

June 2015

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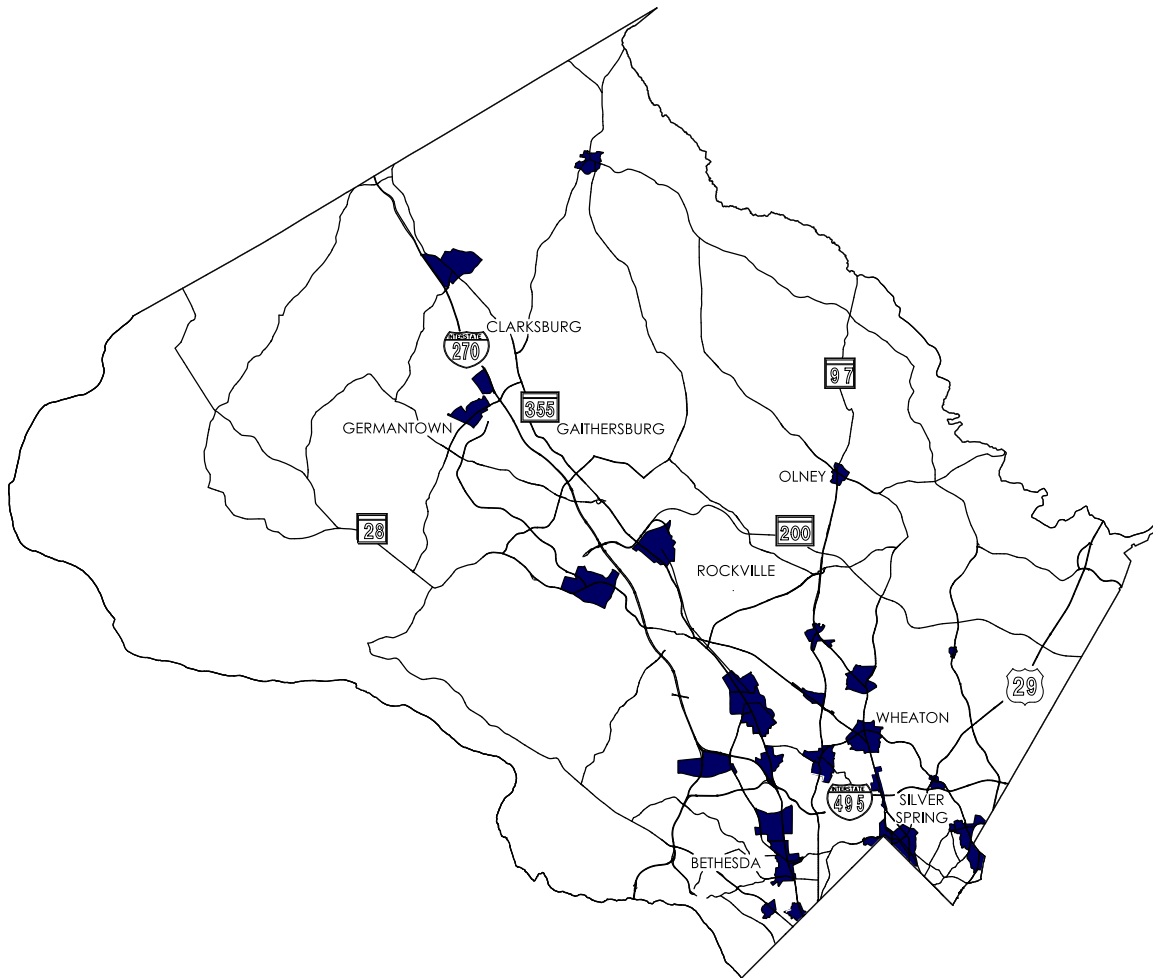
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# Appendix A

## Bicycle and Pedestrian Laws, Codes, and Policies





## PEDESTRIAN RIGHTS AND RULES

According to the Annotated Code of Maryland:

- Pedestrians are subject to all traffic control signals.
- The driver of a vehicle shall come to a stop when a pedestrian is crossing a roadway in a marked or unmarked crosswalk.
- A pedestrian may not suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close that it is impossible for the driver to yield.
- If a pedestrian crosses a roadway at any point other than in a marked crosswalk or in an unmarked crosswalk at an intersection, the pedestrian shall yield the right of way to any vehicle approaching on the roadway.
- Between adjacent intersections at which a traffic control signal is in operation, a pedestrian may cross a roadway only in a marked crosswalk.
- Drivers must exercise due care to avoid colliding with any pedestrian.
- Where a sidewalk is provided, a pedestrian may not walk along and on an adjacent roadway. Where a sidewalk is not provided, a pedestrian who walks along and on a highway may walk only on the left shoulder, if practicable, or on the left side of the roadway, as near as practicable to the edge of the roadway, facing any traffic that might approach from the opposite direction.
- In general, the driver of a vehicle shall yield the right of way to a blind, hearing impaired, or mobility impaired pedestrian.

## BICYCLIST RIGHTS AND RULES

According to the Annotated Code of Maryland, a person riding a bicycle:

- Has the same rights and duties as a person driving a vehicle.
- May not ride on any roadway where the posted maximum speed limit is more than 50 miles per hour or on an expressway.
- Shall ride as near to the right side of the roadway as practicable and safe, except when making intersection movements, riding on a one-way street, passing, avoiding pedestrians or hazards, or traveling in a lane that is too narrow for a bicycle and a vehicle to travel side by side (i.e. a signed shared lane or marked sharrow lane).



- Shall use the bike lane or shoulder (where there is a usable, smooth paved, no debris) and may not ride on the roadway, except for intersection movements, and may not leave a bike lane or shoulder until the movement can be made with reasonable safety and the only after giving an appropriate signal.

## **MONTGOMERY COUNTY ROAD DESIGN AND CONSTRUCTION CODE**

In Montgomery County, bicyclists may also ride on sidewalks.

According to the Montgomery County Road Design and Construction Code, Section 49-25:

Each transportation facility in the County must be planned and designed to:

- a) maximize the choice, safety, convenience, and mobility of all users,
- b) respect and maintain the particular character of the community where it is located, and
- c) minimize stormwater runoff and otherwise preserve the natural environment.

To achieve these goals, each County road and street must be designed so that the safety and convenience of all users of the roadway system - including pedestrians, bicyclists, transit users, automobile drivers, commercial vehicles and freight haulers, and emergency service vehicles – is accommodated. Each road and street must facilitate multi-modal use and assure that all users can travel safely in the public right of way. A specified quantity of stormwater must be managed and treated on-site, in the road or street right of way, including through the use of vegetation-based infiltration techniques. These context-sensitive policies must be employed in all phases of facility development, including planning, design, construction, and reconstruction.

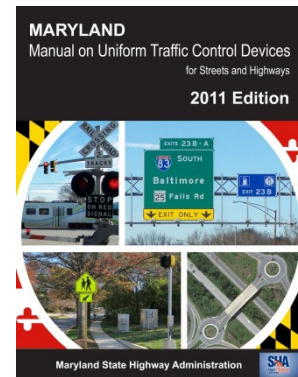
Furthermore, according to the Montgomery County Road Design and Construction Code, Section 49-29:

Bikeways and walkways must be constructed when any County road is constructed, reconstructed, or relocated, unless the County Council finds (for a road improvement authorized in a capital improvements program) or the Planning Board finds (for a road improvement made a condition of preliminary plan or site plan approval) that bikeways or walkways in that location would reduce public safety, would not be feasible, or would be disproportionate in cost to their probable use. All bikeways and walkways must conform to approved capital improvements programs and be consistent with area master plans and transportation plans adopted by the Planning Board.

## POLICIES

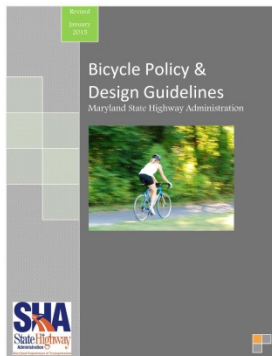
### Manual for Uniform Traffic Control Devices, 2011 (MUTCD)

This Federal Highway Administration publication is considered the national standard for traffic control devices. The Maryland State Highway Administration (SHA) has developed a state supplement of this document which includes more specific interpretations and requirements.



### Accessibility Policy and Guidelines for Pedestrian Facilities along State Highways, June 2010 (MDSHA-ADA)

This policy and guide is the SHA's interpretation of the American with Disabilities Act. According to this policy, all SHA projects are developed to accommodate and provide accessibility for persons with disabilities where it is reasonable, feasible and appropriate to do so. This comprehensive guide provides designers with the tools to identify non-compliant pedestrian features and guidelines for upgrades.

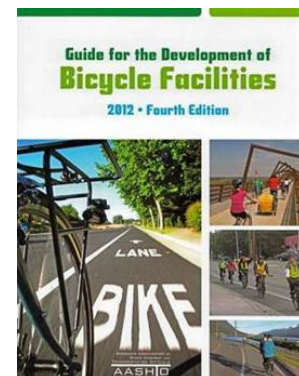


### Bicycle Policy and Design Guidelines, January 2015 (SHA-BDG)

With the SHA's presentation of the policies in this document in 2013, implementation of these guidelines on state roads can now be considered standard practice.

### Guide for the Development of Bicycle Facilities, 2012, 4th Edition (AASHTO-BDG)

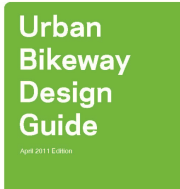
This document, published by the American Association of Highway and Transportation Officials and commonly referred to as the AASHTO Bicycle Design Guide, is recognized and referred to by roadway engineers for planning and design of bicycle facilities, except where preceded by jurisdictional requirements.





## Urban Bikeway Design Guide, April 2011 Edition (NACTO-UBDG)

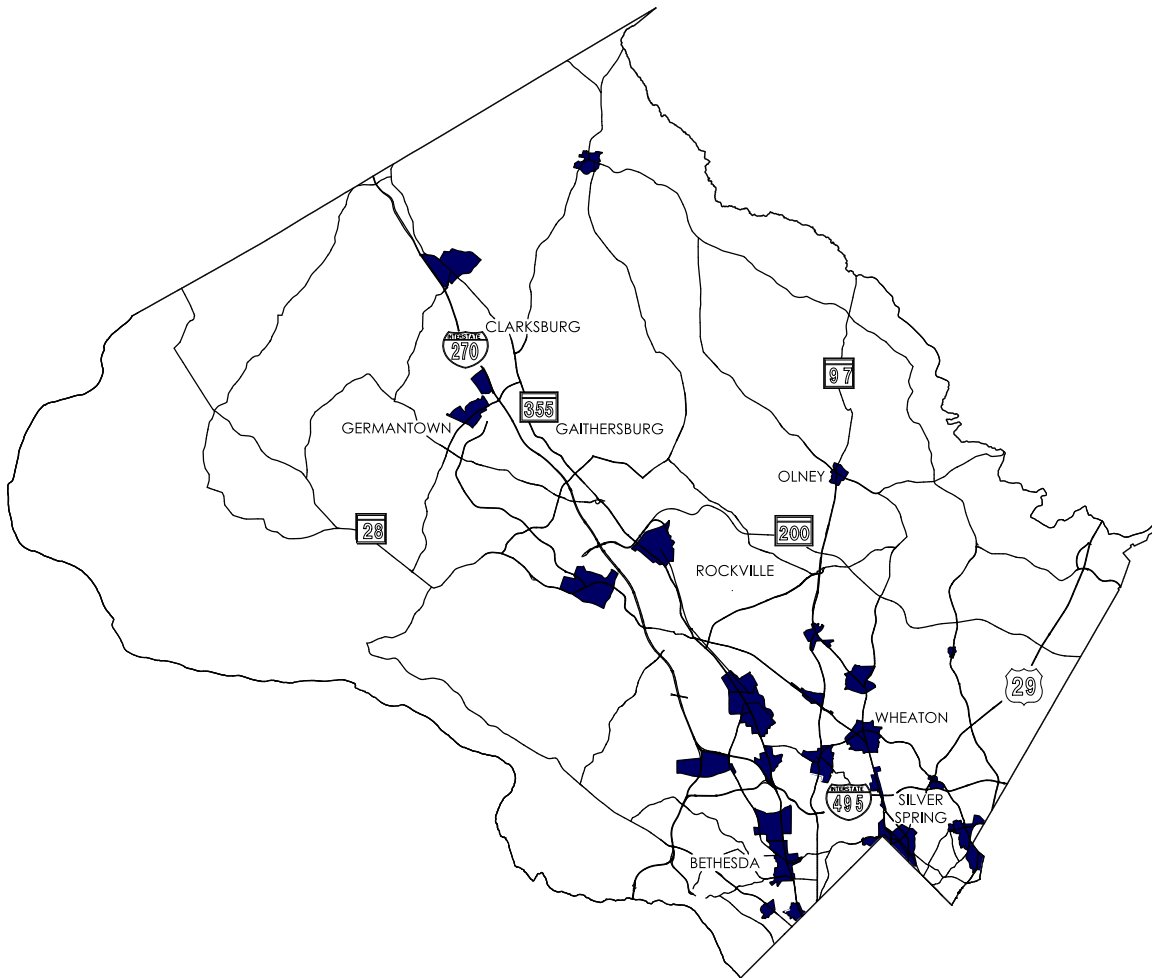
# NACTO



This progressive document, published by the National Association of City Transportation Officials, is a relatively new planning resource that is quickly gaining traction with bicycle advocates, urban planners, and designers alike. Guidance in the NACTO-UBDG is applicable in urban districts, but can be extended into suburban settings, as well. Montgomery County has recently implemented projects -- protected cycle tracks, bike boxes, and the "green paint" treatments -- incorporating guidance consistent with the NACTO-UBDG. It is important to note that this document is not a formally adopted policy in the county. Specific treatments should be approved on a case-by-case basis.

# Appendix B

## Funding Sources and Cost Information



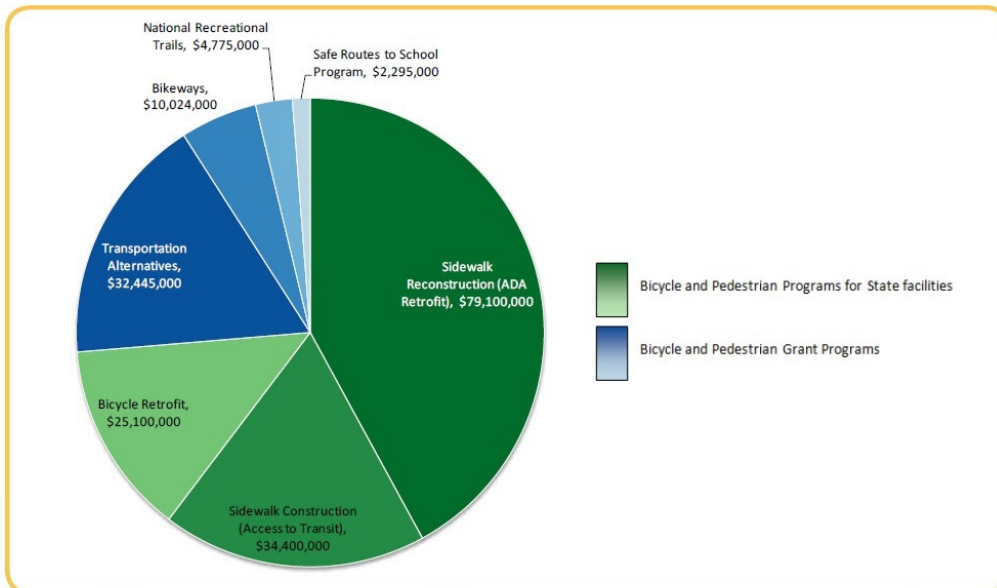


## FUNDING SOURCES

According to the Maryland Department of Transportation’s Maryland Twenty-year Bicycle and Pedestrian Master Plan, January 2014, there are number of funding sources available for improvements including:

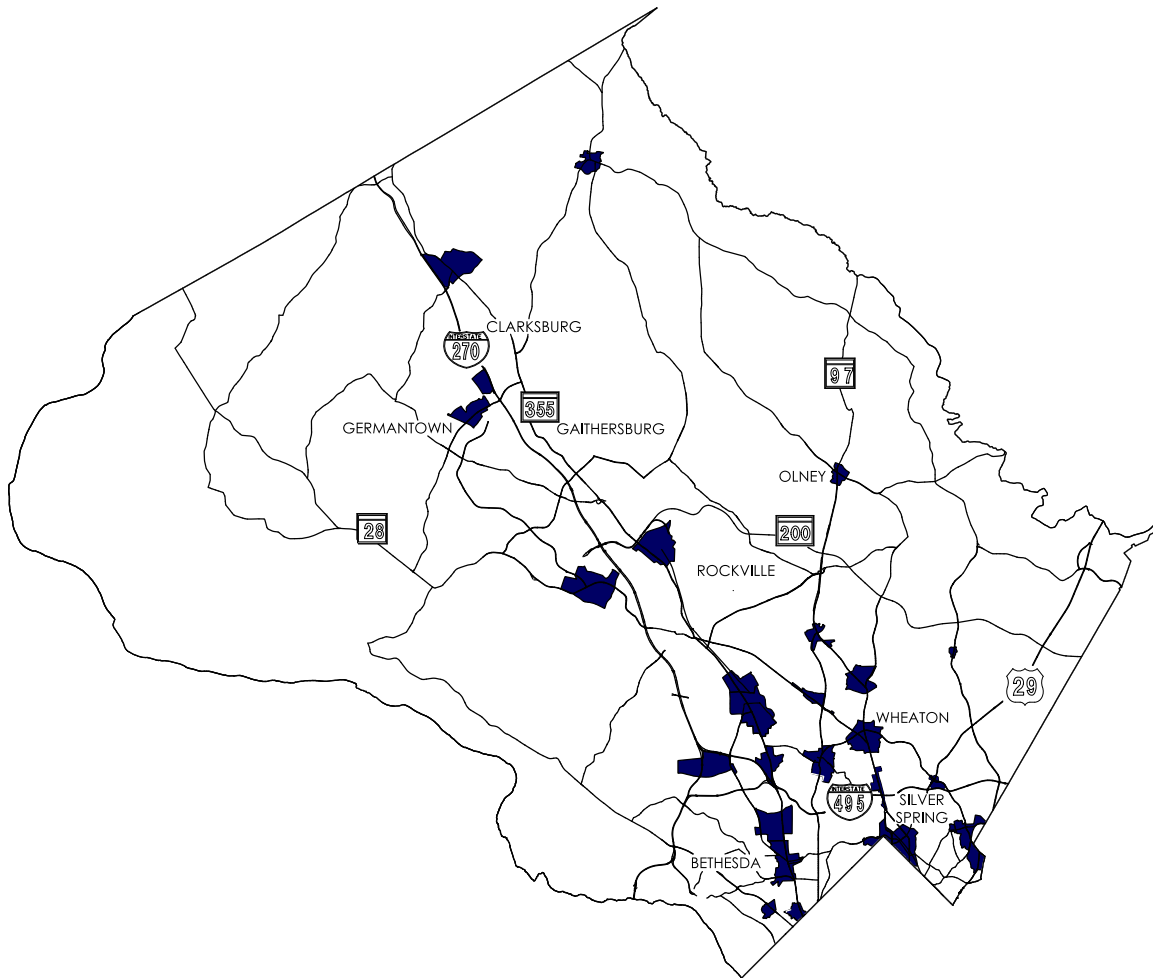
- Transportation Alternatives Program (Federal grants, SHA-administered, \$11 million per year)
- National Recreational Trails (Federal grants, SHA-administered, \$1 million per year)
- Maryland Bikeways Program (State grant, MDOT administered, \$3 million per year)
- Maryland Bikeshare Program (State grant, \$1 million to Montgomery County in FY2013)
- Sidewalk Construction (State fund, \$34.4 million over the next six years)
- Sidewalk Reconstruction / ADA upgrades (State fund, \$79.1 million over the next six years)
- Bicycle Retrofits (State fund)
- Community Safety and Enhancements (State fund, \$134 million over six years)

*MDOT Bicycle and Pedestrian Program Funding Levels (2014-2019)*



# Appendix C

## Improvement Types



## Sidewalks Construction/Reconstruction

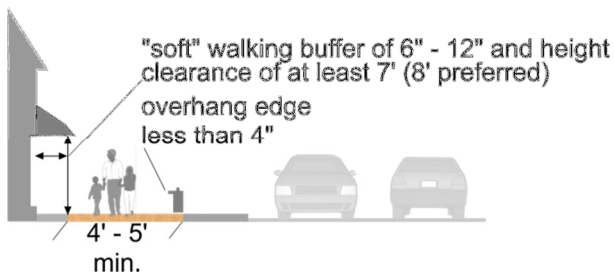
Commonly, existing sidewalks were constructed for single file pedestrian use and do not meet minimum width requirements for MCDOT (4 ft minimum) and SHA (5 ft minimum). Older sidewalks with gaps in connectivity are considered higher priority for replacement than sidewalks which serve lower pedestrian volumes and are in good condition. Also, in locations where obstacles limit the width of a sidewalk, such as the location of a utility pole, the obstacle should be relocated or the sidewalk width should be increased to provide a minimum 3-ft passing width, per ADA standards.



**Figure 2 – Example of Non-Compliant Sidewalk**



**Figure 1 – Example of ADA-Compliant Sidewalk, 4-ft min. width**



**Figure 3 – Best Practices for Sidewalk Design**



**Figure 4 – Example of ADA-Compliant Sidewalk at Horizontal Obstruction, 3-ft min. width**



## Shared-Use Paths

Shared-use paths provide a greater level of service and comfort to pedestrians and bicyclists by providing a 10 – 14-ft wide asphalt surface, 1 – 2-ft clear width, lighting, and landscaped grass buffers. An 8-ft width is acceptable where there are low pedestrian volumes and/or physical constraints. An important distinction between shared-use paths and sidewalks is the absence of obstructions, such as utility poles or street furniture.

Shared-use paths should be planned and implemented along major corridors and to provide connectivity between residential communities, shopping centers, parks, transit stops/stations, and other existing shared-use paths. Special emphasis should be placed on connecting with planned developments. By improving the surrounding areas walkability and bikeability, the redevelopment potential increases significantly.



Figure 5 – Example of Shared Use Path, Glenmont Greenway

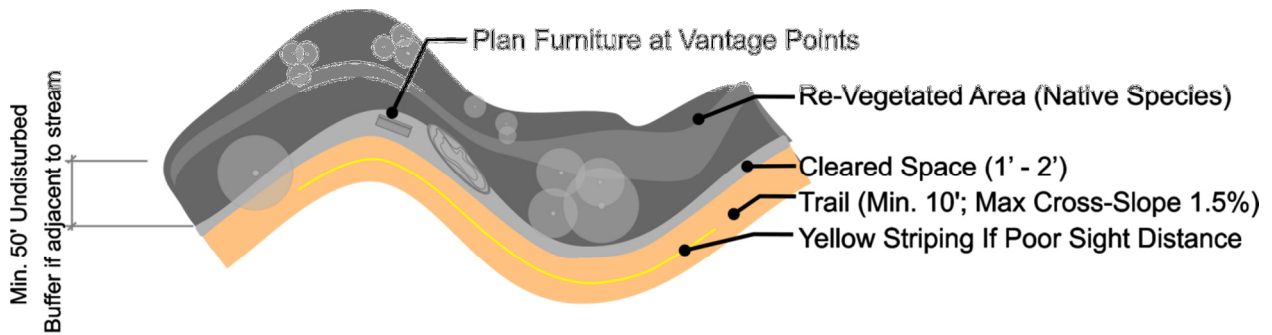


Figure 6 – Best Practices for Shared-Use Path Design

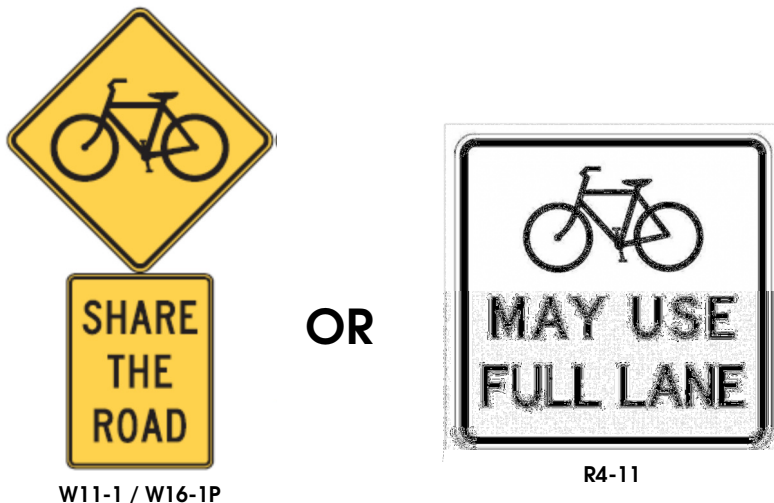
## Shared Roadways

This improvement is the highest priority bicycle improvement. Sharrows benefit bicyclists by clearly indicating to drivers their responsibility to share the traveled way. Recommendations for shared roadway improvements include the installation of sharrows at the far side of intersections and at regular 250 ft intervals along designated bicycle routes. Sharrow markings should be placed a minimum 4 ft from face of curb. If there is an existing parking lane, sharrows should be placed a minimum 4 ft from the edge of the parking lane, to prevent collisions with opening car doors. For narrow residential roadways, where vehicles alternate right of way, opposing sharrow markings should be staggered and placed with a slight offset from the centerline.

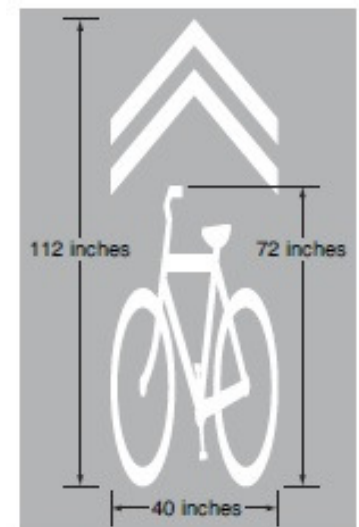
It is also recommended that "Bicycle Route", "Share the Road", and "Bicycle May Use Full Lane" sign assemblies be implemented along designated bicycle routes.



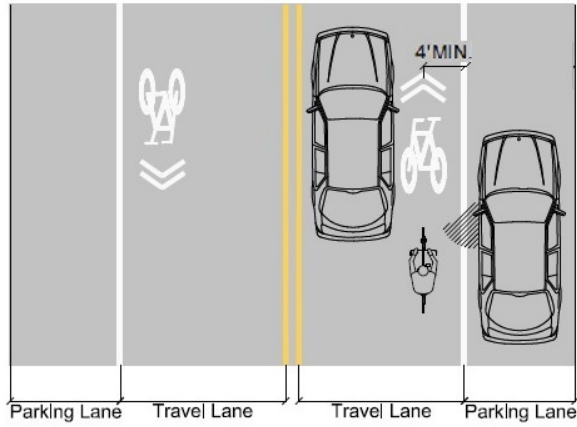
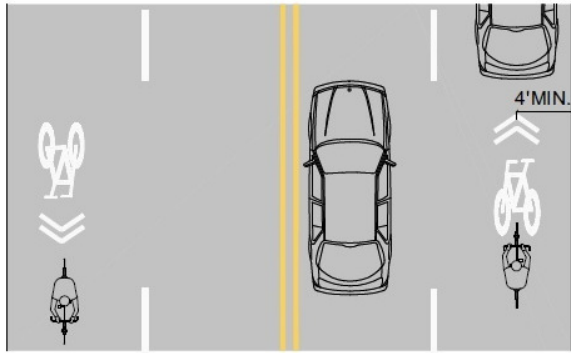
**Figure 7 – Example of Sharrow Marking in Silver Spring, MD**



**Figure 8 – Shared Roadway Signage**  
Install sharrow markings at far side of intersection and 250 ft intervals. Use W11-1/W16-1P sign assembly where lanes are <13 ft to 15 ft wide; use R4-11 where lanes are less than 13 ft wide.



**Figure 9 – Sharrow Marking**



**Figure 10 – Best Practice for Sharrows Placement**  
 Adjacent to curb lane (top);  
 Adjacent to parking lane (bottom).



**Figure 11 – Example of bicyclist riding next to parking lane**  
 Bicyclists tend to shy away from parked vehicles to avoid collisions with opening car doors.

## Bike Lanes

Bicycle lanes create an exclusive space for cyclists; provide a buffer between automobiles and pedestrians; and create a narrower space for cars that may influence speeds downward. Bicycle lanes can also be viewed as safety “clear zones” in the sense that they introduce more space between the motorway and vertical edge elements like curbing, signs, utilities, and street trees. The major benefits accrue to cyclists in that they are able to travel at their preferred speed with minimal interference from automobiles. Bicyclists can choose to use the bicycle lanes or not, particularly when making left-turn maneuvers that may necessitate crossing out of the bike lane and into a left-turn lane.

The preferred width of a bicycle lane is six feet, although narrower adaptations to accommodate limited rights-of-way may create a four-foot bike lane. The MdMUTCD notes that *“if used (for marked bicycle lanes only), Bike Lane signs and plaques should be used in advance of the upstream end of the bicycle lane, at the downstream end of the bicycle lane, and at periodic intervals along the bicycle lane as determined by engineering judgment based on prevailing speed of bicycle and other traffic, block length, distances from adjacent intersections, and other considerations.”* In some circumstances, colored pavements (green or red) or buffering may be considered to reinforce the presence of bicycle lanes, notably where there are a number of commercial driveways that intersect perpendicular to the bicycle lane, on-street parking, high truck volumes, or are located on higher-speed facilities. Special attention at intersections is critical, particularly where turning lanes or end-of-bike lane situations exist.

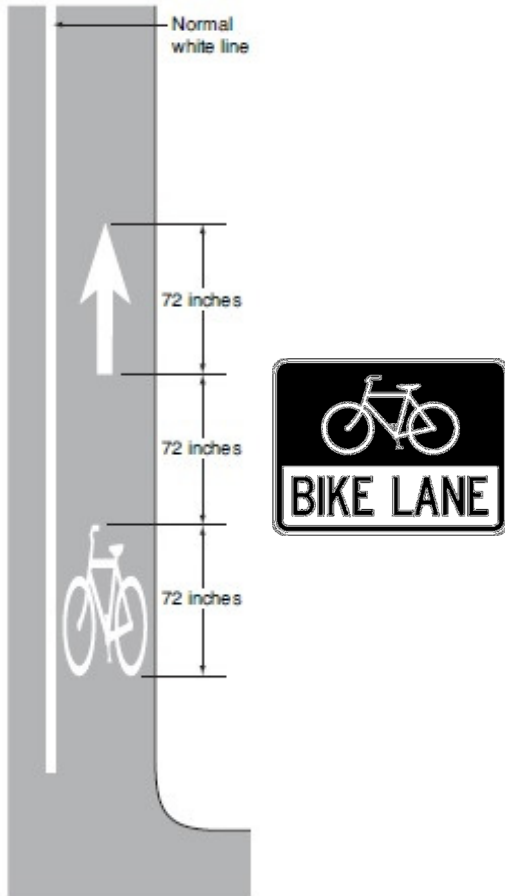


**Figure 12 –  
Examples of Bike  
Lanes**

Adjacent to curb  
(top); Buffered Bike  
Lane (middle); Bike  
Lane adjacent to  
parking (bottom).

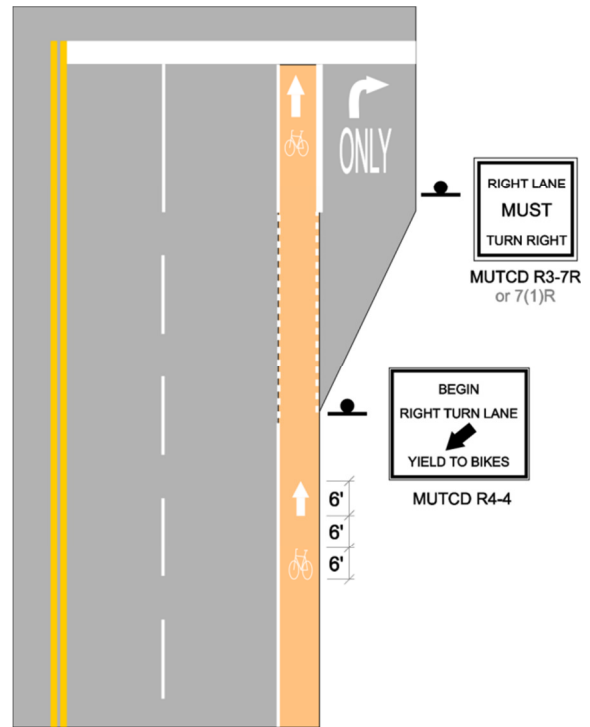


**Figure 13 – Bike Lane on  
Calverton Boulevard,  
Montgomery County**



**Figure 15 – Bike Lane Markings**

For 35 mph or less, min. width = 4'  
Place markings (left) and sign assembly (right) at far side of intersections and every ½ mile.



**Figure 14 – Best Practice for Bike Lanes at Intersections**



## Cycle Track

Cycle Tracks provide a buffered area between a bike lane and automobile traffic, typically with some form of vertical separation created either by the relative height of the bike way itself or through the use of markings and bollards or raised pavement. Cycle tracks can be either two-way or one-way (on each side of a two-way street). There are many design considerations inherent with cycle tracks, particularly as they interface with intersection crossings, on-street parking, transit stops, pedestrian crossings, and commercial driveways. Locations with very high right-turning volumes may be at a disadvantage for cycle track applications, since it can be difficult to accommodate right-turn-only lanes into the design. The MdMUTCD is relatively silent on design parameters, but the NACTO Urban Bikeway Design Guide is a good resource



**Figure 16 – Example of One-way, Protected Cycle Track**



**Figure 17 – Example of Two-way; Protected Cycle Track along Woodglan Drive, Montgomery County**

## Curb Ramp Construction/Reconstruction

The reconstruction of sidewalk curb ramps is easily justifiable based on ADA standards. Running slopes, parallel to the direction of travel should be limited to 12:1, while cross slopes perpendicular to the direction of travel should be limited to 48:1. The average cost for replacing a sidewalk curb ramp is \$1,000 per sidewalk curb ramp.

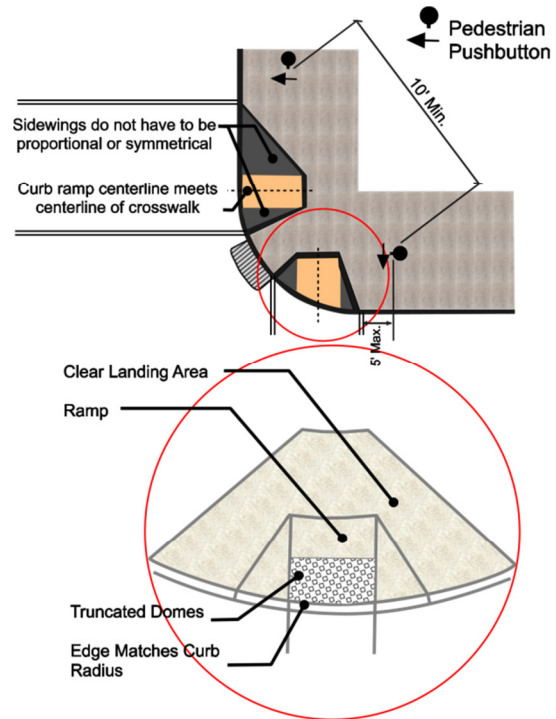


**Figure 18 – Example of Non-Compliant Curb Ramp**



**Figure 19 – ADA-Compliant Perpendicular Curb Ramp**

4'x4' min. landing area with 48:1 cross slope; 12:1 running slope; detectable warning surface



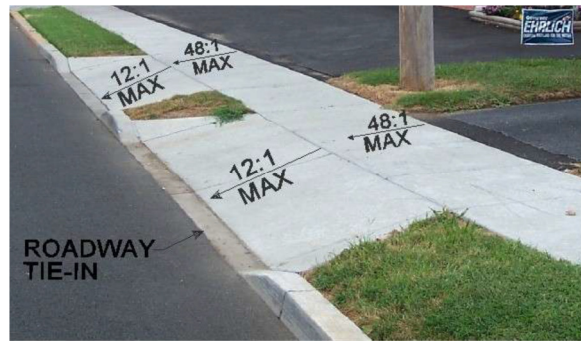
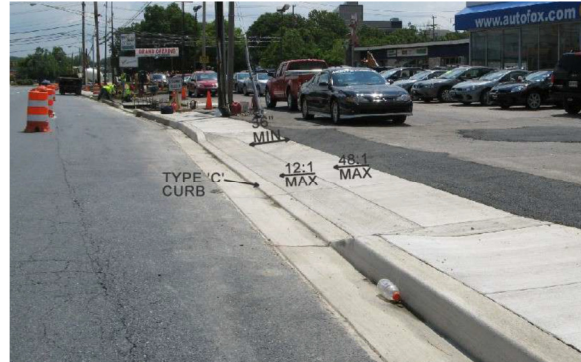
**Figure 20 – Best Practices for Curb Ramp**

## Driveway Apron Reconstruction

The reconstruction of driveway aprons is also easily justifiable based on ADA standards. Running slopes, parallel to the direction of travel should be limited to 12:1, while cross slopes perpendicular to the direction of travel should be limited to 48:1. The average cost for replacing a driveway apron is \$1,000 per driveway. The average cost for replacing a sidewalk curb ramp is \$1,000 per sidewalk curb ramp.

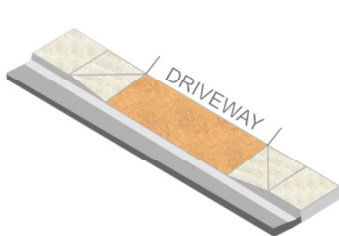


**Figure 21 – Example of Non-Compliant Driveway Apron**

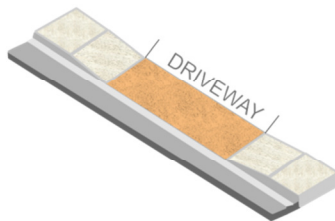


**Figure 22 – Example of ADA-Compliant Driveway Aprons**

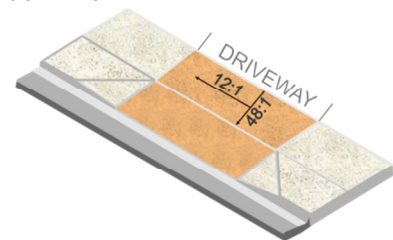
Source: MDSA-ADA



Steep cross-slope makes wheelchair travel along the sidewalk difficult



"Dip" sidewalk path OK in areas where this is necessary



The planting strip and sidewalk set back behind driveway apron allows unimpeded wheelchair travel

**Figure 23 – Best Practices for Driveway Apron Design**



## Median Refuge

There are typically a number of locations that are suitable for median refuge installation. These can be located at intersections (most common) or used to narrow lane widths and pedestrian crossing distances at popular mid-block crossing points.

Ideally, median refuge areas should be designed with a 40-foot minimum length and a minimum six-foot width to accommodate bicycles and strollers without either one sticking out into the motor way. The curb opening should measure the full width of crosswalk, and may be aligned at an angle to orient pedestrians to look at oncoming traffic prior to crossing. Median refuges should include components such as curbing, curb ramps, detectable warning surfaces, crosswalk signing & marking, object markers, and/or bollards. An advance limit line should be placed 20 to 50 feet ahead of the crosswalk.



**Figure 24 – Examples of Median Refuge**

Lockwood Drive (left) and Edson Lane (right), Montgomery County; Install with Signage to promote driver awareness, R1-6a (top, right) and R1-6 (bottom, right)

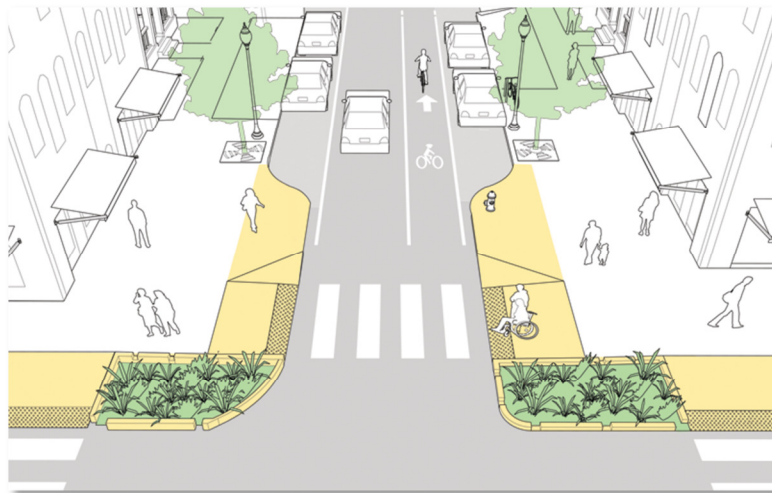


**Figure 25 – Best Practices for Median Refuge**

## Curb Extension

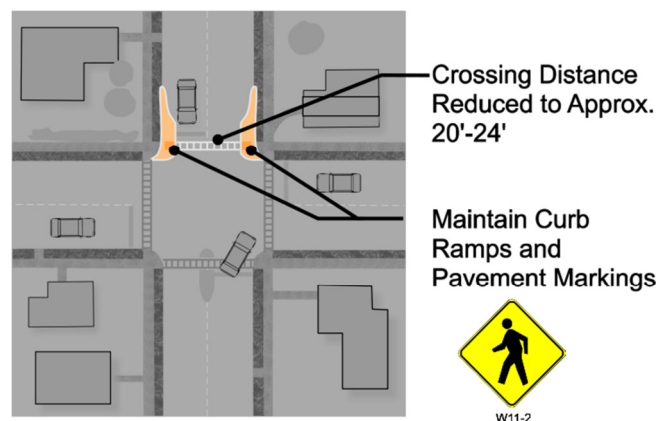
Curb extensions are another tool for both increasing the visibility of pedestrians prior to their crossing at an intersection, as well as decreasing the amount of time and distance in the motor way during a crossing. Curb extensions typically have the added effect of slowing down turning vehicles, since the curb radius of an extension is smaller than a standard return.

Design considerations include right-of-way widths, presence of in-street drainage infrastructure, impacts to on-street parking (although they can also shield on-street parking if the extension is at least seven feet from the edge of curb), and accommodations for landscaping or other amenities (typically minimal or under two feet in height to maintain good sight lines). Pedestrian crossing signs (W11-2, or paired with down-angle arrow W16-7P) are commonly provided in advance of curb extensions, particularly if they are constructed in relatively isolated locations.



**Figure 27 – Curb Extension/Bulb-out**

Source: NACTO



**Figure 26 – Best Practices for Curb Extensions**

Source: NACTO



## Bike Box

Bike boxes are a safety feature that promotes bicyclist visibility and assists with bicycle through and left-turn movements. Bike boxes should be installed at signalized intersections along marked bicycle routes, especially where two-way cycle tracks create complex maneuvers.

Bike boxes allow a bicyclist to move to the front of the queue and become more visible to all traffic. Bike boxes also allow a bicyclist to clear the intersection first and indicate to drivers that it is acceptable for a bicyclist to jump to the front of the queue.

Design considerations for bike boxes include sight distance triangles, vertical sight lines in advance of the bike box, heavy motor vehicle left-turning movements, and interfaces with high-volume driveways. Reinforcing the correct stopping position for motor vehicles is important, with the STOP bar often accompanied by a STOP HERE ON RED (MUTCD R10-4) sign.



Figure 29 – Example of Bike Box at Woodglen Drive & Nicholson Lane, Montgomery County

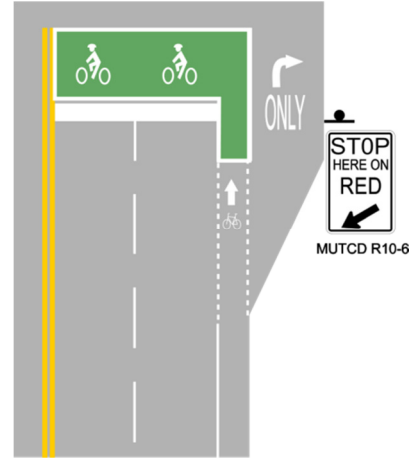


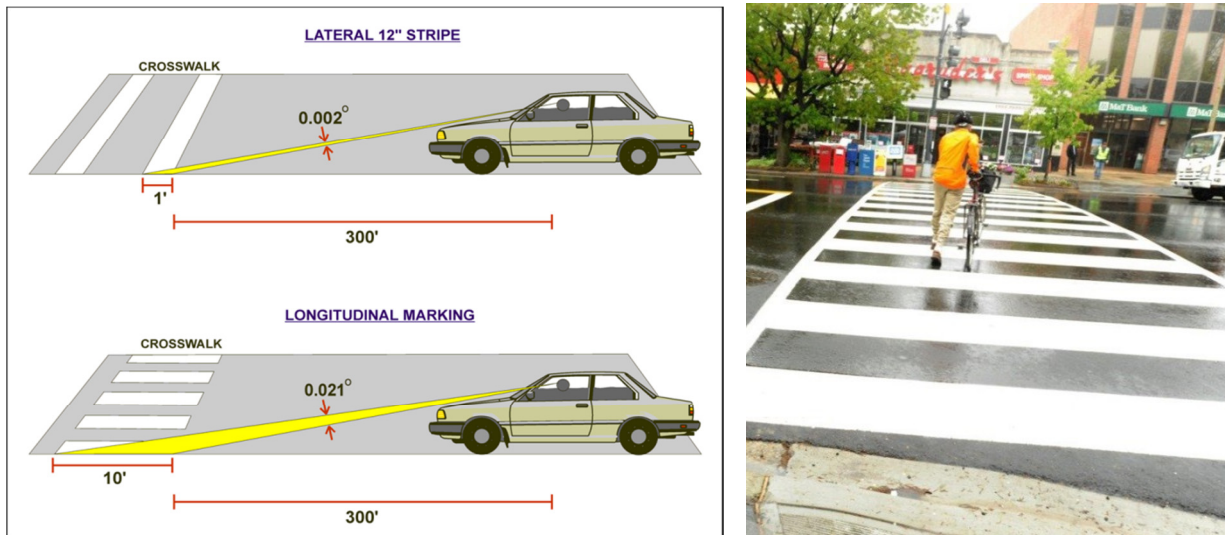
Figure 28 – Best Practices for Bike Boxes

## Crosswalks

Reviewing the MdMUTCD definition of a crosswalk is insightful:

*(a) that part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or in the absence of curbs, from the edges of the traversable roadway, and in the absence of a sidewalk on one side of the roadway, the part of a roadway included within the extension of the lateral lines of the sidewalk at right angles to the center line; (b) any portion of a roadway at an intersection or elsewhere distinctly indicated as a pedestrian crossing by pavement marking lines on the surface, which might be supplemented by contrasting pavement texture, style, or color.*

Crosswalk markings can be at mid-block locations, but are most often at intersections. High-visibility crosswalks have thicker crossbars than the typical “ladder” style, with the most minimal (and commonplace) markings simply consisting of two, 4” parallel lines extending from curb to curb. Higher visibility crosswalks, including colored pavements, should be considered in locations where there is potential or evidence of many vehicle/pedestrian conflicts.



**Figure 30 – Crosswalk Markings**  
 Piano stripe Crosswalks (left) provide better visibility to approaching motorists; Crosswalk in Washington, DC (right)

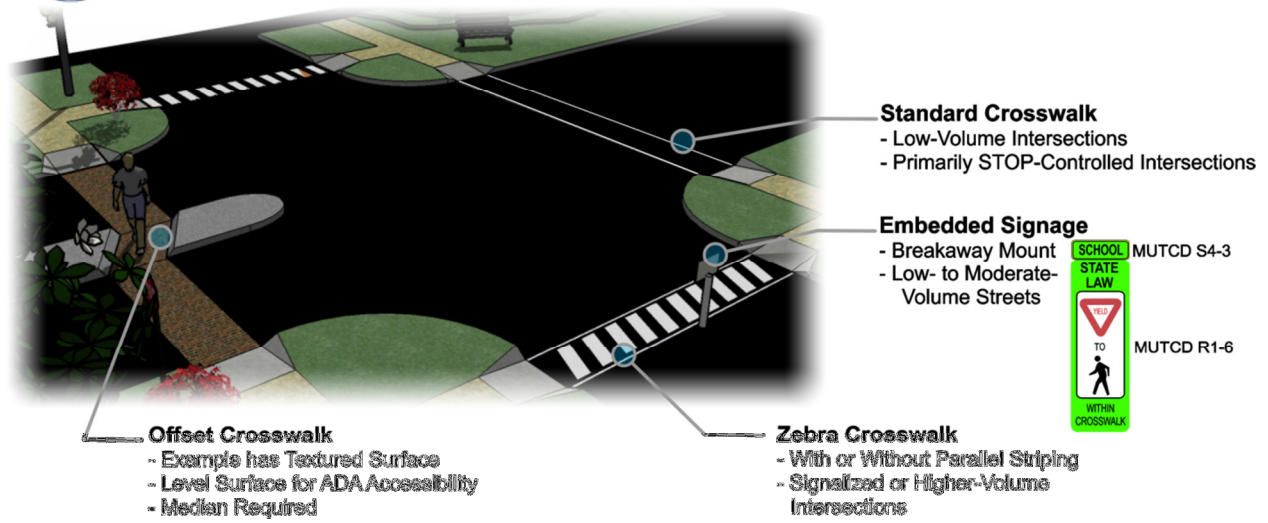


Figure 32 – Best Practices for Crosswalks



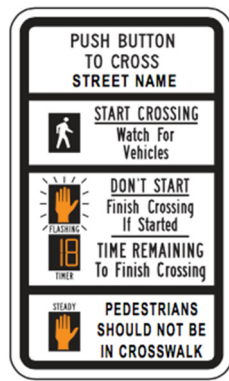
Figure 31 – Crosswalk Signage

Highly visible R1-6a signs are effective for uncontrolled crossings.

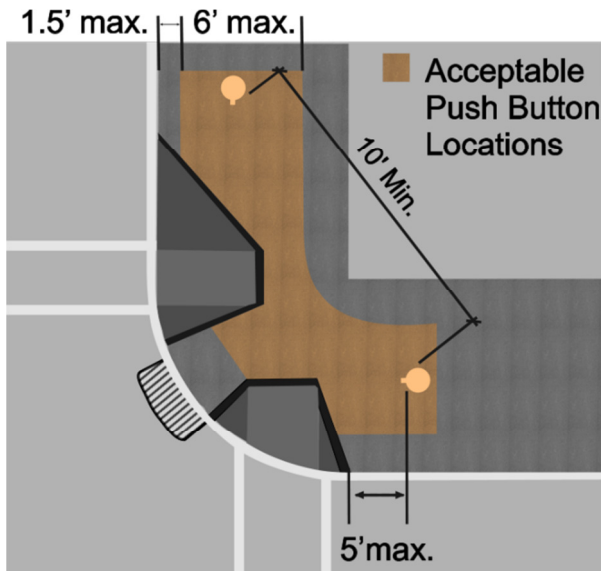


## Accessible Pedestrian Signal / Countdown Pedestrian Signal

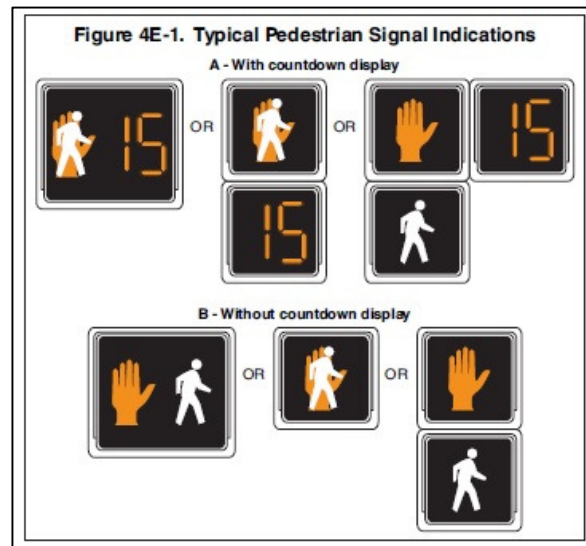
Accessible pedestrian signal and countdown pedestrian signal (APS/CPS) upgrades are easily justifiable. Generally, intersections will include CPS; however, a number of intersections have not been upgraded to include ADA-compliant push button assemblies. The MdMUTCD now recommends that push buttons be located within a specific distance of the ramp landing area and installed for each crosswalk. A typical four-legged intersection with four crosswalks would require eight push button assemblies. Ideally, push buttons should be located within the reach of a person seated in a wheelchair waiting within the landing area of the curb ramp.



R10-3(1)



**Figure 33 – Accessible Pedestrian Signal (APS)**  
Audible push button assembly (top, left); Standard push button plaque (top, right); Push button locations per MdMUTCD (bottom).



**Figure 34 – Countdown Pedestrian Signal (CPS)**  
Walk phase (top, left); Don't start phase (top, right); full progression per MdMUTCD (bottom).



## Pedestrian Actuated Signal

Pedestrian actuated signals are appropriate on high volume, multi-lane roadways where there is a moderate to high demand for uncontrolled pedestrian (or bicycle) crossings. Pedestrian actuated signals operate with flashing yellow beacons until a push button is activated. When the push button is activated by a pedestrian, the flashing yellow beacon progresses to solid yellow and/or then solid red. A traffic signal warrant study should be performed to confirm the need for this improvement.



**Figure 35 – Examples of Pedestrian Signals**

Located in College Park, MD (left, Source: Greg Dohler/The Gazette) and Silver Spring, MD (right)