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1515.01 **General**^[AFS1]

~~Shared use paths are designed for both transportation and recreation purposes and are used by pedestrians, bicyclists, skaters, equestrians, and other users. This chapter will include technical provisions for making newly constructed and altered shared use paths covered by the Americans with Disabilities Act of 1990 (ADA) and the Architectural Barriers Act of 1968 (ABA) accessible to persons with disabilities. As with any roadway projects, design shared-use paths need to fit into the context of a multi-modal community, and engage various discipline experts including landscape architects, soils and pavement engineers, maintenance staff, traffic control experts, ADA and Bicycle coordinators, and others. Additionally, when designing such facilities, the emerging use of technology (e.g. way-finding) should be considered. Exhibits are also provided throughout this chapter to illustrate possible design solutions and should be treated with appropriate flexibility so long as doing so complies with corresponding laws, regulations, standards and guidance. The Americans with Disabilities Act of 1990 (ADA) requires that pedestrian facilities be designed and constructed such that they are readily accessible and usable by individuals with disabilities. Because shared-use paths include pedestrians, accessibility requirements apply.~~ Where possible, provide a wide separation between a shared-use path and the roadway's traveled way where the path is located near a roadway. ^[AFS2] ~~Design shared-use paths in accordance with this chapter.~~ This chapter covers shared-use paths that are two-directional.

Some common locations for shared-use paths are along rivers, streams, ocean beachfronts, canals, utility rights of way, and abandoned railroad rights of way; within college campuses; and within and between parks. Another common application of shared-use paths is to close gaps in bicycle networks. There might also be situations where such facilities can be provided as part of planned developments.

~~Shared-use paths often provide recreational opportunities. They also serve to minimize motor vehicle interference by providing direct commute routes for path users.~~

Design shared-use paths and roadway crossings in consultation with your region's ^[AFS3] ADA Coordinator and Bicycle Coordinator. For additional information on pedestrian and bicycle facilities, see Chapters 1510 and 1520, respectively.

~~As with roadway projects, design shared-use paths to fit the context to the community, and engage various discipline experts including landscape architects, soils and pavement~~

~~engineers, maintenance staff, traffic control experts, ADA and Bicycle coordinators, and others.~~

1515.02 References ^[WC4]

[Manual on Uniform Traffic Control Devices \(MUTCD\) - Washington State](#) ^[AFS5]

[Manual on Uniform Traffic Control Devices \(MUTCD\)](#)

The ~~2009~~ MUTCD provides information on signing and pavement marking as well as signing-related way-finding for shared-use paths.

The *Standard Plans* show shared-use path pavement markings at obstructions and show placement of detectable warning surfaces.

http://www.wsdot.wa.gov/publications/fulltext/Standards/english/PDF/m09.60-00_e.pdf

Chapter 3 *Equestrian Design Guidebook for Trails, Trailheads and Campgrounds*

provides guidance to accommodate equestrian users on shared use paths. ^{[FHWA][SLS6]}

Pedestrian Bicycle Information Center. <http://www.bicyclinginfo.org/engineering/paths-principles.cfm>

Guide for the Planning, Design, and Operation Development of Bicycle Facilities, AASHTO.

1515.03 Definitions

shared-use path A facility physically separated from motorized vehicular traffic within the highway right of way or on an exclusive right of way with minimal crossflow by motor vehicles. Primarily used by pedestrians and bicyclists, shared-use paths are also used by joggers, skaters, wheelchair users (both nonmotorized and motorized), equestrians, and other nonmotorized users.

rest area An area to the side of the path.

running slope A slope measured in the direction of travel, normally expressed as a percent.

landing A level (0 to 2% grade in any direction) paved area within the shared-use path, designed to provide turning and maneuvering space for wheelchair users and as a resting place for pedestrians.

1515.04 Shared-Use Path Design – The Basics

When designing shared-use paths, the bicycle may not be the critical design user for every element of design. For example, the crossing speeds of most intersections between roads and pathways should be designed for pedestrians, as they are the slowest users. Accommodate all intended users and minimize conflicts. When designing to serve equestrians, it is desirable to provide a separate bridle trail along the shared-use path ^[CW7] to minimize conflicts with horses.



Shared-Use Path
Exhibit 1515-1

(1) *Design Speed*

The design speed for a shared-use path is based on the bicycle user and is dependent on the terrain and the expected conditions of use. Design the shared use path to encourage bicyclists to operate at speeds compatible with other users. Higher speeds are discouraged in a mixed-use setting. Design shared use paths to maintain speeds at or below the speeds shown in Exhibit 1515-2 by designing to the following **minimum horizontal curve radius**. [CW8]

| Conditions [CW9] | Design Speed (mph) | Minimum Curve Radius (ft) |
|---|---------------------------|----------------------------------|
| Long downgrades (steeper than 4% and longer than 500 ft) | 30 | 166 |
| Open country (level or rolling); shared-use path in urban areas | 20 | 74 |
| <u>Approaching intersections</u> | <u>12</u> | <u>27</u> |

Bicycle Design Speeds
Exhibit 1515-2

When minimum radius curves cannot be obtained because of right-of-way, topographical or other constraints, consider installing the following mitigation measures for traffic calming to slow bicyclists when approaching curves.

- Use intermittent curves to slow or maintain desired speeds.
- Standard curve warning signs and supplemental pavement markings in accordance with the MUTCD.

- Perpendicular stripes can be painted on the pathway in decreasing intervals to provide the perception of increased speed. This has been shown to slow drivers when applied to roadways.
- Consider changes in pavement texture to encourage reductions in speed at tight curve approaches.

The negative effects of tight radius curves can also be partially offset by widening the pavement through the curves. Steeper vertical grades affects running speed of bicycles and ideally, a shared use path should be designed not to exceed 5%, see 1515.04(3) for further guidance.

(2) Widths, Cross Slopes, Side Slopes, and Clearances

(a) Shared Use Path Widths [WC10]

The appropriate paved width for a shared-use path is dependent on the context, volume, and mix of users. The desirable paved width of a shared-use path, excluding the shoulders on either side, is 12 feet. The minimum paved width, excluding the shoulders on either side, is 10 feet.

The paved width of more than 12- feet [WC11], excluding the shoulders on either side may be appropriate when substantial use by both pedestrians and bicyclists is expected or maintenance vehicles are anticipated.

Shared-use path shoulders are typically unpaved and 2 feet wide on either side. Exhibits 1515-3 through 1515-5 provide additional information and cross sectional elements.

On bridges or tunnels, pave the shared-use path paved width and shoulder width across the structure. This usable width can be advantages for emergency, patrol, and maintenance vehicles and allows for maneuvering around pedestrian and bicyclists who may have stopped.

In addition, a path width of 8 feet may be used for a short distance due to a physical constraint such as an environmental feature, bridge abutment, utility structure, fence, etc. Warning signs that indicate the pathway narrows, per the MUTCD should be considered at these locations.

In very rare circumstances, a reduced width of 8 feet may be used where the following conditions prevail:

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

(b) Existing Shared-Use Paths - Considerations

Some existing shared-use paths were constructed to narrower dimensions, generally providing 8 feet of pavement. Evaluate existing older paths for current needs. Consider widening an existing shared-use path to meet current geometric standards.

(c) Cross Slope^[WC12]

The maximum cross slope, on a paved shared-use path shall be 2%. The cross slope of the shoulders can be no steeper than 6:1. To accommodate drainage, the entire section including shoulders, should transition through curves. It is desirable to design the pivot point on outside edge one side of the shoulder or the other to avoid a pavement crown. (see Exhibits 1515-3 through 1515-5).

It is recommended that cross slopes be designed to be less than the allowed maximum to account for some tolerance in construction. For example, design for a 1.5% cross slope (rather than 2% maximum).

Sloping the pavement surface to one side is desirable and usually simplifies drainage design and surface construction. Generally, surface drainage from the path is dissipated as it flows down the side slope.

(d) Side Slopes and Pedestrian Rail

Side slopes along shared use paths are an important design feature. Embankment side slopes of 6:1 or flatter provide a gently sloping path border. Avoid fill slopes steeper than 3:1.

Where a shared-use path is adjacent to canals, ditches, fill slopes steeper than 3H:1V, or where obstacles that present a risk exist at the bottom of an embankment, consider:

- A minimum 5-foot separation from the edge of the pavement to the embankment edge. This can be accomplished by providing a 5 foot shoulder as shown in Exhibit 1515-5, Example 2.
- A physical barrier, such as dense shrubbery, railing, or chain link fencing, may be beneficial at the top of a high embankment.
- Where a shared-use path is adjacent to a vertical drop of 2 feet 6 inches or more, a pedestrian rail is needed. Due to the presence of bicyclists, a 54 inch rail height^[CW13] is ~~required~~^{needed} (and, to meet accessibility criteria for handrail, provides an intermediate handrail with a height between 34 and 38 inches. See Chapter 1510 for further guidance on accessibility criteria.)
- If vertical drop is less than 2 feet 6 inches, then a 4-inch curb at edge of shared use path is recommended in place of pedestrian railing^[AFS14].

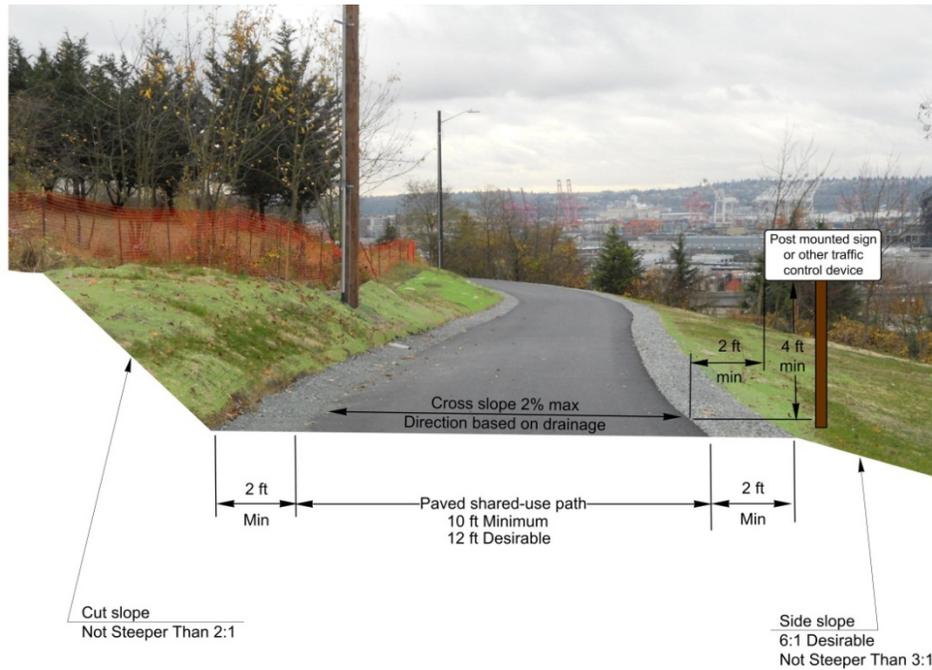
~~Where a shared use path is constructed on the side of a hill, drainage facilities may need to be considered. a^[CW15] drainage ditch on the uphill side might be needed to intercept the hillside drainage.~~

(e) Clearances

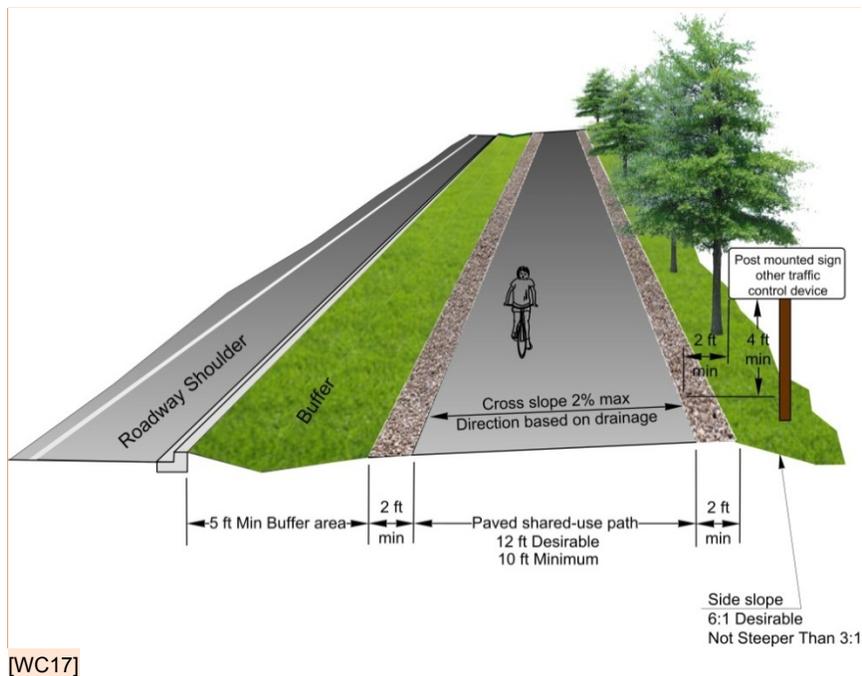
The minimum horizontal clearance from the edge of pavement to^[AFS16] an obstruction (such as bridge piers or guardrail) is 2 feet. Where this clearance cannot

be obtained, document justification and install signs and pavement markings to warn users of the condition. (For pavement marking details, see the [MUTCD](#) and the [Standard Plans](#).)

Provide a minimum vertical clearance of 10 feet from pavement to overhead obstructions. This should be adequate to accommodate maintenance vehicles, bicyclists, and equestrians.

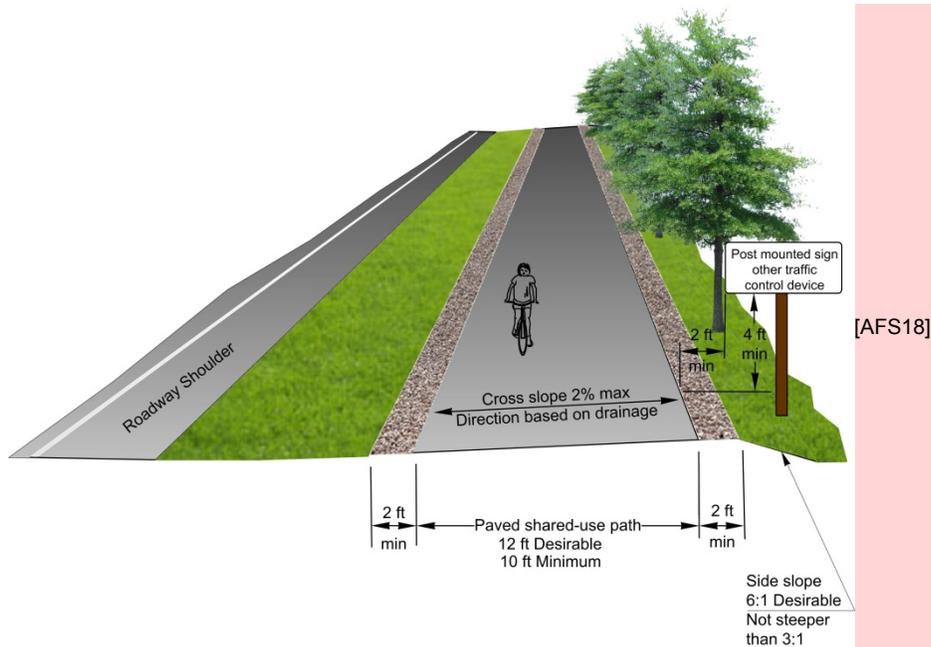


Two-Way Shared-Use Path: Independent Alignment
Exhibit 1515-3



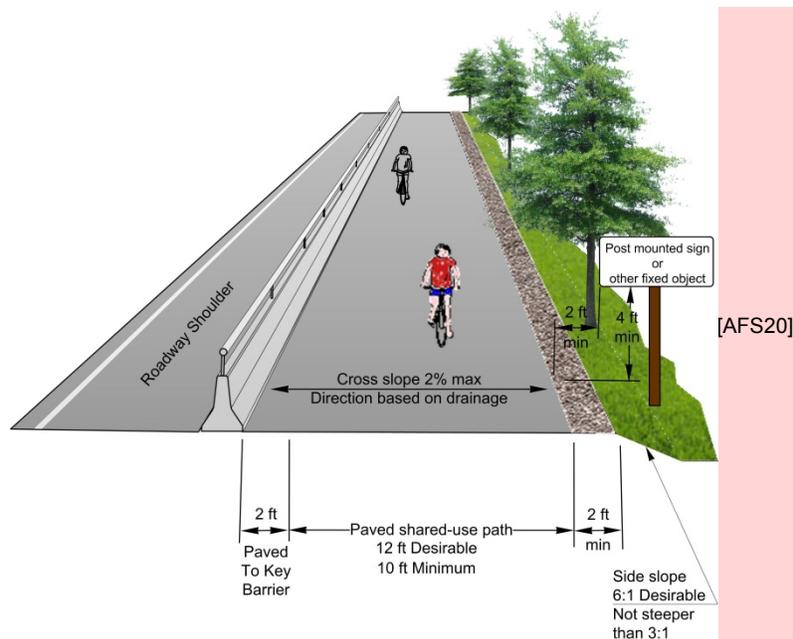
When path is adjacent to roadway, its running slope can match the grade of the roadway but not exceed it.

Two-Way Shared-Use Path: Adjacent to Roadway (≤ 35 mph)
Exhibit 1515-4a



When path is adjacent to roadway, its running slope can match the grade of the roadway[SLS19] but not exceed it. See Chapter 1600 for roadway clear zone design guidance.

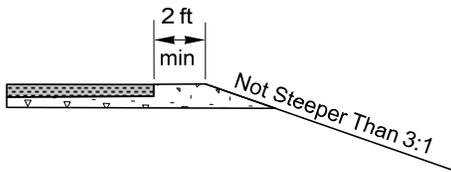
Two-Way Shared-Use Path: Adjacent to Roadway (> 35 mph)
Exhibit 1515-4b



When path is adjacent to roadway, its running slope can match the grade of the roadway but not exceed it. [It is desirable to slope toward grass areas for drainage.](#)

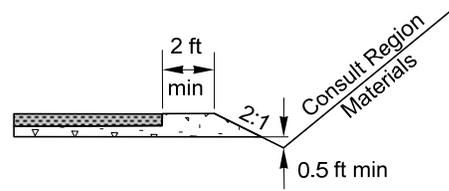
Two-Way Shared-Use Path: Attached to Roadway

Exhibit 1515-4c



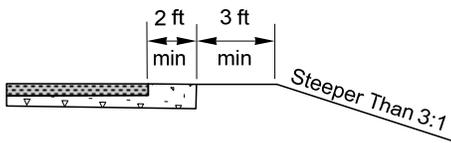
Example 1: 6:1 Embankment

Depicts desirable condition
Based on context, flatter slopes are desirable.



Example 3 – Cut section with ditch

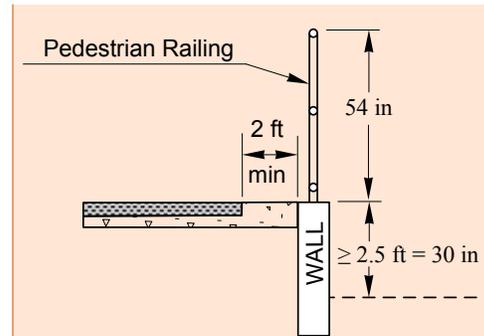
Consult geotechnical report for cut slopes.



[AFS21]

Example 2: Shoulder Widening to 5 feet or more

Used with steeper fill slopes to provide ample clear space between the hinge point and path. Vegetation can also be used as a buffer on slopes. In lieu of 3' additional widening, consider pedestrian railing".



[CW22]

Example 4 – Railing used at drop off

Apply railing when a drop off is present, such as along a retaining wall. The taller 54 inch railing is shown here to accommodate bicyclists. Determine if shoulder along wall is should be paved or not.?

These drawings depict some common applications for various slope alternatives

Shared-Use Path Side Slopes and Railing [AFS23]

Exhibit 1515-5

(3) Running Slopes, Landings, and Rest Areas

(a) Running Slopes^[WC24]

It is desirable to keep running slopes (grades) on shared-use paths less than or equal to 5% to accommodate all user types, including pedestrians with disabilities.

Requirements for running slopes include:

- When the path is adjacent to a roadway, its running slope can match the general grade of the roadway but not exceed it.
- Provide a smooth vertical transition when the running slope changes within a vertical crest curve, see Exhibit 1515-16.
- Provide a smooth vertical transition when the running slope changes within a vertical sag curve (3-ft minimum vertical sag curve)^[CW25]
- Where it is impracticable to achieve 5% or less, contact the region ADA Coordinator and the Headquarters (HQ) Design Office for further design guidance.

Grades on paths in constrained areas on shared use paths on independent alignments should be designed as follows:

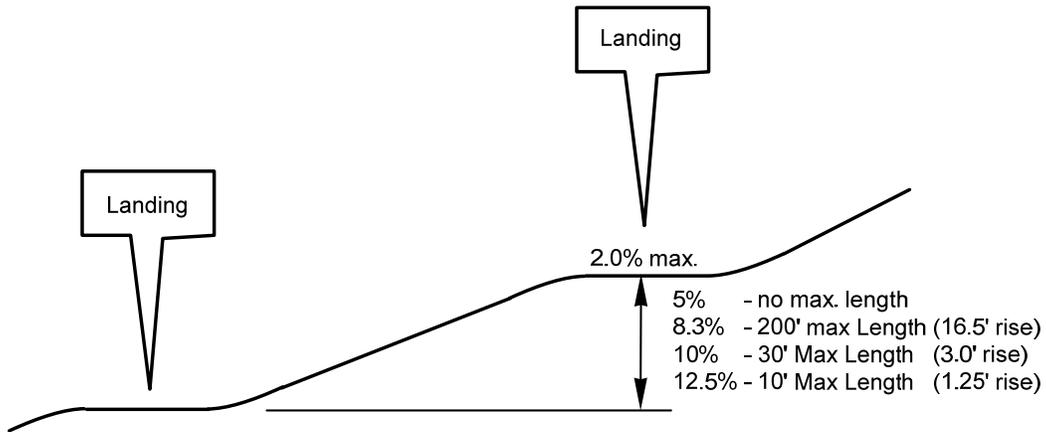
- Less than 5% for any distance
- 8.3% percent maximum for up to 200 feet
- 10% percent maximum for up to 30 feet
- 12.5% percent for up to 10 feet

(b) Landings

Shared-use path landings provide users a place to rest on running slopes between 5% and ~~8.3~~12.5% and a level area to turn into an adjacent rest area. Exhibit 1515-7 shows these features^[WC26].

Requirements for landings include:

- Provide landings on each end of running slopes exceeding 5% for every 10 feet or less of elevation change, as shown in Exhibit 1515-6. Consult with the ADA Coordinator early to obtain endorsement of landing locations. Obtain Assistant State Design Engineer concurrence on landing designs and spacing.
- The maximum running and cross slopes of a landing are 2%.
- Landings are to be in line with the shared-use path and at least as wide as the path.
- Landings are to be at least 5 feet long.
- Provide smooth vertical transitions into and out of the landing. It is undesirable to have abrupt grade changes or angle points. ~~Thus consider d~~Designing transitions to landings using vertical curve lengths as stated in 1515.04(3)(a).
- Lessons learned have taught that asphalt landings may present construction challenges when rolled and compacted (they may not hold their shape well.) Consider using PCCP instead of asphalt for landings. ^[CW27]

**Notes:**[WC28]

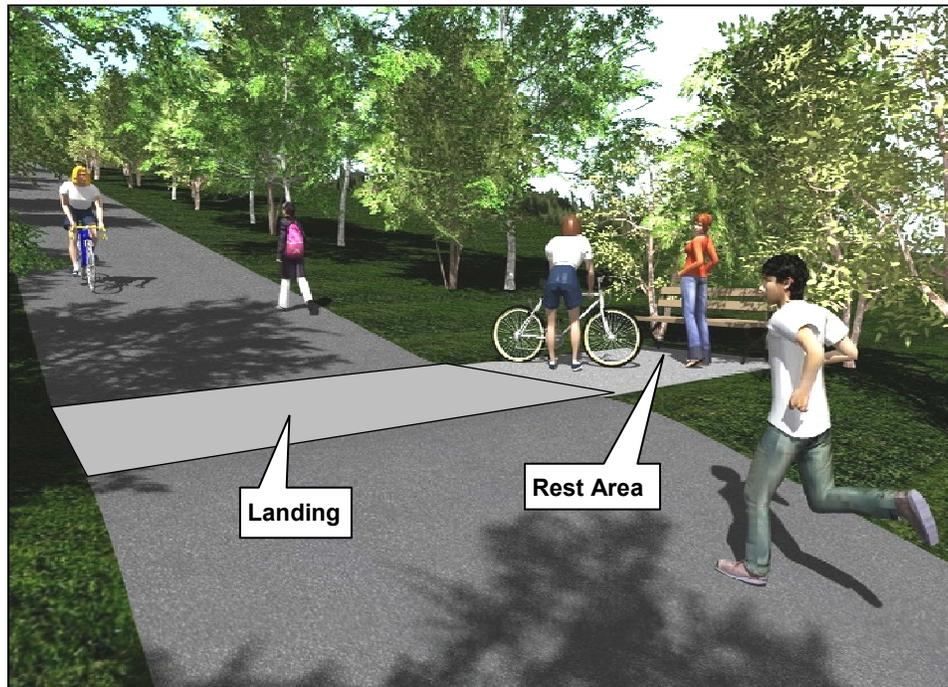
- Landings are required on running slopes that exceed 5%.
- [Design vertical curves based on 1515.04\(3\)\(a\) to transition from the steep grade to the landing.](#)
- Exhibit 1515-7 illustrates a landing and a rest area.

Shared-Use Path Landings Profile*Exhibit 1515-6***(c) Rest Areas**

Although not required, rest areas may be provided adjacent to the path, as shown in [Exhibit 1515-7](#). These provide the additional benefit of a resting area outside the path travelled way.

Requirements for rest areas include:

- The maximum slope is 2%.
- The minimum size is to be 5 feet by 5 feet.
- If features such as benches are provided, they must meet ADA requirements; consult with the region ADA Coordinator for guidance.

**Notes:**

- Design inline landings at least 5 feet long and as wide as the shared-use path.
- Design inline landings with a maximum cross slope and running slope of 2%.
- A rest area is shown adjacent to the path landing.

Shared-Use Path Landing and Rest Area

Exhibit 1515-7

(4) Pavement Structural Section

Design the pavement structural section of a shared-use path in the same manner as a highway, considering the quality of the subgrade and the anticipated loads on the path. (Design loads are normally from maintenance and emergency vehicles.) Provide a firm, smooth, slip-resistant pavement surface.

Design the pavement structural section as recommended by the Region Materials Engineer.

Use a crushed rock or other suitable material for shoulder graded areas. Consult with the Region Materials Engineer.

(5) Stopping Sight Distance

(a) Stopping Sight Distance

The distance needed to bring a path user to a fully controlled stop is a function of the user's perception and braking reaction times, the initial speed, the coefficient of friction between the wheels and the pavement, the braking ability of the user's equipment, and the grade. Exhibit 1515-15 provides a chart or an equation to obtain gives the minimum stopping sight distances for various design speeds and grades.

(b) Stopping Sight Distance on Crest Vertical Curves

Exhibit 1515-16 ~~gives~~ provides a chart or equation to obtain the minimum lengths of crest vertical curves for varying stopping sight distances and algebraic differences in grade design speeds. The values are based on a 4.5-foot eye height for the bicyclist and a 0-foot height for the object (path surface).

(c) Stopping Sight Distance on Horizontal Curves

Exhibit 1515-17 gives the minimum clearances to line-of-sight obstructions for sight distance on horizontal curves. Provide lateral clearance based on the sum of stopping sight distances from Exhibit 1515-15 for bicyclists traveling in both directions and the proposed horizontal curve radius. Where this minimum clearance cannot be obtained, provide curve warning signs and use centerline pavement markings in accordance with the MUTCD.

Exhibits 1515-15, -16, and -17 are presented at the end of this chapter.

1515.05 Intersections and Crossings Design

This section covers path / roadway intersections and grade-separated crossings. Bollards are presented in this section, as they are primarily used at junctions with roadways.

(1) Intersections With Roadways

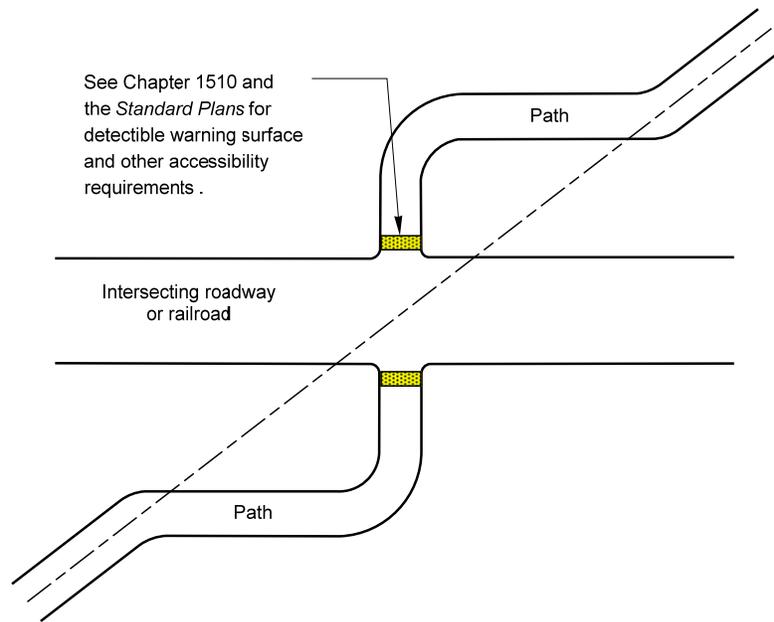
Clearly define who has the right of way and provide sight distance for all users at shared-use path and roadway intersections.

The common types of shared-use path/roadway at-grade intersection crossings are midblock and adjacent.

For roadway intersections with roundabouts, see Chapter 1320.

Midblock crossings are located between roadway intersections. Installation of a midblock crossing on a state highway ~~is a design deviation that~~ requires ASDE approval and documentation in the form of a Design Decision Memo. [CW29] When possible, locate the path crossings far enough away from intersections to minimize conflicts between the path users and motor vehicle traffic. ~~[SC(O30)] A 90° crossing is desirable; however, a 75° angle is acceptable. A 45° angle is the minimum acceptable to minimize the right of way needed. It is preferable for midblock path crossings to intersect the roadway at an angle as close to perpendicular as practical. A minimum 60-degree crossing angle is acceptable to minimize right of way needs.~~ A diagonal midblock crossing can be altered as shown in Exhibit 1515-8.

There are other considerations when designing midblock crossings. They include traffic right of way assignments; traffic control devices; sight distances for both bicyclists and motor vehicle operators; refuge island use; access control; and pavement markings.

**Notes**[CW31]

- For path and highway signing and markings, see the [MUTCD](#) and the [Standard Plans](#). http://www.wsdot.wa.gov/publications/fulltext/Standards/english/PDF/m09.60-00_e.pdf
- [For radii approaching roadway intersections, see Exhibit 1515-2](#)

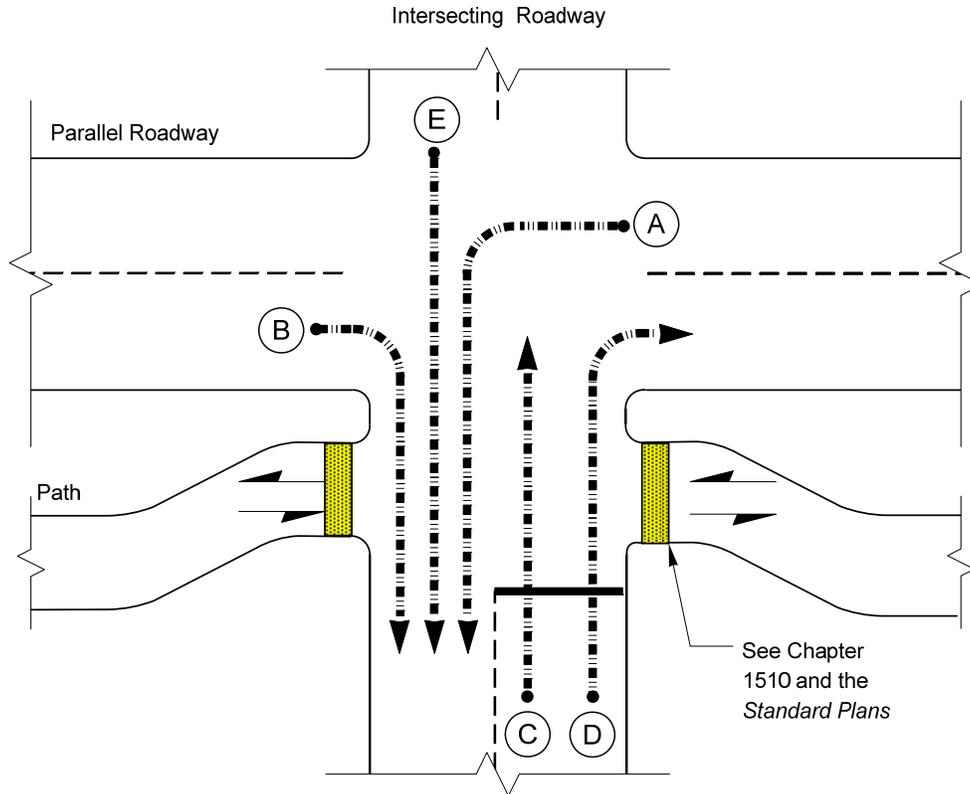
Typical Redesign of a Diagonal Midblock Crossing

Exhibit 1515-8

Adjacent path crossings are located at or near public intersection crosswalks and are normally placed with them. These crossings are usually placed with pedestrian crossings, where motorists can be expected to stop. If alternate intersection locations for a shared-use path are available, select the one with the greatest sight distance.

Adjacent path crossings occur where a path crosses an existing intersection of two roadways, a T intersection (including driveways), or a four-way intersection, as shown in [Exhibit 1515-9](#). It is desirable to integrate this type of crossing close to an intersection so that motorists and path users recognize one another as intersecting traffic. The path user faces potential conflicts with motor vehicles turning left (A) and right (B) from the parallel roadway and on the crossed roadway (C, D, and E).

Consider crossing improvements on a case-by-case basis. Suggested improvements include: move the crossing; evaluate existing or proposed intersection control type; change signalization timing; or provide a refuge island and make a two-step crossing for path users.

**Note:**

For signing and pavement markings, see the [MUTCD](#) and the [Standard Plans](#).

Adjacent Shared-Use Path Intersection

Exhibit 1515-9

Important elements that greatly affect the design of these crossings are traffic right of way assignments, traffic control devices, and the separation distance between path and roadway.

(a) Additional Roadway/Path Intersection Design Considerations

Additional roadway/path intersection design considerations include the following:

1. Evaluate Intersection Control

Determine the need for traffic control devices at path/roadway intersections by using [MUTCD](#) warrants and engineering judgment. Bicycles are considered vehicles in Washington State, and bicycle path traffic can be classified as vehicular traffic for [MUTCD](#) warrants. Provide traffic signal timing set for pedestrians.

2. Signal Actuation Mechanisms^[AFS32]

Place the manually operated accessible pedestrian signal button in a location that complies with ADA requirements. For additional information, see Chapters [1330](#) and [1510](#). A detector loop in the path ^[CW33]pavement may be provided in addition to the manually operated accessible pedestrian signal button.

3. Signing

Provide sign type, size, and location in accordance with the [MUTCD](#). Place path STOP signs as close to the intended stopping point as feasible. Do not place the shared-use path signs where they may confuse motorists or place roadway signs where they may confuse shared-use path users. For additional information on signing, see the [MUTCD](#) and [Chapter 1020](#).

4. Approach Treatments

Design shared-use path and roadway intersections with level grades, and provide sight distances. Provide advance warning signs and pavement markings ([see the MUTCD](#)) that alert and direct path users that there is a crossing ([see the MUTCD](#)). Do not use speed bumps or other similar surface obstructions intended to cause bicyclists to slow down. Consider some slowing features such as horizontal curves, [see Exhibit 1515-2 and Exhibit 1515-8](#). Avoid locating a crossing where there is a steep downgrade where bike speeds could be high.

5. Sight Distance

Sight distance is a principal element of roadway and path intersection design. At a minimum, provide stopping sight distance for both the roadway and the path at the crossing. Decision sight distance is desirable for the roadway traffic. (See [Chapter 1260](#) for stopping sight distance for the roadway and [1515.03\(8\)](#), [\(9\)](#), and [\(10\)](#) for shared-use path stopping sight distance.)

6. Curb Ramp Widths

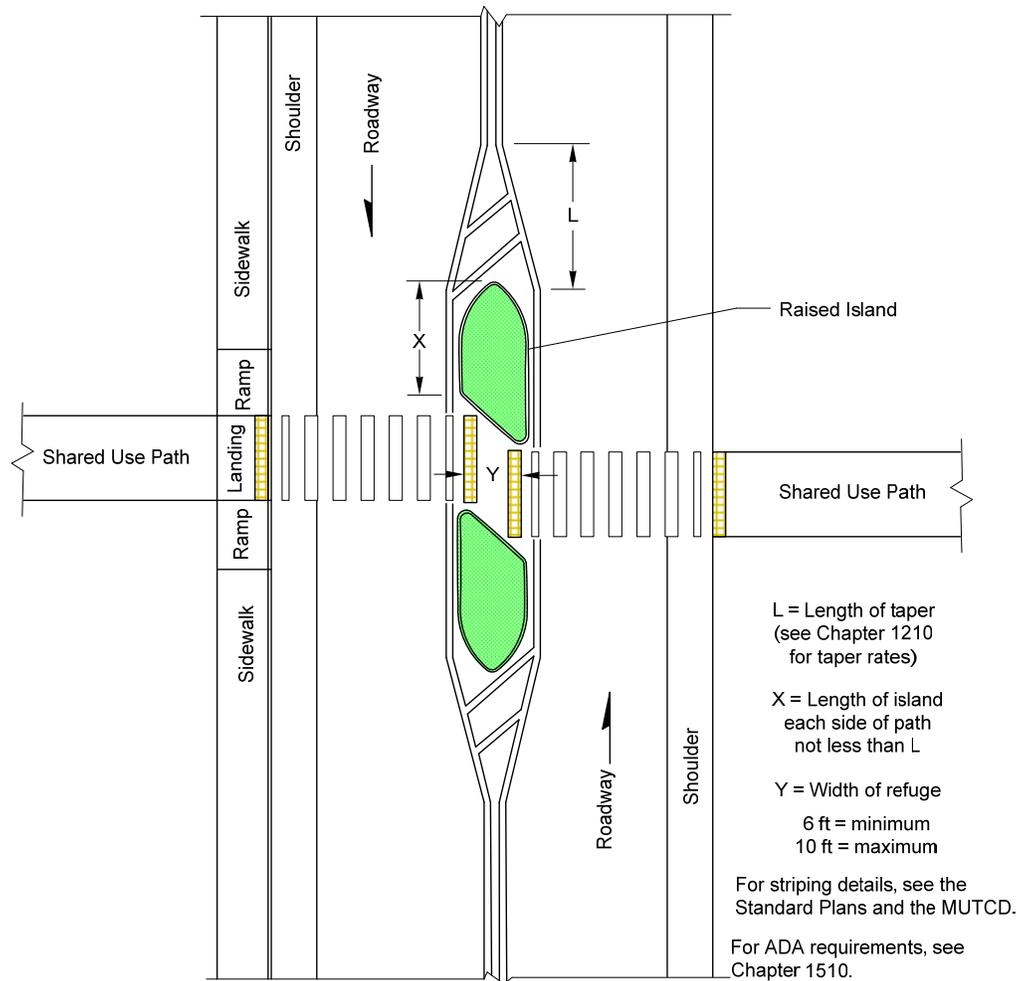
Design curb ramps with a width equal to the shared-use path width. Curb ramps and barrier-free passageways are to provide a smooth transition between the shared-use path and the roadway or sidewalk (for pedestrians). Curb ramps at path/roadway intersections must meet the requirements for sidewalk curb ramp at a crosswalk. For design requirements, see [Chapter 1510](#), and for curb ramp treatments at roundabouts, see [Chapter 1320](#).

7. Refuge Islands

Consider refuge islands where a shared-use path crosses a roadway when one or more of the following applies:

- High motor vehicle traffic volume and speeds
- Wide roadways
- Use by the elderly, children, the disabled, or other slow-moving users. (See [Exhibit 1515-10](#) for details.)

The refuge area may be designed with the storage aligned perpendicularly across the island (as shown in [Exhibit 1515-10](#)) or via a diagonal. The diagonal storage area has the added benefit of directing attention toward oncoming traffic; therefore, it should be angled toward the direction from which traffic is approaching.

**Notes:**

- This exhibit shows cases where a path intersects a roadway framed with either a sidewalk or a paved shoulder, for purpose of showing detectible warning surface placements.

Roadway Crossing Refuge Area Exhibit 1515-10

(2) At-Grade Railroad Crossings

Wherever possible, design the crossing at right angles to the rails. For signing and pavement marking for a shared-use path crossing a railroad track, see the [MUTCD](#) and the [Standard Plans](#). Also, see Chapter 1510 for design of at-grade pedestrian railroad crossings.

1515.06 Grade Separations Structures

Structures intended to carry a shared-use path only are designed using pedestrian loads and emergency and maintenance vehicle loading for live loads.

Provide the same minimum clear width as the approach paved shared-use path plus the graded clear areas. [CW34]

Carrying full widths across structures has two advantages:

- The clear width provides a minimum horizontal shy distance from the railing or barrier.
- It provides needed maneuvering room to avoid pedestrians and other bicyclists.

For undercrossings and tunnels, provide a minimum vertical clearance of 10 feet for path users from the path pavement to the structure above. This allows access by emergency, patrol, and maintenance vehicles on the shared-use path.

Consult the region Maintenance Office and the HQ Bridge Preservation Office to verify that the planned path width meets their needs. If not, widen to their specifications.

Provide a smooth, slip resistant surface to traverse the shared-use path across bridges.

Use expansion joints for decks that accommodate bikes and wheelchairs. Expansion joints should be perpendicular to the path and have a maximum gap of ½ inch or be covered with a skid-resistant plate.

Vertical clearance is the critical height under a structure that will accommodate vehicular and rail traffic based on its design characteristics. See Chapter 720 for minimum vertical clearance guidance.

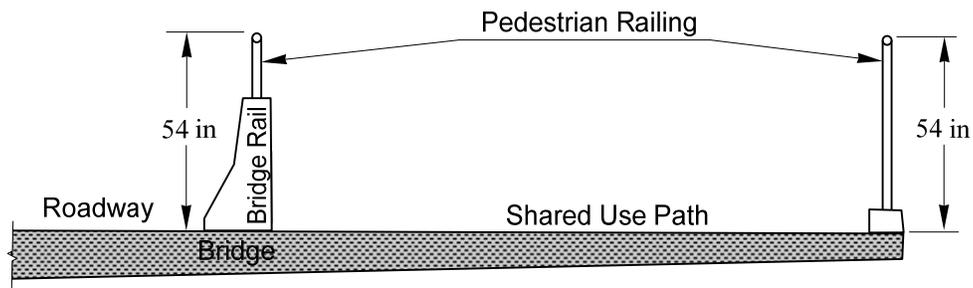


[CW35]

Shared-Use Path Bridge and Approach Walls
Exhibit 1515-11

(1) Bridge rail

On structures, the bridge railing type and height are part of the structure design. Contact the HQ Bridge and Structures Office for additional information. (See Chapter 720 and the Bridge Design Manual LRFD for further considerations.) [CW36]

**Notes General:** [AFS37]

- Where the path is adjacent to the roadway, its running slope can match the grade of the roadway but not exceed it.
- Photo above shows bridge with wide sidewalk with a traffic barrier separating the sidewalk from the roadway. Pedestrian rail is used on the outside edge.
- Drawing above depicts same application for shared-use path.

Bridge and Pedestrian Rail [SC(O38)]
Exhibit 1515-12

1515.07 Signing, Pavement Markings, and Illumination

Generally, WSDOT does not provide continuous centerline striping, or channelization for user modes, on shared-use paths. However, signing and pavement markings can be beneficial to warn shared-use path users of curves, grades, obstructions, and intersections.

~~Refer to the MUTCD for guidance and directions regarding signing, and pavement markings, and signing related way-finding on shared-use paths, see the MUTCD. The 2009 MUTCD provides information on signing and pavement marking as well as signing related way finding for shared use paths.~~

The *Standard Plans* show shared-use path pavement markings at obstructions and show placement of detectible warning surfaces in accordance with the MUTCD.

http://www.wsdot.wa.gov/publications/fulltext/Standards/english/PDF/m09.60-00_e.pdf

For pavement marking around bollards and other obstructions, see *Standard Plan M-9.60*.

The level of illumination on a shared-use path is dependent upon the amount of nighttime use expected and the nature of the area surrounding the facility^[AFS39]. ~~If illumination is used, provide illumination in accordance with Chapter 1040.~~^[CW40]

1515.08 Restricted Use Controls

This section presents considerations on use of fencing and other treatments used to restrict roadway and path users to their domains. ^[AFS41]

(1) Fencing

Limited access highways often require fencing or other forms of controlling access. Shared-use paths constructed within these corridors, such as shown in Exhibit 1515-13, likely require fencing. For guidance on fencing, limited access controls, and right of way, consult ~~with Division 5 the 500 series of the Design Manual chapters.~~

Where a shared-use path is adjacent to a fully controlled limited access highway, and space permits, provide fencing as described in *Chapter 560*, in conjunction with a normal height traffic barrier between the path and the highway. Otherwise, provide a taller barrier—~~54-inch minimum height~~^[CW42].

Fencing between a shared-use path and adjacent property may also be installed to restrict access to the private property. Discuss the need for fencing and the appropriate height with the property owners during project design.

Evaluate the impacts of barriers and fencing on sight distances



Shared-Use Path in Limited Access Freeway Corridor

Exhibit 1515-13

(2) Restriction of Motor Vehicle Traffic

Shared-use paths often need some form of physical barrier at roadway intersections to prevent unauthorized motor vehicles from entering.

Bollards have been used by many path owners to prevent unauthorized vehicle access. However, bollards should not be applied indiscriminately, and there are other considerations to bollard installation.

Some path owners have employed other means such as splitting a path into two channels at roadway intersections. This method essentially creates an island in the middle of the path rather than installing a bollard. Such an island could be planted with low growing, hardy vegetation capable of withstanding the occasional authorized vehicle traveling over it. Consider this in lieu of bollards. When splitting a path, employ MUTCD pavement markings and signing, such as is used for bollards and obstructions.

The remainder of this section covers additional bollard considerations.

Typically, one bollard located in the center of the path is sufficient to control motor vehicle access to the path. If more than one bollard is needed, the additional bollards should be placed at the edge of the shared use path.

Install bollards at entrances to shared-use paths to discourage motor vehicles from entering. Do not use bollards to divert or slow path traffic. When locating such installations, stripe an envelope around the bollards and paint and reflectorize them to be visible to path users both day and night. Bollards located in or adjacent to shared-use paths represent an object that needs to be avoided by bicyclists, pedestrians, and

wheelchair users. To increase the potential for appropriate maneuvering to occur, provide designs where the post is clearly visible and recognizable.

When designing bollards, the following information applies:

- The desirable design is to provide a single bollard, installed in the middle of the path to reduce confusion.
- When multiple bollard posts are used in wide path sections, use a minimum 5-foot spacing between bollard posts to permit passage of bicycle-towed trailers, wheelchairs, and adult tricycles, with room for bicycle passage without dismounting.
- Provide 4 feet minimum (5 feet desirable) clear width between the face of bollard and edge of path.
- At a minimum, provide stopping sight distance to bollards. An ideal location for bollard placement is in a relatively straight area of the path where the post placement has the stopping sight distance given in Exhibit 1520-13. Do not place bollards in difficult-to-see locations (for example, immediately upon entering a tunnel).
- For cases where multiple posts are used longitudinally along the path, locate them at least 20 feet apart, with the first post in line from each direction having stopping sight distance[SLS43].
- Use a contrasting striping pattern on the post.
- Use reflective materials on the post, such as a band at the top and at the base.
- Design all bollards along a corridor to be uniform in appearance. Frequent cyclists can become familiar with the posts and recognize them easily.
- Provide pavement markings in accordance with the *Standard Plans* and *MUTCD* at all bollards on paved paths.
- Use removable bollards (Bollard Type 1) to permit access by emergency and service vehicles. Use bollard sleeves that are flush with the pavement surface.
- Non-removable bollards (Bollard Type 2) may be used where access is not needed.

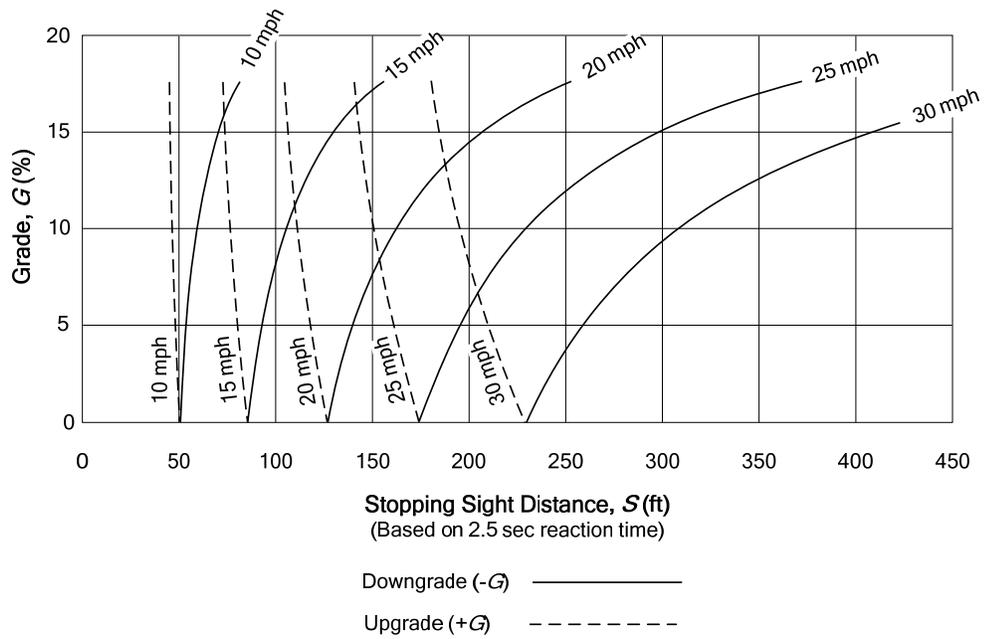
Refer to the *Standard Plans* for bollard designs and the *Standard Plans* and *MUTCD* for pavement markings at bollards.

When bollards need to be placed near the roadway, see [Chapter 1600](#) for clear zone requirements.

1515.09 Documentation

For the list of documents required to be preserved in the Design Documentation Package and the Project File, see the Design Documentation Checklist:

🔗 www.wsdot.wa.gov/design/projectdev/



$$S = \frac{V^2}{0.30(f \pm G)} + 3.67V$$

Where:

- S = Stopping sight distance (ft)
- V = Speed (mph)
- f = Coefficient of friction (use 25[CW44])
- G = Grade (%)

Stopping Sight Distance
Exhibit 1515-15

| A (%) | Stopping Sight Distance, S (ft) | | | | | | | | | | | | | |
|-------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|
| | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 30 | 70 | 110 | 150 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 20 | 60 | 100 | 140 | 180 | 220 | 260 | 300 |
| 4 | 3 | 3 | 3 | 3 | 15 | 55 | 95 | 135 | 175 | 215 | 256 | 300 | 348 | 400 |
| 5 | 3 | 3 | 3 | 20 | 60 | 100 | 140 | 180 | 222 | 269 | 320 | 376 | 436 | 500 |
| 6 | 3 | 3 | 10 | 50 | 90 | 130 | 171 | 216 | 267 | 323 | 384 | 451 | 523 | 600 |
| 7 | 3 | 3 | 31 | 71 | 111 | 152 | 199 | 252 | 311 | 376 | 448 | 526 | 610 | 700 |
| 8 | 3 | 8 | 48 | 88 | 128 | 174 | 228 | 288 | 356 | 430 | 512 | 601 | 697 | 800 |
| 9 | 3 | 20 | 60 | 100 | 144 | 196 | 256 | 324 | 400 | 484 | 576 | 676 | 784 | 900 |
| 10 | 3 | 30 | 70 | 111 | 160 | 218 | 284 | 360 | 444 | 538 | 640 | 751 | 871 | 1,000 |
| 11 | 3 | 38 | 78 | 122 | 176 | 240 | 313 | 396 | 489 | 592 | 704 | 826 | 958 | 1,100 |
| 12 | 5 | 45 | 85 | 133 | 192 | 261 | 341 | 432 | 533 | 645 | 768 | 901 | 1,045 | 1,200 |
| 13 | 11 | 51 | 92 | 144 | 208 | 283 | 370 | 468 | 578 | 699 | 832 | 976 | 1,132 | 1,300 |
| 14 | 16 | 56 | 100 | 156 | 224 | 305 | 398 | 504 | 622 | 753 | 896 | 1,052 | 1,220 | 1,400 |
| 15 | 20 | 60 | 107 | 167 | 240 | 327 | 427 | 540 | 667 | 807 | 960 | 1,127 | 1,307 | 1,500 |
| 16 | 24 | 64 | 114 | 178 | 256 | 348 | 455 | 576 | 711 | 860 | 1,024 | 1,202 | 1,394 | 1,600 |
| 17 | 27 | 68 | 121 | 189 | 272 | 370 | 484 | 612 | 756 | 914 | 1,088 | 1,277 | 1,481 | 1,700 |
| 18 | 30 | 72 | 128 | 200 | 288 | 392 | 512 | 648 | 800 | 968 | 1,152 | 1,352 | 1,568 | 1,800 |
| 19 | 33 | 76 | 135 | 211 | 304 | 414 | 540 | 684 | 844 | 1,022 | 1,216 | 1,427 | 1,655 | 1,900 |
| 20 | 35 | 80 | 142 | 222 | 320 | 436 | 569 | 720 | 889 | 1,076 | 1,280 | 1,502 | 1,742 | 2,000 |
| 21 | 37 | 84 | 149 | 233 | 336 | 457 | 597 | 756 | 933 | 1,129 | 1,344 | 1,577 | 1,829 | 2,100 |
| 22 | 39 | 88 | 156 | 244 | 352 | 479 | 626 | 792 | 978 | 1,183 | 1,408 | 1,652 | 1,916 | 2,200 |
| 23 | 41 | 92 | 164 | 256 | 368 | 501 | 654 | 828 | 1,022 | 1,237 | 1,472 | 1,728 | 2,004 | 2,300 |
| 24 | 43 | 96 | 171 | 267 | 384 | 523 | 683 | 864 | 1,067 | 1,291 | 1,536 | 1,803 | 2,091 | 2,400 |
| 25 | 44 | 100 | 178 | 278 | 400 | 544 | 711 | 900 | 1,111 | 1,344 | 1,600 | 1,878 | 2,178 | 2,500 |

Minimum Length of Vertical Curve, L (ft)

$$L = \frac{AS^2}{900} \quad \text{when } S < L$$

$$L = 2S - \frac{900}{A} \quad \text{when } S > L$$

|
Shaded area represents $S \leq L$.

Where:

- S = Stopping sight distance (ft)
 - A = Algebraic difference in grade (%)
 - L = Minimum vertical curve length (ft)
- Based on an eye height of 4.5 ft and an object height of 0 ft.

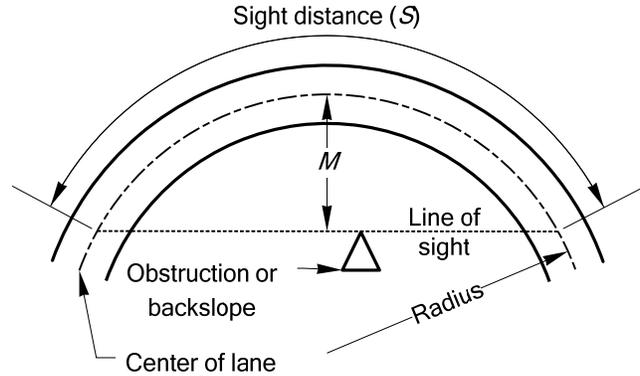
Sight Distances for Crest Vertical Curves
Exhibit 1515-16

Height of eye: 4.50 ft
 Height of object: 0.0 ft
 Line of sight at the M distance is normally 2.25 ft above centerline of inside lane at point of obstruction, provided no vertical curve is present in horizontal curve.

$$M = R \left(1 - \cos \frac{S 28.65}{R} \right)$$

$$S = \frac{R}{28.65} \left[\cos^{-1} \left(\frac{R - M}{R} \right) \right]$$

$S \leq$ Length of curve
 Angle is expressed in degrees.



Where:
 S = Sight distance (ft)
 R = Centerline radius of inside lane (ft)
 M = Distance from inside lane centerline (ft)

| R (ft) | Stopping Sight Distance, S (ft) ^[1] | | | | | | | | | | | | | |
|--------|--|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 |
| 25 | 7.6 | 15.9 | | | | | | | | | | | | |
| 50 | 3.9 | 8.7 | 15.2 | 23.0 | 31.9 | 41.5 | | | | | | | | |
| 75 | 2.7 | 5.9 | 10.4 | 16.1 | 22.7 | 30.4 | 38.8 | 47.8 | 57.4 | 67.2 | | | | |
| 95 | 2.1 | 4.7 | 8.3 | 12.9 | 18.3 | 24.6 | 31.7 | 39.5 | 47.9 | 56.9 | 66.2 | 75.9 | 85.8 | |
| 125 | 1.6 | 3.6 | 6.3 | 9.9 | 14.1 | 19.1 | 24.7 | 31.0 | 37.9 | 45.4 | 53.3 | 61.7 | 70.5 | 79.7 |
| 150 | 1.3 | 3.0 | 5.3 | 8.3 | 11.8 | 16.0 | 20.8 | 26.2 | 32.1 | 38.6 | 45.5 | 52.9 | 60.7 | 69.0 |
| 175 | 1.1 | 2.6 | 4.6 | 7.1 | 10.2 | 13.8 | 18.0 | 22.6 | 27.8 | 33.4 | 39.6 | 46.1 | 53.1 | 60.4 |
| 200 | 1.0 | 2.2 | 4.0 | 6.2 | 8.9 | 12.1 | 15.8 | 19.9 | 24.5 | 29.5 | 34.9 | 40.8 | 47.0 | 53.7 |
| 225 | 0.9 | 2.0 | 3.5 | 5.5 | 8.0 | 10.8 | 14.1 | 17.8 | 21.9 | 26.4 | 31.2 | 36.5 | 42.2 | 48.2 |
| 250 | 0.8 | 1.8 | 3.2 | 5.0 | 7.2 | 9.7 | 12.7 | 16.0 | 19.7 | 23.8 | 28.3 | 33.0 | 38.2 | 43.7 |
| 275 | 0.7 | 1.6 | 2.9 | 4.5 | 6.5 | 8.9 | 11.6 | 14.6 | 18.0 | 21.7 | 25.8 | 30.2 | 34.9 | 39.9 |
| 300 | 0.7 | 1.5 | 2.7 | 4.2 | 6.0 | 8.1 | 10.6 | 13.4 | 16.5 | 19.9 | 23.7 | 27.7 | 32.1 | 36.7 |
| 350 | 0.6 | 1.3 | 2.3 | 3.6 | 5.1 | 7.0 | 9.1 | 11.5 | 14.2 | 17.1 | 20.4 | 23.9 | 27.6 | 31.7 |
| 400 | 0.5 | 1.1 | 2.0 | 3.1 | 4.5 | 6.1 | 8.0 | 10.1 | 12.4 | 15.0 | 17.9 | 20.9 | 24.3 | 27.8 |
| 500 | 0.4 | 0.9 | 1.6 | 2.5 | 3.6 | 4.9 | 6.4 | 8.1 | 10.0 | 12.1 | 14.3 | 16.8 | 19.5 | 22.3 |
| 600 | 0.3 | 0.7 | 1.3 | 2.1 | 3.0 | 4.1 | 5.3 | 6.7 | 8.3 | 10.1 | 12.0 | 14.0 | 16.3 | 18.7 |
| 700 | 0.3 | 0.6 | 1.1 | 1.8 | 2.6 | 3.5 | 4.6 | 5.8 | 7.1 | 8.6 | 10.3 | 12.0 | 14.0 | 16.0 |
| 800 | 0.2 | 0.6 | 1.0 | 1.6 | 2.2 | 3.1 | 4.0 | 5.1 | 6.2 | 7.6 | 9.0 | 10.5 | 12.2 | 14.0 |
| 900 | 0.2 | 0.5 | 0.9 | 1.4 | 2.0 | 2.7 | 3.6 | 4.5 | 5.5 | 6.7 | 8.0 | 9.4 | 10.9 | 12.5 |
| 1,000 | 0.2 | 0.4 | 0.8 | 1.2 | 1.8 | 2.4 | 3.2 | 4.0 | 5.0 | 6.0 | 7.2 | 8.4 | 9.8 | 11.2 |

Minimum Lateral Clearance, M (ft)

Note:

[1] S is the sum of the distances (from Exhibit 1515-15) for bicyclists traveling in both directions.

Lateral Clearance on Horizontal Curves

Exhibit 1515-17