14 Shared Use Path Design

CHAPTER

Shared-Use Path Design

Figure 14-1. *Shared-use paths provide recreation and transportation opportunities for a variety of user groups including pedestrians and bicyclists.*

A shared-use path serves as part of a transportation circulation system and supports multiple recreation opportunities, such as walking, bicycling, and inline skating. A shared-use path typically has a surface that is asphalt, concrete, or firmly packed crushed aggregate. The 1999 AASHTO Guide for the Development of Bicycle Facilities defines a shared-use path as being physically separated from motor vehicular traffic with an open space or barrier (AASHTO, 1999). Shared-use paths should always be designed to include pedestrians even if the primary anticipated users are bicyclists.

Shared-use paths provide a transportation function. All newly constructed shared-use paths should be built to provide access for people with disabilities. In addition, existing shared-use paths should be improved to enhance access whenever possible. If improvements to existing facilities cannot be made immediately, it is recommended that information, including signage, be provided at all path entrances. This information should clearly convey objective information to trail users, including data about grade, cross slope, surface, and width.

CHAPTER 14 SHARED USE PATH DESIGN

14.1 Background information

For most shared-use paths, bicyclists are the primary user group. Cyclists include tandem, recumbent, and hand powered three-wheelers. Road racing wheelchairs may use shared-use paths, reaching speeds of over 30 mph on downhill sections, and should have the same rights and privileges as cyclists. In many cases, the design requirements for bicyclists are similar, if not more stringent, than the design requirements for pedestrians with disabilities. For example, people who use wheelchairs can travel over small changes in level. However, because bicyclists are often traveling at faster speeds, smooth surfaces are needed. Although people with vision impairments can identify an edge protection in a trail environment if it is more than 76 mm (3 in) high, an edge protection lower than a 1.065 m (42 in) railing can be dangerous for a bicyclist.

For this report, the majority of the accessibility recommendations for shared-use paths are based on the 1999 AASHTO Guide for the Development of Bicycle Facilities (AASHTO, 1999). Additional issues, such as protruding objects (that are not addressed in the AASHTO bicycle facility guide) are also included in this report. However, the recommendations for grade in this report are based on the work by the Regulatory Negotiation Committee for Outdoor Developed Areas because the maximum grades identified for bicyclists in the AASHTO bicycle facility guide do not provide access to many people with mobility impairments.

14.2 Access to shared-use paths

Creating a shared-use path that provides access for people with disabilities involves more than the trail itself. Ensuring that an accessible pathway leads up to the shared-use path must also be considered. In addition, all access points along the shared-use path should be accessible to people with disabilities. Furthermore, the facilities around the trail should also be designed for access. For example:

CHAPTER 14 SHARED USE PATH DESIGN

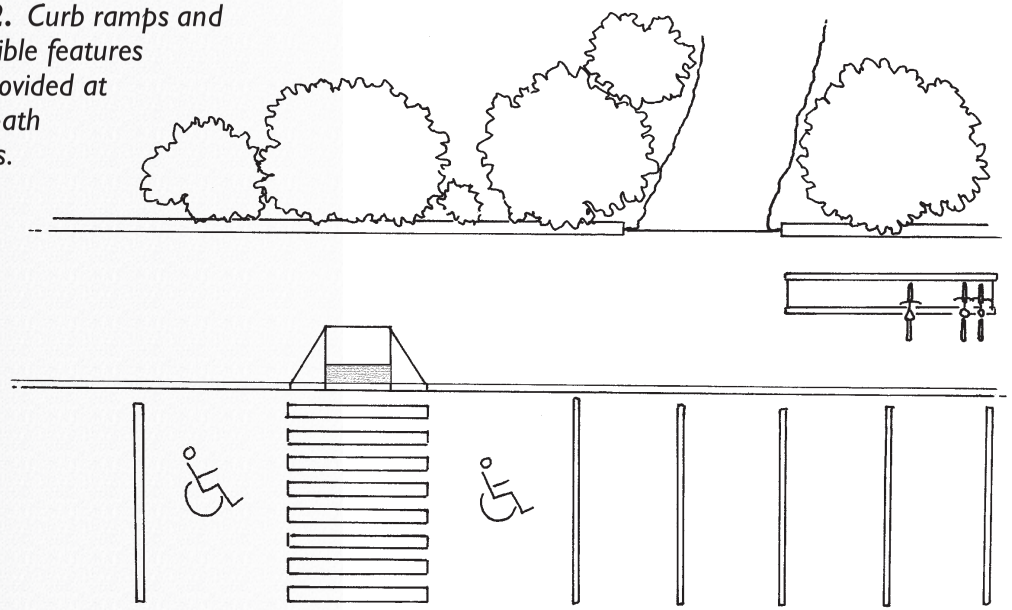

Figure 14-2. *Curb ramps and other accessible features should be provided at shared-use path access points.*

Case Study 14-1

Anticipated to span eight counties between Chadron and Norfolk, Nebraska, the 550 km (321 mile) Cowboy Trail will be the longest rails to trails conversion in the United States when it is complete.

- Trailhead and destination areas with parking and bathrooms should conform to ADAAG requirements for accessible parking and bathrooms;
- Elements, such as picnic areas, should be connected with a pathway that meets the accessible design recommendations for shared-use paths;
- Road access points should meet the recommendations in Chapter 16; and
- Signage at the access point should conform to ADAAG requirements for font size, font type, and contrast.

As previously indicated, the design of pathways leading up to shared-use paths should provide the same standard of accessibility as is provided on the path itself. However, the full 3.05 m (10 ft) that is recommended for tread width may not be necessary unless traffic is expected to be heavy.

14.2.1 Rail trails

Rail trails are an example of shared-use paths that are created from the right-of-way of abandoned railroad lines. Because railroad beds have gradual grades and turns, relatively few barriers exist in

CHAPTER 14 SHARED USE PATH DESIGN

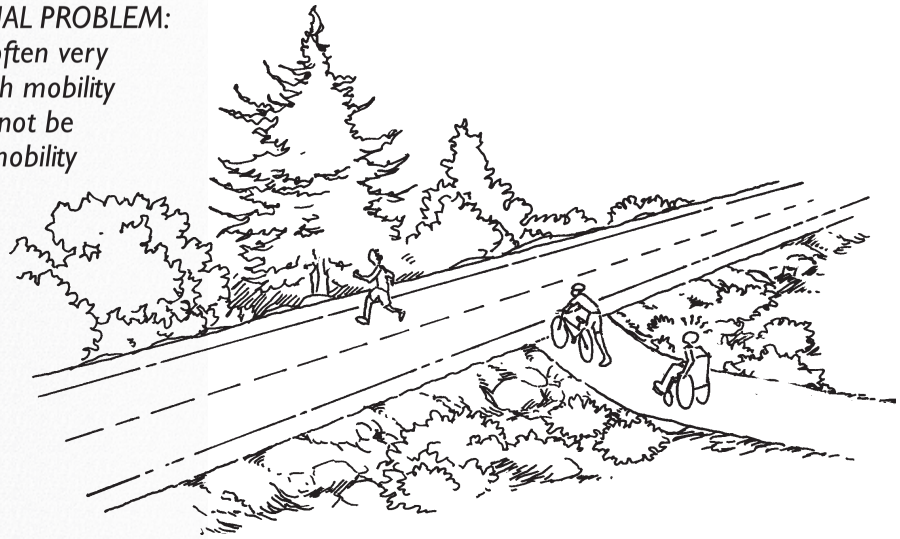

Figure 14-3. *POTENTIAL PROBLEM: Although rail trails are often very accessible to people with mobility impairments, they may not be usable by people with mobility impairments if the path leading up to the trail is very steep or includes unstable surfaces.*

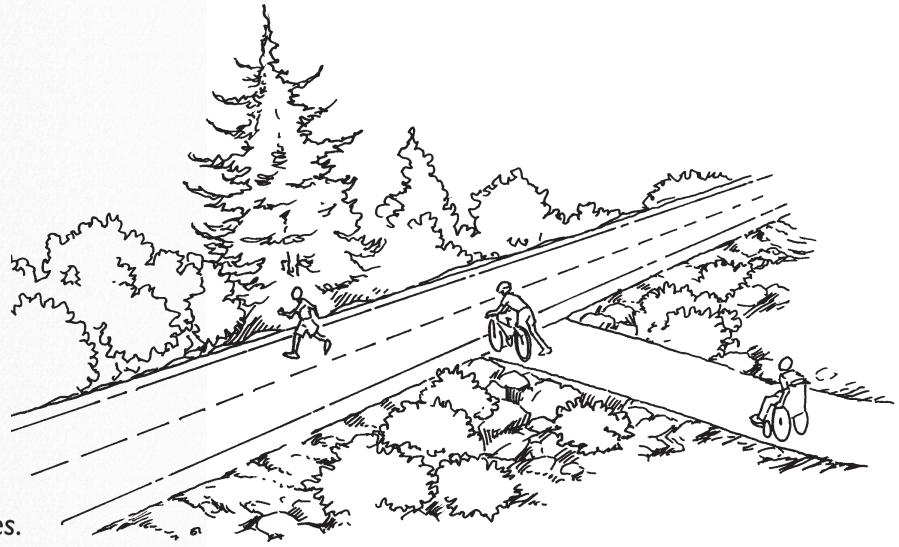

Figure 14-4. *GOOD DESIGN: Access to rail trails can be improved by replacing steep grades with more gradual slopes.*

making this type of trail accessible. The greatest challenge is typically designing an accessible pathway to the shared-use path. If the rail bed is raised high above the surrounding areas, providing access for people with mobility impairments may involve changes in design, such as reducing grade through the use of switchbacks or building ramped surfaces.

14.3 Conflicts between multiple user groups

Shared-use paths attract a variety of user groups who often have conflicting needs. All pedestrians are affected by sudden changes in the environment and by other trail users, such as bicyclists, who travel at high speeds. However, the conflicts on shared-use paths are especially significant for people who cannot react quickly to hazards, such as some people with mobility impairments. To improve the shared-use path experience for all users, including people with disabilities, designers and planners should be aware of potential conflicts and employ innovative

CHAPTER 14 SHARED USE PATH DESIGN

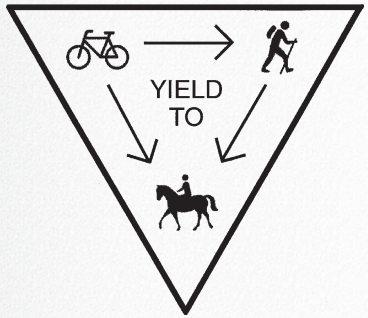

Figure 14-5. *Shared-use paths attract a variety of user groups. Providing signs that clearly indicate which users have the right of way will help avoid conflict.*

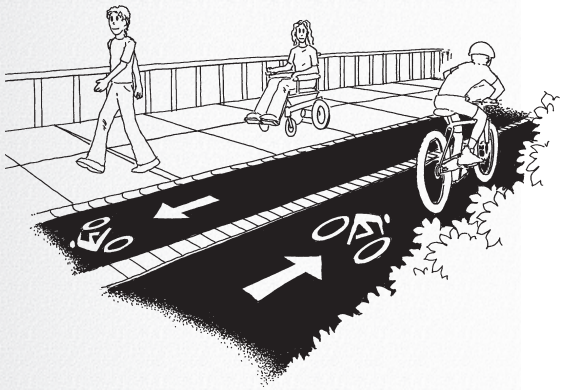

Figure 14-6. *GOOD DESIGN: Shared-use paths that provide different lanes for users who travel at different speeds prevent conflicts between user groups on high use trails.*

solutions whenever possible. Basic conflicts can be reduced by:

- Providing information, including signage, in multiple formats that clearly indicates permitted users and rules of conduct;
- Ensuring that the shared-use path provides sufficient width and an appropriate surface for everyone, or providing alternate paths for different types of users;
- Providing sufficient separation for users traveling at different speeds. For example, if volume and space permits, bicyclists and pedestrians should have different lanes or pathways;
- Providing the necessary amenities for all users. For example, bicyclists require bike racks or lockers; and
- Considering the needs of people with disabilities within all of the user groups permitted on the path. For example, many individuals with disabilities may use a longer hand cycle or wider tricycle design that may not be compatible with bike racks, bathroom stalls, or lockers of limited width. Longer and wider equipment may need additional maneuvering space in restrooms and when transferring from the chair to benches.

14.4 Shared-use path surfaces

The condition of the surface is a significant factor in determining how easily a person with a disability can travel along a shared-use path. The accessibility of the shared-use path surface is determined by a variety of factors including:

- Surface material;
- Surface firmness and stability;
- Slip-resistance;
- Changes in level; and
- Size and design of surface openings.

CHAPTER 14 SHARED USE PATH DESIGN

14.4.1 Surface material

There are various surface materials that can be used in outdoor environments. Shared-use paths are generally paved with asphalt or concrete, but may also use prepared surfaces such as crushed stone or soil stabilizing agents mixed with native soils or aggregates. High use trails passing through developed areas or fragile environments are commonly surfaced with asphalt or concrete to maximize the longevity of the shared-use path surface and promote bicycle and inline skating use.

The surfacing material on the shared-use path significantly affects which user groups will be capable of negotiating the terrain. Shared-use paths that have been built using crushed aggregate generally are unusable by inline skaters and slow down the speed of bicyclists. Paved surfaces should be provided in areas that are subject to flooding or drainage problems, in areas with steep terrain, and in areas where bicyclists or inline skaters are the primary users.

14.4.2 Surface firmness, stability, and slip resistance

The firmness, stability, and slip resistance of the shared-use path surface affects all users but is particularly important for people using mobility devices such as canes, crutches, wheelchairs, or walkers.

- **Firmness** is the degree to which a surface resists deformation by indentation when a person walks or wheels across it. A firm surface would not compress significantly under the forces exerted as a person walks or wheels on it.

- **Stability** is the degree to which a surface remains unchanged by contaminants or applied force so that when the contaminant or force is removed, the surface returns to its original condition. A stable surface would not be significantly altered by a person walking or maneuvering a wheelchair on it.

CHAPTER 14 SHARED USE PATH DESIGN

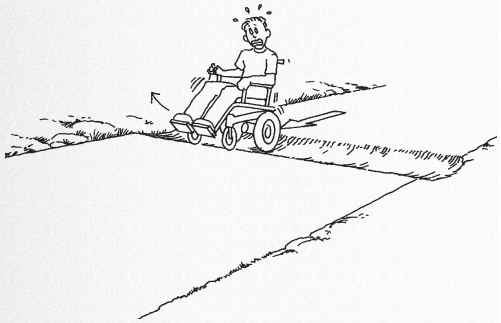

Figure 14-7. *Oftentimes, surface maintenance issues are addressed in small segments rather than resurfacing the entire path. Improperly recompacted trenching can contribute to loss of control and cause the wheelchair to flip over backwards.*

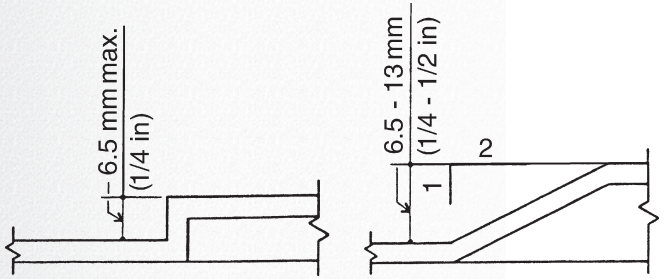

Figure 14-8. *Vertical changes in level on shared use paths should not exceed 6 mm (0.25 in). A bevel should be applied to changes in level between 6 mm (0.25 in) and 13 mm (0.5 in).*

- **Slip resistance** is based on the frictional force necessary to permit a person to ambulate without slipping. A slip resistant surface does not allow a shoe heel, wheelchair tires, or a crutch tip to slip when ambulating on the surface.

Shared-use paths should have a firm and stable surface. When a person walks or wheels across a surface that is not firm and stable, energy that would otherwise cause forward motion instead deforms or displaces the surface or is lost through slipping. Asphalt and concrete are firm and stable in all conditions. Other shared-use path materials, such as crushed limestone, are also firm and stable under most conditions. If a more natural surface is desired, synthetic bonding materials should be considered.

Under dry conditions, most asphalt and concrete surfaces are fairly slip resistant. Shared-use paths should be designed with a surface that is slip resistant during typical weather conditions. A slip-resistant surface reduces the possibility of a person's shoes, crutch tips, or tires sliding across the surface. The U.S. Access Board Technical Bulletin #4 addresses slip resistance in further detail (U.S. Access Board, 1994a).

14.4.3 Changes in level

Changes in level are defined as the maximum vertical change between two adjacent surfaces. Examples of changes in level that may be seen on shared-use paths include uneven transitions from the shared-use path surface to a bridge or walkway, cracks caused by freezing and thawing, or a sudden change in the natural ground level (often caused by earthquakes or nearby trees).

Although changes in level are not desirable for people with mobility impairments, they are most harmful to bicyclists and inline skaters. Abrupt changes in level can cause pedestrians to trip and fall. The risk is particularly acute

for individuals who have difficulty lifting their feet high up off the ground or who have limited vision and may be unable to detect the change in level. Catching a wheel on an obstacle or change in level can easily tip wheeled devices over as the individual's momentum continues despite the wheel having suddenly stopped. Minimizing or eliminating changes in level will greatly improve shared-use path safety for all users.

For shared-use paths, the following recommendations should be followed:

- Vertical changes in level should not be incorporated in new construction;
- If unavoidable, small changes in level up to 6 mm (0.25 in) may remain vertical and without edge treatment;
- A beveled surface with a maximum slope of 50 percent should be added to small level changes in levels between 6 mm (0.25 in) and 13 mm (0.5 in); and
- Changes in level such as curbs that exceed 13 mm (0.5 in) should be ramped or removed.

14.4.4 Openings

Openings are spaces or holes in the tread surface. On recreation trails, openings may occur naturally, such as a crack in a rock surface. On shared-use paths, however, openings are usually constructed, such as spaces between the planks of a boardwalk that allow water to drain from the surface. A grate is an example of an opening that is a framework of latticed or parallel bars that prevents large obstacles from falling through a drainage inlet but permits water and some sediment to pass through. Another example of an opening is a flangeway gap at a railroad crossing.

If at all possible, openings should not be within the shared-use path surface. Openings, such as drainage grates, should be located outside the shared-use path tread. Wheelchair casters or walkers, crutch and cane tips, inline skate wheels,

CHAPTER 14 SHARED USE PATH DESIGN

and the tires of road bicycles can get caught in poorly placed grates or gaps creating a serious safety hazard.

When designers cannot avoid placing openings in the shared-use path, they employ the following specifications:

- **Opening Width** — The size of the open space should not permit a 13 mm (0.5 in) diameter sphere to pass through the opening. If a wider gap is unavoidable because of existing design constraints, it may be acceptable to extend the width to a maximum of 19 mm (0.75 in); and
- **Opening Orientation** — If the open space is elongated, it must be oriented so that the long dimension is perpendicular to the dominant direction of travel.

14.5 Shared-use path grade and cross slope

Steep grades and cross slopes have significant drawbacks for people with mobility impairments. For example, more energy is required to traverse sloped surfaces than level surfaces. Powered wheelchairs use more battery power on steep grades because the chair compensates for the difficult terrain. Furthermore, both powered and manual wheelchairs are less stable on sloped surfaces, particularly if wet or frozen.

14.5.1 Grade

People with mobility impairments have a difficult time negotiating steep grades because of the additional effort required to travel over sloped surfaces. Manual wheelchair users may travel very rapidly on downhill pathways but will be significantly slower on uphill segments. Steep running grades are particularly difficult for users with mobility impairments when resting opportunities are not provided. Less severe grades that extend over longer distances may tire users as much as shorter, steeper grades. In general, running grades on shared-use paths should not exceed 5 percent and the most gradual slope possible should be used at all times.

CHAPTER 14 SHARED USE PATH DESIGN

If steeper segments are incorporated into the shared-use path, the total running grade that exceeds 8.33 percent should be less than 30 percent of the total trail length. In addition, it is essential that the lengths of the steep sections are minimized and are free of other access barriers. Negotiating a steep grade requires considerable effort. Users should not be required to exert additional energy to simultaneously deal with other factors, such as steep cross slopes and change in vertical levels. When designing maximum grade segments, the following recommendations should be used:

- 8.3 percent for a maximum of 61.0 m (200 ft);
- 10 percent for a maximum of 9.14 m (30 ft); and
- 12.5 percent for a maximum of 3.05 m (10 ft).

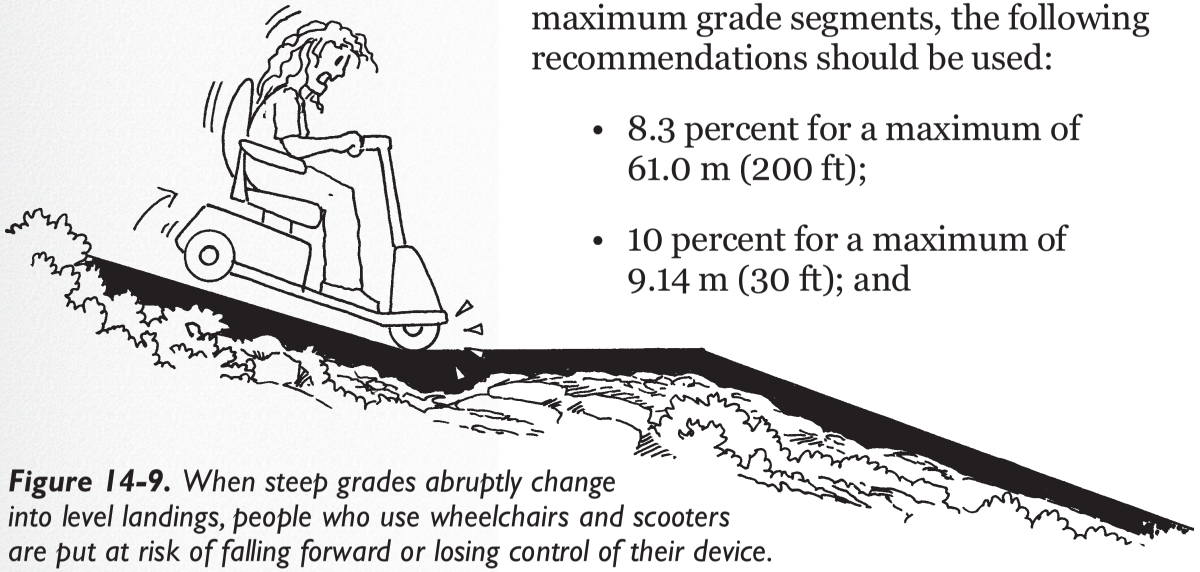

Figure 14-9. *When steep grades abruptly change into level landings, people who use wheelchairs and scooters are put at risk of falling forward or losing control of their device.*

Although the recommended maximum grades are similar to those recommended in the 1999 AASHTO Guide for the Development of Bicycle Facilities, the maximum distances are significantly shorter.

Near the top and bottom of the maximum grade segments, the grade should gradually transition to less than 5 percent. In addition, rest intervals should be provided within 7.6 m (25 ft) of the top and bottom of a maximum grade segment. Rest intervals may be located on the shared-use path but should ideally be located adjacent to the path for the safety of all users (see Section 14.5.2). Well-designed rest intervals should have the following characteristics:

- Grades that do not exceed 5 percent;
- Cross slopes on paved surfaces that do not exceed 2 percent and cross slopes on non-paved surfaces that do not exceed 5 percent;

CHAPTER 14 SHARED USE PATH DESIGN

- A firm and stable surface;
- A width equal to or greater than the width of the path segment leading to and from the rest interval;
- A minimum length of 1.525 m (60 in); and
- A minimum change of grade and cross slope on the segment connecting the rest interval with the shared-use path.

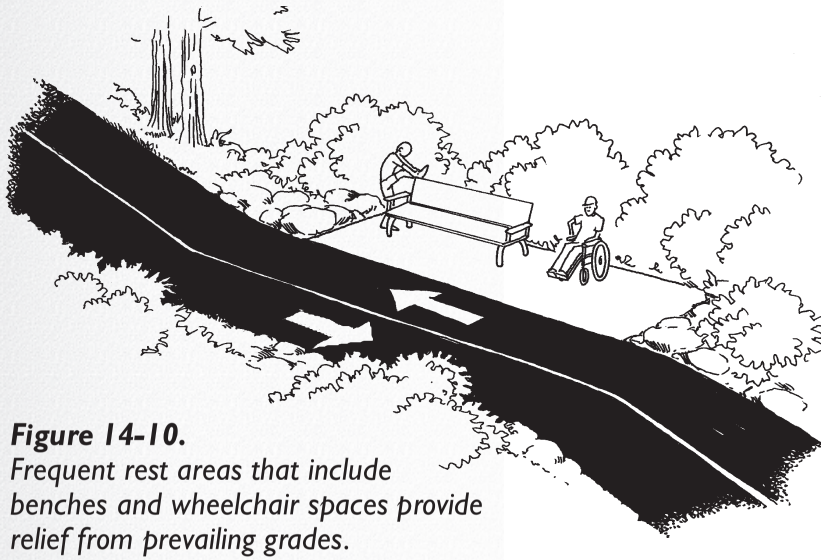

Figure 14-10.
Frequent rest areas that include benches and wheelchair spaces provide relief from prevailing grades.

14.5.2 Rest areas

Periodic rest areas are beneficial for all shared-use path users, particularly for people with mobility impairments that expend more effort to walk than other pedestrians. Rest areas are especially crucial when grade or cross slope demands increase. The frequency of rest areas should vary depending on the terrain and intended use. For example, heavily used shared-use paths should have more frequent opportunities for rest. Rest areas provide an opportunity for users to move off the trail, instead of remaining on the trail to stop and rest. If a rest area is only provided on one side of the trail, it should be on the uphill side. Having separate rest areas on both sides of the trail is preferred when there is a higher volume or higher traffic speed. This reduces trail users from having to cross in front of other trail users moving in the opposite direction.

A rest area will have many of the same characteristics as a rest interval (see Section 15.5.1.3). However the additional space allows for more amenities. In general, rest areas should have the following design characteristics:

- Grades that do not exceed 5 percent;
- Cross slopes on paved surfaces that do not exceed 2 percent and cross slopes on non-paved surfaces that do not exceed 5 percent;

- A firm and stable surface;
- A width equal to or greater than the width of the trail segment leading to and from the rest area;
- A minimum length of 1.525 m (60 in);
- A minimal change of grade and cross slope on the segment connecting the rest area with the main pathway; and
- Accessible designs for amenities such as benches, where provided.

Benches can be particularly important for people with disabilities, who may have difficulty getting up from a seated position on the ground. Some benches should have backrests to provide support when resting, and at least one armrest to provide support as the user resumes a standing position. Accessible seating should provide the same benefits as seating for users without disabilities. For example, providing a wheelchair space facing away from the intended view would not be appropriate.

14.5.3 Cross slope and drainage

Severe cross slopes can make it difficult for wheelchair users and other pedestrians to maintain their lateral balance because they must work against the force of gravity. Cross slopes can cause wheelchairs to veer downhill and create problems for individuals using crutches who cannot compensate for the height differential that cross slopes create. The impacts of cross slopes are compounded when combined with steep grades or surfaces that are not firm and stable.

Cross slope can be a barrier to people with mobility impairments. However, some cross slope is necessary to drain water quickly off of shared-use paths. Designers must balance the negative effect cross slopes have on pedestrian mobility against the necessity of including cross slopes to provide adequate drainage. Designers should use the minimum cross slope necessary for the shared-use path. For asphalt and concrete, a cross slope of 2.0 percent should be adequate. For non-paved surfaces, such as crushed

CHAPTER 14 SHARED USE PATH DESIGN

aggregate, the maximum recommended cross slope is 5 percent.

14.6 Shared-use path width

The width of the shared-use path tread not only affects pedestrian usability but also determines the types of users who can use the path. Factors, such as the movement patterns of designated user groups, should be considered. For example, skaters may use a lateral foot motion for propulsion that is wider than the stride of most pedestrians. In addition, shared-use paths should be designed to accommodate high-speed users in both directions.

The tread of a shared-use path should be at least 3.05 m (10 ft) wide. A minimum of 2.44 m (8 ft) may be used on shared-use paths that will have limited use. Shared-use paths should also have graded areas at least 610 mm (2 ft) on either side of the path. On shared-use paths with heavy volumes of users, tread width should be increased to a range from 3.66 m to 4.27 m (12 ft to 14 ft).

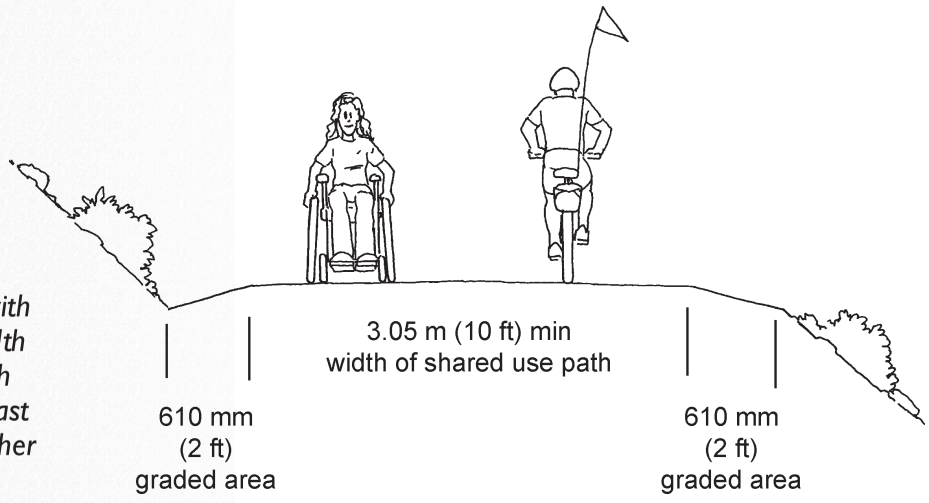

Figure 14-11.
Shared-use paths should be designed with a minimum tread width of 3.05 m (10 ft) with graded areas of at least 610 mm (2 ft) on either side of the path.

14.6.1 Passing space

Generally, passing spaces are not necessary on shared-use paths because the width of the shared-use path exceeds the recommended dimensions that require a passing space. If a shared-use path is narrow, periodic passing spaces of at least 1.525 m x 1.525 m (60 in x 60 in) should be provided.

14.6.2 Protruding objects

Protruding objects are anything that overhangs or protrudes into the

14 Shared Use Path Design

CHAPTER

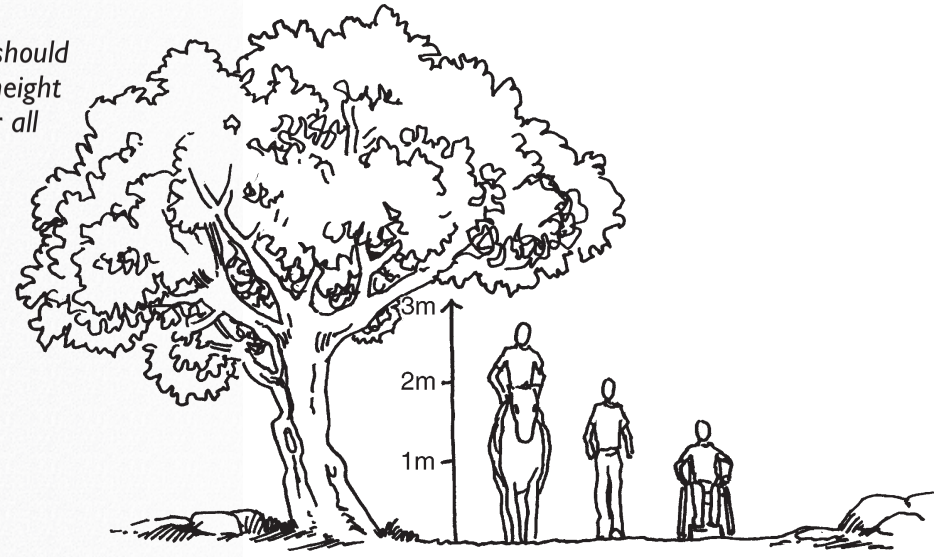

Figure 14-12.
Overhead branches should be maintained to a height which is sufficient for all expected users of a shared-use path.

shared-use path tread whether or not the object touches the surface. Examples of protruding objects include lighting posts, poorly maintained vegetation, and signs.

People with vision impairments who use guide dogs for navigation are able to avoid obstacles in the pathway up to 2.030 m (80 in). Objects that protrude into a shared-use path but are higher than 2.030 m (80 in) tend to go unnoticed because most pedestrians require less than 2.030 m (80 in) of headroom. People with vision impairments who use long white canes to navigate can easily detect objects on the shared-use path that are below 685 mm (27 in). However, objects that protrude into the pathway between 685 mm (27 in) and 2.030 m (80 in) are more difficult because the cane will not always come in contact with the object before the pedestrian comes in contact with the object.

Ideally, objects should not protrude into any portion of the clear tread width of a shared-use path. If an object must protrude into the travel space, it should not extend more than 101 mm (4 in). Furthermore, a vertical clearance of 2.44 (8 ft) should be provided rather than the 2.030 m (80 in) needed for pedestrians, to accommodate other shared-use path users, such as bicyclists. On shared-use paths where there is the potential for emergency or maintenance vehicles to gain access to areas, it may be necessary to increase the vertical clearance. In addition, when an underpass such as a tunnel is used, 3.05 m (10 ft) of vertical clearance is recommended (Section 16.4).

CHAPTER 14 SHARED USE PATH DESIGN

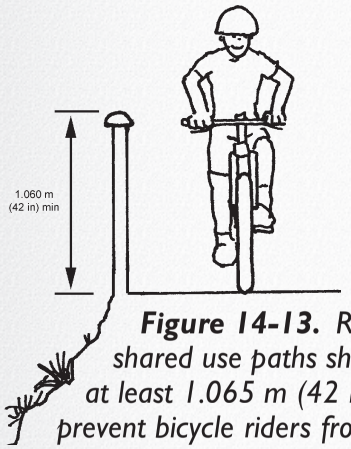

Figure 14-13. *Railings on shared use paths should be at least 1.065 m (42 in) high to prevent bicycle riders from flipping over the top. AVOID protrusions at handlebar height.*

14.7 Railings

Low forms of edge protection, such as curbs, are not recommended on shared-use paths because of the negative impact they have on bicyclists. If edge protection is needed, it should take the form of a railing. The minimum railing height on a shared-use path should be 1.065 m (42 in). In some situations, it may also be beneficial to provide a gripping surface for pedestrian use in addition to the protective railing. If a handrail is included as part of the railing design, it should meet the specifications in ADAAG 4.26.

Figure 14-14.
Signs that provide objective information about shared-use paths using simplified text and graphics benefit all users.

14.8 Signs

Signs that clearly describe the shared-use path conditions are an essential component to enhance pedestrian access. Signs should be provided in an easy to understand format with limited text and graphics that are understood by all users. Providing accurate, objective information about actual shared-use path conditions will allow people to assess their own interests, experience, and skills in order to determine whether a particular shared-use path is appropriate or provides access to them with their assistive devices. Providing information about the condition of the shared-use path to users is strongly recommended for the following reasons:

- Users are less likely to find themselves in unsafe situations if they understand the demands of the shared-use path before beginning;

- Frustration is reduced and people are less likely to have to turn around on a shared-use path because they can identify impassible situations, such as steep grades, before they begin;

- Users can select shared-use paths that meet their skill level and desired experience;

- The level of satisfaction increases because the user is able to select a shared-use path that meets his or her expectations; and

- If more difficult conditions will be encountered, users can prepare for the skill level and equipment required.

Objective information about the shared-use path conditions (e.g., grade, cross slope, surface, width, obstacles) is preferable to subjective difficulty ratings (e.g., easier, most difficult). Because subjective ratings of difficulty typically represent the perceptions of the person making the assessment, the ratings cannot be accurate or appropriate for the range of shared-use path users. Individuals with respiratory or heart conditions, as well as individuals with mobility impairments, are more likely to have different interpretations of shared-use path difficulty than other users.

A variety of information formats may be used to convey objective shared-use path information. The type of format should conform to the policy of the management agency. Written information should also be provided in alternative formats, such as Braille, large print, or an audible format. For example, the text of a shared-use trailhead sign can also be made available on audiocassette or using a digital voice recorder. In addition, simplified text and reliance on universal graphic symbols will provide information to individuals with limited reading abilities.

The type and extent of the information provided will vary depending on the shared-use path, environmental conditions, and expected users. It is recommended

that the following information be objectively measured and conveyed to the user through appropriate information formats:

- Shared-use path name;
- Permitted users;
- Path length;
- Change in elevation over the total length and maximum elevation obtained;
- Average running grade and maximum grades that will be encountered;
- Average and maximum cross slopes;
- Average tread width and minimum clear width;
- Type of surface; and
- Firmness, stability, and slip resistance of surface.