

Chapter

13

PEDESTRIAN

AND

BICYCLE

GENERAL

The purpose of this chapter is to provide guidance for bicycle and pedestrian facilities on State Highways. Other chapters address the design of intersections, interchanges, urban design, and public transportation and provide additional and/or similar information on bicycle and pedestrian design considerations. A thorough guide for bicycle and pedestrian design is contained in [Appendix L](#) the Oregon Bicycle and Pedestrian Design Guide. This chapter summarizes which parts of [Appendix L](#) apply to ODOT highways, since [Appendix L](#) also contains design guidance that may only apply to city and county roads.

The design standards in this chapter reflect ODOT's commitment to the US Department of Transportation policy statement, issued on March 11, 2010, recommending that states accommodate bicyclists and pedestrians while accommodating motorized vehicles. See discussion in [Section 2.3](#) for Accommodation and Design for Pedestrians and Bicyclists.

PRACTICAL DESIGN

ODOT adopted a policy of context sensitive design to establish project scopes that meet specific needs that may omit unrelated improvements in order to systematically prioritize improvements that optimize the transportation system. Practical Design also has application where ideal conditions do not exist, thus permitting non-standard roadway sections that meet the intent of the design to the maximum extent feasible, often through a design exception

For example, the scope of a project on a 45 mph state highway on the urban fringe includes construction of sidewalk where none existed. The standard is a 6-foot sidewalk behind a 4-foot buffer, but only 9 of the required 10 feet of right-of-way are available. A practical design approach would be to construct the 6-foot sidewalk with a 3-foot non-landscaped buffer strip, which is better than a curbside sidewalk, but less than the 4-foot landscaped buffer standard. See [Section 1.2](#) for more information on Practical Design.

13.1 ON-ROAD BIKEWAYS

Bicycles are accommodated in two ways. They can be accommodated within the curb-to-curb section of roadway with motor vehicles, or they can be accommodated on a separated path, behind the curb or edge of pavement. Typically, bikes are accommodated on each side of the roadway rather than together on a separated path. Two-way shared use paths are a preferred bicycle facility for limited access expressways or urban freeways and are discouraged in other areas. Separated paths are discussed in [Section 13.7](#). Separated paths also include raised bike lanes, cycle tracks, shared use paths and multi-use trails.

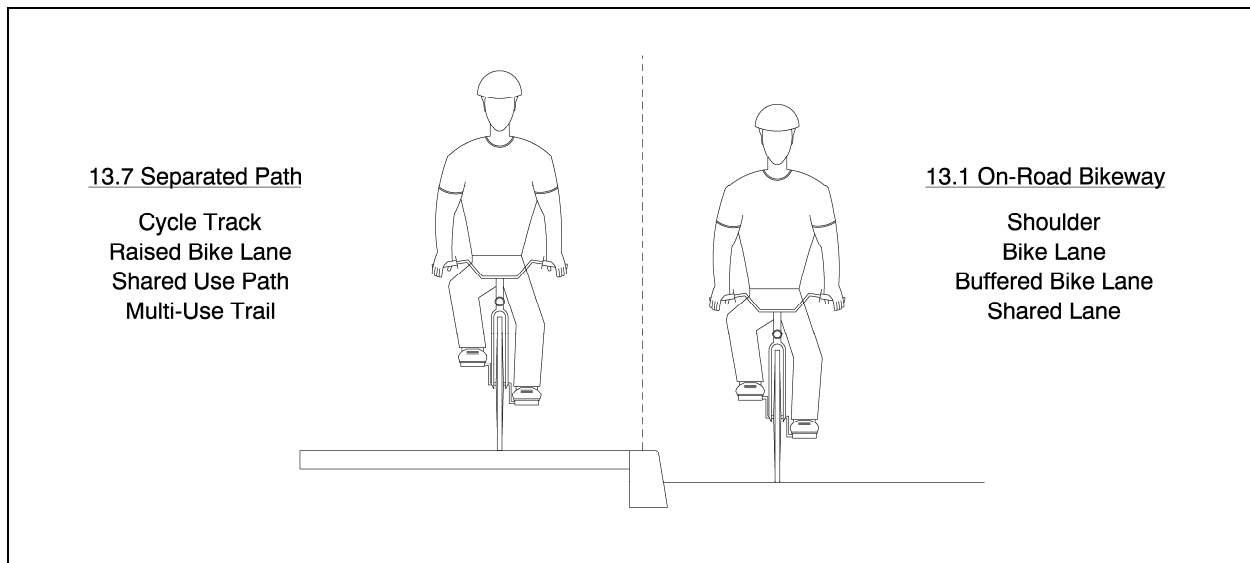


Figure 13-1: On-Road Bikeway Definition

See Oregon Bicycle and Pedestrian Design Guide for design discussion regarding pavement surfacing, ([Appendix L](#) page 1-16) and railroad crossings ([Appendix L](#), pages 1-17 to 1-18).

13.1.1 RURAL BICYCLE ACCOMMODATION

In the majority of rural highway projects, the paved shoulder widths recommended in [Chapters 5](#) and [7](#) are sufficient to accommodate bicycle travel. The occasional pedestrian using a rural highway is also served by paved shoulders.

13.1.1.1 SHOULDERS

Shoulders provide for safety, capacity and maintenance area along highways. Standard shoulder widths in 4-R projects are listed in [Table 13-1](#) and minimum shoulder widths in 3-R projects are listed in [Table 13-2](#)

13.1.1.2 DESIGNATED BIKEWAYS

Rural (or urban) highways designated as Scenic Bikeways, National Bike Routes or other recognized bikeways should have greater attention to bicycle accommodation. Rumble strips are usually omitted along sections of highway that are designated bikeways, but may be included where their impact on cyclists is sufficiently mitigated. Shoulder width is a significant consideration. See [Traffic Manual](#), section 6.27. Ongoing maintenance to keep shoulders clear should be a priority on these routes. Construction activity on shoulders of designated bikeways should make provisions to accommodate cyclists during construction or consider signed detours that may be different from motor vehicle detour routes. A list of milepoints, corresponding to currently designated bikeways can be found in [Appendix E](#).

13.1.2 URBAN BICYCLE ACCOMMODATION

The greatest need for bicycling facilities is on urban highways. The following section describes types of bicycle facilities. [Table 13-1](#) compares the required minimum 4-R shoulder width with a list of possible bicycle facility types for each type of highway segment designation. The proper bicycle facility is context dependent. Factors for consideration are given in the Urban/Suburban Recommended Separation Matrix in [Appendix L](#), pages 1-2 to 1-5.

13.1.2.1 SHOULDERS AND BIKE LANES

Shoulders are usually striped as bike lanes in urban areas; this designates the shoulder as an area for preferential travel by bicyclists. Low potential bicycle use is not a reason to not provide a shoulder bikeway. The decision to designate shoulders as bike lanes is made by the Region Traffic Manager/Engineer and should be based on anticipated bike use, local transportation plans and/or bicycle plans, posted speed, inventory data of bikeway need and other factors. See [Appendix F](#) for instructions on how to access roadside inventory bikeway need data through the FACS-STIP tools.

A bike lane is normally located immediately adjacent to a motor vehicle through travel lane. The standard width for bike lanes is 6 feet. In constrained areas, narrower lanes may be acceptable through a design exception. The minimum width is 4 feet on open shoulder. An additional foot is required when in-between lanes of traffic or for each side that is next to curb, guardrail or parking. A gutter pan may be included as part of the bike lane if there is 4 feet of pavement beyond the longitudinal joint in the gutter pan.

Bike lanes may also be wider than the standard 6 feet in areas of very high use or on high-speed facilities. However, a wider lane could be mistaken for a motor vehicle lane or parking area. Additional roadway width can indicate bicycle use by marking a painted buffer.

Bike lanes on one-way streets are typically only in the direction of motor vehicle traffic. In areas of high bicycle demand, the left shoulder may be marked as a contra-flow bicycle lane when approved by the Region Traffic Manager/Engineer.

A bike lane may separate from motor vehicle lanes onto a separate alignment to bypass obstacles such as merging lanes, transit stops, a parking lane or the circulatory roadway of a roundabout, but rejoin beyond the obstacles as an on-road bike lane. Bike lanes may also be separated from the roadway as speed, volume and heavy vehicle percentages increase, in order to partially mitigate the speed differential between modes. Cycle Tracks, Raised Bike Lanes and Shared Use Paths are discussed in [Section 13.7](#)

A bike lane that is not located immediately adjacent to a motor vehicle travel lane, but remains within the paved travel way is a buffered bike lane. 4-feet is the width recommended to buffer a bike lane. A buffered bike lane can be as narrow as 8 feet. The painted buffer can separate bikes from high-speed vehicles to the left, or it can be used to separate bikes from parked cars.

13.1.2.2 SHARED LANE

When the posted speed of a highway is 25 mph or less, such as STAs or traditional downtown areas, bike lanes are not required. Bicyclists can ride in the travel lane with motor vehicles. The painted stripe can be omitted from the required minimum shoulder width to result in a shared lane, wider than a typical travel lane. However, not all bicyclists are comfortable in traffic, especially children. Consider improved bicycle accommodation where riding is prohibited on sidewalks.

Narrow bridges, tunnels, and other locations that reduce the width of a highway require bicyclists to ride in the travel lane with motor vehicles. Often, these conditions occur on high-speed roads. Full width shoulders should be provided. However, when structural widening is beyond the scope of a project, high speed shared lanes can be treated with traffic control such as advance signing and active warning beacons. See sections 5.2.2.2 and 6.2 in the [ODOT Traffic Manual](#).

Table 13-1: 4R Shoulder Widths and Bicycle Accommodations

Highway Characteristics		Shoulder Min. Width	Bike Facility	
			Accommodation	Std. Width
Urban	Special Transportation Area (STA) or traditional downtown	5'	Bike Lanes	6'
			Buffered Bike Lanes (buffered from parking)	8'
			Shared travel lane (25 mph)	Included in travel lane width
	UBAs, commercial centers & other developed areas	6'	Bike Lanes	6'
			Parallel streets *	NA
	Urban Fringe: 35-45 mph	6'	Bike Lanes	6'
	Urban Fringe: 50-55 mph or Expressway: 45 mph	8'	Shoulder	8'
			Cycle Track	6' **
			Buffered Bike Lanes (buffered from vehicles)	8'
			Raised bike lane	7'
	Expressway: 50-55 mph	8'	Separated Path	10' **
			Shoulder	8'
Separated path			10' **	
Freeway	10'	Parallel streets *	NA	
		Shoulder	10'	
		Separated path	10'	
Rural	Collector <400 ADT	2'	Shoulder	Same as shoulder width
	Arterial <400 ADT	4'		
	Collector 400 -1500 ADT	5'		
	Arterial 400-1500 ADT	6'		
	1500-2000 ADT	6'		
	>2000 ADT	8'		
	Mountainous 4-lane Expressway	8'		
	Other expressways	10'		

* Follow criteria for "Alternatives to Bike Lanes on Main Thoroughfares: Guidelines for Providing Bikeways on Parallel Routes" in [Appendix L](#), page 1-15.

** Standard widths for separated paths and cycle tracks do not include the buffer width.

13.1.2.3 PARALLEL STREETS

Bicyclists should not be precluded from the state highway or signed onto other local routes because of constraints. However, in some locations, bike lanes do not function well and bicyclists may prefer to travel on alternate routes. Bike lanes are not recommended on roads with travel speeds greater than 45 mph. On an expressway, if a well-connected parallel on-street bike network is available, the highway shoulder is sufficient to accommodate the occasional cyclist, without requiring a separated bicycle facility. See explanation in [section 6.2.1.3](#). Developed locations, such as UBAs and Commercial Centers often feature frequent business driveway access. Under these conditions, crash risk increases as bike lanes are interrupted and blocked by traffic. A shoulder is still required to facilitate bicyclists to access businesses. A well-connected parallel on-street bike network can serve the bicycle trips if access to the highway is provided. See Chapter 1 of [Appendix L](#) for guidelines on local street bike routes such as bicycle boulevards.

Table 13-2: 3R Shoulder Widths
(Based on AASHTO Minimums)

Average Running Speed	Design Year Volume (ADT)		
	<750	750-2000	>2000
50 mph or over	2'	3'	4'
Under 50 mph		2'	

13.1.3 DESIGN EXCEPTIONS

Design Exceptions are required for shoulder widths less than the minimum widths shown in [Table 13-1](#) for 4R projects or [Table 13-2](#) for 3R projects.

13.2 LANE RECONFIGURATIONS

The configuration of travel lanes on a highway may be modified to provide bike lanes within a highway cross-section that did not previously include them. This can be done by reducing the number of travel lanes, eliminating on-street parking or changing the median treatment. Reconfigured roadways from 4-lanes to 3-lanes with center turn lane and bike lanes show a significant crash reduction. Any reconfiguration of travel lanes requires Region Traffic Engineer/Manager approval and a freight mobility review as described in [Appendix C](#). See Chapter 2 of [Appendix L](#) for specific examples of road lane reconfigurations.

13.3 BICYCLE PARKING

Bicycle parking within the public right-of-way is often desirable in STA and traditional downtown areas. Many bicyclists use a series of transportation modes. Consider installation of bicycle parking at park and ride lots and transit stops. For bicycle parking design criteria, see Chapter 3 of [Appendix L](#).

13.4 WALKWAYS

13.4.1 PEDESTRIAN ACCOMMODATION

The greatest need for pedestrian accommodation is along urban highways. Paved shoulders serve pedestrians using rural highways. Sidewalks separated with a buffer are the preferred facility for pedestrians. Provide sidewalks on all urban highways within city limits with the possible exception of limited access expressways. Sidewalks will most likely also be needed on highways beyond city limits, within the urban growth boundary, or in unincorporated areas, based on existing and planned land use. Sidewalk need can also be determined through roadside inventory data and from local planning documents. See [Appendix F](#) for instructions on how to access roadside inventory sidewalk need data through the FACS-STIP tools. Provide pedestrian heads, push-buttons and crosswalks at signalized intersections, even in the absence of sidewalks. Transit operations may require consideration of additional improvements at specific locations.

13.4.2 AMERICANS WITH DISABILITIES ACT (ADA)

ADA is a federal Civil Rights law that mandates both the private and public sectors to make their facilities accessible. For ODOT, that means that sidewalks and connections to private properties must be built so people with limited mobility and sight can easily use them. Consult the most current [ADA Standards for Accessible Design](#) and [Public Right-Of-Way Accessibility Guidelines](#) in addition to the information provided in this chapter. Additional guidance on ADA width, grade and cross-slope is in [Appendix L](#), pages 4-13 through 4-16.

The US Access Board recommends two curb ramps per corner at intersections for new construction, as one oblique ramp may direct users into the travel way. Curb ramps constructed as part of preservation, 3R or sidewalk infill projects are considered retrofits, not new construction. Maintain a 4 foot wide passage with a cross slope of 2% behind curb ramps. See Standard Drawings [RD700-series](#) for detailed curb ramp construction drawings.

Design pedestrian facilities so people with impaired vision can track their way safely along the sidewalk, across approaches and through intersections. Keeping the sidewalk clear of obstructions is important. The most critical areas for the vision impaired are locations where street crossing points may not be readily apparent to motorists, for example at a corner with a large radius. Complex intersections with many turn lanes, skewed angles and slip lanes with free-flowing traffic are particularly confusing to the blind. Additional techniques that can help reduce confusion:

1. Keep the radius as tight as possible and place the crosswalks in areas where they are expected: in line with the approach sidewalks. See [sections 2.4](#) and [8.3.8](#) for discussion

of intersection radii; and

2. Provide a clear and straight path through raised islands, pointed straight at the crosswalks;
3. Provide detectable warning surface (truncated domes) on sidewalks in advance of at-grade rail crossings, placed 12' 8" from the nearest railroad track for freight rail or 6' for light rail;

13.4.3 SIDEWALK DIMENSIONS

The standard width for sidewalks is 6 feet; local agency requirements may be greater. If local requirements are less, the 6-foot standard remains the requirement on state highway system or on bicycle and pedestrian single-function projects. Sidewalk widths are exclusive of curb. The minimum clear width of a pedestrian access route within a sidewalk is 4 feet. In very constrained areas, such as around obstacles that cannot be moved, a minimum passage of 4 feet must be maintained for a maximum length of 200 feet. The pedestrian access route shall be level (maximum 2% cross slope), have a smooth surface and be clear of utility poles, signs, signal poles, trees and other obstructions. The balance of the sidewalk width can be used to make up grade differences if necessary. The minimum sidewalk width, through a design exception is 5 feet. This width should only be considered in constrained areas with low anticipated pedestrian use. Several conditions require greater widths:

1. In the absence of a buffer, the width of a curbside sidewalk shall be 8 feet in locations, where: design speed is 45 mph and above or where signs, mailboxes, or other appurtenances become numerous;
2. The standard width for sidewalks in Central Business Districts (CBDs), STAs and traditional downtowns is 10 feet, where buildings are located at the back of the sidewalk. The preferred sidewalk width in high use business areas is 14-16 feet.
3. Curbside sidewalks on bridges shall be at least 7 feet wide, to account for a shy distance from the bridge rail. In no case shall the bridge sidewalk width be less than the approach sidewalk width.
4. Where a sidewalk is separated from traffic with a barrier at the curb line, sidewalk shall be at least 7 feet wide.

13.4.3.1 BUFFER STRIPS

All sidewalks should be designed so that a buffer distance separates the sidewalk from traffic, unless right of way or other constraints preclude this feature. Buffers may include a planted buffer strip, a shoulder barrier, a parking lane or a bike lane.

A buffer strip should be at least 4 feet wide to include landscaping with plantings. Planted buffers are not recommended in downtown areas with on-street parking; the sidewalk should be widened to create a buffer zone for street furniture and other amenities out of the walking

path. The buffer zone can also be called the furniture zone. Benefits of the furniture zone for pedestrians and other road users are discussed in [Appendix L](#), pages 4-2 to 4-3. Where constraints preclude the use of a buffer throughout a project, it can be interrupted and then resumed where the constraint ends.

Trees, street furniture and other objects should not reduce visibility of pedestrians, bicyclists and signs, especially at intersections. Plants should be selected that require little maintenance and watering; their roots should not buckle sidewalks.

Table 13-3: 4R Sidewalk Widths

Highway Characteristic		Standard Sidewalk	Buffer
Urban	Special Transportation Area (STA), Central Business District (CBD) or traditional downtown	10'	Paved furniture zone included
		8'	4'-6' buffer strip
	Urban Business Area (UBA), commercial centers & other developed areas	6'	Curbside*
			4'-8' buffer strip
	Urban Fringe: 35-45 mph	8'	Curbside
		6'	4'-8' buffer strip
	Urban Fringe: 50-55 mph	6'	4'-8' buffer strip
	Expressway: 45 mph	8'	Curbside*
		6'	8' buffer strip
	Expressway: 50-55 mph	6'	8' buffer strip
Bridge Sidewalk	7'	NA	
Sidewalk separated by traffic barrier	7'	Traffic Barrier	

* If signs, mailboxes, or other appurtenances in the sidewalk become numerous, the sidewalk should be widened to 8'.

** Curbside sidewalks should be avoided on expressways.

13.4.4 SURFACING

Concrete is the preferred material for sidewalks. It provides a smooth, durable finish that is easy to grade and repair. Bricks and pavers are not recommended as the primary walking surface. They can be used within the furniture zone to provide an aesthetically pleasing affect if they are laid with a great degree of smoothness (no beveled edges), the surface is slip-resistant when wet; and long-term maintenance costs are recognized.

An alternative to pavers is stamped and dyed concrete. This alternative provides much of the aesthetic value of bricks with the durability and smooth surface of concrete. Do not use stamped concrete patterns that create rough surfaces.

13.4.5 GRADE

ADA requires that constant grades be kept to 5% or below; short sections may be built up to 8.3% if a level landing is provided for every 2.5 feet in rise. However, for most practical applications, sidewalks parallel to the road are built to the grade of the land, so an exception is not required if a street is steeper than 5%. The requirement to keep grades below 5% (or 8.3% for up to a 2.5 feet rise) applies primarily to man-made features such as curb cuts, ramps to buildings, the dip created by driveways, etc.

13.4.6 CROSS-SLOPE

The maximum allowable cross-slope for a walkway is 2%. For discussion purposes, 2% is considered "level." It is critical to maintain a 4 foot wide minimum level passage across driveways, curb ramps and road approaches (in crosswalks, marked or unmarked). The following techniques can be used to maintain a level area at driveways and prevent exaggerated warp and cross-slopes:

1. Reduce the number of accesses, thereby reducing the need for alterations at every driveway;
2. Separate the sidewalks from the curb with a buffer; this allows the sidewalk to remain level, with the driveway grade change occurring in the planting strip;
3. Where constraints don't allow a planting strip, meandering the sidewalk to the rear of the driveway entrance has a similar effect;
4. Dip the entire sidewalk to keep the cross-slope at a constant grade on curbside sidewalks.

In downtowns, sidewalk grades are influenced by the elevation of building entrances. A level (2% cross-slope) area should be provided in the middle of the sidewalk; any warpage should be handled within the area adjacent to the buildings, or within the outer edge, where signs and trees are most likely to be placed. See Standard Drawings [RD700-series](#) for detailed driveway construction drawings.

The cross slope in crosswalks is permitted to equal the grade of the highway at intersection legs that are not controlled by yield or stop control. Highway cross-streets, controlled by yield or stop control shall have a 2% maximum cross slope within the crosswalk. The counter slope of the highway or gutter at the foot of a curb ramp shall be 5%, maximum.

13.4.7 HANDRAIL

There are two categories of handrail that can be used along sidewalks: bridge rail in the Standard Drawing [BR200-series](#), and open handrail in [RD770](#).

13.4.7.1 BRIDGE RAIL

Provide handrail on all bridge sidewalks. Use an appropriate bridge railing from the Standard Drawing [BR200-series](#) for bridges and at any time that there is a vertical drop greater than 5 feet. Bridge handrail should be considered when the vertical drop is between 3 feet and 5 feet.

Three conditions are shown in [Figure 13-1](#). Use handrail without barrier on bicycle and pedestrian-only bridges. If there is a vertical drop greater than 5 feet and there is vehicle use, include a traffic barrier as shown in the two sketches on the right. Higher speed roadways may have a concrete barrier between the sidewalk and motor vehicle lanes. The subsequent handrail beyond the sidewalk does not need a second barrier. If there is no only barrier between motor vehicles and the drop off, the pedestrian rail shall incorporate the traffic barrier function. When a traffic barrier is between the sidewalk and the roadway, as shown in condition B, use a barrier end-treatment that allows for continuous pedestrian travel.

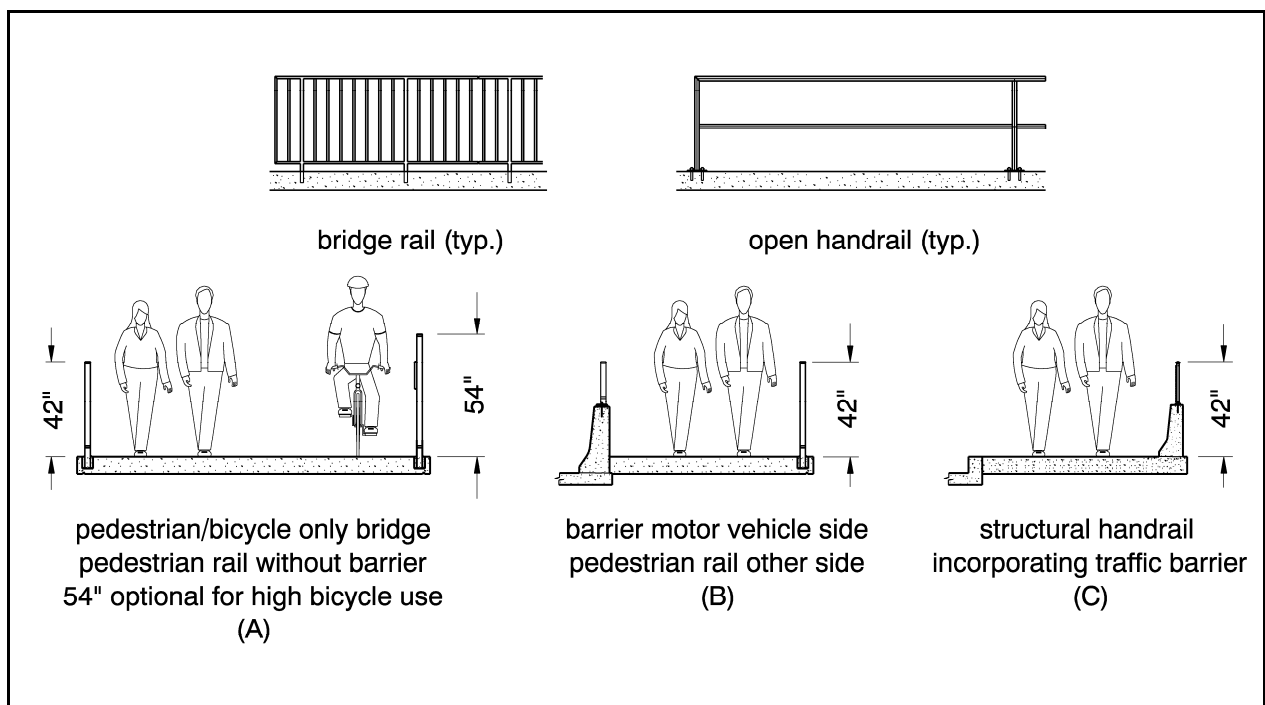


Figure 13-2: Handrail at Bridges and Vertical Drops greater than 5'

13.4.7.2 OPEN HANDRAIL

Handrail may be required at locations other than bridges, including ramps and back-of-walk locations. [RD770](#) handrail is sufficient for these conditions.

ADA requires that ramps with a rise greater than 6 inches include handrail.

The need for a rail at the back of the sidewalk depends on the combination of several factors. No one factor alone can trigger a need, and mitigating for one may remove the need for a rail. Consider the combined effect of the following when determining the need for a rail:

1. **Height:** A vertical drop of 2.5 feet or more would normally require a rail.
2. **Steepness of slope:** A slope steeper than 1:2 would normally require a rail.
3. **Material of slope:** Riprap or other hard and sharp materials may trigger a need for rail.
4. **Shy distance:** A shy distance of 2 feet or greater may be sufficient to mitigate the need for a rail.
5. **Hazard at bottom of slope:** Moving traffic, deep or fast-running water would normally require a rail.
6. **Users:** A preponderance of elderly, disabled or very young pedestrians would benefit from a rail if there is a higher likelihood they would lose their balance if they wandered off the sidewalk.

For example, a sidewalk on a 10 foot high fill, with a 1:1 side-slope made up of rip-rap, at the edge of a deep river, would undoubtedly require hand rail. But a 10 foot high fill, with a grassy side-slope, at the edge of a field, could be mitigated by ensuring there is a 2 foot shy distance beyond the back of walk (see [Figure 13-3](#)).

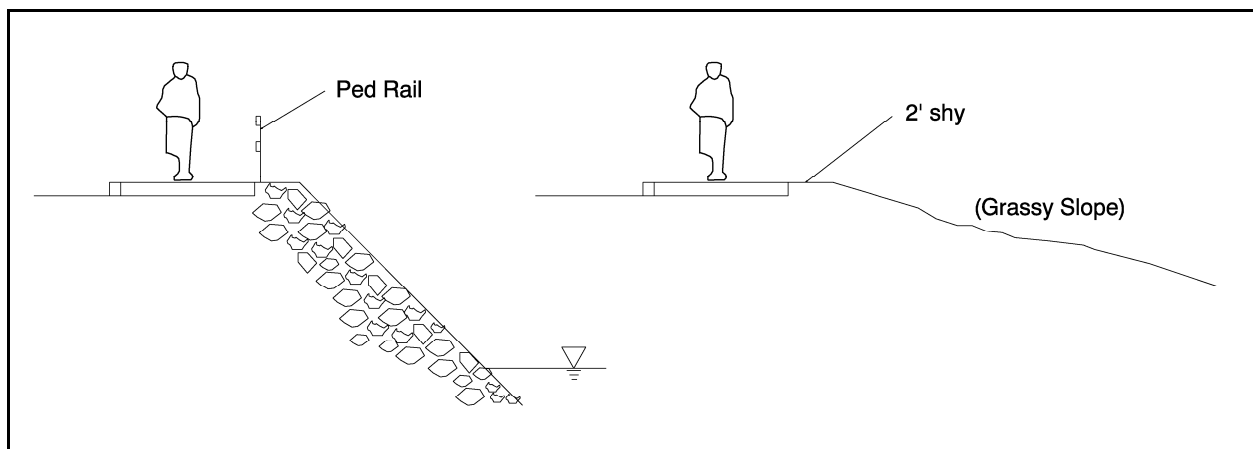


Figure 13-3: Criteria for Pedestrian Rail At Back Of Walk

13.4.7.3 RAIL HEIGHT

Pedestrian rail shall be 42 inches, minimum. When designing for high bicyclist traffic, the handrail height may be 48 to 54 inches. A 12-inch wide rub rail is recommended from 30 inches to 42 inches.

13.4.8 TRANSIT STOPS

Refer to [Chapter 12](#) for details on transit design.

If a highway project is on a transit route, a complete sidewalk system should be provided for the length of the project. If the project ends at a transit stop, sidewalks should continue to the nearest intersection or to the nearest section of existing sidewalk. Sidewalks should wrap around corners to join existing sidewalks on side streets.

ADA requires an 8 foot by 5 foot landing pad at bus entrances and exits. Local requirements may be greater. It is preferable to construct a continuous 8 foot wide sidewalk the length of the bus stop, or at least to the front and rear bus doors. At bus stops in uncurbed areas, the shoulder should be 8 feet wide to provide a landing pad.

A standard-size bus shelter requires a 6 foot by 10 foot pad, with the shelter placed no closer than 4 feet from the curb. Local requirements vary. The adjacent sidewalk should be 6 feet with a 5 foot clear passage. Orientation of the shelter should take into account prevailing winter winds. Bike racks should be considered at bus stops in urban fringe areas.

One of the most critical phases of designing for pedestrians on transit routes is the location of bus stops in relation to street crossing opportunities. Where high motor vehicle traffic volumes warrant a bus pullout at an intersection, a far-side location is preferred. The needs of passengers boarding or exiting a bus should not conflict with the needs of pedestrians and bicyclists moving through the area. The curb at the corner should not be recessed, as this creates the illusion of an acceleration lane for right-turning motorists. Placing a curb extension at the corner in line with the rest of the curb helps pedestrian crossing movements, prevents motorists from entering the bus pullout area and reduces conflicts with through bicyclists. Crossing islands should be considered to aid in pedestrian crossings too. Each stop should be designed to meet roadway conditions and bus characteristics. On streets with parking, near-side bus stops also benefit from curb extensions, so passengers can board or dismount the bus directly without stepping onto the street; this also makes it easier to meet ADA requirements (the bus pulls up right next to the curb). The designer should contact the local transit agency to ensure that appropriate amenities are included in the project.

13.4.9 DESIGN EXCEPTIONS

Design exceptions are required for sidewalks that are less than the values shown in [Table 13-3](#). Buffer distances less than the values shown do not require a design exception. Sidewalks that are less than 5-feet wide or whose running slopes are both steeper than 5% and do not match the grade of the adjacent roadway require an ADA exception. Other ADA standards that are not met also require ADA exceptions. Refer to [section 14.3.4](#) for information about ADA exceptions.

13.5 STREET CROSSINGS

Sidewalks provide mobility along the highway, but full pedestrian accommodation also requires frequent, safe and convenient crossing opportunities. Wide highways carrying large traffic volumes can be barriers to pedestrians, making facilities on the other side difficult to access.

Crossing opportunities are not limited to marked crosswalks and signals; many other design elements can enhance the pedestrian's ability to cross a highway.

Most pedestrian crashes occur when a pedestrian crosses a road, often at locations other than controlled intersections. Mid-block and uncontrolled intersection crossings need to be considered, as people will take the shortest route to their destination. Prohibiting such movements is counter-productive if pedestrians cross the road with no protection. It is better to design highways that enable pedestrians to cross safely.

13.5.1 CROSSING LOCATIONS

Developed, urban state highways should provide a safe and convenient pedestrian crossing no less frequent than every quarter-mile. Crossing improvements should be no closer than 300 feet from the nearest signalized crosswalk. Planning documents may also help identify potential locations for crossings. Note that crossing locations must take into account property access and circulation.

13.5.1.1 RELATED ISSUES

Safe and convenient pedestrian crossings cannot be considered in isolation from the following issues, which should be addressed when seeking solutions to specific problems. Chapter 5 of [Appendix L](#) describes each of the following issues in detail.

1. Volume to Capacity (V/C) and Design Standards ([Appendix L](#), page 5-3)
2. Land Use ([Appendix L](#), page 5-4)
3. Transit Stops ([Appendix L](#), page 5-4)
4. Signal Spacing ([Appendix L](#), page 5-4)
5. Access Management ([Appendix L](#), page 5-5)
6. Out-of-Direction Travel ([Appendix L](#), page 5-6)
7. Midblock versus Intersection Crossings ([Appendix L](#), page 5-6)

8. Maintenance ([Appendix L](#), page 5-7)

13.5.2 CROSSING DESIGN

No one solution is applicable in all situations as the issues will vary on any given section of highway. In most cases, it is best to combine measures to improve pedestrian crossing opportunities and safety. Note that some crossing treatments and curb extensions can trigger freight mobility concerns described in [Appendix C](#).

13.5.2.1 RAISED MEDIANS

Raised medians are a solution in locations where pedestrian crossings are not isolated to a single location and crosswalks are not marked. Raised medians benefit pedestrians on two-way, multi-lane streets, as they allow pedestrians to cross only one direction of uncontrolled traffic at a time. Raised medians should be constructed so they provide a pedestrian refuge by ensuring that they have a smooth level surface. On landscaped medians, plants should be low enough so they do not obstruct visibility, and spaced far enough apart to allow passage by pedestrians. Flat, paved areas can be provided approximately every 50 feet to provide a place to stand and wait (see [Figure 13-4](#)).

13.5.2.2 CROSSING ISLANDS

Where it is not possible to provide a continuous raised median, crossing islands can be created between controlled intersections. These should be located across from high pedestrian generators such as schools, park entrances, senior and disabled residential facilities, libraries, parking lots, etc.

An island can also be provided in the middle of an intersection.

An island must be a minimum of 4 feet wide, preferably more, especially if bicycles are accommodated. See [section 13.5.2.9](#) for bicycle crossing accommodation. Provide truncated domes in the cut-through if the cut-through length is 6-feet or greater. The cut-through area may be angled up to 45 degrees to position pedestrians to face oncoming traffic.

The minimum length of an island is 6-feet. It is preferable to extend 30 feet to the advance stop bar. Islands must be large enough to provide refuge for several pedestrians waiting at once. For wheelchair accessibility, it is preferable to provide at-grade cuts rather than ramps. Poles must be mounted away from curb ramps and out of the pedestrian path.

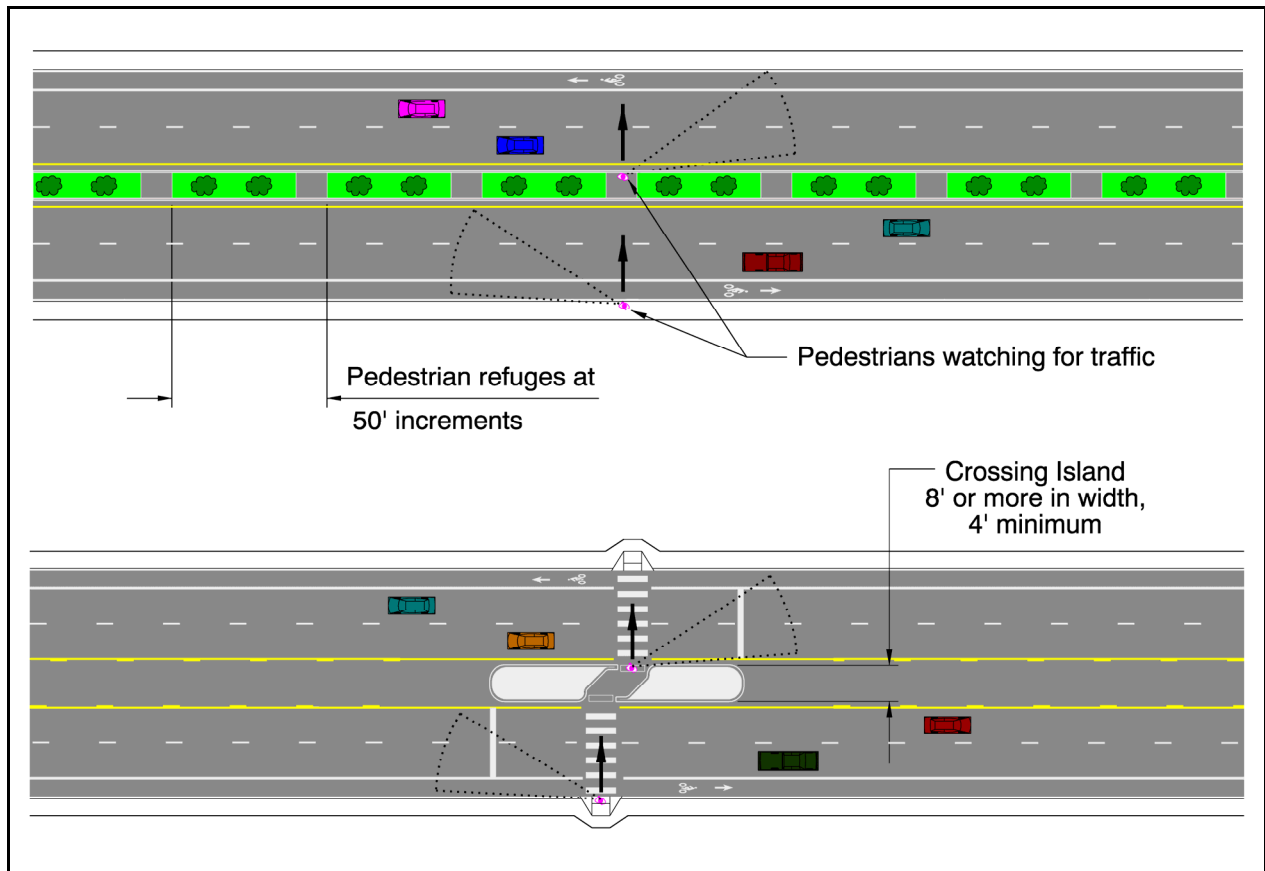


Figure 13-4: Continuous Raised Median versus Cut-Through Crossing Island

13.5.2.3 RIGHT TURN ISLANDS

At wide intersections, there is often a triangular area between the through lanes and right turn lane that is not used by motor vehicle traffic. Placing a raised island in this area benefits pedestrians by:

1. Allowing pedestrians to cross fewer lanes at a time, and to judge conflicts separately;
2. Providing a refuge so that slower pedestrians can wait for a break in the traffic stream;
3. Reducing the crossing distances (which provides signal timing benefits); and
4. Providing an opportunity to place easily accessible pedestrian push-buttons.
5. Simplifying signalization where the right turn lane can be left unsignalized.

13.5.2.4 CURB EXTENSIONS

Curb extensions are used in conjunction with on-street parking. They reduce the pedestrian crossing distance by extending the sidewalk to the edge of the parking lane, thereby improving the visibility of pedestrians for motorists (see [Figure 13-5](#)). They provide a place for pedestrians to congregate while waiting to cross the street. Where parking is not marked, curb extensions help enforce the ORS restriction against parking 20 feet from the crosswalk line.

Curb extensions can improve signal head alignment and stop sign placement. Reducing pedestrian crossing distance improves signal timing if the pedestrian phase controls the minimum green time for the corresponding signal phase. The time saved is substantial when two corners can be treated with curb extensions. Non-signalized intersections also benefit from curb extensions: reducing the time pedestrians are in a crosswalk improves pedestrian safety and vehicle movement.

Mid-block curb extensions may be considered where pedestrians frequently cross between midblock generators on both sides of the road.

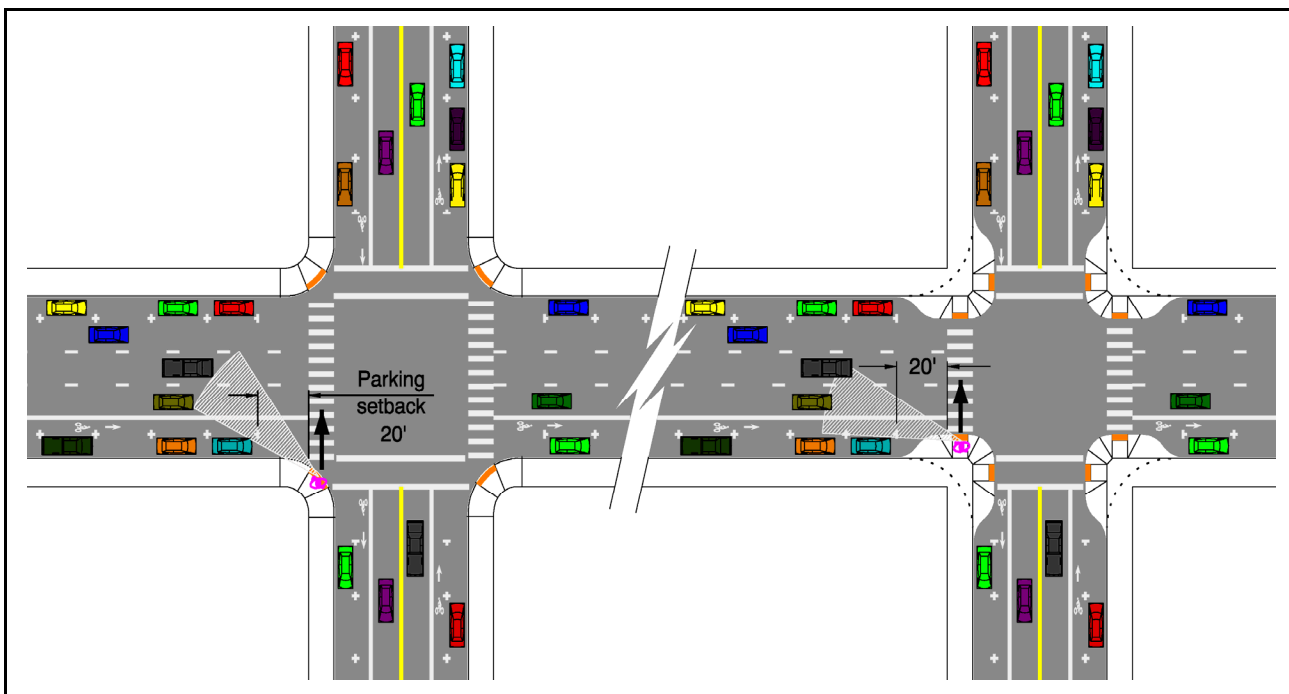


Figure 13-5: Sight Lines with Curb Extensions

13.5.2.5 ILLUMINATION

Providing adequate illumination is essential to increase nighttime safety, especially at mid-block or uncontrolled crossings which are often not expected by motorists. Guidance for

illumination at pedestrian crossings is given in [Appendix L](#), pages 5-12 to 5-13, [ODOT Traffic Manual](#), section 6.6.6., [ODOT Traffic Lighting Design Manual](#), IESNA Lighting Handbook, Tables 2 and 3 and the FHWA report: FHWA-HRT-08-053.

13.5.2.6 CROSSWALKS

All legs of signalized intersections should have a marked crosswalk. Crosswalks may also be considered at other locations. Combined with curb extensions, illumination and signage, marked crosswalks can improve the visibility of pedestrian crossings. Crosswalks send the message to motorists that they are encroaching on a pedestrian area. A traffic study will determine if a marked crosswalk will enhance pedestrian safety. This is usually in locations that are likely to receive high use, based on adjacent land use. Refer to the ODOT crosswalk policy ([ODOT Traffic Manual](#), section 6.6) for further details on marking crosswalks.

Crosswalks should be 10 feet wide, or the width of the approaching sidewalk if it is greater. Consider high visibility crosswalks to increase their effectiveness.

Textured crossings, using non-slip bricks or pavers, are generally not recommended. They give the initial impression that the visibility of the crosswalk is enhanced, but after time they fade and are barely distinguishable from the roadway surface. The inherent roughness also makes them difficult for wheelchair users.

13.5.2.7 PEDESTRIAN ACTIVATED CROSSWALK BEACONS

Crosswalks alone do not reliably warn drivers to stop for pedestrians on high speed or high volume multilane highways. Pedestrian-activated flashing beacons warn drivers that pedestrians are intending to cross. Examples of pedestrian activated crosswalk beacons include Pedestrian Hybrid Beacons, Rectangular Rapid Flashing Beacons and circular amber flashing beacons. Pedestrian activated crosswalk beacons may be combined with curb extensions, raised medians and refuges. Refer to the [ODOT Traffic Manual](#), section 5.2.2.2 for further details.

13.5.2.8 PEDESTRIAN SIGNALS

A pedestrian activated signal may be warranted where a significant number of people are expected to cross a roadway at a particular location. Anticipated use must be high enough for motorists to get used to stopping frequently for a red light (a light that is rarely activated may be ignored when in use). Additionally, sight-distance must be adequate to ensure that motorists will see the light in time to stop. Warning signs should be installed on the approaching roadway.

Refer to the Manual on Uniform Traffic Control Devices (MUTCD) for pedestrian signal warrants. Pedestrian signals may be combined with curb extensions, raised medians and refuges.

13.5.2.9 BICYCLE CROSSINGS

Drivers are required to stop for pedestrians in crosswalks, but are not necessarily required to stop for bicyclists. Bicyclists can use crosswalks to cross the street at pedestrian speed. However, most bicyclists ride within crosswalks. Where bicycles are prevalent, such as bicycle boulevards, crossing islands can be designed to serve bicyclists and pedestrians separately. If the crossing island acts as a diverter to through motor vehicle traffic, include a separate opening in the crossing island 6' to 8' in width, or two openings, each 5' wide. The cut-through area may be angled up to 45 degrees to position bicyclists to face oncoming traffic. The desirable island width is 10 feet or greater to accommodate bicycles with trailers or groups of bicycles. The minimum width to accommodate a single bicycle is 6-feet.

13.5.2.10 SIGNING

Recommended signs include both advance warning signs and pedestrian crossing signs at the crossing itself, and regulatory signs at intersections to reinforce the message that motorists must yield to pedestrians. These signs should only be placed at warranted locations, because excessive signage leads to signs being missed or ignored.

13.5.2.11 SIGHT DISTANCE

One of the greatest factors determining the safety of a pedestrian crossing is visibility. Every effort should be made to remove or relocate objects that could obscure the view of and by pedestrians. These include signs, traffic control boxes, tall vegetation, kiosks, etc. When possible, efforts should also be made to ensure that objects located on private property, such as neon and other illuminated signs, that could be a distraction to drivers are not located close to a crossing point.

13.6 INTERSECTIONS

For a thorough and detailed discussion on intersection design, see [Chapter 8](#). The following discussion will help the designer understand some of the key intersection design features that help enhance the safety and convenience of pedestrians and bicyclists.

Most conflicts between roadway users occur at intersections, where one group of travelers crosses the path of others. Good intersection design clearly identifies right of way between motorists, pedestrians and bicyclists.

At signalized intersections, pedestrian signal heads should be clearly visible - this requires that they not be placed too far from the nearest safe refuge. Crossing islands and curb extensions should be used to decrease crossing distances. Bicycle lanes should not be placed to the right of a right-turn only lane or to the left of a left-turn only lane, unless conflicting movements are controlled by a traffic control signal. Other intersection design principles for pedestrians and bicyclists are discussed in detail in [section 2.3.1](#) and [2.3.2](#) and in [Appendix L](#), pages 6-1 and 6-5.

Conflicts between motor vehicles, pedestrians and bicyclists often occur at interchange areas. Free-flow ramps should be avoided. Where they exist, "Turning Vehicles Yield to Peds" symbol sign may be considered for unprotected pedestrian crossings. Consider grade separation when there is either two-lane right or left turn lanes or where free flow ramps are utilized. Other interchange design principles for pedestrians and bicyclists are discussed in detail in [Appendix L](#), pages 6-20 to 6-25

13.7 SEPARATED PATHS

13.7.1 CONTEXT

Separated paths are facilities for pedestrians and/or bicyclists that are physically separated from the roadway. When the pathway serves both pedestrians and bicyclists together, it is a shared use path. Combinations of the words “shared use” and “multi use,” or “path” and “trail” are used interchangeably. Multi-use trails may include accommodation of additional users, such as equestrians. Separated pathways may be constructed on ODOT facilities in any of the following three contexts:

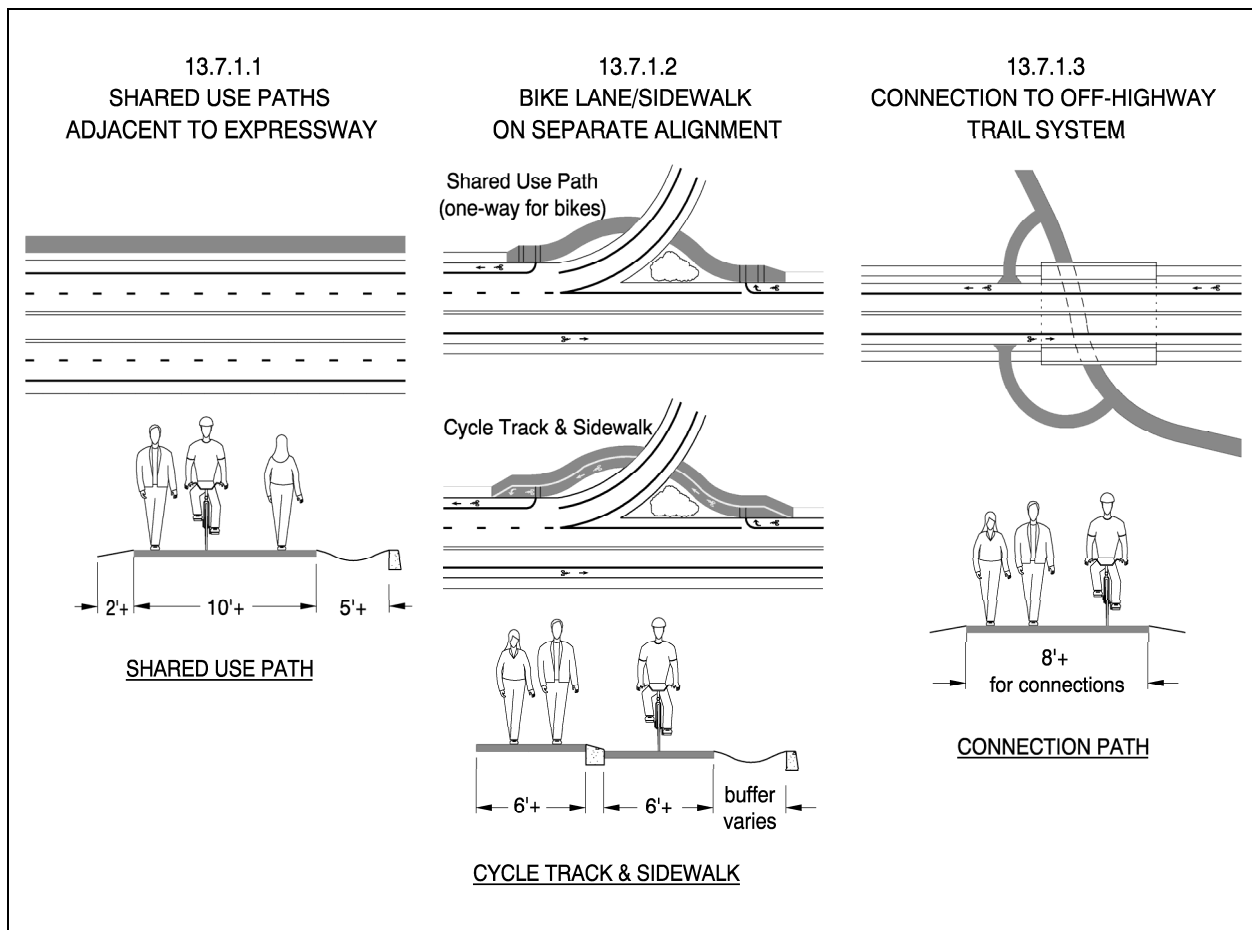


Figure 13-6: Types of Separated Paths

13.7.1.1 SHARED USE PATHS ON EXPRESSWAYS

Combining pedestrians and bicyclists together along one side of a highway on a shared use path, is discouraged on highways without access control, but is a preferred facility option for limited access expressways and urban freeways. Crash potential increases when bicycle traffic rides against the normal flow of motor vehicle traffic on highways with frequent driveway or street access. Since expressways are designed for access-restriction, many of the conflicts are mitigated. A separated bicycle facility may not be needed when a well-connected network of bicycle facilities parallel to the freeway or expressway provides the same access that bicycle accommodation on the expressway would provide. The wide shoulder would then provide bicycle accommodation as necessary. Review [section 6.2.1](#) for design of urban expressways. Guidelines for providing bikeways on parallel routes are given in [Appendix L](#), page 1-15.

13.7.1.2 BIKE LANES ON SEPARATE ALIGNMENT (CYCLE TRACKS)

A bike lane may separate from motor vehicle lanes onto a separate alignment to bypass obstacles such as merging lanes, transit stops, a parking lane or the circulatory roadway of a roundabout, but rejoin as an on-road bikeway. Bike lanes may also be separated from the roadway as speed, volume and heavy vehicle percentages increase, in order to partially mitigate the speed differential between modes. Provide an 8' wide ramp from the bike lane to the path as illustrated in [Appendix L](#), Figure 1-40. Means of path separation include horizontal and/or vertical elements. Buffered bike lanes are located within the paved travel way and are discussed in [section 13.1](#) with on-road bikeways. A cycle track is located beyond the edge of pavement or curb onto a physically separated alignment. When separated, it does not join with a sidewalk. A raised bike lane is a type of cycle track that is immediately adjacent to the roadway and separated by a mountable curb. Cycle Tracks and Raised Bike Lanes are considered one-way separated paths. A bike lane may also diverge from the travel way beyond the edge of pavement and join the sidewalk. It serves bicyclists in one-direction, but it serves pedestrians in both directions. For design purposes, this is considered a two-way separated path.

13.7.1.3 OFF-HIGHWAY TRAIL CONNECTIONS

Many recreational trails cross the state highway system. Users often use these trail systems as transportation links. Highways that cross these pathways should have access to the trail systems. If a highway has a separate-grade crossing with a pathway, provide a short path connection from the pedestrian and bicycle facilities along the highway to the pathway. See [section 13.5](#) for at-grade path crossings. See [Appendix L](#), pages 7-13 through 7-16 for design guidance on under crossings and over crossings.

13.7.2 DESIGN STANDARDS

ODOT has adopted the AASHTO Guide for the Development of Bicycle Facilities for path design standards. Consult also the most current [ADA Standards for Accessible Design](#) and [Public Right-Of-Way Accessibility Guidelines](#). For multiple tread trails that accommodate horses, consult the [Equestrian Design Guidebook for Trails, Trailheads and Campgrounds](#). The AASHTO guide should be consulted for geometric design standards such as sight-distance, and horizontal and vertical curves. Standards applicable to ODOT are summarized in this section. Though shared-use paths are intended for many users, the bicycle is the appropriate design vehicle because of its higher travel speeds. Carefully choose appropriate design speeds for pathway segments. The AASHTO guide contains factors to consider, but does not dictate design speed. Design speeds for shared use paths impact other design elements including sight distance and horizontal and vertical curves. If design curve length or sight distance does not meet the value shown in the AASHTO guide, based on the chosen design speed, consult the ODOT Pedestrian and Bicycle Facility Specialist or Region Bicycle and Pedestrian Coordinator to discuss whether a design exception is needed.

13.7.2.1 TWO-WAY SEPARATED PATHS

10 feet is the standard width for a two-way shared-use path; they should be 12 feet wide or more in areas with high use. 8 feet is the width for connection paths. The minimum width for other two way paths, through a design exception, is 8 feet; only to be used at pinch points or where long-term usage is expected to be low. The minimum total width required for a mode-separated path is 16 feet: two 5-foot bike lanes and a 6-foot walking area. 18 or 20 feet are needed in areas of very high use. At roundabouts, the sidewalks become shared use paths, as they operate one-way for bicyclists and two-way for pedestrians. The sidewalk shared use path width should be widened to 10 feet. Provide an 8' wide curb ramp bicyclists to merge from the bike lane onto the shared use path 165 feet in advance of the yield line to the circulatory roadway of a roundabout. See [section 8.6](#) and [Appendix L](#), Figure 1-40.

13.7.2.2 ONE-WAY SEPARATED PATHS

6 feet is the standard width for a one-way path. Although one-way separated paths may be intended for one direction of bicycle travel, they will often be used as two-way facilities, especially by pedestrians. Caution must be used in selecting this type of facility. If needed, they should be at least 6 feet wide and designed and signed to ensure one-way operation by bicyclists.

Cycle tracks are a type of one-way separated path. They are used extensively in Europe on major arterials and are characterized by a physical separation from both motor vehicle traffic and pedestrian traffic. Both vertical and horizontal elements are used to separate modes. Sidewalk must be present in order for the one-way path to serve bicyclists only. Cycle tracks

require special attention to traffic operations at intersections such as bicycle signals and two-stage left turn devices.

A raised bike lane is a type of one-way separated path and a type of cycle track. It generally does not include a horizontal buffer from the motorized vehicle lanes. The above cycle track guidance applies. Raised bike lanes may be curbed on both sides. The curb adjacent to traffic is generally 2-6 inches in height. A buffer distance of 1-foot is required for each side of the bike lane adjacent to a curb. The minimum width for a raised bike lane is 7 feet, including curb and striping. Greater width may be required for mountable curb. Additional guidance on raised bike lanes is given on page 1-30 in [Appendix L](#).

13.7.2.3 CLEARANCE AND GRADE

A 2 foot shy distance on both sides of a shared-use path is required for safe operation. It is desirable to have 3 feet or more. Shy distance less than 2 feet may be acceptable through a design exception. This area should be graded level, flush to the path and free of obstructions to allow recovery by errant bicyclists. This applies to cut-sections, where falling debris can accumulate, stimulating weed growth, further restricting the available width.

The standard clearance to overhead obstructions is 10 feet, min. 8 feet where fixed objects or natural terrain prohibit the full 10-ft clearance.

Where a path is parallel and adjacent to a roadway, there should be a 5-foot or greater width separating the path from the edge of roadway, or a physical barrier of sufficient height should be installed.

To meet ADA requirements, the grade of separated shared use pathways shall not exceed 5%, and the standard cross-slope grade is 2%, to provide drainage. Sharp curves should be banked with the high side on the outside of the curve to help bicyclists maintain their balance.

See Chapter 7 of [Appendix L](#) for additional information about typical pavement sections, drainage, vegetation, rail requirements, illumination, and structures, preventing motor-vehicle access, bollards and geometric design.

13.7.3 DESIGN EXCEPTIONS

Design Exceptions are required for two-way path widths less than 10-feet, one-way path widths less than 6-feet, shy distance less than 2 feet, Design Exceptions may also be required for other design factors. Consult with the ODOT Pedestrian and Bicycle Facility Specialist or Region Bicycle and Pedestrian Coordinator to determine if a design exception is required. An ADA Exception is required where a path grade is steeper than 5% for paths that are not on the same alignments with an adjacent roadway.