

PEDESTRIAN COUNTERMEASURES

INTERSECTION TYPE GUIDANCE

Every location needs tailored design and engineering judgment. That judgment should follow the guidelines described in each of the following device sheets, as well as other guidance from the CA MUTCD and other documents. We can, however, identify the treatments that are commonly used at different types of intersections. They are as listed below.

UNCONTROLLED CROSSINGS (NO SIGNAL OR STOP SIGN)

- > High-visibility continental crosswalks
- > Advance yield lines
- > Signs
- > Crossing islands (the most important device at multi-lane crossings)
- > Rectangular rapid-flash beacons
- > Hybrid beacons

As the number of travel lanes, traffic volume, street width and speed increases, more devices are needed. Pedestrians need signals to cross four-lane crossings with ADTs between 20,000 and 30,000 (or greater); the exact threshold depends on the number of lanes, speeds, and roadway width.

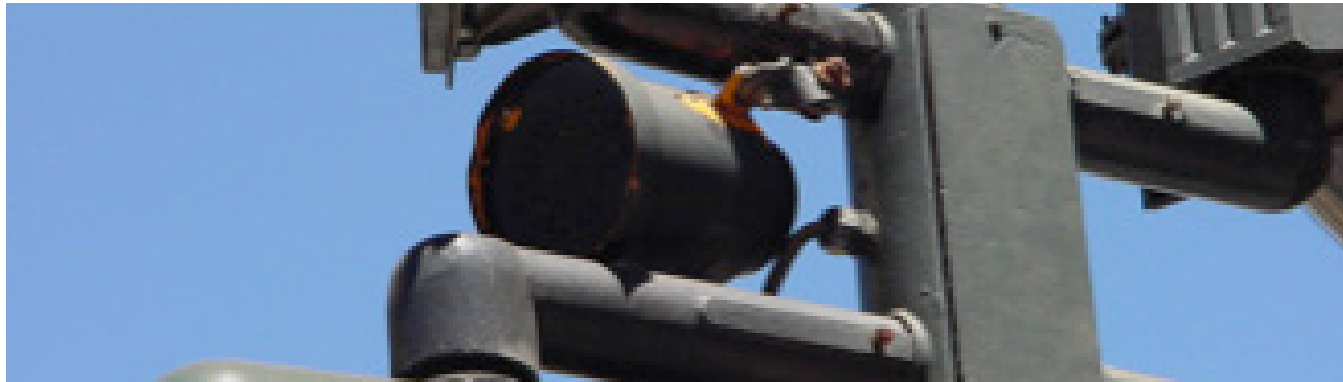
STOP-CONTROL CROSSINGS

- > Marked crosswalks (high-visibility continental crosswalks depending on traffic volumes, number of lanes, street width, number of pedestrians, presence of schools nearby)
- > Advance stop bars
- > Perpendicular curb ramps with tactile warning devices
- > Curb extensions where on-street parking exists (depending on traffic volumes, number of lanes, street width, number of pedestrians, presence of schools nearby)
- > Crossing islands (depending on number of travel lanes, street width, traffic volumes)

SIGNALIZED CROSSINGS

- > Countdown pedestrian signal heads
- > Advance stop bars
- > High-visibility continental crosswalks
- > Accessible pedestrian signals
- > Curb extensions where on-street parking exists
- > Crossing islands (depending on available space, traffic volumes, number of lanes, street width, number of pedestrians, presence of schools nearby)

ACCESSIBLE PEDESTRIAN SIGNALS ▶▶▶



DESCRIPTION

An accessible pedestrian signal is a device that communicates information to pedestrians in a non-visual format such as audible tones, verbal messages, and/or vibrating surfaces. These signals provide accessibility to those who have visual impairments. Verbal messages are generally preferred to tones.

KEY DESIGN FEATURES

- > Provide pedestrian signal information to those who cannot see the pedestrian signal head across the street
- > Provide information to pedestrians about the presence and location of pushbuttons, if pressing a button is required to actuate pedestrian timing
- > Provide unambiguous information about the WALK indication and which crossing is being signaled
- > Use audible beaoning only where necessary
- > Two poles should be installed for APS speakers, located close to departure location and crosswalk
- > Ensure accessibility to for pushbutton placement

BENEFITS

- > Create a more accessible pedestrian network
- > Assist those who are visually impaired
- > Can contain additional wayfinding information in messages
- > More accurate judgments of the onset of the WALK interval
- > Reduction in crossings begun during DON'T WALK
- > Reduced delay
- > Significantly more crossings completed before the signal changed

APPLICATIONS

- > ADA requires newly constructed or altered public facilities to be accessible, regardless of the funding source
- > Installed by request along a specific route of travel for a particular individual, or group of individuals who are blind or visually impaired

ADVANCE STOP BARS ▶▶▶



DESCRIPTION

A placing of the stop limit line for vehicle traffic at a traffic signal behind the crosswalk for the added safety of crossing pedestrians.

KEY DESIGN FEATURES

- > Vehicle stop line moved four to six feet further back from the pedestrian crossing

BENEFITS

- > Keep cars from encroaching on crosswalk
- > Low cost, effective device
- > Improve visibility of through cyclists and crossing pedestrians for motorists
- > Allow pedestrians and motorists more time to assess each other's intentions when the signal phase changes

APPLICATIONS

- > Can be used at any signalized or stop-controlled intersection
- > Presence of advanced stop bar is more important on roadways with higher speeds (30 mph and greater)
- > Should be included at all crossings of road with four or more lanes without a raised median or crossing island that has an ADT of 12,000

ADVANCE YIELD LINES ▶▶▶



DESCRIPTION

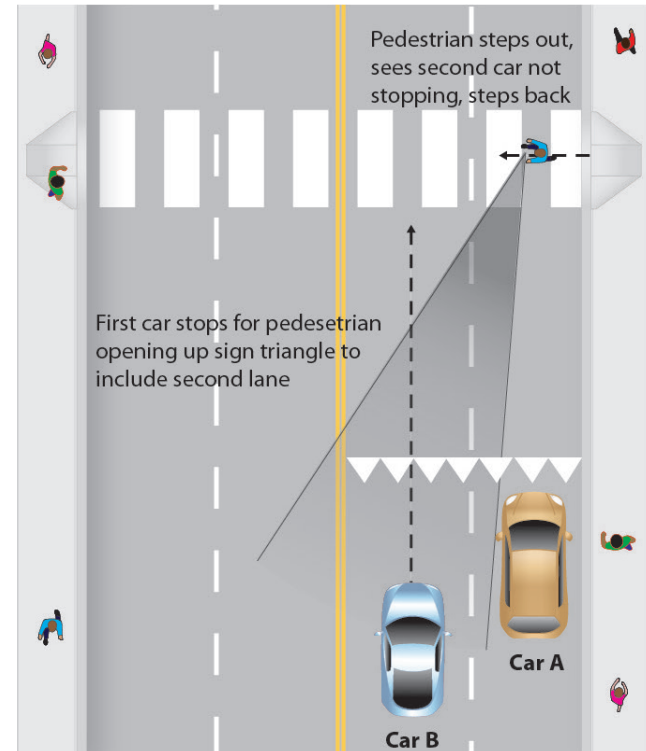
A placing of the yield line (shark's teeth) for vehicle traffic in advance of a crosswalk at uncontrolled locations.

KEY DESIGN FEATURES

- > Advance yield lines should be placed 20 to 50 feet in advance of crosswalks along with "Yield here to pedestrians" sign placed adjacent to the markings

BENEFITS

- > Inexpensive treatment
- > Improve sight visibility of pedestrians and motorists when used correctly
- > Help reduce potential of multiple-threat crashes
- > Yielding vehicle does not screen the view of motorists in the pedestrian's next lane of travel
- > Reduce likelihood that vehicle traveling behind yielding vehicle will cross centerline and strike pedestrian



APPLICATIONS

- > Crosswalks on streets with uncontrolled approaches
- > Right-turn slip lane crossings
- > Midblock marked crosswalks
- > Presence of advanced yield line are most important on multi-lane streets

COUNTDOWN SIGNALS ▶▶▶



DESCRIPTION

A walk signal that provides a countdown to the next solid “don’t walk” signal phase in order to provide pedestrians with information on how much time they have to cross.

KEY DESIGN FEATURES

- > Ensure that signals are visible to pedestrians
- > When possible, provide a walk interval for every cycle
- > Pedestrian push buttons must be well positioned and within easy reach for all approaching pedestrians

BENEFITS

- > Indicate appropriate time for pedestrians to cross
- > Provide pedestrian clearance interval



APPLICATIONS

- > Should be placed for each crossing leg at signalized intersections

CROSSWALK MARKINGS ▶▶▶



DESCRIPTION

High-visibility crosswalks — continental, zebra-stripe, piano key, or ladder style, should be provided at any intersection where a significant number of pedestrians cross. They are most important at uncontrolled crossings of multi-lane streets.

APPLICATIONS

- > Enhance all marked crossings
- > Necessary at marked midblock and uncontrolled crossing locations

KEY DESIGN FEATURES

- > Locations should be convenient for pedestrian access
- > Used in conjunction with other measures such as advance warning signs, markings, crossing islands, and curb extensions
- > Place to avoid wear due to tires

BENEFITS

- > Indicate preferred pedestrian crossings
- > Warn motorists to expect pedestrians crossing
- > Higher visibility than typical lateral-line marked crosswalks
- > Can be placed to minimize wear and tear (between tire tracks)

CURB EXTENSIONS ▶▶▶



DESCRIPTION

A curb extension is a segment of sidewalk, landscaping, or curb that is extended into the street at the corner, and usually associated with crosswalks. A curb extension typically extends out to align with the edge of the parking lane. They can be placed at locations where there is no on-street parking by tapering the extensions to the approach.

KEY DESIGN FEATURES

- > Curb extensions sited at corners or midblock
- > Extends out to approximately align with parking (typically one foot to two feet less than parking lane width)
- > Reduced effective curb radius
- > Can be tapered at approach in cases where there is no on-street parking
- > Should not block travel or bicycle lanes
- > Paired with bicycle lanes, curb extensions can increase the effective curb radius for larger vehicles
- > Bulb-outs are a type of curb extension that has a distinct bulb-shape that extends into the on-street parking lane (see graphic)

BENEFITS

- > Shorten pedestrian crossing
- > Reduce curb radius, slowing turning vehicles
- > Provide traffic calming
- > Improve sight visibility for pedestrians and motorists
- > Provide space for landscaping, beautification, water treatment, furnishings, signs, etc.
- > Often can provide space for perpendicular curb ramps

APPLICATIONS

- > Areas with high pedestrian traffic (downtown, mixed-use areas) where traffic calming is desired
- > Jurisdiction must evaluate placement on case-by-case basis, taking into account drainage, signal pole modification, lane widths, driveways, and bus stops

CURB RAMPS ▶▶▶



DESCRIPTION

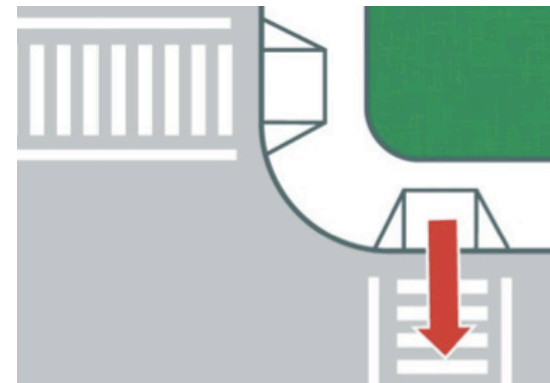
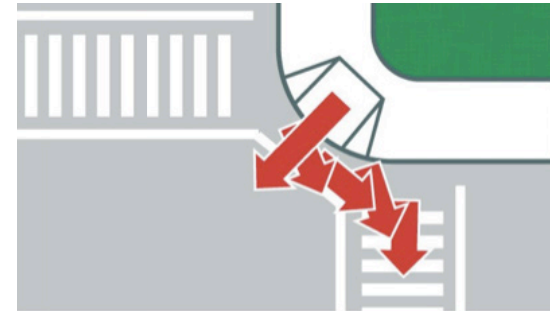
A curb ramp is a ramp and landing that allows for a smooth transition between sidewalk and street via a moderate slope. The Americans with Disabilities Act requires wheelchair access at every street corner. On streets with low traffic volumes and short crossing distances, diagonal ramps may be acceptable.

KEY DESIGN FEATURES

- > Where feasible, ramps for each crosswalk at an intersection are preferable
- > Tactile warnings will alert pedestrians to the sidewalk/street edge
- > Curb ramps must have a slope of no more than 1:12 (must not exceed 25.4 mm/0.3 m (1 in/ft) or a maximum grade of 8.33 percent), and a maximum slope on any side flares of 1:10

BENEFITS

- > Double curb ramps make the trip across the street shorter and more direct than diagonal ramps
- > Provide compliance with ADA



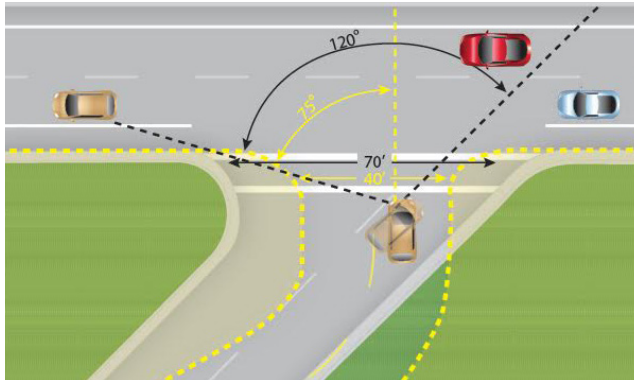
when designed correctly

- > Improve pedestrian accessibility for those in wheelchairs, with strollers, and for children

APPLICATIONS

- > Curb ramps must be installed at all intersections and midblock locations where pedestrian crossings exist, as mandated by federal legislation (1973 Rehabilitation Act and 1990 Americans with Disabilities Act)
- > Priority locations for curb ramps are in Downtown, near transit stops, schools, parks, medical facilities, and near residences with people who use wheelchairs

INTERSECTION GEOMETRY MODIFICATION ▶▶▶



DESCRIPTION

Geometry sets the basis for how all users traverse intersections and interact with each other. Intersection skew can create an unfriendly environment for pedestrians. Skewed intersections are those where two streets intersect at angles other than right angles. Intersection geometry should be as close to 90 degrees as possible.

KEY DESIGN FEATURES

- > Consider removing one or more legs from the major intersection and creating a minor intersection further up or downstream (if there are more than two streets intersecting)
- > Close one or more of the approach lanes to motor vehicle traffic, while still allowing access for pedestrians and bicyclists
- > Introduce pedestrian islands if the crossing distance exceeds three lanes (approximately 44 feet)
- > General use, travel lanes, and bike lanes may be striped with dashes to guide bicyclists and motorists through a long undefined area

BENEFITS

- > Skewed intersections are undesirable
- > Slow turning vehicles by making angles more acute
- > Shorten pedestrian crossing distances
- > Improve sight visibility

APPLICATIONS

- > Every reasonable effort should be made to design or redesign the intersection closer to a right angle

MEDIAN NOSES ▶▶▶



DESCRIPTION

A median nose, which extends past the crosswalk, protects people waiting on the median and slows turning drivers.

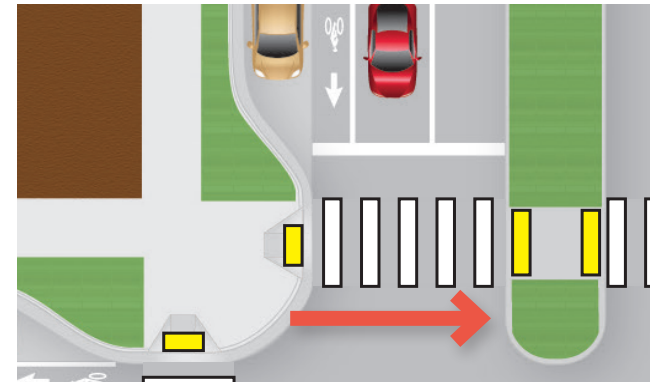
Median noses, which create refuge areas, are a FHWA Proven Safety Countermeasure.

KEY DESIGN FEATURES

- > Should be as wide as the existing median but preferably a minimum of six feet wide
- > Do not block through path for pedestrians and turning movements for vehicles
- > Separate directions of vehicle travel

BENEFITS

- > Allow pedestrians to cross one direction of traffic at a time
- > Slow vehicles
- > Provide refuge if crossing time is insufficient



APPLICATIONS

- > Any bi-directional street with adequate width, typically where a raised median exists
- > Especially important on multi-lane streets
- > Intersections where there are mixtures of significant pedestrian and vehicle traffic (typically with more than 12,000 ADT and intermediate or high travel speeds)

MIDBLOCK CROSSINGS ▶▶▶



DESCRIPTION

A crosswalk designed at a mid-point between intersections. These are best suited where there is a long distance (greater than 400 feet) between crosswalks on retail streets, in front of schools, etc. Intersections without traffic signals or STOP signs are considered uncontrolled intersections.

KEY DESIGN FEATURES

- > High-visibility crosswalk marking
- > Crossing islands, median gap, or short crossing
- > Advanced crossing and crossing signs
- > Advanced yield markings and signs
- > Signs
- > Rapid-flash beacons where traffic volumes and street width merit
- > Pedestrian activated signals should be used for streets with high speeds and volumes

BENEFITS

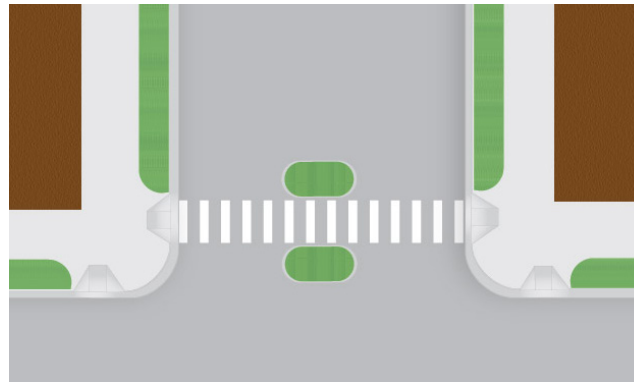
- > Bring both sides of the street closer for pedestrians

- > Enhance visibility of pedestrians
- > Informs drivers to expect pedestrians, and directs pedestrians to cross at specified locations
- > Deter pedestrians from dashing across street at random

APPLICATIONS

- > Decision to mark a crosswalk at an uncontrolled location should be guided by an engineering study
- > Consider vehicular volumes and speeds, roadway width and number of lanes, stopping sight distance and triangles, distance to the next controlled crossing, night time visibility, grade, origin-destination of trips, left turning conflicts, and pedestrian volumes.
- > On multi-lane roadways, marked crosswalks alone are not recommended under the following conditions: ADT > 12,000 without median; ADT > 15,000 with median; or speeds > 40 mph. Add devices such as advanced stop bar, crossing islands, etc.

PEDESTRIAN CROSSING ISLANDS ▶▶▶



DESCRIPTION

A defined area in the center of the street that is raised and provides a refuge area for pedestrians crossing a street. They can be used at any street crossing but are most important at uncontrolled crossings of multi-lane streets.

Pedestrian crossing islands are a FHWA Proven Safety Countermeasure.

KEY DESIGN FEATURES

- > Raised, curbed islands that flank marked crosswalk
- > Do not block through path
- > Separate directions of vehicle travel
- > Preferred width of at least six feet wide (minimum of at least four feet wide per FHWA)

BENEFITS

- > Allow pedestrians to cross one direction of traffic at a time
- > Slow vehicles
- > Provide refuge if crossing time is insufficient

APPLICATIONS

- > Any bi-directional street with adequate width
- > Especially important on uncontrolled multi-lane streets
- > Can be placed in between lanes, in slip lanes, and replace center turn lanes
- > Need to be designed to accommodate turning movements of large vehicles

PEDESTRIAN HYBRID BEACONS ▶▶▶



DESCRIPTION

A pedestrian hybrid beacon is used to warn and control traffic at an unsignalized location so as to help pedestrians cross a street or highway at a marked crosswalk.

The pedestrian hybrid beacon is an intermediate option between the operational requirements and effects of a rectangular rapid-flash beacon (RRFB) and a full pedestrian signal because it provides a positive stop control in areas without the high pedestrian traffic volumes that typically warrant the installation of a signal. Pedestrian Hybrid Beacons are a FHWA Proven Safety Countermeasure.

KEY DESIGN FEATURES

- > Minimum of 20 pedestrians per hour is needed to warrant installation
- > Should be placed in conjunction with signs, crosswalks, and advanced yield lines to warn and control traffic at locations where pedestrians enter or cross a street or highway
- > Should only be installed at a marked crosswalk



Drivers		Pedestrians	
... will see this	... will do this	... will see this	... will do this
	Proceed with Caution		Push the Button to Cross
	Slow Down (pPedestrian has activated the push button)		Wait
	Prepare to Stop		Continue to Wait
	STOP! (Pedestrian in Crosswalk)		Start Crossing
	STOP! Proceed with Caution if Clear		Continue Crossing (Countdown Signal)
	Proceed if Clear		Push the Button to Cross

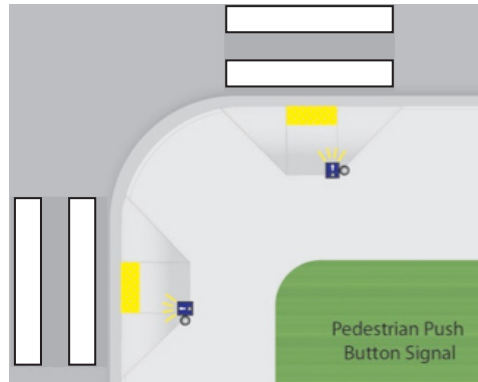
BENEFITS

- > Installations should be done according to the Federal MUTCD and CA MUTCD Chapter 4F, "Pedestrian Hybrid Beacons."

APPLICATIONS

- > Can be used at a location that does not meet traffic signal warrants or at a location that meets traffic signal warrants but a decision has been made to not install a traffic control signal
- > Additional safety measure and warning device at uncontrolled location
- > Remain dark until activated

PEDESTRIAN-ACTIVATED PUSHBUTTONS ▶▶▶



DESCRIPTION

Pedestrian-activated traffic controls require pedestrians to push a button to activate a walk signal. Where significant pedestrian traffic is expected, pedestrian-activated signals are generally discouraged, and "WALK" signal should automatically come on.

KEY DESIGN FEATURES

- > Should be located as close as possible to top of curb ramps without reducing the width of the path
- > Buttons should be at a level that is easily reached by people in wheelchairs near the top of the ramp
- > U.S. Access Board guidelines recommend buttons raised above or flush with their housing and large enough (a minimum of two inches) for people with visual impairments to see them
- > Buttons should also be easy to push



BENEFITS

- > Provide for smoother traffic flow if there are few pedestrians, and no need to provide walk signal for every cycle

APPLICATIONS

- > Areas where there are few pedestrians
- > Midblock crossings at locations where signalized crossing is needed

RAILROAD PEDESTRIAN CROSSING TREATMENTS >>>

DESCRIPTION

Pedestrian crossings of railroads require special design approved by the California Public Utilities Commission to ensure that pedestrians cross only at the right time and along the correct path.

KEY DESIGN FEATURES

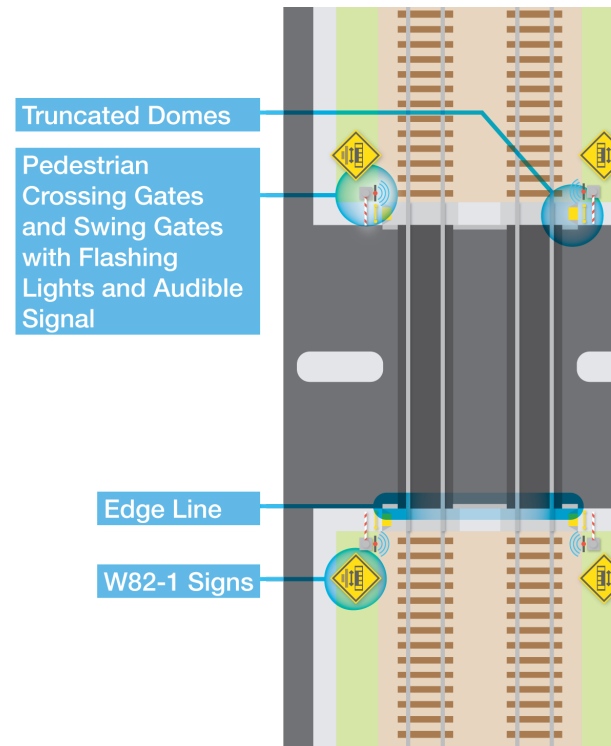
- > Sidewalks
- > Detectable warning tactile strips
- > Pedestrian flashers
- > Pedestrian gates
- > Swing gates
- > Channelization
- > Fencing
- > Signing and striping
- > Crossing surface extensions and gap fillers

BENEFITS

- > Design for safe pedestrian crossing
- > Prevent interference with trains
- > Channelize pedestrians away from motor vehicles

APPLICATIONS

- > Wherever there is a pedestrian crossing of a railroad that has gates or flashing beacons



RAISED CROSSWALKS ▶▶▶



DESCRIPTION

A crosswalk that has been raised in order to slow motor vehicles and to enhance the visibility of crossing pedestrians.

KEY DESIGN FEATURES

- > Trapezoidal in shape on both sides and have a flat top where the pedestrians cross
- > Level crosswalk area must be paved with smooth materials
- > Texture or special pavements used for aesthetics should be placed on the beveled slopes, where they will be seen by approaching motorists
- > Often require culverts or another means of drainage treatment

BENEFITS

- > Increase visibility of pedestrian, especially to motorists in large vehicles
- > Traffic calming
- > Continuous level for pedestrians

APPLICATIONS

- > Areas with significant pedestrian traffic and where motor vehicle traffic should move slowly, such as near schools, on college campuses, in Main Street retail environments, and in other similar places
- > Effective near elementary schools where they raise small children by a few inches and make them more visible

RECTANGULAR RAPID-FLASH BEACONS (RRFB) ►►►



DESCRIPTION

The RRFB uses rectangular-shaped high-intensity LED-based indications, flashes rapidly in a wig-wag “flickering” flash pattern, and is mounted immediately between the crossing sign and the sign’s supplemental arrow plaque.

KEY DESIGN FEATURES

- > Placed at crosswalk and in center median / crossing island
- > Crosswalk sign with arrow
- > Wig-wag flickering flash pattern mounted between crossing sign and arrow pointing to crosswalk

BENEFITS

- > Increase motorist compliance to yield to pedestrians crossing at uncontrolled marked locations
- > Provide additional visibility to crosswalks
- > Visible at night and during the day

APPLICATIONS

- > Approved for interim use by the California Traffic Control Device Committee (CTCDC) and FHWA
- > City should go through appropriate CTCDC steps to use
- > Use of RRFBs should be limited to locations with the most critical safety concerns, such as pedestrian and school crosswalks at uncontrolled locations

REDUCED CURB RADIUS >>>

DESCRIPTION

The geometry of the corner radius impacts the feel and look of a street. Tight corner radii create shorter crossing distances, and provide a traffic calming effect.

KEY DESIGN FEATURES

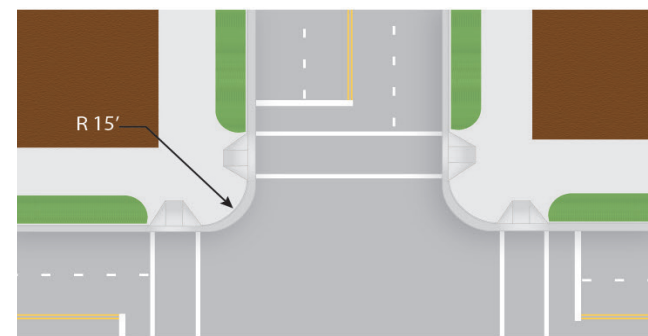
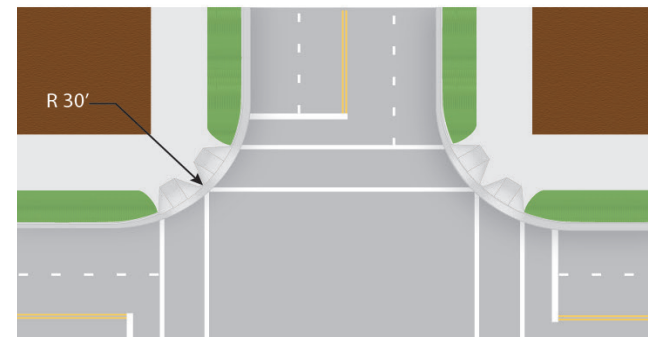
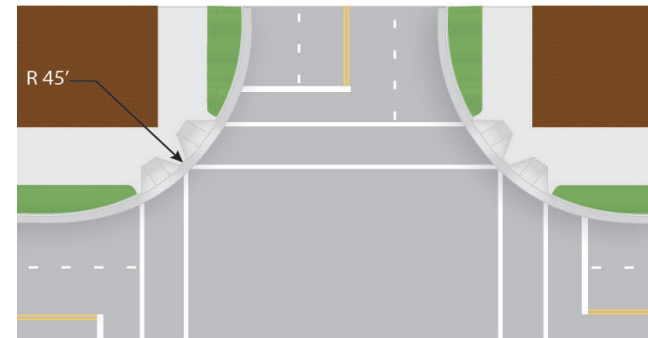
- > Default design vehicle should be the passenger (P) vehicle; initial corner radius is between 15 and 25 feet
- > Larger design vehicles should be used only where they are known to regularly make turns at the intersection (such as in the case of a truck or bus route)
- > Design based on the larger design vehicle traveling at near 5 mph or crawl speed
- > Consider the effect that bicycle lanes and on-street parking have on the effective radius, increasing the ease with which large vehicles can turn

BENEFITS

- > Slower vehicular turning speeds
- > Reduced pedestrian crossing distance and crossing time
- > Better geometry for installing perpendicular ramps for both crosswalks at each corner
- > Simpler and more appropriate crosswalk placement that aligns directly with sidewalks on the other side of the intersection

APPLICATIONS

- > All corners



RIGHT-TURN CHANNELIZATION ISLANDS ▶▶▶



DESCRIPTION

A raised channelization island between the through lanes and the right-turn lane is a good alternative to an overly large corner radius and enhances pedestrian safety and access. This countermeasure allows pedestrians to cross fewer lanes at a time.

KEY DESIGN FEATURES

- > Provide a yield sign for the slip lane
- > Provide at least a 60-degree angle between vehicle flows
- > Place the crosswalk across the right-turn lane about one car length back from where drivers yield to traffic on the other street
- > Typical layout involves creating an island that is roughly twice as long as it is wide. The corner radius will typically have a long radius (150 feet to 300 feet) followed by a short radius (20 feet to 50 feet)
- > Necessary to allow large trucks to turn into multiple receiving lanes

BENEFITS

- > Allow motorists and pedestrians to judge the right turn/pedestrian conflict separately
- > Reduce pedestrian crossing distance, which can improve signal timing for all users
- > Balance vehicle capacity and truck turning needs with pedestrian safety
- > Provide an opportunity for landscape and hardscape enhancement
- > Slow motorists

APPLICATIONS

- > Right-turn lanes should generally be avoided as they increase the size of the intersection, the pedestrian crossing distance, and the likelihood of right-turns-on-red by inattentive motorists who do not notice pedestrians on their right
- > Heavy volumes of right turns (approximately 200 vehicles per hour or more)

SCRAMBLE PHASES ▶▶▶



DESCRIPTION

A scramble phase provides a separate all-direction red phase in the traffic signal to allow pedestrians to cross linearly and diagonally. They are most appropriate in retail districts with heavy volumes of both pedestrians and motor vehicles, and/or many vehicle turning movements.

KEY DESIGN FEATURES

- > Signs indicating scramble is permitted
- > Countdown signals
- > Markings indicating diagonal cross
- > Allow pedestrians to cross straight and reduces delay

BENEFITS

- > Reduce pedestrian delay for those crossing both directions
- > Reduce pedestrian-vehicle conflicts by providing an all-pedestrian crossing phase
- > Does not necessarily eliminate regular walk phase



APPLICATIONS

- > Exclusive pedestrian phases may be used where turning vehicles conflict with very high pedestrian volumes and pedestrian crossing distances are short
- > Should be used in areas with high pedestrian volumes such as near shopping centers or downtowns

SIGNAL TIMING/PHASING ▶▶▶



DESCRIPTION

Signals provide control of pedestrians and motor vehicles. Signals can be used to control vehicle speeds by providing appropriate signal progression on a corridor. Traffic signals allow pedestrians and bicyclists to cross major streets with only minimal conflict with motor vehicle traffic. Signalized intersections often have significant turning volumes, which conflict with concurrent pedestrian and bicycle movements. Modifying signal timings and signal coordination along a corridor and providing additional signal phases for high volume movements, such as protected left-turn phasing, can improve safety.

KEY DESIGN FEATURES

- > Signal progression at speeds that support the target speed of a corridor
- > Short signal cycle lengths
- > Ensure signals detect bicycles
- > Place pedestrian signal heads in locations where they are visible
- > Time the pedestrian phase to be on automatic recall



- > Where few pedestrians are expected, place pedestrian pushbuttons in convenient locations, using separate pedestals if necessary
- > Include adequate pedestrian crossing time of 3.5 feet per seconds or more
- > Leading Pedestrian Intervals (LPI) allows pedestrians to begin crossing while all directions of traffic have red signal
- > Protected left-turn phases are preferable to permissive movements

BENEFITS

- > Reduces pedestrian-vehicle conflicts by providing separate phases for travel
- > Limiting permissive turning movements at signalized intersections improves safety for pedestrians
- > Walk signals timed at 3.5 feet per second reduce conflicts; less where large numbers of seniors or disabled pedestrians crossing

APPLICATIONS

- > City must follow standard warrants in the California MUTCD

SIGNS ▶▶▶



DESCRIPTION

Signs alert motorists to the presence of crosswalks and pedestrians. Center signs can help slow traffic. These are placed according to the CA MUTCD.

KEY DESIGN FEATURES

- > Placed with adequate sight distance and according to MUTCD standards
- > Should not block pedestrian view or obstruct pathways
- > Kept free of graffiti and in good condition
- > Should have adequate nighttime reflectivity

BENEFITS

- > Provide important information
- > Give motorists advance warning
- > Regulatory signs require certain driver actions and can be enforced



APPLICATIONS

- > Overuse of signs can create noncompliance and disrespect
- > Signs should be placed at locations where appropriate to enforce certain types of behavior
- > Uncontrolled crossings
- > Commonly used signs are advanced pedestrian crossing sign in advance of marked uncontrolled crossing; pedestrian crossing sign at uncontrolled crossing; and advanced yield signs
- > Advance warning for stop-controlled and signal-controlled intersections where people are failing to stop
- > Approaches to railroad crossings
- > Wherever MUTCD calls for them