

APPENDIX D – ANNOTATED BIBLIOGRAPHY

An immense amount of information on bicycling is available and much of it can be accessed online. A brief description of many of these resources is given below organized by subject matter. For more detailed information on topics of interest, see the annotated bibliographies section immediately following these descriptions.

Bicycling Benefits—This section presents samples of the many resources on why biking is good for health, the environment, and the economy.

Alternative Transportation on Public Lands—Alternative transportation options on public lands have been the focus of several studies. A two part Federal study, authorized by Congress as part of Section 3039 in transportation legislation TEA-21, was completed in 2001 and 2004. This landmark study documents the need for alternatives to the private automobile on public lands including lands managed by the NPS, USFS, FWS and the BLM. Other efforts include a paper presented at the 2004 Transportation Research Board annual conference that explores the possibility and merit of “small” technologies such as bicycles, 4-wheel-cycles and other options that are well suited to give visitors a positive experience and an alternative to the automobile. The other study described in this section looks at visitors experience and perspectives on alternative transportation in Yosemite National Park. This study found that visitors were more likely to be walking or riding bicycles when their most significant or memorable experience of the park occurred.

Federal Transportation Planning Resources and Toolkit—It is difficult to accommodate bicycles without an understanding of the transportation planning process. There is a lot to know about coordinating with state and metropolitan planning agencies and qualifying for funding. A comprehensive manual of policies and guidance for project development and design related activities was developed by the FHWA Central Federal Lands Highway Division (CFLHD). Two transportation guidebooks have been developed specifically for federal land managers as well as a web based resource: to “A Transportation Toolkit for Federal Land Managers, April 2006 at <http://www.cflhd.gov/toolkit/flt/default.htm> (Accessed March 2008)

Bicycling Planning and Design References

- **Standard References** — AASHTO’s Guide for Development of Bike Facilities and FHWA’s Manual on Uniform Traffic Control Devices (MUTCD) are often referenced by planners and engineers to guide them through U.S. bicycle planning and design.
- **State, Local and International Planning/Design Resources**—These documents are from cities or States that have well developed bicycle programs such as Portland, Oregon. Local references often provide a greater level of detail than the standard AASHTO and FHWA references mentioned above.

- ***Shared-Use Paths/Greenways***—These references include recent research that recommends design parameters for shared use paths and guidance to help planners choose path widths to ensure a high quality of service. A rails-with-trails lessons learned is listed here and a Teton County, WY guidebook provides details on how to plan and design shared use pathways.
- ***Trails/Mountain Biking***—These references include a guide developed specifically to manage mountain biking on BLM lands, two recent IMBA guides on managing mountain biking and designing sustainable trails, and a handbook to help managers plan trails with wildlife in mind.
- ***Comprehensive Bicycle Planning and Bicycle specific Toolkits***—BIKESAFE is an interactive online tool to help select engineering, education, or enforcement treatments. This site has many ideas about how to improve bicyclist safety along with dozens of case studies, photos and lessons learned. <http://www.bicyclinginfo.org/bikesafe/index.cfm> (Accessed July 2008). A 38 page “Bicycle and Pedestrian Toolbox” has also been developed on bicycle planning and design. “From the Margins to the Mainstream. A Guide to Transportation Opportunities in Your Community” reviews how federal surface transportation law can support increased travel options, including bicycling and pedestrian modes.
- ***Other Planning and Design Resources***— Learn about traffic calming, road diets and road-trail intersections, concepts that can make roads more bicycle friendly. Traffic calming typically consists of physical measures intended to slow down or “calm” traffic such as speed bumps, chicanes, offset intersections, constrictions and surface textures and colors. The Institute of Transportation Engineers (ITE) has a traffic calming web page and discussion group at <http://www.ite.org/traffic/index.html> (Accessed March 2008). Road diets reduce the number of lanes, allowing space for other uses such as bicycle lanes, landscaping, parking, or wider sidewalks. The final reference listed here examines present practice for road-trail intersection safety.

Bicycle Trends, Tracking, and Classification Technologies—It is difficult to manage what you can’t measure. This section includes a Bureau of Transportation statistics document summarizing bicycling data sources, gaps and needs. Another useful reference, *the National Bicycle and Pedestrian Documentation Project*, develops a consistent method of bicycling data collection. Other studies listed here present case studies and research on various bicycle counting devices such as pneumatic tube counters, passive and active infrared, video cameras and others.

Bicycling Promotion and Safety—There is much to learn from the 46 bicycling friendly cities case studies presented in a publication prepared by the League of American Bicyclists. A presentation and a paper from Professor John Pucher of the Bloustein School of Planning and Public Policy at Rutgers University are filled with photos, charts and statistics demonstrating bicycling as a mainstream mode of transportation all around the world. A study published in the *Injury Prevention Journal* in 2003 suggests increased numbers of bicyclists and pedestrians makes these modes of transport safer. This section also includes a report highlighting best

practices for improving conditions for biking and walking. Finally, a Teton County, Wyoming handbook includes sections on why pathways are important and can help sell homes; just one more method to promote biking.

Bicycle-Transit Integration—A synthesis on integrating bicycles with transit highlights this important link to a well connected alternative transportation system.

Costs- Bicycling Facility Construction and Maintenance—This section has a few resources to help estimate bicycle facility costs. These include an online tool to get ballpark costs, a few project specific costs from Wisconsin, typical trail costs from IMBA projects, and typical unit costs per mile for facilities in California and Nevada.

National Bicycling and Walking Study Reports—Between 1991 and 1994, one million dollars were appropriated to complete the National Bicycling and Walking Study, a series of 24 case studies investigating bicycling and walking issues. These reports gathered bicycling and walking information from around the world and provided a snapshot of the state of bicycling and walking in the U.S. in the early 1990s. The titles of these studies are listed here.

BICYCLING BENEFITS

Benefits of Trails and Greenways. www.americantrails.org/resources/benefits/index.html
Accessed online Sept. 2007. This website organizes benefits into concepts, community, physical health and spirituality.

Bikes Belong Coalition. [Bicycling/ Moving America Forward Booklet](#). Printed 5/2006.

Colorful 13 page booklet highlighting the appeal of bicycling and benefits such as economic, health, lifestyle and safety. Contains attractive photos of all types of bicyclists and interesting statistics. Promotional book to encourage bicycling. Available from bikesbelong.org. P.O. Box 2359 Boulder, CO 80306. 303-449-4893.

Cycling Promotion Fund and Bicycle Federation of Australia. [Health Benefits of Cycling- Cycling Fact Sheet](#)- www.cyclingpromotion.com accessed July 2007.

Highlights benefits of cycling, citing statistics from the U.S., Australia and Europe. Concise summary based on 30 references to various health, physical activity, safety and environmental journals and publications.

FHWA-PD-93-015. [National Bicycling and walking Study Case Study No. 15. The Environmental Benefits of Bicycling and Walking](#).

Focuses on the amount of fuel consumption and automotive pollution that could be avoided by displacing the use of passenger vehicles. Estimates petroleum, carbon dioxide (CO₂), carbon

monoxide (CO), mono-nitrogen oxides (NO_x) and volatile organic compounds (VOC) emissions that could be displaced under different scenarios.

Oregon Trails 2005-2014: A Statewide Action Plan. Benefits of Non-motorized trails- pages 24-33. Available online at <http://egov.oregon.gov/OPRD/PLANS/docs/trails/NonMotorized.pdf>. Accessed Sept. 2007

Rails to Trails <http://www.railtrails.org/whatwedo/trailadvocacy/2010Campaign.html>

From the Making the Case box, click on Mobility, Economic Development, Climate, Family and Community and Health to find many benefits associated with trails, pathways and bicycle facilities.

Transportation Research news January-February 2006. Bikeways to Prosperity. Assessing the Economic Impact of Bicycle Facilities. Institute for Transportation Research and Education, North Carolina State University.

This case study of bicycle tourism in the Outer Banks of North Carolina demonstrates a method to gauge the economic benefits of bicycle facilities. This study found that visitors who bicycle in the northern Outer Banks have a significant economic impact on the area. The study suggests that public investment in a network of bicycle facilities in coastal and resort areas could return similar benefits, whether the area attracts tourist for bicycling or other reasons.

ALTERNATIVE TRANSPORTATION ON PUBLIC LANDS

Cambridge Systematics, Inc. August 2001. Federal Lands Alternative Transportation Systems Study – Congressional Report.

Section 3039 of the Transportation Equity Act for the 21st Century (TEA-21) required a comprehensive study of alternative transportation needs in national parks and Federal lands. The study identified existing transit services that need to be expanded or modified, as well as new transit services. Transit vehicles identified in this study include trams, standard transit buses, small buses, historic trolleys, trolley cars, waterborne vessels, and aerial tramways. This document does not consider bicycling as an alternative transportation mode. Results identified transit needs on NPS, BLM, and FWS lands. Two hundred and seven (207) sites were evaluated in the study; 85 with extensive field visits and 122 with telephone calls or brief visits. This study defined alternative transportation system as transit (not including bicycles). The later 2004 study acknowledged non-motorized corridors including bicycle facilities as an alternative transportation mode.

Cambridge Systematics, Inc. January 2004. Federal Lands Alternative Transportation Systems Study- Summary of Forest Service Needs. Final Report Volume III.

This study is an addition to the 2001 study, documenting alternative transportation system (ATS) needs on 30 sites managed by the Forest Service. Unlike the original 2001 study, this study

considers bicycle and pedestrian facilities to be alternative transportation. This study was initiated due to concerns of high use that compromise visitor experience and degrade natural, cultural and historic resources. The study identifies opportunities to preserve sensitive natural, cultural and historic resources; reduce pollution; relieve traffic congestions and parking shortages; enhance visitor mobility and accessibility; provide improved interpretation, education, and visitor information services; and improve economic development opportunities for surrounding communities. This report recognizes that impacts to many public lands are due less to the number of people visiting than the number of automobiles. Includes a good description of Section 3039 of the Transportation Equity Act for the 21st Century (TEA-21)

Gimmler, Franz, 2004. Transportation Research Board Annual Meeting. The Personal Transportation Alternative for America's Parks and Public Lands.

This paper examines urban and rural park settings and conventional mass transportation (buses, trains) and emerging "small" technologies such as bicycles, 4-wheel cycles, motor-scooters, small electric cars and others. It notes that conventional transportation available to parks and public lands as alternatives to the automobile are optimized for an urban environment. Parks and public lands create different transportation needs for visitors than urban areas. This paper proposes smaller, slower, more efficient forms of transportation are more appropriate for park settings as an alternative to the automobile.

White, Dave D. An interpretive Study of Yosemite National Park Visitors' perspectives Toward Alternative Transportation in Yosemite Valley. School of Community Resource and Development, Arizona State University, Tempe, AZ 85287-4703, USA. Published November 14, 2006.

This research, focusing on visitors perspectives towards alternative transportation, qualitatively analyzed the results of 160 interviews with visitors in Yosemite National Park. Individual psychological factors discussed include perceived freedom, environmental values and beliefs, prior experience with Yosemite and other national parks, prior experience with alternative transportation and sensitivity to crowding. Situational influences discussed include convenience, access, flexibility of travel modes, type of visit, type of group and park use level. The results suggest communications designed to influence visitors' travel mode choices should target both psychological and situational factors. To promote bicycling, NPS interpretation should highlight not only the social and environmental benefits, but also the opportunity for more intimate, meaningful and satisfying experiences in the park. Interpretive communications should highlight the long history of alternative transportation in national parks, which included stagecoach tours, railroad routes and touring auto coaches. Interpretation should include nostalgic images, quotes from early visitors, nostalgic artifacts and alternative transportation with historic design features such as classic red busses called "Jammers" at Glacier National Park or old cruiser style bicycles.

FEDERAL TRANSPORTATION PLANNING RESOURCES AND TOOLKIT

FHWA Federal Lands Highways Project Development and Design Manual (PDDM), March 2008. <http://www.wfl.fhwa.dot.gov/design/manual/> Accessed April 2008.

This comprehensive manual provides policies and guidance for project development and design related activities. Several sections contain planning and design guidance for bicycle facilities; and refer to other standard bicycle references such as the AASHTO Guide for Development of Bicycle Facilities and the MUTCD for more details. The bicycle related sections include: Section 4.7 Alternatives Development and Evaluation, 9.3.1.5.4 Future Traffic Projections Forecasts, 9.3.1.10 User Characteristics, 9.3.8.2 Shoulder Width and Type, 9.3.11.3 Curb Offsets, 9.3.14.11 Pedestrian, Bicyclist and Transit Considerations at Intersections, and 9.3.17 Bicycle Considerations and Facilities. Section 9.3.17 contains the USDOT policy statement that bicycle facilities will be incorporated into all projects, unless exceptional circumstances exist.

USDA Forest Service, October 2007. Federal Surface Transportation Programs and Transportation Planning for Federal Land Management Agencies- A Guidebook.

<http://www.fs.fed.us/eng/pubs/pdf/07771814.pdf> Accessed November 2007.

This guide was designed to help federal land managers understand and participate in FHWA and FTA surface transportation programs. It describes how agencies must participate in the State's and/or region's transportation planning process. The guide further provides a resource for funding eligibility, where to find funding, how federal land managers can access and benefit from funds, and how to integrate federal land management objectives with State and local objectives. This is an updated version of the Forest Service's December 2001 document (described below) for SAFETEA-LU.

USDA Forest Service, December 2001. Innovative Approaches to Transportation- A Guidebook. <http://www.fs.fed.us/eng/pubs/pdf/01771806.pdf>. Accessed Sept. 2007.

This older version was updated in October 2007. Describes Forest Service transportation planning process and how it fits into statewide and metropolitan planning. Describes funding through FHWA and FTA programs and some potential non-traditional funding sources that may be applicable to bicycle facilities. Provides understanding of statewide planning, federal and non-traditional funding sources and examples of funding sources and partnerships.

National Park Service, Sept. 1999. The National Park Service Transportation Planning Guidebook. <http://www.nps.gov/transportation/tmp/planning.htm> Accessed March 2008.

Describes policy, funding and who to involve in the transportation planning for the national park setting. Pages 65-67 discuss bicycle and pedestrian issues for improving circulation in parks. Recommends amenities to increase convenience and encourage bicycling: increase transit compatibility, provide bicycle storage and bicycle rentals. Describes visitor transportation systems at various parks and contains partnerships and fundraising examples.

Transportation Toolkit for Federal Land Managers, April 2006.
<http://www.cflhd.gov/toolkit/flt/default.htm> Accessed Sept. 2007.

This online Transportation Toolkit will assist Federal lands managers in identifying transportation challenges and solutions. The Toolkit is targeted to managers with limited previous exposure to transportation issues, processes and solutions. Potential solutions are described in a series of fact sheets that include a definition of each solution, reference areas where the solution has been implemented, implementation requirements, advantages and disadvantages, and order of magnitude costs. The toolkit also provides definitions, an overview of the planning process for transportation projects, and links to other references/resources. Please review the PowerPoint presentation located under the “Planning Process” tab called “Federal Highway Administration Planning and Project Development: Putting it All Together” or at <http://www.cflhd.gov/toolkit/flt/FLH%20Planning.pdf>. It describes how Federal lands management agencies need to coordinate with Metropolitan planning organizations and state planning organizations. It also explains how policy, priorities, funding and other decisions are influenced by planning.

BICYCLING PLANNING AND DESIGN REFERENCES

Standard References

American Association of State Highway & Transportation Officials (AASHTO) Guide for Development of Bike Facilities. 3rd Edition 1999.
<http://www.communitymobility.org/pdf/aashto.pdf> Accessed Sept. 2007.

This standard guide has three chapters: 1) Planning, 2) Design and 3) Operation and Maintenance. The planning chapter defines bicycling terms (bikeway, bike route, shared use path etc); planning considerations such as types of bicyclists (children, basic, advanced) and facility type (shared roadway, bike lane, shared use path etc). The design chapter provides discussions of design features as well as diagrams, cross sections and photos and constitutes most of the report. Design features that can improve bicycle travel include bicycle-safe drainage grates and bridge expansion joints, improved railroad crossings, smooth pavements, adequate sight distances and signal timing and detectors that respond to bicycles as well as shoulder improvements and wide curb lanes. The operations and maintenance chapter is one page that recommends routine maintenance of bike facilities. This document is currently being revised to reflect the many advances in bicycle facility planning and design since 1999. Revisions are planned for completion in March 2009. For more information on revisions, see <http://www.trb.org/trbnet/projectdisplay.asp?projectid=417> (Accessed July 2008).

Federal Highway Administration- MUTCD- 2003 Edition. Manual on Uniform Traffic Control Devices. <http://mutcd.fhwa.dot.gov/pdfs/2003r1/pdf-index.htm> Accessed Sept. 2007.

Published by the FHWA under 23 CFR, Part 655, Subpart F. MUTCD defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways. Part 9 contains traffic control for bicycle facilities. The MUTCD is undergoing revisions in 2008. For proposed changes to the MUTCD, see: http://mutcd.fhwa.dot.gov/resources/proposed_amend/index.htm.

State, Local and International Planning and Design References

Federal Highway Administration-PD-93-006 Case Study No. 24. August 1992. National Bicycling and Walking Study- Planning Guidelines/ Design Standards Used by State/ Local Agencies for Bicycle/ Pedestrian Facilities.

This study defined current (from 1992) guidelines and design standards used by states and localities to develop bicycle and pedestrian facilities. This case study presents a compilation of the best practices in use across the country on bicycle and pedestrian planning and design. The document contains specific design examples and recommended the following list of best practice documents. Also of note, page 85 contains a certification questionnaire for bike planning/design guidelines-required for all state-funded transportation projects in New Jersey.

State of Colorado Bikeways Standards and Design Guidelines. Best new compilation of material from existing plans and guidelines.

State of North Carolina Bicycle Facilities Planning and Design Guidelines – Best document for including detailed technical information on a variety of specific bike design issues.

State of Florida Bicycle Facilities Planning and Design Manual and State of Florida Development Manual For Comprehensive Regional Bicycle Plans – Best documents focusing on planning for bicycle facilities

State of Oregon Bicycle Master Plan, State of Florida Bicycle Facilities Design Training Course – Best publications for people unfamiliar with bicycle facility design and technical subject matter.

City and County of Denver Construction Detour Standards for Bikeways and Multi-Use Trails – Best standards for bicycle construction detours.

State of Arizona Bicycle Facilities Planning and Design Guidelines – Best Standards for developing bicycle signage.

State of New Jersey Bicycle Compatible Roadways- Planning and Design Guidelines, State of Florida Bicycle Facilities Design Training Course, State of Minnesota Bikeway Design Manual – Best use of graphics in publications to illustrate various bicycle needs and design guidelines.

State of New Jersey Bicycle Compatible Roadways- Planning and Design Guidelines – Best Manual for On Road Facilities.

Guidelines for Creating Greenways, Charles Fink and Robert M. Seams, 1993. and Design and Management Manual of Multi-Use Trails - Best references for multi-use trails and off-road paths.

City of Seattle, Washington, State of Wisconsin Facilities Development Manual, State of California Highway Design Manual – Best integration of bicycle facilities into transportation planning.

State of North Carolina Bicycle Facilities Planning and Design Guideline and State of Ohio Policy and procedure on Bicycle Projects. Best operational procedures for bicycle facility planning and development.

City of Eugene, Oregon: Transplan Policies Related to Alternative Transportation Modes. Best incentives for bicycle facility development.

Alta Planning and Design July 2005. Pedestrian and Bicycle Facilities in California. A Technical Reference and Technology Transfer Synthesis for Caltrans Planners and Engineers.

This planning and design resource contains standard and innovative practices for pedestrian facilities, traffic calming and bicycle facilities. Includes useful diagrams and photos.

Canadian Institute for Planners. 3/31/90 Updated June 2004. Go for Green Community Cycling Manual. A Planning and Design Guide
http://www.goforgreen.ca/at/eng/resources/cycling_manual.aro Accessed Sept. 2007.

This is a comprehensive planning guide for community bicycling facilities, emphasizing the integration of planning, engineering, education and enforcement. Major sections include Strategic Planning, Facilities Design and Maintenance as well as a bibliography and glossary.

Shared-Use Path and Greenway References

Federal Highway Administration HRT-04-103. 2004. Characteristics of Emerging Road and Trail Users and Their Safety. <http://www.tfhrc.gov/safety/pubs/04103/index.htm> Accessed Sept. 2007.

This study is on multi-use trail use by adult tricycles, assistive power scooters, bike trailers, electric bicycles, hand cycles, in-line skates, wheelchairs and others. It suggests different design parameters than AASHTO Guide for Development of Bicycle Facilities should be considered to better accommodate multiple users safely.

Federal Highway Administration-HRT-05-138. July 2006. Evaluation of Safety, Design, and Operation of Shared-Use Paths: User Guide.
<http://www.tfhrc.gov/safety/pedbike/pubs/05138/index.htm> Accessed Sept. 2007.

This document describes how to analyze the quality of service provided by shared-use paths of various widths. Given an estimate of the overall path user volume, this method can provide the level of service (LOS) for path widths ranging from 2.4 to 6.1 meters (8.0 to 20.0 feet). The document describes input data, step-by-step instructions, and example applications.

Alta Transportation Consulting U.S. Department of Transportation. August 2002. Rails-with-Trails: Lessons Learned, Literature Review, Current Practices, Conclusions

This report examines safety, design, and liability issues associated with the development of shared use paths and other trails within or adjacent to active railroad and transit rights-of-way.

Explores lessons learned from the experience of rails-with-trails and suggests practices to enhance safety and security for railroads, transit, and trail users.

Teton Valley Trails and Pathways 2007. Pathways Handbook: How they are important, How they help sell homes, How to build them. www.tvtap.org. Accessed Dec. 2007.

This handbook is a resource containing the many benefits of pathways and examples of trails and pathway success stories. It describes how to plan bike paths, shared-use paths, bike lanes, ski trails and unpaved footpaths as well as specifications for bike lanes, shared-use paths and bike route systems.

Trail and Mountain Biking References

U.S. Department of Interior, Bureau of Land Management, November 2002. National Mountain Bicycling Strategic Action Plan. http://www.blm.gov/mountain_biking/ Accessed Sept. 2007.

This is a general guidance document for BLM field offices and others on ways to address mountain biking and other non-motorized issues. It provides approaches to protect soil, water, wildlife habitat, and other natural resources while providing for high-quality recreational opportunities. It contains sections on public participation, management goals, coordination, education/interpretation/enforcement, planning and environmental considerations, funding, emerging issues and regulations.

International Mountain Biking Association (IMBA) 2007. Managing Mountain Biking: IMBA's Guide to Providing Great Riding.

This 256 page book complements IMBA's earlier publication, *Trail Solutions*. Management strategies focus on mountain biking, but may be beneficial to all trail users and managers. Topics covered include what mountain bikers want, planning and designing trails, partnerships, managing volunteers, environmental impacts, user conflicts, safety and risk management, mountain bike patrols and trail signs. This guide is full of colorful photos, examples and success stories and takes a comprehensive look at trails management.

International Mountain Bike Association (IMBA) 2004. Trail Solutions. Guide to Building Sweet Singletrack.

This 272 page book is focused on designing, constructing and maintaining sustainable trails. While this reference is focused on mountain biking, it is a good reference covering all trail users. This book demonstrates new techniques and proven fundamentals with many photos and examples. This book is a how-to guide to build and maintain primarily single-track contour trails with switchbacks, retaining walls, water control and other design features.

Trails and Wildlife Task Force, Colorado State Parks, Hellmund Associates. Sept. 1998. Planning Trails with Wildlife in Mind. A handbook for Trail Planners.

<http://parks.state.co.us/Trails/Publications/> Accessed Sept. 2007.

This handbook for trail planners focuses on protecting habitat. It discusses how trails affect wildlife and includes sections on the zone of influence, natural features, human-wildlife interactions, management decisions. It includes a wildlife and trails checklist and several case studies along with various sources of information.

COMPREHENSIVE BICYCLE PLANNING AND BICYCLE SPECIFIC TOOLKITS

Federal Highway Administration, January 2006. BIKESAFE Bicycle Countermeasure Selection System. <http://www.bicyclinginfo.org/bikesafe/index.cfm> Accessed Sept. 2007.

This website focuses on how to improve safety and mobility of bicyclists. BIKESAFE was designed to enable practitioners to select engineering, education, or enforcement treatments to help mitigate a known crash problem and/or to help achieve a specific performance objective. The tool leads you through a series of questions specific to your site, then recommends specific measures. Each measure includes a description of its purpose, considerations, estimated costs and several case study examples. Case studies provide valuable insight from bicycle projects around the country. This site provides a list of guides, handbooks and references for many bicycle related topics.

Minnesota Department of Transportation, January 2006 Implementation Report. Bicycle and Pedestrian Toolbox. www.lrrb.org/pdf/200602.pdf Accessed Sept. 2007

This is a good reference for bicycle and pedestrian planning, facilities and design guide. It was prepared by HNTB for Minnesota DOT. It includes bikeability and walkability checklists. One example of useful information is a matrix of average daily traffic/speed/ bicycle design options (pg24).

Surface Transportation Policy Partnership, Final Edition 2006. From the Margins to the Mainstream. A Guide to Transportation Opportunities in Your Community. <http://www.transact.org/> Accessed Sept. 2007.

This document explains complexities of transportation laws, programs and processes. It provides guidance on planning process, funding allocation methods and how ideas become projects. It lists examples of organizations that have performance measures in place to assess whether transportation systems meet goals. This Guidebook reviews how federal surface transportation law can be used to support local and statewide efforts to build more livable communities and expand travel options.

OTHER PLANNING AND DESIGN RESOURCES

Traffic Calming -Center for Transportation Research and Education Iowa State University. November 2007. Evaluation of Gateway and Low-Cost Traffic-Calming Treatments for Major Routes in Small Rural Communities <http://www.ctre.iastate.edu/reports/traffic-calming-rural.pdf> Accessed March 2008.

Provides a summary of traffic calming measures such as bulb outs, rumble strips, chicanes, landscaping, center islands and others appropriate for rural main streets. Evaluates traffic-calming treatments on the major road through small Iowa communities.

Road Diets - Rosales, Jennifer, July 2007. Road Diet Handbook: Setting Trends for Livable Streets.

Designing streets to accommodate all modes of transport including walking, bicycling, public transit and private motor vehicles is important. A road diet, accomplishes this by reducing the number of lanes and using the remaining space for other uses such as bicycle lanes, landscaping, parking, or wider sidewalks. This handbook contains examples, photographs, and lessons learned from road diet projects across the U.S. and in Australia. It includes planning, analysis and design guidelines for implementing road diet projects. Road diets may be one low cost option to consider to increase the bicycle friendliness of some of our public lands.

Road and Trail Intersection Safety Parks & Trails New York, December 2006. Road and Trail Intersection Safety: An examination of present practice Recommendations for future actions.

This report recommends that design of intersections of trails and roadways include appropriate right of way; alert trail and road users of an approaching crossing; and minimize risk at crossings. Examples of safety innovations include “Yield to Pedestrians” devices, remote detection-activated flashing beacons, and ‘sharks tooth’ yield markings to improve safety at trail-roadway intersections. (Alta, 2007) (see www.ptny.org).

BICYCLE TRENDS, TRACKING, AND CLASSIFICATION TECHNOLOGIES

U.S. Department of Transportation Bureau of Transportation Statistics, 2000. Bicycle and Pedestrian Data: Sources, Need, & Gaps. BTS00-02 Washington, D.C.
http://www.bts.gov/publications/bicycle_and_pedestrian_data/entire.pdf Accessed Sept. 2007

This document inventories existing sources of bicycle and pedestrian data, including their extent, quality, and limitations. It identifies and prioritizes data needs and recommends ways to improve bicycle and pedestrian data quality. Two data needs were categorized as high priority:

- 1) The number of bicyclists and pedestrians by facility or geographic area; and
- 2) Safety and demand impacts of design features.

Information on existing conditions and trends in usage, crash rates, and facilities are important to set policy and make funding and programmatic decisions. The U.S. Census Bureau, U.S.DOT, Metropolitan Planning Organizations, Center for Disease Control, National Highway Traffic Safety Administration, and National Sporting Goods Association are a few places where bicycle/pedestrian data can be found. See Table 2-1 in this document for a more detailed list of data sources.

Alta Planning and Design, August 2005. National Bicycle and Pedestrian Documentation Project.

This project responds to the need to count bicyclists. Lack of documentation on bicycle and pedestrian usage and demand makes it difficult to measure the positive benefits of investments in these modes. This paper describes the methodology to participate in a nationally consistent model of data collection.

Alta Planning and Design, August 2007. Estimating Bicycle and Pedestrian Demand in San Diego. Transportation Research Board 2008 paper.

This paper describes a two year study that will measure bicyclist and pedestrian demand in San Diego County. Manual peak counts will be performed at 80 locations and automated (active and passive infrared) counts will be collected at four locations. Count methodology is based on the National Bicycle and Pedestrian Documentation Project (Alta, 2005). Field intercept surveys will be collected at twenty of the count locations. The project will evaluate the effects that socio-demographic factors and physical factors have on walking and biking rates.

Schneider, R.; Patton, R; Toole, J. and Rabor, C. Jan. 2005. Pedestrian and Bicycle Data Collection in United States Communities: Quantifying Use, Surveying Users, and Documenting Facility Extent. PBIC University of North Carolina at Chapel Hill. Sponsored by FHWA.

Available on the web at

http://www.pedbikeinfo.org/pdf/casestudies/PBIC_Data_Collection_Case_Studies.pdf

This document contains eight detailed case studies on automated counting methods and a case study on manual counting methods from communities around the U.S.

Dharmaraju Raghuram,. Noyce David A,. Lehman Joshua D, May 2002. Evaluation of Technologies for Automated Detection and Classification of Pedestrians and Bicycles, FHWA, Massachusetts Highway Administration and University of Massachusetts Transportation Center.

Available on the web at http://www.topslab.wisc.edu/publications/noyce_2001_0049.pdf

This document provides descriptions of available motor vehicle detection technologies and explores their applicability to bicycles and pedestrians. The study concludes that none of the available devices completely serves the purpose of detecting, counting, and classifying pedestrians and bicycles. It recommends further research on active infrared technology.

Goodridge, Steven G. Detection of Bicycles by Quadrupole Loops at Demand-Actuated Traffic Signals. Available on the web at

<http://www.humantransport.org/bicycledriving/library/signals/detection.htm>

This document describes how to provide reliable detection of bicycles using inductive loop sensors. It discusses operation, improved loop design configurations and detector circuit sensitivity.

Macbeth Andrew B., Sept. 2002. Automatic Bicycle Counting IPENZ Transportation Group Technical Conference. Available on the web at

http://www.ipenz.org.nz/ipenztg/ipenztg_cd/cd/2002_pdf/34_Macbeth.pdf

This document evaluates two pneumatic tube counters for both motor vehicle and bicycle detection. It concludes both counters are satisfactory for counting bicycles, either off-street or on-street. Difficulties were encountered with setup and counter results were somewhat inconsistent.

SRF Consulting Group, Feb. 2003. Bicycle and Pedestrian Detection Final Report. Prepared for FHWA and Minnesota Department of Transportation. Available on the web at <http://ntl.bts.gov/lib/23000/23300/23330/BikePedDetFinalReport.pdf>

This document's goal was to identify applications and evaluate accuracy of non-intrusive technologies for detecting non-motorized traffic (bikes and pedestrians). This study tested six sensors including ferrous and non ferrous (aluminum) bicycles and contains a useful literature review. This study was carried out on pathways that are separate from road. It does not present information about how or if systems may differentiate between bikes, pedestrians or vehicles on roadway.

Wachtel, Alan. Re-Evaluating Traffic Signal Detector Loops. Bicycle Forum 50 article. Available on the web at <http://www.bikeplan.com/aw-signals.pdf>

This article discusses various inductive loop types, characteristics and configurations for detecting bicycles at traffic signals.

BICYCLING PROMOTION AND SAFETY

League of American Bicyclists, 2006. Bicycle Friendly Communities, Enhancing Cities Through Cycling. Sponsored by Bikes Belong.

This document presents case studies of 46 cities all around the country that have effectively integrated biking in some way. Each case study contains photos of bicycling projects, significant accomplishments and contact information. This document shows the significance of bicycling across the country and provides city population and size in square miles which may be useful for land managers to consider in regards to gateway communities and what types of bicycle facilities may be appropriate for a lands of varying sizes and geographical layout.

Pucher, John 2007. "Cycling for Everyone: Key to Public and Political Support," keynote address at the 2007 National Bike Summit, League of American Bicyclists, Washington, DC, March 16, 2007. http://policy.rutgers.edu/faculty/pucher/BikeSummit2007COMP_Mar25.pdfm

This is a PowerPoint presentation about mainstreaming bicycles into the transportation system and includes graphs on health, obesity and bicycling. This presentation suggests marketing bikes to everyone (women, young children, seniors...) and includes photos of nuns biking in Germany and international photos of car free zones. It points out that bicycles are a major part of transportation systems in many places overseas. Some ideas presented here are photos of "contraflow" lanes in Toronto and Sidney, Australia allowing cyclists to travel in both directions on otherwise one-way streets

Pucher, John 1997. Bicycling Boom in Germany: A Revival Engineered by Public Policy. *Transportation Quarterly*, Vol 51, No. 4 Fall 1997 (31-46). Available online at www.policy.rutgers.edu/faculty/pucher/bicyclingboomgermany_TQ1997.pdf

This article suggests that transportation policy changes can significantly affect mode shifts from autos to bicycles. It contrasts low bike use in the U.S. to high use in several western European countries. Factors such as climate, topography, access to transit, trip distances, weather, trip distance, and presence of university are discussed. This article concludes the main reason for differences in the level of bicycle use in the U.S. versus Western Europe is due to policy. Several policies are noteworthy:

- 1) Provide an integrated network of bicycle paths, most of them separated from both auto and pedestrian traffic.
- 2) Bicyclists benefit from over 300 km of bike routes over lightly traveled roads restricted to local traffic.
- 3) Traffic-calming measures give pedestrians and bicyclists right-of-way priority and restrict auto speeds to 30 km per hour (19 mph). A list of similar publications from Pucher can be found at <http://policy.rutgers.edu/faculty/pucher/> Accessed July 2008.

Jacobsen, P.L. *Injury Prevention Journal* 2003; 9: 205-209 Safety in Numbers: more walkers and bicyclists, safer walking and bicycling.

This study examined the relationship between the numbers of people walking or bicycling and the frequency of collisions between motorists and walkers or bicyclists. Results suggest the likelihood of a pedestrian or cyclist being struck by a motorist varies inversely with the amount of walking or bicycling. It appears that motorists adjust their behavior in the presence of people walking and bicycling. A motorist is less likely to collide with a person walking and bicycling if more people walk or bicycle. Policies that increase the numbers of pedestrians and cyclists appear to be an effective method to improve pedestrian and cyclist safety.

Rails to Trails Conservancy and Association of Pedestrian and Bicycle Professionals, January 1998. Improving Conditions for Bicycling and Walking. A Best Practices Report. Prepared for the FHWA.

This report highlights examples of best practices on outstanding pedestrian and bicycle projects. These projects have been recognized for increasing walking and bicycling numbers and safety. A few examples discussed in this report include Portland, Oregon; Davis, California; Anchorage, Alaska; Birmingham, Alabama; Chicago, Illinois; King County, Washington. Examples include successes, lessons learned, funding, contacts, and other examples of project work.

Teton Valley Trails and Pathways 2007. Pathways Handbook: How they are important, How they help sell homes, How to build them. www.tvtap.org.

This handbook is a resource containing the many benefits of pathways and examples of trails and pathway success stories. It describes how to plan bike paths, shared-use paths, bike lanes, ski

trails and unpaved footpaths as well as specifications for bike lanes, shared-use paths and bike route systems.

BICYCLE-TRANSIT INTEGRATION

Federal Transit Administration Prepared by Robert Schneider, Toole Design Group, LLC 2005. TRB's Transit Cooperative Research Program (TCRP) Synthesis 62: Integration of Bicycles and Transit.

This synthesis examines how transit agencies may improve their existing services and assist other communities in developing new bicycle and transit services. It includes a summary of existing programs, specifications, bicycle parking, and costs. It addresses safety, equipment procurement, scheduling, and inter-jurisdictional cooperation issues. This synthesis includes information on bicycle-on-bus, bicycle-on-rail, and bicycle on-ferry programs. This document updates TCRP Synthesis 4: Integration of Bicycles and Transit (1994).

http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_62.pdf (Accessed January 2008)

COSTS- BICYCLING FACILITY CONSTRUCTION AND MAINTENANCE

National Cooperative Highway Research Program Report 552. Prepared by University of Minnesota 2006.. Guidelines for Analysis of Investments in Bicycle Facilities.

This 119 page report presents tools to estimate the cost and value of bicycle facilities. This research was developed into a web-based tool for estimating costs, demands and benefits associated with specific facilities (<http://www.bicyclinginfo.org/bikecost/>). When testing the online tool for a one mile stretch of 10 foot wide asphalt trail in Milwaukee, the resulting estimate was \$110,645 (or \$125,205 if 4 streetlight equipment costs are included). This number seems reasonable when compared to estimates provided from Milwaukee County trails plan (see below). This is a planning tool to obtain ballpark cost estimates that is quick and provides a list of trail components to consider (signs, painting, drainage, landscaping, bollards, root dams...). The estimate can be saved to your computer in an excel format, which contains only values, not formulas. It is time consuming to update the excel file if changes are required. The resulting cost in this example did not include the equipment cost (check results of spreadsheet for errors). The demand is based on population densities and percentage of riders estimated for an area. The benefits component provides a dollar estimate for recreation, mobility, health, and decreased auto use.

American Trails.org - Trail Maintenance and Management: Construction and maintenance cost for trails <http://www.americantrails.org/resources/ManageMaintain/MilwMaintcost.html>
Accessed Sept. 2007

The following paragraphs demonstrate examples of information available from the americantrails.org web site. Cost information is from the Milwaukee County Trails Network Plan, 2007 (www.countyparks.com). Four summaries give a realistic trail construction estimate including trail amenities, bridges, signage and drainage.

- \$149,206 per mile -10 foot wide asphalt trail -Honey Creek Parkway (no bridge construction)
- \$301,014 per mile -10 foot wide asphalt trail -Root River (not including boardwalk, includes drainage culverts and railings)
- \$176, 470 per mile -10 foot wide asphalt trail (Kinnickinnic River)
- \$224,307 per mile -10 foot wide asphalt trail (includes retrofit of bridges). County estimate for construction of 6.5 mile Hank Aaron State trail

Maintenance of asphalt, concrete, and crushed gravel trails differ due to varying material properties. Labor costs, access to machinery and volunteers also affect maintenance costs. Listed below are typical routine maintenance costs to keep trails operating safely such as annual evaluation for minor repairs, removing vegetation, mowing, map/sign updates, trash removal, water repairs, silt cleanup, culvert clearing, patching or minor regarding, planting, pruning, landscaping.

- \$1500 per mile – Iowa Trails 2000 plan (mix of different trail surfaces)
- \$2525 per mile- Milwaukee County Park system (asphalt paths)
- \$1,200 per mile (absolute minimal cost) in the Rail Trail Maintenance & Operation Manual provided by the Rails-to-Trails Conservancy.
- \$2,077 per mile for government run trails provided in the Rail Trail Maintenance & Operation Manual provided by the Rails-to-Trails Conservancy.
- \$2,042.06 per mile of unpaved trail in the Trail Cost Model - Draft by the Wisconsin Department of Natural Resources.
- Snow removal costs range from \$24.13/mile on the Glacial Drumlin Trail - E to \$154.13/mile on the Red Cedar State Trail.

International Mountain Biking Association, 2004. *Trail Solutions: IMBA's Guide to Building Sweet Singletrack* Pages 187-188.

Factors to consider when estimating trail building time and cost:

Type of trail -A primary access trail in an urban trail system may require extensive construction work to achieve a wide, smooth tread. A 12-inch-wide single-track could be built with fewer resources. Terrain- Time and effort increase as soil gets harder, roots and rocks increase, vegetation gets thicker and the grade gets steeper. Trail location- Proximity of work site to vehicles, materials, tools and trail workers. Hand or Mechanized Tools- Mechanized tools can reduce construction time and cost. Professional or volunteer labor- On average, an experienced professional can build 10 feet of bench cut trail per hour using hand tools (80 feet per day). Trail Structures- Every switchback adds between \$300 and \$1,000, or many hours of volunteer time. Large bridges can cost \$50,000 to \$80,000 or more depending on the location (2004 cost estimate). The following estimates are based on a poll of several professional contractors in 2004. Costs should be adjusted for inflation to reflect current costs.

- \$5,000 per mile- Singletrack trail construction by machine or hand- easy conditions

- \$26,000 per mile- Singletrack trail construction by machine- hard conditions
- \$52,000 per mile- Singletrack trail construction by hand- hard conditions

Tahoe Metropolitan Planning Organization, October 2006. Lake Tahoe Regional Bicycle and Pedestrian Master Plan. Final Report. Page - 82

Unit cost summary for the construction of bicycle and pedestrian facilities in Lake Tahoe. Estimates are based on costs experienced in the region and similar communities in California and Nevada. However, they should be used only to develop conceptual construction cost estimates. More detailed estimates should be developed after preliminary engineering as individual projects advance to implementation.

Class III/Bike Route on roadway

- Signing only \$1,000 mile/\$1,700 kilometer
- Signing plus minor road improvements \$40,000/ \$67,700
- Signing plus moderate roadway improvement \$150,000/ \$254,000
- Signing plus major roadway improvement \$300,000/ \$508,000

Class II/Bike Lane on roadway

- Signing and striping only \$5,000 mile/ \$8,500 kilometer
- Signing and striping plus minor roadway improvement \$50,000/ \$84,700
- Signing and striping plus moderate roadway improvement \$300,000/ \$508,000
- Signing and striping plus major roadway improvement \$500,000/ \$846,700

Class I/Shared Use Path Separated from roadway

- Construct asphalt path on graded right of way with drainage and new sub-base \$1,000,000 mile/ \$1,693,400 kilometer
- Construct asphalt path on un-graded right of way with drainage and new sub-base \$2,000,000/ \$3,386,900

NATIONAL BICYCLING AND WALKING STUDY REPORTS

The National Bicycling and Walking Study consisted of 24 case studies investigating bicycling and walking issues. The study resulted in two overall goals:

1. Double the percentage of total trips made by bicycling and walking in the U.S. from 7.9 percent to 15.8 percent of all travel trips; and
2. Simultaneously reduce by 10 percent the number of bicyclists and pedestrians killed or injured in traffic crashes.

These goals were designed together to ensure that gains in safety were not achieved by discouraging use. A 10-year status report on the Study indicates a significant increase of the total number of reported bicycling and walking trips since 1991 as shown below.

	1990 Nationwide Personal Transportation Survey	2001 National Household Travel
Number of trips taken by bicycling and walking	19.7 billion	36.8 billion
Percent of trips taken by bicycling and walking	7.9 percent	9.5 percent (goal is 15.8 percent)

Safety targets exceeded the Study goals with declines between 1993 and 2003 in pedestrian fatalities (17.3%), pedestrian injuries (27.7%), bicyclist fatalities (23.3.%) and bicyclist injuries (35.5%). The Study also resulted in a nine-point Federal Action Plan within the USDOT. Responsibility for action items was assigned to at least one of the modal administrations within the Department (e.g. FHWA, National Highway Traffic Safety Administration (NHTSA), Federal Transit Administration , Federal Railroad Administration, or Office of the Secretary of Transportation). For more details on the Ten-year status report, see <http://www.fhwa.dot.gov/environment/bikeped/study/>. (Accessed March 2008) A list of the Final and Status Reports and 24 case studies is shown below.

FHWA-PD-94-023 National Bicycling and Walking Study Executive Summary (1994)

National Bicycling and Walking Study Five Year Status Report (1999)

National Bicycling and Walking Study Ten-Year Status Report (2004)

See <http://www.fhwa.dot.gov/environment/bikeped/study/index.htm> (Accessed April 2008)

Case Studies:

FHWA-PD-92-041 #1 Reasons Why Bicycling & Walking are Not Being Used More

FHWA-PD-92-038 #2 The Training Needs of Transportation Professionals

FHWA-PD-93-039 #3 What Needs to be Done to Promote Bicycling and Walking

FHWA-PD-93-031 #4 Measures to Overcome Impediments to Bicycling and Walking

FHWA-PD-93-008 #5 An Analysis of Current Funding Mechanisms

FHWA-PD-93-024 #6 Analysis of Successful Grass-Roots Movements

FHWA-PD-92-040 #7 Transportation Potential and Other Benefits of Off-Road Facilities

FHWA-PD-93-007 #8 Organizing Citizen Support and Acquiring Funding

FHWA-PD-93-012 #9 Linking Bicycle/Pedestrian Facilities with Transit

- FHWA-PD-94-012 #10 Trading Off Among the Needs of Motor Vehicle Users, Peds, Bikes
- FHWA-PD-93-009 #11 Balancing Engineering, Education, Law Enforcement, Encouragement
- FHWA-PD-92-036 #12 Incorporating Consideration of Bicyclists & Pedestrians into Education
- FHWA-PD-93-018 #13 A Synthesis of Existing Bicyclist and Pedestrian Related Laws
- FHWA-PD-93-025 #14 Benefits of Bicycling and Walking to Health
- FHWA-PD-93-015 #15 The Environmental Benefits of Bicycling and Walking
- FHWA-PD-92-037 #16 A Study of Bicycle and Pedestrian Programs in European Countries
- FHWA-PD-93-016 #17 Bicycle/Pedestrian Policies and Programs in Asia, Australia, New Z.
- FHWA-PD-93-010 #18 Analyses of Successful Provincial, State, and Local Programs
- FHWA-PD-93-028 #19 Traffic Calming, Auto Restricted Zones, and Traffic Management
- FHWA-PD-93-037 #20 The Effects of Environmental Design on the Amount and Type
- FHWA-PD-93-017 #21 Incorporating Bicycle and Pedestrian Considerations into Planning
- FHWA-PD-93-019 #22 The Role of State Bicycle/Pedestrian Coordinators
- FHWA-PD-93-014 #23 The Role of Local Bicycle/Pedestrian Coordinators
- FHWA-PD-93-006 #24 Current Planning Guidelines and Design Standards