



# POTENTIAL PEDESTRIAN SAFETY IMPROVEMENT EVALUATION GUIDELINE

Traffic Safety Engineering Division

Updated: August 2016



**zero Fatalities**  
Drive Safe Nevada

## **EXECUTIVE SUMMARY**

During the February 2015 Transportation Board meeting, Governor Brian Sandoval championed the pedestrian safety cause and directed the Nevada Department of Transportation (NDOT) to provide efficient funding to pedestrian safety improvements. NDOT Traffic Safety Engineering (TSE) has since been tasked with developing pedestrian safety improvement projects provided with state highway funding. Since the Transportation Board meeting, projects have been identified and are in various stages of design or construction, along with a list of locations where future possible pedestrian safety improvements are identified.

NDOT TSE has recently become aware of the limited guidance for evaluating potential pedestrian safety improvement locations. The division determined an evaluation process was needed to help provide a clear guidance to all NDOT divisions. Having the task to determine which crossing locations will benefit from pedestrian safety improvements can be a complex process but can also be approached in a systematic manner to provide benefits to all roadway users. This evaluation guideline emphasizes the importance for engineering judgement while allowing for design flexibility and therefore providing support for the decision making process.

The evaluation guideline primarily consists of four parts: 1) Identify, 2) Collect Data, 3) Field Visit, and 4) Project Selection. The potential outcome will then include recommendations for pedestrian safety improvements.

## **DEFINITIONS**

### **Federal Highway Administration (FHWA)**

A branch of the US Department of Transportation that administers the federal-aid Highway Program, providing financial assistance to states to construct and improve highways, urban and rural roads, and bridges.

### **Regional Transportation Commission (RTC)**

The mission of the northern and southern RTC's is to provide leadership, vision, public policy development, and quality transportation systems through a commitment to excellence and pursuit of goals and objects that meet the community's present and future needs.

### **Americans with Disabilities Act (ADA)**

The Americans with Disabilities Act is a law that was enacted by the United States Congress in 1990. It is a wide-ranging civil rights law that prohibits discriminations based on disability.

### **Manual on Uniform Traffic Control Devices (MUTCD)**

The national standard for all traffic control devices installed on any street, highway, bikeway, or private road open to the public.

### **Highway Safety Manual (HSM)**

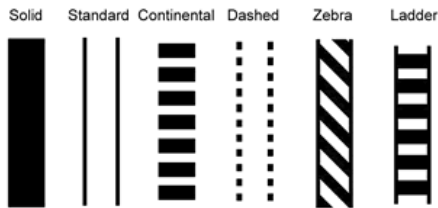
Provides practitioners with information and tools to consider safety when making decisions related to design and operations of roadways. The HSM assists practitioners in selection countermeasures and prioritizing projects, comparing alternatives, and quantifying and predicting the safety

performance of roadway elements considered in planning, design, construction, maintenance, and operations.

### Annual Average Daily Traffic (AADT)

The total volume of vehicle traffic of a roadway for a year divided by 365 days.

## PEDESTRIAN SAFETY COUNTERMEASURES



### High-Visibility Crosswalks

The standard treatment for marked crosswalks at locations consists of retro-reflective thermoplastic stripes that delineate the sides of the pedestrian walking area.



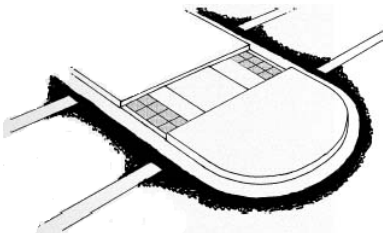
### Rectangular Rapid Flashing Beacon (RRFB)

Small rectangular flashing lights that are positioned with pedestrian crossing signs. They are activated by pedestrians manually with a push button or passively by a pedestrian detection system. Once activated, an irregular flashing pattern will flash for a predetermined amount of time to allow the pedestrian time to cross the roadway.



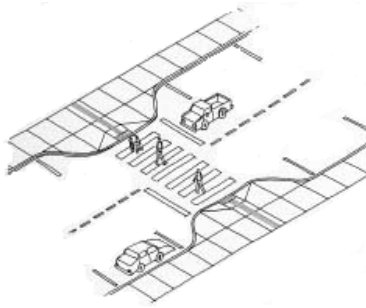
### Crosswalk Lighting

FHWA developed an information report on crosswalk lighting (FHWA-HRT-08-053: *Informational Report on Lighting Design for Midblock Crosswalks*) which provides information on lighting parameters and design criteria.



### Pedestrian Refuge Island

The area between opposing lanes of traffic to allow pedestrians to cross one direction of traffic at a time. In January 2012, FHWA issued a “Guidance Memorandum on Promoting the Implementation of Proven Safety Countermeasures”. Medians and Pedestrian Crossing Islands is one of the FHWA proven safety countermeasures.

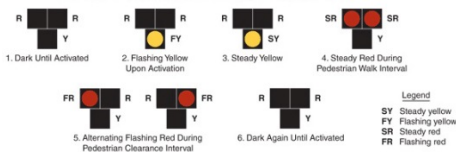


### Curb Extensions

Curb extensions are used to extend the sidewalk to reduce the crossing distance for pedestrians. They allow the pedestrian to be seen by approaching vehicles when other vehicles are parked and visually blocking the pedestrian from the roadway.

### Pedestrian Hybrid Beacon (PHB)

A pedestrian activated warning device located on the roadside or mast arm over a midblock crossing location. In general, they should be used if gaps in traffic are not adequate to permit pedestrians to cross. Chapter 4F of the MUTCD contains information on when a PHB may be installed. In January 2012, FHWA issued a “Guidance Memorandum on Promoting the Implementation of Proven Safety Countermeasures”. Pedestrian Hybrid Beacon is one of the FHWA proven safety countermeasures.



## **POTENTIAL PEDESTRIAN SAFETY IMPROVEMENT LOCATION EVALUATION GUIDELINE**

### Introduction

This guideline has been developed as a supplemental informational guide to help all NDOT divisions have an outline to the steps used in the process of evaluating a potential pedestrian safety improvement location. This guideline offers a process to follow, allowing for all locations to be analyzed in the same matter. When using this guideline, engineering judgement should always be used when evaluating a potential pedestrian safety improvement location. Every location will have its own conditions since no two locations are alike. While the MUTCD offers a minimum standard for pedestrian crossings, signage, and markings, the purpose of this guideline is to offer guidance and supplement engineering judgement for pedestrian safety improvements.

### Evaluation Steps

#### **1: Identify**

NDOT TSE is able to analyze potential pedestrian safety improvement locations for the entire state of Nevada with the use of pedestrian crash data. NDOT TSE also relies on the communication with the cities, counties, NDOT districts, and RTC’s to get a better understanding of the pedestrian behavior within their jurisdictions. Some important steps to help identify potential pedestrian safety improvement locations are:

- Collaborate with other entities
- Analyze pedestrian crash data
- Review Road Safety Assessments (RSA's), corridor studies, safety management plans, etc.
- Create a potential pedestrian safety improvement location list

## 2: Collect Data

Use the Pedestrian Safety Improvement Evaluation form prior to going out into the field. Some key focus points to consider:

- |   |  |
|---|--|
| • Pedestrian crash data                           | • Distance from intersection               |
| • Number of lanes                                 | • Is it in a school zone?                  |
| • Roadway width                                   | • Sight distance issues                    |
| • Median  | • Nearest bus stop locations               |
| • Stop Sign/Signal/Uncontrolled                   | • Roadway functional classification        |
| • Presence and type of lighting                   | • Is there sidewalk and ramps?             |
| • Current signage                                 | • Are sidewalk and ramps ADA compliant?*   |
| • AADT  | • Is there sidewalk leading to bus stops?  |
| • Current crossing design                         | • Is there a multi-used path or bike lane? |
| • Pedestrian volume                               | • Speed limit                              |
| • Distance from nearest crosswalk                 | • Is there on-street parking?              |
| • Are ramps directional to crosswalk or diagonal? |  |

\*Use the ADA GIS Feature Inventory to determine if sidewalks and ramps are ADA compliant: <https://ndot.maps.arcgis.com/home/webmap/viewer.html?webmap=0202ae8a996a4715b9da2fe1b2e2548e>

The next step is to use the Uncontrolled Crosswalk Decision Matrix to help determine possible countermeasures while in the field. The matrix utilizes AADT, speed limit (mph), and number of lanes to help suggest possible countermeasures when implementing pedestrian safety. The Uncontrolled Crosswalk Decision Matrix is not a substitute for engineering judgement, as many other factors may need to be considered.

**UNCONTROLLED CROSSWALK DECISION MATRIX**

(Treatment to be applied only if evaluations of conditions and engineering judgement indicates that the treatment will provide a significant safety benefit)

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT > 9,000 to 12,000			Vehicle ADT > 12,000 to 15,000			Vehicle ADT > 15,000		
	Posted Speed Limit											
	≤30 mph	35 mph	40 mph	≤30 mph	35 mph	40 mph	≤30 mph	35 mph	40 mph	≤30 mph	35 mph	40 mph
Two lanes	C/1	C/1	P/2	C/1	C/1	P/2	P/2	P/3	P/3	P/2	P/3	P/3
Three lanes	C/1	C/1	P/2	C/1	P/2	P/2	P/2	P/2	P/3	P/2	P/3	P/3
Multilane (four or more lanes with raised median)	C/1	C/2	P/2	C/2	P/2	P/3	P/2	P/2	P/3	P/3	P/3	P/3
Multilane (four or more lanes without raised median)	C/1	P/2	P/3	P/2	P/2	P/3	P/3	P/3	P/3	P/3	P/3	P/3

**C - Candidate sites for marked crosswalks\***. 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 in depth study of vehicle speeds, sight distance, vehicle mix, and other factors may be needed at other sites. See Crossing Treatment Type Number 1.

**P - 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 at uncontrolled locations should follow the requirements of the Manual on Uniform Traffic Control Devices (most current version).*

**Crossing Treatment Types:**

**1** - High visibility Crosswalk Striping is recommended, and consideration of additional treatments such as a Pedestrian Refuge Island and/or Advanced Yield Lines and street lighting.

**2** - Crossing treatments such as a Pedestrian Refuge Island, Overhead Pedestrian Crossing Signs, Pedestrian Activated Rectangular Rapid Flashing Beacons (RRFB), Yield Lines, parking removal between crosswalk and Yield Lines and street lighting should be considered. Consider using advanced Pedestrian Activated RRFBs at locations with limited sight distance to the crosswalk or on four to six lane arterial streets with a 45 mph or greater posted speed limit.

**3** - Crossing treatments such as a Pedestrian Hybrid Beacon, Flashing Beacon (at crosswalk and advanced), 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 marking on the surface.

## POTENTIAL PEDESTRIAN SAFETY IMPROVEMENT EVALUATION FORM

Primary Street: \_\_\_\_\_ Secondary Street: \_\_\_\_\_

City: \_\_\_\_\_ County: \_\_\_\_\_

Speed Limit: \_\_\_\_\_

AADT<sub>major</sub>: \_\_\_\_\_

AADT<sub>minor</sub>: \_\_\_\_\_

Urban

Rural

### Existing Traffic Control:

2-Way Stop Sign

4-Way Stop Sign

Traffic Signal

Uncontrolled

Roundabout

### Existing Crossing:

Midblock

Intersection

\_\_\_\_\_ Number of Crosswalks per Intersection

Crosswalk Striping: Poor / Fair / Good

Crosswalk

Pedestrian Signage

Advance Signage

Crosswalk Lighting

Curb Extensions

RRFB

Pedestrian Refuge

HAWK

Pedestrian Signal

### Existing Roadway:

Bus Only Lane

\_\_\_\_\_ Roadway Width

Raised Median

Street Lighting

Sight Distance Issues

School Zone

Bus Stops

On-Street Parking

Bike Lane

Is there Sidewalk? Yes / No

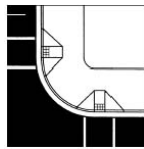
One Side of the Roadway

Both Sides of the Roadway

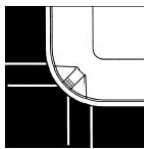
ADA Compliant Sidewalk

ADA Compliant Ramps

Directional Ramps



Diagonal Ramps



2-Lane Undivided

2-Lane with TWLTL

2-Lane with Median

4-Lane Undivided

4-Lane with TWLTL

4-Lane with Median

6-Lane with TWLTL

6-Lane with Median

**Notes:**

**What to look for based on the Uncontrolled Crosswalk Decision Matrix Crossing Treatment Types:**

<input type="checkbox"/> <b>Type 1</b>	<input type="checkbox"/> <b>Type 2</b>	<input type="checkbox"/> <b>Type 3*</b>
<ul style="list-style-type: none"><li>• High-visibility crosswalk striping</li><li>• Pedestrian Refuge Island</li><li>• Advance Yield Lines</li><li>• Street Lighting</li></ul>	<ul style="list-style-type: none"><li>• Pedestrian Refuge Island</li><li>• Overhead Pedestrian Crossing Signs</li><li>• RRFB</li><li>• Yield Lines</li><li>• Parking removal between crosswalk and Yield Lines</li><li>• Street Lighting</li></ul>	<ul style="list-style-type: none"><li>• Pedestrian Hybrid Beacon</li><li>• Flashing Beacons (at crosswalk and advanced)</li><li>• Stop or Yield Lines</li><li>• Parking removal between crosswalk and Yield Lines</li><li>• Street Lighting</li></ul>

*\* Installation of traffic signals cannot be considered unless traffic conditions meet warrant criteria in the MUTCD.*



### **3: Field Visit**

A field review team is able to collect the data that was not available prior to the field visit. The field review team is also able to get a better understanding of what possible pedestrian safety countermeasures can and cannot work for each location. Engineering judgement plays a key role in determining the proper pedestrian safety countermeasures that can be implemented for each location.

### **4: Project Selection**

Once all the existing condition data is collected and analyzed, the next step is to determine where projects can be developed. NDOT TSE developed a system to help with the project selection process, allowing for a justifiable way to determine which potential pedestrian locations should be addressed first. NDOT TSE developed a system using a matrix point system. The Potential Pedestrian Safety Improvement Project Selection Matrix is based on demographics and pedestrian high, medium, and low generators. This allows for all potential pedestrian safety improvement locations be weighted in a fair and equal manner.

**POTENTIAL PEDESTRIAN SAFETY IMPROVEMENT PROJECT SELECTION MATRIX**

Category	Sub-Category	Examples/Notes	Weight	Weight	Weight
			1/8 Mile	1/4 Mile	1/2 Mile
High Generator	University or College		15	10	5
	Major Generator	Convention Center, Casino	15	10	5
	Multi-family Living	Condominiums, Apartments, Mobile Home Park	10	5	3
Medium Generator	School		5	3	1
	Major Retail	Grocery Store, Convenient Store, Banks, etc.	5	3	1
	Bars		5	3	1
	Hotels	Motels	5	3	1
	Food Services	Restaurants, Fast Food, etc.	5	3	1
	Hospital	Clinics	5	3	1
	Bus Stop		5	3	1
	Senior Living	Hospice Care	5	3	1
Low Generator	Community Services	Community Centers, Libraries, Post Offices, Social Services, Churches, etc.	5	3	1
	Minor Retail	General Retail, Offices, etc.	3	1	0
	Park		3	1	0
	Trials	Bike Path, Multi-Use	3	1	0
Street Classification	Local			1	
	Collector			3	
	Minor Arterial			4	
	Principal Arterial			5	
Speed Limit	≤ 30			1	
	35+			3	
	40+			4	
	≥ 45			5	
Sidewalk Status	Missing			20	
	Narrow	< 4 feet		10	
	Standard	4 - 6 feet		0	
	Wide	> 6 feet		-10	
Parking	Yes On-street parking			0	
	No On-street parking			5	
Curb	Yes			0	
	No			2	
Road Width	0 - 24 feet			0	
	24 - 36 feet			2	
	36 - 48 feet			4	
	48 - 60 feet			6	
	61+ feet			10	
Distance Between Major Intersections	0 - 500 feet			0	
	500 - 1000 feet			2	
	1000 - 2000 feet			4	
	2000+ feet			5	
Stop Control	Roundabout			-4	
	Signal			-3	
	4-way Stop Sign			-2	
	2-way Stop Sign			-1	

## **NDOT TRAFFIC SAFETY ENGINEERING GUIDELINES**

NDOT TSE coordinated with NDOT Traffic Operations to develop a design standard for crosswalk lighting and RRFBs, both in post and cantilever detail, along with solar and AC power. The design standard will be added to the next edition of the NDOT Standard Plans for Road and Bridge Construction.

- When installing RRFBs, use a cantilever RRFB if there are two or more lanes in each direction and a speed limit of 35 mph or more.
- Crosswalk lighting should be added to all potential pedestrian safety improvement locations. While the design standard is focused for midblock locations, engineering judgment must be used when determining the best possible solution while designing intersection crosswalk lighting. NDOT has determined luminaires should be located so that it provides 20 vertical lux at the crosswalk and be located at least 15 to 65 feet from the crosswalk. The specification states that LED luminaires should be utilizing 16,500 lumen or greater.
- Use advance RRFB's when there is limited sight distance to the crosswalk, when there are three or more lanes in each direction, on an arterial roadway with a 45 mph or greater posted speed limit, and on sections where traffic signals are a half of mile to one mile apart.
- Curb extensions can be considered if there is on-street parking and if speed limits are less than 35 mph.

These guidelines should be considered unless they are not feasible based on engineering judgement. For any questions, concerns, or modifications needed, contact NDOT Traffic Safety Engineering.

### **TIME CONSTRAINTS**

All potential pedestrian safety improvement locations will have their own conditions. Some of the possible time constraints can be right-of-way, utilities, and environmental. When any of these items are involved, there are rules set in place that can potentially delay planned projects. For more information regarding the rules, contact NDOT Right-of-Way, NDOT Right-of-Way Utilities, and NDOT Environmental.

### **NEXT STEPS**

The goal for NDOT TSE is to provide the pedestrian with the most efficient and safe route. The division strives to evaluate all possible resources to determine the best engineering solution. Using a practical design concept and engineering judgement is key to designing a safe pedestrian crossing. NDOT Traffic Safety Engineering is committed to continuing this process as potential pedestrian safety improvement locations keep growing.

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