

# Bicycle Transportation

## Introduction

Bicycling is an important mode of transportation and is also a healthful recreational activity that is available to people of all ages and socioeconomic levels. For around 8% of City of Madison residents aged 18 or older, the bicycle is their primary mode of transportation, according to a 2004 City of Madison Health Department telephone survey of adult residents. Bicycling Magazine recently designated the City of Madison as the most bikeable city in the country among cities in the 200,000-to-500,000 population range.

Bicycling is an efficient and convenient mode of transportation that, like the automobile, provides a high degree of independence, flexibility, and freedom of choice relative to schedule and destination. Door-to-door travel times are comparable to the automobile for short trips up to three miles, particularly in the downtown and UW-Madison campus areas where parking adjacent to buildings is limited. Bicycling levels are much higher during the warmer weather months, but many people bicycle all year long.

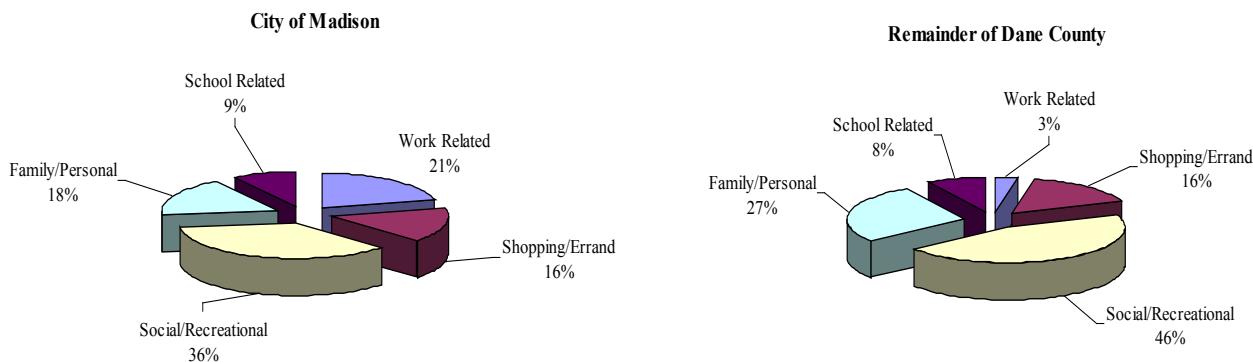
Census data and bicycle traffic counts in the City of Madison show that bicycling levels continue to increase as the growing and increasingly interconnected bikeway network in the region makes bicycling more convenient and enjoyable.

## Bicycle Travel

Bicycle trips accounted for around 2.4% of all average daily person trips in the City of Madison and 1.0% of person trips in the rest of Dane County, according to a special county add-on sample of the 2001 National Household Transportation Survey (NHTS). The average length of bicycle trips was 3.4 miles for all trips countywide.

Figure 23 shows the distribution of trip purposes for bicycle trips in the City of Madison and the rest of Dane County. Social/recreational trips made up a much higher percentage of bicycle trips than for all person trips, accounting for 36% of City trips and 46% of trips in the rest of the county compared to 19% of all person trips countywide. Work trips accounted for 21% of bicycle trips in the City versus just 3% of bicycle trips in the rest of the county.

**FIGURE 23  
TRIP PURPOSE DISTRIBUTION FOR BICYCLE TRIPS**



In 2000, over 3,800 or around 3.2% of City of Madison workers commuted to work by bicycle, according to U.S. Census figures.<sup>7</sup> This was a 7.6% increase from 1990. Around 7.1% of workers residing within the greater Isthmus area<sup>8</sup> bicycled to work in 2000. Around 400 or 0.3% of workers in the rest of Dane County (excluding the City of Madison) commuted by bicycle.

<sup>7</sup> It should be noted that census data is collected during the last week of March when bicycling levels are lower compared to the warmer weather months. Actual bicycling levels are also probably underestimated by the census due to the fact that the data only identifies a person's primary mode of transportation. Many persons drive or use transit the majority of time to work, but still regularly bicycle during good weather. Some persons also drive to a close-in location and bicycle to work from there.

<sup>8</sup> Includes the area bounded by University Bay Dr., Franklin Ave., and Glenway St. to the west, Haywood Dr. to the south, and Commercial Ave. and Starkweather Creek to the east (Census Tracts 9-12, 16.01, 16.02, 17.01, 18, 19 and part of 20 and 21).

The University of Wisconsin (UW) – Madison Transportation Services Department conducts a biannual transportation survey on student and faculty/staff commuting habits and attitudes. According to the March 2005 survey, around 16% of students, 12% of staff/faculty, and 10% of UW Hospital & Clinics employees bicycle to campus in good weather. For UW staff/faculty residing in the City of Madison, 20% bicycle to campus. For all persons working in either the UW campus or downtown area, around 5% bicycled to work according to the 2000 U.S. Census.

As is the case of walk trips, the much higher percentage of bicycle trips by City of Madison residents and for those residing or working in the greater Isthmus area can be attributed in large part to the more compact, mixed-use development pattern and the extensive bicycle facility network in the Madison area. The cost of parking in the UW campus and downtown areas also likely contributes to the higher numbers of bicycle commuters.

The City of Madison collects bicycle path traffic counts from 24-hour detection devices placed in paths at several street intersection locations and in the contra-flow bike lane on University Avenue at Mills Street. Table 18 shows average weekday bicycle traffic at these locations for the latest year for which complete data is available. Bicycle traffic on the John Nolen Path has increased 42% from 1997 to 2004, while traffic on the University Avenue bike lane has increased 89% from 1995 to 2003. The East Rail Isthmus Path has also seen a significant increase in use between 1999 and 2003—the first and last years a full year of data is available—growing 26% during this time. A partial set of data for 2004 shows that use of the path has continued to grow.

The Wisconsin Department of Transportation (WisDOT) sponsored a statewide multi-use path/trail use study with counts by time of day and user characteristics data recorded at locations along ten selected higher use paths and along a roadway from 2003 to 2005<sup>9</sup>. The study locations included three in Dane County—the Southwest Commuter Path near the Breese Terrace intersection, the Capital City Trail (E-Way Segment) at the Fish Hatchery Road intersection, and STH 19 at the Kingsley Road intersection in Waunakee. Table 19, on the next page, shows the number of bicyclists and pedestrians at these locations and the dates and times the data was collected. The vast majority of bicyclists using the Southwest Path near the UW-Madison campus on two different weekdays were categorized as either “commuter/utilitarian” (52%) or “generic” (41%), while just 7% were categorized as “racing cyclists.” The breakdown for Capital City Trail users was 12% commuter, 67% generic, and 21% racer on a weekday and 83% generic and 17% racer on a Saturday. The breakdown users at the STH 19 location in Waunakee on a Saturday was 5% commuter, 51% generic, and 44% racer.

**TABLE 18  
CITY OF MADISON BICYCLE TRAFFIC COUNTS**

<b>Path/Location</b>	<b>Year</b>	<b>Number of Bicyclists on Average Weekday</b>		
		<b>Annual Avg.</b>	<b>April – Oct.</b>	<b>Nov. – March</b>
Brittingham Bay @ West of North Shore Dr.	2004	352	481	171
East Rail Isthmus @ Yahara River Bike Bridge	2003	629	888	266
John Nolen Drive @ East of North Shore Dr.	2004	955	1,358	389
John Nolen Drive @ Bridge SW of North Shore	2004	746	1,051	318
Wingra Creek @ Park Street	2000	206	295	81
University Ave. Contra-Flow Bike Lane @ Mills Street	2003	6,688	8,843	3,670

Source: City of Madison Traffic Engineering Division

<sup>9</sup>Wisconsin Bicycle and Pedestrian Trail Use Study, Research Report 2005-3, Traffic Operations and Safety Laboratory, UW-Madison Dept. of Civil and Environmental Engineering, sponsored by WisDOT, November 2005.

**TABLE 19**  
**BICYCLE/PEDESTRIAN TRAFFIC AT SELECTED MADISON AREA LOCATIONS**  
**(FROM WISCONSIN TRAIL/PATH USE STUDY)**

Path/Location	City/Village	Usage	Date	Time Period of Counts
Southwest Path (west of Breese Terrace)	Madison	980 (171 ped) 160 (30 ped)	8/29/03 (Fri.) 9/2/03 (Tues.)	8 a.m. to 8 p.m. 5:30 a.m. to 8 a.m.
Capital City Trail (Fish Hatchery Rd. intersection)	Fitchburg	441 (77 ped) 745 (111 ped)	6/29/04 (Tues.) 8/14/04 (Sat.)	5:30 a.m. to 8:30 p.m. 5:30 a.m. to 8:30 p.m.
STH 19 (Kingsley Rd. intersection)	Waunakee	41 (3 ped)	8/21/04 (Sat.)	6 a.m. to 8 p.m.

Source: WisDOT

### ***Existing Bicycle Facilities in Dane County***

The Madison area has an extensive network of bicycle facilities that has been developed over the last few decades. Regional and City of Madison policies have supported the inclusion of bicycle facilities as part of roadway construction and reconstruction since the first Madison area bicycle plan was adopted in 1975. Funding for independent bicycle projects increased substantially in the early 1990s when the landmark Federal transportation legislation, the Intermodal Surface Transportation Efficiency Act (ISTEA), created a dedicated program for local bicycle, pedestrian, and other "transportation enhancement" projects. This has greatly accelerated the pace of development of major multi-use paths and bicycle/pedestrian over- and underpasses in the Madison area.

There are currently about 47 miles of on-street bicycle facilities (bike lanes, paved shoulders) in the City of Madison and 263 miles in all of Dane County. Major local arterial streets in the Madison area with bike lanes include: Johnson and Gorham Streets; University Avenue (through UW campus); Mineral Point Road; Old Sauk Road; Fish Hatchery Road; portions of Park Street; portions of Gammon Road; Seminole Highway; and North Thompson Drive. Bike lanes are being added to East Washington Avenue as it is being reconstructed from Blair Street to Thierer Road with two of five segments already completed. Bike lanes will also be added to Monona Drive as part of reconstruction planned to start in 2008.

There are currently over 42 miles of bike paths and trails in the City of Madison and 151 miles in all of Dane County. Major paths constructed in the past ten years include: Starkweather Creek Path (Shopko Dr. to MATC); Capital City Trail (E-Way and Verona Road segments); Wingra Creek Path; Southwest Commuter Path; Blackhawk Path, reconstruction of the west end of the UW-Madison Campus Path; Marsh View/East Branch Creek Path; USH 12 Corridor Path; and Pheasant Branch Trail. A number of important pedestrian/bicycle over- or underpasses have also been built during this time.

Signed bicycle routes are not a bicycle facility per se, but a shared roadway or multi-use path that has been designated by signing as a preferred route for bicycle use. The purpose of a bicycle route system is to highlight for way-finding purposes reasonably direct routes through the urban area on either paths or streets that most bicyclists will feel comfortable using. Routes are located to provide access to major bicyclist destinations such as schools, parks, and employment centers. The City of Madison has an extensive signed route system that covers a portion of the City of Monona. The City of Fitchburg also has a recently signed route system and other communities such as the Cities of Middleton and Stoughton are in the process of developing them. There are currently 114 miles of signed bike routes in the City of Madison and 149 miles in Dane County.

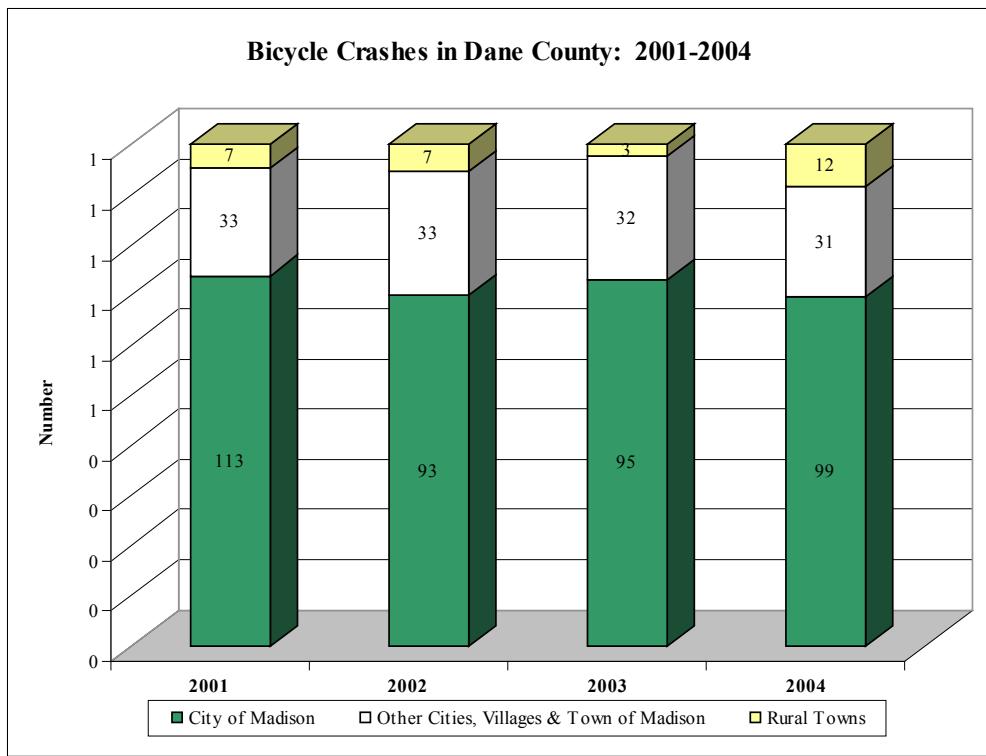
Figure 24, on the next page, shows existing bicycle facilities and signed bicycle routes in Dane County.

While the bicycle facility network in the Madison area is extensive, there are still missing links in the network and barriers that bicyclists face in certain corridors. In addition, better commuter routes need to be developed connecting some of the suburban communities with the central Madison area.

### Bicyclist Safety Data and Education

Countywide from 2001-2004, there was an average of 140 bicycle crashes annually involving a motor vehicle that resulted in an injury, fatality, or property damage. There were a total of four fatalities during the four-year period. Figure 25 shows the number of crashes during this time in the City of Madison, other larger cities and villages, and small villages or towns. In the City of Madison, the annual number of crashes has dropped from a high of around 340 in 1985 to 99 in 2004 despite increasing bicycle use. Part of the decrease in the number of crashes, however, can be attributed to a reduction in the threshold for reporting crashes from \$200-\$500 to \$1,000 in property damage. The Madison Police Department also stopped reporting crashes not involving a motor vehicle. There has also been a downward trend in bicycle crashes statewide since the 1980s.

**FIGURE 25**



Note:

Includes crashes involving fatality, injury, and property damage. The vast majority were injury crashes. There were no fatalities in 2001, two in 2002, none in 2003, and two in 2004.

Source: WisDOT

Bicyclists aged 20-44 are involved in the majority of bicyclist/motorist crashes in the City of Madison, reflecting the high level of adult bicycle usage in the city. They accounted for 60% of the crashes in 2003. Bicyclists aged 10-24 are over-represented in terms of the number of reported crashes they are involved in compared to their percentage of the population. They accounted for 51% of the crashes in 2003, but account for only around 29% of the population according to the 2000 Census. Statewide, children under age 16 account for the majority of bicyclist/motorist crashes.

Turning, merging, and crossing movements at intersections, driveways, and other junctions account for the vast majority of all bicyclist/motorist crashes, particularly in urban areas. The most common types of crashes in the City of Madison in 2002-'03 were: right angle at intersection (43%); left turn/through – opposite direction (21%); and angle crash at mid-block (e.g., entering or leaving driveway) (14%). Sideswipe – same direction crashes accounted for 5% of bicycle-motor vehicle crashes. While the vast majority of bicyclist/motor vehicle crashes occur in urban areas, a much smaller percentage of the severe injuries and fatalities occur in such areas due to the lower speeds on urban streets.

In adult bicyclist/motorist crashes, both national and local data indicate that the motorist is the one who most often makes the critical error. Failure to yield by the motorist is the most common error. In 2002-'03, this factor was involved in 37% of the crashes while the motorist being inattentive was the main factor in another 9% of crashes. The bicyclist's failure to yield or disregard the traffic signal was the main factor in 14% of the crashes.

In child bicyclist/motorist crashes, the child bicyclist is most often the one who makes the critical error. The most common type of crashes are: bicyclist mid-block ride-out; bicyclist ride-out at uncontrolled intersection; and bicyclist makes unexpected turn or swerves into traffic.

Riding on the sidewalk is not as safe as people generally perceive it to be and may even have a higher rate of crashes per bicycle-mile than roadway bicycling. A detailed study of City of Madison crash data from 1987-1990 found that 30% of all crashes occurred on sidewalks or within crosswalks with almost three-quarters of these occurring while the bicyclist was riding against the flow of traffic in the adjacent street. Other studies around the country have confirmed the greater risk of traveling on a sidewalk, particularly when riding against the flow of traffic.

Bicyclist/motorist crashes in the City of Madison are concentrated in the UW-Madison campus area (particularly along University Avenue and Johnson Street) where bicycle usage is highest, there is a high level of motor vehicle traffic congestion, and there are many intersections and other conflict points.

The studies on bicyclist/motorist crashes show that bicyclist and motorist education and training is very important to efforts to improve bicyclist safety. Bicyclists need to be taught how to properly ride in traffic and motorists need to be taught how to operate with and be more attentive to bicyclists.

The City of Madison has a pedestrian and bicycle safety program with a full-time Bicycle/ Pedestrian Safety Educator who teaches basic safety skills to elementary children at the public schools and local agencies. The Madison Area MPO supports this position through an annual allocation of its Federal Surface Transportation Program (STP) – Urban funding. The City's Bicycle/Pedestrian Coordinator advocates for bicyclists by working with the City of Madison and other area planning and transportation agencies to improve bicycle facilities and increase their safety.

The UW-Madison Transportation Services Department employs a full-time Bicycle/Pedestrian Coordinator to provide bicycle safety education and encouragement. The coordinator offers courses, distributes maps and other materials, and advocates for bicyclists on campus. A WisDOT grant in 2003 enabled the university to implement a Bike Ambassador Program in which students are hired to raise awareness of bicycle and pedestrian safety through various activities, including tours and skills workshops.



The WisDOT Bureau of Transportation Safety administers a pedestrian/bicycle education and enforcement reimbursement program, offers a variety of bicycle safety education courses, publishes a number of bicycle safety education materials, and conducts other educational activities. The City of Madison, other communities, and the Bicycle Federation of Wisconsin assist in distributing the educational materials. WisDOT also plays an important role in educating drivers through its driver licensing responsibility, including publishing of the Motorist's Handbook.

The Bicycle Federation of Wisconsin (BFW), American Automobile Association (AAA), and other area organizations and health agencies conduct a variety of other bicycle safety activities, including educational programs, training courses, and distribution of materials. The BFW offers classes, organizes the annual Bike to Work Week event, and conducts numerous other promotional activities. Through a grant, BFW conducted a major educational program throughout the county that included motorist as well as bicyclist education. A coalition of organizations, including BFW and the Safe Community Coalition, is currently conducting a program that will include law enforcement training, overtime grants for enforcement of bicycle-related laws, children's "pre-driver education" training, television PSAs, and billboards.

### ***Existing Bicycle Plans and Bicycle-Related Policies***

#### Regional Bicycle Transportation Plan

The Madison Area MPO prepared a comprehensive regional bicycle plan in 2000. The Bicycle Transportation Plan for the Madison Urban Area and Dane County was adopted by Dane County and the City of Madison as well as the MPO. It provides a blueprint for continuing to improve bicycling conditions and safety and increasing bicycling levels.

The plan covers the "four Es" of engineering (facility improvements), education, encouragement, and enforcement. It includes a vision statement, three broad goals, and detailed objectives and recommendations within the following categories:

- Bicycle facilities planning and development
- Bicycle facilities maintenance
- Support facilities and transit connections
- Education and encouragement
- Enforcement

The most important objective is to integrate the consideration of bicyclists' needs into the community and neighborhood planning and development plan review processes, and local and state agencies' planning, design, and operation of transportation projects and programs.

The bicycle transportation plan identifies and prioritizes on-street bicycle facility (bike lane/paved shoulder) needs and proposed off-street paths/trails for the Madison urban area and rural Dane County. It also identifies recommended bicycle routes for the Madison urban area and routes connecting communities and parks within the county. On-street facility improvement needs were based on an analysis of the compatibility for bicycling on arterial and collector roadways in the Madison urban area and rural Dane County. Proposed off-street facility improvements were based on:

- The need to provide alternative and/or more direct connections to desired destinations (e.g., where suitable on-road alternative does not exist).
- The need to cross barriers, mostly freeways or high-volume arterial roads.
- Available opportunities for paths/trails such as in rail and open space/environmental corridors.

The proposed on- and off-street bicycle facility improvements were prioritized based on a set of criteria focused primarily on the extent to which the facility improves mobility and accessibility in regional travel corridors and on anticipated use.

As part of this regional transportation plan update, an updated countywide bikeway system plan and an updated list of high priority regionally significant off-street bicycle facility projects have been prepared (See Bicycle Transportation Recommendations on page 151).



The 2000 bicycle transportation plan also includes detailed design guidelines for bicycle facilities in an appendix. Issues covered by the design guidelines include:

- Types of bicycle facilities
- Wide streets with low parking occupancy
- Bicycle boulevards
- Bike lane treatments at intersections
- Retrofitting streets with bike lanes
- Traffic signals
- Traffic calming - considerations for bicyclists
- Bicycle parking

The guidelines primarily follow the national AASHTO guidelines, but go beyond these in some cases and also address some issues that aren't addressed or are not addressed in sufficient detail. These guidelines provide a valuable reference for local planners and engineers.

#### Madison Area MPO Policies Supporting Bicycle Transportation

The Bicycle Transportation Plan for the Madison Urban Area and Dane County prepared and adopted by the Madison Area MPO includes specific objectives and recommended actions by the MPO, WisDOT, Dane County, and local jurisdictions for achieving the goals of the plan to provide safe, convenient, and enjoyable travel by bicyclists, increase bicycling levels, and reduce bicyclist crashes.

One of the most important ways in which the Madison Area MPO supports bicycle transportation is through its criteria for selecting projects to be funded with Federal Surface Transportation Program (STP) – Urban funds. The STP provides flexible funding that can be used for a wide variety of transportation projects. A portion of STP funds, called STP – Urban, is designated for urban areas. Large urbanized areas (population over 200,000) such as Madison receive a direct apportionment of funds. In 2006, the Madison urban area received \$6.2 million. Federal rules provide MPOs with the responsibility to coordinate and approve priority project listings for use of these STP – Urban funds.

The Madison Area MPO's scoring criteria for selecting STP – Urban projects from applications submitted by local units of government in the urban area and Dane County favors multi-modal projects and those that support the region's goals of compact land use and environmental preservation. Projects that include accommodations for bicyclists, pedestrians, and/or transit users, have a high degree of multi-modal use, support compact land use, and reduce environmental impacts of the transportation system receive extra points and are thus more likely to be funded. As a result, almost all of the roadway construction and reconstruction projects that have been funded through the STP – Urban have included bike lanes. In addition, the Madison Area MPO has as a matter of policy agreed to utilize a portion of these funds each year (\$53,000 in 2006) to support the City of Madison's Bicycle and Pedestrian Safety Education Program.

MPOs also play a central role in the selection of Federal Transportation Enhancements (TE) Program projects in urban areas as part of WisDOT's Multi-Modal Improvement Program. The TE program is designed to fund projects that increase multi-modal transportation alternatives and enhance communities and the environment. A state review committee recommends TE projects for funding for approval by the WisDOT Secretary from local applications. However, MPOs are asked to prioritize projects within their planning areas and the state committee generally follows the MPO priorities. The Madison Area MPO's criteria for prioritizing TE projects emphasizes regional mobility and accessibility and therefore strongly favors bicycle projects.

#### State Bicycle Plan

WisDOT completed the first comprehensive state bicycle plan in December 1998 called the *Wisconsin Bicycle Transportation Plan 2020*. The plan establishes WisDOT goals, objectives, and policies or action statements regarding the provision of bicycle accommodations on state roadways and state-supported roadways and covering the other "E's" of education, enforcement, and encouragement. The plan also includes advisory objectives and policies for local roadways. The plan includes separate intercity and urban/suburban elements and is primarily policy-oriented, but it does include recommenda-

tions for seven key inter-city trails, including the Madison-to-Belleville Rails-to-Trails corridor. WisDNR is in the process of designing and developing a bike path/trail in this corridor.

#### WisDOT Policies Supporting Bicycling

WisDOT has established a vision to “establish bicycling as a viable, convenient, and safe transportation choice throughout Wisconsin” and has established a policy that bicyclists’ needs should be considered in virtually all transportation projects. WisDOT recently adopted a Community Sensitive Design (CSD) program that reinforces this vision and calls for greater citizen participation and additional flexibility in roadway design standards. For projects designed under CSD, it is assumed that bicycle and pedestrian accommodations will be incorporated. Procedure 11-45-10 of the WisDOT Facilities Development Manual indicates specifically that bicycle facilities are to be provided on state roadways when the roadway is on an officially designated bike plan or 25 or more bicycle trips a day are anticipated during the peak season and the current motor vehicle traffic volume on the roadway exceeds 1,000 vehicles a day.

In 2004, WisDOT published the *Wisconsin Bicycle Facility Design Handbook*, which describes and illustrates specific design features and approaches for accommodating bicyclists both on- and off-road. The handbook is comprehensive, covering basic roadway improvements, bicycle lanes, and shared-use paths. Topics covered under basic roadway improvements include street network design, pavement quality, intersection sight lines, railroad crossings, traffic signals, structures, and traffic calming.

#### Dane County Policies Supporting Bicycling

It is the policy of the Dane County Highway & Transportation Department to provide paved shoulders (4- to 5-feet wide where possible) on all rural county trunk roadways with an average daily traffic of 1,000 vehicles or more when they are resurfaced or reconstructed. For improvement projects on county roadways through or adjacent to cities and villages, the county has a policy to share in one-half of the costs of a widened roadway section or bridge available for bicycle use. The department also supports bicycling through its “Bicycle Paths” grant program, which funds bicycle projects by local municipalities. A total of \$65,000 was available in 2006. A 25% local match is required and no more than 50% of the total available funds may be allocated to any one municipality. The department also financially supports the printing of the Dane County Bicycle Map prepared by Madison Area MPO staff.



#### Local Bicycle Plans

The Cities of Middleton and Fitchburg and the Village of Wauaukeee and Town of Westport have adopted comprehensive bicycle and pedestrian plans for their communities. Many other communities have bicycle elements in the transportation sections of the local “smart growth” comprehensive plans that they have prepared or are in the process of preparing. The Madison Area MPO has worked with City of Madison staff to prepare a detailed bicycle facilities plan for the West Side and a similar effort is planned for the East side. Local bicycle plans are particularly important for identifying intra-neighborhood connections, inter-neighborhood street connections in developing areas, and other local issues that are beyond the scope of the regional bicycle plan.

#### U.S. Department of Transportation Policy on Accommodating Pedestrian and Bicycle Travel

It is Federal transportation policy to promote the increased use and safety of bicycling and walking as transportation modes. Federal legislation and regulations require that the safe accommodation of non-motorized users be given due consideration in state and regional transportation plans and during the development and construction of all Federal-aid transportation projects (For more information on this policy, see the Pedestrian Transportation section of the plan at page 79).

## **Issues**

### Accommodating Bicyclists on Roadways

Off-street multi-use paths are a very important and popular supplement to the Madison area and countywide bikeway system. However, roadways must still serve as the backbone for the bikeway system. The roadway system already exists and most destinations that bicyclists want to reach are located along it, thus it presents the greatest opportunity for improving bicyclists' mobility. Bicyclists can use local streets with low traffic volumes and slow speeds without the need for special accommodations. However, to safely accommodate bicyclists on busier collector and arterial roadways, appropriate facilities must be provided. Bicycle lanes are the preferred facility in urban areas. Providing bicycle facilities on collector and arterial roadways is critical because they:

- Serve mobility needs by providing the most direct, continuous routes;
- Provide convenient access to the many destinations located on them;
- Are protected from minor street cross traffic by traffic controls;
- Provide controlled crossings of other major roadways; and
- Bridge obstacles such as expressways and railroad tracks.

### Street and Intersection Design

An interconnected street system is the most important design feature for bicyclists. This provides direct routes to destinations and alternatives to travel on high-volume, higher speed roadways. Streets that parallel arterials make excellent bicycle routes. A highly connected street system also spreads motor vehicle traffic over a large number of streets, minimizing the need for multi-lane (especially six-lane) roadways with large complex intersections that serve as major barriers for bicyclists and pedestrians.

Intersection design is also very important since this is where most conflicts and crashes occur between the various roadway users. Where possible, bike lanes should be carried through to the intersection, creating space and a travel path for bicyclists that is direct, logical and as consistent as possible with the path of motor vehicle traffic. A network of streets with bike lanes does not fully meet bicyclists' needs if intersections present obstacles.

Care must also be taken to ensure good visibility at intersections. If sight lines are blocked by vegetation, fences, or other obstructions, motorists may not be able to see bicyclists and vice versa. This is a particular issue for child bicyclists.

### Conducive Community Development Patterns and Site Design

A more compact pattern of development with mixed-use neighborhood and community activity centers and buildings oriented to the street provides destinations within easy bicycling distance of people's homes and workplaces. A network of slower speed streets and paths connecting the different land uses provides direct and attractive bicycle routes. Managing access on arterial streets through limiting and consolidating driveways and use of medians is also important in reducing the number of conflict points between turning motor vehicles and bicyclists riding on the roadway.

### Eliminating Barriers and Hazards

Freeways, other major, multi-lane roadways, bridges without bicycle accommodations, large, complex intersections, and interchange areas are examples of major barriers to bicyclist circulation. Solutions need to be identified to overcome or reduce them. Opportunities for building non-interchange street crossings and pedestrian/bicycle over- or underpasses of freeways should be identified so options are not foreclosed in the future. While interchanges will always provide a lower level of service for bicyclists than non-interchange crossings, they can still be designed to better accommodate bicyclists and pedestrians (e.g., avoiding free-flow movements).

Demand-actuated traffic signals that don't detect bicyclists or signals that don't allow sufficient green time for bicyclists to clear large intersections can also create problems for bicyclists. Bicycle-sensitive loop detectors should be used and bicyclists considered in the timing of signals.<sup>10</sup> At-grade railroad crossings can create hazards if the road surface is not at the same elevation as the rail tracks and/or bicyclists are unable to cross the tracks at a right angle. Improperly designed and/or located drainage grates are another common hazard for bicyclists.

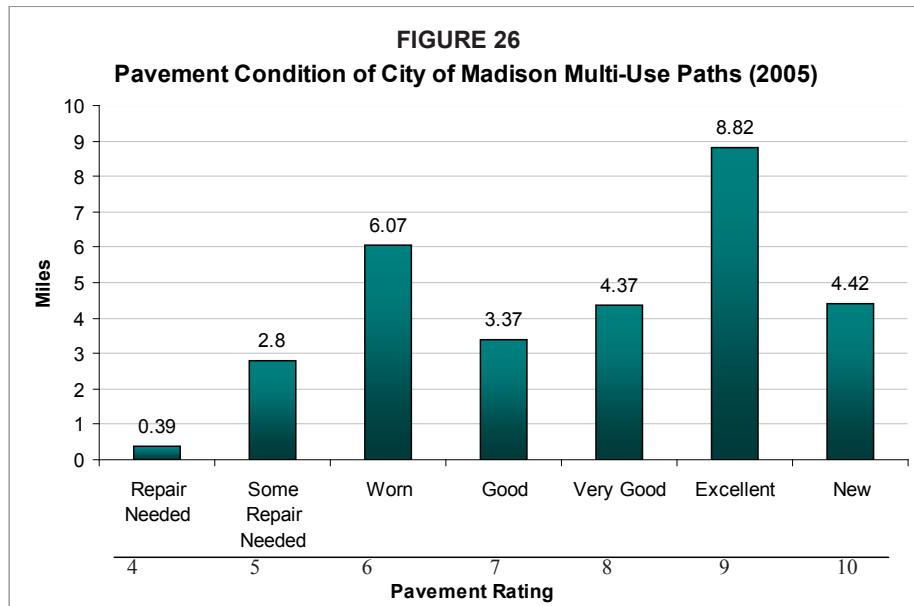
<sup>10</sup> A state law was recently adopted that allows bicyclists facing a red signal to proceed cautiously through the intersection after waiting at least 45 seconds if the bicyclist believes the signal is actuated but is unable to detect bicycles. However, the best and safest solution is to install bicycle-sensitive detectors.

### Maintenance of Bicycle Facilities

Pavement quality and smoothness is an important issue for bicyclists. Bicycles ride on two narrow, high-pressure tires and have no suspension, so deteriorated surfaces with holes, bumps, or large cracks can create hazards for bicyclists. To the extent practicable, pavement surfaces should be kept free of such irregularities.

The City of Madison Engineering Department recently conducted an inventory of the pavement condition of the City's multi-use paths, which is illustrated in Figure 26. A total of 17.6 miles of path or 58% is rated 8-10 meaning the path is new and requires no maintenance. Another 9.4 miles or 31% is rated 6-7 meaning minor maintenance (e.g., crack filling) is required. The City initiated a path maintenance program in 2006 to extend the life of paths, delaying the need for reconstruction.

Street and path surfaces also need to be kept free of debris, which can also create a hazard. Bike lanes in particular are subject to debris accumulation and require periodic sweeping. Bikeways must also be kept free of snow and ice in the winter.



### Parking and Transit Connections

Adequate, secure parking is needed at all likely bicyclist destinations. Weather-protected parking is important for employment sites and other long-term parking areas. Bicycle racks should accommodate the high security U-shaped bike locks and allow securing of the frame and at least one wheel. Transit and bicycling have the potential to complement each other well. Secure bicycle parking is needed at major transit stops and bicyclists also require access to the transit system such as through bike racks on buses.

### Safety, Public Education

As with pedestrians, bicyclists commonly experience a lack of respect for their rights from motorists. Education and outreach efforts focusing on both motorists and bicyclists are needed to promote bicycle safety and awareness. The most critical education program for bicyclists is traffic operation, training them to ride as vehicle operators on the street system.

### Traffic Enforcement

Most bicyclist/motorist crashes occur from either the bicyclist or motorist not following the "rules of the road." While funding is always an issue, safety education programs must be combined with enforcement programs focusing on common violations by bicyclists and motorists. WisDOT offers a course for police officers, Enforcement for Bicycle Safety. Three City of Madison police officers have been trained with the course and ten more will be trained in 2006 with a grant. Each fall when UW-Madison students arrive, there is a special effort at enforcement to instill good riding habits. The City of Madison Bicycle-Pedestrian Coordinator periodically offers a bicycle safety class that bicyclists may take to have their tickets excused. The City of Madison Police Department has four officers that make up a special Traffic Enforcement Safety Team, working with neighborhoods to target enforcement in problem areas.

