

## Signalized Intersections



## Signalized Intersections Can Be Improved For Pedestrians By:

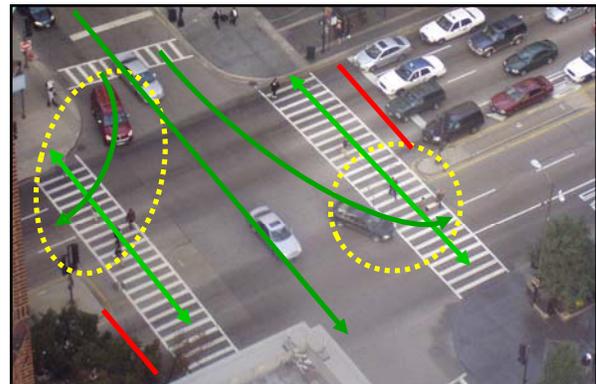
1. *Using good geometric design*
2. *Placing islands to break up complex crossings*
3. *Placing crosswalks in logical locations*
4. Improving convenience and ease of use of pedestrian pushbuttons and signals
5. Using techniques to reduce conflicts with turning vehicles

*1, 2 & 3 addressed in earlier module*

Traffic signals assign the of right of way, regulate the flow of traffic and create gaps



Traffic signals do not guarantee safety – in fact, signalized intersections have more crashes than non-signalized



Turn movements often result in conflicts

Improving convenience and ease of use of pedestrian signals

- Proper pushbutton placement
- Need and placement of pedestrian signal heads
- Signal timing for pedestrians
- Countdown Signals
- Intelligent Transportation Systems (ITS)

## Proper Pushbutton Placement

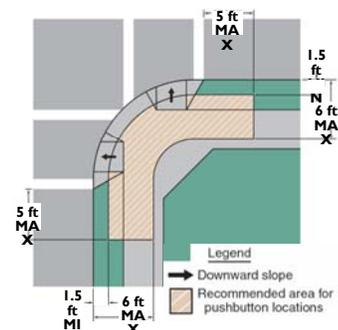
### MUTCD Recommendations:

- In line with crosswalk;
- Buttons at least 10' apart;
- Between 1.5' and 6' from curb
- Button face parallel to xwalk



## Proper Pushbutton Placement

The MUTCD recommends these dimensions



MUTCD Figure 4E-3 Designing for Pedestrian Safety – Signalized Intersections

6-7

## Poor Pushbutton Placement



Inconspicuous



Too far from ramp

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6-8

## Poor Pushbutton Placement



Behind guardrail



Behind vegetation

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## Poor Pushbutton Placement



At back of pole



In front of pole

Portland OR Salem OR

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6-10

## Poor Pushbutton Placement



All of the Above?

Hillsborough Co. FL Designing for Pedestrian Safety – Signalized Intersections

6-11

## Proper Pushbutton Placement



On side of pole



At top of ramp

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6-12

## Communicate With Pedestrians



LED tells peds the button works and the signal has received the call (*like an elevator*)



Tactile arrow gives direction to blind and sighted pedestrians

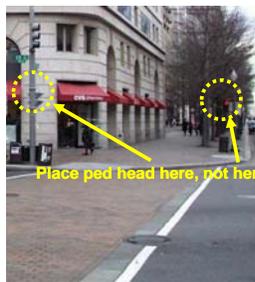
## New Requirement in the 2009 MUTCD

Combination of sign legends and pushbutton placement shall clearly indicate which crosswalk signal is activated by each pushbutton



MUTCD Sec. 2B.52 and Section 4E.08

Ped head placement: close to crosswalk, visible to pedestrians, especially with long crosswalk



Poor example



Good example

Two-step signals: ensure pedestrians don't see conflicting signals

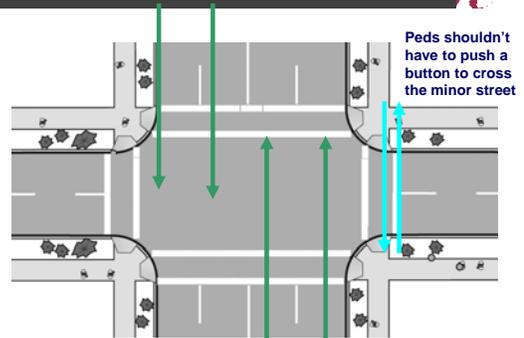


These pedestrians kept walking, not noticing the separate signal for the 2<sup>nd</sup> half of the roadway



At high-use crosswalks, pedestrians should get a signal at every cycle

Set pedestrian signals to recall to WALK when major street is set to recall to green



# Signal Timing & Walking Speeds

## Use Short Signal Cycle Length



Long wait causes stacking: pedestrians wait in street, or don't wait and cross against the signal

## Pedestrian Walking Speeds

2009 (old) MUTCD requirements:

- 7 sec steady walk (peds may enter crosswalk); 4 sec "option"
- Pedestrian clearance time (flashing orange hand) calculated at 4'/sec curb-to-curb
- Example: 60' crosswalk requires 15 sec
- Example: 15 + 7 = 22 sec absolute minimum walk plus clearance



## Pedestrian Walking Speeds

2009 MUTCD:

- 7 sec walk, 4 sec option (no change)
- Ped clearance time (flashing hand) calculated at 3.5'/sec curb-to-curb.
- Example: 60' crosswalk requires 17 sec
- 7 + 17 = 24 sec total

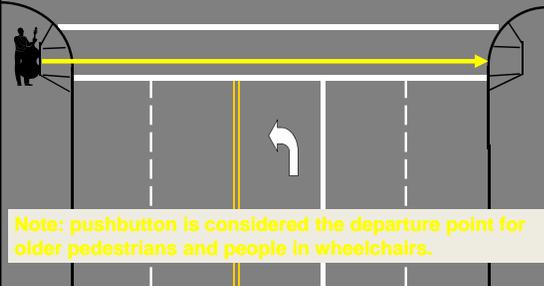
Additional test for walk plus clearance time: Calculate travel time from push button (or 6' feet from curb if no button) to curb on other side at 3'/sec

- Example: 6' + 60' crosswalk = 66
- 66' requires 22 sec
- 24 sec > 22 sec; passes test.



Guidance for walk plus clearance: Calculate time from pushbutton (or 6' from curb) to curb on other side at 3'/sec

60' crosswalk + 6' = 66' total; @ 3'/sec = 22 sec walk plus ped clearance



Note: pushbutton is considered the departure point for older pedestrians and people in wheelchairs.



New system: countdown pedestrian signal tells pedestrians how much time remains for crossing



**Countdown pedestrian signal research results:**

1. Pedestrians understand how it works
2. More people start crossing during clearance phase, but...
3. Fewer people initiate walk late in clearance phase
4. Very few pedestrians in crosswalk in steady don't walk
5. Drivers don't take a cue and accelerate to beat the light



**What about crash reduction?**

Results from San Francisco study are promising:

CMF = 0.75 (CRF = 25%)

**Change included in 2009 MUTCD**

Countdown displays required for new pedestrian signals (except the rare situation where the change interval is 7 seconds or less)



**Signs: Remind Turning Drivers to Yield to Peds**



R10-15 in 2009 MUTCD

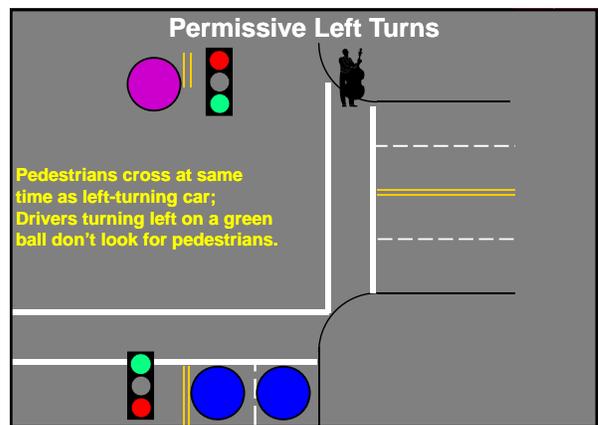
MUTCD Sec. 2B.53, Paragraph 09

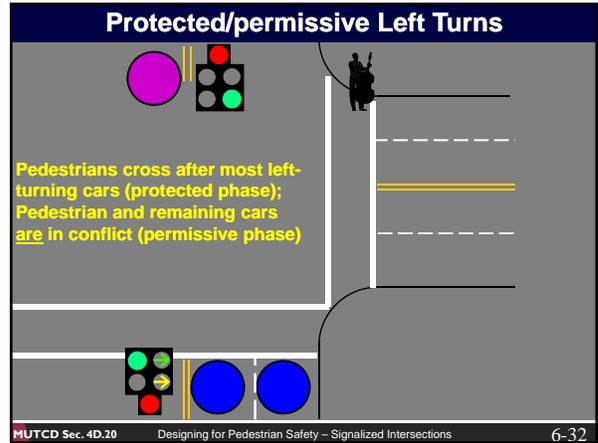
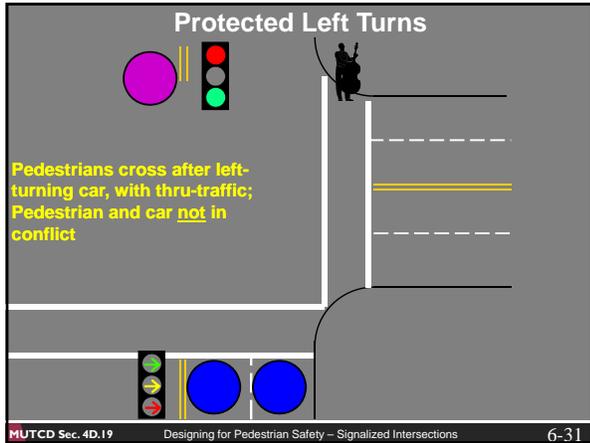


**Protected Vs. Permissive Left Turns**



\* CMF = 0.3 (CRF 70%) (all crashes) converting permissive left turns to protected only left turns

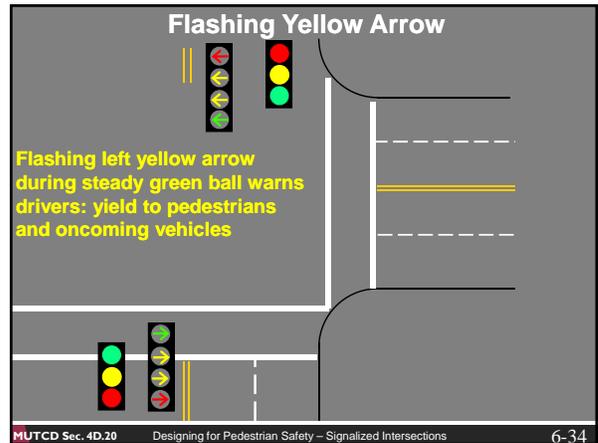




### Protected/permissive Left Turns: Solutions

1. Provide protected-permissive phasing by default, but revert to protected-only when pedestrian button is pushed or based on time of day
2. Flashing Yellow Arrow (details on the next slide)

MUTCD Sec. 4D.20 Designing for Pedestrian Safety – Signalized Intersections 6-33



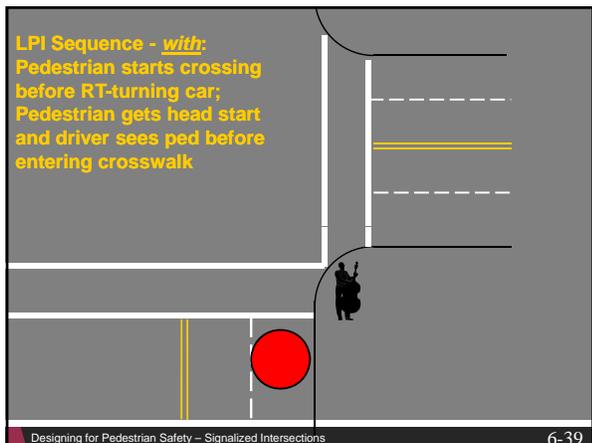
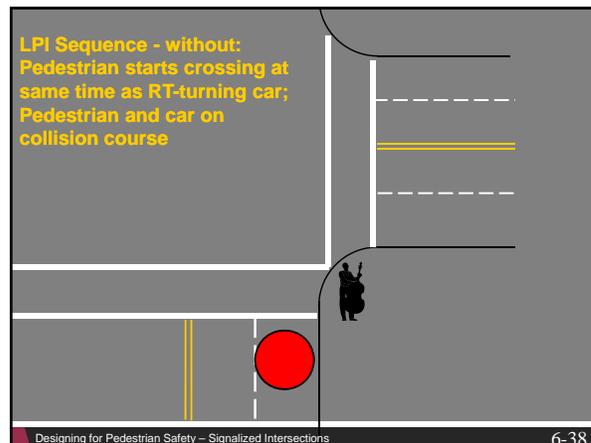
### LPI = Lead Pedestrian Interval

*LPI gives pedestrians a head start*  
*It's like a "mini" exclusive phase*

MUTCD Sec. 4E.06, paragraphs 19-23

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# Questions?