



Bike Network Plan

Appendix D: Bike Facility Guidelines for Future Amendments



**City of San Antonio
Transportation Department**

**Produced in Association With:
Kittelson & Associates, Inc.
Design Workshop**

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Introduction

Purpose of This Document

Over time, traffic demand has increased, street widths have expanded, and our streets have turned into major thoroughfares primarily designed for driving and with little to no emphasis on accommodating other types of users. As San Antonio continues to grow, a change in the way we think about and utilize our public right-of-way is necessary so all residents can safely and comfortably travel regardless of what mode they choose.

Rather than a “one-size-fits-all” approach, the Bike Facilities Guidelines for Future Amendments serves as a tool to determine the appropriate bicycle facility based on the broader street context, vehicle volumes and speeds, and the modal needs of a street. The planning, designing, and implementation of bicycle facilities still follows the City’s rigorous process that includes engineering assessment and public engagement. These guidelines, however, form the foundation for decision-making and collaboration to better move people.

It is important to note that this is a living document that should be updated with changes to land use plans, future transportation planning efforts, zoning ordinances, and changes in public desires and needs.

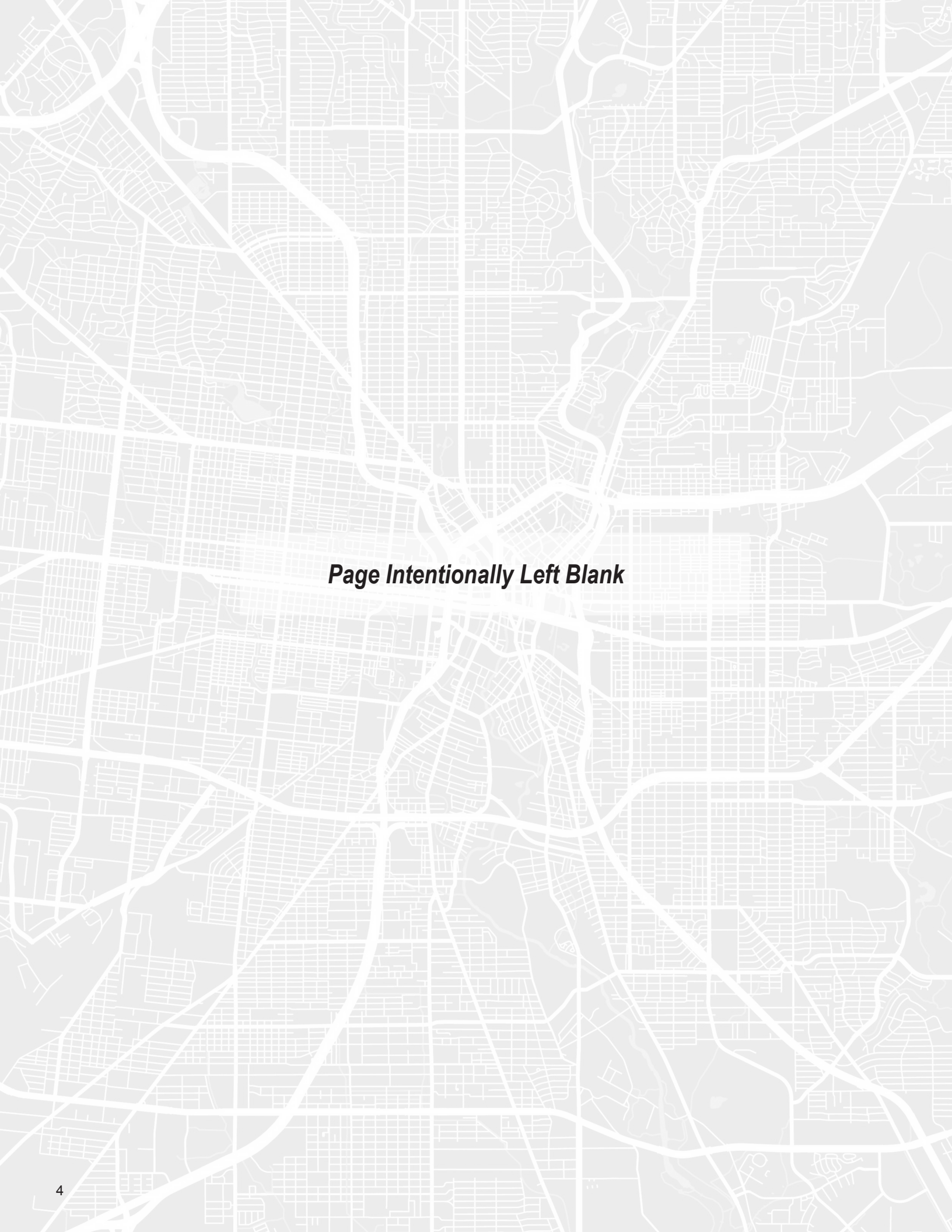
Guiding Principles

- Provide comfortable and connected multimodal facilities for users of all ages and abilities;
- Allocate space for vulnerable roadway users in the street design process;
- Recognize the relationship between streets and the adjacent land uses by integrating existing and future land uses to bicycle facility selection and design;
- Ensure that bicyclists are accommodated in future roadway improvement projects;
- Improve safety for all users, regardless of mode; and
- Improve bicycle network connectivity and circulation.

Relationship to Other Standards and Guidance

This Bike Facilities Guidelines for Future Amendments document provides San Antonio-focused guidelines that build off local, state, and national design standards and guidance. The guidance carries forward principles from the San Antonio Bike Network Plan, Tomorrow Sub-Area Plans, Major Thoroughfare Plan, and existing standards and policies that guide the design of San Antonio's built environment. It also integrates best practices in urban design from national research and guidance. The documents listed below provide a start to but not a comprehensive list of the guidance that led to the development of these guidelines and should be referenced as they evolve to keep up with the newest guidance. Resources include those from the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the National Association of City Transportation Officials (NACTO).

- San Antonio Unified Development Code § 35-506 and 35-207
- San Antonio Downtown Design Guide
- Bicycle Accommodation Design Guidance (TxDOT)
- Roadway Design Manual (TxDOT)
- Guide for the Development of Bicycle Facilities (AASHTO)
- Urban Street Design Guide (NACTO)
- Urban Bikeway Design Guide (NACTO)
- Transit Street Design Guide (NACTO)
- Evaluation of Safety, Design, and Operation of Shared-Use Paths (FHWA)
- Separated Bike Lane Planning and Design Guide (FHWA)
- Manual on Uniform Traffic Control Devices (FHWA)



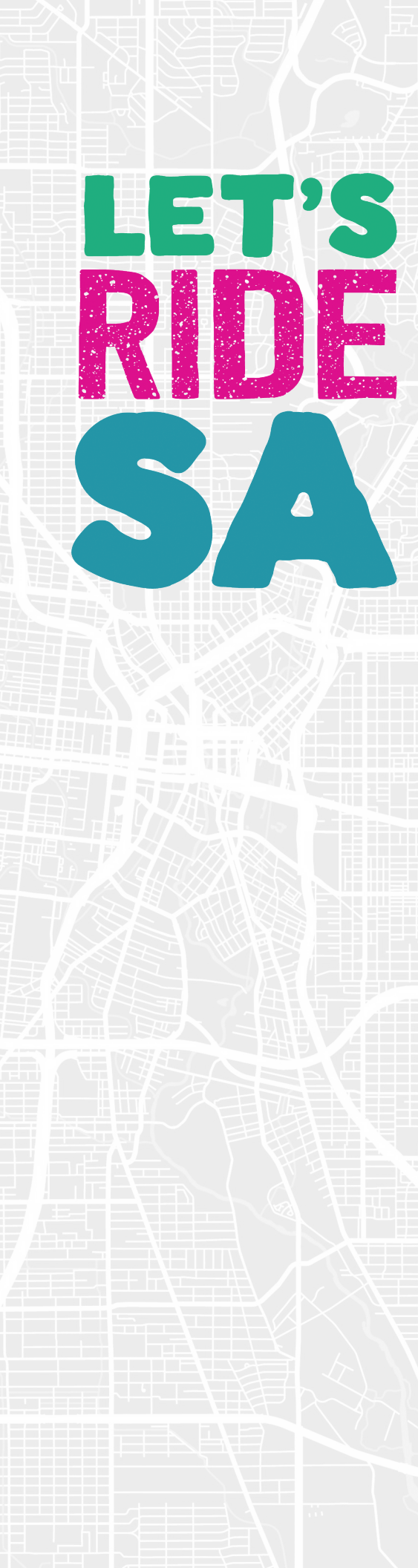
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Bicycle Facility Selection

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LET'S RIDE SA

Building Off the Bike Network Plan

A great bicycle facility alone may not be used if people can't safely and comfortably reach it. Only with a connected and complete bicycle network can people actually get where they need and want to go via riding a bicycle. By building out bicycle facilities that are efficient, seamless, and easy to use, San Antonio can encourage more people to bicycle.

The San Antonio Bike Network Plan developed a vision for a comfortable and interconnected system of bikeways to connect San Antonians to the places they want to go. The network informs facility selection by showing where high-quality bicycle facilities are needed the most. Ultimately, the Bike Network Plan creates a blueprint for investing in and implementing context-sensitive bicycle facilities.

How Do I Use the Bike Network Plan?

If a project is planned on a roadway identified in the Bike Network Plan, integrating recommended bicycle infrastructure should be prioritized during the design phase. It is important to remember that the quality of the bicycle infrastructure matters. Simply adding a bicycle lane on any corridor can be a missed opportunity to build out a low-stress/high-comfort bicycle network that serves all users and all abilities. Because projects are limited, there may not be another chance to build a high-quality bicycle connection for decades.

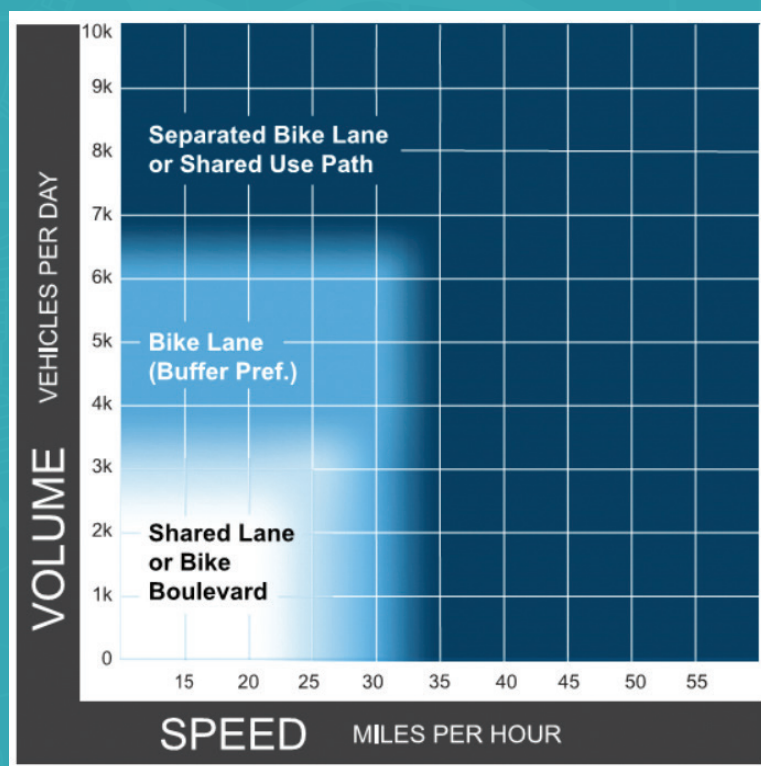
Additionally, if a project is planned on a road that is not identified in the Bike Network Plan, a discussion between Public Works, Transportation, and Planning should occur to determine appropriate bicycle facility needs.

Designing for All Ages and Abilities

Picking the Right Facility for Users

According to national guidance, the appropriate bicycle facility for a corridor is ideally matched to the prevailing traffic volumes and speeds. The chart below provides general guidance from the FHWA's 2019 Bikeway Selection Guide on the appropriate facility to keep people riding bicycles comfortably. In addition, the **NACTO Urban Bikeway Design Guide** provides guidance for choosing a bikeway design to create an All Ages & Abilities bicycling environment.

This document builds off FHWA and NACTO guidance to create context-sensitive bicycle facility guidance specifically for the City of San Antonio. It is important to note that the right bicycle facility design should include a comprehensive viewpoint that looks at the context and roadway characteristics. Simply adding a bike lane on a given road may not provide the proper infrastructure to make the facility comfortable for most.



Designing for people of all ages and abilities requires physical separation at certain vehicle volumes (y-axis) and speeds (x-axis). The FHWA Bikeway Selection Guide provides general guidance for providing the appropriate facility based on the volume and speed of a road.

Notes:

1. Chart assumes operating speeds are similar to posted speeds. If they differ, use operating speed rather than posted speed.
 2. Advisory bike lanes may be an option when traffic volume is <3K ADT.
- Credit: Bikeway Selection Guide, FHWA, 2019

Understanding the Impact of Speeds and Volumes

Whether or not people will bike on a given corridor is heavily influenced by how comfortable they feel. For bicyclists, two of the biggest factors for comfortability are vehicle speeds and volumes. Even small increases in either of these two factors can greatly decrease a bicyclist's physical safety or perceived comfort.

SPEED

The speed of vehicles along a corridor greatly impacts safety of all roads users by narrowing driver sight, increasing stopping distance, and escalating the likelihood of a crash to include a fatality of serious injury. When designing for an All Ages and Abilities Bicycle Network, it's important to understand how speeds impact the overall design of the bicycle facility.



Design Speed: A tool used to determine the geometric features of a road during road design. Higher design speeds often mandate larger curb radii, wider travel lane widths, on-street parking restrictions, guardrails, and clear zones. Lower design speeds reduce observed speeding behavior, providing a safer place for people to bike.



Target Speed: The highest speed that designers intend drivers to go on a specific road or street.



Posted Speed: The maximum lawful vehicle speed designated for a roadway.

Supporting safe travel speeds is an essential aspect of San Antonio Vision Zero work to eliminate traffic deaths and severe injuries. Therefore, design speeds should align with a safe and reasonable speed for the roadway's context and use. To reduce prevailing speeds, there are a multitude of countermeasures that can be considered, including:

- Narrowing travel lanes to cause motorists to naturally slow their speeds;
- Adding physical elements such as curb extensions, raised elements, and medians;
- Incorporating elements such as on-street parking, trees, and planting areas; and
- Reducing turning radii at intersections and slip lanes.
- Avoiding right-run slip lanes.

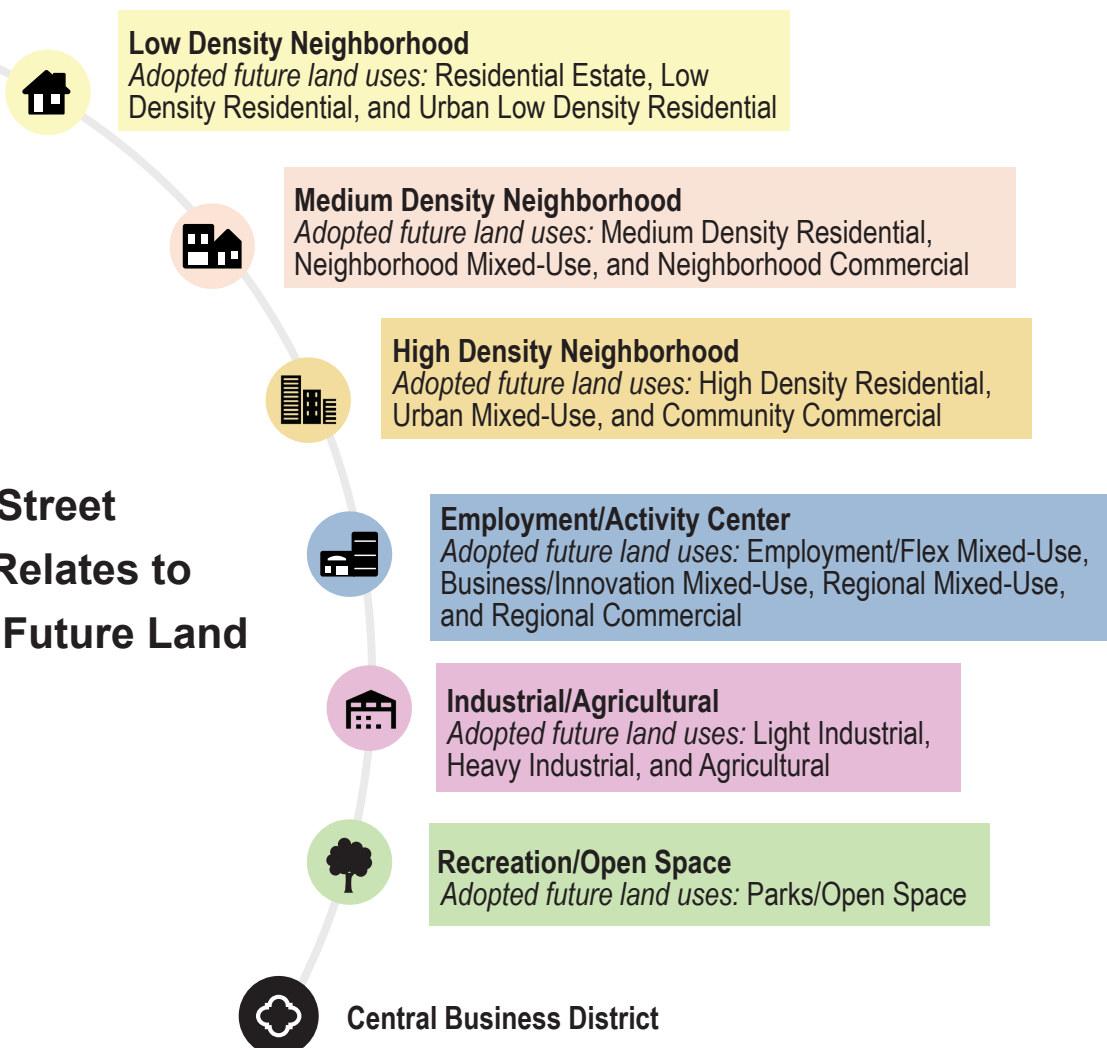
VOLUME

Biking with mixed traffic is generally comfortable only when vehicle volumes and speeds are low. As volumes increase it becomes increasingly difficult for motorists and bicyclists to share roadway space. On roadways that have high peak hour volumes, greater separation between bicyclists and vehicles can be beneficial, particularly when the peak hour coincides with peak volumes for bicyclists.

Understanding a Street's Context

San Antonio is formed by different neighborhoods that vary by their mix of uses, density, scale of buildings, block patterns, and amenities. These neighborhood characteristics affect network connectivity and influence how people travel. For example, people living in dense, mixed-use urban areas are more likely to walk or bike for their daily needs, requiring enhanced pedestrian and bicycle amenities. Understanding the challenges and opportunities of each surrounding street context (land use) is key to developing a bicycle network that works for the whole city and all users. As illustrated below, the surrounding street context categories developed for the Bike Network Plan are condensed, generalized variations of the 18 future land use categories developed by the San Antonio Planning Department. These surrounding street contexts are subject to change based on development.

How the Street Context Relates to Adopted Future Land Uses



Recommended Bicycle Facilities*

San Antonio's bicycle facility selection is organized by 1) the City's roadway functional classification, and 2) surrounding land use context. In consultation with the City's Planning Department staff, the SA Tomorrow Comprehensive Plan, and the SA Tomorrow Sub-Area plans, land use categories were consolidated to create seven street contexts based on land uses. In total, there are 42 unique combinations of functional classification and land use-based street contexts.

Functional Classifications

-  Primary Arterial
-  Secondary Arterial
-  Collector A and B
-  Collector C
-  Local A
-  Local B and C

Street Context

-  Low Density Neighborhood
-  Medium Density Neighborhood
-  High Density Neighborhood
-  Employment/Activity Center
-  Industrial/Agricultural
-  Recreation/Open Space
-  Central Business District

* Selection of bike facilities on existing or proposed streets for street contexts (classification / land use) not included in the UDC table 506-4, shall be done in coordination with and approval from the Director of Development Services and the Director of Public Works.

How to Use This Document

For each combination of street context and functional classification, a one-page bicycle facility selection sheet describes the expected street land use context, desired key street characteristics, and guidance to choose an appropriate bicycle facility.

Functional classification and street context

Collector A/B High Density Neighborhood

Collectors in high density neighborhoods connect neighborhood streets to the City's broader transportation network. These streets typically carry higher volumes and, with additional design elements, can make walking and biking an attractive option for many short trips.

Desired Characteristics in this Street Context

RIGHT OF WAY 70' 80' 70-80 feet	AVERAGE VEHICLE TRAVEL SPEED (Target Speed) 25-30 miles per hour	TARGET SHADE COVERING Refer to Table 510-1 and 510-2 in the UDC
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Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	PREFERRED BICYCLE FACILITY	Alternative Options to Consider***
2 Lanes	25 MPH^	<3,000	 Bike Boulevard see page 74 Striped Bike Lane see page 76	- Buffered Bike Lane - Protected Bike Lane - Shared Use Path - Alternative Route
2 Lanes	30 MPH	<3,000	 Striped Bike Lane see page 76 Buffered Bike Lane see page 76	Alternative Route
2 Lanes	40 MPH	>3,000	 Buffered Bike Lane see page 76 Protected Bike Lane see page 80	- Shared Use Path - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.
 ** Represents projected future year traffic volumes and not Design ADT.
 *** Alternative options may be considered if the preferred facility type does not fit within the right of way.
 ^ UDC recommends a 35 MPH design speed for Collectors A/B. A 25 MPH design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study should be conducted prior to using 25 MPH design/posted speed. If 25 MPH speed is not justified, a striped bike lane or buffered

Desired right-of-way width, vehicle travel speed, and target shade covering

Preferred cycling facility types and alternatives based on speed, number of lanes, traffic volumes, and street context. If the preferred facility is not feasible, alternative bicycle facility options are identified.

The background of the page is a light gray map of a city street grid. The map shows a dense network of streets, with some major roads highlighted in a slightly darker shade. The text is centered over this map.

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Primary Arterial

Primary arterials allow for longer trips across the city. These roads move the largest volumes of vehicles but also have significant right-of-way that can be used to separate people walking and biking from vehicle traffic. Enhanced bicycle facilities are needed along these corridors to increase comfort and safety for people of all ages and abilities. If high-quality dedicated bicycle facilities or shared use paths are not feasible, it is recommended to identify alternative routes for cyclists. Many primary arterials also serve as VIA transit routes, so enabling efficient transit service and access to transit are critical elements when designing streets and accommodating bicyclists.

Existing UDC Standards (Table 506-3)

Total Right-of-Way	120'
Number of Travel Lanes	4 – 6
Design ADT (vpd)	4 Lanes: 30,000-34,000 6 Lanes: > 46,000
Design Speed	45 mph
Pavement Width	48' - 81'
Median Width	16' min
Curb	Yes
Attached Sidewalk Width	6' min
Bicycle Facilities	Required
Landscaped/Sidewalk Buffer Width	5' min
Streetscape Planting	Yes
On-Street Parking	Not Permitted

Note: Refer to UDC Table 506-4 for design standards related to streets in Traditional Neighborhoods and Table 506-4A.1 for enhanced street design standards.



Primary Arterial Low Density Neighborhood

Because vehicles travel at relatively high speeds and there are multiple travel lanes, providing space between vehicles and pedestrians and bicycle facilities is a top priority.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



120
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



40–45
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2–4 Lanes	40 mph	Up to 30,000	 Protected Bike Lane see page 84	 Shared Use Path see page 92	- Protected Bike Lane (at-grade not recommended on 6-lane or 45 mph roadways) - Alternative Route
6 Lanes	40 mph	>30,000	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	
2–6 Lanes	45 mph	Up to 30,000			
		>30,000			

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, primary arterials have 4–6 lanes. Bicycle facility selection guidance is also provided for 2-lane primary arterials as several streets exist today with this configuration. Coordination and approval from the Public Works Director may be needed.



Primary Arterial Medium Density Neighborhood

Arterials traversing medium density neighborhood land uses often support high traffic volumes with widely spaced intersections and crossings. Because vehicles travel at relatively high speeds, providing space between vehicle, pedestrian, and bicycle facilities is a top priority.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



120
feet

AVERAGE VEHICLE TRAVEL SPEED

(Target Speed)



40–45
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2–4 Lanes	40 mph	Up to 30,000	 Protected Bike Lane see page 84	 Shared Use Path see page 92	- Protected Bike Lane (at-grade not recommended on 6-lane or 45 mph roadways) - Alternative Route
6 Lanes	40 mph	>30,000	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	
2–6 Lanes	45 mph	Up to 30,000	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	
		>30,000	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, Primary Arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane Primary Arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.



Primary Arterial High Density Neighborhood

Arterials in high density neighborhoods provide access to local destinations and services. Many trips from adjacent neighborhoods to access these destinations can be made by walking or biking, so safety and convenience for these users should be balanced with the street's overall efficiency.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



120
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



35–40
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2–4 Lanes	35 mph	Up to 30,000	 Protected Bike Lane see page 84	 Shared Use Path see page 92	- Protected Bike Lane (at-grade not recommended on 6-lane or 45 mph roadways) - Alternative Route
6 Lanes	35 mph	>30,000	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	
2–6 Lanes	40 mph	Up to 30,000	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	
		>30,000	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

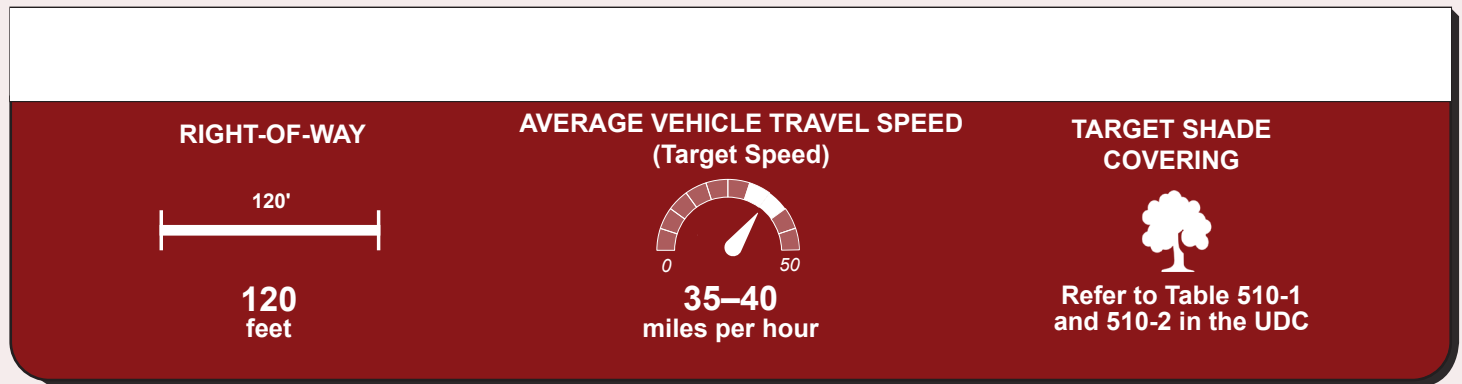
^ Per UDC, a design speed of 45mph should be used for future roads. However, a posted speed of 40 mph is recommended for this street context.

Note: Per UDC, primary arterials have 4–6 lanes. Bicycle facility selection guidance is also provided for 2-lane primary arterials as several streets exist today with this configuration. Coordination and approval from the Public Works Director may be needed.



Primary Arterial Employment/Activity Center

Arterials within employment/activity centers are important corridors for moving people and providing access to employment, services, and commercial centers. Employment /activity centers also include higher density housing and should encourage a safe environment for people walking, biking, and accessing transit.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2–4 Lanes	35 mph	Up to 30,000	Protected Bike Lane see page 84	Shared Use Path see page 92	- Protected Bike Lane (at-grade not recommended on 6-lane or 45 mph roadways) - Alternative Route
6 Lanes	35 mph	>30,000	Protected Bike Lane see page 84	Shared Use Path see page 92	
2–6 Lanes	40 mph	Up to 30,000	Protected Bike Lane see page 84	Shared Use Path see page 92	
		>30,000	Protected Bike Lane see page 84	Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, Primary Arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane Primary Arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.

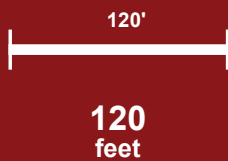


Primary Arterial Industrial/Agricultural

Arterials in industrial areas need to provide direct, convenient, and efficient access between commercial and industrial locations to regional routes and destinations. On these high-volume routes careful attention should be given to ensuring lane widths and turning radii are designed with pedestrian and bicycle safety in mind.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2–4 Lanes	40 mph	Up to 30,000	 Protected Bike Lane see page 84	 Shared Use Path see page 92	- Protected Bike Lane (at-grade not recommended on 6-lane or 45 mph roadways) - Alternative Route
6 Lanes	40 mph	>30,000	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	
2–6 Lanes	45 mph	Up to 30,000			
		>30,000			

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, primary arterials have 4–6 lanes. Bicycle facility selection guidance is also provided for 2-lane primary arterials as several streets exist today with this configuration. Coordination and approval from the Public Works Director may be needed.



Primary Arterial Recreation/Open Space

Recreation and open spaces attract large numbers of visitors, particularly from surrounding neighborhoods. Helping residents access these spaces safely and without needing a vehicle are top priorities. Robust pedestrian and bicycle facilities help provide comfortable and safe connections to trails.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



120
feet

AVERAGE VEHICLE TRAVEL SPEED

(Target Speed)



30–45
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2–6 Lanes	<35 mph	Any	 Protected Bike Lane see page 84	 Shared Use Path see page 92	- Protected Bike Lane (at-grade not recommended on 6-lane or 45 mph roadways) - Alternative Route
2–6 Lanes	>40 mph	Any	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, primary arterials have 4–6 lanes. Bicycle facility selection guidance is also provided for 2-lane primary arterials as several streets exist today with this configuration. Coordination and approval from the Public Works Director may be needed.

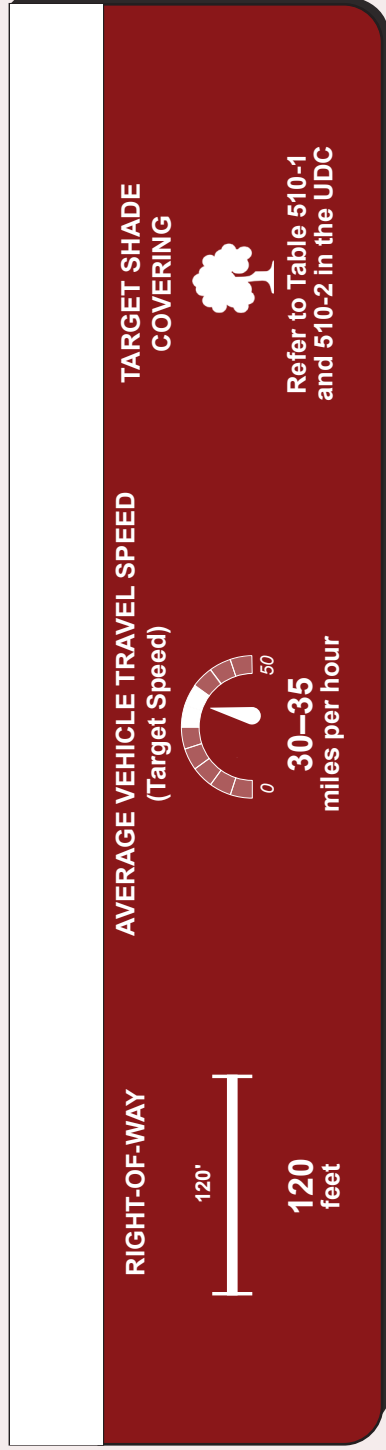


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Primary Arterial Central Business District

The Central Business District experiences some of the highest amount of street-level activity in San Antonio today. Therefore, arterials should be designed to provide a safe, pleasant environment for people walking and biking, and to create an inviting public realm. Providing access to key destinations for people using all modes is a primary goal, that must be balanced with moving people on these corridors.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**		PREFERRED BICYCLE FACILITY	Alternative Options to Consider***
2–4 Lanes	30 mph	Up to 30,000		 Protected Bike Lane see page 84	- Protected Bike Lane (at-grade not recommended on 6-lane or 45 mph roadways) - Alternative Route
6 Lanes	30 mph	>30,000		 Shared Use Path see page 92	
2–6 Lanes	35 mph^	Up to 30,000		 Protected Bike Lane (Raised) see page 84	
		>30,000		 Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ Per UDC, a design speed of 45mph should be used for future roads. However, a posted speed of 35 mph is recommended for this street context.

Note: Per UDC, primary arterials have 4–6 lanes. Bicycle facility selection guidance is also provided for 2-lane primary arterials as several streets exist today with this configuration. Coordination and approval from the Public Works Director may be needed.



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Secondary Arterial

Along with primary arterials, secondary arterials form the backbone of San Antonio's street network. These roads move large volumes of vehicles and provide direct regional access to key destinations and activity centers. Enhanced bicycle facilities are needed along these corridors to increase comfort and safety for vulnerable users. If high-quality dedicated bicycle facilities or shared use paths are not feasible, it is recommended to identify alternative routes for cyclists. Many secondary arterials also serve as VIA transit routes, so enabling efficient transit service and access to transit is critical when designing the streets and accommodating bicyclists.

Existing UDC Standards (Table 506-3)

Total Right-of-Way	86'-110'
Number of Travel Lanes	4
Design ADT (vpd)	4 Lanes: 30,000-34,000
Design Speed	40 mph
Pavement Width	48' - 81'
Median Width	16' min
Curb	Yes
Attached Sidewalk Width	6' min
Bicycle Facilities	Required
Landscaped/Sidewalk Buffer Width	5' min
Streetscape Planting	Yes
On-Street Parking	Not Permitted

Note: Refer to UDC Table 506-4 for design standards related to streets in Traditional Neighborhoods and Table 506-4A.1 for enhanced street design standards.



Secondary Arterial Low Density Neighborhood

Because vehicles travel at relatively high speeds and there are multiple travel lanes, providing space between vehicles and pedestrians and bicycle facilities is a top priority.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



86–110
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



35–40
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2 Lanes	35–40 mph	Any	 Protected Bike Lane see page 84	 Shared Use Path see page 92	- Buffered Bike Lane (not recommended on 4-lane or 40 mph roadways) - Alternative Route
2–4 Lanes	40 mph	Any	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

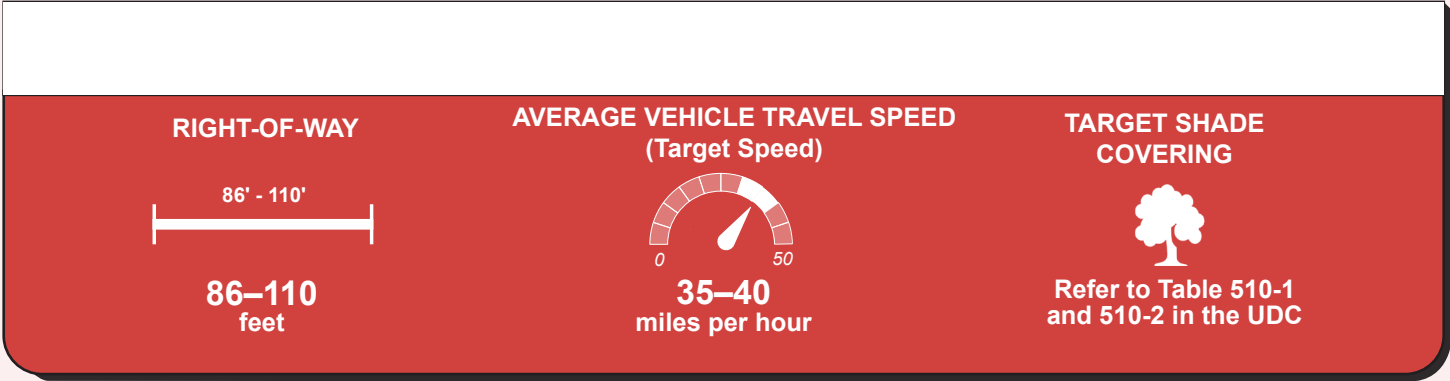
*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, secondary arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane secondary arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.



Secondary Arterial Medium Density Neighborhood

Arterials traversing medium density neighborhood land uses often support high traffic volumes with widely spaced intersections and crossings. Because vehicles travel at relatively high speeds, providing space between vehicles and pedestrians and/or bicycle facilities is a top priority.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider***
2 Lanes	35–40 mph	Any	 Protected Bike Lane see page 84  Shared Use Path see page 92	• Buffered Bike Lane (not recommended on 4-lane or 40 mph roadways) • Alternative Route
2–4 Lanes	40 mph	Any	 Protected Bike Lane (Raised) see page 84  Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, secondary arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane secondary arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.



Secondary Arterial High Density Neighborhood

Arterials in high density neighborhoods provide access to local destinations and services. Many trips from adjacent neighborhoods to access these destinations can be made by walking or biking, so safety and convenience for these users should be balanced with the street's overall efficiency.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



86–110
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



35–40
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2 Lanes	35–40 mph	Any	 Protected Bike Lane see page 84	 Shared Use Path see page 92	- Buffered Bike Lane (not recommended on 4-lane or 40 mph roadways) - Alternative Route
2–4 Lanes	40 mph	Any	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, secondary arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane secondary arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.



Secondary Arterial Employment/Activity Center

Arterials within employment/activity centers are important corridors for moving people and providing access to employment, services, and commercial centers. Employment/activity centers also include higher density housing and must provide a safe environment for people walking, biking, and accessing transit.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
			 Protected Bike Lane see page 84	 Shared Use Path see page 92	
2 Lanes	35–40 mph	Any			• Buffered Bike Lane (not recommended on 4-lane or 40 mph roadways) • Alternative Route
2–4 Lanes	40 mph	Any	 Protected Bike Lane (Raised) see page 84	 Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, secondary arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane secondary arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.



Secondary Arterial Industrial/Agricultural

Arterials in industrial areas need to provide direct, convenient, and efficient access between commercial and industrial locations to regional routes and destinations. These high-volume routes should pay careful attention to ensuring lane widths and turning radii are designed with pedestrian and bicycle safety in mind.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



86–110
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



35–40
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider***
2 Lanes	35 mph	Any	 Protected Bike Lane see page 84	• Buffered Bike Lane (not recommended on 4-lane or 40 mph roadways) • Shared Use Path • Alternative Route
2–4 Lanes	40 mph	Any	 Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, secondary arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane secondary arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.



Secondary Arterial Recreation/Open Space

Recreation and open spaces attract large numbers of visitors, particularly from surrounding neighborhoods. Helping residents access these spaces safely and without needing a vehicle are top priorities. Robust pedestrian and bicycle facilities help provide comfortable and safe connections to trails.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



86–110
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



40
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider***
2–4 Lanes	40 mph	Any	 Protected Bike Lane see page 84  Shared Use Path see page 92	- Buffered Bike Lane (not recommended on 4-lane or 40 mph roadways) - Shared Use Path - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, secondary arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane secondary arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.

The background of the page is a light gray map of a city street grid. The map shows a dense network of streets, with some major roads highlighted in a slightly darker shade of gray. The text is centered over this map.

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Secondary Arterial Central Business District

The Central Business District experiences the most street-level activity in San Antonio today. Therefore, arterials should be designed to provide a safe, pleasant environment for people walking and biking, and to create an inviting public realm. Providing access to key destinations for people using all modes is a primary goal, which must be balanced with moving people on these corridors.

Desired Characteristics in this Street Context

RIGHT-OF-WAY

86' - 110'

86–110 feet

AVERAGE VEHICLE TRAVEL SPEED
(Target Speed)

30–35 miles per hour

TARGET SHADE COVERING

Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	PREFERRED BICYCLE FACILITY	Alternative Options to Consider***
2–4 Lanes	30–35 mph	Any	Protected Bike Lane see page 84 Shared Use Path see page 92	- Buffered Bike Lane (not recommended on 4-lane or 40 mph roadways) - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Per UDC, secondary arterials have 4 lanes. Bicycle facility selection guidance is also provided for 2-lane secondary arterials as several streets exist today with this configuration. Coordination and approval from Public Works Director may be needed.



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Collector A/B

Collector streets link residents to nearby destinations and adjacent neighborhoods and connects to San Antonio's arterials, enabling longer, cross-town trips. Many trips on collectors are shorter, making walking and biking more feasible. Collectors should be designed for moderate vehicle volumes and lower speeds. Combined with high-quality sidewalks and bicycle facilities, enhanced landscaping, furniture, and shading, collector streets can be attractive corridors for walking and biking. As defined in San Antonio's Unified Development Code, Collector A and Collector B streets vary from Collector C streets based on available right-of-way and traffic volumes.

Existing UDC Standards (Table 506-3)

	Collector A	Collector B
Total Right-of-Way	70'	80'
Design ADT (vpd)	8,000–10,000	8,000–10,000
Design Speed	30 mph	35 mph
Pavement Width	30'	34'
Median Width	Not Required	Not Required
Curb	Yes	Yes
Attached Sidewalk Width	6' min	6' min
Bicycle Facilities*	Required	Required
Landscaped/Sidewalk Buffer Width	5' min	5' min
Streetscape Planting	Yes	Yes
On-Street Parking	Not Permitted	Not Permitted

* Refer to UDC Table 506-3 for minimum widths for shared use paths.

Note: Refer to UDC Table 506-4 for design standards related to streets in Traditional Neighborhoods and Table 506-4A.1 for enhanced street design standards.



Collector A/B

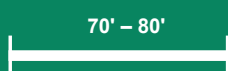
Low Density Neighborhood

Collectors in Low Density Neighborhoods provide direct connections to neighborhood streets. These streets typically carry low volumes of traffic at low speeds and, with additional design elements, can make walking and biking an attractive option for many short trips.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



70–80
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



25–30
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number
of Lanes

Speed*

Traffic Volumes**



**PREFERRED BICYCLE
FACILITY**

Alternative Options to
Consider***

2 Lanes	25 mph [^]	<3,000	 Bike Boulevard see page 78	- Striped Bike Lane - Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	30 mph	<3,000	 Striped Bike Lane see page 80  Buffered Bike Lane see page 82	
2 Lanes	30 mph	>3,000	 Buffered Bike Lane see page 82  Protected Bike Lane see page 84	- Shared Use Path - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

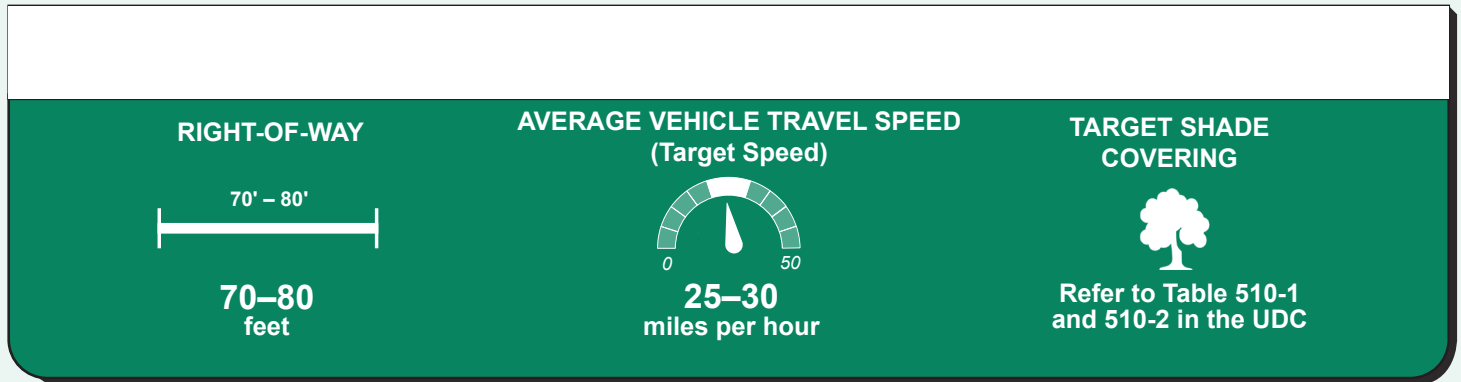
*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

[^] UDC recommends a 30/35 mph design speed for Collectors A/B. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead.



Collector A/B Medium Density Neighborhood

Collectors in Medium Density Neighborhoods connect neighborhood streets to the city's broader transportation network. These streets typically carry moderate volumes and, with additional design elements, can make walking and biking an attractive option for many short trips.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	PREFERRED BICYCLE FACILITY		Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	Bike Boulevard see page 78		- Striped Bike Lane - Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	30 mph	<3,000	Striped Bike Lane see page 80	Buffered Bike Lane see page 82	
2 Lanes	30 mph	>3,000	Buffered Bike Lane see page 82	Protected Bike Lane see page 84	- Shared Use Path - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30/35 mph design speed for Collectors A/B. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead.

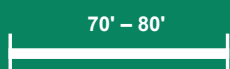


Collector A/B High Density Neighborhood

Collectors in high density neighborhoods connect neighborhood streets to the City's broader transportation network. These streets typically carry higher volumes and, with additional design elements, can make walking and biking an attractive option for many short trips.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



70–80
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



25–30
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2 Lanes	25 mph^	<3,000	 Bike Boulevard see page 78	 Striped Bike Lane see page 80	• Buffered Bike Lane • Protected Bike Lane • Shared Use Path • Alternative Route
2 Lanes	30 mph	<3,000	 Striped Bike Lane see page 80	 Buffered Bike Lane see page 82	
2 Lanes	30 mph	>3,000	 Buffered Bike Lane see page 82	 Protected Bike Lane see page 84	• Shared Use Path • Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30/35 mph design speed for Collectors A/B. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead.



Collector A/B Employment/Activity Center

Collectors in employment and activity centers link people to major employment and commercial centers and services. They should deliver an efficient experience for people using all modes of transportation, and their design should anticipate significant numbers of people walking.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



70–80
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



25–30
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of
Lanes

Speed*

Traffic Volumes**



PREFERRED BICYCLE
FACILITY

Alternative Options to
Consider***

2 Lanes	25 mph [^]	<3,000	 Bike Boulevard see page 78	 Striped Bike Lane see page 80	- Buffered Bike Lane - Protected Bike Lane
2 Lanes	30 mph	<3,000	 Striped Bike Lane see page 80	 Buffered Bike Lane see page 82	- Shared Use Path - Alternative Route
2 Lanes	30 mph	>3,000	 Buffered Bike Lane see page 82	 Protected Bike Lane see page 84	- Shared Use Path - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

[^] UDC recommends a 30/35 mph design speed for Collectors A/B. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead.



Collector A/B Industrial/Agricultural

Collectors in industrial areas need to provide links from industrial and agricultural sites to regional routes and destinations. Although volumes and speeds are lower, bicycle facilities should still be protected or separated from vehicle traffic.

▼

Desired Characteristics in this Street Context

RIGHT-OF-WAY

70' – 80'

70–80 feet

AVERAGE VEHICLE TRAVEL SPEED
(Target Speed)

050

30 miles per hour

TARGET SHADE COVERING

Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider***
2 Lanes	30 mph	Any	 Buffered Bike Lane see page 82  Protected Bike Lane see page 84	• Buffered Bike Lane • Protected Bike Lane • Shared Use Path • Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

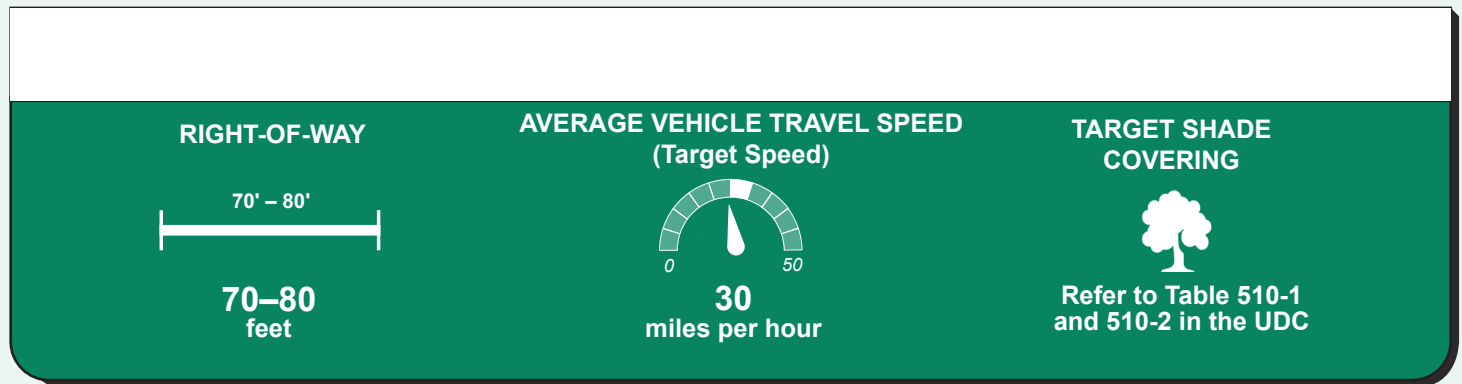
** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.



Collector A/B Recreation/Open Space

Collector streets within recreation and open space areas should enable everyone, from our youngest to our oldest residents, to comfortably access San Antonio's parks and open spaces. Low volumes and travel speeds, plentiful trees and vegetation, wide sidewalks and bicycle facilities create a welcoming environment for all.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2 Lanes	30 mph	<3,000	 Striped Bike Lane see page 80	 Buffered Bike Lane see page 82	- Protected Bike Lane - Shared Use Path - Alternative Route
2 Lanes	30 mph	>3,000	 Buffered Bike Lane see page 82	 Protected Bike Lane see page 84	- Shared Use Path - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

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Collector A/B Central Business District

The Central Business District experiences the most amount of street-level activity in San Antonio today. Collectors in downtown San Antonio should be designed to maximize space for people walking and to create an inviting public realm.

Desired Characteristics in this Street Context

RIGHT-OF-WAY



70–80
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



25–30
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider***
2 Lanes	25 mph [^]	<3,000	 Bike Boulevard see page 78	 Striped Bike Lane see page 80	- Bike Boulevard (only 2 lanes/25 mph) - Striped Bike Lane (only 2 lanes/25 mph) - Buffered Bike Lane - Protected Bike Lane - Shared Use Path - Alternative Route
2 Lanes	25 mph [^]	>3,000	 Buffered Bike Lane see page 82	 Protected Bike Lane see page 84	
2 Lanes	30 mph	<3,000	 Striped Bike Lane see page 80	 Buffered Bike Lane see page 82	
2 Lanes	30 mph	>3,000	 Buffered Bike Lane see page 82	 Protected Bike Lane see page 84	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

[^] UDC recommends a 30/35 mph design speed for Collectors A/B. A 25 mph design/posted speed is recommended in this downtown context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed.



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Collector C

Collector streets link residents to nearby destinations and adjacent neighborhoods and connect to San Antonio's arterials, enabling longer, cross-town trips. Many trips on collectors are shorter, making walking and biking more feasible. Collectors should be designed for moderate vehicle volumes and lower speeds. Combined with high-quality sidewalks and bicycle facilities, enhanced landscaping, furniture, and shading, collector streets can be attractive corridors for walking and biking. As defined in San Antonio's Unified Development Code, Collector C streets vary from Collector A and B streets based on available right-of-way and traffic volumes.

Existing UDC Standards (Table 506-3)

Total Right-of-Way	100'
Design ADT (vpd)	10,000 – 30,000
Design Speed	35 mph
Pavement Width	44'
Median Width	16'
Curb	Yes
Attached Sidewalk Width	6' min
Bicycle Facilities	Required
Landscaped/Sidewalk Buffer Width	5' min
Streetscape Planting	Yes
On-Street Parking	Not Permitted

Note: Refer to UDC Table 506-4 for design standards related to streets in Traditional Neighborhoods and Table 506-4A.1 for enhanced street design standards.



Collector C

Low Density Neighborhood

Collectors in Low Density Neighborhoods provide direct connections to neighborhood streets. These streets typically carry low volumes of traffic at low speeds and, with additional design elements, can make walking and biking an attractive option for many short trips.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



100
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



35
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of
Lanes

Speed*

Traffic Volumes**



PREFERRED BICYCLE FACILITY

Alternative Options to
Consider**

2 Lanes	35 mph	Any	 Protected Bike Lane (At-Grade) see page 84	- Protected Bike Lane (Raised) - Shared Use Path - Alternative Route
4 Lanes	35 mph	Any	 Protected Bike Lane (At-Grade) see page 84  Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

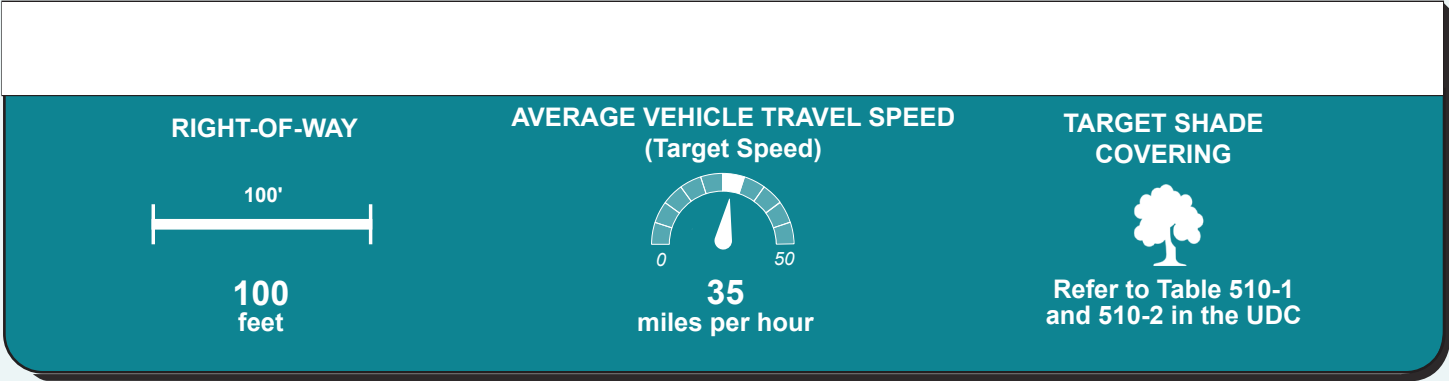
*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.



Collector C

Medium Density Neighborhood

Collectors in Medium Density Neighborhoods connect neighborhood streets to the city’s broader transportation network. These streets typically carry moderate volumes and, with additional design elements, can make walking and biking an attractive option for many short trips.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider***
2 Lanes	35 mph	Any	 Protected Bike Lane (At-Grade) see page 84	- Protected Bike Lane (Raised) - Shared Use Path - Alternative Route
4 Lanes	35 mph	Any	 Protected Bike Lane (At-Grade) see page 84  Shared Use Path see page 92	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.



Collector C

High Density Neighborhood

Collectors in high density neighborhoods connect neighborhood streets to the city's broader transportation network. These streets typically carry higher volumes and, with additional design elements, can make walking and biking an attractive option for many short trips.

Desired Characteristics in this Street Context

RIGHT-OF-WAY

100 feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)

30–35 miles per hour

TARGET SHADE COVERING

Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	PREFERRED BICYCLE FACILITY		Alternative Options to Consider**
2 Lanes	30 mph	<3,000	Striped Bike Lane see page 80	Buffered Bike Lane see page 82	- Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	30 mph	>3,000	Buffered Bike Lane see page 82	Protected Bike Lane see page 84	- Protected Bike Lane - Shared Use Path - Alternative Route
2-4 Lanes	35 mph	Any	Protected Bike Lane (At-Grade) see page 84	Shared Use Path see page 92	- Protected Bike Lane (Raised) - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

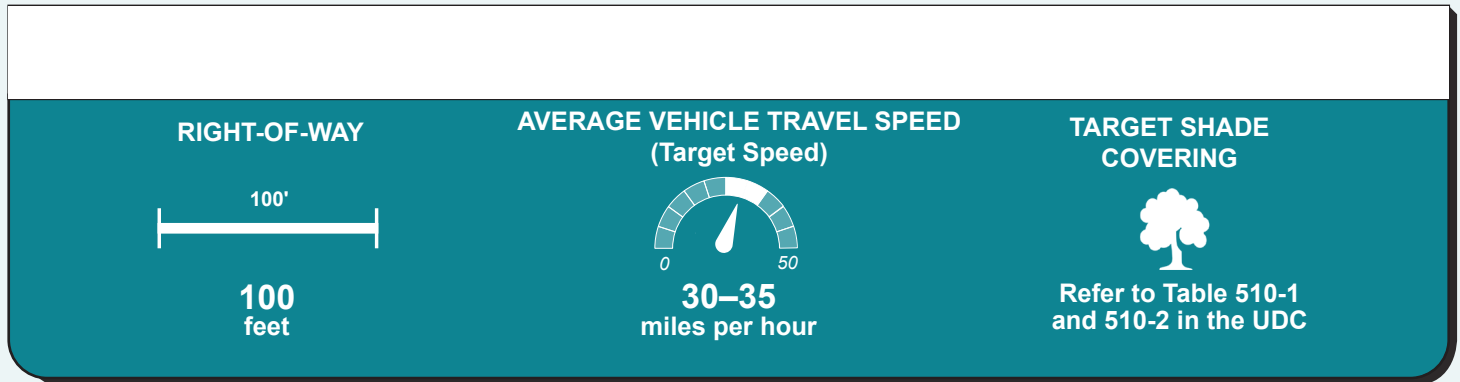
** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.



Collector C Employment/Activity Center

Collectors in employment and activity centers link people to major employment and commercial centers and services. They should deliver an efficient experience for people using all modes of transportation, and their design should anticipate significant numbers of people walking.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	PREFERRED BICYCLE FACILITY		Alternative Options to Consider**
2 Lanes	30 mph	<3,000	Striped Bike Lane see page 80	Buffered Bike Lane see page 82	- Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	30 mph	>3,000	Buffered Bike Lane see page 82	Protected Bike Lane see page 84	
2-4 Lanes	35 mph	Any	Protected Bike Lane (At-Grade) see page 84	Shared Use Path see page 92	- Protected Bike Lane (Raised) - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.



Collector C

Industrial/Agricultural

Collectors in industrial areas need to provide links from industrial and agricultural sites to regional routes and destinations. Although volumes and speeds are lower, bicycle facilities should still be protected or separated from vehicle traffic.

Desired Characteristics in this Street Context

RIGHT-OF-WAY

AVERAGE VEHICLE TRAVEL SPEED
(Target Speed)

TARGET SHADE
COVERING

Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2-4 Lanes	35 mph	Any	 Protected Bike Lane (At-Grade) see page 84  Shared Use Path see page 92	- Protected Bike Lane (Raised) - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

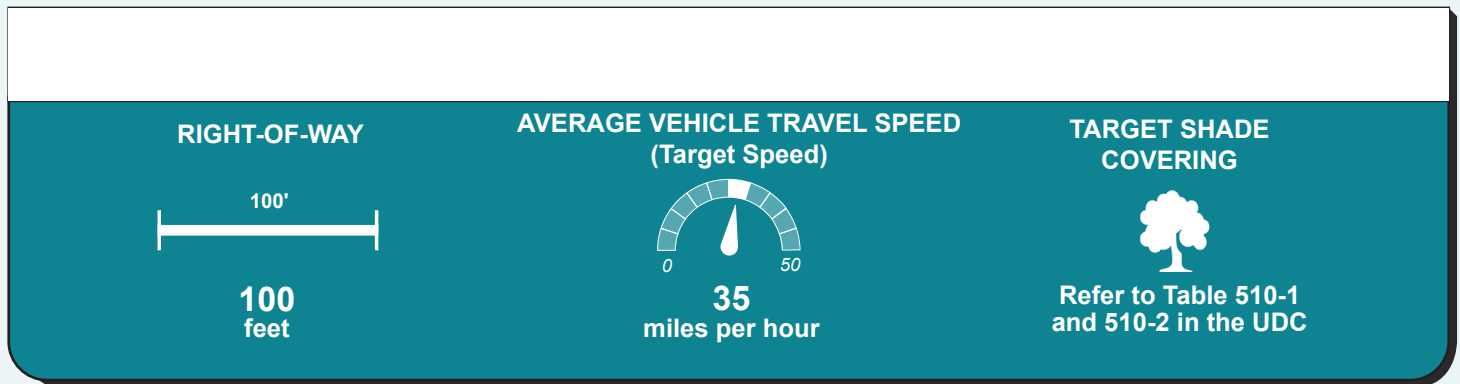
*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.



Collector C

Recreation/Open Space

Collector streets within recreation and open space areas should enable everyone, from our youngest to our oldest residents, to comfortably access San Antonio's parks and open spaces. Low volumes and travel speeds, plentiful trees and vegetation, wide sidewalks and bicycle facilities create a welcoming environment for all.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2-4 Lanes	35 mph	Any	 Shared Use Path see page 92	- Protected Bike Lane - Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

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Collector C Central Business District

The Central Business District experiences has the highest amount of street-level activity in San Antonio today. Collectors in Downtown San Antonio should be designed to maximize space for people walking and to create an inviting public realm.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



100
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



25–30
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Bike Boulevard see page 82	 Striped Bike Lane see page 80	- Bike Boulevard (only 2 lanes/25 mph) - Striped Bike Lane (only 2 lanes/25 mph) - Buffered Bike Lane - Protected Bike Lane - Shared Use Path - Alternative Route
2 Lanes	25 mph^	>3,000	 Buffered Bike Lane see page 82	 Protected Bike Lane see page 84	
2 Lanes	30 mph	<3,000	 Striped Bike Lane see page 80	 Buffered Bike Lane see page 82	
2 Lanes	30 mph	>3,000	 Buffered Bike Lane see page 82	 Protected Bike Lane see page 84	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 35 mph design speed for Collectors C. A 25 mph design/posted speed is recommended in this downtown context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed

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Local A

Local streets connect residents to the city's transportation network and act as places for neighbors to recreate and socialize. Local streets are designed to carry very little traffic and for cars to move slowly; they should be calm, shaded, and kid-friendly. Local streets may include flex zones that can be used for on-street parking and green infrastructure, as well as additional uses in higher density areas. As defined in San Antonio's Unified Development Code, Local A streets vary from Local B and Local C streets based on available right-of-way.

Existing UDC Standards (Table 506-3)

Total Right-of-Way (ROW)	50'
Design ADT (vpd)	<1,000
Design Speed	30 mph
Pavement Width	30'
Median	Not Required
Curb	Yes
Attached Sidewalk Width	4' min
Bicycle Facilities	Not Required
Landscaped/Sidewalk Buffer Width	Not Required
Streetscape Planting	Not Required
On-Street Parking	Allowed

Note: Refer to UDC Table 506-4 for design standards related to streets in Traditional Neighborhoods and Table 506-4A.1 for enhanced street design standards.



Local A

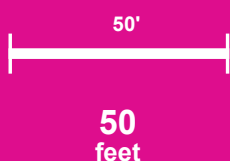
Low Density Neighborhood

Local streets in low density neighborhoods areas enable residents to step out their front door and connect to San Antonio's broader transportation network. They also serve as shared community spaces and extensions of residents' front yards and should encourage drivers to travel at safe speeds.

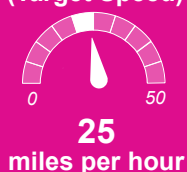


Desired Characteristics in this Street Context

RIGHT-OF-WAY



AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



TARGET SHADE COVERING



Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Bike Boulevard see page 78	• Striped Bike Lane • Shared Use Path • Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30 mph design speed for Local A. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead.





Local A High Density Neighborhood

Local streets in high density neighborhoods connect residents to their homes and their daily needs (i.e., grocery stores, restaurants, shopping centers, etc.). Local streets are often residential, which means that the street's function as a public and social spaces.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



50
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



25
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Bike Boulevard see page 78  Striped Bike Lane see page 80	• Buffered Bike Lane • Shared Use Path • Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

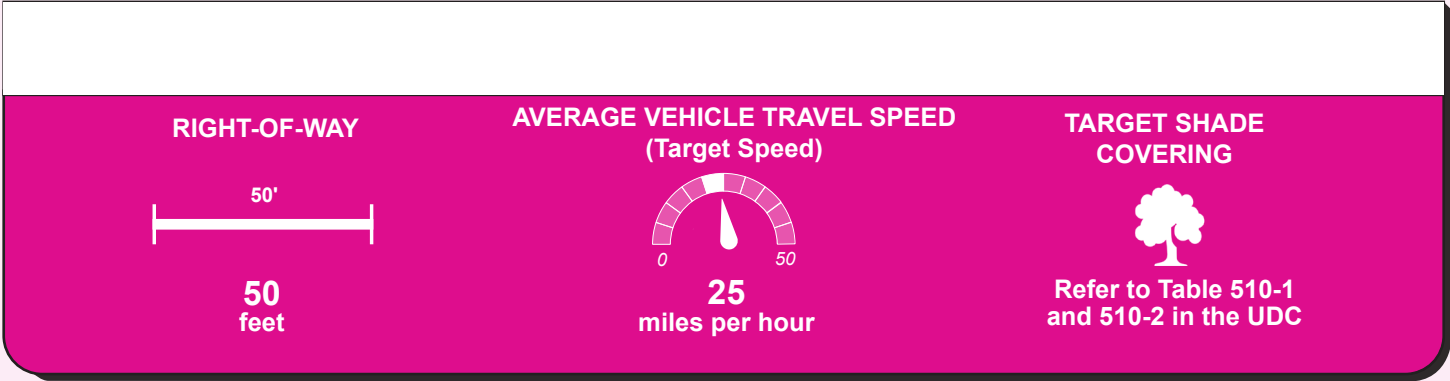
*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30 mph design speed for Local A. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead.



Local A Employment/Activity Center

Local streets in employment and activity centers link people to major employment and commercial centers and services. They also can provide circulation within these centers and allow for people to move between destinations.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Bike Boulevard see page 78  Striped Bike Lane see page 80	• Buffered Bike Lane • Shared Use Path • Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30 mph design speed for Local A. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead.



Local A Industrial/Agricultural

Local streets in industrial and agriculture areas provide vital, short-distance connections from commercial and industrial buildings to the larger transportation network. Minimizing conflicts between freight traffic and people walking and biking is critical.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



50
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



25
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Striped Bike Lane see page 80	• Buffered Bike Lane • Shared Use Path • Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

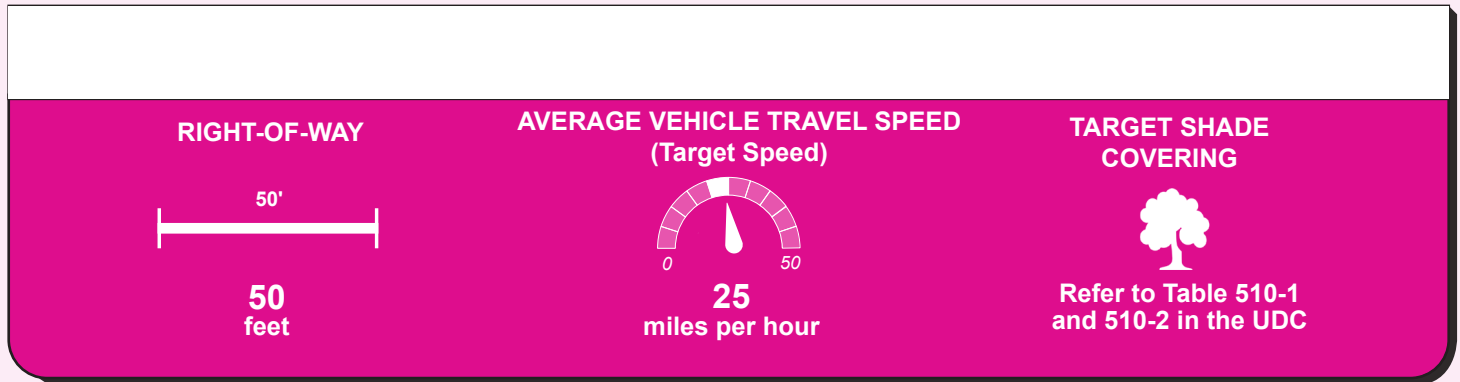
*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30 mph design speed for Local A. A 25 mph design/posted speed is recommended in this industrial context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a buffered bike lane or shared used path should be used instead.



Local A Recreation/Open Space

Local streets within recreation and open space areas should enable everyone, from the youngest to the oldest residents, to comfortably access San Antonio's parks and open spaces. Low volumes and travel speeds, plentiful trees and vegetation, wide sidewalks and bicycle facilities create a welcoming environment for people walking and biking.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph [^]	<3,000	 Bike Boulevard see page 78  Striped Bike Lane see page 80	• Buffered Bike Lane • Shared Use Path • Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

[^] UDC recommends a 30 mph design speed for Local A. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead

The background of the page is a detailed, light gray map of a city street grid. The map shows a complex network of streets, including major thoroughfares and smaller residential roads. A semi-transparent white rectangular box is centered on the page, containing the text "Page Intentionally Left Blank".

AVERAGE VEHICLE TRAVEL SPEED

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Local A Central Business District

The Central Business District experiences the most street-level activity in San Antonio; therefore, local streets should be designed to maximize space for people walking and to create an inviting public realm. Local streets typically have low volumes and low speeds and may include on-street parking, bicycle parking, seating, and space for mingling in the shade to create activity and support local businesses.

Desired Characteristics in this Street Context

RIGHT-OF-WAY

50 feet

AVERAGE VEHICLE TRAVEL SPEED
(Target Speed)

25 miles per hour

TARGET SHADE COVERING

Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Bike Boulevard see page 78  Striped Bike Lane see page 80	• Buffered Bike Lane • Shared Use Path • Alternative Route

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30 mph design speed for Local A. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead.



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Local B and C

Local streets connect residents to the city's transportation network and act as places for neighbors to recreate and socialize. Local streets are designed to carry very little traffic and for cars to move slowly; they should be calm, shaded, and kid-friendly. Local streets may include flex zones that can be used for on-street parking and green infrastructure, as well as additional uses in higher density areas. As defined in San Antonio's Unified Development Code, Local B and C streets vary from Local A streets based on available right-of-way.

Existing UDC Standards (Table 506-3)

	Local B	Local C
Total Right-of-Way (ROW)	60'	60'
Design ADT (vpd)	1,000 – 4,000 (if houses fronting) 4,000 – 8,000 (if no houses fronting)	4,000 – 10,000
Design Speed (mph)	30 mph	30 mph
Pavement Width (feet)	34'	36'
Median	Not Required	Not Required
Curb	Yes	Yes
Sidewalk Width	4' min houses fronting 6' min no houses fronting	6' min
Bicycle Facilities	Allowed	Allowed
Landscaped/Sidewalk Buffer Width	Not Required: 3' min	Not Required: 3' min
Streetscape Planting	Not Required	Not Required
On-Street Parking	Allowed	Allowed

Note: Refer to UDC Table 506-4 for design standards related to streets in Traditional Neighborhoods and Table 506-4A.1 for enhanced street design standards.



Local B/C

Low Density Neighborhood

Local streets in low density neighborhood areas enable residents to step out of their front door and connect to San Antonio's broader transportation network. They also serve as shared community spaces and extensions of residents' front yards and should encourage drivers to travel at safe speeds.

Desired Characteristics in this Street Context		
RIGHT-OF-WAY  60 feet	AVERAGE VEHICLE TRAVEL SPEED (Target Speed)  25–30 miles per hour	TARGET SHADE COVERING  Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Bike Boulevard see page 78  Striped Bike Lane see page 80	- Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	25 - 30 mph^	>3,000	 Striped Bike Lane see page 80	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30 mph design speed for Local B/C. A 25 mph design/posted speed is recommended in this context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a buffered bike lane or shared use path should be used instead.



Local B/C

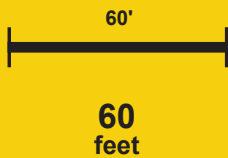
Medium Density Neighborhood

Local roadways in medium density neighborhoods connect residents to the city's broader transportation network. They also serve as shared community spaces and extensions of residents' front yards and should encourage drivers to travel at safe speeds.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



TARGET SHADE COVERING



Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY		Alternative Options to Consider**
2 Lanes	25 mph [^]	<3,000	 Bike Boulevard see page 78	 Striped Bike Lane see page 80	- Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	25 - 30 mph [^]	>3,000	 Striped Bike Lane see page 80	 Buffered Bike Lane see page 82	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

[^] UDC recommends a 30 mph design speed for Local A. A 25 mph design/posted speed is recommended in this context for a bike boulevard. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a striped bike lane or buffered bike lane should be used instead



Local B/C High Density Neighborhood

Local streets in high density neighborhoods connect residents to their homes and their daily needs (i.e., grocery stores, restaurants, shopping centers, etc.). Local streets are often residential, which means that the streets function as a public and social spaces.

Desired Characteristics in this Street Context

RIGHT-OF-WAY

60'
60 feet

**AVERAGE VEHICLE TRAVEL SPEED
(Target Speed)**

0 50
25–30
miles per hour

TARGET SHADE COVERING

Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph [^]	<3,000	Striped Bike Lane see page 80	- Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	25 - 30 mph [^]	>3,000	Striped Bike Lane see page 80 Buffered Bike Lane see page 82	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

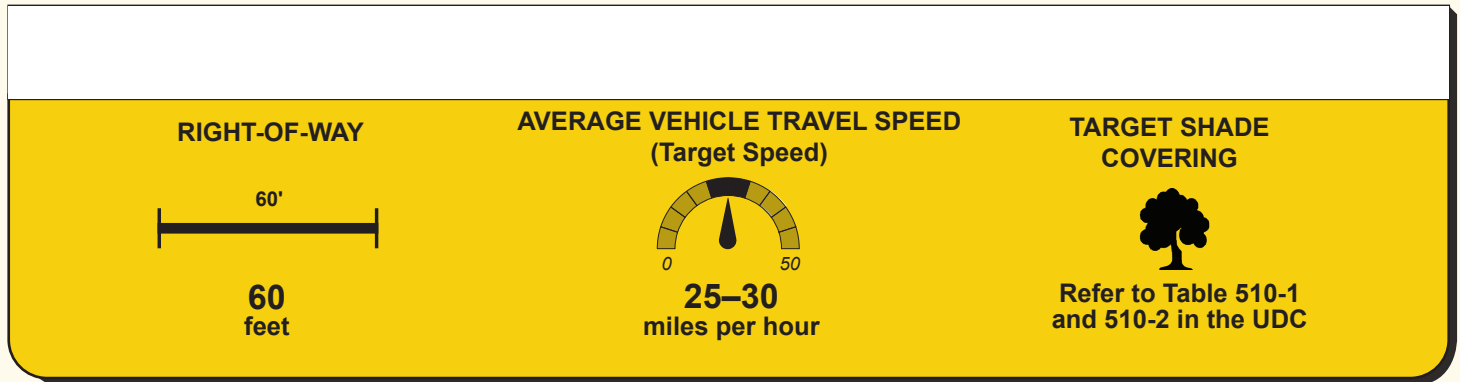
*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

[^] UDC recommends a 30 mph design speed for Local B/C. A 25 mph design/posted speed is recommended in this context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a buffered bike lane or shared use path should be used instead.



Local B/C Employment/Activity Center

Local streets in employment and activity centers link people to major employment and commercial centers and services. They also can provide circulation within these centers and allow for people to move between destinations.



Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph [^]	<3,000	 Striped Bike Lane see page 80	- Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	25 - 30 mph [^]	>3,000	 Striped Bike Lane see page 80  Buffered Bike Lane see page 82	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

[^] UDC recommends a 30 mph design speed for Local B/C. A 25 mph design/posted speed is recommended in this context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a buffered bike lane or shared use path should be used instead.



Local B/C Industrial/Agricultural

Local streets in industrial and agriculture areas provide vital, short-distance connections from commercial and industrial buildings to the larger transportation network. Minimizing conflicts between freight traffic and people walking and biking is critical.

Desired Characteristics in this Street Context

RIGHT-OF-WAY

60 feet

AVERAGE VEHICLE TRAVEL SPEED
(Target Speed)

25–30 miles per hour

TARGET SHADE COVERING

Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Striped Bike Lane see page 80	- Shared Use Path - Alternative Route
2 Lanes	25 - 30 mph^	>3,000	 Striped Bike Lane see page 80  Buffered Bike Lane see page 82	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30 mph design speed for Local B/C. A 25 mph design/posted speed is recommended in this context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a buffered bike lane or shared use path should be used instead.



Local B/C Recreation/Open Space

Local streets within recreation and open space areas should enable everyone, from the youngest to the oldest residents, to comfortably access San Antonio's parks and open spaces. Low volumes and travel speeds, plentiful trees and vegetation, and wide sidewalks and bicycle facilities create a welcoming environment for people walking and biking.



Desired Characteristics in this Street Context

RIGHT-OF-WAY



60
feet

AVERAGE VEHICLE TRAVEL SPEED (Target Speed)



25–30
miles per hour

TARGET SHADE COVERING



Refer to Table 510-1
and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph [^]	<3,000	 Striped Bike Lane see page 80	- Buffered Bike Lane - Shared Use Path - Alternative Route
2 Lanes	25 - 30 mph [^]	>3,000	 Striped Bike Lane see page 80  Buffered Bike Lane see page 82	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

[^] UDC recommends a 30 mph design speed for Local B/C. A 25 mph design/posted speed is recommended in this context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a buffered bike lane or shared use path should be used instead.



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Local B/C

Central Business District

The Central Business District experiences the most street-level activity in San Antonio; therefore, local streets should be designed to maximize space for people walking and to create an inviting public realm. Local streets typically have lower volumes and slower speeds and may include on-street parking, bicycle parking, seating, and space for mingling in the shade to create activity and support local businesses.

▼

Desired Characteristics in this Street Context

RIGHT-OF-WAY

60'

60 feet

AVERAGE VEHICLE TRAVEL SPEED
(Target Speed)

050

25–30 miles per hour

TARGET SHADE COVERING

Refer to Table 510-1 and 510-2 in the UDC

Preferred Bicycle Facility Based on Speed, Lanes, and Volumes

The following table outlines preferred and alternative bicycle facility types based on national design guidance to create a comfortable bicycle facility for all ages and abilities.

Number of Lanes	Speed*	Traffic Volumes**	 PREFERRED BICYCLE FACILITY	Alternative Options to Consider**
2 Lanes	25 mph^	<3,000	 Striped Bike Lane see page 80	• Buffered Bike Lane • Protected Bike Lane • Shared Use Path • Alternative Route
2 Lanes	25 - 30 mph^	>3,000	 Striped Bike Lane see page 80  Buffered Bike Lane see page 82	

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

^ UDC recommends a 30 mph design speed for Local B/C. A 25 mph design/posted speed is recommended in this context. A traffic engineering study (speed study) is required prior to using 25 mph design/posted speed. If 25 mph speed is not justified, a buffered or protected bike lane or shared use path should be used instead.

The background of the page is a light gray map of a city street grid. The grid is composed of numerous thin white lines representing streets, with some thicker white lines indicating major thoroughfares or highways. The map covers the entire page, with the text centered over a slightly darker gray rectangular area.

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Additional Bicycle Facility Guidelines



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Bicycle Facility Types

The following pages outline general guidelines to consider for each bicycle facility type:

<u>Bike Boulevard</u>	<u>78</u>
<u>Striped Bike Lane</u>	<u>80</u>
<u>Buffered Bike Lane</u>	<u>82</u>
<u>Protected Bike Lane</u>	<u>84</u>
<u>Shared Use Path</u>	<u>92</u>



Bike Boulevard

Treatment Summary

Bike Boulevards, also known as Bicycle Boulevards, Neighborhood Greenways, or Neighborhood Bike Routes, are typically traffic calmed residential streets with low vehicle volumes and low speeds where motor vehicles and bicycles share the road space. Bike Boulevards use pavement markings, signs, and traffic calming elements to enhance safety and comfort for people on bicycles.

Bike Boulevards are only appropriate on-streets with low speeds (preferably 20-25 MPH) and vehicular volumes (preferably 3,000 vehicles per day or less). If speeds and volumes are higher than that, traffic calming or other treatments should be applied to create the appropriate environment. Bike Boulevards aim to optimize through-travel for people biking and include treatments to create low-stress crossings across busy streets. They should be designed to be as direct as possible and should include connections to nearby destinations that limit out of direction travel.

The following section summarizes general design guidance for bike boulevards. Refer to the most recent MUTCD, AASHTO Guide for the Development of Bicycle Facilities, and NACTO Urban Bikeway Design Guide for additional information as needed.

Recommended Elements

- A1** Bicycle wayfinding signage and pavement markings shall be included on Bike Boulevards. Pavement markings should be used to indicate preferred positioning in the road as well as wayfinding at turns.
- A2** Bicycle wayfinding signage should be placed anywhere there is a decision point or turn required. The signs should include destinations with arrows and distances.
- A3** The orientation of the chevron marking as part of the shared lane marking should indicate the appropriate direction of travel along the Bike Boulevard.
- A4** Traffic calming elements should be included at regular intervals (preferably 250-300'), both mid-block and at intersections.
- A5** Bike Boulevards should be designed for average travel speeds of 20-25 MPH, although posted speed may differ.
- A6** Pavement widths should match the widths noted in the UDC.
- A7** The curb should be painted red where parking is not allowed. No parking signs (MUTCD R8-3) may be used to discourage or prohibit parking in the bike lane.
- A8** At intersections and crossings, detectable warning surfaces and curb ramps shall be installed.
- A9** At offset or complex intersections, shared lane markings may be painted through the intersection.

Optional Enhancements

- B1** If on-street parking is included, consider marking a 2' to 3' buffer between the travel lane and parking lane if the travel lanes are wider than 11'.
- B2** In addition to standard directional wayfinding signage, confirmation signs listing destinations and distances may be included.
- B3** On one-way streets, a contraflow bike lane may be included to allow bicycle travel in the opposite direction of traffic. For more information on Bike Lanes, see ["Striped Bike Lane" on page 80](#).
- B4** Where there is additional space, Bike Boulevards may include striped bike lanes in addition to traffic calming. For more information on Bike Lanes, see ["Striped Bike Lane" on page 80](#).



Striped Bike Lane

Treatment Summary

Striped bike lanes designate exclusive space for people biking through the use of pavement markings and are typically appropriate on-streets with speeds of 30 MPH or less. Bike lanes are intended for one-way travel and are typically provided on both sides of two-way streets, and on one side of one-way streets. Conventional bike lanes may vary in width. In some cases, contraflow bike lanes may be provided to support access on one-way streets. Bike lanes are typically on the right side of the street, between the outside travel lane and curb, parking lane, or road edge. While the bike lane distinguishes predictable areas for bicyclist and automobile movement, bicyclists may leave the bikeway to pass other bicyclists or avoid debris and other traffic conflicts.

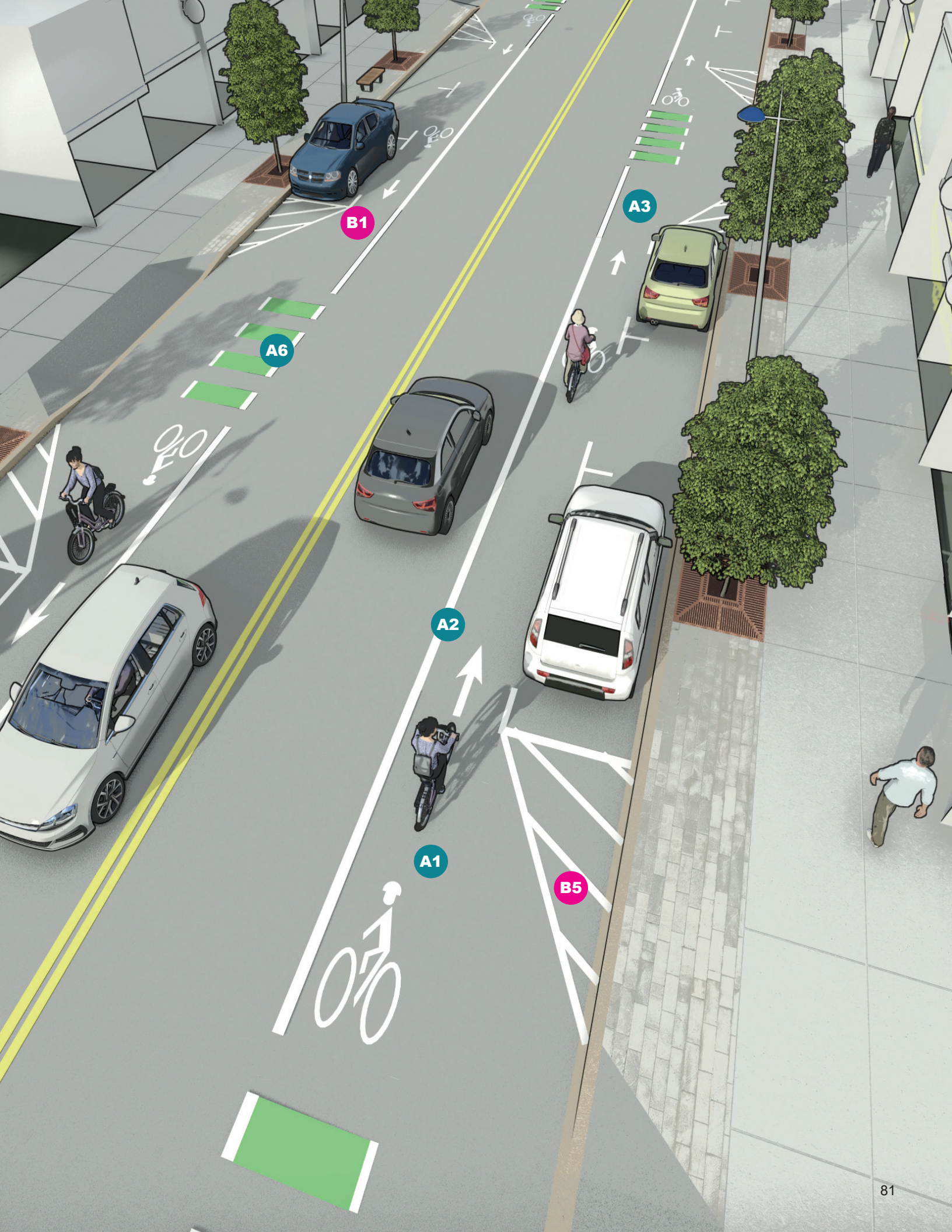
The following section summarizes general design guidance for bike lanes. Refer to the most recent MUTCD, AASHTO Guide for the Development of Bicycle Facilities, and NACTO Urban Bikeway Design Guide for additional information as needed.

Recommended Elements

- A1** Bicycle lane word, symbol, and/or arrow markings shall be placed at the beginning of the bike lane and along periodic intervals based on engineering judgement.
- A2** A solid wide white lane line shall be used to identify the edge of the bike lane.
- A3** Preferred bike lane width is determined based on facility type, context, and engineering assessment.
- A4** The curb may be painted red where parking is not allowed. No parking signs (MUTCD R8-3) may be used to discourage parking in the bike lane.
- A5** At intersections and crossings, detectable warning surfaces and curb ramps shall be installed.
- A6** At intersections and driveways, conflict striping may be considered to improve visibility for all users.
- A7** Manholes, drainage grates, and other obstacles should be set flush with the paved roadway, and grates should be positioned perpendicular to the path of travel so as not to trap bike tires.

Optional Enhancements

- B1** If the bike lane is adjacent to on-street parking, the bikeway should be placed between the travel lane and on-street parking. If there is space to provide a 3' buffer between the bikeway and parking lane while maintaining the minimum recommended bikeway width, the bikeway should be placed between the curb and the parking lane. Consider making bike lanes as wide as possible to allow people biking to avoid the door zone.
- B2** At bus stops, a bus island should be considered. People biking should yield to people walking at these points. If there is not space for a bus island, the bus may pull out to the curb and share the space with people biking.
- B3** To further indicate priority users, yield markings and/or raised crossings may be installed where people walking are anticipated to cross the bikeway.
- B4** Where drivers are observed parking or driving in a bike lane, protected bike lanes should be considered.
- B5** Where on street parking is present, prohibiting parking within 20 feet of driveways and intersections, or "daylighting," may be used to improve visibility for all roadway users.





Buffered Bike Lane

Treatment Summary

Buffered bike lanes provide additional horizontal separation between the bike lanes, travel lanes, or parking lanes, increasing comfort and separation for people biking. Buffered bike lanes are preferred along streets with higher volumes and speeds, where conventional bike lanes may not adequately enhance comfort and safety for people biking. Buffers provide a greater space for bicycling without making the bike lane appear overly wide; overly wide space may attract unintended motor vehicle use for driving or parking.

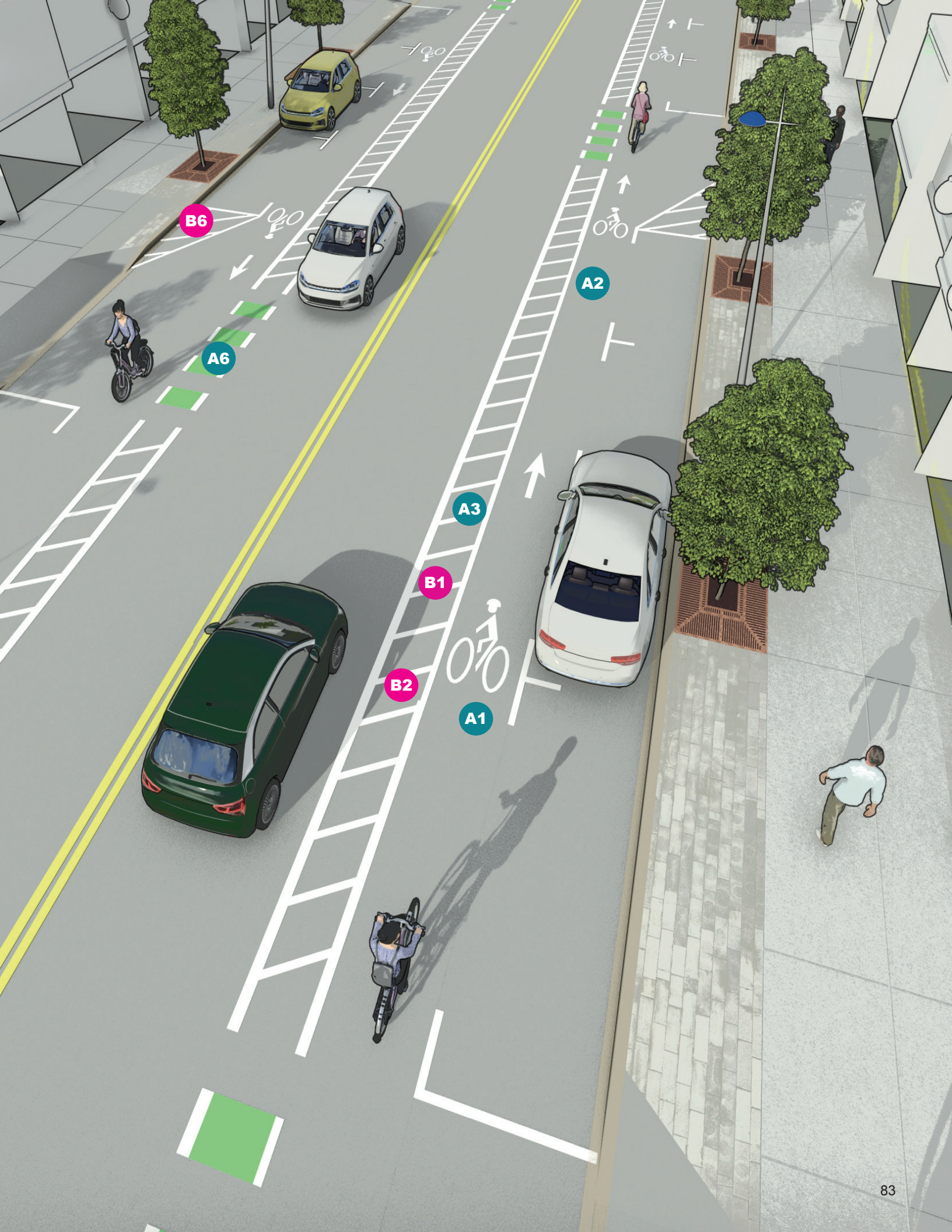
The following section summarizes general design guidance for buffered bike lanes. Refer to the most recent MUTCD, AASHTO Guide for the Development of Bicycle Facilities, and NACTO Urban Bikeway Design Guide for additional information as needed.

Recommended Elements

- A1** Bicycle lane word, symbol, and/or arrow markings shall be placed at the beginning of the bike lane and along periodic intervals based on engineering judgement.
- A2** Preferred bike lane width is determined based on facility type, context, and engineering assessment.
- A3** The buffer shall be marked with two solid white lines and hatching. Preferred buffer width is determined based on facility type, context, and engineering assessment.
- A4** The curb should be painted red where parking is not allowed. No parking signs (MUTCD R8-3) may be used to discourage parking in the bike lane.
- A5** At intersections and crossings, detectable warning surfaces and curb ramps shall be installed.
- A6** At intersections and driveways, conflict striping may be considered to improve visibility for all users.
- A7** Manholes, drainage grates, or other obstacles should be set flush with the paved roadway and grates should be positioned perpendicular to the path of travel so as not to trap bike tires.

Optional Enhancements

- B1** If the bike lane is adjacent to on-street parking, the bikeway may be placed between the curb and the parking lane. Consider making bike lanes as wide as possible to allow people biking to avoid the door zone. Where this is infeasible, the bike lane may be placed between the parking lane and vehicle lane. In these cases, buffers should be placed on both sides of the bike lane. If there is not space for a buffer on both sides of the bike lane and the bike lane must be placed between the parking lane and driving lane, the buffer may be placed only on one side. The determination of which side should be made based on engineering judgment and should consider parking turnover, vehicle speed, and volume.
- B2** A minimum 3' buffer is suggested when parking is present.
- B3** At bus stops, a bus island should be considered. People biking should yield to people walking at these points. If there is not space for a bus island, the bus may pull out to the curb and share the space with people biking.
- B4** To further indicate priority users, yield markings and/or raised crossings may be installed where people walking are anticipated to cross the bikeway.
- B5** Where drivers are observed parking or driving in a bike lane, protected bike lanes should be considered.
- B6** Where on street parking is present, prohibiting parking within 20 feet of driveways and intersections, or "daylighting," may be used to improve visibility for all roadway users.





Protected Bike Lane

Treatment Summary

Protected bike lanes, also known as cycle tracks and separated bikeways, incorporate physical separation from motorized traffic, parking lanes, and adjacent walking facilities. Physical separation varies and includes flexible post delineators, raised medians, landscaping, or another physical object. This vertical element differentiates protected bike lanes from striped and buffered bike lanes. Streets with protected bike lanes should also have sidewalks on both sides to accommodate people walking.

Protected bike lanes can accommodate one-way or two-way travel, be placed on one or both sides of the street, and may be built at street level, sidewalk level, or somewhere in between. One-way protected bike lanes are usually preferred as they reduce potential conflict points at driveways and intersections while providing access to both sides of the street. However, two-way facilities may be preferred along streets with long, uninterrupted blocks with most destinations on one side like parks. Two-way bike lanes require additional considerations at driveways and intersections so drivers know to look for two-way bike traffic.

The following section summarizes general design guidance for protected bike lanes. Refer to the most recent FHWA Separated Bike Lane Planning and Design Guide and/or the NACTO Urban Bikeway Design Guide for additional information as needed.

Recommended Elements

- A1** Bicycle lane word, symbol, and/or arrow markings shall be placed at the beginning of the protected bike lane and along periodic intervals based on engineering judgement.
- A2** Preferred bike lane width is determined based on facility type, context, and engineering assessment.
- A3** Physical separation, which may or may not include painted markings, shall be used. Separation type shall be based on facility type, context, and engineering assessment. Separation type examples can be found in ["Separator Types" on page 86](#).
- A4** A curb, detectable edge, or other feature shall be used to provide visual and physical queues to separate the bikeway and walkway.
- A5** At intersections and crossings, detectable warning surfaces and curb ramps shall be installed.
- A6** At intersections and driveways, conflict striping should be considered to improve visibility for all users. Raised side street crossings may be installed at side streets and driveways, especially if the bikeway is at sidewalk level.
- A7** Manholes, drainage grates, and other obstacles should be set flush with the paved roadway, and grates should be positioned perpendicular to the path of travel so as not to trap bike tires.

Optional Enhancements

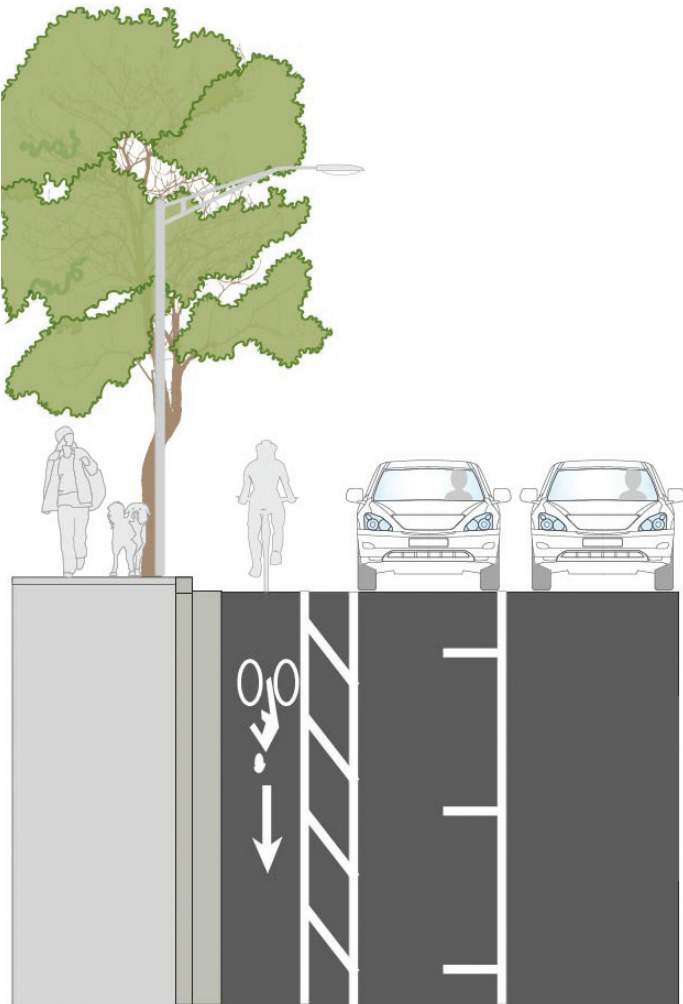
- B1** If the bike lane is parking protected, additional vertical elements should be considered between the parking lane and the bike lane. The buffer shall be at least 3' when parking is present.
- B2** If parking is provided, accessible parking shall also be provided. The bikeway may be narrowed to accommodate the required path of travel, and curb ramps should be installed to provide access to the sidewalk. Where possible, place accessible parking spaces near intersections.
- B3** Where on street parking is present, prohibiting parking within 20 feet of driveways and intersections, or "daylighting," may be used to improve visibility for all roadway users.
- B4** Where parking protected bike lanes are installed, the curb may be painted red and a colored stripe may be painted in the parking space to indicate parking restrictions similar to what would be painted on the curb (white, green, yellow, or blue curb).
- B5** At bus stops, a bus island should be considered. People biking should yield to people walking at these points.
- B6** To further indicate priority users, yield markings and/or raised crossings may be installed where people walking are anticipated to cross the bikeway. Additionally, any space where people are anticipated to walk should be designed to meet ADA cross slope standards.

Separator Types

Vertical separation between the bikeway and vehicle lanes is one of the most important design elements to consider when designing a protected bike lane. There are a variety of potential options that can be used to separate bike lanes from vehicular traffic. Many factors influence the design decisions for these buffers, including number of driving lanes, vehicular speeds and volumes, drainage, driveways, available right-of-way, maintenance, aesthetics, durability, cost, and long-term maintenance.

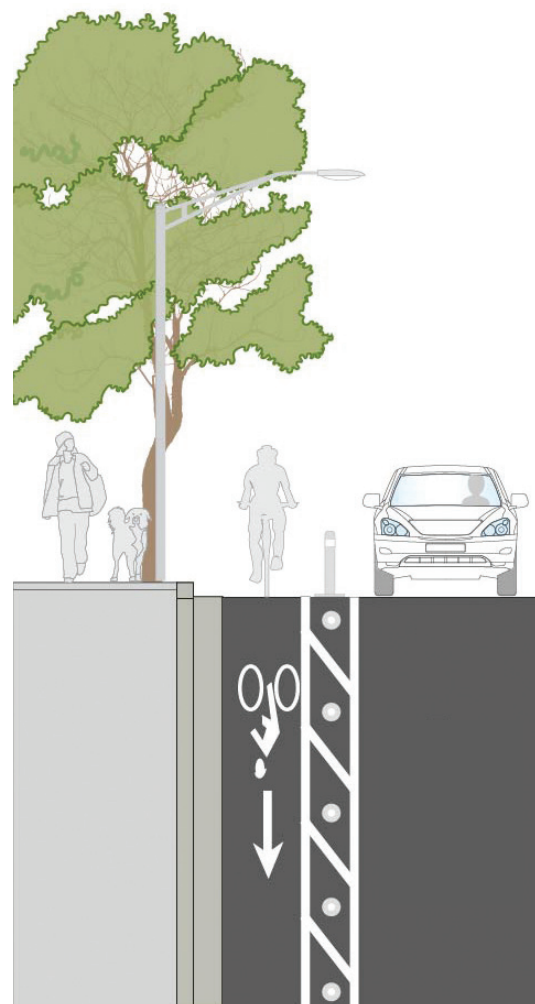
This document does not include an exhaustive list of types of separation and is designed to allow flexibility for the City to identify and implement new forms of separation as technology evolves. The following section describes a snapshot of potential separation technologies available to the City today. The table below provides a summary of some considerations for forms of separation. Each form is described in more detail on the following pages.

	Cost	Perceived Safety	Durability and Maintenance	Stormwater Management	Level of Separation from Vehicles	Aesthetics	Construction Impacts	Minimum Width Required
Parked Cars	Low Cost	Med	High	High	Med	Med	High	11'
Flexible Delineator Posts	Low Cost	Med	Low	High	Med	Low	Med	1.5'
Tuffcurb	Low Cost	High	Low	High	Med	Low	Med	1.5'
Armadillos	Low Cost	Med	Med	High	Med	Med	Med	2'
Parking Stops	Low Cost	Med	Med	High	Med	Low	Med	2'
Planters	Medium Cost	High	Low	Med	High	High	Med	4'
Concrete (Jersey) Barriers	High Cost	High	High	Med	High	Med	Med	3'
Rigid Bollards	Low Cost	Med	Med	High	Med	Med	High	1.5'
Raised Medians	High Cost	High	High	Med	High	High	High	1.5'
Sidewalk Level (Raised)	High Cost	High	High	Low	High	High	High	2'



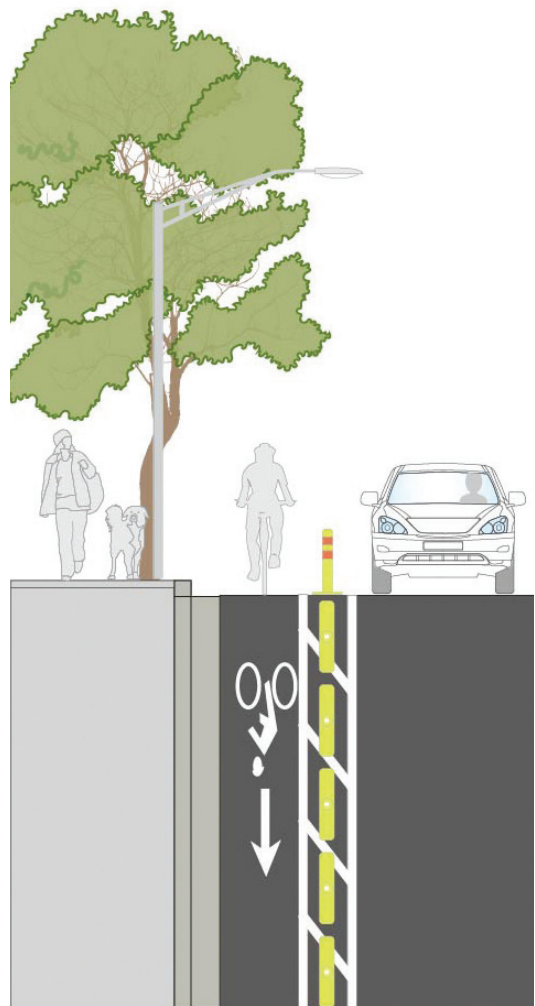
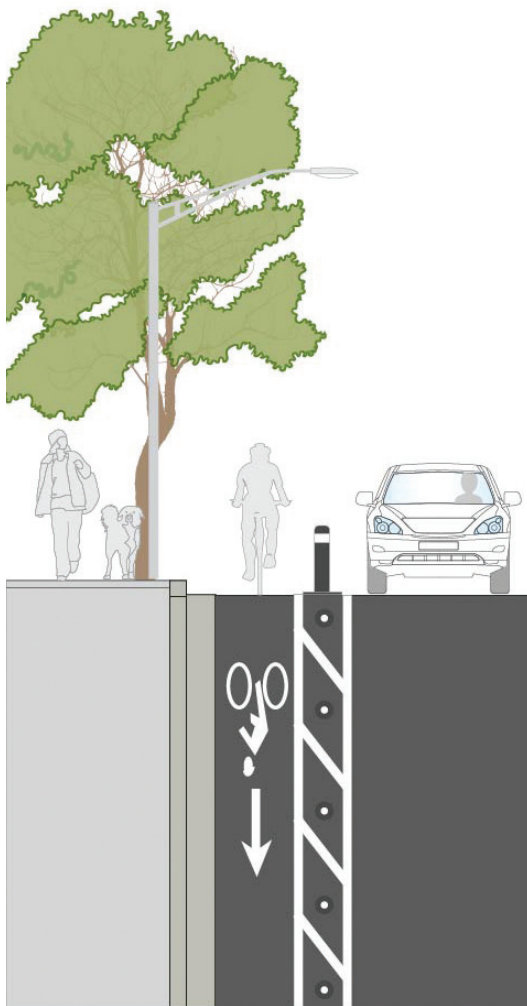
Parked Cars

- Parked vehicles are used to provide visual and physical separation.
- Only effective on its own when parking is fully or almost fully occupied. Otherwise, additional vertical elements may be considered to provide separation.
- A minimum 3' buffer is required to provide space for the opening of car doors.
- If used, additional vertical elements should take into account the need for the opening of car doors.



Flexible Delineator Posts

- Hard but bendable posts.
- Closer spacing and/or additional vertical elements should be used if there are concerns about drivers parking in the bikeway.
- Relatively inexpensive to install.
- May require frequent maintenance.
- May be used for permanent installations.
- Easy to modify and allow flexibility for design changes over time.

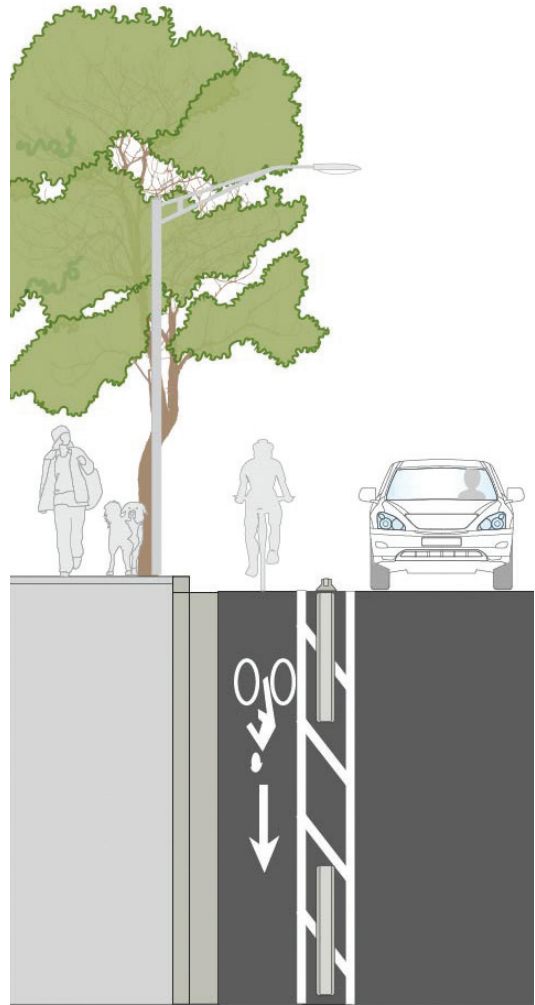
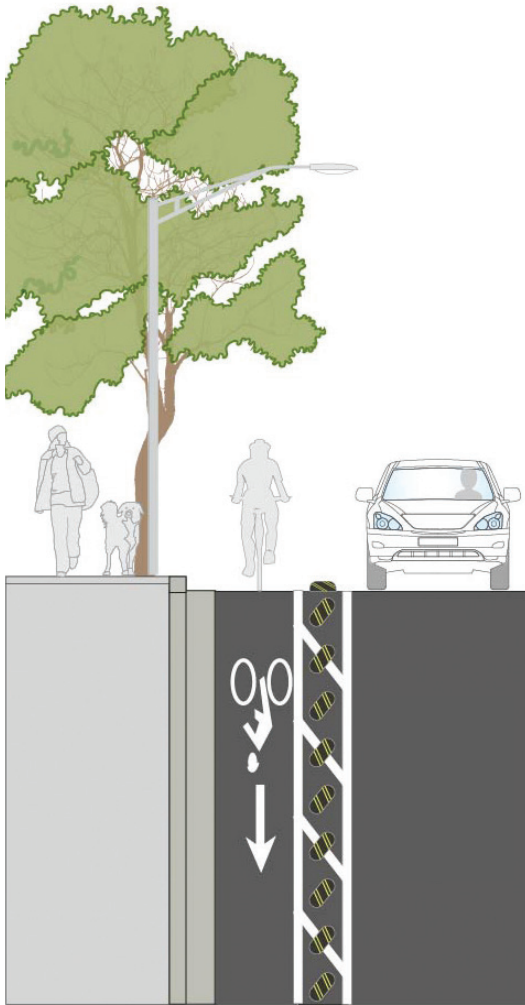


Rigid Bollards

- Operate similar to flexible posts, but are sturdier and have a higher cost.
- Generally considered more attractive than flexible posts.
- As with flexible posts, closer spacing and/or additional vertical elements should be used if there are concerns about drivers parking in the bikeway.

Tuffcurb

- Resembles a curb stop with a flexible post mounted on top of it.
- The combination of vertical and horizontal features provides a greater level of comfort for people walking and biking and also discourages drivers from driving into the bike lane.
- While more expensive than a standard flexible post, this treatment is still relatively inexpensive and can be modified more easily than a curb.

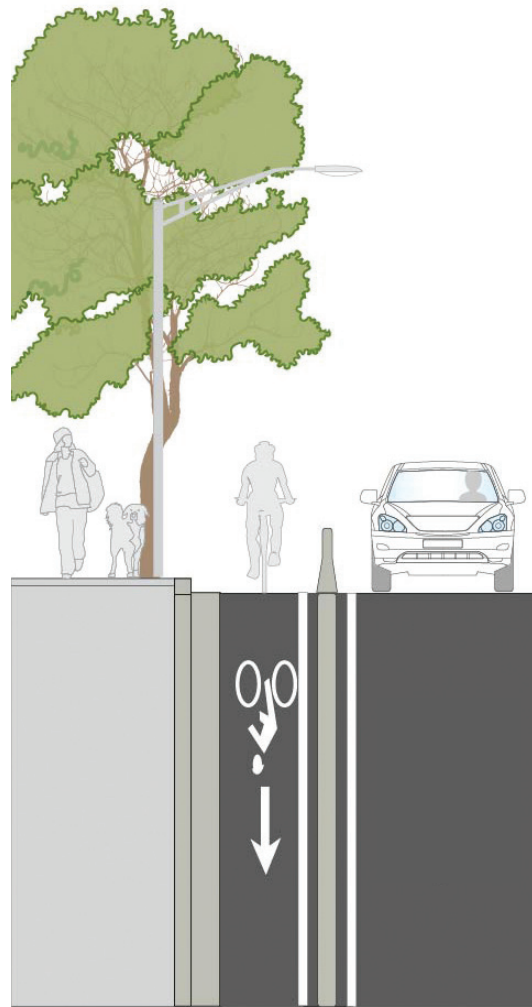
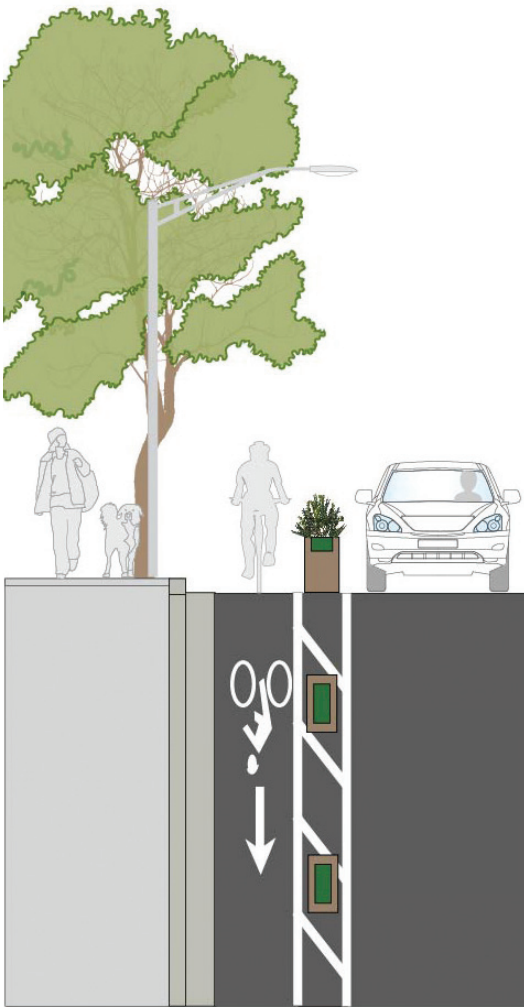


Armadillos

- Small, oblong objects that are generally painted with yellow or white stripes to increase visibility.
- Due to low profile, these provide less visual separation.
- May be used in combination with taller vertical elements to increase visibility.
- May pose a tripping hazard if used next to a parking lane.
- Low cost and easy to modify over time.

Parking Stops

- Inexpensive, low linear barrier.
- High level of durability.
- Provides near-continuous separation.
- The low profile limits visual separation; may be used in combination with taller vertical elements to increase visibility.
- Wider buffers may be preferred with this treatment to offset the lower level of visual separation from vehicles.

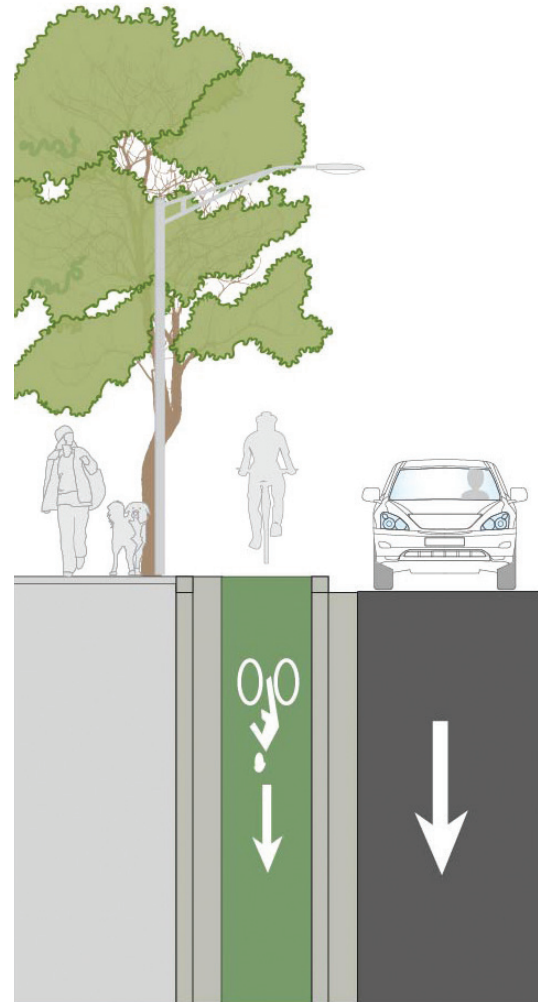


Planters

- Provides a strong visual and physical barrier between people biking and drivers.
- Offers an opportunity for placemaking and beautification.
- May be placed closer together to provide a consistent barrier.
- Generally considered an expensive treatment to install and may require significant maintenance.
- Require a wider buffer space given their width and height.
- Most appropriate on-streets with lower speeds and volumes.

Concrete (Jersey) Barriers

- Lower-cost treatment that provides continuous vertical separation.
- Highly durable treatment appropriate on roads with high vehicular speeds and volumes.
- May be painted to improve visual appeal.
- Not compatible with on-street parking.
- Crash cushion may be needed at barrier ends.
- May have drainage impacts.



Raised Medians

- Concrete curbs that are cast in place or precast.
- More expensive to construct but lower maintenance needs.
- Provide a high level of separation.
- Wider medians may provide space for landscaping, stormwater treatments, and other placemaking elements.
- May be mountable where emergency access is required.
- Gaps should be placed between medians to maintain drainage.

Sidewalk Level (Raised)

- Provides a high level of comfort.
- Expensive to construct, but lower maintenance needs.
- A detectable edge, such as a grass strip or textured pavement, should be installed to provide visual and tactile delineation between the sidewalk and the bikeway.
- In constrained situations, different pavement types and markings may be used to provide separation between the sidewalk and bikeway.



Shared Use Path

Treatment Summary

Shared use paths are bi-directional paths for nonmotorized uses. They may run fully separate from a road or be directly adjacent to streets as a sidepath. These facilities may include separated lanes for people walking and biking or mix modes together, and they may also include an adjacent unpaved path to accommodate equestrian use. These facilities offer network connectivity outside of the roadway network and are usually located in parks, along rivers, beaches, greenbelts, or utility corridors and they may also run alongside streets as sidepaths.

Shared use path design is similar to roadway design. It follows many of the same core design principles but on a different scale and with typically lower design speeds. When considering shared use paths, the competing needs of the corridor should be evaluated to best support adopted City policies and prioritize the most vulnerable users of our roadways. Shared use paths are not appropriate for streets with high pedestrian and bicycle volumes unless separate space can be provided for each mode. Shared use paths require intersection designs that safely accommodate bi-directional bicycle traffic.

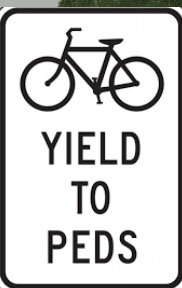
The following section summarizes general design guidance for protected Shared Use Paths. Refer to the most recent MUTCD, AASHTO Guide for the Development of Bicycle Facilities, and NACTO Urban Bikeway Design Guide for additional information as needed.

Recommended Elements

- A1** Preferred width is determined based on facility type, context, and engineering assessment.
- A2** Shared use paths should include a shoulder on either side, and the edge of the path should be separated from the roadway with a landscape buffer.
- A3** On wider shared use paths, a centerline stripe may help clarify the direction of travel and organize traffic. On very wide paths, separate walking and biking space may be designated.
- A5** At intersections and crossings, detectable warning surfaces and curb ramps shall be installed.
- A6** At intersections and driveways, conflict striping should be considered to improve visibility for all users.
- A7** Shared use paths are best suited for areas where roadway crossings and driveways can be minimized or where overpasses and underpasses are feasible. Raised side street crossings should be installed at side streets and driveways, especially if the bikeway is at sidewalk level.

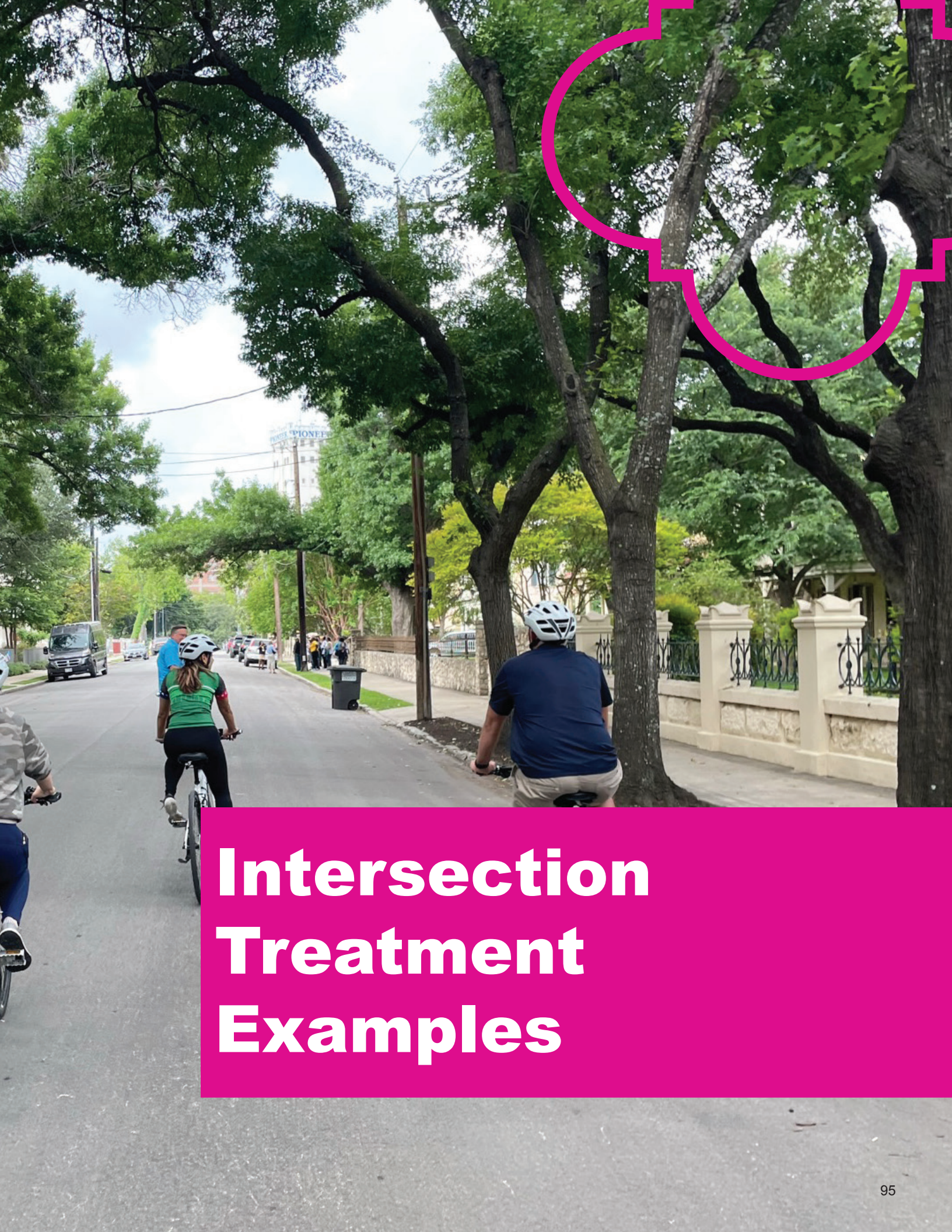
Optional Enhancements

- B1** Shared use paths may use materials such as asphalt or colored concrete to visually differentiate the space from a conventional sidewalk.
- B2** Shared use paths may be placed on both sides of the road where there are destinations on both sides of the road to increase access.
- B3** Short segments of sidepaths or shared use paths may be used to connect other bike facilities.
- B4** If drivers are anticipated to encroach on the shared use path, bollards or other preventative features may be placed at the entrance to the path. These should be highly visible, well lit, and designed for someone on using a wheelchair or riding a bike to pass through easily and, for people on bikes, without having to dismount.
- B5** If there is space to do so, it is ideal to include a detectable surface such as grass or a small curb where fully separated space is delineated for people walking and biking.



The background of the page is a detailed, light gray map of a city street grid. The map shows a complex network of streets, including major thoroughfares and smaller residential streets. The text is centered over a semi-transparent white rectangular area.

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A photograph of a tree-lined street with several cyclists riding away from the camera. The street is paved and has a sidewalk on the right with a trash can and a fence. Large trees line both sides of the street, and a building with a sign that says "PIONEER" is visible in the distance. A pink decorative graphic, resembling a stylized tree or a series of connected circles, is overlaid in the top right corner of the image.

Intersection Treatment Examples



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Intersection Typologies

What are Intersection Typologies?

Intersection Typologies provide intersection design guidelines for the development of future amendments based on the context of San Antonio's streets and the needs of people biking when they intersect. These guidelines are derived from best practices and recommendations from the Texas MUTCD, NACTO Bike Design Guide, and other sources.

Furthermore, the Intersection Typologies offer an approach to determine which intersection treatments and solutions are most appropriate based on existing or planned bike facilities, as well as the project's goals and constraints. This process is designed to present a range of intersection treatments and solutions that can be used for intersection retrofits, new builds, or applied to whole intersections or specific legs of an intersection.

Why Intersection Typologies?

Intersections are critical points of conflict between different road users and represent a particularly challenging and potentially stressful place for people biking to navigate. For those "interested but concerned" in biking—or rather the majority of San Antonians—the presence of bike facilities alone may not be sufficient to encourage biking if intersections are not designed to be comfortable for people biking. These users are more likely to choose biking as a mode of transportation if they feel secure navigating intersections, which are frequently perceived as the most intimidating and hazardous parts of a journey. By ensuring that intersection designs address the specific needs and concerns of these riders, intersection typologies can help create a more comprehensive and inviting bike network, ultimately encouraging more people to choose biking as a viable and safe option.

<u>Intersection Typology Selection</u>	98
<u>Two-Way Stop Control</u>	102
<u>Raised Intersection</u>	104
<u>Neighborhood Traffic Circle</u>	106
<u>Median Diverter</u>	108
<u>Partial Closure / Half-Closure Diverter</u>	110
<u>Diagonal Diverter</u>	112
<u>Bike Box Intersection`</u>	114
<u>Protected Roundabout</u>	116
<u>Dedicated Intersection</u>	118
<u>Protected Intersection</u>	120

Intersection Details

Intersection Typology Selection

STEP 1

*Determine
Bike Path
Compatibility*

STEP 2

*Refine Options
Considering Project
Goals and Constraints*

STEP 3

*Review Applicable
Intersection Typologies*

Step 1 of the Intersection Typology process includes determining which types of bike facilities will be present or are planned for the intersection and selecting Intersection Typologies that are compatible with the bike facilities. In Step 2, consider the goals the project, such as costs, available right of way, among others. Each treatment is rated on a scale from Low to High regarding how well they meet each goal. Select one or more Intersection Typologies as potential candidates based on these ratings. In Step 3, review the selected Intersection Typologies. Each Intersection Typology has a two-page spread with the elements below. Additional information regarding unique intersection types as well as intersection treatment, marking, and signage details are also provided in this chapter to support the design process.

Formal guidance documents for nationally accepted standards which should be referenced when designing the intersections

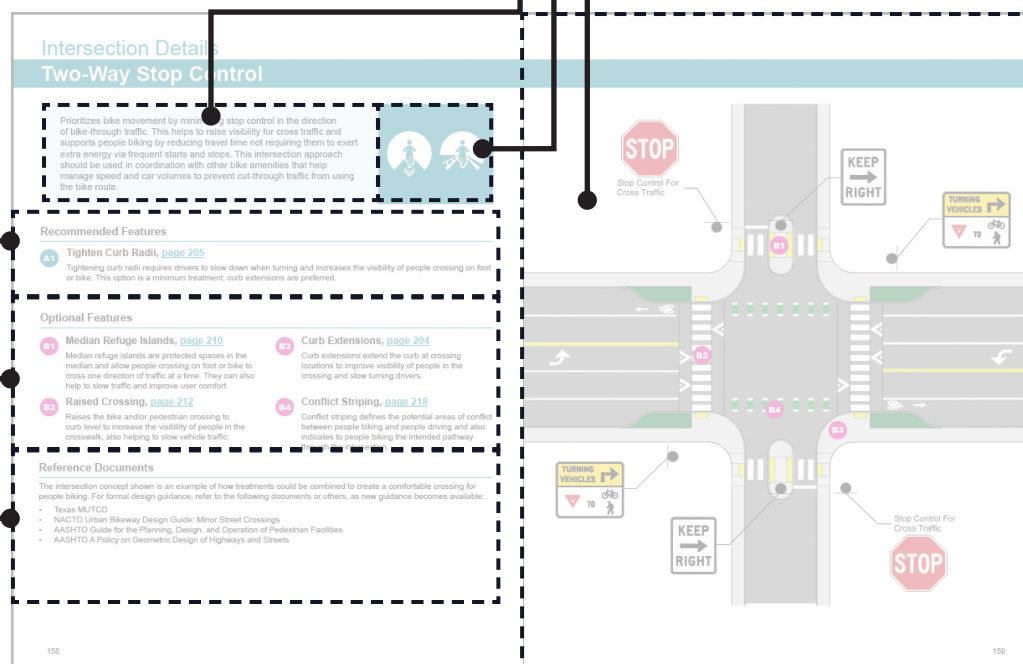
Optional intersection elements that may be used but can be removed from the design if they are determined infeasible or unnecessary in the design process

Recommended intersection elements that may be considered for the intersection, with hyperlinks to pages with further detailed guidance

A brief description of the solution and general application considerations

Icons indicating which bike facilities are compatible with the design recommendations

Intersection design example and callouts for recommended and optional intersection elements



Determine Bike Path Compatibility

Identify intersection types that are compatible with the bike facility.

NOTE: In some cases, different legs of the intersection may have different solutions.



Bike Boulevard



Striped Bike Lane or
Buffered Bike Lane



Protected Bike Lane



Shared Use Path *

				
Two-way Stop Control				
Raised Intersection				
Neighborhood Traffic Circle				
One-Way Traffic Diverter				
Median Diverter				
Diagonal Diverter				
Partial Closure / Half-Closure Diverter				
Bike Box Intersection				
Roundabout				
Dedicated Intersection				
Protected Intersection				

*NOTE: Most Shared Use Paths crossings will be handled as Midblock Crossings or as a Side Path Crossing.

Refine Options Considering Project Goals and Constraints

From those options, narrow further based on project goals and constraints:

	Manages Vehicular Volumes	Manages Vehicular Speeds	Reduces Bike Exposure	Increased Comfort of People Biking	Right of Way Impacts	Project Cost
Two-way Stop Control	✗	Low	Med	Low	Low	Low
Raised Intersection	✗	High	Low	Med	Low	Med
Neighborhood Traffic Circle	✗	Med	High	Med	Low	Low
One-Way Traffic Diverter	✓	Low	High	High	Low	Med
Median Diverter	✓	Low	High	High	Low	Med
Partial Closure / Half-Closure Diverter	✓	Low	High	High	Low	Med
Diagonal Diverter	✓	Med	High	High	Low	Med
Bike Box Intersection	✗	Low	Med	Med	Low	Low
Roundabout	✗	High	High	High	High	High
Dedicated Intersection	✗	Med	High	High	Med	Med
Protected Intersection	✗	Med	High	High	High	High

Review Applicable Intersection Typologies and Review Design Details

Review the Intersection Typology details as well as the recommended and optional intersection elements, their respective design details, and real-world constraints of the project. Using best engineering judgment, select the intersection treatments appropriate for the project and apply using best engineering practices and the latest design guidance and standards.

<u>Intersection Typologies</u>	<u>97</u>
<u>Two-Way Stop Control</u>	<u>102</u>
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<u>Protected Roundabout.....</u>	<u>116</u>
<u>Dedicated Intersection.....</u>	<u>118</u>

The Intersection Typologies provide standard designs that combine a number of treatments and work for many intersections. However, San Antonio has a variety of unique intersection types that may require additional design considerations. When no Intersection Typology fits an intersection, review the following sections for unique intersection designs, intersection details, and markings and signage details that can be combined or applied individually to help meet the needs of all intersection users.

<u>Protected Intersection.....</u>	<u>120</u>
<u>Offset Intersections.....</u>	<u>123</u>
<u>Midblock, Side Street, and Driveway Crossings</u>	<u>131</u>
<u>Slip Lane Retrofits.....</u>	<u>137</u>

Intersection Details

Two-Way Stop Control

Prioritizes bike movement by minimizing stop control in the direction of bike-through traffic. This helps to raise visibility for cross traffic and supports people biking by reducing travel time by not requiring them to exert extra energy via frequent starts and stops. This intersection approach should be used in coordination with other bike amenities that help manage speed and car volumes to prevent cut-through traffic from using the bike route.



Recommended Features

- A1 Tighten Curb Radii**
Tightening curb radii requires drivers to slow down when turning and increases the visibility of people crossing on foot or bike. This option is a minimum treatment; curb extensions are preferred.

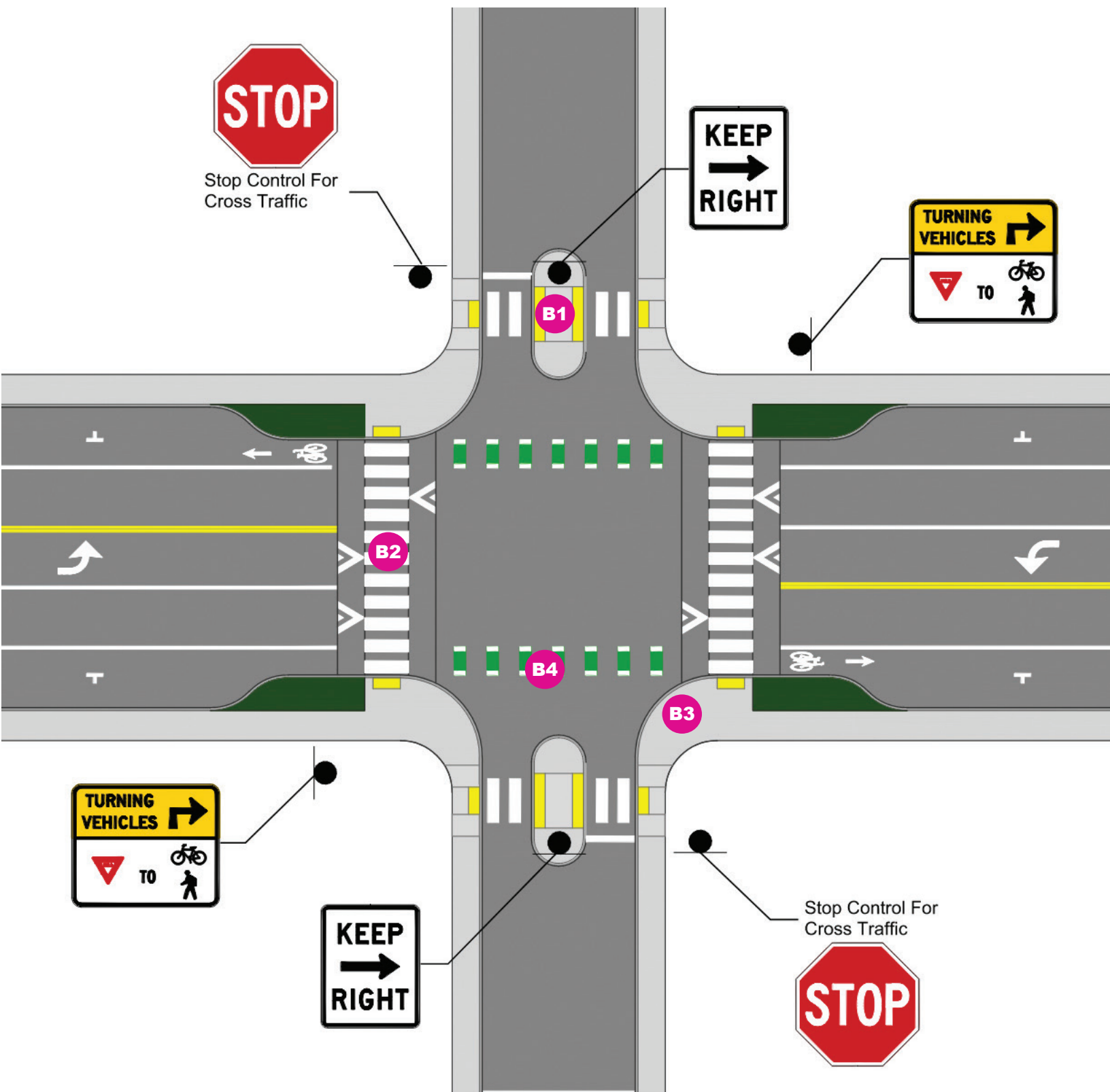
Optional Features

- | | |
|---|--|
| <p>B1 Median Refuge Islands
Median refuge islands are protected spaces in the median and allow people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and improve user comfort.</p> | <p>B3 Curb Extensions
Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers.</p> |
| <p>B2 Raised Crossing
Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, and to slow vehicle traffic.</p> | <p>B4 Conflict Striping
Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking their intended pathway through the intersection.</p> |

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Minor Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



Intersection Details

Raised Intersection

A Raised Intersection is when the full intersection, including the crosswalks, is raised sidewalk level to slow traffic and increase visibility for all users. This solution may be implemented with additional features like pavers to provide an opportunity for placemaking. FHWA recommends that raised intersections only be installed on roadways with speeds of 30 MPH or less. Drainage impacts should be evaluated.



Recommended Features

A1 Raised Crossing

Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, which also helping to slow vehicle traffic.

Optional Features

B1 Curb Extensions

Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and slow turning drivers.

B2 Tighten Curb Radii

Tightening curb radii requires drivers to slow down when turning and increases the visibility of people crossing on foot or bike. This option is a minimum treatment; curb extensions are preferred.

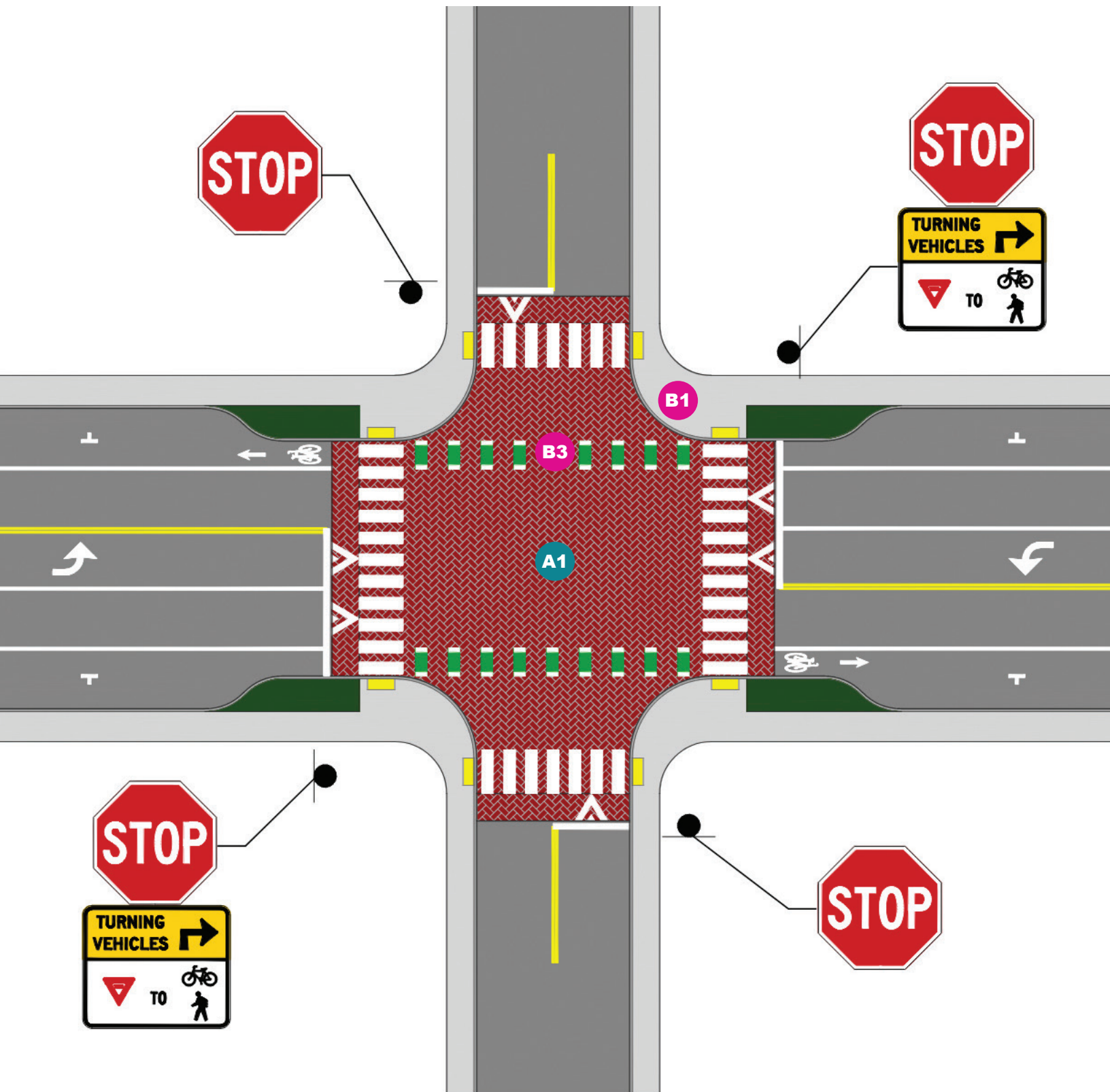
B3 Conflict Striping

Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking their intended pathway through the intersection.

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

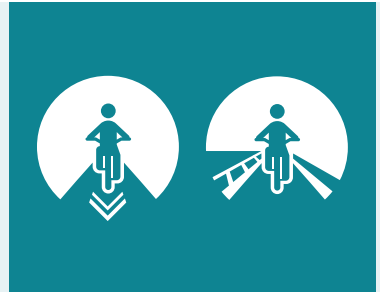
- Texas MUTCD
- NACTO Urban Street Design Guide: Raised Intersections
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



Intersection Details

Neighborhood Traffic Circle

Neighborhood traffic circles are typically raised, circular elements are placed in an intersection to slow drivers. They provide an opportunity for placemaking as the raised elements can be installed with planters or other beautifying elements. This solution is less ideal for locations where there is significant walking expected and may or may not be installed with stop control.



Recommended Features

A1 Tighten Curb Radii

Tightening curb radii requires drivers to slow down when turning and increases the visibility of people crossing on foot or bike. This option is a minimum treatment; curb extensions are preferred.

Optional Features

B1 Raised Crossing

Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, which helps slow vehicle traffic.

B3 Median Refuge Islands

Median refuge islands are protected spaces in the median, and they allow people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and improve user comfort.

B2 Curb Extensions

Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers.

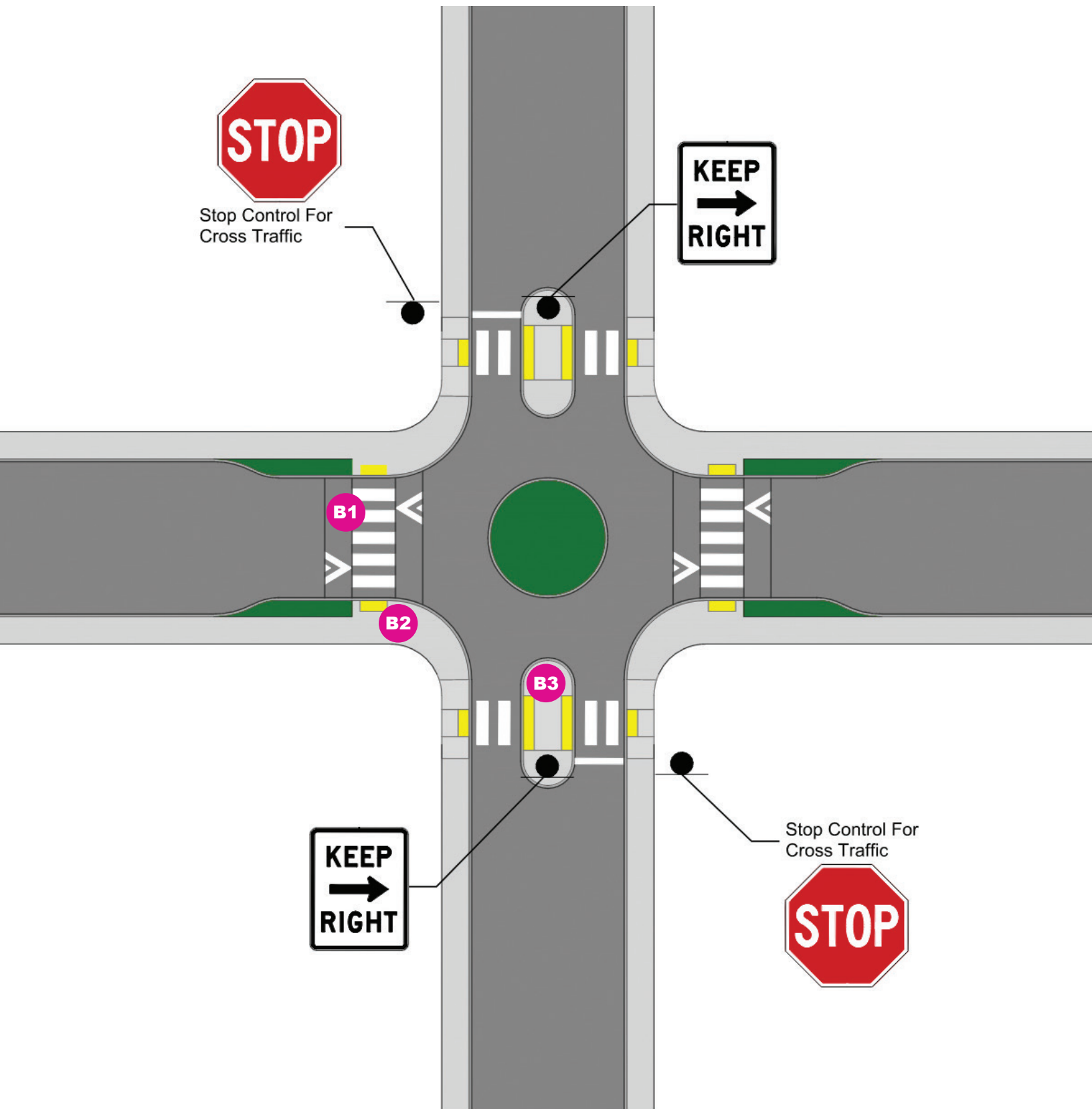
B4 Directional Markers

Directional markers indicate the intended path for biking through the intersection and increase the visibility of people biking to drivers.

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

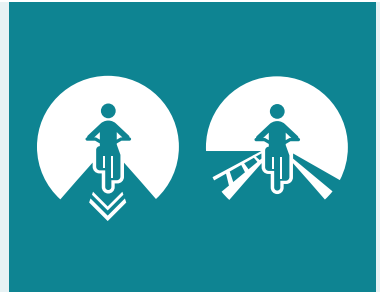
- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Minor Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets
- NCHRP Research Report 1043: Guide for Roundabouts



Intersection Details

Median Diverter

A center island prevents through traffic for vehicles but provides a protected space for people walking and biking to wait for gaps in traffic and cross the road one direction at a time. Median diverters are typically used where a lower stress bike facility such as a bike boulevard intersects with a higher-volume or higher-speed street. The median can be designed to be mountable for emergency access.



Recommended Features

- | | |
|--|---|
| <p>A1 Tighten Curb Radii
Tightening curb radii requires drivers to slow down when turning and increases the visibility of people crossing on foot or bike. This option is a minimum treatment; curb extensions are preferred.</p> <p>A2 Conflict Striping
Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates the intended path for people biking.</p> | <p>A3 Directional Markers
Directional markers provide guidance to people biking how to proceed through the intersection. Typically used in complex or wide intersections to increase the visibility of people biking to drivers.</p> <p>A4 Reflective Approach Edge
The approach edge of the refuge island shall be outlined in retroreflective white or yellow material.</p> |
|--|---|

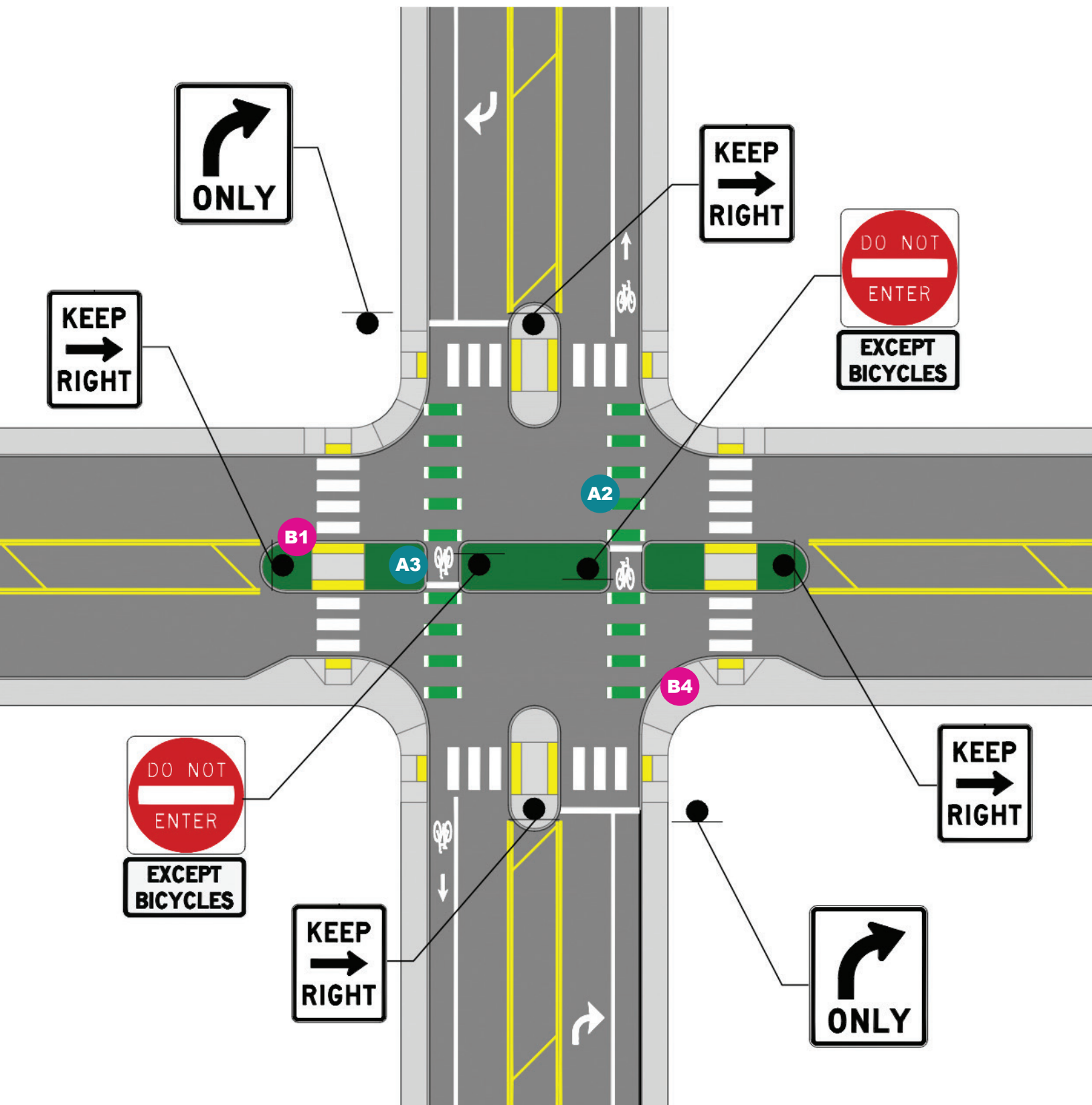
Optional Features

- | | |
|--|--|
| <p>B1 Median Refuge Islands
Median refuge islands are protected spaces in the median, and they allow people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and improve user comfort.</p> <p>B2 Raised Crossing
Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, which also helps slow vehicle traffic.</p> <p>B3 Additional Reflective Markers
Reflective markers can be used in place of the KEEP RIGHT sign. For more guidance see Section 31.02 of the MUTCD.</p> | <p>B4 Curb Extensions
Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and slow turning drivers.</p> <p>B5 Two-Stage Bicycle-Turn Queue Box or Bike Box
These designated spaces provide space for people biking to stage ahead of traffic or to make left-turns at multi lane intersections in multiple signal stages. These treatments are only MUTCD compliant if the intersection is signalized.</p> |
|--|--|

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Major Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



Intersection Details

Partial Closure / Half-Closure Diverter

In both a partial and half-closure, vehicles are permitted to exit one leg of the intersection, but not enter while people walking and biking can proceed unimpeded in both directions. This can be achieved by either using an island (with an optional pedestrian refuge island) in the case of a Partial Closure, or by using a curb extension in the case of a Half Closure. Volume control measures such as partial/half closures should not be used along primary emergency response routes.



Recommended Features

- | | |
|--|---|
| <p>A1 Bicycle Access
Treatments should provide a contra-flow bike lane or an opening between an island and curb to allow channeled bike access.</p> <p>A2 Tighten Curb Radii
Tightening curb radii requires drivers to slow down when turning and increases the visibility of people crossing on foot or bike.</p> <p>A3 Curb Extensions
Curb extensions extend the curb at crossing locations to reduce the crossing distance and slow turning drivers. In a half closure, the curb extension should be long enough to discourage drivers from traveling in the wrong direction.</p> | <p>A4 Median Refuge Islands
Median refuge islands are protected spaces in the median that allow people crossing on foot or bike to cross one direction of traffic at a time. When used with a Partial Closure, the median island should be extended to the centerline.</p> <p>A5 Reflective Approach Edge
The approach edge of the refuge island shall be outlined in retroreflective white or yellow material.</p> |
|--|---|

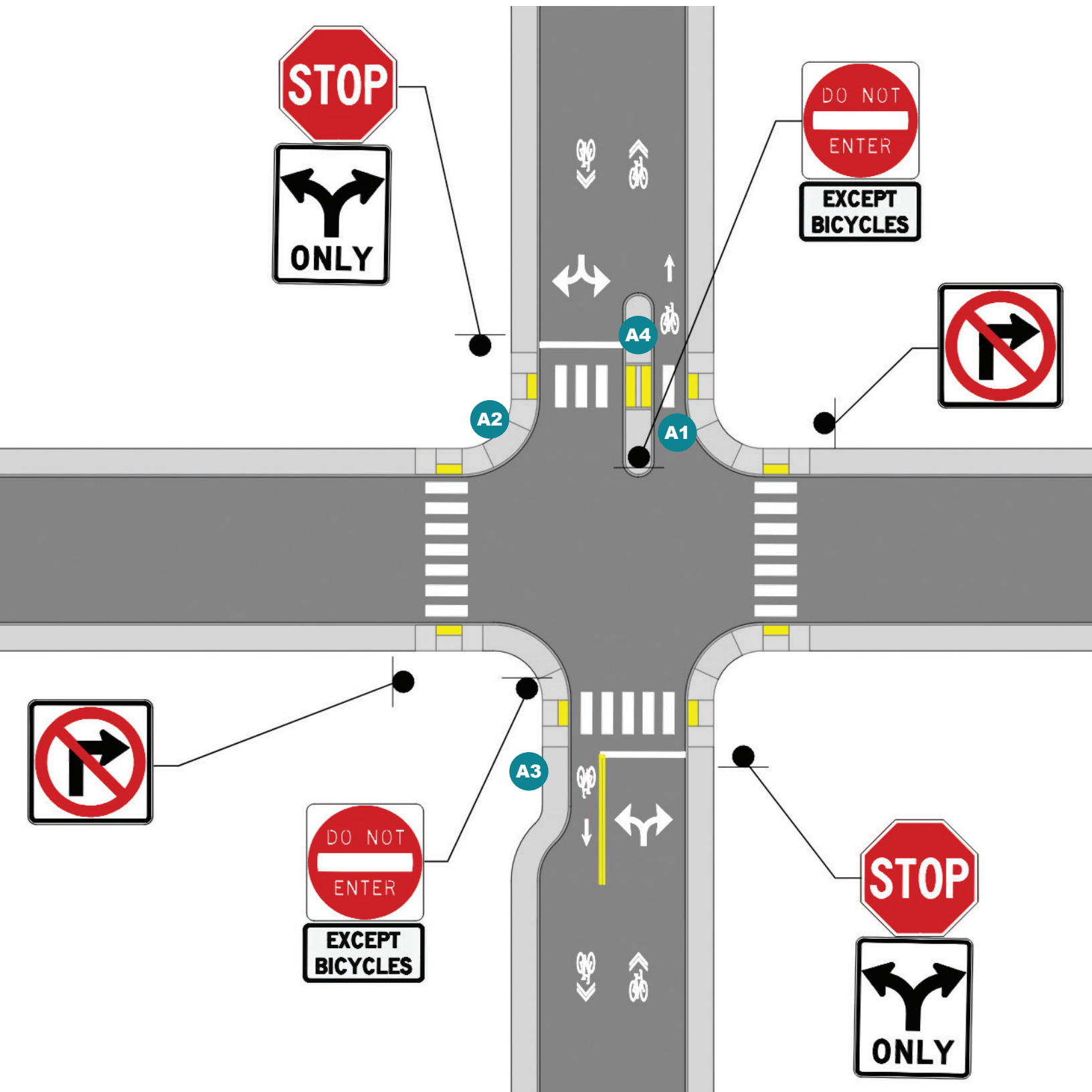
Optional Features

- | | |
|---|--|
| <p>B1 Raised Crossing
Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, also helping to slow vehicle traffic. Alternatively, the whole intersection can be raised.</p> | <p>B2 Additional Reflective Markers
Reflective markers can be used in place of the KEEP RIGHT sign. For more guidance see Section 31.02 of the MUTCD.</p> |
|---|--|

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Major Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



Intersection Details

Diagonal Diverter

Vehicular traffic is channelized to take either a right or left-turn, but people walking and biking can proceed through. Diverters can be designed with landscaping to support placemaking and stormwater drainage, or with cutouts to maintain existing flowlines.



Recommended Features

A1 Directional Markers

Directional markers indicate the intended path for biking through the intersection and increase the visibility of people biking to drivers.

A2 Median Island or Raised Feature

A median island is placed in the middle of the diverter to prevent vehicles from driving through. It may be mountable for emergency vehicle access.

A3 Tighten Curb Radii

Tightening curb radii requires drivers to slow down when turning and increases the visibility of people crossing on foot or bike. This option is a minimum treatment; curb extensions are preferred.

Optional Features

B1 Curb Extensions

Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers.

B2 Raised Crossing

Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, which also helps slow vehicle traffic.

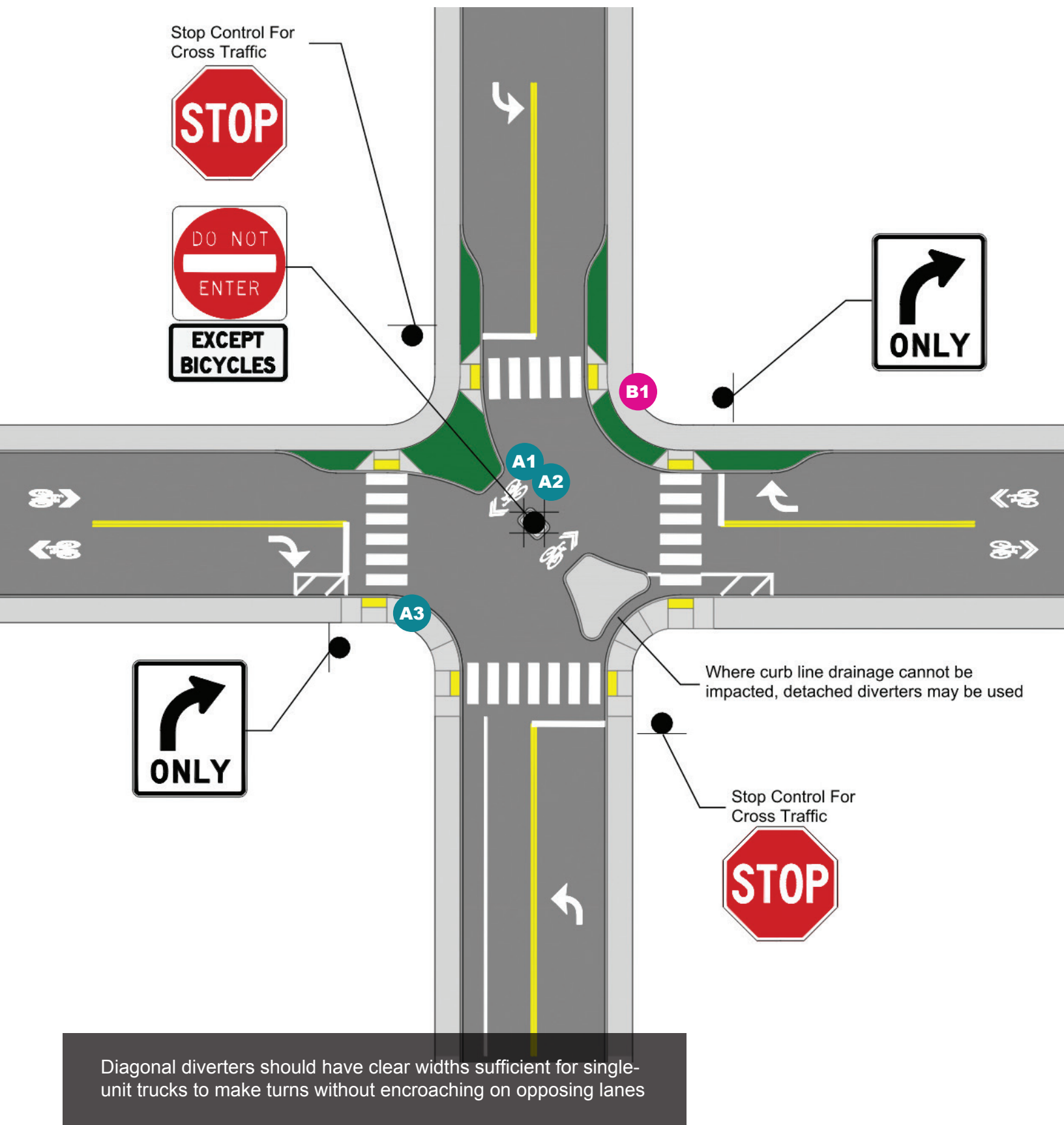
B3 Additional Reflective Markers

Reflective markers can be used in place of the KEEP RIGHT sign. For more guidance see Section 31.02 of the MUTCD.

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Major Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



Intersection Details

Bike Box Intersection

Bike boxes and two-stage bicycle-turn queue boxes can be used as elements to enhance other intersection solutions or used alone to make up the Bike Box Intersection. Bike Boxes should only be considered at signalized intersections.



Recommended Features

- A1 Bike Box**

Bike boxes provide designated spaces for people biking to queue in front of vehicles and/or transition to left-turn lanes at red lights in signalized intersections.
- A2 Two-Stage Bicycle-Turn Queue Box**

Queue boxes provide designated space for people biking to make left-turns at multi lane intersections in multiple signal stages.
- A3 Conflict Striping**

Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates the intended path for people biking.
- A4 Tighten Curb Radii**

Tightening curb radii requires drivers to slow down when turning and increases the visibility of people crossing on foot or bike. This option is a minimum treatment; curb extensions are preferred.

Optional Features

- B1 Bend-Outs**

Bend-outs allowing people biking to queue closer to the street crossing, improving visibility and providing yield space for right-turning drivers.
- B2 Centerline Hardening**

A raised treatment is placed along the centerline, requiring drivers to slow down when making left-turns.
- B3 Curb Extensions**

Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers.
- B4 Raised Crossing**

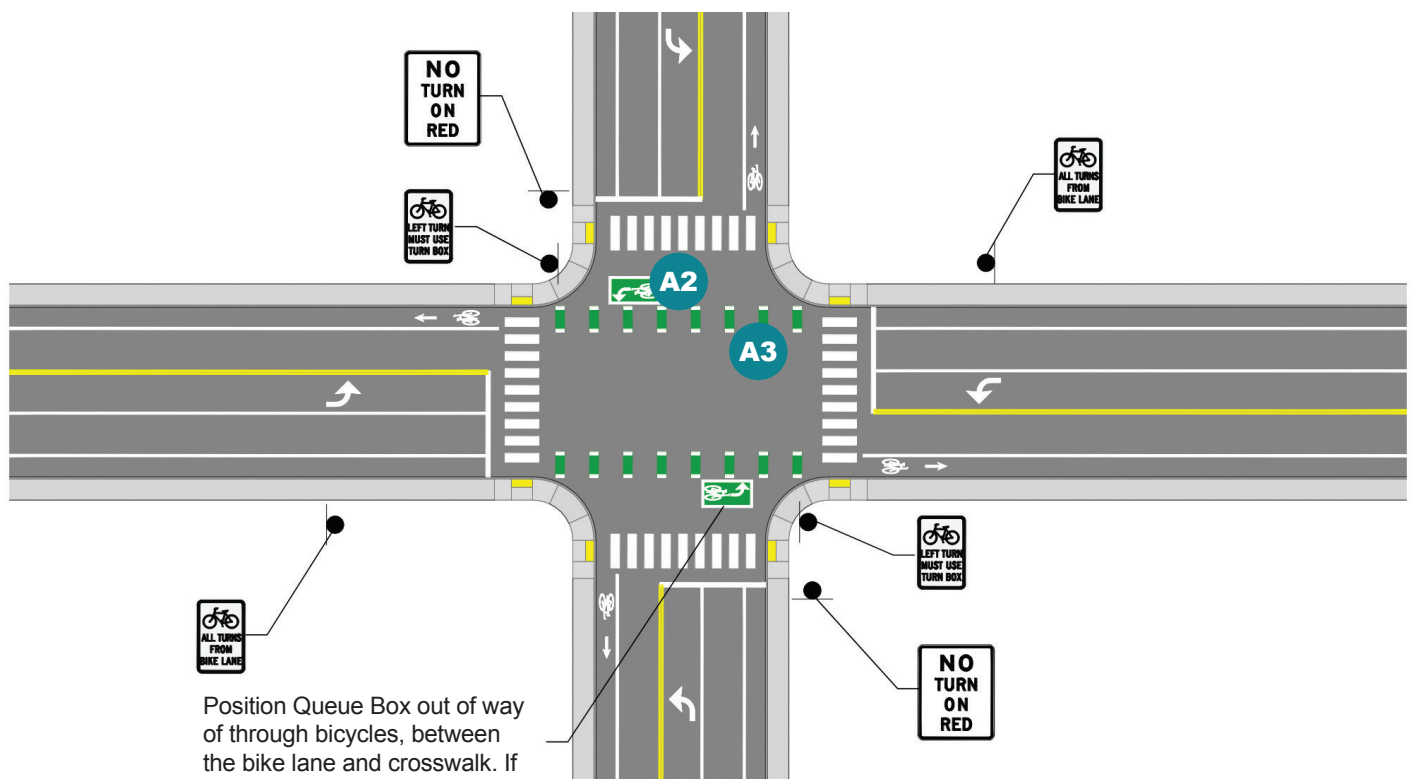
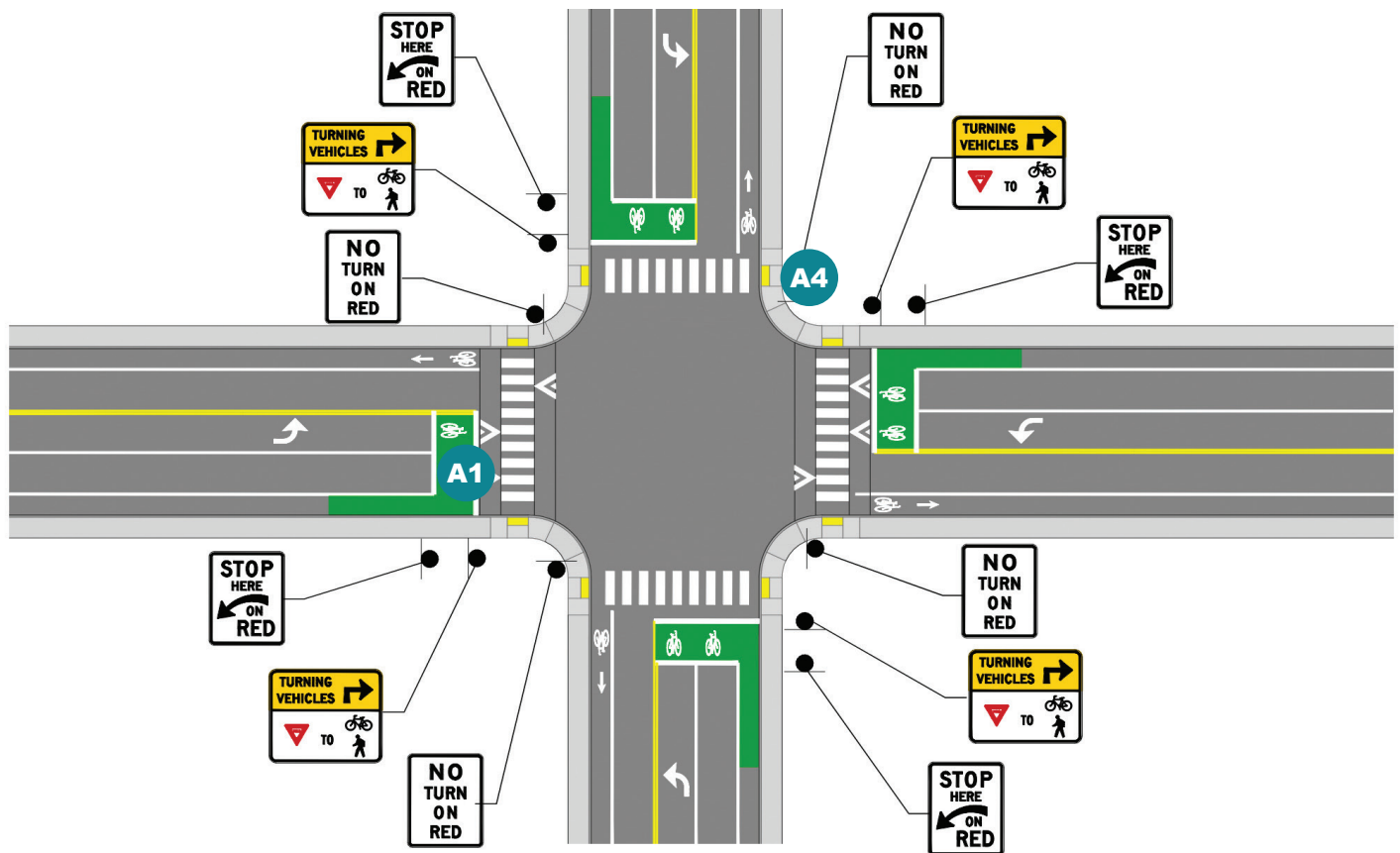
Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, which also helps slow vehicle traffic.
- B5 Median Refuge Islands**

Median refuge islands are protected spaces in the median that allow people crossing on foot or bike to cross one direction of traffic at a time.

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Major Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



Position Queue Box out of way of through bicycles, between the bike lane and crosswalk. If parking or raised features are present, Queue Box may be moved to inside of bike lane

Intersection Details

Protected Roundabout

Roundabouts slow traffic while maintaining continuous vehicle flow through an intersection. When paired with a protected bike lane, the roundabout maintains separation between modes through the intersection. They may also be paired with raised crossings to further slow traffic.



Recommended Features

- A1 Conflict Striping**

Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking their intended pathway through the intersection.
- A2 Splitter Islands**

Splitter islands slow vehicular traffic approaching the roundabout and help to guide drivers to the right when they reach the circular part of the intersection.
- A3 Median Refuge Islands**

Median refuge islands are protected spaces in the median, and they people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and improve user comfort.

Optional Features

- B1 Raised Crossing**

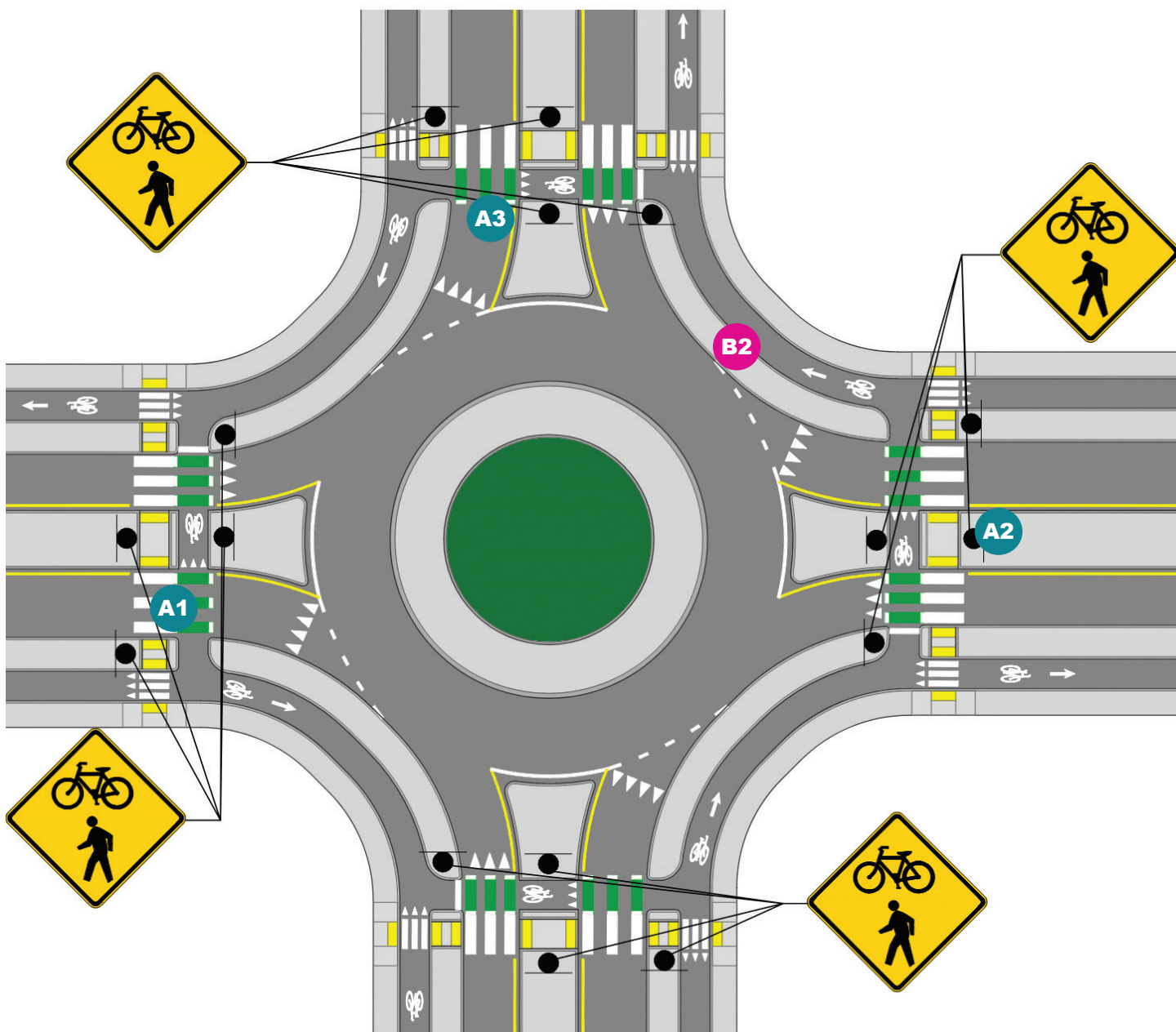
Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, and to slow vehicle traffic.
- B2 Bikeway Protection**

Where a protected bikeway approaches a roundabout, or where additional comfort and separation is desired, medians or other vertical barriers can be used to protect the bikeway through the roundabout. Where this treatment is applied, crosswalks and appropriate ADA ramps and features must be applied, similar to a protected intersection or bend-out. If the bikeway is not protected through the intersection, a ramp may be provided and bicycle traffic may travel along a shared sidepath through the intersection.

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Major Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets
- NCHRP Research Report 1043: Guide for Roundabouts



Intersection Details

Dedicated Intersection

People biking are given a dedicated path to traverse through the intersection, reducing the conflict points between people biking and motorists especially when the treatment is combined with protected-permissive bike signal phasing.

Dedicated intersections are typically recommended in constrained scenarios when there is not enough space for a full protected intersection. They have positive effects on perceived comfort and traffic calming. However, they do not provide as much space for turning drivers to yield to people in the crosswalk or crossbike and the wedge islands are mountable so they provide less protection than a protected intersection.



Recommended Features

A1 Centerline Hardening

A raised treatment is placed along the centerline, requiring drivers to slow down when making left-turns.

A2 Corner Wedge Island

Corner wedge islands are small, raised wedges, that require drivers to slow down when making right turns and provide a small level of physical separation for people biking. They may be mountable to accommodate larger vehicles.

A3 Conflict Striping

Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking the intended pathway through the intersection.

A4 Bike Signalization

Using a combination of leading bike and pedestrian intervals can be provided if a shared through/turn lane is next to the bikeway. If a dedicated right- or left-turn lane is next to the bikeway, a protected-permissive bike signal phase should be considered.

A5 Bike Lane Yield Markings and Crosswalks

Communicates to people biking to yield to people walking across the bikeway and to wait at the median island. Also indicates where people walking should cross. Detectable warning surfaces shall be placed before and after the crossing of the bikeway.

Optional Features

B1 Median Refuge Islands

Median refuge islands are protected spaces in the median and the allow people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and to improve user comfort.

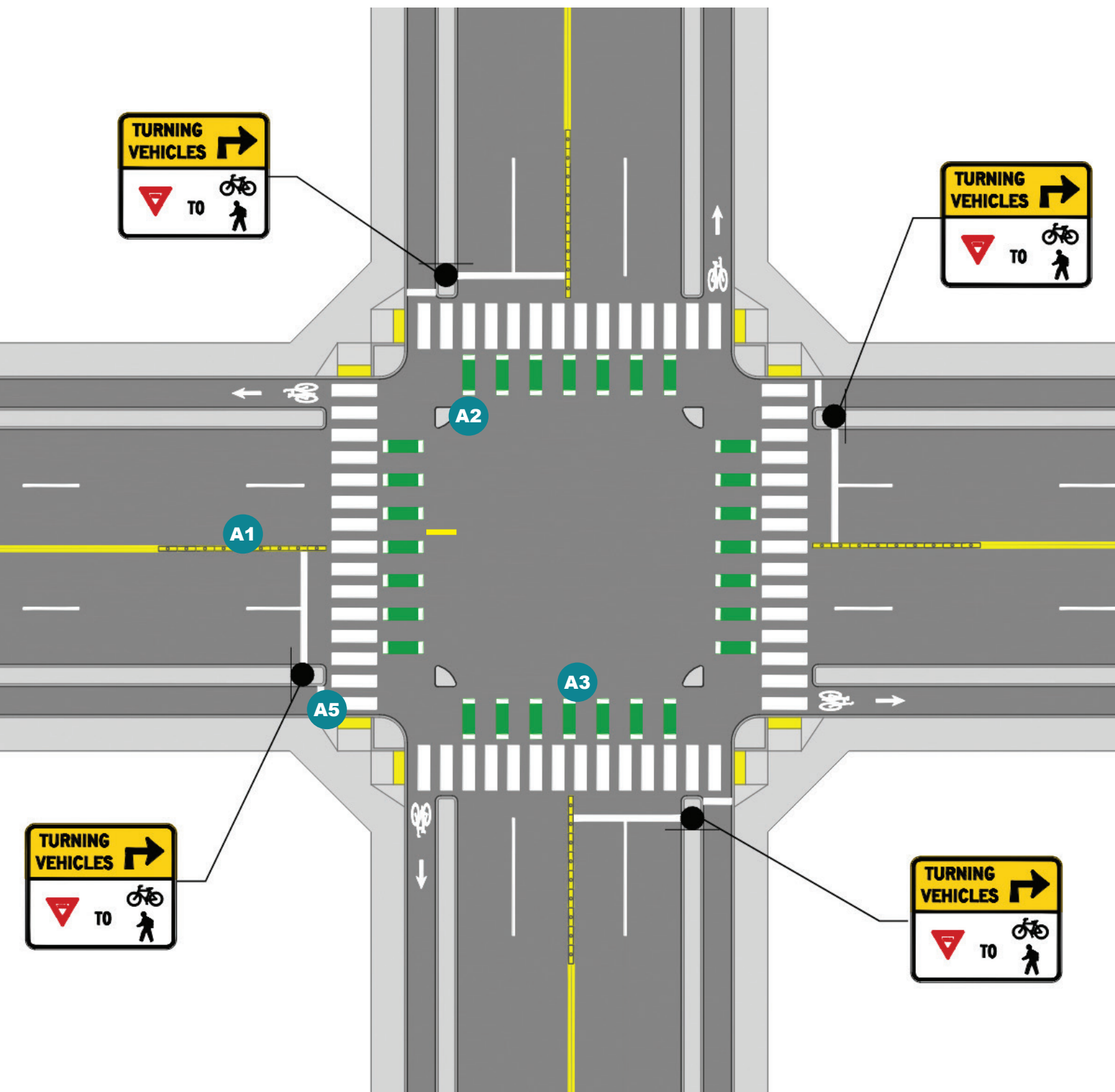
B2 Crosswalk Separator

Crosswalk separators are small raised elements between the crosswalk and crossbike to help provide guidance for people with visual impairments.

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Major Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



Intersection Details

Protected Intersection

People biking are given a dedicated path to traverse through the intersection, providing physical separation throughout the intersection that exposes people biking when they cross vehicle travel lanes.



Recommended Features

- A1 Driver Yield Zone**

The driver yield zone provides space for turning vehicles to yield to people crossing. The preferred offset distance between the crossing and adjacent street is enough allow for one full vehicle to queue, but may reduced in constrained situations or lengthened where higher vehicle speeds are anticipated.
- A2 Corner Islands**

Corner islands provide physical separation between the bikeway and moving vehicles. The curb radius of the corner island should be designed to slow turning vehicle speeds to 15 mph or less. The corner island may include a mountable truck apron where needed.
- A3 Forward Bike Queue Area**

This area provides space for people biking to queue prior to crossing the intersection. The bike queue area should, at a minimum, allow two people on bikes to queue, but larger queue areas can accommodate higher bike volumes and longer bikes.
- A4 Bike Lane Taper**

If a lateral shift is required to position the bikeway, a gentle shift is preferred. The preferred taper is 1:4 or 1:5.
- A5 Conflict Striping**

Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking the intended pathway through the intersection.
- A6 Signal Treatments**

A leading pedestrian interval with a concurrent bike signal phase may be used to provide people walking and biking with a head start, although a dedicated bike phase is preferred. In either event, right turns on red should be prohibited.
- A7 Detectable Edge**

Where the bikeway is at sidewalk level, a detectable edge should be placed between the bikeway and sidewalk.
- A8 Bike Lane Yield Markings and Crosswalks**

Communicates to people biking to yield to people walking across the bikeway and to wait at the median island. Detectable warning surfaces shall be placed before and after the crossing of the bikeway.

Optional Features

- B1 Median Refuge Islands,**

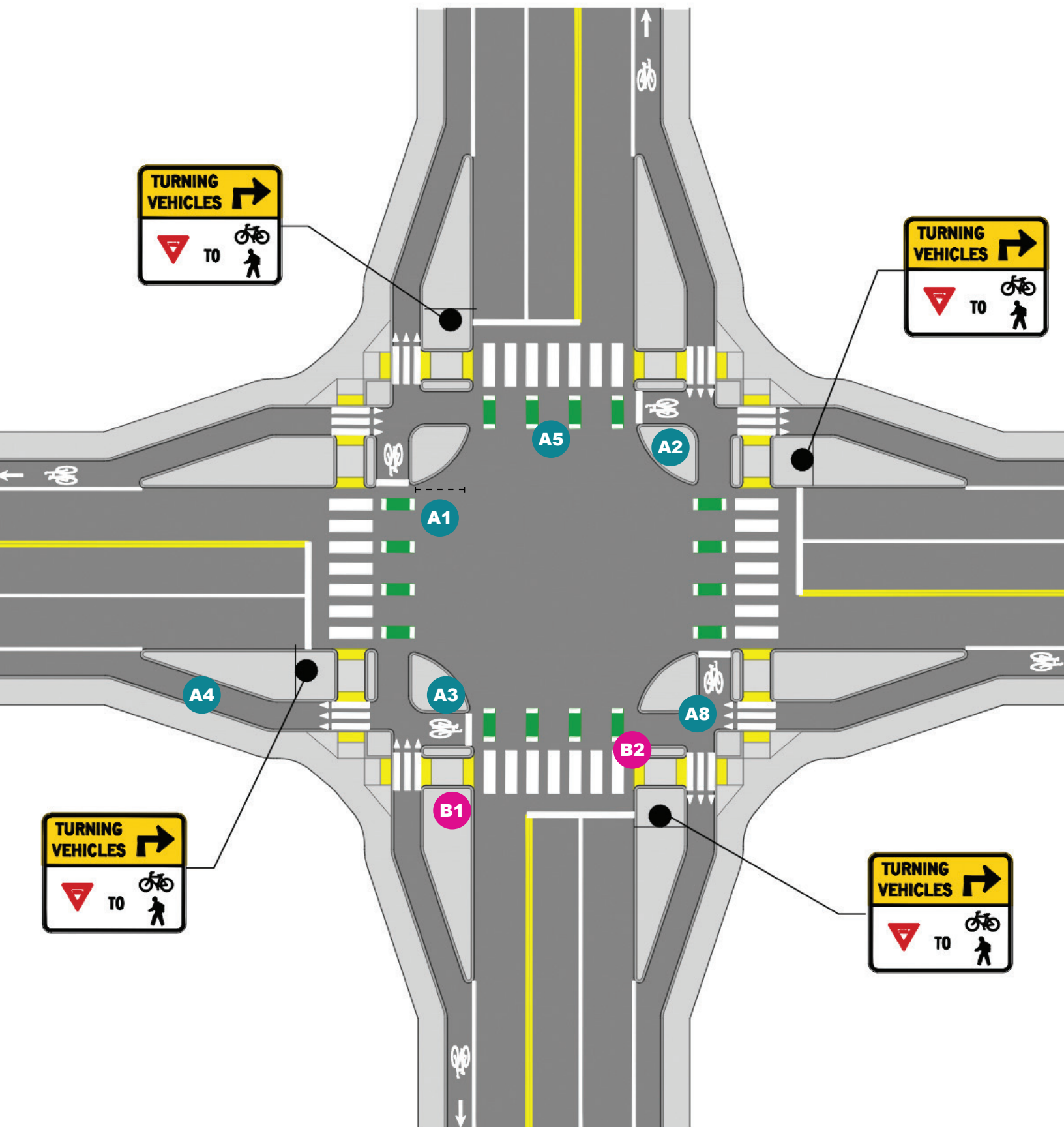
Median refuge islands are protected spaces in the median, and they allow people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and improve user comfort.
- B2 Crosswalk Separator**

Crosswalk separators are small raised elements between the crosswalk and crossbike to help provide guidance for people with visual impairments..

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

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Offset Intersections

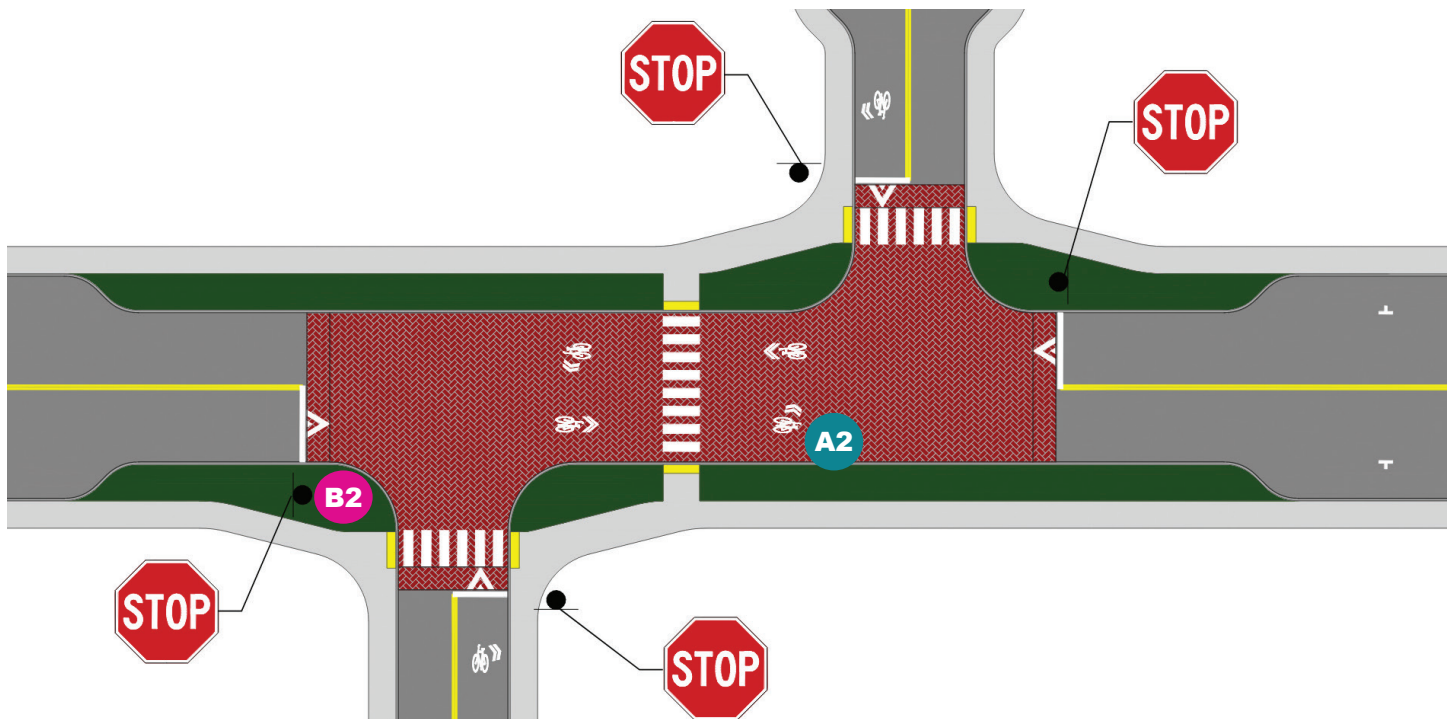
An offset intersection, also known as a “staggered intersection”, occurs when two opposing legs of a minor road are not aligned, requiring those traveling along the minor road to utilize the major road for a short distance in order to proceed through. While offset intersections can be challenging for all road users, they are particularly challenging for people biking, as lack of infrastructure can encourage them to make multiple, complex maneuvers at two back-to-back intersections while navigating space with potentially fast-moving and high volumes of cars along the major road. The following design guidance is intended to provide design options that can help people biking navigate offset intersections with greater comfort.

<u>Raised Offset Intersection</u>	<u>124</u>
<u>Slow Zone Offset Intersection</u>	<u>125</u>
<u>Cycle Track Connection</u>	<u>126</u>
<u>Median Refuge Turn Pocket</u>	<u>127</u>
<u>Two-Stage Turn Queue Boxes</u>	<u>128</u>

Offset Intersections

Raised Offset Intersection

Raised offset intersections elevate the entire major roadway and intersections between the minor roads to the level of the sidewalk, creating a slow zone for motorists throughout the offset intersection. Raised intersections also improve the visibility and comfort of people walking and biking and create a continuous surface for people walking to cross. Raised intersections should only be used on roads with lower speeds and volumes.



Recommended Features

- | | |
|---|---|
| A1 Wayfinding Signs
Wayfinding signs indicate to people biking how to turn and proceed through the intersection in order to remain on the desired bikeway. | A2 Directional Markers
Directional markers indicate the intended path for biking through the intersection and increase the visibility of people biking to drivers. |
|---|---|

Optional Features

- | | |
|---|--|
| B1 Rectangular Rapid Flashing Beacon
This treatment may be paired with rectangular rapid flashing beacons (RRFBs) at each marked crossing to further indicate to drivers the need to yield to people walking and biking. | B2 Curb Extensions
Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers. |
|---|--|

Reference Documents

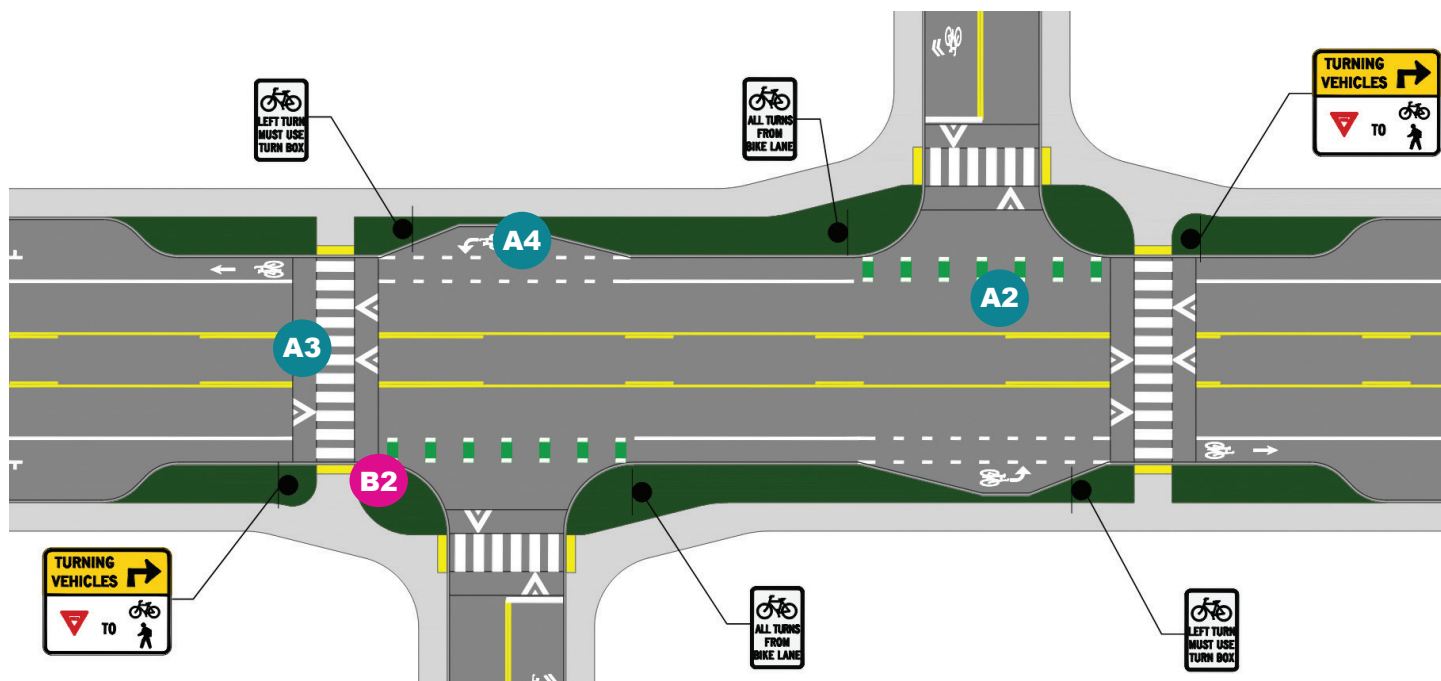
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Minor Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets

Offset Intersections

Slow Zone Offset Intersection

Slow zone intersections utilize raised crosswalks across the major roadway on either end of the intersection to create a slow zone for motorists throughout the offset intersection. Raised crossings improve the visibility and comfort of people walking and biking, and should only be used on roads with lower speeds and volumes. Two-stage bicycle-turn queue boxes are used to provide people biking with a spot to wait for a gap in traffic to cross.



Recommended Features

- A1 Wayfinding Signs**
Wayfinding signs shall be used to indicate to people biking how to turn and proceed through the intersection in order to remain on the desired bikeway.
- A2 Conflict Striping**
Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking their intended pathway through the intersection.
- A3 Raised Crossing**
Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk, which also helps slow vehicle traffic.
- A4 Two-Stage Bicycle-Turn Queue Box,**
Queue boxes provide designated space for people biking to make left-turns at multi lane intersections in multiple signal stages.

Optional Features

- B1 Rectangular Rapid Flashing Beacon**
Pedestrian activated flashing beacons at crosswalks which indicate to drivers the need to yield.
- B2 Curb Extensions**
Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and slow turning drivers.

Reference Documents

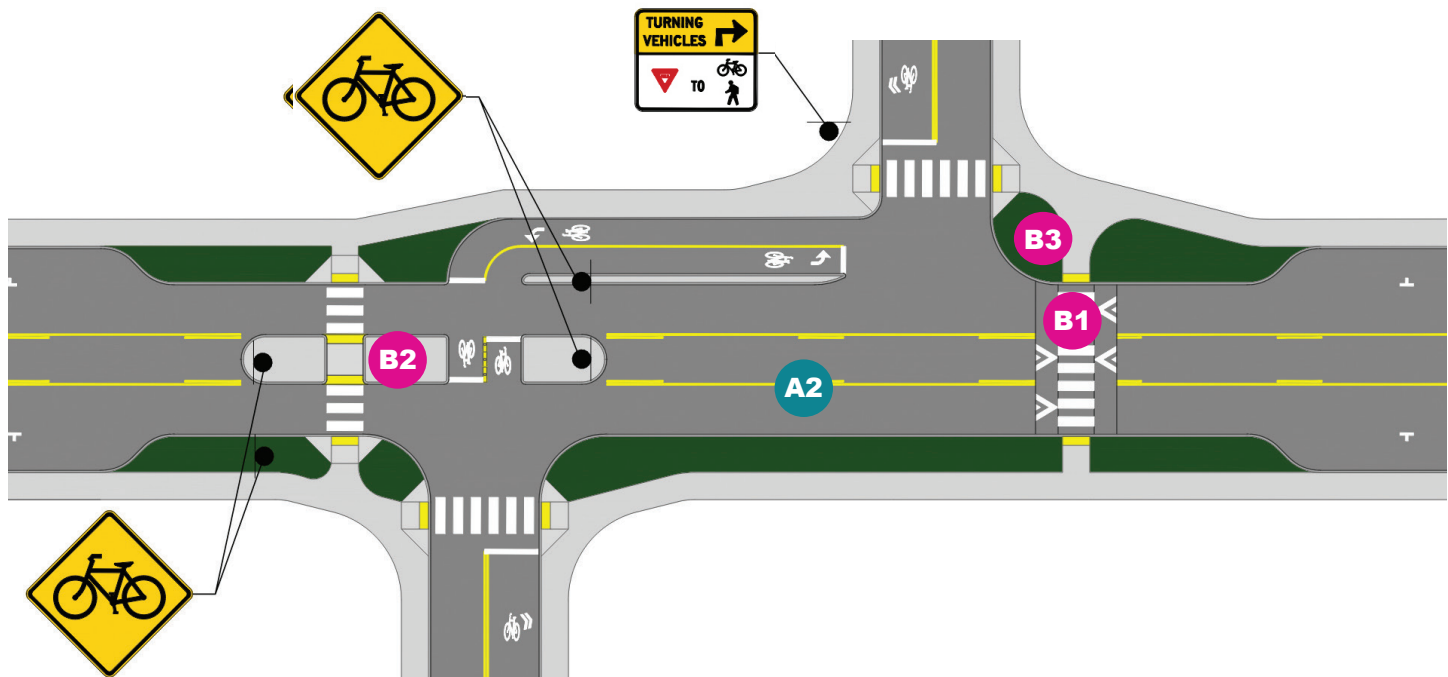
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Major Street Crossings
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets

Offset Intersections

Cycle Track Connection

A two-way cycle track diverts people biking from either side of the minor street to a single crossing location. This minimizes the cost of crossing treatments and can enable the use of beacons and other crossing signals and treatments that cannot be used in close proximity to each other.



Recommended Features

- | | |
|--|---|
| <p>A1 Wayfinding Signs</p> <p>Wayfinding signs shall be used to indicate to people biking how to turn and proceed through the intersection in order to remain on the desired bikeway.</p> | <p>A2 Directional Markers</p> <p>Directional markers are turn arrows that help indicate the intended path of travel for people biking.</p> |
|--|---|

Optional Features

- | | |
|---|--|
| <p>B1 Raised Crossing</p> <p>Raises the bike and/or pedestrian crossing to curb level to increase the visibility of people in the crosswalk and slows drivers as they pass the raised element.</p> | <p>B3 Curb Extensions</p> <p>Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers.</p> |
| <p>B2 Median Refuge Islands</p> <p>Median refuge islands are protected spaces in the median that allow people crossing on foot or bike to cross one direction of traffic at a time. They can help slow traffic and are useful on multi-lane roads.</p> | |

Reference Documents

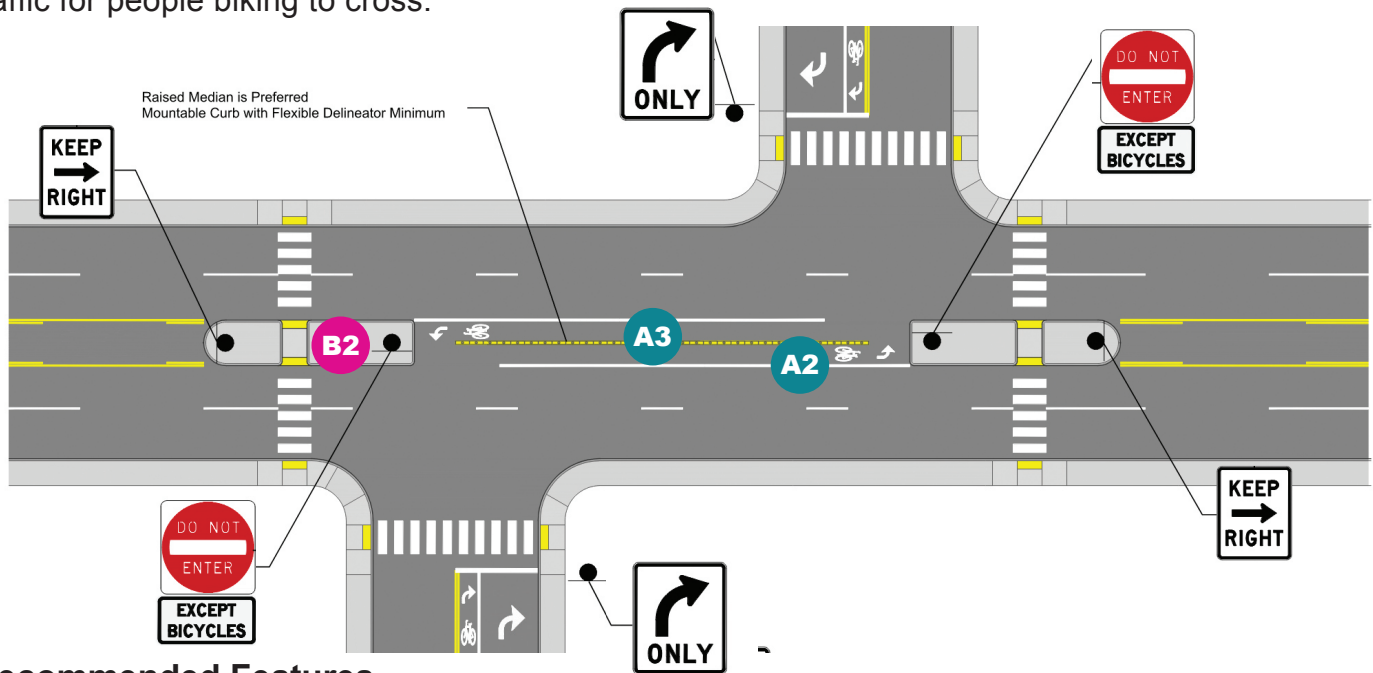
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Major Street Crossings; Offset Intersections
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets

Offset Intersections

Median Refuge Turn Pocket

Center-turn lanes are provided and designed specifically for people biking and are protected with median islands. The center-turn lanes allow people biking to cross from the minor street into the center turn lane, bike along the center turn lane, and then have a protected space to wait for a gap in traffic to cross to the opposing leg of the minor street. This solution is most appropriate where there vehicle speeds and volumes are low enough on the major street to provide sufficient gaps in traffic for people biking to cross.



Recommended Features

- A1 Wayfinding Signs**
Wayfinding signs shall be used to indicate to people biking how to turn and proceed through the intersection in order to remain on the desired bikeway.
- A2 Directional Markers**
Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking their intended pathway through the intersection.
- A3 Centerline Hardening**
A raised treatment is placed along the centerline, preventing drivers from turning left and separating the bike lane by direction of travel. Alternatively, the lane lines between the bike lanes and driving lanes can be hardened to provide a similar effect while increasing comfort for people biking.

Optional Features

- B1 Rectangular Rapid Flashing Beacon**
Pedestrian activated flashing beacons at crosswalks that indicate to drivers the need to yield.
- B2 Median Refuge Islands**
Median refuge islands are protected spaces in the median that allow people crossing on foot or bike to cross one direction of traffic at a time. They can help slow traffic and are useful on multi-lane roads.

Reference Documents

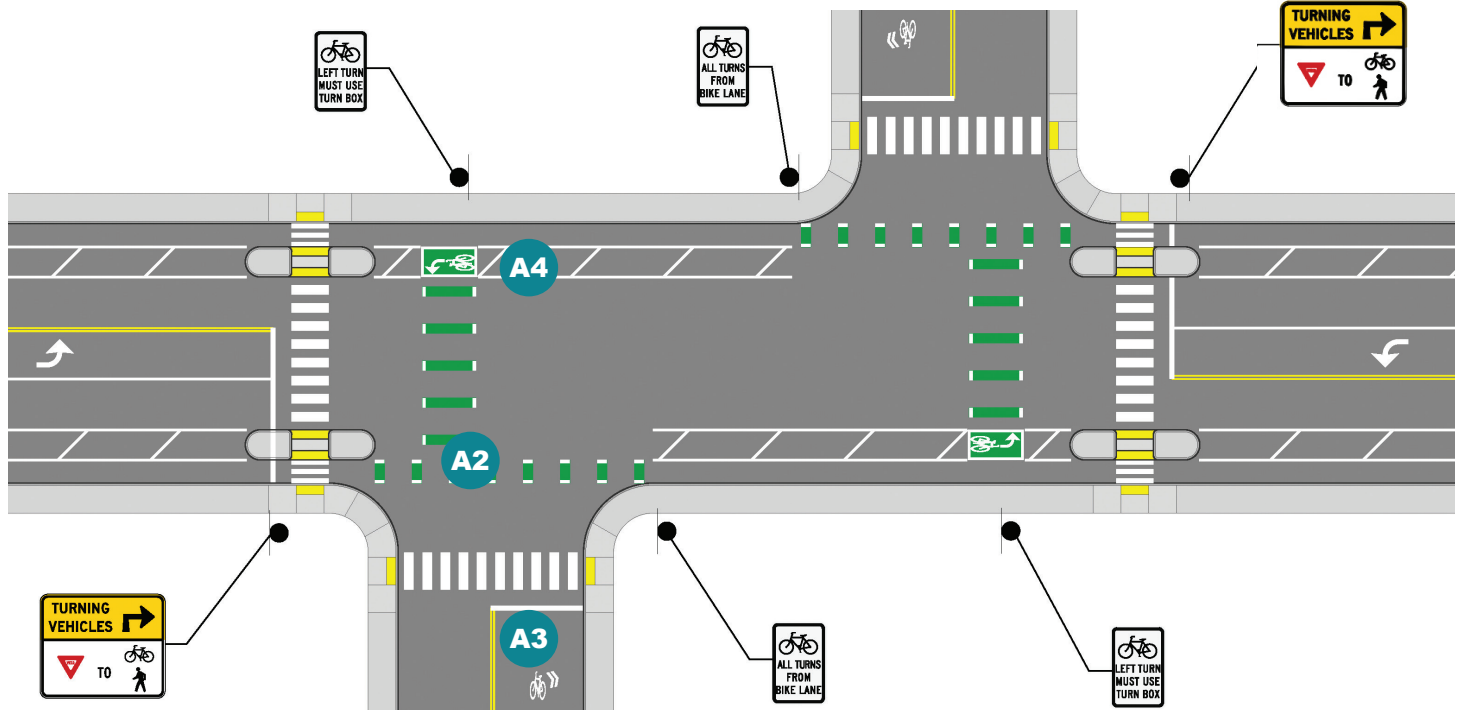
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Major Street Crossings; Offset Intersections
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets

Offset Intersections

Two-Stage Turn Queue Boxes

Two-stage Turn Queue Boxes allow people biking to position themselves and wait for a crossing opportunity. This solution provides a pathway that limits conflicts between people biking and drivers.



Recommended Features

- A1 Wayfinding Signs**
Wayfinding signs shall be used to indicate to people biking how to turn and proceed through the intersection in order to remain on the desired bikeway.
- A2 Conflict Striping**
Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking the intended pathway through the intersection.
- A3 Directional Markers**
Directional markers are turn arrows that help indicate the intended path of travel for people biking.
- A4 Two-Stage Bicycle-Turn Queue Box**
Queue boxes provide designated space for people biking to make left-turns at multi lane intersections in multiple signal stages.

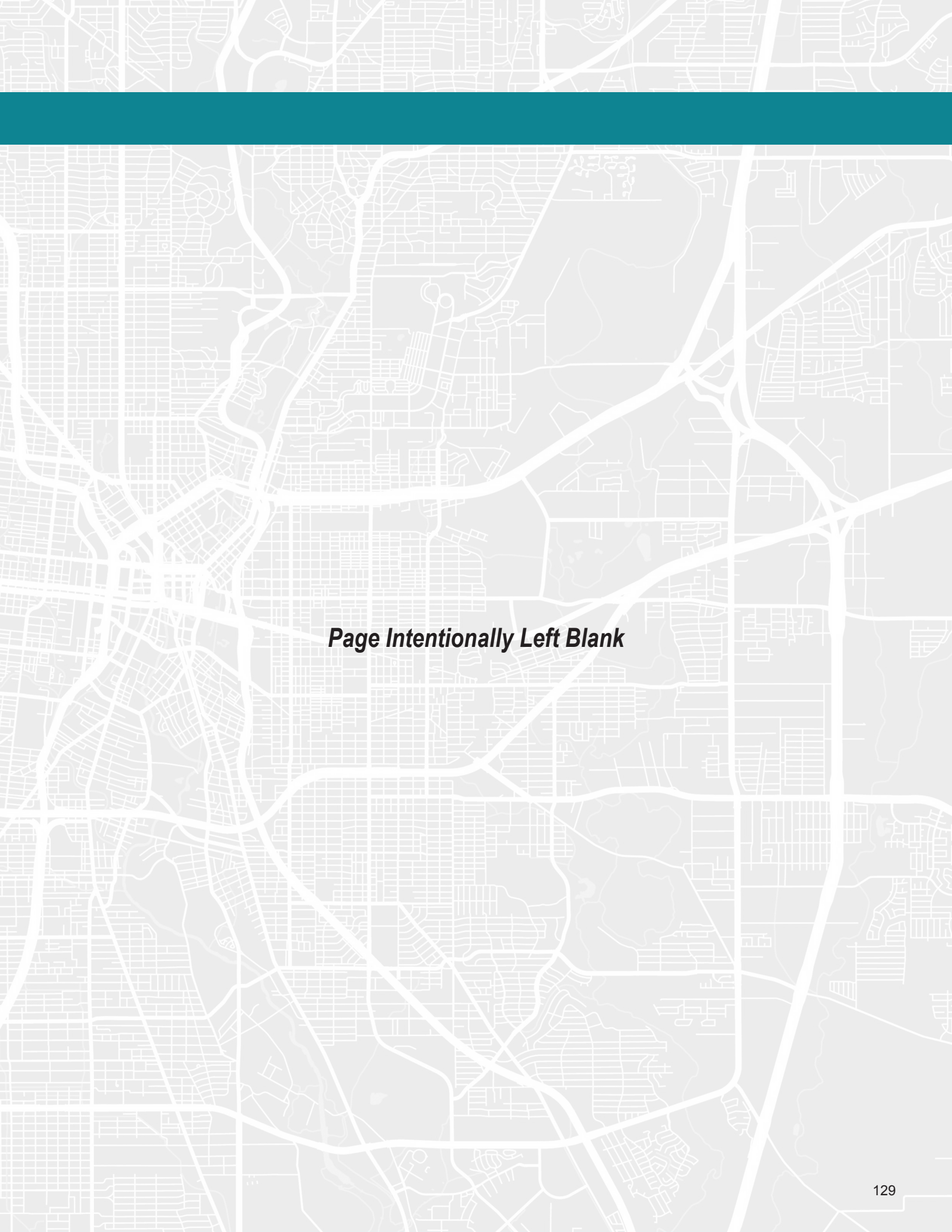
Optional Features

- B1 Rectangular Rapid Flashing Beacon**
Pedestrian activated flashing beacons at crosswalks that indicate to drivers the need to yield.
- B2 Median Refuge Islands**
Median refuge islands are protected spaces in the median that allow people crossing on foot or bike to cross one direction of traffic at a time. They can help slow traffic and are useful on multi-lane roads.

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Major Street Crossings; Offset Intersections
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



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Midblock, Side Street, and Driveway Crossings

Active transportation facilities require special considerations for midblock, side street, and driveway crossings.

Midblock crossings occur outside of an intersection, and they are often installed to support shared use path crossings. These crossings require additional consideration to alert drivers of the potential for people crossing, as drivers may not expect the crossing outside of a signalized intersection.

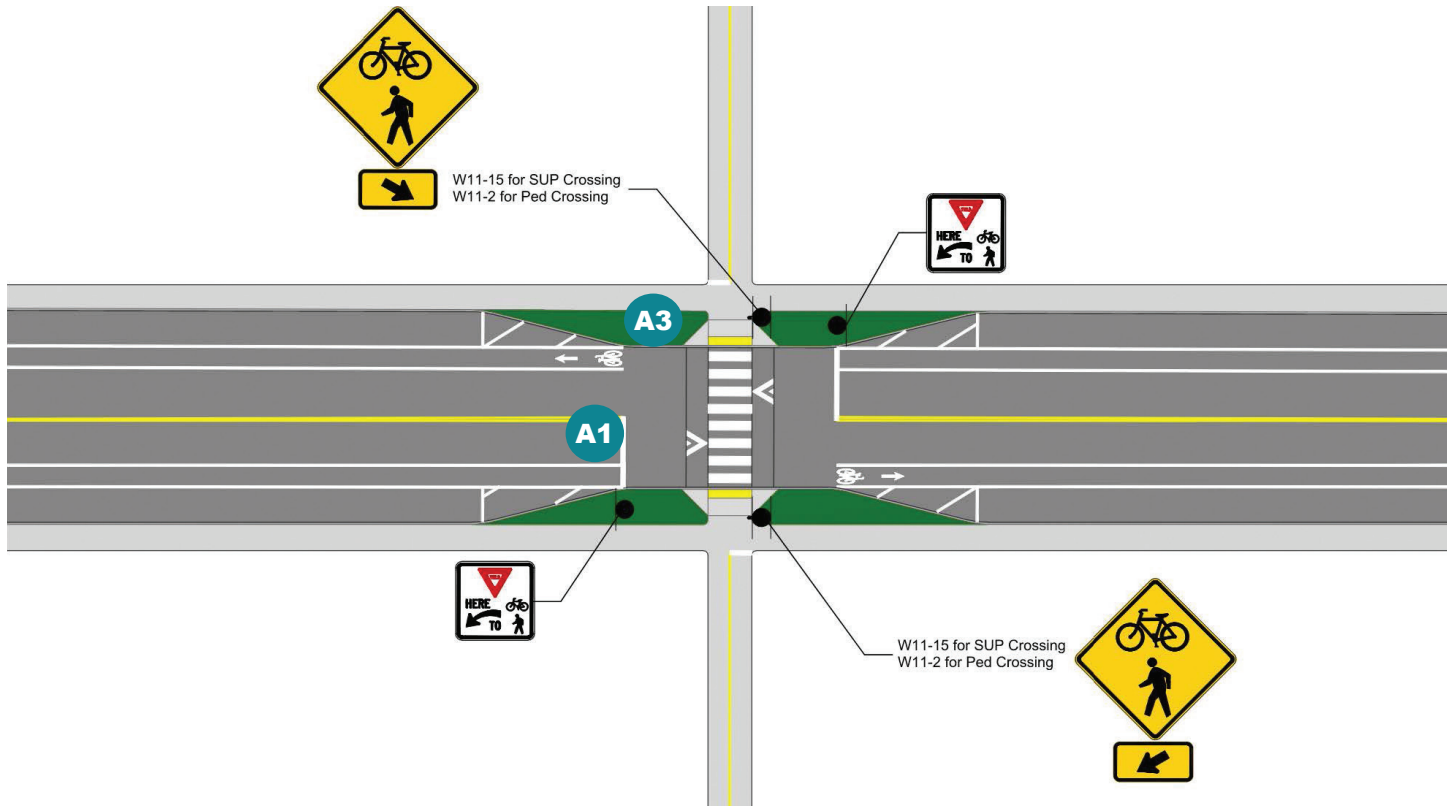
Bikeways and shared use paths also require additional consideration when crossing side streets or driveways. In these locations, the bikeway or shared use path should be designed to minimize conflict between people crossing on foot or bike and drivers turning into or out of the side street or driveway. While conflict markings and crosswalks alone may be sufficient in many places, side streets and driveways that are heavily utilized, those that have experienced crashes between turning vehicles and people walking and biking, in places where additional comfort is desired, additional treatments may be considered.

<u>Raised Shared Use Path Crossing</u>	<u>132</u>
<u>Shared Use Path with Midblock Signal</u>	<u>133</u>
<u>Protected Bike Lane Crossing</u>	<u>134</u>
<u>Shared Use Path or Sidepath Crossing</u>	<u>135</u>

Midblock Crossings

Raised Shared Use Path Crossing

Where shared use paths cross streets, the crossing may be elevated to the same height as the sidewalk. A raised crossing helps increase the visibility of people using the path to people driving. The raised crossing also helps to slow down drivers when they travel over the raised portion, which helps increase driver reaction time and increase yielding to people in the crossing.



Recommended Features

A1 Stop Lines

Stop lines at midblock crossings should be set back to ensure that a person crossing is visible.

A2 Median Refuge Islands

Median refuge islands are protected spaces in the median, and they allow people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and to improve user comfort.

A3 Curb Extensions

Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers.

A4 Bike Lane Yield Markings and Crosswalks

Communicates to people biking to yield to people walking across the bikeway to wait at the median island. Also indicates where people walking should cross. Detectable warning surfaces shall be placed before and after the crossing of the bikeway.

Reference Documents

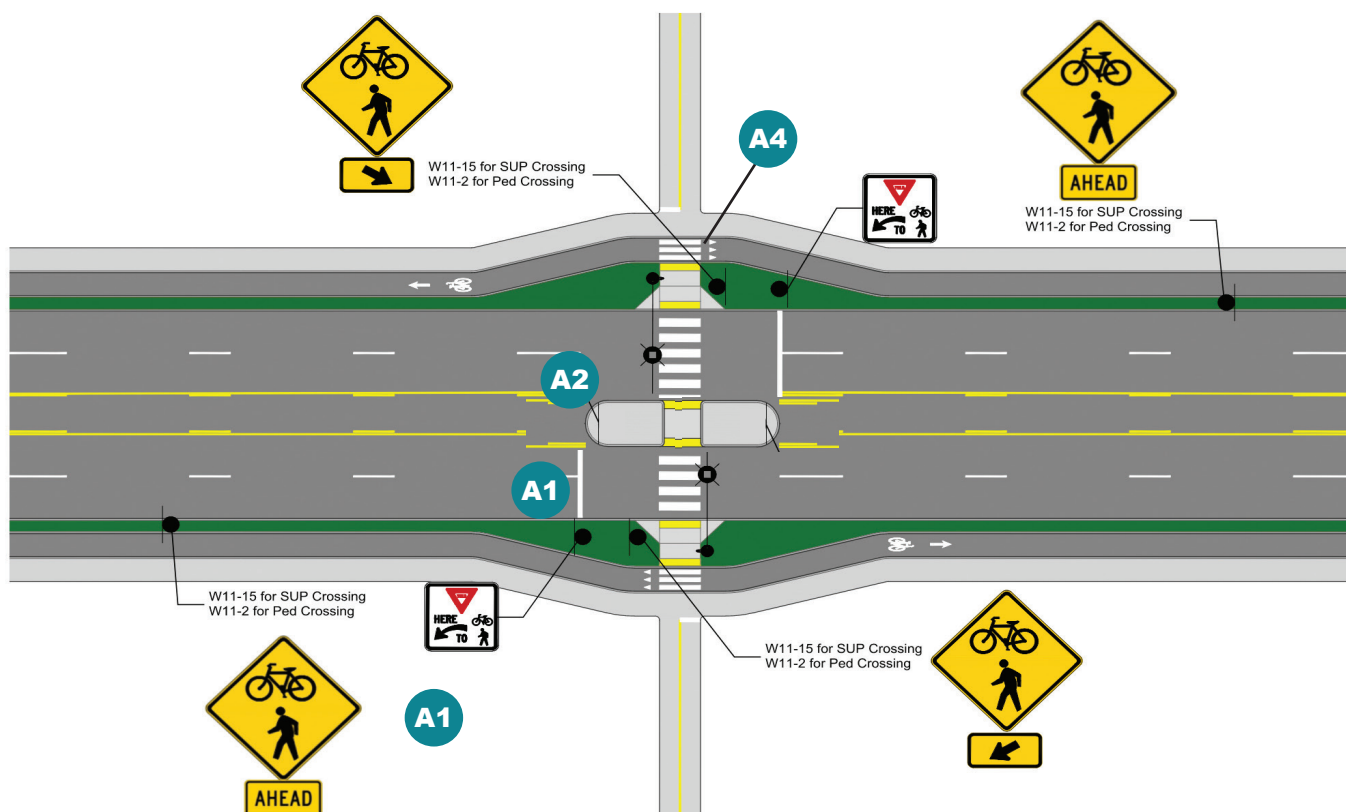
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Mid Block Crosswalks
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- AASHTO A Policy on Geometric Design of Highways and Streets

Midblock Crossings

Shared Use Path with Midblock Signal

A midblock signal is a traffic control device intended to facilitate safe crossings for people walking or biking particularly across higher-stress roadways. The signal is activated by push button by a person walking or biking. The signal can also be automated through detection systems.



Recommended Features

- | | |
|---|---|
| <p>A1 Stop Lines</p> <p>Stop lines at midblock crossings should be set back to ensure that a person crossing is visible.</p> | <p>A3 Curb Extensions</p> <p>Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers.</p> |
| <p>A2 Median Refuge Islands</p> <p>Median refuge islands are protected spaces in the median, and they allow people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and to improve user comfort.</p> | <p>A4 Bike Lane Yield Markings and Crosswalks</p> <p>Communicates to people biking to yield to people walking across the bikeway to wait at the median island. Also indicates where people walking should cross. Detectable warning surfaces shall be placed before and after the crossing of the bikeway.</p> |

Reference Documents

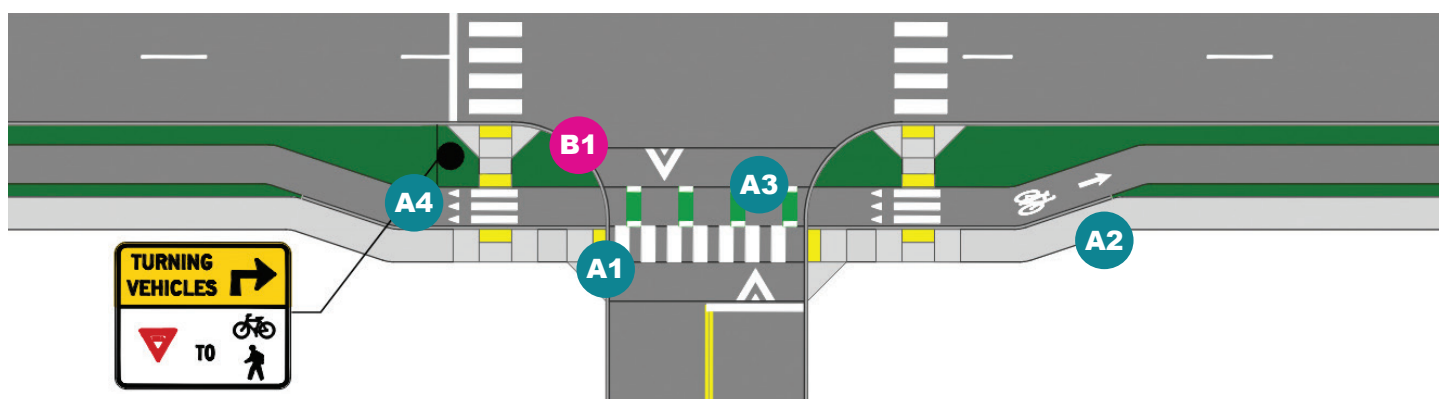
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide: Mid Block Crosswalks
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- AASHTO A Policy on Geometric Design of Highways and Streets

Side Street & Driveway Crossings

Protected Bike Lane Crossing

When protected bike lanes are provided at sidewalk level, it is often more comfortable to provide raised crossings across side streets and driveways to avoid frequent elevation changes. Additionally, raised crossing can help to slow turning vehicles and to improve visibility of people walking and biking. This solution is most effective when applied consistently across a corridor, especially along multi-lane or higher-volume roads.



Recommended Features

- | | |
|---|---|
| A1 Raised Crossing
Raises the bike and/or pedestrian crossing to curb level which increases the visibility of people in the crosswalk and slows drivers as they pass the raised element. | A3 Conflict Striping
Conflict striping defines the potential areas of conflict between people biking and people driving and also indicates to people biking their intended pathway through the intersection. |
| A2 Bend-Outs
Bend-outs allowing people biking to queue closer to the street crossing, which improves visibility and provides yield space for right-turning drivers. | A4 Bike Lane Yield Markings and Crosswalks
Communicates to people biking to yield to people walking across the bikeway to wait at the median island. Also indicates where people walking should cross. Detectable warning surfaces shall be placed before and after the crossing of the bikeway. |

Optional Features

- | | |
|--|---|
| B1 Curb Extensions
Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers. | B2 Median Refuge Islands
Median refuge islands are protected spaces in the median, and they allow people crossing on foot or bike to cross one direction of traffic at a time. They can also help to slow traffic and to improve user comfort. |
|--|---|

Reference Documents

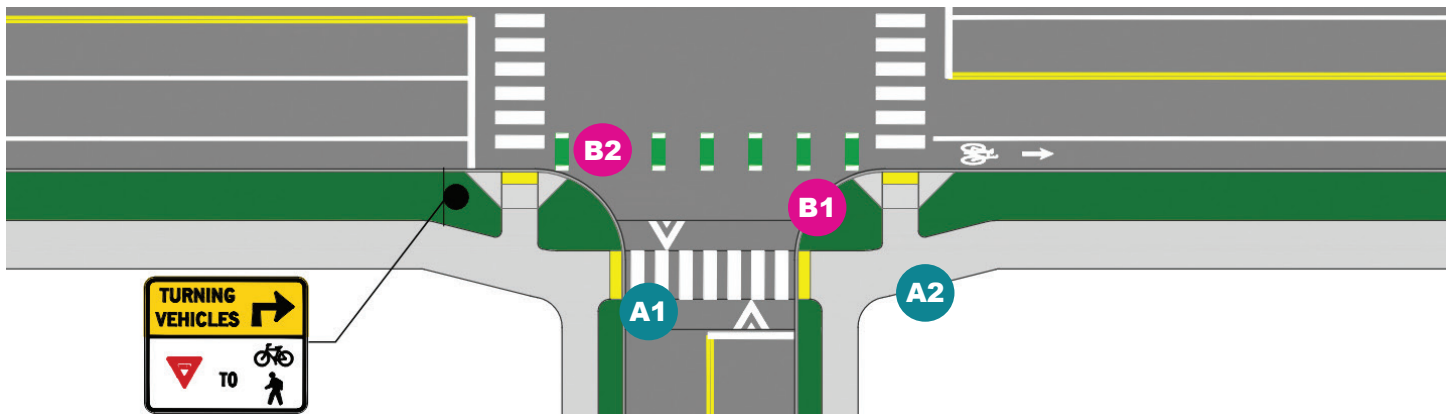
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Mid Block Crosswalks
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets

Side Street & Driveway Crossings

Shared Use Path or Sidepath Crossing

When shared use paths and sidepath cross driveways and side streets, it is often more comfortable to provide raised crossings across side streets and driveways to avoid frequent elevation changes. Additionally, raised crossing can help to slow turning vehicles and improve visibility of people walking and biking. This solution is most effective when utilized consistently across a corridor, especially along multi-lane or higher volume roads.



Recommended Features

- | | |
|--|--|
| <p>A1 Raised Crossing</p> <p>Raises the bike and/or pedestrian crossing to curb level, which increases the visibility of people in the crosswalk and slows drivers as they pass the raised element.</p> | <p>A2 Bend-Outs</p> <p>Bend-outs allowing people biking to queue closer to the street crossing, which improves visibility and provides yield space for right-turning drivers.</p> |
|--|--|

Optional Features

- | | |
|--|--|
| <p>B1 Curb Extensions</p> <p>Curb extensions extend the curb at crossing locations to improve visibility of people in the crossing and to slow turning drivers.</p> | <p>B2 Bike Lane and Conflict Striping</p> <p>While most people may be more comfortable biking shared use paths, some may prefer to travel on street in bike lanes to avoid interacting with people walking. If bike lanes are provided adjacent to a shared use path, conflict striping may be painted at intersections and driveways..</p> |
|--|--|

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
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- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



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Slip Lane Retrofits

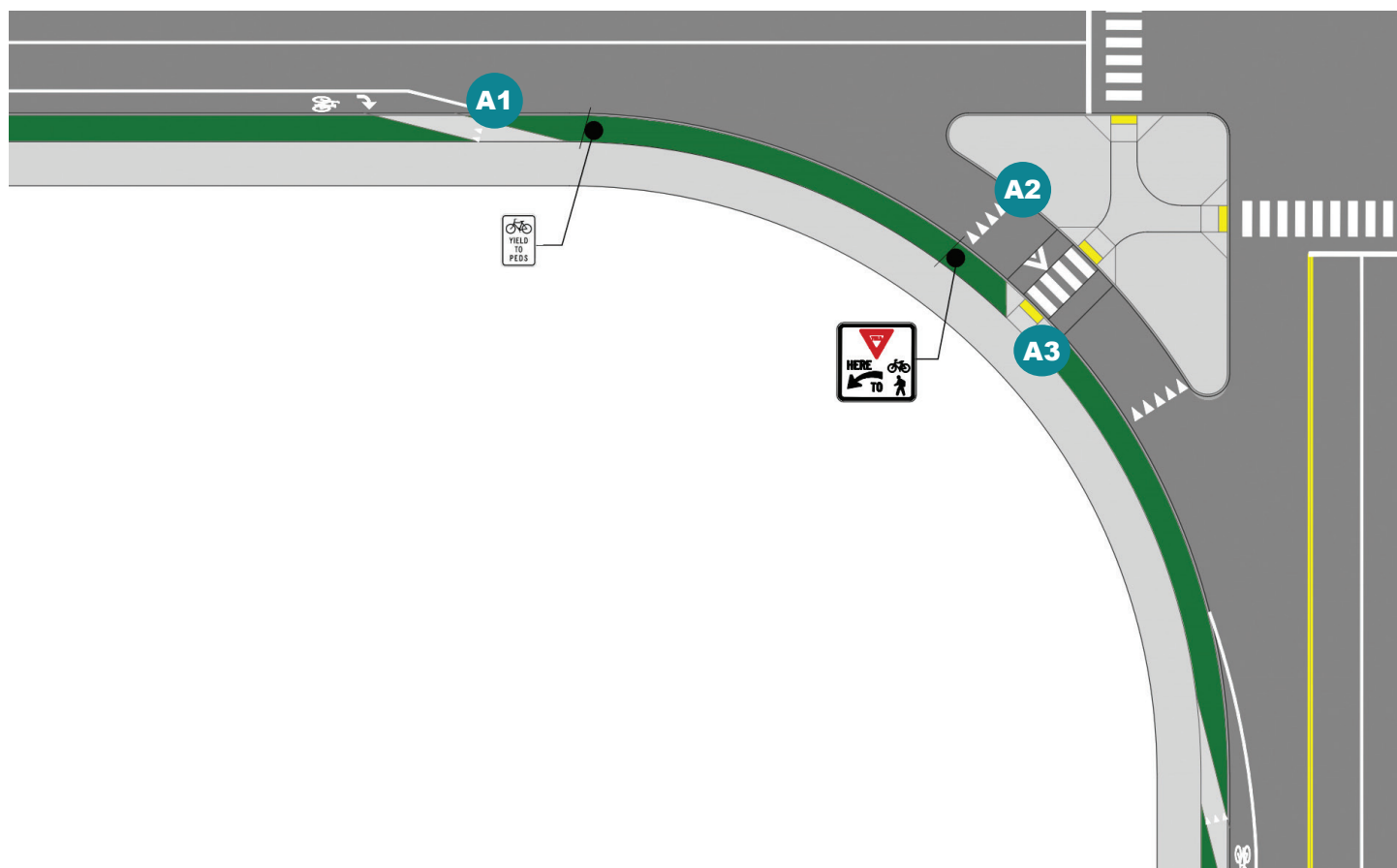
Slip lanes, or channelized right-turn lanes, present challenges for people biking and other roadway users. Slip lanes may encourage higher right-turning speeds, which can reduce driver reaction time in the same area that people walking and biking must cross the intersection. Further, drivers using a slip lane must also split their attention between the pathway in front of them where people may be crossing. The following guidelines are recommended for existing intersections that are to be retrofitted to be more comfortable for people biking.

<u>Raised Crossing in Slip Lane</u>	<u>138</u>
<u>Slip Lane Closure</u>	<u>139</u>
<u>Partially Protected Intersection</u>	<u>140</u>

Slip Lane Retrofits

Raised Crossing in Slip Lane

A raised crossing in the slip lane slows right-turning traffic through the slip lane, especially on the approach of the crossing for people walking and biking. In this example, the bikeway transitions to sidewalk level into a shared use path to facilitate the crossing.



Recommended Features

- A1 Bike Lane Transition to Sidepath**
People biking transition out of the bike lane onto a sidepath and use the raised crossing to traverse the intersection.
- A2 Yield Lines**
Communicates to people driving to yield to people walking in the crosswalk and to yield to through traffic as they exit the slip lane.

- A3 Raised Crossing**
Raises the bike and/or pedestrian crossing to curb level, which increases the visibility of people in the crosswalk and slows drivers as they pass the raised element.

Reference Documents

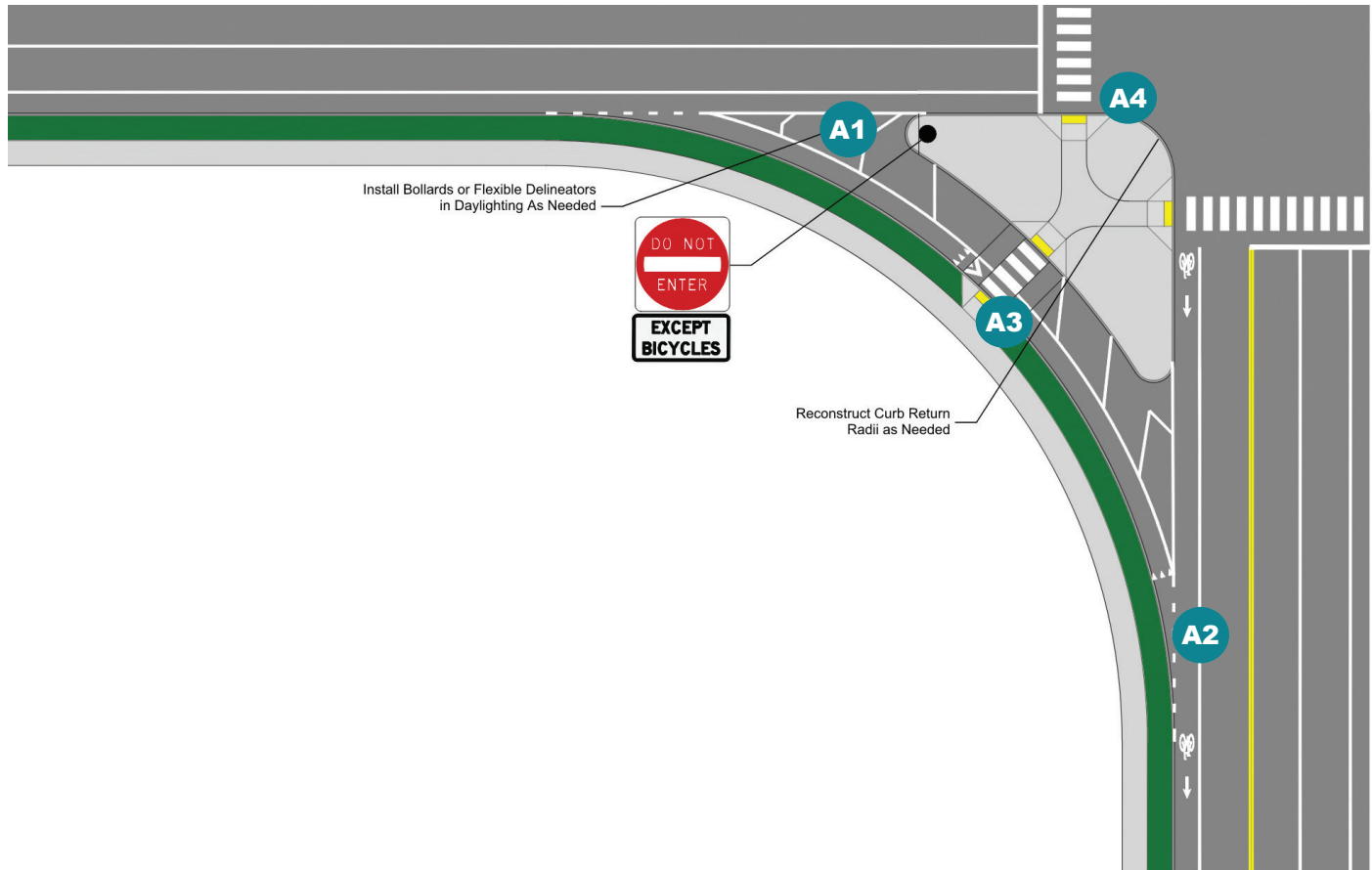
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Mid Block Crosswalks
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets

Slip Lane Retrofits

Slip Lane Closure

Closes the slip lane to vehicular traffic but permits people biking. Drivers may turn right at the stop bar, but at slower speeds due to the tighter turning radii. In addition, closing the slip lane reduces the total number of potential conflicts between drivers and people walking and biking.



Recommended Features

- | | |
|--|--|
| <p>A1 Lane Closure</p> <p>Hatched paint or other quick-build materials such as flex posts can be used to help reinforce that the slip lane is closed to motorist and is only intended for smaller vehicles, or rather, people biking.</p> | <p>A3 Raised Crossing</p> <p>Raises the bike and/or pedestrian crossing to curb level, which increases the visibility of people in the crosswalk and slows drivers as they pass the raised element.</p> |
| <p>A2 Bike Lane Yield Lines</p> <p>Communicates to people biking to yield to people walking in the crosswalk and also to yield to through-bike traffic as they exit the slip lane.</p> | <p>A4 Through Bike Lane</p> <p>Allows people biking to travel through the intersection along their original path of travel if they do not wish to transition off of the street.</p> |

Reference Documents

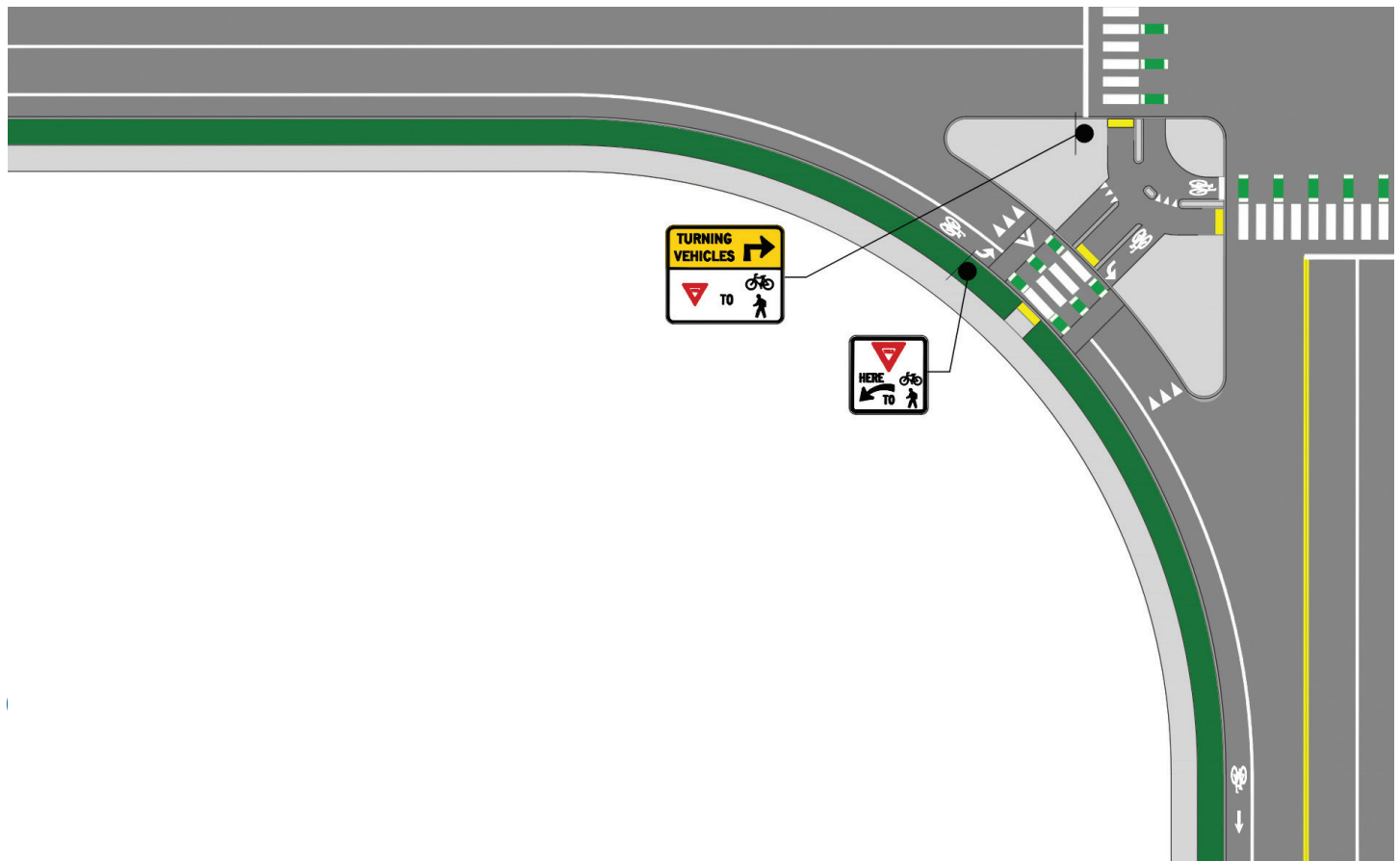
The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Mid Block Crosswalks
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- AASHTO A Policy on Geometric Design of Highways and Streets

Slip Lane Retrofits

Partially Protected Intersection

The bike lane is transitioned to a protected intersection treatment in the island next to the slip lane. The bike lane utilizes the raised crossing, which slows down drivers and increases the visibility of people crossing the slip lane.



A4 Inrough Bike Lane

Allows people biking to travel through the intersection along their original path of travel if they do not wish to transition off of the street.

A5 Bike Lane Yield Lines and Crosswalks

Communicates to people biking to yield to people walking across the bikeway to wait at the median island. Also indicates where people walking should cross. Detectable warning surfaces shall be placed before and after the crossing of the bikeway.

A6 Detectable Edge

Where the bikeway is at sidewalk level, a detectable edge should be placed between the bikeway and sidewalk.

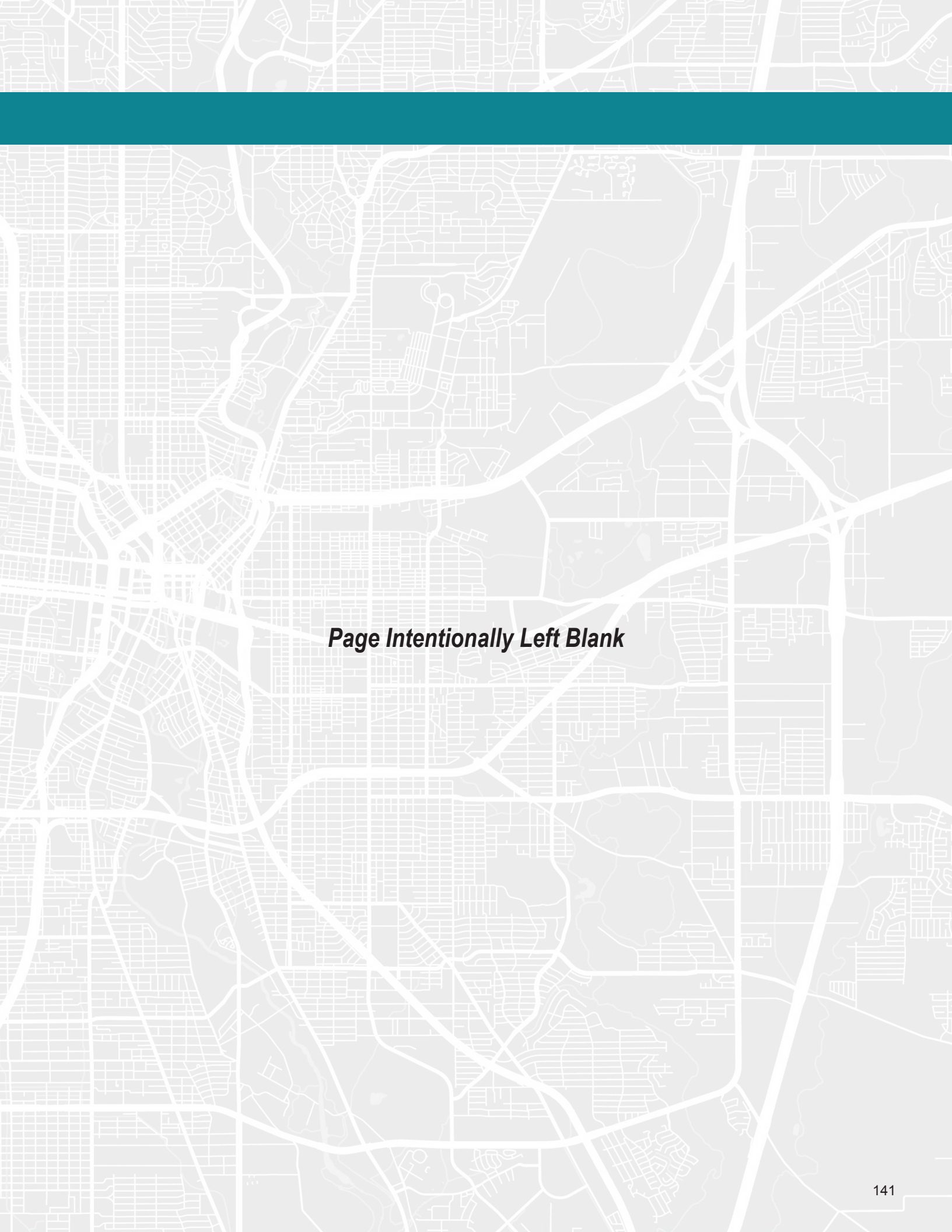
A7 Forward Bike Queue Area

This area provides space for people biking to queue prior to crossing the intersection. The bike queue area should, at a minimum, allow two people on bikes to queue. Larger queue areas can accommodate higher bike volumes and longer bikes.

Reference Documents

The intersection concept shown is an example of how treatments could be combined to create a comfortable crossing for people biking. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD and FHWA MUTCD, 11th Edition, Part 9 (for bicycle treatments not yet in Texas MUTCD)
- NACTO Urban Bikeway Design Guide: Mid Block Crosswalks
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets



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Additional Guidance

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Parking and Loading

Bike facilities and parking and loading facilities may both occupy a similar space between the driving lanes and the curb. Both types of facilities are an important role for vulnerable road users: people who are on bikes and people who are exiting vehicles – especially those with disabilities who require access to level walkways on the curb. With some planning, the needs of these groups can be met through thoughtful designs, as described on the following pages:

<u>Accessible On Street Parking</u>	<u>146</u>
<u>Loading Zones</u>	<u>148</u>

Parking and Loading

Accessible On Street Parking

Generally, on-street parking should be designed following city standards. Where a buffered or protected bikeway is placed next to On-Street parking, the buffer space shall be at least 3 feet. Accessible parking spaces shall be provided where other designated On-Street parking is provided. Parallel on-street parking spaces may be located at the end of a block with access to existing curb ramps, although they may also be located mid-block where a curb ramp is provided. Sample configurations for accessible on-street parking at block end and mid-block locations are shown below.

Recommended Features

- | | |
|---|--|
| A1 Provide an access aisle of at least 5-feet in width for vehicle lift deployment and accessing the designated crossing. The aisle must connect to a pedestrian access route via a curb ramp or blended transition. | A3 Detectable warning surfaces should be placed at the transition between the sidewalk and the crossing. |
| A2 If a pedestrian aisle is not provided, a signed accessible space must be located at the end of a block face and the adjacent sidewalk must be free of obstructions for vehicle lift deployment. | A4 Rear access aisles should be painted for driver side access to the sidewalk. |
| | A5 Bike yield lines and a crosswalk across the bikeway indicates to people biking and they need to yield to people walking. |

Optional Features

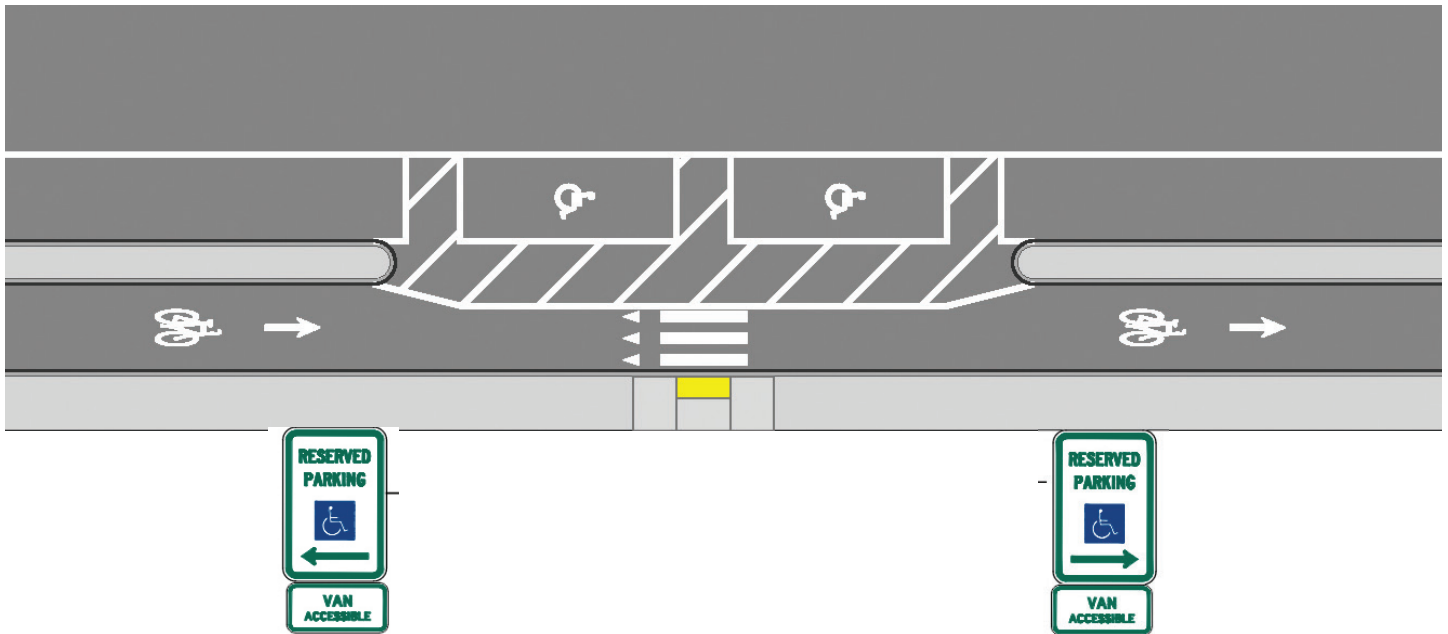
- | | |
|--|---|
| B1 The bikeway may be narrowed to 4-feet at accessible parking spaces in constrained areas. | B2 When the accessible parking space is at the end of the block, median refuge islands are recommended to prevent parking encroachment on the accessible space and path. |
|--|---|

Reference Documents

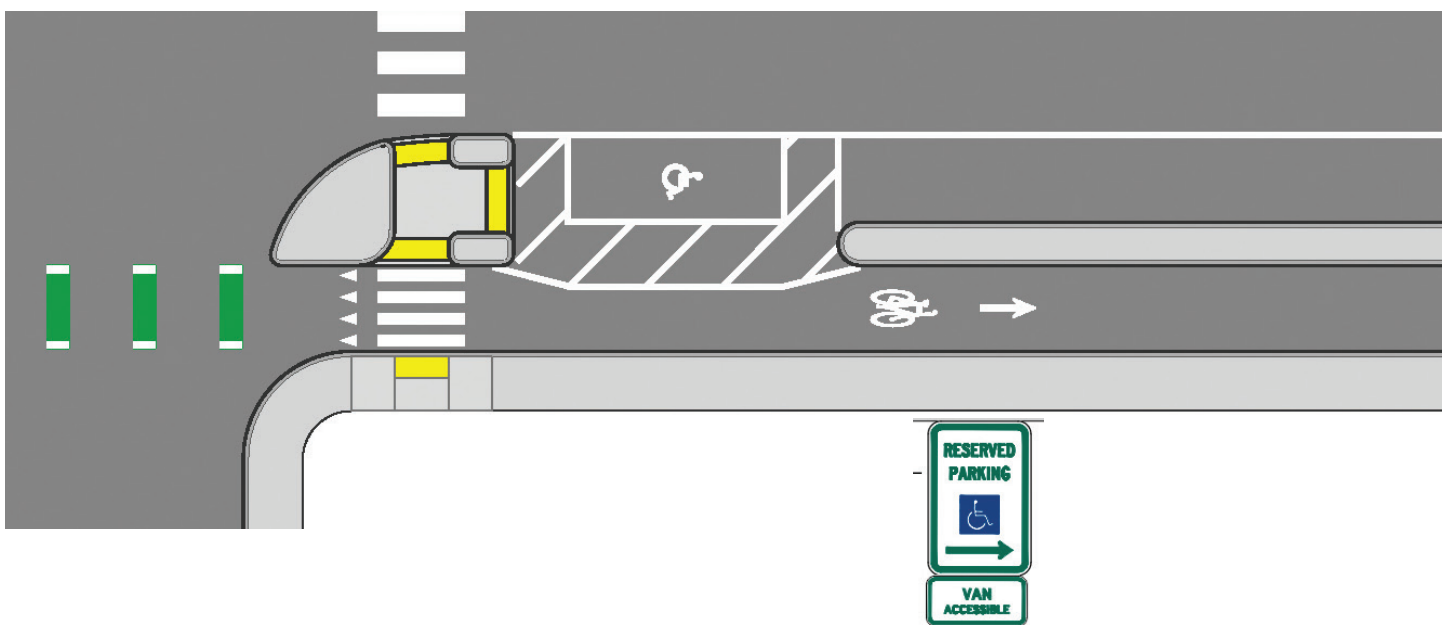
The accessible parking concepts shown are an example of how treatments could be combined to maintain a comfortable place for people walking and biking while also supporting people with disabilities. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets
- PROWAG technical requirement R310.2, Table R211 for frequency and availability of ADA parking spaces.

Mid-Block Accessible Space Configuration



End of Block Accessible Space Configuration



Parking and Loading

Loading Zones

Loading zones may be strategically placed to accommodate passenger and/or commercial loading and unloading in front of businesses, schools, hotels, or other key locations. Where possible, the bikeway should be maintained through the loading zone. Where passenger loading is expected, a curb ramp, crosswalk, and detectable warning surfaces should be present. Yield markings should be placed in the bikeway to indicate to people biking to slow down. Bollards or other vertical elements should be used to ensure people do not park vehicles in the bikeway. Green conflict markings may also be striped in the bikeway through the loading zone to indicate the shared space for all users.

Recommended Features

- A1** Provide an access aisle of at least 5-feet in width for the entire length of the loading zone for vehicle lift deployment and accessing the designated crossing. The aisle must connect to a pedestrian access route via a curb ramp or blended transition.
- A2** The length of the loading zone should be at least 20-feet but may be longer to accommodate the length and number of vehicles expected to use the space.
- A3** Detectable warning surfaces should be placed at the transitions between the sidewalk and the crossing.
- A4** Bike yield lines and a crosswalk across the bikeway indicates to people biking and they need to yield to people walking.

Optional Features

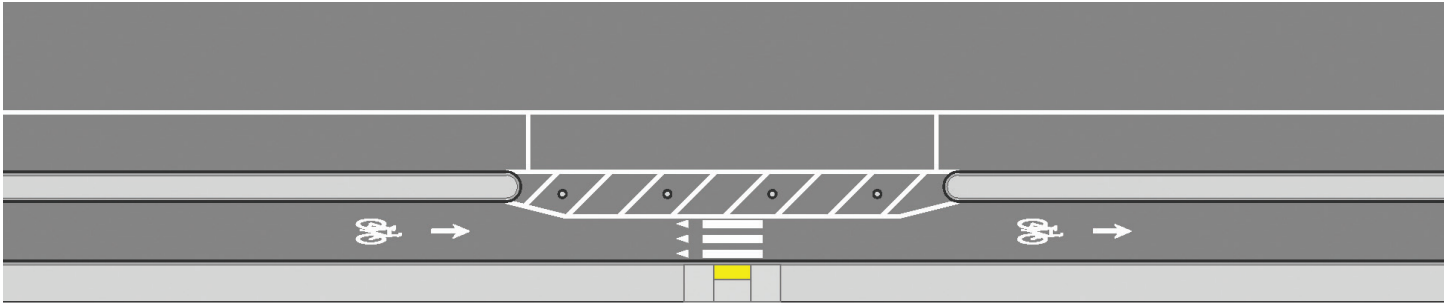
- B1** The bikeway may be narrowed to 4-feet at loading zones in constrained areas.
- B2** Curb ramps should be wide enough to accommodate dollies/hand trucks, or other delivery devices that may be used.

Reference Documents

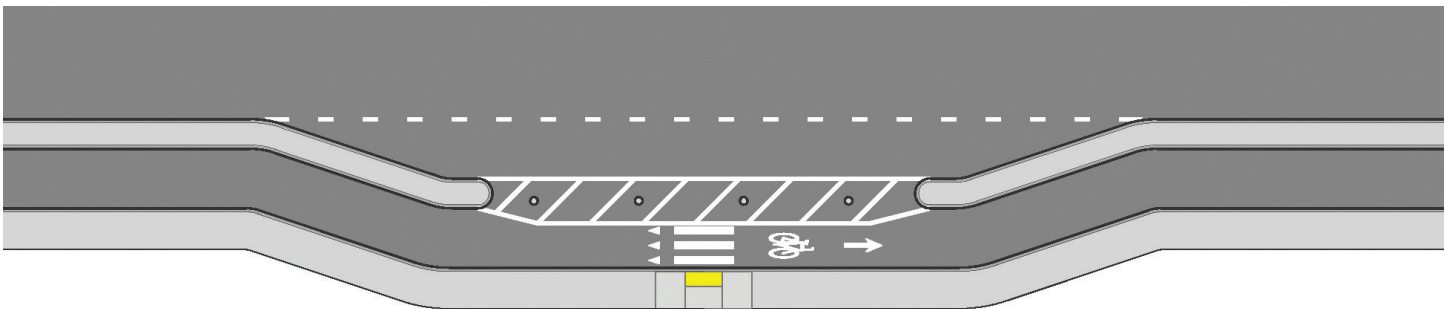
The loading zone concepts shown are an example of how treatments could be combined to maintain a comfortable place for people walking and biking while also supporting people with disabilities. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets
- PROWAG technical requirement R310 for accessible passenger loading guidance and PROWAG R302.7 for surface guidance

Loading Zone Where On-Street Parking is Present



Loading Zone Where On-Street Parking is Not Present





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Bus Stops

Transit and bikeways are complimentary modes of transportation, as biking can provide a great option to cover the "last mile" connection between a transit stop and a final destination. However, without consideration, buses and bikes may compete for curb space. This section presents options for bus stop designs that are compatible with bike facilities:

<u>Bus Islands</u>	<u>152</u>
<u>Constrained Bus Stops</u>	<u>154</u>
<u>Curbside Bus Stops</u>	<u>155</u>

Bus Stops

Bus Islands

When bike facilities run along bus routes, especially those with protected bike lanes, shared use paths, or those that see four or more buses per hour, the bike facility should be routed behind the bus stops to create a bus island. This treatment limits potential conflicts between people biking and buses. If a shared use path is present, the shared use path is subject to the same design criteria a sidewalk would be behind a bus stop. It is preferred, however, to separate the bikeway and walkway near bus islands to limit potential conflicts and indicate the need to slow down for people biking.

Protected / separated bikeways require some additional considerations near bus islands. Because people riding the bus must cross the bike lane to get to the bus island, intended crossing locations should be clearly marked using crosswalks and detectable warning surfaces. Yield markings should be used to indicate drivers' need to slow down for people biking. The bikeway may be raised to sidewalk level behind the bus stop to create a level path of travel for people walking and further indicating the need to slow down to people biking. Alternatively, keeping the bikeway at street level provides additional separation between people walking and biking.

Recommended Features

- | | |
|--|--|
| A1 Bus boarding areas must have a 5 x 8-feet clearance space where boarding and alighting occurs for ramp deployment and have a 4-foot clear pedestrian path. | A2 Detectable warning surfaces should be placed at transitions between sidewalks and the crossings. |
| | A3 Bike yield lines and a crosswalk across the bikeway indicates to people biking to yield to people walking. |

Optional Features

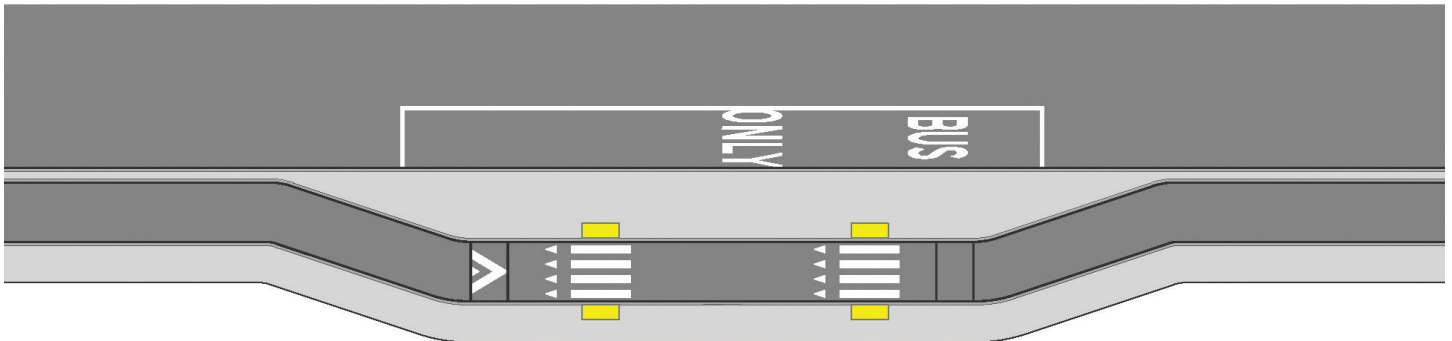
- | | |
|--|--|
| B1 Two pedestrian crossings from the sidewalk to the bus island help provide additional crossing locations for people walking. | B4 If the bikeway is raised through the bus island or a shared use path is present at an end of block configuration, a raised crosswalk may also be installed. |
| B2 The bikeway may be raised the entire length of the boarding island or only at the pedestrian crossings to indicate to people biking to slow down and provide level crossings for people on foot. | B5 Leaning rails may be installed along the edge of the bus island to provide further separation between the bikeway and bus island. These should only be installed where the bikeway is wide enough so that people biking do not get handlebars caught in the railing (generally, 6-feet or wider is preferred). |
| B3 If raised to sidewalk level, a separate bike path may be narrowed to 4-feet at bus islands in constrained areas. | |

Reference Documents

The bus island concepts shown are an examples of how treatments could be combined to maintain a comfortable place for people walking and biking while also supporting people with disabilities. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide, Transit Street Design Guide
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets
- Accessibility requirements ADA Std. 810.2.2

Mid-Block Bus Island Configuration*



End of Block Bus Island Configuration*

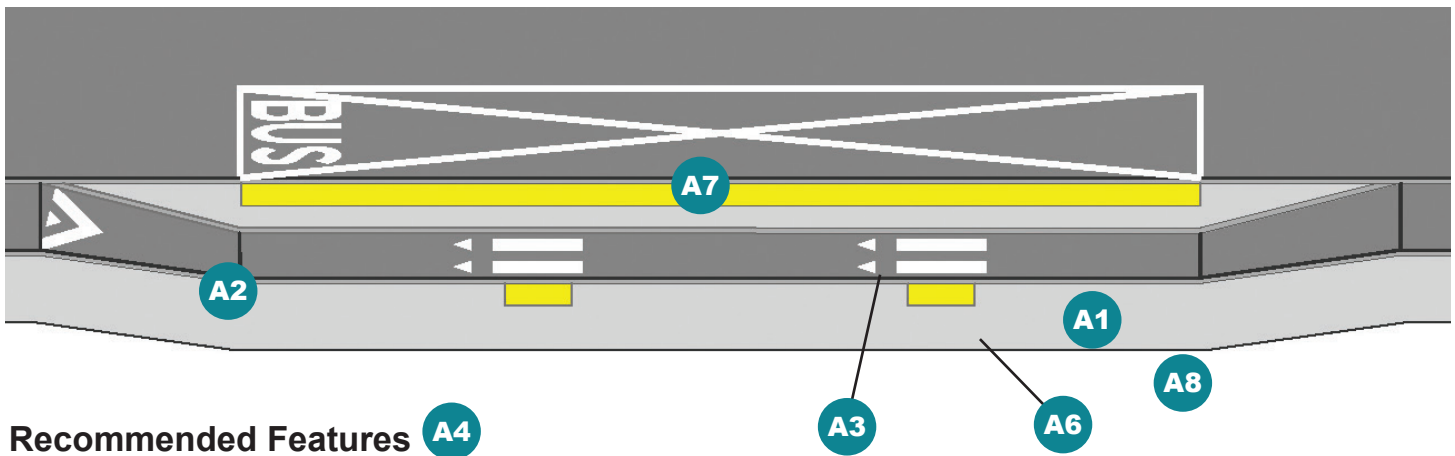


*Shared use paths and separate bike facilities are recommended to include bus islands. Where feasible, bikeways and walkways should be separated to eliminate bus-bike "leapfrogging" conflict at stops.

Bus Stops

Constrained Bus Stops

Where a full bus island cannot be provided due to right of way or other space constraints, it is still desirable to maintain separation between the bike lane and bus stop. In these cases, the bike lane may be raised to sidewalk level and should run along the bus boarding area. When no buses are present, people can bike through the boarding area and people waiting for the bus wait on the sidewalk out of the bikeway. People biking yield during bus loading and unloading. Detectable warning strips may be placed along the edge of the sidewalk where passengers step into the raised boarding area and along the curb where passengers board the bus. The whole width of the separated bicycle lane can be used as the accessible boarding area for wheelchair lifts from the bus. However, stops must provide wheelchair users an accessible waiting area outside of the bike lane.



Recommended Features

- A1** Bus boarding areas must have a 5 x 8-foot clearance space where boarding and alighting occurs for ramp deployment and have a 4-foot clear pedestrian path.
- A2** Raise the bike lane to sidewalk level throughout the length of the intended bus stop.
- A3** Bike yield lines and a crosswalk across the bikeway indicate to people biking to yield to people walking.
- A4** The bikeway may be narrowed to 4-feet at bus islands in constrained areas.
- A5** The accessible waiting area is on the sidewalk. Any transit amenities should be placed on the sidewalk.
- A6** Detectable warning surfaces should be placed at transitions between sidewalks and the crossings.
- A7** Detectable warning surfaces should be placed along the entire length of the edge of the boarding platform.
- A8** A minimum 4-foot wide buffer should be placed between the curb and the bikeway.

Reference Documents

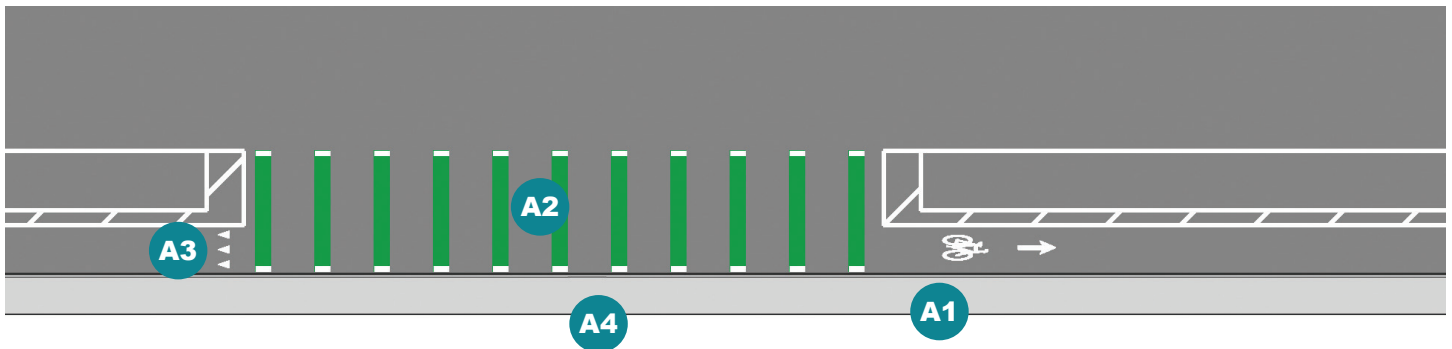
The concept shown is an example of how treatments could be combined to maintain a comfortable place for people walking and biking while also supporting people with disabilities. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide, Transit Street Design Guide
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets
- Accessibility requirements ADA Std. 810.2.2

Bus Stops

Curbside Bus Stops

Where bus volumes are low (less than four buses per hour) and/or other constraints prevent the construction of stops that separate the bus from the bike lane, curbside bus stops are a low-cost option. In these stops, the bus merges into the bike lane, and people biking must either merge into traffic to bypass the bus or wait for the bus to move. Where on street parking is present, a curbside pullout may be used and the bike lane can be routed around the bus stop. This configuration may be more comfortable than the traditional curbside bus stop. In all cases, green conflict markings should be used to indicate the shared area for all users.



Recommended Features

- | | |
|--|---|
| A1 Bus boarding areas must have a 5 x 8-foot clearance space where boarding and alighting occurs for ramp deployment and have a 4-foot clear pedestrian path. | A3 Bike yield lines indicate to people biking they should yield to the bus. |
| A2 Paint conflict markings through the entire width of the bus stop to indicate to people biking buses may stop there. | A4 The accessible waiting area is on the sidewalk. Any transit amenities should be placed on the sidewalk. |

Reference Documents

The concept shown is an example of how treatments could be combined to maintain a comfortable place for people walking and biking while also supporting people with disabilities. For formal design guidance, refer to the following documents or others, as new guidance becomes available:

- Texas MUTCD
- NACTO Urban Bikeway Design Guide, Transit Street Design Guide
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO A Policy on Geometric Design of Highways and Streets
- Accessibility requirements ADA Std. 810.2.2



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Wayfinding

Wayfinding helps people navigate from one location to another, using visual cues and information systems. Clear signage and markers help people biking avoid getting lost, minimize travel time, and enhance their overall experience. Good way finding systems can also increase the comfort of people biking by directing riders to lower-stress routes or to locations where bike facilities are present. This section presents some options for wayfinding signage. The City may wish to develop a comprehensive, branded wayfinding program.

Wayfinding Signage

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Wayfinding

Wayfinding Signage

MUTCD Section 9b.20 Bicycle Guide Signs presents comprehensive guidance on signs, and Section 9B.01 of the MUTCD gives specific design details on the placement of signs including mounting height and lateral placement from the roadway. The information in the following section provides information on key signage that can help to guide people biking through San Antonio.

Confirmation Signs

Indicates to people biking that they are riding along a designated bikeway and alerts people driving to expect higher volumes of bike riders along the roadway. Confirmation signs can be as simple as a BIKE ROUTE (MUTCD D11-1) or can be a community-branded sign with additional details such as distances to major destinations along the route.

Confirmation signs should be placed every 2-3 blocks along a bike boulevard, and especially after turns to confirm to riders they are taking the correct route. For shared use paths, confirmation signs should be placed every quarter to half mile.



D11-1



D11-1bP



M1-8b



M1-8

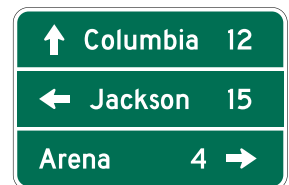
Turn Signs

Indicates to people biking that the intended bike path turns from one street to another. Arrows are used with these signs to indicate the direction people biking should follow in order to remain on the bikeway.

Turn signs should be placed on the near side of intersections where the bike route turns.



D1-2b



D1-3a



D1-1b



M5-2P



M6-1P



M6-2P



M6-3P



M6-4P



M6-5P



M6-6P



M6-7P

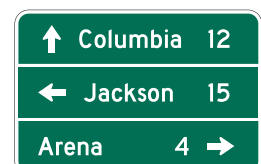
Decision Signs

Decision signs indicate to people biking that there are two or more bikeways that converge or diverge and inform the rider of which route leads where. These signs often include information such as directional arrows and distances to key destinations.

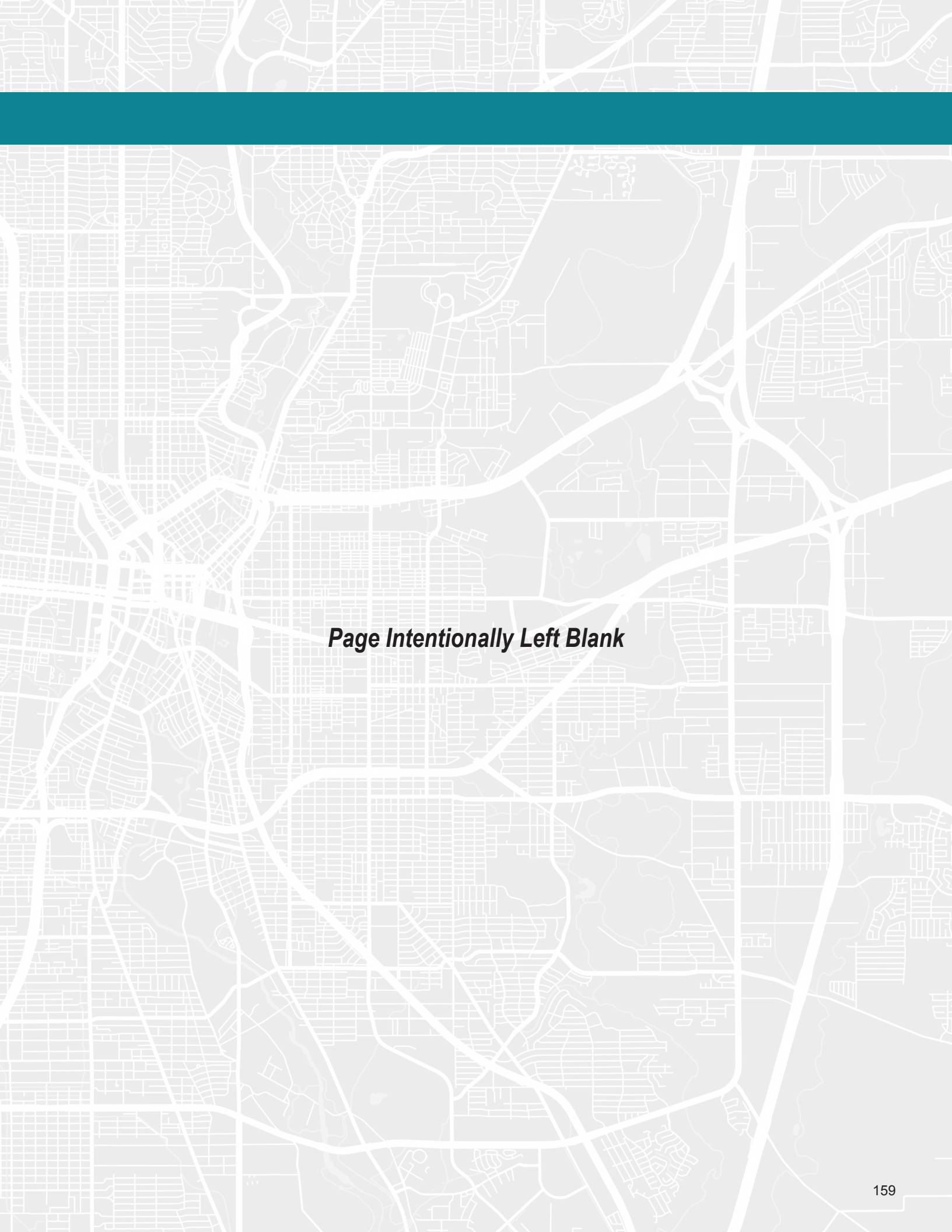
Decision signs should be placed on the near side of intersections where two or more bikeways meet.



D1-3c



D1-3a



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Bike Parking

Safe, convenient, and accessible bike parking is an important component of the bike network. People may decide whether or not to bike based on if there is parking at their destination and if they feel confident their bike will not be damaged or stolen. In order to ensure this, bike parking should be reliably available throughout the city, especially where there are concentrations of businesses or other destinations. The following section provides guidance on where to install bike parking and the potential options that could be provided.

Bike Parking

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Bike Parking

Bike Parking

The City of San Antonio requires that bike parking be built in certain areas based on the Unified Development Code (UDC) Section 35-525 - Parking and Loading Standards. The number of bike parking spaces required is based on a percentage of required vehicle spaces. The UDC generally leaves it up to the discretion of the developer whether these spaces are short- or long-term spaces in most areas. In the Downtown and Infill Development Districts, a larger minimum rate of bike parking is required. In the UDC, bike parking is required to be provided within 50-feet of a primary building entrance and every 150-feet along the facade of a building with multiple tenants. As the City implements the Bike Network Plan, the following additional considerations and guidance should be considered.

Location and Siting of Bike Parking

Bike parking should be located at all destinations where people may choose to bike, including:

- Commercial districts, grocery stores, and convenience stores
- Parks and recreation sites
- Schools and universities
- Libraries, community centers, churches, post offices, museums, and other community serving destinations
- Employment centers
- Transit centers
- High density residential areas

Bike parking may be located within the public right-of-way on sidewalks or within on-street parking spaces. It may also be located on private property especially in secured garages or bike cages, if built by developers.



Types of Bike Parking

The type of bike parking selected should be based on factors such as the anticipated duration of a stay, type of destination, security needs, and proximity to a destination. Based on this, the designer can determine whether long- or short-term bike parking is preferable.

Short-Term Bike Parking

Short-term bike parking accommodates people who are visiting a destination for approximately two hours or less, such as a grocery store, healthcare office, restaurant, or gym. Short-term visitors may be less familiar with the area and prioritize visibility and access to their bike, and so short-term bike parking spaces should be placed within eyesight of a building entrance. Short-term bike parking in other locations, such as alleys or unsecured locations in parking garages, may be less secure and should be avoided. The following considerations are relevant for short-term bike parking:

- Placed in visible locations close to entrances (50-feet or less)
- Racks should be securely fastened to the ground, accommodate U-locks, and support the bicycle at two points to allow the frame and both wheels to be locked
- Consider adding a weather-protected cover
- Should be well lit
- Location should be visible to the public or seen from within the destination
- May be co-located with amenities such as bike repair stations
- May be designed with creative shapes or colors

Examples of Short-Term Bike Parking Options

U-Rack



Source: Kittelson & Associates

Bike Corral



Source: Kittelson & Associates

Creative Bike Racks



Source: Kittelson & Associates

Long-Term Bike Parking

Long-term bike parking is intended to store bike for several hours or more. This type of parking accommodates regular visitors, like employees, students, residents, or public transit users. Because users leave their bike for long periods unattended, security is critical, as is weather protection. That said, location convenience is less important for long-term users. People may choose to leave their bike long term in a secure space in a building lobby or parking garage, as opposed to prioritizing highly visible locations in front of main entrances. The following considerations are relevant for long term bike parking:

- Signage should be present for first-time users
- Locations may vary, but secure facilities are most important
- Should be directly accessible without stairs
- Should be designed to fit larger bikes like cargo bikes
- May include outlets for e-bike charging
- May be co-located with other amenities like a bike shop or repair station
- Security may include individual user locks, keys, smart cards, mobile applications, or other technologies

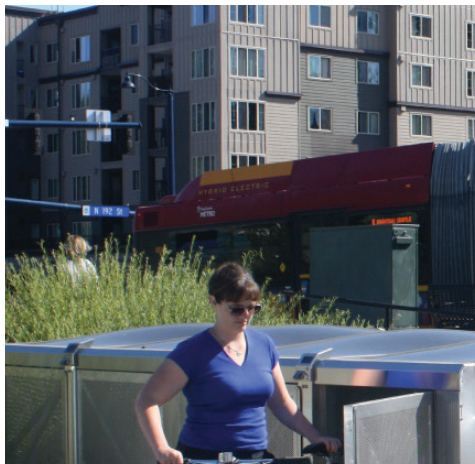
Examples of Long-Term Bike Parking Options

Bike Hangar



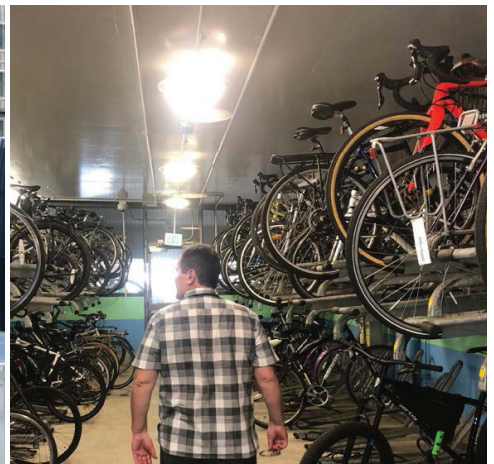
Source: Transport for London

Bike Locker



Source: King County Metro

Bike Storage Room



Source: Kittelson & Associates



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Bike Signals

Bicyclist movements can often be controlled by vehicle or pedestrian signals. However, where protected bike lanes are used, at complex crossings, where there is a desire to let people biking get a head start, or in other unique situations, a bike signal may be used. Bike signals are signals specifically designed to facilitate crossings for people on bikes. They operate similarly to vehicle signals, but may include a special bike symbol in the signal head. These signals should only be used in conjunction with a conventional traffic signal, and can help address safety or operational challenges. This section provides high-level guidance on when and how to use bike signals. The decision of if and when to install a bicycle signal and how to design phasing should be made based on engineering judgment and consider the needs of everyone crossing through the intersection.

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<u>Bike Signal Equipment and Faces</u>	167
<u>Bike Signal Phasing</u>	168

Bike Signals

When to Consider a Bike Signal

MUTCD Chapter 4H Bicycle Signals presents comprehensive guidance on the installation and other elements of bicycle signals. The information in the following section provides guidance on when bicycle signals may be appropriate.

When Bicycle Signals May Be Considered

Bike signals may be appropriate in many scenarios, and the determination to use them should be based on an holistic evaluation of the study area, warrant considerations, and engineering judgement. The Federal MUTCD provides warrants for the installation of bike signals where a new traffic control signal is being installed in Chapter 4C; however, it is noted that the installation of bike signals at existing traffic control signals should be made based on engineering judgement.

Locations where it may be appropriate to install bike signals include, but are not limited to:

- Providing a protected bicycle signal phase;
- Providing a leading or lagging bicycle interval or to make it legal for a person biking to enter the intersection; during an all-pedestrian phase;
- Controlling a bicycle through movement for a bicycle lane running on the right-hand side of a right-turn lane, such as for protected bike lanes or through bike lanes;
- At protected intersections, dedicated intersections, or bend outs;
- At intersections with unique bicycle movements, such as a diagonal transition
- To provide for a bike through movement across a T intersection where no concurrent vehicle movement exists;
- Where there are high volumes of right turning vehicles (greater than 150 vehicles per hour for a one-way separated bikeway or 100 vehicles per hour for a two-way separated bikeway or sidepath);
- Controlling a bicycle through movement for contraflow bike lanes or two-way bikeways; and
- Locations where existing traffic signal heads are not visible to people biking.

In general, bike signals should be consistently installed along a corridor if they are used. Otherwise, it can be confusing for people biking if they must look for a combination of vehicle, pedestrian, and/or bike signals.



Bike Signals

Bike Signal Equipment and Faces

The MUTCD establishes requirements for where bike signal displays can be placed at an intersection. Generally, they may be placed on the near- and far-side at an intersection and are co-located with vehicle traffic signals. The following guidance supplements what is noted in the MUTCD.

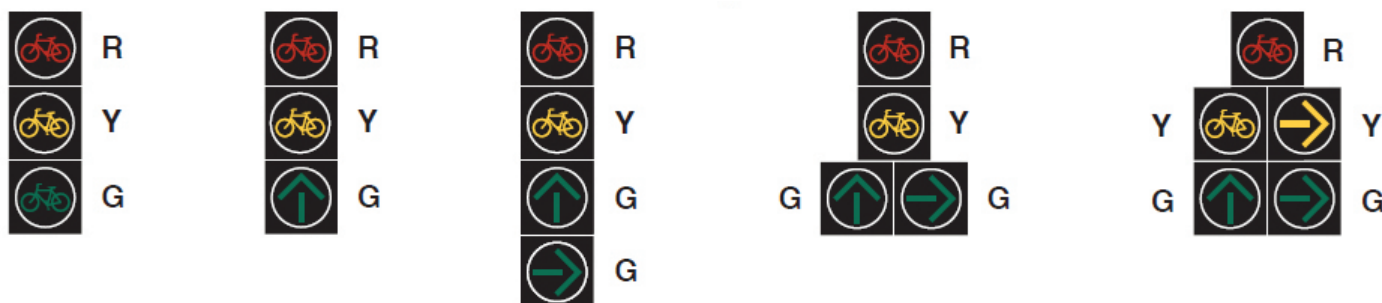
Bicycle Signal Equipment and Faces

Bicycle signal faces may be designed as standard signal faces or may include a bike stencil. The following elements should be considered in bike signal design:

- If designed as a standard signal face, a “BICYCLE SIGNAL” plaque (R10-10b) is required. The sign is optional if a bike stencil is used.
- Bike signal faces may be designed using an 8- or 12-inch circular indicators. If a secondary, near-side signal is installed, 4-inch circular indicators may be utilized on the nearside signal.
- One bike signal face is sufficient, but a second face may be provided to provide additional clarification and guidance for people biking.
- Bike signal heads should be designed to be visible by people biking. This is especially important in locations with contraflow or two-way bikeways.
- Bike signals may be designed with shielded louvers to prevent confusion for vehicle drivers.
- Bike signals shall be placed a minimum of 7-feet above sidewalk or the ground. If a 4-inch nearside signal is used, the signal face shall be a minimum of 4-feet and a maximum of 8 feet above the ground.

Typical Arrangements of Bike Signal Faces

Vertical Faces



Horizontal Faces



Source: FHWA MUTCD Attachment IA-16-1

Bicycle Detection

The bike signal phase may or may not occur every phase. If actuation is required, passive actuation is preferred using bike loop detectors over requiring people biking to use push buttons. If push buttons are used, they should be mounted in a way that does not require people biking to dismount.

If a push button is used, it shall be accompanied by appropriate regulatory signs (MUTCD R10-4, R10-24, or R10-26) explaining the purpose and operation of the push button. If the push button is intended to be used by both people walking and biking, the button must be designed to meet all accessibility needs.

Bike Signals

Bike Signal Phasing

There are a variety of types of phasing that may be used to reduce potential conflicts between people biking and other roadway users or to increase convenience for people biking. Overall waiting time, among other elements, should be considered when determining a signal phasing plan. The following section presents a non-exhaustive discussion of potential phasing options. For more information, please see the NACTO Urban Bikeway Design Guide and/or the FHWA Separated Bikeway Planning and Design Guide.

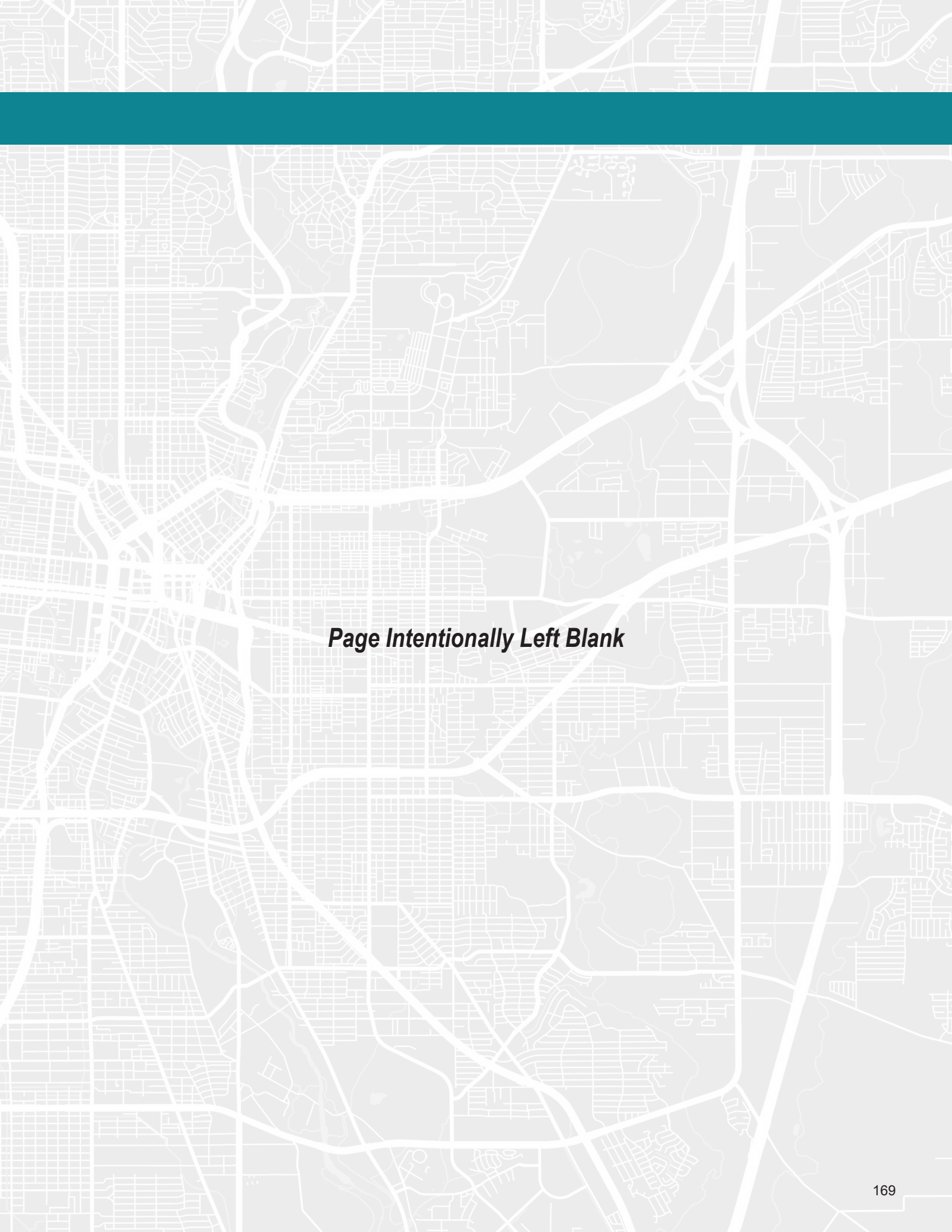
Clearance Intervals

There are no national standards for determining the appropriate clearance intervals for bike signals. People biking typically require longer minimum green times than drivers because people biking move slower than drivers. Therefore bicycle minimum clearance times should be determined using the time it would take an average person to cross the width of the intersection on a bike. The NACTO Urban Bikeway Design Guide recommends utilizing 14-feet per second, or 9.5 mph, as an average intersection crossing speed. Additional time may be provided for start-up time. Yellow and all-red intervals may be incorporated into the vehicle phases as long as the minimum clearance time is met.

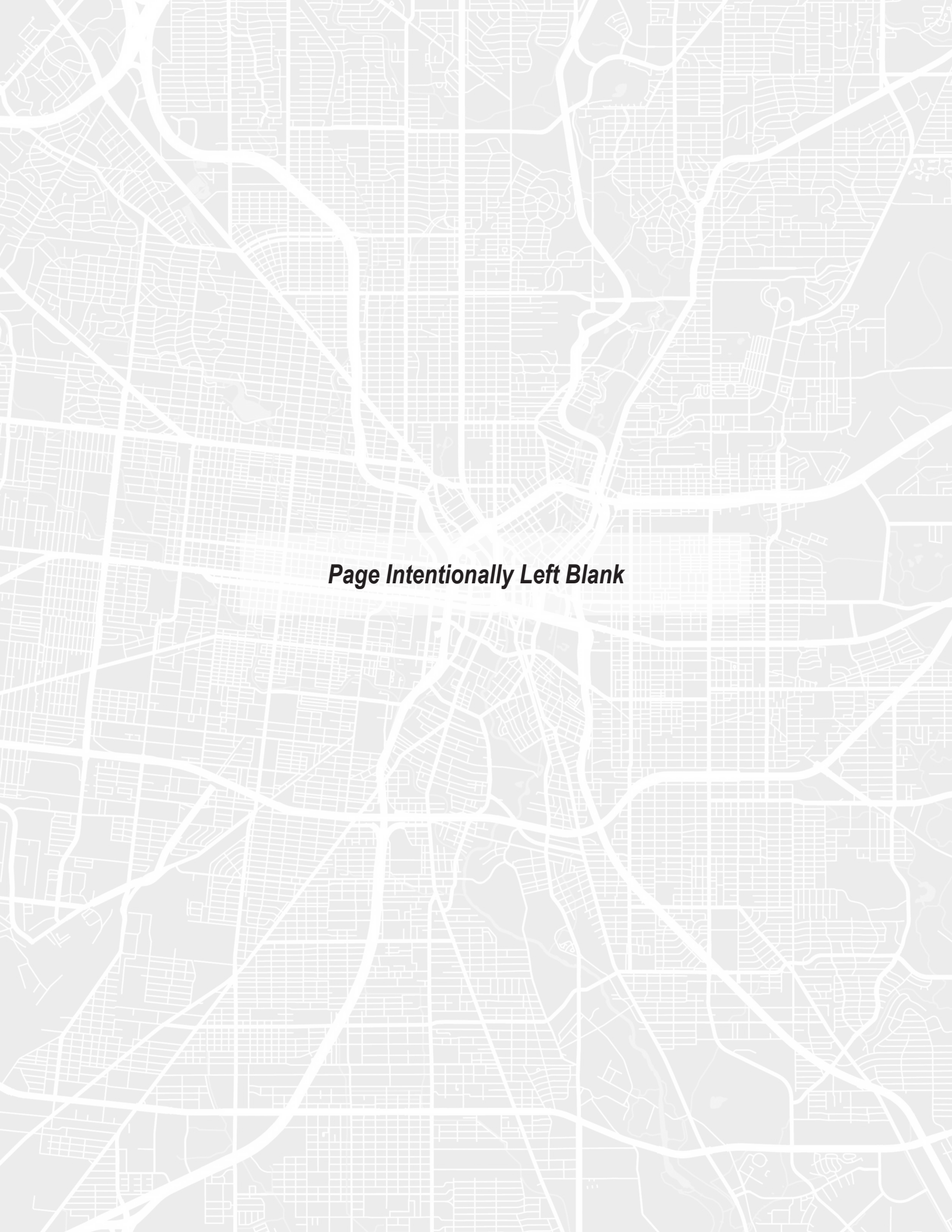
Phasing Options

The following phasing options may be considered at bike signals:

Phasing Option	Description	Benefits	Constraints
Leading Bike Interval	People biking are provided a 3- to 5- second head start in front of all vehicles. This treatment may also provide a head start for people walking.	• People walking and biking enter the intersection before drivers • Improved visibility and reduced conflict potential between all users	• Increased delay for drivers • May be less appropriate in areas with high volumes of right-turning drivers
Protected	Vehicular right turns on red are prohibited during the bike through movement. Then, through bike movements are halted and drivers are permitted to turn across the bike path.	• People biking and walking are fully separated from right-turning vehicles • Drivers are not required to yield when turning	• Longer cycle lengths may be required • Requires a right-turn lane
Protected - Permissive	Through-moving vehicles start at the same time as people biking and walking. A flashing yellow turn phase is then provided for right-turning vehicles.	• People walking and biking can enter the intersection before right-turning vehicles • Improved visibility and reduced conflict potential between all users	• May be less appropriate in areas with high volumes of right-turning drivers
Bike Only Phase	All vehicle traffic is stopped and people biking may move through the intersection. The current MUTCD does not allow bike scrambles.	• People biking and walking are fully separated from drivers • Drivers are not required to yield to other users	• Increases delay for all users, which may result in reduced compliance



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Appendix

What are the Right Bike Facility Types for San Antonio?

Building off national guidance, San Antonio’s bicycle facility selection is a context-sensitive approach that involves a planning- and engineering-based process. As motor vehicle speeds and volumes increase and as the urban form changes, more separation between bicyclists and motor vehicle traffic may be necessary. The following table outlines recommended and allowable bicycle facility types for San Antonio’s unique streets and their surrounding contexts .

Primary Arterials

■ Preferred Facility ● Alternative Options to Consider***

Number of Lanes	Speed*	Traffic Volumes**	Bike Boulevard	Striped Bike Lane	Buffered Bike Lane	Protected Bike Lane (At-Grade)	Protected Bike Lane (Raised)	Shared Use Path	Alternative Route
Low Density Neighborhood									
2-4 Lanes	40 MPH	Up to 30,000							
6 Lanes	40 MPH	> 30,000							
2-6 Lanes	45 MPH	Up to 30,000				(Not on 6 lanes/45 MPH)			
		> 30,000				(Not on 6 lanes/45 MPH)			
Medium Density Neighborhood									
2-4 Lanes	40 MPH	Up to 30,000							
6 Lanes	40 MPH	> 30,000							
2-6 Lanes	45 MPH	Up to 30,000				(Not on 6 lanes/45 MPH)			
		> 30,000				(Not on 6 lanes/45 MPH)			
High Density Neighborhood									
2-4 Lanes	40 MPH	Up to 30,000							
6 Lanes	40 MPH	> 30,000							
2-6 Lanes	45 MPH	Up to 30,000				(Not on 6 lanes/45 MPH)			
		> 30,000				(Not on 6 lanes/45 MPH)			
Employment/Activity Center									
2-4 Lanes	40 MPH	Up to 30,000							
6 Lanes	40 MPH	> 30,000							
2-6 Lanes	45 MPH	Up to 30,000				(Not on 6 lanes/45 MPH)			
		> 30,000				(Not on 6 lanes/45 MPH)			
Industrial/Agricultural									
2-4 Lanes	40 MPH	Up to 30,000							
6 Lanes	40 MPH	> 30,000							
2-6 Lanes	45 MPH	Up to 30,000				(Not on 6 lanes/45 MPH)			
		> 30,000				(Not on 6 lanes/45 MPH)			
Recreation/Open Space									
2-6 Lanes	<35 MPH	Any							
2-6 Lanes	> 40 MPH	Any				(Not on 6 lanes/45 MPH)			
Central Business District									
2-4 Lanes	30 MPH	Up to 30,000							
6 Lanes	30 MPH	> 30,000							
2-6 Lanes	35 MPH	Up to 30,000				(Not on 6 lanes/45 MPH)			
		> 30,000				(Not on 6 lanes/45 MPH)			

* Represents design speed for future roads and posted speed for existing roads.
** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Please refer to the individual bicycle selection context sheets for detailed footnotes.

What are the Right Bike Facility Types for San Antonio?

Building off national guidance, San Antonio’s bicycle facility selection is a context-sensitive approach that involves a planning- and engineering-based process. As motor vehicle speeds and volumes increase and as the urban form changes, more separation between bicyclists and motor vehicle traffic may be necessary. The following table outlines recommended and allowable bicycle facility types for San Antonio’s unique streets and their surrounding contexts .

Secondary Arterials

■ Preferred Facility

● Alternative Options to Consider***

Number of Lanes	Speed*	Traffic Volumes**	Bike Boulevard	Striped Bike Lane	Buffered Bike Lane	Protected Bike Lane (At-Grade)	Protected Bike Lane (Raised)	Shared Use Path	Alternative Route
Low Density Neighborhood									
2 Lanes	35-40 MPH	Any			●	■	■	■	●
2-4 Lanes	40 MPH	Any			● (Not on 4 lanes/40 MPH)	●	■	■	●
Medium Density Neighborhood									
2 Lanes	35-40 MPH	Any			●	■	■	■	●
2-4 Lanes	40 MPH	Any			● (Not on 4 lanes/40 MPH)	●	■	■	●
High Density Neighborhood									
2 Lanes	35-40 MPH	Any			●	■	■	■	●
2-4 Lanes	40 MPH	Any			● (Not on 4 lanes/40 MPH)	●	■	■	●
Employment/Activity Center									
2 Lanes	35-40 MPH	Any			●	■	■	■	●
2-4 Lanes	40 MPH	Any			● (Not on 4 lanes/40 MPH)	●	■	■	●
Industrial/Agricultural									
2 Lanes	35-40 MPH	Any			●	■	■	■	●
2-4 Lanes	40 MPH	Any			● (Not on 4 lanes/40 MPH)	●	■	■	●
Recreation/Open Space									
2-4 Lanes	40 MPH	Any			● (Not on 4 lanes/40 MPH)	■	■	■	●
Central Business District									
2-4 Lanes	30-35 MPH	Any			● (Only on 2 lanes/30 MPH)	■	■	■	●

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Please refer to the individual bicycle selection context sheets for detailed footnotes.

What are the Right Bike Facility Types for San Antonio?

Building off national guidance, San Antonio’s bicycle facility selection is a context-sensitive approach that involves a planning- and engineering-based process. As motor vehicle speeds and volumes increase and as the urban form changes, more separation between bicyclists and motor vehicle traffic may be necessary. The following table outlines recommended and allowable bicycle facility types for San Antonio’s unique streets and their surrounding contexts .

Collector A/B

Preferred Facility

Alternative Options to Consider***

Number of Lanes	Speed*	Traffic Volumes**	Bike Boulevard	Striped Bike Lane	Buffered Bike Lane	Protected Bike Lane (At-Grade)	Protected Bike Lane (Raised)	Shared Use Path	Alternative Route
Low Density Neighborhood									
2 Lanes	25 MPH	<3,000	■	●	●			●	●
2 Lanes	30 MPH	<3,000		■	■			●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●
Medium Density Neighborhood									
2 Lanes	25 MPH	<3,000	■	●	●			●	●
2 Lanes	30 MPH	<3,000		■	■			●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●
High Density Neighborhood									
2 Lanes	25 MPH	<3,000	■	■	●	●	●	●	●
2 Lanes	30 MPH	<3,000		■	■	●	●	●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●
Employment/Activity Center									
2 Lanes	25 MPH	<3,000	■	■	●	●	●	●	●
2 Lanes	30 MPH	<3,000		■	■	●	●	●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●
Industrial/Agricultural									
2 Lanes	30 MPH	Any			■	■	■	●	●
Recreation/Open Space									
2 Lanes	30 MPH	<3,000		■	■	●	●	●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●
Central Business District									
2 Lanes	25 MPH	<3,000	■	■	●	●	●	●	●
2 Lanes	25 MPH	>3,000	●	●	■	■	■	●	●
2 Lanes	30 MPH	<3,000		■	■	●	●	●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Please refer to the individual bicycle selection context sheets for detailed footnotes.

What are the Right Bike Facility Types for San Antonio?

Building off national guidance, San Antonio’s bicycle facility selection is a context-sensitive approach that involves a planning- and engineering-based process. As motor vehicle speeds and volumes increase and as the urban form changes, more separation between bicyclists and motor vehicle traffic may be necessary. The following table outlines recommended and allowable bicycle facility types for San Antonio’s unique streets and their surrounding contexts .

Collector C

Preferred Facility

Alternative Options to Consider***

Number of Lanes	Speed*	Traffic Volumes**	Bike Boulevard	Striped Bike Lane	Buffered Bike Lane	Protected Bike Lane (At-Grade)	Protected Bike Lane (Raised)	Shared Use Path	Alternative Route
Low Density Neighborhood									
2 Lanes	35 MPH	Any				■	●	●	●
4 Lanes	35 MPH	Any				■	●	■	●
Medium Density Neighborhood									
2 Lanes	35 MPH	Any				■	●	●	●
4 Lanes	35 MPH	Any				■	●	■	●
High Density Neighborhood									
2 Lanes	30 MPH	<3,000		■	■			●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●
2-4 Lanes	35 MPH	Any				■	●	■	●
Employment/Activity Center									
2 Lanes	30 MPH	<3,000		■	■			●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●
2-4 Lanes	35 MPH	Any				■	●	■	●
Industrial/Agricultural									
2-4 Lanes	35 MPH	Any				■	●	■	●
Recreation/Open Space									
2-4 Lanes	35 MPH	Any				●	●	■	●
Central Business District									
2 Lanes	25 MPH	<3,000	■	■	●	●	●	●	●
2 Lanes	25 MPH	>3,000	●	●	■	■	■	●	●
2 Lanes	30 MPH	<3,000		■	■	●	●	●	●
2 Lanes	30 MPH	>3,000			■	■	■	●	●

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Please refer to the individual bicycle selection context sheets for detailed footnotes.

What are the Right Bike Facility Types for San Antonio?

Building off national guidance, San Antonio’s bicycle facility selection is a context-sensitive approach that involves a planning- and engineering-based process. As motor vehicle speeds and volumes increase and as the urban form changes, more separation between bicyclists and motor vehicle traffic may be necessary. The following table outlines recommended and allowable bicycle facility types for San Antonio’s unique streets and their surrounding contexts .

Local A

■ Preferred Facility ● Alternative Options to Consider***

Number of Lanes	Speed*	Traffic Volumes**	Bike Boulevard	Striped Bike Lane	Buffered Bike Lane	Protected Bike Lane (At-Grade)	Protected Bike Lane (Raised)	Shared Use Path	Alternative Route
Low Density Neighborhood									
2 Lanes	25 MPH^	<3,000	■	●				●	●
Medium Density Neighborhood									
2 Lanes	25 MPH^	<3,000	■	●				●	●
High Density Neighborhood									
2 Lanes	25 MPH^	<3,000	■	■	●			●	●
Employment/Activity Center									
2 Lanes	25 MPH^	<3,000	■	■	●			●	●
Industrial/Agricultural									
2 Lanes	25 MPH^	<3,000		■	●			●	●
Recreation/Open Space									
2 Lanes	25 MPH^	<3,000	■	■	●			●	●
Central Business District									
2 Lanes	25 MPH^	<3,000	■	■	●			●	●

* Represents design speed for future roads and posted speed for existing roads.

** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Please refer to the individual bicycle selection context sheets for detailed footnotes.

What are the Right Bike Facility Types for San Antonio?

Building off national guidance, San Antonio’s bicycle facility selection is a context-sensitive approach that involves a planning- and engineering-based process. As motor vehicle speeds and volumes increase and as the urban form changes, more separation between bicyclists and motor vehicle traffic may be necessary. The following table outlines recommended and allowable bicycle facility types for San Antonio’s unique streets and their surrounding contexts .

Local B/C

■ Preferred Facility

● Alternative Options to Consider***

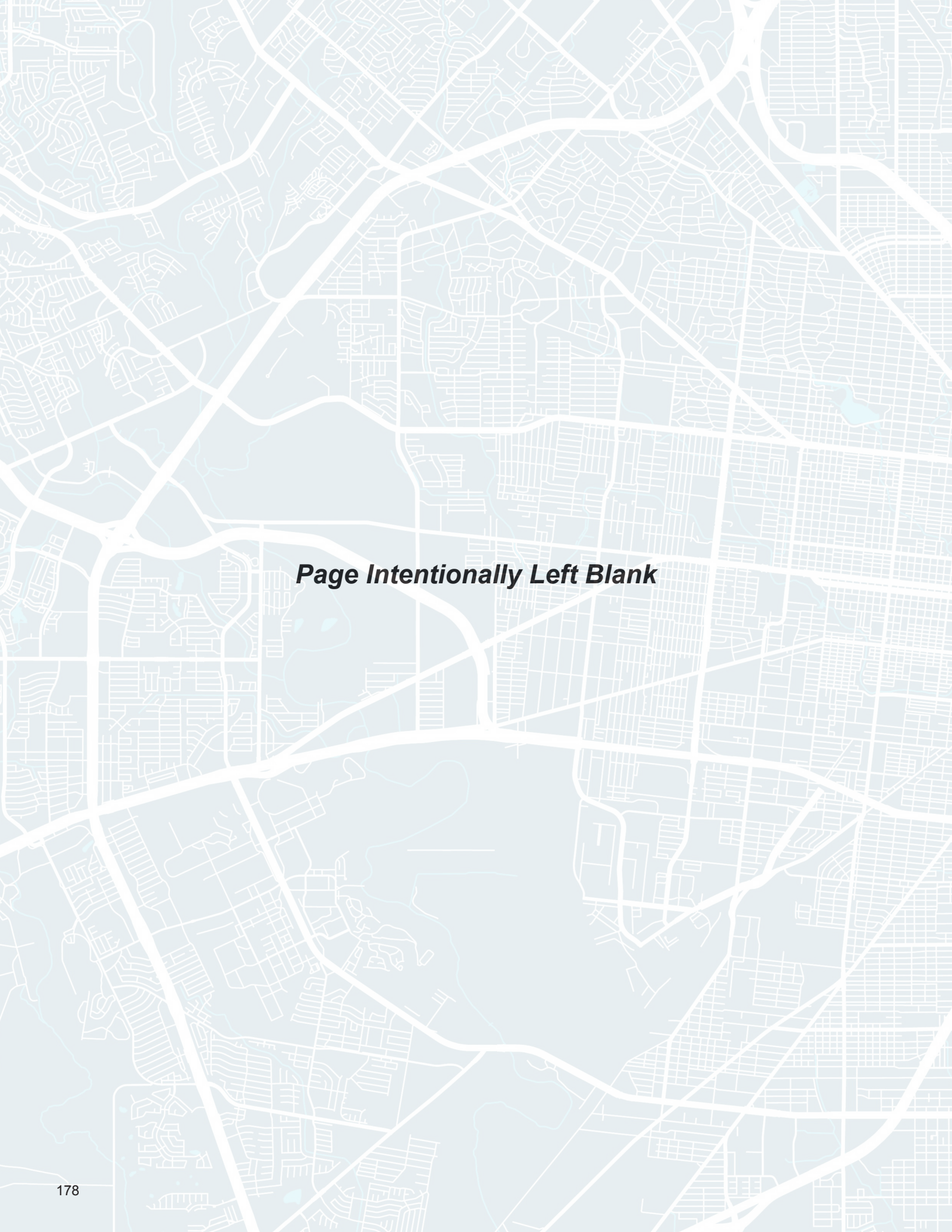
Number of Lanes	Speed*	Traffic Volumes**	Bike Boulevard	Striped Bike Lane	Buffered Bike Lane	Protected Bike Lane (At-Grade)	Protected Bike Lane (Raised)	Shared Use Path	Alternative Route
Low Density Neighborhood									
2 Lanes	25 MPH^	<3,000	■	■	●			●	●
2 Lanes	25 - 30 MPH^	>3,000		■	●			●	●
Medium Density Neighborhood									
2 Lanes	25 MPH^	<3,000	■	■	●			●	●
2 Lanes	25 - 30 MPH^	>3,000		■	■			●	●
High Density Neighborhood									
2 Lanes	25 MPH^	<3,000		■	●				
2 Lanes	25 - 30 MPH^	>3,000		■	■				
Employment/Activity Center									
2 Lanes	25 MPH^	<3,000		■	●			●	●
2 Lanes	25 - 30 MPH^	>3,000		■	■			●	●
Industrial/Agricultural									
2 Lanes	25 MPH^	<3,000		■				●	●
2 Lanes	25 - 30 MPH^	>3,000		■	■			●	●
Recreation/Open Space									
2 Lanes	25 MPH^	<3,000		■	●			●	●
2 Lanes	25 - 30 MPH^	>3,000		■	■			●	●
Central Business District									
2 Lanes	25 MPH^	<3,000		■	●	●		●	●
2 Lanes	25 - 30 MPH^	>3,000		■	■	●	●	●	●

* Represents design speed for future roads and posted speed for existing roads.

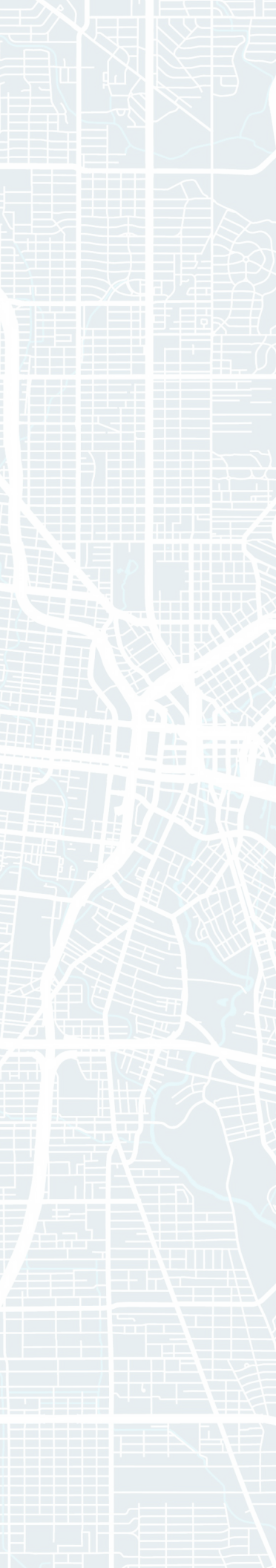
** Represents projected future year traffic volumes and not Design ADT.

*** Alternative options may be considered if the preferred facility type does not fit within the right-of-way. Coordination with the Transportation Department should be performed to ensure connectivity.

Note: Please refer to the individual bicycle selection context sheets for detailed footnotes.



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Green Stormwater Infrastructure (GSI)

Green stormwater infrastructure (GSI) refers to a collection of practices and techniques designed to manage stormwater in a more environmentally friendly and sustainable manner. It utilizes natural processes to slow down, filter, and cleanse stormwater runoff before it enters water bodies or the water table.

Green stormwater infrastructure helps to mitigate the impacts of urbanization on natural hydrological processes by reducing flooding, improving water quality, replenishing groundwater, and enhancing overall urban biodiversity. Strategies should be utilized in accordance with **Street Typologies Steps 1-4 as an overlay system of improvements.**

<u>What Are GSI Components?</u>	<u>180</u>
<u>Components</u>	<u>182</u>
<u>Bioretention Swale</u>	<u>183</u>
<u>Bioretention Planter</u>	<u>186</u>
<u>Stormwater Tree Well /Tree Pit</u>	<u>189</u>
<u>Biofiltration Planter</u>	<u>192</u>
<u>Pervious Pavement</u>	<u>195</u>
<u>Hybrid System</u>	<u>198</u>

What Are GSI Components?

This section provides guidance for the City of San Antonio to implement practices for sustainable stormwater management within the public right-of-way. Green Stormwater Infrastructure (GSI) offers San Antonio numerous benefits, including improved flood mitigation by managing stormwater and reducing runoff, which helps prevent damage and recharge the Edwards Aquifer. GSI enhances water quality by filtering pollutants, cuts infrastructure and water treatment costs, and beautifies public spaces while reducing the urban heat island effect. Environmentally, it supports improved air quality, biodiversity and boosts climate resilience. Additionally, it helps San Antonio meet environmental regulations, fostering a sustainable and resilient urban future. This particular report focuses on the implementation of GSI in the public right-of-way as a design overlay to bike facilities. Examples of Green Stormwater Infrastructure include:

- Bioretention swales
- Bioretention planters
- Tree well/ Stormwater tree or Tree pit
- Hybrid system
- Bioretention planter
- Pervious pavement

For additional information on technical standards in the private realm, along waterways and parks, see [San Antonio River Authority projects and master plans](#).



Bioretention swales (BS)

Typically constructed as shallow, vegetated channels with gently sloping sides allowing stormwater to flow through them. Swales are engineered to capture, filter, and treat stormwater, promoting infiltration into the soil and reducing the quantity of pollutants entering nearby water bodies. Bioretention swales are less expensive to construct than planters but use more space for filtration, and can handle low to moderate flows of runoff.



Biofiltration planter (BF)

Typically used where infiltration cannot be accomplished due to contextual characteristics, native soils, or other constraints, walled planters can be designed with an impermeable base and supporting drainage infrastructure that collects water, filters runoff downward through soil media, and channels treated runoff through an underdrain (perforated) pipe. Biofiltration planters provide water quality treatment and reduce runoff volumes, and may be applied in rights-of-way that have narrower widths.



Bioretention planter (BP)

Also known as a rain garden, a bioretention planter is a constructed feature designed to capture, filter, and treat stormwater runoff. It consists of a shallow depression planted with a variety of vegetation, such as native plants, grasses, and shrubs, along with engineered soil mixes. The planter is strategically located to intercept stormwater runoff from impervious surfaces like rooftops, parking lots, or roads. As stormwater enters the bioretention planter, it is temporarily stored and allowed to slowly infiltrate into the soil or be taken up by the plants also serve to take up pollutants.



Tree well/ Stormwater tree/ Tree pit (T)

Tree wells or pits are a box housing a single tree. Wells can have walled sides or structural soil systems to protect soil from compaction and retain stormwater. Tree wells are connected or linear tree boxes that usually have a subsurface system for distributing runoff among a series of trees. Stormwater trees are often constructed in the sidewalk zone, though may also succeed in center medians or service street medians. These trees are chosen for their ability to absorb and utilize large amounts of water, and reduce the volume of stormwater runoff reaching the ground.



Pervious pavement (PP)

Pervious pavement is designed to allow percolation or infiltration of stormwater through the surface into the soil below where the water is naturally filtered. Pervious pavement effectively treats, detains, and infiltrates stormwater runoff where landscape-based strategies are restricted or less desired. Pervious pavements have multiple applications, including sidewalks, street furniture zones, and entire roadways (or just parking lane or gutter strip portions).



Hybrid system (H)

A hybrid system combines elements of both swales and planters, featuring a walled side opposite a graded side slope to increase vegetated space and infiltrating area, while providing a softer streetscape treatment for people walking. Walls or graded sides can be configured adjacent to either a street or sidewalk, and can utilize a range of materials including concrete, rocks, or steel-faced curbs.

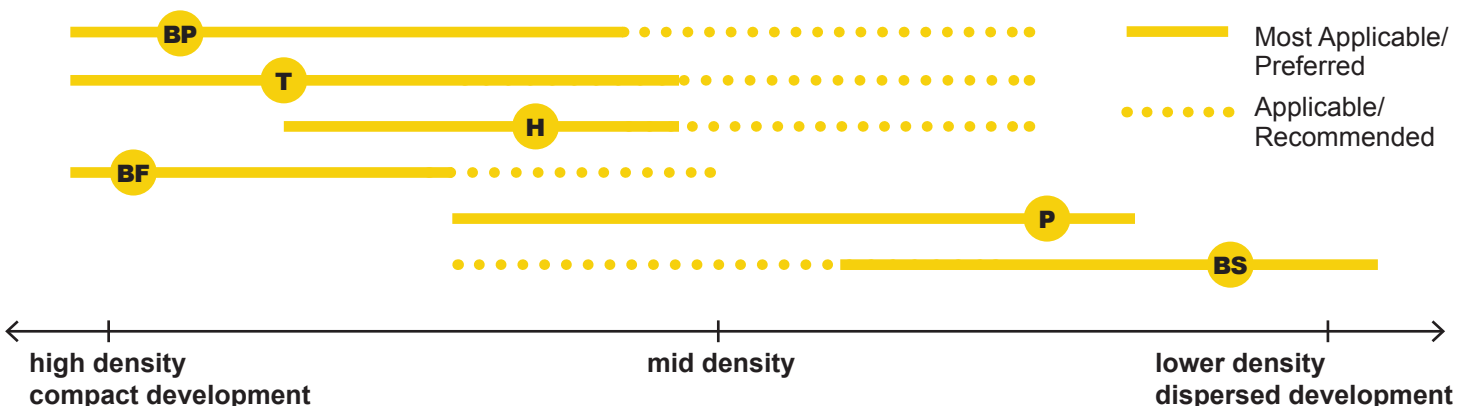
Green Stormwater Infrastructure Components

Municipalities typically base stormwater strategies on federal regulations, current sewer system, rainfall patterns, ecology and soil conditions. Drainage policies for the City of San Antonio have changed over the years to provide the most current criteria as it relates to stormwater management. The purpose of this section is to provide best practices on stormwater treatment as it relates to street typologies incorporating bike facilities. Application of GSI components in the table below is outlined to highlight preferred versus applicable treatment along “High” density to “M-low” (Mid to low density) street typologies. For specific code and dimensional criteria, refer to the [2019 Stormwater Design Criteria Manual](#).

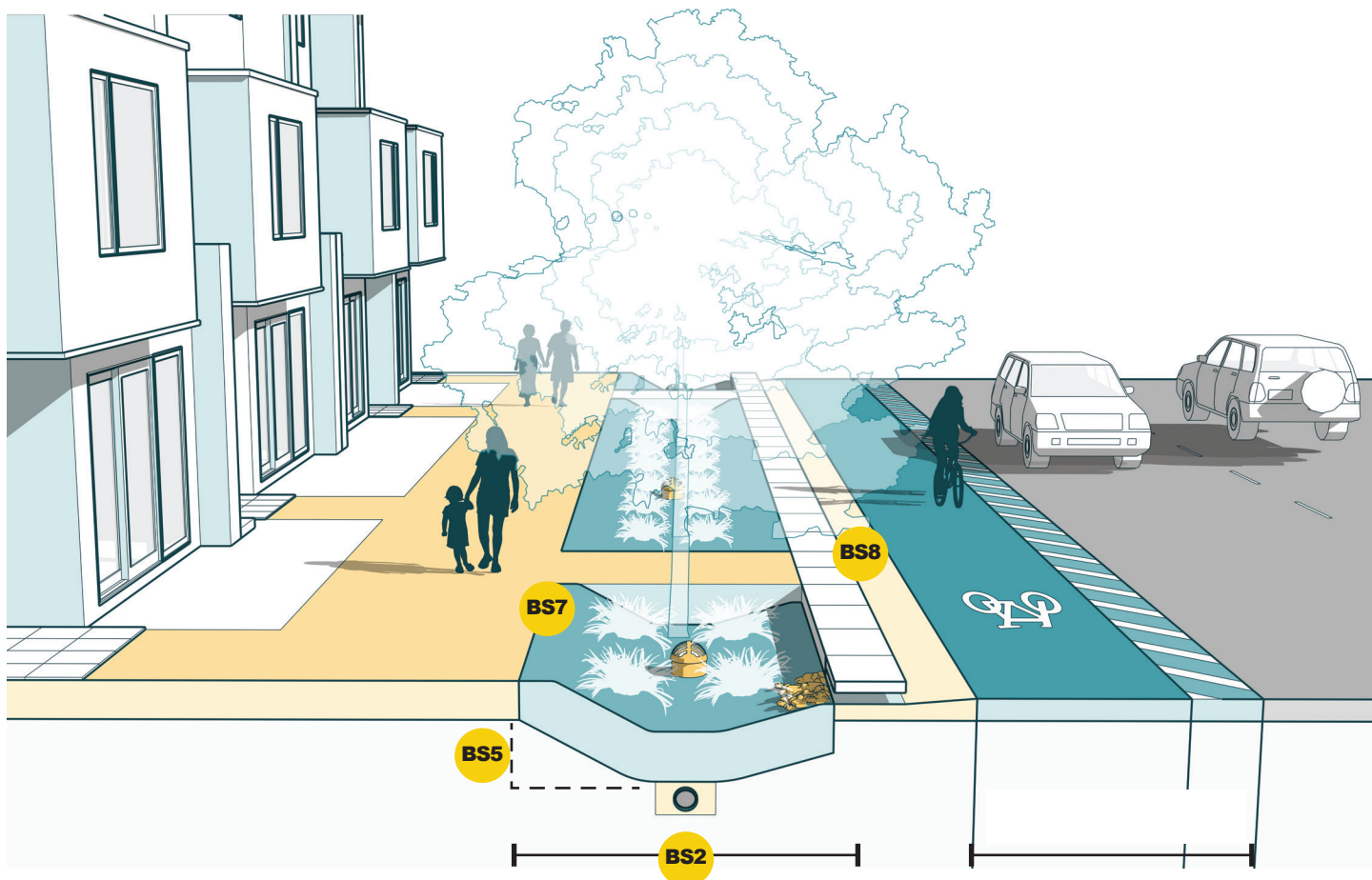
Street Type	Potential GSI Components for Application											
Functional classification	Bioretention swale (BS)		Bioretention planter (BP)		Tree well/ Tree pit (T)		Biofiltration planter (BF)		Pervious pavement (P)		Hybrid system (H)	
Density Level	High	M-low	High	M-low	High	M-low	High	M-low	High	M-low	High	M-low
Primary Arterial		●	●	●	●				●	●	●	●
Secondary Arterial	●	●	●		●	●	●		●	●	●	●
Collector A/B	●	●	●	●	●	●	●		●	●	●	●
Collector C	●	●	●	●	●	●	●	●	●	●	●	●
Local A/B		●	●	●	●	●	●	●	●	●	●	
Local C		●	●	●	●		●	●	●	●	●	

- Most Applicable/ Preferred
- Applicable/ Recommended
- N/A

Context-sensitive application: The suitability of each GSI component varies based on the environment and context. High-density areas have more people per square mile, dense development, robust public transportation, and proximity to amenities. Low- to mid-density areas have fewer people per square mile, development on larger lots, and more reliance on cars, offering added space. In high-density urban areas with heavy vehicular traffic, space within the right-of-way is often limited, making bioretention planters, tree wells, and biofiltration planters particularly effective. Conversely, lower-density suburban areas, with less vehicular debris, are well-suited for pervious pavements. These suburban settings also typically offer more space for impactful GSI treatments such as bioswales. For an overview of the general application of each type of GSI component across different conditions, refer to the diagram below.



Bioretention swale



Application

- BS1** Swales are typically most applicable in lower density or lower traffic zones. Swales can take up large footprints due to slope requirements and are commonly implemented on neighborhood or residential streets, along shared-use paths, medians and other unused right-of-way areas where more space is available.
- BS2** Swales are typically shallow, less than 24 inches. The bottom base area along with the side slopes is considered the infiltration footprint area. The wider the bottom base of the base, the more runoff can be detained. The width ranges from 12- to 18 inches. Swales should be designed with site context in mind. Refer to the 2019 Stormwater Design Criteria Manual for detailed design criteria.
- BS3** On streets with excess asphalt—such as slip lanes or excessively wide curb radii—swales can be implemented to reclaim right-of-way space, enhancing safety, livability, and stormwater management.
- BS4** Determine swale slope based on factors such as soil erosion potential, maintenance needs, the likelihood of vehicle off-road incidents (especially near intersections or high-speed roads), the presence of curbs, and the expected pedestrian activity and proximity to the swale. In urban contexts, 2.5:1 ratios are best used to balance cyclist/ pedestrian comfort with surrounding context. Vegetation health and maintenance support requires a minimum of 3:1 slope. Criteria may differ between side slopes along sidewalk or street.
- BS5** Runoff should be directed into swales through curb cuts, pipes or trench drains.

Bioretention swale

Green Stormwater Infrastructure Components

Application continued...

- BS6** To prevent pedestrian encroachment into bioretention swales, use hardy ground covers and short fencing to mark the edge, and provide clear access paths between the sidewalk and street.
- BS7** In high-turnover parking areas, install a 12- to 24-inch concrete strip behind the curb and set the side slope to 3:1 for better pedestrian comfort.
- BS8** Level areas along the edge of swales should be comprised of compacted native soils of 95% or so particularly in urban areas to support pedestrian or cyclist flow.
- BS9** Local stone or cobbles can increase vertical slope and control erosion if anchored down appropriately.

Benefits

- A** **Natural Aesthetics and Habitat Creation:** Swales can support a wide range of plantings to increase beneficial habitat and greenscape. Swales also provide flexibility and can be planted along any street and region as long as native plants are utilized.
- B** **Capacity for Larger Volumes:** Retention swales typically have a larger surface area and volume compared to planters. This allows them to capture and retain more stormwater runoff, thereby reducing peak flows and minimizing the risk of flooding downstream.
- C** **Flexibility in Siting:** They may be designed to convey any size storm, but are most effective in treating frequent, small rain events. Areas such as lots and suburban streets or urban streets where land is available are ideal for placement.
- D** **Safety and Transition:** Where space is available, bioretention swales with graded side slopes allow gentler transitions between bike facilities, pedestrian zones and the roadway.
- E** **Installation:** Use of graded sloped make is easier to adjust or modify after installation than walled planters, and make access

points grounded utilities easier to locate. They are typically less expensive to build but use more space for infiltration and conveyance than planters. Swales can handle low-to-moderate flows of stormwater run-off.

- F** **Reduced Irrigation Needs:** Once established, native vegetation in retention swales typically requires less irrigation compared to planters, which often need regular watering to support plant growth in urban environments.

Bioretention Swale Context Application

The chart below demonstrates preferred versus applicable sighting for street design elements.

		high density		low density	
primary/ secondary arterial	Median			Median	
	Landscape		Buffer	Landscape	
	Flex Zone (Curb Extensions)			Flex Zone (Curb Extensions)	
collector	Median			Median	
	Landscape		Buffer	Landscape	
	Flex Zone (Curb Extensions/ Floating Strips)			Flex Zone (Curb Extensions/ Floating Strips)	
local	Median			Median	
	Landscape		Buffer	Landscape	
	Flex Zone (Curb Extensions/ Floating Strips)			Flex Zone (Curb Extensions/ Floating Strips)	

- Most Applicable/ Preferred
- Applicable/ Recommended
- N/A



Swale in median; Bradley Road, Brown Deer, WI



Green Streets, Chesapeake Bay, Arlington, VA



Bioretention swales; Hoboken, NJ



Swales along the Indianapolis Cultural Trail, Indianapolis, IN



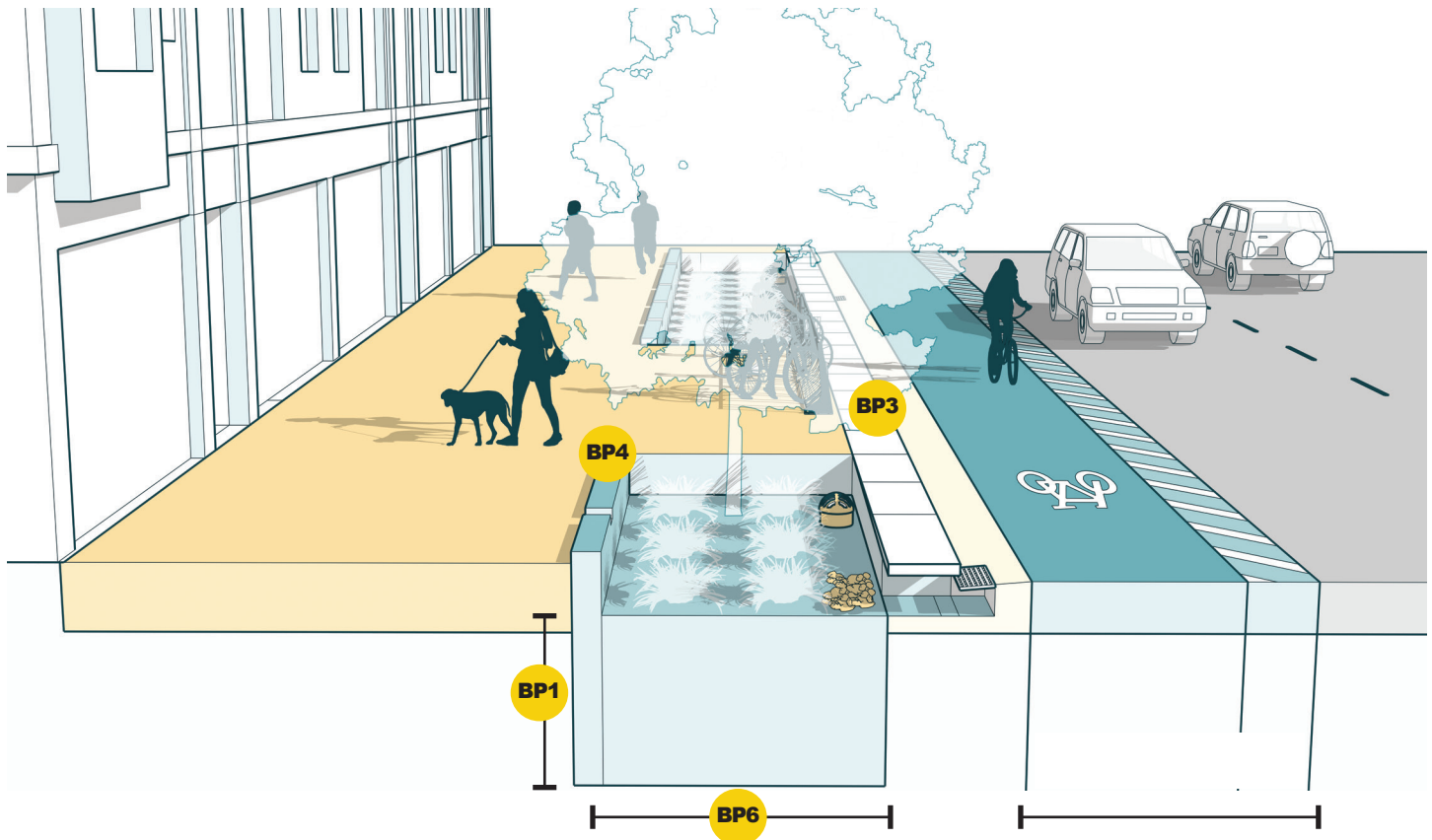
Swales buffering bike facilities from vehicles on North Lake Ave, Temple City, CA



Swales in the right-of-way, Yale St., Seattle, WA

Bioretention planter

Green Stormwater Infrastructure Components



Application

- BP1** Because bioretention planters are walled vertical cells, they maximize the bottom area and volume to be used as temporary storage for water. The depth of the vertical wall is determined by the water storage depth, the slope of the road and the structure's bottom slope. Shallow-rooted plants, such as annuals and herbs, may require less depth, around 12- to 18 inches. Deeper planters, up to 36 inches, are better for larger plants, shrubs, or small trees, which need more room for root growth. Ensure if placed next to a sidewalk or bike path, the walled element serves as a protection for cyclists and people or use fencing and railing as an added feature. A 4-inch curb or barrier minimum is required.
- BP2** Planters can be integrated into any part of the streetscape including as curbside planters to protect cyclists and pedestrians from vehicles, within median strips to help slow down traffic, intersection bumpouts to help increase visibility at crossings, adjacent parkettes and at transit stops.
- BP3** Planters are typically installed in urban areas where space may be limited. They are most effective where right-of-way width is constrained or multi-modal capacity is high. They can run down the length of a block with gaps as necessary to provide cyclist or pedestrian access, typically 3 feet. The length is also determined by soil type, roadway slope and vertical drop of planter wall.
- BP4** The vertical walls are typically made from concrete (either prefabricated or cast in place) but other materials may be used.
- BP5** Use native plants adaptable to each neighborhood or area that require minimal irrigation or maintenance.
- BP6** Planter bottoms should generally be at least 4 feet wide for healthy trees. Shrubs/groundcover could grow in less than constrained areas like bikeway buffers or narrow sidewalks, narrower cells can be used but must balance plant health, runoff and cost.
- BP7** Bioretention planters should drain within 24- to 72 hours after a storm event.

Application continued...

- BP8** Size bioretention planters to manage runoff from the design area. Use multiple linked or sequential planters to avoid overloading any single one.

Benefits

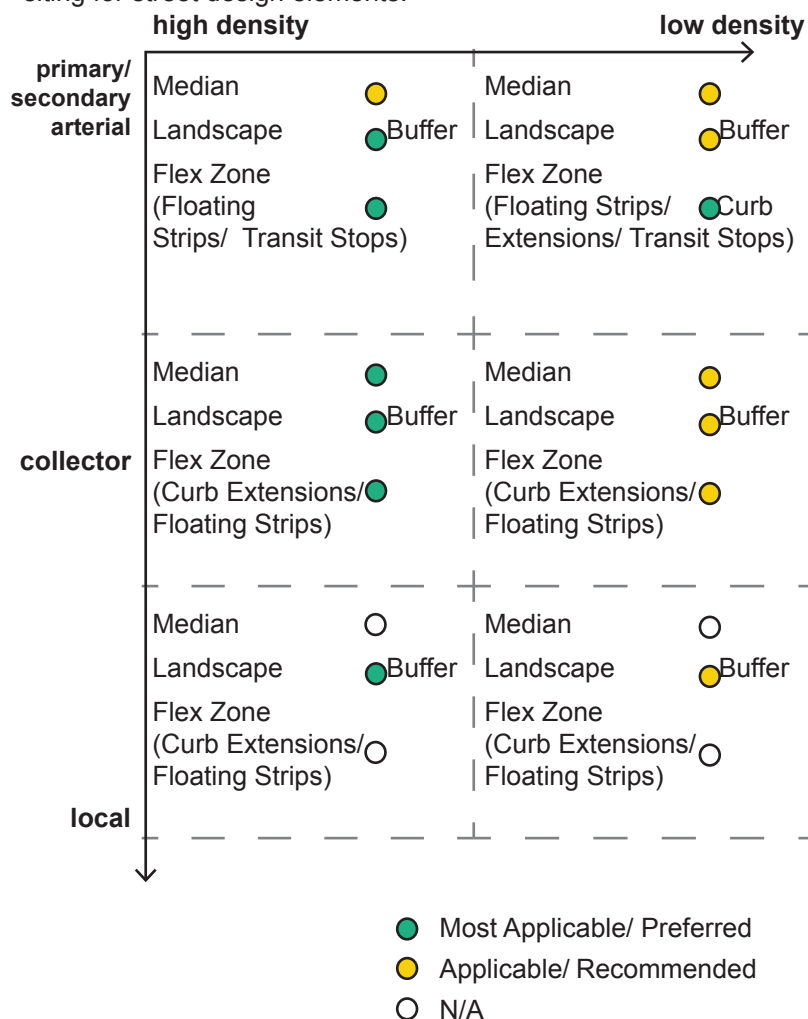
- A Construction Stability:** Bioretention planters are infiltration cells constructed with vertical walled sides, a flat bottom area and large volume capacity to capture, treat and manage runoff.
- B Space Efficiency:** Bioretention planters are often more compact and can be integrated into smaller or more densely developed urban spaces, such as sidewalks, parkettes and roadways where swales might be impractical due to space constraints.
- C Aesthetic Appeal:** Bioretention planters can be designed to enhance the aesthetics of an area, incorporating a variety of plants and landscaping features that can complement the surrounding context. They are particularly beneficial in urban areas in providing green visual impact in an otherwise concrete-dominated environment.
- D Maintenance:** The contained nature of bioretention planters often makes them easier to access and maintain compared to larger, more spread-out swales.
- E Water Quality Improvement:** The engineered soil media in bioretention planters is specifically designed to filter out pollutants more effectively than the typical soils found in swales. The structured environment of a bioretention planter allows for more controlled and efficient removal of nutrients, heavy metals, and other contaminants.
- F Stormwater Retention:** Bioretention planters often incorporate additional features such as underdrains and storage reservoirs that enhance their ability to manage and store stormwater.
- G Urban Heat Island Mitigation:** The vegetation in bioretention planters can contribute to cooling effects in urban areas,

mitigating the heat island effect more effectively than swales, which are often more exposed and less vegetated

- H Adaptability:** Bioretention planters and gutters can be installed in a variety of settings like between bike paths and vehicular lanes or along building edges offering greater flexibility than swales, which typically require larger areas. They can be more easily retrofitted into existing urban infrastructure without the need for extensive excavation or land reshaping.

Bioretention Planter Context Application

The chart below demonstrates preferred versus applicable siting for street design elements.



Bioretention Planter

Green Stormwater Infrastructure Components



Bioretention planter, 12th & Green Street



Bioretention planter bulb-out, Royal Oak, MI



Urban street planters, Columbus, OH

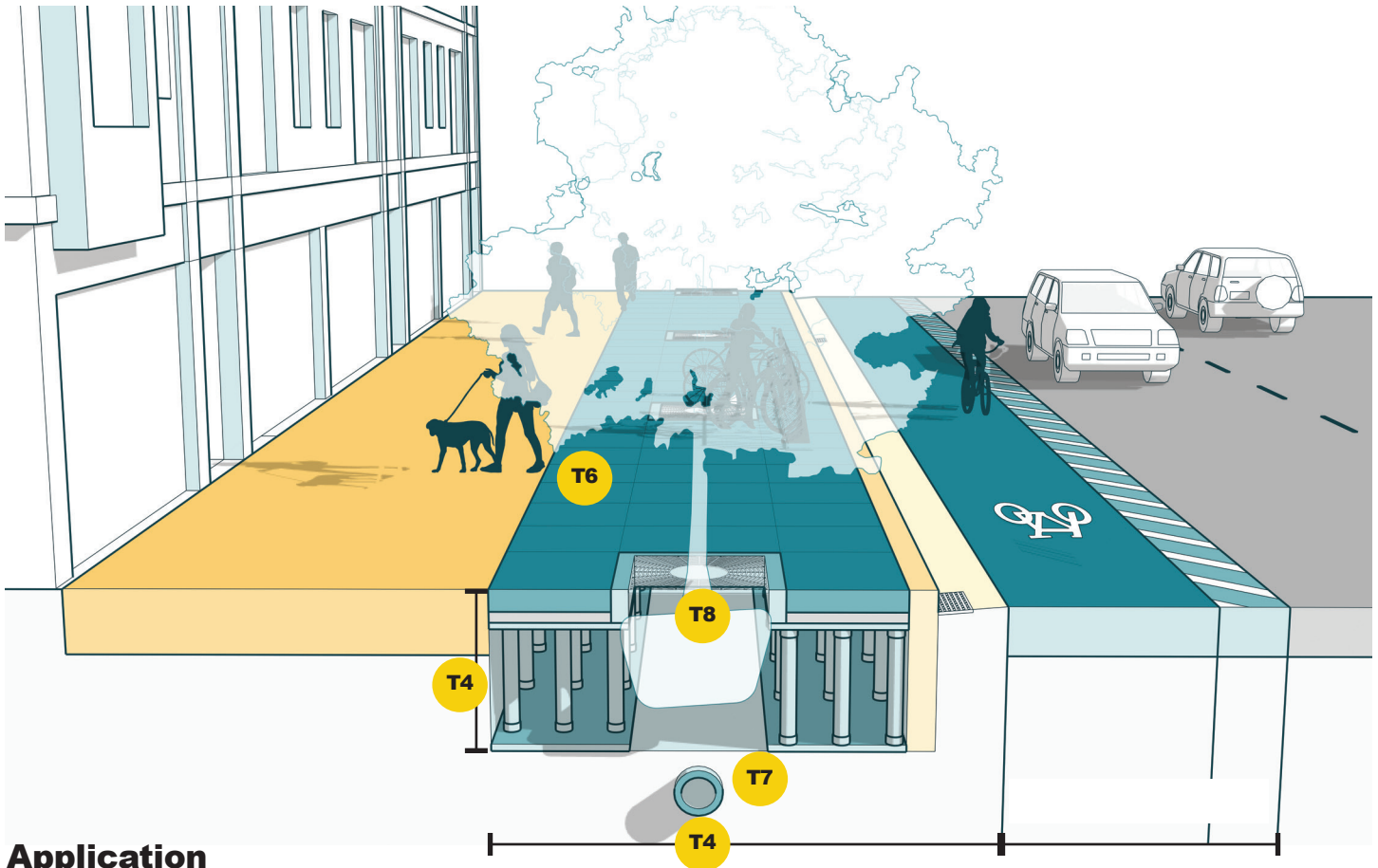


El Cerrito's rain gardens alongside pilot bikeway, San Pablo Ave, CA



Rain gardens along, Fell St, San Francisco, CA

Stormwater Tree well/ Tree pit



Application

- T1** Tree wells or pits are a box that holds a single tree with walled sides or structural soil systems to protect soil from compaction and retain stormwater.
- T2** Tree wells are linear tree boxes featuring a subsurface system that distributes runoff among multiple trees. Typically constructed in the sidewalk area, tree trenches can also be effective in medians.
- T3** Sizing and locating tree wells requires a determination of the area draining to the tree well. The upstream end of a block is generally not an effective place to install a tree trench, while the middle or downstream end of a block is usually conducive. Adjustments can be made to locations and tree trench sizes to arrive at a properly sized facility in a desirable location. Siting tree trenches is also influenced by the presence of a storm drain system; ideally, a nearby inlet or manhole provides a convenient location for discharge of the underdrain.
- T4** Tree wells or pits have the same applications as urban street tree plantings and can be used interchangeably. Trees are typically located 4- to 6 feet from the back of curb with a step-out zone on the curb side of the trees and the sidewalk on the other. The width of excavation for the tree pit is typically 9 feet and tree planting areas with a minimum of 5 feet in width.
- T5** If tree wells are planted within walled planters, sufficient volume and width is required to allow for medium and large trees to grow to maturity. For smaller trees, select species that provide enough clearance for cyclists or pedestrians with the right-of-way (8- to 14 feet clearance). Use root barriers to direct roots to proper growth area.

Stormwater tree well/ Tree pit

Green Stormwater Infrastructure Components

Application continued...

- T6** The preferred treatment surrounding the tree is a 4 inch curb with no tree grate. When tree grates are used, maintain a minimum separation of 4 inches between the grate and the tree trunk. Another option is to use permeable interlocking concrete pavement on top of the tree trench and continuing this to within 6 to 12 inches of the tree trunk.
- T7** For trees planted in the sidewalk zone adjacent to curb with bioretention capabilities, provide an appropriate inlet to capture runoff and distribute to tree boxes. This may be a curb cut or depression, or a catch basin that circulates water through connected tree boxes using capillary action.
- T8** Tree wells typically require an uncompacted rooting volume of 750- to 1000 cubic feet per tree, but design and construction is based on soil conditions and tree type (diverse and climate appropriate).

Benefits

- A** **Runoff Reduction:** Stormwater tree wells, also known as tree pits, are designed to manage and treat urban stormwater runoff. They combine the benefits of urban trees with stormwater management practices capture and infiltrate stormwater runoff, reducing the amount of water that flows into storm drains and sewers.
- B** **Pollutant Filtration:** The soil and root systems in tree wells filter out and uptake pollutants such as sediments, nutrients and heavy metals.
- C** **Infiltration:** By allowing stormwater to percolate through the soil, tree wells help recharge groundwater supplies, maintaining local water tables.
- D** **Cooling Effect and Air Quality:** Trees provide shade and contribute to cooling through evapotranspiration, reducing the urban heat island effect and cooling the surrounding environment. Street trees play a crucial role in enhancing local air quality by removing air pollutants and filtering particulate matter.

- E** **Aesthetic and Biodiversity:** Tree wells enhance the visual appeal of urban areas by adding greenery and creating more pleasant streetscapes. They are particularly beneficial for habitat creation including birds, insects and small mammals.
- F** **Tree Health:** Stormwater tree wells are designed to provide trees with adequate water and nutrients, promoting healthier and more robust urban trees.
- G** **Traffic-calming:** Street trees calm motor vehicle traffic by visually narrowing the street and providing a well-defined roadside edge. The presence of trees can reduce speeding and crashes, improving safety for all street users.
- H** **Energy Saving:** Trees provide shade that can reduce energy costs for cooling buildings in the summer.

Stormwater Tree well/ Tree pit Context Application

The chart below demonstrates preferred versus applicable siting for street design elements.

	high density				low density			
primary/ secondary arterial	Median	●			Median	●		
	Landscape	●	Buffer		Landscape	●	Buffer	
	Flex Zone (Floating Strips/ Stops/	●	Transit Curb Extensions)		Flex Zone (Floating Strips/ Extensions/	●	Curb Transit Stops)	
collector	Median	●			Median	●		
	Landscape	●	Buffer		Landscape	●	Buffer	
	Flex Zone	●	(Curb Extensions/ Floating Strips)		Flex Zone	●	(Curb Extensions/ Floating Strips)	
local	Median	○			Median	○		
	Landscape	●	Buffer		Landscape	●	Buffer	
	Flex Zone	○	(Curb Extensions/ Floating Strips)		Flex Zone	○	(Curb Extensions/ Floating Strips)	
	● Most Applicable/ Preferred ● Applicable/ Recommended ○ N/A							



Tree wells on Hudson St, Manhattan, New York, NY



Tree wells in suburban conditions, Houston, TX



Tree wells with curb inlets in residential areas



Tree wells with stone surface treatment Pace University



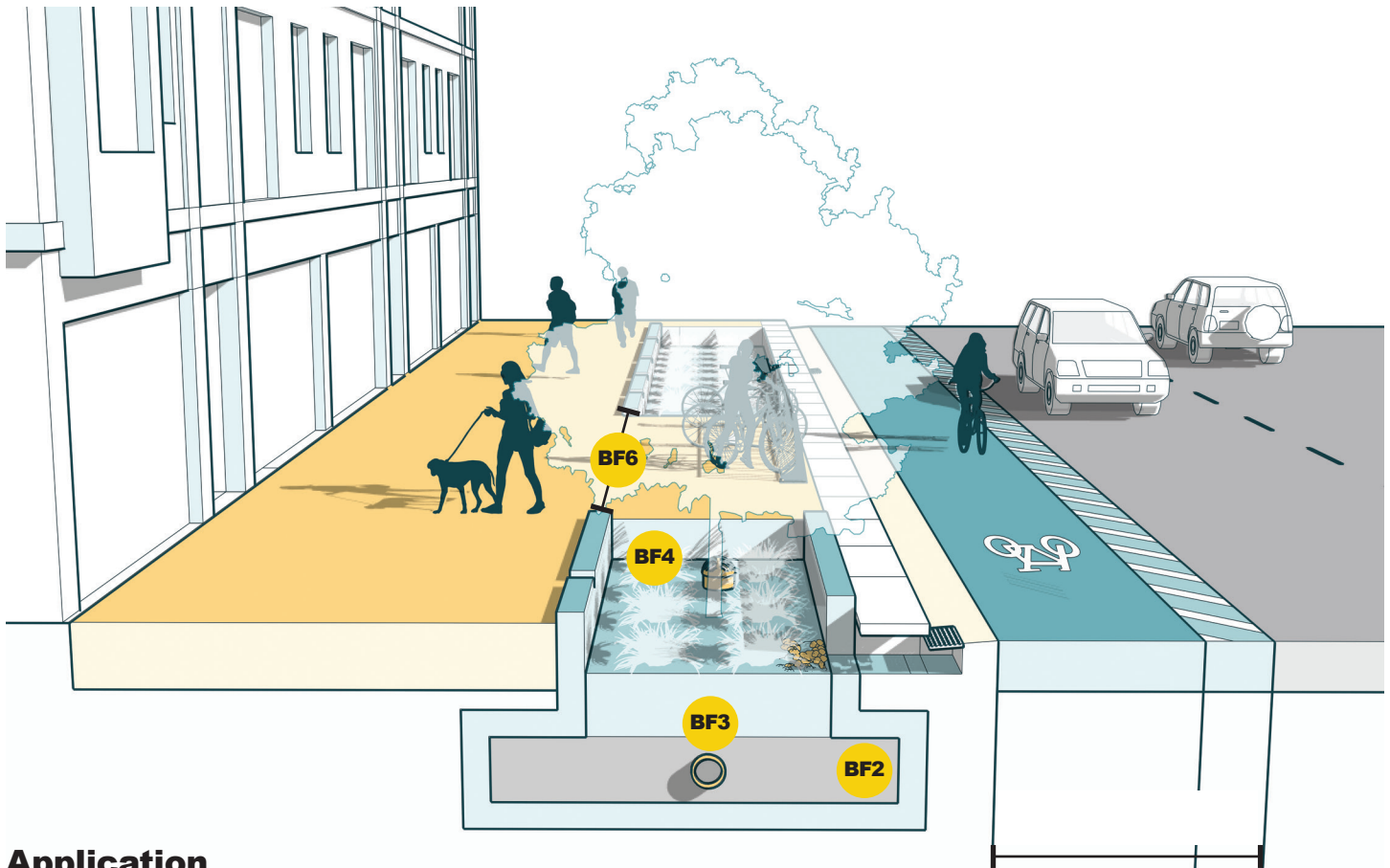
Tree wells and pits along Benjamin Franklin Parkway, Philadelphia, PA



Stratacell bioretention tree planting, Greener Grange town, Wales

Biofiltration planter

Green Stormwater Infrastructure Components



Application

- BF1** In locations where stormwater infiltration is not feasible—such as sites with limited space next to buildings, areas with poor soil conditions, near steep slopes (greater than 4%), or in regions with contaminated soils—non-infiltrating bioretention planters equipped with subsurface drain systems can be used.
- BF2** The bottom of the bioretention planter at subgrade may be made of concrete, or may have a liner attached to all sides of the planter in order prevent water from entering. The soil and rock layers must be encased either by these concrete constructed walls or liner to prevent infiltration into surrounding soil.
- BF3** The underdrain pipe required as part of this system can either connect directly to the storm sewer system or incorporate something like a catch basin or manhole to regulate the outflow rate. If an opening is used, it can also function as an overflow mechanism if placed within the planter, or it can be positioned outside the planter for easier maintenance access. Install a perforated pipe at the base of the planter to collect treated runoff.
- BF4** Implement a raised drain or curb cut to redirect overflow back to the gray water system when rainfall exceeds the design capacity. The biofiltration planter must be able to drain within 24- to 72 hours.
- BF5** Maximize the surface area of the biofiltration cell, particularly when multiple cells share a continuous rock layer underneath. Interconnecting several surface expressions can expand the overall bioretention capacity of the facility. Smaller surface cells may be more prone to erosion and debris accumulation.
- BF6** Ensure a 5 feet minimum pedestrian cut-through is placed about 20- to 40 feet to allow bike or pedestrian access from the curb.
- BF7** Native planting that are adaptable to each neighborhood or area should be used to be able to withstand seasonal flooding or drought. This

Application continued...

will also limit the amount of maintenance and irrigation that maybe required.

BF8 Planters are typically installed in urban areas where space may be limited and where existing soil conditions are poor.

Benefits

A **Contextual Constraints:** In situations where infiltration is not possible due to the surrounding context, soil conditions, or other limitations, walled planters with impermeable bases and drainage systems can be utilized. These planters collect water and filter runoff through soil media, directing the treated water through an underdrain (perforated) pipe. Biofiltration planters improve water quality and reduce runoff volumes, making them suitable for areas with restricted rights-of-way.

B **Advanced Filtration Media:** Biofiltration planters often use specialized filtration media that can more effectively remove a wider range of pollutants, including finer particulate matter and dissolved contaminants, compared to the more general soil mixes used in bioretention planters..

C **Space Efficiency + Modularity:** Biofiltration planters are typically more compact and can be installed in tighter urban spaces. They often come in modular units that can be easily installed in various configurations, adapting to different site constraints.

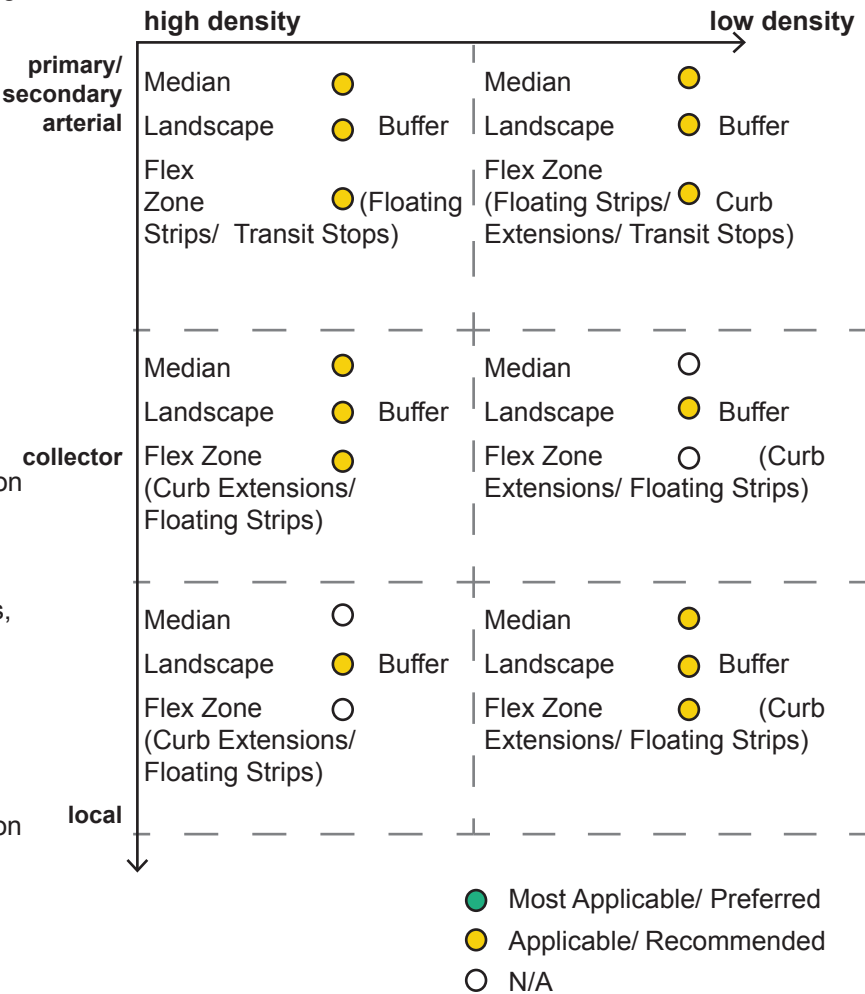
D **Maintenance + Longevity:** Biofiltration planters are often designed for easier maintenance, with features like removable filter cartridges that simplify upkeep compared to vegetated areas of bioretention planters. The controlled environment within biofiltration planters can lead to more consistent performance over time, with less variability due to soil and plant health fluctuations.

E **Installation:** Biofiltration planters are often pre-fabricated and can be installed more quickly and with less disruption to existing infrastructure.

F **Operational Efficiency:** Biofiltration planters typically include engineered components such as underdrains and overflow systems that provide better control over stormwater flow rates and volumes, ensuring efficient operation during various storm events. The engineered design allows for more predictable performance.

Biofiltration planter Context Application

The chart below demonstrates preferred versus applicable siting for street design elements.



Biofiltration planter

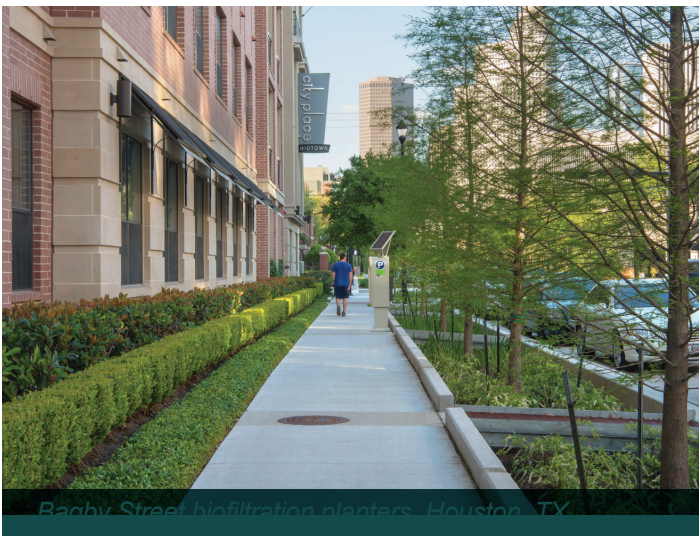
Green Stormwater Infrastructure Components



Biofiltration planters in medians



Biofiltration planters along Indianapolis Cultural Trail



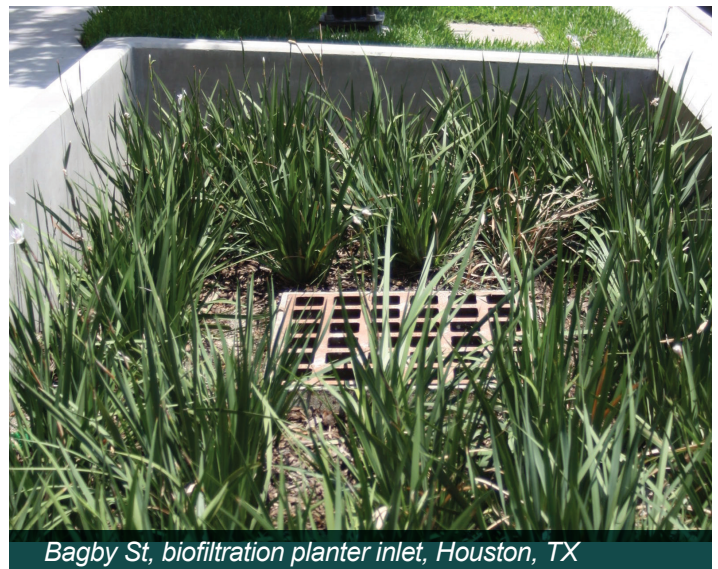
Bagby Street biofiltration planters, Houston, TX



Moncus Park biofiltration planters, Lafayette, TX

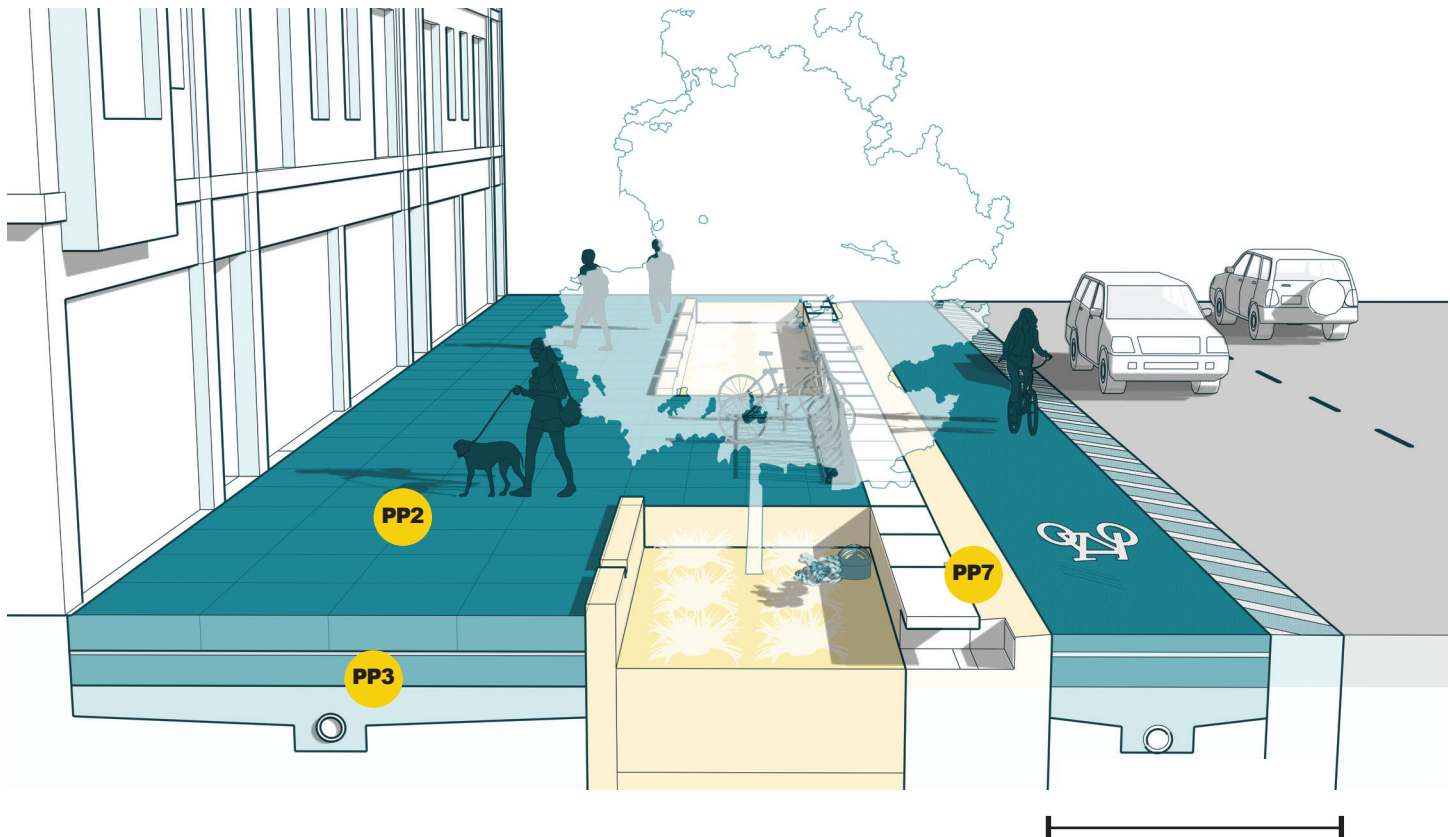


Biofiltration planters along major arterials within median, Surrey, BC, Canada



Bagby St, biofiltration planter inlet, Houston, TX

Pervious pavement



Application

- PP1** It is important to investigate existing and planned underground utilities and to avoid utility conflicts with permeable pavement cavity. It is also critical to understand the condition of existing utilities so that impacts that might be associated with the installation of pervious pavements.
- PP2** Permeable or pervious pavement are typically made from several materials: pervious concrete, porous asphalt, permeable interlocking pavers or plastic grid systems. For bike paths, smooth surfaces with pervious concrete or asphalt is best.
- PP3** Pervious pavements can be applied along any portion of the street provided surface and subsurface conditions are ideal. They are best applied to bike paths, parking lanes, sidewalks or alleys and vehicular lanes with low traffic volumes and low load weight. Pervious treatments are not ideal for high volume travel and are most effective on shallow slopes of 5% or less to allow water to infiltrate.
- PP4** Evaluate the surrounding surfaces to identify areas where soil erosion or debris from adjacent properties, such as gravel driveways, could affect the permeable pavement. These areas may need more frequent street vacuuming to remove any sediment that accumulates.
- PP5** If interlocking pavers are being used, regular maintenance is required to replace loose aggregate between blocks. They may also settle reducing smooth surfacing for effective accessibility.
- PP6** Pervious pavement requires ongoing maintenance to be effective. This includes sweeping, washing or vacuuming to remove sediment or grease.
- PP7** If the bike lane runs alongside a curb, consider paving the permeable pavement up to the curb without a gutter. This approach prevents water

Pervious pavement

Green Stormwater Infrastructure Components

Application continued...

from flowing down the gutter and bypassing the permeable pavement, ensuring better water infiltration.

PP8

Assess the run-on water volume and characteristics across the entire roadway, not just where pervious pavement is applied (ie: bikeway). Run-on from erosive soils can increase maintenance if sediment sources are not controlled. Bike lanes, while not pollution-generating, may receive run-on from adjacent areas. Check City of San Antonio [code for water quality treatment requirements](#); a soil media layer may be needed before stormwater infiltrates the native soils.

the ground, which decreases the burden on stormwater drainage systems. By absorbing rainfall, it helps to reduce peak flow rates during storms, lowering the risk of flooding and erosion.

F

Versality + Application: Permeable pavement can be used in a variety of settings, including bike lanes, driveways, walkways, and low-traffic roads. It comes in different materials such as porous asphalt, pervious concrete, and permeable pavers, offering design flexibility to match different project needs and aesthetics.

G

Cost-savings: By managing stormwater on-site, permeable pavement can reduce the need for extensive stormwater infrastructure such as pipes, retention basins, and treatment facilities.

Benefits

A

Infiltration: The extensive presence of impervious surfaces in cities significantly contributes to urban stormwater issues. By utilizing permeable pavement materials, the amount of impervious cover can be reduced, enabling water to infiltrate through streets and sidewalks and decreasing runoff.

B

Additional Capacity: Permeable pavements provide extra space for water infiltration, especially in areas like alleyways, sidewalks, bike lanes or along curblines, where it is crucial to manage flooding and other issues without limiting mobility. Permeable pavements also creates added stormwater capacity, reducing burden on other stormwater elements.

C

Groundwater Recharge: Permeable pavement facilitates groundwater recharge by allowing water to percolate through the pavement and into the soil, which helps to maintain local water tables.

D

Water Quality Improvement: The underlying soil and microbial activity can further break down pollutants, improving the quality of the water that recharges groundwater supplies.

E

Runoff Reduction: Permeable pavement reduces the volume of surface runoff by allowing water to infiltrate directly into

Pervious Pavement Context Application

The chart below demonstrates preferred versus applicable siting for street design elements.

		high density		low density	
primary/ secondary arterial	Sidewalk	●	Sidewalk	●	
	Bikeway	●	Bikeway	●	
	Flex Zone (Parking Zones/ Roadway, Transit Stops)	○	Flex Zone (Parking Zones/ Roadway, Transit Stops)	○	
collector	Sidewalk	●	Sidewalk	●	
	Bikeway	●	Bikeway	●	
	Flex Zone (Parking Zones/ Roadway, Transit Stops)	○	Flex Zone (Parking Zones/ Roadway, Transit Stops)	●	
local	Sidewalk	●	Sidewalk	●	
	Bikeway	●	Bikeway	●	
	Flex Zone (Parking Zones/ Roadway, Transit Stops)	●	Flex Zone (Parking Zones/ Roadway, Transit Stops)	●	

●

Most Applicable/ Preferred

●

Applicable/ Recommended

○

N/A



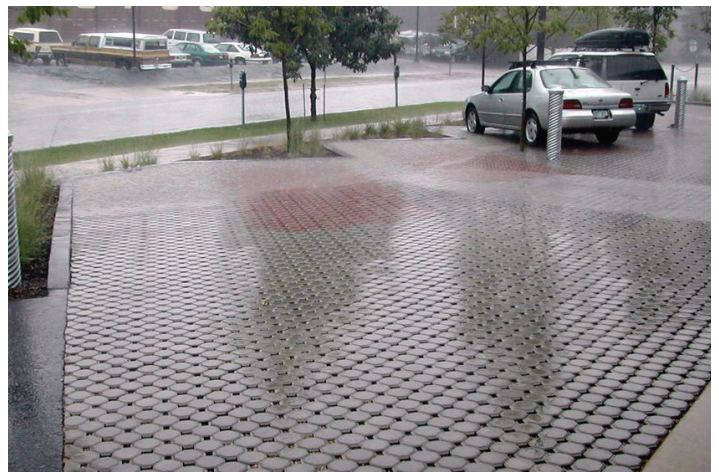
Pervious pavement along Governors Island Park, New York, NY



Permeable paving blocks, Zollhallen plaza, Freiburg, Germany



Permeable pavers, Indianapolis Cultural Trail, Indianapolis, IN



Plastic grid system for permeable paving, Colonial Beach, VA



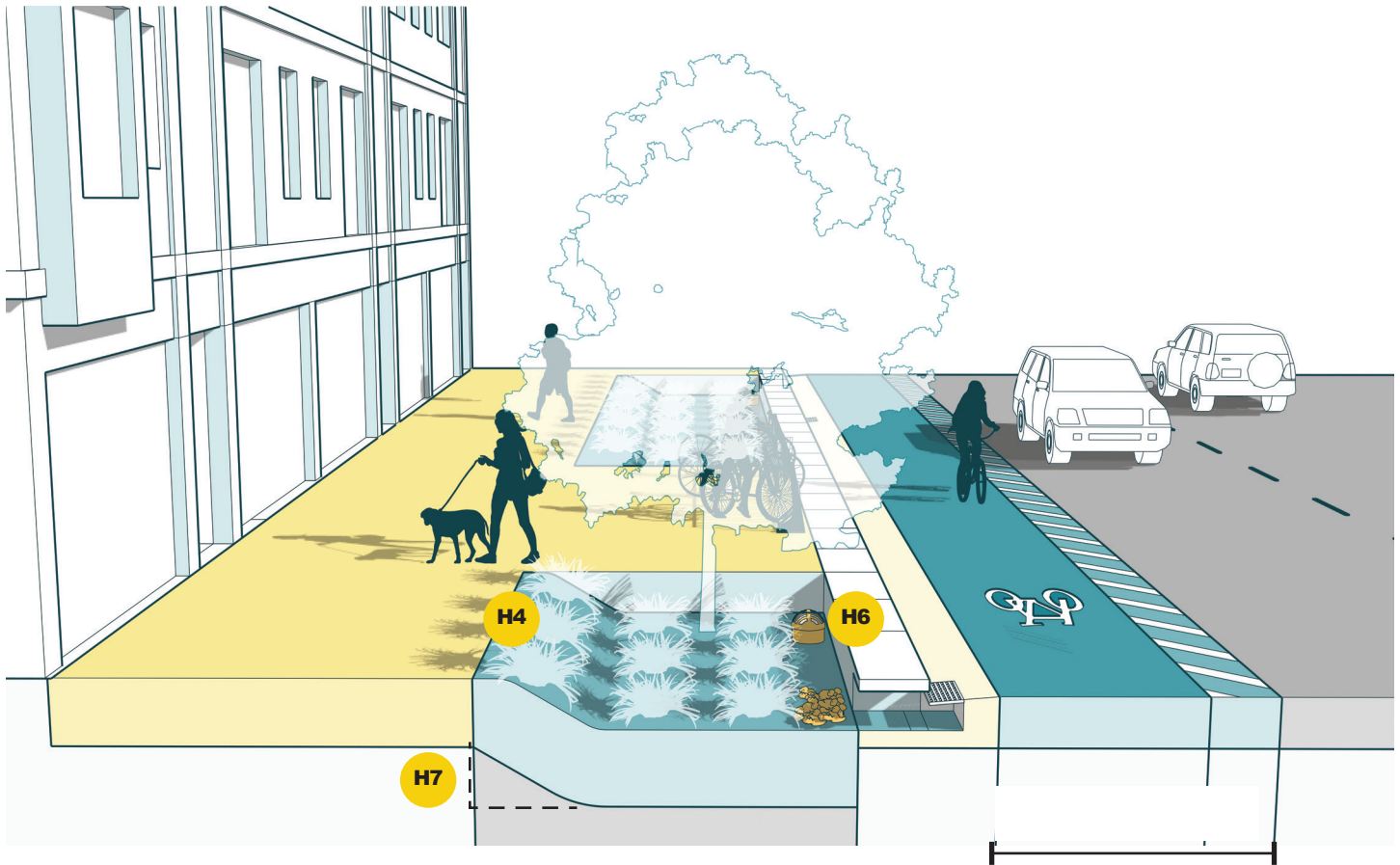
Permeable paving treatment along trail and intersection, Indianapolis Cultural Trail, Indianapolis, IN



Pervious concrete treatment, Queensboro Bridge Greenway, NY

Hybrid system

Green Stormwater Infrastructure Components



Application

- H1** Hybrid cells are ideal for low to moderate-density, low-traffic areas and are typically installed in planting strips along neighborhood or residential streets. These strips are usually too narrow for full-sized bioretention swales with graded side slopes but can adequately accommodate hybrid cells.
- H2** Hybrid cells are ideal for residential streets with low traffic where space constraints make typical bioretention planters impractical.
- H3** Hybrid systems combine filtration and drainage systems that provide better stormwater management and water quality improvement in compact urban settings.
- H4** The design of hybrid bioretention planters may be impacted by the space between the sidewalk and the curb. In situations with limited space, positioning the vertical wall towards the sidewalk side can minimize the required width of the planter.
- H5** When designing hybrid bioretention planters, accommodate street trees by placing them on the graded side slope, which allows their growth without obstruction from the vertical wall. Also, ensure that subsurface utilities are located in a way that does not conflict with the planned root space for the trees.
- H6** If the vertical wall is on the street side, it should be built to handle vehicular loads, which may require installing new curbs or repaving sections of the street. If the vertical wall is on the sidewalk side, it must be designed to support pedestrian traffic, possibly necessitating the construction of reinforced footings, additional bracing, and even sidewalk replacement.
- H7** Hybrid systems are typically less deep than walled planters due to the required width for a slope. A maximum of 18 inches is required with a slope that is 2.5:1 and 3 feet minimum bottom width. Width could vary with the sloped edge.

Application continued...

The chart below demonstrates preferred versus applicable siting for street design elements.

Benefits

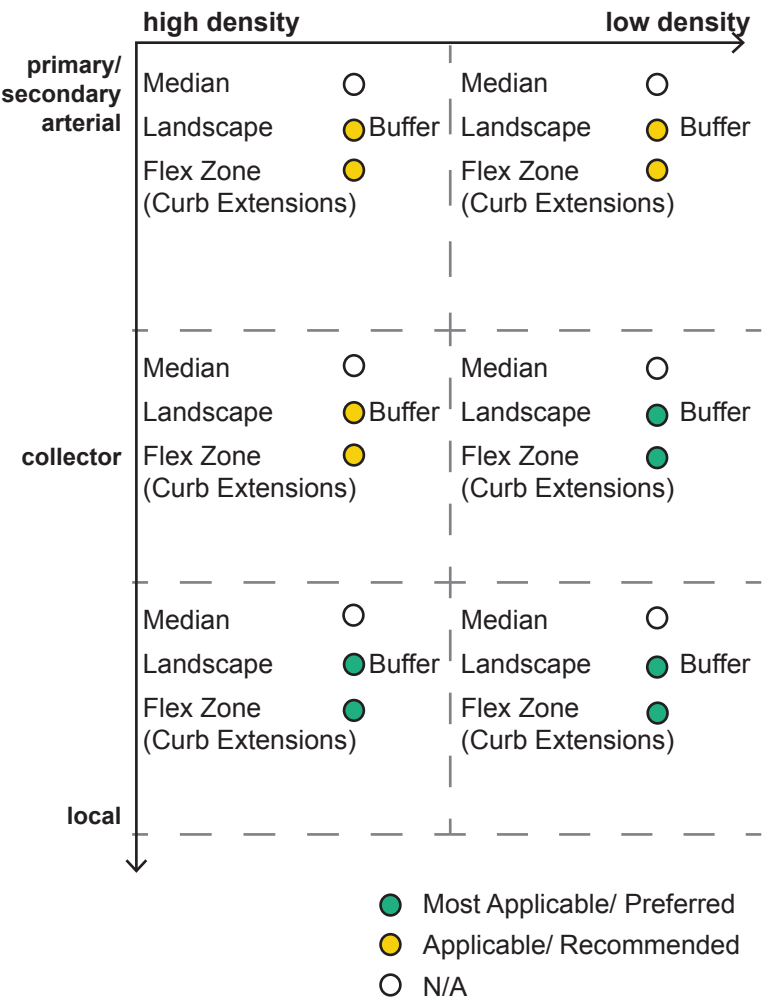
- A Improved Hydrological Performance:** Hybrid bioretention planters often incorporate additional features such as underdrains or permeable pavements, improving their ability to manage high volumes of runoff more effectively than standard bioretention planters.
- B Multilayer Systems:** The hybrid design may include multiple layers or different filtration media, offering superior pollutant removal compared to traditional bioretention planters that typically use a single soil mix.
- C Versality:** Hybrid planters can be adapted for various urban settings and site constraints, making them more versatile compared to traditional bioretention planters, which might be less flexible in terms of design and application.
- D Better Integration with Urban Infrastructure:** Hybrid bioretention planters can be more easily integrated with existing urban infrastructure, such as roads and sidewalks, while traditional bioretention planters might require more extensive site preparation.
- E Optimized Space Utilization:** Hybrid planters are designed to maximize the use of available space, which can be advantageous in densely developed areas where traditional bioretention planters might be too large or intrusive.
- F Reduced Irrigation Needs:** Once established, native vegetation in retention swales typically requires less irrigation compared to planters, which often need regular watering to support plant growth in urban environments.

G

Visual Appeal: Hybrid systems can combine functional elements with aesthetic design, creating more vibrant urban spaces compared to the often larger and less aesthetically flexible traditional bioretention planters.

Hybrid System Context Application

The chart below demonstrates preferred versus applicable siting for street design elements.



Hybrid system

Green Stormwater Infrastructure Components



Hybrid system for bulb-outs, San Francisco, CA



Hybrid system with inlet detail, Seattle, WA



Visitacion Valley urban watersheds, San Francisco, CA



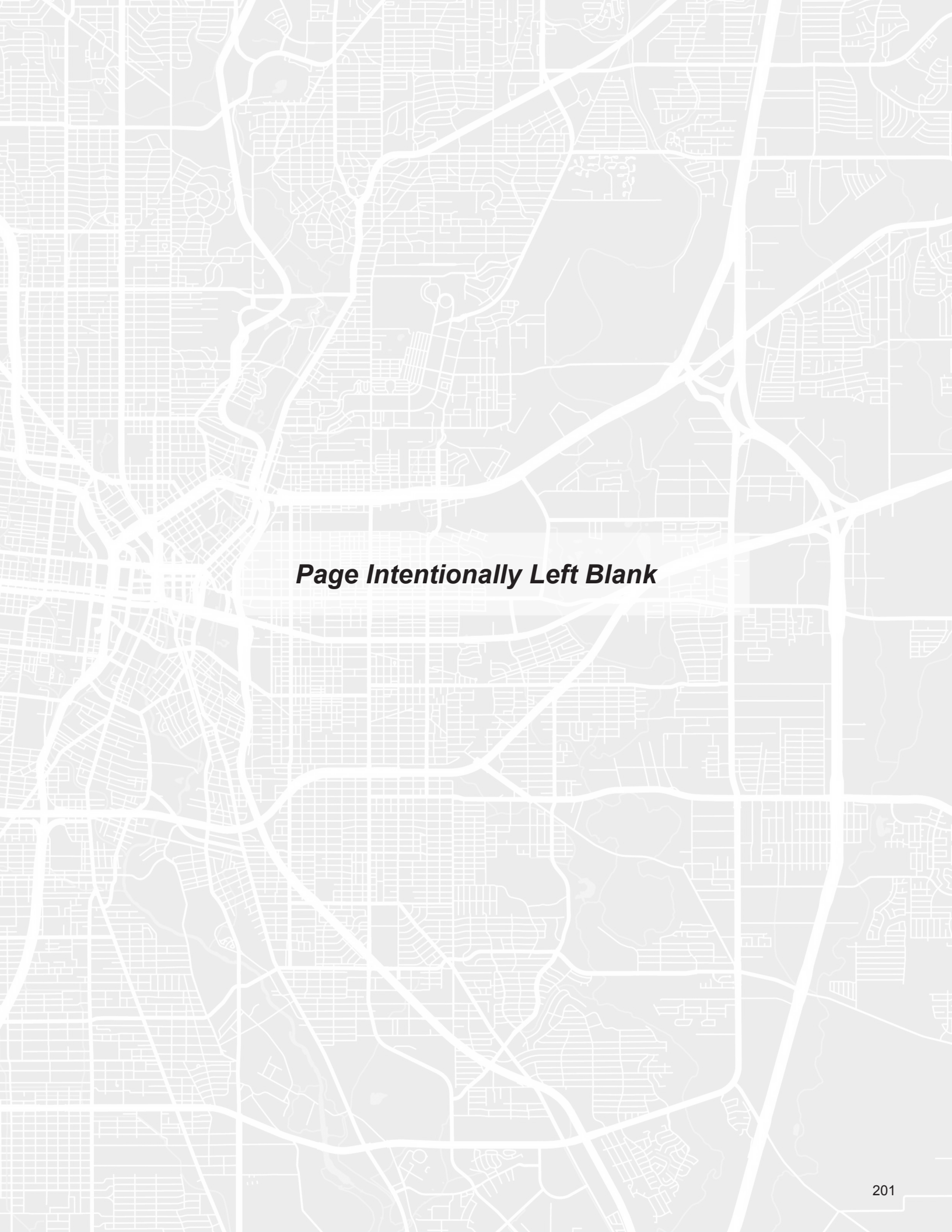
Montgomery Urban Center Plaza, Portland, OR



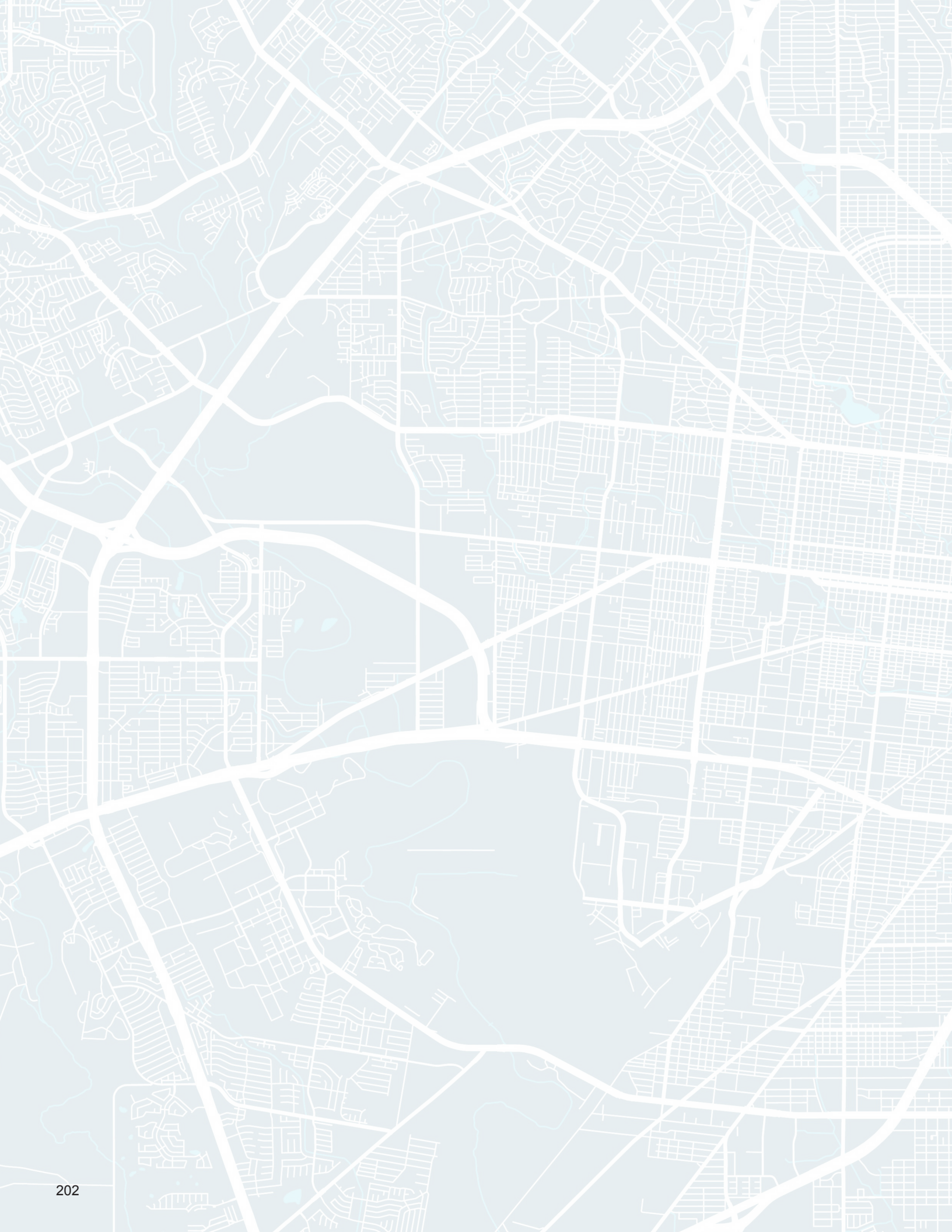
Hybrid system for bulb-outs, El Cerrito, Los Angeles, CA

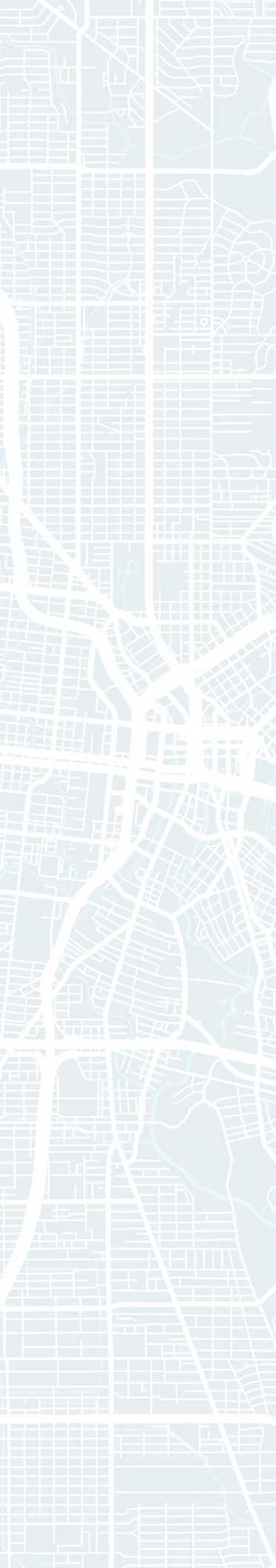


River East Center, Portland, OR



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Placemaking

Placemaking refers to a practice and collaborative process with municipalities, private sector and the public by which public spaces are planned, designed, and managed to create places that promote people's health, well-being and culture. It involves understanding components in the public realm that reflect and contribute to local culture and identity. Strategies outlined in this chapter should be utilized in accordance with **Street Typologies Steps 1-4 as an overlay system of improvements.**

<u>What are Placemaking Components?</u>	<u>204</u>
<u>Wayfinding + Monumentation</u>	<u>206</u>
<u>Street Amenities</u>	<u>212</u>
<u>Transit Amenities</u>	<u>216</u>
<u>Green Spaces</u>	<u>218</u>
<u>Lighting</u>	<u>222</u>

What are Placemaking Components?

This section provides guidance for the City of San Antonio to apply elements along the public-right-of-way that would contribute to the creation of sense of place through placemaking elements such as lighting, outdoor seating, art, and landscaping. Benefits of placemaking include:

- **Cultural Expression:** Elements allow communities to express identity through design of the public realm.
- **Enhanced Community Well-being:** Creating spaces that promote social interaction and physical activity foster a sense of community and belonging, encouraging social connections, health and community pride.
- **Economic Development:** Vibrant public spaces with access to well-designed bike facilities in the public right-of-way can attract businesses, tourism, and investment, boosting the local economy.
- **Environment:** Green spaces and sustainable design can improve urban environments, reduce pollution and enhance biodiversity. See Green Stormwater Infrastructure (GSI) chapter for specific green space enhancements.



Street Amenities (S)

Street amenities refer to furnishings in the public realm that provide a level of comfort for pedestrians and that make circulation welcoming and experiential. Furnishings can include benches, tables, chairs, waste receptacles, planters, water fountains, etc.



Lighting (L)

Lighting includes equipment used to produce light in the public realm -street lights, accent lights, bollard lights, path lights, roadway lights, etc. The goal is to illuminate pathways, sidewalks, bikeways and other areas where cyclist and pedestrian navigation occurs. Lighting is integral to creating a safe nighttime environment for cyclists, pedestrians and vehicles. Brighting and sizing of these elements should reflect the intensity of use in the public realm.



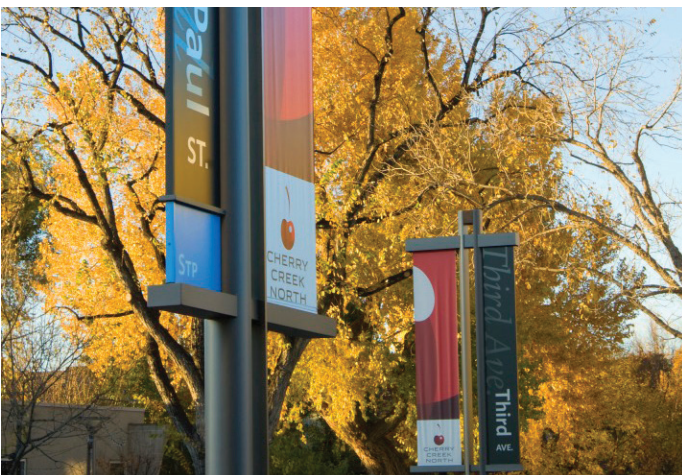
Transit Amenities (T)

Transit facilities provide comfort for people using bus transit or bike routes for recreation or work. Furnishings could include bike racks, enhanced bus shelters that include digital maps and timetables, trash receptacles, charging stations, transit curbs, ticket vending machines, access to Wi-fi and comfortable seating.



Green Spaces (G)

Green space zones refer to areas where plants are used in the pedestrian realm including tree wells, garden beds and planters. Green spaces serve a number of functions related to buffers, aesthetic and seasonal appeal, habitat creation, water quality and stormwater management. See Green Stormwater Infrastructure (GSI) chapter for specific green space enhancements and Street Typologies chapter for specific dimensional standards.



Wayfinding + Monumentation (WM)

Wayfinding refers to signage elements that provide an overall image of a district, mark entry/exit points and provide informational cues about directions and destinations. These are vital in orienting cyclists and motorists, pedestrians, and limiting potential clashes. Monumentation indicates the use of significant, often large, and architecturally distinct signs or markers that help guide and orient people within a space. These signs serve as important landmarks and are typically designed to be highly visible and easily recognizable, often incorporating elements of the surrounding environment or cultural references to enhance their effectiveness.

Wayfinding + Monumentation

Placemaking Components

Navigation from place to place is a fundamental human activity and an integral part of everyday life and placemaking. People use their knowledge and previous experiences to find their way to and from destinations in the built environment. Monumentation and wayfinding/ signage systems provide the ability to inform users of their surroundings. It is critical to illustrate branding and information at strategic points to guide cyclists in the right direction. To tackle this, creating a system of markers or landmarks can help ground perception of time and physicality to certain locations in a community. This section provides guidance on the types of wayfinding systems that make navigation easier for users, but also contribute to placemaking by its physical attributes and siting. Application of Wayfinding and Monumentation components in the table below is outlined by streetscape typologies. For specific code and dimensional criteria, refer to [W](#).

Street Type	Wayfinding and Monumentation				
Functional classification	Regulatory Signage	Directional/ Informational Signage	Monumentation		
			Small	Medium	Large
Primary Arterial	●	●			●
Secondary Arterial	●	●		●	●
Collector A/B	●	●	●	●	
Collector C	●	●	●	●	
Local A/B	●	●	●		
Local C	●	●	●		

- Most Applicable/ Preferred
- Applicable/ Recommended

Directional/Informational signage

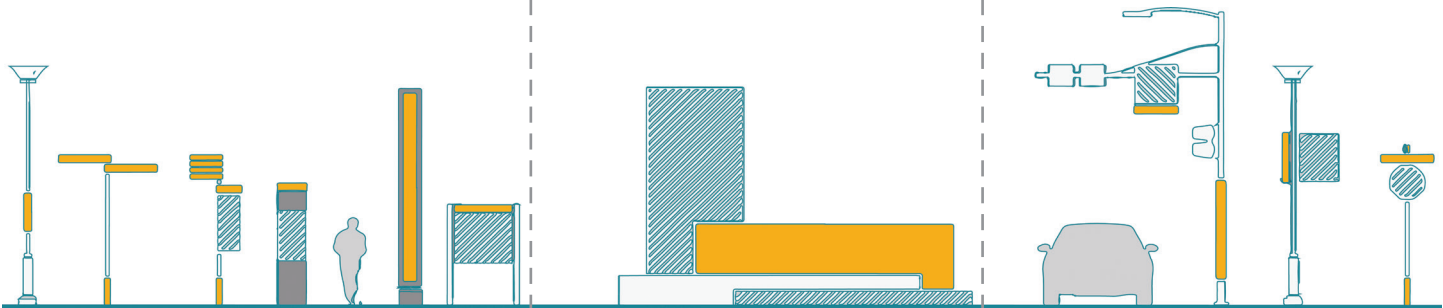
Directional and informational signage display location information about points of interests in an area and distances to reach them. These can be placed along trails, key points of entry/exit along a sidewalk, etc.

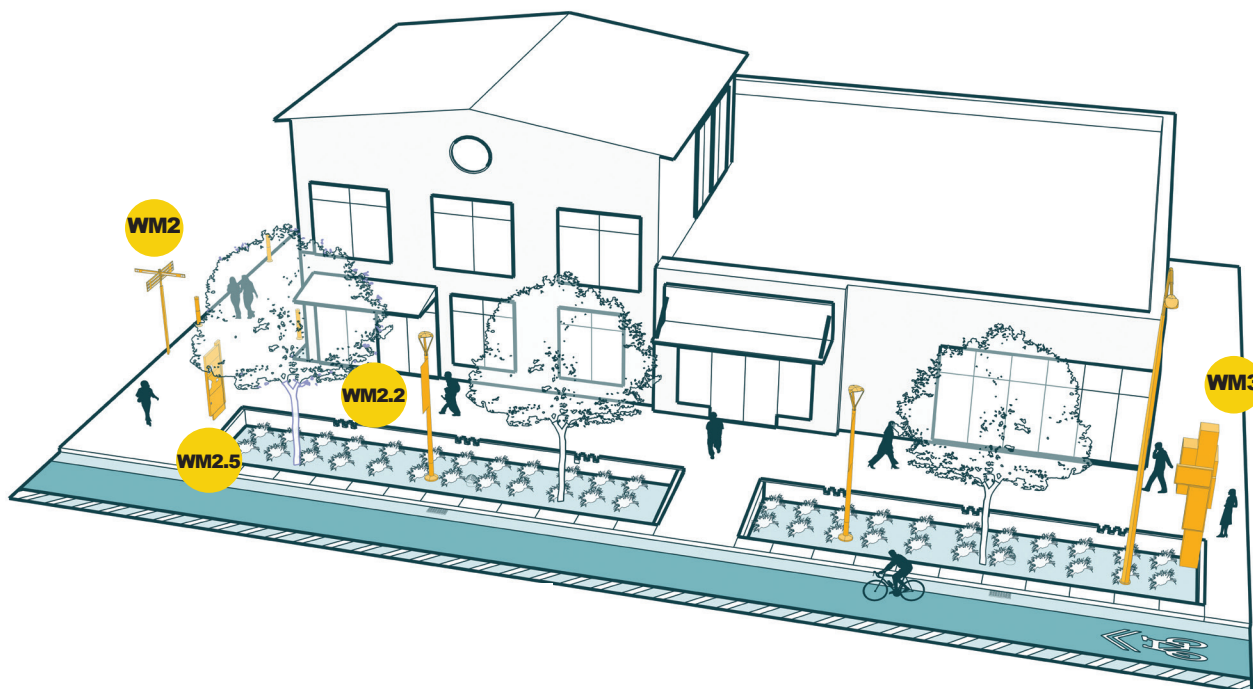
Gateway monuments/markers

Monumentation helps define a place. They are structures that are built not only to serve a purpose, but be an iconic symbol that is easily recognizable and representative of a place.

Regulatory signage

Regulatory signs describe a range of signs that are used to indicate or reinforce traffic laws, regulations or requirements which apply either at all times or at specified times of the day (ie: stop, yield, right/left turn signs).





Wayfinding Application

Typical application for signage and wayfinding include all streets and/ or bicycle facility types that are part of the bicycle network and corridors with circuitous bikeway facility routes to guide bicyclists to their intended destination.

WM1

Regulatory Signage: Locate regulatory signage (posted speed, bike routes, roadway indicators) near intersections and gateways into the district or sub-districts. Consolidate information onto one sign every 0.25 miles limit clutter along the right-of-way where possible.

- Include bike wayfinding signage and pavement markings along bike paths or shared use paths.
- Enlarge markings enough to be visible to all roadway users ([See City of San Antonio Design Guidance Manual](#) for specific requirements).

WM2

Directional Signage: Directional signage typically considers prominent points of interest or bike facility in a community or District. Consider ranking destinations to determine which should be listed on a sign where more than three destinations are nearby in a neighborhood.

1. Refer to [VIA Metropolitan Transit Long Range Plan 2040](#) for specific standards associated with transit wayfinding.

2. Signs located at key intersections and focal points should direct people to major arterials and attractions. Signs located along major shared use paths or bikeways should give distances and directions to community destinations.
3. Align wayfinding in the public realm with adopted city-wide signage standards.
4. Banners can be attached to light-poles with a sign typically no larger than 100 square feet. Refer to [_](#) for more information.
5. Consider creative features such as outdoor interactive technology that connects patrons to each community or neighborhood through real-time information at parks, transit destinations, community nodes and at entrances/exits to trails.
6. Emerging centers or gateways should be identified through the use of special lighting, banners, monuments, or small plazas. [See Monumentation section](#) for toolkit application.

Wayfinding + Monumentation

Placemaking Components

Wayfinding Benefits

- A** **Navigation and Orientation:** Signage and wayfinding systems help cyclists and pedestrians navigate unfamiliar environments by providing clear and accessible directions. In addition, it saves users time by guiding them directly to their destinations without unnecessary detours.
- B** **Enhanced User Experience:** Clear signage can improve safety by directing people to exits, emergency routes, and first aid stations, and minimizes the stress associated with being lost or confused.
- C** **Movement Efficiency:** A well-designed and sited system helps manage the flow of people, preventing congestion and improving crowd control.
- D** **Compliance:** Where space is available, bioretention swales with graded side slopes allow gentler transitions between bike facilities, pedestrian zones and the roadway.
- E** **Cultural and Educational Value:** Signage systems foster information dissemination in a way that promotes educations, historic and cultural insights. For cyclists and pedestrians, the system is a method to engage users by providing information about events, landmarks, public services and efficient ways to access them.



Regulatory signage for bike routes, Atlantic Ave,



Branded regulatory signage, UTSA, San Antonio, TX



Directional signage indicating locations of destinations, routes and transit hubs, Downtown Houston, TX



Directional signage indication bike routes and locations of important nodes, landmarks and destinations, Downtown Georgetown, TX



Stroud Preserve trail markers (informational signage), Natural Land Trust, NJ



San Antonio Riverwalk directional signage, San Antonio, TX

Wayfinding + Monumentation

Placemaking Components

Monumentation Application

WM3

Emerging centers, hubs and gateways into and out of the City districts or neighborhoods should be identified as ideal locations for branded markers and monuments (major intersections, major transit stations or interchanges, public parks, etc). Do not obstruct or overwhelm District or neighborhood monuments and markers by nearby private signage/markers.

1. Monumentation and landmarks are typically applied along major roadways in urban contexts. They may vary in size, application and scale (see Wayfinding + Monumentation table). Markers of varying sizes can be applied based on the location and purpose. Medium to smaller markers are suitable for secondary arterials and collector roads outside metropolitan areas. “Smaller monuments” refer to compact objects positioned behind the curb, occupying minimal space. “Medium monuments” are also placed behind the curb but may extend across both public and private property; these are typically freestanding vertical elements. “Larger monuments,” often located at major intersections, transit hubs, or district boundaries, may span the entire right-of-way, serving as prominent indicators of entry or exit points.
2. Monuments and markers should emphasize the brand and character of the area/ district/ subdistrict, scaled appropriately to be seen by both vehicles, cyclists and pedestrians. Consider the consistency in design between all gateway markers and monuments to ensure that all elements are recognized as part of a district or area.
3. Locate gateway monuments away from areas of cyclist and pedestrian traffic.

Monumentation Benefits

F

Identity and Branding: Monumentation helps define a place. They are structures that are built not only to serve a purpose, but be an iconic symbol that is easily recognizable and representative of a place. A well-designed marker can become a symbol of the area and integrate art to define public spaces..

G

Navigation: Gateway markers often function as wayfinding tools, helping people navigate through an area. They indicate the entrance to significant locations, helping orient people within a larger environment.

H

Economic Draw: A well-placed and attractive gateway monument can draw cyclists to a particular area, boosting tourism and local commerce. Users are often drawn to areas that have a strong sense of place.

I

Heritage and History: Gateway markers can celebrate and preserve the cultural heritage and history of a place. Structures also foster a sense of pride by serving as symbols of inclusivity and representation.

J

Functional Appeal: In some cases, gateway markers are designed to serve functional purposes, such as slowing down traffic at the entrance to a neighborhood or district. This can improve safety for pedestrians and drivers.



Monuments (small): Kokoda Track War historical markers, Australia



Monuments (small): First brick road historical marker, Albion, Ohio



Monuments (medium): "Torch of Friendship" marker,



Monuments (medium): Midtown gateway marker, Bagby Park, Houston, TX



Monuments (large): Fillmore Plaza gateway marker, Cherry Creek North, Denver, CO



Monuments (large): Post Oak Boulevard gateway marker, Houston, TX

Street Amenities

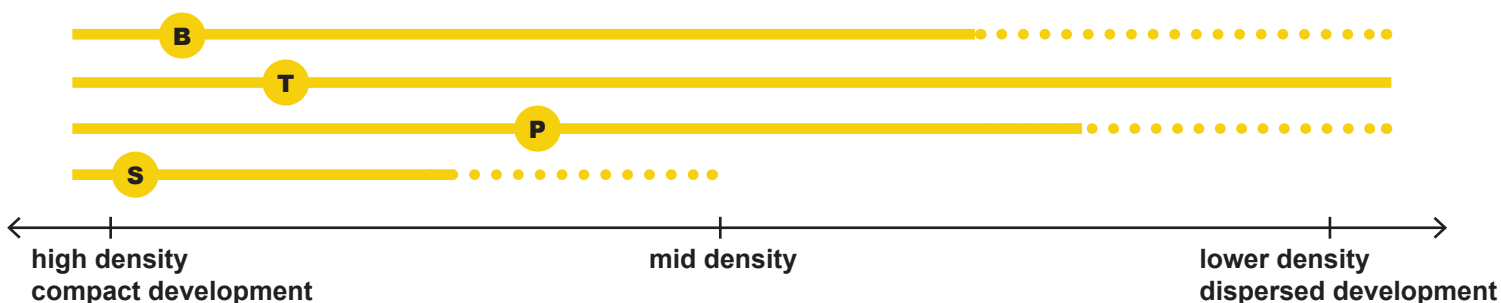
Placemaking Components

Street amenities like benches, planters, shade structures and trash cans play a crucial role in the functionality, comfort, and aesthetic appeal of public spaces. Amenities are essential to the functionality, cleanliness, and upkeep of public spaces, contributing to the overall quality of life for cyclists and pedestrians. Seating and benches provide moments of respite in typically high foot-traffic areas. Waste receptacles are essential in the upkeep and maintenance of the public realm while shade structures and planters promote opportunities for aesthetic appeal and human comfort. Application of Street Amenities components in the table below is outlined by streetscape typologies. For product specifications and dimensional criteria, refer to each neighborhood or district guidelines.

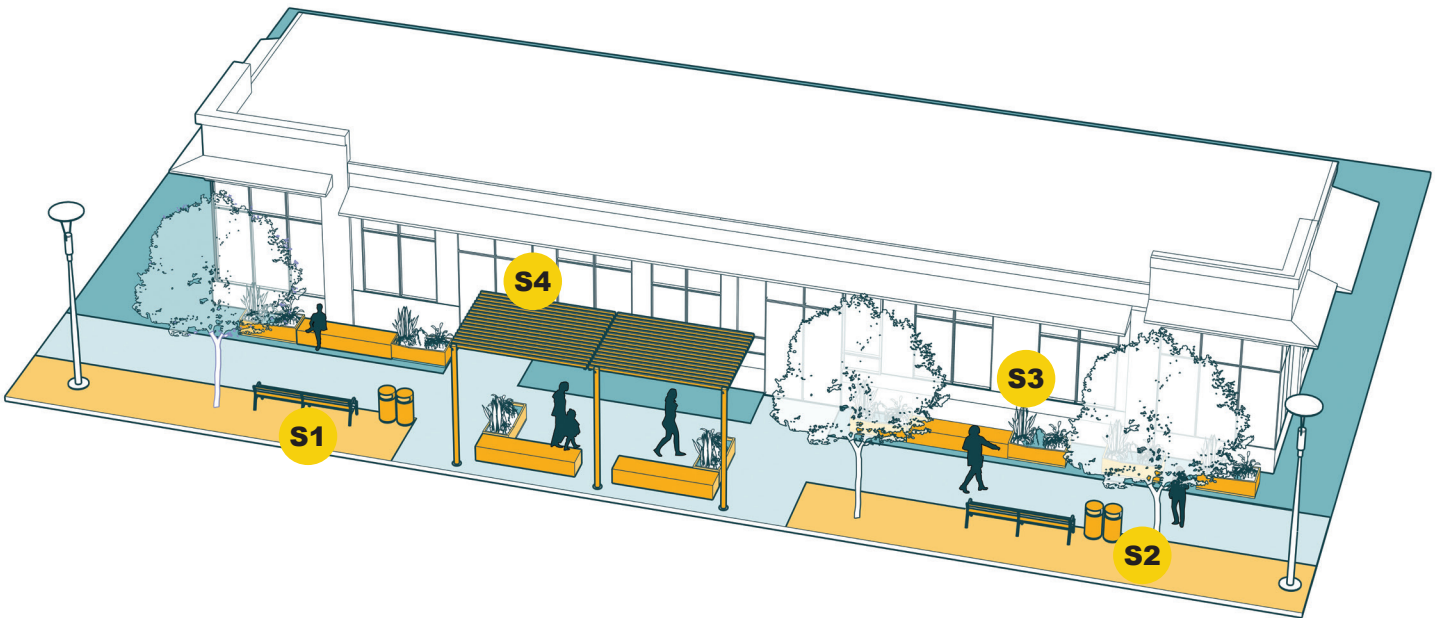
Street Type	Street Amenities			
Functional classification	Benches/ Seating	Trash receptacles	Planters	Shade Structures
Primary Arterial	●	●		
Secondary Arterial	●	●	●	
Collector A/B	●	●	●	
Collector C	●	●	●	●
Local A/B	●	●	●	●
Local C	●	●	●	●

- Most Applicable/ Preferred
- Applicable/ Recommended

Context-sensitive application: The suitability of each Placemaking component varies based on the environment and context. High-density areas have more people per square mile, robust public transportation, and proximity to needs for amenities in the public space. Low- to mid-density areas have fewer people per square mile, development on larger lots, and more reliance on cars, offering added space, but may require fewer amenities or amenities that are less frequent. Urban areas where there is typically a high presence of ground floor activity and pedestrian foot traffic are ideal conditions for street amenities such as seating, shade and planters. For an overview of the general application of each type of streetscape amenity across different conditions, refer to the diagram below.



- Most Applicable/ Preferred
- ... Applicable/ Recommended



Application

S1

Benches and Seating:

1. Design Considerations: Benches are often designed with accessibility in mind, offering seating options for people of all ages and physical abilities. This includes features like armrests and appropriate seat heights (min. 17 inches). Ensure they are designed to prevent accumulation of water; avoid material that retain heat or locate under shade when possible.
2. Placement: Benches are typically placed in high-traffic areas, near landmarks, rest stops or transit areas. They are also positioned to take advantage of views or shade behind the curb. At small stops provide several individual seats or a bench with raised separation between seats. In some cases, benches are arranged behind the curb in clusters to encourage social interaction or placed individually to offer privacy and solitude. Site 50% of benches and seating in areas with mid-day shade.

S2

Waste Receptacles:

1. Design Considerations: Modern waste receptacles include compartments for recycling, encouraging environmentally responsible behavior and supporting

sustainability efforts. Use smart trash cans and recycling that are solar powered when possible with enabled fill-level sensors (particularly along key arterials). Ensure furnishing are made from durable, weather-proof materials such as concrete, stone, wood or powder-coated metals. Lids may be used to keep pests away.

2. Visibility: Waste receptacles should be designed to be easily identifiable and accessible, often featuring bright colors or clear signage to indicate their purpose.
3. Location + Placement: Waste receptacles are placed in areas where people are likely to generate waste. Locate receptacles near street crossings, intersections, and other high-traffic areas such as plazas, transit stations, bike stops and points of egress and ingress.

S3

Planters:

1. Location: Select streets or areas where planters will be most effective. Consider high foot traffic zones, intersections, bus stops, and areas lacking greenery. In addition, ensure planters do not obstruct visibility for drivers or pedestrians. Place them in a way that complies with ADA guidelines

Street Amenities

Placemaking Components

Application continued...

for accessibility.

2. **Materiality:** Choose types that suit the location — ground-level planters, raised beds, hanging baskets, or vertical gardens. Use durable materials like concrete, metal, recycled plastic, or wood and consider weather resistance, ease of maintenance, and aesthetics.
3. **Plant Selection:** Opt for native, flood-tolerant and drought-resistant, low maintenance planting that thrive in San Antonio. See the [City of San Antonio Plant List](#) for specific plant options.

S4

Shade Structures:

1. **Location:** Target high-traffic cyclist and pedestrian areas, public transportation stops, outdoor seating areas, nearby playgrounds and streets prone to high temperatures lacking tree shade. Consider partnering with local businesses like F&Bs (food and beverage) to coordinate efforts.

2. **Materiality:** Use durable materials like steel, aluminium, wood, or high-quality fabric that can withstand weather conditions. Consider materials with reflective properties or those that provide UV protection. Options range from permanent structures like pergolas, retractable structure like canopies, awnings or sails, smart design that integrate solar panels or green canopies that combine provide plants and vines.
3. **Urban Elements:** Integrate with other street features such as benches, planters, public WiFi/ charging stations or bike racks to create multifunctional urban spaces.
4. **Maintenance:** Routine inspections should be conducted to ensure check for structural integrity or damage.
5. Refer to [Green Spaces section](#) for tree shade specifications

Street Amenities Benefits

A

Benches and Seating: Benches provide a place for people to sit, rest, and socialize. They are essential along sidewalks, and other public areas where people may spend time. Benches are often designed with accessibility in mind, offering seating options for people of all ages and physical abilities. This includes features like armrests and appropriate seat heights.

B

Waste Receptacles: Trash cans are vital for maintaining cleanliness in public spaces. They provide a designated place for disposing of litter, helping to reduce waste on the streets. Today's trash cans include compartments for recycling, encouraging environmentally responsible behavior and supporting sustainability efforts.

C

Planters: Planters make it possible to introduce plants and greenery into small or densely populated urban areas where ground space is limited. They can be used to greenery and aesthetic appeal while providing flexibility in design and placement because of its temporary display. Unlike permanent landscaping, street planters can be moved or reconfigured as needed. In addition, planters can be used to delineate sidewalk space from outdoor private space or street tree or utility zones. Planters

allow you to control the soil quality, ensuring that plants have the right type and composition of soil for optimal growth. This is particularly important in areas where the natural soil may be poor, contaminated, or not suitable for the desired plants. Planters offer better control over drainage, preventing waterlogging and root rot. Using planters helps reduce the risk of weeds and pests that are commonly found in the ground soil, reducing the reliance on upkeep and maintenance.

D

Shade structures: Shade structures like canopies, pergolas, structured sails and awnings along streets whether provided by private entities as extensions of businesses or municipalities as public amenities, help reduce temperatures by blocking sunlight, encouraging pedestrians and cyclists to spend time during peak San Antonio sun hours. Shade structures provide rest areas in areas with high pedestrian traffic, such as parkettes, street plazas and commercial corridors. In areas with public transportation, shade structures provide shelter for people waiting for buses or trains, improving the overall transit experience. Lastly, shade structures can be designed as works of public art, reflecting the cultural identity of the community and adding a unique character to the area.



Republic Square transit stop with amenities, Austin, TX



On-street amenities, Tahoe, CA



The Domain seating, Rock Rose District, Rose Ave, Austin, TX



Larimer Square planters and seating, Denver, CO



Shade structures along the right of way, Cherry Creek North, Fillmore Plaza, Denver, CO



Shade structures with seating, Hermann

Transit Amenities

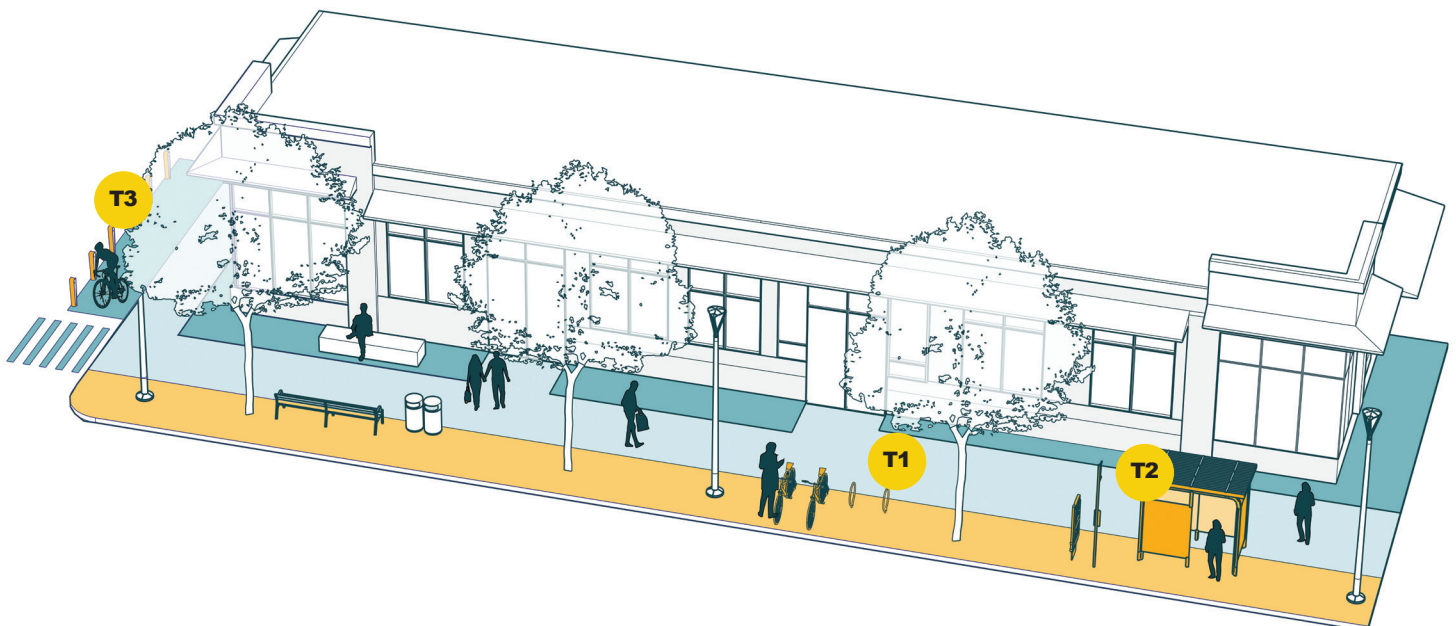
Placemaking Components

Transit amenities refer to the infrastructure and facilities provided to enhance the experience of using bike transportation and improve the overall urban environment. These amenities can vary widely depending on San Antonio's local needs and transit system. Transit facilities provide comfort for people using bus transit or bike routes for recreation or work. Furnishings could include bike racks, stop bollards that separate bike paths from vehicles and pedestrians, enhanced micromobility shelters or stations that provide digital maps, bike repair features, charging stations, access to Wi-fi and comfortable seating.

Street Type	Transit Amenities		
Functional classification	Bike Racks*	Micromobility Stations*	Stop Bollards
Primary Arterial	●	●	
Secondary Arterial	●	●	●
Collector A/B	●	●	●
Collector C	●	●	●
Local A/B	●	●	●
Local C	●	●	●

*Note: Elements that indicate level of frequency and placement in the right of way (ie: every 50 feet versus 100 feet).

- Most Applicable/ Frequent*
- Applicable/ Less Frequent*



Transit Amenities Application

T1

Bike Racks/ Bike Shares: Place bike racks and bike shares near public transit stations allowing people to bike to transit hubs and continue their journey by bus. Also locate them near major destinations or commercial areas with high pedestrian count to encourage biking to such locales. Real-time information on the availability of shared bikes including locations of docking stations should be provided. Install bike racks 3 feet apart in well-lit areas in full view of walking paths and every half-mile along designated bike route. Ensure there is a clear zone around racks to avoid impeding pedestrians traffic.

T2

Micromobility Stations/ Hubs: These hubs should integrate features like bike repair kits, charging stations, seating, bike shares, racks, shade, lighting and digitized information about bike availability, transit maps and nearby points of interest. Locate these hubs near major transit stops or destinations (maximum of 50 feet of).

T3

Stop Bollards: Vertical elements such as bollards can be used to separate pedestrian walkways or sidewalks from back of curb bike paths (cycle tracks) or other spatial dividers in the public and private realm (ie: emergency vehicular paths, food truck aisles, parks and plazas).

Transit Amenities Benefits

A

Enhanced Connectivity: Transit amenities enable people to more easily travel between areas and access new destinations. In turn, this connects people in a way that fosters interaction and accessibility.

B

Increased Accessibility: Providing amenities that contribute to the comfort and reliability of multi-mobility options, such as bike racks, micromobility stations, and charging stations, makes spaces more accessible and reduces the need for reliance on personal vehicles.

C

Improved User experience: Amenities like shelters, bike repair kits, bike parking/bike shares, real-time information displays and bollards to separate from other modes of travel make bike transit more comfortable, safe and predictable.

D

Enhanced Quality: Improving or integrating transit amenities into the street right of way can reduce traffic congestion, thereby reducing noise, improving air quality, and increasing safety for pedestrians and bicyclists. The reduction of car traffic and parking also makes an area more welcoming and vibrant with the introduction of more cyclists.



Bike racks adjacent to seating, Daybreak, Salt Lake City, UT



'Locky Dock' micromobility hubs, Auckland, NZ

Green Spaces

Placemaking Components

Green space zones refer to areas where plants are used in the public realm including tree wells, garden beds and planters. Green spaces serve a number of functions related to buffers, aesthetic and seasonal appeal, habitat creation, water quality and stormwater management. Green spaces beautify streets, making them more inviting and comfortable for pedestrians and cyclists. A few factors are to be considered when designing green spaces in the public realm including types of trees, tree spacing, irrigation, soil conditions and ground cover landscaping. This section focuses on the selection of vegetation that can be incorporated into stormwater systems referenced in the [‘Green Stormwater Infrastructure \(GSI\)’ chapter](#).

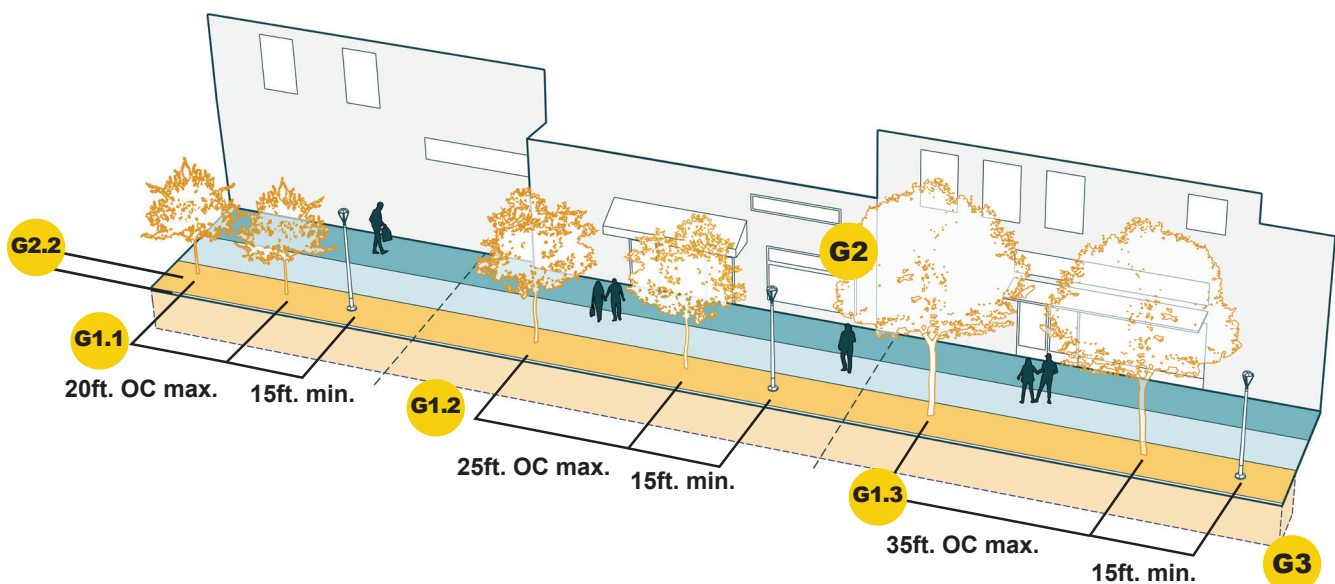
Street Type	Street Tree Appropriation by Street Type		
Functional classification	High Profile Street	Medium Profile Street	Low Profile Street
Primary Arterial	●		
Secondary Arterial	●		
Collector A/B		●	
Collector C		●	
Local A/B			●
Local C			●

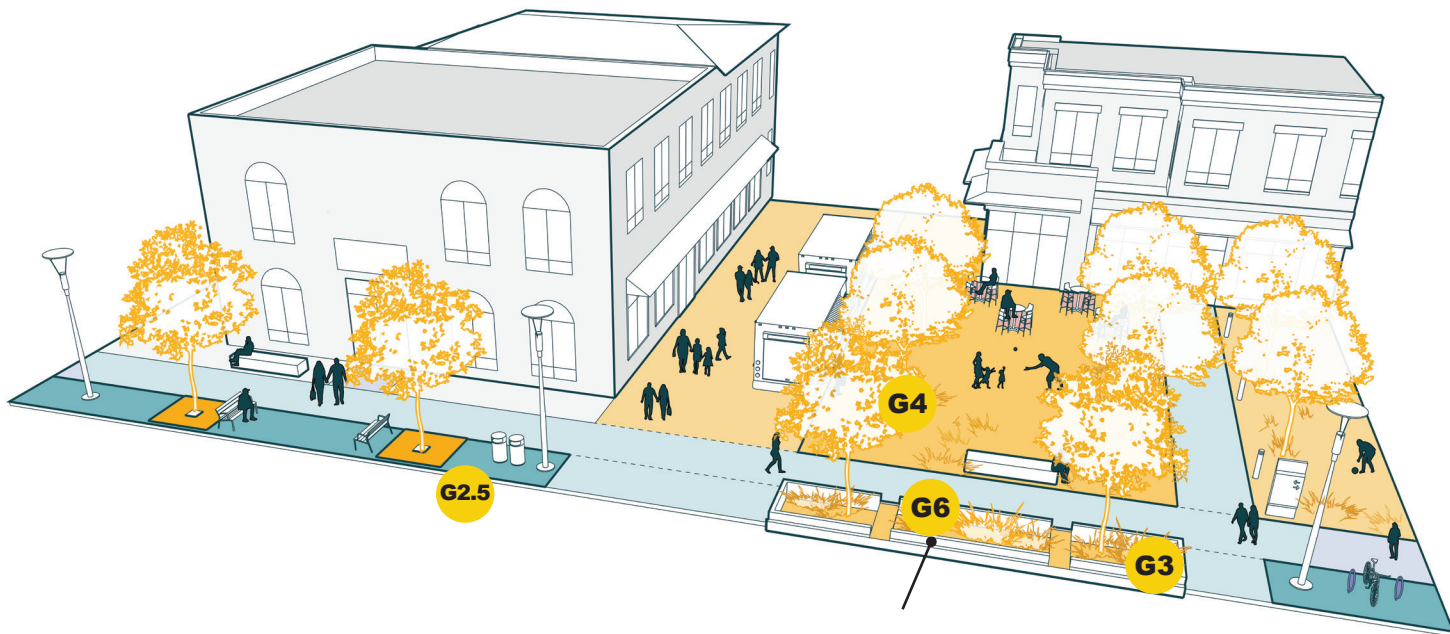
Street tree selection needs to address functional needs while enhancing the character of the district and considering resiliency. The chart above shows the street tree typologies based on streetscape.

High Profile Street: Characterized by fast interactions with an emphasis on vehicular travel. Tree palette needs to be a strong, bold statement to create a district character.

Medium Profile Street: A mix between the high and low profile streets.

Low Profile Street: Neighborhood streets that are used daily and have the potential for more seasonal interest.





Green Spaces Application

G1 Tree Spacing:

1. 35 feet maximum (max.) on center (OC) for large trees (>35 feet crown diameter at maturity). Large trees planted in clusters maybe planted as close as 10 feet OC.
2. 25 feet max. OC for medium trees (20-35 feet crown diameter at maturity); Medium trees planted in cluster maybe planted as close as 8 feet OC.
3. 20 feet max. OC for small trees (<20 feet crown diameter at maturity).

G2 Tree Planting Considerations:

1. Trees and plants should meet the City's Parks Department requirements.
2. Place trees a minimum of 25 feet from the crosswalk edge at intersections to avoid motorist and pedestrian sight line interference (visibility triangle); a minimum of 3 feet from the curb; a minimum (min.) of 10 feet from driveways, hydrants and loading zones; and 15 feet from streetlights or signage poles.
3. Trees may be clustered or planted in groups of three and four to allow resistance against wind. In high traffic areas, install physical

measures such as curbs, seatwalls or steel railing to protect the planting zone.

4. A key connector, corridor or street should have a diversity of tree species to support a resilient urban forest. The same tree species should not be utilized sequentially more than three times in a row. Install low growing trees in areas where existing utility lines are present.
5. Open planters are preferred over tree grates except in narrow or urban areas where considerable foot traffic is present. Ensure that tree openings for grates can accommodate large tree trunk diameter.
6. Preserve existing native trees. Native trees that are in poor health (as determined by a certified arborist) may be removed. Replacement trees must be native with a min. calliper size of 3-inches and a max. calliper size of 8-inches. Exotic trees may be removed as long as each specimen is replaced with a native tree of at least 3-inch calliper.
7. Provide landscape and tree species that not only promote seasonal color but provide a high-quality habitat for native insects and animals.

Green Spaces

Placemaking Components

Green Spaces Application continued...

- G3 Tree Soil:** If adjacent hardscape restricts the amount of soil volume needed for long-term healthy tree growth, use techniques such as engineered structural soil to engineer soil profiles for support. The soil area required for most trees is a minimum of 75 square feet of surface area.
- G4 Landscaping Considerations:**
1. Plants should not interfere with sight lines to traffic, intersections and signs when placed near roadways.
 2. No more than 60% of a planting area of a corridor should be dedicated to turf as an understory. Emphasize variety in site-wide planting strategies in a logical rhythm.
- G5 Irrigation:**
1. Trees and landscaping require temporary irrigation in the establishment period (EP) or the first two-years. Permanent drip irrigation is mandatory thereafter.
 2. Regularly monitor soil moisture to prevent under- or over-watering. Moisture meters or soil probes can help determine when irrigation is necessary. Maintain consistent soil moisture for young trees and shrubs to support root development, while allowing the soil to dry slightly between waterings for mature plants.
- G6 Green Stormwater Infrastructure:** Utilize stormwater management best practices when possible to detain, retain and cleanse runoff volumes.

Green Spaces Benefits

- A Environmental Benefits:** Green spaces provide habitats for urban wildlife, supporting biodiversity even in densely populated areas. In addition, trees and permeable green areas absorb rainwater, reducing surface runoff and the risk of urban flooding. This helps alleviate pressure on drainage systems. Lastly, green spaces help cool cities by reducing urban heat island. Vegetation provides shade and cools the air through evapotranspiration. While green space zones is a mechanism for cooling, trees and landscaping also improves air quality by absorbing pollutants.
- B Streetscape Character and Sense of Place:** Vegetation and green spaces promote benefits such as shade, seasonal interest, visual and sound buffer from vehicles and added texture in the public realm. They soften streetscapes, noise pollution and effects of adjacent building structures. In addition, coordinated vegetative strategies promote community branding and opportunities for social engagement, community activities, and leisure, fostering stronger neighborhood connections.
- C Improved Cyclist and Pedestrian Experience:**
Comfort and Safety: Trees and greenery provide shade, making cycling or walking more comfortable during summers. Well-designed green streetscapes can also create buffers between cyclists/pedestrians and road traffic, enhancing safety.
Traffic Calming: Green spaces can serve as natural traffic calming measures by visually narrowing streets, encouraging drivers to slow down and be more cautious, especially in residential or cyclist and pedestrian-heavy areas.
- D Aesthetic Appeal:** Green streetscapes encourages use of active transportation by making integrating green spaces into streetscapes aligns with sustainable city planning, promoting the use of green infrastructure to create resilient, livable cities that can better adapt to climate change.

See [City of San Antonio Approved Plant List](#) for approved tree species.



High Profile Street Trees

Function: Provide a continuous canopy of shade. Create distinct moments at key destinations and intersections.

Form: Large, shade trees i.e., (Bald Cypress, Cottonwood, Western Soapberry, etc).

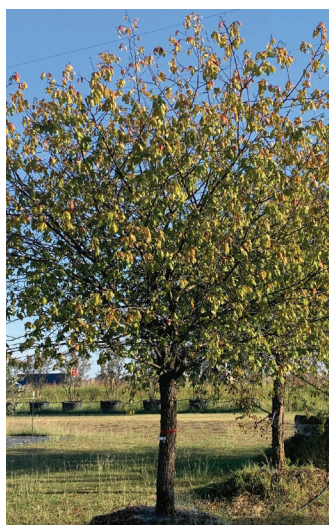


Medium Profile Street Trees

Function: Provide shade, seasonal interest and screening for adjacent uses.

Form: Large to medium shade trees with more variation and diversity than the high profile typology i.e., (Lacey Oak, Texas Ash, Bur Oak, Black Willow, Honey Locust, etc).

Note: Trees listed in the high profile typology may be utilized here but can result in a be smaller tree if minimal soil volume is not reached.



Low Profile Street Trees

Function: Provide shade and seasonal interest. Emphasize the pedestrian scale and encourage vehicular traffic to slow down i.e., (Mexican Plum, Desert Willow, Kidneywood, Mexican Buckeye, etc).

Form: Medium trees that have more seasonal characteristics.

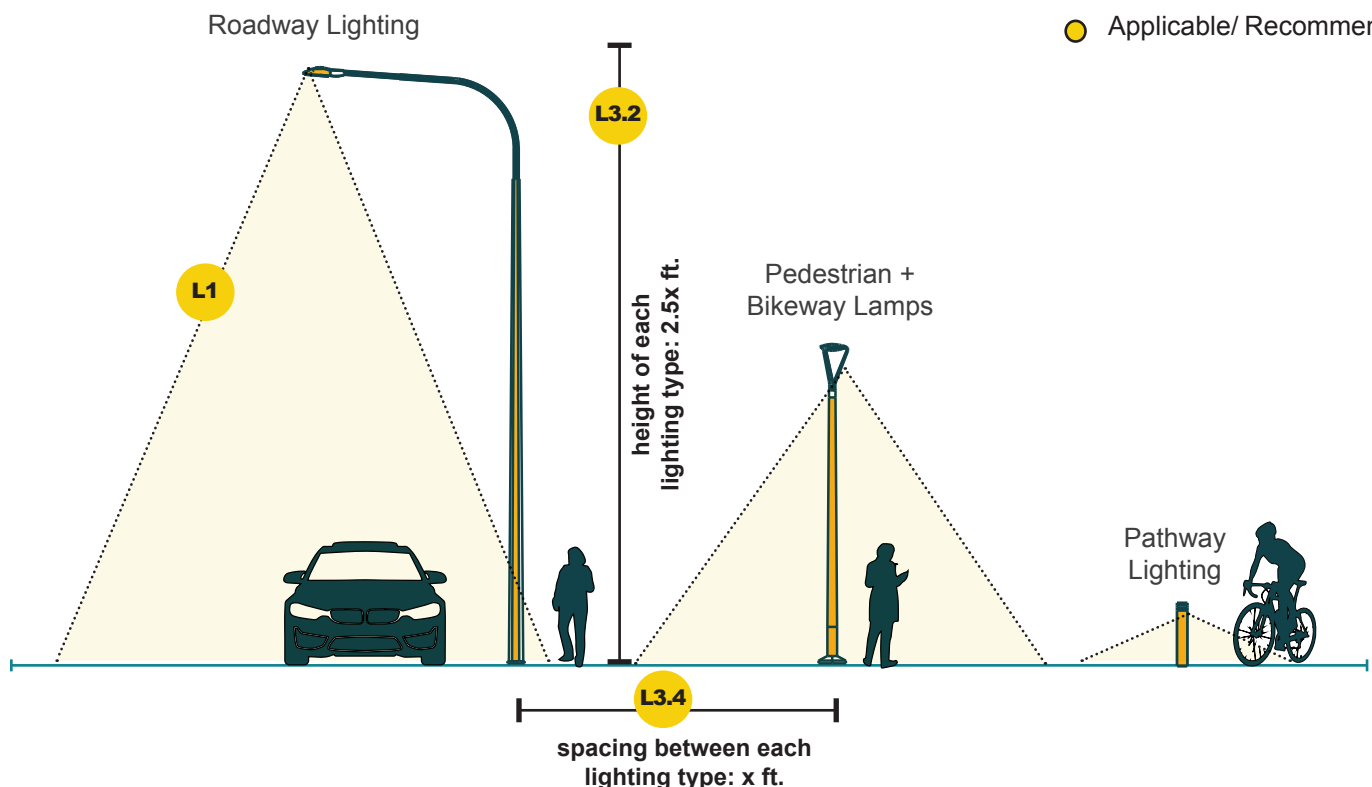
Lighting

Placemaking Components

Lighting as part of placemaking refers to illumination along streets to enhance visibility in transportation systems, especially at night or under low-visibility conditions. Proper lighting design can significantly reduce accidents, improve driving comfort, and support pedestrian and cyclist safety. Incorporating lighting into bike facility planning in San Antonio is essential for ensuring the safety, accessibility, and usability of the city's growing network of bicycle lanes and trails. As San Antonio aims to become a more bike-friendly city, thoughtful lighting design plays a key role in supporting cyclists, especially during evening hours or early mornings. There are three key types of lighting features that should be explored to ensure lighting levels are appropriately designed and placed for, not only cars, but cyclists and pedestrians. Each mode requires a different lighting feature, scaled to fit the mode and speed of travel.

Street Type	Lighting Types/ Features		
Functional classification	Roadway Lighting	Pedestrian and Bikeway Lamps/	Pathway Lighting
Primary Arterial	●	●	
Secondary Arterial	●	●	●
Collector A/B	●	●	●
Collector C	●	●	●
Local A/B	●	●	●
Local C	●	●	●

- Most Applicable/ Preferred
- Applicable/ Recommended



Lighting Application

L1

General Notes:

1. Brighting and sizing of lighting elements should reflect the intensity of use in the public realm.
2. Appropriately match light levels to usage zones, time and vehicular/pedestrian traffic with the added goal of energy efficiency and long-term sustainability. Lighting should not interfere with residential buildings. Transition lighting intensity between residential areas, 9-5 office parks and high-intensity commercial zones.
3. Provide LED, dark sky lighting or low energy lighting that create true color rendering and reduce light pollution should be used. Avoid uplighting that is not ground mounted and exposed bulbs or “drop” lenses.
4. Mercury vapor, low-pressure sodium, high-pressure sodium and metal halide lighting should not be used.
5. Use smart technology (sensors for dimming, cameras, solar panels, noise detection) where possible to provide a sense of security and long term cost savings on energy.

L2

Roadway Lighting: Roadway lighting in this case refers to illumination levels geared towards vehicles. Roadway lighting typically focuses on providing long-range visibility to accommodate high-speed traffic and intersections. Tall poles with wide beam spread are common. Refer to the [City of San Antonio 2017 Design Guide Manual](#) and the [2019 Urban Lighting Master Plan](#) for detailed foot candle and spacing specifications.

L3

Bicycle and Pedestrian Lamps: Bicycle and pedestrian lighting or street lamps refer to illumination on urban streets, areas with slower-moving modes like cycling and walking and within the right-of-way. Bicycle lamps can be paired with roadway lighting and often uses lower mounting heights and narrower beam angles. Below are additional applications. Refer to [City of San Antonio 2017 Design Guide Manual](#) and the [2019 Urban Lighting](#)

[Master Plan](#) for detailed standards and approaches.

1. Bicycle and pedestrian lamps provide higher-intensity lighting for both cyclists and pedestrian over pathway lighting, ensuring visibility over a larger area, especially in busy traffic zones and intersections.
2. Use a consistent illumination of at least one foot-candle and spacing that is 2.5-3X the height of poles. Features should consider lower-height poles and softer light to avoid glare. However, brighter lighting should be provided at intersections and road crossings where visibility is most critical.
3. Ensure lighting is full cut-off with a consistent, familiar color temperature of 2500K-4500K throughout the public realm (the average foot candle reading along a given corridor shall be no less than one half of a foot candle [0.5 fc]).
4. Space lighting poles evenly between trees and in line with other utilities as to not obstruct bike paths and sidewalks. Hanging light fixtures should face bike paths.

Pathway Lighting: Pathway lighting refers to illumination systems specifically designed in enhancing visibility and safety for cyclists and pedestrians on dedicated biking and walking paths. This type of feature is primarily used along trails and parks. In this case, pathway lighting refers to bollard-height poles or in-ground lighting that may be interchanged with pedestrian and bicycle lamps and/ or roadway lighting particularly in lower density areas. When possible, lamps should be used along roadways. Ped/bike lamps are taller and provide brighter, more widespread illumination, while pathway lighting is often lower and more focused on a smaller, specific area. Below are additional criteria to consider when applying pathway lighting. For more information and detailed specifications, refer to [City of San Antonio 2017 Design Guide Manual](#) and the [2019 Urban Lighting Master Plan](#).

1. Pathway lighting is designed to minimize light pollution and environmental disruption, making them more discreet in natural settings.
2. Pathway lighting should be used when bike routes are placed behind the curb and are raised facilities adjacent to walking paths.

Lighting

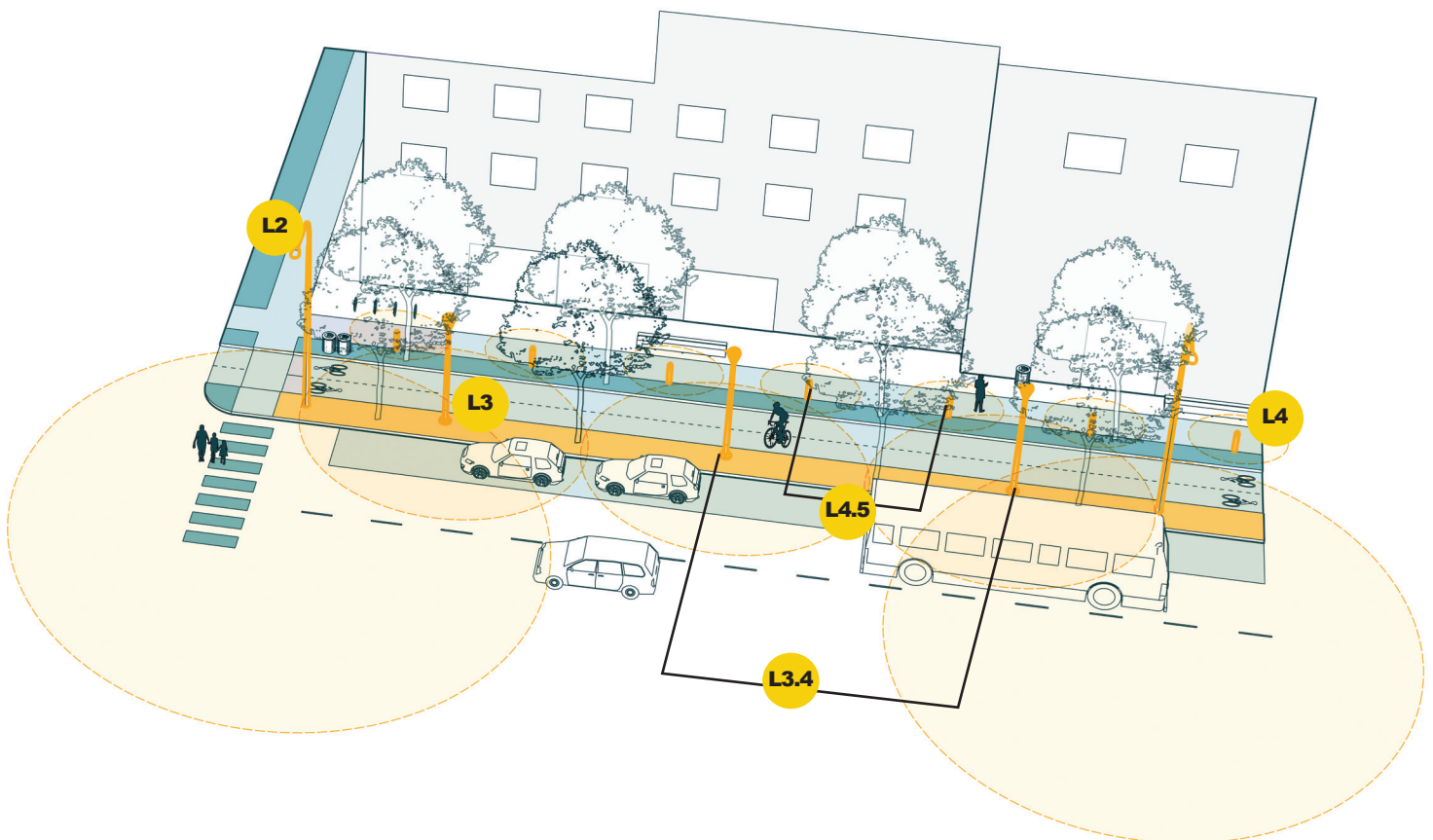
Placemaking Components

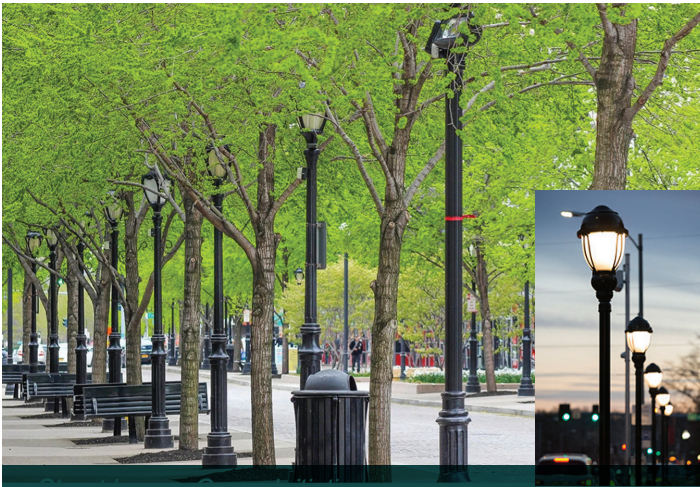
Lighting Application continued

- L4** If used within the roadway, use bollards or other delineators rather than pathway lighting to safely separate bike routes from vehicles (See stop bollards in the 'Transit Amenities' section TA3).
- 3. Pathway lighting maybe used to separate walking paths from bike routes as either in-ground or bollard-height poles.
- 4. It is encouraged to utilize solar-powered LED fixtures when designating pathway lights or lamps.
- 5. Place pathway lights no more than 2 feet from the edges of pathways and ideally 6- to 8 feet apart.

Lighting Benefits

- A** **Navigation:** Lighting can support people navigating places more easily. Well-lit paths, signage, and landmarks help users become oriented in an unknown or intricate space.
- B** **Safety:** Dark areas may attract crime and accidents. On the flip side, illuminating spaces improves visibility and security, thereby reducing these risks and making an area feel more safe and secure.
- C** **Extended Usability:** Lighting enables public spaces to be used in the hours of darkness. By extending the hours for people to socialize and explore, the overall vibrancy and utility of public spaces will be improved before and after daylight.
- D** **Accessibility:** Illuminated spaces contributes to a user-friendly environment for all abilities. Lighting improves navigability not only for those during the night time, but also for users with visual impairments.





Infrastructure, Ontario, CA



*Delmar Blvd. street lamps adjacent to roadway lights
St. Louis, MO*



*Street lamps and accent path lighting, Baton Rouge
Greenway, LA*



*Roadway and street lamps, Rua da Pêga
Redevelopment, Portugal*



Shared use trail, Meridian Ave., Miami, FL



Solar cat eyes, in-ground lighting, France

