Paths are most commonly designed for two-way travel, and the guidance herein assumes a two-way facility is planned unless otherwise stated.

Shared use paths can serve a variety of purposes. They can provide users with a shortcut through a residential neighborhood (e.g., a connection between two cul-de-sac streets) or access to schools. They can provide a commuting route between residential areas and job centers or schools. Located in a park or a greenway, they can provide an enjoyable recreational opportunity. Shared use paths can be located along rivers, ocean fronts, canals, abandoned or active railroad and utility rights-of-way, roadway corridors, limited access freeways, within college campuses, or within parks and open space areas. Shared use paths can also provide bicycle access to areas that are otherwise served only by limited-access highways. Shared use paths that run adjacent to a roadway are called sidepaths. These are discussed further in Section 5.2.2.

Shared use paths should be thought of as a system of off-road transportation routes for bicyclists and other users that extends and complements the roadway network. Shared use paths should not be used to preclude on-road bicycle facilities, but rather to supplement a network of on-road bike lanes, shared roadways, bicycle boulevards, and paved shoulders. Shared use path design is similar to roadway design, but on a smaller scale and with typically lower design speeds.

5.1.1 Accessibility Requirements for Shared Use Paths

Due to the fact that nearly all shared use paths are used by pedestrians, they fall under the accessibility requirements of the Americans with Disabilities Act (ADA). The technical provisions herein either meet or exceed those recommended in current accessibility guidelines. Paths in a public right-of-way that function as sidewalks should be designed in accordance with the proposed *Public Rights-of-Way Accessibility Guidelines* (PROWAG) (*13*), or subsequent guidance that may supersede PROWAG in the future. These guidelines also apply to street crossings for all types of shared use paths.

Shared use paths built in independent rights-of-way should meet the draft accessibility guidelines in the *Advance Notice of Proposed Rulemaking (ANPRM) on Accessibility Guideline for Shared Use Paths* (*12*), or any subsequent rulemaking that supersedes the ANPRM. The ANPRM separates shared use paths from recreational trails and more closely aligns draft accessibility provisions with those provided for sidewalks and other pedestrian facilities. Refer to the U.S. Access Board website (www.access-board.gov) for up-to-date information regarding the accessibility provisions for shared use paths and other pedestrian facilities covered by the Americans with Disabilities Act and the Architectural Barriers Act.

5.2 ELEMENTS OF DESIGN

Shared use path design criteria are based on the physical and operating characteristics of path users, which are substantially different than motor vehicles. Due to a large percentage of path users being adult bicyclists, they are the primary design user for shared use paths and are the basis for most of the design recommendations in this chapter. This chapter also provides information on critical design issues and values for other potential design users, which should be used in the event that large volumes of these other user types are anticipated.

Some paths are frequently used by children. The operating characteristics of child bicyclists are highly variable, and their specific characteristics have not yet been fully defined through research

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.

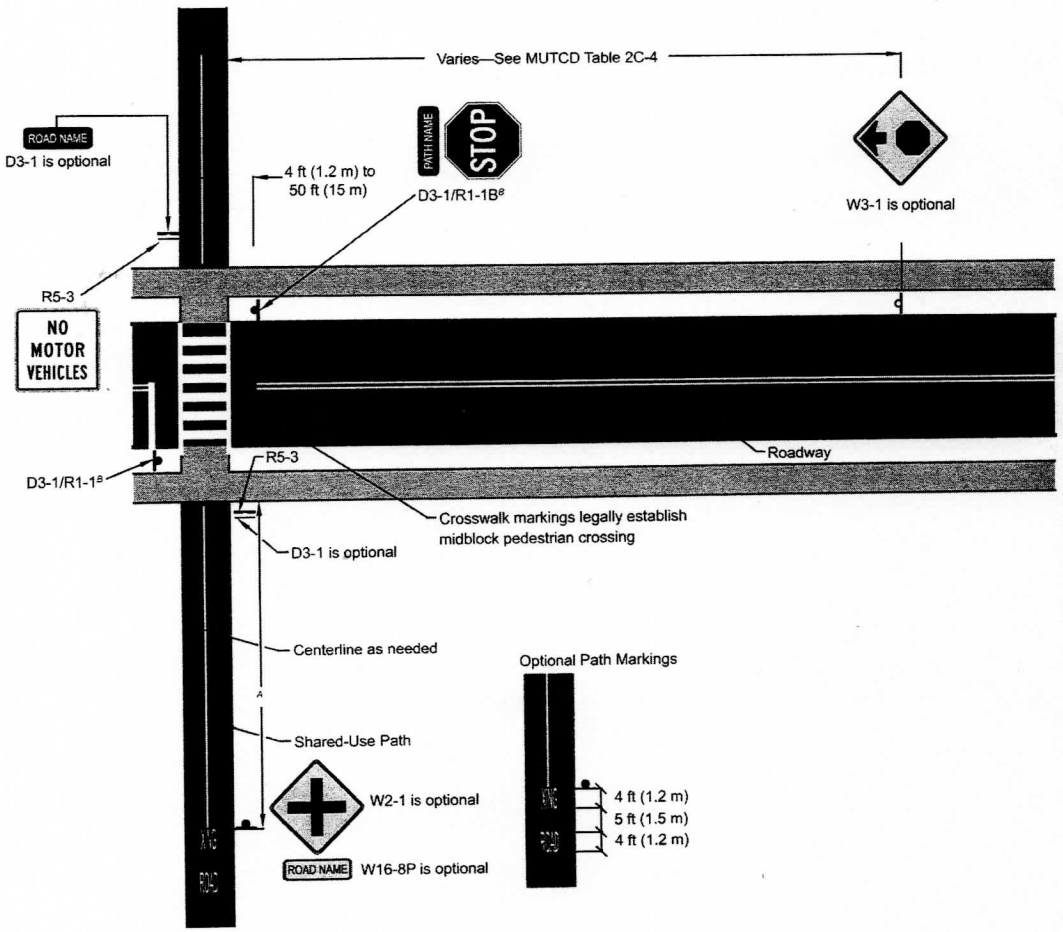
The discussion in this section refers to two-way sidepaths. Additional design considerations for sidepaths are provided in Section 5.3.4. Utilizing or providing a sidewalk as a shared use path is undesirable. Section 3.4.2 highlights the reasons sidewalks generally are not acceptable for bicycling. It 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.



Notes:

A Advance warning signs and solid centerline striping should be placed at the required stopping sight distance from the roadway edge, but not less than 50 ft (15 m).

B D3-1 sign is optional, R1-2 sign is required. At multilane road crossings, the R1-5 series (Yield Here To/Stop Here for Pedestrians signs and markings, placed in advance of the crosswalk to reduce muliple-threat crashes) may be a more appropriate solution.

Figure 5-20. Example Mid-Block Path–Roadway Intersection—Roadway is Stop Controlled

5.3.4 Sidepath Intersection Design Considerations

This section presents several design measures that may be considered when designing sidepath intersections. Depending upon motor vehicle and pathway user speeds, the width and character of the adjacent roadway, the amount of separation between the pathway and the roadway, and the characteristics of conflict points, sidepath travel may involve lesser or greater likelihood of motor vehicle collisions for bicyclists than roadway travel. This section concludes with additional details on the operational challenges of sidepath intersections, building upon the challenges described in Section 5.2.2.

The first and most important step in the design of any sidepath is to objectively assess whether the location is a candidate for a two-way sidepath. Guidance on this issue is given in Section 5.2.2. At-grade intersections of roadways and driveways with sidepaths, especially those with two-way sidepaths, have inherent conflicts that may result in bicycle–motor vehicle crashes. When ap-

proaching an intersection, drivers focus their attention in certain specific directions, depending on the planned maneuver through the intersection. If planning to turn left from the parallel roadway, drivers focus their attention ahead to watch for a gap in oncoming traffic and to the left to watch for potentially conflicting traffic on the side road. When turning right from the parallel roadway, drivers focus their attention ahead and to the right, as this is the direction from which they expect conflicting traffic. When turning onto the parallel roadway (or crossing the parallel roadway) from a side road or a driveway, drivers almost exclusively focus on traffic approaching from the left, in order to look for a gap and to avoid conflicting traffic. Figure 5-4 illustrates the typical scanning behavior of drivers when turning or approaching an intersection or driveway near a sidepath.

Sidepaths, especially two-way sidepaths, insert path users into intersections at locations that do not match with the ingrained scanning behaviors of motorists, which can in effect create virtual "blind spots," even in locations with no actual restrictions on sight distance or visibility. For example, a driver turning left from the parallel roadway across the sidepath might do a very conscientious job of looking for potentially conflicting traffic from the parallel road and crossroad, but completely miss a path user approaching from behind and to the driver's left, a location from which a driver is not conditioned or trained to expect conflicting traffic. It is nearly impossible for a driver turning left from the parallel roadway across the sidepath to accurately monitor the presence, location, or speed of sidepath traffic approaching from behind and to the left without compromising the ability to look for potential conflicts from other directions. Similar mismatches between scanning behavior of roadway traffic and arrival locations of sidepath traffic can be found with right turns from the parallel roadway and movements from the crossing roadway. On multilane streets with higher speed limits, the situation can be more challenging, due to narrowing field of vision, shorter reaction times, and the screening effect of other traffic in adjacent lanes.

Sidepath users typically take their right of way cues from either the pedestrian signalization or the signals controlling the parallel roadway. Path users typically enter the intersection when the parallel roadway has a green indication. Some path users, mainly pedestrians, observe the pedestrian signal and enter under the walk phase, but bicyclists often continue to enter and cross the intersection well into the "DONT WALK" phase. Conflicts between roadway traffic and sidepath users can be complicated by the perception among some path users that turning and crossing drivers will yield to sidepath traffic when the path user has the right of way (e.g., when given a green signal or "WALK" signal) and the potentially conflicting vehicle is visible to the path user; however, due to scanning patterns, the vehicle driver may not look in the direction of the path user. Conventional signalization may not be effective in mitigating these conflicts.

Assuming that the location has been determined to be a candidate for a two-way sidepath, pathway width and separation from roadway at intersections and driveways should be determined with respect to roadway speeds and number of lanes. Motorists on multilane roadways with higher speeds are more distracted by driving conditions, and are less likely to notice the presence of bicyclists on the sidepath during turning movements. On roads with speed limits of 50 mph (80 km/h) or greater, increasing the separation from roadway is recommended to improve path user comfort and potentially reduce crashes. At lower speeds, greater separation does not reduce crashes; therefore the sidepath should be located in close proximity to the parallel roadway at intersections, so motorists turning off the roadway can better detect sidepath riders (*11*).

Three countermeasures that may reduce crash frequency and severity at driveways and intersections are: (1) reduce the speeds of both path users and motorists at conflict points; (2) increase

the predictability of sidepath and road user behavior; and (3) limit the amount of exposure at these conflict points as much as practical.

While the design measures described here are not necessarily supported by research that shows their implementation will reduce crashes, they are rational measures that may improve the quality of bicycle facilities. These design measures include the following:

- Reduce the density of driveways and the incidence of less predictable driveway movements through access management. For example, combine driveways of adjacent properties, reduce driveway width to the minimum needed to accommodate ingress and egress volumes, and prevent left turns into driveways by allowing only right-in, right-out movements. However, if the access management instead serves to concentrate the traffic at a single driveway or intersection, then the conflicts may be displaced from the old location to the new location.

- Design intersections to reduce driver speeds and heighten awareness of path users. Strategies include tighter corner radii, avoidance of high-speed, free-flowing movements (such as ramp-style turns), providing median refuge islands, maintaining adequate sight distances between intersecting users, and other measures to reduce motor vehicle speeds at intersections. The use of additional standard signs and markings, or the use of enhanced or unconventional signs and markings, may not have a notable effect on driver or path user behavior.

- Design driveways to reduce driver speeds and heighten awareness of path users. Strategies can include tighter corner radii; maintaining adequate sight distances; and keeping the path surface continuous across the driveway entrance, so that it is clear that motorists are crossing an area where the path user has the right of way, among other measures. The use of additional standard signs and markings, or the use of enhanced or unconventional signs and markings, may not have a notable effect on driver or path user behavior.

- Consider design measures on approaches to intersections and driveways that encourage lower speeds for pathway approaches. There are a variety of measures that jurisdictions have used to encourage lower speeds; however, it is important that these measures not limit visibility or create conflicts for pathway users, or cause the pathway to become inaccessible. This is another reason why in many cases it is important to accommodate bicycles on the roadway as well as the sidepath, so that bicyclists who prefer to travel at faster speeds may do so on the roadway.

- Employ measures on the parallel roadway (appropriate to the roadway function) to reduce speeds. These may include, among others, installation of raised medians, reduction of the number of travel lanes, and provision of on-street parking (configured so as to avoid restriction of sight lines at driveways).

- Design intersection crossings to facilitate bicycle access to and from the road or driveway that is being crossed, as this location represents an entry and exit point to the pathway.

- *Keep approaches to intersections and major driveways clear of obstructions due to* parked vehicles, shrubs, and signs on public or private property. Consider adding stop bars or yield markings for vehicles pulling up to the sidepath intersection.

At signalized intersections, the pathway should be integrated into the controls of the intersection following the same principles as a pedestrian crossing. Care should be taken to avoid turning movements that will conflict with the "green" signal for the pathway. Some design measures may include:

- Institute fully-protected left- and right-turn movements from the parallel street across the sidepath. This may help to mitigate some crash types; however, this may have significant effects on intersection operation and capacity, especially when implementing protected-only right-turns.
- Prohibit right turns on red from the crossing roadway. This may help to mitigate conflicts, but may need targeted enforcement to maintain effectiveness if drivers do not perceive a need for this restriction.
- Provide a leading pedestrian interval, and provide an exclusive pedestrian phase where there are high volumes of path users.

Pedestrian countdown signal heads and accessible push buttons should be provided along with high visibility crosswalks, crossing islands at wide intersections, and sufficient space for queuing bicyclists, if high volumes of pathway users are expected.

As described above, in locations where the sidepath parallels a high-speed roadway and crosses a minor road, it is advisable to move the crossing away from the intersection to a mid-block location. By moving the crossing away from the intersection, motorists are able to exit the high speed roadway first, and then turn their attention to the pathway crossing.

5.3.5 Other Intersection Treatments

Curb Ramps and Aprons

The opening of a shared use path at the roadway should be at least the same width as the shared use path itself. If a curb ramp is provided, the ramp should be the full width of the path, not including any side flares if utilized. The approach should provide a smooth and accessible transition between the path and the roadway. The ramp should be designed in accordance with the proposed PROWAG (*13*). Detectable warnings should be placed across the full width of the ramp. A 5-ft (1.5-m) radius or flare may be considered to facilitate turns for bicyclists. Unpaved shared use paths should be provided with paved aprons extending a minimum of 20 ft (6 m) from paved road surfaces.

Path Widening at Intersections

For locations where queuing at an intersection results in crowding at the roadway edge, consideration can be given to widening the path approach. This can increase the crossing capacity and help reduce conflicts at path entrances.