I

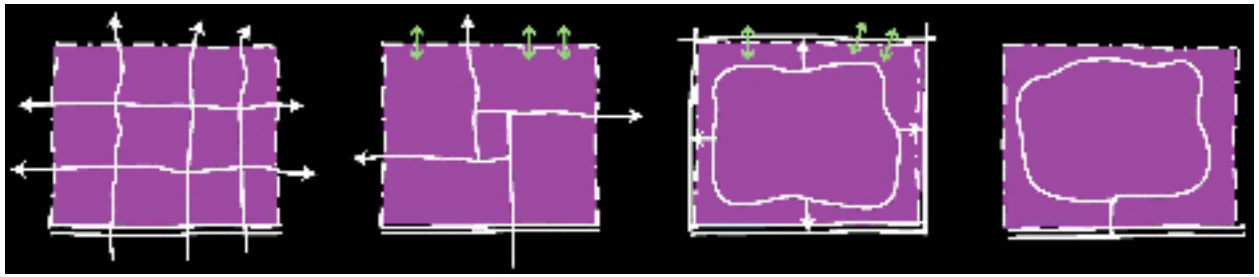
Livable Streets Toolbox

In order to create a great place, there needs to be a great emphasis on the design of streets. Streets are key determinants of neighborhood livability. They provide access to homes and neighborhood destinations for pedestrians, and to a variety of vehicle types, from bicycles and passenger cars to moving vans and emergency response trucks.

The design of streets, together with the amount and speed of traffic they carry, contributes significantly to a sense of community, neighborhood feeling, and perceptions of safety and comfort. The fact that these may be intangible values makes them no less real or important when considering variables that affect street design.

Because of their key role in overall sense of community, many disciplines must collaborate to achieve the best street patterns.

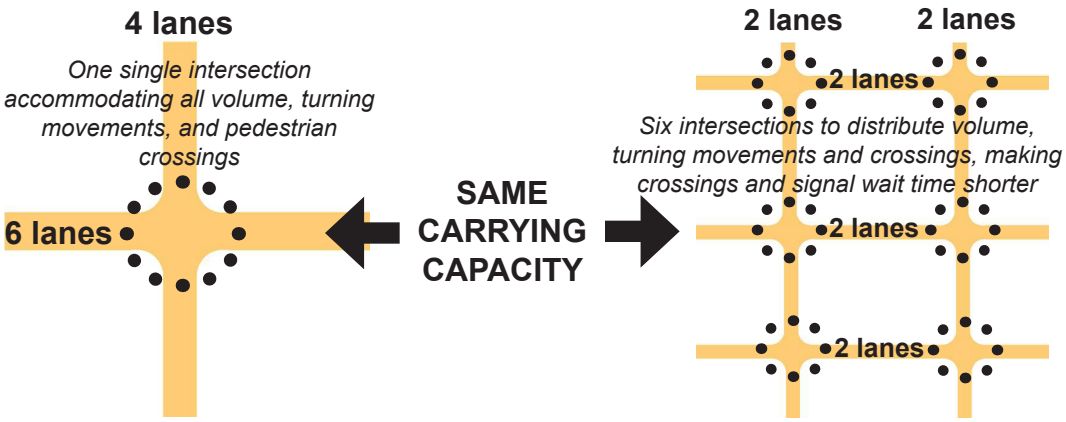
The degree to which communities are connected has strong implications for how well they serve pedestrians. The greater the number of opportunities to form direct paths, to choose between alternative routes, and generally to navigate through our built environment, the more attractive and practical walking becomes as an option. Minimizing the length of trips saves energy and time. The following illustrations underscore the importance of connectivity and why it should be enhanced.

Traditional	Interior	Perimeter	Single Entry
			
200' – 600' street spacing	1000' street spacing	1000' – 2000' street spacing	No network of streets
200 – 600' spacing between bike/ped crossings	400 – 600' Spacing between bike/ped crossings	600 – 800' Spacing between bike/ped crossings	Single bike/ped crossing at entry point
All Streets Fronted	Connectors Fronted	Connectors Walled	No connection of streets.

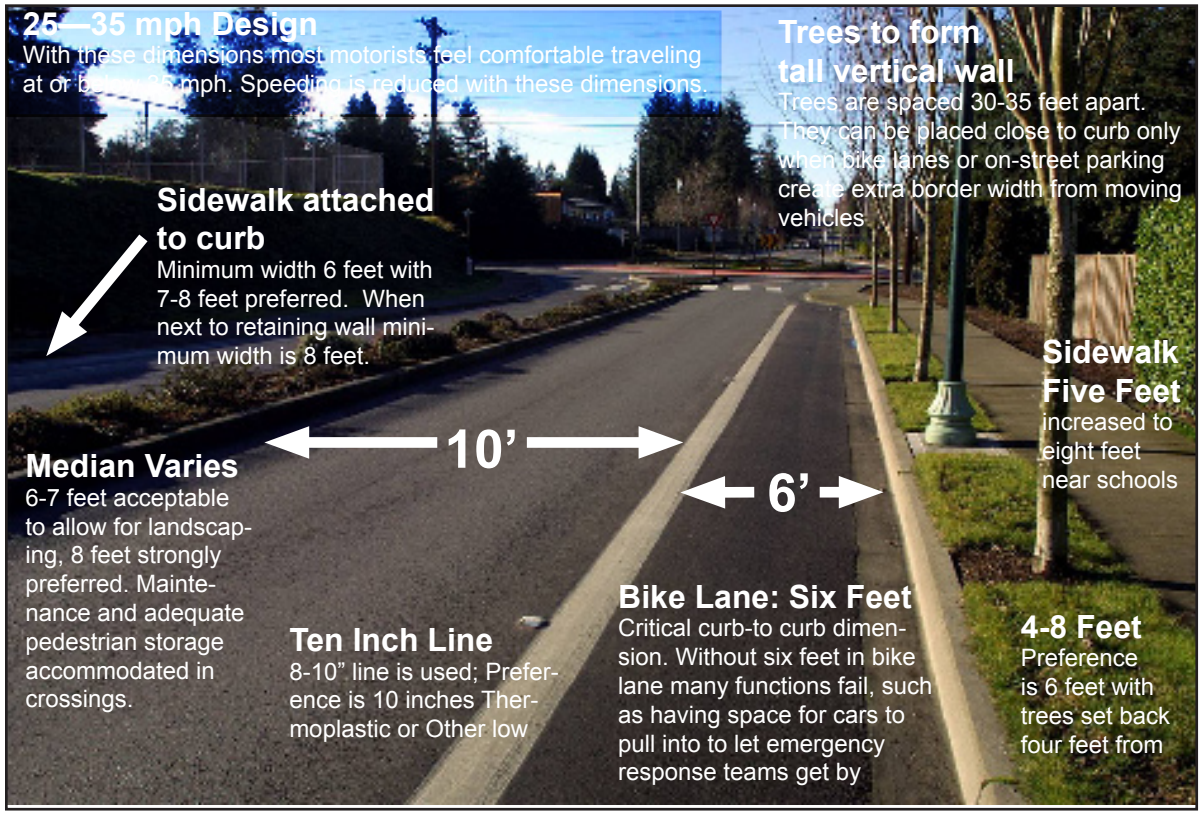
This illustration underscores the consequences if we fail to provide connectivity. Though the actual distance between the house circled in yellow and the house circled in blue is less than two hundred feet, the street path that must be taken is many times that. Improved connectivity would make walking between these two points a more practical option, compared to the current street design which makes walking highly inconvenient. Walkability depends on connectivity to make moving around on foot an attractive and useful choice.

This diagram of Meriam Park in Chico, California illustrates the principle of connectivity. Not only are there well-established paths for pedestrians and motorists alike to cross the streets on the edge of the neighborhood, the close block spacing provides more options and disperses traffic. Diagram courtesy of New Urban Builders

Connectivity provides greater options for vehicle movements. The two diagrams below illustrate the same number of lanes in each direction: four total lanes north and south, six total lanes east and west. In the diagram on the left, all of these lanes must be managed through a single intersection. Assuming this intersection is signalized, the wait times are longer. In the well-networked diagram on the right, vehicle wait times are much shorter with increased turning opportunities at each intersection.



The difference also has implications for pedestrians. Instead of crossing narrower streets that have collectively distributed traffic flow of a larger area, pedestrians must cross larger, busier roads that are less safe and potentially require greater crossing time.



10-foot travel lanes provide a good balance between vehicle and pedestrian safety and comfort.

Lane width is an important element of roadway design in determining vehicle speed and overall safety. Lane widths of ten feet allow ample separation for both cars and trucks on urban streets. Eleven-foot lane widths are acceptable, and twelve-foot widths should be avoided on urban streets.

Many urban streets have been designed to the specifications of rural roads and highways, namely with wider lanes and overall wider roadways. Motorists feel more comfortable speeding on oversized streets, but streets can be designed to encourage drivers to go slower and create a more walkable environment. Reducing lane widths and including bike lanes, sidewalks, medians and shade trees can be used to naturally decrease speeds.

Reducing excessive travel lane widths also allows the same roadway to accommodate additional functions. For example, turning lanes that keep through traffic flowing without impediment can be added or on-street parking that enhances viability and access to land uses along the street.

Planning solely for the motor vehicle has lead to numerous unintended problems including stark streets, high traffic speeds, and reduce d accessibility. These negative impacts have the additional effect of discouraging people from walking or biking, further adding to traffic congestion as they use their cars instead.

Ten foot travel lanes, curb extensions, trees, shrubs, and improved markings bring speeds to more appropriate levels, reduce crossing distances and allow areas to be reclaimed for mixed use. Speed reductions of 2-7 mph are common with a comprehensive treatment.

Mounting evidence is available regarding the safety and effectiveness of narrow lanes. The tendency to use 12 foot travel lane widths as the starting point for urban travel lanes may no longer be justified for safety or capacity. Narrow lanes carry vehicles at lower speeds, which result in fewer fatal crashes.

Conclusions

The results of this analysis suggest that changes in highway infrastructure that have occurred between 1984 and 1997 have not reduced traffic fatalities and injuries and have even had the effect of increasing total fatalities and injuries.

This conclusion conflicts with conventional engineering wisdom on the benefits of "improving" highway facilities and achieving higher standards of design (Transportation Research Board, 1987). While not all explicit highway design improvements were analyzed, the fact that adding new and higher design standard lane miles leads to increased fatalities and injuries suggests that new "improved" design standards are not achieving safety benefits.

— Robert B. Noland

TRAFFIC FATALITIES AND INJURIES: ARE REDUCTIONS THE RESULT OF 'IMPROVEMENTS' IN HIGHWAY DESIGN STANDARDS?
(November, 2000)

Olive Avenue. Lanes were narrowed to 10 feet in downtown West Palm Beach, Florida in 2005-06. This city is now completing a series of lane width reductions on four different typical sections of Olive Avenue (formerly 3 to 5 lanes wide).

ADA requirements were often originally met in haste without proper alignment of paths. Many municipalities are now correcting these placements.

Crossings should be wide enough to accommodate the expected volumes, including people with disabilities.

Pedestrian-friendly crossings feature a continuous path with the sidewalk. If it is not possible to create a continuous path, deviation should be minimized.

In general, crossings should be of adequate width for the volume of pedestrians that the street is carrying. They should not be significantly narrower than corresponding sidewalks, though accessible ramps can be narrower.

Tactile edges allow the vision-impaired to sense the edge of the "safe zone" for pedestrians and know they are crossing traffic.

Crossing enhancements (especially stripes) should be maintained to draw motorist attention to pedestrian zones. Crossings that are not maintained lead to less certain (and less visible) pedestrian paths.

Crossings can be either informal (bottom) or formal (top). In many cases it is preferred to formalize crossings in order to direct pedestrians to the best places to cross. These areas should have a minimum of six seconds of detection (discovery) time.

On streets with on-street parking, curb extensions reduce the total crossing distance, which helps pedestrians in two ways: it reduces the time they are exposed to moving traffic, and it makes it easier for pedestrians to assess and find an acceptable gap, because the time needed to cross is shorter. They also increase visibility: the waiting pedestrian can better see approaching motor vehicle traffic and motorists can better see pedestrians waiting to cross the road; their view is no longer blocked by parked cars. Curb extensions should be designed to accommodate storm water drainage and should never extend into a bicycle lane.

Mid-block crossings are appropriate on longer block lengths. Though intersections are the preferred locations for pedestrian crossings, when block lengths exceed 400 feet it is a good idea to consider formalized mid-block crossings to avoid "impromptu crossings" from pedestrians that may be unsafe. Using a diagonal shift from one leg of the crossing to the next (image at top right) allows pedestrians to have refuge, and physically shifts the pedestrian's view toward motorists, forcing them to look in the direction of oncoming traffic. The eye contact established with the motorist also helps to tame his or her behavior, resulting in a safer pedestrian environment

Mid-block crossings seek to minimize the distance between intersections, but careful placement (especially in front of important civic buildings, transit facilities, and other destinations) renders them far more useful and allows them to contribute better to overall pedestrian safety than when their placement is arbitrary (or at least determined solely by distance).

To aid motorist detection of islands, it is best to have both colorful ground cover and vertical trees. When using ground cover preference is given to native species that are slow growth varieties. Irrigation may be required with many plant types. Many areas may prefer low maintenance designs. Vegetation should be kept trimmed so it does not block the view of pedestrians or drivers.

Pedestrians and bicyclists seek to cross streets without going too far out of their direction of travel. Crossing islands or crossing points allow pedestrians to cross where conflicts are minimized. Crossing islands reduce the potential for a crash by up to 40%. A pedestrian crossing island breaks an otherwise difficult crossing maneuver into two easier, shorter steps. Instead of needing to find a gap long enough to cross all lanes at once, a pedestrian looks left, finds an acceptable gap in one direction only, crosses to the island, then looks right and finds a second gap. Principles include:

ADA – crossing angle can be detected by blind.

Basic and advanced measures:

1. Assure 6 or more seconds of sight lines (discovery time) at crossing points
2. Use good lighting of crossings
3. Use high emphasis crosswalk markings
4. Use at least minimum required signing and pavement markings (MUTCD). Additional measures are encouraged.
5. Use curb extensions on streets with parking to maximize view of pedestrians and motorist conflicts, and to minimize crossing distances.
6. Use raised tables on appropriate streets

Activated by Pedestrian

Information provided

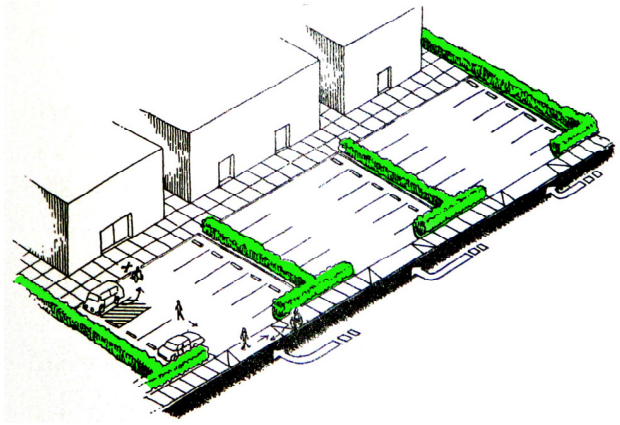

Activated Automatically

Driveways, alleys and other crossings. Many driveways are incorrectly designed to look like a street intersection. They are often overly wide, poorly lit, and pose multiple threats (up to six conflict points) to pedestrians. Transitioning from suburban areas where pedestrians were largely omitted from roadway designs includes changing driveway designs to look, act and feel like driveways. Suburban driveways were often designed to allow high speed exits to and from adjacent roadways. Transitioning to pedestrian friendly corridors requires the following measures:

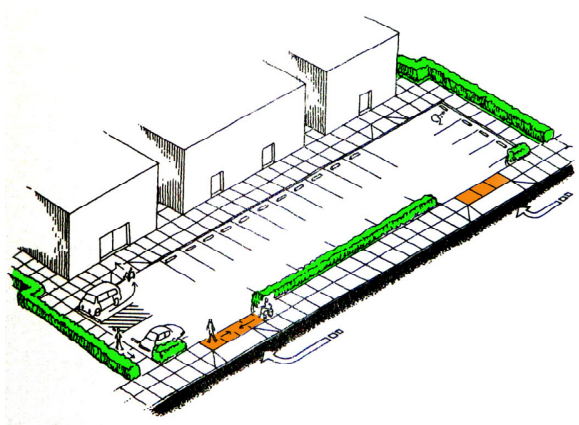
Driveway details:

1. Keep entry and exit speeds low. General approach speeds should be 5-8 mph, or less.
2. Speed can be controlled by a change in grade (gradual ramps increase speed potential).
3. It is best to use color, patterns and texture to highlight and make clear to motorists that they are intruding into the right-of-way of pedestrians, and that they have a legal duty to allow pedestrians to complete their movements.
4. In some cases tactile areas are used to define edges of safe zones (especially for visually-impaired pedestrians). Use of color and texture helps all people, especially during twilight when changes in grade are difficult to detect.
5. When necessary, sidewalks can be brought down to lower driveway elevations in order to meet ADA needs. It is often best, however to use planter strips and have grade changes be in portions of the right-of-way occupied by planter strips. Keep sight lines open.
6. Keep higher capacity (commercial) driveways well lit, with strong, well defined edges to accentuate crossing areas.
7. Pedestrian crossings of driveways are best when kept to the full width of the sidewalk. A five foot minimum width sidewalk is necessary on long driveways (more than 20 feet wide).
8. Right-in, right-out (or single direction) driveways are strongly preferred, especially on multiple lane roadways.

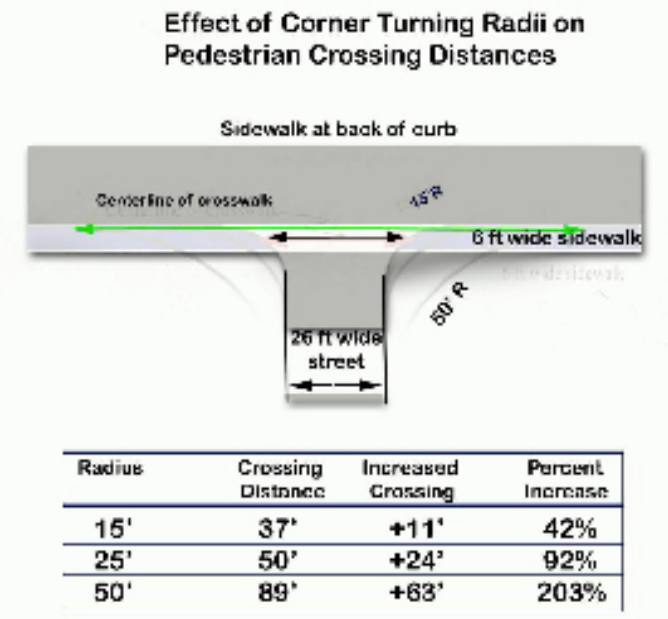
Landscape bumpouts and sensitive ramp treatments can ease driver behavior when frequent driveway cuts need to be employed.



Multiple driveway access points increase the hazard to the pedestrian.



Consolidating driveway access extends the pedestrian's path without conflict opportunity.



Radius	Crossing Distance	Increased Crossing	Percent Increase
15'	37'	+11'	42%
25'	50'	+24'	92%
50'	89'	+63'	203%

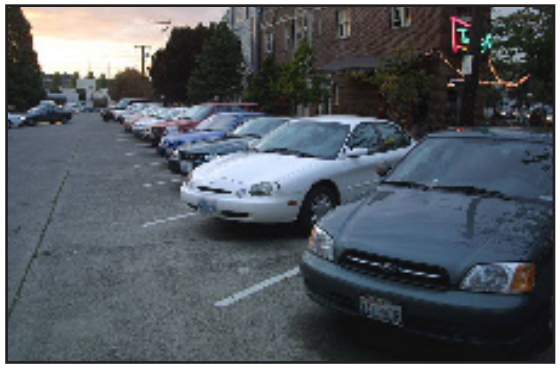
In addition to the benefit of facilitating vehicle movements by eliminating the numbers of turning opportunities that make streets and roads inefficient, managing and consolidating access to fewer points lengthens the pedestrian's comfort zone and minimizes the opportunity for vehicle-pedestrian conflicts.

The wider a turning radius, the greater the distance a pedestrian must travel to cross the street at a corner. The extended distance increases the potential for conflicts, especially toward the edges of the crossing areas (the corners) where motorist attention may be diverted to checking for oncoming traffic before making turns.

In addition to managing access by limiting the number of driveways, it is important to ensure that turning radii at corners are adequate to allow safe movement but not overly wide.

Traditional streets favor on-street parking over off-street parking. On-street parking can be used as part of the strategy to reduce motorist speed through increased "side-friction." Sight lines are preserved at intersections with 30 to 50 foot parking setbacks from intersecting legs.

Compared with on-street, off-street parking requires three times the land and creates three times the heat gain, increases water runoff and other negative environmental impacts. Walkable communities tap into significant on-street parking. Visual effects from on-street parking provide multiple benefits of including traffic calming, improved safety, buffers to sidewalks and shopping convenience.



Head-in angled parking is familiar to most motorists along with its primary benefit (larger parking supply) and its primary safety problem (blindly backing out into a travel lane). A growing number of cities are converting their head-in parking to back-in parking.

Back-in angled parking is safer and easier to manage than head-in angled and parallel parking. The most important safety advantage is the driver's ability to see into the travel lane when pulling out of the parking stall.

Road diets, bike lanes and on-street parking can be used in combination. A number of minimum dimensions are needed to maximize speed reductions, safe entry and exit from autos, and comfortable bike lane use.

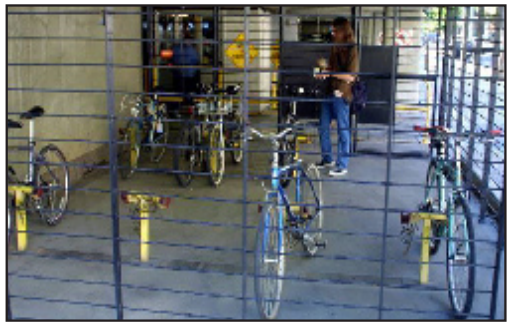
The following principles apply:

1. Quiet neighborhood collectors. If volumes and speeds are low (25 mph or less), keep roadways compact, and do not use bike lanes. Bicyclists do well when there are few autos, and in this case bicycle lanes result in wider streets and higher vehicle speeds which discourage bicycling.
2. On major collectors and arterials, the higher the volume and speed the more important bike lanes become. Minimize width of marked parking to six feet, then maximize the width of bike lanes (7 feet is preferred, and no less than 6 feet should be used next to parking).
3. With two-lane ten foot lane diets shown to the right, parking is kept to six feet. A two foot valley gutter adds bonus width to both the bike lane and/or parking lane. This combination, next to travel lanes creates low speed travel and a designated place for bicyclists.
4. Although narrow lanes and on-street parking with bike lanes may be comfortable for many, it is the very low turnover of parking and moderately low traffic volume that creates the greatest comfort. Taking one additional foot out of the travel lane increases comfort, and reduces the tendency to travel fast. The primary purpose of an auto trip here is to search for elusive parking spaces.

Bicycle parking. Convenient and secure bicycle parking should be provided at several locations on each block of all commercial areas. Employers with more than 25 employees and all schools should also provide bicycle parking. All bike parking should be attractive, convenient, and in plain view for security reasons. It can also be whimsical and fun as some of these photos show.

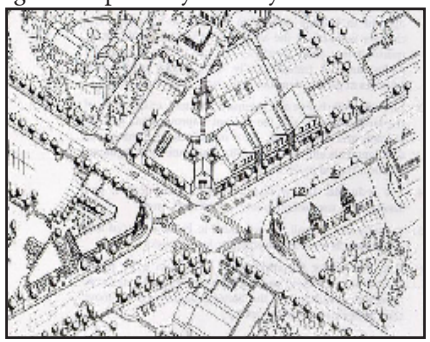
Apartments and employers should provide interior, secure parking.

- Large work centers (50 or more employees) should provide showers and lockers.
- Parking garages should have fenced in, secure parking near toll operations. Access by key code or other convenient, secure systems are needed.
- Significant transit stops should have parking. Major transit stops should provide lockers.
- Parking garages and all employment centers with 25 or more employees should have secure parking (lockers, garage space or interior building parking).



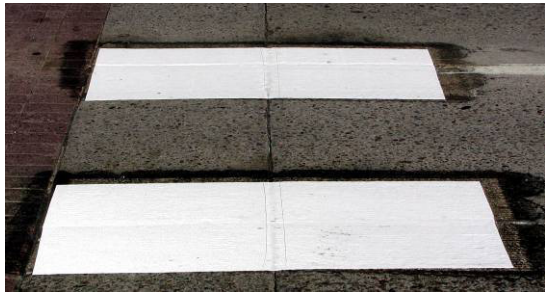
Intersections. To enhance walkability the following generic geometric, operations and maintenance practices are recommended .

- All lanes and intersections should be built as narrow and compact as practicable to perform their mission to safely and efficiently move and provide for all modes of travel.
- Curb radii should be kept tight, generally using 15 foot radii when practicable. Wider radii should be used in industrial areas, as appropriate, to meet truck turning needs. Effective turn radii are enhanced through curb extensions, bike lanes and parking lanes.
- Curb extensions should be used whenever practicable to reduce crossing distances and times, add greenery, and to allow shorter signal clearance intervals.
- Enhanced crosswalk markings should be used for crossings of all primary road systems.



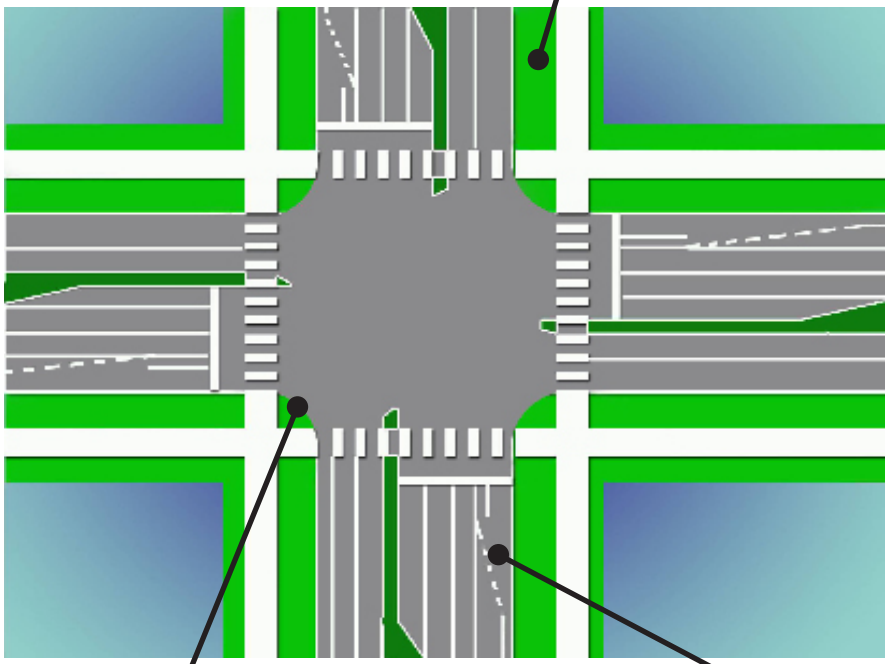
Side street crossings can be maintained with either enhanced or standard, well maintained crosswalk markings.

- Countdown signals should be installed on all crossings greater than 50 feet.
- Pedestrian Lead Intervals should be used where there is a history of turning motorists cutting off pedestrians.
- Medians and median noses should be provided on all intersections where they are practicable. Signal recall controls should be used in medians.
- Primary streets do not require pedestrian push button controls as they should automatically signal for pedestrian crossings on each cycle.
- Pedestrian signals automatically activate where sufficient time exists for pedestrian crossings. Push buttons are used in many walkways and trails, but not on main streets.



Large intersections do not have to be impediments to connectivity, but they must be given special treatment to optimize safety and accessibility.

Medians as refuge islands
Medians should be extended through the alignment of the sidewalk to allow them to function as pedestrian islands.

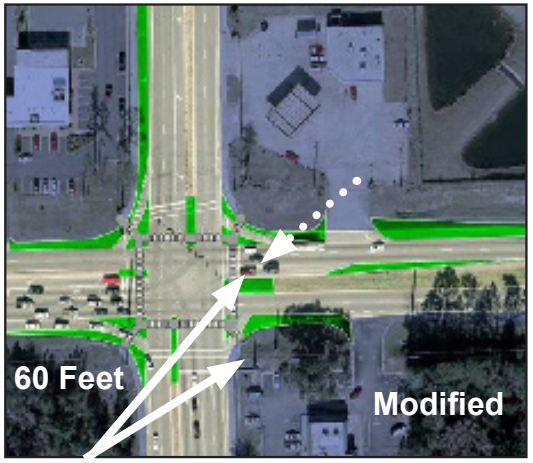


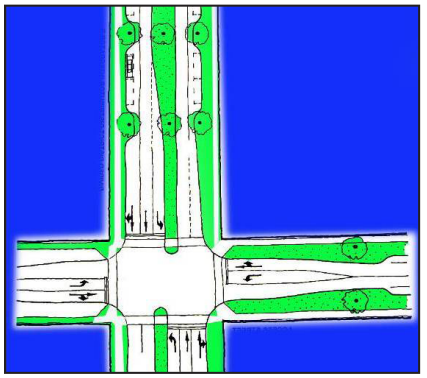
Correct crossing placement
Crossings should **be** *ahead* of the stop bar to keep motorists (especially right turns) from violating the pedestrian's right-of-way

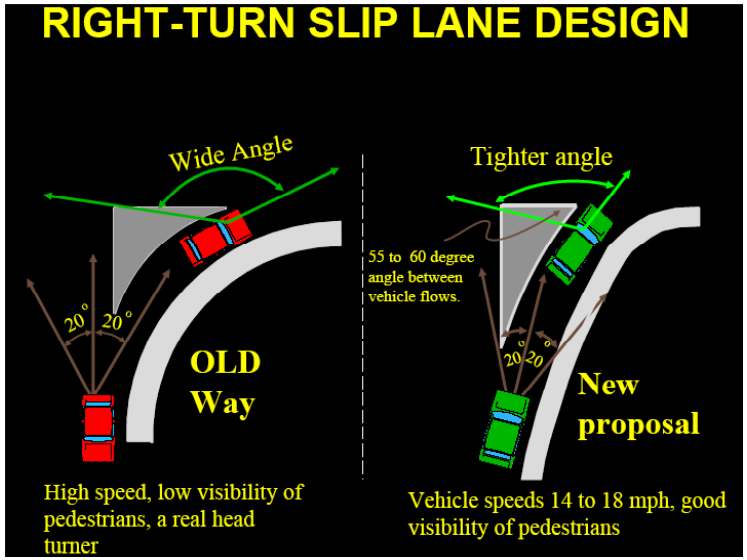
Bicycle lane transitions
Bicycle lanes should be aligned to direct traffic through the intersection, meaning right-turn vehicle lanes are aligned outside of them. Proper striping to guide the bicycle lane and to alert the motorists of this change in alignment will allow for a safe and effective transition.

Overly wide intersections create unsafe conditions, discourage walking and bicycling, and lead to long delays of motorists. The pedestrian clearance interval for this crossing is 60 seconds.

Crossing islands (pork chop islands) medians and more compact designs shorten pedestrian crossings to 30 second allowing motorists to be underway with less delay.

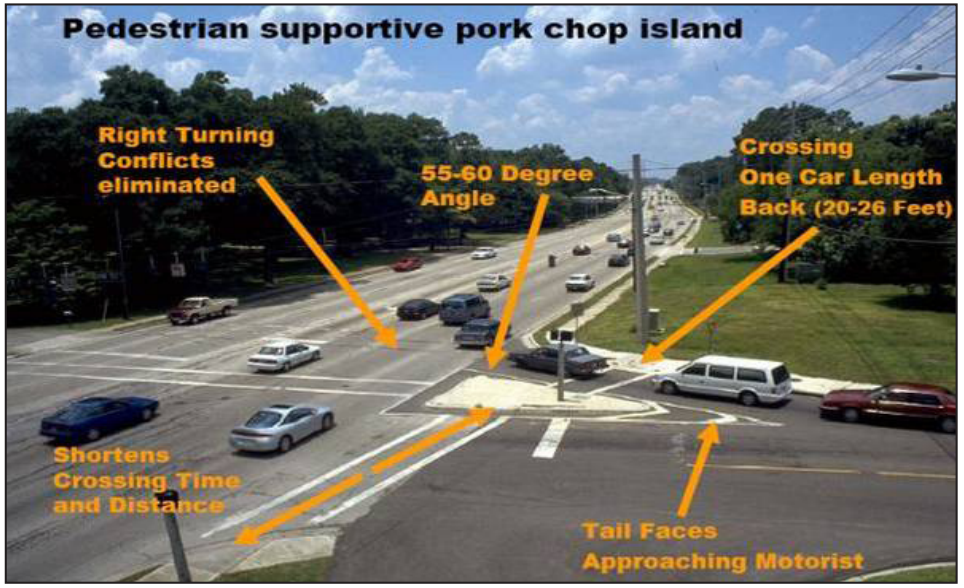


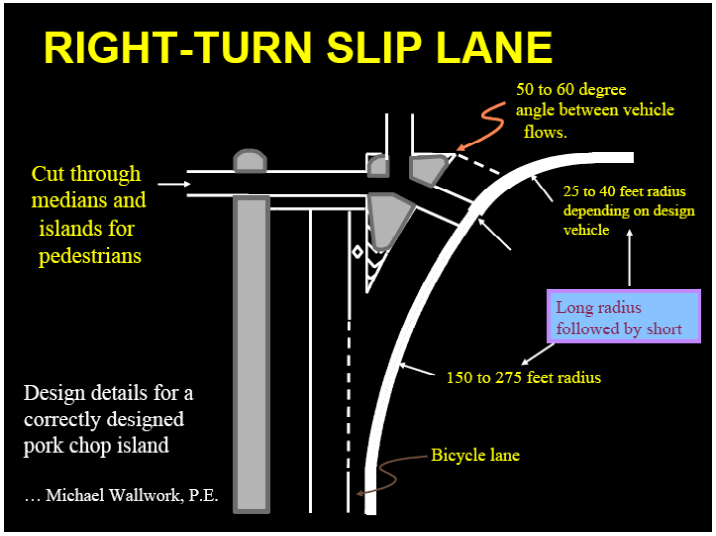




Geometry. Entry ramps (pork chop islands) in urban areas should control speeds to safe and efficient levels. In general, 10-12 mph entry speeds give the best opportunity to merge safely in standard intersections, while 15-25 mph may be acceptable over some ramp areas and allow trailing motorists time and distance to respond. These speeds also produce the greatest yielding rates to pedestrians and bicyclists.

At larger intersections, right-turn slip lanes provide additional storage room for vehicles attempting right turns and, in volumes that do not exceed the length of the lane, allow the outer travel lane of the street to be reserved for through traffic. While they have advantages to motorists and are beneficial from a traffic engineering perspective, they can be a detriment to a safe and convenient pedestrian environment. Right turn slip lanes increase the distance pedestrians must travel from corner to corner when crossing a street, and the curve in most designs (old way in diagram to left) suggests that motorists may make the turn without slowing. The new design shown here lowers speeds, makes pedestrians more visible and allows drivers to find a gap without turning their necks as much.





The illustration at top left provides design details when bike lanes are used at conventional intersections. Entry principles remain similar in a SPUI (Single Point Urban Interchange). Other ways to reduce crashes include high emphasis crossings and focus on entry angles of pedestrians (face toward motorists).

When these slip lanes are augmented by pedestrian crossings that take advantage of them, they function as refuge islands between vehicles making right turns and those moving through the intersection, and they allow the paths of sidewalks to remain aligned mostly parallel to the streets with minimal diversion.

The photo to the right illustrates a low speed entry ramp accentuated by a raised crossing to assure low speeds.

At certain intersections, placement of a roundabout greatly facilitates
through traffic and turning movements without requiring signal control delays. Roundabouts are made up of a circulating roadway with a raised island that is often used for landscaping or other decorative features. The circulating roadway is typically wider than approach roadways and features an additional "raised truck apron" on the outer section of the circle; both of these features allow for operating contingencies, especially with trucks, emergency response vehicles, and other large vehicles.

Roundabouts most often increase intersection capacity up to 30 percent: as the only requirement for yielding the right-of-way is to traffic already in the circulating roadway, vehicles can continue moving through intersections carrying a light volume, requiring no queue at the approach roadways and potentially allowing all intersecting streets to use the intersection at once.

Roundabout benefits are so significant that some states and cities require that any intersection rebuilds must be first modeled to see if a roundabout will work. Benefits include:

1. Reduction in personal injury crashes (80-90%)
2. Reduced delays
3. Increased capacity (often 30% is a safe estimate).
4. Increased property values. At times higher development potential can pay the cost of new roundabouts.
5. Improved conditions for motorists, pedestrians and bicyclists.
6. Space conserving. As a general rule a single lane roundabout fits into a 130-foot intersection (measured diagonally from one corner to another). Some roundabouts can fit into less space (see above Bradenton Beach, Florida roundabout.

Bradenton Beach, Florida. This high-volume intersection was one of the town's most dangerous for pedestrians, though immediately adjacent to its prime amenity.

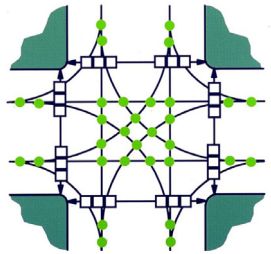
Myth breaker. This Brighton, Michigan roundabout disproved the myth that roundabouts with dominant primary street volumes will not let side street traffic enter during peak periods. It handles 20,000 vehicles per day and vehicles on the secondary street find numerous gaps when cars enter or exit the roundabout, a pedestrian crosses or a cars slow to park.

Installation of a roundabout calmed traffic speeds and facilitated pedestrian crossing. It also improved property values and catalyzed redevelopment.

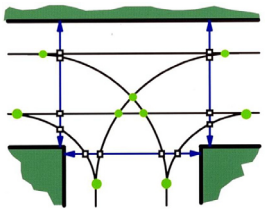
Roundabouts provide safer and more amenable pedestrian crossings, namely from use of the splitter island on each approach as a pedestrian refuge. Including one car length between the yield line and crossing optimizes roundabout efficiency for vehicles, allowing vehicles waiting to enter the circulating roadway to be closer and preserving a safe distance between pedestrians and vehicles traveling out of the circulating roadway to one of the cross streets.

One very important safety feature of roundabouts is their reduction of conflict opportunities. When crossing, pedestrians face only one potential conflict (traffic either entering or exiting the roundabout, divided by the splitter island).

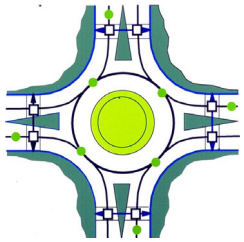
Pedestrian crossings at roundabouts require as little as 13-14 feet of exposure per crossing versus 60-100 feet at signalized intersections capable of carrying similar traffic volumes. Speeds and crashes are greatly reduced.



FOUR-WAY INTERSECTION
32 Vehicle-Vehicle conflicts
24 Vehicle-Pedestrian conflicts

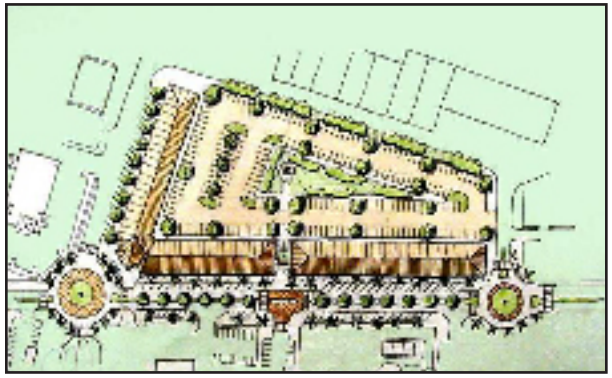


THREE-WAY (T) INTERSECTION
9 Vehicle-Vehicle conflicts
12 Vehicle-Pedestrian conflicts



ROUNDABOUT
8 Vehicle-Vehicle conflicts
8 Vehicle-Pedestrian conflicts

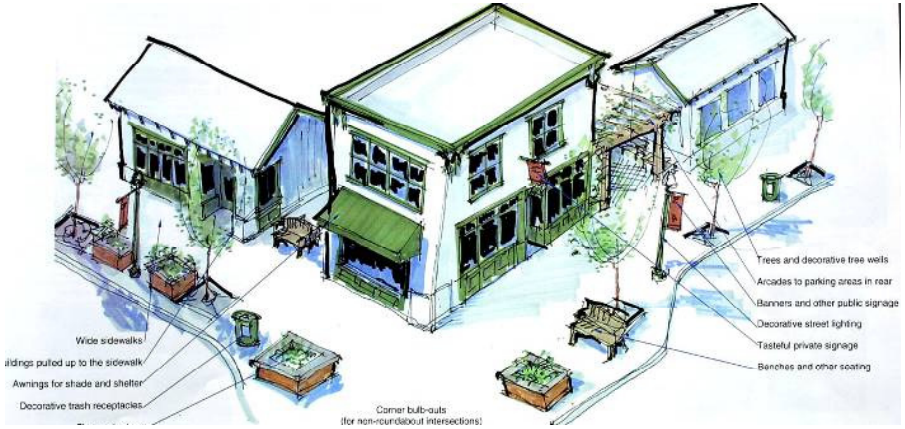
A 2000 report by the Insurance Institute for Highway Safety reported that: "Results of this study indicate that converting conventional intersections from stop sign or traffic signal control can produce substantial reductions in motor vehicle crashes."



Streets are the most fundamental and basic public space in our built environments. Not only do streets provide the crucial function of circulation, they also create a sense of place through their celebration of local architecture, local customs or simply the integration of natural and built environments.

Streetscaping refers to the planting of street trees, median treatment, corner treatment, decorative signs, park benches, pathways, color, lighting, transit stops, etc. All these amenities increase motorists' awareness of the various purposes of the street besides moving cars.

Engaging streets also provide opportunities for discovery and surprise. Public art, street furniture decoration or other functional elements can be used to proclaim a place's history, its people and its values. These additions to the street define its character and charm.



The best urban environments have a very strong sense of place: the feeling of ownership and belonging that people have for their communities and the sentiment of pride and distinction that visitors experience, creating memories of their visit and knowing without a doubt where they are.

Signs that celebrate local culture, environment or monuments affirm a walkable environment by speaking about the character of a place. Gateways offer a sense of arrival and help to mark transitions between one part of a place and another, such as crossing town limits or moving from one neighborhood to another.

While communities without a strong sense of place may have all of the characteristics of a walkable environment, the nod to local culture signifies that certain places have utilized their walkability to more than a functional level: their streets have become public space and incubators of social activity, exchange and community interaction.