INFRASTRUCTURE AND SPEED REDUCTION FOR PEDESTRIAN SAFETY

THE FHWA PERSPECTIVE

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IL DOT Pedestrian Safety Peer Exchange
NHTSA Traffic Safety Facts 2017

Speeding

Figure 9
Percentage of Speeding-Related Fatalities, by State, 2017

Source: FARS 2017 ARF
Australian PSA on Speed

- 60 kph vs. 65 kph
- 37 mph vs. 40 mph
As motor vehicle speeds increase, the risk of serious injury or fatality for a pedestrian also increases (AARP Impact Speed and a Pedestrian’s Risk of Severe Injury or Death 2011, p. 1). Also, motorist visual field and peripheral vision is reduced at higher speeds.
Speed Affects Crash Avoidance

High speeds equate to greater reaction and stopping distance.
How have we built our urban roadway system?
Curbs & sidewalks slow traffic more than speed sign
Before: road looks and feels wide
After: curb extension integral to sidewalk
Street looks narrow even with no parked cars
Curb extension integrated into sidewalk
Study of Crosswalk Markings (Zegeer et al 2005)

- Marked vs. Unmarked Analysis
- Speeds < or = to 40 mph
  - Two-lane roads: No significant difference in crash rate
  - Multilane roads (3 or more lanes)
    - Under 12,000 ADT: no significant difference in crash rate
    - Over 12,000 ADT w/ no median: crashes marked > crashes unmarked
    - Over 15,000 ADT & w/ median: crashes marked > crashes unmarked
New marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and/or either:

- Has 4 or more lanes without a raised median or island and ADT of 12,000 or more, or
- 4 or more lanes with raised median island and ADT of 15,000 or more
- (2009 MUTCD Section 3B.18)
Table 1. Recommendations for installing marked crosswalks and other assisted pedestrian improvements at uncontrolled locations.*

<table>
<thead>
<tr>
<th>Roadway Type (Number of Travel Lanes and Median Type)</th>
<th>Vehicle ADT</th>
<th>Speed Limit**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 9,000</td>
<td>&lt; 48.3 km/h (30 mph)</td>
</tr>
<tr>
<td>Two lanes</td>
<td></td>
<td></td>
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<tr>
<td>C</td>
<td>C</td>
<td>C</td>
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<tr>
<td>P</td>
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<td>C</td>
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<tr>
<td>C</td>
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<td>N</td>
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</tbody>
</table>

* These guidelines include intersection and marked locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A primary concern here is not crosswalks or marks in the road. Crosswalks should be marked at locations where other pedestrian safety improvements are not possible due to factors such as the presence of other traffic, crosswalks, or high-speed roads.

** The speed limit must be at least 48.3 km/h (30 mph) for pedestrian crossing to be considered safe and effective. Before installing a marked crosswalk, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. Factors considered include the level of pedestrian activity, vehicle speed, traffic volume, and other factors.

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**Table 1. Application of pedestrian crash countermeasures by roadway fixtures.

<table>
<thead>
<tr>
<th>Roadway Configuration</th>
<th>Vehicle ADT &lt; 3,500</th>
<th>Vehicle ADT 3,500 - 5,000</th>
<th>Vehicle ADT 5,000 - 7,500</th>
<th>Vehicle ADT &gt; 7,500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 mph</td>
<td>55 mph</td>
<td>55 mph</td>
<td>55 mph</td>
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</table>
Crosswalk Visibility Enhancements
Raised Crosswalks
Pedestrian Refuge Island
Rectangular Rapid Flashing Beacon (RRFB)
Pedestrian Hybrid Beacon (PHB)
Road Diets

Leading Pedestrian Interval (LPI)
Crosswalk Visibility Enhancements

- High Visibility Markings
- Signs
- Curb Extensions
- Curb Radii
- Lighting
- Parking Restriction
Crosswalk Visibility Enhancements
High Visibility Crosswalk

What Pedestrians See

What Drivers See

Photo Source all 4: Michael Ronkin
In-street pedestrian crossing signs

Tampa FL

2009 MUTCD Section 2B.12 and Figure 2B-2

Yield or Stop depends on state law

R1-6  MUTCD signs

R1-6a
### Gateway Treatments

#### Gateway Treatment, Three–Lane Configuration

<table>
<thead>
<tr>
<th>Without Refuge Island</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel Lanes</strong></td>
</tr>
<tr>
<td><strong>Passing/Turn Lanes</strong></td>
</tr>
<tr>
<td><strong>R1-6 Signs</strong></td>
</tr>
<tr>
<td><strong>Flexible Delineators</strong></td>
</tr>
</tbody>
</table>

#### Yielding Compliance

- Between 60% and 90% compliance rate if speed limit is 30 mph or less for ADT up to 25,000.
- If the speed limit is 35 mph expect similar results if ADT is 12,000 or less. UNKNOWN above 12,000 ADT.

#### Approximate Cost

- $1,200 for materials
- 20-minute installation
- 8 minutes to remove for winter
- 8 minutes to reinstall in spring

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**General Description:**

Note: By installing the gateway on the near side of the intersection, both crosswalks are covered with only four signs. Data show that a gateway at the near side crosswalk continues to be effective for the far side of the intersection, as the motorist on the far side has already passed through a gateway on the near side.

The signs on the curb side in the gutter pan would have a better chance of survival if they are moved placed between 3 and 50 feet in Advance of the crosswalk markings. This would reduce the chance of the sign being struck by a turning vehicle. Figure 6b shows a typical installation.
Effect of large radius: higher speed turns

Note right-turning vehicle
Minimize curb radius

Calculate effective radius: Larger than built radius if travel lanes offset from curb with parking and/or bike lane.
Effective Curb Radius
Right-Turn Slip Lane: Design for Pedestrians

Old Way

Wide Angle

40°

High speed, head turner = low visibility of pedestrians

New way

Tighter angle

55 to 60 degree angle between vehicle flows.

40°

Slow speed, good angle = good visibility of pedestrians
Minimize Curb Radius w/ Truck Apron
Driveways built like intersections encourage high-speed turns
Driveways built like driveways encourage slow-speed turns
This driveway was built like an intersection

Driver exits at high speed, not looking at pedestrians
This driveway tells drivers watch for pedestrians
Raised Crosswalk

- May be appropriate for roads with:
  - Two or three lanes
  - Speed limits of 30 mph or less
  - AADT below 9,000
Pedestrian Refuge Islands

- In-Street Pedestrian Crossing sign
- High-visibility crosswalk markings
- Warning sign
- Overhead lighting
- Curb extension
Pedestrian Refuge Islands
Rectangular Rapid Flashing Beacon (RRFB)

An RRFB is a pedestrian-actuated conspicuity enhancement used in combination with a pedestrian crossing warning sign to improve safety at uncontrolled crossing locations. The device includes two rectangular-shaped yellow indicators, each with an LED-array-based light source, that flash with high frequency when activated.

The RRFB is a treatment option at many types of established pedestrian crossings. For example, an RRFB may be considered for crossings of 2 or more lanes with speed limits of 35 mph or above and/or at crossings of 3 or more lanes with any speed limits. However, for high-speed roads (40 mph or greater) combined with high vehicle volumes (annual average daily traffic of 15,000 and above) and/or certain combinations of high-volume and high-speed, the RRFB may not be sufficient, and a Pedestrian Hybrid Beacon is likely a better option.

Features:
- Enhanced warning
- Improves motorist yielding

Often used with:
- Crosswalk visibility enhancements
- Pedestrian refuge islands
- Advance STOP or YIELD markings and signs
IA-21 3.a For any approach two RRFB required, one on right-hand and one on left-hand of roadway. If divided highway left-hand should be installed on median if practical rather than far left-hand.
Pedestrian Hybrid Beacons (PHB)

A Pedestrian Hybrid Beacon (PHB) is an automated traffic control device that improves safety and reduces collisions at unsignalized intersections. It consists of a rectangular, illuminated housing that can be mounted on a pole, on an overhead mast arm, or on the side of a vehicle. The PHB is activated by detecting the presence of pedestrians, typically through the use of infrared or microwave sensors. Once activated, the beacon flashes a red light to alert drivers and pedestrians of the crossing. PHBs can also be used at crosswalks, school zones, and other locations where pedestrian safety is a concern.

Key Features:
- Improves safety at unsignalized intersections
- Reduces collisions and near-collisions
- Can be used at crosswalks, school zones, and other locations
- Automatically activated by pedestrian detection

Applications:
- Crosswalks
- School zones
- Higway intersections
- Median crossings
- Pedestrian plazas

EDC's Implementation:
EDC has implemented PHBs in various locations across the country, including schools, crosswalks, and highway intersections. These devices have proven effective in reducing collisions and improving pedestrian safety.

Pedestrian Hybrid Beacon (PHB)
EDC's website: [www.EDC.gov/pedestrianhybridbeacon]
Pedestrian Hybrid Beacons (PHB)

CRF: Vehicle/Pedestrian 69%

1. Blank for drivers
2. Flashing yellow
3. Steady yellow
4. Steady red
5. Wig-Wag

Return to 1
Excerpts from 2009 MUTCD Chapter 4F For Pedestrian Hybrid Beacons

- The CROSSWALK STOP ON RED sign shall be used
- There are **Guidelines** (similar to signal warrants) for Pedestrian Hybrid Beacons – variables include:
  - Pedestrian volume
  - Traffic speeds
  - Traffic volumes
  - Crosswalk length

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Standard:
A CROSSWALK STOP ON RED (symbolic circular red) (R10-23) sign shall be mounted adjacent to a PHB face on each major street approach.

Option:
- State MUTCD’s may allow other appropriate MUTCD approved ped, bike or school crossing signs
Optional Signing

Courtesy: City of Columbus

CROSSWALK
STOP ON RED
PROCEED ON
FLASHING RED
WHEN CLEAR
Road Diet / Roadway Reconfiguration / Road Buffet

Before

After

Road Diet

- Multi-lane roads can take longer to cross and vehicular speeds may be high.
- Road Diets can decrease the lane crossing distance and reduce vehicle speeds.
- Road Diets can reduce total crashes by 19–47%*.

*19% in urban areas, 47% in suburban areas.

Features:
- Reduced crossing distance and exposure.
- Reduced vehicle speeds.
- Promote Complete Streets.
- Provide space for installing curb extensions and widening sidewalks.
- Create space for bicycle, transit, and/or parking lanes.
Before

Reclaiming road space creates room for ped islands

Charlotte NC
Reclaiming road space creates room for ped islands
Intersections

- Signal timing or phasing changes at intersections to optimize operations and safety benefits
- Roundabouts Single Lane
  - ~ 20,000 ADT
Before and After Example
Before and After Example
Yes the speed of a vehicle can determine if a pedestrian who is hit lives or dies.

Yes infrastructure can make a difference in the speed of vehicles

Yes we can design roads that move vehicles but doesn’t kill pedestrians
Contact Information

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