There is a significant impact on cycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high. To narrow the range of facilities appropriate for a given roadway use Table 1. Applicable to both the rural and urban setting, Table 1 illustrates the appropriate facilities that may be considered at various speed/volume thresholds. To use this table, identify the daily traffic volume on the y-axis and travel speed on the x-axis for the existing or proposed roadway. Depending on the inputs, the roadway context will fit into one of three categories, 1, 2, or 3. Within each category the available facility types have been ranked in order of their level of protection. Select the facility with the highest protection level and proceed to STEP 2 where potential roadway modifications are identified to accommodate this type of bikeway.

This step in the process will help the designer, planner, or engineer determine if the preferred (most protected) facility type fits within the existing curb-to-curb pavement width. It also identifies potential strategies for accommodating the facility, pending a constrained right-of-way (ROW). For this step, Washington County’s existing Road Design Standards are used. The County’s road standards provides information on existing lane configuration and available pavement width for each road classification. This process examines Arterial, Collector, Neighborhood and Local roadways.

The table below provides information regarding the additional pavement width necessary for each treatment and how that treatment might be applied in each roadway class. If the preferred facility type does not fit within the existing pavement width, or if the potential modifications are unacceptable, repeat the process using the second most protected facility type from the identified speed/volume category on the previous page. Proceed to STEP 3 only when a bikeway facility and roadway modification strategy have been identified.

### ROADWAY MODIFICATION*

**Narrow travel lanes:** bikeways may be added by adjusting wide travel lanes or parking lanes within the established minimums. No reduction to the number of travel lanes required (requires a design exception)

**Remove travel lane:** where motor vehicle volume is below roadway capacity, the removal of a travel lane can provide the necessary pavement width to accommodate on-street bikeways. May require a traffic impact assessment or TSP amendment prior to lane removal.

**Parking removal:** underused on-street parking on one side of the street is removed to create space for bike lanes. For example, an acceptable situation for this scenario includes areas that have large surface parking lots adjacent to existing on-street parking. A parking utilization study should be conducted prior to removal of on-street parking.

**Narrow/remove center turn lane:** roadways with an underused, or extra-wide, center turn lane provide an opportunity for reallocating pavement width to develop new bikeway facilities. May require a traffic impact assessment or TSP amendment prior to lane removal or width reduction.

**Add pavement width:** If additional right-of-way is available along the corridor it may be possible to pave a new roadway shoulder to develop a bikeway facility.

*For detailed information regarding the dimensions and applications of different types of cycle track facilities refer to pages 21 - 23 of the Toolkit*
Now that a preferred facility type has been identified, it is time to run this selection through a set of “checks”. Due to the wide range of factors influencing bikeway facility selection these checks will help confirm that the selected facility is the best choice for the specific roadway context.

Is the facility on a Freight, Transit, or Emergency Services Route?

Is there on-street parking?

Is there challenging roadway geometry?

Are there frequent conflict points such as driveways or intersections along the route?

Are there unique ROW constraints present, such as bridges or permanent structures, that may be cost prohibitive to design around?

Consider facilities that increase separation between travel lane and bikeway. See page 3, ‘Freight, Transit and Emergency Services Route’ for more information.

Requires increased design emphasis at junctions with bikeway. See page page 3, ‘Access Points: Intersections, Alleys and Driveways’ for more information. See also, the ‘Treatments’ section on page 27 for specific design strategies.

Ensure that the selected facility provides an adequate buffer between bicyclists and open car doors. See the ‘Facilities’ section on page 16 for preferred facility dimensions.

See page 4, ‘Roadway Geometry’ for more information. Additional analysis and engineering judgment may be required.

Does facility connect to a school, park, or commercial area?

Re-examine the user group being targeted by selected treatment. Determine if a facility requiring less ROW will meet TSP goals.
**CONVENTIONAL BIKE LANE**

Washington County Bicycle Facility Design Toolkit

**DESIGN SUMMARY**

Designated exclusively for bicycle travel, bike lanes are separated from vehicle travel lanes with striping and pavement stencils. Bike lanes are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation. Bike lanes also increase safety and reduce wrong-way riding. This treatment is required on arterials and collectors when roads are newly constructed or reconstructed, per Washington County’s existing Road Design Standards.

- Defines road space for bicyclists and motorists, reducing the possibility that motorists will stray into cyclists’ path
- Discourages bicyclists from riding on the sidewalk
- Reminds motorists that bicyclists have a right to the road

**DIMENSIONS:**

- 6’ recommended; required if on-street parking is present
- 5’ acceptable if no parking or parking not marked
- 4’ minimum in constrained locations
- 7’ maximum if buffer or barrier is not provided (greater widths may encourage vehicle loading or driving in bike lane)

**TYPICAL APPLICATION:**

- Streets with traffic volumes ≥ 3,000 AADT
- Streets with posted travel speeds ≥ 25 mph

**LAND USE CONTEXT:**

- Urban, suburban, rural

**PEER COMMUNITIES/LOCAL EXAMPLES:**

- Washington County (Baseline Rd and Murray Blvd)

**ADDITIONAL GUIDANCE:**

- AASHTO, MUTCD, NACTO

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**URBAN ROADWAY WITH BIKE LANES**

On-street parking was removed on this suburban street to accommodate bike lanes

**RURAL ROADWAY WITH BIKE LANES**

Bike lanes on rural roadways help to separate bicyclists from large vehicles such as transit, freight, and emergency vehicles
Buffered Bike Lanes Design Summary

Bike lanes on high-volume or high-speed roadways can be dangerous or uncomfortable for cyclists, as automobiles pass or are parked too close to bicyclists. Buffered bike lanes are designed to increase the space between the bike lanes and the travel lane or parked cars. Buffered bike lanes are not currently addressed in the Washington County Road Design Standards.

- Allows motorists greater separation from bicyclists in the bike lane (as travel speeds increase greater separation is needed)
- Provides space for cyclists to pass one another without encroaching into the travel lane

Dimensions:
- Same as a Conventional Bike Lane (5’ to 6’) with the addition of a 2’ to 3’ painted buffer
- Buffer is typically diagonally hatched to increase visibility

Typical Application:
- Any location where a bike lane may be considered and sufficient right-of-way exists
- Streets with posted travel speeds ≥ 25 mph
- Where motor vehicle traffic volumes ≥ 10,000 AADT

Land Use Context:
- Urban, suburban, rural

Peer Communities/Local Examples:
- Washington County (Tualatin-Sherwood Rd and Evergreen Rd); Portland, OR (SE 101st Ave)

Additional Guidance:
- NACTO, CROW Design Manual, London Bicycle Design Standards
Protected cycle tracks are on-street bikeway facilities that provide the safety and comfort of multi-use paths within the road right-of-way. This is accomplished by combining a painted buffer with a physical barrier such as flexible bollards, a landscaped buffer, or a parking lane. The added protection further separates motor vehicles and bicyclists where travel speeds and/or motor vehicle traffic volumes are high. This type of facility appeals to a wider range of bicycle users than a conventional bike lane. Protected cycle tracks are not currently addressed in the Washington County Road Design Standards.

- Dedicates and protects space for bicyclists and improves perceived comfort and safety
- Reduces risk of ‘dooring’ compared to a bike lane, and eliminates the risk of a doored cyclist being run over by a motor vehicle (if adjacent to a parking lane)

**DIMENSIONS:**
- 5’ to 7’ bike throughway
- 2’ to 3’ painted buffer (can be combined with planted median, flexible bollards, standard curb and gutter, or other barrier)
- Greater design emphasis is required to provide sufficient sight lines at intersections and for the treatment of pedestrian crossings of the cycle track

**TYPICAL APPLICATION:**
- Streets with multiple lanes and high traffic volumes (≧ 10,000 AADT)
- Streets with high travel speeds (≧ 40 mph)
- Streets with few intersections and driveway access points (requires innovative design treatment at intersections)
- One-way or two-way streets

**LAND USE CONTEXT:**
- Urban and suburban

**PEER COMMUNITIES/LOCAL EXAMPLES:**
- Portland, OR (SW Broadway); Missoula, MT (Higgins Ave)

**ADDITIONAL GUIDANCE:**
- NACTO, Portland Bicycle Plan for 2030 (Appendix D)
RAISED CYCLE TRACK

Basic Information:

- **Dedicates space for bicyclists and improves perceived comfort and safety**
- **Allows bicyclists to easily exit the bike lane to ready for turns or when overtaking other cyclists**

**DIMENSIONS:**

- 5' to 7'
- Mountable curb should be 1.5' and have a 4:1 slope edge
- Special attention needed for drainage to prevent pooling

**TYPICAL APPLICATION:**

- Streets with multiple lanes and high traffic volumes (≥ 10,000 AADT)
- Streets with high travel speeds (≥ 40 mph)
- Streets with few intersections and driveway access points
- One-way or two-way streets

**LAND USE CONTEXT:**

- Urban and suburban

**PEER COMMUNITIES/LOCAL EXAMPLES:**

- Bend, OR (Alderwood Circle); Portland, Oregon (Cully Blvd)

**ADDITIONAL GUIDANCE:**

- NACTO, Oregon Bicycle and Pedestrian Plan (2007 Update)
Two-way cycle tracks allow for bicycle travel in two directions on the same side of the road. They share many of the same benefits and characteristics of one-way cycle tracks, but require additional design treatments at intersections due to the limited visibility of bicyclists riding behind parked cars or barriers. This is due to some bicyclists traveling in the opposite direction of travel, which may be confusing for motorists entering/exiting the roadway. Two-way cycle tracks are not currently addressed in the Washington County Road Design Standards.

- Dedicates and protects space for bicyclists and improves perceived comfort and safety
- May reduce bicyclist out of direction travel
- Can improve bicycle connectivity by allowing contra-flow travel

**DIMENSIONS:**

- 10’ min. and 12’ preferred width
- Can be combined with parking buffer, mountable curb, or physical barrier (width varies)

**TYPICAL APPLICATION:**

- Streets with multiple lanes and high traffic volumes (≧ 10,000 AADT)
- Streets with high travel speeds (≧ 40 mph)
- Streets with few intersections and driveway access points (requires innovative design treatment at intersections)
- One-way or two-way streets
- On streets where contraflow bike travel is desirable

**LAND USE CONTEXT:**

- Urban and suburban

**PEER COMMUNITIES/LOCAL EXAMPLES:**

- Washington DC; Portland, Oregon; New York City, New York

**ADDITIONAL GUIDANCE:**

- NACTO, CROW, London Bicycle Design Standards
Multi-use paths serve bicyclists and pedestrians and provide additional
width over a standard sidewalk. Public Works only constructs paths
within the existing ROW (e.g., adjacent to roads). Paths constructed
in other locations may provide transportation benefits, but would be
constructed by the Parks Department. Paths constructed next to roads
must have some type of vertical (e.g., curb or barrier) or horizontal
(e.g., landscaped strip) buffer separating the path area from adjacent
vehicle travel lanes. This treatment is allowed in the right-of-way under
Washington County’s existing Road Design Standards.

**DIMENSIONS:**
- 10’ is the minimum allowed for a two-way shared-use path and is
  only recommended for low traffic situations
- 12’ or greater is recommended for high-use areas, or in situations
  with high concentrations of multiple users such as joggers,
  bicyclists, rollerbladers and pedestrians. In some cases pavement
  markings/signage may be used to separate trail users

**TYPICAL APPLICATION:**
- Where there are few at-grade crossings such as driveways and
  alleyways
- Where the existing roadway context makes a completely separated
  bikeway the preferred alternative (i.e. high traffic speeds and
  volumes in a constrained right-of-way).

**LAND USE CONTEXT:**
- Urban, suburban, rural

**PEER COMMUNITIES/LOCAL EXAMPLES:**
- Off-street multi-use paths are popular in communities both urban
  and rural across the country

**ADDITIONAL GUIDANCE:**
- AASHTO, Metro Greenway Trails
TREATMENTS

- Colored Bike Lane
- Contraflow Bike Lane
- UPHILL BIKE LANE; DOWNHILL SHARED LANE MARKING
- Bicycle Signal
- Intersection Crossing Markings
- Bike Box
- Two-Stage Left Turn Queue Boxes
- Wayfinding
- Lighting
**COLORED PAVEMENT IN CONFLICT ZONE**

**Washington County Bicycle Facility Design Toolkit**

**DESIGN SUMMARY**

Bicyclists are especially vulnerable at locations where the volume of conflicting vehicle traffic is high, and where the vehicle/bicycle conflict area is long. Some jurisdictions use colored pavement in the bikeway to guide cyclists through major vehicle/bicycle conflict points (FHWA requires green colored pavement). These conflict areas are locations where motorists and cyclists must cross each others’ path (e.g., at intersections or merge areas). The colored pavement typically extends through the entire bicycle/vehicle conflict zone (e.g., through the entire intersection, or through the transition zone where motorists cross a bike lane to enter a dedicated right turn lane).

- Draws attention to conflict areas
- Increases motorist yielding behavior
- Emphasizes expectation of bicyclists on the road

**DIMENSIONS:**

- Width is the same as a conventional bike lane with addition of colored thermoplastic or colored aggregate and dashed lines
- Can be paired with ‘Yield to Bikes’ signs in conflict areas

**TYPICAL APPLICATION:**

- Where bikeway crosses motor vehicle merge lane
- Across motor vehicle slip lanes and turn pockets
- Challenging intersections

**LAND USE CONTEXT:**

- Urban, suburban, rural

**PEER COMMUNITIES/LOCAL EXAMPLES:**

- Portland, OR (NE Broadway); Eugene, OR (Alder St)

**ADDITIONAL GUIDANCE:**

- MUTCD (interim approval; see Section 3G.01), NACTO
At some intersections bicyclists have different needs than other roadway users (e.g. bicycle only movements; conflicts with motorists, transit, or pedestrians). In these areas, bicycle signal heads can be used to provide additional guidance to bicyclists and other roadway users. Bicycle signals are used in combination with conventional traffic signals and use the standard green, yellow, red lenses with the addition of a bicycle stencil. Bicycle signals are not currently addressed in the Washington County Road Design Standards.

- Prioritizes bicycle movements and separates them from conflicting movements
- May improve safety and comfort of cyclists and overall intersection operations
- Preferable to instructing bicyclists to use pedestrian signals

**DIMENSIONS:**

- Signal head should be clearly visible to oncoming bicycles
- Bicycle phase should provide adequate clearance time and actuation/detection (if not pretimed)

**TYPICAL APPLICATION:**

- Intersections with bicycle only movements, (e.g., a transition from a trail to an on-street facility on the opposite side of the intersection), or where there are conflicts with other roadway users
- Multi-use path crossings

**LAND USE CONTEXT:**

- Urban, suburban, rural

**PEER COMMUNITIES/LOCAL EXAMPLES:**

- Portland, OR (NE Broadway/Williams)

**ADDITIONAL GUIDANCE:**

- Currently there are no standards for determining bicycle clearance times. Design and operation should consider general MUTCD guidance, local conditions, and engineering judgment.
Intersection crossing markings are pavement markings through intersections that delineate the path that bicyclists should take through an intersection or across a driveway or ramp. Different marking strategies, including colored bike lanes or chevrons are used throughout the country. Crossing markings are not currently addressed in the Washington County Road Design Standards.

- Establish expected bicycle travel paths and increase the visibility of cyclists
- Define and raise awareness of potential conflict zones
- Increases bicyclist level of comfort by delineating route through intersections

**DIMENSIONS:**
- Width is generally the same as a conventional bike lane, with addition of dashed lines (MUTCD 3B.08), and optional colored thermoplastic, chevrons, and/or shared lane markings (MUTCD 9C-9)
- Minimum striping width of 6” adjacent to travel lane

**TYPICAL APPLICATION:**
- Signalized, wide, or complex intersections on streets with bike lanes or cycle tracks
- Areas where vehicle movements encroach into or cross bicycle facilities (e.g. ramps)

**LAND USE CONTEXT:**
- Urban and suburban

**PEER COMMUNITIES/LOCAL EXAMPLES:**
- Dotted line extensions are used in many cities nationwide
- Other intersection markings used in New York, NY (9th Ave); Portland, OR (Interstate Ave)

**ADDITIONAL GUIDANCE:**
- AASHTO, NACTO

**ROADWAY WITH INTERSECTION MARKINGS**

Source: NACTO
Bike boxes move back the stop bar for vehicles at signalized intersections in order to create a designated area for bicyclists to wait during the red signal phase. Bike boxes create a more comfortable and safe environment for cyclists by increasing their visibility to motorists and providing them a way to get ahead of queued traffic. Bike boxes are not currently addressed in the Washington County Road Design Standards.

- Increases visibility and safety of cyclists
- Helps prevent "right-hook" conflicts between cyclists and vehicles
- Facilitates cyclist left turns and transitions from right to left side bike lanes (if box extends across entire intersection)

**DIMENSIONS:**
- Transverse lines shall be used to create a bike box 10’ to 16’ deep and indicate where motor vehicles are required to stop (MUTCD 3B.16)
- A Bike Symbol or Helmeted Bicyclist Symbol (MUTCD 9C-3A or 9C-3B) shall be centered between the crosswalk line and stop line
- Bike boxes may be combined with a green colored pavement background

**TYPICAL APPLICATION:**
- Signalized intersections on streets with bike lanes or cycle tracks
- Intersections with high volumes of motorists and bicyclists
- Intersections with frequent motorist right-turns and/or bicyclist left-turns

**LAND USE CONTEXT:**
- Urban and suburban

**PEER COMMUNITIES/LOCAL EXAMPLES:**
- Portland, OR (SE Hawthorne); Eugene, OR (Alder St)

**ADDITIONAL GUIDANCE:**
- NACTO, MUTCD

A blue bike box in Vancouver, BC alerts motorists to remain behind bicyclists waiting for a signal change.

One of Portland’s first green bike boxes located at SW 14th Ave and Burnside Street.
Wayfinding signs are typically placed at key locations leading to and along bicycle boulevards, including where multiple routes intersect and at key bicyclist “decision points.” Wayfinding signs displaying destinations, distances and “riding time” can dispel common misperceptions about time and distance while increasing users’ comfort and accessibility to key destinations. ‘Bike Route’ signage is currently allowed under the Washington County Road Design Standards; more detailed bikeway signage is not addressed.

- A cost-effective yet highly-visible treatment that can improve the riding environment

**DIMENSIONS:**
- Note that too many signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists and pedestrians, rather than per vehicle signage standards.
- It is important that signs be consistently placed along designated bicycle routes to be highly effective

**TYPICAL APPLICATION:**
- Designated bicycle routes
- Bicycle Boulevards

**LAND USE CONTEXT:**
- Urban, suburban, rural

**PEER COMMUNITIES/LOCAL EXAMPLES:**
- Portland, OR; Eugene, OR

**ADDITIONAL GUIDANCE:**
Bicycle facility lighting can help to increase user comfort and safety, is viewed as a crime deterrent, and can help increase year-round bicycle facility use. Although there are no industry accepted warrants for non-freeway lighting, design guidance is available to support engineering judgment. For example, luminaires should be placed adjacent to facilities crossing roadways as opposed to directly above the facility in order to better illuminate pedestrians and bicyclists. Washington County’s existing Road Design Standards include roadway design light levels based on road classification and “pedestrian conflict” rank, which considers pedestrian night activity levels and surrounding land uses. All lighting equipment must be included in the current Portland General Electric approved street lighting equipment list. Solar and other alternative energy sources should be considered where practical.

DIMENSIONS:
- Off-street facilities typically use pedestrian-scale luminaires
- Poles and luminaires should provide adequate vertical (8') and horizontal (2') clearance. Pedestrian lighting is typically positioned ≤ 16’ above the sidewalk or path
- Average illuminance levels for high/medium/low conflict roadways and intersections are provided in the Washington County Road Design Standards, Exhibits 11 and 12
- Illumination at midblock crossings is evaluated on a case by case basis

TYPICAL APPLICATION:
- Areas with high expected night usage (e.g. colleges, commuter routes)
- Intersections and areas with varying geometry (e.g. turns, tunnels)
- Facilities with bicycle volumes or crash rates

LAND USE CONTEXT:
- Urban, suburban, rural

ADDITIONAL GUIDANCE:
APPENDICES

APPENDIX A. MAINTENANCE AND CONSTRUCTION
APPENDIX B. INTERSECTION TREATMENT ALTERNATIVES
APPENDIX C. GENERIC FACILITY SELECTION CASE STUDY
BIKE LANE INTERSECTION TREATMENTS (1 of 2)
BIKE LANE INTERSECTION TREATMENTS (2 of 2)
BUFFERED BIKE LANE INTERSECTION TREATMENTS
CYCLE TRACK INTERSECTION TREATMENTS (1 of 2)
CYCLE TRACK INTERSECTION TREATMENTS (2 of 2)
DRIVEWAY TREATMENTS