

# America WALKS

SIGNALIZED INTERSECTION ENHANCEMENTS  
THAT BENEFIT PEDESTRIANS



Making America a Great Place To Walk

## Table of Contents

---

Introduction .....	ii
Geometric Treatments .....	1
Signal Hardware .....	4
Operational Measures .....	6

Prepared for America Walks by

**FEHR & PEERS**

# America WALKS

Making America a Great Place To Walk

## WELCOME

*America Walks is a national resource which fosters walkable communities by engaging, educating, and connecting.*

Walking is a healthy, environmentally friendly, and socially equitable form of transportation. Improvements to the safety and convenience of walking are critical to maximizing the number of people who walk.

According to *Bicycling and Walking in the United States – 2010 Benchmarking Report* (Alliance for Biking & Walking, 2010), pedestrians account for 11.3% of all traffic fatalities nationwide and 25% of all traffic fatalities in major U.S. cities. Signalized intersections are an inherent element of the roadway network in cities; they are a common point of convergence for pedestrians and vehicles and many pedestrian traffic fatalities occur at signalized intersections. Improving safety at signalized intersections is therefore critical to reducing the number of pedestrian traffic fatalities.

The purpose of this resource is to educate decision makers, planners, engineers, and citizens on signalized intersection enhancements that can improve pedestrian safety and convenience. This resource is intended to summarize a wide array of potential treatments for a variety of signalized intersections; not all of the treatments summarized in this resource are appropriate for every signalized intersection.

This resource categorizes signalized intersection enhancements into three types:

- Geometric treatments
- Signal hardware
- Operational measures

# America WALKS

Making America a Great Place To Walk

## GEOMETRIC DESIGN TREATMENTS

*Geometric design treatments are those that relate to an intersection's physical attributes: it's dimensions, pavement or concrete layout, and striping pattern.*

### Fewer Travel Lanes



Fewer travel lanes decrease roadway width and crosswalk length. It takes an average pedestrian almost four seconds to cross each additional travel lane. Therefore, reducing the number of travel lanes minimizes the amount of time that pedestrians are in the crosswalk. More travel lanes than necessary can also increase vehicle travel speeds; research has shown that the severity of pedestrian collisions increases sharply with increased vehicle speed.



### Narrower Travel Lanes



Travel lanes are typically designed to be 12 feet wide. Where fewer travel lanes are not possible, research shows travel lanes can be safely narrowed to as little as nine feet, especially left- and right-turn pockets. Narrower travel lanes decrease roadway width and crosswalk length, thereby minimizing the amount of time that pedestrians are in the crosswalk.

### Median Pedestrian Island



Median pedestrian islands provide a safe place for pedestrians to stand if they do not have sufficient time to cross a street. They can be enhanced with median pedestrian push buttons.

### Corner Bulbouts



Corner bulbouts extend the curb and sidewalks further into the roadway, shortening the length of the crosswalk. They act as a traffic calming device by narrowing the effective width of the roadway. Because they extend into the roadway, often past parallel-parked vehicles, they improve visibility for pedestrians. Corner bulbouts can be constructed with reduced curb radii and to accommodate ADA improvements, such as directional curb ramps.

### Reduced Curb Radius



Vehicles travel faster through turns with a large turn radius than turns with a small curb radius. Reducing the radius of a corner curb is an effective way of reducing vehicle speeds. In suburban

environments turn radii generally do not need to exceed 30 feet. In urban environments turn radii can be 10 feet or less, especially where the meeting of one-way streets prohibits turning movements. Where on-street parking is permitted on one or both streets, consideration for further reductions of radii should occur acknowledging that the effective radius is increased with on-street parking. Corner curb radii on multi-lane streets should acknowledge that trucks turning right can turn into two lanes.

#### **Directional Curb Ramps (with Truncated Domes)**



Curb ramps offer wheelchair access to/from the sidewalk and crosswalk. Truncated domes, which are often yellow, warn pedestrians with limited or no sight that they are about to enter a crosswalk. The best practice for curb ramps is to install two per corner so that each ramp points directly into the crosswalk and to the curb ramp at the other side of the street. Directional curb ramps help blind pedestrians by pointing them in the correct direction while crossing. Corner bulbouts can be used to increase the amount of space available for directional curb ramps. Flared sides may not be necessary when two ramps are provided per corner.

#### **Raised Crosswalk**



Raised crosswalks are speed tables (flat-topped speed humps) outfitted with crosswalk markings and signage, providing pedestrians with a level street crossing. By raising the level of the crossing, vehicles drive more slowly through the crosswalk and pedestrians are more visible to approaching motorists. At signalized intersections, they are most appropriate where “pork-chop” islands separate channelized right-turn lanes from the adjacent through lanes.

#### **Improved Right-Turn Slip-Lane Design**

Free right-turns allow vehicles to turn right on red without stopping. Since the vehicles are never controlled by the traffic signal, pedestrians must always treat crosswalks across a free right-turn lane as an uncontrolled crosswalk. Controlled right-turn movements are preferable for pedestrians because they require a vehicle to stop on red before turning right. Where “pork-chop” islands that channelize right-turns are necessary to provide acceptable turning radii, raised crosswalks are a pedestrian enhancement. The geometry of the free right-turn lane can enforce a safe turning speed.

#### **Advanced Yield Lines**



Advanced yield lines, often referred to as “sharks teeth”, are placed in front of uncontrolled crosswalks to improve yield compliance. At signalized intersections, they can be used to remind free right-turning vehicles to yield to pedestrians.

#### **Textured Pavement**



Textured pavement can be used in crosswalks or in intersections as an aesthetic enhancement. Because of its texture, it also calms traffic by slowing vehicles before they cross an intersection. It can also make crosswalks more visible. Textured pavement can be made of brick or, alternatively, both concrete and asphalt can be stamped to look like brick or stone.

#### **Anti-Skid Surfacing**

Roadway paint, including the paint used to mark crosswalks, can become slippery when wet. Alternative pavement marking materials, such as tape and thermoplastic, are less slippery than paint when wet.

# America WALKS

Making America a Great Place To Walk

## Advanced Stop Bars



Advanced stop bars are placed in front of crosswalks. They keep vehicles from encroaching into the crosswalk when stopped at a red light. On multi-lane roads, advanced stop bars placed at least one car-length back from the crosswalk allow pedestrians to be seen by drivers in adjacent lanes.

## Marked Crosswalks (on all approaches)



Marking a crosswalk across all approaches of an intersection improves pedestrian accessibility. At a four-way intersection, a missing crosswalk forces pedestrians to cross three times instead of once. Crosswalks on all approaches can often be accommodated without a significant impact to traffic signal operations.

## High-Visibility Markings



Design policies should require different crosswalk markings for controlled and uncontrolled crosswalks. Standard crosswalks are generally acceptable across controlled approaches; however, high-visibility crosswalks are appropriate in areas with high pedestrian volumes. High-visibility crosswalks should also be used across uncontrolled locations including midblock and at free right-turns. Continental, zebra, ladder, or triple-four crosswalks are all examples of high-visibility crosswalks. High-visibility markings improve yield compliance. Having a uniform design policy for marked and unmarked crosswalks delivers a clear message to pedestrians when they are about to enter a crosswalk.

## Colored Crosswalks / Intersections



Colored crosswalks improve crosswalk visibility for motorists. They can be designed to complement the colors of a city or school.

## Proper Locations for Signal Controllers



Signal controller boxes should be located such that they do not present a barrier for pedestrians. The best placement for signal controller boxes is completely off of the sidewalk, but still accessible for maintenance.

# SIGNAL HARDWARE

Signal hardware includes all of the physical elements of a traffic signal: signal heads, pedestrian signals, and push buttons.

## Blank Out Turn Restriction LED Signs



The ubiquity of conventional turn restriction signs, usually for no right-turn on red, contributes to their disregard by motorists. Blank out turn restriction signs, usually for no right-turn on red, activate only when the specified movement is prohibited.

## Protected Left-Turn Signals



The “Walk” signal at a crosswalk usually begins at the same time that through- and turning-vehicles in the same direction receive a green light. Where permitted left-turns are allowed, denoted by a “Left Turn Yield on Green” sign, left-turning vehicles can conflict with pedestrians in the crosswalk. By making the left-turn protected, so that it is allowed only with a green arrow, the “Walk” signal at a crosswalk occurs at the same time that through- and right-

turning vehicles in the same direction receive a green light. This reduces the risk of left-turning vehicle conflicts with the opposing crosswalk; since left-turns typically occur at a higher speed than right-turns, collisions of increased severity can be avoided by protecting left-turns.

## Pedestrian Signals



Pedestrian signal heads minimize vehicle-pedestrian conflicts by assisting pedestrians in deciding when to begin crossing the roadway. For best results, post pedestrian signal heads in the same general vicinity as vehicle heads for conflicting movements such that pedestrians know what to expect from traffic. This is especially important where permitted left-turns are allowed, denoted by a “Left Turn Yield on Green” sign.

Pedestrian heads should be located on the same post as the vehicle indications and on the intersection side of the crosswalk rather than at the back of the crosswalk. This reduces the likelihood of view obstruction by large vehicles.

## Pedestrian Countdown Signals



Pedestrian countdown signals give pedestrians “Walk” and “Don’t Walk” signals and inform them how long they have to cross the street. Research suggests that pedestrians are more likely to obey the “Don’t Walk” signal when delivered using a countdown signal. The 2009 Manual on Uniform Traffic Control Devices requires that all new pedestrian signals be countdown signals.

## Animated Eyes Pedestrian Signals



Animated eyes pedestrian signals feature eyes that look from side to side when a “Walk” signal is given. The signals remind pedestrians to look for turning vehicles before proceeding into the crosswalk. Research has indicated that animated eyes pedestrian signals reduce conflicts between vehicles and pedestrians.

# America WALKS

Making America a Great Place To Walk

## Pedestrian Push buttons



To receive a “Walk” signal at a crosswalk, pedestrians are often required to use a push button. The location and design of buttons should comply with ADA guidelines.

## Median Pedestrian Push buttons



Where median pedestrian islands exist, median pedestrian push buttons can be provided for pedestrians who become stranded mid-crossing. Occasionally, pedestrians who walk slowly, such as the elderly or children, are unable to cross the street in one cycle length. Providing a push button in the pedestrian median island allows them to receive a “Walk” signal for the next phase of their crossing. In general, the benefits of a median pedestrian push button are more pronounced when the total crossing distance is 60 feet or greater.

## Passive Detection Devices

Passive detection of pedestrians, which can be accomplished using video or radar detection devices, register the presence of a pedestrian waiting to cross a street without the use of a push button. Additionally, they can track the location of a pedestrian as he crosses the street to determine if more crossing time is needed. Advances in video and infrared technology are improving the reliability of passive detection devices; in Santa Clara, CA, the City recently began using infrared technology at traffic signals to extend the crossing time when needed.

## Accessible Pedestrian Signals



Accessible pedestrian signals and detectors provide information, such as “Walk” indications and direction of crossing, in non-visual formats to improve accessibility for blind pedestrians. Audible options for accessible pedestrian signals include audible tones and speech messages. Vibrotactile push-buttons are effective options that alleviate the impacts of noise created by audible pedestrian signals.

## Braille Wayfinding



Braille characters can be added to the “Push Button for Walk Signal” plaques to provide basic information about the intersection.

## Extended Push button

Some pedestrians may need extra time to safely cross a street. Traffic signals can be retrofitted to allow pedestrians to increase the crossing time by pressing the push button a bit longer.

# OPERATIONAL MEASURES

*Changes to a signalized intersection's operations can often be made inexpensively without making physical changes to the intersection.*

## Short Cycle Lengths

Long cycle lengths at signalized intersections result in long pedestrian wait times to cross a street. By shortening an intersection's cycle length, pedestrians do not have to wait as long to cross after pushing the button to request a "Walk" signal.



Longer crossing times at crosswalks ensure that all pedestrians are safely able to cross the street within the allotted time. Previous to 2009, crossing time for crosswalks at signalized intersections was based on an average walking speed of 4.0 feet per second. Guidance in the 2009 Manual on Uniform Traffic Control Devices specifies that a walking speed of 3.5 feet per second should be assumed to determine crossing times. A speed slower than 3.5 feet per second can be used where slower pedestrians routinely use the crosswalk, such as locations near schools, hospitals, or senior centers. Additionally, where a crosswalk's concurrent green vehicle phase is greater than the minimum phase for pedestrians, the duration of the pedestrian phase can be increased to be the same as the concurrent vehicle phase.

## Leading Pedestrian Interval



A leading pedestrian interval illuminates the "Walk" signal for a few seconds prior to stopped through-vehicles receiving a green light. Allowing pedestrians a head start into the intersection can reduce conflicts between pedestrians and turning vehicles and makes crossing pedestrians more visible. The Manual on Uniform Traffic Control Devices recommends that leading pedestrian intervals be at least three seconds in duration.

## Pedestrian Scramble Phase



Pedestrians usually have to cross two roadways to get from one corner of an intersection to the opposite corner. A scramble phase allows pedestrians to cross in all directions, including diagonally. Right-turn on red for vehicles must be restricted during the walk phase to ensure pedestrian safety.

## No Right-Turn on Red



When attempting to turn right on red, vehicles must look left to see if the road is clear; drivers often forget to look right before turning and may not see pedestrians to their right. Restricting right-turns on red can reduce conflicts between vehicles and pedestrians. Blank out turn restriction signs are more effective than conventional "No Right Turn on Red" signs. "No Right Turn on Red" signs that specify time-of-day restrictions or "When Pedestrians are Present" are confusing to motorists and are often disregarded.

## Pedestrian Recall

Pedestrian recall gives pedestrians a "Walk" signal at every cycle. No push-button or detection is necessary since a "Walk" signal will always be given. Pedestrian recalls are useful in areas with high levels of pedestrian activity. They demonstrate that an intersection is meant to serve both vehicles and pedestrians. In general, pedestrian recall should be used if pedestrians actuate a "Walk" signal 75 percent of the time during three or more hours per day.

National Office  
PO Box 2834  
Alexandria, VA 22301  
703.738.4889

---

[www.americawalks.org](http://www.americawalks.org)



FEHR  PEERS  
Transportation Consultants