Rapid City Area
Bicycle and Pedestrian Master Plan

PREPARED BY:
Alta Planning + Design

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Kadrmas Lee & Jackson
Engineers Surveyors Planners

Acknowledgments

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Steering Committee

Marcia Elkins, Rapid City Growth Management
Monica Heller, Rapid City Growth Management
Kip Harrington, Rapid City Growth Management
John Less, Rapid City Public Works
Jerry Cole, Rapid City Parks and Recreation
Brad Remmich, South Dakota Department of Transportation
Dan Staton, South Dakota Department of Transportation
Mark Hoines, Federal Highway Administration

Alta Planning + Design

Steve Durrant, Principal-in-Charge
Ann Freiwald, Project Manager
Hannah Kapell, Planner

In association with

Kadrmas, Lee and Jackson (KLJ)

RDG Planning and Design

alta PLANNING + DESIGN

Kadrmas Lee & Jackson Engineers Surveyors Planners

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Chapter 1. Introduction

The Rapid City Bicycle and Pedestrian Master Plan ("Bicycle and Pedestrian Master Plan") builds on past and on-going efforts by the Rapid City Area Metropolitan Planning Organization (MPO) and the City of Rapid City to enhance transportation options and improve the quality of life in the Rapid City area. The Bicycle and Pedestrian Master Plan, which will be adopted as part of the *Rapid City Comprehensive Plan*, will guide the development of a network of bicycle and pedestrian routes that link activity centers within the city and provide opportunities for connections to surrounding areas. This network will not only make bicycling and walking a more viable mode of transportation, but it will contribute to an enhanced quality of life in the community and provide economic development opportunities.

Throughout this plan, the term "pedestrian" refers to a person moving from place to place, either on foot and/or with the use of an assistive mobility device (when that person has a disability and/or medical condition). "Walking" or "to walk" are the terms used to describe the movement of a pedestrian.

Similarly, the term "bicyclist" refers to a person moving from place to place using a bicycle or similar human-powered vehicle like a tandem bicycle, tricycle, recumbent bicycle, etc. "Bicycling" and "to bicycle/to bike" are terms used to describe the movement of a person operating a bicycle.

Vision, Goals, and Objectives

Vision

Rapid City will enhance transportation choices by developing a network of on-street and off-street bicycle and pedestrian facilities that provide connections to destinations throughout the city.

Figure 1. The Leonard "Swanny" Swanson Memorial Pathway provides a continuous facility that acts as a spine for the bicycle and pedestrian networks.

Goals & Objectives

Goal 1. Support bicycling and walking as viable transportation modes in Rapid City.

Objective 1.1. Implement the Rapid City Area Bicycle and Pedestrian Master Plan facility recommendations to provide bicycling and walking routes to key destinations.

- Action 1. Complete the high-priority bikeway network and sidewalk gap projects in the next five years (2011 – 2015).

Benchmark: Miles of new bikeways and sidewalks completed; percentage of high-priority projects identified in the Bicycle and Pedestrian Master Plan completed.

- Action 2. Complete the medium-priority projects within the next 20 years (2011 – 2030).

  Benchmark: Miles of new bikeways and sidewalks completed; percentage of medium-priority projects identified in the Bicycle and Pedestrian Master Plan completed.

Figure 2. While Rapid City has an extensive off-street bikeway network, the City does not currently designate any on-street bikeways.

Objective 1.2. Seek new funding sources and strategies to reduce the financial impact on the City.

- Action 1. In the case where grant requirements or construction as part of another project make construction of a lower priority project possible or required by law, pursue funding for that project regardless of priority.

  Benchmark: Proportion of roadway restriping, reconstruction, and construction projects that include bicycle and/or pedestrian improvements.

- Action 2. Seek funding for bicycle and pedestrian transportation projects through grant opportunities.

  Benchmarks: Number of grants applied for; amount of grant funding acquired.

Objective 1.3. Improve bicyclists' and pedestrians' safety and comfort by accommodating these modes during construction or facility repair activities.

- Action 1. Minimize disruption to bicycle and pedestrian travel by providing alternate routes during construction or repair activities.

  Benchmark: Development of guidelines/policies for providing bicycle and pedestrian access through or around construction zones.

Goal 2. Promote bicycling and walking in the Rapid City area by improving awareness of bicycle and pedestrian facilities and opportunities.

Objective 2.1. Improve public awareness of the on-street bicycle network and presence of bicyclists.

- Action 1. Install signs along all local and regional bikeways to assist with wayfinding and to increase awareness of bicyclists by motorists.

  Benchmark: Development of a wayfinding signage plan; number of signs installed.

- Action 2. Make bicycling and walking resources available through the City of Rapid City website.

  Benchmark: Development of web content on the City of Rapid City's website providing information about walking and bicycling; frequency of page views.

- Action 3. Increase action by law enforcement officers in regards to bicycle- and pedestrian- related violations by motorists, bicyclists, and pedestrians.

  Benchmark: Number of informational warnings and citations issued related to bicyclists or pedestrians; number of crashes involving bicyclists or pedestrians.

- Action 4. Promote the availability of bicycle racks on RapidRide buses.

- Benchmark: Development of web content on the RapidRide website providing information on how to use bike racks on the buses.

Objective 2.2. Support education and encouragement efforts in the region.

- Action 1. Apply to become a Bicycle Friendly Community (BFC) through the League of American Bicyclists' award program.

  Benchmark: Completed BFC application; goal of initial recognition at the bronze level with a target of obtaining gold level recognition.

- Action 2. Convene a standing Bicycle Advisory Committee (BAC) to focus on Plan implementation and obtaining funding for bicycle and pedestrian projects and programs.

  Benchmark: Appointment of a BAC; at least four meetings each year.

Goal 3. Integrate bicycle and pedestrian planning into Rapid City's Planning Processes.

Objective 3.1. Institutionalize bicycle and pedestrian planning into Rapid City Growth Management's work plan and Engineering department plans.

- Action 1. Review and update the Bicycle and Pedestrian Master Plan project and program priorities every five years.

  Benchmark: Revised project priorities list every five years.

- Action 2. Revise the street criteria manual to include consideration of bicycles based on road classification.

- Benchmark: Updated street design criteria manual; appropriate bicycle and pedestrian access provided in new developments as specified in this plan.

Objective 3.2. Require inclusion of bicyclists and pedestrians in citywide planning efforts.

- Action 1. Adopt a Complete Streets policy to consider the needs of pedestrians and bicyclists in new development and roadway reconstruction.

  Benchmark: Adopted Complete Streets Policy.

Chapter 2. Existing Conditions

This chapter provides both an overview and a more detailed inventory of existing pedestrian and bicycle facilities in the Rapid City area, including sidewalks, intersection improvements, shared-use paths, on-street bicycle facilities, and bicycle parking. The second section of this chapter identifies important destinations for bicyclists and pedestrians, especially connections to transit and schools. An analysis of system strengths and weaknesses follows, which highlights key areas where improvements may be needed.

Figure 3. Downtown Rapid City has wide sidewalks with planters and pedestrian-scale lighting in the buffer zone.

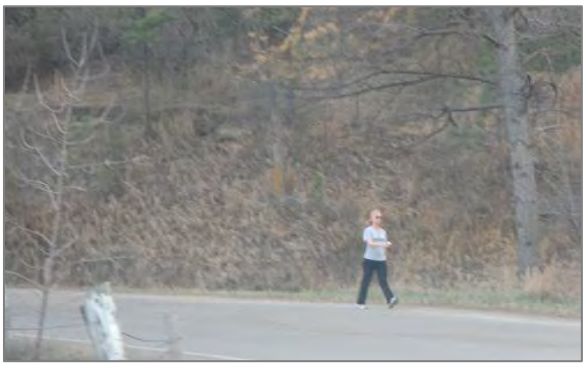


Figure 4. Many outlying streets accommodate pedestrian travel along wide shoulders.

Overview of Bicycle and Pedestrian Facilities

Pedestrian Facilities

Pedestrian travel is typically accommodated by sidewalks, shared-use paths, and road shoulders. Pedestrian facilities recognized by the American Association of State Highway and Transportation Officials (AASHTO) are:

- Sidewalks are walkways along roadways that are separated from the roadway with a curb and/or planting strip and have a hard, smooth surface (usually concrete). The travel way for pedestrians should be clear of utility poles, sign posts, fire hydrants, and other furnishings (Figure 3).
- Shared-use paths are facilities that are typically separated from the roadway right-of-way, often located on former rail corridors, or along waterways or utility corridors, or passing through parks and open spaces. Shared use paths are used by multiple user types including pedestrians, bicyclists, skaters, and/or runners. Shared use paths may be paved or unpaved.
- Roadway shoulders often serve as pedestrian routes in rural areas. Rural roads should usually have shoulders wide enough so that both pedestrians and bicyclists can use them (Figure 4).

These three types of facilities comprise the majority of Rapid City's pedestrian facilities network.

Note: Guidelines and minimum standards for pedestrian facilities are provided in the *Americans with Disabilities Act* guidelines, primarily in the draft *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

Sidewalks

A fairly complete sidewalk system (with sidewalks on both sides of streets) can be found in downtown Rapid City and nearby older residential neighborhoods. Downtown Rapid City's sidewalk environment includes a variety of complementary pedestrian facilities such as curb ramps, pedestrian-scale lighting, curb extensions and amenities like benches, trash receptacles, and public art. Outside of downtown Rapid City, newer developments have sidewalks, but in many other locations, demand trails indicate the need for additional sidewalks.

Figure 5. Curb-tight sidewalks on arterials can be an uncomfortable walking environment.

Curbside sidewalks can be uncomfortable for pedestrians, particularly along arterial streets or major collectors without on-street parking to act as a buffer (Figure 5). Providing a planting strip or buffer between the street and the roadway improves the pedestrian environment and planting strips can be used to store snow in the winter, keeping the sidewalk clear (Figure 6).

Figure 6. Buffers or planting strips provide space for utilities, bus stops, and snow storage.

ADA-Compliance at Intersections

Curb ramps are fundamental to an accessible pedestrian network – a sidewalk without a curb ramp is useless to a person who utilizes a wheelchair or similar assistive device as it forces them to travel in the street and/or to use driveways to make crossings. Likewise, curb ramps that are too steep, lack a level landing area or have a lip between the street and end of the ramp greater than 1" high also pose access problems.

Current design standards for curb ramps now require tactile domes be installed at the ends of every ramp to indicate there is a street or large driveway crossing (Figure 7). The domes are large enough to be felt underfoot or with long canes used

Figure 7. ADA-compliant curb ramp with tactile domes.

by visually impaired pedestrians. Tactile domes also should be a contrasting color to the sidewalk pavement as some people with visual impairments can discern surface color changes.

Push-buttons to trigger pedestrian walk signals should also accommodate all users. Accessible push buttons are large and can be pushed using a fist, elbow, arm, etc. instead of the smaller buttons on older versions that must be pushed by a finger.

Figure 8. Frequent pedestrian use along Deadwood Avenue is evident by the worn "demand trail", indicating a good location for a pedestrian facility investment.

Demand Paths

In some parts of Rapid City there are worn paths along roadways without pedestrian facilities where people are obviously walking despite the lack of a sidewalk (Figure 8). These trodden paths are often referred to as "goat paths", "desire lines" or "demand trails". Self-worn paths are not appropriate formal pedestrian accommodations, but they do provide a clear indication where people are already walking and the investment in a sidewalk or paved path would be beneficial.

Multi-User Facilities

Shared-Use Paths

Shared-use paths (also referred to as "trails" and "multi-use paths") are often viewed as recreational facilities, but they are also important corridors for utilitarian (work, shopping, or other functional) trips. Shared-use paths can provide a desirable facility particularly for pedestrians and bicyclists of all skill levels because they are separated from traffic. They are important assets for a community by encouraging healthy and active lifestyles, promoting nonmotorized transportation over longer distances, and making the area more attractive to visitors.

One type of shared-use path that has specific design considerations is a side path, or a two-way trail on one side of the road, located within the road right-of-way. Side paths can be differentiated from shared-use paths that have an exclusive right-of-way, such as paths in a greenway, park, or trails adjacent to a railroad or utility corridor. Local shared-use paths with exclusive right-of way are listed in Table 1; Map 1 shows their locations.

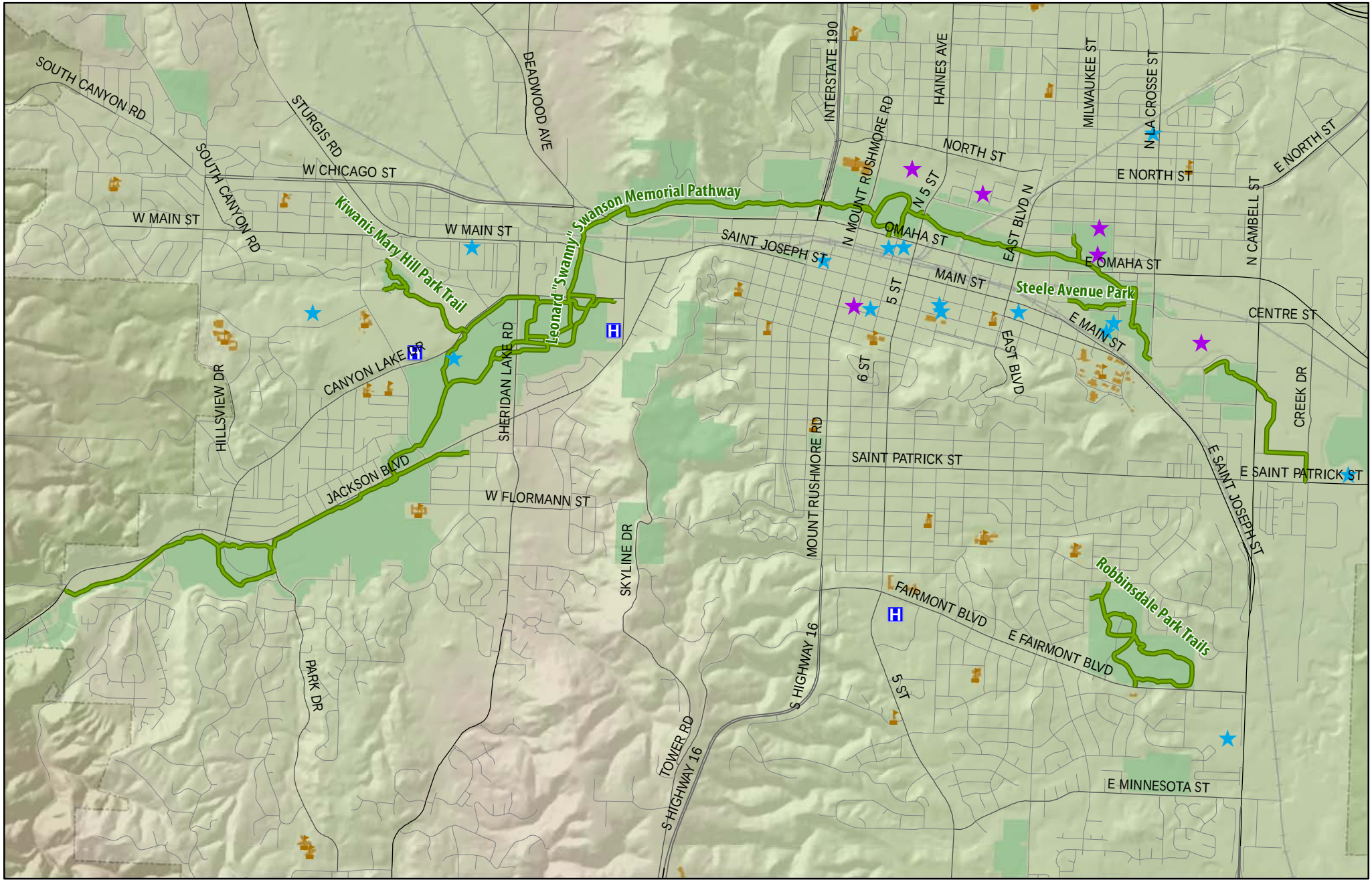
Figure 9. The Leonard "Swanny" Swanson Memorial Pathway is a popular walking and bicycling facility.

Table 1. Existing Shared-Use Paths with Exclusive Right-of-Way

Pathway Name	Pathway Limits	Length (mi)
Leonard "Swanny" Swanson Memorial Pathway	Jackson Boulevard - E St Patrick Street	11.8
Kiwanis Mary Hall Park Trail	Brookside Drive - Canyon Lake Drive	0.8
Robbinsdale Park Trails	Internal trail	1.8
Steele Avenue Park	Elm Avenue - Steele Avenue	0.3
Total shared-use paths with exclusive right-of-way:		14.6

Side Paths

Several shared-use paths in the Rapid City area are directly adjacent to roadways and within the street right-of-way (Figure 10). These 'side paths' serve both bicyclists and pedestrians and are wider than a standard sidewalk. Side paths provide routes between residential areas and employment centers as well as to retail areas.



Map 1. Existing Shared-Use Paths

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: August 2010

0 0.4 0.8 Miles

Shared-Use Path
Hospital
Civic Destination
Recreational/Tourist Destination
School
Parks
Railroads
City of Rapid City

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Most side paths in Rapid City have a buffer from the roadway, while at intersections the side path turns toward the street so bicyclists cross at intersections. However, drivers at intersections or entering and exiting driveways may not be expecting faster moving bicyclists traveling adjacent to the roadway and sometimes against the flow of traffic. Because bicyclists are expected to stop at every intersection on a side path even along a main street that has right-of-way, riding on a side path is slower than on-street riding and many commuter or long-distance riders prefer riding on street.

Table 2 lists the side paths currently existing in Rapid City.

Figure 10. Less-confident bicyclists can use side paths adjacent to roads to avoid mixing with vehicle traffic in Rapid City.

Table 2. Existing Side Paths

Street Name	Side Path Extent	Length (mi)
5th Street	Texas Street - E Minnesota Street	0.51
5th Street	Columbus Street - Cleveland Street	1.04
Anamosa Street	Milwaukee Street – Racine Street	0.23
Cambell Street	Rocker Drive - E Saint James Street	0.18
Elm Avenue	E Talent Street – E Oakland Street	0.2
E Fairlane Drive	Fairmont Boulevard - Maple Avenue	0.06
E Minnesota Street	Odde Drive - Minnesota Street Park	0.32
E Minnesota Street	5th Street - West of Parkview Drive	0.36
E Saint Patrick Street	Creek Drive - Star of the West Sports Complex	0.42
Haines Avenue/N 5th Street	North of Cobalt Drive - Omaha Street	4.11
Hillsview Drive	Raider Road - W Saint Patrick Street	0.29
Lemmon Avenue/N 1st Street/Memorial Park East	College Avenue - Memorial Park East Trail	0.98
Omaha Street	Mount Rushmore Road - 5th Street	0.29
Park Drive	Canyon Lake Park to Corral Drive	1.66
Parkview Drive	E Minnesota Street - Parkview Park	0.22
Range Road	Raider Road - Soo San Drive	0.60
Sheridan Lake Road	Corral Drive to Wildwood Drive	0.96
Sheridan Lake Road/ Corral Drive	Sioux Park Trail to Park Drive	2.91
Twilight Drive	Shadow Drive - Reservoir Road	1.47
Total side paths:		**16.81**

Figure 11. Shoulder bikeways are delineated with a fog line, and can use pavement stencils and signs.

Figure 12. Designated bike lanes are designated with pavement markings and signs, and parking is prohibited.

Figure 13. Shared lane marking treatments improve visibility of bicyclists on streets where bicyclists and automobiles share a travel lane.

Bicycle Facilities

In addition to shared use paths and side paths discussed above, bicycling is often accommodated using on-street bicycle facilities and improvements.

On-street bikeways can take several forms, depending on the speed and volume of traffic on the roadway, space available to accommodate bicyclists, and type of user expected on the facility. Formal on-street bikeways facility types include:

- Shoulder bikeways – paved roadways with striped shoulders wide enough for bicycle travel, may include signs. (Figure 11)
- Bike lanes – separate roadway space for bicycles accompanied by pavement stencils and signage. (Figure 12)
- Shared lanes – roads where bicyclists and automobiles share a travel lane. Two types of shared lanes include:
    - Shared lane markings can be used on shared streets with higher vehicular speeds and volumes, to improve visibility of bicyclists (Figure 13).
    - Signed shared roadways are low traffic speed and volume streets, where greater separation is not necessary to accommodate bicyclists of all abilities.

Currently Rapid City has only a few formalized on-street bikeways. An un-signed wide shoulder on Mountain View Road is designated for bicycle travel. Sixth Street from Omaha Street to Kansas City Street is under development as a shared lane.

Bicycles are not prohibited on any roads in Rapid City, including I-90 and I-190. As such, the city's entire street network is effectively the bicycle network, regardless of whether or not a bikeway stripe, stencil, or sign is present on a given street. Bicyclists share the road with cars on streets with lower traffic speeds and volumes, or on roadways with a wide shoulder where a bicyclist can avoid riding in traffic.

In addition to these on-street bicycle facilities, cycle tracks and mountain bicycling areas accommodate off-street bicycle travel, described below.

Cycle Tracks

A cycle track is a hybrid facility combining the experience of a side path with the on-street infrastructure of a conventional bike lane (Figure 14). Cycle tracks provide exclusive space for bicyclists that is physically separated from pedestrians and motor vehicle drivers. Cycle tracks are appropriate on streets with high traffic volumes where greater separation is needed, and where cross-traffic is limited. Cycle tracks require special attention at intersections. Likewise, maintenance needs to be a factor when considering the use of cycle tracks.

Figure 14. Cycle track on Kansas City Street.

Rapid City has a cycle track on Kansas City Street in downtown. However, the street usually has low automobile traffic speeds and volumes, and many bicyclists tend to ride in the street rather than on the cycle track.

Mountain Bicycling Trails

In addition to the transportation and recreation routes listed above, the Rapid City area is home to high-quality mountain bicycle opportunities and hiking trails. The "M Hill" area north of Omaha Street and west of I-190 has several mountain bicycling trails of varying difficulty. These trails provide recreational opportunities to Rapid City residents as well as visitors to the area. High-quality bicycle and pedestrian routes should be provided to encourage riders or hikers to access the system via nonmotorized means.

Related Facilities/Services

Bike Parking

Bike parking is a critical component of a community's bikeway network and can strongly influence one's decision whether to complete a trip via bicycle. Some bike racks are provided in downtown Rapid City near the library (see Figure 15), in a few other sidewalk locations, and at local schools.

Figure 15. Bicycle parking at the library.

The quality of existing bike parking facilities varies by location, particularly due to the style of rack chosen and/or placement of the rack. For example, some existing racks near schools are considered substandard

Figure 16. Bike racks provided at several schools do not support bicycles when they are locked.

because they do not provide sufficient points of contact to support a bicycle at two points (Figure 16). In other words, they do not allow a bicycle frame and at least one wheel to be locked to the rack without the use of a long bicycle cable or mounting the bicycle over the rack.

Informal bike parking includes bicycles locked to hand rails, street signs, light poles and other objects and indicates a demand for additional bike parking supply. Some bikes were observed informally parked in downtown Rapid City, suggesting that insufficient formal bike parking is being provided and/or that it is not conveniently located in close proximity to a storefront or building entrance.

Figure 17. RapidRide bus stop with a bench but no concrete waiting pad between the street and sidewalk.

Transit Connections

The Rapid Transit System (RTS) serves the metropolitan area and carries more than 215,000 annual passenger trips.[1] RapidRide is the fixed-route transit service for the Rapid City area and consists of five routes with 30-minute headways serving the north, south and west areas of the region.

Providing a strong pedestrian and bicycle link to transit is an important part of making non-motorized transportation a part of daily life in the Rapid City area. There are several main components of bicycle and pedestrian transit integration:

- Allowing bicycles on transit, either by providing bicycle racks on the front of buses and/or allowing bicycles to be brought on the buses;
- Providing benches, shelters, posted schedules, bicycle parking and other features at transit stops; and
- Improving connections between walkways, bikeways and transit

[1] Rapid City 2009-2013 Transit Development Plan (2009)

RapidRide buses are already equipped with front-mounted bicycle racks that hold two bicycles. However, RapidRide's website or the individual route schedules do not provide any information about riding the bus with a bicycle. Adding information about the availability of the bicycle racks on the buses and how to use them onto RapidRide's website and/or schedules would be an easy and low-cost improvement the City could quickly implement.

While the RapidRide transit system provides transportation options in the Rapid City area, the service is limited by the service hours of 7 am to 6 pm, which requires passengers to be at the station by 5:30 at the latest. In addition, the routes are limited in extent and several populated areas are not served by transit. The availability of the bicycle racks on the buses can help extend the system's coverage area if passengers combine bus and bicycle trips.

Some bus stops do not provide shelter, which can be a deterrent for potential riders during snow in the winter, heat in the summer, and thunderstorms year-round. Several do not include a concrete pad or curb ramp, which provide an accessible route to the stop.

The RTS also operates the City View Trolley and the Dial-a-Ride paratransit service. Operating from Memorial Day weekend through mid-October, the trolley provides a narrated tour of Rapid City and is mostly geared to visitors. The Dial-a-Ride paratransit service serves persons with disabilities and seniors who cannot use the RapidRide fixed route transit service. Neither of these services provides bicycle accommodation, which could encourage bicycle tourism and assist bicycling to transit.

Table 3 shows ridership numbers for 2009 and 2010.

Table 3. Rapid Transit System Ridership, 2009-2010

Year	RapidRide	Dial-A-Ride	City View Trolley
2009	218,476	71,775	124 (Daily Average)
2010	250,286	75,324	146 (Daily Average)

Pedestrian and Bicyclist Destinations

It is particularly important for the bicycle and pedestrian networks to provide access to popular destinations in the community. Within Rapid City area, popular destinations include:

- Educational Facilities: the South Dakota School of Mines and Technology, the National American University, Western Dakota Technical Institute, the University of South Dakota's School of

Nursing, Black Hills State University (four locations), elementary schools, junior high schools, and high schools.

- Employment Centers: Rapid City Regional Hospital, Wal-Mart/Sam'sClub, Green Tree, NEW Finance Corporation, and others.
- Commercial Areas: the Rushmore Mall, the East Family Thrift Center, the Midland Shopping Center, Baken Park, the City of Rapid City's central business district, and neighborhood commercial areas.
- Hospitals and Health Centers: Rapid City Regional Hospital, Rapid City Regional West – Center for Behavioral Health, Sioux San Indian Hospital, Rapid City Community Health Center, Black Hills Rehabilitation Center.
- Downtown Rapid City: Rapid City Public Library, the Rushmore Plaza Civic Center and the Journey Museum.
- Regional parks: Badlands National Park, Wind Cave National Park, Devil's Tower National Parks, and the Black Hills trails.
- Regional national areas: Mount Rushmore National Memorial and the Jewel Cave National Monument.

System Opportunities and Constraints

This section provides an overview of the positive characteristics that currently support walking and bicycling, and it identifies potential barriers to accommodating and encouraging bicycle and pedestrian trips, which this plan seeks to address. Appendix C provides additional discussion of these opportunities and constraints, as well as a review of existing conditions by area.

Opportunities

Positive characteristics that currently support bicycling and walking in Rapid City include:

Figure 18. Pedestrians walk in the median along West Boulevard.

- Topography in the downtown area
- Downtown land use characteristics
- Presence of existing walk- and bike-friendly streets
- Existing spine trail
- Presence of grade-separated shared-use path crossings of streets
- Available space to implement low-cost improvements

Constraints

However, people walking and bicycling in and around the Rapid City area face a variety of challenges, including:

- Challenges crossing some major streets,
- Roadway connectivity barriers formed by interchanges, Rapid Creek, and railroads
- Limited street system connectivity
- Lack of wayfinding tools such as signs guiding bicyclists to key destinations
- User conflicts on trails
- Maintenance issues
- Uncomfortable travel environments along high-volume roadways
- Fragmented sidewalk network in some areas
- Sidewalk obstructions and access, including utility poles, snow storage, and ADA-accessibility
- Lack of on-street bikeways

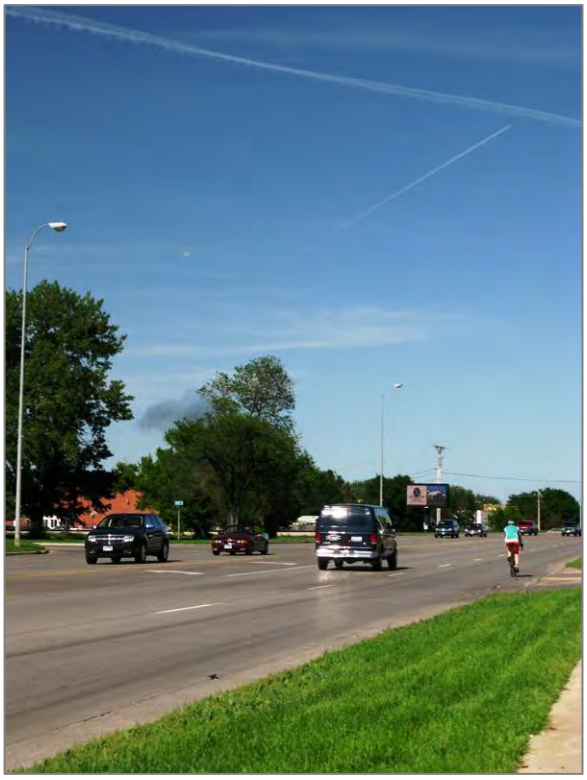

Figure 19. The 'Gap' (West Main Street between Jackson Boulevard and 12th Street) presents significant difficulties for bicycle access.

Chapter 3. User Needs Assessment

This chapter presents an overview of the needs of existing and potential pedestrians and bicyclists in the Rapid City area. Adequate identification of user needs enables planners and policy-makers to develop sound solutions for improving the community's bicycle and pedestrian networks.

The second part of this chapter summarizes estimates of existing and future system demand. The text presents a model that predicts the number of bicycle and pedestrian trips currently occurring and that may occur in the future in the Rapid City area. The travel demand model also estimates the resulting air quality benefits as well as difficult-to-quantify benefits of improved walking and bicycling networks in Rapid City such as livability, safety, public health, and other benefits.

Needs and Types of Bicyclists

The needs and preferences of bicyclists vary depending on a bicyclist's skill level and the type of trip a rider wishes to take. This plan aims to provide more comfortable and direct bicycling routes for existing cyclists and to encourage other residents and visitors to begin riding for transportation and/or recreation.

Needs of Casual and Experienced Riders

Casual bicyclists typically include youth, adults and seniors who ride a few times per month or less. Child bicyclists, seniors and adults new to bicycling may prefer shared use paths, while bicyclists with more experience may prefer on-street facilities like bike lanes. Bicyclists who ride for recreational purposes may prefer scenic, winding, shared use paths whereas bicyclists who ride to work or for errands may prefer more direct on-street bicycle facilities. Table 4 summarizes the needs of casual and experienced bicyclists.

Due to the existing shared use path, Rapid City offers many opportunities for casual bicyclists. In several locations, the existing shared use paths are accessible from residential neighborhoods. Many experienced bicyclists also use the trail system. This combination of fast-moving bicyclists on training rides with slower-moving bicyclists and pedestrians may result in user conflicts.

Table 4. Characteristics of Casual and Experienced Bicyclists

Casual Riders	Experienced Riders
Prefer off-street shared use paths or bike lanes along low-volume, low-speed streets	Prefer on-street or bicycle-only facilities as opposed to shared use paths
May have difficulty gauging traffic and may be unfamiliar with the rules of the road. May walk bicycle across intersections	Comfortable riding with vehicles on streets. Negotiate streets like a motor vehicle, including "taking the lane" and using left-turn pockets
May use a less direct route to avoid Arterials with heavy traffic volumes	May prefer a more direct route
May ride on sidewalks and ride the wrong way on streets to avoid a difficult crossing or to access a destination on a particular side of the street.	Avoid riding on sidewalks or on shared use paths. Rides with the flow of traffic on streets
May ride at speeds slightly faster than walking	Ride at speeds up to 20 MPH on flat ground, up to 40 mph on steep descents
Bicycle for shorter distances: up to 2 miles	May cycle longer distances, sometimes more than 100 miles

Characteristics of Recreational and Utilitarian Trips

Bicycle trip purposes can be separated into recreational and utilitarian trips. Recreational trips can range from a short family outing to a local park to a long distance group ride or something in between. Many utilitarian trips are made by commuter bicyclists going to and from work or school, as well as people who use bicycles to go shopping or run other errands. Utilitarian bicyclists include those who choose to use a bicycle as a means of transportation as well as those who have no other alternative transportation due to economic, medical or licensing reasons. Table 5 summarizes general characteristics of recreational and utilitarian bicycle trips.

The Rapid City area's shared-use path system provides excellent access to several parks, recreation areas and downtown. However, not all neighborhoods have easy bicycle access to employment centers, schools and shopping. For casual recreational riders, this may not be a serious deterrent, since they may be willing and able to drive with their bicycle to a shared-use path access point. However, this may not be desirable for more experienced recreational riders or commuters as they typically like to use their bicycles for the whole trip. Bicycle-friendly on-street connections between residential areas and the trails and between residential areas and shopping and commute destinations would likely increase the prevalence of bicycle commuting and may also increase recreational riding.

Table 5. Characteristics of Recreational and Utilitarian Bicycle Trips

Recreational Trips	Utilitarian Trips
Directness of route not as important as visual interest, shade, protection from wind	Directness of route and connected, continuous facilities more important than visual interest, etc.
Loop trips may be preferred to backtracking	Trips generally travel from residential to shopping or work areas and back
Trips may range from under a mile to over 50 miles	Trips generally are 1-5 miles in length
Short-term bicycle parking should be provided at recreational sites, parks, trailheads and other activity centers	Short-term and long-term bicycle parking should be provided at stores, transit stations, schools, workplaces
Varied topography may be desired, depending on the skill level of the cyclist	Flat topography is desired
Cyclists may be riding in a group	Bicyclists often ride alone
Cyclists may drive with their bicycles to the starting point of a ride	Bicyclists ride a bicycle as the primary transportation mode for the trip; may transfer to public transportation; may or may not have access to a car for the trip
Trips typically occur on the weekend or on weekdays before morning commute hours or after evening commute hours	Trips typically occur during morning and evening commute hours (commute to school and work); shopping trips also occur on weekends
Cyclists' preferred type of facility varies, depending on the skill level of the cyclist	Generally use on-street facilities, may use trails if they provide easier access to destinations than on-street facilities

Bicycle and Pedestrian Safety

Safety concerns are another reason to improve bicycling conditions in Rapid City. Although the incidence of collisions involving bicycles may be low, concerns about safety have historically been the single greatest reason people do not commute by bicycle, as captured in polls as early as 1991.[2] A national Safe Routes to School survey in 2004 similarly found that 30 percent of parents consider traffic-related danger to be a barrier to allowing their children to walk or bike to school.[3] Addressing those concerns for bicyclists through physical and program improvements is another major objective of this plan. Improving safety for bicyclists can also be accomplished by increasing the number of people who walk and bike; as

[2] Lou Harris Poll (2001)

[3] U.S. Centers for Disease Control and Prevention. *Barriers to Children Walking to or from School United States 2004, Morbidity and Mortality Weekly Report* September 30, 2005. Available:www.cdc.gov/mmwr/preview/mmwrhtml/mm5438a2.htm.

more people walk, a pedestrian's risk of being injured by a motorist is reduced.[4]

Safety Needs Analysis

Local crash data is a valuable source of information for identifying difficult areas of the community for bicyclists and pedestrians to traverse. It can also highlight specific interactions between bicyclists and motorists and pedestrians and motorists that require increased awareness or engineering.

Appendix E provides an overview of bicycle crash typologies and common unsafe bicyclist behaviors, which can be addressed through engineering and education or awareness programs. The appendix also presents a summary of crash data involving bicycles and pedestrians provided by the City for the Rapid City Pedestrian/Bicycle Crash Report (2002-2008) as well as state records from 2004-2008. The 2002-2008 Pedestrian and Bicycle Crash Report identifies trends and specific locations to target improvements.

Key findings from this safety analysis include:

- Between 2002 and 2008, 121 crashes involving bicyclists and 136 crashes involving pedestrians were reported in the City of Rapid City.
- A high incidence of crashes occurred in the month of October between the hours of 12:00 pm and 7:00 pm.
- Over half of bicyclists and the majority of pedestrians involved in crashes were under 20 years of age.

While the majority of crashes involving bicyclists were due to ride-out crashes, crash location indicates locations where expectations of bicyclists and motorists may not be clear or where other improvements might benefit bicyclists.

Crash Location

The majority of crashes involving pedestrians occurred within Rapid City's downtown and along major corridors including Mt. Rushmore Road, 5th Street/Haines Avenue, and East Boulevard/E North Street. Crashes involving bicyclists occurred more commonly along Van Buren Street, St. Patrick Street, W. Main Street, and Jackson Boulevard. Most of these streets are busy with more than two lanes of traffic. In several locations, bicyclists have few alternate routes and because they need to access nearby destinations.

[4] Jacobsen, P.L. (2003). *Safety in numbers: more walkers and bicyclists, safer walking and bicycling.* Injury Prevention 9:205-209.

The majority of the crashes involving bicycles and pedestrians took place at an intersection (Figure 20). Measures to increase visibility of bicycles and pedestrians at all crossing locations would increase safety for bicyclists and pedestrians. Complicated intersections should be simplified where possible.

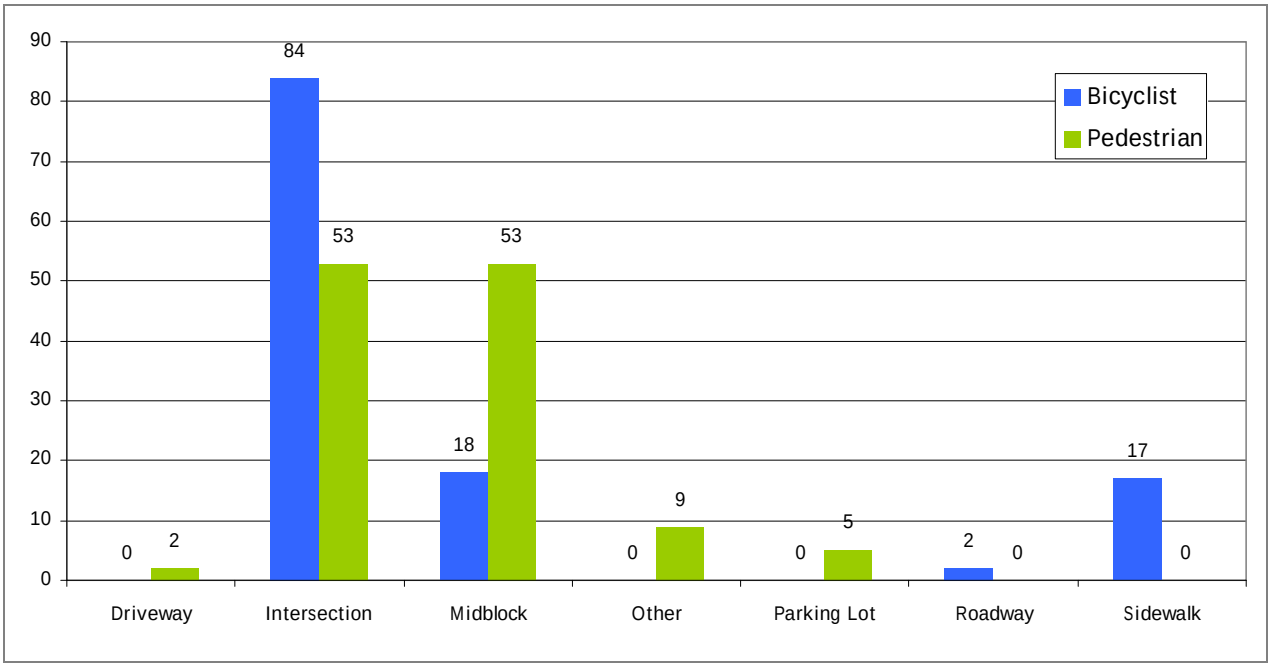

Figure 20. Location of Crashes Involving Bicyclists and Pedestrians, 2002-2008

Analysis

Locations that have experienced crashes are prioritized in the Bicycle and Pedestrian Master Plan recommendations. In addition, the types of crashes bicyclists tend to be involved in indicates lack of awareness and a need for improved facilities that offer clear guidance to drivers and bicyclists about which mode is expected to yield in different situations.

Appendix E provides additional analysis of the crash data in Rapid City.

Predicting Walking and Bicycling Demand

Demand models estimate usage of existing pedestrian and bicycle facilities and anticipate the potential usage of new facilities. The model used in this plan is based on data from the U.S. Census American Community Survey (ACS) 2006-2008 and other planning documents from the City of Rapid City and the MPO. This model assumes that, in addition to people who reported they commute exclusively by bicycle or walking that:

- A proportion of people that commute via transit access it on foot or by bicycle,
- A number of people who work from home take trips during the day, and
- Groups not captured by traditional commute trips tend to have a higher nonmotorized mode split, particularly students.

Full model assumptions and methodology can be found in Appendix D.

Table 6 and Table 7 show the models predicting the number of daily pedestrian and bicycle trips in the Rapid City area. (Note: trips are defined in the Census as primary mode; this analysis separated partial trips that are taken by walking or bicycling, including access to transit.)

Table 6 . Existing Pedestrian Demand Model Results

Variable	Value	Source
Study area population	120,858	ACS 2006-2008 estimate for the Rapid City Metropolitan Area
Employed population	61,757	ACS Population of workers over 16
Walk-to-work mode share	2.0%	ACS Means of transportation to work for workers over 16
Number of walk-to-work commuters	1,239	(employed persons) * (walking mode share)
Work-at-home mode share	4.8%	ACS Means of transportation to work for workers over 16
Number of work-at-home walk commuters	739	Assumes 25% of population working at home makes at least one daily walking trip
Transit-to-work mode share	0.7%	ACS Means of transportation to work for workers over 16
Transit pedestrian commuters	392	Assumes 85% of transit riders access transit by foot
School children, ages 6-14	19,726	ACS 2006-2008 School enrollment by level of school
School children walking mode share	11.0%	National Safe Routes to School surveys, 2003
School children walk commuters	2,170	(school children pop.) * (walking mode share)
Number of college students	7,161	ACS 2007 School enrollment by level of school
Estimated college walking mode share	60.0%	*National Bicycling & Walking Study*, FHWA, Case Study 1, 1995
College walking commuters	4,297	(college student pop.) * (walking mode share)
Total number of walk commuters	8,837	(bike-to-work trips) + (school trips) + (college trips) + (utilitarian trips)
School and commute walking trips subtotal	17,673	Total walk commuters x 2 (for round trips)
Other utilitarian and discretionary trips:		
Ratio of "other" trips to commute trips	2.73	*National Household Transportation Survey*, 2001
Estimated non-commute trips	48,248	
Current Estimated Daily Pedestrian Trips:	**65,921**	

Table 7. Existing Bicycle Demand Model Results

Variable	Value	Source
Study area population	120,858	ACS 2006-2008 estimate for the Rapid City Metropolitan Area
Employed population	61,757	ACS Population of workers over 16
Bike-to-work mode share	0.1%	ACS Means of transportation to work for workers over 16
Number of bike-to-work commuters	62	(employed persons) * (bicycling mode share)
Work-at-home mode share	4.8%	ACS Means of transportation to work for workers over 16
Number of work-at-home bike commuters	296	Assumes 10% of population working at home makes at least one daily bicycle trip
Transit-to-work mode share	0.7%	ACS Means of transportation to work for workers over 16
Transit bicycle commuters	115	Assumes 25% of transit riders access transit by bicycle
School children, ages 6-14	19,726	ACS 2007 School enrollment by level of school
School children bicycling mode share	2.0%	*National Safe Routes to School* surveys, 2003
School children bike commuters	395	(school children pop.) * (bicycling mode share)
Number of college students	7,161	ACS 2007 School enrollment by level of school
Estimated college bicycling mode share	5.0%	National Bicycling & Walking Study, FHWA, 1995
College bicycling commuters	358	(college student pop.) * (bicycling mode share)
Total number of bike commuters	1,110	(bike-to-work trips) + (school trips) + (college trips) + (utilitarian trips)
School and commute bicycling trips subtotal	2,221	Total bicycle commuters x 2 (for round trips)
Other utilitarian and discretionary trips:		
Ratio of "other" trips to commute trips	2.73	*National Household Transportation Survey*, 2001
Estimated non-commute trips	6,062	
Current Estimated Bicycle Trips:	**6,062**	

The bicycle and pedestrian demand model for the Rapid City area indicates that approximately 65,600 walking trips and more than 6,000 bicycle trips are taken each day. The model also indicates the largest group of pedestrians is school students (around 2,000) and the largest trip purpose is for non-work-related commute trips (approximately 48,000). Likewise, most bicycle commuting trips in Rapid City are made by school students (almost 400). The model also shows that non-commuting trips comprise the vast majority of existing bicycle demand. Note: These numbers are applicable to weekdays only and are averaged over the course of the year.

Current Air Quality Benefits

The expected number of walking and bicycling trips in the Rapid City can be directly translated into reduced motor vehicle trips. This number can be used to determine approximate reduction in motor vehicle miles traveled (VMT), which has a direct effect of reducing vehicular emissions and improving air quality.

Table 8. Vehicle Trips/VMT Reduction for Current Bicycle and Pedestrian Trips

Variable	Pedestrian Trips	Bicycle Trips
Reduced Vehicle Trips per Weekday*	6,017	816
Reduced Vehicle Trips per Year	1,570,363	212,904
Reduced Vehicle Miles per Weekday†	6,415	5,062
Reduced Vehicle Miles per Year	1,674,326	1,321,217

* Assumes 73% of walking/bicycling trips replace vehicle trips for adults/college students and 53% for school students.
† Assumes average walking round trip travel length of 1.2 miles for adults/college students and 0.5 mile for school children and bicycling trip length of 8 miles for adults/college students and 1 mile for school children.

From the model's estimate of the current levels of bicycling and walking in the Rapid City area, it is possible to calculate that bicycling and walking currently replace approximately 6,000 motor vehicle trips every weekday (trips that otherwise would be made via automobile). The reduction of 6,000 motor vehicle trips daily equates to an annual reduction of more than 1,600,000 vehicle miles. Table 8 illustrates the results of the vehicle trips and vehicle mileage reduction from existing pedestrian and bicycle trips, respectively. Notably, the replacement of 6,000 motor vehicle trips each weekday results in 11,000 pounds less carbon dioxide emitted in Rapid City daily, which totals over 1.77 million pounds less carbon dioxide emitted annually.

Additional air quality benefits from the existing bicycle and walking trips taken in Rapid City are enumerated in Appendix D.

Estimating Future Walking and Bicycling Trips

Estimating future benefits requires additional assumptions regarding Rapid City's future population and commuting patterns in the year 2035. Future population predictions determined by the Rapid City MPO were used in this model. The mode split variables used as model inputs represent a realistic, achievable goal of what the daily number of pedestrian and bicycle trips could be with a more complete pedestrian and bikeway system.

The future analyses assume a more complete pedestrian and bicycle transportation network and concurrent program development to encourage use. Walking and bicycling commute mode share was increased to address the higher use potentially generated by the addition of new facilities and enhancements to the existing system. Based on this analysis, it is anticipated that daily pedestrian trips will increase to 109,000 and bicycle trips will increase to almost 29,500 trips by 2035. While this is a substantial increase over existing numbers of trips, each additional person walking or bicycling is expected to take several trips, and people who may not have walked or bicycled at all previously may begin walking or bicycling.

Based on projected population growth and the expected increase in walking and bicycling, developing the Rapid City bicycle and pedestrian network will replace about 12,000 weekday motor vehicle trips, which would eliminate more than 8,000,000 motor vehicle miles traveled per year and result in a substantial decrease in vehicle emissions (see Table 9).

Table 9. Vehicle Trips/VMT Reduction for (2035) Future Pedestrian and Bicycle Trips

Variable	Pedestrian Trips	Bicycle Trips
Reduced Vehicle Trips per Weekday*	9,888	2,777
Reduced Vehicle Trips per Year	2,580,885	724,843
Reduced Vehicle Miles per Weekday†	11,796	20,018
Reduced Vehicle Miles per Year	3,078,741	5,224,805

* Assumes 73% of bicycle trips replace vehicle trips for adults/college students and 53% for school children.
† Assumes average walking round trip travel length of 1.2 miles for adults/college students and 0.5 mile for school children, and average bicycle round trip \ length of 8 miles for adults/college students and 1 mile for school children.

Difficult-to-Quantify Benefits of Bicycling

Although bicycling is known for its environmental and health benefits, it also has tangible economic benefits. The League of American Bicyclists reported that bicycling makes up $133 billion of the US economy, funding 1.1 million jobs.[5] The League also estimates bicycle-related trips generate another $47 billion in tourism activity. Many communities have enjoyed a high return on their investment in bicycling. For example, the Outer Banks of North Carolina spent $6.7 million to improve local bicycle facilities, and reaped the benefit of $60 million of annual economic activity associated with bicycling.[6]

Figure 21. Walking and bicycling are safe, healthy, and fun activities that contribute to quality of life.

Multiple studies have also shown that walkable, bikeable neighborhoods are more livable and attractive, increasing home values, [7] and resulting in increased wealth for individuals and additional property tax revenue. Similarly, bike lanes can improve retail business directly by drawing customers and indirectly by supporting the regional economy. Patrons who walk and bike to local stores have been found to spend more money to visit local businesses than patrons who drive.[8]

By replacing short car trips, bicycling and walking can help families defray rising transportation costs. Families that can replace some of their driving trips with walking or bicycling trips send a lower proportion of their income on transportation, compared to households that rely on cars[9] freeing additional income for local goods and services.

Bicycling can also improve quality of life. Since bicycling is among the most popular forms of recreational activity in the U.S.,[10] when bicycling is available as a daily mode of transportation, substantial health benefits result. The health benefit of bicycling for exercise can reduce the cost of

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[5] Flusche, Darren for the League of American Bicyclists. (2009). *The Economic Benefits of Bicycle Infrastructure Investments.*

[6] N.C. Department of Transportation, Division of Bicycle and Pedestrian Transportation. (). *The Economic Impact of Investments in Bicycle Facilities.* atfiles.org/files/pdf/NCbikeinvest.pdf

[7] Cortright, Joe for CEOs for Cities. (2009). *Walking the Walk: How Walkability Raises Home Values in U.S. Cities.*

[8] The Clean Air Partnership. (2009). *Bike Lanes, On-Street Parking and Business: A Study of Bloor Street in Toronto's Annex Neighborhood.*

[9] Center for Neighborhood Technology. (2005). *Driven to Spend: Pumping Dollars out of Our Households and Communities.*

[10] Almost 80 million people walking and 36 million people bicycling for recreation or exercise nationally, and 27.3 percent of the population over 16 bicycling at least once over the summer. (National Sporting Goods Association survey, 2003)

employer spending on health care by as much as $500 a year (by decreased sick leave and compensation), which provides a financial incentive to businesses that provide health coverage to their employees.[11]

[11] Feifei, W., McDonald, T., Champagne, L.J., and Edington, D.W. (2004). *Relationship of Body Mass Index and Physical Activity to Health Care Costs Among Employees.* Journal of Occupational and Environmental Medicine. 46(5):428-436

Chapter 4. Recommendations

This chapter lays out a 20-year plan for completing the system of walkways, bikeways, and shared-use paths. The recommended network builds upon previous and on-going local and regional planning efforts and reflects the extensive input offered by city staff, the project Steering Committee, bicycle and pedestrian stakeholder groups, and Rapid City residents.

The recommended bicycle and trail network includes a comprehensive and diverse set of bicycle and trail facilities connecting key destinations in and around Rapid City. System improvements include establishing a formalized on-street bikeway system, completing gaps in the existing sidewalk system, upgrading intersections for safer trail crossings, and projects to enhance safety and encourage bicycling and walking. Suggested improvements include low-cost measures yielding immediate results, such as re-striping of streets to accommodate bike lanes. Other improvements, such as expanding the local trail system, represent longer-term strategies for transforming Rapid City into a truly bicycle- and pedestrian-friendly community.

The Bicycle and Pedestrian Master Plan allows the City of Rapid City to focus and prioritize implementation efforts where they will provide the greatest community benefit.

Recommended Walkway Improvements

The recommended pedestrian network builds upon Rapid City's existing system of sidewalks and shared-use paths. The City completed an inventory of sidewalks on arterial and collector roadways, which was used to identify major roads without sidewalks on either side of the road. While sidewalks on both sides of a street are preferred, they are particularly necessary near pedestrian attractors, such as schools and community centers and in the downtown area. In addition, along major roads where crossings are further than an eighth of a mile apart, sidewalks should be provided on both sides to accommodate pedestrians walking to a crossing.

Sidewalk Project Selection

A sidewalk inventory developed by Rapid City staff was used to locate gaps in the sidewalk network on arterial and collector streets. The Bicycle and Pedestrian Master Plan sidewalk project list includes identified sidewalk gaps on either side of the street. Criteria used to identify the priority project list prioritized demand paths, which indicate where people walk despite the lack of sidewalk. Sidewalks adjacent to pedestrian trip attractors are also prioritized, as pedestrian activity is expected to be high close to these uses. Criteria used to prioritize sidewalks are shown in Table 10.

Table 10. Sidewalk Prioritization Criteria Selection

Criteria	Score	Measurement
Land Uses	12	Within 1/8 mile of a school, park, or destination (includes work release sites, hospitals, fire department stations, civic uses, the Rapid City Public Library, and others)
	8	Project within ¼ mile of school, park, or destination
	4	Project within ½ mile of school, park, or destination
	0	Project further than ½ mile to a school, park, or destination
Roadway Classification	15	Principal arterial
	10	Minor arterial
	5	Collector
Demand	20	Existing demand path
	0	No existing demand path
Transit	8	Within 1/8 mile of a bus route
	4	Project within ¼ mile of a bus route
	2	Project within ½ mile of a bus route
	0	Project further than ½ mile of a bus route

Sidewalk Recommendations

Table 11 and Table 12 show the high-priority sidewalk projects in the city and the three-mile planning area, respectively. All recommended sidewalk improvements are shown in Map 2.

Table 11. Top City Sidewalk Projects

Name	Extent	Length (miles)	Land Uses	Classification	Demand	Transit	Total Points	Side
5th Street	South Street - Clark Street	0.05	12	15	20	8	55	West
Cambell Street	Centre Street - Rocker Drive	0.23	12	15	20	8	55	Both
Cambell Street	Rocker Drive - 560' S of Saint James Street	0.26	12	15	20	8	55	East
Cambell Street	280' N E St. Charles Street - E St. Patrick Street	0.18	12	15	20	8	55	East
E Omaha Street/E Highway 44	La Crosse Street - S Valley Drive	1.74	12	15	20	8	55	Both
Omaha Street	West Boulevard - Mount Rushmore Road	0.20	12	15	20	8	55	North
S 5th Street	57' S 3rd Street - 95' N Elk Street	0.15	12	15	20	8	55	West
W Omaha Street	Mountain View Road - Oshkosh Street	0.51	12	15	20	8	55	Both
W Omaha Street	Oshkosh Street - Founders Park Drive	0.21	12	15	20	8	55	North
Deadwood Avenue	N Plaza Drive - W Chicago Street	1.72	12	15	20	4	51	Both
Total City Sidewalk Recommendations		**5.25**						

Table 12. Top Sidewalk Projects in the Three-Mile Planning Area

Name	Extent	Length (miles)	Land Uses	Classification	Demand	Transit	Total Points	Side
E Highway 44	City Limits - Jolly Lane	0.52	4	15	20	0	39	Both
Haines Avenue	City Limits - Mall Drive	1.33	8	15	0	8	31	East
Country Road	City Limits - 3 Mile Limits	3.34	12	15	0	0	27	Both
Highway 16	City Limits - 3 Mile Limit	4.91	12	15	0	0	27	Both
Highway 44	Jolly Lane - 3 Mile Limit	7.45	12	15	0	0	27	Both
Jackson Boulevard	Dark Canyon Place - City Limits	1.53	12	15	0	2	29	Both
N La Crosse Street	Seger Drive - E Mall Drive	0.19	4	15	0	8	27	Both
Nemo Road	3 Mile Limit - City Limits	5.78	12	15	0	0	27	Both
Reservoir Road	Avenue A - Lamb Road	4.30	12	15	0	0	27	Both
S HIghway 79	City Limits - 3 Mile Limits	4.72	12	15	0	0	27	Both
Sheridan Lake Road	3 Mile Limit - City Limits	5.76	12	15	0	0	27	Both
W Highway 44	3 Mile Limit - City Limits	3.67	12	15	0	0	27	Both
Total Three-Mile Planning Area Sidewalk Recommendations		**43.5**						

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Prioritized Sidewalk Projects

Within City Limits

- High Priority
- Medium Priority
- Low Priority

Three-Mile Planning Area

- High Priority
- Medium Priority
- Low Priority

- Shared-Use Path
- Sidewalks Both Sides
- Sidewalk One Side
- Desire Paths
- Railroads
- Special Generators
- City of Rapid City
- Box Elder
- Three-Mile Planning Area

Note: The sidewalk inventory evaluated sidewalks on collector and arterial roadways only. Sidewalks should be provided on both sides of local streets when development or street construction occurs.

0 1 2 Miles

N

Map 2. Prioritized Sidewalk Projects

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: February 2011

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Recommended Bikeway Improvements

Although Rapid City currently lacks a comprehensive on-street bikeway network, the City could formalize a network with signs and pavement markings, as well as longer-term improvements. The following recommendations also recognize that costs and difficulty of implementation vary widely. The phasing plan divides projects into three classifications, based on ease of implementation:

- Classification I: Signed shared roadways and bike lane restriping
- Classification II: Bike lane
- Classification III: Shared-use paths and bicycle facilities on undeveloped streets

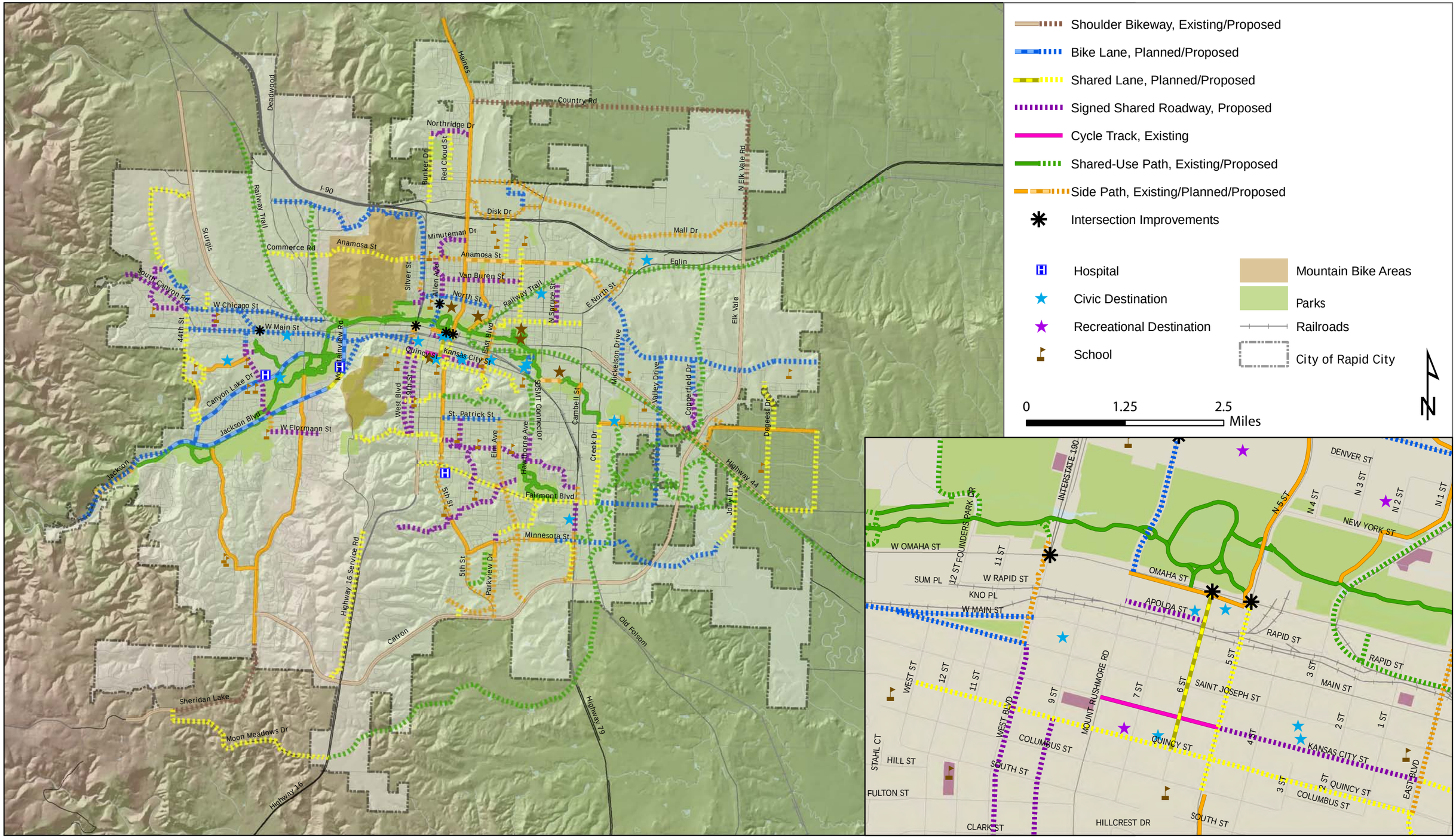
Bicycle Project Selection

The recommended bicycle network builds upon the previously proposed bikeways and connects to existing bikeways. The recommended network fills system gaps, continues expansion of the regional shared-use path network, formalizes existing routes used by bicyclists, and improves access between residential, employment, civic, and commercial destinations. Table 13 summarizes the criteria and methodology used to attribute points to each potential bikeway project. Points were assigned out of a total of 76 points. Within each of the classification groups, projects were divided into short-, medium-, and long-term in approximate thirds.

The project priorities may change according to available funds, new roadway projects, new development and redevelopment opportunities, or other factors. Medium- and long-term projects are also important and may be implemented at any point in time as part of a development or public works project. In general, as new public works projects are contemplated, bicycle accommodations should always be included regardless of priority.

Table 13. GIS-Based Bicycle Project Criteria

Criteria	Score	Measurement	Technical Notes
System Connectivity	20	Project within an 1/8 mile of existing bicycle/shared use facilities	Used 'as the crow flies' distance and considered existing bike lanes, side paths, shared-use paths, and cycle tracks.
	15	Project within a 1/4 mile of existing bicycle/shared-use facilities	
	10	Project within a 1/2 mile of existing bicycle/shared use facilities	
	5	Project provides partial connection where no other facilities exist	Visual analysis of locations where street connectivity is poor to determine critical regional links.
	0	Project further than a ½ mile of existing facilities or does not connect to the existing system	
Land Uses	12	Within 1/8 of a school, park, or destination (includes work release sites, hospitals, volunteer fire department stations, civic uses, the Rapid City Public Library, and others)	Used 'public buildings' shapefile as well as additional locations provided by the City.
	8	Project within ¼ mile of school, park, or destination	
	4	Project within ½ mile of school, park, or destination	
	0	Project further than ½ mile from a school, park, or destination	
Dedicated Facility	15	Off-street facilities and bike lanes	Based on recommended facility type.
	8	On-street bikeway along a collector road/road with posted speeds of 30 mph or less	30 mph or less
	4	On-street bikeway along a minor arterial/road with posted speed of 35-45 mph	35-45 mph
	0	On-street bikeway along a primary road/road with posted speeds of 50 mph or more	50 mph or more
Regional Benefit	15	Connects to neighboring community	Based on review of the map.
	8	Connects to outlying area in the Rapid City Area	
	0	Does not provide regional benefits	
Cost Effectiveness	14	Project team has identified sufficient space for a bike route	Based on proposed project type.
	8	Other on-street facility (additional review required)	
	6	Off-street facility	



Map 3. Recommended Bikeways

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: May 2011

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Recommendations for Shared Roadways and Bike Lane Restriping Projects

Many on-street bicycle facilities can be developed inexpensively with paint and signs. These facilities include shoulder bikeways, bike lane restriping, shared lane markings, and signed shared roadways.

Shoulder Bikeways

Rapid City has several streets with existing paved shoulders wide enough to accommodate bicyclists (four feet minimum continuously). To identify these as bicycle routes, the City should install "Bike Route" signs and repaint edge lines as needed. Accommodation for bicyclists on these streets should be preserved when they are reconstructed, or when intersections or turning lanes are developed. If any of these streets is built to an urban cross-section with curb and gutter, the road should include bike lanes.

Table 14. Shoulder Bikeway Projects

Route	Extent	Length (miles)	Tier
Country Road	Haines Avenue - N Elk Vale Road	3.50	High
Airport Road	Airport - E Highway 44	1.29	Low
N Elk Vale Road	Country Road - E Mall Drive	1.43	Low
Total Shoulder Bikeway Recommendations		**6.22**	

Bike Lane Restriping

Designated exclusively for bicycle travel, bike lanes are separated from vehicle travel lanes with striping and are denoted by pavement stencils and signs. On streets in Rapid City that have high vehicle speeds, dedicated bike lanes are appropriate to separate bicyclists from motor vehicle travel and turn lanes. On many of these roads, physical constraints limit street retrofit measures, and bike lanes must be retrofitted to the existing curb-to-curb widths. The least expensive and intrusive method is to narrow vehicular travel lanes and re-stripe the street with bike lanes. Table 15 lists the bike lane projects that could be implemented through restriping roadways.

Table 15. Bike Lane Restriping Projects

Route	Extent	Length (miles)	Tier
Jackson Boulevard	W Main Street - Mountain View Road	0.48	High
Mountain View Road	W Omaha Street - Jackson Boulevard	0.58	High
North Street	West Boulevard N - Allen Avenue	0.91	High
Soo San Road	W Main Street - Brookside Road	0.16	High
W Chicago Street	N 44th Street - Deadwood Avenue	1.76	High
West Boulevard N	Anamosa Street - Silver Street	0.26	High
Mt. Rushmore Road	North Street - Omaha Street	0.45	Medium
Steele Avenue	Brennan Avenue - Railroad	0.28	Medium
Jackson Boulevard	W Highway 44 - Chapel Lane	1.53	Low
W Main Street	44th Street - Soo San Drive	0.76	Low
Total Bike Lane Restriping Recommendations		**7.17**	

Shared Lane Markings

Shared lane markings are often used on streets where bike lanes are desirable but are not possible due to width constraints, and where motor vehicle speeds are moderate (less than 35 mph). High visibility pavement markings (MUTCD Section 9C.07) are placed in the travel lane to alert motorists of bicycle traffic, while also encouraging cyclists to ride at an appropriate distance from the "door zone" of adjacent parked cars. Placed in a linear pattern along a corridor, shared lane markings also encourage cyclists to ride in a straight line so their movements are predictable to motorists. These pavement markings have been successfully used in many small and large communities throughout the U.S.

Table 16. Shared Lane Marking Projects

Route	Extent	Length (miles)	Tier
44th Street	W Chicago Street - Raider Road	1.06	High
5th Street	Omaha St - Columbus St	0.46	High
Covington Street	Twilight Drive - E Highway 44	0.89	High
E Centennial Street/Locust Street	Parkview Drive - E Fairmont Boulevard	0.82	High
E New York St/N Maple Ave/E Philadelphia Street	East Boulevard - Cambell Street	1.00	High
Flormann Street/Meade Street	West Boulevard - 5th Street	1.27	High
Jackson Boulevard	Mountain View Road - Mountain View Road	0.28	High

Route	Extent	Length (miles)	Tier
Jolly Lane	E Highway 14 - Daly Circuit	0.90	High
Milwaukee Street	Crestwood Drive - E New York Street	1.00	High
Cathedral Drive/Fairmont Boulevard	Mount Rushmore Road - Creek Drive	2.35	Medium
City Springs Road Extension	Sturgis Road - Galena Drive	1.57	Medium
Creek Drive	E Saint Patrick Street - Fairmont Boulevard	1.01	Medium
Franklin Avenue/Belleview Drive/E St Andrew St	West Boulevard - 5th Street	0.55	Medium
N 40th Street	Fish and Game Site - W Chicago St	0.25	Medium
N Maple Avenue	Disk Drive - Anamosa Street	0.57	Medium
Quincy Street	West Street - East Boulevard	1.20	Medium
Raider Road	44th Street - Hillsview Drive	0.55	Medium
Triple Crown Drive	E Minnesota Street - E Catron Boulevard	0.53	Medium
Anamosa Street	Commerce Road - Silver Street	1.14	Low
Bunker Drive	Sagewood Street - Disk Drive/I-90	0.86	Low
Black Hills Boulevard	E Stumer Road - E Catron Boulevard	0.13	Low
Commerce Road/Lien Street	Railroad - Rand Road	0.81	Low
Degeest Drive	Homestead Street - Twilight Drive	0.65	Low
Dunsmore Road	Sheridan Lake Road - Moon Meadows Drive	0.14	Low
E Kansas City Street	East Boulevard - SD School of Mines & Technology	0.60	Low
East Boulevard	E Quincy Street - Signal Drive	0.45	Low
Hillsview Drive	Canyon Lake Road loop	0.46	Low
Moon Meadows Drive	Dunsmore Road - Highway 16	2.27	Low
Red Cloud Street	Northridge Drive - Mall Drive	0.63	Low
Reservoir Road/Longview Road	Twilight Drive - E Highway 44	1.48	Low
Total Shared Lane Marking Recommendations		**25.88**	

Signed Shared Roadways

Signed shared roadways are streets where motorists and bicyclists share the same space. A motorist will usually have to cross over into the adjacent travel lane to pass a bicyclist unless a wide outside lane is provided. The most suitable roadways for shared bicycle use are those with low speeds (25 mph or less) or low traffic volumes (3,000 vehicles per day or fewer). The route should be signed with standard Manual on Uniform Traffic Control Devices (MUTCD) green bicycle route signs with directional arrows.

Rapid City has a relatively well-connected system of lower-volume streets with posted speed limits of 25 mph. With the addition of relatively small-scale treatments, many streets in the area could become good bikeways for riders of all ages and skills.

Table 17. Signed Shared Roadway Projects

Route	Extent	Length (miles)	Tier
Alta Vista Drive/Anaconda Road	East of City View Drive - E Fairmont Boulevard	1.65	High
E Fairlane Drive	Elm Avenue - Robbinsdale Park	0.25	High
E Oakland Street	Hawthorne Avenue - Cambell Street	0.87	High
Kansas City Street	5th Street - East Boulevard	0.48	High
Meade Street/E Indiana Street	5th St - Hawthorne Avenue	1.21	High
Minuteman Drive	Lindbergh Avenue - Anamosa Street	0.60	High
Parkview Drive	E Liberty Street - E Minnesota Street	0.14	High
Sagewood Street/Northridge Drive	Bunker Drive - Haines Ave	0.56	High
Soo San Road	Brookside Drive - Range Road	1.00	High
Van Buren Street	Allen Avenue - Milwaukee Street	0.99	High
W South Street	Soo San Road – Mary Hill Park	0.11	High
9th Street	Quincy Street - Flormann Street	0.99	Medium
Cambell Street Service Road	Fairmont Boulevard - Richland Drive	0.37	Medium
Hawthorne Avenue	E Main Street - E Oakland Street	0.34	Medium
N Spruce Street	Meadowlark Road - E Philadelphia Street	0.50	Medium
Nordby Lane	W Saint Louis Street - W Main Street	0.19	Medium
Oak Avenue	E Indiana Street - Colorado Street	0.62	Medium
Silver Street/Philadelphia Street	N 11th Street - Boegel Street	0.61	Medium
West Boulevard	Leonard "Swanny" Swanson - Flormann Street	1.18	Medium
Allen Avenue	Anamosa Street - North Street	0.51	Low
Apolda Street	N Mount Rushmore Road - 6th Street	0.19	Low
Copperfield Drive	End of Existing Street - Highway 44	0.61	Low
Prairie Avenue	Saint Patrick Street - E Indiana Street	0.35	Low
San Marco Boulevard	City Springs Road - South Canyon Road	0.36	Low
San Marco Boulevard	South Canyon Road- W Chicago Street	0.31	Low
South Canyon Road	Berry Boulevard - N 44th Street	2.04	Low
W Chicago Street	San Marco Boulevard - N 44th Street	0.35	Low
W Flormann Street	Argyle Street - Mountain View Road	0.63	Low
Total Signed Shared Roadway Recommendations		**18.01**	

Recommendations for Bike Lanes Requiring Construction

While several of the bike lane projects can be accomplished simply by restriping a roadway, other projects would require additional construction and engineering effort. These projects may be able to reallocate existing street width through road diets or parking reduction to accommodate bike lanes, while some projects may require road widening.

Table 18. Bike Lanes Requiring Construction

Route	Extent	Length (miles)	Tier
St. Joseph Street	W Main Street - West Boulevard	0.32	High
W Main Street	Soo San Road - West Boulevard	2.14	High
E Minnesota Street	Minnesota Street Park - Cambell Street	0.25	Medium
Harmony Heights Lane	Plaza Boulevard - Anamosa Street	2.79	Low
N Maple Avenue	Mall Drive - Disk Drive	0.47	Low
N Plaza Drive/Plaza Boulevard	Deadwood Avenue - Harmony Heights Lane	1.08	Low
St. Patrick Street	5th Street - Elm Avenue	0.73	Low
Total Bike Lane Construction Recommendations		**7.78**	

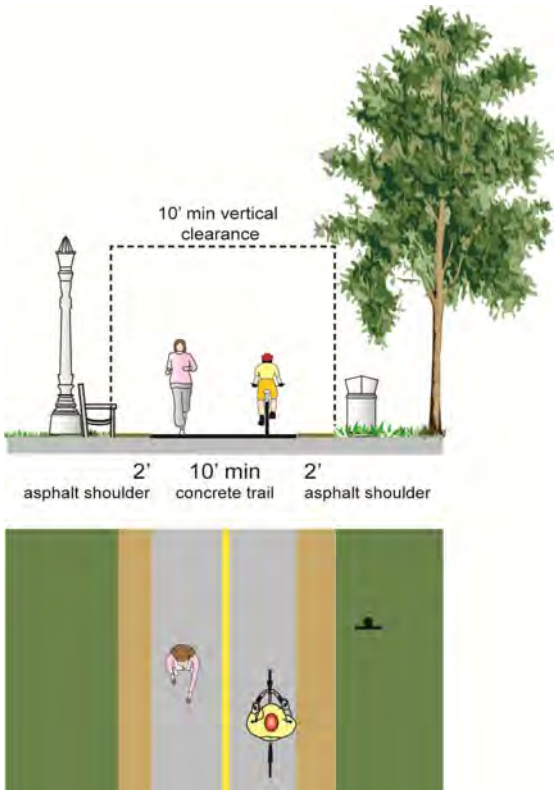

Figure 22. Recommended width for Leonard "Swanny" Swanson Memorial Pathway.

Recommendations for Shared-Use Paths, Side Paths, and Bikeways on Undeveloped Streets

The final category of bikeways is facilities that require additional financial outlay or that should occur in conjunction with a roadway construction or reconstruction project. These include bike lanes recommended on streets that have not been constructed, side paths, and shared-use paths.

Shared-Use Paths

In addition to the following specific project recommendations, it is recommended that the existing Leonard "Swanny" Swanson Memorial Pathway be widened to a 10-foot minimum standard with two-foot shoulders along its entire length (Figure 22). In addition, lighting along the trail would enhance safety for users and facilitate use of the trail for winter commuting. Development of trail projects requires significant coordination and is usually

facilitated by grant funding. This plan therefore does not prioritize all recommended shared-use paths; rather, shared-use paths should be planned and constructed as opportunities arise. In particular, the City should pursue opportunities to connect to and expand the existing Leonard "Swanny" Swanson Memorial Pathway. Table 19 shows the prioritization for these segments.

In addition to these shared-use paths and others shown in the recommended bikeways maps, the City should pursue opportunities to connect neighborhoods via drainage ways and shared used paths throughout the city.

Table 19. Prioritized Leonard "Swanny" Swanson Memorial Pathway Extensions

Extent	Length	Tier
Fairmont Boulevard – Cambell Street	0.81	Low
E St. Patrick Street – Fairmont Boulevard	1.38	Medium
Minnesota Street – S Highway 16	5.61	Low
S of Fairmont Boulevard – Minnesota Street	0.57	Low

Bike Lanes on Future Roadways

Future roads should be constructed with sufficient right-of-way to accommodate bicyclists via bike lanes. Table 20 lists planned future roads which would build out the bicycle network.

Table 20. Bike Lanes on Future Roadways

Route	Extent	Length	Tier
Anamosa Street	Valley Drive - Elk Vale Road	1.01	Low
Copperfield Drive	E Anamosa Street - Existing Street	0.42	Low
E Anamosa Street	E North Street - Mickelson Drive	0.60	Low
E Anamosa Street	Mickelson Drive - Valley Drive	0.58	Low
E Anamosa Street	Elk Vale Road - N Reservoir Road	1.03	Low
Fairmont Boulevard	Creek Drive - S Valley Drive	0.75	Low
Highway 16 Service Road	Skyline Drive/Tower Road - Catron Boulevard	1.98	Low
Mickelson Drive	E Anamosa Street - E HIghway 44	0.51	Low
E Minnesota Street	Cambell Street - Jolly Lane	2.10	Low
St. Martins Drive/N 44th Street	Sturgis Road - W Chicago Street	0.67	Low
Valley Drive	Anamosa Street - Fairmont Street	1.87	Low
Total Bike Lane on Future Roadway Recommendations		**11.52**	

Side Paths

While this plan focuses on the development of an on-street bikeway network to complement and connect to existing off-road facilities, in some locations vehicular speeds are too high to accommodate bicyclists on the roadway. In other locations, side paths provide a connection between other facilities on one side of the roadway. Table 21 shows the proposed side path project list.

Table 21. Side Paths

Route	Extent	Length	Tier
5th Street	Cleveland Street - Texas Street	0.87	High
Anamosa Street	Silver Street - Haines Avenue	0.66	High
Anamosa Street	Haines Ave - Milwaukee Street	0.70	High
E Anamosa Street	Racine Street - Century Road	0.77	High
Anamosa Street	Century Road - E North Street	0.27	High
E St. Patrick Street/Highway 44	Existing Side Path - Twilight Drive	1.14	High
East Boulevard	E Quincy Street - E New York Street	0.61	High
Jackson Boulevard	Cliffside Park - Existing Trail	0.75	High
Jackson Boulevard	Cleghorn Canyon Road - Cliffside Park	0.75	High
Parkview Drive	Parkview Park - 5th Street	0.53	High
5th Street	E Minnesota Street - E Catron Boulevard	0.99	Medium
Argyle Street	Jackson Boulevard - W Flormann Street	0.20	Medium
Cambell Street	E Oakland Street - Fairmont Boulevard	0.19	Medium
Cambell Street	Richland Drive – Elk Vale Drive	0.67	Medium
Disk Drive	Haines Avenue - N La Crosse Street	1.13	Medium
E Minnesota Drive	Parkview Drive- Odde Drive	0.46	Medium
Elm Avenue	E Saint Patrick Street – E Talent Street	0.31	Medium
Elm Avenue	E Oakland Street – Field View Drive	1.33	Medium
Elm Avenue	Field View Drive - E Catron Boulevard	0.56	Medium
I-190/Drainageway	West Boulevard N - Silver Street	0.13	Medium
San Francisco Street	La Crosse Street - Cherry Avenue	0.29	Medium
Stumer Road	Enchantment Road - 5th Street	0.63	Medium
West Boulevard	W Omaha Street - Saint Joseph Street	0.26	Medium
Concourse Drive	Elk Vale Road - Twilight Drive	0.20	Low
E North Street	Mall Drive - Anamosa Street	0.71	Low
Mall Drive	Haines Avenue - N Elk Vale Road	3.72	Low
Twilight Drive	E Highway 44 - Shadow Drive	0.18	Low
Total Side Path Recommendations		**19.01**	

Education and Encouragement Strategies

Improvements to bicycle and pedestrian infrastructure should be complemented by programs and activities designed to promote bicycling and walking. There are a number of existing efforts to encourage bicycling and walking in Rapid City, including efforts by local agencies and active community groups, shown in Table 22.

Table 22. Existing Education and Encouragement Programs in Rapid City

Resource or Event	Available
Rapid City Parks and Recreation Facilities Map	www.rcgov.org/pdfs/Parks-and-Recreation/bike_path_map.pdf
George S. Mickelson Trail Guide	www.sdgfp.info/parks/regions/northernhills/mickelsontrail/GSMTrailGuide.pdf
Bike Walk Run Committee	On hiatus
Black Hills Mountain Bike Association (BHMBA)	http://bhmba.org/
Black Hills Reconditioned Bikes for Kids	http://www.rapidnet.com/~bikerbfk/
Black Hills Volkssport Association	http://www.ava.org/clubs/bhva/
South Dakota Bicycle Coalition (SDBC)	http://www.sdbicyclecoalition.org/
Black Hills Fat Tire Festival	http://www.bhfattirefestival.com/
Black Hills Journey	Not available
League of American Bicyclists (national organization)	http://www.bikeleague.org/
Mickelson Trail Trek	http://gfp.sd.gov/state-parks/directory/mickelson-trail/trail-trek.aspx
Police Department Pedestrian Safety Campaign, "Pedestrian Safety, It's a Two-Way Street"	http://temp.rcgov.org/police/
Yellow Bike-a-Thon	http://www.rapidnet.com/~bikerbfk/

Program Recommendations

The City can encourage bicycling and walking in the region through select programs and by supporting local advocates' efforts. Key strategies include applying to become acknowledged as a Bicycle Friendly Community by the League of American Bicyclists. This program would require only staff time for the application. Another program the MPO might take a leading role in is to convene a Bicycle and Pedestrian Advisory Committee, with a work plan developed through the development of this Bicycle and Pedestrian Master Plan.

The MPO can also support advocates' efforts by providing in-kind support, meeting space, tables, publicity, and printing for groups holding an event.

The MPO can support the school district in their desire to implement a Safe Routes to School program by providing grant writing and technical expertise. Table 23 summarizes these key programs. Additional information is available in Appendix H.

Table 23. Program Recommendations

Resource or Event	Description	Potential Partners	Purpose	Timeframe
Become a Bicycle Friendly Community	Focus improvements on the League of American Bicyclists' award program and apply for recognition	South Dakota Bicycle Coalition	Receive recognition; build community support	One-time, with regular updates
Convene a Bicycle Advisory Committee (BAC)	Appoint citizen volunteers and key staff to advise the City on pedestrian and bicycling issues and assist with grant applications, plan review, etc.	South Dakota Bicycle Coalition	Advise City on bicycle and pedestrian issues	Ongoing
Develop and Launch a Bicycle/ Pedestrian Safety Awareness Media Campaign	Develop a marketing campaign highlighting bicyclist and pedestrian safety	Local bicycling and walking groups	Create awareness of bicycling and walking; promote safety	Late spring/ early summer, or in con-junction with back to school
Host National Bike Month Activities	Host group rides and events, offering incentives and rewards	South Dakota Bicycle Coalition, local groups and shops, large employers	Encourage bicycling and build a cycling community	Annually in May
Establish a "Create a Commuter" Program	Provides basic bicycle safety education and fully-outfitted commuter bicycles to low-income adults striving to connect to work, workforce development, or other daily needs by bicycle	Local bicycling groups and shops, such as Black Hills Reconditioned Bikes for Kids	Empower low-income residents to bicycle for transportation	Ongoing
Safe Routes to School Program – Phase 1	Educate students and their parents about walking and biking to school	Rapid City /Meade School Districts, parent groups, school neighbors	Improve safety with facilities/programs, encourage more bicycling and walking to and from school	School year

Community-Wide Improvements

Supporting facilities encourage bicycle trips and improve comfort and usability of the physical network.

Bicycle Wayfinding Signing Plan

Landmarks, natural features, civic destinations, neighborhood business districts and other visual cues help residents and visitors navigate through Rapid City. Placing signs throughout the city indicating to bicyclists their direction of travel, location of destinations, and the distance to those destinations will increase users' comfort and convenience of the bicycle system. Wayfinding signs also visually cue motorists that they are driving along a bicycle route and should expect bicycle traffic.

Rapid City should adopt an on-street wayfinding signage similar to the MUTCD-approved sign shown in Figure 23 for use along bicycle facilities.

Signage can serve both wayfinding and safety purposes including:

- Familiarizing users with the bikeway system
- Helping users identify the best routes to destinations
- Addressing misperceptions about travel time and distance
- Helping overcome a "barrier to entry" for people who do not bicycle often and who fear becoming lost

Wayfinding signs are a relatively cost-effective means for improving the walking and bicycling environment. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes. Guidance for sign placement and height can be found in Appendix F.

Rapid City should create a community-wide Bicycle Wayfinding Signage Plan that identifies:

- Sign locations along existing and planned bicycle routes
- Sign type – what information should be included and what is the sign design
- Destinations to be highlighted on each sign – key destinations for bicyclists
- Approximate distance and riding time to each destination

Figure 23. Model MUTCD-approved wayfinding signage.

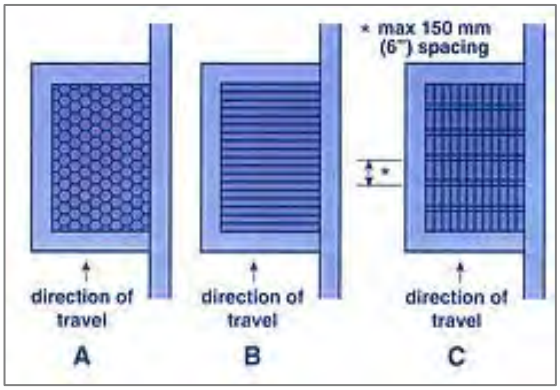

Figure 24. Examples of bicycle-safe drainage grates.

Drainage Grate Retrofits

The City should continue its efforts to retrofit existing drainage grates as roads are being resurfaced. Some older drainage grates can create slippery conditions for bicyclists and/or catch a bike wheel if they have metal grates that are parallel to the direction of travel. Newer grate styles have grates that are perpendicular to the travel lane or in a grid or mesh pattern. These newer grate types are much safer for bicyclists. Figure 24 demonstrates examples of bicycle-safe drainage grate coverings.

Rapid City should establish a goal for the number of drainage grates to retrofit each year. Retrofitting and replacing existing drainage grates will facilitate safe bicycle crossing movements and can reduce the City's liability exposure.

Bicycle Parking

Bicycle parking is an essential element of the bikeway network; without an adequate place to park, people may decide not to take a trip via bicycle. Improperly locked bicycles can crowd the sidewalk and restrict pedestrian movement.

Rapid City should consider linking bicycle parking requirements to land uses. Sample bicycle parking requirements recommended by the Association of Pedestrian and Bicycle Professionals (APBP) in the 2010 *Bicycle Parking Guidelines* are provided in Appendix G.

Street Design Criteria Manual Update

The City of Rapid City's Street Design Criteria Manual contains minimum street width standards by street classification but does not include bicycle accommodations as part of street design cross-sections. The City should revisit its Manual using the bicycle and pedestrian design guidelines provided in Appendix F to provide guidance for bicycle accommodation by level of street. The Manual should be modified to require bike lanes on all new arterial and collector streets, and revised cross-sections should be added to illustrate the new street designs. Figure 25 through Figure 27 show alternatives for how bicycles could be accommodated on arterial, collector, and local streets, respectively.

While shared lane markings are technically allowed on arterial roadways with posted speeds of 35 mph, this treatment is not comfortable for the majority of bicyclists and other treatments such as bike lanes and side paths are recommended. However, some bicyclists prefer riding on the street and

are comfortable sharing a lane with traffic, and those confident cyclists should be allowed to ride in the street.

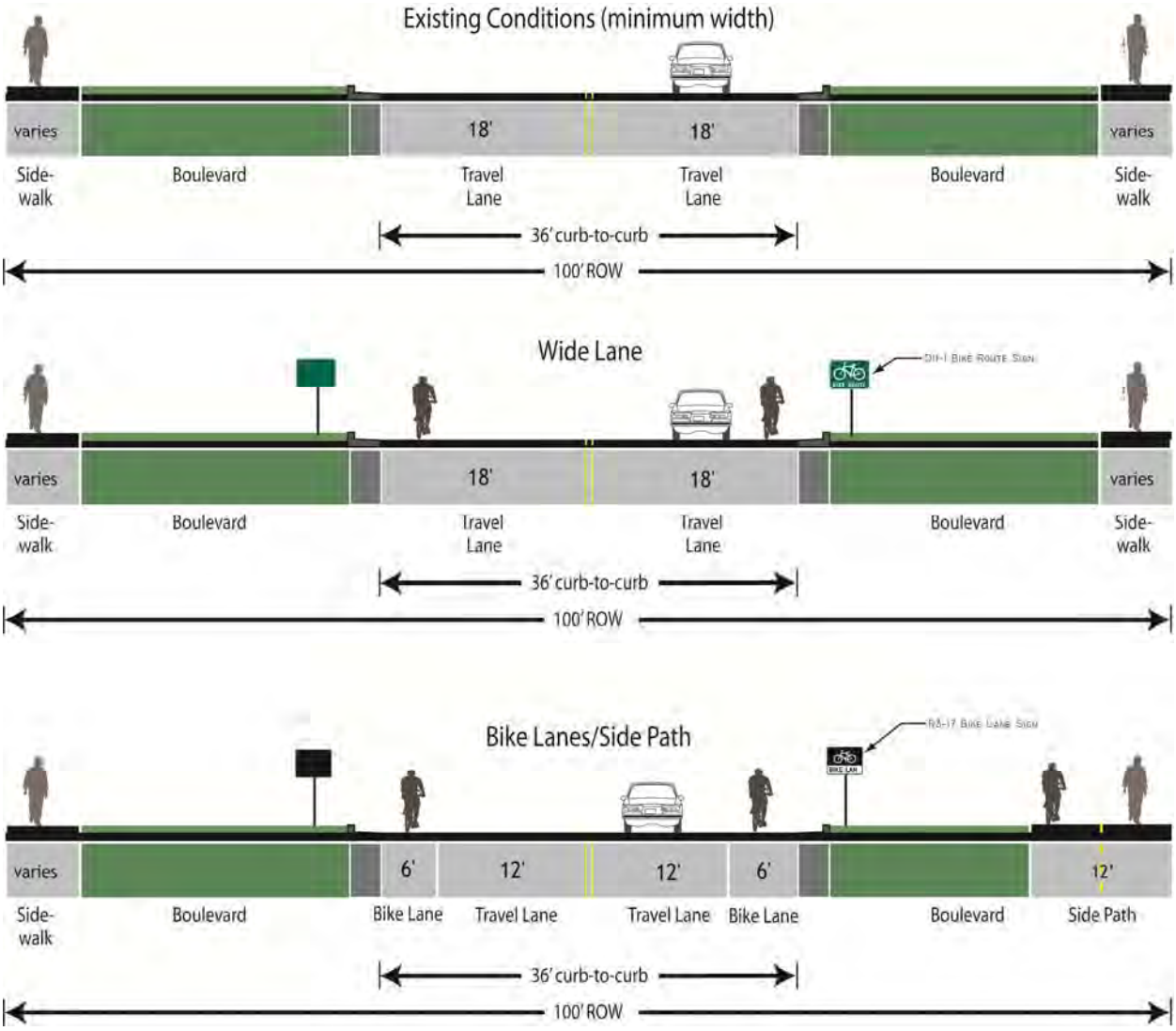

Figure 25. Alternatives for bicycle accomodation on arterial roadways.

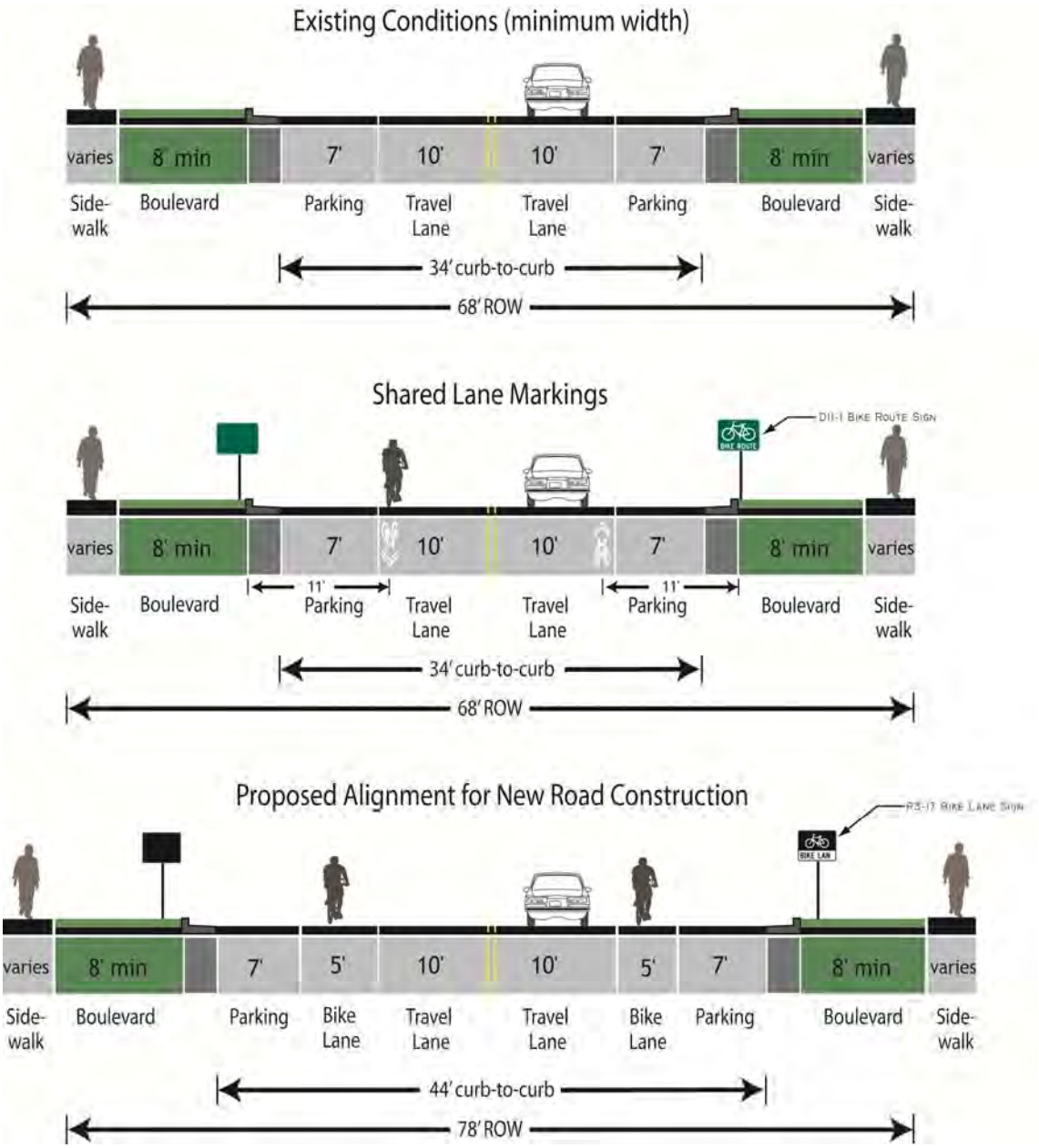

Figure 26. Alternatives for bicycle accomodation on collector roadways.

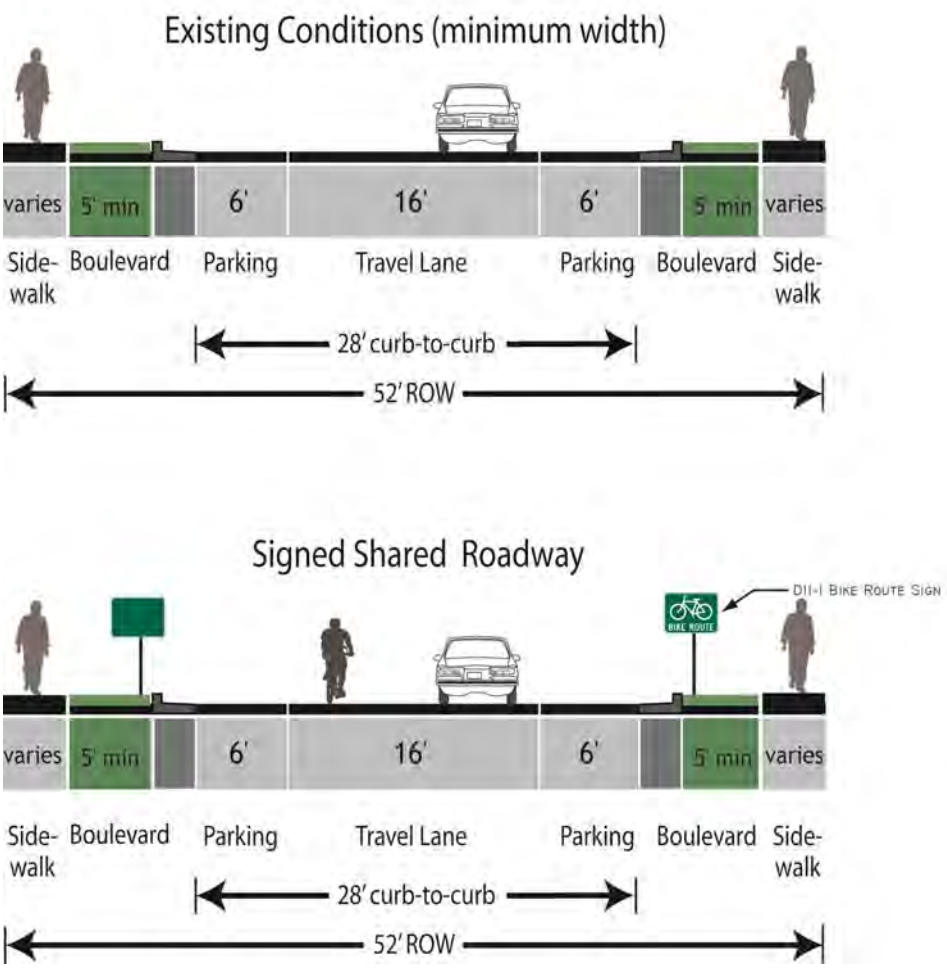

Figure 27. Alternatives for bicycle accomodation on local roadways.

Proposed Subdivision Requirements

Typical subdivision design in the U.S. promotes the almost exclusive use of the automobile. Residential subdivision streets are wide, non-linear, often lack connectivity and may or may not provide sidewalks. Most homeowners have ample room to park in their garages or in their driveways, however, little on-street parking is generally provided now. The use of cul-de-sacs and streets that limit circulation in and out of subdivisions can overload arterial streets that typically do not accommodate nonmotorized travel well. Retrofitting existing suburban neighborhoods to make them more bicycle and pedestrian friendly can often be more politically difficult than physically difficult. Design solutions include a number of options:

- Adding sidewalks, preferably on both sides of the street;
- Adding accessible curb ramps;
- Adding marked crosswalks;
- Creating bike lanes with striping and signage;

- Creating public access connectors between cul-de-sacs and adjacent streets to enhance circulation on foot or by bicycle; and
- Narrowing the streets (through a variety of techniques) to slow traffic and increase safety for nonmotorized users.

New subdivision design should include the following criteria at a minimum:

- Grid street pattern wherever possible with multiple intersections to provide ample opportunity for connectivity;
- Public right-of-way connections for bicyclists and pedestrians between cul-de-sacs and adjacent streets;
- Minimum of 5' wide sidewalks on both sides of the street;
- Shorter street blocks; and
- Proximity to neighborhood amenities such as parks, shops, schools, etc.

Multimodal Connections

Transit has an integral role in ensuring the success of an active transportation system. Quality integration among travel modes is mutually beneficial in extending the reach and catchment area of transit services, particularly in lower-density areas, as well as increasing the distance that can be comfortably traveled by a pedestrian or bicyclist.

Transit agencies have identified a number of reasons for providing active transportation connections to transit including:

- Increasing the number of multimodal trips;
- Removing motor vehicles from roads and parking lots to better utilize that space;
- Enhancing quality of life in the community by reducing emissions, noise, and traffic congestion and supporting active living, improved public health, equity and accessibility;
- Increasing the visibility of walking and bicycling as viable transportation options;
- Contributing to regional commuter assistance programs and extending low-cost transportation options; and
- Providing an alternative for pedestrians and bicyclists so that they can bypass areas that are barriers to bicycling, such as bridges, tunnels, steep hills, roads with traffic, and avoid riding at night or during adverse weather conditions. [12]

[12] Based on responses to a survey included in the TCRP *Bicycle and Transit Integration* study.

Transit Supportive Facilities

Facilities that improve the ability of people to walk or bicycle are critical in attracting and maintaining transit riders. Recommended provisions at transit stops, which will vary depending on the type and use of stops, include:

- Seating: either benches or seats adjacent to the transit stop post. Seating should be placed so that waiting passengers are visible to the bus driver.
- Shelter: provision of dedicated shelters at transit stops, especially higher volume stops, or use surrounding building elements such as awnings to provide protection from the elements.
- Trip Information: essential information that should be provided at every transit stop includes the route number and the stop number. It is also preferable to provide a route map and timetable.
- Bicycle Parking: In general, suburban and rural stops can make do with existing street furniture or simple bike racks. More guidance is provided in the design guidelines.
- Pedestrian-Scale Lighting: increase security and visibility for riders and transit operators by providing lighting; and
- Trash/Recycling Container.

Accessibility

Pedestrian Access to Transit Stops

Difficult and unsafe routes to transit stops can discourage or prevent pedestrians, including those that use wheelchairs, walkers and strollers from using the transit system.

Factors that influence pedestrian access to a transit stop include:

- Crossing location distance/quality
- Posted speeds
- Sightlines and distances
- Number of travel lanes
- Curb-to-curb width
- Traffic volume
- Pedestrian collisions
- Existence/ condition of sidewalks
- Slope

Sidewalks, ramps, and crossings are also essential parts of the pedestrian network and connect transit stops with adjacent and nearby land uses. Corridors that are served by a transit route are priority locations in the recommended pedestrian network. In addition, standards and guidelines for marked crossings and mid-block crosswalks are provided in the design guidelines.

Crossings are particularly important and where possible, these should be provided along the most direct path as pedestrians are typically unwilling to walk out-of-direction to access a crosswalk. This includes mid-block crossings, which should be treated appropriately depending on the crossing opportunities afforded by traffic and prevailing conditions of the roadway. Treatments to improve pedestrian crossings include:

- Clearing visual obstructions – street trees, telephone poles, limiting on-street parking, etc.
- Moving the stop to an existing marked or signalized crossing
- Adding curb extensions or median refuges to shorten the crossing distance
- Adding pedestrian signals

Bicycle Access to Transit Stops

The bicycle network should also connect to transit stops, especially since the RapidRide buses are equipped with bicycle racks to carry passengers' bikes. Key elements of bicycle access to bus stops include:

- Actuated traffic signals near the station that can be activated by bicycles; and
- Signed bikeway links should indicate streets leading to bus stops.

Bicycles on Transit

The local RapidRide buses are already equipped with front-loaded bicycle racks that carry up to two bicycles. These racks help extend the coverage area of the transit system as some passengers can use bicycles to connect to their origins and/or destinations that may not be served by the transit system.

Carrying bicycles onto transit also enables bicyclists to bypass potentially difficult situations like large hills, busy streets, long distances and inclement weather. It can also reduce the fear of being stranded in the case of equipment failure and may also prevent theft of bikes that would otherwise have to be locked up at a transit stop

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Chapter 5. Implementation Plan

As described in Chapter 4, Rapid City's recommended bicycle and pedestrian improvements consist of a comprehensive network of on-street bikeways and sidewalks of all types. This chapter begins with an implementation strategy, which presents a targeted approach for how Rapid City can institutionalize bicycle and pedestrian planning into its City processes. Possible federal, state and local funding sources are also identified.

Action Plan

The following actions are recommended as the first steps to implement the Rapid City Area Bicycle and Pedestrian Master Plan:

1. Adopt a Complete Streets policy to consider the needs of pedestrians and bicyclists in new development, redevelopment and roadway reconstruction and update the City's Infrastructure Design Criteria Manual to include consideration for bicycle and pedestrian travel based on road classification to begin policy implementation.
2. Dedicate Capital Improvement Plan (CIP) funds to bicycle and pedestrian projects. The City currently allocates $50,000/year for ADA (disability access) compliance projects. Providing a dedicated capital fund for bicycle improvement projects and sidewalk infill projects would allow the City to make progress on developing the bikeway network and completing the pedestrian network.
3. Implement several recommended bikeway projects annually, including those that are located on low-speed, low-volume streets where wayfinding signs would be sufficient to designate the bikeway.
4. Form a Bicycle/Pedestrian Advisory Committee to help guide the implementation of the Master Plan.
5. Complete five sidewalk infill projects - The highest priority locations were chosen where demand paths indicate existing walking activity and the travel speed and traffic volume of the adjacent streets are high.

Implementation Policies

The Rapid City Bicycle and Pedestrian Master Plan provides the long-term vision for the development of a community-wide bikeway network usable by all residents for all trip purposes. Implementation of the plan will take

place over many years. The following strategies and action items are provided to guide Rapid City toward the vision identified in the plan:

Strategy 1: Strategically Pursue Infrastructure Projects

City of Rapid City staff should utilize the City's existing capital improvement program (CIP) funding process to advance project recommendations in this Bicycle and Pedestrian Master Plan. Additionally, staff should incorporate bicycle and pedestrian improvements into other planned projects, pursue outside and grant funding and seek partnerships with other agencies and community partners

Policies:

Rapid City should seek to implement identified projects through current funding sources and track progress of plan implementation.

Policy 1.1 Pursue capital improvement funding or grant funding for pedestrian and bicycle improvements.

Policy 1.2 Install approved pedestrian and bicycle projects in conjunction with road improvement projects scheduled in the same area.

Policy 1.3 Publish a public report documenting the status of and on-going actions for all pedestrian and bicycle projects at the end of each fiscal year.

Strategy 2: Regularly Revisit Project Prioritization

Projects have been prioritized based on system connectivity, overcoming barriers, community support and other criteria described in Chapter 4. This list should be reviewed every fiscal year so new projects can be added, completed projects removed, and the priorities revised as conditions change. This strategy also supports collaborations with nearby jurisdictions on regionally-important walkways and bikeways.

Policies:

Complete an annual review and update of the bikeway and pedestrian improvements project lists by City staff with input from Pennington County, the Rapid City Parks Department, and other relevant agency staff. These updated lists should be made available to the public.

Policy 2.1 Annually review and update the Rapid City Area Bicycle and Pedestrian Master Plan project lists.

Policy 2.2 Share updated project lists with the public and other jurisdictions, including Pennington County and the Rapid City MPO.

Policy 2.3 Review and update the Bicycle and Pedestrian Master Plan as needed, but at least every five years.

Strategy 3: Integrate Bicycle Planning into Rapid City's Planning Processes

To ensure the Bicycle and Pedestrian Master Plan is implemented, the plan must be a living document that is incorporated into the day-to-day activities of transportation planning, design, funding, construction and maintenance in Rapid City. This plan recommends several ways for bicycle and pedestrian planning to be integrated into these processes.

Policies:

Policy 3.1 Implement a Complete Streets policy to ensure that bicycle and trail facilities are included in all major construction and reconstruction projects. Pedestrian, bicycle, and trail facilities should be addressed at the project scoping stage.

Policy 3.2 Revise the City's Infrastructure Design Criteria Manual to reflect the Bicycle and Pedestrian Design Guidelines in Appendix F and to ensure that appropriate pedestrian, bicycle, and trail facilities are built in new developments in accordance with this plan and other relevant plans.

Policy 3.3 Incorporate a pedestrian and bicycle facilities checklist into the plan review process.

Policy 3.4 Require sufficient right-of-way to be set aside for pedestrian, bicycle, and trail facilities as redevelopment projects occur.

Policy 3.5 Adopt a bicycle parking ordinance that establishes guidelines for bicycle parking linked to land uses.

Strategy 4: Encourage Private Donors to Support the Bicycle and Pedestrian System

The Friends of Rapid City Parks or other advocacy groups in the community could provide volunteer construction and maintenance services as well as possibly funding small projects like signage and wayfinding programs. Likewise, a formal "Adopt a Bikeway" program could be developed so corporations, institutions and individual private donors can support the existing and proposed bikeway and shared-use path system. This program can be leveraged to enhance maintenance through volunteer work and connect philanthropy with fundraising to help sustain the system.

Policies:

Policy 4.1 Encourage corporations, institutions and individual private donors to support the existing and proposed bikeway, shared-use path, and walkway systems.

Policy 4.2 Leverage this program to enhance maintenance through volunteer work and connect philanthropy with fundraising to help sustain the system.

Policy 4.3 Evaluate opportunities for establishing a philanthropic program that can be used to support the construction and maintenance of Rapid City's walkways, bikeways, and shared-use paths.

Strategy 5: Implement Education, Encouragement and Enforcement Activities

The City should augment the expanded bicycle network with education, encouragement and enforcement activities to support increased walking and bicycling by Rapid City residents. These support programs are critical to the success of the Master plan and have been prioritized based on cost and ease of implementation.

Policies:

Policy 5.1 Pursue grant and donor funding for recommended programs.

Policy 5.2 Form a Bicycle/Pedestrian Advisory Committee to help guide the implementation of the Master Plan.

Policy 5.3 Work with schools, youth groups, and other organizations to provide education and encouragement programs to Rapid City residents.

Policy 5.4 Work with the Police Department, media, advocacy and safety groups to create an educational program to educate pedestrians, bicyclists, and drivers on rights, responsibilities and safe practices to share the road safely and comfortably.

Cost Opinions

Unit prices were provided by Rapid City staff or taken from bicycle and pedestrian master plans and experience in nearby communities. Table 24 shows cost opinions (expressed in 2011 dollars) for elements of bicycle, pedestrian, and shared-use path improvement projects. Detailed inputs to

the cost estimates and planning-level cost opinions for the proposed bicycle and pedestrian improvements are provided in Appendix I.

*Table 24. Planning-Level Costs for Bicycle and Pedestrian Improvements**

Facility Type	Price*	Unit	Notes
Shoulder Bikeways	$1	LF	Signs every 600'.
Bike Lanes	$35	LF	Striping removal, re-striping (paint), pavement markings, and signs.
Shared Lane Markings	$7	LF	Pavement markings every 100' each direction, signs every 600'.
Signed Shared Roadway	$1	LF	Signs every 600'.
Side Path	$79	LF	Includes clearing and grubbing, grading, 12' wide asphalt surface
Sidewalk	$144	LF	6' width, includes concrete curb and gutter and drainage.
Amenity Costs			
Pedestrian Refuge Island	$12,000-$15,000	EA	
High-Visibility Crosswalks	$7,500	EA	Thermoplastic
ADA-Compliant Curb Ramps	$1,000	EA	
Curb Extensions	$12,500	EA	
Signs	$300	EA	Includes sign, pole and mounting hardware cost plus labor for installation
Bicycle Loop Detector	$2,500	EA	Imbedded pavement sensor so bicycles can trigger the traffic signal
Bicycle/Pedestrian Signal	$40,000	EA	
Drainage Grate	$1,500	EA	Bicycle-friendly

* 2011 estimated unit costs

* Costs include engineering (25%), contingency (15%), and design (20%) allowances.

Costs for including bicycle facilities on streets that are being constructed or re-constructed need to include right-of-way purchase costs in some cases.

Maintenance

On-street bikeways, sidewalks, and trails require regular maintenance and repair. On-street bikeways are typically maintained as part of standard roadway maintenance programs, and extra emphasis should be placed on keeping bike lanes and roadway shoulders clear of debris and keeping

vegetation overgrowth from blocking visibility or creeping into the roadway. Typical maintenance costs for on-street bikeway facilities are shown in Table 25.

Table 25. On-Street Bikeway Maintenance Frequency and Cost Opinions

Activity	Materials Type	Frequency	Cost Opinion*
Pavement resurfacing	Asphalt	Every 20 years	$50,000/mile
	Concrete	Every 20 years	$50,000/mile
	Aggregate	Every 3 years	$3,000/mile
Pavement sweeping	All	Weekly/monthly as needed	Part of regular street sweeping activities
Snow removal	All	Weekly/as needed	Depends on conditions, ~$150/mile
Tree/shrub trimming	All	5 months – 1 year	Part of regular street maintenance activities
Sign repair/ replacement	Worn	Every 10 years	$250/sign
	Stolen/damaged	As needed	$250/sign
Re-striping	Paint	Semi-annually	$2,600/mile
	Thermoplastic striping	Every 10-15 years	$10,600/mile

* 2011 estimated unit costs

Funding Sources

Acquiring funding for projects and programs is considerably more likely if it can be leveraged with a variety of local, federal and public and private sources (South Dakota does not have specific statewide funding for bicycle or pedestrian improvements). This section identifies potential matching and major funding sources available for bicycle and pedestrian projects and programs as well as their associated need and criteria.

Funding sources for bicycle and pedestrian facilities are listed below. Additional detail about these sources is provided in Appendix J.

Federal Funding Sources

Federal funding for bicycle and pedestrian facilities is primarily provided by the latest federal transportation act, the Safe, Accountable, Flexible, Efficient Transportation Equity Act – a Legacy for Users (SAFETEA-LU). SAFETEA-LU authorizes the Federal surface transportation programs for

highways, highway safety and transit for the five-year period 2005-2009. At this time, the authorization of a new federal transportation bill has not yet been completed; public agency staff should monitor the status of this legislation as federal funding programs currently available may be changed under new legislation. Existing federal programs under SAFETEA-LU that fund bicycle and pedestrian improvements include:

- Surface Transportation Program (STP)
- Highway Safety Improvement Program (HSIP)
- Transportation Enhancements (TE)
- Recreational Trails Program (RTP)
- State and Community Highway Safety Grant Program (Section 402)
- Safe Routes to School (SRTS)
- Community Development Block Grants (CDBG)
- Rivers, Trails and Conservation Assistance Program
- Land and Water Conservation Fund (LWCF)
- Transportation, Community and System Preservation Program (TCSP)
- National Scenic Byways Program

Metropolitan Planning Organization (MPO) Funding Sources

Metropolitan Planning Organizations (MPOs) are encouraged to use their federal planning funds to advance bicycle and pedestrian transportation improvements in their regions. Specifically, MPOs must incorporate nonmotorized transportation plans as integral parts of their regional Long Range Transportation Plans (LRTP).

Local Funding Sources

Communities throughout the country have looked to different local sources to find funding for bicycle, pedestrian and shared-use path projects. These sources vary from reallocation of an existing tax, to local bond measures. Existing local funding sources include:

- Road Use Tax (RUT) Funds
- Annual Capital Improvement Program (CIP) funding
- CDBG Entitlement Grant
- Tax Increment Financing/Urban Renewal Funds
- Rapid City's Vision 2012 Funding

Appendix A. Public Outreach Summary

Home Show

At a home show held in spring 2010, residents were asked to vote on the projects in the Long-Range Transportation Plan (LRTP). A poster showing the projects asked, "How would you invest in the region's future bicycle facilities system for the next 20 years?" Results are shown in Table 26.

Table 26. Feedback from the Home Show

Project	Type	Tally
Catron Boulevard: 5th Street to Sheridan Lake Road	Bike Lane	25
Canyon Lake Drive: Sheridan Lake Road to Beach Drive	Bike Lane	14
Sheridan Lake Road: Jackson Boulevard to South of Catron Boulevard	Existing	13
Deadwood Avenue: N Plaza Drive to Omaha Street	Bike Path	11
Rapid Creek/Wally Byam: Valley Drive to Jolly Lane*	Bike Path	11
Universal Drive: Merritt Road to Lien Street	Bike Path	10
Mt Rushmore Road: Omaha Street to Main Street	Bike Path	10
Jackson Boulevard: Fish Hatchery to Cliffside Park	Bike Path	9
E Minnesota St LaCroix Links Jolly Lane	Bike Path	9
Rapid Creek E St Patrick St Fairmont Blvd/South	Bike Path	9
5th Street: Columbus Street to Omaha Street	Bike Path	8
5th Street: Oakland Street to Texas Street	Bike Path	8
Hillsview Drive/Red Dale Drive: W St. Patrick Street to Canyon Lake Drive	Bike Path	7
Maple Avenue/Disk Drive/Bunker Drive: Vickie Powers Park to North Street	Bike Path	7
Jackson Boulevard: Mountain View Road to 32nd Street	Bike Lane	7
Main Street: 44th Street to Omaha Street*	None	6
SD Hwy 44: Mickelson Drive to Long View Road	Bike Path	5
Elk Vale Road: Highway 44 to 5th Street	Bike Lane	5
Memorial Park: I-190 to 7th Street	Bike Path	5
Elk Vale Road: Mall Drive to Highway 44	Bike Lane	4
Parkview Drive/Parkview Park: Parkview Drive to 5th Street	Bike Path	3
Rapid Valley Drainage: Twilight Drive to Covington Street	Bike Path	3
West Street: St. Joseph Street to South Street*	None	3
West Boulevard: Quincy Street to Flormann Street*	None	3
N Plaza Drive: Sturgis Road to Deadwood Avenue	Bike Path	2
Minnesota Street: 5th Street to US Hwy 16/Enchanted Pines Drive	Bike Path	2

Project	Type	Tally
Minnesota Street: Parkview Drive to Odde Drive	Bike Path	2
E Fairlane Drive: Robbinsdale Park to Elm Avenue	Bike Path	2
7th Street: Omaha Street to Columbus Street	Bike Lane	2
Rapid Street/3rd Street: 5th Street to Omaha Street	Bike Path	2
Centre Street: LaCrosse Street to Star of the West	Bike Path	1
Concourse Drive: Elk Vale Road to Twilight Drive	Bike Path	1
Roosevelt Park/E New York Street/Waterloo Street: Maple Avenue to Omaha Street	Bike Path	0
S Valley Drive: E Fairmont Street to E Minnesota Street	Bike Path	0

* Write-in projects that received more than two votes. Project extents are approximated from dot placement.

Rapid City Biking and Walking Survey

The Bicycle and Pedestrian Master Plan survey asked twenty questions about existing conditions and residents' perceptions and preferences about bicycling and walking in Rapid City. Seventy-six responses were received as of April 5, 2010. Key findings are listed below.

Respondent Demographics and Location

Most respondents to the survey were male and 40 to 59 years old. Nearly half of respondents reported living in 57701 zip code, while many others live in 57702 or 57703.

Walking

About three quarters of respondents walk at least one to three times per week, and nearly half of respondents walk daily (Figure 28).

Three-quarters of respondents walk at least two miles per week, and about one-fifth walk more than ten miles per week. Almost all respondents walk for recreation and exercise, and walking to work and for shopping/errands is also common (respondents were allowed to check multiple trip purposes).

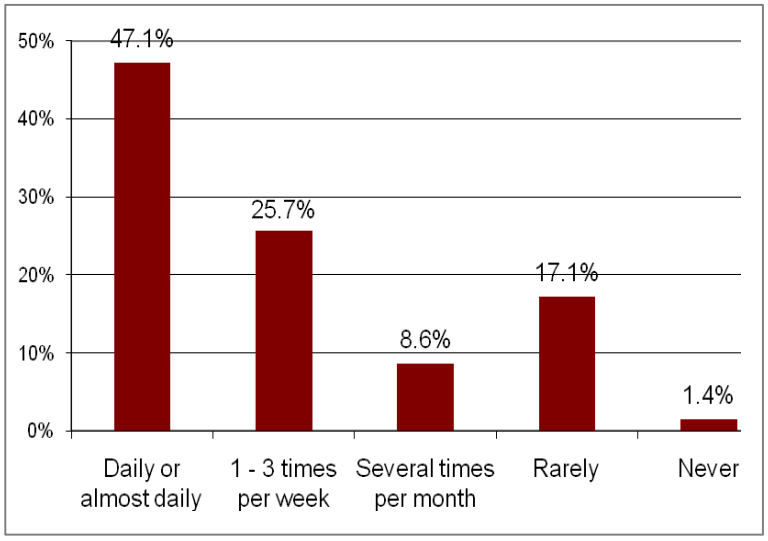

Figure 28. Responses to, "How often do you walk?"

Over half of respondents most frequently walk on sidewalks, while about one-fifth primarily walk on off-street paths and trails. Only three percent of respondents most frequently walk on unpaved shoulders.

The most common barrier to walking is availability and condition of facilities, followed by weather, then excessive vehicle speed and volumes (Figure 29).

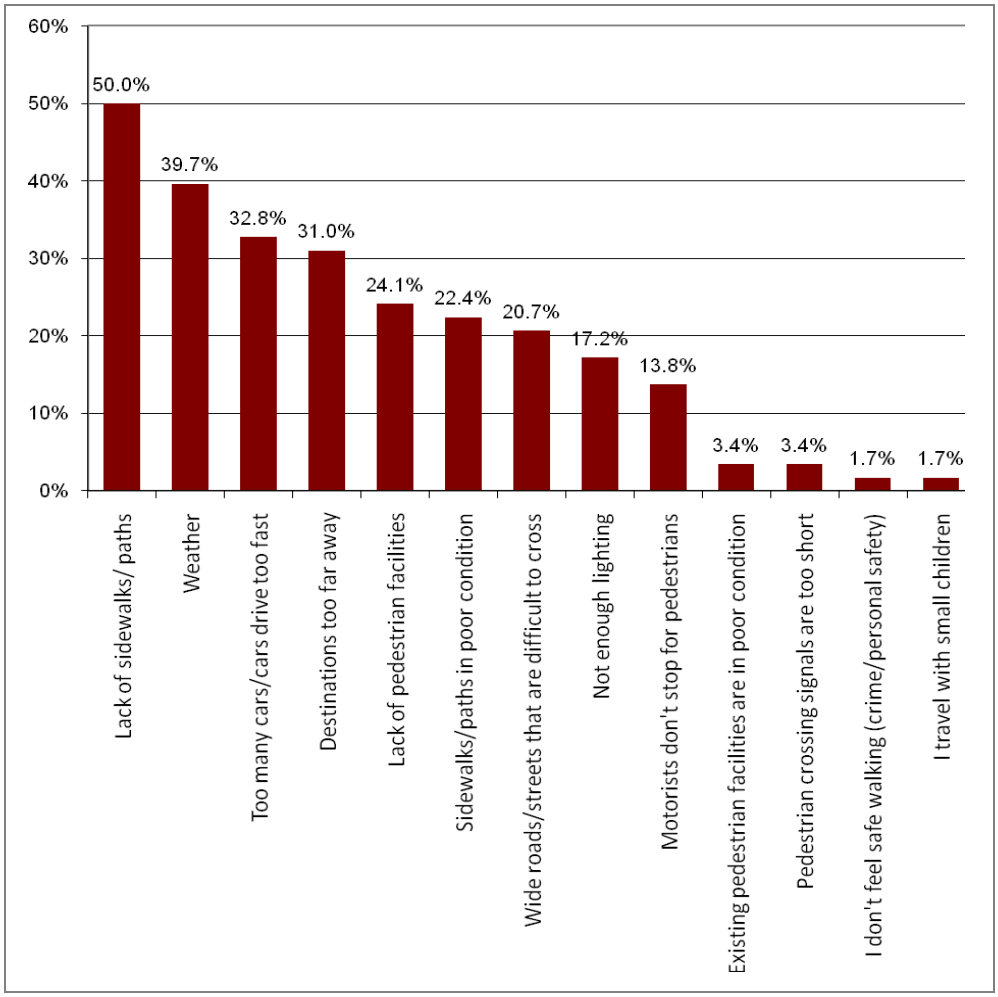

Figure 29. Responses to, "What prevents you from walking more frequently?"

Respondents wrote-in the following factors that prevent them from walking more often:,

- Own lack of will or motivation (four responses)
- No time to walk (three responses)
- Lack walking facilities in the area (three responses)
- Concern with aesthetic qualities (three responses)
- Maintenance of walking facilities (two responses)
- Concerns about dogs (two responses)

Problem areas that people reported avoiding while walking include:

- Bike path from Fifth Street to First Street.
- Bike path behind Prairie Market (between Maple Avenue and N 5th Street)
- Deadwood Avenue
- East end of City bike path (East of 5th Street)
- 3rd Street bridge
- E Saint Joseph Street at E Saint Patrick Street
- Hard to cross Saint Joseph Street or Mount Rushmore Road
- Fifth Street south of Elm Avenue
- Anywhere in The Gap (between Jackson Boulevard and 12th Street)
- Lack of sidewalks in Box Elder
- Older section of Williams Street in Rapid Valley
- Omaha and West Boulevards
- Rough sidewalks at Flormann and St. Anne Streets

Bicycling

About half of respondents reported bicycling at least several times a month, although only one-fifth bicycle daily (Figure 30).

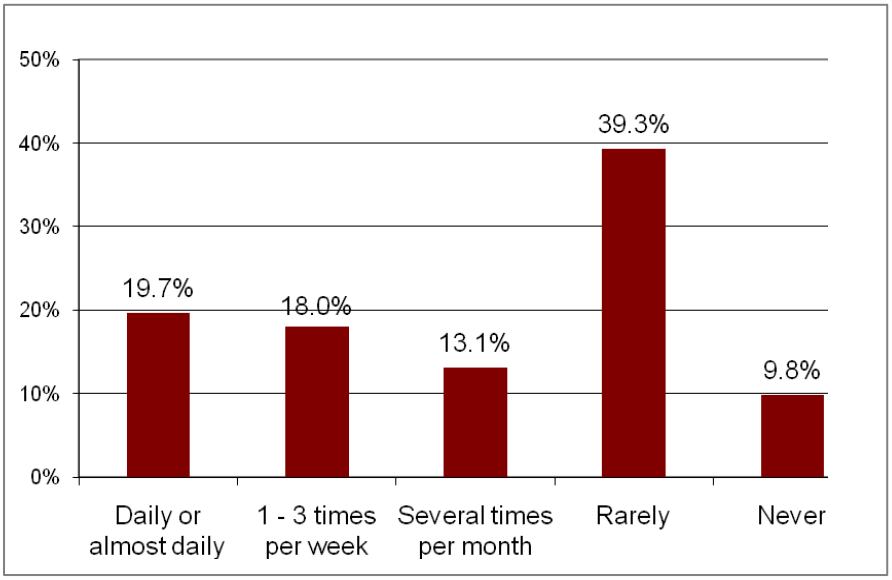

Figure 30. Responses to, "How often do you bicycle?"

Rapid City residents ride for long distances: few respondents ride fewer than two miles, while about one-fifth of respondents ride over 25 miles on their average bicycle trip.

Most bicycling is recreational. Only one-fifth of respondents reported bicycling to work and one-eighth bicycle for shopping trips or to run errands.

Most respondents felt that general lack of bicycle facilities was an issue. Concerns about vehicle volume, speed and behavior were also reasons respondents gave for not bicycling.

When asked where they bicycle, respondents preferred off-street paths most strongly, followed by bike lanes, then bike boulevards. Un-striped bike routes were the least popular.

Write-in response about problem areas that people avoid while bicycling included:

- All of E St. Joseph Street (wet, no shoulder)
- St. Patrick and Cambell Street intersections
- Deadwood Avenue
- Sheridan Lake Road and Highway 44 (too narrow)
- Omaha Street and West Boulevard

Key issues identified through write-in responses included:

- Intersections and roads without bike lanes
- Underpasses on the east end of the bike path (East of 5th Street)
- Lack of safe crossings
- Box Elder – roads not paved
- The Gap (between Jackson Boulevard and 12th Street)

Respondents were asked to complete a matrix prioritizing their top six preferred bicycle improvement projects. Almost half of respondents ranked "Paved off-street paths" and "Bike lanes on major streets" as their first or second priority. Almost as many respondents ranked "Bike routes" as "Priority 1" or "2". No other improvement project garnered many total Priority 1 or 2 votes, indicating respondents see the creation of new facilities as the most important improvements

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Appendix B. Background Data and Plans Review

This appendix describes background plans and studies relevant to the Rapid City Area Bicycle and Pedestrian Master Plan. The text summarizes previous and on-going planning efforts affecting Rapid City and its streets. The summary identifies issues that may impact the findings and ultimate recommendations of this project. The report focuses on plans and studies prepared by the Rapid City Area Metropolitan Planning Organization (MPO), as well as relevant information from the Cities of Rapid City and Box Elder.

The following documents were reviewed for this analysis:

Rapid City Area Metropolitan Planning Organization (MPO) Planning Documents

- Jackson Boulevard Extension Corridor Analysis Study (2004)
- RapidTRIP 2035: The Long Range Transportation Plan for the Rapid City Area (2010)
- Pedestrian/Bicycle Crash Report 2002-2008 (2009)
- Coordinated Public Transit – Human Service Transportation Plan (2007)
- Sheridan Lake Road Extension Study (2008)
- Major Street Plan (2010)
- Mount Rushmore Road Corridor Development Plan (2010)

City of Rapid City Planning Documents

- Rapid City Bikeway/Walkway Plan (2006)
- Rapid City 2009-2013 Transit Development Plan (2009)
- Rapid City Code of Ordinances
- Rapid City East Greenway Master Plan (1999)
- Omaha Street Corridor Enhancement Project Master Plan (2005)

Other Regional Planning Documents

- Pennington County Comprehensive Plan (2003)
- Chapel Valley Access Traffic Analysis and Route Alignment Study (2010)
- Spring Creek Neighborhood Area Future Land Use Plan (2010)
- Box Elder Corridor Study (DRAFT 2010)

Rapid City Area MPO Planning Documents

Jackson Boulevard Extension Corridor Analysis Study (2004)

The *Jackson Boulevard Extension Corridor Analysis Study* is a feasibility and benefits analysis for the extension of Jackson Boulevard from West Main Street to intersect with Omaha Street. This project would:

- Provide relief to congestion on the Mountain View Road commercial corridor
- Improve distribution of traffic between Omaha Street and West Main Street connecting western Rapid City with downtown.

The analysis of alternatives is based on projected travel demand in 2025. Alternatives are shown in Figure 31. Bicycle and pedestrian access through the corridor was not mentioned in this document.

The study found that the cost and right-of-way requirements of extending the roadway from W. Main Street to W. Omaha Street would exceed the benefit that would result from the extension.

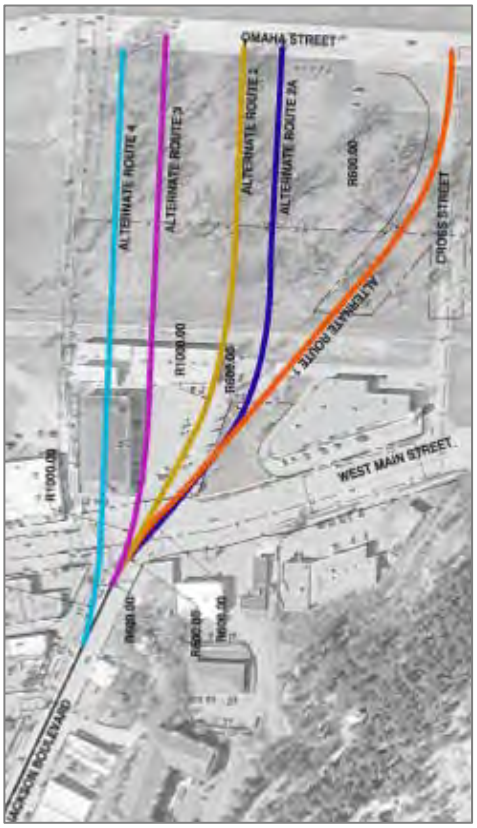


Figure 31. Jackson Boulevard Alignment Alternatives.

RapidTRIP 2035: The Long Range Transportation Plan for the Rapid City Area (2010)

Adopted September 2010, the *Long Range Transportation Plan* (LRTP) provides guidance for the development of streets and other transportation facilities throughout the Rapid City MPO's jurisdiction. A federal requirement, the plan recognizes increasing interest in alternative mode options.

The plan's key issues are sustainability, livability, and safety and security. Goal 1 is, "To develop and maintain a transportation system that will be coordinated with land use patterns and will incorporate all available modes of transportation into a safe, efficient, and effective system of moving goods and people within and through the community." Objectives related to bicycle and pedestrian planning include:

- Provide for an effective bicycle and pedestrian transportation system for the Rapid City area.
- Minimize motor vehicle, rail, bicycle, and pedestrian conflicts

Evaluation criteria identify many of the benefits of bicycle and pedestrian facilities, particularly economic vitality, accessibility and mobility, protecting and enhancing the environment.

Two of the plan's key messages specifically relate to walking and bicycling. The Downtown Rapid City goal states that "Walkability, parking, housing, and bicycle accessibility issues should be considered." The Modal Balance issue states,

> *"In order to provide choice and transportation mobility for youth, seniors, persons with disabilities, and others, future investments in the transportation system should shift towards maintenance and alternative modes while funding for roadway capacity might be reduced".*

The community involvement conducted during plan development resulted in the following comments:

Bicycle Network

- The existing bike path is an important component of the transportation system due to the east/west connectivity it provides. A similar north/south facility should be implemented.
- The bicycle network should be expanded to serve commuter cyclists and not just recreational trips. This includes additional off-street multiuse trails and on-street bicycle lanes; although some comments indicated that bike lanes were not wanted on new roads.
- The transportation system should support healthy lifestyles.

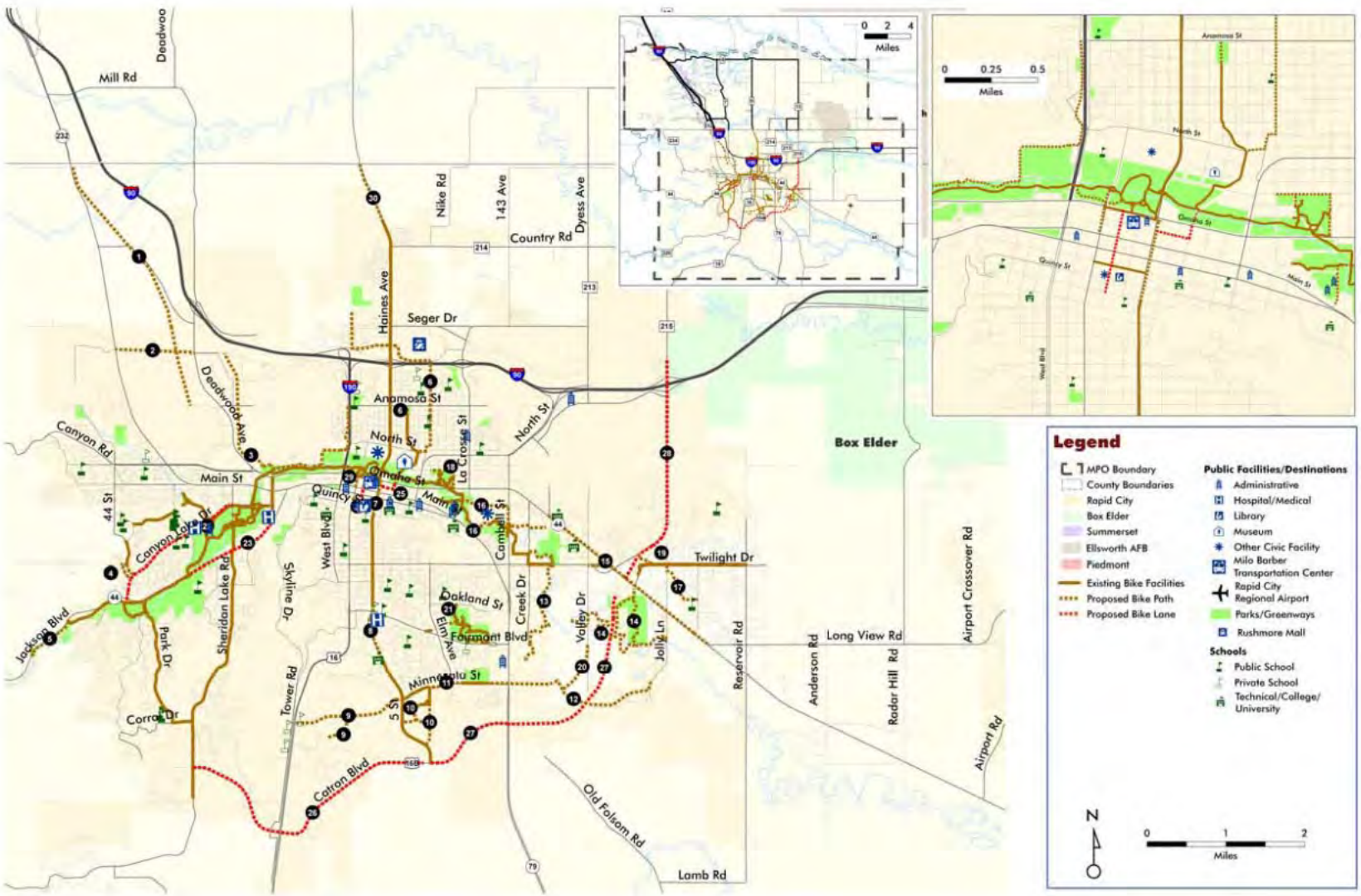
Pedestrians

- Pedestrian mobility should be elevated in importance in the community. Many roads do not have sidewalks on one or both sides of the street.
- Pedestrian access and mobility in downtown Rapid City is deficient and unfriendly to some stakeholders.
- The transportation system should support healthy lifestyles.

The *Bikeway/Walkway Plan* (discussed later in this document) served as the foundation for the Bicycle and Pedestrian Plan Chapter of the *Long Range Transportation Plan*. This Bicycle and Pedestrian Master Plan will be an extension or implementing component of *RapidTRIP 2035*.

At the time the previous plan was written, 31 miles of trails existed, with the Leonard "Swanny" Swanson Memorial Pathway acting as the system backbone. This eight-foot wide concrete path is augmented by several additional paths, including those along Haines Avenue, Fifth Street, Minnesota Street, Twilight Drive in Rapid Valley, Sheridan Lake Road, Park Drive, Corral Drive, and others.

The majority of the recommended facilities are designated 'bike routes,' which, along with bike paths, trails and bike lanes make up the recommended 2035 bicycle network shown in Map 4. Trails are lower-order facilities than paths, and are unpaved while paths are paved and shared use. The plan defines bike routes as "segment or system of roadways signed for the shared use of automobiles and bicycles without striping or pavement markings." The plan also considers bicycle and pedestrian crossings of arterial streets. Locations for improvements are identified in Map 4.



Map 4. RapidTrip 2035 Recommended Bicycle and Pedestrian Plan Priorities
Source: Rapid City Area 2035 Long Range Transportation Plan (2010)

The plan also recommends an implementation plan, prioritizing the recommended facilities by popular short trips (under five miles), as well as critical 'missing links' in the existing system. Identified short-term priorities are recommended for the timeframe of the *Long Range Transportation Plan*, while medium and long term projects are recognized as taking longer to implement. Other high priority objectives identified in the plan include:

- Prioritize and develop cost estimates for the high priority projects
- Pursue Transportation Enhancements and Recreational Trails funding for high priority and other projects
- Establish a dedicated, long-term funding program to implement the Pedestrian and Bicycle Facilities Plan
- Update the Bikeway/Walkway Plan periodically
- Consider the issue of signing bike routes
- Consider expanding the use of on-street bicycle lanes as part of new, widened, or reconstructed roadways

Chapter 7 addresses the Roadway System, providing guidance for designing streets and classifying roadways. The section regarding collector streets mentions accommodations for bike lanes, stating, "Individual access from residential lots should be discouraged, particularly where bicycle lanes or routes are provided." Subcollector, or Residential Collector Streets are the lower-speed streets recommended for primary bicycle and pedestrian routes. Traffic calming and pedestrian crossing improvements are appropriate on these streets. Accommodations for bicyclists and pedestrians are not mentioned in any of the higher-order street types.

The Environmental Justice Analysis recognizes the community benefits of bicycle and pedestrian facilities. The text reads,

> *Bicycle and pedestrian facilities should be incorporated into new and widened roadways to increase options for citizens without cars or driver's licenses. New bicycle facilities and pedestrian improvements are considered to have positive benefits in terms of additional transportation options and increased access to the community for target populations.*

Pedestrian/Bicycle Crash Report 2002-2008 (2009)

Written in cooperation with the City of Rapid City, Traffic Operations Section – Engineering Services Division and the Public Works Department, the Pedestrian/Bicycle Crash Report provides an analysis of traffic crashes involving bicyclists and pedestrians between 2002 and 2008. The three purposes of the Report are:

- To present an overview of those reported crashes that involved pedestrians and bicyclists;

- To present the results of trend analyses of the available crash data; and
- To identify, if appropriate, mitigation measures that would reduce the frequency of crashes involving pedestrians or bicyclists.

In general, Rapid City's pedestrian injury crash rate exceeded the statewide and national rates, as shown in Table 27. One reason for this is the higher densities and rates of walking in the Rapid City area, as compared to the rest of South Dakota. Approximately 26 percent of the crashes occurred in Rapid City's Central Business District (CBD). Over the seven-year period, 15.5 percent of the pedestrian crashes occurred when the pedestrian or driver was under the influence of drugs and/or alcohol.

Table 27. Comparison of Pedestrian Crash Rates, 2002-2008[i]

Year	2002	2003	2004	2005	2006	2007	2008
Rapid City							
Injury Rate	29.1	38.1	28.1	26.2	15.2	23.4	45.3
Fatality Rate	1.6	0	0	4.6	0	0	3.1
South Dakota							
Injury Rate	13.7	11.9	12.3	11.5	14.5	13.8	N/A
Fatality Rate	1.1	1.3	1.2	1.9	0.9	0.9	N/A
United States							
Injury Rate	24.7	24.1	23.2	22	20.2	23.2	N/A
Fatality Rate	1.7	1.6	1.6	1.65	1.6	1.5	N/A

[i] *Source: Pedestrian/Bicycle Crash Report 2002-2008*

Six fatal crashes involving pedestrians occurred during the seven-year period. Locations with fatalities include:

- Fifth Street, north of Omaha Street
- Haines Avenue, north of Lawrence Drive
- Mt. Rushmore Road, south of St. Cloud Street
- I-90 near I-190
- E Omaha Street, west of Cambell Street
- Fifth Street at Oakland Street

The majority of crashes involving pedestrians occurred along Mt. Rushmore Road, 5th Street/Haines Avenue, and East Boulevard/E North Street corridors, as well as in the central business district. In absence of area-wide bicycle and pedestrian counts, this crash data indicates where people bicycle and walk in the Rapid City Area.

In addition, crash data provides information about dangerous intersections and corridors for walking and bicycling.

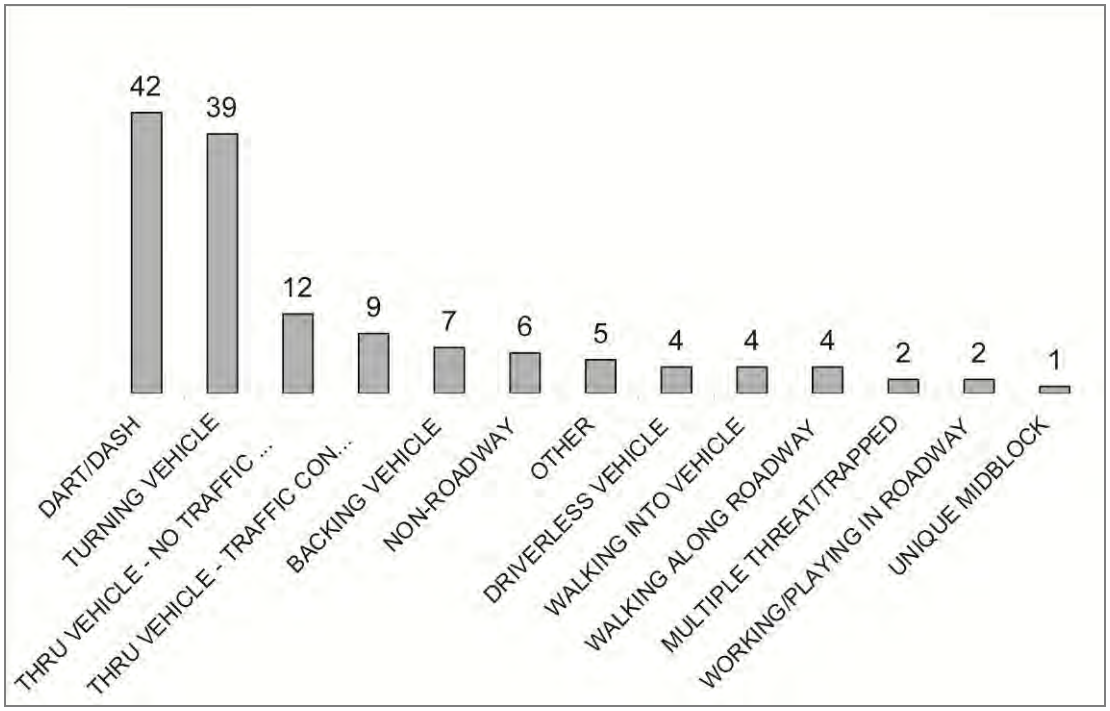


Figure 32. Rapid City Pedestrian Crash Types by Frequency, 2002-2008.

A total of 137 crashes involving bicyclists occurred in the Rapid City area between 2002 and 2008, none of which resulted in fatalities. 'Bicyclist ride out' crashes were the highest crash type, all of which were judged to be the bicyclists' fault (see Figure 33). Fifty-nine of these occurred when the bicyclist was riding on the sidewalk, and entered an intersection.

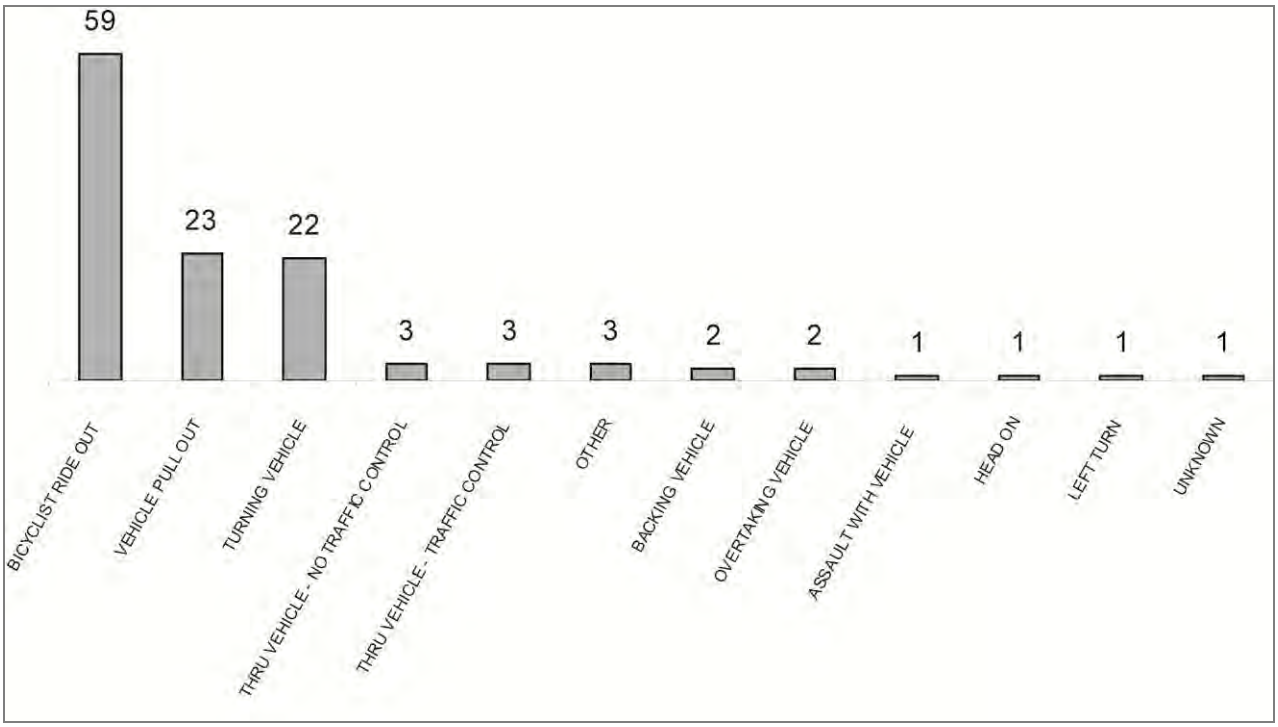


Figure 33. Rapid City Bicyclist Crash Types by Frequency, 2002-2008.

The majority of the 'vehicle pull out' crashes were judged to be the fault of the driver. In almost half of the crashes, the bicyclist was riding on the sidewalk. Similarly, in 11 of the 16 'turning vehicle' crashes, the bicyclist was riding on the sidewalk. As noted in the report, "Most of the bicyclists involved in crashes at intersections demonstrated a lack of understanding of South Dakota law specifically that bicyclists must stop before entering a crosswalk or highway from a sidewalk or sidewalk area." Education for cyclists of all ages is an important safety measure to reduce crashes.

While Rapid City did not experience a bicycle-related fatality, the region has a significantly higher bicyclist injury rate than either South Dakota or the United States, as shown in Table 28. Similarly to pedestrian crash patterns, 18 percent of crashes involving bicyclists occurred in the central business district.

Table 28. Comparison of Bicyclist Crash Rates, 2002-2008[i]

Year	2002	2003	2004	2005	2006	2007	2008
Rapid City							
Injury Rate	29.1	27.5	15.6	24.7	31.9	29.7	29.7
Fatality Rate	0	0	0	0	0	0	0
South Dakota							
Injury Rate	11.47	14.3	10.0	12.5	12.9	12.7	N/A
Fatality Rate	0.13	0.13	0.13	0	0.13	0	N/A
United States							
Injury Rate	16.7	15.8	14.0	15.2	14.6	14.4	N/A
Fatality Rate	0.23	0.21	0.25	0.27	0.26	0.23	N/A

[i] *Source: Pedestrian/Bicycle Crash Report 2002-2008*

In addition, more than 40 percent of bicyclists involved in crashes were between the ages of 6 to 13, while another 25 percent were 14 to 19. This indicates the need for greater educational programs to teach students how to safely cross the street and ride a bicycle.

Coordinated Public Transit – Human Service Transportation Plan (2007)

Adopted in 2007 by the Rapid City Area MPO Executive Policy Committee, the *Coordinated Public Transit – Human Service Transportation Plan* outlines "how transit providers, human service agencies and key stakeholders can coordinate and streamline transportation services for low income households, the elderly, and disabled from home to work and/or to services within the Rapid City area."

As low income households, services and employment centers are widely spread throughout the region, the Coordinated Plan develops area-wide strategies through public-private coordination. Six agencies in the Rapid City Area have been awarded vehicles through the Federal Transit Administration's (FTA) Job Access and Reverse Commute Program (JARC).:

- Behavior Management Inc.
- Black Hills Workshop and Training Center
- Club for Boys
- Rapid City YMCA
- Rapid Transit

- Youth and Family Services Inc. (includes Girls Incorporated of Rapid City, YFS Childcare, and Rapid City Head Start)

While the document does not address walking and bicycling, these modes can significantly improve access for low-income residents. Federal funding is available for bicycle and pedestrian related transportation projects. In addition, the Rapid City Area Bicycle and Pedestrian Plan will prioritize improvements in areas with higher populations of low-income residents, focusing on providing safe and accessible routes to work and services.

Sheridan Lake Road Extension Study (2008)

The *Sheridan Lake Road Extension Study* follows the *Jackson Boulevard Extension Corridor Analysis Study* recommendation to not extend Jackson Boulevard. Addressing increasing congestion on the Mountain View Road commercial corridor as well as 'The Gap,' the study's extents are West Main Street to Omaha Street and Deadwood Avenue. 'The Gap' is the narrow corridor between two large hills that funnels east-west traffic on the west side of town onto West Main and Omaha Streets.

Unlike the previous Jackson Road Study, the Sheridan Lake Road Study recognizes that "Sheridan Lake Road serves a variety of transportation uses and needs, providing commuter route by auto, bicycle, transit and foot." Sidewalks are generally provided along the corridor. Along Storybook Island Park, the sidewalk is located between the parking lot and the park. Marked crosswalks along Sheridan Lake Road exist at Jackson Boulevard, south and north side of Rapid Creek, Ploof Drive, Canyon Lake Drive, and W. Main Street. In addition, Sheridan Lake Road has a designated side path, extending from south of the study area along Sheridan Lake Road to the Rapid Creek bike path.

Significant concerns regarding bicyclist and pedestrian safety along the corridor emerged during the public input for the roadway widening alternatives. As a result, safety considerations became focused at improving safety for users on the Rapid Creek Path, particularly at the crossing of Sheridan Lake Road. The recommendation was to "raise the elevation of the existing bridge to allow the bike path to go underneath the bridge." The Plan also recognizes the potential for constructing a grade-separated bicycle and pedestrian bridge when the existing bridge over Rapid Creek becomes structurally deficient.

For pedestrian travel, sidewalks will be provided along both sides of Sheridan Lake Road for the entire length of the study area (proposed 10' width from Rapid Creek to Canyon Lake Drive). Crosswalks and ADA-

approved curb ramps with detectable warnings will be incorporated at all crossings.

Two intersections are particularly critical: Canyon Lake Drive and the Leonard "Swanny" Swanson Memorial Greenway. The former is recommended to provide signal timing adequate for pedestrians, while the latter could either be grade-separated, or a signal could be provided.

Mount Rushmore Road Corridor Development Plan (2010)

Presenting a strategy for Mt. Rushmore Road reconstruction, the *Mount Rushmore Road Corridor Development Plan* is a collaboration between Rapid City and the South Dakota Department of Transportation. The roadway currently provides access between Rapid City and the Mt. Rushmore National Memorial, as well as connections to the Black Hills region and serves as a key business and service district in Rapid City.

Recognizing that streets are also "major public spaces that affect the visual and experiential quality of a city, and economic lifelines for adjacent businesses" and can present barriers to some users, the Plan aims to improve pedestrian and bicyclist access through the corridor.

Currently, Mt. Rushmore Road lacks bicycle route designation or any accommodation for bicyclists. In the project area, 5th Street from South and Cleveland Streets is a designated (signed) bike route. The road generally has complete sidewalks, although some sidewalks are deteriorating and some intersections are not accessible. Pedestrians are forced to walk on paved shoulders on Cleveland Street. Fast vehicle speeds and narrow sidewalks along the corridor result in a poor pedestrian environment.

The vision for Mt. Rushmore Road is of a complete street. Complete streets are defined as "corridors that safely and efficiently accommodate all transportation modes, including motor vehicles, transit, and pedestrian and bicycle transportation." Complete streets also include traffic calming and crossing treatments.

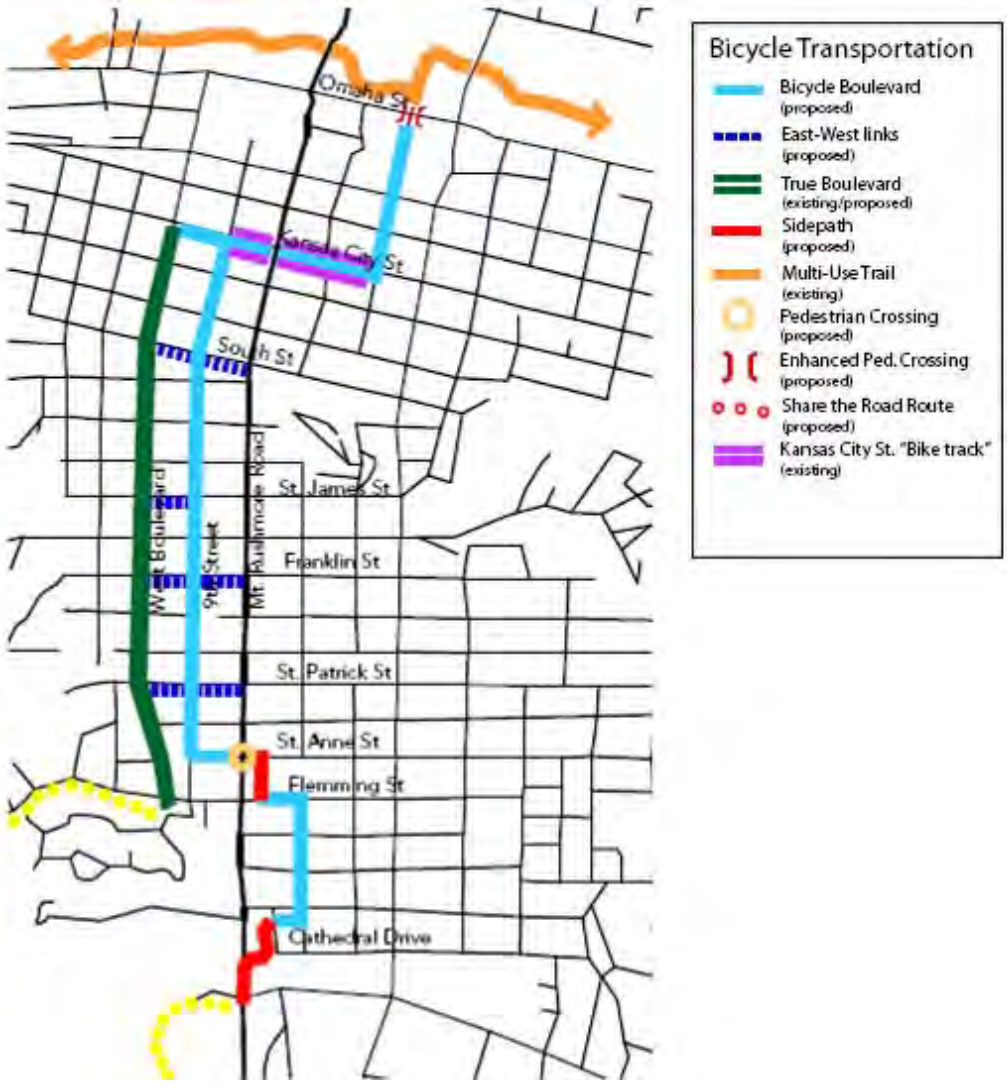


Figure 34. Bicycle Transportation Recommendations, DRAFT Mount Rushmore Road Corridor Development Plan.

The recommendation for bicycle accommodation through the corridor is to provide parallel bicycle routes, as high traffic volumes and turning movements create a difficult bicycling environment. The Plan recommends the following improvements, shown in Figure 34:

- **Construct a signed shared roadway on 9th Street between Kansas City Street and Flormann Street.** This would include pavement markings, traffic calming, signage, bike-safe drainage grates, and removal of other hazards to cycling. The 9th Street bikeway would connect to the Leonard "Swanny" Swanson Memorial Pathway on 6th Street via Kansas City Street. The route may benefit from a nonmotorized bridge over Omaha Street in the future.

- **Provide bike lanes and a pedestrian connection on Flormann Street from Mt. Rushmore Road to Tower Road**. This route would continue south as a signed shared bikeway along 7th to Cleveland, and use a new path on easements to the Cathedral Drive and Tower Road intersection. The route loops back on itself where the Flormann Street route continues as a shared facility to old Highway 16 and the Tower Road overpass.
- **Designate east-west linkages from West Boulevard/9th Street to 5th Street across Mt. Rushmore Road.** These designated bicycle routes would connect parallel bicycle-friendly streets to Mt. Rushmore Road destinations. Potential linkages include South, St. James, Franklin, St. Patrick, and Flormann Streets.

Figure 35. Mid-Block Pedestrian Crossing Concept.

The Plan also recommends bicycle parking along the corridor.

Strategies for pedestrian transportation include separated six- to eight- foot sidewalks with a parkway, where space is available. The Plan recommends a five-foot minimum sidewalk width, with ADA-compliant features and crossings (see Figure 35). In addition, the Plan recommends aesthetic qualities for the pedestrian environment, including winding sidewalks where appropriate, and consistent materials to define the crosswalks. Finally, the plan recommends the use of "speed tables, a slight elevation of the crosswalk above the paving surface with a very gradual vehicular incline in the street, on cross streets to slow traffic and define the transition between the commercial and residential environments."

Recommended locations for improved pedestrian crossings are along Mt. Rushmore Road at the following locations

- Omaha Street (additional improvements recommended)
- Main Street
- St. Joseph Street
- Kansas City Street
- Quincy Street
- Columbus Street
- South Street (unsignalized)
- Franklin Street
- St. Patrick Street
- Flormann Street (realignment)
- Cathedral Drive

The proposed offset pedestrian crossing at Fulton Street may be problematically close to the South Street crossing, and is not identified with pavement markings. Other potentially problematic mid-block crossings recommended in the plan include:

- Seventh Street, close to the Fairview Street intersection
- North of St. Cloud Street
- North of St. Andrew Street
- South of St. Charles Street
- North of St. Francis Street
- South of Meade Street

Additional engineering is recommended for these locations.

The Rapid City Area Bicycle and Pedestrian Master Plan will revisit these recommendations for addition into the project lists. The Bicycle and Pedestrian Plan will prioritize connections to key destinations, such as the Mt. Rushmore Road business district, and will identify key connections to these routes from outlying areas, connecting into the network. In addition, it is recommended to increase the minimum sidewalk width in this key business and service corridor. The Mt. Rushmore Road area will potentially experience heavy pedestrian traffic, and adequate width should be provided to ensure a good walking environment.

In addition, signage and amenities throughout the bicycle and pedestrian networks should coincide with other public art and signage. For example, the corridor markers shown in Figure 36, and the Wilson Park/West Boulevard signage system should be used throughout the bicycle and pedestrian networks.

Figure 36. Recommended corridor markers for Wilson Park/West Boulevard, DRAFT Mount Rushmore Road Corridor Development Plan.

City of Rapid City Planning Documents

Rapid City Bikeway/Walkway Plan (2006)

A component of the Transportation Element of the Comprehensive Plan for the City of Rapid City and the Long Range Transportation Plan for the Rapid City Area MPO, the Rapid City Bikeway/Walkway Plan evaluates existing conditions and identifies proposed projects for the region.

The plan's goals and objectives are:

- Promote bicycling and walking as a means of reducing traffic congestion and pollutants from automobile emissions.
    - Support accommodations for bicyclists at places of employment.

- Relieve traffic and parking congestion in the Central Business District.
    - Support a downtown bicycle storage facility.
- Promote a bikeway / walkway system which serves all major trip generators.
    - Complete sections of the bikeway / walkway system to achieve system continuity.
    - Develop walkways between neighborhoods to improve circulation and reduce pedestrian traffic along major roadways.
    - Map out a corridor bikeway system that links schools with neighborhoods, parks, the greenway, major employers, and shopping centers.
- Promote bicycle and pedestrian safety.
    - Identify hazardous locations on roadways and the bikeway / walkway system and develop strategies to mitigate the problems.
    - Assist with the Rapid City Police Department bicycle safety programs.
    - Promote the use of bicycle helmets.
    - Increase motorist awareness of the needs and rights of bicyclists and pedestrians.
- Integrate the transit and bikeway systems.
    - Evaluate the use of bicycle racks on Rapid Transit buses.
    - Develop bicycle storage facilities at the Milo Barber Transportation Center and at key transit stops.
- Enhance the transit / pedestrian interface.
    - Assure all transit stops are lit and secure.
    - Provide benches / shelters at key transit stops.
- Assist with the formulation and adoption of design standards.
    - Promote the adoption of road design standards which encourage bicycling.
    - Assist with the design of major road intersections to ensure safe crossing for bicyclists and pedestrians.
    - Review all project plats and plans for compatibility with a comprehensive bikeway / walkway system.
- Assume the role of an advocacy group for bicycling and walking.
    - Work with bicycle groups across the state on favorable legislation and SDDOT policies on bikeway development and funding.
    - Participate in local, state, regional, and national conferences on bicycling and non-motorized travel.

- Establish a program to conduct traffic counts and surveys of bicycle and pedestrian activity at key locations throughout the community.
- Inventory and catalog funding sources and methods for bikeway planning and system improvements.
- Promote the use of alternative easements and rights-of-ways, such as drainageways, for bikeway / walkway corridors.
- Promote the construction of sidewalks along school routes, commercial activity centers, and high volume and high speed roadways.

The plan defines the following types of bicycle facilities:

- **BICYCLE LANE.** A portion of the roadway which has been designated by striping, signing, or pavement markings for the preferential or exclusive use of bicyclists.
- **BICYCLE PATH**. A bikeway physically separated from motorized vehicle traffic by an open space or barrier, either within the highway right of way or within an independent right of way.
- **BICYCLE ROUTE.** A segment of a system of bikeways designated by the jurisdiction having authority with appropriate directional and informational markers, with or without a specific bicycle route number.
- **BIKEWAY.** Any road, path, or way which in some manner is specifically designated as being open to bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.

The majority of streets in Rapid City are allowable bicycle routes, with the exception of sidewalks in the central business district. The City of Rapid City does not have any bike lanes. In addition, several of the designated 'bike paths' are in reality sidewalks. Bicyclists should be discouraged from riding on sidewalks, due to potential conflicts between pedestrians as well as automobiles where the path crosses a roadway or a driveway.

High-priority projects identified in the *Rapid City Bikeway/Walkway Plan* include:

- The creation of bicycle lanes in the central business district on Seventh, Third, Kansas City, and Rapid Streets.
- A bike path segment along Fifth Street from Oakland Street to Texas Street.
- An extension of the bike path from Cambell Street east to Rapid Valley.

- The creation of bicycle lanes on Canyon Lake Drive from Sheridan Lake Road to Jackson Boulevard

The 2011 *Rapid City Area Bicycle and Pedestrian Master Plan* will revisit these recommendations and provide recommendations for implementing the identified projects.

Chapel Valley Access Traffic Analysis and Route Alignment Study (2010)

The City of Rapid City worked with the Rapid City Area MPO to develop alternative alignments access to the Chapel Valley area. The plan considers the feasibility of providing additional access to the Chapel Valley area. It does not consider bicycle or pedestrian access or circulation.

Rapid City 2009-2013 Transit Development Plan (2009)

The Transit Development Plan makes recommendations for improving pedestrian access to transit. Operations recommendations include:

6. Build ADA wheelchair loading pads at all stops with shelters (minimum) and benches (desirable)
7. Evaluate connections to local sidewalks, work with city to extend or connect sidewalks to bus stops where appropriate and not prohibitive in cost

The plan does not discuss accommodations for bicycles on buses or bicycle parking at bus stops.

Rapid City Code of Ordinances

Pedestrians

The Rapid City Code addresses pedestrians in Title 10, Chapter 36. The Code requires that drivers yield to pedestrians in the right-of-way:

10.36.010 Right-of-way.

A. The operator of any vehicle shall yield the right-of-way to a pedestrian crossing the roadway within any marked crosswalk or within any unmarked crosswalk at the end of a block or entrance to an alley, except at intersections where the movement of traffic is being regulated by police officers or traffic control signals. Whenever any vehicle has stopped at a crosswalk or intersection to permit a pedestrian to cross a roadway, the operator of any other vehicle approaching from the rear shall not overtake and pass the stopped vehicle.

B. At intersections where traffic is controlled by traffic control signals or police officers, drivers of vehicles, including those making turns, shall yield the right-of-way to pedestrians crossing or those who have started to cross the roadway on a walk signal; and, in all other cases, pedestrians shall yield the right-of-way to vehicles lawfully proceeding directly ahead or turning on a green or go signal.

C. Every pedestrian crossing a highway at any point other than a pedestrian crossing, a crosswalk or intersection shall yield the right-of-way to vehicles upon the highway.

The section also requires pedestrians to use the right half of the crosswalk when crossing a street. Section *12.20.070 Sidewalks–Snow and ice removal* requires owners or tenants to keep the sidewalk free of snow and ice.

Bicycles

The Rapid City Code of Ordinances defines bicycles as:

> *Every vehicle propelled solely by human power upon which any person may ride, having 2 tandem wheels and including any device generally recognized as a bicycle though equipped with 2 front or 2 rear wheels, except the vehicles with a seat height of no more than 25 inches from the ground where the seat is adjusted to its highest position, and except scooters and similar devices (10.64.010A).*

The Code requires that every bicycle is registered with the Police Department (Title 10, Chapter 64, Section 30). Registration costs $1. While this does not cause a financial burden for bicyclists, the requirement may deter individuals from riding in the area. Required registration is difficult to enforce and deleting this requirement should be considered.

The Code of Ordinances specifies where bicyclists should ride in the street:

> *10.64.170 Any person operating a bicycle upon a roadway at less than the normal speed of traffic at the time and place and under the conditions then existing shall ride in the right 4 feet of roadway near the right-hand curb or edge of the roadway, except under any of the following conditions:*
>
> - *When overtaking and passing another bicycle or vehicle proceeding in the same direction;*
> - *When preparing for a left turn at an intersection or into a private road or driveway; and*
> - *When reasonably necessary to avoid conditions including, but not limited to fixed or moving objects, parked or moving vehicles, bicycles, pedestrians, animals, surface hazards or substandard width lanes that make it unsafe to continue along the righthand curb or edge. For purposes of this section, a SUBSTANDARD WIDTH LANE is a lane that is too narrow for a bicycle and vehicle to travel safely side by side within the lane.*
>
> *Any person operating a bicycle upon a 1-way street or highway with 2 or more marked traffic lanes may ride as near the left-hand curb or edge of the roadway as practicable. Cyclists should stay in the left 4 feet of roadway whenever possible to avoid interfering with traffic.*

This ordinance helps inform cyclists where it is safe to ride. It allows cyclists to avoid potentially dangerous situations such as glass or debris in a bike lane, as well as allowing cyclists to pass each other or turn left. The Code also allows cyclists to pass motor vehicles on the right hand side, such as riding up to an intersection in a bike lane.

10.64.190 Passing vehicles on the right.

A. The operator of a bicycle may overtake and pass another vehicle upon the right only under conditions permitting the movement in safety. A bicycle may travel off the main traveled portion of the roadway when making the movement.

B. The operator of a bicycle may not pass the first vehicle at an intersection unless the bicycle is preparing to turn right and the vehicle is not signaling a right turn.

C. The operator of a bicycle shall not overtake another vehicle on the right when the overtaken vehicle is signaling to make a right turn.

Bicyclists in the Rapid City Area may ride on the sidewalk, except in a central business district. Bicyclists who are riding on the sidewalk must abide by the same provisions as pedestrians, and additionally must yield the right-of-way to pedestrians. The ordinance reads,

10.64.210 Operation on sidewalk or crosswalk.

A. A person operating a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, shall have all the rights and duties applicable to a pedestrian under the same circumstances.

B. Any person operating a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, shall yield the right-of-way to any pedestrian and shall give an audible signal before overtaking and passing a pedestrian.

C. No person shall operate a bicycle upon a sidewalk within a central business district as defined by Chapter 10.04 of this code.

D. The Traffic Engineer is authorized to erect signs on any sidewalk or roadway prohibiting the riding of bicycles thereon by any person, and when the signs are in place, no person shall disobey the same.

Bicyclists are also allowed to park their bicycles on the sidewalk, provided they do not:

- Impede the normal and reasonable movement of pedestrian or other traffic
- Hinder or restrict handrails or ramps; or
- Lock the bicycle to a fire hydrant.

Finally, the Rapid City Code of Ordinances designates bicycle trails as an allowable use in flood hazard districts.

Rapid City East Greenway Master Plan 1999

This plan compiled existing information and field observations to create an overall assessment of the 870-acre East Greenway – consisting of 4 miles of Rapid Creek and its existing floodway. Bicycle and pedestrian access to the area is limited by Highways 44 and 79 so recommendations include creating safe connections to the greenway.

Omaha Street Corridor Enhancement Project Master Plan (2005)

This plan focused on the 1.5 mile parkway corridor that contained Founders Park, Executive Golf Course, West Memorial Park and Memorial Park. Expansion to Omaha Street affected the corridor's circulation system and landscape. Plans were created to improve the four parklands within the corridor. Recommended pedestrian and bicycle improvements include:

- Executive Golf Course: New sections of walkway will connect the bike path to curbside walks on the westside of I-190 and northside of Omaha to improve pedestrian and bicyclist access to the bike path from West Boulevard to the south and residential areas to the north.
- West Memorial Park: Relocate the bike path south of its existing alignment to allow for stormwater management; New sections of walkway will connect the bike path to existing curbside walks on the east side of I-190 and west side of Eighth Street. This improves pedestrian and bicyclist access to the bike path from residential areas and Central High School to the north: addition of an at-grade pedestrian crossing between West Memorial Park and Memorial Park is located north of parking lot to decrease potential for vehicular pedestrian conflicts.
- Memorial Park: New sections of walkway will enhance the connection to the adjacent West Memorial Park and encourage the flow of pedestrian traffic from the Civic Center through the park to downtown.

Other Regional Planning Documents

DRAFT Spring Creek Neighborhood Area Future Land Use Plan

The intent of the Spring Creek Neighborhood Area Future Land Use Plan is threefold:

- Residential growth patterns will increase as single family dwelling units
- Extension of infrastructure is identified to support the anticipated growth patterns
- South Dakota Highway 79 and United States Highway 16 are entryway corridors into Rapid City. Tourism and general commercial uses have been identified along these corridors to accommodate and encourage business development.

The Plan identifies an 'Entryway' overlay area, which is comprised of all property within 500 feet of SD Highway 79 right-of-way. Pedestrian and bicycle paths are an allowable use in the landscape zone "when integrated into the landscaping." In addition, the recommendations include:

w) Pedestrian and bicycle paths shall be integrated into all development with linkages provided to both commercial and residential areas identified in the Study Area.

The final summary also supports the development of additional bicycle and pedestrian facilities: "There is a need for additional parks and recreational opportunities in the Neighborhood Area as additional residential development occurs.

Box Elder Corridor Study (DRAFT 2010)

A study for South Dakota Highway 1416 from Interstate 90 to Ellsworth Road in Box Elder, the Corridor Study is complete but had not been adopted at the time of this writing.

The Plan recommends four-foot bike lanes between eight-foot parking or loading zones and 10.5 foot travel lanes. This is a significantly constrained alignment, and it is recommended that the minimum width for bike lanes on a higher-speed street be five feet. This may require the reduction of parking on one side of the street, or the removal of the center turn lane in some locations. Another alternative would be to provide cycle track facilities, which are bike routes on the inside of the parking or loading areas, providing a more protected bicycle environment.

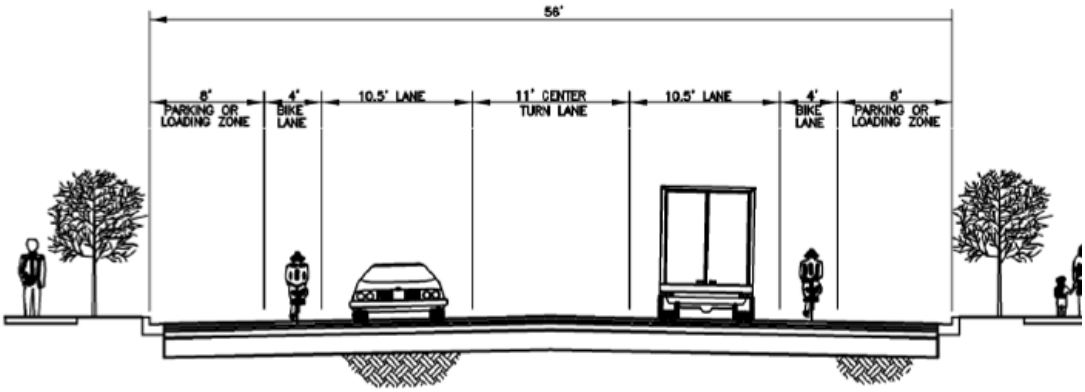


Figure 37. Proposed Highway 1416 Section with Bike Lanes.

Pennington County Comprehensive Plan (2003)

Section 5.2 of the Pennington County Comprehensive Plan considers alternative methods of transportation. However, the plan states, "given the large geographical area covered by Pennington County, it is not realistic to anticipate wide usage of bike trails for the movement of people." There are no regional trails in Pennington County.

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Appendix C. Existing Conditions Analysis

System Opportunities and Constraints

This section provides an analysis of the existing conditions for walkways and bikeways in the Rapid City Area. The section also identifies potential barriers to accommodating and encouraging bicycle and pedestrian trips, which this plan seeks to overcome.

Figure 38. Pedestrians walk through the median along West Boulevard.

Opportunities

Described below, various characteristics foster an environment where bicycling and walking are safe and enjoyable in the Rapid City area.

Topography in the Downtown Area

Rapid City has few challenging hills to deter bicycling or walking on trails or on-street through the downtown area. Trails such as the Leonard "Swanny" Swanson Memorial Pathway are comfortable routes for families, with minimal slopes.

Downtown Rapid City Land Use Characteristics

Land use characteristics, particularly along Main Street and Saint Joseph Street in downtown Rapid City, foster a pedestrian-friendly environment. Buildings fronting the sidewalk edge create a tight urban form and an inviting pedestrian atmosphere. The presence of angled on-street parking along both streets also buffers foot traffic from adjacent motor vehicle traffic. Walking and bicycling as a means for running errands is also encouraged through the grouping of diverse land uses in the downtown area.

Presence of Walk- and Bike-Friendly Streets

Most residential areas benefit from a pedestrian- and bicycle-friendly environment. As many homes in the Rapid City Area are located on low-volume streets with relatively complete sidewalks, pedestrians and bicyclists of all ages and skills can travel most neighborhoods comfortably and safely.

Existing Spine Trail

The Leonard "Swanny" Swanson Memorial Pathway encourages both families with children and longer-distance recreational riders by providing a

continuous, separated route through the region. Existing on-street connections allow residents to access the trail via nonmotorized modes.

Presence of Grade-Separated Trail Crossings

The Leonard "Swanny" Swanson Memorial Pathway crosses many major streets along its length. Bicycle and pedestrian trips are facilitated and improved by the trail crossing under most of these roadways. Undercrossings in the Rapid City Area tend to be well-designed and short to minimize potential pedestrian and bicyclist discomfort when crossing.

Space to Provide Low-Cost Bicycle Improvements

Several roadways in the Rapid City Area appear to have more vehicle capacity than is currently needed, such as Sturgis Road. This excess roadway space could be better utilized to enhance multi-modal access and mobility. Bicycle facilities on these streets could be developed through relatively simple treatments, such as roadway re-striping, travel lane narrowing or reduction, and/or signage allowing bicyclists to share wide lanes, or paving wider shoulders.

Constraints

Described below, bicyclists in and around the Rapid City Area face a variety of challenges.

Barriers

I-90 and I-190 serve as major barriers for bicyclists and pedestrians due to the lack of bicycle and pedestrian facilities along and across the roadways. The "Gap" is a well-known barrier along Main Street, from West Street to Jackson Boulevard.

The Rapid Creek represents another significant barrier to non-motorized transportation in the Rapid City Area, with limited crossing opportunities, although the trail running parallel to the Creek provides key connections through the region.

Dakota Minnesota & Eastern railroads operate in the Rapid City Area. These railroads represent challenges for bicyclists, as at-grade railroad crossing opportunities are limited to major roads that currently have minimal pedestrian or bicycle facilities. Poorly designed railroad crossings can be dangerous to cyclists, with potential for riders to fall on the tracks or be forced into traffic.

Limited Street System Connectivity

Although streets are well-connected in the downtown Rapid City Area, there is minimal connectivity in other areas. Throughout unincorporated Meade and Pennington Counties, roads providing the most connectivity and

covering longer distances tend to be high-volume streets lacking bicycle or pedestrian facilities. Some of these principal arterials include Sturgis Road and Mount Rushmore Road.

Lack of Wayfinding Tools

The Rapid City Area's walkway and bikeway system could benefit from signage and other wayfinding tools to orient users and direct them to and through major destinations like the downtown, schools, parks, and commercial areas. Currently, a few signs identify side paths, but do not provide additional wayfinding information.

User Conflicts on Trails

Conflicts often arise between faster-moving cyclists and slower-moving pedestrians along trails in the Rapid City Area, particularly where the trails pass through areas of higher use. City of Rapid City should consider implementing programs to address "trail etiquette" by educating trail users about where they should be located and how to safely pass other trail users.

Maintenance Issues

Described below, several maintenance issues complicate pedestrian and bicycle travel on the existing walkway and bikeway networks in the Rapid City Area. These issues include faded crosswalks, snow and ice removal, and damaged or deteriorated sidewalks and trails.

Crosswalk Issues

At many intersections, crosswalks are difficult to see for approaching motorists. Crosswalk bars on many of the city's longitudinal (also known as "ladder style") crosswalks are fairly narrow. Furthermore, crosswalk bars have faded or have been worn out by vehicle tires in several locations.

Snow and Ice Accumulation

Snow and ice represent challenges to walking and bicycling during winter months in the Rapid City Area. When snowplows remove snow and ice from roadways, it is usually deposited on roadway edges. This creates a very difficult bicycling environment, forcing many cyclists to ride in the road, rather than on the shoulder.

Damaged/Deteriorated Sidewalks

Existing sidewalks in various parts of the community suffer from cracking, heaving, and/or vegetation growing between pavement seams. Uneven pavement joints (often caused by tree roots below the sidewalk) create tripping hazards and complicate travel for wheelchair users. Water ponding on sidewalk surfaces can further challenge walking, especially when ponding water freezes in cold weather.

Uncomfortable Walking and Bicycling Environment along High-Volume Roadways

Large vehicles (e.g., trucks, buses, and recreational vehicles) and high vehicle speeds and volumes create challenging, uncomfortable, and potentially unsafe walking and bicycling conditions on major streets, particularly through the "Gap." Streets without paved roadway shoulders present challenging bicycling conditions, as cyclists must ride in the roadway with motorists. Example corridors include Sturgis Road and Haines Avenue.

Fragmented Sidewalk Network in Some Areas

Discussed earlier, some areas of Rapid City benefit from a fairly complete sidewalk network, while in other areas the system is fragmented. Generally, a relatively complete sidewalk system exists in downtown Rapid City, while many streets in outer areas do not have sidewalks.

Sidewalk Obstructions

Although sidewalks exist on numerous streets, their use is occasionally hindered by obstructions such as utility poles, fire hydrants and other items. Additionally, overgrown vegetation obstructs sidewalks and paths in some areas, forcing pedestrians to walk in the planter strip or the road.

Difficult Crossings of High-Volume Streets

Crossing I-90 and other major roadways such as I-190, Highway 79, and Highway 44 is challenging for pedestrians and bicyclists due to relatively long distances between signalized intersections and marked crossings. High vehicle speeds and lengthy distances between signalized intersections discourage pedestrians from walking to services along these corridors. In some cases, pedestrians choose to dart across the roadway to reach their desired destinations, instead of using a marked crossing.

Difficulties for Disabled Pedestrians

Pedestrians with disabilities experience crossing difficulties in some parts of the Rapid City Area. Curb ramps at some intersections are in poor condition or disrepair, while other intersections lack curb ramps altogether. In some cases, marked crosswalks lead to sidewalks with no curb ramps, or are not aligned with existing curb ramps. This can make traveling by wheelchair or motorized mobility device challenging, if not impossible. Visually- and mobility-impaired pedestrians also experience difficulty navigating through intersections with curb ramps oriented diagonally toward the intersection's center rather than toward a crosswalk.

Interchange Areas

Pedestrians face crossing difficulties at highway interchange areas. Channelized right turns at these intersections create higher vehicle turning speeds, especially for motorists entering freeway on- ramps from the local street network. Broad vehicle turning radii at ramp termini also create excessively long vehicle/pedestrian conflict zones.

Lack of On-Street Bikeways

Mentioned earlier, the Rapid City Area lacks a formalized on-street bikeway system. The region has a good shared-use path system, but there are no formal on-street bikeway connections to the trails. This creates difficulties for people who do not live directly adjacent to a trail or who wish to travel quickly and easily to destinations within the region.

Existing Conditions by Area

This analysis provides a description of existing conditions within the City of Rapid City. The brief summary of outlying areas focuses on connections from the City to other specific areas with notable issues or opportunities. East and south Rapid City are not discussed specifically, as fewer issues were evident for those areas.

Downtown Rapid City

Downtown Rapid City is a center of business and tourism, with a high density of destinations for pedestrians and bicyclists. Whether it is a leisurely ride along the Leonard "Swanny" Swanson Memorial Pathway or a trip to the public library, many residents enjoy walking and bicycling throughout the downtown area. Located to the southeast of downtown, the South Dakota School of Mines and Technology has an enrollment of almost 2,200 students. Other key destinations include the Rushmore Plaza Civic Center, the Dahl Fine Arts Center, Dakota Middle School, the YMCA, and many others, shown in Map 5.

Pedestrian Facilities

On main pedestrian roadways such as Main Street, Saint Joseph Street and Mount Rushmore Road, sidewalks provide sufficient width for pedestrians to pass each other comfortably (minimum of six feet). Street trees improve the pedestrian environment, offering a buffer between the sidewalks and the roadways.

Intersections downtown generally have pedestrian countdown signals. At some intersections, the walk signal must be activated by a pedestrian before a 'Walk' phase will be shown. Curb ramps with detectable warning strips exist at many intersection corners in downtown Rapid City. However, many intersections do not provide ramps on all corners or lack ramps

entirely. On various locations downtown, several curb extensions have been provided to minimize crossing distances for pedestrians. These increase pedestrian space and significantly improve the pedestrian environment.

Bicycle Facilities

The Leonard "Swanny" Swanson Memorial Pathway passes through Rapid City, providing access to the downtown area from the north via several on-street connections. Side path facilities along Omaha Street, Haines Avenue, and Lemmon Avenue/N 1st Street connect trail users with the road system and area parks.

While none of the streets in downtown Rapid City have designated on-street bicycle facilities, traffic speeds tend to be low and confident bicyclists can share the road with vehicular traffic. A cycle track has been developed on Kansas City Street, which dedicates a portion of the sidewalk to bicycling. However, the street environment is comfortable for most cyclists, and the cycle track is often partially obstructed by parked cars overlapping the curb.

Bicycle parking is provided in several locations downtown, including the library. However, where insufficient parking is provided, cyclists will lock their bicycles wherever they can, which can impede pedestrian travel on the sidewalk.

Map 5. Existing Bicycle and Pedestrian Facilities in Downtown Rapid City

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: November 2010

0 0.15 0.3 Miles

- Shared-Use Path
- Cycle Track
- Side Path
- Shoulder Bikeway
- Committed Bike Lane
- Sidewalks Both Sides
- Sidewalk One Side
- Hospital
- Civic Destination
- Recreational Destination
- School
- Parks
- Railroads
- City of Rapid City

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West Rapid City

The western area of Rapid City is characterized by steep grades and a disconnected roadway network. Major streets through this area include W Chicago Street, W Main Street, and Jackson Boulevard. Existing pedestrian and bicycle facilities in the area are shown in Map 6.

Due to topographic challenges, there is limited street connectivity around the area of West Middle School and through the Rapid Creek greenbelt. Soo San Drive/32nd Street, Range Road, 44th Street/Hillsview Drive, and Sheridan Lake Road are the north/south streets through this area. W Main Street/Sturgis Road, City Springs Road, and Deadwood Avenue offer connections to the north and to Black Hawk. W Main Street and Jackson Boulevard link this area to downtown Rapid City.

Pedestrian Facilities

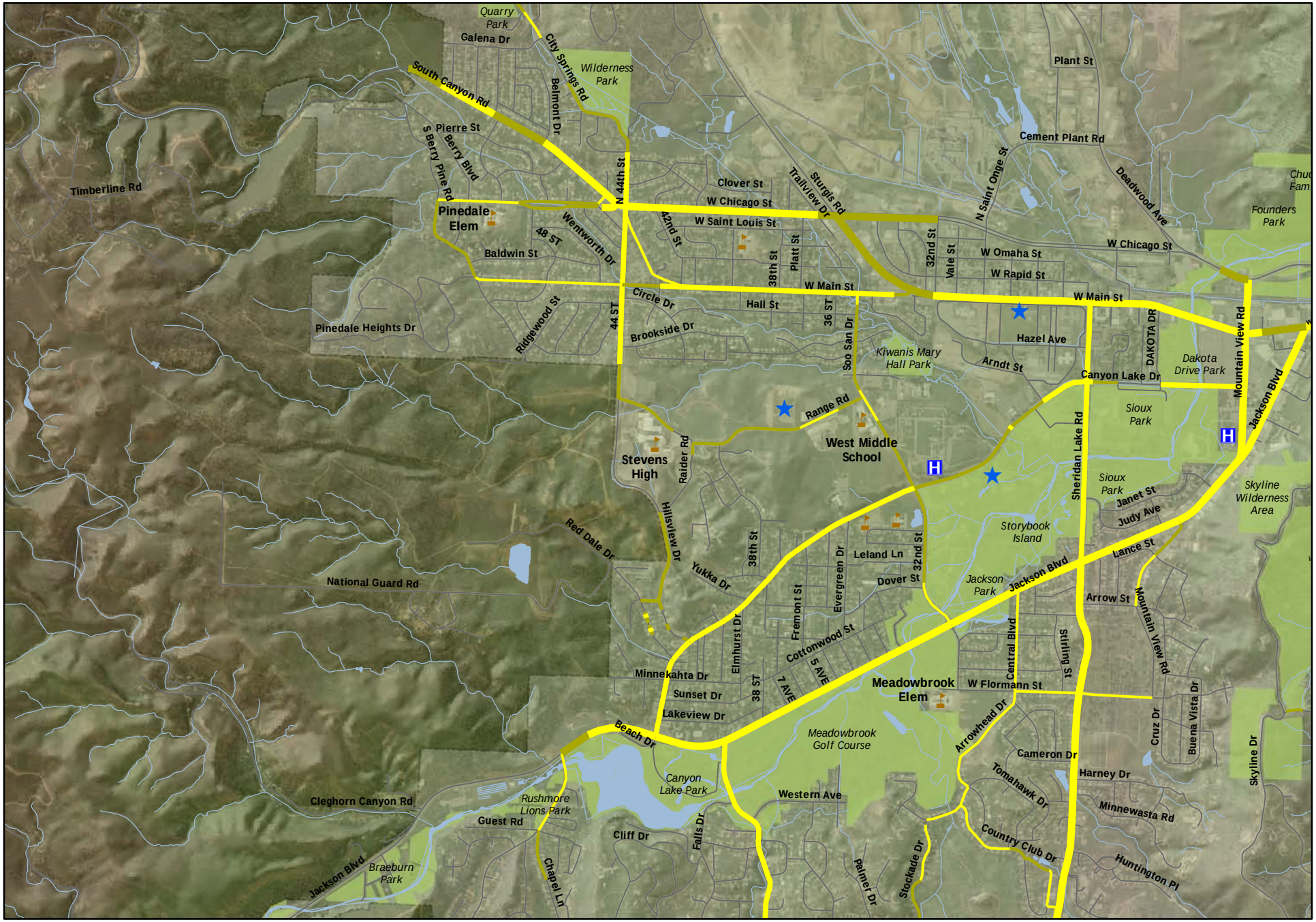
West of Dinosaur Park, most major streets offer sidewalks. Narrow, curb-tight sidewalks along Jackson Boulevard present an uncomfortable walking experience. A median strip on the west side of Mountain View Road offers a small buffer from traffic, although large parking lots in front of businesses deter pedestrians. A wider planting strip in some locations on the south side of Canyon Lake Drive offers a pleasant pedestrian environment, while a wide sidewalk on the east side of 44th Street provides good connectivity for pedestrians. W Chicago Street is a major thoroughfare that does not have any sidewalks.

Residential neighborhoods in western Rapid City tend to have narrow sidewalks with wide planting strips.

Bicycle Facilities

The Leonard "Swanny" Swanson Memorial Pathway travels through the southeastern part of this area, providing connections into downtown and to the hospitals. A side path on Range Road provides a route between Stevens High School and West Middle School. Another side path on Sheridan Lake Road runs south from the Leonard "Swanny" Swanson Memorial Pathway at Sioux Park.

Few roads provide continuous connections through this area. N 44th Street, W Main Street, W Chicago Street, and S Canyon Street are all bigger streets where experienced cyclists may be willing to ride, and a few residential streets provide comfortable through-routes. Brookside Drive is an exception, which may serve as a route for current cyclists. In addition, S Canyon Road has wide shoulders that are minimally used for parking, which could act as a bicycle route.



Map 6. Existing Bicycle and Pedestrian Facilities in West Rapid City

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: November 2010

0 0.25 0.5 Miles

- Shared-Use Path
- Cycle Track
- Side Path
- Shoulder Bikeway
- Committed Bike Lane
- Sidewalks Both Sides
- Sidewalk One Side
- Hospital
- Civic Destination
- Recreational Destination
- School
- Parks
- Railroads
- City of Rapid City

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North Rapid City

The area north of the Rapid Creek has a relatively complete grid pattern, which offers multiple routes to destinations for bicyclists and pedestrians. I-90 bisects this area, running east-west and meeting up with I-190 west of Haines Avenue.

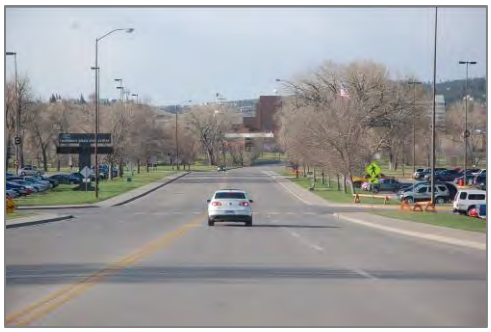


Figure 39. The crosswalk at Rapid City Central High School includes warning signage.

Pedestrian Facilities

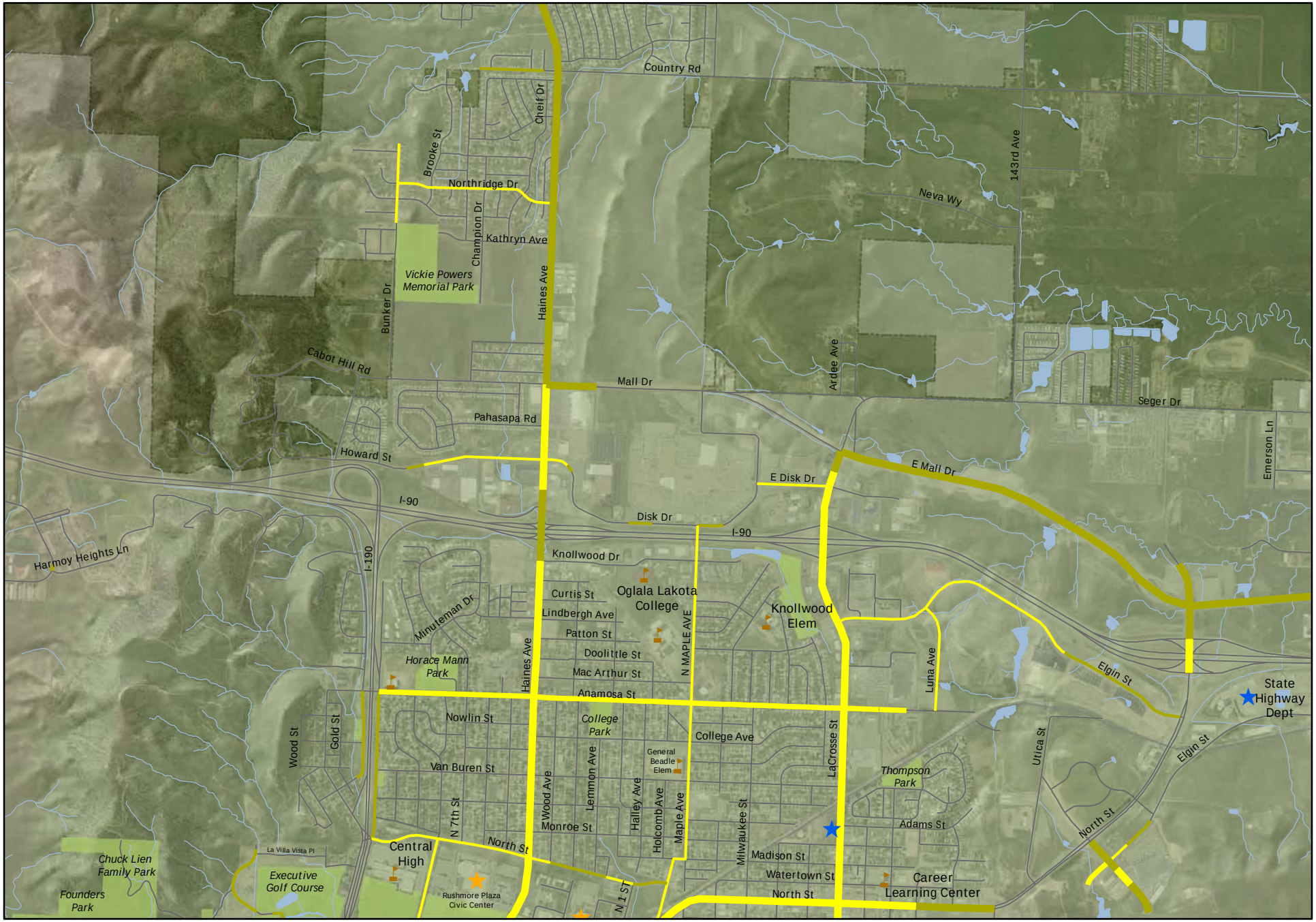
Sidewalks on bigger streets such as E North Street and Haines Avenue are quite narrow, especially considering the higher roadway volumes, which decrease pedestrians' comfort level. Sidewalks on E North Street drop east of N Cambell Street, where density decreases and pedestrian levels are likely to be low. North of I-90, a planter strip on the east side of N Haines Avenue provides a buffer for pedestrian travel. In addition, where I-90 crosses Haines Avenue, pork chop islands (a pedestrian island outside a right-hand turn lane) enable drivers entering and exiting the interstate to do so at high speeds, endangering pedestrians.

Pedestrian access across the interstate highways is limited. Haines Avenue has a designated side path on the west side of the roadway, and crossing treatments at the interstate ramps are faded. N Lacrosse Street has wide sidewalks for pedestrians crossing I-90, and crossings are marked on the west side of the street. North Maple Street provides a sidewalk on the east side of the street. While there are fewer pedestrian destinations west of I-190, it is important to provide connections for residents. Anamosa Street passes over I-90 with sidewalks on both sides of the street. The only other crossing of I-190, North Street, is an underpass without pedestrian facilities.

Bicycle Facilities

Bicyclists in north Rapid City experience difficulties crossing the interstates. The Haines Avenue side path crosses under I-90; however, crosswalks are mostly faded and little additional signage or warnings serve to raise awareness of the presence of bicyclists and pedestrians.

Cyclists may also use the undercrossing on I-90 at N Maple Avenue by sharing the road with motor vehicles, as no designated bicycle facilities exist.



Map 7. Existing Bicycle and Pedestrian Facilities in North Rapid City

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: November 2010

0 0.25 0.5 Miles

- Shared-Use Path
- Cycle Track
- Side Path
- Shoulder Bikeway
- Committed Bike Lane
- Sidewalks Both Sides
- Sidewalk One Side
- Hospital
- Civic Destination
- Recreational Destination
- School
- Parks
- Railroads
- City of Rapid City

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Outlying Areas

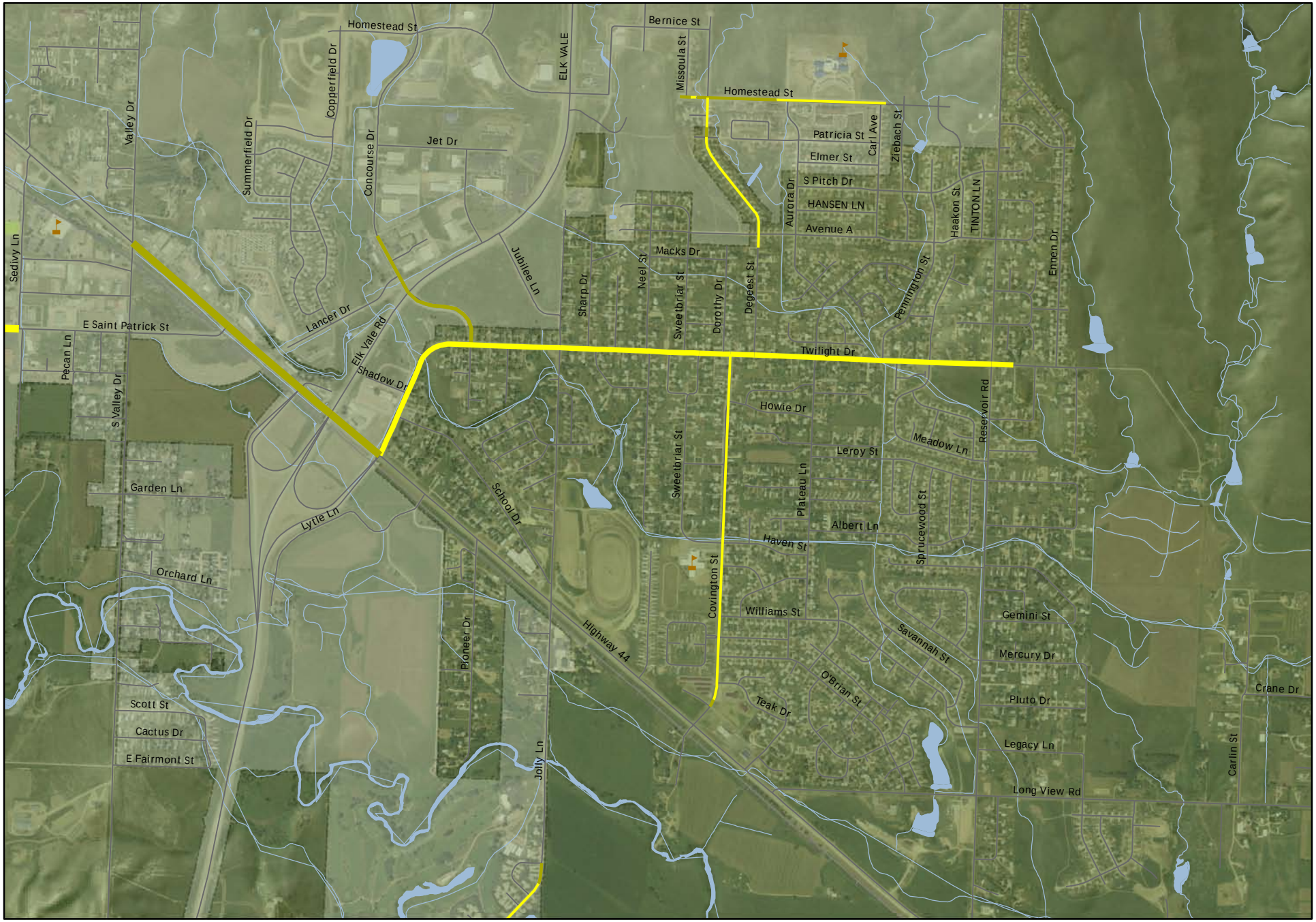
Rapid Valley

An unincorporated suburb to the southeast of Rapid City, Rapid Valley is a predominantly residential area. The majority of residents commute into Rapid City for work. The airport is annexed to the City of Rapid City and is located near the valley.

East of Elk Vale Road, Twilight Drive is the main through-street. A side path on Twilight Drive provides pedestrian connections through the area. Most of the larger neighborhood streets in the Rapid Valley Area provide sidewalks with a buffer area, including Covington Street, Plateau Lane north of Twilight Drive, Meadow Lane and Ennen Drive. Collector streets lacking sidewalk facilities include Jolly Lane, Sweetbriar Street, Plateau Lane south of Twilight Drive, and Reservoir Road.

Rapid Valley has a designated bike path running the length of Twilight Drive. The facility is a side path north of the roadway. Marked crossings are provided at all cross streets.

Rapid Valley is predominantly residential, and the majority of streets accommodate bicyclists in shared lanes with relatively slow motor vehicle traffic.



Map 8. Existing Bicycle and Pedestrian Facilities in Rapid Valley

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: November 2010

0 0.2 0.4 Miles

- Shared-Use Path
- Cycle Track
- Side Path
- Shoulder Bikeway
- Committed Bike Lane
- Sidewalks Both Sides
- Sidewalk One Side
- Hospital
- Civic Destination
- Recreational Destination
- School
- Parks
- Railroads
- City of Rapid City

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Box Elder

The Box Elder community is located northeast of the City of Rapid City, along I-90. Ellsworth Air Force Base (AFB) is north of I-90 and connections include Commercial Gate Road, N Ellsworth Road, and Main Gate Road.

The I-90 Frontage Road provides a connection to Rapid City, becoming Eglin Street and connecting to E North Street/N Cambell Street. County Road C212/Radar Hill Road is the only roadway traveling south of Box Elder, and the road connects to Highway 44 southeast of Rapid Valley. County Highway 1416 continues east of Box Elder.

- Pedestrian Facilities: Few streets in Box Elder provide sidewalks. South of I-90, S Ellsworth Road provides a wide shoulder that can accommodate pedestrian travel, while the residential area at the south end of Ellsworth Road provides sidewalks in the neighborhood.
- Bicycle Facilities: No dedicated bicycle facilities exist in Box Elder. Most residential streets comfortably accommodate bicycle travel, although the major streets connecting the area to surrounding jurisdictions have higher speeds and volumes. N Ellsworth Road has wide lanes which could potentially accommodate bicycle travel to the Air Force base.

Black Hawk

Located northwest of Rapid City along I-90, Black Hawk is a small community with an elementary school, Divine Shepard Lutheran Church and Black Hawk Community Church. Peaceful Pines Road, W Elm Street, Sturgis Road, Mill Road, and Merritt Road are the major roadways in the community. Mill Road provides access to the east, while Peaceful Pines Road is the only roadway leading west of the area.

- Pedestrian Facilities: The Black Hawk community accommodates pedestrians on unpaved roadway shoulders. Peaceful Pines Road has a sidewalk along the southern side of the street, while W Elm Street, Ash Street, Sturgis Road, Valley View Drive, and Merritt Road lack sidewalks entirely.
- Bicycle Facilities: No bicycle facilities are provided in Black Hawk. Bicycle travel is accommodated on residential streets within the community, while low traffic volumes on more rural streets may provide recreational opportunities for more comfortable bicyclists.

Walkway Gap Analysis

This section defines and identifies gaps in the Rapid City area walkway network. The text defines common walkway gap types: spot, connection,

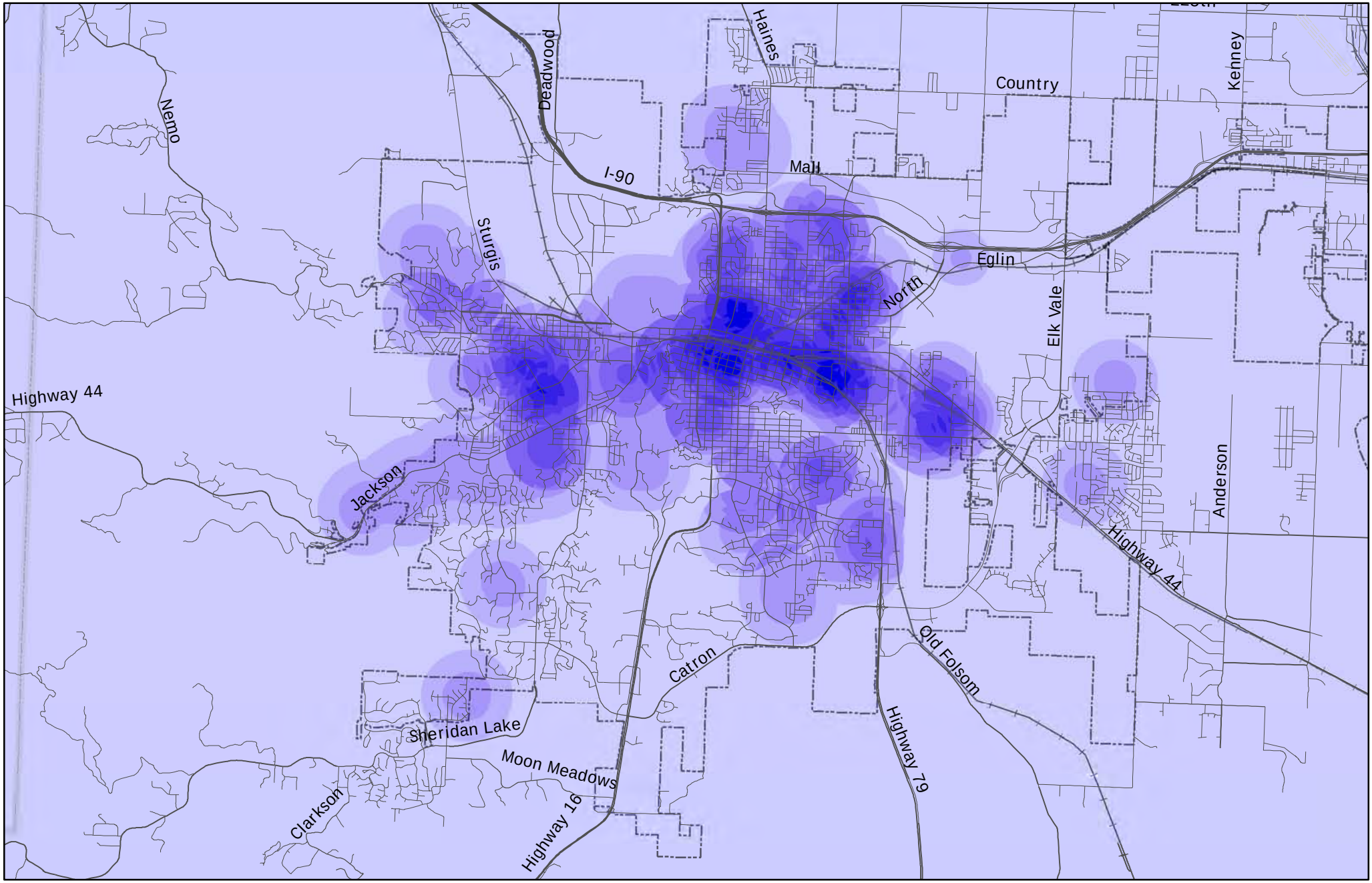
lineal, corridor and system gaps with respect to both on-street facilities and off-street paths. The spectrum of gap closure measures used throughout the United States is also discussed.

Pedestrian Attractors

Because a majority of people walk relatively short distances (a mile or less) to key destinations, the Rapid City Area Bicycle and Pedestrian Master Plan will focus pedestrian recommendations on areas that are close to these destinations. Map 9 displays the relative density of pedestrian attractors for the Rapid City Area. The map was developed with Spatial Analyst, a GIS tool which combines individual attractors into a composite with higher values assigned to locations closer to the pedestrian attracting land uses and lower values assigned to locations further away from pedestrian attracting land uses.

Varying weights were assigned to locations in the Rapid City Area based upon their proximity to pedestrian attracting land uses. Concentric rings were created to illustrate the relative geographic distance of each destination from other attractive land uses measured in this study.

As shown on Map 9, the composite pedestrian attractor map identifies several high-attraction areas within Rapid City, particularly in the downtown area and in Box Elder.



Map 9. Pedestrian Attractors

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: April 2010

0 1.25 2.5 Miles

City of Rapid City

Box Elder

Railroads

Rapid City MPO Boundary

Pedestrian Attraction

High

Low

N

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Defining Walkway Gaps

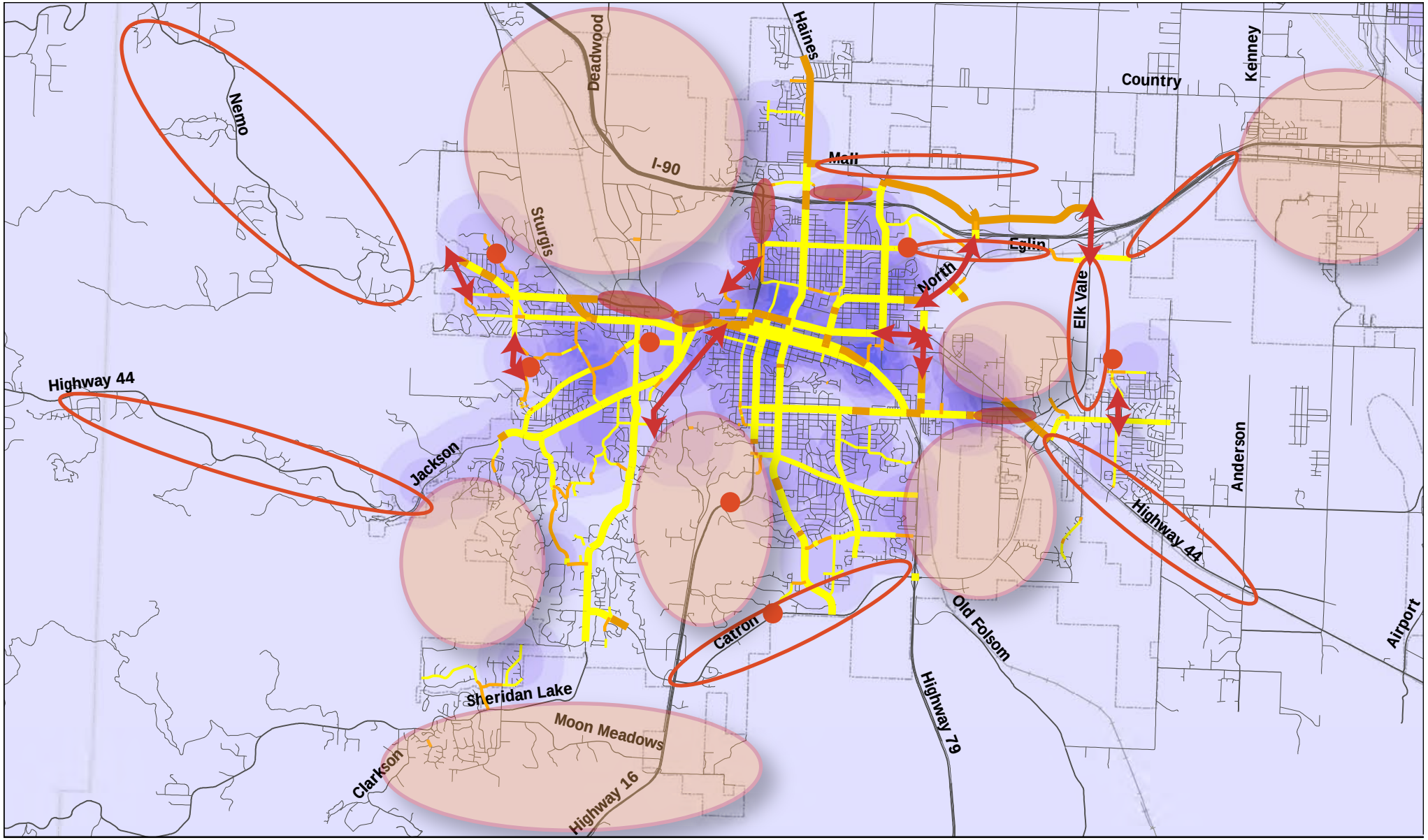
Walkway gaps exist in various forms, ranging from short "missing links" on a specific street or path corridor, to larger geographic areas with few or no facilities at all. Walkway gaps can be classified into three main categories:

- Spot gaps: Spot gaps refer to point-specific locations lacking dedicated facilities or other treatments to accommodate safe and comfortable pedestrian travel. Spot gaps primarily include intersections and other areas with potential conflicts with motor vehicles. Examples include a lack of intersection crossing treatments for pedestrians on a route or sidewalk as they approach a major street.
- Connection gaps: Connection gaps are missing segments (¼ mile long or less) on a clearly defined and otherwise well-connected walkway. Major barriers standing between destinations and clearly defined routes also represent connection gaps. Examples include a discontinuous sidewalk along a street, or a freeway located between a major pedestrian or bicycle route and a school.
- Lineal gaps: Similar to connection gaps, lineal gaps are ½- to one-mile long missing link segments on a clearly defined and otherwise well-connected walkway.

Gaps typically exist where physical or other constraints impede walkway network development. Typical constraints include narrow bridges on existing roadways, severe cross-slopes, and potential environmental damage associated with wider pavement widths. Traffic mobility standards, economic development strategies, and other policy decisions may also lead to gaps in a network.

Walkway System Gap Analysis Results

Map 10 shows the results of the Walkway System Gap Analysis. In the map, yellow lines indicate sidewalks on both sides of the street, while brown lines indicate sidewalks on one side only. This information was collected by the Rapid City Area MPO. Width, maintenance, and other factors affecting usability of the existing sidewalks were not considered in this analysis. The width of the lines depicting sidewalks indicates the classification of the road; the widest lines are along Arterial roadways, while narrower lines are along Collector streets. Local road sidewalks were not evaluated.



Map 10. Pedestrian Gap Analysis

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: May 2010

0 1 2 Miles

Pedestrian Attraction
High
Low

Existing Sidewalks, both sides
Existing Sidewalks, one side
Railroads

Spot Gap
Connection Gap
Lineal Gap
Corridor Gap
System Gap

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Gap Closure Measures

The following sections discuss various gap closure measures, ranging from minor treatments (e.g., marked crossings) to larger-scale applications (e.g., grade-separated crossings). The measures generally fall into two categories:

- Pedestrian gap closure measures within the right-of-way
- Off-street gap closure measures

The two categories reflect the typical location of gap closure measures (e.g., off-street measures utilize non-roadway corridors to complete system gaps). In some scenarios, the on- and off-street measures can be used interchangeably to complete system gaps where necessary. For instance, on-street gap closure measures (e.g., intersection treatments) may be necessary to complete an off-street path that crosses several major streets with difficult crossings.

The following section provides a list of possible gap closure strategies. Strategies are not described in detail here, but definitions and best practices for implementation will be included in the design guidelines.

Figure 40. High-visibility crosswalk near a school in Fairfax, CA

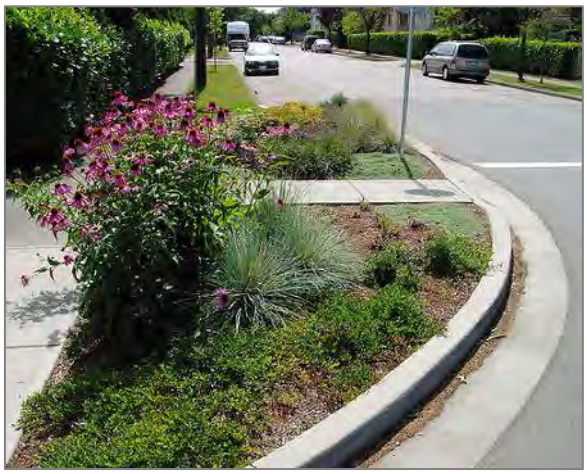


Figure 41. Planted curb extension in Portland, OR

Pedestrian Gap Closure Measures Within the Right-of-Way

The on-street pedestrian gap closure measures fall within three major categories:

- **Intersection improvement measures** facilitate safe, comfortable and convenient pedestrian travel through intersections where intersections lack marked crossings or curb ramps
- **Mid-block crossing measures** provide a marked crossing at a non-intersection location along a high-pedestrian-traffic route or route to school
- **Sidewalk infill measures** develop sidewalk facilities in locations that currently lack sidewalks

Intersection Improvement Measures

Intersection improvements concentrate on facilitating safe, convenient and comfortable pedestrian travel through intersections that lack marked crossings or curb ramps. Treatments for improving intersections for pedestrians include:

- High-visibility crosswalks (see Figure 40)
- Curb extensions (see Figure 41)
- Pedestrian refuge islands (see Figure 42)
- Pedestrian-actuated signal phases

Mid-block Crossing Measures

At a non-intersection location along a high-pedestrian-traffic route or route to school, mid-block crossing measures provide a marked crossing to increase safety for pedestrians crossing a road. Mid-block crossings are often appropriate near schools or other major destinations and at trail crossings of major streets. Additional mid-block crossing treatments include:

- High-visibility crosswalks
- Curb extensions
- Pedestrian refuge islands (Figure 42)
- Pedestrian-actuated signal phases

Figure 42. Pedestrian refuge island at mid-block crossing.

Sidewalk Infill Measures

Sidewalk infill measures develop sidewalk facilities in locations that currently lack sidewalks or which have smaller gaps in the sidewalk network. Locations that should be targeted for sidewalk infill include areas close to major pedestrian destinations (including schools, hospitals, community centers, parks, retail corridors, employment centers, etc.), or where high pedestrian traffic is experienced.

Figure 43. Route of the Hiawatha rail-to-trail in Wallace, ID.

Off-Street Gap Closure Measures

The sections below describe shared use path gap closure measures emphasizing off-street treatments. The measures largely focus on completing off-street walkway/bikeway gaps (e.g., discontinuous path segments), and are most appropriate for addressing connection, lineal, corridor and system gaps on the off-street network. It should be noted however that some measures could effectively address some on-street walkway or bikeway gaps, especially connection gaps near on-street bikeways (e.g., a bicycle/pedestrian bridge crossing a freeway to connect an on-street bikeway with a nearby school).

Figure 44. Rail-with-trail along Metro Orange Line, Los Angeles, CA.

Off-street gap closure methods can include:

- **Rails-to-Trails** utilize abandoned railroad corridors to complete shared use path system gaps. Rail corridors offer several advantages, including relatively direct routes

Figure 45. Accessways provide connections through cul-de-sac neighborhoods

between major destinations, and following generally flat terrain. (Figure 43)

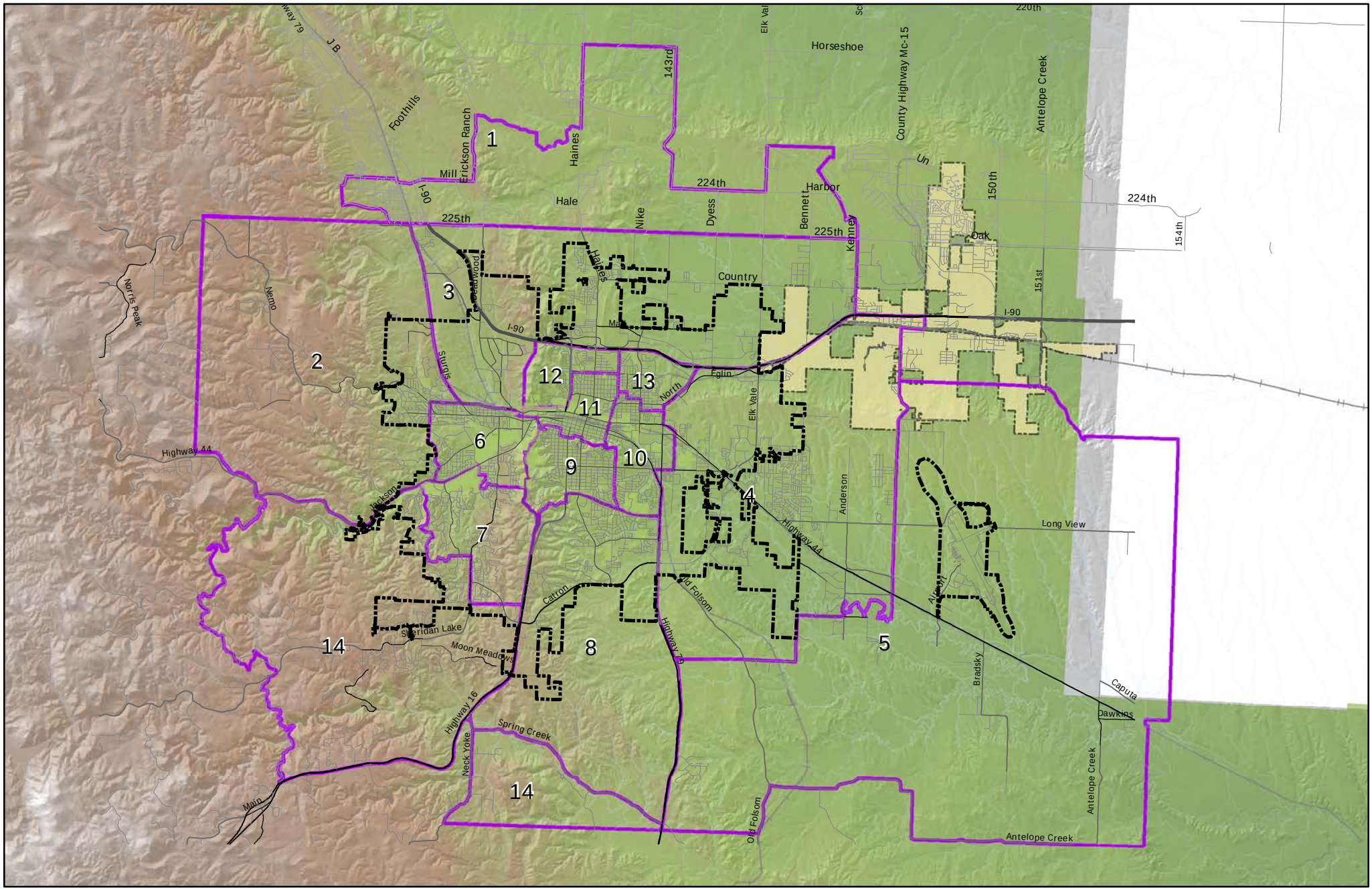
- **Rails-with-Trails** typically consist of paths adjacent to active railroads. Offering the same benefits as rail-to-trail projects, these projects often have additional constraints, including a need for space preservation, limited right-of-way width, inadequate setbacks, concerns about trespassing, and numerous mid-block crossings. (Figure 44)
- **Utility and drainageway Corridor Trails** typically include power line and sewer corridors, as well as canals, drainage ditches, rivers, and beaches. These corridors offer excellent transportation and recreation opportunities for walkers and cyclists of all ages and skills.
- **Bicycle/pedestrian overcrossings and undercrossings** provide critical non-motorized system links by joining areas separated by any number of barriers. Overcrossings and undercrossings address real or perceived safety issues by providing users a formalized means for traversing "problem areas" such as deep canyons, waterways or major transportation corridors.
- **Accessways** provide short connections from roadways or off-street paths to important pedestrian destinations such as schools, parks, transit centers and mixed-use centers. (Figure 45)

Cycle Zone Analysis

The Cycle Zone Analysis (CZA) was used to evaluate existing bikeway conditions for the Rapid City Area Bicycle and Pedestrian Master Plan. This analysis aids the planning effort by:

- Highlighting factors that affect bicycling conditions in different areas of the city
- Identifying zones with the highest potential for good bicycling conditions to maximize the efficacy of investments
- Guiding the development of new bikeway design tools that enhance user experience and maximize bicycling potential

The area was divided into 14 zones of roughly similar bicycling characteristics with boundaries determined by census tracts, as well as barriers such as highways, major roadways, or hills, shown in Map 11.



Map 11. Cycle Zones Analysis Cycling Zones

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: June 2010

0 2 4 Miles

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The goal of the CZA is to evaluate the bicycling experience throughout the city; areas such as the low density Meade County portion of the Rapid City Area and the connected street grid of downtown Rapid City have significantly different challenges and opportunities. This analysis projects which areas have the greatest potential for bicycling through an evaluation of connectivity, trip attractors, and trip detractors. Each metric incorporated the following data:

- Connectivity: roadway network density, bicycle network density
- Attractors – park density, population density
- Detractors - roadway slopes over five percent, density of barriers (streets over 40 mph, railroads, density of reported crashes)

The Bicycle and Pedestrian Master Plan will use this information to target investment recommendations to locations that are likely to result in the highest increase in walking and bicycling.

Data Gathering and Synthesis

The analysis was based on existing data from the Rapid City Area Metropolitan Planning Organization (MPO), with supplementary data from the 2000 Census and U.S. Department of Agriculture Natural Resources Data.

The reasoning for each measure's inclusion in the CZA is discussed in more detail below. In many cases, the selected measures were translated into density units (e.g. square acres or linear feet) to account for size variations between zones.

Each of these factors was normalized to result in a score of 0-1. The score was then multiplied by the weight to give a number that is a percentage of the weighting factor. This scoring system can be modified to include other factors and calibrated and weighted based on the purpose of the specific model run. For example, the preliminary analysis weighted measures of connectivity as totaling half of the final score, while attractors and detractors each contributed a quarter to the final score. This weighting allows the analysis to highlight the importance of bicycle facilities to overcome barriers in each zone.

The following section discusses each of the factors used in the Rapid City Area Cycle Zone Analysis model, outlining the rationale for their inclusion in the model and a basic methodology for how they were calculated.

Connectivity

Connectivity measures the roadway network as well as the existing bicycle network. In a well-connected street grid, traffic is dispersed over many roadways, and bicyclists can choose routes with low motor vehicle traffic to

travel to their destinations. Where many bicycle routes are provided, bicyclists can easily access all destinations in an area, and a variety of bicycle routes serves different user groups (e.g. off-street trails may be preferred by families and recreational riders, while cyclists commuting to work prefer direct on-street routes provided by bike lanes).

Table 29 shows the footage of roadway and bikeway networks in each cycle zone, as well as the calculation of density used in the model.

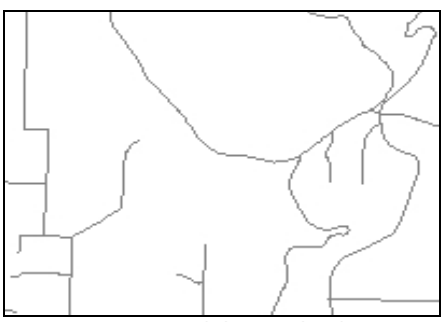
Table 29. Connectivity Cycle Zone Factors

Cycle Zone	Area (acres)	Roadway Network (ft)	Road Network Density (ft/acre)	Existing Bikeways (ft)	Bicycle Network Density (ft/acre)
1	12,706	286,968	23	0	0.00
2	18,618	362,683	19	211	0.00
3	16,441	609,312	37	14,362	0.02
4	19,806	747,859	38	9,926	0.01
5	45,158	347,213	8	0	0.00
6	2,140	250,694	117	36,485	0.15
7	3,128	222,394	71	30,043	0.14
8	12,356	361,574	29	7,445	0.02
9	1,692	234,854	139	5,755	0.02
10	1,740	202,224	116	23,179	0.11
11	1,124	171,547	153	25,661	0.15
12	1,187	114,470	96	2,904	0.03
13	972	121,546	125	0	0.00
14	21,163	502,762	24	7,762	0.02

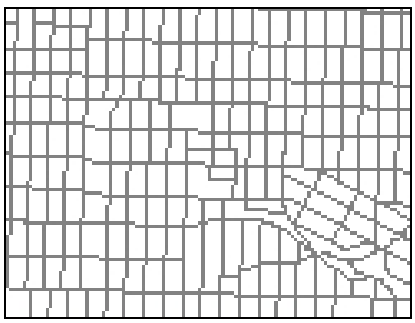
Total Road Network Density:

Definition: The density in linear feet per square acre of all roads in the bicycling zone. This includes roads of all types, including local streets, arterials, highways and freeways.

Example:



A sparse network limits rider choice



A dense network facilitates rider choice

Reasoning**:** A zone with a greater density of roads will facilitate a better bicycling experience. Riders will be able to go more places and have greater route choice.

Basic Methodology: GIS tools were used to determine the overall length of roads falling within each cycle zone. This was divided by the zone's acreage to obtain an average road network density.

Bike Network Density

Definition: The proportion of all roadways in the zone that provide bicycle accommodation.

Reasoning**:** The presence of facilities designed for cyclists increases their comfort and safety. A greater presence of cycle facilities will improve the bicycling experience.

Basic Methodology: The bicycle network layer was intersected with the cycle zone boundary, and then the lengths of each segment or partial segment that fell within a specific zone were summed. The resulting number was divided by the total length of all roadways in the zone to obtain the density of bikeways.

Attractors

Residents are more likely to use a bicycle to access specific destinations, including parks, tourist/recreational attractions, and schools. In addition, most bicycle trips originate at people's homes, and areas with higher densities are likely to attract more bicycle trips. The 'attractor' model accounts for population density, as determined by the 2008 Rapid City MPO Transportation Analysis Zone (TAZ) estimates, as well as density of parks and density of other destinations, including schools, tourist/recreational attractions, hospitals, civic destinations, and retail centers. Table 30 shows the attractor factors used in this analysis.

Table 30. Attractor Cycle Zone Factors

Cycle Zone	Park Acreage	Park Density	Pop. (HH)	Pop. Density	Employ-ment 2008	Employ-ment Density	Destin-ations (count)	Destin-ation Density
1	0.00	0.00	3,031	0.24	891	39.45	0	0.00
2	41.61	0.00	4,101	0.22	1,533	78.69	1	0.54
3	36.73	0.00	3,490	0.21	11,103	299.59	1	0.61
4	57.39	0.00	5,451	0.28	9,577	253.64	6	3.03
5	0.00	0.00	1,072	0.02	1,752	227.86	0	0.00
6	335.68	0.16	4,464	2.09	5,354	45.71	11	51.40
7	245.68	0.08	2,511	0.80	1,096	15.42	3	9.59
8	64.98	0.01	4,019	0.33	3,412	116.60	5	4.05
9	122.58	0.07	3,835	2.27	2,256	16.25	6	35.46
10	249.45	0.14	3,045	1.75	5,658	48.67	9	51.74
11	183.78	0.16	2,315	2.06	10,863	71.20	12	106.73
12	90.75	0.08	1,385	1.17	1,150	11.93	3	25.27
13	17.32	0.02	1,703	1.75	3,011	24.07	4	41.17
14	35.45	0.00	2,867	0.14	1,025	43.14	0	0.00

Park Acreage

Definition: The density of parks and greenways in each zone.

Reasoning**:** Parks are an important destination for bicyclists. Larger parks such as Sioux Park and Jackson Park attract bicyclists from throughout the region.

Basic Methodology: The parks GIS layer was intersected with the cycle zone boundaries, then the total area of segments within a each zone were summed.

Population Density

Definition:: The number of households estimated in each zone divided by total acreage.

Reasoning: Larger numbers of residents in a zone represent more people who are potential bicyclists.

Calculation: The population of each zone was determined from 2008 Rapid City Area MPO Transportation Analysis Zones (TAZs), and divided by the zonal acreage to determine density.

Employment Density

Definition: The total retail, service, base, and public employment of each zone divided by total acreage.

Reasoning: Employment numbers represent likely numbers of trips; each employed person is likely to take two trips each day.

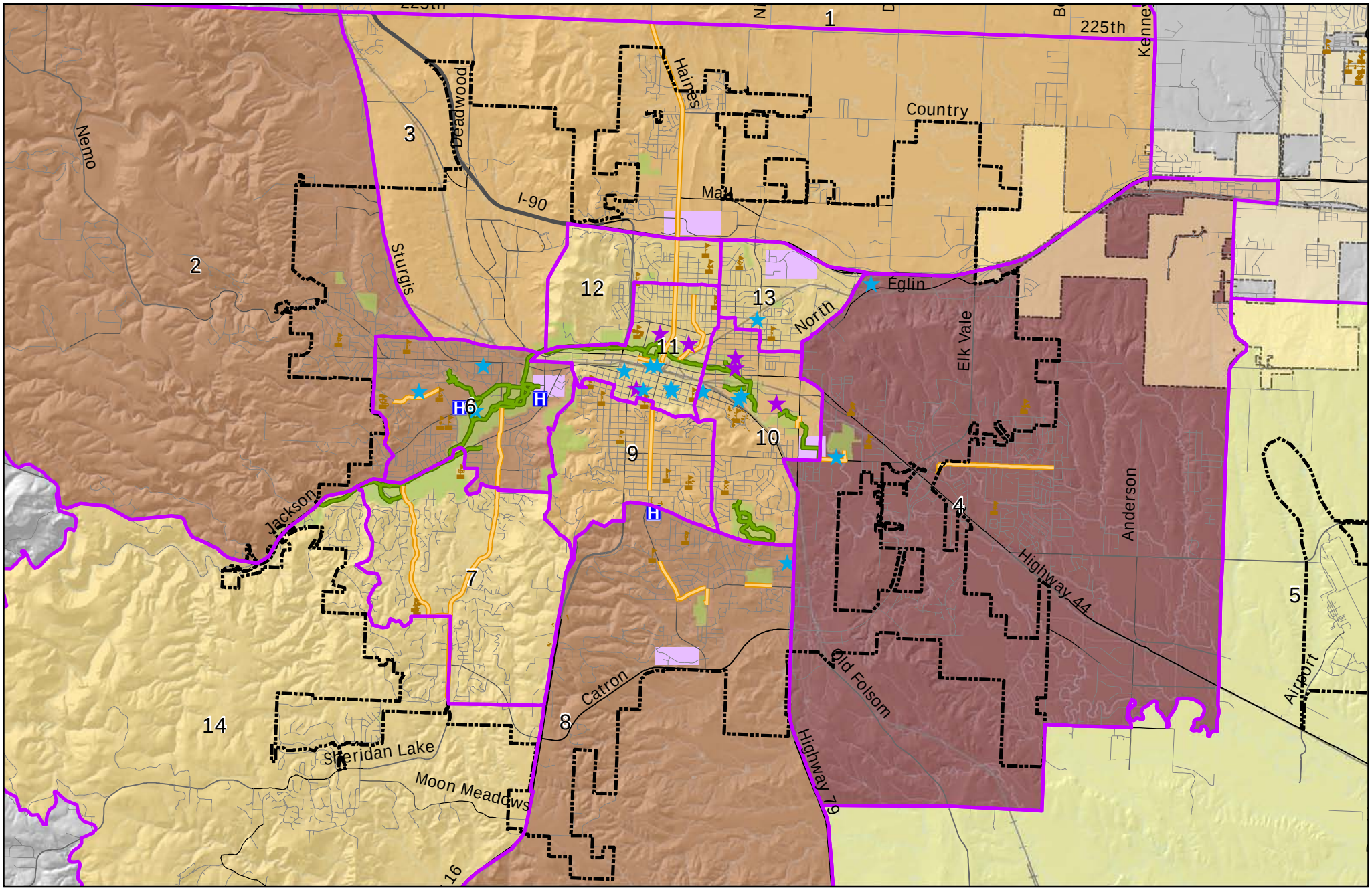
Calculation: The employment of each zone was determined from 2008 Rapid City Area MPO Transportation Analysis Zones (TAZs), and divided by the zonal acreage to determine density.

Destination Density

Definition: The density of hospitals, civic destinations, recreational/tourist destinations, schools, and retail centers in each zone.

Reasoning: Popular destinations attract bicycle trips. The Bicycle and Pedestrian Master Plan will focus on providing good access to these destinations, as well as encouraging residents and visitors to make these trips via bicycle.

Calculation: The Rapid City Area MPO provided a 'public buildings' shapefile, which included the relevant information. Other buildings which are not key bicycle destinations, such as volunteer fire departments and the water treatment plant, for example, were excluded from this analysis. In addition, MPO staff indicated key retail centers to be included in this analysis.



Map 12. Cycle Zones Analysis - Bicycle Trip Attractors

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: June 2010

0 1 2 Miles

- Cycle Zones
- Bike Path
- Side Path

- < 1,000 households (HH)
- 1,000 - 3,000 HH
- 3,001 - 4,000 HH
- 4,001 - 5,000 HH
- 5,001+ HH

- Hospital
- Civic Destination
- Recreational Destination
- School

- Parks
- Railroads
- Retail

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Detractors

Factors that detract from bicycle trips include steep slopes, major roadways that present uncomfortable bicycling conditions, railroads that are difficult to cross, and areas with a history of crashes involving bicyclists and pedestrians. Major roadways and railroads were combined into one factor, called 'Barriers.' Table 31 shows the outputs of the detractor analysis.

Table 31. Detractor Cycle Zone Factors

Cycle Zone	Slope (% streets over 5%)	Barriers	Barrier Density	Crashes Involving Bicyclists or Pedestrians (count)
1	6.1%	1.96	0.02	0
2	26.4%	7.11	0.04	4
3	5.7%	33.38	0.20	15
4	3.1%	38.99	0.20	1
5	4.2%	36.03	0.08	2
6	13.2%	1.86	0.09	29
7	40.6%	0.51	0.02	4
8	15.2%	23.06	0.19	4
9	11.0%	0.00	0.00	21
10	3.8%	5.90	0.34	38
11	0.7%	4.57	0.41	96
12	2.4%	3.84	0.32	16
13	6.4%	3.61	0.37	26
14	33.6%	20.83	0.10	1

Slope

Definition: The percent of roadways in each zone with an average slope over five percent.

Example:

Steep hills can be significant barriers for some cyclists

Flat terrain reduces barriers to bicycling.

Reasoning: Topography can decrease the ease of bicycling. A great cycle zone will be relatively flat. Topography is an issue that is difficult or impossible to change and is very important to consider when evaluating the bikability of a zone.

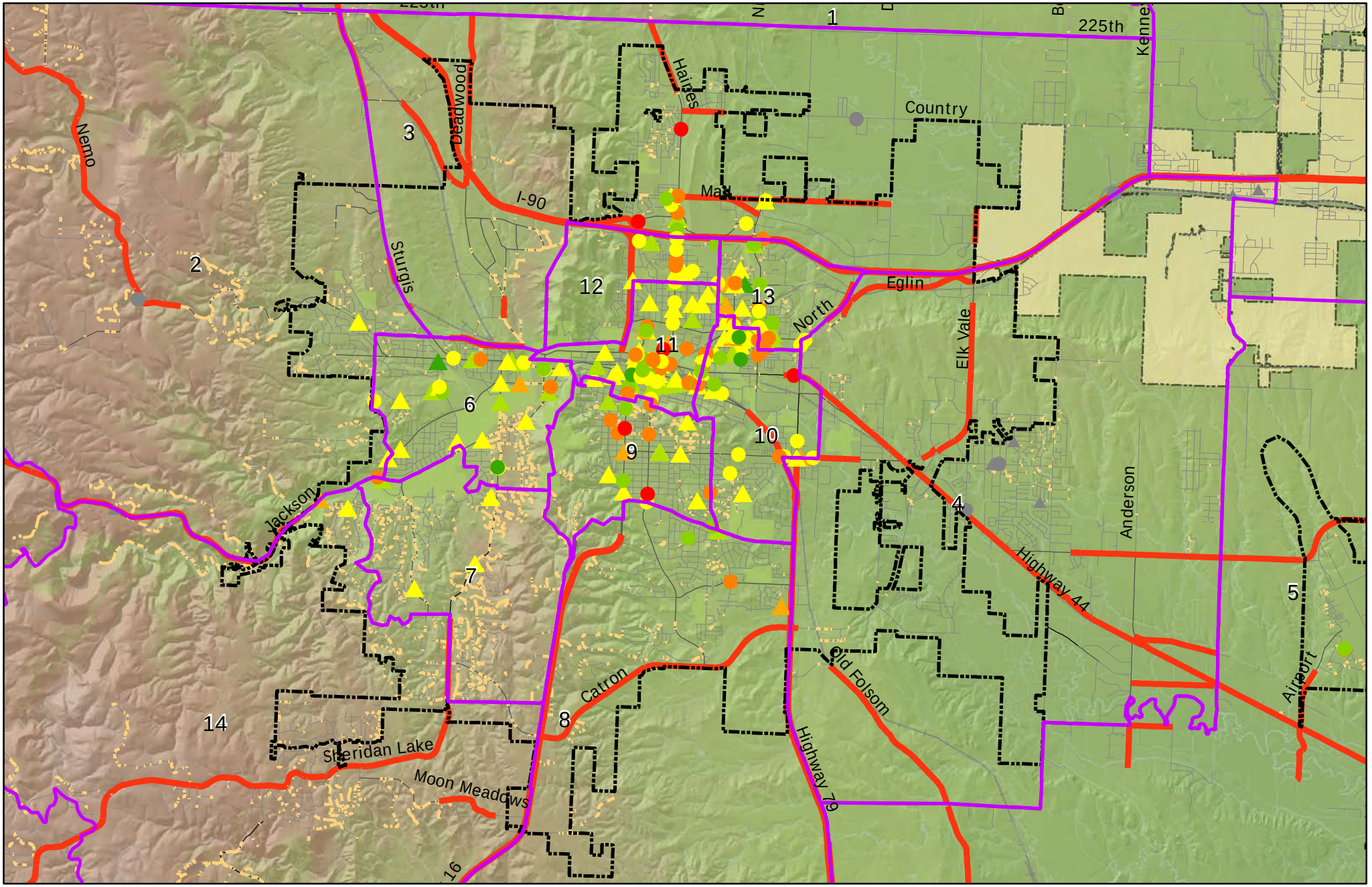
General Methodology**:** USDA Natural Resources elevation data was used to determine the slope at 100 foot intervals throughout the city. Roadways were divided in 100 foot segments and average slope was recorded using GIS. Roadways with average slope over five percent were added together to estimate the footage of roadway with slope over five percent in each zone. This result was then divided by the total roadway footage to arrive at a percent.

Barrier Density

Definition: Barriers that impede bicycling travel include streets over 40 mph and railroads.

Reasoning: Limited crossing opportunities along major roads and railroads force bicyclists to ride along the major roadways with cars and/or force bicyclists to ride significantly out of their way to access a destination.

Calculation: GIS was used to measure the length of streets with over a 40 miles per hour limit and railroads in each zone. This measure was divided by the total acreage of the zone to determine density.



Map 13. Cycle Zones Analysis - Bicycle Trip Detractors

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: June 2010

0 1 2 Miles

Pedestrian
Bicycle
No Injury
Possible Injury
Minor Injury
Major Injury
Fatality
Streets over 40 mph
Streets over 5% Slope

N

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CZA Evaluation

The resulting scores for each factor for each zone were normalized, weighted and incorporated into the model. Each factor has a potential normalized score of one, with the eight factors adding to a maximum of eight points. The preliminary weighting was then applied, as shown in Table 32.

Table 32. Cycle Zone Weighting

Factor	Weight
Road Network Density	25
Bicycle Network Density	25
Park Density	8
Population Density	9
Destination Density	8
Slope	6
Barrier Density	12
Nonmotorized Crash Density	7
Total	100

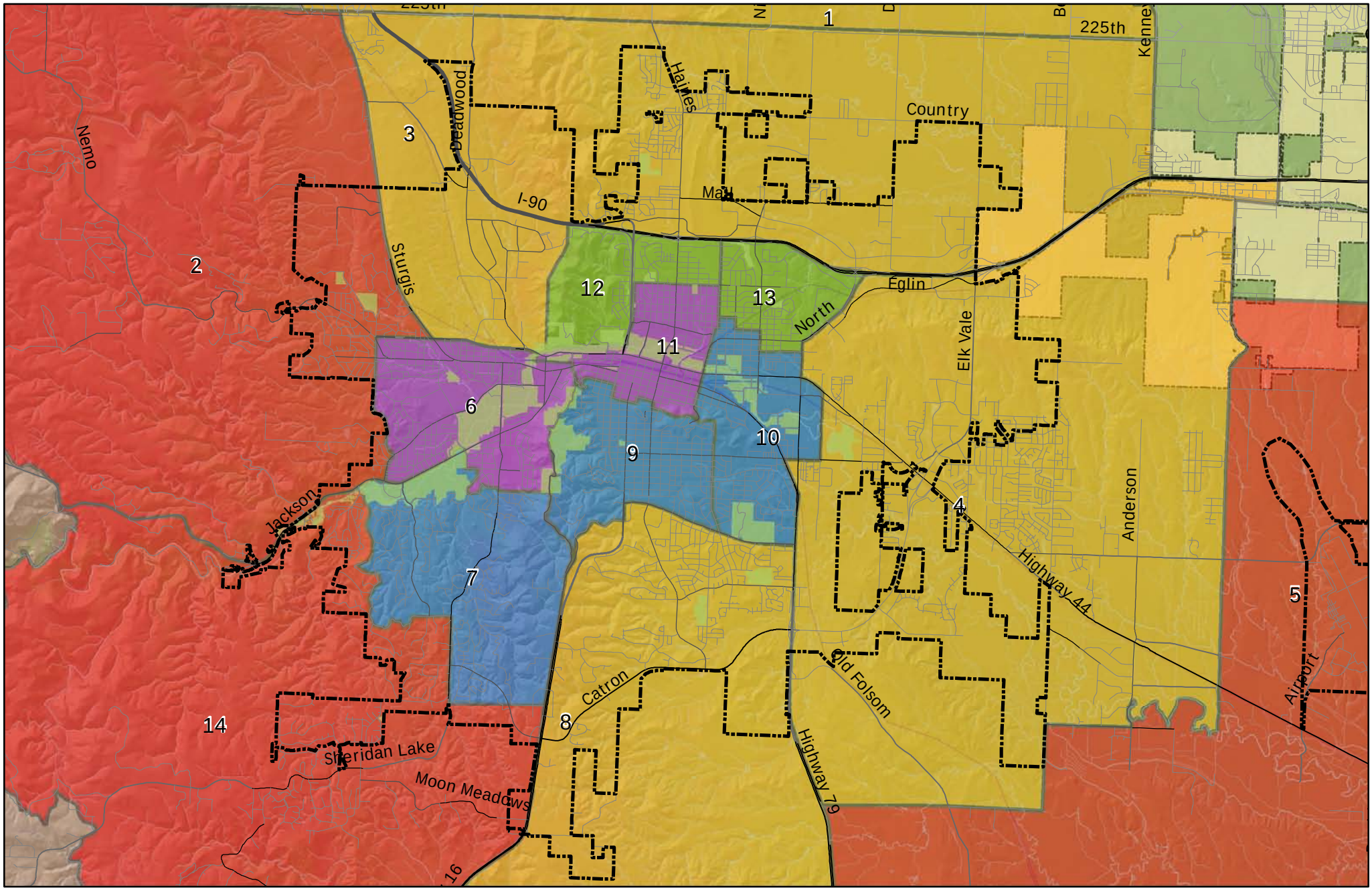
A score of 100 therefore represents a 'perfect' cycle zone. The influence of each variable can be weighted by changing the percentage that a variable contributes to the final score. For example, slope can account for five percent or 50 percent of a zone score depending on the need to emphasize or de-emphasize a factor.

Using CZA to Identify Bicycling Potential

This tool can be used to highlight zones with issues such as topography and lack of road network connectivity that preclude an easy solution through planning. Road network density, roadway connectivity, slope and destinations are all baseline factors that define the bicycling potential in a given area. The development of the bicycle network will improve a zone from the baseline.

Goal Setting with CZA

This tool can also be used for goal setting by setting a target that all zones must rate a score of five or higher by 2020, for example. The CZA can be calibrated to highlight areas where additional bicycling facilities will increase the rating from good to great, or poor to good. This could be accomplished by heavily weighting the scores associated with bike infrastructure density while keeping the other factors equal.



Map 14. Cycle Zones Analysis Results

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: June 2010

0 1 2 Miles

Lowest Score

Highest Score

N

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Appendix D. Predicting Walking and Bicycling Demand

Demand models are often used to quantify usage of existing pedestrian and bicycle facilities, and to estimate the potential usage of new facilities. As with all models, the results show a range of accuracy that vary based on a number of assumptions and available data. The models used for this study incorporated information from existing publications as well as data from the U.S. Census American Community Survey (ACS) 2006-2008 estimates for the Rapid City Metro Area. All data assumptions and sources are noted in the tables following each section of the analysis.

Existing Pedestrian and Bicycle Demand

The Rapid City Area pedestrian and bicycle demand models consist of several variables, including commuting patterns of working adults and predicted travel behaviors of area college students and school children. The year 2008 was used as the baseline for the demand analysis, as it is the most recent year for which data is available.

For this analysis, population data for the existing labor force (including the number of workers and percentage of pedestrian and bicycle commuters) were obtained from the 2006-2008 ACS estimate for the Rapid City Metropolitan Area. In addition to people commuting to the workplace via walking or by bicycle, the model also incorporates a portion of the labor force working from home. Specifically, it was assumed that about 25 percent of those working from home would make at least one walking trip, and another ten percent would make at least one bicycling trip during the workday.

The 2008 ACS was also used to estimate the number of children in the Rapid City Area. This figure was combined with data from National Safe Routes to School surveys, which found that approximately 11 percent of school children walk to and from school every day. College students constitute a third variable in the model due to the presence of the South Dakota School of Mines and Technology. Rapid City is also home to a National American University Campus, Western Dakota Technical Institute, and Oglala Lakota College's He Sapa College Center. However, the latter schools are not residential and are likely to have similar mode split to other local employment, rather than that of traditional college students. Data from the Federal Highway Administration regarding walking and bicycling mode share in university communities was used to estimate that 60 percent of students commuting to college walk to school. The 2001 National Household Transportation Survey found that commute trips

(including work and school trips) comprise only approximately a third of total trips; trips for shopping, recreation and socializing are a significantly greater proportion of total trips. Table 33 shows results of the pedestrian demand model and identifies the variables and assumptions used in the model.

Many of the same assumptions from the pedestrian model were used to develop the bicycling model. The National Safe Routes to School surveys found that approximately two percent of school children bike to school. For college students, the Federal Highway Administration found that bicycling mode share in university communities is ten percent of students. Again, the large proportion of trips that are non-commute requires a multiplier to estimate the number of total bicycle trips in the Rapid City Area. Table 34 summarizes results and assumptions of the bicycle demand model and the estimated existing daily bicycle trips in the area.

Table 33. Existing Pedestrian Demand Model Results

Variable	Value	Source
Study area population	120,858	ACS 2006-2008 estimate for the Rapid City Metropolitan Area
Employed population	61,757	ACS Population of workers over 16
Walk-to-work mode share	2.0%	ACS Means of transportation to work for workers over 16
Number of walk-to-work commuters	1,239	(employed persons) * (walking mode share)
Work-at-home mode share	4.8%	ACS Means of transportation to work for workers over 16
Number of work-at-home walk commuters	739	Assumes 25% of population working at home makes at least one daily walking trip
Transit-to-work mode share	0.7%	ACS Means of transportation to work for workers over 16
Transit pedestrian commuters	392	Assumes 85% of transit riders access transit by foot
School children, ages 6-14	19,726	ACS 2006-2008 School enrollment by level of school
School children walking mode share	11.0%	National Safe Routes to School surveys, 2003
School children walk commuters	2,170	(school children pop.) * (walking mode share)
Number of college students	7,161	ACS 2007 School enrollment by level of school
Estimated college walking mode share	60.0%	*National Bicycling & Walking Study*, FHWA, Case Study 1, 1995
College walking commuters	4,297	(college student pop.) * (walking mode share)
Total number of walk commuters	8,837	(bike-to-work trips) + (school trips) + (college trips) + (utilitarian trips)
School and commute walking trips subtotal	17,673	Total walk commuters x 2 (for round trips)
Other utilitarian and discretionary trips:		
Ratio of "other" trips to commute trips	2.73	*National Household Transportation Survey*, 2001
Estimated non-commute trips	48,248	
Current Estimated Daily Pedestrian Trips:	**65,921**	

Table 34. Existing Bicycle Demand Model Results

Variable	Value	Source
Study area population	120,858	ACS 2006-2008 estimate for the Rapid City Metropolitan Area
Employed population	61,757	ACS Population of workers over 16
Bike-to-work mode share	0.1%	ACS Means of transportation to work for workers over 16
Number of bike-to-work commuters	62	(employed persons) * (bicycling mode share)
Work-at-home mode share	4.8%	ACS Means of transportation to work for workers over 16
Number of work-at-home bike commuters	296	Assumes 10% of population working at home makes at least one daily bicycle trip
Transit-to-work mode share	0.7%	ACS Means of transportation to work for workers over 16
Transit bicycle commuters	115	Assumes 25% of transit riders access transit by bicycle
School children, ages 6-14	19,726	ACS 2007 School enrollment by level of school
School children bicycling mode share	2.0%	National Safe Routes to School surveys, 2003
School children bike commuters	395	(school children pop.) * (bicycling mode share)
Number of college students	7,161	ACS 2007 School enrollment by level of school
Estimated college bicycling mode share	5.0%	National Bicycling & Walking Study, FHWA, 1995
College bicycling commuters	358	(college student pop.) * (bicycling mode share)
Total number of bike commuters	1,110	(bike-to-work trips) + (school trips) + (college trips) + (utilitarian trips)
School and commute bicycling trips subtotal	2,221	Total bicycle commuters x 2 (for round trips)
Other utilitarian and discretionary trips:		
Ratio of "other" trips to commute trips	2.73	National Household Transportation Survey, 2001
Estimated non-commute trips	6,062	
Current Estimated Bicycle Trips:	**6,062**	

The tables indicate that approximately 65,600 walking trips occur in the Rapid City Area each day, along with more than 6,000 bicycle trips. The largest group of pedestrians are school students (around 2,000), and the largest trip purpose is for non-commute trips (approximately 48,000). Most bicycle commuting trips are made by school students (almost 400). The model also shows that non-commuting trips comprise the vast majority of existing bicycle demand. These numbers are applicable to weekdays only, and are averaged over the course of the year.

Current Air Quality Benefits

The expected number of walking and biking trips in the Rapid City Area can be directly translated into reduced vehicle trips, as the current rates of walking and bicycling represent both residents and visitors using alternatives to driving. This number can be used to determine approximate reduction in vehicle miles traveled (VMT), which has the direct effect of reducing vehicular emissions.

The number of reduced vehicle trips, VMT and the ensuing vehicle emissions reduction was estimated from the results of the demand models described above. It was assumed that about 73 percent of pedestrian and bicycle trips would directly replace vehicle trips for adults and college students. For school children, the reduction was assumed to be 53 percent. The analysis estimated that the average pedestrian trip is roughly 1.2 miles in length for adults, whereas for children the distance is one-half mile. A bicycle roundtrip distance of eight miles was used for adults and college students, and one mile for school children. These distance assumptions have been used in various non-motorized benefits models throughout the United States. The vehicle emissions reduction estimates also incorporated calculations commonly used in other models.

From this estimate of the current levels of bicycling and walking in the Rapid City Area, it is possible to estimate that bicycling and walking currently remove approximately 6,000 vehicle trips per weekday, translating to a yearly reduction of about 1,600,000 vehicle trips. Table 35 through Table 38 illustrates the results of the vehicle trips, miles reduction and air quality benefits for pedestrian and bicycle trips, respectively.

Table 35. Vehicle Trips/VMT Reduction for Pedestrian Trips

Variable	Value	Source
Reduced Vehicle Trips per Weekday	6,017	Assumes 73% of walking trips replace vehicle trips for adults/college students and 53% for school children
Reduced Vehicle Trips per Year	1,570,363	Reduced number of weekday vehicle trips multiplied by 261 (weekdays in a year)
Reduced Vehicle Miles per Weekday	6,415	Assumes average round trip travel length of 1.2 miles for adults/college students and 0.5 mile for schoolchildren
Reduced Vehicle Miles per Year	1,674,326	Reduced number of weekday vehicle miles multiplied by 261 (weekdays in a year)

Table 36. Air Quality Benefits from Pedestrian Trips[*]

Variable	Value	Source
Reduced Particulate matter (PM10; tons/weekday)	118	Daily mileage reduction multiplied by 0.0184 tons
Reduced Nitrogen Oxide (NOX; tons/weekday)	3,200	Daily mileage reduction multiplied by 0.4988 tons
Reduced Reactive Organic Gas (ROG; tons/weekday)	466	Daily mileage reduction multiplied by 0.0726 tons
Reduced Carbon Dioxide (CO2; lb/weekday)	5,876	Daily mileage reduction multiplied by 0.916 lb
Reduced PM10 (tons/year)	30,808	Yearly mileage reduction multiplied by 0.0184 tons
Reduced NOX (tons/year)	835,154	Yearly mileage reduction multiplied by 0.4988 tons
Reduced ROG (tons/year)	121,556	Yearly mileage reduction multiplied by 0.0726 tons
Reduced CO2 (lb/year)	1,533,683	Daily mileage reduction multiplied by 0.916 lb

[*] *Source: NHTSA Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks, Table VIII-5*

Table 37. Vehicle Trips/VMT Reduction for Bicycle Trips

Variable	Value	Source
Reduced Vehicle Trips per Weekday	816	Assumes 73% of bicycle trips replace vehicle trips for adults/college students and 53% for school children
Reduced Vehicle Trips per Year	212,904	Reduced number of weekday vehicle trips multiplied by 261 (weekdays in a year)
Reduced Vehicle Miles per Weekday	5,062	Assumes average round trip travel length of 8 miles for adults/college students and 1 mile for schoolchildren
Reduced Vehicle Miles per Year	1,321,217	Reduced number of weekday vehicle miles multiplied by 261 (weekdays in a year)

Table 38. Air Quality Benefits from Bicycle Trips[*]

Variable	Value	Source
Reduced Particulate matter (PM10; tons/weekday)	93	Daily mileage reduction multiplied by 0.0184 tons
Reduced Nitrogen Oxide (NOX; tons/weekday)	2,525	Daily mileage reduction multiplied by 0.4988 tons
Reduced Reactive Organic Gas (ROG; tons/weekday)	368	Daily mileage reduction multiplied by 0.0726 tons
Reduced Carbon Dioxide (CO2; lb/weekday)	4,637	Daily mileage reduction multiplied by 0.916 lb
Reduced PM10 (tons/year)	24,310	Yearly mileage reduction multiplied by 0.0184 tons
Reduced NOX (tons/year)	659,023	Yearly mileage reduction multiplied by 0.4988 tons
Reduced ROG (tons/year)	95,920	Yearly mileage reduction multiplied by 0.0726 tons
Reduced CO2 (lb/year)	1,210,262	Daily mileage reduction multiplied by 0.916 lb

[*] *Source: NHTSA Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks, Table VIII-5*

Potential Future Walking and Bicycling Trips

Estimating future benefits requires additional assumptions regarding the Rapid City Area's future population and anticipated commuting patterns in 2035. The variables used as model inputs generally resemble the variables used in the demand model discussed earlier and represent a realistic, achievable goal of what the daily number of pedestrian and bicycle trips could be with a more complete pedestrian and bikeway system. Future population predictions determined by the Rapid City MPO were used in this model.

According to models developed for the *RapidTrip 2035* Long Range Transportation Plan, the area will be home to 58,371 households in 2035. The 2006-2008 ACS household distribution was used to estimate the total population in 2035.[13] *RapidTrip 2035* also predicts that employment will increase to 103,865 employed workers in the area. The distribution of the population who are school children or college students was assumed to

[13] The 2006-2008 ACS estimates found that approximately 27% of the households in the Rapid City Metropolitan Area are single-person households, 40% were two-person, 14% had three people, and 20% had four or more people. This distribution was applied to the 2035 household estimate to determine the population in 2035. For this analysis, it was approximated that households with four or more people have an average of five people.

remain the same. The estimated proportion of residents working from home was also not changed.

Regarding commuting patterns, walking and bicycling mode share was increased to address the higher use potentially generated by the addition of new facilities and enhancements to the existing system. Table 39 summarizes data on potential future pedestrian demand in the year 2035, while Table 40 illustrates the results of the demand model predicting 2035 demand for bicycle trips. Both of these analyses assume a more complete pedestrian and bicycle transportation network and concurrent program development to encourage use.

Table 39. Future Pedestrian Demand Model Results

Variable	Value	Source
Future study area population	143,861	*Rapid City Area 2035 Long Range Transportation Plan.*
Future employed population	103,865	*Rapid City Area 2035 Long Range Transportation Plan.*
Future walk-to-work mode share	4.8%	Based on increase from previous mode split due to improvements in the pedestrian network
Future number of walk-to-work commuters	4,973	(employed persons) * (walking mode share)
Future work-at-home mode share	4.8%	Same as 2006-2008 ACS mode split
Future number of work-at-home walk commuters	2,487	Assumes 50% of population working at home makes at least one daily walking trip.
Future transit-to-work mode share	1.0%	Based on increase from previous mode split due to improvements in the pedestrian network
Future transit pedestrian commuters	883	Assumes 85% of transit riders access transit by foot.
Future school children, ages 6-14 (grades K-8)	23,480	Same as 2006-2008 ACS mode split
Future school children walking mode share	29.0%	Portland Safer Routes to School Survey, 2007
Future school children walk commuters	6,809	(school children pop.)* (walking mode share)
Future number of college students in study area	8,524	Same as 2006-2008 ACS population proportion
Future estimated college walking mode share	60.0%	*National Bicycling & Walking Study*, FHWA, 1995.
Future college walking commuters	5,114	(college student pop.) * (walking mode share)
Future total number of walk commuters	20,266	(walk-to-work trips) + (school trips) + (college trips) + (utilitarian trips)
Future total daily walking trips	40,533	Total walk commuters x 2 (for round trips)
Other utilitarian and discretionary trips:		
Ratio of "other" trips to commute trips	2.73	*National Household Transportation Survey*, 2001
Estimated non-commute trips	110,654	
Future Daily Pedestrian Trips:	**151,187**	

Table 40. Future Bicycle Demand Model Results

Variable	Value	Source
Future study area population	143,861	*Rapid City Area 2035 Long Range Transportation Plan*
Future employed population	103,865	*Rapid City Area 2035 Long Range Transportation Plan*
Future bike-to-work mode share	2.0%	Based on increase from previous mode split due to improvements to the bicycle network
Future number of bike-to-work commuters	2,084	(employed persons) * (bicycling mode share)
Future work-at-home mode share	4.8%	Same as 2006-2008 ACS mode split
Future number of work-at-home bike commuters	2,487	Assumes 50% of population working at home makes at least one daily bicycling trip.
Future transit-to-work mode share	0.1%	Based on increase from previous mode split due to improvements in the pedestrian network
Future average daily bicycle on bus boardings	26	Assumes 25% of transit riders access transit by bicycle
Future school children, ages 6-14 (grades K-8)	23,480	Same as 2006-2008 ACS population proportion
Future school children bicycling mode share	3.0%	Portland Safer Routes to School Survey, Spring 2007
Future school children bike commuters	704	(school children pop.)* (bicycling mode share)
Future number of college students in study area	8,524	Same as 2006-2008 ACS population proportion
Future estimated college bicycling mode share	8.0%	*National Bicycling & Walking Study*, FHWA, 1995.
Future college bike commuters	682	(college student pop.) * (bicycling mode share)
Future total number of bicycle commuters	5,957	(bike-to-work trips) + (school trips) + (college trips) + (utilitarian trips)
Future total daily bicycling trips	11,913	Total bike commuters x 2 (for round trips)
Other utilitarian and discretionary trips:		
Ratio of "other" trips to commute trips	2.73	National Household Transportation Survey, 2001
Estimated non-commute trips	32,524	
Future Estimated Bicycle Trips:	**44,437**	

Potential Air Quality Improvements

Based on population growth and the expected increase in walking and bicycling, developing the Rapid City bicycle and pedestrian network will replace more than 17,000 weekday vehicle trips, eliminating more than 12 million vehicle miles traveled per year, shown in Table 41 through Table 44. Walking and bicycling throughout the region prevents significant quantities of vehicle emissions from entering the ambient air. Pedestrian and bikeway network enhancements are expected to generate more walking and bicycling trips in the future. This growth is expected to improve air quality by further reducing the number of vehicle trips, vehicle miles traveled, and associated vehicle emissions.

Table 41. Vehicle Trips/VMT Reduction for Pedestrian Trips

Variable	Value	Source
Reduced Vehicle Trips per Weekday	13,433	Assumes 73% of walking trips replace vehicle trips for adults/college students and 53% for school children
Reduced Vehicle Trips per Year	3,505,899	Reduced number of weekday vehicle trips multiplied by 261 (weekdays in a year)
Reduced Vehicle Miles per Weekday	16,540	Assumes average round trip travel length of 1.2 miles for adults/college students and 0.5 mile for schoolchildren
Reduced Vehicle Miles per Year	4,316,912	Reduced number of weekday vehicle miles multiplied by 261 (weekdays in a year)

Table 42. Air Quality Benefits from Pedestrian Trips[*]

Variable	Value	Source
Reduced Particulate matter (PM10; tons/weekday)	304	Daily mileage reduction multiplied by 0.0184 tons
Reduced Nitrogen Oxide (NOX); tons/weekday)	8,250	Daily mileage reduction multiplied by 0.4988 tons
Reduced Reactive Organic Gas (ROG; tons/weekday)	1,201	Daily mileage reduction multiplied by 0.0726 tons
Reduced Carbon Dioxide (CO2; lb/weekday)	3,211,476	Daily mileage reduction multiplied by 0.916 lb
Reduced PM10 (tons/year)	79,431	Yearly mileage reduction multiplied by 0.0184 tons
Reduced NOX (tons/year)	2,153,276	Yearly mileage reduction multiplied by 0.4988 tons
Reduced ROG (tons/year)	313,408	Yearly mileage reduction multiplied by 0.0726 tons
Reduced CO2 (lb/year)	3,954,381	Daily mileage reduction multiplied by 0.916 lb

[**] *Source: NHTSA Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks, Table VIII-5*

Table 43. Vehicle Trips/VMT Reduction for Bicycle Trips

Variable	Value	Source
Reduced Vehicle Trips per Weekday	4,227	Assumes 73% of bicycle trips replace vehicle trips for adults/college students and 53% for school children
Reduced Vehicle Trips per Year	1,103,129	Reduced number of weekday vehicle trips multiplied by 261 (weekdays in a year)
Reduced Vehicle Miles per Weekday	31,199	Assumes average round trip travel length of 8 miles for adults/college students and 1 mile for schoolchildren
Reduced Vehicle Miles per Year	8,142,942	Reduced number of weekday vehicle miles multiplied by 261 (weekdays in a year)

Table 44. Air Quality Benefits from Bicycle Trips[*]

Variable	Value	Source
Reduced PM10 (tons/weekday)	574	Daily mileage reduction multiplied by 0.0184 tons
Reduced NOX (tons/weekday)	15,562	Daily mileage reduction multiplied by 0.4988 tons
Reduced ROG (tons/weekday)	2,265	Daily mileage reduction multiplied by 0.0726 tons
Reduced CO2 (lb/weekday)	28,579	Daily mileage reduction multiplied by 0.916 lb
Reduced PM10 (tons/year)	149,830	Yearly mileage reduction multiplied by 0.0184 tons
Reduced NOX (tons/year)	4,061,699	Yearly mileage reduction multiplied by 0.4988 tons
Reduced ROG (tons/year)	591,178	Yearly mileage reduction multiplied by 0.0726 tons
Reduced CO2 (lb/year)	7,459,103	Daily mileage reduction multiplied by 0.916 lb

[*] *Source: NHTSA Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks, Table VIII-5*

Appendix E. Safety Needs Analysis

Local crash data is a valuable source of information for identifying difficult or dangerous areas for bicyclists. It can also highlight specific interactions between bicyclists and motorists that require increased awareness or engineering. This section provides an overview of bicycle crash typologies and common unsafe bicyclist behaviors, which can be addressed through engineering and education or awareness programs. The section also presents a summary of crash data involving bicycles and pedestrians provided by Rapid City for 2002-2008. This analysis builds on the *2002-2008 Pedestrian and Bicycle Crash Report* and identifies trends and specific locations to target improvements. The section ends with specific engineering and programmatic improvement recommendations to improve safety for bicyclists and pedestrians in the Rapid City Area.

Interpreting Crash Data

According to national and local surveys, concerns about safety are the most common reasons why people do not bicycle (or do not ride more often).[14] Many bicyclists feel that motorists do not see them or are openly hostile to them on roadways, particularly at intersections. Bicycle crash research supports concerns about bicycle/motorist interactions at intersections: the most commonly reported bicycle/vehicle crashes occur at busy arterial intersections. In addition, many bicyclists involved in crashes are younger people who have less experience riding on the road and/or cyclists who are riding the wrong way on the street or on the sidewalk. Both of these issues indicate the need for increased education for bicyclists and motorists alike.

Safety is also an important consideration for pedestrians. As the most vulnerable roadway users, pedestrians should feel safe walking along or crossing a street. Crash rates affect how safe people feel walking and bicycling in the city.

Certain caveats are necessary when interpreting crash data. First, pedestrian and bicycle crashes are generally considered to be significantly under-reported worldwide, particularly for crashes that do not result in serious injury. A street or intersection that did not experience a crash over the analysis period is not an indication that people are not bicycling or walking there, or that the area does not present hazards to walking or

[14] A 2009 study in Oregon and southwest Washington found that people who feel that bicycling is very safe ride more than twice as often in an average week than those who feel that it is not safe. Source: http://bikeportland.org/wp-content/uploads/2009/10/btasurveyreportfull2.pdf

bicycling. Crash data also do not take into consideration "near misses" which characterize conditions at many high-risk locations without reported incidents. Second, in absence of bicycle, pedestrian and vehicle counts, there is no way to measure "exposure" to crashes. For example, consider two streets that experienced the same number of crashes but different levels of bicycling. The street with significant bicycle traffic is likely to be less dangerous than the street that saw the same number of crashes despite seeing little bicycle traffic (measured by crashes per bicyclist or crashes per miles traveled). Third, coding of crash data may be inaccurate, incomplete, or biased, which would limit the explanatory power of the data.

Crash Typologies

Identifying types of crashes involving bicyclists and pedestrians suggests several design and engineering solutions for reducing crashes. Some crash types can be reduced through good design at specific intersections, while other types indicate the need for greater overall education and visibility of bicyclists on the roadways or in paths. This section addresses crash typologies as defined by the Federal Highway Administration (FHWA). FHWA documented national bicycle and pedestrian injury and crash trends in a 1990 study that created standard typologies for crashes involving bicyclists.[15]

The *2002-2008 Pedestrian/Bicycle Crash Report* categorized crashes based on the Federal Highway Administration's *PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System* (2004) and the National Highway Traffic Safety Administration's (NHTSA) *Pedestrian and Bicycle Crash Analysis Tool* software. Pedestrian crashes were divided into the following typologies:

- Backing Vehicle - The pedestrian was struck by a backing vehicle on a street, in a driveway, on a sidewalk, in a parking lot, or at another location.
- Bus Related - The pedestrian was struck by a vehicle while: (1) crossing in front of a commercial bus stopped at a bus stop; (2) going to or from a school bus stop; or (3) going to or from, or waiting near a commercial bus stop.
- Dart/Dash - The pedestrian walked or ran into the roadway at an intersection or midblock location and was struck by a vehicle. The motorist's view of the pedestrian may have been blocked until an instant before the impact.

[15] *Pedestrian and Bicycle Crash Types of the Early 1990's*, Publication No. FHWA-RD-95-163, W.H. Hunter, J.C. Stutts, W.E. Pein, and C.L. Cox, Federal Highway Administration, Washington, DC, June, 1996.

- Driverless Vehicle – The pedestrian was struck by a driverless vehicle that was left in gear or one that rolled forward or back.
- Multiple Threat/Trapped - The pedestrian entered the roadway in front of stopped or slowed traffic and was struck by a multiple threat vehicle in an adjacent lane after becoming trapped in the middle of the roadway.
- Non-Roadway - The pedestrian was standing or walking near the roadway edge, on the sidewalk, in a driveway or alley, or in a parking lot when struck by a vehicle.
- Other - Pedestrian struck after a vehicle/vehicle collision, pedestrian struck by falling cargo, emergency vehicle striking a pedestrian, pedestrian lying in the road, etc.
- Thru Vehicle No Traffic Control - The pedestrian was struck at an unsignalized intersection or mid-block location. Either the motorist or the pedestrian may have failed to yield.
- Thru Vehicle, Traffic Control - The pedestrian was struck at a signalized intersection or mid-block location by a vehicle that was traveling straight ahead.
- Turning Vehicle - The pedestrian was attempting to cross at an intersection, driveway or alley and was struck by a vehicle that was turning right or left.
- Unique Mid-block – The pedestrian was struck while crossing the road to/from a mailbox, newspaper box, or ice cream truck, or while getting into or out of a stopped vehicle.
- Unknown – The crash report did not provide adequate information to type the crash.
- Walking Along Roadway - The pedestrian was moving along the roadway and was struck from the front or from behind by a vehicle.
- Working/Playing in Road - A vehicle struck a pedestrian who was: (1) standing or walking near a disabled vehicle, (2) riding a play vehicle that was not a bicycle, (3) playing in the road or (4) working in the road.

This analysis will provide additional detail regarding crashes involving bicyclists, which may be less intuitive than crash typologies involving pedestrians.

Nationally, the most common crash types involving bicyclists are:

- Drive out - motorist failure to yield to a bicyclist in the roadway or failure to yield to a bicyclist who is crossing the roadway in a bike path or on a sidewalk.
- Ride out – bicyclist failure to yield to a motor vehicle (ran stop sign or red light, or failed to yield from uncontrolled driveway).

- Riding without required equipment – bicyclist failure to have required front light and rear reflector when riding after dark.

The following text describes these crash types, defines contributing factors, and outlines potential solutions.

Drive Out Crashes

Categories of drive out crashes identified in the 2008 crash report include:

- Turning vehicle - motorist made a right or left turn in front of a bicyclist.
- Thru vehicle, traffic control - bicyclist struck at a signalized intersection or mid-block location by a vehicle that was traveling straight ahead.
- Backing vehicle –bicyclist struck by a backing vehicle on a street, in a driveway, on a sidewalk, in a parking lot, or at another location
- Overtaking vehicle – bicyclist struck by a vehicle that was traveling in the same direction.
- Assault with vehicle –bicyclist intentionally struck by a driver
- Vehicle pull out - bicyclist struck at a location where the vehicle was facing a traffic control device or the vehicle exiting from an alley or driveway.

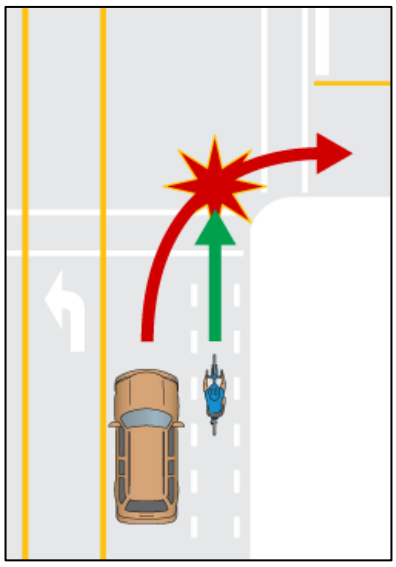


Figure 46. Right hook crash.
Source: Florida Bicycle Association

Drivers may not watch for bicyclists who are riding on the sidewalk or riding the wrong way in the street, and drive out crashes are often associated with these behaviors.

Right hook crashes are the most common type of drive out crash . They occur when a motorist turns right and hits a bicyclist who is continuing straight on the roadway. Right hooks often happen when bicyclists are crossing in a crosswalk, particularly at a side path or shared-use path crossing of a major roadway. Right hooks can occur when the turning motorist is turning right on a red light and the cyclist, who has a green light, is traveling perpendicular across the intersection.

Right hooks are the most frequent crash type for adult bicyclists, and can occur in bike lanes, making them a significant danger even for experienced cyclists in well-engineered locations.

One particular dangerous drive-out type crash, a 'multiple threat' crash occurs when one vehicle stops for a bicyclist in a crosswalk or street crossing, blocking the view from another motorist, who continues through (Figure 47). This crash type only occurs on multilane roads, and tends to occur more frequently on high-speed roadways.

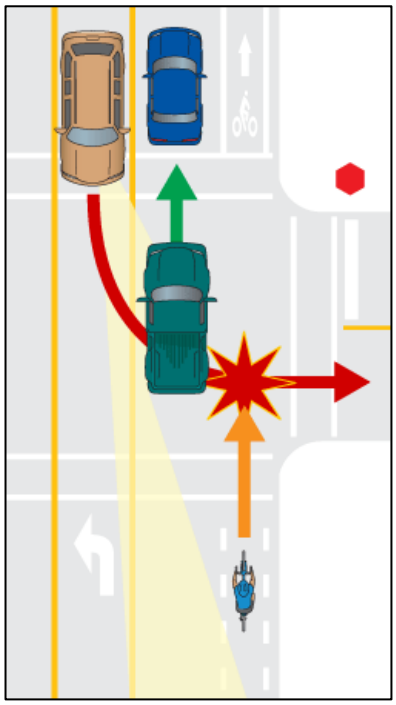


Figure 47. Left-turn multiple threat crash.
Source: Florida Bicycle Association

Mitigation

Drive out crashes indicate the need for additional education, both to increase motorists' awareness of the presence of bicyclists at intersections

and in the roadway, and for cyclists to be aware of safe riding practices. Wrong-way riding and sidewalk riding should be discouraged.

Educational programs and marketing campaigns targeted at drivers can increase awareness about bicyclists. In addition, bicyclists should be taught about how to position themselves for maximum visibility and how to proceed safely. For example, if a motor vehicle passes a bicyclist shortly before the intersection and turns right in front of the bicyclist, the bicyclist should be prepared to make a sharp right turn to avoid colliding with the vehicle. Bicyclists can learn to anticipate this type of driver as well as practicing techniques for avoiding the crash.

An engineering solution to this problem is to mark a difficult crossing with pavement markings. Flashing lights and signage can also help increase visibility at the crossing. In significantly problematic locations, the vehicle right turn signal phase can be separated from the bicycle crossing phase at bike path crossings. Pedestrian refuge islands can help unsignalized intersections, where a bicyclist can cross half the roadway and wait in the center for a gap in traffic on the other direction.

Figure 48. Example high-visibility crosswalk with fresh paint and a warning sign with flashing lights.

Ride Out Crashes

Usually occurring when a bicyclist enters the roadway from a driveway, alley or sidewalk or runs a stop sign/red light and does not yield to an oncoming car; ride out crashes are the most common type of crash for child cyclists. This type of crash is also often caused by lack of visibility, frequently due to parked cars impeding the bicyclists' view of oncoming traffic.

Rapid City's Code of Ordinances provides specific regulations for motor vehicles crossing sidewalks:

> *10.12.300 Crossing sidewalks.*
>
> *A. A vehicle shall not cross a sidewalk except where a driveway is provided, and in crossing a sidewalk to or from an alley, lot, building or street, no vehicle shall be driven at a speed greater than 5 mph.*
>
> *B. Every person driving any vehicle to or from an alley, lot, building or street across any sidewalk shall give warning of his or her approach and shall yield the right-of-way to all pedestrians using the sidewalk and vehicles traveling on the street.(Prior code § 28-88)*

Additional crash types under the ride out crash type include:

- Bicyclist left turn in front of traffic
- Bicyclist lost control
- Bicyclist right turn while facing traffic
- Wrong way cyclist

Mitigation

Many ride out crashes can be attributed to inexperienced bicyclists or riders who do not understand safe ways of riding in the street. Nationally, the majority of ride-out crashes are caused by children or intoxicated bicyclists and are exacerbated by cyclists riding incorrectly or unsafely on a sidewalk or the wrong way on the street. Education for cyclists is important for reducing ride out crashes, as well as ensuring that sufficient treated crossings are provided, to prevent a cyclist from having to dart across the street in order to cross.

One solution for a location that has experienced ride out crashes is to limit parking around the driveway or intersection. Cyclists of all ages should be educated about the dangers of this type of behavior, and that they need to follow the same traffic laws as other drivers.

Riding Without Required Equipment

According to U.S. DOT NHTSA, *Fatal Accident Reporting System* (2002), 43 percent of all bicycle fatalities occur in non-daylight hours, and 17 percent of all car-bike collisions happen at night. The State of South Dakota requires that bicyclists have a light on the front visible to 300 feet and a yellow or red light or reflector on the back, visible for at least 200 feet (32-17-25; Figure 49).

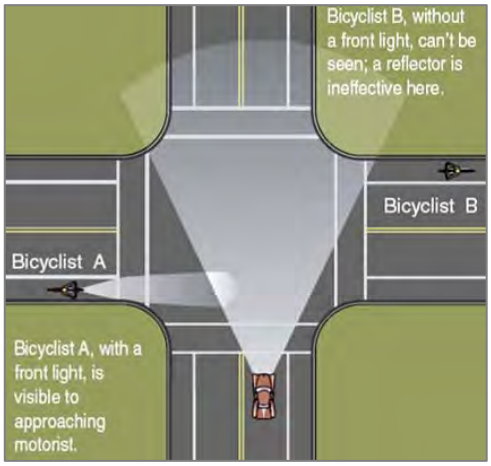


Figure 49. Effectiveness of bike lights.
Source: Oregon Department of Transportation

Mitigation

Media campaigns can raise awareness of the importance of bicyclists having proper lighting at night. "Get Lit" campaigns remind cyclists to use proper lighting. Bike light giveaways can also ensure that cyclists have access to required equipment.

Common Unsafe Bicyclist Behaviors

Several common behaviors are not illegal, but can be very dangerous for bicyclists, and should be discouraged. These include sidewalk riding, wrong-way riding and dangerous lane positioning. The MPO should encourage safe bicycling practices and should avoid policies or treatments that foster unsafe behaviors.

Sidewalk Riding

Though riding on the sidewalk may feel safer than riding with motor vehicle traffic in the street, it is often more dangerous and is illegal in many jurisdictions. In Rapid City, it is illegal to ride on sidewalks in the central business districts. Cyclists riding on the sidewalk in other areas are

required to yield to pedestrians and provide an audible warning when passing. Reasons why sidewalk riding is less safe than street riding include:

- Cyclists riding on sidewalks can be blocked from view by cars parked along the street and landscaping.
- Motorists and pedestrians do not expect to encounter cyclists on sidewalks. The unexpected appearance of a cyclist can surprise all of the involved parties and result in reduced reaction times and increased likelihood of a crash.
- Cyclists riding on the sidewalk encounter more potential conflict points. Generally, these conflict points are driveways and intersections but they can also include areas where street furniture creates pinch points, and areas where people congregate (e.g., bus stops).
- Cyclists riding on the sidewalk often travel two to three times faster than pedestrians (8 to 10 MPH versus 2-3 MPH) and can be difficult for sidewalk and roadway users to see and respond to.

If cyclists choose to ride on the sidewalk, they should ride slowly, with the flow of traffic, and should be aware of drivers entering and exiting driveways and side streets. Children should be closely supervised by adults and encouraged to ride in the street as they get older and their riding skills improve.

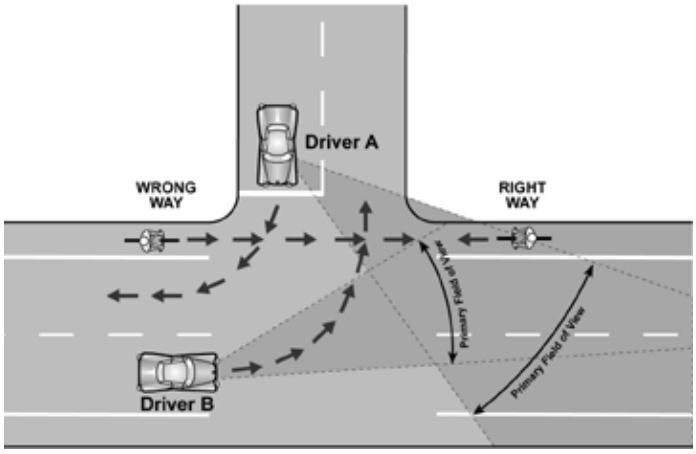


Figure 50. Conflicts caused by wrong-way riding. Source: Oregon DOT Bicyclist's Manual

Wrong-Way Riding

Riding against the flow of traffic is a widespread, yet unsafe, cyclist behavior. Though wrong-way riding accounts for only 2.5 percent of all bicycle crashes, it has been shown to be a contributing factor in several common types of crashes (Figure 50).

Wrong way riding puts the bicyclist in a place where drivers do not expect a vehicle. Wrong-way riders also cannot see traffic signs and signals and risk head-on collisions with lawful cyclists.

People ride facing traffic because it is considered the proper way to walk in the street and is what many bicyclists were told to do, because it is convenient not to have to cross the street, or because bicyclists are afraid of being struck from behind.

Dangerous Lane Positioning

Rapid City requires that cyclists ride within four feet of the right–hand curb, except under certain conditions. The Code of Ordinances states,

> *10.64.170 Any person operating a bicycle upon a roadway at less than the normal speed of traffic at the time and place and under the conditions then existing shall ride in the right 4 feet of roadway near the right-hand curb or edge of the roadway, except under any of the following conditions:*
>
> *When overtaking and passing another bicycle or vehicle proceeding in the same direction;*
>
> *When preparing for a left turn at an intersection or into a private road or driveway; and*
>
> *When reasonably necessary to avoid conditions including, but not limited to fixed or moving objects, parked or moving vehicles, bicycles, pedestrians, animals, surface hazards or substandard width lanes that make it unsafe to continue along the righthand curb or edge. For purposes of this section, a SUBSTANDARD WIDTH LANE is a lane that is too narrow for a bicycle and vehicle to travel safely side by side within the lane.*
>
> *Any person operating a bicycle upon a 1-way street or highway with 2 or more marked traffic lanes may ride as near the left-hand curb or edge of the roadway as practicable. Cyclists should stay in the left 4 feet of roadway whenever possible to avoid interfering with traffic.*

These exceptions recognize that bicyclists should ride on the right-hand side of the lane (or the left-hand side of a one-way street) to allow motorists to pass them, and that riding too far to the right can be dangerous. In addition to the concerns listed above, cyclists should avoid riding in the 'door' zone

Getting "doored" is a frequent cause of bicycle crashes in places with on-street parking (Figure 51). Dooring can result in serious injuries and property damage to both bicycles and automobiles. Bicyclists should always ride at least a door's width away from cars. Some cyclists are afraid to ride further out into the travel lane because they believe that they are required to ride all the way to the right, and because they are intimidated by other traffic, but cyclists are much more likely to be involved in a crash with a car door than with an overtaking car. They are never required to ride further to the right than is safe.

In addition, many cyclists try to pass other traffic on the right, particularly where vehicles are waiting at an intersection. This can be dangerous because most drivers do not expect overtaking vehicles to be to their right and motorists have blind spots immediately to the right of their vehicles.

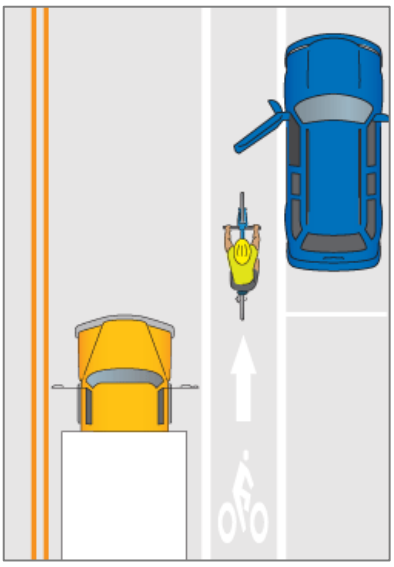


Figure 51. 'Door zone'
Source: Source: Florida Bicycle Association

Rapid City Bicycle and Pedestrian Crash Data

Two data sets were used in this analysis. Data collected for the Rapid City Pedestrian/Bicycle Crash Report (2002-2008) provided valuable background information for this analysis. The 2008 report incorporated police records for the crashes involving bicyclists and pedestrians, and categorized crashes based on crash type, as previously discussed. However, the data set is limited to Rapid City. For crash data outside of the City of Rapid City, the State records from 2004-2008 were used. These records did not collect as much information as the 2008 report; for example, information regarding injury status of the pedestrian or bicyclist is not included. For this reason, as well as the difference in time frame between the data sets, they are discussed separately in the following analysis.

Data were provided by the Traffic Operations Section of the Rapid City Engineering Services Division.

Crash Rate

Between 2002 and 2008, 257 crashes involving bicyclists or pedestrians were reported in Rapid City. Of these, 121 involved bicyclists and 136 involved pedestrians. In addition, State data indicate that seven crashes involving pedestrians and six crashes involving bicyclists occurred in the Rapid City Area but outside of the City of Rapid City from 2004-2008. The city crash data indicate an average of 37 crashes involving bicyclists or pedestrians occurring annually.

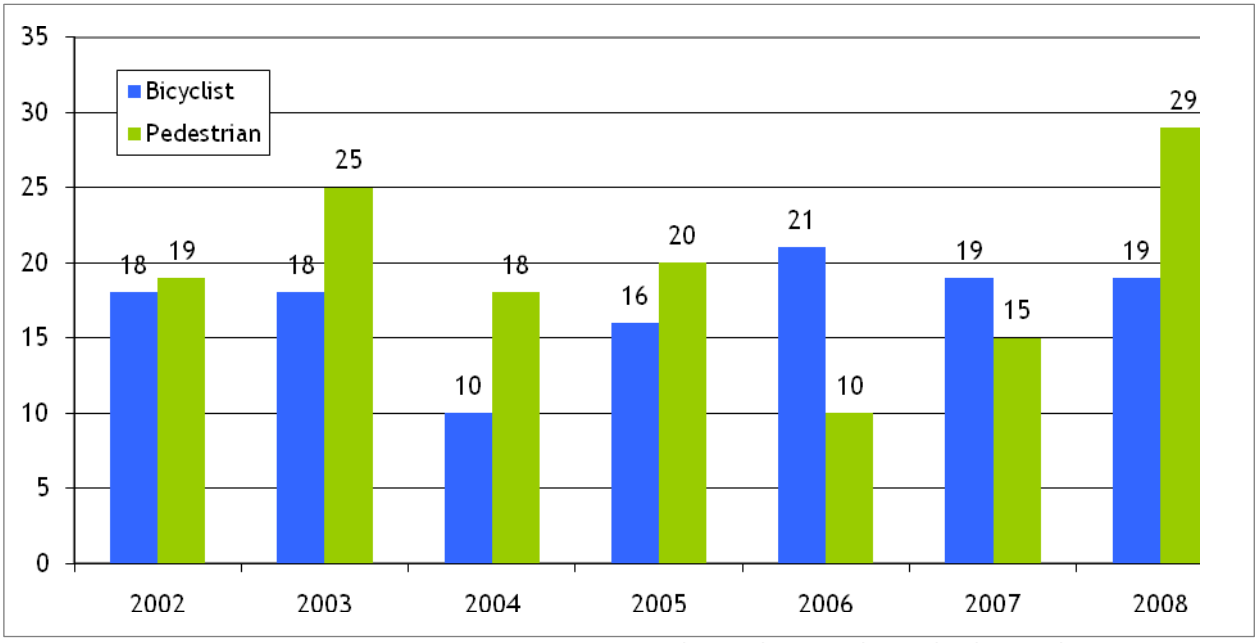


Figure 52. Crashes Involving Bicyclists and Pedestrians by Year, 2002-2008

Monthly crash data shows a relatively even distribution of pedestrian crashes throughout the year. Crashes involving bicyclists were more frequent during the summer months of the seven year period reviewed. This seasonal pattern likely indicates that more residents bicycle in the Rapid City area during summer months. The highest rates of crashes involving bicyclists occur through the summer, with another outlier in October. The majority of the 35 crashes that occurred in October took place in daylight, with clear conditions. However, 24 of those occurred between the hours of 12:00 pm and 7:00 pm, with 14 happening during commute hours (5:00 pm to 7:00 pm). This indicates that there is poor visibility of bicyclists in the afternoon and evening in the fall.

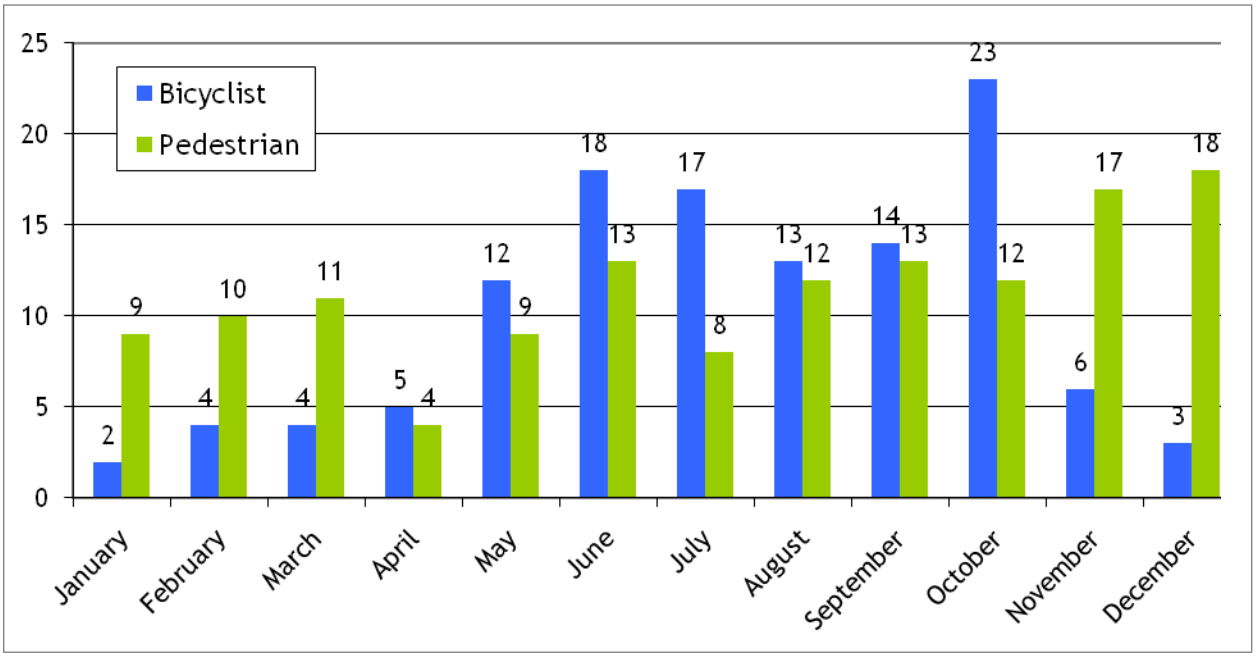


Figure 53. Crashes Involving Bicyclists and Pedestrians by Month, 2002-2008

The majority of crashes experienced from 2002 to 2008 in the Rapid City Area occurred in the afternoon, with 28 percent of crashes occurring between noon and 4 p.m. and another quarter during evening rush hour times. Notably more pedestrian crashes than crashes involving bicyclists occurred after 7 p.m.

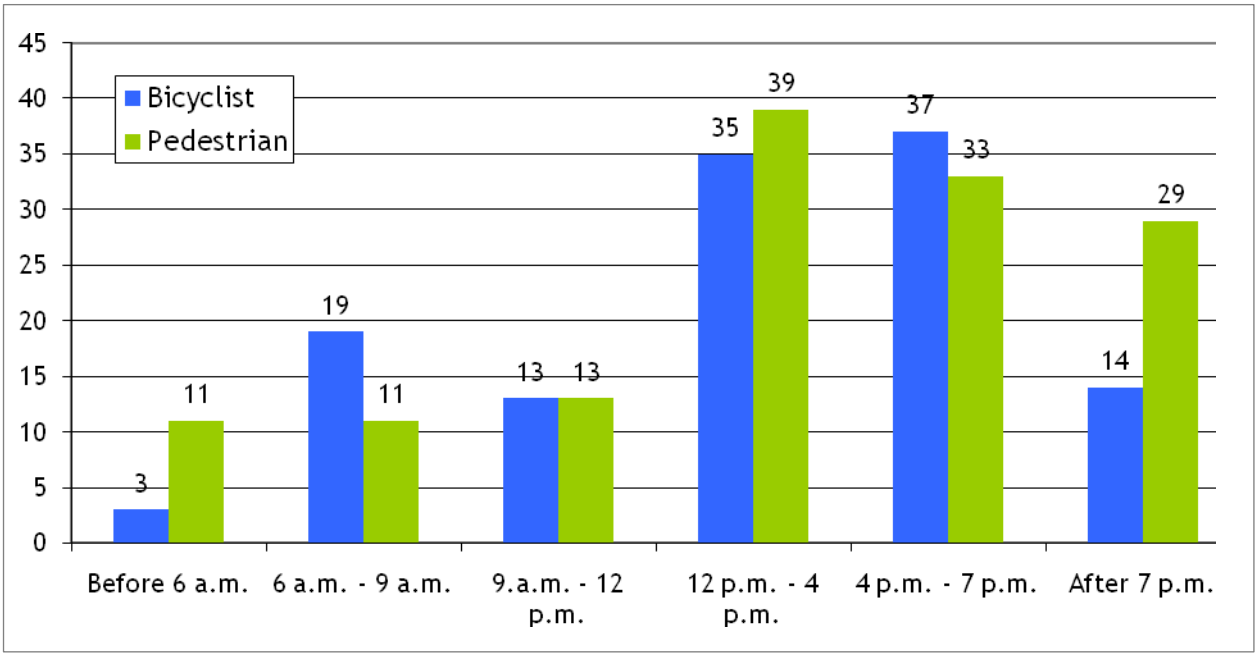


Figure 54. Crashes Involving Bicyclists and Pedestrians by Time of Day, 2002-2008

Bicyclist or Pedestrian Age

Age is another important factor in a crash analysis. As young people cannot drive, a larger proportion of people under 16 walk or ride bicycles. Younger bicyclists and pedestrians may be less aware of safe practices and are more prone to cross a road without checking to see if cars are present. As shown below, over half of bicyclists involved in crashes during the time period were under 20 years of age. The majority of pedestrians involved in crashes were also under 20 years old.

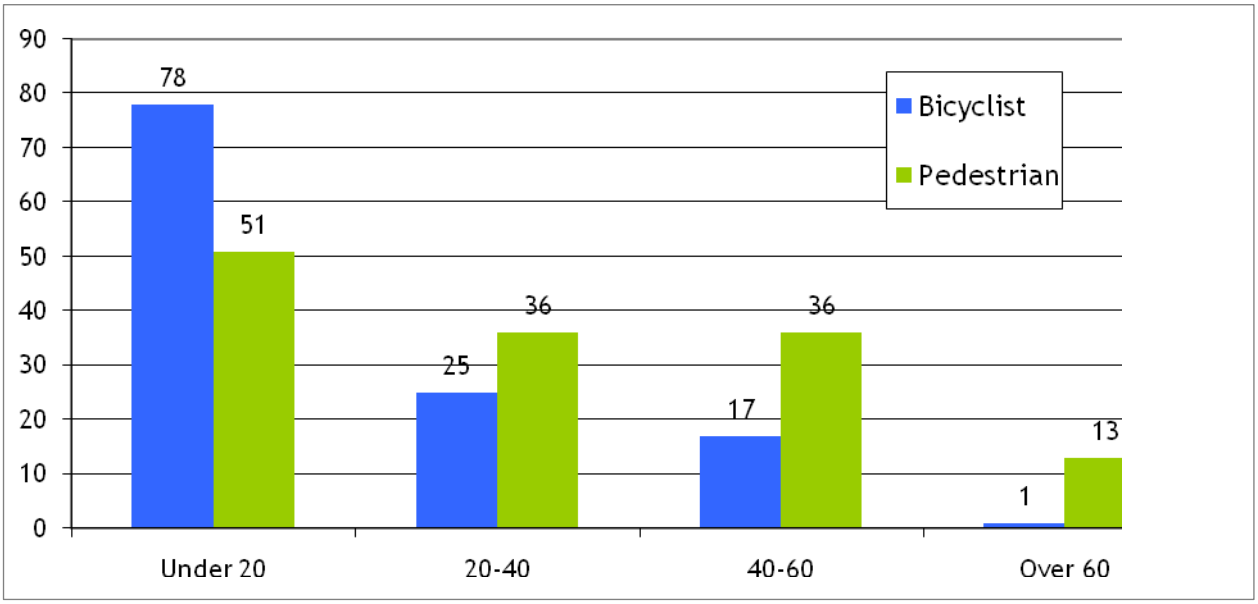


Figure 55. Age of Bicyclists or Pedestrians Involved in Crashes, 2002-2008

Crash Severity

The majority of crashes involving bicyclists and pedestrians during the time period studied resulted in minor injuries. There were six pedestrian fatalities, and no fatalities involving bicyclists (see Figure 56).

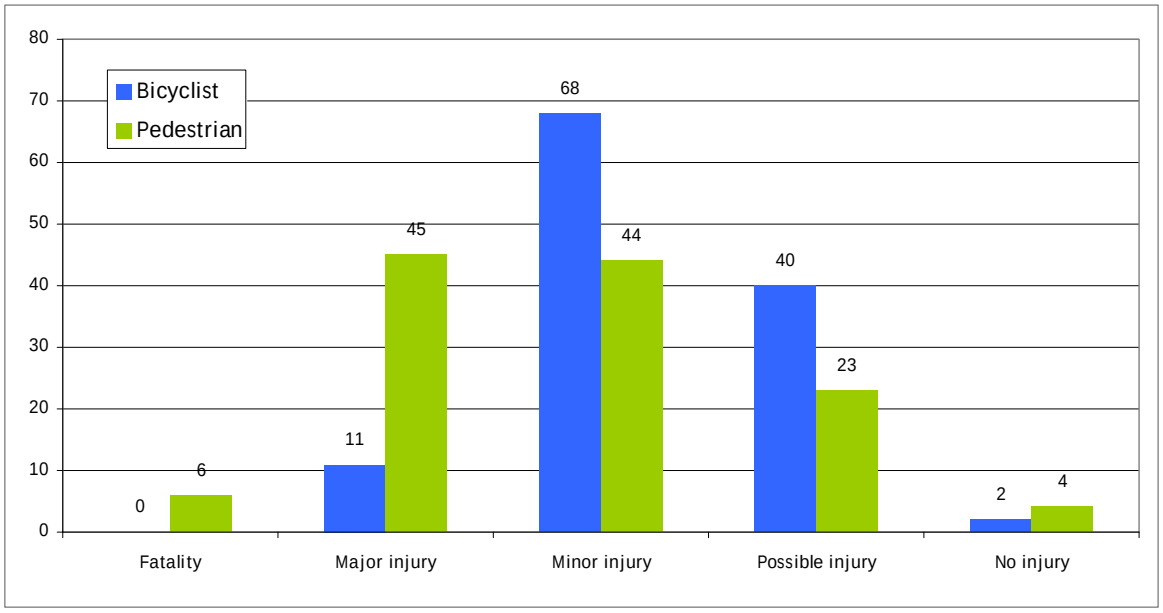


Figure 56. Severity of Crashes Involving Bicyclists and Pedestrians, 2002-2008

The 2008 study provided additional details on three of the fatalities involving pedestrians in 2005 and two in 2008.

- 2002 – Fifth Street, north of Omaha Street, Non-Roadway crash. This crash was caused by a minor-aged driver losing control of the vehicle and leaving the roadway, striking the pedestrian on the sidewalk. The crash occurred during daylight conditions, on dry pavement and no alcohol or drug usage was involved.
- 2005 – Haines Avenue, north of Lawrence Drive, Walking Along Road crash. This crash was caused by a driver driving under the influence of alcohol. The crash occurred during the dawn hours, on dry pavement within a construction zone. The pedestrian was struck when the driver crossed the centerline.
- 2005 – Mt. Rushmore Road, south of St. Cloud Street, Dart/Dash crash. This crash was caused by a pedestrian stepping into a travel lane mid-block. The crash occurred at dusk on dry pavement; alcohol use by the pedestrian was a factor in the crash.
- 2005 – I-90 near I-190, Dart/Dash crash. This crash was caused by a pedestrian stepping into a travel lane. The crash occurred at night

on dry pavement; it is unknown whether or not alcohol or drug use by the pedestrian was a factor in the crash.

- 2008 – E. Omaha Street, west of Cambell Street, Other crash. The pedestrian was lying in the roadway and was run over by a vehicle. The crash occurred at night on dry pavement; alcohol use by the pedestrian was a factor in the crash.
- 2008 – Fifth Street at Oakland Street, Thru Vehicle No Traffic Control crash. The pedestrian was hit while crossing Fifth Street at an unmarked crosswalk. The crash occurred at night on dry pavement; neither alcohol nor drug use was a factor in the crash.

As noted in the 2008 crash report, the City of Rapid City did not experience a bicycle-related fatality. However, the region has a significantly higher bicyclist injury rate than either South Dakota or the United States. Similar to pedestrian crash patterns, 18 percent of crashes involving bicyclists occurred in the central business district.

Contributing Factors

The majority of crashes involving bicyclists and pedestrians in Rapid City occurred during clear conditions (84 percent). Less than an eighth of crashes occurred during cloudy conditions, while rain was a factor in four crashes and snow in three crashes.

Almost three-quarters of crashes occurred during daylight, although 33 pedestrian crashes occurred at night, in a lit area. This finding, combined with the relatively larger number of pedestrians involved in crashes after 7 p.m., may indicate that additional or improved lighting should be provided in key pedestrian areas, such as downtown Rapid City.

Crash Location

Figure 57 shows the locations of all reported crashes involving bicyclists or pedestrians in Rapid City from 2002 through 2008. The map shows that reported crashes are clustered in areas expected to have higher volumes of pedestrians and bicyclists due to commercial development or high population densities.

The crash data also provide an indication of where in the Rapid City Area people are bicycling and walking and where they may experience unclear or dangerous conditions. The 2008 Pedestrian/Bicycle Crash Report noted that the majority of crashes involving pedestrians occurred within Rapid City's central business district (CBD) and along corridors including Mt. Rushmore Road, 5th Street/Haines Avenue, and East Boulevard/East North Street.

Crashes involving bicyclists occurred more commonly along Van Buren Street, Saint Patrick Street, W. Main Street, and Jackson Boulevard, among others. Most of the streets where crashes occurred are busy streets with more than two lanes of traffic that present complicated traffic patterns. In several of these locations, bicyclists are likely using these routes because alternatives do not exist and because they need to access destinations on these streets. Alternate routes can be provided on less busy streets, while a complimentary network of signage can direct cyclists to safer routes. While it may be desirable to provide bicycle facilities to encourage bicycle travel on less trafficked streets, key destinations such as stores, restaurants and employment sites are often located on busy streets. It is thus important to provide facilities to enable bicyclists to safely travel on streets with key destinations. Furthermore, bicyclists sometimes travel on busy streets because they prefer direct and fast routes to their destinations and/or because lower-traffic streets have many stop signs, which can slow bicyclist travel times as much as three times more than another route. Finally, some busy streets do not have a lower volume parallel street that is better suited for bicycles due to a lack of street connectivity. For the above reasons, creating multi-modal streets may be a worthy goal for some of the busier streets in Rapid City.

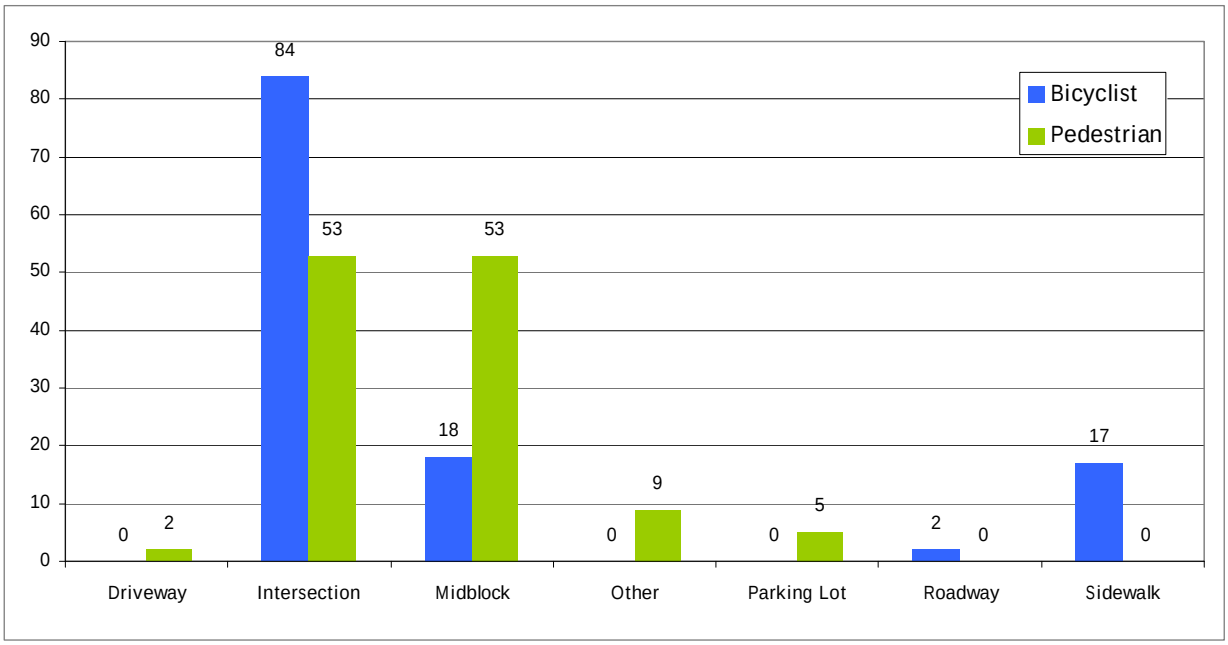
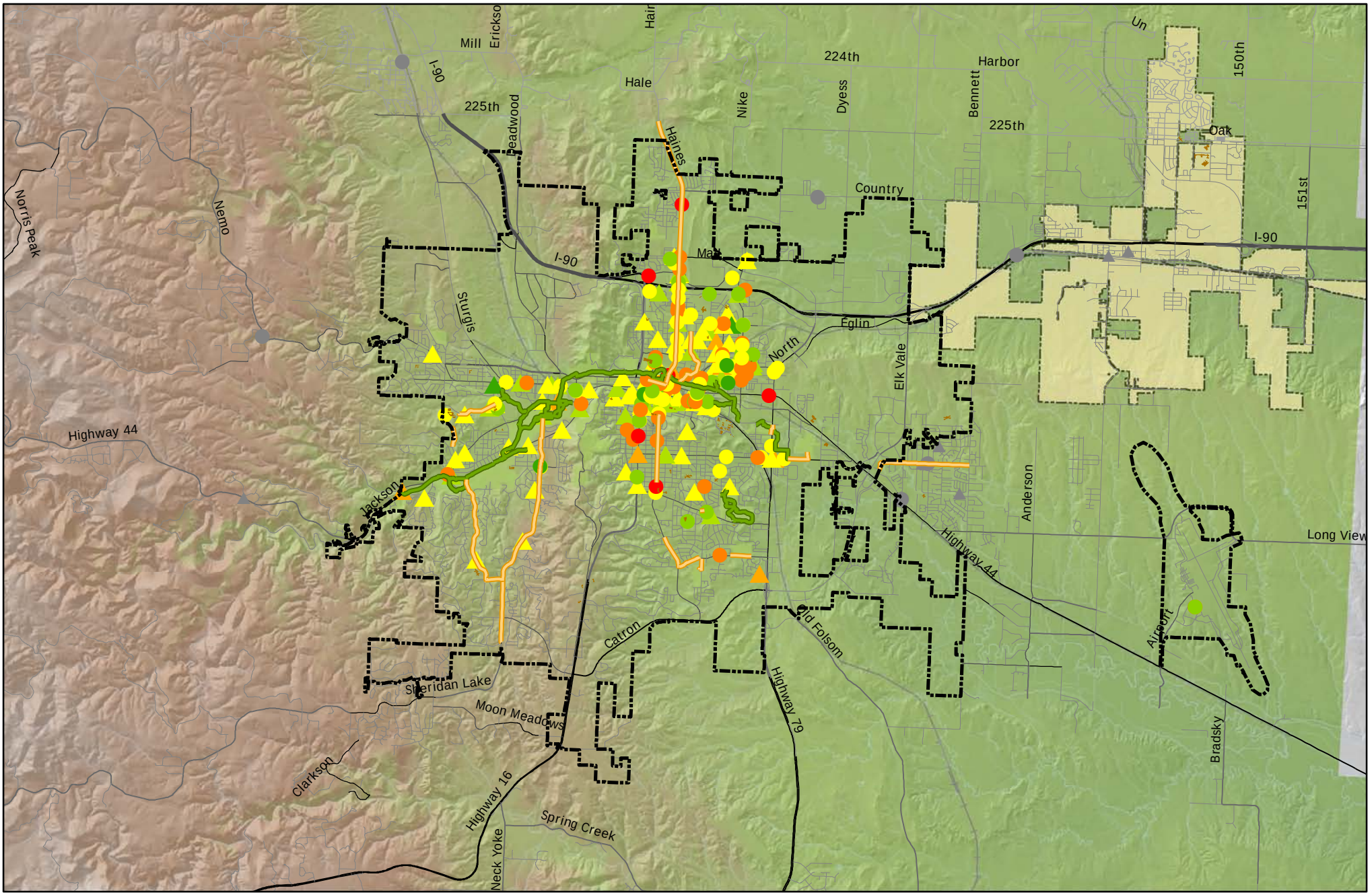


Figure 57. Location of Crashes Involving Bicyclists and Pedestrians, 2002-2008



Map 15. Crashes Involving Bicyclists or Pedestrians, 2004-2008

Rapid City Area
Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO
Author: HWK
Date: June 2010

0 1.25 2.5 Miles

Pedestrian
Bicycle

No Injury
Possible Injury
Minor Injury

Major Injury
Fatality

N

alta PLANNING + DESIGN

The majority of the crashes involving bicycles and pedestrians took place at an intersection (56 percent of total crashes, and 69 percent of crashes involving bicyclists). In addition, midblock crossings saw a high proportion of crashes (29 percent for all types, and 43 percent of pedestrians). Measures to increase visibility of bicycles and pedestrians at intersections would increase safety for cyclists. Strategies for increasing bicycle visibility include colored bicycle boxes, which place bicycles in front of traffic to increase visibility at intersections and limits right-turn conflicts when the traffic signal changes from the red to the green phase (Figure 57). Colored paint can also be used to alert motorists to the presence of bicycles on intersection approaches. Complicated intersections should be simplified where possible.

Figure 58. Bike boxes have been installed at several intersections in Portland, OR where right-turning motorists conflict with through bicyclists.

Where slip lanes allow drivers to make right turns without slowing, reconstructing the corners can significantly improve bicyclist and pedestrian safety.

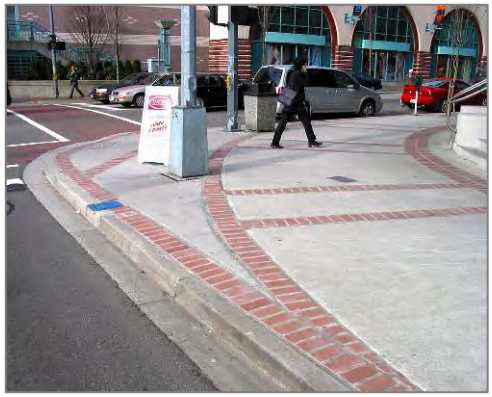


Figure 59. Reducing the radius of a turn reduces traffic speed and greatly improves safety for bicyclists and pedestrians

The majority of crashes outside of the City of Rapid City occurred along major roadways. In Box Elder, crashes occurred on I-90, on Box Elder Road, and on Douglas Road. In Rapid Valley, two collisions occurred along Twilight Drive, which provides a side path for bicycle and pedestrian travel. Both were located at intersections, one at Sweetbriar Street and the other at Dorothy Drive.

Fault

According to the analysis of the data presented in the 2008 report, pedestrians were at fault in 40 percent of crashes involving pedestrians, while drivers were at fault in almost 50 percent of these crashes. The most common cause of crashes was found to be dart/dash crossings, wherein a pedestrian crossed the roadway without a signal. While the crashes were judged to be the fault of the pedestrian, these crashes indicate a location where the pedestrians want to cross the roadway, but no appropriate crossing treatment is provided.

The other major cause of injury was related to a turning vehicle (see Figure 60). One mechanism for increasing pedestrian safety at intersections is to reduce the curb radius to force drivers to slow down when making turns (Figure 59).

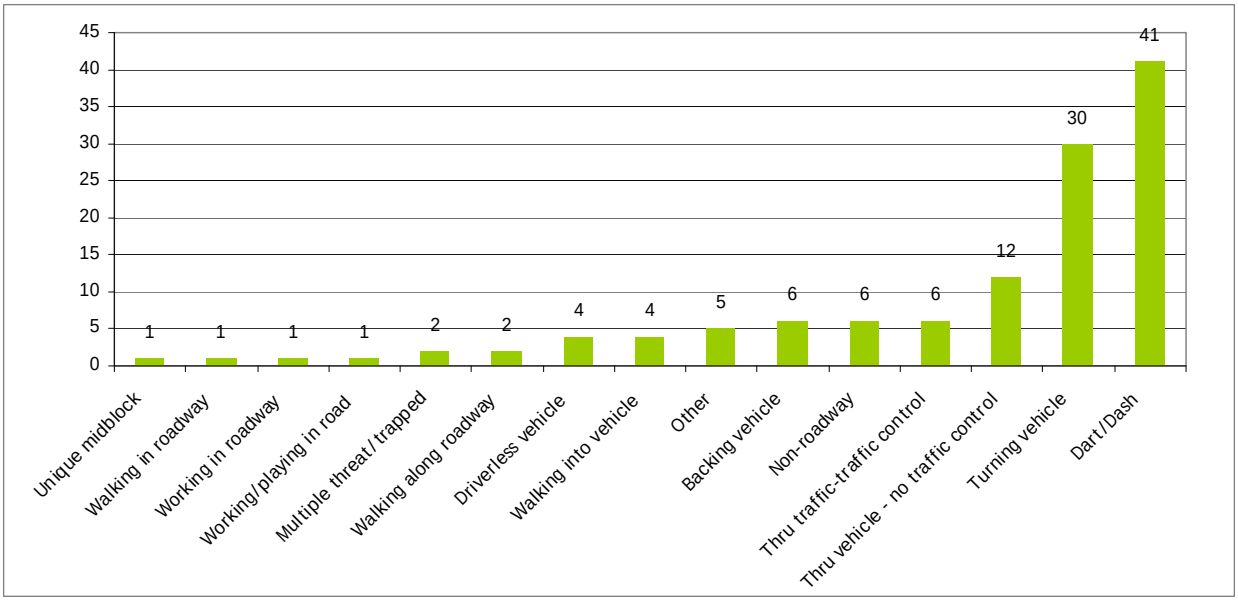


Figure 60. Cause of Crashes Involving Pedestrians, 2002-2008

The largest cause of crashes involving bicyclists was the 'bicyclist ride-out,' which includes many different behaviors and situations. This finding indicates that bicyclist education is an important strategy for improving bicyclist safety. In addition, designating separated space for bicyclists can encourage them to follow the rules of the road. Drivers were found to be at fault in 38 percent of crashes involving bicyclists, and bicyclists were found to be at fault in 60 percent of crashes. The major driver-fault crashes were caused by vehicles pulling out or turning into bicyclists. These issues can be improved by increasing visibility and awareness, both with improving sightlines and through awareness campaigns.

The majority of crashes involving pedestrians occurred along Mt. Rushmore Road and 5th Street/Haines Avenue, as well as in the central business district. In absence of area-wide bicycle and pedestrian counts, this crash data indicates where people bicycle and walk in the Rapid City Area.

As previously discussed, a significant proportion of bicyclists and pedestrians involved in crashes were under 20; almost 40 percent of bicyclists were between the ages of 6 to 13, while another 19 percent were 14 to 19. This indicates the need for greater educational programs to teach students/young people how to safely cross the street and ride a bicycle. Figure 62 shows that the majority of crashes involving people under 20 were categorized as 'bicyclist ride out,' while a significant number involved turning vehicles or dart/dash crashes.

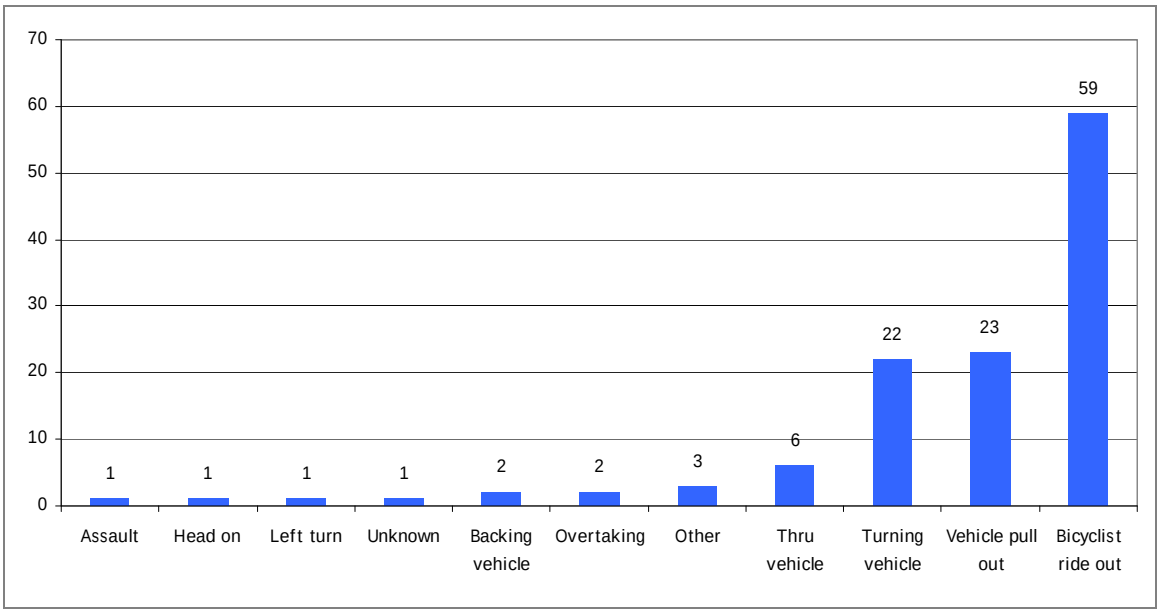


Figure 61. Cause of Crashes Involving Bicyclists, 2002-2008

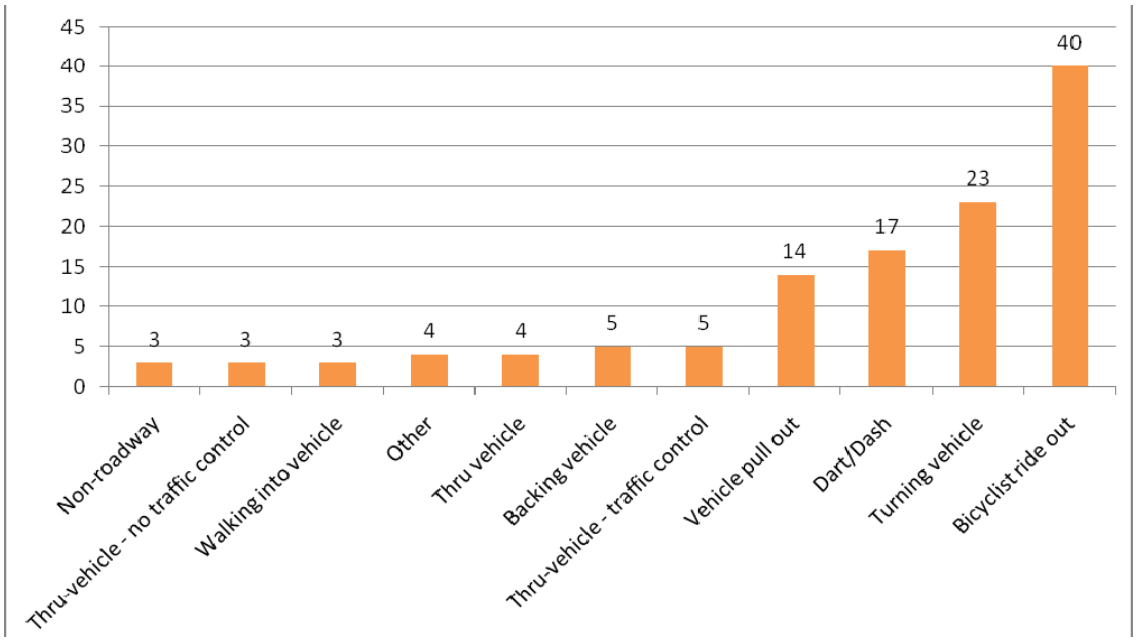


Figure 62. Cause of Crashes Involving Bicyclists or Pedestrians Under 20 Years of Age, 2002-2008

Analysis and Recommendations

The 2008 Pedestrian/Bicyclist Crash Report made the following conclusions:

- Rapid City's pedestrian and bicyclist injury crash rates are generally higher than corresponding statewide and national rates
- No location-specific trends were identified for pedestrian or bicyclist crashes

- There is a general trend for pedestrian crashes to occur within the central business district (CBD) and along the Mt. Rushmore Road, 5th Street/Haines Avenue, and East Boulevard/East North Street corridors
- The age distribution of Rapid City pedestrians and bicyclists involved in crashes is consistent with statewide data
- The most frequently occurring pedestrian crash types are dart/dash and turning vehicle
- Alcohol use by pedestrians is a significant factor in dart/dash pedestrian crashes
- The most frequently occurring bicyclist crash types are bicyclist pull out, vehicle pull out and turning vehicle
- A significant number of bicyclist crashes involved bicyclists who were using the sidewalk at an intersection. Most of the bicyclists involved in crashes at intersections demonstrated a lack of understanding of South Dakota law, specifically that bicyclists must stop before entering a crosswalk or highway from a sidewalk or sidewalk area. Failure to comply with this law is a direct cause of crashes since the higher operating speed of bicycles versus pedestrians (1) makes it difficult for drivers to judge the necessity of yielding to bicyclists who do not stop, and, (2) allows for bicyclists to pass slowing vehicles approaching an intersection leading to drivers being "surprised" by crossing bicycle traffic at the intersection.

Locations that have experienced crashes are prioritized in the Master Plan recommendations. In addition, the types of accidents bicyclists tend to be involved in indicates lack of awareness and a need for improved facilities that offer clear guidance to drivers and cyclists about which mode is expected to yield in different situations.

The prevalence of 'side path' type facilities in the Rapid City Area may contribute to the perception that bicyclists do not stop at intersections. On a facility that crosses many side streets and driveways, a cyclist may not want to come to a full stop at every intersection, similarly to as if they were riding in a bike lane. Having the bicyclist separated from traffic, often with parked cars or trees between the drivers and cyclists, limits driver visibility and increases the rate of crashes.

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Appendix F. Bicycle and Pedestrian Standards and Design Guidelines

Rapid City is interested in implementing pedestrian, on-street bikeway, and shared-use path projects in order to encourage walking and cycling. While the Rapid City area is growing rapidly, it also contains an existing built environment; many future projects will involve retrofitting existing streets and intersections. When looking to implement bike lanes or other improvements on Rapid City's streets, most standard design manuals offer limited solutions.

The design concepts presented in this document are based on current walkway, bikeway, and trail design guidelines provided in federal, state, and local design and standards documents, as well as best practices from several communities throughout the country. The bicycle and pedestrian design guidelines use these documents as a baseline for minimum conditions. The guidelines are intended to find creative solutions to the problem of providing bicycle and pedestrian facilities in a wide variety of conditions. These treatments draw upon creative solutions in use in other states as well as additional treatments in use in other urban areas in the U.S. and abroad.

Key Design Principles

The following are key principles for these pedestrian and bicycle guidelines:

- **The walking and bicycling environments should be designed with safety in mind.** Sidewalks, shared-use paths, roadway crossings, and bicycle routes should be designed and built to be free of hazards and to minimize conflicts with vehicular traffic.
- **The pedestrian and bicycle network should be accessible.** Bicycle and pedestrian facilities should accommodate the needs of people regardless of age or ability. At a minimum, facilities should be designed for the use of experienced cyclists, with a goal of providing for inexperienced bicyclists (especially children and seniors) to the greatest extent possible.
- **The walking and bicycling environment should be clear and easy to use.** Design bicycle and pedestrian facilities so people, including those with mobility and sensory impairments, can easily find a direct route to a destination and delays are minimized.
- **Bicycle and pedestrian improvements should be economical.** Improvements should be designed to minimize construction and maintenance costs as well. Where possible, improvements in the right-of-way should stimulate, reinforce and connect with adjacent private improvements.

References

The following is a list of references and sources utilized to develop design guidelines for the Rapid City Bicycle and Pedestrian Master Plan. Many of these documents are available online and are a wealth of information and resources available to the public.

Federal Guidelines

- *2010 ADA Standards for Accessible Design*, 2010. Department of Justice. http://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm#curbramps
- AASHTO *Guide for the Development of Bicycle Facilities*,[16] 1999. American Association of State Highway and Transportation Officials, Washington, DC. www.transportation.org
- AASHTO *Policy on Geometric Design of Streets and Highways*, 2001. American Association of State Highway and Transportation Officials, Washington, DC. www.transportation.org
- *Accessibility Guidelines for Buildings and Facilities*, 2002. United States Access Board, Washington, D.C. http://www.access-board.gov/adaag/html/adaag.htm
- *Manual on Uniform Traffic Control Devices* (MUTCD), 2003. Federal Highway Administration, Washington, DC. http://mutcd.fhwa.dot.gov
- *Public Rights-of-Way Accessibility Guidelines* (PROWAG), 2007. United States Access Board, Washington, D.C. http://www.access-board.gov/PROWAC/alterations/guide.htm

State and Local Guidelines

- *Road Design Manual.* (2007). State of South Dakota Office of Road Design. www.sddot.com/pe/roaddesign/plans_rdmanual.asp
- *Standard Specifications for Roads & Bridges.* (2004). State of South Dakota Operations Support Office. www.sddot.com/operations/specifications/specbook_div2_04.htm

Best Practices Documents

- *Berkeley Pedestrian Master Plan.* (2010). City of Berkeley, California. http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=16124
- *Bicycle Facility Selection: A Comparison of Approaches..* (2002). Michael King, for the Pedestrian and Bicycle Information Center http://www.bicyclinginfo.org/pdf/bikeguide.pdf

[16] The Guide for the Development of Bicycle Facilities is currently being updated, and the new document can not be quoted at the time of this writing. However, many of the facilities under consideration for the update are included in the following pages.

- *Bicycle Parking Design Guidelines.* (No Date). Bicyclinginfo.org http://www.bicyclinginfo.org/engineering/parking.cfm
- *Bicycle Parking Guidelines, 2nd Edition.* (2010). Association of Pedestrian and Bicycle Professionals (APBP). http://www.apbp.org/resource/resmgr/webinars/bpg_exec_summary_4-21-10.pdf
- *City of Chicago Bike Lane Design Guide.* (No Date). http://www.chicagobikes.org/pdf/bike_lane_design_guide.pdf
- *Designing Sidewalks and Trails for Access.* (2001). FHWA. http://www.fhwa.dot.gov/environment/sidewalk2/contents.htm
- *Florida Bicycle Facilities Planning and Design Handbook.* (1999). Florida Department of Transportation. http://www.dot.state.fl.us/safety/ped_bike/ped_bike_standards.htm#Florida%20Bike%20Handbook
- *Oregon Bicycle and Pedestrian Plan.* (1995) Oregon Department of Transportation. http://www.oregon.gov/ODOT/HWY/BIKEPED/planproc.shtml
- *Portland Bicycle Master Plan for 2030.* (2010). City of Portland, Oregon Department of Transportation. http://www.portlandonline.com/transportation/index.cfm?c=44597&a=289122
- Road Diet Handbook: Setting Trends for Livable Streets.. (2006). Jennifer Rosales.
- *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations.* (2005). FHWA Report HRT-04-100 http://www.tfhrc.gov/safety/pubs/04100/
- *The North Carolina Bicycle Facilities Planning and Design Guidelines.* (1994). North Carolina Department of Transportation Division of Bicycle and Pedestrian Transportation. http://www.ncdot.org/transit/bicycle/projects/resources/projects_facilitydesign.html
- *Wisconsin Bicycle Facility Design Handbook.* (2004). Wisconsin Department of Transportation. http://www.dot.wisconsin.gov/projects/bike.htm

Toolkit

1. On-Street Pedestrian Facilities

Sidewalks, shared-use paths, and roadway shoulders are typically recognized as pedestrian facilities. Pedestrian travel is accommodated by intersection treatments such as crosswalks, curb ramps, as well as boulevards and other amenities. Standards for accessible pedestrian facilities are primarily from the United States Access Board.

1.1. Sidewalks

Design Summary

	Curb	Planting Strip (Buffer)*	Sidewalk Width
Arterials and Collectors	1 ft.	6-8 ft.	8 ft.†
Local Streets	0-1 ft.	6-8 ft.	5 ft. †
Bus Stops	1 ft.	varies	5'x8' area‡
Commercial Walkways	1 ft.	6-8 ft.	6-10 ft.
Mixed Use Center Streets	1 ft.	6-8 ft.	10-12 ft.

** In constrained locations, the full sidewalk width should be provided, with a reduced-width planting strip/buffer.*

† Note: short sidewalk segments can have narrower widths in physically-constrained areas.

‡ Required minimum by ADA and SDDOT Road Design Manual

A well-designed sidewalk provides plenty of pedestrian space.

Discussion

Recommended widths enable two pedestrians (including wheelchair users) to walk side-by-side, or to pass each other comfortably. Proposed sidewalk guidelines apply to new development and depend on available street width, motor vehicle volumes, surrounding land uses, and pedestrian activity levels. Standardizing sidewalk guidelines for different areas of the region, dependent on the above listed factors, ensure a minimum level of quality for all sidewalks. As part of a roadway reconstruction project on a street with a narrow sidewalk corridor, planners should analyze the impact of reclaiming a portion of the existing right-of-way. If this proves impractical, the feasibility of acquiring additional right-of-way should be examined. Acquisition should be considered where cost is reasonable in proportion to the overall project cost.

The SDDOT *Road Design Manual* recommends that construction/reconstruction projects should be designed to follow PROWAG guidelines where practical. Where not practical, the manual allows for ADAAG compliance, except for crosswalk design, which should be based on ADAAG.

Guidance

- United States Access Board. (2002). *Accessibility Guidelines for Buildings and Facilities.*
- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).
- SDDOT Road Design Manual.

1.1. Sidewalks

1.1.1. Addressing Sidewalk Obstructions

Design Summary

- Place obstructions such as sign posts, utility and signal poles, mailboxes, fire hydrants and street furniture between the sidewalk and the roadway to create a buffer for increased pedestrian comfort.
- Where sidewalks abut perpendicular or angled on-street parking, use wheel stops to prevent parked vehicles from overhanging in the sidewalk.
- Where sidewalks abut hedges, fences, or buildings, add two feet of lateral clearance for shy distance.

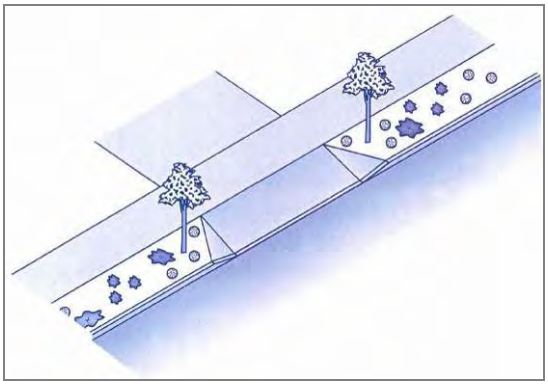
Discussion

Driveways are a common obstacle to the sidewalk network and should be minimized where possible. Where access management is not feasible, options for minimizing the impact of driveways to the sidewalk environment include:

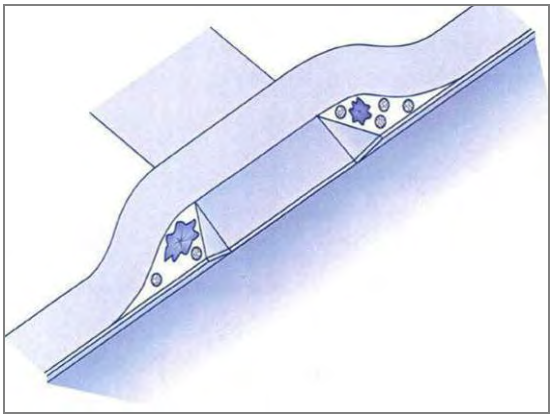
- Provide a planter strip allowing sidewalks to remain level, with the driveway grade change occurring within the planter strip (top graphic).
- Wrap the sidewalk around the driveway (middle graphic). However, this may have disadvantages for visually-impaired pedestrians who follow the curb line for guidance.
- Dip the entire sidewalk at the driveway approach to maintain a constant grade on the cross-slope (bottom graphic). However, this may be uncomfortable for pedestrians where driveways are frequent and could create drainage problems behind the sidewalk.

Guidance

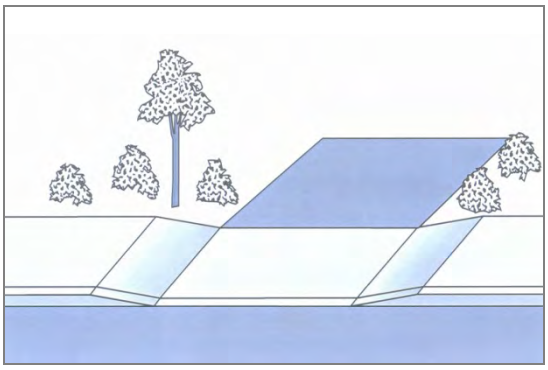
- United States Access Board. (2002). *Accessibility Guidelines for Buildings and Facilities.*
- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines (PROWAG).*



Driveway apron utilizing the planting strip.



Sidewalk wrapped around driveway.



Entire sidewalk dips at driveway.

1.1. Sidewalks

1.1.2. Sidewalk Maintenance

Design Summary

- Minimize barriers for pedestrians, particularly with mobility and sensory impairments, by providing a level surface with a minimum of ¼ inch grade changes.
- Trim tree limbs to leave at least 8 feet of clear space above the sidewalk.

Subsurface tree roots can lift concrete sidewalk slabs, causing the surface to become uneven.

Discussion

Root Protection

Street trees are a desirable part of the street environment, to shade pedestrians and improve aesthetics. However, sidewalk damage can occur, primarily from improper tree selection and from soil freeze and thaw. To minimize sidewalk damage from trees, choose appropriate trees based on water and light availability, the quantity of air, and root space available at the specific location.

Grates

Designers should consider using tree well grates or treatments such as unit pavers in high pedestrian use areas. All grates within the sidewalk should be flush with the level of the surrounding sidewalk surface, and should not interfere with pedestrian zone.

Tree well grates can create uneven sidewalk conditions and should not be placed within the thru-pedestrian zone.

Hatch Covers

Hatch covers should be located within the sidewalk furnishings zone. Hatch covers must have a surface texture that is rough, with a slightly raised pattern. The surface should be slip-resistant even when wet. The cover should be flush with the surrounding sidewalk surface.

Curb Ramp Maintenance

The interface between a curb ramp and the street be maintained adequately. Asphalt street sections typically have a shorter life cycle than a concrete ramp, and can develop potholes at the foot of the ramp, which can catch the front wheels of a wheelchair. Existing ramps, and crossings without ramps, must be brought to current accessibility standards during reconstruction periods.

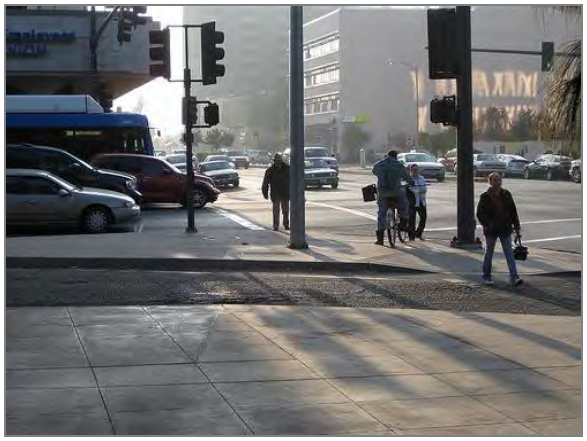
Guidance

- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2. Intersections

Design summary

- Intersection frequency on mixed-use streets and other high pedestrian use areas:
  - Generally not farther apart than 200-300' where blocks are longer than 400'.
  - Generally not closer together than 150'.
- Intersection frequency on residential or local streets:
  - Frequency based on adjacent uses. Do not prohibit for more than 400'.
  - Generally not closer together than 150'.



Intersections with many user types should provide good crossing opportunities and clearly delineate crossing patterns.

Discussion

In general, pedestrians are not inclined to travel very far out-of-direction to access a designated crosswalk, so providing sufficient crossings is critical for a safe pedestrian environment. Crosswalks can also be designed for increased visibility of pedestrians, and curb ramps and vehicle turning radii should also be considered for the pedestrian environment.

In areas of high pedestrian use, the convenience and travel time of pedestrians deserves special consideration when considering signal placement and timing. In these locations, pedestrian mobility and access may need to be weighted against the efficiency of vehicle progression.

Attributes of pedestrian- and bicycle-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, textures, must meet accessibility standards.
- Separation from Traffic — Corner design and construction must be effective in discouraging turning vehicles from driving over the pedestrian area.

Guidance

- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2.1. Marked Crosswalks

Design Summary

- See MUTCD for pavement marking spacing.
- Mark all crosswalks at signalized intersections. At un-signalized intersections, mark crosswalks 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 mid-block locations, mark crosswalks where:
  - There is a demand for crossing AND
  - There are no nearby marked crosswalks.

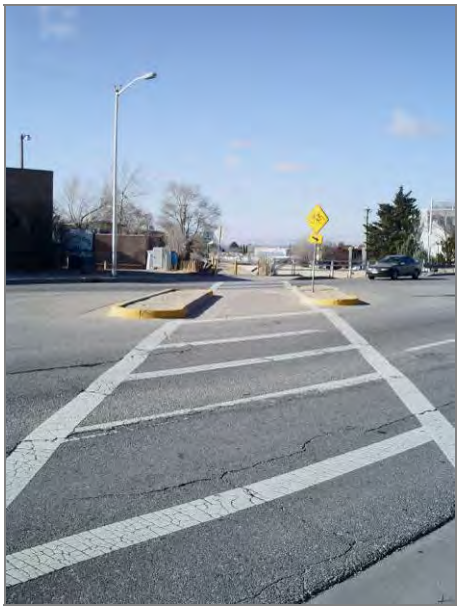
Parallel markings are the most basic crosswalk marking type, and are applied where textured concrete crosswalks are used.

Discussion

Marking crosswalks signals to drivers that they should stop for pedestrians, and encourages pedestrians to cross at safer locations. Crosswalk markings also indicate to pedestrians the appropriate route across traffic, to facilitate crossing by the visually impaired and remind turning drivers of potential conflicts with pedestrians.

Use ladder pavement markings 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.



Zebra striped crossings can increase visibility of pedestrians.

Guidance

- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).
- FHWA. (2005). *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations Final Report and Recommended Guidelines.* http://www.fhwa.dot.gov/publications/research/safety/04100/

2.1. Marked Crosswalks

2.1.1. High-Visibility Crosswalk Techniques

Design Summary

- Additional treatments can be used to increase visibility of the crosswalk at high-use locations and in locations with high use from school children, elderly pedestrians, or pedestrians with disabilities.

Discussion

Rapid Flash Beacon

Designed to encourage motorists to stop for a pedestrian waiting at a mid-block crossing, rapid flash beacons call attention to the crossing location. These devices use a stutter flash pattern similar to that used on emergency vehicles.

Rapid flash beacon.

Raised Median

A raised median eliminates grade changes from the sidewalk and gives pedestrians greater prominence. Raised crosswalks should be where a special emphasis on pedestrians is desired such as at a mid-block crossing.

Additional guidelines include:

- Use detectable warnings at the curb edges to alert vision-impaired pedestrians that they are entering the roadway.
- Design approaches to the raised crosswalk to be similar to speed humps, so they also act as traffic calming.
- Use post-mounted pedestrian crosswalk signs placed on the median and on the right side of the roadway for each approach.

Raised medians require drivers to slow down.

In-Street "Yield to Pedestrians" Signs and Flashers

In-street "Yield to Pedestrian" signs are flexible plastic 'paddle' signs installed in the center of a roadway to enhance a crosswalk at uncontrolled crossing locations. In-pavement flashers may be appropriate on undivided roadways in densely developed areas that do not offer median refuges for crossing pedestrians.

In-street yield to pedestrian sign.

Guidance

- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2.1. Marked Crosswalks

2.1.2. Reducing Crossing Distance

Design Summary

- Minimize pedestrian exposure to travel lanes by shortening the crossing distance; 50-feet or four travel lanes is generally the longest uninterrupted crossing of an unsignalized crosswalk.

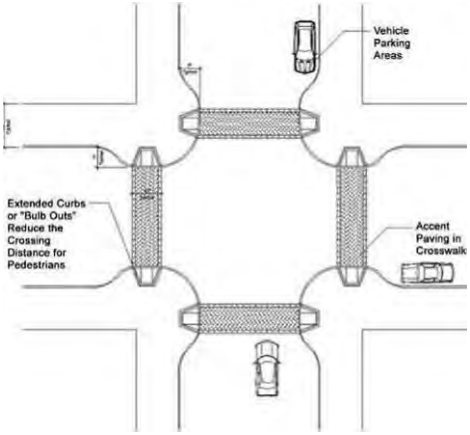
Discussion

Curb Extension

Curb extensions may be constructed where there is a parking lane adjacent to the curb. They can be used as bus stop locations to improve safety for transit riders. However, if there is no parking lane, the extensions may impede bicycle travel (where no bike lane is striped).

Guidelines for use:

- Design curb extensions to transition between the extended curb and the running curb in the shortest practicable distance.
- For street sweeping, use the minimum radius for the reverse curves of 10 feet and balance the two radii to be nearly equal.
- Stop the curb extensions one foot short of the parking zone for bicycle safety.



Curb extensions improve visibility of pedestrians and provide additional sidewalk space at street corners.

Median Refuge Island

In addition to narrowing the crossing distance, median refuge islands provide a crossing refuge, allowing pedestrians to gauge safe crossing of "one direction" of traffic at a time, and slowing motor vehicle traffic.

The refuge island must be accessible, preferably with an at-grade passage through the island rather than ramps and landings.

A median refuge island should be at least six-feet wide between travel lanes and at least 20-feet long. On streets with posted speeds over 25 mph, include double centerline marking, reflectors, and "KEEP RIGHT" signs.

If a refuge island is landscaped, the landscaping should not compromise the visibility of pedestrians crossing in the crosswalk. Tree species should be selected for small diameter trunks and tree branches should be no lower than 14 feet. Shrubs and ground plantings should be no higher than one foot, six inches.

Median refuge islands break up a crossing and allow pedestrians to cross one side of a street at a time.

Guidance

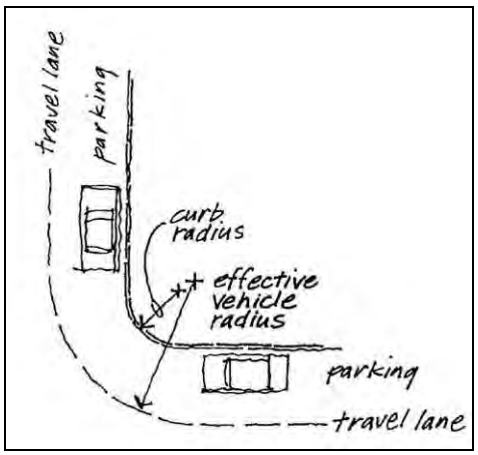
- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2.1. Marked Crosswalks

2.1.3. Minimizing Curb Radius

Design Summary

- Consider the desired pedestrian area of the corner, traffic turning movements, the turning radius of the design vehicle, the geometry of the intersection, the street classifications, and whether there is parking or a bicycle lane (or both) between the travel lane and the curb.
- Use the smallest possible curb radius for the circumstances:
  - o May be three-feet where there are no turning movements.
  - o Increase to five-feet where there are turning movements and there is adequate street width and a larger effective curb radius created by parking or bicycle lanes.



An "effective radius" is created by the presence of a parking lane or bike lane.

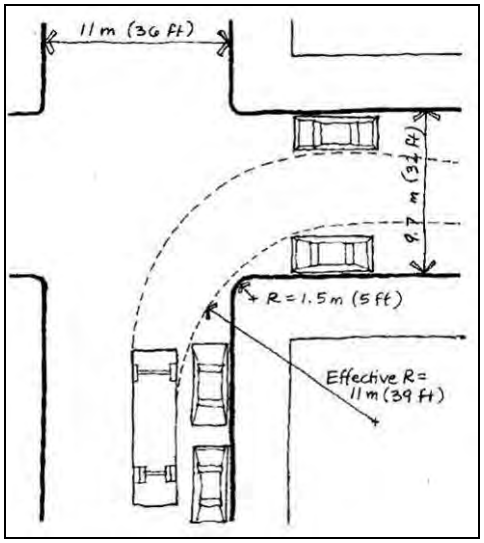
Discussion

Factors that govern the choice of curb radius in any given location include:

- The desired pedestrian area of the corner
- Traffic turning movements
- Turning radius of the design vehicle
- Geometry of the intersection
- Street classifications
- Whether there is parking or a bike lane (or both) between the travel lane and the curb

In general, smaller curb radii are preferred for pedestrians. A tight curb radius provides more pedestrian area at the corner, allows more flexibility in the placement of curb ramps, results in a shorter crosswalk, and requires vehicles to slow more as they turn the corner. A small curb radius is also beneficial for street sweeping.

The presence of a parking or bike lane creates an 'effective radius' that allows the designer to choose a radius for the curb that is smaller than the turning radius required by the design vehicle.



Where there is an effective curb radius sufficient for turning vehicles, the actual curb radius may be as small as 5 ft (1.5 m).

Guidance

- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2.1. Marked Crosswalks

2.1.4. Minimizing Conflict with Automobiles

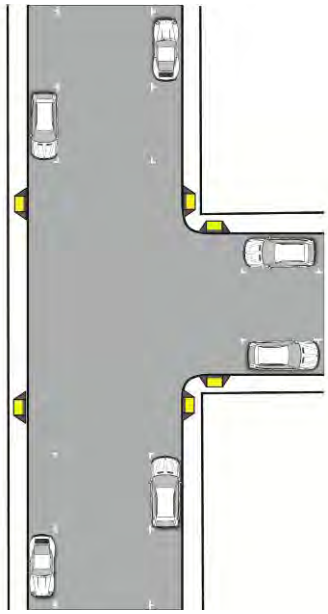
Design Summary

- Separating pedestrians and motor vehicles at intersections improves safety and visibility.

Discussion

Parking Control

Parking control improves visibility in the vicinity of the crosswalk. Prohibit parking within all intersections and crosswalks unless otherwise signed. At "T" and offset intersections, where the boundaries of the intersection may not be obvious, this prohibition should be emphasized with signage.



Prohibit parking in advance of intersections and at 'T' intersections to improve pedestrian visibility.

Advance Yield Bars

Advance yield bars increase pedestrian comfort and safety by stopping motor vehicles well in advance of marked crosswalks, allowing drivers a better line of sight of pedestrians.

They give drivers in the traffic inner lane time to yield to pedestrians, minimizing the danger of a multiple threat crash. Without an advance yield bar, the driver in the outer lane may yield to the pedestrian, but the vehicle in the inner lane proceeds, increasing the possibility of a vehicle-pedestrian conflict.

Pedestrians may also feel more comfortable since motor vehicles are not stopped adjacent to the crosswalk.

Advanced stop bars should be used:

- 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 30-feet in advance of the crosswalk.
- A "Yield Here for Pedestrians" sign must accompany the advance yield bar.

Advance stop bars alert motorists of pedestrians.

Guidance

- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2.2. ADA-Compliant Curb Ramps

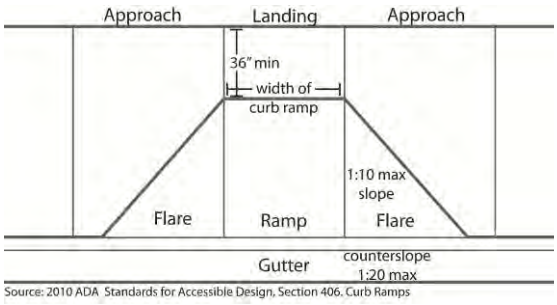
Design Summary

- Provide a landing at the top of every curb ramp that:
  - Is at least 4' long
  - Is at least the same width as the ramp itself.
  - Slopes no more than 1:50 (2.0%) in any direction
- Maximum ramp slope: 1:12 (8.3%) with a cross slope of no more than 1:50 (2.0%).
- Minimum width of a ramp: 3'
-

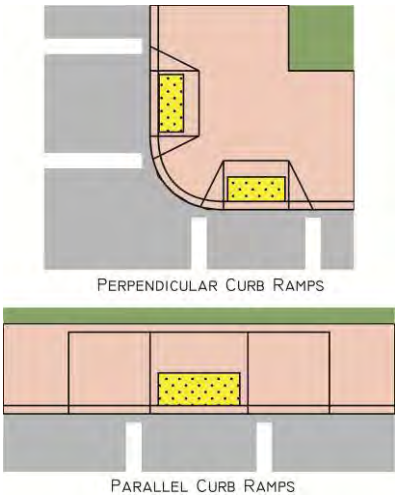
Discussion

The 2010 ADA Standards (Section 405) define a curb ramp as, "a short ramp cutting through a curb or built up to it." Curb ramps provide a transition from the street to the sidewalk at a street corner. Properly designed curb ramps ensure that the sidewalk is accessible to all types of pedestrians 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.

The ADA defines two types of curb ramp systems, "perpendicular ramps" and "parallel ramp," shown right. Diagonal curb ramps, which are a single ramp at a corner, are not recommended because they place the pedestrian in the middle of the intersection, rather than at the crosswalk.



ADA standards for curb ramps.



Curb ramp options identified by the U.S. Access Board.

Example of an ADA-compliant perpendicular curb ramp

Guidance

- 2010 ADA Accessibility Standards, http://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm
- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2.2. ADA-Compliant Curb Ramps

2.2.1. Raised Tactile Devices Used as Detectible Warnings

Design Summary

- Raised tactile devices (also known as truncated domes) alert people with visual impairments to changes in the pedestrian environment and should be used at:
  - The edge of depressed corners.
  - The border of raised crosswalks and intersections.
  - The base of curb ramps.
  - The border of medians.
  - The edge of transit platforms where railroad tracks cross the sidewalk.

A diagonal curb ramp with detectible warning.

Discussion

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 must provide color contrast so partially sighted people can see them.

Raised Tactile Devices Used for Wayfinding

Raised tactile devices can also be used for wayfinding along a pathway or across a road. This is particularly useful to visually impaired pedestrians in areas where the pedestrian environment is unpredictable. Complex intersections, roundabouts, wide intersections and open plazas are areas where raised tactile devices could be considered. No standards or guidelines for these devices have been adopted nationally. Raised devices with bar patterns can indicate the proper walking direction. Textured pavement that provides enough material and color contrast can be used to mark the outside of crosswalks, in addition to white paint or thermoplastic.

Guidance

- 2010 ADA Accessibility Standards, http://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm
- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2.3. Accommodating Bicyclists and Pedestrians at Signals

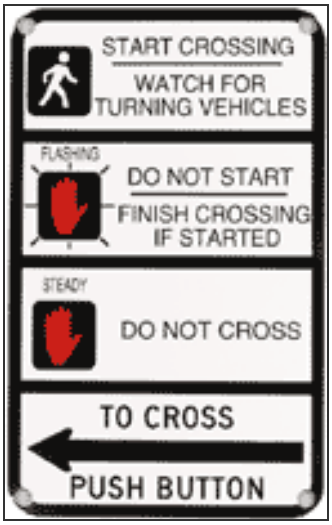
2.3.1. Pedestrian Push-Buttons

Design Summary

- Locate 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.
- Mark (for example, with arrows) so that it is clear which signal is affected.
- Raise buttons above or flush with their housing.
- Provide buttons that are large enough for people with visual impairments to see, minimum 2".
- The U.S. Access Board recommends the force to activate the signals should be no more than 22.2 Newtons.

Example standard pedestrian push button.

(Polara Navigator)



Pedestrian push buttons can be accompanied by informational signage.

Discussion

Pedestrian push buttons are used to permit the signal controller to detect pedestrians desiring to cross. They can be used at an actuated or semi-actuated traffic signal at intersections with low pedestrian volumes, and at mid-block crossings.

Accessible pedestrian signals should be installed whenever major signalized intersection upgrades are undertaken or when new signals are installed.

Signalized crossings in areas of high pedestrian use may automatically provide a pedestrian crossing phase during every signal cycle, excluding the need for pedestrian push-buttons. In high pedestrian use areas, there should be a demonstrated benefit for actuated signals before push buttons are installed. The following are some criteria for that benefit:

- The main street carries through traffic or transit, such as a major city traffic or transit street, or a district collector.
- Traffic volumes on the side street are considerably lower than on the main street.
- The pedestrian signal phase is long (for example, on a wide street) and eliminating it when there is no demand would significantly improve the level of service of the main street.

Where push buttons must be installed in high pedestrian use areas, designers should consider operating the signal with a regular pedestrian phase during off-peak hours.

Guidance

- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

2.3. Accommodating Bicyclists and Pedestrians at Signals

2.3.2. Accommodating Pedestrians at Signals

Design Summary

- Assume a pedestrian walking speed of three feet per second to provide sufficient time for a pedestrian to safely cross during the signal phase (per MIUTCD guidance).
- Assume slower crossing speeds at crossings where older pedestrians or pedestrians with disabilities are expected.
- Provide special pedestrian phases to increase visibility or crossing time for pedestrians at certain intersections.

Pedestrian signal indication.

Discussion

Pedestrian Signal Indication ("Ped Head") and Countdowns

Pedestrian signal indicators use a symbol to indicate when to cross at a signalized crosswalk. All traffic signals are now required to be equipped with pedestrian signal indications except where pedestrian crossing is prohibited by signage. Countdown pedestrian signals are particularly beneficial, as they indicate whether a pedestrian has time to cross the street before the signal phase ends.

Traffic signals should provide sufficient time for pedestrians of all ages and abilities to cross.

Audible Pedestrian Traffic Signals

Audible pedestrian traffic signals provide crossing assistance to pedestrians with vision impairment at signalized intersections. To be considered for audible signals, the location must:

- Be suitable to the installation of audible signals (safety, noise level, and neighborhood acceptance).
- Have a need, demonstrated through a user request.

Audible signals should be activated by a pedestrian push-button with at least a one second-delay to activate the sound.

Pre-Timed Signal

Pre-timed signals use automatic "phasing" concurrent with parallel vehicle traffic, as opposed to actuated signals, where pedestrians push an activation button to trigger the walk signal.

Leading Pedestrian Interval (LPI)

At intersections where there are conflicts between turning vehicles and pedestrians, pedestrians are given a "walk" designation a few seconds before the associated green phase for the intersection.

Guidance

- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).
- MUTCD

2.3. Accommodating Bicyclists and Pedestrians at Signals

2.3.3. Accommodating Bicyclists at Intersections

Design Summary

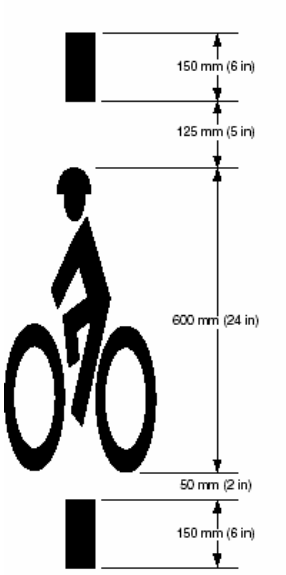
- Provide mechanism for cyclists to trigger signals when cars are not present.
- Avoid requiring cyclists to merge right and dismount to press a pedestrian button.
- It is particularly important to provide bicycle actuation in a left-turn only lane where cyclists regularly make left turn movements.

Discussion

Loop Detectors

Loop detectors are installed within the roadway to allow the presence of a motor vehicle to trigger a change in the traffic signal. They can be calibrated to detect bicyclists, allowing cyclists to stay within the lane of travel rather than having to merge to the side of the road to trigger a push button.

Current loops that are sensitive enough to detect bicycles should have pavement markings to instruct cyclists how to trip them, as well as signs (see right).



Recommended loop detector marking design.

Detection Cameras

Video detection cameras can also be used to determine when a vehicle is waiting for a signal. These systems use digital image processing to detect a change in the image at the location. Cameras can detect bicycles, although cyclists should wait in the center of the lane, where an automobile would usually wait, in order to be detected. Video camera system costs range from $20,000 to $25,000 per intersection.

Detection cameras are currently used for cyclists in the City of San Luis Obisbo, CA, where the system has proven to detect pedestrians as well.

Instructional Sign

(MUTCD Sign R10-15).

Remote Traffic Microwave Sensor Detection (RTMS)

RTMS uses frequency modulated continuous wave radio signals to detect objects in the roadway. This method is marked with a time code which gives information on how far away the object is. The RTMS system is unaffected by temperature and lighting, which can affect standard detection cameras.

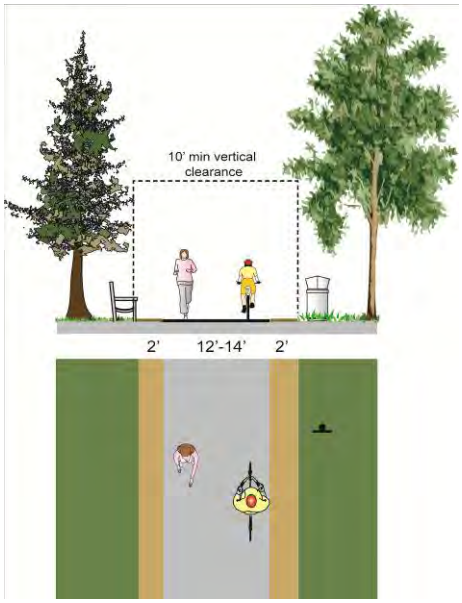
Guidance

- Additional technical information is available at: www.humantransport.org/bicycledriving/library/signals/detection.htm
- ITE Guidance for Bicycle—Sensitive Detection and Counters: http://www.ite.org/councils/Bike-Report-Ch4.pdf

3. Shared-Use Path Design Guidelines

Design Summary

- Width:
  - o Minimum for a two-way shared-use path (only recommended for low traffic situations): 10'
  - o Recommended for high-use areas with multiple users such as joggers, bicyclists, rollerbladers and pedestrians:12' or greater
- Lateral clearance: 2' or greater shoulder on both sides.
- Overhead clearance: 8' minimum, 10' recommended.
- Maximum design speed for shared-use paths: 20 mph. Speed bumps or other surface irregularities should not be used to slow bicycles.
- Grade:
  - o Recommended maximum: 5%
  - o Steeper grades can be tolerated for a maximum of 500 feet



Recommended multi-use path design.

Discussion

A hard surface should be used for shared-use paths. Concrete, while more expensive than asphalt, is the hardest of all shared-use path surfaces and lasts the longest. However, joggers and runners prefer surfaces such as asphalt or decomposed granite due to its relative "softness". While most asphalt is black, dyes (such as reddish pigments) can be added to increase the aesthetic value of the path itself.

When concrete is used the path should be designed and installed using the narrowest possible expansion joints to minimize the amount of 'bumping' cyclists experience on the path.

Multi-use paths should provide sufficient width to accommodate a variety of users.

Guidance

- U.S. Access Board, *Public Rights-of-Way Accessibility Guidelines (PROWAG).*
- FHWA. *Designing Sidewalks and Trails for Access.*

3.1. Managing Multiple Users

Design Summary

- Barrier separation – vegetated buffers or barriers, elevation changes, walls, fences, railings and bollards.
- Distance separation – differing surfaces.
- User behavior guidance signage.

Discussion

Differing surfaces suitable to each user group foster visual separation and clarity of where each user group should be. When shared-use path corridors are constrained, the approach is often to locate the two different surfaces side by side with no separation.

Informing users of acceptable etiquette is a common issue when multiple user types are anticipated. Yielding the right-of-way is a courtesy and yet a necessary part of a safe trail experience involving multiple trail users. Shared-use path right-of-way information should be posted at trail access points and along the path. The message must be clear and easy to understand. Where appropriate, trail etiquette systems should instruct trail users to the yielding of cyclists to pedestrians and equestrians and the yielding of pedestrians to equestrians.

Guidance

- MUTCD

Centerline striping encourages trail users to provide space for other users to pass.

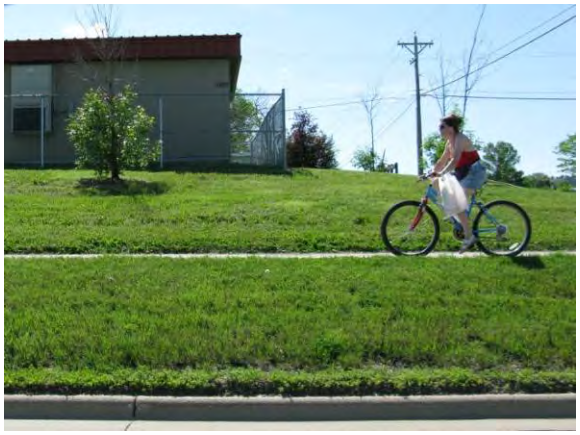
Guidance signage encourages multiple users to share trail facilities.

A commonly used multi-use trail etiquette sign.

3.2. Shared-Use Paths Along Roadways (Side Paths)

Design Summary

- Shared-use paths may be considered along roadways under the following conditions:
  - The path will generally be separated from all motor vehicle traffic.
  - Bicycle and pedestrian use is anticipated to be high.
  - To provide continuity with an existing path through a roadway corridor.
  - The path can be terminated at each end onto streets with good bicycle and pedestrian facilities, or onto another well-designed path.
  - There is adequate access to local cross-streets and other facilities along the route.



Example of a substandard side path

Discussion

Also known as "sidepaths", 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 cyclists enter or leave the path. This can create an unsafe situation where motorists entering or crossing the roadway do not notice bicyclists coming from their right, as they are not expecting traffic from that direction. Stopped cross-street motor vehicle traffic or vehicles exiting side streets or driveways may frequently block path crossings. Bicyclists coming from the left may also be unnoticed, particularly if sight distances are poor.

Additional concerns about shared-use paths directly adjacent to roadways (with minimal separation) are:

- When the path ends, cyclists riding against traffic tend to continue to travel on the wrong side of the street, as do cyclists making their way to the path. Wrong-way bicycle travel is a major cause of vehicle/bicycle crashes.
- At intersections, motorists crossing the path often do not notice bicyclists approaching from certain directions, especially where sight distances are poor.
- Bicyclists on the path are required to stop/yield at cross-streets or driveways, unless posted.
- Stopped vehicles on a cross-street or driveway may block the path.
- Because of the closeness of vehicle traffic to opposing bicycle traffic, barriers are often necessary to separate motorists from cyclists. These barriers serve as obstructions, complicate facility maintenance and waste available right-of-way.
- Paths directly adjacent to high-volume roadways diminish users' experience by placing them in an uncomfortable environment. This could lead to a path's underutilization.

As bicyclists gain experience and realize some of the advantages of riding on the roadway, some riders stop using paths adjacent to roadways. Bicyclists may also tend to prefer the roadway as pedestrian traffic on the shared-use path increases due to its location next to an urban roadway. When designing a bikeway network, the presence of a nearby or parallel path should not be used as a reason to not provide adequate shoulder or bike lane width on the roadway, as the on-street bicycle facility will generally be superior to the "sidepath" for experienced cyclists and those who are cycling for transportation purposes. Bike lanes should be provided as an alternate (more transportation-oriented) facility whenever possible.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*

3.3. Path/Roadway Crossings

Design Summary

- Type 1: Marked/Unsignalized Unprotected crossings include path crossings of residential, collector, and sometimes major arterial streets or railroad tracks.
- Type 1+: Marked/Enhanced – Unsignalized intersections can provide additional visibility with flashing beacons and other treatments.
- Type 2: Route Users to Existing Signalized Intersection – Shared-use paths that emerge near existing intersections may be routed to these locations, provided that sufficient protection is provided at the existing intersection.
- Type 3: Signalized/Controlled – Shared-use path crossings that require signals or other control measures due to traffic volumes, speeds, and path usage.
- Type 4: Grade-separated crossings - Bridges or under-crossings provide the maximum level of safety but also generally are the most expensive and have right-of-way, maintenance, and other public safety considerations.

An offset crossing forces pedestrians to turn and face the traffic they are about to cross.

Discussion

While at-grade crossings create a potentially high level of conflict between path users and motorists, well-designed crossings have not historically posed a safety problem for path users. This is evidenced by the thousands of successful paths around the United States with at-grade crossings. In most cases, at-grade path crossings can be properly designed to a reasonable degree of safety and can meet existing traffic and safety standards.

Evaluation of path crossings involves analysis of vehicular and anticipated path user traffic patterns, including:

- Vehicle speeds.
- Street width.
- Sight distance.
- Traffic volumes (average daily traffic and peak hour traffic).
- Path user profile (age distribution, destinations served).

Crossing features for all roadways include warning signs both for vehicles and path users.

Consideration must be given for adequate warning distance based on vehicle speeds and line of sight, with visibility of any signing absolutely critical. Catching the attention of motorists jaded to roadway signs may require additional alerting devices such as a flashing light, roadway striping or changes in pavement texture. Signing for path users must include a "STOP" sign and pavement marking, sometimes combined with other features such as bollards.

Guidance

- Federal Highway Administration (FHWA), *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations.*

3.3. Path/Roadway Crossings

Guidance (continued)

Summary of Path/Roadway At-Grade Crossing Recommendations[17]

Roadway Type	Vehicle ADT ≤ 9,000			Vehicle ADT > 9,000 to 12,0 0			Vehicle ADT >12,000 to 15,000			Vehicle ADT >15,00		
	Speed Limit (mph)											
	30	3	40	30	35	40	30	3	40	30	35	40
2 Lanes	1	1	1/1+	1	1	1+	1	1	1+/3	1	1/1+	1+/
3 Lanes	1	1	1+	1	1/1+	1/1+	1/1+	1/1+	1+/3	1/1+	1+/3	1+/3
Multi-Lane (4+) with raised median ***	1	1	1/1+	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3
Multi-Lane (4+ lanes) without raised median	1	1/1+	1+/3	1/1+	1/1+	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3	1+/3

*General Notes: Crosswalks should not be installed at locations that could present an increased risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding which treatment to use.

For each pathway-roadway crossing, an engineering study is needed to determine the proper location. For each engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites.

** Where the speed limit exceeds 40 mi/h (64.4 km/h), marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and AASHTO guidelines. A two-way center turn lane is not considered a median.

Key:

1= Type 1 Crossings. Ladder-style crosswalks with appropriate signage should be used.

1/1+ = With the higher volumes and speeds, enhanced treatments should be used, including marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

1+/3 = Carefully analyze signal warrants using a combination of Warrant 2 or 5 (depending on school presence) and Equivalent Adult Unit (EAU) factoring. Make sure to project pathway usage based on future potential demand. Consider Pelican, Puffin, or Hawk signals in lieu of full signals. For those intersections not meeting warrants or where engineering judgment or cost recommends against signalization, implement Type 1 enhanced crosswalk markings with marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

[17] This table is based on information contained in the U.S. Department of Transportation Federal Highway Administration Study, "*Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations*," February 2002.

3.4. Path Amenities

Design Summary

Amenities can make a path more inviting to users. Costs vary depending on the design and materials selected for each amenity. Amenities should be designed and located so as not to impede accessibility.

Discussion

Benches

Providing benches at key rest areas and viewpoints encourages people of all ages to use the path by ensuring that they have a place to rest along the way. Benches can be simple (e.g., wood slates) or more ornate (e.g., stone, wrought iron, concrete).

Benches and rest areas encourage path use by seniors and families with children.

Restrooms

Restrooms benefit path users, especially in more remote areas where other facilities do not exist. Restrooms can be sited at trailheads along the path system.

Water Fountains

Water fountains provide water for people (and pets, in some cases), encouraging path users to take a longer trip and improving user comfort.

Bicycle Parking

Bicycle parking allows path users to store their bicycles safely for a short time. Bicycle parking should be provided if a path transitions to an unpaved pedestrian-only area.

Bathrooms are recommended for longer paths and in more remote areas.

Trash Receptacles

Litter receptacles should be placed at access points. Litter should be picked up once a week and after any special events held on the path, except where specially designed trash cans have been installed. If maintenance funds are not available to meet trash removal needs, it is best to remove trash receptacles.

Signs

Informational kiosks with maps at trailheads and signage for other destinations can provide information for path users. They are beneficial for areas with high out-of- area visitation rates as well as the local citizens.

Art installations can provide a sense of place for the path.

Guidance

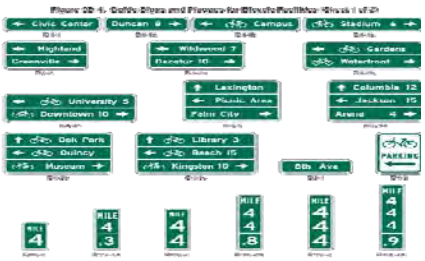
- AASHTO *Guide for the Development of Bicycle Facilities.*

4. Wayfinding Standards and Guidelines

4.1. On-Street Bikeway Signs

Design Summary

- Destinations for on-street signs can include:
  - On-street bikeways
  - Commercial centers
  - Regional parks and paths
  - Public transit sites
  - Civic/community destinations
  - Local parks and paths
  - Hospitals
  - Schools



Wayfinding sign concept MUTCD sign D1-3C.

- Confirmation signs confirm that a cyclist is on a designated bikeway. Confirmation signs can include destinations and their associated distances, but not directional arrows.
- Turn signs indicate where a bikeway turns from one street onto another street. Turn signs are located on the near-side of intersections.
- Decision signs mark the junction of two or more bikeways. Decision signs are located on the near-side of intersections. They can include destinations and their associated directional arrows, but not distances.

Discussion

Signage can serve both wayfinding and safety purposes including:

- Helping to familiarize users with the pedestrian and 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 infrequent cyclists or pedestrians (e.g., "interested but concerned" cyclists).

Bicycle wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution.

Wayfinding that includes distance and time can aid cyclists in route-finding.

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 and pedestrians, rather than per vehicle signage standards. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes.

Guidance

- City of Oakland. (2009). *Design Guidelines for Bicycle Wayfinding Signage.*
- City of Portland (2002). *Bicycle Network Signing Project.*
- MUTCD

4.2. Shared-Use **Path Signing**

Design Summary

- Provide consistent signing style and imagery throughout the shared-use path to provide the trail user with a sense of continuity, orientation, and safety.
- Do not over sign the path. Where possible, incorporate signs into trailside vertical elements such as bollards.

Discussion

Directional signs may be useful for pathway users and motorists alike. For motorists, a sign reading "Path Xing" along with a Rapid City emblem or logo helps both warn and promote use of the path itself. For path users, directional signs and street names at crossings help direct people to their destinations. The directional signing should impart a unique theme so path users know which path they are following and where it goes. The theme can be conveyed in a variety of ways: engraved stone, medallions, bollards, and mile markers. A central information installation at trailheads and major crossroads also helps users find and acknowledge the rules of the path. They are also useful for interpretive education about plant and animal life, ecosystems, and local history.

Trail Etiquette Signs

Establishing goals and policies sets a common framework for understanding trail rules and regulations. Rights and responsibilities of trail usage should be stated at main trail access points. Once rules and regulations are established, the trail managing agency has a means of enforcement. Local ordinances may be adopted to help enforce trail policies. Penalties such as fines or community service may be imposed in response to non-compliance.

Informational Kiosks

Interpretive signs provide enrichment to the trail user experience, focuses attention on the unique attributes of the local community, and provides educational opportunities. Natural and cultural resources in trail corridors may provide opportunities for interpretation. Including historic signs and photos, boat ramps, and wildlife.

Directional and Shared-Use Path Etiquette Signage

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*

5. On-Street Facility Design Guidelines

A range of bicycle facilities can be applied in various contexts, providing varying levels of protection or separation from automobile traffic.

5.1. Shoulder Bikeways

Design Summary

- Recommended widths (measured from painted edgeline to edge of pavement):
  - 6′ on roadways with posted speed limits > 40 mph
  - 5′ on roadways with posted speed limits < 35 mph
  - 4′ on low-speed, low-volume streets where right-of-way constraints exist
- Can include pavement markings and 'Share the Road" signage.
- See bike lane section for additional guidance for determining if bike lanes are required.

Recommended shoulder bikeway configuration.

Discussion

On streets without adequate space for bike lanes, or on rural roads with a large shoulder, shoulder bikeways can accommodate bicycle travel. Shoulder bikeways are generally used by commuter and long-distance recreational riders, rather than families with children or more inexperienced riders. Parking is generally not allowed along shoulder bikeways.

In many cases, the opportunity to develop a full standard bike lane on a street where it is desirable may be many years. It is possible to stripe the shoulder in lieu of bike lanes if the area is 50 percent of the desirable bike lane width and the outside lane width can be reduced to the AASHTO minimum.

The SD DOT *Road Design Manual* states that, "Where pedestrians and bicyclists are to be accommodated on the shoulders, a minimum usable paved shoulder width, clear of rumble strips, of 4 feet should be used."

Shoulder bikeways are appropriate along wide rural roads where vehicles can avoid passing close to bicyclists.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*
- MUTCD

5.2. Bike Lanes

Design Summary

- Recommended widths (minimum-maximum):
  - Adjacent to on-street parallel parking: 6′ (4′-7′)
  - Adjacent to on-street diagonal parking: 6′ (5′-7′)
  - Without on-street parking, no gutter: 6′ (4′-7′)
  - Without on-street parking, curb & gutter: 6′ (5′-8′)
- Place the bicycle lane symbol marking immediately after an intersection and other locations as needed.
- If the word or symbol pavement markings are used, "Bicycle Lane" signs shall also be used, but the signs need not be adjacent to every symbol to avoid overuse of the signs. (AASHTO guidance)

Bike lanes provide a travel lane for bicyclists that is separated from motor vehicle travel and parking lanes.

Discussion

Designated exclusively for bicycle travel, bike lanes are separated from vehicle travel lanes with striping and also include pavement stencils. Bike lanes are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation.

Bike lanes help to define the road space for bicyclists and motorists, reduce the chance that motorists will stray into the cyclists' path, discourage bicyclists from riding on the sidewalk, and remind motorists that cyclists have a right to the road.

One consideration in designing bike lanes in an urban setting is to ensure that bike lanes and adjacent parking lanes have sufficient width so that cyclists have enough room to avoid a suddenly opened vehicle door.

Bike lane pavement markings in Portland provide character to the roadway.

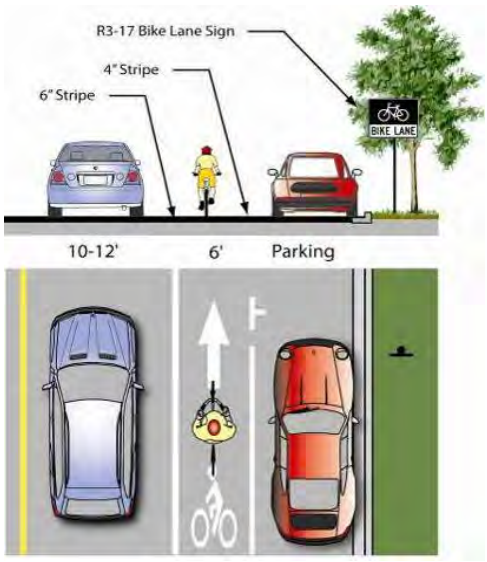
Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*

5.2.1. Bike Lane Adjacent to On-Street Parallel Parking

Design Summary

- Bike Lane Width:
  - 6′ recommended when parking stalls are marked
  - 4′ minimum in constrained locations
  - 7′ maximum (wider lanes may be used by drivers)
- Travel Lane Width
  - 12′ for a shared lane adjacent to a curb face
  - 11′ minimum for a shared bike/parking lane where parking is permitted but not marked on streets without curbs



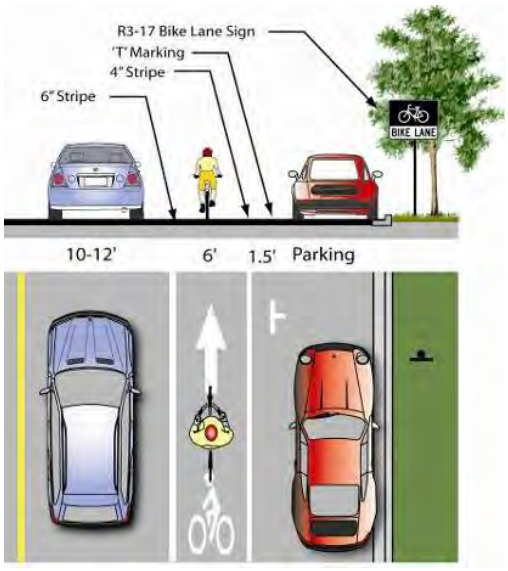
Design for a bike lane adjacent to on-street parallel parking.

Discussion

On bike lanes adjacent to on-street parallel parking, suddenly-opened vehicle doors are a common hazard for bicyclists.

However, wide bike lanes may encourage the cyclist to ride farther to the right to maximize distance from passing traffic. Wide bike lanes may also cause confusion with unloading vehicles in busy areas where parking is typically full. Some alternatives include:

- Installing parking "T's" (top graphic).
- Provide a buffer zone (lower graphic) This design also provides motorists with space to stand outside the bike lane when loading and unloading.



Preferred design if space is available.

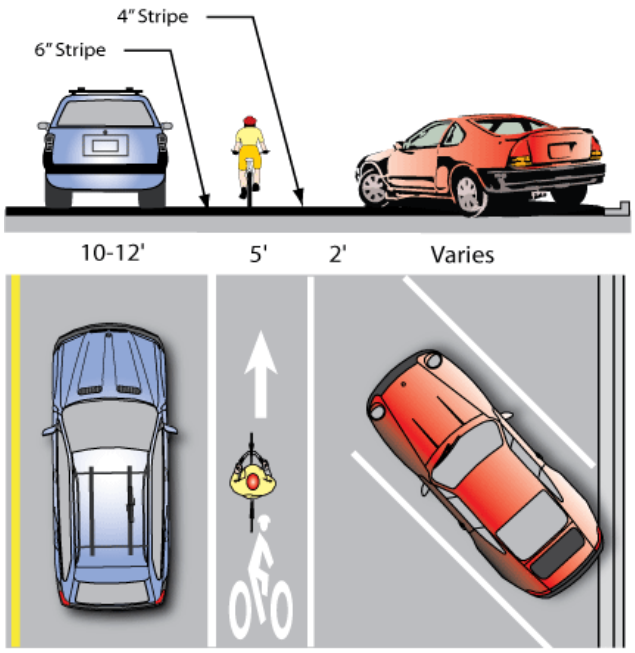
Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*

5.2.2. Bike Lane Adjacent to On-Street Diagonal Parking

Design Summary

- Bike lane width:
  - 5' minimum
  - White 4" stripe separates bike lane from parking bays
  - Parking bays are sufficiently long to accommodate most vehicles (vehicles do not block bike lane)



Recommended Design

Discussion

In areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply. Conventional "head-in" diagonal parking is not recommended in conjunction with high levels of bicycle traffic or with the provision of bike lanes as drivers backing out of conventional diagonal parking spaces have poor visibility of approaching bicyclists.

The use of 'back-in diagonal parking' or 'reverse angled parking' is recommended over head-in diagonal parking. This design addresses issues with diagonal parking and bicycle travel by improving sight distance between drivers and bicyclists and has other benefits to vehicles including: loading and unloading of the trunk occurs at the curb rather than in the street, passengers (including children) are directed by open doors towards the curb, no door conflict with 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.

'Back-in' diagonal parking is safer for cyclists than 'head-in' diagonal parking due to drivers' visibility as they exit the parking spot.

Guidance

- Currently slated for inclusion in the upcoming AASHTO *Guide for the Development of Bicycle Facilities.*

5.2.3. Bike Lane Without On-Street Parking

Design Summary

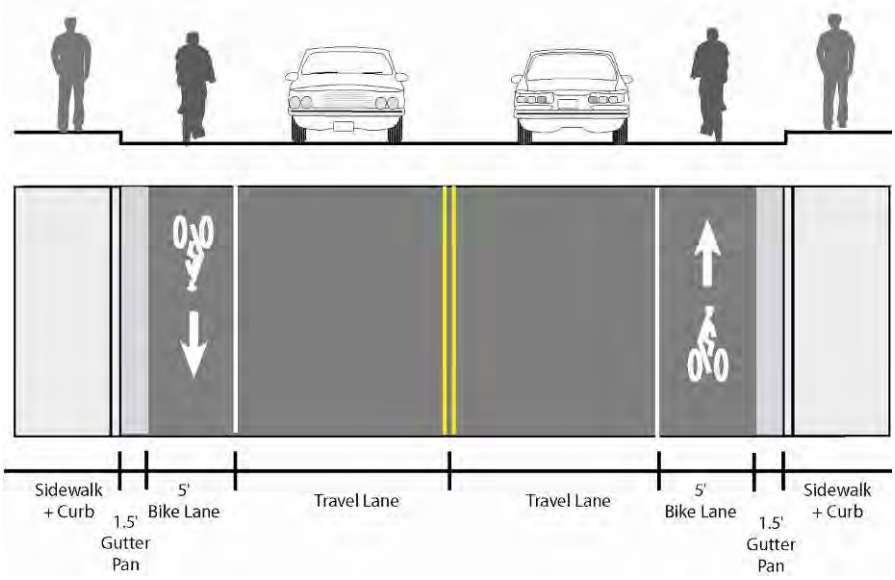
- Bike lane width:
  - 4′ minimum when no curb & gutter is present
  - 5′ minimum when adjacent to curb and gutter (3′ more than the gutter pan width if the gutter pan is wider than 2′)
- Recommended width:
  - 6′ where right-of-way allows
- Maximum width:
  - 8′ Adjacent to arterials with high travel speeds (45 mph+)

Recommended Design

Discussion

Wider bike lanes are desirable in certain circumstances such as on higher speed arterials (45 mph+) where a wider bike lane can increase separation between passing vehicles and cyclists. Wide bike lanes are also appropriate in areas with high bicycle use. A bike lane width of 6 to 8 feet makes it possible for bicyclists to ride side-by-side or pass each other without leaving the bike lane, increasing the capacity of the lane. Appropriate signing and stenciling is important with wide bike lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane.

Guidance



Two Lane Cross-Section with No Parking*

**Bike lanes may be 4′ in width under constrained circumstances*

5.2.4. Retrofitting Existing Streets with Bike Lanes and Shoulder Bikeways

Most major streets in Rapid City pose physical and other constraints to installing bike lanes or shoulder bikeways, requiring street retrofit measures within existing curb-to-curb widths. As a result, many of the recommended measures effectively reallocate existing street width through striping modifications or roadway widening.

Roadway Widening

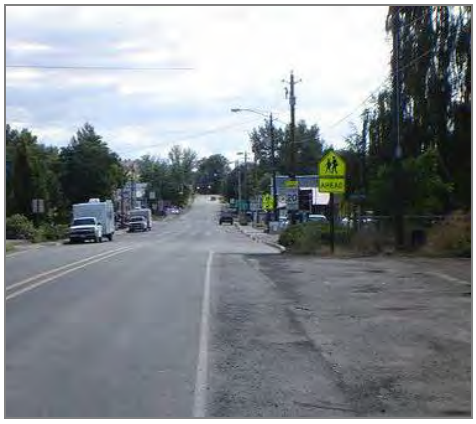
Design Summary

- Bike lane /shoulder bikeway width: see appropriate design guidance.

Discussion

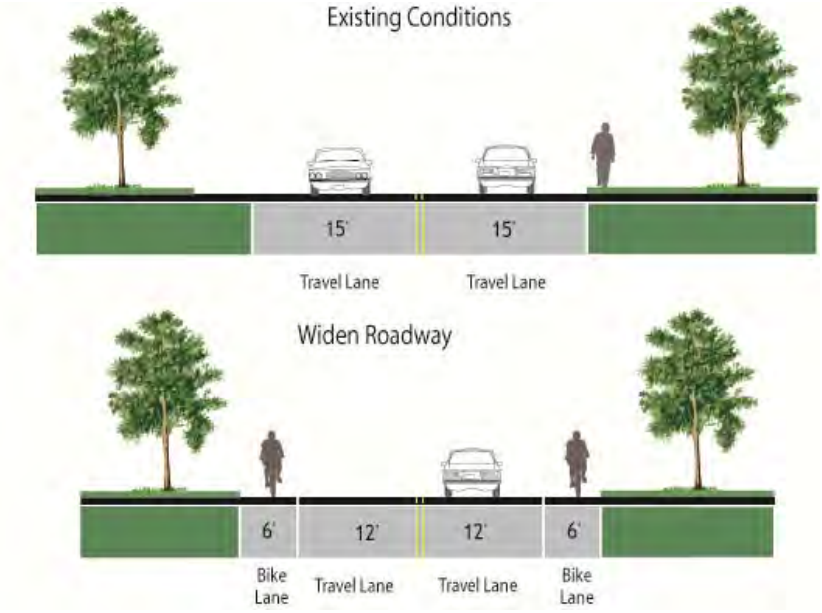
Although street widening incurs higher expenses than re-striping projects, shoulder bikeways could be added to streets currently lacking curbs, gutters and sidewalks without the high costs of major infrastructure reconstruction.

As a long-term measure, Rapid City should find opportunities to add bike lanes or shoulder bikeways to major when streets and bridges are widened for additional auto capacity or as property development necessitates street reconstruction.



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

Guidance



Example of roadway widening to accommodate shoulder bikeways.

5.2.4. Retrofitting Existing Streets with Bike Lanes and Shoulder Bikeways

Lane Narrowing (Road Diet 1)

Design Summary

- Bike lane width: see bike lane design guidance.
- Vehicle lane widths: before: 12 to 15 feet; after: 10 to 11 feet.

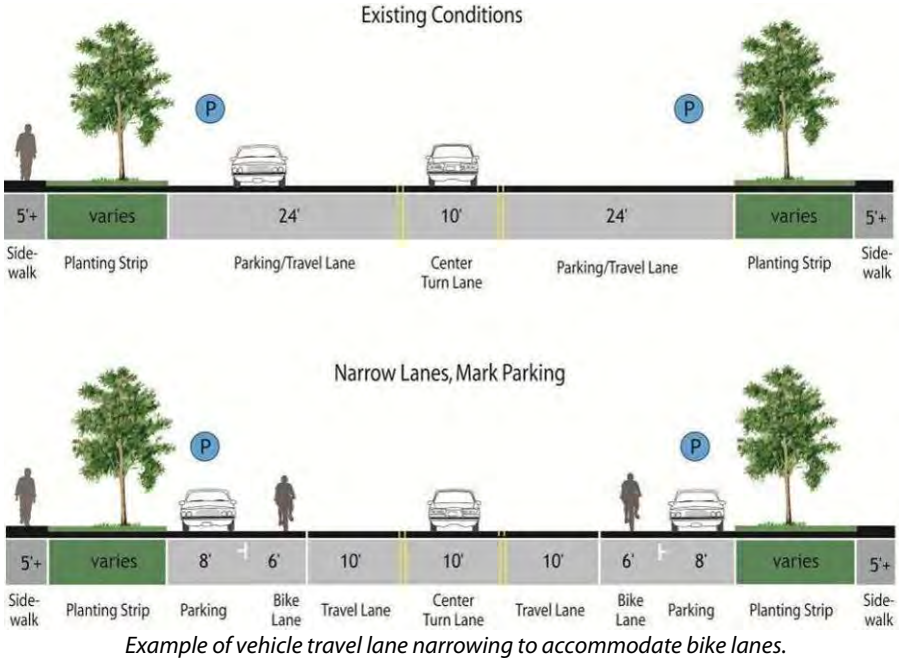
This street previously had 13' lanes, which were narrowed to accommodate bike lanes without removing a lane.

Discussion

Also called a 'Road Diet', lane narrowing utilizes roadway space that exceeds minimum standards to create the needed space to provide bike lanes. Many roadways in the Rapid City area have existing 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.

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.

Guidance



Example of vehicle travel lane narrowing to accommodate bike lanes.

5.2.4. Retrofitting Existing Streets with Bike Lanes and Shoulder Bikeways

Lane Reconfiguration (Road Diet 2)

Design Summary

- Bike lane width: see bike lane design guidance.
- Vehicle lane width: depends on project. No narrowing may be needed if a lane is removed.

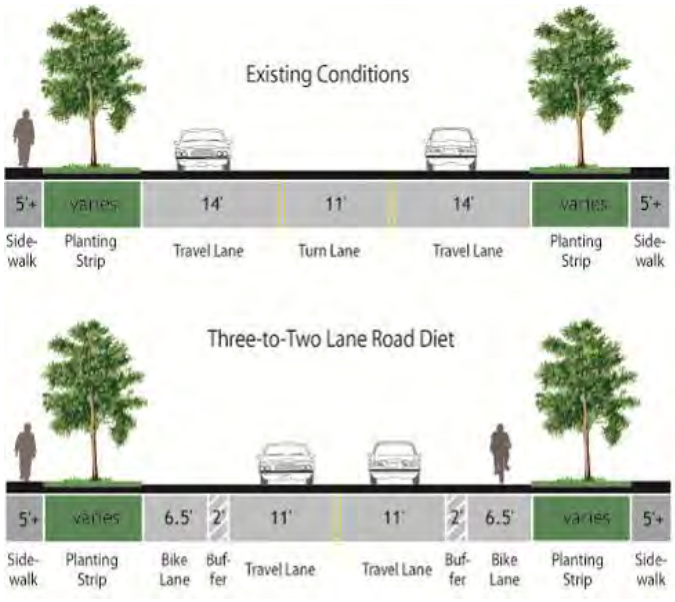
This road was re-striped to convert four vehicle travel lanes into three travel lanes with bike lanes.

Discussion

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

This treatment is currently slated for inclusion in the upcoming AASHTO *Guide for the Development of Bicycle Facilities.*

Guidance



Example of vehicle travel lane reconfiguration to accommodate bike lanes.

5.2.4. Retrofitting Existing Streets with Bike Lanes and Shoulder Bikeways

Parking Reduction (Road Diet 3)

Design Summary

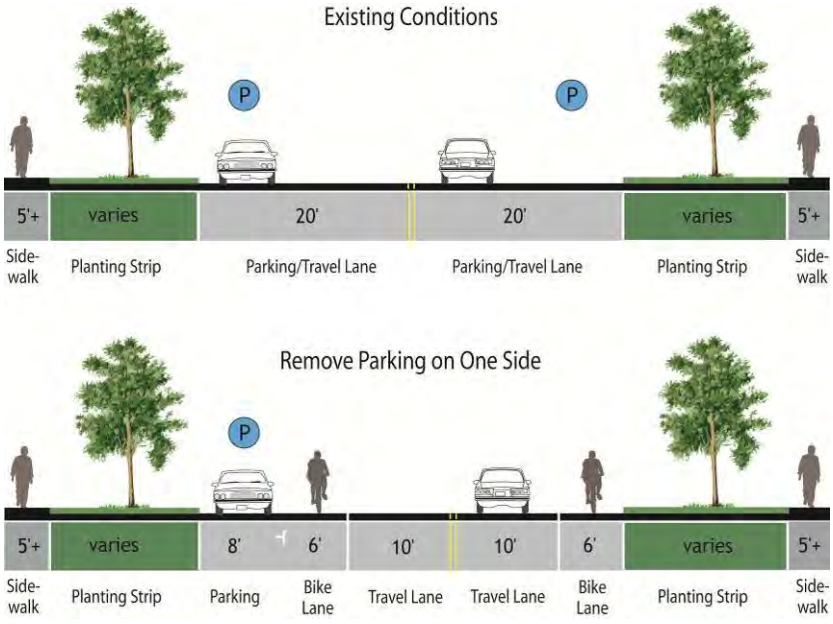
- Bike lane width: see bike lane design guidance.
- Vehicle lane width: depends on project. No narrowing may be needed depending on the width of the parking lane to be removed.

Some streets may not require parking on both sides.

Discussion

Bike lanes could 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 instance, parking may be needed on only one side of a street (as shown below and at right). Eliminating or reducing on-street parking also improves sight distance for cyclists in bike lanes and for motorists on approaching side streets and driveways. 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.

Guidance



Example of parking removal to accommodate bike lanes

5.2.5. Bike Lanes at Intersections

Bike Lanes With Right Turn Pockets

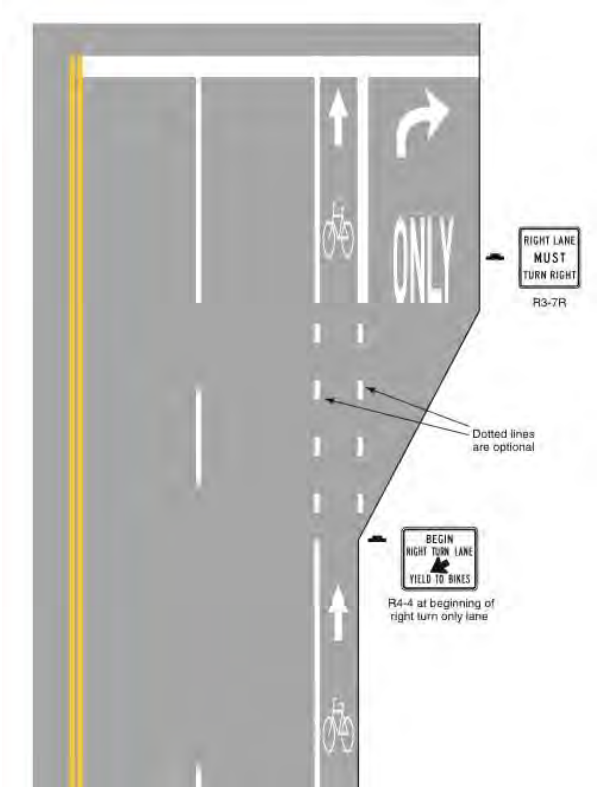
Design Summary

- Bike lane width:continue existing bike lane width; standard width of 5′ to 6′ or 4′ in constrained locations.

Discussion

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 drop the bike lane entirely approaching the right-turn lane. The design (right) illustrates a bike lane pocket, with signage indicating that motorists should yield to bicyclists through the conflict area. While the dashed lines in this area are currently an optional treatment, it is recommended that they be an integral part of any intersection with this treatment in Rapid City.

Dropping the bike lane is not recommended, and should only be done when a bike lane cannot be accommodated at the intersection.



Recommended Design

Guidance

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

Continuing a bike lane straight while providing a right-turn pocket reduces bicycle/motor vehicle conflicts

5.2.5. Bike Lanes at Intersections

Shared Bicycle/Right Turn Lane

Design Summary

- Width:
  - o Shared turn lane – min. 12' width
  - o Bike Lane pocket – min. 4'-5' preferred

Discussion

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

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

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).

Advantages of the shared bicycle/right turn lane:

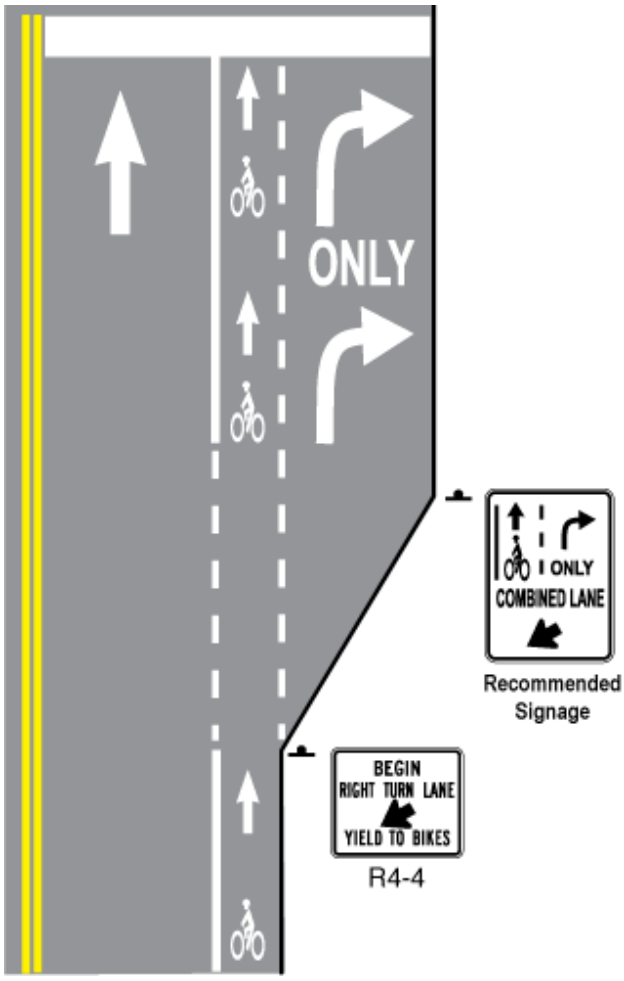
- Aids in correct positioning of cyclists at intersections with a dedicated right turn lane without adequate space for a dedicated bike lane.
- Encourages motorists to yield to bicyclists when using the right turn lane.
- Reduces motor vehicle speed within the right turn lane.

Disadvantages/potential hazards:

- 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.

Guidance

- Upcoming AASHTO *Guide For the Development of Bicycle Facilities*.
- Implemented in San Francisco, CA and Eugene, OR.



Recommended Design

Shared bike-right turn lanes require warning signage as well as pavement markings

5.2.5. Bike Lanes at Intersections

Bike Box

Design Summary

- Bike box dimensions: 14' deep to allow for bicycle positioning.
- Use appropriate signs as recommended by the MUTCD. Signs should prohibit 'right turn on red' and to indicate where the motorist must stop.

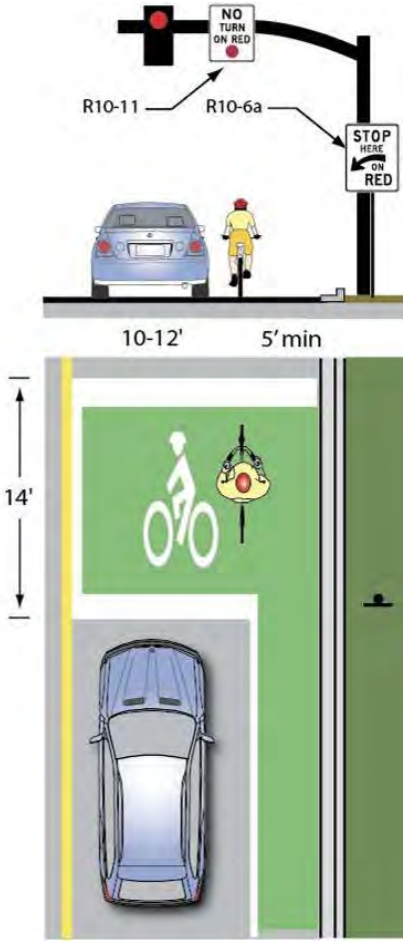
Discussion

A bike box is generally a right angle extension of a bike lane at the head of a signalized intersection. The bike box allows bicyclists to move to the front of the traffic queue on a red light and proceed first when that signal turns green. Motor vehicles must stop behind the white stop line at the rear of the bike box.

Bike boxes can be combined with dashed lines through the intersection for green light situations to remind right-turning motorists to be aware of bicyclists traveling straight, similar to a colored bike lane treatment. Bike boxes can be installed with striping only or with colored treatments to increase visibility. Use of coloration substantially increases costs of maintenance over uncolored (striping, bicycle symbol, and text only) treatments.

Bike boxes should be located at signalized intersections only, and right turns on red should be prohibited. Bike boxes should be used locations that have a large volume of cyclists, and are often utilized in central areas where traffic is usually moving slowly. Reducing right turns on red improves safety for cyclists and does not significantly impede motor vehicle travel.

On roadways with one travel lane in each direction, the bike box also facilitates left turning movements for cyclists.



Recommended design of a bike box.

Bike boxes have been installed at several intersections in Portland, OR where right-turning motorists conflict with through bicyclists

Guidance

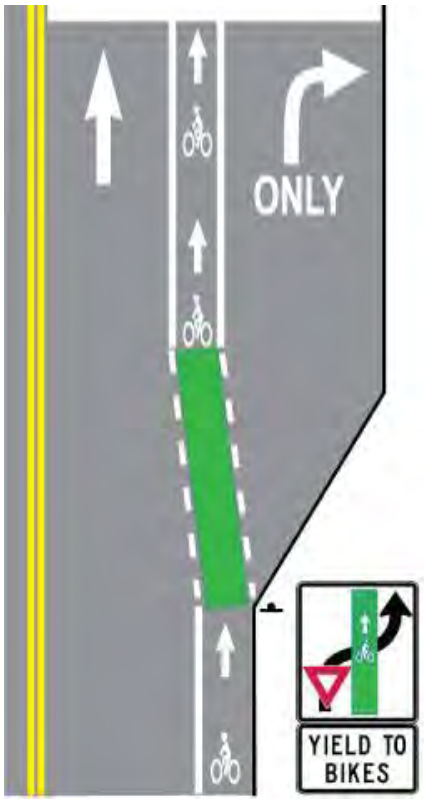
- Evaluation of Innovative Bike-Box Application in Eugene, Oregon, Author: Hunter, W.W., 2000

5.2.6. Innovative Bike Lane Treatments

Colored Bike Lanes

Design Summary

- Bike lane pocket – min. 4'-5' preferred.
- Use colored pavement through entire merge area.
- Dash lines to indicate that automobiles are crossing the bike lane.
- Provide signs reminding drivers to yield to cyclists in the bike lane.



Recommended colored bike box design.

Discussion

Cyclists are especially vulnerable at locations where the volume of conflicting vehicle traffic is high, and where the vehicle/bicycle conflict area is long. Some cities are using colored bike lanes to guide cyclists through major vehicle/bicycle conflict points. These conflict areas are locations where motorists and cyclists must cross each other's path (e.g., at intersections or merge areas). Colored bike lanes typically extend through the entire bicycle/vehicle conflict zone (e.g., through the entire intersection, or through the transition zone where motorists cross a bike lane to enter a dedicated right turn lane.

There are three colors commonly used in bike lanes: blue, green, and red. Several cities initially used blue; however, this color is associated with amenities for handicapped drivers or pedestrians. Green is the color recommended for use in Rapid City.

Although colored bike lanes are not an official standard at this time, they continue to be successfully used in cities, including Portland, OR, Philadelphia, PA, Cambridge, MA, Toronto, Ontario, Vancouver, BC and Tempe, AZ. This treatment typically includes signage alerting motorists of vehicle/ bicycle conflict points. Portland's Blue Bike Lane report found that significantly more motorists yielded to bicyclists and slowed or stopped before entering the conflict area after the application of the colored pavement.

Portland, OR has implemented blue bike lanes and has since changed them to green.

Guidance

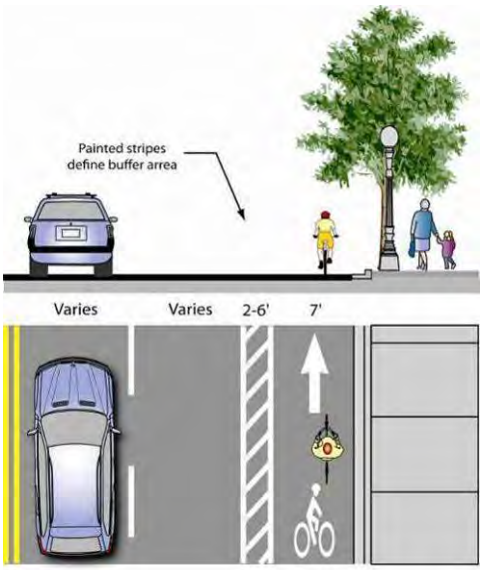
- Portland Office of Transportation (1999). Portland's Blue Bike Lanes: Improved Safety through Enhanced Visibility. *Available: www.portlandonline.com/shared/cfm/image.cfm?id=58842*

5.2.6. Innovative Bike Lane Treatments

Buffered Bike Lanes

Design Summary

- Width: 6′ recommended
- Minimum of 2′ buffer area



Recommended buffered bike lane design.

Discussion

Bike lanes on high-volume or high-speed roadways can be dangerous or uncomfortable for cyclists, as automobiles pass or are parked too close to bicyclists. Buffered bike lanes are designed to increase the space between the bike lanes and the travel lane or parked cars.

This treatment is appropriate on bike lanes with high automobile traffic volumes and speed, bike lanes adjacent to parked cars, and bike lanes with a high volume of truck or oversized vehicle traffic. Frequency of right turns by motor vehicles at major intersections should determine whether continuous or truncated buffer striping should be used approaching the intersection.

Advantages of buffered bike lanes:

- Provides cushion of space to mitigate friction with motor vehicles on streets with narrow bike lanes.
- Provides space for cyclists to pass one another without encroaching into the travel lane.
- Provides space for cyclists to avoid potential obstacles in the bike lanes, including drainage inlets, manholes, trash cans or debris.
- Parking side buffer provides cyclists with space to avoid the 'door zone' of parked cars.
- Provides motorists greater shy distances from cyclists in the bike lane.

Buffered bike lanes protect cyclists from fast-moving traffic

Disadvantages / potential hazards:

- Requires additional roadway space.
- Requires additional maintenance for the buffer striping.
- Frequency of parking turnover should be considered prior to installing buffered bike lanes.
- Increases the debris collection in the bike lane.

Guidance

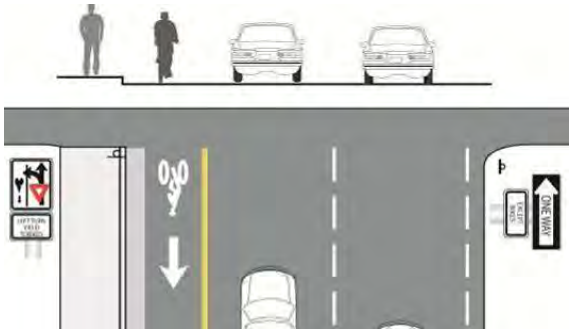
- City of Portland, OR *Bikeway Design Best Practices for the 2030 Bicycle Master Plan*.
- Currently used in Brussels & Bruges, Belgium, Budapest, Hungary, London, UK, Seattle, WA, San Francisco, CA, and New York, NY.

5.2.6. Innovative Bike Lane Treatments

Contraflow Bike Lane

Design Summary

- Width: 5.0 feet to 6.5 feet and marked with a solid double yellow line and appropriate signage.
- Bike lane markings should be clearly visible to ensure that contraflow lane is exclusively for bicycles.
- Coloration should be considered on the bike lane.



Recommended contraflow bike lane design.

Discussion

Contraflow bike lanes provide bi-directional bicycle access along a roadway that is one-way for automobile traffic. This treatment can provide direct access and connectivity for bicyclists, avoiding detours and reducing travel distances for cyclists.

Advantages of contraflow bike lanes:

- Provides direct access and connectivity for bicycles traveling in both directions.
- Influences motorist choice of routes without limiting bicycle traffic.
- Cyclists do not have to make detours as a result of one-way traffic.

Disadvantages / potential hazards

- Parking should not be provided on the far side of the contraflow bike lane.
- Space requirements may require reallocation of roadway space from parking or travel lanes.
- The lane could be illegally used by motorists for loading or parking.
- Conversion from a two-way street requires elimination of one direction of automobile traffic
- Public outreach should be conducted prior to implementation of this treatment.

This contraflow bike lane in Portland, OR (left) provides a key connection along a narrow one-way street.

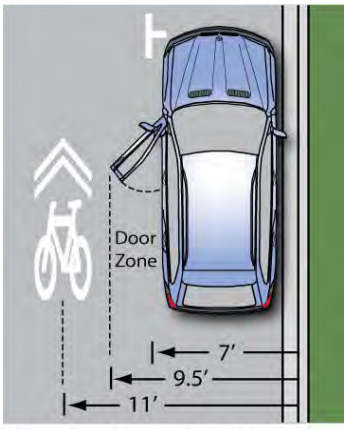
Guidance

- *Wisconsin Bicycle Facility Design Handbook.*
- City of Portland, OR *Bikeway Design Best Practices for the 2030 Bicycle Master Plan.*
- Currently used in Olympia and Seattle, WA; Madison, WI, Cambridge, MA, San Francisco, CA, and Portland, OR.

5.3. Shared Lane Markings

Design Summary

- Place at least 11′ from face of curb (or shoulder edge) with on-street parking.
- Place at least 4′ from face of curb (or shoulder edge) without on-street parking.
- Place every 100-200 feet.
- Use on roadways with posted speeds of 35 mph or below.



Shared lane marking placement guidance for streets with on-street parking.

Discussion

Shared lane markings are high-visibility pavement markings that help position bicyclists within the travel lane. These markings are often used on streets where dedicated bike lanes are desirable but are not possible due to physical or other constraints.

Shared lane markings are placed strategically in the travel lane to alert motorists of bicycle traffic, while also encouraging cyclists to ride at an appropriate distance from the "door zone" of adjacent parked cars. These pavement markings have been successfully used in many small and large communities throughout the U.S. Shared lane markings made of thermoplastic tend to last longer than those using traditional paint.

This marking has been included in the 2009 update of the MUTCD, which allows shared lane markings to be used in locations with and without on-street parking. Placing shared lane markings between vehicle tire tracks (if possible) will increase the life of the markings.

Shared lane markings can be used on minor and major roadways.

Guidance

- MUTCD

5.4. Signed Shared Roadways

Design Summary

- Any street without specific bicycle facilities, where bicycling is permitted.
- Can be signed connections, often to trails or other major destinations.

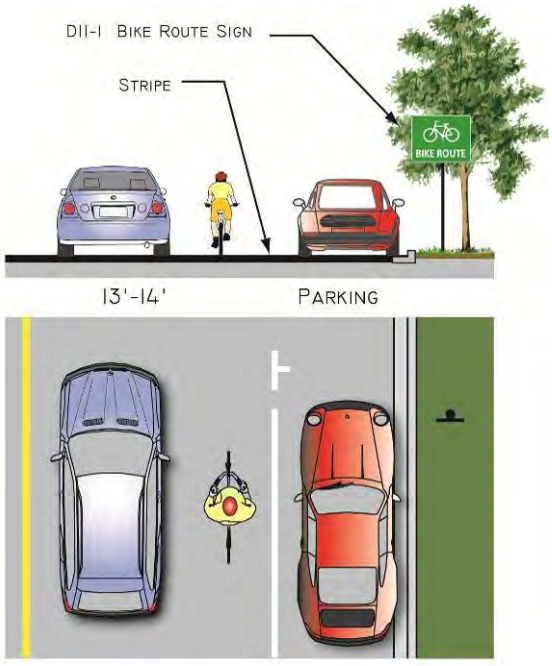
Discussion

A treatment appropriate for commuter riders and those accessing a trail, shared roadways can provide a key connection. Shared roadways are indicated exclusively by signs and provide key connections to destinations and trails where providing additional separation is not possible.

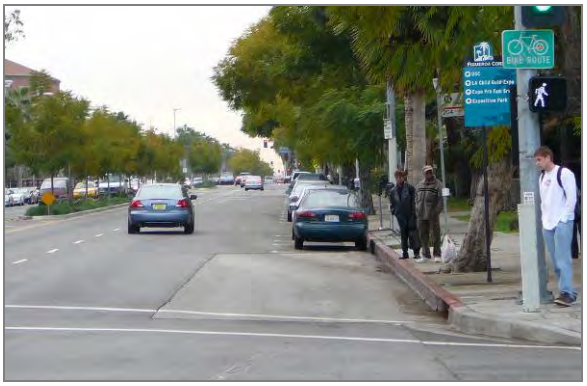
Roadways appropriate for shared roadways often have a centerline stripe only, and no designated shoulders. Bicyclists are forced to share a travel lane with automobiles. This type of facility can be developed on a rural roadway without curb and gutter. It can also be used on an urban road where traffic speeds and volumes are low (photo), although shared lane markings in addition to signage may be more appropriate in these locations.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*
- MUTCD



Shared roadway recommended configuration.



This bike route in Los Angeles provides a wide outside lane adjacent to on-street parking.

Bike Route signs are used to indicate the street is designated for bicycle use.

5.5. Bikeway Intersection Treatments

5.5.1. Bikeway Intersection Treatments at Minor Unsignalized Intersections

Design Summary

- Reduce bicycle travel time by eliminating unnecessary stops and improving intersection crossings.

Discussion

Stop Sign on Cross-Street

Unmarked intersections can be dangerous for bicyclists because cross-traffic may not be watching for cyclists. Stop signs minimize bicycle and cross-vehicle conflicts by identifying which street has the right-of-way. However, placing stop signs at all intersections along bikeways on local street may be unwarranted as a traffic control device (see MUTCD guidance).

Stop signs effectively minimize conflicts along bikeways on local streets.

Bicycle Forward Stop Bar

A second stop bar for cyclists placed closer to the centerline of the cross street than the first stop bar increases the visibility of cyclists waiting to cross a street. This treatment is typically used with other crossing treatments (i.e. curb extension) to encourage cyclists to take full advantage of crossing design. They are appropriate at unsignalized crossings where fewer than 25 percent of motorists make a right turn movement.

Bicycle forward stop bars encourage cyclists to wait where they are more visible.

Medians/Refuge Islands

At uncontrolled intersections at major streets, a crossing island can be provided to allow cyclists to cross one direction of traffic at a time when gaps in traffic allow. The bicycle crossing island should be at least 8' wide to be used as the bike refuge area. Narrower medians can accommodate bikes if the holding area is at an acute angle to the major roadway. Crossing islands can be placed in the middle of the intersection, prohibiting left and through vehicle movements.

Medians should provide space for a bicyclist to wait.

Guidance

- AASHTO *Guide for the Development of Bicycle Facilities*
- MUTCD

5.6. Cycle Tracks

Design Summary

- Use for one-direction bicycle travel (both sides of street).
- 7′ minimum to allow passing.
- 12′minimum for two-way facility.

Discussion

A cycle track is an exclusive bicycle facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. Cycle tracks can be either one-way or two-way, on one or both sides of a street, and are separated from vehicles and pedestrians by pavement markings or coloring, bollards, curbs/medians or a combination of these elements. Cycle tracks provide:

- Increased comfort for bicyclists.
- Greater clarity about expected behavior.
- Fewer conflicts between bicycles and parked cars as cyclists ride inside the parking lane.
- Space to reduce the danger of "car dooring."

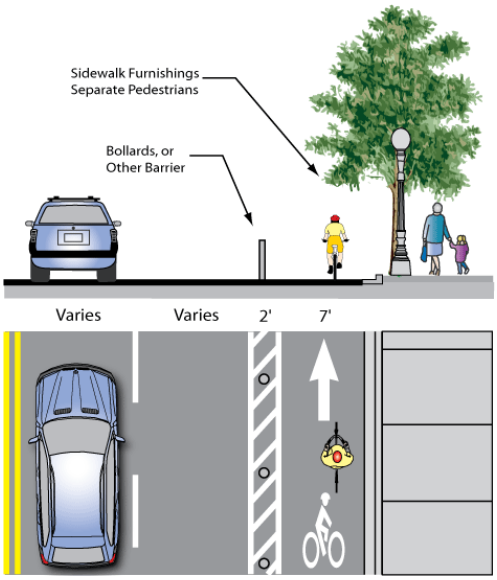
Danish research has shown that cycle tracks can increase bicycle ridership 18-20%, compared with the 5-7% increase associated with bike lanes. However, disadvantages of cycle tracks include:

- Increased vulnerability at intersections.
- Regular street sweeping trucks cannot maintain the cycle track; requires smaller sweepers.
- Conflicts with pedestrians and bus passengers can occur, particularly on cycle tracks that are un-differentiated from the sidewalk or that are between the sidewalk and a transit stop.

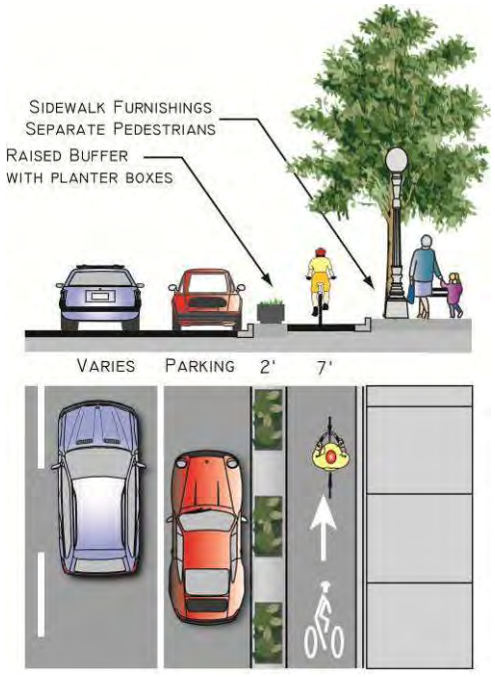
While recently implemented in the US, cycle tracks have been used in European countries for several decades. The cycle track design guidance following was developed using European experience applied to American situations.

Guidance

- *Cycle Tracks: Lessons Learned*, Alta Planning + Design (2009)



Recommended cycle track design without parking, using striping and flexible bollard separation.



Recommended design with on-street parking, using a raised buffer with planter boxes for separation.

6. Bicycle Parking

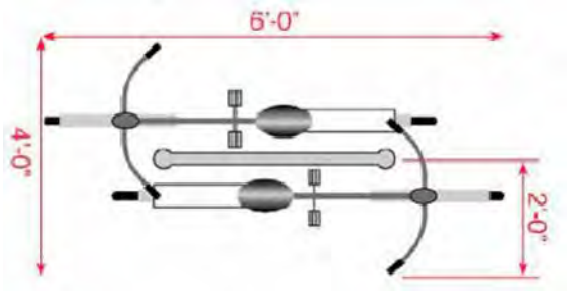
Bicycle parking can be broadly defined as either short-term or long-term parking:

- Short-term parking: parking meant to accommodate visitors, customers, messengers and others expected to depart within two hours; requires approved standard rack, appropriate location and placement, and weather protection.
- Long-term parking: parking meant to accommodate employees, students, residents, commuters, and others expected to park more than two hours. This parking is to be provided in a secure, weather-protected manner and location.

6.1. Short-Term Bicycle Parking

Design Summary

- Location:
  - 50′ maximum distance from main building entrance.
  - 2′ minimum from the curb face to avoid 'dooring.'
  - Avoid fire zones, loading zones, bus zones, etc.
  - Location should be highly visible from adjacent bicycle routes and pedestrian traffic.
- Provide a minimum clear distance of 5′-6′ between the bicycle rack and the property line to allow ample pedestrian movement.
- If two racks are to be installed parallel to each other, a minimum of 2.5′ should be provided between the racks.



Standard bicycle rack

Discussion

Bicycle racks should be located close to the entrances of key destinations such as shops or shopping centres. They are generally appropriate for commercial and retail areas, office buildings, healthcare and recreational facilities, and institutional developments such as libraries and universities.

Guidance

- Association of Bicycle and Pedestrian Planners, *Bicycle Parking Design Guidelines.* (2010).

6.2. Long-Term Bicycle Parking

Design Summary

- Place in close proximity to building entrances or transit exchanges, or on the first level of a parking garage.
- Provide door locking mechanisms and systems.
- A flat, level site is needed; concrete surfaces preferred.
- Enclosure must be rigid.
- Transparent panels are available on some models to allow surveillance of locker contents.
- Integrated solar panels have been added to certain models for recharging electric bicycles.
- Minimum dimensions: width (opening) 2.5'; height 6'; depth 4'.
- Stackable models can double bicycle parking capacity.

Bike lockers at a transit station.

Discussion

Although bicycle lockers may be more expensive to install, they can make the difference for commuters who are deciding whether or not to cycle. Bicycle lockers are large metal or plastic stand-alone boxes and offer the highest level of bicycle parking security available. Some lockers allow access to two users - a partition separating the two bicycles can help ensure users feel their bike is secure. Lockers can also be stacked, reducing the footprint of the area, although that makes them more difficult to use.

Security requirements may require that locker contents be visible, introducing a tradeoff between security and perceived safety. Though these measures are designed to increase station security, bicyclists may perceive the contents of their locker to be less safe if they are visible and will be more reluctant to use them. Providing visibility into the locker also reduces unintended uses, such as use as homeless shelters, trash receptacles, or storage areas. Requiring that users procure a key or code to use the locker also reduces these unintended uses.

Lockers available for one-time use have the advantage of serving multiple users a week. Monthly rentals, by contrast, ensure renters that their own personal locker will always be available. Bicycle lockers are most appropriate:

- Where demand is generally oriented towards long-term parking.
- At transit exchanges and park-and-rides to help encourage multi-modal travel.
- Medium-high density employment and commercial areas and universities.
- Where additional security is required and other forms of covered storage are not possible.

Guidance

- Association of Bicycle and Pedestrian Planners, *Bicycle Parking Design Guidelines.* (2010).

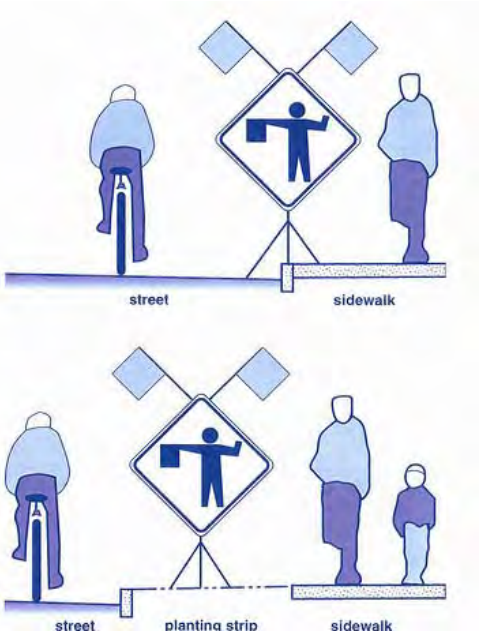
7. Bikeway Maintenance

This section presents guidelines for incorporating bicycle facilities into construction, maintenance and repair activities. The guidelines are a menu of options and considerations for maintenance activities, and not strict guidelines.

7.1. Street Construction and Repair

Design Summary

- Do not lead bicyclists into conflicts with work site vehicles, equipment, moving vehicles, open trenches or temporary construction signage.
- Where possible, re-create a bike lane (if one exists) to the left of the construction zone, or provide signs warning motorists to expect cyclists in the roadway.
- Place construction signage in a location that does not obstruct the path of bicyclists or pedestrians (see right).
- Require that steel plates do not have a vertical edge greater than ¼" without an asphalt lip.



Recommended construction sign placement (source: Oregon Bicycle and Pedestrian Plan)

Discussion

Safety of all roadway users should be considered during road construction and repair. Wherever bicycles are allowed, measures should be taken to provide for the continuity of a bicyclist's trip through a work zone area. Only in rare cases should pedestrians and bicyclists be detoured to another street when travel vehicle lanes remain open.

Steel plates are commonly used during construction and the plates' lip can puncture a bicycle tire and/or cause a cyclist to lose control. These plates can be dangerously slippery, particularly when wet. Non-skid materials are preferred.

Guidance

- ODOT Bicycle and Pedestrian Plan
- MUTCD

7.2. Bikeway Maintenance

Design Summary

- Establish a seasonal sweeping schedule that prioritizes roadways with major bicycle routes.
- On all bikeways, use the smallest possible chip for chip sealing bike lanes and shoulders.
- If the condition of the bike lane is satisfactory, consider chip sealing only the travel lanes.
- Maintain a smooth surface on all bikeways that is free of potholes.
- 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.
- Check regulatory and wayfinding signs along bikeways for signs of vandalism, graffiti, or normal wear and replace signs as needed.
- Ensure that shoulder plants do not hang into or impede passage along bikeways.

Recommended Walkway and Bikeway Maintenance Activities

Maintenance Activity	Frequency
Inspections	Seasonal –beginning and end of summer
Pavement sweeping	As needed, weekly in fall
Pavement sealing	5 - 15 years
Pothole repair	1 month after report
Culvert and drainage grate inspection	Before winter and after major storms
Pavement markings replacement	1 – 3 years
Signage replacement	1 – 3 years
Shoulder plant trimming (weeds, trees, brambles)	Twice a year; middle of growing season / early fall
Tree and shrub trimming	1 – 3 years
Major damage response (washouts, flooding)	As soon as possible

Discussion

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, 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.

Bicycles are 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 after trenches and other holes are filled can lead to uneven settlement, which affects the roadway surface nearest the curb where bicycles travel.

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

Bikeways can become inaccessible due to overgrown vegetation. All landscaping needs to be designed and maintained to ensure compatibility with the use of the bikeways. After a flood or major storm, bikeways should be checked along with other roads, and fallen trees or other debris should be removed promptly.

Guidance

- ODOT Bicycle and Pedestrian Plan
- MUTCD

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Appendix G. Recommended Bicycle Parking Guidelines

Table 45. Recommended Parking Requirements, Residential Land Uses

Type of Activity	Long-Term Bicycle Parking Requirement	Short-Term Bicycle Parking Requirement
Single family dwelling	No spaces required	No spaces required
Multifamily dwelling		
a) With private garage for each unit*	No spaces required	0.5 spaces for each bedroom
b) Without private garage for each unit	0.5 spaces for each bedroom, minimum 2 spaces	0.5 spaces for each bedroom, min 2 spaces
c) Senior housing	Minimum 2 spaces	Min 2 spaces

* A private locked storage unit may be considered as a private garage if a bicycle can fit into it.

Table 46. Recommended Parking Requirements, Civic/Cultural Land Uses

Type of Activity	Long-Term Bicycle Parking Requirement	Short-Term Bicycle Parking Requirement
Non-assembly cultural (library, government buildings, etc.)	1 space for each 10 employees, min 2 spaces	1 space for each 10,000 s.f. of floor area, min 2 spaces
Assembly (church, theater, stadium, park, beach, etc.)	1 space for each 20 employees, min 2 spaces	Spaces for 2% of min expected daily attendance
Health care/hospital	1 space for each 20 employees or 1 space for each 70,000 s.f. of floor area, whichever is greater, min 2 spaces	1 space for each 20,000 s.f. of floor area, min 2 spaces
Education		
a) Public, parochial, and private day-care centers for 15 or more children	1 space for each 20 employees, min 2 spaces	1 space for each 20 students of planned capacity, min 2 spaces
b) Public, parochial, and private nursery schools, kindergartens, and elementary schools (1-3)	1 space for each 10 employees, min 2 spaces	1 space for each 20 students of planned capacity, min 2 spaces
c) Public, parochial, and elementary (4-6) public and high schools	1 space for each 10 employees, plus 1 space for each 20 students or planned capacity, min 2 spaces	1 space for each 20 students of planned capacity, min 2 spaces
d) Colleges and universities	1 space for each 10 employees, plus 1 space for each 10 students or planned capacity; or 1 space for each 20,000 s.f. of floor area, whichever is greater	1 space for each 20 students of planned capacity, min 2 spaces
Rail/bus terminals and stations/airports	Spaces for 5% projected a.m. peak period daily ridership	Spaces for 1.5% a.m. peak period daily ridership

Table 47. Recommended Parking Requirements, Commercial Land Uses

Type of Activity	Long-Term Bicycle Parking Requirement	Short-Term Bicycle Parking Requirement
Retail		
General food sales or grocery	1 space for each 12,000 s.f. of floor area, min 2 spaces	1 space for each 2,000 s.f. of floor area, min 2 spaces
General retail	1 space for each 12,000 s.f. of floor area, min 2 spaces	1 space for each 5,000 s.f. of floor area, min 2 spaces
Office	1 space for each 1,000 s.f. of floor area, min 2 spaces	1 space for each 20,000 s.f. of floor area, min 2 spaces
Auto Related		
Automotive sales, rental & delivery, automotive servicing/repair, cleaning	1 space for each 12,000 s.f. of floor area, min 2 spaces	1 space for each 20,000 s.f. of floor area, min 2 spaces
Off-street public parking lots/garages without charge or on a fee basis	1 space for each 20 automobile spaces, min 2 spaces – unattended surface parking lots excepted	Min 6 spaces or 1 per 20 auto spaces – unattended surface parking lots excepted

Table 48. Recommended Parking Requirements, Industrial Land Uses

Type of Activity	Long-Term Bicycle Parking Requirement	Short-Term Bicycle Parking Requirement
Manufacturing and production	1 space for each 15,000 s.f. of floor area, min 2 spaces	Number of spaces to be prescribed by the Director of City Planning. Consider min 2 spaces at each public building entrance

Appendix H. Education and Encouragement Programs

Apply to Become a Bicycle Friendly Community	
Target audience	League of American Bicyclists
Primary agency	City of Rapid City
Potential partners	South Dakota Bicycle Coalition
Purpose	Highlight bicycling initiatives and get national recognition for implementing the Bicycle and Pedestrian Master Plan
Time frame	One-time, with regular updates; can happen at any time
Program information	http://www.bikeleague.org/programs/bicyclefriendlyamerica/

The League of American Bicyclists has a well-respected Bicycle-Friendly Communities award program. Communities fill out a detailed application that covers bike-related facilities, plans, education efforts, promotion initiatives, and evaluation work that has been completed by the jurisdiction. The award is designed to recognize progress that has been made, as well as assist communities in identifying priority projects to improve bicycling conditions. Receiving the award is a media-worthy event, and may give elected officials the opportunity to receive media coverage for the positive work they are doing. Awards are granted for Bronze, Silver, Gold and Platinum bicycle-friendly communities.

It is recommended that Rapid City apply for bicycle-friendly community status after several of the bicycle improvements recommended in this Bicycle and Pedestrian Master Plan have been implemented. City staff should obtain a copy of the application and review it annually to determine when Rapid City is ready to apply. The League may also be able to assist with a readiness assessment.

Convene a Permanent Bicycle Advisory Committee

Target audience	Citizen advocates
Primary agency	City of Rapid City
Potential partners	South Dakota Bicycle Coalition
Purpose	Advise City on bicycle and pedestrian issues
Time frame	Ongoing
Sample program	Beaver Creek, OH: http://ci.beavercreek.oh.us/boards-commissions/bikeway-advisory/

Many states, Metropolitan Planning Organizations, and cities have an official Pedestrian and/or Bicycle Advisory Committee consisting of citizen volunteers, appointed by City Council, to advise the city on pedestrian and bicycling issues. An advisory committee establishes the area's commitment to making bicycling and walking safer and more desirable, and has the potential to assist the Rapid City area in getting funding for bicycle and pedestrian projects. Establishing a committee is also desirable for receiving Bicycle Friendly community designation.

The Rapid City area has had many advisory groups in the past, including the Bike Walk Run Committee and the Pedestrians Avoiding Traffic Hazards (PATH) committee. The Bicycle and Pedestrian Advisory Committee (BPAC) should be composed of representatives from all bicycle and pedestrian stakeholder groups, including but not limited to road bicyclists, walkers, runners/joggers, and mountain bicyclists.

The charges of the BPAC should include some or all of the following:

- Review and provide citizen input on capital project planning and design as it affects bicycling (e.g., corridor plans, street improvement projects, signing or signal projects, and parking facilities)
- Review and comment on changes to zoning, development code, comprehensive plans, and other long-term planning and policy documents
- Participate in the development, implementation and evaluation of bicycle and pedestrian master plans and bikeway and pedestrian facility standards
- Provide a formal liaison between local government, staff, and the public
- Develop and monitor goals and indices related to bicycling in the jurisdiction
- Promote bicycling, including bicycle safety and education

Because BPAC members are volunteers, it is essential to have strong staffing supporting the committee in order for it to be successful. An agency staff person should be formally assigned to the BPAC and should take charge of managing the application process, managing agendas and minutes, scheduling meetings, bringing agency issues to the BPAC, and reporting back to the agency and governing body about the BPAC's recommendations and findings.

Develop and Launch a Bicycle/Pedestrian Safety Awareness Media Campaign	
Target audience	General public
Primary agency	City of Rapid City
Potential partners	Local jurisdictions, local bicycling and walking groups
Purpose	Create awareness of bicycling and walking; promote safety
Time frame	Late spring or early summer, or in conjunction with Bike to Work Day or back to school
Sample program	Sonoma County (CA) Transit: http://www.sctransit.com/bikesafe/bikes.htm

A marketing campaign that highlights bicyclist and pedestrian safety is an important part of creating awareness of bicycling and walking in Rapid City. This type of high-profile campaign is an effective way to reach the general public, highlight bicycling and walking as viable forms of transportation, and reinforce safety for all road users.

Figure 63. In order to be most effective, a safety campaign should be simple, yet memorable.

A well-produced safety campaign will be memorable and effective. One good example is the Sonoma County Transit "You've got a friend who bikes!" campaign. It combines compelling ads with an easy-to-use website focused at motorists, pedestrians and bicyclists. This type of campaign is particularly effective when kicked off in conjunction with other bicycling/walking events or back to school in the fall.

It is recommended that the Rapid City area develop and launch a safety awareness campaign similar to Sonoma County Transit, with additional messages related specifically to safety and "sharing the road." The safety and awareness messages should be displayed near high-traffic corridors (e.g., on billboards), printed in local publications, and broadcast as radio and/or television ads.

Host National Bike Month Activities	
Target audience	Bicyclists and potential bicyclists
Primary agency	City of Rapid City
Potential partners	South Dakota Bicycle Coalition, other local bicycling groups and shops, large employers such as SMSDT and Rapid City Regional Hospital
Purpose	Encourage bicycling by hosting group rides, offering incentives and rewards, and hosting events
Time frame	Annually in May
Sample program	Bike Month NYC: http://bikemonthnyc.org/index.php

Bicycling to work or to other destinations is a great way to get exercise, save money, reduce pollution, and have fun. Cities and towns across the country participate in National Bike Month. The League of American Bicyclists (LAB) hosts a website for event organizers. The website contains information on nationwide and local events, an organizing handbook, and promotional materials.

Figure 64. Bike Month activities build excitement around bicycling, and are an opportunity for novices to get support and encouragement.

It is recommended that the City of Rapid City kick start National Bike Month events and activities, with the support of local bicycling groups and shops.

A sampling of National Bike Month activities include:

- Bike to Work Day events: morning commute energizer stations with food, encouragement, information, and sponsored goodies for participants; rally or celebration with raffles, food, and vendors.
- Group rides to the business center with the mayor and/or local celebrities.
- Discounts at local businesses for bicycle commuters.
- Bike vs. Bus vs. Car challenge. This is a fun competition to determine which transportation mode arrives at the city center in the least amount of time.
- Commuter Challenge in which local companies participate by recording the number of employees who bike to work over a given

time period. The percentage of bicycle commuters are then compared between participating companies and recognition is awarded through press, trophies or plaques, and a final award party or event.

- Family or themed rides, such as a Mother's Day Ride or a ride to visit local parks or cultural destinations.

Establish a "Create a Commuter" Program

Target audience	Low-income residents
Primary agency	City of Rapid City with support from other groups
Potential partners	Local bicycling groups and shops, such as Black Hills Reconditioned Bikes for Kids
Purpose	Empower low-income residents to bicycle for transportation
Time frame	Ongoing
Sample program	Community Cycling Center "Create a Commuter" Program, Portland, OR: http://www.communitycyclingcenter.org/index.php/programs-for-adults/create-a-commuter/

A "Create a Commuter" program provides basic bicycle safety education and fully-outfitted commuter bicycles to low-income adults striving to connect to work, workforce development, or other daily needs by bicycle.

Bicycles can be donated by members of the community and refurbished with volunteer or local group support. Participants are outfitted with everything a bicycle commuter would need including fenders, front and rear lights, locks, pumps, patch kits, tools, and racks.

The program can work with local social service agencies or service providers to identify candidates. Candidates should complete a half-day bicycle safety education and commuting basics course before receiving their bicycle.

The course should cover the following topics:

- Mechanical skills
- Safety checks
- Parts identification
- Cleaning and basic maintenance
- Safe riding skills and making safe decisions on the road
- Laws and rules of the road
- Helmet fitting
- Group riding skills
- Map reading
- Hand signals

Safe Routes to School Program – Phase 1	
Target audience	Parents, schoolchildren, administrators, city planners & engineers
Primary agency	City of Rapid City, school districts (Rapid City School District, Meade School District)
Potential partners	Parent groups at schools, school neighbors
Purpose	Encourage and educate students and their parents about walking and biking to school; improve safety through physical improvements and programs
Time frame	School year
Sample programs	Marin County National Model Program: http://www.saferoutestoschools.org/index.shtml

Helping children walk and bicycle to school is good for children's health and can reduce congestion, traffic dangers and air pollution caused by parents driving children to school. Robust Safe Routes to School programs address all of the "Five E's" (Engineering, Education, Encouragement, Enforcement, and Evaluation).

Figure 65. Safe Routes to School programs improve conditions for walking and bicycling near schools and in surrounding neighborhoods.

The City of Rapid City should work with local school districts to implement the first phase of a Safe Routes to School Program. This phase will use a walkabout (also known as a bicycle and pedestrian audit) to assess walking and biking conditions of streets adjacent to elementary schools. Parents, students, neighbors, and city planners and/or traffic engineers should be invited to join in the walkabout. Safety concerns, issues, and ideas should be recorded.

After the bicycle and pedestrian audit is conducted, parent maps for each elementary school showing recommended routes to reach school, along with high-traffic intersections and routes to avoid, should be produced and distributed.

As a final step, an initial infrastructure improvement plan should be produced for each elementary school, including cost estimates and a prioritized project list. This infrastructure improvement plan will serve as a blueprint for future investments, and can be used to apply for further grant funding.

Develop and Adopt a Complete Streets Policy

Target audience	Rapid City planners and engineers
Primary agency	City of Rapid City
Potential partners	Federal Highway Administration, South Dakota Department of Transportation, local transportation and health advocacy groups
Purpose	Adopt policy language that creates streets for all users, including drivers, freight, walkers, bicyclists, and transit riders
Time frame	One-time; can happen at any time
Sample programs	Sample policies and real-life examples: http://www.completestreets.org/

Local governments adopt Complete Streets policies in order to direct transportation planners and engineers to consistently design roadways with all users in mind (e.g., motorists, transit riders, pedestrians, bicyclists, older people, children, and people with disabilities). There are many ways to implement Complete Streets policies. Once a policy is in place, training is recommended for professionals whose work will be affected by the policy (e.g., planners and engineers).

The Principle:

- Complete Streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a Complete Street.
- Creating Complete Streets means changing the policies and practices of transportation agencies.
- A Complete Streets policy ensures that the entire right-of-way is routinely designed and operated to enable safe access for all users.
- Transportation agencies must ensure that all road projects result in a complete street appropriate to local context and needs.

Create Walking and Bicycle Maps

Target audience	Current and potential bicyclists
Primary agency	City of Rapid City
Potential partners	Downtown Rapid City Economic Development Corporation, Rapid City South Dakota Convention and Visitors Bureau, Parks and Recreation, South Dakota Bicycle Coalition, local bicycling and walking groups, and local bike shops
Purpose	Assist bicyclists in wayfinding by offering a map with clear symbols and graphics, destinations and services attractive for cyclists, and a good selection of routes
Time frame	One-time, with regular updates; can happen at any time
Sample programs	Sample bike maps: Des Moines Regional Trails Map (online): http://www.dsmbikecollective.org/node/74/zoomify Long Beach, CA: http://admin.longbeach.gov/civica/filebank/blobdload.asp?BlobID=27418

One of the most effective ways of encouraging people to bike and walk is through the use of maps and guides showing that the infrastructure exists, to demonstrate how easy it is to access different parts of the city by bike or on foot, and to highlight unique areas, shopping districts or recreational areas. Bicycling and walking maps can be used to promote tourism, encourage residents to walk or bike, or promote local business districts. Maps can be citywide, district-specific, or neighborhood/family-friendly maps.

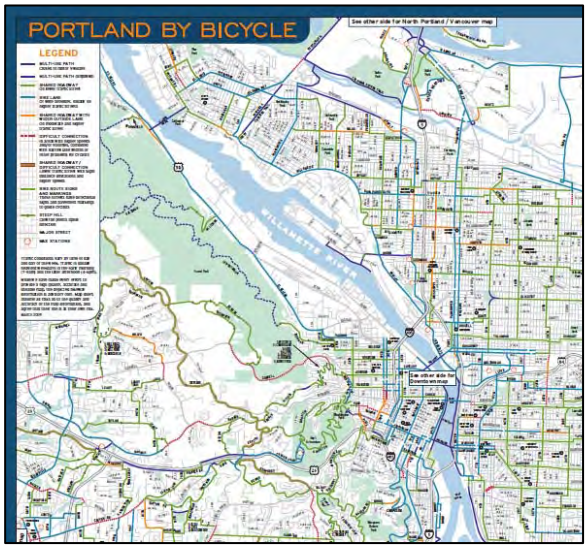

Figure 66. A bike map can stand alone, like the one above from Portland, Oregon, or walking and bicycling routes and information can be incorporated into one comprehensive map.

The Rapid City South Dakota Convention and Visitors Bureau and the Downtown Rapid City Economic Development Corporation currently produce a Rapid City walking map, depicting destinations and services in the area (Figure 66). As the on- and off-street bikeway system is further developed, the City of Rapid City and local jurisdictions should create a complementary regional bike map or incorporate bicycling routes into the existing walking map or a complementary bicycling map should be produced.

Once a bike map is produced or the existing map updated to include bicycling routes, the map should be made available online and distributed to residents by mail, at local bike shops, and/or at community events such as those recommended here. The walk/bike map(s) can also be promoted through flyers in utility bills, city newsletters, and other community media outlets. Maps should be updated every few years to incorporate new bikeways or other changes.

Develop a Rapid City Area "Walk and Bike Central" Website

Target audience	Current and potential bicyclists and walkers
Primary agency	City of Rapid City
Potential partners	Local bicycling and walking groups, e.g. South Dakota Bicycle Coalition
Purpose	Make bicycling and walking information easier to find by providing resources, maps, safety information, events, group listings, and more in one central place.
Time frame	Ongoing
Sample programs	Bike Long Beach (CA) Website: http://www.bikelongbeach.org/

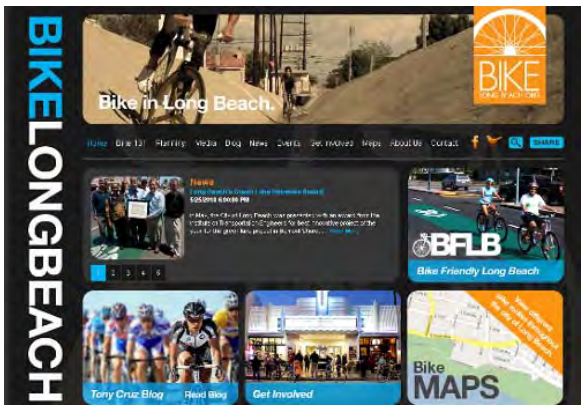

Figure 67. A comprehensive walk/bike website provides "one-stop shopping" for walking and bicycling information.

Many current and potential bicyclists and pedestrians do not know where to turn to find out about bicycling and walking laws, events, maps, tips, and groups. The City of Rapid City should develop a "one-stop shopping" website with comprehensive bicycling and walking information.

The Rapid City area "Walk and Bike Central" website should contain:

- A list of all walking and bicycling groups, including clubs, racing teams, and advocacy groups
- Information about the Bicycle and Pedestrian Advisory Committee (including how to get involved, meeting times and dates, agendas and minutes)
- Information about current projects and how to get involved (e.g. public meetings, comment periods)
- Maps and other resources (links to online maps and brochures, where to find in person, and how to request mailed materials)
- Links to laws and statutes relating to bicycling and walking
- Walking and bicycling tips
- Links to all relevant local jurisdictions and their pedestrian/bicycle contacts
- Information about bicycling and walking events (rides, classes, volunteer opportunities)
- A list of local bike shops, including phone number and address

A one-stop walk and bike website will not be difficult to set up, but it will only be successful if the site is both easy to use and updated regularly. All

website content should be reviewed regularly for accuracy. The bicycle community can assist in keeping the site up to date. Rapid City should consider adding a standing agenda item for the BPAC to discuss the website in order to hear about new content that should be added or out-of-date content that should be updated or removed.

Perform Annual Bicycle and Pedestrian Counts

Target audience	N/A
Primary agency	City of Rapid City
Potential partners	Local bicycling and walking groups, local volunteers
Purpose	Track bicycling and walking trends and measure success of the Bicycle and Pedestrian Master Plan implementation
Time frame	Annually
Model program	National Bicycle & Pedestrian Documentation Project: http://bikepeddocumentation.org/

Many jurisdictions, including the City of Rapid City, do not perform regular bicycle or pedestrian counts. As a result, they do not have a mechanism for tracking bicycling or walking trends over time, or for evaluating the impact of projects, policies, and programs.

It is recommended that the City of Rapid City perform and/or coordinate annual counts of bicyclists and pedestrians on both on- and off-street facilities according to national practices. The National Bicycle and Pedestrian Documentation Project has developed a recommended methodology, survey and count forms, and reporting forms, and this approach may be modified to serve the needs and interests of individual jurisdictions.

Figure 68. Conducting counts assists in planning for the future of the bicycle and pedestrian network, and provides a mechanism evaluating projects and programs.

The City of Rapid City should take the lead role in standardizing a regional approach to counts and surveys. The MPO should handle tracking, analysis, and reporting. Counts can be done manually by staff/volunteers or using video, piezometric (pressure-sensing) tubes, or infrared, radar, ultrasonic, magnetic loop technologies.

Launch Parties for New Bicycle/Pedestrian Facilities	
Target audience	General public, particularly residents living near a newly-completed facility
Primary agency	City of Rapid City
Potential partners	Local jurisdictions, local bicycling and walking groups and shops
Purpose	Inform residents about new bicycle facilities to encourage use and promote awareness
Time frame	As new bikeways are built
Sample program	When a new bikeway is built, the City of Vancouver throws a neighborhood party to celebrate. Cake, t-shirts, media and festivities are provided and all neighbors are invited as well as city workers (engineers, construction staff, planners) who worked on it.

When a new bicycle or pedestrian facility is built, some residents will become aware of it and use it, but others may not realize that they have improved options available to them. A launch party/campaign is a good way to inform residents about a new bike or pedestrian facility, and can also be an opportunity to share other bicycling and walking information (such as maps and brochures) and answer resident questions. It should be a media-friendly event, with elected official appearances, ribbon cuttings, and a press release that includes information about the new facility, other facilities and support services, and any timely information about bicycling or walking (such as Bicycle Friendly Community designation, an increase in bicycling or walking mode share or user counts, etc.).

Figure 69. A launch party informs residents about a new facility and provides an opportunity for additional outreach.

Launch a "Share the Path" Campaign

Target audience	Path users
Primary agency	City of Rapid City
Potential partners	Local jurisdictions, local bicycling or walking groups, local volunteers
Purpose	Encourage responsible, respectful behavior by path users
Time frame	Can be done anytime, particularly during nice weather months
Sample program	Share the Path (Portland, OR): http://www.bta4bikes.org/btablog/2007/07/24/path-users-share-300-bike-bells-and-50-scoops-of-ice-cream-on-saturday/

Conflicts between path users can be a major issue on popular, well-used pathway systems like the Leonard "Swanny" Swanson Memorial Pathway. Communities around the country have launched successful "Share the Path" programs to help educate users about safety and courtesy. Share the Path campaigns can be run by agencies, nonprofits, or any user group (equestrian, hikers, etc.). These programs educate users about expected behavior and how to limit conflicts. Volunteers often give out brochures and engage with users in a non-confrontational way. Volunteers can also report back to agencies about path maintenance or safety/security issues. Media outreach should be included as well. Common strategies include a bicycle bell or bike light giveaway, the distribution of maps and information, posting signs, tabling, and 'stings' that reward good behavior.

Figure 70. A "Share the Path" campaign encourages respectful behavior on multi-use paths.

Coordinate a Bike Light Campaign

Target audience	Bicyclists (especially students and low-income bicycle commuters)
Primary agency	City of Rapid City
Potential partners	Local jurisdictions, South Dakota Department of Transportation, South Dakota Bicycle Coalition, local bike shops
Purpose	Encourage and enforce the use of bike lights
Time frame	Fall, annually
Sample programs	Portland, OR "See & Be Seen" campaign: http://www.portlandonline.com/transportation/index.cfm?&c=deibb&a=bebfjh Dutch "Lights On" campaign: http://www.valopmetjefiets.nl/

Figure 71. A Bike Light Campaign with free light giveaways is a win-win situation: bicyclists get free lights, and streets and paths get safer.

The majority of bicycle related crashes in the Rapid City Area occur in the fall as the skies get darker earlier, daylight savings ends, and bicyclists are harder to see. Many bicyclists, especially students, are unaware that lights are required by law, or they have simply not taken the trouble to purchase or repair lights. Research shows that bicyclists who do not use lights at night are at much greater risk of being involved in bike-car crashes.

Every fall in the Netherlands, as days get shorter, a national "lights on" campaign reminds cyclists to use bicycle lights. This "lights on" campaign focuses several complementary strategies into a short time frame for maximum impact, pairing media messages (ads, posters, radio spots, and TV ads) with police enforcement of 'fix it' tickets.

A similar bike light campaign is recommended for the Rapid City Area. This multi-pronged outreach effort should take place every fall, as the days are getting shorter and as kids and university students are returning to school.

The Rapid City area bike light campaign should include the following elements:

- Well-designed graphic ads, to be placed on billboards and in local newspapers.
- Police enforcement of bike light laws. This enforcement will be most likely to result in behavior change if the bicyclist is able to avoid penalty if they obtain a bike light. Ideally, the police would give a warning, explain the law, and then install a bike light on the spot. If this is not possible, the bicyclist should receive a 'fix it ticket' along with a coupon for a free or discounted light at a local bike shop; once the bicyclist shows proof that they have purchased a bike light, their fine will be waived.
- Partnership with local bicycling groups to get the word out to their members and partners. These groups can be counted as campaign partners at no cost to them, enhancing the campaign's credibility and community exposure. Groups should be supplied with key campaign messages to distribute with their constituents along with coupons for free or discounted bike lights.
- Earned media outreach: The City of Rapid City should distribute media releases with statistics about the importance of using bike lights, relevant legal statutes, and the campaign's goal, timing, activities, and partners. If possible, a meeting with local media editorial boards should be sought.

South Dakota School of Mines & Technology Bike Orientation

Target audience	SDSMT students, especially incoming freshmen
Primary agency	South Dakota School of Mines and Technology
Potential partners	City of Rapid City, local bike shops
Purpose	Encourage bicycling and promote safety for incoming freshmen and returning students.
Time frame	At the beginning of the academic year
Sample program	Stanford University Bike Program: http://transportation.stanford.edu/alt_transportation/BikingAtStanford.shtml

University students are ideal candidates for bicycling outreach programs; many students live on or near campus and may not own a car or choose not to drive. The City of Rapid City should partner with the South Dakota School of Mines and Technology to promote bicycling to students at the beginning of the school year.

The SDSMT Bike Orientation should include:

- Bike maps and information provided to incoming and returning students at the beginning of the year through school information packets
- Flat clinics, bike legal clinics, and guided rides, advertised through flyers, email and bulletin boards, and campus newspaper
- Information tabling at campus events and prominent locations (e.g., bookstore, quad) during the first few weeks of school
- A Bikes at SDSMT web page with links and more information
- At-cost or low-cost bike lights sold at tabling events and through the campus bookstore

If desired, a "bike buddy" program may be implemented to match current bicycling students with interested students. This can be a simple program where bicyclists wear a sticker that says "I bike to SDSMT, ask me how," or a more involved program that matches bike buddies with interested students who live in their neighborhood for mentoring. A bike buddy program would increase the cost of the program. This could be set up through the existing campus rideshare website.

Youth Bike Safety Education

Target	School-age children
Primary agency	City of Rapid City, Rapid City School District, Meade School District
Potential partners	Parent groups at schools, community volunteers
Purpose	In-school and/or after-school on-bike skills and safety training
Time frame	Ongoing
Sample programs	LAB's Kids I and Kids II curriculum: http://www.bikeleague.org/programs/education/courses.php#kids1 BTA's Bike Safety Education Program: http://www.bta4bikes.org/resources/educational.php

Nearly every child in America can look forward to in-depth training before receiving a driver's license. Bicycles are also vehicles that are used on the roads, but most Americans do not receive any training about the rules of the road, how bicycles work, or how to ride a bicycle on the roadway.

At the time that this program is planned, the City of Rapid City should decide whether to start a program from scratch, or modify an existing program. Two excellent model programs are the League of American Bicyclists' Kids I and Kids II classes, and the Bicycle Transportation Alliance's Bike Safety Education Program (see "sample program" links, above, for more information).

Safe Routes to School Program – Phase 1

Target audience	Parents, schoolchildren, administrators, city planners & engineers
Primary agency	City of Rapid City, school districts (Rapid City School District, Meade School District)
Potential partners	Parent groups at schools, school neighbors
Purpose	Encourage and educate students and their parents about walking and biking to school; improve safety through physical improvements and programs
Time frame	School year
Sample programs	Marin County National Model Program: http://www.saferoutestoschools.org/index.shtml

Helping children walk and bicycle to school is good for children's health and can reduce congestion, traffic dangers and air pollution caused by parents driving children to school. Robust Safe Routes to School programs address all of the "Five E's" (Engineering, Education, Encouragement, Enforcement, and Evaluation).

The City of Rapid City should work with local school districts to implement the first phase of a Safe Routes to School Program. This phase

will use a walkabout (also known as a bicycle and pedestrian audit) to assess walking and biking conditions of streets adjacent to elementary schools. Parents, students, neighbors, and city planners and/or traffic engineers should be invited to join in the walkabout. Safety concerns, issues, and ideas should be recorded.

After the bicycle and pedestrian audit is conducted, parent maps for each elementary school showing recommended routes to reach school, along with high-traffic intersections and routes to avoid, should be produced and distributed.

Figure 72. Safe Routes to School programs improve conditions for walking and bicycling near schools and in surrounding neighborhoods.

As a final step, an initial infrastructure improvement plan should be produced for each elementary school, including cost estimates and a prioritized project list. This infrastructure improvement plan will serve as a blueprint for future investments, and can be used to apply for further grant funding.

Coordinate Enforcement Actions

Target audience	Motorists and bicyclists
Primary agency	Local law enforcement
Potential partners	City of Rapid City, South Dakota Department of Transportation
Purpose	Deter unsafe behaviors by motorists and bicyclists by enforcing traffic laws
Time frame	Can be ongoing or concentrated into short "stings" or campaigns

Enforcement actions can include motor vehicle speed enforcement, speed reader board deployment, bicycle light enforcement, crosswalk enforcement, and other actions.

Speeding vehicles endanger bicyclists and pedestrians and discourage non-motorized transportation modes. Targeted speed enforcement activities can address these issues. Law enforcement agencies can enforce speed limits on designated bikeways, near schools, and in response to resident complaints. These campaigns are ideal for a Safe Routes to School Program. A speed reader board request program will deploy speed reader boards at the request of neighborhood associations and schools. The boards should be mounted temporarily (e.g. for two weeks) and then be moved to another location to keep motorists from becoming inured to the speed reader board effect.

Appendix I. Project Costs

Table 49. Costs for Sidewalk, Drainage, Curb and Gutter

Item Description	Unit	QTD	Unit Cost	Total Cost	Notes
Standard Concrete Curb and Gutter	LF	5,280	$18.00	$95,040.00	
Sidewalk	SY	3,520	$45.00	$158,400.00	6' wide
12 Inch Storm Sewer Pipe, 10' deep	LF	2,640	$70.00	$369,600.00	Storm System Pipe, including trenching/backfill, assuming half roadway
Storm Manhole	EA	9	$2,800.00	$24,640.00	Every 300' assuming half roadway
Standard Catch Basin	EA	18	$1,500.00	$27,000.00	Every 300'
Cost per mile:				$489,880.00	
Fully burdened cost per mile:				$759,314	
Construction Cost per LF:				**$144**	

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Table 50. Costs for Shoulder Bikeways

Item Description	Unit	QTD	Unit Cost	Total Cost	Notes
Signs	EA	18	$250.00	$4,500.00	Every 600' each direction
Cost per Mile				$6,9750	
Construction Cost per LF:				**$1**	
Sign replacement	EA	2	$250.00	$45	18 signs every 10 years
Cost per Mile				$45	
Annual Maintenance Cost per LF:				**$0.01**	

Table 51. Costs for Bike Lanes (Roadway restriping)

Item Description	Unit	QTD	Unit Cost	Total Cost	Notes
Striping Removal	LF	10,560	$1.50	$15,840	Assumes 2 lanes
Re-striping	LF	21,120	$4.50	$95,040	2 lanes w/ bike lanes
Pavement markings	EA	53	$50.00	$2,650	Every 200' each direction
Signage	EA	18	$250.00	$4,500	Every 600' each direction
Cost per Mile				$118,030	
Fully burdened cost per mile:				$182,947	
Construction Cost per LF:				**$35**	
Re-striping	LF	5,280	$4.50	$23,760	2 lanes, every 2 years
Sign replacement	EA	2	$250.00	$500	18 signs every 10 years
Patching	LF	10,560	$0.04	$400	Twice per year
Cost per Mile				$24,660	
Annual Maintenance Cost per LF:				**$5**	

Table 52. Costs for Shared Lane Markings

Item Description	Unit	QTD	Unit Cost	Total Cost	Notes
Shared Lane Markings	EA	106	$175.00	$18,480	Every 100' each direction
Custom Signs	EA	18	$250.00	$4,400	Every 600' each direction
Cost per Mile				$22,880	
Fully Burdened Cost per Mile				$35,464	
Construction Cost per LF:				**$7**	
Sign replacement	EA	2	$250.00	$440	18 signs every 10 years
Patching	LF	10,560	$0.04	$400	Twice per year
Cost per Mile				$840	
Annual Maintenance Cost per LF:				**$0.16**	

Table 53. Costs for Signed Shared Roadways

Item Description	Unit	QTD	Unit Cost	Total Cost	Notes
Signs	EA	18	$250.00	$4,500.00	Every 600' each direction
Cost per Mile				$6,9750	
Construction Cost per LF:				**$1**	
Sign replacement	EA	2	$250.00	$45	18 signs every 10 years
Cost per Mile				$45	
Annual Maintenance Cost per LF:				**$0.01**	

Table 54. Costs for Side Paths

Item Description	Unit	Qtd.	Unit Cost	Total	Notes
Selective Site Demolition	LF	5,280	$0.66	$3,500	assume minor removals
Clearing and Grubbing	Acre	5,280	$3.73	$19,694	25' wide corridor
Soil Stripping and Stockpiling	CY	5,280	$1.75	$9,240	27' corridor, 12" deep
Fine Grading	SY	15,840	$1.08	$17,107	27' corridor
Finish Grading	SY	15,840	$0.20	$3,168	27' corridor
Erosion Controls	LF	10,560	$1.25	$13,200	both sides, length of project
Sedimentation Controls	LF	100	$7.15	$5,016	hay bales
Aggregate Base Courses	SY	9,387	$5.25	$30,782	16' wide base course (2' shoulders + 12' tread), 3/4" stone base, 3" deep
Asphalt Paving Wearing Course 4" thick	SY	7040	$15.00	$105,600	16' wide base course (2' shoulders + 12' tread)
Mechanical Seeding	SY	5280	$0.50	$2,640	9' corridor
Cost per mile:				$209,948	
Fully Burdened Cost per Mile				$522,872	
Construction Cost per LF:				$99	
Patching	LF	5,280	$0.04	$200	Twice per year
Repaving	LF	264	$9.47	$2,500	Asphalt, every 20 years
Landscaping	SF	21,120	$1.25	$26,400	2' shoulders each side, yearly
Restriping	LF	1,056	$4.50	$4,752	6", every 5 years
Cost per Mile				$33,852	
Annual Maintenance Cost per LF:				$6	

Table 55. Costs for Bike Lane Restriping, Shoulder Bikeway, Shared Lane Marking, and Signed Shared Roadway Treatments

Facility	Route	Extent	Length	Points	Planning-Level Cost Estimate
Signed Shared	Sagewood Street/Northridge Drive	Bunker Drive - Haines Ave	0.56	69	$3,900
Shared Lane	Jackson Boulevard	Mountain View Road - Mountain View Road	0.28	65	$9,900
Bike Lane	Jackson Boulevard	W Highway 44 - Chapel Lane	1.53	65	$279,900
Shared Lane	Red Cloud Street	Northridge Drive - Mall Drive	0.63	64	$22,300
Shared Lane	5th Street	Omaha St - Columbus St	0.46	62	$16,300
Signed Shared	Alta Vista Drive/Anaconda Road	East of City View Drive - E Fairmont Boulevard	1.65	62	$11,500
Shared Lane	Cathedral Drive/Fairmont Boulevard	Mount Rushmore Road - Creek Drive	2.35	62	$83,300
Shoulder Bikeway	Country Road	Haines Avenue - N Elk Vale Road	3.50	62	$38,800
Shared Lane	Covington Street	Twilight Drive - E Highway 44	0.89	62	$31,600
Shared Lane	Creek Drive	E Saint Patrick Street - Fairmont Boulevard	1.01	62	$35,800
Shared Lane	E Centennial Street/Locust Street	Parkview Drive - E Fairmont Boulevard	0.82	62	$29,100
Signed Shared	E Fairlane Drive	Elm Avenue - Robbinsdale Park	0.25	62	$1,700
Shared Lane	E New York St/N Maple Ave/E Philadelphia Street	East Boulevard - Cambell Street	1.00	62	$35,500
Signed Shared	E Oakland Street	Hawthorne Avenue - Cambell Street	0.87	62	$6,100
Shared Lane	Flormann Street/Meade Street	West Boulevard - 5th Street	1.27	62	$45,000
Signed Shared	Meade Street/E Indiana Street	5th St - Hawthorne Avenue	1.21	62	$8,400
Shared Lane	Milwaukee Street	Crestwood Drive - E New York Street	1.00	62	$35,500
Signed Shared	Minuteman Drive	Lindbergh Avenue - Anamosa Street	0.60	62	$4,200
Bike Lane	North Street	West Boulevard N - Allen Avenue	0.91	62	$166,500
Signed Shared	Parkview Drive	E Liberty Street - E Minnesota Street	0.14	62	$1,000
Shared Lane	Raider Road	44th Street - Hillsview Drive	0.55	62	$19,500

Facility	Route	Extent	Length	Points	Planning-Level Cost Estimate
Signed Shared	Silver Street/Philadelphia Street	N 11th Street - Boegel Street	0.61	62	$4,300
Signed Shared	Soo San Road	Brookside Drive - Range Road	1.00	62	$7,000
Bike Lane	Soo San Road	W Main Street - Brookside Road	0.16	62	$29,300
Signed Shared	Van Buren Street	Allen Avenue - Milwaukee Street	0.99	62	$6,900
Signed Shared	W South Street	Soo San Road - Mary Hill Park	0.11	62	$800
Shared Lane	Jolly Lane	E Highway 14 - Daly Circuit	0.90	61	$31,900
Bike Lane	Jackson Boulevard	W Main Street - Mountain View Road	0.48	60	$87,800
Shared Lane	Bunker Drive	Sagewood Street - Disk Drive/I-90	0.86	59	$30,500
Shared Lane	44th Street	W Chicago Street - Raider Road	1.06	58	$37,600
Shared Lane	6th Street	Omaha Street - Kansas City Street	0.38	54	
Signed Shared	9th Street	Quincy Street - Flormann Street	0.99	54	$6,900
Signed Shared	Apolda Street	N Mount Rushmore Road - 6th Street	0.19	54	$1,300
Shared Lane	Black Hills Boulevard	E Stumer Road - E Catron Boulevard	0.13	54	$4,600
Shared Lane	Degeest Drive	Homestead Street - Twilight Drive	0.65	54	$23,100
Shared Lane	Franklin Avenue/Belleview Drive/E St Andrew St	West Boulevard - 5th Street	0.55	54	$19,500
Signed Shared	Hawthorne Avenue	E Main Street - E Oakland Street	0.34	54	$2,400
Shared Lane	Hillsview Drive	Canyon Lake Road loop	0.46	54	$16,300
Signed Shared	Kansas City Street	5th Street - East Boulevard	0.48	54	$3,300
Bike Lane	Mt. Rushmore Road	North Street - Omaha Street	0.45	54	$82,300
Shared Lane	Quincy Street	West Street - East Boulevard	1.20	54	$42,600
Shared Lane	Reservoir Road/Longview Road	Twilight Drive - E Highway 44	1.48	54	$52,500

Facility	Route	Extent	Length	Points	Planning-Level Cost Estimate
Bike Lane	Steele Avenue	Brennan Avenue - Railroad	0.28	54	$51,200
Signed Shared	W Flormann Street	Argyle Street - Mountain View Road	0.63	54	$4,400
Signed Shared	West Boulevard	Leonard "Swanny" Swanson - Flormann Street	1.18	54	$8,200
Signed Shared	Allen Avenue	Anamosa Street - North Street	0.51	52	$3,600
Signed Shared	Cambell Street Service Road	Fairmont Boulevard - Richland Drive	0.37	52	$2,600
Shared Lane	City Springs Road Extension	Sturgis Road - Galena Drive	1.57	52	$55,700
Shared Lane	N 40th Street	Fish and Game Site - W Chicago St	0.25	52	$8,900
Shared Lane	N Maple Avenue	Disk Drive - Anamosa Street	0.57	52	$20,200
Signed Shared	N Spruce Street	Meadowlark Road - E Philadelphia Street	0.50	52	$3,500
Signed Shared	Nordby Lane	W Saint Louis Street - W Main Street	0.19	52	$1,300
Signed Shared	Oak Avenue	E Indiana Street - Colorado Street	0.62	52	$4,300
Shared Lane	Triple Crown Drive	E Minnesota Street - E Catron Boulevard	0.53	52	$18,800
Shoulder Bikeway	Airport Road	Airport - E Highway 44	1.29	50	$14,300
Signed Shared	Copperfield Drive	End of Existing Street - Highway 44	0.61	50	$4,300
Bike Lane	Mountainview Road	W Omaha Street - Jackson Boulevard	0.58	50	$106,100
Shoulder Bikeway	N Elk Vale Road	Country Road - E Mall Drive	1.43	50	$15,800
Signed Shared	South Canyon Road	Berry Boulevard - N 44th Street	2.04	50	$14,200
Shared Lane	E Kansas City Street	East Boulevard - SD School of Mines & Technology	0.60	49	$21,300
Signed Shared	Prairie Avenue	Saint Patrick Street - E Indiana Street	0.35	49	$2,400
Bike Lane	W Main Street	44th Street - Soo San Drive	0.76	49	$139,000
Bike Lane	W Chicago Street	N 44th Street - Deadwood Avenue	1.76	46	$322,000

Facility	Route	Extent	Length	Points	Planning-Level Cost Estimate
Shared Lane	Moon Meadows Drive	Dunsmore Road - Highway 16	2.27	45	$80,500
Shared Lane	East Boulevard	E Quincy Street - Signal Drive	0.45	44	$16,000
Shared Lane	Anamosa Street	Commerce Road - Silver Street	1.14	43	$40,400
Shared Lane	Dunsmore Road	Sheridan Lake Road - Moon Meadows Drive	0.14	42	$5,000
Signed Shared	San Marco Boulevard	City Springs Road - South Canyon Road	0.36	42	$2,500
Signed Shared	San Marco Boulevard	South Canyon Road- W Chicago Street	0.31	42	$2,200
Signed Shared	W Chicago Street	San Marco Boulevard - N 44th Street	0.35	42	$2,400

Table 56. Costs for Bike Lanes Requiring Additional Treatments

Route	Extent	Length	Points	Planning-Level Cost Estimate
St. Joseph Street	W Main Street - West Boulevard	0.32	56	$29,250
W Main Street	Soo San Road - West Boulevard	2.14	56	$343,900
E Minnesota Street	Minnesota Street Park - Cambell Street	0.25	50	$45,700
Harmony Heights Lane	Plaza Boulevard - Anamosa Street	2.79	44	$510,400
N Plaza Drive/Plaza Boulevard	Deadwood Avenue - Harmony Heights Lane	1.08	44	$197,600
St. Patrick Street	5th Street - Elm Avenue	0.73	44	$133,600
N Maple Avenue	Mall Drive - Disk Drive	0.47	37	$86,000

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Appendix J. Funding Sources

Acquiring funding for projects and programs is considerably more likely if it can be leveraged with a variety of local, state, federal and public and private sources. This section identifies potential matching and major funding sources available for bicycle and trail projects and programs as well as their associated need and criteria. It identifies funding sources available at the Federal, State (through South Dakota Department of Transportation, SDDOT) and potential local sources.

Federal Funding Sources

Federal funding is primarily distributed through a number of different programs established by the Federal Transportation Act. The latest act, The Safe, Accountable, Flexible, Efficient Transportation Equity Act – a Legacy for Users (SAFETEA-LU) was enacted in August 2005 as Public Law 109-59. SAFETEA-LU authorizes the Federal surface transportation programs for highways, highway safety, and transit for the five-year period 2005-2009.

In South Dakota, Federal funding is administered through the State (SDDOT). Most, but not all, of these funding programs are oriented toward transportation versus recreation, with an emphasis on reducing auto trips and providing inter-modal connections. Federal funding is intended for capital improvements and safety and education programs, and projects must relate to the surface transportation system.

SAFETEA-LU

There are a number of programs identified within SAFETEA-LU that provide for the funding of bicycle and pedestrian projects, described in the following section.

Surface Transportation Program

The Surface Transportation Program (STP) provides states with flexible funds which may be used for a wide variety of projects on any Federal-aid Highway including the National Highway System, bridges on any public road, and transit facilities.

Bicycle and trail improvements are eligible activities under the STP. This covers a wide variety of projects such as on-street facilities, off-road trails, crosswalks, bicycle and pedestrian signals, bike parking, and other ancillary facilities. SAFETEA-LU also specifically clarifies that the modification of sidewalks to comply with *Americans with Disabilities Act* requirements is an eligible activity.

As an exception to the general rule described above, STP-funded bicycle and pedestrian facilities may be located on local and collector roads which are not part of the Federal-aid Highway System. In addition, bicycle-related non-construction projects such as maps, coordinator positions, and encouragement programs are also eligible for STP funds.

Ten percent of each State's STP apportionment is set aside for two infrastructure safety programs: the Hazard Elimination Program (HEP) and the Railway-Highway Crossing Program. Under the HEP, States must "conduct and systematically maintain an engineering survey of all public roads to identify hazardous locations… which may constitute a danger to motorists, bicyclists, and pedestrians," and implement prioritized improvements at identified hazardous locations. Eligible projects include improvements on any public highway, public transportation facility, and any public bicycle or pedestrian pathway or trail, as well as traffic calming projects.

Highway Safety Improvement Program

This program funds projects designed to achieve significant reductions in traffic fatalities and serious injuries on all public roads, bikeways and walkways. This program includes the Railway-Highway Crossings Program and the High Risk Rural Roads Program and replaces the Hazard Elimination Program from TEA-21.

Transportation Enhancements

Administered by SDDOT, this program is funded by a set-aside of STP funds. Ten percent of STP funds are designated for Transportation Enhancement Activities (TEAs), which include "*provision of facilities for pedestrians and bicycles, provision of safety and educational activities for pedestrians and bicyclists,*" *and the "preservation of abandoned railway corridors (including the conversion and use thereof for pedestrian and bicycle trails*." (23 USC Section 190 (a) (35)). Under TEA-21, approximately $9.0 million was available annually, of which $4.5 million was allocated to Statewide TE funds. The reauthorization of the Federal transportation bill will determine funding availability for 2010 and later.

TE funding in South Dakota can be used to build projects that enhance bicycle and pedestrian safety, and to build bicycle and pedestrian facilities. Facility development can include both development of new facilities as well as modifications of existing facilities. Bicycle facilities must be transportation-oriented (not solely for recreational purposes), can be located within or outside of the highway ROW and could include riding or walking surfaces and related amenities. Eligible projects under the safety category include non-construction safety-related activities, such as safety

and educational activities. Projects must be accessible to the general public or targeted to a broad segment of the general public.

From FY 1992 to 2008, SDDOT has programmed $13,858,739 for bicycle and pedestrian facilities, the largest proportion of Transportation Enhancement funds. However, no money was allocated for safety programs.

Recreational Trails Program

The Recreational Trails Program of the Federal Transportation Bill provides funds to states to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses. Example trail uses include hiking, bicycling, in-line skating, and equestrian use. These funds are available for both paved and unpaved trails, but may not be used to improve roads for general passenger vehicle use or to provide shoulders or sidewalks along roads.

Recreational Trails Program funds may be used for:

- Maintenance and restoration of existing trails
- Purchase and lease of trail construction and maintenance equipment
- Construction of new trails, including unpaved trails
- Acquisition or easements of property for trails
- State administrative costs related to this program (limited to seven percent of a State's funds)
- Operation of educational programs to promote safety and environmental protection related to trails (limited to five percent of a State's funds)

In South Dakota, the Recreational Trails Program is administered by Division of Parks and Recreation in the Department of Game, Fish, and Parks.

State and Community Highway Safety Grant Program (Section 402)

Administered by National Highway Traffic Safety Administration (NHTSA) and Federal Highway Administration (FHWA), as well as by the designated State Highway Safety Offices (SHSO), Section 402 monies support State highway safety programs that are intended to reduce traffic crashes and resulting deaths, injuries, and property damage. Grant funds are provided to States each year according to a statutory formula based 25 percent on population and 75 percent on road mileage. States must submit a Performance Plan with goals and performance measures as well as a Highway Safety Plan, which should describe how they will achieve the Performance Plan.

Funds may be used for a wide variety of highway safety activities and programs including those that improve pedestrian and bicycle safety. States

are to consider highly effective programs (previously known as National Priority Program Areas), including bicycle and pedestrian safety, when developing their programs, but are not limited to this list of activities.

Safe Routes to School (SRTS)[18]

Under the SRTS Program, Federal funds are administered by SDDOT. The grants can be used to identify and reduce barriers and hazards to children walking or bicycling to school (70 to 90 percent of funds) or for non-infrastructure encouragement and education programs (10 to 30 percent). Eligible projects must be within two miles of a school and are fully funded with no local match requirement. One infrastructure and/or non-infrastructure application will be accepted, with three projects maximum that can be funded per school district. There is a $250,000 funding limit for the total infrastructure project application and $100,000 maximum for non-infrastructure projects.

Community Development Block Grants

The Community Development Block Grants program provides money for streetscape revitalization, which may be largely comprised of pedestrian improvements. Federal Community Development Block Grant grantees may "*use Community Development Block Grants funds for activities that include (but are not limited to): acquiring real property; reconstructing or rehabilitating housing and other property; building public facilities and improvements, such as streets, sidewalks, community and senior citizen centers and recreational facilities; paying for planning and administrative expenses, such as costs related to developing a consolidated plan and managing Community Development Block Grants funds; provide public services for youths, seniors, or the disabled; and initiatives such as neighborhood watch programs.*"

Rivers, Trails and Conservation Assistance Program

The Rivers, Trails and Conservation Assistance Program (RTCA) is a National Parks Service program providing technical assistance via direct staff involvement to establish and restore greenways, rivers, trails, watersheds and open space. The RTCA program provides only for planning assistance—there are no implementation monies available. Projects are prioritized for assistance based on criteria that include conserving significant community resources, fostering cooperation between agencies, serving a large number of users, encouraging public involvement in planning and implementation, and focusing on lasting accomplishments.

[18] http://www.sddot.com/srts/default.aspx

Land and Water Conservation Fund

The Land and Water Conservation Fund (LWCF) is a Federally-funded program, providing grants for planning and acquiring outdoor recreation areas and facilities, including trails. Funds can be used for right-of-way acquisition and construction.

Transportation, Community and System Preservation Program

The Transportation, Community and System Preservation Program provides Federal funding for transit-oriented development, traffic calming and other projects that improve the efficiency of the transportation system, reduce the impact on the environment, and provide efficient access to jobs, services and trade centers. The program is intended to provide communities with the resources to explore the integration of their transportation system with community preservation and environmental activities. The Transportation, Community and System Preservation Program funds require a 20 percent match.

The National Scenic Byways Program[19]

Administered by the Federal Highway Administration (FHWA), the National Scenic Byways Program funds 50 percent of an eligible project's costs. Projects must be along a designated scenic highway and meet accessibility guidelines under ADA. Eligible projects include, "*Improvements for enhancing access to a recreation area include bicycle and pedestrian facilities … to the extent that the project and recreational area have a clear, demonstrated role in enhancing the byway traveler experience (rather than primarily serving the existing customer base of the operator of the recreational area).*"

Local Funding Sources

Tax Increment Financing/Urban Renewal Funds[20]

Tax Increment Financing (TIF) is a tool to use future gains in taxes to finance the current improvements that will create those gains. When a public project (e.g., sidewalk improvements) is constructed, surrounding property values generally increase and encourage development or redevelopment in the area. The increased tax revenues are then dedicated to finance the debt created by the original public improvement project. Tax Increment Financing typically occurs within designated Urban Renewal Areas (URA) that meets certain economic criteria and are approved by a

[19] http://www.byways.org/
[20] http://www.rcgov.org/Growth-Management/tifprojectplanhistory.html

local governing body. To be eligible for this financing, a project (or a portion of it) must be located within the URA.

Appendix K. Priority Project Sheets

During the year long planning process several areas of Rapid City came up repeatedly as areas that local bicyclists and walkers would like better access to or feel are difficult to cross. Alta Planning and Design has provided suggestions for each of these areas in the form of the following project priority sheets. The intent of these graphics is to provide ideas to City staff and consulting engineers when these high priority areas of Rapid City are considered for reconstruction or other improvements. The high priority areas include:

- West Main Street and Jackson Boulevard intersection and the "Gap", which is defined as West Main Street from Jackson Boulevard to West Boulevard. The public provided several comments that these streets are key access points to downtown from the west and are challenging for bicyclists and pedestrians.
- Omaha Street intersections from 5th St to 12th Street, as many public open house participants noted that Omaha Street is a very difficult street to cross and asked for suggestions to improve pedestrian and bicycle crossing of this busy street.
- Soo San Drive area by the schools- detail a network that connects the schools and the neighborhoods
- Catron Boulevard and 5th Street- review the proposed Wal-Mart/retail center development and provide suggestions for biking and walking access to and from the surrounding neighborhoods
- Cambell Street between Minnesota Street and Fairmont Boulevard, using the frontage road as a signed shared road and shared use path to connect Minnesota Street and Fairmont Boulevard, which are part of the bicycle network.

W Main St & St Joseph St Improvements (11th St):

- Add marked high visibilty crosswalks.
- Consider Rectangular Rapid Flashing Beacons.
- Consider crossing safety flags.

W Main St & St Joseph St Improvements (West St):

- Add marked high visibilty crosswalks.
- Consider Rectangular Rapid Flashing Beacons.
- Consider crossing safety flags.

W Main Street Improvements:

- Remove one travel lane in each direction
- Provide Two Way Left Turn Lane where needed
- Provide wide bike lane, or buffered bike lane depending on available shoulder width.
- Current ADT is at upper end of capacity for 4-lane urban road.

Main St / Jackson Blvd Intersection:

- Install pedestrian countdown timers
- Install pedestrian crossing on western leg
- Install pedestrian refuge island on western leg in unused center turn lane - will also require modifications to ACE Hardware exit
- Install pedestrian crossing on southern leg
- Improve refuge island on southern leg
- Add Leading Pedestrian Interval (LPI) to Pedestrian Phase when called
- Coordinate pedestrian phases with vehicle phases to minimize conflicts

Legend

- Bike Lane, Planned/Proposed
- Shared Lane, Planned/Proposed
- Signed Shared Roadway, Proposed
- Shared-Use Path, Existing/Proposed
- Side Path, Existing/Planned/Proposed

0 400 800 Feet

West Main Street Improvements

Rapid City, SD

alta PLANNING + DESIGN

***Note:** SDDOT will change signal timing along the corridor to a Traffic Adaptive Signal Control System. Recommend below improvements be considered following signal changes and Corridor Study.

5th St & Omaha St Improvements:
- Install pedestrian signals on free right lane.
- Alter signal phasing to separate left turn movements from through movements to eliminate turning conflicts in crosswalks and add Leading Pedestrian Interval (LPI).

Recently Relocated Pedestrian Crossing
- Ensure crossing is connected to Shared-Use Path System.
- Crossing between 6th and 7th has been removed.

Mt Rushmore Rd & Omaha St Improvements:
- Alter signal phasing to add Leading Pedestrian Interval (LPI).

West Blvd & Omaha St Improvements:
- Install pedestrian countdown timers.
- Install pedestrian signals on free right lanes.
- Alter signal phasing to separate left turn movements from through movements to eliminate turning conflicts in crosswalks and add Leading Pedestrian Interval (LPI).

Legend
- Bike Lane, Planned/Proposed
- Shared Lane, Planned/Proposed
- Signed Shared Roadway, Proposed
- Shared-Use Path, Existing/Proposed
- Side Path, Existing/Planned/Proposed

0 300 600 Feet

Omaha Street Improvements
Rapid City, SD

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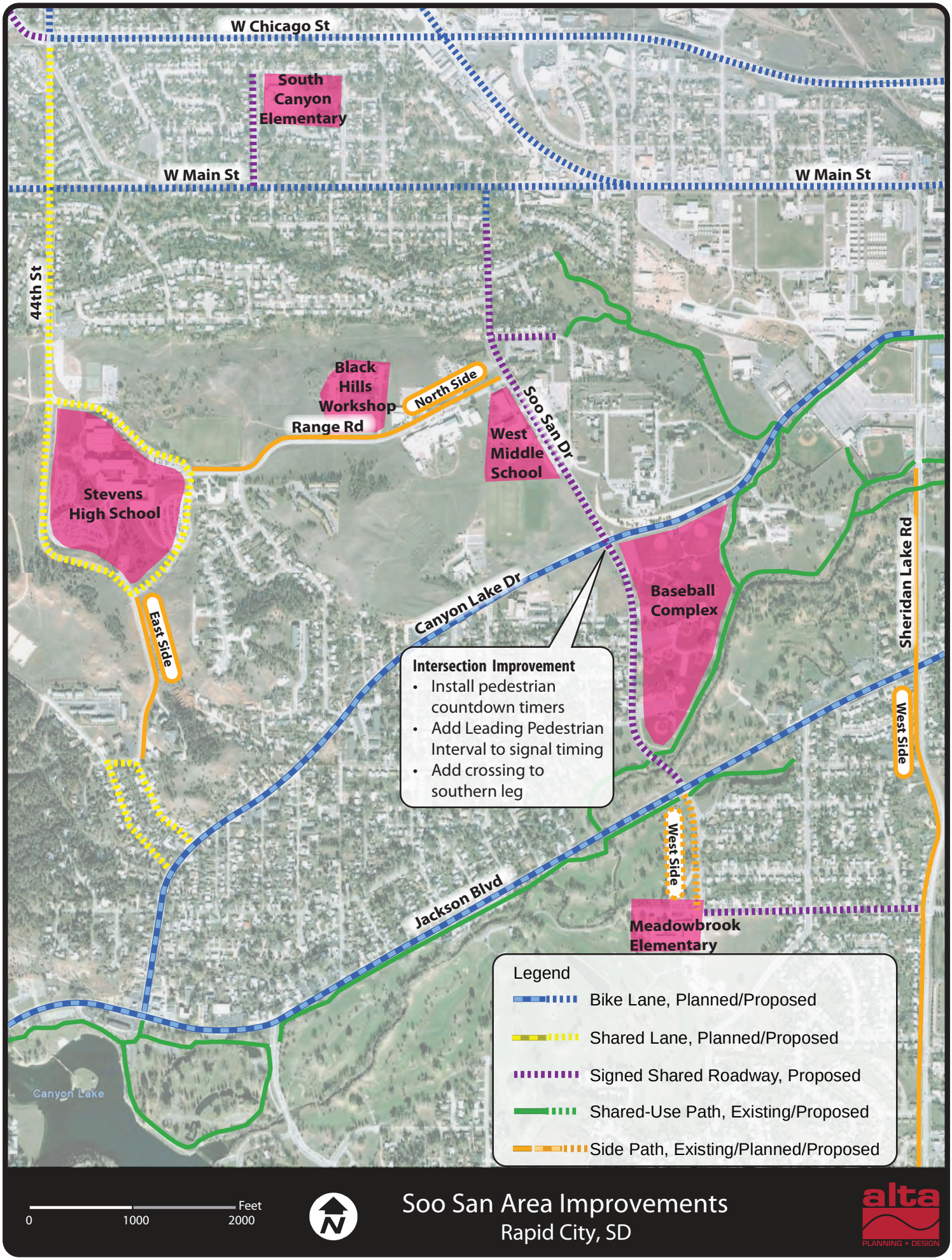

Soo San Area Improvements

Rapid City, SD

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5th Street (Walmart) Improvements

Rapid City, SD

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E Fairmont Blvd & Cambell St Treatments:

- Install Crosswalk on eastern leg.
- Install Pedestrian Signals on free right lanes.
- Alter signal phasing to separate left turn movements from through movements to eliminate turning conflicts in crosswalks (when pedestrian phase is active).

Frontage Road Treatments:

- Install Bike Route Signs
- Install 'Share the Road' Signs

Minnesota St & Cambell St Treatments:

- Install Crosswalk on eastern leg.
- Install Pedestrian Signals on free right lanes.
- Alter signal phasing to separate left turn movements from through movements to eliminate turning conflicts in crosswalks (when pedestrian phase is active).

Legend

- Shoulder Bikeway, Existing/Proposed
- Bike Lane, Planned/Proposed
- Shared Lane, Planned/Proposed
- Signed Shared Roadway, Proposed
- Shared-Use Path, Existing/Proposed
- Side Path, Existing/Planned/Proposed

0 500 1000 Feet

Cambell Street/ Frontage Road Improvements

Rapid City, SD

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Alta Planning + Design
408 East Wilson Street
Madison, WI 53703

www.altaplanning.com