Chapter 1520 Roadway Bicycle Facilities

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1520.01 General

Bicycle facilities within Washington State Department of Transportation (WSDOT) right of way are an important component of the overall transportation system. Bicycle facilities or improvements for bicycle transportation are included in WSDOT's project development and highway programming processes.

This chapter is a guide for designing bicycle transportation facilities within state highway right of way or between the curb lines on city streets designated as state highways. When designing facilities outside of state highway right of way or beyond the curb on city streets designated as state highways, coordinate with the local agency to determine the appropriate design guidance.

Guidance in this chapter applies to typical situations encountered on state highways and includes options for intersection and interchange design. Unique design challenges are resolved using expertise and guidance from the regional Active Transportation Coordinator and WSDOT headquarters Active Transportation Coordinator. If unique design solutions are needed, include the region Assistant State Design Engineer (ASDE). Additional resources that can be used to develop concepts for unique situations can be found in guides referenced in Section 1520.07.Work with your ASDE to determine the appropriate guidance and documentation needed.

The Region Traffic Engineer is responsible for determining which sections of state highways are inappropriate for bicycle traffic. The State Traffic Engineer, after consultation with HQ Design and HQ Active Transportation, prohibits bicycling on sections of state highways through the traffic regulation process.

1520.02 Policy

WSDOT seeks to provide appropriate bicycle facilities along and across sections of state routes as an integral part of the transportation system. Federal Highway Administration (FHWA) and WSDOT policy is that bicycle facilities be given full consideration in the planning and design of new construction and reconstruction highway projects, except where bicycle use is prohibited. Use a performance-based approach as described in this chapter to select and design the appropriate solution to address the need to accommodate bicycle uses, including those uses associated with projects that are providing for a Complete Streets facility.

1520.03 Bicycle Facility Selection

This section provides additional information on facility selection based on the Safe System Approach.

Facilities that reduce driver operating speeds, reduce bicyclist exposure to potential crashes with motor vehicles, increase the predictability of motor vehicle and bicycle interactions, and increase the conspicuity of vulnerable road users decrease the likelihood of a serious injury or fatality crash. See Exhibit 1520-5.

Reduce operating speeds: Measures to reduce operating speeds of roadways are used to increase safety for both drivers and active transportation users of the transportation system (see Section 1103.05). Bike facilities do not necessarily reduce vehicular operating speeds, rather different bike facility types are chosen to mitigate for higher speed conditions. Some bicycle facilities, such as protected intersections, directly influence vehicle turning speeds.

Reduce bicyclist exposure to potential crashes with motor vehicles: Bike facilities generally reduce bicyclist exposure to potential crashes along roadways. Exposure decreases as separation and protective elements increase.

Exposure can also be decreased by reducing the number or length of conflict zones or crossing areas with motor vehicle traffic, or by controlling traffic movements at points of conflict (i.e., signalized control of conflicting movements). Protected intersections and protected roundabouts provide significant reductions in bicyclist exposure at intersections by reducing the total number of potential conflict points in the intersection.

Increase predictability of motor vehicle/bicycle interactions: Bike facilities provide a means for increasing the predictability of interactions between motor vehicle and bicycle traffic by providing an identified and recognizable space for bicycle traffic to travel, especially in locations where most cyclists are traveling at a slower speed than motor vehicle traffic. At intersections, separated or marked bike facilities help establish both where differing traffic modes can be expected to travel as well as indicating locations where the paths of differing modes cross one another. Signalized intersections with dedicated signal phases for cyclists can further support predictable traffic movements through intersections.

Increase bicyclist conspicuity: Bike facilities may increase a driver's attention to the fact that bicyclists may be present and bike facility enhancements such as green paint can accentuate this effect. Raised bike lanes (i.e., bicycle facilities that are vertically separated from the adjacent travelled lane), protected intersections, and bike boxes can directly increase bicyclist conspicuity.

Reference the Traffic Manual Exhibit 4-6 to assist in selecting an appropriate bicycle facility based on the context of the roadway.

1520.03(1) Speed Considerations

While Exhibit 1520-2, Exhibit 1520-3,Exhibit 1520-4, and Exhibit 1520-5 provide ranges of roadway speeds in which different types of bike facilities may be appropriate, it is critical to understand that motor vehicle speed plays a significant role in crash severity between motor vehicles and cyclists. When designing multimodal facilities, a target speed selection within the low-speed design control is encouraged. Safety performance increases as motor vehicle speeds are decreased. See Chapter 1103 for further discussion on target speed and speed management treatments.

1520.03(2) Roadway Bicycle Facilities

There are three general types of dedicated bicycle facilities. See Exhibit 1520-1.

Conventional bike lanes (CBLs) have a paint stripe, signing, and pavement markings to provide a clear indication to bicyclists and drivers about the purpose of the facility. See Exhibit 1520-7.

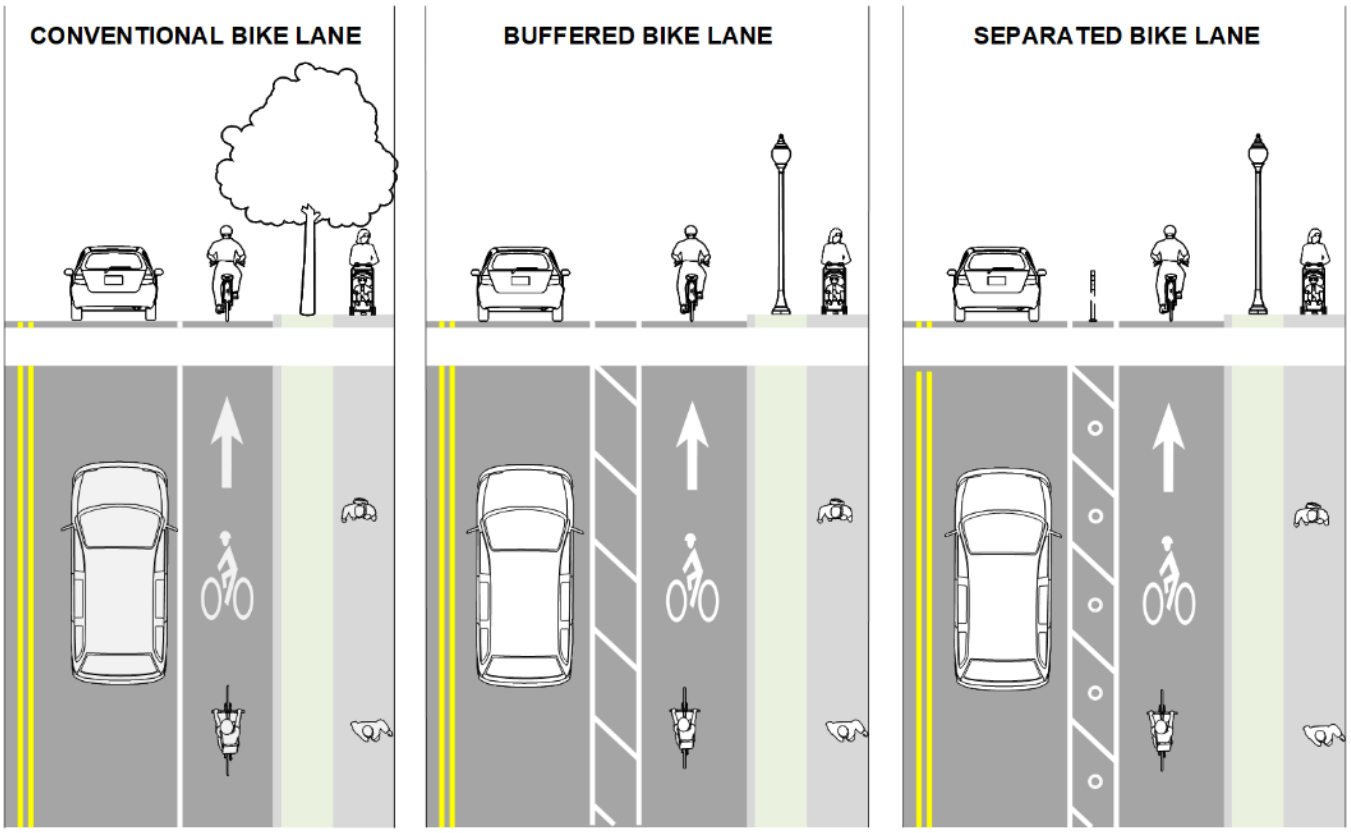
Buffered bike lanes (BBLs) are similar to conventional bike lanes, except they also provide a painted buffer to improve rider comfort and provide the benefit of having greater space between cyclists and motor vehicle traffic. See Exhibit 1520-8.

Separated bike lane (SBLs) also provide a painted buffer, but also include vertical elements to further improve rider comfort and improve the buffer's visibility and the driver's awareness of the buffer. See Exhibit 1520-9.

The width of a bicycle lane with a buffer (BBLs and SBLs) does not include the width of the buffer.

Shared-use paths (see Chapter 1515) are another option for providing physical separation from traffic.

Exhibit 1520-1 Roadway Bicycle Facilities

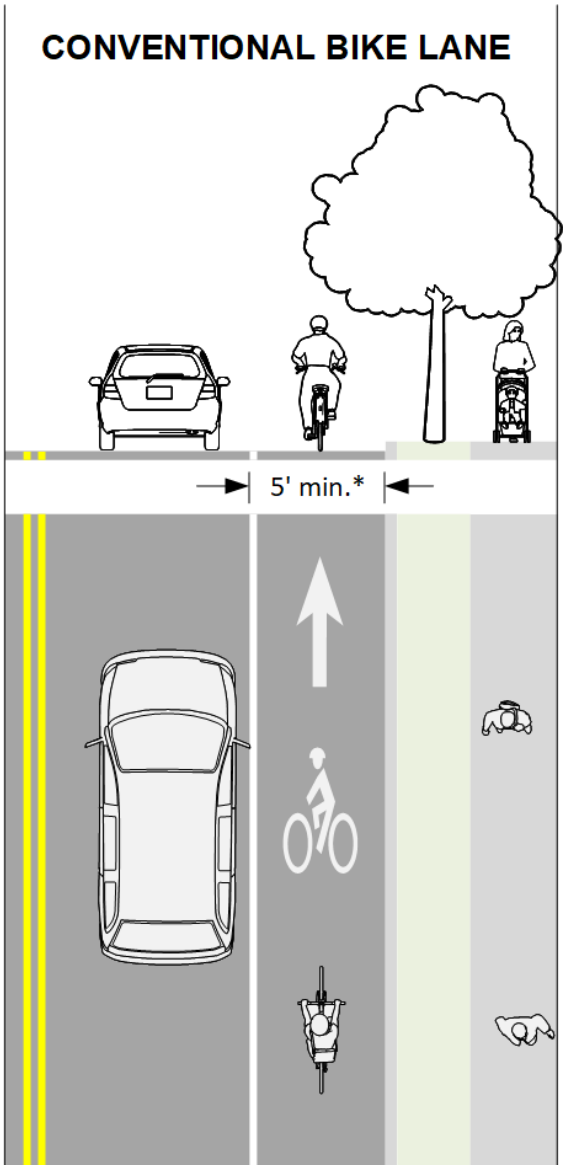


1520.03(2)(a) Conventional Bike Lane

Conventional bike lanes are at grade and adjacent to motor vehicle traffic lane. They are designated by a single solid wide stripe between the motor vehicle lane and bike lane. Additional bike markings (see the *Standard Plans*) in the bike lane and signage are also employed. Where on-street parking is present, a conventional bike lane is always located between the parking lane and the vehicular travel lane.

The minimum width for a conventional bike lane is 5 feet (not including the gutter pan, where present); the minimum width is 6 feet, not including gutter pan, when the posted speed is > 30 mph and the bike lane is either adjacent to vehicle parking or there is a higher volume of vehicle traffic (> 6,000 vehicles per day or > 5% trucks).

Exhibit 1520-2 Conventional Bike Lane



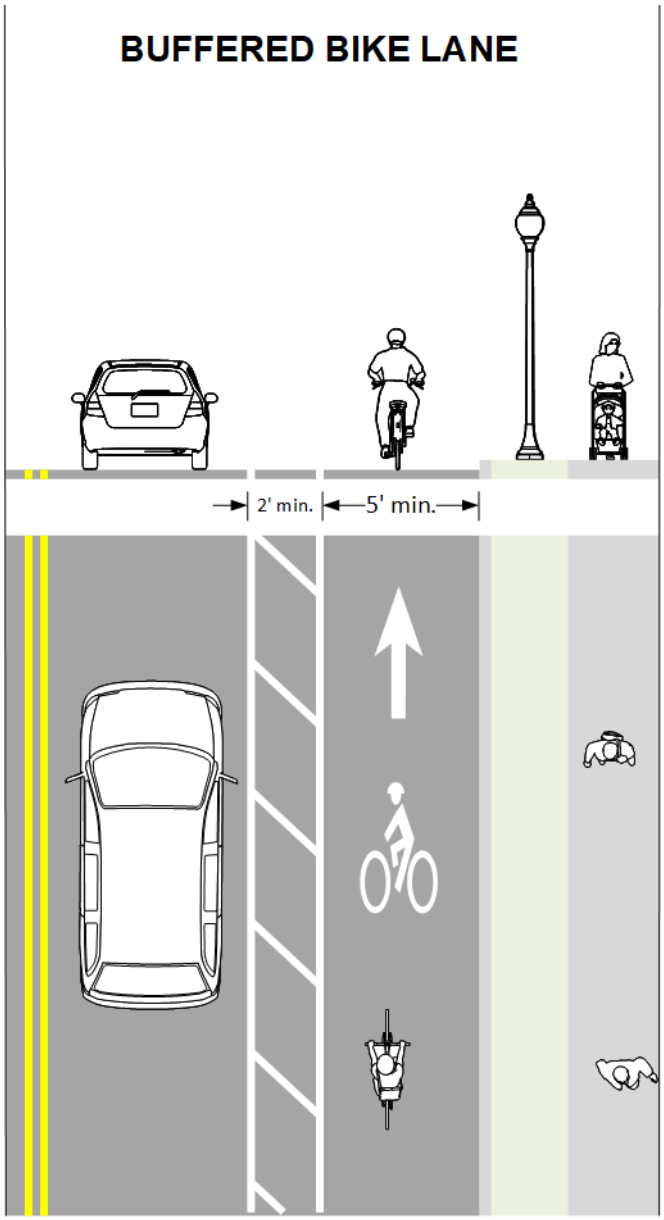
* 6 feet min. when the posted speed is > 30 mph and the bike lane is either adjacent to vehicle parking or a sharp pavement drop off, or when higher than 6,000 vehicles per day or 5% heavy trucks.

1520.03(2)(b) Buffered Bike Lane

As the name suggests, a buffered bike lane is a bike lane with a marked buffer between the bike lane and adjacent motor vehicle traffic. The buffer is typically placed between the bike lane and an active traffic lane but can also be placed between a bike lane and a curbside parking lane. The buffer treatment consists entirely of pavement markings (including RPMs in some cases) with no vertical elements.

Provide a minimum 2-foot buffer strip, and a 5 foot wide minimum bike lane (not including the gutter pan, if present). Widths in excess of the minimum are normally associated with the need to accommodate bicycle passing due to higher volumes, mix of bicycle traffic (i.e., bicyclists with differing levels of aptitude and/or types of bicycles) or steep uphill grade.

Exhibit 1520-3 Buffered Bike Lane



1520.03(2)(c) Separated Bike Lanes

Separated bike lanes include a bike lane and a buffer area like a buffered bike lane; however, a separated bike lane also includes a vertical element in the buffer area between the bike lane and motor vehicle traffic. Bike markings (see the *Standard Plans*) in the bike lane and signage are also employed. For these designs, provide a minimum 5 foot wide bike lane (not including the gutter pan, where present). Widths in excess of the minimum are normally associated with the need to accommodate bicycle passing due to higher volumes, mix of bicycle traffic (i.e., bicyclists with differing levels of aptitude and/or types of bicycles) or steep uphill grade.

Provide a minimum 2 foot wide buffer, or 3 feet wide if the buffer is adjacent to parked cars. By incorporating vertical features into the buffer as described below, BLTS is improved.

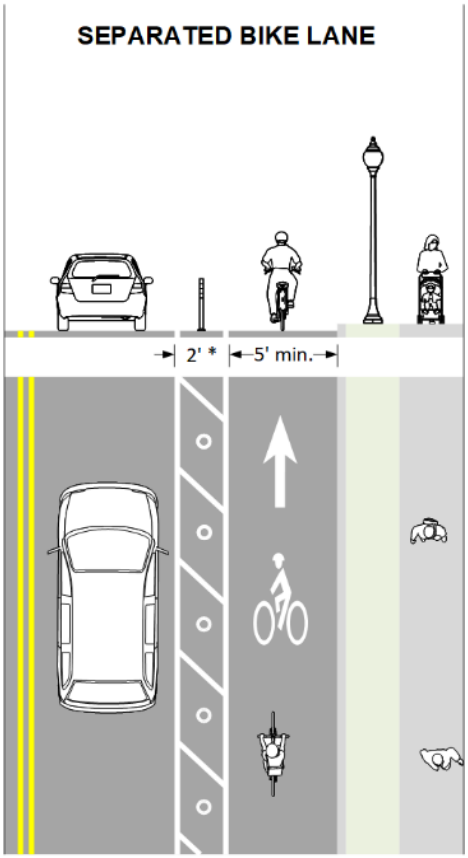
Install one of the vertical features available for this purpose in the center of the designated buffer area. For buffers that are wider than 4 feet, the centerline of the vertical features may be aligned 2 feet from the street edge of the buffer. Acceptable vertical features include tubular markers, precast or cast in place curb, traffic barrier, vehicle parking, or a curbed planter strip. Other physical separation features may be used; consult with your region Active Transportation Coordinator or HQ Active Transportation Division.

If a curb or traffic barrier is used, review the recommended lateral clearances to vehicle traffic appropriate for the design speed of the roadway in Section 1239.06. Use bike markings in the bike lane and signage as shown in the *Standard Plans*). If curb is used with a street level separated bike lane and without any other vertical elements, paint the curb white and provide guideposts to mark the ends.

The surface elevation of a separated bike lane can be raised above the elevation of the adjacent roadway. Raising the surface of a bike lane serves to reinforce the separation of the bike facility from the vehicular lanes and can also provide better access between the bike lane and street frontage uses in some contexts.

For bike lanes that are raised to match the elevation of the sidewalk, provide separation features between the bike lane and the sidewalk to ensure separation of modes in practice. This separation is typically provided in the form of a landscape or other non-traversable buffer between the bike lane and the sidewalk, and differing paving types to distinguish between the two facilities. Typically, the bike lane should be paved in asphalt and the sidewalk in cement concrete. If there is no physical buffer between a fully raised bike lane and an adjacent sidewalk, provide a detectable directional strip (see Section 1520.05(4)) along the boundary between the bike lane and the sidewalk. The width of the detectable directional strip cannot be included in the design width of either the bike lane or the sidewalk.

Exhibit 1520-4 Separated Bike Lane (tubular markers shown as vertical feature)



* 2 foot minimum. 3 feet minimum if the separation is adjacent to parked cars or has a traffic barrier. Contact HQ Roadside Safety if considering concrete barrier for additional width requirements.

1520.03(2)(d) Bike Boulevard

Bike boulevards (also known as Neighborhood Greenways, Bicycle Priority Streets, and other names) can be used on streets with posted speeds of ≤ 25 mph with low vehicle volumes. Bike boulevards are designed to give bicyclists and pedestrians priority. Signs, pavement markings, speed humps, chicanes, diverters, and other tools discourage vehicle through travel and encourage low speeds. Bike boulevards may be used on state highways with ASDE approval; however, it is more likely that bike boulevards will interface with state highways through crossing situations. It is important to consider how to configure an intersection or dedicated bicycle crossing location when intersecting with a bicycle boulevard network (see Section 1520.04(5)).

1520.03(2)(e) Shoulder Use by Bikes

Accommodating bicycle use on the shoulder is common on state highways that are not designated as Complete Streets. Shoulder improvements to facilitate bicycle travel include widening the shoulders to a minimum width of 4 feet, removing surface obstacles, and reviewing existing drain grates for compatibility with bicycles. If shoulder rumble strips are present, provide for at least 4 feet of usable shoulder between the rumble strip and the outside edge of shoulder. When barrier is present, provide for at least 5 feet of shoulder between the edge of traveled way (or rumble strip if present) and the face of the traffic barrier.

Note that shoulders wide enough for bicycles are not dedicated bicycle facilities, and bicycle users do not have the same operating privileges as with designated roadway bike facilities.

In rural to suburban/urban transition areas consider adding bike facilities, both to encourage speed management of motor vehicle users through the transition and to establish a dedicated special-use lane for cyclists to tie into the local network.

Rumble strips are common on rural highways. and rumble strips and rumble stripes need to be properly installed and maintained (see Section 1600.05(1)) so that the shoulder can be used by bicyclists.

1520.03(3) Design Performance Metric – Level of Traffic Stress

The Level of Traffic Stress (LTS) performance metric is used to evaluate Complete Streets projects. Complete Streets projects require a Level of Traffic Stress of 2 or better (i.e., LTS 1 or LTS 2). See Chapter 1510 for guidance on Pedestrian Level of Traffic Stress.

Provide a buffered bike lane or separated bike lane where the existing or proposed posted speed is greater than 30 mph. Separation can be provided by adding a physical barrier such as tubular markers, curb, traffic barrier, or other (see Section 1520.03) or providing a separate facility such as a shared-use path.

See Section 1510.02(5)(a) for guidance on Level of Traffic Stress for pedestrians (PLTS).

1520.03(3)(a) Bicycle Level of Traffic Stress

Use the following tables to determine the Bicycle Level of Traffic Stress (BLTS) for each project alternative under consideration (see Chapter 1104). These tables can also be used to identify potential changes needed to achieve BLTS 1 or 2 for an alternative – including additional bicycle infrastructure, speed reductions, and/or lane reductions. Note that speed referred to in the tables is target speed.

Shared use paths meeting the full requirements of Chapter 1515 meet the LTS 2 target by definition, and therefore are not included in the tables below.

Exhibit 1520-5 Bicycle Level of Traffic Stress in mixed traffic (no bicycle facility)

BLTS in mixed traffic (no bicycle facility)								
Lanes	AADT	Target Speed						
		≤20	25	30	35	40	45	50+
1 thru lane per direction (or 1 lane one-way street)	0 - 750	1	2	3	4	4	4	4
	751 - 1500	1	2	3	4	4	4	4
	1501 - 3000	2	2	3	4	4	4	4
	> 3000	2	3	3	4	4	4	4
2 thru lanes per direction	0 - 6000	3	3	3	4	4	4	4
	> 6000	3	3	4	4	4	4	4
3+ thru lanes per direction	Any ADT	4	4	4	4	4	4	4

Exhibit 1520-6 Bicycle Level of Traffic Stress for Conventional Bike Lane

Conventional Bike Lanes (5' or greater)								
Lane Configuration	AADT (total)	Target Speed						
		≤20	25	30	35	40	45	50+
1 thru lane per direction (or 1 lane one-way street)	0-750	1	1	2	3	4	4	4
	751-1500	1	1	2	3	4	4	4
	1501-3000	1	1	2	3	4	4	4
	3000+	2	2	2	3	4	4	4
2 thru lanes per direction	0-6000	2	2	2	3	4	4	4
	>6000	2	2	3	3	4	4	4
3+ thru lanes per direction	Any ADT	3	3	3	4	4	4	4

Exhibit 1520-7 Bicycle Level of Traffic Stress for Buffered Bike Lane

Buffered Bike Lanes (minimum 2' buffer / greater than or equal to 7 feet total)								
Lane Configuration	AADT (total)	Target Speed						
		≤20	25	30	35	40	45	50+
1 thru lane per direction (or 1 lane one-way street)	0-750	1	1	2	3	4	4	4
	751-1500	1	1	2	3	4	4	4
	1501-3000	1	1	2	3	4	4	4
	3000+	2	2	2	3	4	4	4
2 thru lanes per direction	0-6000	2	2	2	3	4	4	4
	>6000	2	2	3	3	4	4	4
3+ thru lanes per direction	Any ADT	3	3	3	4	4	4	4

Exhibit 1520-8 Bicycle Level of Traffic Stress for Separated Bike Lane

Separated Bicycle Lane								
Lane Configuration	AADT (total)	Target Speed						
		≤20	25	30	35	40	45	50+
1 thru lane per direction (or 1 lane one-way street)	0-750	1	1	1	2	2	2	2
	751-1500	1	1	1	2	2	2	2
	1501-3000	1	1	1	2	2	2	2
	3000+	2	2	2	2	2	2	2
2 thru lanes per direction	0-6000	2	2	2	2	2	2	2
	>6000	2	2	2	2	2	2	2
3+ thru lanes per direction	Any ADT	2	2	2	2	2	2	2

1520.04 Intersection Design

Provide accommodation for bicycle movement approaching and through intersections on facilities where bicycles are allowed. See Section 1310.03 for design examples, additional design elements beyond those listed in this chapter, and the appropriate configurations and dimensions of those elements.

1520.04(1) Intersection Design Treatments

Design intersections for bicycle mobility and safety performance to provide a visible, distinct, predictable, and clearly designated path leading to and through the intersection while managing potential conflicts between all other users and cyclists. This chapter covers options for intersection design for bicyclists while chapters in the 1300 series provide guidance for intersection control type selection and design.

Intersection design in terms of bicycle safety and mobility performance is unique to each location. In every case, provide clear delineation of the bike facility leading up to and through the intersection, as well as segregating or prioritizing movements where appropriate. Although intersection treatments and design methods depicted in this manual are considered state-of-the-practice for WSDOT, certain pavement markings or configurations may not currently appear in the *Manual on Uniform Traffic Control Devices*. In these cases, contact the Region Traffic Engineer for more information about documentation requirements.

1520.04(1)(a) Bike Lane Through Intersection

The approach to intersections needs to balance the bicycle user's safety needs with the mobility needs of other users. Eliminate or minimize conflict areas especially at intersections. If conflict areas exist, use dotted lines to identify the conflict area. Colored pavement markings can be used to further enhance and delineate the conflict area. Exhibit 1520-9 shows different applications of the approach through lane most likely to be encountered.

There are several different ways to delineate bike lanes through the intersection. Dotted lines are the basic treatment that can be supplemented with green pavement markings (see Section 1520.05(1)) to further enhance the bike facility's presence and position within an intersection.

1520.04(2) Intersection Bike Boxes

An intersection bike box is a designated area on the approach to a signalized intersection, between an advance stop line and the intersection stop line, intended to provide bicycles a space in which to wait in front of stopped motor vehicles during the red signal phase so that they are more visible to motorists at the start of the green signal phase, as shown in Exhibit 1520-10. Bike boxes are used at signalized intersections and increase both mobility and safety performance for the bicycle mode. Intersection Bike Boxes are permitted throughout the state of Washington under FHWA approval number IA-18.35. Additional information regarding the use and application of Intersection Bike Boxes is found in FHWA Interim Approval IA-18.

Applying a bike box (see Exhibit 1520-12) assists mobility performance by prioritizing the bicycle movement at an intersection. Positioning bicyclists in the center of the appropriate lane allows them to turn from a location where they are more visible to surrounding traffic, can increase the visibility of stopped bicycle traffic at an intersection, can reduce conflicts between bicycles and motor vehicles, can help mitigate intersection right-turn ("right-hook") conflicts, and can help group bicycles together to clear intersections more quickly. Bike boxes have also been found to prevent cyclist and motor vehicle encroachment into the pedestrian crossing, reducing conflicts with pedestrians at intersections. Bicycle safety performance is improved by increasing the visibility of the cyclist, and by reducing conflicts between motor vehicles making a right turn and the bicycle through movement (also known as "right-hook" conflict).

1520.04(3) Two-Stage Bicycle Turn Boxes

The two-stage bicycle turn box is an area set aside for bicyclists to queue to turn at a signalized intersection outside of the traveled path of motor vehicles and other bicycles. When using a two-stage bicycle turn box to make a left turn, a bicyclist would proceed on a green signal indication to the turn box on the right-hand side of the travel lanes, and then turn left within the turn box and wait for the appropriate signal indication on the cross street to proceed. Two-stage bicycle turn boxes can also be used with a left-side bicycle facility to facilitate bicyclists turning right. In addition to mitigating conflicts inherent in merging across traffic to turn, two-stage bicycle turn boxes reduce conflicts between bicycles and pedestrians and separate queued bicyclists waiting to turn from through bicyclists moving on the green signal.

Two-Stage Bicycle Turn Boxes are permitted throughout the state of Washington under FHWA approval number IA-20.17. Additional information regarding the use and application of Intersection Bike Boxes is found in FHWA Interim Approval IA-20.

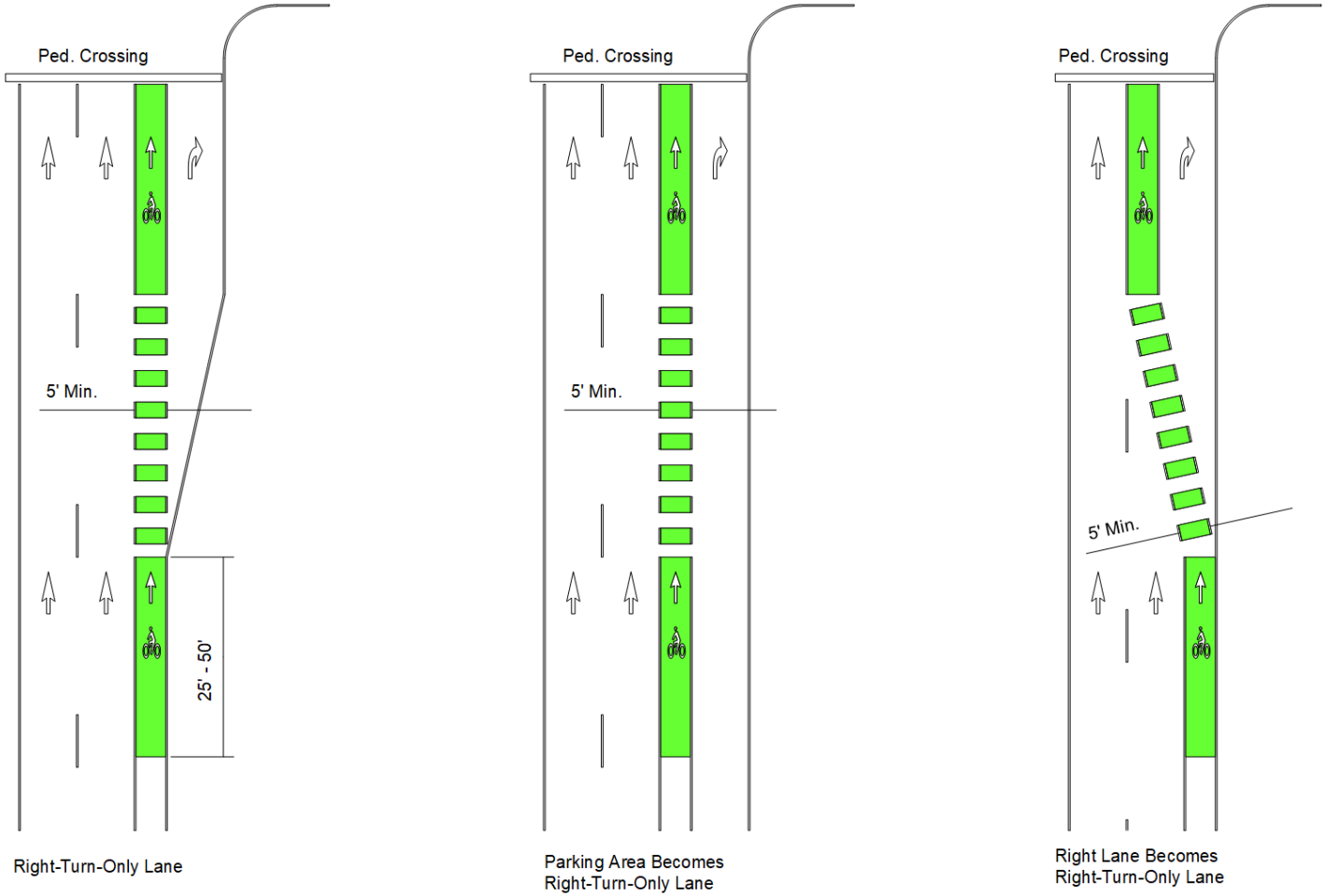
Exhibit 1520-12 shows an example of a two-stage left-turn design for bicycle users (two-stage right-turns are available). This design utilizes a rectangular bike box to enable cyclist queueing at the crossroad signal phase. The bicyclist passes partway through the intersection to access the bike box, and then waits for the crossroad next signal phase to eliminate the bicyclist left turn movement. This treatment's best application is at intersections with significant volumes of motor vehicle traffic or large volumes of left-turn cyclists, or when separated or buffered roadway bicycle facilities are used on the segment.

This treatment can increase safety performance by reducing conflicts between cyclists and other users, segregating motor vehicle and bicycle users, and separating turning cyclists from through cyclists.

The position of the queue box is a critical aspect of this intersection design. Depending on the size and configuration of the intersection, it may present a modal performance trade-off between bicycle mobility and safety versus motor vehicle mobility performance. Use turn simulation software to verify the queue box is outside the crossroad left-turn path, or restrict left turns at the crossroad to accommodate the queue box.

The two-stage turn box should be positioned out of the path of travel of conflicting through traffic proceeding through the intersection on a green light, including other bicycle traffic passing through the intersection on the same signal phase as the bicycle traffic that will be using the turn box. Use turn simulation software to verify the turn box is outside the crossroad left-turn path, or restrict left turns at the crossroad to accommodate the turn box. Similarly, right turns from the crossing road may need to be restricted on red lights if the path of the right turn passes over the turn box. Avoid placing the turn box in a position where it lies between lanes of the crossing street, unless accompanied by a traffic island (e.g., where a right turn lane on the crossing street passes to the right of a traffic island on the approach to the intersection).

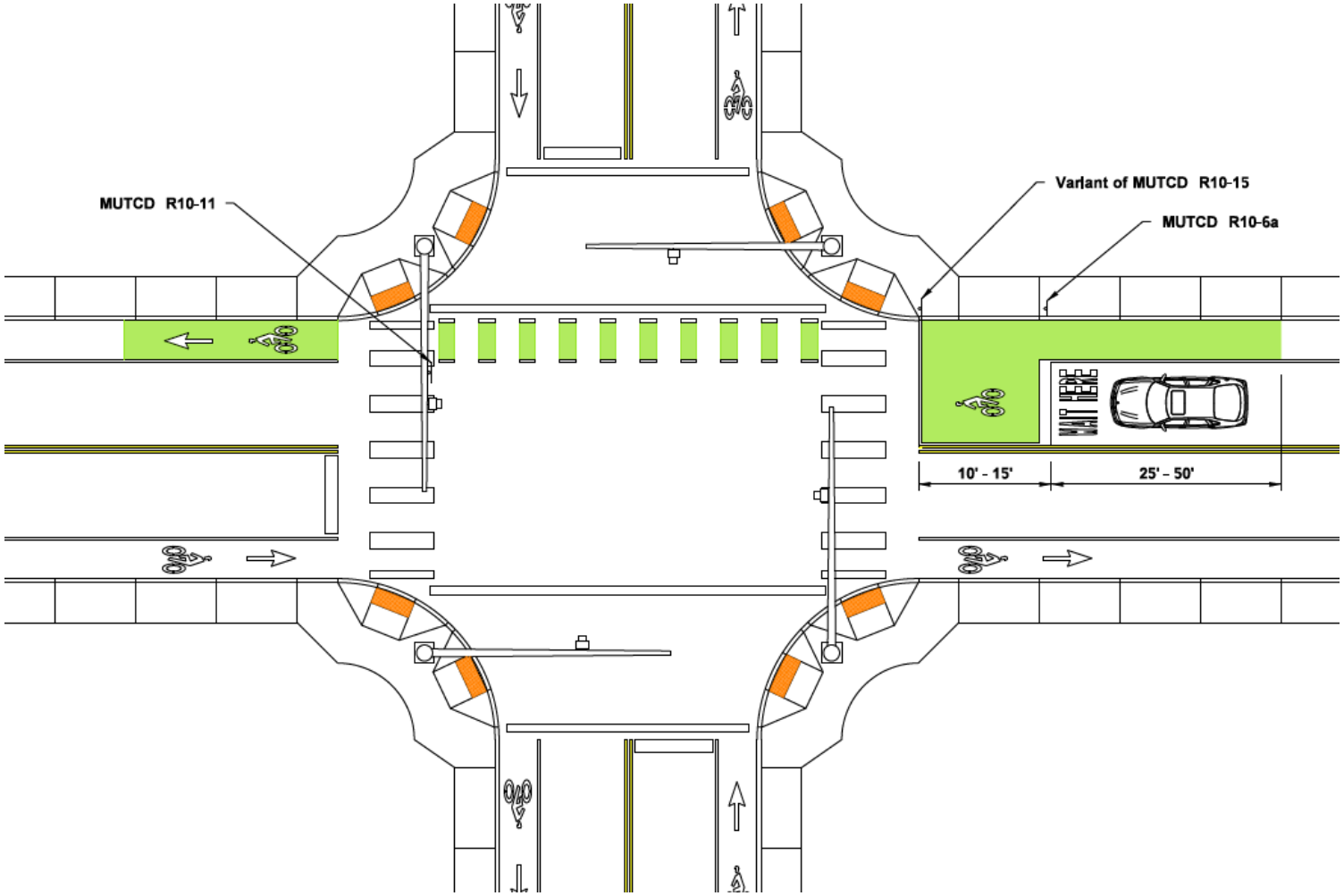
Exhibit 1520-9 Approach Through Lanes



Notes:

- Not to scale and not all dimensions shown.
- See Section 1520.05(1)(a) for criteria when considering the use of green colored pavement markings.
- Consider both the speed of motorized vehicles and bicyclists when determining the length of weave and degree of taper for the bike lane.

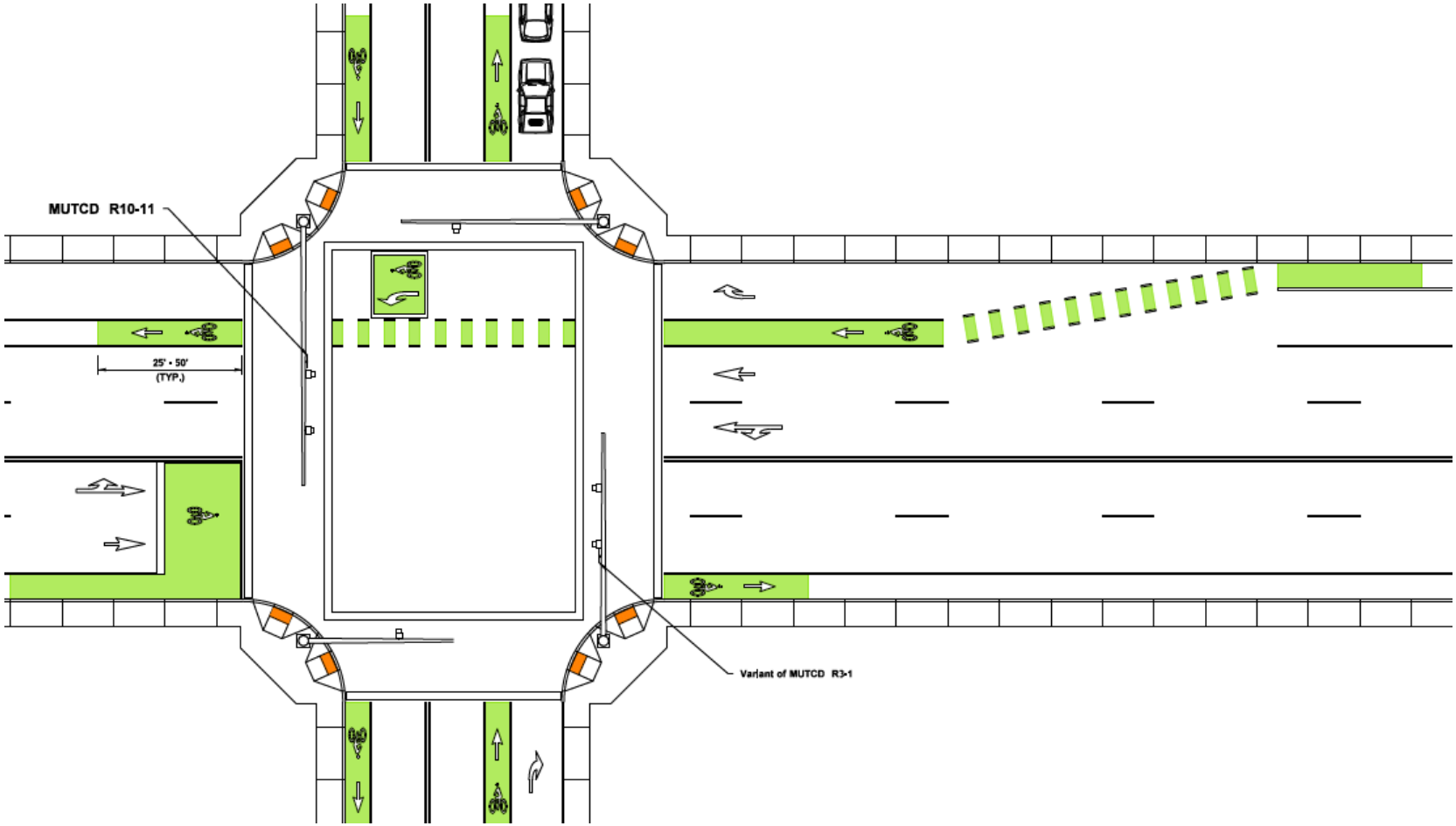
Exhibit 1520-10 Bike Box and Intersection Crossing Markings



Notes:

- This exhibit is intended to illustrate options for bike facilities through intersection areas, and not intended to represent recommended practice for any other features including ADA criteria (See Chapter 1510 for ADA and pedestrian design).
- See Section 1520.05(1)(a) for criteria when considering the use of green colored pavement markings.

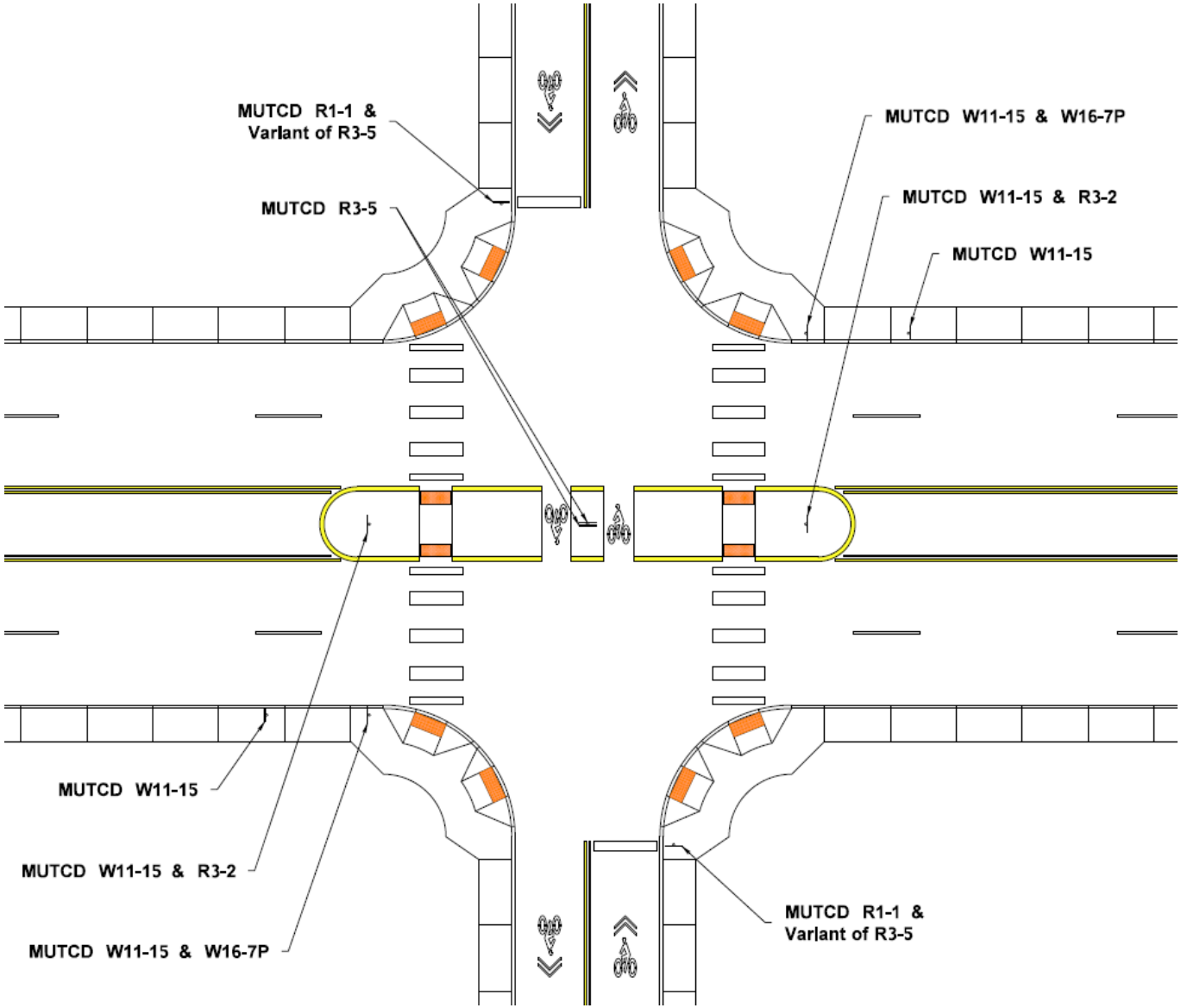
Exhibit 1520-11 Two-Stage Turn Box



Notes:

- This exhibit is intended to illustrate options for bike facilities through intersection areas, and not intended to represent recommended practice for any other features including ADA criteria (See Chapter 1510 for ADA and pedestrian design).
- Consider both the speed of motorized vehicles and bicyclists when determining the length of weave and degree of taper for the bike lane.
- See Section 1520.05(1) for criteria when considering the use of green colored pavement markings.

Exhibit 1520-12 Median Diverter



1520.04(4) Traffic Signals Considerations

Consider bicycle needs and intersection geometry when timing the traffic signal cycle and when selecting the method of detecting the presence of cyclists. Contact the Regional Active Transportation Coordinator and the Region Traffic Engineer for assistance in determining the timing criteria. At a minimum consider safety performance needs, projected bicycle volume, motor vehicle volume, traffic delay, roadway grade and the types of bicyclists using the intersection that may require more time to clear the intersection. Consider the installation of effective loop detectors or other methods of detecting a bicycle within the bike lane (in advance of the intersection) and turn lanes. Select detectors sensitive enough to detect bicycles and use a bike detector symbol to identify detector presence.

Push button actuators may also be used to facilitate movement of bicyclists through a signalized intersection. However, requiring bicyclists to go out of their way to use push button actuators may create motor vehicle driver confusion of the bicyclists intended path through the intersection, as well as inconveniencing the bicyclist. If pushbutton actuators are used, consider their position relative to the bike facility. Pushbutton actuators are more effective when the bike facility is adjacent to the curb (curb extensions at intersections can create this environment). Consider an additional push button actuator for the exclusive use of cyclists when positioning of the actuator is in conflict with ADA design requirements (see Chapter 1510). For additional guidance on signal design, see Chapter 1330.

1520.04(4)(a) Bike Signals

Intersections with separated bike lanes, other complex multimodal intersection treatments or those with a specific baseline need to increase bicycle user safety performance may incorporate a dedicated bike signal head with detection or actuation systems. Bike signal heads further separate modal user movements at intersections, while also allowing for priority to cyclists at intersections. Contact the Region Traffic Engineer for approval for application of this treatment.

At the time of this publication, bike signal faces are subject to requirements of FHWA Interim Approval IA-16.

1520.04(5) Median Diverter

A median diverter prohibits drivers at side street approaches from traveling straight or left at an intersection and drivers on the mainline from turning left while still allowing pedestrian and bicyclists to cross. Median diverters can also provide refuge for pedestrians and bicyclists at a multi-stage crossing. The channelization reduces cut through traffic to create lower vehicular volume facilities and improve pedestrian and bicyclist comfort while also allowing pedestrians and bicyclists to cross one direction of vehicle traffic at a time.

Consider a median diverter when one or more of the following occurs:

- Bike facilities cross a roadway with median restricted left turns.
- Neighborhood greenways
- Used on the cross street.
- There is a performance need to restrict motor vehicle through traffic on a bike route.

Exhibit 1520-12 shows an example of a median diverter designed to accommodate bicyclist through traffic. Design refuge areas between 4 and 5 feet wide (longitudinally with respect to the median), additional width may be needed if high volumes of cyclists exist or are anticipated at the crossing. It is best to provide separate cut-throughs in the median for each direction of bicycle traffic in order to preserve the diverter function of the median.

However, if the bi-directional bicycle movement is accommodated by a single median cut-through, a tubular marker or other treatment may be needed in the center of the cut-through in order to enforce the diverter function of the median.

Consider the types of cyclists and destinations when determining the median refuge length (lateral dimension with respect to the median) to adequately store the bicycle. Consider what locations may need to accommodate the length of a bicycle and trailer. The refuge area is to be in alignment with the approach and receiving lanes of the crossroad. In other situations, the median refuge island may be designed for both pedestrians and bicycle users. When this is the case, design the median refuge predominately for the pedestrian as with midblock crossings (See Chapter 1510), note that additional lateral and longitudinal dimensions will be necessary.

1520.05 Additional Bicycle Design Requirements and Considerations

1520.05(1) Signing and Pavement Markings

Use the MUTCD and the *Standard Plans* for signing and pavement marking criteria. (See Chapter 1020 for additional information on signing and Chapter 1030 for information on pavement markings). Pavement marking and signing options for bicycle facilities are rapidly changing. Situations may exist where unique project concerns may necessitate innovative pavement markings or signage. Consult, as appropriate, the Federal Highway Administration (FHWA) MUTCD website for bicycle facilities for a listing of the current status of bicycle-related pavement markings and treatments:
www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/mutcd/index.cfm

HQ Transportation Operations Division approval is necessary for traffic control devices not currently approved for use through the MUTCD.

1520.05(1)(a) Green Pavement Marking – Criteria for Consideration

Green-colored pavement markings are a traffic control device that's used as a supplemental treatment for standard striping configurations for bicycle facilities. Green colored pavement markings are used to help mitigate the effects of conflicts between cyclists and other design users, areas where other design users are intended to yield to cyclists, provide corridor or network continuity, and help prevent non-bicycle uses (such as vehicle parking).

The use of green colored pavement for bike lanes is permitted throughout the state of Washington under FHWA approval number IA-14.20. Additional information regarding the use and application of green colored pavement for bike lanes is found in FHWA Interim Approval IA-14.

The below criteria are provided when evaluating the need to apply green colored pavement markings.

1. Existing Bike Facilities – retrofitting an existing facility with green pavement may be considered when two or more of the following apply:
    a. It is the engineering judgment of the Region Traffic Engineer
    b. There is an existing traffic conflict area, such as bike lane crossing a motor vehicle turn lane, and there are one or more observed motor vehicle and bicyclist crashes in the last 5 years.
    c. The bike mode is a modal priority (see Chapter 1103), and there is a baseline or contextual need identified associated with increasing safety performance of the mode.
    d. When a bike route intersects a multilane highway, and the crossing is neither signalized nor a roundabout.

2. Changing of Bike Facility Type –consider green pavement markings when one or more of the following apply:
    a. It is the engineering judgment of the Region Traffic Engineer.
    b. A transition from a separated facility through a functional intersection or interchange area necessitates additional delineation to create a clear, visible, predictable and distinct travel path for bike users, and a bike signal or actuation device is not used.
    c. The facility type change does not substantively alter the configuration of an existing conflict area, and there are one or more observed motor vehicle and bicyclist crashes in the last 5 years at that conflict area.
3. New Bike Facility – Generally, the immediate application of green colored pavement on a new bike facility is discouraged until the need for increased safety performance is demonstrated. This said, consider green colored pavement when two or more of the following conditions exist:
    a. It is the engineering judgment of the Region Traffic Engineer
    b. The bike mode is a modal priority (see Chapter 1103), and there is a baseline or contextual need in which the application of green colored pavement markings is needed to meet the stated modal safety performance target (see Chapter 1101).
    c. The bike facility nodes and/or crossings are within 1 mile of activity centers, such as schools, libraries, colleges, etc.
    d. The bike facility crosses a motor vehicle free right turn to or from an interchange ramp.
    e. The bike facility is a bike route or bike boulevard (for definition, see NACTO's *Urban Bikeway Design Guide*).
    f. The state route is also a city street, and the city policy or municipal code requires green colored pavement markings as their standard.
    g. The bike facility is raised and curb separated, and the city engineer requests green colored pavement markings at either crossings or conflict areas.

1520.05(1)(b) Green Pavement Marking – Configuration

Use green pavement markings to supplement the conventional white bike lane striping as required by the MUTCD and FHWA IA-14. Apply green colored pavement markings in conflict areas where bike lanes cross driveways and intersections. If closely spaced conflict areas exist, it may be appropriate to carry solid green into the next conflict area as determined by the Region Traffic Engineer. Additional configurations or styles exist for the application of green colored pavement and can be used with the approval of HQ Transportation Operations Division. Consider specifically when bike route continuity with a local agency's bike facilities is a concern.

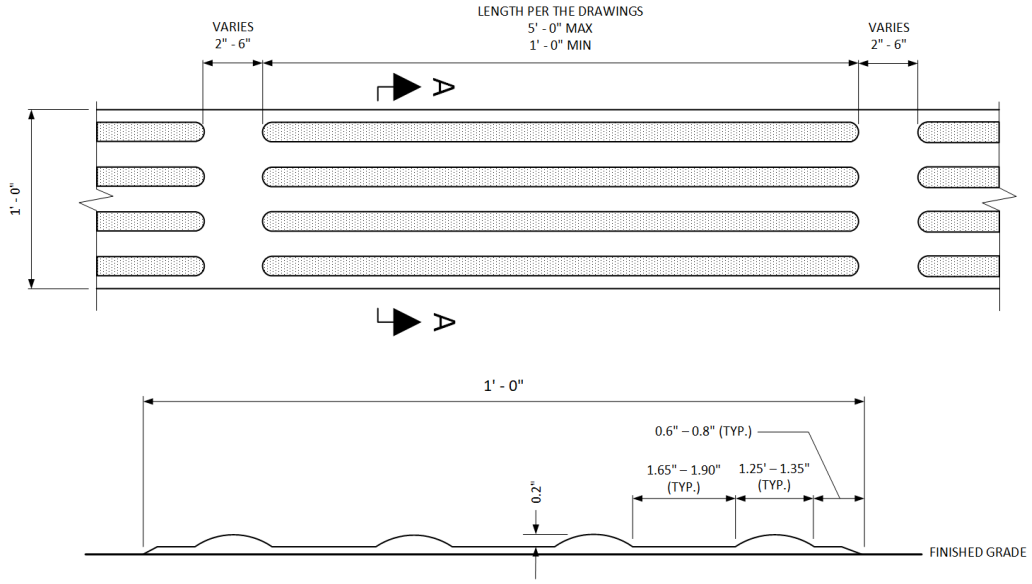
1520.05(2) Detectable Directional Strip

Detectable directional strips are used to define the edge of a dedicated bicycle facility if it is flush with an adjacent pedestrian or shared use facility. The purpose of the detectable directional strip is to provide a detectable edge for low vision or blind pedestrians to identify the limits of the pedestrian or shared use facility. This detectable strip enables the low vision or blind pedestrian to avoid accidentally entering a dedicated bicycle facility such as a bike ramp or a raised separated bike lane.

Detectable directional strips may also be used in conjunction with standard signing to indicate locations of closed pedestrian crossings. At the time of publication this is an emerging best practice; consult with your ASDE if this use is desired.

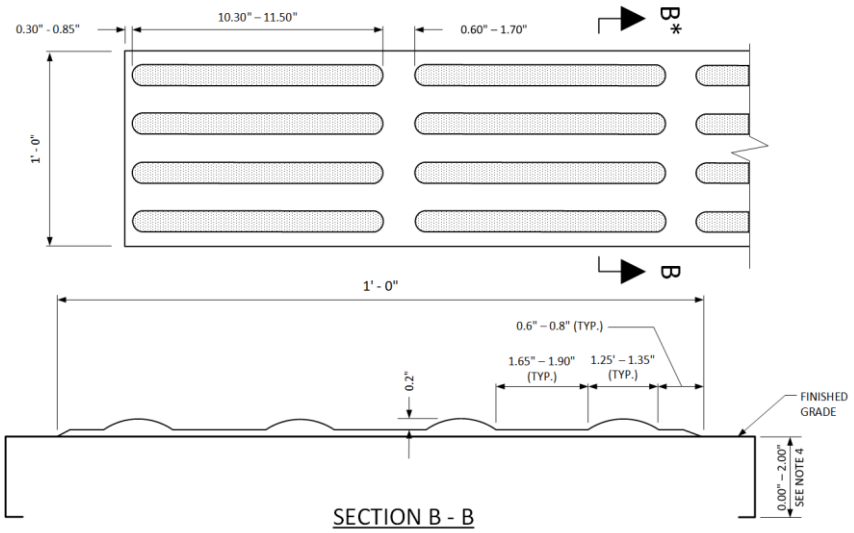
Detectable directional strips should contrast visually (either light-on-dark or dark-on-light) with the adjacent surfaces. Detectable directional strips may be installed either as pre-manufactured cast-in-place tiles, or as a profiled surface applied material such as methyl methacrylate. Both tiles and surface applied materials must conform with all dimension ranges shown on Exhibit 1520-13:

Exhibit 1520-13 Detectable Directional Strip Details (New 2024)



SECTION A - A

DETECTABLE DIRECTIONAL STRIP – SURFACE APPLIED



SECTION B - B

DETECTABLE DIRECTIONAL STRIP – CAST-IN-PLACE

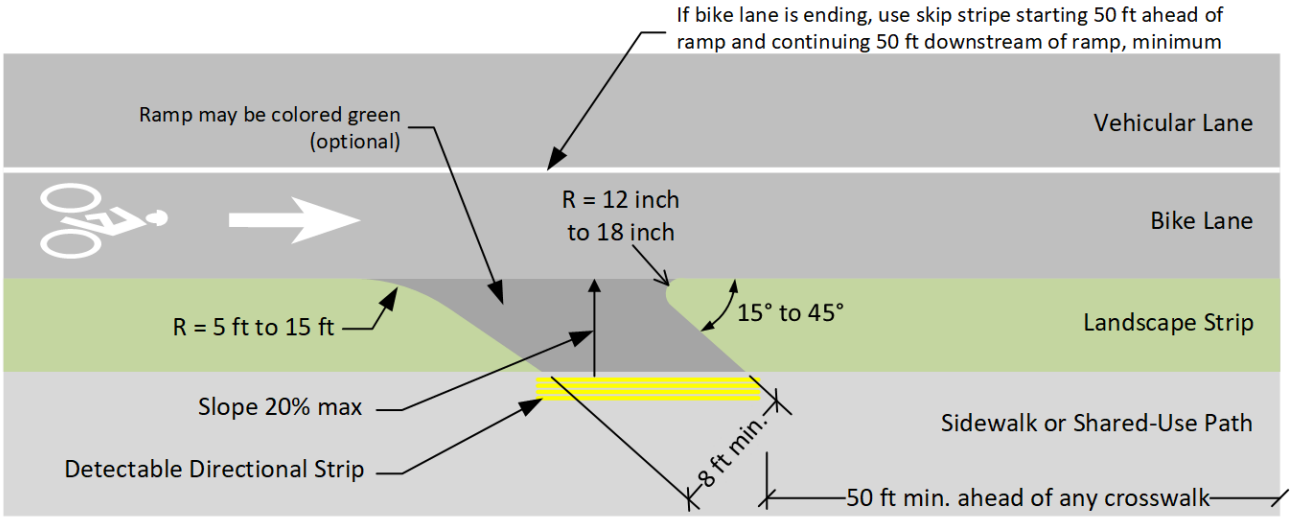
1520.05(3) Bike Ramps (New 2024)

Bike ramps are provided when a bicycle connection is needed between a roadway (with or without bike lanes) and a sidewalk or shared use path. Bike ramps are intended for exclusive bicycle use, and as such they include a detectable directional strip to ensure positive separation from the pedestrian circulation path.

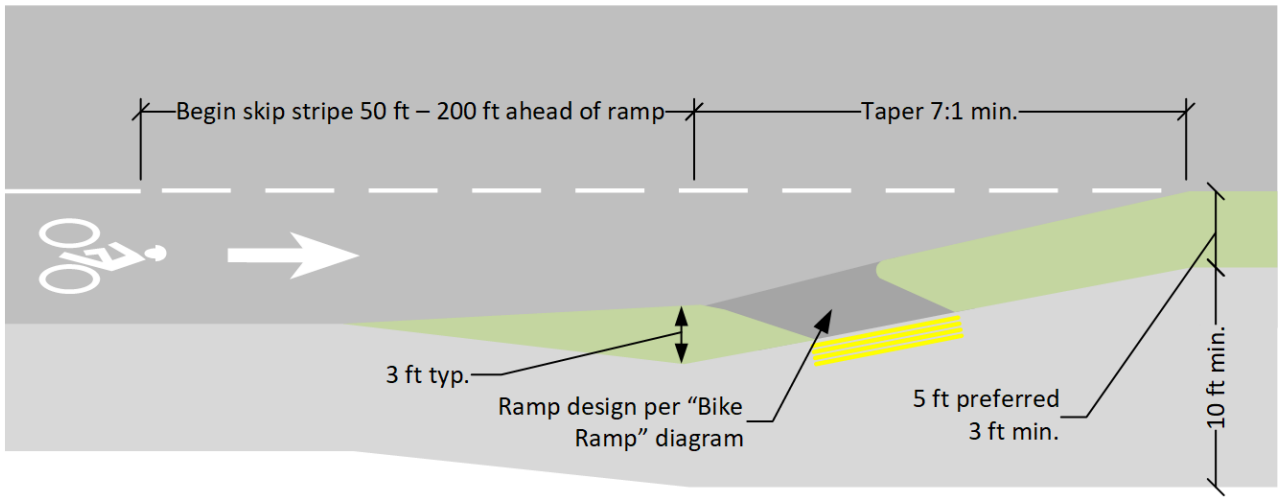
A ramp that serves both bicyclists and pedestrians is not a bike ramp and must be designed as an ADA-compliant curb ramp per Chapter 1510 and Chapter 1515.

Bike ramps shall conform with Exhibit 1520-14.

Exhibit 1520-14 Bike Ramp Details (New 2024)



BIKE RAMP (N.T.S.)



BIKE RAMP AT ROUNDABOUT (N.T.S.)

1520.05(4) Drainage Grates and Manhole Covers

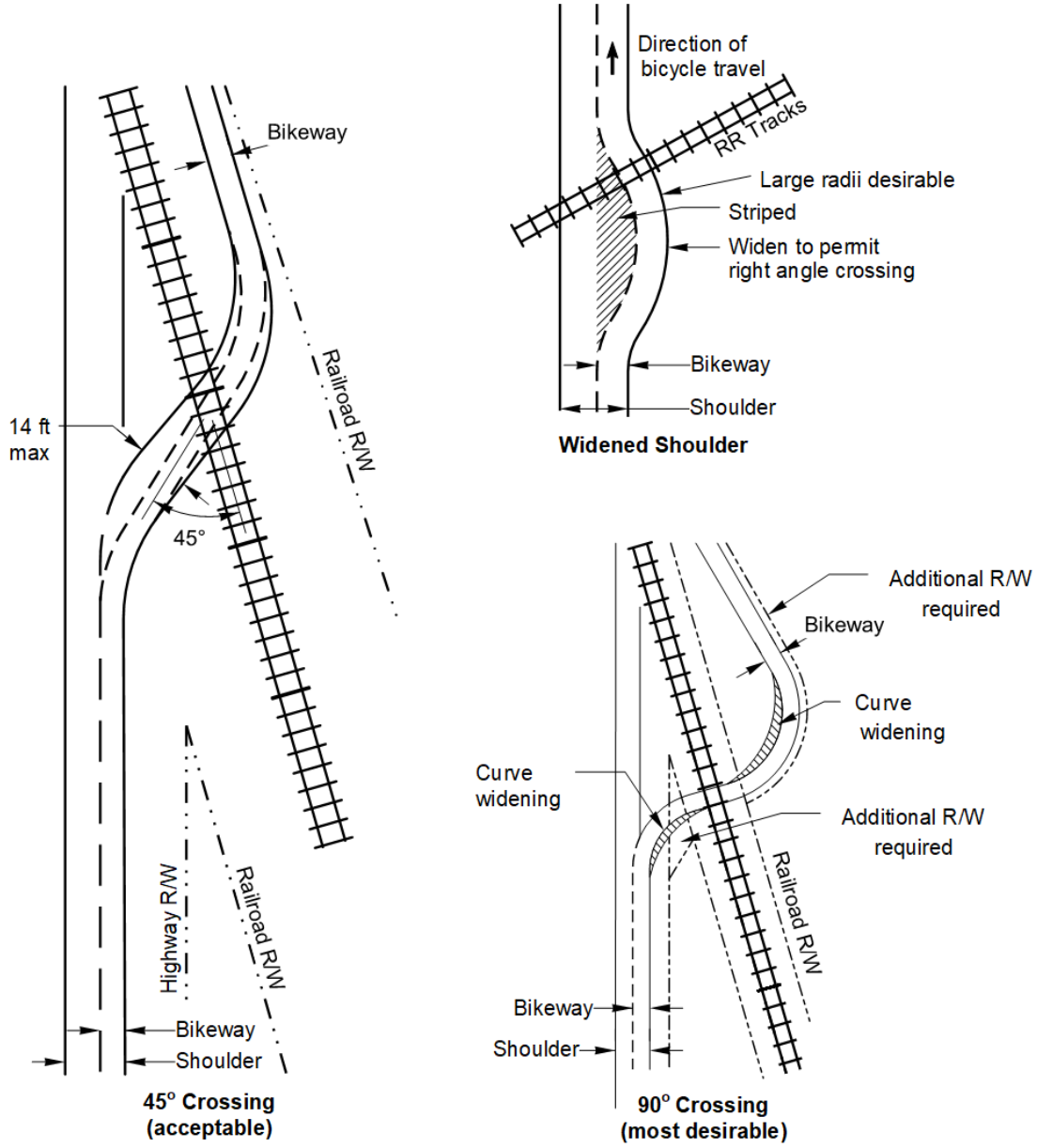
Locate drainage inlet grates and manhole covers to avoid bike lanes. When drainage grates or manhole covers are located in a bike lane, minimize the effect on bicyclists. Consider providing 3 feet of lateral clearance between the edge of a drainage inlet grate and the bike lane stripe, when practicable. Install and maintain grates and manhole covers level with the surface of the bike lane.

Provide drainage inlet grates on bicycle facilities that have openings narrow enough and short enough that bicycle tires will not drop into the grates. Replace existing grates that are not designed for bicycles: a WSDOT vanned grate, herringbone grate, or other grate with an opening 4 inches or less center to center and perpendicular to the direction of travel.

1520.05(5) At-Grade Railroad Crossings

Whenever a bike lane crosses railroad tracks, continue the crossing at least as wide as the bike lane. Use special construction and materials to keep the flangeway depth and width to a minimum. Wherever possible, design the crossing at right angles to the rails. Where a skew is unavoidable, widen the shoulder or bike lane, to permit bicyclists to cross at right angles. Exhibit 1520-15 shows options and details to consider for at-grade railroad crossings.

Exhibit 1520-15 At-Grade Railroad Crossings



Notes:

- Provide additional width at railroad crossings to allow bicyclists to choose their own crossing routes.
- When pedestrians are provided for, design as a shared-use path (see Chapter 1510 and Chapter 1515).

1520.05(6) Barrier, Railing, Fence, or Wall

When the edge of the bike lane is within 5 feet of a vertical object like a barrier, railing, fence, or wall, provide a minimum object height a of 42 inches or more to reduce the potential for bicyclists to fall over the object.

Where bicycle speeds are likely to be high (such as on a downgrade), where high winds are typical (such as on bridges), or where a bicyclist could impact a barrier, railing, fence, or wall at a 25-degree or greater angle (such as on a curve or an angle point in the alignment), a higher 48 in. to 54 in. continuous vertical element may be considered to account for the higher center of gravity of a bicycle rider. If the object is needed for bicycle fall protection because of a vertical drop of 30 inches or greater, or on a bridge the minimum height of the vertical object is 54". If the object is concrete barrier, consider using or converting to single slope barrier to alleviate conflicts with the barrier and bicycle pedal movement that can occur with other barrier designs.

On existing structures, the bridge railing type and height are part of the structure design. Contact the HQ Bridge and Structures Office for additional information. (See Section 1610.07 for further considerations.)

1520.05(7) Transit Considerations

Transit and bicycle facilities can generate unique conflicts because of their typical position within the geometric cross section of the traveled way zone. Where public transport and cycling facilities meet, an integrated design that does not inconvenience either mode is desirable to meet the performance needs of these modes. Consider the following:

- Route the bike lane behind the transit stop location using a raised bike lane or outer separation for that spot location. Ensure the resulting outer separation provided for the transit stop meets the Americans with Disabilities Act (ADA) requirements (see Chapter 1510). Ensure signing and pavement markings are used to alert cyclists and pedestrians of the conflict area created with this design.
- Provide additional delineation in the bike lane to highlight the pedestrian and cyclist conflict, when separated buffered bike lanes and in-lane transit stops are used. Bus loading and other conflict areas will need to meet ADA requirements (see Chapter 1510) and those of the transit agency.
- Where bus operating speeds are low, consider a bus-bicycle shared lane with the transit agency.

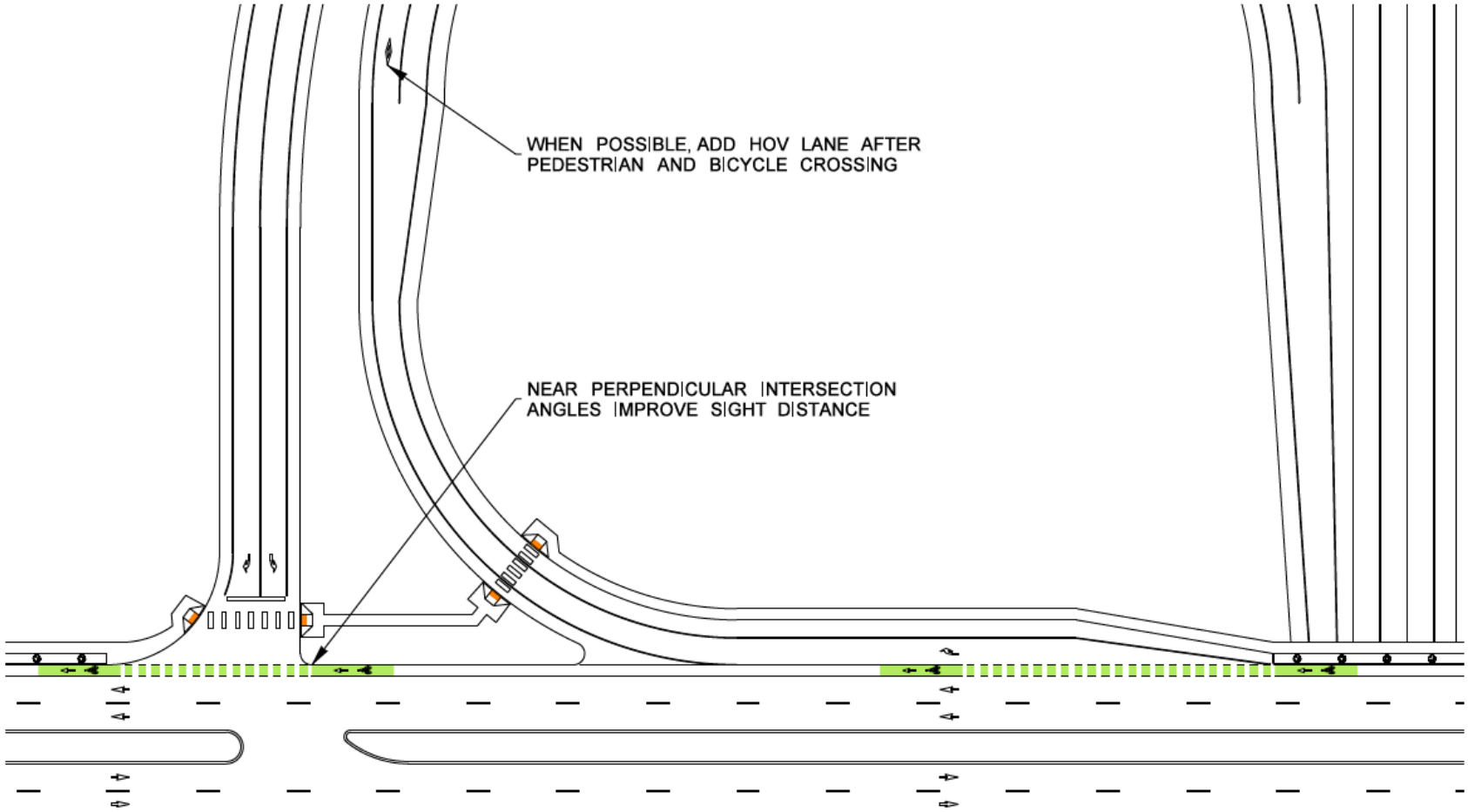
Consider providing bicycle parking facilities near public transportation stops to improve accessibility performance needs.

1520.05(8) Interchange Considerations

Crossing bicycle facilities through an interchange functional area has a greater potential for conflict because of higher travel speeds and lane configurations. Interchange crossings designed in a manner similar to intersection crossings are more compatible to bicyclists. Exhibit 1520-16 through Exhibit 1520-19 illustrate design options for bike facilities design through an interchange functional area. Interchanges can be special environments to evaluate the safety and mobility needs of the bike mode. The specific challenge is often the inclusion of motor vehicle free right turns to or from interchange ramps. The preferred configuration for bicycle safety performance at an interchange will not provide the motor vehicle free right turn and will realign ramps to intersect perpendicular with the crossroad (see off-ramp terminal in Exhibit 1520-17).

In some cases, it is possible to align the bike facility to cross an off-ramp with a more direct path for the bike crossing (see Exhibit 1520-19). Breaking up the workload for the motor vehicle driver is one advantage of this configuration, similar to pedestrian treatments common in roundabout design. Shortening the crossing distance required for the bicyclist is another advantage with this configuration. Consider the inclusion of Rectangular Rapid Flashing Beacons (RRFB) or a refuge island when there are multiple travel lanes. This configuration may also require additional speed management (see Section 1103.05(1), signing or striping treatments on the ramp.

Exhibit 1520-16 Bike Facility Crossing On- and Off-Ramps

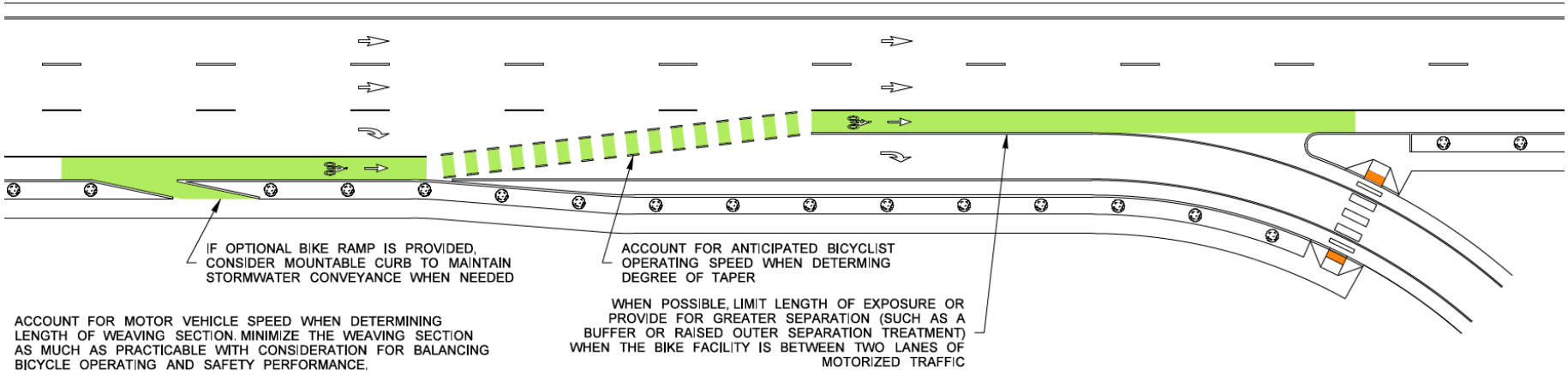


Notes:

Adapted from the Draft Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges, ITE, unpublished.

This exhibit is intended to illustrate options for bike facilities through interchange areas, and not intended to represent recommended practice for any other features including ADA criteria (See Chapter 1510 for ADA and pedestrian design).

Exhibit 1520-17 Bicycle Facility Crossing Single-Lane On-Ramp



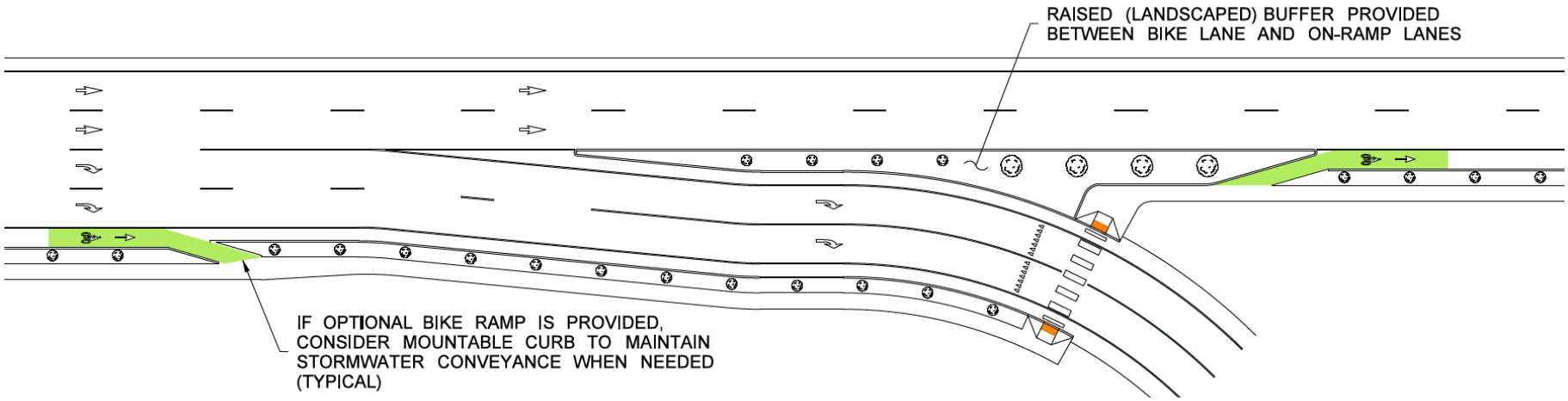
Notes:

Adapted from the Draft Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges, ITE, unpublished.

This exhibit is intended to illustrate options for bike facilities through interchange areas, and not intended to represent recommended practice for any other features including ADA criteria (See Chapter 1510 for ADA and pedestrian design).

Consider both the speed of motorized vehicles and bicyclists when determining the length of weave and degree of taper for the bike lane.

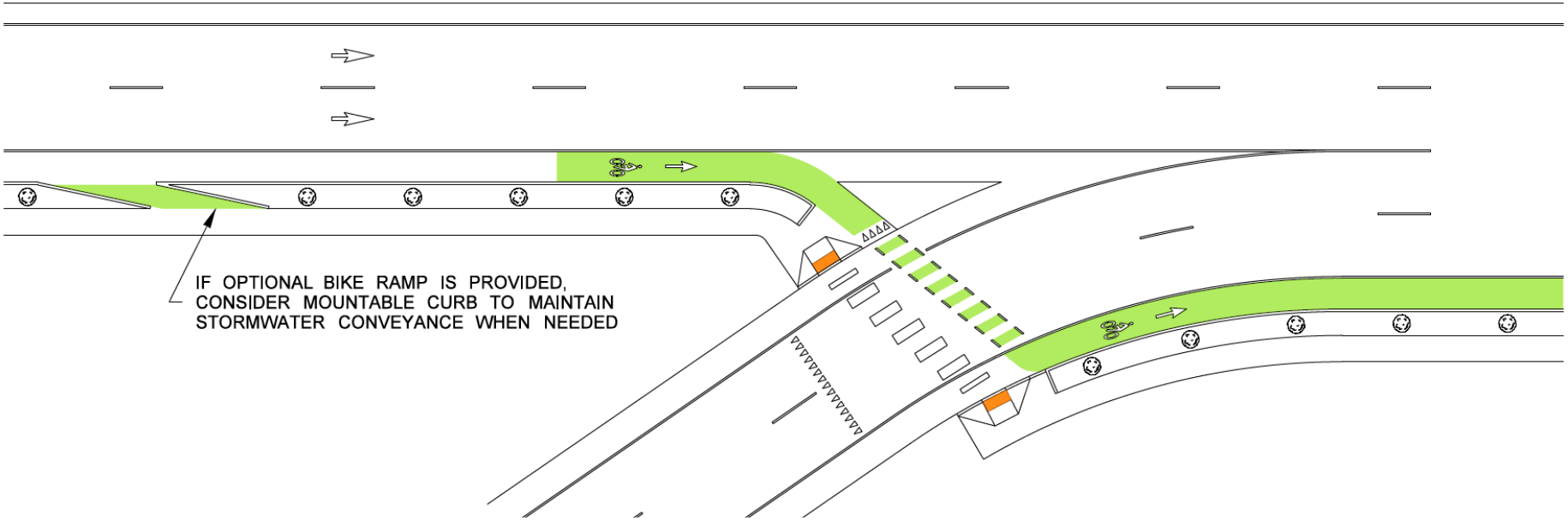
Exhibit 1520-18 Bicycle Facility Crossing Option for Dual Lane On-Ramp Configuration



Notes:

- Adapted from the Draft Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges, ITE, unpublished.
- This exhibit is intended to illustrate options for bike facilities through interchange areas, and not intended to represent recommended practice for any other features including ADA criteria (See Chapter 1510 for ADA and pedestrian design).

Exhibit 1520-19 Bicycle Facility Crossing Option for Dual Off-Ramp



Notes:

- Adapted from the Draft Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges, ITE, unpublished
- This exhibit is intended to illustrate options for bike facilities through interchange areas, and not intended to represent recommended practice for any other features including ADA criteria (See Chapter 1510 for ADA and pedestrian design).

1520.05(9) Sight Triangles at Intersections and Conflict Areas

The visibility of all users is to be evaluated at intersections. Identifying sight triangles can help determine the optimal configuration of bicycle and pedestrian crossings. See Chapter 1310 for determining sight distance at an intersection, and Chapter 1340 for sight distance at road approaches near midblock crossings. Visibility is impacted by both speed and the configuration of the intersection. There are multiple benefits in multimodal intersection configurations to proactively manage motorized vehicle speeds (see Chapter 1103 for speed reducing traffic calming treatments) at intersection locations, rather than widening the intersection and/or removing elements from the roadside or streetside zone to obtain the needed sight distance. The primary objective at intersections and interchanges is to create a clear, distinct, and predictable travel path for all users through the intersection.

1520.05(10) Maintenance Considerations

Consult with all maintenance jurisdictions for partnering opportunities and clearly understand which jurisdiction will be responsible for specific elements of the bike facility maintenance. Some maintenance jurisdictions may be better equipped to maintain the bike facility than others. Certain bike facilities, like the raised and curb separated, clearly fall within the jurisdictional authority of an incorporated city (see Chapter 1103 and Chapter 1600 for more information). For other facility types it may be more advantageous to discuss the capabilities of each maintenance jurisdiction and develop a maintenance agreement (see Chapter 301).

It is important to obtain information from maintenance regarding the facility type and dimensioning and discuss methods for maintaining the facility. The Maintenance Owner's Manual (See Chapter 301) is suggested to contain frequency, equipment needs and material types necessary for the continual maintenance of facility features, including but not limited to:

- Sweeping
- Snow removal
- Striping and pavement markings
- Signing

1520.06 Documentation

Document the type of bike facility employed or changed in section 5 of the Basis of Design. Dimensions chosen for the facility are documented on design parameter sheets.

1520.07 References

1520.07(1) Federal/State Laws and Codes

Americans with Disabilities Act of 1990 (ADA)

23 Code of Federal Regulations (CFR) Part 652, Pedestrian and Bicycle Accommodations and Projects

Revised Code of Washington (RCW), Chapter 35.75, Streets – Bicycles – Paths

http://apps.leg.wa.gov/rcw/default.aspx?cite=35.75

RCW 46.04, Definitions

http://apps.leg.wa.gov/rcw/default.aspx?cite=46.04

RCW 46.61, Rules of the road

http://apps.leg.wa.gov/rcw/default.aspx?cite=46.61\

RCW 46.61.710, Mopeds, electric-assisted bicycles – General requirements and operation

http://apps.leg.wa.gov/rcw/default.aspx?cite=46.61.710

RCW 47.26.300, Bicycle routes – Legislative declaration

http://apps.leg.wa.gov/rcw/default.aspx?cite=47.26.300

1520.07(2) Supporting Information

Urban Bikeway Design Guide, NACTO, current edition (WSDOT endorsed)

http://nacto.org/publication/urban-bikeway-design-guide/

Guide for the Development of Bicycle Facilities, AASHTO, current edition

https://bookstore.transportation.org/collection_detail.aspx?ID=116

Separated Bike Lane Planning and Design Guide, FHWA, current edition

www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/page00.cfm

Bicycle Parking Guidelines, Association of Pedestrian and Bicycle Professionals, current edition

www.apbp.org/?page=Publications

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA; as adopted and modified by Chapter 468-95 WAC "Manual on uniform traffic control devices for streets and highways" (MUTCD)

www.wsdot.wa.gov/publications/manuals/mutcd.htm

Standard Plans for Road, Bridge, and Municipal Construction (Standard Plans), M 21-01, WSDOT

www.wsdot.wa.gov/publications/manuals/m21-01.htm

Understanding Flexibility in Transportation Design – Washington, WSDOT, 2005

www.wsdot.wa.gov/research/reports/600/638.1.htm

Selecting Roadway Design Treatments to Accommodate Bicycles, USDOT, Federal Highway Administration (FHWA), 1994

NCHRP Report 766: Recommended Bicycle Lane Widths for Various Roadway Characteristics, Transportation Research Board of the National Academies, 2014

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_766.pdf

NCHRP Report 500 Volume 18: A Guide for Reducing Collisions Involving Bicycles, Transportation Research Board of the National Academies, 2006

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_500v18.pdf

Four Types of Cyclists?, Dill, Jennifer, and Nathan McNeil, Transportation Research Record: Journal of the Transportation Research Board 2387.1 (2013): 129-138.

Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges, ITE, unpublished.

http://ecommerce.ite.org/IMIS/ItemDetail?iProductCode=RP-039

Montgomery County Bicycle Planning Guidance, Montgomery County Department of Transportation, 2014.

www.montgomeryplanning.org/transportation/bikeways/documents/FINALBicyclePlanningGuidance.pdf

Separated Bike Lane Planning and Design Guide, Massachusetts Department of Transportation (MassDOT), 2015

Separated Bike Lane Planning & Design Guide | Mass.gov