DESIGNING IN CONTEXT OF COMPLETE STREETS

Module 5
Crossing the Road
Lighting
Transit
WHAT TYPE OF CROSSING WOULD YOU INSTALL?
Why Crosswalk Markings?

- To indicate to pedestrians where to cross
- To indicate to drivers where to expect pedestrians
- At mid-block locations, crosswalk markings legally establish the crosswalk.
How to determine where to mark a crosswalk? Consider origins and destinations.

In this case, apartments across from bus stop & stores.
MARKED CROSSWALK MUST BE VISIBLE TO BOTH PEDESTRIAN AND DRIVER

What the pedestrian sees

What the driver sees

(same crosswalk)
Place longitudinal markings to avoid wheel tracks, reducing wear & tear & maintenance.
CREATIVE BUT NOT COMPLIANT
Marked vs. Unmarked Analysis

Speeds \leq 40 \text{ 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
Text in the 2009 MUTCD Section 3B.18

- 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 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
Part 1
- High Visibility Markings
- Illumination
- Signing
- Advance Stop Bars
- Median Islands
- Raised Crosswalks
- Curb Extensions

Part 2
- RRFB
- PHB
- Pedestrian Signals
- Road Diets

EDC4 STEP Treatments Underlined
EXAMPLES OF CROSSING TABLES

**UNCONTROLLED CROSSWALK DECISION MATRIX**
(Treatments to be applied only if evaluations of conditions indicates that the treatment will provide a significant safety benefit)

<table>
<thead>
<tr>
<th>Roadway Type (Number of Travel Lanes and Median Type)</th>
<th>Vehicle ADT ≤ 9,000</th>
<th>Vehicle ADT &gt;9,000 to 15,000</th>
<th>Vehicle ADT &gt;15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two lanes (four or more lanes with raised median)</td>
<td>C/1</td>
<td>C/1</td>
<td>C/1</td>
</tr>
<tr>
<td>Three lanes (four or more lanes)</td>
<td>C/1</td>
<td>C/1</td>
<td>C/1</td>
</tr>
<tr>
<td>Multilane (four or more lanes without raised median)</td>
<td>C/1</td>
<td>C/1</td>
<td>C/1</td>
</tr>
</tbody>
</table>

- Candidate sites for marked crossings. An engineering study is required to determine whether a marked crosswalk will provide a significant safety benefit. A site review may be sufficient at some locations, while a more indepth study of vehicle speeds, sight distance, vehicle mix, and other factors may be needed at other sites. It is recommended that a minimum utilization of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians be confirmed at a location before placing a high priority on the installation of a crosswalk treatment. See Crossing Treatment Types Number 1.

- Possible increase in pedestrian crash risk if crosswalks alone are added without other pedestrian facility enhancements. If the evaluation determines that a crosswalk would provide a significant safety benefit, then crosswalk locations should be enhanced with other pedestrian crossing improvements such as those shown in Crossing Treatment Types Number 2 or 3.

Minimum crosswalk treatments must follow the requirements of the Manual on Uniform Traffic Control Devices (most current version).

Crossing Treatment Types:
1. High visibility crosswalk. Recommended, and consideration of additional treatments such as a raised refuge island and/or Advanced Yield Lines and street lighting should be considered. Additional information is available in the NDOT Flashing Beacon policy.
2. Crossings such as a pedestrian refuge island, Overhead Pedestrian Crossing Signs, Flashing Beacons, Yield Lines, parking removal between crosswalk and Yield Lines and street lighting should be considered. Additional information is available in the NDOT Flashing Beacon policy.
3. Crossings such as a Pedestrian Hybrid Beacon, Pedestrian Signal, or Two-Stage Crossing. Stop or Yield Lines, parking removal between crosswalk and Yield Lines and street lighting should be considered. Installation of traffic signals cannot be considered unless traffic conditions meet warrant criteria specified in the Manual on Uniform Traffic Control Devices.

*NRS 484A.065 “Crosswalk Defined.” Crosswalk means: 1. That part of a highway at an intersection within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or, in the absence of curbs, from the edges of the traveled portions of highways; or 2. Any portion of a highway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface.

Table 1: Total Pedestrian Delay – Treatment Selection Guidance

<table>
<thead>
<tr>
<th>Speed</th>
<th>Motorist Complain</th>
<th>Total Pedestrian Delay Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (≤ 1.3 ped-hrs)</td>
<td>Medium-Low (≥ 1.3 to &lt; 5.3 ped-hrs)</td>
<td>Medium-High (≥ 5.3 to &lt; 19.3 ped-hrs)</td>
</tr>
<tr>
<td>High (≥ 19.3 ped-hrs)</td>
<td>Move to Step 4</td>
<td>Move to Step 4</td>
</tr>
</tbody>
</table>

Figure 16 illustrates a plotted point in the Medium-High category. In this example, the Total Pedestrian Delay is Medium-High, the speed is less than 35 mph, and motorist compliance is low. Table 1 indicates that the evaluator move to Step 4 to continue to assess the crossing location for a Pedestrian Hybrid Beacon.

Example Scenario:
- Crossing location: road in an urban area.
- Speed limit or 85th percentile operating speed: 35 mph or less.
- Crossing distance: 30 ft.
- Peak-hour vehicle volume: 2,000 vehicles/hour.
- Peak-hour pedestrian volume: 20.
- Motorist Compliance: Low.

Figure 16: Example scenario using the “Speed Limit 35-35 mph – Crossing Distance 36” – Population=2 10,000” chart from Appendix C to determine Total Pedestrian Delay type. Example shows a Medium-high delay between 5.3 and 19.3 ped-hrs.

Nevada DOT 8/14/14
NC Ped Crossing Research Report FHWA/NC/2014-15
Free pdf version online
Study was carried out by

1. Surveying state departments of transportation (DOTs) and local transportation agencies
2. Identifying and synthesizing current recommended practice and policy guidance
3. Performing a comprehensive literature review of safety evidence for more than 25 pedestrian crossing treatments.
2009 MUTCD  W11-2
Sec. 2C.50 & Fig. 2C-10
IN-STREET PEDESTRIAN CROSSING SIGNS

Yield or Stop depends on state law

2009 MUTCD Section 2B.12 and Figure 2B-2
ADVANCED STOP/YIELD BAR

Without (Image Left)
- 1st car stops to let pedestrian cross, blocking sight lines
- 2nd car doesn’t stop, hits pedestrian at high speed

With (Image Right)
- 1st car stops further back, opening up sight lines
- 2nd car can be seen by pedestrian
ADVANCE STOP LINE AND SIGN

R1-5b  R1-5c

2009 MUTCD Section 3B.16
MUTCD Sec. 2B.11 and Figure 2B-2

R1-5  R1-5a
Crossing island at marked crosswalk - same principle:
Breaks long complex crossing into two simpler crossings
Continuous raised median –

Breaks long complex crossing into two simpler crossings
A FLUSH MEDIAN IS NOT A REFUGE
ADD A RAISED ISLAND
CURB EXTENSIONS

When
- Limited Sight Distance
  - Pedestrians & Vehicles
  - Vehicles and Signs
- Want to put two curb ramps in
- Discourage High speed turning
- High number of pedestrians waiting on corner

Where
- Wherever there is 24/7 on-street parking
  - Intersections
  - Midblock
CROSSING THE ROAD - CURB EXTENSIONS

Pedestrians wait where they can see - in front of parked cars

Curb extension places pedestrian where they can see and be seen
PARKING LANE LOOK AND FEEL AS SIDEWALK AND CURB EXTENSION
PARKING INTEGRATED WITH SIDEWALK
Bollards, planters, & other fixed objects may be placed at the back of curb to protect pedestrians and prevent vehicles from driving onto the sidewalk.
PAINT & DELINEATOR POSTS
Mostly two-lane streets and residential collectors

Raised intersections have been used in residential, central business district, and other commercial zones.

Lower speeds

Improved motorist yielding at some locations

CMF estimate of 0.70 for all crashes

- CRF 30%

CMF estimate of 0.64 for all fatal injury crashes

- CRF 36%
Guidance Document: supplement AASHTO, IES & CIE guides

- Policy and guidance
- Basic terms and concepts
- Warranting criteria
- Lighting impacts
- Application considerations
- Other systems and issues
Fatal crash numbers in daylight are about the same as in darkness, but only 25 percent of vehicle-miles traveled occur at night.

- Nighttime fatality rate is three times the daytime rate.

- Lighting for pedestrian safety can also benefit vehicle safety.
CROSSING THE ROAD - LIGHTING

- Informational Report on Lighting Design for Midblock Crosswalks
- FHWA-HRT-08-053
  - April 2008
Fig 11. Traditional midblock crosswalk lighting layout

Fig 12. New design for midblock crosswalk lighting layout

Recommended Lighting Level: 20 lux at 5’ above pavement
No specific research done to address higher background luminance typically found at intersections.

30 vertical lux considered conservative estimate.
Roadway lighting typically 25 ft or higher
- Overhead streetlights
- Light source over roadway

Road lighting may be sufficient for motorists to navigate & avoid obstacles
- Often insufficient for specialized pedestrian needs

Pedestrian-level lighting pedestrian needs typically 20 ft or less (18 ft on non-arterials) from the surface
LIGHTING

CONSIDER TREE EFFECTS

TRR 2120 - Trees, Lighting, and Safety in Context-Sensitive Solutions
ARLINGTON LIGHTING - LAMAR BLVD.
STREETSCAPE LIGHTING LAYOUTS

2 LANE URBAN ROAD - PEDESTRIAN LIGHT OPTION
STREETSCAPE LIGHTING LAYOUTS

4 LANE URBAN ROAD - PEDESTRIAN AND OVERHEAD LIGHTS, BOTH SIDES
GENERAL CONSIDERATIONS FOR TRANSIT
The primary goal of transit is to carry passengers between residences, employment, and other destinations in a safe, efficient, and reliable manner.

The physical safety of ALL passengers is vital to the success of any transit system— not only to retain riders, but to encourage new riders.

However...
AGENCY CONSIDERATIONS

Primary Agencies
- Transit Agency
- Roadway Agency

Core Areas
- Ridership
- Transit Facilities
- Roadways
- Crashes

Transit vs. DOT Responsibility:
- DOT Responsibility
- Transit Responsibility

Team Approach
Focus resources on areas of need

- High-Use Locations (ridership)
  - Busy Corridors
  - Busy Stops near key generators or high transfer activity

- Infrastructure Gaps/Needs
  - Sidewalks
  - Crossings
  - ADA compliance

- Safety Considerations
  - High incident locations
• Waiting space should meet passenger demand
• This may change as routes change and land use changes
Understand activities and locations that generate demand

Understand pedestrian paths
TRANSFER ACTIVITY

- Understand passenger travel patterns and the effect on pedestrian paths

Source: RTD Denver
Access to transit exists on multiple levels:

- Access at transit stop
- Connections to transit routes
- Access at transit stop
CATCHMENT AREA

- Bus Stop
- Bus Stop Catchment Area
- Corridor Catchment Area

$\frac{1}{4}$ mile
ADA COMPLIANCE
ADA Standards – Ramps

Running slope < 1:20

Cross slope < 1:48

Change in direction:
ADA Standards – Accessible routes

Minimum width:
- 36” (2.7’) for a maximum length of 2’.
- Within public right-of-way: 48” (4’) for a maximum length of 200’.
- Passing zones must be provided (3’ or 5’ within public right-of-way).

Source: U.S. Access Board
RESOURCES

- Complete Streets Local Policy Workbook (Smart Growth America 2013)
- PEDSAFE

Design Documents
- Stop location and design

Planning documents
- Corridor studies
- System plans
  - Transit Development Plans
  - Long-range Transit Plans
QUESTIONS