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Montgomery County
Accessible Design Guide

MCDOT
Montgomery County
Department of Transportation

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This guide contains information intended to be used as an input during the design process; however, field verification, site condition assessments, engineering analysis, and design are necessary prior to implementing guidance contained herein.

Table of Contents

Attachment A: Accessible Design Guide

Acronyms

ADA: Americans with Disabilities Act of 1990

APS: Accessible pedestrian signal

ABA: Architectural Barriers Act of 1968

BRT: bus rapid transit

CSDG: Montgomery County Complete Streets Design Guide

EV: electric vehicle

DWS: Detectable warning surface

FHWA: Federal Highway Administration

ID: identification

LOS: level of service

LLF: light loss factor

MAC: Maryland Accessibility Code

M-NCPPC: Maryland-National Capital Park and Planning Commission

MUTCD: Manual on Uniform Traffic Control Devices

MdMUTCD: Maryland Manual on Uniform Traffic Control Devices

MCDOT: Montgomery County Department of Transportation

NCHRP: National Cooperative Highway Research Program

PROWAG: Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way

PAR: pedestrian access route

SHA: Maryland Department of Transportation State Highway Administration

SUP: shared use path

SUPLOS: shared use path level of service

TDI: tactile direction indicator

TCRP: Transit Cooperative Research Program

TWSI: tactile walking surface indicator

US: United States

USDOJ: United States Department of Justice

USDOT: United States Department of Transportation

1 Introduction

This document provides guidance for designing accessible pedestrian facilities in the public right-of-way as required by Section 504 of the *Rehabilitation Act of 1973*, Title II of the Americans with Disabilities Act of 1990, and other federal, state, and local laws. It is intended for Montgomery County staff, contractors, and residents, and builds on the United States Access Board's recently adopted *Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way* (PROWAG) as well as previous guidance developed by Montgomery County, including *Planning and Designing Streets to be Safer and More Accessible for People with Vision Disabilities*.

1.1 Why this guide?

This guide has three key purposes:

- To provide a single resource that brings together key accessibility guidance from federal, state, and local sources and to address conflicts and gaps in that guidance.
- To help County staff and contractors meet and exceed the legal minimum requirements for accessible pedestrian facilities in the public right-of-way, and to inform County residents about requirements and best practices.
- To make pedestrian facilities in the public right-of-way more accessible and consistent, thereby benefiting not just individuals with disabilities but all Montgomery County residents.

1.2 Who is this guide for?

The primary audience for this guide is anyone who is involved in the planning, design, and construction or alteration of facilities in the County's public right-of-way, including County staff and contractors. This guide is also intended as a resource for County residents to help them understand accessibility requirements and best practices.

Montgomery County is committed to meeting and exceeding the minimum federal and state requirements for accessible facilities in the public right-of-way. The County has been, and will continue being, a national leader in accessible design nationally.

1.3 What does this guide include?

- A list of documents incorporated by reference and other key guidance documents that practitioners should be familiar with.
- Facts about people with disabilities, including their prevalence in Montgomery County, the impacts of inaccessible design on people with disabilities and their families, and related issues that are important to consider.
- Guidance on engaging people with disabilities in the planning and design of facilities in the public right-of-way.
- General principles for the accessible design of facilities in the public right-of-way.
- 18 topic sections, each of which includes a list of challenges reported by people with disabilities, a summary of key requirements, and information on where and how a particular treatment should be implemented.
- Appendices, including a glossary of terms, checklists for contractors, further guidance for engaging people with disabilities in the design process, and information on emerging treatments.

Note: This guide does not address shared and curbless street design. Guidance on shared and curbless street design, including accessibility aspects, has been developed as part of a separate project conducted by the Montgomery County Department of Transportation (MCDOT) and Montgomery County Planning Department.

1.4 What authority does this guide have?

This guide includes requirements and best practice guidance.

1.4.1 Requirements

Key requirements are summarized with links provided to relevant supplemental documents. These requirements must be implemented for all new construction in undeveloped areas of the County. In developed areas, alterations, which include certain modifications to existing facilities and construction of new facilities, must comply to the maximum extent feasible where existing physical constraints make compliance technically infeasible.

Failure to comply with requirements could result in a lawsuit or an obligation to cure the defect at the applicant's own cost.

Requirements are indicated by the terms "shall," "must," and "required" or "requirement."

"Technically infeasible" means that it is highly unlikely or impossible to meet accessibility requirements due to underlying terrain, underground structures, adjacent developed facilities, drainage, and significant natural or historical features.

1.4.2 Best Practice Guidance

Best practice guidance includes guidance that is not explicitly required in federal or state accessibility guidance but is regarded as best practice by the County. Best practice guidance should be implemented, except in cases where the Montgomery County Department of Transportation or other appropriate Montgomery County regulating agency provides a written exemption.

Best practice guidance is indicated by the term "should."

1.5 How was this guide developed?

This guide was developed based on national and international best-practice research and a robust engagement process in Montgomery County. The best-practice research included outreach to local government officials, accessible design specialists, and disability advocacy groups in the United States and around the world. The engagement process emphasized input from people with an array of disabilities, including ambulatory, vision, hearing, intellectual, developmental, and others. It included presentations to the Project Management Team, comprised of staff from several County agencies and representatives from the County's disabled communities, on January 5 and May 25, 2023, and February 21, 2024; an open, online public meeting on April 13, 2023[1]; and presentations to the County's Commission on People with Disabilities on May 10, 2023.

1.6 Accessibility Challenges Survey

The engagement process included an online survey that asked people with disabilities and others about the challenges they face while traveling in the County as pedestrians. The Accessibility Challenges Survey was advertised on the County's website and social media and was open for responses from March 4 to March 24, 2023. By the end of the survey period, 247 people had completed the survey.

Of the respondents, 20% identified themselves as a person who has difficulty traveling as a pedestrian due to accessibility challenges, 19% as a caregiver, family member, friend, or advocate of such a person, and 5% as a travel trainer or other professional who works with people with disabilities or mobility difficulties. Another 17% selected "other" and wrote in answers. They included people with conditions such as narcolepsy that prevent driving, parents using strollers, older adults, and non-disabled individuals who have been affected by pedestrian facilities with accessibility challenges.

Overall, respondents found crossing the street to be the most challenging activity from an accessibility standpoint, followed by traveling on sidewalks, navigating temporary routes during construction, and traveling on shared use paths (Figure 1).

Accessibility challenges have significant impacts on the lives of people with disabilities and their families. When asked how the disability challenges they noted in the survey affected them, nearly two-thirds of survey respondents selected "I can't do things or go places because getting there and back doesn't feel safe" (Figure 2). Many respondents also indicated that the accessibility challenges they noted had effects on their families, such as reliance on family members to drive them places when they might otherwise be able to travel by themselves or driving themselves places when other travel options might be more appropriate (Figure 2).

Figure 1: Top accessibility challenges from Accessibility Challenges Survey

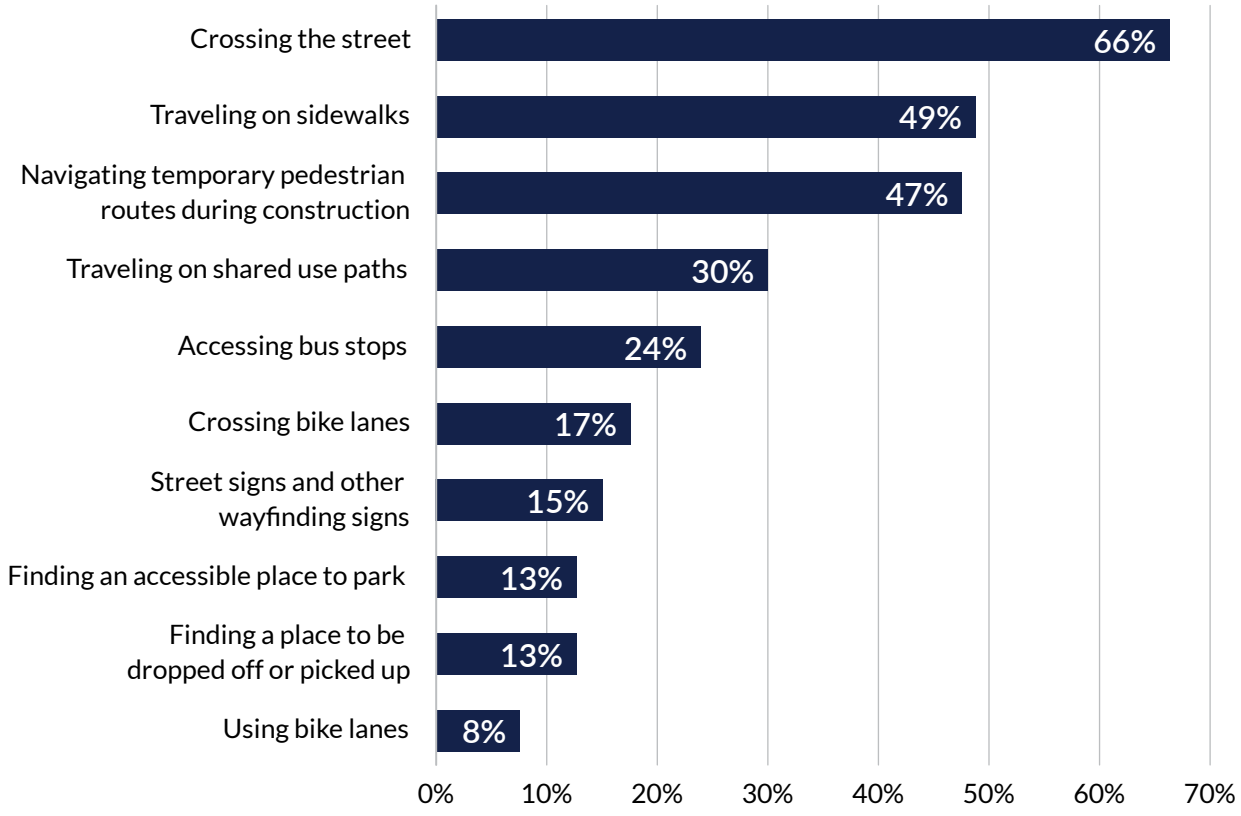
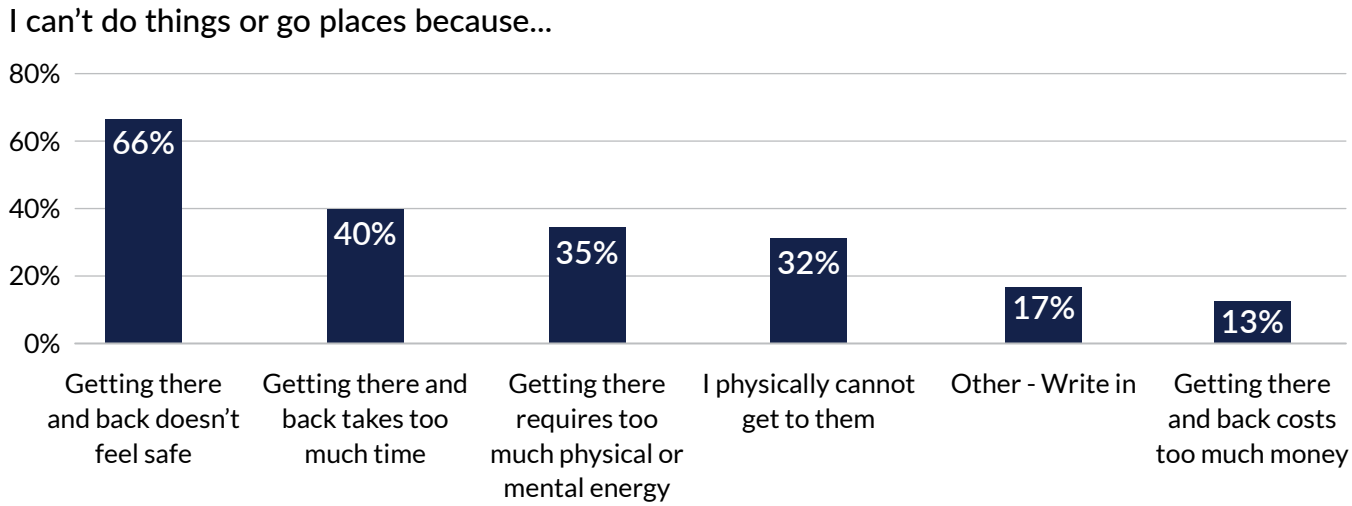


Figure 2: Effects of accessibility challenges from Accessibility Challenges Survey



1.7 Documents Incorporated by Reference & Other Key Guidance Documents

The documents in Table 1 are incorporated by reference into this guide. Street designs developed for the public right-of-way must comply with all applicable standards or requirements in these documents. Table 2 provides a list of other key guidance documents referenced in this guide. The guidance in these documents should be implemented, except in cases where the Montgomery County Department of Transportation or other appropriate Montgomery County regulating agency provides a written exemption.

Table 1: Standard Documents

Full Title (Abbr.) and Issuing Agency	Description
Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) *US Architectural and Transportation Barriers Compliance Board (Access Board)*	• Establishes minimum standards for permanent and temporary facilities in the public right-of-way. • Applies to new construction on undeveloped land and alterations to existing facilities. • At time of publication, these Guidelines have not yet been adopted and made enforceable by US DOJ
Americans with Disabilities Act Standards (ADA Standards) *US Department of Transportation (USDOT), US Department of Justice (USDOJ)*	• Establishes minimum standards for facilities covered by the Americans with Disabilities Act of 1990. • Does not explicitly address the public right-of-way. • Applies to new construction and alterations.
Architectural Barriers Act Accessibility Standards (ABA Standards) *Access Board*	• Establishes minimum accessibility standards for facilities designed, built, or leased with federal funds. • Does not explicitly address the public right-of-way. • Applies to new construction and alterations.
Maryland Manual on Uniform Traffic Control Devices for Streets and Highways (MdMUTCD) *Maryland State Highway Administration (SHA)*	• Establishes standards and guidelines for traffic control devices, including signs, signals, and pavement markings. • Updated within 2 years every time a new edition of the FHWA MUTCD is issued. • Next edition of the MdMUTCD expected in 2025.
Maryland Accessibility Code (MAC) *Maryland Building Codes Administration*	• Establishes minimum accessibility requirements for buildings and facilities, including requirements for accessible parking.

Table 2: Other Key Guidance Documents

Full Title (Abbr.) and Issuing Agency	Description
Montgomery County Complete Streets Design Guide (CSDG) *Montgomery County Department of Transportation (MCDOT), Maryland-National Capital Park and Planning Commission (Montgomery Planning)*	• Provides policy and design guidance on the planning, design, and operation of county roadways. • Applies to new streets, reconstruction of existing streets, capital improvement projects, and street resurfacing projects or other major street projects.
Montgomery County Pedestrian Master Plan (Pedestrian Plan) *Montgomery Planning*	• Recommends policy, design, infrastructure, and programming changes to make pedestrian travel safe, comfortable, convenient, and accessible for pedestrians of all ages and abilities.
Planning and Designing Streets to Be Safer and More Accessible for People with Vision Disabilities (PVD Toolkit) *MCDOT*	• Provides guidance on planning and designing streets for people with vision disabilities. • First edition published in 2021 with funding from the Metropolitan Washington Council of Governments.
Montgomery County Curbless and Shared Streets Design Guide *MCDOT and Montgomery Planning*	• This supplement to the CSDG provides planning, policy, and design guidance for curbless and shared streets in Montgomery County, including ensuring that they are fully accessible for people with disabilities.

Background | 2

Disability is a universal human experience. Almost all County residents will have a short- or long-term disability at some point in their lives, and the share of people with disabilities at any one time is likely to grow as the County's population ages.

County residents rely on accessible pedestrian facilities in the public right-of-way to access jobs, education, healthcare, shopping, social and recreational activities, and other daily needs. Accessible pedestrian facilities play a critical role even when pedestrian travel is not the primary transportation mode. For example, most people access public transportation, taxis, ride-share, and private cars via pedestrian travel.

When pedestrian facilities in the public right-of-way aren't accessible, it affects not just individuals with disabilities but also their families, friends, neighbors, and indeed Montgomery County as a whole, since the value that individual might contribute to the community is thereby limited. On the other hand, when facilities in the public right-of-way are accessible and inclusive, all Montgomery County residents benefit. For example, curb ramps that make it possible for people who use wheelchairs to cross at intersections safely also improve conditions for people pushing strollers, travelers pulling suitcases, and others.

2.1 Facts About People with Disabilities

People with disabilities constitute a significant segment of Montgomery County's population. According to estimates developed by the United States Census Bureau, in 2021 over 91,000 Montgomery County residents had a hearing, vision, cognitive, ambulatory, self-care, or independent living difficulty.[2] This is equivalent to approximately 9% of the County's population, or more than one in every 12 County residents, and does not include people who live in institutions such as nursing homes or jails, or people whose difficulty or disability does not align well with the categories the Census Bureau uses. Taking a broader view, almost every person will have a short or long-term disability that affects their mobility at some point in their lives.

The County's population is aging. Currently, people aged 65+ account for 17% of the County's population. According to estimates developed for the Maryland Department of Planning, by 2040 they are projected to account for 20% the County's population and the overall 65+ population is expected to rise by more than 50,000 people (Figure 3). People who are older are more likely to have a disability. People aged 65+ account for 17% of Montgomery County's population but are 45% of people with disabilities, including 25% of people with cognitive difficulties, 39% of people with vision difficulties, 63% of people with hearing difficulties, and 63% of people with ambulatory difficulties (Figure 4).

People with disabilities often have multiple disabilities. Nearly half (44%) of Montgomery County residents with a disability have more than one disability. For example, a person might have both a vision disability and an ambulatory disability (difficulty walking). Older people are more likely to have multiple disabilities than younger people. Only 3% of people under 18 have a disability, and only one-third have multiple disabilities. By comparison, 24% of people aged 65 years or older have a disability, and more than half (53%) have multiple.

Figure 3: Age 65+ Population, Montgomery County, 1960-2040

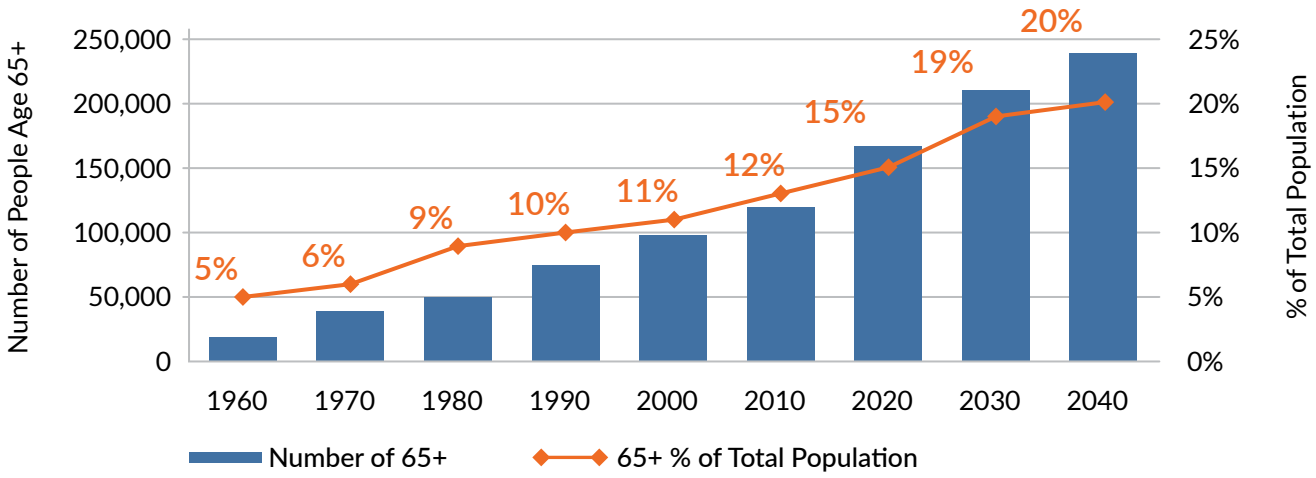
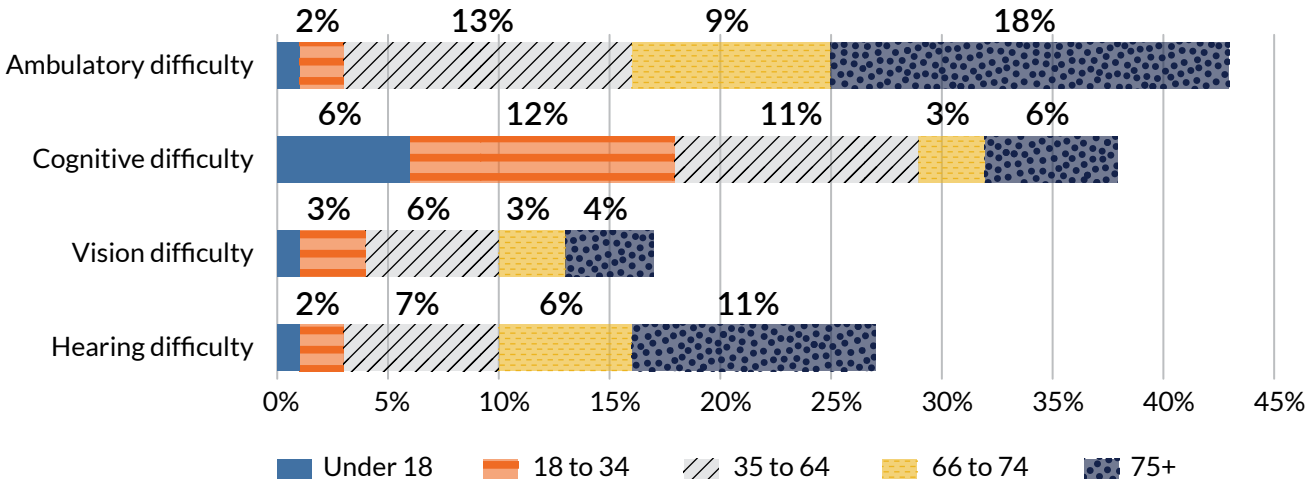


Figure 4: Difficulty Type by Age as a Percentage of People with Disabilities in Montgomery County



People with disabilities use all modes. They are pedestrians, cyclists, transit users, motor vehicle drivers, etc. Work trips constitute a relatively small proportion of the trips people with disabilities in Montgomery County make but are the only trip type recorded in Census data. This data indicates that people with disabilities are more likely than the average worker to travel as pedestrians, transit users, and carpoolers and less likely to drive alone to work (Table 3).

People with disabilities have diverse needs as pedestrians in the public right-of-way. There are many different types of disabilities, and many ways people with disabilities travel as pedestrians in the public right-of-way. For instance, in the category of people with vision disabilities, there are people with reduced visual acuity, peripheral field loss, central field loss, total vision loss, night blindness, and color blindness, to name just the major subcategories. In addition, some people with vision disabilities use a cane (of which there are several types), some use a guide dog, and some rely on a human escort. Others may use no specialized mobility aids at all.

Other disability categories are similarly diverse, and income, race/ethnicity, gender, neighborhood context, and other attributes influence the experience of disability. Street plans and designs must account for this diversity. The best way to ensure this is by proactively engaging people with a range of disabilities, coping strategies, and backgrounds in street planning and design processes, and by engaging people and organizations that have a deep familiarity with this diversity and can offer their expertise.

Table 3: Commute modes of Montgomery County residents with and without disabilities who work, sorted by the difference in mode share (Source: US Census, ACS Table S1811, 2021 5-year and 1-year Estimates) [3]

	% of people with disabilities		% of people without disabilities	
Mode	5-year	1-year	5-year	1-year
Public transportation (excluding taxicab)	14.6%	5.5%	10.8%	4.5%
Car, truck, or van - carpooled	9.9%	13.3%	8.5%	6.5%
Taxicab, motorcycle, bicycle, or other means	3.3%	1.3%	1.9%	2.5%
Walked	2.1%	2.1%	1.8%	1.6%
Worked from home	17.5%	34.9%	17.6%	37.3%
Car, truck, or van - drove alone	52.6%	42.8%	59.4%	47.7%

Engaging People with Disabilities in Street Planning and Design | 3

The decisions that come out of street planning and design processes affect the lives and wellbeing of people with disabilities just as much as other people, and frequently more so. As such, people with disabilities should be engaged in the street design process from start to finish, particularly in the case of street designs that have not been tested locally or are not well-covered by federal accessibility guidance. These include shared spaces, separated bike lanes, bus boarding islands, and roundabouts or other nonconventional intersection designs.

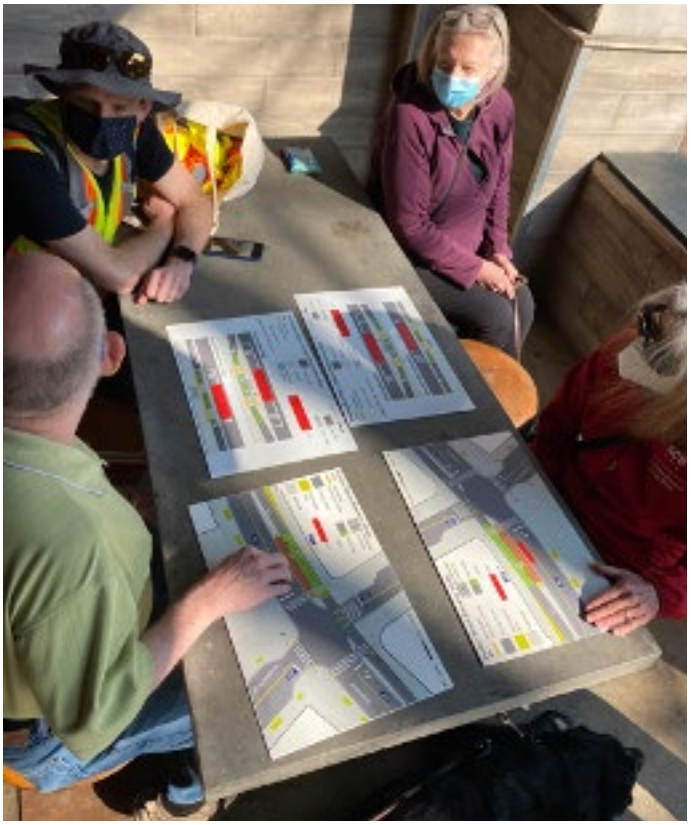
Failure to adequately engage people with disabilities as part of street planning and design processes can result in costly retrofits and other unanticipated costs. While designers are required to follow existing guidelines, they should not expect that doing so will necessarily result in accessible streets. This is because existing standards emphasize minimum requirements, but doing the minimum may not be desirable or ethical, especially if there is the capacity to do more. Also, existing guidelines are often better at addressing the needs of people with certain types of disabilities and less focused on meeting the needs of people with other types. For example, design guides often include considerable detail on how to accommodate people who use wheelchairs. However, guidance on accommodating people with hearing and vision disabilities is relatively limited, and guidance on accommodating people with intellectual and developmental disabilities is almost nonexistent.

In addition, a designers' intuition about the needs of people with disabilities is similarly insufficient, as it is likely to be based on the designer's limited personal experience and may be influenced by biases the designer has about people with disabilities and what they need.

For all these reasons, effectively engaging people with disabilities is critical. Effective engagement requires going beyond the ADA requirements for accessible meetings and materials (Figure 5) and proactively reaching out to people with disabilities and to people familiar with the challenges they face, including rehabilitation professionals, travel trainers, orientation and mobility specialists, and others.

For more information on best practices for engaging people with disabilities, see *Appendix B: Engaging People with Disabilities in Street Design*.

Figure 5: Tactile graphics were used to help people with vision disabilities understand a proposed design for the intersection of Fenton Street and Ellsworth Drive in downtown Silver Spring



Principles of Accessible Pedestrian Facility Design

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4.1 Safety

Streets and other outdoor public spaces are safer for all users when they are safe for people with disabilities.

Montgomery County has a goal of eliminating serious and fatal crashes by 2030, with a focus on vulnerable road users, including people with disabilities, pedestrians, and cyclists. Pedestrians with disabilities are particularly vulnerable as road users, with some studies suggesting they are two to five times more likely to be involved in a fatal or serious injury crash with a motor vehicle than people without disabilities.[4] Many of the measures recommended to reduce fatal and serious injury crashes can significantly improve safety for people with disabilities, including measures to reduce pedestrian exposure to motor vehicle traffic and motor vehicle speeds. Although speed reduction measures are not the focus of this guide, they are a critical factor in creating streets that are accessible and safe for people with disabilities.

4.2 Compliance

Streets and other outdoor public spaces comply with all applicable federal and state laws and standards.

Key federal laws and standards include but are not limited to:

- Section 504 of the Rehabilitation Act of 1973 (Section 504)
- The Americans with Disabilities Act of 1990 (ADA)
- United States Access Board, Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, 2023 (PROWAG)
- United States Department of Transportation, ADA Standards for Transportation Facilities, 2006 (USDOT ADA Standards)
- United States Department of Justice, ADA Standards for Accessible Design, 2010 (USDOJ ADA Standards)
- The Maryland Manual of Uniform Traffic Control Devices (MdMUTCD)

4.3 Inclusiveness

Plans and designs for streets and other outdoor public spaces are developed through an inclusive process that seeks to address diverse user needs.

Inclusiveness is an essential concept when designing for people with disabilities. If people with disabilities avoid using a public facility based on the belief that it is unsafe or uncomfortable, then the facility is not truly inclusive or accessible. In addition, it is important to consider the diverse needs of people with different types of disabilities. What works for a person who has an ambulatory disability may not work for a person who has an intellectual or developmental disability. What works for a person who has low vision may not work for a person who is blind. What works for a person who is blind and has average hearing may not work for a person who is deafblind. The goal is to develop a range of solutions that addresses these diverse needs.

4.4 Consistency and Predictability

Streets and other outdoor public spaces are designed in a way that is consistent and predictable. A person with a disability, including a person with a vision, intellectual, or developmental disability, should be able to navigate a street that they've never been to before.

Consistency and predictability are helpful for all street users, including people with disabilities, but are critical for people with vision disabilities, who often rely on mental maps and assumptions about the built environment for navigation, and for people with intellectual and developmental disabilities who may be easily confused or stressed by unexpected circumstances. Temporary changes in the built environment because of construction or other activities can be especially confusing and disorienting if not handled appropriately.

4.5 Maintenance

All streets and outdoor public spaces are well-maintained and well lighted.

It is especially important that elements that are critical for accessibility, such as sidewalk and crosswalk surfaces, accessible pedestrian signals, detectable warning surfaces, crosswalk markings, and lighting are well-maintained. Lighting is critical for those who have poor night vision and other conditions which leave them with limited vision and unable to perceive hazards in dim lighting.

Pedestrian Access Routes and Pedestrian Circulation Paths

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A pedestrian access route is an accessible, continuous, and unobstructed path of travel for use by pedestrians with disabilities within a pedestrian circulation path in the public right-of-way. A pedestrian circulation path is a prepared exterior or interior surface provided for pedestrian use in the public right-of-way (PROWAG R104.3).

Pedestrian access routes typically coincide with or are contained within pedestrian circulation paths. Pedestrian access routes can be conceptualized as continuous three-dimensional corridors through which pedestrians with disabilities can easily move.

Pedestrian circulation paths may include spaces that are inaccessible to some people with disabilities, e.g., stairs; however, they must meet certain accessibility requirements, including requirements for protruding objects.

5.1 Potential Accessibility Challenges

- Pedestrian access route not provided.
- Pedestrian access route does not connect to accessible elements, spaces, and pedestrian facilities.
- Pedestrian access route is difficult to distinguish from other spaces.
- Pedestrian access route is difficult to distinguish from other spaces at night.
- Pedestrian access route is not direct or intuitive.
- Pedestrian access route does not have accessible or effective signage.

5.2 Guidance

5.2.1 Where to Apply

- Pedestrian facilities shall contain or connect to a pedestrian access route (PROWAG R203.1). Pedestrian facilities include any structure, route, or space for pedestrian circulation or use located in the public right-of-way, including but not limited to:
  - Sidewalks
  - Shared use paths
  - Crosswalks
  - Curb ramps and blended transitions
  - Pedestrian at-grade rail crossings
  - Pedestrian overpasses and underpasses
  - Ramps
  - Elevators and limited use/limited application elevators
  - Platform lifts
  - Doors and gates
- Pedestrian access routes shall connect accessible elements, spaces, and pedestrian facilities required to be accessible and connect to accessible routes that connect building and facility entrances to public streets and sidewalks (PROWAG R203.2). Examples of facilities that pedestrian access routes are required to connect to include pedestrian push buttons, accessible street furniture, accessible transit stops and transit shelters, accessible on-street parking spaces, parking meters and parking pay stations, and accessible passenger loading zones.

5.2.2 Key Requirements

Table 4: Key Requirements for Pedestrian Access Routes (PARs)

Design Element	Criteria	Notes	Reference
Clear width	Min 48" exclusive of curb	All PARs except medians/refuges and SUPs	PROWAG 302.2
	Min 60"	Medians and pedestrian refuge islands	
	Full width provided for pedestrian circulation	Shared Use Paths	
Grade	≤ 5% or the grade of the adjacent street, whichever is greater	May exceed 5% in crosswalk if superelevation requires grade greater than 5%	PROWAG R302.4
Cross slope	Max 2.1% To help ensure this standard is achieved during construction, designs should incorporate a max 1% cross slope.	Exceptions for PARs connecting accessible parallel parking spaces to the nearest crosswalk, uncontrolled crosswalks, signalized intersections with a green phase, and midblock and roundabout crosswalks	PROWAG 302.5
Surface	Firm, stable, slip-resistant	Concrete should be used for sidewalk surfaces, asphalt for shared use path surfaces	PROWAG R302.6
Grade breaks	Must be flush	Typical at ramps and curb ramps	PROWAG R302.6.2
Changes in level	0" to 1/4"	Vertical edge permitted	PROWAG R302.6.2
	> 1/4" to 1/2"	Bevel required with max slope 50%	
	> 1/2" to 6"	Max slope 8.3%	
	> 6"	Treat as ramp with max slope of 5%	
Horizontal openings	Must not allow a sphere larger in diameter than ½" to pass through	Elongated openings meeting requirements allowed perpendicular to direction of travel.	PROWAG R302.6.3
Flangeway gaps	Max 2.5"	Nonfreight rail track	PROWAG R302.6.4
	Max 3.0"	Freight rail tracks	
Passing Spaces	Min 60" by 60" every 200' max	Required if clear width is less than 60"	PROWAG R302.3

Table 5: Key Requirements for Pedestrian Circulation Paths

Design Element	Criteria	Notes	Reference
Protrusion limits	Max 4"	Objects with leading edges 27" to 80" above walking surface	PROWAG R402.2
Objects mounted on single post or pylon	Max 4" measured horizontally from the post or pylon or measured horizontally from the outside edge of the base where the base height is min 2 ½"	Objects mounted 27" to 80" above walking surface	PROWAG R402.3
Objects mounted between posts or pylons	Max 27" or min 80" lowest edge	Where clear distance between posts is greater than 12"	PROWAG R402.3.2
Vertical clearance	Min 80"	N/A	PROWAG R402.4

5.2.3 How to Apply

5.2.3.1 Continuous Clear Width

- Pedestrian access routes shall meet or exceed the minimum clear width requirements specified in PROWAG 302.2, which are summarized in Table 4.
- Additional clear width is required on sidewalks by the Montgomery County Complete Streets Design Guide depending on street type and land use context. (See *Section 7* for additional information on sidewalk clear width requirements.)
- Additional clear width can be helpful to people with vision disabilities to maneuver with a long cane or dog guide, to people with hearing disabilities to sign with a companion, and to people with autism spectrum disorder and intellectual and developmental disabilities who may feel uncomfortable on a crowded sidewalk or walking close to traffic.

5.2.3.2 Grade

Grade is the slope parallel to the direction of pedestrian travel.

- Grades shall not exceed the maximum grade requirements in PROWAG R302.4, which are summarized in Table 4.

Table 6: Maximum Cross Slope by Crosswalk Condition

Condition	Maximum Cross Slope
Crosswalk with Yield or Stop Control Devices	1:48 (2.1%)
Crosswalk at Uncontrolled Approach	1:20 (5.0%)
Crosswalk with Traffic Control Signal or Pedestrian Hybrid Beacon	1:20 (5.0%)
Midblock and Roundabout Crosswalk	Not greater than street grade

5.2.3.3 Cross Slope

Cross slope is the slope perpendicular to the direction of pedestrian travel.

- Cross slope shall not exceed the maximum cross-slope requirements in PROWAG 302.5, which are summarized in Table 4.
- Table 6 summarizes PROWAG cross slope requirements for different crosswalk conditions.

5.2.3.4 Surfaces, Grade Breaks, Changes in Level and Horizontal Openings

- Surfaces, grade breaks, and changes in level shall comply with the requirements in PROWAG R302.6, which are summarized in Table 4 and illustrated in Figure 6.
- Horizontal openings in ground surfaces, such as those in gratings and joints, other than flangeway gaps, shall comply with the requirements in PROWAG R302.6.3, which are summarized in Table 4 and illustrated in Figure 7.

Figure 6: Design of changes in level of different heights

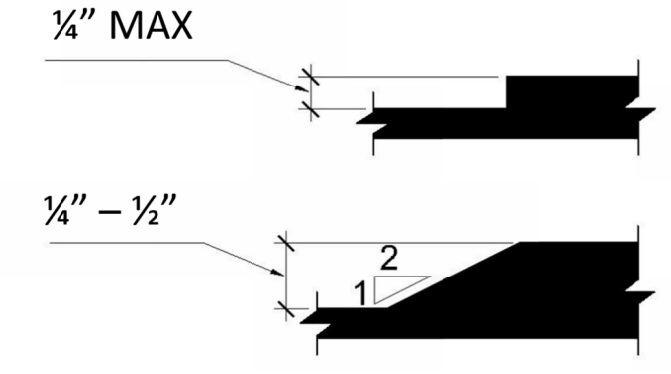
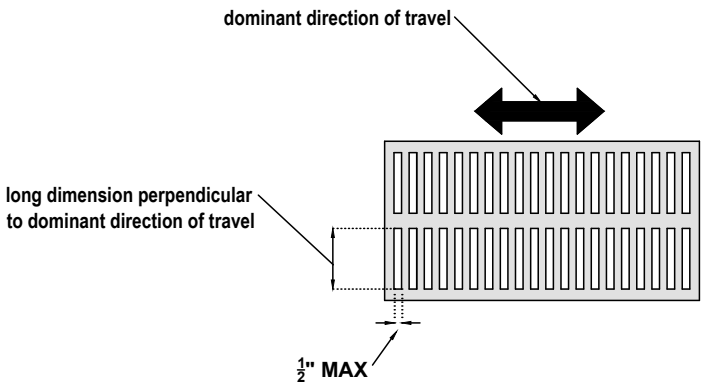


Figure 7: Design of horizontal openings



5.2.3.5 Surfaces at Pedestrian At-Grade Rail Crossings

- Surfaces at pedestrian at-grade rail crossings shall comply with PROWAG R302.6.4. Requirements for flangeway gaps are summarized in Table 4.

5.2.3.6 Lighting

- Pedestrian access routes and pedestrian circulation paths should be provided with adequate, even lighting levels. Lighting design and surface materials should not produce glare. See *Section 16* for additional detail.

5.2.3.7 Protruding Objects and Vertical Clearance

- Protruding objects shall comply with the requirements in PROWAG R402.2, which are summarized in Table 5 and illustrated in Figure 8. Protruding objects include permanent and temporary objects such as streetlights, utility poles and equipment cabinets, fire hydrants, signposts, signs, parking meters, trash receptacles, benches, cafe seating, transit shelters, kiosks, bicycle racks, bicycles, e-scooters, planters, trees, bollards, and street sculptures.
- Vertical clearance shall not be less than the minimum requirements in PROWAG R402.4, which are summarized in Table 5 and illustrated in Figure 8.

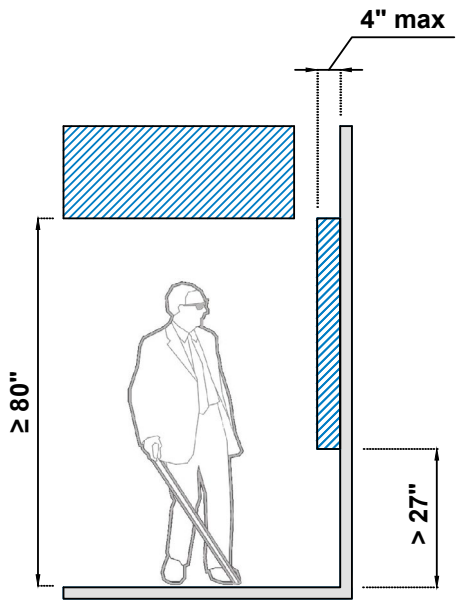
5.2.3.8 Linear and Intuitive

- Pedestrian access routes should be linear and intuitive, avoiding unnecessary zig-zags or curves.
- Pedestrian access routes should be easily distinguishable from other spaces in the public right-of-way, day and night and under all weather conditions, including by people with vision disabilities and people with intellectual and developmental disabilities.
- Using a color for the pedestrian access route that contrasts with adjacent spaces can help pedestrians with disabilities distinguish and follow the pedestrian access route.

5.2.3.9 Non-Intuitive Pedestrian Access Routes

- In cases where the path of a pedestrian access route is not intuitive, guidance tactile direction indicators (TDIs) can help people with vision disabilities stay within the pedestrian access route and may also provide a helpful cue to other pedestrians with disabilities to follow the pedestrian access route, e.g., pedestrians with intellectual and developmental disabilities. (See *Section 6.2* for more.) The path of a pedestrian access route may not be intuitive if it is not straight or is not distinguished by other detectable cues, such as a building line.

Figure 8: Protrusion limits for pedestrian circulation paths. (Protruding objects are not allowed in pedestrian access routes.)



Tactile Walking Surface Indicators | 6

Tactile walking surface indicators (TWSIs) are specialized surfaces installed within or along a walking surface to provide information to people with vision disabilities. They are highly detectable underfoot and with a long white cane and are highly discriminable from each other.

Discriminability (identifiability) is as important as detectability because each surface communicates different information to users. It is critical that the correct TWSI be used in each case or the TWSI could inadvertently lead a pedestrian with a vision disability into danger.

There are only three TWSIs that have been found in US research to be highly detectable and highly discriminable:

- The truncated dome detectable warning surface
- The raised bar tactile direction indicator
- The trapezoidal tactile warning delineator

Detectable warning surfaces and tactile direction indicators are discussed in greater depth in the sections below. The trapezoidal tactile warning delineator is discussed as an experimental treatment in *Appendix D: Experimental Treatments*.

How people with vision disabilities should interpret DWS

When pedestrians who are blind or who have low vision encounter DWS, they should stop, determine whether there is a street crossing, a driveway crossing, or platform edge in front of them, and prepare to cross or board if appropriate.

6.1 Detectable Warning Surfaces

Detectable warning surfaces (DWS) are comprised of truncated domes built into or applied to walking surfaces to indicate the boundary between a pedestrian path of travel and a vehicular way and to warn of hazards. The ADA Standards require DWS on curb ramps and transit boarding platforms. PROWAG additionally requires DWS at blended transitions, pedestrian at-grade rail crossings, edges of bus and rail boarding platforms above standard curb height, and driveways with traffic signals, stop signs, or yield signs.

6.1.1 Potential Accessibility Challenges

- Curb ramps without detectable warning surfaces
- Wrap-around depressed curbs with detectable warnings surfaces at the crossing locations but no detectable edge or warning surface in other locations, leaving gaps where a person with a vision disability might unintentionally walk into the intersection.
- Misinterpretation of detectable warnings surfaces, e.g., misinterpreting a detectable warning on a bike ramp as a crosswalk location.
- Detectable warning surfaces that don't contrast visually with the adjacent surfaces.
- Detectable warning surfaces that need repairs, particularly in locations where vehicles have driven over them.

6.1.2 Guidance

6.1.2.1 Where to Apply

Detectable warning surfaces shall be applied to:

- Curb ramps
- Blended transitions
- Pedestrian refuge islands where the refuge is at least 6' wide
- Pedestrian at-grade rail crossings not located in a street
- Bus platforms not protected by screens or guards where the height of the curb is greater than 8 inches
- Sidewalk and street-level rail boarding and alighting areas
- Sidewalks at driveways with yield or stop control devices or traffic signals
- At the top of bike ramps that transition cyclists between a street and a shared use path.[5]

6.1.2.2 Where Not to Apply

Detectable warning surfaces shall not be used:

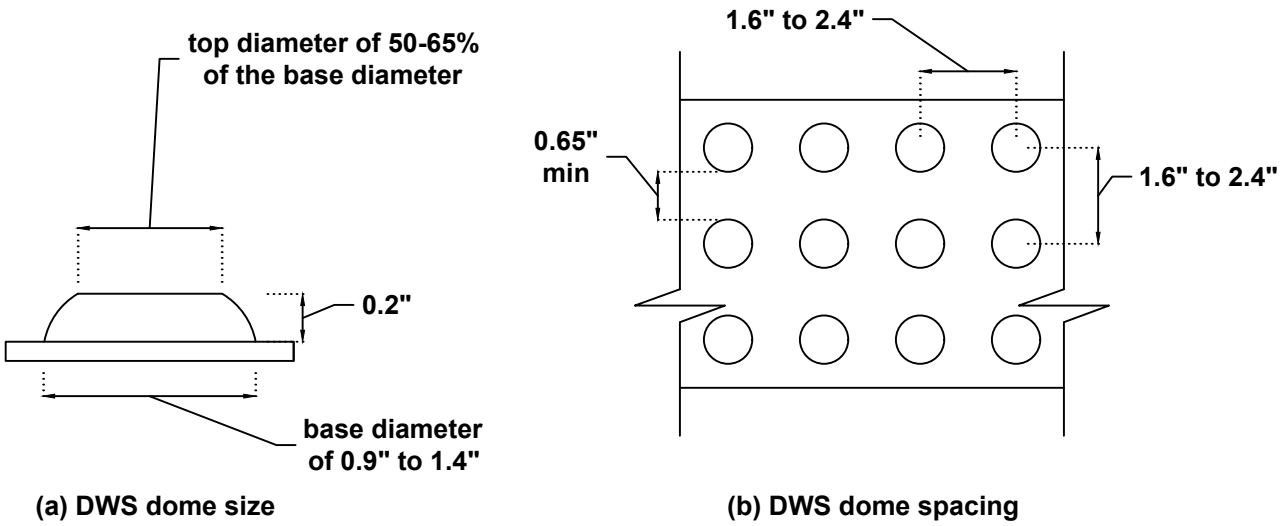
- To provide wayfinding information to pedestrians with vision disabilities, e.g., to guide pedestrians who are blind or have low vision to pedestrian street crossings.
- As a method for indicating the edge of the circulatory roadway at roundabouts except at crosswalks.
- As an edge treatment to indicate the boundary between the comfort zone and the shared zone of a shared space.
- At driveway crossings that do not have yield or stop signs or traffic signals.

6.1.2.3 Key Requirements

Table 7: Key requirements for detectable warning surfaces

Design Element	Criteria	Notes	Reference
Dome Size	Base diameter—Min 0.9", Max 1.4" Top diameter—Min 50% of base diameter, Max 65% of base diameter Height—0.2" *See Figure 9 for illustration.*	When detectable warning surface tiles are cut to fit, partial domes are permitted along the cut edges.	PROWAG R305.1.1
Dome Spacing	Center-to-center spacing—Min 1.6", Max 2.4" Base-to-base spacing—Min 0.65" measured between most adjacent domes *See Figure 9 for illustration.*	EXCEPTIONS When detectable warning surfaces are cut to fit, center-to-center spacing measured between domes adjacent to cut edges shall not exceed twice the normal spacing between domes not adjacent to cut edges. Spacing requirements do not apply at an expansion joint provided the detectable warning surface aligns with both edges of the joint.	PROWAG R305.1.2
Color Contrast	Must contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light[6]	Safety yellow is the preferred color for detectable warning surfaces except on bike ramps, where green is the preferred color. Safety yellow provides superior visibility in different lighting and weather conditions, contrasts well with a range of surfaces, including concrete, asphalt, and brick, and effectively communicates a "warning" message.	PROWAG R305.1.3
Depth	Min 24" in the direction of pedestrian travel	N/A	PROWAG R305.1.4
Width	Curb ramps and blended transitions—Full width of ramp run (excluding flared sides), blended transition, or landing Cut-through pedestrian refuge islands—Full width of pedestrian circulation path opening Pedestrian at-grade rail crossings not located within a street—Full width of the pedestrian circulation path	Max 2" concrete border permitted along edges if required for installation.	PROWAG R305.1.4 PROWAG R305.2

Figure 9: Required DWS Dimensions



(a) DWS dome size

(b) DWS dome spacing

6.1.2.4 How to Apply

- See *Section 13* for guidance on how to apply DWS on curb ramps and blended transitions.

6.2 Tactile Direction Indicator

A tactile direction indicator (TDI) is comprised of raised, parallel, flat-topped, elongated bars and is used to provide wayfinding information to pedestrians with vision disabilities.

TDIs can be used in four ways:

- As a *guidance TDI* to indicate an unobstructed path of travel.
- As a *sidewalk alert TDI* to indicate the location of a non-intersection crosswalk or bus stop.
- As an *alignment TDI* to help people with vision disabilities align properly to the crosswalk.
- As a *transit door location TDI* to help people with vision disabilities identify the location of transit doors.

All applications must meet the requirements shown in Table 8. Additional guidance is provided in application-specific sections below.

6.2.1 Potential Accessibility Challenges

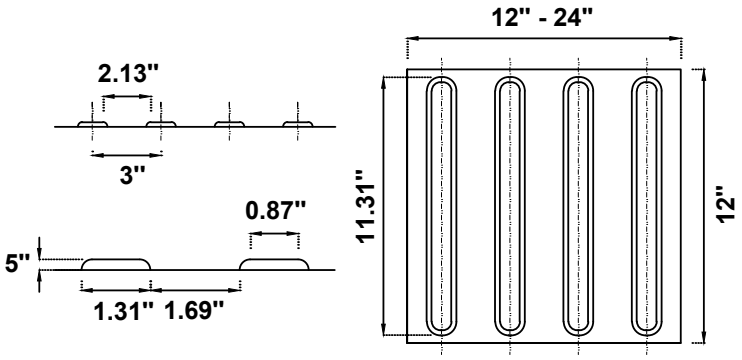
- Trouble navigating in situations where tactile direction indicators might help, e.g., finding midblock crossings, bus stops, and important buildings, navigating transit stations and complex street environments.
- Lack of familiarity with tactile direction indicators and their purposes.
- Tactile direction indicators that are not reliably detectable underfoot, e.g., due to stepping over the surface when the surface is too narrow for the context.
- Peripheral neuropathy making it hard to detect changes in texture.

6.2.2 Key Requirements

Table 8: Key Requirements for Tactile Direction Indicators

Design Element	Criteria	Reference
Bar Size	Base Width—1.31” Top Width—0.87” Length—Min 10.65” Height—0.20” *See Figure 10 for illustration.*	Tactile Wayfinding in Transportation Settings (2024)
Bar Spacing	Center-to-center spacing—3.00” Spacing between adjacent parallel bars—1.69” Spacing between bars ends—0.69” *See Figure 10 for illustration.*	Tactile Wayfinding in Transportation Settings (2024)
Bar Orientation	Guidance TDI—Parallel to the direction of pedestrian travel. Sidewalk alert TDI—Parallel to the direction of pedestrian travel on the sidewalk and perpendicular to the direction of pedestrian travel to the mid-block crosswalk or bus stop.[7] Alignment TDI—Perpendicular to the direction of pedestrian travel across the crosswalk. Transit door location TDI—Parallel to the direction of pedestrian boarding and alighting, i.e., perpendicular to the curb line.	Tactile Wayfinding in Transportation Settings (2024)
Dimensions	Guidance TDI—12” wide if pedestrians only interact parallel to the TDI, 24” wide if pedestrians may interact perpendicular or at an angle to the TDI Sidewalk alert TDI—24” wide and extending the full width of the sidewalk Alignment TDI—24” by 24” Transit door location TDI—24” wide parallel to curb line or transit platform edge, preferred 60” long perpendicular to curb line or transit platform edge (min 36”). [8]	Tactile Wayfinding in Transportation Settings (2024)
Color Contrast	Must contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light.[9]	Tactile Wayfinding in Transportation Settings (2024)
Slip Resistance	Must be slip-resistant	PROWAG R302.6

Figure 10: Required TDI dimensions



How people with vision disabilities should interpret guidance TDIs

When pedestrians with vision disabilities encounter a strip of guidance TDIs, they should understand that this is a surface they can follow to an intermediate or final destination. They can walk on the TDI or follow it on either side. The TDI communicates that following this route is a safe place to walk.

6.2.3 Guidance TDIs

Guidance TDIs can be used to indicate an unobstructed path of travel.

6.2.3.1 Where to Apply

- Guidance TDIs should be considered for locations where other available navigational cues—e.g., curbs, building faces, landscaping—fail to provide sufficient, unambiguous wayfinding information to people with vision disabilities.
- Examples of locations where guidance TDIs may be needed include:
  - Large open plazas or spaces
  - Shared streets
  - Parallel to sidewalk-level separated bike lanes

6.2.3.2 Where Not to Apply

- Guidance TDIs should not be installed within a pedestrian access route that is less than 5' wide as that could create discomfort for people using wheelchairs.
- Guidance TDIs should not be used as an edge delineator between a pedestrian access route and a bicycle or motor vehicle lane.

6.2.3.3 How to Apply

6.2.3.3.1 Width and Bar Orientation

- As specified in Table 8.

6.2.3.3.2 Placement within Pedestrian Access Route

- Guidance TDIs should be installed within a pedestrian access route that complies with PROWAG R302 and that is kept free of permanent or temporary obstructions, such as utility poles, bicycle racks, tree limbs, open doors, sandwich boards, outdoor seating, street vendors, etc.
- Guidance TDIs should not zig-zag back and forth unnecessarily, contain confusing breaks e.g., at a manhole cover, or be used for aesthetic purposes.
- When guidance TDIs are installed on a sidewalk or in an area of a shared space that is intended for the exclusive use of pedestrians, they should generally be placed towards the side of the pedestrian access route closest to the street. This is the side of the pedestrian access route that is most consistent, e.g., it is not affected by different building setbacks. Placing the TDI on this side also minimizes impacts on wheelchair users who can travel along the sidewalk or comfort zone and enter a building without having to cross the TDI. Guidance TDIs should have a clear path of travel on the street side that is at least 12" wide (24" preferable as shown in Figure 11).
- Guidance TDIs should be installed in a way that minimizes impacts on pedestrians who use wheelchairs and other mobility aids. Designers should seek to maintain a minimum width of 3' within the pedestrian access route, on the building side of the TDI, that has a smooth surface and is unobstructed by TDIs (except where two pedestrian access routes with TDIs cross paths).

6.2.3.3.3 Coordination with Pedestrian Push buttons and Accessible Signage

- If guidance TDIs are used to guide people with vision disabilities to a signalized crosswalk, their placement should be coordinated with the location of the pedestrian push button so that people who follow the TDI will also be guided to within easy reach of the push button.

6.2.3.3.4 Junctions and Turns

- Where guidance TDIs cross, they should cross at angles as close to 90 degrees as practicable. The intersections of guidance TDIs should be marked by a blank square "choice point indicator" that is 36 inches by 36 inches, as illustrated in Figure 12.

Figure 11: Guidance TDI when there is a furniture (or buffer) zone between the pedestrian access route and a vehicular lane, bicycle lane, or shared street.

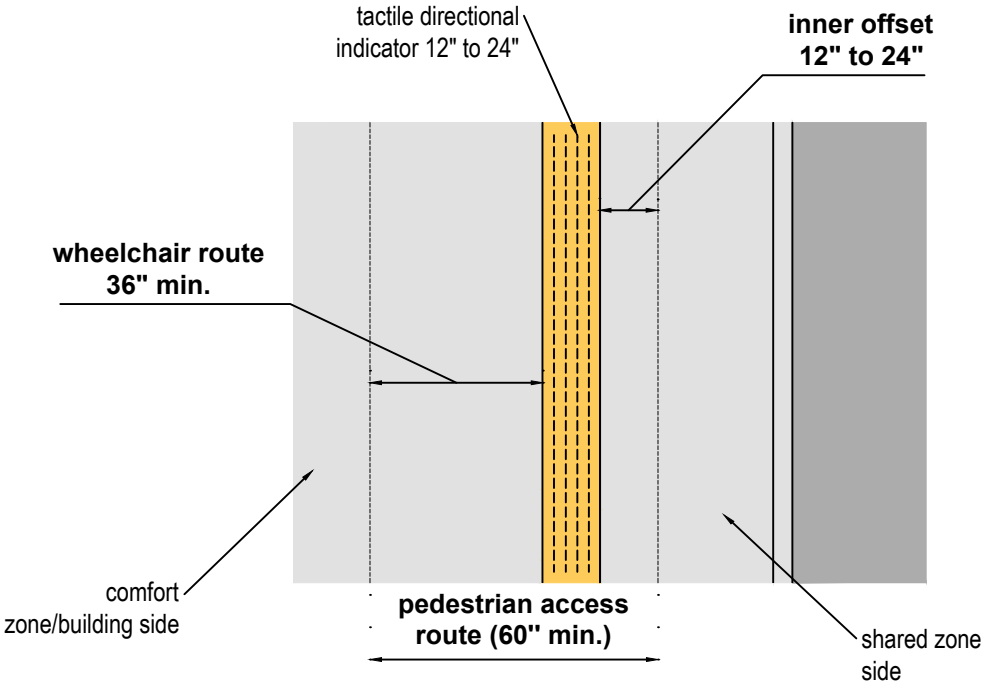
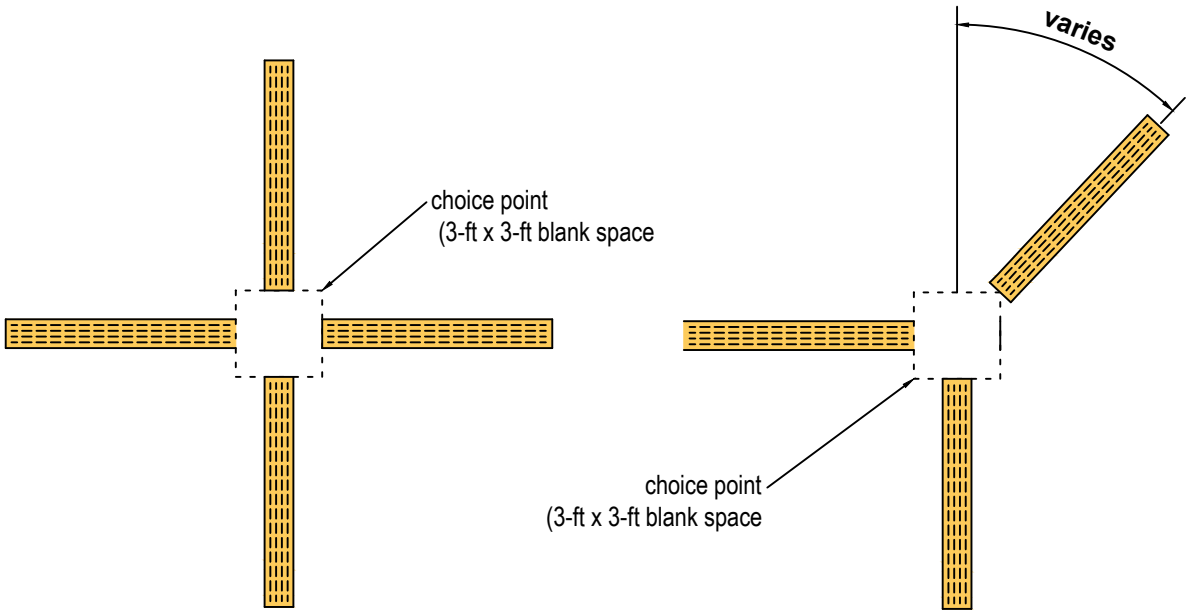


Figure 12: Illustration of choice point indicator at guidance TDI intersection



6.2.4 Sidewalk Alert TDIs

Sidewalk alert TDIs (Figure 13) can be used to indicate the location of a non-intersection (mid-block) crosswalk or bus stop, especially an island bus stop not located at a signalized intersection.

6.2.4.1 Where to Apply

Sidewalk alert TDIs should be considered for non-intersection crosswalks and for bus stops that may be difficult to locate with other available cues, such as island bus stops.

6.2.4.2 How to Apply

6.2.4.2.1 Width and Bar Orientation

As specified in Table 8.

6.2.4.2.2 Placement

- Guidance on the placement of Sidewalk alert TDIs at T-intersections is provided in *Section 11.3.3*.
- Guidance on the placement of Sidewalk alert TDIs at midblock crosswalks is provided in *Section 11.4*.
- Guidance on the placement of Sidewalk alert TDIs at island bus stops is provided in *Section 18*.

6.2.5 Alignment TDIs

Alignment TDIs (Figure 14) can be used to help people with vision disabilities align properly to the crosswalk.

6.2.5.1 Where to Apply

- Alignment TDIs should be considered in cases where the crosswalk is skewed or there is a depressed corner with a blended transition.

6.2.5.2 How to Apply

6.2.5.2.1 Dimensions and Bar Orientation

- As specified in Table 8.

6.2.5.2.2 Placement

- Guidance on the placement of alignment TDIs at skewed intersections is provided in *Section 11.3.1*.
- Guidance on the placement of alignment TDIs at blended transitions is provided in *Section 13.5*.

Figure 13: Example of sidewalk alert TDI
(Source: Jennifer Graham, Accessible Design for the Blind)

Figure 14: Alignment TDIs (shown at right of DWS) were tested as part of a pilot in downtown Silver Spring

6.2.6 Transit Door Location TDIs

Transit door location TDIs (Figure 15) can be used to identify transit boarding areas.

6.2.6.1 Where to Apply

Transit door location TDIs should be considered at bus island stops, but should only located where boarding is allowed, not at door locations where only alighting occurs.

6.2.6.2 How to Apply

6.2.6.2.1 Dimensions and Bar Orientation

- As specified in Table 8.

6.2.6.2.2 Placement

- Guidance on the design of island bus stops, including the placement of transit door location TDIs, is provided in *Section 18*.

Figure 15: Example of transit door location TDIs

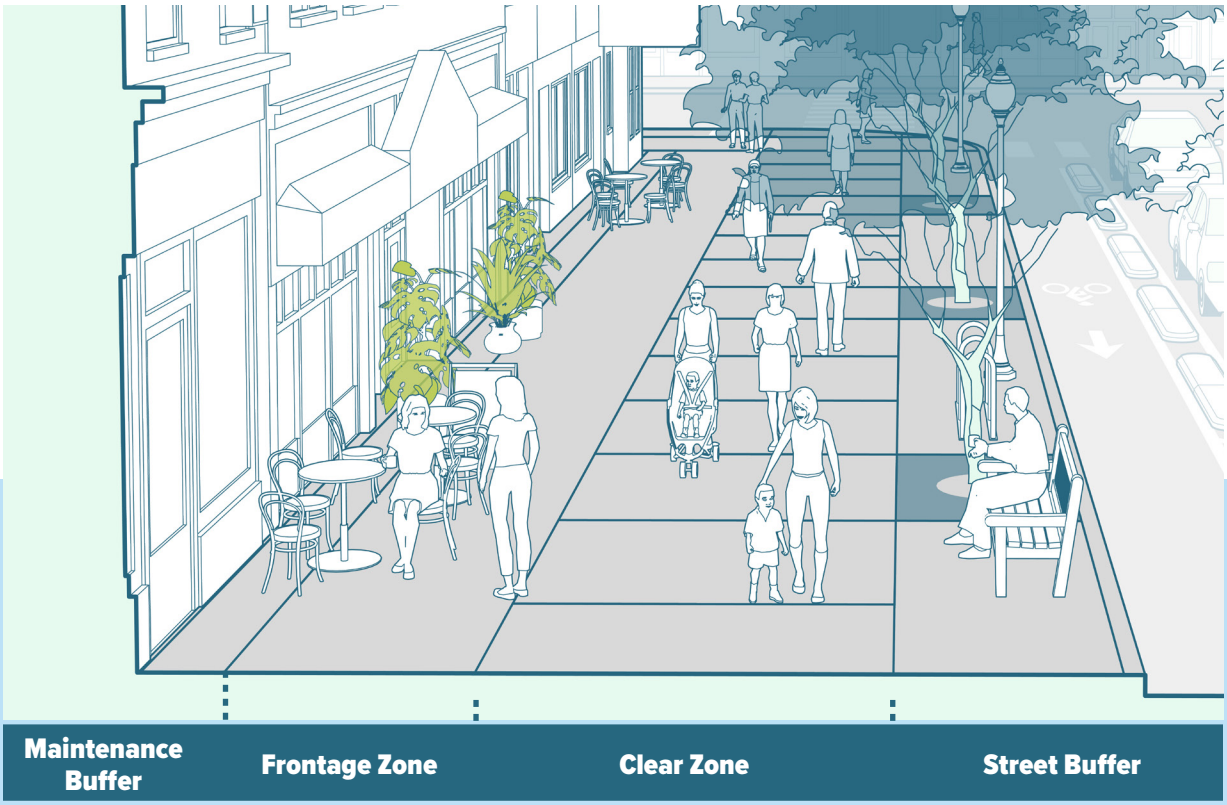
Sidewalks | 7

A sidewalk is the portion of a street designated for pedestrian use behind the curbline. It most commonly refers to a paved (usually concrete) walkway parallel to the road. A sidewalk is required to include a pedestrian access route but can be wider and contain other elements.[10]

The cross-section of a sidewalk is often comprised of three zones (Figure 16).

- **Street Buffer Zone**—This is the area between the roadway or separated bike lane curb face and the sidewalk. This zone buffers pedestrians from the adjacent roadway and is the appropriate location for street trees and vegetation, signs, street furniture, sidewalk cafés, art, green infrastructure, lighting, and other elements.
- **Clear Zone**—This is the area between the Street Buffer Zone and the building Frontage Zone. It is specifically reserved for pedestrian travel or, in cases where there is a side path, pedestrian and bicycle travel.
- **Frontage Zone**— This is the area between the right-of-way line or the front of a building and the Clear Zone. It may include building façades, fences, or low walls. It may also accommodate landscaping, sidewalk cafés, store or building entrances, retail displays, or other.
- **Maintenance Buffer**—This area provides space for maintenance of facilities and appurtenances in the public right-of-way.

Figure 16: The sidewalk is often comprised of three zones plus a maintenance buffer



7.1 Potential Accessibility Challenges

- Missing sidewalks.
- Narrow sidewalks.
- Crowded sidewalks.
- Tipping, tripping, or slipping hazards, e.g., loose, displaced, or missing bricks (Figure 17), root heaves, mud/groundcover intrusion, snow or debris, toys, and other objects.
- Obstructions, e.g., overhanging vegetation (Figure 18), guy wires, utility poles, café seating, scooters, and bicycles.
- Sidewalks with steep cross slopes, e.g., at driveways.
- Sidewalks without landscaped buffers.
- Sidewalk joints that are jarring to wheelchair users and others who roll on the sidewalk.
- Sidewalk pedestrian access routes that are difficult to distinguish from other spaces.
- Sidewalk pedestrian access routes that are not direct or intuitive.

Among respondents to the Accessibility Challenges Survey, **nearly half (49%) selected "traveling on sidewalks" as a top accessibility challenge**, making it the second most frequently cited accessibility challenge overall.

Among these respondents, over three quarters (76%) selected "missing" as a top accessibility challenge with sidewalks. The second choice of respondents, and the top challenge among nearly every group of respondents who reported a difficulty that impacted their mobility as a pedestrian, including those with difficulty seeing, hearing, and walking. "Narrow" was the third most-commonly chosen response.

Figure 17: Example of deteriorated brick sidewalk

Figure 18: Example of vegetation overhanging sidewalk

7.2 Guidance

7.2.1 Where to Apply

Montgomery County law requires that sidewalks be constructed:

- By the County when it is constructing, reconstructing, or relocating a County road, with certain exceptions.[11]
- By private development permittees when the development fronts public roads, also with certain exceptions.[12]
- On all road classifications except rustic or exceptional rustic.[13]

County law also requires that sidewalks be constructed on both sides of all streets "except Secondary and Tertiary Residential Streets, where the Planning Board may require a sidewalk on either or both sides of a street, depending on the area's housing density and the potential uses of the sidewalks."

Per the Complete Streets Design Guide, sidewalks are high-priority elements on Downtown Boulevards and Streets, Town Center Boulevards and Streets, Neighborhood Connectors, Streets, and Yield Streets, Industrial Streets, and Country Connectors and Roads.

7.2.2 Key Requirements

Table 9: Key requirements for sidewalks

Zone	Criteria	Notes	Reference
Street Buffer Zone	Meets or exceeds the default Street Buffer Zone width in Montgomery County Complete Street Design Guide Figure 3-2 for the relevant street type	Buffer widths between the default and minimum should only be considered in rare cases where existing physical constraints make implementing the default dimension technically infeasible.	Montgomery County Complete Street Design Guide, Figure 3-2
Clear Zone	Meets or exceeds the default Clear Zone width in Montgomery County Complete Street Design Guide, Figure 3-2 for the relevant street type	Sidewalk widths between the default and minimum should only be considered in rare cases where existing physical constraints make implementing the default dimension technically infeasible.	Montgomery County Complete Street Design Guide, Figure 3-2
	Includes a pedestrian access route that complies with PROWAG R302, summarized in Table 4	N/A	PROWAG R203
	Protruding objects and vertical clearance comply with PROWAG R402, summarized in Table 5.	N/A	PROWAG R207
	Material is concrete unless facility is a shared use side path, in which case the path material is asphalt	Permeable paving may be appropriate in certain situations discussed in the Complete Streets Design Guide. Other materials require MCDOT approval	Montgomery County Complete Street Design Guide, Section 3.4
Frontage Zone	Meets or exceeds the default Frontage Zone width in Montgomery County Complete Street Design Guide, Figure 3-2 for the relevant street type	Frontage Zone widths between the default and minimum should only be considered in rare cases where existing physical constraints make implementing the default dimension technically infeasible.	Montgomery County Complete Street Design Guide, Figure 3-2
Amenities	Includes elements required in Montgomery County Complete Street Design Guide, Figure 3-3 Street furniture complies with PROWAG R209	N/A	PROWAG R209

7.2.3 How to Apply

7.2.3.1 Buffer Zone

- A Street Buffer Zone shall be provided that meets the requirements in the CSDG, which are summarized in Table 9.
  - › Landscaped buffers make sidewalks more comfortable for all pedestrians, particularly those who may be more susceptible to anxiety and sensory overload, such as those with autism spectrum disorder. Buffers also provide space for benches, bicycle and scooter parking, signs, utility poles, snow storage, and other elements that affect accessibility, as well as create space for directional perpendicular curb ramps. Buffers are especially important on streets with higher motor vehicle speeds and volumes.
- Features in the Street Buffer Zone should be arranged in a continuous linear fashion. Where possible, elements within the Street Buffer Zone should be combined to minimize clutter, e.g., attach signs to light poles.
- If trees are provided in the Street Buffer Zone, consideration should be given to the type of tree selected and the width of the buffer zone or tree box to avoid tree growth and root expansion from uplifting the sidewalk.
- Especially in high-volume areas, curb extensions can extend the buffer zone into the parking lane to provide additional space for trees, pedestrian ramps, bus shelters, waiting areas, or other needs.

7.2.3.2 Clear Zone

- A Clear Zone shall be provided that meets the requirements for width, pedestrian access routes, protruding objects, and material summarized in Table 9.
- The color of the sidewalk should contrast with adjacent zones to help people with low vision and people with intellectual and developmental disabilities distinguish it. Avoid using color in patterns that may be misinterpreted — for example, alternating bands of light and dark may appear as steps to someone with low vision (Figure 19).

Figure 19: The walkway outside Brigadier General Charles E. McGee Library in Silver Spring features alternating bands of dark and light pavers which may look like steps to a person with low vision.

- The sidewalk should be provided with adequate, even lighting levels. Lighting design and surface materials should not produce glare. See *Section 16* for additional detail.
- Sidewalk joints should be saw cut to minimize vibrations for pedestrians using mobility devices or pushing strollers.
- Porous flexible sidewalk pavement should be considered at locations where uplift is occurring or expected due to tree growth or root expansion to mitigate the uplift. Sections of sidewalk constructed with porous flexible pavement shall comply with PROWAG R302.

7.2.3.2.1 Designing ARound Obstacles in the CLEAR Zone

- Obstacles in the sidewalk should be avoided wherever possible. When they cannot be avoided, a pedestrian access route complying with PROWAG R302 must nevertheless be provided on one or both sides of the obstacle to enable pedestrians with disabilities to pass around it.
- The necessary space can be created by widening the sidewalk into the Street Buffer Zone, the Frontage Zone, or adjacent properties (Figure 20), or by creating a curb extension into an on-street parking lane.
- Detectable edges and/or non-prepared surfaces such as grass or landscaping can be used to guide pedestrians who are blind or have low vision around the obstacle (Figure 21).
- Obstacles should be well-lighted and delineated using retroreflective material, so they are more visible at night. Retroreflective pavement markings may be used as a supplement to detectable edges to help people identify the correct path in low-light conditions. Guidance TDIs can also be used to guide pedestrians who are blind or have low vision around an obstacle if the treatments above cannot be implemented or are unlikely to provide sufficient guidance to people who are blind or have low vision.

7.2.3.2.2 Painted Sidewalks

- Sidewalks that have been decorated or marked with paint can make it more challenging for pedestrians with vision, intellectual, and developmental disabilities to distinguish and follow sidewalk pedestrian access routes.
- If painted elements are added to the sidewalk, they should generally be placed outside of a pedestrian access route that meets the minimum requirements in PROWAG 302 and should connect to other pedestrian access routes, as required by PROWAG 203, that do not include decorative paint.
- Consider reviewing decorative painted sidewalk designs with disabled community members before installing, particularly community members with vision and intellectual/developmental disabilities.

Figure 20: Sidewalk widening around pole

Figure 21: A shared use path splits around a utility pole. The wedge of grass provided is a non-prepared surface that may help people with vision disabilities navigate around the obstacle. Retrorefective edge lines could also be used to help define the correct path in this context.

7.2.3.3 Frontage Zone

A Frontage Zone shall be provided as described in Table 9.

7.2.3.3.1 Amenities

- Amenities shall be provided as described in Table 9.
  - Spaces for rest and retreat are particularly important for pedestrians with ambulatory disabilities and for pedestrians with disabilities that make them more susceptible to sensory overload. Spaces for rest and retreat can also provide a place for pedestrians to get their bearings, use a wayfinding app, etc.

7.2.3.3.2 Seating

- The following clear widths should be maintained when installing or placing benches or other seating:
  - 3 feet minimum from the sidewalk but connected with a walkable/paved surface on either side of the seating.
  - 5 feet minimum from fire hydrants
  - 2 feet recommended clearance from all aboveground utilities and utility appurtenances.
- Where the back of the seating abuts a building, wall, or other obstruction, a 1-foot minimum clear width should be provided for maintenance and debris removal.
- Seating should be located to enable pedestrians to view street/sidewalk activity while being outside of the immediate flow of pedestrian traffic. Public seating should be buffered from noise and vehicle exhaust where feasible. Public seating should ideally be shaded.
- Seating at bus stops, whether there is a bus shelter or not, should face the street or face approaching buses.

7.2.3.3.3 Bicycle and Scooter Parking

- Bike and scooter racks should be placed so that parked bicycles and scooters do not intrude on the sidewalk.
- In high-use areas, such as central business districts and town centers, in-street bike and scooter corrals should be installed to discourage riding and parking these vehicles on the sidewalk.
- Dockless vehicle operators should be required to deploy to designated parking locations.
- Dockless vehicle operators should be required to incentivize users to park in designated locations.

7.2.3.4 Considerations

- Consider implementing “no park” and/or “no ride” zones for dockless mobility, or all bikes and scooters, especially in areas with high pedestrian activity. Significant traffic calming may be required to convince bike and scooter users to ride in the street rather than on the sidewalk in these areas. Areas with high pedestrian activity are often also high-volume destinations for bike and scooter riders, so sufficient in-street parking corrals should be created to accommodate expected usage.

Shared Use Paths | 8

A shared use path is a multi-use path designed primarily for use by cyclists, pedestrians, and other authorized motorized and non-motorized users. Shared use paths primarily serve a transportation purpose but may also be used for recreation. Shared use paths are physically separated from motor vehicle traffic by an open space or curb and are either within the street right-of-way or other public right-of-way. Shared-use paths that are in the street right-of-way are referred to as "side paths."

8.1 Potential Accessibility Challenges

- Lack of separation between pedestrians and cyclists.
- Conflicts between pedestrians and cyclists.
- Rough or broken path surface.
- Difficulty seeing path edges at night.

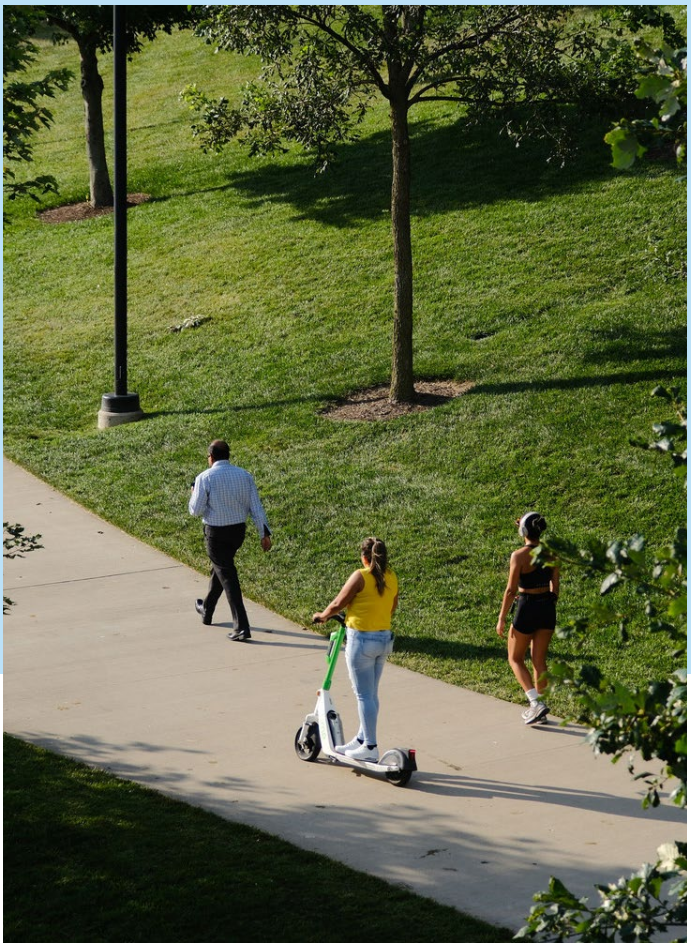
8.2 Guidance

8.2.1 Where to Apply

- Shared use paths are appropriate for locations where observed or anticipated pedestrian demand is low or on streets with high motor vehicle speeds or volumes where physical constrains make installing separate facilities for pedestrians and cyclists infeasible.
- Per the CSDG, side paths are the default bikeway type along boulevards, neighborhood connectors, and major highways.

Among respondents to the Accessibility Challenges Survey, 30% selected "traveling on shared use paths" as a top accessibility challenge, making it the fourth most frequently cited accessibility challenge overall.

Among these respondents, 60% identified "lack of separation between types of users" as a top challenge with using Shared Use Paths and 41% " identified crowding"; at least one of these was also the top issue for nearly every group. People who reported difficulty using stairs were slightly more likely to identify "narrow" or "rough or broken surface" as a top challenge. People who reported a mental-health difficulty identified "inadequate lighting" as a top challenge, with crowding second.



8.2.2 Key Requirements

Table 10: Key requirements for shared use paths

Design Element	Criteria and Notes	Reference
Pedestrian access route	Includes a pedestrian access route that complies with PROWAG R302 (see Table 4 for summary) and extends the full width of the path provided for pedestrian circulation. Obstructions, such as bollards, shall not reduce the clear width of the pedestrian access route to less than 48" measured from the edge of the obstruction.	PROWAG R203
Protruding objects and vertical clearance	Complies with PROWAG R402 (see Table 5 for summary)	PROWAG R207
Curb ramp landings and clear areas	Min 48" long and as wide as the path	PROWAG 304.2.4, 304.2.5
Median cut-through clear width	Width of path or width of crosswalk, whichever is greater	PROWAG R302.2.2
Material	Asphalt **Note**: *Curb ramps and refuge medians will often be concrete.*	N/A
Signs	All signs must comply with PROWAG R410.	PROWAG R208

8.2.3 How to Apply

8.2.3.1 Minimum Requirements

- Shared use paths shall comply with the minimum requirements in Table 10.
- Pedestrian access routes shall be provided connecting shared use paths to sidewalks on adjacent streets.

8.2.3.2 Width

- Shared use paths should be wide enough for pedestrians and cyclists to use together safely and comfortably given expected volumes.
- The paved surface of a shared use path should be 11 feet wide minimum, except in constrained conditions, in which case 8 feet or more is acceptable for short distances.
- Table 11 should be used to inform selection of shared use path width to serve the desired volume, user mix, and operational conditions for the path.
- As path widths begin to exceed 15 feet, consider separating pedestrians from cyclists to minimize the speed differential between pedestrians and wheeled users in lieu of providing a wider shared use path.

Table 11: Shared Use Path Widths to Achieve SUP LOS C for Anticipated Peak Hour Volumes to

Shared Use Path Operating Widths		
Minimum (ft)	SUPLOS "C" Peak Hour Volumes at Preferable Width [14]	Constrained (ft)
10 – 12	150 - 300	8
12 – 15	300 - 500	11
16 – ≥20	500 - ≥600	15

8.2.3.3 Cross Slope

- Enough cross slope should be provided on shared use paths to avoid ponding and ice formation but shall not exceed the maximum 2.1% specified in PROWAG 302.5.

8.2.3.4 Lighting

- Shared use paths should be illuminated at night. The lighting design should provide a consistent level of light along the length of the shared use path that meets the needs of people with vision disabilities and others who may have more difficulty seeing in dark conditions.
- Where path lighting does not operate during all hours of darkness, retroreflective edge lines should be considered to help path users stay on the path.

8.2.3.5 Center and Edge Lines

- A retroreflective dashed center line should be used to help delineate different directions of travel on a shared use path. The line should be solid at locations where passing is discouraged due to poor sight lines or other factors. Where white edge lines are applied to path edges , they should be retroreflective to help pedestrians and cyclists distinguish the edge of the path at night, particularly pedestrians and cyclists with low vision (Figure 22).

Figure 22: Path with edge lines

8.2.3.6 Signage

- Shared-use paths should include wayfinding and regulatory signs and include features, such as raised letters, tactile maps, and audible messaging, that make the signs accessible to people with vision limitations.
- Signage should be provided with enough frequency and detail that if a person with a disability needs assistance, they can easily describe where they are on the path.

8.2.3.7 Spaces for Rest and Retreat

- Shared use path should include spaces for rest and retreat along with supporting amenities, such as benches and drinking fountains.
- Accessible benches should be considered at least every 200 feet.

8.2.3.8 Separation Between Pedestrians and Cyclists

- Separation of pedestrians and cyclists should be considered when:
  - Level of Service is projected to be at or below level “C” as calculated using the FHWA Shared Use Path Level of Service Calculator.
  - Pedestrians can reasonably be anticipated to be 30% or more of the volume.
  - Higher volumes of children, seniors, or individuals with disabilities are likely to be present.
  - Faster cyclist speed is desired to serve regionally significant bicycle travel.
- Where separate pedestrian and bicycle facilities are determined to be appropriate, the pedestrian facility should be made of Portland cement, the bicycle facility should be made of asphalt, and the two facilities should be separated as described in *Section 10*.

8.2.3.9 Designing Around Obstacles

- Obstacles on shared use paths should be avoided wherever possible. When they cannot be avoided, a pedestrian access route complying with PROWAG R302 must be provided on one or both sides of the obstacle to enable pedestrians with disabilities to pass around the obstruction.
- Detectable edges and/or non-prepared surfaces such as grass or landscaping can be used to guide pedestrians who are blind or have low vision around the obstacle.
- Obstacles should be well-lighted and have reflective tape on them, so they are visible at night. Retro-reflective edge lines can be used as a supplement to detectable edges to help people identify the correct path in low light conditions.

8.2.3.10 Considerations

- Consider providing a gravel 'shoulder' on either side of a shared use path. Gravel shoulders can provide a visual, tactile, and audible contrast for people with limited vision. They also provide an intermediate surface for some runners and others who would like something lower impact than asphalt, and limits grass and other vegetation growing over and obstructing the path.

Sidewalk to Shared Use Path Transitions

9

Sidewalks must sometimes transition to shared use paths due to physical constraints in the public right-of-way that make it difficult to accommodate cyclists with an on-street bikeway. Such locations need to be safe, comfortable, legible, and accessible to all users, including pedestrians with disabilities.

9.1 Potential Accessibility Challenges

- Some pedestrians with disabilities, particularly those with vision, intellectual, and developmental disabilities, may not be aware when a sidewalk transitions to a shared use path and may be startled by an approaching cyclist or unable to hear them in time to take evasive action.
- Cyclists, meanwhile, may not be aware that a pedestrian may not be able to see them and may misinterpret their body language as yielding the right-of-way when in fact it may reflect uncertainty or an attempt to assess the situation.
- Pedestrians with disabilities, particularly those with vision, intellectual, and developmental disabilities, can also misinterpret ramps intended for cyclists, known as bike ramps, as pedestrian ramps, which may result in the pedestrian attempting to cross at a potentially unsafe location.

Among respondents to the Accessibility Challenges Survey that identified traveling on shared use paths as a top accessibility challenge, 60% identified "lack of separation between types of users" as a top challenge with shared use paths.

9.2 Guidance

9.2.1 Where to Apply

- Transitions between shared use paths and sidewalks should generally occur at or near signalized or STOP-controlled intersections. In no case should a transition be so abrupt as to create a hazardous or confusing situation for pedestrians or cyclists.
- Where possible, bike ramps that transition cyclists to and from shared use paths should be placed more than 10 feet away from pedestrian curb ramps and outside of the pedestrian path of travel to avoid confusion between the bike ramp and the pedestrian accessible curb ramp.

9.2.2 How to Apply

9.2.2.1 Alerting Pedestrians and Cyclists to the Change in Condition

- Sidewalks should be constructed with concrete and shared use paths should be constructed with asphalt and have retroreflective centerlines.
  - Many people already associate concrete with sidewalks and asphalt with shared use paths, so being consistent about the application of these materials by facility type plays into existing expectations. Also, since concrete and asphalt have contrasting colors, pedestrians with low vision can distinguish the type of facility they are on and identify transition points between the two facility types.
- Use signs and pavement markings to alert path users of approaching transition points.
- Where bicycle facilities transition to shared use paths and a curb ramp is inappropriate to accommodate the transition, e.g., because transition is at a non-crosswalk location, a bike ramp should be provided.

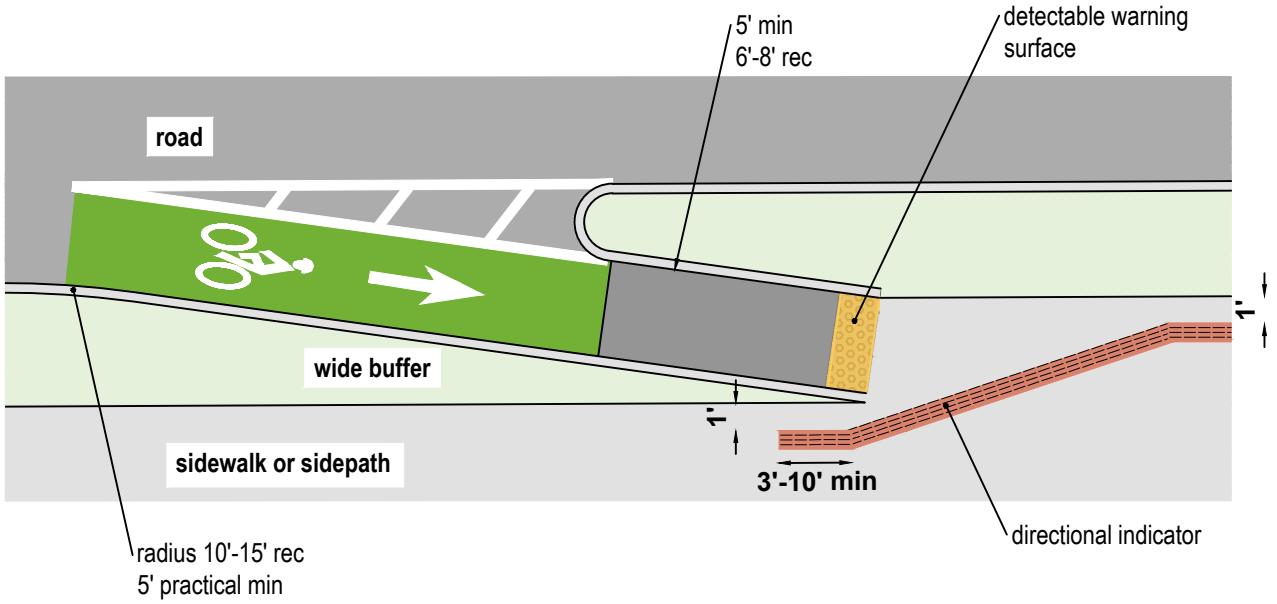
9.2.2.2 Bike Ramps

- Where feasible, bike ramps should be contained within a landscaped buffer. The buffer should be designed so that pedestrians with vision disabilities can use the detectable edge of the buffer zone to maintain their alignment on the sidewalk or shared use path and avoid crossing into the bike ramp.
- The bike ramp should connect with the shared use path at an angle to not align with a pedestrian's path of travel.
- The bike ramp should be colored green to further distinguish it. If there is sufficient space on the bike ramp, a raised speed table symbol pavement marking should also be applied to the ramp.
- A 12-inch-wide guidance TDI should be placed above top grade break of the bike ramp to guide the pedestrians past the bike ramp Figure 23. The guidance TDI should be offset 12 inches from the edge of the pedestrian access route.
- The TDI bars should be oriented parallel to the direction of travel on the sidewalk and should extend beyond the width of the bike ramp on both sides by 3-10 feet depending on other surface or textural changes in the vicinity.
- A detectable warning surface should be included near the top of the bike ramp. Ultimately pedestrians should not interact with this detectable warning surface because the guidance TDI will guide them past this ramp, but if they do encounter the surface it conveys that they are about to enter the roadway.

9.2.2.3 Managing Conflict Zones to Improve Safety

- Bicycle traffic calming measures should be implemented at locations where bike lanes or shared use paths transition to sidewalks, including signage indicating the bike lane ends and vertical and lateral deflection to encourage cyclists to slow down and yield to pedestrians.
- Pedestrians and cyclists should be able to easily see each other at conflict points. Obstacles should not obstruct sightlines.

Figure 23: Recommended bike ramp design



Sidewalk-Level Separated Bike Lanes | 10

Separated bike lanes can be implemented at sidewalk-level (Figure 24), street-level, or intermediate level. Although the default in Montgomery County is intermediate-level (CSDG Section 5.2), there may be rare circumstances where a separated bike lane must be constructed at sidewalk level, e.g., due to physical constraints.

10.1 Potential Accessibility Challenges

Sidewalk-level separated bike lanes can introduce the following accessibility challenges for pedestrians with disabilities if poorly designed:

- Some pedestrians with vision disabilities may not be able to detect the boundary between pedestrian and cyclist space and may inadvertently step out into or walk within the bike lane.
- Some pedestrians with intellectual and developmental disabilities may be confused about which space is intended for pedestrians and which space is intended for cyclists.
- Deploying a wheelchair ramp from a vehicle or opening a car door from an adjacent parking space may create a hazard for the person exiting the vehicle and for oncoming cyclists.

10.2 Guidance

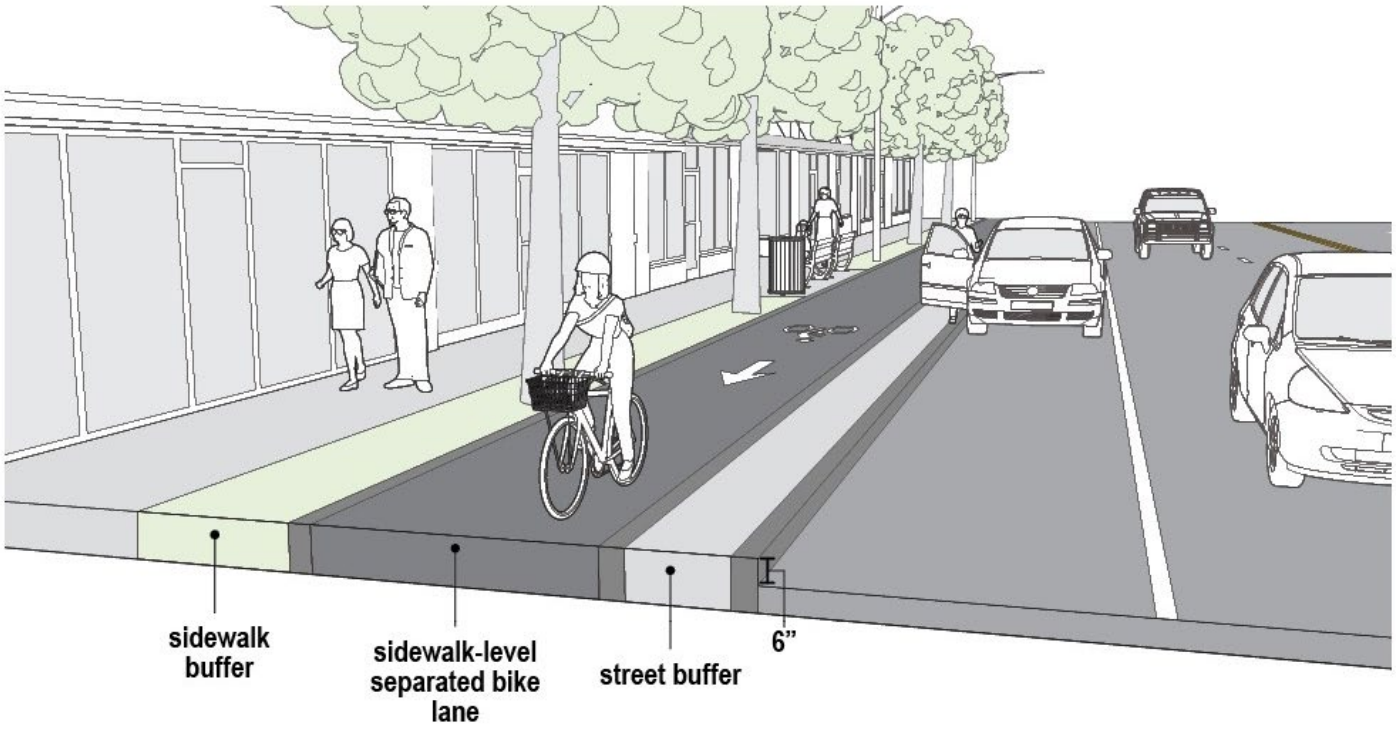
10.2.1 Where to Apply

- Sidewalk-level separated bike lanes should not be implemented in Montgomery County except in rare circumstances where physical constraints make providing an intermediate-level or street-level separated bike lane technically infeasible.

10.2.2 How to Apply

If it is technically infeasible to implement a separated bike lane at intermediate- or street-level, the following treatments should be implemented to improve accessibility.

Figure 24: Sidewalk level separated bike lane



10.2.2.1 General

10.2.2.1.1 Planning Considerations

- Poorly designed separated bike lanes can create accessibility challenges for people with disabilities. As such, people with a range of disabilities, including ambulatory, vision, and intellectual and developmental, as well as Orientation and Mobility Specialists and others with expertise on how people with different types of disabilities navigate, should be actively engaged in the planning and design process.

10.2.2.1.2 Location

- The sidewalk-level separated bike lane should be located closest to motor vehicle traffic and the sidewalk or pedestrian facility should be located closest to the building or property line.

10.2.2.1.3 Facility Widths

- Sidewalk widths shall comply with CSDG Figure 3-2.
- Bike lane widths shall comply with CSDG Figure 5-27.

10.2.2.1.4 Color Contrast and Pavement Markings

- The sidewalk-level separated bike lane and sidewalk should have contrasting colors to distinguish them visually. Green colored pavement is recommended for the bike lane.
- The sidewalk-level separated bike lane should also include bicycle symbol pavement markings to further distinguish it as a space for cyclists.

10.2.2.1.5 Marked Crosswalks

- Crosswalks marked with high-visibility, ladder-style crosswalk markings, detectable warning surfaces on both ends, “Stop for Pedestrians” signage, and coordinated stop bars should be installed across the bike lane at transit stops and midblock crosswalks to indicate to pedestrians where to cross and encourage cyclist yielding.

10.2.2.1.6 Adjacent Land Uses

- At bus stop locations, the design of the bus stop shall comply with the requirements in *Section 18*.
- At mid-block crossing locations, where space exists for a pedestrian refuge, it shall comply with *Section 11.5* between the bicycle lane and street.
- At locations with accessible on-street parking or passenger loading zones, the design of the accessible parking and passenger loading zones shall comply with the requirements in *Section 19*.

10.2.2.1.7 Street Buffer Zone

- At locations with standard parking spaces, i.e., not accessible, on-street parking or passenger loading zones, there should be a minimum 4-foot-wide Street Buffer Zone between the bike lane and the parking or passenger loading area to prevent a person exiting the vehicle from dooring a cyclist and so the person exiting does not step directly into the bike lane.

10.2.2.2 Unconstrained Locations

10.2.2.2.1 Buffer between Sidewalk and Bike Lane

- In locations where it is technically feasible to comply with the requirements in *Section 10.2.2.1* above, provide at least a minimum 2-foot-wide buffer between the separated bike lane and the sidewalk.
- The buffer should have a surface texture that is distinct underfoot from the typical walking surface. Potential surfaces include low shrubs, grass, or river rock. Materials such as colored concrete, stamped concrete, brick pavers, or other common walking surfaces are not reliably detectable by people who are blind or have low vision and shall not be used.

10.2.2.2.2 Buffer Breaks

- Breaks in the buffer that comply with PROWAG R302 shall be provided at midblock crosswalk locations, transit stops, accessible on-street parking spaces, and accessible passenger loading zones to enable accessible pedestrian access.
- Vertical elements, such as trees, benches, light poles, and other street furniture can be incorporated into the buffer and may enhance its detectability but shall not protrude into the sidewalk or the bike lane.

10.2.2.3 Constrained Locations

- In locations where it is technically infeasible to comply with the requirements in *Section 10.2.2.1* above to provide a minimum 2-foot-wide buffer between the separated bike lane and the sidewalk, the following options should be considered.

10.2.2.3.1 Option 1: Guidance TDI (preferred for locations where there is on-street parking or passenger loading)

- Guidance TDIs complying with the requirements in Table 8 should be applied to the sidewalk to help pedestrians stay within pedestrian spaces.
- The guidance TDI should be located at least 12 inches from the edge of the sidewalk nearest to the bike lane (24 inches preferred) and should be at least 12 inches wide.
- The guidance TDI should connect to detectable warning surfaces at designated crosswalk locations as shown in Figure 25.

10.2.2.3.2 Option 2: TacTile Warning Delineator (Preferred for Locations where there isn't on-street parking or passenger loading)

- Trapezoidal tactile warning delineators complying with the specifications provided in *Appendix D: Experimental Treatments*, should be applied between the sidewalk and the separated bike lane.
- At crosswalk locations, the tactile warning delineators should connect to a detectable warning surface (Figure 26) or to a surface with a texture that is distinct underfoot from the typical walking surface, e.g., landscaped area or river rock.

10.2.2.3.3 Option 3: Shared Use Path

- At locations where pedestrian or bicycle volumes are expected to be low, a shared use path may also be considered.

Figure 25: Sidewalk level separated bike lane with guidance TDI

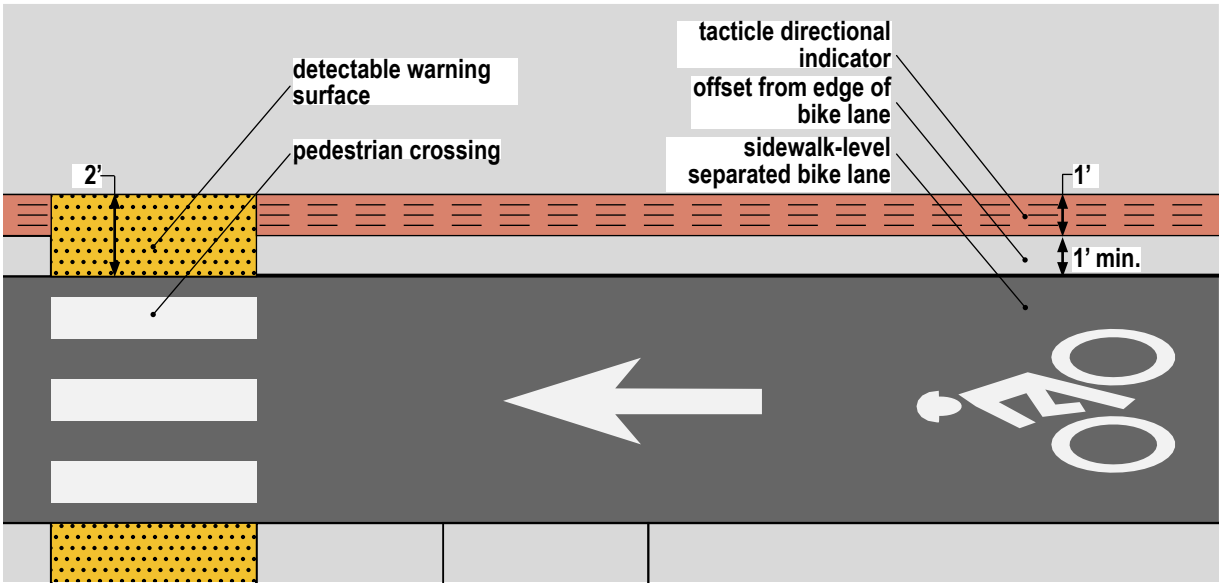
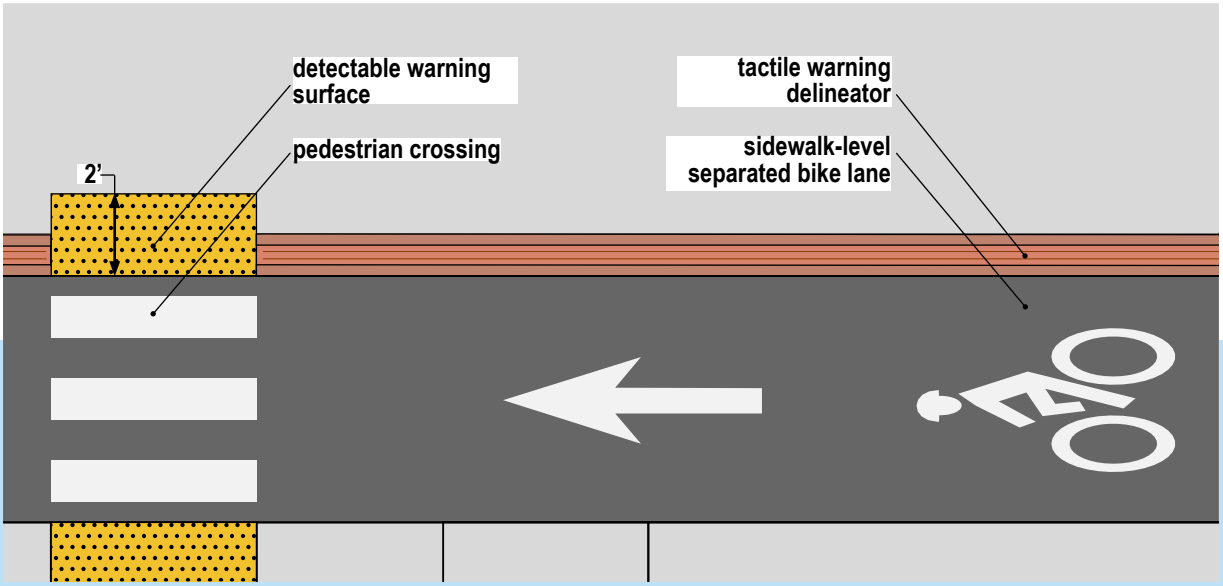


Figure 26: Sidewalk level separated bike lane with tactile warning delineator



Crosswalks 11

A crosswalk is the space designated for pedestrians and cyclists to cross vehicular travel lanes, and where motorists (and other road users) are required to stop for people crossing. In Maryland law, there are three types of crosswalks:

- Anywhere two or more roads intersect, the extensions of their sidewalks across the intersection forms a crosswalk.
- Anywhere a bikeway and a roadway intersect, the extension of the bikeway across the road forms a crosswalk; and
- Anywhere a crosswalk is specifically marked across the roadway.[15]

The first two types—where the lines of a sidewalk or bikeway cross a road—are not required by Maryland law to be marked; a crosswalk exists automatically unless crossing is explicitly prohibited by signs and barriers. Regardless, unmarked crosswalks will not always be understood by drivers or pedestrians as a legal crosswalk, and pedestrian accessibility and legibility must be considered.

11.1 Potential Accessibility Challenges

- High motor vehicle speeds.
- Motorists not yielding to pedestrians in the crosswalk.
- Motorists blocking the crosswalk.
- Locating the crosswalk, particularly when crosswalk markings are missing or faded and/or intersection is skewed, crosswalk is midblock, or crosswalk is part of a roundabout or uncontrolled channelized turn lane.
- Ramps not aligned with the crosswalk.
- Maintaining the correct heading in the crosswalk, particularly if the crosswalk crossing distance is long.
- Inadequate lighting.
- Inadequate crossing time.
- Too much distance between protected/safe crossings.
- Bus stops not near protected/safe crossings.
- Uncontrolled midblock crosswalks without measures to ensure driver yielding or indicate when it is safe to cross.
- Lack of audible cues to know when it is safe to cross, particularly at roundabout, uncontrolled channelized turn lane, t-intersection, and uncontrolled midblock crosswalks.
- Uncertainty about when it is safe to cross due to permissive left and right turns.
- Insufficient stopping sight distances

11.2 Guidance-General

11.2.1 Where to Apply

- This guidance is applicable to all legal crosswalks as defined in Maryland law.

Among respondents to the Accessibility Challenges Survey, two thirds (66%) identified "crossing the street" as a top accessibility challenge, making it the most frequently cited accessibility challenge overall.

Among these respondents, the most significant challenge was drivers not yielding. Secondary challenges included crosswalks blocked by drivers, signals not giving enough time to cross, and missing or faded markings.

11.2.2 Key Requirements

Table 12: Key requirements for pedestrian crosswalks

Design Element	Criteria	Notes	Reference
Pedestrian Access Route	Shall include pedestrian access route complying with PROWAG R302	Pedestrian access route must extend the full length of the crosswalk including medians and pedestrian refuge islands	PROWAG R203.4
Grade	Max 5%	Where design requires superelevation at the crosswalk, grade can be same as superelevation	PROWAG R302.4.3
Cross Slope	Max 2.1%	Intersection crosswalks where approach is controlled by yield or stop signs	PROWAG R302.5.2
	Max 5%	Intersection crosswalk where approach is uncontrolled or controlled by a signal or pedestrian hybrid beacon	
	Max running slope of street	Roundabout crosswalk or midblock crosswalks will match road grade	
Markings	Shall comply with MdMUTCD Section 3B.18	Ladder-style high-visibility crosswalk should be used for all crossings	MdMUTCD Section 3B.18
Locations where pedestrian crossing not intended	Pedestrian circulation path shall be separated from the curb with landscaping or another nonprepared surface a minimum of 24" wide, or with a vertical edge treatment with a bottom edge 15" maximum above the sidewalk grade blocking the full width of the crosswalk.	N/A	PROWAG R306.4.1.1

11.2.3 How to Apply

11.2.3.1 Length

- Crosswalks should be as short as possible to reduce pedestrian exposure to motor vehicle traffic and make it easier for people with vision disabilities to maintain the proper heading to the other side of the crosswalk. Wherever possible, curb extensions should be installed to shorten pedestrian crossing distances and provide space for directional curb ramps aligned with each crossing. For guidance on curb ramps, see *Section 13*.
- In cases where crosswalks are long (over 40 feet), a pedestrian refuge island, alignment TDIs, audible beaconing, crosswalk guide strips, and/or crosswalk delineator strips should be considered as part of the crosswalk design. See *Section 11.5* below for guidance on pedestrian refuge island design. See *Appendix D: Experimental Treatments* for discussion of crosswalk guide strips and crosswalk delineator strips.

11.2.3.2 Width

- Crosswalk widths shall comply with the minimum continuous clear width requirements in PROWAG R302.2 and must fully encompass the connecting curb ramps.
- Crosswalks that connect to sidewalks should generally be no less than 10 feet wide, and should be wider in locations with high pedestrian demand (CSDG 6.13).
- The width of crosswalks that connect to shared use paths shall be at least as wide as the shared use path.

11.2.3.3 Grade

- Grades shall not exceed the maximum grade requirements in PROWAG R302.4.3, which are summarized in Table 12.

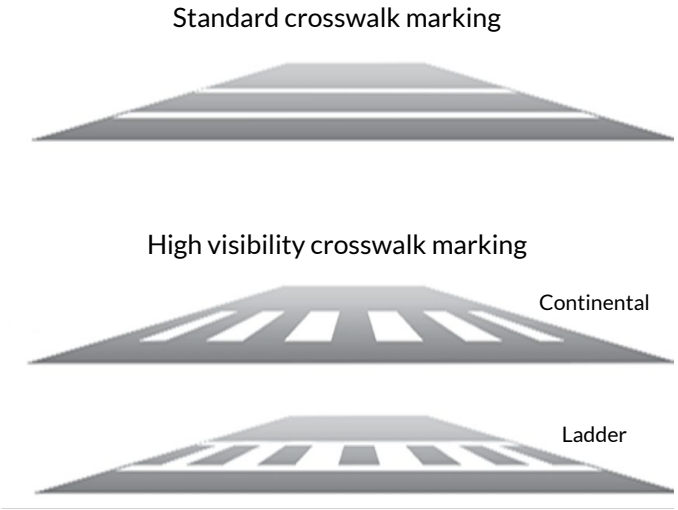
11.2.3.4 Cross Slope

- Cross slopes shall not exceed the maximum cross slope requirements in PROWAG R302.5.2, which are summarized in Table 12.

11.2.3.5 Markings

- Crosswalks should be marked with high-visibility, ladder-stye markings (Figure 27) unless pedestrian crossings are prohibited. Many people with low vision favor the ladder-style marking because the transverse edge lines help them to maintain the correct heading in the crosswalk.[16] Studies have also demonstrated that ladder-style markings are the most visible to drivers and have the greatest impact on driver yielding behavior.[17]
- Crosswalk markings must contrast visually with the pavement around them. On light-colored pavement, a black border is recommended to provide contrast around the white marking.
- Markings should be inspected regularly and replaced when they are worn, faded, or damaged to the point they are near or at minimum retro-reflectivity levels or are no longer effective at communicating to drivers and pedestrians.

Figure 27: Examples of standard and high visibility crosswalk markings



11.2.3.6 Stop Lines

- Stop lines complying with MdMUTCD 3B.16 and paired with the appropriate stop here for pedestrians signage should be installed on all crosswalk approaches to discourage drivers from obstructing the crosswalk and to improve visibility between drivers and pedestrians at multi-lane approaches.
- The stop line shall be at least 4 feet from the nearest edge of the crosswalk. On approaches with more than one lane in the same direction and no traffic control, the stop or yield line should be placed 20–50 feet in advance of the crosswalk and parking should be prohibited in the area between the stop line and the crosswalk. 20 feet is appropriate on lower speed streets while 50 feet is appropriate for higher speed streets.
- Stop lines should be inspected regularly and replaced when they are worn, faded, or damaged.

11.2.3.7 Speed management and daylighting

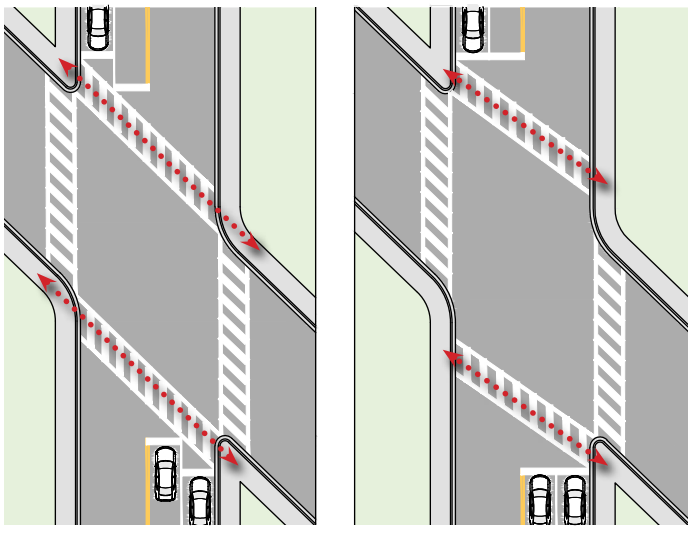
- Curb extensions, pedestrian refuge islands, raised crosswalks, and other speed management measures should be considered to encourage drivers to slow and stop for pedestrians in the crosswalk and to improve visibility between pedestrians and drivers, particularly at uncontrolled crosswalks.
- Parking should be restricted for at least 20 feet on either side of a marked crosswalk and for a minimum of 30 feet prior to a flashing beacon, stop sign, or traffic control devices to preserve sight lines between pedestrians and motorists.

11.2.3.8 Decorative Crosswalks

Decorative or artistic crosswalks can be difficult for people with vision, intellectual, and developmental disabilities to see and recognize as a crosswalk. Dark areas can also look like holes in the pavement, which may be confusing or frightening to pedestrians.

- If decorative elements are added to a crosswalk, standard retroreflective crosswalk markings complying with MdMUTCD Section 3B.18 should be provided and should not be obscured by the decorative design. The ladder-style high-visibility marking is preferred, and decorative elements must be non-reflective and placed outside the limits of the crosswalk. Decorative crosswalk designs must still preserve the contrast requirements for the ladder-style crosswalk markings.
- Consider reviewing decorative crosswalk designs with disabled community members before installing, particularly community members with vision and intellectual/developmental disabilities.

Figure 28: Options for crosswalk alignment at skewed intersections

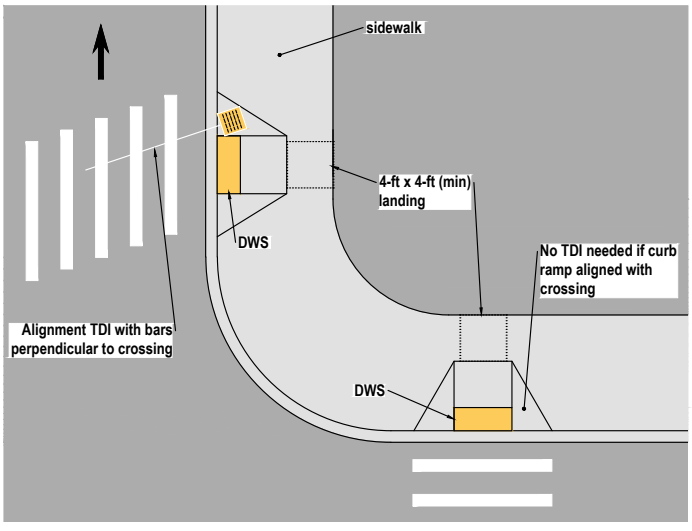


11.3 Guidance-Intersection Crosswalks

11.3.1 Skewed Intersections

- Ideally intersections should be designed so that the angles created by the intersecting streets are as close to 90 degrees as possible. Intersections with angles at or near 90 degrees result in better visibility between pedestrians and motorists, shorter crosswalks, and slower motor vehicle turns.
- Modifications, such as curb extensions, should be considered at skewed intersections to bring the angles closer to 90 degrees.
- Where it is infeasible to fully correct the skew of an intersection, the crosswalk alignment must strike a balance between shortening crossing distances, reducing out of direction travel for pedestrians, ensuring that pedestrians are visible to turning motorists, and that the crosswalk is located where turning motorist speeds are lowest. This often means closely following the skewed alignment of the street with some skew to shorten crossing distances. In general, the pedestrian crosswalk on the downstream side of the motorist turn should be no more than 20 feet from the parallel roadway (Figure 28).

Figure 29: Alignment TDI at a skewed intersection



- To give pedestrians more options, designers may consider a variable width crosswalk so that the inside edge aligns with the sidewalk on both sides of the cross street, and the outside edge is more perpendicular to the cross street, thereby providing the shortest path of travel across the crosswalk (Figure 30). Care should be taken to not push the crosswalk so far back that sight lines between pedestrians and turning motorists are compromised and the intersection clearance increases, resulting in more vehicles passing through the crosswalk during the pedestrian walk phase. In these options, pedestrian crossing times must be based on the longest crosswalk crossing distance or the distance from the pedestrian pushbutton to the receiving curb ramp (whichever is longer).
- At conventional intersections, i.e., those which are not curbless or shared, directional curb ramps that align with the direction of pedestrian travel on the associated crosswalks should be used to help people with vision disabilities align properly to cross.
- Alignment TDIs, audible beaconing, crosswalk guide strips, and/or crosswalk delineator strips should be considered to help people with vision disabilities maintain their heading while in the crosswalk. See Figure 29 for an example of how alignment TDIs can be used. See *Section 14.2.2.7* for discussion of audible beaconing. See *Appendix D: Experimental Treatments* for discussion of crosswalk guide strips and crosswalk delineator strips.
- Pedestrian refuge islands should be considered to reduce pedestrian exposure to motor vehicle traffic, particularly at uncontrolled crossings.

11.3.2 Channelized Turn Lanes and Roundabouts

- Channelized turn lanes should be avoided and existing channelized turn lanes should be considered for removal.
- When incorporated into an intersection design, crosswalks at roundabouts and channelized turn lanes shall comply with PROWAG R306.4 and PROWAG R306.5.
- Since poorly-designed channelized turn lanes and roundabouts can create significant navigational challenges for people with vision disabilities and intellectual/developmental disabilities, active engagement in the planning and design process should include people with these disabilities, Orientation and Mobility Specialists, and others with expertise on how people with different types of disabilities navigate.

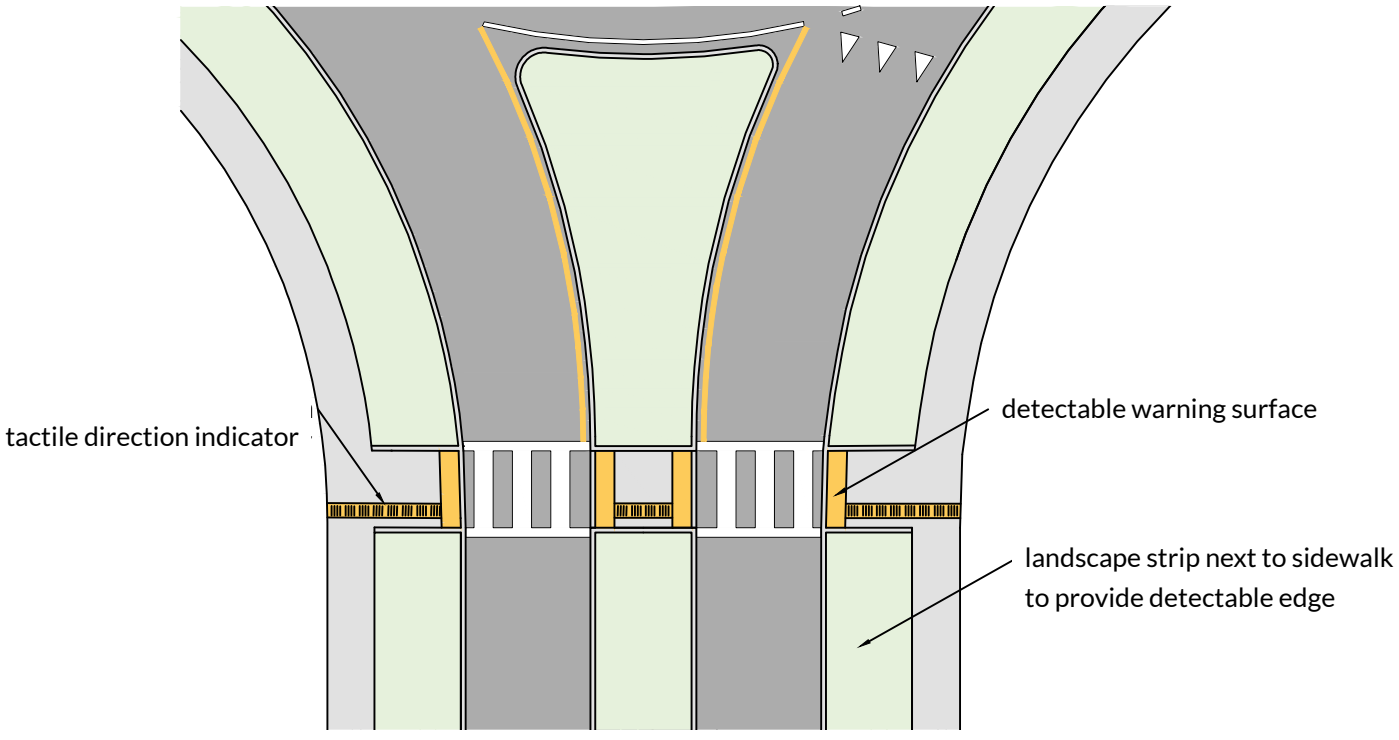
Figure 30: Example of variable width crosswalk (Source: Google Streetview)

- In addition, the following key features should be incorporated into the design:
  - Sidewalk alert TDIs, with the bars aligned perpendicular with the associated crosswalk, should be considered to help people with vision disabilities find the crosswalk locations and align properly to cross (Figure 31).
  - Rectangular rapid-flashing beacons (RRFBs) or other treatments may be appropriate to help people with disabilities make their intention to cross known.
  - Crosswalk guide strips, crosswalk delineator strip, and/or audible beaconing should be used to help people with vision disabilities maintain their heading while in the crosswalk. See *Appendix D: Experimental Treatments* for discussion of crosswalk guide strips.
  - Audible (textured) paving should be considered to provide an audible cue when motor vehicles exit the circulatory roadway (roundabout) or enter the channelized turn lane.
  - Measures to slow motor vehicle speeds should be included, such as raised crossings, mountable truck aprons, and roadway geometry that discourages high-speed turns. See CSDG 6.6 for more.
  - Consult NCHRP 834[18] and NCHRP 1043[19] for use of tactile direction indicators and other guidance for designing roundabouts to be accessible to people with vision and other disabilities.

11.3.3 T-Intersections

- Sidewalk alert TDIs, with the bars aligned perpendicular with the associated crosswalk, should be considered to help people with vision disabilities find crosswalk locations and align to cross at the top of the T-intersection.
- If the T-intersection is signalized, the placement of sidewalk alert TDIs should be coordinated with the location of the pedestrian push button so that people with vision disabilities who follow the TDI will be guided to within easy reach of the push button.
- Crosswalk guide strips , crosswalk delineator strips, and/or audible beaconing should be considered to help people with vision disabilities maintain their heading while in the crosswalk.

Figure 31: Key features of roundabout designs



11.4 Guidance- Midblock Crosswalks

11.4.1 Where to Apply

Protected midblock crosswalks should be considered where the distance between protected intersection crosswalks exceeds the thresholds in Table 13 or where there is a significant midblock pedestrian crossing desire line due to the presence of a major destination or midblock bus stop.

11.4.2 How to Apply

- The crosswalk should be straight and perpendicular to the street.
- Sidewalk alert TDIs should be considered to guide people with vision disabilities to the crosswalk (Figure 32).
- If the midblock crosswalk is signalized, the placement of sidewalk alert TDIs should be coordinated with the location of the pedestrian push button so that people with vision disabilities who follow the sidewalk alert TDI will be guided to within easy reach of the push button.

Figure 32: Example of tactile direction indicator used to guide pedestrians with vision disabilities to a midblock crosswalk in Melbourne, Australia. Note that the bars are not oriented as specified in this guide for sidewalk alert TDIs.

Table 13: Pedestrian crossing distance and intersection spacing by street type

Design Element	Maximum Protected Crossing Spacing*	Generally Accepted Minimum Signal Spacing**
Downtown Boulevard	400’	400’
Downtown Street	400’	400’
Boulevard	800’ - 1600’	1300’
Town Center Boulevard	600’	600’
Town Center Street	400’	400’
Neighborhood Connector	600’ - 1200’	1300’
Neighborhood Street	N/A	N/A
Neighborhood Yield Street	N/A	N/A
Industrial Street	800’	800’
Country Connector	1300’ - 2700’	2700’
Country Road	1300’ - 2700’	2700’
Major Highway	1300’	2700’

* On streets with operating speeds of 30 mph or higher, “protected” crossings include full signal, HAWK, all-way stop control, or grade-separated crossing. Figures are targets - engineering judgement is needed to determine the ultimate placement and spacing between signals, with a focus on sight lines. Where ranges are provided, the lower end of the range is recommended in commercial areas, on BRT corridors, and near schools (or similar destinations).

** Refers to a full signalized intersection or roundabout. Engineering judgement is needed to determine the ultimate placement and spacing between signals,

- If curb ramps are needed, i.e., if accessing the crosswalk requires a change in level, they should be directional.
- The crosswalk should be marked with ladder-style, high-visibility markings.
- A crosswalk guide strip, crosswalk delineator strip, and/or audible beaconing should be considered to help people with vision disabilities maintain the correct heading in the crosswalk.
- If the crossing is uncontrolled, it should be supported with midblock pedestrian crossing signs and other appropriate countermeasures per the FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations. Pedestrian crossing signs can improve motor vehicle yielding at midblock crossings and help pedestrians with low vision locate the crossing.
- The crosswalk should be lit as specified in *Section 16*.
- If there is a parking lane, curb extensions should be installed to minimize pedestrian crossing distance, improve visibility between pedestrians and drivers, and encourage driver yielding.
- If the crossing involves crossing more than one motor vehicle lane in each direction, a pedestrian hybrid beacon with accessible pedestrian push button should be installed.

11.5 Guidance—Pedestrian Refuge Islands (Crossing Islands)

Pedestrian refuge islands, also referred to as crossing islands, enable pedestrians to cross streets in two stages and to focus on one direction of motor vehicle travel at a time when crossing a two-way street. Pedestrian refuge islands can be extremely helpful for people with disabilities, particularly those who move more slowly or find it difficult to judge gaps in two-way traffic at uncontrolled crossings, e.g., due to a vision, intellectual, or developmental disability.

11.5.1 Where to Apply

Pedestrian refuge islands should be installed whenever a median is incorporated into a street design and must be provided when a street is too wide for pedestrians to cross in a single signal cycle and it is not feasible to provide more time in the signal cycle or to narrow the road; however, pedestrian refuge islands can be considered for other crosswalks, particularly those that are uncontrolled.

11.5.2 Key Requirements

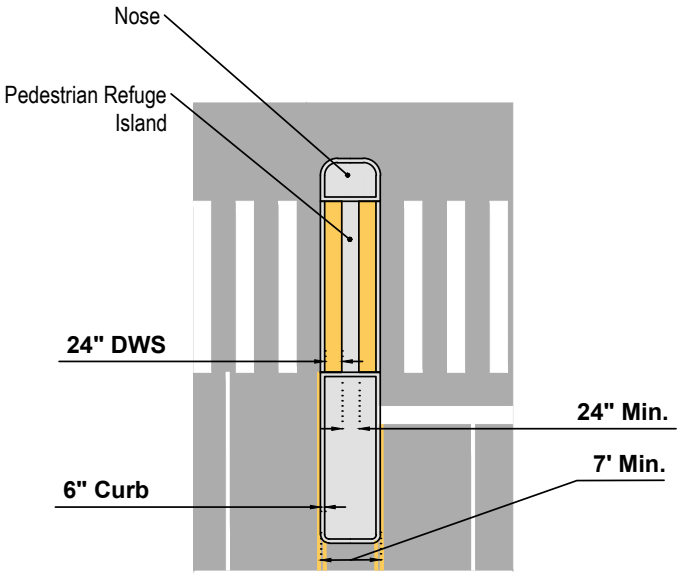
Table 14: Key requirements for pedestrian refuge islands

Design Element	Criteria	Notes	Reference
Width of cut through	Min 60", width of crosswalk preferred	Pedestrian refuge islands that do not serve shared use path crosswalks	PROWAG R302.2.1
	Width of shared use path	Pedestrian refuge islands that serve shared use path crosswalks	
Length in direction of pedestrian travel	Min 72", 96-120" preferred [20]	If 72" length is provided, detectable warning surfaces must be installed aligned with the face of curb.	PROWAG R305.2.4
Detectable warning surfaces	Shall extend full width of the pedestrian circulation path opening but can include a 2" concrete band around the warning surface if needed for constructability. Shall be located max 6" from the edges of the pedestrian refuge island or at back of curb and shall provide at least 24" between the detectable warnings surfaces within the pedestrian refuge median.	N/A	PROWAG R305.1.4, PROWAG R305.2.4
Push button or passive detection device	Required if pedestrian clearance time is calculated to a pedestrian refuge island	N/A	PROWAG R306.2

11.5.3 How to Apply

- Pedestrian refuge islands shall comply with the requirements in PROWAG R302.2.1, R305.1.4, R305.2.4, and R306.2, which are summarized in Table 14 above.
- Pedestrian refuge islands should be designed with physical, raised barriers as protection on either side and an at-grade cut-through for pedestrians. The "nose" of the pedestrian refuge island defines a protected space for pedestrians to wait and helps reinforce slower turning movements for motor vehicles (CSDG 6.13) (Figure 33).

Figure 33: Pedestrian refuge island design



Driveway Crossings

12

Driveway crossings are where driveways cross sidewalks. As such, they are potential conflict points between pedestrians and motorists. Minimizing the number of driveway crossings and designing them to slow motorists is critical to pedestrian safety, comfort, and accessibility.

12.1 Potential Accessibility Challenges

- Sidewalks with too much cross slope at the driveway crossing, which can destabilize a person walking or using a mobility aid, such as a wheelchair.
- Wide driveway crossings without effective tactile and visual cues defining the pedestrian route, which can be difficult for pedestrians with disabilities to navigate.
- Lack of reliable auditory cues for determining when it is safe to cross, which can make driveway crossings difficult for pedestrians with vision disabilities.
- Driveway crossings with sightlines that are obstructed by hedges, building facades, or other obstacles, which can make it difficult for crossing pedestrians to see drivers and vice versa, and may also result in drivers pulling forward and blocking the sidewalk to see oncoming traffic.

12.2 Guidance

12.2.1 Where to Apply

- The number of driveways should be minimized, and driveways consolidated as much as possible, to reduce the number of discrete conflict points between motorists and pedestrians.

12.2.1.1 How to Apply

12.2.1.1.1 Pedestrian Access Route

- Driveway crossings shall include a pedestrian access route that complies with PROWAG R302. See Table 4 for a summary of pedestrian access route requirements.[21]
- The pedestrian access route should be clearly delineated and maintain the grade, slope, and material of the sidewalk through the driveway instead of ramping down to the driveway (Figure 34). However, if necessary, the sidewalk can ramp down on both sides of the driveway (Figure 35).
- For wide driveway crossings, consider incorporating a sidewalk-adjacent mountable curb on the side closest to the property line as a detectable edge to help people with vision disabilities navigate across the driveway opening.

12.2.1.1.2 Driveway Apron

- The driveway apron ramp should be contained within the Buffer Zone to avoid a cross slope on the sidewalk. Where a Buffer Zone is not present or insufficient, the pedestrian access route should be shifted away from the roadway as needed to achieve a maximum 2.1% cross slope.
- In especially constrained circumstances where this isn't possible, it may be necessary to ramp the sidewalk down to or near street level (Figure 35).

12.2.1.1.3 Driveways with Stop, Yield, or Signal Control

- Where driveways are controlled with yield or stop control devices or traffic signals, detectable warning surfaces shall be provided on the sidewalk where it meets the driveway (PROWAG R305.2.8).
- Where the driveway is controlled by a traffic signal, pedestrian signal heads and accessible pedestrian signals shall be provided to support the driveway crossing.

12.2.1.1.4 Sight Distances

- A person jogging at a speed of 5 miles per hour should be considered as the preferred user profile when assessing sight distances for sidewalk driveway crossings. A person cycling at a speed of 15 mile per hour should be considered as the preferred user profile when assessing sight distances for shared use path driveway crossings. Designing sight distances for these faster users will naturally accommodate the slower pedestrian facility users.[22]
- Consider prohibiting parking, and restricting other visual obstacles, within 20 feet of a driveway entrance. County law prohibits parking within 5 feet of a driveway entrance.[23]

Figure 34: Raised driveway crossing. (Source: Ohio Multimodal Design Guide.)

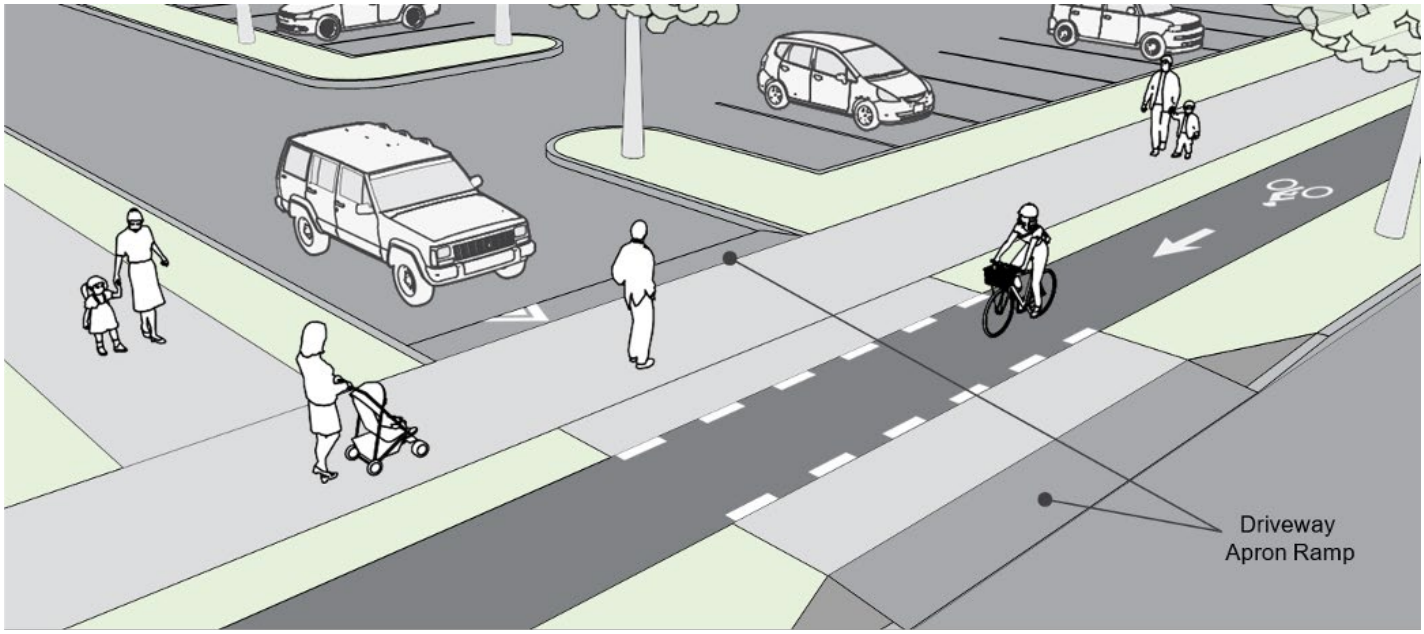
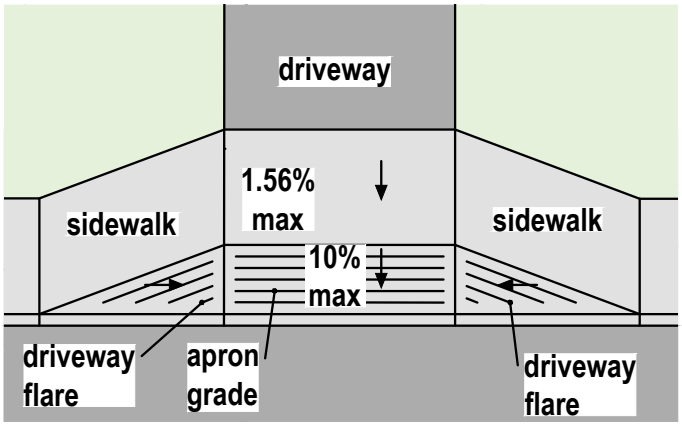
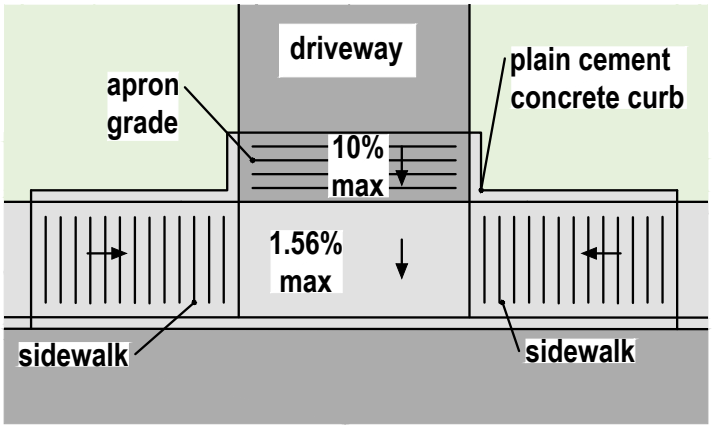


Figure 35: Two options for configuring driveway crossings in constrained locations. Left: Reroute the sidewalk away from the curb far enough to minimize its cross slope between the driveway and apron. This option is preferred if the sidewalk cannot be maintained at its location and grade across the driveway. Right: Use parallel ramps to drop the sidewalk low enough to minimize its cross slope between the driveway apron and roadway. This option may be acceptable in limited circumstances but should be avoided if possible. (Source: Ohio DOT Multimodal Design Guide.)





Curb Ramps and Blended Transitions | 13

Curb ramps may be perpendicular or parallel to the curb or to the street they serve or be a combination thereof. Curb ramps allow people using wheelchairs or other mobility aids to access the street from the sidewalk and vice versa. They are also used for the same reason by parents pushing strollers, people pulling grocery carts or suitcases, and people on bicycles.

A blended transition is a wraparound connection at a corner, or a flush connection where there is no curb to cut through.

In the case of a temporary alternate pedestrian access route, curb ramps may build up to the curb instead of cutting through them.

13.1 Potential Accessibility Challenges

- Missing curb ramps.
- Curb ramps that are not aligned with crosswalks (Figure 36) requiring people using mobility aids, such as wheelchairs, to reorient themselves in the street at the bottom of the curb ramps to avoid going into the intersection and making it difficult for people with vision disabilities to orient properly to the crossing.
- Curb ramps that are too steep.
- Curb ramps that lack detectable warning surfaces.
- Curb ramps that are obstructed either by temporary or permanent obstacles.
- Blended transitions with detectable warnings at the crossing locations but no detectable edge or warning surface in other locations, leaving gaps where a person with a vision disability might unintentionally walk into the intersection. (Figure 37)

Figure 36: Example of a blended transition, where there are detectable warning surfaces at the crosswalk but not in other parts of the depressed curb.

Figure 37: Example of curb ramp that is not aligned with crosswalk.

Among respondents to the Potential Accessibility Challenges Survey that identified crossing street as a top accessibility challenge, 21% identified “lack of accessible ramps to/from the crossing” as a top challenge with crossing streets and 19% identified “ramps no aligned with crosswalk” as a top challenge. People who reported difficulty using stairs were most likely to identify “lack of accessible ramps to/from the crossing” as a top challenge, while people who reported difficulty seeing were most likely to identify “ramps not aligned with crosswalk” as a top challenge.

13.2 Guidance—Where to Apply

13.2.1 General

- When alterations are made to crosswalks, curb ramps or blended transitions shall be provided on both ends of the crosswalk where the pedestrian access route crosses a curb (PROWAG R203.6.2).

13.2.2 At Intersection Crosswalks

- At an intersection corner, one curb ramp or blended transition shall be provided for each crosswalk. A single blended transition that spans all crosswalks at the intersection corner may be provided (PROWAG R203.6.1.1).
- Montgomery County's preferred standard is two perpendicular curb ramps per corner, each aligning with the crosswalks they serve. Other PROWAG-compliant curb ramp designs may be considered if two perpendicular ramps are infeasible at a specific location; however, engineering judgment and approval from MCDOT would be required (CSDG 6.10).
- A single diagonal or apex ramp that serves two crosswalks is not permitted in new construction on undeveloped land and is only permitted in alterations if providing curb ramps or blended transitions for each crosswalk is technically infeasible (PROWAG R203.6.1.1) and MCDOT has provided written approval for the design.
- Where pedestrian crossing is prohibited, curb ramps or blended transitions shall not be provided, and the pedestrian circulation path shall be either (a) separated from the roadway with landscaping or other non-prepared surface or (b) separated from the roadway by a detectable vertical edge treatment with a bottom edge 15 inches maximum above the pedestrian circulation path. (PROWAG R203.6.1.1).

13.2.3 At Midblock Crosswalks

- At a mid-block or roundabout crosswalk, curb ramps shall be provided on both ends of the crosswalk. Where pedestrian crossing is not intended, curb ramps or blended transitions shall not be provided, and the pedestrian circulation path shall be either (a) separated from the roadway with landscaping or other non-prepared surface or (b) separated from the roadway by a detectable vertical edge treatment with a bottom edge 15 inches maximum above the pedestrian circulation path (PROWAG R203.6.1.2).

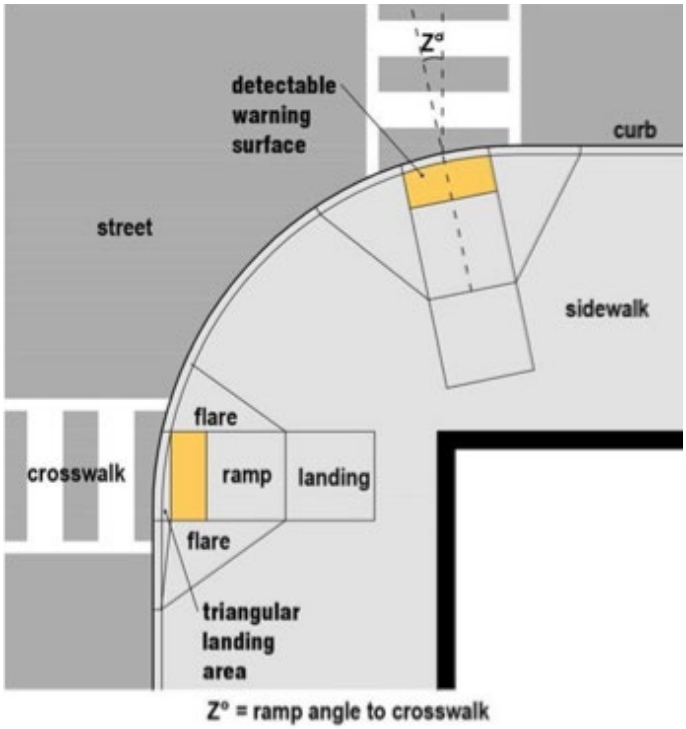
13.2.4 At Accessible Parking Spaces

- At parallel on-street parking spaces complying with the dimensions specified in PROWAG R310.2.1, a curb ramp or blended transition shall be provided at either end of the parking space to connect the parking space to a pedestrian access route (PROWAG R203.6.1.3). Where parking is located proximate to signalized intersections, the curb ramp should be integrated into the signalized crossing.
- At perpendicular and angled on-street parking spaces, and at passenger loading zones, a curb ramp or blended transition shall be provided to connect the access aisle to a pedestrian access route (PROWAG R203.6.1.4).

13.3 Guidance—Perpendicular Curb Ramps

Perpendicular curb ramps are installed perpendicular to the curb. (Figure 38) Users will generally be traveling perpendicular to vehicular traffic when they enter the street at the bottom of the ramp. Perpendicular curb ramps can be designed as directional curb ramps that align pedestrians with the crosswalk orientation and eliminate the need for people in wheelchairs to reorient themselves within the street. Non-directional ramps are perpendicular to the curb but do not provide a straight path of travel for pedestrians. Perpendicular ramps that are directional are generally the best design for pedestrians, provided that a minimum 48-inch landing is available for each sidewalk approach.

Figure 38: Perpendicular curb ramp types: Non-directional (top) and directional (lower).



13.3.1 Where to Apply

- Locations where a minimum 48-inch by 48-inch landing can be provided for each sidewalk approach.

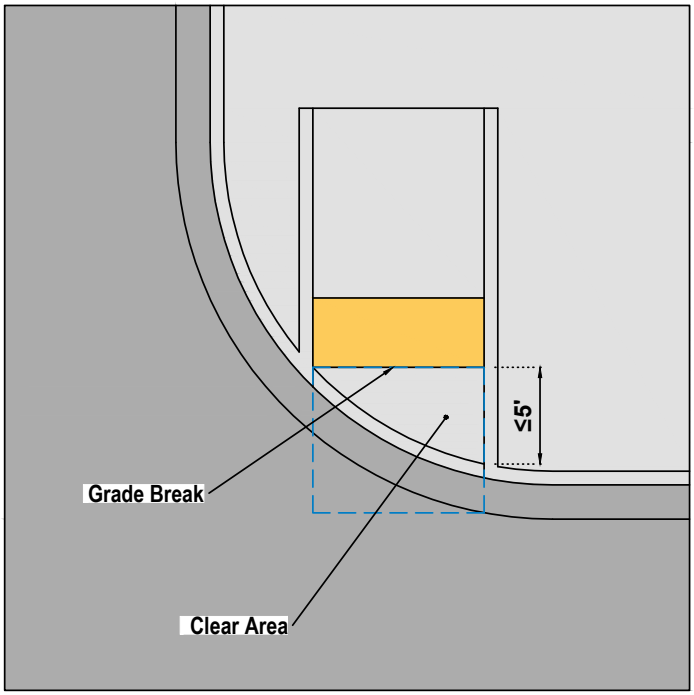
13.3.2 Key requirements

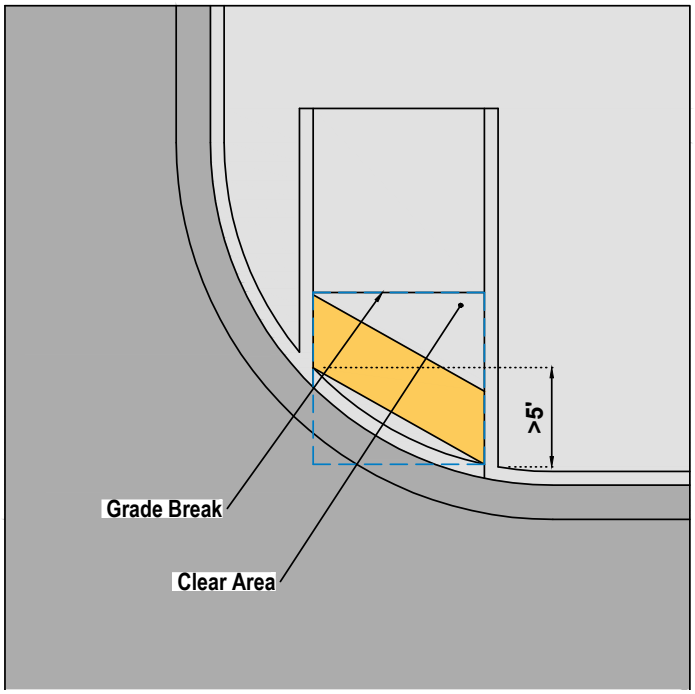
Table 15: Key Requirements for Perpendicular Curb Ramps

Design Element	Criteria	Notes	Reference
Curb ramp run width	Min 48", ≥ 60" preferred	Not shared use path	PROWAG R304.5.1
	Width of shared use path	Shared use path	
Relationship to crosswalk	Shall be contained wholly within the crosswalks they serve	N/A	PROWAG R304.5.3
Surface	Shall be firm, stable, slip resistant. Changes in level not permitted.	N/A	PROWAG R304.5.4
Running slope	Oriented perpendicular to the grade or gutter Max slope 8.3% To help ensure this standard is achieved during construction, designs should incorporate a max 7% cross running slope.	Where the curb ramp length must exceed 15' to achieve an 8.3% running slope, the curb ramp length shall extend at least 15' and may have a running slope greater than 8.3%.	PROWAG 304.2.1
Cross slope	Max 2.1% To help ensure this standard is achieved during construction, designs should incorporate a max 1% cross slope.	At crosswalks, the cross slope of the curb ramp run shall be permitted to be equal to or less than the cross slope of the crosswalk as specified by PROWAG R302.5.	PROWAG R304.2.2

Design Element	Criteria	Notes	Reference
Grade breaks	Perpendicular to the direction of the ramp run.	N/A	PROWAG R304.2.3
Change of grade	13.3% max	Alternatively, a transitional space with min 24" length in the direction of pedestrian travel, running slope max 2.1%, and cross slope no greater than specified in PROWAG R302.5.	PROWAG R304.5.2
Clear area	Min 48" by 48" Provided beyond bottom grade break of ramp run within the width of the crosswalk and wholly outside vehicular lanes, including bicycle lanes Max 5% running slope	At shared use paths, the clear area shall be as wide as the shared use path.	PROWAG 304.2.4
Landing	Min 48" by 48" Provided at top of curb ramp if change of direction required Max slope parallel to curb ramp run 2.1% Max slope perpendicular to curb ramp run ≤ cross slope of curb ramp run	At shared use paths, the landing shall be as wide as the shared use path. Where landing serves two curb ramps, max landing slope in either direction shall not exceed the cross slope of the crosswalk parallel to the direction of travel as specified in PROWAG R302.5.	PROWAG 304.2.5
Flared sides	Max 10% slope measured parallel to adjacent curb line	N/A	PROWAG R304.2.6
Detectable warning surface placement *See Figure 39*	Back of curb or no greater than 6" from the edge of pavement where there is no curb	Ends of bottom grade break in front of back of curb or edge of pavement	PROWAG R305.2.1
	On the ramp run at the bottom grade break	Ends of bottom grade break behind back of curb or edge of pavement 6" or less	
	On the clear area so that front corners are at back of curb or no greater than 6" from the edge of pavement where there is no curb.	Ends of bottom grade break behind back of curb or edge of pavement 6" or more	
Connection to pedestrian facilities	Pedestrian access route complying with PROWAG R302 must connect curb ramps and landings to adjacent pedestrian facilities	A transitional segment may be used in the connection.	PROWAG R304.2.7

Figure 39: Options for detectable warning surface placement





13.3.3 How to Apply

13.3.3.1 General

- Perpendicular curb ramps shall comply with the requirements in PROWAG R304.2, R304.5, and R305.2.1 which are summarized in Table 15.

13.3.3.2 Directional Perpendicular Curb Ramps

- Directional perpendicular curb ramps are preferred over non-directional perpendicular curb ramps.
- If a fully directional curb ramp cannot be provided, the running slope of the curb ramp should generally be aligned within 15 degrees of the angle of the crosswalk. Curb ramps that are not aligned with crosswalks can make it more difficult for pedestrians with vision disabilities to align for the crossing, particularly curb ramps that are misaligned by 15 degrees or more.[24]
- If a curb ramp is placed along a corner radius but is not perpendicular to the curbline, a triangular area is needed at the bottom of the ramp to enable ramp alignment with the crosswalk. This triangular area must slope toward the curbline at 2.1% maximum.

13.3.3.3 Side Treatments

- Where a pedestrian circulation path crosses the side of a curb ramp, the side of the curb ramp shall be flared and the slope of the flare shall comply with the requirements in PROWAG R304.2.6, which are summarized in Table 15.
- In cases where a pedestrian circulation path does not cross the side of a ramp, i.e., the ramp is not within a walkabout area, the sides of the ramp may be vertical curbs or rolled flares that exceed the slope requirements of PROWAG.

13.3.3.4 Cues for Proper Crosswalk Alignment

- To provide an additional alignment cue to people with vision disabilities, especially where traffic and tactile cues are absent or misleading, a 24 inch by 24-inch alignment TDI, with bars aligned perpendicular to the direction of travel on the crosswalk, may be placed on the side of the curb ramp farthest from the center of the intersection. In the case of a curb ramp with a compliant flare, the alignment TDI would be placed on the flare.

13.3.3.5 Constrained Conditions

- In constrained conditions, consider creating a shared landing at the top of the ramp (Figure 40), implementing a curb extension to create for a directional perpendicular curb ramp (Figure 41), or implementing a combination curb ramp (*see Section 13.4 below*). Parallel ramp designs may also be considered, but only after the options above have been considered and determined to be impracticable.

13.4 Guidance—Parallel Ramps

Parallel curb ramps have one or two ramps leading down towards a level landing at the bottom, with a level landing at the top of each ramp (Figure 42). They can be installed where the available space between the curb and property line is too narrow to permit the installation of both a ramp and a landing, and they are effective on steep terrain or at locations with high curbs. Unfortunately, sidewalk users must negotiate two ramp grades in this configuration. Since the landing is depressed and level, drainage of the ramp landing at the street must be carefully designed to provide positive drainage toward the street.

13.4.1 Where to Apply

- Locations where a minimum 48-inch by 48-inch landing cannot be provided for each approach.
- Locations on steep terrain or at locations with high curbs.
- Designers should consider whether perpendicular ramps or combination ramps can be implemented prior to settling on a parallel ramp design. Parallel ramps require users traveling past the ramp on the sidewalk to ramp down and back up again and can have drainage issues, which is why other ramp options are generally preferred. (See *Section 13.2* above and *Section 13.4* below.)

Figure 40: Example of perpendicular directional curb ramps with shared landing

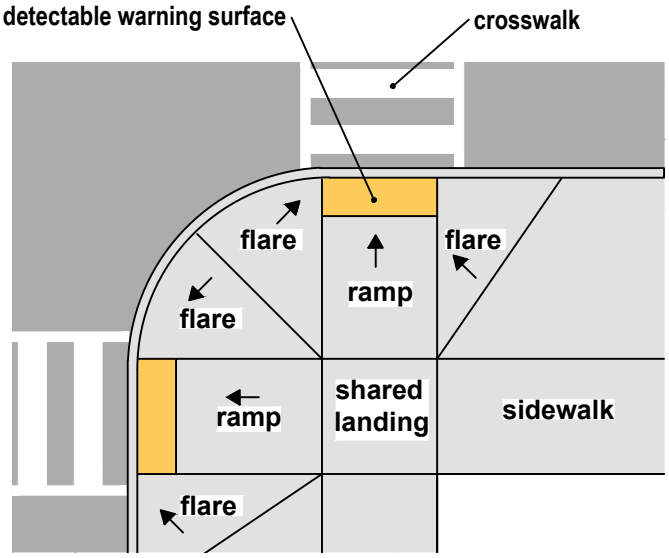
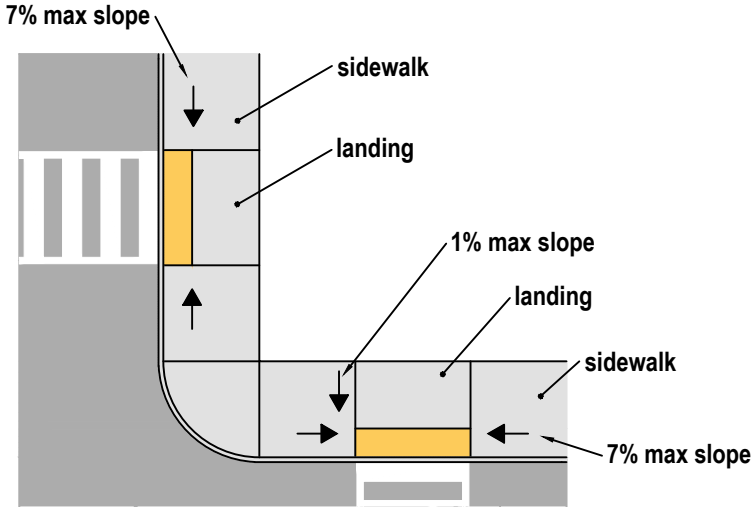


Figure 41: Example of perpendicular directional ramps enabled by curb extension

Figure 42: Parallel curb ramp example



13.4.2 Key Requirements

Table 16: Key Requirements for Parallel Curb Ramps

Design Element	Criteria	Notes	Reference
Curb ramp run width	Min 48" , ≥ 60" preferred	Not shared use path	PROWAG R304.5.1
	Width of shared use path	Shared use path	
Relationship to crosswalk	Shall be contained wholly within the crosswalks they serve	N/A	PROWAG R304.5.3
Surface	Shall be firm, stable, slip resistant. Changes in level not permitted.	N/A	PROWAG R304.5.4
Running slope	Oriented parallel to the curb Max slope 8.3% To help ensure this standard is achieved during construction, designs should incorporate a max 7% cross running slope.	Where the curb ramp length must exceed 15' to achieve an 8.3% running slope, the curb ramp length shall extend at least 15' and may have a running slope greater than 8.3%.	PROWAG R304.3.1
Cross slope	Max 2.1% To help ensure this standard is achieved during construction, designs should incorporate a max 1% cross slope.	At crosswalks, the cross slope of the curb ramp run shall be permitted to be equal to or less than the cross slope of the crosswalk as specified by PROWAG R302.5.	PROWAG R304.3.2
Grade breaks	Perpendicular to the direction of the ramp run.	N/A	PROWAG R304.3.3
Change of grade	13.3% max	Alternatively, a transitional space with min 24" length in the direction of pedestrian travel, running slope max 2.1%, and cross slope no greater than specified in PROWAG R302.5.	PROWAG R304.5.2
Landing	Min 48" by 48" Provided at bottom of ramp Max slope parallel to curb ramp ≤ slope of roadway or cross slope as specified in PROWAG 302.5	N/A	PROWAG 304.3.4
Detectable warning surface	DWS complying with PROWAG R305.1 located on the landing at either the back of curb edge of pavement	N/A	PROWAG R305.2.2

13.4.3 How to Apply

- Parallel curb ramps shall comply with the requirements in PROWAG R304.3, R304.5, and R305.2.2 which are summarized in Table 16.

13.5 Guidance—Combination Curb Ramps

There may be locations where neither a perpendicular curb ramp nor a parallel curb ramp is feasible. Particularly when site constraints include an existing grade change, limited sidewalk depth, or a narrow street buffer width, a combination curb ramp may be the appropriate solution. A combination ramp uses a parallel ramp to lower the elevation level of the landing, and pairs it with a perpendicular ramp to bridge the remaining elevation change from the landing to the roadway (Figure 43).

13.5.1 Where to Apply

- Locations where a perpendicular ramp is not feasible due to space constraints, curb height, or other factors. Combination ramps are preferred over parallel ramps.

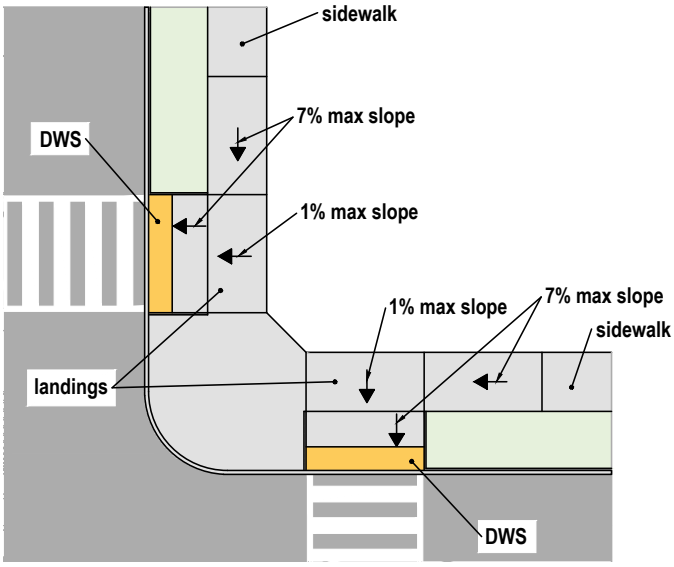
13.5.2 How to Apply

- Combination ramps shall comply with requirements in PROWAG R304.2 for perpendicular ramp components of the combination ramp, PROWAG R304.3 for the parallel ramp components of the ramp, and the common curb ramp requirements in PROWAG R304.5.
- A detectable warning surface complying with PROWAG R305.1 shall be located on the perpendicular component of the combination ramp according to PROWAG R305.2.1.

13.6 Diagonal Ramps

- Diagonal ramps are perpendicular or parallel curb ramps that are located near the apex of a curbed intersection. Diagonal ramps usually provide access to two or more crosswalks and typically do not align with any crosswalk, instead directing pedestrians toward the center of an intersection.

Figure 43: Combination curb ramp example



13.6.1 Where to Apply

- Diagonal ramps are prohibited except in alteration projects if designs that provide separate curb ramps for each crossing are technically infeasible, including the design options for constrained conditions discussed in *Section 13.3.3.5*.

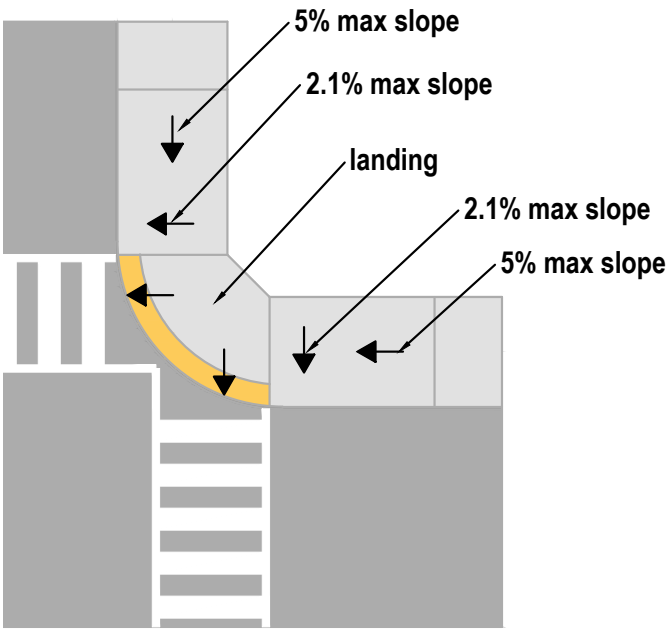
13.6.2 How to Apply

- If perpendicular diagonal ramps are installed, they shall comply with the requirements in PROWAG R304.2, R304.5, and R305.2.1, which are summarized in Table 15. The clear area at the bottom of the diagonal ramp must be contained within the crosswalk and must be wholly outside the adjacent vehicular lanes, including bicycle lanes.
- If parallel diagonal ramps are installed, they shall comply with the requirements in PROWAG R304.3, R304.5, and R305.2.2, which are summarized in Table 16. In addition to the minimum 48” by 48” clear area at the base of the parallel ramp, a minimum 48” by 48” clear area must also be provided in front of the curb line adjacent to the ramp, which must be wholly outside the adjacent vehicular lanes, including bicycle lanes.
- Diagonal curb ramps provided at marked crossings shall provide the 48” by 48” minimum clear space within the marked crosswalks.

13.7 Blended Transitions

A blended transition is a wraparound connection at a corner, or a flush connection where there is no curb to cut through (Figure 44).

Figure 44: Blended transition example



13.7.1 Where to Apply

- Raised pedestrian crossings or similar connections between the pedestrian access route made at the level of the sidewalk and crossing a street where the grade is 5% or less, such as on an uncurbed roadway.
- Blended transitions that serve more than one crosswalk should generally be avoided, because of the challenges they create for people with vision disabilities.

13.7.2 Key Requirements

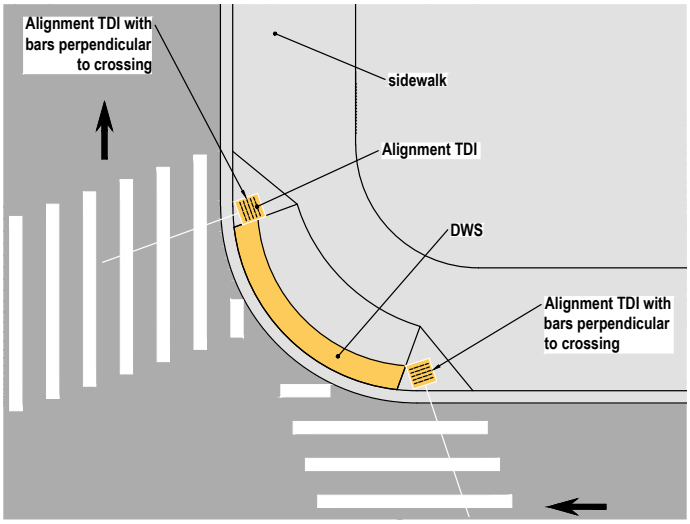
Table 17: Key requirements for blended transitions

Design Element	Criteria	Notes	Reference
Width	Min 48" , ≥ 60" preferred	Not shared use path	PROWAG R304.5.1
	Width of shared use path	Shared use path	
Relationship to crosswalk	Min 48" shall be contained wholly within the crosswalks	Not shared use path	PROWAG R304.5.3
	Full width shall be contained within crosswalk	Shared use path	PROWAG R304.5.3
Surface	Shall be firm, stable, slip resistant. Changes in level not permitted.	N/A	PROWAG R304.5.4
Running slope	Max 5.0%	N/A	PROWAG R304.4.1
Cross slope	Equal to or less than the cross slope of the crosswalk	N/A	PROWAG R304.4.2
Bypass	If blended transition serves more than one pedestrian circulation path and has running slope greater 2.1%, a bypass pedestrian access route is required	This allows pedestrians who are not crossing the street to bypass the grades of the blended transition.	PROWAG R304.4.3
Change of grade	13.3% max	Alternatively, a transitional space with min 24" length in the direction of pedestrian travel, running slope max 2.1%, and cross slope no greater than specified in R302.5.	PROWAG R304.5.2
Detectable warning surface	DWS complying with PROWAG R305.1 located so front corners are at back of curb or no greater than 6" from the edge pavement where there is no curb	N/A	PROWAG R305.2.3

13.7.3 How to Apply

- Blended transitions shall comply with the requirements in PROWAG R304.4, R304.5, and R305.2.3 which are summarized in Table 17.
- In cases where a blended transition serves more than one crosswalk:
  - The curb line should have a detectable warning around the entire corner where there is no level change.
  - 24-inch by 24-inch Alignment TDIs, with the bars aligned perpendicular with the associated crosswalk, should be placed within the width of the crosswalk, near each end of the detectable warning to help people with vision disabilities find the crosswalk locations and align with the crosswalk. (Figure 45)
- Crosswalk guide strips, crosswalk delineator strips, and/or audible beaconing should be used to help people with vision disabilities maintain their heading while in the crosswalk. See *Appendix D: Experimental Treatments* for discussion of crosswalk guide strips and crosswalk delineator strips.

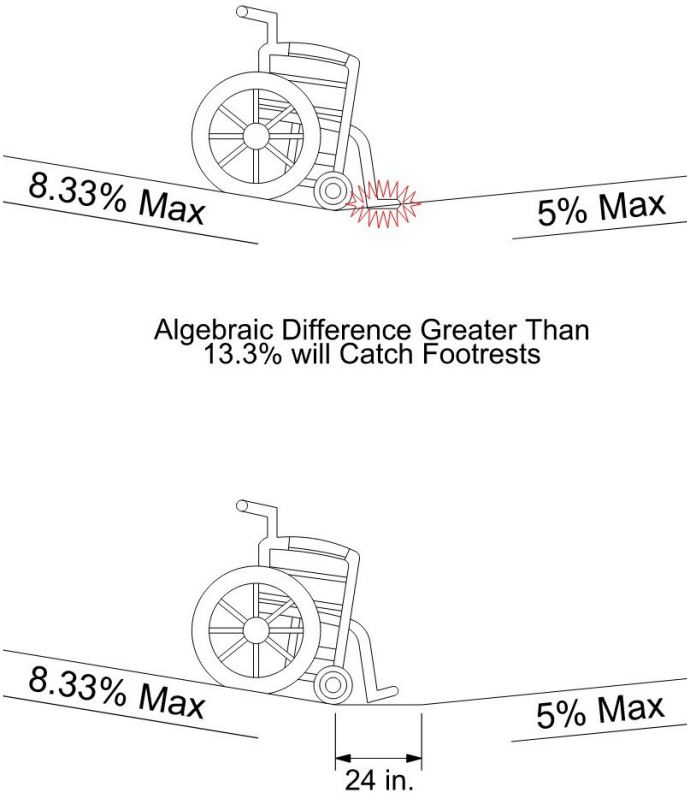
Figure 45: Alignment TDIs used at a multi-crosswalk blended transition



13.8 Changes of Grade

- Changes of grade, or counter slope, for curb ramps and blended transitions shall comply with the requirements in PROWAG 304.5.2. These requirements are illustrated in Figure 46.

Figure 46: Changes of grade (counter slope)



Pedestrian Signal Heads and Push Buttons

14

Pedestrian signal heads are devices containing the walking person symbol (symbolizing "walk") and the upraised hand symbol ("don't walk") that are installed to direct pedestrian traffic at a crosswalk.

Pedestrian push buttons are devices that activate a beacon (e.g. rectangular rapid flashing beacon, pedestrian hybrid beacon) or signal timing for pedestrians, cyclists, or others crossing a roadway.

Accessible pedestrian signals (APS) include features such as accessible pedestrian push buttons (Figure 47) that help pedestrians who are blind, have low vision, or deafblind know when it is safe to cross. APS can also help pedestrians with autism spectrum disorder and intellectual and developmental disabilities by providing audible, visual, and vibrotactile information confirming when to begin crossing.

APS can be configured to provide information about street names and intersection geometry with speech messages, braille, raised print, maps, and diagrams. APS can also be configured to provide audible beacons that can help people with vision disabilities maintain their alignment while crossing, which is particularly important for longer crosswalks.

14.1 Potential Accessibility Challenges

- Pedestrian signals without APS.
- Difficulty hearing APS locator tones above ambient background noise.
- APS that are too loud or that have a sound some pedestrians with disabilities find grating or anxiety-inducing, particularly pedestrians with autism spectrum disorder.
- Push buttons that are not in predictable locations.
- Push buttons that are too far from the curb ramp.
- Push buttons that are too low, e.g., difficult to reach for a person navigating with a guide dog (Figure 48).
- Push buttons that are difficult to reach from a wheelchair (Figure 49).

Among respondents to the Accessibility Challenges Survey, 12% identified "pedestrian push buttons that are hard to reach" as a top challenge associated with crossing streets, 11% identified pedestrian push buttons that lack audible or vibrotactile feedback as a top challenge, and 4% indicated "audible feedback is too soft or unclear" as a top challenge.

Figure 47: Example of an accessible pedestrian push button

Figure 48: Person with guide dog having difficulty reaching a pedestrian push button that is too low

- APS that are malfunctioning
- Tactile arrows on push buttons that are not aligned with the crosswalk.

14.2 Guidance

14.2.1 Where to Apply

- Pedestrian signal heads shall be provided for all crosswalks that are supported by a traffic control signal or pedestrian hybrid beacons.
- All new and altered pedestrian signals installed at crosswalks shall include APS, including pedestrian signals that are activated by passive detection and pedestrian signals that have an automatic pedestrian phase that doesn't require activation through the pedestrian push button (PROWAG R206).
- Existing pedestrian signals shall be upgraded to include APS. The prioritization tool provided in Accessible Pedestrian Signals: A Guide to Best Practices can be used to prioritize intersections and crossings for APS retrofits.
- Where the pedestrian clearance time is calculated to a pedestrian refuge island, an additional pedestrian push button shall be provided on the pedestrian refuge island (PROWAG R306.2).
- APS shall be provided on pedestrian refuge islands if the pedestrian clearance time provided for the crossing is insufficient to cross all the way to the other side of the street, i.e., the clearance time is sufficient only to cross from the curb or shoulder to the refuge island (PROWAG R306.2). This signal phasing strategy requires approval from MCDOT as it increases pedestrian delay and forces pedestrians to wait within a median between moving traffic.

14.2.2 How to Apply

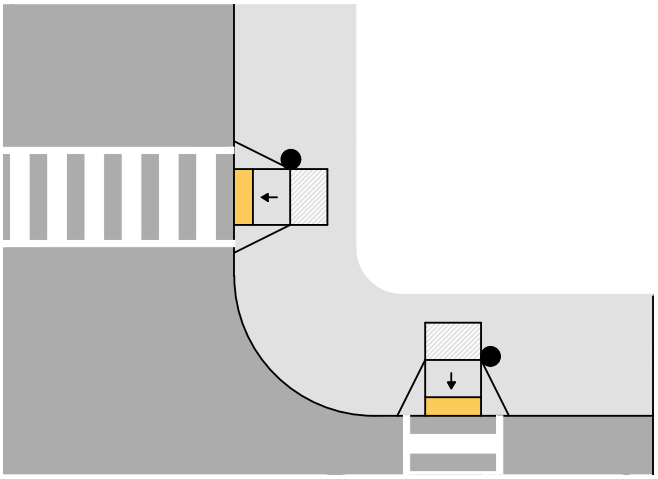
14.2.2.1 Location and Spacing

- Pedestrian push buttons must be placed within the following lateral and longitudinal placement thresholds (Figure 50):
  - Lateral placement: No greater than 5 feet from the side of a curb ramp run or the edge of the farthest associated crosswalk line from the center of the intersection. (PROWAG R307.4)
  - Longitudinal placement: Between 1.5 and 10 feet from the edge of the curb or pavement. (PROWAG R307.4) A distance of 6 feet is

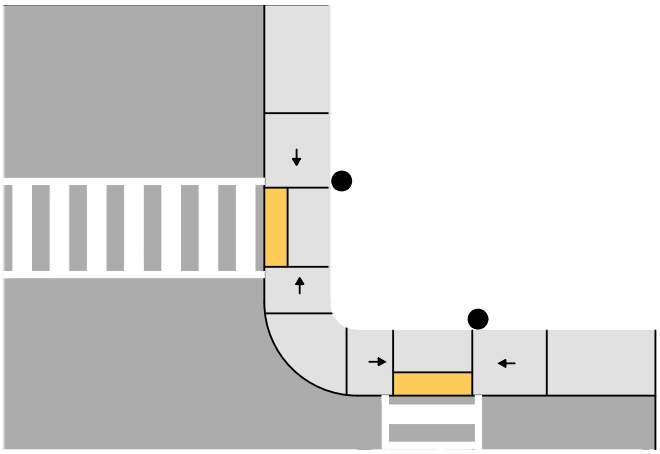
Figure 49: Person in wheelchair can't reach pedestrian push button due to large concrete base.

Figure 50: Placement of pedestrian push buttons

Perpendicular Ramps with Crosswalks Far Apart



Parallel Ramps with Narrow Sidewalk and Tight Corner Radius



preferable to provide greater physical separation from moving traffic and allow cyclists and pedestrians pushing strollers to stop at the push button without the front end of their wheel(s) getting closer than 2 feet from the face of curb or edge of road. Since pedestrian clearance times must be calculated from the location of the pedestrian push button, push buttons that are placed further from the edge of the curb will result in longer required clearance times.

- One pedestrian push button assembly should be provided for each crossing.
- Where two pedestrian push buttons are provided on the same corner, they must be 10 feet or more apart. In cases where it is technically infeasible to provide 10 feet of separation between pedestrian push buttons on the same corner, a pedestrian push button information message complying with PROWAG R308.3.2 shall be provided.
- Pedestrian push buttons must be within a 10-inch reach of a landing area that is at least 4 feet by 4 feet and has a level surface (slope less than 2.1% in all directions toward the curbline). This ground space must connect to or overlap the pedestrian access route that connects to the crossing.

14.2.2.2 Pedestrian Push Button

- Pedestrian push buttons shall be provided even in cases where pedestrian signals do not require a push button for signal activation to enable people with disabilities to take advantage of APS features, such as the vibrotactile walk indication, speech messaging, and additional crossing time (PROWAG R206.2).
- Pedestrian push buttons shall have vibrotactile arrows aligned in the direction of travel of the associated crosswalk, so users can confirm that the push button they are actuating is associated with the street they want to cross (PROWAG R307.5 and 307.9).
- Pedestrian push buttons shall emit a locator tone (short, highly localizable bursts of sound at 1 second intervals when the walk sign is not illuminated). (PROWAG R307.8.2). The tone lets pedestrians know there is a button to actuate, helps pedestrians find the push button, helps pedestrians orient themselves before crossing, and helps pedestrians distinguish signalized from unsignalized portions of a multistage crossings.
- Pedestrian push buttons should include a pilot light that informs pedestrians when the pedestrian signal has been triggered. If a pilot light is used at an APS location, each actuation shall be accompanied by the speech message, “Wait” (PROWAG R308.3.2.4).
- Pedestrian push buttons must be mounted at a height no lower than 15 inches and no higher than 48 inches maximum above the sidewalk or finished pedestrian surface measured to the midpoint of the button (PROWAG R403.3); however, a push button height between 42 and 48 inches is preferred.
- Pedestrian push buttons shall be 2 inches minimum in diameter.
- Pedestrian push buttons shall require a maximum of 5 pounds of pressure to activate the pedestrian signal (PROWAG 403.4).

14.2.2.3 Pedestrian Push Button Sign

- A pedestrian push sign shall be located directly adjacent to the push button to explain the purpose of the device and how to use it. The sign should include both visual and braille information.
- The push button sign must clearly indicate the direction of the crosswalk that it serves (MdMUTCD 2B.62).
- The sign shall be mounted immediately above or incorporated into push button detector units (MdMUTCD 2B.52).
- The sign should clearly indicate when a push button press is not required to activate the pedestrian signal head.

14.2.2.4 Walk Indication

14.2.2.4.1 Vibrotactile Walk Indication

- When the walk signal is activated, the tactile arrow on the push button shall vibrate to indicate to people with vision and hearing difficulties that the walk signal is on (PROWAG R307.6).
- Vibrotactile walk indications shall not be provided with active warning devices such as rectangular rapid flashing beacons, because active warning devices do not provide a walk interval (PROWAG R307.7).

14.2.2.4.2 Audible Walk Indication

- When the walk signal is activated, an audible walk indication or speech message shall be emitted from the APS to indicate to people with vision disabilities that the walk signal is on (PROWAG R308.2) .
- Audible walk indications shall be louder than ambient sound up to a maximum volume of 5 dBA louder than ambient sound. Automatic volume adjustment in response to ambient traffic sound level shall be a maximum volume of 100 dBA (PROWAG R308.4).
  - › EXCEPTION: Where audible beaconing is provided in response to an extended push button press, the beaconing can exceed 5 dBA louder than ambient sound.
- The audible walk indication is required to be a rapidly repeating tone unless two devices on a corner are less than 10 feet apart (PROWAG R308.3.1).
- In retrofit situations, if it is not possible to provide at least 10 feet of separation between pedestrian push buttons, the walk indication shall be a speech message (PROWAG R308.3.2).
  - › For walk signals concurrent with vehicle signals, the speech messages must indicate the street name to cross and then that the walk sign is on to cross that street (PROWAG R308.3.2.2).
- The pedestrian push button shall vibrate during the walk interval (PROWAG R308.5).
- For walk signals in an exclusive pedestrian phase e.g., pedestrian scramble phase, the speech message must indicate that the walk signal is on for all crossings (PROWAG R308.3.2.3).
- When the walk signal is off, a speech message is not required. If it is used, the speech message shall begin with the term “wait” to indicate that the “do not walk” signal is active (PROWAG R308.3.2.1).

14.2.2.5 Pedestrian Activated Warning Devices

- Where a pedestrian push button or a passive detection device is provided for pedestrian activated warning devices, such as rectangular rapid flashing beacons, the pedestrian push button or passive detection device shall activate a speech message that indicates the status of the beacon in lieu of an audible walk indication, e.g., “warning lights are flashing” for rectangular rapid flashing beacons. (PROWAG 307.7).
- The speech message volume shall comply with PROWAG R308.4.
- Where a pedestrian push button is provided, it shall not include vibrotactile features indicating a walk interval. (PROWAG 307.7).

14.2.2.6 Extended Press Push Button Features

- Extended presses of the pedestrian push button may be used to activate additional features of the device such as additional walking time, an audible beacon, or additional speech.

Figure 51: R10-32P Plaque

- If an extended press is used, pushes less than one second must activate only the pedestrian timing and any associated walk indication, while pushes of one second or more must activate the pedestrian timing, walk indications, and any additional features (PROWAG R307.3).
- Where a leading pedestrian interval (LPI) or exclusive pedestrian phase is implemented, an extended push button press should alert waiting pedestrians to these features.
- If an extended push button press provides additional crossing time, then an R10-32P plaque (Figure 51) shall be mounted adjacent to or integral with the accessible pedestrian push button. For these locations, accessible pedestrian push buttons shall be marked with three braille dots forming an equilateral triangle in the center of the push button.

14.2.2.7 Audible Beaconing

Audible beaconing is the use of an audible signal to help pedestrians with vision disabilities maintain the correct heading while in the crosswalk. The signal is triggered by an extended press of the accessible pedestrian push button and is broadcast from a speaker on the far side of the crossing directed at the middle of the crosswalk (Figure 52).

- Audible beaconing should be considered to help people with vision disabilities orient to maintain the proper heading while crossing in the following situations, as specified in MdMUTCD 4E.13:
  - Crosswalks longer than 70 feet, if not divided by a median where an APS is already installed
  - Skewed crosswalks
  - Intersections with irregular geometry
  - Crosswalks where beaconing is requested by an individual with vision disabilities
  - Intersections where the use of beaconing is considered beneficial
- Audible beacons are discouraged in the case of channelized turns and protected phasing due to the possibility of the signal being heard at the wrong crosswalk.
- The audible beaconing loudspeaker should:
  - Be mounted at the far end of the crosswalk within the width of the crosswalk.
  - Be mounted at a height of 7 feet to 10 feet above the pavement.
  - Be pointed toward the middle of the associated crosswalk (i.e., the centerline of the road).

Figure 52: Illustration of how audible beacons work (Source: Polara)

14.2.2.8 Pedestrian Signal Phase Timing

Pedestrian signal phase timing must comply with PROWAG R306.2.

14.2.2.8.1 Walk Interval

- The walk interval shall be a minimum of 7 seconds; however, longer crossing time should be prioritized where possible (PROWAG R306.2).

14.2.2.8.2 Pedestrian Clearance Time

- Pedestrian clearance times shall be calculated using a pedestrian walking speed of 3.5 ft/s or less from the location of the pedestrian push button to a pedestrian refuge island or the far side of the traveled way. Where the pedestrian clearance time is calculated to a pedestrian refuge island, an additional pedestrian push button or passive detection device shall be provided on the pedestrian refuge island (PROWAG R306.2).
  - EXCEPTION: If a passive pedestrian detection device is used to automatically adjust the pedestrian clearance time based on the pedestrian's actual clearance of the crosswalk, a faster walking speed may be used. (PROWAG R306.2).
- Pedestrian clearance time calculations should be based on a walking speed of 2.5 feet per second at locations frequented by older pedestrians, younger pedestrians, and people with disabilities.
  - EXCEPTION: If a passive pedestrian detection device is used to automatically adjust the pedestrian clearance time based on the pedestrian's actual clearance of the crosswalk, or if a pedestrian clearance time based on a walking speed of 2.5 feet per second can be requested by a long press of the pedestrian push button, a faster walking speed may be used in these locations.
- Pedestrian clearance time calculations should not include the buffer interval.

14.2.2.9 Considerations

- Setting APS sound levels must be done carefully, and adjustments may be required after installation. APS sound levels can be adjusted to operate within different ranges by time of day. APS volumes have been reported to be a nuisance after peak hour traffic volumes have subsided. While APS may require a high audible volume during peak traffic times, the same volume in the evening can be a nuisance in residential or mixed-use areas.
- At complex intersections or crossings, consider providing a tactile map of the intersection near the pedestrian push button for additional wayfinding guidance. The tactile map must comply with the guidance in PROWAG regarding protruding objects.
- Apps now exist that can actuate APS remotely, and that may provide audible signal information from smart phones. However, an app is not a substitute for APS because many people with vision disabilities do not have smart phones, have smart phones with limited capability, or are not aware of the app. Additionally, smartphones and apps may not work properly even if people have them and know how to use them. Some apps can provide information about intersection geometry, location, WALK, DON'T WALK, directionality, and clearance on a person's smartphone. There are multiple potential advantages, including that they provide a touchless option for APS activation for people with smartphones, which can help prevent the spread of germs and viruses.

Pedestrian Signs 15

There are many different types of signs. Pedestrian signs provide directions, warnings, or other information exclusively for pedestrians. This signage helps pedestrians understand how to navigate an intersection or where to cross and can further define the pedestrian route in a corridor.

Other signs, such as street name signs, are intended to provide information to pedestrians, motorists, and other street users. Still other signs identify the routes served by transit stops, which are referred to as transit signs.

Signs can be visual, audible, and tactile, and potentially all three. The most common type of sign is visual.

15.1 Potential Accessibility Challenges

- Difficulty seeing wayfinding signs (font too small, too high up, poorly illuminated).
- Difficulty seeing signs at transit stops from a distance.
- Difficulty seeing street signs at crossings.
- Lack of tactile and audible signs.
- Tactile/braille signs that are difficult to reach or placed in locations where they're unlikely to be found.
- Signs with messages or symbols that are unfamiliar, unclear, or difficult to interpret.
- Signs that obstruct the pedestrian access route, particularly temporary signs such as sandwich boards or work zone signs.

15.2 Guidance

15.2.1 Where to Apply

- Pedestrian signs should be provided to effectively guide pedestrians of all abilities to key destinations, including:
  - Transit stations
  - Bus stops
  - Libraries/community resources
  - Parks and recreation facilities
  - Educational facilities
  - Hospitals/health care facilities
  - Civic offices
- Pedestrian signs should also be provided to help people with disabilities navigate in atypical situations where they might otherwise have difficulty navigating. Examples include complex intersections and island bus stops.
- Temporary signs should be provided to help people with disabilities and other pedestrians to navigate closures due to events, construction, or other reasons. See *Section 21* for more information.
- Where a visual sign is provided, the information provided on the sign should also be provided in an audible and/or tactile format to accommodate people cannot read, e.g., due to a vision disability.

Among respondents to the Accessibility Challenges Survey, 15% identified "street signs and other wayfinding signs" as a top accessibility challenge; however, the share of people who reported difficulty seeing and difficulty with cognition was 30% and 32%, respectively.

According to survey respondents, the top accessibility challenges associated with street signs and other wayfinding signage included:

- I can't see them—44%
- There isn't any signage—42%
- Signage is unclear—33%

15.2.2 Key Requirements

Table 18: Summary of Requirements for Visual Characters on Signs

Design Element	Criteria and Notes	Reference
Finish and Contrast	Non-glare finish, characters contrast with background, either light on dark or dark on light	PROWAG R410.2
Style	Conventional form. No italic, oblique, script, highly decorative, etc.	PROWAG 410.4
Character proportions	Width of the uppercase letter "O" is 55-110% of the height of the uppercase letter "I"	PROWAG R410.5
Visual character height	Complies with PROWAG Table R410.6, which is reproduced as Table 19 below.	PROWAG R410.6
Stroke thickness	Stroke thickness of uppercase letter "I" shall be 10% minimum and 30%	PROWAG R410.7
Character spacing	10-35% of character height measured between two closest points of adjacent letters	PROWAG R410.8
Line spacing	135-170% of character height	PROWAG R410.9
Height from ground surface	Visual characters shall be min 40" above the ground surface	PROWAG R410.10

Table 19: Visual Character Height (based on PROWAG R410.6)

Height to Finish Surface from Baseline of Character	Horizontal Viewing Distance	Minimum Height of Uppercase "I"
Greater than 40", but less than or equal to 70"	Less than 6'	5/8" (16 mm)
	6' and greater	5/8" plus 1/8" per foot of viewing distance above 72"
Greater than 70", but less than or equal to 120"	Less than 15'	2"
	15'and greater	2" plus 1/8" per foot of viewing distance above 180"
Greater than 120"	Less than 21'	3"
	21' and greater	3" plus 1/8" per foot of viewing distance above 21'

15.2.3 How to Apply

15.2.3.1 Legibility and Font

- Visual characters on signs shall comply with PROWAG R410, which is summarized in Table 19.
- The lettering used on pedestrian signs should be in a conventional sans-serif font.
- Where possible, both letters and symbols or icons should be used on pedestrian signs to make them more accessible to people who do not read or do not read English.
- If the lettering is visual only (no tactile properties), then it should be a mix of uppercase and lowercase characters. If the lettering is also meant to be read by touch, then it should be all uppercase.[25]
- The lighting and positioning of the signage should be carefully considered to avoid glare under expected lighting conditions.
- Internally illuminated or backlit signs should be avoided because they may be difficult to read ffor people with low vision to read .

15.2.3.2 Location

- Pedestrian signs should be placed in locations that are consistent, predictable, and accessible to people with disabilities.
- Pedestrian signs are particularly important at decision points, points where people with disabilities are likely to have trouble navigating ,e.g., because of nonconventional street designs, and points where people with disabilities and other pedestrians may need reassurance such as along a lengthy pathway.
- Pedestrian signs should be approachable via a pedestrian access route to a point close enough for pedestrians with disabilities, including pedestrians with vision disabilities, to access the sign content.
  - Signage that provides only visual information should ideally be placed at eye level (approximately 5 feet above the walking surface) outside the pedestrian access route.[26] If the sign protrudes into a pedestrian circulation path by more than 4 inches, then it must be 7 feet above the walking surface.
  - Signage that includes tactile information should be placed at a height of 42 inches minimum to 48 inches maximum. The face of the sign must be within a 10-inch reach of a 4-foot by 4-foot level landing located adjacent to the sign.
  - If information on the sign is provided in an audible format, people with disabilities must be able to get close enough to trigger and hear the audible message.
- Pedestrian signs should be legible to people with vision disabilities from various vantage points, and enough space should be provided near the sign to enable multiple people to view it at once.

15.2.3.3 Other Signage

- Street name signs for cross streets along a pedestrian path of travel should be provided at all intersections. Ideally, these signs are visible to a pedestrian with corrected vision of 20/200 in their best eye without having to cross the street at the intersection.
- Transit schedules, maps, and timetables posted at a stop location are not required to comply with PROWAG R410.
- Signs at or incorporated into a push button unit for a crossing signal are also exempt from PROWAG R410.

Lighting 16

Lighting enables pedestrians to navigate streets in dark or low-light conditions, allowing them to see, identify, and react to obstacles, read street signs, and recognize the facial expressions and movements of fellow travelers quickly and accurately. Lighting is also critical for ensuring that drivers can quickly and accurately see, identify, and react to pedestrians and other road users. For people with vision disabilities, discerning wayfinding cues and avoiding hazards can be especially difficult in dark, low light, or high glare conditions.

The primary function of pedestrian lighting is to illuminate sidewalks and other pedestrian areas.

Effective street lighting for navigation depends on the following factors[27]:

- Illuminance—the amount of light reaching a surface, measured in footcandles (fc). Illuminance can be divided into horizontal and vertical illuminance, both of which are important.
  - Horizontal illuminance is the amount of light on a horizontal surface, such as the sidewalk.
  - Vertical illuminance is the amount of light on a vertical surface, such as a sign or a person.
- Luminance—the amount of light reflected from a surface, measured in candelas per square inch (cd/in^2). Illuminance refers to the amount of light on an object; Luminance is how much actually reaches an observer.
- Contrast (or Luminance Contrast)—the difference between the luminance values of two surfaces, or an object and its background. High contrast allows a person to discern the difference between surfaces, but too-high contrast can cause glare.
- Uniformity—the evenness of light, which must be balanced with contrast so that objects in the visual field don't all look the same. Stated as a ratio of the maximum brightness to the minimum, such as "3:1."
- Glare—excessive light entering the eye from a bright light source or reflective surface. This excess brightness can cause discomfort or loss of visual performance or visibility. Direct glare, such as from a poorly angled luminaire, can be mitigated with shielding or proper equipment selection and placement.
- Adaptation—the amount of time it takes to respond to changes in light level. Most people have more difficulty adapting when moving from areas of bright to dim lighting than the reverse, but older adults and those with low vision tend to have much poorer adaptation and in both directions.

16.1 Potential Accessibility Challenges

- Not enough lighting for sidewalks, shared use paths, and crosswalks.
- Lighting that is uneven, creating a series of dark and light spaces. Particularly dark spots can be mistaken for holes or can hide holes, vertical discontinuities, and other hazards.
- Lighting that is too bright or glaring, overwhelming the eye and causing pain or discomfort. Even after the brightness is gone or turned down, after-effects can continue to affect vision.

Among respondents to the Accessibility Challenges Survey who had difficulty using sidewalks, about one in five selected "inadequate lighting" as one of their top four challenges. "Inadequate lighting" was also a top challenge for one in four respondents who had accessibility issues with shared use paths.

16.2 Guidance

16.2.1 Where to Apply

- Lighting should be provided as indicated in Table 20.
- In addition, visual information that is important for wayfinding should be illuminated so it can be seen in dark or low-light conditions. This includes, but is not limited to, signs, maps, and TWSIs.

Table 20(a): Street Lighting Warrant Criteria

CSDG Street Type	Active Zone	Street Zone—Intersection	Street Zone—Segment
Downtown Boulevard	Required	Required	Required
Downtown Street	Required	Required	Required
Boulevard	Required	Required	Recommended
Town Center Boulevard	Required	Required	Required
Town Center Streets	Required	Required	Required
Area Connector	Required	Required	Recommended
Neighborhood Connector	Required	Required	Recommended
Neighborhood Streets	Recommended	Required	Optional
Neighborhood Yield Streets	Recommended	Required	Optional
Industrial Street	Optional	Required	Recommended
Country Connector	Optional	Required	Recommended
Country Roads	Optional	Optional	Optional
Major Highway	Optional	Required	Required
Alley	Optional	Optional	Optional
Rustic Road	Optional	Optional	Optional
Shared Street	Required	Required	Required

Table 20(b): Streetlighting Warrant Criteria for Bikeways

Bikeway Type	Active Zone	Street Zone—Intersection	Street Zone—Segment
Off-Street / Trail	Required	Required	N/A
Sidepath / Shared Use Path / Separated or Protected Bike lanes	Required	Required	N/A
On-Street Bikeway	N/A	Required	See street type

Table 20(c): Streetlighting Warrant Criteria for Transit Corridors

Transit Corridors	Active Zone	Street Zone—Intersection	Street Zone—Segment
Dedicated or Shared Transitway	Required	Required	Required

Table 21(a): Target Lighting Levels for Active Zones: Active Zones Adjacent to Roadways

CSDG Street Type	Minimum Horizontal Illuminance (fc), EH,min	Maintained Average Horizontal Illuminance (fc), EH,avg	Maintained Average Vertical Illuminance (fc), EV,min	Uniformity Ratio (EH,avg / EH,min)	Maintained Average Surface Luminance (cd/m2), Lavg
Downtown Boulevard	0.2	0.9	1.0 – 1.2	3.0	2.0 – 2.5
Downtown Street	0.2	0.9	1.0 – 1.2	3.0	2.0 – 2.5
Boulevard	0.2	0.5	0.2 – 0.4	4.0	1.0 – 1.5
Town Center Boulevard	0.2	0.9	1.0 – 1.2	3.0	2.0 – 2.5
Town Center Streets	0.2	0.9	1.0 – 1.2	3.0	2.0 – 2.5
Area Connector	0.2	0.5	0.2 – 0.4	4.0	1.0 – 1.5
Neighborhood Connector	0.2	0.5	0.2 – 0.4	4.0	1.0 – 1.5
Neighborhood Streets	0.2	0.5	0.2 – 0.4	4.0	1.0 – 1.5
Neighborhood Yield Streets	0.2	0.5	0.2 – 0.4	4.0	1.0 – 1.5
Industrial Street	0.2	0.3	0.2 – 0.4	6.0	1.0 – 1.5
Country Connector	0.1	0.2	0.2 – 0.4	10.0	0.4 – 1.0
Country Roads	0.1	0.2	0.2 – 0.4	10.0	0.3 – 0.8
Major Highway	0.2	0.3	0.2 – 0.4	6.0	0.8 – 1.3
Alley	0.2	0.5	0.2 – 0.4	4.0	1.0 – 1.5
Rustic Road	0.1	0.2	0.2 – 0.4	10.0	0.3 – 0.8
Shared Street	0.2	0.9	1.0 – 1.2	3.0	2.0 – 2.5

Table 21(b): Target Lighting Levels for Active Zones: Active Zones in Areas with Increased Security Needs

Specialty	Minimum Horizontal Illuminance (fc), EH,min	Maintained Average Horizontal Illuminance (fc), EH,avg	Maintained Average Vertical Illuminance (fc), EV,min	Uniformity Ratio (EH,avg / EH,min)	Maintained Average Surface Luminance (cd/m2), Lavg
Security	0.5	1.2	2.2 – 2.4	3.0	2.0 – 2.5

Table 21(c): Target Lighting Levels for Active Zones: Active Zones Not Adjacent to Roadways

Facility	Minimum Horizontal Illuminance (fc), EH,min	Maintained Average Horizontal Illuminance (fc), EH,avg	Maintained Average Vertical Illuminance (fc), EV,min	Uniformity Ratio (EH,avg / EH,min)	Maintained Average Surface Luminance (cd/m2), Lavg
Trail / Shared Use Path	0.1	0.4 – 2.0	0.5	4.0	1.0
Tunnel	n/a	5.4	5.4	3.0	2.0

16.2.2 Key Requirements

- Lighting levels for the Active Zones adjacent to roadways shall comply with the targets in Table 21. The Active Zone is the area between the curb line and property line that includes sidewalks and other facilities.
- Lighting levels for intersections shall comply with the targets inTable 22.

16.2.3 How to Apply

16.2.3.1 Pedestrian Lighting

- Pedestrian-scale light should:
  - Be even and consistent in quality.
  - Avoid the creation of strong shadows, dark areas, glare, or hot spots.
- Pedestrian-scale lighting should be 20 feet tall or less depending on context.
- Since the poles are shorter, they should be placed at more frequent intervals, but the exact pole spacing should be determined by the lighting need and other factors, such as interference by trees and other obstacles.
- Shared-use paths and other walkways that are not adjacent to a roadway should have their own lighting.
- A light loss factor (LLF) should be included to account for drops in light levels over time due to wear, dirt, and aging equipment.

16.2.3.2 Crosswalk Lighting

- Per FHWA Informational Report on Lighting Design for Midblock Crosswalks, luminaires should be located at least 10 feet from the crosswalk and positioned to light the side of the pedestrian facing the approaching vehicle.
- Avoid luminaire placement and orientation that shines directly into pedestrians' eyes.

Table 22: Target Lighting Levels for Intersections

Intersection's Highest CSDG Street Type	Minimum Horizontal Illuminance (fc), EH,min	Maintained Average Horizontal Illuminance (fc), EH,avg	Uniformity Ratio (EH,avg / EH,min)
Downtown Boulevard	0.1 – 0.5	1.3 – 2.0	3.0
Downtown Street	0.1 – 0.5	1.3 – 2.0	3.0
Boulevard	0.1 – 0.5	1.3 – 2.0	3.0
Town Center Boulevard	0.1 – 0.5	1.3 – 2.0	3.0
Town Center Streets	0.1 – 0.5	1.3 – 2.0	3.0
Area Connector	0.1 – 0.5	1.3 – 2.0	3.0
Neighborhood Connector	0.2 – 0.5	1.3 – 1.5	4.0
Neighborhood Streets	0.2 – 0.5	1.3 – 1.5	4.0
Neighborhood Yield Streets	0.2 – 0.5	1.3 – 1.5	4.0
Industrial Street	0.2 – 0.5	1.3 – 1.5	4.0
Country Connector	0.2 – 0.5	1.3 – 1.5	4.0
Country Roads	0.2 – 0.5	1.3 – 1.5	4.0
Major Highway	0.1 – 0.5	1.3 – 2.0	3.0
Alley	0.2 – 0.5	1.3 – 1.5	4.0
Rustic Road	0.2 – 0.5	1.3 – 1.5	4.0
Shared Street	0.1 – 0.5	1.3 – 2.0	3.0

16.2.3.3 Considerations

- Coordinate the placement of luminaires and trees, signs, and other vertical elements to avoid shadowing, especially of sidewalks and crossing locations. Since sidewalks are often narrowed behind tree boxes and tree roots can often damage and uplift sidewalks, causing tripping hazards, it is especially important that sidewalks beside trees be illuminated to highlight these potential hazards.
- Consider enhancing pavement, building, and other edges used for wayfinding with lighting or photoluminescent material.
- When selecting fixtures and positioning/orienting them, care should be taken to avoid light trespass (excess light that shines into neighboring properties) and light pollution (excess light that shines into the sky). Even a well-shielded fixture that produces little up-light on its own can cause light trespass or pollution if the intensity is too strong for its surroundings and reflects light into buildings or the sky.

Sidewalk Bus Stops | 17

A sidewalk bus stop is a bus stop located on the sidewalk. A bus stop is an area that is designated for passengers to board and alight from buses that operate on a fixed route or scheduled route, including boarding and alighting areas and passenger waiting areas. Safe, comfortable, and convenient access to bus stops is extremely important for people with disabilities, since many cannot drive and therefore depend on transit for travel to jobs, shopping, health-care, education, and other personal needs.

17.1 Potential Accessibility Challenges

- Lack of safe, accessible, and convenient street crossings to/from the stop.
- Lack of sidewalks connecting to/from the stop.
- Lack of accessible boarding and alighting areas e.g., surface not firm, stable, slip resistant, boarding and alighting area not wide enough.
- Lack of benches and shelters.
- Signs that are difficult to read from a distance, or that face only one way and thus can't be seen by a person traveling in the opposite direction.
- Lack of audible and tactile signage.
- Lack of direct access to nearby destinations via a pedestrian access route.
- Changes in bus service e.g., due to construction.
- Inadequate lighting.

17.2 Guidance

17.2.1 Where to Apply

- This guidance applies to all sidewalk bus stops in Montgomery County except those served by the County's Flash BRT system. Additional guidance for bus stops located on bus boarding islands (island bus stops) is provided in Island Bus Stops .

Among respondents to the Accessibility Challenges Survey, nearly one in four (23%) identified "accessing bus stops" as a top accessibility challenge, making it the fifth most frequently cited accessibility challenge overall, including 45% of people who reported difficulties with mental health, 37% of people who reported difficulties with cognition, 36% of people who reported difficulties with seeing, and 32% of people who reported difficulties with balance.

Among respondents who selected "accessing bus stops" as a top challenge, the top accessibility challenges associated with bus stops included:

- There is no safe, accessible way to cross the road to or from the stop--63%
- Waiting area (lack of shelter/bench)--53%
- Sidewalk doesn't connect to stop--49%

In addition, 36% of people with difficulty seeing and 33% of people with difficulties hearing reported that finding bus stops was a top challenge.

17.2.2 Key Requirements

Table 23: Key Requirements for Bus Stops

Design Element	Criteria		Reference
Boarding and Alighting Areas	Where required	Must serve each accessible bus entry	PROWAG R309.1.1
	Dimensions	Min. 96" measured perpendicular to the face of curb Min. 60" measured parallel to street	PROWAG R309.1.1.1
	Slope	Same as grade of street	PROWAG R309.1.1.2
	Surface	Shall comply with PROWAG R302.6 Should be constructed of concrete with a brushed finish	PROWAG R309.1.3.1
	Connection to Existing Pedestrian Circulation Paths	In alterations, shall be connected to existing pedestrian circulation paths by pedestrian access routes complying with PROWAG R302	PROWAG R309.1.3.2
Transit Shelters	Connection to Boarding and Alighting Area	Shall be connected by pedestrian access routes complying with PROWAG R302 to boarding and alighting areas complying with PROWAG R309.1.1	PROWAG R309.2.1
	Clear Space	Shall include clear space complying with PROWAG R404 entirely within the shelter. Where seating is provided, shall be located either at one end of a seat or so as to not overlap the area within 18 in. from the front edge of the seat	PROWAG R309.2.2
	Environmental Controls	Where provided, shall be proximity actuated	PROWAG R309.2.3
	Protruding Objects	Shall comply with PROWAG R402	PROWAG R309.2.4

17.2.3 How to Apply

17.2.3.1 Locations and Layouts

- Sidewalk bus stops should be located at predictable locations near signalized intersections and enhanced mid-block crosswalks, generally on the far side of the intersection or crosswalk.
- Sidewalk bus stop layouts should be consistent, understanding that some variation will likely be required due to site specific conditions.
- Bus stops, including shelters, should be contained within the Street Buffer Zone of the sidewalk and should not obstruct the pedestrian access route in the Clear Zone.

17.2.3.2 Bus Stop ID Pole and Signage

- A bus stop ID pole and signage should be installed in line with where the front of the bus is intended to stop.
- The pole should be installed between 24 inches and 36 inches from the roadway edge in a location that can be seen by a pedestrian traveling along the sidewalk, standing in a boarding and alighting area, or waiting in a passenger waiting area.
- The Washington region should work toward a common standard unique pole shape and color to help people with vision, intellectual, and developmental disabilities distinguish bus stops from other signage. In testing, a pole with an octagonal cross-section and a bright white color has been well-received and understood by people with vision disabilities. (Figure 53)

- The bus stop ID pole should include a tactile raised letter sign (Figure 54) with the following information: bus line number(s) and direction(s) of travel, customer service number for routing assistance, bus stop ID number. The height of the sign shall comply with PROWAG R406.
- Real time next bus information should be provided in visual and audible formats either on the bus stop ID pole or on the bus shelter. If a person is required to push a push button to activate audible next bus information, the push button shall comply with PROWAG R403.
- With the exception of transit schedules, timetables, and maps, all visual signage provided at bus stops shall comply with PROWAG R410.

17.2.3.3 Boarding and Alighting Areas

The boarding and alighting area is the area from which transit patrons board onto and alight from the bus.

- Boarding and alighting areas shall comply with the requirements in PROWAG R309.1.1, which are summarized in Table 23 and illustrated in Figure 55. Where space is available, boarding and alighting areas should be separated from the pedestrian access route on the sidewalk to maintain accessibility for people traveling on the sidewalk.

17.2.3.4 Passenger Waiting Areas

Passenger waiting areas are designated spaces for people waiting to board transit vehicles. These spaces can include shelters, benches, lighting, and other street furniture.

- Waiting areas should be separated from the pedestrian access route on the sidewalk to maintain accessibility for people traveling on the sidewalk.
- In contexts with increased pedestrian activity and frequently used bus stops, the passenger waiting area and the pedestrian access route on the sidewalk should be separated as much as possible and maximized in dimensions.
  - A passenger waiting area that is 10-foot wide perpendicular to the curb can accommodate a 4-feet-deep shelter facing towards the curb and a 6-foot buffer in between the shelter and curb. A 5-foot buffer is the minimum needed to accommodate the pedestrian access route and an accessible turning space. The design should ensure that at least 4 feet of space is also provided behind the shelter or waiting area to accommodate the pedestrian access route on the sidewalk, although wider is preferred given the context and higher pedestrian volumes.
  - A passenger waiting area that is 8 feet wide perpendicular to the curb accommodates the minimum requirements for the boarding and alighting area at the accessible transit door. A shelter can be accommodated if it either faces away from the curb or has limited or no sides to the shelter.

Figure 53: Example of octagonal shaped pole with tactile signage on it

Figure 54: Example of tactile raised letter sign with bus information

- Transit shelters and benches should be strongly considered for all passenger waiting areas. Transit shelters protect transit patrons from the elements. Benches provide transit patrons with a place to sit and rest, which is particularly important for people with disabilities and older adults who may have difficulty standing for extended periods of time. Transit shelters and benches also make it easier for people with vision disabilities and developmental and intellectual disabilities to distinguish bus stops visually or through echolocation.

17.2.3.4.1 Transit Shelters

- Transit shelters shall comply with the requirements in PROWAG R309.2, which are summarized in Table 23.
- Transit shelters should be set back from the back of curb by a minimum of 4 feet.
- If the shelter sides are transparent, the sides should include high-contrast banding at eye level so that people with vision disabilities do not inadvertently walk into them. The side panels should extend as close to the ground as possible and be no less than 27 inches off the ground to be cane detectable.
- Shelters should be well-lit and provide audible, tactile, and high-contrast visual signage.
- Shelters must provide clear space entirely within the shelter — next to or not within 18 inches in front of any seating — sufficient for a person using a wheelchair to be protected from the elements.

17.2.3.4.2 Benches and Other amenities

- Benches shall comply with PROWAG R209.6.1. Benches should be set back from the edge of the roadway by a minimum of 5 feet.
- Other amenities such as trash receptacles should be cane-detectable, of a visually contrasting color, and located so as not to obstruct accessible use of the stop.

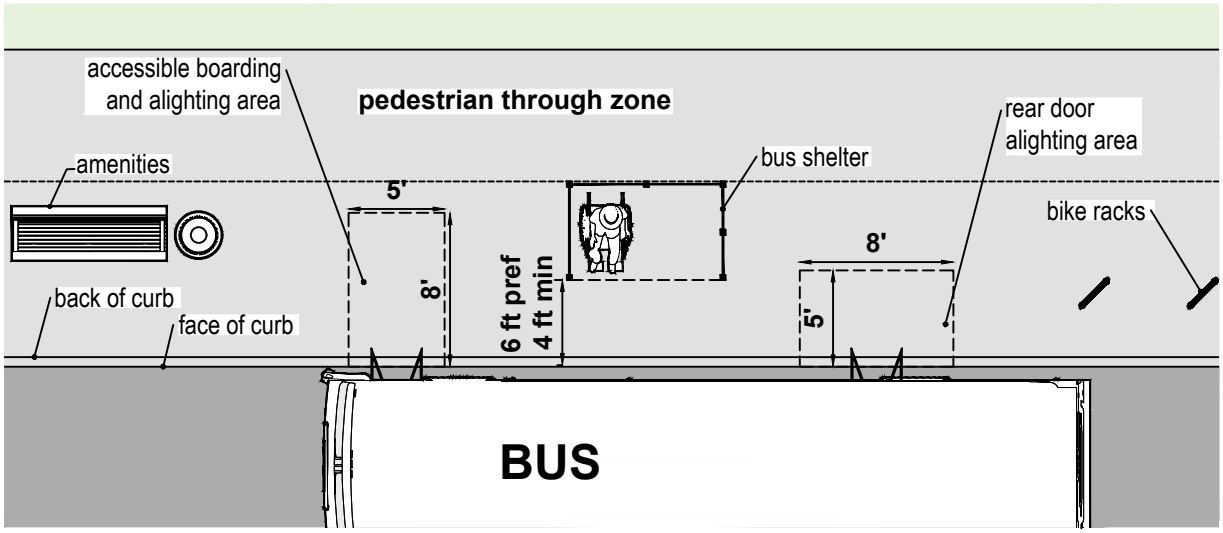
17.2.3.5 Safe and Convenient Crossings

- Safe and accessible pedestrian crossings should be provided within 100 feet of a bus stop for transit patrons crossing to and from bus stops on the other side of the street. Where mid-block bus stops are provided, appropriate mid-block pedestrian crossings help to ensure that pedestrians do not risk making unsafe crossings.[28]

17.2.3.6 Other Guidance

- Audible announcements should be provided from the transit vehicle to let people waiting at the stop know the vehicle has arrived and the route information.
- The design of bus stops should typically include pedestrian-scale lighting to illuminate the shelter and bus stop sign. This creates a better sense of security for passengers and allows operators to better see passengers waiting at the bus stop. Auxiliary lighting may be provided within the shelter itself.

Figure 55: Diagram of boarding and a lighting area with key dimensions



Island Bus Stops | 18

An island bus stop is a bus stop located on a bus boarding island. These stops are also commonly referred to as "floating bus stops." Island bus stops are installed on streets with separated bike lanes. In these designs, the bike lane is routed behind the bus stop to prevent conflicts between buses and cyclists at the stop to improve cyclist safety. However, island bus stops also require transit patrons to cross the bike lane, introducing a potential conflict with cyclists.

18.1 Potential Accessibility Challenges

Island bus stops can introduce the following accessibility challenges for pedestrians with disabilities if poorly designed:

- Additional challenges finding stops due to their location on an island, which is unexpected and difficult to detect from the sidewalk.
- Additional inconvenience and stress if transit users must cross the bike lane to the bus island to determine what bus route(s) are served.
- Difficulty distinguishing the bike lane from the sidewalk.
- Difficulty determining when it is safe to cross the bike lane due to the relative silence of cyclists and scooter riders, uncertainty they will yield, and difficulty in determining when they have yielded.
- Dog guides not trained to cross bike lanes or pay attention to bikes.
- Cyclists coming from two directions (in the case of a two-way separated bike lane).
- Lack of maneuvering space for people using wheelchairs and walkers.
- Lack of shade on the bus island.
- Disorientation when disembarking at an island bus stop.
- Walking down the bus island thinking it is the sidewalk.
- Inconsistency in island bus stop design in Montgomery County and throughout the Metropolitan Region.
- Lack of familiarity with using an island bus stop.

18.2 Guidance

18.2.1 Where to Apply

This guidance applies to all bus stops located on bus boarding islands in Montgomery County except those served by the County's Flash BRT system.

18.2.2 Key Requirements

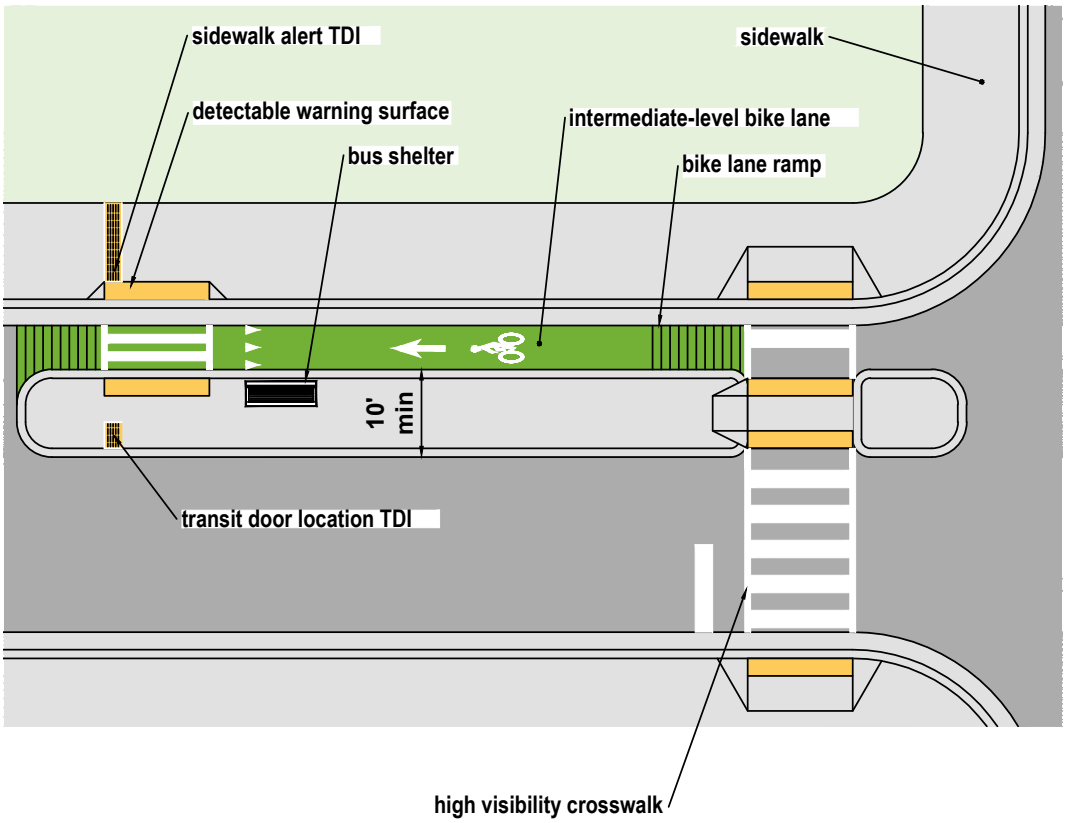
In addition to the requirements listed for *Section 17* above, island bus stops must comply with MUTCD Chapter 31. Islands. The bus island should be at least 10 feet wide (Figure 56).

18.2.3 How to Apply

18.2.3.1 Planning Considerations

- Consider the following questions prior to determining whether a particular location is appropriate for an island bus stop:
  - *Can the bikeway and transit route be accommodated on different corridors?* It may be preferable to provide bikeways and transit routes on the same corridor due to route directness, access to destinations, network connectivity, or other reasons. However, in some cases there may be opportunities and valid reasons to separate a bikeway from a transit route and provide the bikeway on an adjacent corridor.
  - *Is the bikeway located on a corridor with a steep slope?* If the bikeway is located on a project corridor with a steep slope, there is increased risk of cyclists travelling at high speeds, which may present an increased risk of conflict between cyclists and transit patrons. If slopes on the approaching project corridor are greater than 5%, transportation professionals should consider providing a raised or controlled crossing to the bus island.
- Poorly designed island bus stops can create accessibility challenges for people with disabilities. As such, people with a range of disabilities, including ambulatory, vision, and intellectual and developmental, as well as Orientation and Mobility Specialists and others with expertise on how people with different types of disabilities navigate should be actively engaged in the planning and design process.

Figure 56: Key requirements for island bus stops



18.2.3.2 Location and Layouts

- Wherever possible, bus stops on bus boarding islands should be integrated with a signalized crosswalk supported by an APS.
- Clear sight lines should be provided between pedestrians and cyclists at crosswalks. If transit shelters are provided, ensure that the shelter structure or shelter advertising do not limit sight lines.

18.2.3.3 One- or two-way separated bike lane

- On two-way streets, one-way separated bike lanes on each side of the street should be preferred over a two-way separated bike lane on one side of the street, recognizing that there may be circumstances where a two-way configuration is preferred due to the location of existing bicycle facilities, right-of-way constraints, and other circumstances. One-way separated bike lanes provide shorter crossings for pedestrians and present conflicts from only one direction.

18.2.3.4 Tactile Direction Indicators and Detectable Warning Surfaces

- A sidewalk alert TDI should be installed perpendicular to the pedestrian path of travel on the sidewalk to alert people with vision disabilities to the presence of the bus stop.
- Transit door location TDIs should be installed to indicate the boarding location.
- Finally, there shall be detectable warning surfaces at both ends of the bike lane crosswalk and at both ends of the street crossing, if the island bus stop is integrated with an intersection crossing, per PROWAG R205.2.

18.2.3.5 Bike Lane Design

- The bike lane should be colored green for the length of the island bus stop island to distinguish it from a motor vehicle lane or shared use path.
- In the rare case that bike lanes are flush with the sidewalk, the sidewalk area must be separated from the bike lane area with landscaping or channelizing devices to prevent people with vision disabilities from unintentionally crossing into the bike lane. In cases where landscaping or channelizing devices are inappropriate, e.g., due to space constraints, tactile warning delineators complying with the specifications provided in *Appendix D: Experimental Treatments*, may also be used to provide separation if pedestrian cross-traffic is not anticipated. In such cases, the tactile warning delineator should be interrupted with detectable warning surfaces where crossing is intended.
- Measures should be implemented on the crosswalk approaches to encourage more predictable cyclist behavior and yielding. The following measures should be considered:
  - High-visibility crosswalks
  - Vertical and horizontal deflection of the bike lane
  - Stop bars or yield markings
  - Raised crosswalks
  - Rumble strip pavement markings preceding the crosswalk
  - Pavement marking legends reading “STOP FOR PEDS”
  - 6-inch solid yellow line positioned between opposing bike traffic (2-way separated bike lanes)
  - Narrow bike lane behind the island to minimum width in order to minimize pedestrian exposure

18.2.3.6 Crosswalks and Pedestrian Push Buttons

- All crosswalks connecting to an island bus stop should be high-visibility, ladder-style crosswalks.
- If the island bus stop is integrated with a crosswalk at a signalized intersection, PROWAG-compliant pedestrian push buttons should be provided on the sidewalk and on the bus island/pedestrian refuge.
  - The push button located on the sidewalk should provide audible information messages based on the pattern, "Wait to cross bike lane, bus boarding island, and Spring Street at Ellsworth."
  - The push button located on the pedestrian refuge that provides access to the boarding and alighting and waiting areas should have a double arrow indicating one may cross in either direction.. The push button must be positioned in a location that can be easily reached when in the pedestrian refuge. It should provide audible information messages based on the pattern "Wait to cross Spring Street at Ellsworth, or cross, 2-way bike lane to sidewalk."
- APS walk indications shall comply with PROWAG R308.3.

18.2.3.7 Bus Island Design

- The bus island shall not be less than 8 feet wide and should be at least 10 feet wide to allow room for people using wheelchairs and other mobility aids to maneuver on and off the bus. If less than 8 feet is available a step out platform, in which the boarding and alighting area overlaps the bike lane., may be appropriate.
- The boarding location should be marked by a bus stop ID pole and signage (see *Bus Stop ID Pole and Signage on Bus Boarding Island* below).
- Railings at the back (bike lane side) and ends of the bus island should be used to prevent people from walking off the end of the island unintentionally and channelize pedestrians to designated crossing locations. Railings should be a maximum of 3 feet tall, cane-detectable, and colored to contrast visually with the background color.
- A shy distance of at least 6 inches (12 inches preferable) should be provided between the edge of the bike lane and the railing, bus shelter, and any other amenities on the bus island to avoid catching the handlebars of cyclists.
- The height of the bus island should generally not exceed 8 inches. In cases where the bus island is higher than 8 inches (standard sidewalk height), a detectable warning surface shall be placed along the length of the street side of the bus island that is not protected by screens or guards (PROWAG R305.2.6).

18.2.3.8 Passenger Waiting Areas

- Transit shelters and benches should be provided on the bus boarding island wherever space allows for the reasons mentioned above in **Sidewalk Bus Stops**; however, in the case of an island bus stop, there is even greater need for the wayfinding cues offered by shelters and benches. Shelters and benches should not be provided at the back of the sidewalk as it can cause confusion about where the bus stop is located.
- If a transit shelter is provided on the bus island, the position and style of the shelter must be carefully considered to preserve sight lines between pedestrians approaching the bus island crosswalks and cyclists using the separated bike lane. For this reason, it is preferred that shelters located on bus boarding islands have transparent sides and not include ad panels. Side panels must be cane detectable and should include high-contrast banding at eye level, so people do not inadvertently walk into them. The impact of other elements of bus boarding island on sightlines between pedestrians and cyclists should also be considered.

18.2.3.9 Bus Stop ID Poles and Signage

- Each island bus stop should have two bus stop poles with corresponding signs: one on the bus boarding island and one on the sidewalk.

18.2.3.9.1 Bus Stop ID Pole and Signage on Bus Boarding Island

- The pole on the bus boarding island (primary bus ID pole) should comply with the guidance in *Section 17.2.3.2*.
- The secondary bus stop ID pole should include a tactile raised letter sign with the following information in the order listed: the message "Sidewalk is across bike lane," bus line number(s) and direction(s) of travel, the customer service number for routing assistance, and the bus stop ID number. The height of the sign shall comply with PROWAG R406.
- Real time next bus information should be provided in visual and audible formats either on the primary bus stop ID pole or on the bus shelter. If a person is required to push a push button to activate audible next bus information, the push button shall comply with PROWAG R403.
- The Washington region should work toward a common standard unique pole shape and color to help people with vision, intellectual, and developmental disabilities distinguish bus stops from other signage. In testing, a pole with an octagonal cross-section and a bright white color has been well-received and understood by people with vision disabilities.

18.2.3.9.2 Bus Stop ID Pole and Signage on Sidewalk

- The pole on the sidewalk (secondary bus ID pole) should be installed adjacent to the marked crosswalk that provides the most direct path of travel from the sidewalk to the primary bus ID pole.
- The secondary bus ID pole should be installed 12-18 inches from the curb edge and should be positioned so that a person with a vision disability can easily reach it from the top of the ramp, if a ramp is provided, or from the detectable warning surface at the crossing.
- There should be a clear space adjacent to the secondary bus ID pole that measures 30 inches by 48 inches minimum and that complies with the requirements in PROWAG R404.
- The secondary bus stop ID pole should include a tactile raised letter sign with the following information in the order listed: the message "Bus boarding is across bike lane," bus line number(s) and direction(s) of travel, the customer service number for routing assistance, and the bus stop ID number. The height of the sign shall comply with PROWAG R406.
- The secondary bus ID pole should have a round shape and a bright white color to help people with vision disabilities and people with intellectual and developmental disabilities distinguish it.

18.2.3.9.3 Bus Stop Signage Integrated with pedestrian push button

- If the island bus stop is integrated with a signalized crossing, the visual and tactile signage for the integrated crossing should be co-located with PROWAG-compliant pedestrian push buttons on both sides of the street and on the bus island.

18.2.3.10 Other Guidance

- Audible announcements should be provided from the transit vehicle for people with vision disabilities waiting on the bus island to let them know the vehicle has arrived and the route name.
- Audible announcements should be provided for people with vision disabilities inside the bus to inform them of bus stops that are island bus stops and generally how to navigate the stops, e.g., "Next stop Ellsworth bus island. Sidewalk across bike lane."

Accessible On-Street Parking and Passenger Loading Zones

19

Accessible parking spaces are parking spaces that comply with PROWAG R310.

Passenger loading zones are areas that are specifically designed or designated for loading and unloading passengers, but that do not primarily serve vehicles on a fixed or scheduled route.

Accessible parking and passenger loading zones are critical for people with disabilities. Depending on the destination and type of disability, driving and parking at a destination may be the most convenient option. For these people, accessible parking spaces and accessible passenger loading spaces provide additional space to load and unload mobility aids, such as wheelchairs, and to navigate from the vehicle to the sidewalk. However, many people with disabilities cannot drive. For these people, particularly those with autism spectrum disorder and intellectual and developmental disabilities, it is important to have passenger loading zones near their intended destinations, particularly in cases where there is limited available curbside space, so they can be dropped off or picked up.

Accessible parking spaces and passenger loading zones require additional space to allow for the different users e.g., the driver or passenger, and ramp deployment, and to ensure a pedestrian access route is provided to and from the sidewalk. This can present unique challenges when separated bike lanes are present between the accessible parking or passenger loading zone and the sidewalk.

19.1 Potential Accessibility Challenges

- Not enough accessible parking spaces.
- Not enough van-accessible parking spaces.
- Not enough accessible passenger loading zones.
- Accessible parking spaces and passenger loading zones located too far from destination.
- Inconsistently located accessible parking spaces and passenger loading zones.
- No enforcement of illegal use of accessible parking spaces and passenger loading zones
- Lack of access aisles.
- Not enough room to deploy a ramp.
- Lack curb ramps providing access between an accessible parking or passenger loading zone and the sidewalk.
- Feeling unsafe crossing a bike lane to access parking spaces and passenger loading zones.

Among respondents to the Accessibility Challenges Survey, 13% of respondents identified "finding an accessible place to park" as a top accessibility challenge, including 32% of people with walking challenges, 29% of people with challenges using stairs, and 25% of people with balance challenges.

In addition, 13% of respondents identified "finding a place to be dropped off or picked up" as a top accessibility challenge. People with walking challenges, challenges using stairs, and challenges with balance were again most likely to select this option.

19.2 Guidance

19.2.1 Where to Apply

19.2.1.1 On-Street Parking Spaces

- Where accessible parking spaces are required by PROWAG R211, accessible parking spaces complying with PROWAG R310 shall be provided in accordance with PROWAG Table R211. Table 24 summarizes these requirements.

Table 24: Minimum Requirements for Accessible Parking Spaces

Total Number of Metered or Designated Parking Spaces	Minimum Required Accessible Parking Spaces
1 to 25	1
26 to 50	2
51 to75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 and over	4% of total

- Where parking spaces are provided on a block perimeter and are metered or designated by signs or pavement markings, accessible parking spaces complying with PROWAG R310 shall be provided in accordance with PROWAG Table R211. Where parking is metered or designated by signs or pavement markings, but individual spaces are not marked, each 20 feet of block perimeter where parking is designated shall be counted as one parking space (PROWAG R211.2).
- Where parking spaces are provided on a section of a street that is not part of a block perimeter, accessible parking spaces complying with PROWAG R310 shall be provided in accordance with PROWAG Table R211. Where parking is metered or designated by signs or pavement markings, but individual spaces are not marked, each 20 feet of street where parking is designated shall be counted as one parking space (PROWAG R211.3).
- Accessible parking should generally provide convenient access to key destinations.

19.2.1.2 Passenger Loading Zones

- Where permanently designated passenger loading zones other than transit stops are provided, at least one accessible passenger loading zone complying with PROWAG R311 shall be provided in every continuous 100 feet of loading zone space, or fraction thereof (PROWAG R212).
- In central business districts, passenger loading zones should be provided every one or two blocks in consistent locations along the block.

19.2.2 Key Requirements

Table 25: Minimum Requirements for Accessible On-Street Parking Spaces and Passenger Loading Zones

Category	Parallel Parking Spaces	Perpendicular Parking Spaces	Angled Parking Spaces	Passenger Loading Zones
Length	Min 24’	Not specified in PROWAG	Min 132”	Pref 40’-80’, Min 20’
Width	Min 13’	Not specified in PROWAG	Min 132”	Min 96”
Access Aisle	60” access aisle is included in the parking space length and width	Access aisle 96” wide	60” wide	60” wide
Unobstructed clearance between parking spaces and adjacent sidewalk	Center 50% of the length of the sidewalk	Not applicable	Not applicable	Center 50% of the length of the sidewalk
Signage	Requires sign displaying international symbol of accessibility mounted min 60” above the ground surface	Requires sign displaying international symbol of accessibility mounted min 60” above the ground surface	Requires sign displaying international symbol of accessibility mounted min 60” above the ground surface	Passenger Loading Zone signage recommended, especially in central business districts
Common Requirements	• Parking space and passenger loading zone surfaces shall be firm, stable, and slip resistant. Changes and in level are not permitted. • Parking spaces and passenger loading zones shall connect to pedestrian access routes. • If curb ramps or blended transitions are provided to enable a connection to a pedestrian access route, they shall not reduce the required width or length of access aisles or parking spaces, shall be provided in accordance with PROWAG R203.6.1.3, and shall comply with PROWAG 304			

19.2.3 How to Apply

19.2.3.1 Accessible on-street parking

19.2.3.1.1 Parallel Parking Spaces

- Accessible parallel on-street parking spaces shall comply with PROWAG R310.2. Minimum requirements for accessible parallel on-street parking spaces are summarized in Table 25. Figure 57 illustrates the minimum requirement for clearance adjacent to parallel on-street parking spaces.
- Parallel on-street parking spaces shall connect to pedestrian access routes. Where curb ramps and blended transitions are used, they shall not reduce the required width or length of the parking spaces and shall be located at either end of the parking space. Where two or more accessible parallel on-street parking spaces complying with the dimensions specified in PROWAG R310.2.1 are contiguous on a block face, each accessible parallel on-street parking space shall have an independent connection to the pedestrian access route.

19.2.3.1.2 Perpendicular Parking Spaces

- Accessible perpendicular on-street parking spaces shall comply with PROWAG R310.3 and PROWAG R310.5. Minimum requirements for accessible perpendicular on-street parking spaces are summarized in Table 25.
- One access aisle shall be permitted to serve two parking spaces where front and rear entry parking are both permitted. Where an access aisle serves only one parking space and parking is restricted to either front entry or rear entry orientation, the access aisle shall be located on the passenger side of the vehicle (PROWAG R310.3.1).

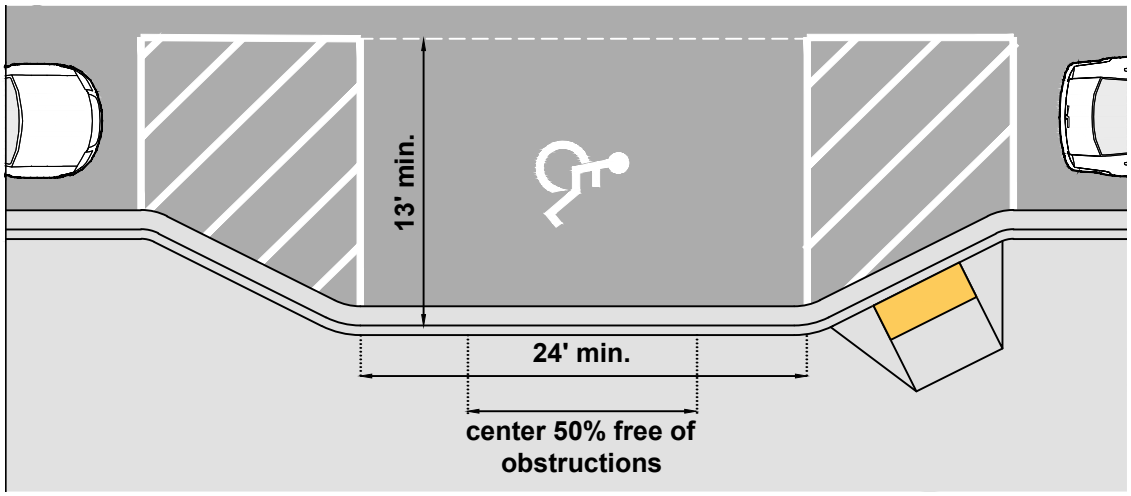
19.2.3.1.3 Angled Parking Spaces

- Accessible angled on-street parking spaces shall comply with PROWAG R310.4 and PROWAG R310.5. Minimum requirements for accessible perpendicular on-street parking spaces are summarized in Table 25.
- Each angled on-street parking space shall have an adjacent access aisle (PROWAG 310.4.2). The access aisle shall be located on the passenger side of the vehicle.

19.2.3.1.4 Common Requirements for Perpendicular and Angled Parking Spaces

- The access aisle surface shall be marked to discourage parking in the access aisle (PROWAG R310.5.1).
- Access aisles shall be located at the same level as the parking space they serve and shall not encroach on the traveled way (PROWAG R310.5.2).

Figure 57: Minimum 50% clearance required adjacent to accessible parallel on street parking space



19.2.3.1.5 Parking Meters and Parking Pay Stations

- Parking meters and parking pay stations that serve accessible parking spaces shall provide operable parts complying with PROWAG R403. The clear space required by PROWAG R403.2 shall be located so that displays and information on parking meters and pay stations are visible from a point located 40 inches (1015 mm) maximum above the center of the clear space in front of the parking meter or parking pay station (PROWAG R310.6).

19.2.3.2 Passenger Loading Zones

- The design of passenger loading zones shall comply with PROWAG R311. Minimum requirements for passenger loading zones are summarized in Table 25. Figure 58 illustrates the minimum requirement for clearance adjacent to passenger loading zones.
- The preferred length of passenger loading zones is 40-80 feet, with more space needed in central business districts and other locations where more drop-off/pick-up activity is anticipated.

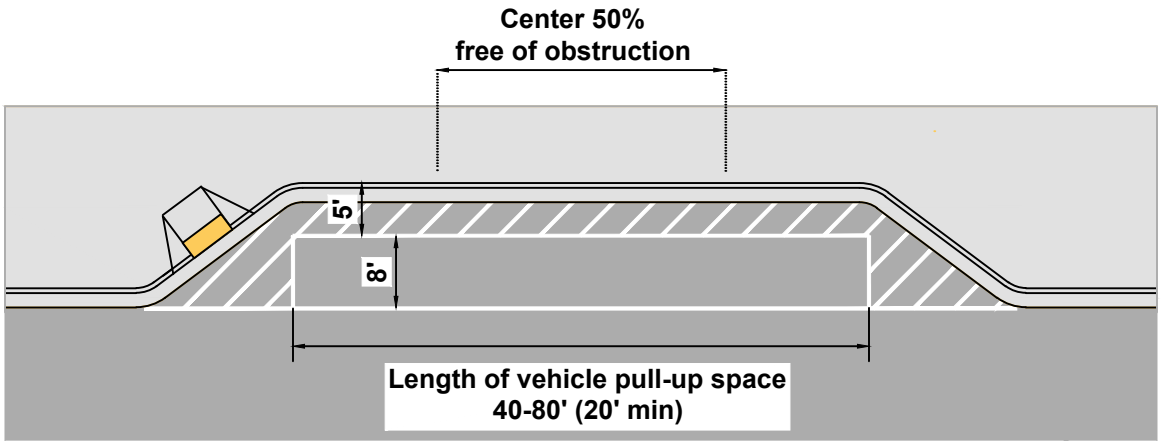
19.2.3.2.1 Waiting Areas

- A waiting area should be provided adjacent to passenger loading zones that is visible and separate from the primary pedestrian circulation path.
- Seating options, enough to accommodate peak-level demand, should be provided in the waiting area.
- Waiting areas and passenger loading zones should be adequately lighted for night conditions.

19.2.3.2.2 Signage

- Passenger loading zones should be identified by a "Passenger Loading Zone" sign on a round pole.
- The pole should be installed between 24 inches and 36 inches from the roadway edge in a location that can be seen by both drivers and pedestrians traveling along the sidewalk.
- The pole should have a round shape and a consistent high-contrast color that is different from bus stop poles to help people with vision disabilities and people with intellectual and development disabilities distinguish it.
- There should be clear space adjacent to the sign pole that measures 30 inches by 48 inches minimum and that complies with the requirements in PROWAG R404.
- The pole should include a tactile raised letter sign with the following information: "Passenger Loading Zone." If there is a bike lane between the passenger loading zone and sidewalk, the sign should say, "Passenger loading zone across bike lane."
- The height of the tactile raised letter sign shall comply with PROWAG R406.

Figure 58: Minimum 50% clearance required adjacent to accessible passenger loading zone



19.2.3.3 Accessible Parking and Loading Zones Adjacent to Separated Bicycle Lanes

- It is preferred to provide accessible parking on cross streets where separated bike lanes are not present; however, where accessible parking is appropriate or needed on a street with separated bike lanes, it may be provided close to intersections or mid-block.
- When accessible parking or loading is provided close to intersections or mid-block crosswalks, the design should allow the intersection curb ramps to also serve as the pedestrian access route for the parking space(s). (Figure 59)
- When accessible parking is provided mid-block, a separate curb ramp will be necessary to provide a pedestrian access route. This curb ramp should include a detectable warning surface complying with PROWAG 304. (Figure 60)
- In constrained locations where accessible parking is provided, the protected bike lane may be narrowed to a minimum constrained width adjacent to the parking. At locations without on-street parking but where an accessible parking or loading area is desired, a lateral deflection (bend-out) of the separated bike lane will often be required to accommodate the accessible space.
- Bike lane deflection should occur gradually to maintain cyclist safety and comfort.
- At locations where there is a higher volume of pedestrians crossing between the separated bike lane such as valets or designated rideshare pick up and drop off, the following treatments should be used:
  - Add a PED XING pavement marking legend across the bike lane in advance of the crosswalk where the approach grade is 3% or greater, or where the location is within 100 feet of an intersection.
  - Use a raised street buffer and sidewalk or intermediate-level separated bicycle lane.
  - Increase the street buffer width. This may result in narrowing the bike lane width to constrained bike lane widths along this short segment.
  - Mark pedestrian crossings and use BIKES YIELD TO PEDS (R9-6) signs.
  - Pedestrian railings may be used along the bikeway to direct pedestrians to marked crossings of the bike lane at loading zones where pedestrian activity is anticipated to be high. When present, these should be placed at an appropriate offset so that they do not present a hazard to cyclists.
  - The bike lane should be colored green to help further distinguish it from the access aisle and sidewalk.

Figure 59: Accessible parking design adjacent separated bike lane at crosswalk location

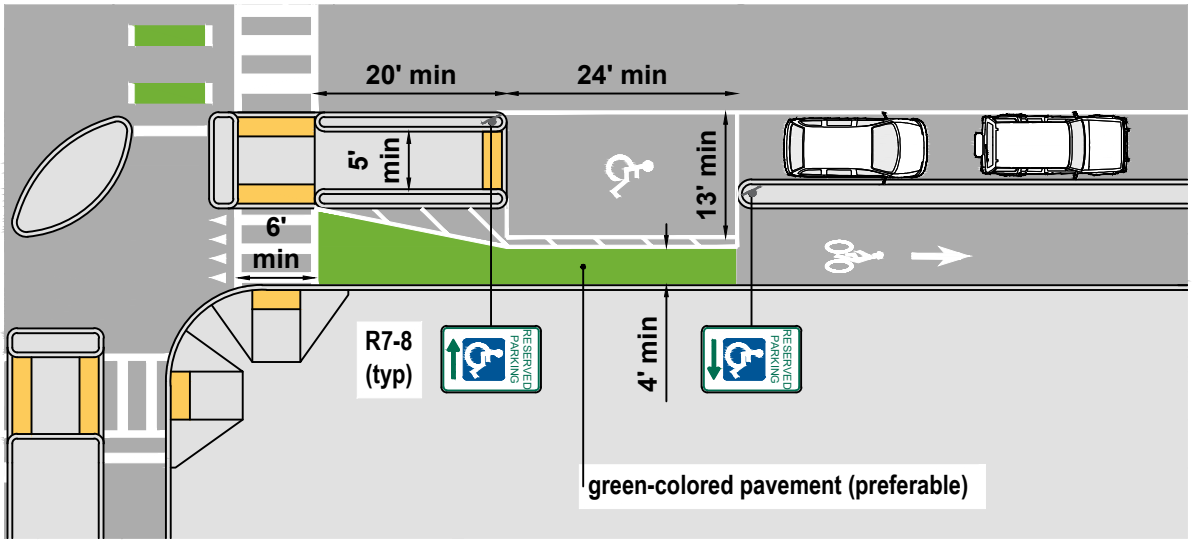
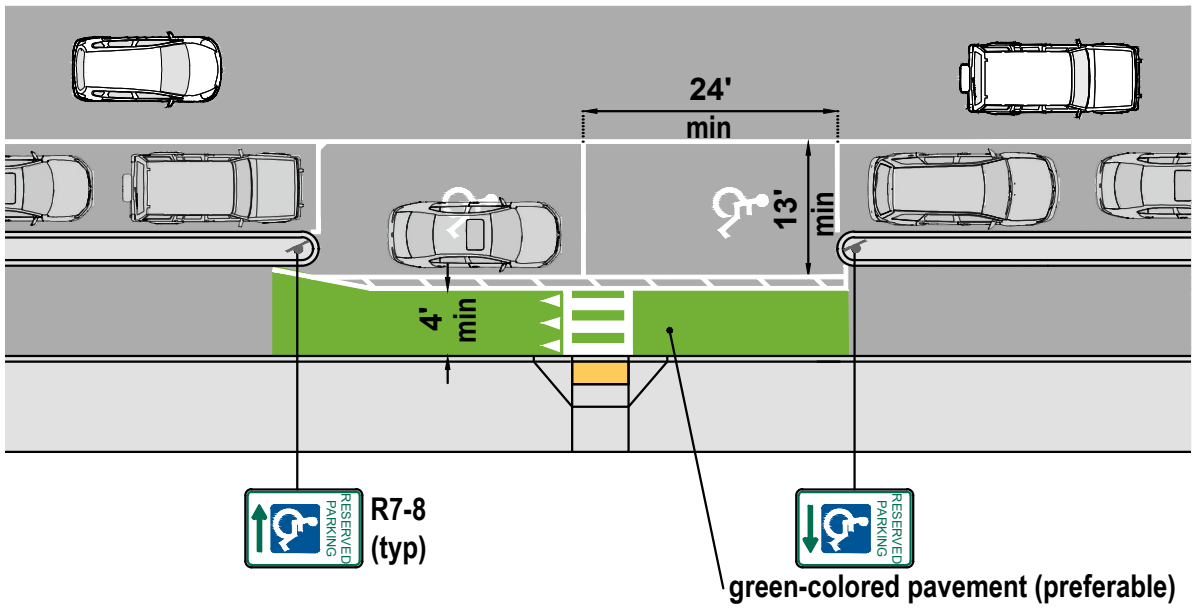


Figure 60: Accessible parking design adjacent separated bike lane at non-crosswalk location



Accessible Electric Vehicle Charging Stations

20

Accessible electric vehicle (EV) charging stations installed in the public right-of-way have unique design challenges due to existing sidewalks and infrastructure.[29]

20.1 Potential Accessibility Challenges

Electric vehicle charging stations can introduce the following accessibility challenges for pedestrians with disabilities if poorly designed:

- Deploying a ramp or exiting a vehicle due to the location of the charging station.
- Accessing and operating the charging station controls.
- Carrying the charging cable between the charging station and the vehicle charging inlet.
- On two-way streets, connecting the charging cable to a vehicle with a charging inlet located on the driver side.
- In constrained conditions, the location of the charger may physically block access to the charging port.

20.2 Guidance

20.2.1 Where to Apply

- Where EV charging stations are provided in the public right-of-way, the number of accessible EV charging stations should comply with Table 26.

20.2.2 Key Requirements

- EV charging stations shall comply with requirements in the ADA and ABA Standards, including requirements for floor and ground surfaces (§302), clear floor or ground space (§305), reach ranges (§308), operable parts (§309), accessible routes (§402), and other provisions where applicable, such as some of the provisions in parking (§502), signs (§703), and fare machines (§707).

Table 26: Recommended Number of Accessible EV Charging Stations Per Total EV Charging Stations

Total Number of EV Chargers	Minimum Recommended Accessible EV Chargers
1 to 25	1
26 to 50	2
51 to75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 and over	4% of total

20.2.3 How to Apply

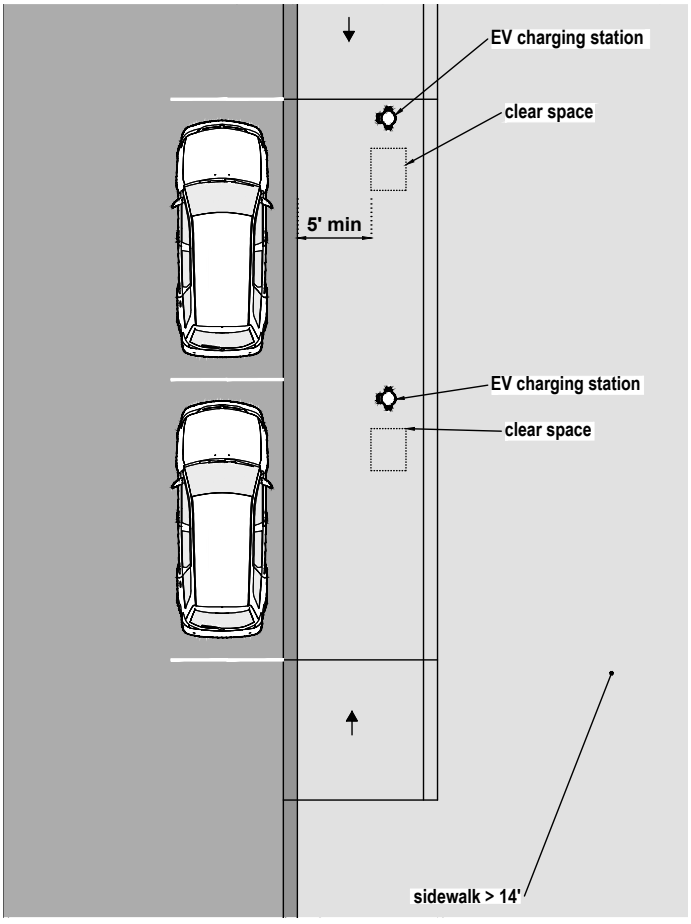
20.2.3.1 Unconstrained Locations

- Where the width of the adjacent sidewalk or available right-of-way exceeds 14 feet:
  - A 5-foot-wide marked access aisle should be provided at street level the full length of the parking space adjacent to the charger.
  - The charger should be placed on the curb and oriented toward the street no further than 10 inches from the face of the curb.
  - The adjacent parking space should connect to a pedestrian access route that complies with the requirements in PROWAG R302, which are summarized in Table 4.
- If curb ramps or blended transitions are provided to enable a connection to a pedestrian access route, they should not reduce the required width or length of access aisles or parking spaces, should be provided in accordance with PROWAG R203.6.1.3, and should comply with PROWAG 304. (Figure 61)

20.2.3.2 Constrained Locations

- Where the width of the adjacent sidewalk or available right-of-way is 14 feet or less:
  - The charger should be located on the curb at the end of the block or adjacent to a midblock crosswalk with curb ramps complying with PROWAG R304.
  - The charger should be located at least 18 inches from the face of the curb.
  - The charger should be oriented facing the Clear Zone or perpendicular to the Clear Zone to allow a person with a disability to approach and operate the charger. (Figure 62).
  - The charger should not be placed within the middle 50% of the sidewalk adjacent to the on-street parallel parking space because this design would obstruct entry to and exit from the vehicle.

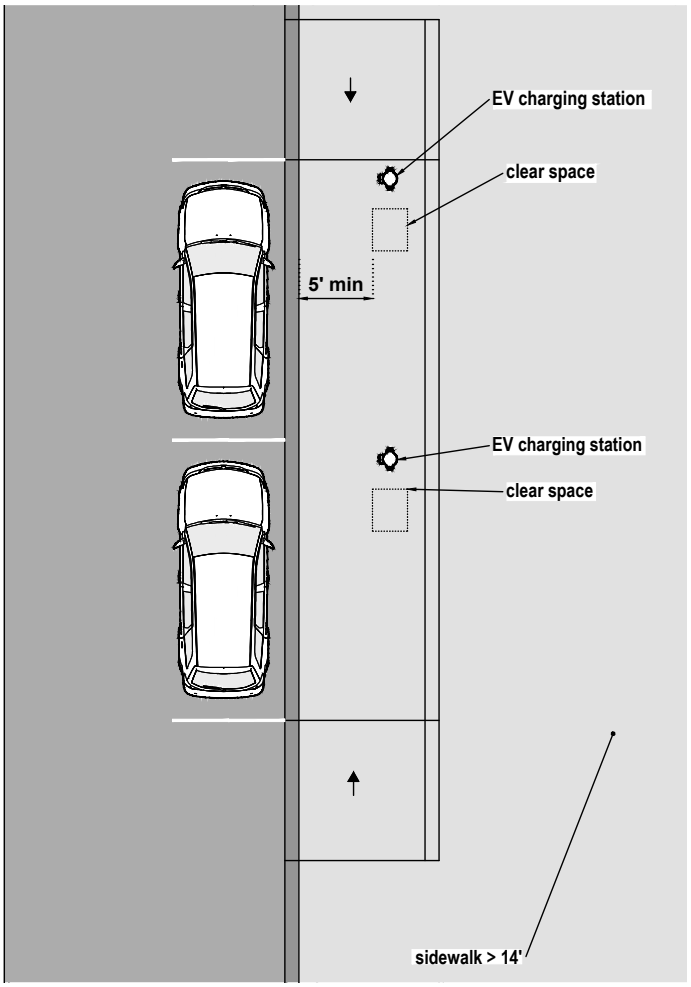
Figure 61: Example of EV Charging Station in an unconstrained location, where the sidewalk is over 14-feet wide (Source: United States Access Board)



20.2.3.3 One-Way Streets

- On one-way streets, chargers should be provided on both sides of the street to enable vehicles with charging inlets on the driver side to charge their vehicle. Otherwise, charging will generally be limited to vehicles with passenger side charging inlets.

Figure 62: Example of EV Charging Station in an constrained location, where the sidewalk is 14-feet wide or less (Source: United States Access Board)



Alternate Pedestrian Access Routes

21

Alternate routes that are accessible to pedestrians with disabilities are required when a pedestrian circulation path is temporarily closed or made inaccessible due to construction, maintenance operations, special events, or other similar circumstances.

21.1 Potential Accessibility Challenges

- Alternate route missing or not provided.
- Alternate routes that are inaccessible due to a lack of accessible curb ramps, insufficient clear width and turning space for people who use mobility aids, or other factors.

Alternate routes that are circuitous or require pedestrians to cross major roads multiple times.

- Alternate routes with insufficient signage in advance of decision points.
- Alternate routes with signage that is inaccessible, e.g., to people with vision disabilities or intellectual and developmental disabilities.
- Signage that obstructs or protrudes into the pedestrian circulation route.
- Lack of regular maintenance, which can result in accumulated debris, temporary barriers being shifted and blocking the alternate route, or elements of the route deteriorating over time and becoming inaccessible, e.g., a temporary wooden curb ramp that becomes warped or splintered.

Among respondents to the Accessibility Challenges Survey, nearly half (47%) identified "navigating temporary routes during construction" as a top accessibility challenge, making it the third most frequently cited accessibility challenge overall.

- Lack of coordination between neighboring project sites, which can result in sidewalks on both sides of a street being closed at the same time and homes, businesses, or other properties being completely inaccessible.

These challenges can have significant impacts on people with disabilities. For example, if an alternate pedestrian access route is not provided or is extremely inconvenient, a person with a disability may be unable to access their intended destination or may decide the attempt is not worth the safety risk or inconvenience. Alternatively, a person with a disability may choose to walk or roll in the street where they are exposed to motor vehicle traffic and a potential crash.

Temporary changes can be particularly challenging for people with vision disabilities, who often rely on mental maps for navigation, and people with intellectual and developmental disabilities, who may have trouble understanding and adapting to changes.

21.2 Guidance

21.2.1 Key Requirements

Table 27: Key Requirements for Alternate Pedestrian Access Routes

Design Element	Criteria	Notes	Reference
Surface	As specified in PROWAG R302 or not less accessible then surface of temporarily closed pedestrian circulation path	N/A	PROWAG R303.3
Continuous clear width	Min. 48”	If an existing pedestrian circulation path is used as the alternate pedestrian access route, the clear width must not be less accessible than the temporarily closed path.	PROWAG 303.4
Protruding Objects and Vertical Clearance	As specified in PROWAG 402 and Table 5 above.	N/A	PROWAG R207
Signs	Signs identifying alternate pedestrian access routes and proximity actuated audible signs	Must be provided in advance of decision points and must comply with PROWAG R410	PROWAG R303.2
Curb ramps or blended transitions	Required where pedestrian access route crosses a curb	N/A	PROWAG R303.5
Detectable edging of channelizing devices	Min 32” and free of sharp or abrasive surface	Top of top detectable edging	PROWAG R303.6
	Max 2” above the walking surface	Bottom of bottom detectable edging	
Temporary Pedestrian signal heads	Must comply with PROWAG R307	N/A	PROWAG R303.7

21.2.2 Where to Apply

- When a pedestrian circulation path is temporarily not accessible due to construction, maintenance operations, event closure, or other similar conditions, an alternate pedestrian access route must be provided (PROWAG 204.1).

21.2.3 How to Apply

21.2.3.1 Planning Considerations

- Whether an event or construction project will last hours, weeks, or months, the scope, plan, and design of the event or project should minimize impacts on pedestrian access routes and pedestrian circulation paths.
- Access should be restored to the permanent walkway as soon as possible, including potentially nights, weekends, and other times work is suspended.
- When a longer-term project is planned (i.e., more than two days of closure), consider providing detour information through additional communication channels, e.g., websites, neighborhood associations and their mailing lists, and social media — including channels used by people with disabilities.
- Especially for longer-term projects, people with disabilities should be engaged in the routing and design of alternative pedestrian routes.

21.2.3.2 Layout

- Keep the alternate route as close to the original as possible. If the existing walkway cannot be kept open, provide a parallel alternative pathway adjacent to the existing walkway, such as in a curbside parking or travel lane that is closed to accommodate the pedestrian route. If the above option is not practicable, provide a parallel alternative pathway that is not adjacent, such as on the other side of the street or around the block.
- Prioritize pedestrian and public transit access over motor vehicle access. Converting a vehicular lane into a temporary pedestrian route may be shorter, safer, and more usable for individuals with disabilities than an alternate route requiring two street crossings, even if the roadway surface is imperfect.[30] Using a scaffold or other covered structure so that the existing walkway can be maintained, and materials moved over the top may be even better.
- Ensure that barriers and other protective structures leave gaps to allow access to and from transit stops, passenger loading zones, and building entrances/exits (including fire exits). If access to these connections is not apparent, pedestrians should be directed to them with signage that is accessible to people who have vision, intellectual, and developmental disabilities.
- Where accessible transit stops are temporarily not accessible, alternate transit stops complying with PROWAG R309 shall be provided.
- Where permanently designated passenger loading zones are temporarily not accessible, a temporary passenger loading zone should be provided. If provided, the temporary passenger loading zone shall comply with PROWAG R311.
- Where temporary transit stops or passenger loading zones are provided, they should be located as close as possible to the existing transit stops and passenger loading zone and should minimize additional street crossings required to reach them.

21.2.3.3 Signs

- Signs identifying alternate pedestrian access routes shall be provided at decision points and shall comply with PROWAG R410. Proximity actuated audible signs (Figure 63) or other non-visual means within the public right-of-way of conveying the information that identifies the alternate pedestrian access route shall also be provided (PROWAG R303.2).
- Signage should include information about the project, how and to whom to report problems, and directions for pedestrians, including pedestrians with a variety of disabilities, e.g., ambulatory, vision, hearing, intellectual, developmental.
- Audible signs should provide a complete physical description of the temporary pedestrian detour including duration, length of (and/or distance to) the bypass, any restrictions/hazards, and project contact information.[31]
- Signage should be positioned so it doesn't block walkways (unless denoting the end of the pedestrian access route) or cause a tripping hazard.

21.2.3.4 Surface

- Alternate pedestrian access routes may include existing or temporary surfaces. Whether modified or not, the surface shall be firm, stable, slip-resistant, and free of tripping hazards (PROWAG R303.3).
- Walkways should be graded so that water will not accumulate on surfaces, especially when temperatures are near freezing.

21.2.3.5 Continuous Clear Width

- Alternate pedestrian access routes shall meet the minimum clear width requirements specified in PROWAG 303.4, which are summarized Table 27.
- Consider providing 12–24 inches of additional width for shy distance along vertical elements such as barriers.

Figure 63: Audible information device in advance of a closed sidewalk (Source: American Traffic Safety Service Assoc. Applying the Americans with Disabilities Act in Work Zones: A Practitioner Guide)

21.2.3.6 Changes in Level

- Changes in level, including transitions between permanent and temporary grades, shall comply with PROWAG 302.6.2.

21.2.3.7 Curb Ramps or Blended Transitions

- Where an alternate pedestrian access route crosses a curb, a curb ramp or blended transition complying with PROWAG R304 shall be provided.

21.2.3.8 Barriers and Channelizing Devices

- When barriers or channelizing devices are used as part of an alternate pedestrian access route, they shall comply with PROWAG R303.6, which are summarized in Table 27.
- Barriers and channelizing devices should be continuous except where pedestrians are intended to cross the street or access a building entrance, transit stop, or other destination. (Figure 64)
- Continuous barriers and channelizing devices must extend the full width of the closed walkway without causing a tripping hazard. Caution tape, or cones and/or barrels that a person can walk between, are not sufficient.

21.2.3.9 Protrusion Limits

- Signage, scaffolding supports, and other objects shall comply with PROWAG R402. Minimum dimensions are summarized in Table 5 above.

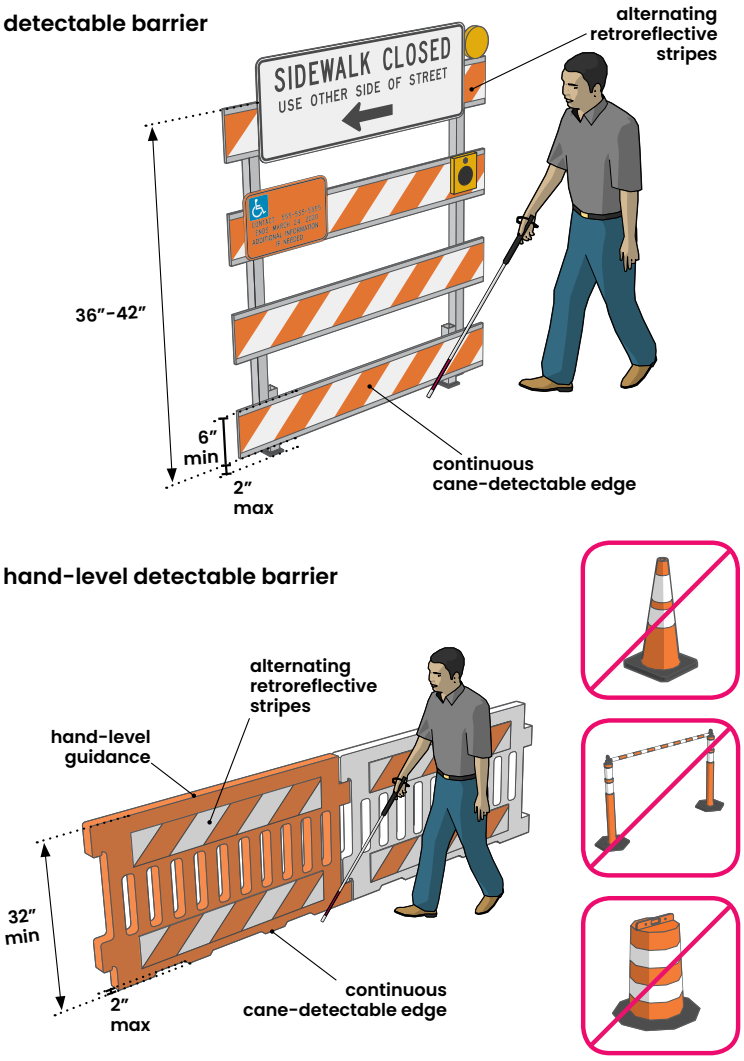
21.2.3.10 Lighting

- Where lighting is provided, walkways must be continuously lit between sunset and sunrise. Additional lighting may be required where existing lighting is removed or obscured during a project, such as when scaffolding is erected over the walkway.

21.2.3.11 Maintenance

- Alternate pedestrian access routes must be maintained so they stay accessible. Regularly check barriers, barricades, plates, and other such devices to make sure they remain to good condition and have not shifted out of position. Check that wooden ramps and other temporary elements that may deteriorate over time remain in good condition. Remove gravel, leaves, litter, snow, ice, and other debris that may collect along the route and present a hazard.

Figure 64: Detectable closure barricade and channelizing barrier examples



Appendix 22

A | Glossary of Terms

A

- **Accessible**: A pedestrian facility or element in the public right-of-way that complies with the Americans with Disabilities Act and this guide.
- **Accessible pedestrian signal**: A device that communicates information about pedestrian signal timing in non-visual formats such as audible tones or speech messages, and vibrating surfaces.
- **Alignment TDI**: A tactile direction indicator used to help people with vision disabilities align properly to the crosswalk.
- **Alteration or altered**: A change to or an addition of a pedestrian facility in an existing, developed public right-of-way that affects or could affect pedestrian access, circulation, or usability.

B

- **Blended transition**: A wraparound connection at an intersection corner, or a flush connection where there is no curb to cut through.
- **Block perimeter**: The near side of the streets surrounding a block. For example, on a block bounded by Bonifant Street to the south, Wayne Avenue to the north, Georgia Avenue to the east, and Dixon Avenue to the west, the block perimeter includes the north side of Bonifant Street, the south side of Wayne Avenue, the west side of Georgia Avenue, and the east side of Dixon Street.
- **Buffer interval**: The part of the pedestrian signal cycle between the end of the pedestrian change interval and the start of the green interval for conflicting traffic. The MdMUTCD requires the buffer interval to last at least 3 seconds, during which a steady upraised hand signal indication (symbolizing "don't walk") is displayed to pedestrians.

C

- **Channelized turn lane**: A channelized turn lane is a traffic design feature sometimes used at intersections to separate turning vehicular movements from through traffic. This is achieved through the use of raised islands, pavement markings, or other means to create distinct paths for vehicles.
- **Clear width**: The continuous, unobstructed width of a pedestrian access route.
- **Crosswalk**: The space designated for pedestrians and cyclists to cross vehicular travel lanes, and where motorists (and other road users) are required to stop for people crossing. In Maryland law, there are three types of crosswalks:
  - Anywhere two or more roads intersect, the extensions of their sidewalks across the intersection forms an unmarked crosswalk;
  - Anywhere a bikeway and a roadway intersect, the extension of the bikeway across the road forms a crosswalk; and
  - Anywhere a crosswalk is specifically marked across the roadway
- **Cross slope**: The slope that is perpendicular to the direction of pedestrian travel.
- **Curb**: A raised feature along the side of a street that delineates the edge of the roadway or pedestrian circulation path.
- **Curb line**: A line at the face of the curb that marks the transition between the curb and the gutter or street.
- **Curb ramp**: A sloped connection that is cut through or built up to a curb. Curb ramps may be perpendicular or parallel to the curb or to the street they serve or be a combination thereof.

D

- **Detectable warning surface**: A standardized truncated dome grid surface built into, or applied to, walking surfaces to indicate the boundary between a pedestrian route and a vehicular route where there is a curb ramp or blended transition, and at the edge of transit boarding platforms above standard curb height.
- **Developed (when used as an adjective)**: Containing buildings, pedestrian facilities, roadways, utilities, or elements.
- **Diagonal curb ramp**: A perpendicular or parallel curb ramp that is located near the apex of a curbed intersection, is not aligned with any crosswalk, and is often intended to serve two or more crosswalks.
- **Directional curb ramp**: A curb ramp with a running slope that aligns with the direction of the corresponding crosswalk.

E

- **Element**: An architectural or mechanical component of a building, pedestrian facility, space, site, or public right-of-way.

G

- **Grade**: See *Running slope*.
- **Grade break**: The line where two surface planes with different running slopes meet.
- **Guidance TDI**: A tactile directional indicator used to help people with vision disabilities follow a pedestrian access route.

M

- **Median**: The area between two roadways of a divided roadway measured from edge of traveled way to edge of traveled way. The median excludes turn lanes. The median width might be different between intersections, interchanges, and at opposite approaches of the same intersection.

O

- **Operable part**: A component of an element used to insert or withdraw objects, or to activate, deactivate, or adjust the element, or to interact with the element.

P

- **Parallel curb ramp**: A curb ramp with a running slope that is parallel to the curb or street it serves.
- **Passenger loading zone**: An area that is specifically designed and designated for loading and unloading passengers, but that does not primarily serve transit vehicles on a fixed or scheduled route.
- **Pedestrian**: A person on foot, traveling by wheelchair or other mobility device, on skates, or on a skateboard.
- **Pedestrian access route**: An accessible, continuous, and unobstructed path of travel for use by pedestrians with disabilities within a pedestrian circulation path.
- **Pedestrian activated warning devices**: Devices that are installed in conjunction with a warning sign and are activated to alert vehicle operators to the presence of a pedestrian, such as rectangular rapid flashing beacons.
- **Pedestrian change interval**: An interval during which the flashing upraised hand signal indication (symbolizing “don’t walk”) is displayed to pedestrians.
- **Pedestrian circulation path**: A prepared exterior or interior surface provided for pedestrian use in the public right-of-way.
- **Pedestrian facility**: A structure, route, or space for pedestrian circulation or use located in the public right-of-way.
- **Pedestrian hybrid beacon**: A special type of traffic beacon with yellow and red signal indications used to warn and control traffic and pedestrian accessible signals to assist pedestrians in crossing a street at a marked crosswalk.

- **Pedestrian refuge island**: A protected area that is at least 72 inches long in the direction of pedestrian travel located within a street crossing where pedestrians can safely wait before completing their crossing.
- **Pedestrian signal head**: A device containing the walking person symbol (symbolizing "walk") and the upraised hand symbol (symbolizing "don't walk") installed to direct pedestrian traffic at a signalized crosswalk.
- **Perpendicular curb ramp**: A curb ramp with a running slope that is perpendicular to the curb or the street it serves.
- **Public right-of-way**: Public land acquired for or dedicated to transportation purposes, or other land where there is a legally established right for use by the public for transportation purposes.
- **Push button**: A button to activate a device or signal timing for pedestrians, cyclists, or others crossing a roadway.
- **Push button locator tone**: A repeating sound that informs approaching pedestrians that a push button exists to actuate an accessible pedestrian signal or beacon, or to receive additional information, and that enables pedestrians who are blind or have low vision to locate the push button.

R

- **Roadway**: That portion of a highway improved, designed, or ordinarily used for vehicular travel and parking lanes, but exclusive of the sidewalk, berm, or shoulder.
- **Roundabout**: A circular intersection with yield control at entry to the circulating roadway, which permits a vehicle on a circular roadway to proceed, and with deflection of the approaching vehicle counterclockwise around a central island.
- **Running slope**: The slope that is parallel to the direction of pedestrian travel.

S

- **Separated bike lane**: A bicycle lane that is physically separated from motor vehicle traffic by vertical elements and a horizontal buffer and physically separated from pedestrian walkways.
- **Shared use path**: A multi-use path designed primarily for transportation purposed for use by cyclists, pedestrians, and other authorized motorized and non-motorized users, which may also be used for recreation. Shared use paths are physically separated from motor vehicle traffic by an open space or barrier and are either within the street right-of-way or other public right-of-way.
- **Shared street**: A shared street includes a shared zone where pedestrians, cyclists, and motor vehicles are intended to mix. They lack traffic controls, such as traffic signals and STOP signs, and are usually curbless.
- **Side path**: A shared use path located within street right-of-way adjacent and generally parallel to a roadway.
- **Sidewalk**: That portion of a street between the curb line, or the lateral line of a roadway, and the adjacent right-of-way line, or on easements of private property, that is paved or improved and intended for use by pedestrians.
- **Sidewalk alert TDI**: A tactile direction indicator used help people with vision disabilities locate a non-intersection crosswalk or bus stop.
- **Splitter island**: A median island used to separate opposing directions of traffic entering and exiting a roundabout.
- **Stair**: A change in elevation comprised of at least one tread and riser. A curb is not a stair.
- **Standard curb height**: The typical height of a curb according to local standards (e.g., 6 inches high in Montgomery County).
- **Street**: See *Roadway*.

T

- **Tactile direction indicator (TDI)**: A surface comprised of raised, parallel, flat-topped, elongated bars complying with International Standard Organization standard 23599 that is used to provide wayfinding information to pedestrians with vision disabilities.
- **Transit door location TDI**: A tactile direction indicator used to help people with vision disabilities identify the location of transit doors.
- **Transit shelter**: A structure provided at a transit stop to provide passengers protection from the weather.
- **Transit stop**: An area that is designated for passengers to board or alight from buses, rail cars, and other transportation vehicles that operate on a fixed route or scheduled route, including bus stops and boarding platforms. This definition does not include intercity rail except where a stop is located in the public right-of-way.
- **Tactile walking surface indicator (TWSI)**: Tactile walking surface indicators are specialized surfaces installed within or along a walking surface to provide information to people with vision disabilities. They are highly detectable underfoot and with a long white cane and are highly discriminable from each other.
- **Transitional segment**: The portion of a pedestrian circulation path that connects adjacent surfaces with different slopes or dimensions to provide a smooth transition.
- **Traveled way**: The portion of the roadway for the movement of vehicles, exclusive of the shoulder, berm, sidewalk, and parking lane.

V

- **Vibrotactile**: A method of communicating information by touch using a vibrating surface.

W

- **Walkway**: A general term used to describe a paved or improved area for use by pedestrians. Walkways include sidewalks, shared use paths, curb ramps, blended transitions, etc.
- **Walk interval**: An interval during which the walking person signal indication (symbolizing “walk”) is displayed to pedestrians.

B | Engaging People with Disabilities in Street Design

This section includes basic principles and practical tips for engaging people with disabilities in street planning and design processes. It has been adapted from Engaging People with Disabilities and Street Design and Planning: 11 Tips for Getting it Right, a resource guide developed by Toole Design.

22.2.3.11.3 Basic Principles

Aim for engagement, not just accessibility.

People with disabilities can and should be included in planning and design processes at different levels. At a minimum, meetings and online materials must be accessible to people with disabilities. This is a legal requirement. However, "engaging" people with disabilities involves going beyond the baseline. It means proactively reaching out to people with disabilities to understand their experiences, solicit their input, and involve them in decisions.

Engage people with different types of disabilities as well as advocates for people with disabilities and professionals who work with them.

There are many different types of disabilities and many ways of living with disability. For instance, in the category of people with vision disabilities, there are people with reduced visual acuity, peripheral field loss, central field loss, total vision loss, night blindness, and color blindness, to name just the major subcategories. In addition, some people with vision disabilities use a cane (of which there are several types), some use a guide dog, and some rely on a human guide. Others may use no specialized mobility aids at all. Finally, income, race/ethnicity, gender, neighborhood context, access to training, and other attributes influence the experience of disability.

Street plans and designs need to account for this diversity. The best way to ensure this is by proactively engaging people with a range of disabilities, coping strategies, and backgrounds in street planning and design processes, and by engaging people or organizations that have a deep familiarity with this diversity and can offer their expertise.

Engage people with disabilities throughout the entire process.

People with disabilities and advocates for people with disabilities should be engaged throughout the transportation planning, design, and implementation process. They should be involved in crafting the project vision and goals, evaluating existing conditions, identifying and prioritizing alternatives, reviewing designs, and evaluating outcomes. Some of these steps are highlighted in greater detail below.

Allow enough time and budget.

Engaging people with disabilities is not something that can be done at the last minute or cheaply. You need to plan ahead and ensure that your budget will enable you to accommodate people with disabilities as part of the process. Potential costs including paying for interpretation services (American Sign Language, Deaf-Blind, CART[1]), and paying for materials that are accessible to people with vision disabilities, such as websites and documents that can be read by a screen reader, braille documents, or tactile graphics.

Use inclusive language and imagery.

As planners and designers, our choice of words, and the way we portray (or fail to portray) people in our work, can send a powerful signal about who our plans and designs are for and how we think about them. When working with a specific person with a disability,

1. Communication Access Realtime Translation

it is best practice to ask the person which terms they prefer to describe their disability. When referring to people with disabilities more broadly, it is generally recommended to use "people first" language, e.g., "a person who is deaf" not "deaf person." Imagery also matters. Showing images of people with disabilities in the materials that are developed for a project can help convey that people with disabilities are valued and encouraged to participate, and that the process and its outcomes are designed to serve their needs.

22.2.3.11.4 Practical Tips

Tip 1: Lay the groundwork for engaging people with disabilities.

As planners and designers, there are several steps we can take to lay the groundwork for planning and design processes that successfully engage people with disabilities. These steps can and should happen outside of specific projects. They include:

- Continually working to improve our knowledge of inclusive public participation processes and effective engagement of people with disabilities.
- Reviewing current planning practices and the roles that people with disabilities play in key decision-making. Tools such as the IAP2 Spectrum of Public Participation can be useful in this review.
- Incorporating best practices for inclusive public participation and engagement of people with disabilities in agency/organization standard procedures, e.g., by developing a public participation plan for the agency/organization.
- Developing a list of key community stakeholders who represent people with disabilities or have an enhanced focus on accessibility (see textbox on next page) and engaging a diverse group of these stakeholders since they often have different perspectives even if they represent people with the same type of disability.
- Cultivating ongoing relationships with key community stakeholders on accessibility issues.

22.2.3.11.5 Key Stakeholders for Accessibility Issues

Covering a range of disabilities or with an enhanced focus on disability

- Montgomery County Commission on People with Disabilities
- AARP
- Holiday Park Senior Center
- Independence Now
- Jewish Council for the Aging
- Jewish Social Service Agency (JSSA)
- Maryland State Department of Education, Division of Rehabilitation Services (DORS)
- Maryland Department of Disabilities
- Maryland Statewide Independent Living Council
- Villages of Montgomery County

For people with vision disabilities

- American Council of the Blind
- Columbia Lighthouse for the Blind
- National Federation for the Blind
- Prevention of Blindness Society
- The Association for Education and Rehabilitation of the Blind and Visually Impaired (AERBVI)
- Guide dog user groups
- Orientation and Mobility Specialists[2]
- Low vision specialists

For people with hearing disabilities

- DORS Department of Deaf and Hard of Hearing
- Gallaudet University
- Hearing Loss Association of America
- Jewish Social Service Agency (JSSA)
- National Association of the Deaf

For people with neurodivergence

- American Association of Intellectual and Developmental Disabilities (AAIDD)
- Community Services for Autistic Adults and Children (CSAAC)
- Community Support Services (CSS)-
- Opportunities, Inc.
- The Arc
- Travel trainers[3]

2. Orientation and Mobility Specialists can be identified through the Columbia Lighthouse for the Blind, DORS Office for Blindness & Vision Services (OBVS), Montgomery County Public Schools Special Education-Vision Services, or the Maryland School for the Blind.

3. Travel trainers can be identified through the Washington Metropolitan Area Transit Authority (WMATA).

Tip 2: Include engaging people with disabilities in the project scope, budget, and timeline.

The parameters for engagement are set well before any meetings or outreach take place. The project scope, budget, and timeline are key determinants. If the project scope fails to highlight engagement of people with disabilities, or if the timeline and budget make real engagement infeasible, then it likely won't happen on the level it should. The project scope, budget, and timeline should:

- Clearly state that improving access for people with disabilities is a project goal.
- Include engagement of people with disabilities as an explicit element of the public outreach and engagement scope throughout the project.
- Allow enough time and resources (both financial and staff) for effective engagement of people with disabilities.
- Allow for flexibility based on input from people with disabilities and organizations that represent them.

Tip 3: Develop a public participation plan that targets people with disabilities.

A project-specific public participation plan can help clarify how people with disabilities will be included in a project. The plan should include:

- Goals and metrics for engaging people with disabilities.
- A strategy and timeline for soliciting input from people with disabilities at every stage in the process.
- Milestones for determining whether people with disabilities are being effectively engaged and changing course if something isn't working, e.g., reviewing participation levels after each public meeting or at regular intervals during an online survey.
- A methodology for evaluating how well a project engaged people with disabilities and lessons learned at project closeout, including direct feedback from people with disabilities about how the process worked for them, which might be solicited through targeted surveys, focus groups, and interviews.

Tip 4: Involve people with disabilities in project oversight and decision-making.

Truly engaging people with disabilities involves going beyond simply making it possible for them to participate. It requires involving them in decision-making. One practical way to do this is to establish a project oversight or steering committee that includes people with disabilities and their advocates. It is important; however, that the committee have real power and influence over the direction of the project. Otherwise, including people with disabilities in the committee amounts to tokenism.

Tip 5: Involve people with disabilities in existing conditions analysis.

Existing conditions analysis establishes the foundation for project recommendations. If this analysis fails to identify the barriers to access that people with different types of disabilities face, then those barriers are unlikely to be fully addressed by the project recommendations. When done thoroughly and completely, with a deliberate focus on the needs of people with disabilities, existing conditions analysis can help identify accessibility barriers that would not have been considered otherwise, resulting in project outcomes that better serve people with disabilities. Best practices include:

- Consult directly with people with disabilities about existing conditions. It is important to understand the transportation needs of people with a range of disabilities as well as the barriers they face in the transportation system. What destinations do they need to access in their daily lives? What modes are they likely to use to get there? What barriers and other considerations shape their transportation decisions? How does this experience vary depending on disability type, income, race/ethnicity, gender, and other attributes? One of the best ways to collect the answers to these questions is to consult with people with disabilities directly.
- Conduct a pedestrian or bicycle audit in the project area that includes people with a range of disabilities and others who are very familiar with the safety and accessibility they face. A group like this is much more likely to identify accessibility

barriers. Observing these barriers in the field, and the challenges people with disabilities in the group experience navigating them, makes the barriers more tangible and immediate to all involved, and this shared experience can help build consensus about what the needs are and possible ways of addressing them.

- Review data from the U.S. Census Bureau and other locally available sources to determine where people with disabilities and older adults are concentrated and where to focus planning and design efforts. A 2016 CDC study found that the likelihood of having any type of disability was three times higher for adults with incomes below the poverty level compared to adults with incomes twice the poverty level[4]. This likelihood goes up to five times higher in the case of mobility disabilities. At the same time, people in lower income neighborhoods are less likely to have access to a private car and more likely to rely on walking, bicycling, and public transportation, amplifying the need for these modes to be accessible.
- Understand that systems for establishing existing conditions and needs based on resident reporting may be biased. For example, it is common for agencies to rely on resident reporting systems, such as 311, to identify locations where there may be a safety or accessibility issue such as a heaved sidewalk or missing curb ramp. However, overreliance on such systems for understanding existing conditions and needs may result in a bias toward neighborhoods where people have more time, greater access to cell phones, and greater comfort and confidence engaging government institutions for their benefit.

Tip 6: Encourage people with disabilities to participate in the public participation process.

- Reach out directly to people with disabilities and their advocates to invite them to participate in public participation activities. Ask about transportation needs and offer to help with these needs, e.g., by coordinating rides.
- Advertise meetings and other public participation activities through organizations that serve people with disabilities (e.g. Easter Seals, Lighthouse for the Blind, AARP, etc.). Consider setting up an opt-in automated phone call system to improve awareness among older adults.
- Establish a Section 508-compliant project website and have a 508 compliance specialist on hand to help ensure project materials are accessible.[5]

Tip 7: Choose locations and times for public outreach activities that are accessible to people with disabilities.

- Hold public outreach activities, such as public meetings, focus groups, walkabouts, pop-up tabling and other in-person events in locations that are served by public transit and accessible to people with a range of disabilities. Ask yourself, could a person who uses a wheelchair access this location? Could a person with a vision, hearing, or cognitive disability?
- Make sure activities are scheduled at times when public transit and paratransit systems are operational and can be easily used for access to and from the activity. Provide information on transit access as part of the meeting announcement.

4. Centers for Disease Control and Prevention. "Prevalence of Disabilities and Health Care Access by Disability Type and Age — United States, 2016." Morbidity and Mortality Weekly Report, vol. 67, no. 32, 2018, pp. 882-887.

5. Section 508 guidance requires federal agencies, and state agencies who choose to adopt this guidance, to provide accessible versions of all websites and materials provided digitally to the public. However, even in cases where Section 508 does not apply, most websites are still required to be accessible. See Do Section 508 Accessibility Standards Apply to My Website? for additional details.

- Make sure there are no physical barriers at the activity location that may impact a participant's ability to get to and move around the space freely and that the lighting is good. Arrange tables, chairs, and other objects to facilitate access by people who have mobility assistance devices, personal care devices, care team members, service animals, etc.
- Appoint a greeter (or greeters) to provide verbal information about the meeting, including directions to the meeting room and bathroom. Incorporate verbal information about bathroom locations and other logistical matters in a "housekeeping" segment at the beginning of the meeting.
- Give people the option of participating in the meeting remotely or move the entire meeting online. Many people with disabilities find it easier to participate in accessible virtual meetings than in in-person meetings.

Tip 8: Make it possible for people with disabilities to fully participate in public outreach activities and proactively engage them during the activity.

- Ask what special accommodations people may need to fully participate in meetings and other public outreach activities. Do not assume that no accommodations are needed unless you ask.
- Provide a point of contact on meeting announcements and invitations, so people who need accommodations can request them. Specify a deadline by which such requests must be submitted to allow sufficient time for arranging them.
- Provide advance copies of meeting materials in accessible electronic formats, including detailed presentation notes with descriptions of images and graphics or "alt text." See Provide Accessible Materials below for additional information.
- Print enlarged copies of presentations for people with low vision, who may be able to read close up but not at a distance.
- Make sure visual materials use high-contrast colors. Avoid using similar colors like blue and purple to demonstrate a concept.
- Use tactile maps or 3-D models to help illustrate key design concepts. Allow enough time for review.

Accessible Virtual Meeting Best Practices

The increasing popularity of virtual meetings creates enormous potential for engaging historically underrepresented groups. For people with disabilities, common barriers, such as travel to meetings, physical barriers within meeting spaces, and lack of access to interpreters, either do not apply or are more easily addressed. However, the shift to virtual spaces also comes with new barriers and challenges, including the need for Internet access, lack of familiarity with online engagement tools, and poor audio-visual quality.

Rooted in Rights, a non-profit organization that focuses on amplifying the voices of people with disabilities, recently released two best-practice resources on accessible virtual meetings that address some of these challenges. The guidance considers accommodations for people with vision, hearing, and intellectual and developmental disabilities in online meeting spaces.

- "Make Your Video Calls Accessible" produced in partnership with King County: https://www.kingcounty.gov/depts/dnrp/wtd/capital-projects/active/coal-creek-sewer-upgrade.aspx
- "How to Make Your Virtual Meetings and Events Accessible to the Disability Community" https://rootedinrights.org/how-to-make-your-virtual-meetings-and-events-accessible-to-the-disability-community/

- Provide detailed verbal descriptions of visual elements that are important for understanding, such as presentation graphics or images.
- Provide and use microphones. All presenters should use a microphone, and microphones should be available for participants to use during group discussion periods. Be deliberate about speaker placement (and seating someone with a hearing impairment) when using microphones. Repeat or summarize questions and comments from the audience so all can hear.
- Hire interpreters for deaf and deaf-blind attendees.
- Speak slowly and clearly, using simple, direct language.
- Actively engage people with disabilities in planning processes. Ask them about their experiences navigating the built environment and their thoughts on plans and designs.

Tip 9: Provide accessible materials.

- Use plain language in written materials. Avoid jargon.
- Make sure that electronic documents can be read by screen readers. This is critical for materials that have complicated layouts. Flow logic and text hierarchy checks in Adobe Acrobat are great first steps for checking not only if a document is screen-reader compliant, but also that it makes sense when read through a screen reader.[6]

Tip 10: Set up phone, online, and mail-back feedback opportunities.

- Regardless of where and when public outreach activities are scheduled, or whether meetings are in-person or virtual, some people will not be able to attend due to scheduling conflicts and other reasons. To address this, planners and designers should provide feedback opportunities outside scheduled activities. Examples include online surveys and feedback forms sent by direct mail with pre-stamped envelopes. Individual interviews by phone may also be an effective strategy.
- Encourage participants to share these feedback opportunities with their community contacts to expand the meeting's reach.

Tip 11: Involve people with disabilities in post-construction evaluation.

It is important to evaluate street designs post-construction to determine whether they are performing as intended and to identify any needed tweaks. It can be particularly helpful to involve people with disabilities in this work since they are best positioned to identify accessibility barriers. Involving people with disabilities at this stage is particularly important for newer street designs, such as separated bike lanes and shared streets, since official guidance on how to make these designs accessible is limited.

6. Additional resources on Adobe's steps and checks for accessible PDFs are available online from Adobe at https://helpx.adobe.com/acrobat/using/create-verify-pdf-accessibility.html.

C | Checklists

Checklists will be developed based on feedback from County staff and contractors and included in this appendix in a subsequent edition of the guide.

D | Experimental Treatments

22.2.3.11.6 Crosswalk Guide Strips

Crosswalk guide strips are raised linear strips that can be installed along a crosswalk to help pedestrians with vision disabilities maintain their heading within the crosswalk. Crosswalk guide strips were piloted at several crosswalk locations in San Diego and Sacramento, California, with generally positive results (Figure 65).

Figure 65: Sacramento crosswalk guide strip example from report conducted by the Sacramento Department of Public Works.

Two crosswalk guide strip materials were tested in San Diego and Sacramento, layered thermoplastic and vitrified polymer composite. The vitrified polymer composite performed better than the thermoplastic because it provided a contrasting sound to the adjacent surface (and different from crosswalk pavement markings) when tapped with a long white cane and did not flatten over time at locations where motor vehicles crossed it like the thermoplastic; however, this material has not been snowplow tested for durability.

Where to Apply

Crosswalk guide strips are an experimental treatment and should only be used in very limited circumstances with MCDOT approval.

In general, crosswalk guide strips should only be considered in the following circumstances:

- Crosswalks over 40 feet long
- Skewed intersections
- Roundabouts and channelized turn lanes
- T-intersection

How to Apply

- Crosswalk guide strips should be 4-6 inches wide and have a maximum height of 0.25 inches.
- Crosswalk guide strips should be placed between the lateral edges or lines of a marked crosswalk (i.e., the edges or lines that are parallel to the pedestrian path of travel), such that there is a minimum of 4 feet (preferable), 3 feet (minimum) between the guide strip and both lateral edges or lines.
- Crosswalk guide strips should start and end as close as possible to the edge of the sidewalk or pedestrian space but should allow for drainage.
- Crosswalk guide strips should contrast visually with the underlying crosswalk surface, either light-on-dark or dark-on-light.
- Crosswalk guide strips must be a firm, stable, and slip-resistant surface, and have a sound that contrasts with the adjacent pavement surface when tapped with a long white cane.
- Crosswalk guide strips should be durable enough to withstand expected motor vehicle traffic and snowplows.
- Crosswalk guide strips should be designed to be traversable by cyclists and not catch snowplow blades.

22.2.3.11.7 Crosswalk Delineator Strips

Crosswalk delineator strips are tactile surfaces that help people with vision disabilities identify the edge of the crosswalk, reducing the potential for them to unintentionally veer outside the crosswalk.

Where to Apply

Crosswalk delineator strips are an experimental treatment and should only be used in very limited circumstances with MCDOT approval.

In general, crosswalk delineator strips should only be considered in the following circumstances:

- Crosswalks over 40 feet long
- Skewed intersections
- Roundabouts and channelized turn lanes
- T-intersection

How to Apply

- Crosswalk delineator strips should be a minimum of 12" wide.
- Crosswalk delineator strips should be applied on along both edges of the crosswalk outside the crosswalk markings.
- Crosswalk delineator strips should start and end as close as possible to the edge of pedestrian space while allowing for drainage.
- Crosswalk delineator strips should start and end as close as possible to the edge of the sidewalk or pedestrian space but should allow for drainage
- Crosswalk delineator strips should be made of a cobble that is embedded in concrete so that it is durable enough to withstand expected motor vehicle traffic and snowplows and that contrasts in color with adjacent surfaces. Concrete headers should be installed on both sides of the crosswalk delineator strips to enhance durability.
- Crosswalk delineator strips should contrast visually with adjacent surfaces.
- Crosswalk delineator strips should be durable enough to withstand expected motor vehicle traffic and snowplows. It is recommended that they be made of a cobble that is imbedded in concrete so that it is durable enough to withstand expected motor vehicle traffic and snowplows and that contrasts in color with adjacent surfaces. Concrete headers should be installed on both sides of the crosswalk delineator strips to enhance durability.
- Crosswalk delineator strips should be designed to be traversable by cyclists and not catch snowplow blades.

22.2.3.11.8 Tactile Warning Delineator

The tactile warning delineator (TWD) is a raised linear surface that is trapezoidal in cross-section and meant to help people with vision disabilities identify the boundary between pedestrian and vehicular space in situations where a detectable edge, such as a curbline, is not present and pedestrian crossing is not intended.

Where to Apply

Tactile warning delineators are an experimental treatment and should only be used in very limited circumstances with MCDOT approval.

In general, tactile warning delineators should only be considered in the case of continuous, parallel, flush pedestrian and bicycle facilities (e.g., a sidewalk-level separated bike lane next to a sidewalk) where it is technically infeasible to comply with the buffer requirements in *Section 10.2.2.2* and where there isn't on-street parking or passenger loading adjacent to the bike facility.

MCDOT's preference is to separate bicycle and pedestrian facilities either vertically or horizontally (or both), with a vertical difference of at least 3 inches in elevation when the facilities cannot be horizontally separated. Tactile warning delineators should be considered when it is not possible to separate the facilities vertically or horizontally, but where possible vertical or horizontal separation should be implemented as the first choice.

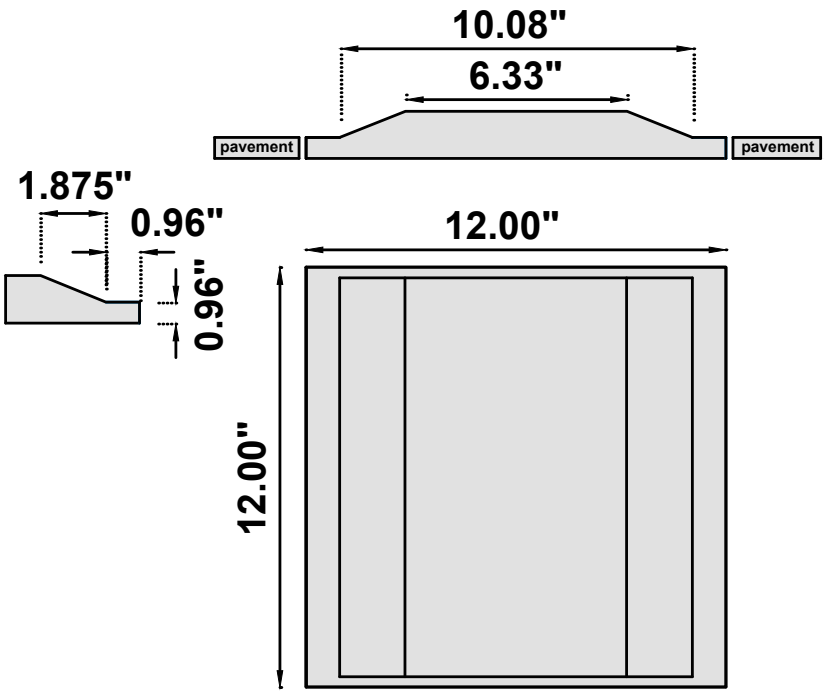
Where Not to Apply

- TWD should not be applied in any location without MCDOT approval.
- TWDs must not cross or protrude into pedestrian access routes, including crosswalks. Pedestrian access routes must comply with the requirements in PROWAG R302, which are summarized in Table 4.
- TWDs should not be used adjacent to on-street parking or passenger loading locations.
- TWDs should not be used across bike ramps (see 9.2.2.2).
- TWDs should not be used where pedestrian cross-traffic is intended or expected based on natural pedestrian desire lines.
- TWDs should not be installed across bike lanes or vehicle lanes.

How to Apply

- TWDs should have the dimensions shown in Figure 66. Initial research conducted in San Francisco (Bentzen, Scott, and Myers 2020) indicated that TWDs with these dimensions are highly detectable underfoot or with a long cane and generally traversable by most people using wheelchairs and other mobility aids.
- TWDs should be arranged in a continuous line between the pedestrian facility and the bicycle facility or vehicular lane, except at crosswalk locations.
- At crosswalk locations, there must a gap in the TWD that extends across the entire width of the crosswalk. In this gap, there must be a DWS that complies with the requirements in PROWAS 305, which are summarized in Table 7. The DWS should be placed as shown in Figure 26.
- TWDs should contrast visually with adjacent surfaces, either light-on-dark or dark-on-light.

Figure 66: Example TWD dimensions



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Maryland State Highway Administration (SHA). *Maryland Manual on Uniform Traffic Control Devices for Streets and Highways (MdMUTCD)*. Maryland State Highway Administration, 2023.

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Montgomery County Department of Transportation. *Planning and Designing Streets to Be Safer and More Accessible for People with Vision Disabilities (PVD Toolkit)*. Montgomery County Department of Transportation, 2021.

National Academies of Sciences, Engineering, and Medicine. 2024. Tactile Wayfinding in Transportation Settings for Travelers Who Are Blind or Visually Impaired. Washington, DC: The National Academies Press. https://doi.org/10.17226/27777.

U.S. Department of Transportation and U.S. Department of Justice. *Americans with Disabilities Act Standards (ADA Standards)*. U.S. Department of Transportation and U.S. Department of Justice, 1990.

United States Access Board. *Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG)*. United States Access Board, 2023.

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Endnotes

1. A PDF of the slides is available here. Notes from the discussion are available here.

2. Luecking, Betsy Tolbert, and Carly Clem. "*Who Has A Disability In Montgomery County, MD? An Overview*". In 2022 Annual Report, Montgomery County Commission on People with Disabilities, 1 Oct. 2022, p. 10, https://www.montgomerycountymd.gov/HHS-Program/Resources/Files/A%26D%20Docs/CPWD/CPWD2022AnnualReport.pdf#page=10.

3. Table 1 includes 1-year estimates and 5-year estimates to illustrate pandemic-related challenges.

4. Schwartz, Naomi, et al. "Disability and Pedestrian Road Traffic Injury: A Scoping Review." Health & Place, vol. 77, Sept. 2022, 102896, https://doi.org/10.1016/j.healthplace.2022.102896.

5. PROWAG R205

6. ISO 23599:2019—Assistive products for blind and vision-impaired persons—Tactile walking surface indicators provides more specific color contrast guidance, requiring that luminance contrast be greater than 50% where TWSIs are used to warn of hazards.

7. Crossing TDIs with bars parallel to their direction of travel have been found to require less effort and cause less instability for pedestrians using wheeled mobility aids than crossing TDIs with bars perpendicular to their direction of travel. At the same time, bars perpendicular to the direction of travel across a mid-block crosswalk can also help people with vision disabilities to align with the crosswalk.

8. The transit door location TDI bar orientation specified in Table 8 is consistent with the California Building Code 11B-247.2 and 11B-705.2 but differs from the bar orientation specified Tactile Wayfinding in Transportation Settings. The California standard was selected because it is more common and has less impact on people boarding and alighting who use mobility aids.

9. ISO 23599:2019—Assistive products for blind and vision-impaired persons—Tactile walking surface indicators provides more specific color contrast guidance, requiring that luminance contrast be greater than 30% using the Michelson Contrast formula where TWSIs are integrated into paving modules of uniform color, and greater than 50% where TWSIs are used to warn of hazards or where discrete elements are used to form TWSIs, e.g., discrete raised bars rather than bars that are part of a single TWSI surface of the same color.

10. MD. Transportation Code § 21-101(w), https://casetext.com/statute/code-of-maryland/article-transportation/ title-21-vehicle-laws-rules-of-the-road/subtitle-1-definitions-general-provisions/section-21-101-effective-1012023-definitions; see also Montgomery County Code, Sec. 49-26 (https://codelibrary.amlegal.com/codes/montgomery county/latest/montgomeryco_md/0-0-0-147967): "*Sidewalk* means any portion of the right-of-way for a County road that is expressly intended for pedestrians, including pedestrian ramps."

11. Montgomery County Code, Sec. 49-29(a), https://codelibrary.amlegal.com/codes/montgomery county/latest/montgomeryco_md/0-0-0-148020.

12. Montgomery County Code, Sec. 49-33(d), https://codelibrary.amlegal.com/codes/montgomery county/latest/montgomeryco_md/0-0-0-148084.

13. Montgomery County Code, Chapter 49, https://codelibrary.amlegal.com/codes/montgomery county/latest/montgomeryco_md/0-0-0-147509.

14. Shared use path user volumes can be collected on an existing path, estimated using a similar path, or projected using land use and other demand characteristics present along the path. If the designer cannot collect or estimate the modal split values, a typical mode split of 60% cyclists, 30% pedestrians, and 10% other wheeled users may be considered.

15. MD. Transportation Code, § 21-101 (i). https://law.justia.com/codes/maryland/2005/gtr/21-101.html

16. NCHRP Project 03-78b FINAL Guidebook for the Application of Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision

Disabilities. http://www.itre.ncsu.edu/wp-content/uploads/sites/2/2017/04/NCHRP-03-78b_Final-Guidelines.pdf

17. Crosswalk Marking Field Visibility Study. 2010, http://www.fhwa.dot.gov/publications/research/safety/pedbike/10068/10068.pdf

18. Schroeder, Bastian, et al. Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities: A Guidebook. NCHRP Research Report 834, Transportation Research Board, Jan. 2017, https://doi.org/10.17226/24678.

19. Kittelson & Associates Inc., et al. Guide for Roundabouts. NCHRP Research Report 1043, Transportation Research Board, June 2023, https://doi.org/10.17226/27069.

20. PROWAG does not explicitly set a minimum size of a refuge island, but implicitly requires they be at least 6 feet deep because it requires a DWS on each side, each 2 feet across, and requires at least 2 feet of space for pedestrians to wait in between them. 120 inches is preferred for all shared use paths as it provides space for a cyclist pulling a trailer to queue within the refuge.

21. Note that in the past it was permissible for a pedestrian access route to narrow to 3 feet wide at a driveway ramp. However, PROWAG does not contain such an exemption to the minimum 4-foot clear width requirement.

22. Ohio Department of Transportation. *Multimodal Design Guide*, section 3.2.1. July 2023, https://www.transportation.ohio.gov/working/engineering/roadway/manuals-standards/multimodal/03/03.

23. Montgomery County Code, Sec. 31-19 and Sec. 31-20 (b)(2), respectively.

24. Alan C. Scott, Janet M. Barlow, David A. Guth, Billie Louise Bentzen, Christopher M. Cunningham, Richard Long J Vis Impair Blind. Author manuscript; available in PMC 2015 Jan 30. Published in final edited form as: J Vis Impair Blind. 2011 Oct; 105(10): 648–661. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4311395/

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27. City and County of Denver, Department of Public Works. *Street Lighting Design Guidelines and Details.* PWES-012.2, Sept. 2019, https://www.denvergov.org/files/assets/public/v/1/doti/documents/standards/pwes-012.2-street_lighting_design_guidelines.pdf.

28. The approved Montgomery County Pedestrian Master Plan includes a recommendation to, "Establish standards for the distance between bus stops and the nearest protected crossing to encourage pedestrians to cross the street at safe locations."

29. The guidance is adapted from the Access Board's Design Recommendations for Accessible Electric Vehicle Charging Stations, which also includes guidance for EV charging stations located in parking lots.

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