SAFE TRAVEL FOR EVERY PEDESTRIAN

DECISION GUIDE AND BEST PRACTICES

Uncontrolled Intersections and Mid-Block Crossings

South Dakota Department of Transportation

6-18-2020

SAFE TRAVEL FOR EVERY PEDESTRIAN

FHWA - EVERY DAY COUNTS INITIATIVE

SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION

EXECUTIVE SUMMARY

The South Dakota Department of Transportation participated in a FHWA Every Day Counts Initiative titled "Safe Travel for Every Pedestrian (STEP)". Pedestrians account for an estimated 16 percent of all roadway fatalities nationwide, the majority of which occur at uncontrolled crossing locations (i.e. mid-block locations) and at intersections with no traffic signal, STOP sign, or YIELD sign. The STEP initiative helps transportation agencies address such crashes by promoting cost-effective countermeasures with known safety benefits. This guidance document includes the best practices to help city engineers and designers address potential safety concerns at uncontrolled crossings.

A committee composed of people with a broad range of interests participated in the STEP initiative:

Name	Representing
Logan Gran	SDDOT - Project Development
Scott Rabern	SDDOT - Road Design
John Less	SDDOT - Road Design
Jerry Ortbahn	SDDOT - Project Development
Christina Bennett	SDDOT - Maintenance and Construction Management
Dustin Witt	SDDOT - Project Development
Tammy Williams	SDDOT - Admin & Local Government Assistance
Jon Suomala	SDDOT - Rapid City Region
Chris Kwilinski	FHWA
Gill Hedman	LTAP
LaJuanda Stands and Looks Back	Rosebud Sioux Tribe
Kip Harrington	Rapid City Metropolitan Planning Organization (MPO)
Beth Davis	SD Dept. of Health

PEDESTRIAN CROSSINGS

DECISION GUIDE AND BEST PRACTICES

INTRODUCTION:

A pedestrian's ability to safely cross highways and streets needs to be considered by designers. Expecting pedestrians to travel significantly out of their way to cross a roadway to reach their destination is unrealistic and counterproductive to encouraging healthier transportation options.

Pedestrians account for an estimated 16 percent of all fatalities in motor vehicle traffic crashes, and these deaths occur at uncontrolled crossing locations such as mid-block or un-signalized intersections. These are among the most common locations for pedestrian fatalities generally because of inadequate pedestrian crossing facilities and insufficient or inconvenient crossing opportunities, all of which create barriers to safe, convenient, and complete pedestrian networks. Uncontrolled and midblock pedestrian crossing locations tend to experience higher vehicle travel speeds, contributing to increased injury and fatality rates when pedestrian crashes occur.

The information in this Decision Guide and Best Practices is provided as a resource to assist agencies in their effort to more safely accommodate pedestrians on their systems of roads and highways. The information in this guidance is consistent with best practices in safety planning as presented in guidance prepared by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the National Cooperative Highway Research Program (NCHRP). This information is provided in an effort to reduce the number of severe crashes with pedestrians, and it is understood that the final decision to implement any of the strategies resides with the responsible agency. There is no expectation or requirement that agencies implement any specific safety strategies, and it is understood that actual implementation decisions will be made by agency staff based on consideration of safety, economic, social, and political issues and location-specific considerations.

Various countermeasures are discussed in this guide, and they include the following:

COUNTERMEASURES:

1. **Flashing Beacons**
    A. **Stop Beacon**
    B. **Warning Beacon**
    C. **School Zone Speed Limit Sign Beacon**
    D. **Intersection Control Beacon**
2. **Radar Speed Feedback Sign**
3. **Rectangular Rapid Flashing Beacons (RRFBs)**
4. **Pedestrian Hybrid Beacons**
5. **Light-Emitting Diode (LED) Enhanced Signs**
6. **Traffic Calming**
    A. **Speed Hump/Table**
    B. **Raised Intersections/Pedestrian Crossings**
    C. **Curb Extensions**
    D. **Choker**
    E. **Road Diet**
7. **Pedestrian Refuge Islands**
8. **Enhanced Visibility at Crosswalks**

Knowing how to determine good crossing locations and which countermeasures to use enables highway agencies and other organizations to increase pedestrian safety. This guide is intended to assist in the decision-making process of determining the best solutions for each particular location.

The type of pedestrian traffic control used, either warning or regulatory, should be related to the volume and speed of traffic, street width and number of travel lanes, existing traffic control, and number of pedestrians crossing the road. For example, the traffic control needed on a major road may not be needed on a residential road. Uniform standards for traffic control are needed to assure the use of similar controls for similar situations. This uniform application of traffic control promotes uniform behavior on the part of the motorist and pedestrian, which in turn provides the safest practical traffic control system.

BENEFITS

Improved Safety. The countermeasures presented are proven solutions for reducing pedestrian fatalities at uncontrolled crossing locations.

Targeted Investment. By focusing on uncontrolled locations, agencies can address a significant national pedestrian safety problem.

Enhanced Quality of Life. Improving crossing opportunities boosts quality of life for pedestrians of all ages and abilities.

1. Flashing Beacons

Definition: A Flashing Beacon is a traffic control or warning signal composed of one or more signal sections that operate in a flashing mode.

Where two displays are used, they may be vertically or horizontally aligned, and they will be alternately flashed. A Flashing Beacon will not be included within the border of a sign except for School Speed Limit Sign Beacons. Flashing Beacons may be hard-wired or solar powered.

Typical applications of Flashing Beacons include the following:

A. Stop Beacon
B. Warning Beacon
C. School Zone Speed Limit Sign Beacon
D. Intersection Control Beacon

Refer to Chapter 4L of the Manual on Uniform Traffic Control Devices (MUTCD) "Flashing Beacons" for information regarding the mounting, flash rate, and additional standard design guidance on the typical applications of Flashing Beacons.

A. Stop Beacon

Definition: A Stop Beacon is used only to supplement a Stop Sign, Do Not Enter Sign, or a Wrong Way Sign and consists of one or more signal sections of standard traffic signal face with a flashing circular red signal indication in each signal section.

Stop Beacon signal indicators will flash simultaneously for two signals aligned horizontally and will flash alternately for two signals aligned vertically. The bottom of the signal housing of the Stop Beacon will be greater than 12 inches but less than 24 inches above the top of the accompanying sign.

B. Warning Beacon

Definition: A Warning Beacon is used only to supplement a warning sign and consists of one or more sections of a standard traffic signal face with one flashing circular yellow display in each section.

Figure 1a. Stop Sign with Stop Beacon

Figure 1b. Warning beacon with pedestrian warning sign

C. School Zone Speed Limit Beacon

Definition: A School Zone Speed Limit Beacon is used only to supplement a School Zone Speed Limit sign and consists of one or more signal sections of standard traffic control signal face with a flashing circular yellow display in each signal section.

When illuminated, the School Zone Speed Limit Sign Beacon will be clearly visible to all drivers it faces for a distance of at least a quarter of a mile, under normal atmospheric conditions, unless otherwise physical obstructed.

A School Zone Speed Limit Sign Beacon may be installed on the School Speed Limit Sign provided that (4) or more of the following criteria are met:

1) The speed limit on the street or highway in question when school is not in session is 30 miles per hour or more.
2) There are at least 20 pedestrians during the highest crossing hour regardless of gaps; or there are at least 10 pedestrians during the highest crossing hour and there are less than 60 adequate gaps in traffic during that period.
3) During the period of time that the school speed limit of 15 miles per hour is in effect, 15 percent or more of the vehicles are exceeding 25 miles per hour and adequate trial of enforcement has failed to reduce this number to less than 15 percent.
4) The volume of traffic is 250 vehicles per hour or greater during normal school hours on the street under consideration.
5) The traffic utilizing the street or highway is comprised of 10 percent or more trucks and commercial vehicles. Truck and commercial vehicles will be defined at any vehicle with six or more wheels on the ground or which exceeds 10,000lbs GVW.
6) If the preceding criteria should not exist to the extent otherwise required, the City Traffic Engineer at his/her discretion may determine that other conditions exist which may satisfy one

warrant. Factors that should be considered include automobile, bicycle and pedestrian volumes, vehicular speeds, crossing distances, the presence of a median or not, potential impact to corridor signal progression, proximity to signalized intersection, and vehicle queue formation.

School Speed Limit Sign Beacons will not be installed where a traffic signal exists within a school speed zone of 250 feet or less in length.

For added visibility, a second School Speed Limit Sign Beacon may also be located on the left side of the approaching roadway. For even more emphasis, the School Speed Limit Sign Beacon sign may be mounted overhead over the approximate center of the approach.

Figure 2. Overhead school flasher Speed Limit Sign

D. Intersection Control Beacon

Definition: An Intersection Control Beacon is used only at an intersection to control two or more directions of travel and consists of one or more circular yellow or circular red displays, directed toward each approach to an intersection

Photos by: FHWA & Texas Transportation Institute

Figure 3. Flashing Beacons at Stop-Controlled Intersections

A red display should be used for any approach required to stop. A yellow display should be used for any uncontrolled approach. Note that all yellow displays should never be used. A Stop Sign will be used on approaches in which a flashing red signal face is displayed on an Intersection Control Beacon.

If two red signal faces are aligned horizontally on an approach for an Intersection Control Beacon, they will be flashed simultaneously. If two red signal faces are aligned vertically, they will be flashed alternately. An intersection Control Beacon should not be mounted in the roadway unless within the confines of a traffic or pedestrian island.

The intersection control beacon will not face conflicting vehicular approaches if used at intersections. If suspended above a roadway, the clearance above the pavement will be a minimum of 15 feet and a maximum of 19 feet.

2. Radar Speed Feedback Sign

Definition: Radar Speed Feedback Signs (RSFS) are installed to provide a real-time dynamic display of a driver's speed at a location where speeding has been documented to be a problem. When the RSFS is activated, the display format will not include animation, rapid flashing, or other dynamic elements.

Figure 4. RSFS with Speed Limit sign installed in Selby, SD

Figure 5. Close up of typical School Zone RSFS

RSFS are typically used at locations where a speed limit transition occurs or in an area where driving the appropriate speed for the highway conditions is particularly critical, such as around school speed zones, or as drivers enter lower speed zones in municipalities. Because law enforcement agencies cannot be expected to constantly monitor speeds in a location, the RSFS serve to supplement regular enforcement of speed limits alerting drivers to specific driving behavior.

The RSFS should be located a minimum of 300 feet inside the posted speed zone. Radar Speed Feedback Signs installed within the clear zone must be mounted on breakaway supports.

Further guidance on the use of RSFS is provided in Part 2 of the MUTCD. When in a school zone, a static sign can't be used on the RSFS. Without the sign, it can run constantly.

If a local agency wants an installation of a RSFS on a state highway, the Department of Transportation needs to be contacted for a Permit to Occupy the ROW.

3. Rectangular Rapid Flashing Beacons

Definition: Rectangular Rapid Flashing Beacons (RRFBs) are user-actuated amber LEDs that use an irregular flash pattern that is similar to emergency flashers on police vehicles to supplement warning signs at unsignalized intersections or mid-block crosswalks. RRFBs are a lower cost alternative to traffic control signals and have been shown to significantly increase driver yielding behavior at crosswalks when supplementing standard pedestrian and school crossing warning signs and markings. The RRFBs are typically activated by manual pedestrian pushbuttons.

An RRFB will consist of two rapidly and alternately flashed rectangular yellow displays having LED-array based pulsing light sources, and will be designed, located, and operated in accordance with the detailed requirements specified below.

Figure 6. Example of RRFB dark (left) and illuminated during the flash period (center and right) mounted with a W11-2 sign and W16-7P plaque at an uncontrolled marked crosswalk.

In March 2018, the Federal Highway Administration issued new interim approval (IA-21) making RRFBs eligible again for interim approval status allowing for optional use in limited circumstances. In July 2018, the South Dakota DOT was granted approval on a blanket basis for all locations in South Dakota at which SDDOT or local agencies install RRFBs under the technical conditions. The interim approval allows for usage as a warning beacon to supplement standard signs and markings at designated pedestrian or school crossings where the crosswalk approach is not controlled by a yield sign, stop sign, traffic-control signal, or at a crosswalk at a roundabout. RRFBs may be installed on 2-lane or multi-lane roadways.

Installation of Rectangular Rapid Flashing Beacons on state highways needs approval from the appropriate DOT Region Traffic Engineer. Installation on a local roadway will be determined by the local agency. The local agency responsible for the RRFB must submit the location of the RRFB to the DOT as the DOT is required to maintain an inventory list of all locations in the state. The local agency has the responsibility to terminate the use of any RRFB at any time that significant negative safety issues arise from the use of the RRFB. The FHWA's office of Transportation Operations has the right to terminate the interim approval at any time if safety issues arise.

The use of RRFBs is optional. However, if an agency opts to use an RRFB, the following design and operational requirements will apply, and will take precedence over any conflicting provisions of the MUTCD for the approach on which RRFBs are used.

- A RRFB will only be installed to function as a Warning Beacon (see 2009 MUTCD Section 4L.03).
- A RRFB will only be used to supplement a post-mounted Pedestrian (W11-2), ,School (S1-1), or Trail (W11-15) crossing warning sign accompanied by a diagonal downward arrow plaque (W16-7P) or an overhead-mounted Pedestrian, School, or Trail crossing warning sign located at or immediately adjacent to an uncontrolled marked crosswalk. (Figure 7a – Figure 7d)
- A RRFB will not be used for crosswalks across approaches controlled by YIELD signs, STOP signs, or traffic control signals. This prohibition is not applicable to a crosswalk across the approach to and/or egress from a roundabout.

Figure 7a. Pedestrian Warning Sign (W11-2)

Figure 7b. School Sign (S1-1)

Figure 7c. Trail Crossing Warning Sign (W11-15)

Figure 7d. Diagonal downward arrow plaque (W16-7P)

In the event sight distance approaching the crosswalk at which RRFBs are used is less than the required stopping sight distance, an additional RRFB may be installed on that approach in advance of the crosswalk, as a Warning Beacon to supplement the Advance Pedestrian Warning sign or Advance School sign. This additional RRFB will be supplemental to and not a replacement for RRFBs at the crosswalk itself.

Refer to the MUTCD Interim Approval 21 – Rectangular Rapid Flashing Beacons at Crosswalks for Sign/Beacon Assembly Locations, Beacon Dimensions, Placement in the Sign Assembly, Flashing Requirements. Refer to the Beacon Operation Section of the MUTCD Interim Approval 21 for guidance on the operation of the beacon.

The duration of operation of the RRFBs following each actuation should be determined by the following equation:

T = W/S + 7

Where: T = Time the RRFBs flash, in seconds

W = Width of roadway, from curb to curb, in feet

S = Assumed walking speed in feet/second (use 3.5 for normal pedestrian traffic)

7 = Pedestrian start-up time in seconds (allows time for drivers to see and react to the RRFBs and for the pedestrian to recognize that traffic has yielded appropriately before starting to cross)

The RRFB flash period will be immediately initiated each time a pedestrian is detected, either through passive detection or the result of a pushbutton, including when the RRFB is already flashing and pedestrians are detected immediately after RRFBs have ceased flashing.

4. Pedestrian Hybrid Beacons

Definition: Pedestrian Hybrid Beacons consist of two horizontally-arranged red displays above a single yellow display that remains "dark" or unlit until activated via a pedestrian. Pedestrian Hybrid Beacons are used to increase motorists' awareness of pedestrian crossing at uncontrolled marked crosswalk locations.

Pedestrian Hybrid Beacons are an ideal treatment for high-speed, multi-lane, high-volume roadways and should be highly considered at midblock crossings. PHBs are most appropriate where traditional crosswalk signage and markings have no affect on traffic or where full traffic signals aren't warranted. The installation of PHBs can reduce the number of crashes for pedestrians and vehicles. FHWA's evaluation of PHBs found a reduction in 69% of pedestrian crashes and a 19% reduction in total crashes.

Photo Credit: Mike Cynecki

Figure 8. Pedestrian Hybrid Beacon Installation

While dark, the pedestrian display shows a DON'T WALK indicator. Once the PHB is activated, the display briefly flashes yellow to warn motorists of activation, then is followed by a steady yellow display, then a red display to indicate to motorists to come to complete stop while pedestrians walk. The Walk sign is lit for pedestrians during the red display for motorists. When the WALK phases ends, the pedestrian signal changes to a flashing DON'T WALK to notify pedestrians to not to begin crossing. During the flashing Don't Walk phase, the PHB is displayed with red alternating flashing lights for the drivers indicating drivers must stop and yield to pedestrians in the crosswalk and can proceed driving when crosswalk is clear of pedestrians. (Figure 9)

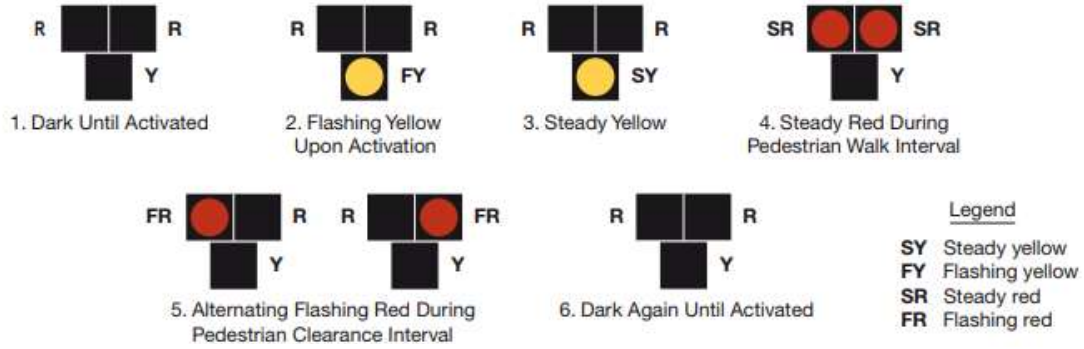

Figure 9. Corresponding Display Sequence for Pedestrian Hybrid Beacon

Stop lines and marked crosswalks are required at PHB crossings. Advance stop lines should be considered to avoid secondary threat crashes. Existing pedestrian signal systems should be considered when installing PHBs. Excessive delays in pedestrian signals may result in impatient pedestrians and non-compliant motorists with the PHB. Immediate response is preferred over pedestrians having to wait for the WALK signal.

Chapter 4F of the MUTCD contains information how to install PHBs and how PHBs may be used in conjunction with signs and pavement markings at locations where pedestrians cross a street or highway. Chapter 4F of the MUTCD also identifies factors to consider in determining if a PHB should be used.

5. Light-Emitting Diode (LED) Enhanced Signs

Definition:

LEDs can be embedded in standard highway warning signs to outline either the sign itself or the words and symbols on the sign. The LEDs may be set to flash or operate in steady mode. LEDs may be illuminated 24 hours a day, or be activated by vehicles or pedestrians. Due to the low power requirements of LEDs, signs with embedded LEDs can typically be powered using stand-alone solar panel units. LED Enhanced Signs provide a cost-effective option for improving safety at intersections by increasing driver awareness, in certain situations.

This treatment is applicable for warning signs at unsignalized intersections with the intended purpose of improving the visual conspicuity of the signs. Typical locations where LED-Enhanced Signs may be implemented include:

- Locations with sight visibility limitations (dusk/dawn glare, etc.);
- Locations with documented problems with drivers failing to recognize an intersection; and
- At STOP signs with documented compliance issues or sight distance issues.

Chapter 2A of the MUTCD contains design and installation information on LED Enhanced Signs.

Figure 10. Example of LED Enhanced signs (Stop Sign and Pedestrian Crossing Sign)

6. Traffic Calming

Speeding is a contributing factor in almost one-third of all fatal crashes in the United States. Simply posting a lower speed limit is usually not effective. Traffic calming is a term used to describe a full range of methods to reduce the speed of traffic.

The following are traffic calming applications that can be used to help lower the speeds of vehicles:

A. Speed Hump/Table
B. Raised Intersection/Pedestrian Crossing
C. Choker
D. Curb Extensions
E. Road Diet

A. Speed Hump/Table

Definition: A Speed Hump is a raised area in the roadway extending transversely across the street. A Speed Table is a long broad (flat-topped) speed hump that is most commonly used with pedestrian

crossings. A Speed Table and Speed Hump are designed to physically limit the speed at which a vehicle can traverse it.

Speed Humps should not be used on roads with steep grades. Colored or specialized paving materials may used to enhance the aesthetics of the Speed Hump. Speed Humps may coordinate with mid-block crossings to provide a safer crossing for pedestrians.

Figure 11. Speed Hump

Figure 12. Speed Table

Refer to MUTCD Section 2C for signage of Speed Humps and Section 3B for Speed Hump markings and advance Speed Hump markings. Refer to the Vertical Speed Control Elements section of the NACTO (National Association of City Transportation Officials) Urban Street Design Guide for design guidance on Speed Humps and Speed Tables.

B. Raised Intersections/Pedestrian Crossings

Definition: A Raised Intersection is a raised area (flush with sidewalk/shared use path) that covers the entirety of the intersection allowing for a safe, slow-speed crossing at public intersections. A Raised Pedestrian Crossing is also a raised area (flush with sidewalk/shared use path) that covers the entirety of the crossing allowing for a continuous, safe crossing for pedestrians.

Figure 13. Raised Intersection

Figure 14. Raised Pedestrian Crossing

Raised Intersections and Raised Pedestrian Crossings enhance the pedestrian environment and crossings by encouraging motorists to reduce speeds and yield to pedestrians at the crosswalk. Consideration should be used when installing raised intersections and crossings if sight distance is limited or the street grade is steep. Raised Intersections and Raised Pedestrian Crossings provide a safer crossing environment for pedestrians.

Refer to the Raised Intersections section of the NACTO Urban Street Design Guide for design guidance on Raised Intersections. Refer to MUTCD Section 2C for signage of Raised Intersections and Raised Pedestrian Crossings and Section 3B for markings and advance markings.

C. Curb Extensions

Definition: A Curb Extension is an extension of the sidewalk or curb line into the parking lane. A Curb Extension reduces the effective street width.

A Curb Extension improves safety for pedestrians and motorists at intersections as it increases visibility and reduces vehicle speed. A Curb Extension also encourages pedestrians to cross at designated locations and prevents vehicles from parking at corners. This prevents motorists from parking in or close to a crosswalk or from blocking a curb ramp. Curb Extensions reduce the pedestrian crossing distance which reduces exposure to traffic. The installation of Curb Extensions are most appropriate where on-street parking is available as Curb Extension must not extend into vehicle travel lanes.

Refer to the Curb Extension section of the NACTO Urban Street Design Guide for additional guidance on Curb Extensions.

Figure 15. Curb Extension

Figure 16. Choker

D. Choker

Definition: A Choker is a midblock curb extension. A Choker narrows the street by widening sidewalks, creating a pinch point along the street.

A Choker can be created by widening the curb on both sides of the street or by dramatically widening the curb on one side of the street. Chokers can be used at mid-block crossings to lessen the distance a pedestrian must cross in the vehicle roadway. A Choker is most appropriate for low volume, low speed, single lane streets. Typically, a Choker is accompanied by parking lanes as to provide an extra parking lane buffer. Landscaping on a Choker can make the traffic calming feature attractive and more visible to the motorist. Care should be given to ensure that vegetation does not hinder the visibility of pedestrians.

Refer to FHWA's Traffic Calming EPrimer – Module 3 for design guidance on Chokers (3.17). The FHWA guidance document explains the advantages and disadvantages of using a Choker in different lane scenarios.

E. Road Diet

Definition: A Road Diet offers several high-value improvements at a low cost when applied to traditional four-lane undivided highways. In addition to low cost, the primary benefits of a Road Diet include enhanced safety, mobility and access for all road users and a "complete streets" environment to accommodate a variety of transportation modes.

A Road Diet converts an existing four-lane undivided roadway segment to a three-lane segment consisting of two through lanes and a center two-way left turn lane (TWLTL). A Road Diet improves safety by including a protected left-turn lane for mid-block left-turning motorists, reducing crossing distance for pedestrians, and reducing travel speeds which decreases crash severity. Additionally, the Road Diet provides an opportunity to allocate excess roadway width to other purposes, including bicycle lanes, on-street parking, or transit stops. A Road Diet is a candidate treatment for an undivided road with multiple, wide travel lanes that can be narrowed or repurposed. Refer to FHWAs Road Diet informational Guide to determine the feasibility, design, and effectiveness of a Road Diet.

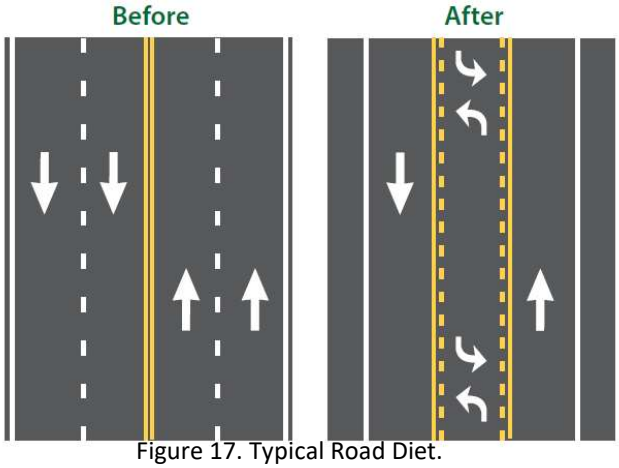

Figure 17. Typical Road Diet.

Figure 18. Before (left) and after (right) Road Diet

7. Pedestrian Refuge Islands

Definitions: A Pedestrian Refuge Island is an area within an intersection or between lanes of traffic where pedestrians may safely wait until motorists have cleared, allowing them to finish crossing the street. Pedestrian Refuge Islands provide enhanced safety for pedestrians not able to completely cross the roadway within the allotted pedestrian crossing time.

A Pedestrian Refuge Island is typically constructed in the middle of a 2-way street and is highly desirable for midblock crossings with four or more lanes. The minimum width of a Pedestrian Refuge Island is 6 feet. Installing such raised channelization on approaches to multi-lane intersections has been shown to be especially effective in enhancing safety at uncontrolled and mid-block crossings.

Figure 19. Pedestrian Refuge Island

Pedestrian Refuge Islands are a particularly important pedestrian safety countermeasure in areas where pedestrians access a transit stop or other clear origins/destinations across from each other.

Providing Pedestrian Refuge Islands at marked crosswalks has demonstrated a 46% reduction in pedestrian crashes.

Refer to section 3B of the MUTCD for guidance on signing a Pedestrian Refuge Island. Refer to Section 15.6 Pedestrian Refuge Islands in FHWA's Lesson 15 Pedestrian Accommodations at Intersections document for guidance on recommended practice and design.

8. Enhanced Visibility at Crosswalks

Pedestrian visibility distance is the distance at which a driver can see a pedestrian or marked crosswalk well enough to be able to respond appropriately. The greater the visibility distance, the more time a driver will have to react to the pedestrian before a conflict occurs.

Poor lighting, parked cars, and roadway curvature can reduce visibility at crosswalks and can lead to higher crash rates, especially at uncontrolled crossings. Crosswalk visibility enhancements can help make these crosswalks and pedestrians more visible to motorists as well as help pedestrians know where to cross the road.

Visibility at crosswalks may be enhanced by a variety of striping designs (i.e. ladder, continental, bar pairs) that are highly recommended at midblock pedestrian crossings. The different striping designs make it easier for an approaching motorist to see the crosswalk.

Figure 20. High-visibility crosswalk striping

Figure 21. High-visibility crosswalk lighting

Parking restrictions should also be considered adjacent to pedestrian crossings. The minimum setback is between 20 and 30 feet depending on vehicle speed. Curb extensions may also be used in conjunction with a parking restriction to allow enhance visibility at crosswalks.

Sign sheeting upgrades may also enhance nighttime visibility. The basic requirement for a sign is that it is legible and understandable in time to permit a proper response. The sign should also be have high visibility during the day and also the night. Refer to Section 2A.06 of the MUTCD for additional guidance on the Design of Signs. Fluorescent Yellow-Green signs provides enhanced visibility. To enhance visibility of signs, the retroreflective sheeting should meet the requirements of ASTM D4956 Type XI. Type XI retro-reflective sheeting maximizes brightness, providing visibility up to 600 feet away. Refer to Section

2A.06 for Maintaining Minimum Retro-reflectivity. The Federal 164 Safety Program provides traffic engineering services to local governments as well as paying for materials for signing improvements. Requests are received annually for traffic related assistance for local governments who do not have traffic and safety engineering personnel on their staff. See the following link for further information on how to apply for this program: https://dot.sd.gov/transportation/highways/highway-safety.

Where significant nighttime pedestrian activity is expected, crossing locations should be carefully evaluated under nighttime conditions. Under non-daylight conditions, the pedestrian visibility distance depends on contrast. Contrast is the difference between the visual appearance of an object of interest and the visual background against which that object is observed, and the contrast is the basis of an object's visibility. There are two aspects of contrast: positive and negative. Positive contrast is when the pedestrian is brighter than the background and negative contrast is when the pedestrian is darker than the background. Positive contrast is used as the basis for lighting design at crosswalks. Detailed guidance on lighting design can be found in the AASHTO Roadway Lighting Design Guide and in the Illuminating Engineering Society's Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting.

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Figures

Figure 1a Stop Beacon: https://www.fhwa.dot.gov/publications/publicroads/06jul/08.cfm

Figure 1b Warning Beacon: https://www.statewidesafety.com/products/blinkerbeacon-solar-led-beacon-12-amber-lens-black-housing-1

Figure 2 School speed limit sign beacon:
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Figure 3 Flashing Beacons: https://safety.fhwa.dot.gov/intersection/other_topics/fhwasa08008/ue11.cfm

Figure 6 RRFB: https://mutcd.fhwa.dot.gov/resources/interim_approval/ia21/index.htm

Figure 7a Pedestrian Warning, 7C Trail Crossing, 7d Downward Arrow Plaque:
https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm#table2C01

Figure 7b School Crosswalk Warning: https://mutcd.fhwa.dot.gov/htm/2009/part7/part7b.htm

Figure 8 Pedestrian Hybrid Beacon: https://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa14014/

Figure 9 Pedestrian Hybrid Beacon Display: https://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa14014/

Figure 10 LED Stop Sign: https://groups.tti.tamu.edu/visibility/led-enhanced-signs/

Figure 10 LED Pedestrian Crossing: https://www.fhwa.dot.gov/publications/publicroads/05nov/03.cfm

Figure 11 Speed Hump: https://safety.fhwa.dot.gov/speedmgt/ePrimer_modules/module3pt2.cfm

Figure 12 Speed Table: https://safety.fhwa.dot.gov/speedmgt/ePrimer_modules/module3pt2.cfm

Figure 13 Raised Intersections: https://nacto.org/publication/urban-street-design-guide/intersections/minor-intersections/raised-intersections/

Figure 14 Raised Crosswalk: https://safety.fhwa.dot.gov/speedmgt/ePrimer_modules/module3pt2.cfm

Figure 15 Curb Extension: https://safety.fhwa.dot.gov/speedmgt/ePrimer_modules/module3pt2.cfm

Figure 16 Choker: https://safety.fhwa.dot.gov/speedmgt/ePrimer_modules/module3pt2.cfm

Figure 17 Typical Road Diet: https://www.fhwa.dot.gov/innovation/everydaycounts/edcnews/10012015.cfm

Figure 18 Before & After Road Diet: http://www.cityofmoorhead.com/home/showdocument?id=4150

Figure 19 Pedestrian Refuge Island: http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=6

Figure 20 High-visibility Crosswalk Striping: https://safety.fhwa.dot.gov/ped_bike/tools_solve/ped_scdproj/sys_impact_rpt/chap_2.cfm

Figure 21 High-visibility Crosswalk Lighting: https://safety.fhwa.dot.gov/older_users/handbook/ch2.cfm

Title VI

The South Dakota Department of Transportation provides services without regard to race, color, gender, religion, national origin, age or disability, according to the provisions contained in SDCL 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994.

Any person who has questions concerning this policy or who believes he or she has been discriminated against should contact the Department's Civil Rights Office at 605-773-3540.

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