (1%), and Geotechnical Engineering (1%)

Total Opinion of Probable Cost does not include cost estimates for either right-of-way or easements.

H Maintenance Costs

CHAPTER CONTENTS

INTRODUCTION

The City of Glenwood Springs is considering investing further in the construction of bicycle and pedestrian facilities such as on-street bikeways, shared-use pathways, and sidewalks, all of which provide significant, valuable recreational and transportation benefits to local residents and visitors. In addition, this LRTP has recommended significant improvements to the vehicular circulation system that will need to be maintained over time. However, ongoing maintenance of these facilities, and in particular, funding sources to support maintenance, is a topic City staff is concerned with.

This memo summarizes existing maintenance activities in a number of cities, based on interviews with staff of local agencies. It also identifies challenges to maintaining on-street bike facilities, sidewalks and multi-use paths. The memo includes a description of components of successful maintenance programs in comparable communities.

Importance of Proper Maintenance

Maintaining on-street bike facilities, sidewalks and multi-use paths to a high standard is important for a variety of reasons.

Safety: Public agencies have a duty to protect the public welfare by maintaining facilities to a level that reduces potential safety hazards. This includes repairing damage on paths and sidewalks that may pose a tripping hazard, clearing snow in a timely manner, and preventing ice from forming.

Universal Access: Public agencies are required by federal law to maintain public facilities so that they are accessible to people with disabilities. Small but abrupt vertical changes in level along a path or sidewalk may not pose a safety hazard to able-bodied pedestrians, but may present an obstacle to people who are using wheelchairs or other mobility-assistive devices.

Attracting Use: Well-maintained facilities, with smooth surfaces, well-kept vegetation, and up-to-date signage will attract and sustain use, increasing the livability of the areas served by the network.

Liability: Allowing hazardous conditions to exist along a path or sidewalk exposes a local agency to potential lawsuits.

Protecting the Public Investment: Regular preventative maintenance on an on-street bike facility, path or sidewalk (e.g. periodic overlays on multi-use paths)

can extend the lifetime of the existing facility and delay the need for more expensive repairs.

Primary Maintenance Functions

- Primary functions of maintaining on-street bike facilities, sidewalks and multi-use paths include:
- Maintaining pavement quality through spot repairs, regular overlays and longer-term repaving (for asphalt surfaces)
- Maintaining trails and sidewalks to 2010 ADA Standards for Accessible Design
- Sweeping and removal of garbage and debris on a weekly basis
- Vegetation trimming to provide clear access on a monthly basis
- Snow removal after storms
- Restriping paths as needed, usually annually
- Landscaping maintenance on a weekly or monthly basis, including irrigation costs
- Lighting feature maintenance, including electricity costs
- Repair of damage due to storms, floods, collisions and other unforeseen events
- Repair and replacement of wayfinding or other signage

The project team used the following strategies to research this topic and identify regional successes and struggles for reference.

- Interviews with Glenwood Springs staff
- Interviews with other city staff
- National research on maintenance issues

Staff from Glenwood Springs and other communities were contacted and asked to share information about maintenance activities in their agency. Staff contacts are listed in Table 1.

Table 1: Agency Staff Contacted Regarding Bicycle and Pedestrian Facility Maintenance

Name	*Agency*	*Most Recent Communication*
Charlie Blosten	*City of Littleton*	*Spoke on 1/29/2015*
Dave Baskett/John Padon	*City of Lakewood*	*Email on 2/3/2015*
Al Laurette	*City of Glenwood Springs*	*Spoke on 7/10/2015*
Previous Research Contacts	*City of Madison, WI*	*Previous Research*
Dan Raine/Emily Snyder	*City and County of Denver*	*Email on 8/5/2015*

RESEARCH FINDINGS

Maintenance policies and procedures varied among the communities contacted.

Of the agencies contacted, none had specific money/funding budgeted for bicycle and pedestrian facility maintenance other than Denver, and none regularly require additional maintenance funding to be provided or allocated when a new bike facility was built. Most agencies stated that bicycle and pedestrian facility maintenance was completed not by one department in particular, but was a cross-department collaboration, often without pre-defined assignments or agreements. Table 2 shows a summary of agency responses to questions relating to bicycle and pedestrian facility maintenance.

Obstacles to Proper Maintenance

There are three main obstacles to successful bicycle and pedestrian facility maintenance programs, according to the other city interviews completed for this and other projects:

1) The first, and most common issue in the cities examined, is a lack of dedicated funding. There are fewer grants available for maintenance activities than are available for construction of new facilities.

2) Second, proper equipment, trained, or allocated personnel may not be available. For example, shared-use trails require narrow snow-blowers for snow removal, but these machines may not be owned by the jurisdiction.

3) Third, coordination between different departments regarding whose responsibility it is to maintain bicycle and pedestrian facilities is a challenge, and the exact duties that are required of the responsible party or department are often not well defined.

Most Cities "Make it Work"

Each of the communities that were surveyed outside of Denver (and many other small to mid-sized communities that have been contacted through other studies) take an enthusiastic "make it work" approach to maintenance of bicycle and pedestrian facilities because the benefits of improved livability and desirability outweigh the additional money/time these facilities may require. It is worth noting that both Lakewood and Littleton have significantly higher lane miles of on-street and off-street bicycle facilities than Glenwood, and they have continued to maintain them as necessary through alternate, combined, and shared funding and responsible agencies.

Case Studies - Why Other Communities are Successful

Additional information was gathered from case study cities (cities with readily available maintenance information) with successful maintenance programs or policies to aid in comparing with Glenwood's current policies and concerns. These case study cities (as well as peer cities) build and maintain bicycling and walking facilities because they are a priority for the community. As a result, they are privy to the economic benefits and quality of life benefits these types of

Table 2: Maintenance Policy and Funding Summary by Agency Interviewed

City	Existing Maintenance Budget for Bike/Ped from Capital Budget?	Add funding to Maintenance Budget when new bike facilities are built?	Funding Sources Used	Maintenance Staff	Maintenance Prioritization	Citizen Reporting?	Existing Maintenance Programs	Maintenance Budget 2015	Current Capital Budget (overall)	Capital Budget Include Bike/ Ped Improvements?
Glenwood Springs	Overall Parks maintenance budget that is $2,137,252 for all open space facilities	No	General fund and open space fund, street tax fund, and Acquisitions & Improvements Sales Tax. Funding is added incrementally.	Parks and Cemetery, Public Works, Streets, and SWAT. Some help from DDA	Safety first, then as needed; vegetation and trash are scheduled	Generic form on the website for citizens to ask questions. Or phone call or email to the department.	None - City usually reacts to citizen request	8 FTE - They maintain on an as needed budget. Total Parks and Cemetery Budget is $227,000 (8 FTE annual salaries)	$6.7 million	None
Littleton	No	No	General fund and open space fund (20% of open space fund). Funding is added incrementally throughout the years.	Grounds maintenance, streets	Some scheduled (graffiti removal), but primarily as needed.	Pothole reporting app	Adopt a Trail, Adopt a Street	$1,950,000 (resurfacing - not only bike/ped)	$8.2 million	Sometimes, but not this year because of recent completions
Lakewood	No	No	Operational budget and General fund for street resurfacing	Public Works and Community Resources	As needed. Funding is just absorbed highest risk areas addressed first. Policy is unwritten - sweep trails once a month.	Yes, highly used	Adopt a Street	$11,287,230 (Public Works - not only bike/ped)	$22 million	$300,000 (plus one-time $2,000,000)
Denver	Bike-Ped Bridges Maintenance Program ($50k); no separate fund for general maintenance	No	TIP Funds; Capital one-time transfers from developers and from General fund; Parks and Rec maintenance and management; Department of Public Works; Public Safety Special Revenue Funds; Grants; Bonds	Parks and Recreation (including on-call staff); City roadway crews; Currently adding 7 employees dedicated to bikeways	Safety first. Then focused on snow removal and general maintenance.	Denver's online service center	Roadway and sidewalk maintenance programs, bike-ped bridge maintenance programs, trails maintenance program	$50k for bike-ped bridges specifically; $63million one-time transfer from General fund for deferred capital infrastructure (not only bike/ped)	$297million	$8million for multi-modal improvements; $10million for curb ramp improvements; $900k for bike boulevards and protected bike lanes; $2.8million in funding for Denver Moves through CIP annual maintenance and discretionary funds. Recent additions for 2016
Madison	No	No	Among others, sidewalks - property owner assessment	Crosses departments (parks and city engineering). Added 1 FTE - 1/2 year striping and 1/2 year bus stop snow removal	Prioritizes higher-use trails. Documents for maintenance practices: (among others) city owned sidewalks and school/handicap crosswalks are maintained during regular business hours during a storm. Main bike routes are maintained starting at 4AM on weekdays in order to be traversable on morning commute.	Website reporting		$500,000 for bikeways program (capital budget); includes some resurfacing, etc.		

Notes: All information provided for Littleton, Lakewood, and Englewood is for FY 2015. Information provided is not necessarily directly comparable due to differences in city budget and department structure.

facilities bestow on the community. For instance, Madison, Wisconsin staff note, "We treat bicycling infrastructure no different from other infrastructure we have. We don't ask that [about maintenance cost concerns] about other development. We don't stop building housing because of the cost of trash pick-up and sewers."

A few examples of information provided by these cities and national averages of calculated continuing maintenance costs are listed below:

- Milwaukee County: The County maintains about 130 miles of paved and natural surface trails. The County spends $2,525 per mile to maintain existing asphalt paths and between $24.13 to $154.13 per mile for snow plowing, depending on the trail and surface type, width, and amount of snowfall. Trimming back vegetation and removing storm-damaged material for approximately 16 weeks out of the year costs $150,000. Landscaping on new trails and replacing landscaping on existing trails totals $110,000 while drainage installation, asphalt and washout repair for two weeks of the year costs $20,000.
- Michigan Trails and Greenways Alliance: High maintenance trails, which include hardscaped trails that run near of through cities and densely populated areas that also see high usage (178,000 users per year for the Pere Marquette Trail and 80,000 to 90,000 on the Kal-Haven Trail) have an estimated cost of $2,275 to $3,500 per mile. These costs cover weekly trash removal and toilet maintenance, tree removal, pruning, picnic table cleaning, graffiti removal, and pesticide spraying and invasive species removal.
- Iowa Department of Transportation: IDOT builds and maintains trails and paths of a variety of surface types. Total annual maintenance costs are estimated at approximately $1,500 per mile.
- Rails to Trails Conservancy: According to the Conservancy's Rail Trail Maintenance & Operation Manual, a minimum of $1,200 per mile for privately owned trails and approximately $2,077 per mile for government-maintained trails is spent on maintenance.
- The national average annual maintenance cost per paved mile of trail is $5,000. This includes trails in urban and rural areas, but is specific to off-street trail infrastructure. On-street and sidewalk facilities annual maintenance costs are harder to define, but can be expected to be significantly lower than the $5,000 per mile noted above. This is because maintenance for on-street facilities and sidewalks often takes place in conjunction with roadway maintenance, and fewer auxiliary costs such as restroom and trash facility maintenance specific to these facilities is required.

CONCLUSIONS

In relative terms, Glenwood is doing well in utilizing available funding and 8 FTE (Parks and Cemetery maintenance budget) and in at least considering prioritization of maintenance items; however it is unknown at this time the success of coordination across agencies in Glenwood.

In order for Glenwood staff to move forward with a maintenance program for area walk and wheel facilities, the following steps are recommended:

- Actively pursue funding commitments from varying sources such as City capital budget or general fund, grants, development funds, and private donations.
- Establishing an overall bicycle and pedestrian coordinating group to manage inter- and intra-department maintenance efforts
- Develop a Maintenance Capital Fund
- Develop a list of immediate and future trail, sidewalk, and on-street bicycle and pedestrian maintenance project needs, such as specific overlay projects or trail segment replacements repairing known current issues
- Develop a regular maintenance schedule for items such as trimming, sweeping/snow clearing, and path/trail overlay
- Provide citizens with an efficient method of input/feedback to allow for additional "citizen inspectors" such as trail inspection forms or a maintenance issue reporting app
- Study and create maintenance guidelines and best practices

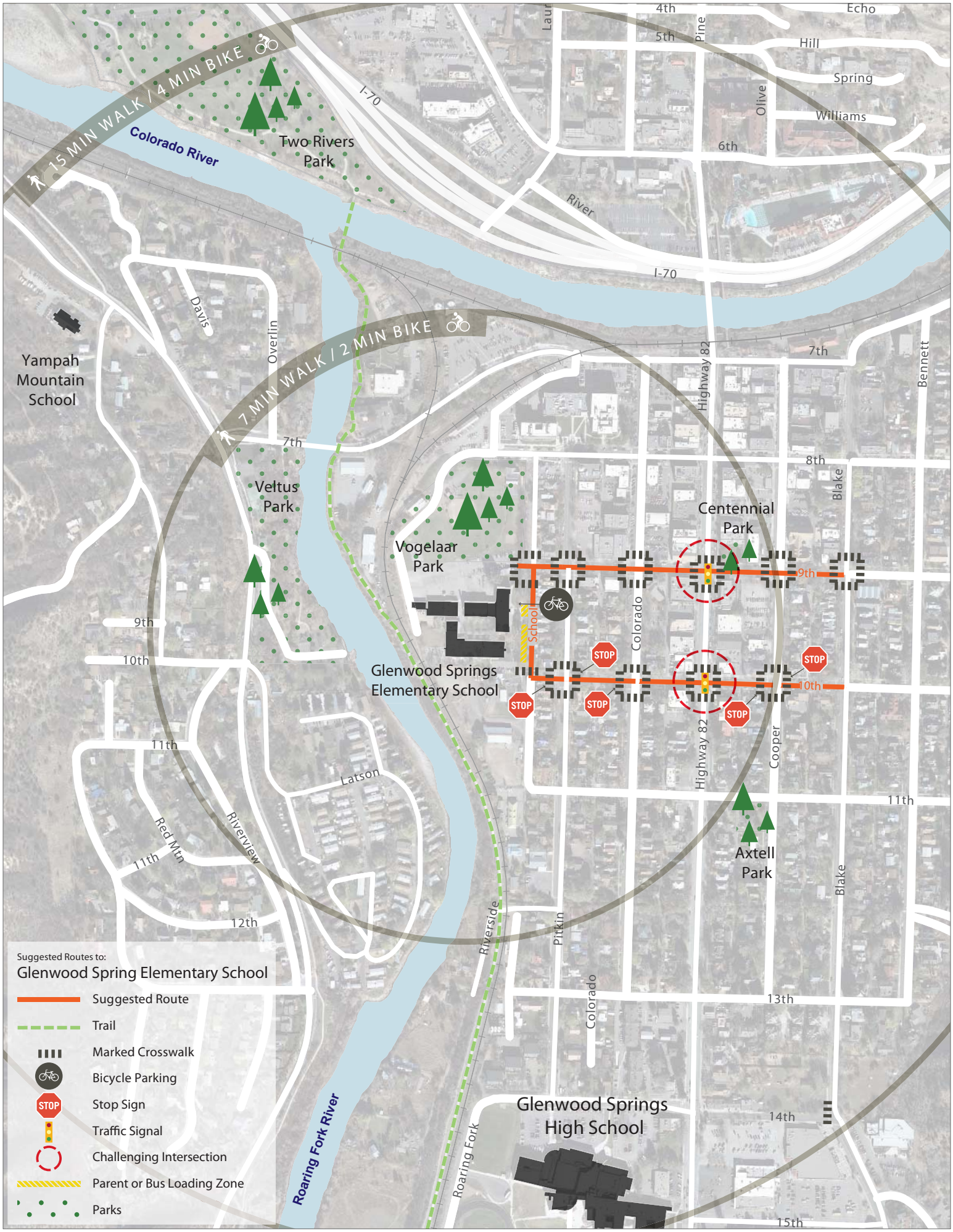
I Safe Routes to School

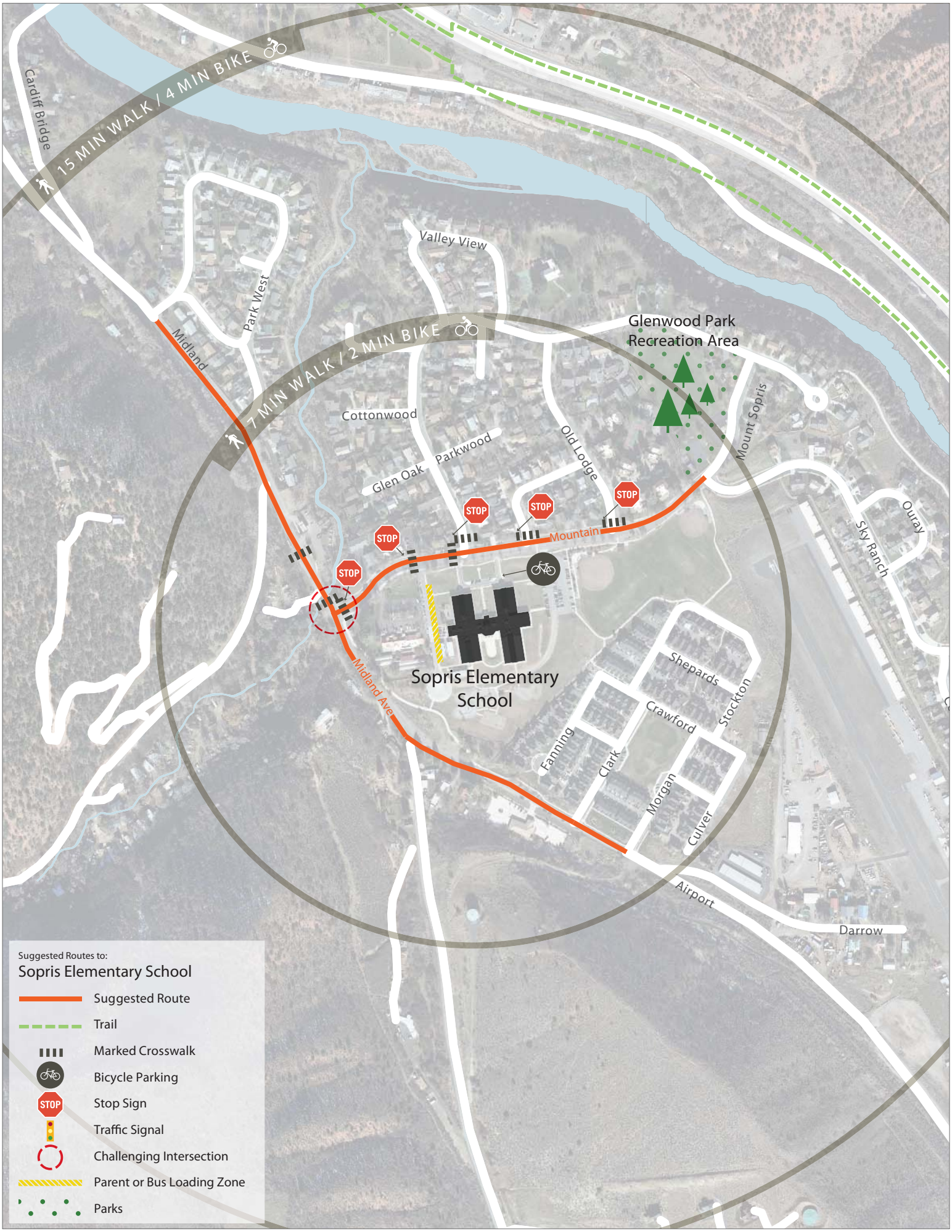
CHAPTER CONTENTS

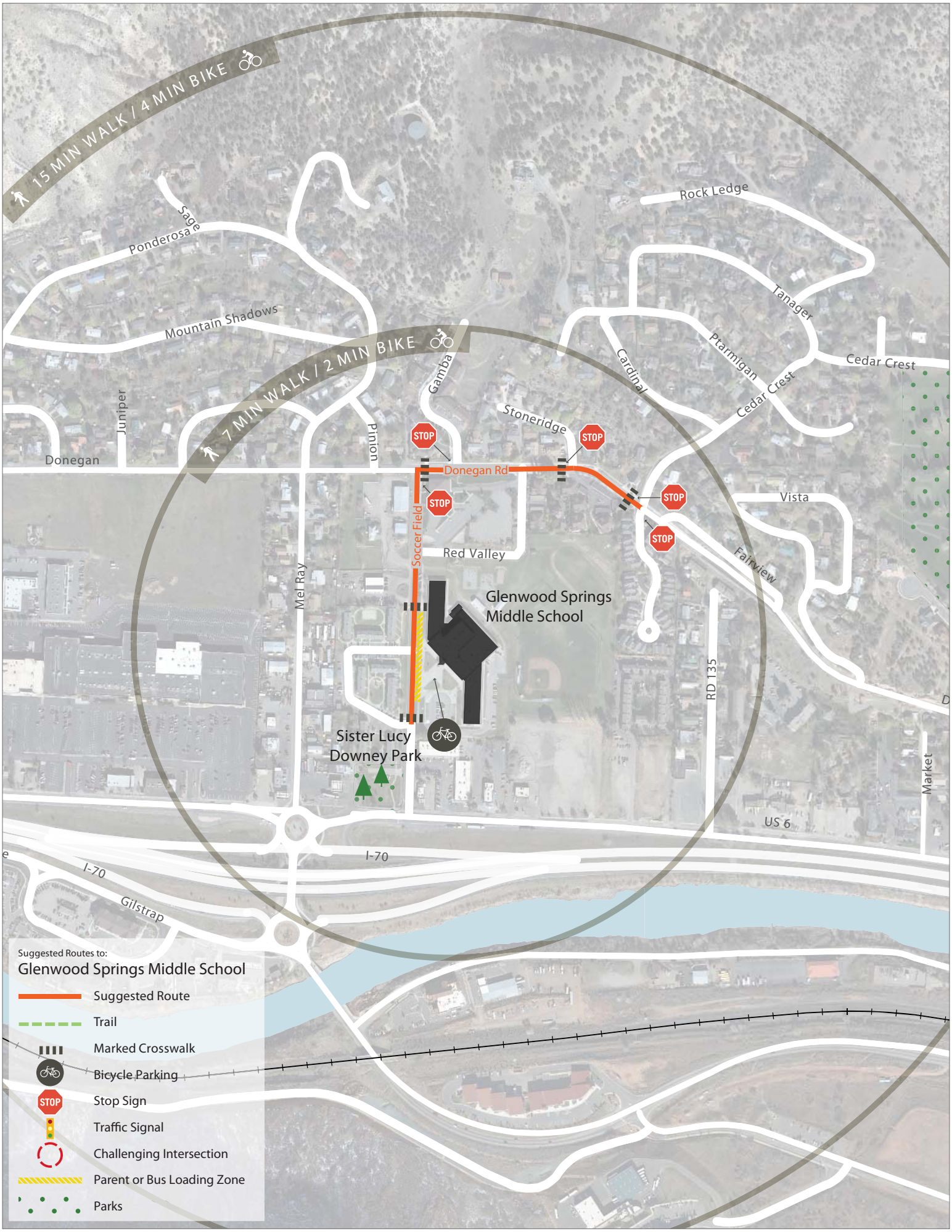
SAFE ROUTES TO SCHOOL

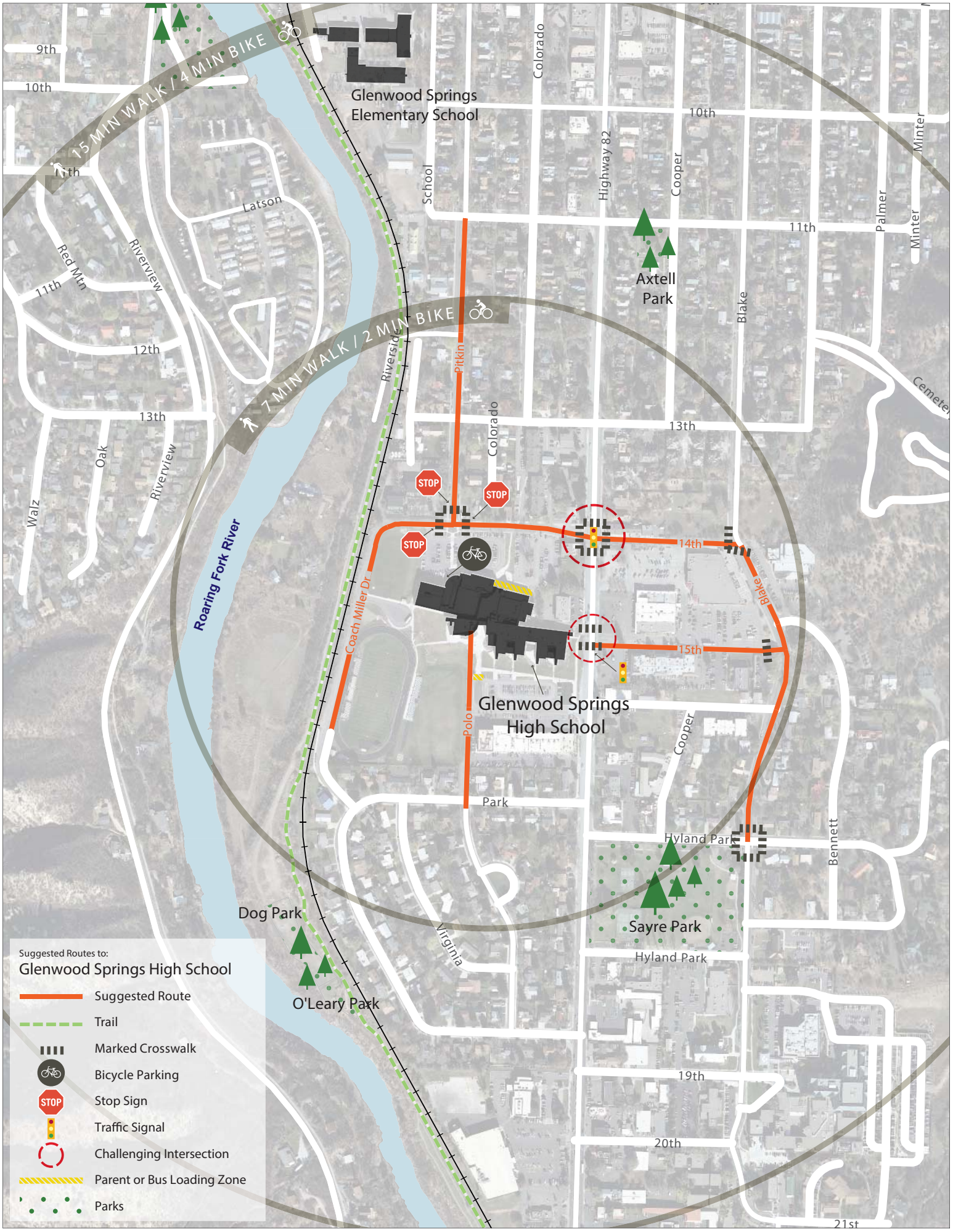
Glenwood Springs last completed a Safe Routes to School (SRTS) audit and improvements report as part of a larger study for the Roaring Fork Valley in 2007. As part of this multi-modal transportation plan, the following high-level exhibits were prepared to help evaluate the adequacy of Safe Routes to School for each of the public schools in Glenwood Springs. Each of the exhibits looked at suggested routes, nearest trail location, marked crosswalks, stop sign location, traffic signal location, bicycle parking at each school, challenging intersections, and parent or bus loading zones. This evaluation was completed for each of the following schools:

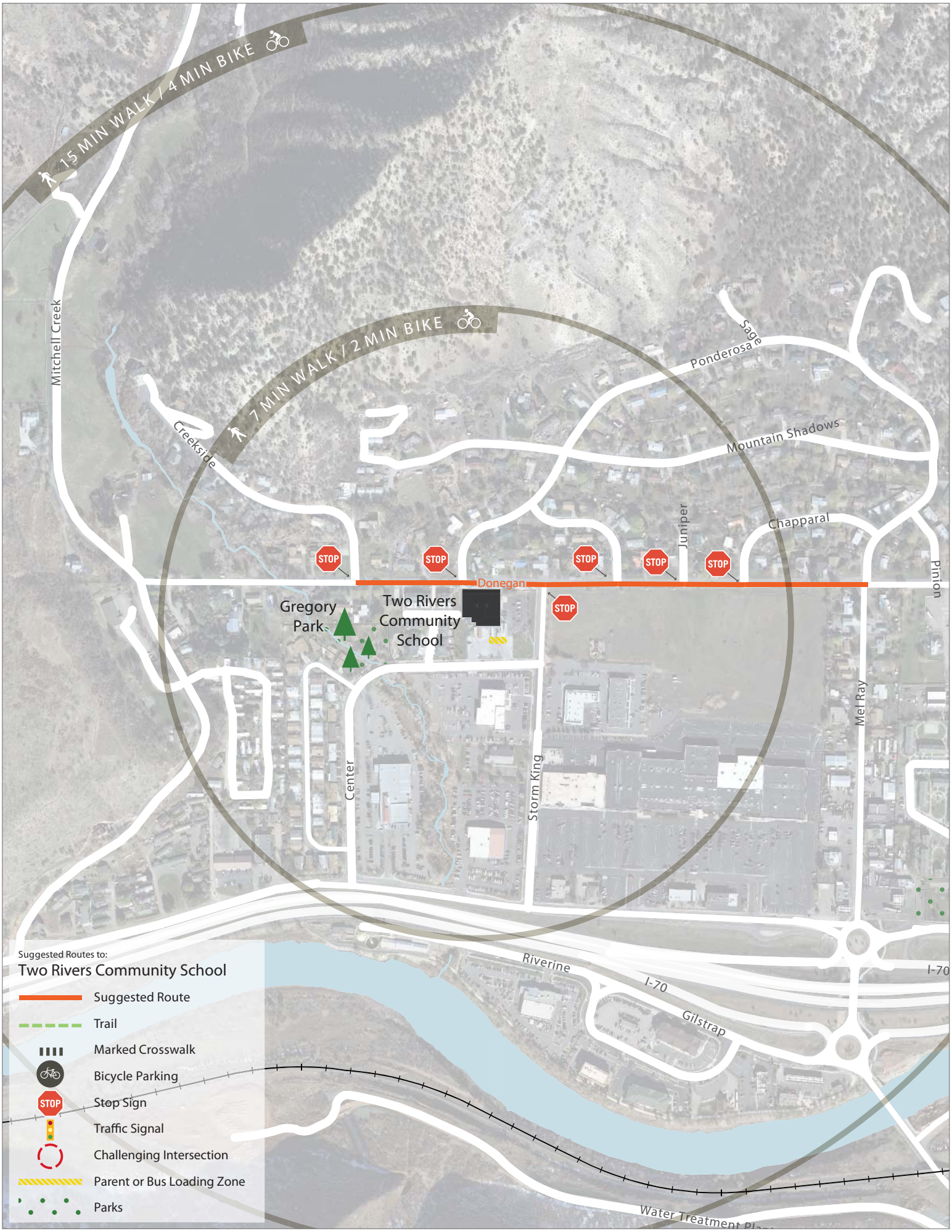
- Sopris Elementary
- Glenwood Springs Elementary
- Glenwood Springs Middle School
- Glenwood Spring High School
- Yampa Mountain High School
- Two Rivers Community School


15 MIN WALK / 4 MIN BIKE
7 MIN WALK / 2 MIN BIKE
Colorado River
Two Rivers Park
I-70
River
Yampah Mountain School
Davis
Overlin
Veltus Park
Vogelaar Park
Glenwood Springs Elementary School
School
Centennial Park
Axtell Park
Glenwood Springs High School
Roaring Fork River
Roaring Fork
Riverside
Pitkin
Colorado
Highway 82
Cooper
Blake
Bennett
Pine
Olive
Laur
Hill
Spring
Williams
Echo
Latson
Red Mtn
Riverview
4th
5th
6th
7th
8th
9th
10th
11th
12th
13th
14th
15th
STOP
Suggested Routes to:
Glenwood Spring Elementary School
Suggested Route
Trail
Marked Crosswalk
Bicycle Parking
Stop Sign
Traffic Signal
Challenging Intersection
Parent or Bus Loading Zone
Parks


15 MIN WALK / 4 MIN BIKE
7 MIN WALK / 2 MIN BIKE
Cardiff Bridge
Valley View
Park West
Midland
Cottonwood
Glen Oak
Parkwood
Old Lodge
Glenwood Park
Recreation Area
Mount Sopris
Ouray
Sky Ranch
Mountain
STOP
Sopris Elementary
School
Midland Ave
Shepards
Crawford
Stockton
Fanning
Clark
Morgan
Culver
Airport
Darrow
Suggested Routes to:
Sopris Elementary School
Suggested Route
Trail
Marked Crosswalk
Bicycle Parking
Stop Sign
Traffic Signal
Challenging Intersection
Parent or Bus Loading Zone
Parks


15 MIN WALK / 4 MIN BIKE
7 MIN WALK / 2 MIN BIKE
Sage
Ponderosa
Mountain Shadows
Juniper
Donegan
Pinion
Gamba
Stoneridge
Rock Ledge
Tanager
Cardinal
Ptarmigan
Cedar Crest
Cedar Crest
Vista
Fairview
Donegan Rd
Soccer Field
Red Valley
Mel Ray
Glenwood Springs
Middle School
Sister Lucy
Downey Park
RD 135
Market
US 6
I-70
I-70
Gilstrap
STOP
Suggested Routes to:
Glenwood Springs Middle School
Suggested Route
Trail
Marked Crosswalk
Bicycle Parking
Stop Sign
Traffic Signal
Challenging Intersection
Parent or Bus Loading Zone
Parks


15 MIN WALK / 4 MIN BIKE
7 MIN WALK / 2 MIN BIKE
Glenwood Springs Elementary School
Axtell Park
Glenwood Springs High School
Roaring Fork River
Dog Park
O'Leary Park
Sayre Park
Hyland Park
Park
9th
10th
11th
12th
13th
14th
15th
19th
20th
21st
Colorado
School
Highway 82
Cooper
Palmer
Minter
Blake
Pitkin
Riverside
Latson
Red Mtn
Riverview
Oak
Walz
Coach Miller Dr
Polo
Virginia
Bennett
Cemetery
STOP
Suggested Routes to:
Glenwood Springs High School
Suggested Route
Trail
Marked Crosswalk
Bicycle Parking
Stop Sign
Traffic Signal
Challenging Intersection
Parent or Bus Loading Zone
Parks


15 MIN WALK / 4 MIN BIKE
7 MIN WALK / 2 MIN BIKE
Mitchell Creek
Creekside
Ponderosa
Sage
Mountain Shadows
Juniper
Chapparal
Pinion
Donegan
STOP
Gregory Park
Two Rivers Community School
Center
Storm King
Mel Ray
Riverine
I-70
Gilstrap
Water Treatment Plant
Suggested Routes to:
Two Rivers Community School
Suggested Route
Trail
Marked Crosswalk
Bicycle Parking
Stop Sign
Traffic Signal
Challenging Intersection
Parent or Bus Loading Zone
Parks


15 MIN WALK / 4 MIN BIKE
7 MIN WALK / 2 MIN BIKE
Meadows
Centennial
Devereux
1st
I-70
Two Rivers Park
Colorado River
Wulfsohn Mountain Park
Yampah Mountain High School
STOP
STOP
Red Mountain Dr
Midland Ave
Davis
Overlin
7th
Veltus Park
Vogelaar Park
9th
10th
11th
Latson
Riverview
Red Mtn
11th
12th
School
Suggested Routes to:
Yampah Mountain High School
Suggested Route
Trail
Marked Crosswalk
Bicycle Parking
Stop Sign
Traffic Signal
Challenging Intersection
Parent or Bus Loading Zone
Parks