

# STREET DESIGN GUIDE

DRAFT



CITY OF PASADENA

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## Table of Contents

<b>1</b>	<b>Introduction</b> .....	<b>1-1</b>
<b>2</b>	<b>Form-Based Framework</b> .....	<b>2-1</b>
	Function.....	2-2
	Context.....	2-4
	Modal Emphasis Overlays .....	2-6
	Challenges and Risks.....	2-8
<b>3</b>	<b>Cross-Section Dimensions</b> .....	<b>3-1</b>
	Vehicle Travel Lane Width .....	3-5
	Bike Facilities.....	3-6
	On-Street Parking.....	3-7
	Sidewalk Clear Walk Zone.....	3-8
	Landscaping Elements.....	3-9
	Challenges and Risks.....	3-11
<b>4</b>	<b>Access Management</b> .....	<b>4-1</b>
	Turning Movement Organization (Medians) .....	4-1
	Secondary Street Access.....	4-2
	Driveway Design.....	4-3
	Safer Multimodal Access .....	4-4
	Challenges and Risks.....	4-5
<b>5</b>	<b>Uses of the Access Zone</b> .....	<b>5-1</b>
	Angle Parking.....	5-1
	Bike Corrals.....	5-2
	Bike-Share Stations .....	5-3
	Parklet.....	5-4
	Curb Extensions .....	5-4
	Open Streets .....	5-5
<b>6</b>	<b>Transit Facilities</b> .....	<b>6-1</b>
	Bus Loading Zone.....	6-1
	Passenger Waiting Area.....	6-2
	Guidance for Implementing Optimal Transit Facilities.....	6-5
	Bus Priority Treatments .....	6-6

**7 Speed Management .....7-1**  
Access Streets ..... 7-1  
Connector-City and Connector-Neighborhood Streets..... 7-2

**8 Intersection Design.....8-1**  
Curb Radius ..... 8-1  
Sight Triangle..... 8-1  
Pedestrian Crossings..... 8-2  
Curb Ramp Placement..... 8-4

**9 Process .....9-1**

**10 Tradeoffs.....10-1**  
Standard Cross Sections .....10-3  
End Notes.....10-9

## Table of Figures

Figure 2-1	Street Function Hierarchy.....	2-2
Figure 2-2	Pasadena Streets by Function, Adopted Mobility Element (2015).....	2-3
Figure 2-3	Observed Street Contexts .....	2-5
Figure 2-4	Examples of Pasadena Street Types.....	2-6
Figure 2-5	Modal Emphasis Overlays .....	2-9
Figure 3-1	Zones of the Street.....	3-2
Figure 3-2	Cross Section Dimensions for Connector-City Streets.....	3-3
Figure 3-3	Cross-Section Dimensions for COnnector-Neighborhood Streets.....	3-3
Figure 3-4	Cross Section Dimensions for Access Streets .....	3-4
Figure 3-5	Curb-Side Buffered Bike Lane .....	3-6
Figure 3-6	7 Foot Parking Lane for Traffic Calming .....	3-7
Figure 3-7	Clear Walk Zone .....	3-9
Figure 3-8	Green Infrastructure.....	3-10
Figure 4-1	Access Management Through Secondary Access.....	4-3
Figure 4-2	Curb Return (left) and Dustpan (right) driveways.....	4-4
Figure 4-3	Green Paint Perpendicular to Driveway.....	4-4
Figure 5-1	Reverse Angle Parking Used to Take up Space in the Right of Way.....	5-1
Figure 5-2	Typical Dimensions of Reverse Angle Parking.....	5-2
Figure 5-3	Bike Corral with Wheel Stop.....	5-3
Figure 5-4	LA Metro Bike Share Station.....	5-3
Figure 5-5	Parklet with Wheel stop and bollard .....	5-4
Figure 5-6	Curb Extension .....	5-4
Figure 5-7	Painted Curb Extension .....	5-5
Figure 5-8	Ciclavia - Open Streets Event.....	5-5
Figure 6-1	Bus Zone Lengths .....	6-1
Figure 6-2	Stop Hierarchy: Minimum Recommended Passenger Amenities by Stop Type.....	6-3
Figure 6-3	Typical Bus Stop Layout (Front Placement Shelter) .....	6-5
Figure 6-4	Typical Bus Stop Layout (Bench).....	6-5

Figure 7-1 Neighborhood Traffic Management Strategies..... 7-1

Figure 8-1 Sight Distance Triangle Usage ..... 8-2

Figure 8-2 Curb Extension (Right) and Sidewalk Extension (Left) to  
Accommodate Directional Curb Ramps..... 8-5

Figure 9-1 Street Design Process ..... 9-1

Figure 10-1 Standard 56-Foot Cross Section for Urban Contexts..... 10-4

Figure 10-2 Standard 56-Foot Cross Section for Suburban Contexts..... 10-4

Figure 10-3 Alternative 56-Foot Cross Section – Non-Buffered Bike Lanes  
(Connector-Neighborhood Only)..... 10-5

Figure 10-4 Alternative 56-Foot Roadway Section – No Bike Facilities ..... 10-5

Figure 10-5 Standard 60-Foot Cross Section for Urban Contexts..... 10-7

Figure 10-6 Standard 60-Foot Cross Section for Suburban Contexts..... 10-7

Figure 10-7 Alternative Cross Section with Sidewalk Extensions for Urban  
Contexts..... 10-8

Figure 10-8 Alternative 60-Foot Roadway Section – No Bike Facilities ..... 10-8



## 1 INTRODUCTION

In 2015 the City of Pasadena adopted an updated Mobility Element of the City’s General Plan. The updated Mobility Element includes new goals and objectives, which address complete streets:

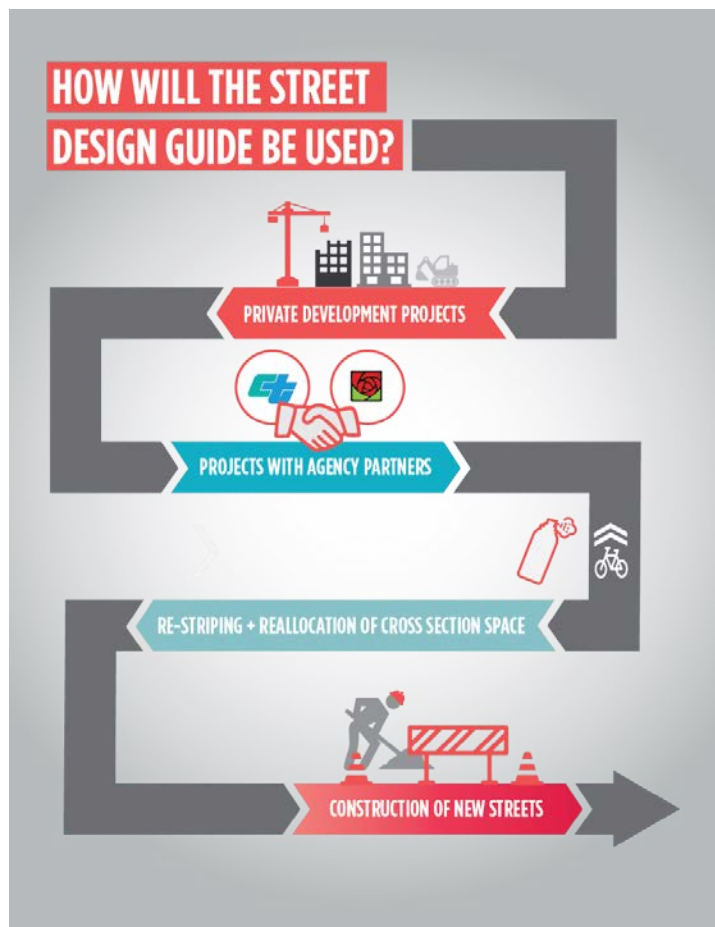
- *Streets should reflect neighborhood character and accommodate all users*
- *Complete Streets: Streets should accommodate all users such as pedestrians, bicyclists, public transit, skateboarders and scooters.*
- *Streets should reflect individual neighborhood character and needs, and support healthy activities such as walking and bicycling.*

This Street Design Guide is the implementation mechanism of the City of Pasadena’s complete streets policy.

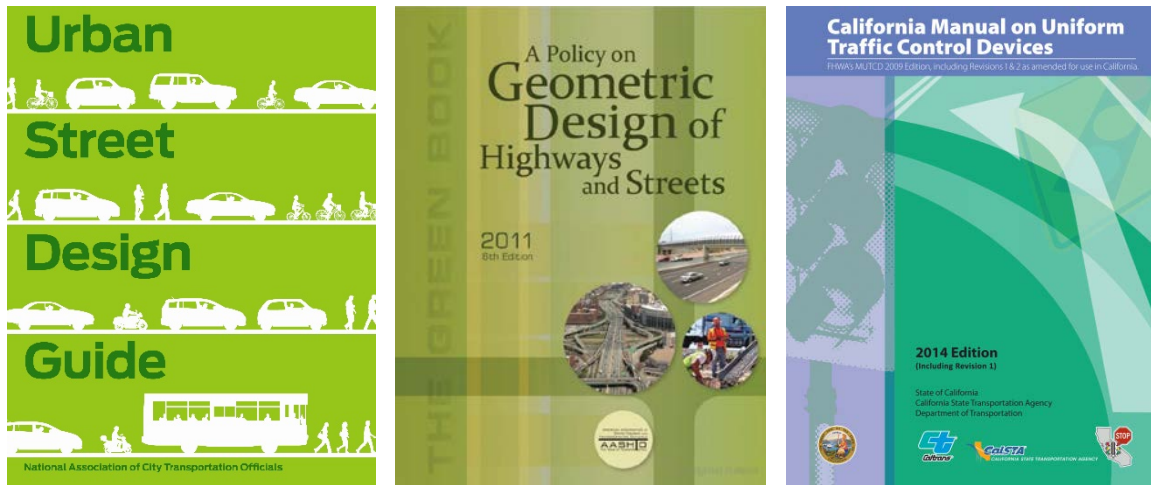
Currently standards and ordinances associated with the design of streets are housed within existing municipal code and different City departments such as Transportation, Public Works, and Planning. In addition, some of the City’s common practices in the design of streets are not documented anywhere. This manual has gathered and reconciled existing policies and best practices to create a set of guidelines in support of the Mobility Element.

### Who should use the Street Design Guide?

The Street Design Guide has been developed primarily for use by city staff. However, it is also intended as a resource for policymakers, developers, and the public and thus every attempt has been made for the content to be clear and understandable. The Street Design Guide is organized to enable predictable, consistent, and collaborative design decisions.



## Supporting Documents



The development of these guidelines builds on national research, National and State engineering standards, and best practices. Recently, the National Association of City Transportation Officials (NACTO) released the Urban Street Design Guide and the Urban Bikeways Design Guide which provides an overview of the ways in which major cities are using street design to make their communities safe and inviting for people to get around in an urban context. The California Department of Transportation (Caltrans) endorsed the NACTO design guides in 2014 and to the maximum extent possible; the principles and approach of these documents are reflected in the Pasadena guidelines.<sup>1</sup>

Other national standards, such as the Geometric Design of Highways and Streets published by the American Association of State Highway and Transportation Officials (AASHTO), and the California Manual for Uniform Traffic Control Devices (MUTCD) provide support and precedent for the processes and design elements covered in this guide.

While these precedent documents help to ground the recommended practices, the topics included in the Pasadena guidelines are tailored to the unique needs and existing conditions in the City of Pasadena. The guidelines build upon local policies and documents throughout, such as:

- Policies and Procedures for Driveway Design, 2015
- Neighborhood Traffic Management Program Community Handbook, 2004
- Best Practices in Arterial Speed Management, 2009
- City of Pasadena Adopted Resolution 19 Approving Green Streets Policy
- Bicycle Transportation Action Plan, 2015
- City of Pasadena Pedestrian Crossing Treatment Guidance, 2016

In addition to pedestrians, cyclists, motorists, and public transit users, streets provide access for emergency services. Public safety is an imperative for Pasadena, which the strategies in this design guide seek to support by providing design cues to prevent conflict between users of the street. Likewise, the design of streets must comply with the City Fire Code

## 2 FORM-BASED FRAMEWORK

The approach to street design described in this guide – the form-based approach – simply involves designing the form of the street to meet the use and character you intend for it. While this idea seems simple, that is not always how streets are designed. More often, the design is driven by national standards – unrelated to the local context – and by counts of cars that happen to be using that street at a given time. The form-based approach is more intentional and holistic.

This holistic approach to street design takes into account the differing conditions and contexts of each street in Pasadena. Streets with different surrounding land uses, constraints, and significance for modes of transportation each require design considerations and treatments unique to those circumstances. The plans and aspirations of the community for the character of the street and adjacent land will also be factored in. This guide describes a system for classifying Pasadena's streets based on three components (presented in more detail in the following sections): Function, Context, and Modal Emphasis Overlays.

Function and Context jointly define the street typology, while Overlays may indicate special design or management of the street. This design guide should be used to first identify the Function, Context, and Overlay of a particular street segment, and then to apply the applicable guidelines that pertain to that street typology.



## FUNCTION

Street Function defines the design of the cartway (or the area between two curbs) for mobility and access. There are four categories of street function defined in the Mobility Element:

- **Connector-City** streets serve “crosstown” trips connecting neighborhoods or districts and destinations in the City that are not in close proximity. Examples include Walnut and Orange Grove.
- **Connector-Neighborhood** streets connect neighborhoods and districts in Pasadena that are adjacent or in close proximity to each other. Examples include Linda Vista, Wilson, and Glenarm.
- **Access Streets** are primarily local destination-serving streets (these make up the majority of streets in Pasadena). Access Streets are wide enough that two cars can pass in opposite directions without having to yield.
- **Access-Yield** streets require passing vehicles to yield to one-another.
- **Access-Alleys** are streets that provide access predominantly to the rear of adjacent buildings for service purposes such as parking access, delivery, and trash collection. They typically do not provide the most desirable route for pedestrians, bicycles, private automobiles or trucks except when directly accessing a destination on that street.
- **Access-Shared** are shared streets, such as Mercantile Alley, where the street is designed to intentionally mix bike, pedestrian, delivery, and local vehicular traffic in the same right-of-way in a shared condition in which bicycles and vehicles travel at low speed and yield to pedestrians.

FIGURE 2-1 STREET FUNCTION HIERARCHY

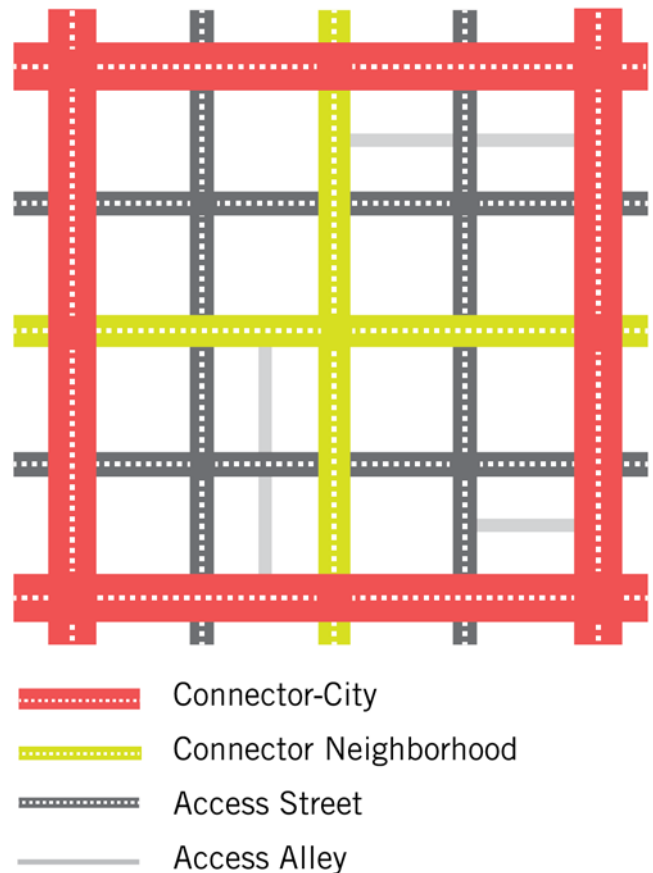
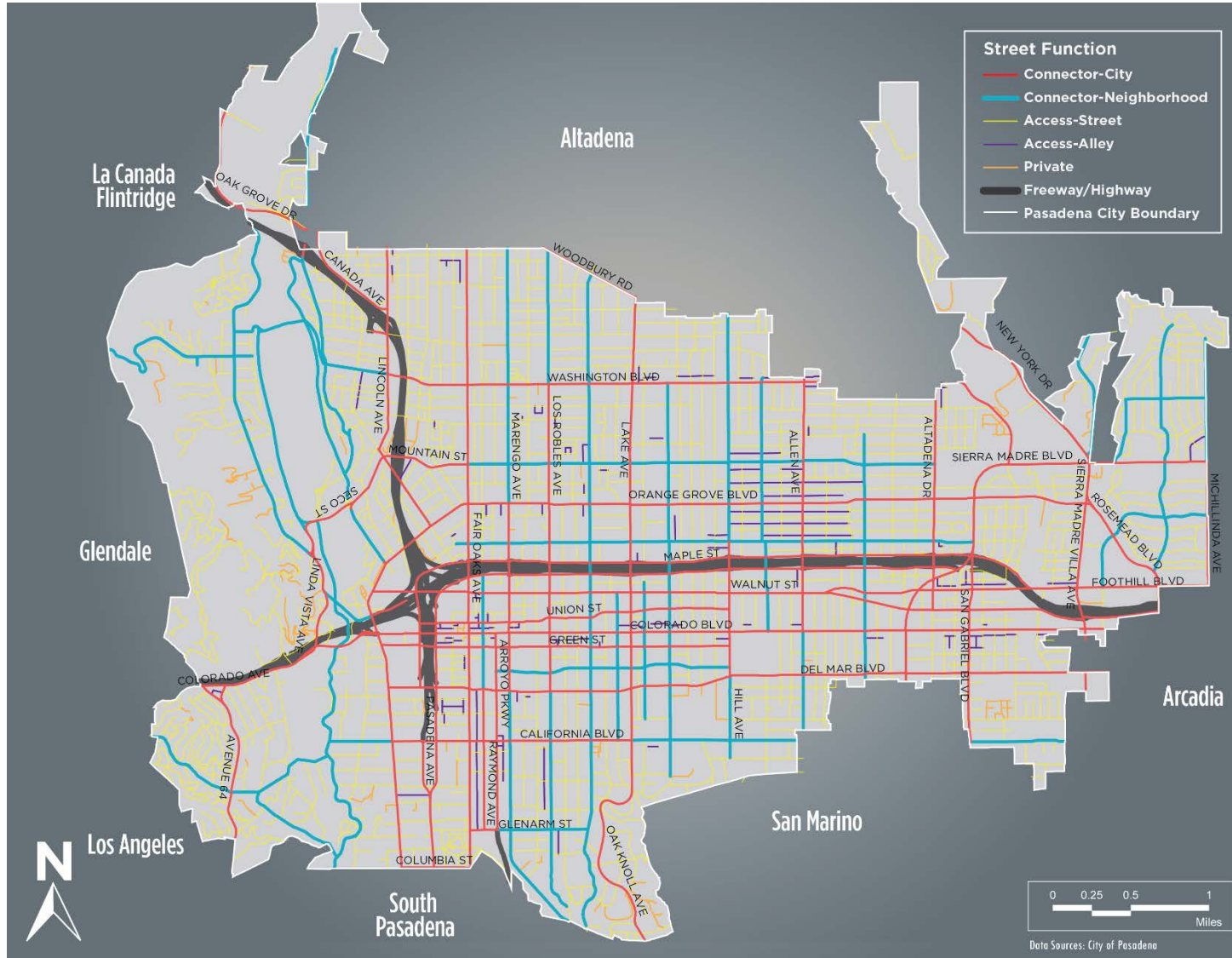


FIGURE 2-2 PASADENA STREETS BY FUNCTION, ADOPTED MOBILITY ELEMENT (2015)



## CONTEXT

Context describes the character of each street in terms of building form and land use. Context informs the design of the space between the building and the edge of the curb (see Figure 3-1). Pasadena's existing streets and corridors can be classified using five primary Context types. The first four of these are defined primarily by predominant ground floor use and urban or suburban design character:

- Commercial / Urban (setbacks less than 10 feet) – This context is typified by buildings oriented directly to the street and a fine-grained mix of uses. As the name implies, this will generally have retail or commercial uses on the ground floor. Examples include Lake Avenue between California Boulevard and Walnut Street and most of Colorado Boulevard west of Hill Street.
- Commercial / Suburban (setbacks greater than 10 feet) – The forms of this context are those more typical to suburban areas and may include parking in front of or beside the commercial building. The buildings are often also a single land use. Examples streets of this context type include, Foothill Boulevard east of Sierra Madre Villa Avenue and Colorado Boulevard east of San Gabriel Boulevard and Colorado Boulevard east of Hill Avenue.
- Residential / Urban (setbacks less than 20 feet) – The forms of buildings on these streets are similar to those described in Commercial/Urban, but in this case the ground floor use is typically residential rather than commercial. Examples include Cordova Street between Arroyo Parkway and Hill Avenue and De Lacey Avenue between Del Mar Boulevard and Dayton Street.
- Residential / Suburban (setbacks greater than 20 feet) – In Pasadena, this context relates predominantly to the City's single-family neighborhoods. It is typified by houses with front yards. Properties may or may not have driveways accessing off-street parking. Examples include Orange Grove Boulevard South of the 134 Freeway, and El Molino Avenue north of the 210 Freeway.
- Green Edge Drive – This context predominately describes streets adjacent to Open Space on one side. Examples include Arroyo Boulevard and New York Drive.

Figure 2-3 serves as a reference and starting point, mapping observed existing street contexts in Pasadena, and Figure 2-4 shows existing examples of the four primary street contexts in Pasadena. It is expected that parts of the City will evolve over time, whether based on the implementation of a new or existing Specific Plan, or a new development proposal. As such, this map too is expected to evolve. However, more important than the future mapping and remapping of specific street contexts, is the understanding of the linkage between the contexts described here - whether the predominant ground-floor use is Residential or Commercial, and whether those uses are Urban, or Suburban in character - and the appropriate street design response. This factor, more than any other, will help determine the suitable type(s) of pedestrian design elements, appropriate parking configurations and landscaping required from curb to building edge, as described in the sections to follow.

A more extensive review of existing contexts can be found in Appendix A.

FIGURE 2-3 OBSERVED STREET CONTEXTS

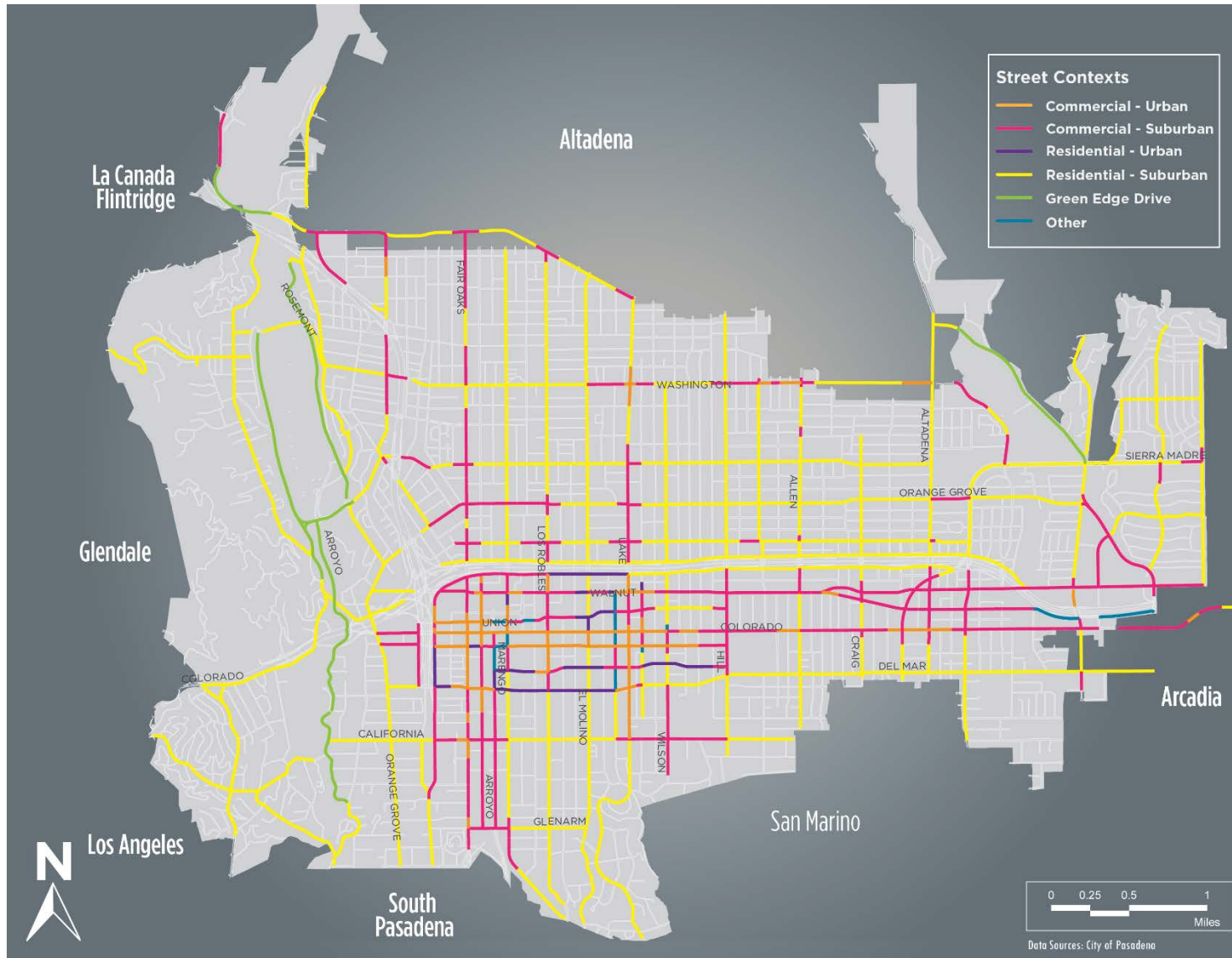




FIGURE 2-4 EXAMPLES OF PASADENA STREET TYPES



Commercial/Urban  
Lake Ave between California Blvd & Del Mar Blvd



Residential/Urban  
De Lacey Ave between Valley St & Dayton St



Commercial/Suburban  
East Foothill Blvd between Sierra Madre Villa Ave & Halstead



Residential/Suburban  
South Orange Grove Blvd between Del Mar Blvd & Waverly Dr

## MODAL EMPHASIS OVERLAYS

A primary challenge in the design of streets is that there is often simply not enough space to do all of the things a community would like to do. We might want a street to have ample sidewalks, beautiful trees, convenient on-street parking, bike lanes and plenty of driving lanes to alleviate congestion. Lacking any clear guidance, this dilemma of wanting more elements than the corridor can hold often leads designers simply to fall back to the status quo and avoid change out of frustration.

A modal emphasis overlay identifies a special condition that can help to reconcile tradeoffs in corridors. Where space is limited, or where there are opportunities to repurpose extra space, the modal emphasis can indicate which elements should be prioritized. Figure 2-5 maps overlays for bicycles, transit, and freight and describes where the emphasized mode may require additional space.



**Bikes** - Pasadena's Bicycle Transportation Action Plan (2015) includes a range of bike facilities, defined below:



- Roseways are low-speed, low-traffic-volume neighborhood streets where people of all ages/abilities can comfortably bicycle and use other forms of active transportation. Roseways incorporate elements of Class III Bike Routes<sup>1</sup> (on-road shared-lane signed bicycle routes) such as sharrows and wayfinding signage to make route finding easy
- Greenways include Class III Bike Route treatments that cumulatively result in a “Bicycle Boulevard”. The treatments associated with a bicycle boulevard will accomplish the following:
  - Provide preferential treatment for cyclists.
  - Minimize the number of stop signs facing bicyclists.
  - Slow the speeds or reduce the volume of motor vehicles.
  - Ease the passage of cyclists through barriers such as busy streets or physical obstructions.
- Bike Lanes, Class II facilities, are on-road and include striping to delineate dedicated space for cyclists separate from motorists. Bike lanes may or may not include a buffer.
- Cycle Tracks are Class IV facilities similar to Bike Lanes in that a designated portion of the roadway is dedicated for cyclists. Cycle Tracks differ from buffered bike lanes in that the bicyclist is separated from the travel lanes by a physical barrier.

For the purpose of this street design guide, bicycle emphasis corridors are limited to streets that have, or are planned to have, facilities that require dedicated space in the roadway: bike lanes and cycle tracks. Pasadena’s Roseways and Greenways are streets that include multiple modes in the same travel lane and thus do not present the need to prioritize space in the right-of-way for one mode or another. For this reason, the Modal Emphasis map does not include Roseways and Greenways. It should be noted that as Pasadena’s Bicycle Transportation Action Plan is updated over time, the bicycle modal emphasis map may change to include new streets with planned dedicated facilities. For a full list of planned bicycle infrastructure, including Roseways and Greenways, refer to the Bicycle Transportation Action Plan (2015).

**Transit** - The transit overlay is present in corridors where the combined headway of the transit routes serving those corridors is at least every 5 minutes, making it appropriate to design streets with high levels of transit vehicles and transit patrons in mind.

**Conflicts with Freight Overlays** - There are several circumstances in which two modal overlays appear in the same corridor. Bicycle and freight overlap on Sierra Madre Boulevard between I-210 and Del Mar Boulevard as well as on Rosemead Boulevard between Halstead Street and Sierra Madre Boulevard. Transit and Freight overlap on Foothill Boulevard between San Gabriel Boulevard and Rosemead Boulevard and on Fair Oaks Avenue between Washington Boulevard and Columbia Street. In these cases, bike and transit design elements should take priority over freight due to the vulnerability of those system users.

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<sup>1</sup> For more information on the Caltrans classification of bike facilities, refer to Chapter 1000 of the Highway Design Manual (2015). <http://www.dot.ca.gov/hq/oppd/hdm/pdf/english/chp1000.pdf>

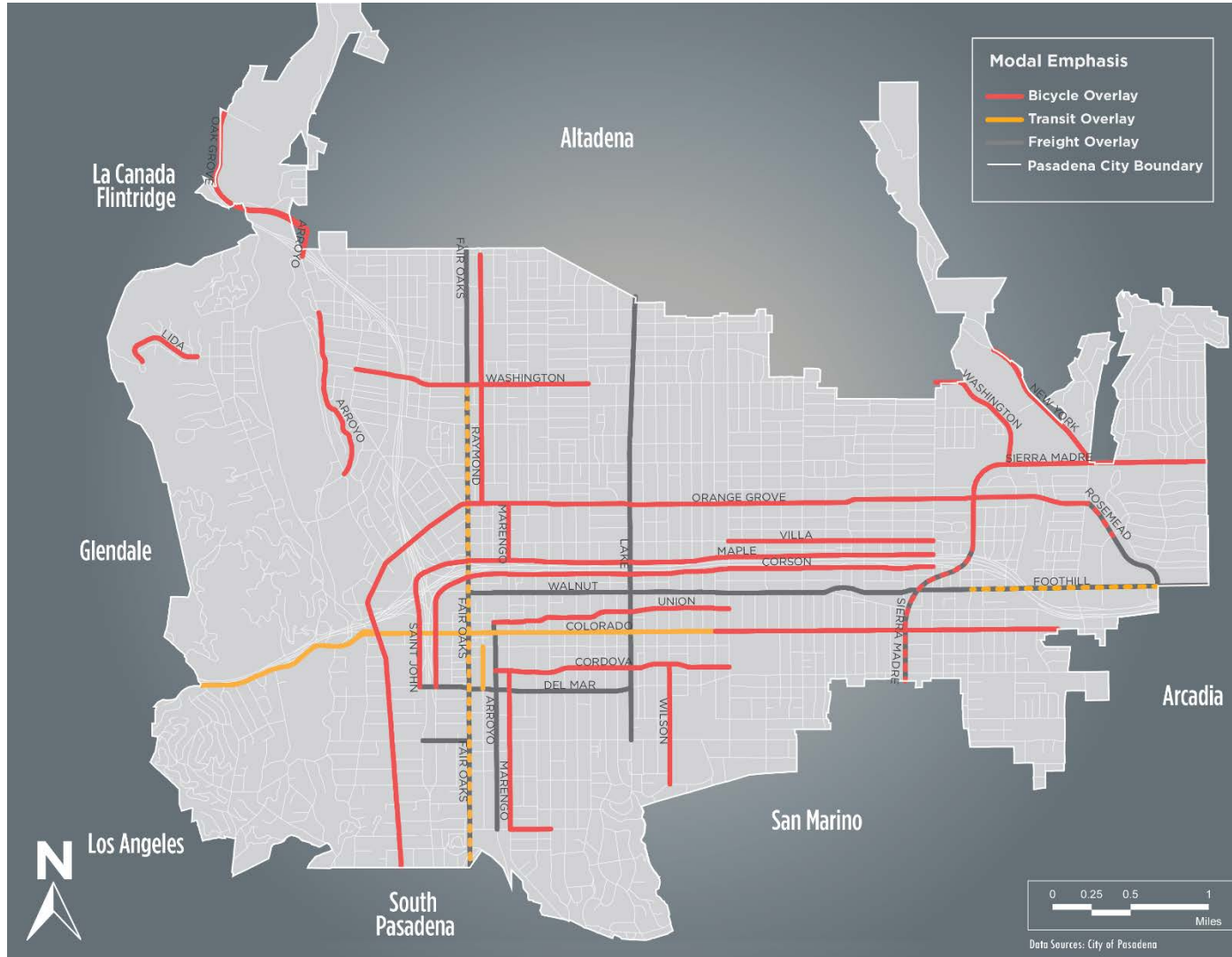
## CHALLENGES AND RISKS

While these systems appear to be straightforward, gaining community consensus on the elements can be challenging:

Context - As some residential communities begin to transition from longtime residents to new residents, opinions about the ideal community character can begin to transform. There are often periods of time when residents who (for example) want a transition to a more urban context are relatively evenly balanced with those who want to preserve an existing suburban context. It may take time for a community to come to a consensus position on these ideas and processes should leave time for this community dialog to occur during specific plan processes.

Modal Emphasis Overlays - For Pasadena, these may be evolving maps. The bike and transit networks , in particular, may become more robust over time as more infrastructure is in place and more residents are using the systems. These guidelines are set up to accommodate such changes if they occur.

FIGURE 2-5 MODAL EMPHASIS OVERLAYS



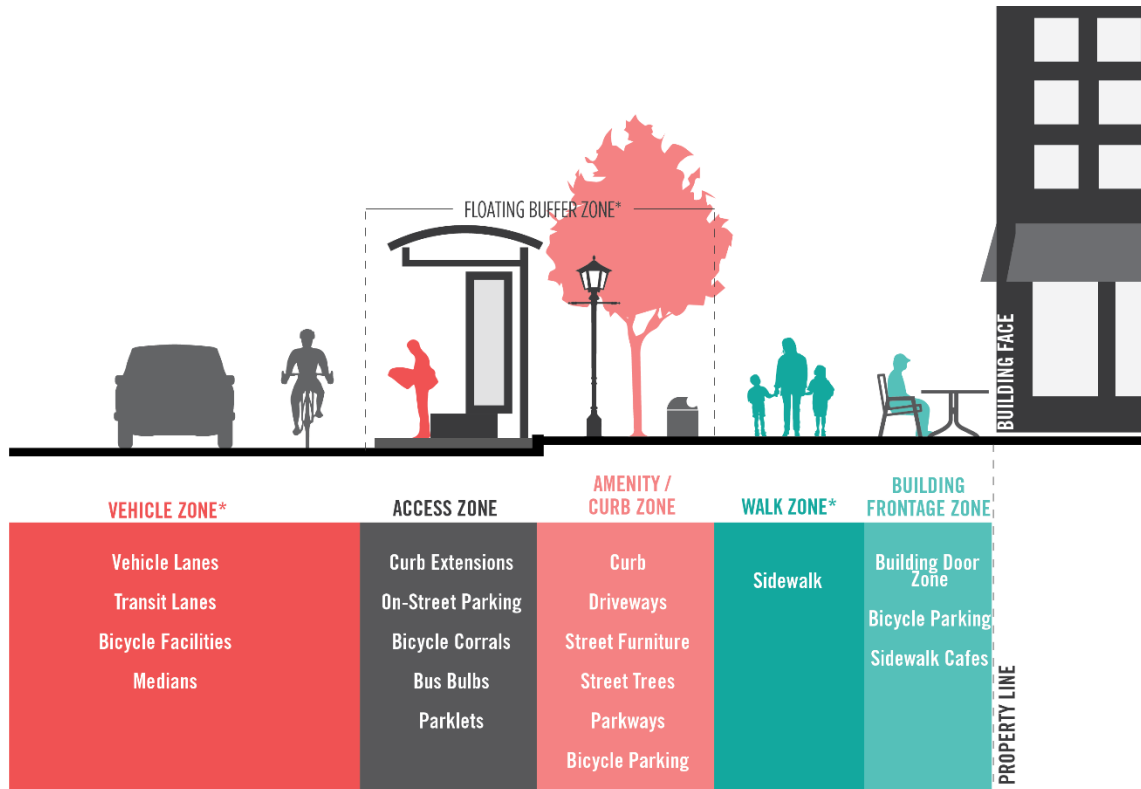
Note: The bicycle overlay shown in the modal emphasis map consists of streets where there are existing or planned bike lanes and cycle tracks. The Bicycle Transportation Action Plan (2015) also includes Roseways and Greenways, streets that will have shared bike facilities.

## 3 CROSS-SECTION DIMENSIONS

Streets seem simple, but can be quite complicated, with sidewalks, trees driving lanes, café dining, transit stops and parking all vying for space within a limited right-of-way. To bring some order to all of these elements and make design discussions easier, the Pasadena design guidelines identify six potential street 'zones' that can make up the right-of-way of the street, described below and depicted in Figure 3-1.

- The **vehicle zone** provides space for moving traffic. This can include cars, bicycles, and buses. The vehicle zone will be present in every street.
- The **buffer zone** is a floating zone that exists as a combination of the access zone and the amenity/curb zone. The buffer zone should be present on every street, but may include elements of only the access zone or amenity/curb zone or both. Buffer zones separate pedestrians from moving traffic and help to foster a safe and comfortable walking environment.
  - The **access zone** includes elements between the curb and the vehicle zone, such as parking spaces and parklets as well as bulbouts at intersections or bus stops. This zone serves stationary uses and makes up part of the buffer zone. The access zone need not be present in every street, but must be present if the amenity/curb zone is 3' or less.
  - The **amenity/curb zone** is located above and adjacent to the curb and provides space for amenities such as lighting, trash receptacles, café dining, bench seating, planters, trees, bicycle racks, etc. This zone makes up part of the buffer zone, and may be limited to 3' if the access zone is present.
- The **walk zone** provides appropriate space for pedestrian traffic to travel without obstruction. It is a sidewalk zone clear of any other elements, and is present in every street.
- The **building frontage zone** complements building uses by serving entryways, or providing space for sidewalk eating or retail spaces. It is within the public right-of-way and immediately adjacent to the building facade, and need not be present in every street.

FIGURE 3-1 ZONES OF THE STREET



\*MANDATORY

The following tables list the recommended dimensions for each zone of the street based on the street typology (function and context). These dimensions are meant to be a guide for typical sections, but may not always be feasible within a given right-of-way. For streets where right of way constraints preclude these dimensions, refer to the tradeoffs section.



FIGURE 3-2 CROSS SECTION DIMENSIONS FOR CONNECTOR-CITY STREETS

Function: Connector-City	Vehicle Zone			Access Zone	Amenity / Curb Zone***	Walk Zone	Building Frontage Zone	Total Sidewalk or Parkway Width
Context	Through / Left Turn Lane	Outside Lane (Maximum)*	Bicycle Lane**	Parking Lane		Clear Walk (Minimum)	(Minimum)	
Urban Commercial	10'	11'	7-9'	7.5'	6-7'	8'	1'	15'-16'
Urban Residential	10'	11'	7-9'	7.5'	6-7'	6'	1'	13'-14'
Suburban Commercial	10'	11'	7-9'	7.5'	3-7'	5'	N/A	8'-12'
Suburban Residential	10'	11'	7-9'	7.5'	3-7'	5'	N/A	8'-12'
Green-Edge Drive	10'	11'	7-9'	7.5'	3-7'	5'	N/A	8'-12'

\*Outside Lane refers to a travel lane that is adjacent to the curb. The outside lane may exceed 11' where severe crowning, depression, or other geometric characteristics are present.

\*\*The 7' bicycle lane includes a 2' buffer on one side; the 9' bicycle lane includes a 2' buffer on both sides.

\*\*\*On Connector-City streets in an urban context, the Amenity / Curb Zone will likely be present. This range represents a 6' planter strip or a 7' transit shelter. More suburban contexts may only have a 3' Amenity / Curb zone for vertical elements such as street lamps if there is a parking lane present.

FIGURE 3-3 CROSS-SECTION DIMENSIONS FOR CONNECTOR-NEIGHBORHOOD STREETS

Function: Connector-Neighborhood	Vehicle Zone			Access Zone	Amenity / Curb Zone***	Walk Zone	Building Frontage Zone	Total Sidewalk or Parkway Width
Context	Through / Left Turn Lane	Outside Lane (Maximum)*	Bicycle Lane**	Parking Lane		Clear Walk (Minimum)	(Minimum)	
Urban Commercial	10'	11'	5-7'	7.5'	3-7'	6'	1'	10'-14'
Urban Residential	10'	11'	5-7'	7.5'	3-7'	6'	1'	10'-14'
Suburban Commercial	10'	11'	5-7'	7.5'	3-7'	5'	N/A	8'-12'
Suburban Residential	10'	11'	5-7'	7.5'	3-7'	5'	N/A	8'-12'
Green-Edge Drive	10'	11'	5-7'	7.5'	3-7'	5'	N/A	8'-12'

\*Outside Lane refers to a travel lane that is adjacent to the curb. The outside lane may exceed 11' where severe crowning, depression, or other geometric characteristics are present.

\*\*The 7' bicycle lane includes a 2' buffer.

\*\*\*Connector-Neighborhood streets may only have a 3' Amenity / Curb zone if there is a parking lane present. If a parking lane is not present, the Amenity / Curb Zone should include a 5' planting zone.

FIGURE 3-4 CROSS SECTION DIMENSIONS FOR ACCESS STREETS

Function: Access	Vehicle Zone			Access Zone	Amenity / Curb Zone***	Walk Zone	Building Frontage Zone	Total Sidewalk or Parkway Width
Context	Through / Left Turn Lane	Outside Lane* (Maximum)	Bicycle Lane	Parking Lane	(Minimum)	Clear Walk (Minimum)	(Minimum)	(Minimum)
Urban Commercial	10'	11'	5-7'	7.5'	3'	5'	1'	9'
Urban Residential	10'	11'	5-7'	7.5'	3'	5'	1'	9'
Suburban Commercial	10'	11'	5-7'	7.5'	3'	5'	N/A	8'
Suburban Residential	10'	11'	5-7'	7.5'	3'	5'	N/A	8'
Green-Edge Drive	10'	11'	5-7'	7.5'	3'	5'	N/A	8'

\*Outside Lane refers to a travel lane that is adjacent to the curb. The outside lane may exceed 11' where severe crowning, depression, or other geometric characteristics are present.

\*\*The 7' bicycle lane includes a 2' buffer.

\*\*\*Amenity/Curb zone is not required for hillside streets if a parking lane is present.

## VEHICLE TRAVEL LANE WIDTH

Citywide, through lanes should be 10 feet wide, regardless of the context or function. Outside lanes should be 11 feet wide, particularly on streets that have significant transit service. The dimension of the outside lane is defined as the space between the curb face and the center of the painted line (including the gutter pan), as motorized vehicles are not impacted by minor tactile differences in the roadway surface. Note that the gutter pan should not be included in the measurement of bicycle lane widths (discussed later in this document), as tactile differences in the roadway may be hazardous to bicyclists. In some cases, the geometry of a roadway impacted by severe crowning or depression may require an outside lane that is wider than 11 feet.

The width of a lane will influence driving speeds, as wider lanes encourage higher travel speeds than narrower lanes. These dimensional guidelines are intended to support a goal to design all streets for operating speeds not to exceed those listed by the street function, detailed below. <sup>ii</sup>

- Connector-City operating speed: less than or equal to 35 mph
- Connector-Neighborhood operating speed: less than or equal to 25 mph
- Access Street operating speed: less than or equal to 25 mph

Currently, Pasadena has streets with posted speed limits that are higher than the goals described above. Posted speed limits on these streets should be lowered when changes to the street, such as lane narrowing, are implemented, so that the operating speed is also reduced. One exception to these citywide speed maximums is New York Drive between Altadena Drive and Sierra Madre Boulevard, which currently has a posted speed limit of 50 mph. Unless there is a community planning process in the future that decides otherwise, this street is exempt from the guidance above.

### Case Study: Knox Street, Dallas, TX

Knox Street, a 4-lane auto-dominated street was temporarily converted to a 2-lane complete street through the installation of a 2-way cycle track and center turn lane. Vehicle lane widths were narrowed from 12' to 10'. During the demonstration project, vehicle speeds were reduced by between 2 and 7 MPH on segments where the road diet was installed.



*Photo courtesy of the Better Block*

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<sup>ii</sup> Design Speed, as defined by AASHTO is related to the geometric characteristics of the roadway. This design guide refers to design for "operating speeds" of 35 mph or less. Design for operating speed primarily refers to tools and design elements that can be used to cue drivers of an appropriate travel speed. It does not refer to altering the "Design Speed" of the roadway as defined by the AASHTO Green Book.

## BIKE FACILITIES

Buffered bicycle lanes, or other bicycle facilities offering an enhanced level of comfort and safety, are an important tool in creating a bicycle network that meets the needs and demands of cyclists of all abilities from young novices, to casual cyclists, experienced riders and cautious older bikers.

City of Pasadena's adopted Bicycle Transportation Action Plan (2015) identifies a series of projects for implementing bicycle infrastructure in Pasadena. These projects included buffered bike lanes and cycle tracks, and bike routes (referred to as Bicycle Boulevards/Roseways). The following are design guidelines for bicycle facilities that require a dedicated portion of the right of way (as opposed to shared facilities such as Bicycle Boulevards and Roseways, which are recommended for specific streets in the Bicycle Transportation Action Plan). These design guidelines are developed based on national best practices and the dimensions and characteristics defined for those projects in the Bicycle Transportation Action Plan:

- On-street bicycle facilities should have a buffer.
- If a bicycle lane is adjacent to on-street parking, a 2-foot buffer is desirable on both sides of the bicycle lane.
- If there is only space for one 2-foot buffer, the following should be taken into consideration in determining which side of the bicycle lane the buffer will provide the most safety and comfort to cyclists:
  - Occupancy and turnover of adjacent parking lane which present more instances of open-door conflicts with cyclists.
  - Speed and volume of adjacent travel lane which may cause cyclists to feel uncomfortable.
  - In general, bicycle lanes in residential contexts should have a buffer adjacent to the travel lane, and bicycle lanes in commercial contexts should have a buffer adjacent to the parking lane.
  - The buffer width should not be distributed as 1-foot on each side of the bicycle lane.
- Dimensions should include 5 feet of bike travel lane and a 2-foot buffer. The gutter pan shall not be included in the width of the bicycle travel lane.
  - Vertical elements that visually reinforce the function of the buffer may be used where higher vehicular speeds are likely and vertical elements would not unduly compromise access to driveways or parking.
- If space is constrained, a 5-foot non-buffered bicycle lane is acceptable. A 4-foot non-buffered bicycle lane is only acceptable if there is a gutter pan adjacent to the bicycle lane.
- A four-foot non-buffered bicycle lane shall never be placed adjacent to on-street parking.
- A bike lane may be placed between the curb and the parking lane when space is available to buffer the car door zone (see Figure 3-5). Design of these facilities must include ensuring visibility of cyclists at

FIGURE 3-5 CURB-SIDE BUFFERED BIKE LANE



intersections. In considering this design, the number of driveways on the street should be taken into account, since these present additional challenges for ensuring visibility of cyclists to entering and existing vehicles.

- There are a series of intersection treatments available for bicycle facilities, including painted markings to heighten driver awareness of cyclists, and two-stage turn queue boxes to reduce conflict between left-turning cyclists and vehicles.

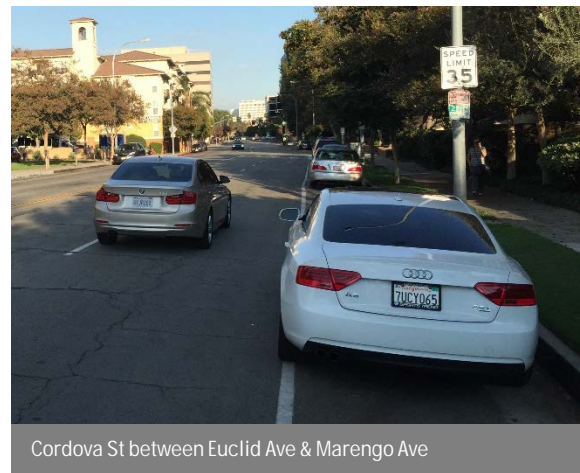
The NACTO Urban Bikeway Design Guide, California MUTCD, and the Pasadena Bicycle Transportation Action Plan should be referenced for more detail on approved design guidance for specific facilities (dedicated and shared) and intersection treatments.

## ON-STREET PARKING

The target width for on-street parking should be 7.5 feet. However, the width of the parking lane may be adjusted to as narrow as 7 feet and as wide as 9 feet to achieve various results:

- For aggressive traffic calming the parking lane should be reduced to 7 feet. In practice, under this condition, parked cars may encroach slightly upon the painted line, making drivers in the adjacent lane perceive a more constrained condition and behave as if their travel lane is narrower.
- To give additional space to a bicycle facility, designers should strongly consider reducing the parking lane to 7 feet and adding the additional 6 inches to the bike lane or buffer.
- In cases where excess right-of-way is present, the parking lane may be increased to as wide as 9 feet in order

FIGURE 3-6 7 FOOT PARKING LANE FOR TRAFFIC CALMING



Cordova St between Euclid Ave & Marengo Ave

- to create narrower travel lanes to reduce driving speeds. An additional way to use up excess space is to delineate the parking lane with an 8 inch painted line, or to widen a painted median. A 9-foot parking lane should not be delineated with an 8 inch painted line, to avoid making the lane appear wide enough to be interpreted as a travel lane.
- A wider parking lane of up to 9 feet may be necessary when there is a commercial loading zone, bus layover facilities, or freight parking.
- The parking lane should not be more than 9 feet wide because it may be interpreted as a travel lane.
- Designated accessible on-street parking spaces should be placed at the end of the block (first space or last space) to make use of the existing curb ramp at the intersection. In addition, the amenity/curb zone adjacent to accessible parking spaces should be kept clear of obstructions to enable use of a passenger-side lift. If these guidelines are followed, there is no need to cut into the existing curb line to create wider on-street

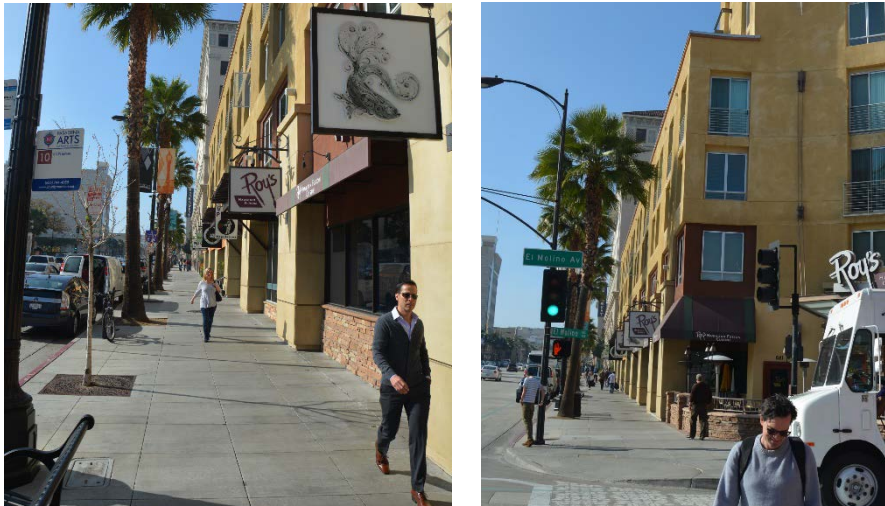


spaces for purposes of PROWAG accessibility compliance. (*Waiting on direction from attorney's office*)

## SIDEWALK CLEAR WALK ZONE

A sidewalk clear walk zone is the area that is primarily for the movement of pedestrians and is free of street furniture, poles, trees, trash receptacles, traffic signal equipment and other obstructions. The clear walk zone does not include the building frontage zone, which should be present even if there is no specific use, such as a sidewalk café, between the clear walk zone and the building face. The building frontage zone is within the public right-of-way. In urban contexts the building frontage zone should be minimum of 1 foot to account for the area around doors and elements that protrude from the building face such as fire hose connections. The width of the sidewalk clear zone is driven by the number of sidewalk users that might be expected in each context, as shown in Figure 3-2. If there is not sufficient space in an existing cross-section to accommodate the minimum clear walk zone desired for the street function and context, the minimum clear walk zone may be achieved either by moving the curb or moving the property line during redevelopment.

FIGURE 3-7 CLEAR WALK ZONE



Clear Walk Zone Continues from Sidewalk through Crosswalk – Colorado Blvd & El Molino Ave



Clear Walk Zone Delineated between Café Seating and Street Trees – Colorado Blvd & Bonnie Ave

## LANDSCAPING ELEMENTS

A parkway, planter strip, and/or street trees may be included in the Curb/Amenity zone. Providing an adequate root volume for trees may require a trade-off between space in the right-of-way and utilizing specialized planting materials. Street trees, if planted without adequate space, may die or damage sidewalks. For most species, 6 feet is acceptable width.<sup>iii</sup> For tree planters in sidewalks in more urban areas, an additional area of surrounding pavement should be underlain by structural soil with the total area of 100-200 square feet, as directed by the City arborist based on tree type and soil type. The City of Pasadena Urban Forest Management Plan (2015) provides guidance on City-Approved tree species, planting standards, and other policies. In constrained

<sup>iii</sup> The City of Los Angeles Street Tree Selection Guide provides recommended widths by species. <http://bss.lacity.org/UrbanForestry/StreetTreeSelectionGuide.htm>

spaces, several tools have been developed to improve tree and sidewalk health and can also be implemented:

- Root Paths can be used to increase tree root volume by connecting a small tree root volume with a larger subsurface volume nearby. A tunnel-like system extends from the tree underneath a sidewalk and connects to an open space on the other side.<sup>2</sup>
- Silva Cells support sidewalks near trees while still providing enough space for roots to grow. These frames fit together and act as a supporting structure for a sidewalk while leaving room for uncompacted soil and roots inside the frame.
- Reinforced Root Barriers redirect roots from growing laterally and force root growth downward, reducing the likelihood of tree roots to lift adjacent pieces of the sidewalk.

Landscaping and other porous materials can be used to manage stormwater runoff. The City of Pasadena has adopted a Green Streets policy for transportation corridors that requires green infrastructure for street and roadway projects which include 10,000 or more square feet of impervious surface (excluding resurfacing or slurry seal projects).<sup>3</sup> Green Streets can incorporate a variety of strategies:

- Pervious strip – Appropriate in most places.
- Bioretention basin – Appropriate where space is available.
- Flow-through planter – Appropriate in non-infiltration areas, usually more urban contexts.
- Bioswale – Appropriate in less urban contexts.
- Street trees – Appropriate in most places.
- Pervious pavement – Can be applied to parking lane, sidewalks, or the curb/amenity zone. Requires more extensive maintenance and can be costly.

The NACTO Urban Street Design Guide provides detailed information on the implementation of these elements.<sup>4</sup>

FIGURE 3-8 GREEN INFRASTRUCTURE



## CHALLENGES AND RISKS

It is important to remember that available space in the real world often does not conform precisely to the dimensions provided in this guide. While every effort should be made to comply with the guidance provided, there should always be allowance for consideration of exceptions based on the design needs of an individual location or community. In cases where these needs are in conflicts, the needs of the most vulnerable users of the system should be prioritized. For example, if there is not space for the desired buffered bike lanes, an unbuffered bike lane is often preferable to abandoning the bike lanes altogether.

## 4 ACCESS MANAGEMENT

The primary cause of traffic crashes are a mixture of vehicle speed and unanticipated access points. Access management is the practice of creating safer and more effective travel environments through the organization of driveways and curb cuts to reduce conflicts and provide clarity to system users. The City of Pasadena Department of Transportation's Policy and Procedures for Driveway Design (2015) details guidelines for driveway location planning, loading docks, and driveway designs. This chapter builds upon that work by integrating national best practices in cities and represents an update of that guidance.

An access management plan in Pasadena will have three essential components:

1. Turning Movement Organization (Generally accomplished by driveway consolidation and/or center medians).
2. Secondary Street Access – To assure cars can get to parking in a clear and safe manner, and
3. Safe Multi-Modal Access – To assure that those biking, taking transit or walking (even if it's just the walk from the car to the building) can do so safely and comfortably.

### TURNING MOVEMENT ORGANIZATION (MEDIANS)

Medians are an essential access management tool. They are a means to reduce vehicle conflicts by organizing turning movements on a corridor to facilitate traffic predictability and safety. Medians can be used as both a traffic calming and beautification tool. They may also simply be flush with the pavement and consist of painted markings, a space protected with bollards, or a raised curb. Striped or painted medians may represent an interim condition that precedes a more permanent change, providing an opportunity to test travel behaviors before making a significant capital investment. Raised medians within the vehicle zone provide opportunities for landscaping and street trees.

- Medians should be at least 10 feet wide if they are to provide turn pockets at intersections.
- Medians that intersect a pedestrian crossing should have a clear walk zone that is at least as wide as the crosswalk that intersects it to avoid a bottleneck mid-crossing and provide adequate space for pedestrians crossing with strollers, bicycles, or wheelchair devices.
- Medians should have breaks at least every 600 feet in conjunction with pedestrian crossings and intersecting streets (discussed in Chapter 8).

According to the Federal Highway Administration, the overarching goal of Access Management is “to limit the number and impact of driver decision and conflict points from impacting on through traffic.”<sup>5</sup> One of the primary tools the FHWA points to for implementing Access Management is



non-traversable medians. While medians are an important tool to restrict access to only those locations where it is safe and expected, medians alone do not represent access management (they would merely be access denial). If not accompanied by a secondary system of access, medians can create excessive U-turn traffic, driver frustration and general bad behavior from users frustrated by the design. Therefore, secondary access is the second necessary component of a safe urban access plan.

## SECONDARY STREET ACCESS

The organizing element (median) must be paired with a secondary access network. This is easy in a downtown area with a gridded street system, where access to parcels can be provided on side streets instead of with a driveway on primary arterial streets. When converting a more suburban arterial (one main road with driveway access to each parcel) to an access managed corridor, however, this secondary system must be created. This is done by eliminating driveways and moving access to side streets and alleys.

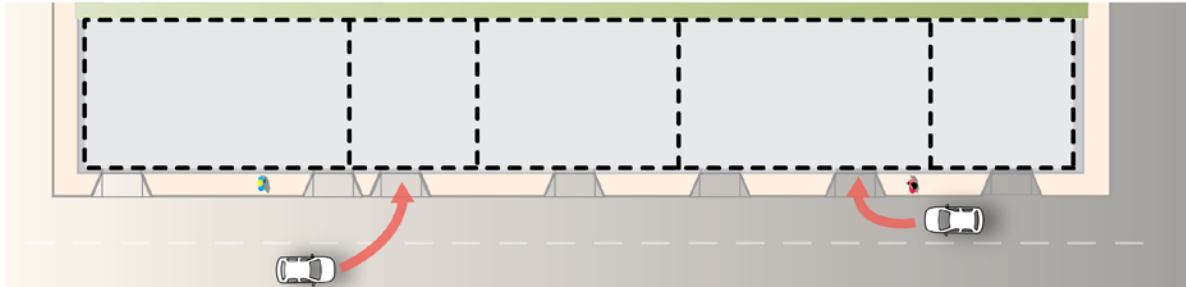
Implementing a secondary access network, shown in Figure 4-1, will result in a safer environment for motorists as well as pedestrians and bicyclists. Along a redeveloping suburban corridor, reflecting the following policies in the zoning code will reduce the number of driveways on the arterial:

- Limit driveways to the minimum number necessary
- Requirement that corner parcels move driveway to lower hierarchy side streets (if parcel faces a connector-city street, access is provided on connector neighborhood or access street)
- Elimination of driveways on parcels that can be accessed through shared driveways and cross-parcel easements

Though a concerted effort should be made to eliminate driveways on the arterial, exceptions may be needed in circumstances where significant site work would be required to create a traversable connection between two parcels or where trip generation rates on a parcel would be a nuisance to the adjacent parcel providing access. In addition, reconfiguration of access associated redevelopment of parcels must be in compliance with City Fire Code. Medians should be employed after driveways have been consolidated and cross-parcel easements have been implemented in order to avoid causing excessive U-turns.

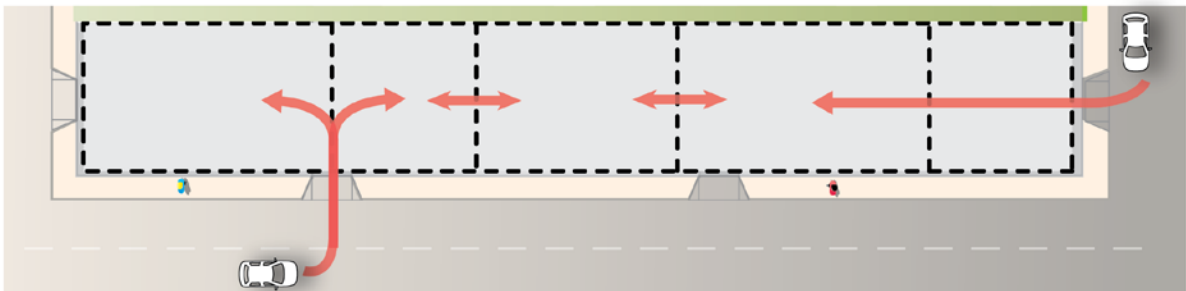
FIGURE 4-1 ACCESS MANAGEMENT THROUGH SECONDARY ACCESS

## BEFORE ACCESS MANAGEMENT



Properties may have one or more driveways on the arterial street, creating multiple points of conflict with vehicles and pedestrians in a single block.

## AFTER ACCESS MANAGEMENT



Driveways on corner parcels are moved to side streets, adjacent driveways are consolidated to shared driveways, and cross-parcel easements provide access to parcels with eliminated driveways. Cross-access connections allow motorists to complete short trips between adjacent uses without having to return to the primary arterial, presenting fewer conflicts.

## DRIVEWAY DESIGN

Driveway widths should fall within the following ranges:

- Commercial driveways should be between 12 feet and 26 feet
- Residential driveways should be between 12 feet and 18 feet

Currently Pasadena’s driveway design standard (S-403) is a “dustpan” type. However, curbed driveways provide visual cues to pedestrians and drivers to be aware of one-another and can encourage drivers to be more cautious when turning into or out of a driveway. To improve safety, Pasadena’s driveway design standard should be a changed to a curbed driveway (S-402). In cases where the amenity zone is not sufficiently wide to offset the clear-walk zone from the curb return, a dustpan type may be used.

To improve pedestrian safety, driveways at signalized T-intersections should be changed to a curb return driveway design and the intersection should have four-legged signal operation (where the driveway is the fourth leg).

FIGURE 4-2 CURB RETURN (LEFT) AND DUSTPAN (RIGHT) DRIVEWAYS



S Lake Ave between Oakwood & California



Arroyo Pkwy between Glenarm & Fillmore

On Connector-City streets where driveways remain necessary, in order to further raise the awareness of conflicts between vehicles and bicycles, segments of bicycle lanes that run perpendicular to driveways should be painted green as often as possible at the discretion of the Department of Transportation..

FIGURE 4-3 GREEN PAINT PERPENDICULAR TO DRIVEWAY



Bluebonnet Lane, Austin, TX  
Photo courtesy of PeopleForBikes

## SAFER MULTIMODAL ACCESS

Highly access-managed arterials which use a traditional approach of closing median openings and optimizing traffic signals have been shown to have fewer crashes in comparison to non-

managed arterials, but also significantly increased speeds.<sup>6</sup> With fewer breaks in medians, pedestrians have limited opportunities to cross the street, and must still traverse driveway curb cuts along an arterial.

The final element to a Pasadena access managed corridor is to assure that all forms of access are accommodated. This involves being cognizant of several elements:

1. Cross-Section Dimensions – The lane width dimensions reflected in chapter 2 must be a part of the project to assure vehicle speeds are managed, thus creating safe pedestrian environments.
2. Intersection Design – The “median breaks” should be fully designed intersections with crosswalks and, if appropriate, elements such as bulbouts. To improve sight lines for turning vehicles, left turn lanes may be placed on the left side of the median at median breaks, separated from oncoming traffic by a double yellow line.
3. Transit Stops – Should be coordinated with the design so that the crosswalks associated with the median breaks can also be “far-side” transit stops.”
4. End of Trip Facilities – Considering elements such a bike racks to make sure the access works for all users must be part of the process.

## CHALLENGES AND RISKS

While consolidation of driveways is a goal that helps to improve traffic flow and pedestrian safety and comfort, it is sometimes not as simple as indicated in the diagrams above:

- There may be physical or contractual reasons that cross-parcel access is not possible
- A single development may span several actual parcels, in which case the development rather than the parcel would be the best unit on which to base access requirements.
- Sometimes a single access point is not sufficient to meet the needs of the site.

While all of these instances may occur, the burden should be placed upon the developer to make a convincing case regarding why they should not have to comply with the guidelines.

## 5 USES OF THE ACCESS ZONE

The access zone is between the vehicle zone and the amenity/curb zone. The access zone can make up some or all of the floating buffer zone which separates vehicular traffic from pedestrian traffic. If the amenity/curb zone is not present, the access zone should be present. The most typical use of the access zone is on-street parallel parking. This chapter discusses alternate uses of the access zone. Dimensions for on-street parking parallel parking can be found in Chapter 3 of this document. On streets that are part of the Rose Parade route, anything installed in the access zone must be removable.

### ANGLE PARKING

There are two primary reasons for using angle parking as opposed to parallel parking on-street. First, angle parking can provide more parking spaces along a curb if needed. Second, angle parking takes up more space in the right-of-way, and can be used as a tool for narrowing travel lanes. Figure 5-1 shows before and after photos of Garfield Avenue between Walnut Street and Ramona Street where reverse angle parking was used to take up extra space in the right of way and narrow lane.

Pasadena should consider making reverse angle parking its standard for angle parking, with cars required to back-in. Reverse angle parking is safer than head-in angle parking because:

- Drivers exiting spaces can better see and account for moving traffic. This is especially significant if reverse angle parking is adjacent to a bike lane.
- Car doors open toward the street, directing passengers toward the sidewalk.
- Car trunks are adjacent to the sidewalk for safer loading and unloading car.

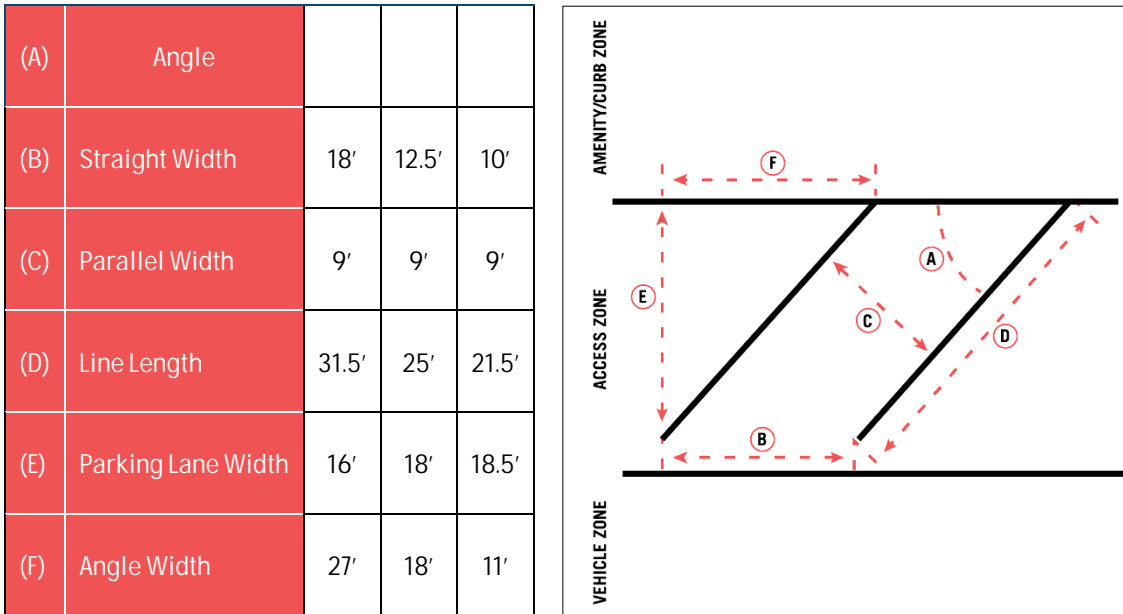
FIGURE 5-1 REVERSE ANGLE PARKING USED TO TAKE UP SPACE IN THE RIGHT OF WAY





Designers should ensure that the clear walk zone will not be impeded by the rear end of cars that have backed up to the curb. This can be accomplished through a sufficient buffer in the amenity/curb zone or through the use of wheel stops, though wheel stops can cause trash accumulation. Figure 5-2 shows typical dimensions and layout of angled parking ranging from a 30° to 60° angle. The required width of the parking lane varies between 16 feet and 18.5 feet depending on the angle.

FIGURE 5-2 TYPICAL DIMENSIONS OF REVERSE ANGLE PARKING



## BIKE CORRALS

Bike corrals may be installed in the access zone in the place of one or more car parking spaces. Bike corrals can serve to move parked bicycles off of sidewalks to make additional room for pedestrians. In addition, because bike corrals are shorter than parked automobiles, they do not obstruct sightlines and can be used at corners without affecting the visibility of pedestrians to moving traffic.

- Bike corrals should provide enough clearance for bicycles from the adjacent travel lane. Racks should be placed perpendicular to the curb where at least 8 feet is available and angled where a minimum 7 feet is available.
- Bike corrals should be oriented so that bikes may be parked on either side of the corral.
- Corrals should be spaced at least 3 feet apart to allow access to and from the sidewalk between corrals.

- The rack should support the bicycle frame in at least two places, allowing both the frame and the wheel to be locked. Bicycle racks should prevent the bicycle from tipping over, not damage the bike, and allow both front in or back in parking.
- The bike corral area should be demarcated using paint, bollards, or planters. Bollards or wheel stops should be installed on either end to separate parked cars from bicycles.

The Association of Pedestrian and Bicycle Professionals Essentials of Bike Parking (2015) may be referenced for additional detail on the design of bike corrals.

FIGURE 5-3 BIKE CORRAL WITH WHEEL STOP



Milwaukee Ave & North Ave, Chicago, IL

## BIKE-SHARE STATIONS

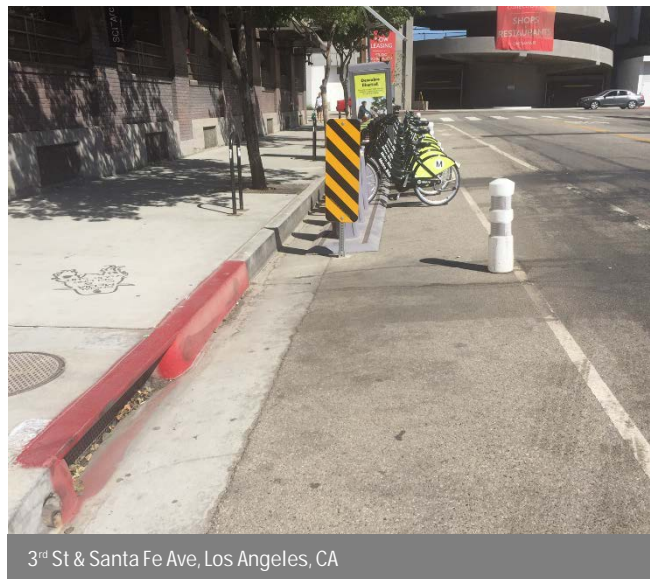
LA Metro plans to launch the second phase of its bike share program in Pasadena with 34 bike stations. In all cases the payment kiosk should face the sidewalk and be located 6 inches from the curb. The kiosk may face the street where sidewalk access is obstructed. Bike share stations come in several layouts:

- Perpendicular (90°) layouts are 6'5½" wide
- Angled layouts are 6'1" wide
- Dual-sided docking layouts are 9'2¼" wide

In addition to the width of the station and 6 inch curbside clearance, bike-share users should be provided

adequate space to back the bicycle out of the dock and maneuver safely. Station lengths vary from 37 feet to 75 feet. In all cases 5 feet of red curb should be painted on either side of the bike station.

FIGURE 5-4 LA METRO BIKE SHARE STATION



3<sup>rd</sup> St & Santa Fe Ave, Los Angeles, CA

## PARKLET

Parklets can be implemented in the access zone to create public spaces and enhance the pedestrian experience and streetscape. The following summarizes NACTO Urban Street Design Guide principles for parklets.<sup>7</sup>

- Parklets should be at a minimum 6 feet wide or the width of the parking lane.
- Parklets should be flush with the curb.
- Parklets should be separated from parked cars using wheel stops or other barrier placed 4 feet from either end.
- Parklets should incorporate vertical elements to make them visible to traffic.
- Parklets should not be placed directly at the corner.

FIGURE 5-5 PARKLET WITH WHEEL STOP AND BOLLARD



Columbus Ave, San Francisco, CA

## CURB EXTENSIONS

Curb extensions are temporary or permanent and can be used for traffic calming or to add public space or landscaping. Curb extensions may be installed at corners or midblock. In cases where the access zone contains vertical elements that obstruct sight lines, such as a parklet, curb extensions at intersections improve visibility between pedestrians and moving vehicles by bringing pedestrians to the edge of the obstructed lane while remaining on the sidewalk. In addition, curb extensions narrow the pedestrian crossing distance.

Where physically extending the curb into the roadway is not feasible, a painted bulbout may be used to delineate the pedestrian zone from the vehicle zone. A painted bulbout intended as a pedestrian waiting area should be implemented according to the City's Painted Safety Zone standard. Key features for delineating the space from vehicle travel lanes include:<sup>8</sup>

FIGURE 5-6 CURB EXTENSION



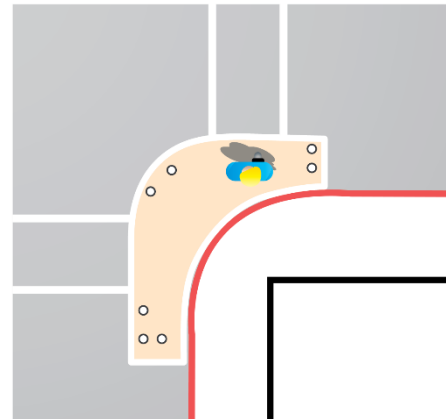
SE Division St, Portland, OR



- 8" white line bordering the bulbout
- Physical barriers such as bollards, planters, or granite blocks

In cases where a curb extension is being used to narrow the travel lane, but is not meant as a pedestrian waiting area, the space may be delineated using raised pavement markers instead of bollards.

FIGURE 5-7 PAINTED CURB EXTENSION



## OPEN STREETS

Pasadena's Access-Shared streets are streets in which users of all modes share the cart-way. Temporary open streets can be a way to take advantage of other roadways for expanded public space. Temporary open streets may be implemented for regularly scheduled events, demonstration projects for planned changes to the street, or one-time events. A traffic management plan should be prepared and implemented to ensure that vehicles do not encroach on a street closure. Police enforcement is not necessary in all cases.<sup>9</sup> On days of the closure, loading and unloading should be permitted for local businesses in the morning and evening hours.

FIGURE 5-8 CICLAVIA - OPEN STREETS EVENT



CicLAvia on Colorado Blvd, 2015  
Photo courtesy of Metro. ©2016 LACMTA



CicLAvia on Colorado Blvd, 2015  
Photo courtesy of Metro. ©2016 LACMTA

## 6 TRANSIT FACILITIES

Street design considerations for transit pertain to the vehicle zone, the access zone, and the amenity/curb zone. Proper design of transit facilities improves transit operating speed and safety, and enhances passenger experience. Design guidance in this chapter may be superseded by more stringent guidance set forth by LA Metro.

### BUS LOADING ZONE

The bus loading zone, or the space in which a bus stops to pick up and drop off passengers, should be in the vehicle zone. Streets should be designed so that transit vehicles do not have to weave in and out of the travel lane. Instead, transit vehicles should stop in lane, adjacent to a curb. In cases where the curb is separated from the travel lane by parked cars or other elements of the access zone, bus bulbs should be used to extend the curb out to the outside travel lane. Bus bulbs should long enough to provide loading space at all doors.

While ideally, bus loading zones are located in the vehicle zone, Figure 6-1 summarizes optimal bus zone lengths for various placements in cases where the outside travel lane is separated from the curb by the access zone. These dimensions ensure that there is space for a vehicle to maneuver from the outside travel lane into the access zone and still have sufficient buffer in front of the vehicle at the stop to merge back into moving traffic. The length of the bus loading zone is dependent on the size of the vehicles serving that stop and the placement of the bus zone within the block. Far-side placement (after the intersection in the direction of travel) is preferred in order to ensure that passengers crossing the street walk behind the bus. In the case of far-side and near-side stops the bus zone begins 5 feet from the radius return at the intersection.

FIGURE 6-1 BUS ZONE LENGTHS<sup>10</sup>

Location/Size	Length of Curb for 40' Bus (feet)	Length of Curb for 60' Bus (feet)
Far-side	90	120
Near-side	100	170
Mid-block	120	140
For each additional vehicle	50	70

Bus stops with high levels of service need space to accommodate multiple vehicles simultaneously. Curb length to accommodate more than one vehicle in a bus zone should be provided at all stops served by 10 or more vehicles per hour. If a bus loading zone is in the access zone, additional space should be provided according to the guidance in Figure 6-1. If a bus loading zone is a bus bulb, the required space for an additional vehicle is equal to the length of the vehicle (40' or 60') primarily used in that corridor.



## PASSENGER WAITING AREA

The City of Pasadena has developed a hierarchy for bus stops that determines what sorts of amenities are installed at bus stops based on the level of use and other characteristics. While the transit modal emphasis overlay should be used to determine in which corridors transit facilities are prioritized in comparison to other modes, the bus stop hierarchy is stop-specific and does not follow a continuous corridor. Projects involving the design or retrofit of a section of sidewalk that contains a bus stop should consider the bus stop hierarchy, detailed below, in order to determine the appropriate amenities to provide.

FIGURE 6-2 STOP HIERARCHY: MINIMUM RECOMMENDED PASSENGER AMENITIES BY STOP TYPE

Stop Type	Definition	Minimum Concrete ADA Area (5'x8)*	Enhanced Concrete Area**	Shelter and/or Bench	Trash Receptacle	Real Time and/or Static Schedule Information***
Heavy Use & Time Points	Scheduled time points or stops used on a consistent basis throughout the day that are not timepoints.		✓	✓	✓	✓
Destination	Specific destination where more transit use is encouraged, e.g. Old Pasadena, PCC, Caltech, etc.		✓	✓	✓	✓
Support	Typically located between Heavy Use and Destination stops along a route. Not heavily used, not specific destination, not scheduled timepoint.	✓				✓
Transfer Point (including stops that directly serve gold line stations)	Transfer points fall into each of the categories above and may allow transfers between two routes or more than a dozen. Where there are a high number of transfer possibilities more amenities should be considered.		✓	✓	✓	✓

\*The width of the concrete area may span the amenity zone and the clear walk zone.

\*\*For stops at which a shelter is installed, the enhanced concrete area should be 27'x8'. For stops at which a bench and no shelter is installed, the enhanced concrete area should be 20'x8' sidewalk width

\*\*\*Though resources do not allow for real-time information to be installed at all bus stops, it will generally be prioritized at heavily used stops.

Bus zones that include a shelter should be designed so that the shelter and surrounding area are separate from the clear walk zone. Additional space can be allocated to accommodate a shelter in the passenger waiting area using bus bulbs on streets with parallel parking or other elements in the access zone. The shelter is essentially moved from the amenity/curb zone into the access zone, leaving more space for the clear walk zone. Shelters may also be placed in the amenity/curb zone or in the building frontage zone, but should not encroach on the minimum clear walk width designated by the street context. Shelters should be at least 10 feet from driveways. The following dimensions for shelters include space needed for the shelter itself as well as clearance between the shelter and the curb (for front placement shelters) or clearance between the shelter and the building face (for rear placement shelters). In addition, clear space is provided for the bus stop sign and passenger waiting/rear door boarding, shown in Figure 6-3.

- Front placement shelter (in the access or amenity/curb zone): 7 feet wide by 27 feet long
  - Width includes 5 foot shelter and 2 foot curb clearance from the roof face of the shelter. As shown in Figure 6-3, the accessible side of the shelter is 3 feet wide and requires 4 feet of clearance on the ground.
  - Length includes 5 foot bus stop sign clear zone, 12.5 foot shelter, and 9.5 foot rear door boarding/passenger waiting area including trash receptacle
- Rear placement shelter (in building frontage zone): 5.5 feet wide by 23 feet long
  - Width includes 5 foot shelter plus 0.5 foot building frontage clearance
  - Length includes 5 foot bus stop sign clear zone, 12.5 foot shelter, and 5.5 foot rear door boarding/passenger waiting area including trash receptacle

At heavily used stops, additional space may be required to provide a waiting area for passengers beyond the shelter area that does not interfere with the clear walk zone. This can be accommodated by delineating waiting areas along a longer section of the block or, in the case of a front placement shelter, setting the shelter further back from the curb, creating a waiting area between the shelter and the edge of the curb.

Other passenger amenity dimensions are as follows:

- Bench: 6 feet by 2 feet, placed 2.5 feet from the curb
- Trash receptacle: 2 feet by 2 feet
- Clear ADA compliant boarding area: 5 feet by 8 feet (the 8-foot dimension may span the amenity/curb zone and the clear walk zone)

All bus zones have a bus sign post. Regardless of the amenities being provided at a particular stop, the sign post should be kept clear of other notices or signs. Bus stop sign posts should be located at least 5 feet from bus shelters. At near-side stops the bus stop sign post should be installed between 5 and 7 feet before the limit line at the intersection. At far-side stops the bus stop sign post should be installed 20 feet before the end of the red curb zone. Figure 6-3 depicts the layout of a typical front placement bus stop and Figure 6-4 depicts the layout of a typical bus stop with a bench.

FIGURE 6-3 TYPICAL BUS STOP LAYOUT (FRONT PLACEMENT SHELTER)

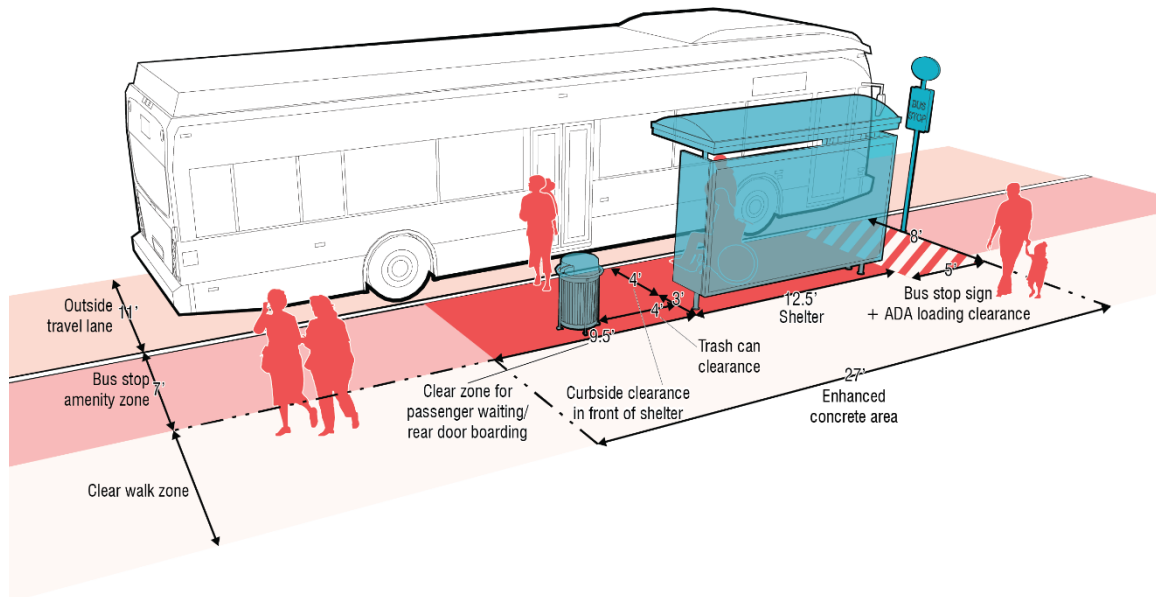
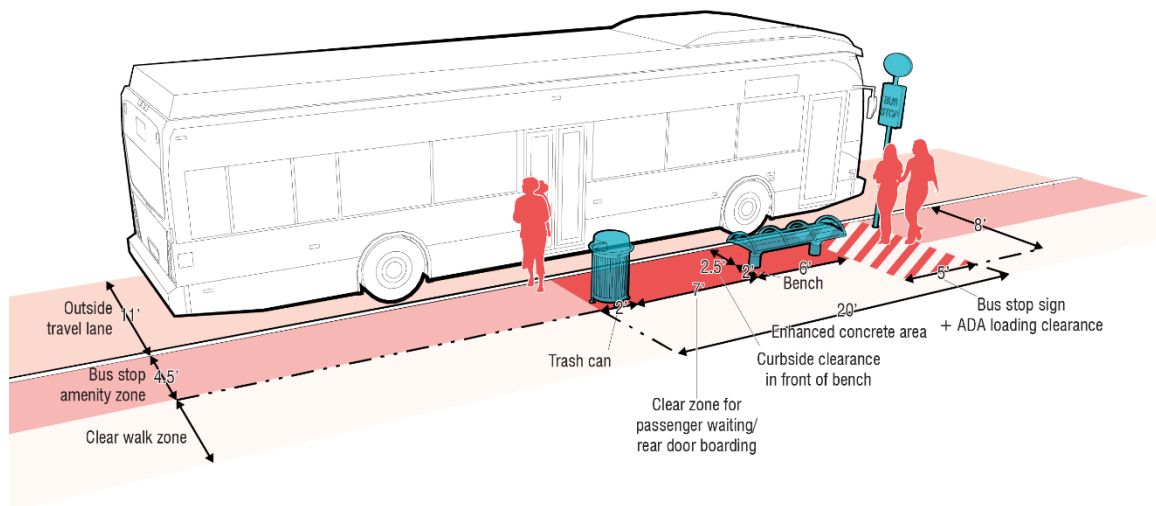


FIGURE 6-4 TYPICAL BUS STOP LAYOUT (BENCH)



## GUIDANCE FOR IMPLEMENTING OPTIMAL TRANSIT FACILITIES

The dimensions for bus loading zones and passenger waiting areas discussed in this chapter are based on ideal conditions. In many cases, transit in Pasadena operates in less-than-ideal conditions. As streets change over time, the following guidelines should be used to take advantage of opportunities to shift transit facilities toward optimal dimensions without creating excessive conflict.

- New conflicts (e.g. trees) should not be approved in the bus loading zone or the passenger waiting area.
- Healthy trees should not be removed from the bus stop unless there is an operational or safety reason to do so. Trees are encouraged in close proximity to (but not within) the bus loading zone and passenger waiting area in order to provide shade.
- Many bus stops in Pasadena were built prior to the American Disabilities Act (ADA) of 1990, and have been grandfathered in. However, when a bus zone that does not meet ADA requirements undergoes physical alterations, it must be made to comply with ADA bus stop guidelines. Alterations include reconstruction, rehabilitation, restoration, and resurfacing.
- Other infrastructure moves should be considered on a cost/benefit basis.
- If conflicts cannot be resolved, consider relocating the bus stop.

## BUS PRIORITY TREATMENTS

While currently there are no on-street bus facilities in Pasadena, peak only bus lanes, fully dedicated bus lanes, and queue jumps should be considered as a strategy to improve mobility when warranted.

Warrants should be developed based on the net gains that can be achieved in person travel time for all users of the roadway, as well as improvements in schedule adherence. The following types of metrics should be included in the development of warrants for bus only lanes and queue jumps.<sup>11</sup>

- Transit frequency in the corridor
- Percent of passengers carried by buses versus the adjacent traffic lane
- Increase in bus travel times during congested conditions
- Schedule adherence



# 7 SPEED MANAGEMENT

The City of Pasadena has developed guidance for traffic calming and speed management on both neighborhood streets and arterials. This section summarizes and builds upon the policies and practice currently in use, with the end goal of designing Connector-City streets in Pasadena for operating speeds of 35 mph or less and all other streets for operating speeds of 25 mph or less.

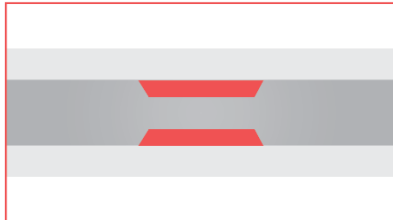
## ACCESS STREETS

Pasadena’s Neighborhood Traffic Management Program Community Handbook (2004) includes a process and toolbox for evaluating the need for and implementing traffic calming strategies on Access Streets. The handbook should be referred to for more detail, but generally includes the tools shown in Figure 7-1:

FIGURE 7-1 NEIGHBORHOOD TRAFFIC MANAGEMENT STRATEGIES<sup>iv</sup>

**Choker**

Chokers or Neckdowns restrict motorists from operating at high speeds on neighborhood streets by narrowing the travel lane.



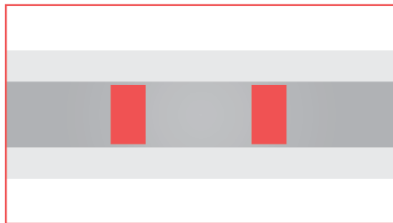
**Roundabout**

Roundabouts and traffic circles reduce speeds at intersections by forcing motorists to move with caution through conflict points.



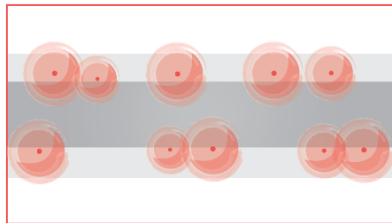
**Speed Hump**

Speed Humps and speed tables vertically deflect vehicles, signaling motorists to drive slowly.



**Beautification/streetscape**

Trees and other vertical elements narrow a driver’s visual field.



<sup>iv</sup> Graphic adapted from NACTO Urban Street Design Guide, 142.

One additional strategy that may be considered is implementing on-street parking on one or both sides of the street in order to create an Access-Yield street. Access-Yield streets have curb-to-curb widths less than 30 feet (where parking is on both sides) or less than 22 feet (where parking is only on one side), resulting in the need for passing vehicles to yield to one-another, greatly reducing speed. If parking utilization on a street is not sufficient to consistently narrow the travel lane, a “checkered” parking scheme can be striped or designated by alternating red curb to improve the effectiveness for traffic calming and allow safer two-way travel.

## CONNECTOR-CITY AND CONNECTOR-NEIGHBORHOOD STREETS

The following design elements are appropriate for speed management on connector-city and connector-neighborhood streets. For more detailed discussion of speed management refer to the City of Pasadena’s Best Practices in Arterial Speed Management (2009).

- Road diet (such as a 4 to 3 lane conversion)
  - Clearly Appropriate for 15,000 – 18,000 Average Daily Traffic (ADT)
  - The 2009 guidance indicates it is possible for 20,000 ADT with capacity analysis. More recent national best practices suggest this latitude should be extended to streets with up to 25,000 ADT
- Lane Narrowing
  - Keeping the same number of lanes but reducing width
  - Excess space can be apportioned to parking, buffers or bike lanes
- Roundabout
  - Typically a single lane will be appropriate for less than 20,000 ADT
  - Multi-lane for more than 20,000 ADT (both conditions based on analysis)
- Pedestrian improvements at intersections
  - Bulbout
  - High visibility crosswalk
  - Decreased turning radii
- Raised intersection
  - Appropriate for posted speeds of 30 mph or less and between 10,000 and 15,000 ADT
  - Most effective if implemented in multiple locations along a speed management corridor
- Pedestrian-scaled intersection spacing (discussed in Chapter 8)
  - Marked or signalized crossings at least every 600 feet will present additional conflict points, introducing more braking potential and encouraging motorists to drive more slowly.

In addition to implementing the elements listed above, a general effort to transition suburban streets to the dimensional standards outlined in Chapter 3 will have a positive effect on speed management. Those cross-section guidelines include elements such as street trees, parallel parking, angle parking, or other elements that provide visual cues to drivers to operate at a

reduced speed. In addition to design elements, speed management may be addressed using enforcement tactics, such as speed feedback signs and targeted speed enforcement corridors, however the first priority should be to design streets for desired operating speeds. Need for enforcement strategies may be an indicator that a street is not properly designed for its context or function.

## 8 INTERSECTION DESIGN

Intersections are a critical component to the street network and the Pasadena streetscape. As locations where modes come together and where most conflicts and collisions occur, intersections are one of the most challenging aspects of street design. These design guidelines focus on creating intersections that encourage appropriate speeds, cautious turning movements, and improved safety for all users.

### CURB RADIUS

Building intersections with large curb radii that are easy for large multi-unit trucks to navigate entails making crosswalks longer and encouraging faster car driving speeds (since they can take these wide turns much faster). Such outcomes are counter to all of the goals reflected in the Mobility Element and should therefore be isolated to those locations where they are absolutely necessary (such as near industrial areas with very high truck volumes). For standard Pasadena intersections the maximum curb radius should be 15 feet. There are two exceptions in which a larger curb radius should be considered:

- The intersection of two freight routes
- The intersection of two narrow streets served by a transit route

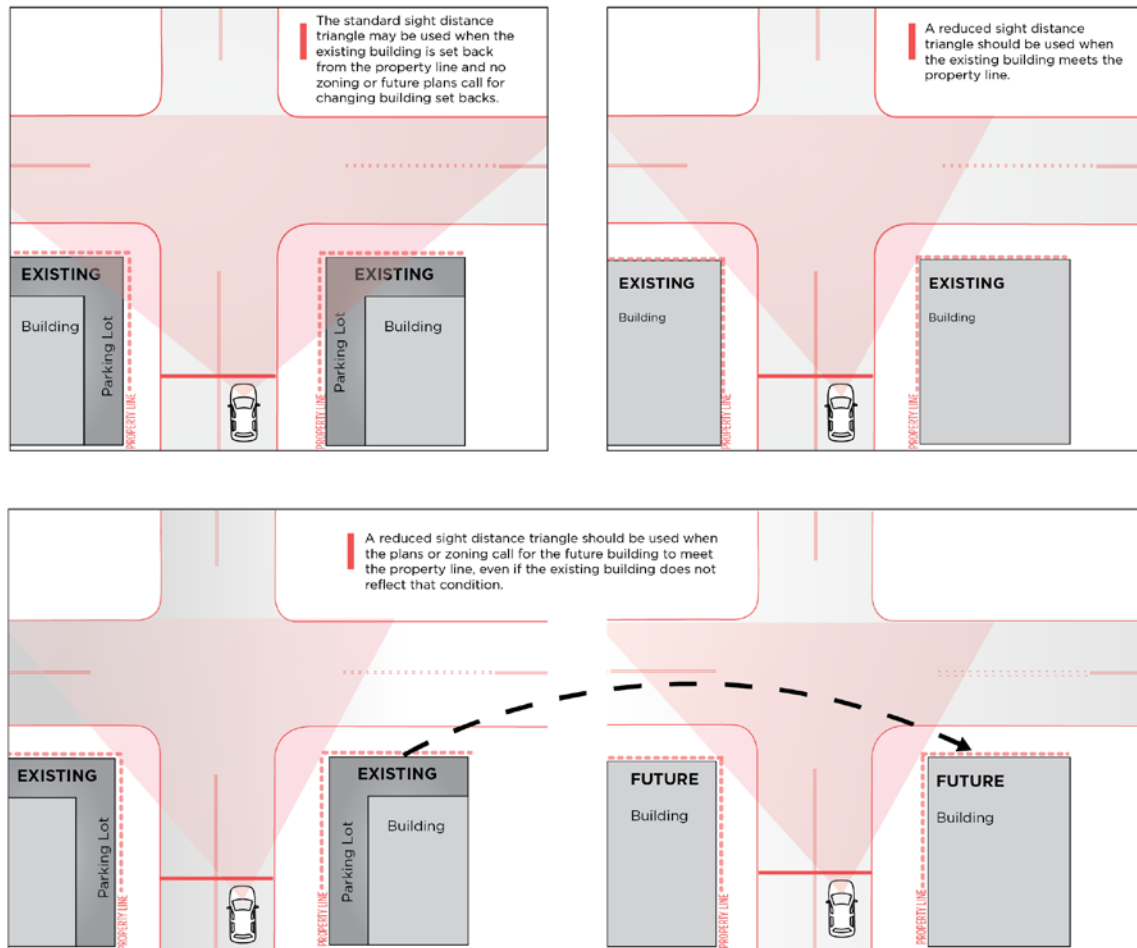
### SIGHT TRIANGLE

Sight distance triangles are a design concept that is intended to ensure unobstructed sight lines around corners for approaching cars. Sections 17.40.180 and 12.12.020 of Pasadena's zoning code stipulates when the sight distance triangle should be enforced at an intersection, and the dimensions of the sight distance triangle. In general, the sight distance triangle is the triangular area between the property lines and a diagonal line joining points on the property lines 25 feet from the point of their intersection. There are certainly more suburban contexts in which this policy is a common sense tool for safety. However, in many of Pasadena's context areas, enforcing a sight distance triangle has no real impact on improving visibility and also prevents the implementation of streetscape elements. For example, if a building meets the property line at a corner, a sight distance triangle that prevents streetscape elements such as trees, planters, or parklets near the intersection will have no impact on the visibility at the corner since the building, a solid object, already obstructs the sight line.

- If the existing or future condition of an intersection will include a building that obstructs the site distance triangle, a reduced sight distance triangle bounded by the stop bar at the intersection and the edge of the building should be used.

- The decision of which size sight distance triangle to use in an intersection design should be based on the planned building setbacks, even if the existing condition does not reflect those plans.
- In general the Commercial / Urban and Residential / Urban contexts presented in this design guide are the locations in which setbacks are less than 10 feet and thus a more narrow sight distance triangle should be used.

FIGURE 8-1 SIGHT DISTANCE TRIANGLE USAGE



## PEDESTRIAN CROSSINGS

The toolbox and decision-making framework for pedestrian crossings at signalized, stop-controlled, and uncontrolled locations is guided by the City of Pasadena Pedestrian Crossing Treatment Guidance (2016).<sup>12</sup> This section explains the general approach to selecting treatments at signalized, stop controlled, and uncontrolled locations. Specific treatments and discussion of their appropriate application is provided in the Pedestrian Crossing Treatment Guidance Treatment Toolbox. Excerpts from the Treatment Toolbox are provided here in italics for reference. As stated in the Treatment Toolbox, crossings can be broken down into three categories:<sup>13</sup>



1. *Uncontrolled Marked Crossing*: Crosswalks that are striped midblock or at intersections not controlled by traffic signals or stop signs
2. *Controlled Marked Crossings*: Crosswalks that are striped midblock or at intersections controlled by traffic signals or stop signs
3. *Unmarked Crossing*: Crosswalks that are not striped at intersections with or without a traffic signal or stop sign.

Pedestrian-scaled spacing of marked crossings (controlled or uncontrolled) encourages pedestrians to use marked crossings. If marked crossings are too far apart, walking distances to get to across a street may be excessively long and may result in pedestrians crossing where there are no marked crossings. Marked crossings should be spaced with a maximum of 600 feet between each. Decisions to convert an unmarked crossing to a marked crossing or create a marked crossing at a location other than an intersection should be made based on the distance between existing marked crossings and also where all of the following occur:<sup>14</sup>

- *Sufficient demand exists to justify the installation of a crosswalk*
- *The location has sufficient sight distance (as measured by stopping sight distance calculations) and/or sight distance will be improved prior to crosswalk marking*
- *Safety considerations do not preclude a crosswalk*

The process for determining sufficient demand for a marked crosswalk is detailed in the Treatment Toolbox.<sup>15</sup> If a candidate location is determined to be appropriate for a marked crossing, signage and markings should be provided at the subject location, as specified in the Treatment Toolbox. Enhanced treatments beyond striping and signing (defined in the Treatment Toolbox) may be needed for candidate marked crosswalk locations under the following conditions:<sup>16</sup>

- *Multi-lane streets (three or more lanes); or*
- *Two-lane streets with daily traffic volumes (ADT) greater than 12,000; or*
- *Streets with posted speed limit exceeding 25 miles per hour*

Additional funding sources should be identified as needed for these enhancements. Failing to provide an enhanced crosswalk and/or removing a crosswalk should be an option of last resort.

While every situation is unique due to characteristics like sight distance, vehicle speeds, number of lanes, and vehicle/pedestrian volumes, the following excerpt from the Treatment Toolbox provides guidance for the marking of crosswalks and applying consistent standards and treatments for marking crosswalks at controlled locations:<sup>17</sup>

- *Signalized intersections: standard parallel white lines across all four legs*
  - *Exceptions:*
    - *Consider high-visibility crosswalk striping near sensitive generators such as schools, libraries, parks, hospitals, senior/community centers, or commercial districts*
    - *Consider restricting crossings if sight distance or some other consideration may not allow for a safe crossing*
- *All-way and two-way/side-street stop-controlled intersections: no crosswalk markings for controlled two-lane roadways*
  - *Exceptions:*

- *Commercial districts and corridors (i.e., stop-controlled minor streets along Colorado Boulevard)*
- *Three or more lane roadways, where pedestrians have additional exposure due to longer crossing distances and increased vehicle activity*
- *Consider high-visibility crosswalk striping near sensitive generators such as schools, libraries, parks, hospitals, or senior/community centers*
- *Consider restricting crossings if sight distance or some other consideration may not allow for a safe crossing*

## CURB RAMP PLACEMENT

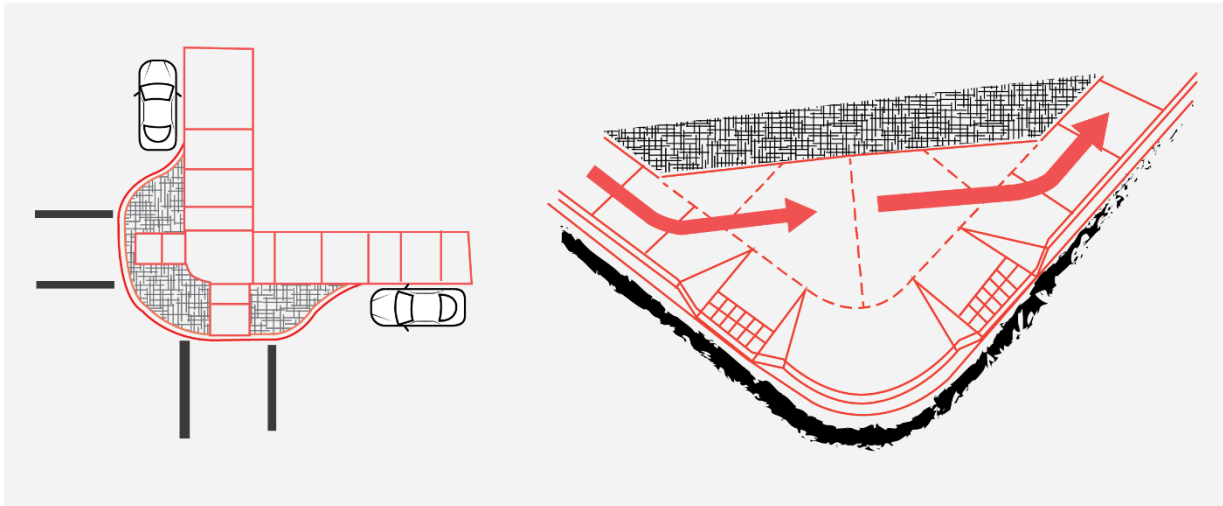
Curb ramps are essential in providing mobility to wheelchair users but contribute to overall utility and livability for a wide range of users including people with other mobility impairments, those pushing strollers or shopping carts, or pulling luggage.

- At intersections, curb ramps should be oriented perpendicular to the natural curb line and oriented to the desired line of travel, typically indicated by the center of the crosswalk.
- Separate ramps should be provided for each directional crossing. Corner curb ramps are generally no longer advised except in instances where diagonal pedestrian crossings are also provided.
- Directional and corner ramps should lie within the area of the crosswalk, ensuring that wheelchair users have a continuous line of travel within the crosswalk between two curbs.

In some cases, space constraints prevent the use of directional curb ramps. The following describes potential strategies to create more space.

- A curb extension may be implemented at the corner to accommodate space for directional curb ramps.
- The sidewalk may be extended toward the property line at the corner if the intersection is chamfered, creating a travel space that does not pass through the curb ramps.

FIGURE 8-2 CURB EXTENSION (RIGHT) AND SIDEWALK EXTENSION (LEFT) TO ACCOMMODATE DIRECTIONAL CURB RAMPS



Implementing directional curb ramps should be prioritized, but may not always be possible. If space for implementing directional curb ramps is constrained by existing or planned street furniture, careful consideration should be applied to its necessity. For example:

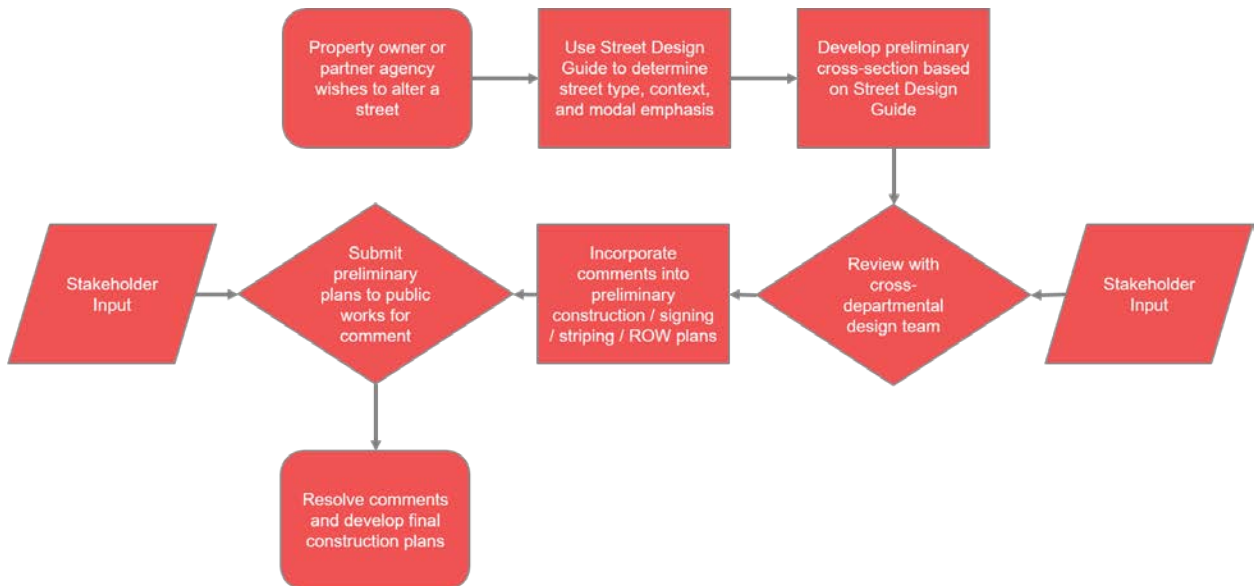
- In cases where a signal pole prevents the installation of directional ramps, a corner ramp may be used instead.
- In cases where a newspaper box prevents the installation of directional ramps, the newspaper box should be removed.

## 9 PROCESS

One of the primary goals in developing this Street Design Guide is to clearly document the standards, practices, and policies of the departments that influence the design of Pasadena’s streets. In order to ensure that the guidance laid out in this document is translated into the construction or reconstruction of streets, the process laid out in Figure 9-1 should be followed. It is important that consensus be built across departments and with community stakeholders throughout the design process. A cross-departmental design team should be consulted in order to ensure that opportunities to accomplish multiple objectives simultaneously by expanding the scope of the project are taken advantage of, and that tradeoffs specific to the constraints of the project in question can be weighed early on.

If a street design project will alter the function or operation of a street, the street design process should include stakeholder input. Project designers should meet with the community to receive feedback on the preliminary cross-section, which will be developed based on the guidance in this document. Stakeholders should be consulted again once the preliminary construction plan has been developed in order to ensure that the final design of the street reflects the community’s desires. At the discretion of City staff, in cases where the project in question has little impact on the community and will not be controversial, stakeholder input may not be required.

FIGURE 9-1 STREET DESIGN PROCESS



## 10 TRADEOFFS

In many cases, the design of an ideal street is constrained by the width of the available right of way. The street context and modal emphasis networks presented in this design guide should be used to weigh tradeoffs and inform the selection of an appropriate cross section when retrofitting a street or when building a new street. Examples of potential tradeoffs include: choices between wider sidewalks or a wider roadway; meeting the needs of trees or the needs of transit; providing bicycle facilities or providing on-street parking. Important elements to consider in balancing priorities:

- Is there a modal emphasis designated for that street?
- What is the context of the street; is it in an urban area or suburban area?
- What are the physical constraints; is the ROW limited, are there mature trees to save, etc.?
- What are the constraints on the project; is it just a resurfacing, are there budgetary constraints, etc.?
- What are the impacts and constraints on public or private properties?
- What input has the community provided?

Several common scenarios of competing priorities are presented below along with guidance on how to identify the appropriate design for the street.

### Removal of Parking to Accommodate a Bicycle Lane

As many cities begin to add to their bike network and the base of bike riders grows, discussions of removing on-street parking on some streets and installing bike lanes in the space created can emerge. This exchange represents a tradeoff that is delicately balanced. Where that balance falls will likely vary from street to street. The following process should be triggered by routine maintenance if the segment proposed matches a segment in the bike modal overlay.

**Step 1** – Determine whether the bike facility called for in the Mobility Element can be easily accommodated via a tradeoff of space that is acceptable to a consensus of the community. For example, if both a bike lane and parking lane can be accommodated by reducing the parking lane to 7 feet in order to allow space for a protected bicycle facility. If the street in question is not part of the bike emphasis network, the parking lane could be reduced to 7 feet in order to accommodate a bike lane, provided that the space for the bike lane is at least 5 feet. When that is not the case, proceed to, Step 2.

**Step 2** – Initiation of Project and Data Collection - Following the proposal for a new bicycle lane on a street, data regarding the number of vehicles using on-street parking, the volume of vehicular traffic and available crash and safety data will be collected. The data will be analyzed to determine which facility has the greater need: the bicycle lane or the on-street parking. If the on-street parking demand is low or the adjacent land uses have other options for parking, staff will



generate a proposal which achieves the recommended bicycle facility in the adopted bicycle plan including the parking modifications required.

**Step 3** (if necessary) – Stakeholder Meeting - Once this plan is developed, notification is drafted to inform affected property owners, tenants, and registered bicycle and neighborhood associations of the project and solicit their input to the extent possible. If the modification is for reasons of a current safety issue, notice will be sent concurrently with addressing the issue, as it is the responsibility of City traffic engineers to expeditiously resolve such issues. A subsequent design will be produced if input from stakeholders can be accommodated in the design.

The notification will consist of relevant project and staff contact information. The notification will also set the date and location of a stakeholder meeting where the proposals can be discussed. At the stakeholder meeting the proposal will be discussed and feedback will be recorded. The goal is for the stakeholder groups and City staff to work toward a common recommendation that best meets the needs of all street users and stakeholder concerns while implementing the Mobility Element bicycle facility. If general agreement is reached, staff will immediately coordinate the installation of the bicycle facility.

**Step 4** (if necessary) – Planning Commission - If Planning Commission involvement is warranted based on a lack of consensus with the stakeholders, the feedback from the stakeholder meeting and staff's final recommendation will be presented at the Planning Commission. In this case this gives stakeholders a second opportunity to make the case for modifications to the staff recommendation. The Planning Commission will then either recommend for staff to proceed or not to proceed with the proposal. If the recommendation is to proceed or if they take no action staff will immediately coordinate the installation of the bicycle facility. If the Planning Commission recommends not proceeding, the project will be reevaluated and/or a bicycle plan amendment will be initiated.

## Bike Lane vs. Sidewalk

The presence of a sidewalk will always be a higher priority than the presence of a bike lane. In situations where a decision must be made regarding how much space to allocate to a bike lane or a sidewalk, use the following guidance:

- If the street in question is part of the bike emphasis network, the bike lane should be prioritized.
- If the street in question is in an urban context (commercial or residential) and not part of the bike emphasis network, the sidewalk should be wide enough to provide at least a 7-foot clear walk zone. The bike lane may be reduced to 5 feet.
- If the street in question is in a suburban context (commercial or residential) and not part of the bike emphasis network, the clear walk zone may be reduced to 5 feet in order to provide a wider or protected bicycle facility.
- In each case, the bike lane can be considered as meeting the mandatory floating buffer requirement

## Transit Access Zone vs. Parking Lane

- On a corridor that is part of the transit emphasis network, the parking lane should be modified to include bump outs at bus stops in order to eliminate the need for transit vehicles to weave in and out of traffic to reach the bus loading zone.

- The parking lane may still exist, but parking spaces may need to be removed to expand the bus stop into the access zone.

## STANDARD CROSS SECTIONS

Chapter 3 provides dimensions for zones of the street in each context and street function, laying a framework for the design of all of Pasadena's streets. This section applies the dimensional guidance to two specific roadway (curb to curb) widths: 56 feet and 60 feet in order to set cross-section standards and illustrate several tradeoffs that may be made to accommodate constraints within the parameters of the design guide. The width of Pasadena's roadways varies widely, thus these dimension will not always be applicable. However, 56 feet and 60 feet were selected due to being more common than other dimensions, wide enough to accommodate some changes in the design of the street, and present on Connector-City and Connector-Neighborhood streets where redevelopment is more likely to occur (as opposed to access streets, which are mostly in residential neighborhoods and less likely to change). In each case, the standard cross section is identified for each context, followed by several alternative cross sections that may be used to accommodate tradeoffs.

### 56-Foot Curb-Curb Width

Figure 1 and Figure 2 show the standard cross section for urban and suburban contexts, respectively. The roadway design is the same for all contexts, including one lane of on-street parking, buffered bike lanes, one travel lane in each direction, and a center turn lane.

In urban contexts the minimum width between the property line and the curb is 15 feet in commercial settings and 13 feet in residential settings. The existing sidewalk dimensions of streets with 56-foot curb-curb widths in Pasadena are narrower, thus implementing this preferred cross section will likely require moving the property line.

In suburban contexts (both commercial and residential), the minimum required space between the property line in the curb is 8 feet, though 10 feet is more common and the preferred width. The existing sidewalk dimensions of streets with 56-foot curb-curb widths in Pasadena is sufficient to meet these standards in most cases.

Figure 3 shows an alternative cross section that may be used where on-street parking is needed on both sides of the street. The reduced space in the vehicle zone results in non-buffered bike lanes. This alternative is only acceptable on Connector-Neighborhood streets. Connector-City streets require a minimum of 7 feet (5-foot lane and 2-foot buffer).

Figure 4 shows an alternative roadway design that may be used where a bike facility is not appropriate. This can be implemented in any context or street type (with the corresponding sidewalk dimensions) and includes one lane of reverse-angle parking, one lane of parallel parking, one travel lane in each direction, and a center turn lane.

FIGURE 10-1 STANDARD 56-FOOT CROSS SECTION FOR URBAN CONTEXTS

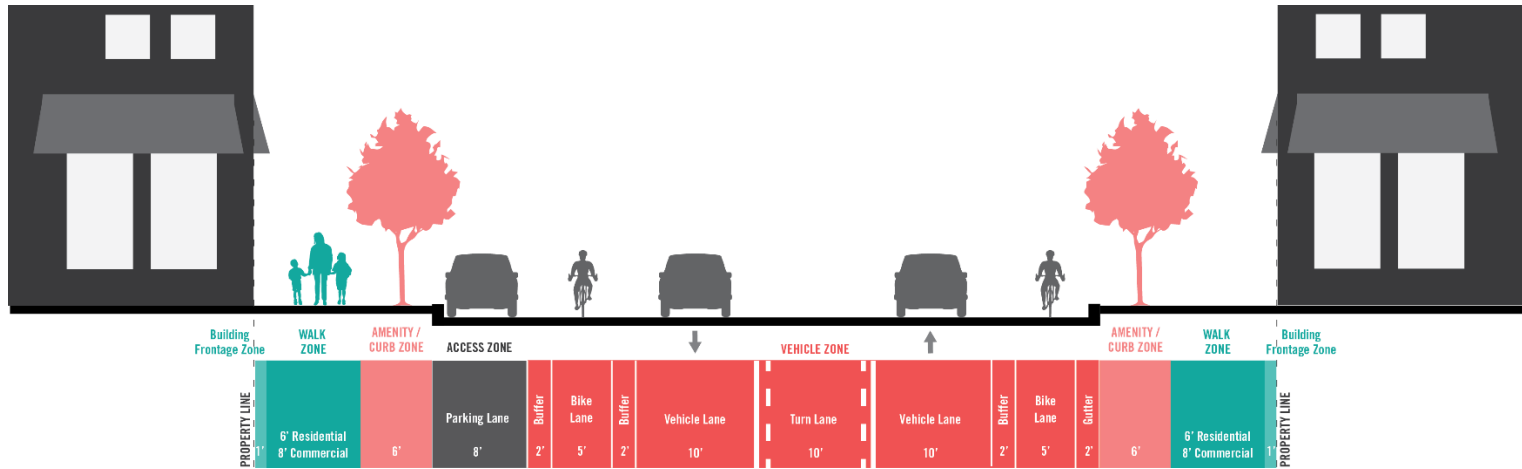


FIGURE 10-2 STANDARD 56-FOOT CROSS SECTION FOR SUBURBAN CONTEXTS

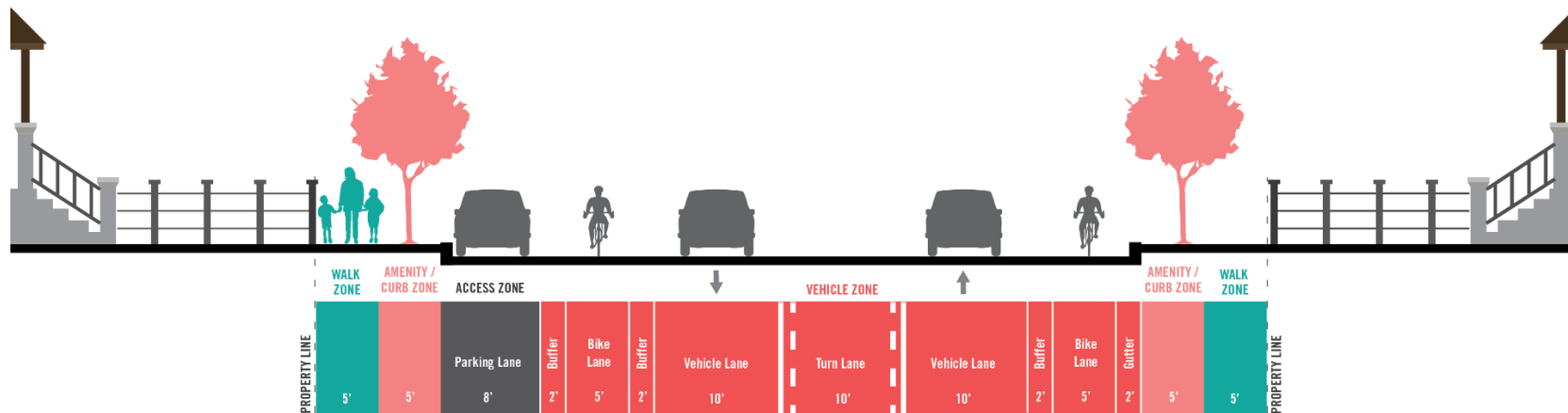


FIGURE 10-3 ALTERNATIVE 56-FOOT CROSS SECTION – NON-BUFFERED BIKE LANES (CONNECTOR-NEIGHBORHOOD ONLY)

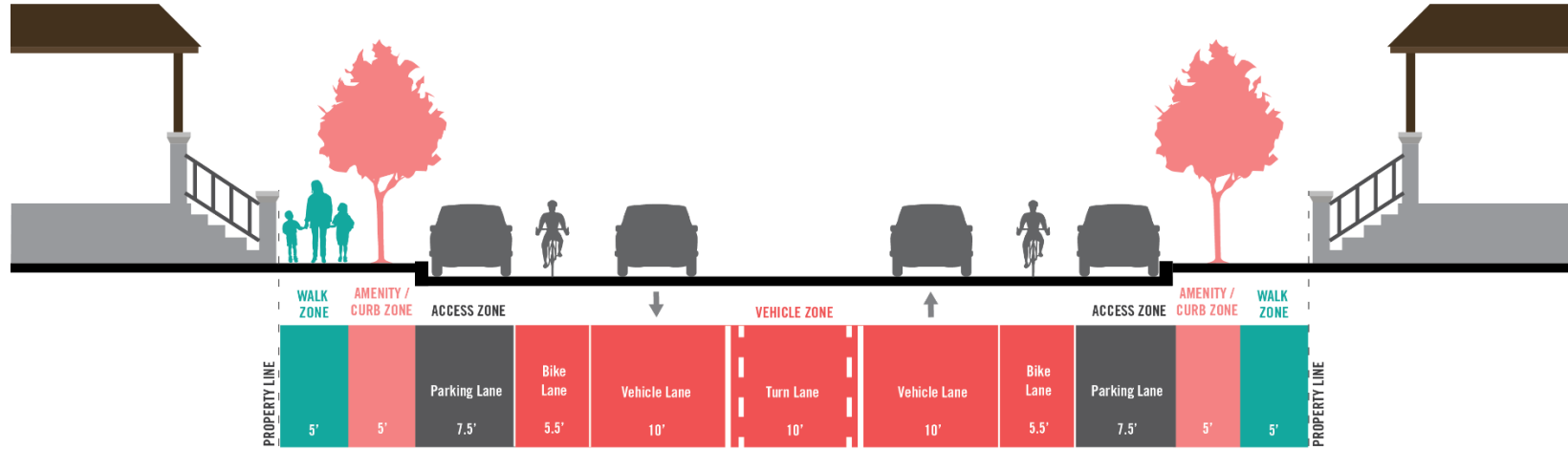
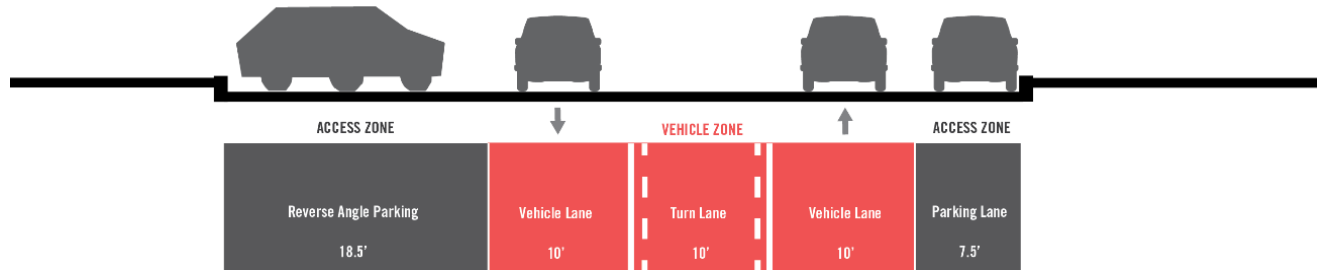


FIGURE 10-4 ALTERNATIVE 56-FOOT ROADWAY SECTION – NO BIKE FACILITIES



## 60-Foot Curb-Curb Width

Figure 10-5 and Figure 10-6 show the standard cross section for urban and suburban contexts, respectively. The roadway design is the same for all contexts, including two lanes of on-street parking, buffered bike lanes, one travel lane in each direction, and a center turn lane.

In urban contexts the minimum width between the property line and the curb is 15 feet in commercial settings and 13 feet in residential settings. The existing sidewalk dimensions of most streets with 60-foot curb-curb widths in Pasadena are narrower, thus implementing this preferred cross section will likely require moving the property line.

In suburban contexts (both commercial and residential), the minimum required space between the property line in the curb is 8 feet, though 10 feet is more common and the preferred width. The existing sidewalk dimensions of streets with 60-foot curb-curb widths in Pasadena is sufficient to meet these standards in most cases.

Figure 10-7 shows an alternative cross section that may be used in urban contexts where it is not possible to move the property line to widen the sidewalks. The curb is extended into the roadway by 3 feet on each side of the street, reducing the roadway width to 54 feet and requiring the removal of one on-street parking lane in order to preserve buffered bike lanes.

Figure 10-8 shows an alternative roadway design that may be used where a bike facility is not appropriate. This can be implemented in any context or street type (with the corresponding sidewalk dimensions) and includes one lane of reverse-angle parking, one lane of parallel parking, one travel lane in each direction, and a center turn lane. Compared to the similar 56-foot cross section, this 60-foot version includes wider parking lanes in order to maintain 10-foot travel lanes.



FIGURE 10-5 STANDARD 60-FOOT CROSS SECTION FOR URBAN CONTEXTS

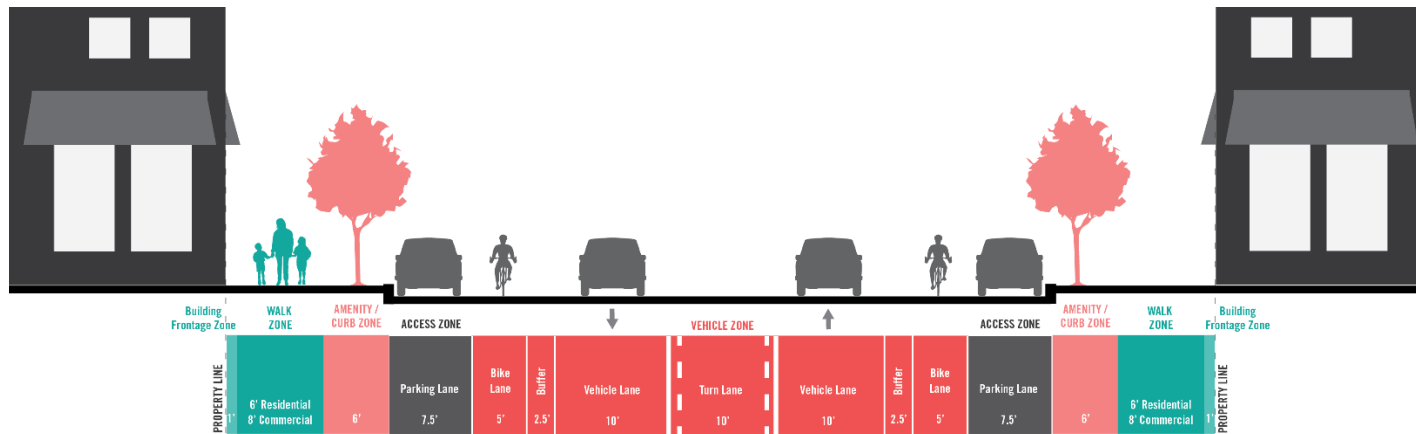


FIGURE 10-6 STANDARD 60-FOOT CROSS SECTION FOR SUBURBAN CONTEXTS

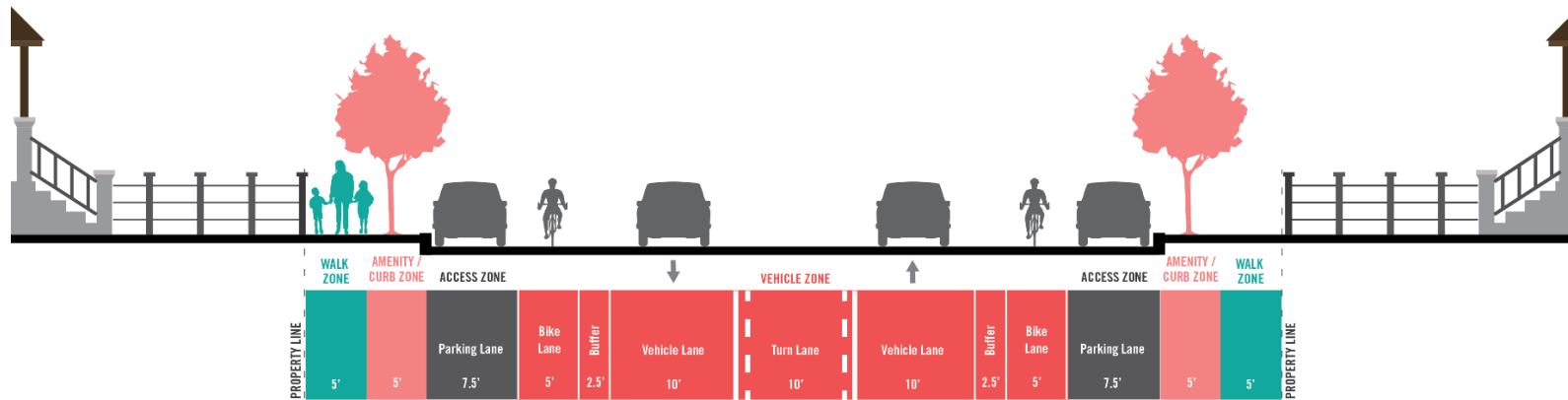


FIGURE 10-7 ALTERNATIVE CROSS SECTION WITH SIDEWALK EXTENSIONS FOR URBAN CONTEXTS

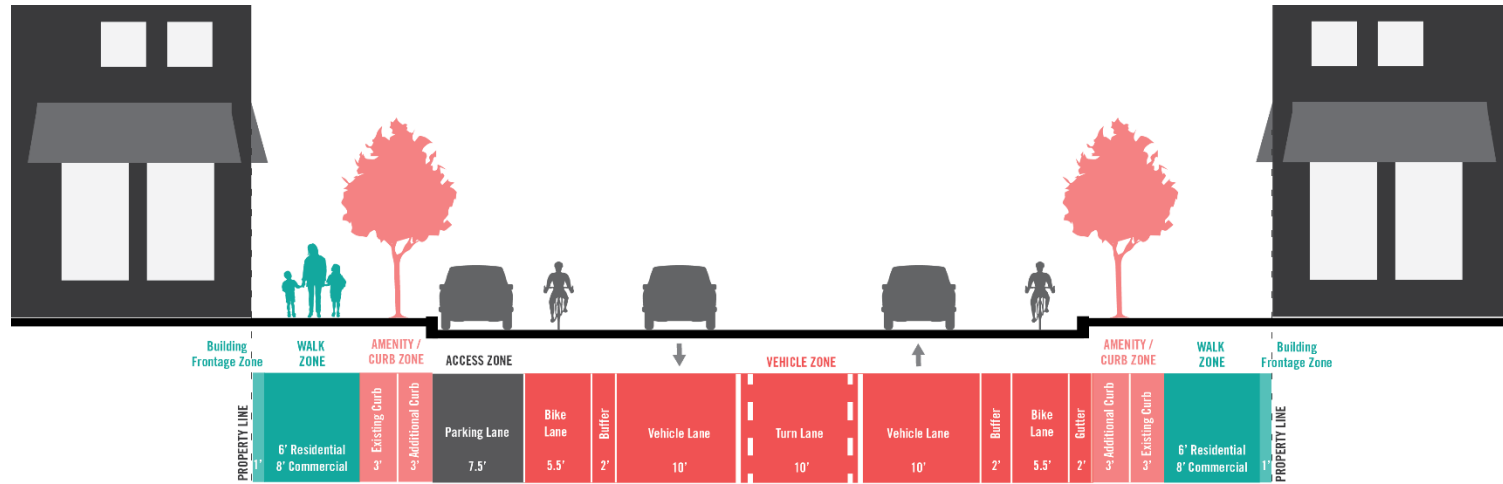
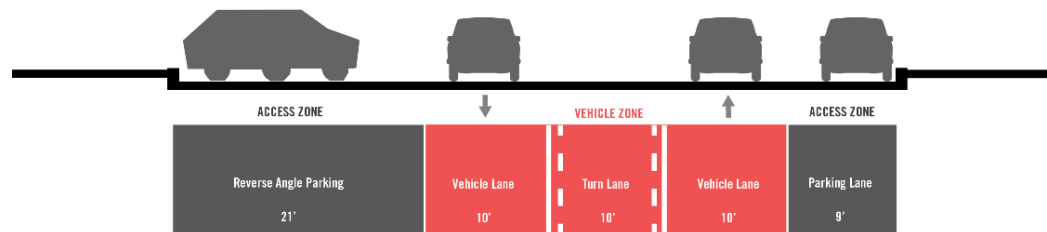


FIGURE 10-8 ALTERNATIVE 60-FOOT ROADWAY SECTION – NO BIKE FACILITIES



## END NOTES

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<sup>1</sup> California Department of Transportation. *Caltrans Backs Innovative Street Design Guides To Promote Biking and Walking*. 2014. Web. 22 Feb 2017. <http://www.dot.ca.gov/hq/paffairs/news/pressrel/14pr036.htm>

<sup>2</sup> Lukes, R. and C. Kloss, *Green Streets Municipal Handbook: Managing Wet Weather with Green Infrastructure*, EPA, (2008), 8. ([https://www.epa.gov/sites/production/files/2015-10/documents/gi\\_munichandbook\\_green\\_streets\\_0.pdf](https://www.epa.gov/sites/production/files/2015-10/documents/gi_munichandbook_green_streets_0.pdf))

<sup>3</sup> City of Pasadena Department of Public Works, AR 19 Stormwater Runoff an Urban Pollution Control, (2015), 4.

<sup>4</sup> NACTO, *Urban Street Design Guide*, (New York, NY, 2013), 65-70.

<sup>5</sup> Spiller, N. *Access Management Principles Introduction and Overview*, FHWA, 21. ([http://www.ops.fhwa.dot.gov/access\\_mgmt/presentations/am\\_principles\\_intro/introamprinciples.ppt](http://www.ops.fhwa.dot.gov/access_mgmt/presentations/am_principles_intro/introamprinciples.ppt))

<sup>6</sup> Spiller, 31-33.

<sup>7</sup> NACTO, 78-80.

<sup>8</sup> NACTO, 86-87

<sup>9</sup> NACTO, 82.

<sup>10</sup> Los Angeles County Metropolitan Transportation Authority, *Transit Service Policy*, (2015), 32. ([http://media.metro.net/images/service\\_changes\\_transit\\_service\\_policy.pdf](http://media.metro.net/images/service_changes_transit_service_policy.pdf))

<sup>11</sup> Litman, Todd, *When are Bus Lanes Warranted?*, Victoria Transport Policy Institute, (2016), 10. (<http://www.vtpi.org/blw.pdf>)

<sup>12</sup> City of Pasadena, *Pedestrian Crossing Treatment Guidance*, (2016), 24-49.

<sup>13</sup> City of Pasadena, *Pedestrian Crossing Treatment Guidance*, (2016), 24

<sup>14</sup> City of Pasadena, *Pedestrian Crossing Treatment Guidance*, (2016), 24

<sup>15</sup> City of Pasadena, *Pedestrian Crossing Treatment Guidance*, (2016), 26

<sup>16</sup> City of Pasadena, *Pedestrian Crossing Treatment Guidance*, (2016), 25

<sup>17</sup> City of Pasadena, *Pedestrian Crossing Treatment Guidance*, (2016), 25