# Bikeways Guide

By
Jay Grossman, Graduate Research Assistant
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Indiana Local Technical Assistance Program
A Federal Highway Administration LTAP Technology Transfer Center

1435 Win Hentschel Blvd., Ste. B100
West Lafayette, IN 47906-4150

(765) 494-2164
or
Toll - free Within Indiana
(800) 428-7639
Fax: (765) 496-1176

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# Preface

Many individuals have contributed to the development of this bikeways guide and should be recognized for their assistance. First, Professor Charles Scholer of Purdue University should be thanked for the conception and continuing support of this project. Professor Gilbert Satterly provided helpful direction in making contacts and gave meaningful insight from the bicyclist's perspective. Other valuable assistance in reviewing this document and in supplying additional resource materials was provided by Margy Deverall, City of West Lafayette; Michael O'Loughlin, Indiana Department of Transportation; Steven Morris, Indiana Department of Natural Resources; and Richard Vonnegut of the Hoosier Rails to Trails Council. The invaluable help of these people have made this guide possible.

# Introduction

This guide is intended to familiarize counties and cities with the basic aspects of bicycle facilities. This includes an overview of what types of facilities are warranted by situation, and how typical bicycle lanes and paths are designed. For the actual design of bicycle facilities however, more in-depth information should be used. A list of helpful contacts and references is included.

### Definitions:

Bikeway: Any road or path which is designated as being open to bicycle traffic. This includes facilities shared by bicycles and other vehicles as well as facilities designated for bicycle use only.

Shared Roadway: Any roadway on which bicycles and automobiles are legally allowed but specific bicycle lanes are not provided.

Bicycle Path: A path designed for the exclusive use of bicycles and which is physically separated from roadways used by automobiles. May be within the same right-of-way as a road, or have a separate right-of-way, and can be in a variety of widths and lane configurations.

Bicycle Lane: A portion of a roadway which is set aside for the exclusive or preferential use of bicycles. The delineation of the bicycle lane can be by painted lines on the pavement or by physical barriers, such as curbs.

# Planning

### Shared Roadways

Shared roadways are the most common type of bicycle facility in use. Almost all city and county roads are considered to be shared roadways as both bicycles and automobiles are legally allowed to use them. Normally, shared roadways work very well when motor vehicle traffic volumes and average speeds are low.

These conditions are most typical of streets in residential areas where bicycles and motor vehicles share the road on a regular basis with few problems. When traffic volumes increase, or the average speed of vehicles is high, consideration might be given to bicycle lanes or paths.

When the average daily traffic (ADT) on a road is less than 2000 vehicles per day (vpd), and the average speed of the vehicles is less than 30 mph, then a twelve foot wide lane is usually sufficient to allow automobiles and bicycles to share the roadway. On roads where the average vehicle speed is still less than 30 mph, but with ADTs in the range of 2000-10000 vpd, a 14 foot wide lane is recommended.

## Bicycle Lanes

Bicycle lanes are often used on major roads within cities where there is moderate to heavy motor vehicle traffic as well as a reasonable number of bicycles. Bicycle lanes work best when motor vehicle speeds are below 45 mph. Above this level, the safety of the bicyclists comes into question. When insufficient land is available for a bicycle path, bicycle lanes may be an appropriate alternative. Most bicycle lanes in urban areas are used on roadways with daily traffic volumes below 10,000 vpd.

In rural areas, bicycle lanes often take the form of paved shoulders. Where the average speed of traffic is less than 30 mph, a four foot wide shoulder is usually sufficient. For areas with faster average traffic speeds, the recommended shoulder widths vary from four feet at 30 mph to six feet for traffic traveling at 50 mph and above.

## Bicycle Paths

Separate paths for bicycles are often warranted when motor vehicle speeds on a roadway are high—typically above 45 mph. They should also be considered if the volume of traffic is high or there are large numbers of trucks using the road.

Bicycle paths are best adapted to rural areas where acquisition of right-of-way is less of a problem and where there are few cross roads or driveways. Difficulties with bicycle paths often occur at such crossings. Bicyclists and motorists alike find intersections between bicycle paths and roads confusing if signs clearly stating who has the right-of-way are not present. Furthermore, bicyclists are not likely to use a path for commuting if they are required to stop frequently for cross traffic and are in danger of being hit by cars backing out of driveways.

In the case of recreational bicycle paths, there can be conflicts between the different users. This is particularly a problem when paths are open to both pedestrians and bicyclists, as each group travels at very different speeds. Problems can also occur between the different types of bicyclists using the path. The bicyclist who uses a path for commuting maintains a much higher speed than a family with children using the path for recreation. In this situation commuting bicyclists often prefer to use the regular roadway instead of a provided bicycle path.

According to the Federal Highway Administration (FHWA), bicycles and motorized traffic are compatible and often afford greater safety for the bicyclist when they travel together. An example of this would be where a bicycle path running parallel to a road must cross a number of side streets. Where the bicycle paths cross these side streets, drivers are often not expecting to see a crossing, and may not be prepared to avoid a collision with a bicyclist who fails to stop there.

# Design

## Bicycle Lanes

Bicycle lanes increase the confidence of bicyclists that motorists will not stray into their path. Lanes should always be one-way facilities. Otherwise bicyclists may have to ride against traffic which creates a safety hazard. Figure 1 is an example of a typical road designed with bicycle lanes.

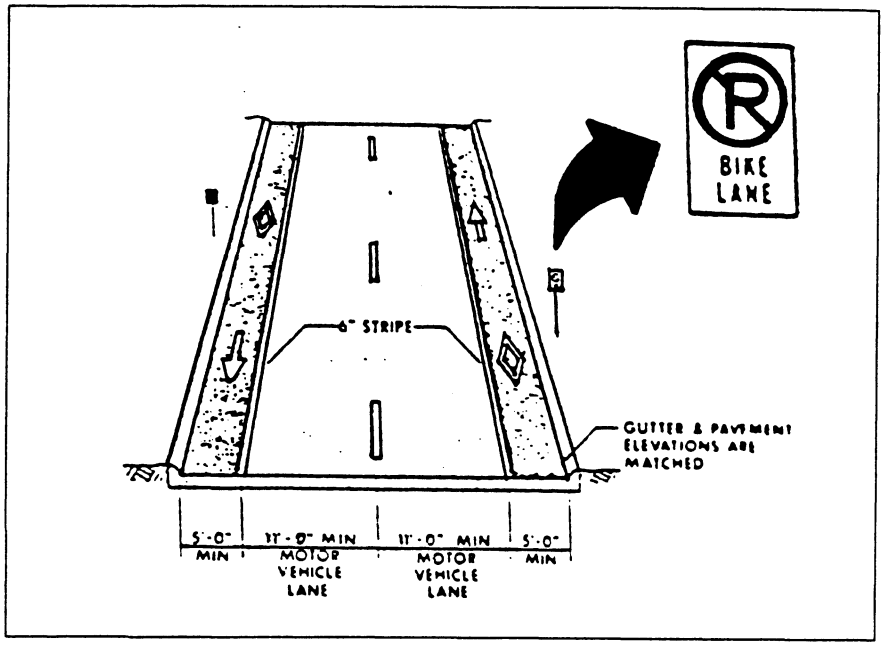



**Figure 1: Typical Road Design with Bicycle Lanes**
Source: FHWA

The minimum width for bicycle lanes is normally four feet, five if a curb is present. Where on-street parking is allowed, the bicycle lanes should be between the parking spaces and the travel lanes. Lanes should be wider than the standard four feet if vehicle speeds are greater than 35 mph. Figure 2 shows an example of bicycle lane designs with and without curbs or on street parking.

Bicycle lanes often complicate turning movements at intersections for both bicycles and motor vehicles. Therefore, the design of bike lanes at intersections should be given careful consideration. At intersections with actuated traffic signals, provisions should be made to insure that bicycles are also detected by the signal equipment. Figure 3 provides examples of various treatments for bicycle lanes at intersections.

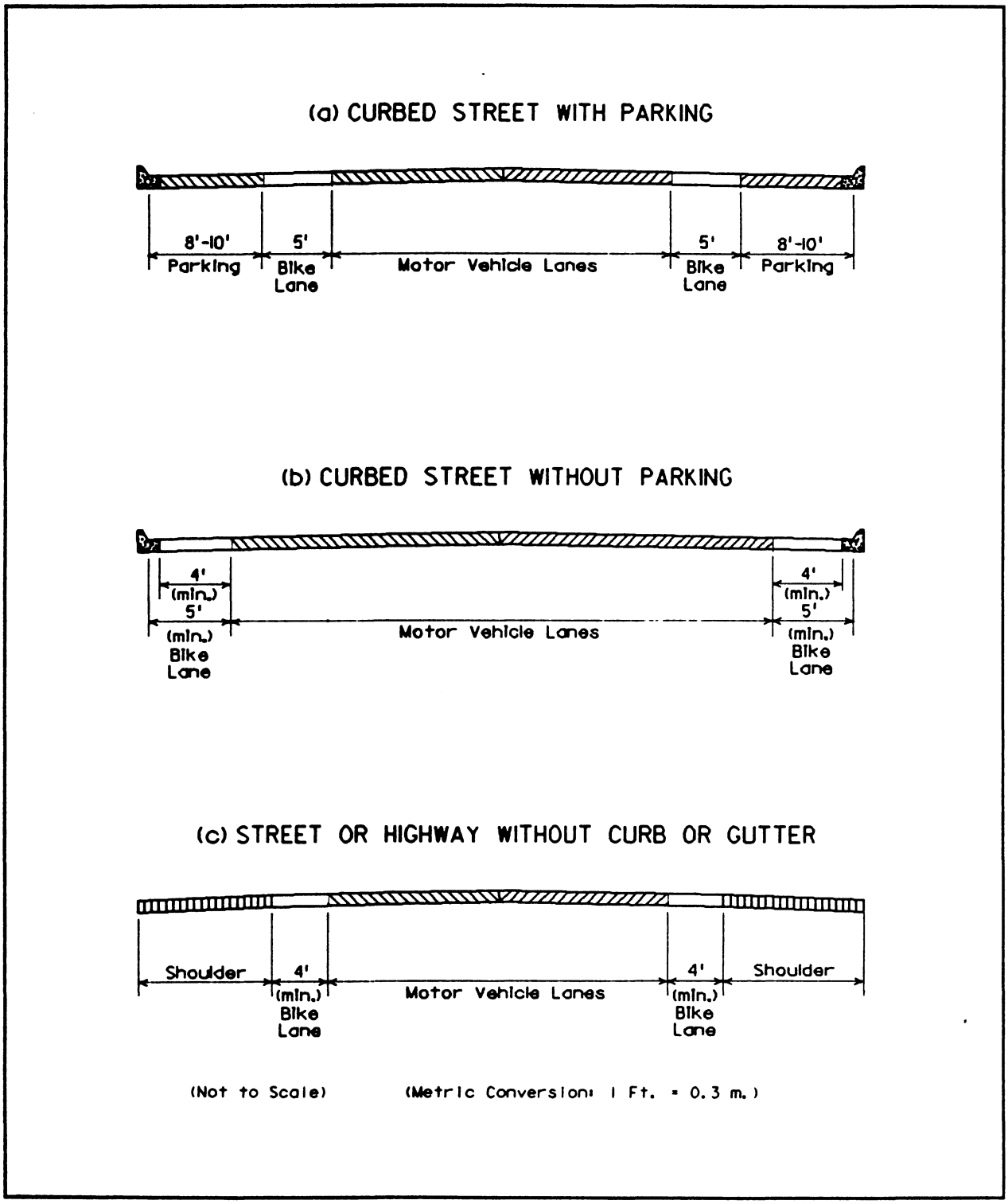



**Figure 2: Examples of Typical Cross Sections for Bicycle Lane Designs**
Source: AASHTO

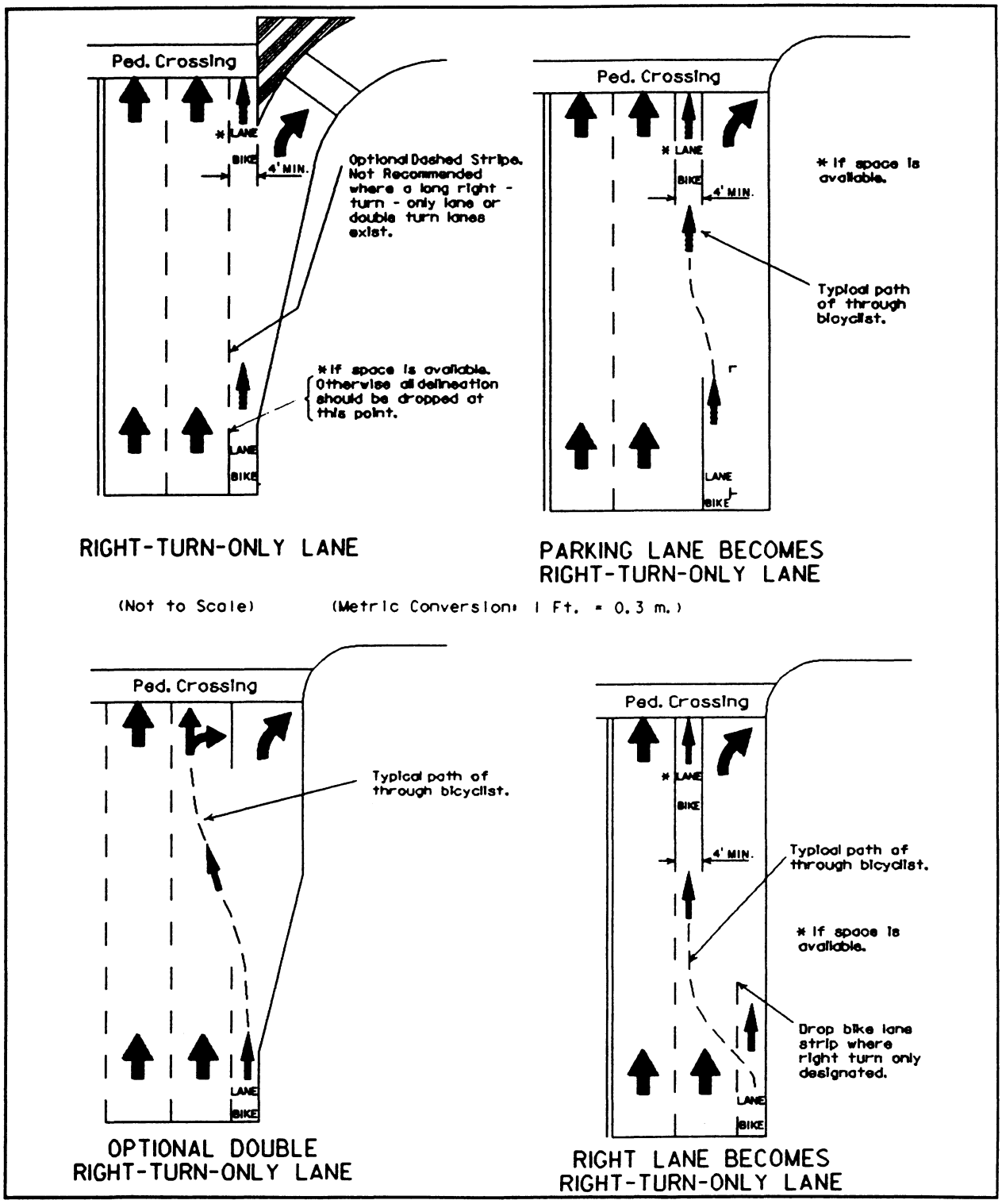



**Figure 3: Bicycle Lane Treatments at Intersections with Right Turn Lanes**
Source: AASHTO

## Bicycle Paths

Bicycle paths can be both for commuting and recreation. They can also provide access for bicyclists to areas which are only served by limited access highways. The design of these paths is similar to the design of roads with considerations given to sight distance, signing, pavement markings, horizontal and vertical clearance, and grades.

Some operational difficulties with bicycle paths should be noted. At intersections and driveways motorists may not be expecting bicyclists, resulting in confusion or collisions. Parked or stopped cars at these locations may also block the bicycle path.

Two-way bicycle paths should be a minimum of ten feet wide, with twelve feet being recommended. This not only allows for the convenient operation of bicycles, but will also allow maintenance vehicles to pass along the facility. A two foot graded area should be maintained on each side of the bicycle path. One-way paths can be five feet wide, though use of these paths is hard to control and they often end up being used as two-way facilities. A three foot clearance is needed between the edge of the path and poles, fences, or other obstructions. Paths should be separated from parallel roadways as much as possible, with a minimum spacing of six to ten feet. Figures 4 and 5 show typical bicycle paths.

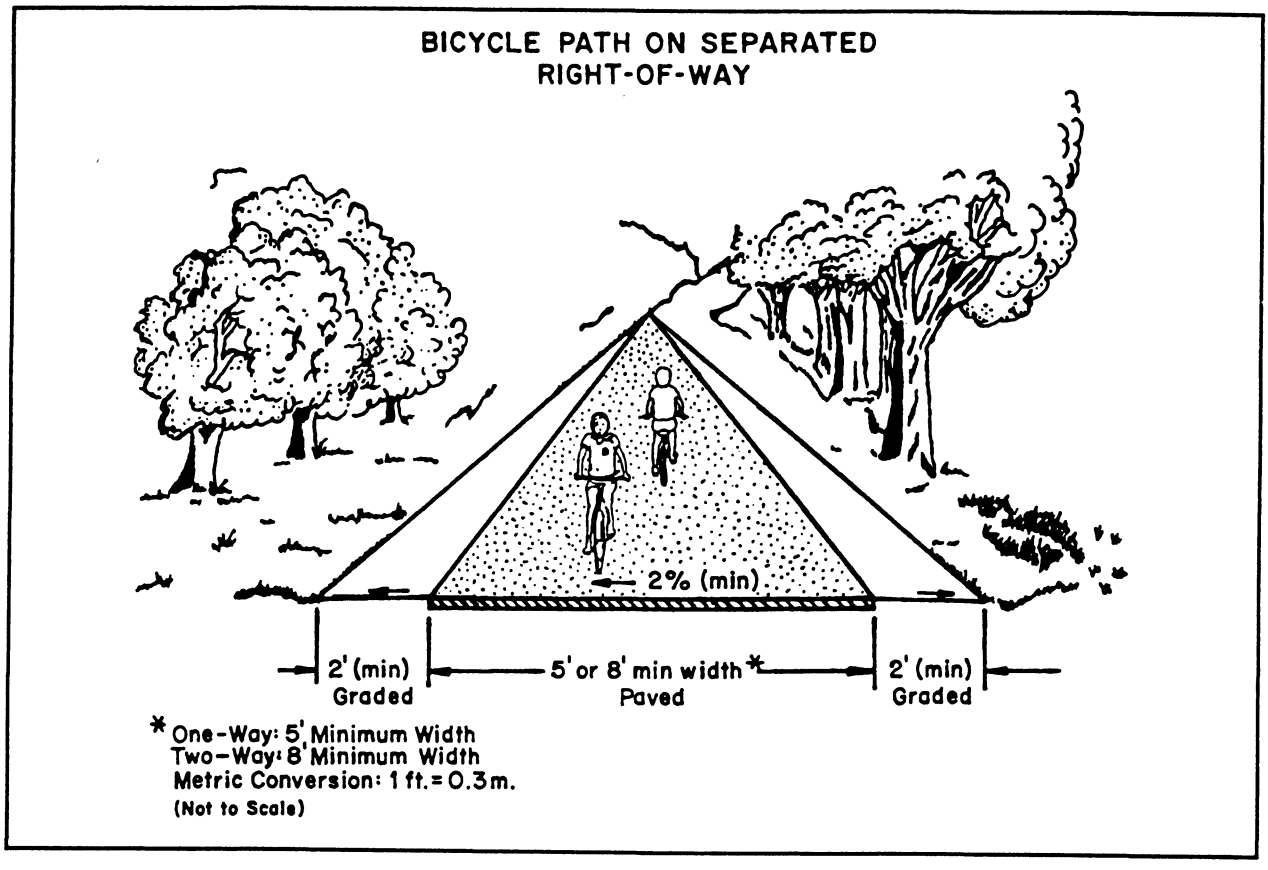
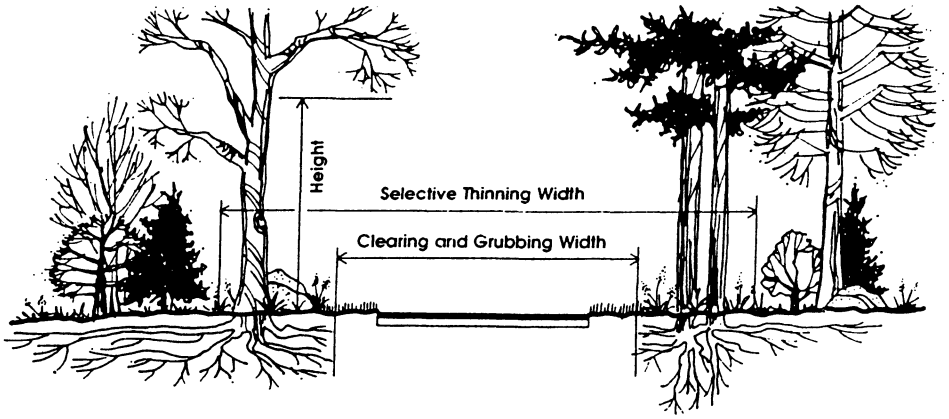



**Figure 4: Typical Bicycle Path Design**
Source: AASHTO




| Trail Type | Clearing & Grubbing Width | Selective Thinning Width | Clearing Height |
|---|---|---|---|
| 6-foot hiking only | 10 feet | 20 feet | 8 feet |
| 8-foot pedestrian only | 14 feet | 24 feet | 8 feet |
| 10-foot pedestrian only | 16 feet | 26 feet | 8 feet |
| 8-foot bicycle only | 16 feet | 26 feet | 10 feet |
| 10-foot bicycle/pedestrian | 18 feet | 28 feet | 10 feet |
| 6-foot horse only | 12 feet | 22 feet | 12 feet |
| 10-foot horse/pedestrian | 16 feet | 26 feet | 12 feet |
| 8-foot cross-country ski only | 12 feet | 22 feet | 8 feet |
| 12 foot snowmobile only | 20 feet | 30 feet | 10 feet |
| 18-foot ski/snowmobile | 26 feet | 36 feet | 10 feet |

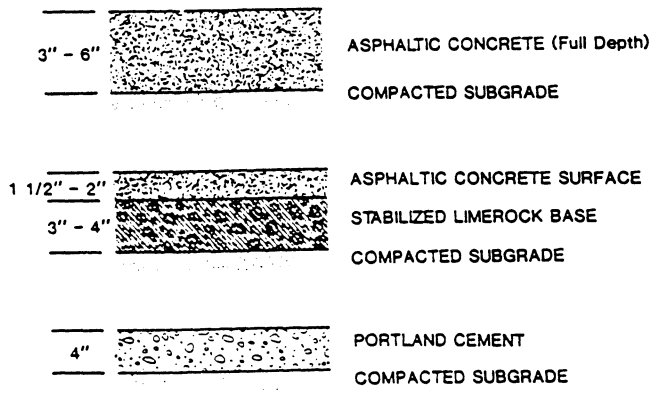
**Figure 5: Clearing and Grubbing Details for Pathways**
Source: FHWA

Pathway surfaces can be either gravel, asphaltic concrete, or Portland cement concrete. In most cases a hard surfaced pathway is desirable as aggregate surface layers provide a much lower level of service. Pavements used for bicycle paths are generally two to six inches thick depending on the level of support available from the subgrade, and are placed without a crown for ease of construction. The smoothness of the pavement is important as bicycles are more susceptible to cracks and bumps than motor vehicles. However, the surface treatment should still provide adequate friction for good braking. Figure 6 shows pavement designs for bike paths used in various states. The use of an underlying geotextile fabric may also be well suited to this application.

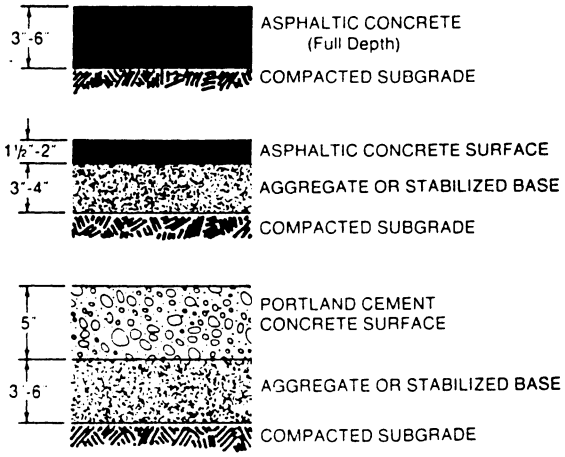
Signage and pavement markings should be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). A centerline stripe might be considered, especially on curves.

Structures may be needed to cross creeks and rivers, or to go under or over busy highways. These structures should be as wide as the pathway and have high (4.5 foot) guardrails to keep bicyclists from falling over the railing. Consideration should be given to whether maintenance vehicles will also need to use it. For short underpasses, a ten foot vertical clearance is desirable, with eight feet being the minimum allowable. Longer underpasses will need to have taller and wider tunnels to make bicyclists feel at ease in using them. For instance a vertical clearance of 12 feet and a horizontal clearance of 20 feet would be more appropriate for tunnels beneath freeways. Some thought should also be given to the need for lighting in tunnels if they are very long, or if they will be used after dark.

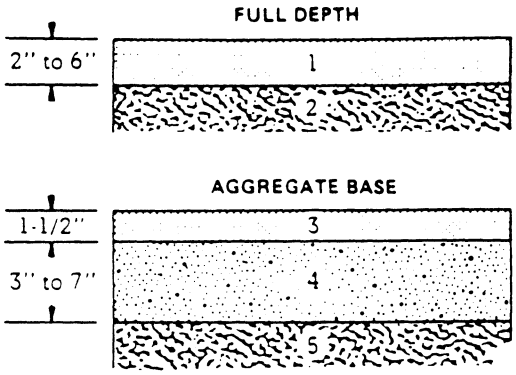
Source: ARIZONA BICYCLE FACILITIES PLANNING AND DESIGN GUIDELINES




Source: STATE OF OREGON BICYCLE MASTER PLAN




Source: MINNESOTA BIKEWAY DESIGN MANUAL




1. Spec. 2331 Wearing Course (Full Depth)
2. Compacted Subgrade
3. Spec. 2331 Wearing Course
4. Class 5 Aggregate Base
5. Compacted Subgrade

Source: NORTH CAROLINA BICYCLE FACILITIES PLANNING AND DESIGN GUIDELINES

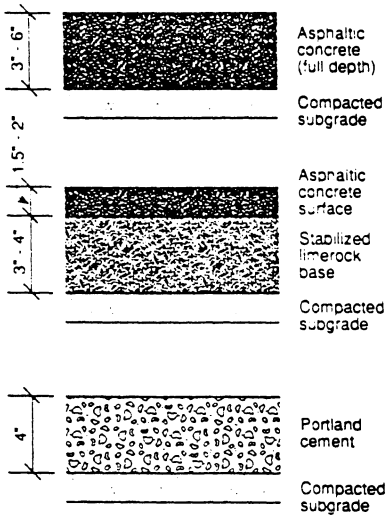



**Figure 6: Samples of Pavements for Bikeways**
Source: FHWA

# Implementation

To help implement a planned bike lane or bike path there are a number of different organizations in the state of Indiana which can provide assistance in the organizing and/or possible financing of these projects.

The Indiana State Department of Transportation (INDOT) has a bicycle and pedestrian coordinator who can help you coordinate your project with other agencies and bicycle advocacy groups in your area. The state coordinator also oversees a transportation enhancement program which helps fund the construction of some bicycle and pedestrian facilities. Contacting the development engineer at your INDOT district office is a good way to find out about planned transportation improvements in your area.

The Indiana Department of Natural Resources also administers programs for recreational trails and can provide some technical planning assistance. A list of state agencies and advocacy groups which may provide aid follow.

## List of Contacts

State Bicycle and Pedestrian Coordinator
Indiana Department of Transportation
100 North Senate Avenue, Room N901
Indianapolis, IN 46204
317-232-5653

Streams and Trails Coordinator
Division of Outdoor Recreation
Indiana Department of Natural Resources
402 West Washington Street, Room W271
Indianapolis, IN 46204
317-232-4070

Director
Indiana Bicycle Coalition
P. O. Box 20243
Indianapolis, IN 46220
1-800-BIKE-110

President
Indiana Trails Fund
P.O. Box 402
Indianapolis, IN 46206-0402
317-237-9348
Fax: 317-237-942
email: trails@kiva.net
or vonnegut@indy.net

Chair
Hoosier Rails to Trails Council
P.O. Box 402
Indianapolis, IN 46206-0402
317-237-9348
Fax: 317-237-942
email: trails@kiva.net
or vonnegut@indy.net

# References

American Association of State Highway and Transportation Officials. August 1991. *Guide for the Development of Bicycle Facilities.* Washington, D.C. Available from the American Association of State Highway and Transportation Officials, 444 North Capitol Street N.W., Suite 225, Washington, D.C. 20001. Telephone: 202-624-5800.

Anderson Pinsof, Suzan, and Terri Musser. 1995. *Bicycle Facility Planning: A Resource for Local Governments.* Planning Advisory Service Report no. 459. Chicago: American Planning Association. Available from the American Planning Association publications office, 122 South Michigan Ave., Suite 1600, Chicago , IL 60603.

U.S. Department of Transportation Federal Highway Administration. August 1992. *National Bicycling and Walking Study, Case Study No. 24: Current Planning Guidelines and Design Standards Being Used By State and Local Agencies for Bicycle and Pedestrian Facilities.* Publication no. FHWA-PD-93-006. Washington, D.C. Copies of excerpts are available from HERPICC.

U.S. Department of Transportation Federal Highway Administration. January 1994. *Selecting Roadway Design Treatments to Accommodate Bicycles.* Publication no. FHWA-RD-92-073. Washington, D.C. Copies of excerpts are available from HERPICC.

Many other related documents may be obtained from the National Bicycle and Pedestrian Clearinghouse, 1506 21st Street N.W., Suite 210, Washington, DC 20036. Toll-free: 800-760-6272.