

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: 44 th 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).

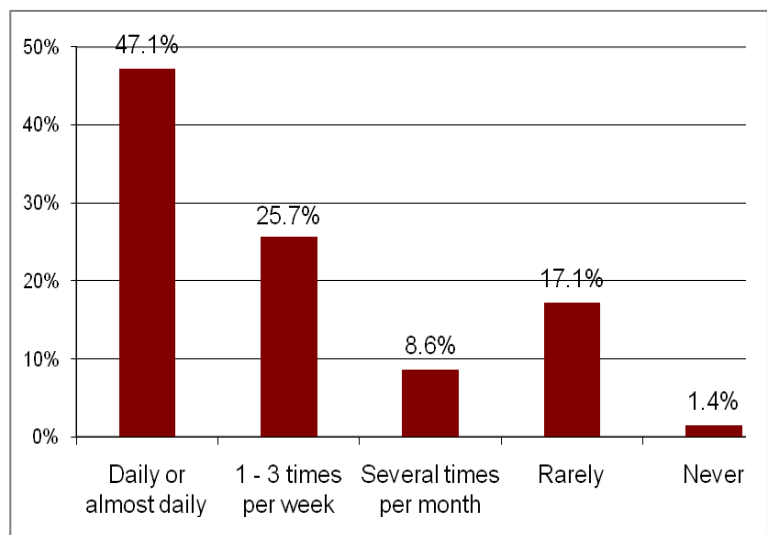


Figure 28. Responses to, "How often do you walk?"

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).

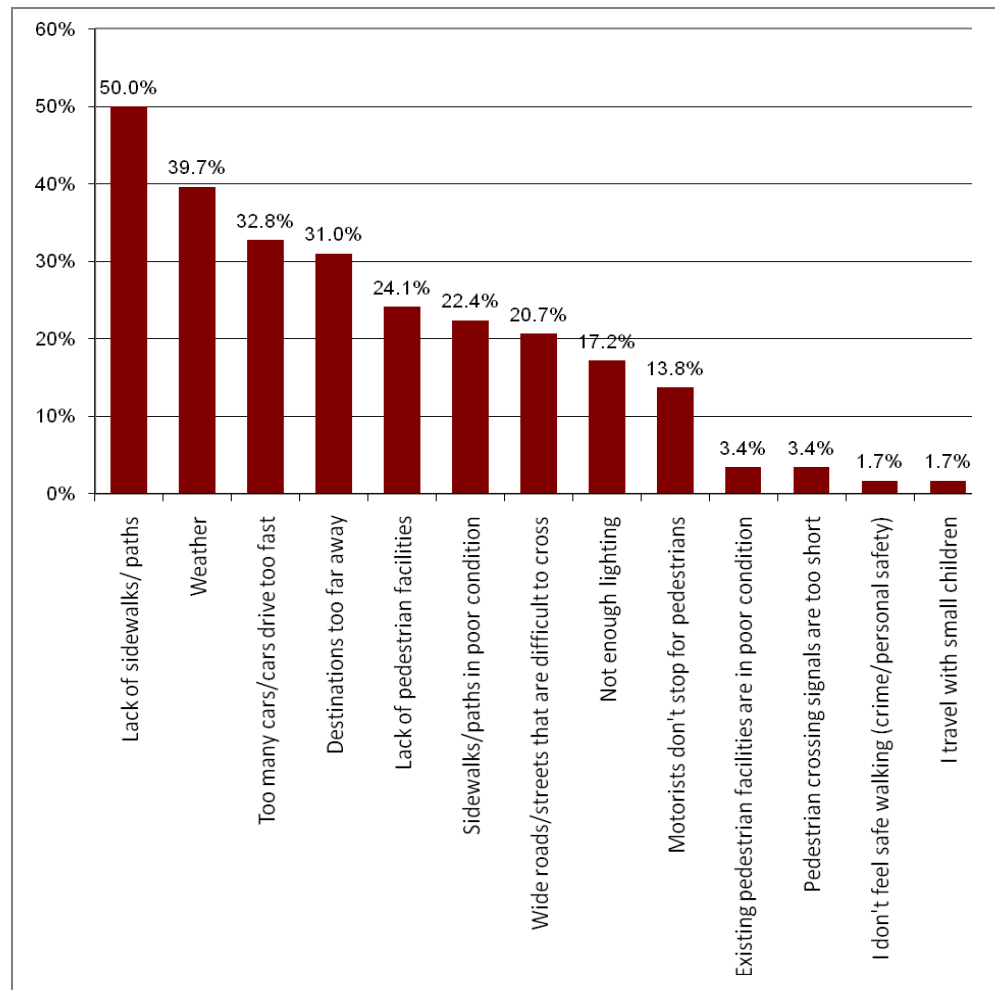


Figure 29. Responses to, "What prevents you from walking more frequently?"

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).

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.

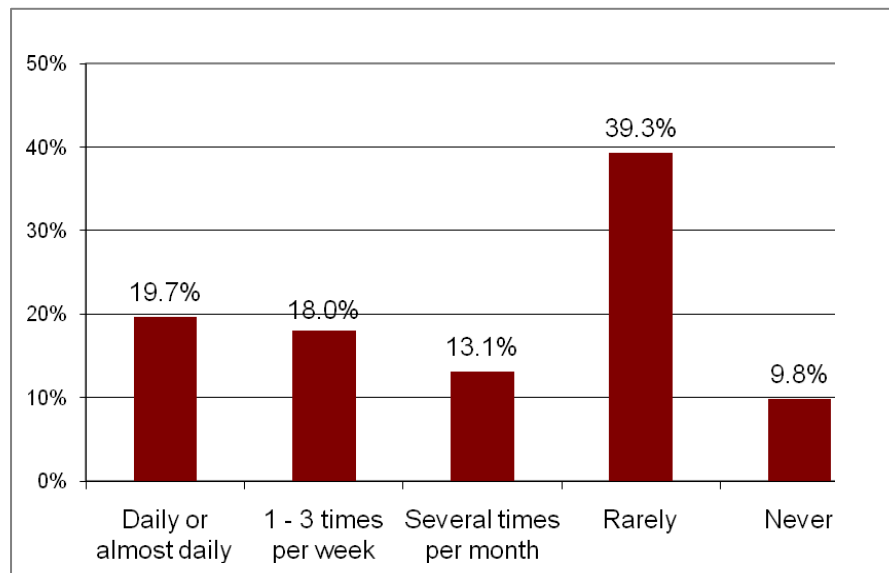


Figure 30. Responses to, "How often do you bicycle?"

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.

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,

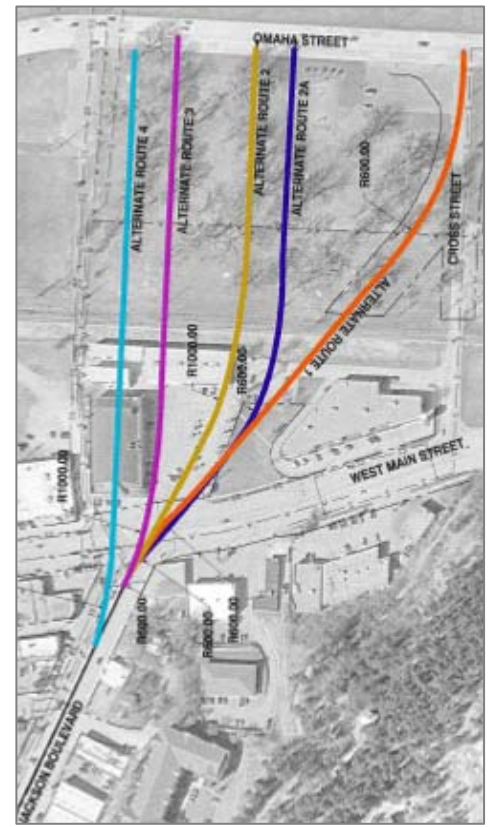


Figure 31. Jackson Boulevard Alignment Alternatives.

“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.

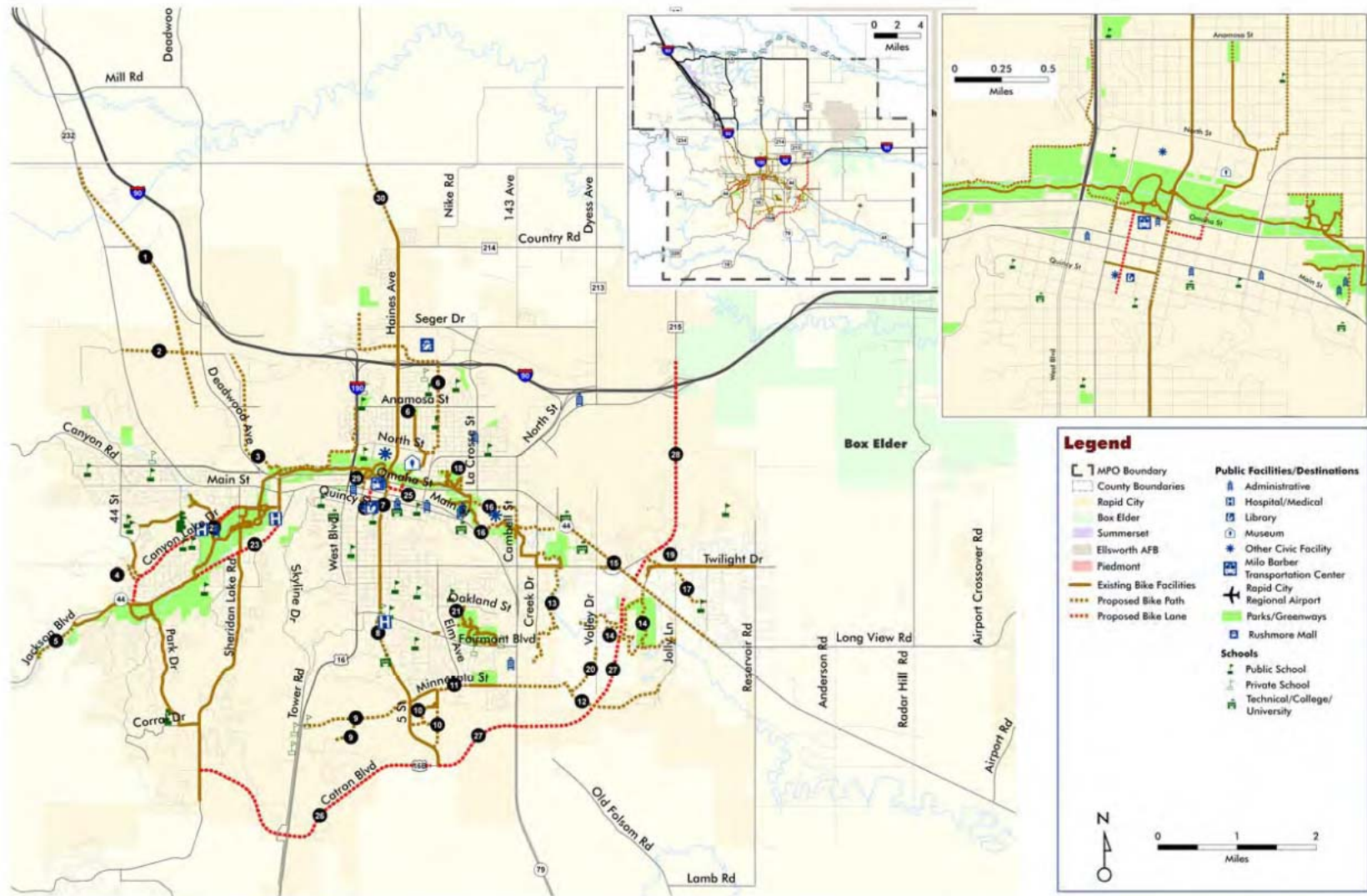
Pedestrians

- 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, 2002-2008ⁱ

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.

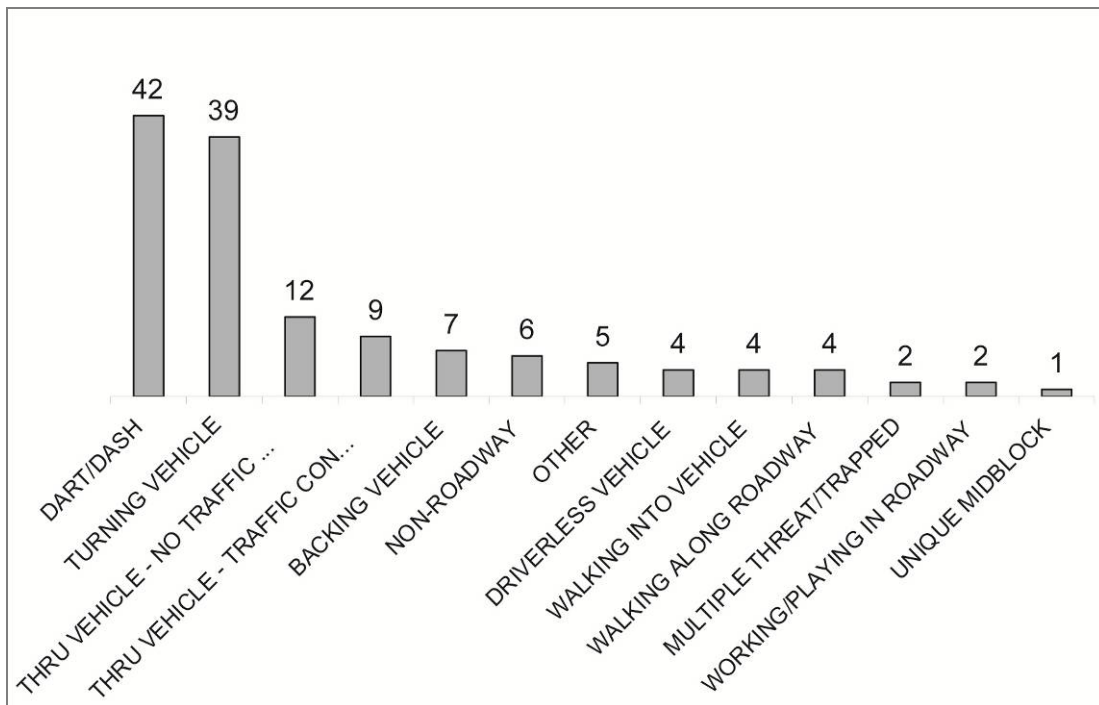


Figure 32. Rapid City Pedestrian Crash Types by Frequency, 2002-2008.

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.

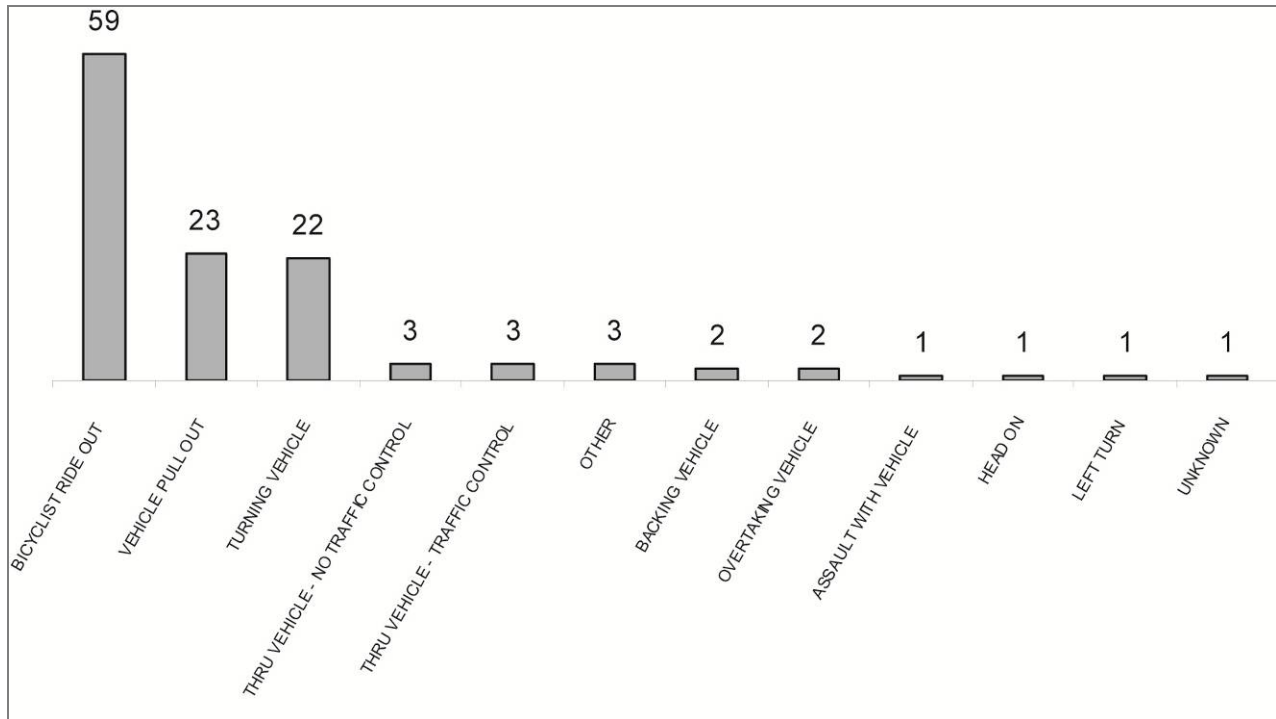


Figure 33. Rapid City Bicyclist Crash Types by Frequency, 2002-2008.

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, 2002-2008ⁱ

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.

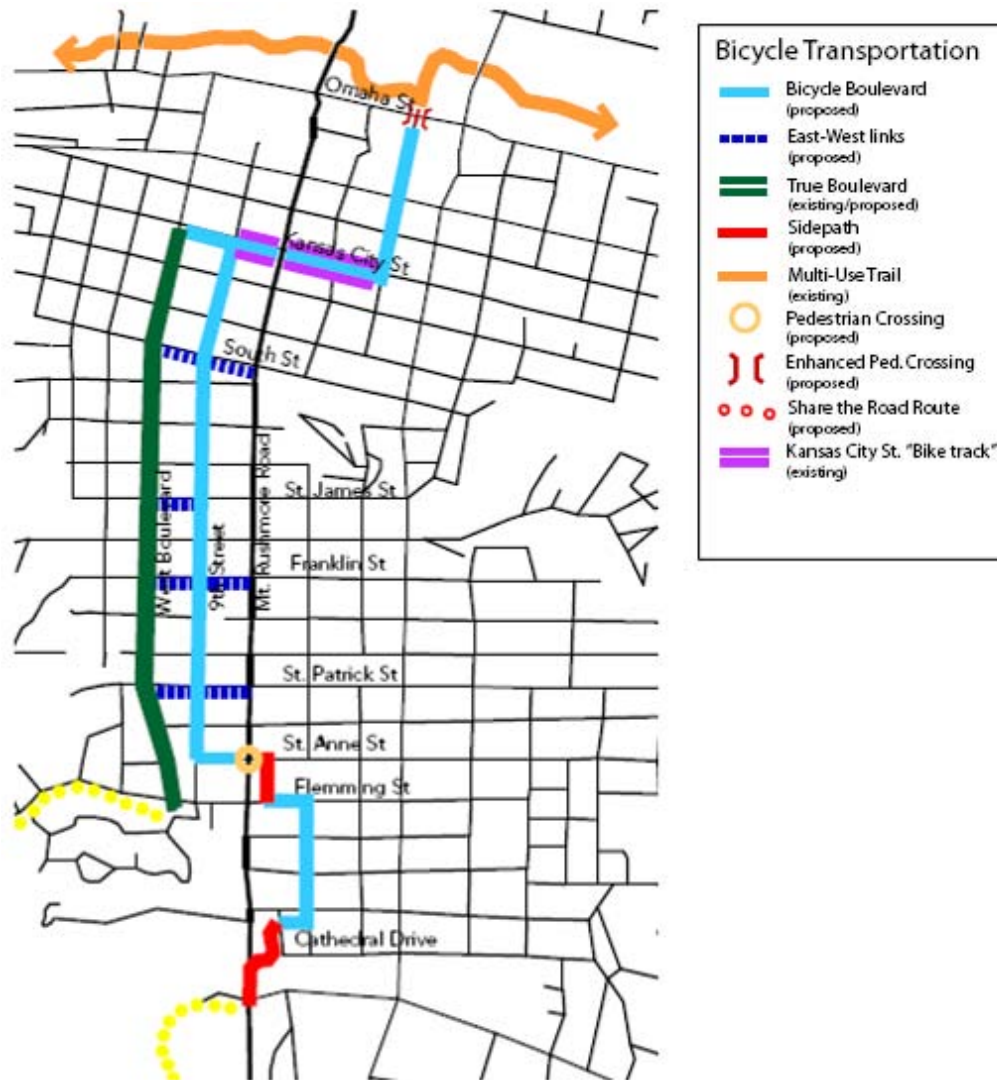


Figure 34. Bicycle Transportation Recommendations, DRAFT Mount Rushmore Road Corridor Development Plan.

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.

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.



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

- 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.

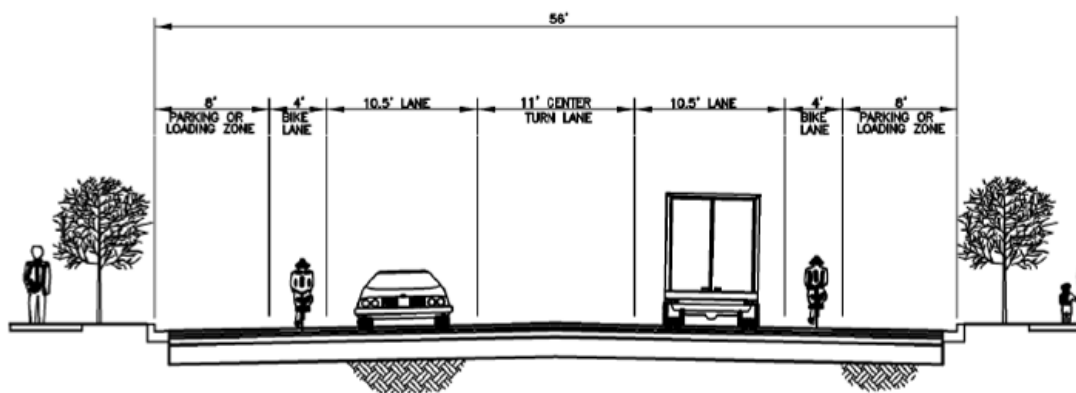


Figure 37. Proposed Highway 1416 Section with Bike Lanes.

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

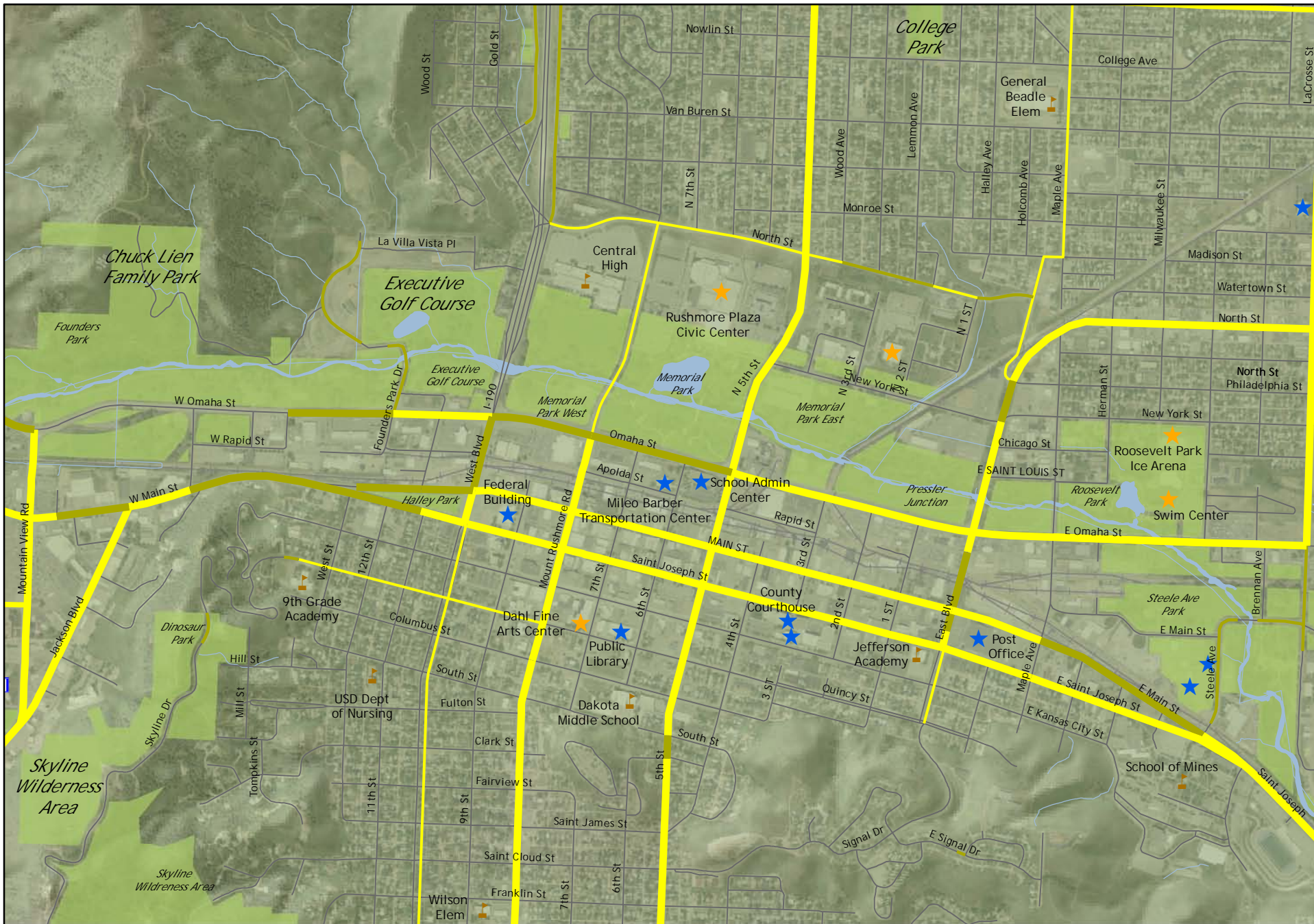
entirely. On various locations downtown, several curb extensions have been provided to minimize crossing distances for pedestrians. These increase pedestrian space and significantly improve the pedestrian environment.

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

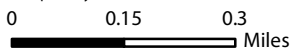
Rapid City Area

Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO

Author: HWK

Date: November 2010



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



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

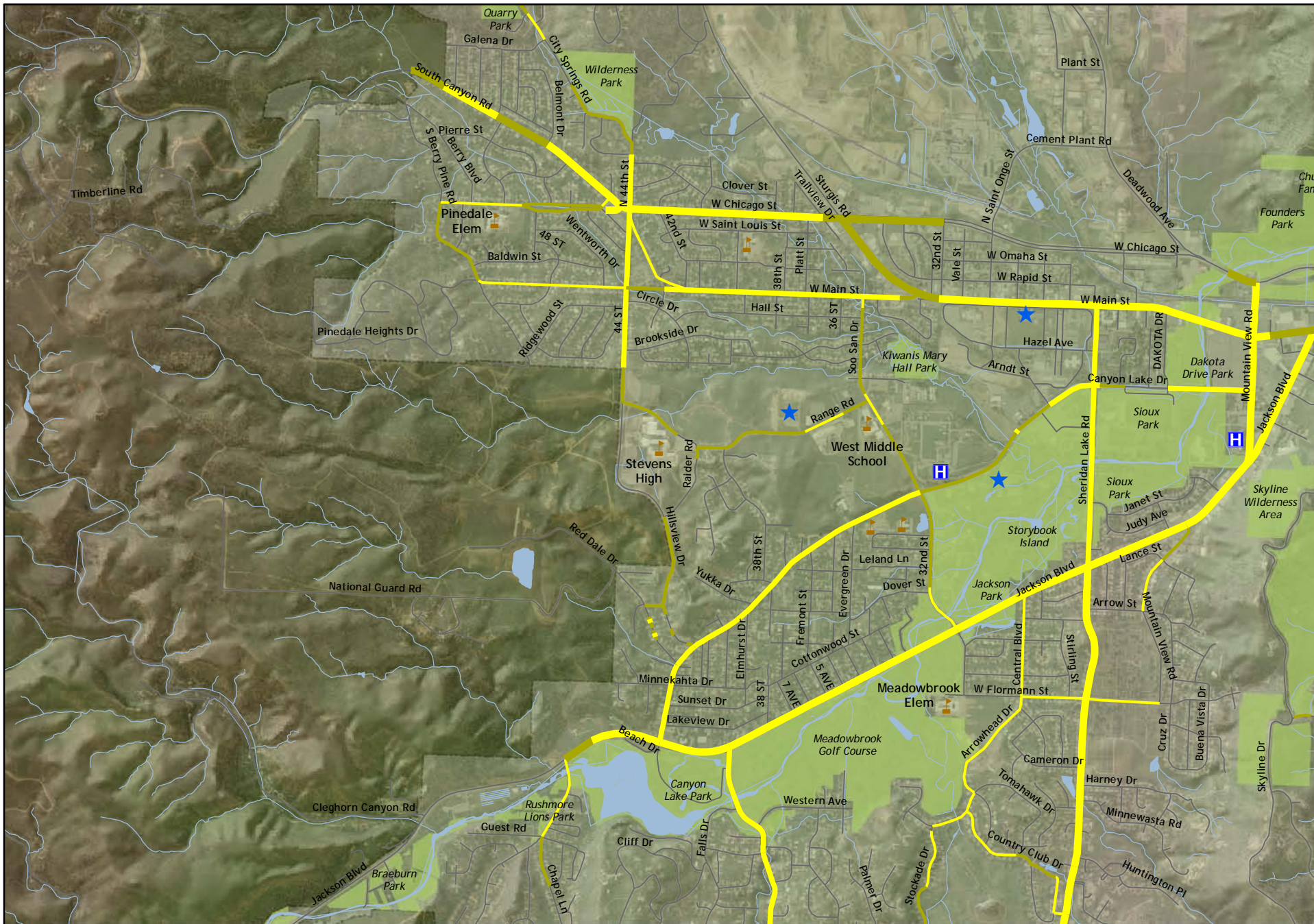
West of Dinosaur Park, most major streets offer sidewalks. Narrow, curb-tight sidewalks along Jackson Boulevard present an uncomfortable walking experience. A median strip on the west side of Mountain View Road offers a small buffer from traffic, although large parking lots in front of businesses deter 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

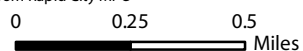
Rapid City Area

Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO

Author: HWK

Date: November 2010



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



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.

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.

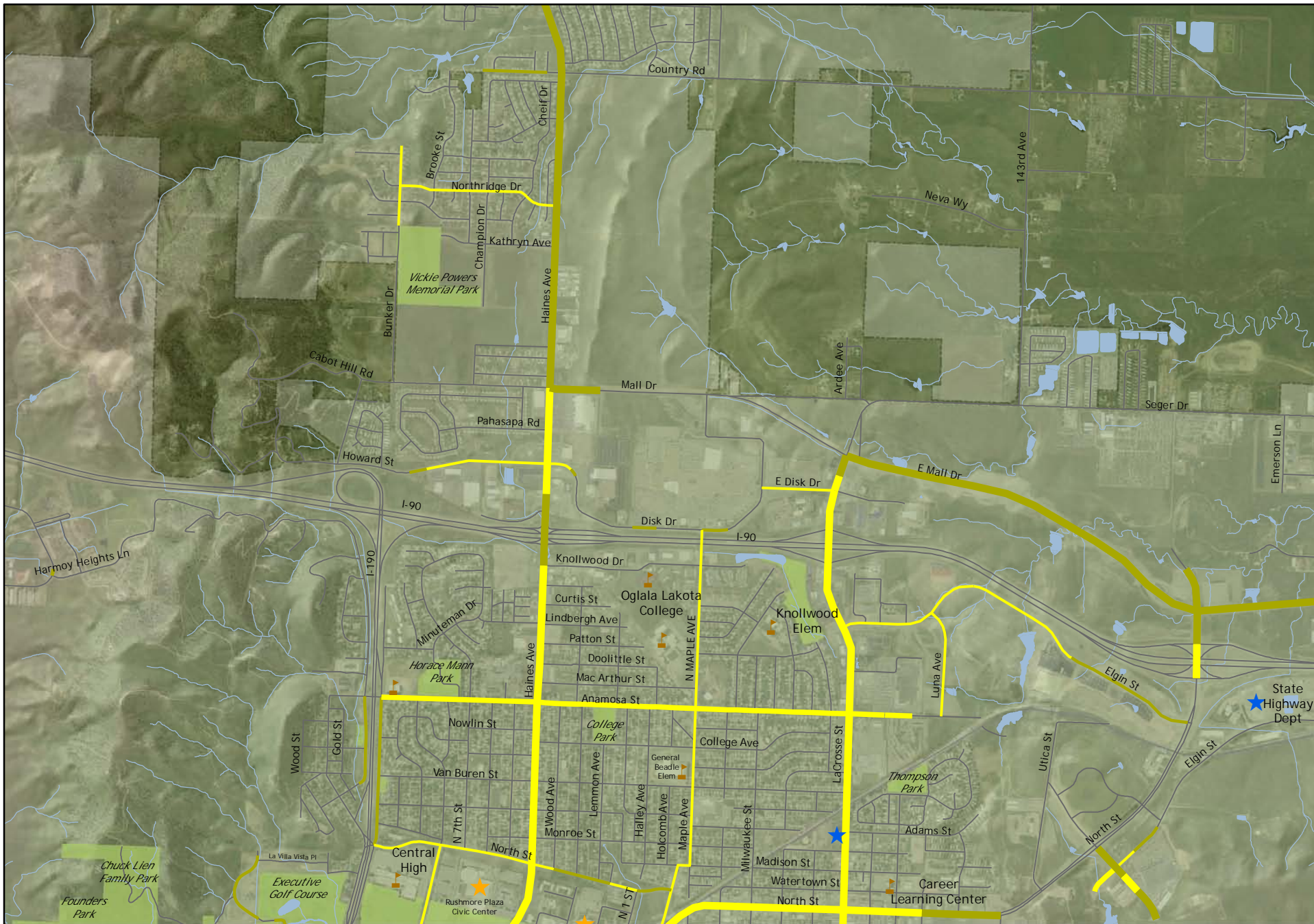
Bicycle Facilities

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.



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



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

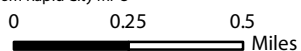
Rapid City Area

Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO

Author: HWK

Date: November 2010



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



Outlying Areas

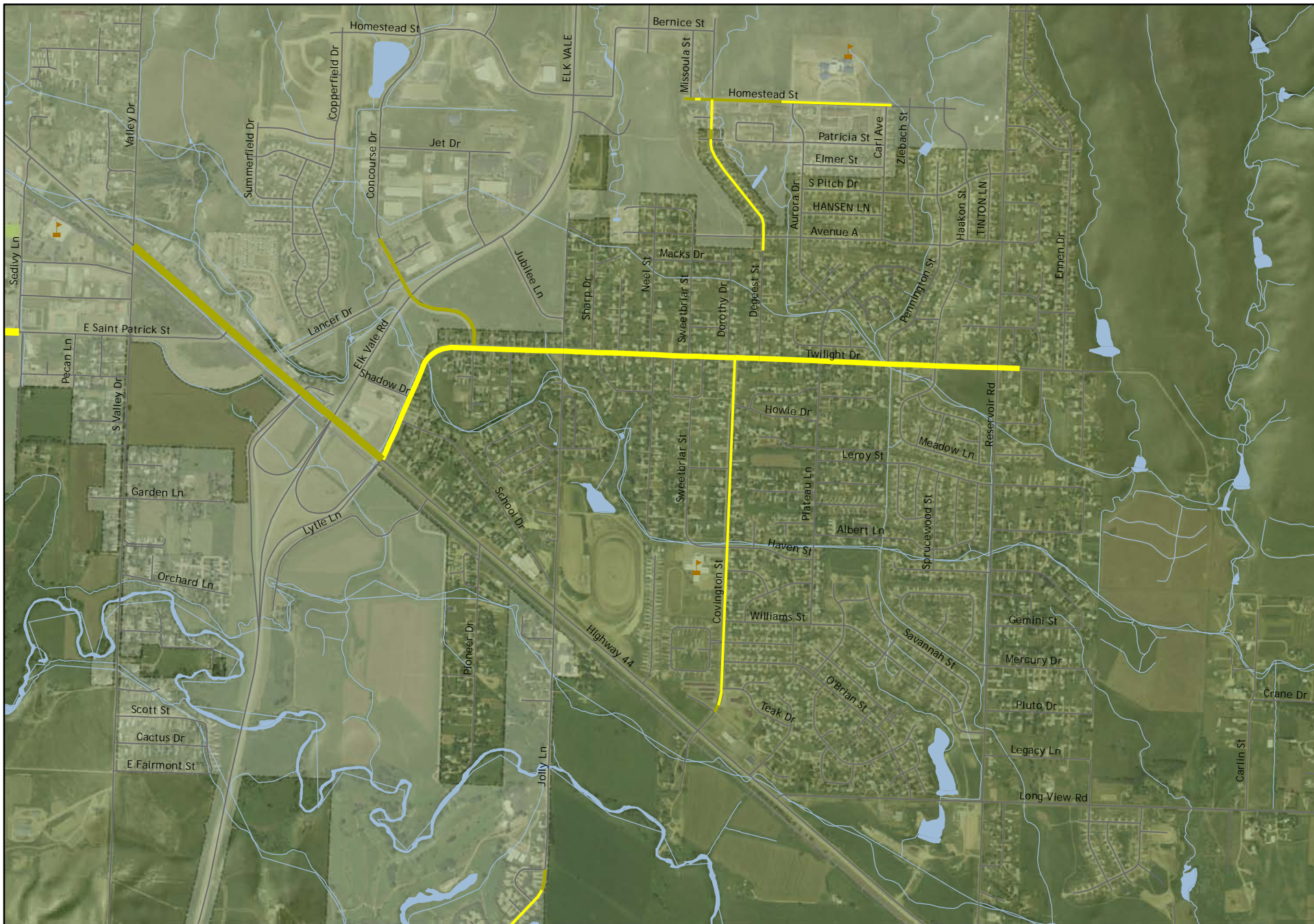
Rapid Valley

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

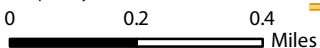
Rapid City Area

Bicycle and Pedestrian Master Plan

Source: Data obtained from Rapid City MPO

Author: HWK

Date: November 2010



- 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



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,

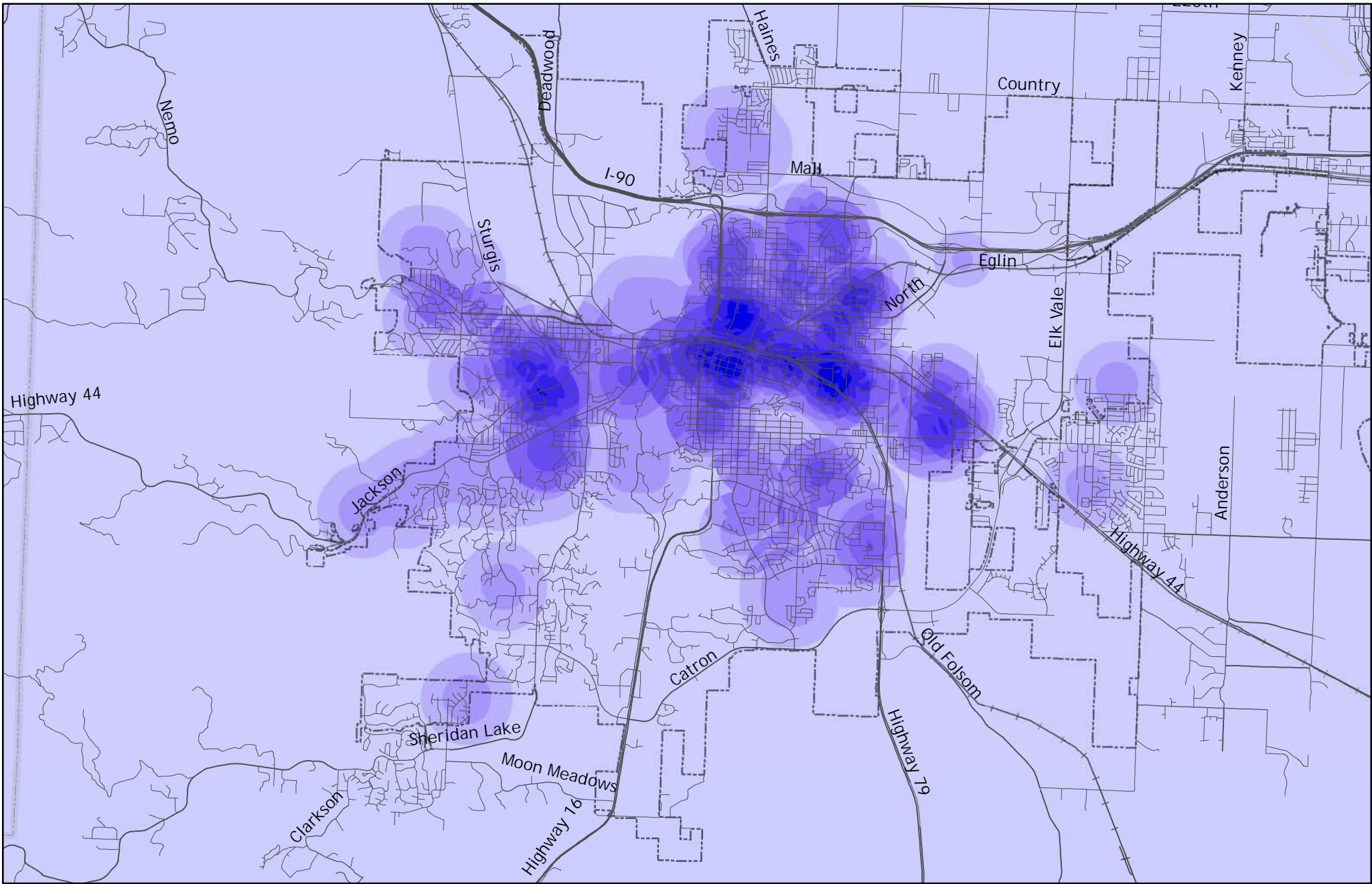
lineal, corridor and system gaps with respect to both on-street facilities and off-street paths. The spectrum of gap closure measures used throughout the United States is also discussed.

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.

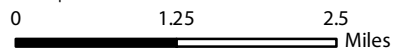
As shown on Map 9, the composite pedestrian attractor map identifies several high-attraction areas within Rapid City, particularly in the downtown area and in Box Elder.



Map 9. Pedestrian Attractors

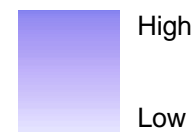
Rapid City Area
Bicycle and Pedestrian Master Plan

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



- City of Rapid City
- Rapid City MPO Boundary
- Box Elder
- Railroads

Pedestrian Attraction



Defining Walkway Gaps

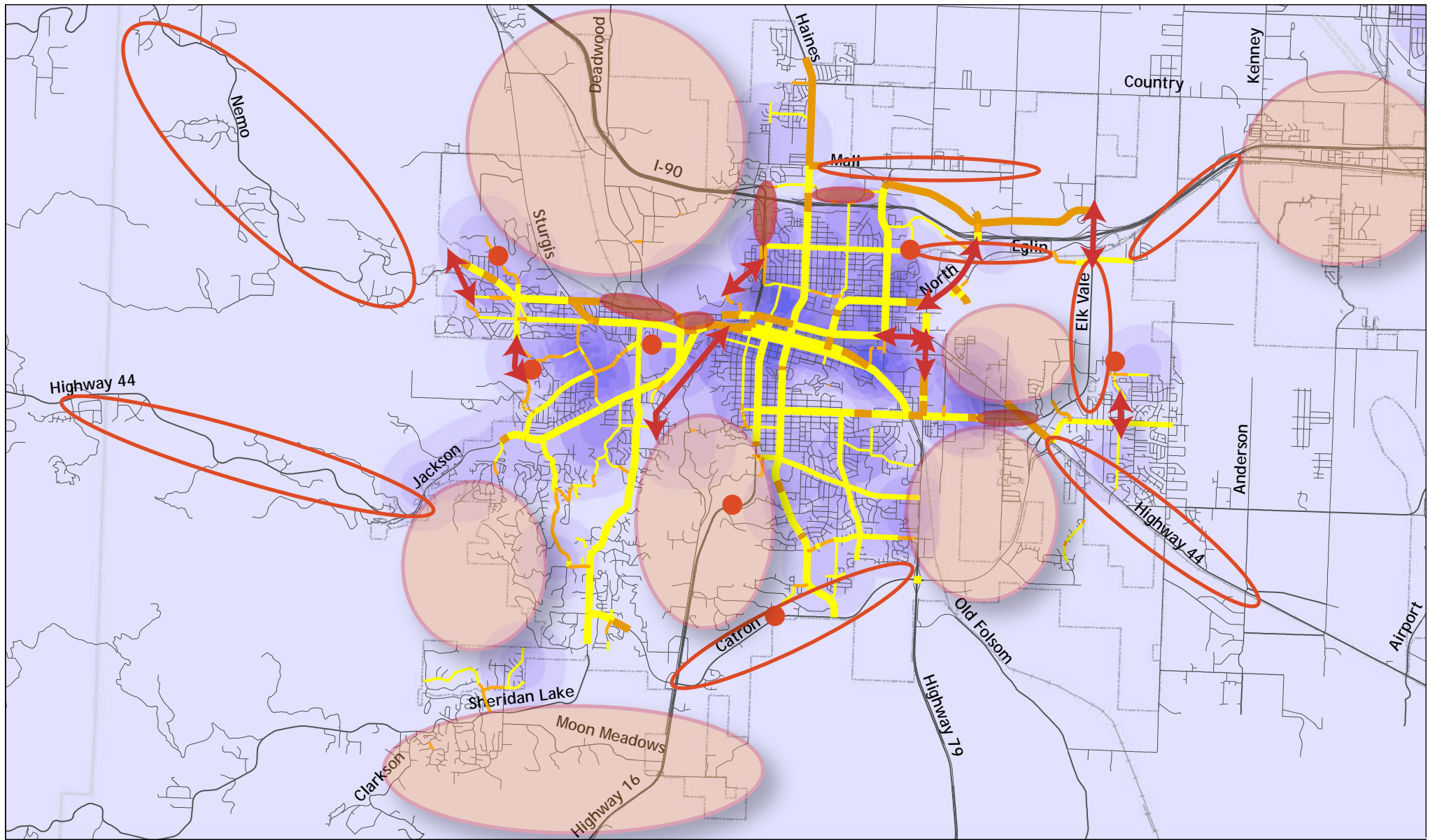
Walkway gaps exist in various forms, ranging from short “missing links” on a specific street or path corridor, to larger geographic areas with few or no facilities at all. Walkway gaps can be classified into three main categories:

- **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

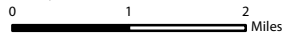
Map 10 shows the results of the Walkway System Gap Analysis. In the map, yellow lines indicate sidewalks on both sides of the street, while brown lines indicate sidewalks on one side only. This information was collected by the Rapid City Area MPO. Width, maintenance, and other factors affecting usability 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



Pedestrian Attraction



Existing Sidewalks, both sides

Existing Sidewalks, one side

Railroads

Spot Gap

Connection Gap

Lineal Gap

Corridor Gap

System Gap



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

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.

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).

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 42. Pedestrian refuge island at mid-block crossing.



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



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



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

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

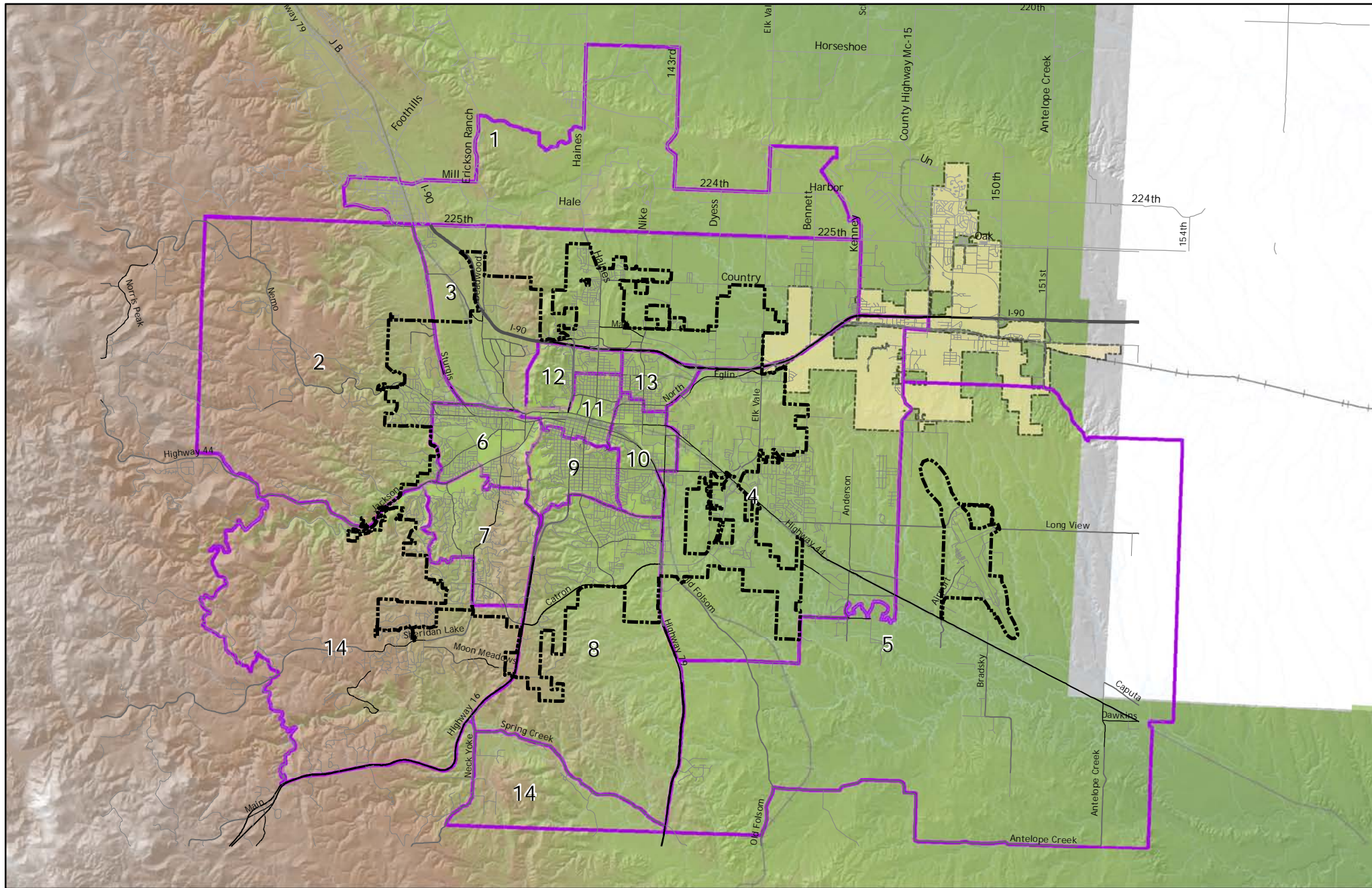
- **Rails-with-Trails** typically consist of paths adjacent to active railroads. Offering the same benefits as rail-to-trail projects, these projects often have additional constraints, including a need for space preservation, limited right-of-way width, inadequate setbacks, concerns about trespassing, 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

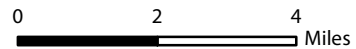
The area was divided into 14 zones of roughly similar bicycling characteristics with boundaries determined by census tracts, as well as barriers such as highways, major roadways, or hills, shown in Map 11.



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



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.

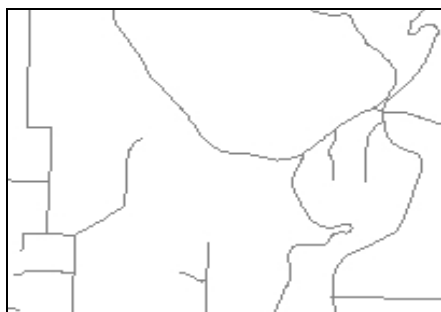
Table 29. Connectivity Cycle Zone Factors

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

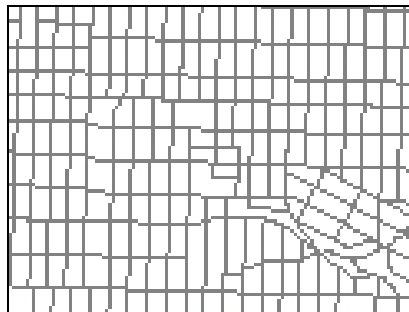
Total Road Network Density:

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	Employment 2008	Employment Density	Destinations (count)	Destination 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.

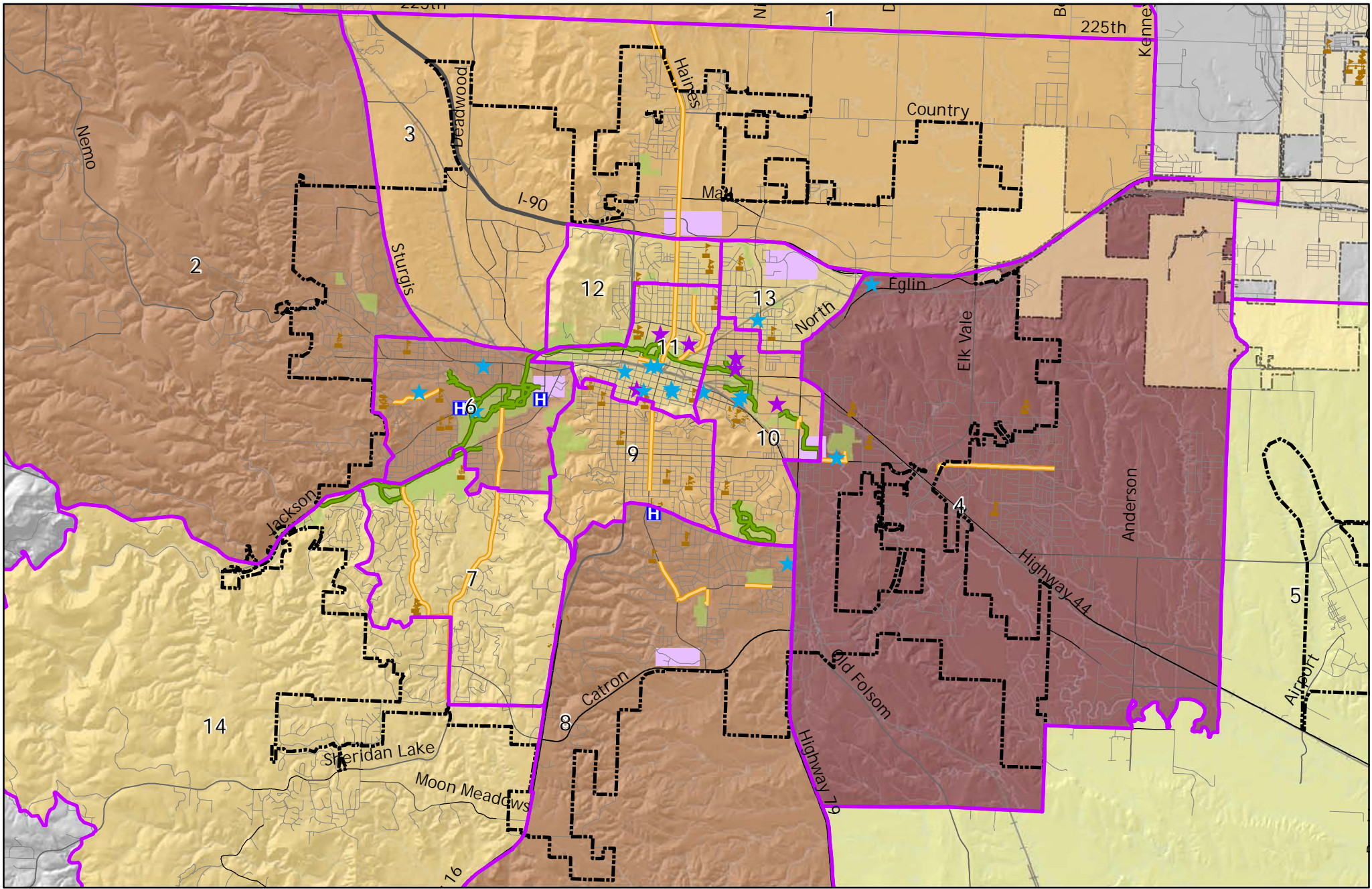
Calculation: The employment of each zone was determined from 2008 Rapid City Area MPO Transportation Analysis Zones (TAZs), and divided by the zonal acreage to determine density.

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



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.

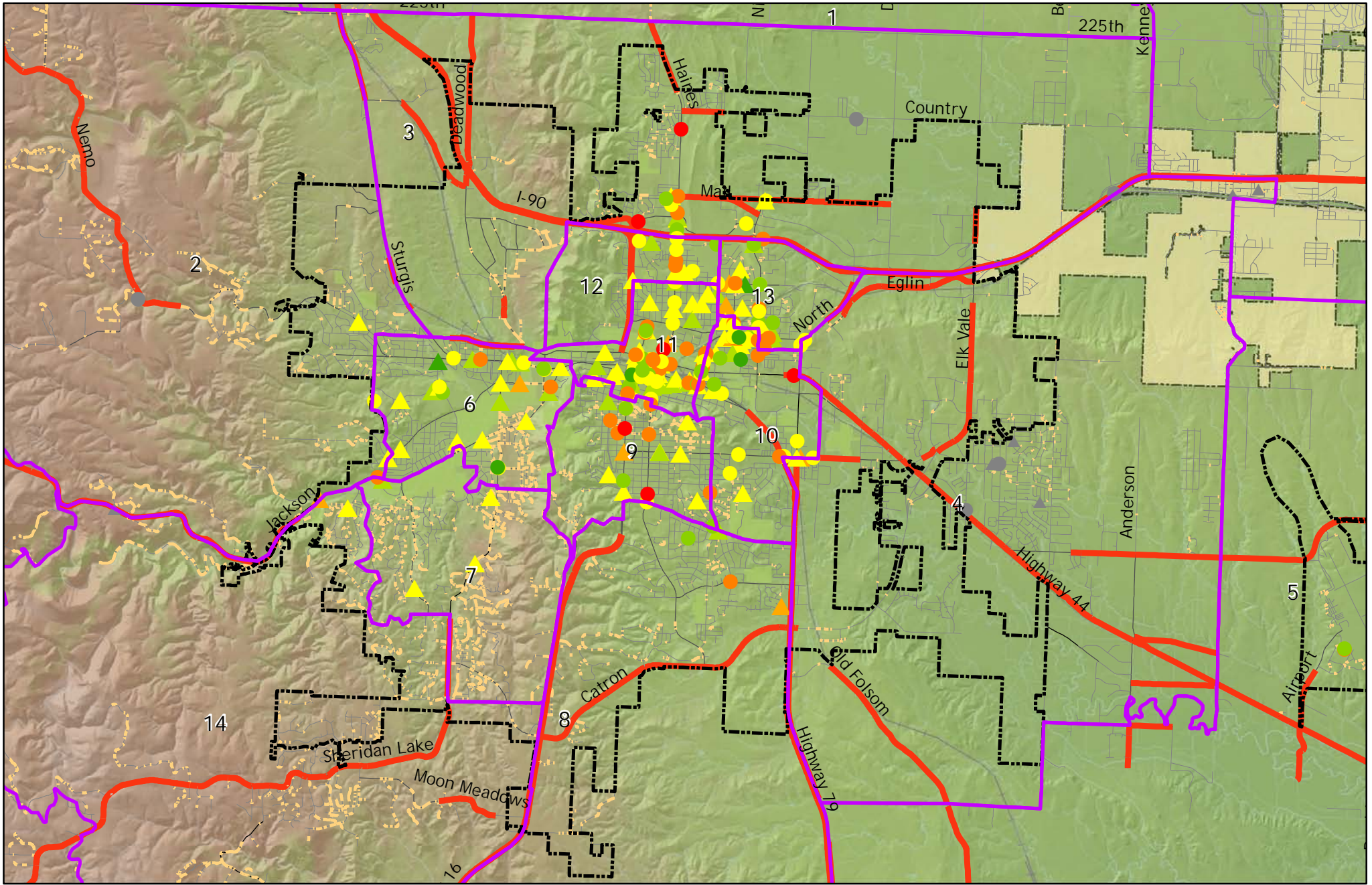
General Methodology: USDA Natural Resources elevation data was used to determine the slope at 100 foot intervals throughout the city. Roadways were divided in 100 foot segments and average slope was recorded using GIS. Roadways with average slope over five percent were added together to estimate the 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.

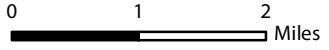
Reasoning: Limited crossing opportunities along major roads and railroads force bicyclists to ride along the major roadways with cars and/or force bicyclists to ride significantly out of their way to access a destination.

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



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



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

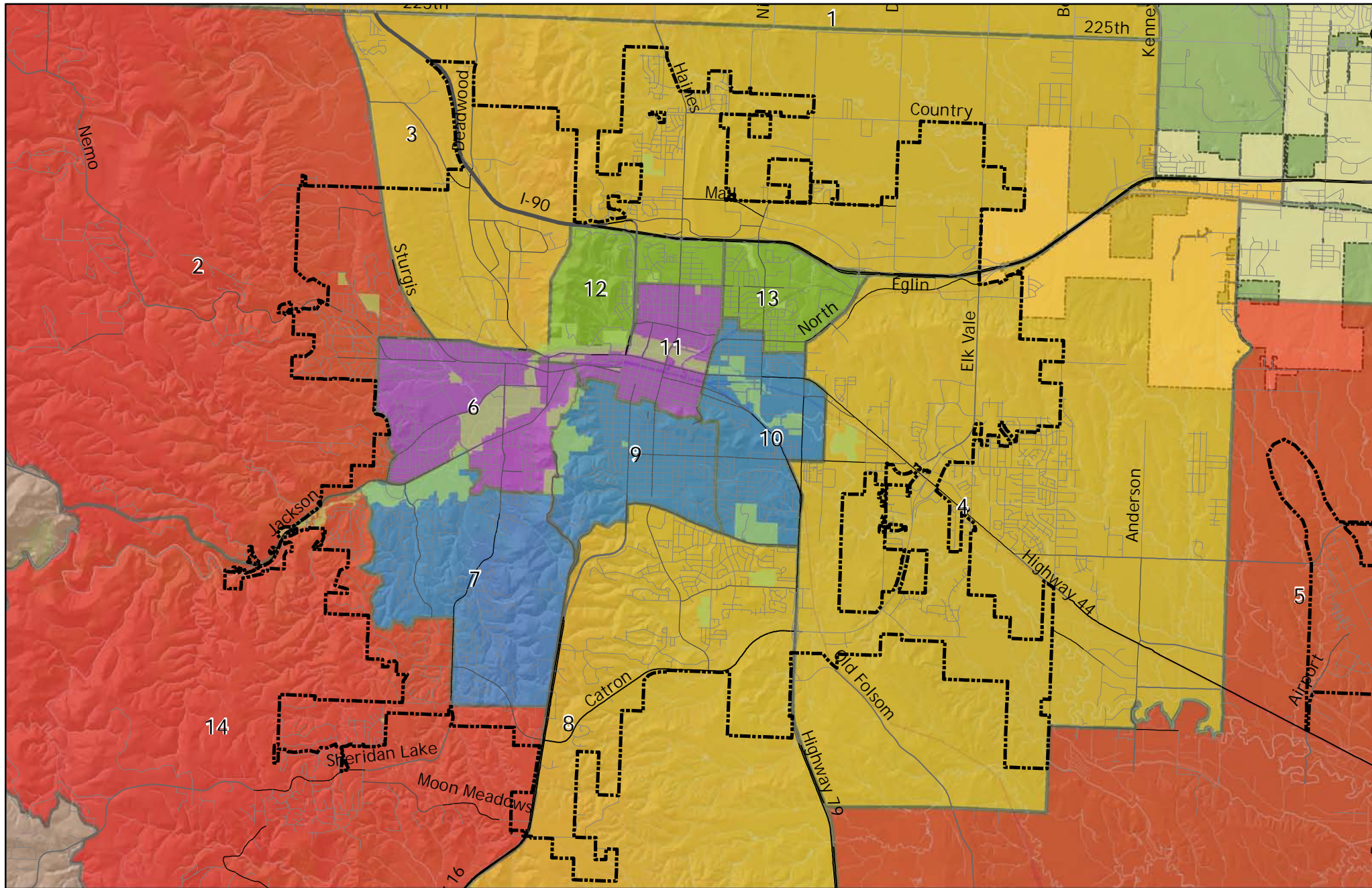
A score of 100 therefore represents a ‘perfect’ cycle zone. The influence of each variable can be weighted by changing the percentage that a variable contributes to the final score. For example, slope can account for five percent or 50 percent of a zone score depending on the need to emphasize or de-emphasize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

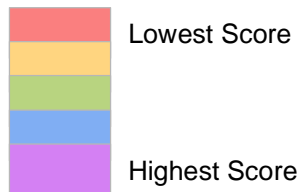
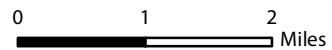
This tool can also be used for goal setting by setting a target that all zones must rate a score of five or higher by 2020, for example. The CZA can be calibrated to highlight areas where additional bicycling facilities will increase the rating from good to great, or poor to good. This could be accomplished 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



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