



ALEXANDRIA COMPLETE STREETS DESIGN GUIDELINES

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Portions of these Guidelines were derived from the Boston Complete Streets Guidelines, prepared by the City of Boston Transportation Department, with permission.

Intent Of The Guidelines

The intent of the Complete Streets Design Guidelines is to ensure that Alexandria's streets meet the needs of all users, including pedestrians, bicyclists, transit users, drivers, residents, workers, visitors, and business owners. The Guidelines are intended to clearly communicate expectations regarding the design of the City's public and private streets.

Many of Alexandria's recent Small Area Plans have called for a green street approach that combines street design with environmental mitigation (i.e. reductions in impervious surfaces, onsite stormwater treatment, and other measures). As a part of the City's efforts to meet environmental goals, green street elements and best management practices (BMPs) have been incorporated into these Guidelines.

The City of Alexandria endorsed the *National Association of City Transportation Officials (NACTO) Urban Street and Bikeway Design Guides* on August 13th, 2015. These guides form the basis of the street design guidance contained in this document and are important reference documents for street design. In addition, the Alexandria Complete Streets Design Guidelines are consistent with, and have been developed to supplement, existing engineering and environmental manuals and standards including the Manual of Uniform Traffic Control Devices (MUTCD) and guidance issued by the American Association of State Transportation Officials (AASHTO).

These Guidelines apply to all street projects in the City. The Guidelines are designed to be comprehensive, covering all aspects of street design. Where necessary, these Guidelines refer the reader to other City policies and design guides.

The Guidelines were formed around the current best practices in street design in Alexandria, the metropolitan DC area, and around the world. As such, they are intended to evolve and adapt to incorporate new treatments and techniques as they are developed and proven. The Guidelines encourage tailoring designs to meet the needs relevant to each neighborhood context. These guidelines are therefore intended to be flexible and responsive to unique site circumstances. In all cases, street design will be subject to staff approval based on these design guidelines and professional judgment.

Audience

The Guidelines are a resource for City departments, design professionals, and private developers and their consultants. Though not intended as a primary audience, they may also serve as reference for elected officials, neighborhood groups, advocates, and interested residents.

Process for Design Exceptions

Many aspects of design require coordination with various City departments and commissions. These departments and commissions are responsible for approving various aspects of street design, as specified throughout this document.

In cases where a modification is desired, applicants should submit a completed Alexandria Design Exception form. All exceptions must be signed off on by the Director of the Department of Transportation and Environmental Services or the relevant department.

At the discretion of the department responsible for reviewing the modification, additional information may be required beyond that which is included in the City form.

1 OVERVIEW



Complete Streets are streets that are designed to work for all users. On any given street this may include pedestrians, transit users, bicyclists, and motor vehicle drivers of all ages and abilities. Complete streets are a cornerstone of Alexandria's vision for maintaining and enhancing the City's livability and quality of life. Alexandria's streets have

evolved over centuries of growth and development. Some areas of the city are easily experienced on foot or by bicycle, while other areas are oriented toward motor vehicles. The Guidelines include designs that rebalance the use of Alexandria's streets so that walking, bicycling and transit are safe and are top priorities for the City.

Vision

Streets are vital to the health, mobility, and accessibility of Alexandria’s residents, workers, and visitors. Alexandria aspires to have a comprehensive, integrated transportation network with design that allows safe and convenient travel for people of all ages and abilities, including children, older adults and individuals with disabilities. The network should accommodate all users, including pedestrians, bicyclists, transit users, and motorists and incorporate green infrastructure to enhance the city’s environmental quality.

Guiding Principles

The vision is implemented through complete street design guidance that follows and advances **five core principles**:



ACCOMMODATE ALL MODES OF TRAVEL

Alexandria’s streets should be safe and convenient for people walking, bicycling, taking transit and using motor vehicles. Projects that impact the public right-of-way will consider the characteristics of all modes of travel so that all users are safe and comfortable.



HEALTH AND SAFETY FOR ALL USERS

Street design in Alexandria should take into account the safety of all users, including children, older adults and individuals with disabilities with a particular emphasis on the protection of vulnerable road users. Alexandria’s streets should encourage walking, bicycling and taking transit as safe, convenient modes of transportation that promote health and independence for all people. Street design will minimize impacts of traffic and strive to protect all users.



NEIGHBORHOOD AND ECONOMIC VITALITY

Alexandria is a city of great neighborhoods. Street design will help to support sustainable neighborhoods by providing more efficient multimodal access between destinations and by creating neighborhoods that attract people and strengthen local economies.



PLACEMAKING AND NEIGHBORHOOD CHARACTER

Streets represent the largest public resource by area in Alexandria. Their design and function should enhance the public realm and create multifunctional places that attract people and commerce. Street design should maintain, and in some cases accentuate, the history and identity of each neighborhood and commercial district while allowing for flexibility in design to strengthen the attributes that make these areas unique.



SUSTAINABLE DESIGN

Transportation projects should emphasize design techniques that reduce lifecycle costs and integrate green infrastructure to improve street tree health, treat stormwater runoff, and improve environmental quality.

Supporting Policies and Documents

Relationship between the Alexandria Complete Streets Guidelines and Small Area Plans:

The Complete Streets Guidelines are intended to supplement the Small Area Planning Process. There are a variety of Small Area Plans (see list and links below) that pre-date the Complete Streets Guidelines. Some of these Small Area Plans address street design. On matters of basic design policy (dimensions, allowable materials, accessibility, design measures related to safety), the Complete Streets Guidelines supercede guidelines found in Small Area Plans. On matters of aesthetic design treatments, or where specific design elements have been selected for consistency and context (for example street tree choices, bench and lighting types, and other similar design issues, Small Area Plans should be followed.

Future Small Area Plans should not conflict with this Guide and should refer to this Guide for more detail on street design.

Small Area Plans that pre-date the Complete Streets Guidelines include the following:

Alexandria Master Plan (and Small Area Plans)

<http://alexandriava.gov/planning/info/default.aspx?id=44614>

- MVA Business Area Plan
- Carlyle Streetscape Design Guidelines
- Etc.

For a map of Alexandria's Small Area Plans, [click here](#).

Complete Streets Policy

<https://alexandriava.gov/uploadedFiles/tes/info/1-6-2010%20Complete%20Streets%20update%281%29.pdf>

Comprehensive Transportation Master Plan

<http://alexandriava.gov/tes/info/default.aspx?id=3088>

Pedestrian and Bicycle Mobility Plan

https://www.alexandriava.gov/uploadedFiles/tes/info/FINAL_FULLPLAN_060108.pdf

Eco-City Charter 2008

https://www.alexandriava.gov/uploadedFiles/tes/info/FINAL_FULLPLAN_060108.pdf

Environmental Action Plan 2030

http://alexandriava.gov/uploadedFiles/tes/eco-city/EAP_FINAL_06_18_09.pdf

Energy and Climate Change Action Plan

<http://alexandriava.gov/uploadedFiles/tes/eco-city/DraftEnergyClimateActionPlan03.14.2011.pdf>

2010 Strategic Plan

<https://alexandriava.gov/uploadedFiles/council/info/ApprovedStrategicPlan.pdf>

Green Sidewalks BMP Design Guidelines

<http://alexandriava.gov/uploadedFiles/tes/info/GreenSidewalksBMPDesignGuidelines%20.pdf>

Landscape Guidelines

https://alexandriava.gov/uploadedFiles/recreation/info/040907_land_guidelines.pdf

Urban Forestry Master Plan

<https://www.alexandriava.gov/uploadedFiles/recreation/info/UFMP%20Final.pdf>

Natural Resource Management Plan

<http://alexandriava.gov/recreation/info/default.aspx?id=48838>

Citywide Parks Improvement Plan

<http://alexandriava.gov/recreation/info/default.aspx?id=65170>

Water Quality Management Supplement

https://alexandriava.gov/uploadedFiles/planning/info/masterplan/Alexandria_Water_Quality_Master_Plan_2001.pdf

2 STREET TYPES



Street Typology Overview

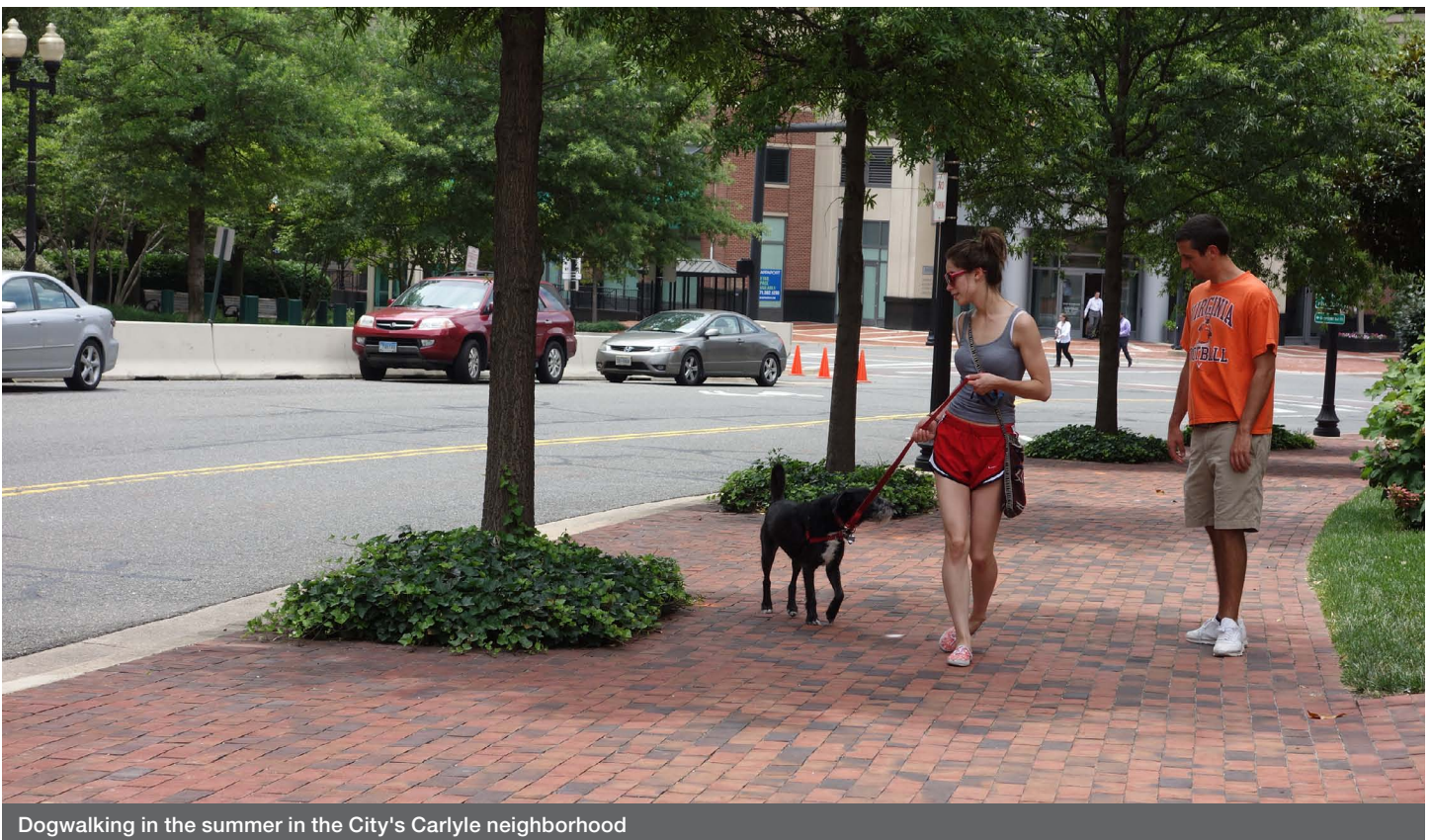
The Guidelines present a set of street types that classify Alexandria's streets to incorporate street character and adjacent land uses — both existing, planned and desired. These new typologies provide a classification system that will help guide future land development, street improvements and road design projects. Streets and public rights-of-way comprise a large portion of the land area of the City of Alexandria and have tremendous influence on economic development and vibrant public life.

The new typologies supplement and enhance the traditional functional classification system. The typologies are unique to the conditions and contexts of Alexandria and provide a roadmap for street design that implements the objectives of the **Comprehensive Transportation Master Plan, Small Area Plans** and the land use vision for the City. The typologies ensure that all modes of travel are safely accommodated, but in general prioritize the needs of pedestrians, bicyclists, and transit riders. This approach does not require transit and/or bikes to be accommodated on every street, rather their accommodation will be determined as part of an overall network (e.g. within mode-specific plans).

Complete streets are healthy streets — both for people, residents and the local and regional economies. They strike a sustainable balance among competing demands. They ensure an overall network that provides for the movement of people of every ability and income level to meet the travel demands of daily life and the movement of freight. Complete Streets also include public spaces that reflect the character and pride of local communities.

Because land use contexts can change throughout the length of a corridor, typologies may change as part of a planning process or significant redevelopment. For example, a corridor may be categorized primarily as a Neighborhood Connector, however a commercial node along it may result in a segment being classified as a Main Street. Street design elements will change accordingly, reflecting the designated street type and its economic and mobility objectives.

Each chapter of this document offers guidance on how different elements of the public realm such as roadways, sidewalks, intersections, and curbside uses should function with respect to typologies.



Dogwalking in the summer in the City's Carlyle neighborhood

Functional Classification

Functional street classification systems such as those promoted by the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) Green Book establish a street hierarchy emphasizing automotive mobility versus property access. This traditional functional classification system is built almost exclusively around a vehicular construct rather than a multimodal perspective of person throughput and goods movement. Expected and accommodated traffic volumes and travel speeds are often based on the assigned classification.

- **Arterial** roadways are expected to emphasize “mobility” (vehicle throughput) over “access” (local economic exchange). These streets, under the traditional system, have typically been designed to facilitate higher vehicle speeds and longer trips with less emphasis on access to and from adjacent properties.
- **Collectors** are expected to balance mobility and access. These streets tend to provide for the throughput of vehicles while still accommodating access to the businesses and properties that line them.
- **Local streets** emphasize access over mobility. They are not expected to serve through traffic, but instead provide access to end of trip destinations.

The functional classification system is the basis for most local, state, and national roadway design manuals and often determines how state and federal transportation funding resources can be applied to the roadway system.

The system of functional classification evolved from a rural context and lends itself well where streets cross long expanses of farmland or forest to connect to, or between, small town centers. However, this classification system breaks down in complex urban environments where corridors may emphasize both mobility and access to intense activity along a dense and interconnected street network.

A more nuanced approach that reflects the diverse uses and functions of Alexandria’s streets is necessary to supplement the traditional functional classification system. Alexandria’s street typologies were developed to provide additional guidance during the selection of street design elements as well as to help inform choices made during the visioning process of a corridor redesign project.



Arterial



Collector



Local

Alexandria Street Typology

Alexandria's street typologies offer a balance between functional classification, adjacent land uses, and the competing needs of all modes of transportation. Each street typology prioritizes users and various design elements based on the context and character of the street. Within Alexandria's constrained public right-of-way, trade-offs must be balanced and should encourage healthy and active transportation options such as bicycling and walking.

The City is undertaking an effort to identify a Street Typology map.



Commercial Connector



Main Street



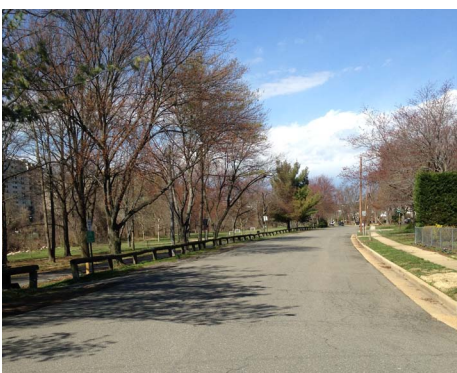
Mixed-Use Boulevard



Neighborhood Connector



Neighborhood Residential



Parkways



Industrial



Shared Street

COMMERCIAL CONNECTOR



Duke Street

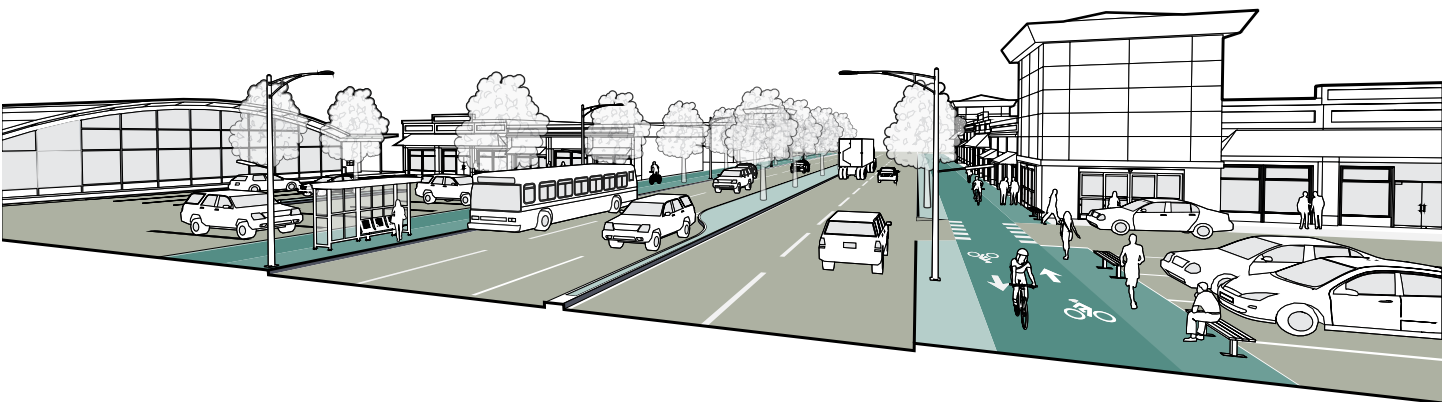
Commercial Connectors typically serve employment and entertainment centers, civic, commercial, and institutional land uses. These streets are currently dominated by motor vehicle traffic and have less pedestrian and bicycle activity. In Alexandria, these corridors often provide regional connections. Street design for Commercial Connectors emphasizes safety for pedestrians and bicyclists by focusing on providing appropriate sidewalks, opportunities for pedestrians and bicyclists to safely cross the street, and separation from high volumes of traffic.

EXAMPLES INCLUDE:

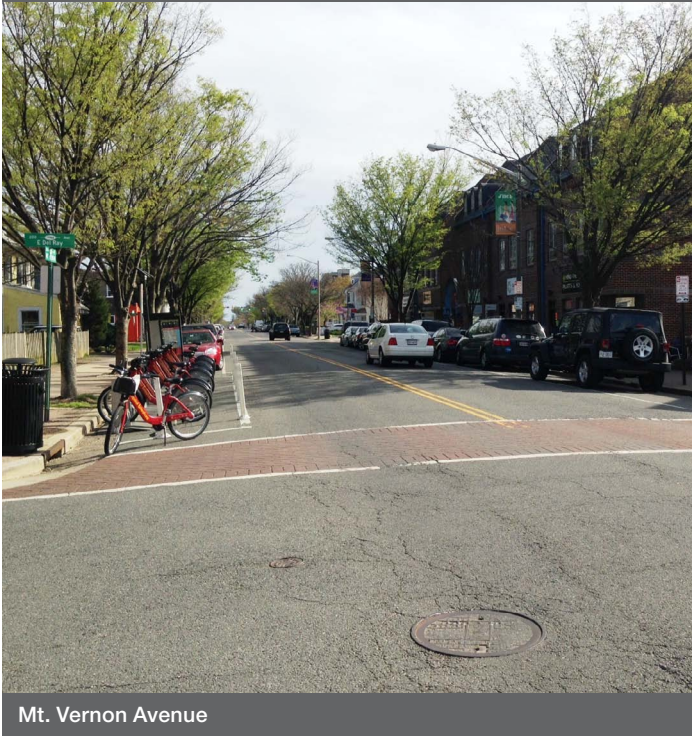
Duke Street (west of Roberts Lane), Braddock Road (west of King Street), Pickett Street, Jefferson Davis Highway, Seminary Road (west of Howard Lane), Duke Street (west of Masonic Temple), Van Dorn Street, and King Street (west of Quaker Lane).

KEY FEATURES

- Land uses: employment and entertainment centers, retail and services
- Buildings generally set back from road
- Serves longer trip lengths and regional destinations
- Dominated by motor vehicle traffic
- Serves transit therefore pedestrian safety is a priority



MAIN STREET



Main Streets are destinations. In Alexandria, they tend to serve small and medium sized businesses, restaurants, civic buildings or residences. Regardless of location or density, buildings are generally located close to the street. In their present form, these streets already have significant pedestrian and bicycle activity and typically offer on-street parallel parking. They almost always have enhanced streetscapes, however sidewalk widths may vary. Street design for Main Streets focuses on retaining and reinforcing the character of the neighborhood. It also looks to 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.

EXAMPLES INCLUDE:

Mount Vernon Avenue, King Street (in Old Town), and Brenman Park Drive in Cameron Station.

KEY FEATURES

- Land uses: serves small and medium sized businesses, occasional residential
- Buildings close to street
- Heavy pedestrian and bicycle activity
- Enhanced streetscape with amenities
- On-street parking



MIXED-USE BOULEVARD



Jamieson Avenue

Mixed Use Boulevards serve areas that generally have taller (five stories or more) buildings that house a mix of retail, residential, office and entertainment uses. Due to the scale of buildings lining Mixed Use Boulevards in Alexandria, these streets often have wider sidewalks. These sidewalks may feature street streets, furnishings, and planted medians. Mixed Use Boulevards may be located in areas that have specific design requirements for finishes, materials, furnishings and lighting. In their present form, these streets already have pedestrian and bicycle activity, in addition to frequent parking turnover and higher traffic volumes. Mixed Use Boulevards are usually located near transit stations and as such are frequently key routes in the transit network. Street design for Mixed Use Boulevards should focus on reducing traffic speed and providing safe and convenient pedestrian, bicycle, and transit choices.

EXAMPLES INCLUDE:

Eisenhower Avenue in Carlyle, Jamieson Avenue, Washington Street.

KEY FEATURES

- Land uses: serves a mix of retail, residential, office and entertainment
- Medium to high density
- Medium to heavy pedestrian and bicycle activity
- May have specific design requirements
- On-street parking



NEIGHBORHOOD CONNECTOR



Neighborhood Connectors primarily serve residential land uses, though some businesses may be integrated into the street fabric. These streets have longer blocks and often serve faster moving traffic. Neighborhood Connectors are currently dominated by 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 speeds, improving crossings, tree plantings, street lighting, and providing sidewalks and potentially bikeways.

EXAMPLES INCLUDE:

Russell Road, Janneys Lane, King Street (north of Masonic Temple), Braddock Road (east of King Street), Quaker Lane, and Commonwealth Avenue.

KEY FEATURES

- Land uses: residential, with occasional businesses
- longer block lengths
- Serves faster moving traffic
- Often serves transit therefore pedestrian safety is a priority
- Bicyclists use these streets when Neighborhood Residential streets don't connect



NEIGHBORHOOD RESIDENTIAL



Typical neighborhood residential street in Alexandria

Neighborhood Residential streets serve residential areas with low levels of motor vehicle traffic. Pedestrian and bicycle activity is common along these streets. Most, but not all, neighborhood residential streets in Alexandria have sidewalks and offer on-street parking. Design for neighborhood residential streets should focus on encouraging slow speeds, pedestrian safety, healthy street trees, and well defined routes to nearby parks, transit, and schools.

EXAMPLES INCLUDE:

Fontaine Street, Cambridge Road, and St. Stephens Road

KEY FEATURES

- Land use: residential
- Low motor vehicle speeds and volumes
- On-street parking
- Medium to heavy pedestrian and bicycle activity, especially during weekends and on evenings



PARKWAYS



Holmes Run Parkway

Parkways extend through or along natural areas or large parks where there is a desire to maintain or create a park-like feel to the street. Elements often include wide planted medians, and shared use paths alongside the road instead of sidewalks. Parkway design should focus on minimizing impacts to the adjacent natural areas and maintaining the park-like character. This may be accomplished through the use of more natural materials such as wood or stone, and by installing shared use paths rather than sidewalks, among other strategies.

EXAMPLES INCLUDE:

Holmes Run Parkway, Timber Branch Parkway, Taylor Run Parkway

(It is important to note that not all streets with “Parkway” in their name meet the criteria for this typology.)

KEY FEATURES

- Land use: adjacent to parks and other natural areas
- Natural material on structures and railings
- Shared use paths instead of sidewalks



INDUSTRIAL



Typical industrial street in Alexandria

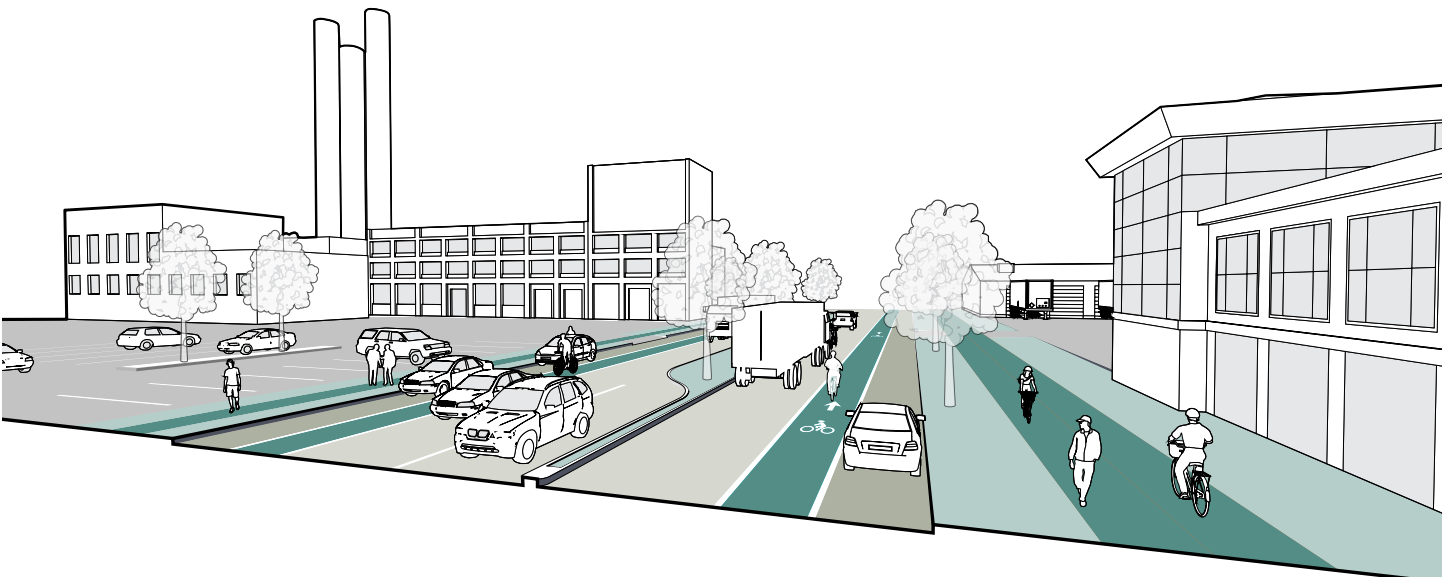
These streets serve industrial corridors and are built to accommodate commercial trucks. While there may be fewer pedestrians and bicyclists in these locations, these streets may also serve as through-routes to adjacent uses. Design considerations for industrial streets should focus on accommodating truck traffic and providing adequate lane width and turning radii, while also accommodating pedestrians and street trees.

EXAMPLES INCLUDE:

Eisenhower Avenue west of Van Dorn Street, Edsall Road, Wheeler Avenue, Van Dorn Street (near Pickett Street), Business Center Drive, and Colvin Street

KEY FEATURES

- Land use: industrial
- Built to accommodate trucks
- Fewer pedestrians and bicyclists, however they often must pass through these areas



SHARED STREETS



TheFridayCycloTouriste

Cady's Alley in Georgetown

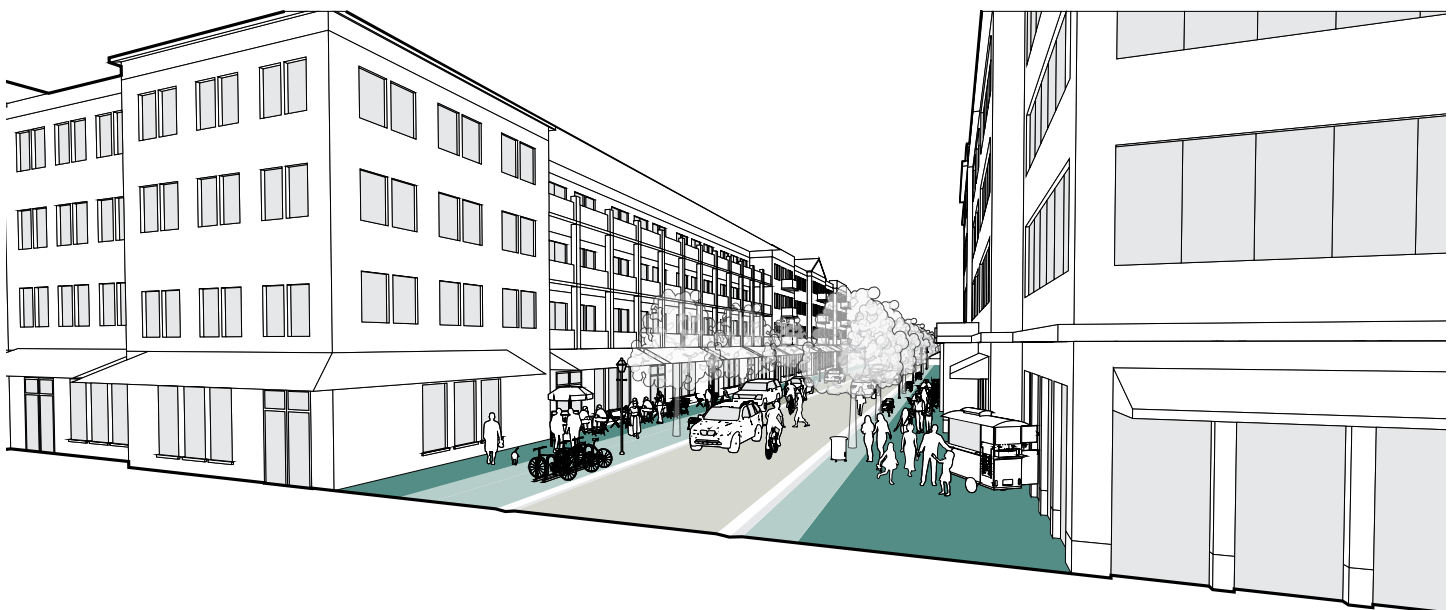
Shared Streets provide a single grade or surface that is shared by people using all modes of travel at extremely low speeds. They are often curbsless and the sidewalk is blended with the travel way. They can support a variety of land uses, including commercial, entertainment, dining, and residences. Design considerations for Shared Streets should include strategically defined edges and zones, and unique paving materials where feasible.

EXAMPLES INCLUDE:

Belle Pre Way (Parker-Gray), Snowden Hallowell Way (Parker-Gray) share some of the characteristics of Shared Streets

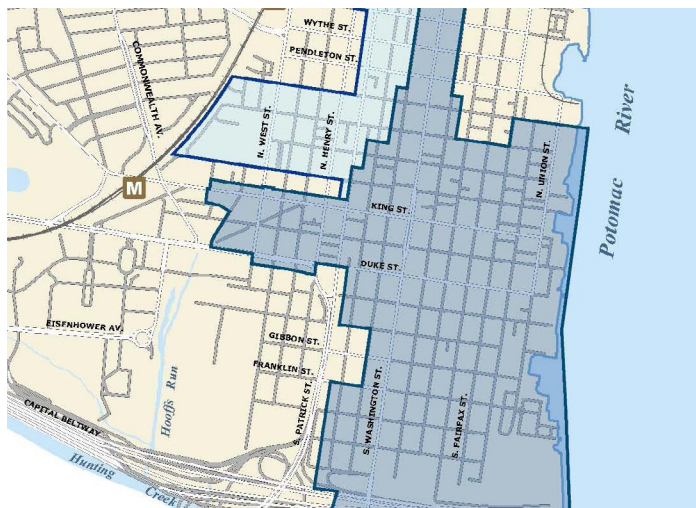
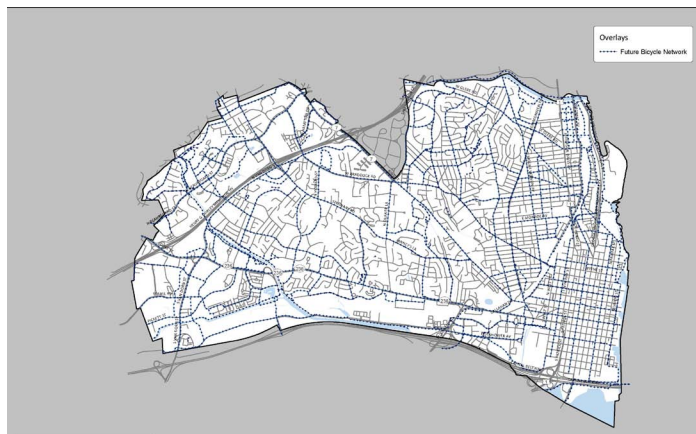
KEY FEATURES

- Land use: multiple
- Curbsless street, sidewalk is blended with travelway
- All modes share the same space
- Extremely low speeds
- Unique paving material where feasible



Street Overlays

Overlays provide an added modal emphasis to some streets. While all streets will fall into a street typology, a few streets will have multiple overlays in order to provide



additional guidance regarding functional priority. The overlays will also assist in navigating trade-offs and allocation of right-of-way in street design.

TRANSIT STREETS

A Transit Street is one that emphasizes transit by employing designs that make it safe for transit to operate in mixed-traffic. The design of Transit Streets provides easy access to transit for all potential users, including people with disabilities. A Transit Street contains a high level of transit service and/or numerous transit routes. This category is not intended to encompass all streets where transit exists, rather the more transit-intensive streets.

BICYCLE NETWORK STREETS

These streets were designated as part of the Citywide Bicycle Network in the 2016 Update to the Pedestrian and Bicycle Chapter of the Transportation Master Plan. Bicycle Network Streets connect important destinations in Alexandria and will feature some form of bicycle facility, ranging from a signed route to a sidepath or protected bicycle lane. Projects will be implemented as part of street repaving, redevelopment, or as standalone capital projects. Decisions about the design and facility type for each Bicycle Network Street will be made based on additional public input and analysis.

HISTORIC STREETS AND ALLEYS

These are streets that are located in a **historic district** or **National Register Historic District**. Priority is on the preservation of historical or original layout and materials to comply with design guidelines and policies. The size, spacing, and orientation of many of these streets were a primary feature of the 1749 plan of Alexandria and later the George Washington Memorial Parkway. Street design should preserve, and in some cases accentuate, the history and identity of these streets without detracting from the historic buildings that frame these streets.

Examples: Old and Historic Alexandria District, Parker–Gray Historic District, Del Ray.

Using Street Types in Complete Streets

Street design is a process of evolution and refinement. Street typologies provide a starting place from which each street can be individually tailored to leverage the land uses and activities along it. Street typologies do not provide an absolute formula for right-of-way distribution. Instead, street typologies can serve as models or provide options for communities to make informed choices as part of a planning or redesign process for each street. They can also help set objectives to be advanced and emphasized through street design to help ensure that context and character is reflected in the design and use of Alexandria's public space.

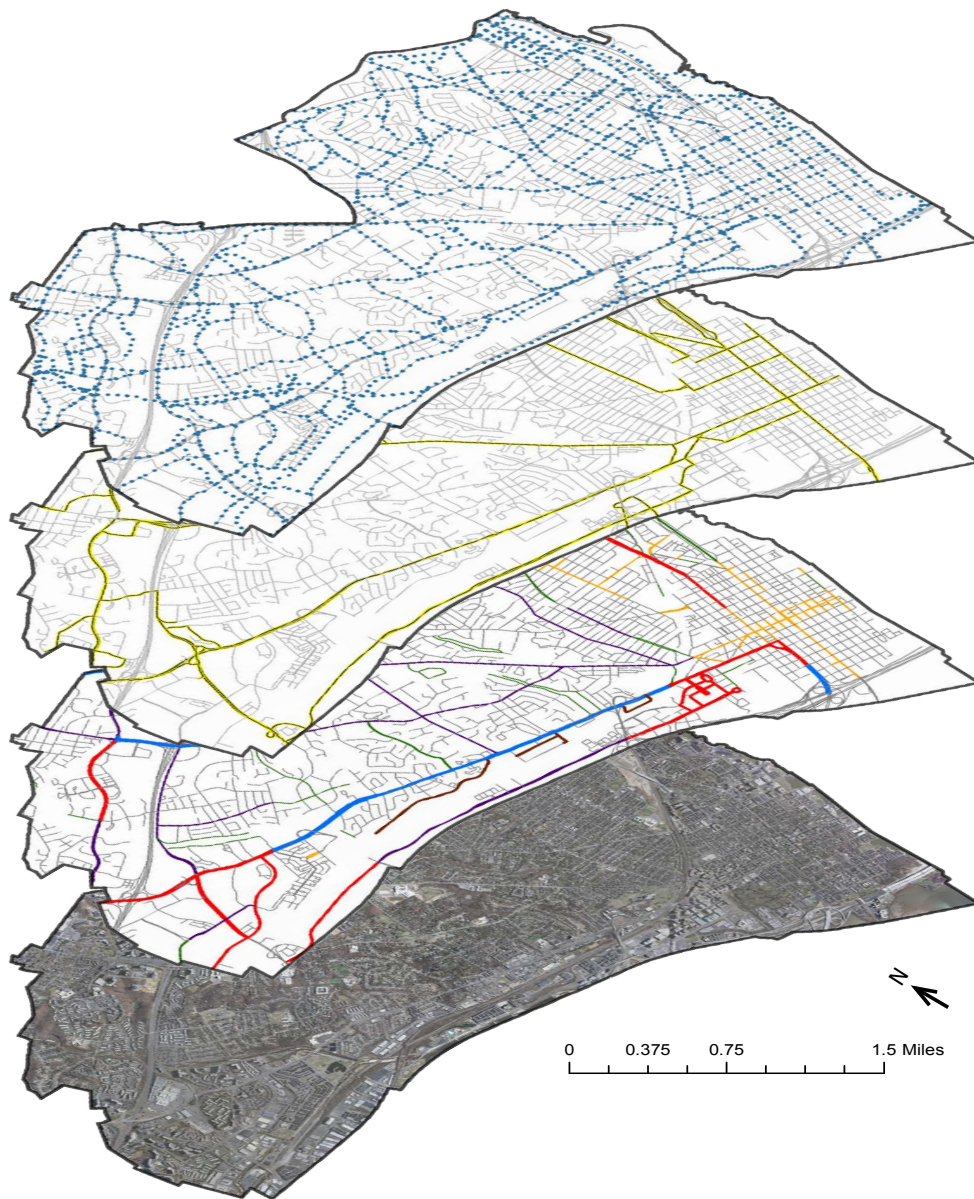
LINKS

Historic District Boundary Map

https://www.alexandriava.gov/uploadedFiles/gis/info/2013_HistoricDistricts.pdf

National Register Historic District

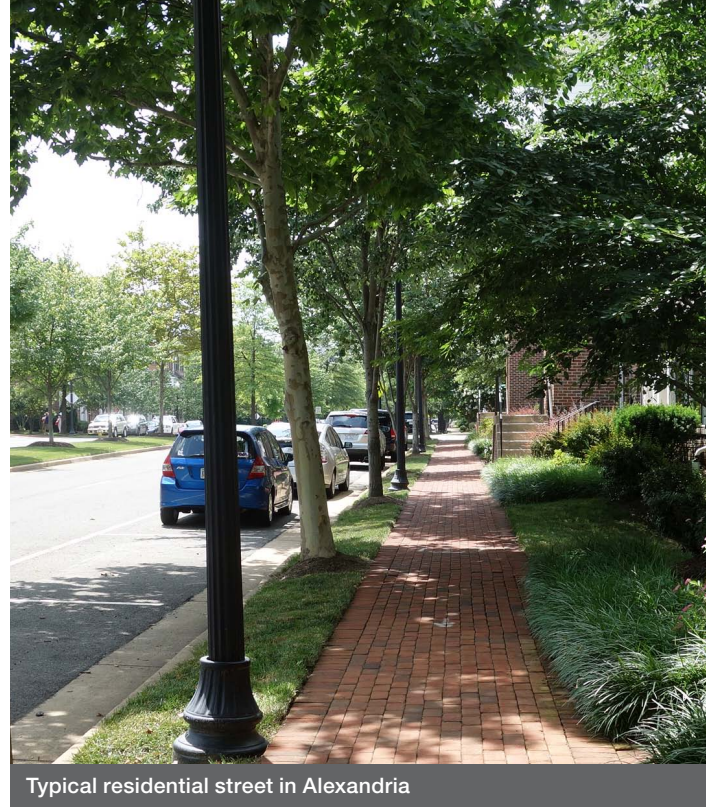
<https://www.alexandriava.gov/historic/info/default.aspx?id=29750>



3 SIDEWALKS



Typical retail street in Alexandria



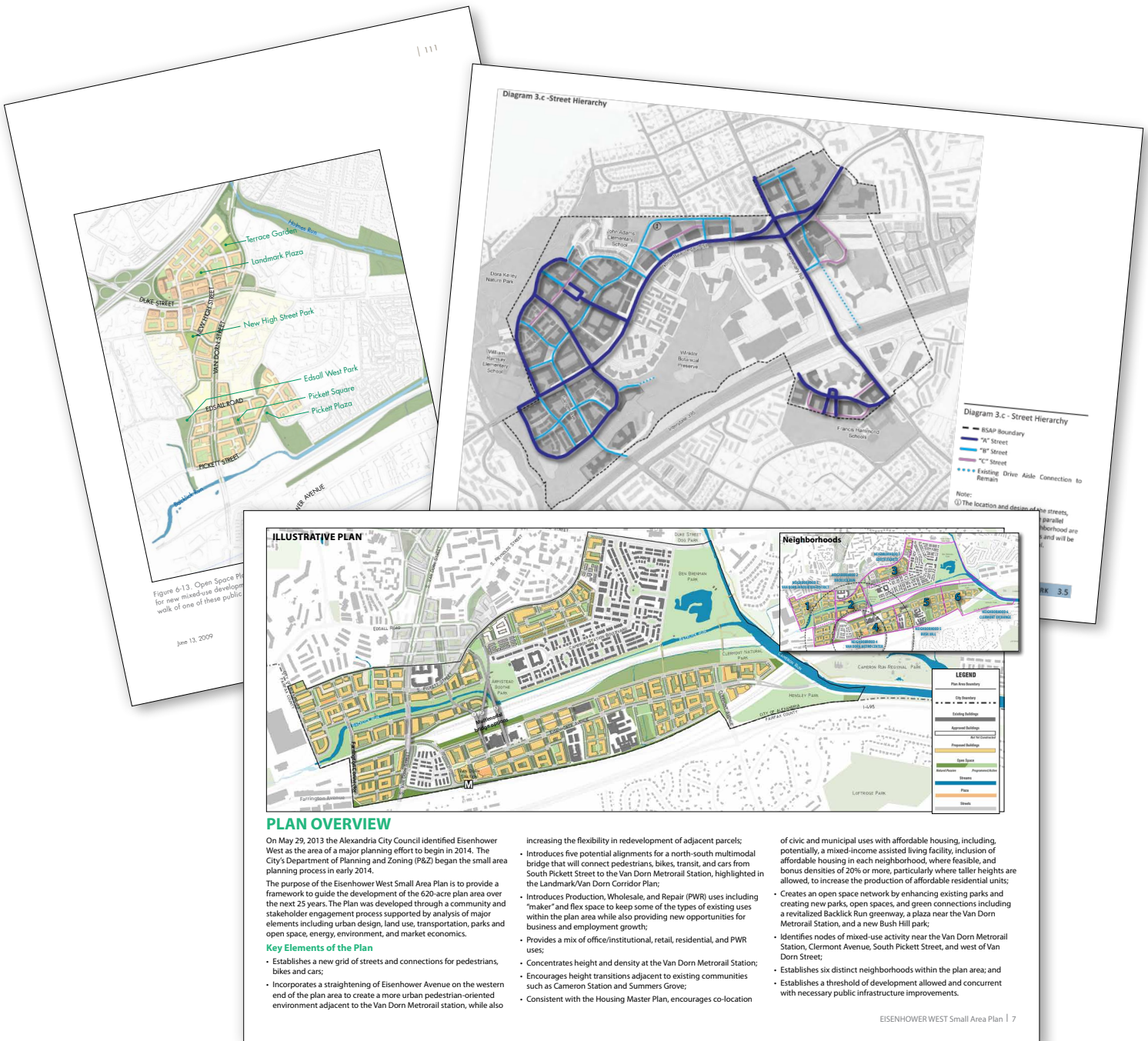
Typical residential street in Alexandria

Sidewalks are one of the most vibrant and active sections of the overall right-of-way. Throughout the city, sidewalks play a critical role in the character, function, enjoyment and accessibility of neighborhoods. Alexandrians value the walkability of their community and neighborhoods and wish to see this quality preserved and enhanced. The function and design of the sidewalk significantly impact the character of each street. Extending from curb to building face or property line, sidewalks are, of course, the place typically reserved for pedestrians, but they also accommodate street trees, stormwater best management practices (BMPs), street lights, bicycle racks, and transit stops. They are a place of transition and economic exchange as restaurants engage the public space and retailers attract people to their windows and shops.

In many ways, Alexandria is two types of cities in one. Old Town and the neighborhoods in the eastern portion of the city reflect a traditional urban pattern characterized by a regular grid of streets. In Old Town and Del Ray the street grid is very intimate: Streets are typically narrow and sidewalks, while also narrow, are generally complete. The grid distributes traffic well and offers many different routing options for pedestrians and travelers using a variety of different modes. Mixed land uses are common in these areas with many homes within walking distance of retail, commercial, community and green space amenities.

In the central and western areas of the city, many streets have a more typical suburban development pattern and curve through quiet residential areas with developed tree canopies. The land use is generally of lower intensity with greater separation and more open space. The sidewalk network is generally complete, however curvilinear streets create atypically shaped intersections with increased crossing distances and decreased pedestrian visibility. Though the neighborhood residential streets are lower volume

and tree-lined, a handful of very broad corridors with large sized blocks cuts across neighborhoods carrying heavily concentrated traffic. The City has recently approved plans such as the **Landmark-Van Dorn Corridor Plan, Eisenhower West Small Area Plan** and **Beauregard Small Area Plan**. These plans will significantly transform portions of this area of the city into a series of more compact, walkable neighborhoods with improved non-motorized access to commercial amenities, schools or other community destinations.

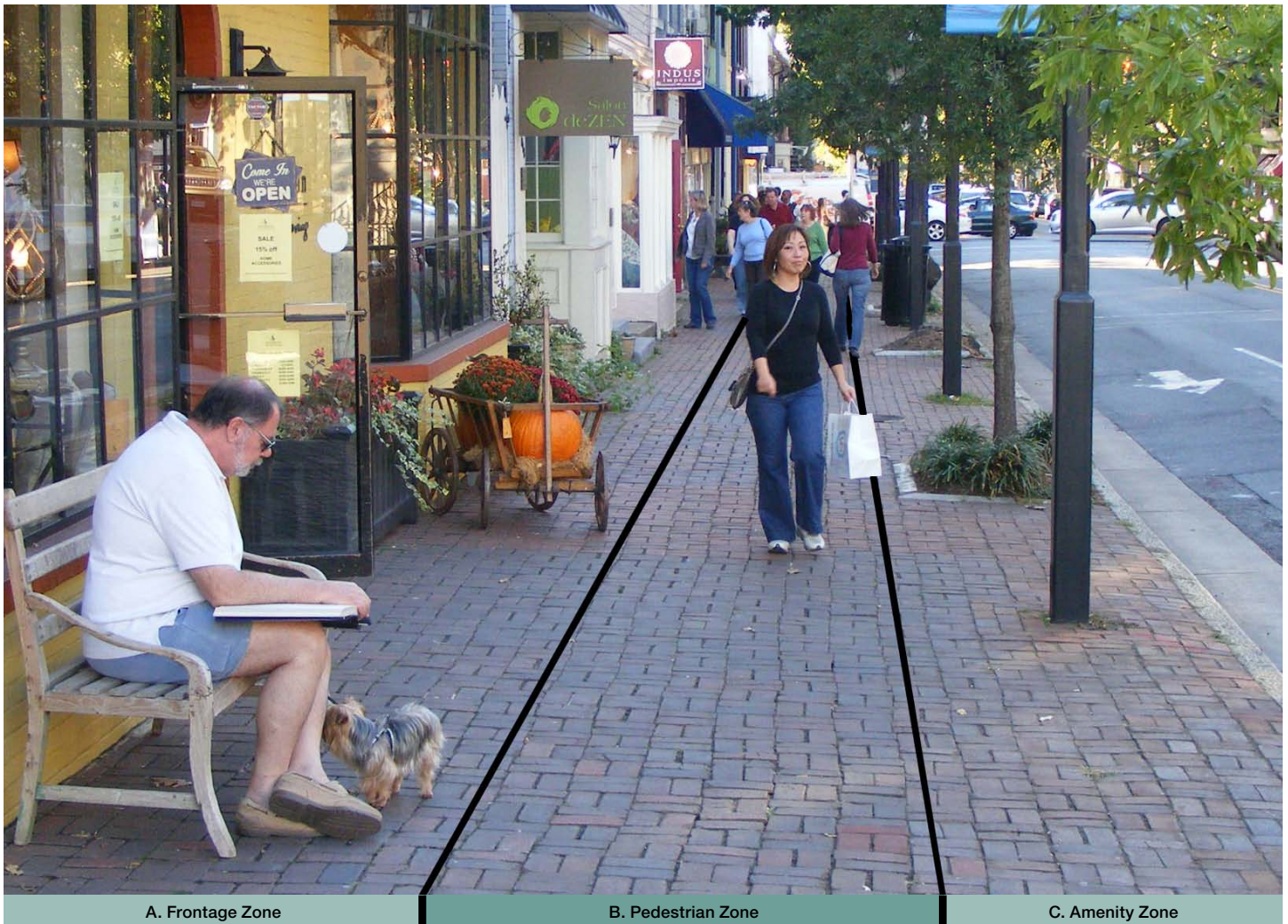


The plans demonstrate City efforts to increase connectivity, mix of uses, block and scale pattern of the West End street grid.

Sidewalk Zones

Sidewalks are not a singular space, but are comprised of distinct usage zones. Sidewalks typically are located in the right-of-way that extends from the curblineline to the property line behind it. They can be broken up into three primary zones performing

unique functions in the overall operation of the street, and interface with adjacent private property uses. Although boundaries between zones may blur and blend, the overall function of each zone generally remains consistent.



A. FRONTAGE ZONE

The Frontage Zone is the area of sidewalk that immediately abuts buildings along the street. In residential areas, the Frontage Zone may be occupied by front porches, stoops, lawns, or other landscape elements that extend from the front door to the sidewalk edge. The Frontage Zone of commercial properties may include architectural features or projections, outdoor retailing displays, café seating, awnings, signage, and other intrusions into or use of the public right-of-way. Frontage Zones may vary widely in width from just a few feet to several yards.

B. PEDESTRIAN ZONE

Also known as the “walking zone,” the Pedestrian Zone is the portion of the sidewalk space used for active travel. For it to function, it must be kept clear of any obstacles and be wide enough to comfortably accommodate expected pedestrian volumes including those using mobility assistance devices, pushing strollers, or pulling carts. To maintain the social quality of the street, the width should accommodate pedestrians passing singly, in pairs, or in small groups as anticipated by density and adjacent land use.

The Pedestrian Zone should have a smooth surface, be well lit, provide a continuous and direct path with minimal to no deviation, and meet all applicable accessibility requirements. Although currently legal throughout most of Alexandria, bicycling on sidewalks is generally discouraged.

C. AMENITY ZONE

The Amenity Zone, or “landscape zone,” lies between the curb and the Pedestrian Zone. This area is occupied by a number of street fixtures such as street lights, street trees, bicycle racks, parking meters, signposts, signal boxes, benches, trash and recycling receptacles, and other amenities. In commercial areas, it is typical for this zone to be hardscape pavement, pavers, or tree grates. In residential, or lower intensity areas, it is commonly a planted strip.

The Amenity Zone can provide an emergency repository for snow cleared from streets and sidewalks, although snow storage should not impede access to or use of important mobility fixtures such as parking meters, bus stops, and curb ramps.

Stormwater Best Management Practices (BMPs) are commonly located in the Amenity Zone. The **Green Sidewalks Best Management Practices (BMP) Design Guidelines** provide guidance on the selection and application of the most appropriate treatments for reducing stormwater pollution from public rights-of-way and improving the health of the street trees.

THE CURB

Although not a zone per se, the curb is a unique and vital element of the street. It is the demarcation line between the pedestrian domain and the vehicular domain. The curb is typically a physical barrier providing vertical separation between the street and sidewalk. The curb coupled with adjacent gutter and stormwater inlets also plays a specific role in the drainage of the sidewalk and roadway and even of the adjacent property at times.

Bulbouts, also called curb extensions, extend the Amenity Zone and curb into the roadway. The use or function of bulbouts typically mirrors or complements that of the Amenity Zone and may include stormwater management features, transit stops or passenger facilities, seating, dining, or additional pedestrian space.

LINKS

Landmark/Van Dorn Corridor Plan

<http://alexandriava.gov/LandmarkVanDorn>

Eisenhower West Small Area Plan

<https://www.alexandriava.gov/EisenhowerWest>

Beauregard Small Area Plan

<http://alexandriava.gov/BeauregardPlan>

Non-roadway Bicycle Routes Ordinance

http://alexandria-va.eregulations.us/code/coord_title10_ch7_sec10-7-4

Green Sidewalks, BMP Design Guidelines

<http://alexandriava.gov/uploadedFiles/tes/info/GreenSidewalksBMPDesignGuidelines%20.pdf>

Preferred Widths for Sidewalk Zones

The width of the various sidewalk zones will vary given the street type, the available right-of-way, scale of the adjoining buildings and the intensity and type of uses expected along a particular street segment. A balanced approach for determining the sidewalk width should consider the character of the surrounding area and the anticipated pedestrian activities. For example, is the street lined with retail that encourages window shopping or does it connect a residential neighborhood to a commercial area where pedestrians frequently need to pass one another? Does the scale of the buildings and the character of the street indicate a need for a wider sidewalk?

The width of the sidewalk should also relate to the street width and the height of adjoining buildings. If sidewalks are too wide, the street may feel empty and pedestrians may seem out of place, lost on a sea of sidewalk. If sidewalks are too constrained, friction may result between the sidewalk zones, leaving less space for healthy tree growth, limited access to parking meters or other fixtures, and a lower pedestrian level of service as pedestrians struggle to travel at their preferred pace.

Many streets in Alexandria have considerable right-of-way constraints. Preferred sidewalk zone widths may not always be possible and design judgment must be used to achieve a comfortable and functional balance. Traditionally, right-of-way has been allocated from the inside out, starting with the needs of motor vehicles, then dividing the remaining right-of-way among all other street users. Complete Streets marks a paradigm

shift: approaching street design from the outside in – considering the uses and activities along the street edge in addition to the through travel demands that dominate an “inside out” approach.

- The standard curb design in Alexandria is a 6" wide concrete curb with a 6" tall curb.
- Fixtures in the Amenity Zone should be installed a minimum of 2' from the front of curb (or 18" into the Amenity Zone)
- The Americans with Disabilities Act requires a minimum 3' clear width while the draft Proposed Right-of-way Accessibility Guidelines (PROWAG) recommend 4' clear width in the Pedestrian Zone. However, in the City of Alexandria, sidewalks are typically 6' at a minimum, though 5' is permitted if the sidewalk is a residential retrofit.
- Where minimums cannot be achieved, a design exception is required (see [Page V](#) of these guidelines). An exception will not be permitted for new developments. They will be considered for existing buildings or utilities that may preclude implementation of the plan.
- In rare cases where a design exception is made and a 4' wide sidewalk is constructed, a 5' wide passing zone must be constructed every 200' to allow two wheelchairs to pass each other.

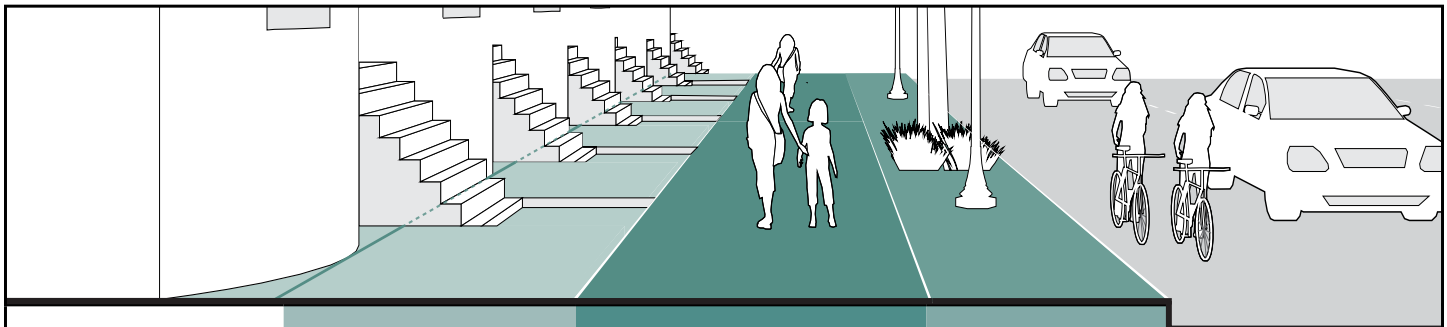


Brick sidewalk with a parking meter in the Amenity Zone



Concrete sidewalk with landscaping in the Amenity Zone

Preferred Widths for Sidewalk Zones



Street Type	Frontage Zone ¹	Pedestrian Zone ²	Amenity Zone ³	Total Width
	Door swings, Awnings, Café seating, Retail signage and displays, Building projections	Zone should be clear of any and all fixed obstacles. Clear space for pedestrian travel only.	Street lights and utility poles, Street trees, Bicycle racks, Parking meters, Transit stops, BMPs, Street furniture and signage	
Commercial Connector	2'-5'	6'-15'	6'-10'	14'-30'
Main Street	2'- 6'	6'-10'	6'-10'	14'-22'
Mixed Use Boulevard	2'- 6'	6'-18'	6'-10'	14'-30'
Neighborhood Connector	2'	6'-8'	6'-7'	14'-17'
Neighborhood Residential	2'	6'	5'-7'	11'-13'
Parkway	N/A	6'-10'	5'-10'	11'-20'
Industrial	2' or N/A	6'	5'-7'	11'-15'
Shared Streets	2'	N/A	N/A	N/A

NOTES SPECIFIC TO ZONES:

1. Frontage Zones used for sidewalk cafés are a special condition and should generally be no less than 6' in width. They should maintain the minimums discussed in the Sidewalk Outdoor Dining section of these guidelines (see page 3-12).
2. In locations with severely constrained rights-of-way, it is possible to provide a narrower Frontage Zone and Pedestrian Zone. Sidewalk width is based on the context, therefore in retrofit locations where development is not occurring and where existing building are anticipated to remain, 5' wide sidewalks may be adequate.
3. Sidewalk BMPs require a minimum of 7' of width for the Amenity Zone. The final dimensions will be established based on the context of each landscape area. Where BMPs are not provided in the Amenity Zone, this area may be at the lower end of the range.

GENERAL NOTES:

- Where on-street parking is not present, the wider dimensions should be provided.
- The provision of tree well or landscape strip within the Amenity Zone will be based on the existing or planned character of the neighborhood.

LINKS

Americans with Disabilities Act, as amended
www.ada.gov

Proposed Right-of-way Accessibility Guidelines
<http://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines>

Green Sidewalks, BMP Design Guidelines
<http://alexandriava.gov/uploadedFiles/tes/info/GreenSidewalksBMPDesignGuidelines%20.pdf>

Alexandria Small Area Plans
<http://alexandriava.gov/planning/info/default.aspx?id=44614>

Features to Activate Sidewalks

Pedestrians generally feel safer and will walk farther on sidewalks with animated edges. Animation can take the form of uses such as cafés and retail storefronts, or other elements such as porches, balconies or residential windows. Public art and plantings can also activate sidewalks by providing visual interest and a sense of motion or progression as leaves rustle, and views of public art come into focus and change, marking the time and progress of a pedestrian's walk.

Pedestrian-friendly sidewalks should be comfortable in terms of scale, light, and shade, and security. The sidewalk environment should be pleasing to the senses, offer visual stimulation, greenery, and provide a social atmosphere. Vibrant, pedestrian-friendly sidewalks attract activity and are both an indicator of, and a factor in, economic vitality.

The following sections describe features that activate sidewalks and how sidewalks can be places in and of themselves. Features range from the seam between sidewalks and buildings where the right-of-way and the private property interact to the overlap between the sidewalk and the street where reducing stress on sidewalks allows for better activation and user experience.

Publicly owned plazas and the permitting of outdoor cafés and push cart vendors are managed by T&ES and must be approved by the Planning Commission. The Department of Planning and Zoning (P&Z) will be consulted in the design of plazas and cafés; maintenance agreements with adjacent property owners are typically required.

There are many areas of the City that have existing small area plans or design guidelines that stipulate defining the street edge, selection of street trees and other sidewalk amenities. Please refer to Alexandria Master Plan (Small Area Plans & Citywide Chapters) for more information.

LINKS

Small Area Plans

<http://alexandriava.gov/planning/info/default.aspx?id=44614>

ACTIVE STREET EDGE



King Street in Alexandria

Street walls define the edge of a street or public space by creating a visual boundary. The street edges where sidewalks and buildings meet contain the dynamism of the city. When people in the public space of the street feel connected to the activities in the private space, their sense of safety, community, and well-being increases. Walking distances seem shorter in places with interesting street walls. Indeed, pedestrians will happily walk much farther through an area with an active and stimulating street edge than through an area that is generally quiet and disconnected from the street's public space.

Activity and transparency are key features of vibrant street walls. Activity at the street level creates valuable experiences for both pedestrians and motorists. Private developments should provide active and inviting ground floor uses. As part of new development and/or redevelopment, parking should also be located behind

or beside the building— or below grade for new developments – to encourage uses adjacent to the sidewalk. Loading docks, garage access, and blank walls should not be located along primary streets and should be accessed from alleys where feasible.

Transparency is most critical at the street level, because this is where pedestrian interaction most often occurs. It is also where the greatest interaction occurs between indoors and outdoors. At a minimum, vibrant street walls should be 50% transparent.

DESIGN

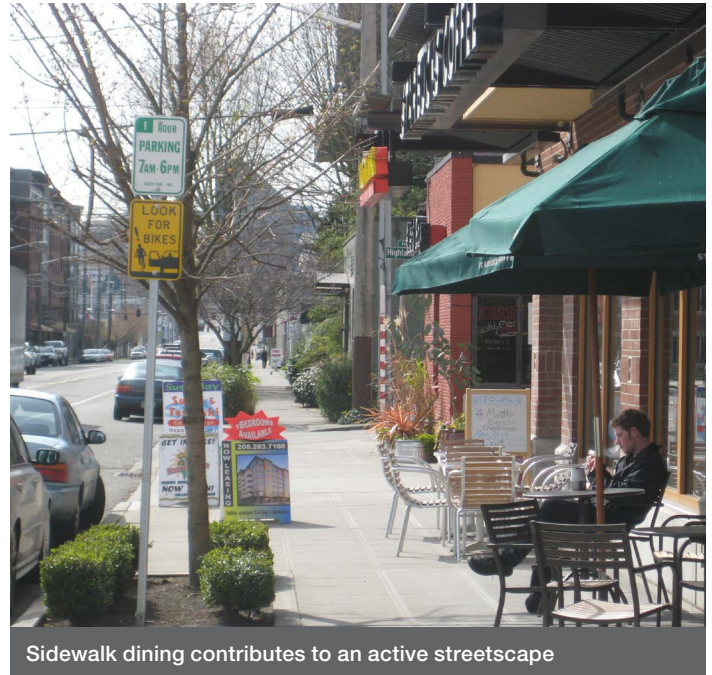
- An active street edge is better achieved when the adjacent building's floor elevation is at or close to sidewalk grade and barriers such as steps and stoops removed or minimized to allow pedestrians maximum visual access to adjacent buildings.

ACTIVE STREET EDGE

- Larger retail floor plates such as major groceries, furniture stores, or other large format retail should line their façades with smaller establishments or specialty units of their enterprise or architectural treatment including materials and color in order to break up the scale of the façade and potentially provide more points of entry and interaction with the sidewalk.
- Transparency calculations should not include garage entrances, loading docks, egress doors, utility vaults, and service areas. Maximize the number of windows with the goal of 50%-70% transparency on the first floor.
- The desired distance between ground-level pedestrian entrances in new development projects along these street types is between 30' and 75', or about one entrance every 10 to 15 seconds as a person walks along a street. More frequent building entrances are encouraged to add street activity.
- Additional visual interest can be provided with awnings, lighting, signs, and foliage with appropriate approval where required. Plantings, banners and public art can provide seasonal color and texture.
- Garage access for all new townhouses will be from the alley rather than the street. Garage access for new multi-family and commercial buildings is encouraged to be from an alley if feasible.

CONSIDERATIONS

- Vibrant street walls with active uses adjacent to the sidewalk are particularly valuable and should be encouraged on all street types excluding the Industrial Street type. Where an active use adjacent to the sidewalk is not feasible, visually engaging walls should be provided adjacent to the street. Strategies to improve the visual quality of a street wall include public art, and “living walls” that encourage plant growth along large expanses of solid surfaces.
- Upper levels can also contribute to a vibrant sidewalk environment as well through large windows, balconies, or other opportunities for private observation of the public space.



Sidewalk dining contributes to an active streetscape

- When ground floor activity and transparency cannot be accommodated by retail or commercial uses, residential uses will need to be provided.
- Also see applicable City Design Standards for streetwall and active use requirements.

LINKS

Public Art Implementation Plan

<http://www.alexandriava.gov/uploadedFiles/recreation/arts/PAIP%20FINAL.pdf>

PLAZAS AND RECLAIMED SPACES



Patent Office Plaza

OVERVIEW

Whereas the sidewalk Pedestrian Zone is a place of movement, plazas and reclaimed spaces are designed to encourage people to linger, look, and gather—creating a sense of place and promoting social interaction.

Plazas are open “rooms” in the city. They may be located in public space or on private property, but are accessible for public use. They can support a wide variety of activities such as temporary markets, art installations, or performances. They utilize paving, seating, and plantings to create a distinct character and may incorporate BMPs to capture stormwater runoff from roofs and adjacent sidewalks and streets.

» *P&Z and the Department of Parks, Recreation and Cultural Activities must be consulted in the design of plazas. These departments are responsible for approving them. Maintenance and management agreements with adjacent property owners are typically required.*

Reclaimed spaces are created from redundant or underutilized street space that has been reallocated for pedestrian use or stormwater management. They can range from slightly enlarged corners at intersections to whole peninsulas of space created when multi-legged intersections are reconfigured. While these types of open spaces are a great benefit to urbanized areas, they should be used judiciously and appropriately.

They should be located in areas where people naturally congregate—close to centers of activity—or they should have features that draw activity to them such as retail offerings, playgrounds, or other attractions.

Management of plazas and reclaimed spaces depends on the type of space and their creation. Plazas located on private property may remain the responsibility of the private property owner who will control their use and manage their maintenance. If properties are given to the City through dedication or easement, generally the Alexandria Department of Recreation, Parks, and Cultural Activities will oversee their use and management.

» *Reclaimed spaces—because they remain fully within the right-of-way of the street—will generally remain the responsibility of T&ES; however often community groups will manage and maintain these sites through an agreement with the City.*

Both plazas and reclaimed spaces are especially valuable in areas of higher density and more intensive activity such as Commercial Connectors, Main Streets and Mixed Use Boulevards. Programming and activity in these open spaces is essential. Lining them with active ground floor uses and enabling and encouraging those uses to spill out into them ensures a vibrant place. They may be further activated by enabling or encouraging commercial activity in the space. This may include pop-up or modular retailing or nearby food service.

Plazas and reclaimed spaces may also be natural points from which to orient travelers to the rest of the community and great spaces to incorporate wayfinding and directional signage, community information, and local transit options information.

DESIGN

- Consider use and maintenance in both day and evening hours and throughout the year. Light and shade are both critical elements of inviting plazas and reclaimed spaces.
- Promote visibility and observation to maintain a sense of safety and connection. Clear sight lines should be maintained to and from the public street and the plazas and reclaimed spaces.

PLAZAS AND RECLAIMED SPACES

- Incorporate public art and the celebration of local history or culture. Addition of public art should be done sensitively and holistically to avoid the appearance of “plop art.”
- Provide a variety of seating options, some of which may be movable. Seating can be incorporated into building edges and walls. Typically, dedicate at least 10% of the open space to seating.
- Plazas and other spaces that are to be maintained by T&ES must be designed according to the **Memo to Industry 10-11 “Paving for Parks and Plazas which are to be City-owned and Maintained.”** [Click here to access the City of Alexandria Standard Materials List for information on pavers.](#)
- Provide trash and recycling receptacles to minimize littering. Receptacles should be placed in a manner as to be visible, yet should not impede pedestrian flow or visually degrade the appearance of the plaza.
- Ensure access for maintenance and emergency vehicles and equipment, as well as accessible routes from the sidewalk and through the plaza to building entrances and transit stops.
- The use and programming of plazas and reclaimed spaces shall be guided by the bi-annual **Alexandria Parks and Recreation Needs Assessment** to ensure the site reflects community interests.
- Maintenance responsibility and funding should be clearly established.
- Provision of electrical power and/or water expands the number and variety of uses that can utilize and activate the space, as well as eases maintenance and care activities, especially the establishment of plants and trees.
- Water features are highly popular and particularly effective at attracting people to plazas; however, they introduce substantial costs and maintenance concerns.
- The use of permeable, recycled, and/or locally sourced materials increases sustainability, reduces life-time energy consumption and improves environmental performance.

LINKS

Memo to Industry 10-11 “Paving for Parks and Plazas which are to be City-owned and Maintained.”

<http://alexandriava.gov/uploadedfiles/tes/info/PavingForParksAndPlazaAreas2.pdf>

Alexandria Parks and Recreation Needs Assessment
<https://www.alexandriava.gov/recreation/info/default.aspx?id=51672>

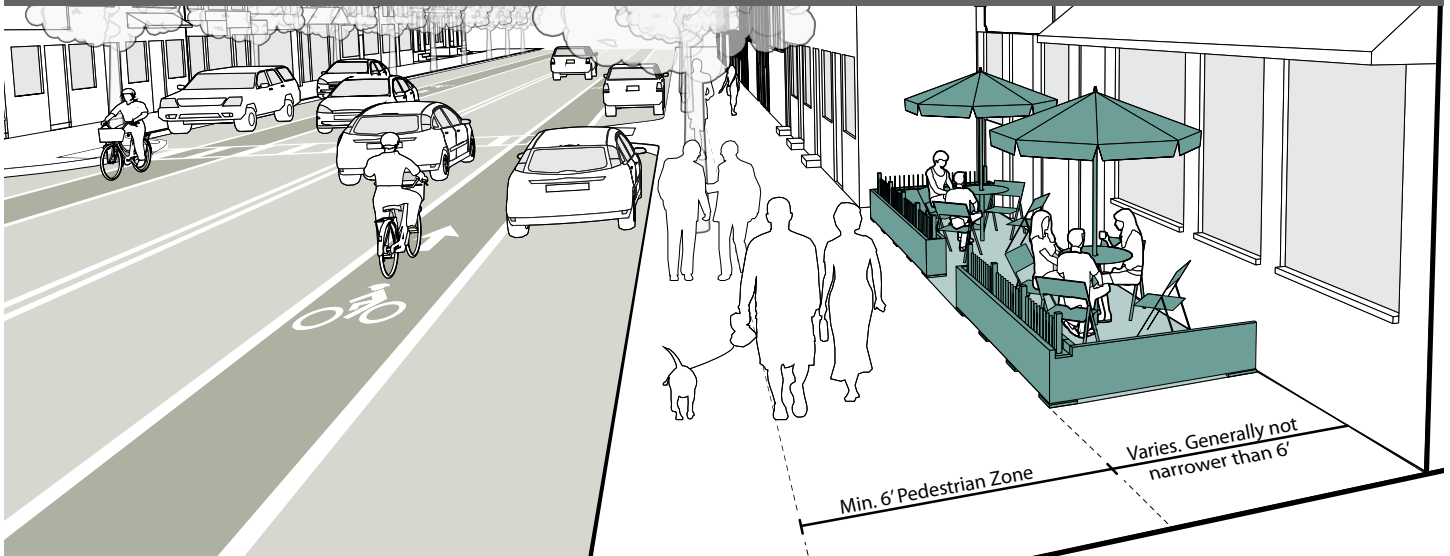
CONSIDERATIONS

- Plazas and reclaimed spaces should accommodate access via a variety of modes, incorporating transit stops and amenities where appropriate and needed, and providing space for bicycle parking.



Reclaimed space in Arlington, VA

SIDEWALK OUTDOOR DINING



OVERVIEW

Outdoor dining opportunities contribute to a lively street environment and add economic value by enabling private commercial activity to spill into the public environment of the street. Sidewalk cafés are encouraged on all street types where commercial activity occurs.

Alexandria has established a special sidewalk café **policy** and **design guidelines** for King Street in Old Town with the express purpose of facilitating café activity as a benefit to the street environment. Sidewalk cafés are generally not public seating, rather they are associated with a particular business and reserved for the explicit use of their patrons. Sidewalk cafés pay a modest fee for this occupancy of public space.

Sidewalk cafés are often, though not always, impermanent and seasonal. They may be removed or taken in every evening after business hours or during the colder winter months.

» *T&ES is responsible for the permitting of outdoor cafés. P&Z must be consulted in the design of cafés and must approve them. Permits generally establish maintenance responsibilities and uses permitted to the sponsoring adjacent property owner(s).*

DESIGN

- Sidewalk cafés may be located either in the Frontage Zone (front or side) or in the Amenity Zone. Sidewalk cafés should not extend beyond the frontage of their respective business without explicit approval.

- Sidewalk cafés should not alternate between Frontage Zone and Amenity Zone in the same block face. They should be consistently located in one zone or the other.
- Sidewalk cafés located in the Amenity Zones should remain at least 2' away from the face of curb to enable curbside parking and other uses access and egress from the roadway to sidewalk.
- A Pedestrian Zone of at least 6' must be maintained. This Pedestrian Zone is determined by applying a straight line down the length of a block face between the outermost obstacles in the Frontage Zone to the innermost obstacles in the Amenity Zone.
- Sidewalk cafés generally require a minimum 6' depth to provide adequate space for tables and seating. Seating may not be located within 5' of a fire hydrant. Sidewalk cafés should not be located within a transit stop loading or landing area.
- A 4' wide corridor to and from the Pedestrian Zone to the restaurant doorway must be maintained.
- The area approved for a sidewalk café should be clearly demarcated with identifiable markers such as ropes and stanchions or planters. If alcohol is served, full enclosure of the space is required. Markers should generally be difficult to move but at the same time must not be permanently affixed to the sidewalk or roadway.

SIDEWALK OUTDOOR DINING

- Furniture should be durable, free-standing, and matching. It should be sized appropriately to the space permitted for use. Plastic furniture is generally discouraged.
- Awnings and/or umbrellas are desirable, but must not project into the Pedestrian Zone at a height less than 7' from sidewalk grade.
- Additional lighting of the sidewalk café area may be necessary in locations with inadequate pedestrian-scale lighting.
- Heat lamps may be used to extend outdoor dining into the colder months.
- In the **Old & Historic Alexandria and Parker-Gray districts**, applications may need Board of Architectural Review approval. **Design guidelines are available for sidewalk cafés on King Street.** SAPs and design guidelines for SAP areas may include requirements for outdoor dining.

CONSIDERATIONS

- Sidewalk cafés in the Frontage Zone eliminate the need for servers and patrons to cross the Pedestrian Zone and potentially conflict with pedestrian through movements. Cafés in the Amenity Zone infill between other street fixtures often optimizing that space.
- Retailers want to have pedestrians walking close to their storefronts so window shoppers can see their wares. While cafés and retailers intermingle along a commercial street, the needs of both should be taken into account when determining the best location for a sidewalk café.
- Sidewalk cafés can be renewed annually. Unannounced inspections should be conducted at least annually to confirm cafés are occupying only permitted seating areas and not encroaching on the Pedestrian Zone or adjacent business frontages.
- Sidewalk cafés are not permitted to advertise in the public space. For instance, umbrellas emblazoned with a vendor product name, logo or brand are not permitted.

- Café furniture should not be stacked and stored in the public space during months when the café is not in use. Furniture and barriers must be entirely removed from the public space during the winter months.

LINKS

Ordinance No. 4521

http://alexandriava.gov/uploadedFiles/planning/outdoor_dining_ordinance.pdf

King Street Outdoor Dining Overlay Zone

http://alexandriava.gov/uploadedFiles/planning/info/outdoor_dining_design_guidelines.pdf

Historic District Boundary Map

https://www.alexandriava.gov/uploadedFiles/gis/info/2013_HistoricDistricts.pdf

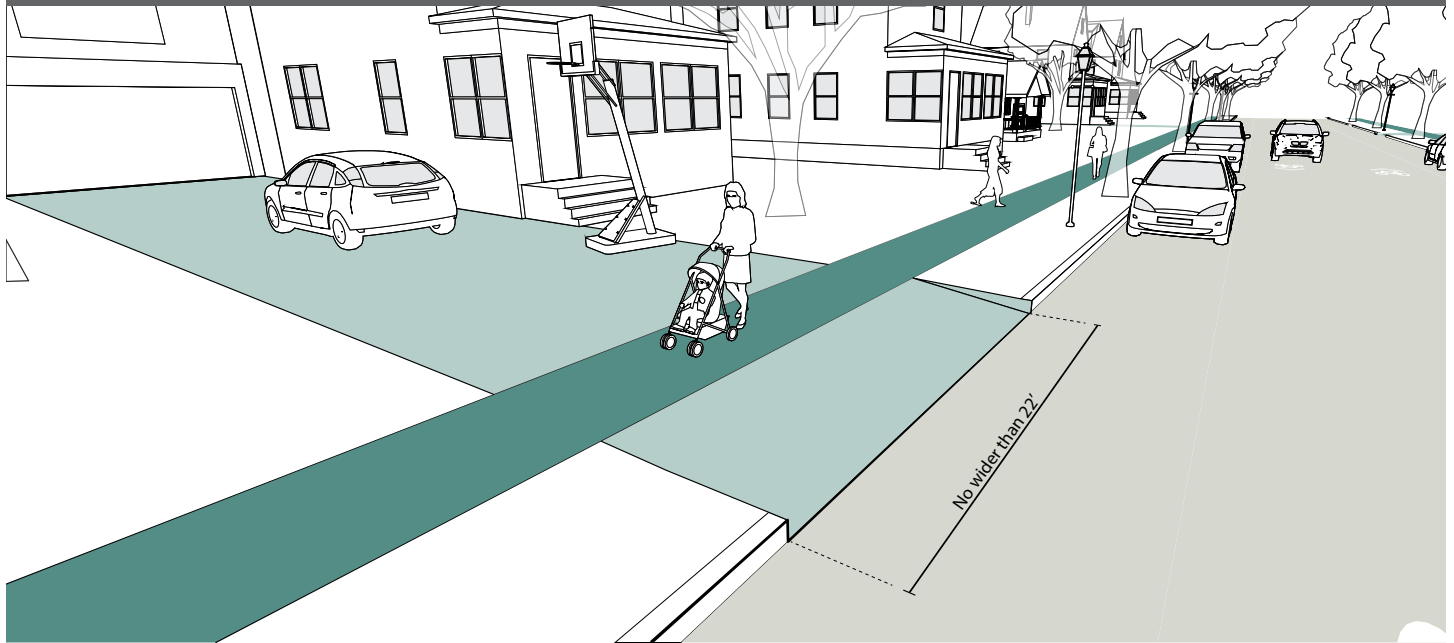


Cafe seating



Sidewalk dining on Mt. Vernon Avenue

DRIVEWAY ACCESS



OVERVIEW

Driveways provide access from public rights-of-way onto private property.

They should be used only where alley access or other shared access points or easements are unavailable. Driveways should be consolidated and/or minimized on higher intensity commercial streets—particularly Commercial Connectors, Main Streets and Mixed Use Boulevards.

Driveways introduce a conflict zone between vehicles, pedestrians, and curbside uses, such as bicycle facilities or transit lanes and driveway vehicular access. Driveways require special treatments in order to maintain a safe and comfortable walking environment.

» **Existing Guidance:** *New driveways, or changes to existing driveways for either commercial or residential use will be processed as outlined in city code section 5-2-14. An application must be submitted to the permit and site plan section of the Department of Transportation & Environmental Services (T&ES).*

» **New driveways or changes to existing driveways for either commercial or residential use must be reviewed by both P&Z and T&ES, and approved by T&ES.**

DESIGN

- When public sidewalks interact with private crossings, public sidewalks are given right-of-way priority. Driveways should be designed to reduce conflict for all modes on both the street and sidewalk.
- Driveway width and apron turn radii should be minimized to the extent possible. Standard design is for 10 mph. Driveway openings should not be larger than 22' wide.
- The Pedestrian Zone must meet ADA Standards at driveway crossings.
- Driveways must maintain the Pedestrian Zone as a continuous, level, and clearly delineated path across to encourage drivers to yield to pedestrians. For example, if the sidewalk is composed of brick, the brick surface treatment should be continuous across the driveway. If the Pedestrian Zone is composed of concrete and it is crossing an asphalt driveway, the concrete should be continuous across the driveway. Materials must meet accessibility requirements outlined in the Sidewalk Materials section found later in this chapter.

DRIVEWAY ACCESS

- In locations where a driveway functions as an intersection, pedestrian safety features should be included. These features may include crosswalks, small corner radii, and pedestrian signal heads (if signalized) as warranted.
- In locations where sight distances are limited for drivers exiting driveways, such as at parking garage exits and other locations, stop/yield signs and other cautionary messages should be provided to ensure drivers proceed cautiously and yield to pedestrians on the sidewalk.

» *Additional details for driveway design are provided by the Infrastructure and Right-of-way Section of T&ES.*

CONSIDERATIONS

- In constrained locations where the sidewalk width is insufficient for a fully raised crossing, the roadway can be partially raised and the sidewalk partially lowered. This design minimizes the disruption to the pedestrian while still providing a traffic calming effect. On a typical 6" high sidewalk, this is achieved by ramping down the sidewalk at the driveway by 3" and raising the driveway by the same amount.
 - Vehicular access across sidewalks must maintain the minimum width requirements in the Pedestrian Zone. If the sidewalk is too narrow to achieve this, a curb extension should be considered where on-street parking is present. These locations should be designed to meet ADA Standards.
 - Properties should typically be restricted to one vehicular entrance (driveway) on each street frontage and no more than two on any street frontage should be permitted without clear documentation of the vital need. The effort to consolidate or eliminate driveways should be made wherever possible. Where alleys exist, access should be provided from alleys.
- » *New driveways, or changes to existing driveways for either commercial or residential uses must be reviewed and approved by T&ES.*



Level sidewalks across driveways improve pedestrian convenience and safety

ALLEYS



Alleys in Alexandria

OVERVIEW

Alleys may be either public or private. Although their primary purpose is for access and service, an alley may also function as a low volume multimodal connector through a block and be attractively designed as a Shared Street.

The low volume nature of alleys provides an ideal opportunity for the installation of stormwater BMPs.

Alexandria has an incomplete alley system. Alleys are more common in the older parts of the City. More recently developed portions tend to rely on private alleys for access rather than the shared alley facilities. Alleys should be required in infill developments and redevelopments as they reduce the number of vehicular access points on the public street and thereby reduce the number of conflict points improving safety, operations, and aesthetics for all uses.

DESIGN

- Newly established alleys should be a minimum of 15' wide if designed as one-way operations but 18' wide to provide two-way access.
- Alleys should be properly drained with either center or side drainage.

- Alleys provide an ideal opportunity for BMPs such as pervious pavement. Though the traffic volumes are low, there are frequently heavier service vehicles, BMPs must be designed with these heavier vehicles in mind.
- Parking and the storage of dumpsters and other obstacles should not be permitted within the right-of-way of the alley as this impedes vehicular access, circulation, and service in the alley.
- Lighting is important in alleys to provide a sense of comfort and promote safety.

CONSIDERATIONS

- Alley maintenance and snow clearance is a low priority for the city. Abutting property owners should be encouraged and enabled to take over maintenance responsibilities if possible.
- Private alleys must be privately maintained.
- In locations where alleys are adjacent to open space or parks, they should be given an enhanced design, similar to Shared Streets, to allow for pedestrian use.

SIDEWALK MATERIALS



Different sidewalk materials in Potomac Yard

Sidewalk materials can reinforce neighborhood identity and history through their selection, arrangement, coloring, or patterns.

At the same time, the use of too many sidewalk materials and patterns can contribute to a disjointed appearance. Ideal sidewalk materials should be smooth, stable, slip resistant and durable to minimize vibrations, tripping hazards and reduce maintenance costs and concerns. With this understanding, the City of Alexandria has given much thought to the design requirements for sidewalks in redeveloped areas—both within and outside historic districts—and has established [the Citywide Sidewalk Map and Neighborhood Guidelines](#) which includes Sidewalk Design and Construction Standards, and [Green Sidewalks: BMP Design Guidelines](#).

OVERVIEW

Alexandria’s sidewalks must be accessible to people of all ages and abilities. This includes people with vision, hearing or mobility disabilities, users of mobility assistance devices, and those who push strollers or carts.

Accessibility is most critical in the Pedestrian Zone and at crossings. Materials and details should be selected to minimize gaps, discontinuities, rough surfaces, or any other vibration causing features. Details should be designed to prevent the creation of tripping hazards as materials settle and age and to avoid uncomfortable or painful bumps and vibrations for pedestrians using wheeled devices such as walkers, strollers, and wheelchairs. To achieve this, the City must meet all applicable accessibility requirements.

New or reconstructed sidewalks should comply with the [Citywide Sidewalk Map and Neighborhood Guidelines](#) and Sidewalk Design and Construction Standards. In Alexandria, granite curbs are required in the Old & Historic Alexandria and Parker-Gray districts, while concrete curbs are required elsewhere. Where bluestone curbs or brick gutters remain, they must be preserved and retained. Unless otherwise indicated on the City Sidewalk Map, the standard material for sidewalks will be City standard concrete. Rolled or mountable curbs should not be used because they enable motorists to encroach onto the sidewalks.

SIDEWALK MATERIALS



Brick sidewalk in Old Town



Brick in the Amenity Zone and concrete in the Pedestrian Zone



Concrete sidewalk in Potomac Yard



Permeable pavement

The City recommends the use of the following sidewalk materials within the public right-of-way or areas where the city is responsible for maintenance. The sidewalk materials used outside the public right-of-way or in areas not subject to city maintenance will be determined as part of the development review process.

City Standard Brick: Provided within areas where brick sidewalks are required or repaired. Brick will be provided in a running-bond pattern.

Combination of brick and concrete:

Provided based on the context of the street, block frontage, and adjoining streets. The intent is to reinforce the existing character of each block and neighborhood, age of building, setting, and context. The material and scoring pattern allow flexibility to keep brick as part of the streetscape, but have concrete within the Pedestrian Zone.

Concrete: Provided within areas where city standard concrete sidewalks are required. The scoring pattern is intended to generally be 3'x3' or the scoring size as depicted in the [Citywide Sidewalk Map and Neighborhood Guidelines](#) where appropriate or required by the city. Other scoring patterns can be approved on a case by case basis.

Permeable pavers and porous pavement:

Provided if determined applicable and appropriate based on the context of the street, grades, subsoils, drainage characteristics, and groundwater conditions.

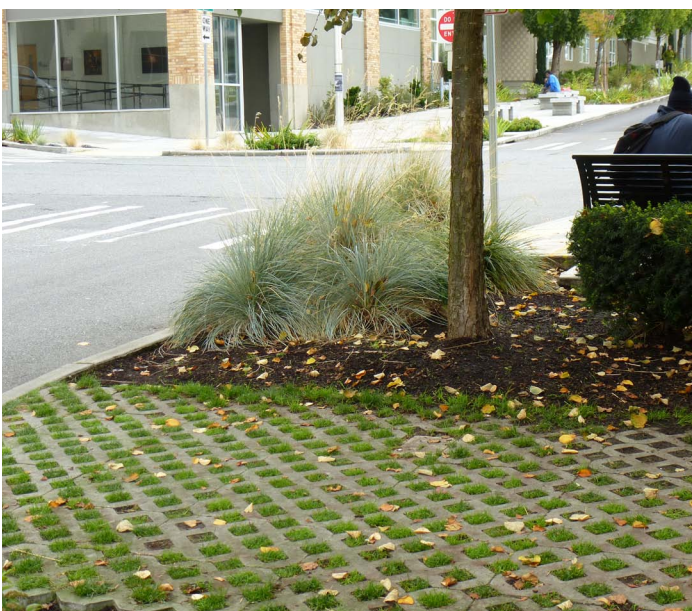
[Click here to access the City of Alexandria Standard Materials List for more information on sidewalk materials and colors.](#)

SIDEWALK MATERIALS

Permeable paving materials and techniques allow stormwater runoff to infiltrate through the sidewalk into the ground rather than running off into the street and storm drain system. They filter pollutants; reduce flooding, and ponding; contribute to improve water quality; and may reduce the size of infrastructure needed to treat and convey stormwater off site. Permeable paving materials include continuous solid expanses of porous materials and/or pavers specially installed to enable rainwater to run through gaps maintained between them.

Permeable pavement systems are typically underlaid with an infiltration bed and subgrade soil and may be used in sidewalks, plazas, cafés, parking areas, alleys, and other low-traffic areas. In specific locations where infiltration is not desired, such as adjacent to building foundations, engineered geotextile liners can be used to redirect the water to an appropriate location. Both systems permit water to permeate through to underground storage before sheeting off and running into the street. Water may then be gradually absorbed into an engineered soil media in a designated stormwater management cell.

Please refer to [Park Facilities Standards Manual](#) and the [Standard Sidewalk Details](#) for preferred permeable paving materials.



Permeable pavers can help to bring greenery into the streetscape

DESIGN

- Surfaces should be smooth, stable, and slip resistant, minimizing gaps, rough surfaces, and vibration causing features. Discontinuities in the surface, such as gaps, rises, and falls should not exceed 1/8". (Some exceptions are necessary to allow gaps between pavers when a pervious surface is desired; however, the surface must still be smooth, stable and slip resistant.)
- The cross-slope of the walking zone may not exceed 2%.
- If permeable pavers are selected, a shallower slope is encouraged to allow runoff to collect in the BMP.
- Ramps must be present at all intersections (excluding raised crosswalks). Their design should minimize conflicts with motor vehicles. Detectable warnings must be included in the ramps or approaching raised crosswalks to indicate where the roadway begins per PROWAG. For more information on ramps, see the [Curb Ramps](#) section.
- The design and installation of the sidewalk base materials plays a crucial role in creating functional and lower maintenance sidewalks and should be considered early in the design process.
- Patterns can be tooled or sandblasted into standard concrete or aggregates to change the surface.
- Joints in the sidewalk should be oriented along the direction of travel where possible to reduce the frequency of joints across the Pedestrian Zone.
- Transitions between concrete panels, bricks, and tree grates should be given special attention and designed to minimize bumps and differential settlement.
- Where installed over a tree trench, paving materials need to be structurally supported. This is typically achieved over a concrete raft or over root cells and allows the tree roots a separate space in which to grow without disturbing the paved surface.

SIDEWALK MATERIALS

CONSIDERATIONS

- Tree grate surfaces are not considered part of an accessible Pedestrian Zone unless the grate surface meets ADA Standards.
 - In some cases, non-standard materials may be used but require maintenance agreements.
 - Permeable paving materials should be regularly **maintained**, including annual inspection, periodic material replacement and actual vacuuming to remove solid particulate matter and unclog sand and debris.
- » *To ensure durability and limit maintenance, all material specifications must be approved by T&ES prior to installation.*
- » *T&ES is responsible for the management of publicly-owned sidewalks. Maintenance agreements with adjacent property owners are required for non-standard materials or installation details.*
- Where sidewalks are provided within the public access easements as part of new development, the responsibility for future maintenance will lie with the property owner/developer.
 - There are some areas of the City that have existing Small Area Plans and design guidelines that stipulate sidewalk materials. Please refer to Alexandria Master Plan (Small Area Plans & Citywide Chapters) for more information.
 - The City advises caution in use of permeable materials due to limited resources for maintenance, especially clearing or unclogging porous surfaces where accumulation of dirt or debris may make surfaces unsafe. Alexandria provides guidance for maintenance of permeable surfaces (See link to the right).

LINKS

Citywide Sidewalk Map and Neighborhood Guidelines
<https://www.alexandriava.gov/uploadedFiles/localmotion/info/gettingaround/Sidewalk%20Materials%20Staff%20Guidance%20Packet%209.5.14.pdf>

Standard Sidewalk Details which includes Sidewalk Design and Construction Standards
[http://alexandriava.gov/uploadedFiles/localmotion/info/programs/Brick-Concrete%20Sidewalk%20Standard%20Details\(1\).pdf](http://alexandriava.gov/uploadedFiles/localmotion/info/programs/Brick-Concrete%20Sidewalk%20Standard%20Details(1).pdf)

Park Facilities Standards Manual
<https://www.alexandriava.gov/uploadedFiles/recreation/parks/Park%20Facilities%20Standards%20Manual.pdf>

Small Area Plans
<http://alexandriava.gov/planning/info/default.aspx?id=44614>

Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way
<http://www.access-board.gov/attachments/article/743/nprm.pdf>

Northern Virginia BMP Handbook
<https://www.novaregion.org/DocumentCenter/Home/View/1679>

Virginia Deq Stormwater Design Specification No. 7 Permeable Pavement
<http://chesapeakestormwater.net/wp-content/uploads/downloads/2014/04/VA-BMP-Spec-No-7-PERMEABLE-PAVEMENT-FINAL-DRAFT-EDITS-v2-0-02April2014.pdf>

Permeable Pavement Maintenance Schedule and Guidelines
<http://alexandriava.gov/uploadedFiles/tes/info/PermeablePavementMaintenanceGuidelines.pdf>

Street Trees

Trees play an important role in making streets comfortable, delightful, memorable, and sustainable. Used appropriately, they can help define the character of a street.



Different types of streets require different trees

Trees provide shade that reduces energy use and mitigates the urban heat island effect. Their leaves capture rainwater and evaporation cools the ambient urban air temperature. Trees sequester carbon dioxide and thus contribute to the mitigation of climate change associated with the greenhouse effect. Trees capture gaseous pollutants and particulates in the tree canopy surface, removing as much as 60% of the airborne particulates at street level.

Trees are part of the urban forest contributing to natural diversity. They provide habitat for a range of living creatures in the urban context, including people. Psychologically, trees have been found to reduce stress and improve concentration. This may partly explain why studies have found that tree lined retail corridors do better than counterparts lacking street trees. Consumers spend more time on tree lined streets more often than those without trees and spend more time and money there.

Street trees require their own allocation of right-of-way in order to thrive. For technical guidance and standards for protection and preservation of existing street trees, crown area coverage, installation procedures and on-going maintenance requirements, please refer to the Landscape Guidelines. The City has developed the Green Sidewalks, BMP Design Guidelines to provide preferred methods of treating stormwater within the right-of-way. The **Plantings and Stormwater Management** section of these Guidelines includes more detail on this element of street design. For additional technical guidance using street trees in sidewalk BMPs, also refer to the Virginia Department of Environmental Quality Stormwater Design Specification for Landscaping.

Any resident of Alexandria can request to have a street tree planted in front of their home or business, provided the right-of-way is wide enough and other specific conditions are met, by calling the Tree Planting Program at 703-746-5496. The City Arborist must inspect the site to determine if a tree can be planted and must evaluate whether establishment and healthy

STREET TREES



Street trees in the Carlyle neighborhood



Newly planted trees along the Potomac Yard trail

growth can be reasonably expected.

» *The Department of Recreation, Parks and Cultural Activities oversees maintenance and planting of trees in the public right-of-way. The maintenance program includes pruning, disease control, removal, and storm damage repairs. The Department's oversight includes review and approval of trees to be planted by others and the planting of new trees throughout Alexandria's neighborhoods. Tree selection and planting design in the public right-of-way must be approved by the Department of Recreation, Parks and Cultural Activities, T&ES and P&Z.*

STREET TREES AND URBAN DESIGN

Street trees are both a transportation and urban design tool. As vertical elements in the streetscape, trees help to frame and define the street wall, accentuate spaces and focus view corridors. Canopy trees provide an enclosure to the street that reinforces the sense of intimacy and scale. This enclosure can have positive effects in slowing traffic and increasing driver awareness.

Street trees improve walkability by providing necessary shade and filtered light. They provide interest and intrigue to pedestrians walking along a block face. Street trees are an opportunity to express the image of a community through plant selection and arrangement. Trees also provide seasonal interest and variation.

SELECTING THE RIGHT TREE

Trees come in a wide variety of shapes and sizes. The Landscape Guidelines provide a list of recommended plant species ranging from large shade trees to small ornamentals, though not all trees on the list are appropriate as street trees.

The biodiversity of the urban forest is an increasingly important aspect of maintaining a healthy tree coverage. Using a range of tree species beyond those typically found on the City's streets is strongly encouraged.

Below is a suggested list of species to be used as street trees due to their tolerance of urban conditions.

SUGGESTED STREET TREE SPECIES

- Maple
- London Plane
- White Oak
- American Elm
- Willow Oak
- Ginkgo
- Sawtooth Oak
- Japanese Zelkova
- Littleleaf Linden
- Eastern Redbud
- Cherry
- Japanese Maple
- Dogwood
- Holly
- Crape Myrtle

In order to select an appropriate street tree for a specific street, the species must have the appropriate scale and form for the context of the street and the adjacent land uses and, most importantly, the appropriate amount of soil volume to thrive. Other considerations include: sun exposure and culture; whether the trees growth might interfere with sidewalks surfaces, site distances, or other site amenities; if overhead and subsurface utilities might impede growth; the desired quality of light and shade; mature canopy size in relation to adjacent buildings; and frequency of curb-running vehicles such as buses.

DESIGN

- Street trees shall be approved for each individual project by the City Arborist and P&Z where part of a development of a master-planned area.
- Tree species should remain constant along the entire length of a block face.
- Exposed surface area of tree wells shall be a minimum of 4' by 10'. Larger dimensions may be required if deemed appropriate by the City Arborist and by P&Z where part of a development of a master-planned area or required as part of the Site Plan process.
- Tree wells shall support a subsurface tree trench large enough to provide sufficient arable soil volume and adequate moisture for individual trees. Tree wells shall hold a minimum volume of 300 ft.³ per tree. Continuous trenches that link individual wells shall be provided where possible.
- Planting strips for existing conditions shall be a minimum of 2.5' in continuous width. New development shall be minimum of 6' in continuous width.
- Planting strips and tree wells should be planted with hardy evergreen ground cover or grass sod or covered with a tree grate. The grate's size, shape, material and design should be approved by the City Arborist and by P&Z where part of a development of a master-planned area.
- In densely urban areas or those with limited sidewalk width, ADA-compliant tree grates are preferred.
- For areas with mid-high residential density, consider low growing shrubs, such as euonymus, that can better withstand the impacts from dogs.
- As street trees mature, they must be limbed up to a height of 7' from finished grade in order to provide clearance for pedestrians.
- Shade trees should be spaced approximately one tree for every 30 linear feet on center.
- Ornamental trees should be specified where overhead utilities are present.
- Smaller ornamental trees should be spaced approximately 20 feet apart feet on center.
- Evergreen trees are not to be used as street trees.
- Street trees do not apply toward crown coverage allowances.

STREET TREES

Street trees should be provided in every street design project. In general, the City's policy is to provide the largest tree species that is possible, given the particular constraints and context of each street. The City's **Landscape Guidelines** cover all aspects and requirements for street tree planting (including acceptable species) and should be consulted when designing streetscapes.

SOILS SELECTION AND MANAGEMENT

Soil selection is crucial not only to ensure plant health, but also to maximize stormwater management benefits. Healthy soils support healthier trees and plants and provide more space to absorb and filter rainwater. Heavily compacted soils are little better than concrete. They provide few nutrients, little ability to absorb water, and a harsh growing environment. Tree roots in compacted soil will migrate toward the surface for air and water, causing sidewalks to crack and heave, degrading the walk environment. Existing soils can be enhanced by aeration to restore porosity and/or through the addition of soil amendments, such as weed-free compost, which help retain soil moisture. Soil maintenance should be part of an operation and maintenance plan for urban vegetation.

Soil volume is as important as soil quality. The City recommends a minimum of 300 cubic feet for standard trees and 450 cubic feet per tree for BMP installations and a soil depth of 36-48". In constrained situations where large open tree trenches or planters are not feasible, soil volume can still be achieved through engineering treatments. Providing sufficient rooting soil in a dense, urban environment can be costly, but is worthwhile given the unique benefits that mature shade trees provide. Dedicated root space prevents buckling of sidewalk pavement and allows street trees to flourish over a longer-term, reducing replacement cost. Many of the significant environmental benefits that street trees provide only occur if trees are able to grow to their full, mature size.

INSTALLATION AND MAINTENANCE

Because trees are living infrastructure, proper installation, care, and maintenance are required to maximize the city's investment. The **Landscape Guidelines** provide recommendations for planting installation seasons, installation standards, and a recommended plant list including the size of street trees, shrubs, perennials and groundcovers.

For established street trees, standard maintenance consists of structural pruning on a regular cycle (typically every 3-5 years depending on the species, size, and location of the tree) and regular inspection by a certified arborist (recommended every 1-2 years) to assess the condition of the tree and determine the presence of any disease or damage that could lead to failure of the tree. Seasonal maintenance includes watering to ensure establishment of plant material; mulching to minimize water use, discourage weeds and protect against erosion; and pruning low shrubs and groundcover to control overgrowth onto sidewalks.

LINKS

City Arborist Tree Planting Program

<http://alexandriava.gov/recreation/info/default.aspx?id=18902>

Landscape Guidelines

https://alexandriava.gov/uploadedFiles/recreation/info/040907_land_guidelines.pdf

Green Sidewalk, BMP Design Guidelines

<http://alexandriava.gov/uploadedFiles/tes/info/GreenSidewalksBMPDesignGuidelines%20.pdf>

Virginia Department of Environmental Quality

Stormwater Design Specification for Landscaping

http://www.vwrrc.vt.edu/swc/documents/2013/DEQ%20Introduction_App%20E_Landscaping_SCraftonRev_03012011.pdf

Small Area Plans

<http://alexandriava.gov/planning/info/default.aspx?id=44614>

PLANTINGS AND STORMWATER MANAGEMENT



Stormwater quality BMPs can take the form of structural underground facilities (known as ultra-urban BMPs) that provide stormwater treatment, or BMPs can take the form of landscape features in the sidewalk or right-of-way that allow for vegetative plantings and treatment of stormwater runoff known as “green infrastructure”. The Guidelines in this section are based on the [Green Sidewalks, BMP Design Guidelines](#) for green infrastructure or urban bioretention techniques, and the [Virginia BMP Clearinghouse](#). They seek to balance the treatment of stormwater with the realities of limited space by using BMPs to create high-performing, healthy, thriving streetscapes that enhance the visual character and pedestrian environment of the street.

With over 500 lane miles, Alexandria’s streets provide an optimal opportunity to rapidly and radically transform traditional practices and implement stormwater BMPs. Additional capture of runoff for treatment in BMPs within the right-of-way helps the City reach its goals for reducing pollutant loads. These goals for meeting target reductions for the Chesapeake Bay Total Maximum Daily Load (TMDL) for nitrogen, phosphorus, and total suspended solids are enforced locally by the Virginia Department of Environmental Quality (VDEQ) through the City’s Municipal Separate Storm Sewer System (MS4) general permit. Additionally, the Virginia Stormwater Management Act, promulgated

under the Virginia Stormwater Management Program (VSMP) Regulations effective July 1, 2014, and adopted into Article XIII of the Zoning ordinance, requires the reduction of phosphorus loads associated with land-disturbing activities. Development and redevelopment projects must also meet the City’s more stringent “Alexandria Water Quality Volume Default” (WQVD) by treating ½” of stormwater runoff generating from all of the site’s impervious area. BMPs installed to meet the WQVD not associated with the state phosphorus reduction requirements may be credited towards the City’s TMDL goals.

Routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original construction of a project is exempt from the VSMP phosphorus reductions requirements. Paving an existing road with a compacted or impervious surface and reestablishing existing associated ditches and shoulders is considered routine maintenance if performed in accordance with local ordinance. Implementing stormwater BMPs for projects that undertake routine maintenance are an opportune time to provide stormwater quality treatment and reductions of pollutants to meet the City’s Chesapeake Bay TMDL requirements. In this case, the City can count all of the pollutant reductions toward the Bay TMDL goals. Land-disturbing activities for linear roadway projects

on prior developed lands meeting the VSMP phosphorus reduction requirements may be applied to Bay TMDL goals. New roads must meet the phosphorus reduction requirements for new development by implementing BMPs and the reduction cannot be credited toward Bay TMDL pollutant reduction targets. For roadways associated with redevelopment, phosphorus, nitrogen, and sediment reductions may be credited toward Bay TMDL pollutant reduction targets. Public and private roads and streets must meet pollutant reduction requirements during the plan review and approval process.

The systems described in this section are closely related to each other and should be customized for each specific location. Landscape architects and civil engineers should survey existing soil and drainage conditions, create an overall drainage and recharge plan, and specify the various components according to the opportunities and constraints for a particular project and location.

LOCATIONS FOR PLANTINGS AND BMPs

Planting in the public right-of-way typically occurs in the Amenity Zone; however, this is not the only place that can accommodate planting. Wherever there is an opportunity for landscape features, street, or development projects should also look for opportunities to incorporate BMPs. The preferred BMPs for use in the right-of-way are above-grade systems located within the sidewalk that treat stormwater runoff from adjacent roads and sidewalks.

Landscaped areas in the Frontage Zone can be excellent places to plant trees as they offer open areas for roots to spread. This is particularly the case when the Frontage Zone consists of (or is adjacent to) lawn panels or other open spaces. Plantings are still possible in the Frontage Zone adjacent to building foundations; however, to avoid any intrusive roots, barrier material is recommended.

It is important to note that while even modest improvements can advance the health of street plantings and the overall environmental performance of the street, surface BMP systems are typically installed only when streets are substantially improved or when new streets or sidewalks are established. The City is currently considering BMP retrofits in both MS4 and CSO areas to meet permit requirements for pollutant reductions in the former and green infrastructure requirements in the latter.

CONSIDERATIONS

- Location of buried utilities and width of sidewalk
- Frequency of pedestrian access and circulation patterns
- Accommodation of other streetscape features such as light poles and parking meters should be considered early in the design process
- Available soil volume and soil quality
- Slopes and gradients
- Level of pedestrian activity
- Where BMPs are required to meet the City's Stormwater Program goals of complying with the Chesapeake Bay TMDL and the MS4 general permit regulations, sizing for the BMPs shall follow the Green Sidewalks guidelines, the Virginia BMP Clearinghouse, the Virginia BMP Handbook and specifications or Bay Program specifications to the satisfaction of the Directors of T&ES and P&Z.
- Where BMPs are required to meet the City's more stringent WQVD not associated with BMPs to meet the state phosphorus reductions, sizing is based on treating the first ½" of runoff and may be based on the **Green Sidewalks** guidelines, the **Alexandria Supplement to the Northern Virginia BMP Handbook**, the **Virginia Stormwater Management Handbook**, or other appropriate design criteria, to the satisfaction of the Director of T&ES.
- Where BMPs are required to meet state phosphorus reduction regulations, they shall be sized in accordance with the Virginia BMP Clearinghouse and/or the most current Virginia BMP Handbook and VDEQ specifications. Water quality is computed using the 1" storm event and must be demonstrated using latest **Virginia Runoff Reduction Method (VRRM)** spreadsheet.
- In areas where design guidelines exist, consideration for the type of BMP system should be chosen to reflect the overall design intent
- BMPs require a 2' setback from the face of curb
- A minimum of 6' unobstructed sidewalk shall be maintained between the building face and the BMP
- Appropriate vision clearance must be maintained at intersections and pedestrian crossings
- Need for accommodating curbside parking or outdoor dining

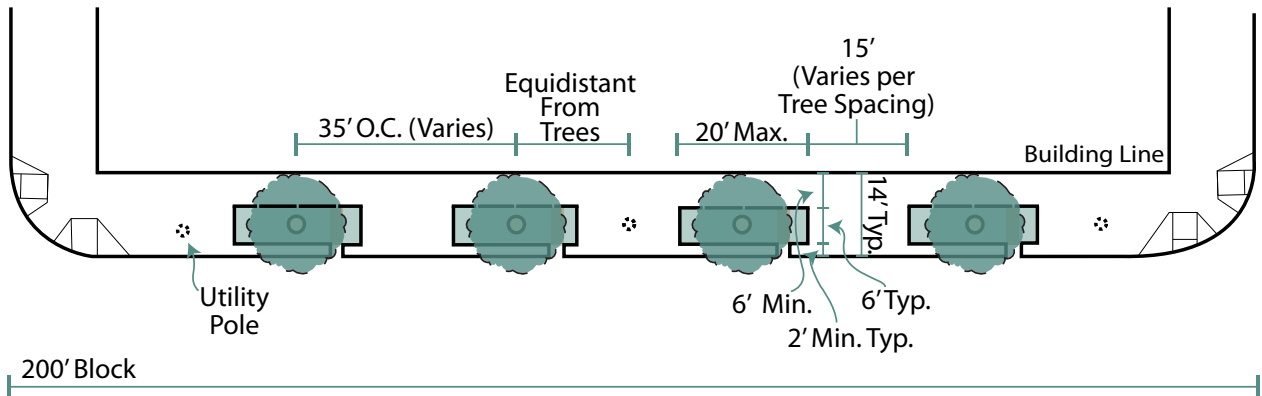
TYPES OF BMPS

There is a symbiotic relationship between the health and function of street trees and the BMP system. While BMPs improve the health of street trees, a healthy tree in turn offers such biological benefits as intercepting precipitation and filtering pollutants, reducing heat island effects and improving air quality.

To enhance tree health and better manage stormwater, designs should utilize and enlarge the space dedicated to street trees. Recommended design treatments do

more than just serve trees and waterways, they also enhance the image and functionality of the street.

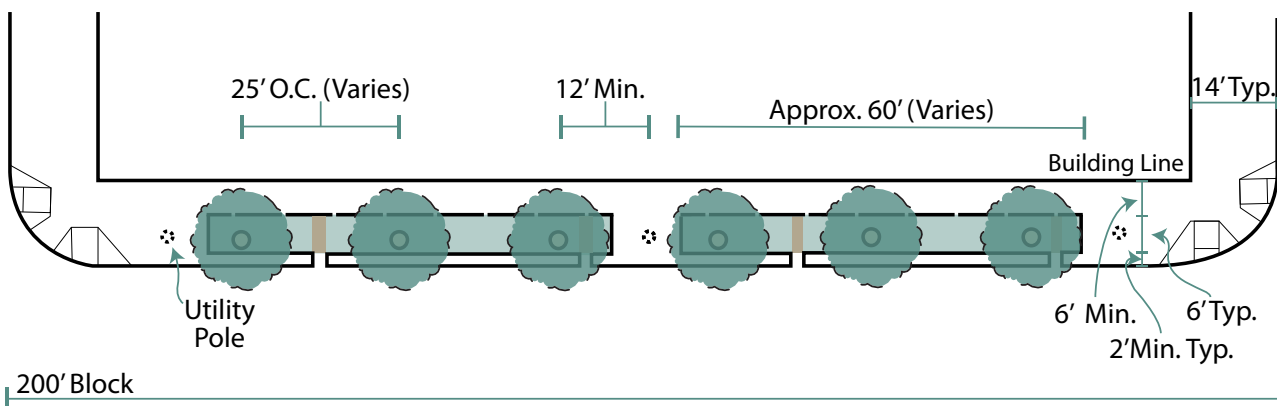
Different urban locations and uses require different BMP solutions. Consideration should be given to the following: street type; whether curbside parking is to be accommodated; adjacent land use and activities; and anticipated pedestrian circulation. Four main types of sidewalk BMPs are recommended in the **Green Sidewalk BMP Design Guidelines**:



Tree Well BMP

A landscape feature in the sidewalk that allows for tree planting and treatment of stormwater runoff. These systems are installed in a series with drains connecting the series. At street level, they appear to be individual features with sidewalk segments separating each well.

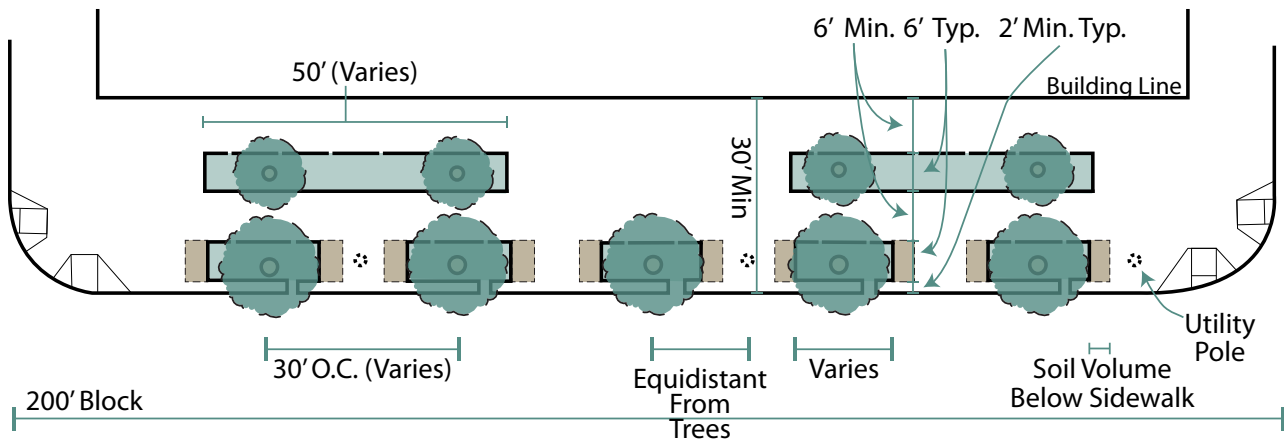
Consider installation on Main Streets, Mixed Use Boulevards and Shared Streets.



Continuous Planting Strip

A landscape feature in the sidewalk that allows for tree planting and treatment of stormwater runoff. These systems are installed in a series with drains connecting the series. At the street level, they appear to be a continuous feature with a large area of visible landscape planting and are occasionally separated by sections of sidewalk.

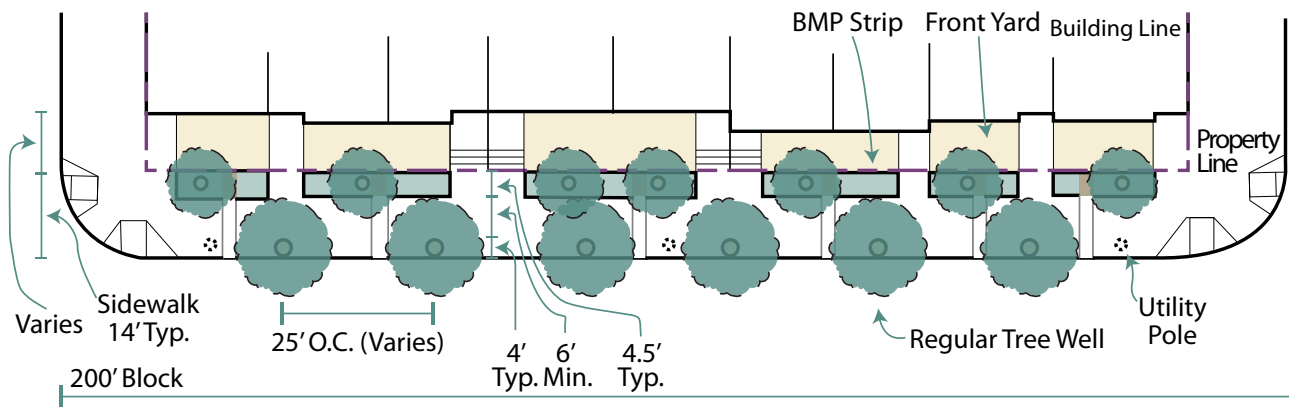
Consider installation on Commercial Connectors, Neighborhood Connectors and Industrial streets.



Mid-Sidewalk BMP

A landscape feature in the sidewalk that allows for tree planting and treatment of stormwater runoff. These systems are installed in a series with drains connecting the series. At the street level, they appear to be a continuous feature with a large area of visible landscape planting and are occasionally separated by sections of sidewalk. They are set back approximately mid-way between the curb and the building line.

Consider installation on Mixed Use Boulevards.



Back of Sidewalk BMP

A landscape feature in the sidewalk that allows for planting and treatment of stormwater runoff. These systems are installed in a series with drains connecting the series. At the street level, they appear to be either a continuous feature or a series of smaller features with an area of visible landscape planting and are occasionally separated by sections of sidewalk. They are located at the back of the right-of-way, and can be adjacent to front yards.

Consider installation on Neighborhood Residential Streets and Neighborhood Connectors.

INSTALLATION AND MAINTENANCE REQUIREMENTS

Please see the **Green Sidewalks: BMP Design Guidelines** for installation and maintenance requirements for green sidewalks in new development or redevelopment projects. While the BMP Design Guidelines provide more detail on where and when BMPs should be used, in general they should be incorporated into projects where “significant new construction will take place (e.g. large scale buildings or facilities, or areas of large scale master plan implementation) that includes either the construction of new roads and sidewalks, or significant rehabilitation of the existing right-of way facility.”

The Green Sidewalks: BMP Design Guidelines include specifications used for the design and installation of sidewalk BMP systems including soil, species, size and spacing, as well as planting design and layout. An appendix of typical details is also included.

In addition, the Green Sidewalks: BMP Design Guidelines address maintenance responsibilities and requirements. In many cases, the City will maintain the BMP after the bond period. In these situations, T&ES maintains the hardscape and drainage elements while the RPCA maintains all associated plantings and landscape elements.

Maintenance responsibilities will form part of a BMP Maintenance Agreement between a developer/applicant and the City. The **Memo to Industry No. 04-2014** shall be the basis for such agreements.

CONSIDERATIONS

- First year maintenance operations to ensure successful establishment
- Spring maintenance inspection and cleanup
- Routine and non-routine maintenance tasks, such as maintaining elevation differences, mulching, and sediment and trash removal

LINKS

Green Sidewalks: BMP Design Guidelines
<http://alexandriava.gov/uploadedFiles/tes/info/GreenSidewalksBMPDesignGuidelines%20.pdf>

Total Maximum Daily Loads (TMDLs)
<http://alexandriava.gov/tes/oeq/info/default.aspx?id=52652>

Virginia Runoff Reduction Method
<http://www.vwrrc.vt.edu/swc/Virginia%20Runoff%20Reduction%20Method.html>

Virginia Department of Environmental Quality Stormwater Design Specifications: Landscaping
http://www.vwrrc.vt.edu/swc/documents/2013/DEQ%20Introduction_App%20E_Landscaping_SCraftonRev_03012011.pdf

Northern Virginia BMP Handbook
<https://www.novaregion.org/DocumentCenter/>

Memo to Industry 10-11 “Paving for Parks and Plazas which are to be City-owned and Maintained.”

<http://alexandriava.gov/uploadedfiles/tes/info/PavingForParksAndPlazaAreas2.pdf>



Newspaper box



Bollards



Bike rack



Off-board bus fare payment machine

Wayfinding and Street Furnishings

Supporting street life requires more than just providing trees and sidewalks.

Streets also require places to park a bicycle, places to sit and linger, and wayfinding guidance to local destinations. Street furnishings such as benches, transit shelters, bicycle parking, bollards and trash receptacles are all key components of the public right-of-way that should be designed to ensure maximum accessibility and enjoyment of the street.

While there are some exceptions, most street furniture installation is installed in the Amenity Zone. For example, on occasion bicycle parking may be installed in the frontage zone if it is sufficiently wide enough to accommodate it. Regardless, street furniture should not impede movement in the Pedestrian Zone.

Street furnishings should enhance the overall function and character of the street. First and foremost, furnishings should be functional and safe for all users. In historic districts and areas with existing design guidelines, site furnishings should comply with the established guidelines. Elsewhere, a consistent palette of street furnishings is desired to provide a complement to the character and context of the street. For areas of Alexandria addressed by Small Area Plans, standard specifications for street furniture are provided. In other locations that are not covered by Small Area Plans, street furniture should be uniform throughout the project and should match the context of the street (subject to review and approval by P&Z).

Newspaper boxes are often a mix of sizes, shapes,, and colors. It is preferable to replace these with more visually appealing newspaper corrals that are placed in locations that do not impede pedestrian flow, while still ensuring freedom of speech and easy access to information.

Street furnishings often share space with other Amenity Zone elements such as sign and light poles, utility covers, hydrants, traffic control devices, and parking meters. Furnishings should be coordinated with these other elements to minimize clutter and maximize use, safety, and comfort. Please refer to the **Park Facilities Standards Manual** for a list of preferred amenities and manufacturers.

STREET NAME SIGNS



OVERVIEW

Street name signs are important for safety and convenience and should be placed at strategic locations to maximize visibility. Street name signs play a critical role in wayfinding throughout the roadway network.

» **All signs on Alexandria's streets should conform to the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD) and meet all accessibility requirements. Locations for signs should be selected based on engineering judgment and must be approved by T&ES.**

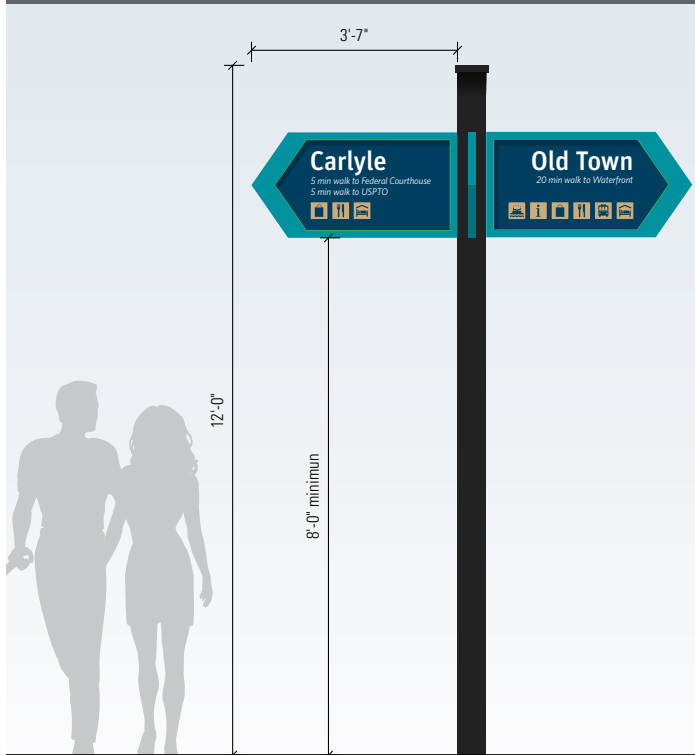
DESIGN

- Street name signs can be mounted overhead or on posts.
- Post-mounted street name signs should be placed on existing posts wherever possible unless obstructions reduce visibility.
- Internally illuminated box street signs should be limited to designated arterials.
- Individual location obstructions including trees, utility poles, traffic signals, and other signs are to be considered.
- Placement of street name signs should be determined on a case-by-case basis using engineering judgment.

LINKS

2010 Wayfinding Design Guidelines
<https://alexandriava.gov/Wayfinding>

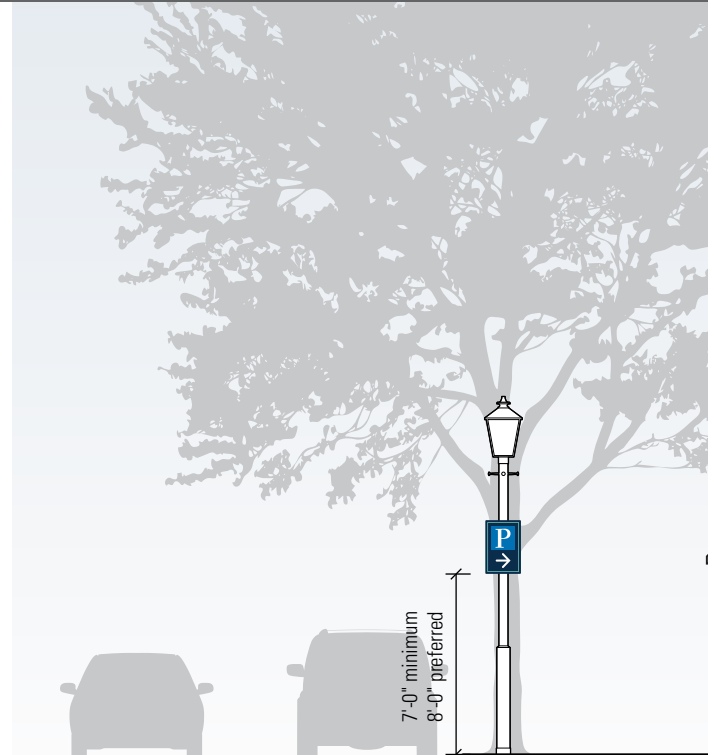
MULTIMODAL WAYFINDING



Alexandria Wayfinding Design Guidelines Pedestrian Signage

A distinct wayfinding system for pedestrians and bicyclists further enhances the efficiency in which people can travel around the City. The ability to create modern and distinctive wayfinding can distinguish walking or bicycling routes, highlight specific destinations, and define popular routes like the Alexandria Heritage Trail.

In September 2010, the City of Alexandria completed the development of a citywide **Wayfinding Design Guidelines Manual** that guides the implementation of wayfinding signs. The wayfinding system projects a consistent image for the entire city; reduces visual clutter; and promotes walking, bicycling, and use of mass transit. The goal of this system is to create an overall identity for the City that is compatible with its historic character that will also help to differentiate existing and emerging districts.



Alexandria Wayfinding Design Guidelines Parking Signage

The design manual addresses the following sign types:

- Highway signs
- City gateways
- Vehicular directional
- Parking signs
- Pedestrian kiosks and directional
- Shared use path signs
- Interpretive signs
- Destination identity
- Banner standards
- Neighborhood identity

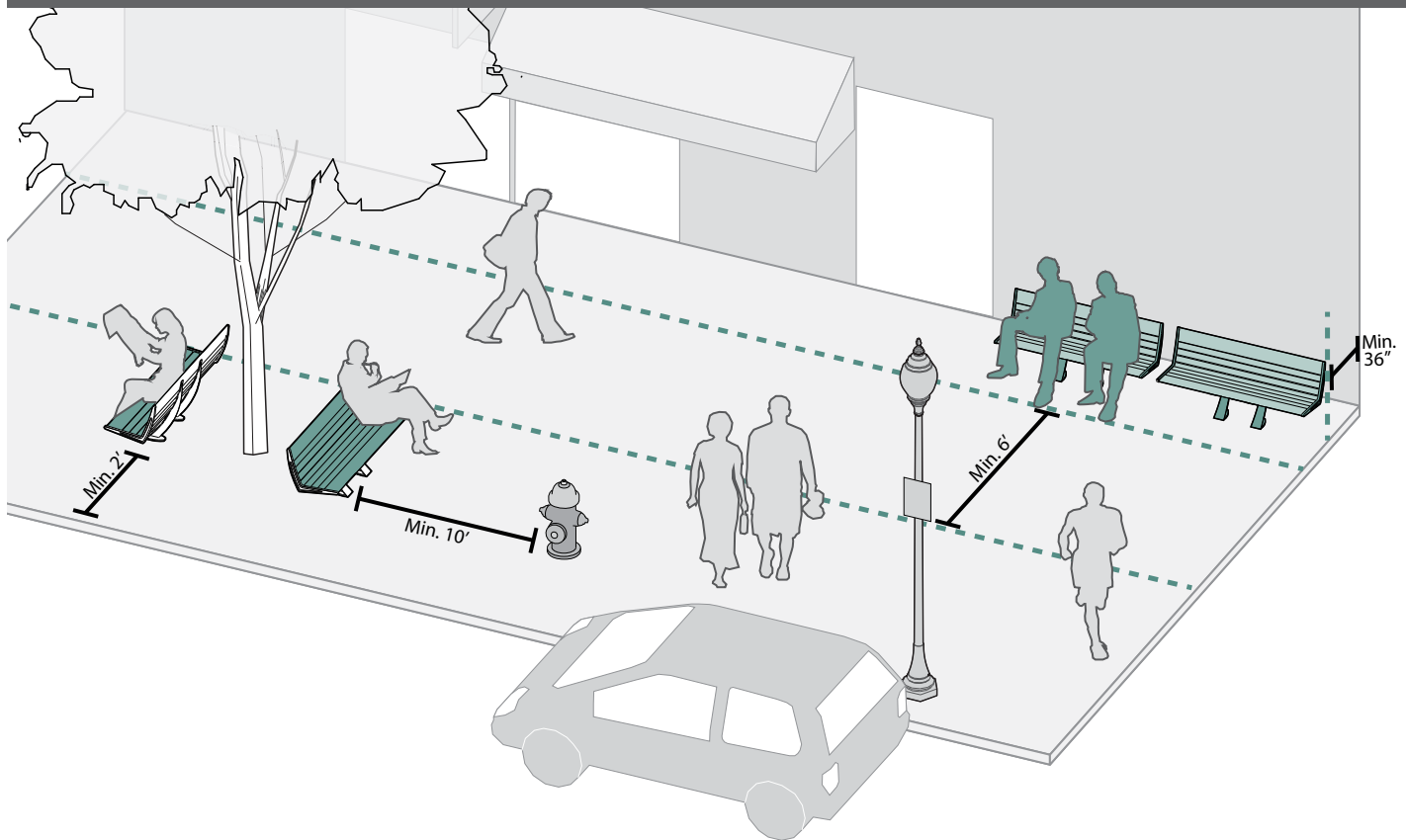
The manual addresses more detailed aspects of wayfinding sign design, including the size, color and design of each sign, as well as the placement of the sign with respect to the adjacent street.

LINKS

2010 Wayfinding Design Guidelines

<https://alexandriava.gov/Wayfinding>

PUBLIC SEATING



OVERVIEW

Public seating enhances the usability and enjoyment of the street and can be provided in a number of different ways. It can be integrated into other street elements such as the edge of planters and steps or as protection around trees. Seating may be fixed or mobile and adaptable. It may be made of any number of materials: however, durability and maintenance are key considerations.

» *T&ES approves certain seating types with specific requirements for anchors and mounting hardware; these must be used in order for T&ES to assume maintenance of any sidewalk furniture.*

DESIGN

- Seating should be located where it is most attractive and useful. Seating that serves a particular need, waiting for transit or resting from shopping, are always welcome.
- Seating is comfortable when it is in an area that has adequate observation to and from street life and sufficient lighting to feel safe.

- Seating in the Amenity Zone should be located at least 2' from the face of curb to reduce conflict with other curbside uses. It should be at least 10' away from fire hydrants and have at least 36" of clear space between it and trash receptacles or other fixed objects.
- Seating should be designed with a bench seat height of 17 inches minimum and 19 inches maximum above the ground.
- Seating is most commonly located in the Amenity Zone of the street, but may also be placed in the Frontage Zone. Seating in the Amenity Zone should generally face away from the street and toward the sidewalk or be aligned perpendicular to the curb. Seating in the Frontage Zone should face the street.
- Seating should be visible, but not obtrusive. It should remain out of the primary paths of travel and not conflict with entrances to buildings, loading zones, parked vehicles, access to fire hydrants or other similar activities.

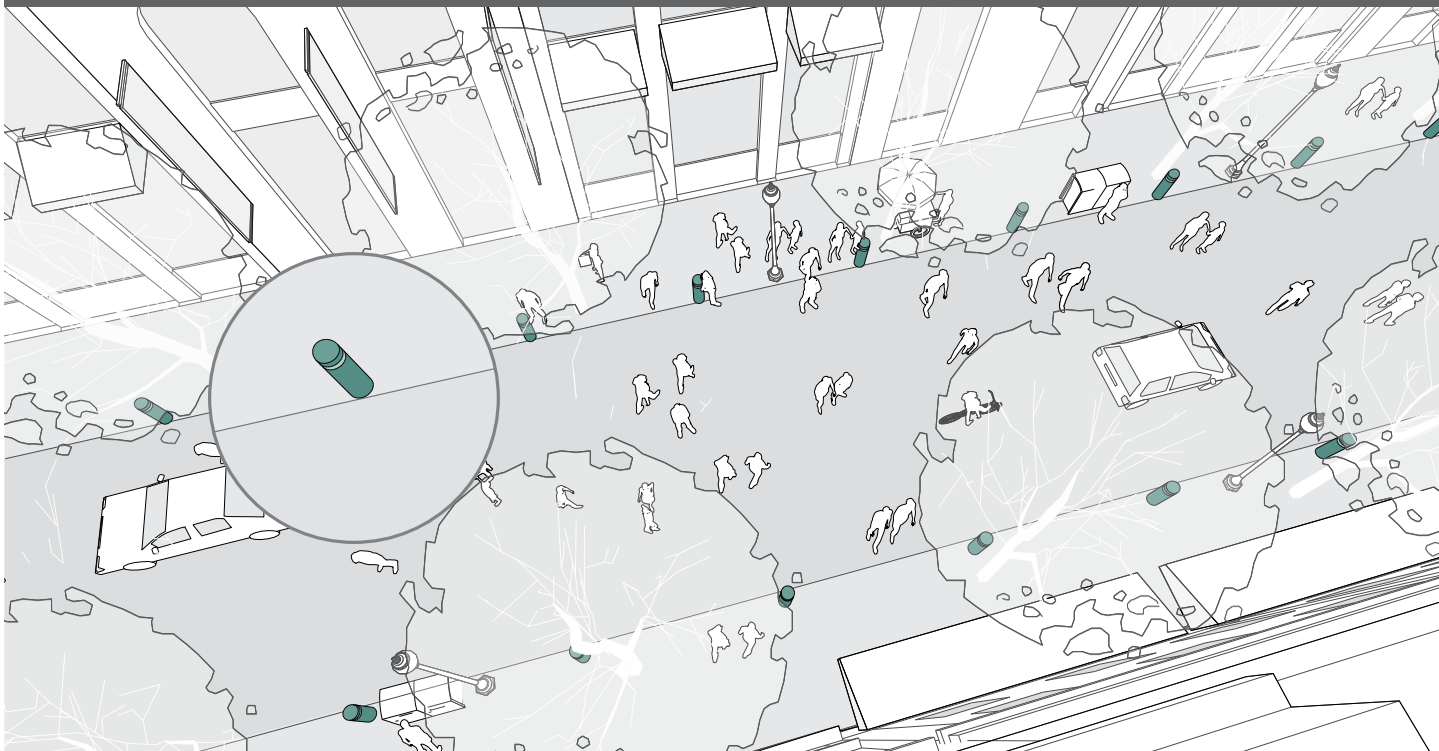
PUBLIC SEATING

- Seating may be located in areas with or without shade. Shaded seating is appreciated in the hot summer months, while seating in sunlight is desirable on colder days.
- Seating should be provided for a minimum of two people. Single seats may be provided as long as they are in groups of two or more.
- [Click here to access the Parks Facilities Standard Manual for more information on public seating.](#)

CONSIDERATIONS

- Seating should be provided both with and without armrests if possible. Armrests provide stability for those who require assistance sitting and standing. Seating without armrests allows a person in a wheelchair to maneuver adjacent to seating or to slide onto it easily.
- Movable seating is generally provided by and/or through a private owner who will store seating at night and monitor its use to ensure it is not placed in any travel way.

BOLLARDS



OVERVIEW

Bollards are posts or objects used to create an unobtrusive boundary between different modes of transportation or different realms of the street. Bollards are commonly used to define protected bicycle facilities; restrict vehicle access or entry; provide protection to pedestrian spaces or other street elements; or as security measures for buildings and infrastructure such as government and financial institutions.

Bollards can be fixed, flexible, or movable. They can be designed to withstand heavy impacts or give way on impact. Movable and breakaway bollards are intended to deter vehicle access but allow entry for fire engines and ambulances in case of an emergency. Information regarding the City's standard bollard is found in the [Parks Facilities Standard Manual](#).

BOLLARDS

» *Bollard locations and types require review by the Fire Department and should not be installed across emergency vehicle entrances or other fire access points.*

DESIGN

- Bollards must be visible under all lighting conditions for all users, particularly pedestrians and drivers.
- Bollards should be appropriately sized and spaced to serve their intended purpose. Bollards typically must be close enough together to restrict vehicle entry but far enough apart to provide accessible passage between them.
- Bollards can provide other amenities, such as bicycle parking, lighting, power outlets, litter and recycling receptacles, and art.
- Bollard use is not recommended at the entrances to off-road shared use paths, per the AASHTO Bike Guide.

CONSIDERATIONS

- Bollards in or adjacent to vehicle travelways are subject to substantial wear and tear. They should be maintained and replaced on a regular basis to ensure they are not a detriment to the street environment and its use.
- Bollards should not obstruct any travel way, but still should be placed appropriately to serve their protective function.
- Bollards should be judiciously and sensitively used. Security concerns in recent years have led to an abundance of bollards in the public space of the Washington DC region. Very few of these contribute to an inviting street environment.
- Bollards may need to be removed or demarcated with a taller vertical element during winter months to ensure they are still identifiable to snow clearance equipment operators.

LINKS

Parks Facilities Standard Manual

<https://www.alexandriava.gov/uploadedFiles/recreation/parks/Park%20Facilities%20Standards%20Manual.pdf>

BICYCLE PARKING



Alexandria Bike Corral



Overnight bike parking at Braddock Metro Station

Without bicycle parking, bicycle networks are of limited use. Bicycle parking enables bicyclists to safely leave their bicycles and enjoy the offerings of the street or to patronize businesses and destinations in the city. Bicycles take up substantially less space than automobiles—in fact, 10 bicycles can typically park in the area needed for a single car. Therefore, by providing bicycle parking, Alexandria can ensure access for many while using a relatively small area of the right-of-way. Visit the [Local Motion website](#) for more information on bicycle parking.

Bicycle parking consists of a rack that supports the bicycle upright and provides a secure place for locking. Bicycle racks should be permanently affixed to a paved surface. Movable bicycle racks are only appropriate for temporary use, such as at major community gatherings.

On-street bicycle parking is intended for short term use. Bicyclists parking overnight should utilize off-street bicycle parking facilities. Bicyclists typically find a variety of fixed objects in the street to which they

lock their bicycles. These include parking meters, tree well fences, lawn fences or other objects. These objects may satisfy the need for bicycle parking, but if this is the intent, they should be designed and located with this use specifically in mind. Otherwise, the use of such objects as parking may indicate insufficient or inappropriately located bicycle parking facilities.

The most common means of providing bicycle parking is with bicycle racks and bicycle corrals. Bike share stations are a unique form of bicycle parking utilized only by bicycles associated with that system.

- » ***Bicycle parking is installed by T&ES and requires agency approval. The City installs over 100 racks each year throughout the city. While most racks were installed based on surveys of need, residents and businesses can request that the City install racks on public sidewalks near their properties.***
- » ***The specific amount and type of bicycle parking required for new developments is outlined in the [City of Alexandria's Bicycle Parking Standards](#).***

BIKE RACKS



OVERVIEW

Bike racks are fixtures that provide a secure place to park and lock a bicycle. Bike racks may be stand-alone items bolted into the surface of the sidewalk or roadway or they may be integrated with other items in the street such as parking meter poles, street light poles, planters, or other items.

The alignment of bike racks should minimize the parked bicycles impact on the use of the sidewalk or curbside. Bike racks are frequently grouped in small clusters to better meet the needs of multiple users.

DESIGN

The City provides a list of [acceptable bicycle rack designs](#). These designs reflect industry standards for acceptable rack design and include the following requirements:

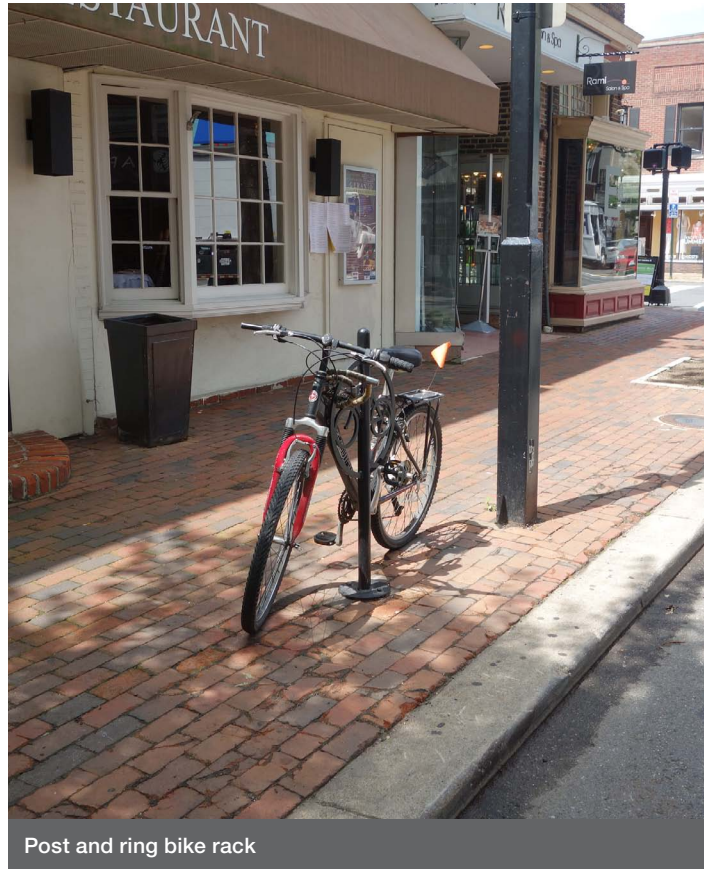
- Bike parking is typically located in the Amenity Zone, in a parking lane, or on curb extensions or bulbouts in groups of at least two.
- Place bike racks at least 5' from fire hydrants and crosswalks; 4' from loading zones, bus stops, bus shelters and benches or other seating; and a minimum of 3' from parking meters, newspaper

racks, mailboxes, light poles, sign poles, driveways, tree wells, trash receptacles, manholes, or other street furniture.

- Bike racks are typically installed parallel to the curb line to prevent intrusion into the Pedestrian Zone. Bicycle racks may be aligned at an angle or perpendicular to the curb where space permits. In all cases, the full length of a typical bicycle (70") should be considered when placing bike racks on sidewalks. A full bike rack should not intrude into the Pedestrian Zone.
- “U-racks” (bicycle racks shaped in an upside-down U) should typically be placed 10' apart on center. Bicycle racks located perpendicular to the curb should be a minimum of 3' apart.
- Bike racks should be installed close to building entrances, preferably within 50', in sites that provide good visibility and personal safety.
- Where possible, bike racks should be placed in a location that provides cover or protection, such as under awnings, shelters or other covered areas.

CONSIDERATIONS

- Bike racks should support the frame of the bicycle at two points above the bicycle's center of gravity.
- Where space permits, bike racks should provide options for parking different bicycle frame sizes and styles, such as bikes with trailers (117"), recumbents (82"), and tandem bikes (96").
- Bike rack design should allow easy locking of the frame and at least one, but preferably both, wheels.
- Bike racks may be customized to highlight a nearby **bicycle-friendly business**, a business or neighborhood district, or just as a feature of public art. If the latter, design must be reviewed to ensure that it can adequately serve its primary purpose of accommodating bicycle parking.
- Property owners are encouraged to request a bike rack on a public sidewalk in front of their property. Applications are available on the City website.
- On-street bicycle parking should be considered where there are space constraints on the sidewalk. This can be accomplished by converting an automobile parking space into a bike corral. Bike corrals are addressed in more detail in the curbside parking section of these guidelines.
- Bike rack installation requires a public space permit.



Post and ring bike rack

LINKS

Bicycle Parking Rules and Regulations

<http://www.alexandriava.gov/uploadedFiles/localmotion/info/gettingaround/Alexandria%20Bicycle%20Parking%20Requirements.pdf>

Local Motion- Bicycle Parking

<http://alexandriava.gov/BicycleParking>

Local Motion and Bicycle Friendly Businesses

<http://alexandriava.gov/localmotion/info/default.aspx?id=49872>

Bike Rack Design

<http://alexandriava.gov/uploadedFiles/localmotion/info/BicycleParkingDesigns.pdf>

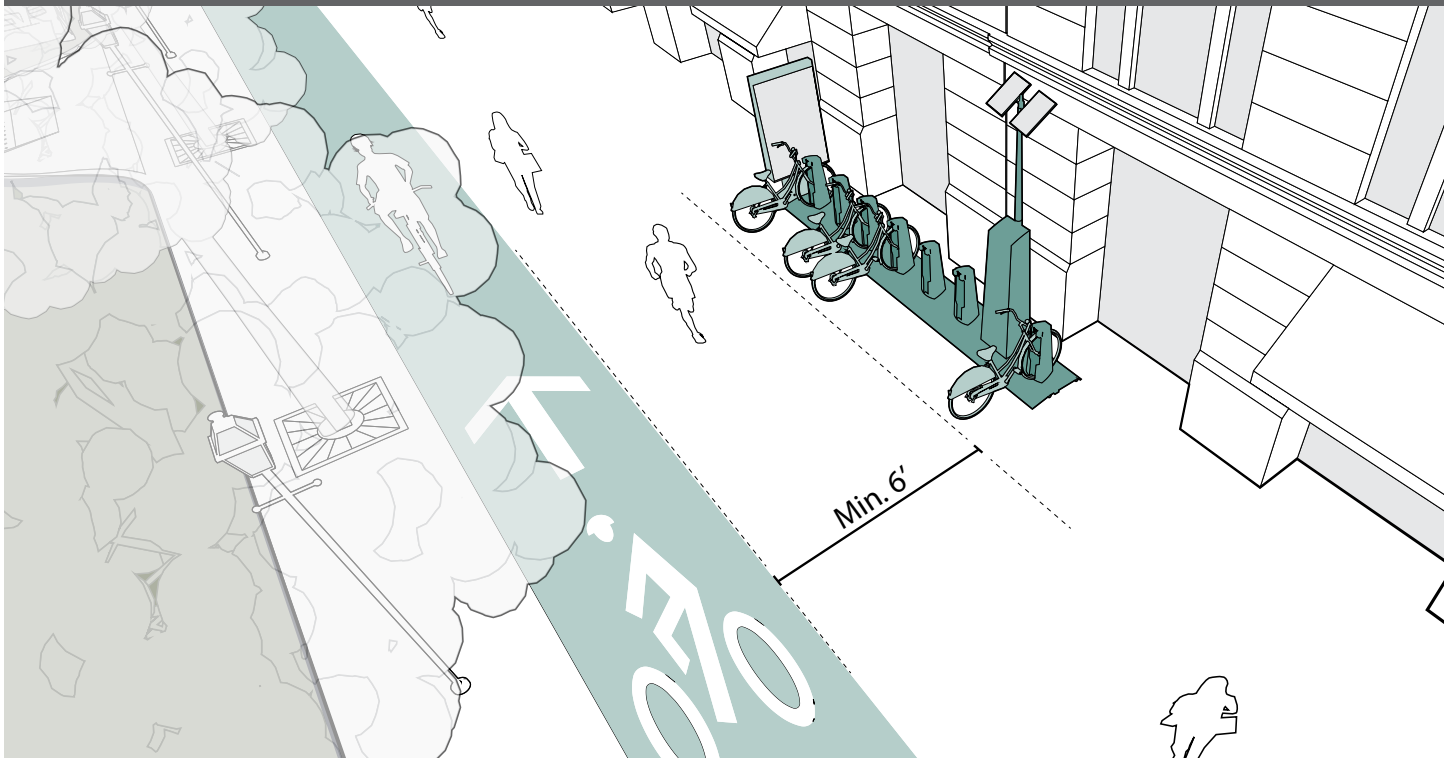
Bicycle Parking Rack Replacement

<http://alexandriava.gov/uploadedFiles/localmotion/info/B-Bike%20Parking%20On%20Street%20-%20Plan.pdf>



"U" bike racks

BIKE SHARE STATIONS



Capital Bikeshare station outside Braddock Road Metro Station

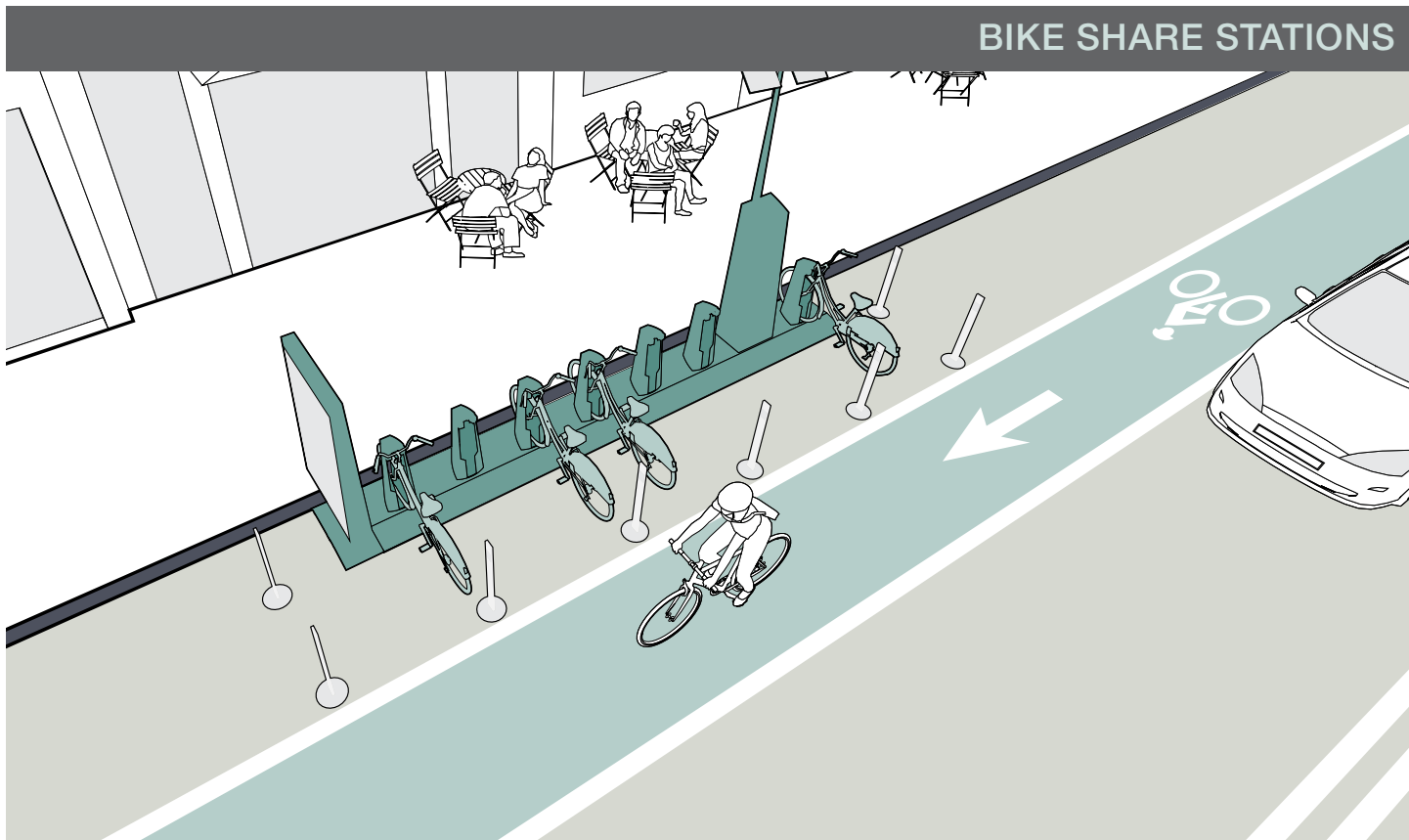
OVERVIEW

Bike share stations should be located to encourage short, one-way trips for commuting, shopping, running errands, social outings, exercise, and sightseeing. Bike share stations help address the first and last mile issue many transit riders face. For more information see the [Local Motion](#) and/or [Capital Bikeshare websites](#).

DESIGN

- Station size and configuration varies. Designers should be aware of the station footprint to ensure successful placement in the public Right of Way.
- Station locations should:
 - Maintain a 6' clear pedestrian path (see [Page 3-6](#))
 - Target popular destinations and high density areas
 - Receive sufficient sunlight for solar apparatus
 - Utilize sidewalks, private property or parking lanes efficiently
 - Avoid obstructing utilities, fire hydrants or other street furniture

BIKE SHARE STATIONS

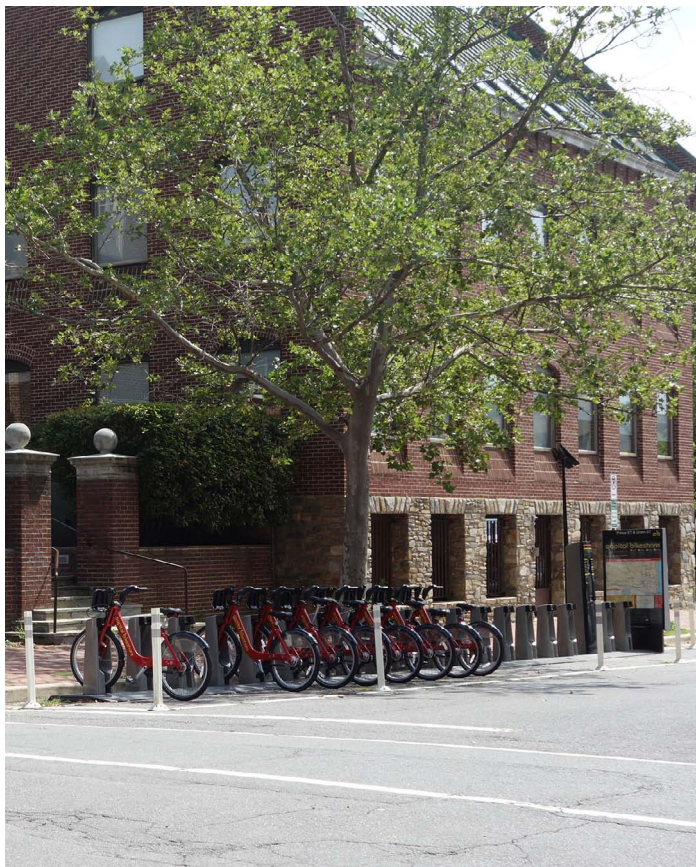


CONSIDERATIONS

- Bike share stations may be located either on the sidewalk or in the curbside of the roadway. They may also be located on parks, in plazas or on privately owned space so long as they remain publicly accessible.
- Bike share stations are modular and can be arranged in a number of different configurations. Bike share stations must be placed so as not to impede the Pedestrian Zone.
- Access to and from a bike share station must be considered, especially when located in the Amenity Zone. The placement should maximize convenience for bike share users, yet minimize conflicts with pedestrians if bicyclists access the station by riding on the sidewalk.

LINKS

Local Motion- Capital Bikeshare in Alexandria
<http://alexandriava.gov/localmotion/info/default.aspx?id=55082>



Capital Bikeshare station at Union and Prince Streets

Transit Amenities

Every transit trip begins and ends as a pedestrian trip. Sidewalks are an integral part of a functioning transit system.

Transit stops, however, must provide for two purposes: the through 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 stop fixtures in concert with other elements of the street edge, such as street trees, street lights, signal boxes, storm drains, and other additional elements. All transit stops must meet all applicable accessibility requirements. All transit stops should have paved sidewalks connecting them to the larger network and area destinations.

Transit stops commonly include, at a minimum, an unobstructed paved pad for boarding and alighting and a signpost indicating the transit provider, route and schedule. Additional basic features may include waste receptacles, seating, or leaning rails and route maps. Premium transit stops may have larger shelters, more comfortable waiting spaces, enhanced rider services, and place-making elements such as unique lighting and/or public art.

Transit stops should be clearly identifiable as such. Enhancing a transit stop with the elements above increases comfort for riders and pride and ownership from the community.

At present, three bus systems provide service within the City of Alexandria: DASH, Metrobus, and Fairfax Connector provide transit service within the City of Alexandria. The free King Street Trolley branded service is operated by DASH. Two of the three premium transit corridors in the City are being planned and one has been implemented

TRANSIT STOPS



OVERVIEW

Any marked or signed location where transit vehicles stop and service passenger boarding and alighting is a transit stop. Transit vehicles will only stop where there is a transit sign. The most basic transit stops have only a pole mounted “header” sign indicating the transit provider and route(s). High frequency routes and higher volume stops generally have more passenger amenities such as benches, shelters, traveler information, trash receptacles, bicycle parking, and other features.

Transit stops can be found on virtually any street type.

All transit stops should be readily identifiable, comfortable, safe, and accessible. The design of the stop, including length and location, should be determined

in consultation with the transit operators within the City. Width should be adequate to ensure waiting transit patrons do not block or constrain pedestrian flow on the sidewalk. All stops are required to be ADA compliant, including providing landing pads and curb heights that allow for the loading and unloading of passengers in wheelchairs.

Transit stops should be designed to accommodate passenger activity at all doors of the transit vehicles. If landscape strips or street trees are provided in the bus zone, these should be located in such a way that does not require transit passengers to walk through or over planting areas. Street trees must be trimmed or located to reduce conflict with the approaching transit vehicle.

TRANSIT STOPS

DESIGN

- Transit stops on urban streets are typically located at the natural curb line or on a bus bulb or transit island. Dedicated transit facilities may use medians. Transit operations, curbside uses, posted speed limits, traffic volumes, transit frequency and typical bus dwell time all influence location decisions for transit stops. See Transit Accommodations at Intersections for bus bulb design guidance.
- Transit stops may be located near-side, far-side, or mid-block. Near-side stops are immediately prior to intersections. Far-side stops are immediately after an intersection. Mid-block stops are located between intersections.
- Transit stops should be proximate to crosswalks. Mid-block stops should provide access to mid-block crosswalks.
- The landing zone at each transit vehicle door should be a clear zone 5' long, (parallel to the curb) by 8' deep (beginning immediately adjacent to the curb). Newly constructed sidewalks should have a 10' by 8' landing zone to provide an accessible space for loading and unloading. If the sidewalk is not wide enough to support an 8' landing zone, a curb extension (bus bulb) should be built where on-street parking is present to accommodate the minimum width. Bus bulbs should extend to within 1' to 2' of the edge of travel lane (see **Bus Bulb** section). All transit stops should meet ADA Standards. 1' to 2' of the edge of travel lane.
- Landing zones should be provided at all doors of the transit vehicle. For articulated buses, the distance between the front and rear landing zones is 18'. Different length buses have different door configurations and landing zones should be designed in coordination with all transit providers.



Patrons board a DASH bus



Users alight from the bus

TRANSIT STOPS

- The landing zone should be clear of all obstructions including street trees, signal or light poles, and signposts.
- When street trees are desired near or within bus stops, the transit provider must be consulted and the following guidelines should be adhered to to avoid conflicts between transit vehicles and street trees (General street tree guidance can be found in the Street Tree section of this document on page 3-21).
 - Trees should be excluded from a 40 ft. zone which represents the length of the bus as it is serving the stop (60 ft. in the case of articulated buses).
 - Trees within both the 10 ft. departure zone and the 20 ft. approach zone (on either side of the 40 ft. zone) should be selectively located to minimize conflict with vehicles and to allow direct line of sight for approaching buses.
- The length of the stop depends on vehicle type as well as the location of the stop, (i.e., near-side, far-side or mid-block) and should be done in consultation with the transit provider. High frequency routes or stops serving multiple transit routes may require additional transit stop space; however, in general:
 - Far-side stops should be at minimum 60' long, 80' for routes with articulated buses
 - Near-side stops should be at minimum 90' long, 100' for routes with articulated buses
 - Mid-block stops should be at minimum 100' long, 120' for routes with articulated buses
- Transit stops should be setback a minimum of 5' from crosswalks. Where feasible, a 10' setback is preferred. Where stops are not at an intersection, pedestrian crossings should be accommodated behind the departing transit vehicle.
- Install signposts indicating the transit providers and routes servicing the stop at the front of the transit stop 2' behind the curb. The signpost is generally used as the stop measure for transit operators indicating the stop point of the front of the vehicle. The rough location of bus doors may be measured from this point.
- Where possible, trash and recycling receptacles should be placed near the front of the transit stop, at a minimum of 18" from landing zones, minimum 3' away from benches or shelters, and in the shade where possible. They should also be anchored to the pavement to deter theft.

CONSIDERATIONS

- Bus bulbs generally enhance transit performance and improve the passenger experience; however, they may only be utilized on streets where curb lanes are not used for travel and generally where posted speeds are 35 MPH or less. See Transit Accommodations at Intersections for guidance on bus bulbs.
- Consider bus bulbs where additional pedestrian space is needed or where a transit vehicle re-merging into traffic is challenging.
- Transit stops should be well lit and highly visible to improve the sense of safety and comfort at all times of the 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.
- Consider opportunities for shade in the vicinity of transit stops such as street trees, awnings, or other elements to improve passenger comfort while waiting, especially in hot or inclement weather.
- Whenever possible, provide bicycle racks at or near transit stops to accommodate intermodal transfers. Bicycle racks should not impede access to or from transit stops or pedestrian flow on the adjacent sidewalk or crosswalk.

TRANSIT SHELTERS



OVERVIEW

Transit shelters increase both the comfort and visibility of transit stops by providing shelter from sun, rain and other elements. Shelters typically, though not always, provide additional seating and lighting at a transit stop adding comfort and convenience for riders.

» *All transit shelter installations must be approved by the City of Alexandria's T&ES Department and meet the design and specifications as approved by the City in May, 2014.*

DESIGN

- Transit shelters should adhere to the most recent standard shelter design and specifications adopted by the City of Alexandria. [Click here for the City's standard bus shelter design.](#) The standard shelter has three sides and is open to the street on the fourth side. It is 5' 4" deep and 12' 11" wide.
- Shelter placement must allow for unobstructed loading and unloading.
- Shelters must not impede pedestrian flow on the sidewalk. A minimum 6' clear Pedestrian Zone must be maintained.
- Per City criteria, shelters are only recommended for stops with 40 or greater passenger boardings per day. Stops should have adequate right-of-way to accommodate a shelter and the required Pedestrian Zone width. Shelters are also considered for locations near designated activity centers and locations serving multiple routes or transfers.
- The following requirements must be met before a shelter can be considered:
 - Property ownership
 - Adjacent property owner approval
 - Compliance with accessibility requirements
 - Adequate physical space and clear widths
 - Close proximity to an existing bus stop
 - Approval and maintenance agreements by the City of Alexandria

TRANSIT SHELTERS

- The following minimum clear widths for shelter placement should be maintained:
 - 1' from a blank building face (shelters should not block active store windows)
 - 8' from the back of curb
 - 15' from crosswalks (for visibility at near-side bus stops)
 - 1' from any ground obstruction (i.e., manhole, tree pit, signpost, etc.)
 - 10' from fire hydrants
 - 3' clear of the landing zone (maximum 25' |to the right of the landing zone)

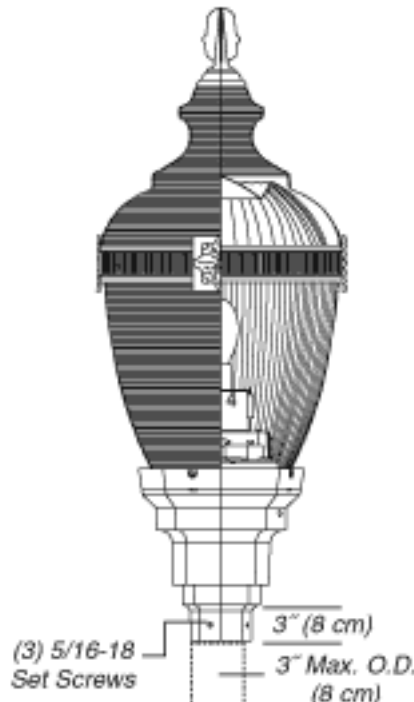
CONSIDERATIONS

- The location of transit shelters should minimize obstruction of sight lines.
- Shelters should be located to facilitate maintenance (e.g. glass and other elements of the shelter can easily be replaced as necessary).
- Shelters should provide their own light source, preferably utilizing solar photovoltaic systems. Where lighting is not provided in the shelter, shelters should be located where street lighting is abundant.
- Shelters should be located between store entrances or shop windows wherever possible to avoid obstructing views of retail activity or offerings.
- Consider opportunities to provide additional passenger amenities concurrent with shelters such as seating, local area information, wayfinding and real time traveler information.
- Transit stops with passenger activity high enough to warrant a shelter also warrant bike racks.



Transit shelter examples in Alexandria

STREET LIGHTS



Street lights add comfort and safety to the street while providing character and scale. Street lighting is typically oriented toward the vehicle or pedestrian travel ways; however, additional street lighting can highlight public art, architectural features, or be an artistic expression itself.

Street lighting can also be an expression of street type. Higher activity commercial streets typically have a higher level of overall street lighting, while lower intensity areas such as residential streets and parkways will generally have less frequent street lights and lower lighting levels.

Lighting levels should be consistent along the street without pools of light and dark. Lighting should be managed to reduce energy consumption and light pollution. The spectrum of light should ideally mimic sunlight where possible as this is more pleasing to the human eye. The City of Alexandria uses

the recommended values in American National Standard Practice for Roadway Lighting (Illumination Engineering Society RP-8-00) for LED street lights and follows Federal Highway Administration standards for lighting for roadways, walkways, bicycle facilities, crosswalks, and pedestrian underpasses. These levels vary depending on light type, street functional classification, and level of pedestrian activity or conflict.

- » Please refer to **Chapter 2 of the Parks Facilities Standard Manual** for information regarding lighting standards.
- » Additionally, [click here to see a map of Gadsby Light District boundaries](#).
- » *Dominion Virginia Power owns and maintains the majority of street lights in the public right-of-way in Alexandria. T&ES approves street lights.*

DESIGN

- In general, lighting should reflect the character and urban design of the street type to create a recognizable hierarchy of roads and spaces.
- Pedestrian scale lighting will be provided for all new development projects
- Comply with lighting requirements in areas with existing design guidelines.
- Light Emitting Diode (LED) or solid-state lighting (SSL) are strongly encouraged. Both LED and SSL are more energy efficient and are therefore consistent with Alexandria's Eco-City Charter. See [Streetlight Pilot Project](#) for more details.
- Lighting is typically located in the Amenity Zone of the street. Depending on conditions, lighting may be permitted in medians, however this is less common and often restricted.
- Light poles are typically located 18" off the front of curb.
- Lighting should be oriented toward travelers both in the roadway and on the sidewalk. Adequate lighting at intersections and crossings is essential.
- Pedestrian scale lighting (lower than 20') should be used alone or in combination with roadway scale lighting in high-activity areas to encourage nighttime use and as a traffic calming device.
- Critical locations such as ramps, crosswalks, transit stops, and seating areas that are used at night must be visible and lit.
- Lighting may either alternate on either side of a street or be arranged parallel. Parallel arrangements are more formal and common in retail activity centers.
- Lighting should be located in concert with street trees—often alternating trees and lights—so that trees do not block the illumination.
- Light poles should not impede the pedestrian way.

CONSIDERATIONS

- Clamp-on brackets for banners or hanging planters are possible but are not installed or managed by Dominion Virginia Power. They are considered enhanced treatments that require maintenance agreements.
- Lighting on residential streets should not illuminate residential quarters such as upper level windows to the extent possible.
- Quality and color temperature of light can impact the character and visitor perception of a street or neighborhood.

LINKS

Chapter 2 of the Parks Facilities Standard Manual
<https://www.alexandriava.gov/uploadedFiles/recreation/parks/Lighting%20Section.pdf>

Alexandria's LED Streetlight Pilot Project

<https://www.alexandriava.gov/tes/oeq/info/default.aspx?id=34122>

Local Motion Solar Bus Shelter

<http://alexandriava.gov/localmotion/info/default.aspx?id=21470&src=rss>

Street Light Maintenance

<http://alexandriava.gov/tes/info/default.aspx?id=3534>

4 ROADWAYS



Alexandria's streets have evolved over centuries to form the transportation network that exists today. In older parts of the city, the roadways are laid out in a regular grid pattern and are relatively compact. In areas of the city that were developed after the 1940's, the roads are more curvilinear and grid patterns are less common. Major roadways are typically quite wide while minor streets can be very narrow.

While Alexandria's roadways have long been dominated by vehicular traffic, the City recognizes the need to rebalance the transportation network to ensure the safe and efficient movement of all forms of transportation including bicycles, automobiles, delivery trucks, and transit vehicles.

This chapter addresses roadway design in Alexandria, specifically covering the area of the street that extends between two curb faces. This is generally intended for vehicular travel and parking. It is often the area where bicycle travel accommodations are

made. Roadways also include medians and other raised features that occur between the curbs delineating the sidewalk zone.

» *T&ES is responsible for approving all roadway designs and all changes on city-owned streets. Roadway designs may also require coordination with the Alexandria Fire Department, Commission on Persons with Disabilities, the Virginia Department of Transportation (VDOT) and P&Z.*

For additional roadway design guidance, reference the **Manual on Uniform Traffic Control Devices (MUTCD)**, the National Association of City Transportation Officials (NACTO) **Urban Street** and **Bikeway Design** Guides, and the **American Association of State Highway and Transportation Officials (AASHTO) "Green Book,"** the **AASHTO Guide for the Development of Bicycle Facilities**, and the **AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities**.

Safe Speeds

Streets should operate at speeds that create comfortable environments for pedestrians and bicyclists as well as motor vehicles. Street designs will aim to limit excessive speeding, and design speeds should be appropriate for the street type and context of surrounding land uses. New streets will be designed to produce operating speeds that match the target design speed. On existing streets with excessive speeds, traffic calming measures will be considered to reduce speeds to improve safety and comfort for all users.

Pedestrians and bicyclists are particularly vulnerable in the event of a crash. Speed is of fundamental importance: the severity of a pedestrian injury in the event of a crash is directly related to the speed of the vehicle at the point of impact. For example, a pedestrian who is hit by a motor vehicle traveling at 20 mph has a 95% chance of survival, whereas a pedestrian hit by a motor vehicle traveling at 40 mph has a 15% chance of survival.¹ In addition, vehicles travelling at lower speeds also have more reaction time, which helps prevent crashes.

**25
MPH**

City streets should be designed to produce an operating speed that does not exceed 25 mph.

The following exceptions apply:

**15
MPH**

Shared Streets and alleys should be designed to produce operating speeds that generally do not exceed 15 mph (Virginia law allows municipalities to set speeds that are lower than 25 mph).

**25
MPH**

Neighborhood Residential Streets should be designed to produce operating speeds that do not exceed 25 mph.

**35
MPH**

Parkways should be designed to produce operating speeds that generally do not exceed 35 mph.

**35
MPH**

Commercial Connectors and Industrial Streets should be designed to produce operating speeds that do not exceed 35 mph.

TARGET SPEED = DESIGN SPEED = POSTED SPEED



Typical 25 mph street

¹ Killing Speed and Saving Lives, UK Dept. of Transportation, 1987, London, England. See also Limpert, Rudolph. Motor Vehicle Accident Reconstruction and Cause Analysis. Fourth Edition. Charlottesville, VA. The Michie Company, 1994, p. 663.

Lane Widths

Minimizing travel lane widths is essential to creating additional roadway space for other users. Travel lane width also has an impact on motor vehicle speeds: motorists tend to drive faster in wide travel lanes and slower in narrower lanes. Traditionally, 12' has been the standard for motor vehicle travel lanes. The AASHTO “Green Book” allows 10' travel lanes in low speed environments (45 mph or less). Narrower lane widths have been avoided in the past due to concerns about vehicle occupant safety and congestion, especially on arterial roadways; however, research on suburban and urban arterials has shown that in most cases, travel lane widths between 10 feet and 11' on arterials and collectors do not negatively impact overall motor vehicle safety or operations, and also have no measurable effect on capacity.² The study found one exception where 10' wide travel lanes should be used with caution—on four-lane, undivided arterial roadways.

The benefits of narrower lane widths include:

- Lower speeds, improving the safety of all users
- Fewer, less severe crashes for all users
- Reduced crossing distance for pedestrians
- Reduced footprint of the roadway, resulting in better use of land and reduced run-off

The chart below summarizes guidelines for designating lane widths in the City of Alexandria. The values in this chart should be applied to major street reconstructions as well as resurfacing or other maintenance projects where lane reallocation or resizing may occur.

Many existing residential streets in Alexandria are “yield streets,” which are two-way streets with parallel parking on both sides, where oncoming drivers must yield in order pass each other when parked cars are present. These streets are generally 25' in width (curb to curb dimension) and carry traffic volumes that do not exceed 1,500 vehicles per day.

STREET TYPOLOGY	MINIMUM ^{3 4 5}	PREFERRED	MAXIMUM
Commercial Connector	10'	11'	12'
Main Street	10'	10'	12'
Neighborhood Residential	9'	10'	10'
Mixed Use Boulevard	10'	10'	12'
Neighborhood Connector	10'	10'	12'
Parkways	10'	10'	11'
Industrial	11'	12'	13'
Shared Streets	N/A	N/A	N/A
Overlays	Minimum	Preferred	Maximum
Bicycle Network Streets	N/A	N/A	N/A
Transit Streets ⁶	11'	11'	12'
Historic Streets and Alleys	N/A	N/A	N/A
Other	Minimum	Preferred	Maximum
Parking Lane	7'	8'	N/A
Two-way left turn lane	10'	12'	12'
Right or left turn lane	9'	10'	11'
Alley (one-way)	N/A	15'	N/A
Alley (two-way)	N/A	18'	N/A

Notes: A design exception may be required for some widths on federal or state-funded projects.

2 Potts, Ingrid B, Harwood, Douglas W and Richard, Karen R. Relationship of Lane width to Safety for Urban and Suburban Arterials. Washington, D.C.: Transportation Research Board, 2007.

3 The width of the gutter is included as a part of the total width of the lane. When a travel lane is adjacent to the curb, add 1' to the preferred lane width. When the speed limit is 35 mph or greater, the width of the concrete gutter should not be counted towards the width of the travel lane adjacent to the curb. Additionally, when a travel lane is next to a raised median, a 1' shy distance should be added to the lane width. There should also be a stripe painted around the median.

4 On streets with high volumes of heavy vehicles (>8%), one 11-foot wide travel lane should be provided in each direction (generally the curb-side lane).

5 A street should not be designed using all minimums.

6 For Complete Streets retrofit projects involving a constrained transit street, maintain the existing width of the transit lane.

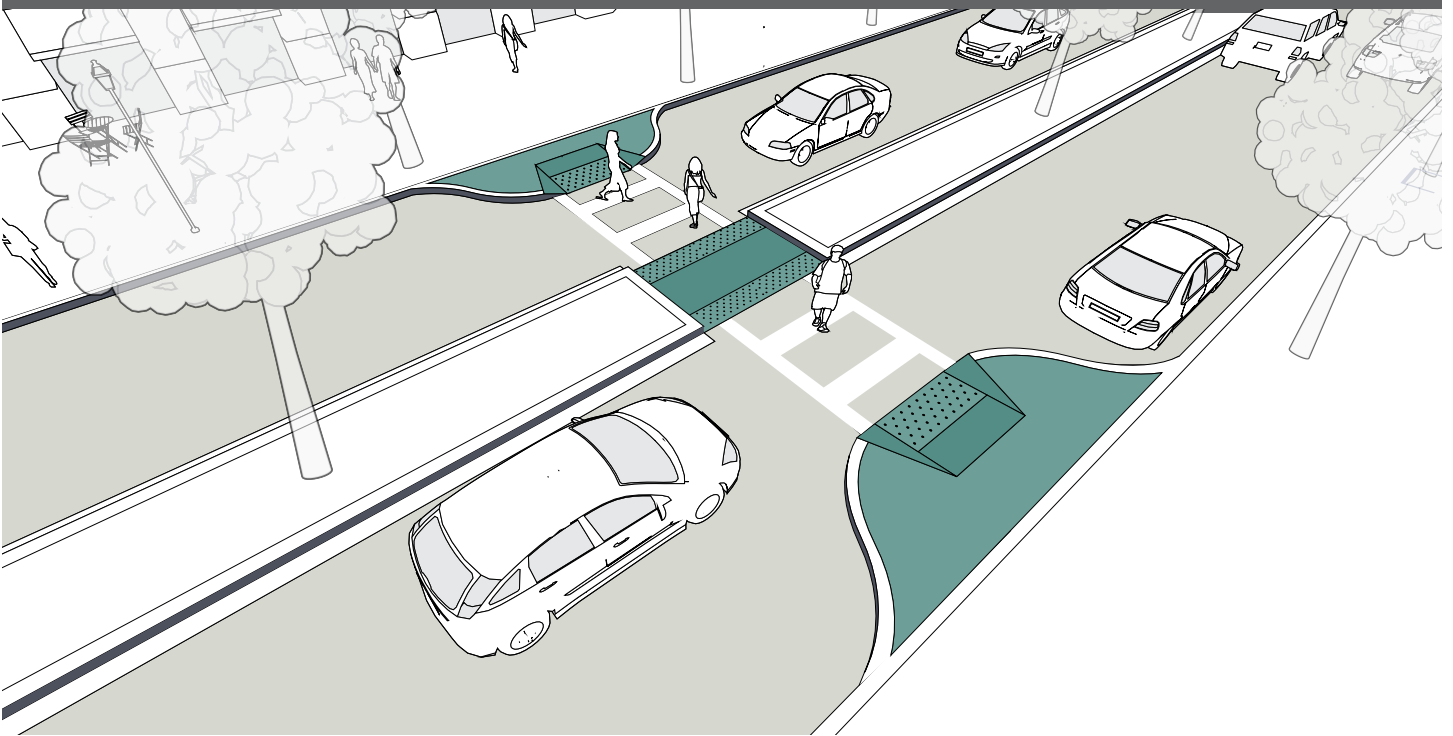
Design Features That Reduce Operating Speeds

Alexandria’s roadways should be designed to operate at speeds appropriate for the context of the street type. Managing traffic speeds is critical to maintaining safety for all users.

There are a number of different tools and treatments that can be used to reduce operating speeds. Ideally, the street environment provides cues to the driver to reduce speed. This can be accomplished through a variety of geometric design features described below.

Enforcement and regulatory measures are a necessary complement to any physical infrastructure to manage travel speeds.

MID-BLOCK NECKDOWNS



OVERVIEW

Neckdowns are curb extensions on opposite sides of the road that create a “pinch-point” at a midblock location. They are particularly useful on streets with longer block lengths where motorists tend to pick up speed.

They can be combined with mid-block pedestrian crossings to further enhance pedestrian safety by reducing crossing distances and increasing visibility.

MID-BLOCK NECKDOWNS

DESIGN

- Neckdowns, like other curb extensions, are typically only used on streets with on-street parking.
- Mid-block neckdowns can be used on both one-way and two-way streets. Neckdowns are most effective on two lane streets in order to deliver the narrowing effect.
- Neckdowns may alternate with intermittent medians to further maintain and encourage reduced speeds along the length of a roadway.
- Vegetation used in the neckdown should be low-growing and low-maintenance. Neckdowns, like other forms of curb extensions, can be an opportunity to apply BMPs for stormwater management.
- In locations with mid-block pedestrian crossings, sight distances must be maintained.

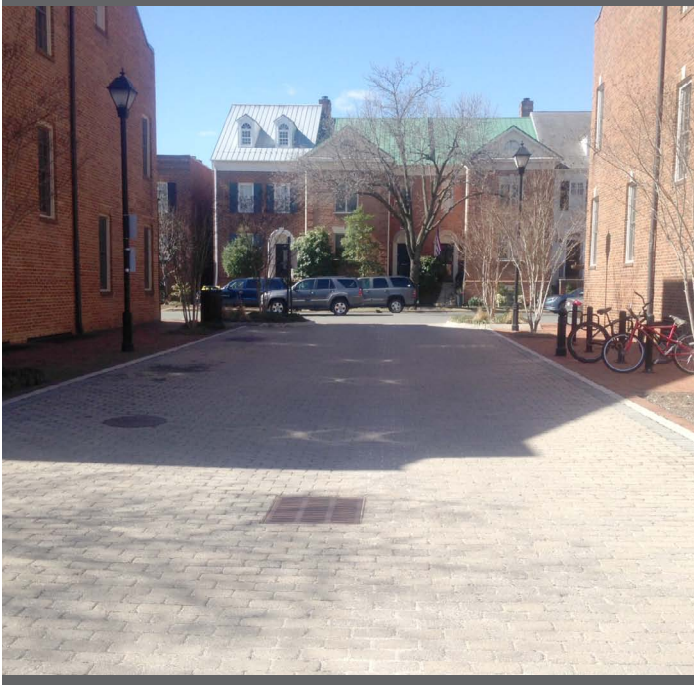


Mid-block Neckdown on Cameron Street

CONSIDERATIONS

- Where neckdowns provide pedestrian crossings, **Americans with Disabilities Act (ADA)** compliant curb ramps, tactile warning strips, and cross slopes must be provided. Other traffic calming elements such as raised crossings may also be considered.
- Mid-block neckdowns can serve as alternatives to speed tables or, combined with raised crossings, can serve both purposes.
- Neckdowns can introduce conflicts on streets with bicycle facilities. Traditional neckdowns should not be used on streets with protected bike lanes or other protected facilities. On streets with bicycle lanes, care should be taken to avoid squeezing bicyclists into the traffic flow.
- On low-volume Residential Streets, neckdowns can reduce the street to a narrowed passage, requiring oncoming drivers to yield and alternate passage through the neckdown. The gap must maintain enough space for fire trucks and other large vehicles.
- Designs should consider snow removal operations. The curb extensions of mid-block neckdowns offer space to store snow in winter; however, visual cues, particularly vertical elements, should alert snow plow operators of the change in the roadway. Turn radii should be designed with snow removal and street sweeping vehicles in mind, where warranted.
- Neckdowns should only be used on non-emergency routes.
- Neckdowns should not be used on curved roadway sections.

PAVING TREATMENTS



Example of brick paving treatment



Example of a cobblestone paving treatment

OVERVIEW

Roadway materials can have significant impacts on traffic safety and speeds, user comfort, vehicle maintenance costs, stormwater management, street noise, and the heat island effect. Paving treatments include stamped concrete or asphalt, and colored pavements.

Paving treatments can help reduce speeds and are more commonly used on streets with high volumes of pedestrians and lower volumes of motor vehicle traffic, such as Mixed Use Boulevards and Main Streets. Alexandria's historic cobblestone streets and alleys are an example of the effects of textured pavements on vehicle speeds. Modern textured pavements are smoother than cobblestones, which help accommodate bicyclists.

Regardless of the material used on the roadway, an accessible, smooth travel path must be provided at crosswalks in order to accommodate people with disabilities.

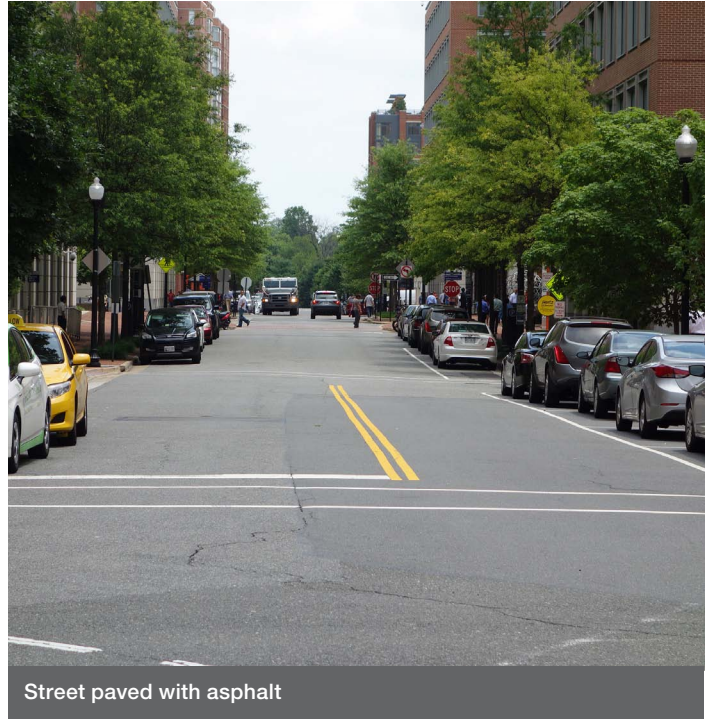
DESIGN

- Asphalt is the preferred pavement for City streets.
- Pavers should generally not be used in roadway construction. Pavers may be used in limited areas to denote special locations if approved by the City.
- Care should also be taken to ensure that materials do not settle to different heights.
- The use of paving treatments in parking lanes can visually reduce the width of the roadway.
- Pedestrian crossings must meet accessibility requirements by providing a smooth, stable, and slip-resistant accessible path, and should include the necessary reflective markings as required in the MUTCD. Pavers should not be used in crosswalks.

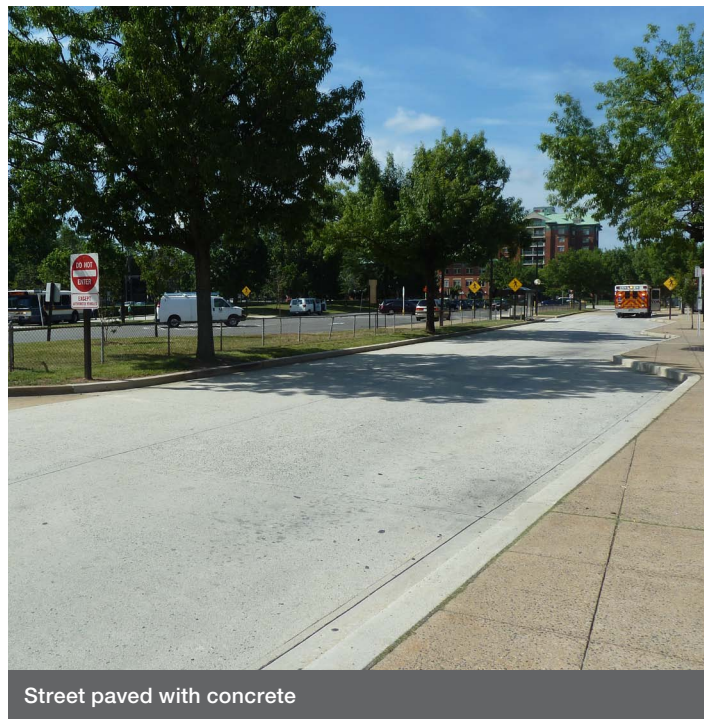
PAVING TREATMENTS

CONSIDERATIONS

- Key considerations for pavement materials selection include constructability, ease-of-maintenance, smoothness, durability, porosity, and color. Also, consideration should be given to the street type, the volumes and types of users (i.e., pedestrians, heavy vehicles, bicyclists, etc.), adjacent land uses, and stormwater management goals.
- Textured pavements are an expensive treatment and include long-term maintenance responsibilities.
- Consider the reflective characteristics of the pavement.
- Slippery surfaces such as smooth granite or tile should not be used as they create slippery conditions for bicyclists and pedestrians in wet weather.
- The use of colored pavements for traffic control purposes (i.e., to communicate a regulatory, warning, guidance message) is narrowly defined by the MUTCD, and may be required to follow Federal Highway Administration's (FHWA) experimentation process.
- Pavements that resist heaving and rutting should be used for locations where heavy vehicles stand or park, or locations that are particularly susceptible to wear such as high-volume intersections or steep grades. Concrete bus pads should be considered on high frequency bus routes.



Street paved with asphalt



Street paved with concrete

OTHER STRATEGIES FOR REDUCING SPEEDS

CHICANE

A chicane is an intentional “S” curve commonly created by alternating curb extensions and/or curbside parking. The undulating path (horizontal deflection) is designed to slow drivers down as they maneuver along the street. If parking is used as the mechanism for deflection, streets should have regular and sustained parking demand along them.

Traffic calming effects are greatest when deflection shifts vehicles at least one full lane width back and forth.

Chicanes may be used on one lane, one-way, or two-lane bi-directional streets. Bi-directional streets should have roughly balanced traffic volumes to ensure that vehicles do not simply speed down the clear center area between curb extensions/deflectors.

- Chicanes may be combined with median islands at the points of deflection to preclude travel down the centerline of the street.
- Chicanes occur along a block, typically on longer block segments to permit sufficient deflection.
- Chicanes are generally only appropriate on low volume, local streets.
- Chicanes can complicate street sweeping and snow removal. If curb extensions are used to establish the chicane, curb extensions may be used for short term snow storage.
- If used on streets where transit vehicles or trucks are expected, chicane design must consider maneuverability.
- Chicanes must maintain clearance required for emergency vehicle access.



Chicane



Diverters

DIVERTERS

Diverters alter the movement of through vehicle traffic either through partial diversion (closing half of a street entrance) or full diversion (prohibiting through movement of all vehicle traffic). Diverters are commonly designed to maintain through travel for bicycles and pedestrians even while altering routes for vehicles.

Partial diverters preclude entry or exit of one direction of traffic and channelize remaining movements. Diagonal diverters are the most common form of full diversion. Diagonal diverters connect diagonal corners creating two disconnected streets. Vehicles are forced into a right angle turn even while maintaining through travel for bicycles and pedestrians.

- Full diverters must be designed with transit and emergency vehicle navigation in mind. Typically, emergency vehicles must be able to travel over the diverter.
- Diverters affect all traffic. They are effective at reducing or precluding cut-through traffic, but as a result all local traffic is diverted as well.

Travel Lanes

The number and configuration of travel lanes has a great impact on the availability of space on Alexandria’s streets. While projects should strive to minimize delay to motor vehicles, the safety and comfort of vulnerable roadway users is an equal priority. Travel lanes should be minimized to the extent possible in order to maintain the narrowest cross section. This supports the comfort of other users of the street, reduces speeding, and decreases impervious surfaces.

ROAD DIETS



Four to three lane road diet conversion

OVERVIEW

A road diet is a reduction in overall roadway width, typically accomplished by removing motor vehicle travel lanes. This strategy can be applied broadly to a wide variety of cross sections where one or more travel lanes are repurposed to provide more space for pedestrians and bicyclists. Road diets are most typically done on roadways with excess capacity where anticipated traffic volumes have not materialized to support the need for additional travel lanes. The most

common road diet configuration involves converting a four lane road to three lanes: two travel lanes with a turn lane in the center of the roadway. The center turn lane at intersections often provides a great benefit to traffic congestion. A three lane configuration with one lane in each direction and a center turn lane is often as productive (or more productive) than a four lane configuration with two lanes in each direction and no dedicated turn lane.

ROAD DIETS

Four to three lane conversions have been found to reduce total crashes by an average of 29%.⁷ The magnitude of the safety benefits at specific locations depends on the street context and the specific design of the conversion. Four to three lane conversions typically have minimal effects on the vehicular capacity of the roadway because left-turning vehicles are moved into a common two-way left turn lane.

Roadway configurations with two travel lanes and a center turn lane can:

- Discourage speeding and weaving.
- Reduce the potential for rear end and side swipe collisions.
- Improve sight distances for left-turning vehicles.
- Reduce pedestrian crossing distances and exposure to motor vehicle traffic.
- Reallocate space for sidewalks, standard bicycle lanes, protected bike lanes, bus bulbs, or curbside parking, which in turn creates a buffer between motor vehicle traffic and pedestrians.
- Improve access for emergency vehicles by allowing them to use the center turn lane to bypass traffic if a continuous two-way left turn lane is provided.

DESIGN

- The space gained for a center turn lane is often supplemented with painted, textured, or raised center islands. If considered during reconstruction, raised center islands may be incorporated in between intersections to provide improved pedestrian crossings, incorporate landscape elements and reduce travel speeds.
- The minimum width of the center turn lane is 12'.
- Four lane streets with volumes less than 15,000 vehicles per day are generally good candidates for four to three lane conversions.
- Four lane streets with volumes between 15,000 to 20,000 vehicles per day may be good candidates for four to three lane conversions. A traffic analysis is needed to determine feasibility.
- Six lane streets with volumes less than 35,000 vehicles per day may be good candidates for six to four lane (with center turn lane) conversions. A traffic analysis is needed to determine feasibility.

⁷ Crash Modification Factor Clearing House, Countermeasure: Road diet (Convert 4-lane undivided road to 2-lanes plus turning lane), http://www.cmfclearinghouse.org/study_detail.cfm?stid=23

PEAK TIME RESTRICTED PARKING LANES



Shared bicycle/bus lane converts to a parking lane with shared lane markings off-peak

OVERVIEW

Peak time restricted parking lanes are parking lanes that are converted to other uses during peak or rush hour times. The traditional application of this treatment involves converting parking lanes to general purpose travel lanes; however, peak time restricted parking lanes can also be converted to other purposes, including transit lanes and bicycle lanes.

Peak time restricted parking lanes can increase the capacity of the roadway for general purpose traffic. Depending on conditions, an additional travel lane can improve capacity by 600 to 1000 vehicles per hour; however, the capacity advantages of peak time restricted parking lanes for moving general purpose traffic assume universal compliance with the parking restriction; enforcement is required to deter illegally parked vehicles during peak hours.

DESIGN

- Peak time restricted parking lanes may be considered on roadways where additional capacity is needed during peak hours.
- The decision to install peak time restricted parking should be accompanied by a prompt and rigorous enforcement effort that involves ticketing and towing illegally parked vehicles.

- Peak hour restricted parking lanes should be a minimum of 12' wide to accommodate parked cars and bicycles in off-peak times. See the Minimum Lane Width Chart for more information.
- Peak time restricted parking lanes are not compatible with curb extensions or neckdowns.

CONSIDERATIONS

- Restricting parking, stopping and standing at the curbside during peak hours can improve traffic capacity and flow, however the decision to restrict parking should be carefully weighed against the other vital demands on curbside use including loading and deliveries, parking or access for persons with disabilities, and buffer and comfort to sidewalk users. Planners and designers should carefully evaluate the effects of temporary parking restrictions on local businesses, community character, and other roadway users,
- Converting parking lanes to general purpose travel lanes at peak times can make it difficult to install bicycle lanes due to safety concerns associated with having moving traffic on both sides of the bicycle lane. Potential solutions include separated bike lanes or shared travel lanes.
- Temporal conversion of parking lanes to travel lanes, regardless of the frequency or duration, precludes the opportunity for curb extensions on the street. Curb extensions, or bulbouts, may only be located on blocks where the curbside is not used for through travel.
- In some situations, there may be benefits to removing peak time restricted parking lanes where they currently exist.

TRUCK AND TRANSIT ROUTES



OVERVIEW

Many of Alexandria's busiest streets are also the primary routes used by heavy vehicles, such as commercial vehicles, transit vehicles, and heavy trucks. These large vehicles have different performance characteristics than cars. They often require more space for turning and longer stopping distances. Their size can intimidate other roadway travelers such as bicyclists, pedestrians, and drivers in small autos and create some discomfort in the environment of the street.

Nonetheless, trucks and transit vehicles are vital to urban economies and should be accommodated in the urban system. It is important to ensure that roads frequented by heavy vehicles are designed to accommodate them safely alongside other roadway users. This may mean providing a more generously scaled travel lane to accommodate the heavy vehicles or extra width in adjacent facilities such as bike lanes or buffers to provide additional comfort and separation.

With the exception of industrial districts, even on primary truck routes, heavy vehicles comprise a minority of the total vehicle traffic on a street. The

majority of vehicles are smaller passenger cars. Care should be taken to accommodate large vehicles appropriate to their level of frequency and need while not inadvertently creating conditions that may lead to speeding by smaller vehicles on the road.

Identifying and appropriately designing targeted corridors to facilitate truck movement in Alexandria ensures that the needs of these vital providers are met while permitting design on the balance of streets to orient around the needs of far more dominant and vulnerable users including pedestrians, bicyclists, and passenger autos.

Transit vehicles are a unique type of heavy vehicle and the interests of transit operators distinctly vary from the interests of truck operators. While transit vehicles are large in size, transit routes should still orient around the pedestrians who are the very riders the transit vehicle serves. Careful balance and sensitive design is necessary to ensure transit vehicles can operate smoothly through their routes while at the same time providing a comfortable street and transit-supportive environment.

TRUCK AND TRANSIT ROUTES

DESIGN

- Industrial streets should have 12' outside lanes.
- Designated truck routes, high frequency transit corridors, and/or higher order streets (e.g. Commercial Connector, Mixed Use Boulevard, and Residential Connector) with more than 8% to 10% heavy vehicles should provide 11' outside lanes, exclusive of the gutter pan, to accommodate heavy vehicle use.
- Lower intensity streets typically have less heavy vehicle traffic. The frequency and volume of trucks and transit vehicles on these streets can generally be accommodated within the overall section of the street without the specific provision of wider lanes.
- Turning movements with a high volume of large trucks, transit, and commercial vehicles should be designed to sufficiently accommodate turning radii and stacking space of the appropriate design vehicle.
- Heavy vehicle braking characteristics should be considered when determining the placement of warning signs for intersections, curves, railroad crossings, mid-block pedestrian crossings, and shared use trail crossings. Heavy vehicles typically require longer stopping distances and therefore more advance warning.
- To the extent possible, bicycle facilities should be separated from travel lanes designed for heavy vehicle traffic. Where there is insufficient roadway space for separation or buffering, on street bicycle lanes should be more generously scaled (as possible) to improve bicyclist comfort and safety.
- Skid resistance and strength should be considered when choosing pavement surfaces for routes frequented by heavy vehicles. For routes with transit stops, consider installing concrete pads within the roadway at transit stops.

CONSIDERATIONS

- Flush medians or center turn lanes of sufficient width can help facilitate left-turn movements for heavy vehicles by providing a space to stop and wait for gaps.
- On sharply curving roads frequented by heavy vehicles, additional lane width may be necessary.

FIRE AND EMERGENCY LANES



Emergency vehicles

OVERVIEW

The mission of the Alexandria Fire Department is to plan for and deliver responsive and caring emergency service, mitigate emergencies and disasters, prevent the loss of life, protect property and enforce applicable construction, fire, and building maintenance codes for the city residents and the general public in order to maintain and enhance public safety. Response time is critical to this mission; therefore, roadway design should consider the specific needs of fire apparatus and emergency medical services vehicles.

Within these guidelines are elements designed to reclaim roadway space for a more equitable division of the public roadway, which often reduces available roadway width and overall travel speed. Pedestrian deaths and injuries significantly decrease as motor vehicle speeds decrease. For example, intersections intended for emergency vehicle access should ensure that the curb radii can accommodate the appropriate emergency vehicle turning radius; however, encroachment into adjacent travel lanes is a regular and expected measure taken by emergency responders to reach their destination quickly.

DESIGN

The City of Alexandria Fire Prevention Code establishes **Emergency Vehicle Easement (Fire Lane) requirements** through Appendix D. The code requires an emergency vehicle easement adjacent to buildings, which can either be satisfied within a driveway or parking lot, or the street right-of-way.

For new streets that fall under the definition of emergency vehicle easements, street design should provide adequate space for fire trucks to access adjacent buildings. In these locations, T&ES will work with the Fire Department to determine the appropriate street cross section and design.

CONSIDERATIONS

- The guidelines for curb radii (see [page 5-2](#) of these Guidelines) take into account the turning radius of the standard city fire truck.
- The design of plazas and curb extensions should take into account the requirements for fire apparatus stabilization arms to provide ladder access to upper stories on buildings.
- Where an Emergency Vehicle Easement transitions from the established grade to a higher or lower grade level and continues as an Emergency Vehicle Easement, a mountable / drivable curb shall be designed to City Standard MOD CG-3 or MOD CG-7 that are based on VDOT standards CG-3 and CG-7.
- Dead-end emergency vehicle easements greater than 100 feet shall be provided with an approved area for turning around the fire apparatus. This can consist of either a circular turning area, or an area where an emergency vehicle can back up to turn around.

Transit Lanes

Efficient, cost-effective public transportation is essential for continued growth and quality of life in a dense, compact city like Alexandria. Compared with single occupancy vehicles, transit vehicles such as buses consume far less public space per person trip and can help relieve congestion, enhance access to goods and opportunities, improve air quality, and reduce greenhouse gas emissions.

Buses that travel in mixed traffic on congested streets are often subject to delays. Transit lanes, which are travel lanes reserved for the exclusive or dominant use of transit vehicles, are one way to improve efficiency in congested areas of the city.

Dedicated transit lanes (bus lanes and protected busways) make it possible to increase the frequency and reliability of bus service along a corridor and help reduce congestion in other travel lanes. When combined with signal priority strategies and bus stop improvements (shelters, seating, off-board fare collection, and real-time information displays), transit lanes can result in high quality, fast, comfortable and cost effective public transportation.

Dedicated transit lanes may be fully and physically separated from other travel lanes or simply designated with signs and pavement markings. They may be located at either the curbside or center lanes of streets. Transit lanes may occasionally serve a shared function such as permitting right turns or concurrently accommodating other high occupancy vehicles.

Where transit lanes are not feasible or appropriate, substantial improvements to transit service can be achieved through the use of intelligent transportation systems (ITS), transit queue jumps, bus bulbs, consolidation of stops, all door boarding, and/or off board fare collection.

CURBSIDE BUS LANES



Bus lane

OVERVIEW

Curbside transit lanes in the roadway are reserved primarily for buses and are typically distinguished by either colored pavement, bus-only pavement markings, or signage. Where there are few curbside access points and adequate right-of-way width, curbside transit lanes may be further enhanced with separation treatments.

Curbside transit lanes are generally open to other vehicles at intersections as right turning lanes. Curbside transit lanes may be located adjacent curbside parking, in which case vehicles cross the bus lane to access parking, or in a curbside lane with an offset parking lane. Although permitted, this condition may result in sub-optimal transit performance as motorists who are parking may interfere with transit progression along the curbside lane.

CURBSIDE BUS LANES

DESIGN

- Curbside transit lanes provide fast, efficient service on one-way or two-way multi-lane streets where there is adequate width to accommodate them.
- Curbside transit lanes are placed on the right hand side of the road, adjacent to the curb or curbside parking. They work best in locations with no curbside parking.
- Generally, transit stops associated with dedicated transit travel lanes are spaced at least a quarter-mile apart.
- To deter encroachment by private vehicles, curbside transit lanes are marked with colored pavement or bus-only pavement markings.
- The minimum width of a transit lane is 11'. 12' is preferred for transit operations but should be evaluated in the overall assemblage of the street. Curbside transit lanes are exclusive of the gutter pan.
- Physical separation is generally preferred for bus rapid transit operations; however, separation should end prior to any intersection where right turning vehicles are permitted to share the transit lane. Where turns do not share the curbside lane, a separate transit signal and phase is required.
- Transit lanes should be appropriately marked to indicate where other vehicles may cross or enter the transit lane such as right turn lanes, curb cuts, driveways, alleys, or other curbside access points.
- Where curbside transit lanes are adjacent to parking, bus bulbs or transit islands should be provided to define parking area and facilitate operations.
- Dedicated curbside transit lanes provide a higher level of transit service. In concert with improved operations, consider providing improved passenger facilities including shelters, traveler information, and other amenities.

CONSIDERATIONS

- Space for a curbside transit lane is typically created by removing a travel lane, parking lane, or median.
- Curbside transit lanes work best when there are few or no curb cuts, driveways, or alleys introducing conflicts at the curbside. Where possible, consolidate or eliminate curb cuts or consider operational solutions such as right-in/right-out only.
- Measures to reduce conflicts with right-turning vehicles and opposing left-turning vehicles through signalization and signage.
- Vehicles performing parking maneuvers in the bus lane will delay buses and decrease the efficiency of service. Curbside parking requiring vehicles to cross the transitway to access should be avoided whenever possible.
- Curbside transit lanes can complicate access to adjacent commercial buildings particularly if parking is removed for installation. Effect should be evaluated and mitigations for access considered.
- Bicyclists should be safely accommodated on every street. Where bicyclists are prohibited from using the transit lane, they should be otherwise accommodated on the street.
- Bicyclists are generally not anticipated in separated curbside transit lanes.

SHARED BICYCLE/TRANSIT LANES



OVERVIEW

Under certain circumstances, a shared lane reserved for transit vehicles and bicyclists can provide much improved accommodation for both traveler groups. Shared Bicycle/Transit Lanes (SBTLs) are specifically designed to provide room for the two users to maneuver together as transit vehicles start and proceed again along a corridor. Shared lanes are commonly also used to accommodate right turning vehicles.

Shared bicycle/transit lanes are appropriate on streets where space constraints preclude the opportunity to provide separate facilities and where bus headways

and speeds are moderate. Shared bicycle/transit lanes typically require less total right-of-way space than separate facilities for each user.

Shared bicycle/transit lanes, however, should not be considered adequate treatments on high frequency transit corridors or on corridors where bicycle volumes are high enough to significantly adversely affect transit operations. In such instances, prioritization of one or the other mode may be necessary or separate facilities provided.

SHARED BICYCLE/TRANSIT LANES

DESIGN

- Shared bicycle/transit lanes should be located in the outermost lane, ideally adjacent to the curb. Bike/transit lanes may be located adjacent to curbside parking; however, this introduces substantial conflict and degrades operations and safety in the priority lane.
- Shared bicycle/transit lanes should have sufficient width for dual bicycle/transit use. 16' is preferred to permit vehicles and bicyclists to pass one another comfortably within the priority lane. The minimum width of shared bicycle/transit lanes is 13' (inclusive of the gutter pan).
- Shared bicycle/transit lanes typically are not physically separated from adjacent travel lanes.



7th Street NW, Washington, D.C.

CONSIDERATIONS

- Bicycle volumes, transit frequency, available right-of-way, total cross section, frequency of transit stops, and temporal changes in street operation should be considered in determining the appropriateness of a shared bicycle/transit lane.
- Shared bicycle/transit lanes are not appropriate on rush hour restricted streets (streets where the curb parking lane converts to a travel lane during peak hours).
- Transit operators should be trained in how to interact with bicyclists in shared bicycle/transit lane facilities.
- Typically, shared bicycle/transit lanes should not be used on any street with a posted speed limit above 30 MPH.
- Vehicles using shared bicycle/transit lanes for through travel can be a major issue. This not only degrades performance, but introduces serious safety concerns. Education and enforcement is always a necessary component when using shared bicycle/transit lanes.
- Shared bicycle/transit lanes may be less inviting or comfortable for inexperienced or timid bicyclists.

MEDIAN TRANSIT LANES



OVERVIEW

Median transit lanes operate in a similar fashion as curbside transit lanes. These lanes are aligned adjacent to a center median in the street. Typically passengers board and alight at stations located in the center median. Lanes may or may not be reserved for transit vehicles. Where reserved use lanes are distinguished by pavement markings and/or signage. Colored pavement is also commonly used to call out the transit lane, as median transit lanes are generally not physically separated from adjacent travel lanes. Where separation is needed, it is more common to utilize a median transitway (please see facing page).

While median transit lanes are viable roadway configurations, they may require special transit vehicles. The median is located on the left side of the transit vehicle which generally requires passenger doors also be available on the left side of the vehicle.

DESIGN

- Median transit lanes may be used on two-way multi-lane streets where there is adequate width to accommodate them.
- Median transit lanes are placed on the left hand side of the road, adjacent to a median or center line.

- The minimum width of a median transit lane is 12' plus 1' shy distance from the median.
- Median transit lanes may be used to route transit vehicles through particularly congested route segments where no stops are made.
- Median transit lanes are commonly used for streetcar or bus rapid transit service where transit vehicles accommodate passenger loading on both sides of the transit vehicle.
- Median transit lanes provide a higher level of transit service. If stops are provided, a higher level of passenger amenities should also be provided including shelters, seating, and traveler information.

CONSIDERATIONS

- Left turn lanes may conflict with median transit lanes. If shared, left turns may negate transit travel time savings. If separated, separate signal cycles are required.

MEDIAN PROTECTED TRANSIT LANES



OVERVIEW

Median protected transit lanes are lanes in the center of multi-lane streets that are separated from general traffic by means of a physical barrier median. Only transit and emergency vehicles are permitted in these lanes. Combined with comfortable stations and off-board fare collection, median protected transitways can form the framework of the City's high capacity transit corridors.

Median protected transit lanes are less flexible than median transit lanes as they do not generally allow passing and buses can only enter and exit at specific locations. Good design, however, may mitigate such conflicts. They are typically more expensive to construct and maintain than median bus lanes, but allow for more consistent speeds and require less enforcement.

DESIGN

- Median protected transit lanes provide fast, efficient, and reliable service on multi-lane streets with adequate width for the lane(s), barriers, and stations.
- Separation from general traffic is achieved by means of a curb, island, fence, greenspace, or other well-defined structural feature.

- Transit stops on median protected transit lanes are generally spaced farther apart (1/3 to 1/2 mile) than typical transit stops (1/5 to 1/4 mile) to permit greater speeds and to reduce trip times.
- The width for a median protected transit lane is 12' for the lane plus 1' shy distance from the median barrier.

CONSIDERATIONS

- Width of stations on median protected transit lanes may vary depending on location, configuration and peak passenger volume.
- Opportunities for passing and entry/exit of vehicles should be designed into the system.
- Use of median protected transit lanes may be limited to high capacity transit service only restricting or prohibiting use by local transit service (with frequent stops) or commuter transit services (with longer dwell times). In Alexandria, local transit service is currently allowed in the median protected transit lanes on Route 1.
- Because of the physical barrier, special procedures for snow removal are required.

Bicycle Facilities

PROTECTED BIKE LANES



Bike lanes separated by vertical objects

OVERVIEW

Protected bicycle lanes, also known as cycle tracks, are exclusive bicycle facilities physically separated by a vertical element from the adjacent motor vehicle lanes. Separation can be achieved through a vertical curb, a parking lane, flexposts, plantings, removable curbs, or other measures. Buffered bike lanes that do not include a vertical element are not considered protected bike lanes.

There are four basic configurations for protected bike lanes:

- Sidewalk-level bike lanes
- Bike lanes constructed at an intermediate level between the sidewalk and the street
- Street-level bike lanes separated from traffic or parking by a curb
- Street-level bike lanes separated from traffic or parking by a vertical object

Protected bike lanes dramatically increase rider comfort and decrease stress. They are usable by a broad spectrum of bicyclists including very young riders and more cautious bicyclists. Protected bike lanes may be used on many different street types and are especially welcome on higher speed, higher volume roadways. Studies show that bicyclists prefer separation from motor vehicles on most types of roadways, which suggests separation can contribute to expanding bicycle mode share. Protected bike lanes can be one-directional or two-directional. They may be provided on both sides of two-way streets or on one side of one-way streets.

DESIGN

- Protected bike lanes are appropriate on streets with operating speeds of 20 mph and higher, or volumes that exceed 4,000 vehicles per day.
- Protected bike lanes can be useful on streets that provide connections to off-street trails, since bicyclists on these streets may be more accustomed to riding in an area separated from traffic.
- Intersection design for protected bike lanes is complex and requires careful attention to conflicts with turning vehicles. For more information, see the [NACTO Bikeway Design Guide](#).

PROTECTED BIKE LANE WIDTH ¹			
One-Way		Two-Way	
Minimum ²	Preferred	Minimum ³	Preferred
5'	7'	8'	12'

¹ Dimensions are for the protected bike lane only and do not include sidewalk or street buffers. Width dimensions include a standard 2' wide gutter pan.

² Minimum width will not accommodate passing. 6.5' is required for two bicyclists to pass one another. The edge condition impacts ability to comfortably pass or ride two abreast. The minimum width is discouraged when a protected bike lane is located between raised curbs. If the width is constrained, the designer should consider options that allow bicyclists to use the buffer space to pass another user.

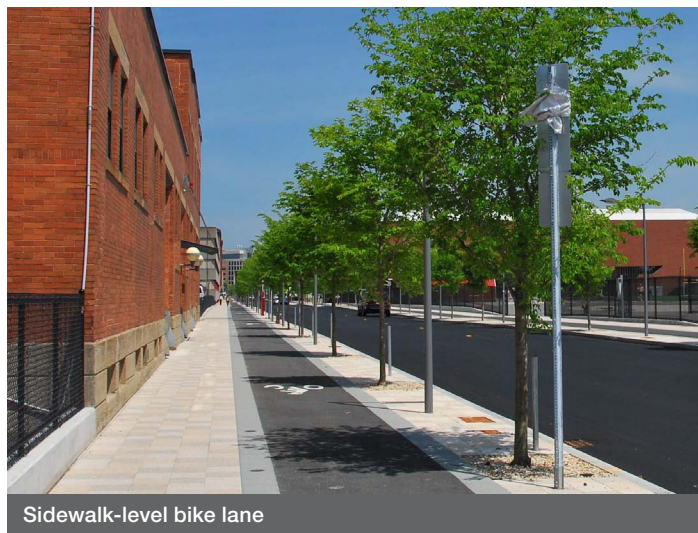
³ Passing may occur in the opposing lane.

PROTECTED BIKE LANES

Adjacent to on-street parking, a minimum 2' to 3' buffer should be provided between parking and the separated bike lane; the buffer serves as a pedestrian loading and unloading zone and helps keep bicyclists out of the door zone of parked vehicles.

CONSIDERATIONS

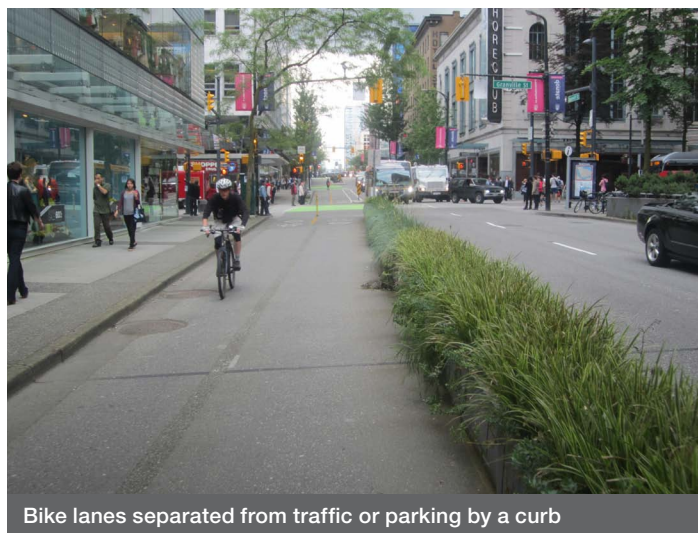
- Protected bike lanes require increased parking restrictions approaching intersections compared to standard bicycle lanes to provide for visibility at intersection transitions.
- Vertical curb separation should be considered where on-street parking is not present. Snow clearance and stormwater drainage will need to be considered with this option. Street-level protected bike lanes may be combined with islands at corners and crossings.
- At transit stops, protected bike lanes should be routed between the passenger waiting area and the sidewalk to reduce conflicts while passengers are boarding and alighting. Signage and/or markings may be added to alert transit riders and bicyclists of the conflict zone as pedestrians cross the bike lane from the sidewalk to the transit stop.
- The presence of drainage and utility structures along the curb may reduce the effective width of a protected bike lane.
- Maintenance should be considered during all seasons including street sweeping and snow removal.
- Please see [Bicycle Accommodation at Intersections](#) for protected bicycle lane design at and approaching intersections.



Sidewalk-level bike lane



Bike lanes between a parking lane and the sidewalk



Bike lanes separated from traffic or parking by a curb

STANDARD BIKE LANES



Bike lane on Braddock Road

OVERVIEW

Bicycle lanes provide an exclusive space for bicyclists in the roadway. Bicycle lanes are established through the use of lines and symbols on the roadway surface. Bicycle lanes are for one-way travel and are normally provided in both directions on two-way streets and/or on one side of a one-way street. Bicyclists are not required to remain in a bicycle lane when traveling on a street and may leave the bicycle lane as necessary to make turns, pass other bicyclists, or to properly position themselves for other necessary movements. Bicycle lanes may only be used temporarily by vehicles accessing parking spaces and entering and exiting driveways and alleys. Stopping, standing and parking in bike lanes is prohibited.

DESIGN

- Bicycle lanes can be used on one-way or two-way streets with single or multiple lanes.
- Bicycle lanes may be placed adjacent to a parking lane or against the curb if there is no parking. Conventional bicycle lanes are located on the right side of the roadway. (see also [Left-Side Bike Lanes](#))
- Bicycle lanes are typically installed by reallocating existing street space (i.e., narrowing other travel lanes, converting travel lanes and/or reconfiguring parking lanes).
- The minimum width of bicycle lanes in Alexandria is 5'. Bicycle lanes may be 4' if adjacent to a gutter pan. Other 4' lanes may be permitted under limited circumstances based on the [AASHTO Guide for the Development of Bicycle Facilities](#).

STANDARD BIKE LANES

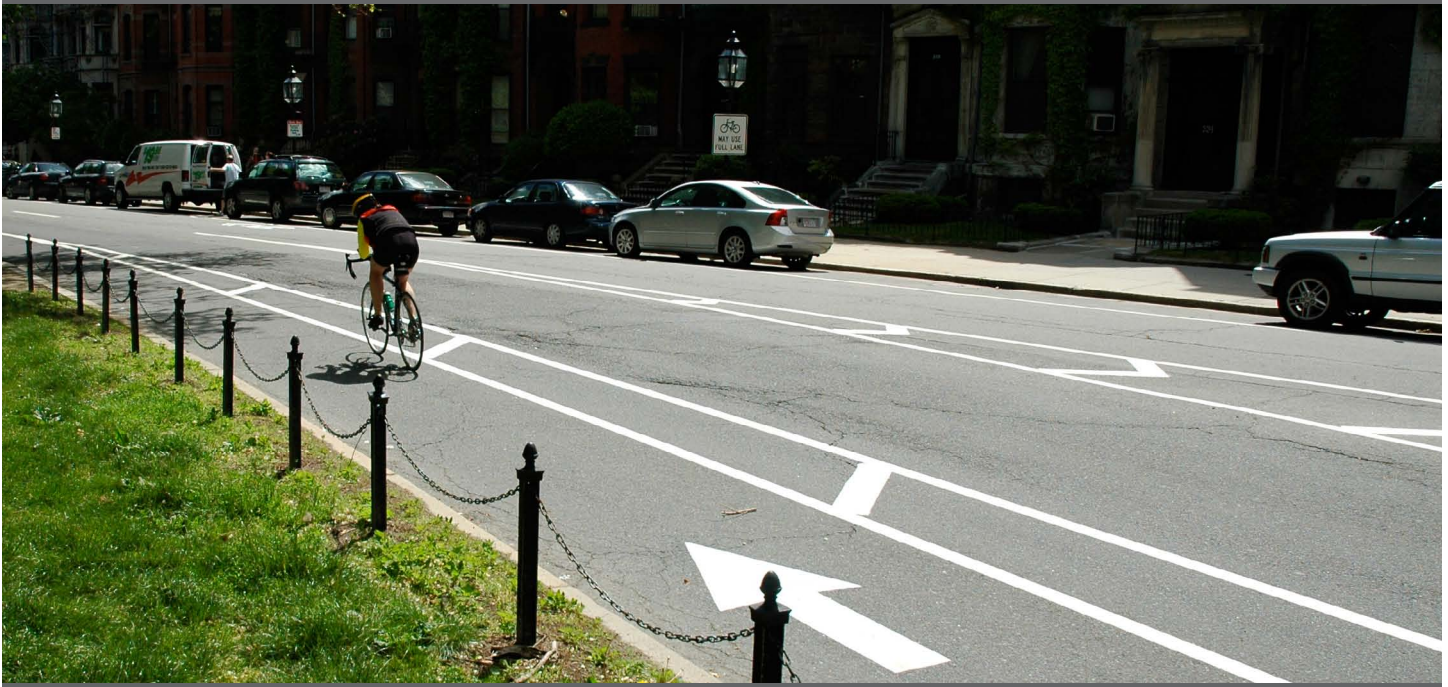
- When bike lanes are adjacent to parking, the combined width (from face of curb) of parking and bicycle lane should be at least 12'.
- Bike lanes are indicated by a solid white line along the left side of the lane. Use dotted or dashed line marks to indicate areas of bicycle/vehicle conflict.

BIKE LANES	Minimum	Preferred
Bicycle lane: parking permitted adjacent	5'	6'
Bicycle lane: parking not permitted, curb and gutter present (<i>width measurement includes the 2' wide gutter pan</i>)	6'	7'
Bicycle lane: parking not permitted, no curb and gutter	4'	5'

CONSIDERATIONS

- Bicycle lane design should consider parking configurations and turnover, the presence of medians, the continuity of the facility, and the configuration and complexity of turning movements at intersections.
- If bicycle lanes are adjacent to guardrails, walls, or other vertical barriers, additional bicycle lane width is desired to account for bicyclist “shy” distance from the edge. Similarly, provide additional space if bicycle lanes are at sidewalk level and adjacent to the curb and travel lanes.
- Ensure gutter seams, drainage inlets and utility covers are flush with the roadway surface. Where possible, these features should be kept out of the bicycle lane.
- Bicycle lanes provided at an intermediate level between roadway and sidewalk should have rolled or mountable curbs down to the roadway and up to sidewalk level.
- Consider using differentiated materials for bicycle lanes at sidewalk level (e.g. asphalt for the bicycle lane and concrete for the sidewalk). When bicycle lanes are at sidewalk level, tree pits with or without grates may not be considered as part of bike lane width. Care should be taken to trim street tree limbs up above the height of bicyclists (a minimum 9' of vertical clearance is desired).
- Wider bicycle lanes (6' to 7') enable bicyclists to pass one another on heavily traveled corridors and increase separation from faster traffic. While wider bicycle lanes improve bicyclist comfort, they may encourage illegal parking or travel in the bike lane.
- Where wider lanes are possible, consider providing a buffered bicycle lane, discussed later in this section.
- On constrained corridors with high parking turnover, consider designing pavement markings to guide bicyclists outside of the door zone of parked vehicles. Treatments include installing a buffer on the parking side of the bicycle lane, door zone, hatch marks, or using parking T's instead of a longitudinal parking line.
- Consider using colored pavements to highlight areas where conflicts might occur such as at intersection and driveway crossings.
- It is critical that bicycle lanes receive the same treatment as the remainder of a street surface with regard to cleaning and snow removal. In addition, bicycle lanes need to have regularly cleaned storm drains (especially during spring and autumn when fallen leaves or other tree debris may collect in drains and cause pooling or flooding of stormwater in curbside bicycle lanes).

LEFT-SIDE BIKE LANES



Left-side bicycle lanes on Commonwealth Avenue in Boston, MA

OVERVIEW

In some locations, bicycle lanes placed on the left-side of the roadway can result in fewer conflicts between bicyclists and motor vehicles, particularly on-streets with heavy right-turn volumes or frequent bus service and stops where buses operate in the right-side curb lane. Other occasions may be where parking is provided only on the right side of the street or where loading predominantly occurs on the right. Left-side bike lanes can increase visibility between motorists and bicyclists at intersections due to the location of the rider on the left-side of the vehicle. However, left-side bike lanes are often an unfamiliar orientation for both bicyclists and drivers and may be less intuitive.

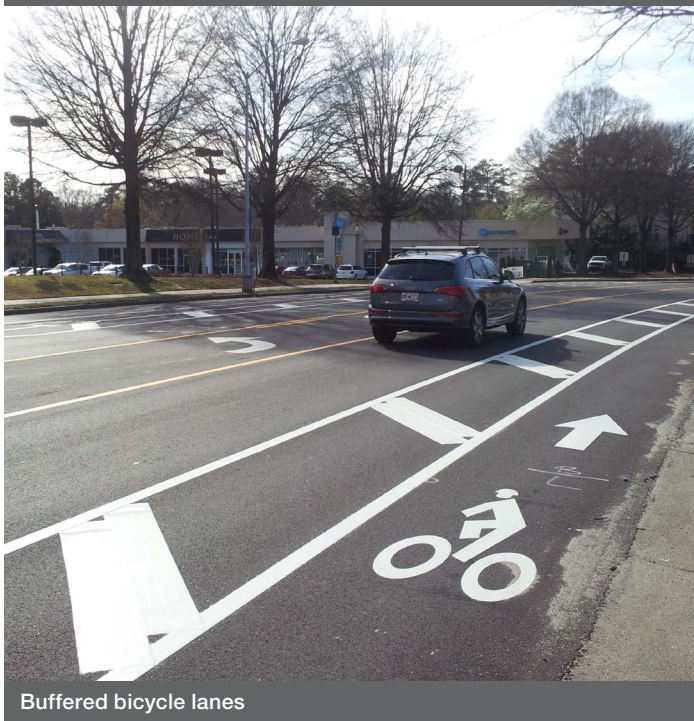
DESIGN

- Left-side bicycle lanes generally may only be used on one-way streets or on median divided streets.
- Left-side bicycle lanes have the same design requirements as right-side bicycle lanes.

CONSIDERATIONS

- On one-way streets with parking on both sides, bicyclists will typically encounter fewer conflicts with car doors opening on the passenger side.
- Colored pavement should be considered in curbside locations to increase awareness of the restriction against parking or stopping in the bicycle lane.
- Left-side placement may not be appropriate in locations where the street switches from one-way to two-way operation.
- Left-side bicycle lanes may not be appropriate near the center or left-side of free flow ramps or along medians with streetcar operations, unless appropriate physical separation and signal protection can be provided including.
- Consider dominant bicycle routes. Where a large proportion of bicyclists make right hand turns, conventional bike lanes may be preferable. Alternatively, bike boxes or left side two-stage turn queues should be provided (detailed on [page 5-44](#)).

BUFFERED BIKE LANES



Buffered bicycle lanes

Buffered bicycle lanes are created by painting or otherwise creating a flush buffer zone between a bicycle lane and the adjacent travel lane. While buffers are typically used between bicycle lanes and motor vehicle travel lanes to increase bicyclists' comfort, they can also be provided between bicycle lanes and parking lanes in locations with high parking turnover to discourage bicyclists from riding too close to parked vehicles.

Buffered bicycle lanes are distinct from protected bicycle lanes in that they have no vertical barrier between travel lanes and/or parking. Like protected bicycle lanes, buffered bicycle lanes have been found to dramatically increase bicycling comfort for a wide range of community bicyclists.

DESIGN

- The recommended minimum width of a buffer is 3'; however, width may vary depending upon the available space and need for separation. All other bicycle lane width dimensions as shown in the chart on [page 4-7](#) apply.
- Buffers should be painted with solid white lines and channelization markings.
- Buffers can be useful on multi-lane streets with higher speeds, but are not required in these locations.

CONSIDERATIONS

- Where only one buffer can be installed on a constrained corridor with on-street parking, the buffer should typically be placed between the bicycle lane and parking lane, depending upon roadway speeds and parking turnover.
- Generally speaking, there is no upper limit for buffer width and buffers of 5' to 6' are common where travel lanes are converted to buffered bicycle facilities; however, wide buffers without vertical separators may invite illegal use for vehicle travel.
- Consider using removable vertical elements such as flexposts, rubber curbing, or planters to further establish the bicycle facility. These elements may be removed seasonally to facilitate snow removal or street resurfacing.
- Ensure that buffered bicycle lanes are maintained with regard to street sweeping and snow removal. If the lanes are separated with vertical elements such as bollards, planters or flexposts, this may require using smaller equipment to treat the width of smooth surface inside the bicycle lane.
- Because they do not require construction of a separating element, buffered bicycle lanes may be established through simple street resurfacing and may enable trial or phasing prior to the installation of separated facilities.
- Buffered bicycle lanes, like protected bicycle lanes, may transition at intersections to provide adequate visibility and safety (see [Bicycle Accommodation at Intersections](#)).

CONTRA-FLOW BIKE LANES

OVERVIEW

The current configuration of one-way streets in Old Town Alexandria has been developed primarily to facilitate efficient movement of automobile traffic. This, combined with the organic, non-gridded nature of much of the rest of the City's street network, often make bicycling to specific destinations within short distances difficult.

Contra-flow bicycle lanes can help to solve this problem by enabling only bicyclists to operate in two directions on one-way streets. Contra-flow lanes are useful to reduce distances bicyclists must travel and can make bicycling safer by creating facilities that help other roadway users understand where to expect bicyclists.



Contra-flow bike lanes

DESIGN

- Contra-flow bicycle lanes are used on one-way streets that provide more convenient or direct connections for bicyclists where other alternative routes are less desirable or inconvenient.
- Contra-flow lanes should be used where there is a clear and observed need for the connection as evidenced by a number of “wrong way riding” bicyclists or bicyclists riding on sidewalks in the opposing direction.
- Contra-flow lanes are often short, connecting segments. They are not typically used along extended corridors.
- Contra-flow lanes may only be established where there is adequate roadway width for an exclusive lane.
- Care should be taken in the design of contra-flow lane termini. Bicyclists should be directed to the proper location on the receiving roadway.

CONSIDERATIONS

- Contra-flow lanes follow the same design parameters as conventional bicycle lanes: however, the left side marking is a double yellow line. The line should be dashed if parking is provided on both sides of the street. Contra-flow lanes may also be separated by a buffer or vertical separation such as a curb.
- Contra-flow lanes must be placed to the motorist's left.
- A bicycle lane or other marked bicycle facility should be provided for bicyclists traveling in the same direction as motor vehicle traffic on the street to discourage wrong way riding in the contra-flow lane.
- Parking is discouraged against the contra-flow lane as drivers' view of oncoming bicyclists would be blocked by other vehicles. If parking is provided, a buffer is recommended to increase the visibility of bicyclists. On-street parking should be restricted at corners.
- Contra-flow lanes are less desirable on-streets with frequent and/or high-volume driveways or alley entrances on the side with the proposed contra-flow lane. Drivers may neglect to look for opposing direction bicyclists on a one-way street.

CLIMBING LANES



Climbing lane on Wheeler Avenue. Note that there is no lane in the downhill direction.

OVERVIEW

On roadways with steep and/or sustained grades where there is not enough space to install standard 5' wide bicycle lanes on both sides of the street, climbing lanes are provided on the uphill side of roadway while shared lane markings are provided in the downhill direction. Bicyclists traveling in an uphill direction move at significantly slower speeds than adjacent traffic and therefore benefit from the presence of a bicycle lane. When travelling downhill, bicyclists gain momentum and can travel at similar speeds as motor vehicles, making shared lane markings in the downhill direction an appropriate treatment.

DESIGN

- Climbing lanes should be used in the uphill direction on roadways with steep grades to provide a dedicated space for bicyclists.
- Climbing lanes have the same minimum width (5') and design as standard bicycle lanes.

CONSIDERATIONS

- In general, bicycle lanes should be provided on both sides of the street where space permits. Wider outside travel lanes with shared lane markings should be provided if standard bicycle lanes do not fit within the provided right-of-way.
- If on-street parking is provided in the downhill direction, it is particularly important to ensure that bicyclists are directed to ride in a location outside of the door zone.

MARKED SHARED LANES (SHARROWS)

OVERVIEW

Marked shared lanes are indicated by specific bicycle symbols called shared lane markings or sharrows. Sharrow markings are two chevrons positioned above a bicycle symbol.

In general, this is a design solution that can only be used in locations where a standard bike lane or protected bike lane is not feasible due to space constraints.

Shared lane markings should be placed in such a manner to direct bicyclists to ride in the most appropriate location on the roadway. They can also be used in multiple lanes to position bicyclists for turning movements.

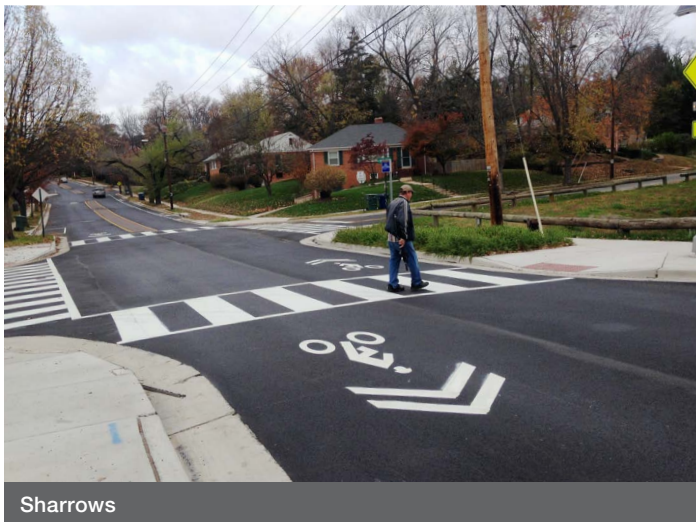
DESIGN USE

- Shared lane markings are not a preferred facility type except in locations with low traffic speeds and volumes (operating speeds less than 25 mph, volumes less than 4,000 vehicles per day).
- On streets that fall outside of these design parameters, shared lane marking can be used as an interim (retrofit) design solution; however, they should not be used on streets with speed limits above 35 mph and are generally not appropriate on roadways with more than four travel lanes (two-way) or more than three travel lanes (one-way).
- Refer to the MUTCD for additional design guidance on the use of shared lane markings.

- On narrow travel lanes adjacent to on-street parking, shared lane markings should be placed in a location that is outside of the door zone of parked vehicles (such as the center of the travel lane).
- Shared lane markings should be supplemented by SHARE THE ROAD signs and BICYCLES MAY USE FULL LANE signs where appropriate.

CONSIDERATIONS

- Marked shared lanes should be provided after considering narrowing or removing travel lanes, parking lanes, and medians as necessary to provide an exclusive bicycle facility.
- Shared lanes can be used as an interim solution to complete connections between bicycle lanes and other facilities.



Sharrows

PRIORITY SHARED LANES



Priority Shared Lane in San Francisco, CA

OVERVIEW

On multi-lane streets, marked shared lane symbols, or sharrows, can be enhanced with dashed longitudinal lines and colored pavements. This marked “lane within the lane” can reduce conflicts by encouraging (though not requiring) vehicles to use inside lanes and reserve the outside lane for bicyclists. On-streets with narrow travel lanes, priority shared lanes direct the bicyclist to the correct and most conspicuous position on the road—the middle of the travel lane.

DESIGN

- Priority shared lanes can be an appropriate retrofit solution on multi-lane one-way and two-way streets where roadway space is not available for separate bicycle facilities. They should be used cautiously in locations with higher operating speeds (35 mph or greater).
- Shared lane markings can be supplemented by SHARE THE ROAD signs and BICYCLE MAY USE FULL LANE signs where appropriate.

CONSIDERATIONS

- Priority shared lanes should be provided after considering narrowing or removing travel lanes, parking lanes, or medians as necessary to provide an exclusive facility.
- Dashed longitudinal lines and/or colored pavement may be provided along the length of the corridor or be location specific.

ADVISORY BIKE LANES



Advisory bike lane on Potomac Greens Drive in Alexandria

Where the width of a two-way street is too narrow for the installation of a standard bicycle lane or protected bicycle lane and a standard travel lane for motor vehicles, advisory bicycle lanes could be an alternative to the marked shared lane. They make safe bicycle and vehicle travel possible on narrow roads.

The layout for advisory bike lanes is a travel lane centered between two bicycle lanes marked with a solid white line on the right and a dotted line to the left. There is no centerline. This directs motorists down the center of the road and provides a defined space for bicycles to pass on either side. When two motorists traveling in opposing directions meet, they yield to passing bicyclists and then use the shared bicycle lanes to pass.

DESIGN

- Advisory bicycle lanes are intended for streets with high bicycle traffic, but not a high volume of car traffic
- Advisory bicycle lanes can be provided where there otherwise wouldn't be room for bicycle lanes.
- Despite narrow street width, streets with advisory bicycle lanes are still two-way streets.

CONSIDERATIONS

- Motorists are allowed to merge into the bike lane; however, they must first yield to bicyclists in the bike lane.
- Bicyclists should be prepared for a motorist in a vehicle to enter the bicycle lane more often than on typical streets.
- Traffic volume should be less than 6,000 ADT.
- Lateral width of travel lane is 14'-16' between dashed bicycle lanes.
- The street is not a designated truck or transit route, nor would the street be expected to facilitate these vehicle types to and from other facilities.
- Green-colored pavement can be used, but should be limited to mixing/weaving locations and/or as a background enhancement to the bicycle symbol, arrow, and/or pavement word markings used to mark the dashed bike lane.

NEIGHBORHOOD BIKEWAYS

Primarily located in residential areas, Neighborhood Bikeways are designed to encourage slow vehicular traffic and to be comfortable for people walking and bicycling. These streets feature design elements such as curb extensions and roundabouts, “calming” traffic and giving priority to local vehicle trips over cut-through traffic. As an important part of the citywide bicycle network, Neighborhood Bikeways may also feature bicycle facilities such as shared lane markings or bike route signage.



Neighborhood Bikeways signage on Wilkes Street

OVERVIEW

What most influences the way people drive isn't the speed limit, a caution sign, or the threat of a ticket. Rather, drivers take their cues from the design of the street. Narrower lanes, trees, wayfinding signage, pavement markings, people walking and biking give the impression that pedestrians and bicyclist are a priority, so drivers slow down.

Neighborhood Bikeways are quiet, often residential streets that are designed for slower speeds. These streets are designed to give priority to pedestrians and bicyclists. They are excellent places to play, walk a dog, or ride a bicycle that connect across neighborhoods and the city.

DESIGN

- Design features that reduce operating speeds are used to maintain low speeds (20 mph or less) on Neighborhood Bikeways.
- Neighborhood Bikeways are best accomplished in neighborhoods with a grid street network (where motor vehicle through-traffic can be directed to parallel routes), but can also be accomplished by combining a series of road and trail segments to form one continuous route.
- Ideally, Neighborhood Bikeways should not carry more than 4,000 motor vehicles per day to be comfortable for pedestrians and bicyclists. Traffic management devices are typically used to discourage motor vehicle through-traffic while still enabling local traffic access to the street.
- Neighborhood Bikeways should be long enough to provide connectivity between neighborhoods and common destinations such as schools or parks.

CONSIDERATIONS

- At major street crossings, Neighborhood Bikeways may need additional treatments other than marked crosswalks for pedestrians and bicyclists. Treatments can include signage, median refuge islands, curb extensions, advisory bike lanes, rapid flash beacons, pedestrian-actuated signals and/or bicycle signal heads.

5 INTERSECTIONS



Intersections are locations where modes come together and where most conflicts and crashes occur on the roadway. Ranging in scale and complexity, they can be simple or challenging to navigate. In older Alexandria neighborhoods like Old Town and Del Ray, many intersections are compact and crossing is more comfortable for pedestrians and bicyclists; however, in other areas of the city, wide intersections are barriers, dividing communities and separating neighborhoods from daily needs and destinations.

People who travel on Alexandria's roadways should feel safe and comfortable; they should experience a minimal amount of delay during all trips regardless

of whether they are made on foot, by bicycle, via transit, or in an automobile. This chapter presents mechanisms to balance the needs of all users while preserving a unique sense of place at Alexandria's intersections.

» ***T&ES is responsible for approving all City intersection designs, along with any other changes made to city-owned right-of-ways. Coordination with VDOT is required on National Highway System (NHS) roadways and on Federal and State funded projects, as well as with stakeholders such as the Alexandria Fire Department and the Commission on Persons with Disabilities.***

Intersection Geometry

Many of Alexandria’s intersections have complicated geometric configurations as the street network has been augmented over time. Within the City’s historic neighborhoods, the roadway grid pattern provides predictable four-legged approaches, but there are also many instances of larger and more complex intersections.

Designing multimodal intersections requires geometry that increases safety for all users in combination with effective and efficient traffic control measures. Changes in geometry can help to reduce vehicle turning speeds, increase pedestrian comfort and safety, and create space for dedicated bicycle facilities. One of the key considerations of intersection geometry is the location of pedestrian crossing ramps and crossings relative to vehicle paths.

» *Intersection geometry must be approved by T&ES who utilize guidelines and standards from:*

- **The Manual of Uniform Traffic Control Devices (MUTCD)**
- **The National Association of City Transportation Officials (NACTO) Urban Street and Bikeway Design Guides** *(both have been endorsed by the City of Alexandria)*
- **American Association of State Highway Transportation Officials (AASHTO) “Green Book”**

CORNERS AND CURB RADII

OVERVIEW

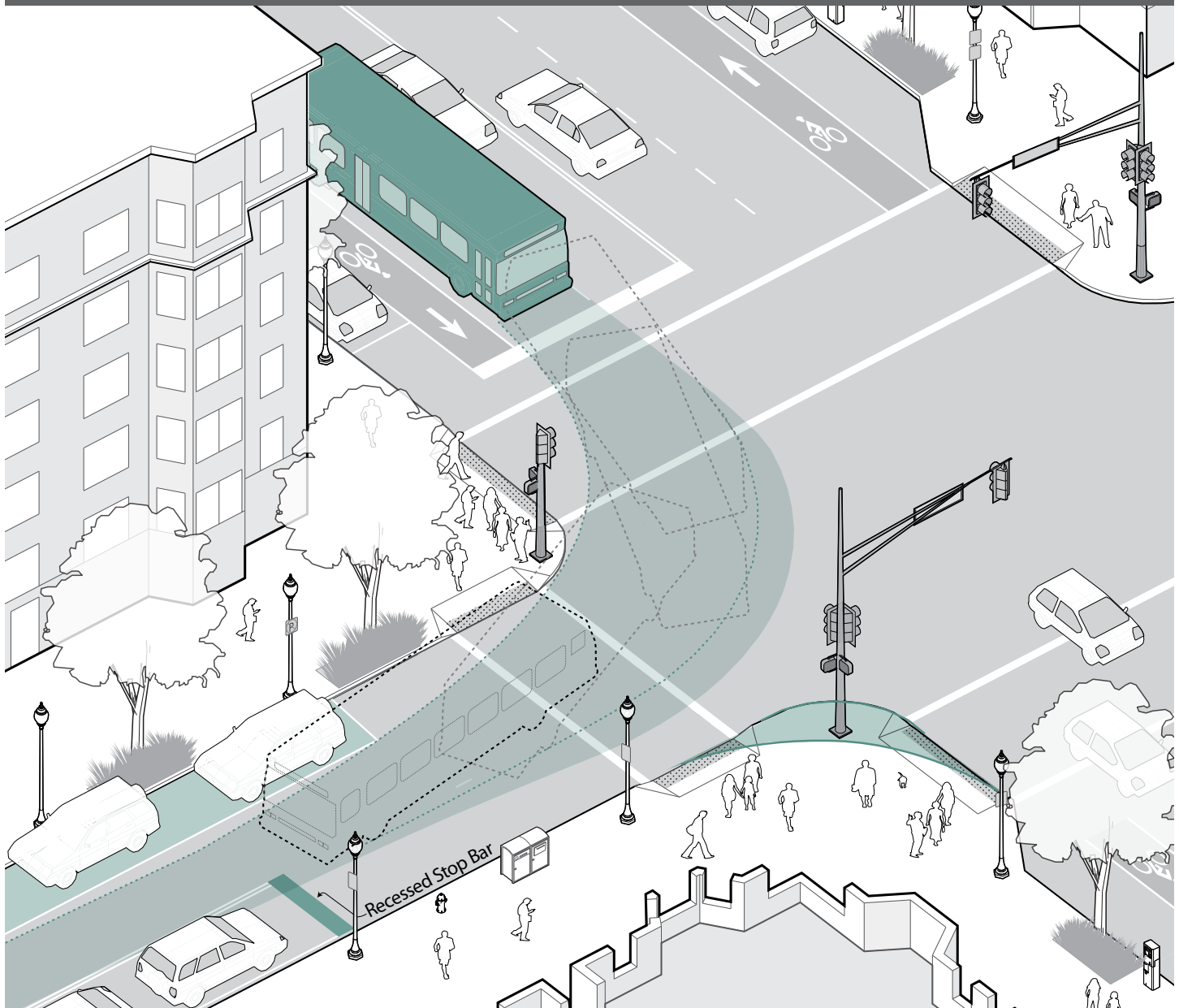
Pedestrian safety and comfort is directly impacted by the width and configuration of street corners; however, streets in Alexandria must accommodate large turning vehicles, including school buses and transit vehicles. One of the most challenging aspects of intersection design is to determine methods of accommodating large vehicles while keeping intersections as compact as possible. This requires a great deal of design flexibility and engineering judgment, as each intersection is unique in terms of the angles of the approach and departure, the number of travel lanes, the presence of a median, and a number of other features that fundamentally impact corner design.

One of the most important aspects of corner design is the selection of a curb radius that is as small as possible while accommodating the appropriate design vehicle for

the intersection. Small curb radii benefit pedestrians by creating sharper turns requiring motorists to slow down, increasing the size of waiting areas, allowing for greater flexibility in the placement of curb ramps, and reducing pedestrian crossing distances.

Two of the most important corner design elements are the effective curb radius and the actual curb radius. Actual curb radius refers to the curve that the curb line makes at the corner, while effective curb radius refers to the curve which vehicles follow when turning, which may be affected by on-street parking, bicycle lanes, medians, and other roadway features. The effective curb radius can in some cases be quite small, while the actual curb radius is bigger and can accommodate large vehicles, especially in locations with on-street parking.

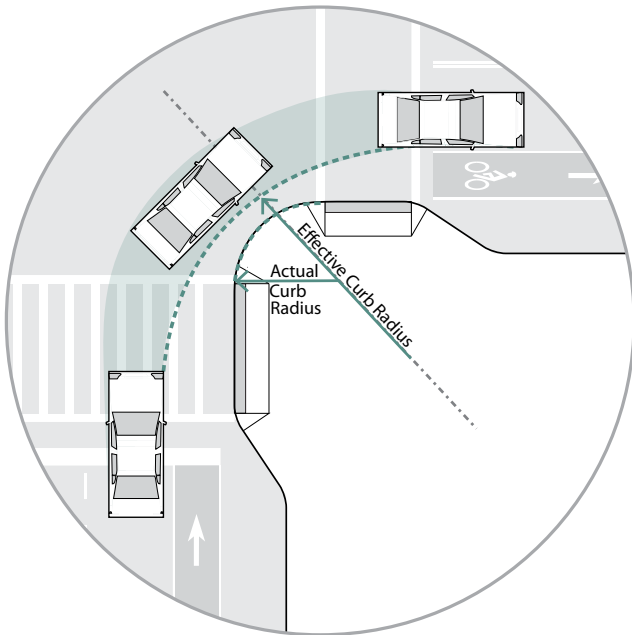
CORNERS AND CURB RADII



DESIGN

- The design vehicle should be selected according to the types of vehicles using the intersection with considerations to relative volumes and frequencies. In most cases, the City of Alexandria will evaluate the curb radii based on a Single Unit vehicle with a 42' turning radius. If the City anticipates the need to accommodate a larger design vehicle, a radius evaluation based on this larger vehicle would be required. Examples of typical turning templates would include a SU, WB-40, WB-50, WB-60 and WB-62.
- Intersection design should strive for an actual curb radii that is between 10' to 25'. The default curb radii for two intersecting Neighborhood Residential Streets is 10' (exceptions apply for angled streets). For all other street classifications, including streets that intersect with Neighborhood Residential Streets, corner design should strive for an actual curb radius that is no more than 15' (exceptions apply for angled streets). Methods to minimize curb radii are described below.

CORNERS AND CURB RADII



- While pedestrian safety is negatively impacted by wide crossings, pedestrians are also placed at risk if the curb radius is too small and the rear wheels of a truck track over the pedestrian waiting area at the corner. Maintenance problems are also caused when trucks must regularly drive over street corners to make turns.
- Channelized right turn lanes at intersections encourage faster motor vehicle turning speeds and should generally be avoided, however, in locations where a channelized right turn lane is necessary, it should be designed to encourage drivers to yield to pedestrians. The lane should approach the intersecting road with a “merge” condition (vehicles in the channelized right turn lane should be required to either yield or stop before turning right onto the receiving roadway).
- As described elsewhere in these guidelines, curb extensions are beneficial to pedestrians. It is acceptable to have a larger curb radius to properly design a curb extension that shortens crossing distances while accommodating large vehicles.

CONSIDERATIONS

A variety of strategies can be employed to minimize curb radii:

- On-street parking and bicycle lanes may provide the larger effective radii to accommodate the appropriate design vehicle.
- On low volume (less than 4,000 vehicles per day), two-lane streets, corner design should assume that a large vehicle will use the entire width of the departing and receiving travel lanes, including the oncoming traffic lane.
- At signalized intersections, corner design should assume the large vehicle will use the entire width of the receiving lanes on the intersecting street.
- At signalized intersections where additional space is needed to accommodate turning vehicles, consideration can be given to recessing the stop bar on the receiving street to enable the vehicle to use the entire width of the receiving roadway (encroaching on the opposing travel lane).
- In some cases, it may be possible to allow a large turning vehicle to encroach on the adjacent travel lane on the departure side (on multi-lane roads) to make the turn.
- A compound curve can be used to vary the actual curb radius over the length of the turn so that the radius is smaller as vehicles approach a crosswalk and larger when making the turn.
- In some cases where there are alternative access routes, it may be possible to restrict turning movements by large vehicles at certain intersections and driveways to enable tighter curb radii. Turn restrictions and alternate access routes should be properly signed and must be approved by T&ES.

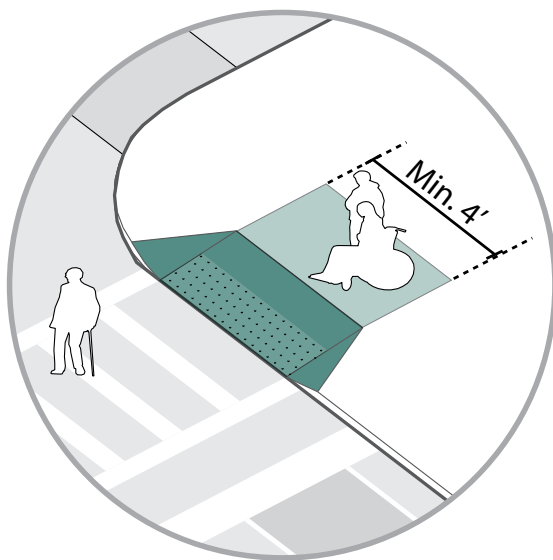
CURB RAMPS

OVERVIEW

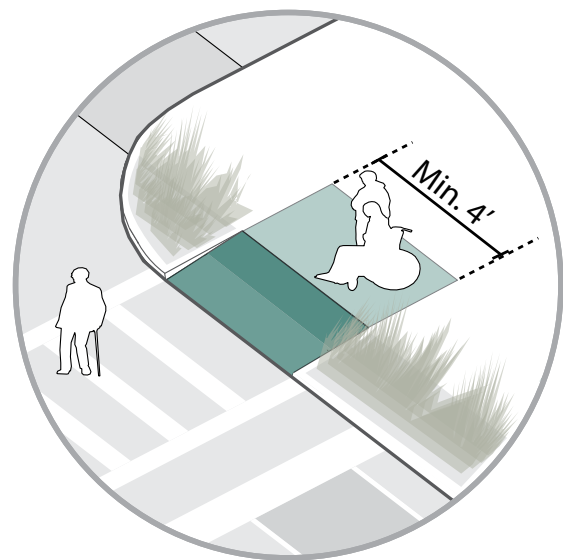
The transition for pedestrians from the sidewalk to the street is provided by a curb ramp. The designs of curb ramps are critical for all pedestrians, but particularly for people with disabilities. The ADA Standards require all pedestrian crossings be accessible to people with disabilities by providing curb ramps at intersections and midblock crossings as well as other locations where pedestrians can be expected to enter the street. Curb ramps also benefit people pushing strollers, grocery carts, suitcases, or bicycles.

DESIGN

- Curb ramps should be provided at every marked crosswalk.
- A consistent approach is needed when it comes to materials used in curb ramps, depending upon the character of the street or neighborhood where they are being installed.
- Wherever feasible, curb ramp locations should reflect a pedestrian's desired path of travel through an intersection. In general, this means providing two separate perpendicular curb ramps at a corner instead of a single ramp that opens diagonally at the intersection. The City of Alexandria discourages the use of diagonal ramps.
- Curb ramps should be designed with drainage inlets to avoid the accumulation of water or debris. During winter, snow should be cleared from curb ramps to provide an accessible route.
- A level landing pad must be provided on the sidewalk. It should be the same width as the sidewalk but no less than 4' in width, with no greater than 2% slope in any direction.
- Curb ramps should generally be as wide as the pedestrian zone on the approaching sidewalk. The curb ramp should lie within the area of the crosswalk; however, flares may extend beyond it.



Flared Curb Ramp



Non-flared Curb Ramp

CURB RAMPS



Curb ramp designed without flares. Note: detectable warning strips must be provided

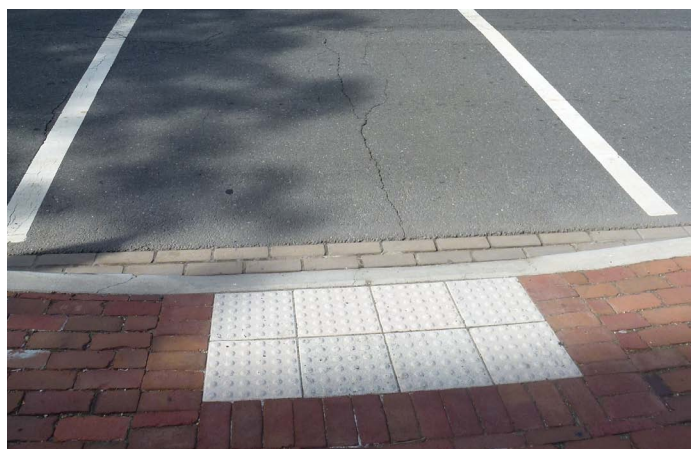
- Curb ramps must include ADA compliant detectable warning strips to alert people who have visual disabilities that they are about to enter a roadway. Detectable warning strips include a series of truncated domes. Detectable warning strips must ensure a 70% contrast in color with the surrounding pavement. Detectable warning strips must be designed according to specifications determined by T&ES.
- Detectable warning strips are required at all roadway crossings, regardless of whether there is grade separation, such as at raised crossings and raised intersections, at crossing islands, or at crossings along Shared Streets.
- If used, pedestrian pushbuttons should be easily activated and conveniently located near each end of the crosswalk, between the edge of the crosswalk line, and the side of a curb ramp.

CONSIDERATIONS

- There are a variety of standard curb ramp designs, including perpendicular ramps and parallel ramps. Perpendicular ramps slope perpendicular to the curb line, and parallel ramps slope parallel to the curb line. The appropriate design should be determined on a site-by-site basis. Key factors to consider include pedestrian crossing distances, desire lines, sidewalk width, and proximity to traffic, curb height, street slope, and drainage.
- Consider providing wider curb ramps in areas of high pedestrian volumes and crossing activities.
- Flares are required when the surface adjacent to the ramp's sides is walkable, however, they are unnecessary when this space is occupied by a landscaped buffer. Excluding flares can also increase the overall capacity of a ramp in high-pedestrian areas.
- Consider installing raised crossings or raising the entire intersection. Raising the crossing or intersection eliminates the need for curb ramps because a continuous sidewalk realm is provided across the intersection. Detectable warning strips still must be provided at raised crossings and intersections. For more information, refer to **Raised Crossings and Intersections** later in this chapter.

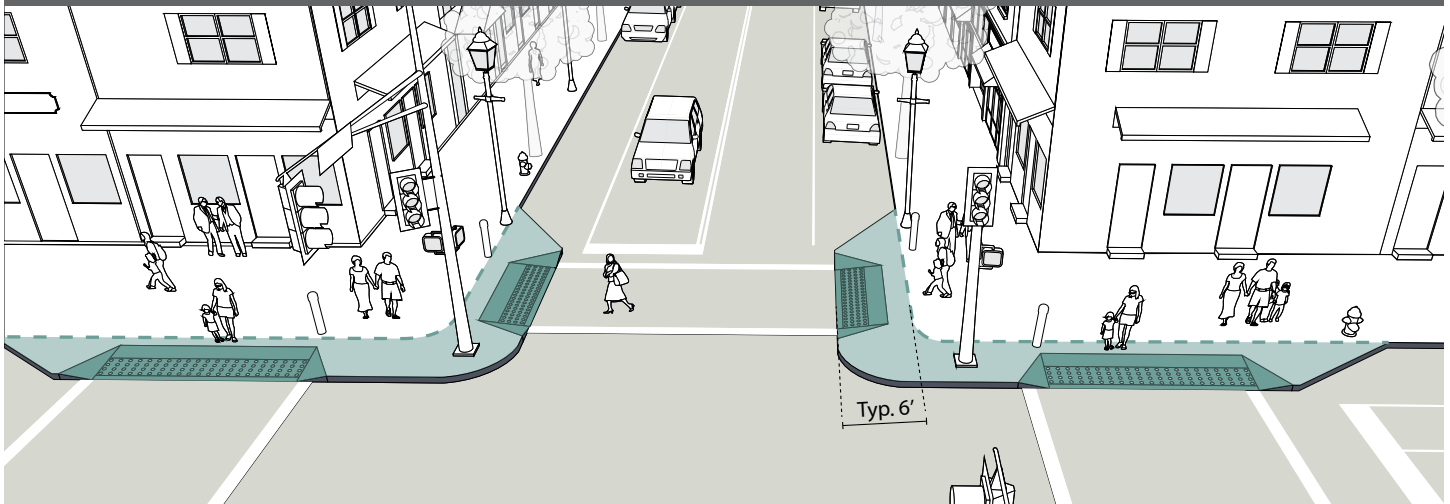


Curb ramp with truncated dome tactile warning



Brick curb ramp with tactile warning near King Street Metro

CURB EXTENSIONS



OVERVIEW

Curb extensions, also known as neckdowns, bulb-outs, or bump-outs, are created by extending the sidewalk at corners or mid-block. Curb extensions are intended to increase safety, calm traffic, and provide extra space along sidewalks for users and amenities.

Curb extensions have a variety of potential benefits including:

- Additional space for pedestrians to queue before crossing
- Improved safety by reducing motor vehicle speeds and emphasizing pedestrian crossing locations
- Less pedestrian exposure to motor vehicles by reducing crossing distances
- Space for ADA compliant curb ramps where sidewalks are too narrow
- Enhanced visibility between pedestrians and other roadway users
- Restricting cars from parking too close to the crosswalk area
- Space for utilities, signs, and amenities such as bus shelters or waiting areas, bicycle parking, public seating, street vendors, newspaper stands, trash and recycling receptacles, and planting and landscape elements

It is noted that maintenance of curb extensions are an important consideration, primarily during the winter months. Extensions should be identified (i.e., flagged) to avoid damage during snow removal.

DESIGN

- Curb extensions should be considered only where parking is present or where motor vehicle traffic deflection is provided through other curbside uses such as bicycle share stations or parklets.
- Curb extensions are particularly valuable in locations with high volumes of pedestrian traffic, near schools, at unsignalized pedestrian crossings, or where there are demonstrated pedestrian safety issues.
- A typical curb extension extends the approximate width of a parked car (or about 6' from the curb).
- The minimum length of a curb extension is the width of the crosswalk, allowing the curvature of the curb extension to start after the crosswalk, which should deter parking; NO STOPPING signs should also be used to discourage parking. The length of a curb extension can vary depending on the intended use (i.e., stormwater management, transit stop waiting areas, restrict parking).
- Curb extensions should not reduce a travel lane or a bicycle lane to an unsafe width.
- Curb extensions at intersections may extend into either one or multiple legs of the intersection, depending on the configuration of parking.
- Street furniture, trees, plantings, and other amenities should not interfere with pedestrian flow, emergency access, or visibility between pedestrians and other roadway users.

CURB EXTENSIONS

- Curb extensions may be located at corners or midblock locations.

CONSIDERATIONS

- The turning needs of emergency and larger vehicles should be considered in curb extension design.
- Care should be taken to maintain direct routes across intersections aligning pedestrian desire lines on either side of the sidewalk. Curb extensions often make this possible as they provide extra space for grade transitions.
- Consider providing a 20' long curb extension to restrict parking within 20' of an intersection.
- Curb extensions should be proposed on snow emergency routes only after consultation with T&ES. Because of the added complexity that curb extensions propose for snow removal, they should be identified or flagged on snow routes to ensure that removal vehicles do not damage curbs.
- In order to move traffic more efficiently, curb extensions should not be installed on arterials with peak hour parking restrictions.
- When curb extensions conflict with turning movements, the reduction of width and/or length should be prioritized over elimination.
- Emergency access is often improved through the use of curb extensions as intersections are kept clear of parked cars.
- Curb extension installation may require the relocation of existing storm drainage inlets and above ground utilities. They may also impact underground utilities, parking, delivery access, garbage removal, snow plows, and street sweepers. These impacts should be evaluated when considering whether to install a curb extension.
- Curb extensions at transit stops are called “bus bulbs.” See [Transit Accommodations](#) later in this chapter for more information.



Curb extension in Old Town

RECLAIMING SPACE AT INTERSECTIONS



There are opportunities in many intersections to reclaim space. The additional space can be used for multiple purposes including improving safety, widening sidewalks, adding bicycle facilities. Additionally, reclaiming space provides room for traffic control devices, utilities, plantings, green infrastructure, street furniture, vending, and public art. Reclaiming space for non-motorized use at intersections can be accomplished with both short-term and long-term solutions:

- **Short-term** ways to creatively redistribute space at intersections include reclaiming parking spaces for parklets, bicycle share stations, temporary plazas, and mock curb extensions. The reclaimed space can be redefined with seating, planters, and paint. Redefinition does not have to involve major capital project funds.
- **Long-term** options include tightening corner radii, narrowing of travel lanes, curb extensions, removal of turn lanes or parking lanes, closure of slip lanes, and incorporating the space into the sidewalk.

The location of reclaimed space can be in the middle of an intersection, extended from corners, or legs of an intersection can be closed to motor vehicle traffic and converted for other purposes such as a pedestrian plaza.



"Mock" curb extension offers a method to test ways of reclaiming space at intersections

CROSSING ISLANDS



Crossing island on Stevenson Avenue

OVERVIEW

As the number of travel lanes increases, pedestrians feel more exposed and less safe entering the intersection. Crossing islands are raised islands that provide a pedestrian refuge while crossing multilane roadways. These features allow pedestrians to find gaps in traffic and make a two-stage crossing movement. At mid-block crossings, islands should be designed with a stagger, or in a “z” pattern, forcing pedestrians to face oncoming traffic before progressing through the second phase of the crossing.

» *Crossing islands must be approved by T&ES and must comply with all accessibility requirements.*

DESIGN

Crossing islands should:

- Use where there is a demand for pedestrians to cross the road, but where the numbers of pedestrians are not high enough to warrant a signalized pedestrian crossing.
- Include at-grade pedestrian cut-throughs as wide as the connecting crosswalks, detectable warnings, and be gently sloped to prevent standing water and ensure adequate drainage.
- Be at least 6' wide, preferably 8–10'. Where a 6' wide median cannot be attained, a narrower raised median is still preferable to nothing. The minimum protected width is 6', based on the length of a bicycle or a person pushing a stroller. The refuge is ideally 40' long.

CROSSING ISLANDS

- Accommodate turning vehicles. Crossing islands at intersections or near driveways may affect left-turn access.
- All crossing islands at intersections should have a “nose” that extends past the crosswalk. The nose protects people waiting on the crossing island and slows turning drivers.
- Safety islands should include curbs, bollards, or other features to protect people waiting.
- Illuminate or highlight islands with street lights, signs, or reflectors to ensure that motorists see them.
- Crossing islands may be enhanced using plantings or street trees. Plantings may require additional maintenance responsibilities and need to be maintained to ensure visibility.
- Signalized intersections with crossing islands should be designed to allow pedestrians to cross in one stage. Please refer to T&ES’s Transportation Division for more information.

CONSIDERATIONS

- Crossing islands should be considered where crossing distances are greater than 50'.
- To guide motorists around crossing islands, consider incorporating diverging longitudinal lines on approaches to crossing islands.
- If there is enough width, center crossing islands and curb extensions can be used together to create a highly visible pedestrian crossing and effectively calm traffic.
- Where possible, stormwater management techniques should be used on crossings islands with adequate space. Plantings should be low growing to maximize visibility and ideally involve minimum maintenance in accordance with the **Green Sidewalk, BMP Design Guidelines**.

LINKS

Green Sidewalk, BMP Design Guidelines

<http://alexandriava.gov/uploadedFiles/tes/info/GreenSidewalksBMPDesignGuidelines%20.pdf>

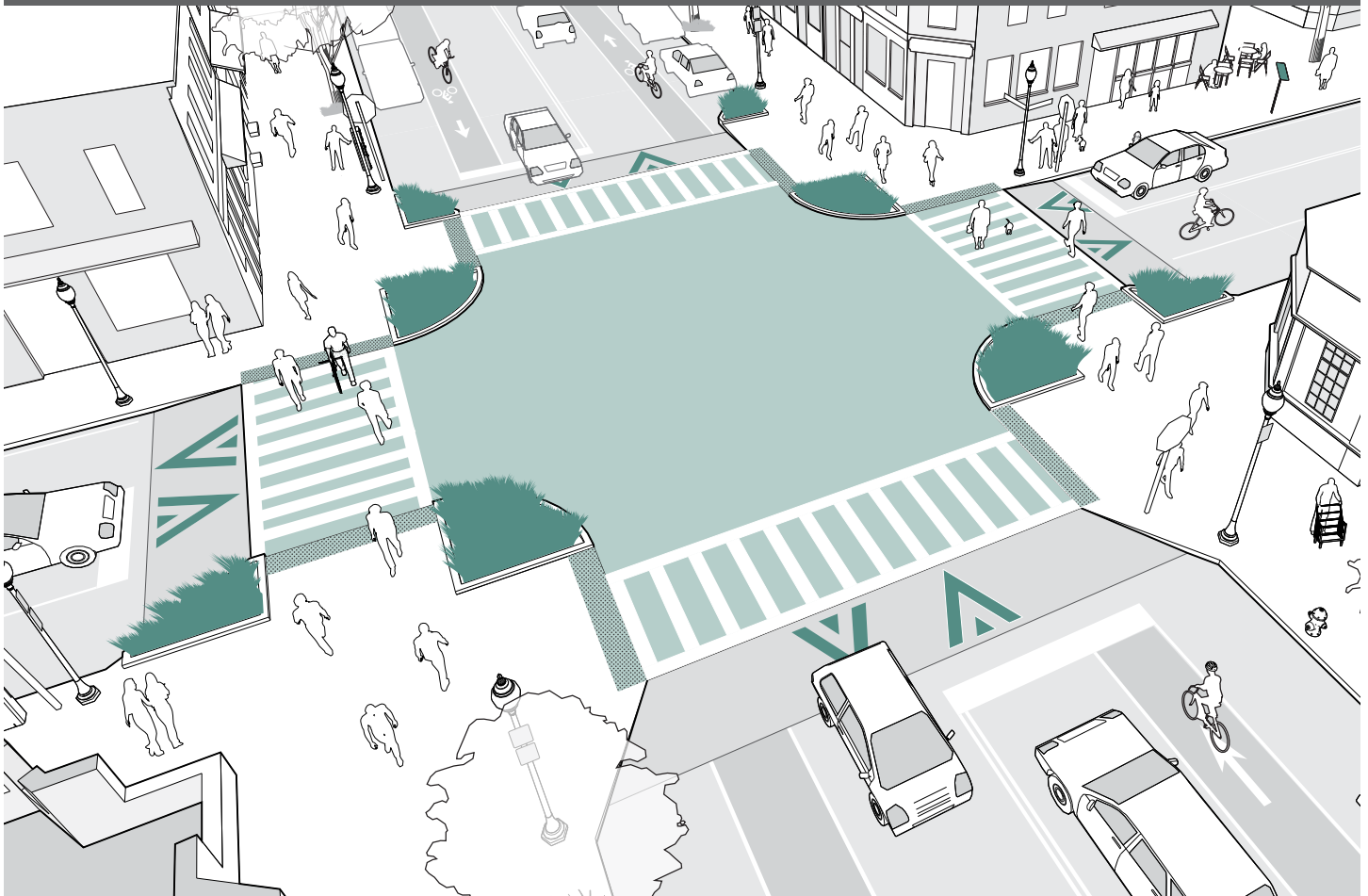
Local Motion- Crosswalks 101

<http://alexandriava.gov/localmotion/info/default-11528.html>

NACTO Urban Street Design Guidelines- Pedestrian Safety Islands

<http://nacto.org/usdg/intersection-design-elements/crosswalks-and-crossings/pedestrian-safety-islands/>

RAISED CROSSINGS AND INTERSECTIONS



OVERVIEW

Raised crossings and intersections create a safe, slow-speed crossing and public space at minor intersections. They are created by raising the level of the roadway to the same level as the sidewalk. Raised intersections are a similar concept to speed tables but are applied to the entire intersection. These treatments provide an array of benefits especially for people with mobility and visual disabilities because there are no vertical transitions to navigate.

» *Raised crossings and intersections must be approved by T&ES, in consultation with the Commission on Persons with Disabilities and the Alexandria Fire Department. Please refer to the [State's Traffic Calming Guidelines for Local Residential Streets](#).*

Raised crossings and intersections:

- Make it physically more difficult for drivers to go through crossings and intersections at unsafe speeds.
- Improve drivers' awareness by prioritizing pedestrian crossings and helping define locations where pedestrians are expected.
- Eliminate standing water and debris collection at the base of ramps.
- Increase visibility between drivers and pedestrians by raising pedestrians in the motorists' field of view and giving pedestrians an elevated vantage point from which to look for oncoming traffic.
- Create pedestrian crossings that are more comfortable, convenient and accessible since transitioning between the sidewalk and roadway does not require negotiating a curb ramp.

RAISED CROSSINGS AND INTERSECTIONS

DESIGN

- Raised crossings and intersections are appropriate in areas of high pedestrian demand, including Main Streets, Mixed Use Boulevards, and Neighborhood Connectors. They should also be considered in school zones and locations where pedestrian visibility and motorist yielding have been identified as concerns.
- Care should be taken to maintain direct routes across intersections aligning pedestrian desire lines on either side of the sidewalk.
- Raised crossings can be provided along side streets of major thoroughfares to slow traffic exiting the main street.
- Raised crossings should provide pavement markings for motorists and appropriate signage at crosswalks per the MUTCD.
- Design speeds and emergency vehicle routes must be considered when designing approach ramps.
- Raised crossings and intersections require detectable warnings at the curb line for persons with visual disabilities.

CONSIDERATIONS

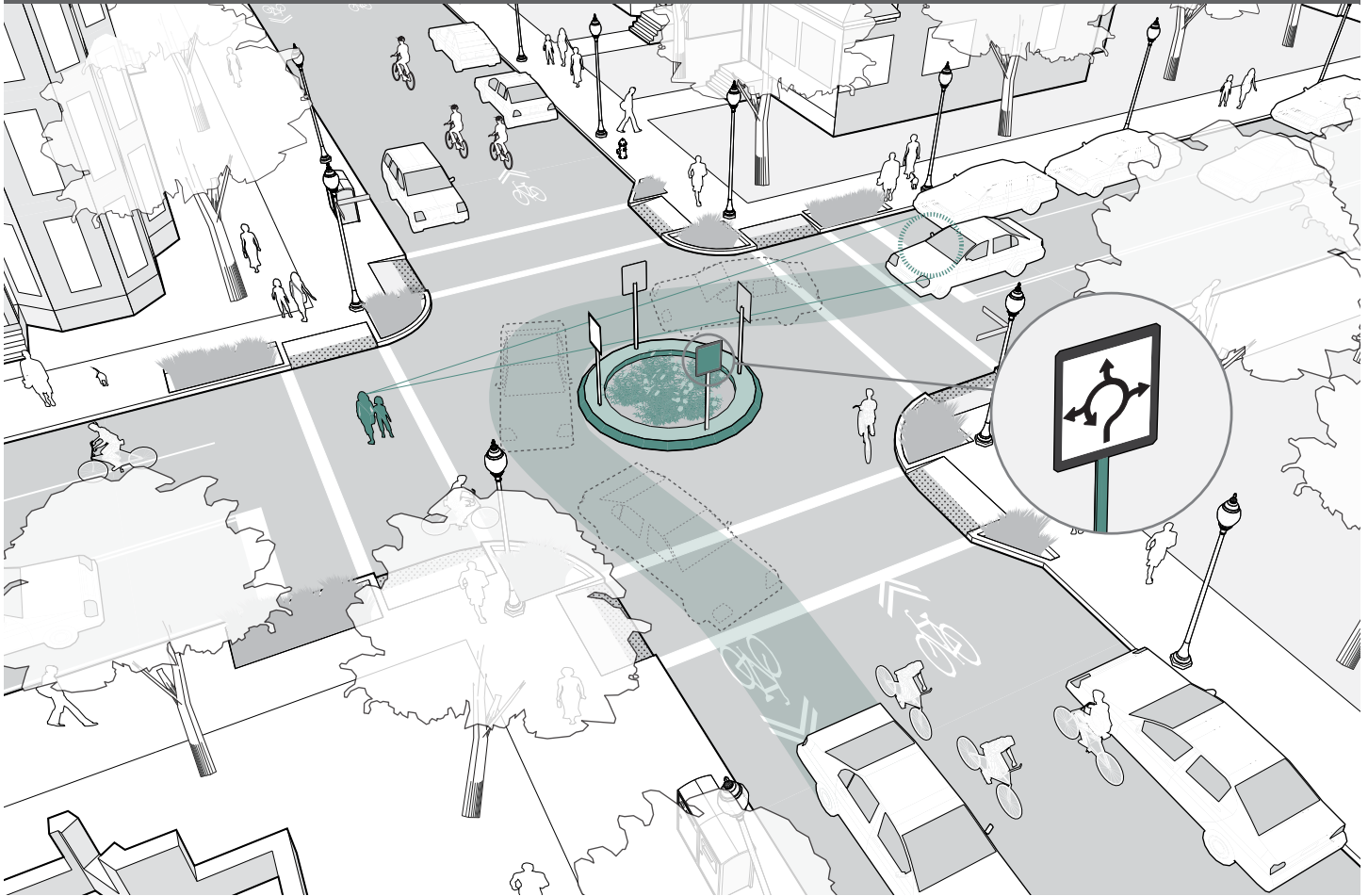
- Raised crossings are particularly valuable at unsignalized mid-block locations where drivers are less likely to expect or yield to pedestrians.
- Raised intersections and crossings can be used as gateway treatments to signal to drivers when there are transitions to a slower speed environment that is more pedestrian-oriented.
- High-visibility or textured paving materials can be used to enhance the contrast between the raised crossing or intersection and the surrounding roadway.
- Installation of raised crossings and intersections may affect snow removal operations. Snow plow operators should be adequately warned and trained.
- Designs should ensure proper drainage. Raised intersections can simplify drainage inlet placement by directing water away from the intersection. If the intersecting streets are sloped, catch basins should be placed on the high side of the intersection at the base of the ramp.

LINKS

State's Traffic Calming Guidelines for Local Residential Streets

<http://www.virginiadot.org/programs/resources/TrafficCalmingGuideOct2002.pdf>

NEIGHBORHOOD TRAFFIC CIRCLES



OVERVIEW

Traffic circles, or mini roundabouts, can reduce speeds and crashes in low-volume areas and are ideal treatment for uncontrolled intersections. They can be installed using simple markings or raised islands, but they also provide great opportunities to include BMPs or pieces of art.

Traffic circles on Neighborhood Residential streets, Neighborhood Bikeways, and Shared Streets provide advantages for bicyclists and vehicles as they reduce the need for a full stop and enable continuous progression when conflicting traffic is not present.

DESIGN

- Traffic circles are a good alternative to stop-controlled intersections, and are usually preferred to four-way stops.
- Incorporate intersection crossing markings to guide bicyclists through the intersection.
- A mountable curb/curb apron should be provided at traffic circles where large trucks or emergency vehicles require access in constrained spaces.
- Careful attention should be paid to the available lane width and turning radius used with traffic circles.

NEIGHBORHOOD TRAFFIC CIRCLES



Traffic circle in Arlington, VA

CONSIDERATIONS

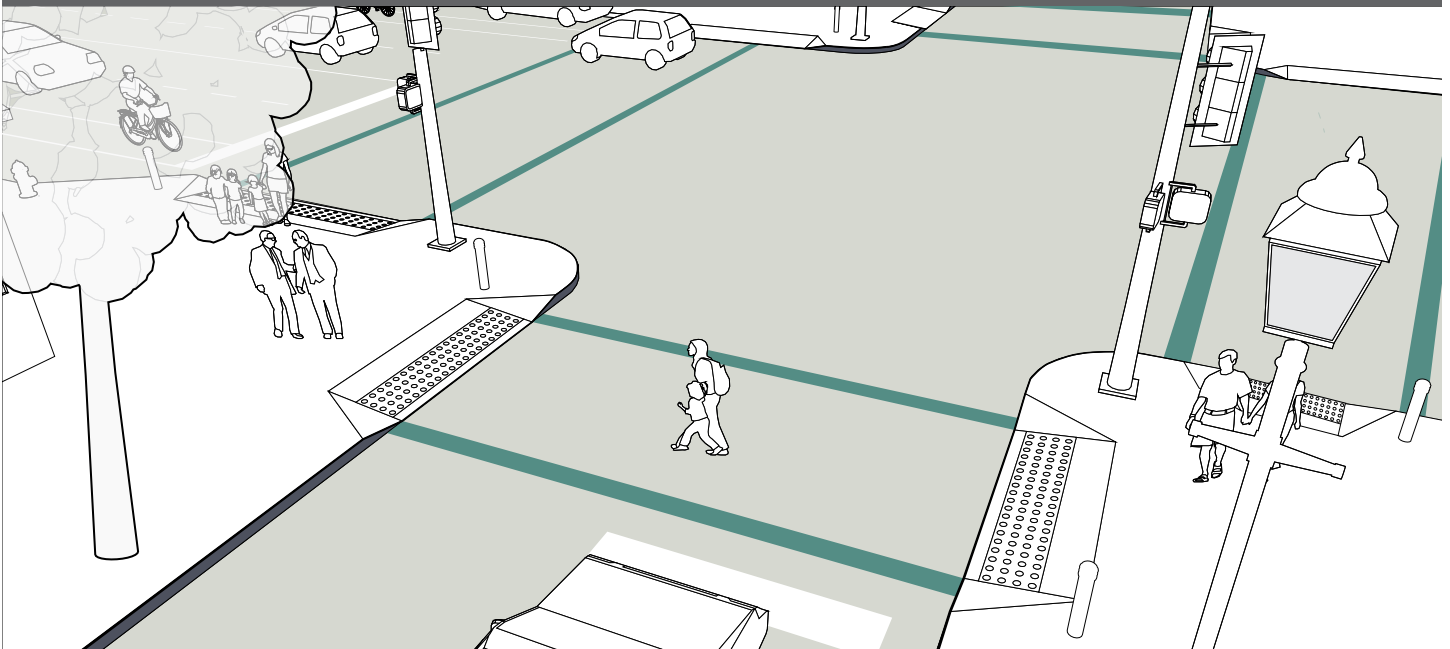
- Designs should consider the speed of the roadway.
- Access to underground utilities should be considered.
- A neighborhood partner should be identified for maintenance of any plantings.
- Circles are ideal locations for art or neighborhood gateway treatments; however, elements must not obstruct visibility.
- Maintain circle visibility with paint and reflectors.
- Regulatory and/or warning signage should be provided to remind traffic to proceed counterclockwise around the circle.

- Crosswalks should be marked to clarify where pedestrians should cross and that they have priority. ADA-compliant ramps and detectable warnings are required.
- Provide approximately 15' of clearance from the corner to the widest point on the circle.
- If plantings are incorporated, they should require minimal maintenance and access paths for maintenance crews should be incorporated into the overall design.

Crosswalk Design

Well-designed crosswalks are an important component of a pedestrian-friendly city. Safety for all pedestrians, especially for those with limited mobility and disabilities, is the single most important criteria informing crosswalk design.

STANDARD CROSSWALKS



OVERVIEW

The City of Alexandria’s standard crosswalk consists of parallel 6" wide reflective white lines placed 10' apart. This type of crosswalk is sufficient for most signalized intersections. The continental style or “high-visibility” crosswalk should be used at uncontrolled crossings or locations with heavy pedestrian volumes. High visibility crosswalks should be designed to comply with the MUTCD. Textured pavement and colored crosswalks are discouraged as they often fade over time and lack sufficient retro-reflectivity.

USE

- Crosswalks should be at least 10' wide or the width of the approaching sidewalk if it is greater. In areas of heavy pedestrian volumes, crosswalks can be up to 25' wide.
- Crosswalks should be aligned with the approaching sidewalk and as close as possible to the parallel street to maximize the visibility of pedestrians while minimizing their exposure to conflicting traffic.

STANDARD CROSSWALKS

- Designs should balance the need to reflect the desired pedestrian walking path with orienting the crosswalk perpendicular to the curb; perpendicular crosswalks minimize crossing distances and therefore limit the time of exposure.
- ADA-compliant curb ramps should direct pedestrians into the crosswalk. The bottom of the ramp should lie within the area of the crosswalk (flares do not need to fall within the crosswalk).
- Stop lines at stop-controlled and signalized intersections should be striped no less than 4' from the approach of crosswalks.

CONSIDERATIONS

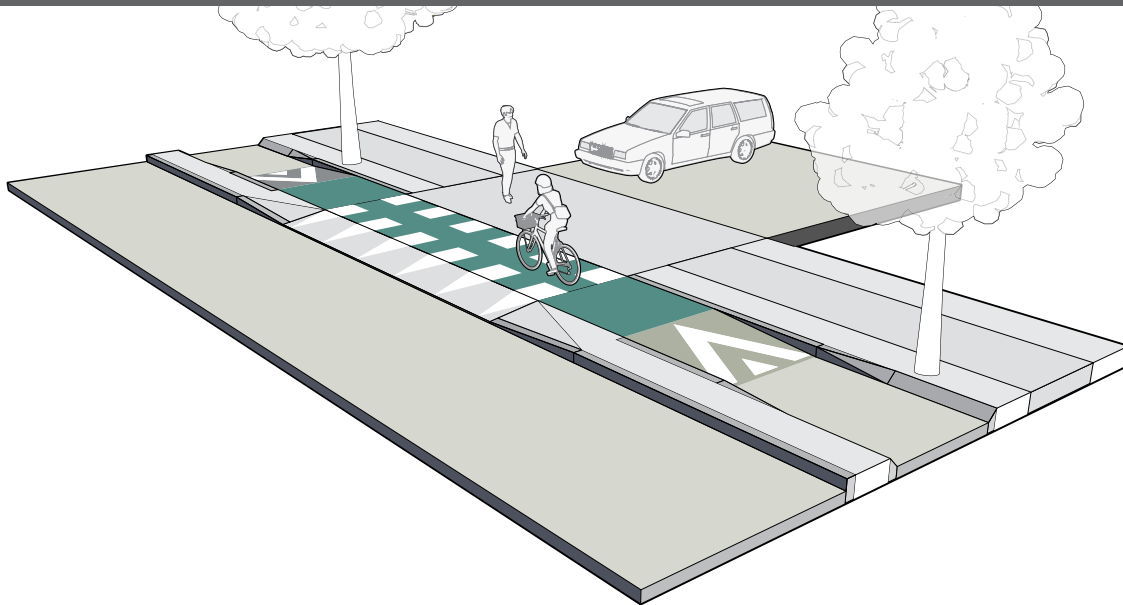
- Crosswalk markings should consist of non-skid, thermoplastic, retro-reflective material. On new pavement, thermoplastic markings should be recessed when possible so that the surface of the marking is flush with the pavement to reduce maintenance needs and provide a smooth, accessible surface.
- Unit pavers and materials that differ from the surrounding pavement such as concrete placed on an asphalt street, may not be used in crosswalks. Pavers can be susceptible to settling and damage and can become uncomfortable and unsafe over time.
- Raised crosswalks further promote driver yielding behavior by slowing their speed before the crossing and increasing visibility of pedestrians.

LINKS

Local Motion- Crosswalks 101

<http://alexandriava.gov/localmotion/info/default.aspx?id=11528>

BICYCLE CROSSING



Protected bike lane crossing a driveway

A bicycle crossing is a marked crossing of an intersection with a street, driveway, or alley. The purpose of the crossing is twofold: 1) to delineate a preferred path for people bicycling through the intersection, and 2) to encourage driver yielding behavior, where applicable. The bicycle crossing may be supplemented with dashed green pavement, yield lines, or regulatory signs.

DESIGN

- The bicycle crossing is bounded by 12" (perpendicular) by 24" (parallel) white pavement dashes, otherwise known as elephant's feet. Spacing for these markings should be coordinated with zebra, continental, or ladder striping of the adjacent crosswalk.
- The bicycle crossing should be a minimum of 6' wide for one-way travel and 10' wide for two-way travel, as measured from the outer edge of the elephant's feet. Bicycle lane symbol markings should be avoided in bicycle crossings. Directional arrows are preferred within two-way bicycle crossings.

- Dashed green colored pavement may be utilized within the bicycle crossing to increase the conspicuity of the crossing where permitted conflicts occur. Green color may be desirable at crossings where concurrent vehicle crossing movements are allowed and where sightlines are constrained, or where motor vehicle turning speeds exceed 10 mph.

CONSIDERATIONS

- Supplemental yield lines, otherwise known as shark's teeth, can be used to indicate priority for people bicycling and may be used in advance of unsignalized crossings at driveways, at signalized intersections where motorists may turn across a bicycle crossing during a concurrent phase, and in advance of bicycle crossings located within roundabouts.
- Raised bicycle crossings further promote driver yielding behavior by slowing their speed before the crossing and increasing visibility of people bicycling.

Guidelines for Crosswalk Installation

Legal crosswalks exist at all locations where two streets cross, including T-intersections, regardless of whether pavement markings are present. In other words, motor vehicles are legally required to yield to pedestrians at intersections even when there are no pavement markings.

Crosswalks should be used only at locations where significant pedestrian activity is occurring or anticipated to help ensure that motorists associate crosswalk and pedestrian activity. In order to create a convenient, connected, and continuous walking network. The first step is identifying location for marked crosswalk. Begin by identifying desire lines and destinations such as schools, parks, civic buildings, retail areas, and transit stops. Then, identify where it is safest for people to cross. These observations should inform location and prioritization of crossing improvements.

Marked crosswalks help guide pedestrians to locations where they should cross the street as well as inform drivers of pedestrian movements. In addition to intersections, marked crosswalks are used in locations where pedestrians may not be expected, such as at mid-block crossings or uncontrolled crossings (crossings where motorists do not have signals or stop signs).

As with any installation of traffic control devices, the most essential tool for crosswalk installation is the use of engineering judgment. Engineering judgment should be used and, if applicable, an engineering study performed when considering the marking of crosswalks.

MARKED CROSSWALKS AT CONTROLLED LOCATIONS

Intersection controls are one of the most important factors in intersection design. The goal of controlling intersections is to provide the safest, most efficient means to move people across an intersection, whether walking, riding a bicycle, taking transit, or driving. Specific attention should be given to vulnerable users, such as pedestrians and bicyclists.



Engineering judgment should be used to establish the most appropriate controls on a site-specific basis. The following factors should be considered when determining intersection controls:

- Vehicular, bicycle, and pedestrian traffic volumes on all approaches
- Number and angle of approaches
- Approach speeds
- Sight distance available on each approach
- Reported crash experience

Depending on the type of intersection and the selected control devices, it may not always be appropriate to mark crosswalks at all legs of an intersection. Alternate treatments may be necessary to optimize safety and visibility, which are discussed in the sections that follow.

MARKED CROSSWALKS AT SIGNALIZED INTERSECTIONS

Typically, marked crosswalks should be installed at each leg of all signalized intersections, unless otherwise determined by an engineering study. Stop lines should be striped at signalized intersections no less than 4' and no more than 30' from the crosswalk to deter motorists from encroaching in the crosswalk. Signalized intersections are discussed in further detail later in this chapter.

MARKED CROSSWALKS AT CONTROLLED LOCATIONS



East Windsor Avenue at Mount Vernon Avenue crosswalk



A bus yields to a pedestrian as it exits the roundabout

MARKED CROSSWALKS AT STOP-CONTROLLED INTERSECTIONS

Stop-controlled approaches are easiest for pedestrians to cross because motorists and bicyclists must stop and yield the right-of-way to pedestrians. Stop-controlled intersections also help reduce pedestrian delay; however, the use of stop signs must balance safety with efficient traffic flow for all modes, including bicycles and transit vehicles. Stop sign installation requires **specific warrants** be met as determined by the MUTCD.

Typically, marked crosswalks should be installed at each leg of all stop-controlled intersections near pedestrian generators, unless otherwise directed by T&ES. For Neighborhood Residential Streets, marked crosswalks should be used at locations where pedestrian crossings are more frequent, such as school walking routes, park entrances, or other locations. Stop lines should be striped at stop-controlled intersections **no less than 4' and no more than 30'** from the approach of crosswalks, unless determined otherwise by an engineering study.

MARKED CROSSWALKS AT CIRCULAR INTERSECTIONS

Circular intersections, such as roundabouts and traffic circles, permit traffic to travel in one direction around a center island. Traffic circles, which are typically larger than roundabouts, can be difficult for pedestrians and bicyclists to navigate but should incorporate crosswalk facilities where appropriate.

Roundabouts have different design specifications; the important difference is the reduction in speeds and diameters, as well as yield-controlled entry. Circles and roundabouts require channelization of vehicles into the circular part of the roadway. In general, multilane roundabouts are not recommended because of safety concerns for pedestrians, especially those with visual disabilities, and bicyclists.

For traffic circles and roundabouts, marked crosswalks are required to be set back at least 20' from the entry of the roundabout. Sight distance for drivers entering the roundabout should be maintained to the left so that drivers are aware of vehicles and bicycles in the circle, as well as to the right when exiting the roundabout for pedestrian crossings.

MARKED CROSSWALKS AT UNCONTROLLED LOCATIONS



High visibility crosswalk on King Street

Marked crosswalks are an important feature of uncontrolled locations, because they are a reminder to motorists that they must yield to pedestrians. In accordance with the **Code of Virginia, Section 46.2-924**, when traffic control signals are not in place or not in operation, motorists shall yield the right-of-way to a pedestrian within a crosswalk marked in accordance with the MUTCD if:

- The pedestrian has entered the crosswalk after having regarded oncoming traffic.
- The speed of the road or street being crossed does not exceed 35 miles per hour.

Motorists shall not pass any other vehicle stopped at a marked crosswalk to permit a pedestrian to cross, and shall not enter a marked crosswalk while a pedestrian is crossing.

This section presents guidance for when and where it is appropriate to provide marked crosswalks at uncontrolled locations (intersections that are not controlled by signage or signalization). The following sections discuss when installing crosswalks alone is insufficient, and additional safety enhancements are required to increase visibility, awareness, and yielding to pedestrians.

USE

- An engineering study should be performed to determine the feasibility of a marked crosswalk at an uncontrolled location. Marked crosswalks at uncontrolled locations must provide adequate sight distances to enable drivers to slow down and yield to a pedestrian in the crossing.
- Multiple marked crosswalks or crossing treatments in close proximity may desensitize motorists and decrease the effectiveness of the treatment. In general, crosswalks at uncontrolled locations should not be placed within 200' of another intersection with traffic control devices.

MARKED CROSSWALKS AT UNCONTROLLED LOCATIONS

- It is important to prioritize new marked crosswalks at uncontrolled locations based on trip generators, pedestrian volumes, pedestrian delay, crash history, and other issues. Studies should also consider the age and mobility of pedestrians at a particular location.
- If multiple crossing locations are identified in close proximity, it may be possible to consolidate these into one marked crosswalk based on trip generators, pedestrian volumes, and the most visible location.
- The proposed crosswalk location should have adequate lighting or have lighting installation planned.
- Drainage structures can impact the ability to provide curb ramps and other changes that are necessary at crosswalks.

CONSIDERATIONS

- There are some locations where installing marked crosswalks alone are insufficient to address pedestrian safety without providing additional measures to increase visibility and reduce traffic speeds. The MUTCD provides specific guidance on when additional safety treatments should be provided at uncontrolled locations with marked crosswalks based on speeds, traffic volumes, number of travel lanes. These locations include any street where speeds exceed 40 mph and either:
 - The roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an average daily traffic (ADT) of 12,000 vehicles per day or greater; or
 - The roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT of 15,000 vehicles per day or greater.

- There are a number of measures that can complement marked crosswalks at uncontrolled locations to improve pedestrian safety. The topics below are covered in detail following sections:
 - Reducing the effective crossing distance for pedestrians by:
 - Providing curb extensions
 - Providing raised pedestrian refuge islands
 - Completing road diets or lane diets
 - Installing traffic calming measures to slow vehicle speeds
 - Providing adequate nighttime lighting for pedestrians
 - Using various pedestrian warning signs, advanced yield lines, rapid flash beacons, and other traffic control devices to supplement marked crosswalks
 - Providing traffic signals (with pedestrian signals) where warranted

LINKS

Local Motion Crosswalks 101

<http://alexandriava.gov/localmotion/info/default.aspx?id=11528>

Local Motion All About Pedestrian and Traffic Signals

<http://alexandriava.gov/localmotion/info/default.aspx?id=11414>

VDOT Guidelines for the Installation of Marked Crosswalks

http://www.virginiadot.org/business/resources/marked_20crosswalks_20final_20guidelines_2012-14-05.pdf

Guidelines for the Installation of Marked Crosswalks

<http://mutcd.fhwa.dot.gov/htm/2009/part4/part4c.htm>

http://nacto.org/docs/usdg/guidelines_for_installation_marked_crosswalks_dougald.pdf

ADVANCED YIELD MARKINGS AND SIGNS



Advanced yield markings

OVERVIEW

Advance yield lines with coordinated YIELD HERE TO PEDESTRIAN signs are used at uncontrolled and yield-controlled mid-block locations and intersections to encourage drivers to stop further back from crosswalks. Advanced yield lines can make it easier for pedestrians and motorists to see one another, discouraging motor vehicles from encroaching on the crosswalk, and thereby preventing multiple-threat collisions. Multiple-threat collisions occur when there are multiple lanes of travel in the same direction and the vehicle in the near lane yields to the pedestrian while the motor vehicle in the far lane does not yield because the pedestrian is blocked from their view.

Effectiveness depends on motorist compliance with the marked stop line. If placed too far in advance of the crosswalk, motorists might ignore the line.

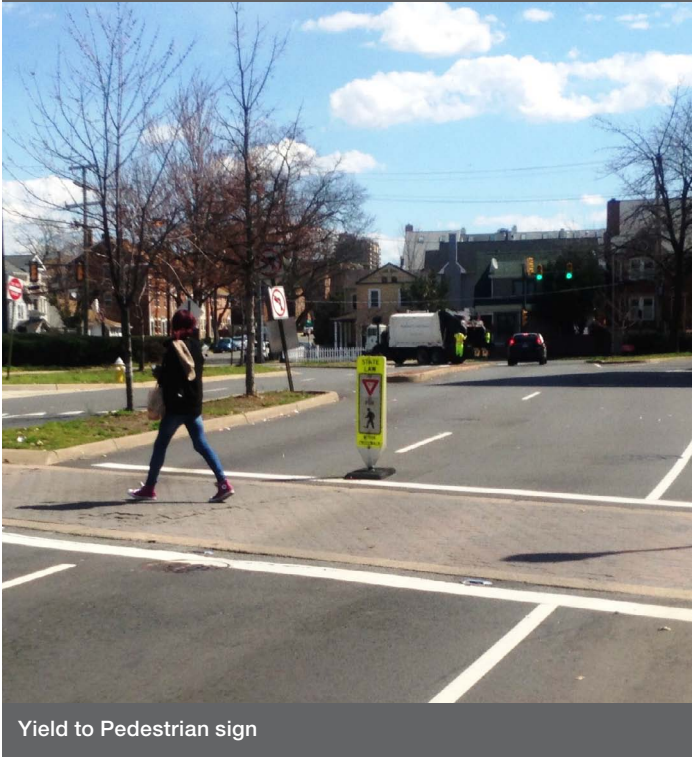
USE

- Advanced yield lines should not be used at locations where drivers are required to stop in compliance with a STOP sign or a signal.
- Advanced yield lines and signs can be used on two-lane, three-lane, and four-lane roadways; however, they are less effective on four-lane roadways unless vehicle operating speeds are 25 mph or less. On four-lane roads with higher speeds, rapid flash beacons are typically a more effective solution. See **Rectangular Rapid Flash Pedestrian Beacon** later in this section.
- Yield lines at unsignalized crossings should be accompanied by YIELD HERE TO PEDESTRIAN signs.
- Advance yield lines and signs should be placed 20' to 50' in advance of crosswalks on uncontrolled multilane approaches, and parking should be prohibited in the area between the yield line and the crosswalk. Pavement markings can be used to reinforce NO PARKING signage.

CONSIDERATIONS

- When determining where to place advance yield lines and signs within the 20' to 50' range, consideration should be given to the number of lanes pedestrians must cross, motor vehicle speeds, sight lines, on-street parking, and turning movements.
- Advance yield lines may be staggered, so that yield lines in one lane are closer to the crosswalk than the yield lines in an adjacent lane. Staggered yield lines can improve drivers' view of pedestrians, provide better sight distance for turning vehicles, and increase the turning radius for left-turning vehicles.

IN-STREET YIELD TO PEDESTRIAN SIGNS



Yield to Pedestrian sign

OVERVIEW

In-street YIELD TO PEDESTRIAN signs are signs placed in the roadway at crosswalk locations to remind roadway users of the laws regarding the right-of-way at unsignalized mid-block locations and intersections. They also increase awareness and visibility of pedestrians crossing. They are often used in commercial districts, at school crossings, or other locations where high pedestrian volumes occur in unexpected locations. In-street signs can be used in conjunction with advanced warning signs and pedestrian crossing signs at crosswalks.

In addition to in-street YIELD TO PEDESTRIAN signs, a variety of signs may be used to indicate locations where drivers must yield to pedestrians, including YIELD HERE TO PEDESTRIAN signs, previously discussed in *Advanced Yield Lines and Signs*, TURNING TRAFFIC YIELD TO PEDESTRIAN signs, and overhead YIELD TO PEDESTRIAN signs. More information on these signs can be found in the MUTCD.

USE

- In-street YIELD TO PEDESTRIAN signs should only be used at uncontrolled intersections. They are prohibited from use at signalized, stop-controlled, or yield-controlled intersections.
- In-street YIELD TO PEDESTRIAN signs should be placed in the roadway close to the crosswalk location on the center line, on a lane line, or on a median island. They should not obstruct the crosswalk. In-street signs should also be placed to avoid turning vehicles from knocking over the sign, and should be designed to bend over and bounce back when struck.
- In-street YIELD TO PEDESTRIAN signs work best on low speed, two lane roads. They are not recommended for roads with high speeds or volumes where drivers are less likely to see them.

CONSIDERATIONS

- May be permanent or temporary. It may be preferable to remove them during winter for snow removal operations.
- Require regular monitoring and should be replaced when damaged. Damaged signs send the message to pedestrians that a crossing is not safe.
- Are typically not used at yield-controlled intersections, and should only be installed using engineering judgment.
- May be used in combination with pedestrian warning signs. Warning signs should be placed on the right side of the road on the sidewalk or mounted on a mast arm above the crosswalk.

RECTANGULAR RAPID-FLASH BEACONS (RRFBs)



RRFB midblock on Mount Vernon Avenue

OVERVIEW

At some uncontrolled crossings, particularly those with four or more lanes, it can be difficult to achieve compliance with laws that require motorists to yield to pedestrians. Vehicle speeds and poor pedestrian visibility combine to create conditions in which very few drivers are compelled to yield.

One type of device proven to be successful in improving yielding compliance at these locations is the Rectangular Rapid Flash Beacon (RRFB). RRFBs are a pedestrian crossing sign combined with an intensely flashing beacon that is only activated when a pedestrian is present. RRFBs are placed curbside below the pedestrian crossing sign and above the arrow indication pointing at the crossing. They should not be used without the presence of a pedestrian crossing sign. The light-emitting diode (LED) flash is a “wig-wag” flickering pattern at a rate of 190 flashes per minute. The beacons are activated by a pedestrian call button.

Another LED panel should be placed facing the pedestrian to indicate that the beacon has been activated. The pushbutton and other components of the crosswalk must meet all other accessibility requirements.

» *The use of an RRFB is subject to review and approval by T&ES.*

USE

- The design of RRFBs should be in accordance with FHWA’s Interim Approval 11 (IA-11) for Optional Use of Rectangular Rapid Flashing Beacons issued July 16, 2008 and the Interpretation Letter 4(09)-41 (I) - Additional Flash Pattern for RRFBs issued July 25, 2014.
- RRFBs can be used when a signal is not warranted at an unsignalized crossing. They are not appropriate at intersections with signals or STOP signs.
- RRFBs are installed on both sides of the roadway at the edge of the crosswalk. If there is a pedestrian refuge or other type of median, an additional beacon should be installed in the median.

CONSIDERATIONS

- RRFBs are considerably less expensive to install than mast-arm mounted signals. They can also be installed with solar-power panels to eliminate the need for a power source.
- RRFBs should be limited to locations with critical safety concerns, and should not be installed in locations with sight distance constraints that limit the driver’s ability to view pedestrians on the approach to the crosswalk.
- RRFBs should be used in conjunction with advance yield pavement lines and signs, which are discussed on the previous page.
- Usually implemented at high-volume pedestrian crossings, but may also be considered for priority bicycle route crossings or locations where bike facilities cross roads at mid-block locations.

Signalized Intersections

T&ES operates nearly 250 traffic signals located in the City of Alexandria through the Transportation Engineering Division. The City of Alexandria’s policy is to prioritize the safety, comfort, and convenience of all users at signalized intersections. All signalized intersections should contain indications for motor vehicles and pedestrians, and signals for bicyclists and transit where appropriate. By optimizing signal phasing and timings, multiple modes are able to safely move through the intersection with limited conflicts, low delay, and more comfort.

- » *All signal designs must be approved by the Transportation Engineering Division of T&ES. For additional signal design guidance, reference the MUTCD, and the HCM.*
- » *The installation of Pedestrian Hybrid Beacons (also called “HAWK signals”) is determined on a case-by-case basis by T&ES. Pedestrian Hybrid Beacons are expensive to install and maintain, and depending on surrounding travel patterns and traffic conditions, may not be the most effective solution. Where used, the design of Pedestrian Hybrid Beacons should be in accordance with the Manual on Uniform Traffic Control Devices and T&ES direction.*

SIGNAL TIMING FOR PEDESTRIANS

OVERVIEW

Signal timing for pedestrians is provided through the use of pedestrian signal heads. Pedestrian signal heads display the three intervals of the pedestrian phase:

The Walk Interval, signified by the WALK indication—the walking person symbol—alerts pedestrians to begin crossing the street.

The Pedestrian Change Interval, signified by the flashing DON’T WALK indication—the flashing hand symbol accompanied by a countdown display—alerts pedestrians approaching the crosswalk that they should not begin crossing the street. The countdown display alerts pedestrians in the crosswalk how much time they have left to cross the street.

The Don’t Walk Interval, signified by a steady DON’T WALK indication—the steady upraised hand symbol—alerts pedestrians that they should not cross the street. The beginning of the Don’t Walk Interval is called the Buffer Interval, which should be displayed for a minimum of a three seconds prior to the release of any conflicting motor vehicle movements.

The total time for the pedestrian change interval plus the buffer interval is called the pedestrian clearance time, or the time it takes for a pedestrian to clear the intersection leaving at the onset of the DON’T WALK indication.

Pedestrian signal heads should be provided at all signalized intersections for all crosswalks. Additionally, it is highly recommended to install crosswalks on all

SIGNAL TIMING FOR PEDESTRIANS

legs of a signalized intersection unless it is determined to be unnecessary due to pedestrian travel patterns. Signal timing for pedestrians should be provided at all newly constructed signalized intersections and incorporated into all signalized intersection improvements. For information on requirements for accessible pedestrian signals, see Accessible Pedestrian Signals on the next page. The following design goals can help improve pedestrian crossing safety and comfort at signalized intersections:

- Reduce vehicle speeds
- Minimize crossing distance
- Minimize delay for WALK indication
- Minimize conflicts with turning vehicles
- Provide sufficient signal time to cross the street

USE

- Pedestrian signals should allocate enough time for pedestrians of all abilities to safely cross the roadway. The MUTCD specified pedestrian walking speed is 3.5 feet per second to account for an aging population and is endorsed by the City. The pedestrian clearance time, which is the total time for the pedestrian change interval plus the buffer interval, is calculated using the pedestrian walking speed and the distance a pedestrian has to cross the street.
- Countdown pedestrian displays inform pedestrians of the amount of time in seconds that is available to safely cross during the flashing Don't Walk interval. All pedestrian signal heads should contain a countdown display provided with the DON'T WALK indication.
- In areas with higher pedestrian activity, such as near transit stops, along Main Streets, and in neighborhood centers, pedestrian push-button actuators may not be appropriate. Pedestrians should expect to get a pedestrian cycle at every signal phase, rather than having to push a button to call for a pedestrian phase.
- At more complex intersections (e.g., where there

is more than one signal phase for each direction), where pedestrian volumes are lower, or uneven or variable volumes of users, pushbuttons should be provided. The responsiveness of the actuated signal should be as prompt as possible (as low as 5 seconds) based on the necessary transition time for approaching motorists to come safely to a stop.

- Along corridors where traffic signals are synchronized, they should be designed to meet target speeds to maintain safe vehicular travel speeds and discourage speeding.
- Refer to the [NACTO Urban Street Design Guidelines](#) for more information on signalization principles and strategies to accommodate pedestrians.

CONSIDERATIONS

- One of primary challenges for traffic signal design is to balance the goals of minimizing conflicts between turning vehicles with the goal of minimizing the time required to wait at the curb for a WALK indication.
- Intersection geometry and traffic controls should encourage turning vehicles to yield the right-of-way to pedestrians.
- Requiring pedestrians to wait for extended periods can encourage crossing against the signal. The 2010 Highway Capacity Manual states that pedestrians have an increased likelihood of risk-taking behavior (e.g., jay-walking) after waiting longer than 30 seconds at signalized intersections.
- Opportunities to provide a WALK indication should be maximized whenever possible. Vehicular movements should be analyzed at every intersection in order to utilize non-conflicting phases to implement Walk Intervals. For example, pedestrians can always cross the approach where vehicles cannot turn at a four-leg intersection with the major road intersecting a one-way street when the major road has the green indication.

ACCESSIBLE PEDESTRIAN SIGNALS (APS)



Accessible Pedestrian Signal on Mount Vernon Avenue

Vibrodetectable devices vibrate to communicate information through touch. Vibrodetectable arrows indicate when the WALK indication is in effect and which direction to cross.

Pushbutton locator tones are used for locating the pedestrian pushbutton needed to actuate the WALK interval. Detectable arrows should be located on pushbuttons to point in the same direction as the crosswalk. At corners of signalized locations where two pushbuttons are present, they should be separated by at least 10'.

For automatically-called pedestrian phases, pushbuttons can be used to activate accessible pedestrian signal features such as detectable arrow indications and/or speech messages.

» **All accessible pedestrian signal designs must be approved by T&ES and conform to the guidelines outlined by the MUTCD and the U.S. Access Board.**

OVERVIEW

Accessible pedestrian signals (APS) and accessible detectors are devices that communicate information in non-visual formats about the pedestrian phase to pedestrians 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.

The major functions of the APS are to provide information for:

- Location of pushbuttons, if used
- Beginning of WALK interval
- Direction of crosswalk
- Location of destination sidewalk
- Intersection signalization with speech messages

Non-visual pedestrian signal features, such as audible signals, should be provided at signalized intersections based on engineering judgment as outlined in the MUTCD. The practice in Alexandria today is for these to be installed at new or reconstructed signals and to be added upon request.

USE

- When new pedestrian signals are installed, APS with pushbuttons are required.
- For existing pedestrian signals, the APS and pedestrian pushbuttons should be provided when the signal controller and software are altered, or the signal head is replaced.
- At new locations where the pedestrian phase is automatic (pushbutton activation is not required as the pedestrian phase recalls every signal cycle), accessible pedestrian pushbuttons only call accessible features, not the pedestrian WALK signal indication.

CONSIDERATIONS

- Audible walk indications should have the same duration as the pedestrian walk indication unless the pedestrian signal rests during the pedestrian phase, in which the audible indication should be provided in the first seven seconds of the Walk interval.

LEADING PEDESTRIAN INTERVAL



The Leading Pedestrian Interval (LPI) initiates the pedestrian WALK indication three to seven seconds before motor vehicles traveling in the same direction are given the green indication. This technique allows pedestrians to establish themselves in the intersection in front of turning vehicles, increasing visibility between all modes.

USE

- The LPI should be used at intersections with high volumes of pedestrians and conflicting turning vehicles and at locations with a large population of elderly or school children who tend to walk slower.
- The LPI should be at least three seconds to allow pedestrians to cross at least one lane of traffic to establish their position ahead of turning traffic.
- A lagging protected left arrow for vehicles should be provided to accommodate the LPI.
- Newly-installed LPIs should provide accessible pedestrian signals to notify visually-impaired pedestrians of the LPI. Additionally, without an accessible pedestrian signal, visually-impaired pedestrians may begin to cross with the vehicular movement when motorists are less likely to yield to them.

NO TURN ON RED



A No Turn on Red sign on Commonwealth Avenue

NO TURN ON RED signs are used to restrict vehicles from turning right, or left on intersecting one-way streets, during the red indication. Restricting this movement eliminates conflicts with pedestrians crossing in front of vehicles making turns. In locations with heavy pedestrian volumes, a leading pedestrian interval may be needed to reduce the resulting conflicts when vehicles get the green light and turn right across the perpendicular crosswalk.

USE

NO TURN ON RED signs should be considered when one or more of the following conditions apply:

- An exclusive pedestrian phase
- An LPI
- High volumes of pedestrian and turning vehicle conflicts
- Poor sight distances and visibility
- Geometry of the intersection may result in unexpected conflicts
- More than three accidents reported in a 12-month period between pedestrians and vehicles where turn-on-red is permitted
- Bicycle boxes

CONSIDERATIONS

NO TURN ON RED signs can be provided at all times or by a dynamic sign that changes when pedestrians are present, by time of day, by a call made by an emergency vehicle, and/or at rail or light transit crossings.

Transit Accommodations at Intersections

The design of intersections and the provisions for transit vehicles need to meet the goals of the transit system—primarily to retain and/or improve the reliability and efficiency of the service. Transit delays occur most often at intersections and are a key element in system and route planning. The delay at traffic signals can account for at least 10% of overall bus trip time and up to 50% or more of bus delay.

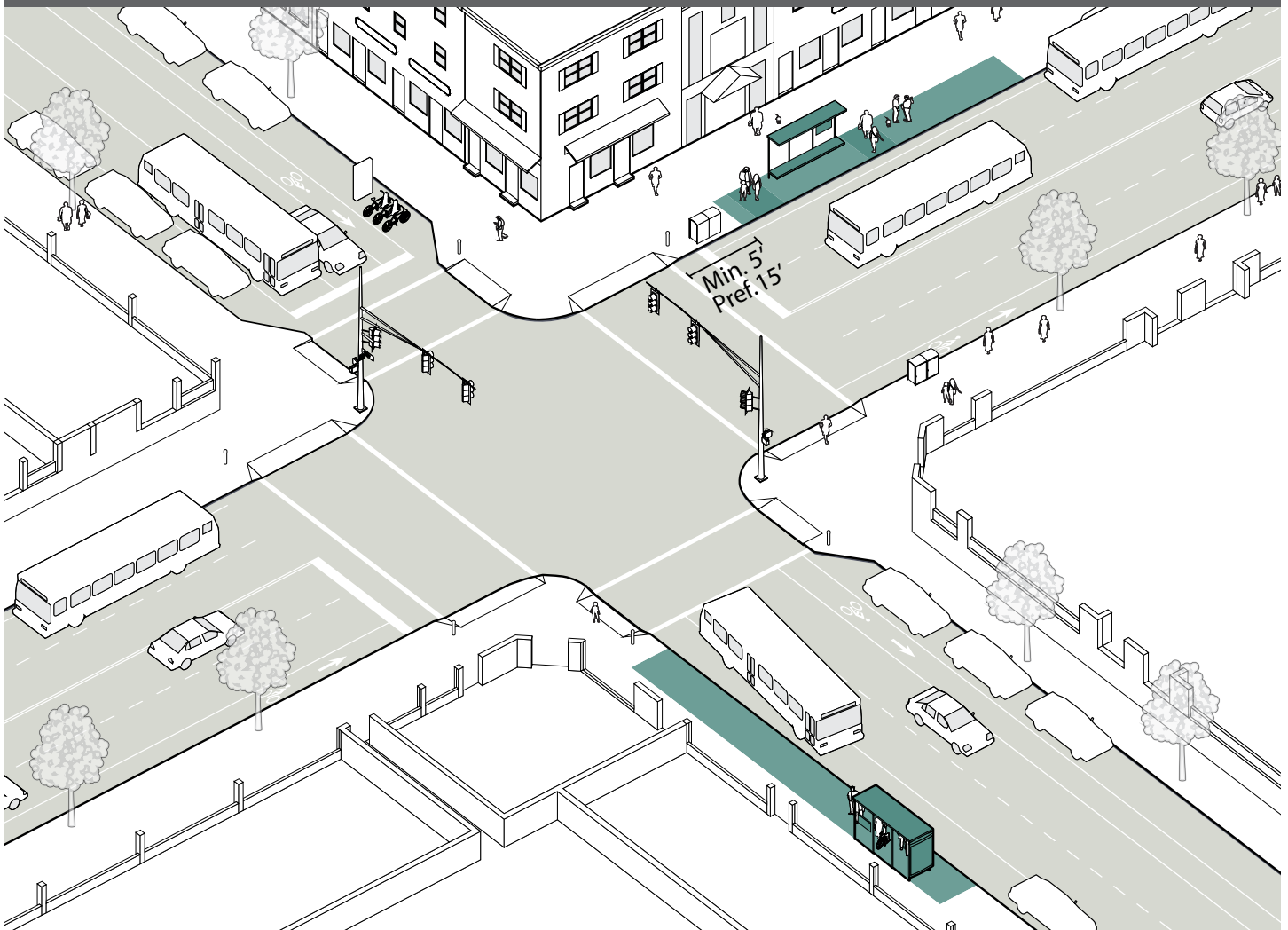
A vast majority of the WMATA and DASH transit stops are located at intersections on Alexandria streets. While many stops are demarcated only by signs, transit shelters and transit stop benches have been installed throughout Alexandria. The City of Alexandria's T&ES Department's transit stop accessibility and amenities program has a replacement initiative to replace Metrobus shelters installed in the 1970s and install new shelters at locations throughout the City.

On Jefferson Davis Highway in Potomac Yard, the new Metroway premium bus service includes median protected transit lanes, introducing a new feature to intersections with cross streets including transit-only signals and advance transit priority signals.

This section covers design strategies to improve transit operations and safety, and reduce delay for transit vehicles at intersections. While individual strategies can be implemented independently, in many cases a combination of strategies, including the appropriate location of the stop and signal prioritization, will be most effective. Implementation of these strategies should also be complemented by operational improvements being carried out by DASH, Fairfax Connector, and WMATA.

» Refer to the *City Standard Treatments Appendix* for information on mast arm standards. All transit accommodations at intersections must be approved by T&ES and WMATA utilizing the [WMATA Bus Stop Planning and Design Guidelines](#) and the *City of Alexandria's Bus Stop and Bus Shelter Policy Guidelines*. All bus shelter installations must be approved by T&ES and meet the design and specifications as approved by the City in May 2014.

TRANSIT STOP LOCATION



OVERVIEW

Transit stops may be located on the “near-side” of an intersection before a signal or cross street, on the “far-side” after a bus has passed through an intersection, or at a mid-block location between intersections. Transit stop locations are determined based on a number of factors including intersection operations, bus routing, curbside conditions, transfer points, intersection geometry and sightlines, consideration of other street users, and major generators or destinations. The location of a transit stop can affect transit travel time, passenger safety, and roadway operations.

Regardless of location, all transit stops must be ADA

compliant, and should be safe, convenient, well-lit, and clearly visible. Transit stops should be connected to the larger pedestrian network with continuous sidewalks, curb ramps, and safe pedestrian crossings.

» *Transit stop locations should be determined on a site-by-site basis utilizing the [WMATA Design and Placement of Transit Stop Guidelines](#) and the [City of Alexandria’s Bus Stop and Bus Shelter Policy Guidelines](#) and must be approved by the City’s Office of Transit Services and WMATA or DASH.*

TRANSIT STOP LOCATION

USE

Transit stops should be located at the near-side or far-side of intersections wherever possible and not at midblock locations. Not only do mid-block bus stops require the most amount of curb side space, they also often require mid-block pedestrian crossings to ensure safe accommodation of passengers going to or from the stop. Intersections permit convenient transfer between transit services or lines, bike routes, and other mobility services. Intersections provide access to a greater portion of the immediate area and provide crosswalks that are familiar and predictable to most drivers and other travelers.

Where bus bulbs are provided, the length of the transit stop can be less than the prescribed minimums (see Transit Stop) because transit vehicles will not be required to pull out of traffic. The minimum transit stop length at bus bulbs should provide a clear and level landing pad at each door of the transit vehicle.

The frequency of stops should be a balance between passenger convenience and minimizing transit travel times. Spacing is typically determined by population density, with transit stops for local services generally located about one-fifth to one-quarter mile apart.

CONSIDERATIONS

- Selecting a location for a transit stop at an intersection depends on a variety of factors:
 - available curb side space
 - conditions of sidewalks
 - width of sidewalks
 - traffic and pedestrian volumes
 - number and width of travel lanes
 - turning movements
 - sight distances
 - presence of parking, bicycle facilities, and crosswalks
- At signalized intersections, far-side placement is generally recommended to permit the bus to pass through the intersection before stopping. This is particularly important where transit signal priority is provided.
- Additional advantages of locating stops on the far-side of an intersection include the following:
 - Pedestrians are encouraged to cross behind the bus, reducing conflict and bus delay.
 - Buses are allowed to take advantage of gaps in traffic flow, especially with signal prioritization, rather than needing to be at the front of the queue at an intersection for a near-side stop.
 - Conflicts between buses and right turning vehicles are minimized and additional right-turn capacity is provided on the near-side of the intersection. This advantage should be weighed carefully at locations where there are heavy turning movements from cross streets.
- Where queue jumps are combined with transit signal priority, near side transit stops (located prior to initiation of the queue jump pocket and TSP sensor) provide the greatest advantage.
 - Location selection should be done on a site-by-site basis in consultation with DASH, WMATA, Fairfax Connector (where applicable), and T&ES.

TRANSIT PRIORITIZATION AT INTERSECTION



A bus takes advantage of transit prioritization to pass stopped automobiles

OVERVIEW

By prioritizing transit at intersections, service can become more reliable, efficient, and environmentally friendly due to less queuing and stopping and starting, thus making transit a more attractive mode of transportation. Transit prioritization strategies include signal coordination, signal priority, transit only lanes, and queue jump or bypass lanes. These strategies can dramatically improve transit operations at a relatively low cost compared to corridor-wide modifications.

Signal coordination times a series of traffic lights along a corridor to permit smooth progression of traffic. This progression reduces overall traffic congestion thus aiding transit travel times together with other vehicular travelers. Signal coordination uses a pre-timed signal timing program.

Transit signal priority (TSP) enables an approaching transit vehicle to communicate with a traffic signal and alter the signal timing in a way to advantage transit progression. Transit signal priority may extend the signal green time, truncate the red phase, swap signal phases, insert a transit-only phase, or skip signal phases. The margin of signal time prioritized for transit is typically made up in modifications to the remaining signal phases with the overall signal cycle length

remaining generally unchanged and fully recovered in the following cycle. Signal priority is being considered for the WMATA Priority Corridor Network program, which includes the Route 7, Route 1, the West End Transitway, and the Little River Turnpike/Duke Street corridor.

During highly congested periods or on routinely congested corridors, TSP alone may be ineffective at improving transit service. In these cases, short transit only “queue-jumper” lanes at intersections provide an opportunity for transit vehicles to bypass stopped traffic and move forward through a congested intersection. Queue-jump lanes may be transit-only or combined with general purpose right turn lanes. They may continue on the far-side of an intersection to permit transit vehicles to remerge with through traffic. Queue jump lanes are often paired with a separate signal to permit the queue jump lane to advance and clear while other vehicles traveling in the same direction are given a red light.

» ***Transit only and queue jump lanes, as well as all signal coordination and prioritization, must be coordinated with and approved by T&ES and WMATA, DASH, and/or Fairfax Connector.***

TRANSIT PRIORITIZATION AT INTERSECTION

USE

- Signal coordination can reduce delay for transit as well as motor vehicles. Signal coordination uses a pre-timed signal program for traffic and pedestrian crossings.
- Transit signal priority requires special communication technology to permit communication between the signal and approaching transit vehicles. TSP may be used on either pre-timed or activated signals.
- Signal coordination and signal priority can be used with or without the presence of dedicated transit only lanes or queue jump and bypass lanes at intersections.
- Advanced stop bars may be used in combination with queue jump lanes to help transit vehicles re-enter the traffic stream or jump to the front of the queue. Advanced stop bars stop all traffic some distance back from the traffic signal.
- Transit-only queue jump lanes may be enhanced with colored pavement or striping to further define it as a transit only space.
- Queue jump lanes gain the greatest advantage when provided separate signal phasing to permit lanes to clear in advance of general traffic.
- Queue jump lanes can be used at intersections without a transit stop as well as with one at either the near- or far-side so long as there is enough space on the roadway.
- Traffic signal priority typically cannot be activated for more than two signal cycles in a row and then cannot be activated until two to three additional signal cycles have passed to enable overall intersection recovery.

CONSIDERATIONS

- Providing a queue jump lane with a leading signal phase should take into consideration the overall signal cycle lengths and impacts to delay for other users.
- If space is not available for a queue jump lane or bypass lane, consider using a right-hand turn lane to double as a transit advantage lane by allowing transit vehicles to move up in the queue at a signal where right turn on red is permitted. If right-turn lanes are used, appropriate signage such as RIGHT LANE MUST TURN RIGHT must be accompanied by EXCEPT BUSES placards.
- Transit signal priority should be considered on all priority transit routes. Studies should be conducted to understand the impact to traffic on cross streets and other corridor users. TSP should be installed only when there is documented schedule adherence issues.
- Signal coordination should take all modes into consideration including travel speeds of bicyclists and pedestrians along the corridor. Signal coordination should seek to optimize progression of all modes.
- Public and transit operator education is needed in how to use queue jump lanes in multimodal environments and how to manage transit vehicle, other or vehicle, pedestrian, and bicycle interactions.
- Compliance may be an issue if advance stop bars are used.

BUS BULBS



OVERVIEW

Bus bulbs are curb extensions along the length of a transit stop that eliminate the need for transit vehicles to pull in and out of traffic. Similar to normal curb extensions found at intersections, bus bulbs have the same advantages of reducing crossing distances for pedestrians and providing additional space for street furniture, landscaping, and pedestrian queuing.

» *Bus bulbs will be installed on a case-by-case basis determined by an engineering study, and all designs must be approved by T&ES in consultation with WMATA, DASH, and/or Fairfax Connector.*

USE

- Bus bulbs are only appropriate on streets where on-street parking is present.
- Bus bulbs provide extra passenger queuing space and are most appropriate at stops with higher passenger volumes.
- Bus bulbs are effective in enforcing parking restrictions within bus stops and do not require as much space as curbside stops because the transit vehicle does not need space to pull in and out of the stop, but may cause occasional traffic delay behind them.

BUS BULBS

CONSIDERATIONS

- Since the transit vehicle remains in the travel lane while stopped, bus bulbs can result in traffic delays or unsafe maneuvers by drivers and bicyclists to steer around buses. In most cases, this delay is minor. Designs should consider the street type, traffic conditions, posted speed, number of travel lanes, and headways of buses.
- Bus bulbs can interfere with right-turning vehicle movements at near-side intersections. In these cases, bus bulbs should be designed to self-reinforce provisions precluding traffic from turning right in front of a stopped bus.
- Bus bulbs are most effective at reducing travel time if they are utilized throughout a corridor by eliminating the need for transit vehicles to pull in and out of traffic all together.
- WMATA and DASH operate different length buses varying from 35' City to 60' articulated vehicles. Bus bulbs will require different lengths depending on the service provided on the transit route. Bus bulbs should be long enough to permit all doors of transit vehicles utilizing the stop to open onto the flat, level surface.
- If multiple routes with frequent service utilize a stop, bus bulbs may need to be long enough to accommodate two or more transit vehicles.
- Bus bulbs, like curb extensions, typically extend the width of the curbside parking space less 1'-2' to avoid friction with the turn lane.
- On corridors with bicycle facilities, lanes for bicycles should be routed behind the bus bulb to remove conflicts between bicycle travel and passenger boarding and alighting activity.
- Bollards may be placed at the beginning of bus bulbs to protect the pedestrian space.
- Bus bulbs are good locations for amenities such as bicycle parking, street trees, and trash and recycling receptacles, so long as the requirements for waiting area, clear path, and the landing zone are met.
- Drainage should be considered when implementing bus bulbs. Stormwater catch basins may need to be relocated.
- Landscape areas within bus bulbs also offer opportunities for landscaping and BMPs.



Transit riders board a DASH bus from a bus bulb

OFF-BOARD FARE COLLECTION



Bus ticket machines in New York City

OVERVIEW

Passenger boarding can be a lengthy process that may be a significant cause of delay in transit travel times. Fare control is often limited to only the front door of vehicles requiring all passengers to load from a single door. Delay is also possible as passengers locate money or fare media or load value onto transit cards.

In addition to promoting “smart card” fares, pre-payment is the fastest method of fare collection. Off-board fare collection enables passengers to enter the vehicle from all doors without waiting in line to pay. Compared to a few additional seconds for exact fare or tap systems, off-board fare collection can save up to a minute per 10 passengers.

USE

Off-board fare collection can reduce transit dwell times and increase schedule reliability; therefore, it is commonly prioritized for use on priority transit corridors, and as a component of premium and/or high capacity transit services.

CONSIDERATIONS

- Off-board fare collection requires more space and infrastructure than standard transit stops.
- Electronic fare equipment may require staffing and cameras. If left unattended at stops, weather and compliance may become problems.
- An alternative to off-board fare collection methods could be additional electronic fare collector (e.g. SmartTrip targets) at all doors to allow patrons with SmartTrip cards to bypass cash-fare customers.
- Fare-free zones could be considered in extremely high-volume destinations.
- Off-board fare collection may require a change in policy and operation to implement systems to monitor compliance and conduct enforcement.

Bicycle Accommodations at Intersections

The majority of motor vehicle crashes involving bicycles in urban areas occur at intersections. In Virginia, on-street bicycles are operating vehicles and are required to follow the same rules of the road as motorists. Good intersection design makes bicycling more comfortable and attractive, reduces conflicts with motor vehicles and pedestrians, and contributes to reduced crashes and injuries. The following principles are applied to intersection design in order to accommodate bicyclists:

- Provide a direct, continuous facility to the intersection
- Provide a clear route for bicyclists through the intersection
- Reduce and manage conflicts with turning vehicles
- Provide signal design and timing to accommodate bicyclists
- Provide access to off-street destinations.

Guidance on different types of bicycle facilities is covered in Chapter 4.

Intersection improvements for bicycles should be considered during all roadway improvement projects, street redesign, and safety improvements or upgrades. Bicycle-related improvements should be coordinated with the 2016 Alexandria Pedestrian and Bicycle Master Plan.

» *Bicycle facility designs must be approved by T&ES. Additional guidance for the design of bicycle facilities can be found in the MUTCD, the NACTO Urban Street and Bikeway Design Guides, and the AASHTO “Bike Guide.”*

LINKS

Manual on Uniform Traffic Control Devices

<http://mutcd.fhwa.dot.gov/>

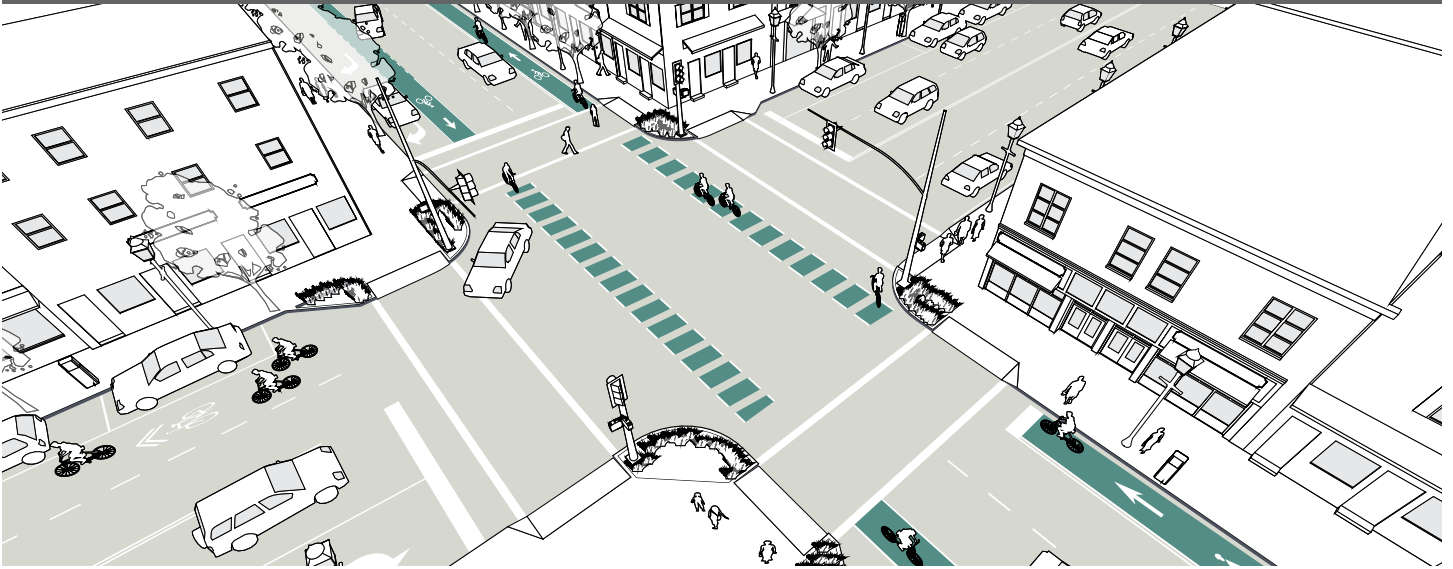
NACTO Urban Bikeway Design Guide

<http://nacto.org/cities-for-cycling/design-guide/>

AASHTO Bike Guide

http://www.pedbikeinfo.org/pdf/Webinar_PBIC_LC_081012_AASHTO_1.pdf

BICYCLE LANES AT INTERSECTIONS



OVERVIEW

Bicycle lanes provide a dedicated space for bicyclists to predictably ride along roadways and through intersections. When designing intersections for bicyclists, approaches should be evaluated and designs should maintain continuity of bicycle facilities to the maximum extent feasible.

Streets with dedicated bicycle lanes should continue striping through unsignalized and complicated intersections to provide additional guidance and safety measures for bicyclists. This design principle is especially important at intersections where there are conflicting vehicular movements, unsignalized crossings, and/or crossings of more than four travel lanes. Signalized intersections may not require striping through each intersection and should be evaluated on a case-by-case basis.

USE

- Standard details for bicycle lane markings at intersections are provided in the [NACTO Urban Bikeway Design Guide](#). Additional guidance can also be found in the MUTCD and AASHTO “Bike Guide.”
- Dedicated bicycle lanes should be provided on intersection approaches where space is available.
- At intersections with a dedicated right turn lane, bicycle lanes should be provided to the left of the right turn only lane unless bicycle signals and dedicated phasing is provided.

CONSIDERATIONS

- Bicycle lane markings, including green-colored pavement, shared lane markings, dashed bicycle lane lines, and signage may be provided through intersections per engineering judgment.
- Selective removal of parking spaces may be needed to provide adequate visibility and to establish sufficient bicycle lane width at approaches to intersections.
- Shared lane markings may be used where space is not available for bicycle lanes at intersections; however, this should only be done if no other design is possible.
- Although the minimum recommended width of a bicycle lane within the intersection is 5', 4' bicycle lanes can be provided in extremely constrained conditions.
- Bicycle lanes at the entrance and exit of a circular intersection should allow direct access to a shared use bicycle/pedestrian path around the perimeter of the intersection via curb ramps; ramps should be provided for bicyclists to mount the sidewalk prior to the intersection. Designs should also enable bicyclists to mix with traffic and proceed through the intersection.

BICYCLES AT SIGNALIZED INTERSECTIONS



A bicyclist stops on the loop detector at Commonwealth Avenue and Mount Vernon Avenue

OVERVIEW

Bicycles have different operating characteristics than motor vehicles and special consideration is necessary in designing traffic signals that accommodate both motorists and bicyclists. Bicyclists generally have the disadvantage of slower acceleration rates than motorists, and traffic signal design should include adjustment of minimum green intervals, clearance time, and extension time to account for the disadvantage. Signal progression should be designed in order to balance the needs of all users, with appropriate design speeds and traffic signal coordination settings.

Appropriate signal timing also can reduce delay, discourage bicyclists from running red lights, and help minimize conflicts.

The **AASHTO Guide for the Development of Bicycle Facilities** provides a specific formula to estimate minimum green time for bicycles from a standing position. It is based on the average adult bicyclists who can operate at 10 miles per hour. A slower speed or extended time may be appropriate at locations with young children such as near schools.

BICYCLES AT SIGNALIZED INTERSECTIONS

USE

- Where actuated signals are present, the signal system should automatically detect bicycles as well as motor vehicles. Typically, the City of Alexandria uses loop detectors at actuated or semi-actuated intersections. In order for bicyclists to prompt the green phase at these intersections, bicycle detection devices should be installed.
 - Detection devices can also include:
 - Video detection
 - Infra-red detection
 - Microwave detection
 - Magnetometers (special locations such as on or under bridges)
 - Detection devices should be located within bicycle lanes or bicycle boxes, marked with a bicycle detector symbol, and supplemented by appropriate signage.
 - When it is not feasible for the detection device to be located within the bicycle lane or bicycle box, detection devices should be located prior to the stop bar and span an appropriate distance to provide for left, through, and right turning bicyclists.
 - Special attention should be given to signal timing at locations with higher vehicular speeds and longer crossing distances. At these locations, bicyclists are more likely to have different signal timing needs than motorists, such as extending the green time to allow bicyclists to clear the intersection before the yellow/red phases. The AASHTO Bike Guide contains detailed guidance for bicyclists' signal timing needs at wide intersections.
 - Bicycle signal heads provide dedicated signal indications to bicyclists and should be positioned to maximize visibility to bicycle traffic. They should be coordinated with pedestrian and non-conflicting vehicular movements to increase safety and minimize overall delay.
 - Bicycle detection devices, particularly loop detectors, need regular testing to ensure the equipment is working correctly.
- » ***Bicycle signal heads will be installed on a case-by-case basis determined by an engineering study and must be approved by T&ES.***

CONSIDERATIONS

- Reference the latest edition of the AASHTO Bike Guide and the NACTO Urban Bikeway Guide for more details on the signal timing needs of bicycles at intersections. The AASHTO Bike Guide provides the technical information necessary to calculate minimum green time and other aspects of signal design to accommodate bicycles. The NACTO Urban Bikeway Design provides less technical detail, but provides information regarding bike signal heads.
- Where right-turn-only lanes for motor vehicles exist, bicycle lanes should be designed to the left of the turn lane.

BICYCLE BOXES



OVERVIEW

A bicycle box is dedicated space located between the crosswalk and the vehicle stop line used to provide bicyclists a dedicated space to wait during the red light at signalized intersections. Placing bicyclists ahead of stopped vehicular traffic at a red light improves visibility and reduces conflicts among all users, which aids bicyclists making turning movements and improves safety and comfort due to

the difference in acceleration rates between bicycles and motor vehicles. Bicycle boxes also provide more space for multiple bicyclists to wait at a red light as opposed to being constrained to a 5' wide bicycle lane. In all cases, the bicycle box allows a bicyclist to be in front of motor vehicles, which not only improves visibility and motorists awareness, but also allows bicyclists to “claim the lane” if desired.

BICYCLE BOXES

USE

- In locations with high volumes of turning movements by bicyclists, a bicycle box should be used to allow bicyclist to shift towards the desired side of the travel way. Depending on the position of the bicycle lane, bicyclists can shift sides of the street to align themselves with vehicles making the same movement through the intersection.
- In locations where motor vehicles can continue straight or cross through a right-side bicycle lane while turning right, the bicycle box allows bicyclists to move to the front of the traffic queue and make their movement first, minimizing conflicts with the turning. Where designs place bicycle boxes in front of a vehicle lane that may turn right on red, NO TURN ON RED signs must be provided.

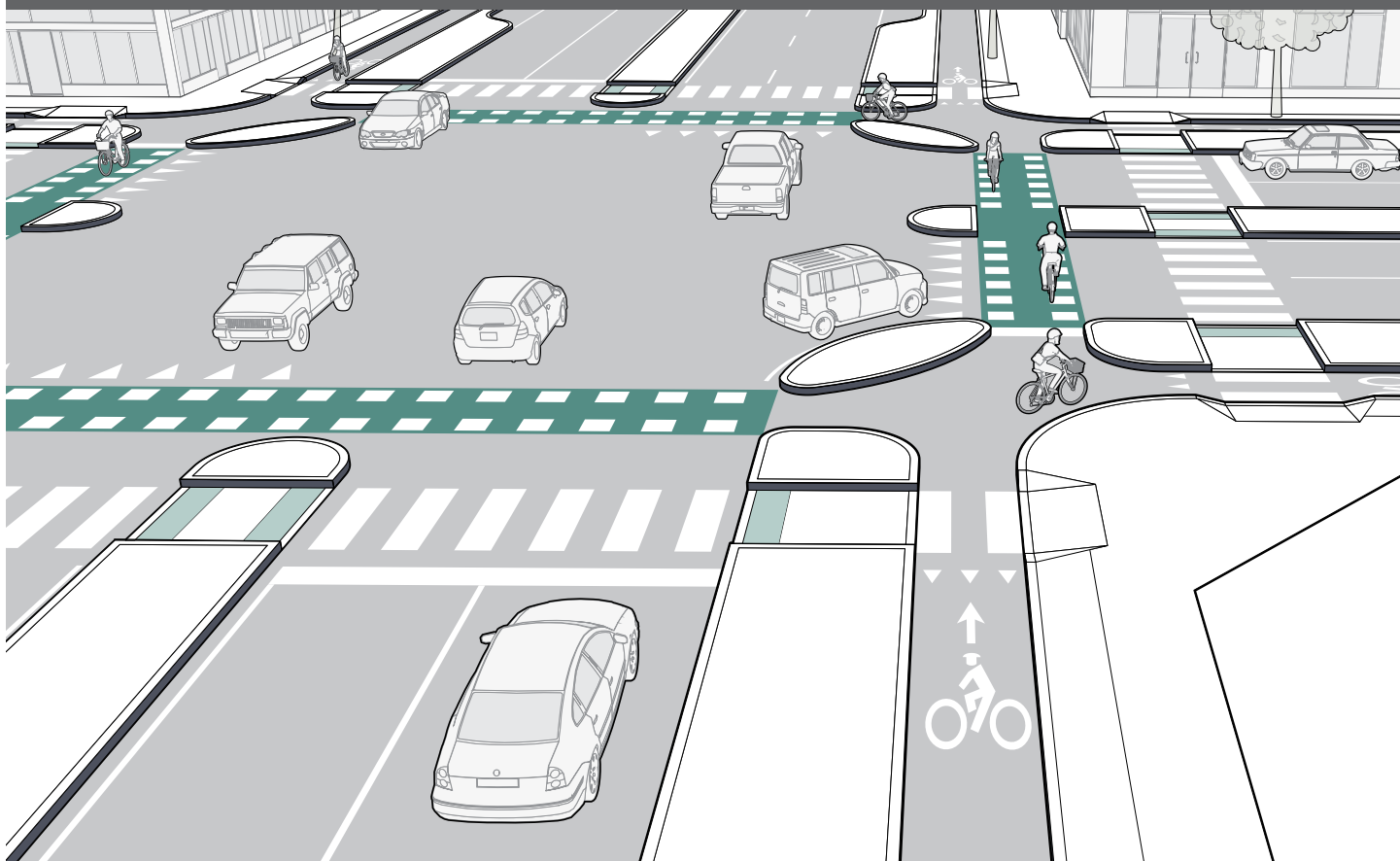
CONSIDERATIONS

- In the City of Alexandria, bicycle boxes are typically painted green and are a minimum of 10' in depth.
- Bicycle box design should be supplemented with appropriate signage according the latest version of the **MUTCD**.
- Bicycle box design should include appropriate adjustment in determining the minimum green time.
- Where right turn only lanes for motor vehicles exist, bicycle lanes should be designed to the left of the turn lane. If a right turn on red is desired, consider ending the bicycle box at the edge of the bicycle lane to allow motor vehicles to make this turning movement.



Bicycle box in Del Ray

PROTECTED BIKE LANES AT INTERSECTIONS



OVERVIEW

Protected bicycle lanes provide an exclusive travel way for bicyclists alongside roadways separate from motor vehicle travel lanes, parking lanes, and sidewalks. Protected bike lane designs at intersections should manage conflicts with turning vehicles and increase visibility for all users.

USE

- It is preferable to maintain the separation of the bike lane through the intersection rather than introduce the bicyclist into the street with a merge lane. Where this is not possible, merge zones should be designed to increase the visibility of bicyclists and reduce motor vehicle speeds. Other measures such as pavement color, shared lane markings and bike boxes should be incorporated where appropriate.

- Increasing visibility and awareness are two key design goals for protected bike lanes at intersections. In some cases, parking restrictions between 20' to 40' are needed to ensure the visibility of bicyclists at intersections.
- Protected bike lanes should typically be routed behind transit stops (i.e., the transit stop should be between the bike lane and motor vehicle travel lanes). If this is not feasible, the protected bike lane should be designed to include treatments such as signage and pavement markings to alert the bicyclist to stop for buses and pedestrians accessing transit stops.
- Markings and signage should be used at intersections to give priority to protected bicycle lanes.

PROTECTED BIKE LANES AT INTERSECTIONS

CONSIDERATIONS

- Protected bicycle lane designs at intersections should give consideration to signal operation and phasing in order to manage conflicts between turning vehicles and bicyclists. Bicycle signal heads should be considered to separate conflicts.
- Shared lane markings and/or colored pavement can supplement short dashed lines to demark the protected bike lane through intersections, where engineering judgment deems appropriate.
- At non-signalized intersections, design treatments to increase visibility and safety include:
 - Warning signs
 - Raised intersections
 - Special pavement markings (including colored surface treatment)
 - Removal of parking prior to the intersection

LINKS

Bicycle Facilities and the Manual on Uniform Traffic Control Devices

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_guidance/mutcd/

NACTO Urban Bikeway Design Guide

<http://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/>

FHWA Separated Bike Lane Planning and Design Guide

https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/page00.cfm



One leg of Davis, CA's protected intersection

6 CURBSIDES



A bike corral and bike repair station at Custis Avenue and Mount Vernon Avenue

Alexandria's curbsides are a valuable commodity and are very much in demand. Many modes of access – pedestrians, parking, transit, bicycles, commercial and private vehicles– compete for curbside access to shops, restaurants, housing, offices and community facilities. As the City of Alexandria pursues its Transportation Demand Management program, it is encouraging the use of environmentally-friendly electric vehicles, bicycle and car-share systems and is accommodating the

parking needs of these vehicles on its streets. Smart and efficient management of the curbside and the use of web-based, on-the-go information technology can help the city accommodate the diverse demands.

» *T&ES regulates curbside uses along city-owned streets, while the Parking Enforcement Unit of the Alexandria Police Department enforces parking laws.*

Multimodal Parking

One of the most common uses of the curbside is for parking. Traditionally, curbside parking was understood to mean parking for private motor vehicles, but increasingly municipalities like Alexandria are locating parking for all types of vehicles at the curb including bike share, private bicycles, motor scooters and car share vehicles. This is not only more efficient but also frees up valuable sidewalk space and makes intermodal travel more convenient and efficient.

PARKING METERS



Parking meter in Old Town Alexandria

OVERVIEW

Parking meters permit payment for the use of curbside space. Traditional mechanical meters govern only a single space and accept only coin media as payment. Fortunately, parking meter technology has modernized in recent years. Alexandria, like many jurisdictions, is expanding the use of “smart meters.” These are single space or multi-space meters that are capable of accepting a range of payment types. More advanced meters can communicate payment and occupancy status to a control center, enabling real time information sharing and management. Multi-space meters use a single payment kiosk to manage payment for a number of spaces on that block or in the areas. The City of Alexandria has been working to install multi-space parking meters throughout the city.

Through its investment in multi-space meters, the City has significantly improved meter operability throughout the city’s metered parking zones. In addition, it has leveraged additional technology such as pay-by-phone services that were rolled out in January 2014.

PARKING METERS

USE

- Metered parking is generally implemented in commercial or mixed use districts where there is significant competition for curbside space.
- Multi-space meters typically govern roughly 10 parking spaces per kiosk. Multi-space meters in Alexandria are “pay and display” meters (as opposed to pay by space). Patrons must pay at the kiosk and return to their car to insert the proof of payment. For this reason, multi-space meters should be conveniently located to access all the spots they are intended to govern.
- Smart single-space meters govern only a single space and are mounted with no more than two meters per post. Single space meters are placed immediately to the front or rear of the spot they are to serve.
- All parking meters must be accessible to persons with disabilities. Street designers should provide a smooth level pathway of at least 36” in width to access the meter. Meters should be installed with payment slot roughly 40” high (from the surface of the sidewalk) and viewer at roughly 42”. At present, persons with disabilities whose vehicle displays a valid designation may park for free for up to 4 hours at any single or multi-space meter in Alexandria.
- Smart meters should be configured to allow payment through credit cards or mobile devices. They should transmit information wirelessly to Transportation and Environmental Services to facilitate real-time monitoring and maintenance.
- All meters should be located in the Amenity Zone at a minimum of 18” from the curb; meters may not be placed in the pedestrian zone. A clear path should provide access to and from parked cars to the pedestrian zone.

CONSIDERATIONS

- Parking meters are generally unnecessary and potentially inappropriate in areas where parking demand is low. Metering should only be in effect during hours of demand where curbside occupancy routinely exceeds 80%.
- If possible, meter rates should be adjusted appropriate to both time of day and location to respond to varying levels of demand.
- By providing many payment modes, smart meters make it easier for drivers to avoid parking tickets. At the same time, parking revenues are maintained due to the more efficient utilization of parking spaces by customers.
- Smart meters should be solar-powered. Such meters should be located to ensure reliable operation.
- Signage should indicate the location of multi-space meters, days, and hours of parking meter operation and any limitations on parking duration.
- Loading zones or other reserved curbside uses may be converted to metered parking spaces when they are not needed.

ACCESSIBLE PARKING



Accessible parking

OVERVIEW

The City of Alexandria proactively facilitates full and equal participation in all aspects of life by persons with disabilities on city streets, including the provision of accessible parking. At present, parking for persons with disabilities (who display a valid designated license plate or hangtag) is free for up to 4 hours at single and multi-space meters in Alexandria. Persons with disabilities may park for up to twice the restricted time posted on signs in

time restricted parking zones. Additionally, designated accessible parking spaces are located throughout the city. These spaces are designated by request and identified by specifically installed signs and markings.

» ***Accessible spaces are installed by request through T&ES and included in the City Code Section 5-8-117.***

DESIGN

- Accessible parking space surfaces must be smooth, stable, and slip resistant and not exceed a 2% slope in any direction. Accessible curbside spaces require accessible curb ramps at the head or foot of the space.
- Accessible parking should be located as close as possible to an accessible entrance.
- Accessible parking spaces should be marked by signs using the international symbol for accessibility.
- Signs should be located at the head of each parking space or no more than 10' away.
- Alexandria exempts vehicles with a valid disabled placard or plate from all public meter fees for up to four hours.
- In addition, individuals with a valid disabled placard or plate may park for twice the restricted time posted on signs in time restricted parking zones.

CONSIDERATIONS

- Accessible parking spaces are distributed throughout the city and provided adjacent to public facilities such as community health centers, senior housing, libraries and transit stations.
- Alexandria residents may apply for disabled parking on the street in front of their home. Businesses may request disabled parking on commercial streets as well.
- The City of Alexandria encourages people to report suspected misuse of disabled placards, plates, or accessible parking spaces.

LINKS

City Code Section 5-8-117

<http://alexandriava.gov/uploadedFiles/tes/info/DisabilityParkingRequest.pdf>

SCOOTER AND MOTORCYCLE PARKING



Jasha_Flickr

OVERVIEW

As in many U.S. cities, the use of motorcycles and scooters has increased in Alexandria. The issue of motorcycle and scooter parking: however, it has not been adequately addressed as popularity has grown. Typically, motorcycles have been permitted to park using a full curbside parking space, whereas scooters have parked on sidewalks where they often impede the pedestrian zone.

DESIGN

- The average 20' long parking space should be divided into four 5' spaces to create stalls for scooters and motorcycles. Users prefer spaces grouped at the end of a block or close to corners rather than in between two cars.
- Stalls can also be installed in pairs.
- Preferred locations include parking spaces that allow cars to maneuver easily without damaging motorcycles or scooters parked perpendicular to the curb, next to crosswalks, and curb extensions, or adjacent to the unoccupied, usable space in front of a fire hydrant. Hydrants require 10' of clearance.

- An appropriate number of spaces should be provided based on neighborhood demand. On average, two to four stalls should be provided for every 50 to 75 regular parking spaces.

CONSIDERATIONS

- Scooters parked on sidewalks also take up space that could be used for bicycle racks.
- Unless restrictions are enforced, people using motorcycles or scooters are likely to park on sidewalks or plazas where sufficient space exists because it is free. Additionally, pay and display multi-space meters are an issue for these types of vehicles since the receipt cannot be displayed securely and may be stolen.
- Consideration should be given to install hitches or rings installed in the asphalt or curb edge to make it easier to lock scooters and motorcycles.

ON-STREET BICYCLE PARKING



Bike corral in Old Town Alexandria

OVERVIEW

Convenient, secure, and ample bicycle parking is a necessity for encouraging bicycling in Alexandria. Bicycle parking is typically found on sidewalks; however, in some areas, sidewalk space may be insufficient to support the high demand of bicycle parking in popular destinations.

On-street bicycle parking is an efficient way to use valuable curbside real estate. When multiple bicycle racks are clustered together in a contained area, it is referred to as a bicycle corral. 10-14 bicycles may be parked in the space of a single on-street vehicle parking space, thus allowing more patrons to park immediately in front of businesses and residences.

Bicycle parking is installed through T&ES, mainly at the request of residents and businesses. In 2013, T&ES installed the city's first four bicycle parking corrals providing fifty new bicycle parking spaces.

DESIGN

- Bicycle corrals and on-street bicycle parking are generally created by clustering typical bicycle hoops or racks in a compact space.
- Bicycle racks should be permanently affixed to a paved surface. Movable bicycle racks are only appropriate for temporary use.
- City code requires the provision of adequate bicycle parking as part of development projects. On-street bicycle parking may help achieve this requirement and improve bike-friendliness.
- All bicycle racks must follow T&ES standards and maintenance agreements. For specific details about bicycle racks, dimensions, and required setbacks and clearances see **Chapter 3: Bicycle Racks**.

CONSIDERATIONS

- On-street bicycle racks can be at the same grade as the sidewalk, as a parklet style bicycle corral, or at the same grade as the street.
- On-street bicycle racks should be considered where there is high demand for bicycle parking and there is not enough width on the sidewalk to satisfy that demand. Bicycles locked to street trees, parking meters, fences and other street furniture are an indicator of parking need.

LINKS

Alexandria Bicycle Parking Requirements:

<http://alexandriava.gov/uploadedFiles/localmotion/info/gettingaround/Alexandria%20Bicycle%20Parking%20Requirements.pdf>

ELECTRIC VEHICLE CHARGING STATIONS



Electric vehicle charging station

OVERVIEW

All-electric and plug-in hybrid electric and other low emissions vehicles (EVs) are smart, clean, and more sustainable modes of transportation that are becoming increasingly prevalent. Encouraging the use of EVs is a key component of the City of Alexandria’s Energy and Climate Change goal in the Environmental Action Plan goal to reduce GHGs by 20% of 2005 levels by 2020.

DESIGN

- All curbside electric vehicle charging stations (“charging stations”) should be Society of Automotive Engineers (SAE) Standard J1772 alternating current (AC) Level 1 or Level 2 charging stations. Preference is given to Level 2 charging stations, which may provide a full charge in a shorter period of time. Charging stations should provide a SAE J1772-2009 connector as the standard method for fueling connection.

- Charging stations utilizing future AC and direct current (DC) charging levels may also be given consideration at such a time as SAE J1772 recognizes their standardization and zoning requirements permits. Such future charging levels will have the ability to charge depleted batteries at a much faster rate than currently available.
- Charging stations should be placed near utility feeder lines, clear from traffic, and away from flood zones.
- To the extent feasible, charging stations should directly incorporate renewable electricity sources (e.g. solar and wind) and be incorporated in “smart” electricity grids.
- Charging stations should be installed in the Amenity Zone directly on the sidewalk (similar to a bollard) or pole-mounted meter. They should be placed at a minimum of 18” from the curb and located at the center of each parking space to maximize access for different positioning of EV charging ports.

ELECTRIC VEHICLE CHARGING STATIONS

- Station should be protected from vehicles mounting the curb.
- Charging stations should be networked and equipped with “smart” features that allow users to track the location of their vehicle, real-time charging updates and the ability to reserve charging stations online, using a smart phones or via a mobile device.
- Payment should adhere to the National Institutes of Standards and Technologies’ Handbook 130 and be possible through a variety of means including transit fare cards, cell phone or mobile devices, or contactless media.
- Signs should designate EV-only parking, instructions for use, and time limits for charging. Signs should be positioned to meet all accessibility requirements and should note that non-EV vehicles utilizing the spot may be charged an additional fine.
- On-street EV charging stations should have a cord management system to ensure functionality in inclement weather and prevent any tripping or cord wrap issues.
- To the largest extent feasible, charging stations should directly incorporate renewable electricity sources (i.e. solar, wind, etc.) to supply electricity or be incorporated in a “smart” electricity grid that includes renewable electricity sources in some or all of its electricity generation supply. Charging units should incorporate renewable and sustainable energy sources, such as solar or wind power, to the largest extent feasible.
- Charging stations that provide ports for multiple vehicles may require additional or enhanced electrical service in coordination with the utility company.
- New technology should be considered to allow for wireless charging of EVs, such as through inductive capabilities using an electromagnetic field to transfer energy between the car and a charging pad.
- Programs to install charging stations on residential streets should be coordinated with neighborhood groups so that location, accessibility, and charging time requirements are geared toward local needs.

CONSIDERATIONS

- Periodic testing of EV hardware and software should be conducted and parts should be replaced as necessary. Stations should be connected to an online network in order to allow for software maintenance and user inquiries to be conducted remotely by an operator.

LINKS

NIST Handbook 130

Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality Part IV. Uniform Regulations, Subpart B. Uniform Regulation for the Method of Sale of Commodities, Section 2. Non-food Products (2014 or most current)

PARKLETS



OVERVIEW

A parklet is the conversion of one or more on-street parking spaces into a temporary or permanent extension of the sidewalk. Parklet features can include benches, tables, chairs, plantings, or bicycle parking. When public art is included as an amenity, it should reflect the character of the location.

These retrofitted pedestrian spaces are required to be open to the public but are typically maintained by adjacent businesses. The reclaimed space can be used seasonally and converted back into parking or used for snow storage in the winter.

DESIGN

- Parklet platforms should be safe, practical, and flush with the adjoining sidewalk. They must also be accessible and meet all ADA requirements.
- Parklets cannot occupy space beyond the dimensions of the existing parking space(s). Parklet designs should not extend beyond the width of the adjacent parking lane, which is a minimum of 8'. Also, designs must provide a 4' wide buffer on either end of the parklet from the adjacent parked cars; buffers may include planters, wheel-stops, barricades or temporary bollards.
- Parklets should not be located in front of fire hydrants, over manholes or over utility access points.
- Parklets are not appropriate for every street and will be approved on a case-by-case basis.
- Parklet platform installation should be sponsored by and coordinated with neighborhood groups and adjacent businesses. The selected applicant is typically responsible for deconstructing and storing materials in the off-season.

CONSIDERATIONS

- Parklets should be located where the street has minimal slopes, platforms are not obstructing curbside drainage, and access to below ground utilities is maintained.
- Parklets should be considered in areas with moderate to high pedestrian traffic and where existing sidewalk widths do not provide space for amenities such as seating, bicycle parking, or sidewalk cafés. Suggested locations include retail districts and restaurants with takeout food service. Parklets are well-suited on Main Streets and Avenue street types.
- Maintenance agreements with area businesses and community groups are key to the long-term viability of parklets.
- When sidewalk cafés are considered for parklets, designs must adhere to the guidelines found in Chapter 2: Sidewalk Outdoor Dining. Note that serving food and alcohol is not permitted across public sidewalks; however, seating and tables are encouraged in parklets to allow patrons to enjoy take-out service.



Alexandria's Mobile Art Lab uses several curbside parking spaces.

POP-UP USES AND MOBILE VENDING



OVERVIEW

Food trucks, mobile vending and sidewalk vending can generate private economic activity while concurrently animating the street environment. Such uses are generally temporary and episodic in nature. Properly located, mobile and pop-up vending uses can create positive, dynamic and creative energy adding to an overall sense of place and liveliness in Alexandria. Careful management is required to ensure that such uses are properly located, effectively governed and enforced, and managed in such a way so as to not adversely affect bricks and mortar businesses or the safe and efficient operation of the street.

» *Beyond food trucks, other pop-up type uses include newspaper vendors and Alexandria's mobile pop-up art truck. All vendors must obtain a permit from T&ES. Vendors with proper permits can sell food, print material, or goods and clothing.*

» *Food trucks must adhere to City Code Section 9-15-15.*

LINKS

Food Truck Pilot Program

<http://www.alexandriava.gov/FoodTrucks>

USE

- In Alexandria, a “Mobile Food Truck” is a mobile food establishment as defined in section 11-2-4 of City Code, but limited to food establishments located in a motor vehicle licensed to operate by a department of motor vehicles.
- Pop-up uses and mobile vending is most welcome on Commercial Connectors, Main Streets, Mixed Use Boulevards, and Shared Streets but may occur virtually anywhere with the exception of Parkways and Residential street types.
- Mobile vendors should not hinder the operation of multimodal networks or adversely affect safety. Mobile vending may not block any vehicular, bicycle, or pedestrian travelways including: ramps, crosswalks, transit zones, and sightlines necessary for safe operation and use of these facilities.
- Mobile vending and pop-up uses generally make use of public waste receptacles. Adequate waste disposal is necessary to minimize litter or other negative effects.
- Consider public seating to serve patrons of mobile vending or pop-up uses.

The City of Alexandria is committed to compliance with the Americans with Disabilities Act, as amended. To request a reasonable accommodation or an alternative format, e-mail geralyn.taylor@alexandriava.gov or call 703.746.4084, Virginia Relay 711.