Fig. 3-1: *A typical striped bicycle lane on a section of roadway without parking.*

3 Bicycle Lanes

A bicycle lane is a portion of the roadway designated for exclusive or preferential use by bicyclists. Bicycle lanes are always one-way facilities and are identified with pavement markings and signing. On two-way streets, a one-way bicycle lane should be provided on each side. Bicycle lanes are the preferred bicycle facility on higher volume urban and suburban roadways (i.e., collector and arterial streets) but are seldom justified on residential streets.

Among the benefits of bicycle lanes are:

- *Defining a space for bicyclists to ride;*
- *Helping less experienced bicyclists feel more confident and willing to ride on busier streets;*
- *Reducing motorist lane changing when passing bicyclists;*
- *Guiding bicyclists through intersections;*
- *Increasing bikeway visibility in the transportation system.*

Secondary benefits include:

- *Reducing the number of bicyclists using the sidewalk or gutter pan;*
- *Increasing the space between pedestrians and motorists (on streets without parking);*
- *Improving sight distances;*
- *Increasing effective turn radii at driveways and intersections;*
- *Providing temporary space for disabled motor vehicles or snow;*
- *Possibly reducing motor vehicle speeds.*

Note: Photos are categorized by their content:

YES — *Positive example*

OK — *Special case example*

NO — *Not recommended.*

Fig. 3-2: Bicycle lanes should be one-way facilities, carrying traffic in the same direction as the adjacent motor vehicle travel lanes.

Fig. 3-3: Two-way bike lanes make it harder for bicyclists and motorists to see each other and increase conflicts at intersections and driveways.

3.1 One-way vs. two-way bicycle lanes**

On two-way streets, bicycle lanes should always carry traffic in the same direction as the adjacent motor vehicle flow. Two-way bicycle lanes on one side of the roadway (Fig. 3-3) are unacceptable for the following reasons:

- *Two-way bicycle lanes require one direction of bicycle traffic to ride against traffic, contrary to rules of the road.*
- *Wrong-way bicycling is a major cause of bicycle-motor vehicle crashes and should be discouraged at every opportunity;*
- *If the bicycle lanes end, bicyclists going against traffic may continue to travel on the wrong side of the street;*
- *Bicyclists may also travel on the wrong side of the street in order to reach the bicycle lanes;*
- *On the other hand, bicyclists riding on the correct side of the road may perform unusual crossing maneuvers to use the two-way bicycle lanes;*
- *Motorists entering or leaving the roadway may not look for the "wrong-way" bicycle traffic.*

***For information on two-way paths parallel to (but off of) the roadway, see Section 4.3.1.*

Fig. 3-4: The proper location for a bicycle lane is to the left of the parking lane. In this location, bicyclists and motorists can clearly see each other.

3.2 Bicycle lane location

Bicycle lanes and parking: Where parking is prohibited, bicycle lanes should be placed next to the curb or edge of the roadway. There are exceptions, like where a bike lane is located to the left of a bus-only lane. Where parking lanes are provided, bicycle lanes should be placed between the parking lanes and the motor vehicle travel lanes.

Bicycle lanes between the curb and the parking lane should not be considered. Such bicycle lanes provide poor visibility for bicyclists and turning motorists at intersections and driveways. They trap bicyclists and provide no escape route in case of danger. For example, when a passenger in a parked car opens the door, the bicyclist has no place to go. And they make it impossible for bicyclists to make normal left turns.

Fig. 3-5: A bicycle lane to the right of parked cars creates sight obstructions, keeping bicyclists and turning or crossing motorists from seeing each other. This is particularly dangerous at intersections and driveways (see arrow). In addition, crossing pedestrians may not notice – or be noticed by – bicyclists.

Fig. 3-6: In special situations, bicycle lanes on the left (like the one shown) can work. But in most situations, bicycle lanes on one-way streets should be on the right, rather than the left.

Bicycle lanes on one-way streets: In general, bicycle lanes should be on the right side on one-way streets. This is where motorists expect to see bicyclists and is consistent with normal bicyclist behavior. For example, most bicyclists learn to look over their left shoulder for traffic, rather than their right. And right turns are more easily accomplished when one is close to the right side of the roadway.

Fig. 3-7: Part-time bicycle lanes are not recommended except in very special situations. And they require vigilant enforcement.

In certain circumstances, however, a bicycle lane on the left may decrease the number of conflicts (e.g., those caused by heavy bus traffic). Furthermore, there are far fewer people exiting cars from the passenger doors of parked cars. Such situations should be evaluated on a case-by-case basis. Certainly one item that should be considered is the frequency of left turns by motorists compared to right turns.

Part-time bicycle lanes: Part-time bicycle lanes are those where parking is allowed during part of the day; at other times, parking is prohibited and the lanes are used by bicyclists. Such bike lanes are not encouraged for general application, and should only be used in special circumstances.

For example, they might be appropriate if the vast majority of bicycle travel occurred during the hours of the parking prohibition. However, part-time bike lanes should only be considered if there is a firm commitment to enforce the parking prohibition. Bike lane striping should be accompanied by regulatory signs identifying the hours the bike lanes are to be in effect.

Peak hour wide lane: an alternative to part-time bicycle lanes
Providing a peak hour parking prohibition in wide outside lanes, rather than designating part-time bicycle lanes, may be preferable in many cases. During the peak hour, bicyclists and motorists share the extra width in the default wide lane. During off-peak hours, a default bike lane exists to the left of the parking.

Contraflow bicycle lanes: Contra-flow bicycle lanes accommodate bike traffic moving in the opposite direction from the rest of traffic. They are seldom used, and are not necessarily appropriate on a two-way street. However, on some one-way streets they may be suitable where:

- *They provide a substantial reduction in out-of-direction travel;*
- *Currently, there is significant wrong-way riding as a result of the added trip lengths;*
- *They provide direct access to high-use destinations;*
- *There are few intersecting streets, alleys, or driveways on the side of the contra-flow lane;*
- *Bicyclists can safely and conveniently enter and leave the contra-flow lane.*

Contra-flow bicycle lanes are sometimes found on arterial roadways (fig. 3-8). In addition, a contra-flow lane may also be appropriate on local access or residential streets that have been made one-way to calm traffic or otherwise restrict motor vehicle access.

Fig. 3-8: A contra-flow bicycle lane on a one-way street protected by a barrier because of high volumes of opposite-flow motor vehicle traffic. On the far side of the street, there is another bike lane for bicyclists going the same direction as traffic.

Fig. 3-9: Providing side street signage is an important element in creating a safe contra-flow bicycle lane. Note that the contraflow bike lane street is not signed as a one-way street. Motorists are simply prohibited from turning the wrong way.

For design purposes, it is useful to envision the candidate street as a two-way street with motor vehicles prohibited in one direction. This approach can help the designer determine where the contra-flow lane should be and how it should be marked. The following important design features should be incorporated:

- *Place the contra-flow bike lane on the far side of the street (to the motorists' left);*
- *Separate the contra-flow lane from the other travel lanes with a barrier (fig. 3-8) or a wide double yellow line.*
- *Post signs at intersecting streets and major driveways telling motorists to expect two-way bicycle traffic (fig. 3-9).*
- *Install appropriate traffic signs and signals for the contra-flow bicycle traffic.*
- *Use proper bike lane markings, but it is especially important to use directional arrows and occasional signage to reduce wrong-way riding.*
- *Determine in advance how the lane will be swept and cleared of snow.*

Because of the potential for serious safety problems associated with contra-flow bike lanes, they should only be used in well-chosen circumstances. They should also be carefully designed and evaluated following installation. See AASHTO's *Guide for the Development of Bicycle Facilities* for additional information.

Figure 3-10: With few exceptions (e.g., contraflow bicycle lanes), barrier-delineated bicycle lanes create more problems than they are intended to solve. For example, they hamper bicycle and motor vehicle turns and motorists exiting from a cross street or driveway can easily block a bicyclist's passage.

Barrier-delineated bicycle lanes: Barrier-delineated bicycle lanes were popular in the early days of bicycle planning and design (fig. 3-10). However, their popularity has largely waned over the past several decades. This is particularly the case in communities with active bicycle facilities programs. With few exceptions, raised barriers (e.g., pin-down curbs, raised traffic bars, and asphalt concrete dikes) should not be used to delineate bicycle lanes, for a number of reasons:

- *Raised barriers restrict the movement of bicyclists needing to enter or leave bike lanes (e.g., to make left turns);*
- *A motorist entering from a side street (fig. 3-10) can effectively block the lane;*
- *They make it impossible to merge the bicycle lane to the left of a right-turn lane;*
- *They are often used incorrectly by wrong-way bicyclists;*
- *They can be considered a hazard that can catch a bicyclist's pedal or front wheel, especially in narrow bike lanes;*
- *They use space that could be included in the bicycle lane;*
- *They collect debris and increase maintenance needs, as well as impede standard maintenance procedures, including snow removal.*

Roadway Median Bikeways and Sidewalk Bikeways
For information on bikeways in divided roadway medians, see Section 4.3.3. For information on sidewalk bikeways, see Section 4.3.1.

3.3 Bicycle lane surface quality

Bicycle lanes should be paved to the same standards as adjacent traffic lanes. The surface should be smooth and free of potholes and the pavement edge should be uniform, whether it meets a shoulder or a gutter pan. There should be no ridges or gaps that could catch a bicycle wheel.

Fig. 3-11: Serious pavement cracks in a bicycle lane can cause a bicyclist's front wheel to turn, resulting in a crash.

Concrete and asphalt; In concrete construction, there should be no longitudinal joints in the bike lane or at the lane stripe, where they can be hidden by the paint. Joints should be saw-cut. This is especially important if a joint is placed between a bike lane and travel lane. The painted lane line should be placed on either side of the joint, ensuring the bike lane has a 5-ft (1.5m). width, measured from the curb face. With asphalt construction, the paved surface should continue smoothly to where it meets gutter pan level; pavement overlays should not be stopped at the bike lane stripe.

Grates and utilities: In addition, manholes, drainage grates, and utility covers should be located outside the bicycle lane because of the difficulty maintaining adequate tolerances. Grates should be contained fully within the standard 2-ft. (0.3m) gutter pan.

Maintenance: Cracks, potholes, and other imperfections should be repaired to an acceptable standard as part of routine maintenance procedures. Hazards for bicyclists are especially pronounced for cracks and-faults that run in bicyclists' direction of travel. In addition, since bicycle lanes are not "swept" by the passing motor vehicles, they tend to collect debris. For this reason, sweepers should pay extra attention to the bike lane to keep it clear. Depending on the season, the particular roadway, and its surrounding environment, sweeping schedules may need to be adjusted to hit a particular bike lane more often than otherwise called for.

At the same time, proper construction can eliminate some of these problems from the start. For example, paving into unpaved driveways and cross streets can reduce the amount of debris brought up onto the bike lane by cross traffic.

In some communities, bicyclists ride through the winter. In other communities, they might like to if the bike lanes were clear. While experienced commuters may use special "studded" tires and often must "take" the travel lane, many bicyclists are reluctant to do so. It is understandable that during a storm, snow may be plowed into the bicycle lane. However, the bicycle lane should not be used for long-term snow storage. The snow should be removed quickly.

***Note:** For more on maintenance issues, see Appendix A.*

3.4 Bicycle lane width

Curbed asphalt street, no parking: On a curbed asphalt street without parking, the standard clear width of a bicycle lane is 4 ft. (1.2 m), as measured from the inside of the stripe to the joint line with the gutter pan (fig. 3-12). Depending on whether a 1 ft. or 2 ft. (0.6 m) gutter pan is used, the total width from face of curb to the inside of the bicycle lane stripe would be either 5 or 6 ft. (1.5 - 1.8 m).

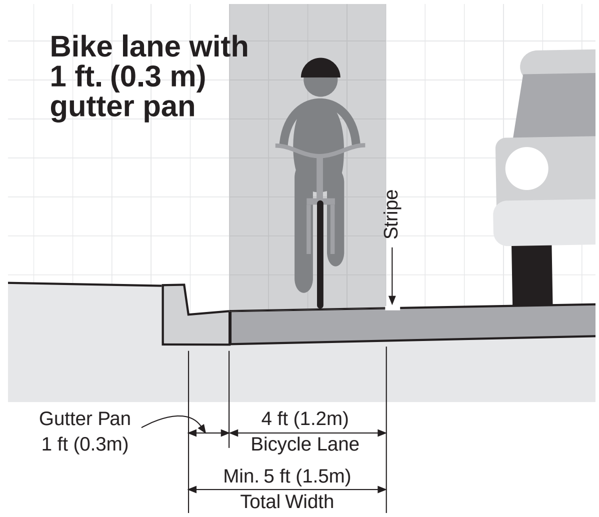


Figure 3-12: A bicycle lane next to the curb on an asphalt roadway may be 4ft. wide. However, this should not include the gutter pan.

On an asphalt roadway, the width of the gutter pan is not included within the bicycle lane measurement because the gutter pan is not considered usable space. There are at least six reasons for this:

- *Riding in the gutter increases the likelihood that a bicyclist will hit a pedal on the curb;*
- *Joint lines between the roadway and gutter pan are often uneven and can cause a bicyclist to crash;*
- *Debris tends to collect in the gutter, having been swept there by passing motor vehicles;*
- *Drainage grates are most often located in the gutter pan;*
- *The gutter pan may have a greater cross slope than the rest of the roadway; this may cause problems for adult tricycles;*
- *A bicyclist riding close to the curb is less likely to be seen by motorists at cross streets and would have a more difficult time taking evasive action.*

Figure 3-13: A drain inset into a 1ft. curb head provides extra space in tight places.

Where space is tight but drainage requirements dictate an 18 in. (0.45 m) drain, a special 1 ft. (0.3 m) curbhead may be used with a 1 ft. (0.3 m) gutter pan (fig. 3-13).

At drain locations, the width of the curb head is reduced to 6 in. (0.15 m) to make room for the grate.

Curbed concrete street, no parking: On a concrete roadway with integral gutter and travel lane (Fig. 3-14), the distance from face of curb to the inside of the bicycle lane stripe should be a minimum of 5 ft. (1.5 m). While there is no joint line between the roadway and the gutter, bicyclists will still need a “shy distance” to the curb face, for safety reasons.

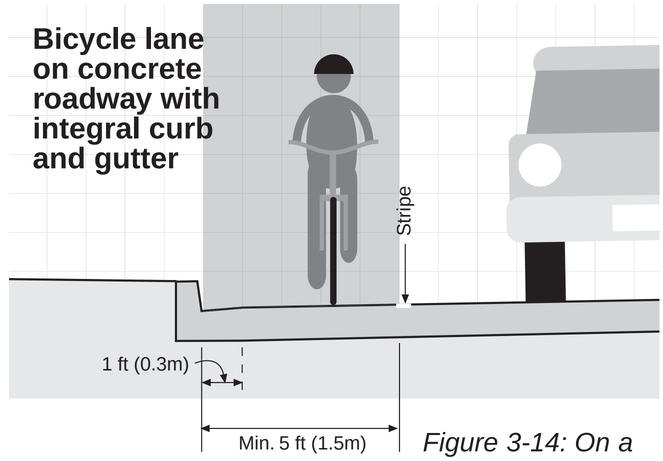


Figure 3-14: On a concrete roadway with integral gutter and travel lane, there is no gutter pan joint line. If a joint needs to be placed, it is best to locate it 1 ft. (0.3m) from the curb face.

Wider bicycle lane situations: Wider bicycle lanes may be desirable in high use areas, on higher volume/higher speed facilities (≥40 mph) or where wider shoulders are warranted. Additional width is also desirable when the adjacent traffic lane is less than 11 ft. wide. In such conditions, motorists may drive closer to the bicycle lane and a wider bicycle lane can help keep the separation. Adequate marking or signing should be used so that the bike lanes are not mistaken for motor vehicle travel lanes or parking areas.

Figure 3-15: Unlike bicycles, motor vehicles are not affected by the joint between the roadway and the gutter pan. As a result, the gutter pan is included when determining the width of the parking lane.

Curbed street with parking: As mentioned previously, on a curbed street with parking, the bicycle lane should be on the roadway side of the parking (Fig. 3-15). The standard width of a bicycle lane in such conditions is 5 ft. (1.5 m). This width allows a bicyclist to stay to the left in case someone in a parked car opens the door (Fig. 3-17). If parking volume is substantial or turnover high, 1 to 2 ft. (0.3 - 0.6 m) of additional width is desirable. An equally important dimension is the width of the parking lane — typically 8 to 10 ft. (2.4 m - 3 m).

Figure 3-16: Typical dimensions for a bicycle lane next to a parking lane.

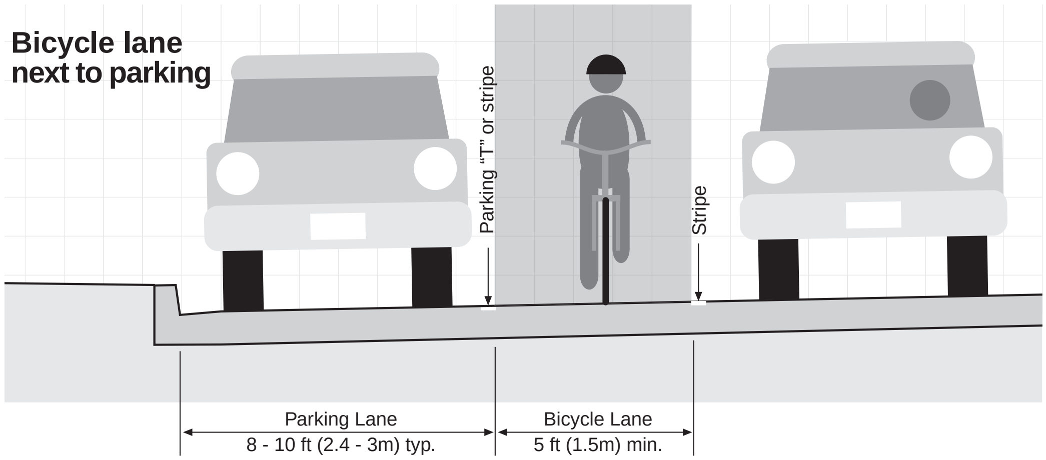


Fig. 3-17: An otherwise adequate bicycle lane next to a very narrow parking lane.

It may be tempting to narrow the parking lane to create more space for the bicycle lane. However, this approach can produce unintended results. Striping a narrow parking lane does not reduce the width of parked motor vehicles (Fig. 3-17). And they may take up part of the bike lane in the process. Narrowing the parking lane too much will put the bicyclist closer to the side of the parked car, leaving less clearance to get around an opening door. In those cases where the parking lane is narrowed to 7 ft. wide to make room for a wider bike lane, the recommended minimum width for the bike lane is 6 ft.

Overall, the total width of the bicycle and parking lanes should be a minimum of 13 ft. (3.9 m). In exceptional circumstances, a minimum combined width of 12 ft. (3.6 m) may be justified. This is acceptable in situations where the bike lane is adjacent to an 11 ft. or wider travel lane and there is low parking usage or where there is low to very low parking turnover. In this situation a 5 ft. wide bike lane can be used next to a 7 ft. wide parking lane.

Combining bicycle lanes and parking lanes without painting parking "T"s or striping between the two is found in some communities. However, the undesignated space may look like a motor vehicle lane. As a result, it may be preferable to identify the parking lane.

Combination “preferential lanes”: In some cases, a single preferential lane may be provided for several uses. For example, a right-hand lane may be a combination bicycle, bus, and right-turn lane (fig. 3-18). While not ideal, such a design can work if speeds and bus volumes are relatively low. Lanes should, ideally, be 16 ft. (4.8m) wide to accommodate all users. However, a 12-ft (3.6m) lane may be adequate, but buses will need to leave the restricted lane to pass bicyclists.

If bus volumes are high, a separate bicycle lane next to a combined bus/right-turn lane may be appropriate (fig. 3-19). The bicycle lane should be at least 5 ft. (1.2-1.5 m) wide and the combined bus/right-turn lane should be at least 12 ft. (3.6 m) wide.

Figure 3-18: Signing and marking for a combination lane should clearly identify its purpose.

Under higher volume conditions, putting the bicycle lane to the left of the bus/right-turn lane is preferable to placing the bicycle lane to the right. This is for some of the same reasons for placing the bicycle lane to the left of a right-turn-only lane (see “Right-turn lanes and bicycle lanes” on p. 3-21). However, it is also intended to address another problem: the need for buses to pull to the curb to discharge and take on passengers and the conflicts introduced with bicyclists passing on the right.

Figure 3-19: A well-used bicycle lane on a busy bus route puts the bicyclists to the left of the buses and right-turning motor vehicles.

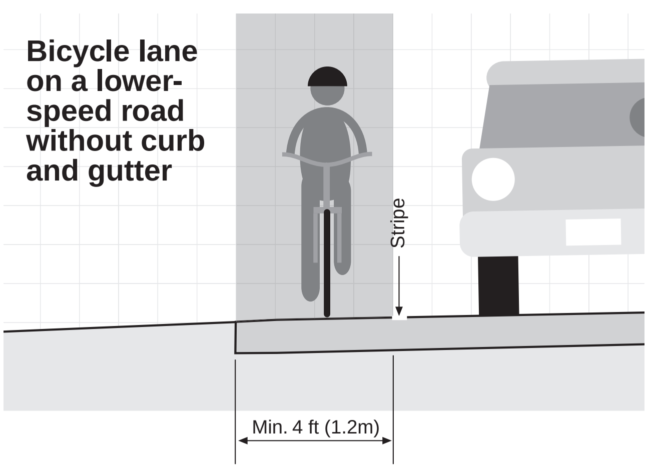
Figure 3-20: Striping bicycle lanes on roadways without curbs can be an important improvement in fast growing suburban and exurban areas.

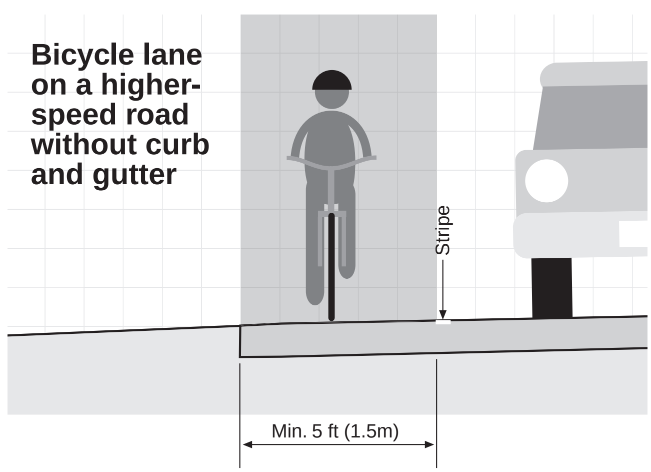
Roadway without curb or gutter: In general, undesignated striped shoulders should be used on rural-type roadways — those without curbs and gutters (see Section 2.1.4). However, such roadways may be found within communities or in developing areas; or they may serve as connections to important destinations (e.g., schools or parks) on the edge of town.

In these situations (fig. 3-20), designating (marking and signing) bicycle lanes can serve an important purpose. Bicycle lanes should be located between the motor vehicle travel lanes and the unpaved shoulder. On lower-speed roadways, bicycle lane widths of 4 ft. (1.2 m) may suffice (Fig. 3-21). But where motor vehicle speeds exceed 35mph, or where there are high motor vehicle volumes, a minimum width of 5 ft. (1.5 m) is recommended (Fig. 3-22). Even greater widths may be advisable on long downgrades.

Figure 3-21 (below left): A Bicycle lane adjacent to a stable gravel shoulder on a roadway without curb or gutter.

Figure 3-22 (below right): On higher speed roadways, the marked bicycle lane should be at least 1.5m (5 ft) wide.





Where these widths cannot be achieved, bicyclists will still benefit from striped shoulders (see Section 2.6). However, such shoulder should simply be designated with an edge line and should not be marked or signed as bicycle lanes. Additional width is also desirable where substantial truck traffic is present.

Figure 3-23: The three primary elements that identify a bicycle lane: regulatory signs, lane striping, and pavement markings.

3.5 Bicycle lane designation

In general, bicycle lanes are designated with signs, lane striping, and pavement markings (fig. 3-23). These elements must comply with Part 9 of the Manual on Uniform Traffic Control Devices (MUTCD); some of the signs mentioned in the MUTCD are shown below.

Bicycle lane signing: The primary signs along a bicycle lane are:

- ***R3-16:*** *used in advance of a marked bicycle lane to call attention to the lane and possible presence of bicyclists.*
- ***R3-16a:*** *used to notify bicyclists that the bicycle lane is ending.*
- ***R3-17:*** *for bicycle lanes with no parking allowed; install this at periodic intervals along the bicycle lane. The words "LEFT" or "CURB" may be substituted for RIGHT if appropriate.*
- ***R3-17a:*** *for bicycle lanes with parking, and is used to tell bicyclists they may encounter parked vehicles; install this at periodic intervals.*

R3-16 *R3-16a*

Figure 3-24: The R3-16 and R3-16a signs should be used in advance of the start and at the end of a bicycle lane, respectively.

R3-17 *R3-17a*

Figure 3-25: The R3-17 and R3-17a signs should be used at periodic intervals along the bicycle lane.

Figure 3-26: The R7-9 or R7-9a should be used where parking is prohibited. The R4-4 should be used in advance of an exclusive right turn lane.

R7-9 R7-9a R4-4

Other signs used along bicycle lanes include:

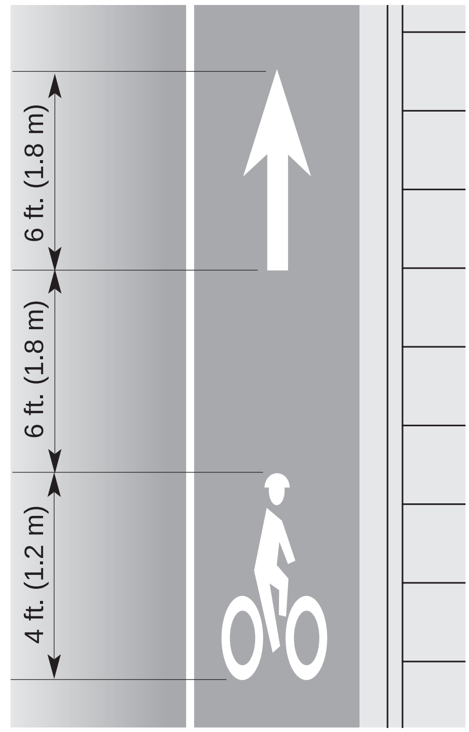
- ***R7-9****, prohibiting parking in bicycle lanes, where no parking lane is provided.*
- ***R7-9a****, a graphic version of the R7-9.*
- ***R4-4****, installed where motorists entering a right-turn lane must weave across bicycle traffic in bicycle lanes; intended to inform the driver and the bicyclist of this weaving maneuver.*

Bicycle lane striping: Bicycle lanes should be demarcated with 4- to 6-in. (100 to 150 mm) white lines using traffic paint or equivalent (e.g., epoxy, cold plastic, etc.). At most locations, lines should be solid, with dashed lines at certain intersections (see Sec. 3.6 and Fig. 3.36) or at bus stops (fig. 3-32). Some materials (e.g., some types of thermoplastic) have been found to be slippery. As a result, materials should be warrantied by the manufacturer as “skid-resistant.”

Figure 3-27: Bicycle lane striping and marking next to a curb.

Bike lane stripes should be placed a constant distance from the outside motor vehicle lane. Bike lanes with parking permitted should not be directed toward the curb at intersections or short stretches where parking is prohibited. This would prevent bicyclists from following a straight course. Where one type of bike lane transitions to another, smooth tapers should be provided in accordance with the MUTCD.

Figure 3-28: The standard marking for a bicycle lane is the bicyclist symbol accompanied by an arrow.



Pavement markings: Pavement markings are used, in conjunction with striping and signing, to identify bicycle lanes. The standard marking is a combination of a bicycle symbol and a directional arrow (fig. 3-28). The pavement marking shall be white.

Designers may, if they choose, select one of the following as an alternative pavement marking (fig. 3-29):

- *The words "Bike Lane" with a directional arrow;.*
- *The words "Bike Only" with an arrow;*
- *The bicycle or bicyclist symbols followed by the word "Lane" and the arrow.*

The "Bike Lane Ends" marking should be used where a bicycle lane terminates, not simply where the striping stops for an intersection or other brief interruption.

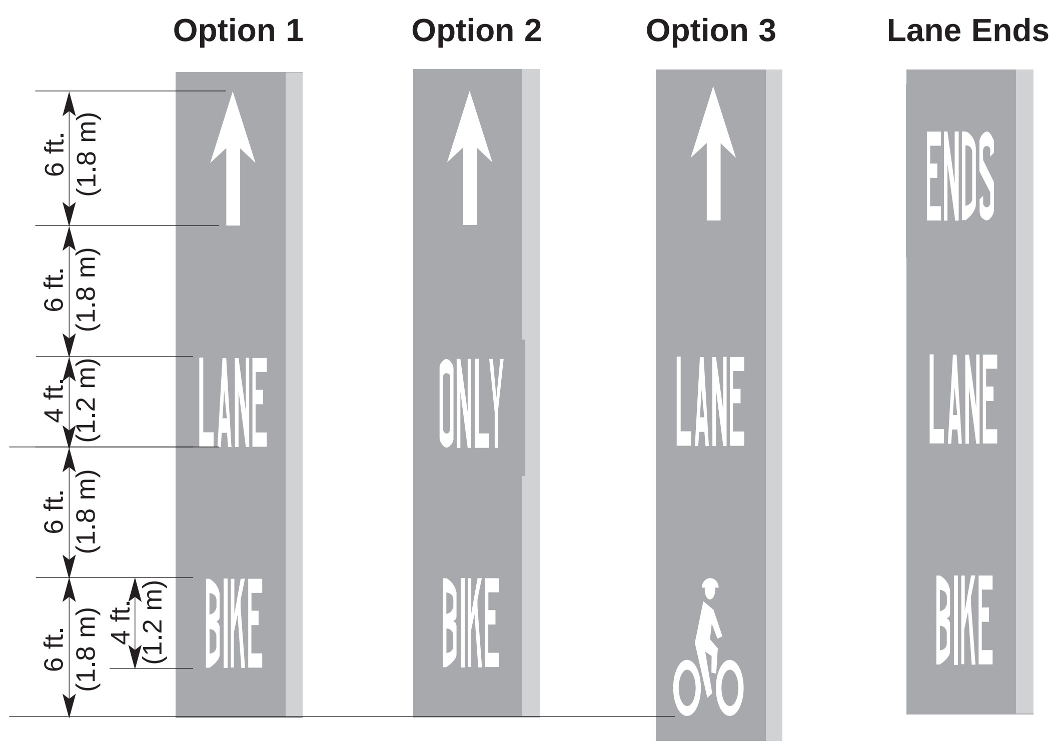


Figure 3-30: Three optional markings: "Bike Lane," "Bike Only" and the bike symbol accompanied by the word "Lane." "Bike Lane Ends" should be placed at the termination of a bike lane section.

Figure 3-31: Lane markings should be spaced about every 600 ft. (180m) for urban sections and every 1 mi. (1.6km) for rural sections.

Lane markings should be appropriately spaced (e.g., about every 600 ft. (180 m) for urban sections and 1 mi. (1.6 km) for rural sections) and placed after every major intersection. Lane markings should also be placed in the short sections of bike lanes used at intersections, most commonly to the left of the right-turn only lane (fig. 3-33).

Bicycle lane signs, striping, and marking: Putting the three elements together, it is possible to create a consistent and comprehensible street design including bicycle lanes.

The two primary signing, striping, and marking designs involve bicycle lanes with or without parking (fig. 3-32). With-parking designs offer two bike lane sign options (R3-17 and R3-17a) that go with an R7 series sign for parking limitations. The no-parking design has three options. The first combines the R3-17 Bike Lane sign and the R8-3a No Parking sign. The other two use either R7-9 or R7-9a combined bike lane/no parking sign.

Standard bicycle lane markings

Figure 3-32: Bicycle lane elements on roadway sections with parking and without. Examples of two types of parking pavement markings are shown. Note dotted line for bus stop on section without parking.

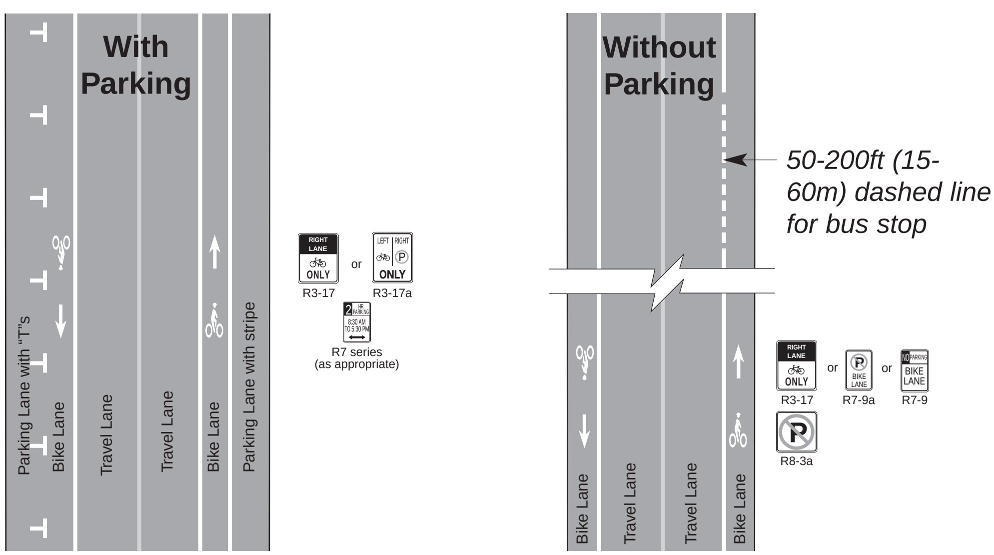


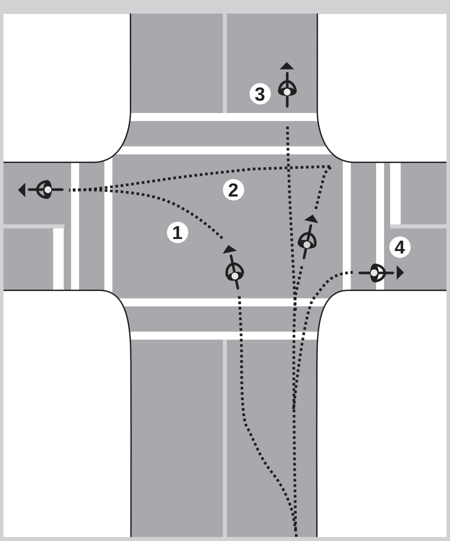
Figure 3-33: Well-designed intersection bicycle lanes can help bicyclists deal with the complexities of traffic movements.

3.6 Bicycle lane intersection design

Bicycle lane treatments at intersections vary according to a number of factors. The primary ones involve the complexity of the intersection, the level of right turning traffic and the presence (or absence) of right turn lanes, either dedicated or optional. These factors should be evaluated based on an understanding of safe bicycling practice and proper turning procedures (see Sidebar below)

Bicycles and intersections

In Wisconsin, bicycles are vehicles and bicyclists have the same rights and duties as other drivers of vehicles. Understanding how lawful bicyclists deal with intersections can help designers provide facilities that foster, rather than hamper, bicyclists' mobility and safety.



Going straight: Bicyclists should go straight from the lane intended for that purpose (3). They should not move right — or into a right-turn lane — nor should they ride too close to the curb, lest they be seen as making a right turn.

Turning left: Bicyclists should turn left in one of two ways: (1) merging to a left turn lane or a position near the center of the roadway, much like a motorist; or (2) making a two-stage turn, stopping at the far corner and proceeding across when safe.

Turning right: Bicyclists should turn right (4) by moving toward the right side of the roadway or into a right turn lane and continuing around the corner.

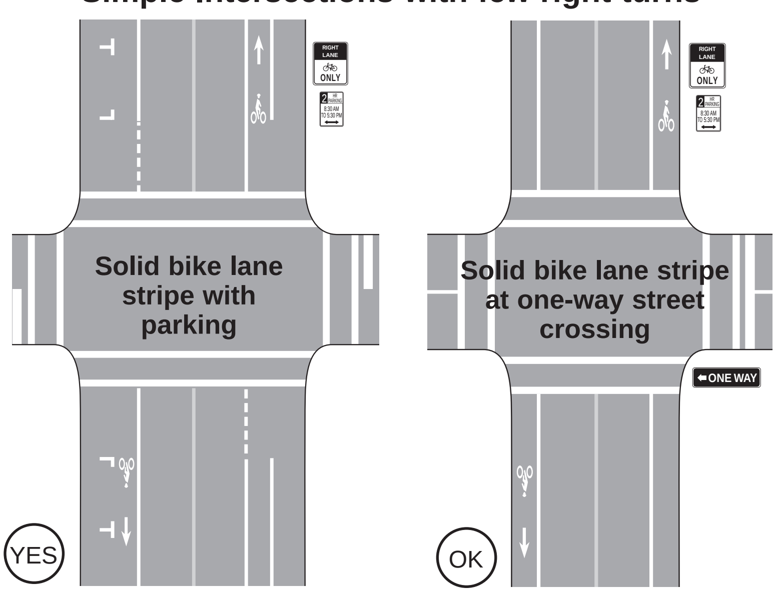
Figure 3-34: Bicycle lane stripes should start at the marked crosswalk or the extension of the adjacent property line.

Figure 3-35: Low-volume cross streets with little right turning traffic can be treated with basic striping, marking, and signage. The image at right shows a solid bike lane strip without parking and with no right turns.

Bike lane text should be placed immediately after, but not closer than 65 ft. (20 m) from, a crossroad. Placed too close to an intersection, the markings may wear quickly due to crossing motor vehicle traffic. The same is true for similar locations (e.g., major commercial driveways). Markings may be placed at other locations as needed.

Simple intersections with few right turns: Most streets with bicycle lanes intersect numerous minor cross streets. The intersections may be controlled with stop signs on the side street and generally feature few conflicts and negligible levels of right turn traffic from the bicycle lane street.

Simple Intersections with few right turns



At such intersections, the dashed line alternative is recommended. At intersections with either no right-turning traffic or extremely low levels of right-turning traffic, the bicycle lanes may be striped to the crosswalk and dropped through the intersection (fig. 3-35). If there is no painted crosswalk, the bike lane stripe should continue to the extension of the adjacent property line. Stripes should be picked up beyond the intersection (fig. 3-34).

If there is a parking lane outside the bicycle lane, the bicycle lane stripe should still be continued to the crosswalk (or extension of adjacent property line). The parking lane markings, however, should be dropped the appropriate distance from the intersection to allow proper sight distances.

Simple intersections with moderate right turn traffic: At other minor intersections, right turning traffic is moderate but does not warrant a dedicated turn lane. In these cases, the solid bicycle lane line should be dropped and replaced with a dashed line (fig. 3-36).

The dashed line should alternate 2ft. (0.6m) dashes with 6ft. (1.8m) spaces. It should begin between 50 and 200 feet (15m - 60m) from the crosswalk, depending on traffic speeds.

Simple Intersections with moderately-light to heavy right turn traffic

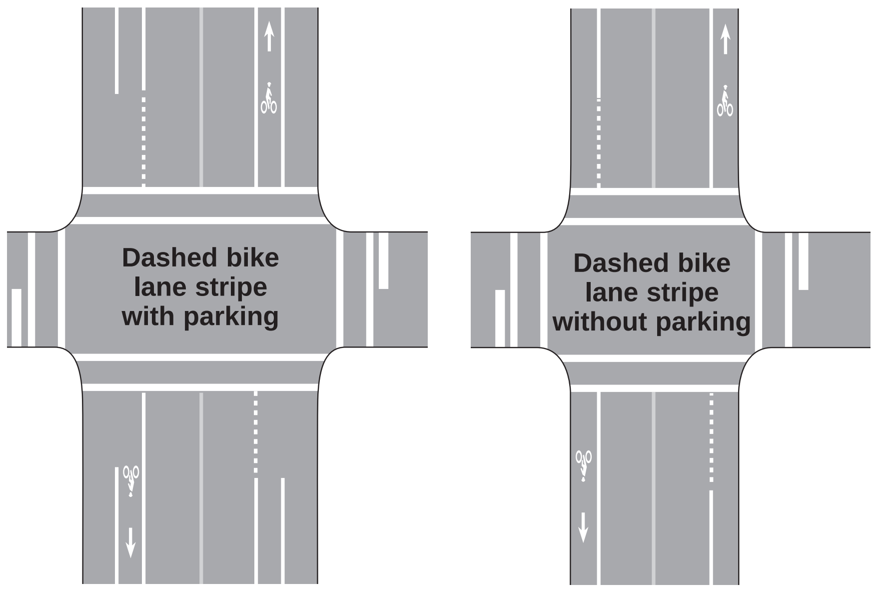
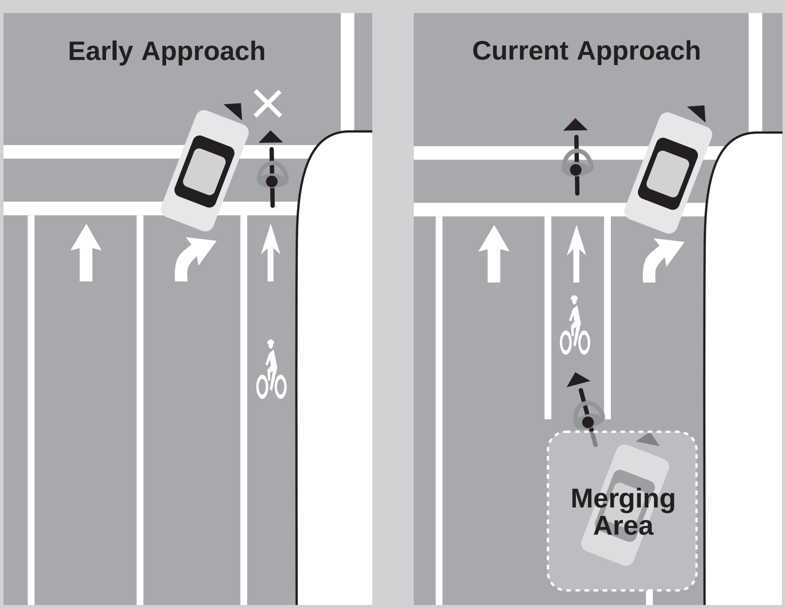


Figure 3-36: With moderate levels of right-turning traffic, the bicycle lane should be dashed.

Right-turn lanes and bicycle lanes

Intersections with right-turn lanes have always posed a challenge for bike lane designers. In the early days, designers striped bike lanes to the right of right-turn lanes. Unfortunately, this approach created a conflict point for bicyclists going straight and motorists turning right.



Moving the bicycle lane to the left of the right-turn lane, however, allowed designers to create a *merging area* ahead of the intersection. This gave bicyclists and motorists the opportunity to negotiate to the proper position before reaching the intersection.

The merging area could be long or short, depending on motor vehicle speeds and turning volumes. This concept has formed the basis of the current design approach to right-turn lanes.

Figure 3-37: This intersection features a bicycle lane to the left of a right-turn lane. Note how it lines up with the bicycle lane on the far side of the intersection.

Tip
In some cases, it helps to think of the bicycle lane and the right through lane as a pair. When the through lane shifts one way or the other — to create a turn lane or a parking lane, for example — the bicycle lane shifts as well.

3.7 Intersections with right-turn lanes

Right-turn lanes often complicate bicycle lane systems (see sidebar on previous page). For this reason, designers should start a bike lane intersection project by first looking at the need for the right-turn lane. In some cases, it may not be warranted and may be eliminated. If right-turn lanes are warranted, there are several designs that can help get the bicycle lane through such an intersection. Several factors help determine the best approach.

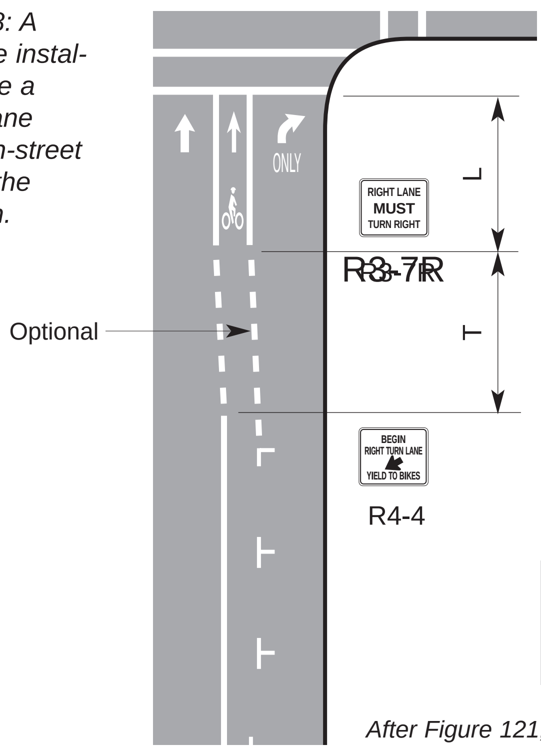


Figure 3-38: A bicycle lane installation where a right-turn lane replaces on-street parking at the intersection.

Right-turn lanes and on-street parking: If the bicycle lane street has on-street parking, dropping the parking lane can create most of the space required for the right turn lane. And, in many cases, the bicycle lane will only have to shift slightly to the left (fig. 3-38). Lane striping should be solid in the storage area and dashed in the taper. Lengths of each should be determined based on right-turn lane requirements (see below).

A second dashed line may be used to delineate the right side of the bicycle lane.

L = Storage length required for right turns
T = Taper length needed for motorists to merge (to be calculated based on standard right-turn configuration)

After Figure 121, Oregon Bicycle/Pedestrian Plan, 1996

Right-turn lanes on widened roadways with no on-street parking: In many cases, the street with bicycle lanes has no on-street parking, but the roadway widens to accept the right-turn lane. In these situations, the bicycle lane should continue across with a dashed line. The length of the right-turn storage area and the taper will determine the length of the dashed line. A second dashed line may be used to delineate the right side of the bicycle lane.

Right-turn lanes on roadways where right through lane is dropped: Roadways where the right through lane is dropped to create the right-turn lane are more difficult situations to deal with. In these cases, the bicycle lane must move to the left, the width of a travel lane. Dropping the right bicycle lane line in this merging zone is an acceptable alternative (fig. 3-40).

Another approach is to stop the curb bicycle lane's solid stripe at the merge zone, replacing it with a dashed line. The bicycle lane to the left of the right-turn lane should then begin with a dashed line (fig. 3-41).

Right turn lane next to optional right turn lane: Optional right-turn lanes create additional problems because the path of the occupying motor vehicle may be either straight or right. As a result, a bicycle lane should not be striped to the right of the optional right-turn lane. Nor should it be striped to the left. In these cases, re-evaluating the warrants for the optional lane should be considered. Otherwise, the bicycle lane should be dropped until after the intersection. A W11-1 warning sign, accompanied by a W11-16 ("Share the Road") subplate may be used.

W11-1, W11-16

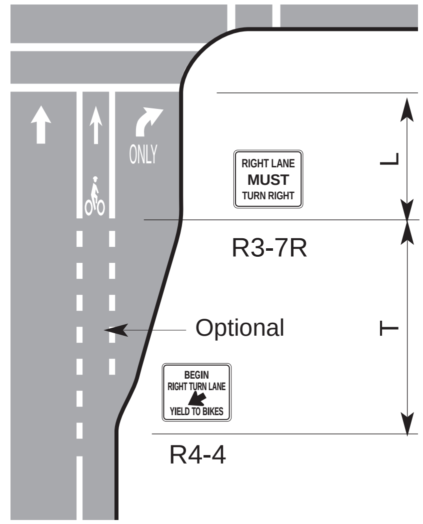


Figure 3-39: This roadway has been widened for a right turn lane. The bicycle lane should continue across the taper as shown with a dashed line.

L = Storage length required for right turns
T = Taper length needed for motorists to merge

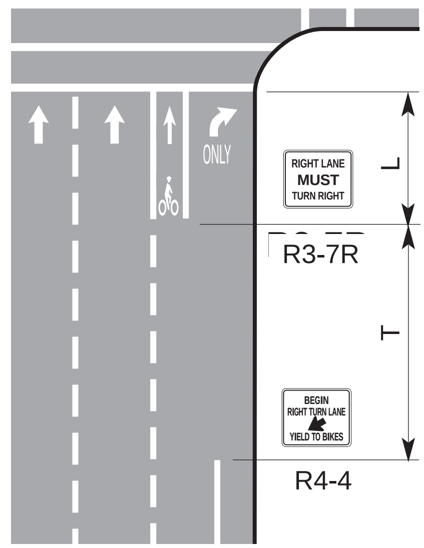
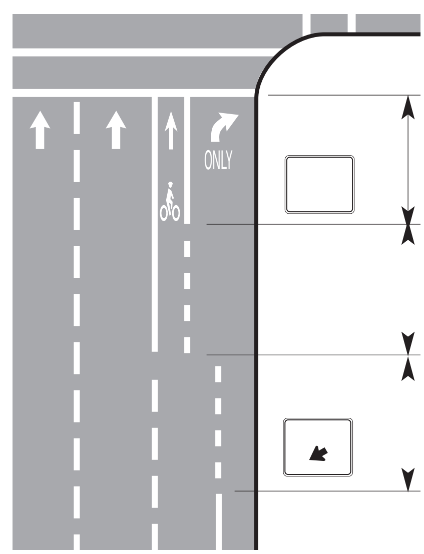


Figure 3-40: Where the right through lane becomes the right turn lane, dropping the lane stripes in the merge zone is an acceptable approach.



After Figure 122, Oregon Bicycle/Pedestrian Plan, 1996

Figure 3-41 (below right): Another approach is to dash the approaching bicycle lane line part way through the merge zone and dot the right line of the intersection bike lane to match.

Figure 3-42 (below left): The "Share the road" sign combination.

L = Storage length required for right turns
D1, D2 = Distance needed for bicyclists to merge left (to be field-determined for each case)

Figure 3-42: A bicycle left-turn lane can help serve heavy bicycle traffic.

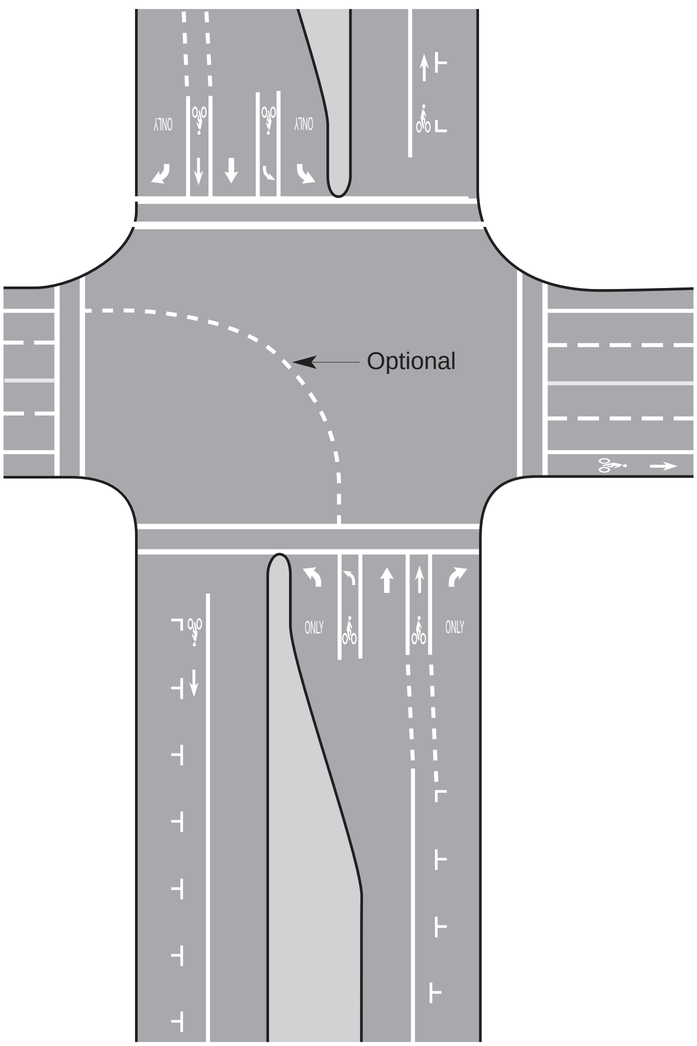


Figure 3-43: As shown in this illustration, dashed lines may be used to lead bicyclists to the destination bicycle lane.

3.8 Left-turn bicycle lane

Bicyclists making left turns will sometimes use the two-stage turn (see “Bicycles and intersections” on p. 3-19), crossing the intersection and stopping at the far side before continuing. Or they may move into a vehicular left turn position (e.g., in the left turn lane) and turn from there. In most cases, there is no particular bicycle facility required to support either of these two options.

Where there are numerous left-turning bicyclists, however, one approach is to provide a separate bicycle left-turn lane, as shown in Figure 3-43.

There are several advantages to this design. For example, it can free up space in the motor vehicle left-turn lane. It can also provide space for more left turning bicyclists. Note the optional dashed line through the intersection. This provides guidance for the bicyclists making their left turn.

Figure 3-44: An urban-style interchange design is easier for bicyclists to negotiate than a rural-style design with its high-speed merges and broad sweeping curves.

3.9 Interchanges

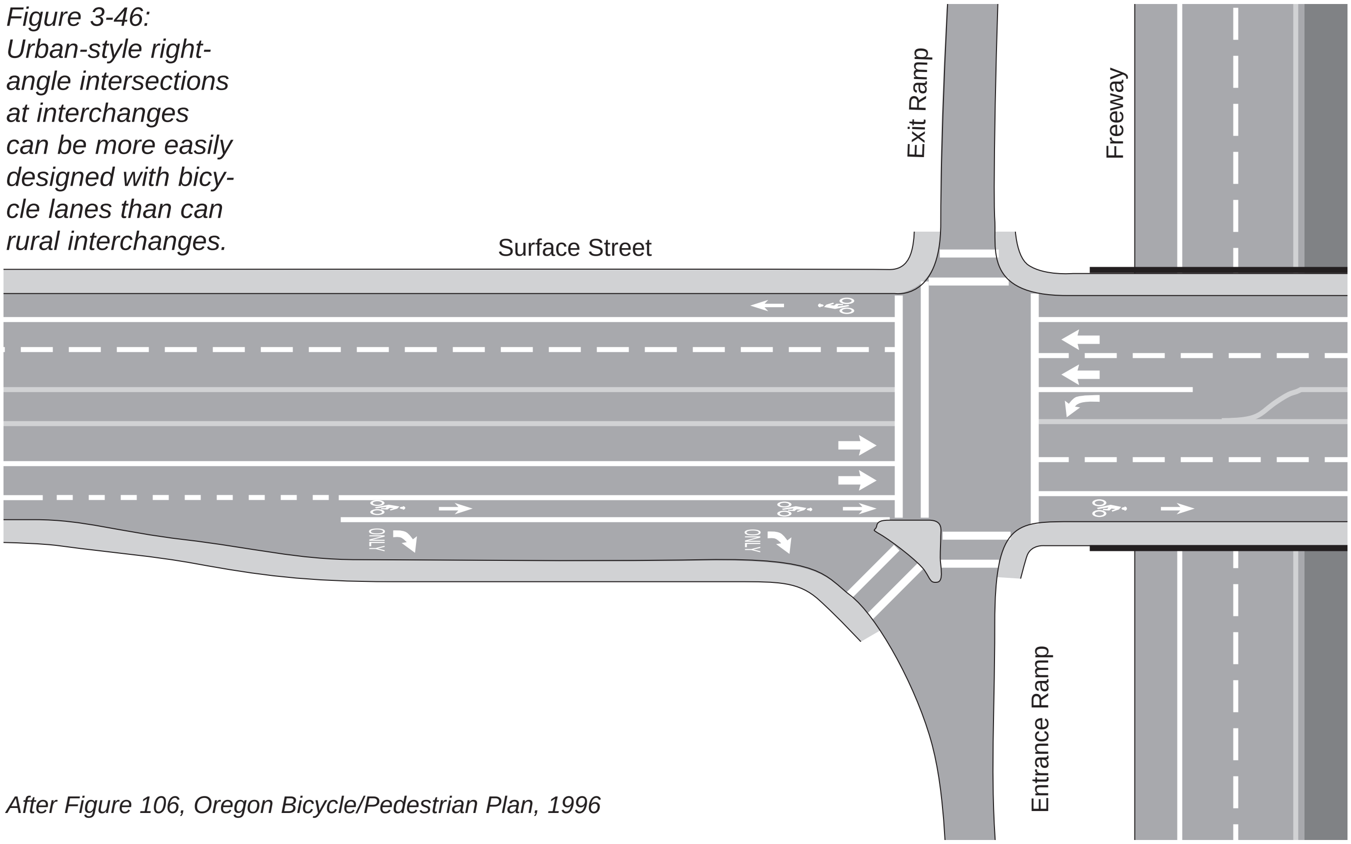
Freeways in urban areas often present barriers to bicycling. Though interchanges function as freeway crossings, they can be obstacles if poorly designed. Bicyclists should be accommodated on the intersecting and parallel streets in urban areas. (Also see discussion in the *Shared Roadway* Chapter, Section 2.9.2)

In rural areas, traffic volumes are usually lower and recreational and touring bicyclists are usually experienced enough to make their way through an interchange. The most useful improvement is to provide adequate shoulder widths through interchanges. However, in urban and suburban areas, bicyclists of all skill levels use the intersecting cross-streets. Well-designed interchanges provide safe and convenient passage from one side to the other.

As mentioned in Section 2.9.2, interchanges in developed (and developing) areas should be designed to an urban model, with tighter curve radii and intersections (fig. 3-44) rather than long

Figure 3-45: Interchanges with higher speed turns and merges are suited only to an environment that will remain rural.

Figure 3-46: Urban-style right-angle intersections at interchanges can be more easily designed with bicycle lanes than can rural interchanges.



After Figure 106, Oregon Bicycle/Pedestrian Plan, 1996

ramps designed for high speeds (fig. 3.45). Figure 3-46 shows how an urban-style interchange can be designed with bicycle lanes.

Configurations with free-flowing right turns and dual left- or right-turns are difficult for bicyclists to negotiate safely. They are particularly vulnerable where a high-speed ramp merges with a roadway. If these configurations are unavoidable, mitigation measures should be sought. Special designs should be considered that allow bicyclists to cross ramps in locations with good visibility and where speeds are low. See the AASHTO *Guide to Bicycle Facilities* and an ITE Proposed Recommended Practice: *Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges* for options that may be used for interchange markings where higher speed ramps are unavoidable.

Another option to consider seriously is the provision of intermediate freeway crossings between interchanges. These completely eliminate the conflicts with on- and off-ramp traffic. Further, such crossings typically involve lower volume roadways (e.g., collectors) where many bicyclists will feel more comfortable.