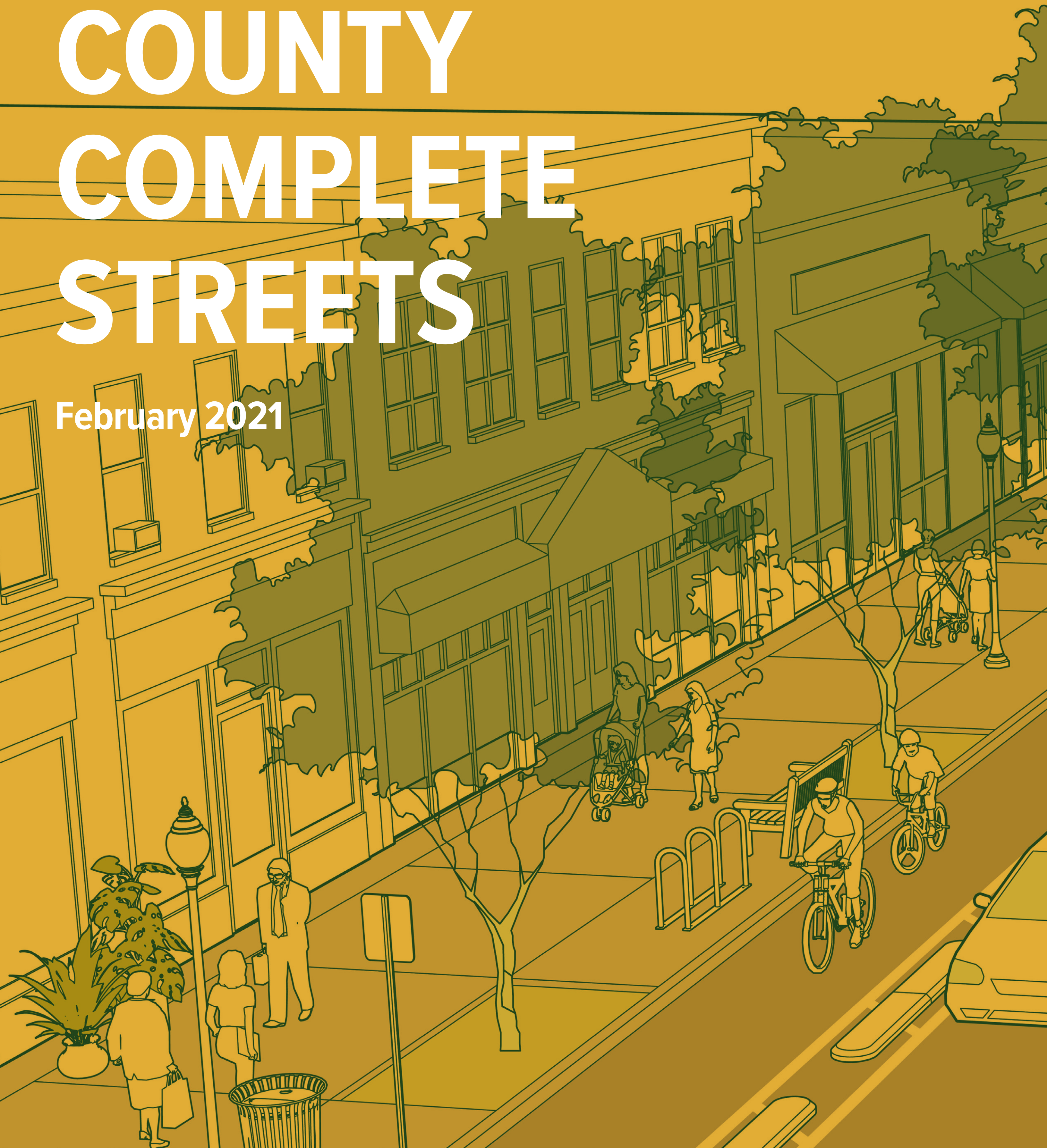
MONTGOMERY COUNTY COMPLETE STREETS

February 2021



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.

Montgomery County Department of Transportation

Montgomery Planning
THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION

Acronyms

- **AASHTO** American Association of State Highway Transportation Officials
- **APS** Accessible Pedestrian Signal
- **ADA** Americans with Disabilities Act
- **ADT** Average Daily Traffic
- **BMP** Stormwater Best Management Practice
- **BRT** Bus Rapid Transit
- **CAV** Connected and Automated Vehicles
- **County Council** Montgomery County Council
- **DEP** Montgomery County Department of Environmental Protection
- **DPS** Montgomery County Department of Permitting Services
- **EMS** Emergency Medical Services
- **ESD** Environmental Site Design
- **FHWA** Federal Highway Administration
- **HAWK** High-Intensity Activated Crosswalk Beacon
- **HCM** Highway Capacity Manual
- **LPI** Leading Pedestrian Interval
- **LOS** Level of Service
- **MCDOT** Montgomery County Department of Transportation
- **MDOT** Maryland Department of Transportation
- **MDOT SHA** Maryland Department of Transportation State Highway Administration
- **M-NCPPC** Maryland-National Capital Park and Planning Commission
- **MUTCD** Manual on Uniform Traffic Control Devices
- **MdMUTCD** Maryland Manual on Uniform Traffic Control Devices
- **MS4** Municipal Separate Storm Sewer System Permit Program
- **PHB** Pedestrian Hybrid Beacon
- **PROWAG** Public Rights-Of-Way Accessibility Guidelines
- **PUE** Public Utility Easement
- **ROW** Right-of-Way
- **RRFB** Rectangular Rapid Flashing Beacon
- **VMT** Vehicle Miles Traveled
- **WMATA** Washington Metropolitan Area Transit Authority

Contents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Chapter 1: **Vision**

1.1 Our Vision for Streets

Streets are vital to the quality of life for Montgomery County's residents, workers, businesses, and visitors. Montgomery County's Complete Streets Design Guide contributes to the creation of great places that are supported by safe and efficient transportation systems, which are designed with the needs of our citizens in mind and are equitably shared among diverse communities. The efficiency of these transportation systems will be enhanced by this guidance for designing new streets and reconstructing or retrofitting existing streets following these principles:

Safety

Maximizing safety for people will be the paramount objective of street design in the county, meaning that lower design speeds and geometric changes will be implemented over time. Street design will maximize safety for drivers, pedestrians and bicyclists alike, consistent with the county's Vision Zero goal to eliminate severe and fatal traffic collisions by 2030. Improving safety throughout the county, including those areas where crashes disproportionately affect people of color[1], will enhance equity in our communities. Improving safety is also increasingly important in a county where the 65-plus population is expected to increase from 10% to 21% by 2045.

Sustainability

Street design will seek to achieve a wide range of benefits to enhance ecological functions and the visual and economic appeal of a streetscape. Sustainable streets with street trees, vegetation, and stormwater management can reduce the urban heat island effect, improve air and water quality, and assist in reducing the effects of climate change.

Vitality

Street design will create great places that attract commerce, encourage a thriving community, and promote all modes of transportation including walking, biking, public transit, and vehicles.

COMPLETE STREETS *Defined*

Complete Streets are roadways that are designed and operated to provide safe, accessible, and healthy travel for all users of our roadway system, including pedestrians, bicyclists, transit riders, and motorists. On a Complete Street, it is intuitive and safe to cross the street, walk to shops, and bicycle to school. The approach to Complete Streets will vary in different parts of Montgomery County. Complete Streets in rural Boyds, suburban Olney, and downtown Wheaton will all look different depending on the adjacent land uses. Some areas may have dedicated bus-only lanes on certain streets, and some streets may vary in what degree of bike facilities they have or whether they require any bike facilities at all. Complete Streets function as a system, ensuring that the transportation network as a whole provides safe and efficient access for all roadway users and only provides designated spaces for each mode when needed.

1 Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 2011-2015 on CDC WONDER Online Database, released December 2016.

1.2 The Roles Streets Play in Montgomery County

Montgomery County's street network is a significant public asset, serving a multitude of important roles in the community. At the same time, streets are not always used to their full potential as public places of shared use. This design guide is an opportunity to make our streets safer, more sustainable, and more vibrant.

Transportation

Each day, thousands of people travel on Montgomery County's streets, making a variety of trips. Some are commuters heading to work or school. Others are making local trips within their community, running errands, or taking part in community activities. They travel via a variety of modes: many by car, but also by transit, foot, or bicycle. Freight and commercial vehicles travel on county streets, delivering packages and collecting locally produced goods for distribution throughout the region and nationwide. Meanwhile, emergency service providers, such as the police and fire departments, use streets to keep the community safe.

Figure 1-1. Clockwise: People accessing transit; People using the Capital Crescent Trail; Congestion approaching Rockville Pike (MD 355)

Economic Exchange

Montgomery County's streets are the lifeblood of the economy. A quality street adds value to the properties surrounding it, strengthening local businesses and generating tax revenue. Streets serve as a venue for commercial activity: as critical arteries for goods movement and commerce; sidewalk dining outside restaurants and cafés; vibrant window displays that draw customers into shops; and opportunities for signage and advertising. In addition to brick-and-mortar businesses, streets can support more temporary or itinerant commercial activities, such as farmers' markets, food trucks, and sidewalk vendors.

Figure 1-2. Clockwise: Street vendor; the Frontage Zone along Woodmont Avenue in Bethesda; Sidewalk dining in Silver Spring

Recreation and Social Engagement

At all scales, Montgomery County's streets serve as the backdrop for public life, outdoor exercise, and social interaction. Our streets are the venue for large celebrations like annual festivals, races, and parades. At other times, streets play host to regular gatherings, like holiday markets or concerts. In neighborhoods, streets play a more intimate role, as the setting for block parties or children's play, and as a conduit for spending time with friends, neighbors, and family. Streets encourage walking and enable neighbors to know each other and protect their communities. They also enable physical activity in many forms, which is central to healthy living.

Figure 1-3. Clockwise: Kids playing on a busy sidewalk; Neighborhood block party; Montgomery County Thanksgiving Parade

Infrastructure and Ecology

Montgomery County streets are a major part of our public infrastructure. They support utilities delivering electricity, gas, water, and communications to homes and businesses. Streets play a role in stormwater treatment, collecting and filtering rainwater. They are also a major contributor to the tree canopy, improving the environment. Street trees can reduce the urban heat island effect, provide a natural habitat and corridor for birds and insects, absorb stormwater, buffer traffic noise, and reduce the impacts from tailpipe emissions.

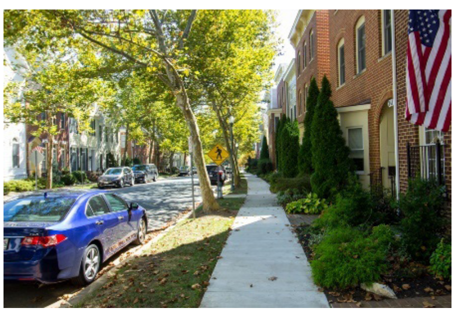


Figure 1-4. Clockwise: Rain garden, Utility lines, Street trees

Montgomery County Streets

BY THE NUMBERS

961 arterial road lane-miles

4,324 planned lane-miles of streets

266 miles of bikeways

- **122** miles of shared use paths
- **97** miles of off-street trails
- **28** miles of stream valley park trails
- **13** miles of bike lanes (including separated and contra-flow lanes)
- **11** miles of neighborhood connectors

844 miles of planned bikeways

116 miles of transitways (planned)

- includes **9** lane-miles of separated BRT transitway (currently under construction)
- and **7** lane-miles of light rail (Purple Line)
- **375** ADA-accessible Ride On buses with 22 million rides each year

ADDITIONAL FACTS

- **885** traffic signals
- **225** traffic cameras
- **1,644** miles of sidewalk
- **72,000** streetlights
- **510** bridges
- **4,600** pedestrian crossings

Figure 1-5. Montgomery County streets by the numbers

1.3 Traffic Safety and Vision Zero

Montgomery County adopted a Vision Zero resolution in 2016, making it one of the first counties in the nation to do so. Vision Zero is an approach to road safety that incorporates engineering, education, and enforcement to eliminate traffic deaths. Originating in Sweden in 1997, the Vision Zero concept has expanded to more than 40 jurisdictions across the United States. While Vision Zero policies may differ from one community to another, they generally share six common principles (from Montgomery County's Vision Zero Action Plan):

1. Transportation–related deaths and severe injuries are unacceptable and preventable.
2. Human life takes priority over mobility and other objectives of the road system. The road system should be safe for all users, for all modes of transportation, in all communities, and for people of all ages and abilities.
3. Human error is inevitable; the transportation system should be designed to anticipate error, so the consequences are not severe injury or death. Advancements in vehicle design and technology, roadway engineering, personal electronic devices, etc., are necessary components for avoiding the impacts of human errors.
4. People are inherently vulnerable, and speed is a fundamental predictor of crash survival. The transportation system should be designed for speeds that protect human life.
5. Safe human behaviors, education, and enforcement are essential contributors to a safe system.
6. Policies and practices at all levels of government need to align, making safety the highest priority for roadways.

Learn more at **montgomerycountymd.gov/visionzero/**

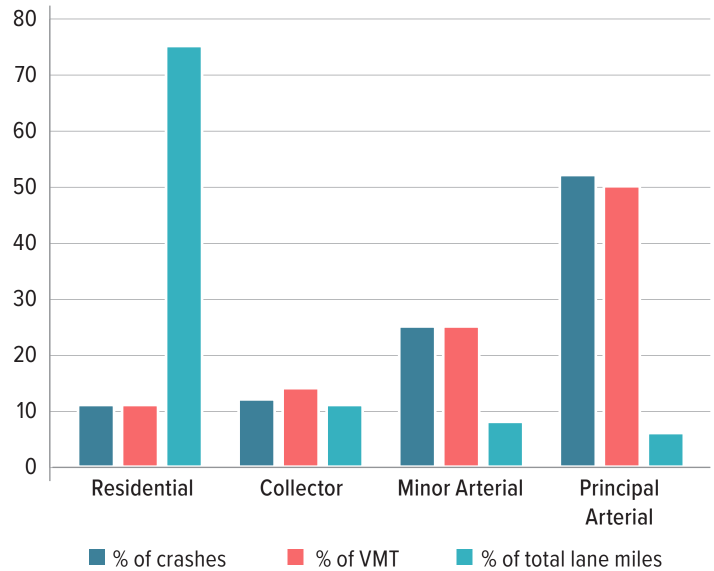
The county's Vision Zero goal is to eliminate all traffic fatalities and severe injuries by 2030. This guide is a critical step toward achieving that ambitious goal.

Montgomery County's Vision Zero program builds on the County Executive's 2008 Pedestrian Safety Initiative. That program included many policies common to Vision Zero programs today and has been successful in reducing traffic injuries, preventing an estimated 250 severe and 33 fatal collisions in the county between 2010 and 2016.[2] While there are many key takeaways from the 2017 Vision Zero Two-Year Action Plan, two findings in particular underline the importance of this Complete Streets Design Guide:

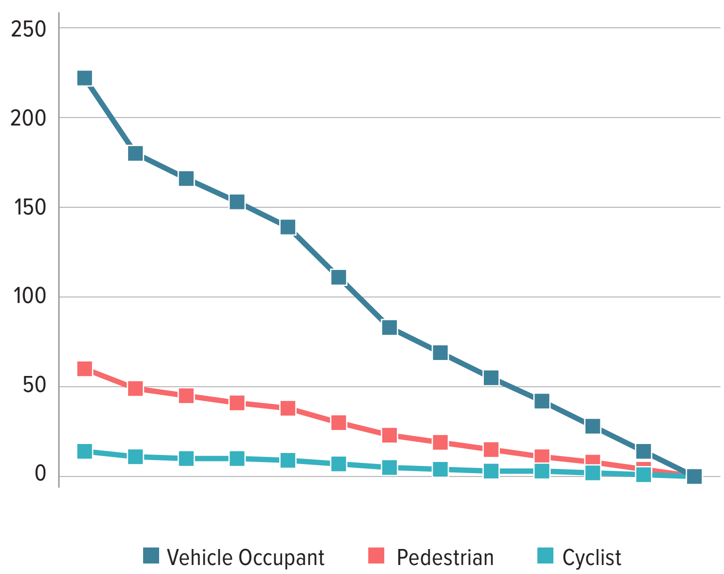
» In Montgomery County, the most severe and fatal collisions occurred on the county's principal arterial roads, which have the widest cross section, the highest traffic volumes, and the highest speeds (other than freeways).

» Nationally, traffic collisions are more common in communities with higher rates of poverty, people of color, and younger residents, making safer streets an equity issue.

52% of all severe and fatal collisions occured on principal arterial roads (highways such as Georgia Avenue and Rockville Pike). Principal arterials carried 50% of the County's traffic.



The Vision Zero Plan outlines how the County aims to reduce serious and fatal crashes each year, moving toward a target of zero by 2030.



Hispanic and Non-Hispanic Black/African American residents have a 33% higher traffic fatality compared to Non-Hispanic White residents.

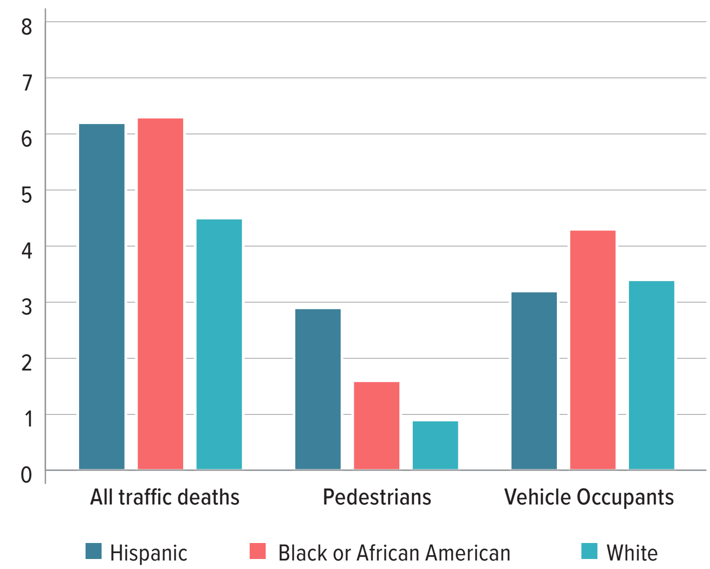


Figure 1-6. Local and national traffic crash data (Source: Montgomery County Vision Zero Plan, from Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 2011-2015 on CDC WONDER Online Database, released December 2016. **Note**: Rates for cyclist and Asian/Pacific Islander not shown due to rates that fell below the reporting threshold.)

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2 Montgomery County Vision Zero Two-Year Action Plan; Montgomery County, MD; Released 2017, https://www.montgomerycountymd.gov/visionzero/action.html

How to Use This Guide

Montgomery County developed this Complete Streets Design Guide to provide policy and design guidance to government agencies, consultants, private developers, and community groups on the planning, design, and operation of roadways for all users. This guide should be used in the following situations:

When designing future streets or reconstructed streets in an area experiencing land development

When implementing a capital improvement project, such as the construction or reconstruction of a street, intersection, or bridge

When resurfacing a street or conducting major work in the street, which may create an opportunity to reconsider some aspects of the street's design

In each of these circumstances, the guide should be used early in the roadway planning and design process to identify the default or desired dimensions and characteristics of the roadway. Recognizing that street design is complex and must respond to varied local conditions and site constraints, this guide should be used in conjunction with engineering judgement to make decisions for specific roadways. This guide does not set standards for vehicle capacity or person delay and does not replace the Subdivision Staging Policy. These guidelines are intended to evolve and adapt to incorporate new treatments and techniques as they emerge.

Montgomery County has an extensive street network and as such, many of the recommendations in this guide are meant to be implemented over time. Complete Street projects may be implemented through a major retrofit of an entire roadway, incrementally on portions of a roadway, or through small neighborhood initiatives. While some construction projects may not represent opportunities to implement the concepts in this guide (e.g., reconstruction of short segments of street due to minor utility repair or utility emergencies), the intent is that anyone involved in a project in the public right-of-way will actively seek out opportunities to design and retrofit streets in the county using this guidance. Cost and maintenance responsibilities must be considered as part of each project.

This guide establishes policy for the design of county-owned roads and private streets located in the county. For state-owned roads, this guide is intended to present the county's vision for the roadway, to serve as a starting point for collaboration between the county and Maryland Department of Transportation, State Highway Administration (MDOT SHA). This guide supplements existing manuals and standards including the **Maryland Manual on Uniform Traffic Control Devices (MdMUTCD)**,[3] guidance issued by the American Association of State Transportation Officials (AASHTO), guidance issued the National Association of City Transportation Officials (NACTO), and other state and county policies (see back cover for a list of relevant guidance and references).

3 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

The guide is organized as follows:

CHAPTER

2 presents new **Street Types** that will be used to establish design priorities and parameters for individual streets.

3 focuses on the **Active Zone,** which includes elements located between the curb and the property line.

4 presents the **Street Zone**, which covers roadway elements located between the curbs.

5 is specific to **Bikeway** design and supplements the county's Bicycle Master Plan and the Planning Department's Bicycle Facility Design Toolkit.

6 focuses on the design of **Intersections** and roadway crossings.

7 covers strategies for **Green Streets**, including street trees, rain gardens, and stormwater.

8 focuses on **Speed Management** strategies and includes a sub-section on arterial roadways.

9 is about **Implementation**, including agency roles/responsibilities and the project development process.

1.4 Applicability to State Roads

The Maryland Department of Transportation State Highway Administration (MDOT SHA) has recently developed its own planning and design resource guide for state roadways, called "Context Driven: Access and Mobility for All Users."[4] This document embraces many of the core concepts in the Complete Streets ideology, namely that context matters in providing a range of access and mobility solutions for all users. Montgomery County's guide applies to county roads and establishes a vision for State roads, though MDOT SHA's guide ultimately applies to State roads.

1.5 Applicability to Private Roads

As part of Development Review, these guidelines will form the basis for discussions with the applicant for how to proceed with their street designs.

4 https://www.roads.maryland.gov/OC/Context_Driven-Access-and-Mobility-For-All-Users.pdf

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Chapter 2:
Street Types

2.1 Overview

This chapter introduces Montgomery County's new street typology.

» Section 2.1 discusses the county's various land use contexts and explains how street types will be used to identify priorities and inform street design.

» Section 2.2 presents an overview of how the zones are defined.

» Section 2.3 presents the street design parameters to be used for each Street Type.

» Section 2.4 discusses street design in constrained rights of way and how prioritization will be used in this guide.

» Section 2.5 presents each street type and provides design guidelines.

» Section 2.6 discusses special street types also considered within this guidance.

A street typology is a commonly used method of categorizing streets based on their function and character. A Complete Street typology differs from the conventional approach to categorizing streets in two primary ways:

» Complete Street types reflect both the transportation function of a street for all travel modes and the surrounding land uses, to more holistically reflect the many functions of a street (e.g., property access, stormwater management, pedestrian and transit access, goods movement, vehicle throughput, and many others).

» Complete Street types may vary along a single street, changing based on the land use character of the surrounding area. For example, the street type for a road such as Georgia Avenue will change multiple times between the District of Columbia and Howard County based on the changing land use pattern (Figure 2-1).

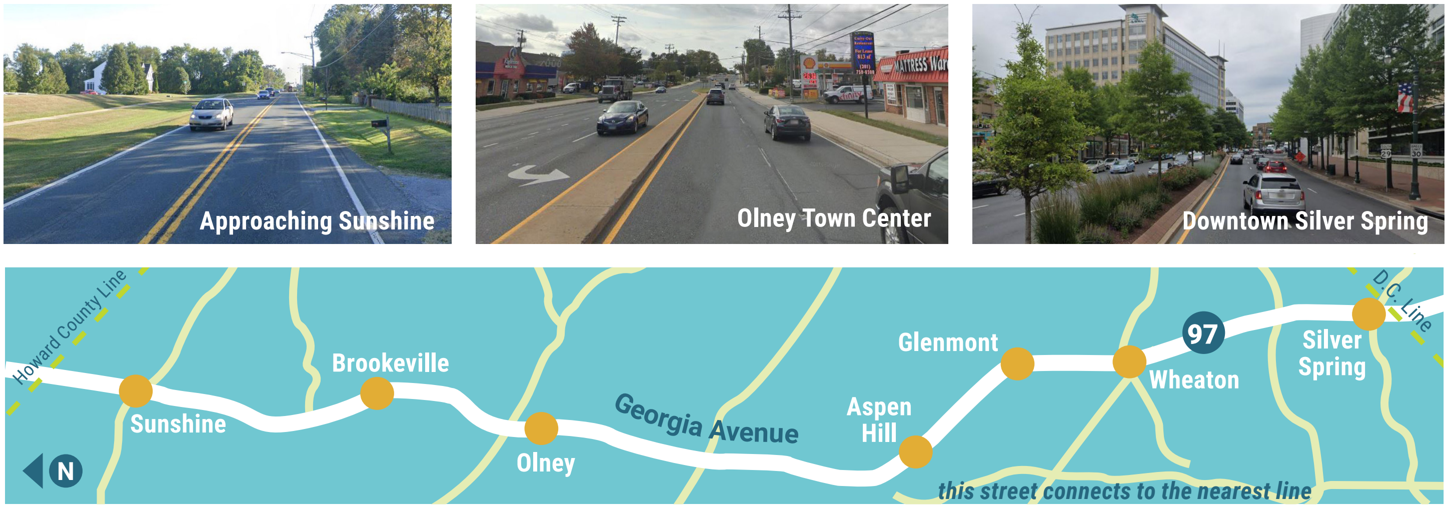

Figure 2-1. While the entirety of Georgia Avenue between Sunshine and Silver Spring is classified as an arterial per the Federal functional classification system, in the Complete Street guide Georgia Avenue will be classified with multiple street types reflecting its changing land use context and mix of users.

The Federal functional classification system promoted by the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) Green Book[5] establishes a street hierarchy based on automotive mobility and property access. It sorts streets into three primary categories: Arterials, Collectors, and Local Streets. This traditional classification system is built almost exclusively around a vehicular perspective rather than the multimodal objectives of person throughput and goods movement. In Montgomery County, the Federal functional classification will still be used; however, the context-based street types presented in this guide will serve as an overlay and supplement to the Federal functional classifications.

Currently, Montgomery County has a road classification system distinct from FHWA's Highway Classification system. FHWA's system is also used by MDOT SHA. It is the intent after the approval of these guidelines that the existing county road classifications will be replaced with these new Complete Streets classifications as part of a comprehensive update to the Master Plan of Highways and Transitways.[6]

In Montgomery County, the Federal functional classification will still be used; however, the context-based street types presented in this guide will serve as an overlay and supplement to the Federal functional classifications.

5 https://store.transportation.org/item/collectiondetail/180?AspxAutoDetectCookieSupport=01

6 https://montgomeryplanning.org/planning/transportation/highway-planning/master-plan-of-highways-and-transitways/

Land Use Context

In order to develop street types that are context-sensitive, a definition of the area context is first needed based on the master plan vision, land use, and zoning. The following area type definitions have been developed:

Downtowns are envisioned as Montgomery County's highest intensity areas including central business districts and urban centers. They are envisioned to have dense, transit-oriented development and a walkable street grid (existing or planned). These areas are envisioned to share the following characteristics:

› Identified as central business districts

› Major employment centers

› Significant consolidated area of Commercial-Residential and Employment zoning designations

› Very high levels of existing or anticipated pedestrian and bicyclist activity and Non-Auto Driver Mode Share (NADMS) goals

› Very high levels of transit service

› Street grid with high levels of connectivity

› Continuous building frontage along streets, with minimal curb cuts

› Mostly below ground or structured parking

Figure 2-2. Grand Park Avenue in North Bethesda

Town Centers are similar to Downtowns but generally feature less intense development and cover a smaller geographic area. While the Town Center area type includes a mixture of uses, it is commonly envisioned as high-to-moderate intensity residential development, including multifamily buildings and townhouses, and retail (existing or planned). These areas are envisioned to generally share the following characteristics:

- Identified as a regional or neighborhood-serving retail nodes with housing and other uses
- Zoning includes Commercial Residential, Commercial Residential Town, Commercial Residential Neighborhood, Residential Multi-Unit and lower intensity Employment zoning designations[6]
- Medium to high levels of pedestrian and bicyclist activity and NADMS goals
- Medium levels of existing or planned transit service
- A street grid that ties into the surrounding streets
- Continuous building frontage along streets, with some curb cuts
- A mixture of structured and underground parking as well as surface lots

The Suburban area type is envisioned as low-to-moderate intensity residential development. These areas are envisioned to generally share the following characteristics:

- Consolidated area of single-unit residential development
- Zoning includes Residential detached, Residential Multi-Unit and Residential-Townhouse designations[6]
- May include isolated retail establishments
- Medium to low levels of pedestrian and bicyclist activity
- Medium to low levels of transit service, except along transit corridors
- A low-intensity grid network or a pattern of cul-de-sacs
- Buildings front the streets but may be set back, curb cuts may exist to access individual addresses
- Structured parking is encouraged, but mostly surface parked

Figure 2-3. Century Boulevard in Germantown

Figure 2-4. MD Route 355 near Cider Mill

The Industrial area type is a unique area where employment and industrial uses are the primary activities. These areas often have higher densities of development but maintain lower to moderate levels of bicycle and pedestrian activity. The Industrial area type has the following characteristics:

- Medium intensity development, primarily focused around warehousing, light manufacturing, trucking, and equipment repair
- Small amounts of residential and retail may be allowed, but is not the norm
- Zoning includes Industrial designations zones[6]
- Low to moderate levels of pedestrian and bicycle activity
- Moderate levels of transit service
- Traditionally wider streets that accommodate high levels of truck traffic
- Many existing curb-cuts along the street edge

» **The Country area** type comprises the least dense portions of the county, with land uses of low intensity residential and agriculture. The Country area shares many of the following characteristics:

- Low intensity large-lot single family dwellings, forests, or agricultural uses
- Uses may also infrequently include institutional uses or small-scale commercial uses
- Little to no availability of public water or sewer infrastructure
- Zoning includes various residential, rural residential and residential detached zones[7]
- Low levels of pedestrian and bicycle activity
- Low levels of transit service
- Little or no grid pattern to streets, rather the development pattern is concentrated along existing roadways or short cul-de-sacs
- Many buildings have little to no direct relationship to the street frontage

Figure 2-5. Gaither Road near Gaithersburg

Figure 2-6. Barnesville Road in Boyds

7 https://montgomeryplanning.org/development/zoning/

How Street Types are Used to Inform Street Design

The street types presented here were developed to help guide future street construction and reconstruction projects based on the planned vision for the roadway. They are intended to help guide *future* street designs and roadway projects. These street types will ultimately be applied to streets in the county through master plans, including an update to the Master Plan of Highways and Transitways[5] and area master plans.[8] When a road is resurfaced or reconstructed, or when new roads are built, the street type designation will inform design characteristics including design speed, lane widths, protected crossing spacing, appropriate bikeway types, and more. A Complete Streets approach does not require that transit and/or bicycling are prioritized on every street. Specific accommodations for these modes will be determined in the county's master plans; however, a Complete Streets approach will result in a transportation network that is safe and convenient for all users, regardless of mode. Subsequent chapters of this guide offer additional guidance on how different elements of the public realm such as roadways, sidewalks, intersections, and curbside uses should function on each street type.

Implementation of the Complete Streets Design Guide will require a comprehensive update to the Master Plan of Highways and Transitways (MPOHT). All roads now in the MPOHT would need to be re-evaluated using the new Street Types presented in the Complete Streets Design Guide. Proposed re-classifications would be recommended and presented to the public and the Planning Board though a detailed public involvement process. This guide alone will not initiate changes to existing right of way widths. Finalized recommendations would then undergo County Council review and approval. Once approved and adopted, county agencies, including the Montgomery County Planning Department, would modify existing review and design policy and standards using the Complete Streets Design Guide.

Other county documents, including County Code Chapter 49 and Chapter 50, the Zoning Code, and others will need to be revised to comply with this guidance.

Montgomery County's Street Types

- Downtown Boulevards
- Downtown Street
- Boulevards
- Town Center Boulevards
- Town Center Streets
- Neighborhood Connectors
- Neighborhood Streets
- Neighborhood Yield Streets
- Industrial Streets
- Country Connectors
- Country Roads
- Major Highways

Special Street Types

In addition to the primary street types listed above, this guide also addresses a few additional street types that occur less frequently under special circumstances:

- Alleys
- Rustic Roads / Exceptional Rustic Roads
- Shared Streets

8 https://montgomeryplanning.org/planning/master-plan-list/

2.2 Zones Defined

For all zones defined, it is critical to understand some basic definitions, as they will be used in this and later chapters in this document. As shown in Figure 2-7, the street Right of Way will be composed of two zones, the Street Zone and the Active Zone.

The **Street Zone** contains all uses that are typically between the curbs or edges of pavement, including travel lanes, transitway lanes, a median, on-street parking, and on-street bike lanes. More descriptions of each of the sub-zones and allowable standards are provided in Chapter 4: Street Zone.

The **Active Zone** is so-named as it contains all active transportation uses (pedestrians and usually bicyclists) and includes a maintenance buffer, a frontage zone, sidewalks or sidepaths, separated bike lanes, and several types of buffers. More descriptions of each of the sub-zones and allowable standards are provided in Chapter 3: Active Zone.

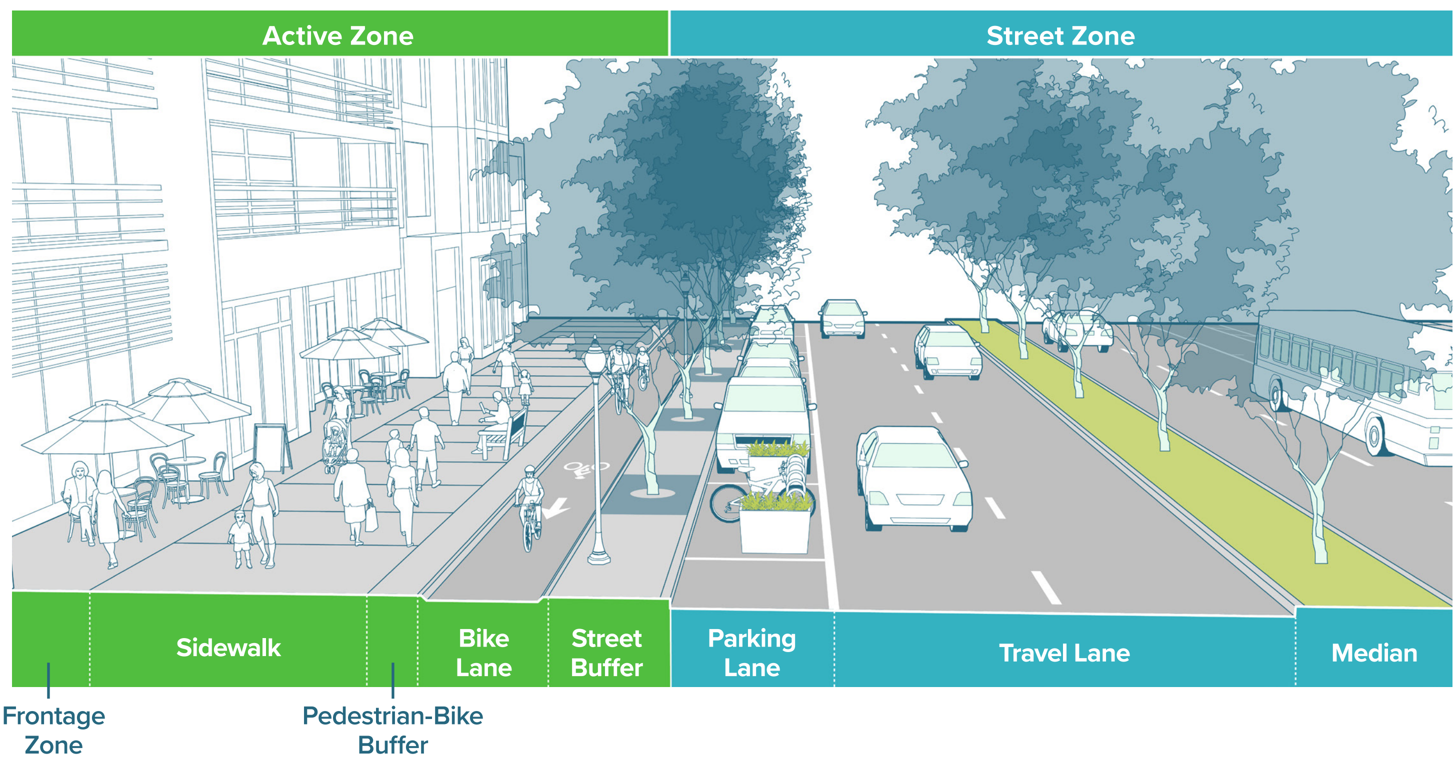

Figure 2-7. Zones Defined

Vehicular travel always occurs in the Street Zone and pedestrian travel almost always takes place in the Active Zone (except at crossings and on Shared Streets, as described later in this Chapter). However, bicycles may be located in either the Street Zone or the Active Zone as shown in the following examples:

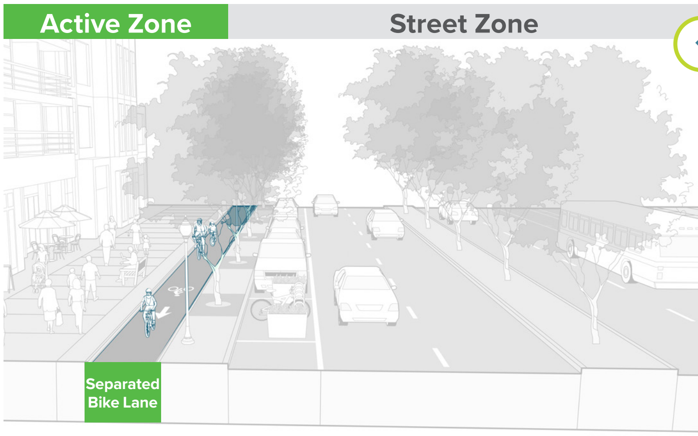

Figure 2-8. Separated Bike Lane

1 **Separated bike lanes** are in the Active Zone, separated from the sidewalk (pedestrian space) by a Pedestrian-Bike Buffer and from the Street Zone by a Street Buffer.

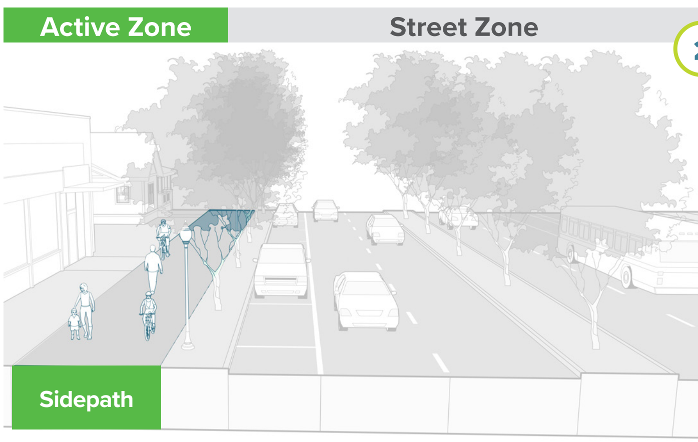

Figure 2-9. Sidepath

2 **Sidepaths** (which are shared by people bicycling and walking) are in the Active Zone, separated from the adjoining land uses by a Maintenance Buffer and from the Street Zone by a Street Buffer.

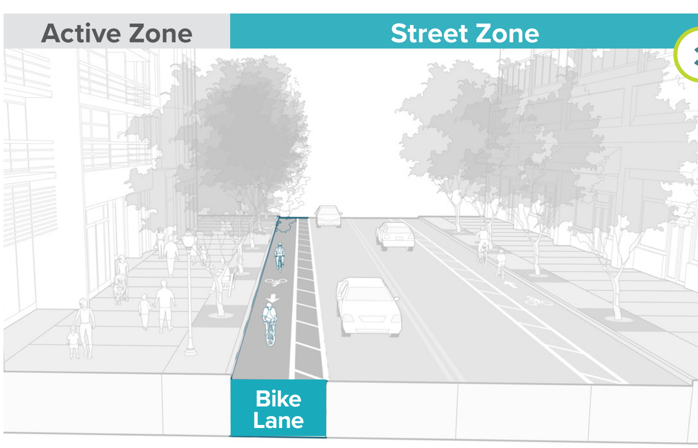

Figure 2-10. On-Street Bike Lane

3 **On-Street bike lanes or bikeable shoulders** are in the Street Zone, located adjacent to travel lanes or, in some instances, between on-street parking and the curb. The bike lanes can be buffered, conventional, or advisory bike lanes.

More descriptions on the design of bikeways are provided in Chapter 5: Bikeways.

2.3 Street Design Parameters

Figure 2-12 is meant as a quick reference for the design guidance that is explained throughout the rest of this guide. This guidance provides a starting point for design decisions on new roads that, when used alongside functional and area master plans, gives designers guidance on the key elements of street design that are essential to delivering safe Complete Streets. If guidance in this document conflicts with approved streetscape standards and/or design guidance: contact the M-NCPPC or MCDOT for clarification. Master planned right of way is determined by the Master Plan of Highways and Transitways[9] and is the minimum width required, not including additional needs such as those at intersections or in the vicinity of transit stations.

1. All roads should meet AASHTO standards, recognizing that AASHTO allows for flexibility; see FHWA Achieving Multimodal Networks[10] and NACTO Street Design Guides[11].
2. Reference the Montgomery County Fire Code[12] and Montgomery County Fire and Emergency Access Performance-Based Design Guidance[13] for details on required clear widths.
3. Targets for speeds, maximum spacing for protected pedestrian crossings, minimum spacing for signalized intersections, and other items in this document are instructive for new developments and can provide a guide for stand-alone Capital Improvements Projects that retrofit existing or create new infrastructure.
4. All figures are provided as a starting point for discussion. If more than 8 percent of vehicles are large trucks or other heavy vehicles, or if other special local circumstances apply, different dimensions may be appropriate. Consult with MCDOT.
5. Master Plans and approved streetscape guidelines may supersede this document.

Note: For intersection guidance presented in this document, if the intersecting streets are different street types (e.g., at the intersection of a Boulevard and a Town Center Boulevard), use the guidance for the street type with the higher design speed.

Definitions used for dimensions in this Guide

Default: the standard dimension that is expected in most cases. If it is not used, designers must provide evidence to prove that it is infeasible.

Preferred: the desired dimension, where feasible.

Minimum: nothing lower than this dimension will be accepted, except in very rare circumstances via a formal exception.

Figure 2-11. Dimension definitions

9 https://montgomeryplanning.org/planning/transportation/highway-planning/master-plan-of-highways-and-transitways/

10 https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/multimodal_networks/

11 https://nacto.org/publication/urban-street-design-guide/

12 https://www.montgomerycountymd.gov/DPS/Codes/FPCC-Codes-Index.html

13 https://montgomeryplanning.org/planning/functional-planning/fire-department-access-performance-based-design-guide/

Figure 2-12. Design Elements for Street Types

Item	Note
Target Speed (MPH)	Target Speeds are the desired operating speed for a roadway facility. These speeds are based on safe operations, and are tailored to the functionality and context of the roadway. Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles are considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law.[14]
Maximum # of Vehicle Through Lanes	This provides guidance primarily for the development of master plans or for non-master planned roads in considering their number of travel lanes.
Maximum Spacing for Protected Crossings	These target distances are intended to ensure that protected pedestrian crossings are located at reasonable intervals.
Generally Accepted Minimum Spacing for Signalized Intersections	These target distances are intended to maintain operations at a level that promotes safe movement by all travel modes.
Center Median	Located at the center of the roadway and often landscaped, these may include left-turn lanes within them or may be replaced by Dedicated Transitways.
Dedicated Transitway	The presence of a Dedicated Transitway is determined in the Master Plan of Highways and Transitways.
Left Turn Lane	These are vehicular travel lanes used specifically to turn left, and may be co-located within the Center Median.
2-Way Left Turn Lane	These lanes allow both directions of traffic to use the same lane for left-turns.
Inside Travel Lane	These are the travel lanes that are not along the outside curb or edge of pavement.
Outside Travel Lane	In general: this is the rightmost vehicular travel lane in each direction. These include the lane along the outside curb, edge of pavement, or alongside outside parking lanes or on-street bikeways.
Parking Lane	Parking Lanes are used for on-street parking.
Shoulder	Shoulders provide a buffer from the edge of the road, and may also serve to provide bicycle accommodations as well as parking.
Street Buffer	The Street Buffer is the space that separates the Street Zone from the Bikeway (if provided) or Sidewalk / Sidepath. It will often include things like landscaping, utility poles, benches, and parking meters.
Bikeway	The default bikeway types for each street type apply to streets without master planned bikeways. For corridors designated as Breezeways, see additional guidance in the Bicycle Master Plan.
Pedestrian-Bike (a.k.a. Ped/Bike) Buffer	When the Bikeway consists of separated bike lanes, the Ped/Bike Buffer provides horizontal separation between the Bikeway and the Sidewalk. Not required on all streets and could be a design feature such as a row of bricks, small plantings, or a row of trees.
Sidewalk / Sidepath	The Sidewalk and Sidepath are areas where pedestrians are generally going to be traveling, and Sidepaths are specifically designed to also enable bicycle use. This element is intended to be free of obstructions and promote ease of navigation.
Frontage Zone	Frontage Zones promote the interaction of adjacent land uses (such as buildings) with the Sidewalk / Sidepath. They are not required on all streets.
Maintenance Buffer Zone	Maintenance Buffers allow for the upkeep of the public right-of-way, particularly adjacent Sidewalks / Sidepaths.

14 https://law.justia.com/codes/maryland/2018/transportation/title-21/subtitle-8/section-21-803/

2.4 Street Design in Constrained Rights of Way

In places with constrained rights of way, it is not always feasible to include every desired design element or preferred width in the street cross section. The most common examples of constrained rights of way are historic districts, environmental areas (special protection areas, steep slopes, critical habitat, wetland, floodplain), bridges, other major structures, or constraints established by master plans. In areas like these, some cross section elements may be eliminated, and some may be reduced to minimum dimensions. While there may be trade-offs between different design elements or travel modes, the street design should always encourage active transportation options such as bicycling and walking.

Guidance is provided in this document (by street type) on whether specific street design features are desired or appropriate. The letters in the table designate street design elements as High (H), Medium (M), or Low (L) priority. Designations are relative to other street elements (i.e., a low priority does not mean the element is not important to include when feasible).

The guidance on priorities is intended as a starting point for conversations between roadway designers and the community as part of individual corridor or street design efforts. Ultimate dimensions are context-specific and will be finalized through a case-by-case review and design process.

Design guidance presented in master plans for specific streets may supersede the information presented here. Elements may potentially be completely eliminated if not defined as required by the guidance in subsequent sections or by master plans, with any such eliminations being similarly considered based on each element's priority.

2.5 Montgomery County Street Types

This section contains detailed information on street design parameters and guidance for each street type. The content describes the ***future*** conditions that are envisioned for each street type in Montgomery County.

The following information is provided for each street type:

1. A street type description and highlight of key distinguishing characteristics.
2. A cross-section graphic showing an example of a typical section. The graphics present desired, future conditions and planned land uses from master plans, not present-day conditions. Not all allowable street elements are shown.
3. Corridor examples within Montgomery County of where this new street type is likely to occur.
4. Detailed figures providing design guidance for corridor design parameters, cross section design parameters, and street design features.

The street types and associated design guidance presented in this section will inform future design decisions made as part of capital projects, redevelopment, and resurfacing.

A. Downtown Boulevards

These are Montgomery County's highest intensity streets – with a bustling mix of vehicle traffic, dense development, walking, bicycling, and transit. Downtown Boulevards are located in central business districts and urban centers. Buildings are located close to the street and offer a blend of places to live, work, shop, and visit. Because Downtown Boulevards carry significant vehicle traffic that operates in potential conflict with high numbers of pedestrians and bicyclists, reducing vehicle speeds is essential to safety. Downtown Boulevards are typically located in areas that have specific design requirements for finishes, materials, furnishings, and lighting. Achieving slower speeds will also require a transition area or zone that extends into adjacent Boulevards.

Key Features:

» **Development intensity**: High-intensity, mixed-use development

» **Pedestrian and bicycle activity**: High

» **Vehicle activity**: High

» **Transit service**: Frequent

» **On-street parking**: Provided in some locations, where feasible

» **Other key features**: Street furniture, street trees, wayfinding, and other streetscape features

FZ Frontage Zone

SW Sidewalk

PB Pedestrian-Bike Buffer

BL Bike Lane

SB Street Buffer

TV Travel Lane

TL Transit Lane

TB Transit Buffer

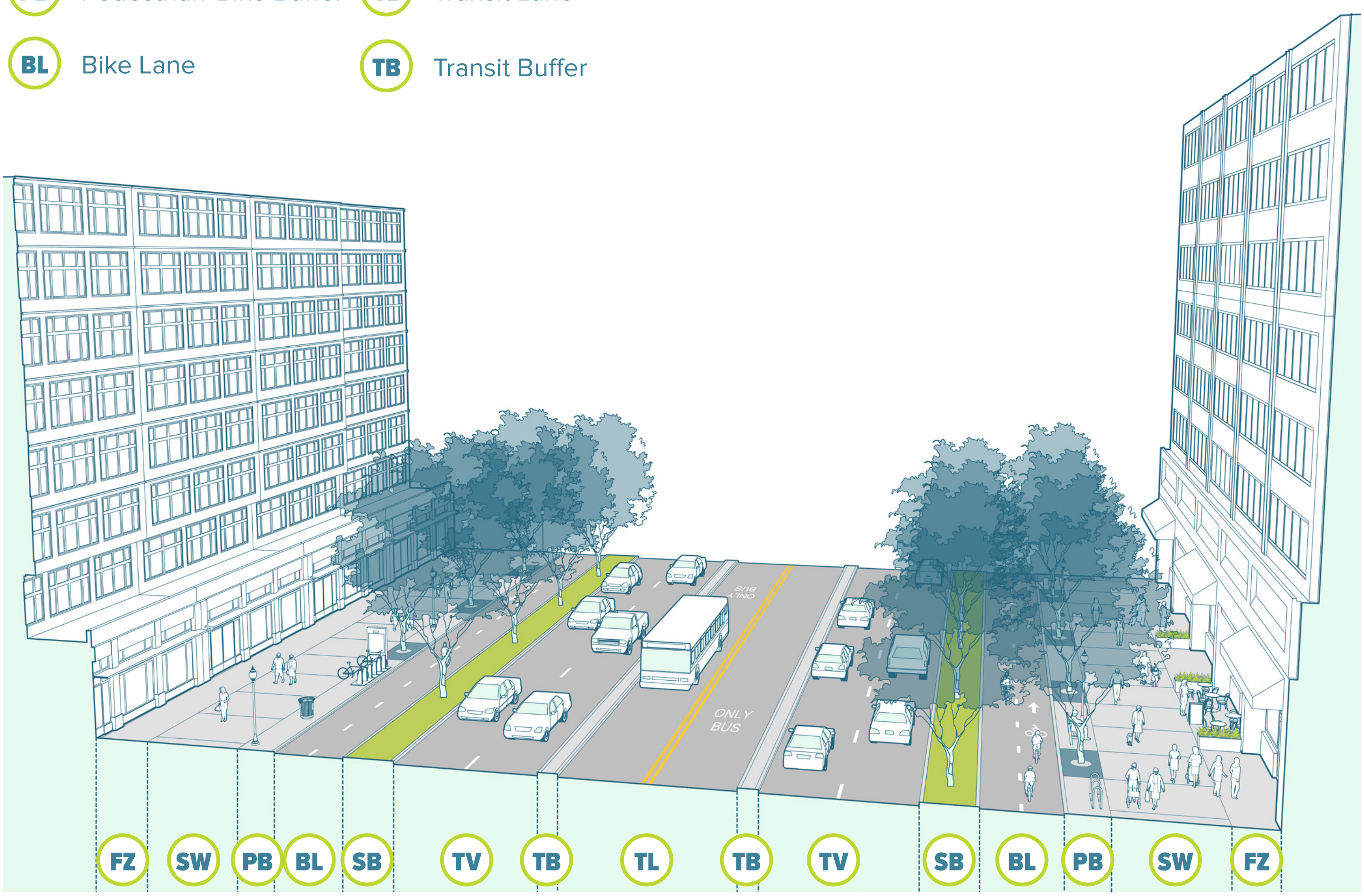

Figure 2-13. DowntownBoulevard

Downtown Boulevard Examples

Figure 2-14. Georgia Avenue (MD Route 97) in Downtown Wheaton

Figure 2-15. Rockville Pike (MD Route 355) near White Flint

Figure 2-16. Wisconsin Avenue in Downtown Bethesda

Downtown Boulevards – Street Design Parameters and Priorities

Below, Figure 2-17 presents a summary of Corridor Design Parameters to be used for Downtown Boulevards. Figure 2-18 presents a summary of Cross Section Design Parameters to be used for Downtown Boulevards. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-17. Corridor Design Parameters for Downtown Boulevards

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	25 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law.	246
Maximum # of Vehicle Through Lanes	6	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	400'	Site-specific needs and conditions will dictate actual implementation.	218
Generally Accepted Minimum Spacing for Signalized Intersections	400'	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-18. Cross Section Design Parameters and Prioritization for Downtown Boulevards

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Recommended 6'-16'	M	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. If the street is planned for a median transitway: transit lane dimensions supersede. Consult MCDOT for detailed info.	151
Dedicated Transitway	Transitway lanes: 13' default, 12' min Transitway buffer: 6' default, 2' min	M	The presence of a dedicated transitway is determined in the Master Plan of Highways and Transitways. If these dimensions vary from those provided in a specific Transitway planning process, those dimensions supersede this document. Dimensions may vary at stations, intersections & other crossing points, and along horizontal curves.	150
Left-Turn Lane	10' default, 9' min	M	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	N/A	N/A	Two-Way Left-Turn Lanes are not appropriate along this street type.	147
Inside Travel Lane	10'	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-18 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	11’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8’	L	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	8’ default, 6’ min	H	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width. Where a lane within the Street Zone is converted to a street-level separated bike lane, the Street Buffer may be reduced to 3’ only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	Two-way SBL on both sides of street. Each SBL: 11’ default, 8’ min	H	SBL = Separated Bike Lane. Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6’ default, 2’ min	M	Provided only if a separated bike lane is provided.	167
Sidewalk	15’ default, 10’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	10’ default, 0’ min	M	Some or all of the frontage zone may occur on private property.	119
Maintenance Buffer	0’	N/A	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line, a maintenance buffer is required even if this table shows a dimension of 0’.	107

Downtown Boulevards – Street Design Features

Figure 2-19 provides a summary of Downtown Boulevard street design features in four different categories and identifies what features are required, recommended, optional, and not permitted. The only design feature specifically not permitted for Downtown Boulevard are traffic diverters.

Figure 2-19. Street Design Features for Downtown Boulevards

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

Zone	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	■	234
	Green Infrastructure/Rain Gardens	■	239
	Seating	■	111
	Bicycle Parking	■	112
	Recycling/Trash Receptacles	▲	110
	Plazas/Parklets	▲	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	■	113
	Pedestrian-Scale Lighting	■	130
	Pedestrian/Bicycle Wayfinding	▲	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	▲	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	▲	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	O	250
	Speed Humps/Cushions	O	252
	Speed Tables/Raised Crosswalks	O	253
	Raised Intersections	O	253
	Curb Extensions/Bulb Outs	▲	253
	Neckdowns/Chokers	▲	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	▲	254
	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	■	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	■	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
	Loading/Pick-up and Drop-off Zones	▲	145
	Accessible Parking	▲	141
	Carshare Parking	▲	142
	E/V Charging Stations	▲	142

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B. Downtown Streets

Downtown Streets are also found in bustling, mixed-use and commercial areas; however, the building heights tend to be lower than on Downtown Boulevards. Downtown Streets are often the side streets in busy commercial areas that connect to Downtown Boulevards. Because of the density of shops and other destinations located on these streets, pedestrian and bicycle volumes are high. Buildings are oriented close to the street, and on-street parking is currently common. Downtown Streets are typically located in areas that have specific design requirements for finishes, materials, furnishings and lighting.

- **FZ** Frontage Zone
- **SW** Sidewalk
- **PB** Pedestrian-Bike Buffer
- **BL** Bike Lane
- **SB** Street Buffer
- **P** Parking Lane
- **TV** Travel Lane

Key Features:

» **Development intensity**: Moderate- or high-intensity, mixed-use development

» **Pedestrian and bicycle activity**: High

» **Vehicle activity**: Moderate

» **Transit service**: Moderate or frequent

» **On-street parking:** Provided on some block faces

» **Other key features**: Loading zones for deliveries, street trees, street furniture, wayfinding, and other streetscape features

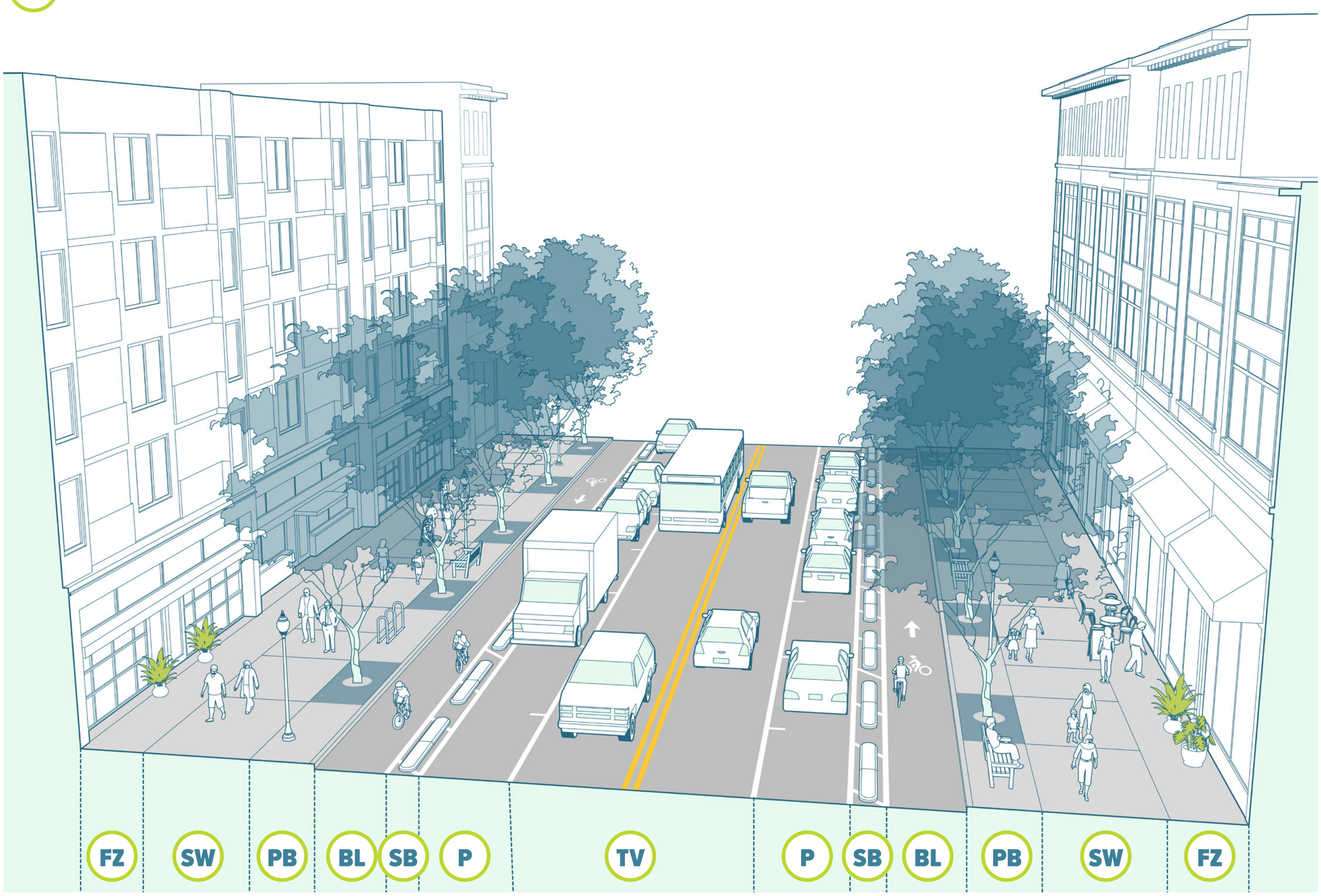

Figure 2-20. Downtown Street

Downtown Street Examples

Figure 2-21. Fenton Street in Downtown Silver Spring


Figure 2-22. Nicholson Lane in White Flint

Figure 2-23. Grandview Avenue in Downtown Wheaton

Downtown Streets – Street Design Parameters and Priorities

Below, Figure 2-24 presents a summary of Corridor Design Parameters to be used for Downtown Streets. Figure 2-25 presents a summary of Cross Section Design Parameters to be used for Downtown Streets. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-24. Corridor Design Parameters for Downtown Streets

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	20 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law.	246
Maximum # of Vehicle Through Lanes	4	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	400'	Site-specific needs and conditions will dictate actual implementation.	218
Generally Accepted Minimum Spacing for Signalized Intersections	400'	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-25. Cross Section Design Features for Downtown Streets

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Optional 6'-10'	L	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. If the street is planned for a median transitway: transit lane dimensions supersede. Consult MCDOT for detailed info.	151
Dedicated Transitway	Transitway lanes: 13' default, 12' min Transitway buffer: 6' default, 2' min	M	The presence of a dedicated transitway is determined in the Master Plan of Highways and Transitways. If these dimensions vary from those provided in a specific Transitway planning process, those dimensions supersede this document. Dimensions may vary at stations, intersections & other crossing points, and along horizontal curves.	150
Left-Turn Lane	10' default, 9' min	M	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	10'	N/A	Only appropriate under limited circumstances.	147
Inside Travel Lane	10'	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-25 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	10.5’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8’	M	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	6’ (11’ if shared w/ street parking)	H	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width. Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3’ only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	One-way SBL: 6.5’ default, 5’ min	H	SBL = Separated Bike Lane. Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6’ default, 2’ min	M	Provided only if a separated bike lane is provided.	167
Sidewalk	10’ default, 8’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	10’ default, 0’ min	M	Some or all of the frontage zone may occur on private property.	119
Maintenance Buffer	0’	N/A	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line, a maintenance buffer is required even if this table shows a dimension of 0’.	107

Downtown Streets – Prioritizing Street Design Features

Figure 2-26 provides a summary of Downtown Street design features in four different categories and identifies what features are required, recommended, optional, and not permitted. The only design feature specifically not permitted for Downtown Streets are traffic diverters.

Figure 2-26. Street Design Features for Downtown Streets

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board
[1] Engineering judgement needed – see Chapter 6: Intersections for details
[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.
[3] Narrowing lanes down to default dimensions for street type

Zone	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	■	234
	Green Infrastructure/Rain Gardens	■	239
	Seating	■	111
	Bicycle Parking	■	112
	Recycling/Trash Receptacles	▲	110
	Plazas/Parklets	▲	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	■	113
	Pedestrian-Scale Lighting	■	130
	Pedestrian/Bicycle Wayfinding	▲	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	▲	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	▲	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	O	250
	Speed Humps/Cushions	O	252
	Speed Tables/Raised Crosswalks	▲	253
	Raised Intersections	▲	253
	Curb Extensions/Bulb Outs	▲	253
	Neckdowns/Chokers	▲	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	O	254
	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	■	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	■	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
	Loading/Pick-up and Drop-off Zones	▲	145
	Accessible Parking	▲	141
	Carshare Parking	▲	142
	E/V Charging Stations	▲	142

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C. Boulevards

Boulevards are critical roadways that typically connect employment and entertainment centers, civic, commercial, and institutional land uses and may also provide cross-county and regional connections. Some buildings are positioned close to the street, while others are set back. These streets are currently dominated by motor vehicle traffic and have less pedestrian and bicycle activity compared to Downtown Streets and Downtown Boulevards; however, much of the walking on these streets is to access frequent transit service. Street design for Boulevards emphasizes safety for pedestrians and bicyclists by managing vehicle speeds, improving access management, and providing comfortable and continuous sidewalks and bikeways, frequent opportunities for pedestrians and bicyclists to safely cross the street, and separation from high speeds and volumes of traffic.

Key Features:

- **Development intensity**: Moderate to low-intensity mixed-use, retail, or residential development
- **Pedestrian and bicycle activity**: Moderate
- **Vehicle activity**: Moderate to high volume of personal vehicles
- **Transit service**: Frequent
- **On-street parking**: Uncommon, though provided in some instances
- **Other key features**: Infrequent driveways, street trees

MB Maintenance Buffer

SP Sidepath

SB Street Buffer

TV Travel Lane

TB Transit Buffer

TL Transit Lane

FZ Frontage Zone

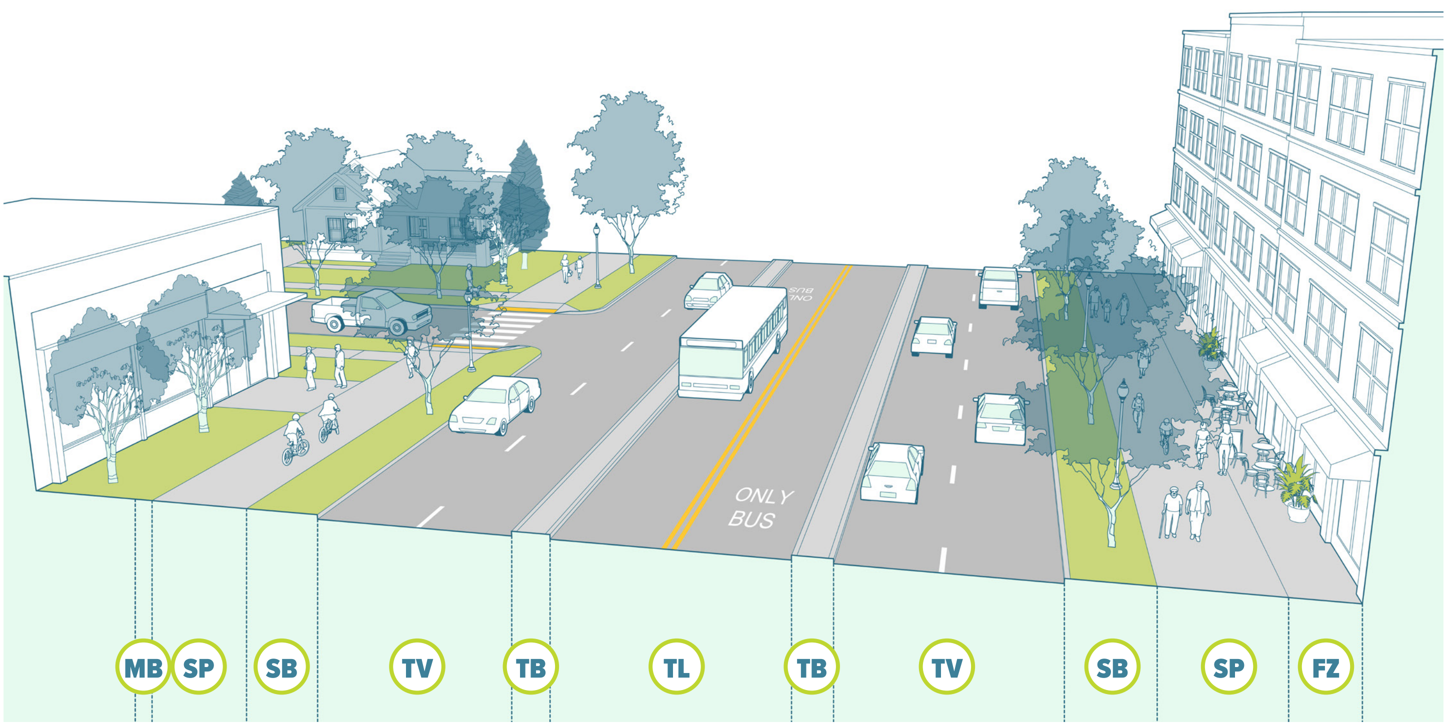

Figure 2-27. Boulevard

Boulevard Examples

Figure 2-28. Observation Drive between Germantown Road and Woodcutter Drive

Figure 2-29. East-West Highway (MD Route 410) between Montgomery Avenue and Rosemary Hills Drive

Figure 2-30. Randolph Road between Colie Drive and Georgia Avenue

Boulevards – Street Design Parameters and Priorities

Figure 2-31 presents a summary of Corridor Design Parameters to be used for Boulevards. Figure 2-32 presents a summary of Cross Section Design Parameters to be used for Boulevards. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-31. Corridor Design Parameters for Boulevards

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	35 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law.	246
Maximum # of Vehicle Through Lanes	6	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	800'-1600'	Site-specific needs and conditions will dictate actual implementation. On streets with operating speeds of 30 mph or more, "protected" crossings include: Traffic/pedestrian signal or HAWK, all-way stop control, or grade-separated crossing.	218
Generally Accepted Minimum Spacing for Signalized Intersections	1300'	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-32. Cross Section Design Parameters for Boulevards

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Recommended 6'-16'	M	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. If the street is planned for a median transitway: transit lane dimensions supersede. Consult MCDOT for detailed info.	151
Dedicated Transitway	Transitway lanes: 13' default, 12' min Transitway buffer: 6' default, 2' min	M	The presence of a dedicated transitway is determined in the Master Plan of Highways and Transitways. If these dimensions vary from those provided in a specific Transitway planning process, those dimensions supersede this document. Dimensions may vary at stations, intersections & other crossing points, and along horizontal curves.	150
Left-Turn Lane	10'	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	N/A	N/A	Two-Way Left-Turn Lanes are not appropriate along this street type.	147
Inside Travel Lane	10'	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-32 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	11’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8’	L	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	8’ default, 6’ min Open Section: 15’ default, 9’ min	H	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width. Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3’ only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	Sidepaths on both sides of the street: 11’ default, 8’ min	H	SBL = Separated Bike Lane. Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6’ default, 2’ min	M	Provided only if a separated bike lane is provided.	167
Sidepath	11’ default, 8’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	7’ default, 0’ min	L	Some or all of the frontage zone may occur on private property.	119
Maintenance Buffer	2’	L	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line, a maintenance buffer is required even if this table shows a dimension of 0’.	107

Boulevards – Prioritizing Street Design Features

Figure 2-33 provides a summary of Boulevard design features in four different categories and identifies what features are required, recommended, optional, and not permitted. The design features specifically not permitted for Boulevards are speed humps/cushions, speed tables/raised crosswalks, raised intersections, and traffic diverters.

Figure 2-33. Street Design Features for for Boulevards

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

Zone	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	■	234
	Green Infrastructure/Rain Gardens	■	239
	Seating	O	111
	Bicycle Parking	O	112
	Recycling/Trash Receptacles	O	110
	Plazas/Parklets	O	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	O	113
	Pedestrian-Scale Lighting	■	130
	Pedestrian/Bicycle Wayfinding	▲	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	▲	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	▲	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	O	250
	Speed Humps/Cushions	X	252
	Speed Tables/Raised Crosswalks	X	253
	Raised Intersections	X	253
	Curb Extensions/Bulb Outs	▲	253
	Neckdowns/Chokers	▲	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	O	254
	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	■	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	O	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
	Loading/Pick-up and Drop-off Zones	O	145
	Accessible Parking	O	141
	Carshare Parking	O	142
	E/V Charging Stations	O	142

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D. Town Center Boulevards

Town Center Boulevards are located in smaller activity centers. Whereas Downtown Boulevards are compact places with continuous building frontages along the street, Town Center Boulevards are more likely to have some buildings close and others set back from the street behind lawns or planted areas. Development density will be more varied, ranging from high- to medium-intensity. Town Center Boulevards will typically transition to Boulevards on both ends, and may occur when a Boulevard enters a Bicycle and Pedestrian Priority Area (BiPPA). For this reason, street design should include elements that slow vehicle traffic, facilitate safe crossings and transit access for pedestrians, and provide visual cues to drivers that more pedestrian and bicyclists may be present. Achieving slower speeds will also require a transition period that extends into Boulevards.

Key Features:

» **Development intensity**: Moderate- to high-intensity, mixed-use or multifamily residential development

» **Pedestrian and bicycle activity**: High to moderate

» **Vehicle activity**: Moderate to high volumes of personal vehicles

» **Transit service**: Frequent

» **On-street parking:** Varies/ provided in some instances

» **Other key features**: Moderate frequency of driveways, street trees

FZ Frontage Zone

SW Sidewalk

PB Pedestrian-Bike Buffer

BL Bike Lane

P Parking Lane

TV Travel Lane

M Median

SB Street Buffer

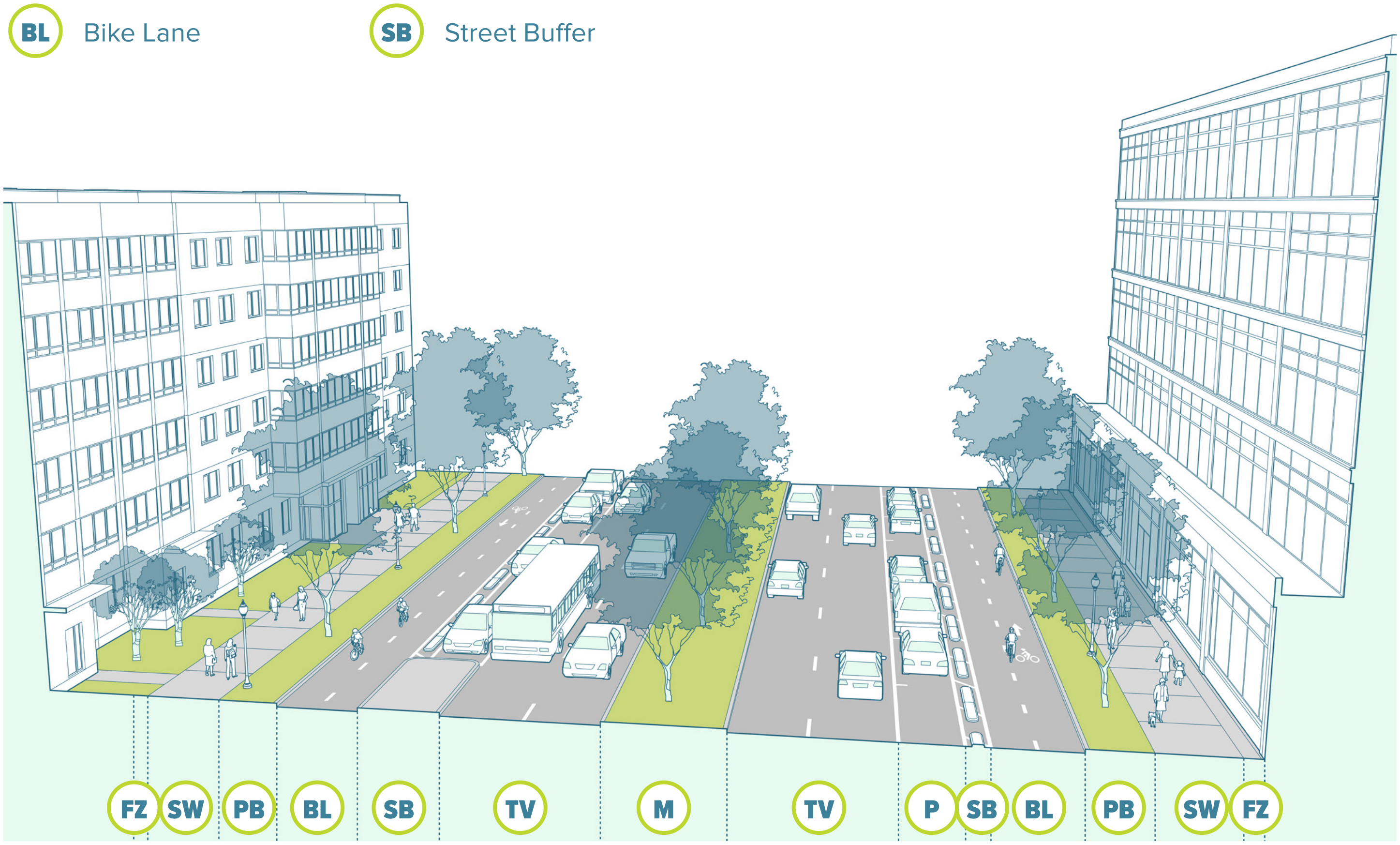

Figure 2-34. Town Center Boulevard

Town Center Boulevard Examples

Figure 2-35. Connecticut Avenue in Aspen Hill

Figure 2-36. Veirs Mill Road (MD Route 586) between Havard Street and Connecticut Avenue

Figure 2-37. River Road in Westbard

Town Center Boulevards – Street Design Parameters and Priorities

Figure 2-38 presents a summary of Corridor Design Parameters to be used for Town Center Boulevards. Figure 2-39 presents a summary of Cross Section Design Parameters to be used for Town Center Boulevards. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-38. Corridor Design Parameters for Town Center Boulevards

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	30 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law. In Urban Areas, streets that are already 25 MPH will retain that target/posted speed.	246
Maximum # of Vehicle Through Lanes	6	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	600'	Site-specific needs and conditions will dictate actual implementation. On streets with operating speeds of 30 mph or more, "protected" crossings include: Traffic/ pedestrian signal or HAWK, all-way stop control, or grade-separated crossing.	218
Generally Accepted Minimum Spacing for Signalized Intersections	600'	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-39. Cross Section Design Features and Prioritization for Town Center Boulevards

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Recommended 6'-16'	M	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. If the street is planned for a median transitway: transit lane dimensions supersede. Consult MCDOT for detailed info.	151
Dedicated Transitway	Transitway lanes: 13' default, 12' min Transitway buffer: 6' default, 2' min	M	The presence of a dedicated transitway is determined in the Master Plan of Highways and Transitways. If these dimensions vary from those provided in a specific Transitway planning process, those dimensions supersede this document. Dimensions may vary at stations, intersections & other crossing points, and along horizontal curves.	150
Left-Turn Lane	10'	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	N/A	N/A	Two-Way Left-Turn Lanes are not appropriate along this street type.	147
Inside Travel Lane	10'	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-39 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	11’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8’	M	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	8’ default, 6’ min	H	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width. Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3’ only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	Two-way SBL on both sides of street. Each SBL: 11’ default, 8’ min	H	SBL = Separated Bike Lane. Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6’ default, 2’ min	M	Provided only if a separated bike lane is provided.	167
Sidewalk / Sidepath	10’ default, 8’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	7’ default, 0’ min	M	Some or all of the frontage zone may occur on private property.	119
Maintenance Buffer	0’	N/A	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line, a maintenance buffer is required even if this table shows a dimension of 0’.	107

Town Center Boulevards – Prioritizing Street Design Features

Figure 2-40 provides a summary of Town Center Boulevard design features in four different categories and identifies what features are required, recommended, optional, and not permitted. The only design feature specifically not permitted for Town Center Boulevard are traffic diverters.

Figure 2-40. Street Design Features for Town Center Boulevards

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

1 Engineering judgement needed – see Chapter 6: Intersections for details

2 Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

3 Narrowing lanes down to default dimensions for street type

Zone	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	■	234
	Green Infrastructure/Rain Gardens	■	239
	Seating	■	111
	Bicycle Parking	■	112
	Recycling/Trash Receptacles	▲	110
	Plazas/Parklets	O	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	▲	113
	Pedestrian-Scale Lighting	■	130
	Pedestrian/Bicycle Wayfinding	▲	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	▲	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	▲	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	O	250
	Speed Humps/Cushions	O	252
	Speed Tables/Raised Crosswalks	O	253
	Raised Intersections	O	253
	Curb Extensions/Bulb Outs	▲	253
	Neckdowns/Chokers	▲	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	▲	254
	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	■	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	■*	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
	Loading/Pick-up and Drop-off Zones	▲	145
	Accessible Parking	O	141
	Carshare Parking	▲	142
	E/V Charging Stations	O	142

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E. Town Center Streets

Town Center Streets are located in areas that have or are planned to have small- and medium-sized businesses, restaurants, civic buildings, or residences. Regardless of location or density, buildings are generally located close to the street. These streets have significant pedestrian and bicycle activity and typically offer on-street parallel parking. They almost always have enhanced streetscapes; however, sidewalk widths may vary. The design of Town Center Streets should focus on retaining and reinforcing the character of the neighborhood. The design should help create or enhance an inviting and enjoyable pedestrian experience and provide flexible spaces for outdoor events and dining and support the generally mixed-use character of the street.

- **FZ** Frontage Zone
- **SW** Sidewalk
- **PB** Pedestrian-Bike Buffer
- **BL** Bike Lane
- **SB** Street Buffer
- **P** Parking Lane
- **TV** Travel Lane

Key Features:

- **Development intensity**: Moderate-intensity development featuring mostly small businesses and occasionally residential
- **Pedestrian and bicycle activity**: Moderate to high
- **Vehicle activity**: Moderate volume of personal vehicles
- **Transit service**: Moderate
- **On-street parking**: Typically provided on many/most block faces
- **Other key features**: Loading zones for deliveries, street trees, street furniture, wayfinding, and other streetscape features

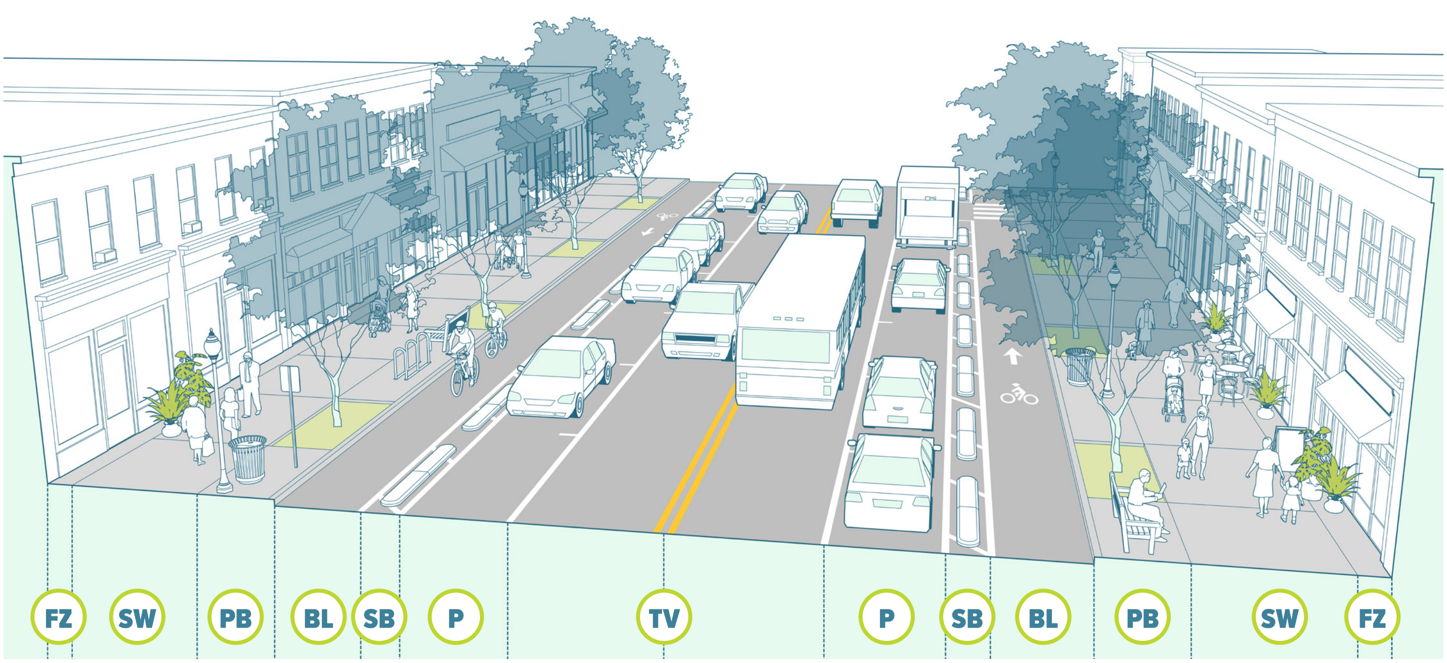

Figure 2-41. Town Center Street

Town Center Street Examples

Figure 2-42. Carroll Avenue in Downtown Takoma Park

Figure 2-43. Century Boulevard in Germantown

Figure 2-44. Tuckerman Lane near Grosvenor Metro Station

Town Center Streets – Street Design Parameters and Priorities

Figure 2-45 presents a summary of Corridor Design Parameters to be used for Town Center Streets. Figure 2-46 presents a summary of Cross Section Design Parameters to be used for Town Center Streets. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-45. Corridor Design Parameters for Town Center Streets

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	25 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of “urban districts” as defined in the law.	246
Maximum # of Vehicle Through Lanes	2	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	400’	Site-specific needs and conditions will dictate actual implementation.	218
Generally Accepted Minimum Spacing for Signalized Intersections	400’	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-46. Cross Section Design Parameters and Prioritization for Town Center Streets

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Optional 6’-10’	L	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. If the street is planned for a median transitway: transit lane dimensions supersede. Consult MCDOT for detailed info.	151
Dedicated Transitway	Transitway lanes: 13’ default, 12’ min Transitway buffer: 6’ default, 2’ min	M	The presence of a dedicated transitway is determined in the Master Plan of Highways and Transitways. If these dimensions vary from those provided in a specific Transitway planning process, those dimensions supersede this document. Dimensions may vary at stations, intersections & other crossing points, and along horizontal curves.	150
Left-Turn Lane	10’	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	10’	N/A	Only appropriate under limited circumstances.	147
Inside Travel Lane	10’	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-46 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	11'	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16'. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8'	L	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	6'	H	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width. Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3' only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3' door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	One-way SBL: 6.5 default; 5' min	H	SBL = Separated Bike Lane. Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6' default, 2' min	M	Provided only if a separated bike lane is provided.	167
Sidewalk / Sidepath	10' default, 8' min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	7' default, 0' min	M	Some or all of the frontage zone may occur on private property.	119
Maintenance Buffer	0'	N/A	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line: a maintenance buffer is required even if this table shows a dimension of 0',	107

Town Center Streets – Prioritizing Street Design Features

Figure 2-47 provides a summary of Town Center Street design features in four different categories and identifies what features are required, recommended, optional, and not permitted. The only design feature specifically not permitted for Town Center Streets are traffic diverters.

Figure 2-47. Street Design Features for Town Center Streets

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

[*] Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	■	234
	Green Infrastructure/Rain Gardens	■	239
	Seating	■	111
	Bicycle Parking	■	112
	Recycling/Trash Receptacles	▲	110
	Plazas/Parklets	▲	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	▲	113
	Pedestrian-Scale Lighting	■	130
	Pedestrian/Bicycle Wayfinding	▲	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	▲	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	O	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	O	250
	Speed Humps/Cushions	O	252
	Speed Tables/Raised Crosswalks	▲	253
	Raised Intersections	▲	253
	Curb Extensions/Bulb Outs	▲	253
	Neckdowns/Chokers	▲	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	O	254
	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	■	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	■[*]	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
	Loading/Pick-up and Drop-off Zones	▲	145
	Accessible Parking	▲	141
	Carshare Parking	▲	142
	E/V Charging Stations	▲	142

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F. Neighborhood Connectors

Neighborhood Connectors are residential through streets. While the land uses are predominately medium- or low-intensity residential development, some businesses may be present. Development is typically set back from the street. These streets have longer block lengths and often serve longer-distance travel compared to Neighborhood Streets and Neighborhood Yield Streets. Neighborhood Connectors are important connections for motor vehicles, but also have a strong need to accommodate and encourage pedestrian and bicycle activity. These streets often have bus stops and are key routes in the transit network. Street design for Neighborhood Connectors should focus on reducing vehicle speeds, implementing safe crossings, and providing street lighting, sidewalks and bikeways.

Key Features:

» **Development intensity**: Moderate- to low-intensity development, primarily residential

» **Pedestrian and bicycle activity**: Moderate

» **Vehicle activity**: Moderate volume of personal vehicles

» **Transit service**: Moderate to frequent

» **On-street parking**: Provided in some locations, where feasible

» **Other key features**: Moderate frequency of driveways, street trees

MB Maintenance Buffer

SP Sidepath

SB Street Buffer

TV Travel Lane

SW Sidewalk

Figure 2-48. Neighborhood Connector

Neighborhood Connector Examples

Figure 2-49. Dale Drive between Georgia Avenue and Colesville Road

Figure 2-50. Watkins Mill Road between Frederick Avenue and Blunt Road

Figure 2-51. Arcola Avenue between Georgia Avenue and University Boulevard

Neighborhood Connectors – Street Design Parameters and Priorities

Figure 2-52 presents a summary of Corridor Design Parameters to be used for Neighborhood Connectors. Figure 2-53 presents a summary of Cross Section Design Parameters to be used for Neighborhood Connectors. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-52. Corridor Design Parameters for Neighborhood Connectors

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	25 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law.	246
Maximum # of Vehicle Through Lanes	2	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	600'-1200'	Site-specific needs and conditions will dictate actual implementation.	218
Generally Accepted Minimum Spacing for Signalized Intersections	1300'	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-53. Cross Section Design Parameters and Prioritization for Neighborhood Connectors

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Optional 6'-16'	L	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. Consult MCDOT for detailed info.	151
Dedicated Transitway	N/A	N/A	Dedicated Transitways are not expected along this street type.	150
Left-Turn Lane	10'	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	10'	N/A	Only appropriate under limited circumstances.	147
Inside Travel Lane	10'	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-53 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	10.5	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16'. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8'	L	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	6' Open Section: 15' default, 9' min (see p84)	H	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width. Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3' only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3' door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	Sidepath on one side of the street: 10' default, 8' min or Bike Lanes 6' default, 5' min	M	Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6' default, 2' min	M	Provided only if a separated bike lane is provided.	167
Sidewalk / Sidepath	Sidewalk: 6' min Sidepath: 10' default, 8' min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	0'	N/A	Frontage Zones are not required along this street type.	119
Maintenance Buffer	2'	L	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line: a maintenance buffer is required, except that a Maintenance Buffer is not required if there is no Sidewalk / Sidepath and the outermost zone is the Street Buffer.	107

Neighborhood Connectors – Prioritizing Street Design Features

Figure 2-54 provides a summary of Neighborhood Connector design features in four different categories and identifies what features are required, recommended, optional, and not permitted. The only design features specifically not permitted for Neighborhood Connectors are traffic diverters. Road diets are labeled as “not applicable” because the target maximum number of travel lanes is two.

Figure 2-54. Street Design Features for Neighborhood Connectors

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

			Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	■	234
	Green Infrastructure/Rain Gardens	■	239
	Seating	O	111
	Bicycle Parking	O	112
	Recycling/Trash Receptacles	O	110
	Plazas/Parklets	O	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	O	113
	Pedestrian-Scale Lighting	▲	130
	Pedestrian/Bicycle Wayfinding	▲	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	▲	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	O	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	X	250
	Speed Humps/Cushions	O	252
	Speed Tables/Raised Crosswalks	O	253
	Raised Intersections	O	253
	Curb Extensions/Bulb Outs	▲	253
	Neckdowns/Chokers	▲	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	O	254
	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	▲	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	O	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
	Loading/Pick-up and Drop-off Zones	O	145
	Accessible Parking	O	141
	Carshare Parking	O	142
	E/V Charging Stations	O	142

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G. Neighborhood Streets

Neighborhood Streets serve predominantly residential areas with low volumes of motor vehicle traffic. Pedestrian and bicycle activity are common along these streets. Neighborhood streets should have sidewalks on both sides of the street, though in retrofit applications, a sidewalk on one side of the street may be an interim objective in existing neighborhoods with limited right-of-way. Most, but not all, Neighborhood Streets in Montgomery County offer on-street parking. Design for Neighborhood Streets should focus on encouraging slow speeds, pedestrian safety, healthy street trees, and well-defined routes to nearby parks, transit, and schools.

MB Maintenance Buffer

SW Sidewalk

SB Street Buffer

P Parking Lane

TV Travel Lane

Key Features:

» **Development intensity**: Moderate- to low-intensity residential development

» **Pedestrian and bicycle activity**: Moderate

» **Vehicle activity**: Low volumes of personal vehicles

» **Transit service:** Typically, limited or none

» **On-street parking**: Varies/ context-dependent

» **Other key features**: Frequent curb cuts/driveways, street trees

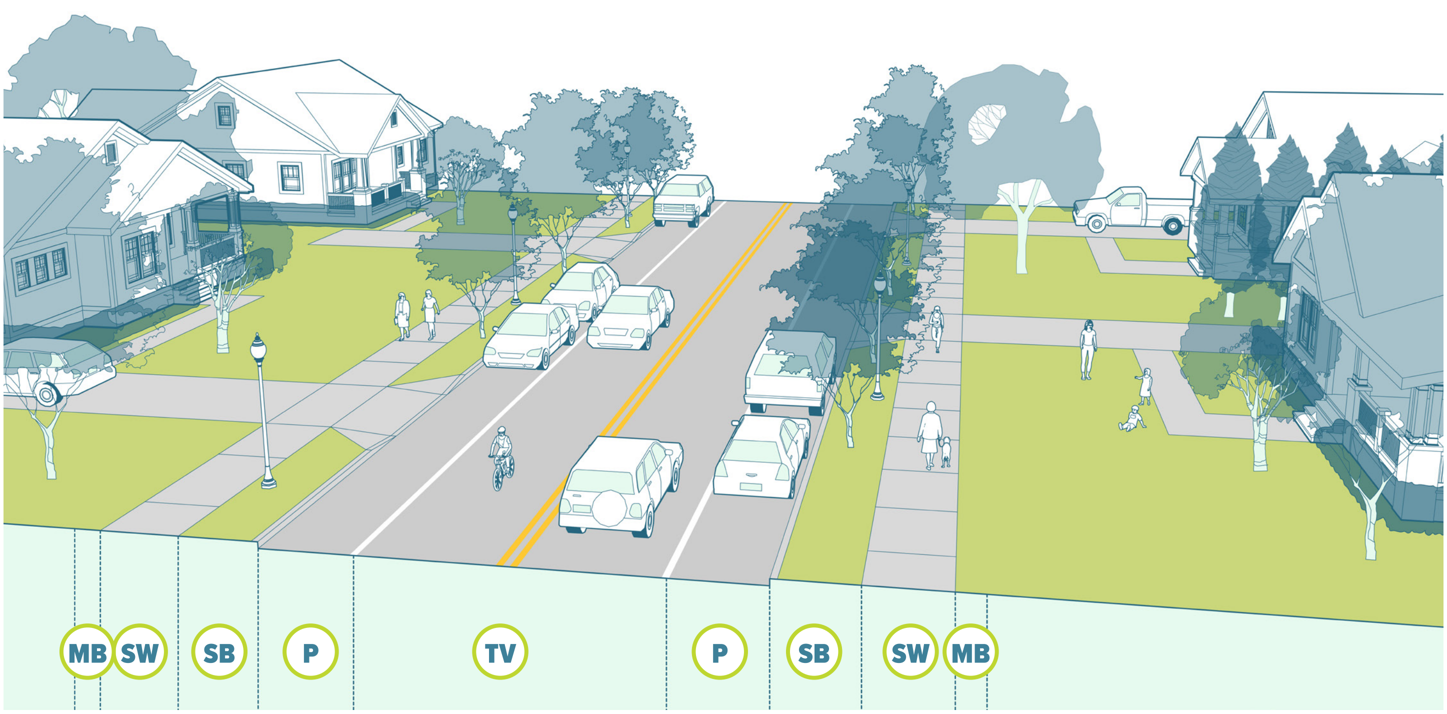

Figure 2-55. Neighborhood Street

Neighborhood Street Examples

Figure 2-56. Wexhall Drive in Fairland

Figure 2-57. Queen Mary Drive in Olney

Figure 2-58. Rolling Green Way in North Potomac

Neighborhood Streets – Street Design Parameters and Priorities

Figure 2-59 presents a summary of Corridor Design Parameters to be used for Neighborhood Streets. Figure 2-60 presents a summary of Cross Section Design Parameters to be used for Neighborhood Streets. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-59. Corridor Design Parameters for Neighborhood Streets

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	20 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of “urban districts” as defined in the law.	246
Maximum # of Vehicle Through Lanes	2	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	N/A	Site-specific needs and conditions will dictate actual implementation.	218
Generally Accepted Minimum Spacing for Signalized Intersections	N/A	Signal spacing not generally a significant issue for this street type.	218

Figure 2-60. Cross Section Design Parameters and Prioritization for Neighborhood Streets

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Optional 6’-10’	L	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. Consult MCDOT for detailed info.	151
Dedicated Transitway	N/A	N/A	Dedicated Transitways are not expected along this street type.	150
Left-Turn Lane	N/A	N/A	Left-turn lanes generally are not applicable along this street type.	147
Two-Way Left-Turn Lane	N/A	N/A	Two-Way Left-Turn Lanes are not appropriate along this street type.	147
Inside Travel Lane	10’	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-60 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	10.5’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8’	L	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	6’ Open Section: 15’ default, 9’ min (see p84)	M	Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	Neighborhood Greenway, Shared Lanes, or Advisory Bike Lanes (for design guidance see Bicycle Facility Design Toolkit)	M	Default bikeway types apply to streets without master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6’ default, 2’ min	M	Provided only if a separated bike lane is provided.	167
Sidewalk / Sidepath	6’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	0’ min	N/A	Frontage Zones are not required along this street type.	119
Maintenance Buffer	2’	L	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line: a maintenance buffer is required, except that a Maintenance Buffer is not required if there is no Sidewalk / Sidepath and the outermost zone is the Street Buffer.	107

Neighborhood Streets – Prioritizing Street Design Features

Figure 2-61 provides a summary of Neighborhood Street design features in four different categories and identifies what features are required, recommended, optional, and not permitted. Road diets are listed as “not applicable” because the target minimum number of travel lanes is two.

Figure 2-61. Street Design Features for Neighborhood Streets

Legend

■ Required
▲ Recommended (Context-Sensitive)
O Optional (Context-Sensitive)
X Not Permitted or N/A

* Unless determined otherwise by Planning Board
[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.
[3] Narrowing lanes down to default dimensions for street type

Zone	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	■	234
	Green Infrastructure/Rain Gardens	■	239
	Seating	O	111
	Bicycle Parking	O	112
	Recycling/Trash Receptacles	O	110
	Plazas/Parklets	O	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	O	113
	Pedestrian-Scale Lighting	▲	130
	Pedestrian/Bicycle Wayfinding	O	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	O	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	O	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	X	250
	Speed Humps/Cushions	O	252
	Speed Tables/Raised Crosswalks	O	253
	Raised Intersections	O	253
	Curb Extensions/Bulb Outs	O	253
	Neckdowns/Chokers	▲	254
	Traffic Diverters	O	149?
	Chicanes/Roadway Curvature	O	254
	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	O	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	O	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	O	213
	Loading/Pick-up and Drop-off Zones	O	145
	Accessible Parking	O	141
	Carshare Parking	O	142
	E/V Charging Stations	O	142

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H. Neighborhood Yield Streets

Neighborhood Yield Streets are similar to other local streets except that they feature a single, narrow travel lane that requires oncoming vehicles to yield to one another in order to pass. Older neighborhoods with narrow rights of way often feature this type of street, though they can be designed as part of newer communities, too. Neighborhood Yield Streets are inviting places for people of all ages and abilities to walk and bike, making them an important connection to parks, schools, and neighborhood shops. They may host informal gatherings (i.e., block parties) or children playing in the street. As a result, this street design only works in places with low vehicle volumes and speeds. On-street parking is provided on one or both sides of the street. It is important that there are either frequent driveways or low parking utilization (40-60 percent or less is common[15]), to ensure that there will be places for motor vehicles to pull over and allow oncoming traffic to pass. It may be necessary to implement alternating or "checkered" parking to ensure that opportunities to yield/pass are convenient. Adequate space for fire and emergency services vehicle operations must be maintained. For additional information, consult the Montgomery County Performance Based Design Guidance for Life Safety Access.[16] Pedestrian and bicycle activity is common along these streets. The design should be intuitive for drivers to navigate without the risk of head-on crashes and should prioritize slow speeds and pedestrian safety. These streets feature sidewalks on both sides of the street, though in retrofit conditions, some Neighborhood Yield Streets may only have sidewalks on one side.

Key Features:

- **Development intensity**: Low-intensity residential development
- **Pedestrian and bicycle activity**: Moderate
- **Vehicle activity**: Low vehicle traffic and speeds
- **Transit service**: None
- **On-street parking**: Present on one or both sides of the street
- **Other key features**: Frequent curb cuts/driveways, street trees

MB Maintenance Buffer

SW Sidewalk

SB Street Buffer

TV Travel Lane

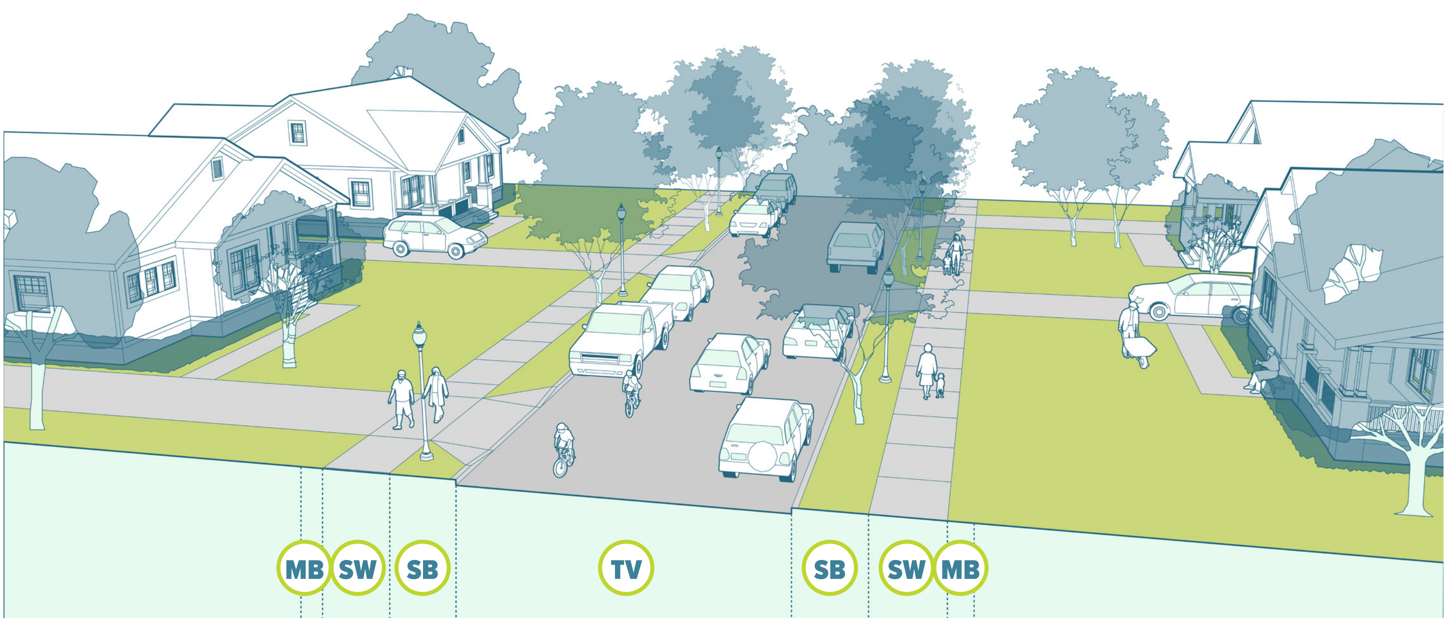

Figure 2-62. Neighborhood Yield Street

15 https://nacto.org/publication/urban-street-design-guide/streets/yield-street/

16 https://montgomeryplanning.org/planning/functional-planning/fire-department-access-performance-based-design-guide/

Neighborhood Yield Street Examples

Figure 2-63. Sanford Road in Forest Glen

Figure 2-64. Allegheny Avenue in Takoma Park

Figure 2-65. Mansfield Road in Silver Spring

Neighborhood Yield Streets – Street Design Parameters and Priorities

Figure 2-66 presents a summary of Corridor Design Parameters to be used for Neighborhood Yield Streets. Figure 2-67 presents a summary of Cross Section Design Parameters to be used for Neighborhood Yield Streets. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-66. Corridor Design Parameters for Neighborhood Yield Streets

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	20 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of “urban districts” as defined in the law.	246
Maximum # of Vehicle Through Lanes	1	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	N/A	Site-specific needs and conditions will dictate actual implementation.	218
Generally Accepted Minimum Spacing for Signalized Intersections	N/A	Signal spacing not generally a significant issue for this street type.	218

Figure 2-67. Cross Section Design Parameters and Prioritization for Neighborhood Yield Streets

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	N/A	N/A	Medians are not applicable along this street type.	151
Dedicated Transitway	N/A	N/A	Dedicated Transitways are not expected along this street type.	150
Left-Turn Lane	N/A	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	N/A	N/A	Two-Way Left-Turn Lanes are not applicable along this street type.	147

Figure 2-67 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Travel Lane	12’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8’	H	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	6’ Open Section: 15’ default, 9’ min (see p84)	M	Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	N/A	N/A	Bikeways are not generally considered along this street type, unless otherwise specified in the Bicycle Master Plan.	185
Ped / Bike Buffer	N/A	N/A	Ped / Bike Buffers are unlikely to be needed along Neighborhood Yield Streets, unless otherwise identified in the Bicycle Master Plan.	167
Sidewalk / Sidepath	6’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	0’	N/A	Frontage Zones are not required along this street type.	119
Maintenance Buffer	2’	L	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line: a maintenance buffer is required, except that a Maintenance Buffer is not required if there is no Sidewalk / Sidepath and the outermost zone is the Street Buffer.	107

Neighborhood Yield Streets – Prioritizing Street Design Features

Figure 2-68 provides a summary of Neighborhood Yield Street design features in four different categories and identifies what features are required, recommended, optional, and not permitted. The design features that are not applicable to Neighborhood Yield Street are road diets, green infrastructure in median, and street trees/landscaping in median.

Figure 2-68. Street Design Features for Neighborhood Yield Streets

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

Zone	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	■	234
	Green Infrastructure/Rain Gardens	■	239
	Seating	O	111
	Bicycle Parking	O	112
	Recycling/Trash Receptacles	O	110
	Plazas/Parklets	O	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	O	113
	Pedestrian-Scale Lighting	▲	130
	Pedestrian/Bicycle Wayfinding	O	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	O	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	O	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	X	250
	Speed Humps/Cushions	O	252
	Speed Tables/Raised Crosswalks	O	253
	Raised Intersections	O	253
	Curb Extensions/Bulb Outs	O	253
	Neckdowns/Chokers	▲	254
	Traffic Diverters	O	149?
	Chicanes/Roadway Curvature	O	254
	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	X	171
	Street Trees/Landscaping in Median (when median is present)	X	138
	Minimize/Consolidate Driveways	O	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	O	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	O	213
	Loading/Pick-up and Drop-off Zones	O	145
	Accessible Parking	O	141
	Carshare Parking	O	142
	E/V Charging Stations	O	142

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I. Industrial Streets

These streets serve industrial corridors and are built to accommodate commercial trucks in addition to passenger vehicles, bicyclists, and pedestrians. While there may be fewer pedestrians and bicyclists in these locations, these streets may also serve as destinations for maker space, retail, or other public-serving uses that may attract foot or bicycle traffic. Safe, continuous connections for all modes at intersections should be provided. The design of Industrial Streets should focus on accommodating truck traffic and providing adequate lane width and turning radii, while also accommodating pedestrians, bicyclists, and street trees.

- MB Maintenance Buffer
- SW Sidewalk
- SB Street Buffer
- P Parking Lane
- TV Travel Lane
- SP Sidepath

Key Features:

» **Development intensity**: Moderate to low-intensity industrial or light industrial uses

» **Pedestrian and bicycle activity**: Moderate

» **Vehicle activity**: Moderate personal vehicle volumes, large/heavy vehicles are common

» **Transit service**: Moderate

» **On-street parking**: Common, including for trucks

» **Other key features**: Street trees

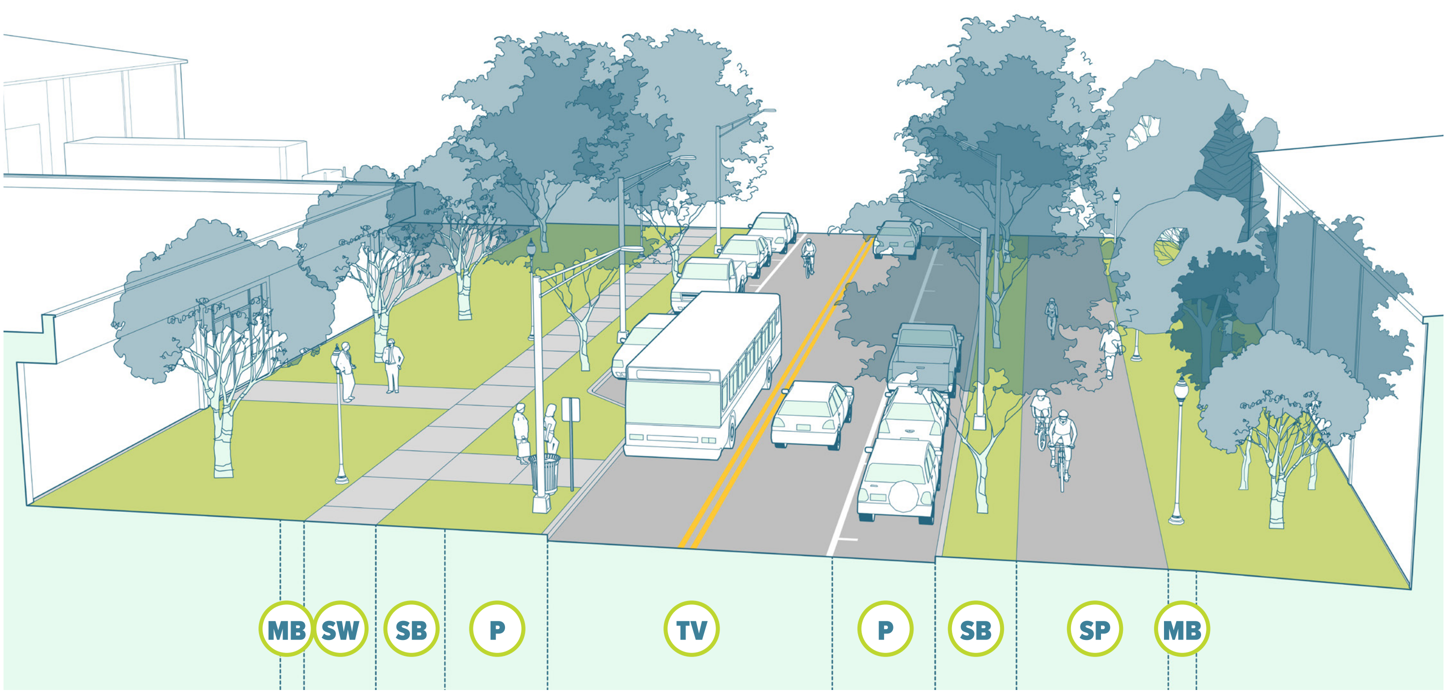

Figure 2-69. Industrial Street

Industrial Street Examples

Figure 2-70. Brookville Road in Lyttonsville

Figure 2-71. Wilkins Avenue in Twinbrook

Figure 2-72. Gaither Road near Gaithersburg

Industrial Streets – Street Design Parameters and Priorities

Figure 2-73 presents a summary of Corridor Design Parameters to be used for Industrial Streets. Figure 2-74 presents a summary of Cross Section Design Parameters to be used for Industrial Streets. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-73. Corridor Design Parameters for Industrial Streets

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	25 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law.	246
Maximum # of Vehicle Through Lanes	4	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	800'	Site-specific needs and conditions will dictate actual implementation.	218
Generally Accepted Minimum Spacing for Signalized Intersections	800'	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-74. Cross Section Design Parameters and Prioritization for Industrial Streets

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Optional 6'-17'	L	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. If the street is planned for a median transitway: transit lane dimensions supersede. Consult MCDOT for detailed info.	151
Dedicated Transitway	Transitway lanes: 13' default, 12' min Transitway buffer: 6' default, 2' min	M	The presence of a dedicated transitway is determined in the Master Plan of Highways and Transitways. If these dimensions vary from those provided in a specific Transitway planning process, those dimensions supersede this document. Dimensions may vary at stations, intersections & other crossing points, and along horizontal curves.	150
Left-Turn Lane	11'	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	11'	N/A	Only appropriate under limited circumstances.	147
Inside Travel Lane	11'	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-74 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	11’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Parking Lane	8’	M	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	139-141
Active Zone				
Street Buffer	6’ Open Section: 15’ default, 9’ min (see p84)	M	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width. Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3’ only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	One-way SBL: 6.5’ default, 5’ min or Sidepath on one side of the street: 10’ default, 8’ min	M	SBL = Separated Bike Lane. Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6’ default, 2’ min	M	Provided only if a separated bike lane is provided.	167
Sidewalk / Sidepath	Sidewalk: 6’ min Sidepath: 10’ default, 8’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	6’ default, 0’ min	L	Some or all of the frontage zone may occur on private property.	119
Maintenance Buffer	2’	L	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line: a maintenance buffer is required, except that a Maintenance Buffer is not required if there is no Sidewalk / Sidepath and the outermost zone is the Street Buffer. Not required if a minimum 2’ Frontage Zone is provided.	107

Industrial Streets – Prioritizing Street Design Features

Figure 2-75 provides a summary of Industrial Street design features in four different categories and identifies what features are required, recommended, optional, and not permitted.

Figure 2-75. Street Design Features for Industrial Streets

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

			Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	▲	234
ACTIVE ZONE	Green Infrastructure/Rain Gardens	▲	239
ACTIVE ZONE	Seating	O	111
ACTIVE ZONE	Bicycle Parking	▲	112
ACTIVE ZONE	Recycling/Trash Receptacles	▲	110
ACTIVE ZONE	Plazas/Parklets	O	143
ACTIVE ZONE	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	O	113
ACTIVE ZONE	Pedestrian-Scale Lighting	O	130
ACTIVE ZONE	Pedestrian/Bicycle Wayfinding	▲	121
ACTIVE ZONE	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
INTERSECTIONS	Crossing Islands	▲	222
INTERSECTIONS	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
INTERSECTIONS	Pedestrian Recall on Signals	O	201
INTERSECTIONS	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
INTERSECTIONS	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
INTERSECTIONS	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
SPEED MANAGEMENT	Road Diet (if volumes meet thresholds for road diet)	O	250
SPEED MANAGEMENT	Speed Humps/Cushions	O	252
SPEED MANAGEMENT	Speed Tables/Raised Crosswalks	O	253
SPEED MANAGEMENT	Raised Intersections	O	253
SPEED MANAGEMENT	Curb Extensions/Bulb Outs	▲	253
SPEED MANAGEMENT	Neckdowns/Chokers	▲	254
SPEED MANAGEMENT	Traffic Diverters	O	149?
SPEED MANAGEMENT	Chicanes/Roadway Curvature	O	254
SPEED MANAGEMENT	Textured Paving Treatment	O	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
STREET ZONE	Street Trees/Landscaping in Median (when median is present)	■	138
STREET ZONE	Minimize/Consolidate Driveways	■	241
STREET ZONE	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	O	236
STREET ZONE	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
STREET ZONE	Loading/Pick-up and Drop-off Zones	O	145
STREET ZONE	Accessible Parking	O	141
STREET ZONE	Carshare Parking	O	142
STREET ZONE	E/V Charging Stations	O	142

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J. Country Connectors

These roads provide important connections through low-density rural areas of Montgomery County. They are surrounded by very low-scale development set back from the road, or undeveloped/agricultural areas. Country Connectors are generally designed with shoulders and roadside ditches. As important through-routes in the county, the design of Country Connectors will emphasize safe and efficient vehicle throughput. Some pedestrian and bicycle traffic may be present (these roads are often popular recreational bicycling routes). Due to higher speed vehicle traffic, designs should provide an ample offset from vehicle traffic for pedestrians and bicyclists.

Key Features:

- **Development intensity**: Low-intensity or no development
- **Pedestrian and bicycle activity**: Moderate to low
- **Vehicle activity**: Moderate to high volume of personal vehicles
- **Transit service**: Moderate to infrequent
- **On-street parking**: Typically not present
- **Other key features**: Infrequent driveways, street trees

S Shoulder

TV Travel Lane

SB Street Buffer

SP Sidepath

MB Maintenance Buffer

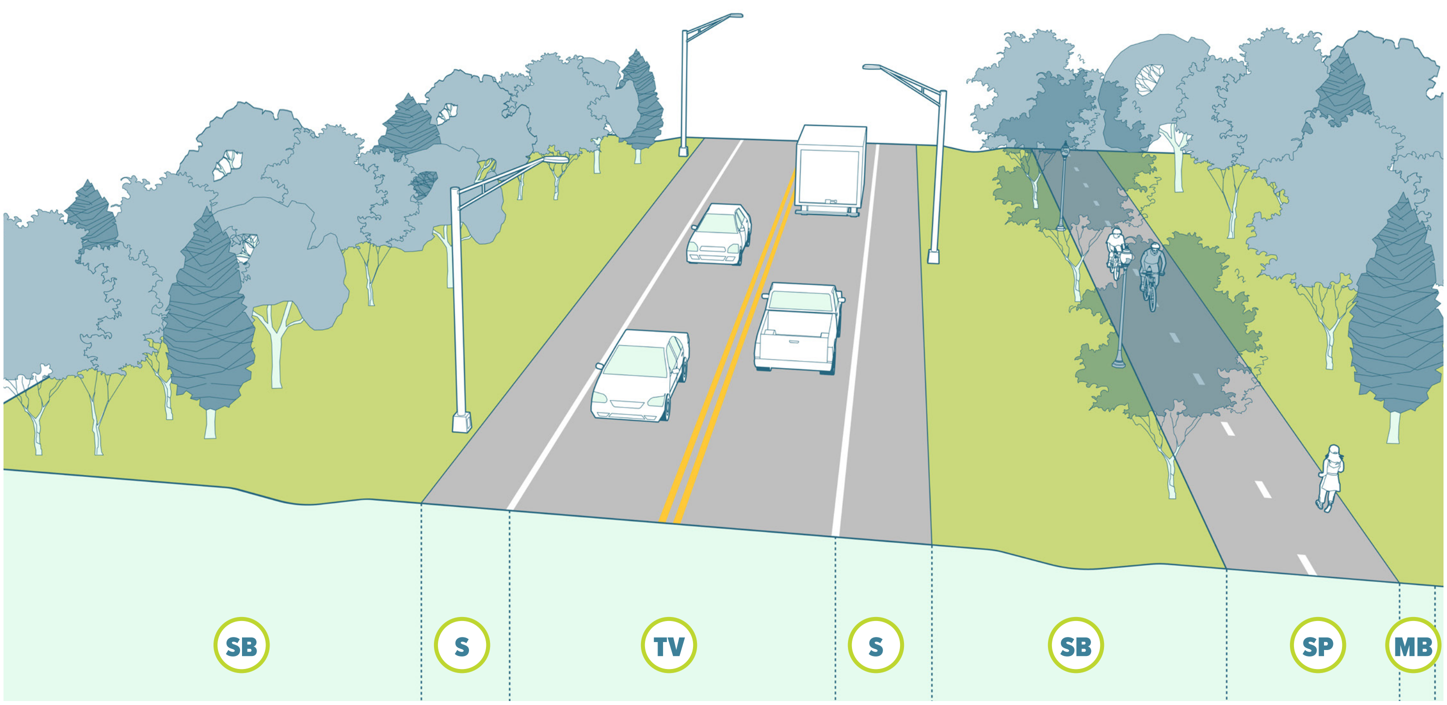

Figure 2-76. Country Connector

Country Connector Examples

Figure 2-77. River Road between Esworthy Road and Seneca Road

Figure 2-78. Germantown Road (MD Route 118) between Germantown Park Drive and Darnestown Road

Figure 2-79. New Hampshire Avenue / Damascus Road (MD 650) between Ashton and Damascus

Country Connectors – Street Design Parameters and Priorities

Figure 2-80 presents a summary of Corridor Design Parameters to be used for Country Connectors. Figure 2-81 presents a summary of Cross Section Design Parameters to be used for Country Connectors. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-80. Corridor Design Parameters for Country Connectors

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	40 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of “urban districts” as defined in the law.	246
Maximum # of Vehicle Through Lanes	4	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	1300’-2700’	Site-specific needs and conditions will dictate actual implementation. On streets with operating speeds of 30 mph or more, “protected” crossings include: Traffic/ pedestrian signal or HAWK, all-way stop control, or grade-separated crossing.	218
Generally Accepted Minimum Spacing for Signalized Intersections	2700’	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-81. Cross Section Design Parameters and Prioritization for Country Connectors

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Optional 6’-17’	L	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. Consult MCDOT for detailed info.	151
Dedicated Transitway	N/A	N/A	Dedicated Transitways are not expected along this street type.	150
Left-Turn Lane	11’	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	N/A	N/A	Two-Way Left-Turn Lanes are not appropriate along this street type.	147
Inside Travel Lane	11’	N/A	Use the Outside Travel Lane dimension if there is only one lane per direction. This includes the lane against the centerline on undivided roads. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-81 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	11’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane. If there is one lane in a direction on a Country facility, the Lane Width + Shoulder shall be at least 16’	147
Shoulder	6’	M	Dimensions only apply if a shoulder is necessary.	108
Active Zone				
Street Buffer	10’ Open Section: 15’ default, 10’ min (see p84)	H	Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3’ only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility. For open section roadways, see Section 3.8 for guidance.	110
Bikeway	Bikeable Shoulders: 10’ default, 5’ min or Sidepath on one side of the street: 10’ default, 8’ min	M	Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6’ default, 2’ min	M	Provided only if a separated bike lane is provided.	167
Sidewalk / Sidepath	Sidewalk: 6’ min Sidepath: 10’ default, 8’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	0’	N/A	Frontage Zones are not required along this street type.	119
Maintenance Buffer	2’	L	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line: a maintenance buffer is required, except that a Maintenance Buffer is not required if there is no Sidewalk / Sidepath and the outermost zone is the Street Buffer.	107

Country Connectors – Prioritizing Street Design Features

Figure 2-82 provides a summary of Country Connector design features in four different categories and identifies what features are required, recommended, optional, and not permitted. Pedestrian recall on signals, accessible parking, carshare parking, and E/V charging stations are not applicable to Country Connectors.

Figure 2-82. Street Design Features for Country Connectors

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

			Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	▲	234
	Green Infrastructure/Rain Gardens	▲	239
	Seating	O	111
	Bicycle Parking	O	112
	Recycling/Trash Receptacles	O	110
	Plazas/Parklets	O	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	O	113
	Pedestrian-Scale Lighting	O	130
	Pedestrian/Bicycle Wayfinding	O	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	O	222
	Pedestrian Signals (when traffic signals are present) or Beacons	▲	225
	Pedestrian Recall on Signals	X	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	O	250
	Speed Humps/Cushions	X	252
	Speed Tables/Raised Crosswalks	X	253
	Raised Intersections	X	253
	Curb Extensions/Bulb Outs	O	253
	Neckdowns/Chokers	O	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	O	254
	Textured Paving Treatment	X	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	▲	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	O	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
	Loading/Pick-up and Drop-off Zones	O	145
	Accessible Parking	X	141
	Carshare Parking	X	142
	E/V Charging Stations	X	142

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K. Country Roads

Country Roads occur in low-density areas of the county. Compared to Country Connectors, Country Roads feature more development activity (most often large lot single-family residential), more frequent driveways, and lower vehicle speeds. Designs should prioritize safe access for vehicles passing through and turning in/out of driveways, as well as an ample offset from vehicle traffic for pedestrians and bicyclists (these roads are often popular routes for recreational bicyclists). Country Roads may or may not have curbs.

- **S** Shoulder
- **TV** Travel Lane
- **SB** Street Buffer
- **SP** Sidepath
- **MB** Maintenance Buffer

Key Features:

- **Development intensity**: Low-intensity residential development or no development
- **Pedestrian and bicycle activity**: Moderate to low
- **Vehicle activity**: Moderate to high volume of personal vehicles
- **Transit service**: Moderate to Infrequent
- **On-street parking**: Typically not present
- **Other key features**: Moderate frequency of driveways/curb cuts, street trees

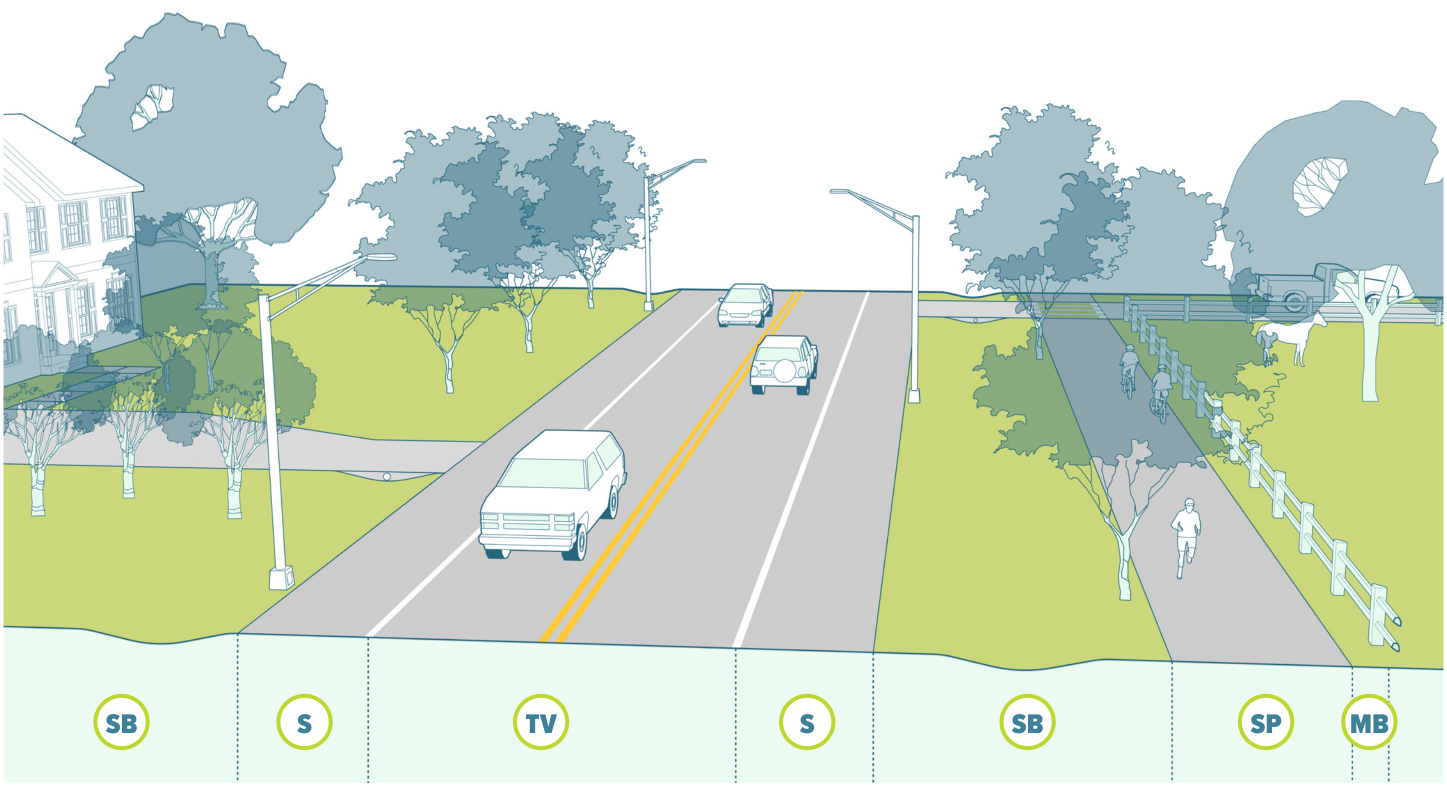

Figure 2-83. Country Road

Country Road Examples

Figure 2-84. Esworthy Road from River Road to Seneca Road

Figure 2-85. Bethesda Church Road from Clarksburg Road to the Frederick County Line

Figure 2-86. Long Corner Road north of MD Route 108

Country Roads – Street Design Parameters and Priorities

Figure 2-87 presents a summary of Corridor Design Parameters to be used for Country Roads. Figure 2-88 presents a summary of Cross Section Design Parameters to be used for Country Roads. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-87. Corridor Design Parameters for Country Roads

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	20 - 35 MPH	Some Country Roads operate as neighborhood streets for short segments, so a range must be considered depending on the land use context. Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of “urban districts” as defined in the law.	246
Maximum # of Vehicle Through Lanes	2	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	1300’-2700’	Site-specific needs and conditions will dictate actual implementation. On streets with operating speeds of 30 mph or more, “protected” crossings include: Traffic/ pedestrian signal or HAWK, all-way stop control, or grade-separated crossing.	218
Generally Accepted Minimum Spacing for Signalized Intersections	2700’	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-88. Cross Section Design Parameters and Prioritization for Country Roads

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Optional 6’-16’	L	The dimensions shown apply only if a median is provided. Medians may be wider than dimensions provided in some circumstances. The median may be replaced or widened to include left turn lanes at intersections. Consult MCDOT for detailed info.	151
Dedicated Transitway	N/A	N/A	Dedicated Transitways are not expected along this street type.	150
Left-Turn Lane	10’	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	N/A	N/A	Two-Way Left-Turn Lanes are not appropriate along this street type.	147

Figure 2-88 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Travel Lane	11’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane. If there is one lane in a direction on a Country facility, the Lane Width + Shoulder shall be at least 16’	147
Shoulder	5’	H	Dimensions only apply if a shoulder is necessary.	108
Active Zone				
Street Buffer	8’ default, 6’ min (if sidewalk / sidepath are provided) Open Section: 15’ default, 9’ min (see p84)	M	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width. Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3’ only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	Bikeable Shoulders: 8’ default, 5’ min or Sidepath on one side of the street: 10’ default, 8’ min	M	Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	N/A	N/A	Ped / Bike Buffers are unlikely to be needed along Country Roads, unless otherwise identified in the Bicycle Master Plan.	167
Sidewalk / Sidepath	Sidewalk: 6’ min Sidepath: 10’ default, 8’ min	H	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	0’	N/A	Frontage Zones are not required along this street type.	119
Maintenance Buffer	2’	L	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line: a maintenance buffer is required, except that a Maintenance Buffer is not required if there is no Sidewalk / Sidepath and the outermost zone is the Street Buffer.	107

Country Roads – Prioritizing Street Design Features

Figure 2-89 provides a summary of Country Road design features in four different categories and identifies what features are required, recommended, optional, and not permitted.

Figure 2-89. Street Design Features for Country Roads

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

Zone	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	▲	234
	Green Infrastructure/Rain Gardens	▲	239
	Seating	X	111
	Bicycle Parking	X	112
	Recycling/Trash Receptacles	X	110
	Plazas/Parklets	X	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	X	113
	Pedestrian-Scale Lighting	O	130
	Pedestrian/Bicycle Wayfinding	O	121
	Sidewalk-Level Driveways	■	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	O	222
	Pedestrian Signals (when traffic signals are present) or Beacons	▲	225
	Pedestrian Recall on Signals	X	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	O	250
	Speed Humps/Cushions	X	252
	Speed Tables/Raised Crosswalks	X	253
	Raised Intersections	X	253
	Curb Extensions/Bulb Outs	O	253
	Neckdowns/Chokers	O	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	O	254
	Textured Paving Treatment	X	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	▲	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	O	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	213
	Loading/Pick-up and Drop-off Zones	O	145
	Accessible Parking	X	141
	Carshare Parking	X	142
	E/V Charging Stations	X	142

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L. Major Highways

Major Highways are limited/controlled access roads that are primarily designed for vehicle safety and mobility. Transit and heavy vehicles are common and pedestrian and bicycle activity is often low (and in some cases, not permitted). However, pedestrian and bicycle access is essential, whether for the accommodation of safe bicycle and pedestrian crossings, or when transit stops are provided on the Major Highway. Some Major Highways include dedicated transit lanes - see the Master Plan of Highways and Transitways. If the Major Highway is master-planned as a critical bicycle or pedestrian connection, separated facilities are needed. Due to high vehicle speeds, significant separation from traffic is needed for pedestrians and bicyclists. On roads with wider medians, street trees in the median (outside clear zone requirements) should be provided where feasible.

Key Features:

» **Development intensity**: None or low-intensity development set back from the road

» **Pedestrian and bicycle activity**: Low

» **Vehicle activity**: High volume of personal vehicles, large/heavy vehicles are common

» **Transit service**: Moderate to frequent

» **On-street parking:** None

» **Other key features**: Limited/ Controlled Access, prioritizes long-distance travel

S Shoulder

TV Travel Lane

M Median

SB Street Buffer

SP Sidepath

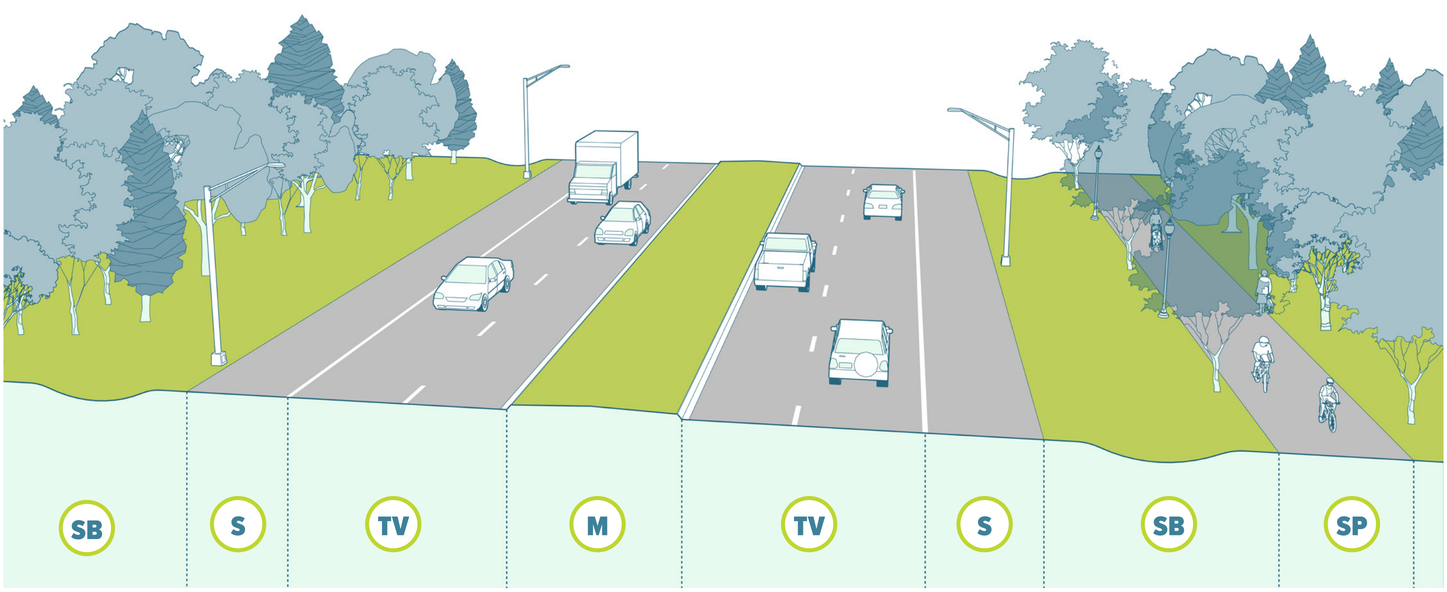

Figure 2-90. Major Highway

Major Highway Examples

Figure 2-91. Sam Eig Highway near Washingtonian Boulevard

Figure 2-92. Great Seneca Highway from Longdraft Road to Mateny Road

Figure 2-93. Columbia Pike (US Route 29) from Prelude Drive to the Howard County Line

Major Highways – Street Design Parameters and Priorities

Figure 2-94 presents a summary of Corridor Design Parameters to be used for Major Highways. Figure 2-95 presents a summary of Cross Section Design Parameters to be used for Major Highways. For ease of reference, a page reference column is provided to orient the user where each subject is covered in more detail.

Figure 2-94. Corridor Design Parameters for Major Highways

Design Parameter	Design Guidance	Notes	Page Ref
Target Speed	45-55 MPH	Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles shall be considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law.	246
Maximum # of Vehicle Through Lanes	N/A	See Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149
Maximum Spacing for Protected Crossings	1300'	Site-specific needs and conditions will dictate actual implementation. On streets with operating speeds of 30 mph or more, "protected" crossings include: Traffic/ pedestrian signal or HAWK, all-way stop control, or grade-separated crossing. Where ranges are provided, the lower end of the range is recommended in commercial areas, on BRT corridors, in BiPPAs, and near schools (or similar destinations).	218
Generally Accepted Minimum Spacing for Signalized Intersections	2700'	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218

Figure 2-95. Cross Section Design Parameters and Prioritization for Major Highways

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Center Median	Required 6'-17'	H	Medians may be wider than dimensions provided in some circumstances. The median may be widened to include left turn lanes at intersections. If the street is planned for a median transitway: transit lane dimensions supersede. Consult MCDOT for detailed info.	151
Dedicated Transitway	Transitway lanes: 13' default, 12' min Transitway buffer: 6' default, 2' min	M	The presence of a dedicated transitway is determined in the Master Plan of Highways and Transitways. If these dimensions vary from those provided in a specific Transitway planning process, those dimensions supersede this document. Dimensions may vary at stations, intersections & other crossing points, and along horizontal curves.	150
Left-Turn Lane	11'	N/A	Dimensions only apply if a left turn lane is provided.	147
Two-Way Left-Turn Lane	N/A	N/A	Two-Way Left-Turn Lanes are not appropriate along this street type.	147
Inside Travel Lane	11'	N/A	This includes the lane against the centerline on undivided roads. Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book.	147

Figure 2-95 (continued)

Design Parameter	Design Guidance	Priority	Notes	Page Ref
Street Zone				
Outside Travel Lane	12’	N/A	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a striped bike lane, the total width (travel lane + bike lane) should be no less than 16’. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147
Shoulder	8’	H	Presumes parallel parking. Gutter pan is included in parking lane dimensions. If there is no parking lane, the gutter pan is already included in the Outside Travel Lane width.	108
Active Zone				
Street Buffer	As wide as feasible (10’ min) Open Section: 15’ default, 10’ min (see p84)	H	Where a lane within the Street Zone is converted to a street level separated bike lane, the Street Buffer may be reduced to 3’ only when implemented by MCDOT as an interim bikeway. Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility.	110
Bikeway	Sidepath on both sides of street: 11’ default, 8’ min	M	Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. If the Bicycle Master Plan recommends something different for a specific street, that supersedes this guidance. Dimensions do not include the street buffer or pedestrian/bicycle buffer (see below). If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways: the Priority is always High & see additional requirements in the Bicycle Master Plan.	185
Ped / Bike Buffer	6’ default, 2’ min	H	Provided only if a separated bike lane is provided.	167
Sidepath	11’ default, 8’ min	M	Using the minimum dimension requires a waiver – consult MCDOT.	118
Frontage Zone	N/A	N/A	Frontage Zones are not required along this street type.	119
Maintenance Buffer	N/A	N/A	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line: a maintenance buffer is required even if this table shows a dimension of N/A, unless there is no Sidewalk / Sidepath and the outermost zone is the Street Buffer.	107

Major Highways – Prioritizing Street Design Features

Figure 2-96 provides a summary of Major Highway design features in four different categories and identifies what features are required, recommended, optional, and not permitted.

Figure 2-96. Street Design Features for Major Highways

Legend

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A

* Unless determined otherwise by Planning Board

[1] Engineering judgement needed – see Chapter 6: Intersections for details

[2] Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.

[3] Narrowing lanes down to default dimensions for street type

Zone	Feature		Page Ref
ACTIVE ZONE	Trees/Landscaping in Buffer	▲	234
	Green Infrastructure/Rain Gardens	▲	239
	Seating	X	111
	Bicycle Parking	X	112
	Recycling/Trash Receptacles	X	110
	Plazas/Parklets	X	143
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	X	113
	Pedestrian-Scale Lighting	O	130
	Pedestrian/Bicycle Wayfinding	O	121
	Sidewalk-Level Driveways	X	129
INTERSECTIONS	Roundabouts (Modern or Mini)	O[1]	202
	Crossing Islands	▲	222
	Pedestrian Signals (when traffic signals are present) or Beacons	■	225
	Pedestrian Recall on Signals	X	201
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	131
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	–[2]	206
	Bicycle Markings/Facilities (when bikeways are present)	■	208
SPEED MANAGEMENT	Lane Diet	▲[3]	251
	Road Diet (if volumes meet thresholds for road diet)	O	250
	Speed Humps/Cushions	X	252
	Speed Tables/Raised Crosswalks	X	253
	Raised Intersections	X	253
	Curb Extensions/Bulb Outs	O	253
	Neckdowns/Chokers	O	254
	Traffic Diverters	X	149?
	Chicanes/Roadway Curvature	X	254
	Textured Paving Treatment	X	256
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	138
	Minimize/Consolidate Driveways	O	241
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	O	236
	Transit Shelters (where transit routes are present and boarding thresholds are met)	O	213
	Loading/Pick-up and Drop-off Zones	X	145
	Accessible Parking	X	141
	Carshare Parking	X	142
	E/V Charging Stations	X	142

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2.6 Special Street Types

Each of the subsequent chapters in this document present design guidance for the primary street types outlined in the prior section. However, there a few additional street types that occur less frequently and under special circumstances: Alleys, Rustic Roads/Exceptional Rustic Roads, and Commercial/Residential Shared Streets. Design guidance for these special street types is provided below.

Alleys

While alleys primarily have a service function—for trash collection, deliveries, etc.—they can also support placemaking and bicycle and pedestrian connectivity in downtowns like Silver Spring, or Wheaton. Residential alleys also provide secondary access to homes for residents and fire/EMS vehicles. Design guidance:

» The total pavement width of a one-way alley should be a minimum of 16 feet, whereas the minimum total width for a two-way alley is 20 feet. Adequate clear width must be provided for site access.

» Alleys should be properly drained with either center or side drainage. "Green alley" treatments that increase permeability may be desirable, including as previous pavement or rain gardens at the edge of the pedestrian path.[17]

» In locations where alleys are adjacent to active commercial strips or parks, they may be activated with café seating, placemaking, murals, or other amenities. These features should not compromise the service function of the alley. For more information, consult Section 3.5, Sidewalk Cafés.

» To maximize safety, pedestrian-scale lighting and sight lines around obstructions are important considerations.

» Particularly on Downtown Boulevards, Downtown Streets, Town Center Boulevards, and Town Center Streets, design should encourage deliveries and loading/unloading in service alleys, to avoid double parking on fronting streets, or obstructing of bicycle or travel lanes.

At intersections of alleys and other streets, careful attention to sight lines, corner radii, and visibility for drivers and pedestrians are essential. Designs should emphasize "crawl" speeds (5 mph) and address sight lines through building design, curbside management, and the design of street buffers. Mirrors are a retrofit solution that are not desired as part of new construction.

Figure 2-97. Alley in Silver Spring

17 NACTO Urban Street Design Guide, 2016.

Rustic Roads / Exceptional Rustic Roads

Each road in the Rustic Roads Program is unique, with some preserving their historic gravel paving while also providing single-lane concrete sections.

Montgomery County's Rustic Roads Program preserves as "rustic roads" those historic and scenic roads that reflect the agricultural character and rural origins of the county. The Rustic Roads program is governed by the Montgomery County Code, Chapter 49, Article 8,[18] which includes criteria that roads must meet for classification as Rustic or Exceptional Rustic Roads. The Program is overseen by the Rustic Roads Advisory Committee.

If a road is designated as a Rustic Road or Exceptional Rustic Road, certain physical features of the road must be retained, and special right-of-way maintenance procedures may apply to keep speeds low and retain road safety. Under County Code, Chapter 50, Article 2[19] during the subdivision process, the Planning Board must not require improvements that are contrary to the rustic roads law or regulations, and the Board may waive or substitute alternative requirements that are consistent with the rustic roads law.

Roads are added and removed from the Rustic Roads Program through local master plan amendments as well as through amendments to the Rustic Roads Functional Master Plan.[20]

The requirements for Rustic Roads and Exceptional Rustic Roads supersede the information presented in this guide. For more information and for a current list of Montgomery County's Rustic and Exceptional Rustic Roads, visit montgomeryplanning.org/rusticroads.

Figure 2-98. Martinsburg Road in Dickerson

18 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/montgomeryco_md/0-0-0-22828#rid-0-0-0-68053

19 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/montgomeryco_md/0-0-0-105854#rid-0-0-0-106123

20 montgomeryplanning.org/rusticroads

Residential and Commercial Shared Streets

Shared Streets typically provide a space that is shared by people using all modes of travel. The design encourages extremely low vehicle speeds and volumes. Shared Streets are often curbless, providing pedestrians with freedom of movement and creating optimal spaces for special events. They can support a variety of land uses, including commercial, entertainment, dining, and residences. Shared Streets should include strategically defined edges and zones, and unique paving materials where feasible. Design considerations include:

» Vehicle operating speeds should not exceed 15 mph.

» Designs should allow for flexibility, so that streets can be easily closed to automobile traffic for events and reconfigured to support a wide range of social and cultural functions.

» Durable materials and an established maintenance regime that includes regular street cleanings, replacement of lost or damaged site furnishings and streetscape elements (including tactile warning strips), maintenance of plantings and trees, and snow plowing/removal are key, as these streets often feature non-standard materials and treatments.

» Streetscape elements must facilitate navigation by pedestrians with vision disabilities, as shared streets allow free-form movement through all spaces for pedestrians and bicyclists. Tactile surfaces should indicate pedestrian-only zones and safe crossings. For more information, see *FHWA Accessible Shared Streets: Notable Practices and Considerations for Accommodating Pedestrians with Vision Disabilities*.[21]

A shared street should be comprised of the following zones:

» A **Frontage Zone**, which is the interface between building faces and the shared street. For additional guidance, consult Section 3.5: Frontage Zone.

» A **Comfort Zone**, which provides a continuous, clearly defined, obstacle-free pedestrian area. The comfort zone should be at least 6 feet wide and should provide connections to all important destinations along the street. The comfort zone can be defined with contrasting materials, colors, or detectable changes in texture.

» A **Furniture Zone** can contain tables, chairs, or other amenities. For additional information on how to design this area, consult Chapter 3: Active Zone.

Figure 2-99. A Shared Street at The Wharf in Washington, DC

21 https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/accessible_shared_streets/fhwahep17096.pdf

» A **Shared Zone**, where users of all modes can expect to encounter one another. These use treatments such as a flush level (curbless) design or colored/patterned pavement, which can help communicate pedestrian priority. A centrally located shared zone may be the most intuitive location for users. The edges of the shared zone should be apparent and detectable by pedestrians with vision disabilities. Edges can be defined by furniture, plantings, or streetscape elements, or with detectable edge treatments.

Crossings should be located at the entry/exit points of the shared street, as well as mid-block if the shared street is more than 600 feet long. White crosswalk markings that meet Maryland Manual of Uniform Traffic Control Devices (MdMUTCD)[22] standards should be used. Directional indicators can also be employed to enable pedestrians with vision disabilities to more easily locate crossings. Detectable warning surfaces should be used to indicate the boundary of the shared zone at designated crossings.

Gateways should clearly define the shared street's entry and exit points. Distinctive treatments, such as changes in surfacing, raised crossings, trees, or landscaping should make it obvious to drivers and pedestrians that they are entering a shared street where modes interact, yet pedestrians have the right-of-way everywhere. Planters or other moveable elements that are used to temporarily block entry/exit points for certain uses or times of day are allowable if they do not block crosswalks or pedestrian Comfort Zones.

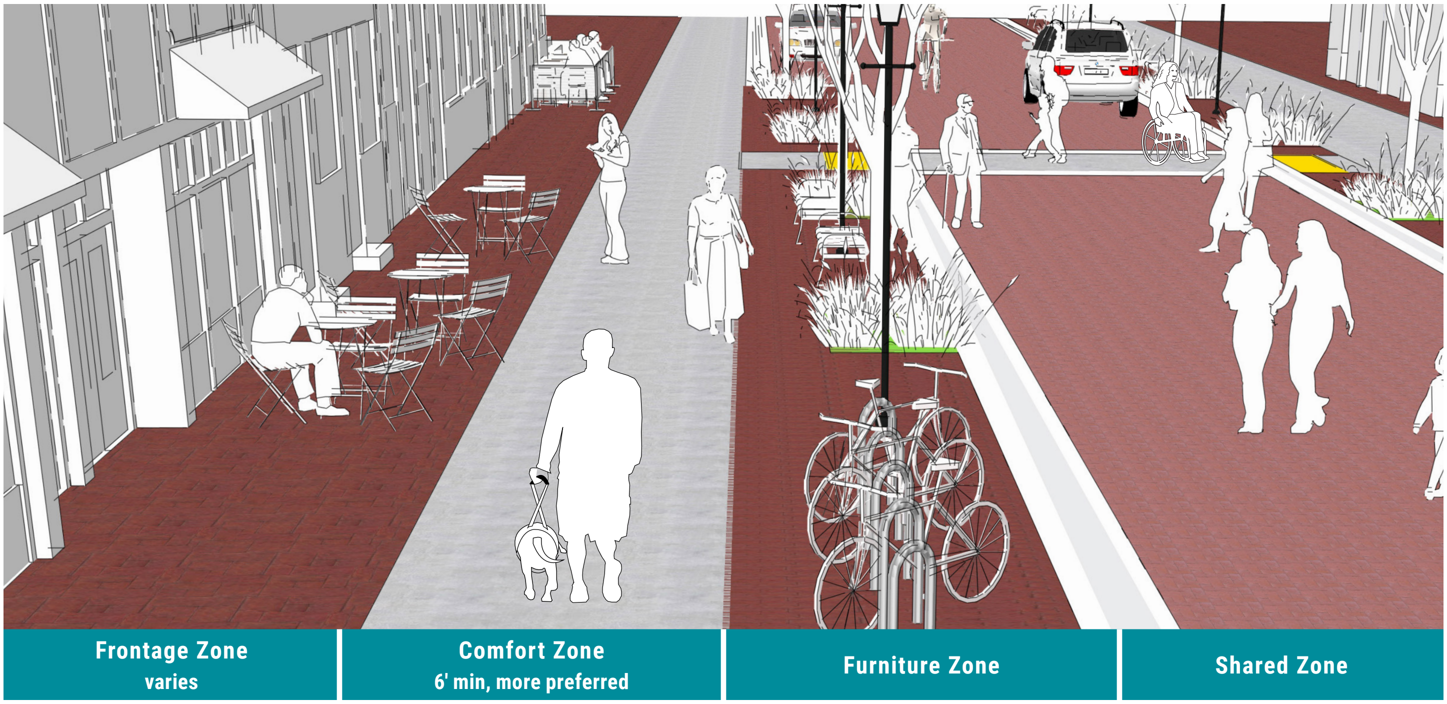


Figure 2-100. Shared Street zones (Source: FHWA Accessible Shared Streets Guide)

22 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

Chapter 3: **Active Zone**

3.1 Overview

No matter what travel mode you use to complete your journey, we all begin and end every trip as a pedestrian. Thus, it is of the utmost importance that the county's sidewalks are safe, comfortable, and accessible to everyone. This chapter gives design guidance for the various zones that comprise the Active Zone and elements commonly found in this zone, including:

» Section 3.3: Street Buffer Zone

» Section 3.4: Clear Zone

» Section 3.5: Frontage Zone

» Section 3.6: Signs

» Section 3.7: Transit Stops

» Section 3.8: Open Section Roadways

» Section 3.9: Driveways

» Section 3.10: Street Lighting

» Section 3.11: Maintenance Responsibilities

Figure 3-1. A sidewalk in Silver Spring

The guiding principles presented in Chapter 1: Vision support the creation and maintenance of a high-quality sidewalk system in Montgomery County, recognizing that:

» Sidewalks make our communities safer, providing a dedicated place for people to move free of conflicts with motor vehicles and reducing the likelihood of pedestrian-related severe and fatal traffic collisions.

» Sidewalks make our community more sustainable. Walking requires no fossil fuels, generates no emissions, and improves public health by creating opportunities for physical activity.

» Sidewalks make our community more vital. They provide a dignified public realm where people from all backgrounds and abilities meld. They tie our communities together, supporting our neighborhoods and local businesses.

» Sidewalks enable freedom of travel for everyone, including children and others who are unable or disinclined to drive.

» Sidewalks must be accessible to everyone, including people using assistive mobility devices. They must be designed to follow state and county standards for accessibility, as well as the requirements of the Americans with Disabilities Act (ADA)[23].

23 https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf

3.2 Active Zones

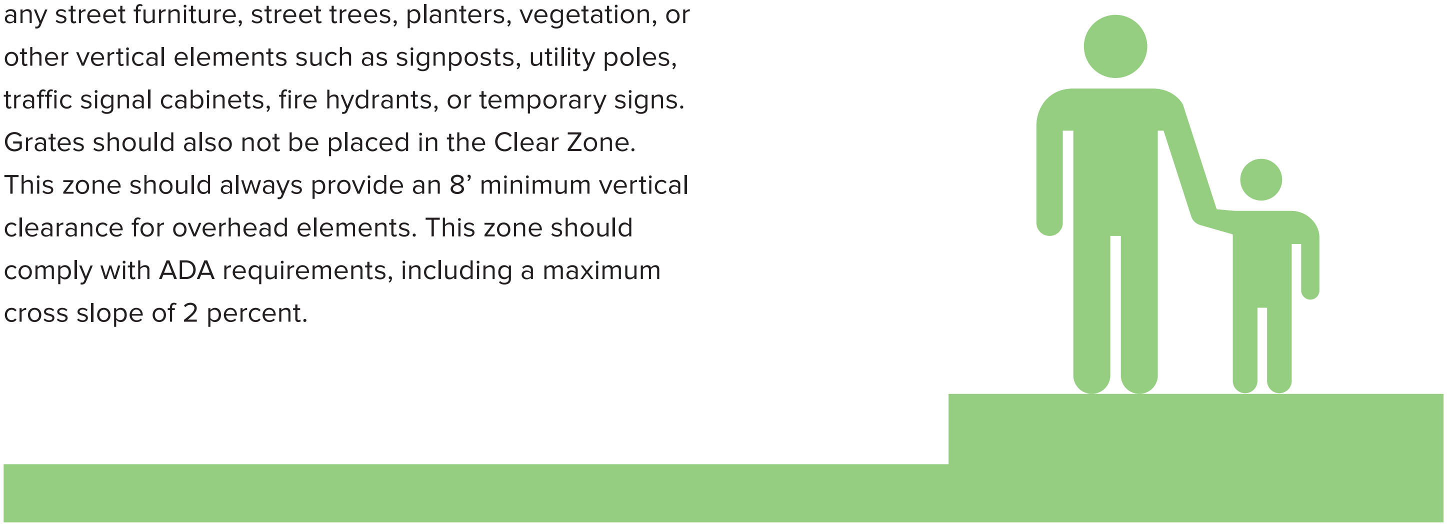
The Active Zone is comprised of three zones: the Street Buffer Zone, the Clear Zone, and the Frontage Zone. It often also includes the bicycle facility, which are covered in Chapter 5: Bikeways.

The **Street Buffer Zone** is the area between the roadway curb face and either the Clear Zone or a separated bike lane. See Figure 3-2 for street buffer dimensions, which include a 6-inch curb. This zone buffers pedestrians (and bicyclists on certain street types) from the adjacent roadway and is the appropriate location for street trees and vegetation, signs, street furniture, sidewalk cafés, art, and/or green infrastructure. It is also the preferred location for other elements such as pedestrian lighting, traffic signal cabinets, fire hydrants, and some above and below-grade utilities. Sight distance is a critical consideration: see Chapter 49 of the Montgomery County Code[24] for clearance and setback requirements that apply to elements in the Street Buffer Zone.

The **Clear Zone** is the area between the street buffer or curb and the building frontage. It is specifically reserved for pedestrian travel and, on facilities designated as sidepaths, for bicycling. See Figure 3-2 for Clear Zone dimensions. To provide an accessible pedestrian space, the Clear Zone should not include any street furniture, street trees, planters, vegetation, or other vertical elements such as signposts, utility poles, traffic signal cabinets, fire hydrants, or temporary signs. Grates should also not be placed in the Clear Zone. This zone should always provide an 8’ minimum vertical clearance for overhead elements. This zone should comply with ADA requirements, including a maximum cross slope of 2 percent.

The **Frontage Zone** is the area between the right-of-way line or the front of a building and the Clear Zone. See Figure 3-2 for Frontage Zone dimensions. In some locations, some or all the Frontage Zone may be on private property. Depending on the street type, a key part of the Frontage Zone is the street wall, which consists of everything that forms the boundary of the street, like building façades, fences, hedges, or low walls. The Frontage Zone may also accommodate landscaping, sidewalk cafés, store or building entrances, retail displays, or other features that activate and enhance the pedestrian environment.

Additionally, the **Maintenance Buffer** allows space for ongoing maintenance of facilities and appurtenances in the public right of way. On all street types other than Downtown Boulevards, Downtown Streets, Town Center Boulevards, Town Center Streets, and Major Highways, the Montgomery County Code requires a 2-foot maintenance buffer in addition to the Frontage Zone. If there is a structure abutting the property line, a maintenance buffer is required in all cases. Structures not part of the roadway design shall not occur in the public right of way. See Chapter 49 of the Montgomery County Code[21] for details. See Figure 3-2 for the dimensions of each zone.



24 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

Street Type	Maintenance Buffer	Frontage Zone	Sidewalk/Sidepath	Street Buffer
Downtown Boulevard	0’	10' default; 0' min	15’ default; 10’ min	8’ default; 6' min
Downtown Street	0’	10' default; 0' min	10’ default; 8’ min	6’; 11’ if shared w/ street parking
Boulevard	2’	7' default; 0' min	11’ default/8’ min	8’ default; 6' min
Town Center Boulevard	0’	7' default; 0' min	10’ default; 8’ min	8’ default; 6' min
Town Center Street	0’	7' default; 0' min	10’ default; 8’ min	6’
Neighborhood Connector	2’	0’	6’ min for sidewalk or 10’ default/8’ min for sidepath	6’
Neighborhood Street	2’	0’	6’	6’
Neighborhood Yield Street	2’	0’	6’	6’
Industrial Street	2’	6' default; 0' min	6’ min for sidewalk or 10’ default/8’ min for sidepath	6’
Country Connector	2’	0'	6’ min for sidewalk or 10’ default/8’ min for sidepath	10’ (if sidewalk/sidepath are provided)
Country Road	2’	0’	6’ min for sidewalk or 10’ default/8’ min for sidepath	8’ default; 6' min
Major Highway	N/A	N/A	11’ default/8’ min	As wide as feasible (10’ min)

Figure 3-2. Sidewalk dimensions (If a separated bike lane is present, a Ped / Bike Buffer is also required. See Chapter 2.) For street buffers on open section roads, see Section 3.8.

Figure 3-3 provides guidance on whether specific street design features are desired or appropriate in the Active Zone on various street types. This figure is intended as a reference to inform choices for individual streets; however, final design decisions will be context specific. More detailed guidance on these street elements is provided in this chapter. Design guidance presented in master plans for specific streets will supersede the information presented here.

LEGEND

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- x Not Permitted or N/A
- * Unless determined otherwise by Planning Board

		Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway	Page Reference
ACTIVE ZONE	Trees/Landscaping in buffer	■	■	■	■	■	■	■	■	▲	▲	▲	▲	166
	Green Infrastructure/ Rain Gardens	■	■	■	■	■	■	■	■	▲	▲	▲	▲	171
	Seating	■	■	O	■	■	O	O	O	O	O	x	x	67
	Bicycle Parking	■	■	O	■	■	O	O	O	▲	O	x	x	68
	Recycling/ Trash Receptacles	▲	▲	O	▲	▲	O	O	O	▲	O	x	x	73
	Plazas/Parklets	▲	▲	O	O	▲	O	O	O	O	O	x	x	99
	Bikeshare Stations/ Dockless Parking Hubs	■	■	O	▲	▲	O	O	O	O	O	x	x	69
	Pedestrian-Scale Lighting	■	■	■	■	■	▲	▲	▲	O	O	O	O	86
	Pedestrian/ Bicycle Wayfinding	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	O	77
	Sidewalk-Level Driveways	■	■	■	■	■	■	■	■	■	■	■	x	85

Figure 3-3. Design elements in the Active Zone

3.3 Street Buffer Zone

The Street Buffer Zone lies between the travel lanes and either the Clear Zone, a sidepath, or a separated bike lane. It forms the transition between the street and areas where vulnerable users travel at slower speeds, either on foot or bike. It is also the space where people board and alight from buses or enter and exit parked vehicles.

On streets where target speeds are 30 mph and below, street trees should be located in the Street Buffer Zone and require a minimum of 6' between the back of the curb and the Clear Zone. The Street Buffer Zone is also where most street fixtures are located, including lighting, bicycle racks, parking meters, signs, signal cabinets, benches, trash and recycling receptacles, and other amenities. Particularly on Downtown Boulevards, Downtown Streets, Town Center Boulevards, and Town Center Streets, this area is typically paved, while in residential or other areas, it may be a planted strip. The Street Buffer Zone can be used to store snow cleared from streets and sidewalks, but snow should not block access to parking meters, bus stops, and curb ramps. This zone is also an ideal location for stormwater management via bioswales or rain gardens (see Chapter 7: Green Streets).

On most Country Connectors and Major Highways, where target speeds are 40 mph or above, the Street Buffer Zone comprises the clear zone meaning that no fixed objects or moveable furniture should be located there. (Some exceptions apply, consult MCDOT.) On Boulevards and in other areas where target speeds are between 30 and 40 mph, or in areas without curbs, engineering judgement is required to determine whether fixed objects in the clear zone present a safety hazard. While fixed objects may present a safety hazard in many higher-speed contexts, tree canopy and a sense of enclosure may help achieve operating speeds that are consistent with target speeds, reducing the risk of severe and fatal crashes. Conversely, an open street section with no enclosure may encourage faster driving speeds. The 2011 AASHTO Roadside Design Guide[25] provides a range of recommendations for clear zones based on the design speed, traffic volumes, and other geometric design characteristics, and should be consulted.

25 https://store.transportation.org/Item/CollectionDetail?ID=105

Seating

Seating comes in a variety of forms, including chairs, benches, ledges, planters, and raised tree beds. Seating should be arranged to define social spaces and encourage people to gather.

Movable seating allows the flexibility for an individual to control the amount of sun exposure and for groups to determine their desired seating arrangement. Movable seating may be most appropriate for plazas, parklets, or outdoor cafés. Movable seating requires a commitment to continually maintain and replace elements that become damaged or stolen.

Figure 3-4. Movable seating

Figure 3-5. Fixed seating

Design

» The following clear widths should be maintained when installing or placing benches or other seating:

› 3 feet minimum from 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

› 2 feet minimum between the seating and the Clear Zone

» 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.

Considerations

» Seating should be affixed in such a way that it is not easily damaged or removed (unless it is movable by design). Care should be exercised to ensure that seating does not interfere with entrances to buildings, heavily used loading zones, parked vehicles, fire escape routes, and other potential conflicts.

» 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.

» Seating at bus stops, whether there is a bus shelter or not, should face the street or face approaching buses.

Bicycle Parking

Bicycle racks can be placed in the Street Buffer Zone, the Frontage Zone, or in parking spaces as part of an in-street bicycle corral (see Chapter 4: Street Zone). The amount and design of bicycle parking is regulated by the Montgomery County Zoning Ordinance,[26] Chapter 59, Section 6.2.6.

Key aspects of county policy include:

» The standard bicycle rack is an inverted-U rack (also called a staple, see Figure 3-6). Alternate rack designs must be approved by the Director of MCDOT and conform to the technical requirements described below.

» Bicycle racks should always allow a bicycle to be locked to the rack in two places (typically the bicycle frame and one wheel) to prevent theft.

» Bicycle racks should be durable and securely anchored, thin enough to allow a standard U-lock to be used, but thick enough so that the rack cannot be cut with bolt cutters.

» Each bicycle parking space must have a minimum length of 72 inches, a minimum width of 18 inches, and a minimum height of 85 inches.

» Bicycle racks intended to serve two bicycles should provide a minimum of 18 inches on each side of the rack for the bikes to park/lean.

» Where long-term bicycle parking is provided, a minimum of 10% of spaces should be at least 120 inches long and 30 inches wide to accommodate non-standard bicycles, such as cargo bikes.

» Bicycle racks should be installed in convenient, well-lit areas where people on the sidewalk or visiting a nearby building can see them.

» Bicycle racks parallel to the curb should be a minimum of 24 inches from the curb and 36 inches from the building face. Bicycle racks placed perpendicular or diagonal to the curb should be a minimum of 48 inches from the curb face and 42 inches from the building face.

» Racks should be installed so that parked bicycles do not obstruct the Clear Zone. They should be a minimum of 14 feet from fire hydrants.

» Bicycle racks should have adequate clearance from driveways, curb ramps, transit loading areas and immediately adjacent to shelters and utility poles.

» Bicycle parking may be placed in the Street Zone with MCDOT approval and if adequate spacing and sight distances are available.

Figure 3-6. Examples of inverted-U racks in Montgomery County

26 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

Consult the Zoning Ordinance[23] (Chapter 59, Section 6.2.6) for the full policy, including requirements for the number of short- and long-term bike parking spaces that are required as part of development projects. Some bicycle rack designs that are available commercially do not meet the above criteria, and therefore should not be used. The MCDOT Bicycle Rack Program website[27] has sample racks and more information.

Bikeshare Stations

Montgomery County participates in the Capital Bikeshare system. Participants access a bicycle using a key fob or credit card and can return bicycles to any station in the network. Bikeshare stations are located to encourage short, one-way trips for commuting, shopping, running errands, attending social outings, exercising, and sightseeing. Bikeshare is often used to access public transit or to reach a person's final destination following a transit trip.

Capital Bikeshare station locations are determined by MCDOT, sometimes in collaboration with business owners or developers. To inquire about installing a Capital Bikeshare station in your community, near your business, or as part of a development project, contact MCDOT Commuter Services at 240-777-8300 or mcdot.commuterservices@montgomerycountymd.gov.

Figure 3-7. A Capital Bikeshare station on New Hampshire Avenue in Takoma Park

27 https://www.montgomerycountymd.gov/dot-dte/bikeways/index.html, tab "Bike Rack Installation"

Bikeshare Station Placement

Bikeshare stations can vary in size and configuration. Montgomery County's bicycle stations typically provide 15 bicycle docking spaces, with a standard footprint of about 6 feet by 45 feet. Higher capacity stations with a larger footprint are appropriate for locations that generate a significant number of trips.

Station locations should:

» Not infringe on the Clear Zone (see Figure 3-8).

» Receive enough sunlight for solar apparatus.

» Provide at least 6 feet of clearance from the back of a docked bicycle to provide room for pedestrian movement.

» Be placed at least 18 inches from the curb where on-street parking is present in order to allow access to vehicles.

» Be at least 2 feet from curb cuts or crosswalks and at least 5 feet from fire hydrants.

» Be placed in visible, well-lit locations, in order to make them easy for users to find, discourage vandalism, and maximize safety for people getting or returning bikes.

» Bikeshare stations may be placed in the Street Zone with MCDOT approval if adequate spacing and sight distances are available.

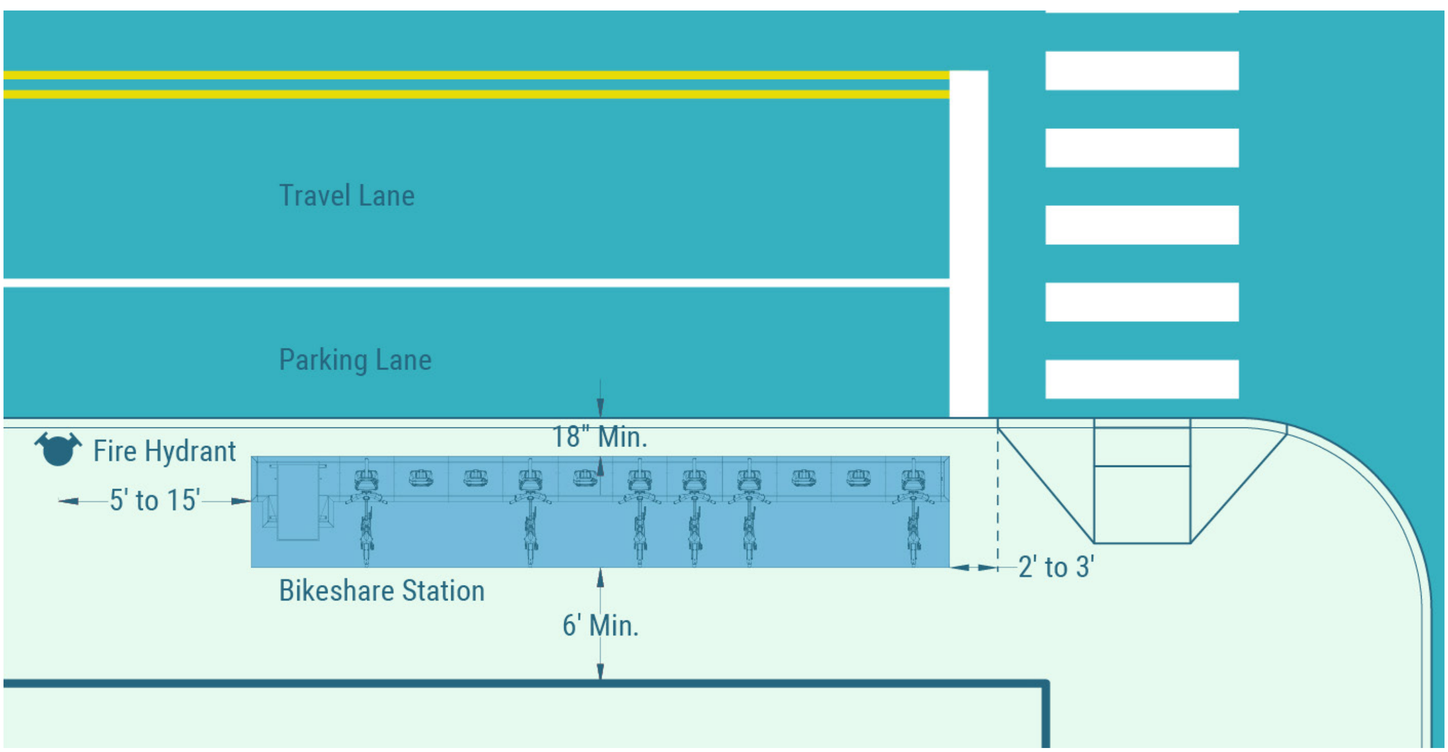


Figure 3-8. Example of bikeshare station clearances on the sidewalk (Graphic modified from NACTO Bike Share Station Siting Guide, https://nacto.org/publication/bike-share-station-siting-guide/)

Dockless Mobility

Mobility choices are evolving continuously, with new dockless and shared mobility options (e.g., electric scooters, electric-assist bikes, etc.) becoming available in Montgomery County. Dockless mobility options are typically reserved through a mobile phone app. **All new shared mobility programs, such as dockless scooters and bicycles, require coordination and approval from MCDOT.** Companies selected to operate in the county will need to sign a memorandum of understanding (MOU).

Particularly in Downtown and Town Center areas, dockless parking zones may be installed to provide better management of shared mobility devices when: 1) the volumes overwhelm the Street Buffer Zone or infringe on accessibility requirements, 2) there is regular clustering at a specific location, and/or 3) where there is a desire to better organize parking of shared mobility devices.

Design guidance for dockless parking zones includes:

» Locate dockless parking zones in the Street Buffer Zone and ensure they do not overlap with the Clear Zone, loading zones, or bus stop loading/landing areas.

» The size of dockless parking zones may vary depending on the anticipated volume of users, but a minimum size of 6 feet by 10 feet is recommended. This will accommodate at least 10 shared mobility devices.

Particularly in Downtown and Town Center areas, dockless parking zones may be installed to provide better management of shared mobility devices when:

1) the volumes overwhelm the Street Buffer Zone or infringe on accessibility requirements,

2) there is regular clustering at a specific location, and/or

3) where there is a desire to better organize parking of shared mobility devices.

Figure 3-9. Dockless bikes in Silver Spring

» Where feasible, dockless parking zones should be co-located with a Capital Bikeshare station to increase the number of transportation options available within one location.

» Dockless parking zones should be easy to recognize and demarcated with pavement markings. Sidewalk dockless parking zones should be designed with white corner outlines to demarcate the space, and bike and scooter symbols should be placed within the zone. Optionally, they may also be marked with vertical white lines to designate the preferred orientation of the devices. All markings should be made from durable, slip-resistant paint. If the dockless parking zone is located within the street, it should apply the same clearances as bike parking corrals (see page 101).

» The apps used to reserve dockless vehicles can ensure and enforce responsible parking behaviors. Vendors should require users to take photos of their parked vehicles and provide prompts or push messages notifying users when they are near a vehicle corral. Based on vendor information, present-day GPS inaccuracies will not allow zones of this size to be geofenced; however, geofencing could be used to discourage parking in certain areas (areas should be a size of 25,000 square feet or more).

Figure 3-10. Example of a scooter parking corral from Long Beach, CA

Recycling/Garbage Cans

Several entities in Montgomery County provide recycling or garbage receptacles in the public realm: urban district organizations in Silver Spring, Bethesda, and Wheaton; local municipalities; Montgomery Parks, Montgomery County Public Schools, and private property owners. Providing receptacles for trash and recycling is important to prevent the spread of litter while demonstrating the county's commitment to waste reduction through recycling.

To ensure the Clear Zone is maintained, receptacles for trash and recycling should be placed in the Street Buffer Zone. Where a Street Buffer Zone is not present, placement of receptacles should ensure that a minimum 5-foot clear zone for pedestrians is maintained. Consider placing trash receptacles near high-pedestrian volume locations such as high-use transit stops, plazas, schools, event centers, and parks. If provided, recycling and garbage cans need to be permanently mounted to prevent them from being moved into a Clear Zone.

For additional information, consult Chapter 48 of the Montgomery County Code,[28] which covers trash and recycling receptacles.

Figure 3-11. Trash and recycling recepticles

28 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

3.4 Clear Zone

The Clear Zone is comprised either of a sidewalk or a sidepath. This section focuses on sidewalks, while sidepath design is covered in Chapter 5: Bikeways. The Clear Zone should be wide enough for people to comfortably travel and pass one another, including people using assistive mobility devices, pushing strollers, or carrying items for delivery or shopping. This zone should be kept clear of any physical obstacles. The Clear Zone should not contain items such as street furniture, street trees, or planters, nor vertical elements such as signposts, utility poles, fire hydrants, or temporary signs.

Sidewalk Materials

Sidewalks shall be constructed and finished per the current MCDOT Design Standards and Specifications. A standard sidewalk is constructed of Portland cement concrete. Permeable paving materials may be considered to allow stormwater runoff to infiltrate through the sidewalk into the ground rather than running off into the street and storm drain system. Permeable paving materials may be appropriate where root systems are likely to lead to heaved sidewalks. Horizontal and vertical clearance and slopes must comply with ADA guidelines regardless of materials used.

Figure 3-12. Example of decorative pavers that may be approved through master plan design guidelines

Any other sidewalk material or finish (bricks, pavers, non-standard scoring patterns, coloring, or texturing) must be approved by MCDOT, unless it has been approved in adopted Design Guidelines or Streetscape Standards as part of an Area Master Plan. If sidewalk pavers are desired, the abutting property owner shall have a perpetual maintenance agreement with the county, including penalties for poor maintenance. **Any deviations from standard sidewalk construction are required to meet ADA guidelines.**

If the pavement of the Frontage Zone and/or Street Buffer Zone uses the same material as the Sidewalk / Sidepath, the design should consider including a detectable strip of differing material along the edge of the Sidewalk / Sidepath (located in the Frontage or Street Buffer Zones). This is intended to assist visually impaired users with following the clear zone established within the Sidewalk / Sidepath, and to assist adjacent land uses with knowing what area is to remain clear.

Grates, vents, and vaults should always be located outside the Clear Zone and typical pedestrian paths of travel (e.g., building entrances) whenever possible. They shall be located in the frontage zone and designed such that they do not present hazards to accessible pathways and bikeways, and to maintain clear widths. Their design must comply with ADA guidelines.

Figure 3-13. Example of grates that may present tripping hazards

3.5 Frontage Zone

The Frontage Zone is where the public realm of the street meets the private realm. This zone is crucial for defining the quality of a street, particularly when there is a building edge. Its design is often the difference between a comfortable sidewalk with room to walk, window-shop, and pause for conversation, compared with a constrained sidewalk that is primarily for movement. Depending on the street type, this zone may contain building entrances, street furniture, sidewalk cafés, retail displays, landscaping, or other items. **In some locations, the Frontage Zone may be partially or entirely on private property.** Although not required, a minimum of 2 feet is preferred for the Frontage Zone to ensure shy distance between the Clear Zone and buildings or other fixed objects. On all street types other than Downtown Boulevards, Downtown Streets, Town Center Boulevards, Town Center Streets, and Major Highways, the Montgomery County Code requires a 2-foot maintenance buffer in addition to the Frontage Zone (unless there is no Sidewalk/Sidepath and the outermost zone is the Street Buffer).

Particularly on Downtown Boulevards, Downtown Streets, Town Center Boulevards, and Town Center Streets, a key part of the Frontage Zone is the street wall (i.e., everything that forms the boundary of the street, like building façades, fences, hedges, or low walls). The street wall defines the edge of a street or public space by creating a visual boundary. When people in the public space of the street feel connected to the activities in the private space, their sense of safety and engagement increases. Walking distances seem shorter in places with interesting street walls, meaning that pedestrians will travel farther through an area with an active and stimulating street edge.

Stoops

Many buildings in Montgomery County have elements that extend past the front wall of the building into the front yard. In new construction and redevelopment, these exterior projections, including open steps and stoops, exterior stairways, terraces, porches, and solar panels, should be located outside of the public right-of-way and may extend no more than 9 feet into the minimum required front yard area. See the County Code, Chapter 59, Article 59-B for more information.

Figure 3-14. The right side of this images shows sidewalk dining in the Frontage Zone on Ellsworth Avenue in Silver Spring

Sidewalk Cafés

Sidewalk cafés provide an opportunity for restaurants, cafés, and bars to expand onto the adjacent sidewalk. With proper design and management, sidewalk cafés can be a great way to encourage walking, add vitality to streets and commercial areas, and promote economic development. Design guidance includes:

- Cafés may be placed in the Frontage Zone or the Street Buffer Zone as long as the required Clear Zone widths are maintained. They may be acceptable in curb extensions as long as they do not inhibit sight lines or accessibility for pedestrians and bicyclists.
- A sidewalk café in the Street Buffer Zone or Curbside Zone should not interfere with the loading and unloading of transit vehicles, designated accessible parking, or bicycle operations.
- All sidewalk cafés must comply with Americans with Disabilities Act (ADA) requirements.
- The preferred minimum width for a sidewalk café is 6 feet.
- A sidewalk café must be enclosed in a clearly delineated area with a controlled point of ingress and egress and surrounded by a continuous barrier between 36-38 inches high, with the lowest point consisting of a continuous rail 2-6 inches from the sidewalk surface.
- Outdoor seating areas must be a minimum of 18 inches from the curb, to provide separation from vehicle parking and travel lanes.
- In the Frontage Zone, a café must be contiguous to the venue. The distance between the storefront and the closest point of the café cannot be greater than 25 feet.
- When placed in the Street Buffer Zone or Curbside Zone, a café must be located on the same side of the street as the venue it serves and can extend no more than 50 feet beyond the width of the storefront in either direction.
- If an outdoor café extends beyond the width of the storefront, the venue must get written permission from all adjoining property owners to operate an outdoor café.

Sidewalk cafés are approved by Department of Permitting Services (DPS). For additional guidance, consult Appendix D, Chapter 5 of the Montgomery County Code of Ordinances, or the county's Outdoor Café Seating Guidelines, available on the county website at www.montgomerycountymd.gov/DPS/Process/Id/outdoor-cafe-seating-permit.html.

Figure 3-15. Example of a sidewalk café

3.6 Signs

Signs are a constant presence on our streets, and they play many different roles: they direct traffic, provide wayfinding, assist with placemaking, mark historic sites, advertise businesses or events, and more. This section primarily focuses on traffic signs, which can both provide directions and inform travelers of the rules of the road. For additional guidance on signs, consult the Montgomery County Zoning Ordinance,[29] Chapter 59, 6.7: Signs.

The Maryland Manual on Uniform Traffic Control Devices (MdMUTCD)[30] defines the standards used by road managers to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public traffic. Sign placement and messaging must follow the MdMUTCD, but engineering staff also consider the specific conditions on that block, such as sight distances, curves, slopes, and vegetation.

Figure 3-16. Street signs on a lamp post in downtown Bethesda

Design and Placement

Sign placement is based on federal and state guidelines but is also dependent on legibility given potential conflicts with trees, utilities, other signs, or how the street is configured. Signs with less stringent federal standards, like midblock “No Parking” signs, can be placed depending on best visibility. When appropriate, evaluate and update existing signs with the most up-to-date signs during street projects. Signs should be designed and placed to ensure accessibility and reduce pedestrian conflicts. Maintenance of Traffic (MOT) signs that are specifically intended to draw pedestrian attention or redirect pedestrians away from a potential hazard may be placed in the Clear Zone if a direct, accessible alternate route is provided. Otherwise, no sign should obstruct the Clear Zone.

29 https://www.montgomerycountymd.gov/DPS/Process/ld/outdoor-cafe-seating-permit.html
30 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

Sign Sight Distance

In a complex urban environment, providing unobstructed sight distance to signs can be a challenge, and it is important that designers consider existing signing, visual obstructions, and the potential for visual clutter. To effectively convey the necessary message, signs must provide both adequate visibility and legibility. New sign locations should consider existing and expected future conditions including tree growth, parked vehicles, and impacts to the pedestrian zone.

Speed Limit (mph)	Sign Sight Distance (ft)
20	100
25	100
30	100
35	100
40	125

Figure 3-17. Sign sight distance (Source: MUTCD Chapter 2C: Warning Signs and Object Markers, https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm)

Sign placement must be compliant with MdMUTCD and ADA standards (where applicable). Newly installed signs must be located to provide minimum unobstructed sight distances (shown in Figure 3-17) from each approaching lane based on the speed limit of the roadway that they are installed on.

Sign height: Signs must be installed high enough from the ground to provide pedestrian clearance and so that drivers can read the sign while sitting in a vehicle. In rural areas, the bottom of the lowest sign on a signpost must be a minimum of 5 feet from the ground. In areas with pedestrian facilities, or in business or commercial areas, the bottom of the lowest sign on a signpost must be a minimum of 7 feet from the ground.

Considerations

» Signs must follow federal and state regulations. Curb space is legally defined by signs but may also be supplemented by paint or other treatments.

» No portion of the sign should be in the Clear Zone.

» Signs should be minimized to only those that are necessary, in order to avoid visual clutter.

3.7 Transit Stops

Three public transit operators currently provide bus service in Montgomery County: Ride On, Metrobus, and MTA Commuter Bus. Together, they carry more than 100,000 people each day. Additionally, Montgomery County Public Schools operates a network of school buses. Many of these design principles may also apply to school bus stops. Transit stops must allow for accessible movement of pedestrians along the sidewalk as well as space for waiting, queuing, and disembarking from transit vehicles. In constrained sidewalk conditions, meeting both demands can be challenging. It requires careful and sensitive placement of transit stops and fixtures in concert with other elements of the street edge, such as street trees, streetlights, signal cabinets, storm drains, and other elements. For more information, consult ADA requirements,[31] the Montgomery County Bus Rapid Transit Station Prototype Design,[32] or WMATA's Design and Placement of Transit Stops.[33]

Basic transit stops have a pole-mounted sign indicating the transit provider and route(s), while higher volume transit stops generally have more amenities such as benches, shelters, traveler information, trash receptacles, bicycle parking, and other features. (Bus Rapid Transit Stops are covered in the following section.) **In Montgomery County, Ride On generally uses thresholds of 50 or more boardings per day for bus shelters and 15 or more boardings per day for benches.**

Transit-stop design, including amenities and location, should be determined in consultation with the transit operators. All stops must be ADA compliant, meaning they must include landing pads, curb heights that allow for the loading and unloading of passengers in wheelchairs, and a continuous, accessible sidewalk to connect to the existing sidewalk network. Transit stops should be designed to accommodate passenger activity at all doors of the transit vehicle.

31 https://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf
32 www.ridetheflash.com/wp-content/uploads/2017/10/MWCOG-BRT-Report-July2017lr.pdf
33 https://www.wmata.com/initiatives/plans/upload/Bus_Stop_Guidelines_Brochure.pdf

Design

- » Locate transit stops at the curb line, on a bus bulb, or on a floating bus island. It is preferable to place stops far-side (after an intersection), and if that is not feasible, near-side (before an intersection). Mid-block stops (between intersections) are strongly discouraged where a mid-block crossing is not present. Stops should be located at least 10 feet back from the crosswalk, though 5 feet is permitted in constrained contexts. For mid-block stops, place pedestrian crossings behind the departing transit vehicle.
- » The landing zone at each transit vehicle door should be a minimum clear zone of 5 feet long (parallel to the curb) by 8 feet deep (from the curb). If the sidewalk is not wide enough for an 8-foot-wide landing zone, a bus bulb should be built extending to within 1 to 2 feet of the edge of the travel lane.
- » Landing zones should be provided to align with all doors of the transit vehicle. The distance between the front and rear landing zones should be 30 feet for stops served by standard buses, or 50 feet at stops that articulated buses will use. The landing zone should be clear of all obstructions, including street trees, signal or light poles, and signposts.

Figure 3-18. A floating bus island

» Street trees should be selectively located to minimize conflict with vehicles and to allow a direct sight line for approaching buses. Trees should not be placed within the 40-foot zone where a bus will stop (60 feet in the case of articulated buses).

» High-frequency routes or stops serving multiple transit routes may require additional transit-stop space. Consistent with WMATA Transit Stop Guidance, far-side stops should be at minimum 70 feet long (90 feet for articulated buses); near-side stops should be at minimum 100 feet long; and mid-block stops should be at minimum 110 feet long (150 feet for articulated buses).

» Signs indicating the transit stop should be installed 2 feet behind the curb, but not interfere with the Clear Zone. The signpost is generally where transit operators stop the front of the vehicle and is the basis for other stop dimensions. Signs should be visible to pedestrians and bicyclists from all directions, as well as from the direction of approaching buses.

» Where feasible, place trash and recycling receptacles near the front of the transit stop, where the front of an approaching bus would stop. Place receptacles at a minimum of 18 inches from landing zones, 3 feet away from benches or shelters, and in the shade where feasible. Receptacles should be anchored to the pavement to deter theft.

Considerations

» A continuous, accessible sidewalk should be provided between bus stops and nearby destinations.

» Bus bulbs generally enhance transit performance and improve the passenger experience; however, they may only be installed on streets where the space nearest the curb is not used for travel (i.e., where on-street parking exists) and generally where posted speeds are 35 mph or lower.

» Transit stops should be well lit and highly visible to improve the sense of safety and comfort at all times of day.

» Consider seating at or near transit stops. Seating need not be a unique and dedicated element, but may include leaning rails, planters, ledges, or other street elements.

» Whenever feasible, provide bicycle racks at or near transit stops. Bicycle racks should not impede access to or from transit stops or pedestrian flow on the adjacent sidewalk or crosswalk.

Bus Shelters

Transit shelters increase both the comfort and visibility of transit stops by providing shelter from sun, rain, and other elements. Shelter design should strive to improve comfort and convenience for riders.

Design

» Transit shelters should adhere to the county's standard shelter design and specifications.

» Shelter placement must allow for unobstructed transit boarding and alighting.

» Shelters must not impede pedestrian flow on the sidewalk (see Figure A-1 for required clear widths).

» The following minimum clear widths for shelter placement should be maintained:

› 1 foot from a blank building face (shelters should not block active store windows)

› 8 feet from the back of curb

› 15 feet from crosswalks (for visibility at near-side bus stops)

› 1 foot from any ground obstruction (i.e., manhole, tree pit, signpost, etc.)

› 10 feet from fire hydrants

› Clear of the transit landing zone and a maximum of 25 feet to the right of the landing zone

Considerations

» The location of transit shelters should minimize obstruction of sight lines and should be near protected crossings for pedestrians.

» Shelters should be located to facilitate maintenance (e.g., glass and other elements of the shelter should be easy to replace as necessary).

» Shelters should provide their own light source. Where lighting is not provided in the shelter, shelters should be located where street lighting is abundant.

» Shelters should consider needs for passenger amenities such as additional seating, local area information, wayfinding, real-time traveler information, and heating or cooling capabilities.

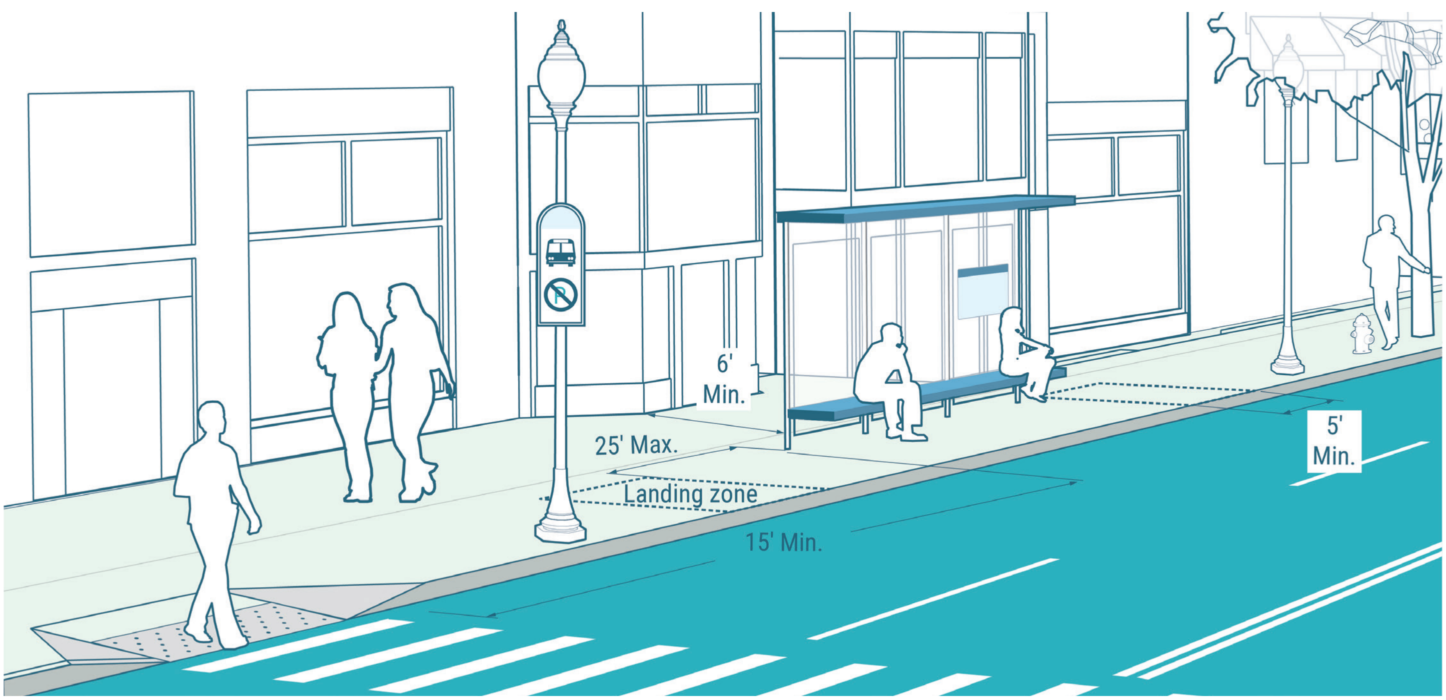


Figure 3-19. Illustration of bus shelter clearances

Bus Rapid Transit (BRT) Stations

In 2013, Montgomery County adopted the Countywide Transit Corridors Functional Master Plan,[34] which recommends building a 100-mile or more BRT network on 10 routes across the county. The county's first route, along US Route 29, is under construction and is anticipated to open in 2020 with 11 stations.

BRT stations may have larger shelters, more comfortable waiting spaces, enhanced rider services, and place-making elements such as unique lighting and/or public art. BRT stations may be located in the Street Buffer Zone if the BRT route runs in the outside travel lanes, or in a Median Zone if the BRT route is center-running. For additional guidance, consult the Countywide Transit Corridors Functional Master Plan[31] and the Montgomery County Bus Rapid Transit Station Prototype Design.[35] In addition to the design guidance provided in the prior sections for conventional bus stops, the following considerations apply to BRT station design:

» To reduce dwell time from passengers entering and exiting the bus, BRT stations should provide off-board fare collection and near-level boarding. This may require higher curb heights, which may have additional ADA considerations.

» Consider opportunities to provide additional passenger amenities such as seating, local area information, wayfinding, and real time traveler information.

Figure 3-20. Image of an enhanced BRT station (Source: Ridetheflash.com, 2019)

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34 https://www.montgomeryplanning.org/transportation/highways/documents/countywide_transit_corridors_plan_2013-12.pdf

35 https://www.montgomerycountymd.gov/dot-transit/flash/

3.8 Open Section Roadways

Many streets in Montgomery County have curbs and gutters, while others, particularly in suburban and rural areas, lack one or both. Roads without curbs are called “open section roads” and require a drainage swale on each side, to collect and remove stormwater from the road surface. Open section roads may have sidewalks or sidepaths on one or both sides.

In most cases, the drainage swales should be in the Street Buffer Zone, between the travel lanes and the sidewalk/sidepath. At driveways, bus stops, mid-block crossings, and anywhere else where a pedestrian or bicyclist would need to access the sidewalk/sidepath, a culvert and at-grade crossing of the swale is required. For additional design guidance, consult the Montgomery County Road Code.[36]

Drainage Swale

A drainage swale is a sloped channel on either side of an open section road that is designed to collect stormwater. It is laid with sod, which allows the ground to absorb water. This area can range in width from 16 feet to 28 feet, and contains the following:

» A **shoulder**, typically 7 to 10 feet wide, with a 16:1 slope that drains water away from the travel lanes. Refer to Figure A-1 for shoulder widths by street type.

» The **swale**, with a 6-foot area sloped away from the travel lanes at a 4:1 ratio, and a 3- to 9- foot area sloped away from adjacent properties at a 3:1 ratio.

Figure 3-21. An open section road in Clarksburg

36 http://www.montgomeryplanning.org/transportation/highways/RoadCode.shtm

3.9 Driveways

Spacing

Driveways cross through the Clear Zone and put vehicles in direct conflict with pedestrians. Therefore, driveway design and the number of driveways have a considerable influence on pedestrian safety and comfort.

» On Downtown Boulevards, Downtown Streets, Town Center Boulevards, Town Center Streets and Boulevards, the frequency of driveways should be minimized.

» On Residential streets (Neighborhood Connector, Neighborhood Street, Neighborhood Yield Street), the current Montgomery County Maryland Driveway Construction Policy and Montgomery County Zoning Standards should be followed.

» To keep driveways out of the functional intersection area, maintain adequate clearance from the corner. During redevelopment, it may be necessary to close non-conforming driveways if they do not meet these minimum guidelines.

Design

Vehicles entering the right-of-way are required to yield to all cross traffic, including bicycles and pedestrians. The design of driveways should clearly communicate this hierarchy to drivers, bicycle riders, and pedestrians.

» Where sidewalks cross a driveway, the Clear Zone should be clearly delineated across the driveway and maintain the grade, slope, and material of the adjacent sidewalk through the driveway. Because the sidewalk continues across the driveway and pedestrian right-of-way is maintained, curb ramps/tactile warning strips are typically not appropriate on either side of most sidewalk-level driveways. Exceptions include driveways that fall within the functional area of a signalized intersections, which should have detectable warnings and a pedestrian signal to cross the driveway.

» Driveway design must meet current ADA standards. Maintain the Clear Zone dimension identified in Figure A-1 across driveways with no more than a 2 percent cross slope.

» The driveway apron ramp should be contained within the Street Buffer Zone to avoid a cross slope on the sidewalk. Where no Street Buffer Zone is present, the Clear Zone should be located further from the roadway while maintaining a maximum 2 percent cross slope. At the driveway ramp, the sidewalk can narrow to 3 feet wide.

» Driveways that cross a drainage swale require a culvert or similar structure to carry stormwater. As with closed section roads, **driveways should always remain at sidewalk level when crossing a sidewalk or sidepath.**

For additional guidance, consult Chapter 50, Subdivision Regulations in the Montgomery County Code,[37] and Chapter 59 of the Montgomery County Zoning Ordinance,[34] Article 59-1.

37 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

3.10 Street Lighting

Montgomery County has more than 68,000 streetlights. Streetlights add comfort and safety to the street while providing character and scale. Street lighting can also be used to highlight public art or architectural features or as an artistic expression itself. Montgomery County follows FHWA standards for illumination levels and uniformity for lighting for roadways, walkways, bicycle facilities, crosswalks, and pedestrian underpasses. Illumination levels vary depending on luminaire type and pole height, street type, pavement type, and level of pedestrian activity or conflict.

Light Fixtures

Lighting is regulated by the Montgomery County Zoning Ordinance,[34] Division 6.4. For details, refer to the MCDOT Luminary and Streetlight Pole specifications.[38] Lighting should be designed to avoid unnecessary light spillover, energy usage, and environmental impacts. Quality and color temperature of light can impact the character and visitor perception of a street or neighborhood. However, special caution should be used in selecting a color temperature for lighting in and adjacent to residential areas. Higher color temperatures produce a bluer light that can disrupt human sleep cycles.

Although various light sources are approved, Light Emitting Diode (LED) lighting is strongly encouraged, as it is more energy efficient. Understanding that technology continues to improve, when replacements take place the county will re-evaluate the light color and distribution pattern that best suits the location. In general, roadway lighting should be designed to use the lowest wattage fixtures and the shortest pole heights available for each type of lighting.

Street Light Siting and Clearances

When selecting the appropriate style and location of lighting, it is important to consider all the users of the street, including people driving, walking, biking, and accessing/waiting for transit. Pedestrian-scale lighting is required on Downtown Boulevards, Downtown Streets, Boulevards, Town Center Boulevards, and Town Center Streets, and recommended on all the neighborhood street types.

» Lighting is typically located in the Street Buffer Zone. Lighting should

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38 https://www.montgomerycountymd.gov/DOT-Traffic/streetlight_specs.html

be oriented towards both the roadway and the sidewalk, and ensure adequate lighting at intersections and crossings, meaning that both are illuminated.

» Lighting along Country Roads is generally not required, but should be considered for intersections, roundabouts, and areas where pedestrians and cyclists may be present.

» Critical locations such as access ramps, crosswalks, transit stops, and seating areas that are used at night must be visible and lit.

» The placement of new streetlights should be sensitive to the location of existing buildings to reduce spillover. All street lighting should include full cutoff fixtures which direct light downward and reduce the potential for glare and light trespass on adjacent properties. Where feasible, place new poles between buildings directed away from windows.

» Lighting should be placed at least 24 inches behind the face of the curb. Poles should not encroach on the Clear Zone. Per FHWA guidance, luminaires should be located at least 10 feet from the crosswalk and positioned to light the side of the pedestrian facing the approaching vehicle.

» Where feasible (based on desired tree and lighting spacing), designers should alternate the placement of streetlights and trees so that trees do not block the illumination.

» Pedestrian-scaled street lighting should be designed for the sidewalk. Luminary mounting heights and pole heights are provided in the MCDOT Luminary and Streetlight Pole specifications.[39]

» Pedestrian lighting can be used alone or in combination with roadway-scale lighting in high activity areas to encourage pedestrian activity at night. Pedestrian lighting can be located on the same pole as roadway lighting to reduce the number of poles within the Street Buffer Zone.

» Spacing and wattage of fixtures, pole heights, and pole placement should be determined by modeling the proposed lighting using illumination engineering software (e.g., AGI 32) to demonstrate compliance with applicable design criteria.

» Streets that are 50 feet wide from curb to curb or less may have street lighting in an alternating pattern on opposite sides of the street.

» Streets wider than 50 feet from curb to curb may have street lighting placed across from each other on each side of the street. Median-separated streets may require additional lighting in the median.

39 https://www.montgomerycountymd.gov/DOT-Traffic/streetlight_specs.html

3.11 Maintenance Responsibility in the Active Zone

Montgomery County and individual property owners each have responsibilities for maintaining the Active Zone. The county is responsible for repairing and replacing the sidewalk, whether due to human activities (such as construction) or natural occurrences (such as a tree falling or root upheaval). Abutting-property owners are responsible for routine maintenance, such as removing leaves, foreign objects, or overgrown vegetation. During snow events, Montgomery County requires residential, commercial, and apartment or condominium building owners to clear their sidewalks, sidewalks ramps, driveways, sidewalk-level bicycle facilities, and entrances – including if snow plowing has pushed snow back onto those areas – within 24 hours of the end of the storm. Snow should be piled in the Pedestrian-Bike Buffer and the Street Buffer, to avoid impeding access.

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Chapter 4:
Street Zone

4.1 Overview

This chapter focuses on the Street Zone - the area between the curbs. It provides guidance on the three zones that comprise the Street Zone and related topics:

» Section 4.3: Curbside Zone

» Section 4.4: Travelway Zone

» Section 4.5: Median Zone

» Section 4.6: Utilities

» Section 4.7: Network Connectivity

> This chapter presents design guidance for the Street Zone that will help achieve Montgomery County's Complete Streets guiding principles of safety, sustainability, and vitality.

The Street Zone provides access and mobility for personal vehicles, transit, freight and emergency vehicles, and sometimes includes curbside uses like on-street parking, commercial or passenger loading, and transit stops. Depending on the street type, a bikeway or shared lane for both motor vehicles and bicycles may exist in the Street Zone. The Street Zone may also include a median with street trees, turn lanes, or stormwater management features. In conjunction with intersection design, the Street Zone is essential to providing a safe transportation system that embodies the Vision Zero principle that transportation-related deaths and severe injuries are preventable and unacceptable (see Chapter 1 : Vision). This chapter presents design guidance for the Street Zone that will help achieve Montgomery County's Complete Streets guiding principles of safety, sustainability, and vitality.

Figure 4-1. The street zone on Nebel Street in White Flint

4.2 Street Zone

The Street Zone is comprised of three functional areas, each with specific roles and associated design requirements. Figure 4-2 illustrates each zone and Figure 4-3 identifies which design features in the Street Zone are required, recommended, optional or not permitted/applicable on each street type in Montgomery County.

The **Curbside Zone** is the area adjacent to the Active Zone. Curbside Zone uses are varied and may include on-street parking, in-street corrals for bicycles and similar vehicles, loading zones for people (taxi or bus stops, app-based ride-hailing companies), loading zones for commercial uses, on-street bicycle facilities, mobile food vendors, parklets, electric vehicle charging stations, and more. Because of the many demands on curbside space, thoughtful planning of curbside uses is essential to a safe, high-functioning street.

The **Travelway Zone** is the area between the curbside uses and includes the lanes used by personal vehicles, transit, emergency vehicles, delivery/freight vehicles, and in many locations, bicycles. Pedestrians use the Travelway Zone on shared streets and at crossings. Speed management and safety are priorities in the Travelway Zone, as well as access for emergency service vehicles. In addition to prioritizing safety, a well-designed Travelway Zone is key to economic growth and the success of county businesses.

The **Median Zone** runs along the center of the Travelway Zone and, if present, may include a median, turn lanes, transit lanes, transit stations, street trees or other landscaping, permeable surface or stormwater management features, gateway and placemaking features, and/or traffic signs. The Median Zone can serve multiple purposes including enhancing safety by reducing conflicts; reinforcing the target speed of a roadway; improving traffic operations; and, supporting environmental goals and beautification through landscaping and green infrastructure (see Chapter 7: Green Streets).

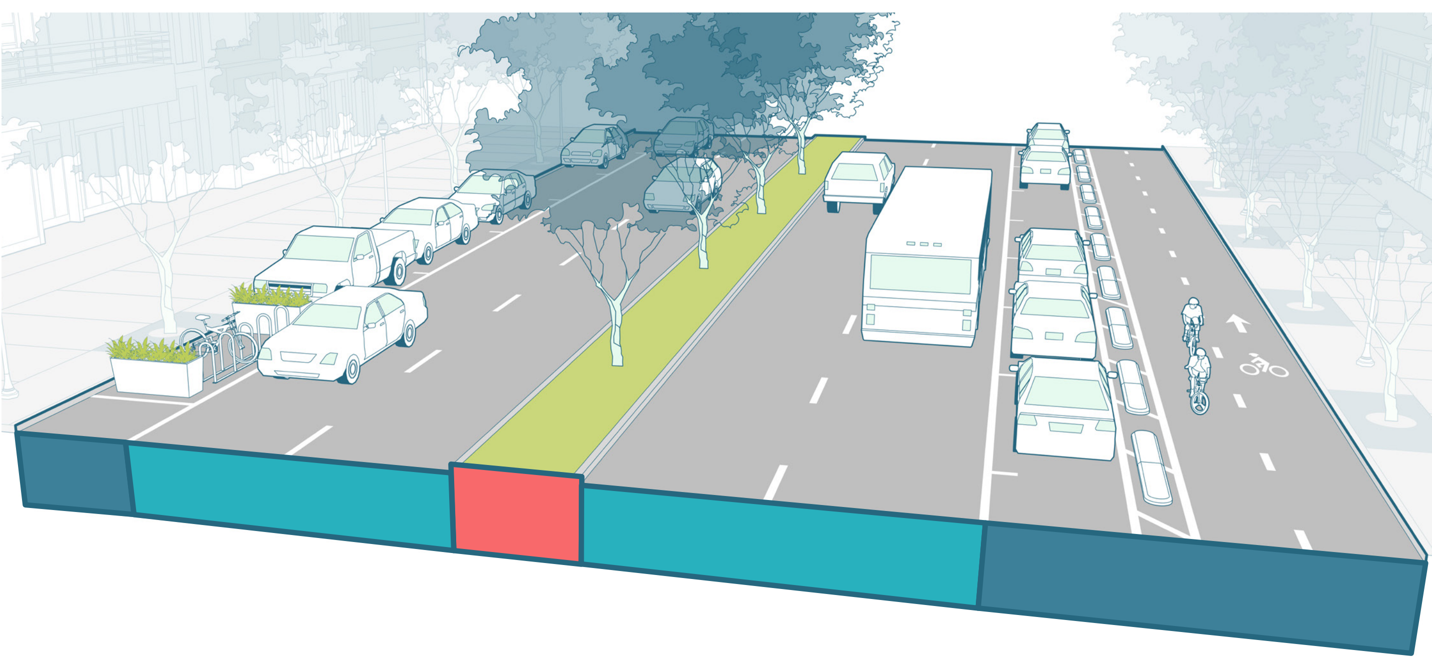

Figure 4-2. Illustration of the Street Zone

LEGEND

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- x Not Permitted or N/A
- * Unless determined otherwise by Planning Board

		Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway	Page Reference
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	▲	▲	▲	▲	▲	▲	x	▲	▲	▲	▲	171
STREET ZONE	Street Trees/ Landscaping in Median (when median is present)	■	■	■	■	■	■	■	x	■	■	■	■	166
STREET ZONE	Minimize/Consolidate Driveways	■	■	■	■	■	▲	O	O	■	▲	▲	O	119
STREET ZONE	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	■	■	O	■*	■*	O	O	O	O	O	O	O	108
STREET ZONE	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	▲	■	▲	▲	▲	O	O	▲	▲	▲	O	82
STREET ZONE	Loading/Pick-Up and Drop-Off Zones	▲	▲	O	▲	▲	O	O	O	O	O	O	x	100
STREET ZONE	Accessible Parking	▲	▲	O	O	▲	O	O	O	O	x	x	x	97
STREET ZONE	Carshare Parking	▲	▲	O	▲	▲	O	O	O	O	x	x	x	101
STREET ZONE	E/V Charging Stations	▲	▲	O	O	▲	O	O	O	O	x	x	x	98

Figure 4-3. Guidance for elements in the Street Zone

4.3 Curbside Zone

Given the multitude of demands on limited curbside space, proactive curbside management and design is needed to promote multimodal access, support nearby land uses, and reduce conflicts. As discussed in Chapter 1: Vision, Complete Streets do not require that every roadway must equally serve every travel mode. Instead, all modes must be safely and conveniently accommodated within each business district, urban area, neighborhood, or corridor. Similarly, the curbside space on each individual street should not aim to accommodate every feasible curbside use. On Downtown and Town Center Boulevards and Streets, "Complete Curbsides" should be planned at a district scale, rather than for individual street segments. In addition to the physical design of curbside spaces, managing the curbside by time-of-day can help achieve the right balance of competing but important uses.

This section provides guidance for the following curbside uses: On-Street Parking, Electric Vehicle Charging, Carshare Parking, Mobile Food Vending, Parklets, In-street Corrals for Bicycles and Similar Vehicles, Ride Hailing App/Taxi Pick-up and Drop-off, Commercial Loading, and Access Management. Other uses that may occur in the Curbside zone are covered elsewhere in this guide, including Bus Stops (see Sections 3.7) and Bikeshare Stations (see Section 3.3).

On-Street Parking

All street types except Major Highways allow on-street parking as an optional feature. While on-street parking can contribute to the design and economic vitality of a commercial area, it can also occupy valuable right-of-way that may otherwise be used to improve pedestrian comfort, bicycle safety, or transit access. In Appendix: Complete Streets Decision-Making Framework, Figure A-2 presents Priorities in Constrained Rights-of-Way and should be used to make decisions about whether and where on-street parking is needed as part of an individual street design project.

On-Street Parking:

+	–
» Can reduce on-site parking requirements and allow direct, visible access for drivers to nearby businesses. » Can send cues to drivers that they are in a walkable, urban area and should expect activity along the street (walking, biking, transit, business, people pulling in/out of parking spaces). » Can contribute to side street "friction" which can have a speed reducing effect. » If metered, can provide revenue to the municipality. » Can provide overflow parking near community facilities with occasional peak parking demand.	» Can increase vehicle miles traveled and emissions as people "cruise" for parking. » Can take up valuable curbside right-of-way that might otherwise be used for multimodal access, commercial deliveries, street trees, or other uses. » Can create conflicts as people pull in and out of parking spaces or open car doors into travel/bike lanes. » If it is provided in areas where it will be seldom used, will result in empty parking lanes that can make travel lanes appear wider, resulting in higher driving speeds.

Figure 4-4. The pros and cons of on-street parking

Parallel On-Street Parking

Parallel parking is the most common arrangement for on-street parking and is generally preferred over angled parking for several reasons:

» Parallel parking is more space efficient than angled parking and requires less paved area per parking space

» Parallel parking is effective for speed management by creating visual friction and enclosure

Dimensions: The minimum standard width for a parallel parking lane is 8 feet. The minimum standard width of 8 feet can be considered in constrained right-of-way and ideally when other street elements (specifically the adjacent travel lane) are also not at minimum widths. The typical length of a parallel parking space is 21 feet. Shorter spaces may be feasible where the driver can pull into space without maneuvering, such as at the end of a block without a curb extension or adjacent to a driveway.

Angled On-Street Parking

Although parallel parking is the county standard, in select locations where there is additional space and a high demand for parking, angled parking can provide more parking spaces per linear foot of roadway. Back-in angled parking (a.k.a. reverse angled parking) has several safety advantages over head-in parking:

» The reverse movement occurs when the parking vehicle controls the lane, requiring oncoming traffic to stop while they back into the space. Oncoming drivers and bicyclists can clearly see the parking movement and avoid conflict.

» When leaving a back-in angle parking space, the driver has visibility of oncoming vehicle and bicycle traffic.

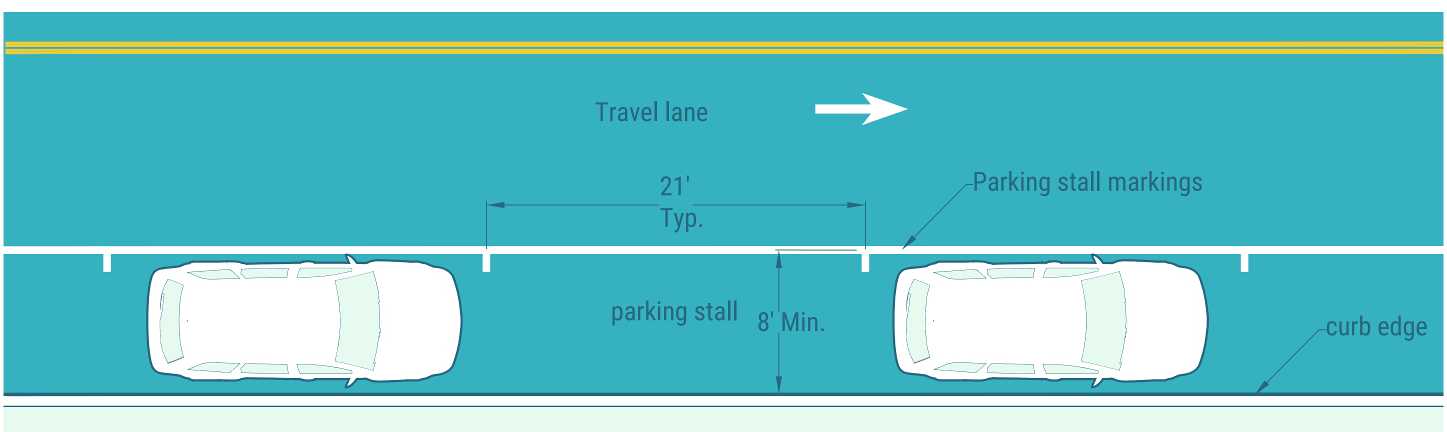

Figure 4-5. Illustration of a typical on-street parallel parking space with dimensions

» As passengers alight from the vehicle, they are naturally guided to the sidewalk rather than blocked from accessing the sidewalk by open doors. When accessing the vehicle, the trunk or rear door of the car faces the sidewalk for safer and easier loading.

Design Considerations: Angled parking consumes significantly more street width than parallel parking, as the parking spaces are wider in cross section, and the adjacent travel lane also needs to be wider to provide space for parking maneuvers. The specific geometric guidance varies with the angle of the parking and is shown in Figure 4-7. The wider travel lanes that are required for angle parking can result in higher traffic speeds. It is important to consider the tradeoffs between dedicating the street width to angled parking in order to gain more spaces versus providing wider sidewalks or street buffers that accommodate on-street dining or other active uses.

The vehicle overhang and encroachment onto the sidewalk must also be considered in the design. On steep slopes, angle parking should be set in the direction that will allow the curb to stop vehicles.

Dimensions: The dimensional requirements for reverse or back-in angle parking depend on the angle with the direction of travel and are shown in Figure 4-7. The minimum stall width for angle parking is 9 feet.

Figure 4-6. Back in angle parking (City of Kelowna, BC, Canada)

Angle (degrees)	**Stall Depth** (perpendicular to curb) (ft/in)	**Minimum width of adjacent travel lane** (ft/in) *	**Curb overhang clearance** (encroachment onto curb) (ft/in) **
45	17’8”	12’8”	0’9”
50	18’3”	13’3”	0’11”
55	18’8”	13’8”	1’1”
60	19’0”	14’6”	1’2”
65	19’2”	15’5”	1’3”
70	19’3”	16’6”	1’4”
90	18’ 0”	24’0”	1’6”

* Lesser widths may result in encroachment into oncoming traffic during parking maneuvers
** Overhang clearance must be increased by 1 foot for head-in angle parking

Figure 4-7. Angled parking design guidance (Source: Designing Walkable Urban Thoroughfares, ITE)

Accessible Parking

County policy is to provide accessible parking spaces via county-owned lots and garages, through private development, and in partnership with the Maryland Department of Transportation Motor Vehicle Administration (MDOT MVA)’s request-based program. Any on-street spaces must be designed in accordance with current guidelines and standards. Particular attention should be given to the design of accessible on-street spaces in cases where separated bike lanes are present.

Electric Vehicle Charging

Electric vehicle (E/V) charging is an important component of a sustainable transportation network, and its availability is crucial to encourage more widespread adoption of E/Vs. While charging stations should be conveniently accessible to commercial areas, it is preferable for them to be in parking lots/garages with perpendicular parking. This allows for dual chargers to serve two vehicles at a time, reducing installation costs per charger; and the charging cords are less likely to create a tripping hazard for people on the sidewalk. The location of the charging port varies on different E/Vs, with some types of vehicles near the front and others near the rear. Perpendicular parking allows head-in or back-in charging. However, where curb-side parallel parking is retained for vehicles, an E/V Option can be provided with respect to the above constraints. In either parallel or perpendicular public parking spaces, enforcement will be required to ensure spaces are only used for E/Vs while vehicle is charging.

Carshare Parking

In some mixed-use areas, Montgomery County dedicates on-street parking spaces for carshare vehicles. To inquire about creating a new dedicated carshare space in the public right-of-way, contact the MCDOT Division of Parking Management at 240-777-8740.

Mobile Food Vending

Montgomery County Department of Permitting Services (DPS) administers the licenses for mobile food vending. Anyone who plans to sell or give away food from a non-fixed location must first obtain a Montgomery County Food Service License. The only exception to the law is the sale of fresh produce or live crustaceans. The dimensions of food trucks are typically 24 feet long by 8 feet wide, although other configurations include a trailer or food cart. A food truck curbside area should provide 3 feet of additional clearance at either end of the food truck for circulation and public safety access. Contact DPS for additional details and license application at 240-777-0311.

Figure 4-8. E/V charging station

Figure 4-9. In-street mobile food vending

Parklets

Parklets can help activate an urban street by providing seating or other amenities in the Curbside Zone, which in turn may support mobile vending or nearby eateries. Parklets should be one foot less in width than the parking space that they occupy (i.e., 7 feet wide in an 8 feet wide parking space) and have 4 feet of clearance from the nearest parking space. Parklets may be public space or designated outdoor dining space for restaurants (in which case, design guidance for sidewalk cafés applies – see Chapter 3: Active Zone). To discuss the conversion of an on-street parking space into a parklet, contact DPS at 240-777-0311.

In-Street Corrals for Bicycles and Similar Vehicles

In areas with narrow Active Zones or high bicycle volumes, reserving curbside space in the street zone for bicycle and scooter parking may be appropriate. In-street bicycle corrals may take up one or two on-street parking spaces and can typically accommodate eight to 12 bicycles per on-street parking space. On-street parking corrals should be provided for dockless vehicles in downtown areas. Corrals for bicycles or similar vehicles must be approved by the Montgomery County Department of Transportation before installation. Design guidance includes:

» The racks should be positioned in a central location at least 1.5 feet from the curb, 3 feet from the outside edge of the on-street parking space, and with 4 feet of clearance from nearest parking space.

» In-street bicycle corrals or scooter parking must be oriented so that users can safely enter and exit without conflicting with motor vehicles or pedestrians.

» Placing in-street corrals near intersections allows them to function like curb extensions, providing visibility and protected space for crossing pedestrians as well as users accessing the corral.

» Pavement markings and flexible bollards are required to define the in-street corral, as well as a cast-in-place monolithic curb median.

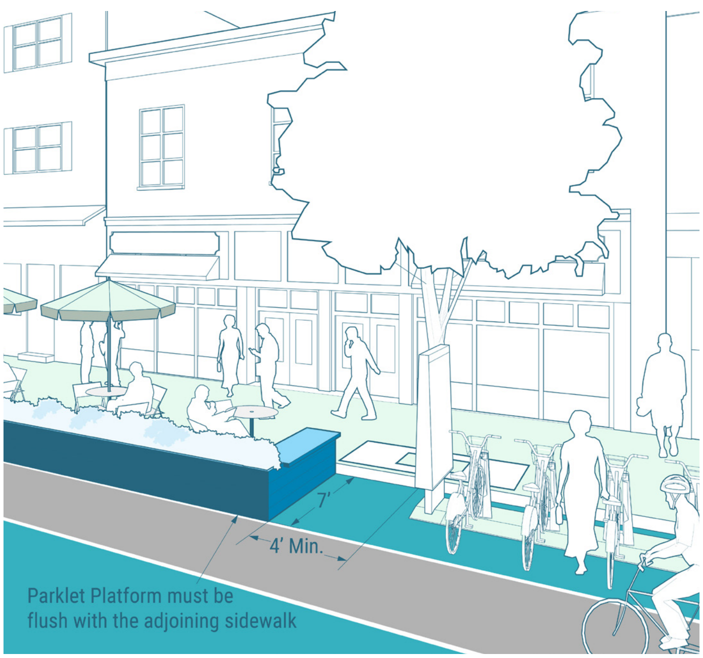

Figure 4-10. Illustration of parklet dimensions

Figure 4-11. On-street bike parking corral at Wayne Avenue and Fenton Street

Commercial Loading Zones

On-street loading zones are typically used by businesses in a commercial area where on-site loading or alleys are not available. They should be planned as a shared resource at a district scale, ensuring there is reasonable access to a dedicated loading area throughout the commercial area.

The typical duration of use is less than 30 minutes. The typical design vehicle for a loading zone is a single unit 30-foot delivery truck (SU-30), although some businesses may receive deliveries from larger vehicles. In some areas, it may make sense to prohibit use of trucks larger than an SU-30 for deliveries. In locating and designing loading zones, it is important to consider the tradeoffs between proximity, size and duration of loading. Options to consider for loading zones include:

» **Side-street zones:** Because a truck loading can take more room than a typical parallel parking space and create conflicts with oncoming traffic, it is often preferable to locate loading zones on a side street rather than on a primary business street.

» **Center-lane loading zones:** On streets where there are medians or left turn lanes, a center loading zone that can serve businesses on either side of the street can be considered as a retrofit solution if no alternative loading zone is feasible. These should have a minimum width of 10 feet to allow room for the driver circulation on each side of the vehicle, and only be located on streets with target and operating speeds of 25 mph or less to avoid conflicts.

» **Goods and passenger loading**: Loading zones allow for loading/unloading of goods or passengers. Loading zones can be used by taxis and ride-hailing services.

Ride Hailing Loading/Unloading Zones

Ride-hailing services (i.e., app-based rideshare companies and taxis) are an important component of urban mobility. Without dedicated pick-up/drop-off zones, ride-hailing vehicles create unexpected conflicts by double parking or blocking bike lanes or bus lanes. A ride hailing drop-off area should allow drop-offs without requiring reversing or other maneuvers and should consider the volume of use to determine how many cars should be able to stop at one time. Designated loading zones can be used for loading goods or passengers and function for ride-hailing zones. The most space-efficient arrangement for ride hailing drop-off zones is at the beginning of a block, as shown in Figure 4-12, because the exiting distance required (C) is less than the entry distance (A).[40] In central business districts, a ride hailing loading/unloading area should be provided every one or two blocks. On Boulevards and some Downtown Boulevards, it is preferable to have designated ride hailing loading/unloading areas on side streets.

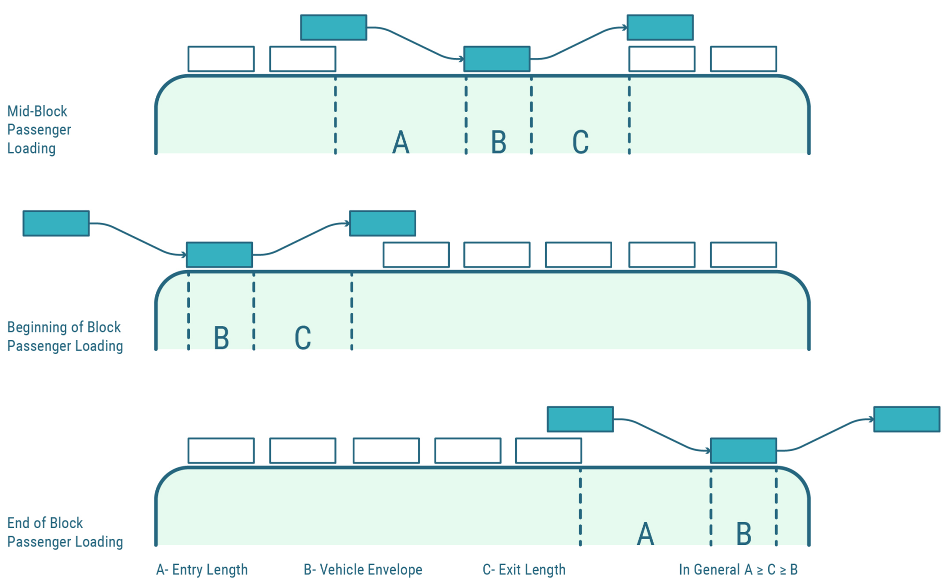

Figure 4-12. Ride hailing pickup/drop-off area diagrams (Graphic content from: ITE Curbside Management Practitioners Guide)

40 https://www.ite.org/pub/?id=C75A6B8B-E210-5EB3-F4A6-A2FDDA8AE4AA

Loading Zones and Bicycle Lanes

Where there is a dedicated bikeway, it is preferable to locate loading areas on intersecting streets. However, if a dedicated bikeway and loading zone must co-exist, careful design is required to avoid potential conflicts. Loading Zones can be designed for passenger loading or for commercial loading. Commercial loading zones are not required to be accessible to individuals with disabilities, but passenger loading areas are. Areas where conventional bike lanes are regularly blocked by commercial delivery vehicles may be appropriate for increased enforcement, vertical separators between the travel lane and the bike lane, or retrofits that better accommodate both loading and bicycle use. On streets with separated bike lanes and on-street parking, it is feasible to design loading zones that are accessible and minimize conflicts with bicyclists. Figure 4-13 provides design guidance for accessible passenger loading zones alongside separated bike lanes, as recommended in the AASHTO Bike Guide. If the design is for a commercial loading zone (not for passenger loading), the area between the loading zone and the bike lane may be reduced to 3 feet in constrained conditions.

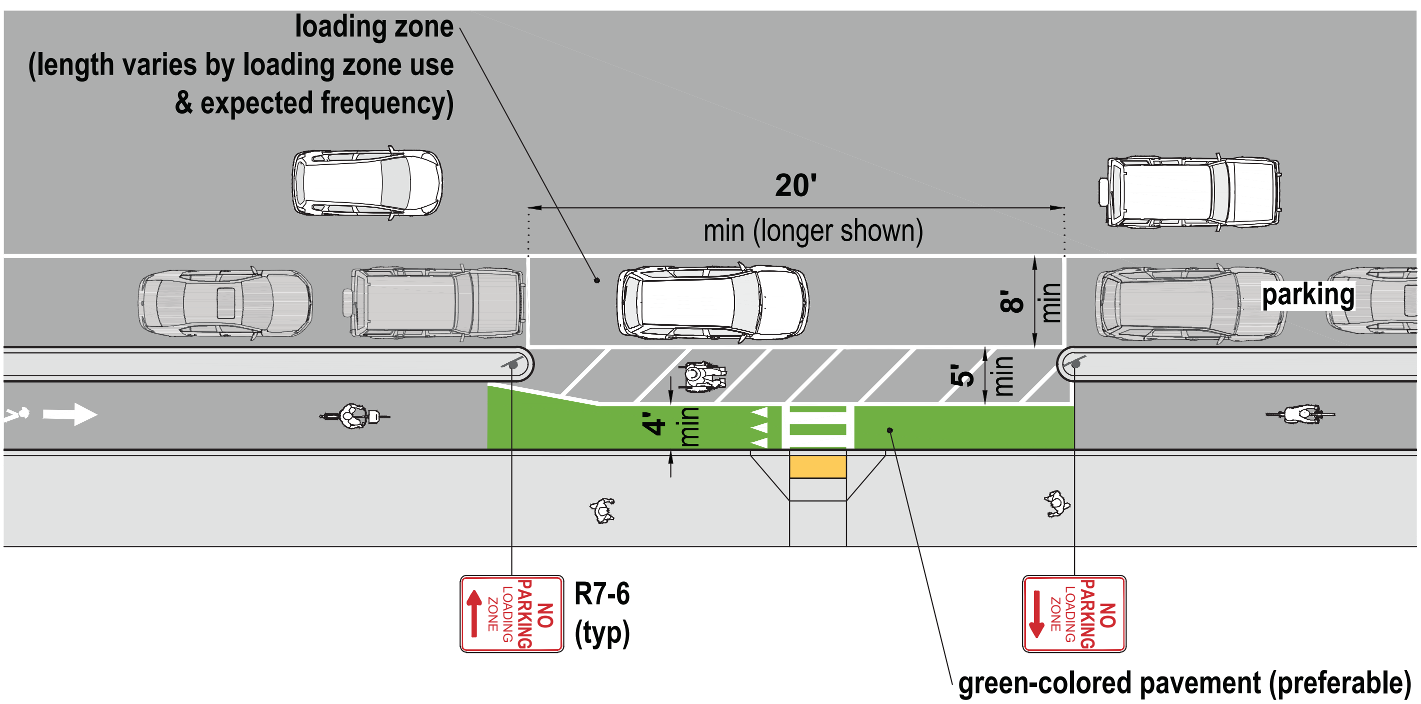

Figure 4-13. Example guidance for passenger loading zone with a separated bike lane

4.4 Travelway Zone

The travelway zone provides for the mobility of vehicular traffic, transit vehicles, and bicycles where separated bikeways are not available. The travelway is the total pavement width of the travel lanes combined. It does not include parking lanes. Travelway width or "clear width" is an important design element for Fire Department and Emergency Services Access. See Montgomery County Fire Department Access Performance-Based Design Guide[41] for elaboration and detail on travelway requirements.

Travel Lanes and Shoulders

Lane widths

Travel lane widths vary with the street type and respond to the context, heavy vehicle volumes, and target speed. A common lane width used in this guide is 10 feet, which can accommodate most vehicle types. Outside travel lanes for certain street types are wider in order to create a shy zone from the curb for larger vehicles and to avoid conflicts with curbside uses. The lane widths in Figure 4-14 are for straight segments of roadway. Roads with horizontal and vertical curvature may require wider travel lanes to accommodate vehicle tracking for larger vehicles – consult the AASHTO Green Book.[42] The street typology and lane widths in Figure 4-13 supersede the Functional Classification and respective road lane widths in Montgomery County Code Section 49-28. (Note: While many two-way left turn lanes exist in Montgomery County, this treatment is only for use under select circumstances because of the increased crash risk associated with this design in many situations.)

Shoulder widths

Shoulder widths also vary with the street type depending on context (See Figure 4-14). Shoulders are an important part of the roadway, particularly on Country Roads and Country Connectors where they often serve as bicycle facilities. Shoulders should be designed to AASHTO standards and wide enough to safely accommodate on-road bicycle travel in these contexts.

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41 https://montgomeryplanning.org/planning/functional-planning/fire-department-access-performance-based-design-guide/

42 American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets (Green Book)

Street Type	Left Turn Lane (if required)	Two Way Left Turn Lane[3]	Inside Travel Lane[1]	Outside Travel Lane (against curb or parking)[2]	Shoulder
Downtown Boulevard	10’ default, 9’ min	N/A	10'	11'	N/A
Downtown Street	10’ default, 9’ min	10'	10'	10.5'	N/A
Boulevard	10'	N/A	10'	11'	N/A
Town Center Boulevard	10'	N/A	10'	11'	N/A
Town Center Street	10'	10'	10'	11'	N/A
Neighborhood Connector	10'	10'	10'	10.5'	N/A
Neighborhood Street	N/A	N/A	10'	10.5'	N/A
Neighborhood Yield Street	N/A	N/A	N/A	12’	N/A
Industrial Street	11'	11'	11'	11'	N/A
Country Connector	11'	N/A	11'	11'	6’
Country Road	10'	N/A	11'	11'	5’
Major Highway	11'	N/A	11'	12'	8’

1. Includes lane against the centerline on undivided roads. All lane widths in chart are for typical tangent (straight) sections.
2. If the outside lane is adjacent to a bike lane, the total width (travel lane + bike lane) should be no less than 16’). These dimensions also serve as guidance for right turn lanes, where needed. Gutter plan is included in parking lane dimensions. If there is no parking lane, gutter pan is included in outside travel lane width.
3. Provided for existing conditions conformity and only for retrofits of four-lane roads to three lanes using a road diet as an allowable treatment. Not encouraged for new roads or reconstruction/widening.
4. On median-divided roadways, the minimum curb-to-curb pavement width is 20’.

Figure 4-14. Lane width dimensions by street type

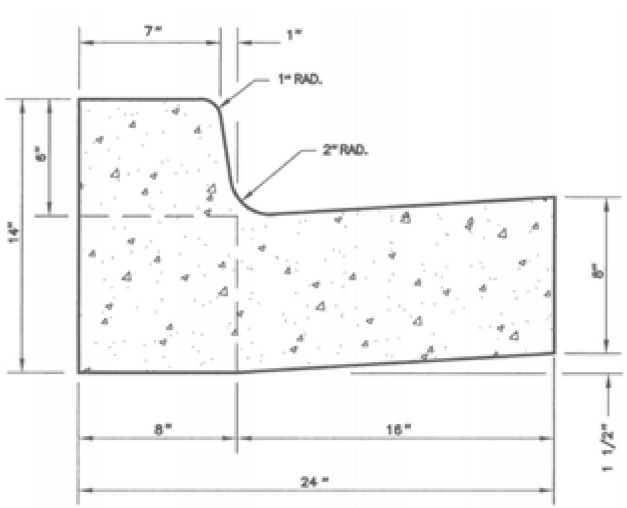

Figure 4-15. Montgomery County curb and gutter dimensions

Gutter Pans

Montgomery County provides standard specifications for concrete curb and gutters, which form the edge of the street and elevate the Active Zone above the street level. The standard curb and gutter unit is 24 inches wide and provides a 6-inch height differential between the street and sidewalk, as shown in Figure 4-15. The gutter pan extends 16 inches into the street zone and should be considered as part of the width of the curbside use (i.e., parking, bike lane, travel lane or other).

Travel Lane Number

Figure 4-16 provides the maximum number of through travel lanes for each street type. Consult the Master Plan of Highways and Transitways for the recommended number of through travel lanes on specific streets, which supersedes this guidance.

Street Type	Maximum # of Vehicle Through Lanes[4]
Downtown Boulevard	6
Downtown Street	4
Boulevard	6
Town Center Boulevard	6
Town Center Street	2
Neighborhood Connector	2
Neighborhood Street	2
Neighborhood Yield Street	1*
Industrial Street	4
Country Connector	4
Country Road	2
Major Highway	N/A

*Ensure compliance with the Montgomery County Fire and Emergency Access Performance-Based Design Guidance

Figure 4-16. Maximum vehicle through lanes per street type

The maximum number of lanes should not be exceeded, because additional travel lanes increase barriers to safe movement for people walking, biking or taking transit.

The following treatments can be considered as an alternative to road widening on corridors that are highly congested. Each of these approaches has design challenges and limitations and should only be considered if broader options to reduce single occupant vehicle (SOV) travel have already been implemented.

Peak Time Restricted Parking Lanes. Parking lanes can be converted to travel lanes during peak traffic hours, with the following considerations:

» The need for parking might coincide with peak travel hours, particularly for businesses that rely on short-duration parking for commuters.

» Enforcement and towing may be needed to enforce the parking restrictions; otherwise vehicles left in the parking spaces during the restricted hours can create a hazard.

» The parking lane will need to be wider than the standard parking lane (10.5 - 12 feet rather than 8 feet), which could lead to higher speeds during the off-peak periods.

Reversible Lanes. For streets that do not have a median, lanes with peak hour reversible operations can provide additional peak hour capacity in unique circumstances. Current examples include US Route 29 and MD Route 97. This design is only appropriate for locations with highly directional traffic flow or managed travel lanes (e.g., transit, high-occupancy vehicle, or high-occupancy toll lanes). Considerations include:

» Implementation of reversible lanes needs to be accompanied by a robust public awareness campaign.

» Dedicated left turn lanes cannot be provided with reversible lanes, which can exacerbate conflicts. The treatment is not suitable for corridors with high density of driveway accesses

High-Occupancy Vehicle Lanes. Also known as carpool lanes, High-Occupancy Vehicle Lanes (HOV lanes) restrict travel to vehicles with either two or more (2+) or three or more (3+) occupants. While HOV2+/3+ lanes are more common on highways, there are examples in the region where they have been used on non-highway roads. The design of HOV lanes will be determined case-by-case based on local conditions.

Dedicated Transit Lanes

As a default, the following dimensions are Montgomery County's standards for dedicated transit lanes:

» **Transitway lanes:** 13 feet preferred, 12 feet min

» **Transitway buffer:** 6 feet preferred, 2 feet min

The Master Plan of Highways and Transitways[43] identifies a network of over 100 miles of planned transitways. These transitways may have exclusive lanes or operate in mixed traffic. The design of streets that are part of the future transitway network should incorporate dedicated transit lanes and stops/stations as specified in the Master Plan and subsequent corridor/transitway plans. Dedicated Transit lanes can also be implemented beyond the formal, designated Transitway corridors.

Lane dimensions include the gutter pan. For transit vehicles that operate in mixed traffic, the lane widths shown in Figure 4-17 apply. These dimensions are for typical segments, not for intersections or stations.

FHWA has issued Interim Approval (IA-22)[44] for the use of red-colored transit lanes. Red colored pavement can help reinforce the transit lane's exclusivity, reducing incursions by non-transit vehicles. Use of red colored pavements should obtain approval from MDOT SHA per Section 1A.10 of the Maryland MUTCD.[45]

43 https://montgomeryplanning.org/planning/transportation/highway-planning/master-plan-of-highways-and-transitways/

44 https://mutcd.fhwa.dot.gov/resources/interim_approval/ia22/ia22.pdf

45 https://www.roads.maryland.gov/mmutcd/2011_Chapters_01A.pdf#page=5

4.5 Median Zone

Medians can serve multiple purposes including:

» Creating more attractive street corridors by providing space for tree plantings, which contribute to a sense of enclosure, increase permeable surface area, and provide shade.

» Providing room for green infrastructure to filter and store stormwater (see Chapter 7: Green Streets for detail).

» Providing room in the cross section so that left turn lanes can be provided where needed without altering the alignment of the curb and through travel lanes.

» Providing space for appurtenances such as street lighting, signs, or traffic signal poles.

» Providing a refuge for people crossing the street, particularly for mid-block crossings of wider streets.

» Reducing traffic conflicts by restricting left turning traffic into or out of driveways.

Dimensions

In Montgomery County, medians are required on Downtown Boulevards, Boulevards, Town Center Boulevards, and Major Highways. Center medians are optional on other street types. **The minimum median width is 6 feet for all street types**, which is also the minimum for a pedestrian refuge. The median width does not include the width of the left turn lane. Excessive median widths are not desirable because they elongate crossing distances. Figure 4-17 presents the center median requirements per street type. For streets where medians are optional, the dimensions shown are for instances where a median is provided. For streets where the median will transition into a left turn lane, a minimum of 16 feet will be required at intersections to allow for a 10- or 11-foot turn lane and a 6-foot pedestrian refuge island. This may require additional right-of-way at intersections if a 16- or 17-foot median is not feasible or desirable along the entire corridor.

Street Type	Center Median	Dimensions
Downtown Boulevard	▲	6’ – 16’
Downtown Street	O	6’ – 10’
Boulevard	▲	6’ – 16’
Town Center Boulevard	▲	6’ – 16’
Town Center Street	O	6’ – 10’
Neighborhood Connector	O	6’ – 16’
Neighborhood Street	O	6’ – 10’
Neighborhood Yield Street	X	–
Industrial Street	O	6’ – 17’
Country Connector	O	6’ – 17’
Country Road	O	6’ – 16’
Major Highway	■	6’ – 17’

■ Required
▲ Recommended
O Optional (Context-Sensitive)
X Not Permitted or N/A

Figure 4-17. Median guidance

4.6 Utilities

Definition and Purpose

This section provides guidance for placement of utilities within and adjacent to the public right-of-way. This section also includes guidance on addressing private utilities proposed in public right-of-way and public easements.

Guidance provided in this section is based on Chapters 49 and 50 of the Montgomery County Code.[46] Chapter 49 establishes requirements, criteria, practices, and procedural guidelines for the planning, design, construction, and approval of public and private utility infrastructure within public streets and roads. Chapter 50 establishes similar requirements for public and private utility infrastructure for subdivided development parcels. MCDOT also has general guidance on placement of "wet" versus "dry" utilities under the paved portion of the right-of-way, which are summarized below.[47]

Water and Sewer

The Washington Suburban Sanitary Commission (WSSC) provides the majority of water and sewer service in the county, and the WSSC Pipeline Design Manual governs the placement of water and sewer facilities within the public street right-of-way.

Water and sewer facilities are typically located within the Street Zone. WSSC's Pipeline Design Manual[48] recommends that water and sewer lines be located on opposite sides of the street centerline, 5 feet from the centerline where the pavement is less than 24 feet wide, and 7 feet from the centerline where pavement is 24 feet wide or greater. If one side of the street is higher than the other, water lines should be located on the high side of the street.

Gas

Gas service in Montgomery County is provided by Washington Gas, and planning, design and construction of gas facilities must be in accordance with National Fuel Gas Code[49] (Pipeline and Hazardous Materials Safety

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46 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

47 https://www.montgomerycountymd.gov/dot-dir/Resources/Files/2016-Utilities-in-Public-ROW.pdf

48 https://www.wsscwater.com/pipelinedesign

49 https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=54

Administration, Code of Federal Regulations 49 CFR 192). Similar to water and sewer lines, gas lines should be located within the paved Street Zone. The horizontal location of gas lines should be carefully selected to minimize exposure to traffic loading and maintain minimum clearances described below.

Dry Utilities

Dry utilities such as electric, telephone, cable, and fiber-optic communications facilities should be installed in a separate Public Utility Easement (PUE) adjacent to the public right-of-way whenever feasible. However, in the case of Downtown and Town Center areas where zero building setbacks are allowed, dry utilities may be installed in the public right-of-way. When located in the public right-of-way, dry utilities should be located within the Frontage Zone and out of the Clear Zone, whenever feasible.

The preferred location of dry utilities is as follows, in order of priority:

» In alleys, private roads and privately-owned open space behind the buildings where access by utility maintenance vehicles is available;

» In the Frontage Zone;

» Under the sidewalk between the building and the street;

» Under the on-street parking lanes;

» Under a travel lane.

Underground Conversion

General guidance on undergrounding utilities is shown in Figure 4-18. However, with the implementation of a Complete Streets framework, the development of a modified policy for the location and placement of utilities within county Rights-of-Way is needed. The Montgomery County Code[50] currently has regulations governing the conversion of aboveground utilities to underground locations (Chapter 49, Section 19) and the provision of underground utilities by development (Chapter 50, Section 4.3.I.1(a) & (b)). Specifically, streetscape guidelines in the urban areas of Montgomery County require the undergrounding of utilities and are currently enforced through the regulatory and permitting process by the M-NCPPC, DPS, and DOT. MCDOT also has general guidance on placement of “wet” versus “dry” utilities under the paved portion of the right-of-way (May 11, 2016 letter from MCDOT to the Planning Board)[51].

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50 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

51 https://www.montgomerycountymd.gov/dot-dir/Resources/Files/2016-Utilities-in-Public-ROW.pdf

The intent of a modified policy would be to strengthen and formalize this process to improve clarity on expectations on development applications and county and state agencies to provide underground utilities. A formalized countywide process should be implemented that provides a framework for implementation and enforcement. General guidance and policy on undergrounding utilities should be applied to in-street design and development projects county-wide; however, special consideration should be given to optional method development projects in the Commercial/ Residential and Employment Zones, if recommended in a Master or Sector Plan, streetscape guideline or design guideline, and on Downtown Boulevards and Downtown Streets.

In addition to modifying the policy to become countywide, a separate utility functional plan should be pursued by the county to address various utility issues including:

» Use of fee in lieu to fund future undergrounding by county;

» Consolidation of utilities;

» Relocation of utilities;

» Conduit installation in place of utility relocation;

» Width requirements for each utility within the right-of-way; and

» Placement of utilities in designated alleys to avoid conflicts with narrower rights-of-way.

LEGEND

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- x Not Permitted or N/A
- * Unless determined otherwise by Planning Board

	Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway
Undergrounding Utilities (unless otherwise specified in a Master Plan)	■	■	O	■*	■*	O	O	O	O	O	O	O

Figure 4-18. Guidance on underground conversion by street type (does not supersede above requirements)

Utility Clearance

In all circumstances, utility placement should be coordinated with other right-of-way features including enclosed storm drainage, streetlights and conduit, traffic signals and interconnect conduit, street trees, pedestrian and bicycle facilities, stormwater management facilities, traffic signs, etc. However, certain utilities require larger clearances from other utilities and right-of-way features. Minimum utility clearances are described below:

Water Lines

» 10 feet minimum horizontal separation between from sanitary or storm sewers, structures, and trees;

» Where 10 feet of horizontal separation cannot be maintained from sanitary or storm sewers, 18 inches vertical separation, with water line above;

» 5 feet minimum horizontal separation between water lines, other utilities, and other underground obstructions;

» 12 inches vertical separation between water lines and other utilities.

Other Underground Utilities

» 10 feet horizontal separation from trees;

» 5 feet minimum horizontal separation from other utilities and underground obstructions;

» 12 inches vertical separation from other utilities.

Overhead Utilities

» 16.5 feet minimum above any vehicular travel lane;

» 12 feet minimum above any sidewalk;

» 15 feet minimum above any commercial driveway.

Where existing constraints preclude meeting separation requirements, clearances may be reduced below minimum values with the approval of the county and the utility provider. Additional measures may be required to protect utilities from damage where clearance is reduced.

Utility Appurtenances

Designers should carefully consider the location of utility appurtenances. Open grates and utility, streetlight, or traffic poles should not be placed in the Clear Zone. Utility covers may be located in either the Street Zone, Street Buffer Zone, or the Clear Zone; but should be set flush with the sidewalk grade to conform to the US Access Board's Public Right-of-Way Accessibility Guidelines,[52] and topped with a non-slip material. The Clear Zone should be the last resort for utility cover placement. Utility covers should not be located within curb ramps, transitions, landings, or gutter areas within the Clear Zone.

Utility covers placed in the Street Zone should be located outside the vehicle wheel path whenever feasible.

> Open grates and utility, streetlight, or traffic poles should not be placed in the Clear Zone.

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52 https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines

4.7 Network Connectivity

A more connected street network can help improve livability by reducing traffic volumes and congestion on major streets. Consistent with the Montgomery County General Plan,[53] roadway designers should take every opportunity to improve network connectivity in the county. This includes providing connections within individual developments, between developments, and taking opportunities to close historic gaps in the existing street grid. In some cases, these new connections will be streets open to all travel modes. In general, developers, designers, and planners should aim to provide access in the four cardinal directions and avoid the dead-end pattern of conventional cul-de-sacs. In specific cases, a bicycle and pedestrian connection may be all that is desirable or feasible. Figure 4-19 shows a hypothetical example of how trail and street connectivity can improve access through infill development in Montgomery County. Whereas Option A shows conventional suburban design that limits all transportation and emergency access and promotes congestion at a single intersection:

» Option B is an improvement compared to A, because it includes a bicycle and pedestrian trail that connects the new development to the existing street network and nearby destinations.

» Option C is the preferred alternative because it provides multimodal access within the new development and multiple primary and secondary connections to surrounding land uses.

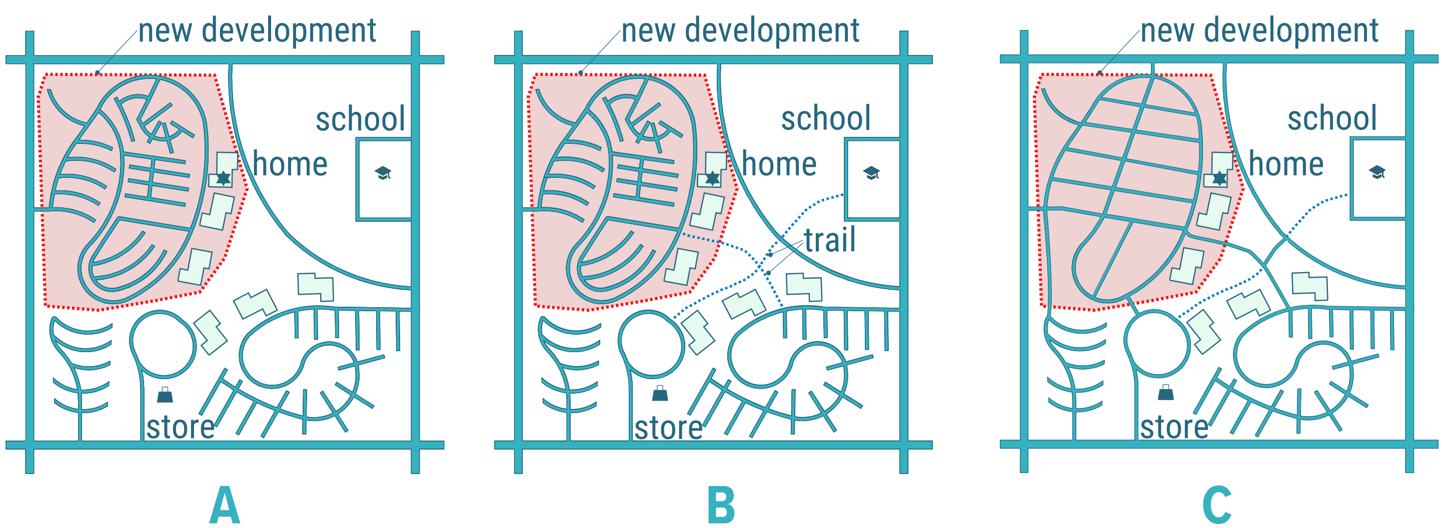

Figure 4-19. Examples of network connectivity and design

53 https://montgomeryplanning.org/planning/master-plan-list/general-plans/

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Capital Crescent Trail
BETHESDA AVE.
M-NCPPC

Chapter 5:
Bikeways

5.1 Overview

Key principles of bikeway design in Montgomery County are that:

1) The bicycling network should accommodate people of all ages and bicycling abilities.

2) Bicycle travel on all streets should be safe, continuous, direct and convenient.

The content of this chapter is organized in three sections:

» Section 5.2 presents general design guidance for bikeways in Montgomery County.

» Section 5.3 presents guidance on additional topics, including shy zones, bicycle ramps, green-colored pavement marking, and references for relevant design topics.

» Section 5.4 identifies appropriate bikeways by street type in Montgomery County.

More detail is provided in the Montgomery Planning's Bicycle Facility Design Toolkit (May 2018)[54] and the AASHTO Guide for the Development of Bicycle Facilities.[55]

Although many trips in the county are short enough to make by bicycle, most are made by private automobile. One barrier to bicycling is known as "traffic stress." The concept of traffic stress is that each person has a certain tolerance for bicycling near traffic, and if that tolerance is exceeded even for a short distance, they may be deterred from bicycling. In order to encourage the broadest segment of the population to bicycle, Montgomery County is creating a bicycling network that accommodates most people's tolerance for traffic stress and does not require an excessive level of detour.

54 https://montgomeryplanning.org/wp-content/uploads/2018/05/Bicycle-Facility-Design-Toolkit-May-2018.pdf

55 https://nacto.org/wp-content/uploads/2015/04/AASHTO_Bicycle-Facilities-Guide_2012-toc.pdf

Providing a low-stress bicycle network that appeals to a broad array of potential bicyclists is the central tenet of the Montgomery County Bicycle Master Plan,[56] adopted in 2018. Bicycle facilities should be designed for all users, ideally such that older adults and families with children would be capable of safely and comfortable navigating them. The Bicycle Master Plan sets forth a vision for Montgomery County as a world-class bicycling community, where people in all areas of the county have access to a comfortable, safe, and connected bicycle network, and where bicycling is a viable transportation option that improves quality of life for residents. In addition to outlining a comprehensive set of program and policy objectives, the Bicycle Master Plan identified a countywide network of bicycle facilities that will be constructed over time (see https://mcatlas.org/bikeplan/). The bikeways identified in the Bicycle Master Plan should be implemented whenever feasible through redevelopment, street reconstruction, repaving, and/or capital improvement projects.

The Bicycle Master Plan defines five categories of bicycle facilities that comprise the planned bicycling network (see Figure 5-1). Each category is discussed in the following section.

Figure 5-1. Montgomery County bikeway facility types (Source: Montgomery County Bicycle Master Plan)

56 https://montgomeryplanning.org/planning/transportation/bicycle-planning/bicycle-master-plan/

When to Separate Pedestrians and Bicycles

As further explained in the next section, sidepaths and trails are shared between bicycles and pedestrians, while a separated bike lane provides separate space for each user group. Deciding which facility is appropriate in each context requires an assessment of the anticipated volume of pedestrians that are expected.

To improve the comfort and safety of bicyclists and pedestrians, and to improve the efficiency of the shared use path for bicycle travel, the Bicycle Master Plan[57] has the following guidance on when to separate walking and bicycling, specifically in these locations:

» Commercial-Residential Zones, Life Sciences Center Zones, their floating zone equivalents, or locations within 0.5 miles of a rail station.

» Areas that are zoned for multifamily residential or townhomes should have separation between walking and bicycling if they are adjacent to properties that are zoned Commercial-Residential, Life Sciences Center, floating zones, or near rail stations.

If separation between pedestrians and bicycles is appropriate, the following strategies may be applied:

» Separate, parallel facilities may be provided, such as a separated bike lane and sidewalk, or two parallel trails (one for pedestrians and one for bicyclists). The breezeway network recommended in the Bicycle Master Plan assumes the development of parallel facilities. See page 183 for more details on Breezeways.

» On trails or sidepaths 15 feet or wider, pedestrians can be provided with a bi-directional walking lane on one side, while bicyclists are provided with directional lanes of travel. This design requires at least 10 feet for two-way bicycle traffic and at least 5 feet for pedestrians. Although areas are marked for separate use by bicyclists and pedestrians, the expectation is that either user may encroach upon the adjacent paved space, and as such the entirety of the trail or sidepath is designed to meet pedestrian accessibility guidelines.

» On sidewalk-level separated bike lanes, designers should include measures that help pedestrians with vision disabilities differentiate the pedestrian walkway from the lanes designated for bicycling. This includes a buffer between the facilities that is detectable underfoot (e.g., rounded cobblestone, unwalkable surfaces). A clear visual contrast can also be provided with different surface materials (e.g., concrete versus asphalt) or through use of surface coloring pavement markings. Directional indicators (a linear, raised guidance surface) may be installed between the separated bike lanes and the pedestrian walkway to guide pedestrians. Care should be taken to ensure that any detectable separation is not a tripping hazard.

57 https://montgomeryplanning.org/planning/transportation/bicycle-planning/bicycle-master-plan/

5.2 General Bikeway Design Guidance

Trails

Trails are located outside of the road right-of-way. They provide two-way travel designated for walking, bicycling, jogging, skating, and traveling by scooter, wheelchair, and other micromobility devices. Trails are typically 10 feet wide. Widths at constrained pinch points can be reduced to 8 feet and may widen to 14 feet wide where usage is likely to be higher. On trails with very high levels of walking and bicycling, spaces for pedestrians and bicyclists are often separated to reduce conflicts and improve comfort. In these situations, trails can be widened to 19 feet wide, including 8 feet for walking and 11 feet for bicycling. If the trail is designated as a Breezeway, the desired width may be greater than 19 feet. Additional design guidance is provided in the Montgomery County Bicycle Facility Design Toolkit.[58]

Pertinent to Complete Street design, intersections of streets and trails must be designed to address conflicts between drivers, pedestrians, and bicyclists.

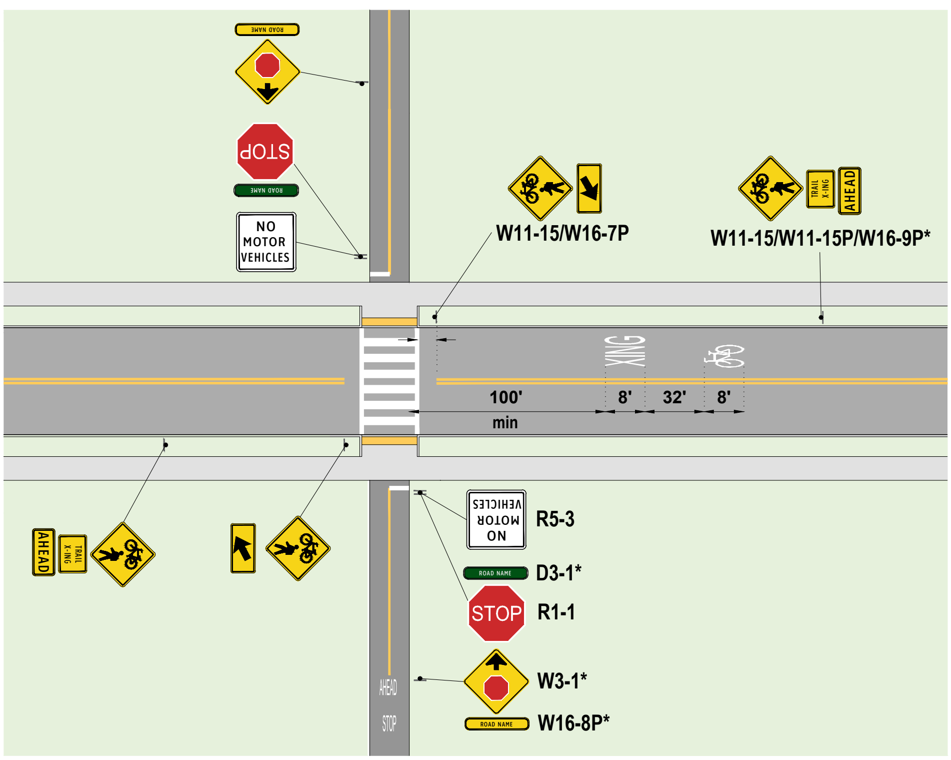


Figure 5-2. Illustration of a trail crossing

58 https://montgomeryplanning.org/wp-content/uploads/2018/05/Bicycle-Facility-Design-Toolkit-May-2018.pdf

Design guidance includes:

» At a minimum, lighting should be provided at path/roadway intersections and should be provided at other locations where personal security may be an issue or where nighttime use is likely to be high.

» Whether the trail is stop- or yield-controlled, roadway and path approaches to an intersection should provide sufficient stopping sight distances so that motorists, bicyclists, and pedestrians can avoid obstacles or potential conflicts within the intersection. Sight distances are based on site conditions and user-based factors. Calculate sight triangles as per the AASHTO Bike Guide.[59]

» The intersection should be conspicuous to all users, which may require trimming or removing landscaping or other fixed objects that limit sight lines and designing intersections to as close to a right angle as practical, given existing conditions.

» Intersections and approaches should be designed with relatively flat grades, when feasible.

» Designers should use speed reduction techniques for trail users and drivers, where needed.

» Trail crossings on uncontrolled multi-lane roads should be avoided where feasible.

» Where a trail crosses a street that is too wide for the design user to make a single, continuous crossing, a median refuge island should be provided. Median islands should be a minimum of 6 feet wide to provide adequate space for multiple people to wait, and preferably 10 feet at trail crossings of 4 to 6 lanes.

59 https://nacto.org/wp-content/uploads/2015/04/AASHTO_Bicycle-Facilities-Guide_2012-toc.pdf

Separated Bikeways

Separated bikeways provide physical separation from traffic. These bikeways are separated from motorized traffic by the Street Buffer and from pedestrians by the Ped / Bike Buffer. There are two types of separated bikeways: Separated bike lanes and Sidepaths.

Separated bike lanes are exclusive bikeways that are physically separated from motor vehicle traffic and distinct from the sidewalk. They operate one-way or two-way. The recommended and minimum widths for separated bike lanes are shown in Figure 5-4. Beveled curbs are recommended adjacent to separated bike lanes. Mountable curbs are recommended adjacent to shops and other destinations to provide easy access to the adjacent sidewalks for people using bicycle parking or bikeshare stations. Standard 6-inch vertical curbs are recommended adjacent to motor vehicle travel lanes and on-street parking to discourage encroachment into the separated bike lane.

Separated bike lanes can be sidewalk-level, street-level, or intermediate-level. **The default in Montgomery County is intermediate-level.** A curb reveal of 3 inches (or a minimum of 2 inches) below sidewalk level is required to provide a detectable edge for visually impaired pedestrians.

Same Direction Bicyclists/ Peak Hour	Bike Lane Width (ft.)		Bidirectional Bicyclists/ Peak Hour	Bike Lane Width (ft.)	
	Rec.	Min.		Rec.	Min.
<150	6.5	5.0	<150	10.0	8.0
150-750	8.0	6.5	150-400	11.0	10.0
>750	10.0	8.0	>400	14.0	11.0

Figure 5-4. Separated bikeway widths (Source: Montgomery County Bikeway Design Toolkit)

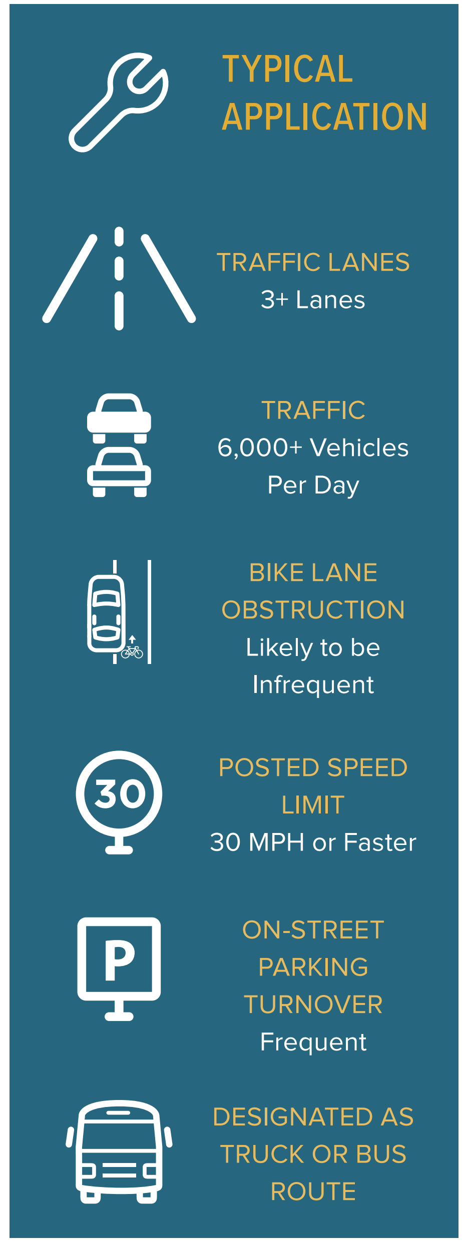


Figure 5-3. Typical application of separated bikeways

The following general design principles apply for separated bikeways:

» Changes in the bike lane elevation and horizontal alignment should be smooth and their frequency minimized.

» Separated bike lanes should not be narrowed at street crossings. Bicycle ramps (see page 186) or curb ramps that connect the separated bike lane to the street should provide the same operating width as the approaching bike lane.

» The width of the bike lane should allow passing of slower bicyclists and side-by-side travel, where feasible.

» The bike lane edges should be free from pedal and handlebar hazards.

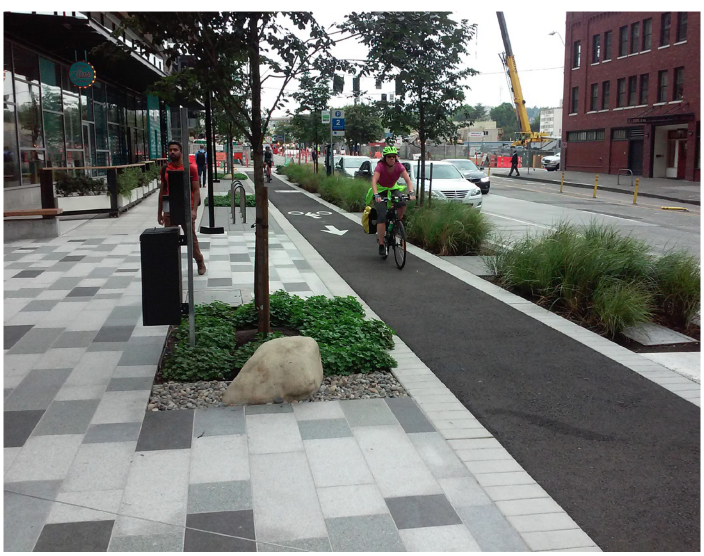
» The design of the separated bike lane should meet the needs of people with disabilities where pedestrians cross the separated bike lane. A detectable edge between sidewalks and bike lanes is required to support the safety of pedestrians with vision disabilities.

» It may be desirable to post "BIKES MAY USE FULL LANE" (MUTCD R4-11) signs and advise faster bicyclists that they should ride in the roadway if their higher operating speed cannot be safely accommodated on the bikeway.

» Asphalt or concrete are recommended for the surface of the bike lane because they provide a smooth, stable, and slip-resistant riding surface. If concrete is chosen, joints should be sawcut, or troweled joints should use a square edge (as an alternative to more common rounded or beveled edge), to maintain a smooth riding surface. Longitudinal joints should be avoided. Permeable pavements can be used in separated bike lanes if they are smooth, stable, and slip resistant.

The Street Buffer along a separated bike lane includes some form of horizontal separation between the bikeway and vehicles. In Montgomery County, preferred types of separation in the Street Buffer include:

Curb with Vegetation



Parked Cars

Figure 5-5. Examples of Street Zone treatments for separated bikeways

Other types of separation such as flexible delineator posts, parking stops, planters, bollards, metal curb systems, and other materials may be considered for interim projects constructed by MCDOT, where the curb line location is not changing.

In addition to the Street Buffer, a Ped / Bike Buffer is desirable between the separated bike lane and the sidewalk. A Ped / Bike Buffer minimizes encroachment between the bike lane and the sidewalk. **The preferred Ped/Bike Buffer width is 6', which allows the inclusion of street trees.** In constrained conditions, a minimum 2' buffer is required between the separated bike lane and the Clear Zone. In locations where physical separation is desirable because of higher pedestrian demand, raised separation in the Ped / Bike Buffer is preferable to ensure pedestrians do not walk in the bike lane, bicyclists do not ride on the sidewalk, and to account for the natural shy space desired between people who are bicycling and walking. More details on how to distinguish the bike lane from the sidewalk are provided in the following section.

Figure 5-6. Ped / Bike Buffer on the 2nd Avenue separated bike lane

Implementing Separated Bike Lanes

Jurisdictions across the United States are using different approaches to implement separated bike lanes. Many are constructing these bikeways as **interim** / low-cost retrofits of existing rights-of-way using flexible delineator posts and paint, while others are constructing more **permanent** forms of separation, such as curb-separated bike lanes, that represent a permanent design standard. Although interim separation types can be easier to implement, agencies have raised concerns about their maintenance costs, aesthetics, and noted that some interim designs may not provide the same degree of comfort and buffer from adjacent automobile traffic as more permanent solutions. Permanent solutions can be more aesthetically pleasing and comfortable for users, although they often carry a higher cost.

Interim Separated Bike Lanes

As with many jurisdictions, Montgomery County is focusing its efforts at building a network of separated bike lanes as quickly as possible, to provide responsiveness to public demands for improved bicycling and to allow ongoing evaluation of new approaches to bikeways. Interim separated bike lanes address separation from traffic using flexible delineator posts, planters, parking stops, concrete barriers or rigid bollards, and are shown on the following pages. These projects substantially improve the comfort of bicycling by reducing traffic stress and make bicycling accessible to a greater segment of the population.

Widths:

Interim separated bike lanes can only be constructed as retrofit projects in the capital improvement program. Interim separated bike lanes will have the following widths:

» One-way separated bike lanes: 5 feet at a minimum, exclusive of shy distances.

» Two-way separated bike lanes: 8 feet at a minimum, exclusive of shy distances.

Intersections:

While the ultimate objective is to implement protected intersections as part of separated bike lane projects, this will not be feasible with all interim projects. Bike boxes and two-stage turn queue boxes are ways to improve intersections in the interim until full protected intersections can be implemented. Bike lane drops are inappropriate for interim separated bike lanes.

Separation from Traffic:

Interim separated bike lanes address separation from traffic using flexible delineator posts, planters, parking stops, concrete barriers or rigid bollards, and are shown on the following pages. These forms of separation help to reduce the stress of bicycling, and can be improved over time as funding becomes available.

Examples of interim one-way separated bike lanes are shown in Figure 5-7 and Figure 5-8.

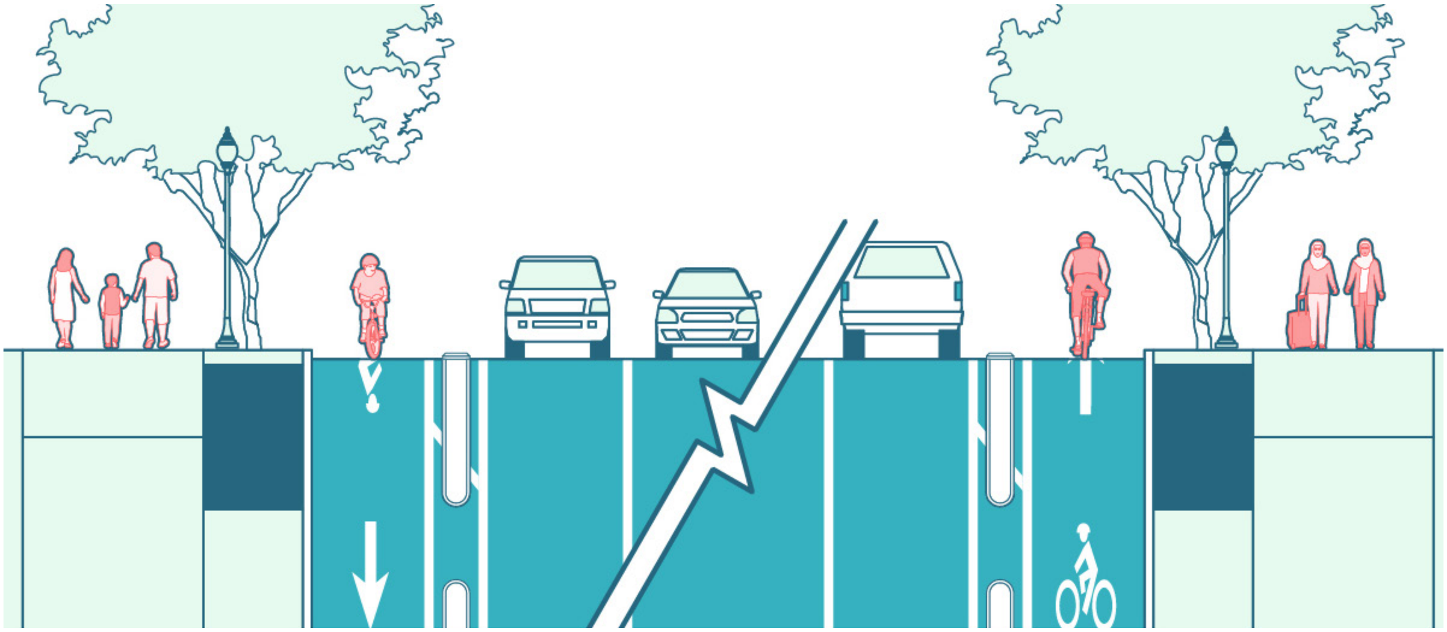


Figure 5-7. One-way Separated Bike Lane, Parking Separated, Interim Condition: **Downtown Street, Town Center Street, Industrial Street**

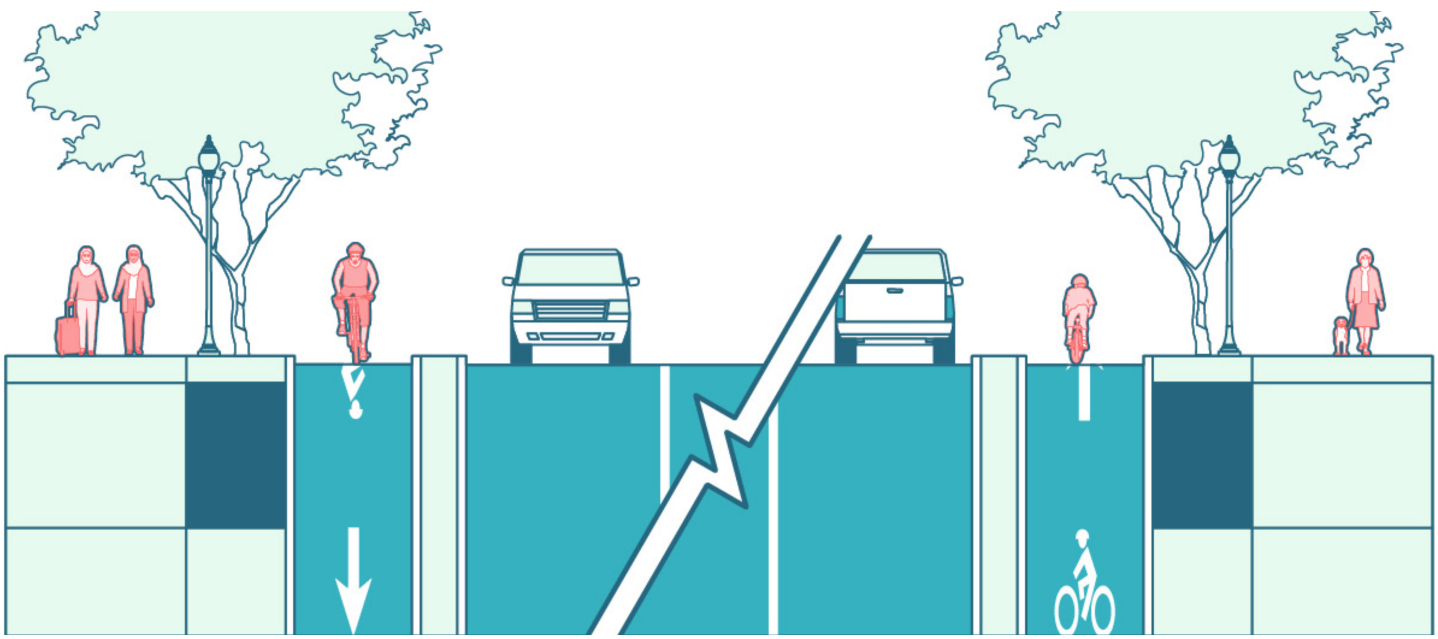


Figure 5-8. One-way Separated Bike Lane, Curb Separated, Interim Condition: **Downtown Street, Town Center Street, Industrial Street**

Permanent Separated Bike Lanes

Permanent separated bike lanes create bicycling environments that are appropriate for people of all ages and bicycling abilities. They expand the capacity of the bicycling network by implementing wide bike lanes that enable passing and incorporate more aesthetically pleasing treatments and stormwater management. Permanent separated bike lanes are to be constructed as part of development projects and as part of larger capital improvement projects.

Widths:

Permanent separated bike lanes will have the following widths:

» One-way separated bike lanes: 6.5 feet, exclusive of shy distances.

» Two-way separated bike lanes: 11 feet, exclusive of shy distances.

Intersections:

Permanent separated bike lanes will reduce conflicts at intersections with protected intersections and mitigate the remaining conflicts.

Separation from Traffic:

Permanent separation provides a high level of protection and often has greater potential for placemaking, quality aesthetics and integration with stormwater management. Examples of permanent separation include raised medians and raised separated bike lanes at an intermediate level, and are shown on the following pages. Each of these separation types provides an increasingly higher level of comfort for bicycling, separation from traffic and opportunity for improved aesthetics within the streetscape. Permanent separation can reduce maintenance costs associated with temporary separation and improve durability and bicyclists' safety on higher volume roadways.

The following figures show examples of the permanent conditions for a two-way separated bike lane (Figure 5-9) and one-way separated bike lane (Figure 5-10).

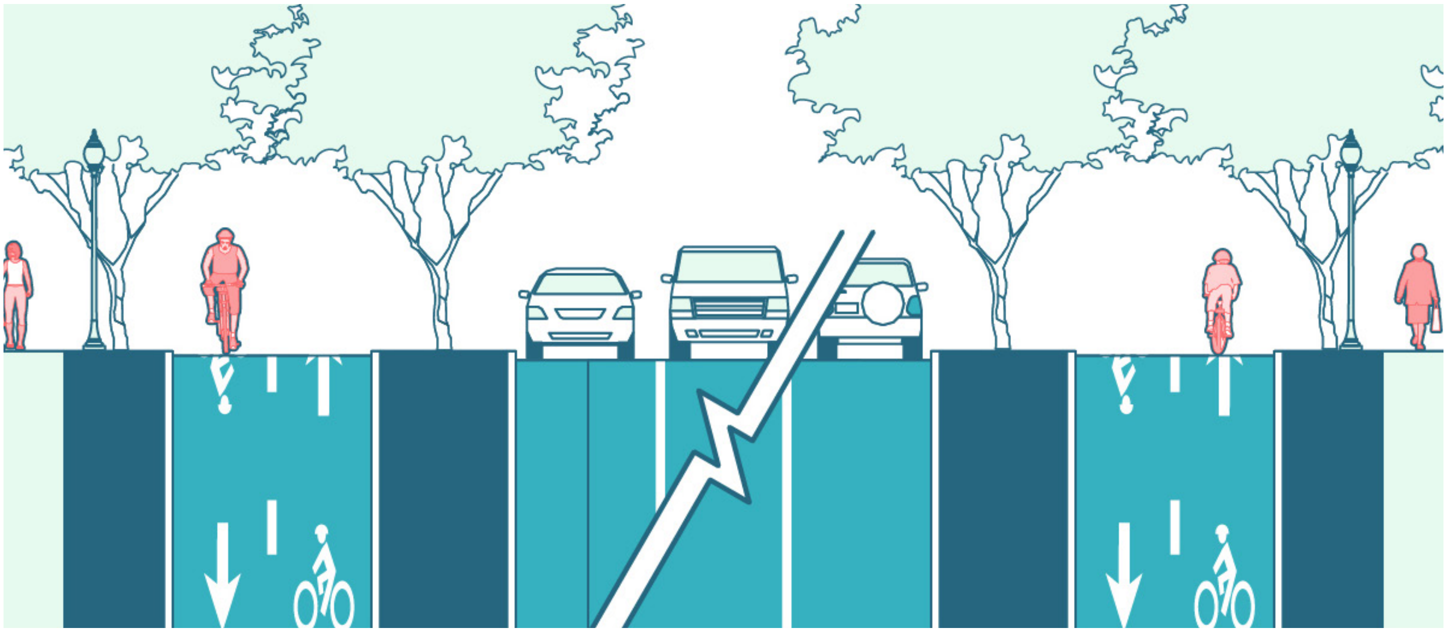


Figure 5-9. Two-way Separated Bike Lane, Both Sides, Permanent Condition: **Downtown Boulevard and Town Center Boulevard**

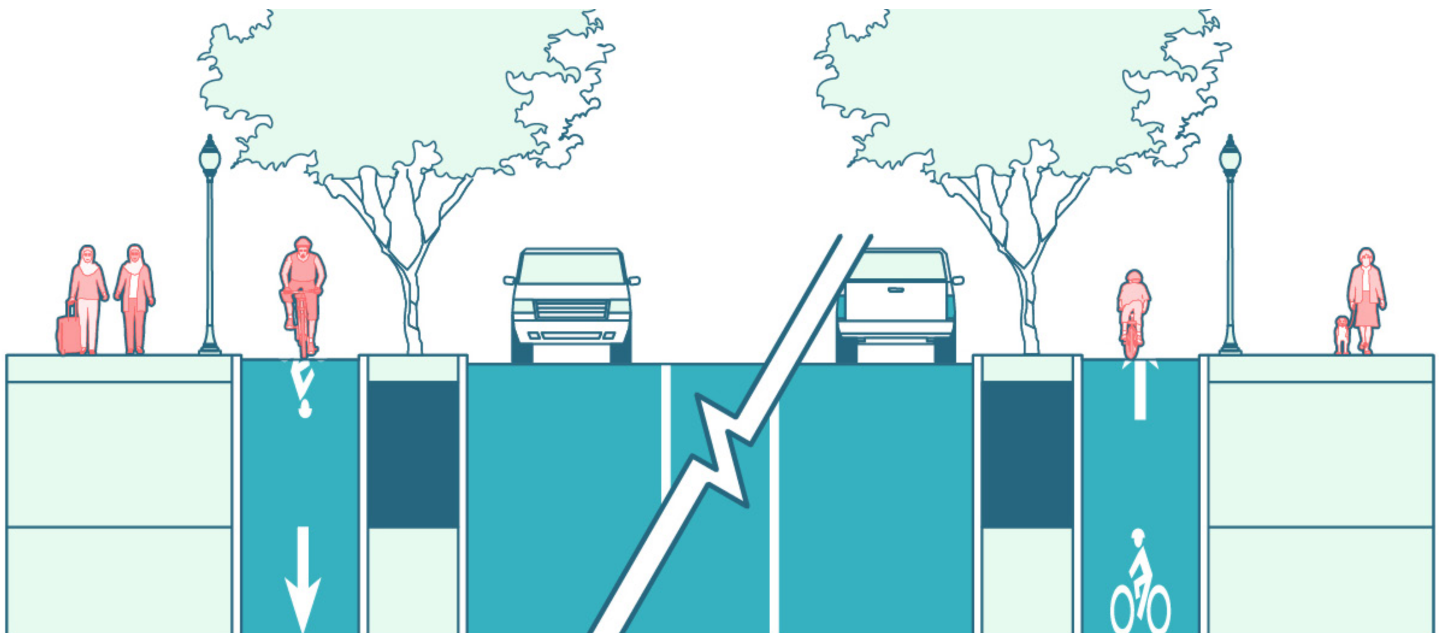


Figure 5-10. One-way Separated Bike Lane, Tree Separated, Permanent Condition: **Downtown Street, Town Center Street, Industrial Street**

Sidepaths are shared-use paths located parallel to and within the road right-of-way. They provide two-way travel routes designated for walking, bicycling, jogging, skating, and riding scooters and other micromobility devices. Sidepaths are typically 10 feet wide but can vary between 8 feet (in short constrained areas with environmental or historic constraints) and over 15 feet (where usage is likely to be higher). Asphalt is the preferred surface material for sidepaths. If concrete is chosen, joints should be sawcut, or troweled joints should use a square edge (as an alternative to the more common rounded or beveled edge), to maintain a smooth riding surface.

Figure 5-11. Example of a sidepath on Watkins Mill Road

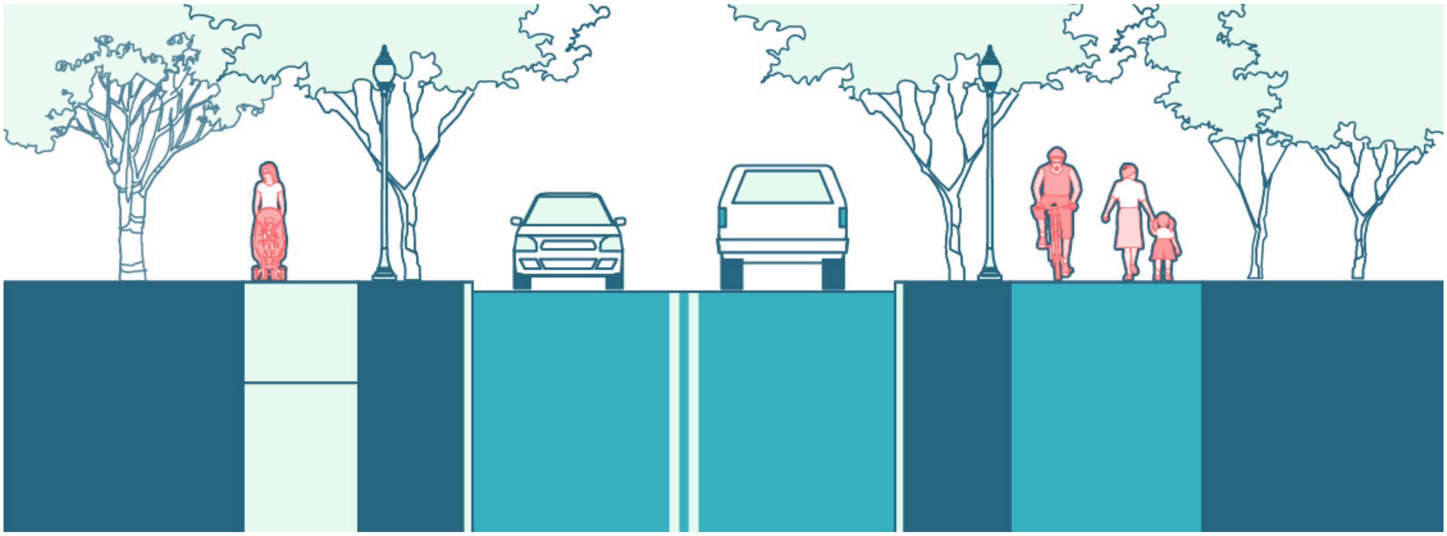


Figure 5-12. Sidepath, One Side of the Street: **Neighborhood Connector, Industrial, Country Connector, Country Road**

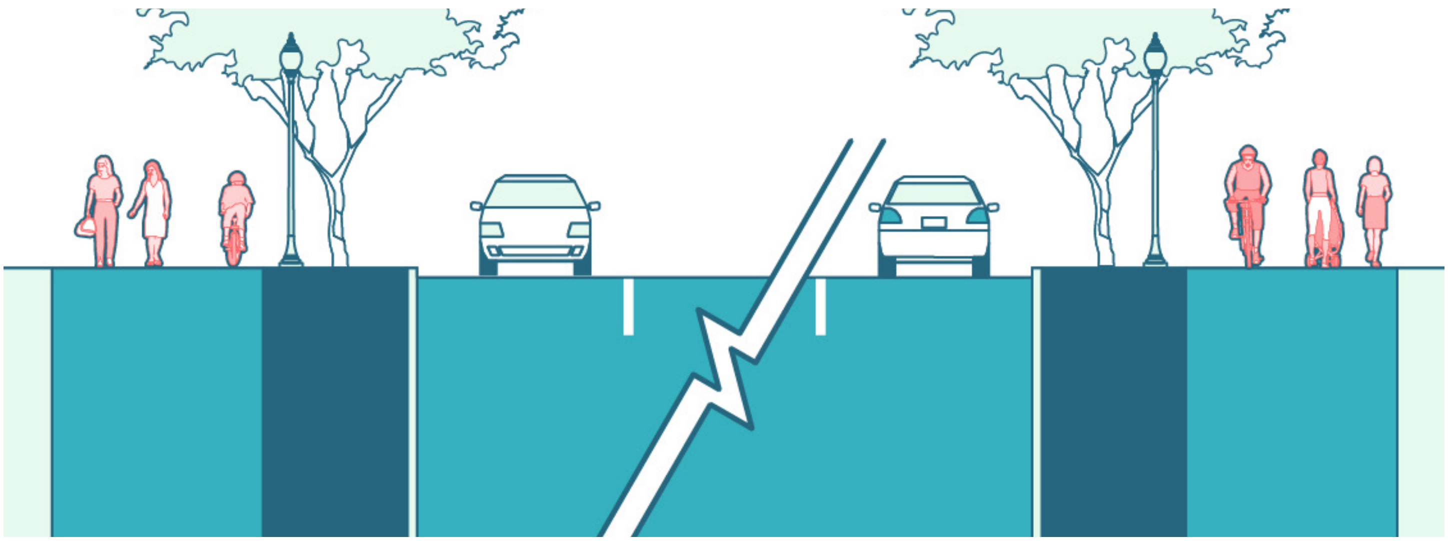


Figure 5-13. Sidepath, Both Sides, 6-8’ street buffer: **Boulevard**

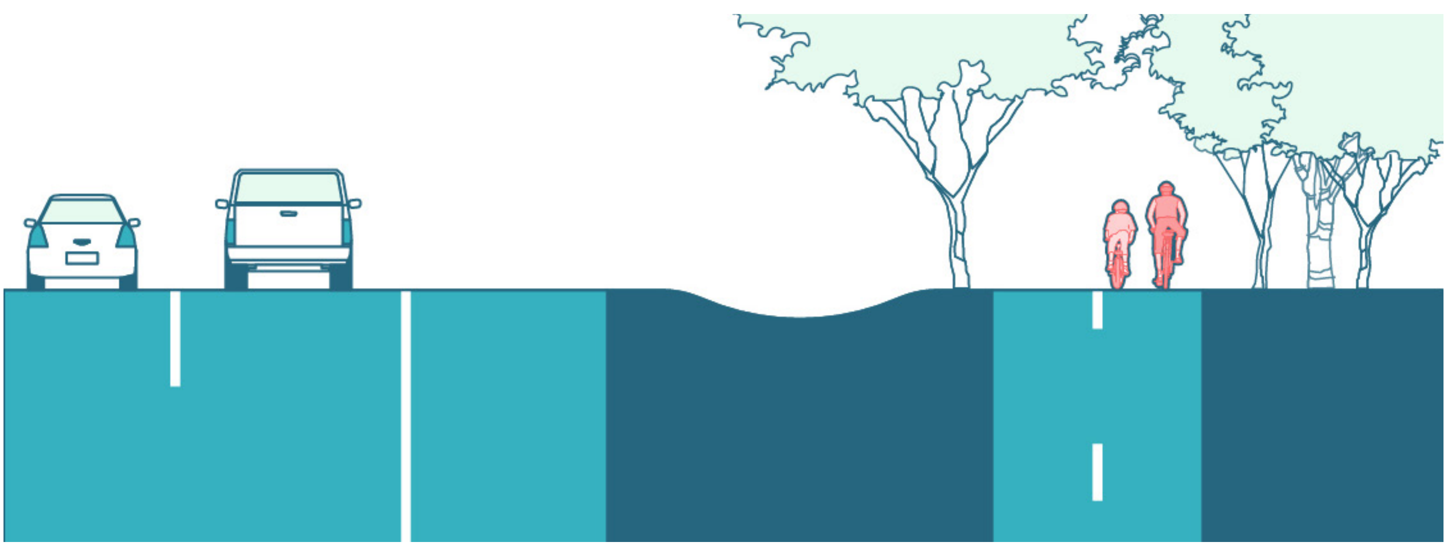


Figure 5-14. Sidepath Both Sides, 10’ street buffer: **Major Highway**

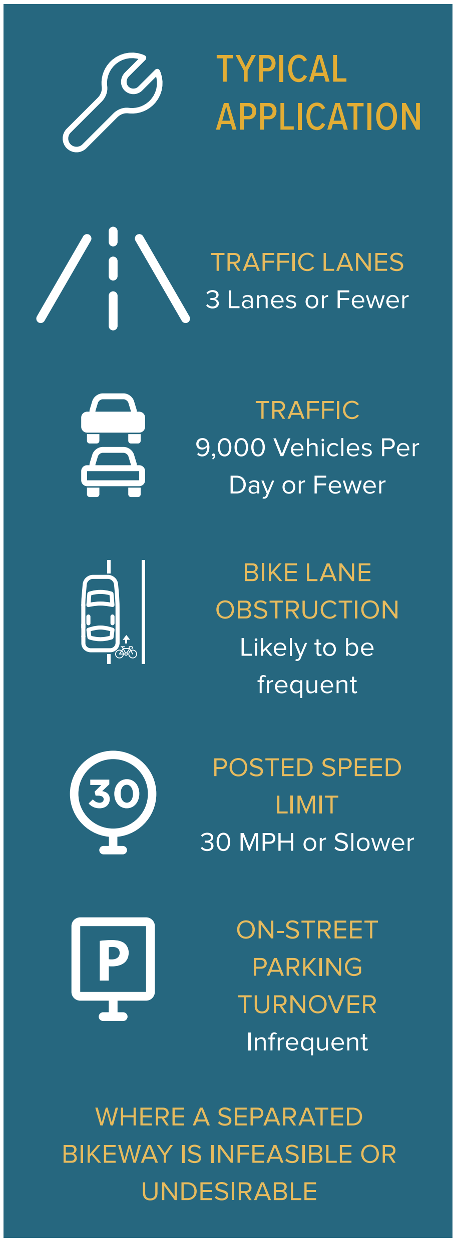


Figure 5-15. Typical application of striped bikeways

Striped Bikeways

Striped bikeways are designated spaces for bicycling that are distinguished from motor vehicle traffic lanes and shoulders by striping and pavement markings. While striped bikeways remain a useful tool to reduce traffic stress along streets with lower motorist speeds and volumes, they are insufficient to attract a broad cross section of potential bicyclists in many environments because they do not provide sufficient separation from traffic and can be obstructed by motorized vehicles.

Conventional bike lanes (i.e., bike lanes) are portions of the street that have been designated by striping, signage, and pavement markings for the preferential or exclusive use of bicyclists. They are typically 5 to 6 feet wide in Montgomery County. Parking Ts or hatch marks can highlight the vehicle door zone on constrained corridors with high parking turnover to guide bicyclists away from doors.

As detailed in the MdMUTCD,[60] a conventional bike lane consists of a white lane line and bike lane symbol or word markings. The markings should be supplemented with the directional arrow indicating the correct direction of travel in the bike lane. The white line may be a normal width (4 to 6-inches wide), or it may be a wide width (8 to 12 -inches wide) to add emphasis. All bike lane markings should be retroreflective.

Bike lane symbol markings should be placed no more than 50 feet downstream from an intersection and generally be spaced at intervals no greater than 250 feet thereafter in urban areas, including Downtown Boulevards, Downtown Streets, Town Center Boulevards, and Town Center Streets. The first marking after an intersection or driveway should be placed outside of the wheel path of turning vehicles to reduce wear. Especially on the street types listed above, it may be appropriate to space the symbols closer than 250 feet where motorist conflicts may be higher, such as approaches to areas with significant parking turnover, intersections, driveways, or turn lanes. In suburban and rural areas, with long distances between intersections and little roadside activity, bike lane symbols may be as far apart as 1,000 feet or more.

60 Maryland State Highway Adminstration MD Manual on Uniform Traffic Control Devices for Streets and Highways, 2011 Edition

Buffered bike lanes are conventional bike lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane to increase the comfort of bicyclists. The minimum buffered bike lane width, exclusive of buffer, is 4 feet with a parking-adjacent buffer and 5 feet with a travel-lane-adjacent buffer or where the bike lane is adjacent to curb. The desirable width is 6 feet. The minimum buffer width is 2 feet. There is no maximum. Diagonal crosshatching should be used for buffers less than or equal to 3 feet wide. Chevron crosshatching should be used for buffers greater than 3 feet wide.

Climbing lanes are conventional bike lanes in the uphill direction. They typically include a shared lane in the downhill direction. In some cases, a climbing lane consists of a standard-width bike line in the downhill direction and a wider width in the uphill direction. These lanes are used to improve safety on hills where there is a higher speed differential between bicyclists and motor vehicles. Where the street grades change, it may be desirable to switch which side of the street a bike lane is provided to maintain the bicycle lane in the uphill direction.

Advisory bike lanes are dashed bike lanes that allow motorists to temporarily enter the bike lane to provide space for oncoming vehicle traffic to pass within the paved roadway. The desirable width of an advisory bike lane is 6 feet. The minimum width of an advisory bike lane is 5 feet adjacent to parking and 4 feet adjacent to curb (exclusive of gutter). The width of the paved motorist space should be 10 to 13-and-a-half feet or 16 to 18 feet wide between the bike lanes. Advisory bike lanes should terminate in favor of shared lanes on sharp curves where stopping sight distance is not provided, and should also terminate ahead of stop signs. Advisory bike lanes require a request to experiment from FHWA.

Contraflow bike lanes (or counterflow bike lanes) are bike lanes designed to allow bicyclists to ride in the opposite direction of motor vehicle traffic. They convert a one-way motorist traffic street into a two-way street for people biking: one direction for motor vehicles and bikes, and the other for bikes only. Contraflow bike lanes should be separated from oncoming traffic by a yellow centerline marking. Vertical separation (e.g., flexposts, curb stops) is optional and context specific. To mitigate potential safety challenges associated with contraflow bicycle travel, the following should be considered:

» The bike lane should be marked in accordance with normal rules of the road, i.e., bicyclists using the lane are traveling on the right-hand side of the roadway, with opposing traffic on their left.

» Where intersection traffic controls are present along the street, traffic control devices should be oriented to face bicyclists using the counterflow lane.

» As contraflow bicycle travel can be unexpected by motorists when entering, exiting, or crossing the roadway, additional treatments should be considered at intersections, alleys, grade crossings, and driveways.

» A bike lane should be provided for bicyclists traveling in the same direction as motor vehicle traffic. If there is insufficient room to provide a bike lane in the dominant-flow direction of the street, shared lane markings should be considered to discourage wrong-way use of the counterflow bike lane.

» On-street parking should also be restricted at corners to ensure counterflow bicyclists and cross street traffic can see each other.

» Bike lane symbols and directional arrows should be used on both the approach and departure of each intersection to remind bicyclists to use the bike lane in the appropriate direction, and to remind motorists to expect two-way bicycle traffic.

» At intersecting streets, alleys, and major driveways, “DO NOT ENTER” (R5-1) signs and turn restriction signs should include a supplemental plaque reading “EXCEPT BICYCLES” (R3-7pB) to establish that the street is two-way for bicyclists and to remind motorists to expect two-way bicycle traffic.

» At traffic signals, signal heads and suitable bicycle detection measures should be provided for counterflow bicyclists.

» Contraflow transitions should normally occur at intersections or locations where bicyclists may return to normal two-way travel or naturally transition to the correct side of the street in another bikeway.

The following graphics present typical conditions for striped bikeway applications in Montgomery County.

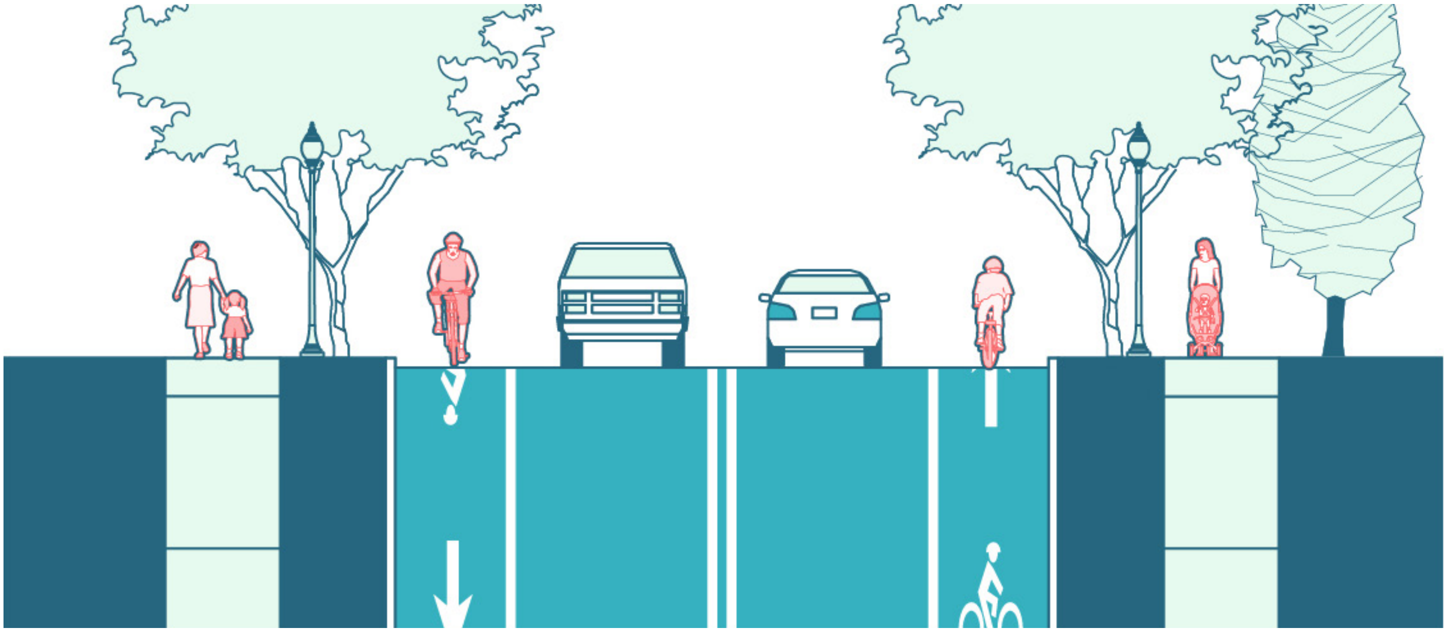


Figure 5-16. Conventional Bike Lane: **Neighborhood Connector**

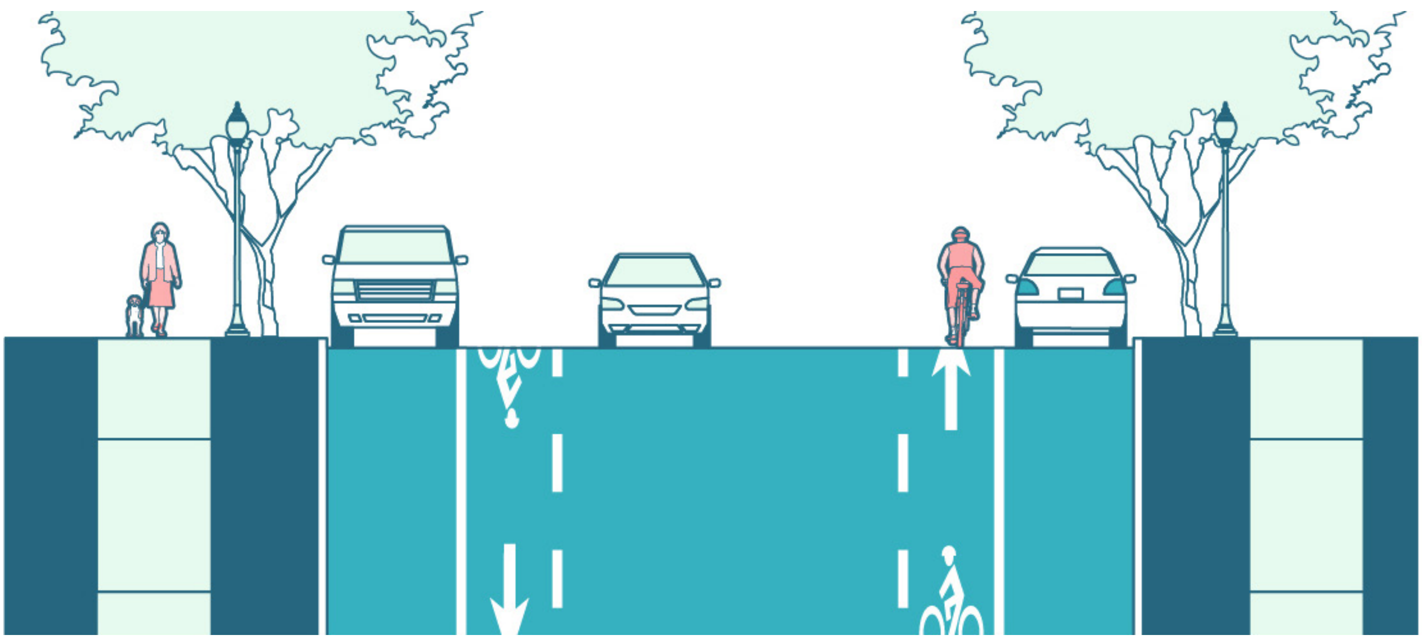


Figure 5-17. Advisory Bike Lanes: **Neighborhood Street**

Bikeable Shoulders

Bikeable shoulders are portions of the roadway that accommodate stopped or parked vehicles, emergency use, bicycles and motor scooters, and pedestrians where sidewalks are not provided.

Bikeable shoulders of at least 5 feet in width can improve comfort on some roadways for some bicyclists with a high tolerance for traffic stress. As motor vehicle speeds and volumes increase, wider shoulders up to 10 feet in width may be appropriate. Bikeable shoulders do not create a low-stress environment on roads where the posted speed limit exceeds 30 mph and volumes exceed 6,000 motorists per day. This threshold can be even lower along roads with higher volumes of truck traffic.

Edge line rumble strips can help to designate bicyclist space on paved shoulders. The width of a shoulder with rumble strips should be measured from the rightmost side of the rumble strip. To improve bicyclist safety and comfort operating within a narrower shoulder, the width of the shoulder for bicycle use should be maximized by placing the rumble strip on the edge line rather than within the shoulder. Periodic gaps should also be provided to allow bicyclists to move across the strip pattern. Where bicycle traffic is expected, rumble strips should be designed as follows to minimize crash risk for bicyclists:

- Length: as little as 6 inches when necessary due to pavement width restrictions and large bicycle traffic volumes.
- Width: 6 inches parallel to the traveled way.
- Depth: a depth of 0.375 inches may be considered for shoulder rumble strips on rural two-lane roads.

Rumble strips designed to these dimensions are more tolerable for bicyclists than other types of rumble strips; however, it is still very difficult for bicyclists to cross them.

The following graphic presents typical conditions for bikeable shoulders in Montgomery County.

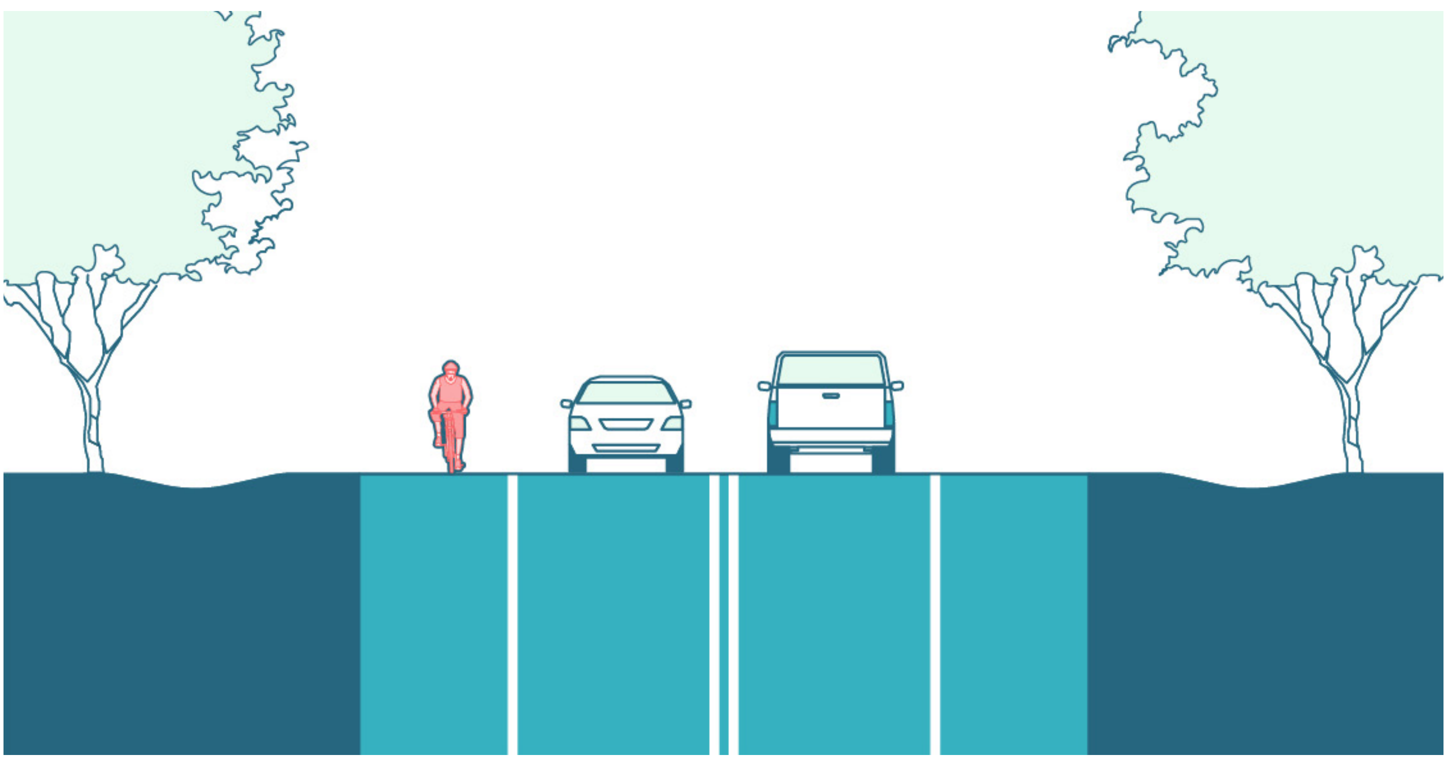


Figure 5-18. Bikeable Shoulders: **Country Connector and Country Road**

Shared Roads

Shared roads are master-planned bikeways that share space with automobiles. They include neighborhood greenways in suburban areas, shared streets in urban areas and priority shared lane markings where there is insufficient space for a dedicated bikeway.

Shared streets constitute an urban design approach where pedestrians, bicycles and motor vehicles can comfortably coexist. Design guidance for shared streets is provided in Chapter 2: Street Types.

Neighborhood greenways are streets with low motorized traffic volumes and speeds, designed and designated to give walking and bicycling priority. They use signs, pavement markings, speed and volume management measures, and other traffic control devices to discourage through trips by motor vehicles and and to improve safety at crossings of busy streets. Neighborhood greenways are an opportunity for local branding and can incorporate a range of design elements, including raised pavement, street narrowing, traffic diversion, mini roundabouts, and/or enhanced crossing treatments (including traffic signals). Guidance on individual elements in presented in Chapter 8: Speed Management.

Figure 5-19. Standard shared lane markings on a neighborhood greenway

Generally, a **shared lane marking** should be placed in the center of the outside travel lane, unless the travel lane is 14 feet or wider in which case the shared lane marking should be placed in the right-hand portion of the travel lane a minimum of 4 feet from the face of curb, gutter seam, or edge of the traveled way. The lateral placement of a shared lane marking is measured from the center of the chevron marking to the face of the curb or edge of the pavement. Shared lane markings should be placed no more than 50 feet downstream from an intersection and generally spaced at intervals no greater than 250 feet thereafter. Under some circumstances, it may be desirable to place shared lane markings at intervals of 25 to 100 feet to increase motorist awareness of bicyclists and to provide additional guidance for bicyclists. This closer spacing may be desirable at locations with a history of conflicts or crashes between bicyclists and motorists, in locations with limited sight distance including approaches to horizontal and vertical curves, to guide bicyclists through intersections, or other circumstances.

Priority shared lane markings communicate bicyclist priority within a shared lane and guide bicyclists to ride outside of the door zone. Green colored backgrounds and more frequent spacing make priority shared lane markings more conspicuous than standard shared lane markings (also known as sharrows), which do not improve bicyclists' comfort in shared lanes with traffic. The green colored background of a priority shared lane marking requires experimental approval from FHWA.

Priority shared lane markings can be installed in limited instances on roadways where it is infeasible to install bicycle lanes, separated bike lanes or shared use paths, but where it is desirable to communicate the priority of bicyclists within a shared lane. They may also be used:

» to fill a gap between two sections of connecting bikeways

» to emphasize bicyclist operating priority on neighborhood greenways

» to encourage bicyclists to operate away from parked vehicles to avoid collisions with opening doors ("dooring")

» to increase awareness that bicyclists may be operating within the lane on streets with sidepaths or separated bike lanes where some bicyclists may choose to not operate in the provided bikeway

» to indicate desirable bicycle lane positioning within intersections

Priority shared lane markings are only to be used as a retrofit on existing streets where implementing the desired bikeway is infeasible. They are not to be used on new streets or on roadways that have operating speeds above 25 mph. They should not be located within bicycle lanes or shoulders.

Signage on Shared Roads

Bicycles may ride on all roadways except where prohibited by statute or regulation. To emphasize the presence of bicyclists on shared roadways, the “BICYCLES MAY USE FULL LANE” sign (R4-11) may be used in situations where motorists must wait behind slower moving bicyclists or change lanes to pass a bicyclist at a safe distance. This sign may be used on roadways without bike lanes or usable shoulders where travel lanes are too narrow (less than 14 feet in width) for bicyclists and motorists to operate side-by-side. Where shared lane markings are used with “BICYCLES MAY USE FULL LANE” signs, the sharrow should be located in the center of the travel lane.

Shared Roads in Rural Conditions

Shared roads are the most common condition in rural areas. The following design features can make rural roadways more compatible with bicycling.

» In general, shared lane markings are not likely to be appropriate on most rural roadways due to their higher operating speeds.

» Appropriate signal timing and detector systems should respond to bicycles.

» There are a number of signs and pavement markings that can be used to alert motorists of potential encounters with bicyclists and that, accordingly, motorists should be mindful and respectful of bicyclists. However, these treatments are not a substitute for appropriate geometric design measures to address operational issues, as the addition of these signs will not

Figure 5-20. Rural shared roadway condition in Montgomery County

significantly improve bicycling conditions. Use of the “SHARE THE ROAD” plaque is not recommended as it does not provide a clear message to users.

» For rural roads and paved shoulders to be suitable for bicycling, surfaces need to be relatively smooth, minimizing exposure of sharp or large pieces of aggregate. Where an unpaved driveway meets a roadway or pathway, it is advisable to pave some portion of the driveway approach to prevent loose gravel from spilling or being carried onto the shoulder or travel lanes. It is recommended to pave at least 10 feet of a low-volume driveway approach and at least 30 feet of a high-volume driveway or unpaved road approach to mitigate the worst effects of loose gravel.

The following graphics present typical conditions for shared lanes in Montgomery County.

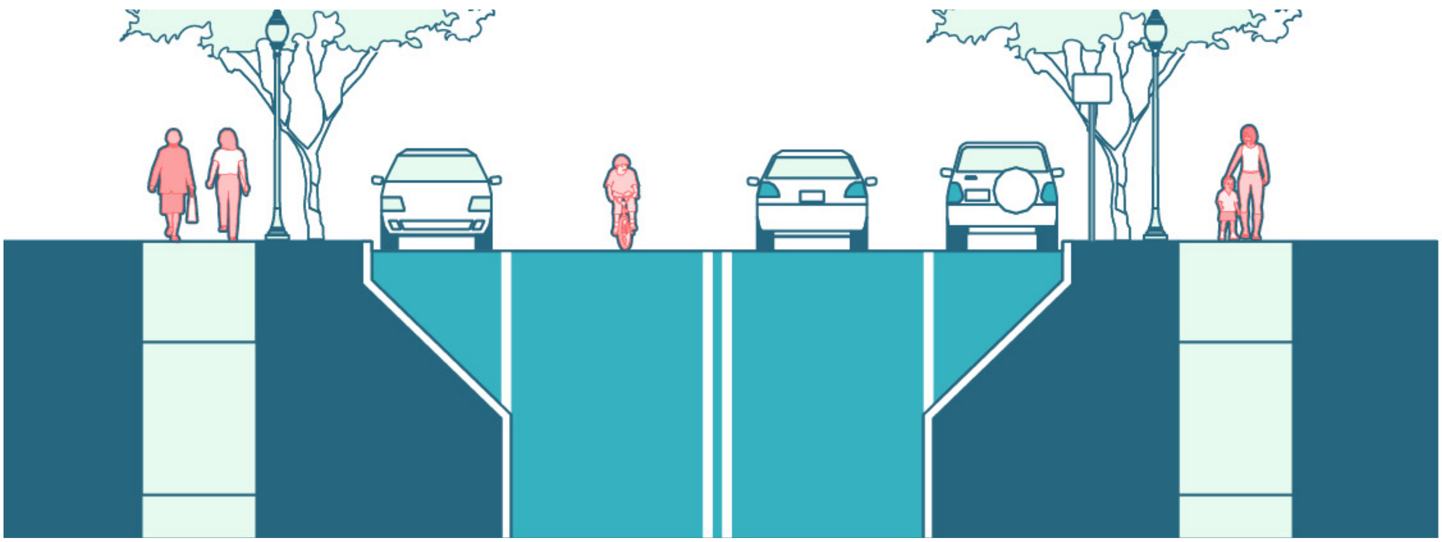


Figure 5-21. Neighborhood Greenway: **Neighborhood Street**

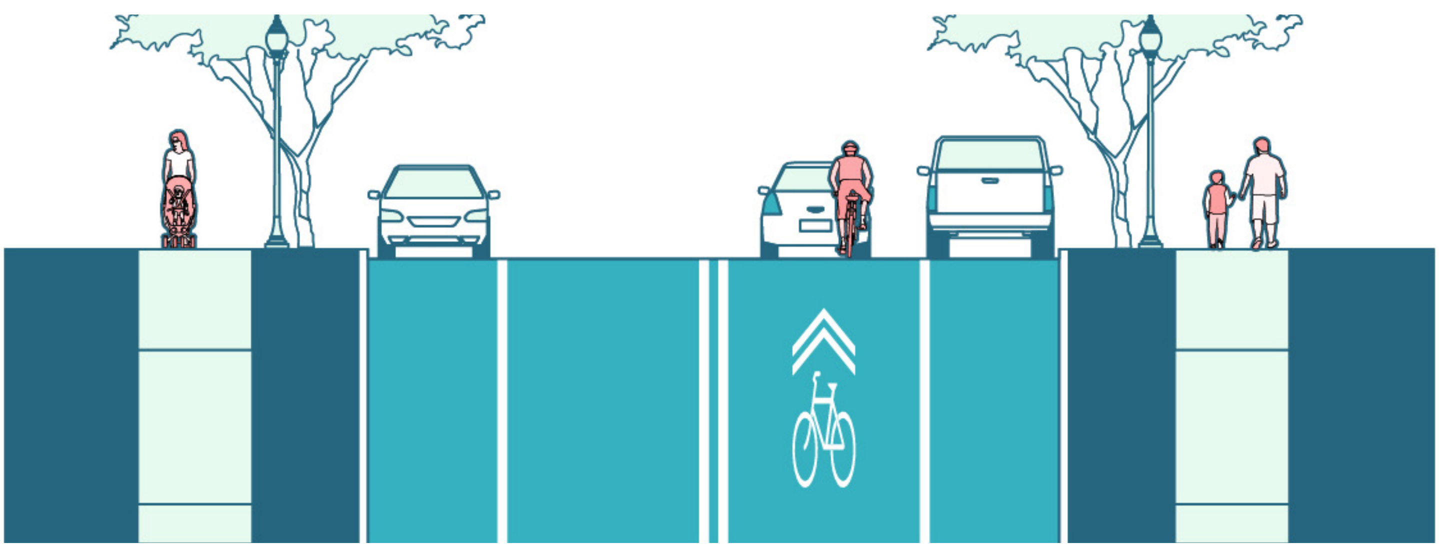


Figure 5-22. Shared Lanes: **Neighborhood Street**

Breezeway Network

Based on similar systems in London, Dubai, and the Netherlands, Montgomery County has adopted a network of special bikeways called Breezeways, which provide the highest level of comfort, convenience, safety and efficiency for bicyclists of all ages and abilities. The Breezeway Network prioritizes higher speed bicycle travel between major activity centers, including central business districts, transit stations, and job centers, since people are more likely to travel longer distances when the travel time for their trip is closer to that of traveling by automobile.

Breezeways can include a variety of bikeway types, including trails, sidepaths, separated bike lanes, and neighborhood greenways. The Breezeway Network will:

» Have a design speed of 20 miles per hour in lower activity areas and 12 mph in higher activity areas. (Design speed is influenced by the pavement quality and bikeway curvature, among other conditions, and is not an endorsement of bicycling at high speeds in crowded locations.)

» Provide fixed, continuous separation from traffic, such as curbs or concrete barriers. Sidepaths or trails that run parallel to a roadway will be separated from the roadway by at least 5 feet. Along high-speed roadways with speed limits of 35 mph or greater, separation greater than 5 feet is required.

» Separate fast and slower users to allow faster users to travel with minimal delay and to improve comfort for all users.

Figure 5-23. The Indianapolis Cultural Trail provides an example of the convenience that will be provided by Montgomery County's Breezeway network

- Minimize delay and increase safety at intersections. Treatments to facilitate breezeway crossings may include:
  - Grade separation, including underpasses and overpasses
  - Protected intersections
  - Colored pavement through intersections
  - Bike signals
  - Leading pedestrian / bicycle intervals
  - Traffic control at crossings, including signalized intersections.
- Be free of obstructions, such as utility poles, trees or signposts.
- Feature corridor-long pedestrian-scale lighting that provides continuous illumination along the travelway and immediate wayside areas. In residential areas or sensitive habitat areas, specialized lighting or screens may be required to avoid adverse impacts on the surroundings.
- Use unique branding to improve legibility and user-friendliness.
- Provide direct, seamless and intuitive transitions between Breezeways and standard bikeways.
- Pavement Surface: Breezeways will be constructed to meet requirements of public road design. They will feature high-quality construction, surface materials and maintenance practices that maximize surface smoothness and pavement life, minimizing potential for pavement cracking and buckling.

Breezeways will feature adequate widths for side-by-side bicycle travel and passing, as well as adequate buffers from motor vehicle traffic.

- Trails and Sidepaths: The minimum bikeway width is 11 feet and the minimum pedestrian width is 5 feet. In areas with high pedestrian demand, the pedestrian width is 8 feet or more.
- Two-Way Separated Bike Lanes: the minimum bikeway width is 11 feet, excluding the gutter pan.
- One-Way Separated Bike Lanes: the minimum bikeway width is 8 feet, excluding the gutter pan.

Within the bikeway network, Breezeways are prioritized for maintenance in a manner similar to how important, county-wide through-streets are prioritized within the roadway network. This priority applies to snow removal, resurfacing, sweeping and other general maintenance activities. See the Bicycle Master Plan for additional details on the Breezeway Network.

5.3 Other Bikeway Design Considerations

Shy Zones

Intermittent vertical elements along the edge of a bicyclists' path (e.g., trees, signs, utility poles) or continuous elements (e.g., fences) can increase the risk of handlebar strikes or other conflicts on bikeways. Where these features are present, the preferable shy space is 2 feet, although the shy space may be eliminated in constrained areas. Exceptions to this guidance are as follows:

» The MUTCD requires no portion of a sign or its support to be placed less than 2 feet laterally from the edge of a trail. Where space is available, wider shy spaces are desirable.

» Bicycle-only pushbuttons or pushbuttons on shared use paths should be located close enough to be pressed without dismounting and placed based on pedestrian accessibility guidelines. The MUTCD provides additional guidance on the location of pushbuttons.

» Lean rails and foot rests (see Figure 5-24) intended for the use of bicyclists at intersections are an exception to the shy distance guidelines and should be located close enough to be functional from the bikeway.

Figure 5-24. Example of bicycle lean rails and foot rests

Bicycle Ramps

Bicycle ramps can be used to transition a bikeway to a different elevation (e.g., from street-level to sidewalk-level) or change the bicycle facility type (e.g., from conventional bike lane to sidepath). Situations where bike ramps may be appropriate include:

» On the approaches to and departures from roundabouts,

» Before interchange ramp crossings or high-conflict zones (such as heavy weaving areas or high turning volume intersections),

» Approaching pedestrian conflict areas or raised crossings, where a change in elevation is desired to meet pedestrian accessibility guidelines, to slow bicyclists prior to conflicts, or to transition the bikeway elevation.

It is preferable to design these bike ramp transitions to connect directly in line to the connecting bikeway type, though conditions may require a more abrupt lateral shift. Bike ramps are intended for the exclusive use of bicyclists and therefore the grades need not comply with pedestrian accessibility guidelines, but grades similar to those of pedestrian curb ramps can help address issues of comfort. Where the bike ramp connects directly to a sidewalk or shared use path, a detectable warning surface or directional indicator should be used at the top of the bike ramp.

Figure 5-25. Image of a bicycle ramp in Seattle

Green-Colored Pavement Markings

Green pavement markings communicate to road users where portions of the roadway have been designated for exclusive or preferential use by bicyclists, and enhance awareness of bicycle lanes, bicycle crossings, bicycle boxes, or two-stage turn queue boxes at or through an intersection. See Chapter 6: Intersections for additional guidance on intersection treatments. Maryland has interim approval to use green pavement markings. In Montgomery County, green pavement may be used on county-owned roads with notification to the Maryland Department of Transportation, while on state-owned roads, the county may install green pavement with approval by MDOT SHA.

References for Other Relevant Design Topics

- Design guidance for **bikeways at intersections**, including bike boxes, two-stage turn queue boxes, protected intersections, and bicycle signals are covered in Chapter 6: Intersections.
- For design guidance for **making transitions between different facility types** at intersections, refer to the Montgomery County Bicycle Facility Design Toolkit (page 24-28)[61].
- The provision of appropriate quantities of **secure bicycle parking** is key to supporting bicycling. In addition to bike parking, other **end-of-trip amenities**—such as showers, lockers, and bicycle repair stations—can enhance the bicycle trip experience and reduce barriers to riding. For information on bicycle parking, refer to the Montgomery County Bicycle Parking Guidelines[62] and the county Zoning Ordinance, Division 6.2.[63]
- For information on recommended and allowable treatments for **state roads**, consult the MDOT SHA Bicycle Policy Design Guidelines (2015).[64]
- For additional detail on all aspects of bikeway design, refer to the current editions of the AASHTO Guide for the Development of Bicycle Facilities[65] and National Association of Cities and Transportation Officials (NACTO) Urban Bikeway Design Guide.[66]

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61 https://montgomeryplanning.org/wp-content/uploads/2018/05/Bicycle-Facility-Design-Toolkit-May-2018.pdf

62 https://montgomeryplanning.org/wp-content/uploads/2016/11/Bicycle-Parking-Guidelines-Final.pdf

63 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

64 https://www.roads.maryland.gov/ohd2/bike_policy_and_design_guide.pdf

65 https://nacto.org/wp-content/uploads/2015/04/AASHTO_Bicycle-Facilities-Guide_2012-toc.pdf

66 https://nacto.org/publication/urban-bikeway-design-guide/

5.4 Appropriate Bikeways by Street Type in Montgomery County

Figure 5-26 presents the default bikeway types for each street type in Montgomery County, as well as the required dimensions for each facility type and context. The bikeway types shown in Figure 5-26 are for non-master planned streets only. If the Bicycle Master Plan[67] recommends a different facility or width for a specific street, that supersedes this guidance.

Figure 5-26. Guidance on appropriate bikeway by street type

Street Type	Street Buffer+	Ped / Bike Buffers	Default Bikeway Types and Widths*
Downtown Boulevard	8' default, 6' min	6’ default, 2’ min	Two-Way SBL on both sides of street. (each SBL: 11' default; 8' min)
Downtown Street	6'; 11' if this space is shared with on-street parking	6’ default, 2’ min	One-way SBL: 6.5' default; 5' min
Boulevard	8' default, 6' min	6’ default, 2’ min	Sidepaths on both sides of the street. (each sidepath: 11' default; 8' min)
Town Center Boulevard	8' default, 6' min	6’ default, 2’ min	Two-Way SBL on both sides of street. (each SBL: 11' default; 8' min)
Town Center Street	6'	6’ default, 2’ min	One-way SBL: 6.5' default; 5' min
Neighborhood Connector	6'	6’ default, 2’ min	Sidepath on one side of the street: 10' default; 8' min, or Bike Lanes: 6’ default, 5’ min
Neighborhood Street	6'	6’ default, 2’ min	Neighborhood Greenway, Shared Lanes, or Advisory Bike Lanes (for design guidance, see Bicycle Facility Design Toolkit)
Neighborhood Yield Street	6'	N/A	N/A**
Industrial Street	6'	6’ default, 2’ min	One-way SBL: 6.5' default; 5' min, or Sidepath on one side of the street: 10' default; 8' min
Country Connector	10' (if sidewalk or sidepath is provided)	6’ default, 2’ min	Bikeable Shoulders: 10' default; 5’ min, or Sidepath on one side of the street: 10' default; 8' min
Country Road	8' default, 6' min	N/A	Bikeable Shoulders: 8’ default; 5’ min, or Sidepath on one side of the street: 10' default; 8' min
Major Highway	As wide as feasible (10' minimum)	6’ default, 2’ min	Sidepath on both sides of street. (each sidepath: 11' default; 8' min)

\+ Where on-street parking is present, a minimum 3’ door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility. Ped / Bike Buffers only required if a separated bike lane is provided. For open section roads, see Section 3.8.

* This is for non-master planned streets only. SBL = Separated Bike Lane. Street buffer widths are not included in these dimensions (see below). If the bikeway is at street level and adjacent to the curb, the dimensions include the gutter pan. For corridors that are designated as Breezeways in the Bicycle Master Plan, see additional guidance in that document.

** Bikeways are not generally considered along this street type, unless otherwise specified in the Bicycle Master Plan.

67 Page 67, http://montgomeryplanning.org/bikeplan. This table is a translation of the approved guidance in the Bicycle Master Plan, applied to the street types identified in this document

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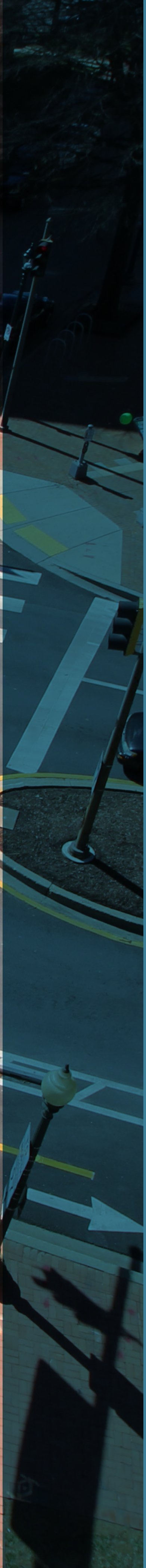


Chapter 6:
Intersections

6.1 Overview

Chapter 6: Intersections covers intersections, with sections on:

- Section 6.2: Access Management
- Section 6.3: Geometric Design Guidance
- Section 6.4: Design Vehicles vs. Control Vehicles
- Section 6.5: Encroachment
- Section 6.6: Mitigating Conflicts
- Section 6.7: Channelized Right Turn Lanes
- Section 6.8: Intersection Features
- Section 6.9: Roundabouts and Mini Roundabouts
- Section 6.10: Curb Ramps
- Section 6.11: Bikeways at Intersections
- Section 6.12 Transit at Intersections
- Section 6.13: Pedestrian Design Elements

Intersections are often epicenters of activity, where people using all modes of travel interact with one another. They also account for a disproportionate percentage of crashes compared to non-intersection locations. In Montgomery County, 43 percent of crashes occur at or near intersections.[68] Intersection design is therefore a vital component of the county's Vision Zero goal of eliminating traffic fatalities and severe injuries by 2030.

The goal of intersection design is to improve safety to the greatest extent feasible, while accommodating the movements of all travelers who use the intersection. **Montgomery County's policy is to reduce pedestrian crossing distances and reduce the speed of turning vehicles to increase the safety of all users at intersections.** This is accomplished by designing compact intersections that provide clear sight distances between users and prioritize slower operating speeds.

A variety of design treatments are discussed in this chapter. While the appropriate design solutions vary depending on roadway characteristics, the guidance in this chapter should be used as a starting point for intersection design in Montgomery County.

Figure 6-1. A compact intersection at Spring Street and 2nd Avenue in Silver Spring

68 Montgomery County, County Stat (https://stat.montgomerycountymd.gov/), January 1, 2015 to June 30, 2019.

6.2 Access Management

Access management is the "coordinated planning, regulation and design of access between roadways and land development."[69] Its goal is to provide a systemic way to improve the safety and efficiency of moving people and goods while reducing conflicts between all modes using and crossing the street, including cars, heavy vehicles, transit, bicycles and pedestrians. Access management is a particularly important tool in the transition from a suburban, auto-oriented development pattern to a more walkable and transit-oriented urban place. On major thoroughfares through Downtown or Town Center areas, closely spaced driveways result in more conflicts between turning traffic, pedestrians, and bicyclists. Driveways can also limit the extent of parallel parking and pedestrian features, making it more difficult to send cues to drivers that they are in a low speed urban environment. Reducing or consolidating driveways can help create a pedestrian-oriented environment with continuous sidewalks, street trees, lighting, and on-street parking.

Techniques to control or manage access include parcel-based (typically through zoning that restricts the number, priority, or location of site access driveways and/or requires access sharing and connections between adjacent parcels), driveway-based (spacing between driveways and managing conflicts near intersections), and corridor-based (spacing between access points and minimum standards for traffic signal spacing and median breaks). Access from lower classification streets should be prioritized per the Department of Permitting Services' Driveway Construction Policy. At a minimum, inter-parcel connections to accommodate through movement and reduce access points are recommended (inter-parcel connections for people walking and bicycling are required). Rear and alley access can also be an important access management tool especially for loading and deliveries. Montgomery County currently addresses access management during site plan review/local area transportation review using a combination of M-NCPPC, MCDOT and DPS regulations and policies including:

» Montgomery County Road Code[70] – Chapter 49, Article 3, Road Design and Construction Code

» Montgomery County Zoning Ordinance[71] – Chapter 59-6, Section 6.1.4 – Driveway Access

» Montgomery County Code,[48] Chapter 50, Subdivision of Land

» Montgomery County Department of Transportation, Private Access Design and Location Guidelines for Commercial, Industrial, Multifamily and Cluster Development (Including Private Driveways)

» Department of Permitting Services, Montgomery County Driveway Construction Policy[72]

Many existing policies and guidelines will need to be modified to align with these Complete Streets Design Guidelines. For all road design and development projects, access management is a critical concern to ensure safe access for parcels, and safe access on adjacent streets. Access management also supports Montgomery County's Vision Zero Action Plan through minimization of conflict points. Later revisions to this document should include more detailed access management standards that are developed as part of a comprehensive Access Management Study (to be conducted by the Planning Department in cooperation with MCDOT and DPS) to address driveway spacing and other access issues systematically for all roads in Montgomery County.

69 Access Management Manual, 2nd Edition, Transportation Research Board, 2014, p 1-3.
70 http://www.montgomeryplanning.org/transportation/highways/RoadCode.shtm
71 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview
72 https://www.montgomerycountymd.gov/DPS/Resources/Files/Code%20Policies/Driveway-Permit-Policy-Guidelines.pdf

Areas of an Intersection

The physical area of an intersection is a fixed space between the corners of two or more intersecting roads. The functional area of an intersection varies by speed, context, traffic queueing and whether the intersection is signal or stop controlled. See AASHTO's A Policy on Geometric Design of Highways and Streets[73] for calculations of upstream functional area. Downstream functional area is not defined in AASHTO. The Transportation Research Board (TRB)'s Access Management Manual[74] states "stopping sight distance is one method for establishing the downstream functional distance of an intersection".

All entry and exit points (driveways) should be designed outside of the functional area of an intersection. Driveways should also be placed to minimize conflict points. This is achieved by locating the driveway access away from the intersection and by prioritizing minor streets for access in compliance with Montgomery County's Code[75] Chapter 50: Subdivision of Land. In addition, see the Montgomery County Department of Permitting Services' Driveway Construction Policy for specific setbacks from horizontal features and limitation on numbers of entrances. On a corner lot, a driveway shall be placed on the street frontage with the lowest road classification. If both streets have the same roadway designation, the entrance shall be placed on the one considered to be the minor street.

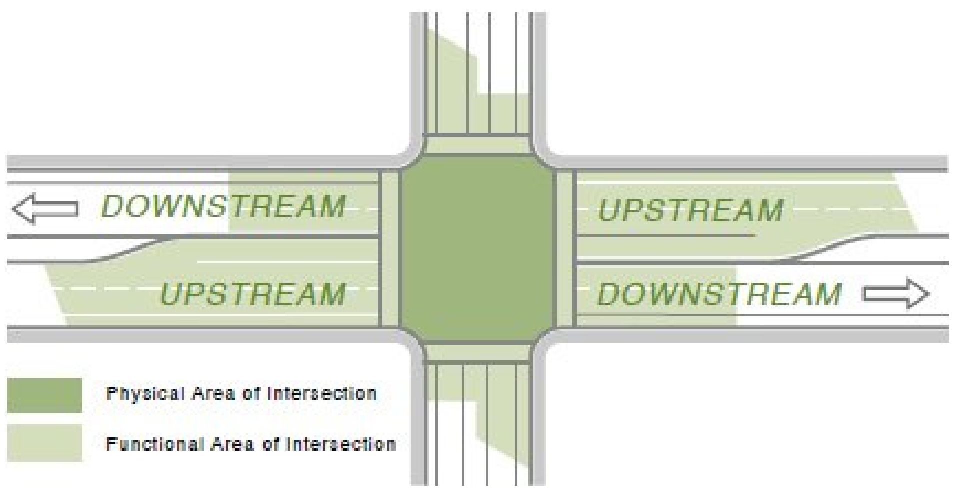


Figure 6-2. Functional and physical areas of an intersection (Source: FHWA Access Managemet in the Vicinity of Intersections)

73 American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets (Green Book)

74 http://www.trb.org/Publications/AMM14.aspx

75 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

6.3 Geometric Design Guidance

Intersection geometry and traffic signal/stop control must be considered in tandem to achieve a compact intersection that encourages slower operating speeds and increases safety for all users.

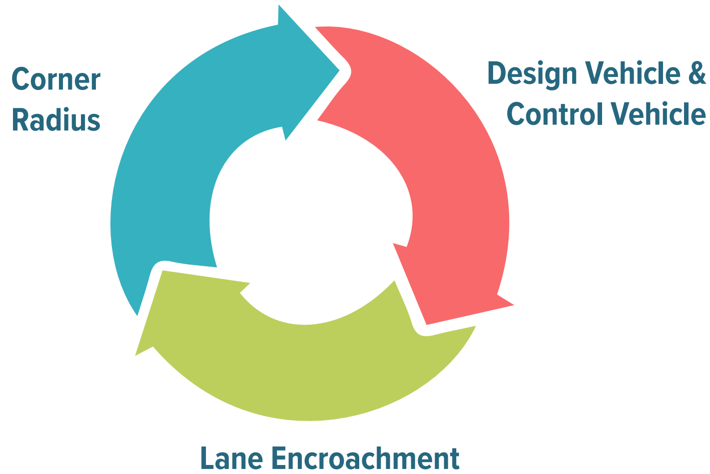


Figure 6-3. These key components of intersection geometric design have an interdependent relationship

Corner Radius

The corner radius dimension has a direct impact on vehicular turning speeds and pedestrian crossing distances. Minimizing the corner radius is essential to creating compact intersections that encourage slower turning speeds; however, this must be balanced with accommodating large vehicles that are likely to move through the intersection.

Effective Turning Radius

Even when using the default corner radius, the presence of parking lanes, bike lanes and/or adjacent travel lanes may allow vehicles to make sweeping, fast turns at intersections. The actual path of travel a vehicle uses to turn is called the effective turning radius. When conducting a turning analysis, the presence of parking lanes and bike lanes should be considered, as they can result in an effective turning radius that is far greater than the default radius.

Guidance for default corner radius in this chapter refers to the physical corner of the intersection. Effective corner radius should be minimized but is not prescriptive.

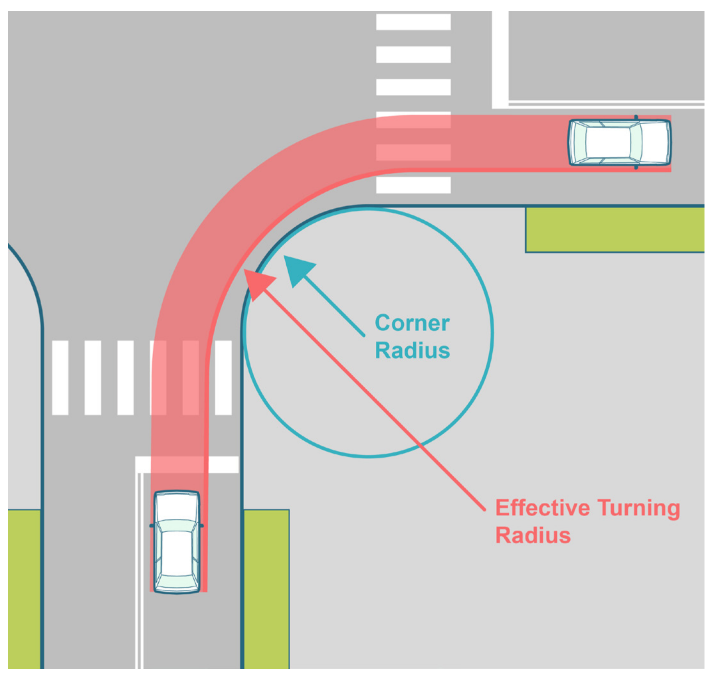


Figure 6-4. Illustration of corner radius and effective turning radius

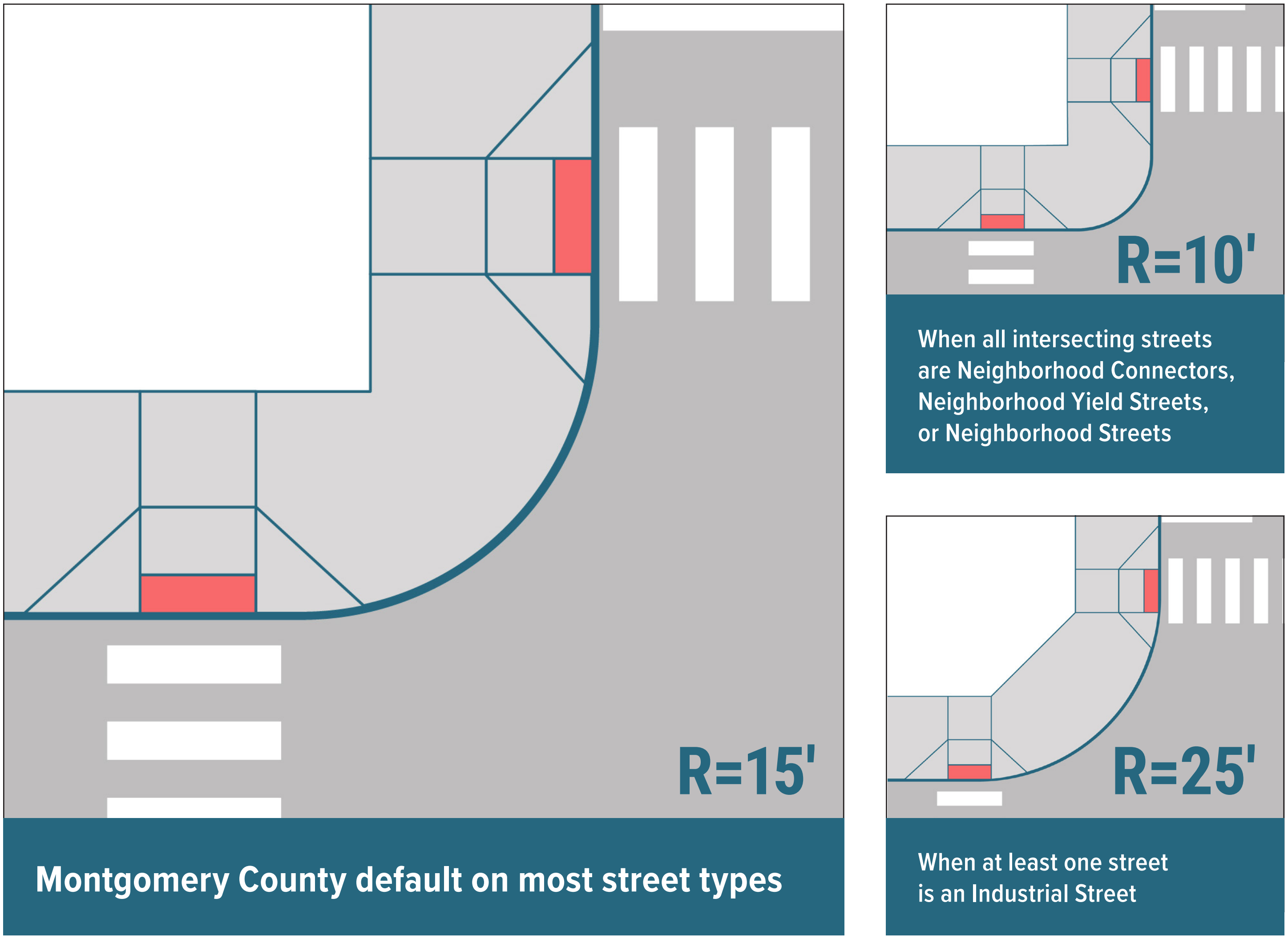


Figure 6-5. Corner radius design guidance

The default corner radius on most street types in Montgomery County is 15'. Exceptions include a default 25' corner radius when at least one street is Industrial and a default 10' corner radius when all intersecting streets are Neighborhood Connectors, Neighborhood Streets, or Neighborhood Yield Streets. Designers should assume a maximum 10 mph turning speed for passenger cars and a 5 mph turning speed for all other vehicles.

Use of the default corner radius is appropriate for roads that intersect at right angles and is usually inappropriate for roads that join at acute angles (skewed intersections), or for situations where a curb extension has been employed to reduce crossing distances. Curb extensions essentially "bump out" the curb radius to meet the effective turning radius.

If the default values are insufficient to accommodate the designated design vehicle, a larger corner radius should be used. The objective is to select the smallest appropriate corner radii while still accommodating the design vehicle. Intersection design requires a great deal of flexibility and engineering judgment, with safety as a primary focus.

In all cases, it is necessary to analyze turning movements and submit a turning template for county review, using the industry standard software (e.g., AutoTurn). If larger corner radii are necessary, other measures should be taken to mitigate longer crossing distances and higher turning speeds, as described in the following section of this chapter. It is often necessary to use one or more of these methods in combination to improve intersection safety.

6.4 Design Vehicle Versus Control Vehicle

Intersections should enable safe and efficient movement by a variety of different vehicle sizes and types. It is important to consider the size of vehicles that will reasonably be expected to move through the intersection, and the frequency of these movements. Policies with respect to allowing encroachment on opposing lanes during turning movements differ depending on whether a large vehicle routinely uses the street, versus an infrequent user or emergency vehicle.

Design Vehicle

The design vehicle is the least maneuverable vehicle that routinely uses the street. Designers use a design vehicle to determine corner radii at intersections. Designers should use this vehicle when conducting intersection analysis with analysis software such as AutoTurn.

Designers have the discretion to use a larger design vehicle than the default for Industrial Streets, Boulevards, Major Highways, and other streets where larger vehicles are anticipated to comprise more than 8 percent of the turning movements at the intersection, and where no alternate route exists that would accommodate larger vehicle turns without compromising pedestrian safety. Examples of typical turning templates for these unique conditions would include a school bus, a WB-40, WB-50, WB-62[76], or in rare instances a WB-67 (on Industrial Streets) or relevant farm machinery (in Rural areas).

Montgomery County's standard design vehicle is a 30-foot single unit truck (SU-30) with a 42-foot turning radius.

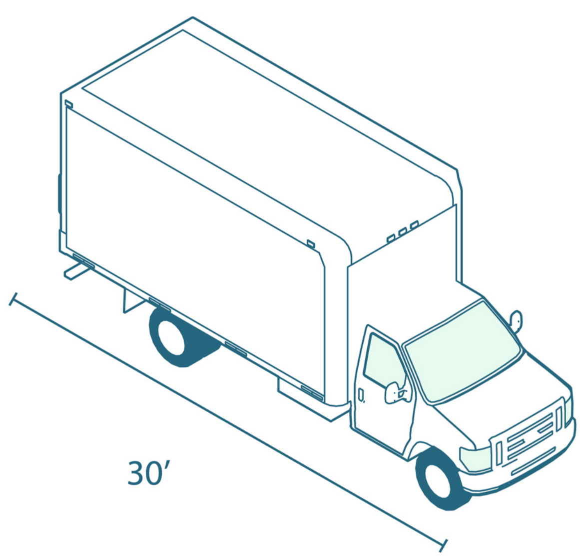


Figure 6-6. Standard design vehicle (Note: MDOT SHA's standard design vehicle is either a 40 or 50-foot single unit truck [SU-40 and SU-50].)

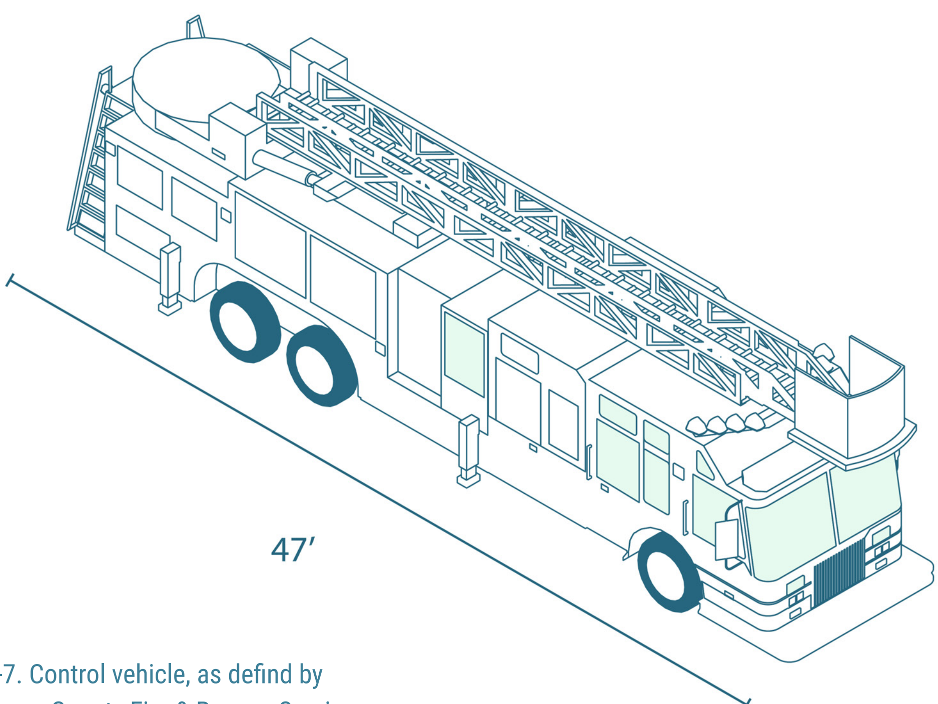
76 These are codes for different sizes of tractor trailers, as used in intersection analysis software.

Designers should analyze impacts and select the smallest appropriate design vehicle to support pedestrian safety, while still accommodating motor vehicle turns. Using a larger design vehicle than an SU-30 at an intersection where either street is a Neighborhood Connector, Neighborhood Street, or Neighborhood Yield Street requires a waiver from MCDOT. If the intersection includes a bus route and does not include a Neighborhood Connector, Neighborhood Street or Yield Street, an appropriately sized bus may be used as the design vehicle. The designer should be cognizant of the bus route and accommodate necessary turning movements through the intersection. If the bus route goes straight through the intersection, it is not necessary to make a bus the design vehicle.

Designers should be prepared to submit supporting documentation, including detailed AutoTurn or equivalent turning analyses, as requested by the county in support of their evaluation of specific corner designs. The county's evaluation will include consideration of strategies for minimizing curb radii described in the following section.

Control Vehicle

The control vehicle is an infrequent but necessary user of the street. The control vehicle for intersection design in Montgomery County is a standard fire truck as defined in Figure 6-7. The design versus control vehicle is an important distinction for the encroachment policy described in the following section.



The Control Vehicle is determined by the Montgomery County Fire & Rescue Services

Figure 6-7. Control vehicle, as defind by Montgomery County Fire & Rescue Services

6.5 Encroachment

Encroachment is the ability for a vehicle to use space outside of its designated travel lane, but within the roadway, to navigate a turning movement. Encroachment does not include tracking over curbs, bike facilities or onto the sidewalk area. Encroachment can occur on single lane and multilane roadways. Illustrations that explain the concept of motor vehicle encroachment are shown in Figure 6-8.

Design Vehicle Encroachment

Allowing large vehicles to encroach on adjacent travel lanes is an important consideration when designing intersections with shorter crossing distances for pedestrians and lower turning speeds. Montgomery County applies the policies shown in Figure 6-9 to designing intersections, with regards to assumptions about design vehicle encroachment on adjacent travel lanes. Notes:

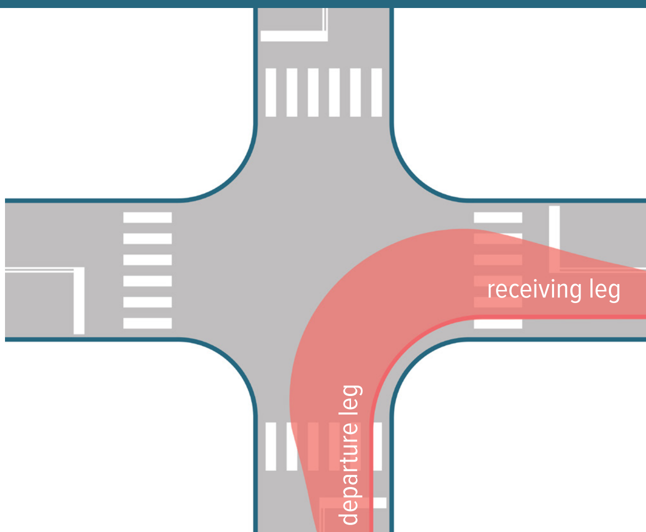
» At an intersection of two Type B streets (Downtown Boulevards, Downtown Streets, Boulevards, Town Center Boulevards, Town Center Streets, Industrial Streets), the designer can assume encroachment into opposing lanes on the departure leg if the intersection is designed with recessed stop bars or other measures to reduce conflicts (see next section).

» Some exceptions to Figure 6-9 apply, depending on vehicle volumes. Consult with MCDOT and use design strategies to reduce the effective turning radius (see next section).

» Bike boxes should be placed outside of design vehicle tracking.

Type A Streets: Neighborhood Connectors, Neighborhood Streets, Neighborhood Yield Streets, Country Connectors, Country Roads

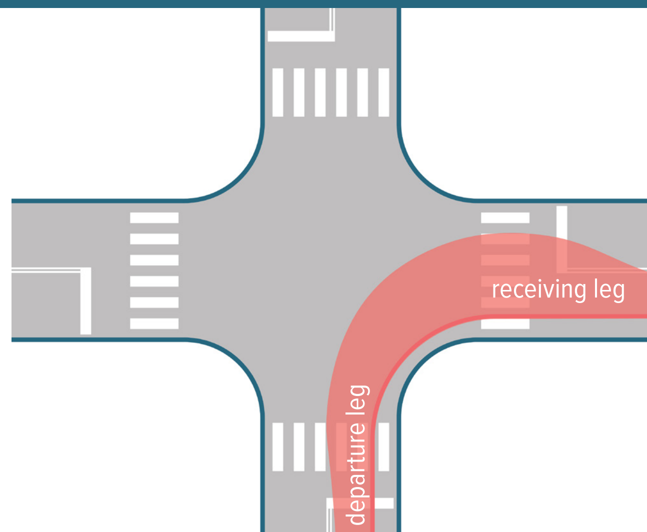
Type B Streets: Downtown Boulevards, Downtown Streets, Boulevards, Town Center Boulevards, Town Center Streets, Industrial Streets



Full Encroachment (2-lane roads)

Vehicles encroach upon opposing lane in both the departure and receiving leg of the intersection. Allowable:

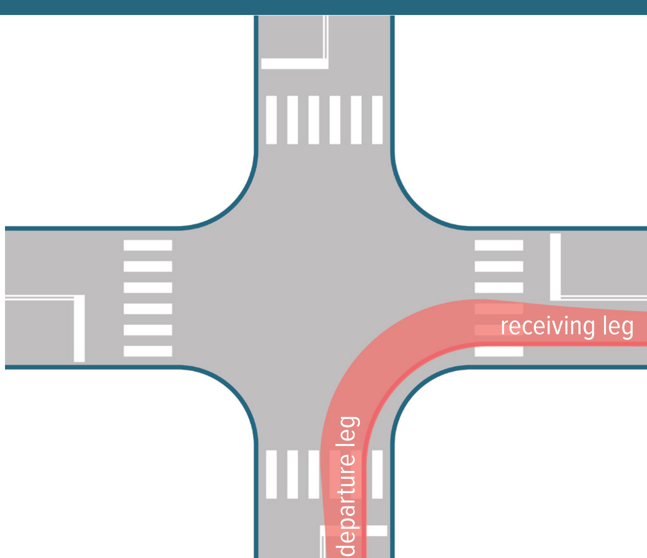
- By large vehicles (e.g., school bus, transit bus) where all intersecting streets are Type A streets



Receiving Lane Encroachment (2-lane roads)

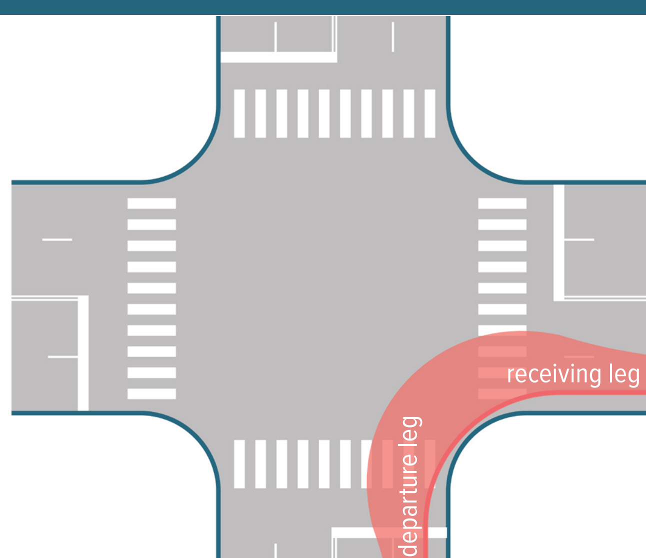
Vehicles encroach upon opposing lanes in receiving leg only. Allowable:

- By large vehicles where the receiving leg is a Type A street and the departure leg is a Type B Street



No Encroachment (2-lane roads)

- Required for a typical passenger vehicle on all street types
- Desired by larger vehicles where all legs are Type B streets (except control vehicle – see next section)



Multilane Roads

Vehicles encroach upon non-opposing (same direction) lanes of both the departure and receiving leg of the intersection. Allowable by larger vehicles on all applicable street types.

Figure 6-8. Explanation of vehicle encroachment

Control Vehicle Encroachment

The control vehicle (Montgomery County Fire Truck) can be assumed to use full encroachment at all intersections. It may use all traversable parts of an intersection, including across centerlines.

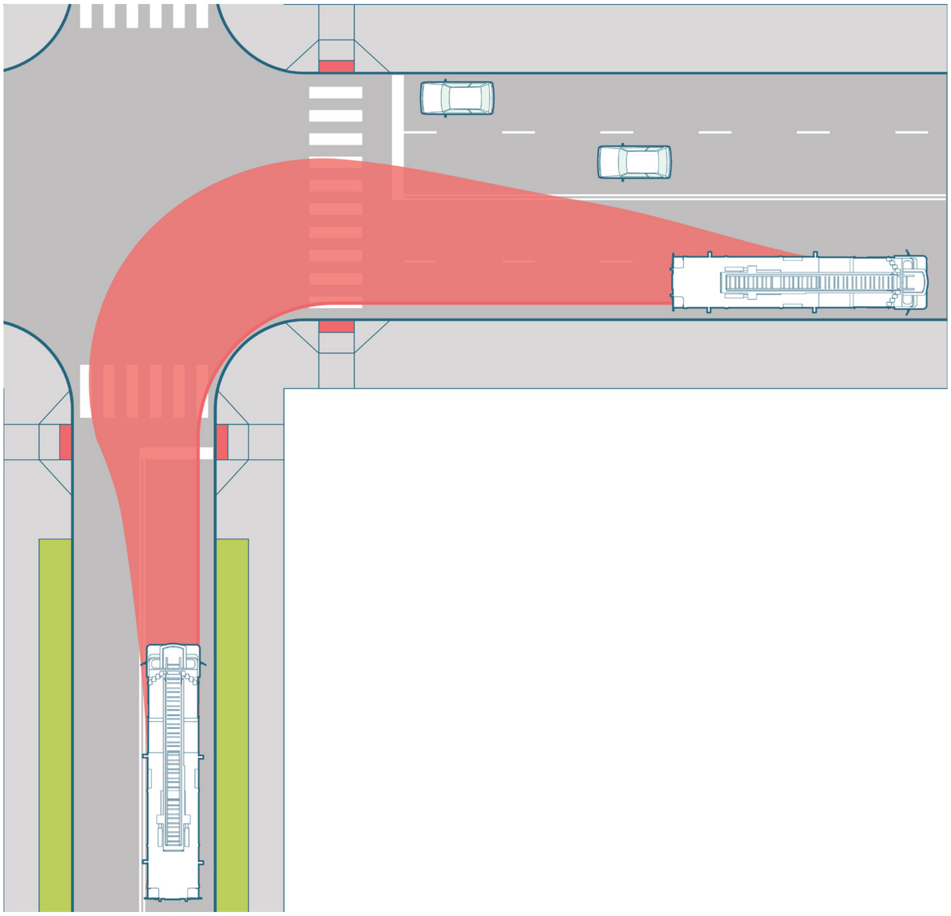


Figure 6-9. Graphic of allowable control vehicle encroachment at intersection

6.6 Methods to Mitigate Conflicts at Intersections

The key to minimizing serious injuries and fatalities from crashes at intersection is to slow the speed of turning vehicles. Slowing the speed of turning motor vehicles allows more sight distance and increases the ability to stop. There are physical and policy measures that can encourage this outcome.

Physical Measures

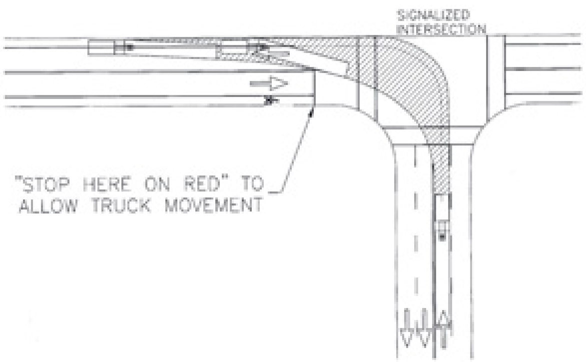


Figure 6-10. Recessed stop bar

Recess the stop bar

In order to allow the design vehicle additional space for encroaching on opposing lanes during turning movements at signalized intersections, the stop bar for the opposing lane(s) on the departure leg can be moved back as shown in Figure 6-10. The maximum distance from stop bar to signal light cannot be exceeded (based on sight distance and clear zone per the MUTCD). Right-turn-on-red should be prohibited at locations where the stop bar is recessed to accommodate turning movements.

Figure 6-11. Curb Extension

Recess on-street parking and provide curb extensions

On-street parking should be set back 40 feet from the intersection to increase sight lines and visibility for all users. Recessed parking combined with curb extensions can encourage slower turning movements.

Provide truck aprons

Truck aprons accommodate larger vehicles within the street zone, while also discouraging higher speed turning movements by smaller vehicles. Where used, truck aprons should be designed to clearly indicate a different surface than both the sidewalk and the street, so that motorists avoid driving on the apron unless necessary, and pedestrians do not confuse it as a waiting area. Truck aprons must be designed to support the weight of large trucks. Special attention is required to accommodate drainage, avoid collection of debris in crosswalks and to ensure that the crosswalk and roadway are ADA compliant.

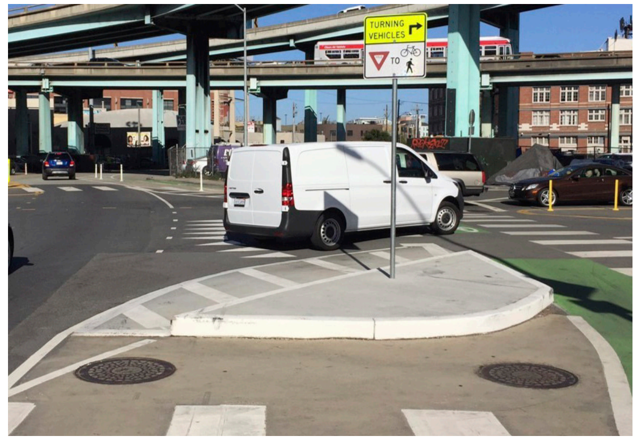


Figure 6-12. Truck Apron

Hardened centerlines/turn wedges

A physical obstacle can improve left-turning drivers' view of the crosswalk and reduce turning speeds. This treatment may be combined with curb extensions or "wedges" made of temporary materials (e.g., modular speed humps and/or flexible posts) or more permanent materials (e.g., curbing) at the corners to further reduce turning speeds. Hardened centerlines and turn wedges can be used on signalized intersections of one-way to two-way or two-way to two-way streets with the appropriate geometry in locations with permissive left turns (no left turn signal).

Figure 6-13. Hardened Centerline

Policy Measures

No-Right-Turn-On-Red (RTOR): No RTOR is a strategy that has been used effectively in Montgomery County to reduce the instances of motorists encroaching on crosswalks and otherwise improve safety at intersections. More information is provided in the following section.

Turning Restrictions: In some cases where alternative routes exist, it may be feasible to restrict certain turning movements.

Delivery Restrictions: In large-scale commercial areas where deliveries are made using tractor trailer trucks (typically Downtown Boulevards and Downtown Streets), it may be appropriate to limit deliveries to non-peak hours in order to reduce potential conflicts related to lane encroachment. If these strategies are used, it is important to clearly indicate the restrictions with signs in the appropriate locations.

6.7 Channelized Right Turn Lanes

Channelized right turn lanes (often called slip lanes) are designed to encourage the uncontrolled flow of right turns at fast speeds. **This design is not recommended for Complete Street intersections and removal of existing channelized right turn lanes should be pursued during road reconstruction projects in locations where pedestrians are permitted.**

In instances where channelized right turn lanes are needed (i.e., skewed intersections), the channelized lane width should be 11 feet maximum, utilizing truck aprons to accommodate larger vehicles. The angle of the lane should direct attention to the crosswalk, reduce turning speed to promote appropriate yielding behavior, and require the motorist to yield to traffic on the receiving leg of the intersection, rather than merging into traffic (see Figure 6-14). A raised pedestrian crossing should be considered across the channelized right turn lane and the pedestrian island should be designed to be ADA compliant.

Figure 6-14. A channelized right turn lane with raised crosswalk, high visibility markings and signs

6.8 Intersection Features

The following section provides design guidance on various designs and features at intersections. Figure 6-15 presents the appropriate usage of common intersection features/designs by street type in Montgomery County.

LEGEND

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- x Not Permitted or N/A
- * Unless determined otherwise by Planning Board

INTERSECTIONS	Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway	Page Reference
Roundabouts	O (engineering judgement needed, see Section 6.9)												132
Crossing Islands	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	▲	152
Pedestrian Signals (when traffic signals are present) or Beacons	■	■	■	■	■	■	■	■	■	▲	▲	■	149
Pedestrian Recall on Signals	▲	▲	▲	▲	O	O	O	O	O	x	x	x	155
Pedestrian Intersection Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	■	■	■	■	■	■	■	■	■	■	■	86
Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes, or conventional bike lanes.												136
Bicycle markings/facilities (when bikeways are present)	■	■	■	■	■	■	■	■	■	■	■	■	138
Speed Tables/ Raised Crosswalks+	O	▲	x	O	▲	O	O	O	O	x	x	x	213
Raised Intersections+	O	▲	x	O	▲	O	O	O	O	x	x	x	213
Curb Extensions/Bulb Outs	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	O	213

+ Covered in Chapter 8. Speed Management

Figure 6-15. Design guidance for intersections by street type

6.9 Roundabouts and Mini Roundabouts

Roundabouts are circular intersections designed to reduce vehicle speeds and eliminate left turn conflicts commonly associated with severe crash types. The inscribed diameter of a roundabout is typically less than 200', and the geometry of the roundabout encourages slow entry and exit speeds. Roundabouts have yield-controlled entry on all legs and pedestrian access is allowed. ADA-compliant median islands and high-visibility crosswalks should be installed to make pedestrian crossings safer and more visible.

A smaller scale version of this intersection treatment is a **mini roundabout**, which is used on low-speed residential streets. Mini roundabouts can be designed using simple markings or raised islands and can be installed in conjunction with low-level plantings and street trees. Lane widths and turning radii should account for the appropriate design vehicle.

Roundabouts versus Traffic Circles

Roundabouts differ from traditional traffic circles (also called rotaries), which are designed with larger diameters of about 200' or more and operate at higher speeds (30 mph or greater). Some traffic circles use signals, stop signs, or yield signs at one or more entries. Traffic circles often have multiple lanes and tend to be difficult for pedestrians and bicyclists to navigate because of higher speeds and multiple conflict points.

Figure 6-16. Roundabout (left) and Mini Roundabout (right)

Design Considerations

While any conventional intersection may be considered for a conversion to a roundabout, roundabouts with skewed legs may require the legs to be realigned to provide adequate space between them and appropriate entry and exit angles. This may result in additional impacts. An engineering study must be conducted to determine the feasibility and appropriateness of the conversion of a conventional intersection to a roundabout. General considerations include the design vehicle, vehicular traffic volumes, pedestrian volumes, and effects on pedestrian route directness.

Refer to the MdMUTCD[77], MDOT SHA's *Roundabout Design Guidelines*[78], and MCHRP Report 672, Roundabouts: An Informational Guide (current edition)[79] for guidance on the design of pavement markings and signs for roundabouts.

Pedestrian and Bicyclist Access

Roundabouts should be designed to facilitate pedestrian and bicycle safety. For more information on how to design roundabouts with bicycle facilities, refer to the AASHTO Guide for the Development of Bicycle Facilities.[80] Roundabouts must be designed to meet the needs of people with disabilities. This is a challenge for people who have vision disabilities because they often navigate by listening to the sounds of motor vehicles starting and stopping. Those sound cues are less clear in a roundabout; therefore, it is recommended to reduce motor vehicle speeds to 15 mph or less at entry and exit points to increase motorist yielding.

Design guidance for roundabout wayfinding for the visually impaired includes:[81]

» Well-defined walkway edges

» Landscaping, bollards, or architectural features at street edge to define and separate walkable areas and preclude unpredictable crossing locations

» Detectible warning surfaces at roadway edge and on splitter island

» Perpendicular crossings; where angled, use curbing for alignment cues

» High-visibility crosswalk markings

» Pedestrian lighting

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77 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

78 https://www.roads.maryland.gov/OHD2/MDSHA_Roundabout_Guidelines.pdf

79 http://onlinepubs.trb.org/onlinepubs/webinars/RoundaboutsPresentations.pdf

80 https://nacto.org/wp-content/uploads/2015/04/AASHTO_Bicycle-Facilities-Guide_2012-toc.pdf

81 https://www.access-board.gov/enforcement/221-research/research-on-public-rights-of-way/modern-roundabouts

Multi-Lane Roundabouts

Multi-lane roundabouts accommodate higher vehicular traffic volumes, but have multiple conflict points and can be difficult for pedestrians to navigate. Multi-lane roundabouts are not recommended in areas where high or moderate levels of pedestrian and bicycle activity are anticipated. Where multi-lane roundabouts are required, enhanced pedestrian treatments like RRFBs should be considered to enhance driver awareness of pedestrians and bicyclists entering the crosswalks.

Stormwater

Modern roundabouts also provide excellent opportunities to implement stormwater management through green street techniques described in Chapter 7: Green Streets. Care should be taken to ensure plant growth does not obstruct sight distances.

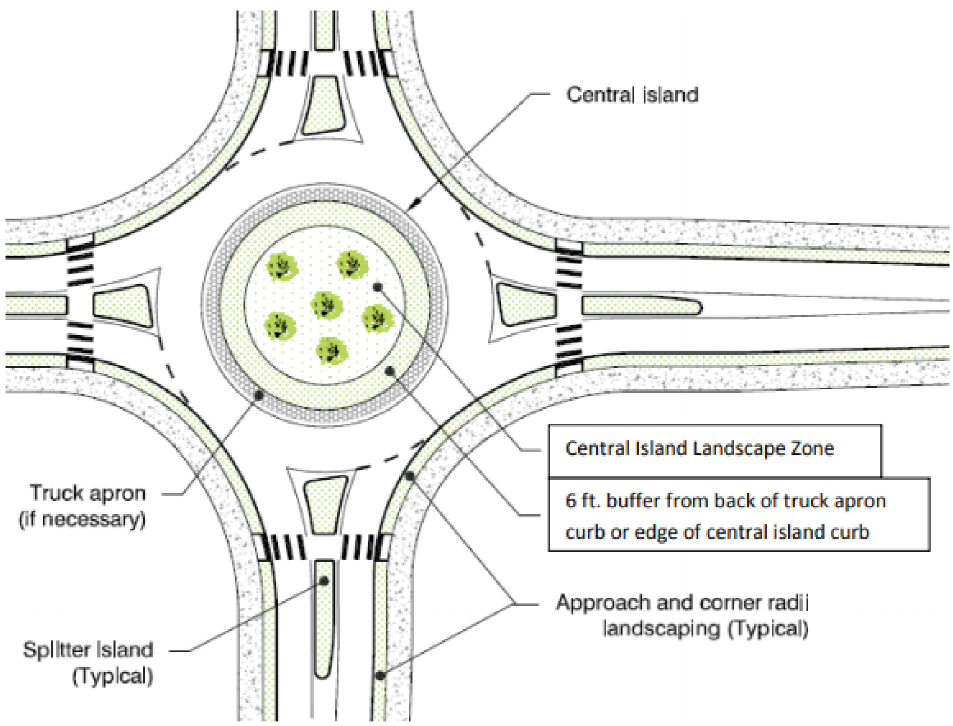


Figure 6-17. Typical roundabout design elements (Source: Maryland State Highway Administration, Roundabout Design Guidelines, 2012)

6.10 Curb Ramps

As the horizontal and vertical connection between sidewalks and crossings, curb ramps are the fundamental elements of accessible pedestrian routes. The Montgomery County preferred standard is two perpendicular curb ramps per corner, each aligning with desired paths of travel. Other ADA-compliant curb ramps may be considered if two perpendicular ramps are not feasible at a specific location; however, engineering judgment and DOT approval would be required. All curb ramps must be compliant with the United States Access Board Public Right-of-Way Accessibility Guidelines (PROWAG).[82]

Ramp placement may be affected by the location and placement of streetscape elements and utilities, including catch basins. The location of fixed objects (e.g., poles, signal cabinets, etc.) should not limit access for pedestrians and bicyclists using sidewalks and curb ramps. Curb ramps and crosswalks should be designed to drain water away from curb ramps, reducing risk of pooling (and icing) across ramps.

The Montgomery County preferred standard is two perpendicular curb ramps per corner, each aligning with desired paths of travel.

Figure 6-18. Street corner with two perpendicular curb ramps that align with crosswalks

82 https://www.access-board.gov/prowag/

6.11 Bikeways at Intersections

The following sections give design guidance for protected intersections, two-stage turn queue boxes, and bike boxes. Protected Intersections are the default intersection treatment for all intersections with separated bike lanes, sidepaths, buffered bike lanes and conventional bike lanes at one or more approaches. When implementing protected intersections as part of retrofit projects is infeasible, bike boxes and two-stage turn queue boxes are ways to modify intersections to accommodate specific turning movements in the interim until protected intersections can be implemented. Mixing zones (i.e., locations in or approaching intersections that are shared by bikes and vehicles) are not recommended for interim separated bike lanes except in rare cases. Additional information below and details on the following treatments can be found in Montgomery Planning's Bicycle Facility Design Toolkit.[83]

Protected Intersections

A protected intersection provides a physical barrier between bicycles and motor vehicles within the intersection. This design provides designated spaces for all users, increases sight lines, reduces turning speeds and provides a safer, more comfortable operating space for vulnerable users. A fully protected intersection has protected bicycle crossings for all movements within the intersection.

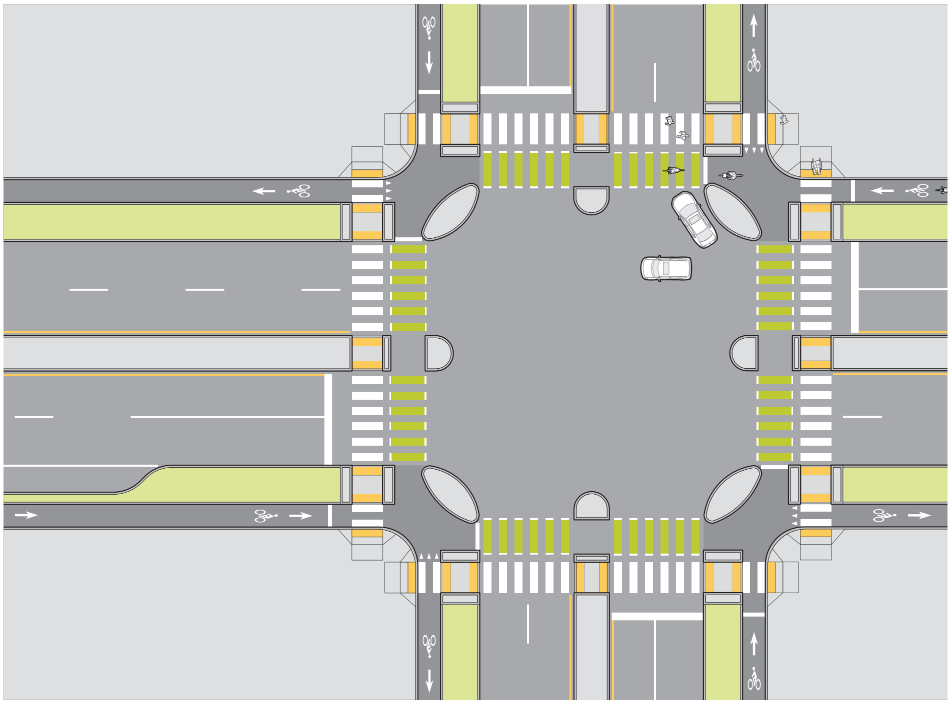


Figure 6-19. Fully protected intersection example from Montgomery County Bicycle Master Plan Appendix B: Facility Toolkit

83 https://montgomeryplanning.org/wp-content/uploads/2018/05/Bicycle-Facility-Design-Toolkit-May-2018.pdf

Two-Stage Turn Queue Box

A two-stage turn queue box is the preferred method of accommodating bicycle left turns at multi-lane signalized intersections when the intersection is not fully protected. Even with the presence of a protected left turn signal phase, a two-state turn queue box is preferred for the all ages and abilities user of the bike lane. This treatment can also be used at unsignalized intersections or mid-block locations to simplify turns from a bike facility. Two-stage turn queue boxes have interim approval from FHWA (IA20)[84]. Use of two-stage turn queue boxes should obtain approval from MDOT SHA per Section 1A.10 of the Maryland MUTCD.[85]

Bike Boxes

Using pavement markings, a bike box provides a designated space for a bicyclist ahead of the vehicular travel lane at a signalized intersection. Bike boxes have interim approval from FHWA (IA18).[86] A bike box can be used for separated and conventional bike lanes where a fully protected intersection does not yet exist – specifically where the right or through movement is unprotected for the bicyclist. By positioning the bicyclist ahead of the vehicles, it provides an opportunity for the more vulnerable user (the bicyclist) to navigate the intersection before the vehicles enter the intersection. Bike boxes are for through- and right-turning cyclists and should not extend beyond one travel lane. A two-stage turn queue box (defined above) is preferred for left turns.

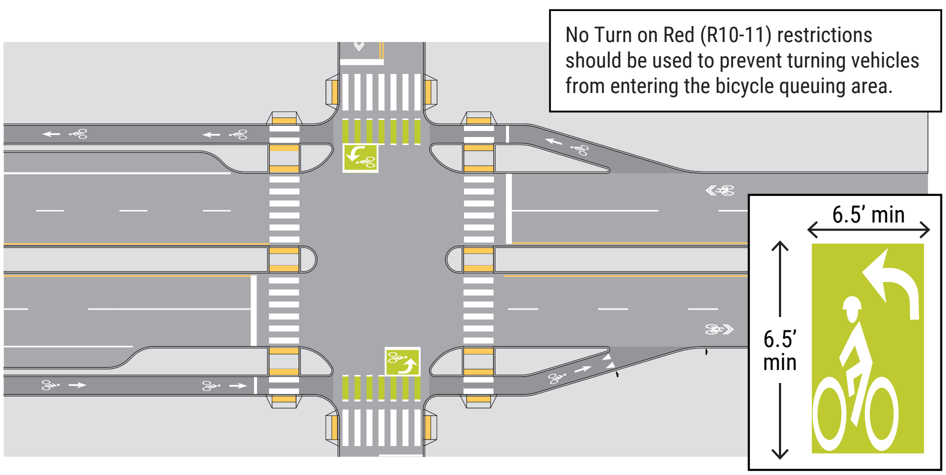


Figure 6-20. Two-stage turn queue box within a partially protected intersection example from Montgomery County Bicycle Master Plan Appendix B: Facility Toolkit

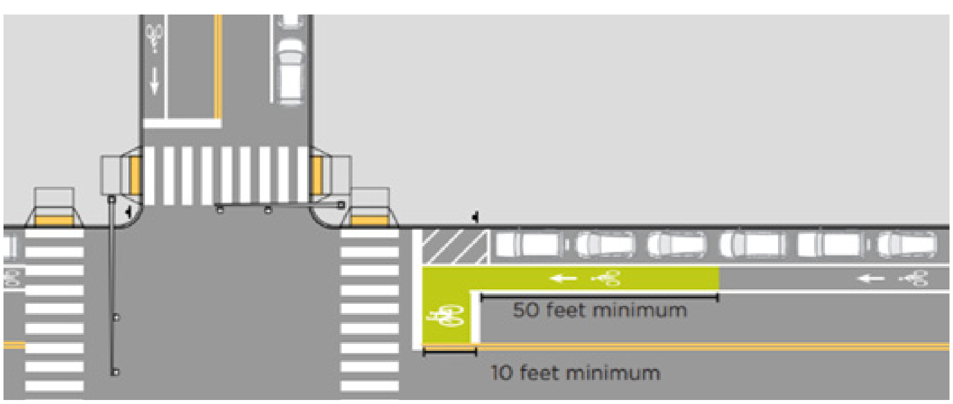
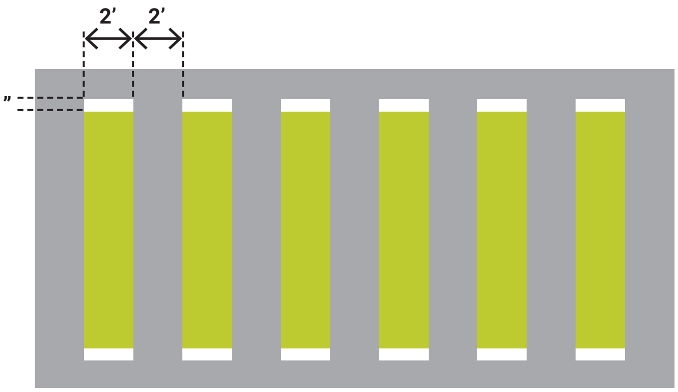


Figure 6-21. Bike box detail from Montgomery County Bicycle Master Plan Appendix B: Facility Toolkit

84 https://mutcd.fhwa.dot.gov/resources/interim_approval/ia20/index.htm
85 https://www.roads.maryland.gov/mmutcd/2011_Chapters_01A.pdf#page=5
86 https://mutcd.fhwa.dot.gov/resources/interim_approval/ia20/index.htm

One-way SBL Crosswalk



Two-way SBL Crosswalk

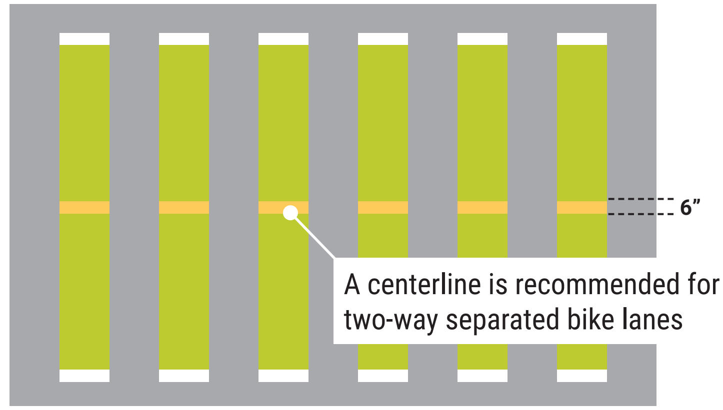


Figure 6-22. Bike crossing detail from Montgomery County Bicycle Master Plan Appendix B: Facility Toolkit

Conflict Zone Striping (Bike Crossings)

Where separated bike lanes cross streets, alleys, and driveways, conflict zone pavement markings should be used. The conflict zone striping typically uses a green-colored surface marking to provide a distinction between it and a pedestrian crossing. When the conflict zone is used for a two-way bike facility, a centerline stripe is recommended, as shown in Figure 6-22.

Bike Crossings at Freeway Ramps

Freeway ramps present significant safety concerns for crossing pedestrians and bicyclists. Motorists tend to accelerate to freeway speeds on entrance ramps. They are often more focused on finding a gap to merge into traffic at exit ramps and less aware of non-motorized users crossing the ramps. To eliminate these impediments and improve the safety of pedestrians and bicyclists, the following design guidance is recommended.

Where feasible, new freeways, freeways undergoing major change or stand-alone capital projects should include grade-separated crossings for intersecting road networks. Preferably, these grade-separated crossings will avoid crossing freeway ramps. Grade-separated crossings will:

» Be a minimum of 12 feet wide (2-foot-wide buffer, 8-foot-wide sidepath, 2-foot-wide buffer) between walls and railings where the connecting bikeway is a sidepath and a minimum of 17 feet wide (2-foot-wide buffer, 8-foot-wide striped two-way separated bike lanes, 5-foot-wide sidewalk and 2-foot-wide buffer) where the connecting bikeway is separated bike lanes.

» Strive to make all locations on the crossing visible from both ends of the crossing.

» Avoid sharp-angled turns.

» Include pedestrian-scale lighting.

» Provide intuitive wayfinding.

» Incorporate welcoming public art and aesthetic features.

Freeways that are undergoing minor or no changes will preferably include traffic signalization to reduce conflicts. The goal of signalizing freeway ramps is to minimize conflicts between motor vehicles, bicyclists, and pedestrians while maximizing visibility between all modes in a constrained right-of-way. Unsignalized treatments with geometric changes are not recommended and should only be considered when overpasses, underpasses and signalized ramps are not feasible.

Montgomery County's Bicycle Facility Design Toolkit (Appendix B)[87] provides additional details on freeway crossing treatments.

Traffic Signals and Bicycles

Where moderate to heavy volumes of bicyclists are anticipated at intersections, signal timings should consider the speed of a bicyclist starting from a stop, as well as the slowest anticipated bicyclist's travel speed, to determine the minimum green time and clearance intervals for the signal respectively. At semi-actuated or fully actuated signals, detection should be designed to detect bicyclists.

Bicyclists traveling in a shared lane are typically subject to vehicular signal heads. Along a sidepath or sidewalk, bicyclists may be subject to pedestrian signal heads. Along a corridor with a consistent bikeway type, it is recommended that traffic signal indications for bicyclists be consistent and as uniform as possible. If bicyclists are supposed to follow the pedestrian signal, the BIKES USE PEDESTRIAN SIGNAL sign (MUTCD R9-5) should be mounted adjacent to the pedestrian signal heads and care should be taken to ensure the pedestrian indication is visible to bicyclists.

A bicycle signal is any signal accompanied by a BICYCLE SIGNAL (MUTCD R10-10b) sign, which is intended for the exclusive use of bicyclists. A bicycle signal may be appropriate in locations where:

» It is necessary to add a signal face where bicyclists cannot see a relevant signal face.

» Bicyclists have a separate directional movement, counterflow, phase, or leading/lagging interval.

» It is desired to maximize the time a bicyclist may legally enter a crosswalk along a shared use path.

» A leading or lagging bicycle interval is needed.

» Where a bicycle lane exists on the right-hand side of an exclusive turn lane that would otherwise be in non-compliance with Section 9C.04 of the MUTCD.[88]

Bicycle signal faces (i.e., signal faces that contain a bicycle symbol) currently have interim approval from FHWA for use where there are no conflicting motor vehicle movements with the signalized bicycle movement. If these signal faces are desired to be used with concurrent conflicting motor vehicle movements, a request to experiment is required from FHWA. For more information, see the FHWA Interim Approval IA-16.[89] Use of bicycle signal faces should obtain approval from MDOT SHA per Section 1A.10 of the Maryland MUTCD.[90]

87 https://montgomeryplanning.org/wp-content/uploads/2018/05/Appendix-B-PB-Final-5.3.18.pdf
88 https://mutcd.fhwa.dot.gov/
89 https://mutcd.fhwa.dot.gov/resources/interim_approval/ia16/
90 https://www.roads.maryland.gov/mmutcd/2011_Chapters_01A.pdf#page=5

6.12 Transit and Intersections

For transit to be a viable travel mode for Montgomery County residents and visitors, it must be a safe and efficient method of travel. Pedestrian and bicyclist access to transit is particularly important. Intersections should be designed to accommodate transit vehicles to encourage safe access to transit stops. Under some conditions, MCDOT may find it beneficial to prioritize transit movements at intersections.

Signal Timing and Coordination

Signal timing is fundamental to improving traffic flow. In addition to signal coordination, transit signal priority enables transit vehicles to shorten or extend a traffic signal phase without disrupting the phase sequence or overall signal timing.

Signal priority for transit vehicles allows transit to stay on schedule during peak hours when there is congestion. Signal priority allows transit vehicle delay to be reduced by extending the green time for an approaching bus or shortening time for the opposing movements for a waiting bus. The difference in the time can be made up in the next cycle of the signal, but all other signal operations can remain intact. All transit signal prioritization must be coordinated with MDOT, MCDOT Transit Services, and MCDOT Division of Traffic Engineering and Operations.

Figure 6-23. A bus shelter and stop in Bethesda

Transit Lanes

Transit lanes are travel lanes designed for the preferential or exclusive use of transit vehicles. Transit-only lanes remove transit from traffic congestion and may provide more continuous and reliable transit service. In some cases where transit headways are infrequent, these lanes can be shared with bicyclists. An engineering analysis is needed to determine if this is a viable solution.

Queue Jump Lanes

Queue jump or bypass lanes are specially designated type of transit lanes at intersections that provide an early green signal or hold a green signal for transit vehicles while other vehicles traveling in the same direction are given a red light.

Transit Stop Locations

Transit stop location and design must address the safety, comfort, and convenience of pedestrians (including people with disabilities) and bicyclists. Transit stops should be placed in well-lit locations with accessible routes, good sight distance, and close proximity to crosswalks. Where feasible, bus stops should be located on the far-side of intersections. Concrete pavement should be considered, particularly at high-volume bus stops.

Transit stop locations must be coordinated with Montgomery County Ride On and WMATA, and should follow WMATA's Guidelines for the Design and Placement of Transit Stops.[91]

Bus Bulbs

Bus bulbs are elongated extensions of the curb that align the waiting area for the bus stop with the parking lane. This design enables the bus driver to access the stop while positioned in the travel lane, rather than pulling out of traffic and merging back into traffic after the stop. The location of a bus bulb and its final design will be approved by MCDOT Transit Services and MCDOT Division of Traffic Engineering and Operations.

91 https://www.wmata.com/initiatives/plans/upload/Bus_Stop_Guidelines_Brochure.pdf

Figure 6-24 provides a diagram of curb bulb design. According to WMATA Bus Stop Design Guidelines, Curb bulbs should be 30 to 40 feet wide for a standard 40-foot transit bus that has front and rear doors. For a 60-foot articulated transit bus, the curb clearance should be 50 feet to accommodate rear-door access. Bus Bulbs must be designed to be accessible and compliant with ADA regulations.

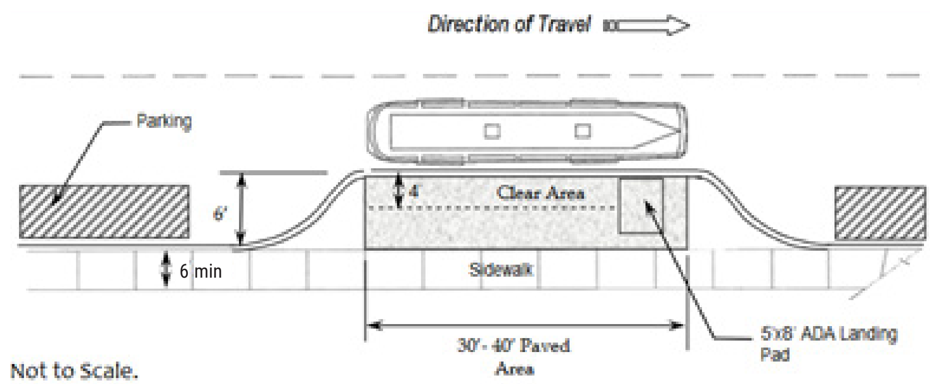


Figure 6-24. Bus Bulb design (graphic modified from WMATA's Guidelines for the Design and Placement of Transit Stops)

Floating Bus Island

Transit stops that are integrated with separated bike lanes are called floating bus islands. Where separated bike lanes and bus stops exist on the same road, floating bus islands are an integral part of the bikeway and transit network. At the time of publication, floating bus island design was an evolving practice. The guidance included in this section represents best practices. Consult MCDOT for more information.

The separated bike lane should be routed behind, rather than in front of, the bus island (see Figure 6-25). This design is intended to reduce conflicts; however, it is necessary to guide transit passengers across the bike lane at clearly marked locations. Two pedestrian crossings are recommended. Channelizing railings, planters, or other treatments can be used to help direct pedestrians, particularly those with vision disabilities, from the floating bus island to the designated crossing locations. Similarly, on the sidewalk side of the separated bike lane, the bike lane and the sidewalk area must be separated either vertically with curb, with landscaping, or channelizing devices to guide visually impaired pedestrians to the crossings. Tactile surfaces such as directional indicators may be used to provide additional guidance to the floating bus stop for visually impaired pedestrians. Yield markings should be placed prior to crosswalks to give clear direction to bicyclists to yield to pedestrians.

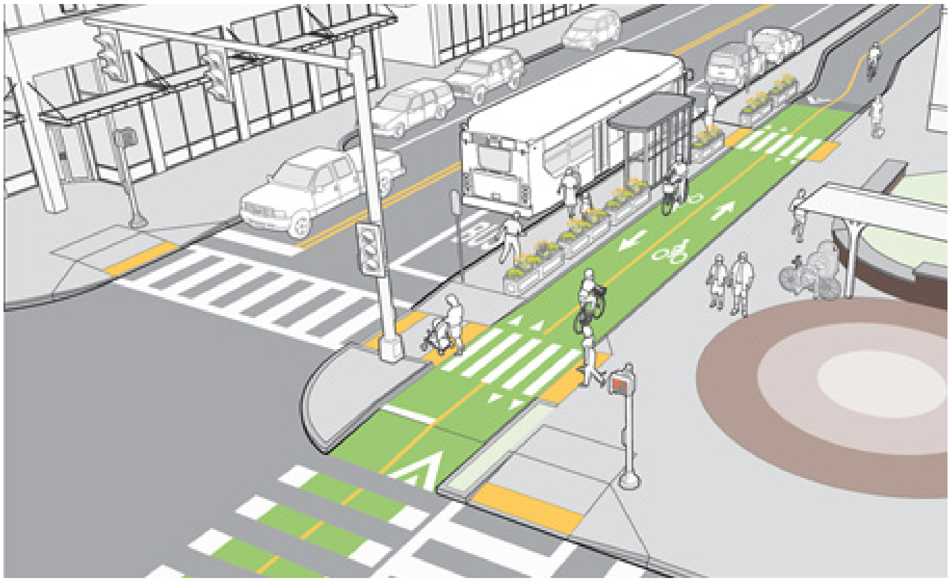


Figure 6-25. Floating bus island
(Note: This graphic shows an intermediate-level bikeway, which is the county's default. This creates a detectable edge between the sidewalk and the bikeway.)

A minimum 5-foot wide by 8-foot long clear boarding and alighting area should be provided that connects to a pedestrian access route. In constrained locations, this area can include the crosswalk that extends across the separated bike lane. Advanced lateral deflection of the bike lane may be necessary to accommodate the boarding and alighting area. In most cases, the bike lane should be elevated to sidewalk level to facilitate movement to and from the transit stop.

Clear sight lines should be provided between pedestrians and bicyclists at expected crossing locations. If transit shelters are provided, ensure that the shelter structure or shelter advertising do not limit sight lines. All aspects of the design should be ADA-compliant. Where necessary, the bike lane width can be reduced (down to 4 feet for one-way bike lanes and 8 feet for two-way) along the transit stop, in order to maintain an accessible sidewalk and transit stop in constrained areas.

6.13 Pedestrian Design Elements

Pedestrians are the most vulnerable users of Montgomery County's intersections and their safety is of paramount importance. Pedestrian/ Bicycle facilities should be designed for all users, ideally such that families and children would be capable of safely and comfortable navigating them.

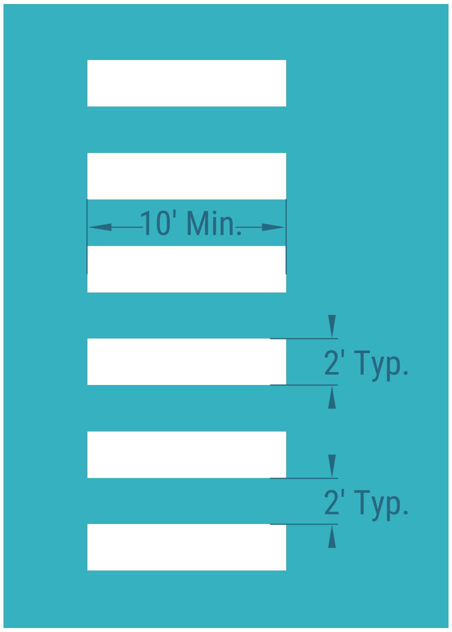


Figure 6-26. Example graphic and photo of a continental crosswalk

Crosswalk Design

A Continental crosswalk is the primary type of crosswalk marking used at intersections and uncontrolled crossings in Montgomery County (see Figure 6-26). The "Continental pattern" consist of a series of wide stripes parallel to the curb for the length of the crossing. The continental marking significantly increases the visibility of a crosswalk to oncoming traffic and as such is the default crosswalk marking in Montgomery County. The "Transverse pattern" crosswalk is an alternative design; however, it is not recommended in most circumstances. Transverse crosswalks consist of two 12-inch-wide white retro-reflective thermoplastic stripes parallel to the direction of pedestrian travel.

Crosswalks should be at least as wide as the sidewalk or sidepath, but no less than 10 feet in width. In locations with high pedestrian or bicycling demand, the crosswalk may be wider than 10 feet. Refer to the MdMUTCD[92] for further guidance with respect to crosswalk markings.

At signalized intersections, stop bars should be provided in advance of the crosswalk. Stop bars should be set back at least 4 feet from the nearest edge of the marked crosswalk to provide a buffer between pedestrians and motor vehicles per MdMUTCD.[74]

The Montgomery County Code (Section 31-20) requires parking to be restricted 20 feet from the back of the crosswalk. In advance of a crosswalk, designers should restrict on-street parking, where present, 20 to 40 feet to provide adequate sight distance (i.e., "daylighting"). In locations with sight distance obstructions, the parking restriction should be extended as necessary. Parking restrictions should be clearly communicated with signage and supplemented with pavement markings and curb extensions, where feasible.

92 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

Artistic Crosswalks

Artistic crosswalks are a way to add unique urban design features to a neighborhood or business district. Care should be taken with this approach, as paint tends to wear off the pavement over time. The current practice in Montgomery County is to permit only white crosswalks with artistic expression in the center of the intersection. Artistic crosswalks can only be installed with approval from MCDOT, and only in locations where community groups, business associations, or local governments have agreed to maintain the crosswalk over time.

Crosswalks can be decorated in paint, inlaid thermoplastic, or by stamping the pavement, as long as the visibility of the crosswalk is comparable to a standard crosswalk.

It is important to ensure artistic crosswalks can be seen at night. The markings should typically consist of a retroreflective continental or transverse pattern with the non-reflective decorative element located within the limits of the crosswalk.

Figure 6-27. A decorative crosswalk in Northhampton, Massachusets

Legal Definition of a Crosswalk

Code of Maryland, Title 21, Section 101:

"Crosswalk" means that part of a roadway that is:

1) Within the prolongation or connection of the lateral lines of sidewalks at any place where two or more roadways of any type meet or join, measured from the curbs or, in the absence of curbs, from the edges of the roadway;

2) Within the prolongation or connection of the lateral lines of a bicycle way where a bicycle way and a roadway of any type meet or join, measured from the curbs or, in the absence of curbs, from the edges of the roadway; or

3) Distinctly indicated for pedestrian crossing by lines or other markings.

Figure 6-28. An unmarked crossing

Uncontrolled Crossings

Uncontrolled pedestrian crossing locations occur where sidewalks or designated walkways intersect a roadway at a location where no traffic control (i.e., traffic signal or STOP sign) is present for the primary street crossing. These common crossing types occur at intersections (where they may be marked or unmarked) and at non-intersection locations (where they must be marked as crossings). Overall, uncontrolled pedestrian crossing locations correspond to higher pedestrian crash rates, often due to inadequate pedestrian crossing accommodations.

Uncontrolled crossings at intersections are legally defined as crosswalks, regardless of whether they are marked with crosswalk markings. This creates a challenge at unsignalized intersections between multi-lane roadways and minor roadways (among other locations). The crossing of the multi-lane roadway at an intersection is a legal crosswalk, even in the absence of pavement markings indicating it as such. It is therefore the responsibility of the designer to employ measures to maximize safety for pedestrians and bicyclists at these locations.

It is Montgomery County's policy to provide crossing opportunities for pedestrians at all legs of intersections, including uncontrolled intersections across non-residential streets. If it is not feasible to adequately address pedestrian safety at the uncontrolled crossing, a traffic signal, grade-separated crossing, or other enhanced treatments should be considered. If the designer declines to accommodate pedestrians at the uncontrolled crossing, it is necessary to submit a waiver that explains why it is not feasible to do so and identifies alternative crossings locations along with the additional travel time required for pedestrians to use the alternative route.

Crossing treatments may also be needed at midblock, non-intersection locations. Examples include locations where a pedestrian attractor is located across the street from a pedestrian generator (such as a parking lot located across the street from a church or school), or where a shared use path crosses a roadway at a midblock location. In these locations, a marked crosswalk is required to legally establish the crossing per Maryland state code.

Marked crosswalks may not be sufficient without other safety measures at uncontrolled crossings, because even though motor vehicles are legally required (in Maryland) to stop for pedestrians in a crosswalk, drivers often do not. An engineering analysis should be done to identify necessary measures that will result in the desired stopping behavior for motorists. Figure 6-29 provides guidance for the types of design treatments that should be employed to improve pedestrian and bicyclist safety at uncontrolled crossings in Montgomery County.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	❶ 2 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6 7 9	① 5 6 7 9	① 5 6 ❾
3 lanes with raised median (1 lane in each direction)	❶ 2 3 4 5	❶ ❸ 5 7 9	① ❸ 5 ❼ ❾	① 3 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❼ ❾	① ❸ 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❾
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	❶ 2 3 4 5 6 7 9	❶ ❸ 5 6 7 9	① ❸ 5 6 ❾	① 3 4 5 6 7 9	① ❸ 5 6 ❼ ❾	① ❸ 5 6 ❾	① ❸ 4 5 6 7 9	① ❸ 5 6 ❾	① ❸ 5 6 ❾
4+ lanes with raised median (2 or more lanes in each direction)	❶ ❸ 5 7 8 9	❶ ❸ 5 7 8 9	① ❸ 5 8 ❾	① ❸ 5 7 8 9	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 8 ❾
4+ lanes w/o raised median (2 or more lanes in each direction)	❶ ❸ 5 6 7 8 9	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ ❼ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ ❼ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 8 ❾

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- ● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- ○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
2 Raised crosswalk
3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4 In-Street Pedestrian Crossing sign
5 Curb extension
6 Pedestrian refuge island
7 Rectangular Rapid-Flashing Beacon (RRFB)**
8 Road Diet
9 Pedestrian Hybrid Beacon (PHB)**

Figure 6-29. Application of pedestrian crash countermeasures at uncontrolled crossings, based on roadway characteristics (source: FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations)

Multiple Threat at Uncontrolled Crossings

When a pedestrian crosses a street with 2 or more travel lanes approaching a crosswalk in the same direction, it is possible that a stopped vehicle will block the field of vision of an oncoming vehicle traveling in the same direction, putting the pedestrian as risk. This is referred to as a multiple threat condition. There are several countermeasures that can be used to mitigate this condition, as shown in Figure 6-29. Potential conflicts may be reduced by introducing RRFBs or signal controls, providing advanced stop lines/signs, curb extensions, or improving the level of traffic control at the crosswalk.

Frequency of Crossing Opportunities

The frequency of pedestrian and bicycle crossing opportunities is linked to the development pattern along a corridor. In an urban area, there is an expectation that pedestrians and bicyclists have more frequent crossing opportunities. In a suburban or rural area, fewer crossing opportunities may be expected. Figure 6-30 lists maximum crossing distances and minimum signal spacing by street type. For some street types, such as Downtown Boulevards, Downtown Streets, Town Center Boulevards and Town Center Streets, the maximum protected crossing spacing and the minimum signalized intersection spacing are the same, indicating that each crossing is expected to be a full traffic signal. On other street types they are different, indicating that traffic control other than full traffic signals are appropriate at some intersection. The maximum protected crossing distance varies from 400 feet along urban streets to 2,700 feet (roughly 1/2 mile) along Country Roads and Major Highways.

The distances given below are **not** intended for use in: a) reducing the provision of Protected Crossings from existing conditions, b) disqualifying crossings at locations with an overwhelmingly demonstrated need, or c) requiring crossings where they are not needed (e.g., a road through an area where pedestrians will never be present).

Street Type	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.

Figure 6-30. Pedestrian crossing distance and intersection spacing by street type

Controlled Crossings

Signal Warrants

Traffic signals manage traffic operations by separating conflicting movements by time. The MUTCD[93] contains nine signal warrants to help determine if a signal is appropriate at a particular location. The warrants are primarily focused on managing vehicular traffic. However, a few of the warrants can be used to support the installation of a signal or half signal to address non-motorized safety concerns. These warrants evaluate pedestrian volumes, crash history, and the need for pedestrian crossings near a school. Designers have considerable flexibility when evaluating signal warrants for non-motorized users. Bicyclists can be counted as either a vehicle or pedestrian at a crossing to meet the objective of a signal warrant. Future pedestrian or bicycle demand can be estimated if the absence of a signal is limiting crossing opportunities (i.e., there are not existing adequate gaps in traffic for vulnerable users to attempt a crossing). In some cases, it may be difficult to meet specific signal warrant criteria, but a signal may still be considered if an engineering study indicates a signal will improve the overall safety of an intersection.

Stop Signs

Stop signs are used at locations where a full vehicle stop is needed to reinforce proper right-of-way behaviors. While stop signs should not be used as traffic calming devices, they can be used to address non-motorized safety in some situations by making it clear that vehicles need to stop for crossing pedestrians or bicyclists (e.g., at unsignalized street intersections or trail crossings). All-way stops at neighborhood street intersections can also reinforce pedestrian priority by removing the uncertainty that a vehicle on any approach should stop for a pedestrian. As volumes of users and the complexity of an intersection increases, all-way stop control may lead to confusion. Right-of-way assignment can become ambiguous on higher volume, multi-lane approaches, or in downtown areas with heavy pedestrian activity. Signalized intersections may be a better option in these locations.

Pedestrian Hybrid Beacon (PHB)

Pedestrian hybrid beacons (PHB), also referred to as a HAWK (high-intensity activated crosswalk) Signal, help pedestrians cross busy or higher-speed streets at midblock crossings and uncontrolled intersections. Research has documented that PHBs can achieve up to 55 percent pedestrian crash reduction.[94]

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93 https://mutcd.fhwa.dot.gov/

94 US Department of Transportation, Federal Highway Administration, Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations, July 2018.

Figure 6-31. A Pedestrian Hybrid Beacon

In Maryland, the beacon head consists of two red lights above a single yellow light. The lights remain “dark” until a pedestrian or bicyclist wanting to cross the street pushes the call button to activate the beacon. The signal then initiates a lighting sequence consisting of flashing and steady yellow and red lights that directs motorists to slow and come to a stop. The pedestrian signal then flashes a “WALK” display to the pedestrian or bicyclist. Once the pedestrian or bicyclist has finished the crossing, the hybrid beacon again goes dark and the motor vehicles may proceed.

The need for a PHB should be considered based on an engineering study that considers traffic volumes, speeds, widths, and gaps in traffic in conjunction with pedestrian volumes, available access and spacing of available protected crossings. Refer to the MdMUTCD[95] for more information on the factors that should be considered when determining if a location is a candidate for a PHB. Montgomery County will consider the use of PHBs at locations that do not meet traffic signal warrants, but where a safer pedestrian or bicyclist crossing is needed.

PHBs shall be used in conjunction with signs and pavement markings to warn and control traffic at locations where pedestrians enter or cross a street or highway. A PHB shall only be installed with a marked crosswalk and a stop line installed on each approach of the crosswalk. At least two PHB faces shall be installed for each approach of the major street and the PHB shall be pedestrian actuated. The pedestrian signal head shall conform to the provisions of MdMUTCD.

95 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

Figure 6-32. A Rectangular Rapid Flashing Beacon (RRFB)

Rectangular Rapid Flashing Beacons (RRFB)

Rectangular Rapid Flashing Beacons (RRFB) can be used to improve safety at uncontrolled pedestrian or bicyclist crossing locations. RRFBs consist of a pair of rapidly flashing rectangular amber beacons beneath a pedestrian crossing warning sign. Research has shown significant improvement in driver yield rates at locations where RRFBs have been installed, and up to a 47 percent reduction of pedestrian crashes.[96]

RRFBs should be implemented per FHWA guidance. They are not appropriate at stop or signal-controlled intersections and should not be installed in locations where site distance issues or prevailing speeds on the roadway are such that motorists do not have enough time to react and stop in advance of the pedestrian crossing.

RRFBs must be installed at both ends of a crosswalk. In locations that include a median or pedestrian refuge island, the RRFBs must be installed on the median (rather than the left side of the crosswalk) and the right side of the crosswalk. Pedestrian activation of the RRFB can be manual, via a pushbutton, or through a passive detection system and must include accessible pedestrian actuation features. Passive detection is preferred but requires regular inspection and maintenance.

The FHWA has issued Interim Approval (IA-21)[97] for the application of RRFBs. Use of RRFBs should obtain approval from MDOT SHA per Section 1A.10 of the Maryland MUTCD[98]. Additional information regarding the conditions of use, including beacon assembly, dimensions, placement, flashing requirements, and accessibility features are included in the interim approval.

96 http://pedbikesafe.org/PEDSAFE/documents/STEP_Guide.pdf#page=39
97 https://mutcd.fhwa.dot.gov/resources/interim_approval/ia21/
98 https://www.roads.maryland.gov/mmutcd/2011_Chapters_01A.pdf#page=5

Other Intersection Safety Features

Curb Extensions

Curb extensions are created by extending the sidewalk or curb line into the street (typically width used for a parking lane) at an intersection or mid-block crossing location in order to shorten the crossing distance for pedestrians and improve visibility at crossing locations. By physically and visually narrowing the street, curb extensions also have a traffic-calming effect. **Curb extensions are strongly recommended on all streets that have on-street parking** and can be used selectively in other locations. Curb extension installation on both sides of a crossing is preferred, but where curb extension installation on one side is infeasible or inappropriate (i.e., no parking lane), this should not preclude installation on the opposite side.

The minimum width of a curb extension shall be the width of the crosswalk although it can extend farther to the no parking limit approaching the intersection. The width of a curb extension can also vary depending on the intended use (e.g., stormwater management, transit loading, restrict parking, bike parking) and potential for sight line improvement. In proximity to transit stops, curb extensions can present challenges with bus maneuverability. Consider expanding the curb extension to include the bus stop area, creating a bus bulb.

The radii of the curb extension should be designed so that street-sweeping equipment can reach the entire curb face without leaving gaps where debris can collect. Landscaping within a curb extension should be limited to low-level plants that will not impact sight distance. Curb extensions retrofitted onto a street can significantly alter the drainage patterns. Drainage must be evaluated as part of the design of both full reconstruction and retrofit curb extensions.

Designers should refer to the Bicycle Master Plan[99] to ensure that curb extensions do not preclude the implementation of a recommended bikeway.

Crossing Islands

Crossing islands create a place of refuge for pedestrians crossing a street. Research indicates that they can achieve up to 32 percent pedestrian crash reduction.[100] Median crossing islands are typically located in the median but may occur elsewhere in the street – such as between vehicular travel lanes and a separated bike lane. They can be placed at controlled or uncontrolled

99 https://montgomeryplanning.org/planning/transportation/bicycle-planning/bicycle-master-plan/

100 http://pedbikesafe.org/PEDSAFE/documents/STEP_Guide.pdf#page=39

Figure 6-33. The "nose" on top of the median crossing island is key to slowing vehicle speeds and supporting pedestrian comfort.

locations. The minimum width of a median crossing island is 6 feet, but the desirable width is 8 to 10 feet. If bicyclists will be using the crossing island, a 10-foot width is preferred to accommodate the length of a standard bicycle (6.5'), longer bicycles, and possible queuing without overlap into the street. Median crossing islands should be designed with physical, raised barriers as protection on either side and an at-grade pass through for pedestrians. The "nose" of the median crossing island defines a protected space for pedestrians to wait and helps reinforce slower turning movements for vehicles (see Figure 6-33). The pass through should meet ADA guidelines. Physical raised barriers provide the greatest comfort for pedestrians and bicyclists waiting to cross, but a low-cost, quick-build option is to provide a painted median island with plastic posts.

Advanced Stop Line

Advanced stop line markings are used in advance of a marked crosswalk that crosses an uncontrolled multi-lane approach. This is a strategy to reduce the instances of multiple threat crashes, by improving sight lines between pedestrians and motorists approaching the crosswalk. They should be placed 20 to 50 feet in advance of the nearest crosswalk line (see the MdMUTCD for details),[101] and parking should be prohibited in the area between the yield line and the crosswalk. The markings are used with the "Stop Here for Pedestrians" regulatory sign. In-street pedestrian crossing signs and "Stop Here for Pedestrians" signs may be used together at the same crosswalk.

101 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

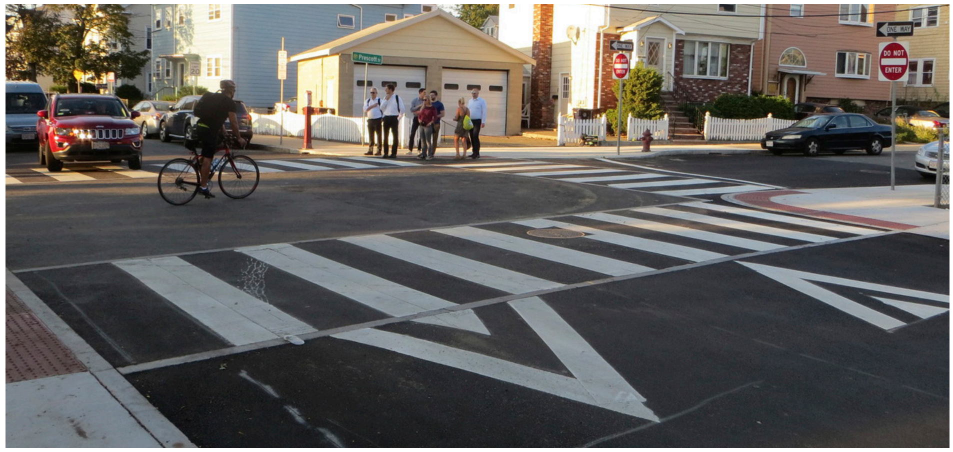

Figure 6-34. Image of a raised intersection

Raised Crossings/Intersections

Raised crossings or intersections can be used to reduce motor vehicle operating speeds and encourage yielding at locations where pedestrians and/or bicyclists regularly cross the road. Raised crossings may reduce fatal and injury crashes by up to 45 percent.[102] Their implementation may be limited by other regulations - consult MCDOT. A raised crossing can be used across a slip lane at an intersection or at an uncontrolled pedestrian crosswalk. A raised intersection can be used to encourage slower vehicle speeds on all approaches to an intersection and is helpful in locations near pedestrian generators such as schools, parks, and shared-use paths. The presence of raised pavement can significantly alter the drainage characteristics of a street. Drainage must be evaluated as part of the design of raised crosswalks and intersections.

In-Street “Stop for Pedestrian” Signs

“Stop for Pedestrian” signs are placed in the street and are used to supplement signs mounted behind the curb where a driver is used to looking for signs and they are required to be placed. Signs mounted in the street can be placed at areas of high pedestrian concentrations and where driver behavior has demonstrated a need for supplemental signs. Potential locations where the in-street signs can be used include crosswalks at schools, parks, senior centers, community centers or business districts. The sign can also be set back in advance of a crossing or intersection, based on turning movement analysis. Signs placed in the median or on the centerline of a street have a likelihood of being hit. To minimize the chance of the sign being hit, consider pavement markings that widen around the sign by one foot on either side of the sign. The sign can also be installed on a rectangular plastic base for additional visibility/protection.

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102 http://pedbikesafe.org/PEDSAFE/documents/STEP_Guide.pdf#page=39

Signal Phases for Pedestrians, and Strategies to Reduce Conflicts

Accessible Pedestrian Signals

Accessible pedestrian signals (APS) are required at signalized intersections in Maryland and should be installed per the MdMUTCD[103] and guidance issued by the U.S. Access Board. APS and accessible detectors are devices that communicate information in non-visual formats about the pedestrian crossing to people with visual and/or hearing disabilities. APS and detectors may include features such as audible tones, speech messages, detectable arrow indications, and/or vibrating surfaces.

Two accessible pedestrian pushbuttons should be provided on each corner, per the MdMUTCD.[78] Pushbuttons should be separated by 10 feet and located no more than 10 feet from the edge of the curb. Audible tone volumes should be set based on ambient noise levels at each location. Pushbutton posts shall maintain a minimum 1.5-foot offset from the face of curb. Ensure proper placement of trees within the buffer zone and/or median do not block signals or signing, or limit sight distance between pedestrians and vehicles. See section on tree spacing and clearances in Chapter 7: Green Streets.

Pedestrian Recall is a walk mode that is programed into signal controllers that automatically provides a walk indication without the need for a pedestrian to push a button. In downtown areas, signals should be placed in pedestrian recall assuming that pedestrians will be present at each cycle. At locations where the pedestrian "WALK" signal automatically displays during every signal cycle, pushbuttons are only used to initiate the accessible features, not the "WALK" signal.

Signal timing for pedestrian crossings is based on the length of crossing and the speed of a pedestrian. The distance traveled should include the full distance between detectable warning surfaces and not just width of the travel lanes. In most locations, signal timing should assume a walking speed of 3.5 feet per second; however, intersections near schools, senior centers, or in downtown areas likely require additional crossing time. Regardless of location, slower pedestrians must be accommodated safely. Outside of making the default speed slower, another option for accommodating slower pedestrians is to allow the pedestrian to request additional crossing time by depressing a push button alongside sign R10-32P (Figure 6-35) per the MdMUTCD,[85] Section 2B.52. With this signal operation, standard crossing distances, speeds, and times may be used, and additional time can be actuated as needed.

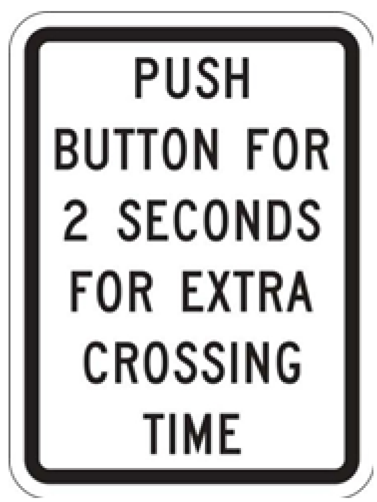

Figure 6-35. R10-32P from the MdMUTCD

103 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

Leading Pedestrian Intervals

Leading Pedestrian Intervals (LPI) initiate the pedestrian "WALK" signal three to seven seconds before motorists traveling in the same direction are given the green indication. This allows pedestrians to enter the intersection prior to turning motorists, increasing visibility between both modes. LPIs give pedestrians a head start to establish themselves in the intersection before vehicles get the green phase. LPIs have been shown to reduce pedestrian crashes by 59 percent.[104]

LPIs are typically used at intersections with high volumes of pedestrians and conflicting motorist turning movements. "NO TURN ON RED" signs should be considered with LPIs. Refer to the MdMUTCD[105] for further guidance on LPIs.

Protected Left Turn Signal Phase

A protected left turn (leading or lagging) provides a green arrow for left turning motorists while stopping both oncoming traffic and pedestrians to eliminate conflicts. A leading left turn is a protected left turn in which the left-turn arrow displays at the beginning of a green phase before motorists traveling straight may pass through the intersection. A lagging left turn is a protected left turn that occurs at the end of the green phase. Lagging left turn phases must be given careful consideration to avoid a "yellow trap," where a left-turning driver with a yellow signal is not aware that opposing traffic may not stop.

Figure 6-36. Pedestrian signal

104http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf
105 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835

Protected left turn phasing reduces conflicts between pedestrians and turning motorists by allowing pedestrians to cross the street separately from left-turning motorists and have been shown to reduce left turn crashes with pedestrians by up to 45 percent.[106]

Protected left turns should be considered where there are conflicts between left-turning motorists, opposing traffic, and people walking and bicycling. They should also be considered at intersections with visibility concerns. Dedicated left turn lanes shall be installed in conjunction with protected-left-turn arrows.

Right-Turn-On-Red Restrictions

Right-turn-on-red (RTOR) restrictions prevent motorists from turning right (or a similar principle to turn left on intersecting one-way streets) while the traffic signal is red. Restricting this movement eliminates conflicts with pedestrians crossing in front of turning motorists. Right-turn-on-red restrictions can significantly increase the portion of motorists who stop at marked stop lines and decrease the number of motorists who turn right on red without stopping.

Right-turn-on-red restrictions have been used as an area-wide policy in some parts of Montgomery County (such as in downtown Silver Spring) to improve pedestrian safety. High compliance rates have been achieved by implementing this strategy at an area-wide scale.

Figure 6-37. No Right-Turn-On-Red restriction

106 http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf

Diagonal Crossings

Diagonal crossings enable pedestrians to cross through the middle of an intersection instead of across one leg at a time. Any conflicting vehicular signals are red.

In many cases, diagonal crossings may require that all vehicular signals be red, allowing all pedestrian movements to have walk signals. These cases are technically referred to as All-Pedestrian Phases or Exclusive Pedestrian Intervals but are more commonly known as either a Barnes Dance or a Pedestrian Scramble.

These can reduce pedestrian delay while improving pedestrian accessibility, comfort, and convenience, particularly at intersections with a high volume of pedestrians otherwise crossing multiple legs of an intersection.

However, the time necessary to ensure a pedestrian can navigate the longer diagonal spans can be a significant portion of a signal's cycle length, and attention must be given toward potential traffic impacts.

Figure 6-38. Diagonal Crossing or "Barnes Dance" located at 14th Street NW and Irving Street NW in Washington, DC. (Source: DDOT)

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Chapter 7: Green Streets

7.1 Overview

This chapter provides guidance for building green streets, which combine traditional transportation elements with vegetation and engineering strategies to achieve a range of environmental and user benefits. The following sections address:

» Section 7.2: Urban Forestry

» Section 7.3: Stormwater Management

Green streets help to filter polluted runoff before it flows into the storm drain system or infiltrates into groundwater. Green streets can also increase resiliency of the built environment and allow for better adaptation to climate change by mitigating carbon emissions. Additional benefits of green streets include:

- Enhanced aesthetics and placemaking
- Improved water quality and protection of riparian habitats along local rivers and streams
- Expanded habitat and food sources for birds, insects, and small animals
- Improved air quality and mitigation of the heat island effect
- Improved pedestrian and bicyclist comfort
- Traffic calming

Green street elements are typically incorporated into the Frontage Zone, Street Buffer, Street Zone, and Median Zone within the public right-of-way. Green street techniques are often compatible with traffic calming measures such as road diets, curb extensions, buffers, medians, and roundabouts.

This chapter is organized around the two most common categories of green street elements: A) Urban Forestry, and B) Green Stormwater Infrastructure. Other green street elements such as energy efficient lighting are discussed in Section 3.10 of this manual. Street designers are encouraged to incorporate additional green and sustainable features aimed at enhancing the urban ecosystem, making use of low-maintenance and recycled materials, and preserving water and energy resources wherever feasible.

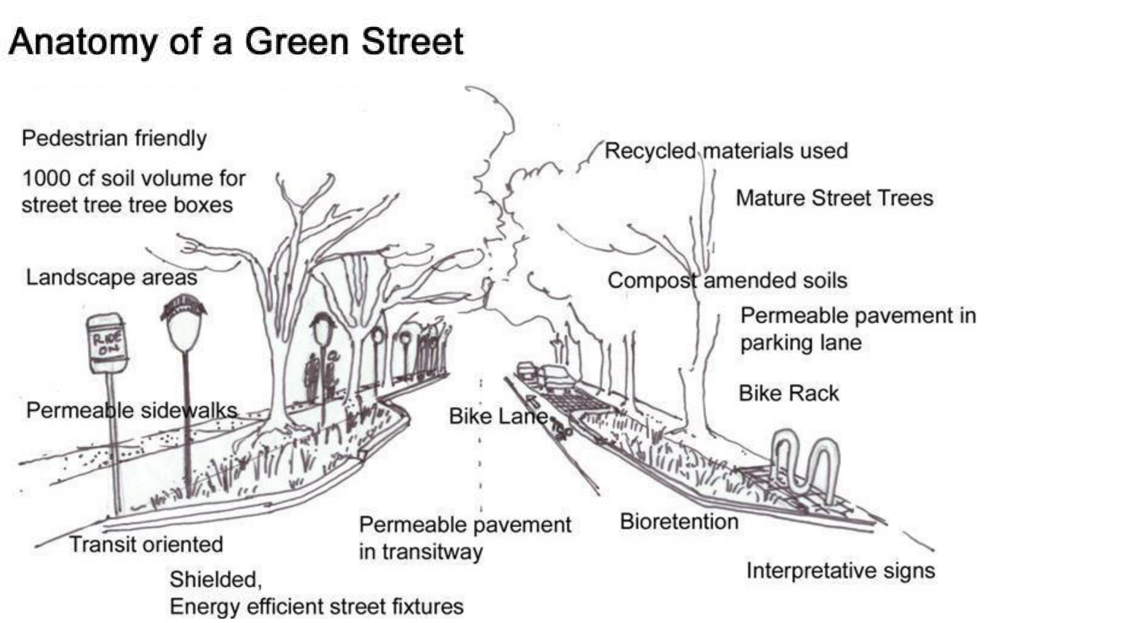


Figure 7-1. Green street diagram (Source: US Environmental Protection Agency, Learn About Green Streets, EPA.gov)

7.2 Urban Forestry

One critical component of green infrastructure is the urban forest system. Trees and vegetation within and adjacent to the right-of-way can contribute to the overall function of the urban forest system. Trees provide numerous benefits, including opportunities for recreation; a sense of enclosure for drivers and comfort for pedestrians; habitat corridors and food source for animals; improved air and water quality; protection of biodiversity; erosion protection and stormwater runoff reduction; urban heat island reduction; improved physical and mental health; and climate change mitigation. One of the major goals of providing green infrastructure in Montgomery County is the creation of a continuous tree canopy over sidewalks and street edges.

Street trees (typically large species trees) and landscaping are required in the Street Buffer Zone on Downtown Boulevards, Downtown Streets, Boulevards, Town Center Boulevards, Town Center Streets, Neighborhood Connectors, Neighborhood Streets, and Neighborhood Yield Streets. They are also recommended on other street types; however, on roads with design speeds of 30 mph or greater, engineering judgement is required to determine whether trees represent a hazard in the Median Zone or Street Buffer Zone. Consult the Montgomery County Roadside Tree Design Guidelines for more information.[107]

Figure 7-2. Green streets typically include trees/landscaping and measures to help manage stormwater

107 https://www.montgomerycountymd.gov/DPS/Resources/Files/Land_Development/RoadsideTreeDesignGuidelines.pdf

Tree/Plant Selection

Species selection and placement of street trees and other vegetation are crucial to ensuring vegetation thrives in the urban environment. Consult the MCDOT list of trees suitable for installation in the street right-of-way[108] and the Montgomery County Department of Environmental Protection *Rain Garden Vegetation Recommendations*[109] for vegetation appropriate for bioretention or rain gardens in sun and in shade. Native tree species and vegetation should be prioritized during the species selection process. Additionally, the species should be appropriate for the scale of the street and selected based on root structures that will not damage sidewalks. However, non-native species that are not invasive may also be planted and sometime preferred over native species based on their predicted success in the surrounding environment. Species should also be selected to provide seasonal interest, establish canopy heights that facilitate pedestrian access, maximize canopy cover, and avoid nuisance features such as fruit or unpleasant fragrances.

There are several important factors that determine how well trees will survive in a high-stress urban environment, including:

» **Soil pH, soil type, and infiltration rates** — Physical and chemical characteristics of the soils proposed for planting areas should be evaluated. Appropriate soil amendments should be considered to ensure soil types are suitable for the proposed vegetation and are neither too acidic nor too alkaline to support growth. Infiltration tests should be performed to confirm planting soils and underlying natural soils will facilitate drainage and oxygen absorption by the root system.

» **Soil volume and compaction** — A tree's ability to grow is directly related to the volume of rooting soil available. Adequate soil volume for each proposed tree species must be provided to ensure trees flourish and achieve projected height. Compaction of soils should be carefully specified to provide adequate void spaces for air and water to circulate and prevent roots from migrating toward the surface, which can cause sidewalks to crack and heave.

» **Sun exposure** — Tree species and other vegetation should be carefully selected to flourish in the natural lighting conditions specific to each street and planting area.

» **Drainage** — In addition to the soil drainage conditions noted above, grading and drainage features in and around planting areas should be

108 https://www.montgomerycountymd.gov/dot-highway/tree/TreePlant.html
109 https://www.montgomerycountymd.gov/water/rainscapes/resources.html

configured to direct surface water to plantings without allowing long-term ponding and oversaturation of root zones. Where saturated drainage conditions cannot be avoided, select interventions suitable for wet areas such as bioretention features or rain gardens.

» **Presence of utilities** — Above- and below-ground utilities are an important consideration in selecting street trees and the size of vegetation. In areas where overhead wires exist, it is important to select smaller tree species that will not encroach on the overhead line. Where underground utilities are present, trees should be located as far from utilities as possible. The root and trunk spread of the selected species should also be considered depending on the utility types located near the proposed plantings.

Where possible, existing trees should be preserved according to current Montgomery County Department of Permitting Services requirements.

Tree Spacing and Clearances

Tree spacing and clearances should be established based on approved standards (MC-700.01 and MC-701.01) or on local streetscape design guidelines, such as the Silver Spring Streetscape Plan Technical Manual[110] and the Bethesda Downtown Plan Design Guidelines.[111] Avoid positioning trees in locations that encroach on sight lines at intersections and commercial driveways.[112]

110 https://montgomeryplanning.org/wp-content/uploads/2020/01/Approved-Silver-Spring-Streetscape-Standards-FINAL-1-9-20.pdf

111 https://montgomeryplanning.org/wp-content/uploads/2017/08/BDP-Urban-Design-Guidelines_Approved-July-2017_sm-1.pdf

112 https://www.montgomerycountymd.gov/DPS/Resources/Files/Land_Development/RoadsideTreeDesignGuidelines.pdf

Street Trees and Landscaping in the Street Buffer Zone, Median Zone, & Frontage Zone

Street trees and landscaping may be provided in the Street Buffer Zone or the Median Zone in a continuous planting strip, in individual tree pits, in raised planters in the Frontage Zone, and within curb extensions. **The preferred minimum width for a planting strip or tree pit that includes trees and larger shrubs is 7 feet**, though it may be reduced to 4 feet in constrained areas given appropriate measures to ensure adequate soil volume (Figure 7-4). A planting strip of less than 6 feet in width is not able to support major street trees. Planting strip grading must accommodate runoff from sidewalk surfaces and drain toward the street.[113] When proposing trees and vegetation in the Median Zone, avoid overly complex landscape installations and ensure trees are not located in areas that are difficult to access for maintenance.

Designers should seek opportunities to maximize planting areas and supporting soil volumes. Open or continuous soil panels are preferred and should be used where practical, rather than tree pits with amended soil panels under the sidewalk. Larger planting strips or tree pits with greater volumes of soil can accommodate more vegetation, more stormwater capture and storage, and street trees with a greater canopy spread. In general, at least two cubic feet of soil is required for each square foot of crown projection (i.e. soil area beneath the crown). Figure 7-4 shows how soil volume requirements vary depending on the tree spacing. According to the approved versions of the Silver Spring Streetscape Plan Technical Manual and the Bethesda Downtown Plan Design Guidelines, a minimum of

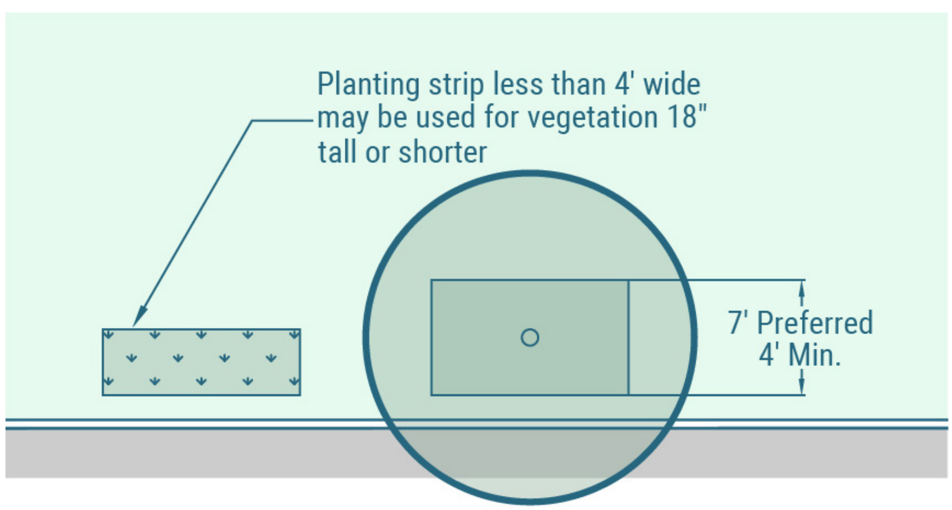


Figure 7-3. Planting strip and tree box dimensions

113 https://www.seattle.gov/Documents/Departments/SDOT/CAMs/cam2304.pdf

600 cubic feet of soil for a small canopy tree and up to 1,500 cubic feet of soil for a large canopy tree is required.

In areas of heavy pedestrian traffic, tree grates can be used to protect tree roots, manage stormwater, and maintain orderly and safe sidewalks. Grates must be ADA-compliant.

Tree grates or decorative planters may be approved on a case-by-case basis as part of the Streetscape Standards in an area master plan. Low fences (12-18 inches high) around open tree pits or raised planters are an alternative solution in high-pedestrian areas; however, low fences can have the unintended consequence of creating a tripping hazard or reducing the effective width of a sidewalk by creating a “shy zone” where pedestrians tend to avoid fixed objects immediately adjacent to the sidewalk.[114]

Soil Panels and Structural Soil

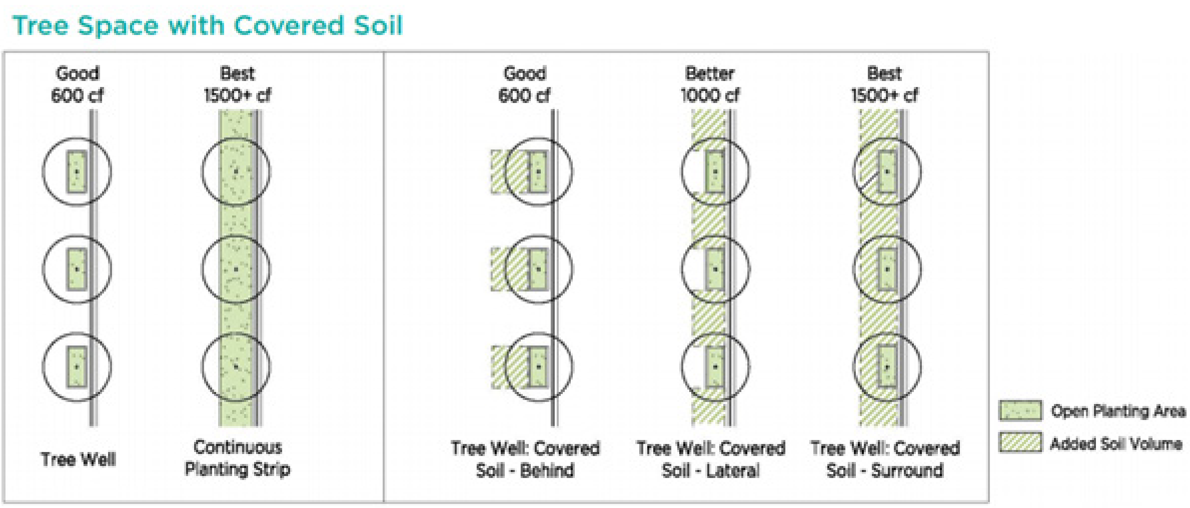


Figure 7-4. Image of soil requirements (Source: Silver Spring Streetscape Standards, 2019)

Soil compaction reduces rooting depth, resulting in stress on the tree that makes it more susceptible to disease and pests.[115] There are a number of methods designers can employ to prevent soil compaction and improve growing conditions.[116] Amended soil panels are the preferred method for achieving the required soil volume in central business districts; however when this is not feasible, soil cells or structural soil may be a viable alternative. Soil cells are man-made structures that transfer loading from the sidewalk and pavement directly to the base material without compacting

114 https://www.mwcog.org/assets/1/6/TakPark-NH-Ave.pdf#page=10

115 https://www.smartcitiesdive.com/ex/sustainablecitiescollective/why-soil-compaction-kills-street-trees/1113425/

116 https://www.deeproot.com/silvapdfs/resources/articles/Comparing_Silva_Cells_and_Structural_Soil.pdf

the soil in between. Structural soil is a soil medium made of crushed stone and mixed in such a way that the compacted material bears the load from stone to stone and the soil between the stones retains voids needed for tree roots to grow and have access to air and water.[117] Where undergrounding of utilities is required, there may be opportunities to include engineered structures to create soil volume for street tree planting areas.

When proposing structural soil, it is important to know the source of the stone material to ensure it does not negatively impact tree health. For example, if limestone rock is used, the corresponding tree must be tolerant of well-drained soils and higher pH.

Tree and Landscape Maintenance

The county is responsible for the health and maintenance of county-owned trees. Permits are required from MCDOT, DPS, and MDE to take any action that impacts a county-owned tree.[118] Designers developing streetscapes and other public planting areas should consider the following measures to minimize maintenance needs:

» Use drought-tolerant, non-invasive vegetation that does not require irrigation;

» Provide designs that include adequate soil volumes;

» Minimize planting in areas that are difficult to access such as under power lines, in roadway medians, and on remote sites;

» Avoid overly complex landscape installations; and

» Include measures in design plans that require the installation contractor to establish and monitor vegetation to ensure survivability rather than performing a full replacement at the end of the warranty period.

Figure 7-5. Soil cells being installed to provide structure under a future sidewalk.

117 https://thefield.asla.org/2014/02/19/structural-soil-part-2/
118 https://www.montgomerycountymd.gov/dot-highway/tree/index.html

7.3 Stormwater Management

Stormwater management is regulated under Chapter 19 of the Montgomery County Code.[119] The code requires that all development or redevelopment projects within Montgomery County, including transportation projects, provide measures to control stormwater runoff and enhance water quality. The Code further mandates that applicants adhere to Environmental Site Design (ESD) practices, which give preference to small, distributed, non-structural practices over larger structural treatments such as retention/detention ponds and underground storage facilities. Applicants must follow the ESD process and implement ESD best management practices (BMPs) to the maximum extent practical before any structural facility can be included in a stormwater management plan. These nonstructural BMPs aim to replicate pre-development hydrology by treating and infiltrating stormwater runoff close to the source. Design criteria for BMPs is based on the requirements contained in the Maryland Department of the Environment's statewide Maryland Stormwater Design Manual,[120] as modified by the Montgomery County Water Resources Policies and Stormwater Management Facility Design Specifications.

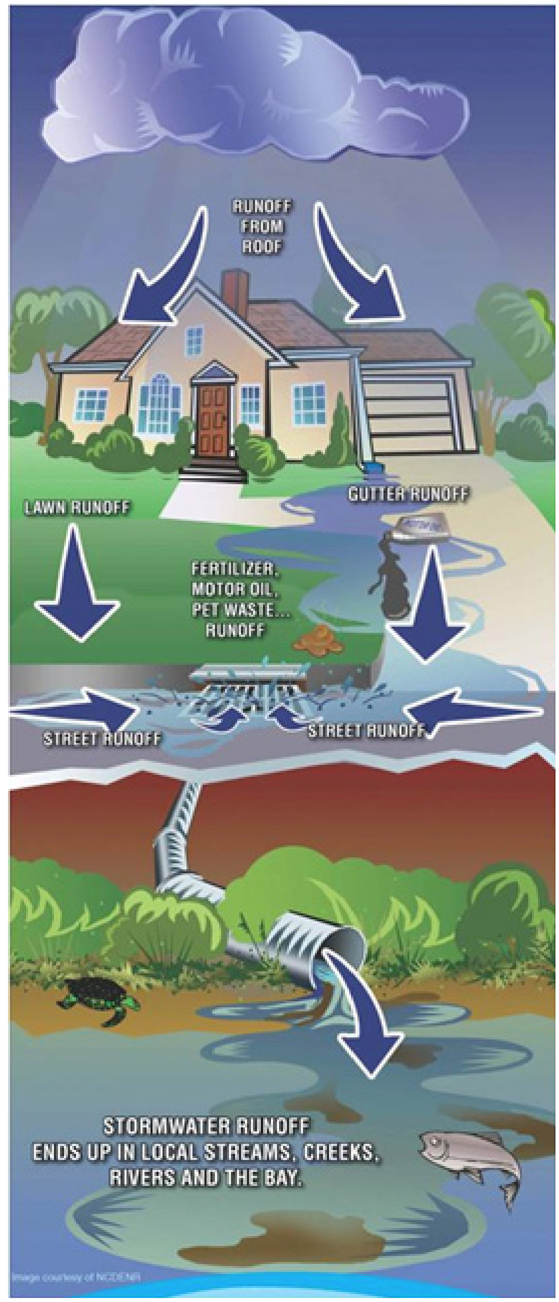


Figure 7-6. Diagram of how stormwater travels through the environment (Source: Chesapeake Ecology Center and North Carolina Department of Environmental Quality, 2012)

119 https://codelibrary.amlegal.com/codes/montgomerycounty/latest/overview

120 https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Pages/stormwater_design.aspx

Opportunities and Constraints

Several Environmental Site Design BMP types are suitable for streetside applications due to their adaptability to narrow, constrained spaces, including:

» Impervious area disconnection and vegetated filter strips

» Bioretention facilities and rain gardens

» Grass swales and bioswales

» Tree box filters and stormwater planters

» Permeable pavements

When implementing these streetside stormwater BMPs, designers must consider existing and potential streetscape constraints, such as:

» **Space availability** – Evaluate physical constraints above and below grade that may limit facility capacity and depth;

» **Soils** – Evaluate in-situ soil suitability and infiltration potential to determine feasibility of infiltration and the need for underdrains;

» **Public access** – Consider curbside activity such as drop-offs, loading, bus stops, access to parking, and the need to maintain accessible pedestrian routes;

» **Safety** – Minimize potential trip or fall hazards while limiting permeable pavements to pedestrian and parking areas;

» **Utilities** – Avoid locations where utilities will encroach longitudinally on stormwater facilities and protect crossing utilities;

» **Drainage** – Locate BMPs in proximity to existing storm drain infrastructure to provide overflow/underdrain connections;

» **Protection of existing built infrastructure** – Locate BMPs to avoid impacts to existing buildings, curb lines, utility poles, lighting, traffic signals, and other roadside features; and

» **Maintenance access** – Establish BMPs in areas where they can be readily accessed by maintenance equipment and personnel.

Incorporating BMPs into Street Design

Rain Gardens and Bioretention

Rain gardens and bioretention facilities use soil and gravel layers, along with plants, to filter and treat runoff. Bioretention areas are typically designed with grading that provides temporary ponding and storage of runoff from small storm events. Refer to the MDE Stormwater Design Manual[121] and DPS Stormwater Management Guidelines for specific design requirements.

Tree Box Filters and Stormwater Planters

Tree box filters and stormwater planters are similar to bioretention facilities in that they use soil and plants to filter and treat runoff; however, they are typically smaller in size. These facility types are typically used when space is limited or when infiltration is not permissible (e.g., adjacent to a building foundations or other structural elements). Given their smaller size, the use of these facilities typically requires an underdrain and/or overflow connection to a storm drain piping system.


Figure 7-7. Examples of rain gardens (Source: Montgomery County Department of Environmental Protection)


Figure 7-8. Examples of other green infrastructure BMPs (Source: Montgomery County Department of Environmental Protection)

121 https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Pages/stormwater_design.aspx

Grass Swales and Bioswales

Grass swales and bioswales are stormwater conveyance channels that attenuate stormwater flows through soil and vegetation to filter and treat runoff while improving downstream water quality. Grass swales typically parallel roadways and are designed to reduce flow velocities and promote infiltration. Bioswales include soil media (i.e., bioretention media) to provide temporary storage volume and to facilitate infiltration while providing runoff conveyance.

Permeable Paving Materials

Permeable paving materials allow a portion of stormwater runoff to infiltrate through the pavement as opposed to traditional paving materials that divert all runoff to the storm drain system. Water permeates through the pavement into a stone reservoir below ground, ultimately allowing the water to infiltrate and recharge the water table or local waterway. Permeable materials can filter pollutants, reduce runoff flow rates, improve water quality, and reduce the volume of infrastructure necessary to direct and convey stormwater offsite.

All designs must consider the drainage characteristics of the underlying soils, the depth of the water table, and the slope and erodibility of adjacent land. Permeable pavements can be used in sidewalks, plazas, cafés, overflow parking areas, emergency access roads, and other low-traffic areas. Permeable pavements in the pedestrian zone must have a surface that is smooth, stable, slip-resistant, and compliant with all accessibility guidelines. Refer to MDE and DPS stormwater management design guidelines for allowable practices.

Curb Extensions

Curb extensions at intersections and mid-block locations can be used to increase the area available for stormwater management facilities and reduce impervious surfaces that facilitate runoff. Typical applications include the construction of a rain garden or bioretention area within the curb extension. Refer to Chapter 6: Intersections for design guidelines and limitations.

Figure 7-9. Examples of green infrastructure treatments in Montgomery County

Facility Footprint Limitations

When stormwater treatment facilities are located within the streetscape environment, consideration should be given to public access. This is especially important when facilities are adjacent to sidewalks, driveways, or public parking. Refer to DOT, MDE, and DPS requirements for safe placement of stormwater practices and design guidelines.

Planting Guidelines

Plant selection and layout within stormwater treatment facilities is a critical factor in the function and appearance of stormwater BMPs. The selected species must be able to withstand the hydrologic variation (inundation as well as dry weather periods), be hardy and tolerant of pollutants common in street runoff (salt, oil, metals), and enhance the aesthetics of the surrounding environment. The MDE Stormwater Design Manual provides the following planting recommendations for bioretention, and similar facilities:

» Native plant species should be specified over non-native species (although non-native species may be specified if not invasive).

» Vegetation should be selected based on a specified zone of hydric tolerance.

» A selection of trees with an understory of shrubs and herbaceous materials should be provided.

» Woody vegetation should not be specified at inflow locations.

Maintenance

Stormwater BMPs should be located in areas that are easily accessible by maintenance equipment and personnel. Installation of drainage and stormwater management features in medians should be avoided but may be allowable if one lane of traffic can be maintained in each direction during maintenance, or if the median is wide enough for a maintenance vehicle to pull fully out of the roadway onto the median. The median must be wide enough to provide adequate space to perform the necessary maintenance activities. Where maintenance vehicles are expected to drive or park on natural surfaces, provide mountable curbing, reinforced turf, or other measures designed to prevent damage to maintenance vehicles and natural surfaces.

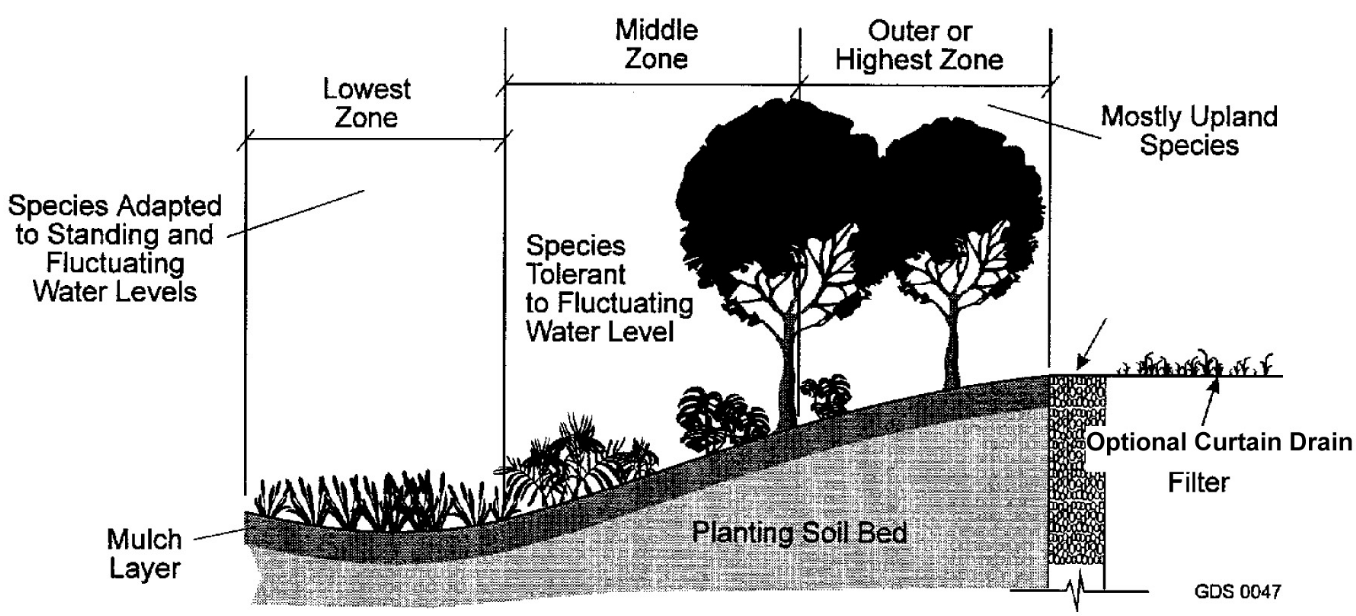
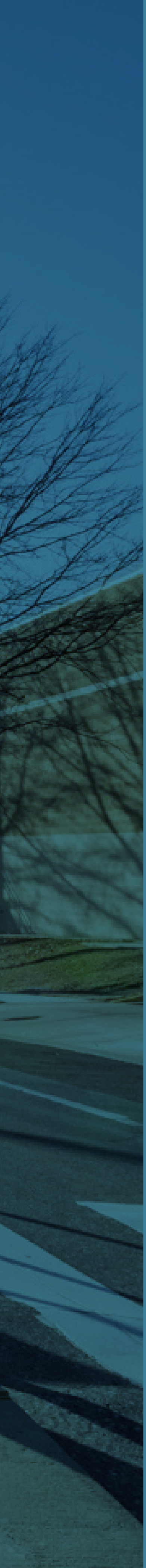


Figure 7-10. Planting Zones for a Bioretention Facility (Source: MDE stormwater manual, Appendix A)



Chapter 8:
Speed Management

8.1 Overview

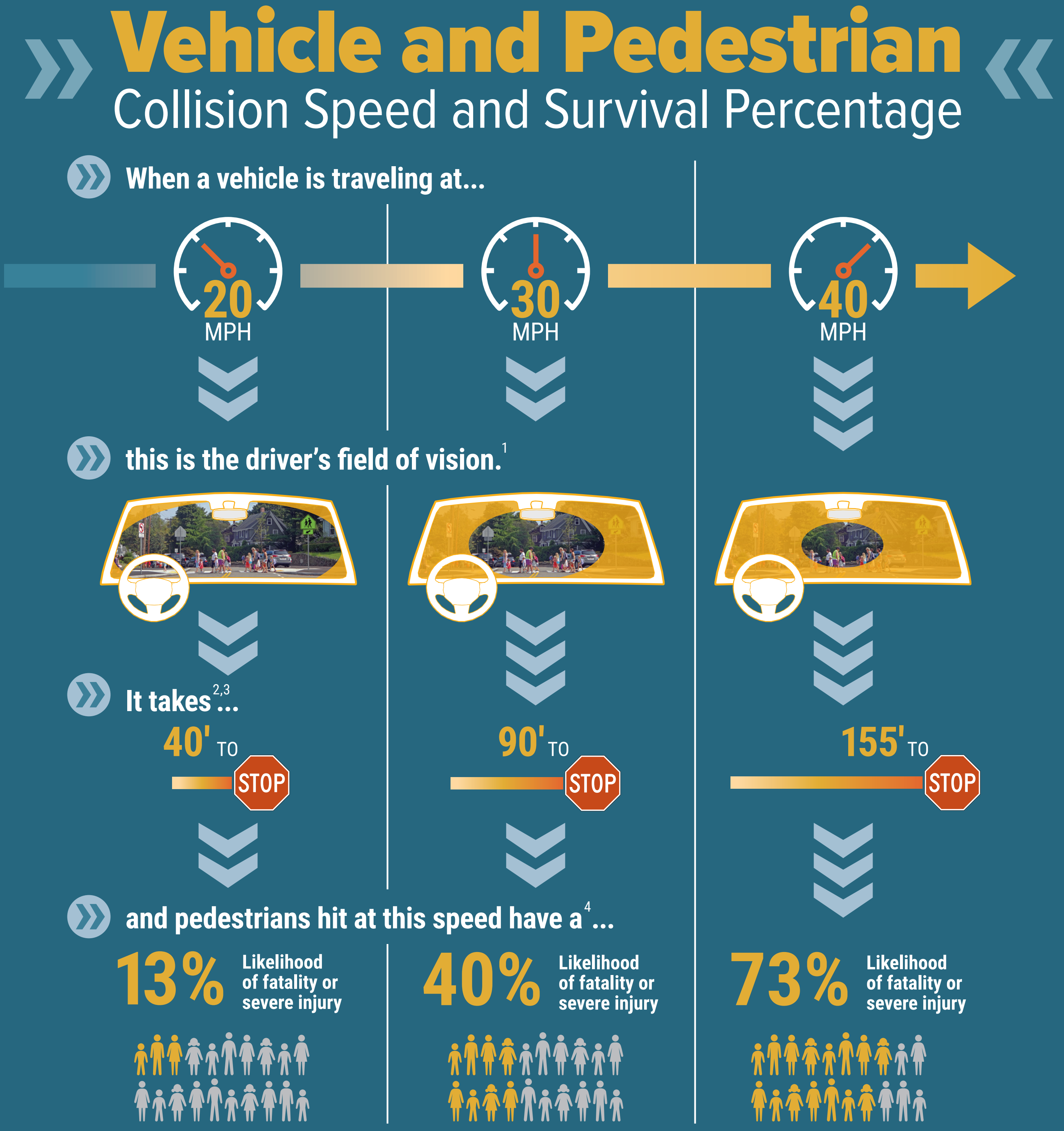
This chapter is specific to Speed Management and is organized in three sections:

- » Section 8.2: Design Speed, Target Speed, and Posted Speed
- » Section 8.3: Strategies for Achieving Target Speed
- » Section 8.4: Retrofitting Arterials for Lower Speed

With Montgomery County's adoption of Vision Zero and a commitment to protecting the safety of the most vulnerable users of the road network, management of traffic speeds is paramount as there is a strong correlation between vehicle speeds and crash outcomes. As vehicle speeds increase, the severity of crashes (i.e., the likelihood of injury and fatality) goes up for all road users, and pedestrians are particularly at risk (see Figure 8-1). Through Vision Zero and the adoption of this guide, the county is renewing its commitment to better align vehicle speeds with the context of the surrounding community. **This will require that public and private sector designers seize every viable opportunity (e.g., redevelopment, street reconstruction, repaving, capital projects) to implement changes aimed at managing driving speeds.**

This chapter presents design guidance that can be used to manage traffic speeds and reduce hazards for all users. While speed management programs have traditionally focused on reducing speeds and cut-through traffic on neighborhood streets, a broader set of tools is needed to manage speeds on all roadways in Montgomery County. For that reason, this chapter includes a section focused on retrofitting arterials for slower speeds. (Arterials roughly correspond with the Boulevard street types described in this guide.) Arterials are magnets for land development, serve as the backbone of the transit network, and typically carry the highest volume and speed of vehicle traffic. Thus, the risk of serious injury or fatality for road users is higher on arterials. Principal arterials (e.g., Georgia Avenue and Rockville Pike) represented 52 percent of severe injuries and fatalities in the county between 2012 and 2016.[122] A strong focus on speed management on arterial roads is necessary to achieve the county's goal of zero severe injuries and fatalities from traffic crashes by 2030.

122 Montgomery County Vision Zero 2-Year Action Plan, 2017.



1 A. Bartmann, W. Spijkers and M. Hess, "Street Environment, Driving Speed and Field of Vision" Vision in Vehicles III (1991).
W. A. Leaf and David F. Preusser. Literature review on vehicle travel speeds and pedestrian injuries. (Washington, D.C.: U.S. Dept. of Transportation, National Highway Traffic Safety Administration, 1999).

2 Braking distances do not account for braking reaction time.

3 AASHTO Green Book—A Policy on Geometric Design of Highways and Streets, 7th Edition. American Association of State and Highway Transportation Officials, 2018.

4 Tefft, Brian C. Impact speed and a pedestrian's risk of severe injury or death. Accident Analysis & Prevention. 50. 2013.

Figure 8-1. Relationship between speed and crash survival for people walking

8.2 Design Speed, Target Speed, and Posted Speed

On arterial roadways, there is often a mismatch between the speed a road was designed for — with the goal of minimizing travel time for motor vehicles — and the speed that would be reasonably safe for the full range of people traveling along the route. Key definitions:

Posted Speed. Speed limits are typically set based on the speed that most people travel on the roadway (termed "85th percentile speed," which means 85 percent of the drivers travel at or below this speed). This means roads designed for faster speeds are more likely to eventually be posted at higher speed limits. However, FHWA has acknowledged several valid approaches to setting speed limits, including an approach where "speed limits are set according to the crash types that are likely to occur, the impact forces that result, and the human body's tolerance for those forces."[123] In other words, speed limits can be set based on the context of a particular roadway. This approach is appropriate in places where people walk or bike.

Design Speed. Design speed, or the speed that the roadway is designed for, is a fundamental factor in roadway design and is used to establish the geometric criteria (such as width, curvature, banking) for the road. Major streets in Montgomery County were built in the conventional highway design paradigm, where arterials were designed with an emphasis on decreasing motor vehicle travel time and the typical practice was to set the design speed as high as reasonably practical. The geometric features of the road were oriented to ensuring that a driver could comfortably operate their vehicle at that speed. The national standards that define these geometric design criteria (the AASHTO Green Book) assume a "lower performing" design vehicle that does not handle as well as most modern passenger cars.[124] As a result, a road with an original design speed of 40 mph is comfortable for most modern passenger cars at speeds of 50 mph or even higher. The combination of selecting higher design speeds for arterials and accommodating lower performing vehicles has created the potential for hazardous crashes, especially in places where people walk, ride a bike, or take the bus along arterial roadways.

123 FHWA Methods and Practices for Setting Speed Limits, Federal Highway Administration (2012)

124 American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets (2018), p. 2-86

Target Speed. A better approach is to design the street to operate at or below a target speed, which intentionally encourages slower speeds through roadway geometry. The target speed is the desired operating speed for a roadway facility. These speeds are based on safe operations on the relevant roadway sections and are tailored to the functionality and context of the roadway in a Complete Streets system. Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles are considered when determining an appropriate target speed. **On a well-designed street, the target speed is self-enforcing.** Wherever feasible, the target speed should match the posted speed limit.[125]

Going forward, the target speeds presented in Figure 8-2 will be the default for each street type in Montgomery County. Over time, measures should be taken to align speeds on existing roadways with these targets, and new streets should be designed to produce operating speeds at or below these speeds. The target speeds for the most local-serving streets reflect the efforts of the "20 Is Plenty" campaign, which advocates capping speeds at 20 mph in some areas. Note: Current Maryland state law requires a minimum posted speed of 25 mph, other than in places defined as "Urban Districts."[126] While that law exists, applicable streets with lower target speeds will be posted at 25 mph.

Street Type	Target Speed (mph)
Downtown Boulevard	25
Downtown Street	20
Boulevard	35
Town Center Boulevard*	30
Town Center Street	25
Neighborhood Connector	25
Neighborhood Street	20
Neighborhood Yield Street	20
Industrial Street	25
Country Connector	40
Country Road	20 - 35
Major Highway	45 - 55

* In Urban Areas, streets that are already 25 MPH will retain that target/posted speed.

Figure 8-2. Target speeds

125 American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets (2018), p. 2-24

126 The law defines an Urban District as anywhere with buildings <100' from each other over a 1/4 mile area. https://law.justia.com/codes/maryland/2018/transportation/title-21/subtitle-8/section-21-803/

8.3 Strategies for Achieving Target Speeds

The following pages provide engineering and operational strategies that can be used to achieve the target speeds in Figure 8-2. Figure 8-3 presents common speed management techniques and indicates whether they are required, recommended, optional or not permitted/applicable on each street type. This table is a starting point for decision-making. **The ultimate design measures for each roadway will be determined based on the local context and through consultation with MCDOT.**

When a speed management approach is considered for any street, Montgomery County applies the following considerations:

» Speed management measures prioritize bicyclists, pedestrians, transit users, and people with disabilities, and should not diminish safety, access, or comfort for these modes.

» Neighborhood involvement is integral to the successful implementation of speed management on neighborhood streets.

» Designs intended to reduce speeds should be predictable and easy to understand for all people.

» Speed management measures should accommodate emergency vehicles, and emergency-response times shall be taken into consideration during project review.

» Speed management projects on major through-streets (e.g., Downtown Boulevards, Boulevards, and Town Center Boulevards) should not significantly impact freight or transit service.

» The area-wide street network should be considered so as not to divert traffic from one street to another.

Where a higher-speed roadway changes to a lower-speed roadway, attention must be given to the degree of speed reduction and the manner in which the reduction occurs. Motorists should be traveling at the slower speed at the start of the slower-speed street type; reductions should occur prior to the establishment of a lower speed. Section 8.4 shows examples of how to achieve this in different contexts.

LEGEND

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- X Not Permitted or N/A
- * Unless determined otherwise by Planning Board

Category	Measure	Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway	Page Reference
ROAD NARROWING	Road Diet (if volumes meet thresholds for road diet)	O	O	O	O	O	X	X	X	O	O	O	O	210
ROAD NARROWING	Lane Diet	▲ (see default dimensions for street type)												211
VERTICAL MEASURES	Speed Humps/Cushions	O	O	X	O	O	O	O	O	O	X	X	X	212
VERTICAL MEASURES	Speed Tables/ Raised Crosswalks	O	▲	X	O	▲	O	O	O	O	X	X	X	213
VERTICAL MEASURES	Raised Intersections	O	▲	X	O	▲	O	O	O	O	X	X	X	213
HORIZONTAL MEASURES	Curb Extensions/ Bulb Outs	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	O	213
HORIZONTAL MEASURES	Neckdowns/Chokers	▲	▲	▲	▲	▲	▲	▲	▲	▲	O	O	O	214
HORIZONTAL MEASURES	Roundabouts	O (engineering judgement needed, see Section 6.9)												
HORIZONTAL MEASURES	Crossing Islands	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	▲	152
HORIZONTAL MEASURES	Traffic Diverters	X	X	X	X	X	X	O	O	O	X	X	X	209
HORIZONTAL MEASURES	Chicanes/ Roadway Curvature	▲	O	O	▲	O	O	O	O	O	O	O	X	214
SURFACE	Textured Paving Treatment	O	O	O	O	O	O	O	O	O	X	X	X	216
ENCLOSURE	Sense of Enclosure (e.g., via street trees, landscaping, buildings, medians, etc.)	■	■	■	■	■	■	■	■	■	O	O	O	107

Figure 8-3. Appropriate speed management measures by street type

Road Narrowing

Road narrowing involves continuous changes to narrow the cross section of the road. Road diets and lane diets, as defined below, are often used in conjunction to narrow the overall width of the roadway dedicated to motor vehicles. These "diets" reduce pedestrian crossing distance and allow space reallocation to other uses.

Road diets reduce the number of travel lanes on a roadway. Roads that have more capacity (i.e., more lanes) than they need during the peak hour are among the most likely to have high speeds. **Right-sizing streets so that they have no more lanes than necessary is one of the most effective ways to reduce speeds and improve the safety of streets.** The most common road diet treatment is converting a four-lane road to three lanes (one travel lane in each direction with center left turn lanes where needed); however, any removal of travel lanes would be considered a road diet. A two-way center turn lane should not be used when there are two or more through lanes in each direction.

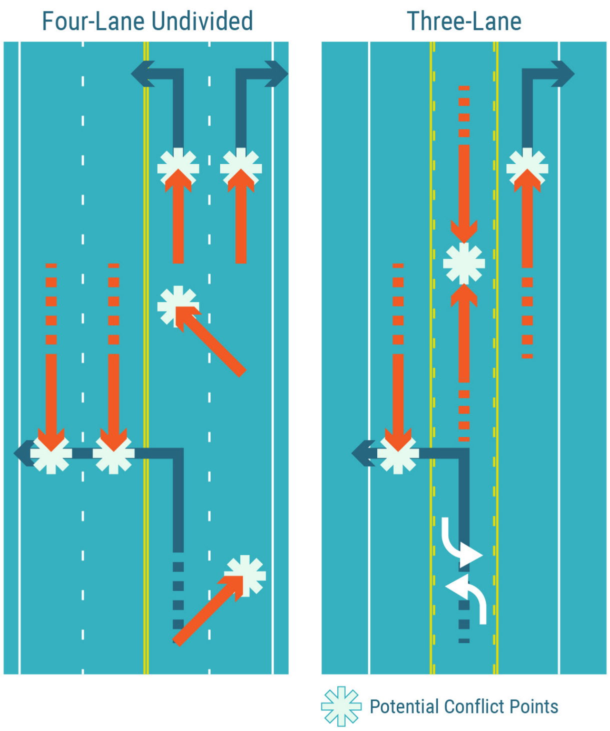


Figure 8-4. Example of the reduced number of conflict points on a 4-lane to 3-lane roadway conversion (Source: Federal Highway Administration, Adapted from Welch, T. The Conversion of Four Lane Undivided Urban Roadways to Three Lane Facilities. 1999.)

Figure 8-5 shows typical volumes for road diets on four-lane roads, which can be used to determine if a roadway may be a candidate for lane reduction. These figures are estimates – actual capacity depends on context, travel patterns, and prevailing driving behaviors. Level of service must be considered; however, in some cases implementing a road diet (including the elimination of turn lanes in some locations) will mean recognizing that some increased congestion during the peak hours of travel is a worthwhile tradeoff for increased safety. Research shows that road diets typically result in improved safety via lower speeds and less exposure to traffic for vulnerable users at crossings.

Less than 10,000 ADT	10,000 – 15,000 ADT
Great candidate for road diets in most instances. Capacity will most likely not be affected.	Good candidate for road diets in many instances. Agencies should conduct intersection analysis and consider signal retiming to determine any effect on capacity.
15,000 – 20,000 ADT	**Greater than 20,000 ADT**
Good candidate for road diets in some instances. Agencies should conduct a corridor analysis. Capacity may be affected at this volume depending on the "before" condition.	Agencies should complete a feasibility study to determine whether this is a good location for a road diet. There are several examples across the U.S. where road diets have been successful with ADTs as high as 26,000. Capacity may be affected at this volume.

Figure 8-5. Typical volumes for arterial road diets, (ADT = Average Daily Traffic) (Source: FHWA Road Diet Myth Busters, safety.fhwa.dot.gov/road diets)

Lane Diets narrow vehicular travel lane widths to default or minimum dimensions per street type. Research shows that narrower travel lanes can contribute to lower operating speeds and reduced crash rates.[127] Narrower travel lanes can also free up roadway width for other uses, such as green infrastructure and bicycle facilities, and shorten crossing distances (and thus exposure) for pedestrians and bicyclists at intersections. Refer to the lane width dimensions in Chapter 4: Street Zone for Montgomery County's default lane widths by street type. Sometimes, narrower lanes can be implemented simply by striping edge lines on streets that do not have them. Any decision to implement a lane diet should be determined using current traffic safety research including the Highway Safety Manual (HSM).

127 FHWA Achieving Multimodal Networks, Federal Highway Administration (2017)

Vertical Measures

Vertical measures involve periodic treatments to slow the speed of the road by creating vertical deflection. They can be used to achieve target driving speeds and keep drivers attentive and aware. **Vertical elements require coordination with emergency service providers and transit agencies to ensure that their operations are not impacted. Their implementation may be limited by other regulations - consult MCDOT.**

Speed humps are commonly used in neighborhood traffic calming, as they are inexpensive and effective. Montgomery County Executive Regulation 1-18AM regulates the spacing and design of speed humps. For streets with target speeds lower than 25 mph, Figure 8-7 provides additional guidance. Speed humps should be placed perpendicular to the flow of traffic. Speed humps are used as a retrofit for streets to achieve an overall lower speed along the corridor. The profile and placement of the speed humps should be designed to achieve the target design speed of the street. Gaps should be provided between the curb line and the end of the speed hump to allow stormwater to bypass the treatment.

Speed cushions reduce vehicle speeds but also provide a cut-through for vehicles with a wider wheelbase. Speed cushions are typically only considered on streets with posted speeds of 30 mph or lower and lower traffic volumes, though they may be used as part of a suite of design strategies to signal a transition to drivers (e.g., when the street type transitions from a Boulevard to a Town Center Boulevard). Speed cushions should be clearly marked with reflective markings and signs. The height of the speed cushion should be tapered towards the gutter to allow for unimpeded bicycle movement.

Figure 8-6. Speed hump

Raised Crossings can reduce speed and provide safety benefits by increasing visibility of people crossing. A raised crossing located at the transition to a neighborhood street from faster roadway is a good indicator of a change in expected driver behavior, especially on streets designated as Neighborhood Greenways by the Bicycle Master Plan.

Raised intersections have similar benefits to raised crossings – see Chapter 6: Intersections for more information.

Raised crossings and raised intersections are also appropriate as retrofit projects on existing streets where the goal is to reduce turning speeds and increase yielding to pedestrians, especially on channelized right-turn lanes (i.e., slip lanes) on arterial roads.

Horizontal Measures

Horizontal measures involve periodic treatments to slow the speed of the road by both narrowing the street to minimum widths and deflecting traffic from a straight path by introducing curvature. Horizontal measures have the potential to change the “wide and straight” character of many of the county’s Boulevards, which can encourage higher-speed driving. To achieve the desired target speeds, the spacing between speed management measures should be a minimum of 250-feet apart and a maximum of 500-feet apart (see Figure 8-7).

Target Speed (mph)	Spacing (feet)
10	250’
15	300’
20	400’
25	500’

Figure 8-7. Recommended spacing of horizontal and vertical speed management measures

Curb extensions extend the sidewalk or curb line into the street at an intersection or mid-block crossing location in order to shorten the crossing distance for pedestrians and improve visibility. Curb extensions extend the full width of an on-street parking lane. Check the Master Plan of Highways

Figure 8-8. Horizontal traffic calming treatment

and Transitways[128] and the Bicycle Master Plan[129] to determine whether the design of the curb extensions needs to accommodate future or existing bikeways, transit or freight priority routes. In some cases, curb extensions may be integrated with vegetation or bioretention to serve as another visual cue to drivers and help manage stormwater runoff from the right-of-way.

A **neckdown or choker** consists of two curb extensions placed mid-block directly opposite each other to physically and visually reduce the width of the roadway. They may be implemented by eliminating on-street parking, shoulders or unneeded roadway width. Neckdowns sometimes narrow the travelway to a single lane and encourage motorists to yield to oncoming traffic to pass before proceeding. A minimum clear width of 12 feet is required between curb extensions to allow safe vehicle passage and emergency access.

Crossing islands can be placed at intersections, mid-block crossing locations, or at the entrance to a community to slow vehicles turning onto a street. When their purpose is solely to reduce motor vehicle speeds, the median can be as narrow as 2 feet wide. When designing to also serve as a pedestrian refuge, the median must be at least 6 feet wide to comply with ADA requirements. At trail crossings of four or six lane roads, a width of 10 feet is preferred. The length of the shifting taper approaching a raised median should be calculated based on design speed. When shifting tapers are provided on streets with speeds of 25 mph or less, the length of the shifting taper calculated from the Manual on Uniform Traffic Control Devices may be reduced in half; this guidance is similar to shifting tapers for work zones and provides a more abrupt transition, which requires drivers to progress at slow speeds. By varying the width of a median along an arterial, some horizontal deflection can also be achieved.

Horizontal traffic calming measures that introduce curvature into the roadway are among the most effective measures to keep speeds at or below the target goal.

Chicanes introduce curvature into a roadway by placing three or more curb extensions in an offset pattern to create a winding path for motorists. Chicanes may require the removal of on-street parking in spot locations. On streets where drivers regularly exceed a target speed of 25 mph or less, chicanes or other speed management tools should be spaced at least every 500 feet. Chicanes should be designed to minimize impacts to storm water drainage.

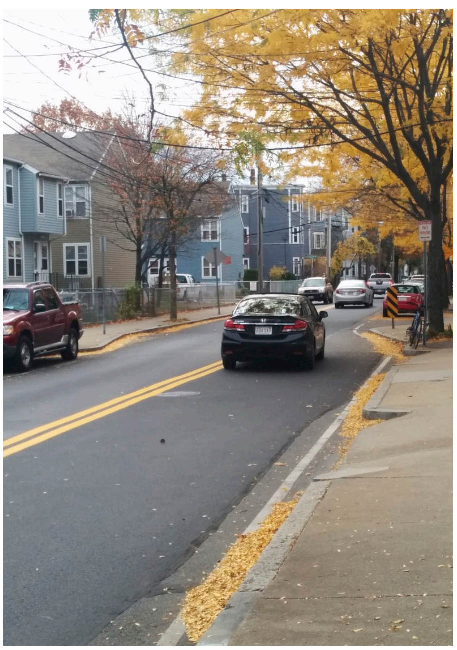


Figure 8-9. Chicane

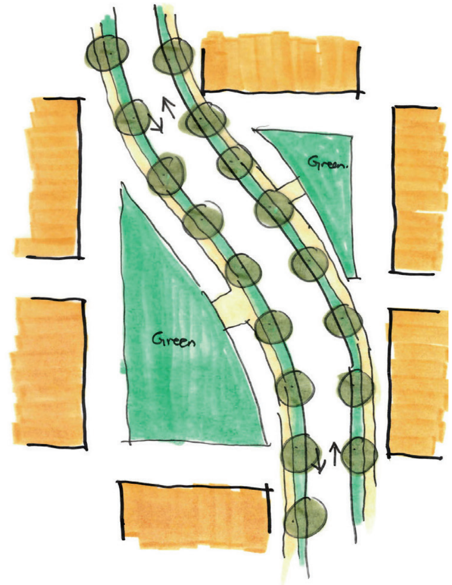
128 https://montgomeryplanning.org/planning/transportation/highway-planning/master-plan-of-highways-and-transitways/

129 https://montgomeryplanning.org/planning/transportation/bicycle-planning/bicycle-master-plan/

Roadway curvature is a key consideration in roadway design, for speed management and overall safety. When feasible, it is advantageous to maintain existing curves on Country Connectors and Country Roads and to superimpose curves on existing straight street segments. Radii for horizontal curves should use the minimum radius identified in the AASHTO Green Book[130] for the desired turning speed. The desired turning speed may be less than the posted speed but may require posting a supplemental speed plaque to identify the recommended speed for the curve. Horizontal curves must also be designed in coordination with vertical alignments and adjacent roadside conditions (vegetation, building siting, etc.) to ensure that clear sight triangles and sight distances are provided. The design vehicle must also be considered when selecting the radius of curvature and the lane widths to ensure that larger vehicles can properly navigate the roadway. Encroachment by infrequent large vehicles into oncoming lanes may be appropriate on low volume, low speed roadways, but a larger radius of curvature, wider lanes, or a mountable truck apron may be appropriate to address off-tracking issues where large vehicles are frequent.

In suburban contexts, roadways with gentler curves may encourage faster driving speeds. It may be feasible to retrofit curving streets like these with speed management measures such as curb extensions or chokers. Or, as part of development/redevelopment projects, in some contexts it may be preferable to design roadways with sharper corners as long as sight lines to oncoming travel lanes and pedestrian crossings are maintained.

In some suburban contexts where gentler curves may lead to higher vehicle speeds, it may also be preferable to design a one-way circuit around a central plaza or park (see Figure 8-10 lower). Because this design requires sharp turns, analysis is needed to ensure whether the county's fire apparatus will be able to navigate the streets. On-street parking may need to be limited in areas with this design, to enable fire access. However, the lower design has advantages over the alternative on the top in that it may help slow vehicle speeds and also creates a greenspace that can be used for recreation and/or stormwater management.



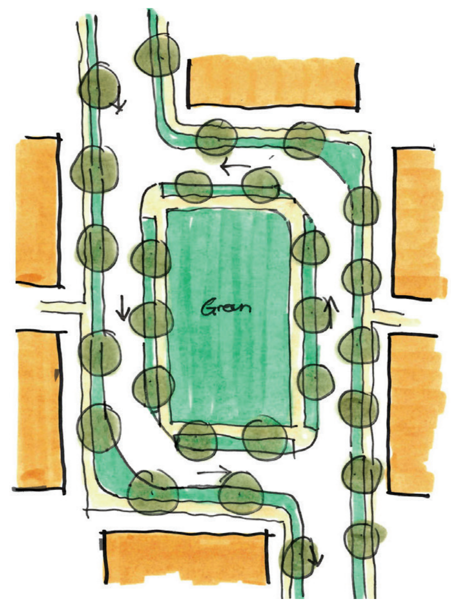


Figure 8-10. Alternative options for roadway geometry in suburban contexts

130 American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets (Green Book)

Figure 8-11. Example of optical speed bars

Surface Measures

A variety of pavement markings can be used to encourage slower driving speeds.

» Converging chevron marking patterns create the illusion of traveling faster as well as the impression of narrower lanes.[131]

» Optical speed bars, a series of white rectangular markings spaced progressively closer, create the illusion of traveling faster.[132]

» Lane narrowing with edge lines, painted medians, or different surface treatment for parking lanes, which can visually narrow the street.

» Textured pavement may be effective in areas with higher pedestrian traffic, or where roads transition from faster, more suburban contexts to slower, more urban zones.

Sense of Enclosure

Urban streets frequently have vertical elements along the edge of the street, such as street trees, buildings that face the street, or other amenities that create a sense of enclosure and visual interest. These design elements create side friction and make a street feel narrower than it is. This has the effect of reducing travel speeds. A street with a raised landscaped median will feel narrower than a street that only has a painted median.

On-street parking can help reduce travel speeds. However, if the parking is underutilized it can have the opposite effect, because vacant on-street parking visually widens the road, resulting in higher speeds.

Using fixed objects and landscaping/trees to create a sense of enclosure can be appropriate in suburban and rural areas or in urban areas lacking enclosure; however, clear zones and sight distance for higher speed streets should be considered when placing street adjacent amenities.

Additional speed management strategies specific to intersections, including signal timing and mini roundabouts, are presented in Chapter 6: Intersections.

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131 PennDOT Speed Management Action Plan, Pennsylvania Department of Transportation (2016)

132 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835 (Section 3B.22)

Progression Speed

The progression speed on a corridor is the speed used to set traffic signal timing such that a user who is traveling that speed can pass through several traffic signals in a row. This is referred to as a “green wave.” The progression speed for corridors in Montgomery County is managed by MCDOT Division of Traffic Engineering and Operations. **If the progression speed is aligned with the target speed for the roadway, drivers who drive the desired speed are “rewarded” with less wait time at red lights.** Similarly, on priority bicycle corridors, where appropriate the progression speed can be set closer to bicycle operating speeds in order to improve convenience for bicyclists and encourage compliance with signals. Common green wave progression speeds for bicyclists are between 12 and 15 mph. This speed can vary depending on the specifics of each location (e.g., grade, sight distance). A green wave encourages slower travel speeds for motor vehicles, which improves safety for all roadway users. Any signal progression issues require evaluation and approval by MCDOT.

Enforcement

An underlying objective of complete streets designs is they achieve self-enforcement of target operating speeds. This enforcement-through-design should reduce the need for enforcement in the first place. Where further enforcement is necessary, however, automated enforcement and radar feedback signs are beneficial tools to reinforce posted speeds, particularly when implemented alongside design solutions. Both tools provide a more consistent application of the law and reduce the need for interactions between police officers and the public.

While radar feedback signs provide a more educational approach to enforcement without assessed penalties, attention must be given toward the implementation of automated enforcement devices to ensure that the implementation of the program is not itself inequitable. As enforcement is more likely to be needed on facilities that have not yet been reconstructed toward achieving the target speeds: this reinforces a need for Equity Emphasis Areas to be considered in prioritizing the Capital Improvement Program and maintenance activities (see Chapter 9).

For more information on enforcement: contact the Montgomery County Police Department, Field Services Bureau for more information.

8.4 Retrofitting Arterials for Lower Speeds

Speed management is particularly important on Montgomery County's arterial network, which serves more than half of all vehicle miles traveled and experiences more than half of all crashes. Higher speeds are encouraged by the straight alignments, low-scale buildings that are set back from the road, and long distances between signals. At higher speeds, drivers have a much narrower cone of vision, and need more time to stop (see Figure 8-1). At lower speeds, drivers have much better visibility of people walking or biking along the road and can stop much more quickly. A significant change in design practices and policies will be needed to address the mismatch between how the existing arterial network was designed (with the goal of increasing capacity and mobility for motor vehicles) and the county's Vision Zero policy.

Speed management on arterials applies the same principles as on other street types but recognizes the role of the corridor as a major thoroughfare and ensures that reduced speeds do not diminish vehicle access and divert traffic onto local streets.

The following pages present three common conditions found throughout Montgomery County, and present a hypothetical set of speed-management strategies that could be employed in cases like these.

Example A: Transitioning a Higher-Speed Road into an Urban Area

In this example, a Boulevard transitions into a Downtown Boulevard as it enters an urbanizing area with shops, employment, and housing. The Boulevard target speed is 35 mph. As a Downtown Boulevard, the target speed is 25 mph. There is significant transit service on the road, and there are limited side streets for comfortable bicycling, which means that many bicyclists use the road too.

The first step is to look at the overall width of the street. The traffic volumes in the corridor should be evaluated to determine if this street is a candidate for lane reduction through a road diet. The widths of the lanes should also be evaluated to see if they can be narrowed – especially as the allowable lane width changes to the new street type. Narrower and/or fewer lanes can allow space for bicycle facilities and/or shorten the pedestrian crossing at intersections. The maximum spacing for protected crossings and minimum spacing for signalized intersections will reduce and provide more pedestrian access. If the signals are timed strategically, speed can be better managed in the more congested environment. Additional changes in the streetscape and the implementation of speed management measures will further communicate the change in land use and target speed to the motor vehicle drivers.

Existing

- Major community destinations and school front the corridor
- Long crossing distances
- Long gaps between pedestrian crossings
- Road design encourages higher driving speeds
- Pedestrian desire lines between transit stops and destinations

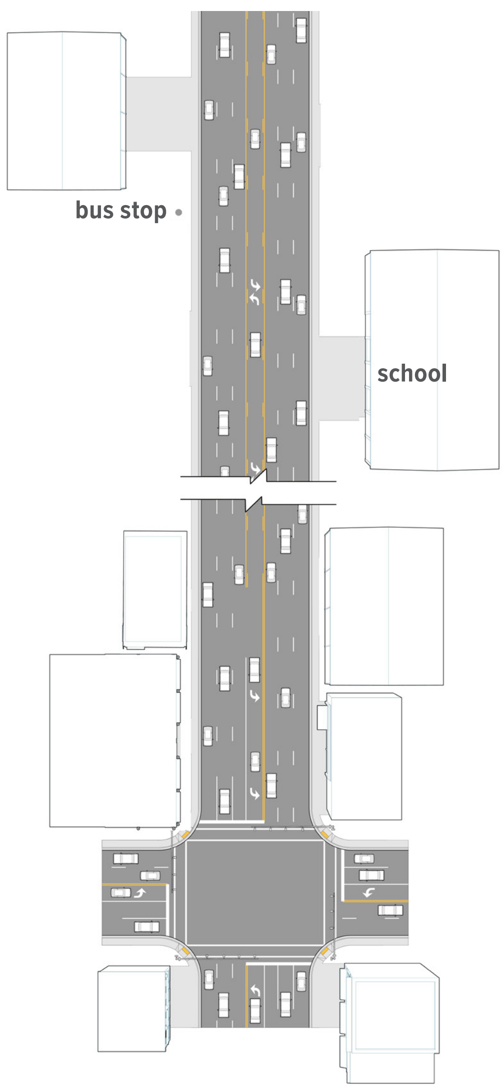

Figure 8-12. Example A, before

Proposed

- Lane reduction
- Separated bike lanes
- Varying-width curb extensions overlay curvature into the roadway as you enter the urban area
- Textured pavement is a cue to drivers that they are entering a different zone
- Signal timing allows continued green flow for vehicles traveling the design speed of 25 mph
- Enhanced mid-block crossing
- Relocate bus stop close to crossing

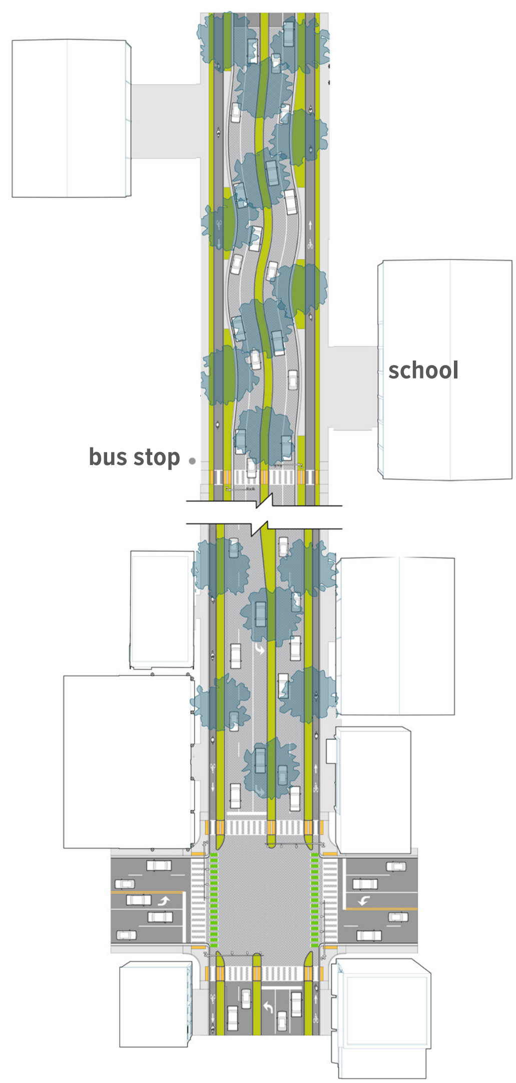

Figure 8-13. Example A, after

Example B: Undivided Town Center Boulevard with Pedestrian Activity

In this example, an undivided Town Center Boulevard in a suburban setting has transit service that results in pedestrian activity with desire lines across the corridor. The suburban development pattern with large setbacks and development oriented away from the arterial contribute to a sense of openness, which leads to higher speeds. The long right turn lanes and painted median also contribute to the feeling of a wider corridor. The existing speed limit is 35 mph, but traffic is often moving significantly faster than the posted speed limit. As a Town Center Boulevard, the target speed is 25 mph.

The traffic volumes in the corridor should be evaluated to determine if this street is a candidate for lane reduction through a road diet. Removal of extra turn lanes should also be considered. The widths of travel lanes should also be evaluated to see if they can be narrowed. The two-way left turn lane is discouraged for this street type and should be removed. Available space from road/lane diets should be allocated to pedestrian and/or dedicated transitway space. The spacing of protected crossing and signalized intersections should match the Street Design Parameters in Figure A-1. Horizontal and enclosure speed management measures should be considered per Figure 8-3. Future land use planning should require development set closer to the road.

Existing

- Pedestrian desire lines between destinations
- No buffer between sidewalk and travel lanes
- Development set back from road increases sense of open, fast roadway
- Bicyclists share sidewalks with pedestrians or travel lanes with vehicles, creating conflicts
- Long spaces between crossings and wide crossing distances for pedestrians
- Two-way center turn lanes lead to wide cross section and creates potential conflicts for drivers

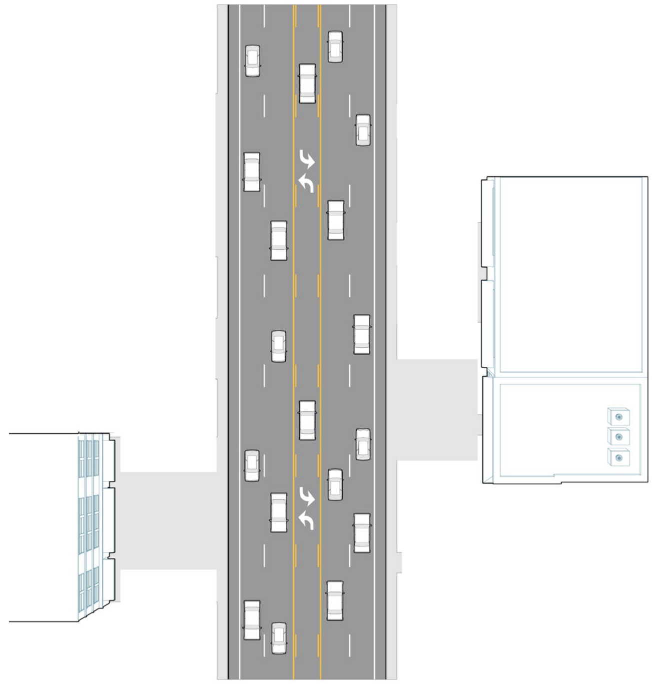

Figure 8-14. Example B, before

Proposed

- Lane reconfiguration slows traffic and creates on-street parking
- Raised mid-block crossing island with high-visibility crosswalks
- Radar speed feedback signs
- Optical speed bars
- Over time, development oriented closer to frontage to create a sense of enclosure
- Street trees, a street buffer, and bike lanes create a more comfortable space for people walking and bicycling

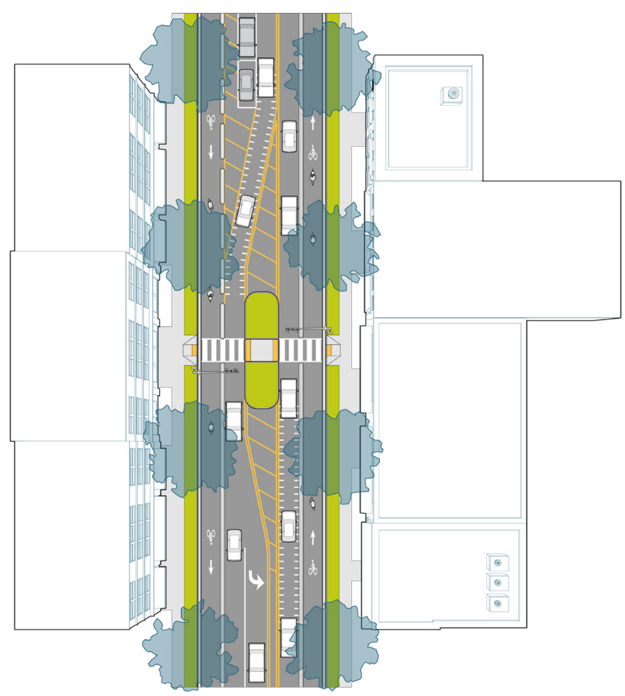

Figure 8-15. Example B, after

Example C: Transitioning a Country Connector into a Town Center Street

In Example C, a two-lane Country Connector with high-speed traffic along much of its course travels through the center of a small town, serving as the “main street” of the community. Traffic is typically exceeding the posted speed limit of 50 mph. As you enter town, there is an increase in vehicle turning movements, pedestrians, and bicyclists. As a Country Connector, the target speed should be 40 mph and as a Town Center Street, the target speed should be reduced to 25 mph. Potential treatments include visual cues to the motorist that they are entering an area of higher development density, lower travel speed, and increased vulnerable users. These visual cues to the driver should be implemented outside of the town center to provide ample time for speed reduction.

Existing

» Vehicles approaching Town Center are traveling 40+ mph

» Wide shoulders and open road section signal a higher speed environment

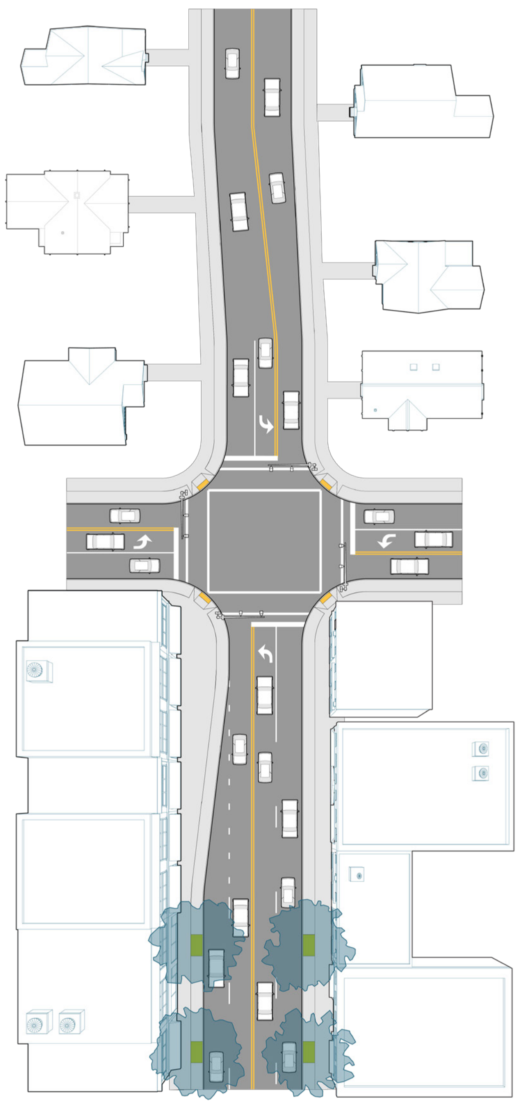

Figure 8-16. Example C, before

Proposed

» Chicanes add curvature that slows drivers as they enter the Town Center

» Landscaping, textured pavement and gateway treatments provide a visual cue

» Narrower lanes, edge line striping, and optical speed bars help reinforce that a change is occurring

» Tighter curb radii, high-visibility crossings, and a raised intersection help pedestrians cross

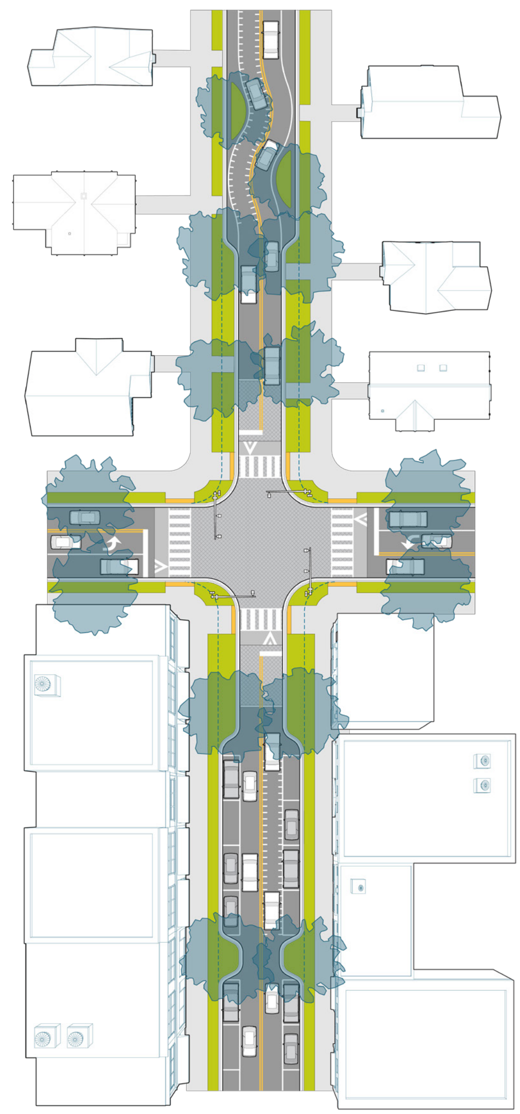

Figure 8-17. Example C, after


NO TURN ON RED

Chapter 9: Implementation

9.1 Overview

Roadway design in Montgomery County involves coordination, review, and permitting by a range of county and state agencies and departments, each of which plays a critical role in the planning, design, operations, compliance, and maintenance of streets. Whether it is led by the public or private sector, the process of implementing a new street design can take months or even years and involves numerous phases, from early planning to post-construction evaluation.

Sections include:

» Section 9.2: Agency Responsibilities on Streets

» Section 9.3: Project Development Process

» Section 9.4: Permits and Approval

Implementation of these guidelines should begin immediately. Projects already through concept design should proceed but should include as many Complete Streets practices as feasible.

This chapter aims to clarify the agencies and process for Complete Street project delivery. It identifies the fiduciary responsibilities of county departments, as well as a step-by-step description of the project development process.

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9.2 Agency Responsibilities on County Streets

This graphic shows the agency lead for projects on county-owned roadways. Close coordination is required with many other agencies and partners, including M-NCPPC, MDOT SHA, MDOT MTA, WMATA, Ride On, and others.

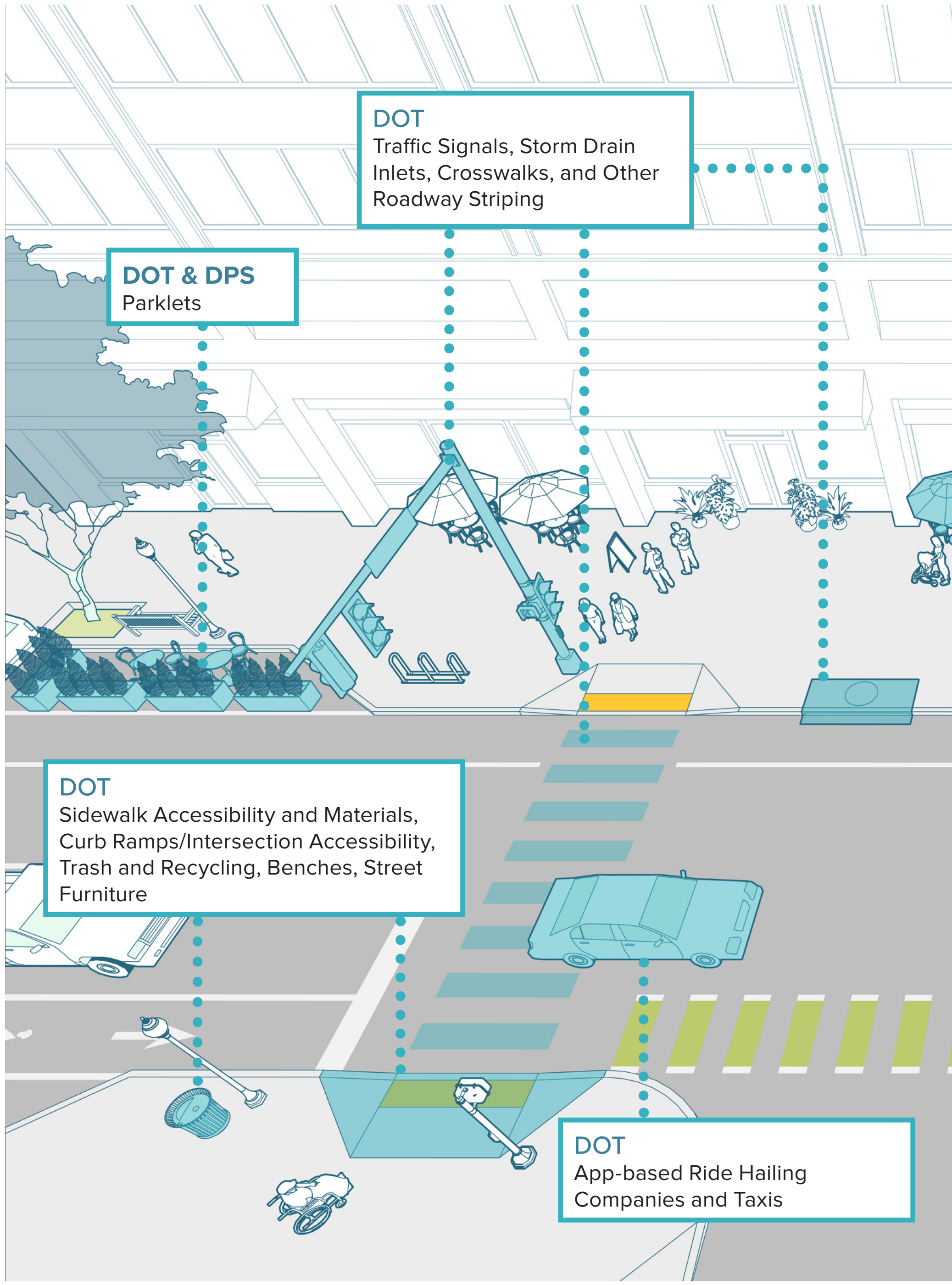
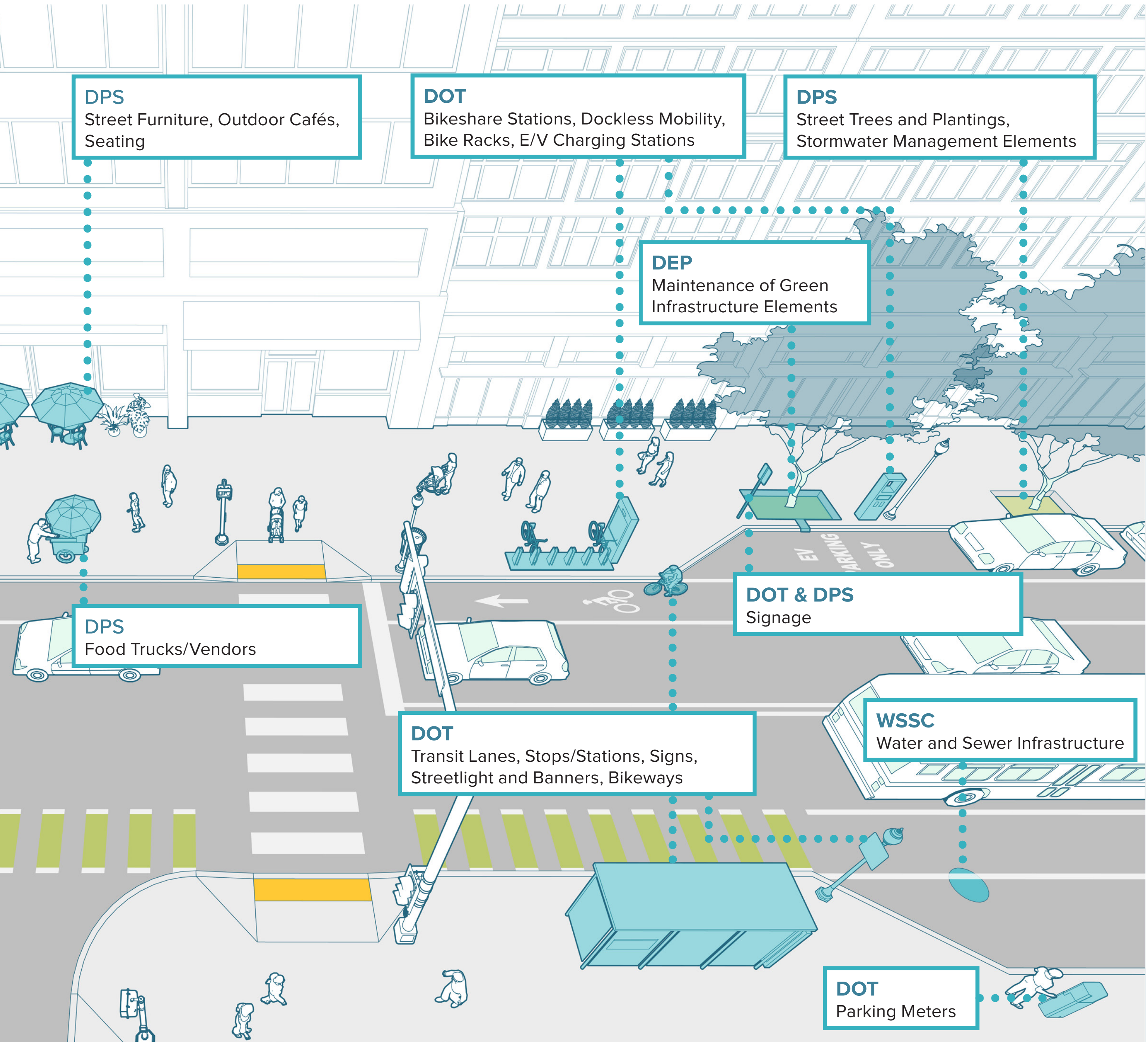


Figure 9-1. Agency responsibilities on county streets

Additional responsibilities for projects on county-owned roadways not shown in the graphic on the right.

Street Element	Agency Lead
Maintenance of Traffic	DOT
Construction, Sediment Control	DPS
Access Management – Site Access	M-NCPPC and DPS
Access Management – Roadway Access	DOT
Road Classification through the Master Plan of Highways and Transitways	M-NCPCC

Note: In areas with designated Urban Districts, the Urban District may be responsible for maintaining many of the features shown in Figure 9-1.


DPS
Street Furniture, Outdoor Cafés, Seating
DOT
Bikeshare Stations, Dockless Mobility, Bike Racks, E/V Charging Stations
DPS
Street Trees and Plantings, Stormwater Management Elements
DEP
Maintenance of Green Infrastructure Elements
EV PARKING ONLY
DOT & DPS
Signage
DPS
Food Trucks/Vendors
DOT
Transit Lanes, Stops/Stations, Signs, Streetlight and Banners, Bikeways
WSSC
Water and Sewer Infrastructure
DOT
Parking Meters

9.3 Project Development Process

The Montgomery County Department of Transportation (DOT) and Department of Permitting Services (DPS) lead and oversee a wide range of projects, from crosswalk installations to major highway reconstructions. All projects have the potential to incorporate Complete Streets principles, but not all projects require the same type of analysis. The Complete Streets Project Delivery Process provides a typical overview of how ideas become concept design and, ultimately, built projects. This description is primarily focused on standalone Capital Improvement Program projects that involve the realignment of curb lines, changes to drainage and utilities, and the installation of new traffic control devices.

Project Prioritization

Most new projects included in the Capital Improvement Program are likely found in master plans and countywide guidance such as this Complete Streets guide. Public resources to implement new projects is limited, given the ongoing costs of planned retrofits, reconstruction, and maintenance activities. Therefore, it is necessary to develop a means of prioritizing how projects would be implemented over time.

With Vision Zero a foundational goal of this guide, prioritization should consider the needs of the most vulnerable road users first. Some examples of this may include prioritizing projects that are located in Equity Emphasis Areas, School Zones, and/or Bicycle Pedestrian Priority Areas.

Public Engagement

Public engagement is a priority for Montgomery County, as it ensures that members of the public have the opportunity to provide meaningful input on issues that matter to them, including our transportation network. For Capital Improvement Program projects, having an extensive outreach process with well-recorded feedback and additional engagement during a project's implementation can make the entire planning process smoother.

Public engagement is a critical component of several stages of the Complete Streets process, and it takes several forms (see Figure 9-2).

Public sector-initiated projects	Private sector-initiated projects
Informational project meetings, led by DOT or other relevant agencies	Pre-submittal presentations to community members
Montgomery County boards, committees, and commissions	Preliminary plan or site plan presentations to community members
Public hearings (for projects requiring approval by the Planning Board or County Council)	Public hearings (for projects requiring approval by the Planning Board or County Council)
Written testimony (to DOT, the Planning Board, or County Council)	Written testimony (to the Planning Board, or County Council)

Figure 9-2.
Typical public engagement processes (More information is available at https://www.montgomerycountymd.gov/dot-dte/facility/lotp.html)

Public Sector Road Projects

Master Plan of Highways and Transitways

- Classifies each street based on traffic volume and function
- Establishes minimum master-planned right-of-way
- Identifies transit priority streets
- Identifies planned Bus Rapid Transit (BRT) station locations
- Recommends number of lanes and target speed

Master Plans and Sector Plans

- Defines land use and urban form
- May include local streetscape guidelines

Bicycle Master Plan

- Recommends bikeways for specific roads

Review and Briefings

ITERATIVE PROCESS

- Review from the Montgomery County Council Transportation, Infrastructure, Energy and Environment (T&E) Committee
- Briefing with the Montgomery County Planning Board

Facility Planning / 35% Design at DOT

- Identify stakeholders and review agencies
- Collect background traffic and environmental data
- Public outreach, in the form of community meetings and written feedback
- Develop concept plans, DOT selects a preferred option to move forward
- Detailed surveying and site investigation (soil conditions, environmental impacts, noise impacts)
- Detailed engineering (horizontal and vertical alignment, right-of-way requirements, structures, intersection design, Stormwater Management Concept approval
- Construction sequencing, costs, and scheduling
- **35% design is enough detail to provide an accurate cost estimate and schedule and allows the project to receive final design and construction funding**

Approval Process

- **Mandatory referral review by the Montgomery County Planning Board**
- **Review by County Council T&E Committee**
- **Approval by DOT Director**

DOT Budget Request

- Office of Management and Budget (OMB) reviews the project
- The County Executive includes the project in their proposed Capital Improvements Plan, which is updated annually and covers a 6-year period
- The County Council reviews the CIP budget
- Public outreach, in the form of County Executive town hall meetings, County Council public hearings, and written feedback
- County Council approves the CIP budget

Final Design

- Local, state, and federal agency review and permits
- Right-of-way acquired (required for construction to start unless County Council authorizes direct takings)
- Update to construction costs at Council

Construction

- DOT selects a contractor
- Project is built, which can take anywhere from several months to several years depending on project size
- Ongoing evaluation throughout the project for quality control and to ensure adherence to the county's design standards
- DOT and DPS conduct final inspection
- Project opens to the public

Private Sector Road Projects

Master Plan of Highways and Transitways

- Classifies each street based on traffic volume and function
- Establishes minimum master-planned right-of-way
- Identifies transit priority streets
- Identifies-planned Bus Rapid Transit (BRT) station locations
- Recommends number of lanes and target speed

Master Plans and Sector Plans

- Defines land use and urban form
- May include local streetscape guidelines

Bicycle Master Plan

- Recommends bikeways on specific streets

Sketch Plan

- Applicants submit an illustrative plan or model of their development, including the location of streets, buildings, and open spaces
- Public outreach, in the form of a pre-submission community meeting and written feedback to the Planning Board
- Sketch plans go to the Development Review Committee for review by planning staff, Department of Transportation (DOT), Department of Permitting Services (DPS), Department of Environmental Protection (DEP), Department of Public Works (DPW), Maryland DOT State Highway Administration (MDOT SHA), and local utilities (WSSC, Pepco, Washington Gas)

Planning Board Hearing and Approval

Preliminary Plan, Site Plan, or Administrative Subdivision Plan (Depending on the project)

- Applicants submit a detailed plan of development with the location of streets and newly created lots and parcels
- Planning staff performs an Adequate Public Facilities finding to determine if the existing transportation network can handle the proposed development, and may recommend changes
- Public outreach, in the form of a community meeting and written feedback to the Planning Board
- Preliminary Plans go to the Development Review Committee

Planning Board Hearing and Approval

Record Plat with lots, parcels, and new public rights-of-way

Construction

- Project is built, which can take anywhere from several months to several years depending on project size
- Ongoing evaluation throughout the project for quality control and to ensure adherence to the county's design standards
- DOT and DPS conduct final inspection
- Project opens to the public

Construction and Maintenance

Road projects must have temporary traffic controls to provide direction for motorists, bicyclists, and pedestrians during construction and maintenance activities that may disrupt normal traffic flow. For additional information, consult the Montgomery County Work Zone Traffic Control Standards Book.[133]

After private road projects are completed, developers must sign a Site Plan Surety and Maintenance Agreement with the Montgomery County Planning Board. This agreement requires developers to follow the final specifications of their approved site plan and to maintain them for one year.

For all road projects, it is critical to consider maintenance responsibilities and ensure that adequate capabilities are in place for infrastructure upkeep. This includes identifying who will be responsible for snow storage and clearance, particularly at pedestrian ramps and along both in-street bikeways as well as bikeways within the Active Zone. Under Montgomery County law, fronting property owners are responsible for clearing their sidewalks, including associated curb ramps and sidewalk-level bicycle facilities, within 24 hours of a snow event.

Resurfacing Projects

Road resurfacing (when the asphalt surface of a road is milled down, replaced, and repainted) can often present an opportunity to implement a bikeway or other planned streetscape or cross section elements. Consult the Bicycle Master Plan and other relevant planning documents to determine what planned design changes could be implemented as part of routine resurfacing or redevelopment. Resurfacing projects typically do not include moving curb lines, though there are exceptions. The extent of design change that is feasible through resurfacing is a case-by-case decision.

Project Evaluation

Upon completion, projects should be evaluated at regular intervals to ensure that they are contributing to a safe, comfortable, and accessible street network. In 2017, Montgomery County adopted the Vision Zero concept for roadway safety, which seeks to eliminate all traffic deaths through education, enforcement, and engineering. As part of this effort, the county tracks several metrics for roadway safety, including the number of severe or fatal collisions, collision factors, the prevalence of safe pedestrian and bicycle crossings, the percentage of “low-stress” bicycle routes, and the amount of linear feet of sidewalk created each year.

While Vision Zero examines countywide trends, individual projects may be evaluated as well. Once the need is established for evaluating a project, the recommended evaluation process could go as follows:

Before the project has been implemented

» Develop an evaluation plan (three months)

» Collect pre-data (two months)

After implementation

» Collect post-data (three to six months)

» Perform analysis, establish key findings, report back (six to twelve months)

133 https://www.montgomerycountymd.gov/DOT-Traffic/temp_tc_standards.html

9.4 Permits and Approvals

The Department of Permitting Services Land Development Division regulates all aspects of land improvement, including stormwater management and any construction activity related to the public right-of-way. Depending on their scope, roadway projects may require the following permits or approvals:

» Awning and Canopy Permit (DPS)

» Crane Permit (DPS)

» Design Plan Approval (M-NCPPC, MCDOT, DPS)

» Drainage Permit (DPS)

» Driveway Permit (DPS)

» Dumpster Permit (DPS)

» Erosion and Sediment Control Approval (DPS)

» Fence in a Storm Drain Easement Permit (DPS)

» Forest Conservation Plan Approval (M-NCPPC)

» Grading Permit (DPS)

» Mandatory Referral Approval (M-NCPPC)

» Misc. Structures in ROW Permit (DPS)

» Natural Resource Inventory/Forest Stand Delineation (NRI-FSD) Approval (M-NCPPC)

» Outdoor Café Seating Permit (DPS)

» Paving or Storm Drain Permit (DPS)

» Portable Storage Container Permit (DPS)

» Private Road Closure Permit (DPS)

» Restoration of ROW Permit (DPS)

» Roadside Tree Permit (DPS)

» ROW Sheeting and Shoring Permit (DPS)

» Stump Removal Permit (DPS)

» Telecom Permit (DPS)

» Test Pit/Directional Boring Permit (DPS)

» Utility Permit (DPS)

» Wireless Permit (DPS)

Access county permits and learn more at https://www.montgomerycountymd.gov/DPS/divisions/land_dev/index.html.

Additional permits, approvals, and agreements may be required from the following organizations and agencies:

» M-NCPPC

» Montgomery County Department of Transportation

» Department of Environmental Protection

» Maryland Department of Natural Resources

» Maryland Department of the Environment

» US Army Corps of Engineers

» MDOT SHA, for projects on or intersecting with state highways

» Local utilities

› Baltimore Gas & Electric (far northern and eastern portions of the county)

› Washington Gas

› Pepco

› WSSC

› Verizon

› Comcast

› Other fiber optic communications (Fiber Tech, Fiberlight, Level 3, etc.)

Key Reference Documents

Montgomery County

- Montgomery County Code, Chapter 49 (Streets and Roads), Chapter 8 (Drainage), Chapter 19 (Erosion and Sediment Control), Chapter 22 (Fire Safety)
- Montgomery County Master Plan of Highways and Transitways
- Montgomery County Standard Details
- Montgomery County Zoning Ordinance
- Montgomery County Bicycle Master Plan
- Montgomery Planning Bicycle Facility Design Toolkit
- Montgomery County Vision Zero Two-Year Action Plan
- Montgomery County General Plan: On Wedges and Corridors
- Montgomery County Fire and Emergency Access Performance-Based Design Guidance
- Montgomery County Rustic Roads Functional Master Plan
- Montgomery County Area Master and Sector Plans
- Montgomery County Bus Rapid Transit (BRT) Plans for US 29, MD 355, and MD 586
- Montgomery County Standards for Utility Construction
- Montgomery County Drainage Design Criteria
- Montgomery County Roadside Tree Design Guidelines and Specifications
- Montgomery County Forest Conservation Law
- M-NCPPC Environmental Technical Manual
- M-NCPPC Guidelines for Environmental Management of Development in Montgomery County
- M-NCPPC Local Area Transportation Review and Transportation Policy Area Review Guidelines
- Montgomery County Bus Rapid Transit Station Design Guide

State of Maryland

- Maryland Manual on Uniform Traffic Control Devices (MdMUTCD)
- Maryland Department of the Environment (MDE) Stormwater Design Manual
- MDE Maryland Standards and Specifications for Soil Erosion and Sediment Control
- MDOT SHA Book of Standards for Highway and Incidental Structures
- MDOT SHA Traffic Control Devices Manual
- MDOT SHA Bicycle Policy and Design Guidelines
- MDOT SHA Accessibility Policy and Guidelines for Pedestrian Facilities along State Highways
- MDOT SHA Environmental Guide for Access and District Permit Applicants
- MDOT SHA Guidelines for Traffic Barrier Placement and End Treatment Design
- MDOT SHA Highway Drainage Manual
- MDOT SHA Standard Specifications for Construction and Materials
- WMATA Design and Placement of Transit Stops

National

- AASHTO Policy on Geometric Design of Highways and Streets (Green Book)
- Manual on Uniform Traffic Control Devices (MUTCD)
- Americans with Disabilities Act (ADA) and the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights-of-Way (PROWAG)
- AASHTO Guide to the Development of Bicycle Facilities
- AASHTO Roadside Design Guide

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Appendix A: **Quick Reference Charts**

Appendix A is intended to serve as a quick, one-stop reference for the topics that are explained in greater detail throughout the guide.

A.1 Street Design Parameters

Figure A-1 is meant as a quick reference for the critical dimensions and design guidance that are explained throughout the rest of this guide. This guidance provides a starting point for design decisions on new roads that, when used alongside functional and area master plans, gives designers guidance on the key elements of street design that are essential to delivering safe Complete Streets. If guidance in this document conflicts with an approved streetscape standards and/or design guidance, contact M-NCPPC for clarification. Master planned right of way is determined by the Master Plan of Highways and Transitways[134] and is the minimum width required, not including additional needs at intersections.

134 https://montgomeryplanning.org/planning/transportation/highway-planning/master-plan-of-highways-and-transitways/

General notes for Figure A-1

1. All roads should meet AASHTO standards, recognizing that AASHTO allows for flexibility; see FHWA Achieving Multimodal Networks[135] and NACTO Street Design Guides[136].

2. Reference the Montgomery County Fire Code[137] and Montgomery County Fire and Emergency Access Performance-Based Design Guidance[138] for details on required clear widths.

3. Targets for speeds, maximum spacing for protected pedestrian crossings, minimum spacing for signalized intersections, and other items in this document are instructive for new developments and can provide a guide for stand-alone Capital Improvements Projects that retrofit existing or create new infrastructure.

4. All figures are provided as a starting point for discussion. If more than 8 percent of vehicles are large trucks or other heavy vehicles, or if other special local circumstances apply, different dimensions may be appropriate. Consult with MCDOT.

5. Approved streetscape guidelines may supersede this document.

135 https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/multimodal_networks/
136 https://nacto.org/publication/urban-street-design-guide/
137 https://www.montgomerycountymd.gov/DPS/Codes/FPCC-Codes-Index.html
138 https://montgomeryplanning.org/planning/functional-planning/fire-department-access-performance-based-design-guide/

		Page Reference	Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway
Target Speed (MPH)	Target Speed is the desired operating speed for a roadway facility. These speeds are based on safe operations; they are tailored to the functionality and context of the roadway in a Complete Streets system. Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles are considered when determining an appropriate target speed. State law requires a minimum posted speed of 25 mph outside of "urban districts" as defined in the law.[139]	246	25	20	35	30	25	25	20	20	25	40	35	45 - 55
Maximum # of Vehicle Through Lanes	See Countywide Master Plan of Highways and Transitways for number of travel lanes on specific streets, which supersedes this guidance. These are primarily for new roads and when considering road diets.	149	6	4	6	6	2	2	2	1	4	4	2	N/A
Maximum Spacing for Protected Crossings	On streets with operating speeds of 30 mph or more, "protected" crossings include: Traffic/pedestrian signal or HAWK, all-way stop control, or grade-separated crossing. These targets are intended to ensure pedestrian crossings are located at reasonable intervals. These general values are aligned with Complete Streets principles; however, site-specific needs and conditions will dictate actual implementation. Where ranges are provided, the lower end of the range is recommended in commercial areas, on BRT corridors, in BiPPAs, and near schools (or similar destinations).	218	400'	400'	800'-1600'	600'	400'	600'-1200'	N/A	N/A	800'	1300'-2700'	1300'-2700'	1300'
Generally Accepted Minimum Spacing for Signalized Intersections	Refers to a full signalized intersection or roundabout. These targets are intended to maintain operations at a level that promotes safe movement by all travel modes. Site-specific needs and conditions, as determined through the regulatory approval process or capital project review, will dictate actual implementation.	218	400'	400'	1300'	600'	400'	1300'	N/A	N/A	800'	2700'	2700'	2700'
Center Median	May be replaced or widened to include a left turn lane at intersections, if needed. Medians may be wider than dimensions provided in some circumstances – consult MCDOT. If the guidance is "optional," the dimensions shown apply if a median is provided. If street is master planned for a transitway, transit lane dimensions supercede.	151	Recommended 6'-16'	Optional 6'-10'	Recommended 6'-16'	Recommended 6'-16'	Optional 6'-10'	Optional 6'-16'	Optional 6'-10'	N/A	Optional 6'-17'	Optional 6'-17'	Optional 6'-16'	Required 6'-17'
Left Turn Lane	Dimensions only apply if a left turn lane is required.	147	10' default, 9' min	10' default, 9' min	10'	10'	10'	10'	N/A	N/A	11'	11'	10'	11'
2-Way Left Turn Lane	Only appropriate under limited circumstances.	147	N/A	10'	N/A	N/A	10'	10'	N/A	N/A	11'	N/A	N/A	N/A
Inside Travel Lane	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. Includes the lane against the centerline on undivided roads.	147	10'	10'	10'	10'	10'	10'	10'	N/A	11'	11'	11'	11'

Figure A-1. Street design parameters summary

139 https://law.justia.com/codes/maryland/2018/transportation/title-21/subtitle-8/section-21-803/

		Page Reference	Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway
Outside Travel Lane (against curb or parking)	Lane width dimensions are intended for typical tangent (straight) sections. Segments with vertical or horizontal curves may require wider pavements per Section 3.3.10 of the AASHTO Green Book. If the outside lane is adjacent to a bike lane, the total width (travel lane + bike lane) should be no less than 16'. Guidance also applies to right turn lanes, where needed. Gutter pan is included in parking lane dimensions (below); however, if there is no parking lane, gutter pan is included in these dimensions for the outside travel lane.	147	11'	10.5'	11'	11'	11'	10.5'	10.5'	12'	11'	11'	11'	12'
Dedicated Transitway	The presence of a dedicated transitway is determined in the Countywide Master Plan for Transitways and Highways. If these dimensions vary from those provided in a specific Transitway planning process, those dimensions supersede. Dimensions may vary at stations, intersections/crossing points, and along horizontal curves.	150	Transitway lanes: 13' preferred, 12' min Transitway buffer: 6' preferred, 2' min											
Parking Lane	Gutter pan is included in parking lane dimensions. If there is no parking lane, gutter pan is included in outside travel lane width.	139-141	8'	8'	8'	8'	8'	8'	8'	8'	8'	N/A	N/A	N/A
Shoulder	Dimensions only apply if a shoulder is required.	147	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6'	5'	8'
Street Buffer	The street buffer is the space between the travel or parking lanes and the bikeway or sidewalk. Where on-street parking is present, a minimum 3' door swing zone is required between the face of curb and any adjacent pedestrian or bicycle facility. Open section roadways, see 3.8.	110	8' default, 6' min	6'; 11' if shared w/ street parking	8' default, 6' min	8' default, 6' min	6'	6'	6'	6'	6'	10' (open section roads: see 3.8)	8' default, 6' min	As wide as feasible (10' min)
Default Bikeways Types and Widths	Default bikeway types apply to streets without master planned bikeways. The widths apply to master planned and non-master planned bikeways. SBL = Separated Bike Lane. Dimensions do not include the street buffer (see below) or Ped / Bike buffer. If bikeway is at street level and adjacent to the curb, dimensions include the gutter pan. For corridors designated as Breezeways, see additional guidance in the Bicycle Master Plan.	185	Two-Way SBL on both sides of street. Each SBL: 11' default; 8' min	One-way SBL: 6.5' default; 5' min	Sidepaths on both sides of the street. Each sidepath: 11' default; 8' min	Two-Way SBL on both sides of street. Each SBL: 11' default; 8' min	One-way SBL: 6.5' default; 5' min	Sidepath on one side of the street: 10' default; 8' min or Bike Lanes: 5'-6'	Neighborhood Greenway; Shared Lanes; or Advisory Bike Lanes (for design guidance, see Bicycle Facility Design Toolkit)	N/A*	One-way SBL: 6.5' default; 5' min or Sidepath on one side of the street: 10' default; 8' min	Bikeable Shoulders: 10' (5' min) or Sidepath on one side of the street: 10' default; 8' min	Bikeable Shoulders: 8' (5' min) or Sidepath on one side of the street: 10' default; 8' min	Sidepath on both sides of street. Each sidepath: 11' default; 8' min
Ped / Bike Buffers	Only required when a separated bike lane is provided.	167	6' default, 2' min	6' default, 2' min	6' default, 2' min	6' default, 2' min	6' default, 2' min	6' default, 2' min	6' default, 2' min	N/A	6' default, 2' min	6' default, 2' min	N/A	6' default, 2' min
Sidewalk / Sidepath	For values with dimensions for both a sidewalk and sidepath, see Bicycle Master Plan to determine which facility is planned. Using the minimum dimension requires a waiver – consult MCDOT.	118	sidewalk: 15' default; 10' min	sidewalk: 10' default; 8' min	11' default/ 8' min for sidepath	10' default; 8' min	10' default; 8' min	6' min for sidewalk or 10' default/ 8' min for sidepath	sidewalk: 6' min	sidewalk: 6' min	6' min for sidewalk or 10' default/ 8' min for sidepath	6' min for sidewalk or 10' default/ 8' min for sidepath	6' min for sidewalk or 10' default/ 8' min for sidepath	11' default/ 8' min for sidepath
Frontage Zone	Not required on all streets. Some or all of the frontage zone may occur on private property.	119	10' default; 0' min	10' default; 0' min	7' default; 0' min	7' default; 0' min	7' default; 0' min	0'	0'	0'	6' default; 0' min	0'	0'	N/A
Maintenance Buffer	Structures not part of the roadway design shall not occur in the public ROW. If there is a structure abutting the property line, a maintenance buffer is required even if this table shows a dimension of 0'. Consult MCDOT.	107	0'	0'	2'	0'	0'	2'	2'	2'	2'	2'	2'	N/A

Figure A-1 continued. Street design parameters summary

* Bikeways are not generally considered along this street type, unless otherwise specified in the Bicycle Master Plan.

A.2 Street Design in Constrained Rights of Way

In places with constrained rights of way, it is not always feasible to include every desired design element or preferred width in the street cross section. The most common examples of constrained rights of way are historic districts, environmental areas (special protection areas, steep slopes, critical habitat, wetland, floodplain), bridges or other major structures. In areas like these, some cross section elements may be eliminated, and some may be reduced to minimum dimensions. While there may be trade-offs between different design elements or travel modes, the street design should always encourage active transportation options such as bicycling and walking.

Figure A-2 is intended to guide decision-making in cases with limited right-of-way. The letters in the table designate street design elements as high (H), medium (M), or low (L) priority. Designations are relative to other street elements (i.e., a low priority does not mean the element is not important to include when feasible.) This table is intended as a starting point for conversations between roadway designers and the community as part of individual corridor or street design efforts. Ultimate dimensions are context-specific and will be finalized through a case-by-case review and design process. Additionally, master plans may make modifications to the street design elements for specific roadways. More detail on each design element is provided in previous chapters.

What do the numbers in Figure A-2 mean?

Median	Medians are not essential on all streets. A low ranking (L) implies that they may be eliminated. A high ranking (H) indicates that it is recommended to include them even if minimum dimensions are used.
Travel Lane Width	A low ranking indicates that, in constrained rights of way, the outside travel lane width may be reduced to match the width of the inside travel lanes.
On-Street Parking	On-street parking is not essential on all streets. A low ranking implies that it may be eliminated or repurposed for other curbside uses, such as ride hailing, deliveries, etc. A high ranking indicates that it is recommended to include it even if minimum dimensions are used.
Dedicated Transitway	Information on the presence and design of dedicated bus/transit lanes is provided in the Master Plan of Highways and Transitways.
Shoulder	Shoulders are not essential on all streets. A low ranking implies that they may be eliminated.
Street Buffer	In constrained environments, the default Street Buffer width is a higher priority than the default Bikeway width.
Bikeway	For corridors designated as Breezeways, the priority is always High (see additional requirements in the Bicycle Master Plan).
Ped / Bike Buffer	Provided only if a separated bike lane is provided.
Sidewalk / Sidepath	This element is intended to be free of obstructions and promote ease of navigation
Frontage Zone	For the Frontage Zone, a low priority indicates that the Frontage Zone may be eliminated or provided on private property.
Maintenance Buffer	A Maintenance Buffer is not essential on all streets. A low priority ranking for this zone implies that it may be eliminated.

LEGEND

H = highest priority

M = medium priority

L = lowest priority

+Priorities apply only to streets where Dedicated Transitways are identified in a Master Plan.

* Because a sidepath is the default bicycle/pedestrian facility, the Bikeway may often be accounted for as part of the Sidewalk / Sidepath.

	Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway
Median	M	L	M	M	L	L	L	N/A	L	L	L	H
Travel Lane Width	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
On-Street Parking	L	M	L	M	L	L	L	H	M	N/A	N/A	N/A
Dedicated Transitway+	M	M	M	M	M	N/A	N/A	N/A	M	N/A	N/A	M
Shoulder	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	M	H	H
Street Buffer	H	H	H	H	H	H	M	M	M	H	M	H
Bikeway	H	H	H	H	H	M	M	N/A	M	M*	M*	M*
Ped / Bike Buffer	M	M	M	M	M	M	M	N/A	M	M	N/A	H*
Sidewalk / Sidepath	H	H	H	H	H	H	H	H	H	H*	H*	M*
Frontage Zone	M	M	L	M	M	N/A	N/A	N/A	L	N/A	N/A	N/A
Maintenance Buffer	N/A	N/A	L	N/A	N/A	L	L	L	L	L	L	N/A

Figure A-2. Priorities in constrained rights of way

A.3 Prioritizing Street Design Features

Figure A-3 provides guidance on whether specific street design features are desired or appropriate on various street types. This figure is intended as a reference to inform choices for individual streets; however, final design decisions will be context specific. More detailed guidance on these street elements is provided in previous chapters. Design guidance presented in master plans for specific streets will supersede the information presented here.

Note: For intersection guidance presented in Figure A-3, if the intersecting streets are different street types (e.g., at the intersection of a Boulevard and a Town Center Boulevard), use the guidance for the street type with the higher design speed.

LEGEND

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- x Not Permitted or N/A
- * Unless determined otherwise by Planning Board

Zone	Feature	Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway	Page Reference
ACTIVE ZONE	Trees/Landscaping in Buffer	■	■	■	■	■	■	■	■	▲	▲	▲	▲	166
	Green Infrastructure/Rain Gardens	■	■	■	■	■	■	■	■	▲	▲	▲	▲	171
	Seating	■	■	O	■	■	O	O	O	O	O	x	x	67
	Bicycle Parking	■	■	O	■	■	O	O	O	▲	O	x	x	68
	Recycling/Trash Receptacles	▲	▲	O	▲	▲	O	O	O	▲	O	x	x	73
	Plazas/Parklets	▲	▲	O	O	▲	O	O	O	O	O	x	x	99
	Bikeshare Stations/Dockless Parking Hubs (if in bikeshare/dockless service area)	■	■	O	▲	▲	O	O	O	O	O	x	x	69
	Pedestrian-Scale Lighting	■	■	■	■	■	▲	▲	▲	O	O	O	O	86
	Pedestrian/Bicycle Wayfinding	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	O	77
	Sidewalk-Level Driveways	■	■	■	■	■	■	■	■	■	■	■	x	85
INTERSECTIONS	Roundabouts (Modern or Mini)	O (Engineering judgement needed – see Chapter 6: Intersections for details)												132
	Crossing Islands	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	▲	152
	Pedestrian Signals (when traffic signals are present) or Beacons	■	■	■	■	■	■	■	■	■	▲	▲	■	149
	Pedestrian Recall on Signals	▲	▲	▲	▲	O	O	O	O	O	x	x	x	155
	Pedestrian Lighting (unless pedestrians are prohibited, e.g., some Major Highways)	■	■	■	■	■	■	■	■	■	■	■	■	86
	Protected Intersections, Bike Boxes, or Two-Stage Queue Boxes	(Required at all intersections with existing or planned separated bike lanes, sidepaths, buffered bike lanes or conventional bike lanes.)												136
	Bicycle Markings/Facilities (when bikeways are present)	■	■	■	■	■	■	■	■	■	■	■	■	138
SPEED MANAGEMENT	Lane Diet	▲ (narrowing lanes down to default dimensions for street type)												211
	Road Diet (if volumes meet thresholds for road diet)	O	O	O	O	O	x	x	x	O	O	O	O	210
	Speed Humps/Cushions	O	O	x	O	O	O	O	O	O	x	x	x	212
	Speed Tables/Raised Crosswalks	O	▲	x	O	▲	O	O	O	O	x	x	x	213
	Raised Intersections	O	▲	x	O	▲	O	O	O	O	x	x	x	213
	Curb Extensions/Bulb Outs	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	O	213
	Neckdowns/Chokers	▲	▲	▲	▲	▲	▲	▲	▲	▲	O	O	O	214
	Traffic Diverters	x	x	x	x	x	x	O	O	O	x	x	x	209
	Chicanes/Roadway Curvature	▲	O	O	▲	O	O	O	O	O	O	O	x	214
	Textured Paving Treatment	O	O	O	O	O	O	O	O	O	x	x	x	216
STREET ZONE	Green Infrastructure in Median (when median is present)	▲	▲	▲	▲	▲	▲	▲	x	▲	▲	▲	▲	171
	Street Trees/Landscaping in Median (when median is present)	■	■	■	■	■	■	■	x	■	■	■	■	166
	Minimize/Consolidate Driveways	■	■	■	■	■	▲	O	O	■	▲	▲	O	119
	Undergrounding Utilities (Master Plan recommendations supersede this guidance)	■	■	O	■*	■*	O	O	O	O	O	O	O	108
	Transit Shelters (where transit routes are present and boarding thresholds are met)	▲	▲	▲	▲	▲	▲	O	O	▲	▲	▲	O	82
	Loading/Pick-up and Drop-off Zones	▲	▲	O	▲	▲	O	O	O	O	O	O	x	100
	Accessible Parking	▲	▲	O	O	▲	O	O	O	O	x	x	x	97
	Carshare Parking	▲	▲	O	▲	▲	O	O	O	O	x	x	x	101
	E/V Charging Stations	▲	▲	O	O	▲	O	O	O	O	x	x	x	98

Figure A-3. Street design features

MONTGOMERY COUNTY COMPLETE STREETS

February 2021