CHAPTER 5: STREET CROSSINGS

INTRODUCTION

Walkways along a road provide mobility, but a successful pedestrian network also requires safe and convenient street crossing opportunities. Wide roads carrying large traffic volumes can be obstacles to pedestrians who need access to destinations on the other side of the street. Pedestrians are less visible and less protected than motorists; well-designed roads take this into account.

Most pedestrian crashes occur when a pedestrian crosses a road, often at locations other than intersections. Midblock crossings are a fact that planners and designers need to consider: people will take the shortest route to their destination. Prohibiting such movements is counter-productive if pedestrians continue to cross the road with no protection. It is better to design roadways that enable pedestrians to cross safely.

Safe street crossings also benefit transit users; in most cases access to or from a bus stop requires crossing a street. Many pedestrian crashes are associated with bus stops. See chapter 4 “Transit Stop Crossings” for a discussion on transit planning and bus stop locations.

Safe street crossings also benefit motorists who park on one side of a street to access destinations across the street. Sidewalks and crossing opportunities allow drivers to park once and walk to several destinations.

CROSSWALKS DEFINED

Oregon law defines a crosswalk as the prolongation of a curb, sidewalk or shoulder across an intersection, whether it is marked or not. Outside an intersection, a crosswalk is created with markings on the road. See ORS 801.220 for the complete legal definition of a crosswalk.

LEGAL CROSSINGS

"Jaywalking" is not a legally defined term in Oregon law. It does not mean crossing a street midblock. The Oregon Vehicle Code states that it is illegal for pedestrians to:

- Cross a street against a traffic signal;
- Cross the street outside of a crosswalk without yielding to vehicular traffic;
- Cross the street outside of a crosswalk at an intersection; and
- Proceed in a crosswalk in a manner that causes an immediate hazard to an approaching motor vehicle.

The right of way laws are:

- At non-signalized crosswalks, marked or unmarked, drivers stop and remain stopped for pedestrians (ORS 811.015, 017 & 028).
- At signalized crosswalks, when the pedestrians are proceeding in accordance with the traffic signal, drivers stop and remain stopped for pedestrians (ORS 811.028). Pedestrians are required to obey traffic signal indications (ORS 814.010).
- At other locations, crossing is allowed, but pedestrians yield to vehicles (ORS 814.040). Some local jurisdictions have passed ordinances prohibiting crossings outside of crosswalks between signalized intersections.

In many instances, a midblock crossing has fewer conflicts than a crossing at an intersection, as the pedestrian has to seek a gap in just the traffic proceeding down the street; at intersections, there are additional conflicts with vehicles turning left and right into the pedestrian’s path. On one-way streets the upstream side of the intersection has fewer conflicts; there are no turning traffic and the pedestrian only has to find a gap for one direction of traffic. Stop controlled intersections (traffic signals and STOP signs) are usually the safest locations to mark crosswalks.

Oregon’s crosswalk laws provide a buffer of safety for pedestrians on the roadway. When turning at a traffic signal drivers must stop and remain stopped for pedestrians until they have cleared the lane into which their vehicle is turning and at least 6 feet of the next lane. At any other crosswalk drivers must stop and remain stopped for pedestrians until they have cleared the lane in which they are traveling or turning and the next lane.

PLANNING AND DESIGN ISSUES THAT AFFECT CROSSINGS

Safe and convenient pedestrian crossings must be considered when planning and designing urban roadways. The following issues should be addressed when seeking solutions to specific problems:

Level of Service (LOS), Speed & Appropriate Design Standards

Appropriate design standards take into account the needs of all users. Pedestrian access and mobility should be considered when determining the desirable LOS and speed for a roadway. In some areas, pedestrian needs should be elevated above the needs of motorized traffic (e.g. downtown or near schools).

There is often an inverse relationship between traffic volumes and/or speeds and the ease of pedestrian crossing, which can lead to conflicting goals when determining priorities for a roadway:

- Some design features, such as raised medians, benefit all users.
- Some designs intended to increase traffic flow may reduce pedestrian crossing safety and opportunities (e.g. it is difficult for pedestrians to cross a high number of travel lanes);
- Some designs that facilitate pedestrian crossings may reduce motor vehicle capacity (e.g. pedestrian signals);

In many cases actual travel speeds are higher than is appropriate for the adjacent land use, and improvements to facilitate pedestrian crossings may help reduce traffic speeds to desirable and legal limits. These include refuge islands and curb extensions. Many residential streets carry faster-moving traffic than the street is designed to carry. The design of a road should not encourage excessive speeds; even a major street can be treated for pedestrian safety without degrading capacity.

Land Use

As the number and density of pedestrian-accessible origin and destination points along a road increases, so does the demand for pedestrian crossings. On corridors with concentrated nodes of activity, special crossing treatments are easier to justify at locations where crossings will likely occur. Examples include apartment complexes, senior citizen centers, schools, parks, shopping areas, libraries, hospitals and other public or institutional uses. On corridors with scattered development and residences, it is difficult to predict where crossings may occur.

Planners and transportation officials must work together to ensure that land use is compatible with the roadway design, and vice versa.

Transit Stops

Most transit users will have to cross the road to access a transit stop on one leg of their trip. Cooperation between public transit agencies and transportation designers is essential to ensure safe pedestrian crossings. By coordinating land use, roadway design and transit stops, passengers will be more secure when boarding or leaving a bus, and walking to or from their destination at either end of the transit trip. See chapter 4 “Transit Stop Crossings” for a discussion on transit planning and bus stop locations.

Signal Spacing

Signalized intersections may be the preferred pedestrian crossing points at peak traffic hours; other crossing opportunities close to signalized intersections benefit from a "platooning" effect, as traffic signals create gaps in traffic. The effect decreases:

- As the distance from the signalized intersections increases;
- As traffic volumes increase; or
- If poor access management allows vehicles to continually enter the roadway between signals.

Access Management

Many uncontrolled accesses to a busy road decrease pedestrian crossing opportunities and increase risk: when a gap is created in the traffic stream, motorists entering the road from driveways fill the gap, making it hard for the pedestrian to cross.
A well designed raised median benefits pedestrians, as it provides a refuge, so they can cross one direction of traffic at a time (pedestrians seeking refuge in a center turn lane are unprotected). However, eliminating road connections and signals also eliminates potential pedestrian crossing opportunities and increases risk. Creating an urban expressway can increase traffic speeds and volumes. Concrete barriers placed down the middle of the road (rather than a raised median) effectively prohibit pedestrian crossings.

Out-of-Distance Travel

Though some crossing solutions appear to offer greater safety, such as traffic signals or overcrossings and undercrossings, excessive added travel distance will discourage pedestrians who want to take a more direct route; they may end up making unsafe crossings. A crossing such as a traffic signal or grade-separated structure must offer obvious advantages over an at-grade crossing.

Midblock vs. Intersection Crossings

The Oregon Vehicle Code allows pedestrians to cross midblock outside of a crosswalk, but they must yield to motor vehicles (ORS 814.040).

Intersections are recognized by road users as areas where conflicts may occur, and prudent drivers proceed cautiously though intersections, expecting the unexpected. This is cited as a reason to encourage pedestrians to cross at intersections rather than midblock.

But the increased number of conflicts at intersections can also make pedestrians more vulnerable, as both pedestrians and drivers have to be on the lookout for conflicts coming from several directions at once: pedestrians have to watch for drivers making turns, as drivers are also looking for multiple motor vehicle conflicts. This can cause a situation where both pedestrians and drivers are not aware of each other's intentions. Pedestrians are particularly vulnerable at signalized intersections where left and right turns are concurrent with the pedestrian walk phase.

At midblock locations, the pedestrian has to look only for traffic on the roadway, and the driver is generally looking straight ahead, at the potential crossing point.

A raised median allows pedestrians to cross midblock more easily; they still must yield to motor vehicles. Marking a crosswalk at a midblock location reverses the right of way, as drivers must yield to pedestrians. Midblock crosswalks are established by the appropriate road authority, and must be approved by the State Traffic Engineer on State Highways.

Maintenance

The effectiveness of a design will be lost if maintenance is excessively difficult or expensive. Forethought must be given to the practicality of future maintenance. Facilities will be effective over time only if they are in good repair. Examples of design features to avoid include:

- Vegetation that can obscure pedestrians;
- Restricted areas that cannot accommodate sweepers or other power equipment; and
- Remote areas requiring hand sweeping.

CROSSING SOLUTIONS

To increase pedestrian crossing opportunities and safety, two approaches can be considered:

1. Designing roads that are inherently easier and safer to cross by incorporating design features such as raised medians, or cross-section elements that slow traffic down or reduce the total roadway width; or
2. Constructing actual pedestrian crossings with features such as refuge islands, pedestrian-activated signals, curb extensions, marked crosswalks, etc.

These solutions are listed in order of complexity and cost; there is no implied preference. No one solution is applicable in all situations, as the issues will usually overlap on any given section of road. In most cases, a combination of measures will be needed to improve pedestrian crossing opportunities and safety. Guidance on crossing treatments on state highways can be found in the ODOT Traffic Manual.

Crosswalks

The two primary purposes of crosswalks are to indicate to pedestrians a desirable place to cross, and to indicate to drivers where to expect pedestrians to cross. Any marked crosswalk must fulfill these two goals before discussing the relative safety of marked crosswalks.

There is considerable debate concerning the utility and safety of crosswalks. Recent studies have indicated that a marked crosswalk alone is not enough to improve safety of pedestrians crossing busy, multi-lane roads. The latest research on this subject is available in the report “Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines FHWA-RD-01-075”: http://www.tfhrc.gov/safety/pubs/04100/04100.pdf

The basic conclusions are:

- On lower volume/lower speed roads (under 10,000 ADT/ 35 MPH), marking a crosswalk is not associated with increased risk to pedestrians. On multi-lane roads with ADT over 12,000 or speeds over 35 MPH, marking a crosswalk is not sufficient; additional measures such as median islands, curb extensions, illumination and advance stop bars are recommended. At very high traffic volumes and speeds, a signal or grade-separation should be considered.
- A traffic study will determine if a marked crosswalk is appropriate. This is usually in locations that are likely to receive high use, based on adjacent land use.

Crosswalks should be marked at all legs of signalized intersections. The decision to close a crossing must take into consideration the safety and convenience of pedestrians. Closing crosswalks usually forces pedestrians to cross three legs of an intersection to reach the opposite corner, which is inconvenient and exposes them to more traffic conflicts (see chapter 6 Intersections for more detail).

If a crosswalk is not working, some possible problems include:

- Enforcement: more rigorous enforcement of traffic laws is needed for motorists to understand that it is their duty to yield to pedestrians in a crosswalk, marked or unmarked;
- Location: marked crosswalks must be placed in locations where they are visible (avoid the crest of a vertical curve) and where obstructions such as poles do not affect sight lines;
- Traffic movement: turning vehicles at a nearby intersection or driveway can compromise the crosswalk;
- Users: some people need extra help crossing a street and crosswalks alone may not be sufficient; for example, young children and elderly pedestrians may need the positive control provided by signals or adult crossing guards.

Crosswalk Striping

Crosswalks should be 10 ft wide, or the width of the approaching sidewalk if it is greater.

The standard in many jurisdictions has been two parallel lines. The staggered continental crosswalk is more effective because it is more visible to drivers and helps pedestrians with vision impairments locate the crosswalk. And since stripes are placed outside of the wheel tracks, it also reduces long-term maintenance costs due to less wear and tear – they don't need to be repainted as often. Staggered continental crosswalks are recommended at midblock crossings and at intersections not controlled by a stop sign or traffic signal. Signalized intersections may be marked with two parallel lines.

Advance Stop Lines

One of the main crash types at marked crosswalks on multi-lane roads is the multiple threat crash. This occurs when a driver in the curb lane stops to let a pedestrian cross, but too close to the crosswalk, masking visibility of the adjacent travel lane. A motorist proceeding in the adjacent lane doesn't notice the first car has stopped to let a pedestrian cross. The pedestrian doesn't see the other car coming and continues to cross, which can result in a high-speed, fatal or severe injury crash.

The likelihood of a multiple-threat crash is greatly reduced with an advance stop line placed about 30' ahead of the crosswalk. This encourages drivers to stop back far enough so a pedestrian can see if a second motor vehicle is not stopping, and take evasive action. Advance stop bars are recommended at midblock crosswalks and at uncontrolled intersection on multi- lane roads.

The advance stop line should be supplemented with signs to alert drivers where to stop for pedestrians. At least one sign should be placed on the right; a 2nd sign may be placed on a median island.

Signs

Pedestrian Crossing signs should be used at locations where a crossing is not normally encountered. This is usually at mid-block locations, and where the adjacent land use is likely to generate a fairly high number of crossings, such as at transit stops.

Sign W11-2 should be used in advance of crossings or areas of high pedestrian use; sign W11-2 may be supplemented with the plaque W16-7p at a crosswalk.

Textured & Colored Crosswalks

Textured crossings, using bricks or pavers, are often assumed to be more visible to drivers; there is also speculation they raise drivers' awareness through increased noise and vibration. Experience has shown that textured/colored crosswalks fade quickly and are less visible to drivers than conventional white markings, especially in the dark. The texture increases vibration for pedestrians using wheelchairs or walkers, slowing them down as they cross the road.

Where coloring and/or texturing is used, the area where pedestrians cross must be smooth, and white lines must be used to demark the crosswalk.

Coloring the pavement surrounding the crosswalk can increase visibility by increasing contrast. Conventional striped crosswalks are set in the colored area, keeping the crosswalk pavement smooth.

Illumination

Pedestrians are disproportionately hit at night. Many crossing sites are not well lit. Providing illumination or improving existing lighting can increase nighttime safety at intersections and midblock crossings, increasing awareness by motorists.

Raised Medians & Refuge Islands

These should be considered the first option on multi-lane, bi-directional roads. On busy highways, it can take a long time to find a gap that allows a person to cross four or more lanes of traffic in both directions. A median allows a pedestrian to cross only one direction of traffic at a time, making it much easier to find and correctly identify acceptable gaps. The crossing task is greatly simplified: the pedestrian simply looks left, waits for an acceptable gap, crosses to the median island, then looks right, and seeks a second gap. Pedestrians are less likely to take risks and try to dash all the way across if they know they only need to cross halfway.

To provide a usable pedestrian refuge, raised medians should be constructed with a curb no higher than used for sidewalks (6”-7”). The surface of the median should be level and smooth. If the median is landscaped, flat paved areas should be placed occasionally to provide a place to stand and wait.

When a raised median is designed for access control, with pedestrian crossings in mind, there is usually no need to mark crosswalks or provide curb cuts; it is a feature that simply allows pedestrians to cross more easily, as the law allows, as long as pedestrians yield to traffic. Marking crosswalks reverses the yield rules, and should only be considered at specific locations where a lot of concentrated crossings are expected; curb ramps or cut-throughs need to be provided where a crosswalk is marked. Midblock crosswalks are established by the appropriate road authority, and must be approved by the State Traffic Engineer on State Highways. Curb ramps or cut throughs must also be provided at unmarked crosswalks at intersections.

Where it is not possible to provide a continuous raised median, refuge islands can be provided across from high pedestrian generators such as schools, park entrances, libraries, parking lots, transit stops etc. If a raised island is placed midblock, with curb cuts and other obvious pedestrian features, a crosswalk should be marked, as the added treatments indicate to pedestrians “this is a place to cross.”

Refuge islands should be made as big as possible, so they are visible to drivers. Other ways to increase conspicuity include painting the curb yellow, providing landscaping (but not so high as to obscure pedestrians) and signing.

Cut-throughs should be at least 5’ wide. Cut-throughs are preferred over ramps, as most islands are not large enough to comfortably fit two ramps and a 4-foot level landing between the ramps as required by ADA. One technique to increase the likelihood a pedestrian will look at oncoming traffic in the 2nd half of the crossing is to skew the cut-through to the right, forcing pedestrians to face oncoming traffic as they traverse the island. A 2-foot section of right-angled curb should be provided at each end to provide guidance for the blind.

In most instances, the width of a raised median or refuge island is the width of the center turn-lane, minus the minimum shy distance on each side. Minimum acceptable width for a median refuge island is 6 feet.

The preferred location for a raised island, based on pedestrian demand, often conflicts with vehicular turning movements if driveway accesses are present at that location. Careful negotiation with property owners is required to ensure placement of island meets the intended goal of improved pedestrian crossings, while taking into account vehicular movements. Moving an island away from the desired crossing location can be counter-productive if it’s too far, as pedestrians will not use it and cross at the desired location with no island. One option is to keep the island where needed for pedestrians, and move the driveways to allow turns to occur.

Curb Extensions

Also known as bulbouts, bumpouts, neckdowns or chokers, curb extensions should be considered at all intersections where on-street parking is allowed. Curb extensions reduce the crossing distance on streets with on-street parking. Other advantages include:

- Better visibility: pedestrians can see approaching motorists and drivers can see pedestrians waiting to cross.
- Increased yielding by drivers: pedestrians standing on a curb extension are more visible, and their intent to cross the street is more obvious.
- Traffic-calming: the roadway appears narrower to drivers, even in the absence of cars parked on the street. This effect is increased when the curb extension includes features such as landscaping and street furniture, and the parking area is paved in concrete or pavers, making the road look narrower to drivers when no cars are parked.
- Slower-speed right-turns: a curb extension prevents right-turning motorists from “cutting the corner.”
- Street furniture (newspaper boxes, poles, bicycle parking, street trees etc) can be placed in the curb extension, outside of the pedestrian zone, as long as they don’t obscure pedestrians waiting to cross.
- Additional on-street parking: curb extensions improve visibility, allowing parking to be located closer to crosswalks. Other techniques to increase the supply of on-street parking include:
  - Carefully inventorying existing parking spot, and finding ways to increase supply by restriping
  - Moving fire hydrants from the sidewalk to the curb extension.

Reducing pedestrian crossing distance improves signal timing if the pedestrian phase controls the signal. The time saved is substantial when two corners can be treated with curb extensions. (The speed normally used for calculating pedestrian crossing time is 3.5 ft/sec). Non-signalized intersections also benefit from curb extensions: reducing the time pedestrians are in a crosswalk improves pedestrian safety and vehicle movement.

At midblock crossings, curb extensions may be considered where there is on-street parking and there are pedestrian generators on both sides of the road. Combined with refuge islands, they greatly increase the ability of a pedestrian to safely cross a street.

In general, curb extensions should extend the full width of the parking lane, to increase conspicuity, but no more: on streets with existing or planned bike lanes, the curb extension should not extend into the bike lane.
Retrofitting curb extensions onto existing roadways often creates design challenges, as the existing sidewalk grade usually slopes at 2% toward the roadway, and the roadways slopes towards the sidewalk. A curb extension usually cannot carry the sidewalk grade out an additional 7 or 8 feet; this reduces curb exposure to below acceptable height. On retrofits, the slope of the curb extension is often reversed, following the grade of the roadway. This creates a slight valley in the curb extension. This is usually not a problem, if a slight grade is created to drain standing water away.

Solutions include slotted drains between the old curb and the extension, or placing new drains at each end of the extensions.

On new construction projects, or when the roadway and sidewalks are completely rebuilt, there is an opportunity to slope sidewalks and curb extensions correctly: a constant 2% across the sidewalk and curb extensions towards the roadway. This creates parking bays that also slope at 2% towards the roadway, requiring a valley drain between the travel lanes and the parking area. Paving the parking area in concrete or pavers makes the road look narrower to drivers when no cars are parked, adding a traffic-calming element to this design.

Pedestrian Signals

A pedestrian-activated signal may be warranted where the expected number of people needing to cross a roadway at a particular location is significant and/or if it difficult for pedestrians to find an adequate gap. Refer to the MUTCD for pedestrian signal warrants. Sight-distance must be adequate to ensure that motorists will see the light in time to stop. Advance warning signs should be installed on the approaching roadway. Signals provided for pedestrians should have the most up-to-date accessible features.

Wherever possible, the response for pedestrians should be "hot." The signal should turn yellow then red for traffic as soon as a pedestrian pushes the button. This will encourage pedestrian to comply with the signal. If there is a substantially delayed response after a pedestrian pushes the button, the pedestrian will often seek a gap and cross against the light. Then when the light does turn red for motorists, the pedestrian is gone, increasing motorist frustration, as they don't understand why they were required to stop.

Curb extensions and raised medians increase the effectiveness of pedestrian signals and decrease motor vehicle delay.

Two-Step Pedestrian Signal

On busy roads, stopping all traffic long enough to let a pedestrian cross may cause undue delay if the pedestrian signal is activated often at peak periods. A two-step pedestrian signal minimizes delay to traffic while allowing pedestrians to cross conveniently. This requires a median refuge island to break the crossing into two distinct parts. Each signal is independently controlled – essentially creating two pedestrian signals across two one-way streets:

- Phase 1: pedestrian pushes button to stop traffic in one direction; traffic stops and pedestrian crosses to median island; traffic in opposite direction is not stopped and continues to travel, uninterrupted.
- At the end of phase 1, traffic in the first direction resumes; pedestrian walks towards second crossing, which is offset to the right.
- Phase 2: pedestrian pushes button in island and stops traffic in other direction; when pedestrian has finished the 2nd crossing, traffic resumes in the 2nd direction.

Pedestrians must be made to walk against on-coming traffic, so they can see it hasn't stopped; pedestrians need to push the second button (a ped push button on island is required). This offset also makes it possible to orient the ped signals to just half the roadway, so pedestrians don't get a mixed message from a ped head that is in their line of sight, but not intended for their half of the roadway.

Overcrossings and Undercrossings

Though grade-separation appears to offer greater safety, the excessive added travel distance often discourages pedestrians who want to take a more direct route. A grade-separated crossing must offer obvious advantages over an at-grade crossing. A structure that is unused because it is inconvenient or feels insecure creates a situation whereby pedestrians are at greater risk when they attempt to cross the road at-grade; drivers don't expect pedestrians to be crossing if they see an overcrossing.

The additional distance is substantial: 17.5' of clearance is required over some highways; the added depth of the structure results in a 20' high bridge. ADA requires ramps to not exceed a 5% grade. 20' of rise at 5% requires a 400' ramp in level terrain, for a total additional distance of 800' for both sides. This can be mitigated with stairs, or a 1:12 rise with a level landing for every 2.5' in rise. Overcrossings are more successful where the roadway to be crossed is sunken.

Undercrossings introduce two other issues that must be addressed: security and drainage. Security can be addressed by ensuring generous dimensions, good visibility and lighting. Drainage often requires a sump pump to ensure year-round operation. Undercrossings are more successful where the roadway to be crossed is elevated. In both cases the pedestrian crossing is level. Undercrossing should be at least 10' high and 14' wide.

See Chapter 7 Shared-use paths for a more complete discussion on the design of bridges and undercrossings.

OTHER INNOVATIVE DESIGNS

These concepts are presented as information, to help ODOT, cities and counties to come up with new solutions to street-crossing problems.

RAISED CROSSWALKS

Raised crosswalks can render the crossing more visible, especially if the beveled edge is textured and colored. Texturing or coloring the crosswalk portion is not recommended, as this area is less visible and can slow pedestrians as they cross. Raised crosswalks also act as speed humps and may be used in areas where excessive speeds are a problem on low speed streets.

The physical design of a raised crosswalk is the same as that of a speed table. The height should be the full height of the curb, so pedestrians can transition from the sidewalk to the crossing seamlessly; the incline of the beveled portion is a function of design speed and design vehicle.

PEDESTRIAN BEACON

The Pedestrian Beacon, also known as the “Hawk,” is a new form of traffic control approved for inclusion in next MUTCD draft. They are primarily intended for use on wide, mid- to high-speed multi-lane roadways with few crossing opportunities, primarily at midblock locations, or at minor intersections. On multi-lane roadways, an advance stop line should be provided, to reduce the risk of a multiple-threat crash.

Their primary purposes are to create gaps in motor vehicle traffic to let pedestrians cross without unduly adding delay. This is accomplished by using a beacon with yellow and red indicators, rather than a full green-yellow-red traffic signal. The main characteristics of a Pedestrian Beacon are:

- At rest, drivers see a blanked out beacon
- At rest, pedestrians see a conventional pedestrian head indicator, set on the steady red hand (DON’T WALK), and a conventional pedestrian push button
- The beacon begins its sequence only after a pedestrian pushes the push button

The sequence is as follows:

1. At rest, blank for drivers, DON’T WALK for pedestrians
2. Pedestrian pushes button, starts the flashing yellow beacon; ped indicator is still steady red hand
3. Flashing yellow turns to steady yellow; ped indicator is still steady red hand
4. Beacon turns steady; ped indicator is steady white walking figure
5. Beacon turns flashing/alternating red (wig-wag); ped indicator is still flashing red hand
6. Beacon turns off and rests at blank.

Phase 5 is timed for a standard pedestrian crossing time of 3.5 or 4 feet/sec. The flashing red indicates to drivers they may proceed after stopping and yielding to pedestrians; this shortens delay considerably.

The warrants for pedestrian beacons are being rewritten so they can be installed at locations where full signal warrants may not be met. Consult the MUTCD for a full description of the pedestrian beacon.

Captions

Crossing the street safely is an important part of many walking trips
Many crossings occur midblock out of convenience
A healthy downtown has destinations on both sides of the street
Fig 1: “Unmarked” crosswalks
A wide, multi-lane street built for ease of motor vehicle traffic is difficult to cross
It is difficult to determine where pedestrians will cross on auto-oriented street with disparate land uses
This crossing links apartments to a bus stop and a shopping center

Traffic signal in the distance creates adequate gaps for pedestrians to cross between signals

Fig 2: Access management techniques such as raised median and consolidated driveways reduce conflict points

Fig 4: Intersection with all turn and crossing movements

Fig 3: Driver and pedestrian waiting for same gap are in conflict when gap opens up

Fig 5: Severed streets prevent several turning and crossing movements

Fig 6: Most pedestrians will cross midblock rather than travel far to a signalized intersection

Fig 7: Conflicts at midblock crossing

Fig 8: Conflicts at intersection

Marked crosswalk on 2-lane road is appropriate

A marked crosswalk on a 5-lane road with no clear crossing point may be inappropriate

Fig 9: Staggered longitudinal crosswalk markings

Staggered longitudinal crosswalk places stripes out of wheel paths

Fig 10: Multiple-threat crash: ped doesn’t see 2nd car

Fig 11: Advance stop bar allows ped to see 2nd car

Fig 12: Sign OR22-25

Fig 13: Brick crosswalks supplemented with white lines

Brick crosswalk as seen by pedestrians

Same crosswalk as seen by drivers

Fig 14: White crosswalk inset into colored pavement

White crosswalk inset into colored pavement

Fig 15: Illumination makes crossings more visible

Fig 16: median allows pedestrian to cross one half of roadway at a time

Fig 17: Midblock island with high-visibility crosswalks, advance stop lines, illumination and angled cut-through

Median island allows pedestrian to cross half the roadway at a time

Pedestrians waiting where curb extension could be

Fig 18: Crosswalk length without curb extension

Fig 19: Crosswalk length with curb extension

Fig 20: Crosswalk improves visibility of/by pedestrian

Motorist yields to pedestrians at curb extension

Curb extension with bicycle parking and fire hydrant

Fig 21: Curb extension retrofit issues

Fig 22: Curb extensions integrated into the roadway

Slotted drain at retrofitted curb extension

Fig 23: 2-step signal, ped stops traffic in one direction

Fig 24: 2-step signal, ped walks along island to 2nd button

Fig 25: 2-step signal, ped stops traffic in other direction

2-step signal: peds cross 2nd half, traffic on right has resumed traveling

Fig 26: Pedestrian overcrossing adds a lot of travel distance when raised above roadway

Fig 27 Pedestrian overcrossing reduces travel distance over lowered roadway

Fig 28: Undercrossing of elevated roadway

Fig 29: Raised crosswalk acts as speed hump

Raised crosswalk