



Rapid City Area Bicycle and Pedestrian Master Plan

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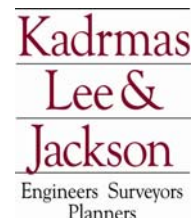
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Chapter 1. Introduction

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.

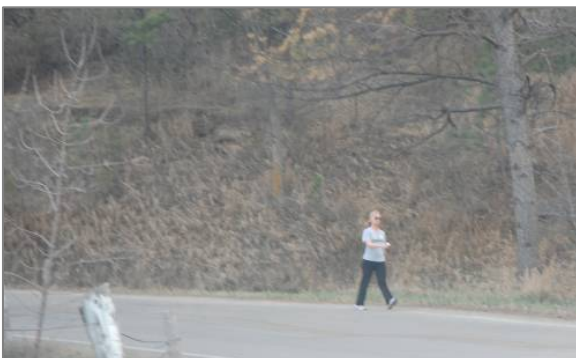


Figure 4. Many outlying streets accommodate pedestrian travel along wide shoulders.

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.

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).

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



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



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.



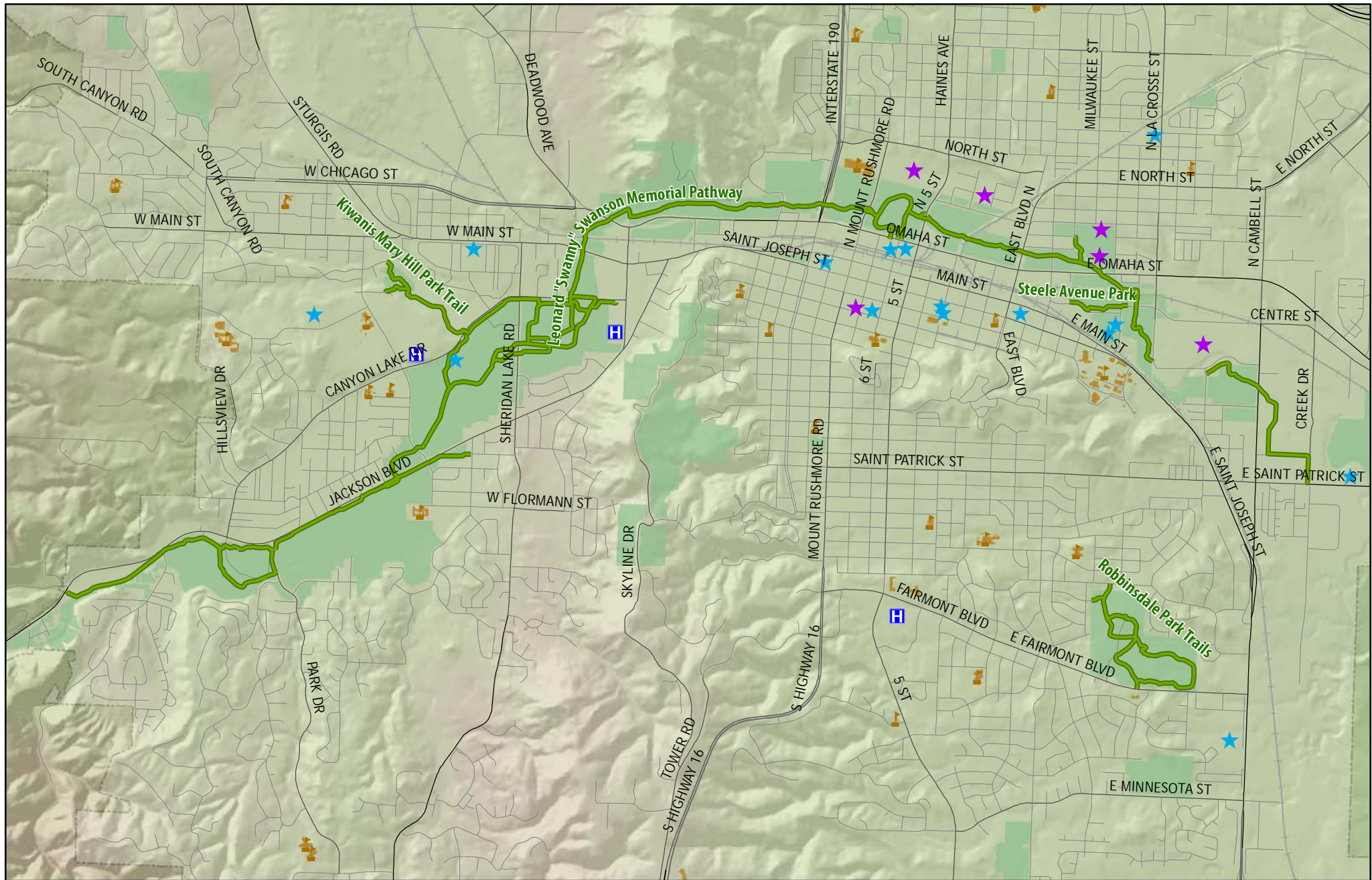
Figure 9. The Leonard "Swanny" Swanson Memorial Pathway is a popular walking and bicycling facility.

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

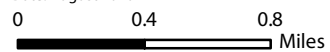
Several shared-use paths in the Rapid City area are directly adjacent to roadways and within the street right-of-way (Figure 10). These ‘side paths’ serve both bicyclists and pedestrians and are wider than a standard sidewalk. Side paths provide routes between residential areas and employment centers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



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



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.



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

Table 2 lists the side paths currently existing 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.

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.



Figure 14. Cycle track on Kansas City Street.

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.

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 15. Bicycle parking at the library.



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.

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



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

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's Club, 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.

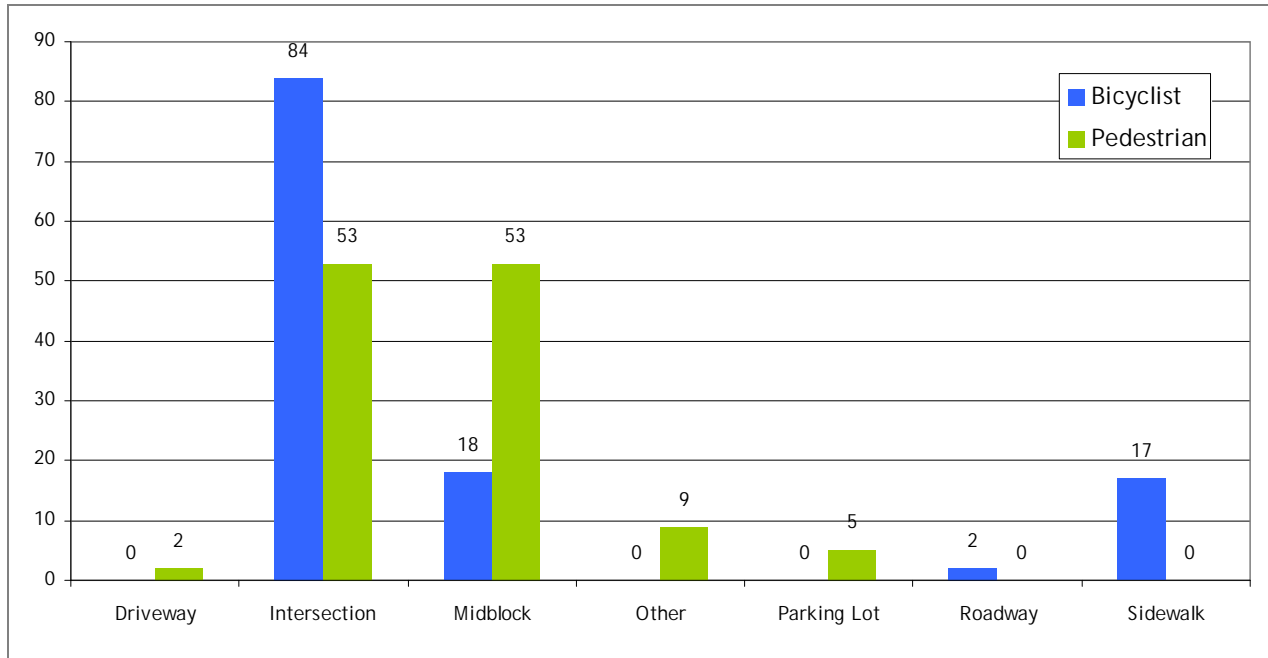


Figure 20. Location of Crashes Involving Bicyclists and Pedestrians, 2002-2008

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%	<i>National Bicycling & Walking Study</i> , 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)
<u>Other utilitarian and discretionary trips:</u>		
Ratio of "other" trips to commute trips	2.73	<i>National Household Transportation Survey</i> , 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%	<i>National Safe Routes to School surveys, 2003</i>
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)
<u>Other utilitarian and discretionary trips:</u>		
Ratio of "other" trips to commute trips	2.73	<i>National Household Transportation Survey, 2001</i>
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 cars⁹ 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

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