Chapter 4—Engineering
4.4 Bicycle Facilities

Introduction

Bicycling is an efficient, cost-effective transportation option, and provides good exercise. There are many different types of bicycle facilities, ranging from separate bike paths to marked on-street bike routes. Increasing bicycle mode share is good for communities; it reduces traffic congestion, reduces pollution, and improves the health of those who bike.

Infrastructure has a major influence on bike mode share; places with good bicycle facilities have more bicycle traffic than places without good bicycle facilities. Not all bicycle facilities are comfortable for all bicyclists. For example, shared roads with sharrows may only be useful to more experienced bicyclists; on the other hand, shared -use paths and barrier-separated cycle tracks may encourage novice bicyclists to ride more.

Legal status of bicycling in Ohio

According to Ohio law, bicycles are considered vehicles. This means bicyclists have the same rights as motor vehicle drivers, and must follow the same rules. Bicycles are permitted on all roads except limited-access highways. Generally, bicyclists should not be expected or encouraged to use sidewalks. Many jurisdictions prohibit sidewalk bicycling.

Bicycle lanes

Bicycle lanes are lanes of a roadway designated for bicycles only.

- Bicycle traffic generally follows the direction of motorized traffic.
- Bike lanes on one-way streets are usually placed to the right of the motorized traffic lanes, but can also be placed to the left. Placement on the left may require additional design and safety considerations.
- Separate facilities, such as sidewalks, are provided for pedestrians.

◄ Good example—bike lane

(Photo: MORPC, Columbus, OH)

- Bike lane is sufficiently wide (5 feet).
- Striped buffer provides protection from motorized traffic.
- Signs and pavement markings indicate that the lane is for bicycle use.

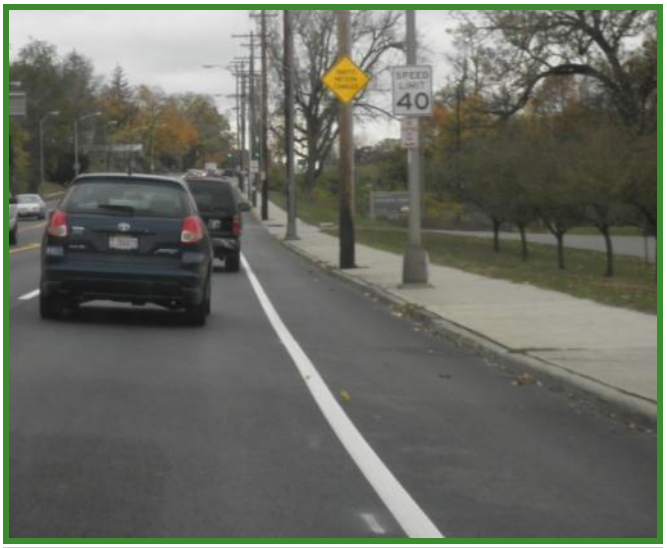
Bike Lane Width

- The recommended minimum width for a bike lane is 5 feet (AASHTO, 1999, p. 23).
- The absolute minimum width is 4 feet of rideable surface (AASHTO, 1999, p. 23). **USDOT encourages transportation agencies to go beyond minimum standards when designing for bicyclists and pedestrians** (USDOT, 2010).
- Minimum widths do not include the gutter pan (AASHTO, 1999, p. 23).
- Extra-wide bike lanes (7 feet or more) may invite illegal use by motorists and therefore pose a safety hazard.

▲ Undesirable

(Photo: MORPC, Columbus, OH)

- Bike lane is as little as 3 feet wide at certain points.
- Gutter next to bike lane forms a crack in which bike tires could get caught.
- Bike lane is adjacent to high-speed traffic.



▲ Good example

(Photo: MORPC, Columbus, OH)

- Bike lane has sufficient width for safe and comfortable riding.
- There are no gutter openings in the bike lane.

Bike Lane Buffers

A buffer is a zone that provides protection and separation. While sidewalk buffers are typically landscaped, most bike lane buffers are simply striped on the road surface.

- Striped buffers can make a bike lane safer and more comfortable for bicyclists.

► Good example

(Photo: MORPC, Columbus, OH)

- 4-foot striped buffer separates bike lane from motorized traffic.

Door Zones

The door zone is the zone parallel to a line of parked cars into which car doors open. Where possible, bike lanes should be built outside the door zone to help prevent door zone crashes. Bike lane placement should reflect tradeoffs related to right-of-way width, parking turnover, traffic volume and speed, bicyclist and motorist behavior, and other factors as determined by engineering judgment.

- Where a bike lane is installed adjacent to on-street parking, the ideal distance between the outside edge of a bicycle and the curb is a minimum of 13 feet. Where adequate right-of-way exists, bike lanes should be built to reflect this.
- Where there is no on-street parking or standing, door zone collisions are generally not a concern.
- One possible solution is to provide cross hatch markings that extend 4 feet from parked cars to alert bicyclists that it is not a safe place to ride (Hart, 2010).
- The effects of door zones on bike lanes should always be considered when designing bike lanes in an urban context.

Door Zone Crashes

Door zone crashes have been studied in several locations. Many cities, including Chicago and Cambridge, Massachusetts, have built door zone bike lanes (Schubert, 2004). Studies have estimated that as many as 16% of bicycle crashes leading to injury in urban environments are caused by opening car doors (Allen, 2002). Educating motorists to check their surroundings before opening a car door, and educating bicyclists to avoid the door zone, can help to mitigate the problem somewhat.

Door zone crashes have resulted in some high-profile fatalities (Schubert, 2004; Southan, 2008). In most fatal door zone crashes, the collision caused the bicyclist to be thrown into the path of a passing vehicle and crushed. In a few cases, bicyclists have died from impact with the car door itself, which can cause head or neck injuries (Popik, 2005), or from impact with the pavement resulting from hitting the car door.

The widths of parked vehicles and their doors are key factors of the size of the door zone. With doors closed, most motor vehicles are around 6 feet wide, and many commercial vehicles are 8.5 feet wide (Oswald, 2010); in addition, motorists in Ohio are allowed to park up to one foot out from the curb (ODPS, 2009, p. 43). A typical door protrusion is about 37 inches, with some older sedan cars having a door protrusion of up to 44 inches (Allen, n.d.).

▲ Undesirable

(Photo: MORPC, Columbus, OH)

- Car door opens into bike lane.

▲ Good example

(Photo: WikiMedia, New York, NY)

- Opening car doors will not protrude into the bike lane.

Bike Lanes: Encouraging Proper Use

Bike lanes should include signs and/or bicycle symbols on the pavement indicating that they are for bicycle use. Signage should also alert motorists to the presence of bicyclists.

- Signs and/or pavement markings should encourage bicyclists to ride in the correct direction (with traffic).
- Other vehicles (such as delivery trucks) should be discouraged from blocking bike lanes.
- On any street with bike lanes, bicyclists will sometimes need to ride outside of the bike lane: for example, to make turns at intersections, or to avoid debris in the bike lane. The presence of a bike lane should never be construed as prohibiting bicyclists from using the other lanes.

- Signs prohibit parking and indicate that the lane is for bicycle use.
- Arrow in the bike lane indicates the correct direction to ride.

▲ Good examples *(Photos: MORPC, Columbus, OH)*

Maintenance of Bike Lanes

Bike lanes should be kept clear of debris and vegetation in order to ensure that it is a safe environment for the bicyclist.

- Jurisdictions should include the cleaning of bicycle facilities in their maintenance policies. An example is the Transportation System Maintenance Element of the City of Salem, Oregon, which includes bicycle lanes in its wording with regard to maintenance (City of Salem website).

- Debris is in the bike lane.
- Vegetation is growing into the bike lane.

▲ Undesirable *(Photo: MORPC, Columbus, OH)*

Bike Lanes at Intersections

Special attention should be paid to the striping of bike lanes at intersections.

- In order to turn left or right, bicyclists will typically have to leave the bike lane and use the right or left turn lanes.
- Signage or sharrows may be useful at some locations to reinforce the message that bicyclists are not restricted to the bike lane (see example below).
- More information is available in the AASHTO Guide for the Development of Bicycle Facilities.

▲ Bike lane striped through an intersection *(Photo: WikiMedia, New York, NY)*

- Striping through the intersection encourages bicyclists to ride through in a straight line.
- Striping also reminds turning motorists that bicyclists may be proceeding straight ahead.

▲ Intersection approach example *(Photo: Flick User sfbike, Portland, OR)*

- In addition to the bike lane for through traffic, the sharrow in the left turn lane encourages bicyclists to use the lane for left turns, and alerts motorists that bicyclists use the lane.
- The bike lane should not be in the gutter pan; otherwise, this is a good example.

Special Types of Bike Lanes

There is a variety of different types of bike lane designs available, depending on the individual context of the location. A few examples are barrier-separated bike lanes, which provide bicyclists with extra protection from motorized traffic; contra-flow bike lanes, which offer bike connectivity along streets that are one-way in the opposite direction for motorized traffic; and two-way on-street bike paths. Examples of these are shown below. These are only a small selection of the wide variety of bike lanes that exist.

Contra-Flow Bike Lanes

This design is used to allow bicycle traffic to flow in the opposite direction of motorized traffic on one-way streets.

- It provides connectivity for bicyclists and discourages wrong-way riding.

- Contraflow bike lane allows bicyclists to cut through to a neighboring street.

▲ Good example: Residential street *(Photo: Flickr User Steven Vance, Portland, OR).*

- Contraflow bike lane allows two-way bike traffic.
- The other bike lane (on the far side) is for bicyclists following the direction of traffic.

▲ Good example: Urban arterial *(Photo: Flickr User Philly Bike Coalition, Philadelphia, PA)*

Floating Bike Lanes

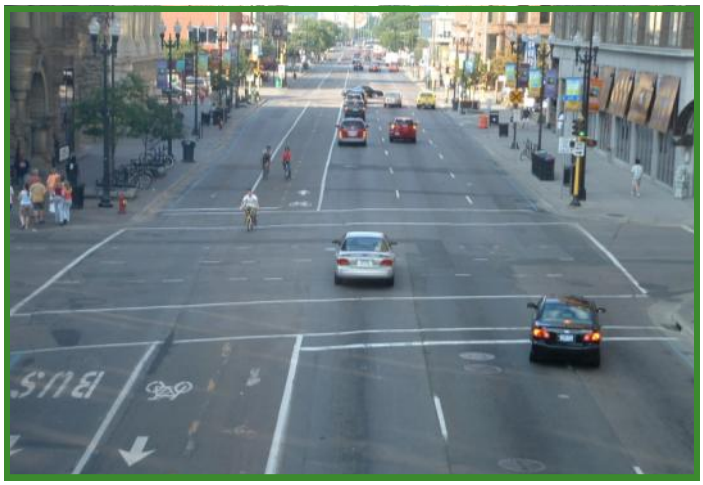
On streets with floating bike lanes, parallel parking is permitted during certain times of the day but not during other times (City of Lexington website). When parallel parking is not permitted, the parking area functions as a bike lane.

- When parallel parking is permitted, bicyclists can use the other lanes and should be encouraged to ride outside the door zone of the parked cars.

Two-Way Bike Lanes

Two-way bike lanes are adjacent lanes accommodating opposite directions of bicycle traffic, striped onto the roadway next to the other travel lanes.

- They are sometimes installed in the middle of the street between travel lanes, sometimes at one side of the roadway.
- Must be designed properly, otherwise there can be safety hazards. For example, if the lanes are too narrow, bicyclists may be too close to oncoming motorized traffic. Narrow lanes can also increase the risk of head-on collisions between bicyclists traveling in opposite directions. Care should be taken to ensure safety at intersections; potential hazards relating to turning bicyclists should be especially considered.



▲ Street with two-way bike lane and bus lane

(Photo: MORPC, Minneapolis, MN)

▲ Two-way buffered bike lane in a median

(Photo: Jeannie Martin, Washington, DC)

Barrier-Separated Bike Lanes

Barrier-separated bike lanes are bike lanes separated from the lanes of motorized traffic by a physical barrier, such as a line of poles, a low wall, or a fence.

- These bike lanes can encourage bicycling by providing additional protection.

▲ One-way barrier-separated bike lane

(Photo:Flickr user SFBike, San Francisco, CA)

▲ Two-way barrier-separated bike lane

(Photo: Ariel Godwin, Baltimore, MD)

Bike boulevards

Bike boulevards are shared roadways that are designed to give bicyclists priority. They are usually built in urban areas. According to the Association of Pedestrian and Bicycle Professionals, the following points define a bike boulevard (APBP, 2010):

- Shared roadway - no specific bicycle or vehicle delineation (e.g., local streets)
- Low motor vehicle volumes and speeds
- Logical, direct, and continuous routes that are well-marked and signed
- Access to desired destinations
- Minimal bicyclist delay
- Comfortable and safe at intersections

► Bike Boulevard

(Photos: Ariel Godwin, Columbus, OH)

Bike Boxes

Bike boxes are a type of road marking intended to reduce the risk of collisions at signalized intersections with heavy bike traffic, especially "right hook" collisions (where a bicyclist going straight is hit by a motorist turning right). Bike boxes assist by designating exactly where bicyclists and motorists should place their vehicles when stopped at a red light. Placing bicycles in front of motorized vehicles makes them more visible.

- Right-turns-on-red through the bike box must not be permitted. Otherwise, motorists will block the bike box and right-turn conflicts will occur.
- Bike boxes are not yet included in the MUTCD and are classified as an experimental treatment.

► Bike Box

(Photos: MORPC, Columbus, OH)

Sharrows

- The term “sharrow” comes from “share” + “arrow.” They are also known as shared-lane markings.
- Sharrows remind motorists of the presence of bicyclists, guide bicyclists to position themselves safely, and discourage wrong-way bicycling.
- Sharrows are appropriate on roadways with speed limits up to 35 mph.
- Sharrows were added to the MUTCD in 2009 (USDOT, 2009, p. 810; Figure 9C-9).

Sharrow positioning

- On streets with narrower lanes, sharrows should be placed in the middle of the lane. This encourages bicyclists to “take the lane” so that motorists will not pass them at an unsafe distance. 3 feet is considered a *minimum* safe lateral distance.
- On streets with lanes wide enough to allow a large vehicle to safely pass a bicyclist within the same lane (at least 14 feet wide), sharrows can be placed to the right.
- Sharrows should guide bicyclists to avoid the door zone. On streets with on-street parking, the center of each sharrow should be 14 feet 8 inches from the curb. For more information, see the subsection on “Door Zones” within this section.

◄ Examples with on-street parking

▲ Good example *(Photo: MORPC, Columbus, OH)*

- Sharrow guides bicyclists along the middle of the lane, outside of the door zone.

▲Undesirable *(Photo: Elly Blue, BikePortland; location: Baltimore, MD)*

- Sharrow is placed in the door zone.

◄ Examples without on-street parking

▲ Good example

(Photo: MORPC, Columbus, OH)

- Sharrows guide bicyclists along the middle of the lane.
- Motorists can pass in the adjacent lane.

▲ Good example

(Photo: MORPC, Hilliard, OH)

- 14-foot lane is wide enough for cars to safely pass a bicyclist (but with caution, slowing down) if the bicyclist is following the sharrow markings.
- This design is not suitable for narrower lanes.

Cycle Tracks

A cycle track is "a bicycle path along a road, physically separated from motor traffic, and distinct from the sidewalk" (APBP 2010).

- A cycle track is not a shared-use path; it is specifically for bicycle use.
- Cycle tracks are often built between the sidewalk and the motorized vehicle lanes.
- One-way and two-way versions exist.
- Cycle tracks are separated from motorized vehicle lanes by a curb, fence, bollards, grade separation, or some other barrier. They are sometimes also physically separated from pedestrian sidewalks.
- Cycle tracks are widespread in Europe, and have been built in a few cities in the United States. Examples include Cambridge, Massachusetts; Portland, Oregon; New York City; and Washington, DC.
- There are many different varieties of cycle tracks. A few are illustrated in the photos in this section.
- The definition of a cycle track is somewhat flexible and may coincide, in some cases, with the definition of a barrier-separated or buffered bike lane.
- Many cycle tracks, especially in Europe, have specific signals installed for bicyclists (see the section on signs and signals).

▲ Two-way cycle track

(Photo: Ariel Godwin, Munich, Germany)

- Tree lawn and on-street parking separate bicyclists and pedestrians from motorized traffic.
- Asphalt cycle track is clearly distinguished from brick sidewalk.
- Arrows on the asphalt indicate two-way bicycle traffic.

▲ One-way cycle track

(Photo: Ariel Godwin, Berlin, Germany)

- Cycle track is distinguished from wide sidewalk by pavement surface.
- Zone between cycle track and street provides space for deliveries, transit users, etc.
- Suitable for slower bicycle traffic.

Cycle Tracks (Continued)

▲ One-way cycle track

(Photo: Anne Price, Berlin, Germany)

- Buffer separates bicyclists and pedestrians from motorized traffic.
- Red cycle track is clearly distinguished from gray sidewalk.

▲ One-way cycle track with bicycle/ pedestrian signal

(Photo: Kerstin Carr, Regensburg, Germany)

- Separate signal head directs bicyclists and pedestrians through the intersection.

▲ Two-way separated cycle track

(Photo: Ariel Godwin, Montreal, Canada)

- Cycle track is grade separated from the sidewalk.
- Raised curb separates cycle track from motorized traffic.
- Dashed line indicates two-way bicycle traffic.
- This might also be considered a barrier-separated two-way bike lane; as mentioned above, definitions can overlap.

Bike Routes

Bike routes are shared roadways identified by signing as preferred bike routes (Bicycling Info website).

- A bike route in itself does not imply any special bicycle infrastructure.
- Following are some reasons a roadway might be designated as a bike route (AASHTO, 1999, p. 19):
  - Continuity between bicycle lanes, trails or other bicycle facilities.
  - Marking a common route for bicyclists through a high-demand corridor.
  - Directing cyclists to low-volume roads or those with a paved shoulder.
  - Directing cyclists to particular destinations (e.g., park, school or commercial district).
- The following factors are recommended for signed bike routes (AASHTO, 1999, p. 19):
  - The route provides through and direct travel.
  - The route connects discontinuous segments of shared-use paths or bike lanes.
  - Bicyclists are given greater priority on the signed route than they are on the alternate route.
  - Street parking has been removed or limited to provide more width.
  - A smooth surface has been provided.
  - Regular street sweeping and maintenance are assured.
  - Wider curb lanes are provided compared to parallel roads.
  - Shoulders are at least four feet wide.

▲ Undesirable *(Photo: MORPC, Columbus, OH)*

- Bike route sign instructs bicyclists to walk on sidewalk in order to make a left turn at the intersection.
- This shows a lack of appropriate bike facilities.
- A better solution would be a designated bike lane, sharrows, and/or a separate bike signal (see the section on bike signals).

▲ Bike route sign

(Photo: MORPC, Columbus, OH)

- Directs bicyclists along a designated on-street bike route.

Bicycle-Related Signs

- Several types of signs relating to bicycle traffic are in the MUTCD (see MUTCD, Part 9).
- Some experimental signs and signals can be used with FHWA's permission.
- Some innovative bicycle traffic control devices are in use in other countries and have not yet been used in the United States.

▲ A selection of bicycle-related signs from the MUTCD

(Image source: USDOT, 2009, p. 793)

Photo: MORPC, San Francisco, CA

Photo: Anne Price, Minneapolis, MN

Photo: MORPC, Columbus, OH

◄ Not in the MUTCD: Examples of other bicycle-related signs.

Bicycle Signals

Bike signals are traffic signals (i.e., traffic lights) specifically for bicycle traffic.

- Bike signals are widespread in Europe and are now in operation in some U.S. cities, including New York City; Portland, Oregon; and Washington, D.C.
- Bike signals can improve traffic flow and reduce turning conflicts. For example, if a bike lane is to the right of a right-turn motorized vehicle lane, separate signals can instruct bicyclists and motorists to proceed (going straight or turning right) at different points in the signal cycle (Streetfilms website: Innovative Bicycle Signal).
- The examples shown are not in the MUTCD.

◄ Bike signal

(Photo: Flickr user BikePortland; Portland, OR)

- Developed as an experimental treatment for a hazardous intersection
- One of the first bike signals in the U.S.A.

▲ Bicycle signal head

(Photo: Ariel Godwin, Amsterdam, Netherlands)

▲ Bicycle and pedestrian signal head

(Photo: Kerstin Carr, Regensburg, Germany)

Shared-use Facilities

Shared-use facilities are transportation facilities shared by multiple types of users. This section covers two types of shared-use facilities: paved shoulders and multi-use paths.

Paved Shoulders

Paved shoulders are the areas at the sides of the road that are outside of the vehicular travel lanes, but are paved. Shoulders are distinguished from the travel lanes by striping.

- The main purpose of paved shoulders is to accommodate stopped vehicles and emergency uses (AASHTO, 2004, p. 312).
- Therefore, they are not specifically designated for pedestrian or bicycle use.
- If no other facilities can be provided, a paved shoulder (if sufficiently wide) may accommodate pedestrians and bicyclists on rural roads with low-intensity land use.
- When walking on the road, including a shoulder, pedestrians should walk facing traffic so they can see any oncoming motor vehicles that might pose a danger to them.
- Bicyclists should ride in the direction of traffic as they must follow the same rules of the road as motorists.
- Paved shoulders should not be a substitute for sidewalks to accommodate pedestrians in urban and suburban areas.
- Paved shoulders should be at least 4 feet wide to accommodate bicycle travel, but if that is not possible, any additional shoulder width is better than none at all (AASHTO, 1999, p. 16).
- Rumble strips are a concern for bicyclists using paved shoulders. Although rumble strips improve highway safety, riding on them can be hazardous and uncomfortable for bicyclists.

▲ Undesirable

(Photo: MORPC, Columbus, OH)

- This paved shoulder, in an urban area, is not adequate for pedestrians.
- Rideable surface of the shoulder is too narrow for use by bicyclists.
- Gravel and debris on the surface pose a safety hazard.

▲ Good example

(Photo: Flickr user BBodjack, Elk Rapids, MI)

- This paved shoulder, on a rural highway, is wide enough for bicycle use
- Pedestrians can use the shoulder, walking facing traffic

Rumble Strips and Rumble Stripes

Rumble strips are sections of corrugated pavement that cause noise and vibration when driven over. They are intended to alert motorists when they stray from their lanes. They are also sometimes used to warn motorists of an approaching stop sign, sharp curve, or other hazard that requires slowing down. A rumble strip becomes a "rumble stripe" when an edge line or center line pavement marking is placed on it (FHWA, "Rumble Strips & Rumble Stripes").

- Rumble strips can be hazardous for bicyclists (League of American Bicyclists, "Bicycling and Rumble Strips").
- The FHWA recommends that rumble strips should not normally be used when their installation would leave a clear shoulder pathway less than 4 feet wide (or less than 5 feet wide if there is an obstruction such as a curb or guardrail) to the right of the rumble strip for bicycle use (FHWA, 2001).
- Gaps in rumble strips should be provided to allow bicyclists to transition from the shoulder to the travel lane if necessary (for example, if the shoulder is blocked by debris). A typical design involves a 28– to 48-foot rumble strip followed by a 12-foot gap (FHWA, 2001).
- On roads with narrower shoulders where bicyclists cannot ride to the right of the rumble strip, rumble strips should be at least 1 foot to the right of the edge line. (FHWA, 2001).

▲ Good example

(Photo: Andrew Bossi, Salisbury, MD)

- Narrow rumble strip is on the left side of a wide shoulder, leaving sufficient space for bicyclists to use the shoulder.

▲ Undesirable

(Photo: Flickr user BradleyGee, Colorado)

- Wide rumble strip takes up too much of the shoulder, making the shoulder impracticable for bicyclists to use.
- A better solution here would be a narrower rumble strip, closer to the white line, or a rumble stripe under the white line. This would provide more usable shoulder space.

Multi-Use Paths (MUPs)

Multi-use paths (MUPs) are intended to accommodate a variety of generally non-motorized uses, e.g., bicycling, walking, jogging, rollerblading, horseback riding, etc.

- They are also known as shared-use paths, multi-use trails, or shared-use trails.
- They are sometimes informally referred to as bike paths or trails.
- Depending on the destinations they connect, multi-use paths are used for recreation and/or for utilitarian purposes, such as commuting.
- They can be designed in a variety of ways to serve many different purposes, depending on the context.
- Multi-use paths are built in rural, suburban, and urban settings.
- They can be paved with asphalt; with rubber and recycled material (see Section 4.8, "Types of Pavement"); or with a gravel-type surface, such as crushed limestone.
- As the AASHTO bicycle facilities guide indicates, multi-use paths should be thought of as a complement to the roadway network and should not be used to preclude on -road bicycle facilities (AASHTO, 1999, p. 33).
- In general, the recommended design speed is 20 mph (AASHTO, 1999, p. 36).

MUP Width

- The *minimum* recommended width for a MUP is 10 feet with a 2—foot-wide graded area to each side (AASHTO, 1999, p. 35).
- Some users, such as roller bladers, need a significant amount of lateral width for safety.
- Wider paths allow two pedestrians to walk side by side while still allowing joggers, bicyclists, and others to safely pass them.

▲ Good example: Wide MUP

(Photo: MORPC, Columbus, OH)

- Path has more than adequate width for a variety of users.

▲ Undesirable: Narrow MUP

(Photo: MORPC, Columbus, OH)

- Path is too narrow for safe passing.
- Sharp turns are hazardous.

Undesirability of Sidewalks as Multi-use Paths

In general, sections of sidewalk should not be designated as MUPs, because sidewalks have lower design speeds (AASHTO, 1999, p. 58).

- If a section of sidewalk must be designated as part of an MUP, the section must be of sufficient width to accommodate the wide range of uses that is typical for an MUP.
- If a sidewalk must be designated as part of an MUP, signs should be installed to make it clear to users that this is the case. This alerts pedestrians to the presence of bicyclists, and reminds faster users that they are sharing the path with slower users.

► Undesirable: Narrow sidewalk is designated as part of an MUP across a bridge.

(Photo: MORPC, Columbus, OH)

- 4-foot sidewalk is too narrow for MUP-type uses.
- 6-inch drop-off at the edge of the curb is hazardous for bicyclists, wheelchair users, and skaters.
- There are no signs to alert users that the sidewalk is part of a multi-use path.
- A better solution would be to designate the sidewalk for pedestrians, and to encourage bicyclists to use the shared roadway, adding sharrows or bike lanes.
- Another solution would be to provide a wider sidewalk (at least 10 feet, with a protective barrier) as part of the MUP.

◄ Better example: Wide sidewalk is designated as part of an MUP across a bridge.

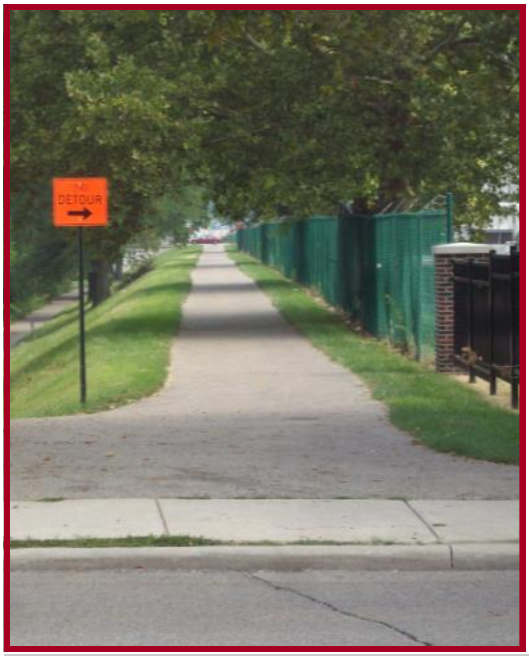
(Photo: MORPC, Columbus, OH)

- 12-foot sidewalk with protective barrier is adequate for MUP-type uses.
- However, there are still no signs to alert users that the sidewalk is part of a multi-use path.

Path-Street Transitions

Where an MUP terminates or intersects with a street, the transition should be made safe and easy for all types of users.

- In particular, MUP design should encourage bicyclists to transition to the street, not to the sidewalk.
- Improper transitions may encourage bicyclists to hop curbs, ride on sidewalks, or dart into traffic.
- Transitions that involve street crossings should also include appropriate crossing facilities for pedestrians, such as marked crosswalks.



▲ Undesirable

(Photo: MORPC, Columbus, OH)

- No marked crosswalk, even though the path continues on the other side of the street.
- No ramp; bicyclists cannot easily transition between the street and the MUP.
- Lack of ramp poses a problem for wheelchair users.
- In this location, bicycling on the sidewalk is prohibited.

▲ Good example

(Photo: MORPC, Columbus, OH)

- Pedestrians can transition easily from the MUP to the sidewalk.
- Pedestrians can cross the street using the crosswalk.
- Bicyclists can use the curb ramp to transition between the street and the MUP.
- In this location, bicycling on the sidewalk is prohibited.

Gaps and Connections

Many multi-use path systems have gaps in connectivity. This generally requires bicyclists to ride on streets and other users to use sidewalks, shoulders, etc. In these cases, safety and ease of use should be maintained for all users.

- Measures should be taken to make connecting roads bike-friendly.
- Sidewalks should be provided for pedestrians.

▲ Good example

(Photo: MORPC, Columbus, OH)

- Multi-use path ends at a low-traffic residential street.
- Signs guide users along the route to where the path continues.

▲ Undesirable

(Photo: MORPC, Columbus, OH)

- Multi-use path dead-ends onto an urban arterial with a 45 MPH speed limit, no sidewalks, and 14,000 ADT (MORPC traffic counts website).
- No connection is provided to nearby smaller roads that are more suitable for non-motorized uses.

Intersections

Since multi-use paths tend to be set back from the motorized vehicle lanes, there can be an increased crash risk at intersections unless proper design countermeasures are taken. Such countermeasures might include:

- Signs to alert both motorists and path users of the approach to the intersection.
- Redesigning diagonal crossings so that path users cross roads at a right angle.
- Maintaining clear sight lines around corners at intersections.
- Assigning right-of-way to motorists or path users appropriately, depending on the context of the intersection.
- Further information on intersection countermeasures is in the AASHTO bicycle facilities guide, pp. 46-54.
- Frequent intersections (including driveways) are not desirable.
- Paths should cross roads at a right angle, not diagonally.

Intersections (continued)

▲ Undesirable *(Photo: MORPC, Hilliard, OH)*

- Multi-use path crosses a road diagonally.

▲ Good example *(Photo: MORPC, Hilliard, OH)*

- Multi-use path crosses road at a right angle.
- Crosswalk is clearly striped.

Personal Safety

When designing any pedestrian or bicycle accommodation, personal safety should be a main consideration so that people feel comfortable using the facilities.

- MUPs should be well lit at night.
- In some areas, consider providing emergency call boxes.

▲ Good example

(Photo: Flickr user Julie Jordan Scott; Location: San Francisco, CA)

- Emergency call box provided on a multi-use path crossing a bridge.

▲ Undesirable

(Photo: Flickr user Star5112, Livermore, CA)

- There are no lights on the MUP.

Types of Multi-use Paths

There is a variety of different types of multi-use path, depending on the location, the path right-of-way available, and the adjacent land uses and destination points.

Rail trails

Rail trails are multi-use paths built on former railroad rights-of-way.

- Rail trails allow communities to benefit from the presence of unused railroad corridors.
- Some rail trails in Ohio cover long distances and provide connections between many communities, ranging from small towns to major urban areas.
- Rail trails are used both for recreation and for utilitarian purposes, such as commuting.
- Rail trails can bring economic benefits to communities by promoting tourism and improving business.

▲ Urban rail trail

(Photo: Ariel Godwin, Minneapolis, MN)

- Striping separates pedestrians and two directions of bicycle traffic.
- Since the trail is along a former rail corridor, there is a limited number of at-grade crossings.

▲ Rural rail trail

(Photo: Ariel Godwin, Millersburg, OH)

- Trail connects rural communities.
- Striping indicates two-way traffic.

Interstate Multi-Use Paths

Interstate multi-use paths are MUPs that run alongside interstate highways or other limited-access highways.

- They can be built within the interstate's right-of-way or adjacent to the ROW.
- Interstate MUPs provide non-motorized access along heavily traveled corridors that would otherwise be restricted to motorized traffic. Therefore, they can provide useful transportation options to bicyclists and pedestrians.
- They can be built on one side of the interstate or along the median.

▲ Interstate MUP

(Photo: MORPC, Columbus, OH)

- Built alongside an interstate.
- Also parallels a city street.
- Connects residential areas with employment centers.

▲ Interstate MUP

(Photo: WikiMedia Commons, Portland, OR)

- Built in the median of an interstate.
- Provides bicycle and pedestrian access across a long interstate bridge, connecting two large cities.

MUPs as alternatives to sidewalks

Although existing sidewalks should not be designated as MUPs, it may be appropriate in some cases to build an MUP instead of a sidewalk alongside a road.

- This may be appropriate alongside a high-speed, high-traffic road, such as a suburban arterial.
- Engineering countermeasures should be used at intersections to prevent conflicts between path users and motorists.
- Bicyclists are still allowed to use the vehicular travel lanes.

◄ Multi-use path alongside a suburban road

(Photo: MORPC, Hilliard, OH)

- More experienced bicyclists can use the vehicular travel lanes (note there are sharrows).
- Less experienced bicyclists can use the multi-use path, shared with pedestrians and other users.
- Sidewalk on the other side of the street is for pedestrians only.

Scenic Multi-Use Paths

Scenic MUPs offer access to scenic areas, such as along rivers, lakes, ocean fronts, or canals.

- These MUPs function as tourist attractions and recreational corridors.
- They are often also used for utilitarian purposes (commuting, etc.) depending on what destinations they connect.

► Scenic riverfront multi-use path

(Photo: MORPC, Columbus, OH)

- Provides scenic views of city center and river.
- Connects residential areas with employment centers; used by commuters.
- Used by workers in the central business district for exercise breaks during the day.

Sources

Allen, John (n.d.). "The Bike Lane Design Guide – 'Honey, they shrunk the cars!'" BikeXprt website. http://www.truewheelers.org/comments/laneguide/index.htm (last accessed Aug. 11, 2010).

Allen, John S. (2002). "About car-door collisions, on-street parking and bike lanes." BikeXprt website. http://www.bikexprt.com/bikepol/facil/lanes/dooring.htm (last accessed Aug. 11, 2010).

AASHTO (American Association of State Highway and Transportation Officials) (1999). *Guide for the Development of Bicycle Facilities*. Washington, DC: AASHTO. http://www.sccrtc.org/bikes/AASHTO_1999_BikeBook.pdf (retrieved Nov. 5, 2010).

American Association of State Highway and Transportation Officials (2004). *A Policy of Geometric Design of Highways and Streets*. Washington, DC: AASHTO.

APBP (Association of Pedestrian and Bicycle Professionals) (Feb. 17, 2010). Webinar: "Cycle Tracks: Concept and Design Practices."

APBP (Association of Pedestrian and Bicycle Professionals) (July 21, 2010). Webinar: "Bicycle Boulevards and Neighborhood Greenways."

Bicycling Info website, "Signed Shared Roadways." http://www.bicyclinginfo.org/engineering/facilities-roadways.cfm (retrieved Nov. 4, 2010).

FHWA (2001). "Roadway Shoulder Rumble Strips." http://safety.fhwa.dot.gov/

roadway_dept/policy_guide/t504035.cfm (retrieved Oct. 25, 2010).

FHWA. "Rumble Strips & Rumble Strips." http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/cmrumblestrips/ (retrieved Jan. 13, 2011).

Hart, Joshua (Nov 8, 2010). "Commentary: Why Are We Building Bikes Lanes That Are Hurting People?" Streetsblog, http://sf.streetsblog.org/2010/11/08/commentary-why-are-we-building-bikes-lanes-that-are-hurting-people/ (retrieved Nov. 9, 2010).

League of American Bicyclists. "Bicycling and Rumble Strips." http://www.bikeleague.org/resources/reports/pdfs/rumble_strips.pdf (retrieved Jan. 13, 2011).

Lexington, City of. "Floating Bike Lanes." http://www.lexingtonky.gov/index.aspx?page=2579 (retrieved Jan. 12, 2011).

MORPC (Mid-Ohio Regional Planning Commission). "Transportation Data Management System." http://www.ms2soft.com/tcds/tsearch.asp?loc=Morpc&mod= (last accessed Nov. 10, 2010).

ODPS (Ohio Department of Public Safety) (2009). *Digest of Ohio Motor Vehicle Laws*. www.publicsafety.ohio.gov/links/hsy7607.pdf (last accessed Aug. 11, 2010).

Oswald, Fred (2010). "Bicycle Blunders and Smarter Solutions." LAB Reform website. http://www.labreform.org/blunders/b5.html (last accessed Aug. 11, 2010).

Popik, Barry (June 1, 2005). "Bicycle 'Dooring.'" *The Big Apple.* http://www.barrypopik.com/index.php/new_york_city/entry/bicycle_dooring/ (last accessed Aug. 11, 2010).

Salem, City of. "Transportation Systems Maintenance Element." http://www.cityofsalem.net/Departments/PublicWorks/TransportationServices/TransporationPlan/Documents/tsp_ts_maint_approved.pdf (retrieved Nov. 4, 2010).

Schubert, John (July 2004). "The Door Prize to Avoid." *Adventure Cycling*. http://www.adventurecycling.org/resources/doorprize.pdf (last accessed Aug. 11, 2010).

SFMTA (San Francisco Municipal Transportation Agency. "Sharrow images for FAQ sheet." http://www.sfmta.com/cms/bsafe/28414.html (retrieved Nov. 4, 2010).

Southan, Rhys (2008). "The Door Prize: Cyclists killed by dooring." Bicycle Safe website. http://bicyclesafe.com/doorprize.html (last accessed Aug. 11, 2010).

Streetfilms website. "Portland, Ore. – Innovative Bicycle Signal." http://www.streetfilms.org/portland-or-innovative-bicycle-signal/ (retrieved Nov. 4, 2010).

USDOT (U.S. Department of Transportation). Federal Highway Administration (2009). *Manual on Uniform Traffic Control Devices for Streets and Highways*. 2009 edition. Washington, DC: FHWA. http://mutcd.fhwa.dot.gov/pdfs/2009/pdf_index.htm (retrieved Oct. 22, 2010).

USDOT, "Policy Statement on Bicycle and Pedestrian Accommodation, Regulations and Recommendations." Signed on March 11, 2010. http://www.fhwa.dot.gov/environment/bikeped/policy_accom.htm (retrieved Oct. 22, 2010)