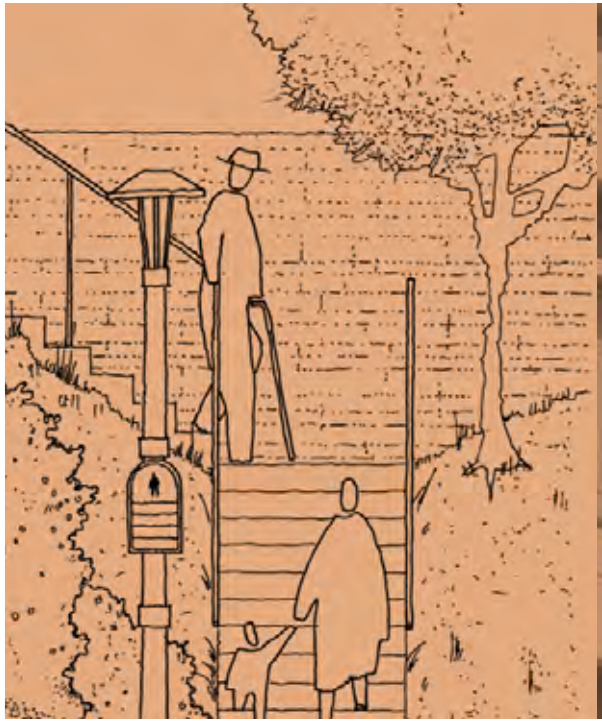

Chapter 5 Design Elements

I have met but one or two people who understand the art of walking.

Henry David Thoreau, American Philosopher

This section identifies design elements for improving Oakland streets, sidewalks, and paths. Rather than proposing design standards, the Pedestrian Master Plan presents design elements to inform designers, planners, and policymakers on available design treatments and best practices for pedestrians. When implementing these elements, engineering judgment will determine the specific locations and features of each design.

The Design Elements are organized into the following three sections. First, the Sidewalk Guidelines section gives minimum requirements for sidewalks and utility zones. Second, the Crossing Treatments section explains best practices for crosswalks and corners. And third, the Traffic Calming section presents concepts for reducing motor vehicle speeds.

Sidewalk Guidelines

Proposed sidewalk guidelines apply to new development and depend upon available street width, motor vehicle volumes, surrounding land uses, and pedestrian activity levels. Standardizing sidewalk guidelines ensures a minimum level of quality for all sidewalks.

The City of Oakland currently requires a minimum 48" wide sidewalk with a 36" through passage for new development. For projects that retrofit existing sidewalks, width must conform to the existing conditions on the block. These dimensions conform to sidewalk requirements found in the Americans with Disabilities Act Accessibility Guidelines (ADAAG) which are

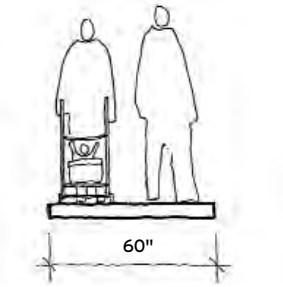

ILLUSTRATION 12
SIDEWALK FOR TWO PEDESTRIANS

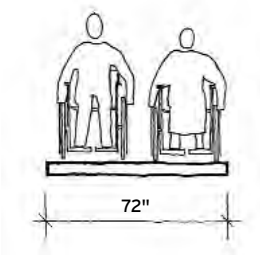

ILLUSTRATION 13
SIDEWALK FOR TWO PEDESTRIANS IN WHEELCHAIRS

minimum widths for passage, not sidewalk width recommendations.

The Institute for Transportation Engineers recommends planning sidewalks that are a minimum 60" wide with a planting strip of 24" on local streets and in residential and commercial areas.

Sidewalk and Utility Zone Widths

Sidewalks consist of the through passage zone and the utility zone. The through passage zone is the paved part of the sidewalk pedestrians use. This zone should be wide enough to accommodate different walking speeds and shared use by people with mobility aids. It should also be proportionate to street size and pedestrian volumes.

All streets require a utility zone to accommodate above ground public infrastructure including street furniture, lampposts, street trees, and signs. Locating this infrastructure in the utility zone prevents it from encroaching on the through passage zone. The utility zone also creates an important buffer between pedestrians

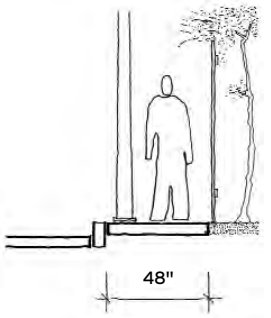

ILLUSTRATION 14
EXISTING OAKLAND SIDEWALK STANDARD

and motor vehicles by providing a horizontal separation and a vertical buffer. Vertical elements like utility poles, signs, parking meters, and street trees improve pedestrian safety and comfort by buffering the sidewalk

from travel lanes. This buffering effect is similar to that provided by curbside motor vehicle parking.

On local hill streets where sidewalks are not possible, a wide shoulder or sidewalk striping with parking restrictions is an acceptable alternative. Walkways and trails do not have utility zones but still require a minimum through passage zone. For accessibility for persons with disabilities, sidewalks should be continuous, stable, firm, and slip-resistant with minimum running slopes and cross slopes.

The proposed guidelines would apply to sidewalks accompanying new development with sufficient right-of-way. For sidewalk retrofits, the existing City policy of sidewalk width conforming to existing conditions would still apply.

STREET TYPE	THROUGH PASSAGE ZONE	UTILITY ZONE	TOTAL WIDTH
ARTERIAL (CITY)	96"	48"	144"
COLLECTOR (DISTRICT)	72"	48"	120"
LOCAL (NEIGHBORHOOD)	60"	48"	108"
WALKWAY	48"	-	48"
TRAIL	72"	-	72"

FIGURE 22 PROPOSED SIDEWALK GUIDELINES

Sidewalk Materials

Paving materials should be consistent, durable, accessible to people using mobility aids, and smooth enough for passage but not slippery. Concrete paving is recommended for arterial, collector, and local sidewalks. The concrete should be textured for safety and scored to match existing patterns. In pedestrian activity areas, painted curbs should be textured to ensure traction. To support pedestrians, cyclists, and joggers, trails may be constructed of asphalt, crushed granite, or bark mulch. However, concrete is the preferred paving material.

Special paving may occur at neighborhood commercial areas, schools, and parks to give them a distinctive identity. Acceptable materials include brick or concrete pavers, stained or scored concrete, decorative tile, rubberized sidewalk coatings, stone, slate, and granite if they provide a consistently smooth travel surface and good traction. The careful selection of such materials for contrasting colors or textures can provide valuable wayfinding cues for people with visual impairments.

Walkways

Walkways are usually made of concrete, wood, or stone. The construction of new walkways and the reconstruction of existing walkways should avoid wood to minimize long-term maintenance costs. Where wood is used, the construction should be of Redwood or Douglas Fir. Continuous handrails of wood on wood stairs and metal on concrete stairs are required on both sides. Stairs should have 7" closed risers, 11" treads with non-slip surfacing, contrasting striping, and sufficient clearance from surrounding

Sidewalk Guidelines

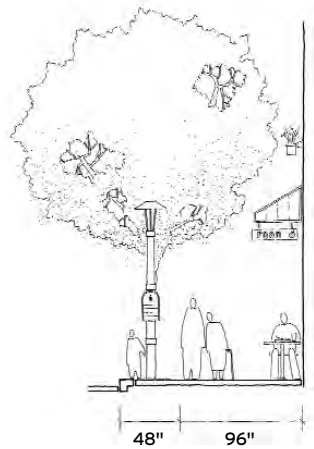

ILLUSTRATION 15
CITY SIDEWALK SECTION

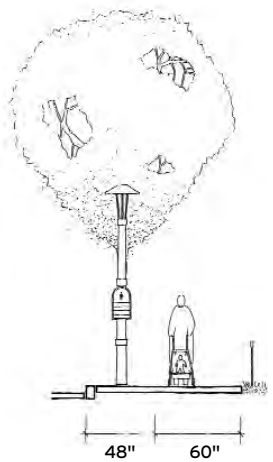

ILLUSTRATION 17
NEIGHBORHOOD SIDEWALK SECTION

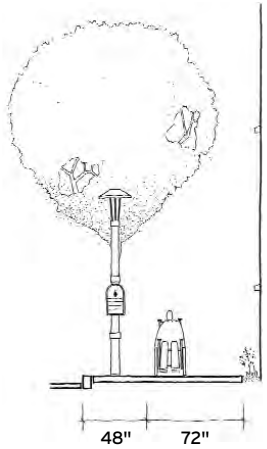

ILLUSTRATION 16
DISTRICT SIDEWALK SECTION

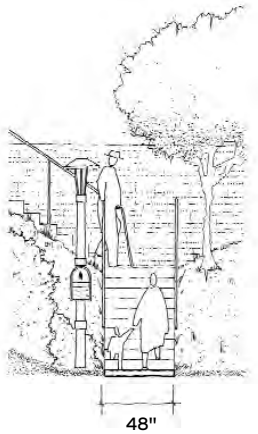

ILLUSTRATION 18
WALKWAY SECTION

vegetation. Stair flights should be 12’ in length or less and separated by 5’ landings with concrete footings.

Lighting

Pedestrian-scale lighting improves accessibility by illuminating sidewalks, crosswalks, curbs, curb ramps, and signs as well as barriers and potential hazards. From the pedestrian’s point of view, frequent lampposts of lower height and illumination are preferred over fewer lampposts that are very tall and bright. The Plan recommends the use of pedestrian-scale lighting in areas of high pedestrian activity and where implementation is practical. Lampposts should be staggered on opposite sides of the street and be placed at crosswalks, bus stops, and corners. These lampposts provide vertical buffers between the sidewalk and street and help define pedestrian areas.

Pedestrian-scale lighting and motor vehicle-scale lighting each should be provided as a complement to the other to ensure that both sidewalks and travel lanes are effectively illuminated.

Pedestrian-scale lighting may be installed between existing lampposts to obtain the frequencies given in the table below. They must be located at least ten feet from the full growth canopy of adjacent trees. Poles and fixtures should be chosen from existing models identified by the City. Existing standards require hoods on lampposts to reduce light pollution.

STREET TYPE	LAMPPOST HEIGHT	DISTANCE BETWEEN LAMPPOSTS	SIDEWALK ILLUMINATION	CROSSWALK ILLUMINATION
ARTERIAL	14′	50′	0.9 FC (10 LUX)	2.0 FC (22 LUX)
COLLECTOR	12′	50′	0.6 FC (6 LUX)	1.0 FC (11 LUX)
LOCAL	12′	50′	0.2 FC (2 LUX)	0.5 FC (5 LUX)
WALKWAY	12′	30′ (OR AT LANDINGS)	0.2 FC (2 LUX)	0.5 FC (5 LUX)
TRAIL	12′	30′	0.2 FC (2 LUX)	0.5 FC (5 LUX)

FIGURE 23 PROPOSED LIGHTING GUIDELINES (FEHR & PEERS ASSOCIATES, 2001)

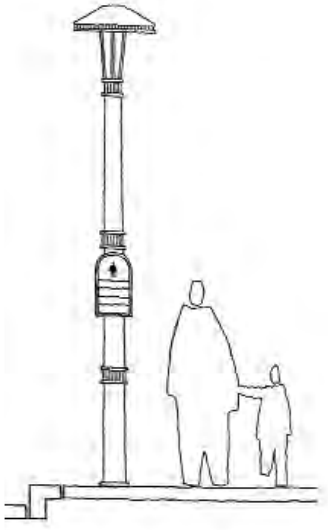

ILLUSTRATION 19 ROUTE LIGHTING

Sidewalk Guidelines

These hoods should also be designed to direct lighting onto the sidewalks. The installation of new lighting should take into account potential overflows that may adversely affect adjacent residents. The proposed lighting guidelines provide guidance in establishing adequate pedestrian-scale lighting for a range of rights-of-way. The implementation of pedestrian-scale lighting should occur as part of pedestrian-oriented street projects as they are completed in the City. The Pedestrian Master Plan does not propose stand-alone lighting projects.

Signage

The Pedestrian Route Network will include signage for pedestrians to aid in wayfinding. The signs will consist of a distinctive logo and directional guidance to neighborhood destinations. They will be attached to lampposts and located at decision points along the route network.

For example, destinations like the Oakland Rose Garden are often

ILLUSTRATION 20 PEDESTRIAN ROUTE SIGNAGE

invisible from adjacent streets like Oakland and Grand Avenues and would benefit from pedestrian-scale signage. The City of Berkeley's bicycle boulevard program includes a successful signage component that may serve as an exemplar. Pedestrian signage will comply with the criteria for character proportion, height, and contrast specified by the Manual on Uniform Traffic Control Devices and the Americans with Disabilities Act Accessibility Guidelines. The implementation of these signs should occur as part of pedestrian-oriented street projects as they are completed in the City. The Plan does not propose stand-alone signage projects.

Plantings

Trees are a dramatic street improvement that creates an attractive visual and psychological separation for pedestrians between the sidewalk and the roadway. Trees may also encourage drivers to move through an area more slowly. They can be located in the utility zone to provide sidewalk shading or placed between on-street parking spaces in tree bulb-outs where sidewalks are narrow. (See the explanation of Bulb-outs, below.) For high pedestrian traffic areas, crushed granite in tree wells is preferred over tree gratings. Tree cages are also acceptable. Refer to the City of Oakland Street Tree Plan for appropriate tree types,

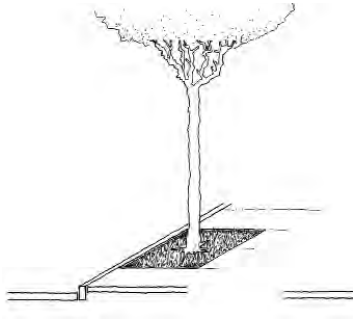

ILLUSTRATION 21 TREE WELL

spacing, tree well sizes, maintenance standards, and potential conflicts with utilities and street lights. The Street Tree Plan is available from the Department of Parks and Recreation.

Street Furniture

Street furniture includes benches, mailboxes, trash and recycling receptacles, bike racks, newspaper boxes, drinking fountains, information boards, kiosks, parking meters, artwork, public phones, signs, bus shelters, and other items used by pedestrians. These features humanize the scale of a street and encourage pedestrian activity. Street furniture should be placed in the utility zone to maintain through passage zones for pedestrians and to provide a buffer between the sidewalk and the street. For bus shelters on crowded sidewalks, bus bulb-outs are recommended for providing additional space. (See the explanation of Bulb-outs, below.) Bus shelters should also have clearly displayed bus schedules and city maps for way-finding.

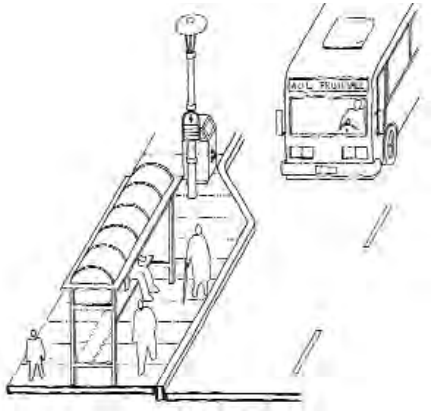

ILLUSTRATION 22 BUS BULB-OUT

Building Edges

Placement of street furniture along building edges is acceptable if the through passage zone is preserved. Buildings with lower floor windows, canopies for rain protection, tables, umbrellas, signs, planters, benches, and other street furniture contribute to street life and enhance the pedestrian environment.

Wayfinding

Straightforward and predictable routing along sidewalks supports wayfinding by persons with visual impairments. Open areas that do not have detectable landmarks like curbs and building edges may not provide sufficient cues. Where a sidewalk borders a park, parking lot, or building setback, a raised edge should be provided as a shoreline for cane travelers. Tactile curb markings may also be used to indicate the location of street edges and pedestrian crossings. The sidewalk's through passage zone should not be obstructed or narrowed by street furniture, especially at turns and ramps. Additionally, items installed for pedestrian use on or along sidewalks should be accessible for persons with disabilities.

Driveways

Driveway entrances can be both dangerous and inconvenient for pedestrians. Driveway curbcuts that extend into the through passage zone may cause people on foot or in wheelchairs

Sidewalk Guidelines

to fall. Driveways expose pedestrians on the sidewalk to motor vehicle cross traffic and cars parked in driveways often block sidewalks. Driveways also reduce the available space for street trees, lighting, street furniture, and parallel parking.

As redevelopment or new development allows, minimum driveway widths and frequencies should be promoted as permitted by the planning code. Wherever possible, entrances should be consolidated such that multiple users share a common curbcut for motor vehicle access. The ramp portion of a drive entrance should be located within the utility zone where possible. Driveways should also be spaced at a minimum of 20’ to reduce the amount of curbside parking eliminated.

Crossing Treatments

Crossing treatments help pedestrians get from one side of the road to the other and provide continuity to sidewalks. Crossing treatments are classified as either passive or active treatments. Passive treatments are physical improvements like crosswalks or curb ramps that do not change in time. Active treatments like traffic signals and audible pedestrian signals have multiple states that are triggered by automated detection or activated by pedestrians. Both types of treatments may be combined to create a comprehensive crossing system. With all treatments, engineering judgment is necessary to determine the specific locations and features of each project.

Passive Crossing Treatments

Crosswalks

Safe and frequent pedestrian crossings are a basic building block of the pedestrian infrastructure. A crosswalk is an area of roadway designated for pedestrian crossings and is a continuation of the sidewalk across an intersection. In addition to marked crosswalks, unmarked crosswalks are legally recognized at most intersections of streets that have sidewalks and meet at right angles. California State law requires drivers to yield to pedestrians in both marked and unmarked crosswalks. Marked crosswalks should be straight for easy navigation and perpendicular to the sidewalks to minimize crosswalk length. However, ensuring the safety of crossings is the most important priority and engineering judgment should be used on a case-by-case basis. In locations where a marked crosswalk alone does not provide a safe crossing, additional treatments like bulb-outs, refuge islands, and signage may be considered to ensure pedestrian safety and access.

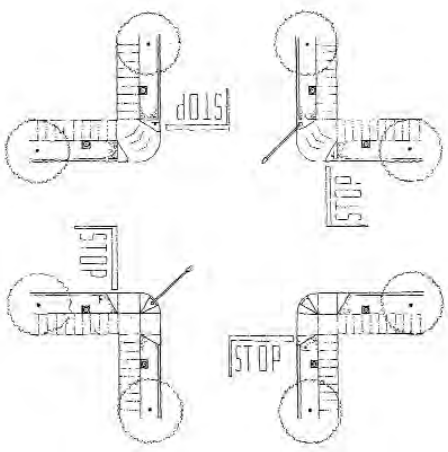

ILLUSTRATION 23 LOCAL INTERSECTION

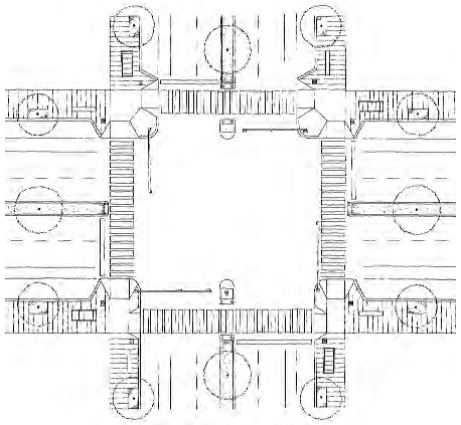

ILLUSTRATION 24 ARTERIAL INTERSECTION

The City of Oakland Transportation Services Division is currently examining its crossing policy based on the most recent Federal Highway Administration guidelines (FHWA 2002a, 2002b). These guidelines are provided in the appendix titled "FHWA Crosswalk Guidelines."

Crossing Treatments

Crosswalk Striping

Crosswalks can be marked with paint, reflective tape, signs, and/or lighting. Two types of crosswalk striping are used in Oakland: standard striping and high-visibility ladder striping. Crosswalks marked in yellow indicate that a crossing is in a school zone. While striping of all four legs of an intersection is recommended, engineering judgment should be used in all cases.

High contrast crosswalk striping also helps people with visual impairments to cross streets. Striping should correspond to the width and location of sidewalks. For improved wayfinding, crosswalk edge stripes can be slightly raised for people using canes.

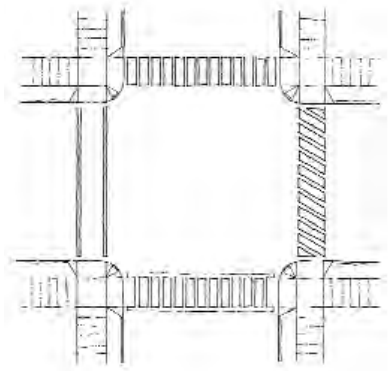

ILLUSTRATION 25 CROSSWALK STRIPING

Crosswalk Paving

Crosswalks may be further marked with distinctive paving materials, colors, or textures. Concrete is preferred over brick for its durability. Concrete may be stained or embossed with patterns to give crossings in a particular area a distinctive feel. Textures should be selected to provide a smooth travel surface and good traction. Pedestrian crossings at railroad tracks should use concrete rather than asphalt to ensure as smooth and constant of travel surface as possible. Asphalt is a poor material for railroad crossings because it tends to curl and crumble at its edges along the rails.

Curb Ramps

According to ADA regulations, all streets with sidewalks and curbs or other barriers must have curb ramps at intersections (U.S. Access Board 1999, p. 58). The City of Oakland requires curb ramp installation at all street intersections contained within street resurfacing, sidewalk improvement, utility, new construction, and alteration projects. New curb ramps must comply with the requirements of the State of California Code of Regulations Title 24 and the Americans with Disabilities Act Accessibility Guidelines.

Curb ramps should be oriented to direct pedestrians to the opposite corner and to provide a direct connection between the sidewalk through passage zone and the crosswalk. Diagonal corner curb ramps are sometimes an

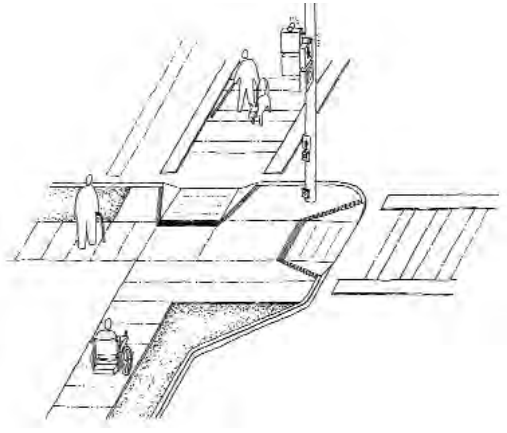

ILLUSTRATION 26 ACCESSIBLE INTERSECTION

acceptable alternative for retrofits. However, signalized intersections on arterial streets should have one curb ramp per marked crosswalk at each corner. Refer to City of Oakland Standard Details for Public Works for curb ramp design guidelines.

Texture and Contrast

Sharply contrasting colors help people with visual impairments identify crosswalks and the boundaries between sidewalks and roadways. Corners and crosswalks should be boldly marked with contrasting colors and textures. Markings can be designed to be both functional and attractive.

Bulb-outs

Bulb-outs reduce the crossing distance for pedestrians, increase visibility for motorists and pedestrians, prevent illegal parking at corners, and provide additional room for people waiting to cross the street. The added space may also be used for street furniture like benches, bike racks, and street trees. Bulb-outs are also important for accessibility because they provide space for curb ramps, crossing buttons, and a safe waiting area. Bus bulb-outs provide space for bus shelters and increase the pick up and drop off efficiency of transit.

Wherever possible, a bulb-out located at a bus stop should be designed as a bus bulb-out. If a bus bulb-out is not possible, the bulb-out should be designed with special care so as not to interfere with bus movements. Tree bulb-outs can be used where sidewalks would otherwise be too narrow for plantings. Bulb-outs can be used at mid-block crossings and are beneficial when combined with pedestrian refuges. All bulb-outs should extend into the street no further than the edge of the travel or bike lane. Bulb-outs and accompanying street furniture will require additional maintenance.

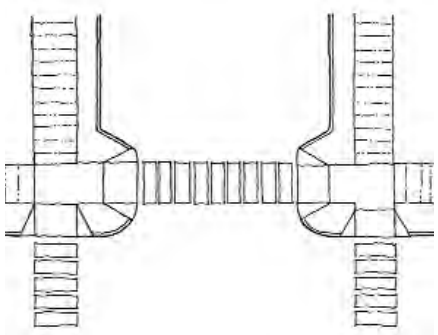

ILLUSTRATION 27 BULB-OUTS

Refuge Islands

Refuge islands are located at crosswalks in the middle of streets to provide a safe waiting area for pedestrians. They may include curbs and bollards to ensure the safety of waiting pedestrians. A refuge island may be part of a median or a stand-alone feature (see Medians below). By allowing pedestrians to cross only half of the street and then wait, the refuge island increases the number of gaps in

traffic that are safe for crossing. While increasing the visibility of pedestrian crossings, refuge islands decrease the percentage of pedestrian collisions by reducing pedestrian/vehicle conflicts, motor vehicle speeds, and exposure time for pedestrians (FHWA 2002b, p. 72). The waiting area in refuge islands

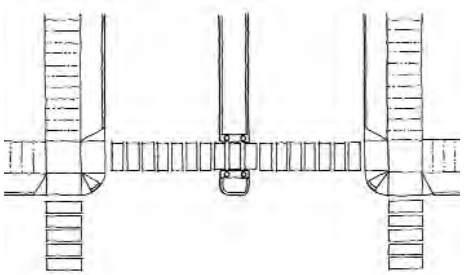

ILLUSTRATION 28 REFUGE ISLAND

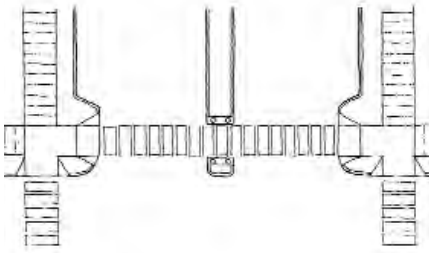

ILLUSTRATION 29
BULB-OUTS AND REFUGE ISLAND

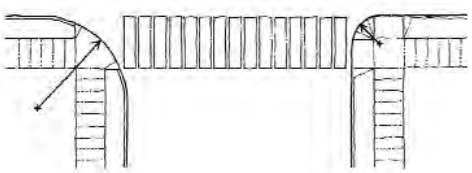

ILLUSTRATION 30 CORNER RADIUS

should be in line with the crosswalk and as wide as the crosswalk such that persons with disabilities are able to pass through without obstruction.

Corner Radius

A corner's turning radius determines how fast a driver can comfortably make a turn. A tighter turn or shorter radius forces drivers to slow down allowing them to see pedestrians better and stop more quickly. Slow corners with short turning radii increase safety for pedestrians at intersections by creating more sidewalk space and less road space. A decreased curb radius also allows for the placement of curb ramps that are aligned parallel to crosswalks. A 10' turning radius is recommended for streets with curbside parking. For streets without curbside parking, a 20' turning radius is recommended. Streets with significant volumes of truck traffic may also have larger corner radii.

Slip Turns

Also known as free right turns, slip turns allow motor vehicles to corner at higher speeds and merge with through vehicle traffic. However, drivers looking over their left shoulders to merge with vehicle traffic are less likely to see pedestrians entering the intersection from the right. The removal of slip turns decreases pedestrian crossing distances, reduces the speed of turning vehicles, and improves pedestrian visibility. To address these three issues, slip turns may be converted to conventional corners or made into pedestrian areas with benches, transit stops, lighting, or selective planting. Where slip turns cannot be eliminated, the problem of vehicle speed may be addressed with traffic signals. However, this solution does not address the increased crossing distance and decreased visibility created by slip turns. The problem of visibility may be addressed with an improved slip turn design (FHWA 2002b, p. 59).

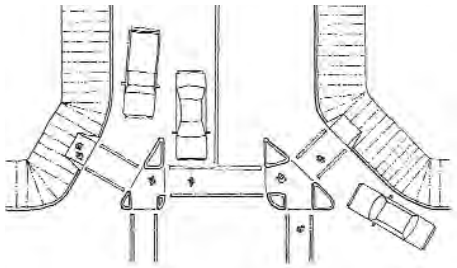

ILLUSTRATION 31 SLIP TURN BEFORE

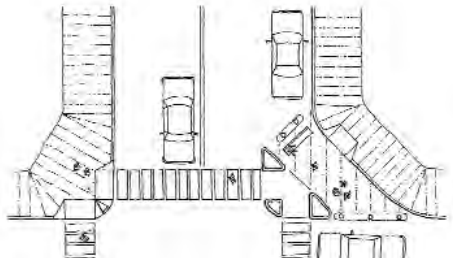

ILLUSTRATION 32 SLIP TURN AFTER

Safety Barrels, Posts, and Bollards

Adding vertical elements at the roadway center line is an inexpensive solution for slowing motor vehicle traffic and improving safety at pedestrian crossings. They can also be used temporarily to test and fine-tune proposed crossing treatments such as refuge islands or bulb-outs. Barrels, posts, and bollards should be highly visible and signed. They should also be positioned to ensure access by people with wheelchairs. Safety barrels, posts, and bollards are not currently used by the City of Oakland. Their inclusion in this plan does not indicate approval or endorsement by the Public Works Agency.

Flashers and Overhead Signs

Flashers are signs showing the universal pedestrian symbol hung from a mast arm that extends over the street. The symbol may be marked in standard yellow, fluorescent yellow, or LED displays. They alert drivers to pedestrian activity and mitigate safety concerns. Flashers are even more visible when combined with overhead signs indicating a pedestrian crossing.

Speed Limit Signs

Speed limit signs should be posted regularly according to Federal guidelines and standards.

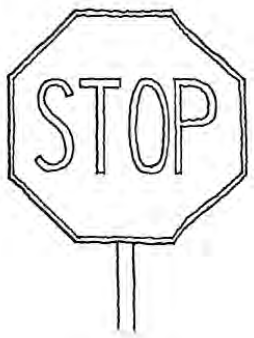

ILLUSTRATION 33 STOP SIGN

Stop Signs

Drivers are more likely to yield to pedestrians when they are already stopped at an intersection. However, stop signs may only be installed where the combined crossing volume of vehicles and pedestrians is comparable to the main street traffic volume.

Active Crossing Treatments

Traffic Signals

Traffic signals provide protected crossing opportunities for pedestrians and may be used with other solutions categorized as either passive or active. Traffic signals can be especially

Crossing Treatments

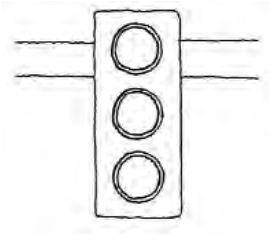

ILLUSTRATION 34 TRAFFIC SIGNAL

effective at maintaining vehicle flow while limiting vehicle speeds to provide a safe and comfortable pedestrian environment. However, such speed regulation requires numerous traffic signals on a single street and the careful coordination of traffic signal timings. See also Pedestrian Signals below.

Pedestrian Signals

Pedestrian signals work in conjunction with traffic signals to assign right-of-way at intersections. Pedestrian signals are appropriate at all intersections with traffic signals where crossing is permitted. Using symbols and colors, they should provide a clear distinction between "walk" and "don't walk" that is readily identifiable for people with limited vision.

The timing of traffic signals may be adjusted in the following ways to benefit pedestrians. These approaches are experimental and should be tailored to particular circumstances by engineering judgment.

- ➔ Set the Walk Phase based on a walking speed of 3.5 ft/sec at intersections commonly used by seniors or persons with disabilities. The City establishes standard crossing times based on a walking speed of 4 ft/sec.
- ➔ Leading Pedestrian Interval Timing improves the visibility of pedestrians by allowing them to enter an intersection before vehicles with conflicting movements.

- ➔ Scramble Pedestrian Signals allow pedestrians to cross in all directions during the walk phase. The City of Oakland has tested such a system at 8th and Webster Streets although this system has not yet been approved by State or Federal agencies.
- ➔ Countdown Signals let pedestrians know the exact amount of time remaining in the walk phase. These systems are being installed throughout San Francisco although they have not yet been approved by State or Federal agencies.
- ➔ Audible Signals indicate to persons who are blind or have low vision

ILLUSTRATION 35 AUDIBLE SIGNAL

the direction in which it is safe to cross. They should be installed at intersections with new traffic signals, actuated signal timings, complex traffic patterns, or irregular traffic volumes. Traffic signals should be retrofitted wherever there is a request from persons with visual impairments.

Pedestrian Call Buttons

Pedestrian call buttons and kickplates allow pedestrians to request a signal phase for safe crossing. Audible call buttons should be installed in conjunction with audible pedestrian signals. They should be conveniently located and clearly marked to indicate the crossing directions they trigger. Tactile symbols may also be installed alongside call buttons to provide crossing information on lane configurations for persons with visual impairments. (For additional explanation, see the discussion of pedestrian auto-detection in "Issues for Further Discussion" at the end of Chapter 4).

Flags

Pedestrian flags increase the visibility of pedestrians who carry them at crosswalks. The bright orange flags are an inexpensive approach to improving safety at high volume intersections. The City of Berkeley is currently experimenting with pedestrian flags. They are not currently used by the City of Oakland. Their inclusion in this plan does not indicate approval or endorsement by the Public Works Agency.

Traffic Calming

Traffic calming modifies the physical arrangement of a street to deflect the path of motor vehicles and thereby slow traffic. It provides a cost-effective alternative to traffic signals for reducing motor vehicle speeds and improving pedestrian safety. Two types of deflection are discussed in this section:

➔ Vertical deflection slows traffic by making motor vehicles drive over traffic calming devices.

➔ Horizontal deflection slows motor vehicles by changing the street width or course of travel.

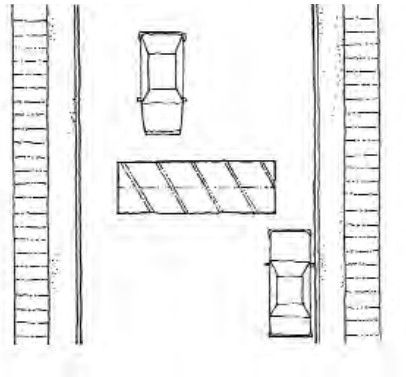

ILLUSTRATION 36 SPEED HUMP

Vertical Deflection

Speed Humps

Speed humps are broad and gently sloping mounds of asphalt added across the width of a street to slow traffic. They are like speed bumps except they tend to be wider such that the slope of the bump is more gradual. Oakland has installed speed humps on many neighborhood streets as part of its citywide traffic calming effort.

To qualify for a speed hump in the City of Oakland, a street must meet the following criteria:

➔ It must be classified as a local street.

➔ The curb-to-curb width must be 40 feet or less.

➔ It must have no more than two lanes with one in each direction.

➔ The street grade must not exceed 8%.

➔ The speed limit must be 25 mph and the 85% speed must be over 32 mph.

➔ The block must not be on AC Transit route.

➔ The street cannot be a cul-de-sac or dead-end street.

➔ It must be in a grid street system.

➔ It must not be in the Oakland Hills area.

Rumble Strips

Rumble strips are textured materials in pavement such as raised plastic bumps that make a rumbling sound when cars pass over. They may be used to create awareness of upcoming pedestrian traffic or of speed limit transitions like at freeway off-ramps.

Raised Crosswalks

Raised crosswalks provide a continuous street crossing for pedestrians at sidewalk level. They additionally work like speed humps to slow motor vehicle traffic at crosswalks. While eliminating the need for curb ramps, raised crosswalks should be marked or textured so that persons with visual impairments are able to identify the street edge. The City of Oakland currently does not use raised crosswalks.

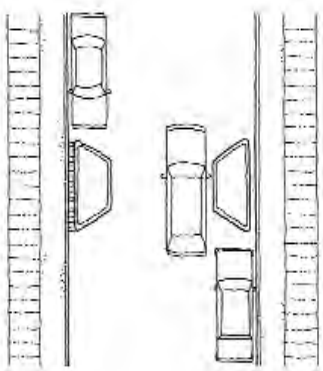

ILLUSTRATION 37 SLOW POINT

Horizontal Deflection

Slow Points

A slow point is an extension of the sidewalk curb in the middle of a block. Slow points are also known as chokers because they narrow the street to slow down motorists. Slow points and bulb-outs are similar in that both extend the curb line to narrow the street and thereby slow traffic. However, bulb-outs are located at crosswalks whereas slow points are not. The extra public

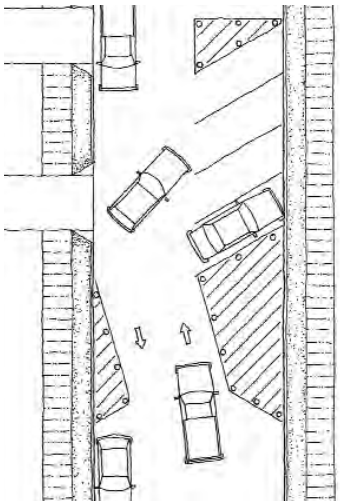

ILLUSTRATION 38 CHICANES

space created by a slow point may be used for benches, bike racks, or street trees. Slow points and their accompanying street furniture may require additional maintenance compared to unimproved street segments.

Chicanes

Chicanes are alternating curb extensions that slow motor vehicles by requiring them to move in an s-motion along a street. Alternating on-street parking from one side of the street to the other is a cost-effective alternative to achieve the same effect (Ewing 1999, p. 38).

Traffic Calming

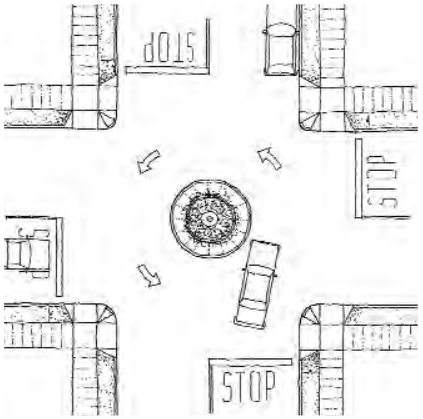

ILLUSTRATION 39 TRAFFIC CIRCLE

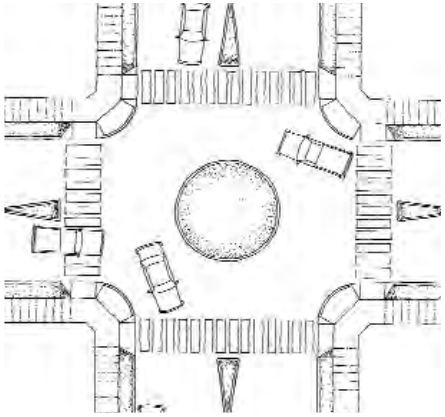

ILLUSTRATION 40 ROUNDABOUT

Traffic Circles

Traffic circles may be raised islands, large planters arranged in a circle, or other elements that cause vehicles to move slowly through an intersection in a counter-clockwise direction. Traffic circles can include landscaping or trees.

Roundabouts

Roundabouts are an alternative to signalized intersections. They use a raised circular island to allow large volumes of traffic to pass counter-clockwise through an intersection at a safe speed without the use of stop signs or signals. Compared to traffic signals, roundabouts have lower rates of collisions at intersections because they reduce motor vehicle speeds and the number of potential conflict points (Insurance Institute for Highway Safety 2000).

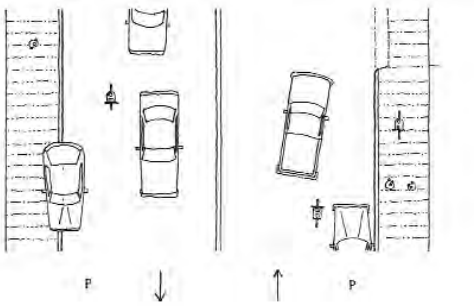

ILLUSTRATION 41 NARROW LANES BEFORE

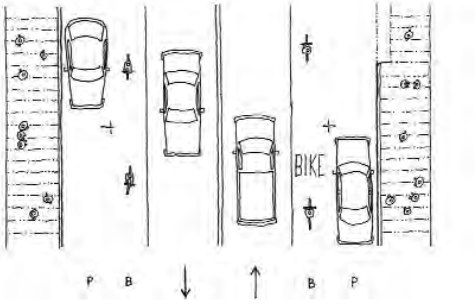

ILLUSTRATION 42 NARROW LANES AFTER

Narrow Lanes

Ten foot lanes increase street flexibility in areas with limited rights-of-way and may reduce motor vehicle speeds. Compared to the twelve foot standard, ten foot lanes provide additional right-of way for bike lanes or sidewalks. Where 5-foot standard bike lanes are not possible, 14-foot outer lanes should be provided to accommodate both drivers and cyclists. While slowing motor vehicle traffic and improving safety and access for non-motorized users, narrow lanes may increase the number of sideswipe and head-on motor vehicle collisions.

Traffic Calming

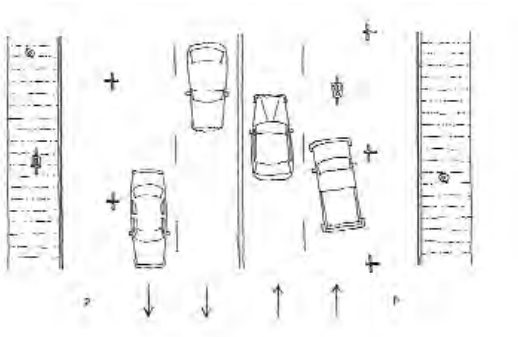

ILLUSTRATION 43 RESTRIPING BEFORE

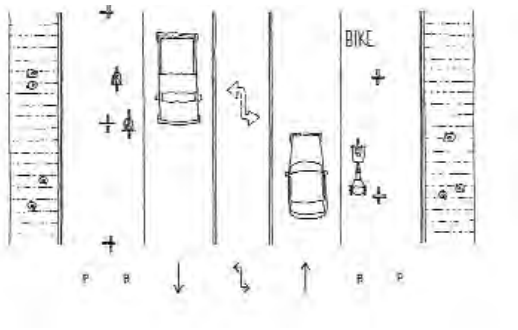

ILLUSTRATION 44 RESTRIPING AFTER

Restriping for Lane Reduction

Restriping streets for fewer lanes slows motor vehicle traffic and increases crossing safety. For streets with four or more lanes, it may be possible to reduce the number of travel lanes without increasing congestion by adding a center turn lane. For example, a four lane street may be restriped to one lane in each direction, a center turn lane, bike lanes, and a wider sidewalk. Proposals for lane reductions require careful study and City Council approval because such reconfigurations may create motor vehicle congestion.

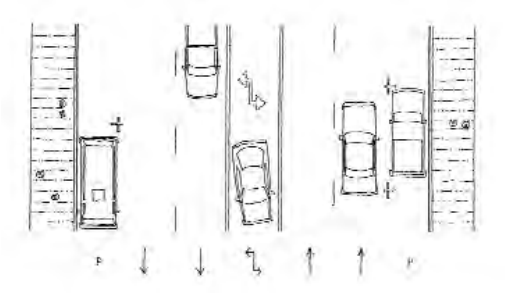

ILLUSTRATION 45 MEDIAN BEFORE

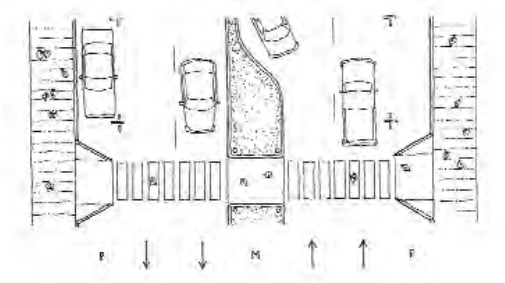

ILLUSTRATION 46 MEDIAN AFTER

Medians and Access Control

Medians increase safety by separating oncoming motor vehicle traffic and minimizing turning conflicts. They may be constructed with curbs or painted stripes and combined with pedestrian refuge islands. Medians also increase the safety of marked crosswalks at uncontrolled intersections (FHWA 2002a). Medians with landscaping will beautify wide streets by breaking up large expanses of pavement and making the street feel smaller. Wide medians can be used for trails or transit stops. Through an approach known as "access control," a street's efficiency may be increased by limiting the number of locations where left turns are allowed.

The benefits of medians should be weighed against the following disadvantages:

- Medians reduce street flexibility by increasing the cost of reconfigurations. Future development, usage patterns, and changing transportation demands may require reconfigurations to accommodate bicycle lanes, bus rapid transit lanes, light rail right-of-way, or new turning movements.
- Medians use limited street width that may be allocated instead to pedestrian, bicyclist, or motor vehicle capacity.
- Medians with plantings may reduce sight lines. Additionally, street trees and plants located along the sidewalk will have a more immediate benefit to pedestrians.

Traffic Calming

On-Street Parking

On-street parking slows traffic and acts as a buffer between pedestrians and motor vehicles. It increases the number of people on the street and thereby increases public safety. Diagonal parking may be used to narrow streets but it causes serious conflicts with bicyclists.

Street Closure

Partial street closures on local streets divert through motor vehicle traffic away from neighborhoods while maintaining access for pedestrians, cyclists, and emergency vehicles. Partial closure is accomplished by installing a physical barrier at one end of the street with accompanying signage. The barriers may include planters. Curbs can be constructed to create closed streets or diagonal diversion at intersections. In addition to the street in question, surrounding streets may be significantly affected by a street closure. The City of Oakland has an existing petition process for the implementation of partial street closures that involves residents on affected streets. Decisions are based on engineering judgment, community input, and council approval. According to a recent study conducted in Oakland, children who live on streets connected directly to arterial streets are twice as likely to be hit by an automobile in their neighborhood as children who live on streets that do not directly connect to arterials (Tester 2001). Street closure may be an effective safety solution by keeping unnecessary motor vehicle traffic out of residential neighborhoods. Numerous street closures exist in the Clinton Park neighborhood of Oakland.

Pedestrian Only Streets

Blocking off both ends of a street creates a pedestrian mall and public open space. There are many examples of pedestrian streets in Oakland. San Pablo Avenue in downtown was transformed into Frank Ogawa Plaza, the civic center and heart of Oakland. 13th Street in downtown was made into City Center, a BART station, and a vibrant shopping area. 34th Avenue will become a pedestrian connection to the Fruitvale BART station.

The key to good pedestrian-only streets is to make sure they connect important places and are pleasant and active in themselves. Civic areas, high-density residential buildings, and public transit are all catalysts for pedestrian street activity. Streets also may be temporarily closed to motor vehicle traffic like 9th Street for the Friday Farmers' Market in Old Oakland. Local residential streets can be designed to become play streets with priority given to bicyclists and pedestrians.