A. Existing Bicycle Travel

Regional and local data on bicycle travel and the characteristics of bicyclists is limited for a number of reasons. The relatively small number of bicyclists compared to those using other transportation modes makes small-scale surveys difficult. Special area transportation studies (e.g., origin-destination surveys) have often either omitted bicycle trips or grouped them together with walking trips. Most available data on bicycling is for work trips, however these make up a small percentage of all bicycle trips. The best current local data in terms of the characteristics of bicyclists and bicycling levels is from transportation surveys the University of Wisconsin (UW) conducts every two years on student and faculty/staff commuting habits.

A comprehensive bicycle survey was conducted in 1974 to provide data and information for development of the 1975 Long-Range Bikeway Program for the Madison area. The survey consisted of three parts. The first part was a broad-based questionnaire mailed to 4,000 households. The second part consisted of a series of one-day field counts and interviews at various intersections, mostly in the central city. The third part was a questionnaire distributed to all classrooms or homerooms from 1st to 12th grades at all Madison area schools. The surveys together provided a relatively complete picture at that time of existing and potential bicycling levels for different areas, bicycle trip characteristics, and bicyclist demographics. This is the only bicycle survey that has been conducted for the Madison area.

The Wisconsin Department of Transportation (WisDOT) recently conducted a statewide bicycle and pedestrian travel survey. The survey included two parts, a phone survey of 1,300 people and a mail survey of 250 people who kept a diary of their trips over a three-day period. The phone survey provided basic data on the percentage of people who had bicycled or walked within the past week, and the percentage of total trips made by those modes. The mail survey provided more detailed information on trip purposes, distance traveled, and percentage of trips taken by different modes.

Bicycling Levels

The Wisconsin Bicycle and Pedestrian Survey conducted in August 1999 found that 13% of respondents had bicycled within the past week. For those persons who did bicycle, the overall average percentage of trips made by bicycle was 26.5%. By comparison, 31% had walked within the past week. For those persons who said they had walked, the overall percentage of trips walked was 26.7%, the same as for bicycle trips. The percentage of total trips bicycled was 3.5% for the phone survey respondents and 2.6% for the mail survey respondents, who filled out one-week trip diaries. The percentage of trips made by walking was 8.1% for the phone survey respondents and 7.9% for the mail survey respondents.

Prior to the state survey, the best source of information available on bicycle travel statewide has been the National Personal Transportation Survey (NPTS). The NPTS has been conducted periodically since 1969 to provide detailed information on changing personal travel behavior. Information is collected for a sample of households nationwide, which is then weighted and adjusted to represent the entire population. According to the 1995 NPTS, around 1.8% of all person trips in Wisconsin were made by bicycle compared to 0.7% nationally.

The percentage of bicycle trips in the City of Madison is most likely considerably higher than the statewide averages found in the state and NPTS surveys. Bicycling levels are much higher in urban areas in general, because many more destinations are easily accessible by bicycle. Bicycling levels in Madison are likely to be considerably higher than other urban areas in the state due to the presence of the university, the large government employment base, the documented relatively high levels of bicycle commuting, and the city’s extensive network of bicycle transportation facilities.

The City of Madison has conducted a bicycle path traffic count program since 1980. The data is collected from 24-hour bicycle detection devices placed in off-street bicycle paths at various locations. The program has recently been expanded to include locations on two new bicycle paths (Isthmus, Wingra Creek) in addition to the original locations on the Law Park (along John Nolen Drive) and Brittingham
Park paths. In 1998, average weekday bicycle traffic on the Law and Brittingham Park bicycle paths ranged from a high of 1,116 in the month of August to a low of 75 in January. The April-to-October average was 872 and the annual average was 594. The total number of bicyclists on these paths has increased from 4,948 in 1996 to 7,123 in 1998. Traffic count data for the Isthmus and Wingra Creek paths is not yet available.

The city takes continuous bicycle traffic counts on the University Avenue bike lanes at the Mills St. intersection. In 1999, average weekday bicycle traffic (two-way combined) on the University Ave. bike lanes was over 7,000 from April to October. The annual average was 6,200.

Bicycle counts were taken in the fall of 1994 at various street intersections within the UW campus area, as part of development of the UW Campus Master Plan. The intersections with the highest volumes of bicycles entering them from 7:30 a.m. to 5:00 p.m. included:

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Number of bicyclists</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Ave. at Park St.</td>
<td>6,265</td>
</tr>
<tr>
<td>University Ave. at Charter St.</td>
<td>4,595</td>
</tr>
<tr>
<td>University Ave. at Randall Ave.</td>
<td>3,795</td>
</tr>
<tr>
<td>Breese Ter. at University Ave/Campus Dr.</td>
<td>3,690</td>
</tr>
<tr>
<td>Park St. at Observatory Dr./Langdon St.</td>
<td>3,225</td>
</tr>
<tr>
<td>Babcock Dr. at Linden Dr.</td>
<td>3,190</td>
</tr>
<tr>
<td>Charter St. at Linden Dr.</td>
<td>2,450</td>
</tr>
<tr>
<td>Johnson St. at Randall Ave.</td>
<td>2,430</td>
</tr>
<tr>
<td>Dayton St. at Randall Ave.</td>
<td>2,230</td>
</tr>
<tr>
<td>State St. at Lake St.</td>
<td>1,175</td>
</tr>
</tbody>
</table>

The UW Transportation Services Department conducts a biannual transportation survey on student and faculty/staff commuting habits. According to the 1997 survey, 25% of the 40,000 students and 11% of the 17,500 faculty and staff travel to campus by bicycle in “good” weather. These percentages have remained generally the same since the late 1980s, but are slightly lower than the percentages of bicycle commuters in the early 1980s during the oil crisis.

### Table 1

<table>
<thead>
<tr>
<th>Region</th>
<th>Total # Work Trips¹</th>
<th>Bicycle Trips</th>
<th>Walk Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>State</td>
<td>2,349,691</td>
<td>11,802</td>
<td>130,136</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
<td><strong>5.54</strong></td>
</tr>
<tr>
<td>Dane County</td>
<td>204,399</td>
<td>3,970</td>
<td>16,859</td>
</tr>
<tr>
<td>Madison Urban Area²</td>
<td>140,388</td>
<td>3,814</td>
<td>14,589</td>
</tr>
<tr>
<td>Central Madison Area³</td>
<td>39,716</td>
<td>2,852</td>
<td>11,351</td>
</tr>
<tr>
<td>Selected Cities/Villages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madison, City</td>
<td>105,887</td>
<td>3,547</td>
<td>13,447</td>
</tr>
<tr>
<td>Fitchburg, City</td>
<td>9,875</td>
<td>55</td>
<td>132</td>
</tr>
<tr>
<td>Middleton, City</td>
<td>7,867</td>
<td>56</td>
<td>251</td>
</tr>
<tr>
<td>Monona, City</td>
<td>4,781</td>
<td>57</td>
<td>185</td>
</tr>
<tr>
<td>McFarland, Village</td>
<td>2,914</td>
<td>0</td>
<td>144</td>
</tr>
<tr>
<td>De Forest, Village</td>
<td>2,782</td>
<td>7</td>
<td>94</td>
</tr>
<tr>
<td>Oregon, Village</td>
<td>2,635</td>
<td>14</td>
<td>132</td>
</tr>
<tr>
<td>Stoughton, City</td>
<td>4,148</td>
<td>20</td>
<td>260</td>
</tr>
<tr>
<td>Sun Prairie, City</td>
<td>8,254</td>
<td>55</td>
<td>258</td>
</tr>
<tr>
<td>Verona, City</td>
<td>2,946</td>
<td>18</td>
<td>145</td>
</tr>
<tr>
<td>Waunakee, Village</td>
<td>3,187</td>
<td>0</td>
<td>102</td>
</tr>
</tbody>
</table>

¹ Includes those working at home.
² Encompasses Madison Area MPO’s Planning Analysis Areas (PAAs) 1-89.
³ Isthmus Study Area (PAAs 1-9.12.13).

Source: 1990 Census Transportation Planning Package (CTPP)

The U.S. Census, which is updated every ten years, provides travel information at a very detailed geographic level, but only for work commute trips. Table 1 shows 1990 bicycle commuting information for the region, central Madison area, and the larger communities in Dane County. National and state data and walking trips are shown for comparison purposes. It should be noted that the census data was collected the last week in March when bicycling levels are generally lower in Wisconsin. Actual bicycling levels are also probably underestimated by the fact that the data identifies only the primary mode of transportation. Many people may drive or take the bus the majority of time to work, but still regularly bicycle during good weather.
Bicycle Trip Characteristics

According to data from the mail-in portion of the state bicycle survey, 46% of all bicycle trips were for social/recreation/fitness, 17% were for personal/family business, 25% for work, and 12% for shopping. Surprisingly, none were for school, however this reflects the very small sample size (82 bicycle trips by 22 different persons) and the fact that only four persons surveyed were aged 11-24.

The 1995 National Personal Transportation Survey (NPTS) data indicate that around 60% of bicycle trips nationally are for a combination of visiting friends and relatives and other social and recreational activities. Around 23% of bicycle trips are for shopping or other personal or family business, 9% are for school or church, and 9% are made for work. Table 2 shows NPTS data on trip purpose distribution for all trips compared to bicycle trips.

According to the WisDOT statewide survey data, 70% of all bicycle trips were two miles or less, 18% were 2-5 miles, 7% 5-10 miles, and 5% 10 miles or greater. The most common distance was ½ to 1 mile. As one would expect, the social/recreational trips tended to be longer distances. Only 15% of the trips for other trip purposes were over two miles. This is consistent with 1995 NPTS data and other local studies around the country, which indicate that the average travel distance for bicycle trips is around two miles.

The 1990 Census Journey-to-Work data indicates that both the median and mean travel time to work for those Dane County residents commuting by bicycle was fifteen (15) minutes. National data show the same average travel time for work and social/recreation trips, while family/personal business trips were somewhat shorter at around eleven (11) minutes. Average travel distances and times to work for UW employees are longer than the national and regional averages. According to the 1997 UW transportation survey, 24% of faculty/staff who commute by bicycle live between five and ten miles from campus. A little over 50% of UW employee bicycle commuters had a travel time of more than twenty (20) minutes, reflecting their longer than average trip distances. Table 3 shows the distances that UW student and employee bicycle commuters live from campus.

Bicyclist Demographics

National data indicate that more men ride bicycles than women. For example, the 1995 NPTS found that men made 72% of the total annual person trips by bicycle. The UW transportation survey found that more male students bicycle to campus (33%) than female students (21%). National data and surveys in other communities also show that the propensity to bicycle decreases with age, with most bicyclists aged 45 and under. University cities had an even more pronounced pattern of younger bicyclists. The WisDOT survey found that the three younger groups of phone survey respondents (with average ages of 19.5, 14.5, and 12) bicycled more than twice as often as the two older groups (with average ages of 48 and 44). Around 20% to 29% of the younger groups of respondents had bicycled within the past week compared to 9% of the older groups.

The NPTS data suggests diminishing bicycle usage with increasing income, particularly for work trips. Interestingly, bicycle trip rates tend to be higher for households with children under age 16, even for non-social/recreational trips.

<table>
<thead>
<tr>
<th>Trip Purpose Distribution</th>
<th>All Person Trips</th>
<th>Bicycle Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work or Work Related</td>
<td>20%</td>
<td>9%</td>
</tr>
<tr>
<td>Shopping</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>School/Church</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Visit Friends &amp; Relatives</td>
<td>8</td>
<td>31</td>
</tr>
<tr>
<td>Other Family/Personal Business</td>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td>Other Social/Recreational</td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td>Other</td>
<td>Less than 1</td>
<td>Less than 1</td>
</tr>
</tbody>
</table>

Source: FHWA, 1995 National Personal Transportation Survey

| Distance That UW Students and Employees Who Commute by Bicycle Live From Campus |
|-----------------------------------------------|----------------|----------------|
| Distance                       | Students | Faculty/Staff |
| Less than 1 mile                | 40.7%   | 5.6%          |
| 1 to 1.9 miles                  | 32.6    | 23.6          |
| 2 to 4.9 miles                  | 19.8    | 44.4          |
| 5 to 9.9 miles                  | 5.8     | 23.6          |
| 10 to 24.9 miles                | 1.2     | 1.4           |
| 25 or more miles                | 0.0     | 1.4           |

Source: 1997 UW-Madison Transportation Survey
B. Existing Bicycle Facilities and Conditions in the Madison Urban Area

The initial step in developing an interconnected network of Madison area and countywide bicycle facilities is to inventory existing bicycle facilities, and analyze the current system’s strengths and weaknesses. Along with information on likely bicycle trip origins and destinations, this type of analysis can help in prioritizing facility improvements to areas where they are most needed. “Bicycle facilities” refers to any facility improvement or provisions made to accommodate or encourage bicycling. For roadways, this includes any special facility or provision beyond the standard 11- to 12-foot travel lane. It also includes off-street paths, signed bicycle routes, parking facilities, and facilities providing bicycle access to transit stations and vehicles.

Special facilities for bicyclists are not needed on local streets where traffic volumes are low and vehicular speeds are slow. Likewise, special facilities are not needed on rural roadways with low traffic volumes. Nonetheless, these local streets and roadways are important for bicycling, providing access to many origins and destinations within a neighborhood or rural community. They can provide an excellent route alternative to the higher volume arterial and collector streets, as long as through connections can be made via connector streets and paths.

A well-developed network of bicycle facilities already exists within the Madison area. However, improvements are needed in some areas to fill in gaps (e.g., adding bike lanes on key arterial roadways and building connecting bike paths) and overcome barriers (e.g., narrow bridges, access-restricted highways, difficult intersections). In addition, bicycle commuter routes need to be developed connecting the central Madison area and suburban communities, such as Sun Prairie and McFarland.

Madison’s extensive bicycle facility network is due to the city’s relatively long history of bicycle transportation planning and facility development and bicycle-supportive policies. It has been City of Madison policy since the 1970s to include provisions for bicycles (wide curb lanes or, in most cases now, bicycle lanes) on arterial streets and collector streets, where feasible. Regional policies have encouraged inclusion of bicycle facilities in roadway construction and reconstruction, parks, railroad rights-of-way, and development projects since the first Madison area bicycle plan was adopted in 1975.

With the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991, a dedicated federal funding source was created for the first time for independent bicycle, pedestrian, and other “transportation enhancement” projects. The City of Madison has been very successful in obtaining funding under this program, in large part due to past planning efforts and investments in bicycle facilities. ISTEA also provided a dedicated transportation funding source for urban areas, and gave metropolitan planning organizations (MPO) the authority to distribute the funds. The funds are flexible and can be used for a wide variety of projects, including roadway projects and bicycle facilities. In 1993, the Dane County RPC, the former MPO, adopted a project selection process for these funds, which favors multi-modal projects. This has resulted in the inclusion of bicycle lanes on most major roadway reconstruction projects in the Madison area.

On-Street Bicycle Facilities

Bicycle Lanes

The most popular and now-preferred bicycle facility for arterial and higher volume collector streets is a bicycle lane. Bicycle lanes are areas of the road striped off for exclusive, or in the case of shared parking/bike or bus/bike lanes, preferential use by bicyclists. Bicycle lanes have the most potential for attracting new bicyclists, in part because of the psychological effect of having space reserved for them. Unlike off-street paths, bike lanes can be integrated into
the street network. They can therefore provide direct access to important destinations and take advantage of existing travel patterns.

Exclusive bike lanes should be at least four feet wide, excluding the gutter pan. In most cases, the bike lanes are also painted with pavement symbols (a diamond or the now preferred bicycle symbol) and/or the words “Bike Lane,” in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). Along with lane striping, the pavement markings inform motorists and bicyclists of the presence of the bike lane.

Some bicycle lanes in the Madison area are a shared parking/bicycle lane on either one or both sides of the street. Parking/bike lanes generally function well where sufficient space is provided—a minimum of thirteen feet is recommended—and the parking turnover rate is not too high. They are generally not recommended on streets with little parking, because they tend to get used as an additional travel lane.

There are also shared bus/bicycle lanes on several major arterial roads. While the bus/bike lanes on the Capitol Square function acceptably, there is a general problem with right-turning vehicles remaining in the bus/bike lane between intersecting streets, particularly on Mineral Point Rd. Separate bus and bicycle lanes are preferable, and are required where there are relatively large volumes of buses and bicycles and traffic speeds are high, such as on University Ave. near the UW campus.

Within the Madison area, there are 49 miles of arterial and collector streets with striped bicycle lanes or paved shoulders.

Existing bike lanes on arterial and local collector streets in the Madison area include:

- Allen Blvd. (CTH Q) – Century Ave. (CTH M) to University Ave. in Middleton
- American Parkway – High Crossing Blvd. to south of Hoepker Rd.
- Bassett St. – Dayton St. to Main St.
- Broadway – Falcon Cir. to USH 51 in Monona
- Charter St. – University Ave. to Observatory Dr. on the UW campus
- Dayton St. – Randall Ave. to Broom St.
- Fish Hatchery Rd. – Wingra Dr. to Badger Rd.
- Gammon Rd. – Tree Lane to south of Odana Rd. and Watts Rd. to Schroeder Rd.
- Gorham St. – University Ave. to Brearly St.
- High Crossing Blvd. – East Springs Dr. to Crossroads Dr.
- Johnson St. – Bassett St. to Brearly St.
- Junction Rd. – Old Sauk Rd. to Blackwolf Dr.
- Lacy Rd. – Fish Hatchery to Seminole Hwy. in Fitchburg
- Lien Rd. – Eagan Rd. to Zeier Rd.
- McKee Rd. (CTH PD) – Fish Hatchery Rd. to Nesbitt Rd west of Verona Rd. in Fitchburg
- Milwaukee St. – Schenk St. to Walbridge Ave. east of USH 51
- Old Middleton Rd. – Old Sauk Rd. to Eau Claire Ave.
- Old Sauk Rd. – High Point Rd. to Old Middleton Rd.
- Packers Ave. (CTH CV) – Darwin St. to Tennyson Lane
- Park St. – University Ave. to Regent St.
- Park Lawn Pl/Park St. – Maywood Ave. to Donna Dr. in Middleton
- Rimrock Rd. – John Nolen Dr. to CTH MM
- Seminole Highway – Manitou Way to Lacy Rd. in Fitchburg
- University Ave. – Gorham St. to Campus Drive through the main UW campus area
- West Beltline Hwy. Frontage Rd (South) – Seminole Hwy. to Landmark Place in the Town of Madison
- Wright St. – E. Washington Ave. to Pierstorff St. through the main MATC campus

Shared bus/bicycle lanes include:

- Fish Hatchery Rd. – Badger Rd. to High Ridge Trail in Fitchburg
- Mineral Point Rd. – Whitney Way to the West Beltline
- Park St. – Plaenert Dr. to Badger Rd.
- Capitol Square
- State Street

There are several two-lane arterial streets in the greater Isthmus area where parking is allowed, except during the peak commuter
period in the peak direction. The 12-foot parking/travel lane provides a space for bicyclists between the parked cars and the curb lane stripe during non-peak hours. These include Monroe St., Regent St., Williamson St., Atwood Ave., and portions of the Outer Capitol Loop.

**Paved Shoulders**

For streets or highways with a rural cross-section (i.e., no curb and gutter), the addition or improvement of paved shoulders is generally the most effective way to accommodate bicyclists on those roadways with higher traffic volumes and speeds. They function much like a bicycle lane if they meet standard specifications, including a minimum width of four (preferably five) feet and a pavement stripe to visually separate the motor vehicle travel way from the shoulder.

Paved shoulders provide motorist safety and maintenance benefits as well by providing space in an emergency, improving drainage, and supporting the traveled portion of the roadway. A 1986 study by the Wisconsin Department of Transportation examined the cost effectiveness of paved shoulders in reducing accidents and maintenance costs, and concluded that 3-foot shoulders were cost effective (i.e. benefits exceeded cost) on highways with initial average daily traffic of 1,085-1,640, depending upon whether virgin or recycled asphalt mixes were used.²

While paved shoulders are not a “bicycle facility” per se, state statutes permit bicycles to be operated on them. Roadways with paved shoulders at least four feet wide (the current minimum standard) in the Madison urban area include:

- Broadway – South Towne Dr. to Falcon Cir. in Monona (which is being converted to an urban cross-section with bike lanes)
- Campus Dr. – Highland Ave. to University Ave. and Randall to Johnson St.
- Cottage Grove Rd. – Thompson Dr. to Sprecher Rd.
- Mineral Point Rd. – from Junction Rd. west
- Fish Hatchery Rd. (CTH D) – High Ridge Tr. to Lacy Rd. in Fitchburg

**Wide Curb Lanes**

On arterial and some collector streets with heavier traffic volumes, widening the right-hand or curb lane to 14 feet, excluding the gutter pan (16 feet plus the parking lane where parking is allowed) provides additional roadway space for a motorist and bicyclist to operate in the same lane without coming too close. Wide curb lanes do not provide as much space as bike lanes and lack the special designation for bicycle use. As a result, many bicyclists do not feel comfortable using them. However, they are a second best alternative in those instances where bike lanes are not feasible.

Arterial and collector streets with wide curb lanes include the following:

- Agriculture Dr. – Pflaum Rd. to Broadway
- Beltline Frontage Rd. (N) – Todd Dr. to Emil
- Beltline Frontage Rd. (S) – Hammersley to Seminole Hwy. (where bike lanes begin)
- Cottage Grove Rd. – USH 51 North Ramp to S. Thompson Dr.
- Gammon (S) Rd. – Schroeder Rd. to McKenna Blvd
- High Point Rd. – Mineral Point Rd. to D’Onofrio Dr. and south of Beltline to Welton Dr.
- High Crossing Blvd. – Crossroads Dr. to Nelson Road
- International Lane – Packers Ave. to end
- Junction Rd. – Blackwolf Dr. to Mineral Point Rd.
- Lein Rd - East Washington Ave. to Eagan Rd.
- McKenna Blvd. – Gammon Rd. to Raymond Rd.
- Milwaukee St. – Walter St. to Schenk St. (where bicycle lanes begin) and S. Stoughton Service Rd. to N. Thompson Dr.
- Odana Rd. – Segoe to Frederick Ln.
- Park St. – Erin St. to Olin Ave.
- Springs (E) Dr. – East Towne Blvd to Zeier Rd.
- Thompson Dr. – Lien Rd. to CTH T
- W. Washington Ave. – Regent St. to Fairchild St.
- Watts Rd. – S. High Point to S. Gammon Rd.
- Winnebago St. – Atwood Ave. to East Washington Ave.

Bicycle Routes

The City of Madison has a signed bicycle route system covering almost all areas of the city and a portion of the City of Monona. The current route system covers 125 miles. The purpose of the route system is to provide reasonably direct major routes through the city on streets that most bicyclists will feel comfortable using. Bicycle paths are used where they are available and do not necessitate too much out-of-direction travel. The routes are located so as to provide access to frequent bicyclist destinations, such as schools, colleges, parks, and employment centers. However, the routes are not designed to link all of these possible destinations. All streets (except limited access highways) are open to bicycle travel. Therefore, actual route selection is determined more by directness, continuity, aesthetics and personal preference.

The bicycle route signs, which are purely informational, include a bicycle symbol and directional arrows. However, individual routes are not typically identified (e.g., by number or name) and no destination and distance information is provided for those routes connecting major destinations.

Several streets in the Town of Madison, including W. Badger Rd. east of Park St., have been signed as bicycle routes. The Cities of Middleton and Fitchburg and the Village of McFarland do not currently have signed bicycle route systems. A route system was identified for Middleton in the city's recently adopted bicycle plan. The city plans on signing the routes in 2001.

On-street bicycle facilities in the Madison urban area are depicted in Figure 1 and existing signed bicycle routes are depicted in Figure 2.

Bicycle Compatibility Evaluation of Madison Area Roadways

The underlying policy or concept of all bicycle transportation planning should be that every street is a bicycling street. The AASHTO Guidelines note that bicycles can be expected to ride on almost all roadways where they are permitted. As a result, the guidelines recommend that “all highways, except those where cyclists are legally prohibited, should be designed and constructed under the assumption that they will be used by cyclists.” Therefore, the first task in developing a bicycle transportation plan should be to evaluate the roadway network with respect to the capability of the roads to accommodate safely and efficiently both bicyclists and motorists.

The newly developed Bicycle Compatibility Index (BCI) methodology was used to evaluate the compatibility for bicycling of all collector and arterial roadways in the Madison area. The BCI methodology is based on research conducted to determine how geometric roadway conditions, traffic operations, and other factors impact a bicyclist's decision whether or not to use a specific roadway. This research expanded upon earlier “stress level” research done to develop a tool that can be used to predict bicyclists’ perceptions of a specific roadway environment and thereby determine the level of bicycle compatibility of the roadway.

The BCI methodology was developed for urban and suburban roadway segments (i.e., mid-block locations exclusive of intersections). It allows analysis of the compatibility of roadway segments for shared-use operations by motorists and bicyclists, and provides assistance in planning for and designing roadways that are bicycle-compatible. The BCI model incorporates the four primary variables typically used to assess the “bicycle friendliness” of a roadway: (1) bike lane or paved shoulder width (where provided); (2) curb lane width; (3) traffic volume; and (4) vehicle speeds. It also includes the additional variables of the presence of a parking lane with more than 30% occupancy and the type of roadside development (residential/open space or other). Finally, adjustment factors are included for truck volumes, parking turnover, and right-turn volumes into driveways and minor streets.

Local and county roadway geometry, parking, and traffic count and operation information was obtained from data compiled by the Wisconsin Department of Transportation (WisDOT) and City of Madison Traffic Engineering Division (Madison). The primary WisDOT data sources were the 1998 version of the Local Roads Inventory and the 1998 Wisconsin Highway Traffic Volume Data Report. For the suburban communities and rural areas, the most recent traffic counts were taken in 1996. City of Madison data sources included: (1) Condition Diagrams showing roadway cross-sections for numerous intersections throughout the city; (2) Traffic Flow Maps with 1997 traffic count information for roadway segments on most collector and all arterial roads; (3) Madison Area Truck Route Map; and (4) City Speed Zone Map. Speed limit data for roadways outside the City of Madison was obtained from local ordinances. All of this information was supplemented by field investigation where necessary.

In those cases where required model data was not available, default values recommended based upon national research were used. For example, the 85th percentile speed was assumed to be the posted speed limit plus either five or nine miles per hour, depending on the type and characteristics of the street and the general area. Ten percent of the annual daily traffic was assumed to occur during the peak hour—the hour of day generally used to evaluate bicycling conditions. Large truck volumes were assumed to range from 1.5% for collector streets to 3.5% for principal arterial roadways. The assumed volume for collector streets on an established truck route (e.g., Femrite Dr., International Ln.) or bus route with frequent service (e.g., Capitol Square) was increased to 2%. Parking occupancy and turnover were based on general observation and any applicable time limits. An exception was areas in the City of Madison where the residential permit parking program is in effect. The program results in significant levels of all day (low turnover) parking in what is technically two-hour parking zones in several areas of the city.

Bicycle level of service (LOS) criteria have been established based on the range of BCI numerical values. Table 4 shows the BCI ranges associated with each LOS designation. The different levels of service reflect the average adult bicyclists' comfort and convenience and freedom to maneuver under different roadway environments. It is recommended that facilities generally be designed for LOS C or better, where this is feasible given traffic volumes, available right-of-way, parking needs, and other considerations. While less than ideal, many of the more experienced bicyclists would still consider most streets in the LOS D range acceptable for riding. However, only a small percentage of bicyclists would be willing to ride in streets with LOS E, F, or even D at least during peak traffic conditions.

Table 4
Bicycle Compatibility Index (BCI) Ranges Associated With Level of Service (LOS) Designations

<table>
<thead>
<tr>
<th>LOS</th>
<th>BCI Range</th>
<th>Compatibility Level1</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Less than 1.50</td>
<td>Extremely High</td>
</tr>
<tr>
<td>B</td>
<td>1.51 to 2.30</td>
<td>Very High</td>
</tr>
<tr>
<td>C</td>
<td>2.31 to 3.40</td>
<td>Moderately High</td>
</tr>
<tr>
<td>D</td>
<td>3.41 to 4.40</td>
<td>Moderately Low</td>
</tr>
<tr>
<td>E</td>
<td>4.41 to 5.30</td>
<td>Very Low</td>
</tr>
<tr>
<td>F</td>
<td>Greater than 5.30</td>
<td>Extremely Low</td>
</tr>
</tbody>
</table>

1Pertains to the average adult bicyclist.

Figure 3 depicts the current level of service for bicyclists on all Madison area collector and arterial streets. With a few exceptions, such as in the UW campus area, local streets were not rated and were assumed to be at LOS C or better due to their low traffic volumes and speeds. It should be noted that the LOS designations generally reflect weekday peak hour conditions. The peak hour analysis will usually represent the “worst case” scenario. The level of service would generally be higher during off-peak times, with perhaps some exceptions (e.g., roadways near major shopping centers). In those cases where significant changes in operating conditions occur at different times of day (e.g., presence of peak-hour parking restrictions), the bicycle compatibility analysis was conducted for each set of conditions.
Figure 2
Existing Bicycle Routes in the Madison Urban Area

Signed Bicycle Routes on Lower Volume Roadways and Paved Off-Street Paths

- Existing Route
- State Trail (unpaved)
- State or County Park

Map Area

Legend

Scale:
1 inch = 1/2 miles

North
Figure 3
Bicycle Compatibility of Madison Urban Area Roadways

Level of Service
- B: Higher
- C
- D: Lower
- E
- F

Bicycling Prohibited or Not Recommended
Not Evaluated*

Map Area

Legend
- County Park
- State Park
- Open Water

*Roadways within the Madison urbanized Area that are not rated are local streets which are assumed to be at Level of Service C or better due to low traffic volumes and speeds. For roadways outside the urban area, see the County Roadway Bicycle Suitability Map.
Approximately 134 miles or 48% of all the roadway segments analyzed function at Level of Service (LOS) C or better for bicyclists. 84.5 miles or 30% are rated LOS D and 59 miles or 21% are at LOS E or F. The vast majority of collector streets (60%) operate at LOS C or better. Those collector street segments rated LOS D are concentrated in the Isthmus area (e.g., Baldwin St., Henry St, Randall Ave, Mills St., Lakeside St.), the West Side (e.g., Regent St west of Speedway Rd, Segoe north of Mineral Point Rd, Grand Canyon Dr. between Mineral Pt. and Odana Rd, and Watts Rd), and East Towne area (East Towne Blvd. and Eagan Rd). A combination of moderately heavy traffic volumes, lack of special bicycle facilities, and, in the Isthmus area, high parking occupancy contributes to the lower level of service rating on these roadway segments.

Due to their generally higher traffic volumes and speeds, only 16% of arterial roadway miles are rated LOS C. These include Old Sauk Rd. east of High Point Rd, Buckeye Rd., McKee Rd (CTH PD) east of Commerce Dr., and Broadway (CTH BW) east of Bridge Rd. 37% of arterial road miles are rated LOS D and 47% rated E or F. Those arterial streets with a level of service of D or better generally have bicycle lanes or paved shoulders. Even with bike lanes, some arterial roads (e.g., Fish Hatchery Rd., Milwaukee St.) still operate at LOS D due to their very high traffic volumes. However, the presence of the bike lane allows bicyclists to use them with greater safety, providing accessibility to many important destinations.

**Off-Street Bicycle Facilities**

**Shared-Use Paths**

Bicycle paths separated from the roadway system are generally referred to as bicycle paths. However, these paths are open to public use by walkers, runners, in-line skaters, and others as well as bicyclists. Therefore, “shared-use path” is the proper term for these facilities, and they need to be designed with these various user groups in mind. Shared-use paths are typically paved a minimum of ten feet wide and designed for two-way travel.

Shared-use paths are significant generators of bicycle use, particularly in areas that are otherwise difficult to access by bicycle. Shared-use paths encourage bicycling by less experienced bicyclists who are not comfortable riding on many streets. They provide enjoyable recreation opportunities as well as desirable commuter routes. Their popularity is starting to impact their generally low-stress travel experience in some cases, most notably on the Law Park path.

A community’s road system provides the best means of accessing various destinations within a community, but shared-use paths can enhance the primary bikeway system. Shared-use paths are most effective when used to provide bikeway system continuity, linkages, and/or short cuts where no adequate on-street facilities are available. Railroad rights-of-way, linear parks, watercourses, lakes, and dead-end streets (if planned in advance) provide the best opportunities for construction of paths.

Some of the longer existing shared-use paths in the Madison area include:

- Brittingham Park path, which connects with the John Nolen Drive path;
- John Nolen Drive path from Blair St to Waunona Way, which provides a commuter route from the south side and serves as part of the Lake Monona bike route loop;
- Isthmus path along the east railroad corridor currently extending from Blair St. to Dempsey Rd.;
- Wingra Creek path connecting the John Nolen path to the UW Arboretum;
- Howard Temin Lakeshore path on the UW campus;
- Starkweather Creek path along Aberg Ave. and then leading to the MATC-Truax campus;
- Pheasant Branch Creek unpaved path in Middleton; and
- Capital City Trail along the Nine Springs E-Way in Fitchburg.

The newly built E-way segment of the Capital City Trail will provide a connection to the Military Ridge Trail to the west once an extension of that trail from CTH PB to McKee Rd. is completed in 2001. It will also provide a connection to the John Nolen Drive path once a short connecting path is constructed under the Beltline north of Nob Hill Road. The Capital City Trail will eventually connect to the Glacial Drumlin Trail in Cottage Grove. Numerous other shorter paths provide routes through community parks and across access-restricted highways, and provide shortcuts through residential neighborhoods.

Off-street bicycle facilities in the Madison urban area are depicted in Figure 1.