studies. However, it is generally assumed that the speed of youth bicyclists is lower than adult bicyclists. Since much of the design criteria in this guide is based on design speed, children will be accommodated to a large extent. When considering criteria unrelated to design speed, engineering judgment should be used when modifying these values for children. Throughout this chapter, several design measures are recommended which are based primarily on pedestrian research. It is presumed that these measures will also benefit bicyclists and other path users, although the research has not been conducted to support this assumption.

5.2.1 Width and Clearance

The usable width and the horizontal clearance for a shared use path are primary design considerations. Figure 5-1 depicts the typical cross section of a shared use path. The appropriate paved width for a shared use path is dependent on the context, volume, and mix of users. The minimum paved width for a two-directional shared use path is 10 ft (3.0 m). Typically, widths range from 10 to 14 ft (3.0 to 4.3 m), with the wider values applicable to areas with high use and/or a wider variety of user groups.

In very rare circumstances, a reduced width of 8 ft (2.4 m) may be used where the following conditions prevail:

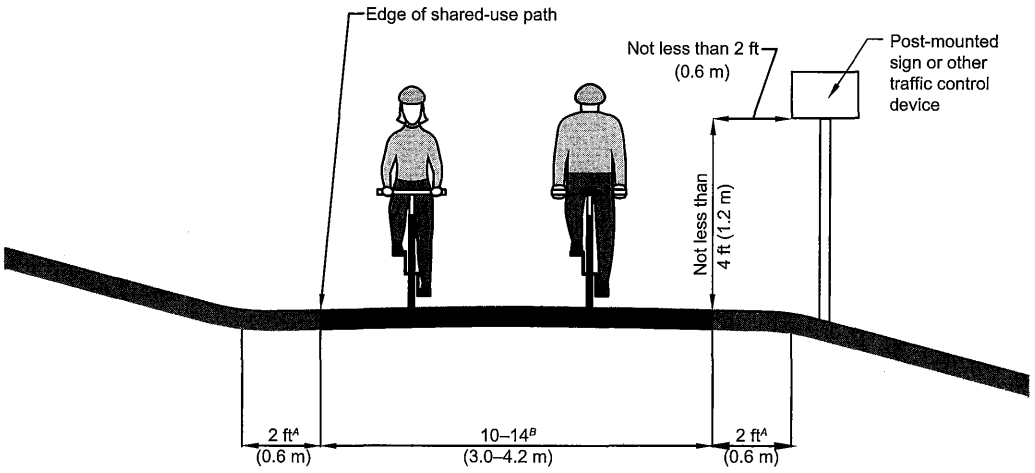
- Bicycle traffic is expected to be low, even on peak days or during peak hours.
- Pedestrian use of the facility is not expected to be more than occasional.
- Horizontal and vertical alignments provide frequent, well-designed passing and resting opportunities.
- The path will not be regularly subjected to maintenance vehicle loading conditions that would cause pavement edge damage.

In addition, a path width of 8 ft (2.4 m) may be used for a short distance due to a physical constraint such as an environmental feature, bridge abutment, utility structure, fence, and such. Warning signs that indicate the pathway narrows (W5-4a), per the MUTCD (*7*) should be considered at these locations.

A wider path is needed to provide an acceptable level of service on pathways that are frequently used by both pedestrians and wheeled users. The *Shared Use Path Level of Service Calculator* is helpful in determining the appropriate width of a pathway given existing or anticipated user volumes and mixes (*9*). Wider pathways, 11 to 14 ft (3.4 to 4.2 m) are recommended in locations that are anticipated to serve a high percentage of pedestrians (30 percent or more of the total pathway volume) and high user volumes (more than 300 total users in the peak hour). Eleven foot (3.4 m) wide pathways are needed to enable a bicyclist to pass another path user going the same direction, at the same time a path user is approaching from the opposite direction (see Figure 5-2) (*8*). Wider paths are also advisable in the following situations:

- Where there is significant use by inline skaters, adult tricycles, children, or other users that need more operating width (see Chapter 3);
- Where the path is used by larger maintenance vehicles;

- On steep grades to provide additional passing area; or
- Through curves to provide more operating space.



Notes:
[A] (1V:6H) Maximum slope (typ.)
[B] More if necessary to meet anticipated volumes and mix of users, per the *Shared Use Path Level of Service Calculator (9)*

Figure 5-1. Typical Cross Section of Two-Way, Shared Use Path on Independent Right-of-Way

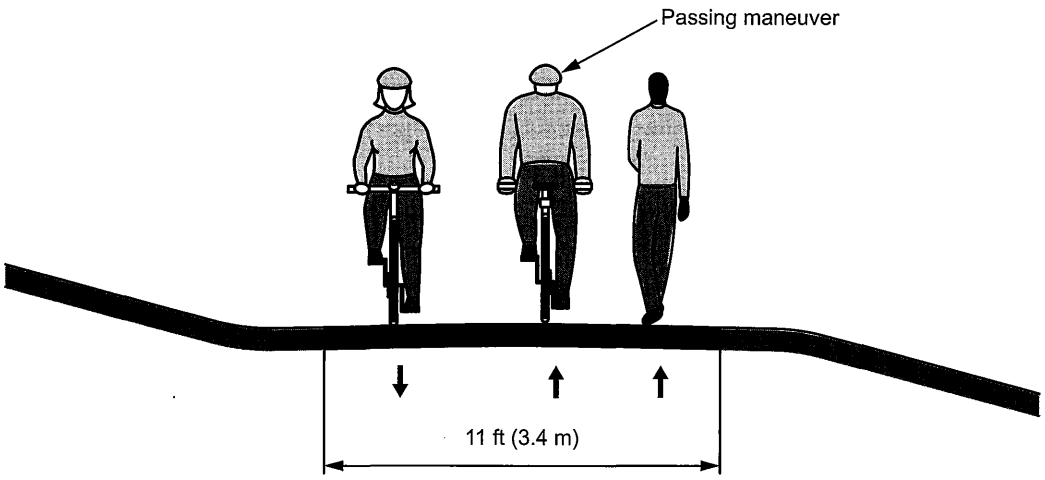


Figure 5-2. Minimum Width Needed to Facilitate Passing on a Shared Use Path

Under most conditions, there is no need to segregate pedestrians and bicyclists on a shared use path, even in areas with high user volumes—they can typically coexist. Path users customarily keep right except to pass. Signs may be used to remind bicyclists to pass on the left and to give an

audible warning prior to passing other slower users. Part 9 of the MUTCD (*7*) provides a variety of regulatory signs that can be used for this purpose.

On pathways with heavy peak hour and/or seasonal volumes, or other operational challenges such as sight distance constraints, the use of a centerline stripe on the path can help clarify the direction of travel and organize pathway traffic. A solid yellow centerline stripe may be used to separate two directions of travel where passing is not permitted, and a broken yellow line may be used where passing is permitted. The centerline can either be continuous along the entire length of the path, or may be used only in locations where operational challenges exist. Per the MUTCD, all markings used on bikeways shall be retroreflective.

In areas with extremely heavy pathway volumes, segregation of pedestrians from wheeled users may be appropriate; however, care should be taken that the method of segregation is simple and straightforward. Pedestrians are typically provided with a bi-directional walking lane on one side of the pathway, while bicyclists are provided with directional lanes of travel. This solution should only be used when a minimum path width of 15 ft (4.6 m) is provided, with at least 10 ft (3 m) for two-way wheeled traffic, and at least 5 ft (1.5 m) for pedestrians.

Where this type of segregation is used on a path with a view (e.g., adjacent to a lake or river), the pedestrian lane should be placed on the side of the path with the view. Again, this solution should only be used for pathways with heavy volumes, as pedestrians will often walk in the "bicycle only" portion of a pathway unless it is heavily traveled by bicycles.

Another solution is to provide physically separated pathways for pedestrians and wheeled users. A number of factors should be considered when determining whether to provide separate paths, such as general site conditions (i.e., the width of separation and setting), origins and destinations of different types of path users, and the anticipated level of compliance of users choosing the appropriate path. In some instances, the dual paths may have to come in close proximity or be joined for a distance due to site constraints. As allowed by the MUTCD (*7*) and described in more detail in Section 5.4.2, mode-specific signs may be used to guide users to their appropriate paths.

Ideally, a graded shoulder area at least 3 to 5 ft (0.9 to 1.5 m) wide with a maximum cross-slope of 1V:6H, which should be recoverable in all weather conditions, should be maintained on each side of the pathway. At a minimum, a 2 ft (0.6 m) graded area with a maximum 1V:6H slope should be provided for clearance from lateral obstructions such as bushes, large rocks, bridge piers, abutments, and poles. The MUTCD requires a minimum 2 ft (0.6 m) clearance to post-mounted signs or other traffic control devices (*7*). Where "smooth" features such as bicycle railings or fences are introduced with appropriate flaring end treatments (as described below), a lesser clearance (not less than 1 ft [0.3 m]) is acceptable. If adequate clearance cannot be provided between the path and lateral obstructions, then warning signs, object markers, or enhanced conspicuity and reflectorization of the obstruction should be used.

Where a path is adjacent to parallel bodies of water or downward slopes of 1V:3H or steeper, a wider separation should be considered. A 5 ft (1.5 m) separation from the edge of the path pavement to the top of the slope is desirable. Depending on the height of the embankment and condition at the bottom, a physical barrier, such as dense shrubbery, railing, or fencing may be needed. This is an area where engineering judgment should be applied, as the risk for a bicyclist who runs off the path should be compared to the risk posed by the rail. Where a recovery area

5.2.2 Shared Use Paths Adjacent to Roadways (Sidepaths)

While it is generally preferable to select path alignments in independent rights-of-way, there are situations where existing roads provide the only corridors available. Sidepaths are a specific type of shared use path that run adjacent to the roadway, where right-of-way and other physical constraints dictate. Children often prefer and/or are encouraged to ride on sidepaths because they provide an element of separation from motor vehicles. As stated in Chapter 2, provision of a pathway adjacent to the road is not a substitute for the provision of on-road accommodation such as paved shoulders or bike lanes, but may be considered in some locations in addition to on-road bicycle facilities. A sidepath should satisfy the same design criteria as shared use paths in independent rights-of-way.

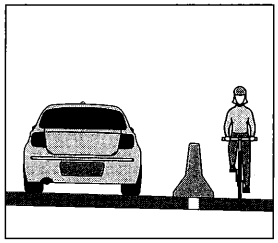
The discussion in this section refers to two-way sidepaths. Additional design considerations for sidepaths are provided in Section 5.3.4. Utilizing or providing a sidewalk as a shared use path is undesirable. Section 3.4.2 highlights the reasons sidewalks generally are not acceptable for bicycling. It is especially inappropriate to sign a sidewalk as a shared use path if doing so would prohibit bicyclists from using an alternate facility that might better serve their needs. In general, the guiding principle for designing sidewalks should be that sidewalks intended for use by bicyclists should be designed as sidepaths, and sidewalks not intended for use by bicyclists should be designed according to the AASHTO *Guide for the Planning, Design, and Operation of Pedestrian Facilities* (*2*).

Paths can function along highways for short sections, or for longer sections where there are few street and/or driveway crossings, given appropriate separation between facilities and attention to reducing crashes at junctions. However before committing to this option for longer distances on urban and suburban streets with many driveways and street crossings, practitioners should be aware that two-way sidepaths can create operational concerns. See Figure 5-4 for examples of potential conflicts associated with sidepaths. These conflicts include:

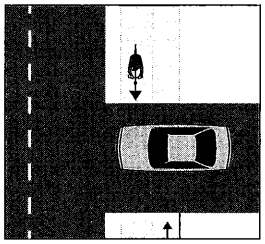
1. At intersections and driveways, motorists entering or crossing the roadway often will not notice bicyclists approaching from their right, as they do not expect wheeled traffic from this direction. Motorists turning from the roadway onto the cross street may likewise fail to notice bicyclists traveling the opposite direction from the norm.
2. Bicyclists traveling on sidepaths are apt to cross intersections and driveways at unexpected speeds (i.e., speeds that are significantly faster than pedestrian speeds). This may increase the likelihood of crashes, especially where sight distance is limited.
3. Motorists waiting to enter the roadway from a driveway or side street may block the sidepath crossing, as drivers pull forward to get an unobstructed view of traffic (this is the case at many sidewalk crossings, as well).
4. Attempts to require bicyclists to yield or stop at each cross-street or driveway are inappropriate and are typically not effective.
5. Where the sidepath ends, bicyclists traveling in the direction opposed to roadway traffic may continue on the wrong side of the roadway. Similarly, bicyclists approaching a path may travel on the wrong side of the roadway to access the path. Wrong-way travel by bicyclists is a common factor in bicycle-automobile crashes.

6. Depending upon the bicyclist's specific origin and destination, a two-way sidepath on one side of the road may need additional road crossings (and therefore increase exposure); however, the sidepath may also reduce the number of road crossings for some bicyclists.
7. Signs posted for roadway users are backwards for contra-flow riders, who cannot see the sign information. The same applies to traffic signal faces that are not oriented to contra-flow riders.
8. Because of proximity of roadway traffic to opposing path traffic, barriers or railings are sometimes needed to keep traffic on the roadway or path from inappropriately encountering the other. These barriers can represent an obstruction to bicyclists and motorists, impair visibility between road and path users, and can complicate path maintenance.
9. Sidepath width is sometimes constrained by fixed objects (such as utility poles, trash cans, mailboxes, and etc.).
10. Some bicyclists will use the roadway instead of the sidepath because of the operational issues described above. Bicyclists using the roadway may be harassed by motorists who believe bicyclists should use the sidepath. In addition, there are some states that prohibit bicyclists from using the adjacent roadway when a sidepath is present.
11. Bicyclists using a sidepath can only make a pedestrian-style left turn, which generally involves yielding to cross traffic twice instead of only once, and thus induces unnecessary delay.
12. Bicyclists on the sidepath, even those going in the same direction, are not within the normal scanning area of drivers turning right or left from the adjacent roadway into a side road or driveway.
13. Even if the number of intersection and driveway crossings is reduced, bicycle–motor vehicle crashes may still occur at the remaining crossings located along the sidepath.
14. Traffic control devices such as signs and markings have not been shown effective at changing road or path user behavior at sidepath intersections or in reducing crashes and conflicts.

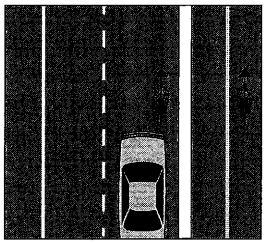
For these reasons, other types of bikeways may be better suited to accommodate bicycle traffic along some roadways.



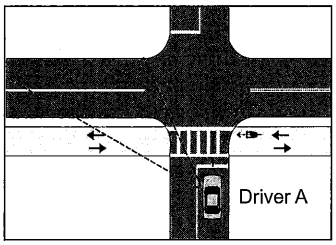
Barriers, while needed in tight spaces, can narrow both roadway and path, and create hazards.



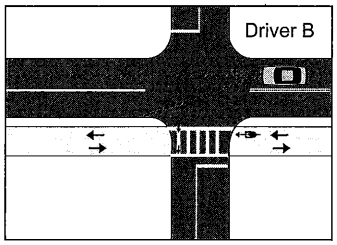
Stopped motor vehicles on side streets or driveways may block the path.



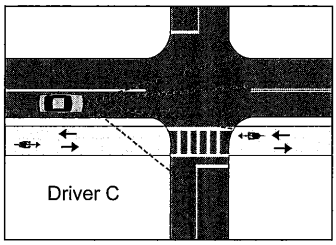
Some bicyclists may find the road cleaner, safer, and more convenient. Motorists may believe bicyclists should use a sidepath.



Right turning Driver A is looking for traffic on the left. A contraflow bicyclist is not in the driver's main field of vision.



Left turning Driver B is looking for traffic ahead. A contraflow bicyclist is not in the driver's main field of vision.



Right turning Driver C is looking for left turning traffic on the main road and traffic on the minor road. A bicyclist riding with traffic is not in the driver's main field of vision.

Figure 5-4. Sidepath Conflicts

Shared use paths in road medians are generally not recommended. These facilities result in multiple conflicting turning movements by motorists and bicyclists at intersections. Therefore, shared use paths in medians should be considered only where these turning conflicts can be avoided or mitigated through signalization or other techniques.

Guidelines for Sidepaths

Although paths in independent rights-of-way are preferred, sidepaths may be considered where one or more of the following conditions exist:

- The adjacent roadway has relatively high-volume and high-speed motor vehicle traffic that might discourage many bicyclists from riding on the roadway, potentially increasing sidewalk riding, and there are no practical alternatives for either improving the roadway or accommodating bicyclists on nearby parallel streets.
- The sidepath is used for a short distance to provide continuity between sections of path in independent rights-of-way, or to connect local streets that are used as bicycle routes.
- The sidepath can be built with few roadway and driveway crossings.
- The sidepath can be terminated at each end onto streets that accommodate bicyclists, onto another path, or in a location that is otherwise bicycle compatible.

In some situations, it may be better to place one-way sidepaths on both sides of the street or highway, directing wheeled users to travel in the same direction as adjacent motor vehicle traffic. Clear directional information is needed if this type of design is used, as well as appropriate intersection design to enable bicyclists to cross to the other side of the roadway. This can reduce some of the concerns associated with two-way sidepaths at driveways and intersections; however, it should be done with the understanding that many bicyclists will ignore the directional indications if they involve additional crossings or otherwise inconvenient travel patterns.

A wide separation should be provided between a two-way sidepath and the adjacent roadway to demonstrate to both the bicyclist and the motorist that the path functions as an independent facility for bicyclists and other users. The minimum recommended distance between a path and the roadway curb (i.e., face of curb) or edge of traveled way (where there is no curb) is 5 ft (1.5 m). Where a paved shoulder is present, the separation distance begins at the outside edge of the shoulder. Thus, a paved shoulder is not included as part of the separation distance. Similarly, a bike lane is not considered part of the separation; however, an unpaved shoulder (e.g., a gravel shoulder) can be considered part of the separation. Where the separation is less than 5 ft (1.5 m), a physical barrier or railing should be provided between the path and the roadway. Such barriers or railings serve both to prevent path users from making undesirable or unintended movements from the path to the roadway and to reinforce the concept that the path is an independent facility. A barrier or railing between a shared use path and adjacent highway should not impair sight distance at intersections, and should be designed to limit the potential for injury to errant motorists and bicyclists. The barrier or railing need not be of size and strength to redirect errant motorists toward the roadway, unless other conditions indicate the need for a crashworthy barrier. Barriers or railings at the outside of a structure or a steep fill embankment that not only define the edge of a sidepath but also prevent bicyclists from falling over the rail to a substantially lower elevation should be a minimum of 42 in. (1.05 m) high. Barriers at other locations that serve only to separate the area for motor vehicles from the sidepath should generally have a minimum height equivalent to the height of a standard guardrail.

When a sidepath is placed along a high-speed highway, a separation greater than 5 ft (1.5 m) is desirable for path user comfort. If greater separation cannot be provided, use of a crashworthy barrier should be considered. Other treatments such as rumble strips can be considered as alternatives to physical barriers or railings, where the separation is less than 5 ft (1.5 m). However, as in the case of rumble strips, an alternative treatment should not negatively impact bicyclists who choose to ride on the roadway rather than the sidepath. Providing separation between a sidepath and the adjacent roadway does not necessarily resolve the operational concerns for sidepaths at intersections and driveways. See Section 5.3.4 for guidance on the design of sidepath intersections.

5.2.3 Shared Use with Mopeds, Motorcycles, Snowmobiles, and Horses

Although in some jurisdictions it may be permitted, it is undesirable to mix mopeds, motorcycles, or all-terrain vehicles with bicyclists and pedestrians on shared use paths. In general, these types of motorized vehicles should not be allowed on shared use paths because of conflicts with slower moving bicyclists and pedestrians. Motorized vehicles also diminish the quiet, relaxing experience most users seek on paths. Motorized wheelchairs are an exception to this rule, and should be permitted to access shared use paths. In cases where mopeds or other similar motorized users are permitted and are expected to use the pathway, providing additional width and improved sight lines may reduce conflicts. Signs that emphasize appropriate user etiquette may also be useful.