



FEHR & PEERS
TRANSPORTATION CONSULTANTS



CROSSWALK TREATMENT IDENTIFICATION TOOL USER'S GUIDE

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TABLE OF CONTENTS

Introduction.....	1
Determining Where and How to Mark Crosswalks	2
Treatments at Uncontrolled Locations.....	4
Appendix A. Field Visit Checklist	16
Appendix B. Crosswalk Safety Research	21

INTRODUCTION

A comprehensive pedestrian safety strategy contains a three-pronged approach including engineering, enforcement, and education programs. This guide focuses on physical elements, such as pedestrian crossing treatments and intersection design.

Development of a pedestrian safety strategy should guide a city in making decisions about where basic crosswalks (two stripes) can be marked; where crosswalks with special treatments, such as high visibility crosswalks, flashing beacons, and other special features, should be employed; and where crosswalks will not be marked due to safety concerns resulting from volume, speed, or sight distance issues.



Image source: www.flickr.com/photos/luton



This document contains a toolbox of elements to improve crosswalk visibility and safety. In addition to standard tools, the toolbox includes very promising, yet experimental, devices, such as the HAWK and Stutter Flash (both have provisional approval).

An Excel-based treatment identification tool accompanies this document. Based on research from the National Cooperative Highway Research Program and Federal Highway Administration, the tool provides guidance about the type of treatments appropriate on various streets and under various conditions. The tool uses simple inputs from a field survey (a field survey checklist is included in Appendix A), such as number of lanes, posted speed, and average daily traffic, to provide a candidate crosswalk treatment at mid-block and uncontrolled locations. The tool is not meant to replace engineering judgment.

FUNCTION OF CROSSWALKS

The main function of a crosswalk is to channelize pedestrians. Well-marked pedestrian crossings accomplish dual goals. They prepare drivers for the likelihood of encountering a pedestrian, and they create an atmosphere of walkability and accessibility for pedestrians. Marked crossings reinforce the location and legitimacy of a crossing. However, motor vehicle codes generally require vehicles to yield the right-of-way to pedestrians at any intersection where crossing is not prohibited (regardless of marked crosswalks).¹

Crossing between adjacent, signalized intersections or anywhere crossing is prohibited is considered *jaywalking*.

While pedestrians and drivers have a responsibility to behave in accordance with the vehicle code, planners and engineers also have a responsibility to provide for safe crossings.



Image source: www.flickr.com/photos/luton



Image source: www.flickr.com/photos/luton

This document and the Crosswalk Treatment Identification Tool were prepared to assist transportation professionals in selecting crosswalk treatments that will improve pedestrian safety and, in doing so, enhance pedestrian accessibility and mobility.

¹ Check your state's vehicle code for the laws in your state

DETERMINING WHERE AND HOW TO MARK CROSSWALKS



Image source: www.cers-safety.com

The first step in identifying candidate crosswalk locations is to identify the places people would like to walk (pedestrian desire lines), which are affected by local land uses (homes, schools, parks, commercial establishments, etc.) and the location of transit stops. This information forms a basis for identifying pedestrian crossing improvement areas and prioritizing such improvements, thereby creating a convenient, connected, and continuous walking environment.

The second step is identifying the locations safest for people to cross. Of all road users, pedestrians have the highest risk because they are the least protected. National statistics indicate that pedestrians represent 14 percent of all traffic incident fatalities while walking accounts for only three percent of total trips. Pedestrian collisions occur most often when a pedestrian is attempting to cross the street at an intersection or mid-block location.²

Several major studies of pedestrian collision rates at marked and unmarked crosswalks have been conducted. In 2002, the Federal Highway Administration (FHWA) published a comprehensive report on the relative safety of marked and unmarked crossings (see Appendix B for a full discussion of this study).³ In 2006, another study was completed that further assists engineers and planners in selecting the right treatment for marked crosswalks based on studies of treatment effectiveness.⁴ With these studies as a backdrop, this document presents a variety of treatment options to mitigate safety, visibility, or operational concerns at specific locations.



Image source: www.pedbikeimages.org

² *Pedestrian Crash Types, A 1990's Information Guide*, FHWA; This paper analyzed 5,076 pedestrian crashes that occurred during the early 1990's. Crashes were evenly selected from small, medium, and large communities within six states: California, Florida, Maryland, Minnesota, North Carolina, and Utah.

³ Zegeer, C.V., J.R. Stewart, H.H. Huang and R.A. Lagerwey. "Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines." Report No. FHWA-RD-01-075. Washington, DC, USA: Federal Highway Administration, March 2002. http://www.walkinginfo.org/pdf/r&d/crosswalk_021302.pdf.

⁴ Fitzpatrick, Kay, et al... *Improving Pedestrian Safety at Uncontrolled Crossings*. TCRP Report 112/NCHRP Report 562. 2006. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_562.pdf.

TREATMENTS AT UNCONTROLLED LOCATIONS

This document and the accompanying tool focus on best practices for the installation of crosswalks at uncontrolled intersection and mid-block locations.

WHEN TO INSTALL CROSSWALKS

The following is the recommended, or best, practice for pedestrian treatments at uncontrolled intersections and mid-block locations.⁵

Crossings should be marked where all of the following occur:

- Sufficient demand exists to justify the installation of a crosswalk (see Demand Considerations below)
- The location has sufficient sight distance (sight distance in feet should be greater than 10 times the speed limit) and/or sight distance will be improved prior to crosswalk marking
- Safety considerations do not preclude a crosswalk

Demand Considerations: Uncontrolled and mid-block crossings should be identified as a candidate for marking if there is a demonstrated need for a crosswalk. Need can be demonstrated by any of the following:

- Location near existing or proposed pedestrian generators (such as a school or park)
- Existing pedestrian volumes
- Pedestrian-vehicle collisions at this location (over several years)
- Location of nearest (adequately) marked or controlled crosswalk
- Citizen surveys, requests, walking audits, etc.



Image source: www.flickr.com/photos/luton

Specific demand considerations should be determined locally. Charts 1 and 2 on the following pages provide an example of demand inputs, which may be appropriate for

⁵ The most common crosswalk of this type will be at intersections where a minor side street is stop controlled and a major street is uncontrolled.

urban and suburban communities. Rural communities may consider reducing pedestrian volume or collision requirements.

CONSIDERATIONS FOR MULTI-LANE, HIGH VOLUME, AND/OR HIGH SPEED LOCATIONS

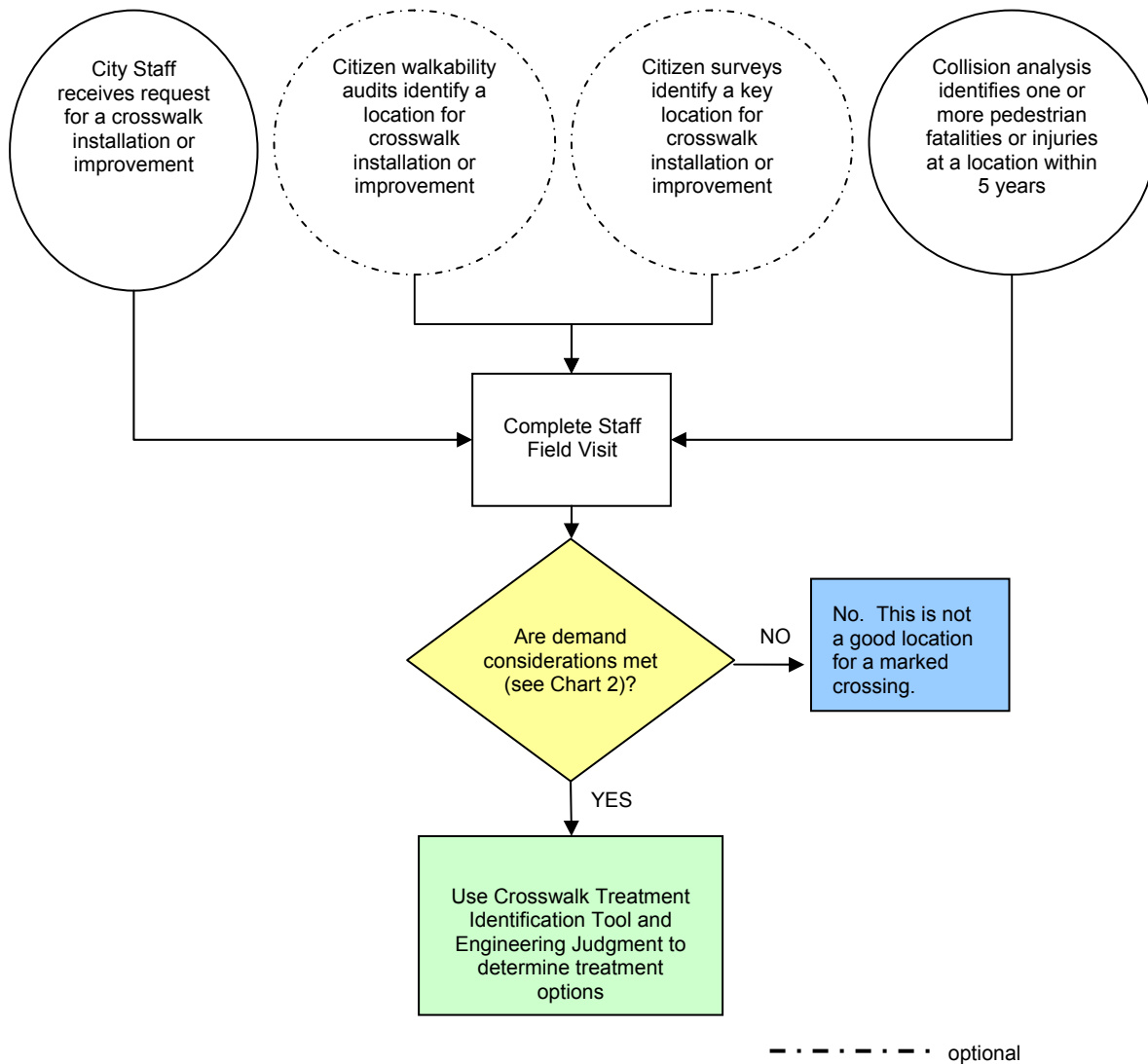
For candidate crosswalk locations on either a multi-lane street (three or more lanes), or on two-lane streets with daily traffic volumes (ADT) greater than 12,000 or with posted speed limit exceeding 30 miles per hour, enhanced treatments beyond striping and signing may be needed.⁶ Additional funding sources should be identified as needed for these enhancements. Failing to provide an enhanced crosswalk and/or removing a crosswalk because it cannot be enhanced should be an option of last resort.

CROSSWALK LOCATION AND TOOL FEASIBILITY ANALYSIS

Charts 1 and 2 on the following pages describe the overall procedures for a model crosswalk policy, from the moment City staff receives a request for a new marked crosswalk (or considers removing an existing marked crosswalk) to the installation of the treatment. As described on the previous pages, the first steps to determine the appropriate location and treatment for the crosswalk include a staff field visit (a recommended form for this field visit is included in Appendix A).

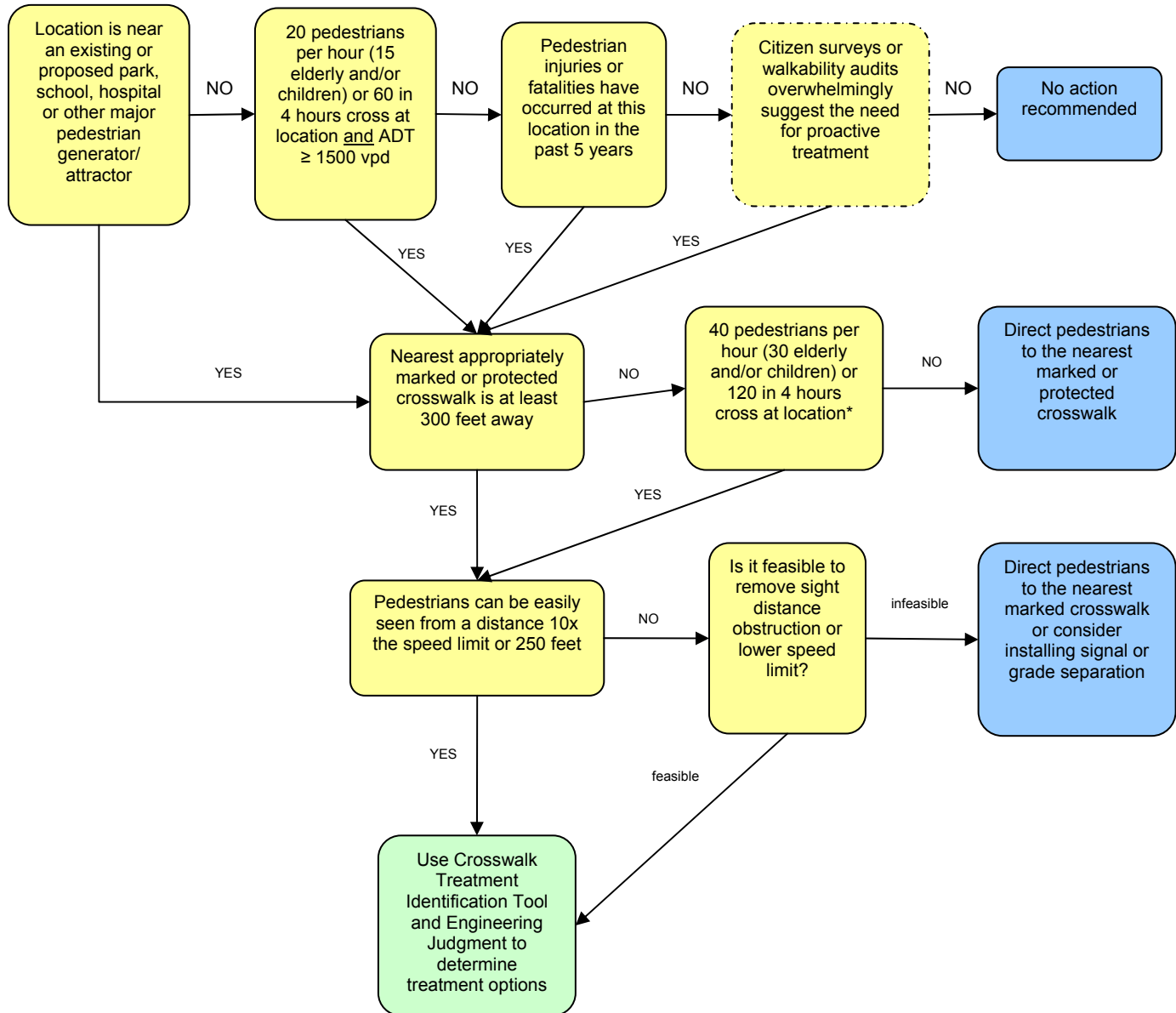
⁶ See Appendix A discussion

Chart 1. Recommended Selection Process for Uncontrolled and Mid-Block Crosswalk Locations



* A field visit checklist is provided in Appendix A

Chart 2. Feasibility Analysis for Treatments at Uncontrolled Locations



* Consider lowering the volume requirements in rural locations or to meet local ranges for pedestrian volumes

--- optional

Note: Where no engineering action is recommended in Chart 2, consider applicable education and enforcement efforts.

TREATMENT IDENTIFICATION

Based on the results of Charts 1 and 2, the Treatment Identification Tool may be used at a candidate crosswalk location. The Treatment Identification Tool follows a two-step process to determine a “match” for the study location characteristics. The first step is to determine if the pedestrian and vehicle volumes meet the signal warrant requirements to install a pedestrian signal. If this warrant is met, the tool will recommend a signal. If the warrant is not met, the tool recommends one or more less “intense” treatments, as described below.

A calculation of Pedestrian Level of Service forms the basis for the Treatment Identification Tool.⁷ Pedestrian Level of Service is the average delay experienced by pedestrians as they are waiting to cross the street. The Treatment Identification Tool calculates the average crossing speed based on curb-to-curb width and gaps in traffic.

Expected motorist compliance is another other key variable for treatment identification. Compliance is based on field observations and engineering judgment. It is meant to reflect typical motorist responses to pedestrians attempting to cross the street. If drivers are likely to stop for a pedestrian, the compliance is rated “high.” If drivers rarely stop for pedestrians, compliance is “low.” The tool sets the compliance rate to low for all locations where the speed limit is greater than 30 MPH.

The treatment matrix, which is embedded within the Tool, assigns treatment by level of enhancement needed (with the most significant enhancement required with the worst LOS and compliance rates).

Level 1 Treatments:

- High Visibility Crosswalk Markings, Advance Yield Lines, Advance Signage

Level 2 Treatments:

- Curb Extensions, Bus Bulb, Reduced Curb Radii, Staggered Pedestrian Refuge

Level 3 Treatments:

- In-pavement Flashers, Overhead Flashing Beacons (two-lane roads)
- Stutter Flash* (multi-lane roads)

⁷ Note: the tool requires data inputs from the Field View Checklist (see Appendix A). The pedestrian level of service calculation is set forth in the Highway Capacity Manual (HCM), published by the Transportation Research Board.

* Not included in the current MUTCD (both treatments have provisional status)

Level 4 Treatments:

- HAWK*, Stutter Flash*, or Direct Pedestrians to Nearest Safe Crossing

Treatments are selected within each level based on the characteristics of the location (presence of bicycle lanes, transit, etc.). Descriptions for each treatment are presented in the next section. For higher levels of treatments, combinations of treatments across levels (such as a HAWK signal with curb extensions) may be appropriate. These combinations should be determined based on site feasibility and engineering judgment.

TREATMENT IDENTIFICATION MATRIX FOR UNCONTROLLED LOCATIONS

PEDESTRIAN LEVEL OF SERVICE ⁸	EXPECTED MOTORIST COMPLIANCE		
	LOW (or Speed > 30 MPH)	MODERATE	HIGH
LOS A-D (average delay up to 30 seconds)	LEVEL 3 2 lane road: In-pavement flashers, overhead flashing beacons Multi-lane road: Stutter flash Plus LEVELS 1 AND 2	LEVEL 2 Curb Extensions, Bus Bulb, Reduced Curb Radii, Staggered Pedestrian Refuge Plus LEVEL 1	LEVEL 1 High Visibility Crosswalk Markings, Advance Yield Lines, Advance signage
LOS E-F (average delay greater than 30 seconds)	LEVEL 4 HAWK, Stutter Flash, or Direct Pedestrians to Nearest Safe Crossing PLUS LEVELS 1 AND 2	LEVEL 3 2 lane road: In-pavement flashers, overhead flashing beacons Multi-lane road: Stutter flash Plus LEVELS 1 AND 2	LEVEL 2 Curb Extensions, Reduced Curb Radii, Staggered Pedestrian Refuge Plus LEVEL 1

Notes:

- A Pedestrian Refuge Island is recommended for consideration in all scenarios with more than 2 lanes of traffic.

⁸ Based on the pedestrian level of service criteria as defined in the 2000 Highway Capacity Manual, Table 18-13 (LOS Criteria for Pedestrians at Unsignalized Intersections) for average delay/pedestrian, where delay is calculated as a function of vehicle flow rates and critical gaps (which are a function of walking speed, crosswalk length, and startup and end clearance times). See the "documentation" tab in the Treatment Identification Tool for formulae and additional details.

- A Road Diet⁹ is recommended for consideration in all scenarios with 4 or more lanes of traffic and a daily traffic volume of less than 15,000 vehicles (ADT).

CANDIDATE TREATMENT DESCRIPTIONS

The following table provides a summary of the treatments include in the Treatment Identification Tool. Additional fact sheets and case studies for many of these treatments are included in the NHCRP 562 Report at http://trb.org/publications/nchrp/nchrp_rpt_562.pdf or the Pedestrian Bicycle Information Center at <http://www.walkinginfo.org/>.

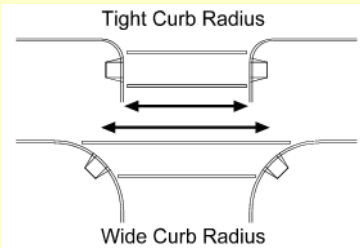
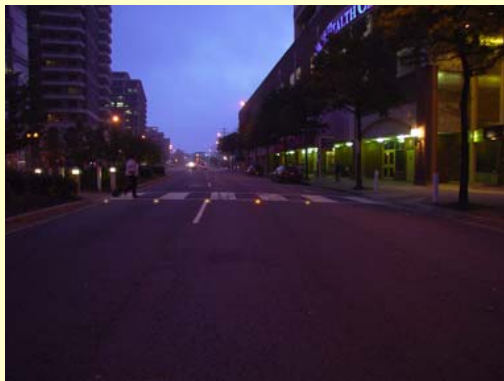
CROSSWALK TREATMENTS			
Measure	Description	Benefits	Application
Level 1			
Marked Crosswalk  <i>Image source: www.walkinginfo.org/pedsafe/</i>	Marked crosswalks should be installed to provide designated pedestrian crossings at major pedestrian generators, crossings with significant pedestrian volumes (at least 15 per hour), crossings with high vehicle-pedestrian collisions, and other areas based on engineering judgment	Marked crosswalks provide a designated crossing, which may improve walkability by signaling a clear "channel" for pedestrian pathways to both pedestrians and vehicles.	Marked crosswalks alone should not be installed on multi-lane roads with more than about 10,000 vehicles/day. Enhanced crosswalk treatments (as presented in this table) should supplement the marked crosswalk.
High-Visibility Signs and Markings  <i>Image source: exodusinnovations.com</i>	High-visibility markings include a family of crosswalk striping styles such as the "ladder" and the "continental." High-visibility fluorescent yellow green signs are made of the approved fluorescent yellow-green color and posted at crossings to increase the visibility of a pedestrian crossing.	FHWA recently ended its approval process for the experimental use of fluorescent yellow crosswalk markings and found that they had no discernable benefit over white markings.	Beneficial in areas with high pedestrian activity, as near schools, and in areas where travel speeds are high and/or motorist visibility is low.

⁹ With a road diet, The number of lanes of travel is reduced by widening sidewalks, adding bicycle and parking lanes, and converting parallel parking to angled or perpendicular parking. An ADT of 15,000 or less is a general guideline for identifying eligible multi-lane roadways where lanes could be removed and vehicle level of service would remain the same or improve.

Crosswalk Treatment Identification Tool User's Guide

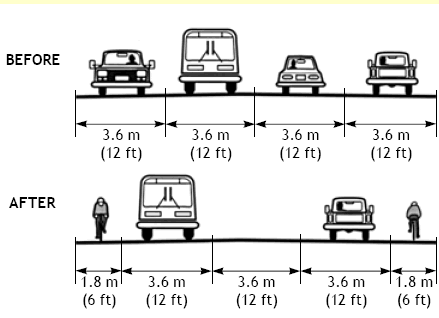
CROSSWALK TREATMENTS			
Measure	Description	Benefits	Application
Advanced Yield or Stop Lines  <i>Image source: www.saferoutesinfo.org</i>	Standard white stop or yield limit lines are placed in advance of marked, uncontrolled crosswalks. Stop or yield lines are determined based on state vehicle codes (requiring the driver to either stop or yield to the pedestrian).	This measure increases the pedestrian's visibility to motorists, reduces the number of vehicles encroaching on the crosswalk, and improves general pedestrian conditions on multi-lane roadways. It is also an affordable option.	Useful in areas where pedestrian visibility is low and in areas with aggressive drivers, as advance limit lines will help prevent drivers from encroaching on the crosswalk. Addresses the multiple-threat collision on multi-lane roads.
In-Street Pedestrian Crossing Signs  <i>Image source: www.seton.com</i>	This measure involves posting regulatory pedestrian signage on lane edge lines and road centerlines. The In-Street Pedestrian Crossing sign may be used to remind road users of laws regarding right of way at an unsignalized pedestrian crossing. The legend STATE LAW may be shown at the top of the sign if applicable. The legends STOP FOR or YIELD TO may be used in conjunction with the appropriate symbol.	This measure is highly visible to motorists and has a positive impact on pedestrian safety at crosswalks.	Mid-block crosswalks, unsignalized intersections, low-speed areas, and two-lane roadways are ideal for this pedestrian treatment. The STOP FOR legend shall only be used in states where the state law specifically requires that a driver must stop for a pedestrian in a crosswalk.
Level 2			
Curb Extension/ Bulb Outs  <i>Image source: Dan Burden</i>	Also known as a pedestrian bulb-out, this traffic-calming measure is meant to slow traffic and increase driver awareness. It consists of an extension of the curb into the street, making the pedestrian space (sidewalk) wider.	Curb extensions narrow the distance that a pedestrian has to cross and increases the sidewalk space on the corners. They also improve emergency vehicle access and make it difficult for drivers to turn illegally.	Due to the high cost of installation, this tool would only be suitable on streets with high pedestrian activity, on-street parking, and infrequent (or no) curb-edge transit service. It is often used in combination with crosswalks or other markings.

Crosswalk Treatment Identification Tool User's Guide

CROSSWALK TREATMENTS			
Measure	Description	Benefits	Application
Reduced Curb Radii  Image Source: www.ci.austin.tx.us	The radius of a curb can be reduced to require motorists to make a tighter turn.	Shorter radii narrow the distance that pedestrians have to cross; they also reduce traffic speeds and increase driver awareness (like curb extensions), but are less difficult and expensive to implement.	This measure would be beneficial on streets with high pedestrian activity, on-street parking, and no curb-edge transit service. It is more suitable for wider roadways and roadways with low volumes of heavy truck traffic.
Staggered Median Pedestrian Island  Image Source: www.tfhrc.gov/	This measure is similar to traditional median refuge islands; the only difference is that the crosswalks in the roadway are staggered such that a pedestrian crosses half the street and then must walk towards traffic to reach the second half of the crosswalk. This measure must be designed for accessibility by including rails and truncated domes to direct sight-impaired pedestrians along the path of travel.	Benefits of this tool include an increase in the concentration of pedestrians at a crossing and the provision of better traffic views for pedestrians. Additionally, motorists are better able to see pedestrians as they walk through the staggered refuge.	Best used on multi-lane roads with obstructed pedestrian visibility or with off-set intersections
Level 3			
In-Roadway Warning Lights  Image Source: www.tfhrc.gov/	Both sides of a crosswalk are lined with pavement markers, often containing an amber LED strobe light. The lights may be push-button activated or activated with pedestrian detection.	This measure provides a dynamic visual cue, and is increasingly effective in bad weather	Best in locations with low bicycle ridership, as the raised markers present a hazard to bicyclists. May not be appropriate in areas with heavy winter weather due to high maintenance costs. May not be appropriate for locations with bright sunlight. The lights may cause confusion when pedestrians fail to activate them and/or when they falsely activate.

Crosswalk Treatment Identification Tool User's Guide

CROSSWALK TREATMENTS			
Measure	Description	Benefits	Application
Overhead Flashing Beacons  <i>Image source: tti.tamu.edu</i>	Flashing amber lights are installed on overhead signs, in advance of the crosswalk or at the entrance to the crosswalk.	The blinking lights during pedestrian crossing times increase the number of drivers yielding for pedestrians and reduce pedestrian-vehicle conflicts. This measure can also improve conditions on multi-lane roadways.	Best used in places where motorists cannot see a traditional sign due to topography or other barriers.
Stutter Flash*  <i>Image source: mutcd.fhwa.dot.gov</i>	The Overhead Flashing Beacon is enhanced by replacing the traditional slow flashing incandescent lamps with rapid flashing LED lamps. The beacons may be push-button activated or activated with pedestrian detection.	Initial studies suggest the stutter flash is very effective as measured by increased driver yielding behavior. Solar panels reduce energy costs associated with the device.	Appropriate for multi-lane roadways.
Level 4			
Hawk Beacon Signal*  <i>Image Source: www.tfsrc.gov/</i>	HAWK (High Intensity Activated Crosswalks) are pedestrian-actuated signals that are a combination of a beacon flasher and a traffic control signal. When actuated, HAWK displays a yellow (warning) indication followed by a solid red light. During pedestrian clearance, the driver sees a flashing red "wig-wag" pattern until the clearance interval has ended and the signal goes dark.	Reduces pedestrian-vehicle conflicts and slows traffic speeds	Useful in areas where it is difficult for pedestrians to find gaps in automobile traffic to cross safely, but where normal signal warrants are not satisfied. Appropriate for multi-lane roadways.

CROSSWALK TREATMENTS			
Measure	Description	Benefits	Application
Level 5			
Traffic Signal  <i>Image source: www.livablestreets.com</i>	Conventional traffic control devices with warrants for use based on the Manual on Uniform Control Devices (MUTCD)	Reduces pedestrian-vehicle conflicts and slows traffic speeds	Must meet warrants based on traffic and pedestrian volumes; however, exceptions are possible based on demonstrated pedestrian safety concerns (collision history)
Pedestrian Overpass/ Underpass  <i>Image source: omahamidcenturymodern.blogspot.com</i>	This measure consists of a pedestrian-only overpass or underpass over a roadway. It provides complete separation of pedestrians from motor vehicle traffic, normally where no other pedestrian facility is available, and connects off-road trails and paths across major barriers.	Pedestrian overpasses and underpasses allow for the uninterrupted flow of pedestrian movement separate from the vehicle traffic. However, for underpasses, security is known to be a major issue.	Grade separation via this measure is most feasible and appropriate in extreme cases where pedestrians must cross roadways such as freeways and high-speed, high-volume arterials. Use of either type of facility falls off rapidly when the additional time required for such use amounts to 20% or more of the time required to cross at grade. This measure should be considered only with further study.
Consider for All Multi-Lane Roads			
Road Diet (aka Lane Reduction)  <i>Image Source: www.tfhrc.gov/</i>	The number of lanes of travel is reduced by widening sidewalks, adding bicycle and parking lanes, and converting parallel parking to angled or perpendicular parking.	This is a good traffic calming and pedestrian safety tool, particularly in areas that would benefit from curb extensions but have infrastructure in the way. This measure also improves pedestrian conditions on multi-lane roadways.	Roadways with surplus roadway capacity (typically multi-lane roadways with less than 15,000 to 17,000 ADT) and high bicycle volumes, and roadways that would benefit from traffic calming measures.

Crosswalk Treatment Identification Tool User's Guide

CROSSWALK TREATMENTS			
Measure	Description	Benefits	Application
Median Pedestrian Island  Image source: http://thegoodcity.wordpress.com/category/transportation/	Raised islands are placed in the center of a roadway, separating opposing lanes of traffic with cutouts for accessibility along the pedestrian path.	This measure allows pedestrians to focus on each direction of traffic separately, and the refuge provides pedestrians with a better view of oncoming traffic as well as allowing drivers to see pedestrians more easily. It can also split up a multi-lane road and act as a supplement to additional pedestrian tools.	Recommended for multi-lane roads wide enough to accommodate an ADA-accessible median
* Treatment not included in the current version of the MUTCD			

APPENDIX A. FIELD VISIT CHECKLIST

Major Road: _____ X Minor Road or Location: _____

Date of Review: _____

Reviewer: _____

Peak Hour Observed: _____

CRITICAL ROADWAY CHARACTERISTICS

Site Distance Issues (circle driver or pedestrian as applicable):

1. Parked cars (driver/ ped)
2. Moving traffic obscures vision during crossing (driver/ ped)
3. Roadway curvature (driver/ ped)
4. Terrain (driver/ ped)
5. Vegetation (driver/ ped)
6. Significant sun glare (driver/ ped)
7. Insufficient building setback (driver/ ped)
8. Moveable roadside items, e.g., street furniture (driver/ ped)
9. Fixed roadside items, e.g., signal control boxes, signs (driver/ ped)
10. Inadequate roadway lighting (driver/ ped)
11. Poor signal visibility (driver/ ped)

Sight distance is generally acceptable if the pedestrian can easily be seen from a distance of 10x the speed limit or 250 feet.

If any of the above issues are circled for the driver or pedestrian, can these issues be mitigated? If no, direct pedestrians to the nearest marked crosswalk (stop field view here) or consider installing a pedestrian signal or grade separation (continue below to collect data for warrant analysis). If yes, make note of mitigation options and continue below.

Mitigation options:

GENERAL PEDESTRIAN CHARACTERISTICS

1. Is the crossing along a direct route to a major pedestrian attractor/ generator?
Circle: yes/no
2. Peak Hour Pedestrian Volume (total crossing major road): _____
pedestrians/hour
3. Pedestrian Crossing Distance, curb to curb: _____ feet
4. Distance to nearest marked crosswalk: _____ feet. Is the crossing
signalized? Circle: yes/no
5. Pedestrian Walking Speed (average): _____ ft/sec
6. Pedestrian Start-up and End Clearance Time: _____ sec
7. Existing Pedestrian Signal Timing (crossing major road): _____ sec
8. Existing Pedestrian Signal Provisions (count down/ push button/ scramble/ other/
none – circle all that apply)
9. Other Existing Pedestrian Accommodations (e.g., signage, crosswalk striping) –
list here and include on diagram:
 - a. _____
 - b. _____

GENERAL VEHICLE/ ROADWAY CHARACTERISTICS

1. Major Road Traffic Speed (posted/ statutory/ 85th Percentile – circle one):
_____ MPH
2. Major Road Traffic Volume (total of both approaches during peak hour):
_____ vehicles/hour

3. Number of Lanes on Major Road: _____ and on Minor Road: _____
4. Typical Motorist Compliance at Pedestrian Crossings in Region: low/ medium/ high (circle one)

BEHAVIORAL INDICATORS

Check all that apply:

1. Inadequate ped search (peds enter roadway without searching): _____
2. Inadequate driver search (drivers proceed without searching): _____
3. Aborted crossing (return to curb after both feet in roadway): _____
4. Crossing against light (entry and exit from roadway against signal): _____
5. Small gaps (accepting gaps which require rapid crossings): _____
6. Leaving crosswalk (crossing starts or ends outside of an available crosswalk): _____
7. Crossing in front of a bus: _____
8. Vehicle overtaking (ped crosses in front of stopped traffic – Multiple Threat) : _____
9. Running (entry or crossing while running or moving fast): _____
10. Short time exposure (e.g., appearance from behind parked car): _____
11. Retreat (momentary reversal in pedestrian direction of travel): _____

ADDITIONAL INFORMATION

Community Characteristics:

1. Population: _____ people
2. Distance to major transit hub: _____ feet or miles (circle one)

3. Average age in Census Block: _____ years versus City-wide average of: _____ years

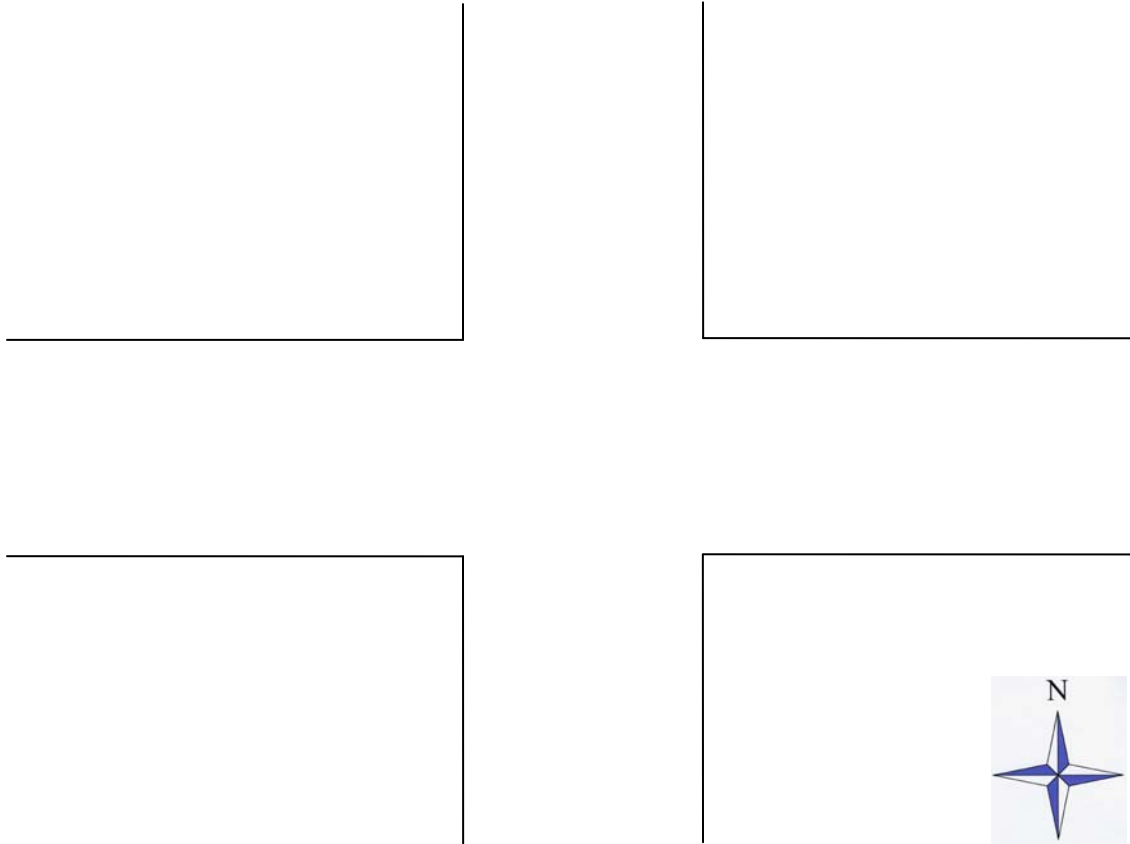
Potential Risk Factors:

1. Have pedestrian collisions occurred at this location in the past 5 years? Circle: yes/no
 - a. Number of injuries: _____ people
 - b. Number of fatalities: _____ people
2. Potential or Observed Conflicts (circle observed or potential as applicable):
 - a. Pedestrian walks too close to a vehicle – NEAR SIDE OF CROSSING (observed/ potential)
 - b. Pedestrian walks too close to a vehicle – FAR SIDE (observed/ potential)
 - c. RIGHT TURN vehicle (on green) too close to pedestrian (observed/ potential)
 - d. LEFT TURN vehicle too close to pedestrian (observed/ potential)
 - e. RIGHT TURN ON RED vehicle too close to pedestrian (observed/ potential)
3. Other Risk Factors (check all that apply):
 - a. Poor crossing surface: _____
 - b. Faded roadway striping (e.g. crosswalk striping): _____
 - c. High crime area/ personal safety concerns: _____
 - d. Bars or package stores near study location: _____
 - e. School near study location: _____
 - f. Senior facility near study location: _____

Observations or suggestions for appropriate education or enforcement measures based on this field view:

INTERSECTION DIAGRAM

(ATTACH PHOTOGRAPHS TO CHECKLIST)



Adapted from Pedestrian Safety Zone Guide, NHTSA,
<http://www.nhtsa.dot.gov/people/injury/pedbimot/ped/ZoneGuideWeb/pages/usingZones.htm>

APPENDIX B. CROSSWALK SAFETY RESEARCH

A study by the City of San Diego in 1970 found that a higher rate of collisions involving pedestrians occurred at uncontrolled locations with marked crosswalks. However, the City of San Diego study, which was widely used by many other cities as a rationale for removing marked crosswalks at uncontrolled locations, fails to differentiate between different types of streets and crossing locations. A separate study conducted on California State highways reached similar conclusions in 1996, but this study was also limited in its applicability to City streets that typically have fewer lanes and carry less traffic volume than State highways.

A landmark study conducted in 2002 for the Federal Highway Administration (FHWA) analyzed five years of pedestrian collisions at 1,000 marked crosswalks and 1,000 matched unmarked comparison sites in 30 U.S. cities. The study found that no meaningful crash risk differences occur on two-lane roads or on low-volume multi-lane roads. However, on multi-lane roads with traffic volumes greater than about 12,000 vehicles per day, having a marked crosswalk alone (without other substantial roadway treatments) was associated with a higher pedestrian crash rate than having an unmarked crosswalk. The researchers concluded that on many roads, particularly high-speed and multi-lane roads, more substantial improvements are often needed for safer pedestrian crossings, such as providing raised median islands, installing traffic signals (with pedestrian signals) when warranted, implementing speed-reduction and lane-reducing measures, and/or other measures.

The 2002 Federal Highway Administration study of pedestrian collisions at marked and unmarked crosswalks is widely recognized as the best resource for determining appropriate locations for marked crosswalks at uncontrolled locations.¹⁰

This study is used because:

- It is extensive. It examined motor vehicle/pedestrian collision rates at a large number of crossing locations not limited by roadway characteristics in four different cities.
- It is thorough. The collision rates were broken down by roadway characteristics (two-lane and multi-lane roads with various speeds and traffic volumes) in order to give the clearest picture of pedestrian safety at each type of location.

¹⁰ Zegeer, Charles V., Stewart, J. Richard, and Huang, Herman, "Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines," University of North Carolina Highway Safety Research Center for Federal Highway Administration, February 2002

2002 FHWA STUDY SUMMARY

Objective

To compare pedestrian crash occurrence at marked versus unmarked crosswalks at **uncontrolled** intersections throughout the U.S.

Data

- 1,000 marked and 1,000 unmarked crossings;
- No school crossings;
- Mid-block locations were included;
- Crash history (5 years), pedestrian volumes; traffic volumes, number of lanes, speed limit;
- 229 pedestrian/vehicle collisions in the sample.

Key Findings

- Marked crosswalks without traffic calming treatments, traffic signals, pedestrian signals, or other substantial crossing improvement under the following conditions are less safe than unmarked crossings:
 - Where the speed limit exceeds 40 miles per hour
 - On a roadway with four or more lanes without a raised median or crossing islands that has an ADT of 12,000 or greater
 - On a roadway with four or more lanes with a raised median or crossing island that has an ADT of 15,000 or greater

No study has conclusively answered why marked crosswalks are sometimes less safe than unmarked crossings. Several authors have theorized that pedestrians do not exercise due caution at marked crosswalks. Additionally, without advance warnings such as signs or overhead flashers, drivers may swerve around stopped cars without seeing the pedestrian in the crosswalk (called “double jeopardy”). The table on the following page summarizes the findings of the 2002 study.

Crosswalk Treatment Identification Tool User's Guide

Table 1. Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations.*

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT >9000 to 12,000			Vehicle ADT >12,000 - 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h
2 Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3 Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multi-Lane (4 or More Lanes) With Raised Median***	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

* These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone **will not** make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. **These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.**

** Where the speed limit exceeds 40 mi/h (64.4 km/h) marked crosswalks alone should not be used at unsignalized locations.

C = Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites. It is recommended that a minimum of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) exist at a location before placing a high priority on the installation of a marked crosswalk alone.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased due to providing marked crosswalks alone. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and American Association of State Highway and Transportation Officials (AASHTO) guidelines.