## WISCONSIN BICYCLE FACILITY DESIGN HANDBOOK



JANUARY 2004

Minor updates in 2006, 2009, 2015 and 2018

WISCONSIN DEPARTMENT OF TRANSPORTATION

### **Acknowledgements**

This guide is a product of the Wisconsin Department of Transportation, Division of Transportation Investment Management's Bureau of Planning. John Williams of Tracy-Williams Consulting prepared the guide under contract with WisDOT, with assistance from Tom Walsh, David Harkey, Glenn Grigg, and Todd Litman. Tom Huber of WisDOT managed the guide's development. Significant contributions and review of the document were provided by the WisDOT Bicycle Committee including Mike Rewey, David Genson, Tom Dobson, Pat Fleming, Bob Pfeiffer, and Doug Dalton. Special thanks to David Liebel of the UW-Madison Department of Engineering Professional Development for preparing the section on bicycle path lighting. Beneficial comments and many photos were provided by Arthur Ross and Tom Walsh of the City of Madison. Thanks also to Rob Miller of the WisDOT Office of Public Affairs for his review.

Numerous state bicycle facility design manuals and guidelines were reviewed in the preparation of this handbook and their language formed the basis of some of this guide's recommendations. Their efforts are much appreciated and this guide is intended to contribute, where possible, to future work of these and other agencies as well. Going back to the 1970s, state bicycle facility guides have built upon each other and it is common to see language and graphics from one used in another. This process of incremental improvement is crucial to the development of the field. Primary sources for this handbook include bicycle guides from the states of Arizona, California, Florida, Minnesota, North Carolina, Oregon, and Washington. In several cases, figures and tables were based on — or used directly from these guides. In such cases, these sources were properly credited below the figure or table. Four figures were either based on the *Oregon Bicycle and Pedestrian Plan* or redrawn from the plan. One figure was based on the Florida DOT *Trail Intersection Design Handbook*.

Other significant sources for the development of this guide were the *Guide for the Development of Bicycle Facilities* published by American Association of State Highway and Transportation Officials (AASHTO) and the *Manual of Uniform Traffic Control Devices* (MUTCD) from the Federal Highway Administration. Data from six tables and four figures were used directly from the AASHTO *Guide* to maintain consistency with this national guide. The majority of these tables and graphics covered technical data related to stopping sight distances, crests of vertical curves, and lateral clearances for horizontal curves for shared-use paths. Sources were properly credited below the figures or tables. Similarly, about a dozen graphics were used from the *MUTCD*. Because the *MUTCD* has legal standing, the graphics are identical or nearly identical to those appearing in the *MUTCD*.

In some cases, the same wording for sentences that appear in the AASHTO Guide appear in this guide. This was done in cases where just a small word change in the statement may alter the meaning and, thus, consistency between the two guides. WisDOT is a member of AASHTO and has contributed significantly in the udpates of the AASHTO *Guide*.

Photo credits belong to Mike Rewey: figs. 2-32, 2-53, 2-55; Arthur Ross: figs. 2-5, 2-28, 2-43, 2-46, 2-52, 4-158, 4-159; Pat Fleming: figs. 2-11, 3-13; Tom Walsh: figs. 2-24, 2-44; Kurt Miller: fig. 2-27; Donna Brown: fig. 4-1; Dan Burden figs. 1-6, 2-37, 2-60, 2-78, 3-2, 3-3, 3-6, 3-10, 3-17, 3-20, 3-31, 3-33, 3-34, 3-37, 4-2, 4-9, 4-21, 4-29, 4-37, 4-44, 4-62, 4-71, 4-80, 4-85, 4-87, 4-93, 4-97, 4-99, 4-102, 4-103, 4-109, 4-112, 4-114, 4-115, 4-122, 4-138, 4-139, 4-143, 4-145, 4-151, 4-155; Ellen Fletcher: fig. 2-66; David Takemoto-Weerts: fig. 3-42; Alex Sorton: figs. 3-5, 3-7, 4-67, 4-89, 4-157; Peter Lagerwey: figs. 2-38, 2-42, 2-58, 2-64, 2-75; Bikeinfo.org: fig. 1-7; Gary MacFadden: fig. 2-22; City of Portland, Oregon: 4-84; WisDOT: fig. 2-81; City of Lincoln, Nebraska: fig. 4-90; Kane County Forest Preserve District: fig. 4-130. All other photos by John Williams and Tom Huber.

For information about this document, contact: Jill Mrotek Glenzinski, WisDOT Planning Section, at (608) 267-7757 or (608) 266-3661; by mail at Wisconsin Department of Transportation, Box 7913, Madison, WI. 53707-7913; or by e-mail at: jill.mrotekglenzinski @dot.wi.gov.

# WISCONSIN BICYCLE FACILITY DESIGN HANDBOOK

## WISCONSIN DEPARTMENT OF TRANSPORTATION 2004

### **Tables**

Table 2.1: Rural Two-Lane State Trunk Highway Paved Shoulder Width	
Requirements to Accommodate Bicycles	2-19
Table 4-1: Desirable Minimum Radii for Paved Shared Use Paths	4-15
Table 4-2. Suggested Grade Limits for Paved Shared Use Paths	4-17
Table 4-3: Minimum Length (in feet) of Crest Vertical Curve (L)	4-22
Table 4-4: Minimum Length (in meters) of Crest Vertical Curve (L)	
Table 4-5: Minimum Lateral Clearance (M) for Horizontal Curves	
Table 4-6: Minimum Lateral Clearance (M) for Horizontal Curves	
Table 4-7: Path Surface Summary	
Table 4-8 Surface Maintenance Treatments	
Table 4-9 Recommended Illumination for Shared-use Paths	4-36
Table 4-10 Path-Highway Crossing Guidance for Rural 2-lane Highway Fa	
Table 4-11: Effects of path-roadway separation distance	
Table 4-12: Overpass and underpass considerations	

### **Wisconsin Bicycle Facility Design Manual**

1 Introduction	1-1	4.3.1 Problems with paths next to roadways	
1.1 Bicycle and bicyclist characteristics		4.3.2 Sidewalk bikeways	4-6
1.2 Design options		4.3.3 Shared-use paths in roadway medians	
1.2 Design options	1-5	4.4. Path width	4-7
O Doois Doodyyay Immuuyayamanta	0.4	4.5 Shoulders and clearances	4-9
2 Basic Roadway Improvements		4.6 Design Speed	4-11
2.1 Roadway types	2-1	4.7 Horizontal alignment & superelevation	4-13
2.1.1 Residential streets		4.8 Grades	4-17
2.1.2 Collector streets	2-2	4.9 Transitions between grades and level ground	
2.1.3 Arterial streets	2-4	4-10 Sight Distance	
2.1.4 Rural highways	2-5	4.11 Pavement structure	
2.2 Pavement quality	2-7	4.11.1 Pavement loads	
2.3 Drainage grates and utility covers	2-9	4.11.2 Vegetation Control	
2.3.1 Grate type	2-9		
2.3.2 Grate or utility cover location	2-10	4.11.3 Foundation preparation	
2.3.3 Grate or utility cover elevation		4.11.4 Asphalt structural section	4-30
2.3.4 Temporary measures		4.11.5 Concrete structural section	
2.4 Corner sight lines		4.11.6 Aggregate Structural section	
2.5 Wide outside lanes	2-13	4.11.7 Surface smoothness and maintenance	
2.5.1 Retrofitting an existing roadway	2 15	4.12 Drainage	
		4.13 Lighting	4-35
2.6 Paved shoulders	2-17	4.14 Signing and marking	
		4.14.1 Regulatory controls	
2.6.2 Overall shoulder width		4.14.2 Warning devices	4-41
2.6.3 Basic recommendations		4.14.3 Informational devices	4-42
2.6.4 Guardrails and slopes		4.14.4 Temporary work zone controls	4-44
2.6.5 Grades		4.14.5 Placement of signs	4-45
2.6.6 Pavement design and loading		4.14.6 Sizes of signs	4-46
2.6.7 Joints between travel lanes and shoulders		4.14.7 Using restraint	
2.6.8 Unpaved driveways		4.15 Path-Roadway Crossings	
2.6.9 Rumble strips		4.15.1 Choosing crossing locations	
2.7 Railroad crossings		4.15.2 Intersection: yes or no?	
2.7.1 Crossing angles and gaps	2-23	4.15.3 Rural vs. urban/suburban locations	
2.7.2 Crossing smoothness	2-26	4.15.3.1 Rural path crossings	
2.7.3 Railroad/path or walkway crossings	2-26	4.15.3.2 Urban/suburban path crossings	
2.8 Traffic signals	2-27	4.15.4 Crossing design	
2.8.1 Bicycle detection	2-27	4.15.4.1 Simple signed crossing	
2.8.2 Signal loop markings	2-29	4.15.4.2 Signed crossings with traffic calming	
2.8.3 Signal timing	2-30	4.15.4.3 Signalized crossings with traine canning	/ 61
2.8.4 Programmed visibility heads	2-30	4.15.5 Parallel Path Crossings	4-63
2.9 Structures	2-31	4.15.5.1 Signalized parallel crossings	
2.9.1 Bridges			
2.9.2 Interchanges		4.15.5.2 Signed parallel crossings	
2.10 Traffic Calming	2-39	4.15.6 Important features of all crossings	
2.10.1 Traffic diversion approaches	2-40	4.15.7 Grade separations	
2.10.2 Measures for slowing traffic	2-42	4.16 Shared-use path structures	
2.11 Bicycle Route Designation		4.16.1 Bridges and overpasses	4-72
2.11 Dicycle Route Designation	2 40	4.16.2 Underpasses and tunnels	
3 Bicycle Lanes	3-1	4.16.3 Combining structures	
3.1 One-way vs. two-way bicycle lanes		4.16.4 Separation on Combined Structures	
3.2 Bicycle lane location		4.17 Shared Use	
3.3 Bicycle lane surface quality		4.17.1 Pedestrians and Bicyclists	
3.4 Bicycle lane width	3.0	4.17.2 Motorbikes and motorcycles	4-86
3.5 Bicycle lane designation		4.17.3 Motor vehicles	4-87
		4.17.4 Horses	
3.6 Bicycle lane intersection design		4.17.5 Cross-country skiers and snowmobiles	4-92
3.7 Intersections with right-turn lanes		•	
3.8 Left-turn bicycle lane		Appendices	
3.9 Interchanges	3-24	A Maintenance & Operations	
4 Shared-use Paths	1.1	B Traffic Conditions & Bridges	B-1
		C Wisconsin Statutes	
4.1 Shared-use path users, purposes, and locations	4-1	D Bibliography	D-1
4.2 Designing paths and roads		E Index	
4.3 Shared-use paths and roadways	4-3		