



**BURLINGTON PUBLIC WORKS**

**QUICK BUILD  
DESIGN +  
MATERIALS  
STANDARDS**

# THANKS EVERYONE!

**This guide is intended to help Burlington build safer streets for everyone - quickly. It is the result of a collaborative effort between:**

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North Union Street protected bike lane.  
Image: Courtesy of Julie Campoli

# QUICK BUILD IS...

**SAFER PLACES TO WALK**

**SAFER PLACE TO BIKE**

**SAFER PLACES TO DRIVE**

**SAFER STREETS FOR EVERYONE!**

## Introduction

The Burlington Quick-Build program is an initiative of the City of Burlington Department of Public Works. The goal is to make streets safer and more accessible for everyone. This Quick Build Design + Materials Standards Guide is one of the first projects to be realized from the planBTV Walk Bike Master Plan, and will help the City implement street safety and community placemaking projects quickly, with low-cost and flexible materials intended to last one to five years. The program will provide opportunities for residents, businesses, and the City of Burlington to experience and evaluate projects before committing to long-term capital projects. If a Quick Build project is successful using the materials and design standards set forth in this Guide, then it will have the opportunity to be refined and kept in place and maintained until made more permanent with long-lasting materials. If a project is not well-received or does not achieve intended safety and accessibility outcomes, then it may be removed or altered.

Quick-Build projects may be implemented citywide but are most appropriate for streets designated by the planBTV Walk Bike Master Plan as a slow-zone, neighborhood greenway, placemaking, bike and / or pedestrian priority corridor.

This Guide was prepared for the City of Burlington by Street Plans and DuBois & King, with review support from Local Motion.



# HOW TO USE THIS GUIDE

This document provides design and materials guidance for the delivery of Quick Build street re-design projects.\* It is to be used by Burlington Public Works and its many community, department, agency, and consulting project partners to build safer and more accessible streets.

The Quick Build Design + Materials Standards guide is organized into two sections – Design Standards and Materials Standards – that may be used to implement a wide range of project types outlined in the PlanBTV Walk Bike Master Plan.

## DESIGN STANDARDS

The Design Standards section provides guidance for a range of project types that create safer conditions for walking, cycling, and driving, while also supporting public and community placemaking opportunities. Each project type contains design guidance – applications, design components, recommended dimensions, and implementation notes – using a palette of simple, flexible, low-cost materials (see below). In addition to this written guidance, each project type includes design and context details illustrating how the design and material standards are to be applied to Burlington's streets.

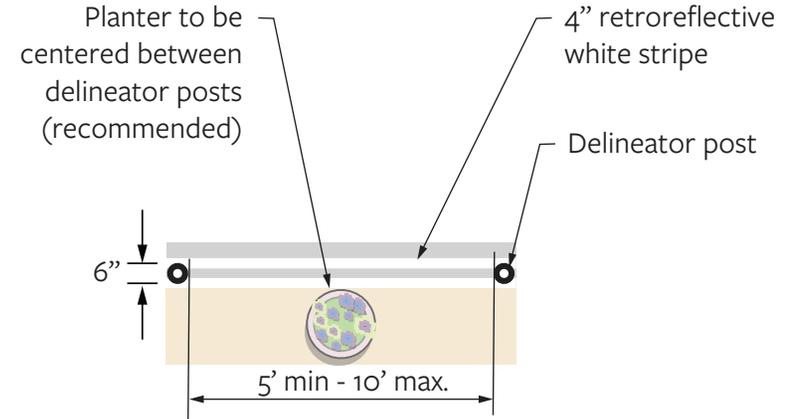
## MATERIALS STANDARDS

The Materials Standards section provides a detailed palette of barrier elements as well as surface materials that are appropriate for a wide variety of project types found in the Design Standards section of this document.

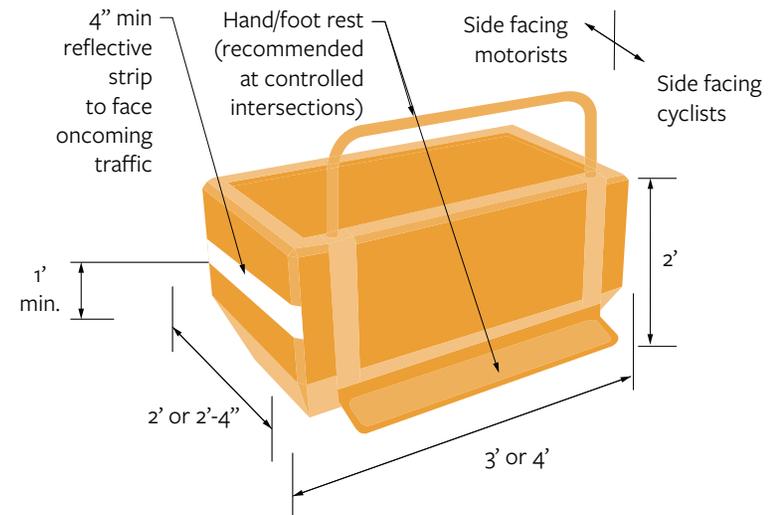
Together, the Design and Materials Standards will allow the City of Burlington to develop and deliver better streets in the short-term while ensuring long-term street redesigns optimize the impact and value of long-term capital budget investments.

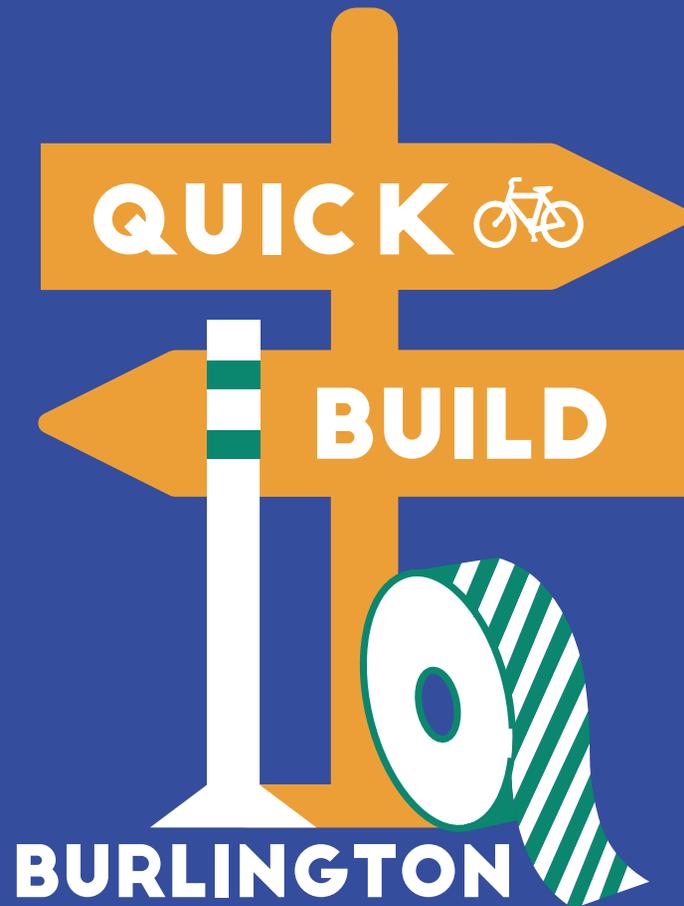
\* Please note the design guidance contained herein is intended to supplement, not replace VTrans, NACTO, AASHTO, MUTCD and other relevant design guidance and standards, such as the Burlington Great Streets Design Guide

## DESIGN



## MATERIALS





**DESIGN STANDARDS**

# I. SAFER PLACES TO WALK

## I.A. CURB EXTENSIONS

Curb extensions shorten crossing distances, provide additional pedestrian waiting space, and calm traffic by physically narrowing the roadway. This reduces vehicular turning speeds and improves motorist sight lines at intersection and mid-block crossing locations. Curb extensions may serve as gateways for neighborhood greenways and neighborhood / downtown slow zones, offering an opportunity to create street surface murals where there is a desire for aesthetic enhancements. Quick Build curb extensions are also a form of public space that may become permanent, providing additional opportunities for environmental and placemaking enhancements, such as rain gardens, bicycle parking, and other public realm amenities.

### Applications

Neighborhood / Corridor / Downtown Slow Zones | High-crash locations

### Components

#### Required

- Retroreflective double 4” stripe shall demarcate curb extension area
- Primary mountable barrier elements shall be used to separate parked and moving vehicles from the curb extension area

#### Recommended

- Surface material should be used to more visibly designate curb extension area
- Secondary unmountable barrier element, such as a planter, may be used when a maintenance partner is identified

#### Optional

- Surface mural art may be used to add visual interest
- Secondary truncated dome pad may be used at curb extension edge
- Crosswalk may be extended through curb extension to the curb line
- Bicycle parking corrals may be used where need exists

### Design Dimensions

#### Required

- Ingress and egress curb return shall be angled at 45 degrees to facilitate snow clearance (unless primary and secondary barrier elements are removed for winter)
- 20’ minimum curb extension ingress length; 5’ minimum egress length
- Primary mountable barrier element spacing shall not exceed 10’ on center

- Overall width shall be at least 1’ less than width of adjacent parking stalls (typically 8’); Minimum width shall be 2’ where curbside parking is not present (see 1B. Mid-Block Crossing illustration)
- Crosswalk entrances shall be clear of vertical barrier elements

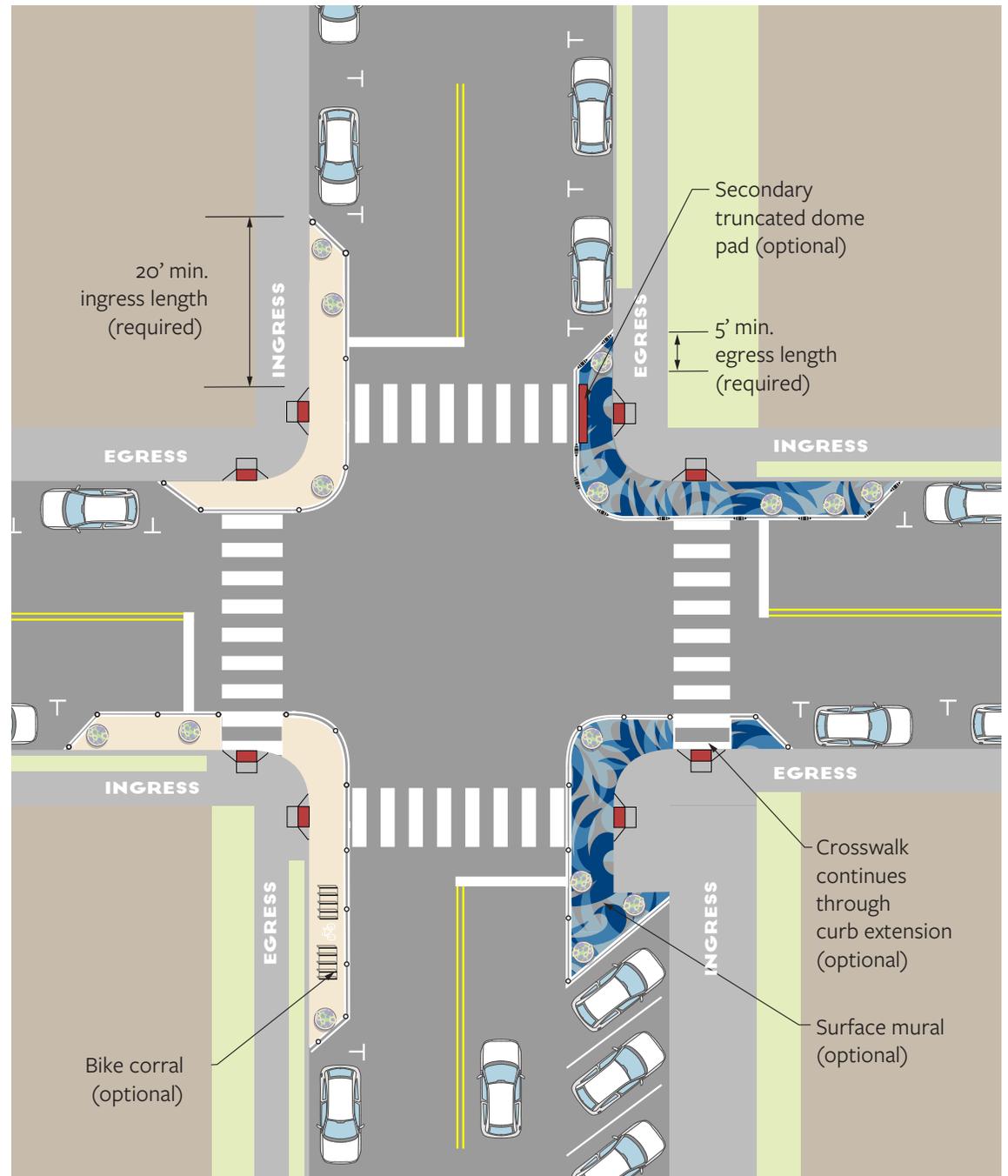
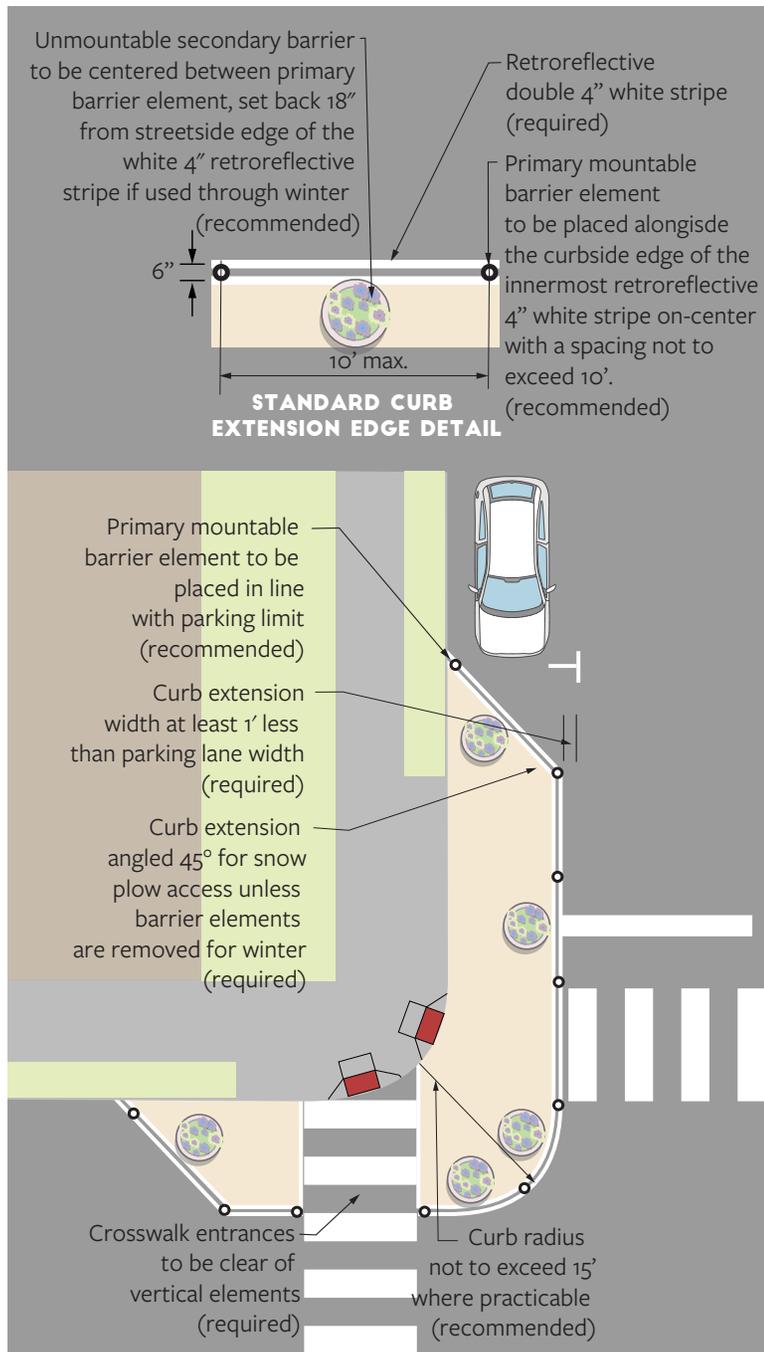
#### Recommended

- Planters should be centered between primary barrier elements, abutting inner white 4” retroreflective stripe abutting if it will be seasonal, or set back 18” from the streetside edge of the white 4” retroreflective stripe if remaining through winter
- Curb radius should be determined by primary design vehicle but wherever possible should not exceed 15’
- Primary barrier elements should be placed along the curbside edge of the innermost retroreflective double 4” white stripe placed at curb extension edge

### Design Notes

- Curb extensions may be used to reduce illegal parking at crosswalks and bus stops
- When applied to streets with bikeways, curb extensions must not infringe upon the designated cycling space
- Where certain bikeway types are present, curb extensions may be used to form a protected intersection configuration
- Barrier elements may be removed November 1st - April 1st so that curb extensions may be used for snow storage
- See NACTO’s Urban Street Design Guide; ITE’s Designing Walkable Urban Thoroughfares: A Context Sensitive Approach; or Burlington’s Great Streets Design Guide for more street design guidance

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## I.B. MID-BLOCK PEDESTRIAN CROSSINGS

Mid-block pedestrian crossings provide highly-visible and safe locations for people to cross streets along existing desire lines, especially between two common mid-block destinations not served by the existing pedestrian network. Such crossings should feature high-visibility crosswalks, curb extensions, barrier elements, and pedestrian refuge islands (where appropriate). Mid-block pedestrian crossings may also reduce speeds of vehicular traffic and offer opportunities for street beautification.

### Applications

Downtown / Corridor / Neighborhood Slow Zones

### Components

#### Required

- Retroreflective double 4" stripe shall demarcate curb extension and / or pedestrian refuge area
- Primary mountable barrier elements shall be used to separate parked and moving vehicles from the curb extension and/or pedestrian refuge area

#### Recommended

- Secondary barrier elements, such as planters, may be used when a maintenance partner is identified
- Surface material should be used to more visibly designate curb extension and/or pedestrian refuge area

#### Optional

- Surface mural art may be used to add visual interest
- Yield line markings may be placed on vehicular ingress side of mid-block crossing

### Design Dimensions

#### Required

- See previous two pages (1A. Curb Extensions) for basic required and recommended dimension details
- Their use is optional but where utilized, yield line markings shall be placed at a minimum of 20' back from the ingress side of crosswalk
- Refuge islands shall be a minimum of 6' in width
- Where no on-street parking is present, curb extension shall be a minimum of 2' in width

- 9' min. clear between primary mountable barrier elements; 14' clear between secondary unmountable barriers

#### Optional

- Pedestrian refuge islands may feature offset crosswalk
- Yield lines

#### Design Notes

- See previous two pages (1A. Curb Extensions) for basic design notes
- Pedestrian refuge islands are appropriate where people walking must cross two wide lanes (or more) and may be implemented within a center turn lane to provide a protected 2-stage crossing for pedestrians
- Offsetting crosswalks helps orient pedestrian oncoming vehicular or cycling traffic
- See NACTO's Urban Street Design Guide; ITE's Designing Walkable Urban Thoroughfares: A Context Sensitive Approach; or Burlington's Great Streets Design Guide for more street design guidance



## I.C. #PARKLETS

Parklets convert curbside parking spaces into usable public spaces. While parklets may be implemented on the street surface, they more commonly make use of a raised platform placed level with the curb/sidewalk. Public seating, landscaping, bicycle parking, and shade elements are a few of the amenities introduced into the streetscape, creating value for adjacent businesses and property owners along commercial corridors with moderate to heavy foot traffic. Many cities partner with local businesses, BIDs, or neighborhood associations to build and maintain these streetscape enhancements, especially along streets with relatively narrow sidewalks. However, unlike private “dining decks”, parklets are fully accessible public spaces and do not require a retail purchase to be used. Parklets may be applied to low-speed residential streets if a stewardship partner is able to be identified.

### Applications

Corridor / Downtown Slow Zones | Placemaking Priority Corridors

### Components

#### Required for platform parklet

- Sub-structure
- Platform
- Seating
- Curb stop and / or other vertical barrier separating the parklet from adjacent parking stalls

#### Required for street surface parklet

- ADA-compliant ramp
- Retroreflective double white 4” lines to demarcate curb extension area
- Curb stop or other vertical barrier separating the parklet from adjacent parking stalls / bicycle and vehicular traffic

#### Recommended for street surface and platform parklets

- Tables, shade structures, lighting, planters and other landscape and design elements - get creative!
- Surface material treatment

### Design Dimensions

#### Required for all parklets

- Minimum length is one standard parking space (18’ - 20’ typ) for parklets in parallel parking lane; three standard spaces for angled parking (27’ typ)
- 4’ buffer between parklet platform edge and any adjacent parking stalls
- 6’ minimum width
- 2’ minimum buffer between travel way / parklet, as required by Burlington Great Streets Standards
- See Burlington Great Streets Standards for more detailed siting and dimensional requirements

### Design Notes

- Given Burlington’s climate, parklet removal November 1st - April 1st is recommended
- See the Burlington Great Streets Standards for additional parklet siting and construction guidance



## I.D. INTERSECTION MURALS

Intersection murals are a low-cost but high impact way for residents to add beauty and character to their neighborhood. Intersection murals are appropriate for low-traffic, low-speed streets. They may be developed in conjunction with other Quick Build traffic-calming projects to ensure vehicular speeds remain low. Intersection murals may also be paired with other safety or placemaking projects.

### Applications

Neighborhood Slow Zones / Downtown Slow Zones | Placemaking Priority Corridors

- For best results, install following a street resurfacing project
- Murals may last a few years and be restored as needed, removed, or repainted with a new design
- Involve local artists in mural design and implementation

### Basic Components

#### Required

- Surface street mural, usually installed with acrylic traffic paint
- Murals should not encroach into crosswalk striping area

#### Recommended

- Pair with other streetscape / placemaking projects, such as high-visibility crosswalks, rain gardens, public seating, public art, bus stop enhancements, curb extensions, bicycle parking, site triangle conversions etc.

#### Optional

- Yield lines may be appropriate in some locations to facilitate a shared space environment

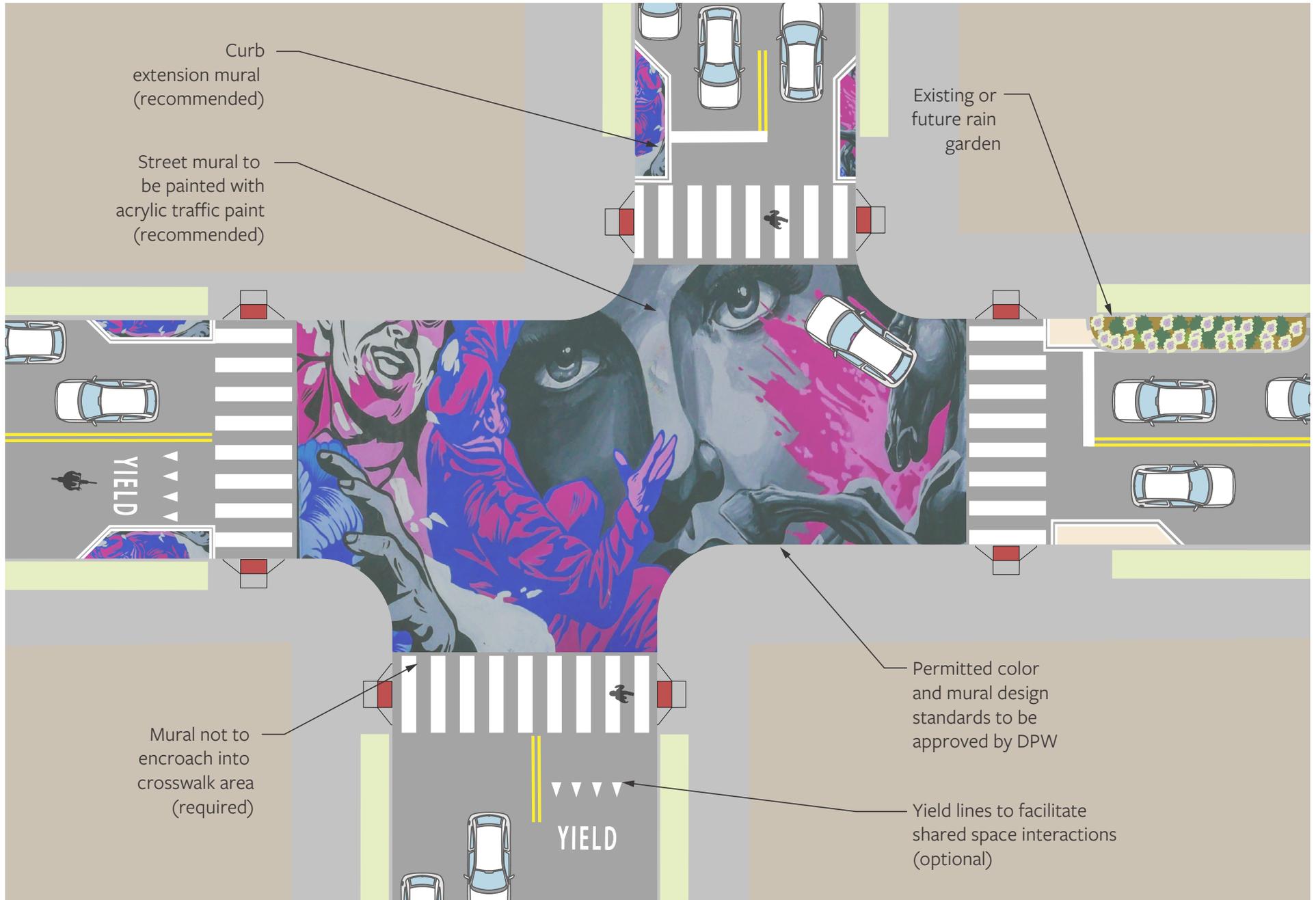
### Design Dimensions

- Intersection mural dimensions will vary based on site conditions

### Design Notes

- Intersection mural should not be considered as a traffic control or traffic-calming device, although they may have that result
- Most appropriate along low-volume streets in conjunction with other traffic-calming methods that optimize for speeds of 20mph or less. Mural themes must be supported by people who live within proximity of the project, exact process is to be further developed by DPW.
- Street surface should be thoroughly swept and power washed before surface design application

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## I.E. PEDESTRIAN PLAZAS

Pedestrian plazas increase street safety and foot traffic in commercial districts and residential areas, benefiting local businesses and supporting an environment in which community interaction can happen naturally. Plazas can be designed to normalize irregular and unsafe historic street geometries, increasing legibility and simplifying complex traffic patterns. Plazas can also create additional space for street furnishings, plantings, and other neighborhood amenities while providing the physical space for street murals where there is a strong community desire for aesthetic enhancements.

### Applications

Neighborhood / Corridor / Downtown Slow Zones | Placemaking Priority Corridors

### Components

#### Required

- Retroreflective double white striped line to demarcate plaza perimeter
- Vertical barrier elements, such as delineator posts and circular or rectangular planters, where curb is not present

#### Recommended

- Surface material treatment
- Seating, community programming, bicycle parking, and other streetscape amenities
- Enhance safety and accessibility by combining pedestrian plazas with other Quick Build project types

#### Optional

- Food truck dock or other designated mobile commercial vendor area where / when appropriate
- Shade structure(s) for summer months
- On-site equipment / street furniture storage

### Design Dimensions

Pedestrian plaza dimensions will vary based on site conditions

#### Required

- 4" retroreflective double white perimeter stripe
- Primary barrier element spacing not to exceed 10'

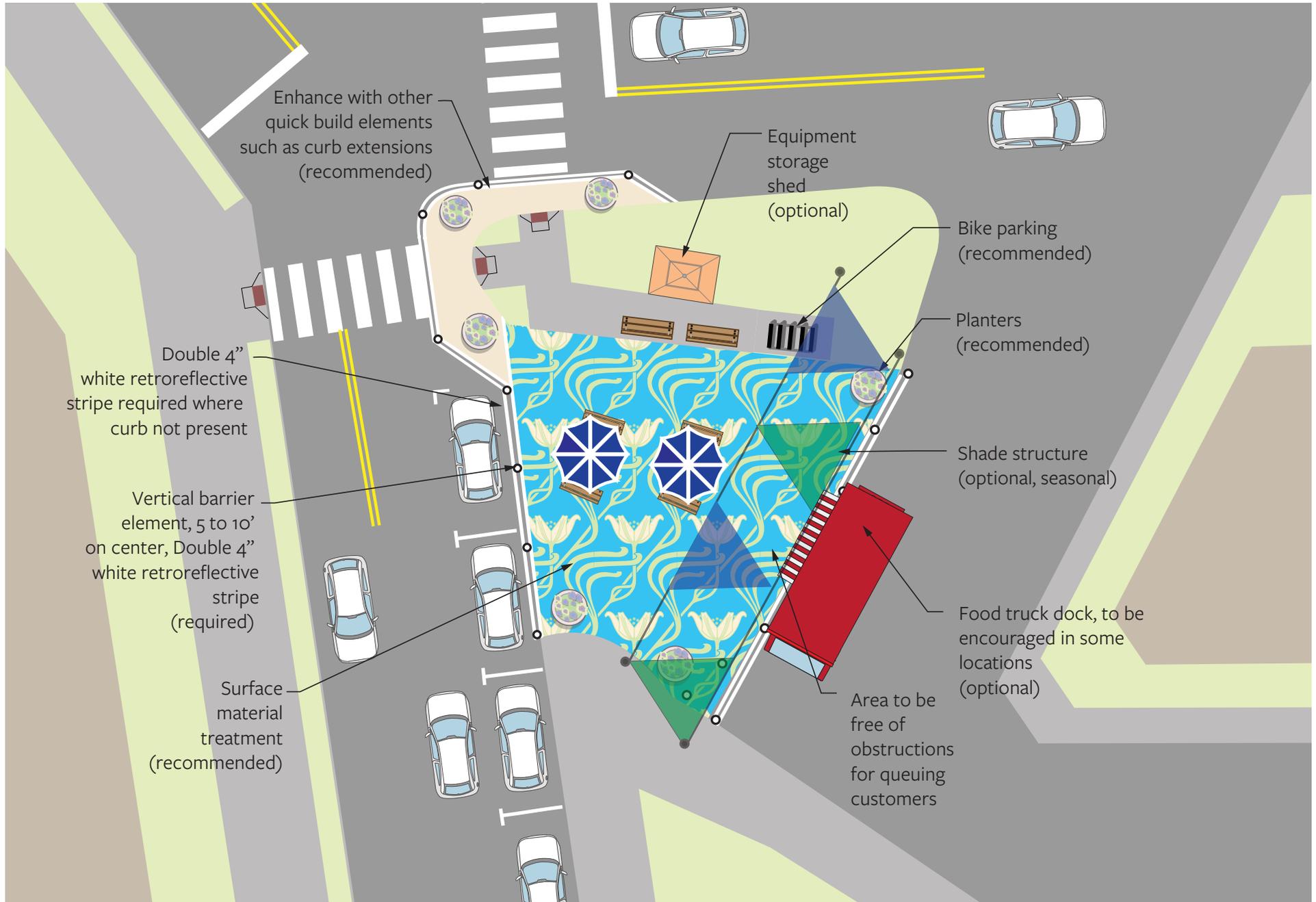
#### Recommended

- Primary barrier elements to be centered between double 4" white retroreflective stripe at edge of plaza
- Planters should be centered between primary barrier elements, abutting inner white 4" retroreflective stripe abutting if it will be seasonal, or set back 18" from the streetside edge of the white 4" retroreflective stripe if remaining through winter.

#### Design Notes

- Pedestrian plazas are well-suited for irregular intersections where one leg of the intersection or a slip lane may be redundant or is sparsely used; or where the plaza may be used to provide a more rectilinear intersection configuration
- Plaza locations should be prioritized near local businesses or in places that generate foot traffic and where existing open space is limited
- Bicycle parking - standard or custom - must meet city standards.
- Site conditions may dictate the need to provide bicycle access to / through the plaza in order to maintain continuity within the bikeway network. In these situations, low speed bicycle riding should be enforced through design, with physical dismounting required only in the rare instance where true space constraints exist.
- Identify a maintenance / stewardship partner who will be able to water and maintain landscaping/plant matter and assist with related programming, trash removal, and space management.
- Develop and maintain a clear process for community event programming.

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT

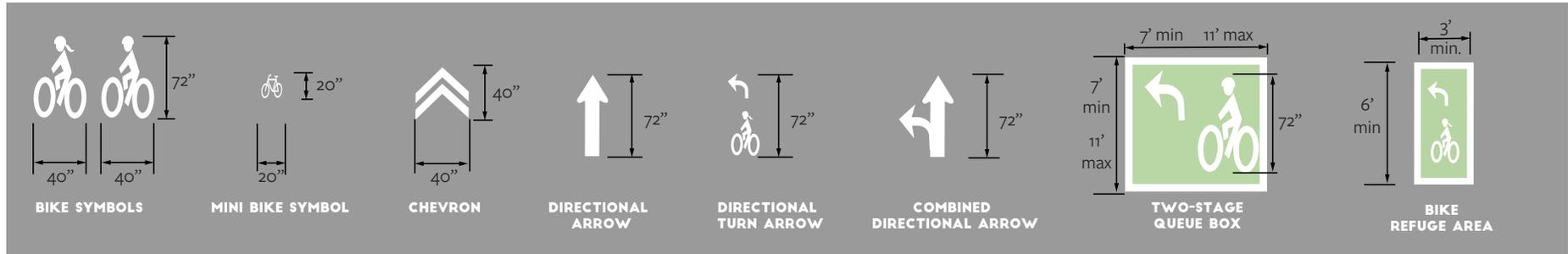


## 2. SAFER PLACES TO BIKE

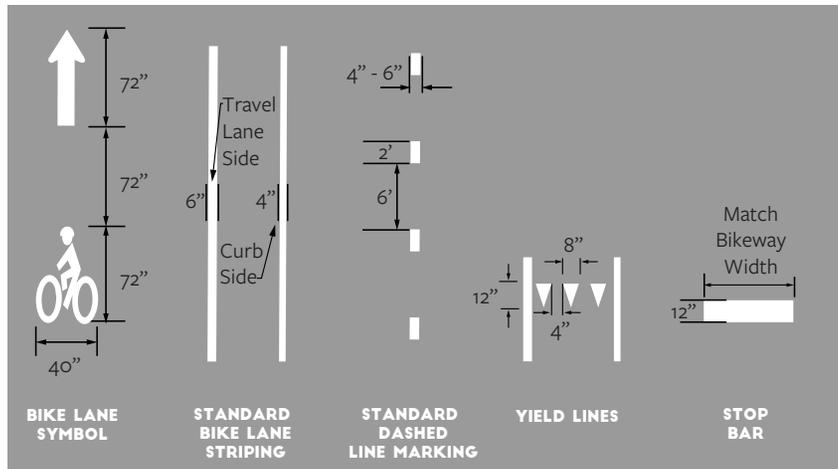
### 2.A BIKEWAY MARKING DETAILS

A range of bikeway markings will help make Burlington's bicycle network more legible and intuitive for cyclists, as well as all other roadway users. The following sections describe the applications and context of each of these markings.

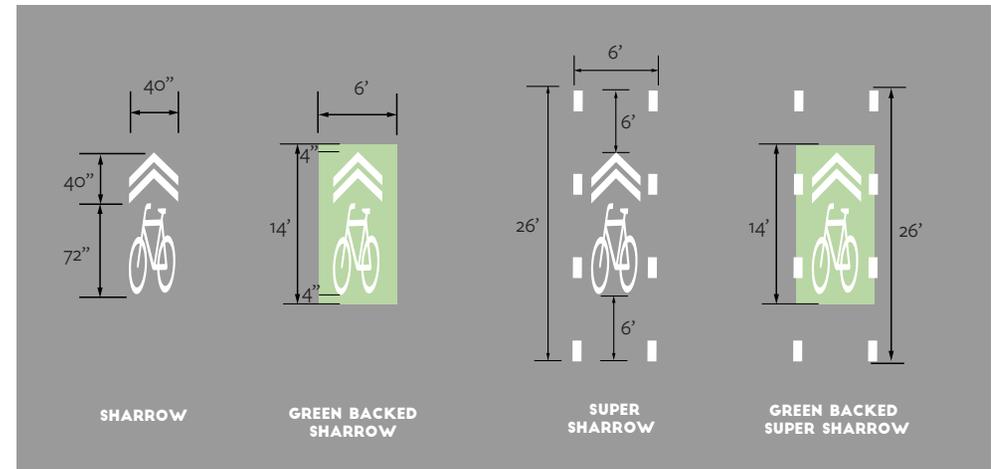
#### DIRECTIONAL MARKINGS



#### BIKEWAY MARKINGS

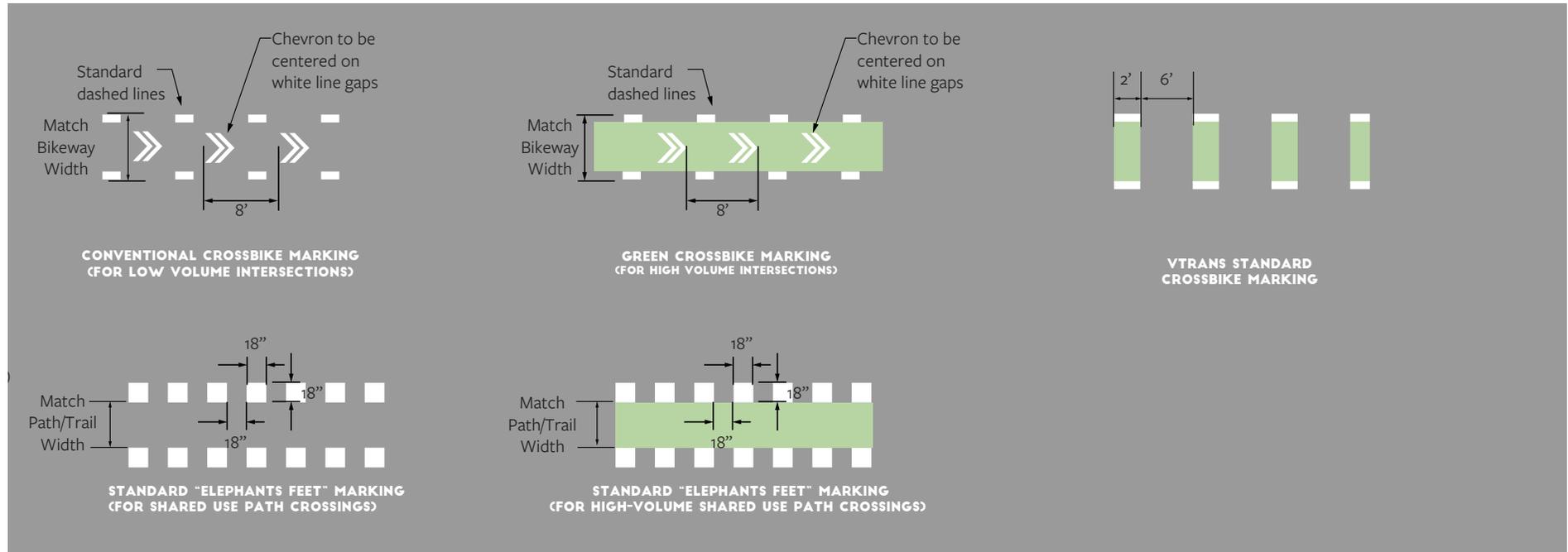


#### SHARED LANE MARKINGS



# CROSSBIKE MARKINGS

(SEE PAGE 26 FOR APPLICATION GUIDANCE)



See separate spec sheet for potential other markings / opportunities to reference other documents (e.g. bike box)

## 2.B CONVENTIONAL BICYCLE LANES

Bicycle lanes designate portions of a thoroughfare for the preferential or exclusive use of people bicycling. Bicycle lanes come in a variety of designs and configurations, including advisory, conventional, buffered, protected, contra-flow and two-way. Each type ranges in level of user comfort, depending on traffic characteristics and the level of separation between cyclists and motor vehicles.

### Applications

See planBTV Walk Bike Master Plan

### Components

#### Required

- Standard MUTCD bikeway pavement marking
- Retroreflective dashed or solid striping demarcating the inside and outside stripe of the bicycle lane where parallel parking is present.

#### Recommended

- Crossbike markings (see page 19, 26)
- Stop bar
- Striped buffer between the bike lane and moving vehicles, parked vehicles, or both wherever conditions allow
- Bike box (where one bikeway intersect another, see page 24 - 25)
- Green paint

#### Optional

- Retroreflective dashed or solid striping demarcating the inside stripe of a curbside bicycle lane.
- Directional turn arrow
- Yield Line markings
- Left or right-turn pocket / queuing area
- Standard MUTCD bikeway pavement marking with ponytail

### Design Dimensions

#### Required

- 5' minimum bike lane width for all one-way bike lanes (4' acceptable for curbside bike lanes on constrained, low-volume streets)
- 2' minimum buffer width (where appropriate)
- See page 18 for striping and marking dimensions

#### Recommended

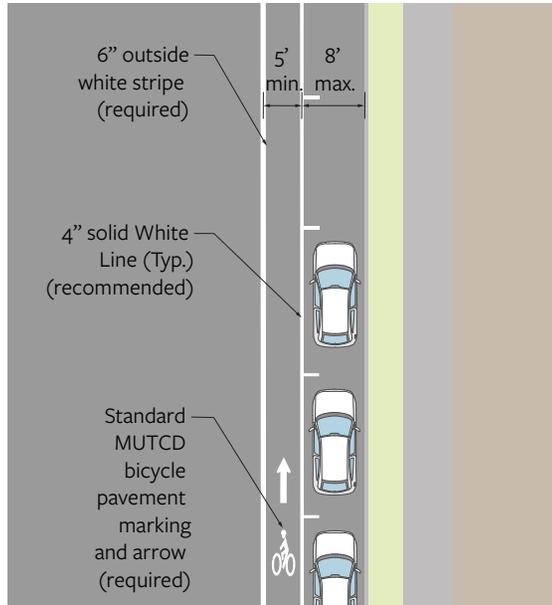
- 6" diagonal buffer stripes @ 37° with 20' gaps (Ref. VTrans)
- 12" stop bar
- Crossbike markings (see page 19 for dimensions)
- Directional turn arrow (see page 18 for dimensions)

#### Design Notes

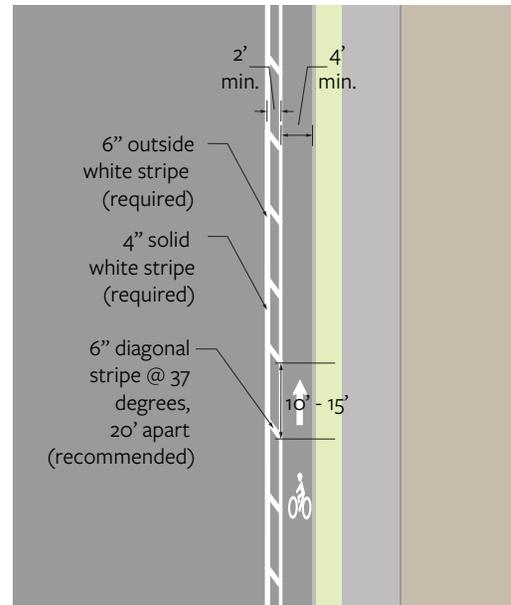
- Bicycle lanes of any type should be made wider than minimum widths wherever possible, however overly wide bicycle lane widths may encourage illegal parking or motor vehicle use of the bike lane
- Bicycle lanes are typically located on the right side of the street, between the adjacent travel lane and curb, road edge, or a parking lane. However, it is recommended that bicycle lanes be placed on the left side when installed along one-way streets to decrease 'dooring' potential, or on the opposite side of parking lane should parking only exist on one-side of the street
- Wherever possible, the parking lane width should be marked at the minimum width so that the bike lane width may be maximized.
- Contra-flow lanes should be marked with clear signing and shall include a double yellow line separating the bicycle lane from the motor vehicle travel lane
- Bicycle lane symbols and/or arrow markings should be placed outside of the motor vehicle tread path at intersections, driveways, and merging areas in order to minimize wear from the motor vehicle path; the curb radius will determine specific placement but typically 10' - 15' beyond the radius edge
- Where irregular intersections or jogs in the route exist, directional turn arrow markings may be used to help people navigate along a specific route or turn onto an intersecting bikeway.
- See NACTO's Bikeway Design Guide for more design guidance

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT

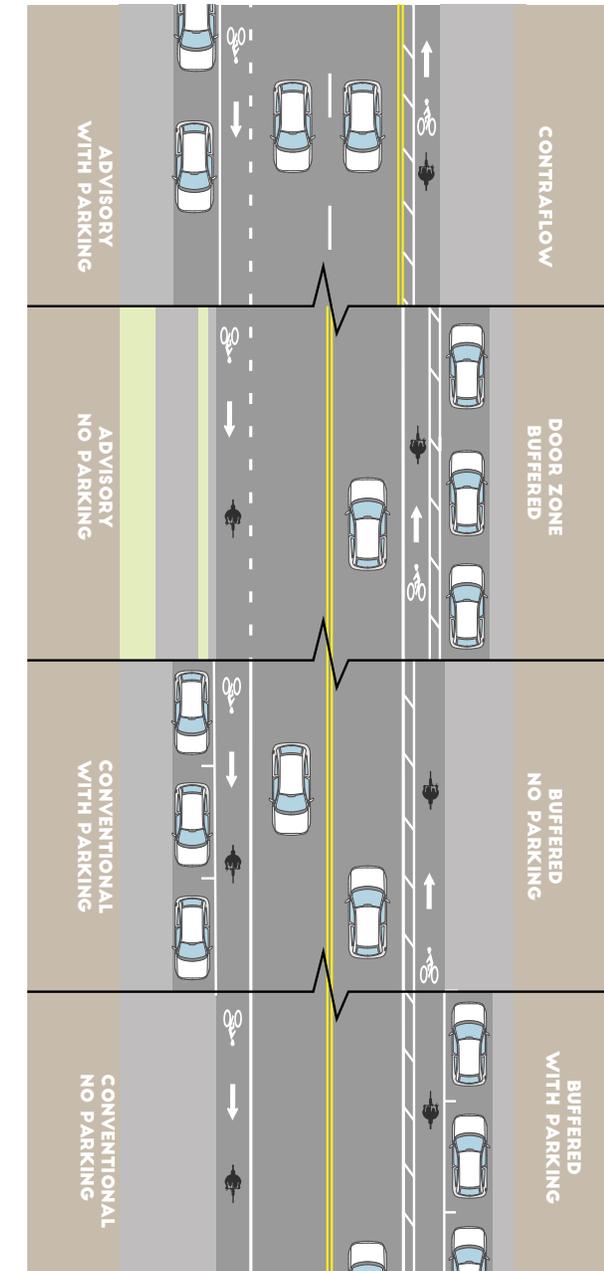
## Conventional - Striped



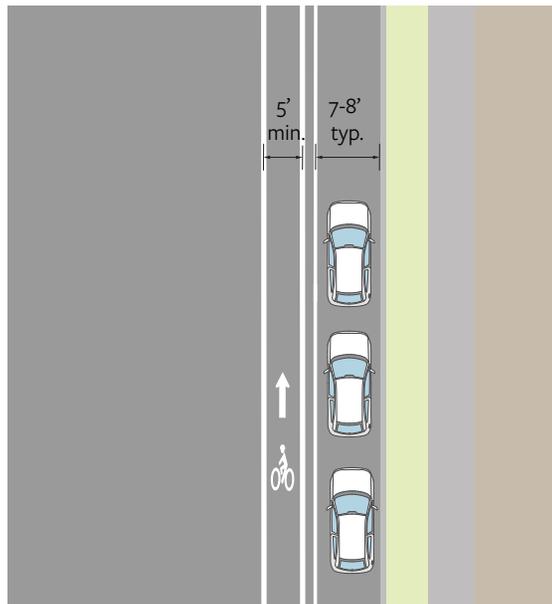
## Conventional Curbside - Buffered



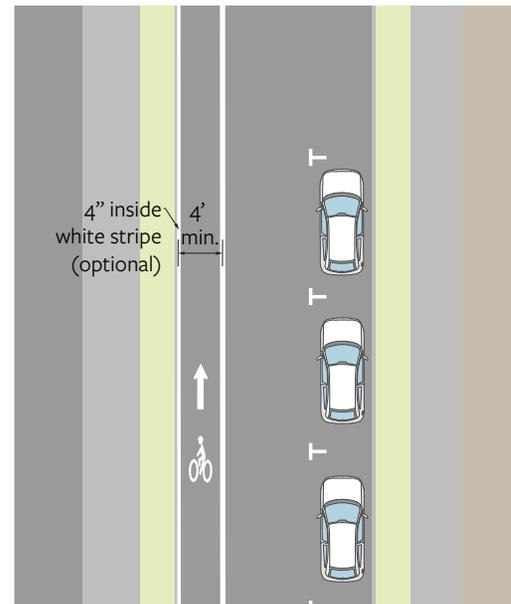
## In Context



## Conventional - With Door Zone Buffer



## Left Curbside (One-Way Street)



## 2.C. PROTECTED BICYCLE LANES

Protected bicycle lanes provide vertical and horizontal separation between people bicycling and people driving. As such, they provide the most comfort and therefore appeal to the widest number of people. Protected bicycle lanes should be implemented wherever built context and physical conditions allow.

### Applications

See planBTV Walk Bike Master Plan

### Basic Components

#### Required

- Standard MUTCD bikeway pavement marking
- Retroreflective dashed or solid striping demarcating the inside and outside stripe of the protected bicycle lane
- Vertical barrier element (parked car, vertical delineators, planters etc.)

#### Recommended

- Striped buffer between the bike lane and moving and/or parked vehicles
- Bike box (see page 24 - 25)
- Crossbike markings (see page 26 - 27)
- Stop bar
- Green paint

#### Optional

- Directional turn arrows
- Yield Line markings (mid-block crossings)
- Left or right-turn pocket / queuing area
- Surface treatments / murals may be incorporated into some project elements, like bikeway buffers
- Standard MUTCD bikeway pavement marking with ponytail

### Design Dimensions

#### Required

- 5' minimum protected bike lane width, 6' desired where possible
- 2' minimum buffer width (If applied)
- 8' min. width for two-way on-street protected bike lanes (not including 2' buffer minimum)
- See page 18 - 19 for all required striping and marking dimensions
- See page 24 - 25 for bike box dimensions

#### Recommended

- 6" diagonal buffer stripes @ 45° with spacing of 10' - 15'
- 1' Stop bar

#### Optional

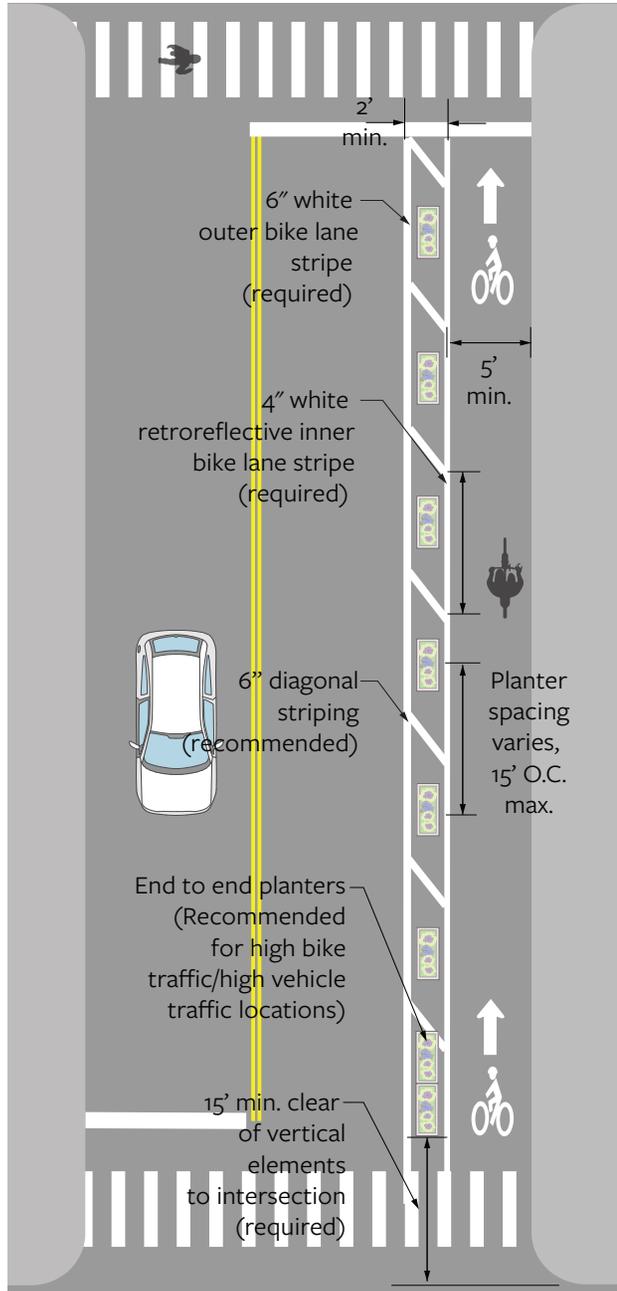
- See page 18 - 19 for all optional striping and marking dimensions

### Design Notes

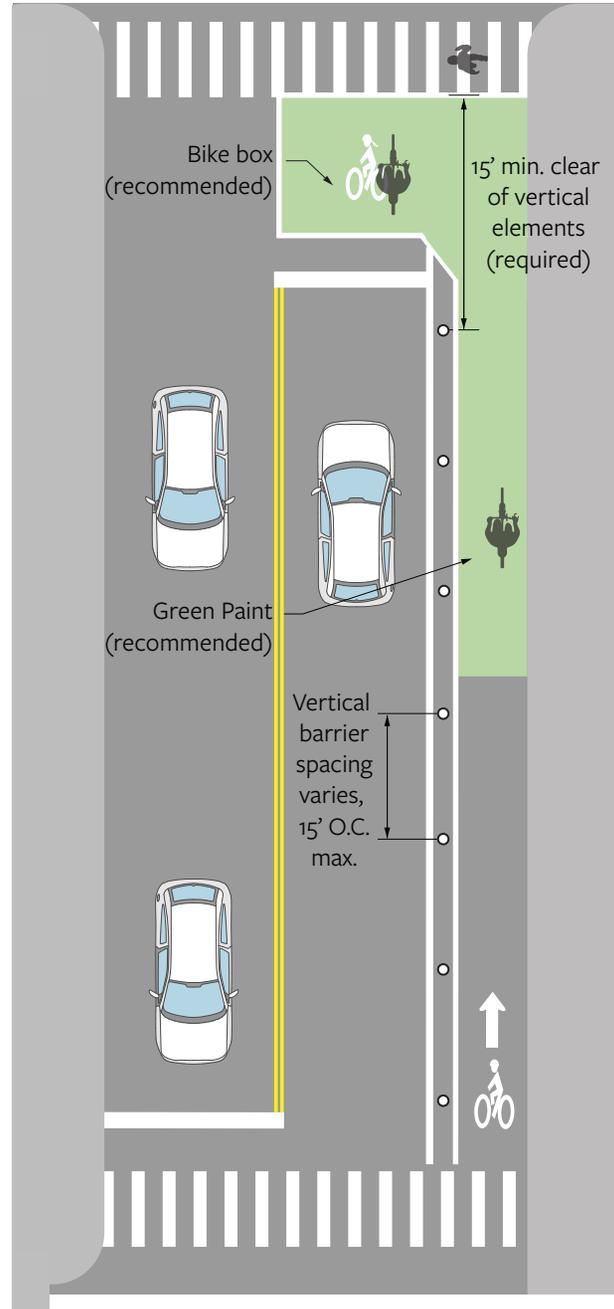
- No vertical barrier elements to be placed within 15' of driveways.
- Except for the select use of planters, vertical barrier elements should be mountable by emergency response vehicles
- Where street width allows for only one protected lane, it is recommended that it be installed on the uphill direction.
- Where possible, contra-flow lanes should include vertical barrier elements.
- See NACTO's Bikeway Design Guide or FHWA's Separated Bike Lane Planning and Design Guide for more detailed design guidance

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT

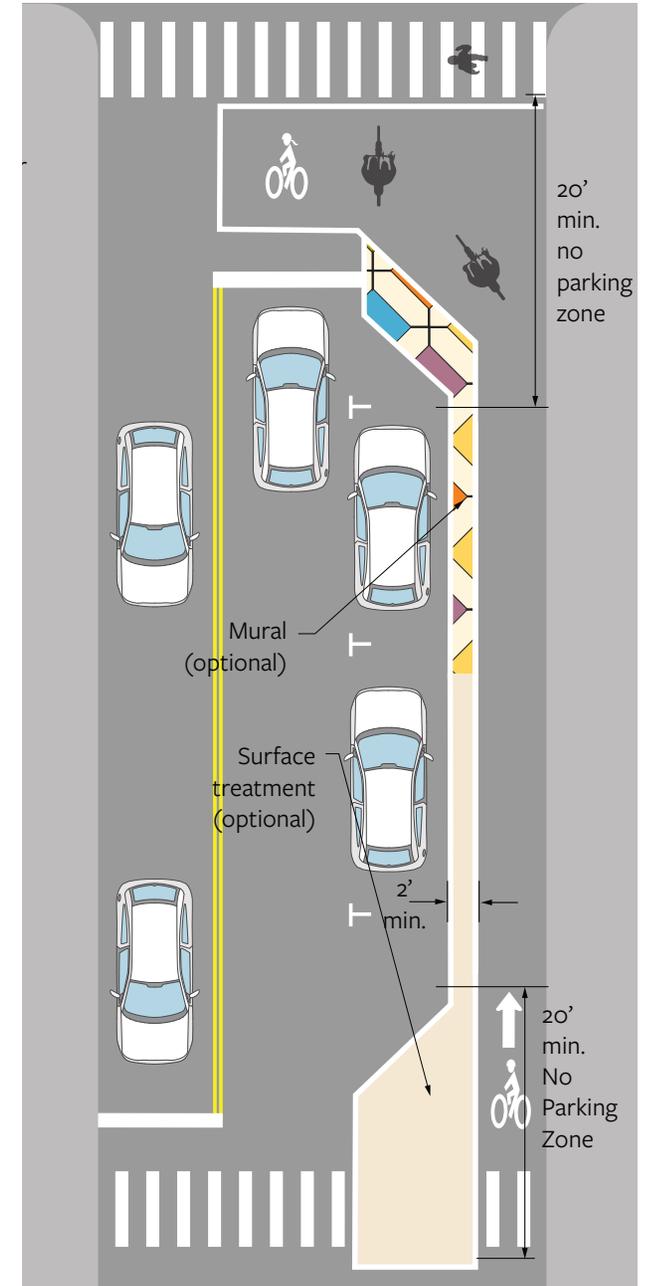
## Rectangular Planter



## Delineator Post



## Parking Protected



## 2.D BIKE BOX

A bike box is a designated area at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of automobile traffic during the red signal phase. Also known as an advanced stop line, these simple and low-cost treatments increase bicyclist visibility, allow bicyclists better positioning for left-hand turns, prevent vehicles from encroaching into the crosswalk space, and help prevent right-turn conflicts between bicyclists and turning motorists.

### Applications

Signalized intersections with designated bikeways with high volumes of bicycle travel and / or motor vehicles, especially those with frequent bicyclist left-turns and / or vehicular right-turns.

### Basic Components

#### Required

- Standard MUTCD bike lane pavement marking
- Retroreflective 6” solid stripe along top, bottom and left side of bike box; 4” retroreflective outside stripe for bike lanes placed between the vehicular lane and parallel parking lane
- Signal detection to be adjusted to recognize new stop location (if applicable)

#### Recommended

- Green surface treatment (required in some scenarios, recommended in others (see below))
- ‘Stop Here on Red’ (R10-6) signs to be placed in line with relocated stop bar

#### Optional

- 4” retroreflective outer stripe for curbside bike lanes
- Standard MUTCD bikeway pavement marking with ponytail
- Curbside planter with footrest

### Design Dimensions

#### Required

- Bike box width to equal travel lane width (and parking lane width where present), plus bike lane width
- 10’ minimum length, 16’ maximum length
- 5’ minimum spacing between stop bar and bottom bike box stripe

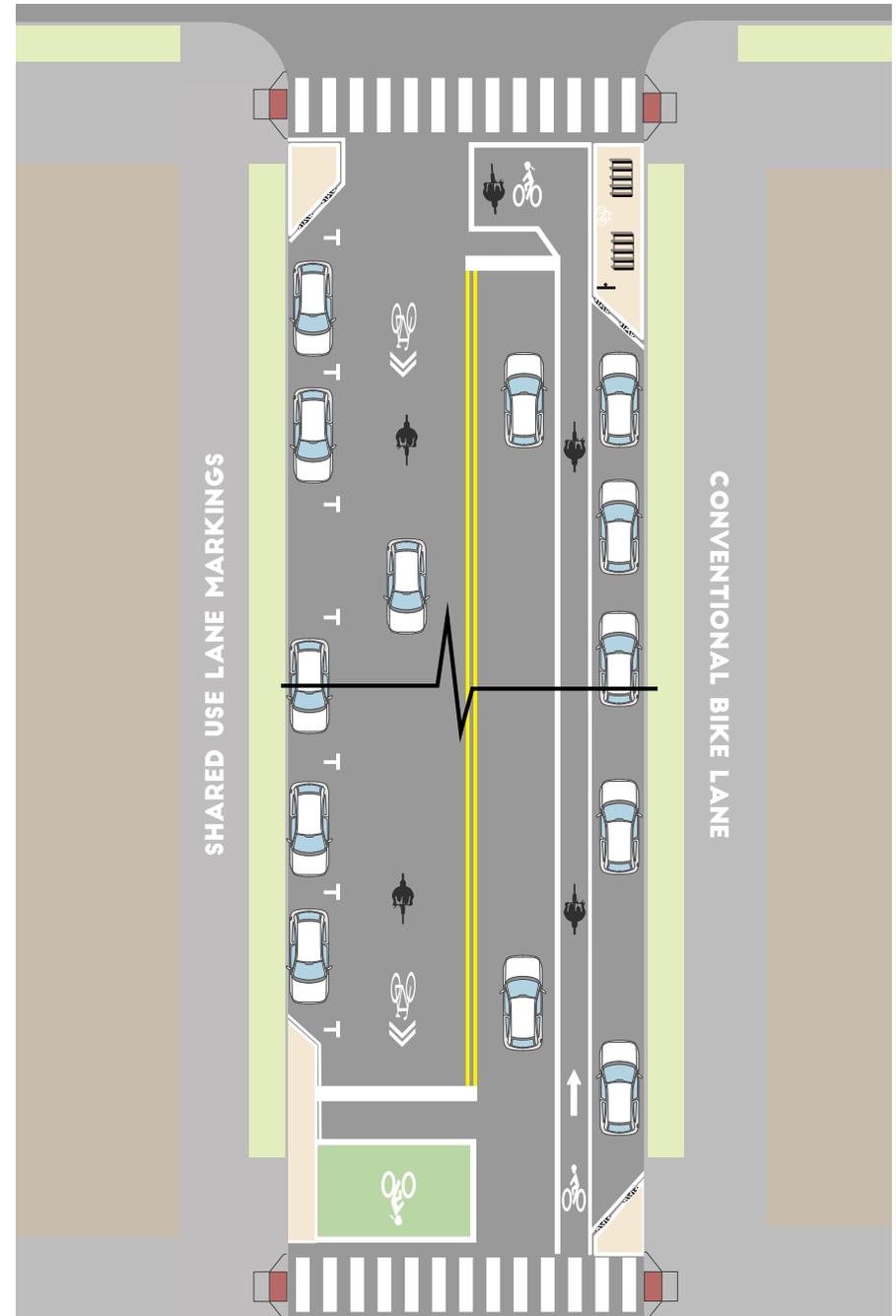
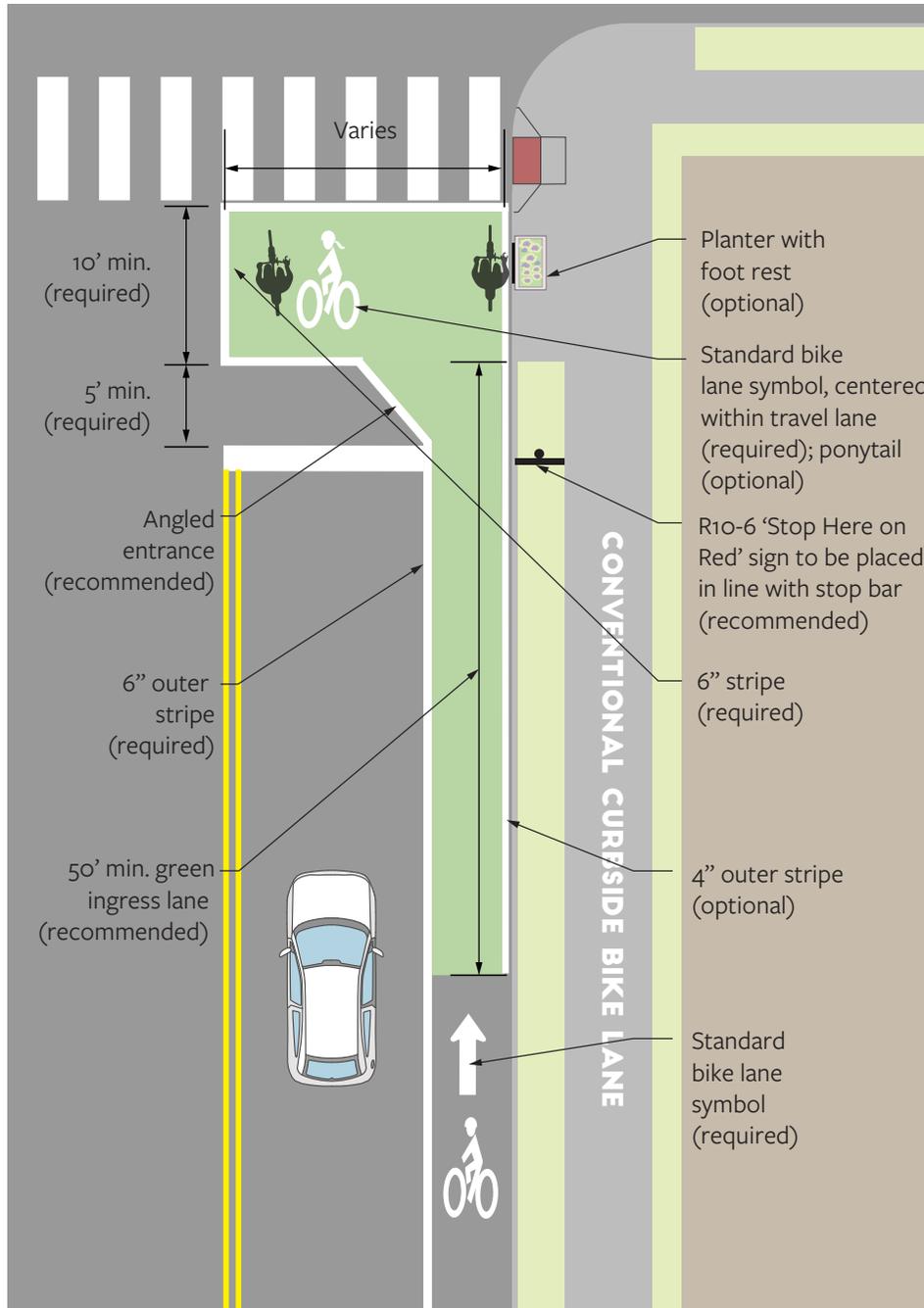
#### Recommended

- Utilize 45 degree angled stripe to facilitate easy bike box access
- 50’ minimum green painted ingress lane for curbside, protected, and conventional bike lanes with elevated bike and / or vehicular traffic volumes

### Design Notes

- Stop bar / crosswalk realignment may be necessary to provide space for bike box
- To help facilitate right turns the bike box may also be used in conjunction with bicycle left-turn or median/center-running bicycle lanes
- Prohibit right-turn-on-red for safe operation
- See NACTO’s Bikeway Design Guide for more details

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 2.E CROSSBIKE MARKINGS

Crossbike markings designate the continuation of a bicycle facility across an intersection or any areas of potential conflict from cross-traffic such as driveways or bicycle thru lanes. Crossbike markings also help reinforce cyclists' and motorists' lateral placement through the intersection, effectively making cycling facilities visible where people bicycling are most vulnerable.

### Applications

Intersections | Driveway crossings | Path crossings | Merge / conflict areas

### Basic Components

#### Required

- White retroreflective traffic paint, thermoplastic, or traffic tape
- Green retroreflective traffic paint, Ruby Lake Glass, or methyl methacrylate to enhance the visibility of crossbike markings across intersection / conflict zones at high-volume locations

#### Recommended

- Chevrons may be used to reinforce direction of travel

#### Optional

- White retroreflective striping may be used to reinforce vehicular travel side of green crossbike markings

### Design Dimensions

#### Required

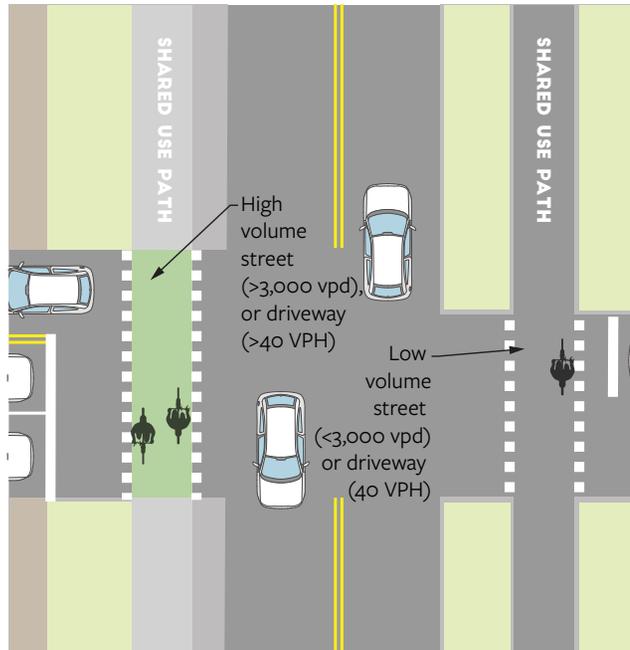
- See page 19 for various crossbike dimensions
- Crossbike width must match bikeway width, not including the width of any associated buffer zone
- Crossbike width must match bikeway width, not including the width of any associated buffer zone

### Design Notes

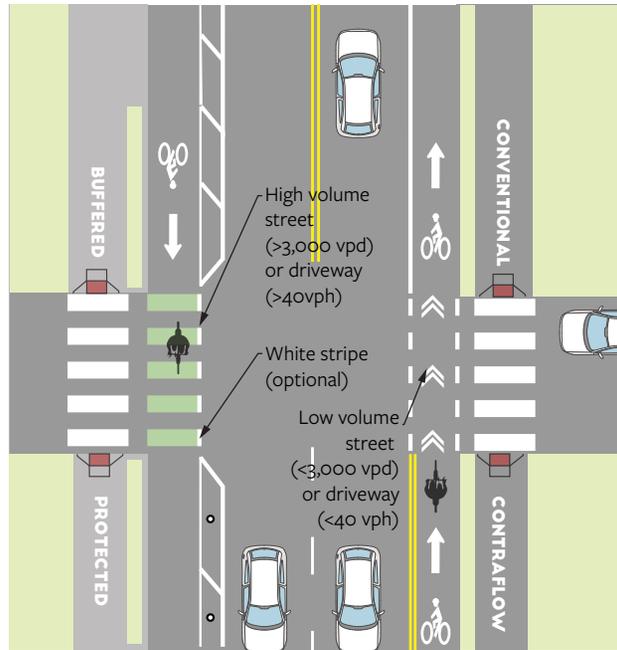
- Green elephant's feet crossbike markings should be paired with ingress bike / shared use paths that intersect with streets carrying more than 3,000 VPD and driveways with more than 40 VPH

- Conventional elephant's feet crossbike markings should be used with ingress bike / shared use paths that intersect with streets carrying less than 3,000 VPD and driveways with less than 40 VPH
- Green continental crossbike markings should be paired with ingress bike lane facilities that intersect with streets carrying 3,000 vehicles or more per day and driveways with more than 40 VPH, per VTRANS standards; and at merge/conflict zones where turn lanes / thru-bike or combo bike/turn lanes are introduced at the intersection approach
- Conventional crossbike markings (dashed stripes and chevrons) should be paired with ingress bike lane facilities that intersect with streets carrying less than 3,000 vehicles per day and driveways with less than 40 VPH
- Green crossbike markings with white dashed stripes and chevrons should be paired with ingress green-backed super sharrows along neighborhood greenway routes, and with super sharrows and shared lane markings that intersect streets carrying more than 3,000 vehicles per day and driveways with more than 40 VPH
- Crossbike treatments should be designed to align ingress / egress bikeways, especially at offset or irregular intersections, or where two different bikeway configurations meet.
- Conventional crossbike markings (dashed stripes and chevrons) should be paired with shared lane markings that intersect with streets carrying less than 3,000 vehicles per day and driveways with less than 40 VPH
- See NACTO's Urban Bikeway Design Guide for more details

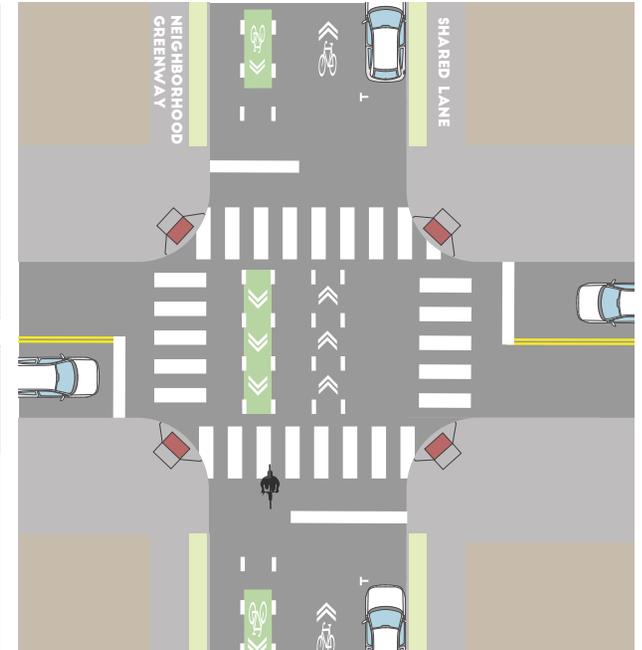
# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



**Shared Use Path High and Low-Volume  
"Elephant's Feet" Crossbike Treatments**



**Bike Lane High and Low-Volume  
Continental Crossbike Treatments**



**Neighborhood Greenway and  
Shared Lane Crossbike Treatments**

## 2.F BIKEWAY + BUS STOP LAYOVER / BUS LANE

In older cities like Burlington, right-of-way constraints often do not allow separate, high-comfort bicycle facilities and bus stops/ bus lanes to be provided within the same right-of-way. Utilizing shared bicycle and bus stop pavement markings may be used to provide increased space and visibility for users of both modes while improving safety and transit reliability.

### Applications

Any / all bus stops located along the bikeway network

### Basic Components

#### Required

- White retroreflective traffic paint, thermoplastic, or traffic tape striping
- Standard MUTCD shared use lane and / or bike lane pavement markings

#### Recommended

- Shared bus lane / bikeway pavement markings should include a “BIKE BUS ONLY” marking
- Shared use lane markings should be located within the bike-bus stop zone, placed on the left edge to facilitate confident cyclists overtaking a temporarily parked bus
- Green retroreflective crossbike markings should be striped with traffic paint, Ruby Lake Glass, or methyl methacrylate to enhance the visibility of crossbike markings through bus conflict zone
- Vertical barrier elements and surface treatments should be used to keep other motor vehicles from encroach upon the bike-bus space

#### Optional

- Rubber bus stop island
- Rubber bus stop island with intergrated bike lane ramp

### Design Dimensions

#### Required

- Curbside bus stops and bus lanes shall be a maximum of 11' in width
- Offset bus stops or bus lanes shall be either 10' or 11' in width, not

including any curb side bike lanes or painted or rubber bus islands, which shall not exceed 9' in total width, inclusive of any buffer zone

- Vehicular travel lanes shall be a maximum of 11' wide, with a minimum width of 9' adjacent to bus stop zones that integrate buffered bicycle lanes; shared bike-bus layover zones that include buffered bike lane shall be a minimum of 16' in width
- To accommodate 40' buses, bus layover zones shall be a minimum of 90' in length

#### Recommended

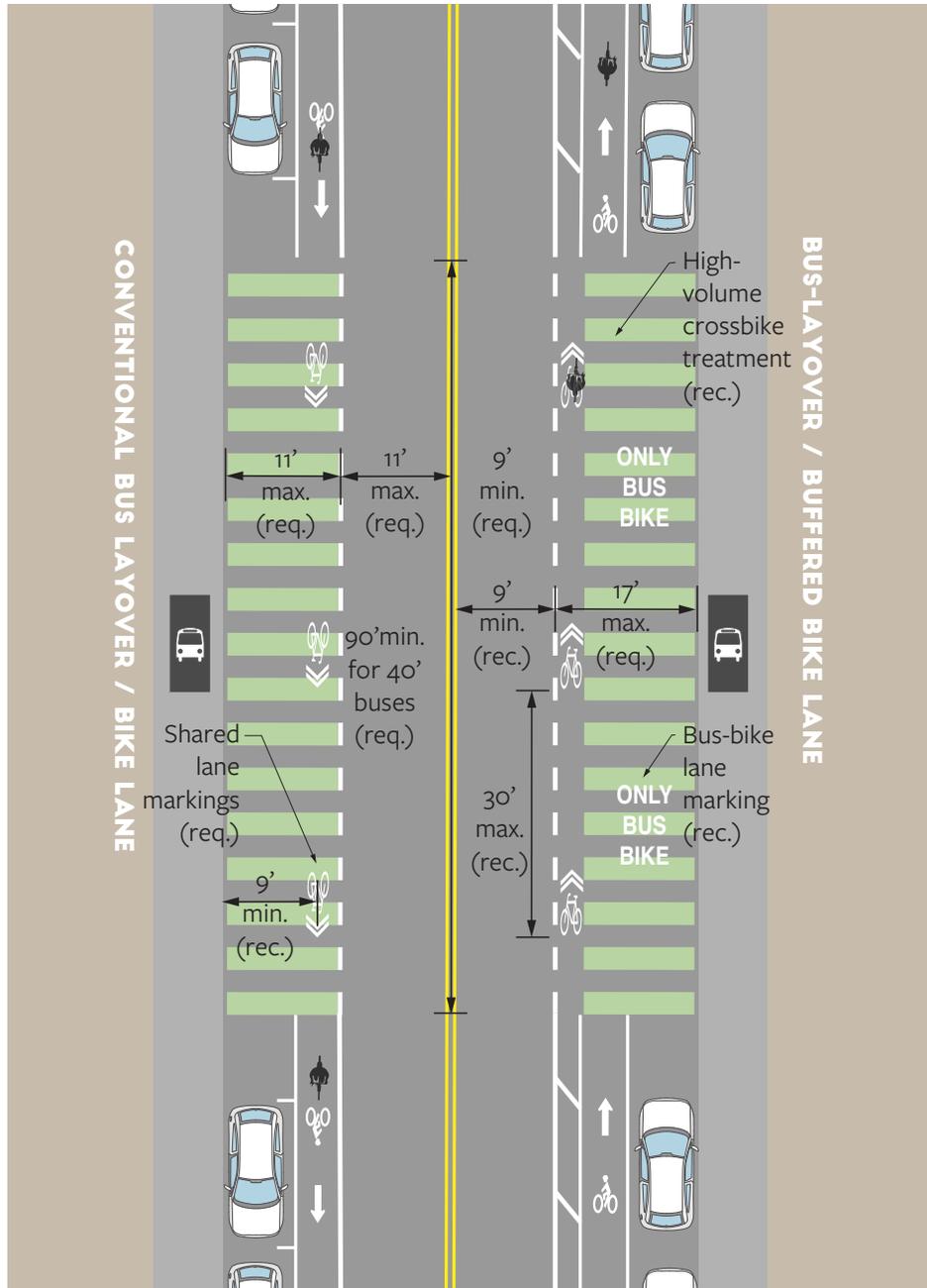
- Shared use lane markings should be spaced every 30' within a 90' bus layover zones
- Shared use lane pavement markings within bus stop zones should be placed 9' feet from the curb face to indicate to bicyclists where to pass the parked bus.

### Design Notes

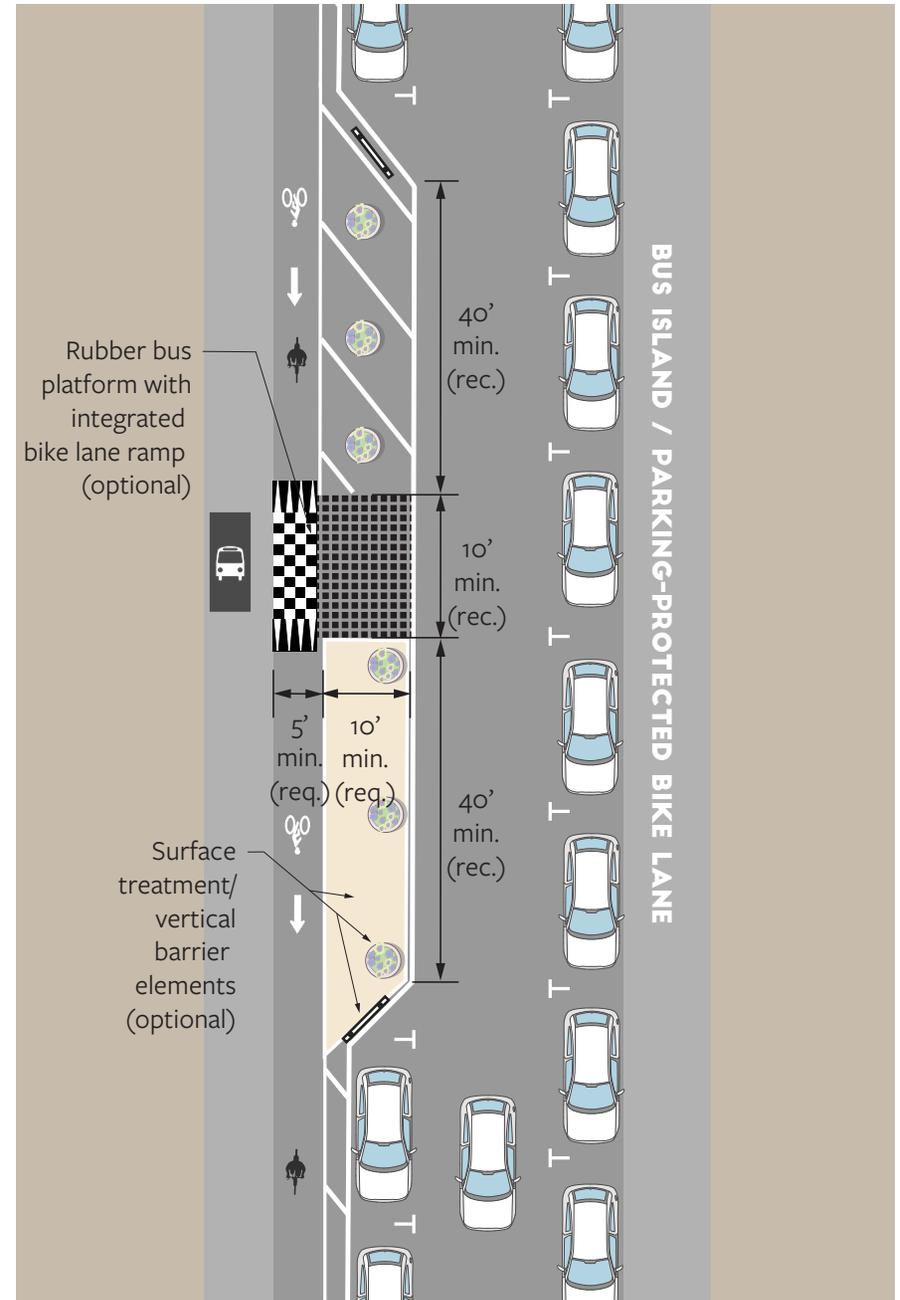
- Completely separate bus and bikeway facilities are always preferred over shared lanes or layover zones
- Bus-bicycle lanes and bus-bicycle stop zones should not be considered a substitute for dedicated bikeways, particularly at peak periods and on high-volume bus routes. If sharing creates consistent conflicts, parallel neighborhood greenways or the removal of on-street parking should be considered as two options for reducing conflicts
- To minimize conflict and resulting discomfort, bicycle / bus stop zones and bicycle / bus lanes should generally be limited to streets where operating speeds average 20 mph or less, and transit headways exceed five minutes
- In some situations adjacent travel lanes may be narrowed when approaching bus stops to create space for a bicyclist passing zone
- See NACTO's Urban Bikeway and Transit Street Design Guides for more details

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT

## Curbside Bus Stop



## Floating Bus Stop



## 2.G THRU BIKE LANES

Thru bike lanes allow bicyclists to safely position themselves between vehicular travel lanes to the left of dedicated right-turn lanes, or to the right of dedicated left-turn lanes. Thru lanes reduce conflicts between turning motorists and people bicycling to and through an intersection. They also provide bicyclists with clear visual guidance at the intersection approach, allowing for more predictable travel patterns, thus reducing the risk of ‘right hook’ crashes. Finally, combined bike-thru / turn lanes give bicyclists priority in the absence of a dedicated bicycle thru lane, encouraging motorists to yield to bicyclists when crossing into the right-turn lane.

### Applications

Bicycle / motor vehicle intersection approach | Merge / conflict zones

### Basic Components

#### Required

- White retroreflective solid and dashed traffic paint, thermoplastic, or traffic tape striping
- Green retroreflective traffic paint, Ruby Lake Glass, or methyl methacrylate continental crossbikes

#### Recommended

- Where appropriate, pair with other intersection design treatments, such as a bicycle boxes, curb extensions, vertical barrier elements etc.

### Design Dimensions

#### Required

- See page 19 for various crossbike / merge area marking dimensions
- Combined / thru bike lane merge / conflict area markings should be a minimum of 50’ in length but may vary given existing traffic volume, speed, and street geometry
- The preferred width of a thru bike lane markings is 6’, with a minimum acceptable width of 5’
- The width of a combined thru bike / vehicular turn lane shall be 9’ minimum, 13’ maximum; the minimum width of a thru travel lane and combined thru bike lane / vehicular lane is 18’

#### Recommended

- Width of combined bike/turn lane should be 9’ minimum, 13’ maximum
- Green ingress and egress lanes should be a minimum of 30’ in length
- Vertical delineator posts spaced at a maximum of 15’ should be used to separate vehicular and bicycle movements

- Wherever possible protected intersections should be painted, marked, and provided with vertical barrier elements to reduce conflicts

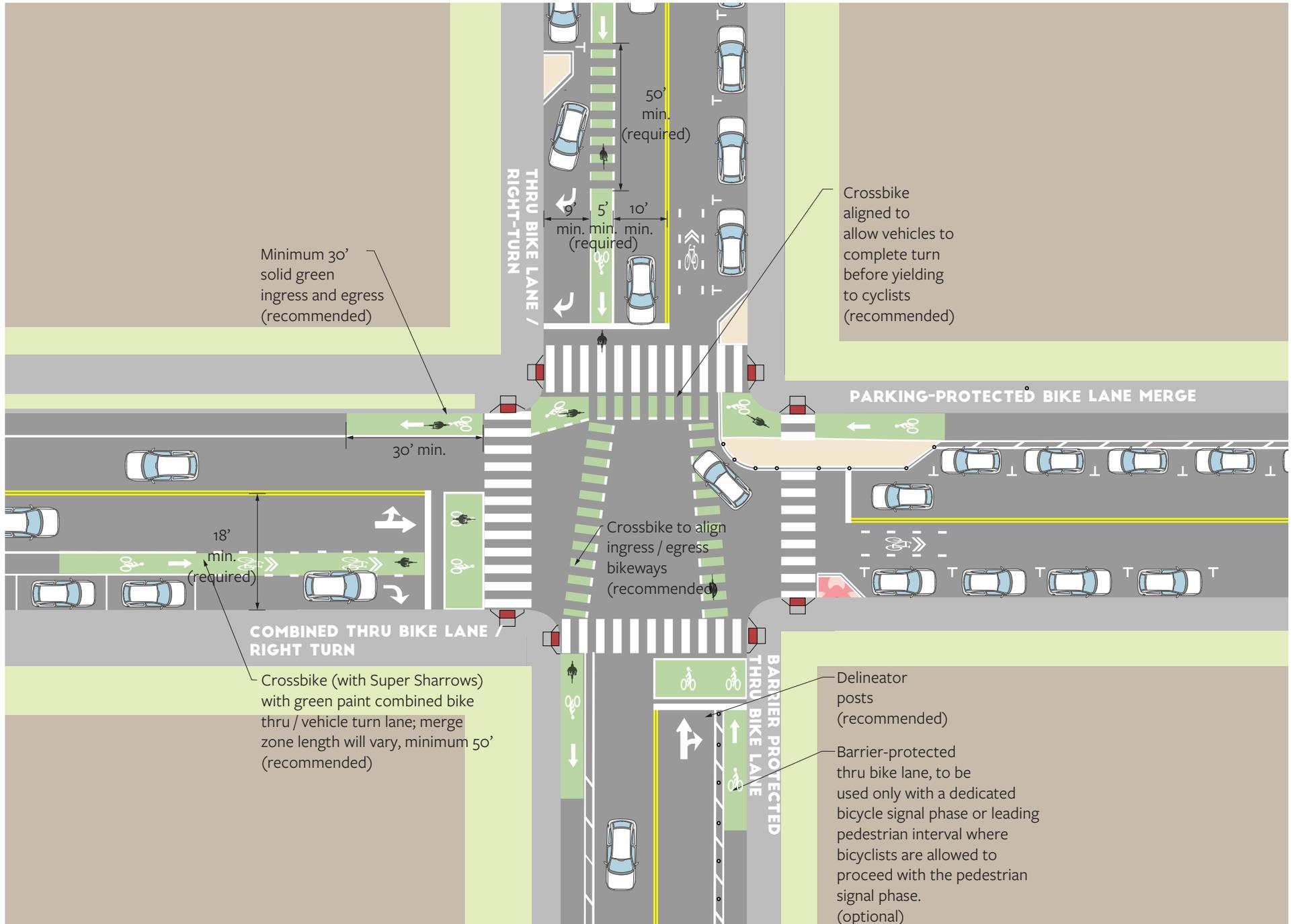
### Optional

- Barrier-protected thru bike lane may be used only with a dedicated bicycle signal phase or leading pedestrian interval where bicyclists are allowed to proceed with the pedestrian signal phase

### Design Notes

- Thru bike lanes may be used along thoroughfares that have the following lane configurations: Right-side bike lane and right-turn only lane(s); Left-side bike lanes and a left-turn only lane(s); Bike lanes and an auxiliary right-turn-only lane added in advance of the intersection; and bike lanes / parking lane that transition into a turn lane.
- Right-turn lane length should be minimized as much as possible to reduce motor vehicle speed and the time bicyclists are exposed to the merge condition
- Crossbike treatments should be designed to align ingress / egress bikeways, especially at offset or irregular intersections, or where two different bikeway configurations meet
- Wherever possible, bicycle detection technology should be used for cyclists within the thru bike lane
- Thru bike lanes may be combined with the travel lane that has the least movement (e.g. combined with the right turn lane when right turn movements are less than through traffic volumes)
- See NACTO’s Urban Bikeway Design Guide for more details

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 2.H SUPER SHARROWS

Super sharrows are a pavement marking used to indicate a shared lane for people bicycling and people driving. Like regular shared use lane markings (“sharrows”), super sharrows should not be considered a substitute for dedicated bike infrastructure, such as bicycle lanes or protected bikeways. However, the two parallel dashed line markings are intended to emphasize cyclist priority along designated neighborhood slow zone / neighborhood greenway streets.

### Applications

Neighborhood Slow Zones and Neighborhood Greenways  
(See planBTV Walk Bike Master Plan)

### Basic Components

#### Required

- Standard MUTCD shared use lane pavement marking
- White retroreflective solid dashed traffic paint, thermoplastic, or traffic tape striping
- Green retroreflective traffic paint, Ruby Lake Glass, or methyl methacrylate continental crossbikes (for neighborhood greenways)

#### Recommended

- Mid-block center line removal should be considered for all designated slow zone / neighborhood greenway streets

#### Optional

- “Stop” markings may be placed in conjunction with stop bars

### Design Dimensions

#### Required

- Super sharrows shall be marked using the dimensions detailed on page 18 of this guide

#### Recommended

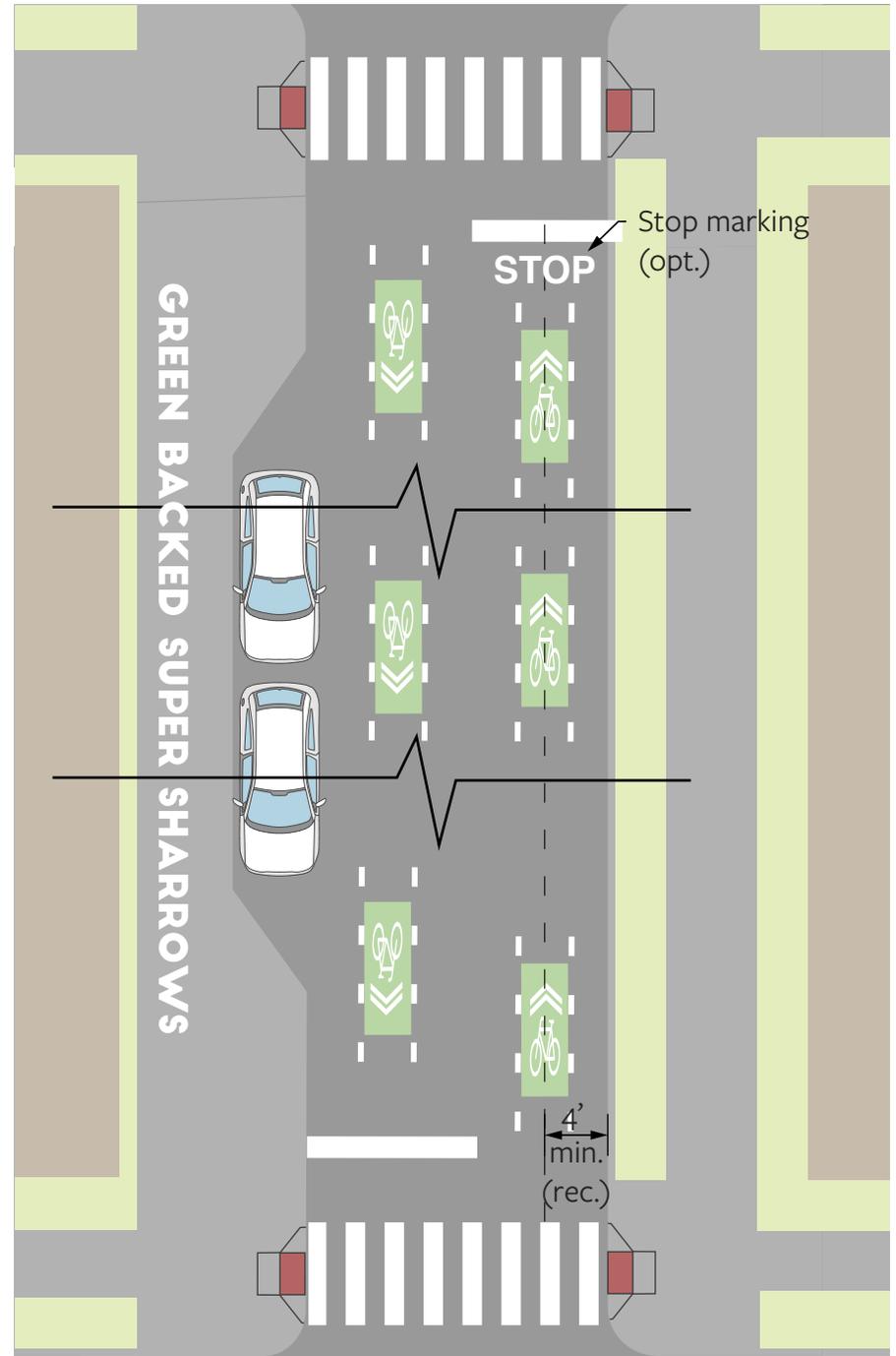
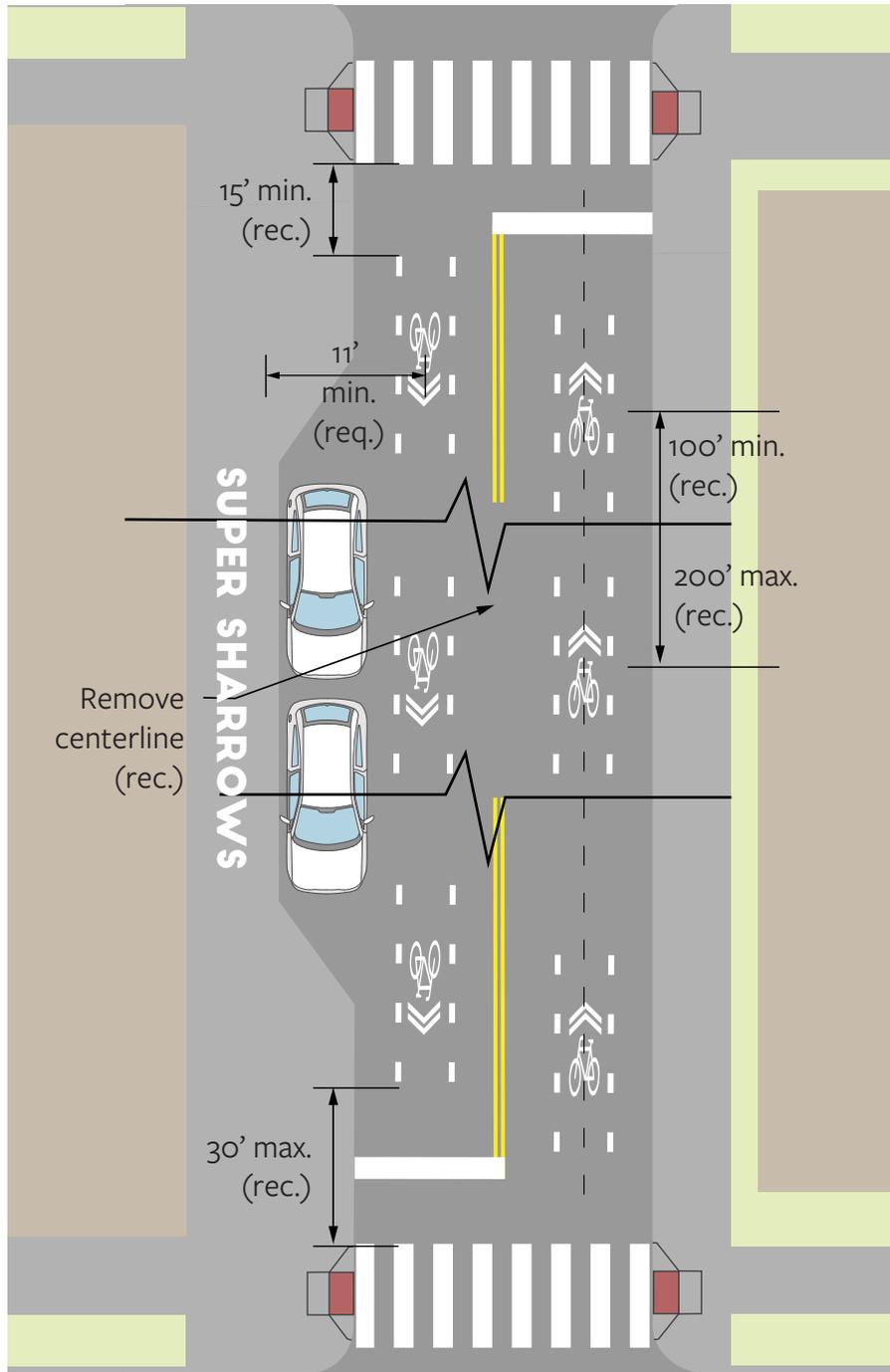
- Super sharrows should be spaced at maximum of 200’ apart
- Markings should be placed no more than 30’ from the stop bar (ingress) / 15’ from the bottom of the crosswalk (egress)
- Super sharrows should be placed in the center of the travel lane when applied to all neighborhood slow zone or neighborhood greenway streets

- The center of the super sharrow marking should be placed at a minimum of 4’ from the curb face where on-street parking is not present; 11’ from the curb face where parallel parking is present; or in the center of the travel lane where angled on-street parking exists
- Super sharrows should be spaced at minimum of 100’ apart except on very short blocks where closer spacing may be appropriate

### Design Notes

- Along short blocks with bi-directional travel lanes there should be a minimum of four markings, two per travel lane
- For one-way streets, at least one marking should be placed at either end of the block.
- For bi-directional streets, markings should be placed in pairs where possible. (Short blocks, offset block links, or driveways may make exact placement impractical)
- Where possible, super sharrow marking centerline should be placed within the center of the travel lane to prevent wheel tracking deterioration and to encourage people to bicycle outside of the door zone
- Where parking lanes are unmarked, super sharrow marking centerline should be a minimum of 12’ from the curb face
- Directional arrows may be placed in conjunction with super sharrow markings to help direct people bicycling along the Neighborhood Greenway route where irregular intersections / jogs in the cycling network exist

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 2.1 CURBSIDE BIKE CORRALS

Bike corrals typically repurpose one curbside vehicular parking space to accommodate 8 - 12 bicycle parking spaces. Corrals may also be installed within site visibility triangle zones. Bike corrals help reduce haphazard or oversubscribed sidewalk bike parking that often interferes with pedestrian access. Increased bike parking has been shown to have positive impacts on adjacent retail businesses, who benefit from increased activity and customer convenience.

### Applications

All thoroughfares with on-street parking | Surface or structured parking

### Basic Components

#### Required

- Standard city u-rack or custom bike rack
- 4" retroreflective double white perimeter stripe
- Vertical barrier element(s), such as circular or rectangular planters, parking stops, or vertical delineator posts

#### Recommended

- Surface treatment
- Mini-bike pavement marking

#### Optional

- Fix-it-station
- Adjacent bicycle lane yield line parallel with corral entry
- Site visibility triangle zone corrals may be paired with curb extensions to create a pedestrian refuge island
- Planter with built-in hand and footrest
- Green retroreflective corral ingress marking

### Design Dimensions

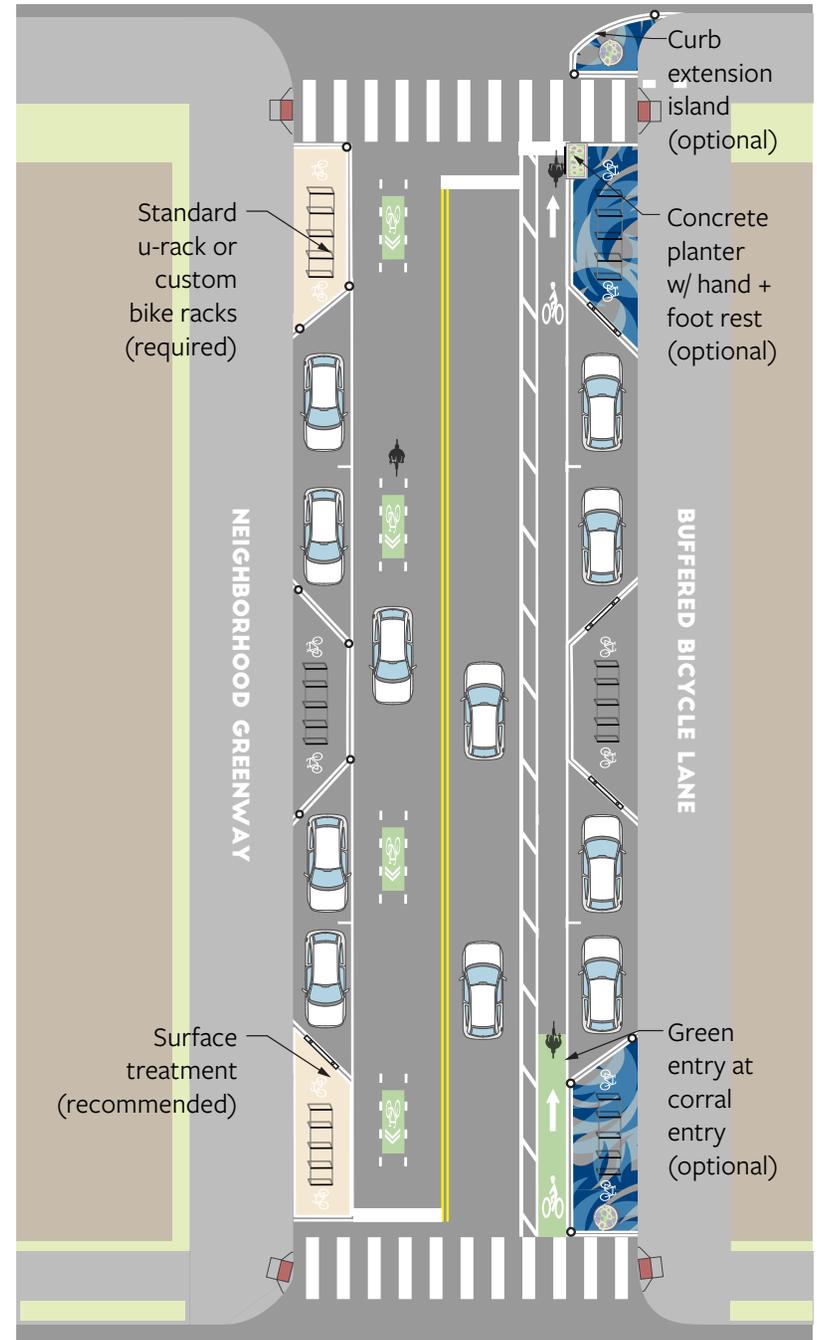
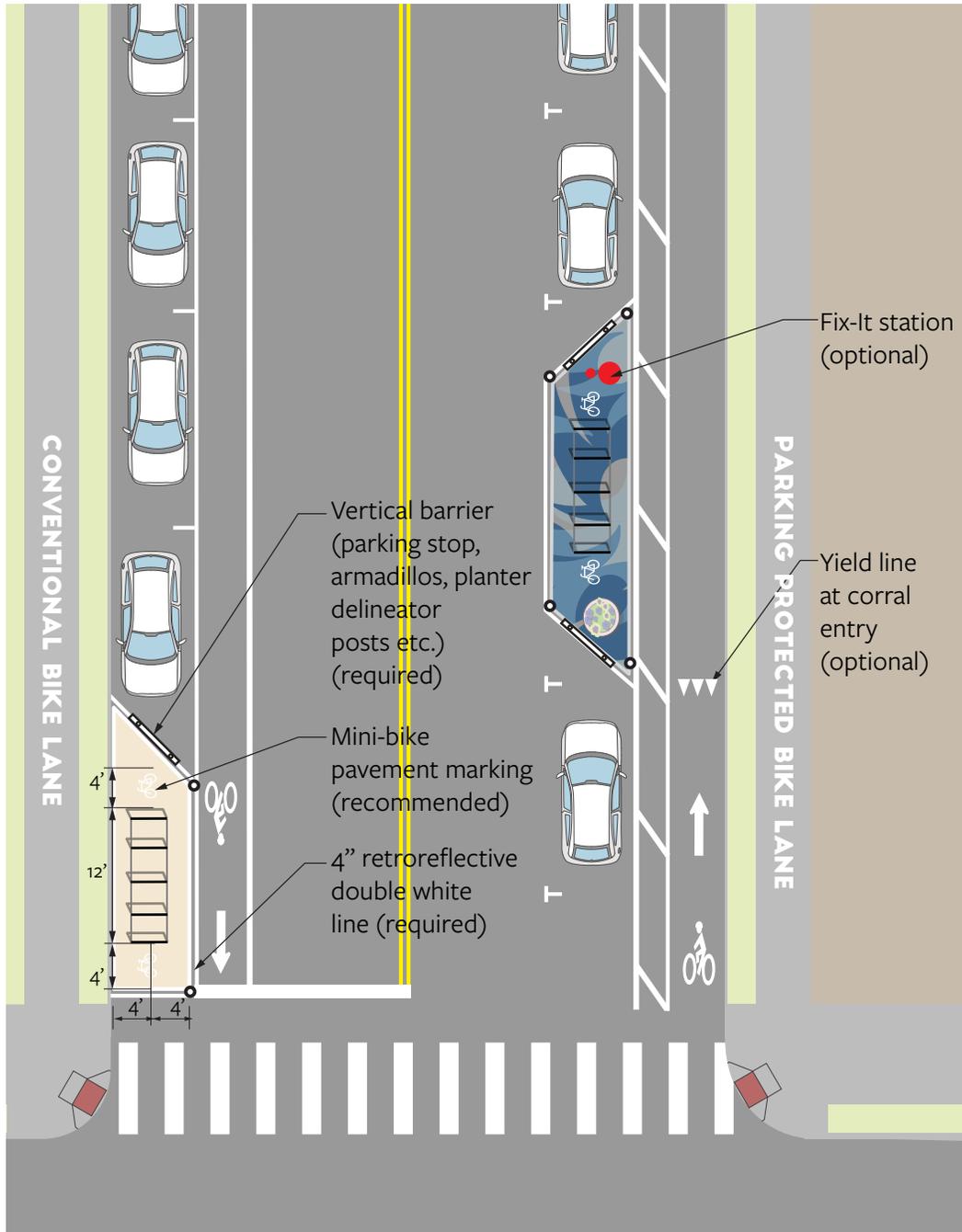
#### Required

- Typical bicycle corrals shall be 20' x 8' per corral (typical Burlington parking stall dimension)
- A 4" double retroreflective stripe shall be used to demarcate the bicycle corral area
- A 4' clear zone shall be provided between on-street vehicular parking space(s) and rack element and between the crosswalk and rack element

### Design Notes.

- Standard inverted-u racks (anchored in asphalt or on rails) or custom art racks may be used so long as the rack element is capable of supporting the bicycle frame with two points of contact.
- Site conditions, parking layout, demand, and various applications may dictate different corral size requirements
- All bicycle parking should be placed so correctly parked bikes do not encroach on the adjacent bicycle or vehicular travel lanes.
- Street murals may be used to add character, increase visibility and support neighborhood aesthetics, as desired.
- See APBP's Essentials of Bike Parking: Selecting and Installing Bike Parking that Works (2015) for more details.

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 2.J TWO-STAGE LEFT-TURN QUEUE BOX

A two-stage left-turn queue box provides people cycling the visible option to make safe, comfortable left turns in two stages at multi-lane signalized intersections. This reduces the need for a demanding ‘look over the left shoulder and turn’ maneuver. Two-stage left-turn queue boxes can improve bicyclist’s visibility, and create a formal queuing space for bicyclists, reducing conflicts between travel lanes, thru-bike lanes and crosswalks.

### Applications

- Signalized intersections where bicyclists turn left from a right side bikeway, especially along protected bikeways; At “T” intersections with a high number of left-turning cyclists; Unsignalized intersections where the queue box can be used to simplify turns from one bikeway to another

### Basic Components

#### Required

- Two-stage queue box
- Standard MUTCD bicycle pavement marking
- Left-turn arrow marking
- Crossbike link to receiving bikeway

#### Recommended

- Green retroreflective traffic paint, Ruby Lake Glass, or methyl methacrylate

### Design Dimensions

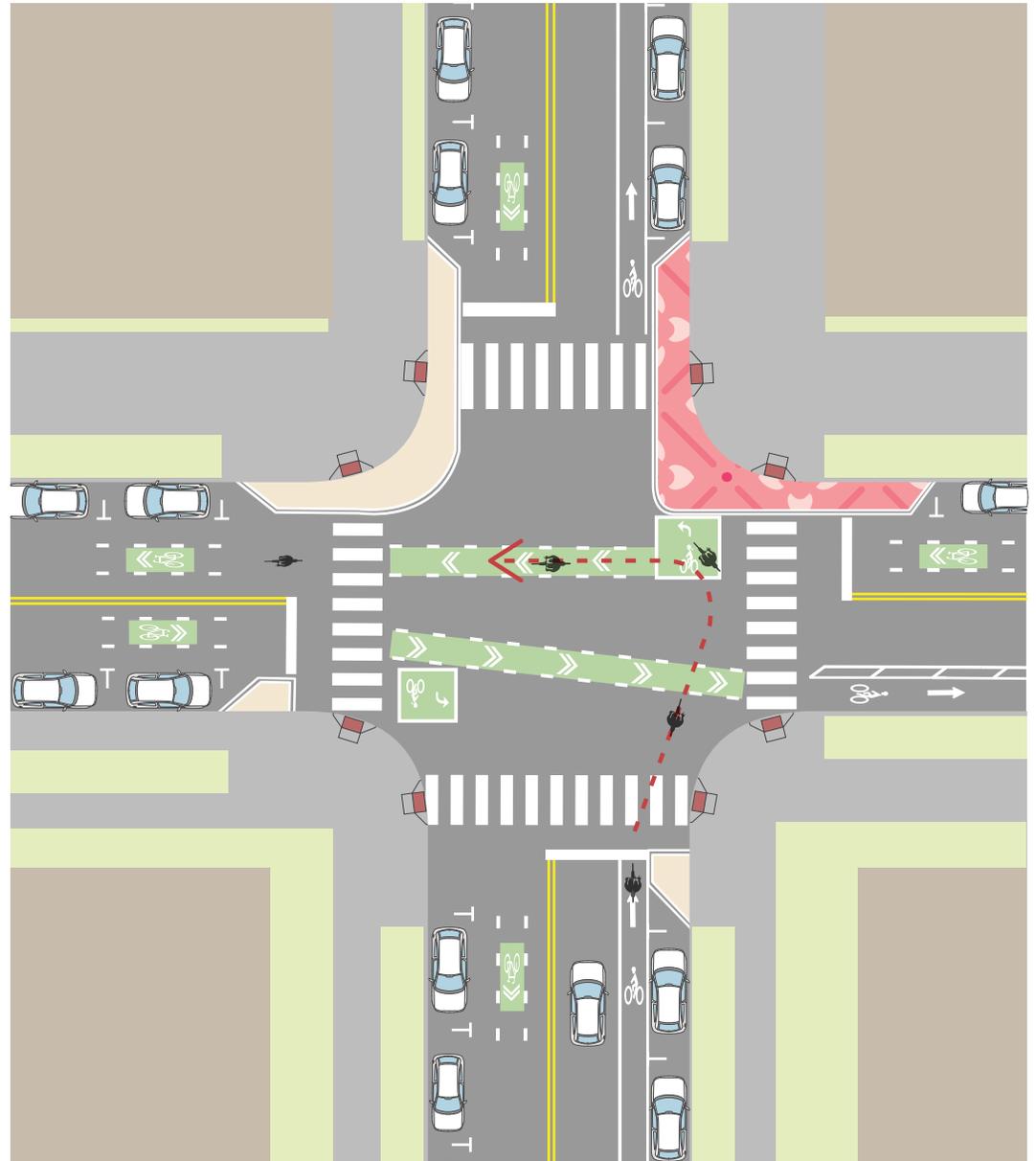
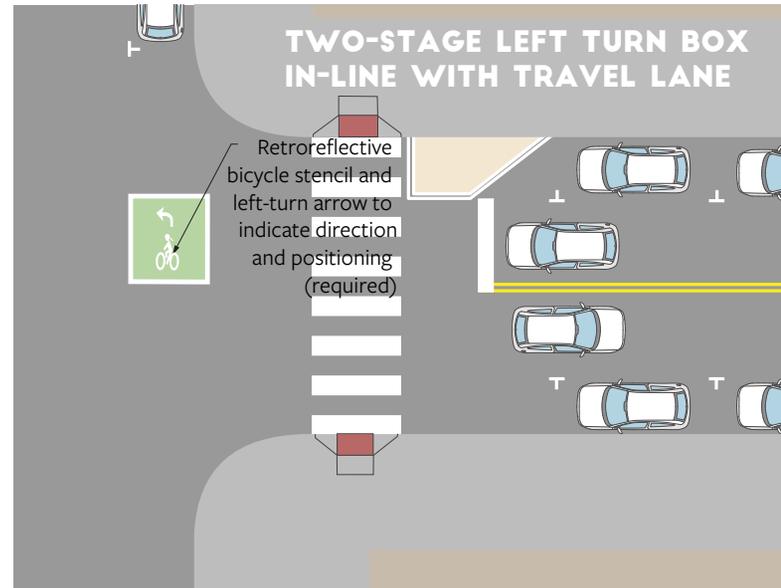
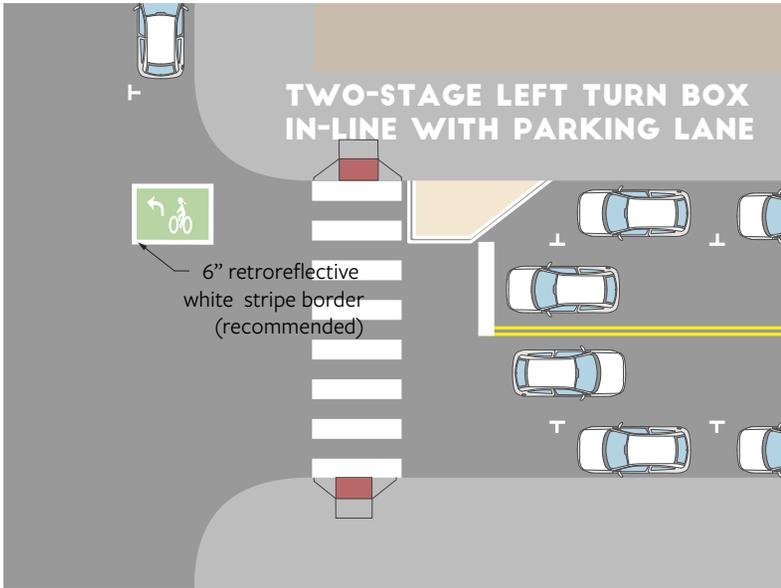
See page 18 for dimension details

### Design Notes

- Wherever possible the two-stage queue box shall be placed in a “protected area,” typically in line with an on-street parking lane and /or between crossbike markings and the crosswalk
- Two-stage left-turn boxes may be added to intersections with bike boxes, offering cyclists an alternate left-turn maneuver option.
- Multiple positions are possible for queuing boxes, depending on intersection configuration and signalization
- Bicycle stencil and a turn arrow should clearly indicate proper bicycle direction and positioning

- The specific crossbike marking used will depend upon the sending bikeway type and the volume of motor vehicles traveling through the intersection
- Stop bars and crosswalks may be adjusted or realigned to allow space for a queue box where existing roadway geometry is constrained
- “No Turn on Red” sign must be installed overhead to prevent vehicles from entering the queue box at a red signal phase
- Where mid-block turns are necessary, the left-turn queue box may be integrated into the sidewalk space (known as a “jug-handle”) or take the form of a left-turn “pocket” if a bikeway buffer is present
- A bicycle signal, with leading bicycle interval phase, may be installed in conjunction with the two-stage turn queue box
- See NACTO’s Bikeway Design Guide for more details

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 2.K BICYCLE REFUGE ISLAND

Bicycle refuge islands provide protected mid-crossing areas, in which cyclists can safely wait at the mid-point of a two-stage street crossing. Bicycle refuge islands decrease the crossing distance for less confident cyclists, and reduce the barrier effect created by wider roads.

### Applications

Neighborhood Greenways | Shared Use Path Crossings

### Basic Components

#### Required

- 4" double yellow retroreflective traffic paint, thermoplastic, or traffic tape striping around refuge islands with vehicular traffic traveling in opposing directions
- Mountable vertical barrier element(s), such as parking stops or vertical delineator posts shall be used along the perimeter of the bicycle refuge
- Standard MUTCD bicycle pavement marking
- Crossbike link to receiving bikeway

#### Recommended

- Green retroreflective bicycle marking (traffic paint, Ruby Lake Glass, or methyl methacrylate)
- Bicycle refuge surface treatment (traffic paint, Ruby Lake Glass, or methyl methacrylate)
- Bicycle refuge marking stop bar
- Yellow retroreflective bicycle refuge island splitter lines

#### Optional

- Planters with built-in hand and footrest may be used to add comfort
- Circular / rectangular planter may be used as barrier elements
- Bike box may be used to help direct bicycle refuge crossing

### Design Dimensions

#### Required

- Bicycle refuge island shall be a 6' minimum in width
- Travel lanes shall be a minimum of 9' in width between mountable vertical barrier elements; 14' between non-mountable barrier elements
- Bicycle refuge island marking shall be a minimum of 5' in width

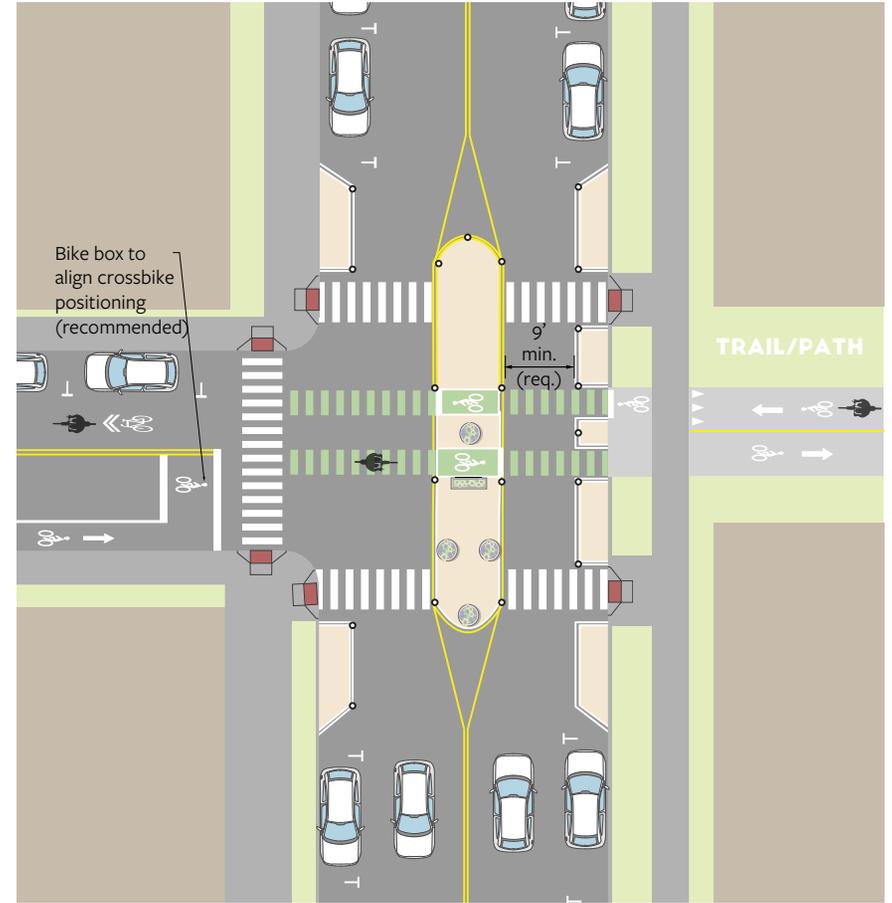
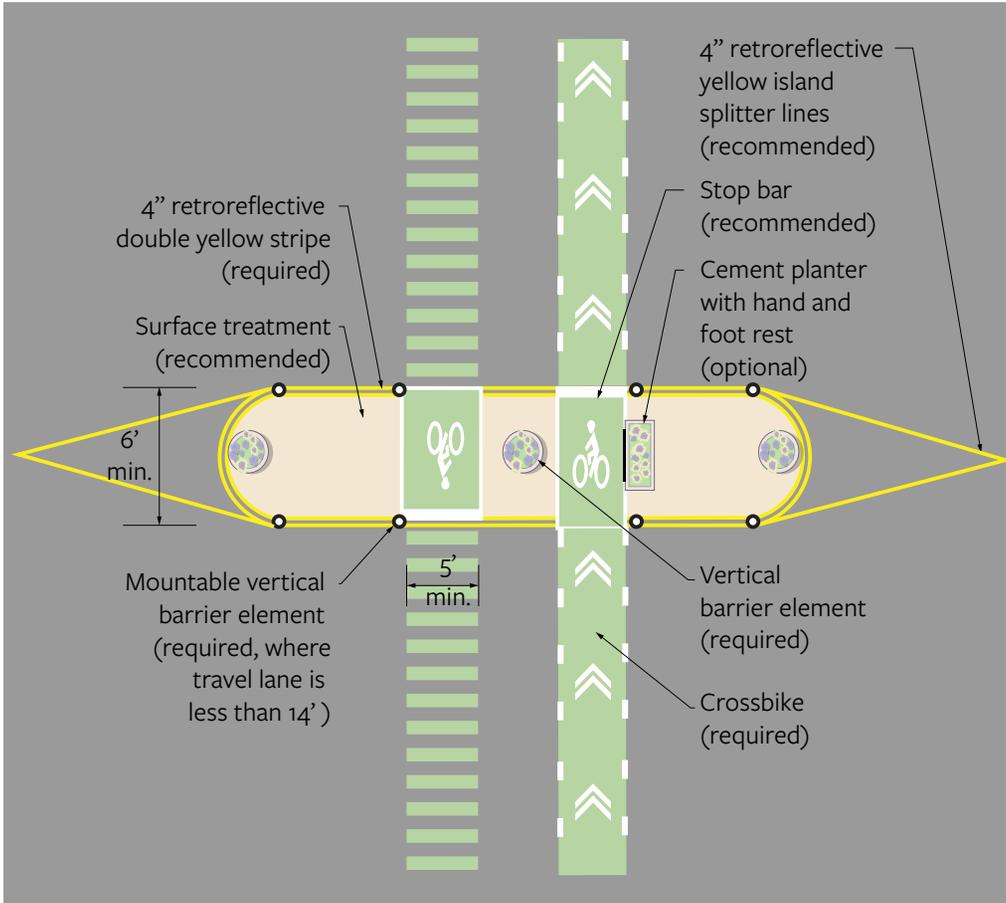
#### Recommended

- Bicycle refuge stop bars should be used and be 12" in width

### Design Notes

- Vehicular left-turns shall be restricted wherever bicycle refuge islands are created
- Pedestrian crosswalk may be adjusted or realigned to enable a vehicular left-turn and provide vertical protection for queuing cyclists

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 3 SAFER PLACES TO DRIVE

### 3.A MINI-ROUNABOUT / NEIGHBORHOOD TRAFFIC CIRCLE

Mini-roundabouts and neighborhood traffic circles simplify vehicle turning movements and lower vehicle speeds at intersections. These traffic-calming facilities have been shown to improve safety, air quality, and reduce noise pollution. Roundabouts can be installed using road markings, and vertical quick-build elements. In the long-term, the implementation of permanent roundabouts or neighborhood traffic circles offer opportunities to beautify streets through greenery and/or artistic installations.

#### Applications

Neighborhood Slow Zones | Neighborhood Greenways

#### Basic Components

##### Required

- A center Island shall be used and demarcated by a 4" retroreflective yellow stripe (traffic paint, thermoplastic, or traffic tape)

##### Recommended

- Splitter Island should be demarcated by 4" single or double yellow perimeter stripe
- Circular planters should be used to increase vertical deflection and beauty, and should include 4 circular intersection W2-6 sign or similar
- Surface material should be used to more visibly designate the mini roundabout and splitter islands
- Yield line markings should be placed in advance of the intersection

##### Optional

- Splitter Islands may be used to calm and deflect vehicular traffic approaching the intersection
- Ceramic markers, rubber speed humps, armadillos, delineators and other barriers may be used to to define the perimeter of the roundabout or splitter islands
- A mini rubber or mounded asphalt roundabout island may be used as a more robust, but still inexpensive and removable island option
- Mural surface treatment may be used but shall not to be paired with full intersection murals
- Chevrons maybe used to reinforce the direction of travel

#### Dimensions

##### Required

- Mini roundabouts shall maintain 15' clear between any curb and vertical element used to define the roundabout island
- Travel lanes shall be a minimum of 9' between the curb and the nearest edge of the splitter island (if used), and a maximum of 11'

##### Recommended

- Mini roundabout island dimensions will vary, but 10' diameter is common

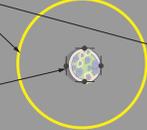
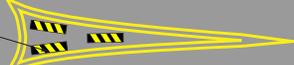
#### Design Notes

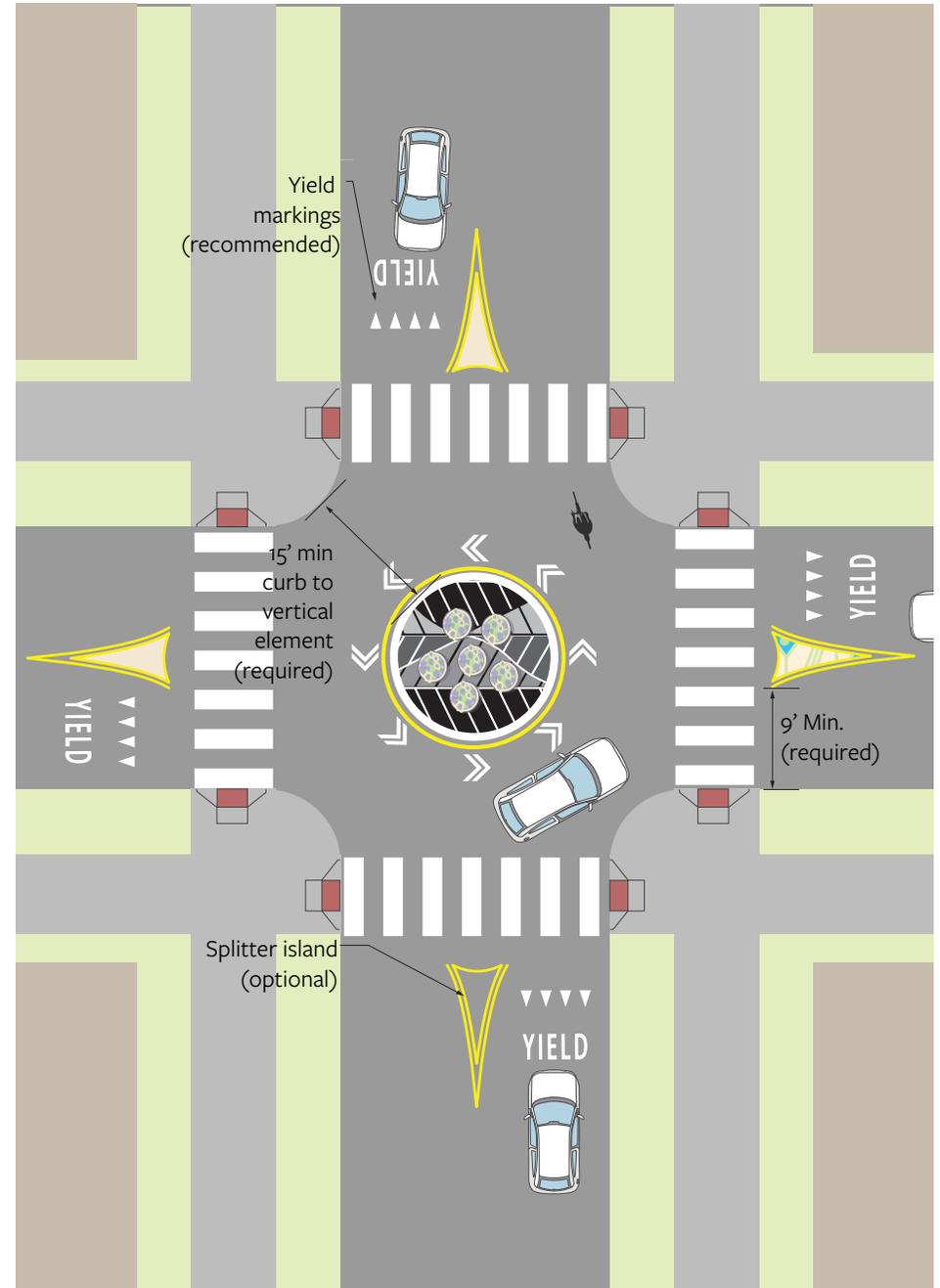
- Mini-roundabouts operate as yield controlled while neighborhood traffic circles operate as stop controlled
- Mid-point of center island should be positioned where diagonal curb to curb lines intersect
- Design must allow emergency and design vehicles to make turn in front of and/or over any mountable vertical barrier elements
- Epoxy recommended as an adhesive for the long-term installation of the mini rubber roundabout island and speed humps
- Partner with community organizations and/or city contractors to maintain planters and street murals
- See NACTO's Urban Street Design Guide for more details

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT

## Center Island

## Splitter Island

4" retroreflective yellow perimeter stripe (required)		
Circular planter with 4 x circular intersection W2-6 sign or similar (recommended)		
Surface treatment (recommended)		
1' retroreflective white stripe (optional)		
Armadillo / zebra (optional)		
Ceramic marker (optional)		
Mural art (optional)		
<b>MINI RUBBER ROUNDABOUT ISLAND</b>		
mini rubber roundabout island (optional)		
<b>SPEED HUMP ARRAY</b>		
4' Recycled rubber or heavy-duty rubber speed bumps (optional)		
<b>MOUNDED ASPHALT</b>		
Sinusoidal mounded asphalt with 5" center height (optional)		
Retroreflective chevrons to indicate travel direction (optional)		



## 3B CHICANES

Chicanes are offset curb lines that introduce lateral shifts to travel lanes, creating a ‘slalom effect’ that can reduce vehicular speeding along residential or downtown streets. Chicanes can also provide an opportunity to introduce public art or other street enhancements, like planters and on-street bicycle parking. Low-cost chicanes may be created along narrow streets with only one parking lane by alternating the location of the parking.

### Applications

Neighborhood Greenways | Neighborhood / Downtown Slow Zones

### Basic Components

#### Required

- A 4” retroreflective double white stripe shall be used to demarcate the chicane area (traffic paint, thermoplastic, or traffic tape)

#### Recommended

- Parking stops and other vertical barrier elements (ceramic markers delineator posts, armadillos etc. ) may be placed between the parking lane and the chicane, as well as along the hypotenuse side of the chicane triangle to discourage vehicular encroachment
- A surface material (traffic paint, Ruby Lake Glass, or methyl methacrylate) should be used to more visibly designate the chicane area

#### Optional

- Circular or rectangular planters may be used to beautify chicane areas
- Murals may be used to beautify the chicane area

### Dimensions

#### Required

- The minimum chicane ingress length shall be 15’
- The minimum chicane egress length shall be 5’
- Chicanes shall have a maximum width of 7’
- Chicane width shall be equal to one foot less than parking lane width
- Street width with two-way travel lanes and chicanes shall be a minimum of 25’ in width, with 18’ dedicated to the travelway

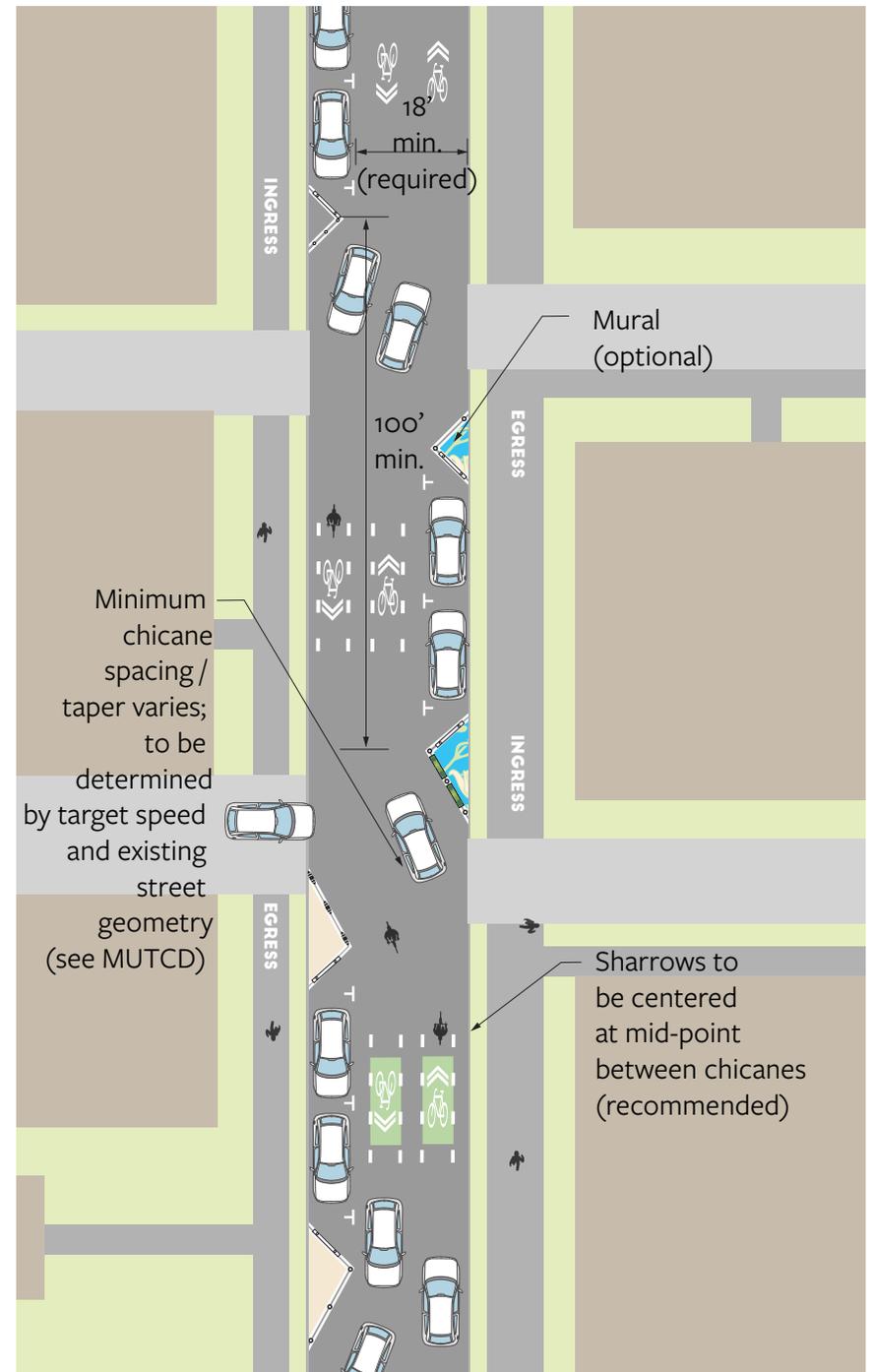
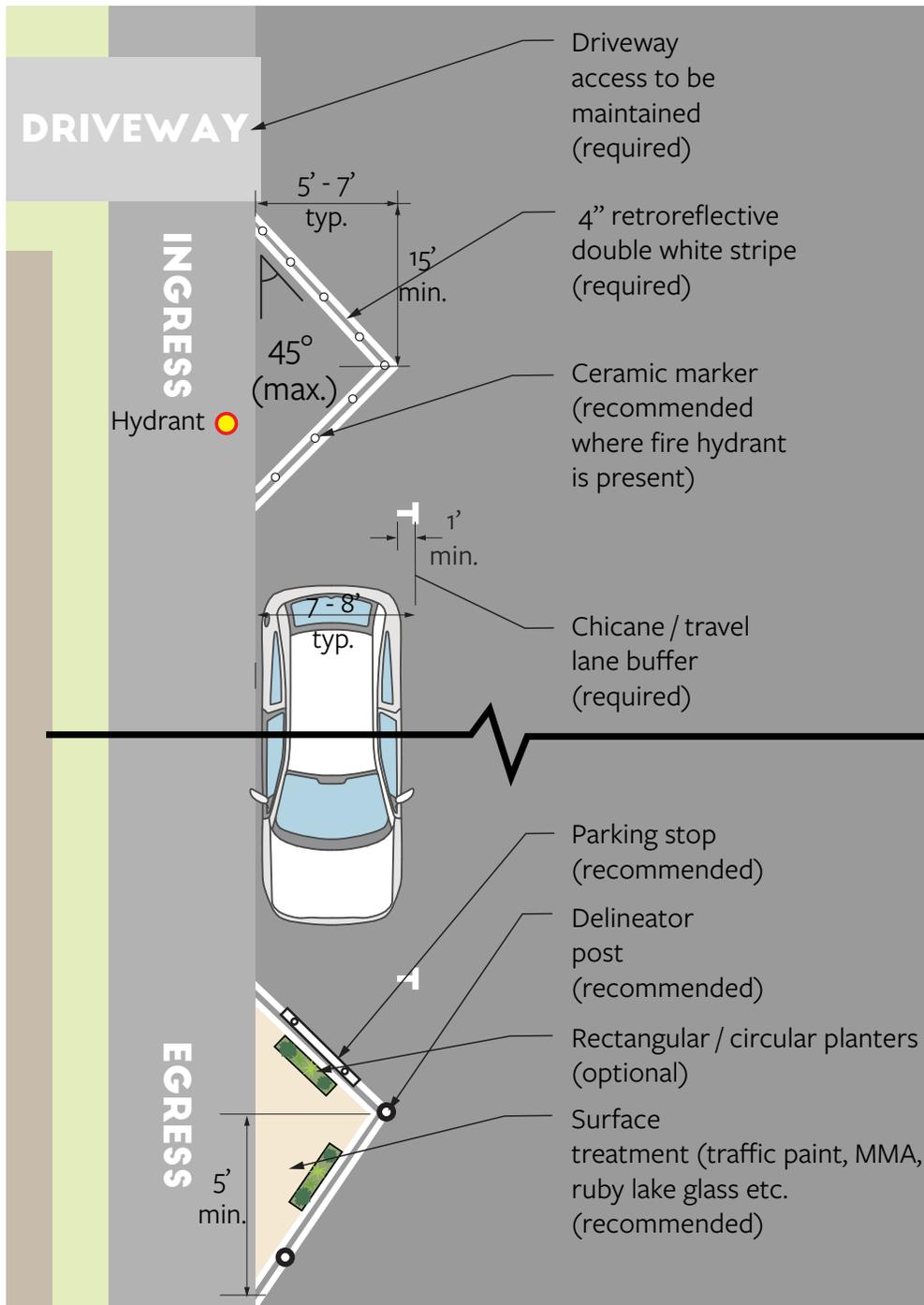
#### Recommended

- Chicanes should utilize a 45° angle (or shallower), as measured from the curb to allow safe lane shift, facilitate snow plowing operations, and to maximize available on-street parking
- A minimum 1’ buffer should be provided between the outside edge of the chicane and the outside edge of the parking lane
- Where used, shared use lane markings shall be centered between chicane locations

#### Design Notes

- Chicanes may be installed on low-speed (25 mph or lower) and low-volume (3,000 ADT or lower) streets such as neighborhood greenways and within neighborhood / downtown slow zones
- Parking chicanes should be placed on alternate sides of the street approximately every 100’ as driveways and intersections allow
- Placement of chicanes should not impede access to / from existing driveways, unless part of an access management plan
- Except for intersection approaches, consider removing centerline from streets with chicanes
- Minimum chicane spacing / taper varies; to be determined by target speed and existing street geometry (see MUTCD for more guidance)
- Chicanes must maintain stormwater flow / drainage.
- Vertical barrier elements should be used to alert drivers and snow plow operators to presence of the chicane area, or removed for winter
- Ceramic markers are recommended as the vertical barrier element at chicanes adjacent to fire hydrants
- See NACTO’s Urban Street Design Guide for more details

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 3C FLUSH MEDIAN

A median is a continuous designated linear area in the middle of the thoroughfare that separates directionally opposing travel lanes. Medians are used to slow vehicular traffic by reducing travel lane width and providing shorter crossing distances and refuge for pedestrians. Medians can also beautify a street by creating space for greenery and artistic street mural installations.

### Applications

Neighborhood Greenways | Neighborhood / Downtown Slow Zones

### Basic Components

#### Required

- A 4" retroreflective double yellow line shall demarcate the flush median area (traffic paint, thermoplastic, or traffic tape striping)
- Mountable vertical barrier element(s), such as parking stops or delineator posts shall be used along the perimeter of the flush median

#### Recommended

- A surface material (traffic paint, Ruby Lake Glass, or methyl methacrylate) should be used to more visibly designate the flush median area

#### Optional

- Ceramic markers and armadillos may also be used as vertical, mountable barriers along the perimeter of flush medians.
- Murals may be used to delineate the flush median area
- Circular or rectangular planters may be used for beautification and to further delineate flush medians

### Dimensions

#### Required

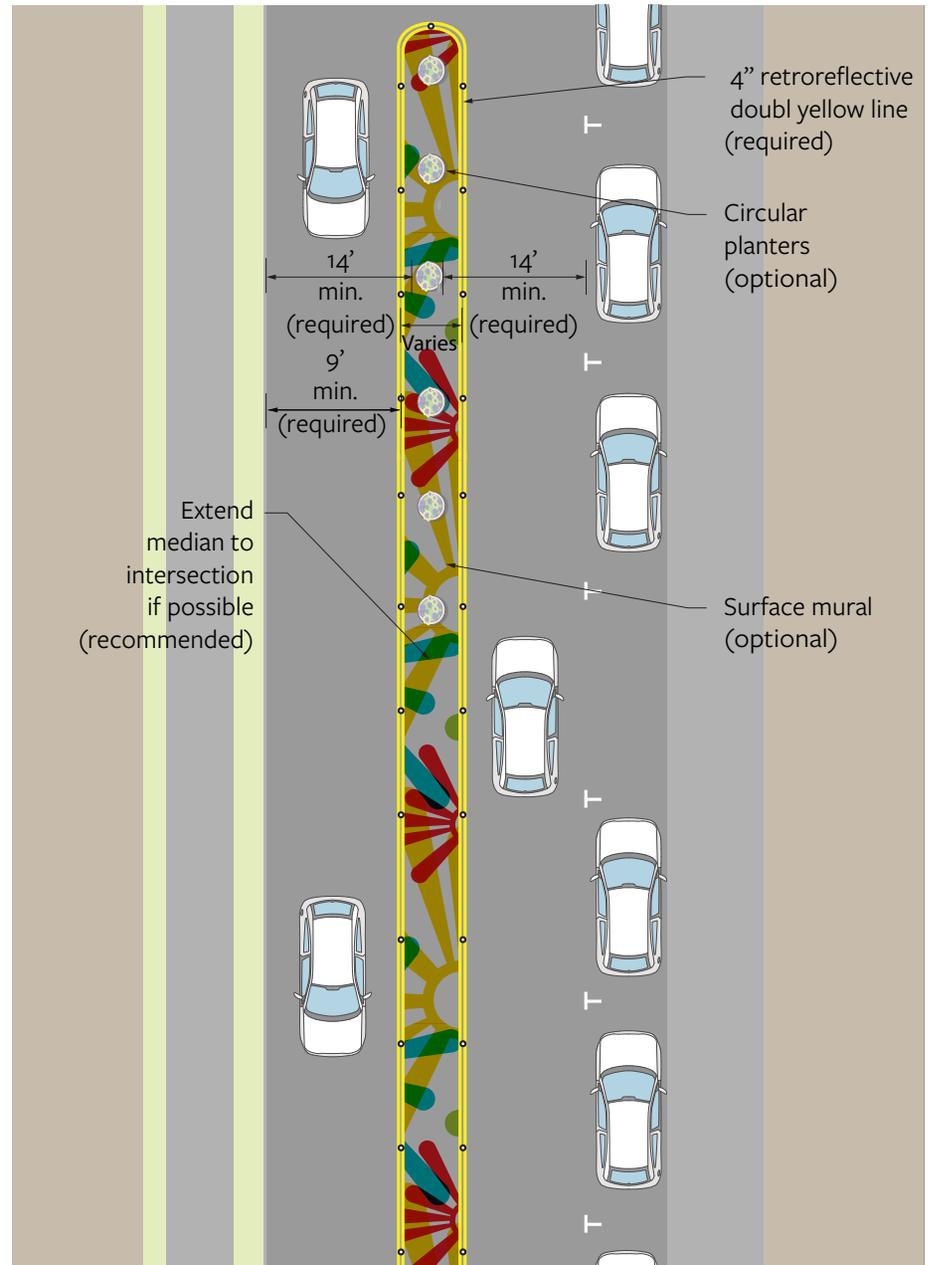
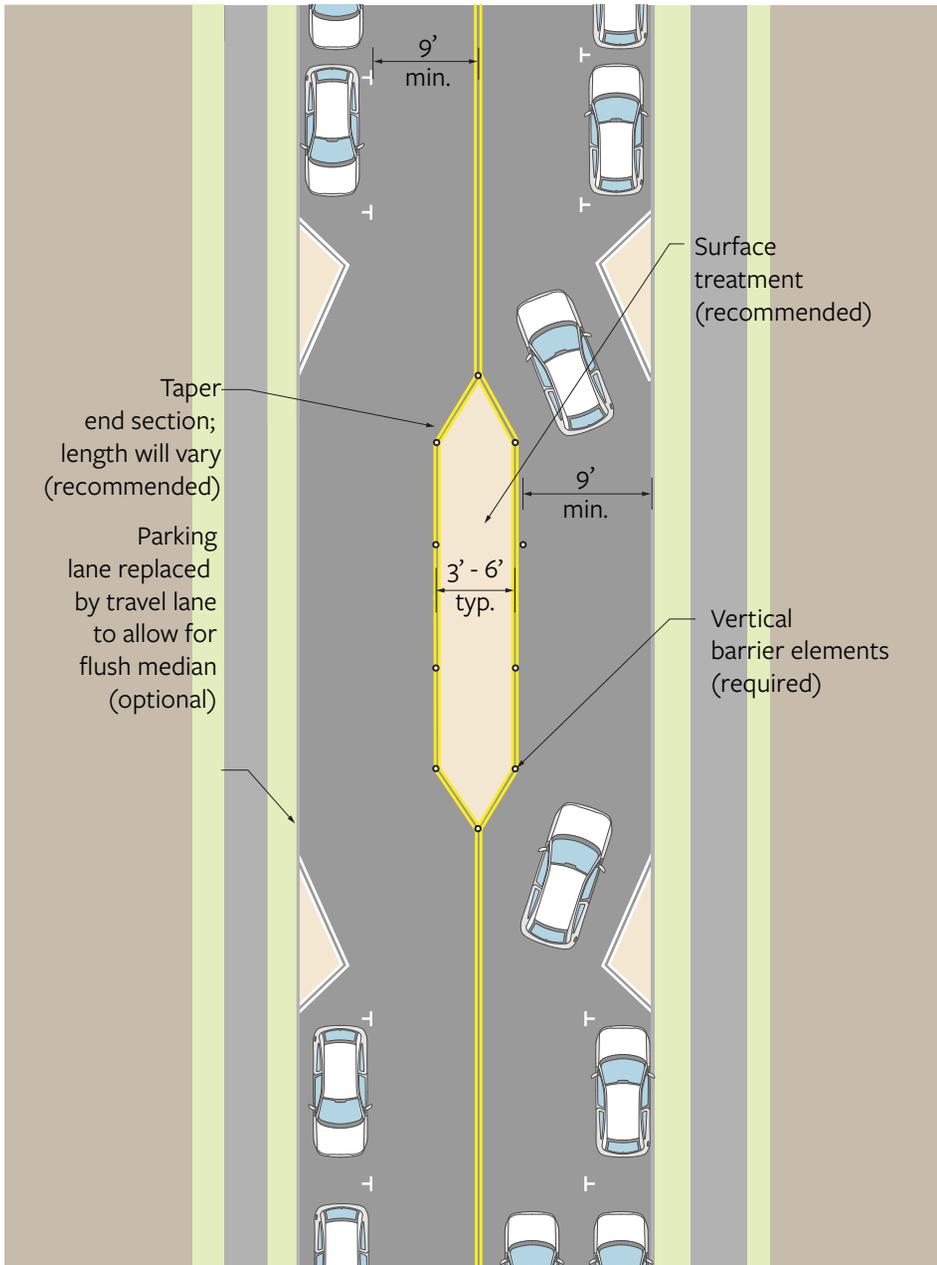
- Length and width will vary based on specific street dimensions; Minimum width shall be 3', or 6' if intended for use as a pedestrian or bicycle pedestrian refuge island
- Travel lanes should maintain a minimum 9' clear width between the curb and mountable vertical barriers to enable emergency vehicle access
- 14' clear width between non-mountable vertical barriers shall be maintained for emergency vehicle access / operation

- Median taper lengths will be determined by target speed and existing street geometry (see MUTCD for more guidance)

### Design Notes

- Flush medians may be installed along thoroughfares with wide travel lanes that are not designated for a bikeway in the Plan BTV Walk/Bike Plan
- Flush medians should be centered along the thoroughfare's centerline, between the opposing directions of travel
- Mid-block parking lanes may be replaced by travel lanes where a mid-block crossing or traffic-calming is desired
- Flush medians may be used as snow storage areas; vertical barrier elements may need to be removed seasonally to allow snow plow operators to best utilize the median area
- Flush medians should be extended to intersections wherever possible
- Flush median islands do collect debris and will require occasional maintenance, especially if they incorporate a pedestrian or bicycle refuge

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 3.D SIGHT TRIANGLE CONVERSIONS

Sight triangle visibility zones restrict the proximity of on-street parking near intersections. Often called “daylighting,” this design technique allows people driving to negotiate tight turn movements while also increasing the visibility of other street users, such as bicyclists and pedestrians. Daylighting intersections also allows for the conversion of valuable street space into enhancements for people walking and cycling. Sight visibility triangle zone conversions are appropriate where larger curb extensions are not warranted or desired.

### Applications

All city streets with on-street parking

### Basic Components

#### Required

- A single or double 4” retroreflective white stripe (traffic paint, thermoplastic, or traffic tape) shall demarcate the sight triangle area

#### Recommended

- Barrier elements such as parking stop, armadillos, ceramic markers or delineator posts should be used to ensure motor vehicles do not encroach into the sight triangle area.
- A surface material (traffic paint, Ruby Lake Glass, or methyl methacrylate) should be used to more visibly designate the sight triangle zone

#### Optional

- Murals may be used to delineate the sight visibility triangle area
- Circular or rectangular planters may be used for beautification and to further prevent vehicular encroachment
- Bicycle parking corrals may be added to sight visibility triangle zones, provided there is a demonstrated need and adequate space to do so

### Dimensions

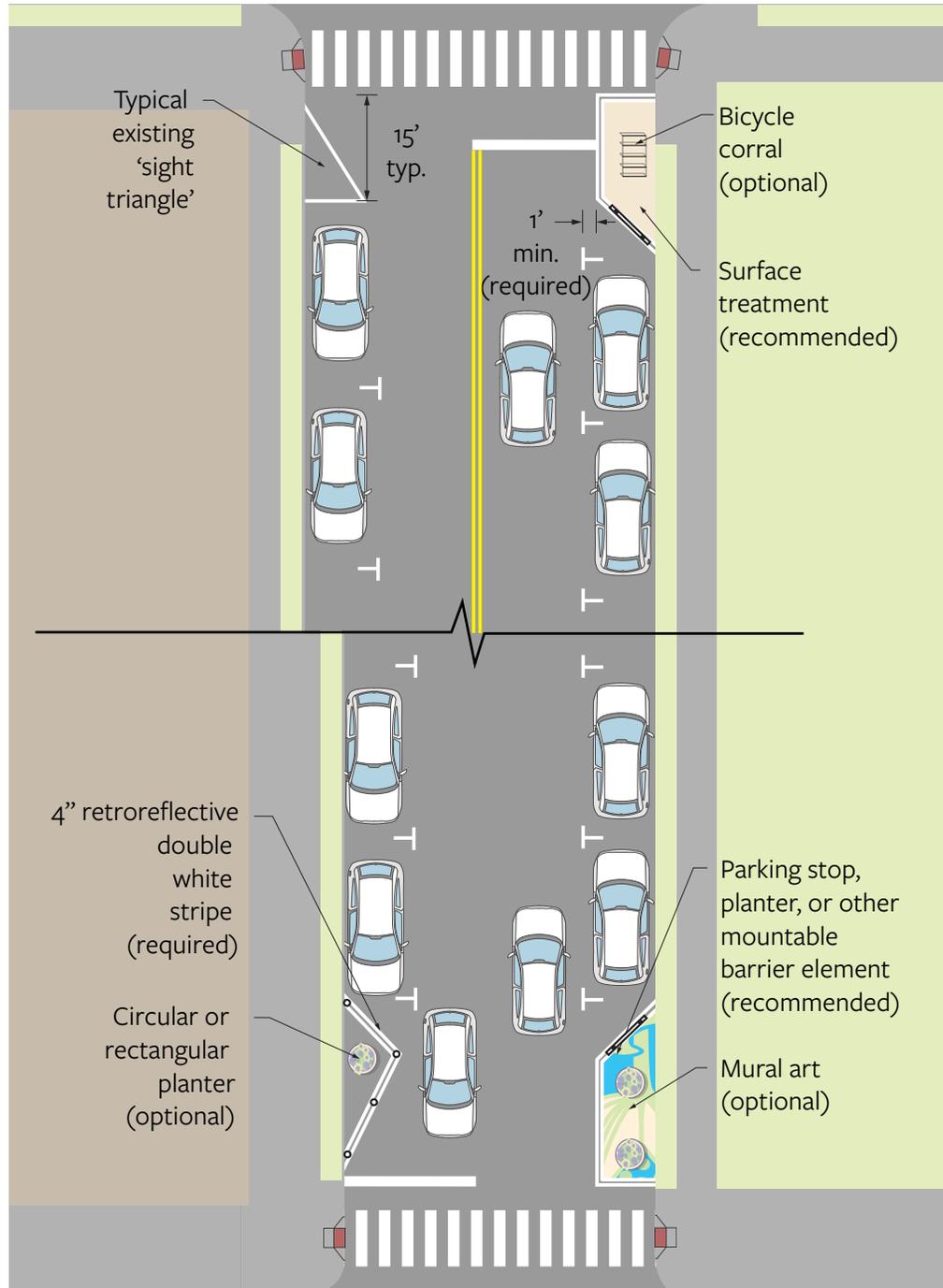
#### Required

- Sight triangle width shall be 1’ less than parking lane width
- Sight triangle length will vary, depending on existing street dimensions and built context; 10’ minimum length, 15 - 20’ is typical

### Design Notes

- When determining the sight distance triangle, use the thoroughfare’s desired target speed, rather than the design speed
- Large corner radii with large sight triangles may enhance visibility, but may also encourage people driving to speed, effectively diminishing any peripheral visibility gains retained at a slower speed
- Because street corners and intersections frequently serve as gathering places for people, facilitate commerce, and accommodate bus stops, bicycle parking, and other amenities, street design should focus on creating eye contact between people driving and all other street users, rather than focus on the creation of clear vehicular sight-lines only.
- Traffic control devices must be unobstructed in the intersection and shall be free of tree cover or visual clutter
- Where present, site visibility triangle treatments may be used to further delineate ‘no parking’ zones for fire hydrant access
- Vertical elements placed in the sight triangle must still meet visibility requirements using engineering judgement
- Where site triangle visibility zones exist, consider the addition of bicycle parking, painted curb extensions, planters, mural art, and/other amenities that maintain site lines while providing a higher and better use of street space

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT



## 3.E VEHICULAR PINCH POINTS

Pinch Points, sometimes called “travel lane chokers” are mid-block curb extensions that may be applied to both sides of one- or two-way streets. Pinch points are similar to neckdowns, only they do not feature marked crosswalks. Pinch points help slow traffic speeds by forcing a yield condition between opposing directions of vehicular travel, or by narrowing the travelway along a one-way street. They also provide opportunities for placemaking enhancements such as public art, benches/planters, bus stop amenities, and other stormwater treatments (when built out with permanent materials).

### Applications

Neighborhood Greenways | Neighborhood / Downtown Slow Zones

### Basic Components

#### Required

- A 4” retroreflective double white stripe (traffic paint, thermoplastic, or traffic tape) shall demarcate the pinch point area
- Mountable vertical barrier elements such as parking stops, armadillos, ceramic markers, or delineator posts shall be used to ensure motor vehicles do not encroach into the pinch point area

#### Recommended

- A surface material (traffic paint, Ruby Lake Glass, or methyl methacrylate) should be used to more visibly designate the pinch point

#### Optional

- Yield markings may be used to reinforce desired vehicular movement
- Circular or rectangular planters may be used for beautification and to further prevent vehicular encroachment
- Murals may be used for beautification and to increase the visibility of the pinch points

### Dimensions

#### Required

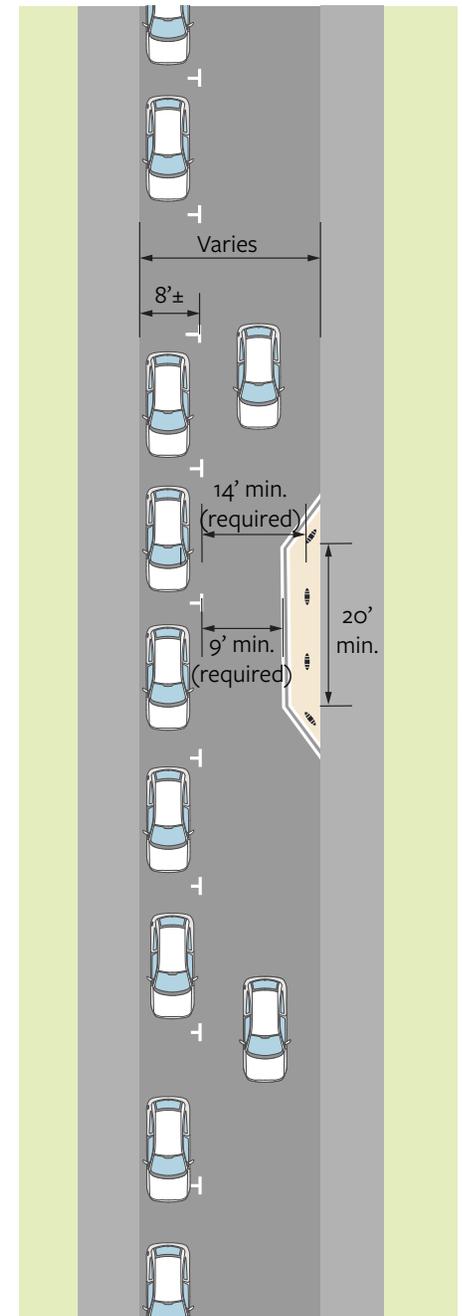
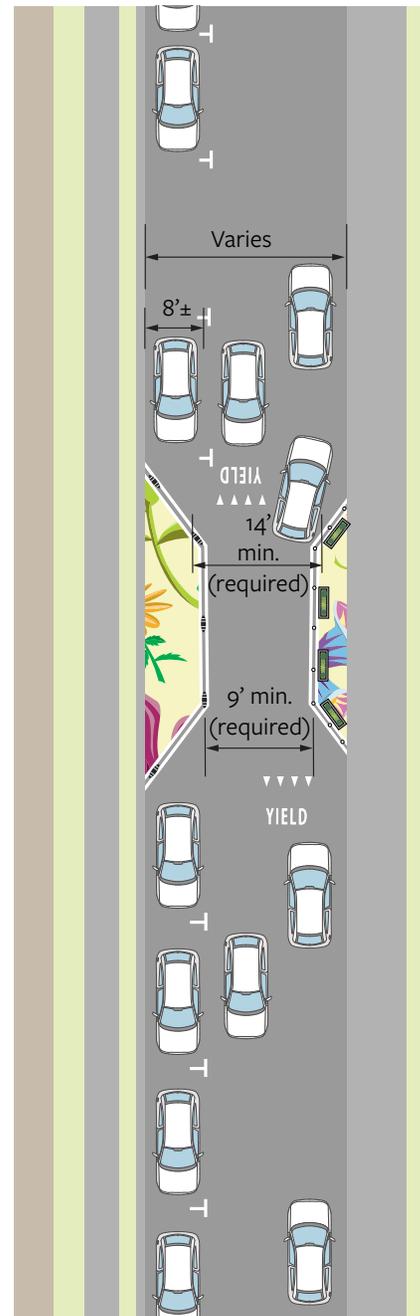
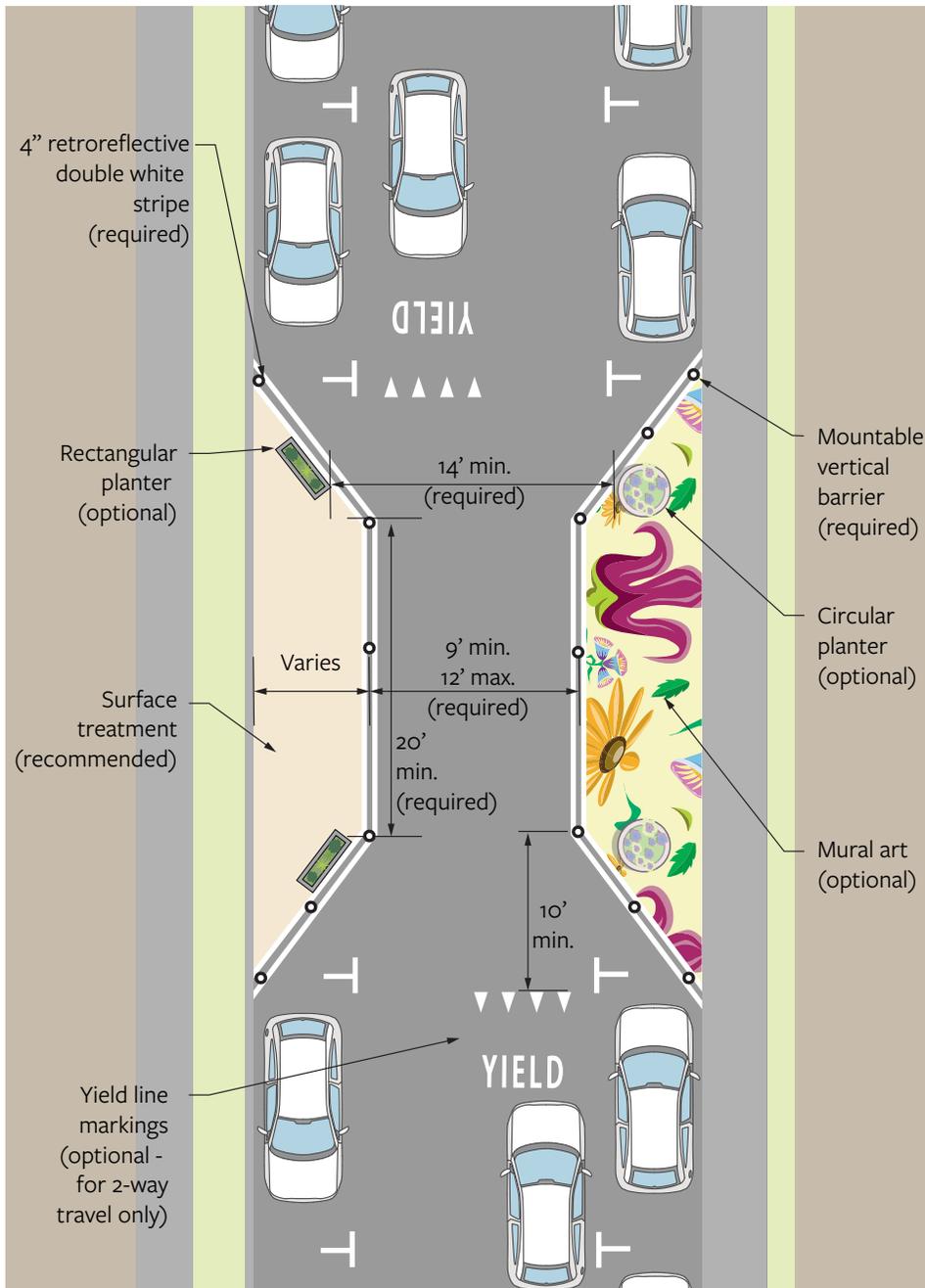
- The ‘choke zone’ length shall be a minimum of 20’
- The choke point width will vary based on street design /configuration, but shall be a minimum of 6’ wide where parallel on-street parking is present
- If used, yield lines shall be located at least 10’ from the beginning of the choke point

- Travel lanes should maintain a minimum 9’ clear width between mountable vertical barriers to enable emergency vehicle access
- A 14’ clear width between non-mountable vertical barriers shall be maintained for emergency vehicle access / operation

### Design Notes

- Pinch points may be installed on low-speed (25 mph or lower), low-volume (3,000 ADT or lower) streets such as neighborhood greenways and within neighborhood/downtown slow zones
- Pinch point width is typically one foot less than the width of the parking lane, but the curb extension can also extend to the curbside edge of the bicycle lane when one is striped
- Placement of pinch points should not impede access to/from existing bicycle lane or bus stops, or driveways unless part of an access management plan
- Except for intersection approaches, consider removing the centerline from streets with pinch points
- In select locations, the area defined by a pinch-point may be used for other streetscape amenities, such as bicycle parking / fix-it stations, trash receptacles, benches, bus stops, etc. but must not impede pedestrian flow, obstruct clear path emergency vehicle operations, or limit sight lines
- Pinch point curb extensions must maintain stormwater flow / drainage
- Vertical barrier elements should be used to alert drivers and snow plow operators to presence of the pinch point area
- Pinch points may be designed in conjunction with a fire hydrant, however the length of the curb extension should be equal to / greater than the ‘no parking’ zone (typically 15 feet in either direction) and access to the hydrant must not be impeded by any non-mountable vertical barrier elements

# COMPONENTS AND DESIGN DIMENSIONS IN CONTEXT





**MATERIALS STANDARDS**

## 4.0 BARRIER ELEMENTS

The Burlington Quick-Build Standards include 13 barrier elements that may be applied to one or more project types found in the table below. Note that this materials standards guide should be seen as a starting point as the Quick Build program continues to be established. The City of Burlington will need flexibility in its approach as it optimizes its material choices for safety, durability, aesthetics, and maintenance concerns. Thus, ongoing material experimentation and feedback is to be expected and is encouraged as the program continues to evolve.

	PROJECT TYPE								
BARRIER ELEMENT	PROTECTED BIKE LANE	BIKE CORRAL	BICYCLIST / PEDESTRIAN REFUGE ISLAND	CURB EXTENSION	PEDESTRIAN PLAZA	PARKLET	CHICANE/ PINCH POINT	MINI- ROUNDABOUT/ TRAFFIC CIRCLE	TRAFFIC CALMING OR OTHER
4.A Zicla Zebra System “Armadillo”									
4.B Ceramic Markers									
4.C Cycle Lane Delineator									
4.D Delineator Post									
4.E K-71 High-Impact Bollard									
4.F Parking Stop									
4.G Planter - Rectangular Concrete									
4.H Planter (Circular)									
4.L Planter (Rectangular)									
4.J Quick Curb + Delineator Post									
4.K Rubber Roundabout Island									
4.L Speed Hump									
4.M Zicla Bus Island									

## 4. BARRIER ELEMENT DETAILS

### 4.A. ARMADILLO (ZICLA ZEBRA SYSTEM)

#### Applications

Protected Bike Lane | Curb Extension | Bicyclist / Pedestrian Refuge Island | Pedestrian Plaza | Chicane / Pinch Point | Mini-Roundabout / Neighborhood Traffic Circle | Parklet / Bike Corral

#### Component

- Zicla Zebra System (13, 9 or 5 series)

#### General Design Guidance

##### Protected Bike Lanes (see page 22)

- Armadillos to be spaced no more than 8' apart, per manufacturer specifications (5' recommended, rotated 30° where buffer width allows)
- Where driveways exist, no armadillo should be placed closer than 15' to either side of the driveway or intersection.
- Use higher profile Armadillos on streets with higher potential vehicular speeds
- Alternate with delineator post where increased vertical visibility is required, or where vehicles are more likely to cross into or park in the bike lane

##### Curb Extensions | Bicyclist / Pedestrian Refuge Islands | Pedestrian Plazas | Chicanes / Pinch Points

- Place armadillo unit every 5 - 10' along perimeter, between 4" retroreflective double white stripe; ensure placement does not obstruct accessibility / ADA compliance or stormwater flow

##### Mini-Roundabout / Neighborhood Traffic Circles

- The Zicla Zebra system offers differing levels of mountability; Use lower profile armadillos where larger vehicles are expected to mount the center island more frequently
- Place end-to-end in a circular formation to create inner island, leaving small gaps to accommodate stormwater flow where necessary
- Accompany with appropriate MUTCD-compliant signs

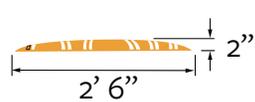
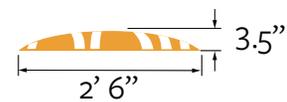
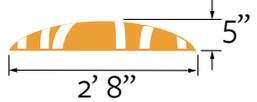
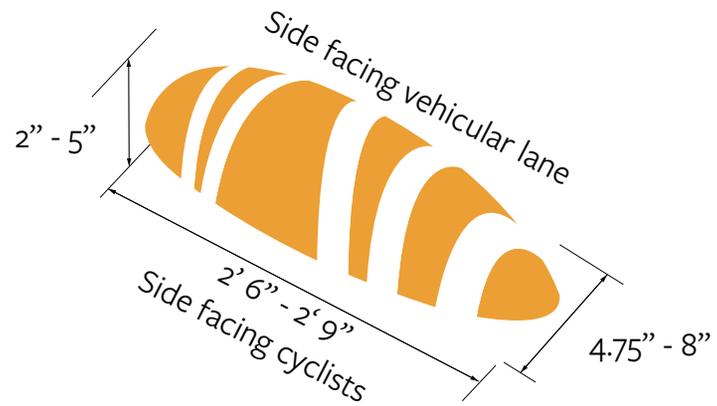
#### Parklet | Bike Corral

- Place at least two units at either end of the parklet or bike corral, perpendicular to the curb along perimeter of buffer stripe to discourage vehicular encroachment into the parklet or bike corral area

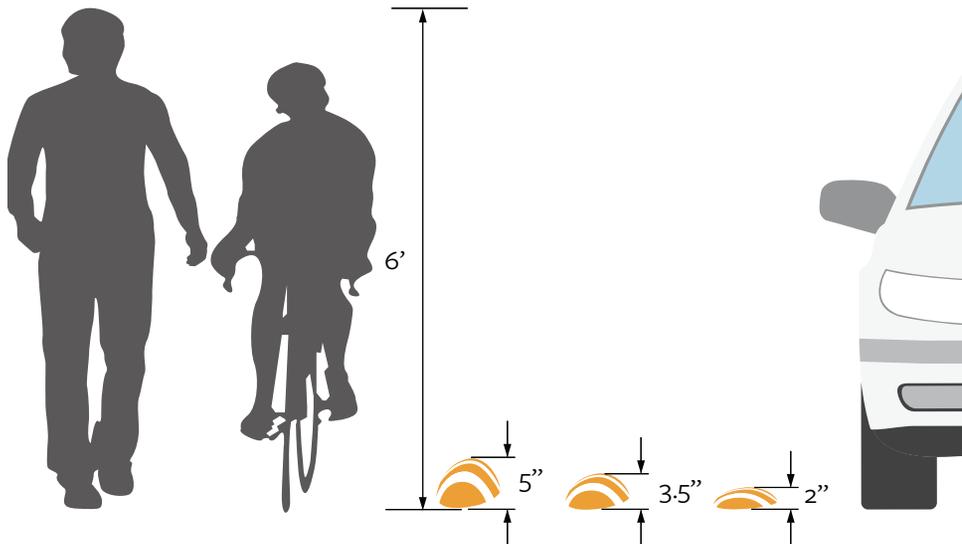
#### Design Notes

- Ensure placement does not obstruct accessibility
- Mountable profile ensures emergency and city service vehicle access, and minimal / no stormwater obstruction
- If necessary, remove for winter to facilitate snow plowing / removal; If intended for year-round use, pair with delineator posts to increase visibility for snowplow operators
- Where aesthetics are a concern, Armadillos offer a less visually obtrusive option (compared to vertical delineator posts etc.)
- The Armadillo's low visual profile may lead to decreased safety perception for people walking or biking (compared to more vertical barrier elements like planters or delineator posts etc.)
- The reflective markings on each unit are asymmetrical; it is recommended that the side with the greater density of reflective bands face oncoming vehicular traffic

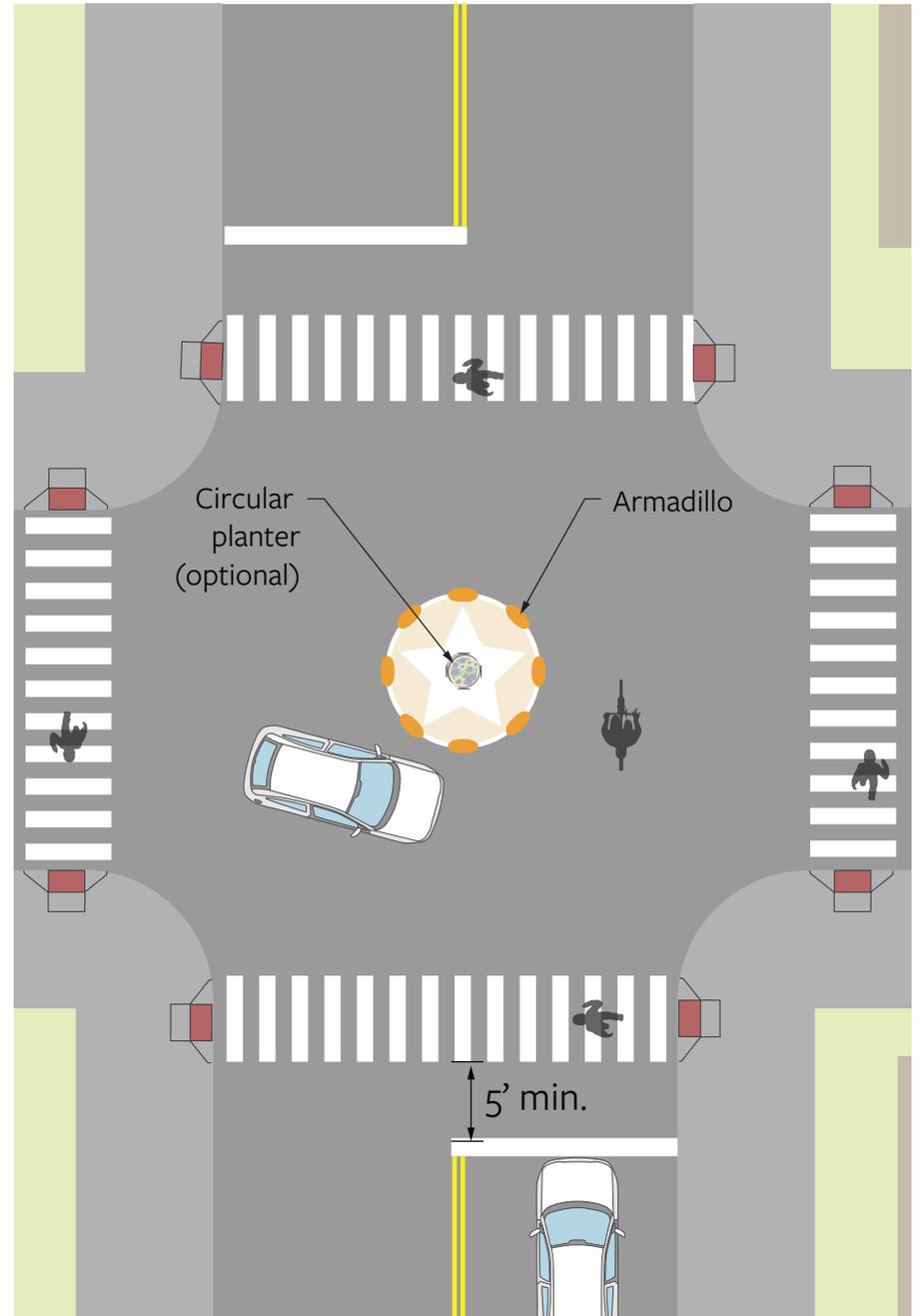
## DETAIL



## PROFILE



## IN CONTEXT



## 4.B. CERAMIC MARKERS

### Applications

Curb Extension | Pedestrian Plaza | Chicane / Pinch Point | Mini-Roundabout / Neighborhood Traffic Circle | Bike Corral

### Components

- 4", 6", or 8" circular or rectangular Ceramic Marker

### General Design Guidance

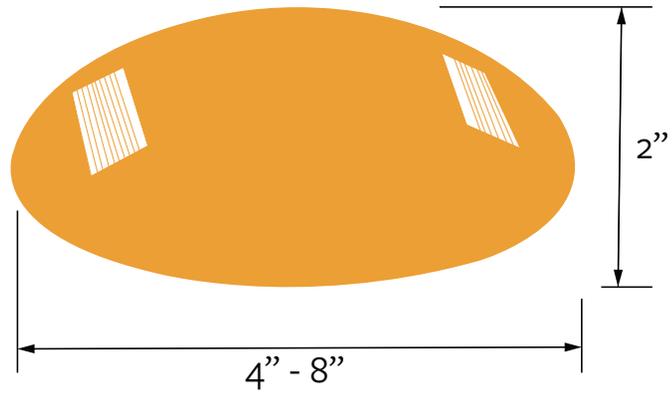
#### All Applications

- Affix to pavement per manufacturer's specifications (see Apex or Ennis-Flint products) no more than 5' apart to discourage vehicular encroachment
- Installation / adhesive set time will be impacted by weather and temperature
- Markers should be allowed to fully set before sustaining any impact
- Center or place ceramic markers along inside edge of retroreflective 4" double white stripe demarcating perimeter of the Quick Build project element (curb extension, pedestrian plaza etc.)

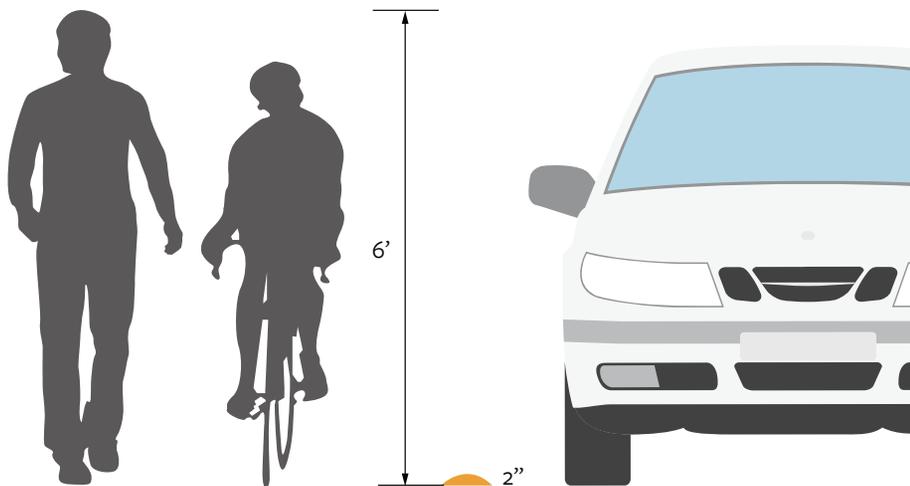
### Design Notes

- Reflective and non-reflective ceramic markers are available; reflective ceramic markers are strongly encouraged
- Ceramic markers are fully mountable and may especially appropriate where emergency vehicle need access, such as along curb extensions or pinch point
- Ceramic markers should be used in conjunction with other vertical elements (such as circular or rectangular planters, delineator post, K-71 bollards etc.) where physical protection is required.
- For use only along low-volume streets only (3,000 ADT or less)

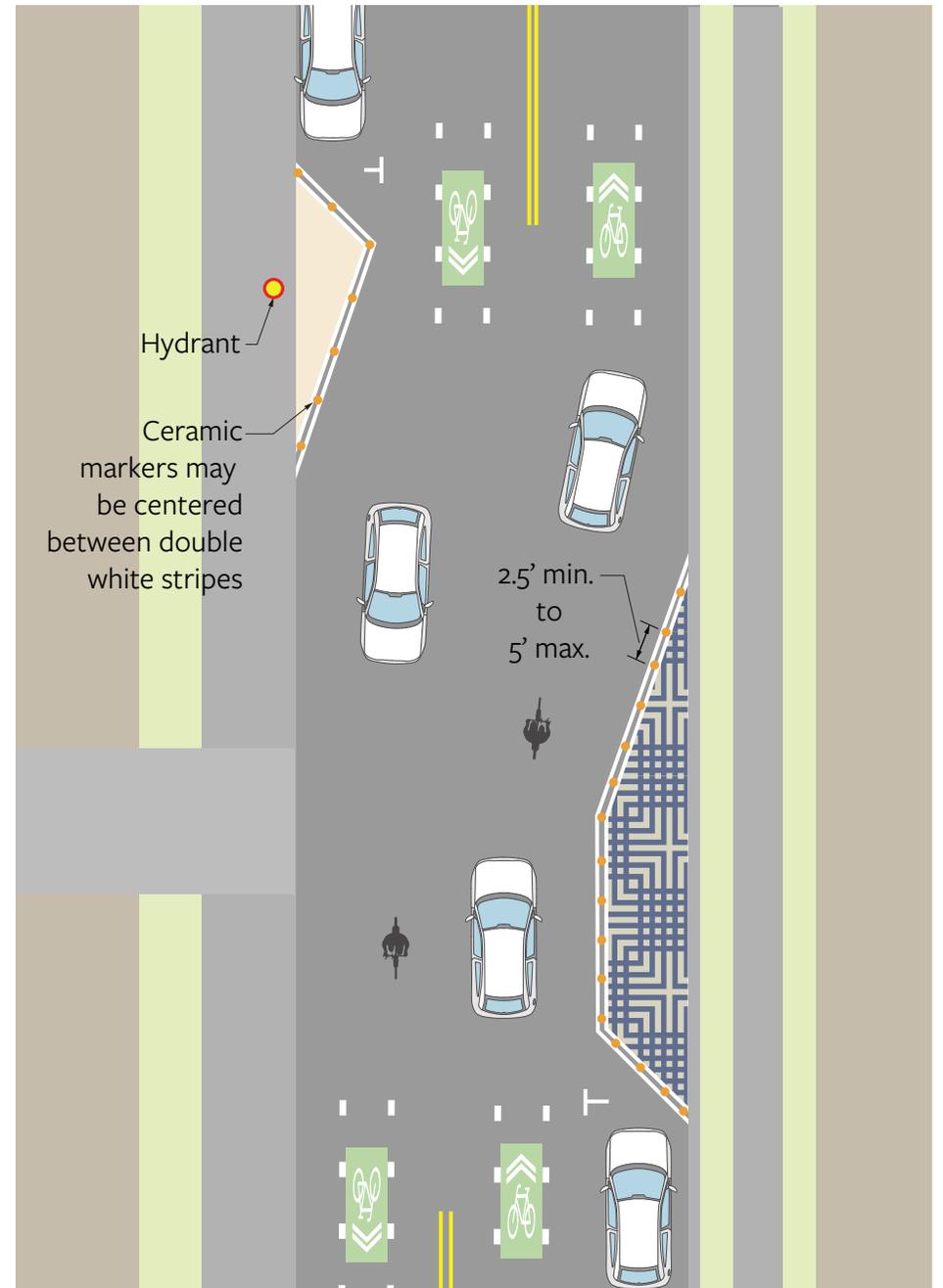
## DETAIL



## PROFILE



## IN CONTEXT



## 4.C. CYCLE LANE DELINEATOR

### Applications

Protected Bike Lanes

### Components

Traffic Logix CycleLane or similar (Recycled rubber delineator unit with reflective white marking tape).

### General Design Guidance

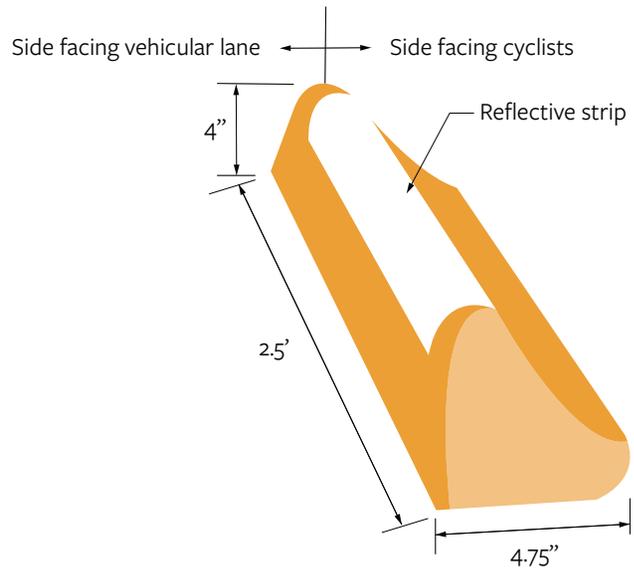
#### Protected Bike Lanes

- Place curved edge facing the bike lane
- Ensure placement does not obstruct accessibility / ADA access or flow of stormwater
- Ensure retroreflective strip is placed on the delineator for night-time visibility; Replace strips as necessary
- Center CycleLane delineators within bike lane buffer
- Use a 5' minimum to 15' maximum spacing to discourage motorists from using portions of the bike lane for movement or parking
- Allow a minimum of 2 ft. clear width for installation.
- Cycle lane delineators be placed end-to-end at intersection approaches
- Where driveways exist, no delineator shall be placed closer than 15' to either side of the driveway or intersection.

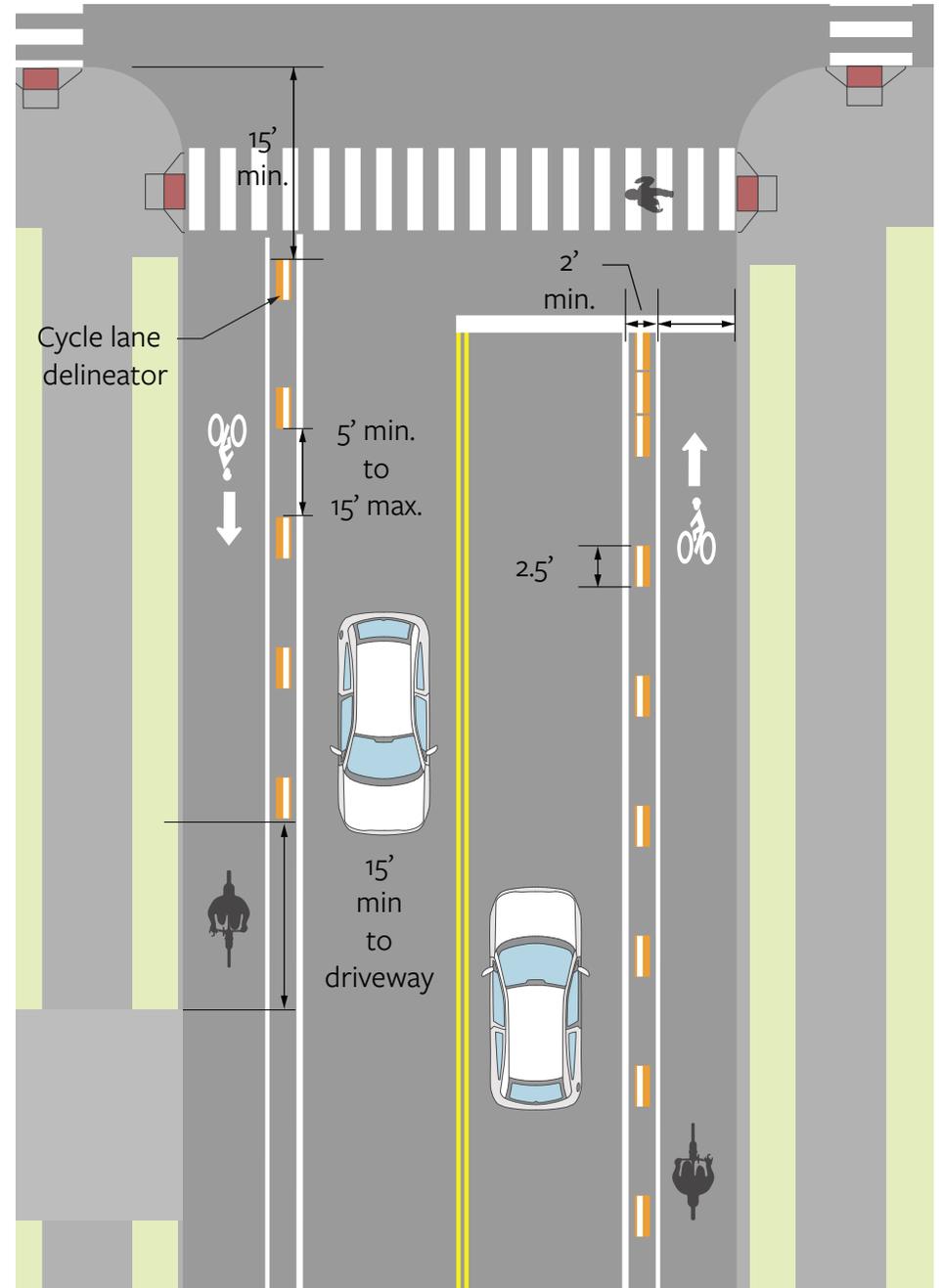
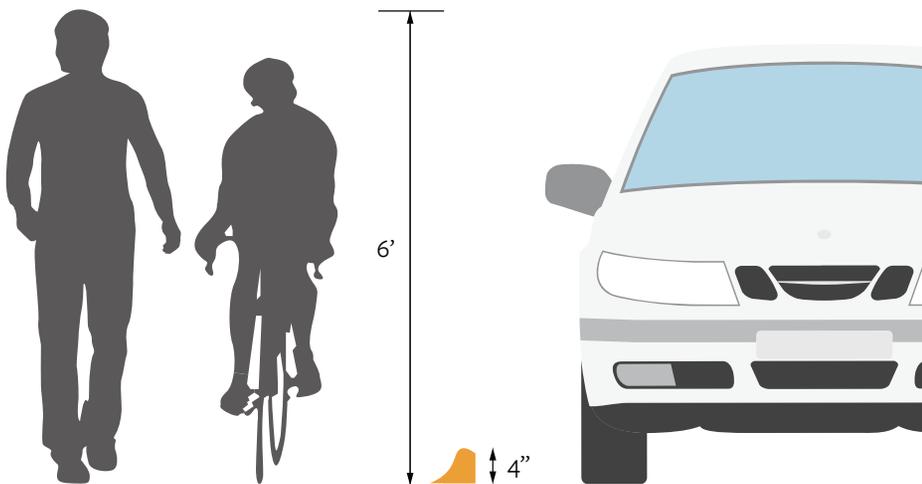
### Design Notes

- Cycle lane delineators may be removed for road resurfacing, snow plows, or to simply test a few units at a specific location.
- Allow gaps for stormwater drainage, curbside pedestrian access, or for cyclists to cross through the barriers as necessary.

## DETAIL



## PROFILE



## 4.D. DELINEATOR POST

### Applications

Protected Bike Lanes | Curb Extensions / Chicanes / Pinch Points | Pedestrian / Bicyclist Refuge Islands | Pedestrian Plazas | Parklets / Bike Corrals

### Components

- Removable plastic delineator post with reflective strip
- Removable plastic base

### General Design Guidance

#### Protected Bike Lanes

- Delineator posts to be centered between retroreflective 6" and 4" white stripes, with a minimum spacing of 5' and a maximum spacing of 15' to discourage motorists from using portions of the bike lane for movement or parking
- 27" delineator posts may be considered for bikeways and other applications where 3' delineator posts could interfere with bicycle handlebars (e.g. on two-way bikeways where bike lane width is less than 5')

#### Curb Extensions / Chicanes / Pinch Point

- Delineator posts to be placed between retroreflective 4" double white stripes, with a minimum spacing of 5' and a maximum spacing of 10'
- To increase visibility / detection, place delineator posts at the corners of the crosswalk and the curb extension; posts may be placed / spaced strategically in other locations to facilitate detection / accessibility

#### Pedestrian / Bicyclist Refuge Islands

- Delineator posts to be placed between retroreflective 4" double white stripes, with a minimum spacing of 5' and a maximum spacing of 10'
- Delineator posts shall be placed on the outside edges of the crosswalk and may be placed / spaced strategically in other locations to facilitate detection / accessibility
- Where bi-directional crossbikes are present, delineator posts should be placed on the outside edges of the two crossbike markings; where uni-directional crossbikes are used, delineator posts should be placed

on the crossbike edge nearest to oncoming vehicular travel

#### Pedestrian Plazas

- Delineator posts to be centered between retroreflective 4" white stripes, with a minimum spacing of 5' and a maximum spacing of 10'.
- Delineator posts shall be placed on the outside edges of crosswalks (if present) and may be placed / spaced strategically in other locations to facilitate detection / user accessibility

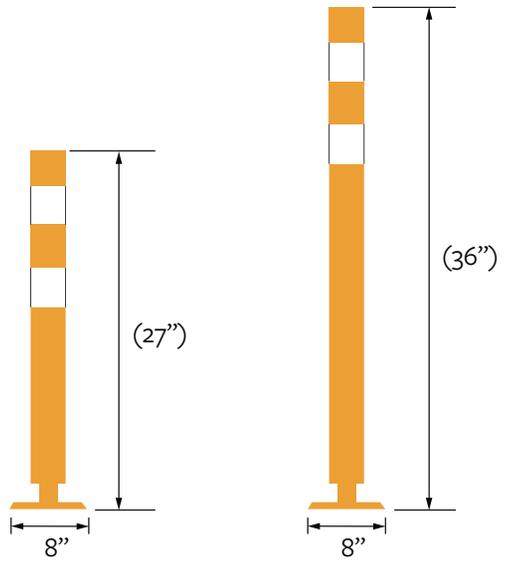
#### Parklet / Bike Corral

- Place at least two delineator posts at either end of the parklet or bike corral, along the perimeter of the buffer stripe perpendicular to the curb, to discourage vehicular encroachment into the parklet or bike corral area
- Delineator posts may be installed atop parking stops

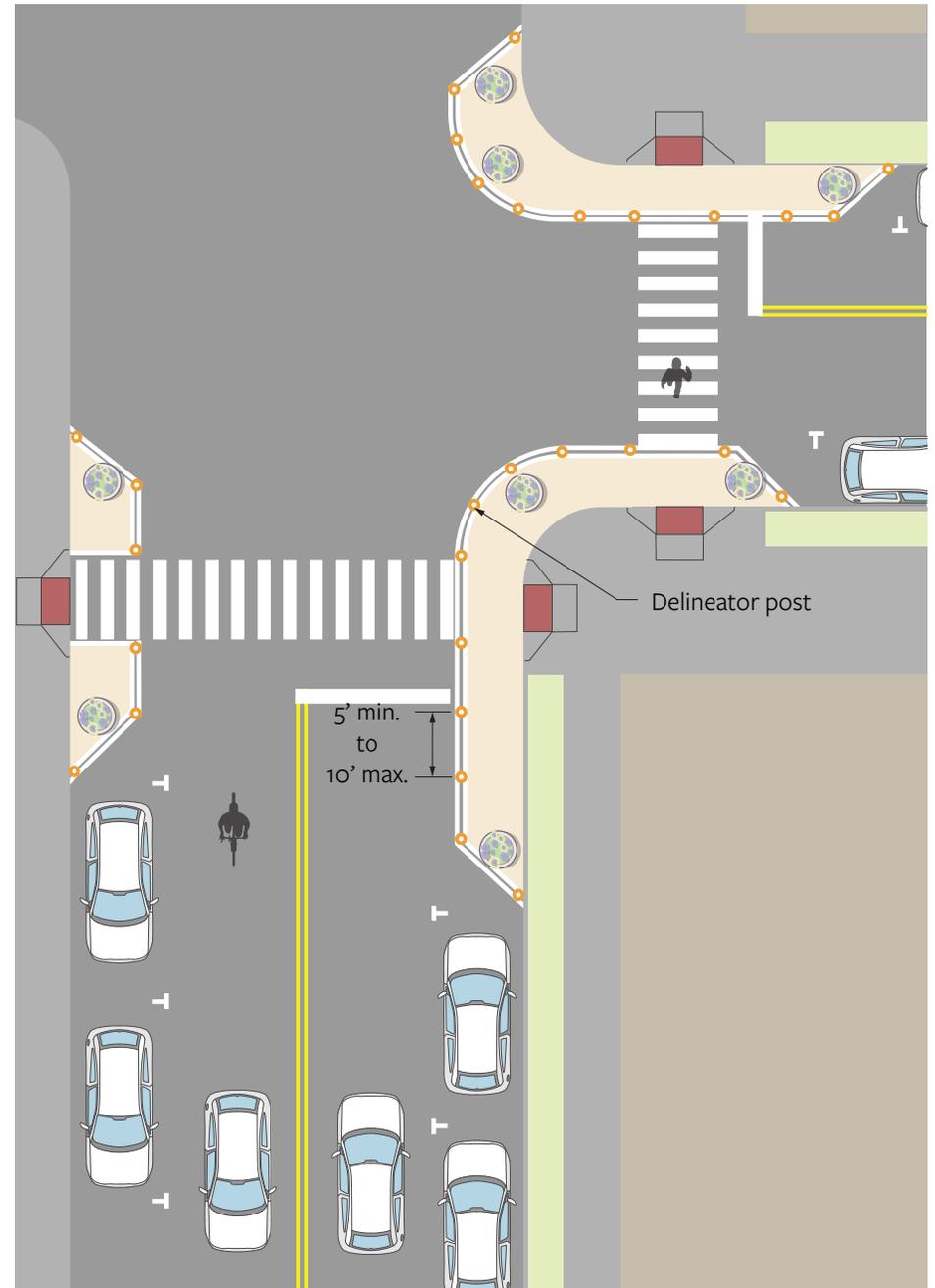
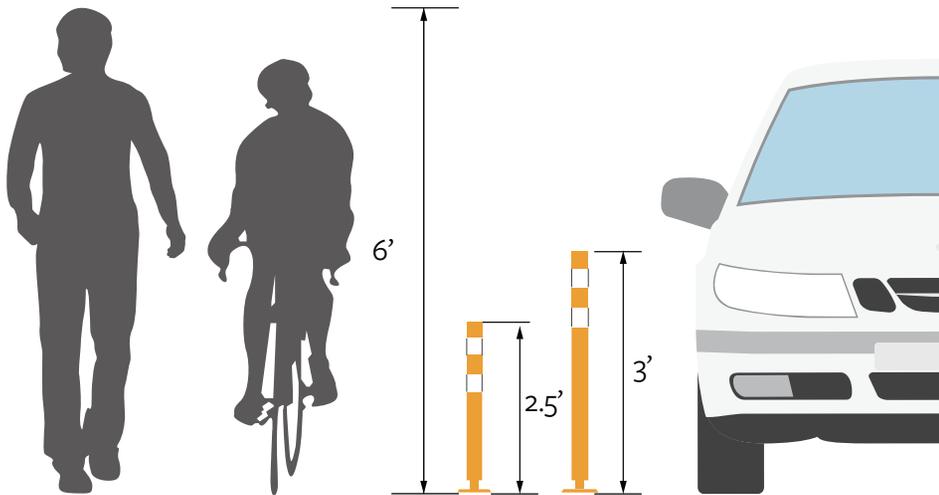
#### Design Notes

- To improve aesthetics and help create a sense of enclosure, pair delineator posts with other vertical elements such as planters
- Delineator may be removed in winter to facilitate snow plowing / removal
- Diminishing aesthetic quality / durability of delineator posts can present challenges for quick-build design projects in some contexts
- Monitor replacement rate and decide whether a more robust vertical barrier element is appropriate / cost effective for the context, especially if a capital funding has yet to be programmed
- Spacing between delineator posts may be greater if paired with more aesthetically pleasing vertical barrier elements, such as planters
- Where driveways exist, no delineator post should be placed closer than 10' to either side of the driveway or intersection
- Delineator posts are available in a variety of colors

## DETAIL



## PROFILE



## 4.E. K-71 BOLLARD

### Applications

Protected Bike Lanes | Bicyclist / Pedestrian Refuge Islands | Curb Extensions | Pedestrian Plazas

### Component

- Plastic bollard with reflective collars and ‘T-Bar’ anchoring system

### Specific Design Guidance

#### Protected Bike Lane

- Bollards to be centered between retroreflective 6” and 4” white bike lane buffer stripes, with a minimum spacing of 5’ and a maximum spacing of 15’ to discourage motorists from using portions of the bike lane for movement or parking

#### Bicyclist / Pedestrian Refuge Islands

- Bollards should be placed on the outside edges of the crosswalk and may be placed / spaced strategically in other locations to facilitate detection / accessibility
- Where bi-directional crossbikes are present, delineator posts should be placed on the outside edges of the two crossbike markings; where uni-directional crossbikes are used, delineator posts should be placed on the crossbike edge nearest to oncoming vehicular travel

#### Curb Extensions

- Bollards to be placed between retroreflective 4” double white stripes or along the edge of the inside line, with a minimum spacing of 5’ and a maximum spacing of 10’
- To increase visibility / detection, place bollards at the corners of the crosswalk and the curb extension; posts may be placed / spaced strategically in other locations to facilitate detection / accessibility

#### Pedestrian Plazas

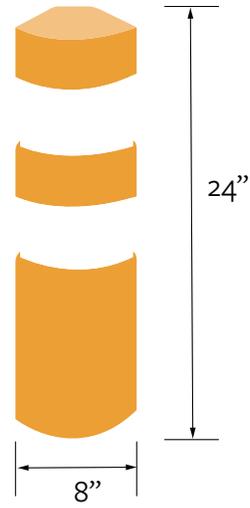
- Bollards to be placed between retroreflective 4” white stripes or along the edge of the inside line, with a minimum spacing of 5’ and a maximum spacing of 10’
- To increase visibility / detection, place bollards at the corners of the

crosswalk and the pedestrian plaza; bollards may be placed / spaced strategically in other locations to facilitate detection / accessibility

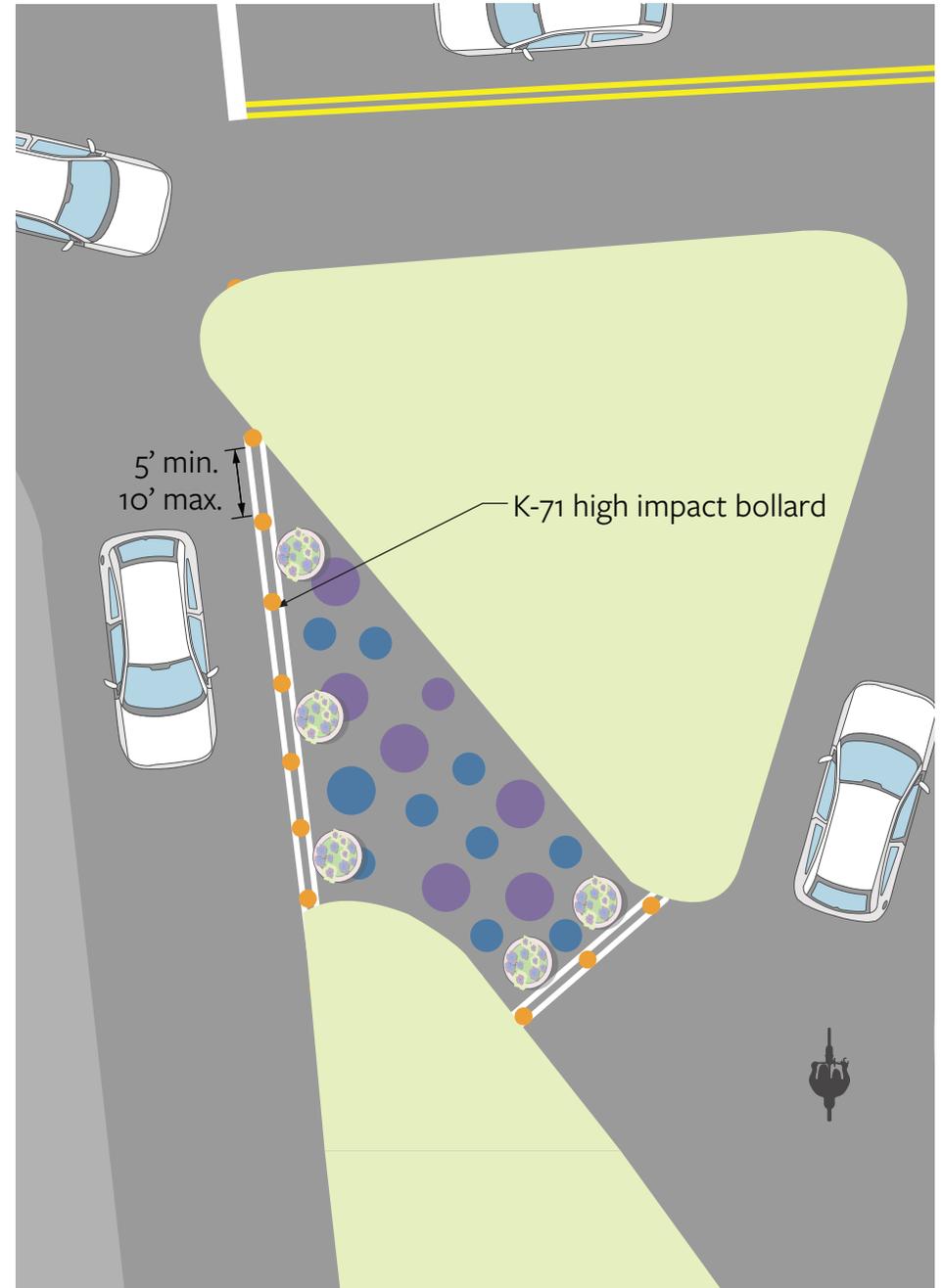
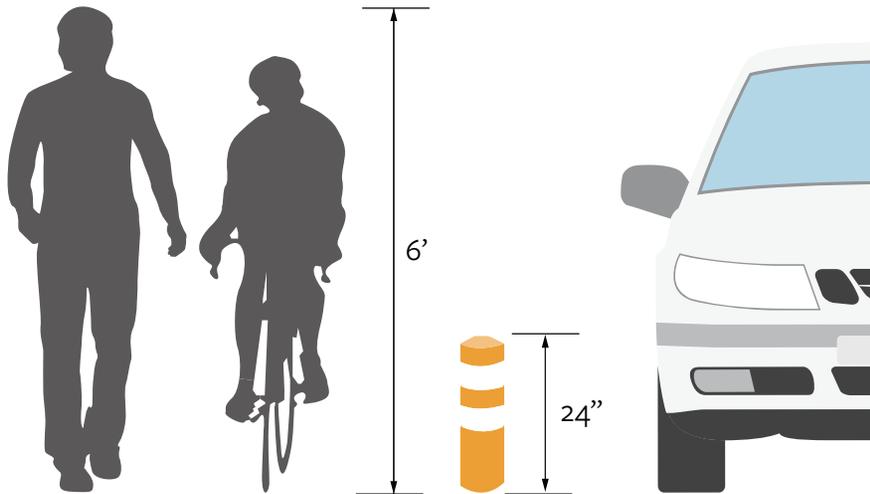
### Design Notes

- Collapsible profile ensures emergency and city service vehicle access, and minimal / no stormwater obstruction; may sustain impacts of 65 mph
- If necessary, bollards may be removed and holes plugged for reinstallation to facilitate snow plowing / removal
- Diminishing aesthetic quality / durability can present challenges for some quick build design projects; monitor replacement rate and decide whether a more robust vertical barrier element is appropriate / cost effective for the context
- 2’ height is less obtrusive than delineator posts, which improves street aesthetics; larger diameter size may help reinforce design intent and enhance pedestrian / cyclist comfort
- The K-71 Bollard is available in a wide variety of colors

## DETAIL



## PROFILE



## 4.F. PLANTER (CIRCULAR)

### Applications

Bike Corrals | Bicyclist / Pedestrian Refuge Islands | Curb Extensions / Pedestrian Plazas | Mini-Roundabouts / Neighborhood Traffic Circles

### Components

- Plastic Planter - Sybertech 36 or 42 inch bowl planters or similar with reflective strip
- Soil and filler
- Plant matter

### General Design Guidance

#### Bike Corrals

- Place a planter on either side of the corral, leaving 2' clear for bicycles to be parked on the outside edge of the rack
- Where the corral is adjacent to parallel parking, pair planter with curb stop placed between the planter and the adjacent parking space(s)

#### Bicyclist / Pedestrian Refuge Island

- Place a planter on either side of the bicyclist / pedestrian refuge area, providing a vertical element protecting the crosswalk / crossbike

#### Curb Extensions / Pedestrian Plazas

- Place planters 18" from edge of double white line for snow storage, with a minimum spacing of 8' and a maximum spacing of 10'
- Planters to be centered between other vertical barrier elements where used (delineator posts, K-71 bollards etc.)
- Planters should be placed on either side of crosswalks
- Planters may also be used as landscaping / greenery throughout the plaza area, including adjacent sidewalks with adequate width;

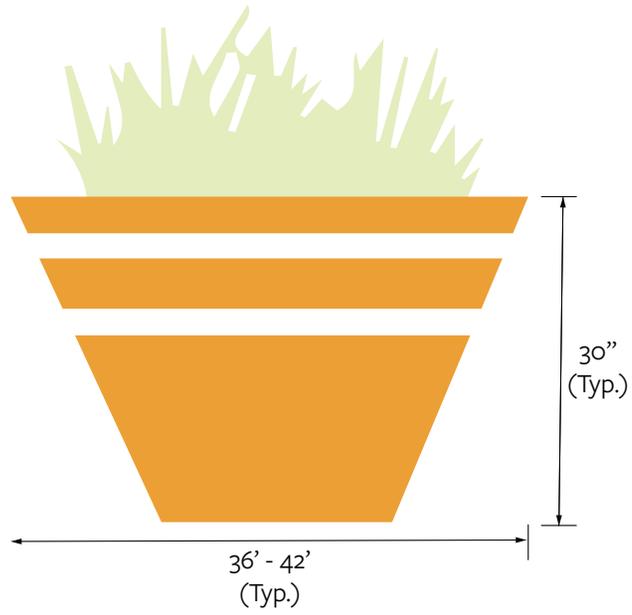
#### Mini-Roundabouts / Neighborhood Traffic Circles

- Place a single planter, or an array of planters if space allows, in the center of the island.

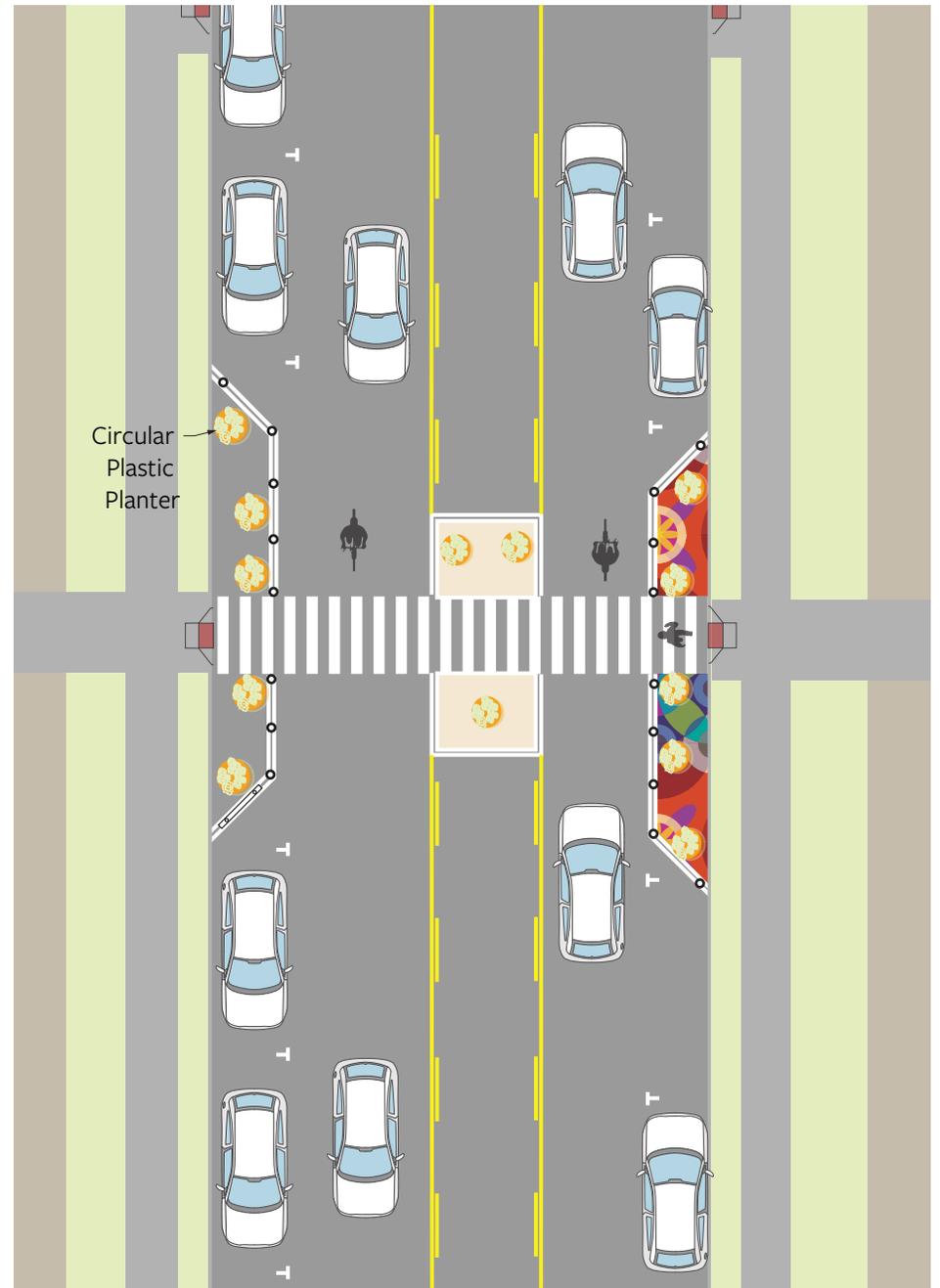
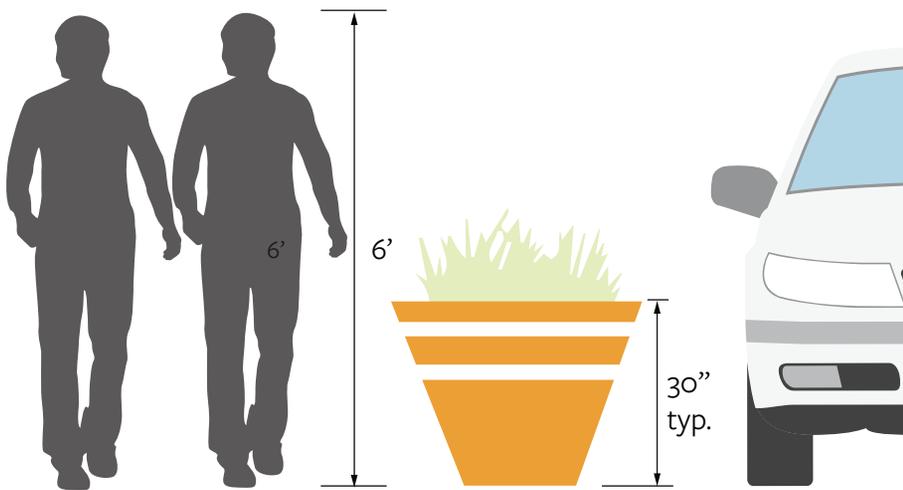
### Design Notes

- Planters may be paired with other vertical barriers to enhance visibility / sense of enclosure as required
- Identify a maintenance / stewardship partner who will be able to water and maintain the plant matter
- Ensure placement does not obstruct accessibility / ADA compliance.
- In some instances retroreflective strip for night-time visibility may be warranted
- Planters may be removed during winter months, or set back a minimum of 18" to avoid plow blades

## DETAIL



## PROFILE



## 4.G. PLANTER (RECTANGULAR)

### Applications

Protected Bike Lane | Curb Extension | Pedestrian / Bicyclist Refuge Island | Pedestrian Plaza

### Components

- DeziLine Planter “A”: 48”L x 28”W x 24”H or DeziLine Planter “B”: 36”L x 24”W x 24”H
- Soil and filler
- Plant matter
- PEDISTILL Hand + Foot Rest (optional)
- Self-watering system (optional)

### General Design Guidance

#### Protected Bike Lane

- Center planters between retroreflective 6” and 4” white bike lane buffer stripes, with a maximum spacing of 15’ to discourage motorists from using portions of the bike lane for movement or parking
- Planters may be placed end-to-end at intersection ingress / egress locations
- In some locations, planters may need to be spaced to maintain stormwater flow / or to facilitate mid-block exit / entrance for people cycling

#### Pedestrian / Bicyclist Refuge Island

- Place a planter(s) on either end of pedestrian / bicyclist refuge island, as well as along perimeter as conditions allow, providing a vertical element protecting the crosswalk / crossbike
- Planters may be placed on the outside edges of the crosswalk and may be placed / spaced strategically in other locations to facilitate detection / accessibility

#### Curb Extension / Pedestrian Plaza

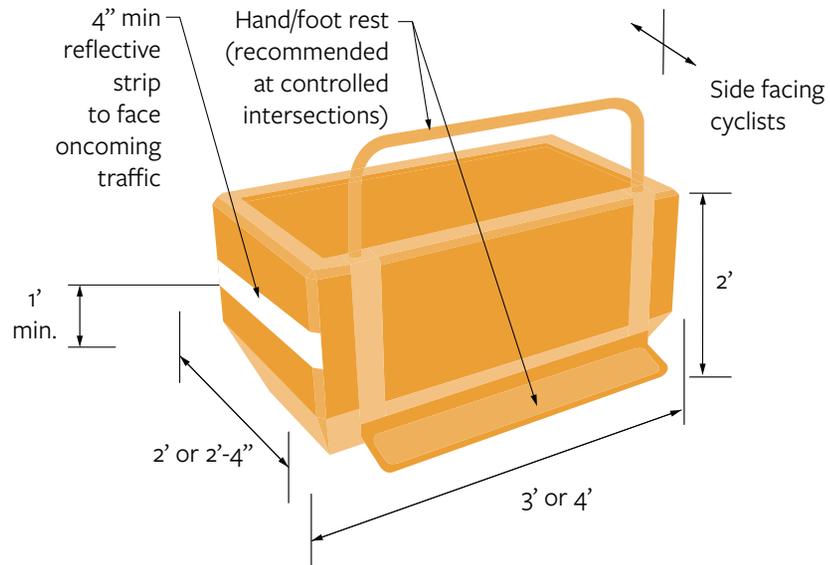
- Planters to be placed parallel along the inside edge of the retroreflective 4” double white stripe demarcating the perimeter of the curb extension or pedestrian plaza

- Planters should be placed every 5’ - 10’
- In areas of high foot traffic ensure 4’ gaps between planters for pedestrian permeability / accessibility

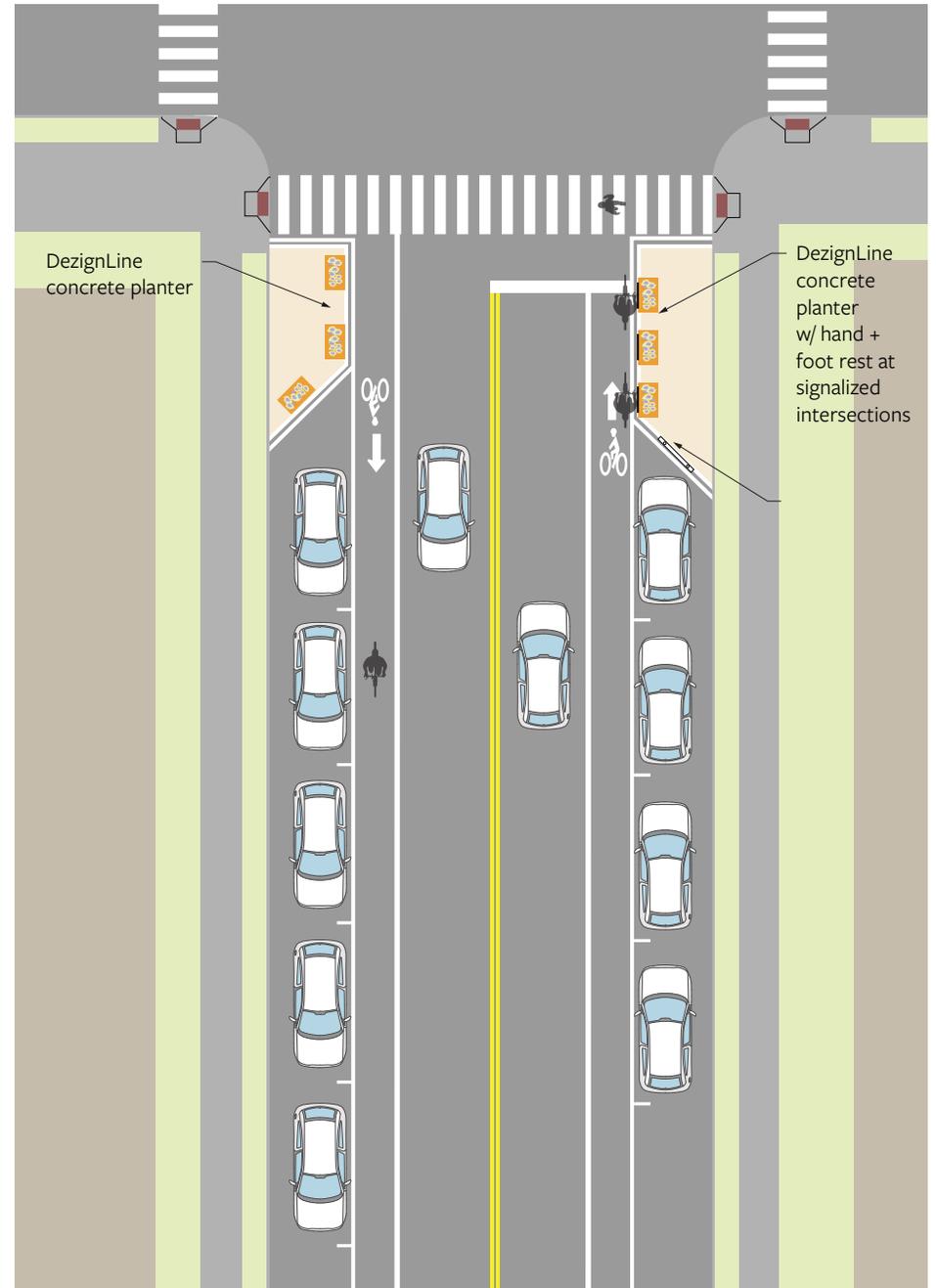
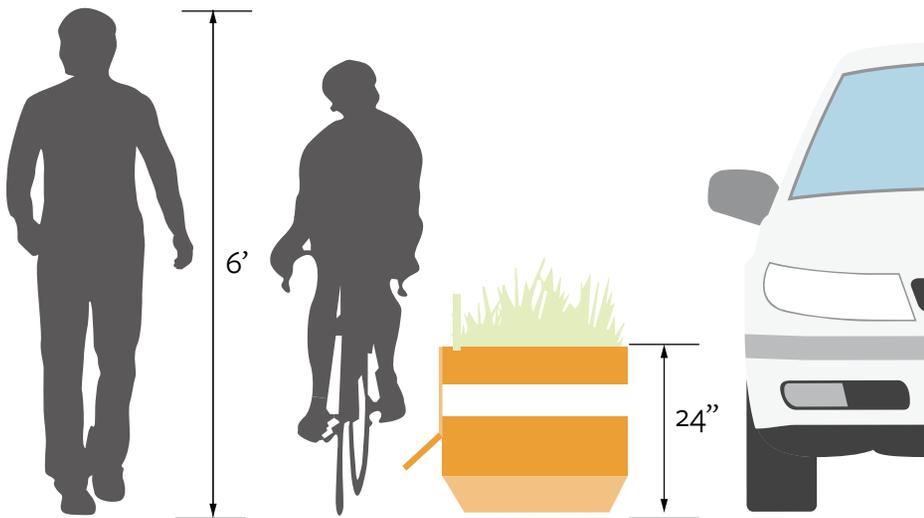
### Design Notes

- Planters may be paired with other vertical barriers (e.g. delineators posts) to enhance visibility / sense of enclosure
- Identify a maintenance / stewardship partner who will be able to water and maintain the plant matter
- Ensure placement does not obstruct accessibility / ADA compliance or stormwater flow
- In some instances a retroreflective strip for night-time visibility may be warranted
- Planters may be removed during winter months, or set back a minimum of 18” to avoid plow blades

## DETAIL



## PROFILE



## 4.H. PARKING STOP

### Applications

Protected Bike Lane | Bike Corral | Parklet | Chicane | Mini-Roundabout / Neighborhood Traffic Circle

### Components

- Parking stop unit

### General Design Guidance

#### Protected Bike Lane

- Parking stops to be centered between retroreflective 6" and 4" white stripes, with a minimum spacing of 5' and a maximum spacing of 15' to discourage motorists from using portions of the bike lane for movement or parking

#### Bike Corral

- For mid-block locations, place parking stop on either side of the bicycle rack(s), between the retroreflective 4" double white stripe at the edge of the adjacent parallel parking space
- For corner / site triangle conversion locations, a single parking stop may be used, placed between the retroreflective double 4" stripe at the edge of the adjacent parallel parking space

#### Parklet

- Place a parking stop on either side of the parklet, perpendicular to the curb and centered within the striped buffer and parallel parking space(s)

#### Chicane

- Place parking stops along chicane perimeter, centered between the retroreflective 4" double white stripe.

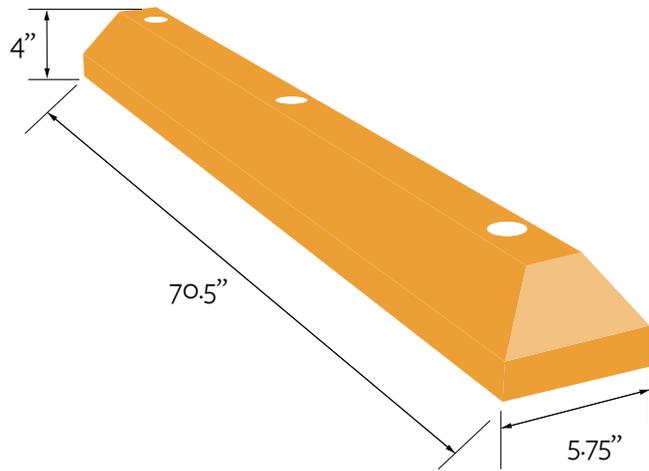
#### Mini-Roundabout / Neighborhood Traffic Circle

- Place parking stops with equal spacing in a circular fashion or create a star pattern to provide a mountable barrier demarcating the roundabout island

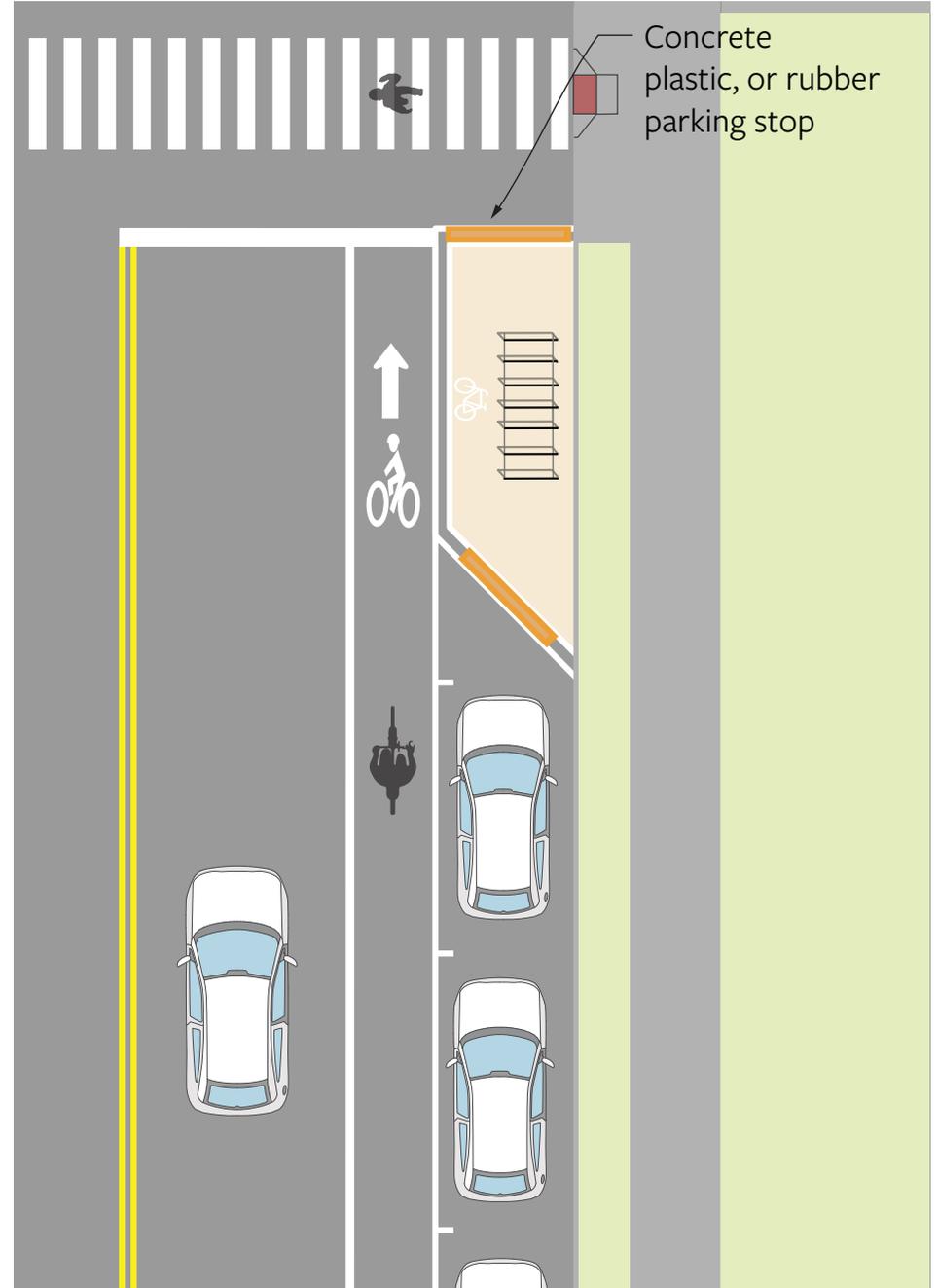
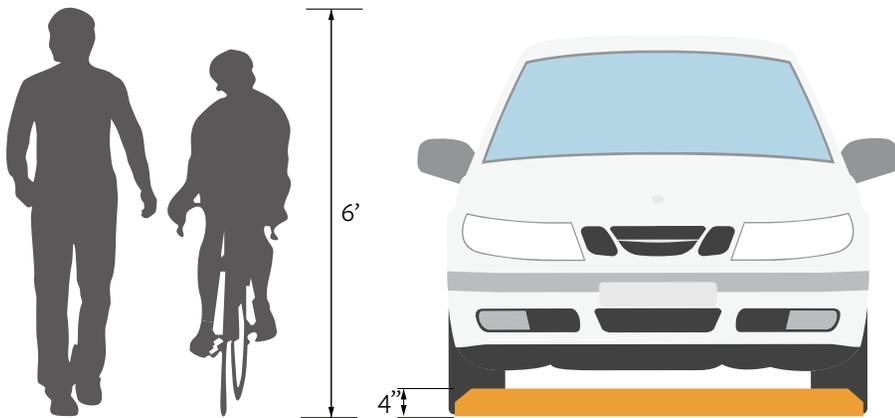
### Design Notes

- Parking stops are available in various sizes; 70.5 or 72" L x 5.75" W x 4" H is recommended for most applications; 6" height may be warranted in some instances
- Parking stops are available in a variety of materials: plastic, rubber, or concrete; Use plastic curb stops for demonstration projects only, rubber or concrete for Quick Build or interim design projects
- Ensure parking stop placement does not interfere with stormwater flow or accessibility
- Delineator posts may be placed atop parking stops for enhanced visibility
- Parking stops may be removed during winter months, or set back a minimum of 18" to avoid plow blades

## DETAIL



## PROFILE



## 4.1. TUFF CURB XLP + DELINEATOR POST

### Applications

Protected Bike Lane | Pedestrian / Bicyclist Refuge Island / Island | Mini-Roundabout / Neighborhood Traffic Circle

### Components

- Modular base segment (“tuff curb”)
- Delineator post with reflective strip

### General Design Guidance

#### Protected Bike Lane | Bicyclist Refuge Island

- Center tuff curb / bike lane delineator posts between retroreflective 6” and 4” white buffer stripes, with a minimum spacing of 3” and a maximum spacing of 15’ to discourage motorists from encroaching into the bike lane for movement or parking
- May place tuff curb end-to-end at select locations (intersection ingress / egress); a 3” gap should be left between segments to maintain stormwater flow; larger gaps may be required to facilitate mid-block turn movements for cyclists

#### Pedestrian / Bicyclist Refuge Island

- Tuff curb / delineator posts should be placed between retroreflective 4” double white perimeter stripes, with a minimum spacing of 5’ and a maximum spacing of 10’
- Tuff curb / delineator posts shall be placed on the outside edges of the crosswalk, parallel with the direction of vehicular travel, and may be placed / spaced strategically in other locations to facilitate detection / accessibility
- Where bi-directional crossbikes are present, tuff curb / delineator posts should be placed parallel to vehicular travel on the outside edges of the two crossbike markings; where uni-directional crossbikes are used, tuff curb / delineator posts should be placed on the crossbike edge nearest to oncoming vehicular travel

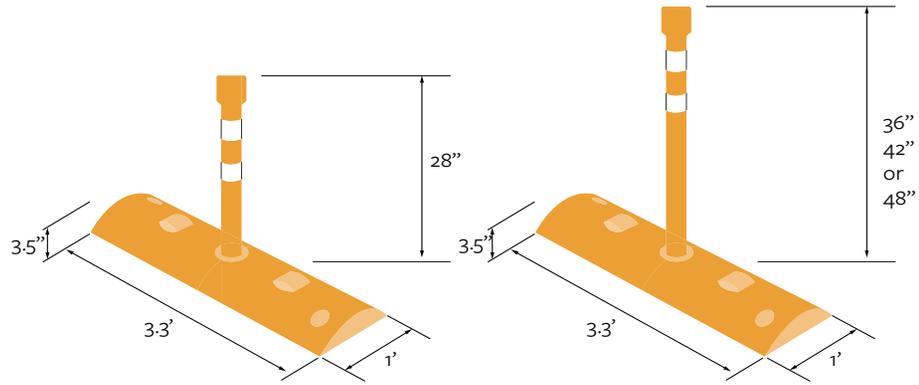
#### Mini-Roundabout / Neighborhood Traffic Circle

- Tuff curb / delineator posts should be placed end-to-end in a circular formation to create a roundabout / traffic circle island, leaving small gaps to accommodate stormwater flow where necessary

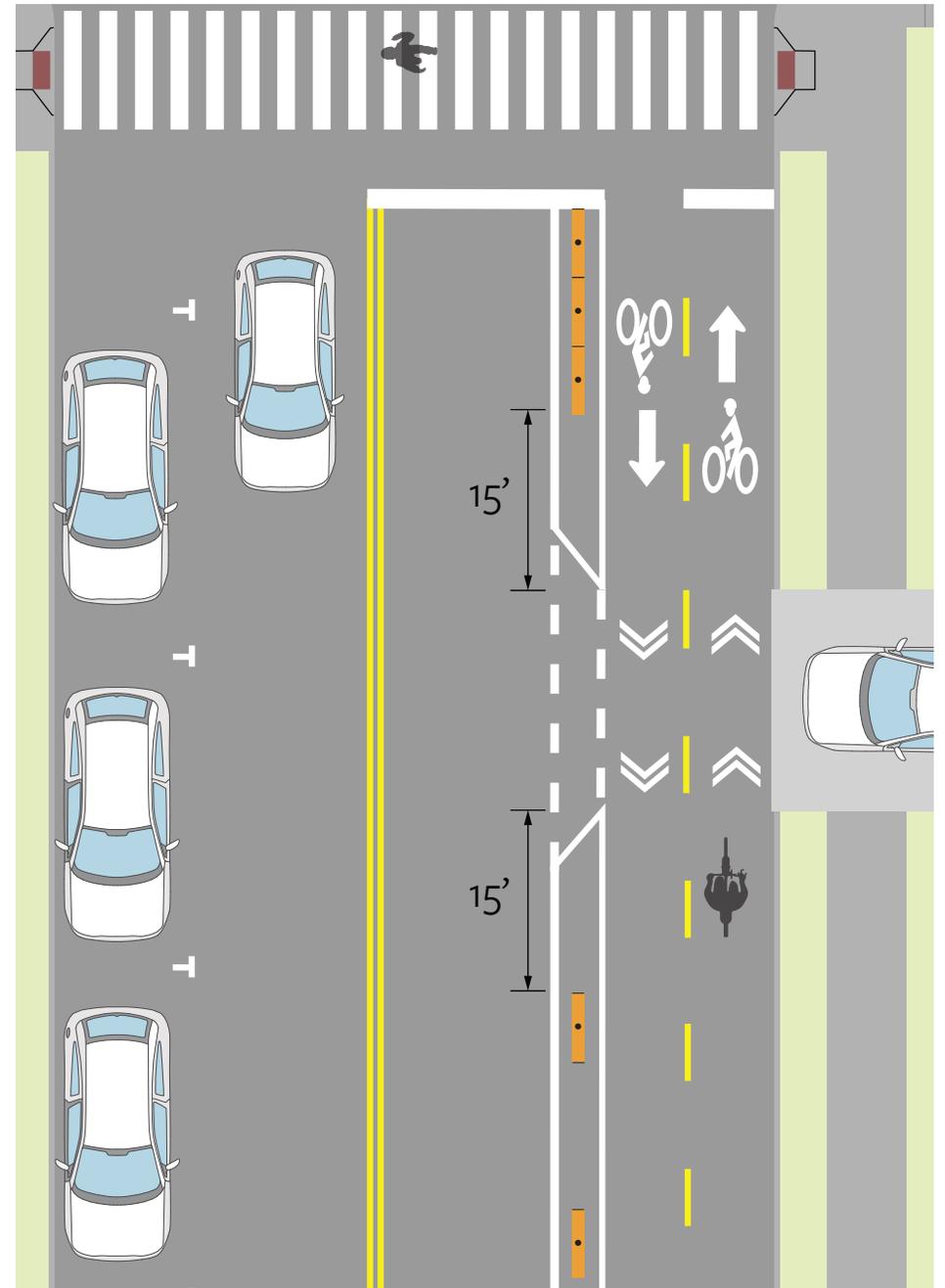
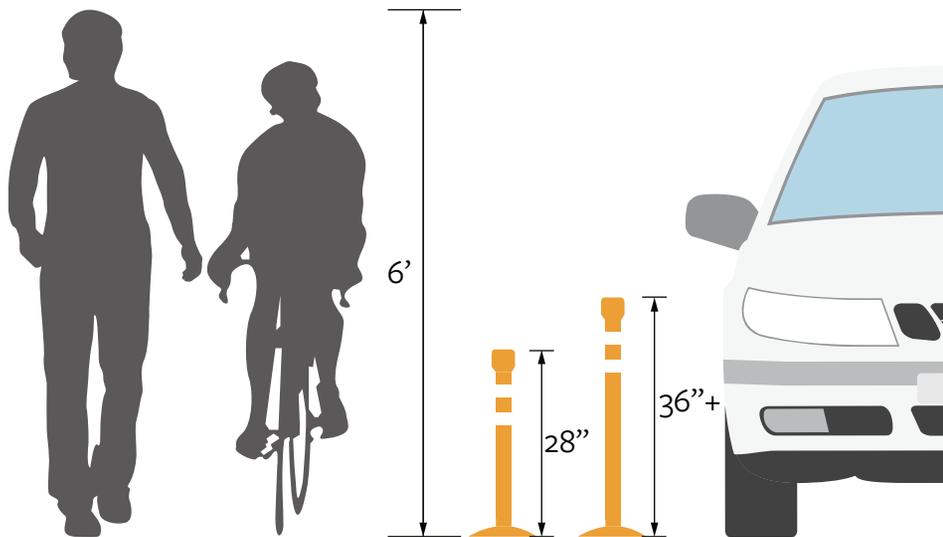
### Design Notes

- Tuff curb / bike lane delineator posts are available in 28,” 36,” 42,” and 48” heights
- Modular quick curb spacing may be customized for local conditions (driveways, short blocks etc.) and to maintain stormwater flow
- Tuff curb / delineator posts may need to be removed seasonally to facilitate snow storage / removal
- Diminishing aesthetic quality / durability can present challenges for some quick build design projects; monitor replacement rate and decide whether a more robust vertical barrier element is appropriate / cost effective for the context
- Use 28” delineator posts along protected bikeways or wherever application may conflict with bicycle handlebars
- Tuff curb / delineator posts may be paired with other vertical barriers, such as circular or rectangular planters

## DETAIL



## PROFILE



## 4.J. RUBBER ROUNDABOUT ISLAND

### Applications

Mini-Roundabout / Neighborhood Traffic Circle

### Component

- Gummitechnik Mini-Roundabout

### General Design Guidance

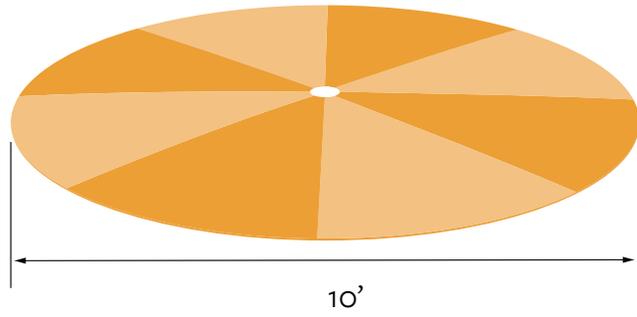
#### Mini-Roundabout / Neighborhood Traffic Circle

- Place roundabout Island in the middle of the intersection, leaving 15' clear between the outside edge of the Island and the vertex of the curb radii

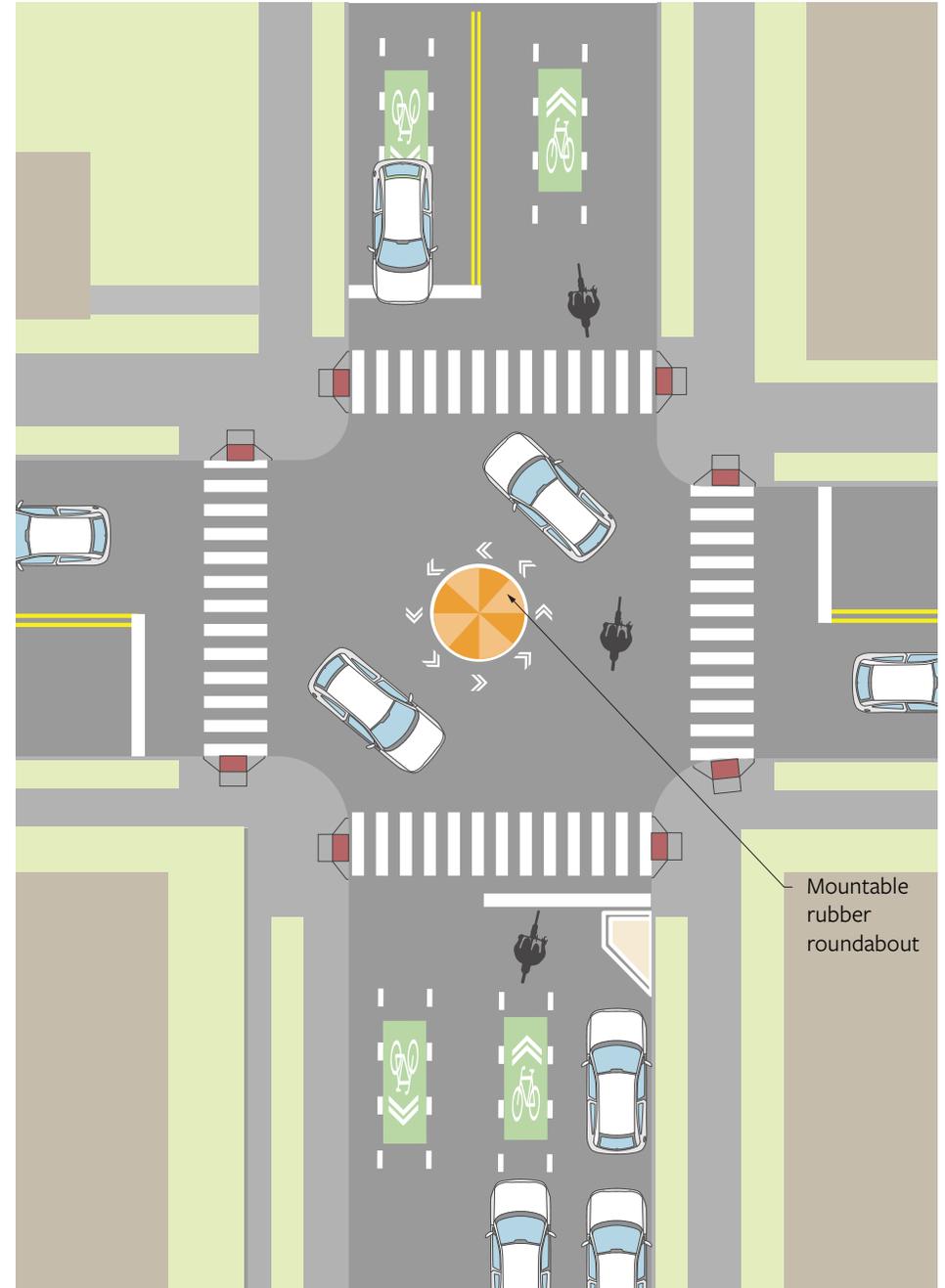
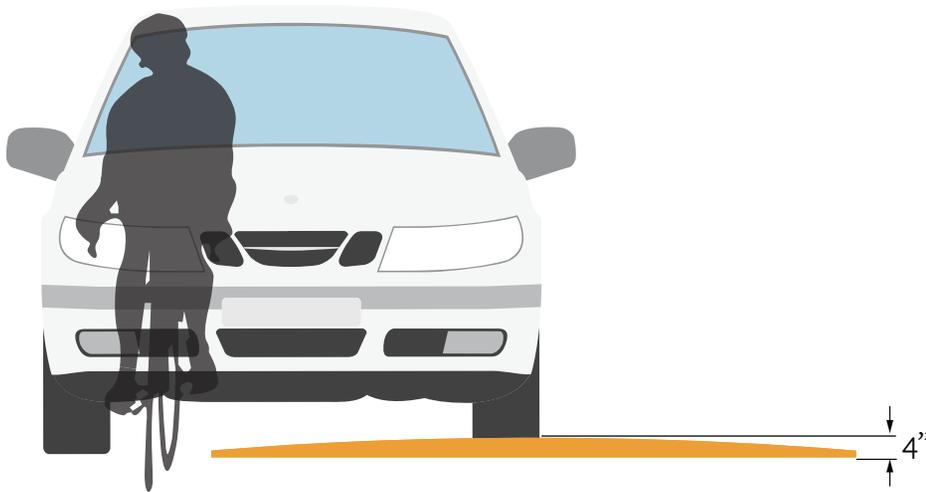
### Design Notes

- Mountable profile ensures emergency and city service vehicle access, and minimal / no stormwater obstruction
- If necessary, remove for winter to facilitate snow plowing / removal.
- May lead to decreased safety perception for people walking or cycling; pair with other traffic-calming to help control speed of motorists entering the intersection

## DETAILS



## PROFILE



## 4.K. SPEED HUMPS / SPEED CUSHION

### Applications

Neighborhood Greenway | Neighborhood Slow Zone

### Components

- Asphalt speed hump
- Vulcanized rubber speed cushion

### General Design Guidance

#### Neighborhood Greenway | Neighborhood Slow Zone

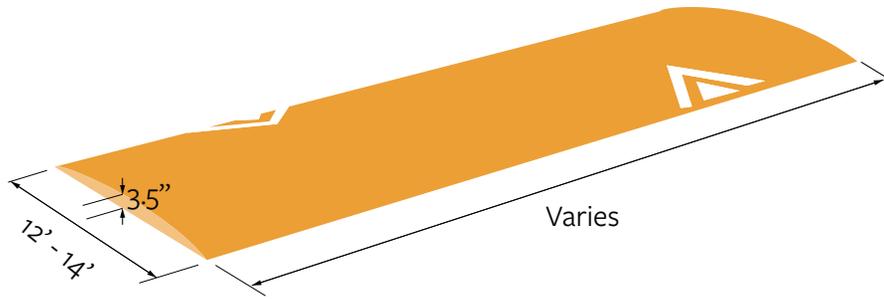
- Speed humps / cushions should be used almost exclusively on street designated as residential Slow Zones or Neighborhood Greenways
- The spacing for and height of speed humps / cushions should be determined based on the target speed of the roadway. Speed humps, and other traffic calming elements, should be spaced no more than a maximum of 200 ft. apart and be a height of 3" - 4" to achieve target speed of 15 - 20 mph
- Speed humps / cushions shall not be placed in front of driveways or other rights-of-way requiring a curb cut; Where frequent driveways make the application of a speed hump difficult, work with local residents to develop other traffic-calming solutions
- Where used on bus routes, major emergency access routes and / or commercial corridors, speed cushions designed to accommodate the wheelbase of such vehicles should be selected over speed humps
- Speed hump slopes should not exceed 1:10 or be less steep than 1:25. Side slopes on tapers should be no greater than 1:6. The vertical lip should be no more than a quarter-inch high
- Where curbside bicycle lanes exist, taper the speed hump width to allow a 2.5' clear 'cycling slot' smooth bicycle passage, which may also facilitate better stormwater drainage

### Design Notes

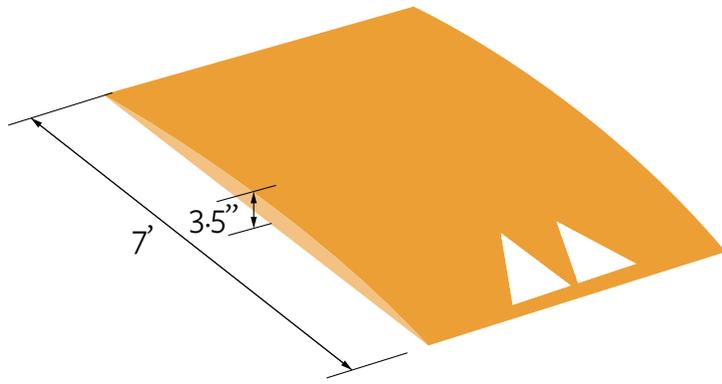
- Speed humps may be applied on 1-way or 2-way streets
- Vertical speed control elements (like speed humps) shall be accompanied by a sign warning drivers of the upcoming device
- Vulcanized rubber speed hump units may be removed for road resurfacing, snow plows, or to test the product at various locations

## DETAILS

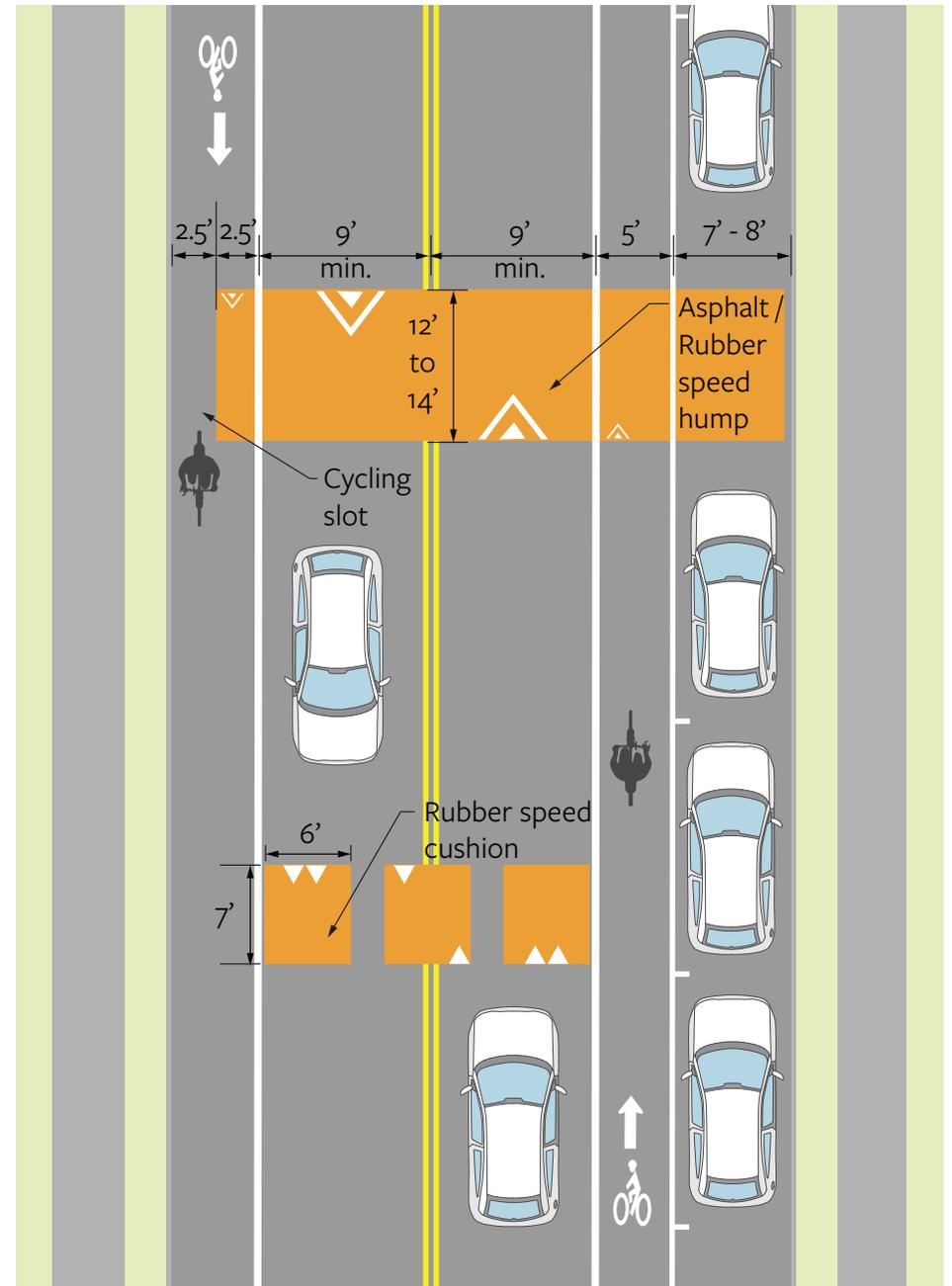
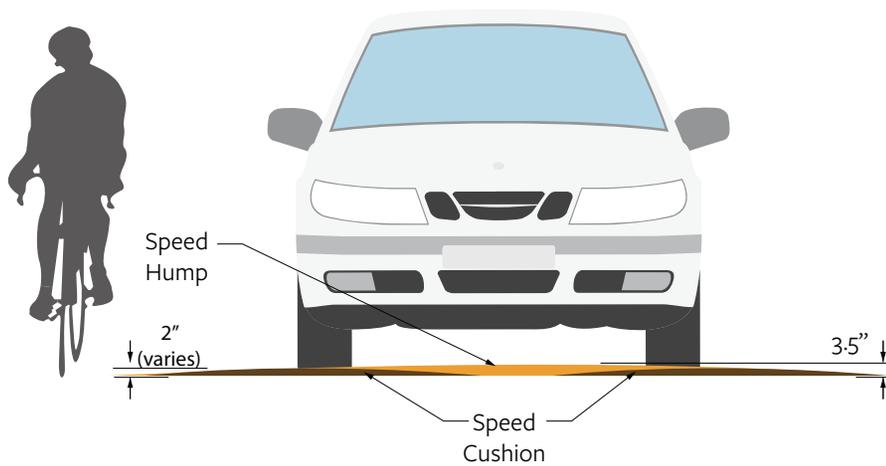
### Speed hump



### Speed Cushion



## PROFILE



## 4.L. ZICLA BUS PLATFORM

### Applications

Bus / Bike network overlap | Transit stops where vehicle conflicts reduce safety or increase transit delay

### Components

- Bus Platform
- Curb sections
- Curb end sections
- Interlocking modules
- Access ramps
- Thru bike lane (optional)
- Traffic ramp (optional - bike lane)

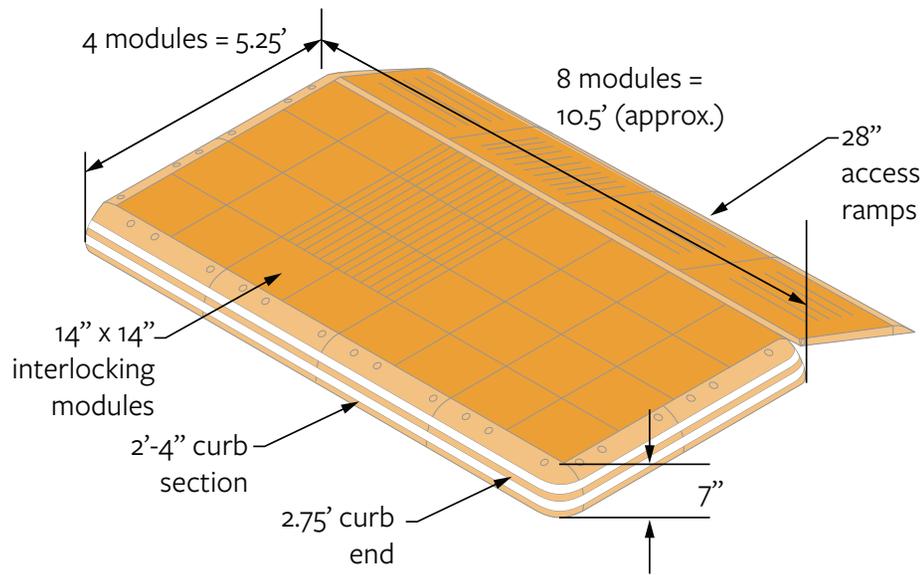
### General Design Guidance

- The Ziclas bus platform is modular and able to be assembled to various, desired widths and lengths
- Access ramps can be adjusted to height of adjacent curb / sidewalk

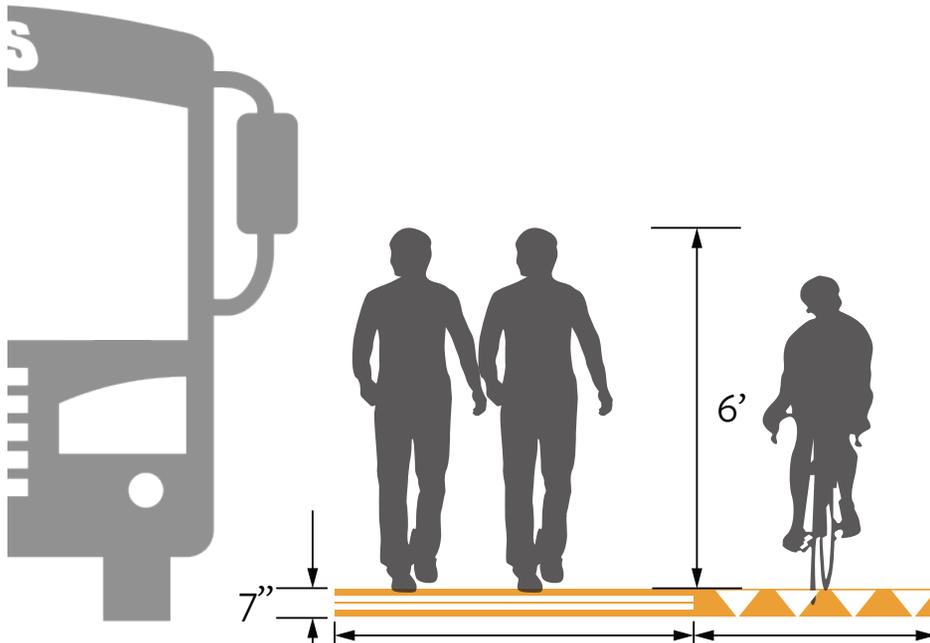
### Design Notes

- Bus platforms prioritize transit by allowing buses to pull out immediately after picking up passengers, without having to wait to merge back into traffic
- Bus platforms provide space for passengers to wait on a non-slip, elevated surface, visible to bus drivers, and separate from the sidewalk
- Bus platforms can be placed in existing on-street parking lanes or wide bike lane buffers
- The Ziclas access ramp allows bus platforms to be installed quickly where curb cuts do not currently exist
- Thru bike lanes can reduce bike / pedestrian conflicts by reducing the need for passengers to negotiate crossing the bike lane and boarding the bus simultaneously
- Thru bike lanes can reduce bike / vehicle conflicts by providing a clear path while the bus is stopped at the bus stop

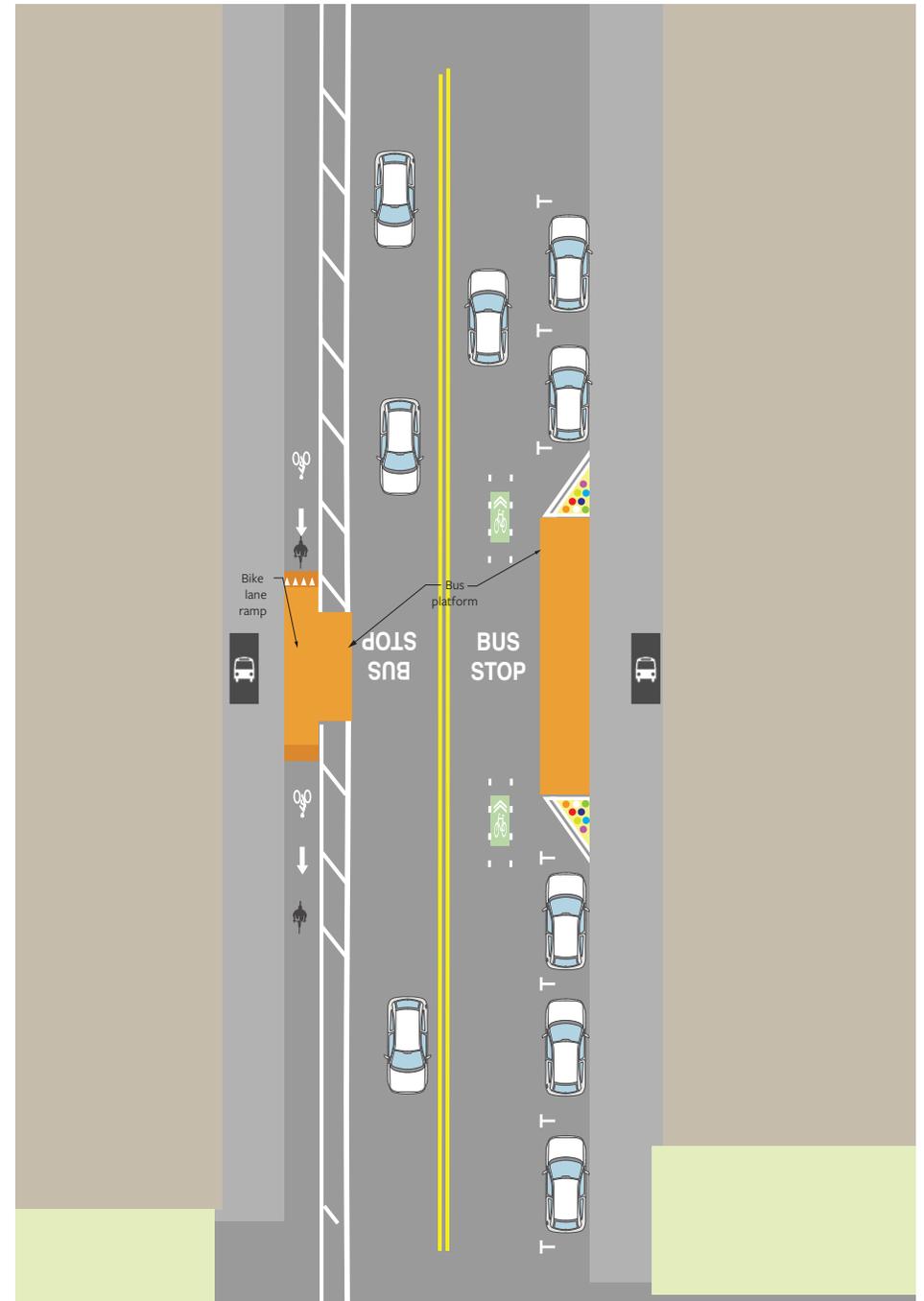
## DETAILS



## PROFILE



## IN CONTEXT





**SURFACE TREATMENTS**

## 5. SURFACE TREATMENTS

Six materials may be used for surface treatment related to striping, marking, and designating street designs that support safe walking, bicycling, and driving. Because a few of the materials have not been used on Burlington’s streets, it is anticipated that a range of materials and locations be tested so that performance / public response can be used to expand the materials list and shape quick build projects in the years to come. Indeed, The City of Burlington will need this flexibility as it optimizes surface material choices to address safety, durability, aesthetics, and maintenance concerns.

	RUBY LAKE GLASS	EPOXY GRAVEL	METHYL METHACRYLATE	ACRYLIC TRAFFIC PAINT	CONTRACTOR GRADE TRAFFIC TAPE	RETROREFLECTIVE THERMOPLASTIC
<b>STRIPING + MARKING</b>						
Crosswalk	●	●	●	●	●	●
Solid White Stripe				●	●	●
Dashed White Stripe				●	●	●
Stop Bar				●	●	●
Yield Line Markings				●		●
Directional Arrow				●		●
Chevrons				●	●	●
Shared Use Lane Marking (Sharrow)				●	●	●
Bike Lane Marking				●	●	●
Elephant Feet				●	●	●
<b>PEOPLE WALKING</b>						
Curb Extension / Refuge Islands	●	●	●	●		
Pedestrian Plaza	●	●	●	●	●	●
Mid-Block Crossing	●	●	●	●	●	●
Parklets	●	●		●	●	●
Intersection Murals				●	●	●
<b>PEOPLE BICYCLING</b>						
Green Backed Super Sharrow	●		●	●		
Bicycle Box	●	●	●	●		●
2-Stage Left Turn Box / Pocket	●	●		●		●
Green Crossbike / Conflict Area Marking	●			●		●
Bike Corral	●	●	●	●		
<b>PEOPLE DRIVING</b>						
Roundabout	●	●	●	●		
Flush Median	●	●	●	●	●	●
Chicane	●	●	●	●	●	●
Pinch Point	●	●	●	●	●	●
Site Triangle Visibility Zone	●	●	●	●	●	●

## 5.B SURFACE MATERIALS COLOR PALETTE

Colored pavement can amplify the visibility and intended use of Quick Build projects. For example, the use of green paint within a bicycle lane increases the visibility of the bikeway, identifies potential areas of conflict with motorists, and/or assigns priority to bicyclists along Neighborhood Greenways. Surface treatment materials are available in an almost unlimited number of colors, and creative use of these options is encouraged.

As such, the tan colored areas in this guide are candidates for colorful patterns and community murals. The Color Palette Matrix presented here is intended to guide the use of color for specific project types.

SURFACE TREATMENT COLOR	DESIGN APPLICATION NOTES	REQUIRED	RECOMMENDED	OPTIONAL
<b>GREEN</b>				
<b>Through Movements</b>				
Bike Lane Intersection Ingress	Paint 50' ingress to bike box entrance or intersection stop bar		●	
Super Sharrows	Use along all Neighborhood Greenways	●		
<b>Turn Movements</b>				
Bicycle Box	Use at signal controlled intersections where two on-street bikeways intersect		●	
Two-Stage Queue Box	Apply at signal controlled intersections where two on-street bikeways intersect		●	
Left-Turn Pocket	Use to facilitate left-turn movements from right-side bike lanes at T intersections		●	
<b>Conflict Areas</b>				
Crossbike Markings	The use of specific crossbike markings to be determined by conflict area type*	●		
Through Bike Lane / Combined Bike-Turn Lane	Use to continue bike lane where right-turn lanes are introduced at intersection approach	●		
Shared Bikeway + Bus Stop Conflict Zone	Apply where bike lanes interact with bus stop zones	●		
<b>TAN</b>				
<b>Walking</b>				
Pedestrian Plaza	Apply at irregular intersections with redundant street segment / excess capacity		●	
Pedestrian Refuge Islands	Use at mid-block crossings on multi-lane thoroughfares		●	
Curb Extension	Apply at crosswalks / where greater visibility / safety is desired		●	
<b>Cycling</b>				
Bike Corral	Use at corner or mid-block locations where space is limited / bike parking demand is high		●	
Bicyclist Refuge Island	Apply along Neighborhood Greenway or path crossings over multi-lane thoroughfares		●	
<b>Driving</b>				
Roundabout/Neighborhood Traffic Circle Island	Neighborhood Greenway, Neighborhood/Corridor Slow Zone		●	
Chicane	Neighborhood Greenway, Neighborhood Slow Zone		●	
Pinch Point	Neighborhood Greenway, Neighborhood Slow Zone		●	
Site Triangle Visibility Zone	Thoroughfares with on-street parking		●	
Flush Median	Neighborhood Greenway, Neighborhood / Corridor Slow Zone		●	

\*See page for 26-27 for specific application guidance

**SURFACE TREATMENT COLOR**

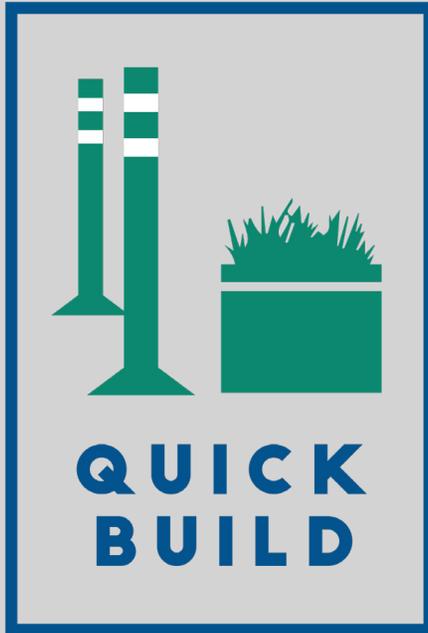
**DESIGN APPLICATION NOTES**

**REQUIRED RECOMMENDED OPTIONAL**

**STREET MURAL** 

<b>Walking</b>				
Pedestrian Plaza	Apply at irregular intersections with redundant street segment / excess capacity			●
Pedestrian Refuge Island	Use at mid-block crossings on multi-lane thoroughfares			●
Curb Extension	Apply at crosswalks / where greater visibility / safety is desired			●
Intersection Mural	Apply at low-speed and low-volume streets, such as Neighborhood Greenways / Slow Zones			●
<b>Cycling</b>				
Bike Corral	Use at corner or mid-block locations where space is limited / bike parking demand is high			●
Bicyclist Refuge Island	Apply along Neighborhood Greenway or path crossings over multi-lane thoroughfares			●
<b>Driving</b>				
Roundabout / Neighborhood Traffic Circle Island	Neighborhood Greenway, Neighborhood/Corridor Slow Zone			●
Chicane	Neighborhood Greenway, Neighborhood Slow Zone			●
Pinch Point	Neighborhood Greenway, Neighborhood Slow Zone			●
Site Triangle Visibility Zone	Thoroughfares with on-street parking			●
Flush Median	Neighborhood Greenway, Neighborhood / Corridor Slow Zone			●





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