better streets
SAN FRANCISCO

CHAPTER 5.0

CHAPTER

5.0

STREET DESIGNS

GUIDE:

STREET DESIGNS

The location and shape of curb lines exerts a strong influence on pedestrian comfort and usability of streets as public spaces. This chapter describes pedestrian-oriented guidelines for curb lines, crosswalks and other street design features to enhance pedestrian safety and comfort and enable generous, usable public spaces

Marked crosswalks are an essential part of the pedestrian realm that enable safe, convenient pedestrian travel across roadways.

Crosswalks and Pedestrian Signals

5.1

CROSSWALK MARKINGS

Marked crosswalks are an essential tool for helping pedestrians move safely, conveniently and predictably across roadways. When treated with decorative paving material, crosswalks also provide a unique streetscape design treatment to emphasize pedestrians' presence and primacy.

Marked crosswalks alert drivers to expect crossing pedestrians and to direct pedestrians to desirable crossing locations – marking crosswalks at every intersection is not necessary or desirable. Although many motorists are unaware of their precise legal obligations at crosswalks, the California Vehicle Code requires drivers to yield to pedestrians in any crosswalk, whether marked or unmarked.

Streetscape design should emphasize crosswalks as a fundamental part of the pedestrian realm, not as an intrusion into the roadway reserved for vehicles only.

Placement

Crosswalks are present by law at all approximately right angle intersections, whether marked or unmarked, unless the pedestrian crossing is specifically prohibited. At mid-block locations, crosswalks only exist where marked. At these non-intersection locations, it is the crosswalk markings that legally establish the crosswalk. Most importantly, the decision to mark a crosswalk should not be considered

in isolation, but rather in conjunction with other measures to increase motorists' awareness of pedestrians. Without additional measures, marked crosswalks alone are unlikely to increase pedestrian safety and may decrease safety, particularly on multi-lane streets. Follow SFMTA crosswalk guidelines in determining when to stripe new crosswalks.

Controlled Intersections

Intersections can be controlled by traffic signals or STOP signs. Per existing City policy, marked crosswalks should be provided on all intersection legs controlled by traffic signals, unless the pedestrian crossing is specifically prohibited. Crosswalks may be considered at all STOP-controlled intersections. SFMTA has developed detailed guidelines on when to stripe crosswalks at controlled intersections. Factors to be considered include: high pedestrian volumes, vehicle volumes, school zone location, substantial volume of elderly or disabled use, or other safety reasons.

Uncontrolled Intersections

Intersections without traffic signals or STOP signs are considered uncontrolled intersections. The decision to mark a crosswalk at an uncontrolled location should be guided by an engineering study. Factors considered in the study include vehicular volumes and speeds, roadway width and configuration, stopping sight distance, distance to the next controlled crossing, night time visibility, grade, and pedestrian volumes.

See the SFMTA crosswalk guidelines for direction on when to stripe crosswalks at uncontrolled intersections.

High-Visibility Crosswalks

Because of the low approach angle at which pavement markings are viewed by drivers, the use of longitudinal stripes in addition to or in place of the standard transverse markings can significantly increase the visibility of a crosswalk to oncoming traffic. While research has not shown a direct link between increased crosswalk visibility and increased pedestrian safety, high-visibility crosswalks have been shown to increase motorist yielding and channelization of pedestrians, leading the Federal Highway Administration (FHWA) to conclude that high-visibility pedestrian crosswalks have a positive effect on pedestrian and driver behavior.

San Francisco has chosen to utilize continental crosswalks for high-visibility crosswalk locations. Maintenance and installation of high-visibility 'continental' crosswalks costs more than standard crosswalks. Despite their added cost and the lack of hard evidence pointing to their safety benefits, many cities see continental crosswalks as a cost-effective way to improve the walking environment and to send a message that pedestrians are present. For this reason they are often employed even at controlled locations that are neither near schools nor at mid-block locations yet still deserve extra attention.

In San Francisco, continental crosswalks have typically been employed only at school crossings and mid-block locations. The SFMTA plans to expand the use of continental crosswalks to some uncontrolled intersections.

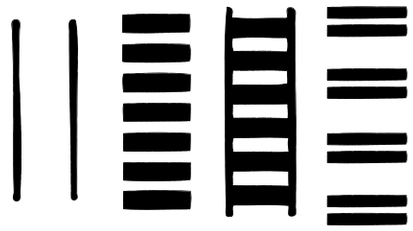
Mid-Block Crosswalks

In areas with short block lengths, closely-spaced intersections ensure that pedestrians can easily find crosswalks without having to go out of their way, but many areas have long blocks with widely-spaced intersections and fewer crossing opportunities. Mid-block crosswalks may provide a convenient crossing for pedestrians when other crossing opportunities are distant, or where a destination creates high crossing demand.

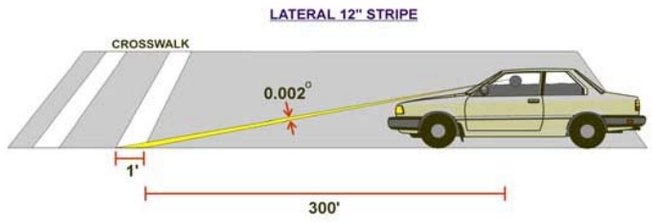
See the SFMTA crosswalk guidelines for direction on when to stripe mid-block crosswalks. Site-specific analysis and environmental clearance would be required for any proposed mid-block crossing to identify whether it would result in or contribute to unacceptable levels of service or delay to transit vehicles.

Design

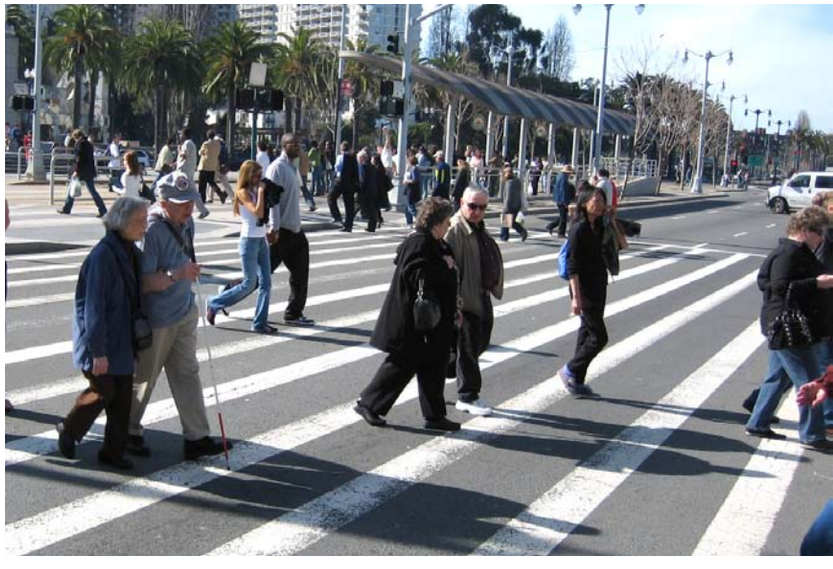
Crosswalks should be at least as wide as the sidewalk, but may be wider in locations with high pedestrian demand or narrow sidewalks. Crosswalks should be no less than 10 feet in width. Crosswalks must be outfitted with curb ramps and tactile warning strips per federal accessibility guidelines. The California Manual on Uniform Traffic Control Devices (MUTCD) contains standards and guidance on crosswalk warning signs and supplementary markings.



▲ Typical crosswalk markings.
Left to right: Standard, Continental, Ladder, Staggered Continental



▲ Driver's view of crosswalk markings.
Source: ITE Professional Development Complete Streets



Standard Crosswalks

The standard treatment for marked crosswalks at intersection locations consists of two 12 inch-wide white retro-reflective thermoplastic stripes that delineate the sides of the pedestrian walking area. The stripes should be perpendicular (or transverse) to the direction of vehicle travel and parallel to the direction of pedestrian travel. School crosswalks must be yellow per state code; in San Francisco, school crossings should be given a yellow, continental crosswalk treatment.

High-Visibility Crosswalks

High-visibility crosswalks should be marked using the continental pattern of crosswalk striping, which consists of a series of wide stripes parallel to the curb for the length of the crossing. (These are distinguished from ladder crosswalks, which retain the transverse side stripes of the standard crosswalk in addition to the wide 'rungs' of the ladder, or zebra crosswalks, which have diagonal stripes. See diagram on previous page.)

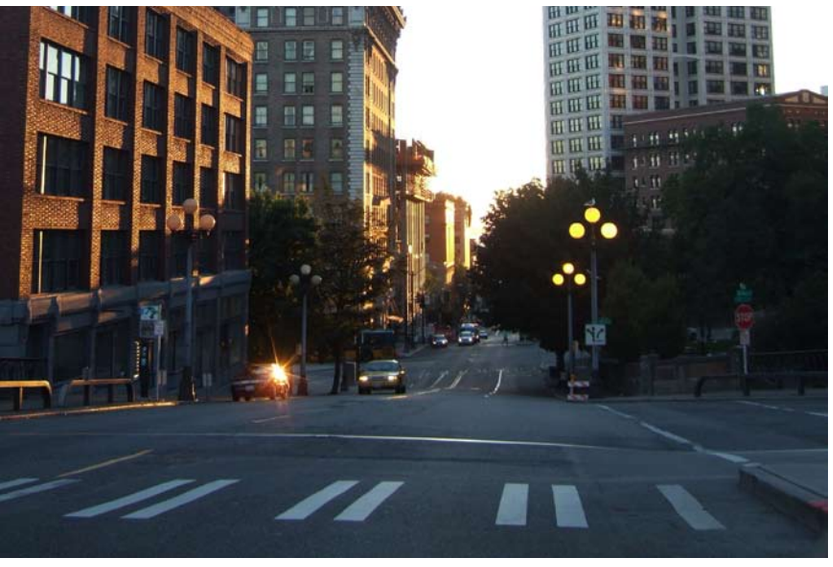
In order to provide high-visibility crosswalks while minimizing increases to maintenance costs, the SFMTA plans to implement a pilot installation of a "staggered" continental crosswalk, with the longitudinal stripes positioned to avoid vehicle wheel paths as much as possible, reducing wear. This strategy has been employed successfully in Washington, Oregon, and Colorado for many years.

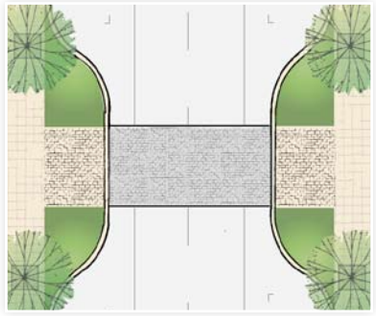
Mid-Block Crosswalks

Mid-block crossings should:

- be enhanced through the use of signage, striping, signalization, or other special treatments such as flashing beacons, special paving materials, or raised crossings;
- be constructed in combination with mid-block curb extensions (see Curb Extensions, Section 5.3); and
- include pedestrian lighting oriented toward the crossing.

The staggered continental crosswalk increases crosswalk visibility but positions stripes to avoid vehicle wheels, reducing maintenance burdens





Mid-block crossings improve pedestrian convenience, especially on long blocks.

SUPPLEMENTARY PEDESTRIAN CROSSING TREATMENTS

Pedestrian Warning Signs

Pedestrian warning signs are used to alert road users to the potential presence of pedestrians. Their use should follow MUTCD guidance and be limited to locations where pedestrians may make unexpected entries into the roadway or where drivers' sight distance is restricted. In San Francisco, placement of pedestrian warning signs has historically not followed this guidance, leading to an over-proliferation of the signs and a consequent dilution of their effectiveness. The City should review the placement of its existing pedestrian warning signs and remove them at unwarranted locations, potentially increasing their impact where they are most needed.

Advance Stop and Yield Lines

Stop lines (or limit lines) are solid white lines 12 to 24 inches wide, extending across all approach lanes to indicate where vehicles must stop in compliance with a stop sign or signal. Advance stop lines reduce vehicle encroachment into the crosswalk and improve drivers' view of pedestrians.

On multilane roads, advance stop & yield lines can be an effective tool for preventing multiple threat vehicle and pedestrian collisions. SFMTA has developed guidelines for the installation of advanced stop lines consistent with the national guidance found in section 3B.16 of the MUTCD, which allows for their use from 4 to 50 feet in advance of crosswalks, depending upon location-specific variables such as vehicle speeds, traffic control, street width, on-street parking, potential for visual confusion, nearby land uses with vulnerable populations, and demand for queuing space.

Yield lines are another option that can be used to reduce the possibility of multiple threat collisions at uncontrolled crosswalks on multi-lane roadways. They consist of a single row of white triangles placed across each approach to indicate the point at which vehicles must yield, and may be placed a minimum of 4 feet in advance of uncontrolled marked crosswalk locations.

Flashing Lights and Beacons

In-roadway flashing lights are intended to call extra attention to pedestrians in crosswalks where signage or other design treatments are deemed insufficient. The flashers can be activated passively with infra-red or microwave detectors, or actively by pedestrian push-buttons. In San Francisco and elsewhere, in-roadway flashing lights have not performed well due to ongoing maintenance issues. In San Francisco, little or no effect on injury collisions has been discernible (for lack of collisions), but measurable increases in motorists yielding to pedestrians have been found.

Section 4L.02 of the MUTCD provides a list of factors to consider (including vehicle and pedestrian volume thresholds) when evaluating the need for in-pavement warning lights at crosswalks, as well as standards for their installation and operation.

If reliability can be improved, in-pavement flashing crosswalks should be considered at high-conflict uncontrolled crossing locations with posted speeds under 35 mph and significant pedestrian volumes that require extra visibility.

Flashing beacons can be used to control traffic at intersections where traffic or physical conditions do not justify a full signal but crash rates indicate the possibility of a special need, or to provide supplementary warning of a midblock or uncontrolled school crosswalk. They should be considered for use at high-conflict uncontrolled crossing locations with significant pedestrian volumes where visibility is compromised by grades, curves, or other conditions.

Chapter 4K of the MUTCD provides guidance for the use of flashing beacons.

Parking Restrictions at Crosswalks

Red parking zones on approaches to crosswalks improve sight distance between pedestrians and approaching motorists and are recommended in the MUTCD for both controlled and uncontrolled intersections. In San Francisco, a minimum 10 foot red zone should be painted on all crosswalk approach legs. Longer red zones should be used at locations with a greater need for improved visibility due to unique sight distance, geometric, or other conditions.

In San Francisco, due to limited on-street parking supply and high demand, the practice has been to allow parking up to intersections unless there are location-specific grounds for parking removal. The new 10 foot minimum guideline will be implemented on a case-by-case basis as resources allow. Priority should be given to intersections with safety issues, existing project locations, and locations where staff is conducting safety reviews. SFMTA's Crosswalk guidelines should be consulted for further guidance regarding red zones.

Special Intersection Paving

Special intersection paving treatments can break the visual monotony of asphalt streets, highlight crossings as an extension of the pedestrian realm, and announce key civic or commercial locations. Special intersection paving treatments include integrated colors, textures, and scoring patterns. They may be instituted within crosswalk markings or across an entire intersection.

▲ Advance yield lines (top) alert drivers to an impending crosswalk; advance stop lines (bottom) require vehicles to stop in advance of a crossing

◀ Pedestrian warning sign

▲ Special crosswalk treatments may include a raised crosswalk, colored paving treatment, and trees in the parking lane

Special decorative paving, including colored and/or textured concrete, asphalt or pavers, or any similar treatment does not define a crosswalk and should not be seen as a safety measure. Standard transverse or longitudinal high visibility crosswalk markings are still required.

Special intersection paving treatments are more costly to build and maintain than standard treatments. Where capital and maintenance budgets allow, they may be considered on:

- streets important to the city pattern;
- commercial streets;
- at entries to residential areas where residential streets intersect with higher volume streets;
- at key civic locations, such as civic buildings or entries to open spaces; and
- at mid-block crosswalks.

Paving treatments should:

- use integrated color, texture, and pattern. Potential materials include but are not limited to colored and stamped asphalt, poured concrete, and stone or concrete pavers;
- provide a surface that does not cause discomfort due to excessive vibration to those using wheelchairs or other assistive mobility devices;
- use stable, durable, and slip resistant materials per DPW Director's Order 176,112;
- include edging treatments to visually contrast with the primary material and with the asphalt roadway; and
- include crosswalk striping (parallel white lines) on the outer edge of the crossing.

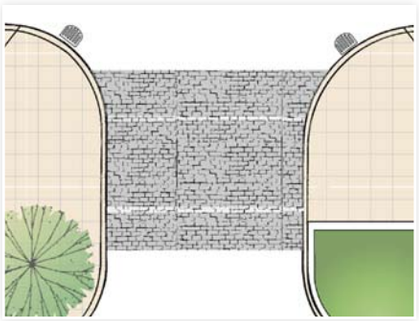
See also Section 6.4: Paving.

Raised Crosswalks and Intersections

Raised crosswalks bring the level of the roadway to that of the sidewalk, forcing vehicles to slow before passing over the crosswalk and providing a level pedestrian path of travel from curb to curb. Raised crosswalks can be located at intersections or mid block. At intersection locations, the raised area can be extended to include the entire intersection.

Raised crosswalks should be considered:

- as a standard treatment at alleys and shared public ways;
- where low-volume streets intersect with high-volume streets, such as at alley entrances, neighborhood residential streets, and local access lanes of multi-way boulevards;
- where a street changes its function or street type. For example, a commercial throughway may become a neighborhood commercial or a residential street as the land uses along it change; and
- at key civic locations.



▲ Raised crosswalks make pedestrian crossing easier and safer for pedestrians by more overtly continuing the sidewalk across an intersection, not only making crossings more visible to drivers, but physically requiring them to slow.

▼ Raised crossing at Octavia and Hayes Streets

Raised crosswalks should not be used on designated transit routes or where there are steep grades or sharp curves.

Raised crosswalks should:

- be flush with the sidewalk in height, and at least the width of the crossing or intersection;
- be long enough in the direction of travel to allow both front and rear wheels of a passenger vehicle to be on top of the table at the same time - typically 10 feet. Specific lengths should be determined by using the ITE/FHWA document Traffic Calming: State of the Practice;
- be instituted in combination with special paving treatments as discussed above, or use the same material as that of adjacent sidewalks;
- provide detectable warnings where pedestrians will cross into the vehicle area;
- be designed such that the vertical transition does not cause unnecessary jarring or discomfort to vehicle passengers with spinal cord injuries when driven over at the appropriate speed; and
- consider resulting drainage patterns—depending on grade, this may necessitate additional catch basins, trench drains, or other measures;

Pedestrian refuge islands

Crosswalks may also include pedestrian refuge islands to break up the crossing and slow cars. See Section 5.4: Medians and Islands.

PEDESTRIAN SIGNALS

Pedestrian signal indications should be used at all traffic signals. The international pedestrian symbol signal should be used rather than WALK/DON'T WALK text.

Pedestrian Signal Timing

Pedestrian signals should allow sufficient time for pedestrians to cross the street, including seniors, children, and people with disabilities.

Historically, a standard walking speed of 4.0 feet per second has been used to calculate the minimum pedestrian clearance interval (the flashing red hand plus yellow and any all-red) for pedestrian signals in San Francisco. In anticipation of upcoming changes to federal standards, the City has reduced the walking speed used to time the pedestrian clearance interval to 3.5 feet per second. In nearly all locations in the City, signals allow pedestrians walking as slow as 2.5 feet per second to cross the entire street if they step off the curb at the beginning of the walk phase.

Walking speed is a function of the age and physical ability of the population. The walking speed used to calculate the pedestrian clearance interval should closely match that of pedestrians in San Francisco, including seniors, children, and people with disabilities. San Francisco is also experimenting with video detection systems to give slower pedestrians additional crossing time. As a next step, San Francisco should conduct studies to determine if slower walking speeds are appropriate and, if so, what those speeds should be.

Pedestrian 'scrambles': Exclusive pedestrian phases (i.e. pedestrian 'scrambles') may be used where turning vehicles conflict with very high pedestrian volumes and pedestrian crossing distances are short.

Pedestrian 'head-start signals': Leading pedestrian intervals, which give pedestrians a head start before vehicles are given the green, may be considered at signalized intersections with a high incidence of pedestrian conflicts and right-of-way violations.

Pedestrian-actuated signals: In San Francisco, signals on short, fixed time cycles should generally be used rather than actuated signals (pedestrian push-buttons) to allow consistent crossing opportunities. Pedestrian actuation should only be used when pedestrian crossings are intermittent, at

In-roadway flashing lights enhance crosswalk visibility

Flashing beacon (at left)

locations with relatively long pedestrian clearance time that can result in excessive delay to transit vehicles, and to activate audible pedestrian signals or to provide an extended WALK interval. Since many pedestrians fail to notice pushbutton devices, additional research on passive video and infra-red detection should be conducted.

Timed progression of traffic signals should ensure that sufficient time is allocated per cycle for pedestrian crossings.

Pedestrian countdown signals

Pedestrian countdown signals are designed to enhance the effectiveness of pedestrian signals at clearing the crosswalk before a signal changes direction. Surveys show that most people misinterpret the meaning of the flashing hand of the traditional pedestrian signal. Providing the pedestrian countdown device helps pedestrians better interpret the pedestrian signals. Countdowns also enable pedestrians to stop on a median refuge, where provided, and wait for the next phase if they find the time left to be too short to finish crossing. Pedestrian countdown signals have been shown to have a 25% reduction in pedestrian injury collisions.

Pedestrian countdown signals should be provided at all signalized intersections.

Accessible pedestrian signals

Accessible pedestrian signals (APS) provide information in non-visual format such as audible tones, verbal messages, and/or vibrating surfaces. The MUTCD addresses specific pushbutton design and placement for APS and contains standards on audible tones, verbal messages and vibro-tactile devices. San Francisco's observations have shown that APS benefits all pedestrians by providing audible and vibro-tactile cues.

APS should be provided at all new signalized intersections. Existing signals should be retrofitted over time, using the SFMTA's APS Prioritization Tool, developed using the draft version of the National Cooperative Highway Research Program (NCHRP) APS Prioritization Tool, in consultation with the Mayor's Office on Disability and individuals and advocacy groups representing the visually impaired community.

VEHICLE TURNING MOVEMENTS AT CROSSWALKS

Right Turn on Red

The California Vehicle Code allows drivers to turn right on red after coming to a complete stop, unless prohibited by a sign. Right turn on red (RTOR) prohibitions can be an important tool for increasing pedestrian safety at certain intersections. Under some circumstances, prohibiting RTOR can reduce conflicts and collisions, and it deters motorists from blocking the perpendicular crosswalk while they inch forward to turn. On the other hand, prohibiting RTOR may mean increased vehicle delay, including delay to transit. RTOR prohibition can also lead to more conflicts during right turns on green, since turning motorists must now wait to turn while pedestrians are crossing with the green light.

The MUTCD and the Institute of Transportation Engineers suggest considering the prohibition of RTOR under the following circumstances:

- inadequate sight distance to vehicles approaching from the left (or right, if applicable);
- geometrics or operational characteristics of the intersection that might result in unexpected conflicts;
- an exclusive pedestrian phase;
- an unacceptable number of pedestrian conflicts with right-turn-on-red maneuvers;

Pedestrian countdown signal and accessible pedestrian signal

Pedestrian scrambles allow a dedicated signal phase for pedestrians to cross in any direction at an intersection

- heavy volume of pedestrian crossings;
- request from pedestrians with disabilities using the intersection;
- school crossings;
- railroad crossings; and
- traffic signals with three or more phases.

Beyond the conditions listed above, the City also considers high speeds on cross streets and a verified collision history caused by RTOR maneuvers. As of 2007, signs were posted on one or more approaches of 14% of all signalized intersections citywide (169 out of 1,166).

San Francisco's practice of considering RTOR prohibition at intersections on a case-by-case basis should be continued, subject to the guidelines listed above. RTOR prohibitions may be considered at intersections that:

- have fewer than 300 cars making the right turn per hour; and
- do not have curb-running transit with near-side transit stops.

At intersections that do not meet all of these criteria, RTOR prohibitions may still be appropriate pursuant to additional study and environmental review.

Multiple turn lanes

Compared to single turn lanes, multiple turn lanes decrease pedestrian comfort and increase potential conflicts between turning vehicles and pedestrians crossing concurrently with the vehicular turning movement. Safety may be compromised if one turning vehicle obscures the driver's view of pedestrians in the crosswalk from a second, trailing vehicle in an adjacent turn lane. Multiple turn lanes may also compromise bicycle safety.

The presence or absence of multiple turn lanes is not by itself a predictor of an intersection's propensity to generate pedestrian collisions. It is important to consider how removing a multiple turn lane and requiring the same number of vehicles to turn from one lane will affect pedestrian and vehicular safety. However, pedestrian perception of safety and conflict reduction is also an important consideration in intersection design.

Multiple turn lanes should be avoided wherever possible. No new multiple turn lanes with conflicting vehicle/pedestrian movements should be built in San Francisco. Existing multiple turn lanes should be pro-actively eliminated or mitigated.

Feasibility of multiple turn lane removal is contingent upon vehicle level of service, queuing, transit operations, and upstream traffic safety considerations. Even if consideration of these criteria do not point to removal of multiple turn lanes, it may still be advisable to make lane assignment changes if there is a documented history of relevant collisions involving pedestrians, and other attempted mitigations have proven ineffective.

If removal is not possible, the City should consider potential mitigations for multiple turn lane conditions found to be problematic. Strategies to mitigate problematic multiple turn lane conditions include the following:

- separate pedestrian and turning movements;
- leading pedestrian intervals;
- permissive-protected signal phasing (pedestrian crossing phase ends before vehicle phase);
- limited hours of multiple turn lanes;
- parking restrictions; and
- signs and enforcement.

CROSSWALK CLOSURES

San Francisco has a number of closed crosswalks, creating discontinuous pedestrian paths of travel and making walking inconvenient. A primary motivation for closing crosswalks is to safeguard pedestrians in the face of very high traffic volumes or speeds and auto-oriented design, but many times pedestrians ignore crosswalk closures rather than crossing three times to reach a destination that could be reached by one illegal crossing, creating additional safety issues.

New crosswalk closures should not be instituted.

Existing closed crosswalks should be evaluated for opening. This may necessitate additional safety measures such as pedestrian actuation and signal timing changes. Reopening of crosswalk closures will require site-specific analysis and environmental review. At the time the study is undertaken, the effects of removal of crosswalk closure would be evaluated for its impact on the physical environment.

▲ Intersection leg closed to pedestrian crossing

CURB RAMPS

Curb ramps provide pedestrian access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, crutches, handcarts, bicycles, and pedestrians who have trouble stepping up and down high curbs.

Curb ramps must be installed at all intersections and mid-block locations where pedestrian crossings exist per ADA guidelines. Curb ramps are required at mid-block locations to access on-street accessible parking spaces, where provided, and at all new passenger loading zones. New curb ramps should be prioritized per the City's ADA transition plan for sidewalks and curb ramps.

Guidelines

Curb ramps must comply with DPW standard plans. ADA required slopes and dimensions are detailed in DPW Curb Ramp Standard Plans CR-1 through CR-6 and summarized in the figure below.

Per standard plans, curb ramps should be installed parallel to the direct path of travel across an intersection. At four-way intersections, two curb ramps should be installed at each corner.

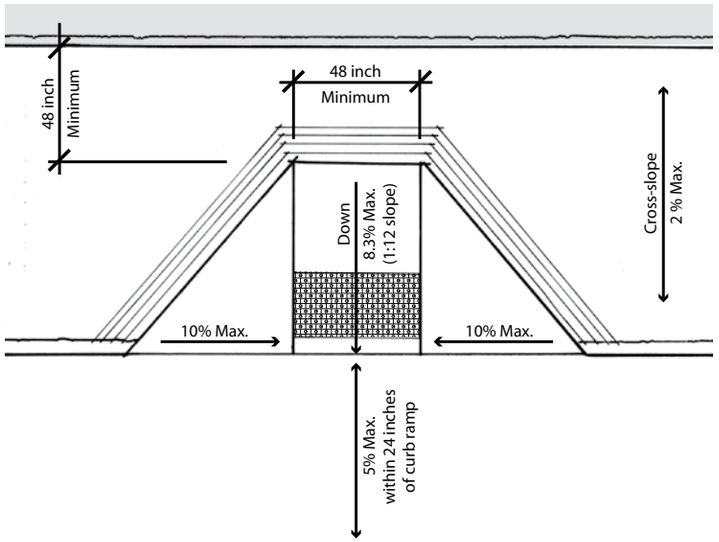
At raised crossings or intersections or other flush transitions between the sidewalk and the roadway, curb ramps are not necessary, but detectable warning strips must be provided. A 3 foot deep detectable warning surface is required where the ramp, landing, or blended transition connects to a crosswalk.

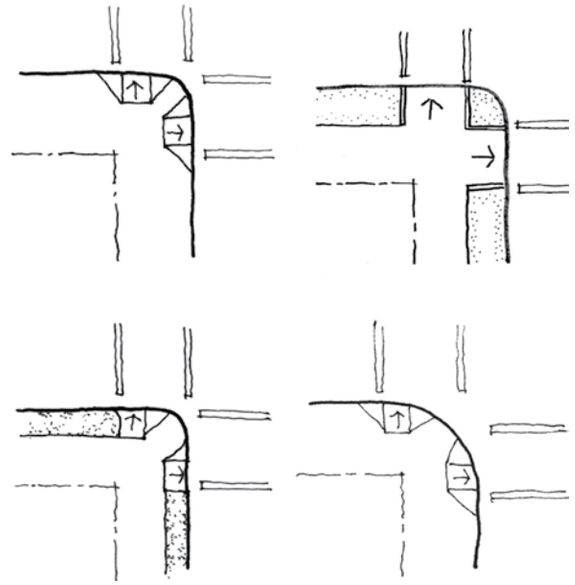
On new streets, storm drainage inlets should be placed on the uphill side of curb ramps to prevent standing water at curb ramp landings.

Small planting areas can be installed at corners on either side of curb ramps as shown in the diagram below.

Curb ramps and crosswalks should remain clear of obstacles. Existing conflicting elements should be moved as opportunities and budgets allow. No new pole, utility or other impediment should be placed in the curb ramp return areas.

▲ Accessible curb ramps





▲ Accessible curb ramps should be provided at all corners, one per crosswalk end

The length of a corner radius can have a significant effect on the overall operation and safety of an intersection.

Corner Curb Radii

5.2

The shape of a corner curb radius (the radius defined by two sidewalks on perpendicular streets that come together at a corner) has a significant effect on the overall operation and safety of an intersection. Smaller turning radii increase pedestrian safety by shortening crossing distances, increasing pedestrian visibility, and decreasing vehicle turning speed.

The shape and dimensions of curb radii vary based on street type and transportation context

DEFINITIONS

Design vehicle: selected vehicle type used in determining appropriate turn radius at an intersection

Design for [a vehicle turn]: to allow for a particular vehicle type to complete a turn fully within its designated travel lane or lanes

Accommodate [a vehicle turn]: to allow for a particular vehicle type to complete a turn with latitude to use adjacent or opposing lanes on the origin or destination streets

Curb radius: the actual radius proscribed by the curb line at an intersection

Effective radius: The radius available for the design vehicle to make the vehicle turn, accounting for the presence of parking, bike lanes, medians, or other features

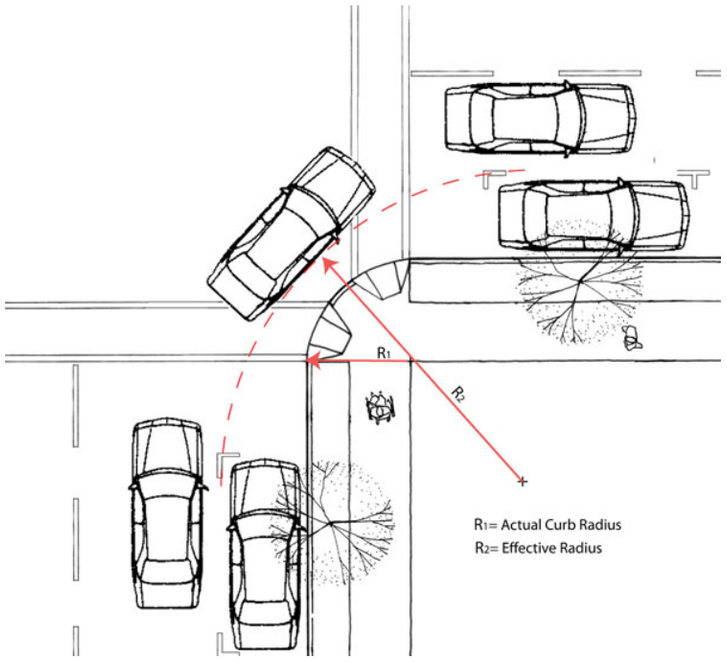
GUIDELINES

Curb radii should be designed to maximize pedestrian space and shorten pedestrian crossing distance to the greatest extent feasible; the smallest possible curb radius should be used while allowing vehicle movements as described below.

The effective turning radius, not the curb return radius, should always be used to determine the ability of vehicles to negotiate a turn.

These guidelines provide a general overview of the bulb-out design process. However, curb radius design is sensitive to a wide range of variables; these guidelines cannot replace professional judgment and technical analysis. Each project should consider the particular characteristics of the site, and adjust the design as necessary.

EFFECTIVE RADIUS: Where a curbside parking and/or bicycle lane is present, the effective radius of the turn is increased.



Design vehicles

Determining a design vehicle should consider and balance the needs of the various users of a street, from pedestrians and bicyclists to emergency vehicles and large trucks, considering the volume and frequency of these various users. The designer should distinguish between "designing for" and "accommodating" the needs of large vehicles (see definitions above).

For example, on designated transit or freight routes with frequent large turning vehicles, streets should be "designed for" these vehicles. Where large vehicles are occasional users of a street, there are low traffic volumes, or other characteristics such as high pedestrian volumes necessitate taking greater measures for pedestrian safety and comfort, designers may consider "accommodating" these vehicles.

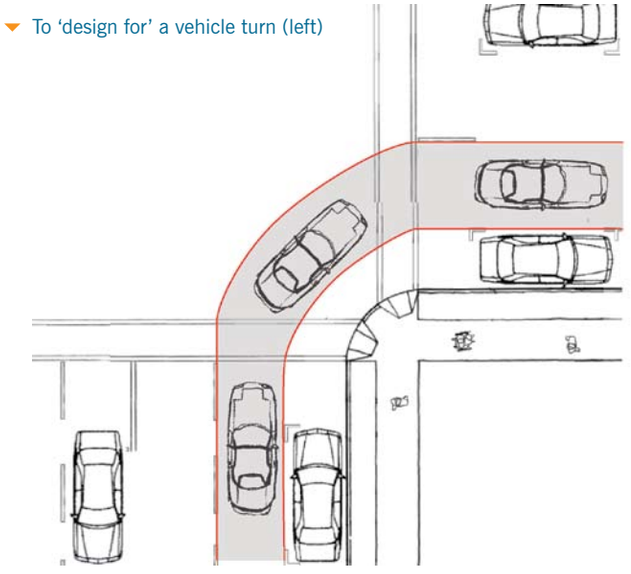
General conditions

General conditions apply to all streets where conditions are present as described below.

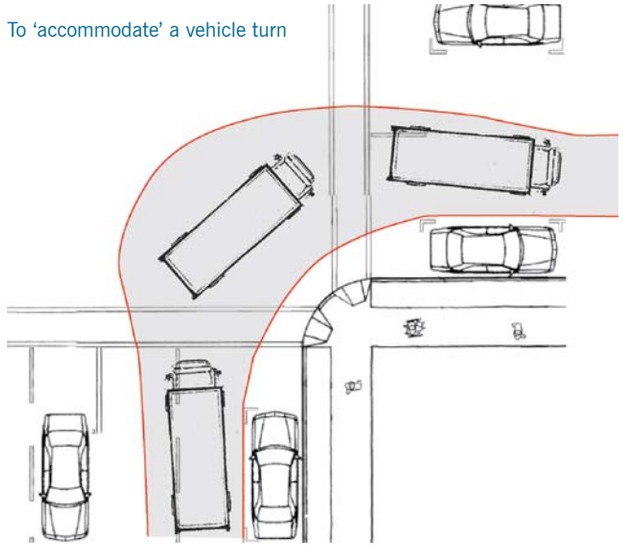
Emergency vehicles: All streets greater than 150' in length should accommodate emergency vehicle (WB-40) turns within the full right-of-way of the intersection. Because emergency vehicles have sirens and flashing lights and other vehicles must pull over, they can typically use the full right-of-way without encountering opposing vehicles. On busier streets, the ability of emergency vehicles to swing wide may be limited by queued traffic which may not be able to pull over.

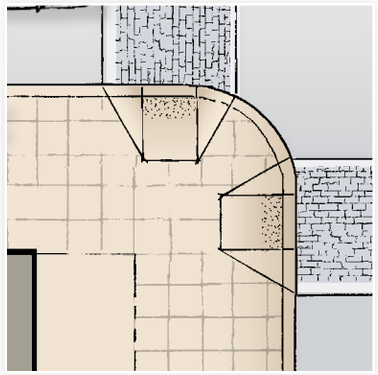
Transit routes: Transit routes include transit service routes as well as routes transit vehicles use to start their run and return to the yard. At intersections where buses make designated turns, streets should be designed for a B-40 bus. On some Muni community routes, Muni may use a B-30 – check with SFMTA. On other corners along Muni routes, where buses may have to make occasional detours, turns should accommodate a Muni vehicle using the entire roadway, similar to an emergency vehicle.

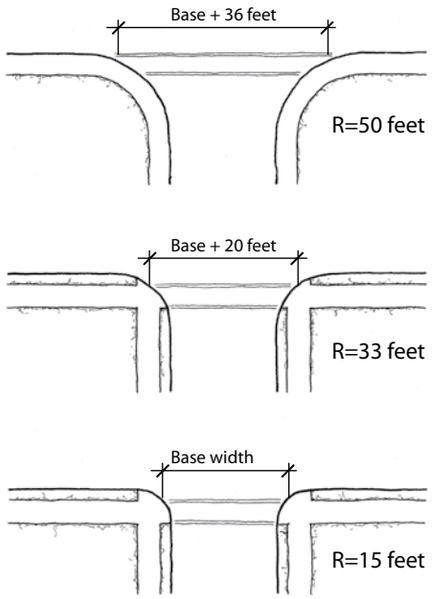
To 'design for' a vehicle turn (left)



To 'accommodate' a vehicle turn







▲ Small curb radii are more pedestrian friendly because they decrease crossing distances and slow vehicles at turns.

Other transit considerations include:

- To determine whether a particular intersection is used by transit vehicles to start their run or return to the yard, check with SFMTA.
- On trolley bus routes, overhead wire locations determine the turning envelope for the bus. No curb radius should be constructed that forces the bus to deviate more than nine feet on center from the middle of the overhead wires. On Muni LRV routes, the curb radius should be constructed such that no part of the sidewalk is closer than two feet from the dynamic envelope of a turning LRV. These routes must also accommodate historic streetcars.
- On streets where other transit providers are present, the curb radius should be designed for their transit vehicles as well.
- Consideration should also be given to private transit operators in areas where large tourist buses and vans are likely to conduct business on a regular, ongoing basis.

Freight routes: Freight routes are streets that are designated as "Routes with Significant Truck Traffic" on Map 15 in the Transportation Element of the General Plan. Freight routes should be designed for WB-50 trucks. Larger WB-60 trucks may also be present on City streets, particularly on designated state highways and in industrial areas. These may need to be accommodated in certain instances, though they are not practical in most of San Francsico.

Standard street types

Standard street types describe appropriate design vehicles to use per street types, based on Better Streets Plan street types.

Local streets: Local streets are typically narrower streets with low traffic volumes and speeds, and limited need for large vehicles.

Pedestrian-activity streets: Pedestrian-activity streets typically have high volumes of pedestrians, moderate traffic

CATEGORY	LOCATION	DESIGN VEHICLE	POTENTIALLY ALLOWABLE EXCEPTIONS
TRANSIT ROUTES	corners with turning buses on Muni rapid or local routes or routes rapid or local buses use to start run or return to yard	B-40	P: turn partially from adjacent lane
	corners with turning buses on Muni community routes or routes community buses use to start run or return to yard	B-40; some routes have B-30 buses, check with SFMTA	P: turn partially from adjacent lane
	corners with turning buses on routes served by Golden Gate Transit, AC Transit, SamTrans, Vallejo Transit, University of California transit services, PresidiGo	check with transit provider	P: turn partially from adjacent lane
	corners with potential occasional turning buses due to detours	B-40	P: turn partially from adjacent lane; turn fully from adjacent lane, turn from opposite lane, turn into opposite lane
EMERGENCY VEHICLES	all intersections at streets > 150' in length	WB-40	P: turn partially from adjacent lane, turn fully from adjacent lane, turn from opposite lane, turn into opposite lane
DESIGNATED FREIGHT ROUTES	GP transportation element Map 15 designated "Routes with significant truck traffic"	WB-50	P: turn partially from adjacent lane

P = permitted

volumes, and frequent need for loading access. They function as the central public space of San Francisco neighborhoods.

Throughways: Throughways typically have wide roadways, high traffic volumes and speeds, and more large vehicles. They may have significant pedestrian volumes and/or concerns about pedestrian safety or wide crossing distances.

Industrial streets: Similar to freight routes, industrial streets are used for loading, shipping and deliveries. They are typically located in industrial areas with lower levels of pedestrian and car traffic.

Alternative strategies for intersections with frequent large vehicle turns

Before increasing curb radius dimensions to accommodate necessary design vehicles, consider the alternative measures described here:

Compound radius: A compound radius changes the curb radius over the length of the turn, such that it has a smaller radius at the crosswalks, and a larger radius in the center where vehicles are turning. Compound radii effectively shorten crossing distances and make pedestrians visible while accommodating larger vehicles to turn; because they allow more sweeping turns, they do not slow turning vehicles.

Compound radii may be considered where there are high pedestrian volumes, or a desire to make pedestrians visible, but a need for frequent large turning vehicles such as right-turning buses.

At-grade paving treatments: To accommodate occasional trucks in very low traffic areas, consider a corner design in which the area between the large and the small curb returns is at street level, and is textured to discourage high-speed turns but allow low-speed use by larger vehicles. This treatment has limited application, such as industrial streets.

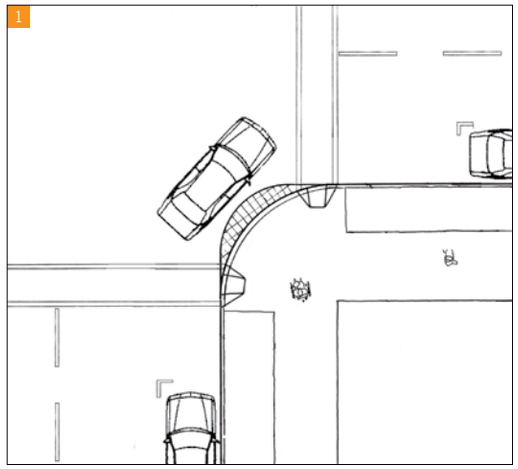
Advance stop lines: Advance stop lines on the destination street can increase the space available for large vehicles to make a turn by enabling them to swing into opposing lanes on the destination street while opposing traffic is stopped.

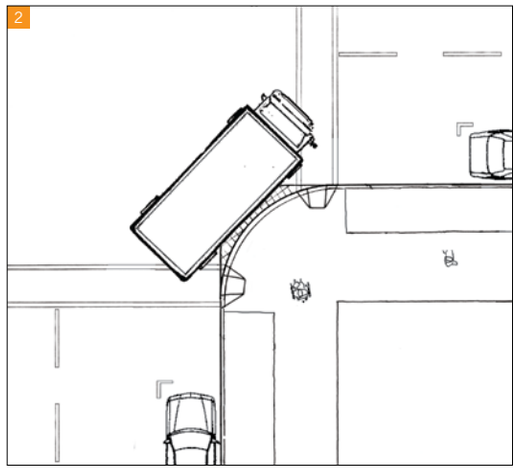
Painted median: Where there is sufficient lane width on the destination street, a painted median can enable a large vehicle to complete a turn without turning into opposing traffic.

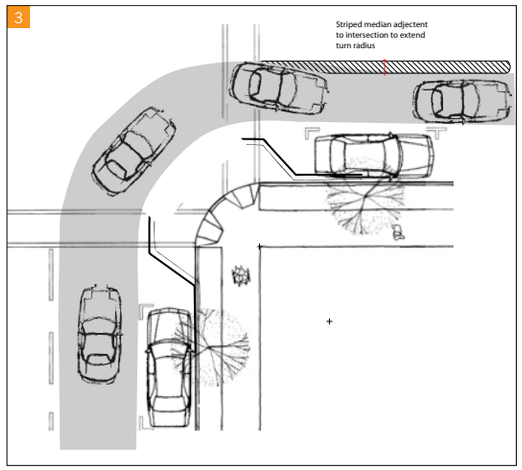
Restricted access: Where there is a desire to keep curb radii small, restrictions on large vehicles making the turn may be considered. This should be considered in light of the overall street network.

CATEGORY	BSP STREET TYPES	DESIGN VEHICLE	ACCOMMODATION VEHICLE*
LOCAL	alley, shared public way, neighborhood residential, local lanes of boulevard	Passenger car	SU-30
PEDESTRIAN-ACTIVITY	neighborhood commercial, downtown commercial, downtown residential	SU-30	WB-40
THROUGHWAY	commercial throughway, residential throughway, urban mixed-use, parkway, through lanes of boulevard	SU-30	WB-40
INDUSTRIAL	industrial	WB-40	WB-50
VARIES	park edge, ceremonial	Varies	Varies

* Accommodations include: turning partially or entirely from adjacent lanes, turning from opposing lanes, or turning into opposing lanes







Two strategies to extend effective turn radius.

1,2: At-grade paving treatment

3: Painted median to extend turn radius

Curb Extensions (Bulb-Outs)

5.3

Curb extensions (also called bulb-outs) extend the sidewalk into the parking lane to narrow the roadway and provide additional pedestrian space at key locations; they can be used at corners and at mid-block locations.

Curb extensions enhance pedestrian safety by increasing pedestrian visibility, shortening crossing distances, slowing turning vehicles, and visually narrowing the roadway. Generally, these benefits are greater the further the bulb-out extends into the roadway and the tighter the turn radius created by the bulb-out, but should be balanced against roadway characteristics and the needs of large vehicles to navigate turns.

Curb extensions can often be lengthened to create public spaces, landscaped areas, or transit waiting areas. They can also be employed as neckdowns or chokers, traffic calming techniques that reduce vehicle travel lanes.

Curb extensions can have the following benefits:

- Increased pedestrian visibility at intersections through improved sight lines.
- Decreased pedestrian exposure to vehicles by shortening the crossing distance.
- Reduced vehicle turn speeds by physically and visually narrowing the roadway.
- Increased pedestrian waiting space.
- Additional space for street furnishings, plantings and other amenities.
- Reduced illegal parking at corners crosswalks and bus stops.
- Facilitated ability to provide two curb ramps per corner.

Although curb extensions have many benefits, they may not be appropriate in all circumstances. Use of curb extensions should consider the following:

- They may be more expensive to construct than other measures.
- They can reduce flexibility of the roadway in construction routing.
- They can reduce future flexibility in making changes to the location of bus zones, roadway lane layout, or crosswalks.

Bulb-outs should also be considered as one among many strategies to enhance pedestrian safety and streetscape character; in some cases, median refuges, raised crossings, other improvements, or a combination of strategies may be more appropriate.

PLACEMENT

Curb extensions should be considered on all street types. Specific priority areas for curb extensions include:

- new streets;
- streets with high pedestrian volumes and/or high traffic volumes and speeds;
- wide streets with long crossing times;
- streets with a history of pedestrian safety concerns;
- locations where neighborhood streets intersect with busier throughways; and
- transit priority streets where shortening crossing cycles would improve transit flow.

Lower priority areas for curb extensions include streets with lower pedestrian and traffic volumes and lower speeds, such as neighborhood residential streets and alleys. However, they may be considered on these street types as well.

Curb extensions should not be used on streets without a parking lane, or that have a peak period tow-away parking lane.

Curb extensions should be placed at transit stops per Section 5.5. Where curb extensions are provided at transit stops, they should be a full-length transit bulb, and not a standard corner bulb, as it can be difficult for a bus to exit or re-enter traffic around a corner bulb-out.

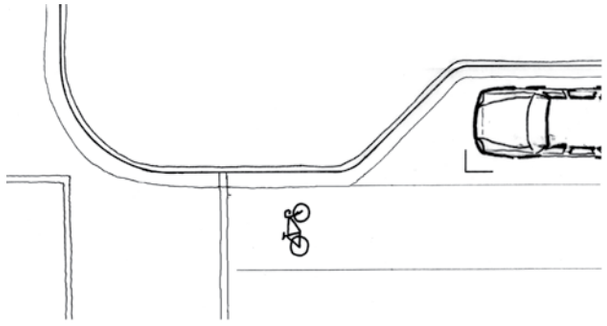
GUIDELINES

Bulb-outs should be designed to maximize pedestrian space and minimize crossing distances as much as feasible, while allowing vehicle movements as described in Section 5.2.

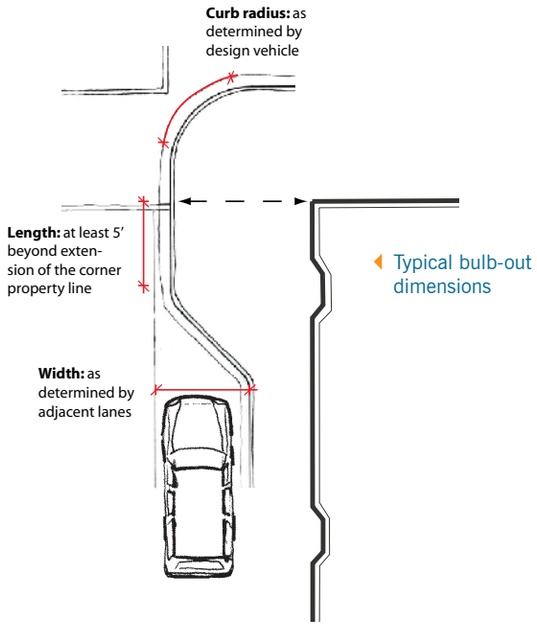
Width and length

Bulb-out width should be maximized based on space for adjacent vehicle and bicycle travel lanes (see Figure 1). The bulb-out should extend to the full width of the parking lane or leave:

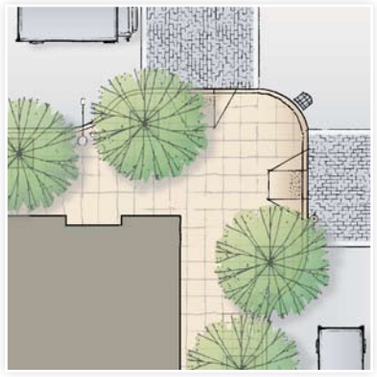
- 10 feet for the nearest auto travel lane;
- 11 to 12 feet for the nearest travel lane if it is a transit lane;
- 12 feet for the nearest travel lane if it is a designated freight route or industrial street; and
- 5 feet or the full width of any adjacent bicycle lanes.



▲ Where bike lanes are present, curb extensions should be set back so that the gutter pan does not extend into the bike lane



Typical bulb-out dimensions



Curb extensions can provide usable neighborhood space for community gathering and socializing.

Street Sweeping at Curb Extensions

Currently in San Francisco, interior radii at curb extensions are designed with wide, curving radii so that street cleaning machines can access the entire street. While these are preferable from a maintenance standpoint, they result in inefficient use of space, with less space available for pedestrian use and landscaping, greater parking loss, and a less sharply defined curb extension. Neighborhoods with bulb-outs that don't meet street sweeping requirements, such as Duboce Triangle, have some of the most desirable streets in the city.

The Better Streets Plan recommends as an alternative the use of sharper turn radii, such that curb extensions return to the prevailing curb line to make efficient use of space. Given current maintenance practices, the alternative strategies suggested in the text should only be used on streets without mechanical street cleaning, on areas with a low maintenance burden (for example on North-South residential streets with less windy conditions), where maintenance funding or agreements are in place (for example, where CBDs or adjacent merchants or property owners agree to pay for hand street sweeping of corners), or in special cases where the benefit of doing so will outweigh the additional maintenance costs.

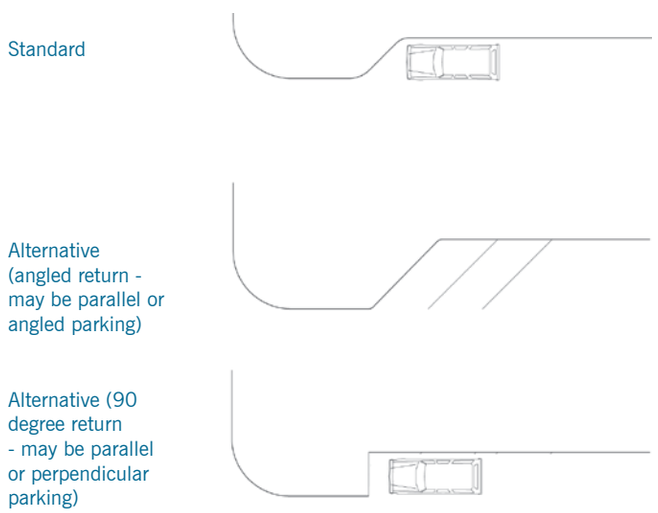
These recommendations require further discussion and study. Meanwhile, the City should explore maintenance strategies to achieve effective street cleaning at curb extensions with sharp radii, such as expanding the use of maintenance agreements.

▼ Where necessary, driveways can cross curb extensions.

Before reducing the width of the proposed bulb-out, consider modifications to lane striping across the entire roadway to provide for the above-listed clearances. Since bulb-outs are often expensive to construct, they should be sufficiently wide to maximize their benefit. Bulb-outs less than 4 feet in width may not be a cost-effective solution as compared to other potential interventions.

Curb extensions should not encroach on cyclists' space. Where bike lanes use a painted inside edge, the bike lane should be painted continuously as the bike lane passes the curb extension, and the bulb-out should be set back so that the gutter does not extend into the bike lane. On lower-speed and volume streets where bikes can travel in mixed flow with vehicles, wider curb extensions may be appropriate, but care should be taken not to force cyclists to merge unexpectedly with faster moving cars at the end of the block. If bulb-outs extend beyond the limit of parked cars, additional efforts should be made to ensure their visibility.

Bulb-outs should continue at least to the inside edge of the crosswalk, and ideally extend 5 feet beyond the property line before beginning to return to the curb to provide additional width for pedestrians, landscaping, or other streetscape features. Existing driveways may cross through bulb-outs.



Radii

Curb extensions should follow corner curb radius guidance in Section 5.2. Where turn radii make adding bulb-outs at each corner prohibitive, strive for two bulbs per intersection, kitty-corner to each other, in order to improve pedestrian conditions for all four crossings of an intersection.

Curb extensions should return to the prevailing curb line as sharply as possible to maximize useable space and minimize parking loss, per the following guidelines:

Standard return: Standard bulb-outs should be designed with an inner/outer curb radius of 20' and 10', sometimes reduced to 15' and 10', to enable street sweeping machinery to sweep the entire curbline.

Non-standard return: Sharper curb returns increase pedestrian space and minimize parking loss while better defining a curb extension. However, they are more difficult and costly to maintain. Where maintenance funding or agreements are in place to account for this, designs may consider the non-standard treatments described below:

- **90 degree return:** Curb extensions may return to the prevailing curb line at a 90 degree angle. This configuration may be used with parallel or perpendicular parking.
- **45 degree return:** Curb extensions may return to the prevailing curb line at an angle. This may be used with either parallel parking (45 degree return) or angled parking (at angle of parking lane).

Temporary Bulb-Outs

Temporary bulb-outs may be used in some instances where permanent bulb-outs are cost-prohibitive. These can be created by delineating the edge of a curb extension with bollards, striping, and other elements to protect the extended sidewalk corner without bringing the curb extension up to the sidewalk level. This should be considered a temporary treatment until funding and time allow construction of a standard curb extension.

Making Sidewalk Widenings and Bulb-Outs More Cost-Effective

Corner bulb-outs and sidewalk widenings are among the most effective tools to enhance pedestrian safety and quality. They are essential components of a truly successful pedestrian environment.

However, they are very expensive to construct, particularly when compared to other potential strategies, which often prohibits their inclusion in pedestrian projects with limited budgets. The high cost of building bulb-outs and widenings comes from various factors, including:

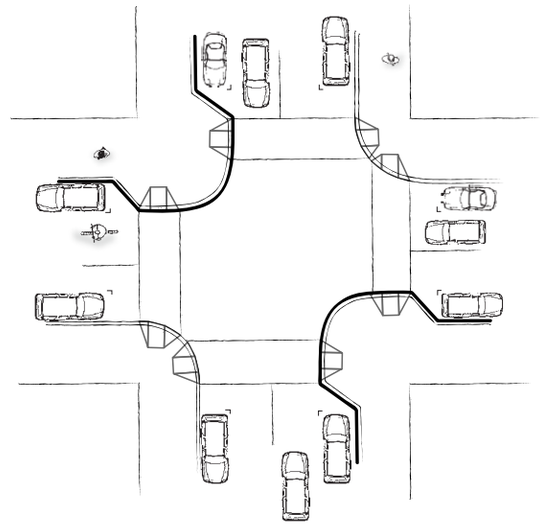
- demolition and reconstruction of curbs;
- re-grading of the roadway;
- curb ramp construction;
- re-alignment of utilities lines and poles;
- more costly re-paving;
- catch basin relocation; and
- fire hydrant relocation.

Some strategies may be considered to reduce costs:

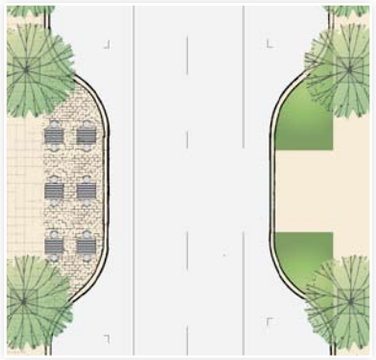
1. Allowing utilities to remain under sidewalk extensions. Per Draft SFPUC policy, sidewalks may be constructed over existing sewer or water lines.
2. Use of trench drains (channels covered with metal grating) to eliminate the need to relocate catch basins or re-grade streets for drainage. Trench drains require additional maintenance to clean out channels, particularly on high-use and commercial streets. See Section 6.2.
3. Allowing fire hydrants to remain in place. Fire hydrant relocation can be prohibitively expensive ($50,000-$100,000) when constructing sidewalk bulb-outs or widenings, often resulting in a decision to not construct a particular curb extension. Current Fire Department standards require hydrants to be between 24 and 27 inches from the curb line. When curb lines are moved, hydrants that are present must be shifted as well. Allowing hydrants to remain in place would result in significant cost savings for constructing bulb-outs and widenings. The bulb-outs would also keep the area clear of illegally parked cars, which improves access to the fire hydrants. Instead of moving hydrants, in-street reflectors, painted curbs, and other technologies may be used to make existing hydrants easy to locate. **Follow up discussions with the Fire Department would be necessary to implement this recommendation. The City should seek a solution that addresses the need to easily and quickly locate hydrants while enabling the cost-effective construction of curb extensions with significant pedestrian safety benefits.**

Trench drains may be used to allow pre-existing catch basin locations to be maintained and decrease the potential cost of curb extension construction. See Section 6.2 for appropriate use and design of trench drains.

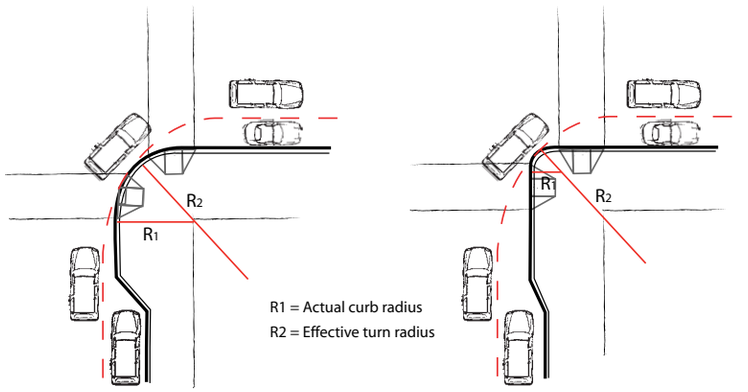
Curb extensions shorten crossings and can act as a choker, narrowing traffic lanes at intersections to calm traffic, improving pedestrian safety at crossings



Where turning radii limit bulb-out dimensions, consider two bulb-outs at opposite corners, thereby shortening all crosswalk lengths



Mid-block curb extensions



Option 1: A shorter crossing and larger overall bulb-out

Option 2: Greater directionality and sharper curb radius

Bulb-out shape alternatives

Shape

Bulb-outs should strive for a rectilinear shape to keep a direct path of travel and to regularize crossings and curb ramps. The adjacent figures show alternative bulb-out shapes with the same turn radius. The figure at left provides greater overall space for pedestrians waiting to cross the street, which may be useful at impacted locations. The figure at right provides more clear directionality and direct curb ramps, as well as a tighter corner. Both alternatives are acceptable; the resulting design should be balanced with the overall goals of the project.

Other design features

Bollards, planters, or other fixed objects may be placed at the back of curb where necessary to protect pedestrians and prevent vehicles from driving onto the sidewalk.

Curb extensions should be designed to hold the 100-year storm within curb width. Stormwater features can help to offset reduced capacity from curb extensions. Individual analysis should be conducted for each project.

Curb extensions should either relocate the corner catch basin to the outer edge of the extension, or provide a covered channel (trench drain) to convey stormwater to the existing catch basin (see side bar, previous page). The channel must be covered with an ADA-compliant cover.

EXTENDED BULB-OUTS

Longer curb extensions may be considered to create space for seating, landscaping, stormwater features, and other amenities, particularly in areas lacking in open space. Extended bulb-outs should use special paving or an edging treatment to distinguish the space as a plaza space separate from the through travel area.

Street furnishings and other above-grade objects should be located on curb extensions outside of crossing areas to increase space for pedestrian through travel on the sidewalk.

MID-BLOCK BULB-OUTS

Mid-block bulb-outs may be considered on all street types to provide additional sidewalk space for landscaping, seating, stormwater treatment, and amenities, and improve safety at mid-block crossings by shortening crossing distances and enhancing pedestrian visibility. Mid-block bulb-outs should follow these guidelines:

- They should include bollards, landscaping, or other buffers between pedestrians and passing vehicles, designed to not impede a driver's view of pedestrians.
- They should use special paving or an edging treatment to distinguish the space as a plaza space separate from the through travel area.
- Street furnishings and other above-grade objects should be located on curb extensions where space allows to increase space for pedestrian through travel on the sidewalk.
- Mid-block curb extensions should be used at designated mid-block crossings. Mid-block crosswalks should be provided per Section 5.1.

The City should explore the use of curb extensions in front of fire hydrants so that the hydrant is not blocked by illegally parked vehicles. This would require a change to current City standards regarding location of fire hydrants relative to the curb. See sidebar.

Mid-block bulb-outs can provide space for landscaping, cafe seating, or pedestrian furnishings.

Medians and islands can calm traffic and provide safe pedestrian refuge, while incorporating space for amenities, landscaping and stormwater management

Medians and Islands

5.4

A median is the portion of the roadway separating opposing directions of the roadway, or local lanes from through travel lanes. Medians may be depressed, raised, or flush with the road surface. Medians are generally linear and continuous through a block. An island is a defined as an area between traffic lanes used for control of traffic movements. Within an intersection, a median is considered an island.[1]

Raised medians and islands provide space to locate pedestrian safety features and traffic control devices, amenities, landscaping and stormwater management. They can provide traffic calming and aesthetic benefit, but the addition of medians alone may also cause an increase in vehicle speeds by reducing friction between opposing directions.

1 AASHTO Green Book

The functions and benefits of medians include:

- separate opposing traffic;
- provide a recovery area for out-of-control vehicles;
- provide an emergency stopping area;
- provide space for speed changes and storage for left- and u-turns;
- minimize headlight glare;
- restrict through travel on streets with two-way left turn lanes or where cross streets intersect with more significant throughways;

- provide space for a pedestrian refuge on wide streets where those on foot cannot cross the entire street in one phase;
- reduce excessive pavement areas, and provide open green space;
- provide space for transit stops;
- separate through traffic from local traffic on ulti-way boulevards; and
- create space for a distinctive design treatment.

Where no median is present, raised islands can be used as traffic calming features to briefly narrow the traveled way, either in mid-block locations, or to create gateways at entrances to residential streets. Islands may also be found at corners.

GUIDELINES

At crossings, the end of medians should be flush with the edge of the crosswalk and should not be significantly rounded. A thumbnail, or raised island on the intersection side of the crosswalk, should be provided in medians that function as pedestrian refuge islands.

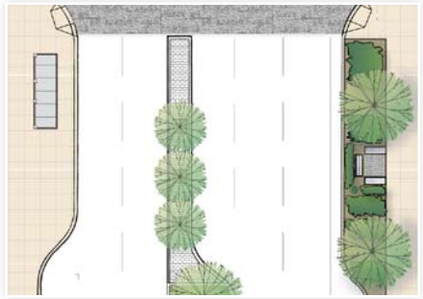
Medians may be combined with parking lane planters, chicanes, bulb-outs, or other traffic calming measures where it is desirable to further moderate traffic speed.

Medians and islands more than 3 feet wide, including curbs, should be landscaped and used for stormwater management. When street trees are desired, a median should be a minimum of 5 feet wide, including curbs, to provide sufficient space for healthy root growth per Sections 6.1 and 6.2.

As budgets allow, medians should be built to the maximum width possible, rather than providing a striped area outside the median. Landscaped medians should be configured so that maintenance personnel do not have to work in traffic lanes, by providing a minimum 2 foot walkable edge or striped area adjacent to the median.

Design and landscaping of medians should emphasize continuity on throughways and ceremonial streets. Landscaping, lighting and street furnishings should maintain a similar look and feel even as the corridor varies in land use, scale and intensity. On neighborhood streets, they may have a more flexible, organic design.

Islands should not interfere with driveway access, unless that is the purpose of the installation (i.e. access management).



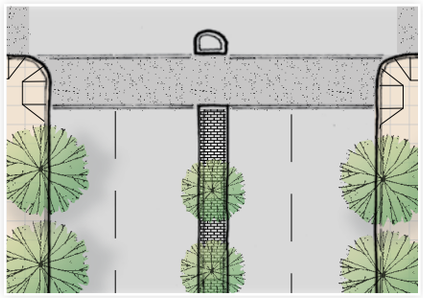
Medians provide space for trees and planting, visually break down the scale of the right-of-way, and create space for pedestrian refuges.

Landscaped medians provide visual coninuity to a corridor

Median islands can designate entrances to residential streets

Stormwater Management in Medians

Landscaped medians reduce impervious space in the roadway, allowing stormwater infiltration or retention in the exposed soil. Medians can also be designed to retain, cleanse, and infiltrate stormwater runoff from the roadway, Where stormwater management is intended in the median, the street should be graded to drain toward the median. For more information on stormwater management, see Section 6.2.



Pedestrian refuges provide space for pedestrans to wait on longer crossings and may include pedestrian amenities.

PEDESTRIAN REFUGE ISLANDS

Pedestrian refuge islands are protected areas where people may safely pause or wait while crossing a street. Pedestrian refuge islands are particularly helpful as resting areas for seniors, persons with disabilities, children, and others who may be less able to cross the street in one stage. At signalized intersections, they allow slow moving pedestrians to cross in two phases. At unsignalized locations, they simplify the act of finding a gap in traffic to cross since vehicles from only one direction must be reckoned with at a time.

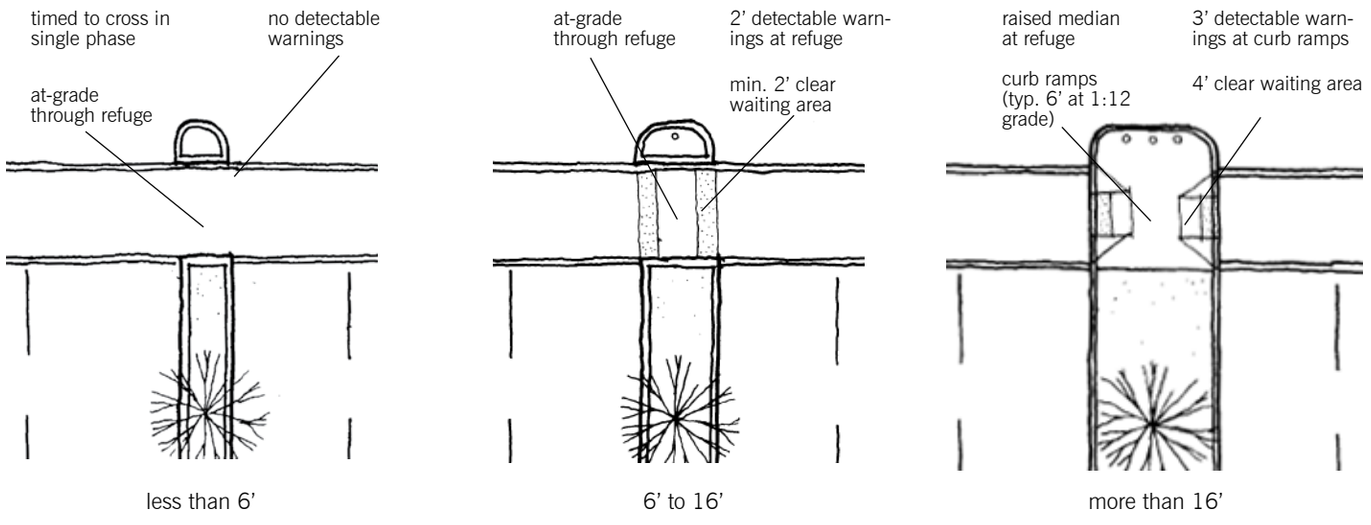
Raised pedestrian refuge islands can be provided in painted center medians, side access lane medians, transit boarding islands (Section 5.5), and corner islands.

Placement

Pedestrian refuge islands should be considered under the following conditions:

- streets with high pedestrian activity;
- where crossing distances are long (60 feet or greater);
- near and within neighborhood retail areas, civic and institutional uses, schools and senior facilities;
- locations with many transfers between transit lines; and
- unsignalized intersections with large numbers of pedestrians.

Median design at various widths



less than 6' | 6' to 16' | more than 16'

Choosing Median Refuge Islands vs Curb Extensions

Pedestrian refuge islands and curb extensions both improve comfort and safety for crossing pedestrians. Curb extensions minimize the distance needed to cross wide streets and facilitate crossing in one stage, while pedestrian refuge islands offer a comfortable resting place between crossing stages. Pedestrian refuge islands are typically significantly cheaper to construct than bulb-outs.

Under the following conditions, median refuge islands may be preferable to curb extensions, or it may be possible to use median refuge islands in addition to curb extensions:

- two-way left-turn lanes;
- excessively wide travel lanes or turn lanes;
- 4 lanes or more where it is may be difficult to cross in one stage;
- a ceremonial purpose, where medians provide an important design function; and
- an existing median.

Dimensions

On streets with medians less than 6 feet wide, signals should be timed so that pedestrians can cross in one signal phase and detectable warning strips are not required.

On medians between 6 and 16 feet wide, the pathway and waiting area should be at street grade, with a row of 2 foot wide detectable warning strips on each end, leaving a 2 foot wide clear zone in the center.[1]

On medians 16 feet wide or greater, pedestrian refuge islands should be raised to provide more visibility for waiting pedestrians. Raised islands should include two ramps (typically 6 feet wide) with 3 foot wide detectable warning strips on each end and a minimum 4 foot wide waiting area.[2] See graphic.

Safety and Design Elements

In order to protect waiting pedestrians, the following elements should be used in pedestrian refuge islands:

- Raised thumbnails should be provided on the intersection side of refuge islands, ideally outside of the crosswalk edge.

- To accommodate turning radii for large vehicles, the thumbnail may need to be within the crosswalk, or have a mountable outside edge.
- A bollard, landscaped feature, or sign should be provided on the thumbnail, unless it is a mountable thumbnail. These features should be 2 to 4 feet tall. Taller elements such as light fixtures or sign poles may be appropriate if they are thin enough to not obscure drivers' view of pedestrians.
- Pedestrian refuge islands should use different paving (concrete or other) in order to distinguish them from the roadway. See Section 5.4: Paving.
- On wider medians, a seatwall or other amenities may be provided

CORNER ISLANDS

Where the pavement area within an intersection becomes excessively large as a result of efforts to accommodate turning movements of large vehicles or due to streets coming together at unusual angles, adding corner islands can help control traffic and break up the crossing for pedestrians.

Adding corner islands creates a "slip lane", which separates right turning vehicles from through traffic. Slip lanes can be stop- or signal-controlled, but are often yield-controlled.

Slip lanes and the very large corner radii that come with them can pose a hazard to pedestrians for a number of reasons:

- Drivers tend to concentrate on merging with oncoming traffic and may not see pedestrians entering the crosswalk.
- In high-traffic areas, inadequate gaps in uncontrolled right-turning traffic may exist, making crossing a slip turn lane difficult for pedestrians.
- The non-standard corner geometry introduced by slip lanes is difficult for people with visual impairments to negotiate.

1 Source: Access Board, Draft Public right-of-way Accessibility Guidelines (R305.4.2)
2 Source: AASHTO ped guide

Offset or 'Corral' Crosswalks

Offset crosswalks are treatments in which the crosswalk is split by a median and is offset on either side of the median. This design forces pedestrians to turn in the median and face oncoming traffic before turning again to cross the second half of the roadway, which may improve safety, especially where there is no signal control at mid-block and T-intersection locations.

While offset crossings provide safety benefits, they may inconvenience or delay pedestrians. Wherever feasible, pedestrians should be given sufficient time to cross the entire roadway in one phase. However, two-phase crossings may occasionally be unavoidable, and in some cases may benefit transit.

Unless offset crosswalks provide tactile cues for visually impaired pedestrians to re-orient themselves before crossing the second half of the roadway, pedestrians navigating with a cane may be misdirected. Offset crosswalks should be built so that each side of the median pass through features a curb running parallel to the crosswalk, forming a "Z".

In order to discourage shortcutting and encourage pedestrians to follow the intended path, some staggered crosswalks include a railing to contain pedestrians and direct them along the desired route, called a corral-crossing. Corral crossings should be avoided. Care should be taken to design a pleasant walking environment that does not make pedestrians feel like barnyard animals. A low seatwall or landscaping may provide an attractive alternative where a physical barrier higher than a curb is necessary.

▼ Offset crossings should minimize inconvenience to pedestrians. The photo on the right would benefit from a feature to redirect people with visual impairments to the direction of the crosswalk.

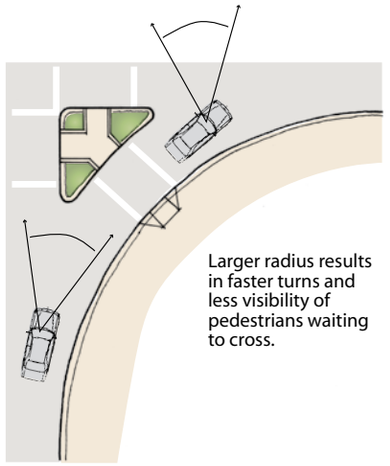
Source (right image): http://www.contextsensitivesolutions.org/content/case_studies/mid-block-crosswalks-school-zone-olympia-wa/#

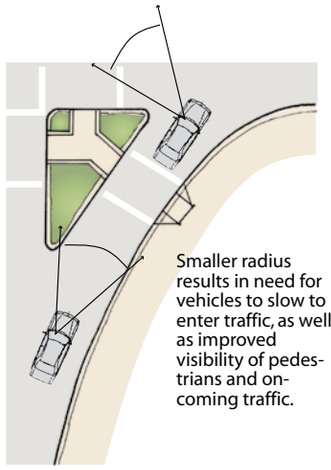
Slip lanes and corner islands should be avoided and removed to create additional pedestrian space wherever possible.

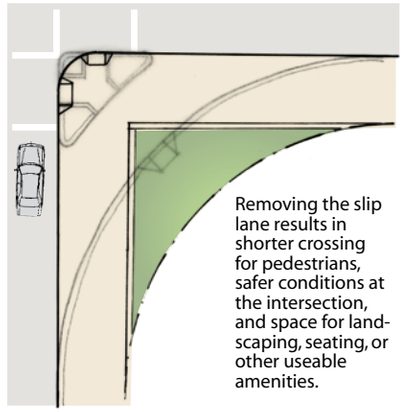
Where the large turning radius provided by a slip lane proves unnecessary, the slip lane should be removed and the corner added to the sidewalk area. This reclaimed space can be made into an attractive pedestrian plaza with furnishings and plantings.

At intersections with very high right turning volumes or which must accommodate very large vehicles, slip lanes may be unavoidable. Where it is not possible to avoid or remove slip lanes, their design should be mitigated, per the following guidelines:

- Raised islands should include a pedestrian refuge
- Uncontrolled slip turn lanes, especially those that turn into a dedicated exit lane (free right turn slip lanes), are discouraged where pedestrians are present
- For maximum pedestrian benefit, slip lanes should be designed with a maximum 30-35 foot turning radius; however, they should follow the guidance in Section 5.2.
- Slip lanes should incorporate additional pedestrian safety measures. Signalizing the right-turn movement creates gaps in vehicle traffic for pedestrians and may be the safest alternative. Crosswalk treatments, such as warning signage, special paving in the slip lane, or a raised crosswalk connecting the sidewalk with a refuge island, may also improve conditions for pedestrians. Slip turn design may employ a compound radius to slows vehicles and improve drivers' visibility. See Section 5.2 for discussion of compound curb radii.







1. Center median
2. Corner island
3. Side median with pedestrian refuges

Transit supportive streetscape design includes safe, comfortable transit waiting areas, convenient routes to transit, and design to enhance pedestrian and transit circulation.

Transit-Supportive Streetscape Design

5.5

Transit stops enhance the experience of waiting for and boarding transit vehicles. Successful transit stops are well connected to the local network of sidewalks and pedestrian routes, and provide convenient connections to residences, work places, and other destinations.

Streetscape elements and pedestrian facilities should be designed to support transit operations. Streetscape designs that benefit pedestrians are often helpful to transit as well.

TRANSIT STOPS

Placement

Sidewalk transit stops should be located in a curb extension wherever possible, per guidelines below. Transit stops should be located in median islands where transit uses center lanes.

At signalized intersections, transit stops should typically be located at the far side of intersections to facilitate bus operations, transit signal priority, and pedestrian movement. This also enables the crossing to be located behind the bus, which is preferable for pedestrian safety. At stop signs, transit stops should typically be located near side. See SFMTA's stop location guidelines for more details.

Transit stops should be located in places that are active and visible to maximize personal security of waiting transit users.

Transit stops should not be located at driveways wherever possible; new driveways should be discouraged at transit stops (and generally along major transit routes).

Layout

Good layout of a transit stop offers transit patrons visual cues on where to wait, clearly defines the transit stop and calls it out as a special place in the sidewalk environment, allows ease of access between the sidewalk, the transit stop, and the transit vehicle, and does not block the path of travel on the adjacent sidewalk.

Transit stops should abide by the following layout guidelines:

- Streetscape elements should be consolidated to create clear waiting space and minimize obstructions between the adjacent sidewalk, waiting areas, and boarding areas.
- Streetscape elements should be evenly spaced throughout the transit stop for ease of access. They should be aligned for ease of detection by people with visual impairments.
- Transit stops may be distinguished from the adjacent sidewalk through the use of special paving treatments, curb extensions, or a row of trees or planters, where space allows. Use of a different species of tree than the prevailing block pattern can help to differentiate the transit stop. These treatments are most appropriate on the Muni Rapid Network or at major transfer points.
- Transit stops should be integrated with adjoining activity centers wherever possible to activate and create a safe space.

Muni's approved transit shelter design

Transit stops must include the following accessibility features:

- A clear 5 foot by 8 foot loading area perpendicular to the curb, with a maximum 2% cross-slope, to allow a transit vehicle to extend its ramp to load people with mobility impairments. The clear loading area should be at the front of the boarding zone and accessible from the transit shelter (where present) and adjacent sidewalk. If a zone is designed for more than one bus, a wheelchair loading zone should be provided for each vehicle.
- A 30 inch by 48 inch clear floor wheelchair space within the transit shelter (where present). This space must be accessible from the sidewalk and the loading area. In some cases, this may necessitate removing one of the panels at the rear of the transit shelter.
- Where boarding platforms are not level with the sidewalk, an accessible ramp must be provided from the sidewalk to the platform.

Transit-Specific Streetscape Elements

Transit-specific streetscape elements should be located within transit stops as follows:

Flag signs should be placed near the front of the stop, to indicate where passengers should wait to board the vehicle. At far side or mid-block stops with bus zones, the flag sign should be placed approximately 25 to 35 feet behind the front of the stop to allow for the bus to pull out of the stop and re-enter traffic. At near side zones, or where there is a transit bulb-out or boarding island, this setback is not necessary.

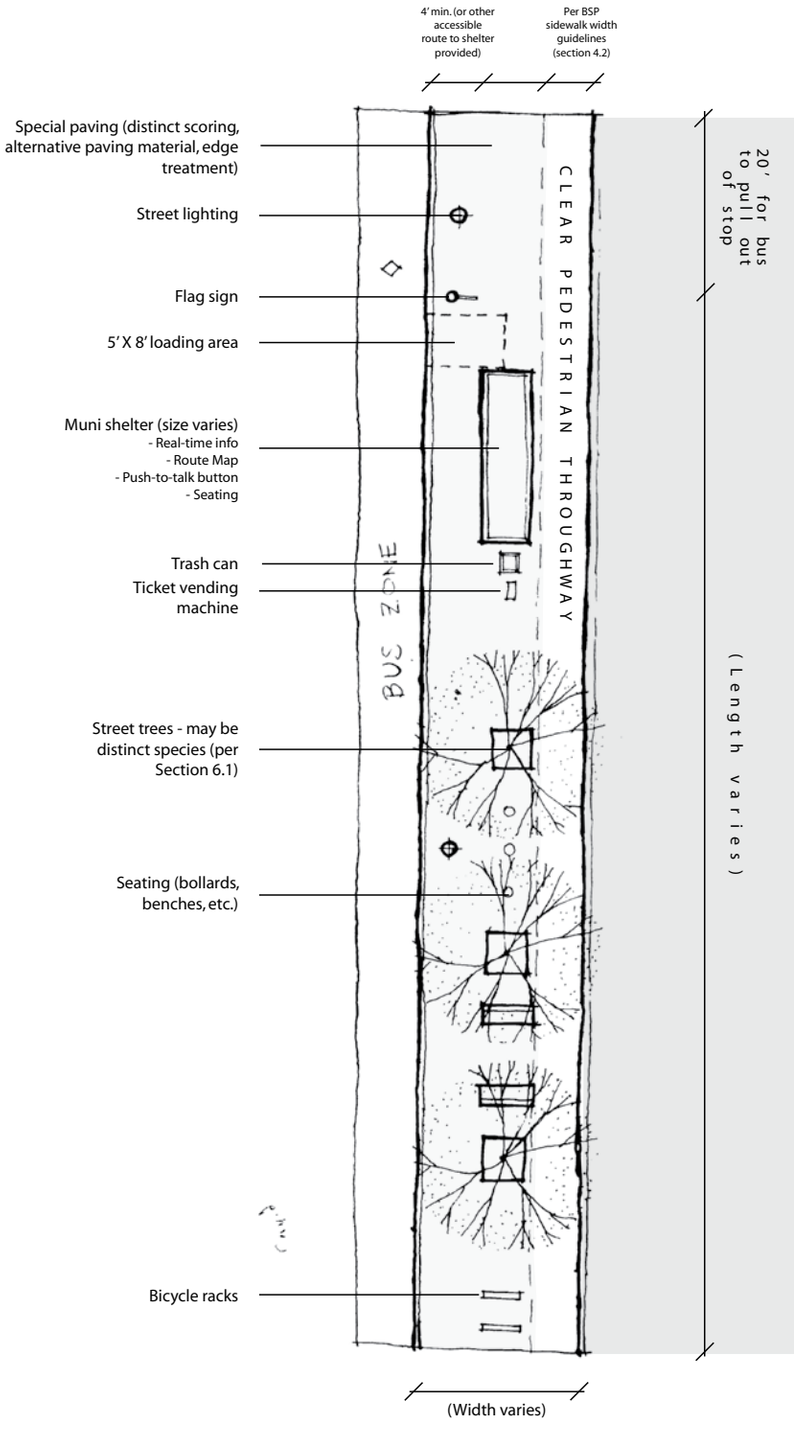
Transit shelters should be located toward the front of the stop to indicate where customers should wait to board the vehicle. The shelter should be placed approximately 25 feet behind the front of the stop to allow for an accessible boarding area (5 feet by 8 feet) and for the bus to pull out of the stop (approximately 20 feet). Where there is a transit bulb-out or boarding island, the first 20 feet of setback is not necessary.

The Transit Effectiveness Project (TEP)

The Transit Effectiveness Project (TEP) is a comprehensive effort to review Muni and recommend ways to create a faster, more reliable and more efficient public transit system for San Francisco. Launched in May 2006, the TEP gathered significant ridership data, studied best practices from other transit systems, and conducted extensive public outreach. Informed by these efforts, the TEP developed a set of preliminary proposals designed to improve reliability, reduce travel delay, and update routes to better meet current and projected travel patterns throughout the City. The SFMTA Board of Directors endorsed the TEP recommendations in October 2008.

The Draft TEP recommendations describe a Muni service framework, based on ridership and frequency of routes. The recommendations focus on providing resources where they are most needed. This includes new routes and route extensions, more service on busy routes and elimination or consolidation of certain routes or route segments with low ridership. The framework categorizes Muni routes into "Rapid," "Local," and "Community" lines, and "Special Services". These terms are referenced in this document.

Transit stops should include sidewalk treatment, better circulation, a clear flag sign, pedestrian lighting, trees, and amenities to create a safe and pleasant waiting experience.



▲ Generalized transit stop layout

Transit shelters should be provided where existing sidewalk space allows or where a curb extension can be added to provide sufficient space, and demand warrants. They should not be provided where sidewalk width is insufficient to accommodate a shelter and at least the minimum required clear path of travel around the shelter (per Section 4.2) or the ability to carry expected pedestrian volumes.

Shelters should be located in the furnishings zone wherever possible. They should be located to provide at least 4 feet of clear space between the edge of the curb and the front edge of the shelter, or another accessible path to the shelter should be provided (for example, by removing one of the back panels of the transit shelter). Alternately, shelters can be placed in the frontage zone so long as they don't block building entrances, but should leave the minimum required clear sidewalk width per Section 4.2.

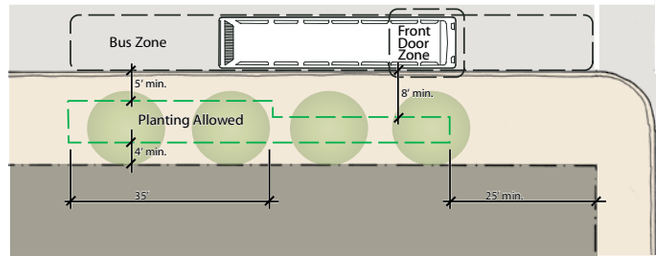
Transit shelters must use the approved Muni transit shelter design, including real-time transit information, route maps, and a push-to-talk button. Exceptions may be considered for LRT or BRT lines to give these lines a distinct character.

Transit shelter widths vary, from 3 feet to 7 feet in width and 8 feet 6 inches to 16 feet 6 inches in length. Transit shelters should be selected to fit the sidewalk context—on narrower sidewalks, narrower shelters should be used to allow pedestrians to pass freely behind. Larger shelters should be used on LRT, BRT, or Rapid Network lines, or at major transfer points where passenger demand is high.

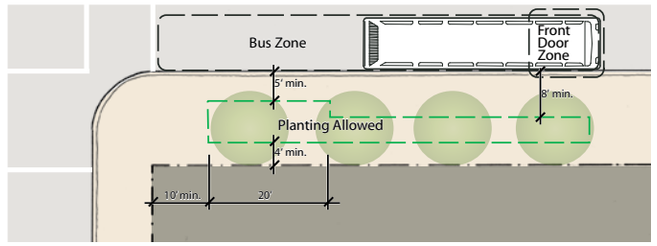
When modifying sidewalks at existing or new transit stops, evaluate adding electrical systems to provide power for shelter amenities such as lighting and real-time information

Ticket vending machines (TVMs), where provided, should be located near to transit shelters within the transit stop. At transit stops where a proof-of-payment (PoP) zone is used, ticket vending machines should be placed outside the paid zone, not next to the transit shelter (see sidebar).

Near Side Bus Stop



Far Side Bus Stop



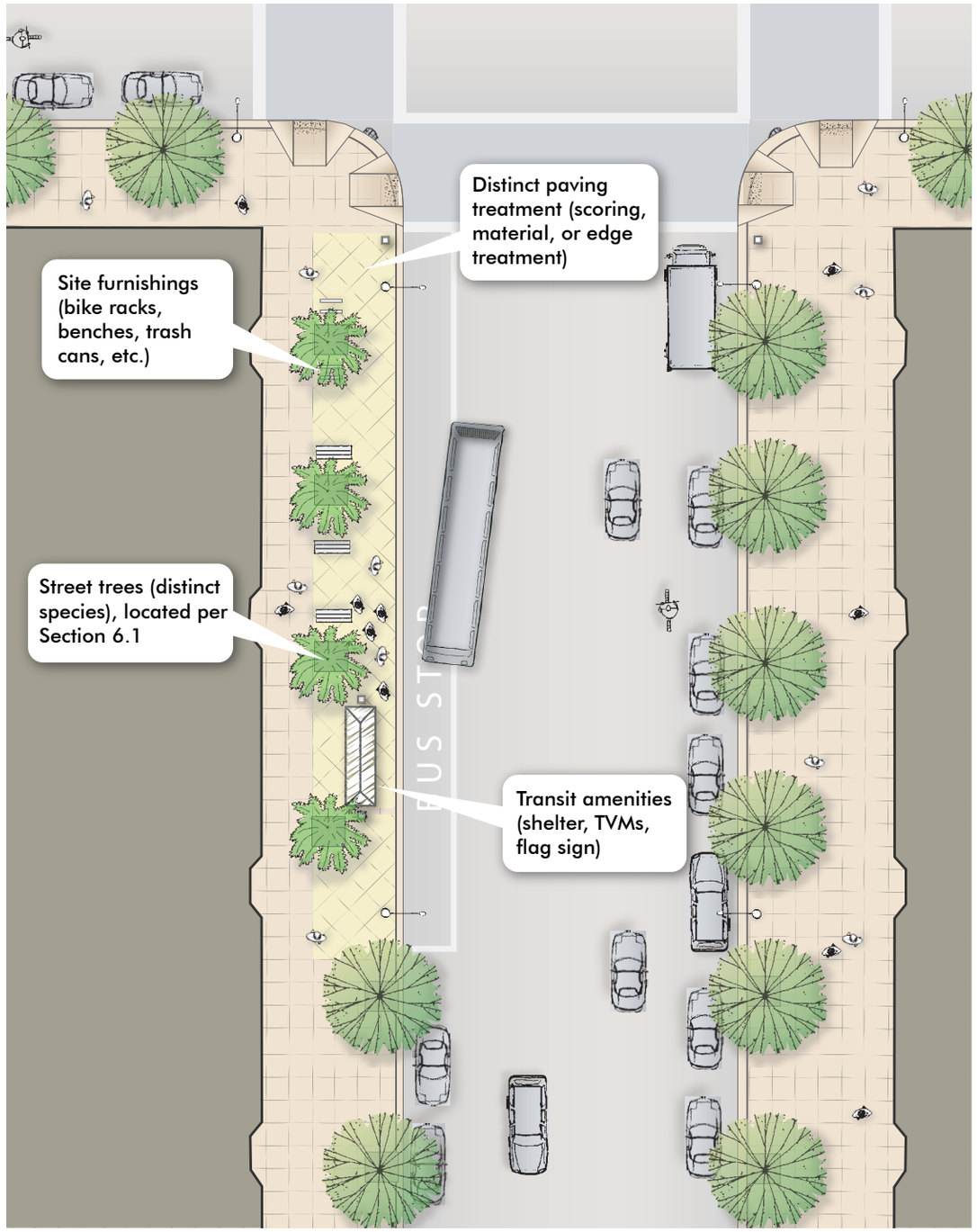
▲ Tree planting in bus zones. See also Section 6.1.

Other Streetscape Elements

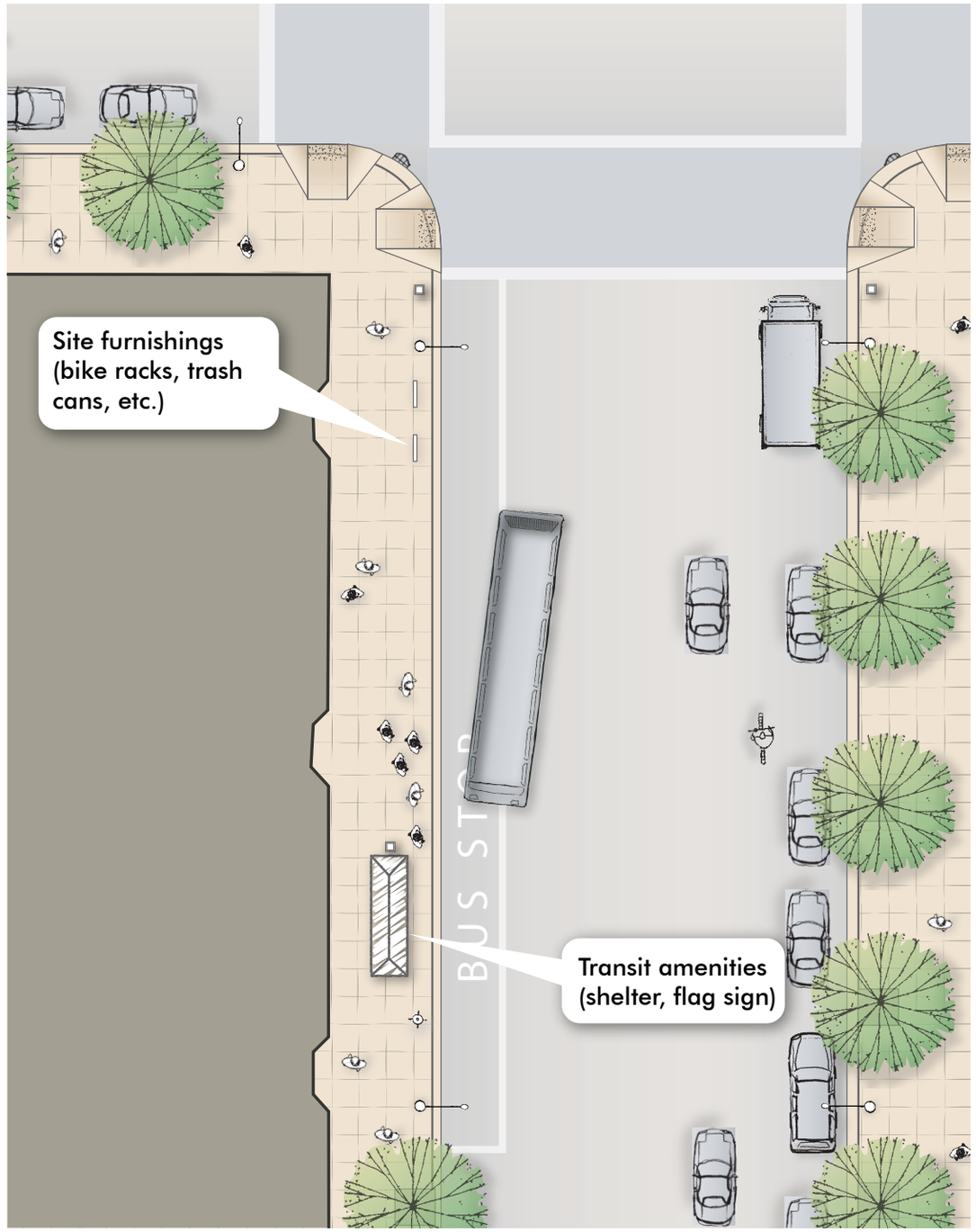
Transit stops and their surrounding area deserve a higher than average level of streetscape amenities to serve waiting passengers. Streetscape amenities should use the following guidelines:

Urban Forest: Trees and planters may be used to distinguish the transit stop from the adjacent sidewalk area or to continue the prevailing pattern of tree planting along a block, but should not interfere with transit operations or pedestrian travel. See Section 6.1 for the correct placement of trees and landscaping at transit stops.

This may often mean that, where space allows, street trees in a transit stop would not be along the same alignment as trees on the rest of the block. This can help call out the transit stop as a special location on the sidewalk; in these cases, selecting tree species distinct from the prevailing tree species on the street can enhance this effect. This treatment is most appropriate on LRT, BRT, or other Rapid Network lines, or at major transfer points.



▲ Muni Rapid Network station (typical)



▲ Muni Local Network station (typical)

Proof of Payment (PoP) Stations

At some surface transit stations (typically BRT or LRT stops), a proof-of-payment system may be used, with a paid zone inside which patrons are required to have proof of payment (transit ticket or pass). The paid zone may be limited to the vehicle, or it may be a waiting area on the sidewalk or boarding island, similar to the area in subway stations inside the fare gates. Patrons without a transit pass would purchase a ticket through a machine at the entrance to the station and then wait in the boarding area. Those patrons on the boarding area without a pass or ticket would be subject to fines.

Special considerations for PoP stops include:

- The paid zone should be differentiated from the sidewalk or median, using design elements such as special paving, grade changes, planters, bollards or other features. This may or may not include literal gates or turnstiles to enter the paid zone.
- Paid zones should allow permeability to the adjacent sidewalk to enable transit passengers to easily enter the zone (passengers should not have to take a circuitous route to enter the paid zone), but create distinct entry points that make it clear to sidewalk users that they are entering a paid transit area.
- TVMs should be located at the entrance to the paid zone, not adjacent to the transit shelter. Stations may need to incorporate a forecourt area outside the paid area with TVMs at the inner (station entrance) end to avoid congestion in crosswalks or at corners resulting from queuing at TVMs.

▲ A proof-of-payment bus stop in Portland, OR

Stormwater: Stormwater facilities may be located within transit areas; however they should not impede the ability to access the transit shelter (where present), or boarding areas. Stormwater facilities appropriate to transit stops include permeable paving in the sidewalk area, building-adjacent planters, or covered channels. See Section 6.2.

Lighting: Lighting should be located to illuminate the transit stop area, particularly the front of the stop and the transit shelter (where present). Lighting may be integral to the transit shelter, or may be provided by standard pedestrian or roadway lighting, where sufficient. See Section 6.3.

Paving: Special paving may be provided to distinguish the transit stop area from the adjacent sidewalk. Special paving may include a unique scoring pattern, a contrasting paving material, or a paving edge treatment delineating the edge of the transit stop. Special paving may be expensive, and is most appropriate at major stops on LRT, BRT, or other Rapid Network lines or at other major transfer points. See Section 6.4.

Site furnishings: Other site furnishings should be located within transit stops as follows. Individual site furnishings should follow the design guidelines in Section 6.5.

- Seating should be located within the transit shelter (where present). Additional seating, either formal (benches, seats with armrests) or informal (bollards, low seat walls, leaning bars), may be placed outside of the shelter, provided it allows permeability to and from the transit shelter and boarding area.
- Trash cans should be placed adjacent to the transit shelter (where present).
- Bike racks, where provided, should be placed near the back of the transit stop (further from the shelter - where present), or be placed outside of but adjacent to the transit stop. Bike-sharing pods, where provided, should be placed outside of but adjacent to the transit stop.
- Wayfinding information may be located within transit stop areas, particularly in downtown, commercial, or tourist areas.

DESIGN BY TYPE OF TRANSIT ROUTE

Service amenities and design should be consistent across service categories (Rapid, Local, Community) to increase the legibility of the Muni system. Transit stops on LRT, BRT, or other Rapid Network corridors and at major transfer points should include a greater level of features and amenities than other locations. LRT, BRT, and other special lines should be designed to have a distinct identity and be "branded" to emphasize their special nature. Special treatments for transit stops along these lines may include special signage, unique transit shelters, TVMs, special paving or landscape treatments, premium materials, and higher numbers of amenities at each stop.

At major transfer stops, stop design should facilitate clear, safe, and comfortable transfers. Designs may include wayfinding signs, real-time transit information, a clear path of travel between stops, a consistent paving treatment, or other visual cues to link facilities. Appropriate pedestrian safety measures, such as high visibility crossings, curb extensions, or pedestrian-priority signal timing (see Section 5.1) should be prioritized at major transfer points.

See Figure 5.1 for appropriate amenities by type of transit route.

FIGURE 5.1
STREETSCAPE AMENITIES BY TYPE OF TRANSIT ROUTE

TYPE OF TRANSIT ROUTE	APPROPRIATE AMENITIES (GENERAL)
LRT, BRT, RAPID NETWORK	Flag sign, trees or containerized planters, lighting, special paving, seating (formal or informal), trash cans, bicycle racks, wayfinding information, real-time transit information, transit shelters and seating (at major transfer points)
LOCAL NETWORK	Flag sign, transit shelter, real-time transit information, trees or containerized planters, lighting, trash cans
COMMUNITY NETWORK	Flag sign, trees or containerized planters, lighting, trash cans
SPECIAL SERVICES	Share stations with above

TRANSIT BULB-OUTS (BUS BULBS)

Bus bulbs are curb extensions that serve a transit stop. Bus bulbs can improve transit performance by eliminating the need for transit vehicles to exit and re-enter the flow of traffic at each stop. They also facilitate accessible boarding as the bus can align directly with the curb. Bus bulbs improve pedestrian conditions by providing extra space for waiting and passing pedestrians and providing a space to locate transit shelters out of the way of pedestrian flow.

Placement

Bus bulbs should be considered on all streets with side-running transit and a parking lane, except:

- where there is a peak period tow-away parking lane;
- where there is a desire to have a queue jump lane for buses; and
- at near side stops with heavy right turn movements.

Bus bulbs should be prioritized:

- on Rapid Network lines and major transfer points;
- where existing sidewalk width is too narrow to accommodate a transit shelter, or where pedestrian through travel is constrained; and
- where transit performance is slowed significantly due to the time delays caused by reentering traffic flow, and a bus bulb will mitigate this problem.

Bus bulbs have traditionally been placed on streets with two or more lanes per direction so that vehicles may pass a stopped bus on the left. Bus bulbs may also be considered on streets with one lane in each direction, subject to a case-by-case evaluation. Where they are placed on streets with one lane in each direction, they may be staggered to allow space for vehicles to pass a dwelling bus.

At flag stops with no bus zone, pedestrian bulbs could be extended to reach the front door of a boarding bus at near side stops.

Due to the high cost of constructing and removing bus bulbs, the ultimate stop spacing for a route should be determined prior to their installation, as stops may be shifted or consolidated. Check with SFMTA.

Guidelines

Bus bulbs should follow the transit stop layout guidelines above. They should follow the curb dimension guidelines for curb extensions specified in Section 5.3.

Bus bulbs should be long enough to accommodate all doors of transit vehicles that will load and unload at the curb extensions plus an additional 5 feet of maneuvering space. Where there is frequent service, such as on BRT or Rapid Network lines, they should be long enough to accommodate two or more vehicles, with a 5 foot space in between. They should leave 10 feet at the back of the bus zone to prevent following cars from blocking the intersection.

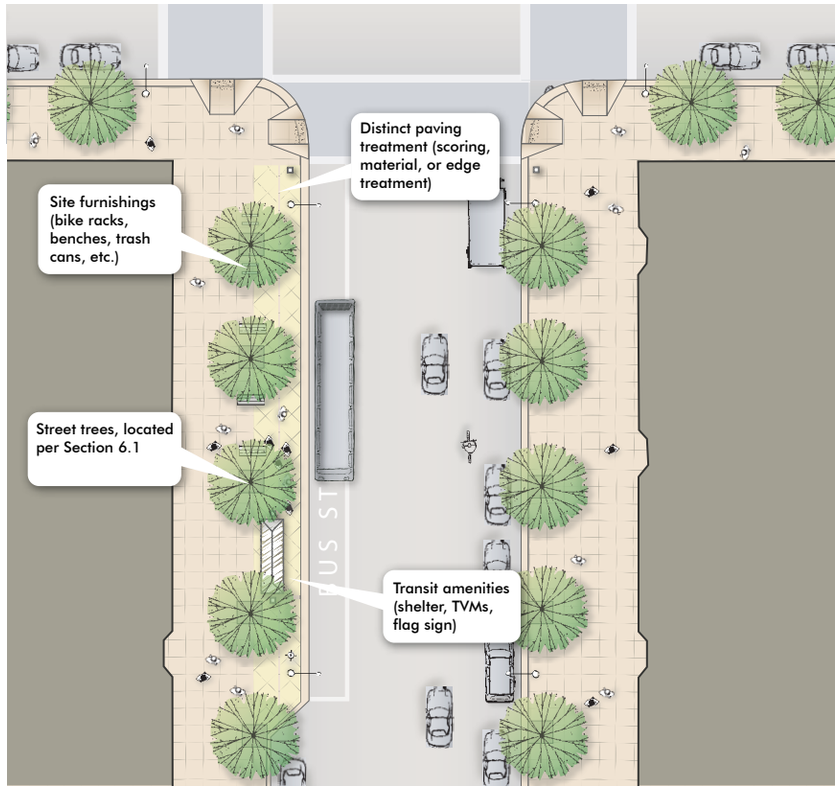
Where bus bulbs are provided, streetscape elements including street trees may continue along the same alignment as the rest of the block. The bus bulb may use special paving treatments or distinct tree species to distinguish it from the adjacent sidewalk.

Bus Bulb and Boarding Island Lengths for Current MUNI Vehicles

- LRT vehicles (two-car train): 155’ near side; 150’ mid-block; 165’ far side
- 1 Standard 40’ bus: 35’ near side; 45’ far side
- 1 articulated 60’ bus: 55’ near side; 65’ far side
- 2 standard buses: 80’ near side: 90’ far side
- 2 articulated buses: 120’ near side; 130’ far side

These requirements may change as Muni vehicle technologies change.

▲ Bus bulb-outs improve transit performance by allowing transit vehicles to load from the travel lane.



▼ Bus bulb-out (typical)

▲ Transit boarding islands are necessary wherever transit runs in center lanes.

TRANSIT BOARDING ISLANDS

Transit boarding islands are waiting areas located on a median. Transit boarding islands can improve transit performance where vehicles run in the center lane, and do not have to exit and re-enter the flow of traffic at each stop. On multi-way boulevards with transit running in center lanes, the side medians should act as transit boarding islands.

Transit boarding islands may also improve pedestrian conditions by locating the transit waiting area and transit shelter outside of the primary sidewalk. However, sidewalk stations are typically preferable to boarding islands for pedestrians as they are connected to the primary pedestrian system and adjacent to land uses and activities – boarding islands should only be used where transit runs in center lanes.

Layout and Amenities

Transit boarding islands should follow the transit stop layout guidelines above. They should follow the guidance for medians in Section 5.4.

In addition, transit boarding islands should use the following guidelines:

Amenities such as shelters, seating, signage and TVMs should have a small profile and be arranged along the back edge of the median. Transit shelters should be transparent and should leave 4 feet of clearance in front; this may require removing the sidewalls of the shelter to enable people to pass in front of the shelter.

Boarding islands should include dividers between the island and side travel lanes between the island and the curb. Dividers should be designed to contribute to the overall aesthetic of the station. Where traffic speeds and volumes are low, dividers may not be necessary, subject to engineering judgment.

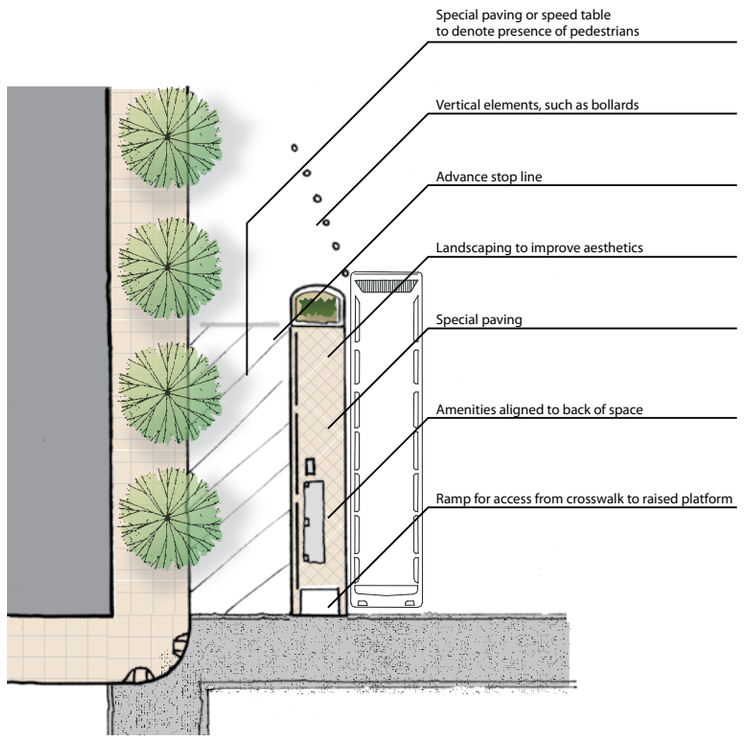
Boarding islands may include low plantings at the back end of transit boarding islands beyond the pedestrian waiting area

Dimensions

Transit boarding islands should be at least as long as the distance between the front of the vehicle and the rear-most door plus 5 feet. At stops where two or more vehicles are expected to stop simultaneously, the island should be large enough to accommodate all vehicles with 5 feet of space between each pair of stopped vehicles.

Transit boarding islands must include a 5-foot wide by 8-foot long clear loading pad or other accessible facility such as a raised platform with ramp for accessible boarding. Accessible boarding facilities will vary based on the type of vehicle using the stop. The median should be designed so that doors used for accessible boarding align with the boarding area.

▼ Transit boarding island (typical)



Pedestrian Access

Transit boarding islands should have a crosswalk with curb ramp access at one end, at a minimum, connecting to the sidewalks of the street. The boarding island may serve as a pedestrian refuge for street crossings. In addition, the design of transit boarding islands may employ the following treatments to enhance the design of transit stops, calm traffic in the vehicle lane between the boarding island and sidewalk, and visually connect boarding islands to the sidewalk:

- Provide a raised or high visibility crossing connecting to one end of the platform, on appropriate street types (see Section 4.1)
- Pave the side lane in concrete or other special paving to distinguish it from center lanes
- Create a single-surface zone including the sidewalk, side lane, and boarding island, where traffic speeds and volumes are low. Shared surface treatments should follow the guidelines in Section 5.8.

ADDITIONAL TRANSIT OPERATIONS CONSIDERATIONS

Bulb-outs should be prioritized on transit routes to enhance pedestrian safety and transit operations. At signalized intersections, bulb-outs can extend green time available for transit on the major street by reducing pedestrian crossing times across the major street from side streets.

At transit stops, bulb-outs should be full-length bus bulbs, and not a standard corner bulb, as it can be difficult for a bus to exit or re-enter traffic around a standard corner bulb-out.

Traffic calming devices on bus routes should be compatible with bus operations (see Section 5.7). In particular, strategies involving vertical and horizontal deflection that could affect transit on-time performance and transit user comfort should not be used, particularly on Rapid and Local routes. Effective corner radii should balance the necessity to accommodate transit vehicles with the need for safe pedestrian crossing conditions (see Section 5.2).

Source: Nelson|Nygaard

Subway Entrances and Vent Shafts

Subway entrances and vent shafts (where provided) take up significant amounts of sidewalk space and should be designed accordingly. They also provide an opportunity to create distinctive design along major transit and pedestrian corridors. Subway entrances should:

- be located out of the sidewalk area, within buildings (as part of joint development) or in off-sidewalk parks or plazas wherever possible, as long as they are clearly marked;
- where they are located in the sidewalk, they should be placed outside of the path of travel and leave sufficient clear width for accessible travel. In many cases, this may mean adding a curb extension and locating the entrance or vent shaft on the bulb-out;
- include a railing or wall around the opening, high enough to prevent people from falling into the opening, but low enough to see over (3 to 4 feet in height). The wall may be topped with decorative fencing or other visually permeable element;
- include canopies to provide cover from rain; and
- incorporate unique design specific to the particular transit line, giving the corridor as a whole a recognizable design character.

Parking Lane Treatments

5.6

The parking lane portion of the roadway, typically reserved for parking or loading of vehicles, may play other roles as well to improve the quality and functioning of the pedestrian realm and provide a variety of streetscape and pedestrian amenities, including landscaping, stormwater treatment, bicycle parking, and seating – it represents a significant untapped resource to extend the pedestrian realm.

In addition, on-street parking may provide a buffer for pedestrians on fast-moving, heavily-trafficked streets, by limiting the negative effect of passing traffic on pedestrians.

GUIDELINES

Narrow right-of-ways without sufficient space for both sidewalks and parking should prioritize the provision of sidewalks to meet recommended sidewalk widths per Section 4.2 of this document. Where parking lanes are not present on busy streets, landscaping, bollards, or other buffering elements should be provided to separate pedestrians and moving vehicles.

Parking lanes may be configured to provide a variety of streetscape and pedestrian amenities, such as landscaping, stormwater treatment, bicycle parking and seating.

▲ Attractive materials can distinguish the parking lane from other lanes. These pavers could be permeable, helping to reduce stormwater runoff.

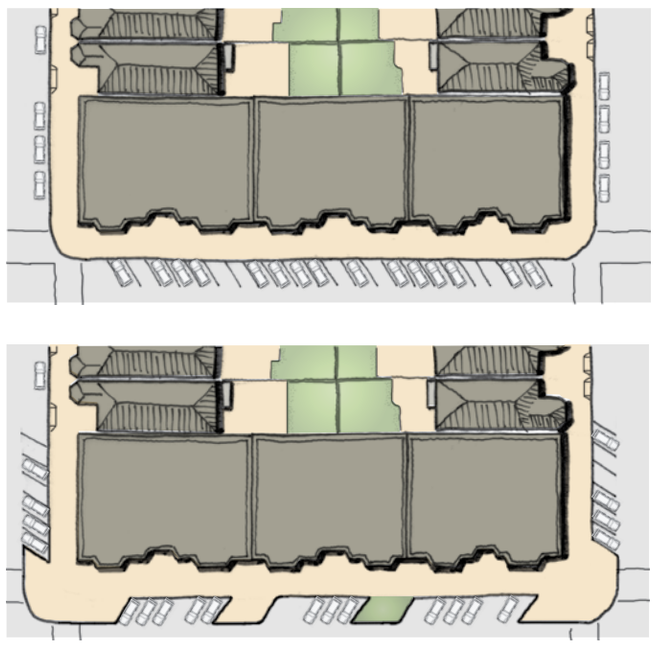
Materials

Where it is not precluded by heavy vehicles, the parking lane should be paved in concrete or special paving materials to match the pavement used on the adjacent sidewalk. Permeable paving such as pervious concrete or pavers should be considered for stormwater management per Section 6.2. On new streets, a parking lane that slopes towards the roadway such that the gutter is placed between the two may be considered, particularly in conjunction with curb extensions.

Plazas at Perpendicular and Angled Parking Lanes

Perpendicular or angled parking lanes may exist or be provided where roadway width allows. They provide additional parking spaces while narrowing the vehicle travelway, which can have a significant traffic calming effect on the street.

Where perpendicular or angled parking is provided, there is an opportunity to create significant public spaces by adding curb extensions adjacent to intersections or mid-block that extend the full length of the parking lane, sometimes up to 20 feet. These generous bulb-outs may include landscaping, seating, and other amenities. Bulb-outs should follow the guidance in Sections 5.2 and 5.3.



▲ Perpendicular or angled parking lanes allow for the creation of generous corner plazas

ALTERNATIVE USES FOR THE PARKING LANE

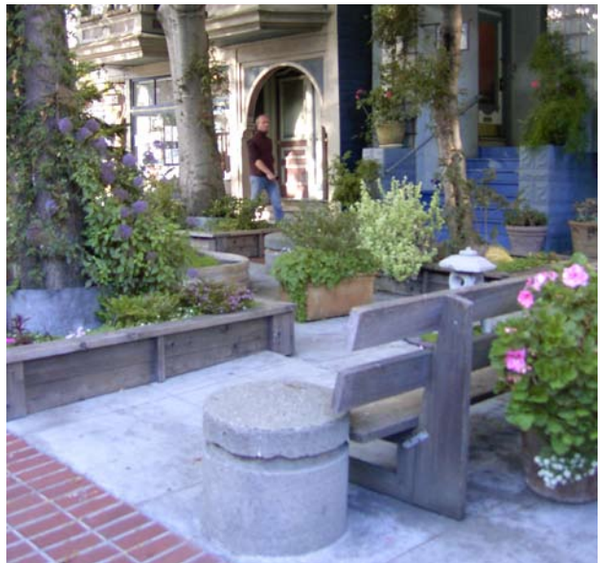
Parking lanes can be either temporarily or permanently converted to active pedestrian uses, public seating, café and restaurant seating, and landscaping. Parking lanes may also be used for bicycle parking, per the San Francisco Bicycle Plan.

Parking Lane Planters

On streets with narrow sidewalks, where tree planting is limited by conflicts with utilities or driveways, or where there is a desire to visually narrow the roadway, landscaped planters may be placed between parking spaces at regular intervals or at specific locations. Because the roadway subbase is typically 95% compacted, soil improvements should be added to avoid premature tree mortality. See Section 6.1.

Planters should not extend beyond the width of the parking lane; they should be a minimum of 6 feet by 4 feet and meet other guidelines for street trees. Tree canopies should be kept clear of conflict with passing vehicles in the near travel lane; they should be pruned to 14 feet for portions of the tree that overhang the roadway, and meet other guidelines for street trees per Section 6.1.

Left: Corner bulb-out plaza on a street with perpendicular parking

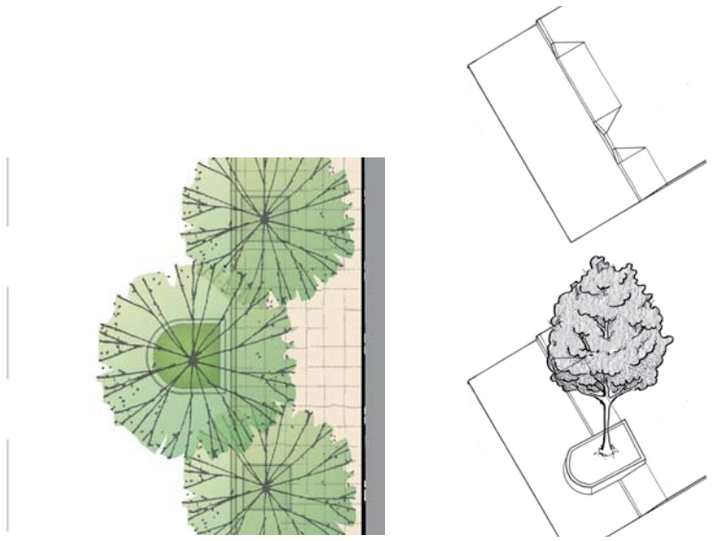


Right: On-street parking is common throughout San Franciso's urban streets, and defines an edge of the pedestrian realm on many streets.

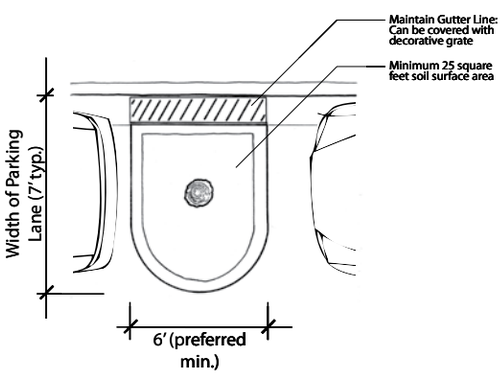
Typically, parking lane planters should be separated from the sidewalk curb by a minimum 1 foot break; this gap may be covered by a metal grate or trench drain. Alternatively, parking lane planters may be joined with adjacent sidewalk planters to create more generous tree basins with a continuous body of soil.

Trees and planters in the parking lane should be protected from errant drivers by a raised curb, bollard, railing ,or other fixed object.

Where in-street planting is designed for stormwater infiltration, the curb may include breaks to allow stormwater to enter and overflow stormwater to exit when the basin is at infiltration capacity. See Section 6.2.



Landscaped planters in the parking lane



Parking lane planters require special maintenance considerations:

- They present a need for additional hand sweeping of gutter areas between the tree basin curb and the sidewalk curb.
- They may present difficulties with repairing concrete pavement located between the tree basin and the sidewalk.

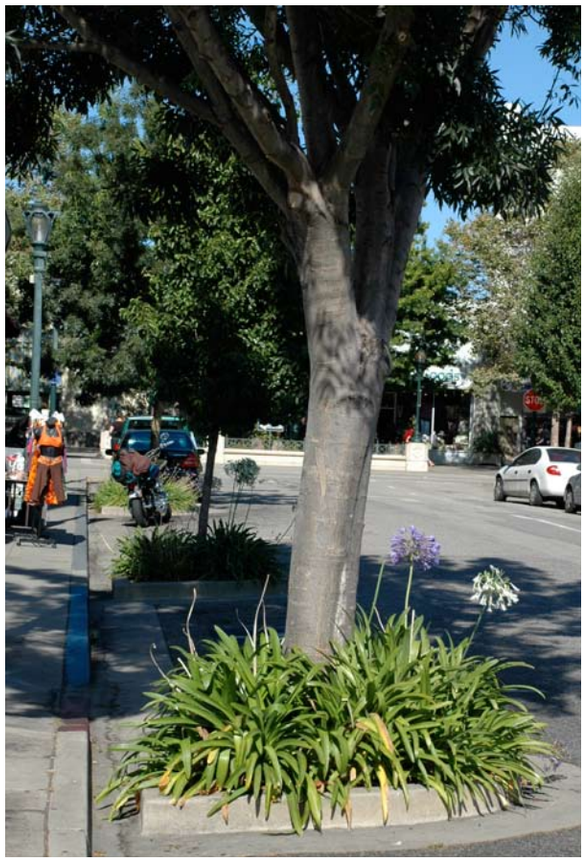
Where parking lane planters are considered, they should be installed with a plan for maintaining the gutter areas and other areas that street sweepers cannot reach.

Flexible Active Use of the Parking Lane

Particularly on active commercial streets, the parking lane may be used for flexible active uses such as café seating on a temporary or semi-permanent basis. Flexible use of parking lanes should be prioritized in commercial areas with high pedestrian volumes or numerous cafes and restaurants, or at individual locations of cafes, schools, libraries and other local destinations. They may also be considered as public spaces on residential streets where property owners agree to maintain any improvements.

Flexible parking may be installed by individual actors, or as part of a full street re-design. This treatment can range along a spectrum from very temporary use to more permanent installations. The City is currently piloting the flexible parking lane concept, and will be developing a permitting process for merchants or property owners.

▼ Trees placed in the parking lane can increase space for available greenery and visually narrow the roadway, calming traffic



▲ Planting and trellises visually narrow the street and define "rooms" within the parking lane

◀ A stepped curb provides easier transition for pedestrians

Flexible use of parking lanes generally requires additional parking and merchant management, either by the City or by a third party such as a merchants association, Community Benefit District (CBD), or individual permit holders.

In general, flexible use of the parking lane should take up the full width of the parking lane and at least one full parking space.

Flexible space should be designed to instill a sense that the space is intended for people, rather than that pedestrians or café patrons are temporarily infringing on automobile space. Landscaping, special materials, and elements should be used to visually and physically break the parking lane down into independent, distinct spaces. Both permanent and temporary elements combine to create this space.

Where flexible use of the parking lane will occur as part of a full street re-design, design elements should include:

Curb Extensions and Permanent Landscaping: Landscaped curb extensions or parking lane planters should be located at least every 5 parking spaces (a maximum of 100 feet apart). Vertical elements such as trees, elevated planters, trellises, and other elements should be used to define the visual character of the flexible spaces.

Special Paving Treatment: Colored and textured paving materials should be used to differentiate these areas from the roadway. See Section 6.4: Paving.

Level Change: A level change of 1 to 2 inches should be introduced between the roadway and the parking lane to differentiate these two areas. The curb between the parking lane and the sidewalk should be designed to include a stepped change in grade, rather than the standard 6" grade change. Flexible space should be made accessible to pedestrians with disabilities by the provision of ramps.

Safety considerations: Safety should be strongly considered when placing useable space in the parking lane. Flexible active use of the parking lane should be installed where there is light, slow-moving traffic, narrow roadways, and a pedestrian character.

Buffering elements should be provided for patrons. Moveable planters, bollards, or other elements should be placed at the roadway edge of the parking lane at times when it will be occupied by people. Elements should be relatively transparent, allowing people to see above or around them.

Flexible parking spaces should be placed so they do not conflict with other uses:

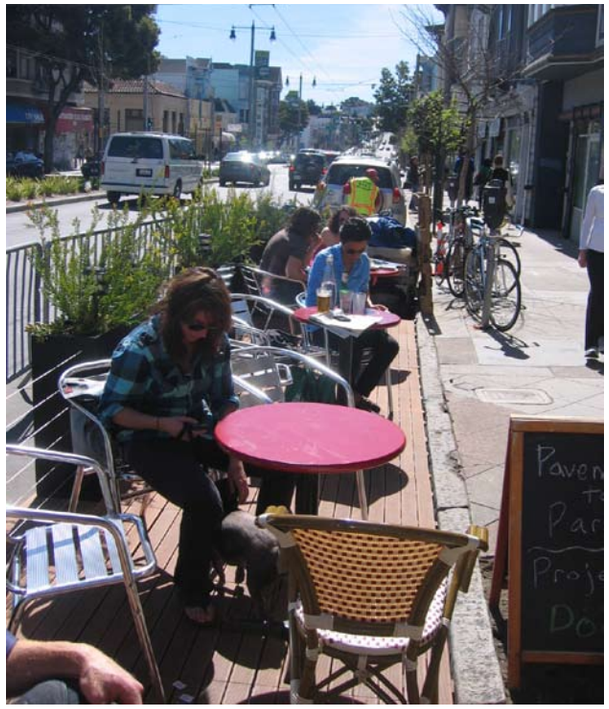
- Accessible parking spaces should not be converted to flexible use.
- Flexible uses of parking lanes should not obstruct the safe travel of bicycles in the adjacent bike lane.
- Flexible uses of parking lanes should not obstruct the safe travel of transit vehicles or the ability of passengers to board or alight vehicles.

Best Practice: Castro Street Flexible Parking

Mountain View, California

As part of a larger downtown revitalization effort, the City of Mountain View converted a 4-lane arterial into a 3-lane pedestrian-oriented main street. In addition to widening sidewalks and adding unique paving and extensive planters, the City installed flexible parking lanes on either side of the street. These areas use urban design details such as attractive paving and trees and planters on bulbouts to define the shared pedestrian and parking space. Cafes along Castro Street spread tables into the parking stalls in front of their businesses during business hours, allowing patrons to sit under the trees. This project was a major part of bringing business and life back to the town center, and has resulted in a number of cafes with outdoor seating and more people walking on the streets and patronizing local businesses.

Park(ing) Day installations illustrate how the parking lane might be used for public or cafe seating



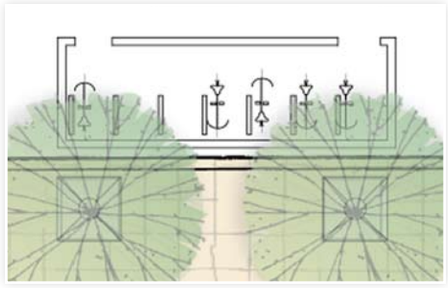
▲ The City's new "Parklet" on Divisadero, part of the Pavement to Parks program

Bicycle Parking in Parking Lanes

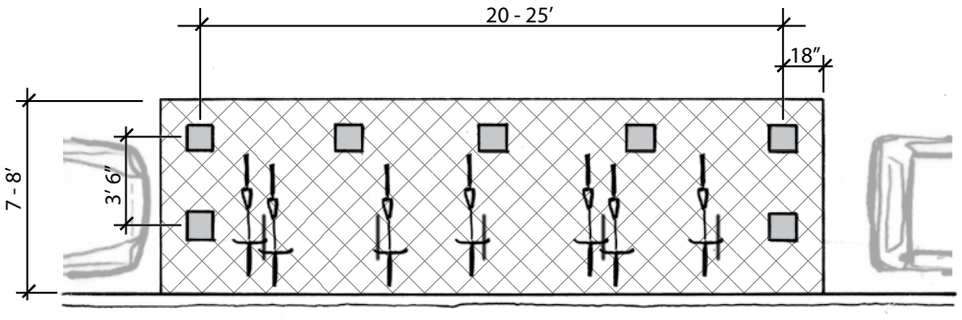
Per the San Francisco Bicycle Plan, on-street vehicle parking spaces may be converted to bicycle parking. Bicycle parking may also be provided in the parking lane where there is not enough room to park a car, such as between driveways.

Bike racks should be placed such that parked bikes are perpendicular to the curb line. One 20 foot parking space can accommodate up to 12 bicycles on 6 U-racks without cluttering limited sidewalk space.

Where possible, bicycle parking should be built on a curb extension. Where implemented at the existing grade, the bike parking area should be protected from errant vehicles via a curb, bollards or other devices at the edge of the parking lane. On-street bicycle parking would preclude mechanical street sweeping, and additional maintenance should be accounted for.



Per the San Francisco Bicycle Plan, on-street spaces can be converted into bicycle parking areas to provide substantially more bicycle parking and reduce sidewalk congestion.



▲ Layout of an on-street bicycle parking space (typical). On-street bicycle parking should be designed with racks perpendicular to the curb, and elements to protect bicycles and racks from errant drivers.

Bike Share Parking

San Francisco is considering implementing a bicycle sharing program similar to programs in Paris, Lyon and Barcelona. If San Francisco implements bicycle-sharing, conversion of some automobile parking spaces to bicycle parking could help accommodate the storage racks which hold as many as 20 to 30 bicycles so as not to block space on the sidewalk for pedestrian travel.

◀ Paris and Lyon are among the cities that have implemented bicycle-sharing programs. To provide the necessary space for the many new bicycles, on-street parking space may be coverted for use as bicycle parking. *Source: Elizabeth Macdonald*

By affecting vehicle speeds, volumes, and trajectories as well as streetscape composition, traffic calming measures can have a tremendous effect on both the safety and quality of the pedestrian realm.

Traffic Calming and Roundabouts

5.7

By slowing traffic and discouraging cut-throughs, traffic calming measures can have a tremendous effect on the safety and quality of the pedestrian realm. Many traffic calming features can also contribute to the aesthetic quality of the streetscape. There are a wide variety of traffic calming devices available to street designers, which are covered fully in many other documents. The intent of this document is not to discuss all potential traffic calming devices.

This section focuses on chicanes, traffic calming circles, and modern roundabouts as representative traffic calming devices, because of their potential synergies with streetscape design, landscaping, and stormwater treatment, and because unlike diverters, turn restrictions, cul-de-sacs, one-way streets, or other measures, they reclaim roadway space for landscaping and other uses without significantly affecting traffic patterns and roadway vehicle capacity, which would go beyond the scope of this plan.

Some related traffic calming measures are discussed in other sections of this document, including:

- raised crosswalks and intersections (Section 5.1);
- curb extensions (5.3); and
- medians and islands (5.4).

The City has existing adopted Traffic Calming Guidelines, which govern appropriate traffic calming procedures and measures (see sidebar).

General Guidelines

Traffic calming features should follow San Francisco's existing Traffic Calming Guidelines. Features discussed in this plan should incorporate landscaping, stormwater treatment, and public space uses wherever possible.

Traffic calming features should be compatible with transit operations. See Section 5.5.

Traffic calming features could slow the movement or affect access for emergency vehicles, if not designed accordingly. Traffic calming features should be designed to retain emergency vehicle access, per guidelines below. See Sidebar, "Traffic Calming and Emergency Access," following page.

CHICANES

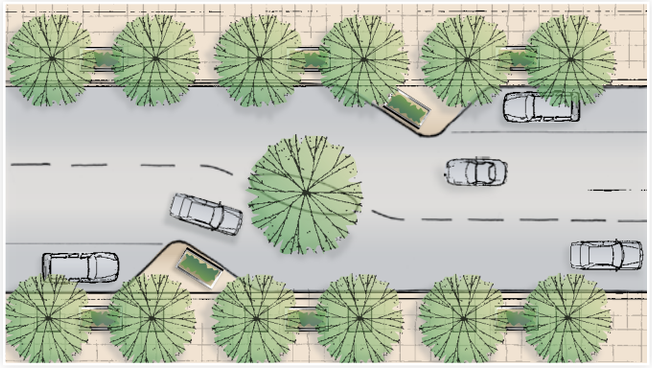
A chicane is a series of alternating mid-block curb extensions or islands that narrow the roadway and require vehicles to follow a curving, S-shaped path, discouraging speeding. Chicanes can also create new areas for landscaping and public space in the roadway.

Guidelines

Chicanes can be created on roads with various roadway configurations, as follows:

- On streets with space for parking on only one side, chicanes can be created by alternating parking from side to side. Chicanes can also be formed by alternating parallel parking and perpendicular parking. Curb extensions should be included at each end of on-street parking.
- Where a wide right-of-way allows, parking may be maintained on both sides of the street through the entire chicane, and the entire roadway can jog from side to side using curb extensions.

Chicanes in both conditions may include a median island at points of deflection to prevent speeding drivers from continuing straight down the center of the chicane, disregarding roadway markings.



▲ Chicane with parking alternating from side to side

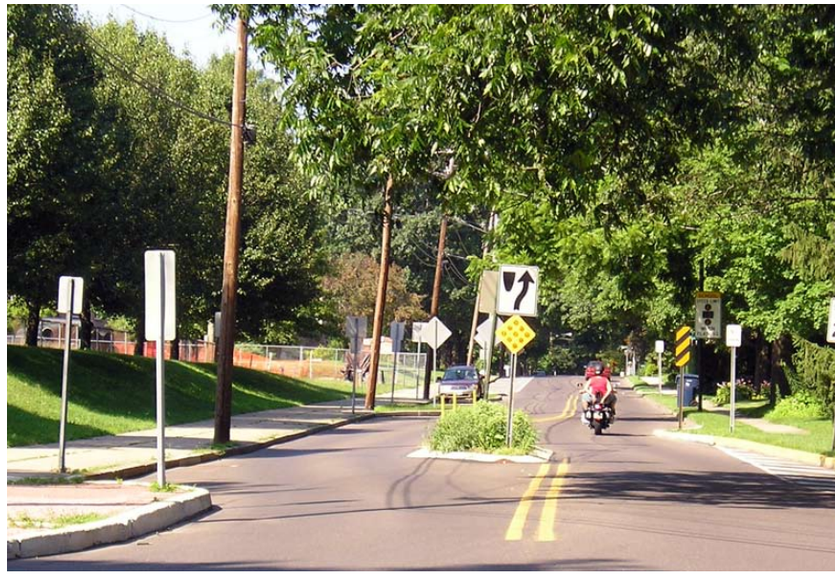
San Francisco's Traffic Calming Guidelines

San Francisco's existing Traffic Calming Guidelines were developed collaboratively by a staff Technical Working Group and a Community Working Group. The Traffic Calming Guidelines are largely procedural, and are based upon a three-track approach:

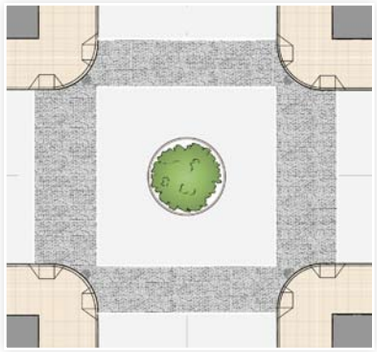
- A track for arterial and commercial streets, using a corridor approach
- A local street track with an area-wide focus and a local street track with a site specific focus, with a streamlined process
- A site-specific track for safe routes to school

The Traffic Calming Guidelines provide a table of traffic calming measures that indicates which measures are acceptable on which types of San Francisco streets. However, they do not provide standard plans or detailed design guidelines for individual measures.

The City has standard plans for traffic circles and speed humps, and is developing standard plans for other traffic calming measures.



▲ Chicanes slow vehicles by causing them to shift their horizontal path. They add opportunities for landscaping to improve street aesthetics. *Source: Mike King*



Traffic circles slow traffic in residential neighborhoods and provide added space for landscaping and stormwater infiltration.

Traffic circles should include landscaping, including trees, and permeable surface. They may be designed to infiltrate stormwater runoff from the roadway.

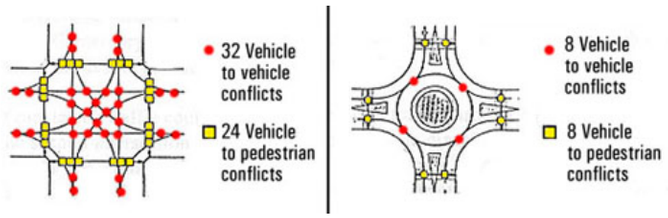
Median islands and curb extensions (in chicanes as elsewhere) should include landscaping, seating, and stormwater facilities per the guidelines for these facilities in Chapter 6.

Because chicanes are intended to slow traffic, designs should consider transit and emergency vehicles:

- Chicanes should not be located on streets with Rapid or Local lines per Muni's operating framework. Though discouraged, chicanes may be implemented on streets with Community lines only; in these cases, the chicane should be located at a bus stop so that the impact on transit service and passenger comfort is minimized.
- Chicanes must maintain required clearances for emergency vehicle access, 14 feet on a one-way street and 20 feet on a two-way street. Among traffic calming measures, emergency vehicle operators typically prefer chicanes to speed humps, but the Fire Department has not expressed a formal preference.

Chicanes should be designed to force vehicles to slow as they change course. Standard CA MUTCD formulas for calculating taper lengths for striping around a horizontal offset caused by obstacles in the roadway typically yield tapers too long to achieve the desired slowing of vehicles. Accordingly, chicanes should be designed using formulas for lower speeds than are actually desired on the street.

Conflict points at traffic calming circles (and roundabouts).



Source: Stidger, Ruth "Can America Handle Roundabouts," Better Roads, May 2003

TRAFFIC CALMING CIRCLES

A traffic calming circle is a raised island located in the center of an intersection around which traffic must circulate. By providing a landscaped area in the middle of the roadway, they can visually break up the scale of wide streets, break up the monotony of the street grid, and provide space for added greenery and stormwater treatment. The outer ring is often mountable so that large vehicles can navigate the otherwise small curb radius. Traffic calming circles are generally used at low volume neighborhood intersections.

If not properly designed or located, traffic calming circles may create confusion or inconvenience for people with visual impairments; care should be taken to minimize confusion and conflicts with their design.

Traffic calming circles should not be confused with roundabouts, which are designed to handle much higher traffic volumes and reduce vehicle delay (see following section). However, they have a similar positive effect of significantly reducing conflicts (see graphic).

Placement

Traffic circles should be located on streets where it is desirable to calm traffic and reduce conflicts, such as residential streets. Traffic circles should not be located on transit routes.

Guidelines

Traffic circle design should follow DPW Bureau of Engineering's standard plan for Traffic Circle Details. However, intersection geometry varies greatly, and the standard plan may need to be adjusted for different conditions.

Traffic calming circles should be large enough that vehicles entering the intersection must slow down and change course, but they should not significantly alter the path of travel for pedestrians or bicyclists. The size of traffic calming circles is determined based on the width of the adjoining streets. The installation of traffic calming circles does not usually require a change in curb geometry.

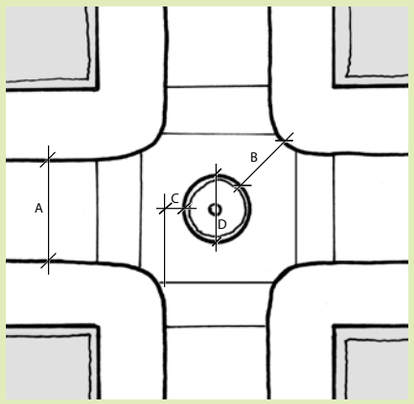
Best Practice: Seattle, Washington Traffic Circles

The City of Seattle has installed over 700 traffic circles on residential streets as part of a citywide plan to reduce auto volumes and speeds in residential areas. The City receives approximately 700 requests for new circles each year, and installs 30 per year at a typical cost of about $10,000 each.

Seattle's traffic circles are large enough to force cars to slow down to go around them. The center islands are attractively landscaped. The outer two feet or so of the circles is a concrete apron, with a low four-inch curb that emergency vehicles can go over easily when necessary. Typical traffic circles on a 25 foot wide residential street range between 12 and 16 feet wide.

The circles typically include 1 or 3 trees. Additionally, neighborhood residents can plant lower brushes and shrubs in the circles. The City encourages planting of low-maintenance plants and publishes a list of suggested trees and planting for traffic circles. Landscaping in the traffic circles is maintained by local residents.

Source: City of Seattle, Seattle Transportation (SEATRAN)



A - Street Width: Existing
B - Opening Width: Typically 16-20 feet
C- Offset Distance: 5.5 feet max. (varies)
D - Diameter: Typically 12-20 feet

OPTIMAL DIMENSIONS	
Offset Distance	Opening Width
5.5' (max)	16' (min)
5.0'	17' (+/-)
4.5'	18' (+/-)
4.0'	19' (+/-)
3.5' or less	20' (+/-)

Design Dimensions (Seattle)

The distance between a traffic circle and the curb (off-set distance) should be a maximum of 5-1/2 feet.

The width between a traffic circle and a curb return (opening width) should be a minimum of 16 feet and a maximum of 20 feet.

As the off-set distance decreases from the maximum 5 ½ feet, the opening width should increase from the minimum of 16 feet according to the table below.

The outside 2 feet of the traffic circle should be constructed with a mountable monolithic cement concrete curb and pavement surface doweled to the existing pavement.

Traffic Calming and Emergency Access

Emergency vehicle access is often a determining factor in street design and traffic calming projects. Emergency access standards can impact a number of design features recommended in this plan.

Emergency service providers may be concerned about traffic calming features, such as chicanes, traffic circles, or speed humps that may slow emergency response time.

On most streets sufficient width exists as a matter of course. However, some treatments discussed in this plan may conflict with minimum width or response time requirements, including traffic circles, chicanes, medians and islands, shared public ways, and local lanes of multi-way boulevards.

In some cases, design techniques may be employed to mitigate impacts on emergency access, for example, by providing mountable curbs or aprons at the edges of traffic circles or medians. In other cases, proposed design features may not work at all, and may have to be eliminated from proposals.

Achieving good street design that meets traffic calming and pedestrian safety and comfort objectives while maintaining necessary emergency access requires further discussion between agencies that design and build streets and emergency service providers. The City should create a forum to focus on this issue.

Traffic calming circles should maintain sufficient space such that vehicles do not swing into crosswalks. In properly designed circles, vehicles navigating the intersection will not intrude into the pedestrian crossing area. A minimum of 11' of clearance between the circle edge and the crossing location should be used per standard plans.

This may mean setting crosswalks back such that they align with the inside edge of the furnishing zone instead of the curb. However, they should retain a linear path of travel from the throughway zone directly to the curb ramp and the crosswalk. Where it is not possible to do this, alternative traffic calming measures should be used.

Traffic calming circles should include signage to indicate the direction of circulation.

Traffic calming circles should be designed with a vertical inner curb and a mountable apron per standard plans. The vertical inner curb prevents vehicles from driving over the circle. The apron is a shallow sloped curb extending out from the bottom of a vertical curb, with a low lip at its pavement-side edge. This apron allows large vehicles to make turns, while slowing other vehicles.

Traffic calming "circles" need not be circular. Other shapes may be used to slow traffic in one direction more than others, for example where a busy street intersects with a residential area.

Traffic calming circles should be landscaped with trees or plantings. Shrubs and grasses should be planted up to 3 feet tall and trees should follow the branching height and pruning guidelines described in Section 6.1.

Trees should be planted a minimum of 4 feet from the inside edge of the curb. In traffic calming circles with a diameter of less than 15 feet, one tree should be planted in the center. On a traffic calming circle with a diameter greater than 15 feet, more than 1 tree should be planted and should be equally spaced around the circle.

Traffic calming circles added by neighborhood request should consider added maintenance burdens; this may require maintenance agreements with adjacent property owners.

Utilities may remain within traffic calming circles.

MODERN ROUNDABOUTS

Roundabouts may be used at large intersections in place of signals and can handle significant traffic volumes. Although their primary purpose is to improve traffic flow, properly designed roundabouts can create a positive pedestrian environment and a unique design opportunity.

Roundabouts have lower vehicle speeds and fewer pedestrian collisions than standard signalized or unsignalized intersections, and experience has demonstrated that vehicular crashes are significantly reduced when low-speed, single lane roundabouts replace four-way intersections.

When vehicular volumes are low to moderate, roundabouts allow pedestrians to cross frequently without waiting for vehicles to stop. However, crossing pedestrians are not protected since vehicles are free flowing. Modern roundabouts incorporate splitter islands to provide crossing refuge for pedestrians and deflect the path of motor vehicles. This deflection reduces vehicle speeds making it easier for pedestrians to cross. Because they introduce non-standard geometry to the intersection, roundabouts can be confusing to pedestrians with visual impairments and special care should be taken to provide wayfinding cues (see sidebar).

Roundabouts & Pedestrian Wayfinding

Modern roundabouts present challenges for pedestrians with visual impairments because vehicles are not required to stop at an intersection with a roundabout as at a conventional intersection. Visibility of crosswalks and detectable entry points of crosswalks should therefore be carefully considered and should be addressed through appropriate signage and higher visibility crosswalk treatments. Signage indicating the presence of the pedestrian crossing should be used to remind drivers that while they are only required to yield to traffic within the roundabout, they are required to stop for pedestrians that are in the crosswalk.

Wayfinding and gap selection cues should be incorporated into the design of roundabouts so they do not become a barrier to pedestrians with visual impairments. Detectable warning strips should be used at all pedestrian crossing entry points. Sidewalks should be set back from the edge of the circulatory roadway by at least 5 feet so that pedestrians with visual impairments can clearly follow designated crossing points. This also serves to discourage pedestrians from crossing to the center island and provides space for landscaping.

Research into how better design roundabouts for pedestrians with visual impairments is currently underway by the National Cooperative Highway Research Program (NCHRP) and should be incorporated into designs when its findings are released.

▲ Roundabouts are typically larger, higher traffic volume intersections than traffic circles. The larger center island and multiple medians provide ample opportunity for planting and stormwater management.

Placement

Roundabouts have limited applicability in San Francisco due to their scale and complexity.

Roundabouts are appropriate at medium to high volume intersections that would otherwise have some other form of intersection control, such as a four-way stop or traffic signal. Modern roundabouts may be considered under the following conditions:

- intersections with more than four intersecting streets;
- high volume grade-separated intersections where there is a desire to bring streets back to surface level to create at-grade intersections; and
- intersections with freeway on and off ramps.

Many typical San Francisco site-specific conditions may preclude installation of a roundabout, including: physical and geometric constraints; heavy pedestrian and bicycle movements; proximity of other traffic control devices that would require preemption (e.g. railroad tracks or Rapid transit routes); or high numbers of oversized trucks.

Where roundabouts are feasible and desirable, their use may be considered pursuant to additional study and environmental review. Where roundabouts are used, they should follow the pedestrian design guidelines in this section.

Guidelines

Crossings at intersections with modern roundabouts should minimize pedestrian exposure to vehicles, using the following techniques:

- Crossing distances should be minimized.
- Unobstructed sight distance between crosswalks and approaching traffic should be provided.
- At single lane roundabouts, the pedestrian crossing should be at least one vehicle length (25 feet) from the yield line at the intersection with the roundabout to allow one car to queue beyond the crossing.
- At double lane roundabouts, the crossing should be at least two vehicle lengths (50 feet) from the yield line.
- Splitter islands should be provided. Pedestrian refuges should meet the guidelines in Section 5.4.

Roundabouts should be landscaped. Plantings should be less than 3- feet tall within 4 feet of the edge of the curb

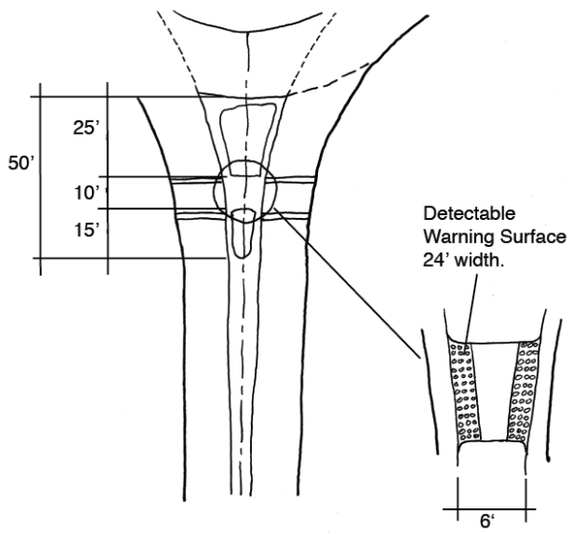
Roundabouts may be considered for distinctive landscape treatments or public art installations such as fountains to create a gateway to major civic locations or to the City from highways. Where space allows, useable public space may be designed within the center island.

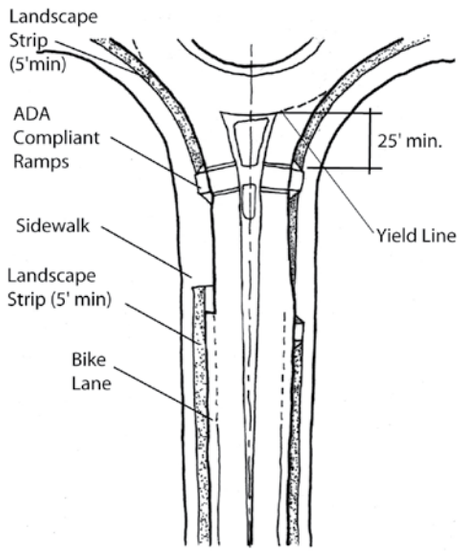
Transit Stops

Transit stops located on the near side of the roundabout should be located far enough away from the splitter island so that a vehicle overtaking a bus would not be forced into the island. For a single lane entry where capacity is not an issue the transit stop can be located at the crosswalk. Transit stops on the far-side of the roundabout should be located beyond the pedestrian crossing and have pull-outs constructed to minimize queuing in the roundabout.

Bike Facilities

Bicyclists may be disadvantaged by roundabout design, and marked bicycle lanes through roundabouts have not been shown to improve safety. Bike lanes should terminate in advance of crosswalks at roundabouts. For one-lane roundabouts with slow speeds and light traffic, bicyclists may merge into the vehicular travel lane comfortably. At multi-lane roundabouts, which are more challenging for cyclists to navigate, additional safety and design features should be provided.





▲ Crossings at roundabouts should have splitter islands and be set back from the intersection

NOTE:
In general, roundabouts have limited application in San Francisco due to the typical constrained conditions at many intersections and on-going debate as to their appropriateness for pedestrian-oriented environments. At some larger intersections with unusual traffic alignments and high traffic volumes they may be considered to improve capacity and roadway function. This section is intended to address safe and attractive design of roundabouts for pedestrians, cyclists, and transit users, where it is determined that a roundabout is to be implemented. It does not focus on transportation and traffic management functions, though these are alluded to in explanation of roundabout function. For additional detail on traffic engineering and design considerations, see *Roundabouts: An Informational Guide,* published by the Federal Highway Administration.

Pedestrian-Priority Designs

5.8

POCKET PARKS

Pocket parks are small, active public spaces created in the existing public right-of-way. They can be located in medians, curb extensions, or in the furnishings zone on sufficiently wide sidewalks. In addition to landscaping, pocket parks may include seating areas, play areas, community garden space, or other elements to encourage active use of the public open space. Pocket parks provide important public space in areas with high-density land use and areas deficient in open space.

Guidelines

Pocket parks should provide a variety of open space functions including active and social activities, in addition to ornamental functions. Pocket parks may include seating, café tables, play or fitness equipment, open lawn space, dog runs, community gardens, ecological/educational displays, and community bulletin boards.

Pocket parks should be landscaped or use special paving materials to differentiate their unique open space function from the normal sidewalk or median.

A landscaped or constructed edge should be included at the edge of the pocket park to create a buffer from passing traffic. The buffer may be landscaped, such as a hedge, or constructed, such as bollards, a low fence, or a low wall (with integrated seating). The buffer should generally not be higher than 30 inches.

Pocket parks may be designed to serve as stormwater retention and infiltration areas. Pocket parks should be terraced along steep streets to maintain ADA access and provide seating areas.

Sidewalk Pocket Parks

Sidewalk pocket parks should be a minimum of 15 feet long and ideally at least 20 feet wide. Specific dimensions should be determined based on the width of the public right-of-way, space between driveways, and the needs of the surrounding neighborhood.

Where on-street parking is provided, a 2 foot minimum vehicle egress area (courtesy strip), and a 4 foot walkable pathway or other accessible route should be provided at each parking space to allow access from parked cars to the sidewalk per Section 4.2.

Median Pocket Parks

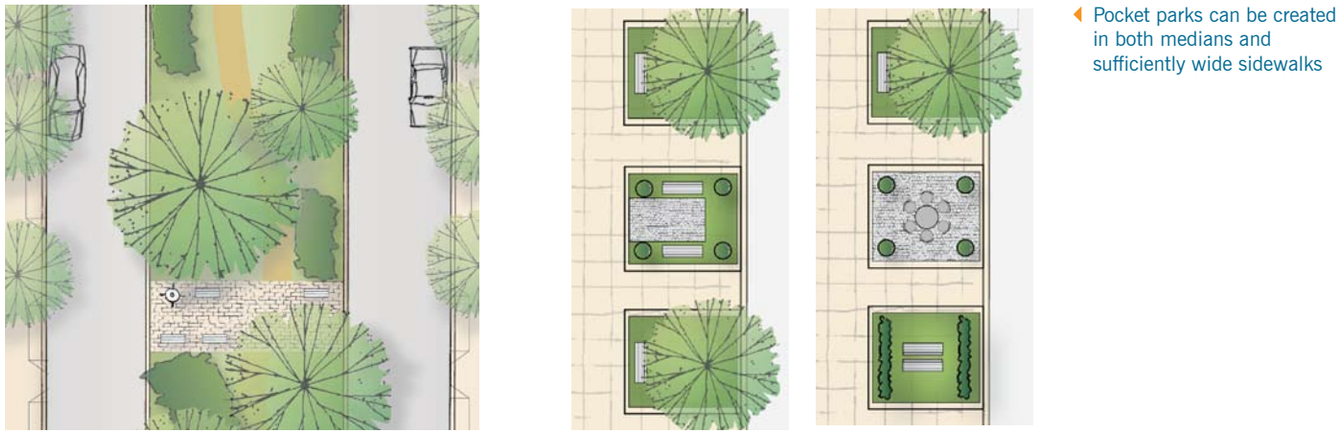
Median pocket parks should connect to the primary pedestrian network through marked crossings at each end and, on long blocks, at a mid-block crossing. Bollards should be provided at the ends of the median to define the edges of the park space and create a formalized, special entrance.

Median pocket parks should extend the full length of the block or as long as space allows.

Median pocket parks should be a minimum of 12 feet wide and 24 feet long, including:

- an accessible pedestrian path, 4 feet or wider, connected to intersection and mid-block crossings;
- a minimum 18 inches of buffer on each side of the median such as landscaping or bollards; and
- a minimum of 5 feet of seating, planting or other amenities.

Median pocket parks should exceed these minimum guidelines as width allows for the setting and intended use of the space. A more flexible approach to the edge of the median can be taken on streets with low traffic volumes and speeds, where a lesser buffer may be necessary. In these cases, special design and paving treatments may be continued through the roadway to emphasize the pedestrian-oriented nature of the space.



Pocket parks can be created in both medians and sufficiently wide sidewalks

Reuse of “Pork Chops” and Excess Right-of-Way

In many locations, historic development patterns and the intersection of street grids result in excessive but unusable pavement spaces (called “pork chops” to describe a common shape). Similarly, many city streets are designed for more traffic than actually uses them. These excess paved areas provide many opportunities for pedestrian improvements, landscaping, and active public space.

Pork chops and unused intersection spaces should be brought to sidewalk level and should include landscaping, seating, and active uses. These spaces can be used to create bosques, rain gardens, paving treatments, public art, and other creative designs.

Each case is unique, but even small spaces can be effectively used for local improvements:

- 25 square feet can be enough for healthy tree planting; even less is necessary for corner landscaping.
- A few feet of roadway width along a street can provide space for a swale or landscaped strip.
- A 7 foot corner or mid-block curb extension can provide space for seating areas (see Section 5.3).

Best Practice: Sandy Boulevard Corner Triangles

Portland, Oregon

Similar to San Francisco, Portland has a grid-based street system with some streets that break the pattern resulting in small spaces at odd corners. On one such street, Sandy Boulevard, these triangular spaces were previously paved as part of the roadway, resulting in crossings of over 100 feet. To improve this situation, the City of Portland extended the curbs to narrow crossings, and constructed stormwater gardens, public parks, and cafes in the resulting open space.

Courtesy City of Portland's Department of Transportation and Bureau of Environmental Services.
Design by Nevue Ngan Associates, URS Engineering, and Lloyd Lindley, FASLA.

1. The Duboce Triangle neighborhood includes a number of small sidewalk pocket parks.

2. This median includes a pedestrian and multi-use path lined with substantial landscape buffers where people can sit and relax. *Source: Mike King*

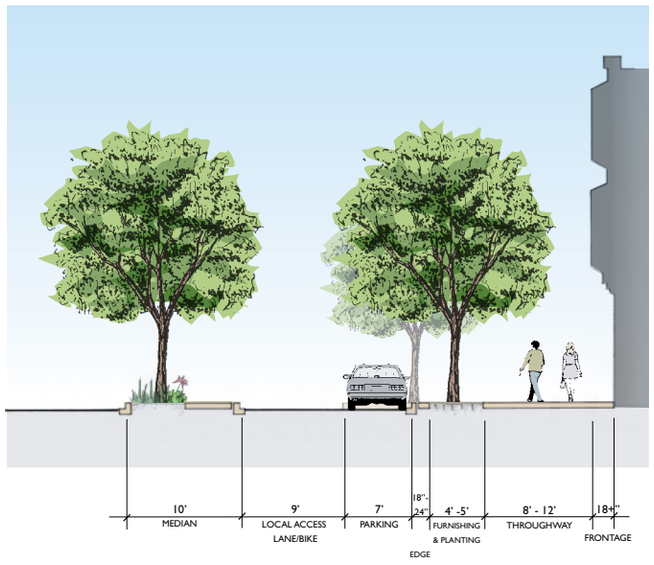
3. San Francisco's South Park is a median pocket park that includes benches, green space, and a children's play area.

PEDESTRIAN DESIGN FOR BOULEVARDS

Multi-way boulevards, such as Octavia Boulevard, are designed to separate through traffic from traffic accessing local uses. Many existing San Francisco streets may be appropriate for conversion to boulevards. Boulevards can improve the experience of the street for all users. Benefits of boulevards include:

- Local access lanes make travel safer and easier for through traffic and local traffic by separating these two functions.
- Local access lanes can be used as a shared space for local uses such as deliveries, calm residential streets for children to bike on, calm, pedestrian-priority streets, and space for local businesses to temporarily use for special events with a street closure.
- Multiple medians create the opportunity to add design features such as multiple rows of trees, special paving areas, and various areas for walking or sitting.

A multi-way boulevard has local access lanes on each side of the street. A one-side boulevard involves the installation of a local access lane on only one side of the street, where there is a constrained right-of-way or a different land use context on each side of the street.



Boulevard treatment should be considered for streets that serve both local traffic and significant through traffic and have sufficient right-of-way (generally more than 100 feet, though a minimum width could be as low as 86 feet).

Definitions

Multi-way boulevard: Street type that separates through traffic from local access through the use of medians

Community Space: Portion of a multi-way boulevard that includes side medians, local access lanes, parking, and sidewalks

Local access lanes: also "Side access lanes" or "Side lanes". Vehicle and bicycle lanes on a multi-way boulevard that serve parking, loading, and adjacent land uses, separated by a median from through traffic

Through lanes: Vehicle and bicycle lanes separated from local uses and parking by a median

Center median: Median separating opposing directions of vehicle travel on through lanes

Side median: Median separating through lanes from local access lanes

Guidelines

Boulevards should clearly demarcate local community space from through traffic. Community space should feature pedestrian and bicycle scale design.

Medians should establish a boundary between through traffic and the neighborhood-oriented space. The preferred width for side medians is 10 feet, including 6 feet for landscaping and street trees, and 4 feet of walkable surface, even if the median is not intended for active use. In order to provide the required 14 feet of emergency access clearance in the side lanes, a mountable curb may be provided and the clear walkable surface included in the emergency access width.

Side medians and local access lanes, such as those on Octavia Boulevard, should be designed as pedestrian space that serves adjacent neighborhoods and businesses.

Best Practice: Octavia Boulevard

San Francisco, California

Octavia Boulevard is the focal element of a larger neighborhood revitalization project in San Francisco's Hayes Valley district.

The design of Octavia Boulevard was the result of extensive stakeholder outreach, design charrettes, and collaboration among City agencies. The street is San Francisco's first modern multi-way boulevard, separating through traffic from local access. It includes an ample pedestrian realm, active recreational areas, and substantial green space in a right-of-way that was formerly an elevated freeway. At one end, the boulevard culminates in Patricia's Green, a new open space for the Hayes Valley neighborhood.

The design of Octavia Boulevard is a mixed success. Many design elements including the multiple rows of trees are attractive and effective, and the street has proven able to successfully carry through traffic and allow local access in a pedestrian-oriented environment. To accomodate emergency vehicles and parking and driveway access, side access lanes were built too wide to effectively discourage through traffic from speeding down them. These lanes feel like any other street, rather than shared space meant for local and neighborhood use, and speed humps have been added retroactively. Narrower lanes, special paving, raised crossings, and curb extensions would more effectively discourage through traffic and slow traffic that does pass through, allowing local residents to confidently venture out into this space and use it and the side medians.

Community space in boulevards should include the following elements:

- Street trees, pedestrian lighting, and site furnishings in the side medians
- A slight grade change (at least 1 to 2 inches) from the local access lane to the median and sidewalk
- Special paving in the roadway of local lanes (see Section 6.4)
- Raised crosswalks at intersections between the sidewalk and side medians (5.1)
- Curb extensions (5.3)

The community space on a multi-way boulevard may also be designed as a Shared public way, with the entire shared space at sidewalk grade. Shared space in boulevards should follow the guidelines for shared public ways in the following section.

Parking may be located on either the median or the sidewalk side of the local access lane and can be parallel parking or angle parking.

There are two alternatives for intersection design on multi-way boulevards:

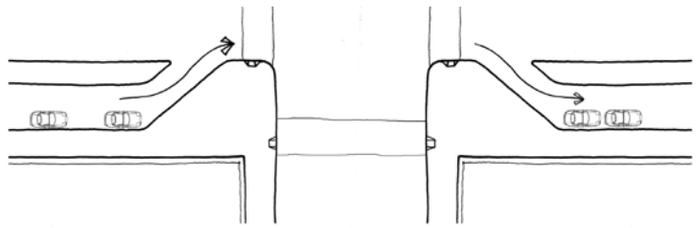
- **Alternative 1:** Bring local access lanes back to through lanes in advance of the intersection to provide a large corner bulb-out with space for seating, landscaping and other amenities. This discourages through travel in the side access lanes.
- **Alternative 2:** Extend the side median directly to the intersection to create a pedestrian refuge island with a thumbnail at the intersection end. This allows continuous traffic flow in both the through traffic lane and in the side access lanes.

Parking on the median side of the local access lane can improve connections between the sidewalk and the local lane, making the side access lanes act as part of the pedestrian realm.

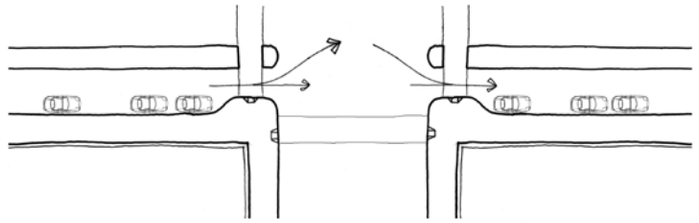
Transit Stops at Boulevards

On streets with transit, transit vehicles can be accommodated in the right-most through lane by placing the transit stop and amenities on the side median. Transit vehicles can also operate in the local access lane if a wide enough travel lane is provided. However, this may result in slower transit performance and increased traffic in the local access lane, which can negate the function of this area as community space.

Alternative 1



Alternative 2



SHARED PUBLIC WAYS

Shared public ways are public right-of-ways designed for pedestrian use which permit vehicles and bicycles to share the open space. Shared public ways:

- prioritize use of the entire right-of-way for pedestrians and public space over vehicular through travel;
- accommodate small numbers of vehicles at low speeds as necessary for local access to building entries and driveways, on-street parking, loading, service and emergency access, and deliveries; and
- provide clarity for people with visual impairments regarding the shared pedestrian/vehicular nature of the space.

The character of a shared public way may vary, from quiet, residential-only lanes to mixed-use residential and pedestrian-oriented commercial streets with or without transit.

Shared public ways may be designed with special paving, a variety of amenities, landscaping, and seating, and pockets of on-street parking, to create a safe environment that encourages public recreational use and socialization. They are especially valuable, and should be prioritized, in neighborhoods with limited opportunities for public open space.

Shared public ways may be considered on streets that:

- do not have parking garages with greater than 100 parking spaces;
- have through traffic of fewer than 100 cars per hour; and
- do not have transit service.

On streets that do not meet all of these criteria, Shared public ways may still be appropriate pursuant to additional study and environmental review.

Definitions

Detectable warning: An approved standardized surface or feature built into or applied to walking surfaces or other elements to warn visually impaired persons of hazards in the path of travel

Gateway: A constrained vehicular entry into the shared public way, composed of physical elements that provide visual and physical cues to vehicle drivers that they are entering a shared public way

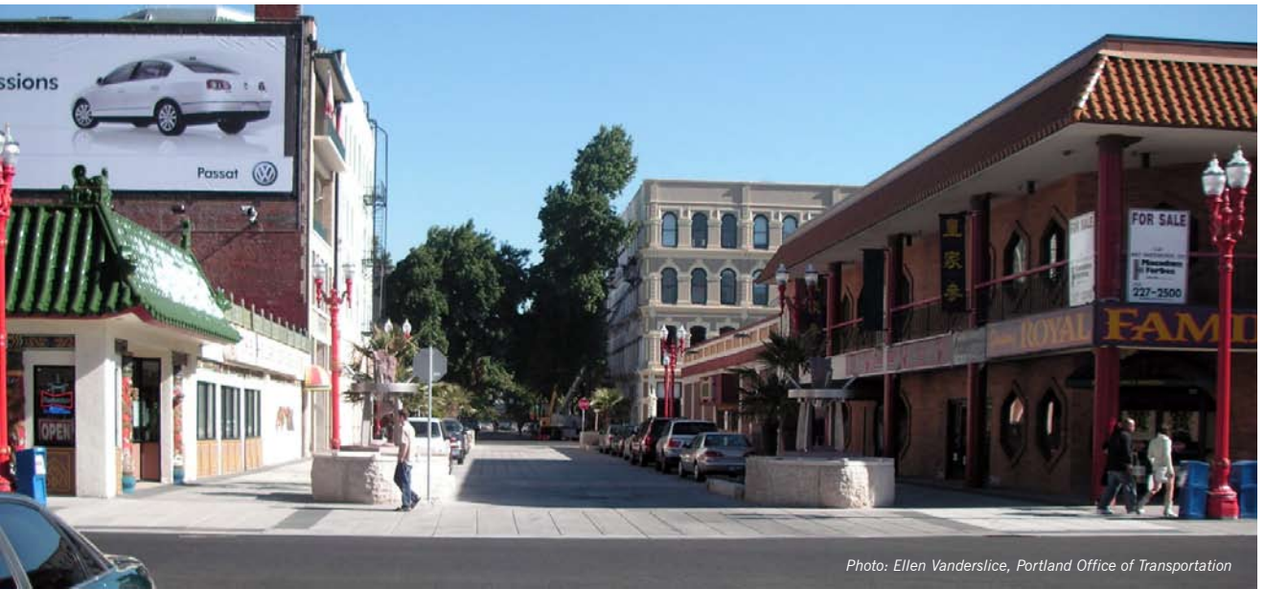


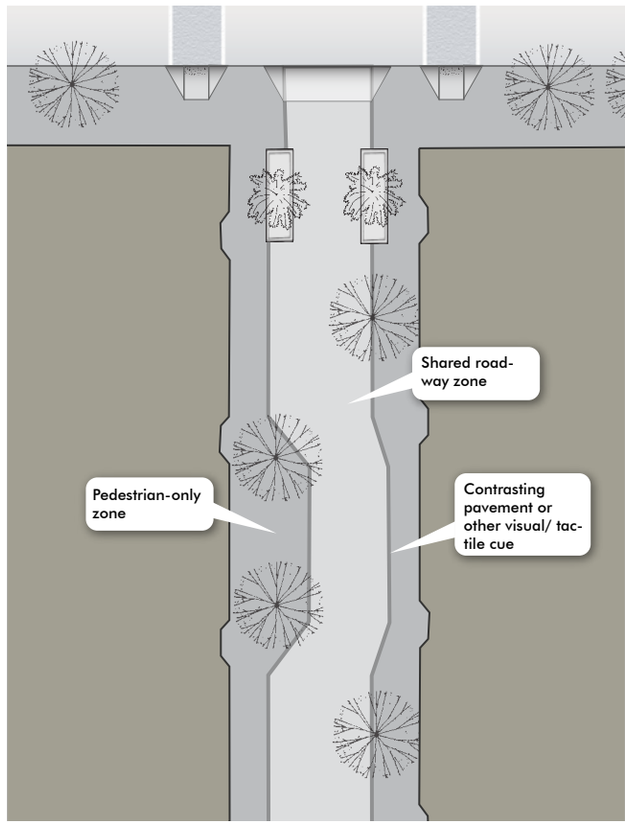
Photo: Ellen Vanderslice, Portland Office of Transportation

Chinatown Festival Street, Portland, OR.

Photo: Ellen Vanderslice, Portland Office of Transportation

Single-surface treatments create unique opportunities for special pedestrian-scale design and amenities, added landscaping, and special spaces within the right-of-way.

▲ Special paving tratments, landscaping, and other elements can be used to delineate spaces within the right-of-way



▲ Shared public ways greater than 15' in width should distinguish between pedestrian-only and shared zones through contrasting paving or other measures

Hazardous vehicular area: A public right-of-way, vehicular street, or alley with a 15 mile per hour or greater speed limit

Pedestrian-only zone: the portion of the shared public way dedicated to pedestrian use (except where driveways cross over)

Shared zone: the portion of the shared public way that is utilized by pedestrians, bicyclists and vehicles

Shared public way: public right-of-ways designed for pedestrian use, and which also permits low volumes and speeds of vehicles and bicycles to share the open space. By definition and through design criteria, shared public ways are not hazardous vehicular areas.

Transit mall: a shared public way that includes transit vehicles

Best Practice: Shared Streets

Cambridge, Massachussets

Over the last 5 years, Cambridge, Massachusetts has had a 12 member design committee working with City staff to plan streetscape improvements around Harvard Square. It had been over 20 years since any urban design projects were constructed, and when it came time to repair some crumbling sidewalks the community saw it as an opportunity to overhaul the area due to its high volume of pedestrian traffic and importance in public life.

Improvements to date include aesthetic and safety-related projects including attractive lighting and landscaping, widened sidewalks, improved signal timing and crossing conditions at intersections, curb extensions, bike parking and bike route improvements, and construction of a number of shared streets. In many cases, high pedestrian volumes and ADA access could not be appropriately accommodated with traffic lanes on historic narrow streets. To address this, many streets were changed to shared public ways in order to refocus the space on pedestrian traffic and provide sufficient space for ADA compliant travel. Now cars may use the streets, but pedestrians have the right-of-way on the whole street. Since the first shared public ways were completed, the public has been enthusiastic about their success and requested that many more streets be converted.

Guidelines

Pedestrian Areas

Shared public ways should be designed to emphasize their pedestrian and public open space character to differentiate them from traditional streets.

On right-of-ways greater than 15 feet in width, shared public ways should include pedestrian-only zones as differentiated from a shared zone. The separate zones should be differentiated through the use of visual detectable cues as described below. Right-of-ways less than 15 feet in width do not need to differentiate between separate zones.

In addition, shared public ways should provide the following pedestrian-oriented elements:

- **Alternative paving materials** patterns distinct from traditional streets. Paving should appear as an integrated, coherent design of patterns, materials, and colors. Paving textures should be smooth and vibration free. Where surface materials are coarse enough to impede wheelchair circulation, a continuous 4' pedestrian path of ADA-compliant smooth materials must be provided to lessen vibration impacts on individuals using wheelchairs. See also Section 6.4.
- **Small plazas or vehicle-free spaces** adjacent to the shared zone that may alternate from side to side to create chicanes, or be interspersed among passenger loading zones, driveways or parking spaces.
- **Landscaping, seating and other streetscape amenities** or furniture located and spaced to allow visual permeability and barrier-free pedestrian movement through the entire shared public way even when vehicles are present.
- **Vehicle closures on an intermittent or temporary basis** for events, restaurant seating, markets, etc.

Visual/Tactile Cues

Visual/tactile cues should be provided to identify the presence of a shared public way as distinct from a traditional street, and to delineate between pedestrian-only and shared zones. Visual/tactile cues should be provided at all edges between pedestrian-only and shared zones, including from the crossing sidewalk. Visual/tactile cues should not impair the potential use of the entire right-of-way by all users.

A variety of materials, treatments and objects may be incorporated into creating visual/tactile cues. Combinations of elements may be used to create a more vibrant environment. Acceptable visual/tactile cues include but are not limited to the following:

- changes of material texture (cobble or rough surfaces at shared zones contrasting to smoother surfaces at pedestrian–only zones, or use of cobbled stone bands between pedestrian–only and shared zones);
- changes of material color and contrast (light on dark or dark on light);
- use of ½ inch maximum beveled transitions in surface treatment;
- use of caning detectable wayfinding or pathing materials (tactile tiles, ½-inch maximum height material ridges or domed material, etc);
- landscaping and raised planters;
- street furniture such as benches, seating ledges, or trash cans;
- bollards, railings and other architectural elements; and
- temporary or movable objects, such as swinging gates, movable planter boxes or retractable bollards.

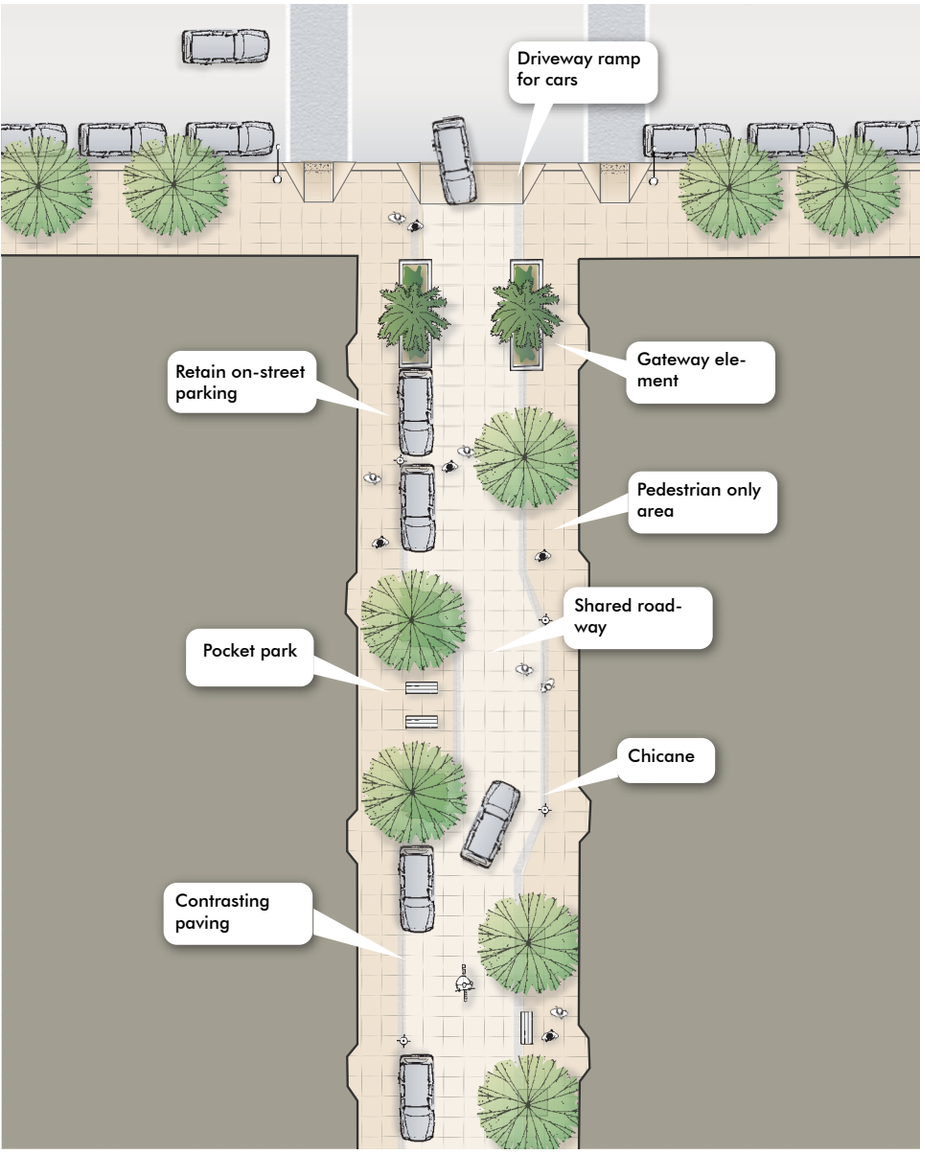
Visual/Tactile Detection in Shared Public Ways

Visual/tactile cues may serve the specific needs of individuals with different types of disabilities. Visual cues serve individuals with low vision. Tactile cues may serve as means for wayfinding as a cane-detectable edge, "shoreline" or pathing. The type and use of treatments is dependant upon the context and uses which may occur in the shared public way.

The use, design and placement of visual/tactile cues should permit effortless permeability of pedestrian circulation between pedestrian-only zones and shared zones. The spacing of vertical objects may serve to prohibit vehicles from entering pedestrian-only zones or other open space plazas or park areas. The placement of vertical and/or caning detectable materials should be aligned to reinforce edges and "shoreline" path markings. The spacing of these vertical objects should allow for continuous and unencumbered pedestrian movement along a shared zone even when vehicles are present, and support the overall use of the shared public way as usable open space.

Per California Building Code (Section 1133B.8.5), if a walk crosses or adjoins hazardous vehicular areas, and the walking surfaces are not separated by curbs, railings or other elements between pedestrian areas and vehicular areas, the boundary between the areas shall be defined by a continuous detectable warning which is 36 inches minimum wide and complying to DPW and State of California technical standard. As noted in definitions, shared public ways are not hazardous vehicular areas, and contain restrictions that mitigate this issue. Curb ramps with detectable warnings are required at pedestrian crossings that intersect raised curbs, if adjacent to hazardous vehicular areas (standard streets).

▼ Bollards or other vertical elements effectively separate shared zones from pedestrian-only zones on a shared public way.



▲ Diagram of a shared public way

Vertical materials or objects should have color or visual contrast with ground surface materials.

Transit malls must provide detectable warnings (or other detectable element such as a curb, raised planter, or other architectural barrier) between pedestrian areas and public transit lanes (bus lanes, light rail tracks, and the like). Detectable warnings must comply with DPW standards for detectable materials.

Where a shared public way leads to curbs, crosswalks and standard streets, curb ramps with detectable warnings must be provided.

Traffic calming

Shared public ways should utilize traffic control and calming strategies to slow traffic and emphasize the pedestrian nature of the space. On shared public ways, vehicles and bicyclists must yield to pedestrians. Shared public ways should have a posted speed limit of no more than 10 miles per hour.

Traffic calming strategies appropriate to shared public ways include but are not limited to:

- **Gateways.** Narrowing the entrance to the shared zone of the shared public way at the entrance from a standard street. Gateways may include flanking raised planters or vertical pylons or temporary element such as motorized gates or retractable bollards. They should not block crossing sidewalks.
- **Driveway treatments.** Raising the entrance to the shared public way to the level of adjacent sidewalks such that vehicles and bicycles must ascend a driveway apron to access the shared public way.
- **Signage.** Signage posting speed limits, instruction to yield to pedestrians and other information, such as name of the public space, or other signage indicating pedestrian priority. (Design considerations for signage should incorporate appropriate aesthetics that reflect the nature and character of the particular shared public way).
- **Paving materials.** Durable, textural material changes at the gateway to the shared public way, such as a band of rough cobblestones, storm drainage grates or textural material bands in pavement that provide a sense of low vibration when a vehicle drives over the material. Color and material contrast (light on dark, dark on light) can also distinguish changes between a standard street and the shared public way and send a cue to drivers that they are in a pedestrian-priority space and must slow down.
- **Chicanes.** Introducing serpentine pathways for vehicle and bicycle travel, employing horizontal shifts (chicanes) through placement of landscaping, bollards, street furniture, parking, and other streetscape elements, while preserving unencumbered pedestrian travel.

Other

Shared public ways may or may not be accepted for maintenance and liability by the City and County of San Francisco. Responsibility for maintenance of all zones of shared public ways should be determined prior to approval of a shared public way.

Design of shared public ways should solicit public input on a project by project basis, including participation and input by individuals with disabilities and groups that represent individuals with disabilities, including people with visual impairments.

Primary access to large shared or common garages should be located away from shared public ways and onto alleys or streets designed for more regular automobile use wherever possible.

Shared public ways should be designed to drain away from buildings, either toward the center of the street, with a side-running gutter on either edge of the central space, or to other stormwater drainage features. See Section 6.2.

PEDESTRIAN-ONLY STREETS

On streets with substantial pedestrian activity, active land uses, and limited need for vehicular access, temporary or permanent street closure to vehicles may be considered to encourage pedestrian use. Pedestrian amenities, including seating, landscaping, pedestrian lighting, retail displays, and café seating should be located in the street right-of-way to help activate the space.

There are three potential types of street closure:

- **Temporary closures:** Streets may be closed for short, pre-determined hours of the day or week, such as weekends, evenings, or special occasions.
- **Pedestrian malls:** Pedestrian malls are permanent closures in areas used by high volumes of pedestrians, such as tourist and major downtown shopping areas.
- **Transit malls:** Transit malls are a type of street closure that close the street to private automobiles, but continue to allow use by transit vehicles.

Pedestrian-only streets may be considered on streets that:

- do not have any parking or loading access, garages, or driveways (or for temporary closures, where parking and loading access may be limited to times of the day when the street is open to vehicular traffic);
- have through traffic of fewer than 100 cars per hour; and
- do not have transit service (except for transit malls).

On streets that do not meet all of these criteria, pedestrian-only streets may still be appropriate pursuant to additional study and environmental review.

Guidelines

Bollards, landscaping, or other gateway elements should be placed at the intersections of the streets to be closed to vehicles and the crossing street to discourage cars from accidentally turning into pedestrian-only streets and to remind pedestrians they have reached a transition point and should be aware of vehicles.

Permanently closed streets should incorporate landscaping, seating, special paving, public art, and other pedestrian-supportive elements in the full public right-of-way – the right-of-way should be designed holistically from property line to property line.

A clear 14 foot path should be maintained through permanently closed areas for emergency vehicle and delivery access. This path does not need to be straight, but should account for truck maneuverability and required clearances for emergency vehicle operations. Removable or automatically retractable bollards may be used to allow emergency vehicles to access areas otherwise closed to vehicle use.

In transit malls, pavement treatments using material and/or color changes should be used to distinguish transit lanes from pedestrian areas. Transit malls should follow the guidelines for shared public ways, previous section.

Single-surface treatments should be used for pedestrian malls to remove tripping hazards and obstacles to people with mobility impairments posed by roadway curbs. Single-surface treatments are appropriate to streets that will be frequently used for temporary closures as well – these streets should follow the guidelines for shared public ways, previous section.

▲ The 16th Street Transit Mall in Denver provides standard sidewalks for pedestrians to walk along storefronts, dedicated lanes for transit vehicles, and a wide array of amenities and landscaping in the center of the right-of-way

1

2

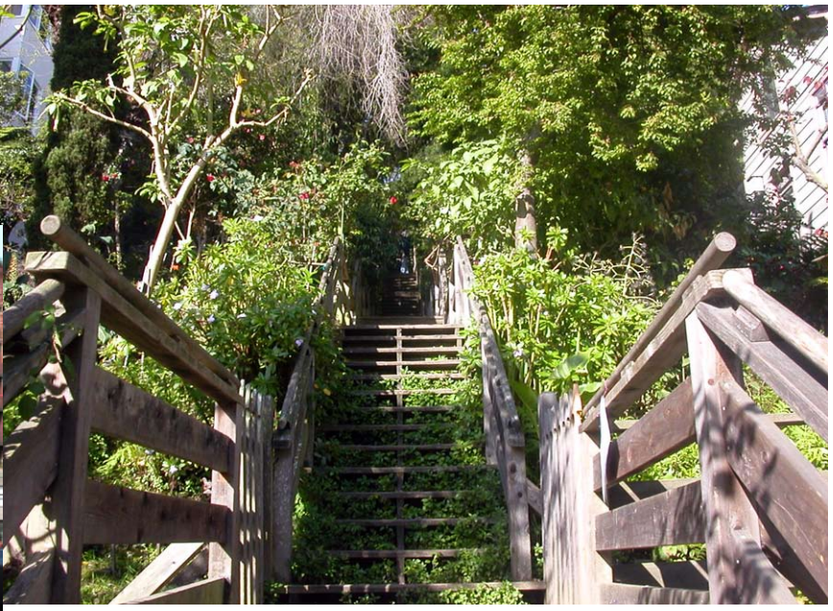
3

Photo: Ellen Vanderslice, Portland Office of Transportation

1. The first block of Powell Street, near Market Street, is a transit mall, which allows pedestrians full use of the street except when transit vehicles (cable cars) are present

2. Belden Lane is a temporary pedestrian mall with cafe seating at the lunch hour

3. Portland's Festival Streets are closed for only a few days a year for the fall Harvest Festival; at other times, they act as a shared public way.



PUBLIC STAIRS

Public stairs enhance the experience of the natural hillsides that help define San Francisco's distinctive identity and, by nature of being pedestrian only, provide unique urban design opportunities.

Public stairs should be used to provide direct pedestrian routes between hillside locations that might otherwise require a pedestrian to travel a significant distance out of their way to connect by sidewalks. Stairs should also be used to provide an alternative to very steep sidewalks along streets.

Guidelines

The minimum width for a public stairway should be 4 feet.

The riser height and tread depth of each stair should be uniform, with treads no less than 11 inches deep.

→ The following formula can be used to determine appropriate tread to riser ratio: 2R +T = 26 to 27 inches, where R = riser and T = tread.

→ Risers should be solid with nosing undersides.

Landings should be provided at frequent intervals to provide rest areas and overlooks, and should provide seating where space allows. The maximum distance between landings should be 12 feet whenever feasible given topography and other existing conditions. The minimum length of the landing should be five feet or equal to the width of the stairway. A continuous handrail that complies with ADA requirements should be provided.

Surface materials should be durable, provide a slip-resistant walking surface—including a contrasting color as per ADA—and be subject to regular inspection and maintenance.

Stair placement, landscaping, and lighting should contribute to visibility to and from the stairway, to improve pedestrian safety and security. Pedestrian scale lighting should be provided at landings to improve safety and comfort at night. Light poles should be located for easy maintainability.

Landscaping should be provided adjacent to stairways. Stairways should be designed to prevent the accumulation of water.

Signage should be provided to indicate that the stair is public right-of-way and should inform users where the stair leads, (e.g. "Public Stairway to Liberty Street"). Signage should alert pedestrians to alternative accessible routes, either along public sidewalks or via ramps where possible.

Technical provisions for accessible features appropriate to public stairs may be found in section 4.7 of ADAAG.

Public stairs may incorporate public art, as in the Tiled Steps Project in the Sunset District