Chapter 5: Complete Streets Design

PURPOSE

The Monterey Bay Area Complete Street Guidebook provides examples of various street features to be considered when designing complete street facilities, so that they are utilized in the appropriate places. Copmlete street design should adhere to design principles and consider critical factors affecting design. The design features herein are organized by complete street type (i.e. Main Streets, Avenues, Local Streets, etc…) and by user zones (i.e. pedestrian, bicycle, street furniture, parking, etc…). Much of the content of this chapter has been adapted or borrowed from the Los Angeles County Model Design Manual for Living Streets.

EXCEPTIONS

The design elements and engineering best practices described in this chapter may not be appropriate for use in all jurisdictions. Local policy must be adhered to and engineering judgment applied; for example, the City of Monterey restricts the use of speed bumps/humps and uses other methods and measures to calm traffic.

DESIGN PRINCIPLES

Design for all users

Street design should accommodate all users of the street, including pedestrians, bicyclists, transit users, automobiles, and commercial vehicles. A well-designed traveled way provides appropriate space for all street users to coexist.

Design with the network in mind

Streets should be well connected and provide access to land uses for a diverse group of users.

Design intuitively

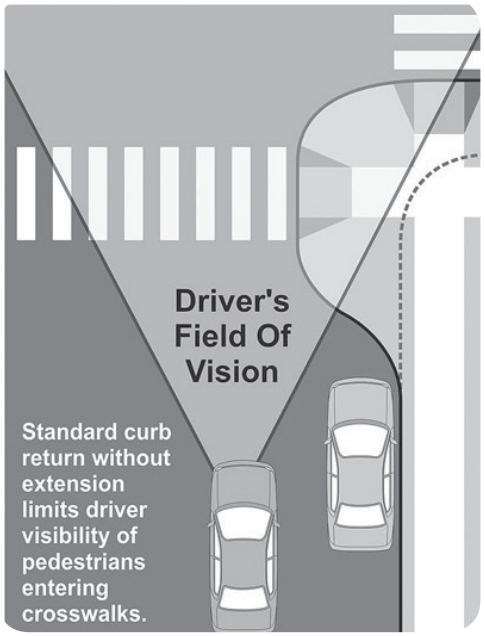
Street design should be intuitive for the users and require minimal signage and markings.

Design using the appropriate speed for the surrounding context

The right design speed should respect the desired role and purpose of the street, including the type and intensity of land use, urban form, the desired activities on the sidewalk, such as outdoor dining, and the overall safety and comfort of pedestrians and bicyclists. The speed of vehicles impacts all users of the street and the livability of the surrounding area. Lower speeds reduce crashes and injuries.

Design for safety

The safety of all street users, especially the most vulnerable users (children, the elderly, and disabled) and modes (pedestrians and bicyclists) should be paramount in any design of the traveled way. The safety of streets can be dramatically improved through appropriate geometric design and operations.



FACTORS AFFECTING DESIGN

Design To Accommodate All Users

Providing safe and convenient routes for all users is a core goal of complete street design. Therefore, it is important to identify and consider the needs of all potential roadway users. Since most modern roadways have been designed for motorists, complete streets design often puts more emphasis on other users such as pedestrians, bicyclists and transit.

Everyone is a pedestrian at some point every day, even if they drive, take the bus or ride a bicycle for the bulk of their trip. Areas that draw pedestrians such as downtowns generate activities that support the community and contribute to a higher quality of life. A recent survey of Monterey Bay Area residents concluded that more people would like to walk and to have nicer pedestrian facilities in their community. Despite some efforts to improved facilities, much more can be done to improve pedestrian conditions.

Studies have shown that most pedestrian crashes occur when a person crosses the road, and the most common crash type is a conflict between a crossing pedestrian and a turning vehicle at an intersection. Vehicle speed is directly related to the severity of injuries in collisions involving pedestrians. The severity of pedestrian injuries and risk of death in a collision with a motorized vehicle dramatically increases as the impact speed increases above 25 miles per hour (see Figure 5-1). Traffic calming can significantly improve pedestrian safety by slowing motor vehicles, especially in areas where there are high rates of pedestrian crossings.

Although incredibly important, pedestrian facility design should not be solely focused on improving safety, but should also consider factors that improve comfort and walking for pleasure. The two most effective methods to achieve these goals are to minimize the footprint dedicated to motor vehicle traffic and to slow down the speed of moving traffic. This approach allows the designer to use features that enhance the walking environment, such as trees, curb extensions, and street furniture, which in turn slow traffic, resulting in a virtuous cycle. All streets should have sidewalks except for rural roads and shared-space streets.

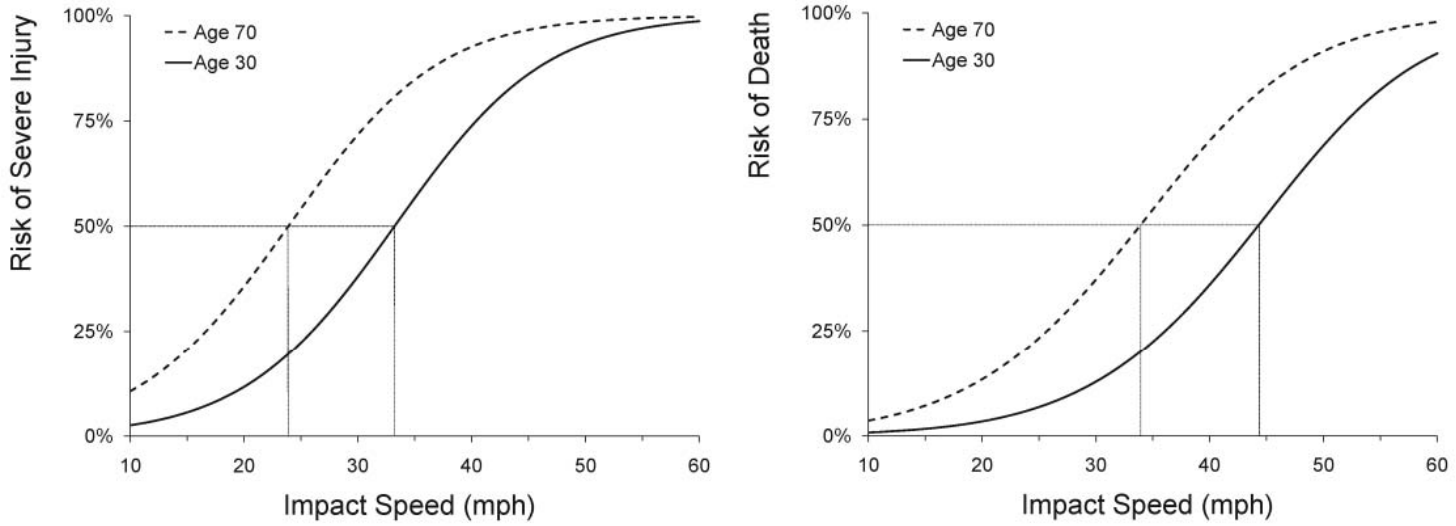


Figure 2: Risk of Pedestrian Injury or Death vs. Vehicle Impact Speed (AAA Foundation for Traffic Safety, 2011)

Accomodating all users also requires considering different needs within each user group. For instance, conditions arise in sidewalk networks that may create trip and fall hazards. Although these conditions, such as such as broken and raised pavement, slopes, vegetation intruding into the walkway, vehicles obstructing sidewalks, and signs, poles, stands or benches that obstruct or narrow the path are a danger for all pedestrians, the elderly, and others with impairments that affect vision and balance, are more susceptible to such hazards. In recognition of the negative impacts poor sidewalk conditions can have on elderly and disabled individuals in particular, the Santa Cruz County Regional Transportation Commission Pedestrian Safety Work Group developed a Program Model for Sidewalk Network Maintanence.

Another example of differenting between needs of users within each user group is the range of experience in bicycle users. Adults who commute by bicycle to work are more likely to feel comfortable riding in a bike lane on a street with higher vehicle volumes and speeds; whereas less experienced bike riders, including children, may feel more comfortable on a bike facility buffered from motor vehicles.

How Streets are Sized

The size and geometric design of a street (including lane width, corner radii, median nose design, and other intersection design details), is determined in large part by the design vehicle, or the typical vehicle considered for use on that particular roadway. Designing for a larger vehicle than necessary is undesirable, due to the potential negative impacts larger dimensions may have on pedestrian crossing distances and the speed of turning vehicles. On the other hand, designing for a vehicle that is too small can result in operational problems if larger vehicles frequently use the facility.

For design purposes, the wheel-base 40 feet (WB-40) is appropriate unless larger vehicles are more common. On bus routes and truck routes, designing for the bus or large WB-40 type truck may be appropriate, but only at intersections where these vehicles make turns. For example, for intersection geometry design features such as corner radii, different design vehicles should be used for each intersection or even each corner, rather than a one-size-fits-all approach, which results in larger radii than needed at most corners. The design vehicle should be accommodated without encroachment into opposing traffic lanes. It is generally acceptable to have encroachment onto multiple same-direction traffic lanes on the receiving roadway.

Furthermore, it may be inappropriate to design a facility by using a larger control vehicle, which uses the street infrequently, or infrequently makes turns at a specific location. An example would be a vehicle that makes no more than one delivery per day at a business. Depending on the turn frequency, under designing the control vehicle can make streets more appropriate for multimodal use by reducing lane and right-of-way widths, without having to encroach on sidewalks and ramps, while allowing larger vehicles to encroach on opposing traffic lanes or make multiple-point turns.

Design Speed

In contrast to the high-speed design approach, the goal for complete streets is to establish a roadway design speed that creates a safer and more comfortable environment for motorists, pedestrians, and bicyclists. The complete streets approach also increases access to adjacent land, thereby increasing its value, and therefore is more appropriate for the surrounding context. For most complete streets, design speeds of 20 to 35 mph are desirable. Alleys and narrow roadways intended to function as shared spaces may have design speeds as low as 10 mph.

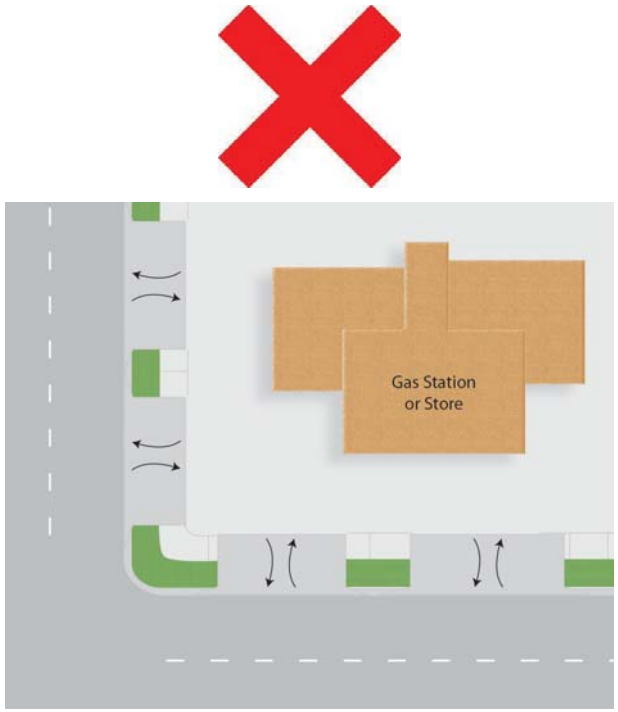
Design speed does not determine nor predict exactly at what speed motorists will travel on a roadway segment. Rather, design speed determines which design features are allowable or mandated. Features associated with high-speed designs, such as large curb radii, straight and wide travel lanes, ample clear zones , and guardrails, degrade the walking experience and make it difficult to design complete streets. Ultimately, designing roads which encourage high speeds creates a vicious cycle. A slower design speed allows the use of features that enhance the walking environment, such as small curb radii, narrower sections, trees, on-street parking, curb extensions, and street furniture, which in turn slow traffic, creating a virtuous cycle.

A narrow roadway with sharrow markings encourages slower speeds and is more comfortable for bicyclists.

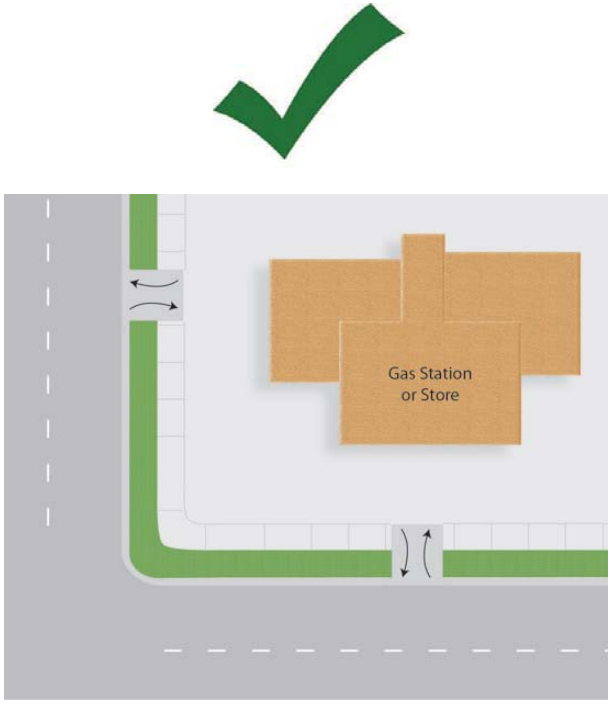
Parkways or expressways are designed for higher speeds which can also benefit transit and bicycle commuters if appropriate facilities are provided.

Access Management

A major challenge in street design is balancing the number of access points to a street with the need for multiple users to enter the facility. There are many benefits of well-connected street networks; on the other hand, most conflicts between users occur at intersections and driveways. The presence of many driveways in addition to the necessary intersections creates many conflicts between vehicles entering or leaving a street and bicyclists riding or pedestrians walking along the street. Particularly in commercial zones, new driveways should be minimized and old driveways should be eliminated or consolidated, and raised medians should be placed to limit left turns into and out of driveways.



Corner with many wide driveways (Credit: Michele Weisbart)



Reconstructed corner with fewer, narrower driveways (Credit: Michele Weisbart)

COMPLETE STREET TYPES CROSS SECTIONS

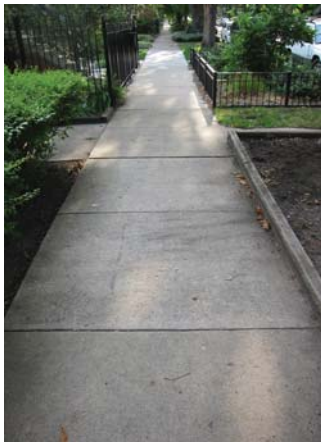
Complete street type cross sections represent example roadway designs that take into consideration the convenience and comfort of all roadway users based on land use and transportation context. Complete street types cross sections should serve as a starting point when designing for complete streets and should not be interpreted as design requirements. Existing roadways undergoing improvements may not have sufficient right-of-way to accommodate all of the design features shown in the complete street cross sections.

The advantage of starting with a complete street type cross section when designing projects is that it provides project sponsors and stakeholders with a vision of a complete street, which prioritizes roadway user needs based on land use and transportation context, before moving into the discussion about constraints and trade-offs. In many cases the final project design will not replicate what is shown in the complete street type cross sections, but that the project design will maintain the balance of roadways user needs as illustrated in the cross sections using the resources, skills and techniques available.

For example, a rural roadway, which is primary designed for truck/agricultural vehicles and private automobiles, and where vehicle lanes cannot be reduced to provide exclusive bicycle or pedestrian facilities, utilizing sharrows to indicate bicycle use of traffic lane and/or providing a wide paved shoulder to allow pedestrian access may be considered when evaluating roadway designs.

User Zones

The complete street types identify the roadway characteristics by mode using "user zones" with the preferred dimensions of elements along the street. The complete street type cross sections go beyond street functional classification by considering bicyclists and pedestrians, not only automobile movement. The specific function of zones may vary by complete street type. However, generally the zones can be defined as follows:



Pedestrian zone: Includes unobstructed sidewalks with appropriate widths based on demands generated by adjacent land uses and pedestrian facilities, as appropriate.

Street Furniture zone: Includes pedestrian, bicycle and transit supportive amenities such as transit shelters, seating, lighting, bicycle parking, signage, kiosks and public art.

Green zones: Includes landscaping or hardscape amenity zones. Supports pedestrian zone by maintaining comfortable pedestrian travel by providing a buffer from motorized zone or by shortening pedestrian crossings through establishing an "island" in the roadway. Can also support traffic calming and neighborhood livability.

Parking zone: Includes parking to serve adjacent businesses. The parking zone also can serve to calm traffic and provide a buffer to the pedestrian zone. Parking zone may be utilized as intermittent transit and bicycle lanes often referred to as "business access and transit lane" (BAT) and/or floating bicycle lanes.

Motor vehicle zone: Includes a variety of possible lane configurations to accommodate desired motorized vehicle speed and volumes.

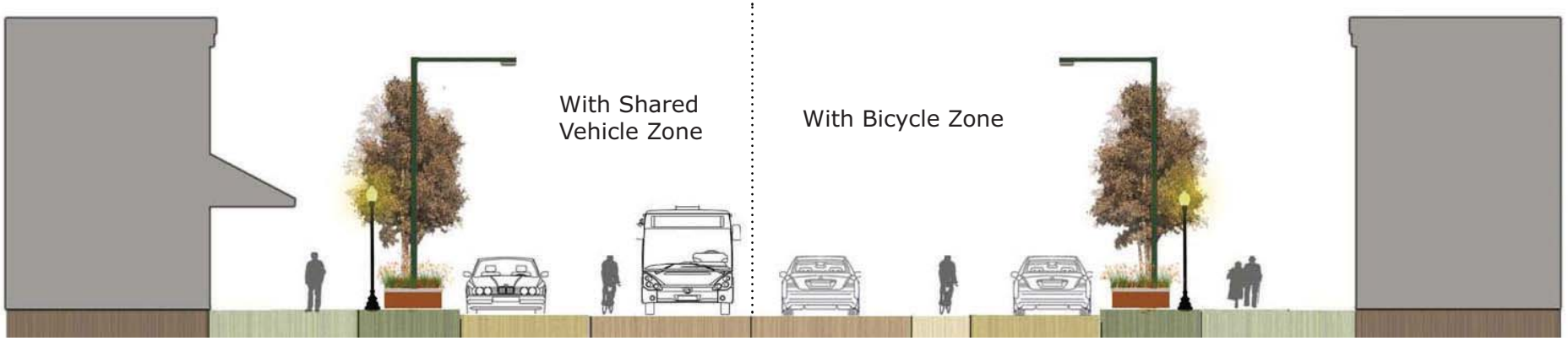
Bicycle zone (exclusive zone): Includes dedicated bicycle facilities on typicall on higher speed and volume roadways and may include additional buffering from other modes. Bicycle treatments can be found in **Appendix K.**

Bicycle zone (mixed vehicle zone): Includes shared facilities with motorists typically on low volume and speed roadways and pavement markings, where appropriate.

Emergency vehicle zone: No specific zone is exclusive to emergency vehicles. Together, motor vehicle and bicycle zones will be meet the California Fire Code that requires public streets to have an unobstructed travel way of at least 20 feet, unless an exception is made.

Main Street Zones

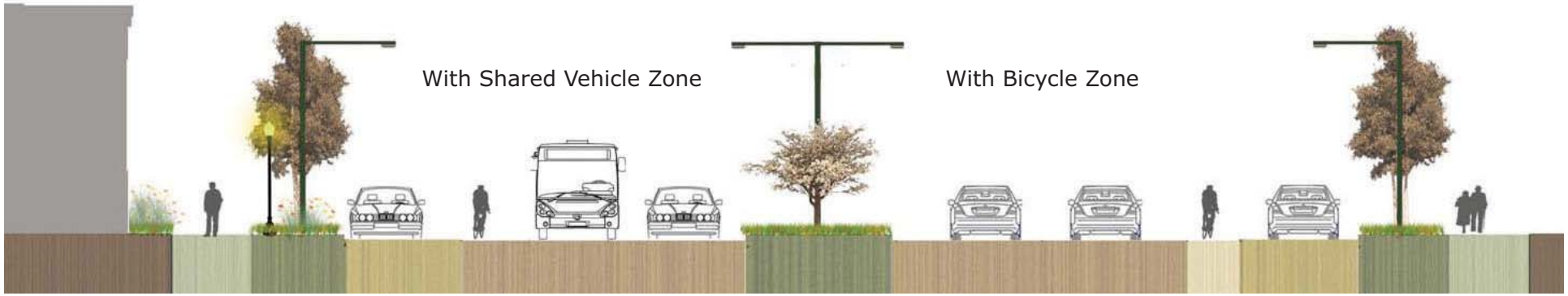
- **Design Speed** – Less than 30 miles per hour
- **User Prioritization**– Pedestrians & Bicyclists
- **Land Use Place Types** - Urban Commercial; Urban Mixed-Use; Town Commercial; Town Mixed-Use; Rural-Town Commercial; Institutional



Pedestrian	Street Furniture	Green	Motor Vehicle	Bicycle	Parking
Main Streets generate high levels of pedestrian traffic and pedestrians should be prioritized over other modes. The unobstructed pedestrian zone should be at least 10' wide and extend to the building frontage.	Pedestrian amenities such as seating, lighting, wayfinding signage, public art, kiosks, and bicycle racks near store entrances are encouraged	Street trees add character to the street and provide shade and shelter from the rain. Trees with deep roots should be selected over those with shallow roots to avoid uplifted sidewalk which can become a tripping hazard	Travel lanes should be 13' if shared with bicyclists; otherwise travel lanes should be narrowed to 10' to provide space for 6' bicycle lanes. Images for each zone	Shared bicycle facilities are appropriate due to low vehicle speeds. Markings ("sharrows") that position bicyclists away from the "door zone" of parked vehicles are recommended as they reduce the risk of injury to bicyclists.	On-street parking is encouraged and acts as a buffer between pedestrians and the motor vehicle zone. Parallel parking is preferred, however angled parking is acceptable. Parking meters should be places as to not block access to the pedestrian zone.

Avenues

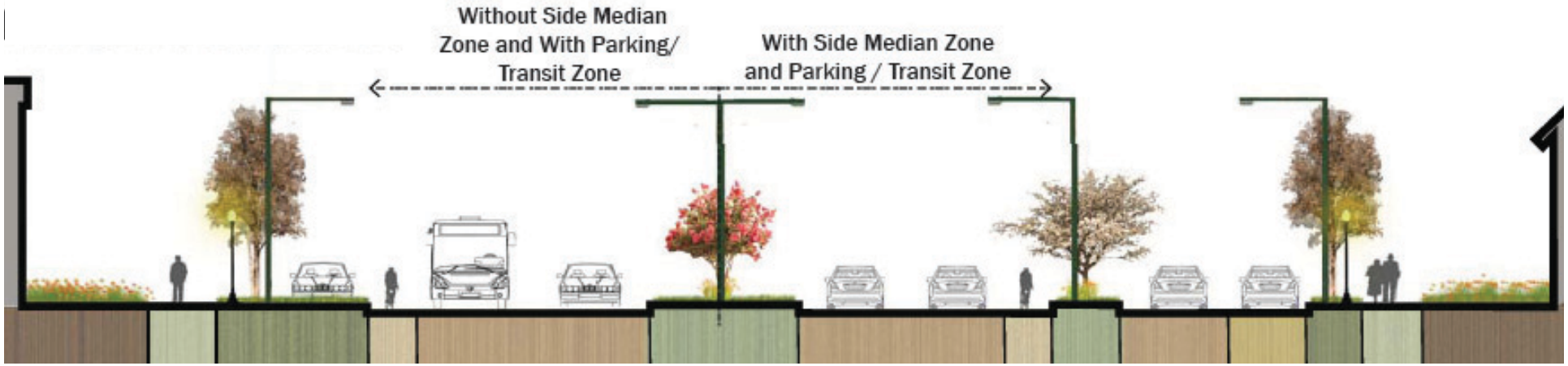
- **Design Speed** – 25-35 miles per hour
- **User Prioritization** – Bicycles, Pedestrians & Transit
- **Land Use Place Types** - Urban Multi-Family Residential; Multi-Family Residential; Neighborhood Commercial; Town Multi-Family Residential; Town Mixed-Use; Institutional; Open Space/Recreation
- **Local Examples**: Sloat Avenue (Monterey); Branciforte Avenue (Santa Cruz)



Pedestrian	Street Furniture	Green	Motor Vehicle	Bicycle	Parking
Avenues serve a variety of land uses and thus generate medium to high levels of pedestrian activity. The unobstructed pedestrian zone should be at least 6' wide but 8' or 10' is preferred.	Amenities such as transit shelters, seating, pedestrian-scale lighting, wayfinding signage, public art, kiosks, and bicycle racks near store entrances are encouraged.	Permeable hardscaping, landscaping and street trees are desired. The green zone should be a minimum of 8' to provide adequate buffer between pedestrians and motorists.	Travel lanes should be 13' if shared with bicyclists; otherwise travel lanes should be narrowed to 10' to provide space for 6' bicycle lanes. Images for each zone	Shared bicycle facilities are appropriate on streets with low vehicle speeds 6' bike lanes are recommended on streets with a posted speed of 30 mph or more. The gutter pan is not considered part of the lane width or bicycle lane width.	On-street parking may be provided. One benefit to parking is that it acts as a buffer between pedestrians and the motor vehicle zone. However, on streets with limited right-of-way there may not be room for both parking and a dedicated bike lane.

Boulevards

- **Design Speed** – 30-40 miles per hour
- **User Prioritization** – Transit, Autos/Trucks & Bicycles
- **Land Use Place Types** - Multi-Family Residential; Neighborhood Commercial; Regional Commercial; Employment Center; Neighborhood Mixed-Use; Institutional; Open Space/Recreation
- **Local Examples**: Munras Avenue (Monterey); Capitola Road (Live Oak/Capitola)



Pedestrian	Street Furniture	Green	Motor Vehicle	Bicycle	Parking
The unobstructed pedestrian zone should be at least 6’ wide but 8’ or 10’ is preferred. The pedestrian zone should also be set back from the street. to mitigate discomfort generated from greater volumes of fast-moving vehicles.	Amenities such as transit shelters, seating, pedestrian-scale lighting, wayfinding signage, public art, kiosks, and bicycle racks near store entrances are encouraged	The green zone should be a minimum of 8’ to provide adequate buffer between pedestrians and motorists. Medians should be landscaped and permeable but remain accessible to pedestrians.	The outside travel lanes should be 14’ if shared with bicyclists; otherwise travel lanes should be 11’-12’. Boulevards should not have continuous left-turn lanes but instead be separated by a median wherever feasible. Medians should be a minimum of 8’ wide.	6’ bike lanes are recommended. The gutter pan is not considered part of the bicycle lane width.	On-street parking is not required but allowed where appropriate. Off-street parking is desired.

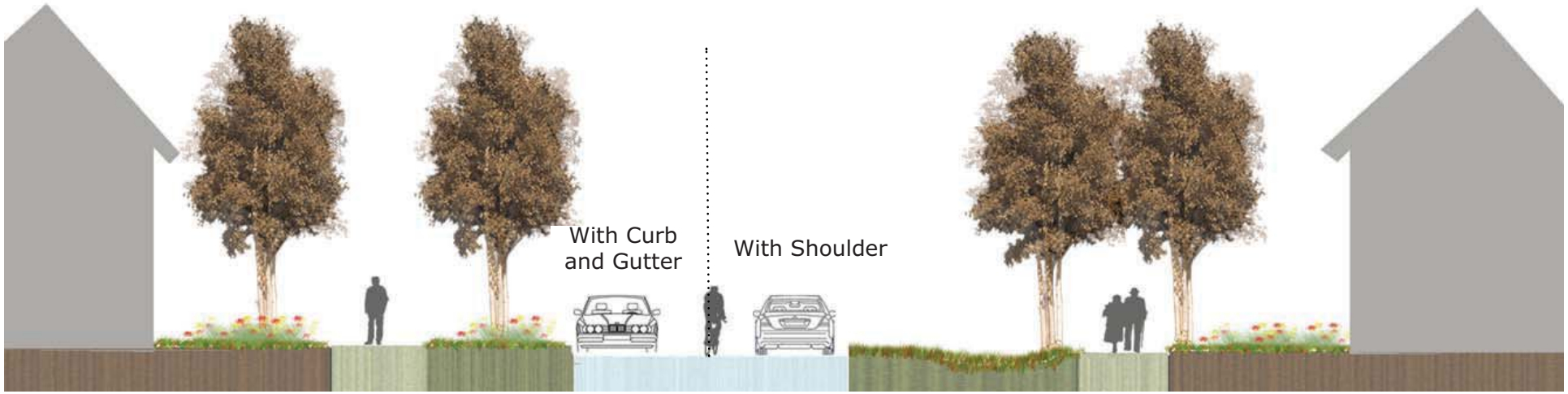
Parkways

- **Design Speed** – 35-45 miles per hour
- **User Prioritization** – Auto/Trucks, Transit & Bicycles
- **Land Use Place Types** - Regional Commercial; Employment Center; Airport; Institutional; Open Space/Recreation
- **Local Examples** - Imjin Parkway/Rd (Marina); Soquel Drive (Aptos); Canyon Del Rey (Del Rey Oaks)

Pedestrian	Street Furniture	Green	Motor Vehicle	Bicycle	Parking
Preferred accomodation for pedestrians is a multi-use path set back from the street.	Amenities such as transit shelters, seating, pedestrian-scale lighting, wayfinding signage, public art, and kiosks are desireable. Transit stops should connect to the sidewalk and/or multi-use trail.	The green zone should be a minimum of20’ to accomodate the “clear zone” and to provide adequate buffer between pedestrians and motorists. Medians should be landscaped and permeable but remain accessible to pedestrians.	Travel lanes should be 11’-12’ wide. Parkways should not have continuous left-turn lanes but instead be separated by a median wherever feasible. Medians should be a minimum of 17’ wide. Shoulders are allowable on an urban parkway if appropriate.	Preferred accomodation for bicyclists is a multi-use path set back from the street. 6’ bike lanes are also appropriate and may better serve experienced bicyclists. The gutter pan is not considered part of the bicycle lane width.	On-street parking should not be permitted along parkways. Instead park and ride lots served by transit should be provided.

Local Streets

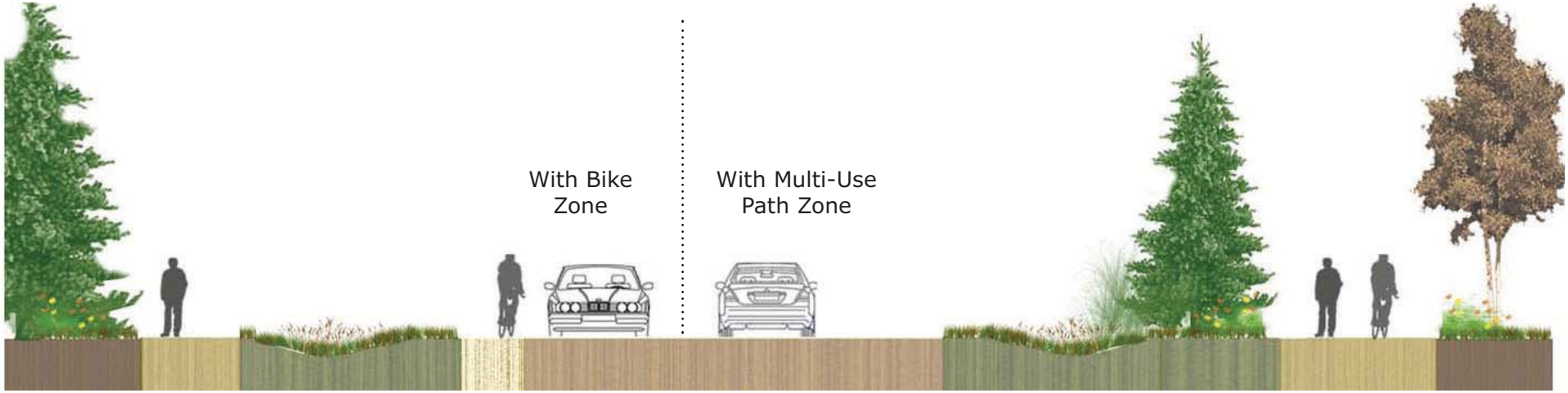
- **Design Speed** – < 25 miles per hour
- **User Prioritization** – Pedestrians, Bicycles & Autos/Trucks
- **Land Use Place Types** - Urban Single-Family Residential; Urban Multi-Family Residential; Urban Mixed-Use; Single-Family Residential; Multi-Family Residential; Town Single-Family Residential; Town Multi-Family Residential; Rural Town Residential; Institutional; Open Space/Recreation



Pedestrian	Street Furniture	Green	Motor Vehicle	Bicycle	Parking
Unobstructed pedestrian zone should be a minimum of 5' with a vertical curb (rolled curbs allow parked cars to encroach in the pedestrian area). Streets with very low traffic volumes may not require sidewalks and instead function as a shared street or "Woonerf ".	Pedestrian-scale lighting and some bicycle/pedestrian wayfinding signage for destinations such as community centers, parks and schools	The green zone should be a minimum of 4' to accomodate landscaping/trees. Bioswales and raingardens may also be appropriate in the green zone.	Travel lanes should be a minimum of 9'-10' with a 4' shoulder. Medians are not typically provided on local streets with the exception of partial medians which can be used for traffic calming and aesthetic purposes	Shared bicycle facilities are appropriate due to low vehicle speeds and traffic volumes. Neighborhood shared streets should have additional amenities such as bicycle boulevard signage, sharrows, partial street closures and traffic calming features.	Parallel on-street parking is recommended along local streets. The parking serves as a buffer between pedestrians and motorists.

Rural Roads

- **Design Speed** – Varies
- **User Prioritization** – Autos/Trucks, Transit & Bicycles
- **Land Use Place Types** –Agriculture and Rural Residential; Exurban Residential; Industrial and Manufacturing; Open Space/Recreation
- **Local Examples** – Corralitos Road (Santa Cruz)



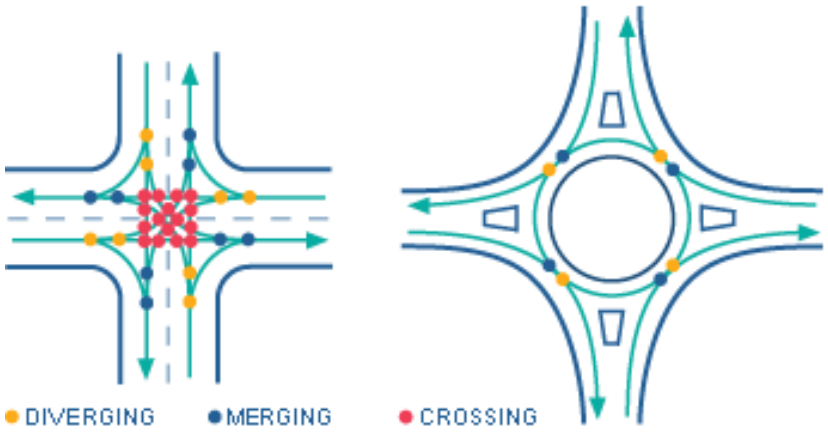
Pedestrian	Street Furniture	Green	Motor Vehicle	Bicycle	Parking
A wide paved roadway shoulder can accomodate both pedestrians and bicyclists in a rural setting. A sidewalk or multi-use path outside of the clear zone may also be appropriate (especially if it provides access to a community resource such as a school).	Pedestrian-scale lighting, amenities at transit stops and some bicycle/ pedestrian wayfinding signage for destinations such as community centers, parks and schools near rural town centers.	The green zone consists of the roadway shoulder and ditch. This area may be paved at intersections to reduce the amount of dirt, mud and debris carried onto the roadway by agricultural vehicles.	A wide paved roadway shoulder can accomodate bicyclists. Multi-use paths ouside of the clear zone may also be appropriate.	Travel lanes should be a minimum of 10’-12’ with a 6’-8’ shoulder.	On-street parking is not recommended on rural roads.

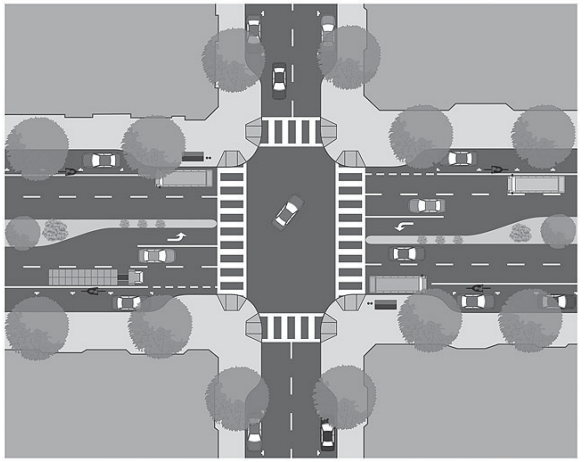
INTERSECTIONS

Principles

The following principles apply to all users of intersections:

- Good intersection designs are compact.
- Unusual conflicts should be avoided.
- Simple right-angle intersections are best for all users since many intersection problems are worsened at skewed and multi-legged intersections.
- Roundabouts reduce points of conflict and severity of potential collisions compared to signalized or stop controlled intersections.
- Access management practices should be used to remove additional vehicular conflict points near the intersection.
- Signal timing should consider the safety and convenience of all users and should not hinder bicycle or foot traffic with overly long waits or insufficient crossing times.





Signalized Intersections

To improve livability and pedestrian safety, signalized intersections should:

- Provide signal progression at speeds that support the target speed of a corridor whenever feasible.
- Provide short signal cycle lengths, which allow frequent opportunities to cross major roadways, improving the us ability and livability of the surrounding area for all modes.
- Ensure that signals detect bicycles.
- Place pedestrian signal heads in locations where they are visible.
- At locations with many crossing pedestrians, time the pedestrian phase to be on automatic recall, so pedestrians do not have to seek and push a pushbutton.
- Where few pedestrians are expected and automatic recall of walk signals is not desirable, place pedestrian push buttons in convenient locations, using separate pedestals if necessary. Use the recommendations regarding push button placement for accessible pedestrian signals found in the Manual on Uniform Traffic Control Devices (MUTCD).
- Include pedestrian signal phasing that increases safety and convenience for pedestrians.

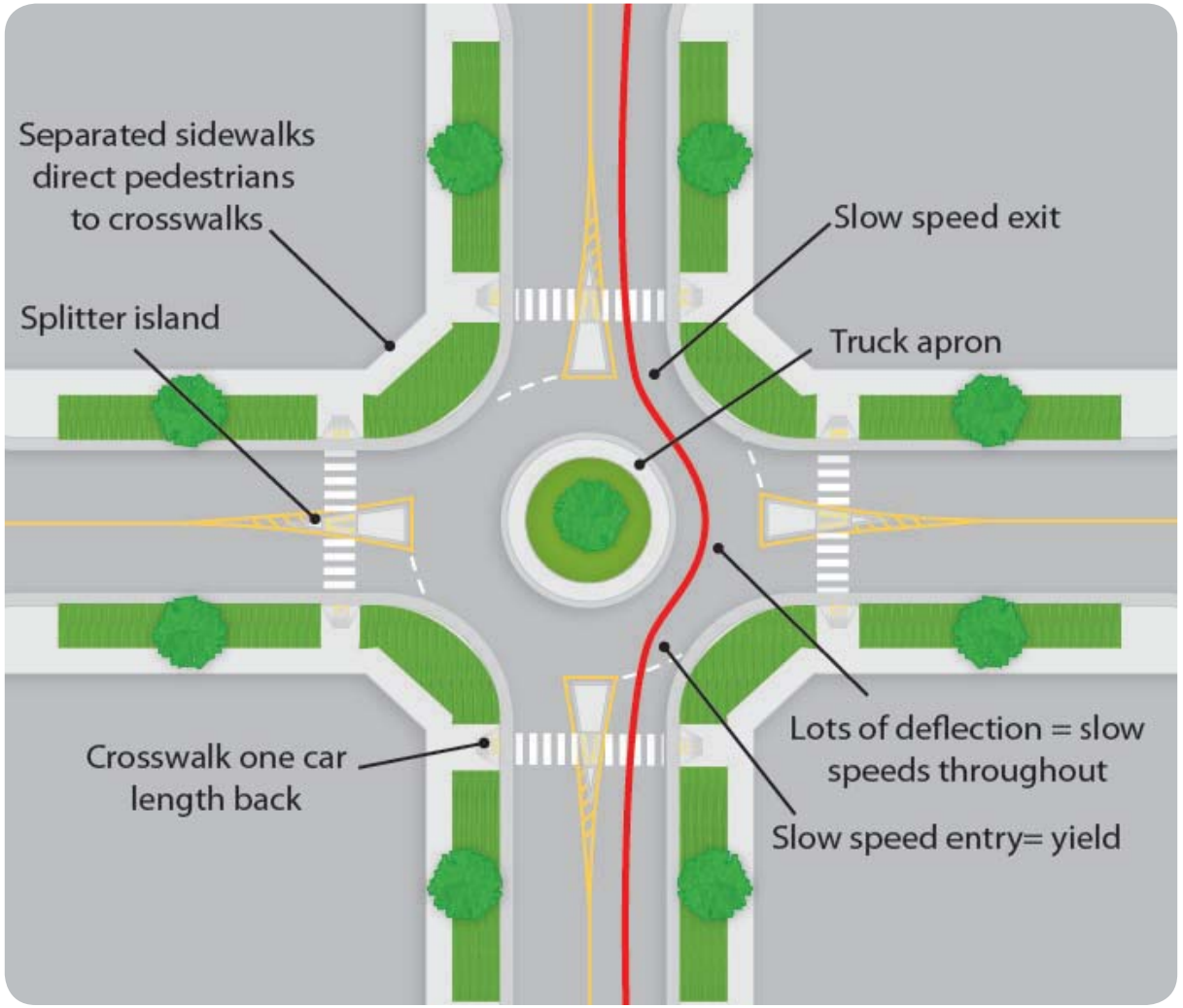
Yield and Stop-Controlled Intersections

Most intersections are either stop-controlled or yield-controlled. In general, stop signs are overused and often mistakenly used for traffic calming. Stop signs are not a traffic calming device. An intersection must meet warrants set forth in the Manual of Uniform Traffic Control Devices (MUTCD) before stop controls may be installed. Intersection control options include the following:

- Yield control, which is under-utilized and should be considered to reduce unnecessary stops caused by the overuse of stop signs.
- Uncontrolled intersections are yield controlled by default.
- Two-way stop control, the most common form of intersection control. This is also an overused device. At many intersections a neighborhood traffic calming circle is a preferable and more effective option.
- All-way stops are often overused, incorrectly, to slow traffic. The use of all-way stops should be consistent with the MUTCD. At many intersections a neighborhood traffic calming circle is a preferable and a more effective option.

Roundabouts

Roundabouts reduce vehicle-to-vehicle and vehicle-to-pedestrian conflicts and, thanks to a substantial reduction in vehicle speeds, reduce all forms of crashes and crash severity. In particular, roundabouts eliminate the most dangerous and common crashes at signalized intersections: left-turn and right-angle crashes.



Other benefits of roundabouts include the following:

- Little to no delay for pedestrians, who have to cross only one direction of traffic at a time.
- Improved accessibility to intersections for bicyclists through reduced conflicts and vehicle speeds.
- A smaller carbon footprint. Less lighting is required for operation and fuel consumption is reduced as motor vehicles spend less time idling and don't have to accelerate as often from a dead stop.
- Opportunity to reduce the number of vehicle lanes between intersections. For example, a five-lane road may be reduced to a two-lane road due to increased vehicle capacity at intersections.
- Little to no stopping during periods of low flow.
- Significantly reduced maintenance and operational costs required by signals and lights
- Reduced delay, travel time, and vehicle queue lengths.
- Lowered noise levels.
- Less fuel consumption and air pollution.
- Simplified intersections.
- Facilitated U-turns.
- The ability to create a gateway and/or a transition between distinct areas through landscaping.
- Light rail can pass through the center of a roundabout without delay because rail has the right of way, although gates may be required

The primary disadvantage of a roundabout is that sight-impaired people can have difficulty navigating around large roundabouts. However, this difficulty can be mitigated with ground level wayfinding devices.
Before starting the design of a roundabout it is very important to determine the following:

- The number and type of lane(s) on each approach and departure as determined by a capacity analysis.
- The design vehicle for each movement.
- The presence of on-street bike lanes.
- The goal/reason for the roundabout, such as crash reduction, capacity improvement, speed control, or creation of a gateway or a focal point.
- Right-of-way and its availability for acquisition if needed.
- The existence or lack of sidewalks.
- The approach grade of each approach.
- Transit, existing or proposed.

UNIVERSAL PEDESTRIAN ACCESS

The following design principles inform the recommendations made in this chapter and should be incorporated into every pedestrian improvement:

- The walking environment should be safe, inviting, and accessible to people of all ages and physical abilities.
- The walking environment should be easy to use and understand.
- The walking environment should seamlessly connect people to places. It should be continuous, with complete sidewalks, well-designed curb ramps, and well-designed street crossings
- The walking environment should not be obstructed.

Legal Framework

Under Title II of the Americans with Disabilities Act (ADA) of 1990, state and local governments and public transit authorities must ensure that all of their programs, services, and activities are accessible to and usable by individuals with disabilities. They must ensure that new construction and altered facilities are designed and constructed to be accessible to persons with disabilities. State and local governments must also keep the accessible features of facilities in operable working condition through maintenance measures including sidewalk repair, landscape trimming, work zone accessibility, and snow removal.

Under the ADA, the U.S. Access Board is responsible for developing the minimum accessibility guidelines needed to measure compliance with ADA obligations when new construction and alterations projects are planned and engineered. These guidelines for public rights-of-way are found in draft form in the Public Rights-of-Way Accessibility Guidelines. The U.S. Department of Transportation has recognized this document as current best practices in pedestrian design and has indicated its intent to adopt the final guidelines.

In addition, Title II of the ADA also requires states and localities to develop ADA Transition Plans that remove barriers to disabled travel.

ADA Transition Plans are intended to ensure that existing inaccessible facilities are not neglected indefinitely and that the community has a detailed plan in place to provide a continuous pedestrian environment for all residents. These plans must:

- Inventory physical obstacles and their location.
- Provide adequate opportunity for residents with disabilities to provide input into the Transition Plan.
- Describe in detail the methods the entity will use to make the facilities accessible.
- Provide a yearly schedule for making modifications.
- Name an official/position responsible for implementing the Transition Plan.
- Set aside a budget to implement the Transition Plan.

Obstructions can make passage difficult or impossible for wheelchair users. (Credit: Michael Ronkin)

User Needs

Wheelchair and scooter users are most affected by the following:

- Uneven surfaces that hinder movement.
- Rough surfaces that make rolling difficult and can cause pain, especially for people with back injuries.
- Steep uphill slopes that slow the user.
- Steep downhill slopes that cause a loss of control.
- Cross slopes that make the assistive device unstable.
- Narrow sidewalks that impede the ability of users to turn or to cross paths with others.
- Devices that are hard to reach, such as push buttons for walk signals and doors.
- The lack of time to cross the street.

Walking-aid users are most affected by the following:

- Steep uphill slopes that make movement slow or impossible.
- Steep downhill slopes that are difficult to negotiate.
- Cross slopes that cause the walker to lose stability.
- Uneven surfaces that cause these users to trip or lose balance.
- Long distances.
- Situations that require fast reaction time.
- The lack of time to cross the street.

Prosthesis users often move slowly and have difficulty with steep grades or cross slopes.

People with visual impairments include those who are partially or fully blind, as well as those who are colorblind. Visually impaired people face the following difficulties:

- Limited or no visual perception of the path ahead.
- Limited or no visual information about their surroundings, especially in a new place.
- Changing environments where they rely on memory
- Lack of non-visual information
- Inability to react quickly
- Unpredictable situations, such as complex intersections that are not at 90 degrees
- Inability to distinguish the edge of the sidewalk from the street
- Compromised ability to detect the proper time to cross a street
- Compromised ability to cross a street along the correct path
- Need for more time to cross the street

People with cognitive impairments encounter difficulties in thinking, learning, and responding, and in performing coordinated motor skills. Cognitive disabilities can cause some to become lost or have difficulty finding their way. They may also not understand standard street signs and traffic signals. Some may not be able to read and benefit from signs with symbols and colors.

Children and many older adults don't fall under specific categories for disabilities, but must be taken into account in pedestrian planning. Children are less mentally and physically developed than adults and have the following characteristics:

- Less peripheral vision.
- Limited ability to judge speed and distance.
- Difficulty locating sounds.
- Limited or no reading ability, so do not understand text signs.
- Occasional impulsive or unpredictable behavior.
- Little familiarity with traffic.
- Difficulty carrying packages.

The natural aging process generally results in at least some decline in sensory and physical capability. As a result, many older adults experience the following:

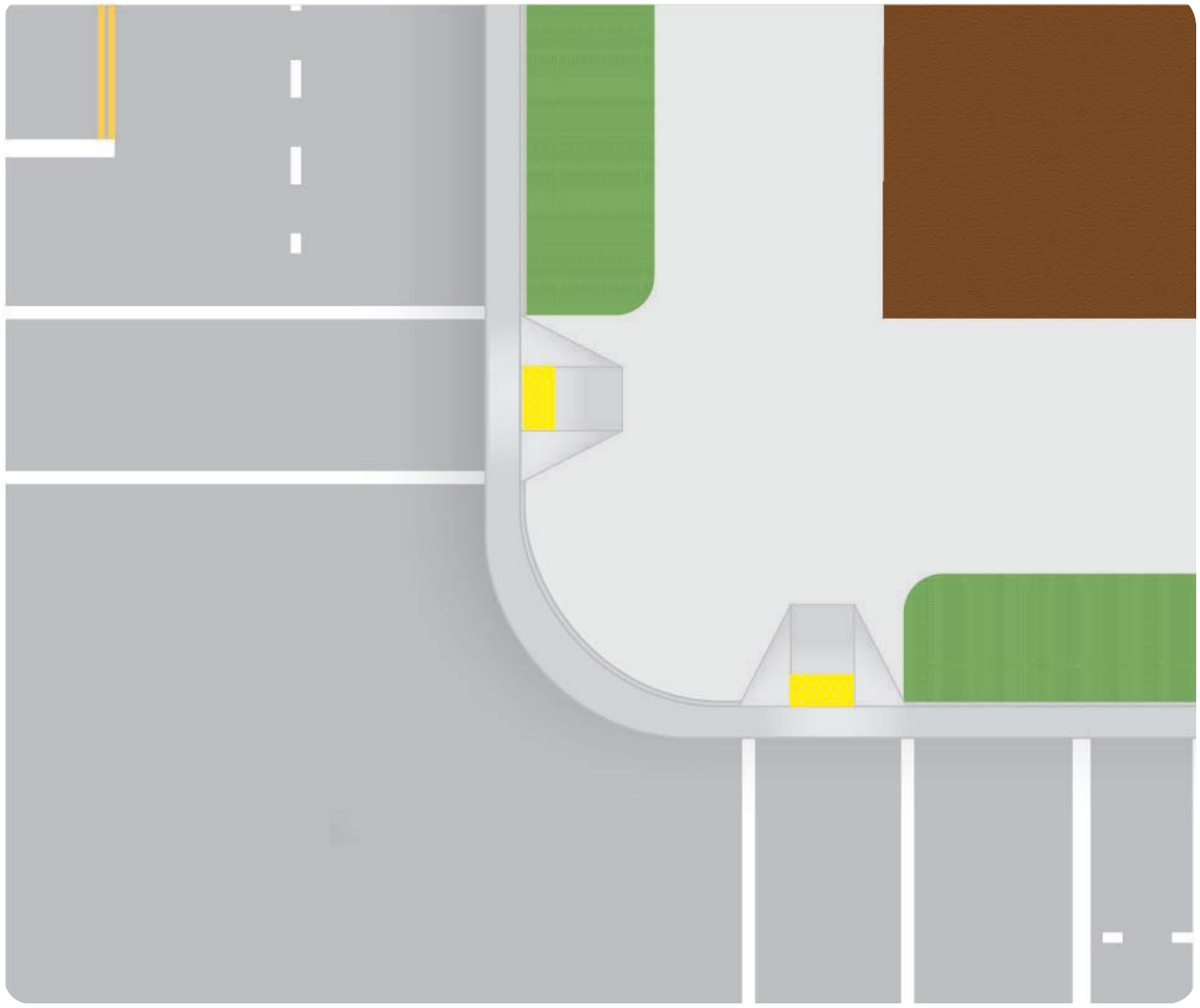
- Declining vision, especially at night.
- Decreased ability to hear sounds and detect where they come from.
- Less strength to walk up hills and less endurance overall.
- Reduced balance, especially on uneven or sloped sidewalks.
- Slowed reaction times to dangerous situations.
- Slowed walking speed.

Accessible Pedestrian Facility Best Practices

Crosswalks and ramps at intersections should be placed so they provide convenience and safety for pedestrians. The following recommended practices will help achieve these goals:

- Allow crossings on all legs of an intersection, unless there are no pedestrian accessible destinations on one or more of the corners. Closing a crosswalk usually results in a pedestrian either walking around several legs of the intersection, exposing them to more conflicts, or crossing at the closed location, with no clear path or signal indication as to when to cross.
- Provide marked crosswalks at signalized intersections.
- Place crosswalks as close as possible to the desire line of pedestrians, which is generally in line with the approaching sidewalks.
- Provide as short as possible a crossing distance to reduce the time that pedestrians are exposed to motor vehicles. This is usually as close as possible to right angles across the roadway, except for skewed intersections.
- Ensure that there are adequate sight lines between pedestrians and motorists. This typically means that the crosswalks should not be placed too far back from the intersection.
- When a raised median is present, extend the nose of the median past the crosswalk with a cut-through for pedestrians.
- Provide one ramp per crosswalk, or two per corner for standard intersections with no closed crosswalks. Ramps must be entirely contained within a crosswalk. The crosswalk can be flared to capture a ramp that cannot be easily relocated. Align the ramp run with the crosswalk when possible, as ramps that are angled away from the crosswalk may lead some users into the intersection.

At intersections where roads are skewed or where larger radii are necessary for trucks, it can be difficult to determine the best location for crosswalks and sidewalk ramps. In these situations, it is important to balance the recommended practices above. Tighter curb radii make implementing these recommendations easier.



One curb ramp per crosswalk should be provided at corners. Ramps should align with sidewalks and crosswalks. (Credit: Michele Weisbart)

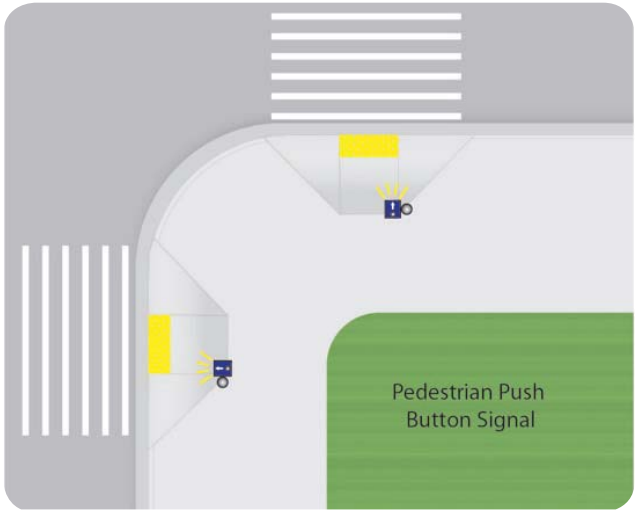
Crossing Times

In planning for people with disabilities, slower speeds must be considered. This is critical in setting the timing of the walk phase of signalized intersections. The Manual on Uniform Traffic Control Devices requires that transportation agencies use an assumed walking speed of 3.5 feet/second for signal timing. In situations where a large number of older adults or persons with disabilities cross, this may be inadequate to meet their needs. Some cities instead use 2.8 feet/second.

Cities may also use Pedestrian-User-Friendly-Intelligent traffic signals to ensure that all pedestrians have adequate time to cross. Pedestrian-User-Friendly-Intelligent crossings use infrared monitors to detect the presence of pedestrians in the crosswalk, and will hold the signal red for cross traffic until the pedestrian has left the crosswalk. Pedestrian-User-Friendly-Intelligent crossings help slower pedestrians, but also help the flow of traffic because they allow the normal pedestrian design speed to be set at a higher level.

Pedestrian-Activated Push Buttons

Pedestrian-activated traffic controls require pedestrians to push a button to activate a walk signal. As noted in Chapter 7, "Pedestrian Crossings," pedestrian-activated signals are generally discouraged. The walk signal should automatically come on except under circumstances described in that chapter. Where pedestrian-activated traffic controls exist, they should be located as close as possible to curb ramps without reducing the width of the path. The buttons should be at a level that is easily reached by people in wheelchairs near the top of the ramp. The U.S. Access Board guidelines recommend buttons raised above or flush with their housing and large enough for people with visual impairments to see them. The buttons should also be easy to push.



Pedestrian push button placement
(Credit: Michele Weisbart)

Accessible Pedestrian Signals

Wayfinding for pedestrians with visual impairments is significantly improved with the use of Accessible Pedestrian Signals at signalized intersections. In fact, Accessible Pedestrian Signals are the most commonly requested accommodation under Section 504 of the Rehabilitation Act of 1973. Accessible Pedestrian Signals communicate information about pedestrian timing in non-visual formats such as audible tones, verbal messages, and/or vibrating surfaces. Verbal messages provide the most informative guidance.

These devices should be installed close to the departure location and on the side away from the center of the intersection. Since they are typically only audible 6 to 12 feet from the push button, 10 feet should separate two devices on a corner. If two accessible pedestrian pushbuttons are placed less than 10 feet apart or on the same pole, each accessible pedestrian pushbutton shall be provided with a pushbutton locator tone, a tactile arrow, a speech walk message for the WALKING PERSON (symbolizing WALK) indication, and a speech push button information message. Volumes of the walk indication and push button locator tone shall automatically adjust in response to ambient sound.