



U.S. Department of Transportation
Federal Highway Administration



Arkansas Department of Transportation

ACTION PLAN FOR IMPLEMENTING PEDESTRIAN CROSSING COUNTERMEASURES AT UNCONTROLLED LOCATIONS

October 2018

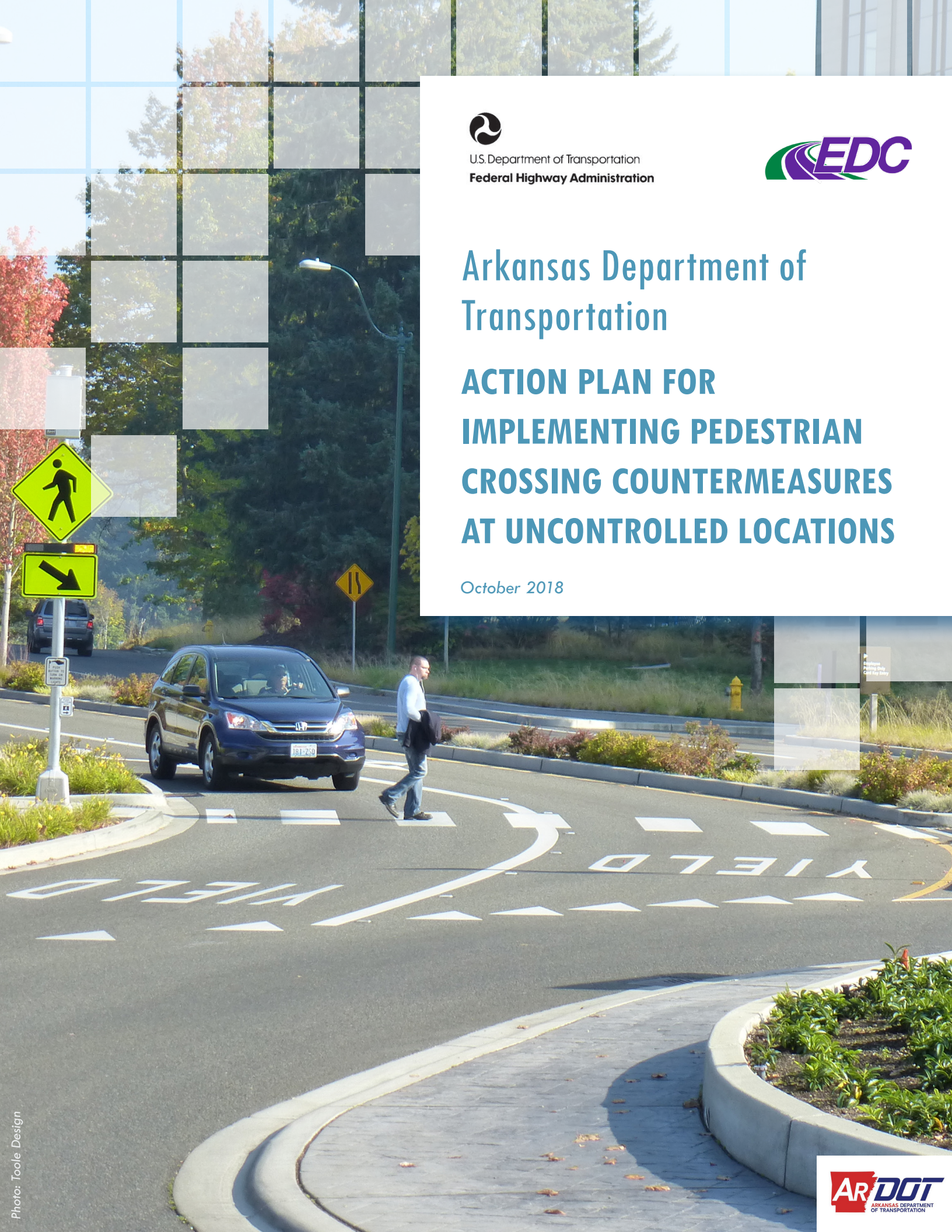


Photo: Toole Design



Acknowledgments

This Safety Plan was developed by a group of dedicated individuals that are committed to reducing the number of lives taken prematurely on our nation's roadways.

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List of Abbreviations

AADT	annual average daily traffic
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADT	average daily traffic
CMF	crash modification factor
CRF	crash reduction factor
EDC	Every Day Counts
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
GIS	geographic information system
HSIP	Highway Safety Improvement Program
HSP	Highway Safety Plan
MUTCD	Manual on Uniform Traffic Control Devices
NHTSA	National Highway Traffic Safety Administration
PHB	Pedestrian Hybrid Beacon
RSA	Road Safety Audit
SHSP	Strategic Highway Safety Plan
STBG	Surface Transportation Block Grant
STEP	Safe Transportation for Every Pedestrian
TZD	Toward Zero Deaths
VMT	Vehicle Miles Traveled
VZ	Vision Zero

Executive Summary

State Participation in STEP Planning Initiative

This Safety Action Plan (“Plan”) has been developed as part of the Safe Transportation for Every Pedestrian (STEP) initiative and targets specific countermeasures for improving pedestrian safety at uncontrolled intersections. STEP is a Federal Highway Administration (FHWA) effort which is part of the Every Day Counts (EDC) initiative. The Arkansas DOT (ARDOT) and several planning organizations are leading this initiative in coordination with the FHWA Arkansas Division Office.

STEP has five stages: Not Implementing; Development Phase; Demonstration Stage; Assessment Stage; and Institutionalized. States self-assess to determine their stage, and then decide if they would like to move up to the next stage. Arkansas is currently in the Development Stage (#2) with an intent of moving to the Demonstration Stage (#3) through the implementation of the recommendations of this plan.

A full day work session was held at Arkansas DOT to review existing practices and policies impacting crossings across the state to develop the recommended actions reflected in this Plan, especially those related to state highway system and MPO areas. A review of the current use of the countermeasures and pedestrian safety processes was conducted before the full day work session and modified as necessary at that session.

Key Recommendations

This Plan recommends actions that when implemented are likely to reduce the number and rate of pedestrian crashes, fatalities, and injuries on Arkansas highways. If emulated by local transportation agencies, these benefits may also be realized on local roads. ARDOT has taken actions in the past several years, specifically with its update of the Strategic Highway Safety Plan and the Bicycle and Pedestrian Plan. More importantly, ARDOT is poised to take additional steps to implement the following STEP recommendations in this plan:

RECOMMENDATIONS: ARDOT should continue to follow the MUTCD engineering conventions for siting marked crosswalks. Additional countermeasures – as triggered by the MUTCD language and provided in this plan – should be incorporated into a Department crosswalk policy and procedure. A future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

RECOMMENDATIONS: ARDOT should conduct analyses that result in critical intersections or “hot spots” proactively identified. Such a systemic analysis can use the criteria established in the MUTCD – speed, number of lanes, presence of a median, crossing distance, etc. GIS would be the most appropriate tool for identification of key intersections using a prioritization tool such as the ActiveTrans Priority Tool¹. The Traffic Safety Section of the Transportation Planning and Policy Division will be

¹ http://www.pedbikeinfo.org/training/webinars_PBIC_LC_120414.cfm

responsible for leading this effort and should be implemented two years from the release of this Action Plan.

RECOMMENDATION: ARDOT should tie together the crosswalk elements from across the department's resources and place them together for one comprehensive crosswalk policy statement and procedure. The MUTCD language would be integrated into the policy and procedure. A future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

RECOMMENDATION: ARDOT should develop a crosswalk inventory and evaluation using for the *Guide for Improving Pedestrian Safety at Uncontrolled Locations* for guidance. The Bicycle and Pedestrian Coordinator in the Program Management Division will be responsible for leading this effort.

RECOMMENDATION: ARDOT should develop a policy on the use of Rectangular Rapid-Flashing Beacons and Pedestrian Hybrid Beacons with criteria established for their use. These criteria should be featured in the proposed crosswalk policy and procedure. A future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

RECOMMENDATION: A significant opportunity exists for ARDOT to review and include STEP recommendations in the two safety plans as they are updated in the near future. For these two documents, opportunities will exist to include policy and planning guidance – as recommended in this plan - for improving pedestrian safety. In addition, the 2005 AHTD Sidewalk Accommodation Policy should be updated to include the provision of safe crossings. A future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

RECOMMENDATION: ARDOT will continue to use the MUTCD and the 2004 AASHTO pedestrian guide and stands ready to review the new and expanded guidance on pedestrian crossings in the updated AASHTO pedestrian guide once it is adopted by that agency. In addition, the Department can include some basic design information or at least links to design guidance, in the proposed crosswalk policy and procedure. ARDOT Roadway Design will be responsible for leading this effort.

RECOMMENDATION: ARDOT will improve its consideration of STEP measures as part of its project development process for highway projects. Of the five countermeasures, enhancing crosswalks are the most universally viable option for projects because of the low cost and ease of implementation. However, if certain state highway projects are considered for road diets or involve reconstruction, additional small to moderate-scale STEP measures (pedestrian refuge islands and corner bump-outs) may become feasible. ARDOT Roadway Design, Maintenance Division, Construction Division will be responsible for leading this effort.

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Introduction and Background

Pedestrians are among the most vulnerable road users, accounting for approximately 16 percent of all roadway fatalities nationally in 2016, per the Fatality Analysis Reporting System (FARS). Pedestrians are especially vulnerable at non-intersection locations where 72 percent of pedestrian fatalities occur. In the State of Arkansas, pedestrians account for approximately 9 percent of all roadway fatalities¹.

What is STEP

STEP is a Federal Highway Administration (FHWA) initiative which is part of the Every Day Counts (EDC) Round 4 effort. This Safety Action Plan (“Plan”) has been developed as part of the Safe Transportation for Every Pedestrian (STEP) initiative and targets five specific countermeasures (described later in this guide) for improving pedestrian safety at uncontrolled crossings including mid-block crosswalks. EDC is a FHWA-State Department of Transportation (DOT) collaboration which focuses on underutilized innovations. STEP was identified as part of the fourth round of EDC innovations because of the cost-effectiveness of the countermeasures it offers with known safety benefits.

Every Day Counts (EDC)

The STEP initiative is part of EDC. In 2009, the Federal Highway Administration (FHWA) launched Every Day Counts (EDC) in cooperation with the American Association of State Highway and Transportation Officials (AASHTO) to speed up the delivery of highway projects and to address the challenges presented by limited budgets. EDC is a state-based model to identify and rapidly deploy proven but underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce congestion and improve environmental sustainability.

Proven innovations through EDC facilitate greater efficiency at the state and local levels, saving time and resources that can be used to deliver more projects for the same money. By advancing 21st century solutions, the highway community is making every day count to ensure our roads and bridges are built better, faster and smarter.

HOW IT WORKS

Through the EDC model, FHWA works with state and local transportation agencies and industry stakeholders to identify a new collection of innovations to champion every two years. Innovations are selected collaboratively by stakeholders, taking into consideration market readiness, impacts, benefits and ease of adoption of the innovation. After selecting the EDC technologies for deployment, transportation leaders from across the country gather at regional summits to discuss the innovations and share best practices. These summits begin the process for states, local public agencies and Federal Lands Highway Divisions to focus on the innovations that make the most sense for their unique program needs, establish performance goals and commit to finding opportunities to get those innovations into practice over the next two years.

Throughout the two-year deployment cycle, specifications, best practices, lessons learned and relevant data are shared among stakeholders through case studies, webinars and demonstration projects. The result is rapid technology transfer and accelerated deployment of innovation across the nation.

¹ NHSTA, “FARS Data Query: 2016 Data.” Fatality Analysis Reporting System (FARS) Encyclopedia. (2017). <https://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx>

Why Create this Pedestrian Safety Plan

The purpose of this Plan is to provide specific recommendations for improving conditions for walking at uncontrolled pedestrian crossing locations, which occur where sidewalks or designated walkways cross a roadway at a location where no traffic control (e.g., traffic signal or stop sign) is present. These common crossing types occur at intersections (where crosswalks may be marked or unmarked) and at non-intersection or midblock locations (where crosswalks must be marked in order for them to be legitimate crosswalks). Overall, uncontrolled pedestrian crossing locations often correspond to higher rates of pedestrian crash than controlled locations, often due to inadequate pedestrian crossing accommodations.²

By focusing on uncontrolled crossing locations, Arkansas Department of Transportation (ARDOT) will address a significant safety problem and improve crossing comfort for pedestrians of all ages and abilities. Recommendations in this Plan follow STEP guidance for implementing lower-cost countermeasures that can be deployed based on specific needs. They have a proven record of reducing crashes and represent underutilized innovations that can have an immediate impact.

This Plan also builds on existing State goals for improving safety, examining existing conditions, and using a data-driven approach to match countermeasures with demonstrated problem locations. Plan recommendations are structured to allow for immediate implementation.

State Participation in STEP

ARDOT and several MPOs (in particular, Jonesboro and Little Rock MPOs) are cooperating on this initiative in coordination with the FHWA Division Office of Arkansas. This Plan recommends actions that when implemented may help reduce the number and rate

of pedestrian-related crashes, fatalities, and injuries on the Arkansas State highway system. If emulated by local transportation agencies, these benefits may also be realized on county and city roads.

How this Safety Action Plan was Developed

This Plan is intended to be used in conjunction with the two US DOT, FHWA publications below (FHWA also features them on-line for its Safe Transportation for Every Pedestrian program).

EDC GUIDE FOR IMPROVING PEDESTRIAN SAFETY AT UNCONTROLLED CROSSING LOCATIONS (2018) (EDC GUIDE)

This guide assists State or local transportation or traffic safety departments that are considering developing a policy or guide to support the installation of countermeasures at uncontrolled pedestrian crossing locations. This document provides guidance to agencies, including best practices for each step involved in selecting countermeasures. By focusing on uncontrolled crossing locations, agencies can address a significant national safety problem and improve quality of life for pedestrians of all ages and abilities. Agencies may use this guide to develop a customized policy or to supplement existing local decision-making guidelines.

FHWA HOW TO DEVELOP A PEDESTRIAN AND BICYCLE SAFETY ACTION PLAN (2017) (FHWA HOW TO)

The purpose of this guide is to assist agencies in developing and implementing a safety action plan to improve conditions for bicycling and walking. The plan lays out a vision for improving safety, examining existing conditions, and using a data-driven approach to match safety programs and improvements with demonstrated safety concerns. This guide will help agencies enhance their existing safety programs and activities, including identifying safety concerns and selecting optimal solutions. It will also serve as a reference for improving pedestrian and bicycle safety through a multidisciplinary and collaborative approach to safety, including street designs and countermeasures, policies, and behavioral programs.

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2 FHWA. Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations. (2018).

The Plan report also references other FHWA publications, American Association of State Highway Transportation Officials (AASHTO) guides, the Manual on Uniform Traffic Control Devices (MUTCD), and relevant State publications for additional information. A complete list of referenced documents and other resources is found at the end of this document.

The three-part process used to develop this Plan helps ensure that recommended actions represent the best use of agency resources:

1. **Discovery:** Current policies, plans, design guidance, prioritization methodologies, crash data and implementation strategies were identified and assembled with the assistance of ARDOT staff.
2. **One-day Work Session:** ARDOT staff along with representatives from two MPOs (Jonesboro and Little Rock) and the FHWA division office met to review materials assembled during the Discovery phase, and to develop the recommended actions reflected in this Plan.
3. **Draft and Final Plan:** Based on the one-day work session, a draft Plan was developed, reviewed by ARDOT, revised and finalized.

This Plan will allow for the consideration of pedestrian safety improvements to be incorporated in other (state DOT) plans such as: Strategic Highway Safety Plan (SHSP), Long Range Transportation Plan (LRTP), traffic and design manuals, and the ARDOT pedestrian accommodation policy.

The recommendations in this Plan provide a roadmap for reducing the number and rate of pedestrian crashes, fatalities and injuries. The recommendations identify current policies and practices that should be continued, as well as others that should be modified or added to better facilitate implementation.

Building a safe and connected pedestrian network requires consideration of topics beyond what is

included in this Plan. Other engineering-based countermeasures exist for signalized intersections and for walking along streets and highways. Pedestrian crossings near schools are not specifically addressed in the Plan and will be subject to other State guidance. Crossing requirements per the Americans with Disabilities Act (ADA) are not specifically addressed in this Plan, although ADA requirements must be addressed as part of any pedestrian crossing improvements project. Resources and further guidance are provided at the end of this Plan.

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Mission, Goals, and Recommendations

Mission

The transportation system should accommodate people of all ages and abilities, including people too young to drive, people who cannot drive, and people who choose not to drive. Pedestrians can be expected to walk along and across all roadways, except where prohibited. Walking is an important element of a multimodal transportation system that supports all users. Well-designed, well-maintained facilities, with low crash frequencies and severities, are important to creating safe and convenient walking conditions.

ARDOT is committed to improving safety for all travel modes, including pedestrians. This commitment is reflected in the agency’s mission to “provide safe and efficient transportation solutions to support Arkansas’ economy and enhance the quality of life for generations to come.”¹ This support is important for providing the overall backing of the recommendations contained in this plan.

Goals and Objectives

The Agency’s commitment to improving safety for all modes is also reflected in the goals for ARDOT’s

Strategic Plan 2017-2022:

Strategic Goal: Provide Safe and Efficient Transportation Solutions

Objective 1: Develop, operate and maintain a safe, efficient and effective transportation system.

Strategy: Optimize the transportation system through well-coordinated planning efforts for all modes.

Strategic Goal: Champion Transportation Solutions that Promote Quality of Life and Economic Development

Objective 1: Optimize Reliability and Resiliency

Strategy: Integrate all modes of transportation in system planning and implementation.

ARDOT recognizes the importance of setting clear, measurable goals for improving pedestrian safety as a way of monitoring progress in reducing fatalities, injuries, and crashes. This is reflected in ARDOT’s bicycle and pedestrian plan². The relevant goals and strategies are:

¹ Arkansas Department of Transportation. Strategic Plan 2017-2022. Retrieved from http://www.ARDOT.gov/Trans_Plan_Policy/ARDOT%20Strategic%20Plan-2017-2021%20%282017-08-10%29.pdf

² Arkansas DOT Bicycle and Pedestrian Plan, Introduction Chapter, Pages 14 and 15, https://www.arkansashighways.com/Trans_Plan_Policy/biking/Arkansas%20Bike-Ped%20Plan%20-%20FINAL%20-03312017.pdf

“Goal 3: Conduct research and analysis leading to implementation of specific strategies for achieving zero pedestrian and bicyclist deaths from crashes with motor vehicles by 2025, and reducing injury crashes by 50 percent (over 2010-2014 levels).”

“Consider use of bicycle- and pedestrian-friendly intersection improvements to reduce traffic congestion, moderate speeds, reduce crashes and efficiently use existing rights-of-way.”

“Develop, operate and maintain a safe, efficient and effective transportation system and optimize the transportation system through well-coordinated planning efforts for **all modes**.”³

RECOMMENDATION: The commitment to safety as expressed in this mission statement and the goals and objectives of the cited plans should be reflected in all ARDOT activities and not isolated to these documents.

Performance Measures

Performance measures are a way to measure the effectiveness of agency policies, projects and programs. They can be a measurement of outcomes (e.g., reduction in number of pedestrian injuries and fatalities), or they can be a measurement of production items (e.g., the number of curb ramps installed). They serve as a tool for building agency accountability. Deciding what to measure is important since it will guide the allocation of resources as agencies strive to meet performance measure objectives.

ARDOT works with FHWA to establish and track safety performance measures as part of the Highway Safety Improvement Program (HSIP). The following performance measures are used to track and measure safety performance as five-year rolling averages:

- » Number of fatalities
- » Rate of Fatalities per 100 million VMT
- » Number of serious injuries
- » Rate of serious injuries per 100 million VMT
- » Number of non-motorized fatalities and serious injuries

There are other performance measures used in Arkansas, but they are administered by ARDOT’s partners: Arkansas Department of Health (ADH), MPOs and other unique partnerships. The Department of Health measures obesity and activity levels and is promoting active living through the Hometown Health Initiative. The ADH partnerships through this program involve local communities and organizations who work to create healthier communities by making active living easier.

RECOMMENDATION: ARDOT will continue to measure the effectiveness of agency policies, projects and programs. ARDOT will also continue to work cooperatively with MPOs and communities to better understand ARDOT project processes to deliver safe, efficient and reliable projects.

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3 A strategy in the State Bicycle and Pedestrian Plan: https://www.arkansashighways.com/Trans_Plan_Policy/biking/Arkansas%20Bike-Ped%20Plan%20-%20FINAL%20-03312017.pdf

3

Prioritizing Pedestrian Crossing Improvements

Data Collection and Analysis Individual Crash Location Analysis

Pedestrian crashes, especially those involving fatalities, are relatively rare at any given individual location. Consequently, to improve pedestrian safety requires identification of problem roadway segments as well as intersection and mid-block locations (note: this is not referring to controlled intersection and midblock crossing locations). A simple mapping of crash locations involving pedestrians will quickly identify high crash locations (likely only a few) and corridors. Typically, five years of crash data is appropriate, though in rapidly changing areas three years might be sufficient.

The Arkansas State Police maintains a database of all motor vehicle crashes, including those involving pedestrians. ArDOT has an agreement with Arkansas State Police to use and analyze crash data. To better understand State-wide pedestrian safety issues on State roads, the location of crashes involving pedestrians that occurred between 2015 and 2016 were mapped as part of the day-long working meeting. (Figure 1) illustrates which roadway segments have a higher number of fatal and injury crashes.

One issue noted during the one-day meeting was that for other agencies, such as Metropolitan Planning Organizations (MPOs), to use and analyze crash data they must submit a memorandum of understanding

(MOU). This requirement to request data rather than using an open data portal can delay the process in which crash data analysis can occur. However, ArDOT considers the limited information that is provided in crash data to be the most significant issue. Detailed crash information recorded by the responding office is not included. The absence of this information greatly limits the depth of analysis that is possible to be performed.

RECOMMENDATION: ArDOT will continue to collect and map pedestrian crashes to identify high crash locations and segments and work with other agencies to improve the quality of the data that is provided to allow for more in-depth and sophisticated crash analysis. Additionally, a transparent methodology detailing how the crash data is collected, cleaned, formatted, and what types of information that data includes should be developed and made readily available.

ArDOT will work with other agencies to make the data more easily shareable through an open process, such as an open data portal that doesn't require a timely and costly process to acquire in-depth data. The Traffic Safety Section of the Transportation Planning and Policy Division will be responsible for leading this effort.

System-wide Crash Analysis

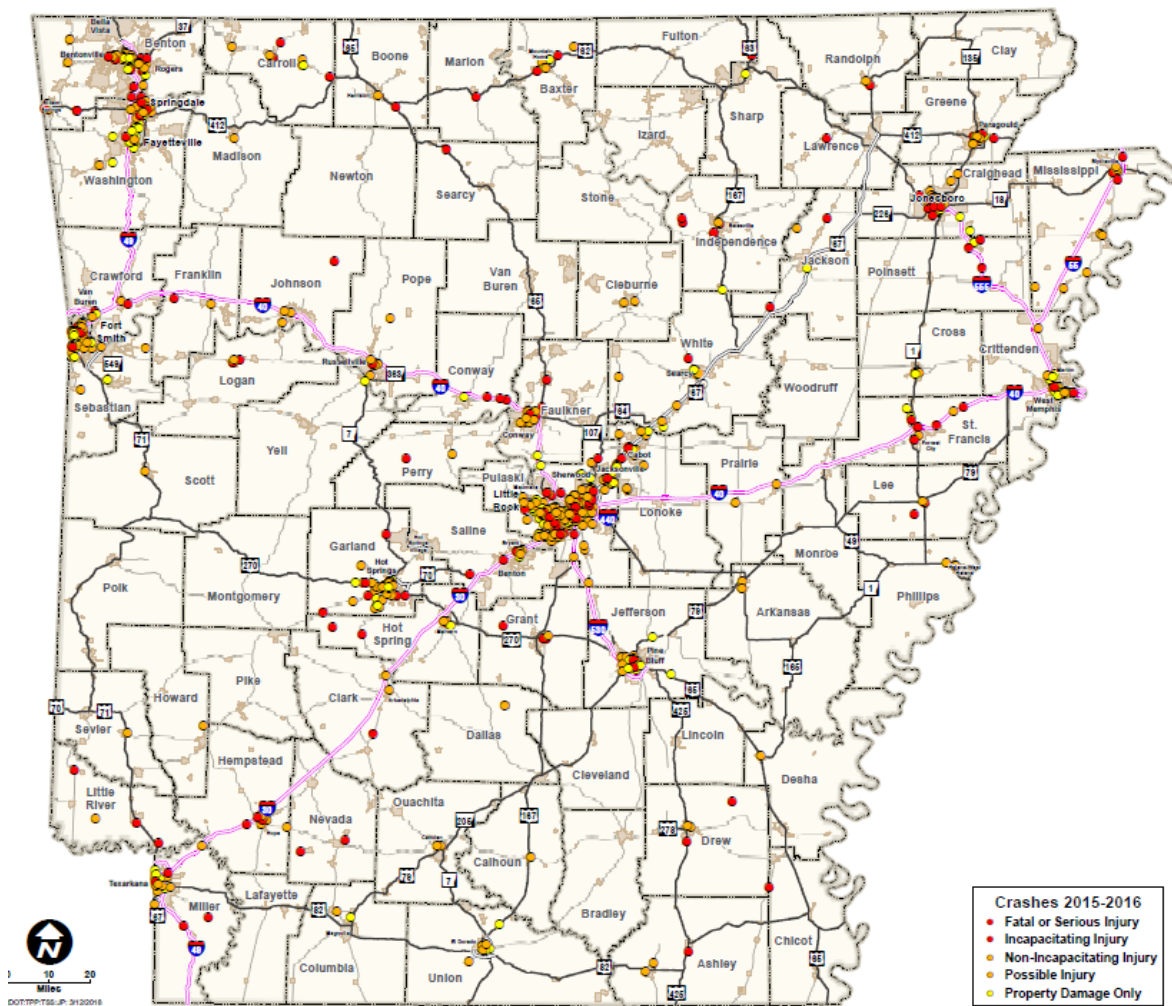
To conduct more sophisticated analyses of pedestrian crashes, additional data are needed. Detailed data, including crash location, time, demographic information about the individuals involved in the crash, and whether drugs or alcohol were involved, are extremely useful to determine whether there are patterns to pedestrian crashes, and if so, to select the best countermeasures to address them. Analysis of detailed data can provide information on where crashes occur, when they occur, and characteristics of the victims.

It can also be helpful to categorize crashes by type. This is known as pedestrian crash typing and was pioneered by the National Highway Traffic

Safety Administration in the 1970s to better define the sequence of events leading up to crashes and the orientation of both the pedestrian and motorist when the crash occurred. While there are over 60 specific pedestrian crash types, pedestrian crashes can generally be sorted into twelve crash type groupings for selecting countermeasures. Crash typing categorizes all crashes based on situational and behavioral circumstances and is a way to target countermeasures in engineering, education and enforcement programs at very specific types of crashes.

ARDOT recognizes the need for more complete and detailed pedestrian data than is currently provided.

Figure 1. Arkansas Pedestrian Crashes, 2015-2016



RECOMMENDATION: In addition to improving basic data collection and dissemination, ArDOT and its partners should conduct more detailed crash analysis and adopt a crash typing methodology. ArDOT should continue to evaluate various safety tools like Safety Analyst and Intersection Manager to expand its pedestrian analysis to once every year.

ArDOT should consider partnering with the Arkansas Department of Health who is willing to help fund more sophisticated analysis tools. The Traffic Safety Section of the Transportation Planning and Policy Division will be responsible for leading this effort.

Pedestrian Volume and Behavior Analysis

Pedestrian counts along with field observations (e.g., driver yielding, conflicts, and pedestrian assertiveness) can be very useful in understanding pedestrian behavior and in considering the need for facilities. Counts and behavior studies, when combined with crash data, can also provide insights into specific crash causes and potential countermeasures, and allow the determination of crash rates. On-site observations will often reveal behavior patterns that lead to design changes. Before and after counts can be used to measure success which in turn can be used to help secure funding for additional improvements at other locations. Pedestrian counts are also important to assess when and where signals, stop signs and marked crosswalks should be installed.

ArDOT currently conducts more bicycle counts than pedestrian counts. Traffic counts that are currently conducted for ArDOT are conducted by consultants. As a result, ArDOT does not own any of the traffic count equipment.

MPOs would like to do before and after counts and are willing to share automatic counters with other agencies to be able to conduct these counts. Additionally, some communities have permanent automated count equipment on existing shared-use

paths that can be used to factor short-duration counts.

There is currently a recommendation in the Arkansas Bike and Pedestrian Plan that suggests conducting a statewide personal travel survey to identify current levels of bicycling and walking for the following activities: utilitarian transportation, recreation, and different types of recreational biking (non-competitive mountain, touring, trail-riding, sports training/competition, etc.).

RECOMMENDATIONS: ArDOT should work on an experimental basis to conduct more counts and provide support to local agencies by purchasing equipment and then loaning it to municipalities. ArDOT could also find a role in being a repository for the data collected by other entities throughout the state. This would involve the development of a bicycle and pedestrian count standard to encourage uniformity among other agencies who collect count data providing a consistent format so the data can be shared and analyzed systematically.

ArDOT should work with MPOs and local agencies to support and conduct more before and after pedestrian counts for STEP-related projects. To fund these counts, other agencies should come together to help share some of the burden of collecting and analyzing the count data. The Bicycle and Pedestrian Coordinator along with the Systems Information and Research Division will be responsible for leading this effort.

Engineering Studies

There are many factors which can affect crossing opportunities including motorist approach speeds and volumes, motorist yielding, roadway configuration (width or roadway, number of travel lanes, etc.), and classification of vehicles, in addition to the volume and assertiveness of pedestrians and bicyclists mentioned above. Engineering studies should examine these factors when decisions are being made about pedestrian crossings.

As part of the engineering studies, sight distances should also be evaluated. Motorists must be provided sufficient stopping sight distance to be able to see, react, and yield to crossing pedestrians. Likewise, pedestrians require sufficient sight distance to identify and judge gaps in traffic. Where sight distance is limited, efforts should be made to increase it by removing parking or other sight obstructions, or to install curb extensions to allow pedestrians to wait closer to the edge of the roadway. Where sight distance cannot be provided, active warning devices should be provided in advance of the intersection, in conjunction with a Pedestrian Hybrid Beacon or traffic signal.

ArDOT currently uses the standards and guidance in the MUTCD when conducting an engineering study to evaluate the safety of an uncontrolled crossing. The Department gets numerous requests monthly for new crosswalk markings. The MUTCD indicates that an engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

Additionally it states that new marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and either: a) the roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater; or b) the roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT

of 15,000 vehicles per day or greater.

RECOMMENDATION: ArDOT should continue to follow the MUTCD engineering conventions for siting marked crosswalks. Additional countermeasures – as triggered by the MUTCD language and furnished in this plan – should be incorporated into a Department crosswalk policy and procedure. A future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

Prioritizing Pedestrian Crossing Improvements and Systemic Analysis Approach

A pre-defined methodology for prioritizing pedestrian improvements ensures that resources are allocated in a way that best meets goals to reduce pedestrian injuries and fatalities. A prioritization methodology should be:

- » Responsive to ArDOT and community values: Decisions should be based ArDOT mission and goals.
- » Flexible: Rather than being a rigid, “one-size-fits-all” tool, a prioritization methodology should be flexible and allow practitioners to choose the most appropriate approach that reflects agency goals and resource availability.
- » Transparent: A prioritization process should be broken down into a series of discrete steps, each of which can be easily documented and explained to the public.

Currently, crossing improvements on state highways are considered on a case-by-case basis. There is no systemic, data driven process used by ArDOT. However, some cities have developed more detailed analyses to help with priority setting.

Many areas may have low pedestrian crash rates,

but still have a high incidence for pedestrian crashes. Emerging methodologies identify these sites based on roadway characteristics combined with land use features of the area. In some cases, it may be possible to select countermeasures to address these crash factors before pedestrian crashes occur. Systemic analysis considers factors such as roadway design characteristics and traffic control devices, lighting conditions, vehicle speeds, and nearby pedestrian destinations. Combinations of these factors will also help identify countermeasures to address and prevent pedestrian crashes.

RECOMMENDATION: ARDOT should conduct analyses that result in critical intersections or “hot spots” proactively identified. Such a systemic analysis can use the criteria established in the MUTCD – speed, number of lanes, presence of a median, crossing distance, etc. GIS would be the most appropriate tool for identification of key intersections using a prioritization tool such as the ActiveTrans Priority Tool¹. The Traffic Safety Section of the Transportation Planning and Policy Division will be responsible for leading this effort.

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1 http://www.pedbikeinfo.org/training/webinars_PBIC_LC_120414.cfm

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Marked Crosswalks at Uncontrolled Locations

Marked Crosswalk Policy

Marked crosswalks delineate optimal or preferred locations for pedestrians to cross streets, and indicate to motorists where to expect pedestrians. Pavement markings must follow one of the types as shown in the MUTCD. New marked crosswalk installations at uncontrolled locations require an engineering study.

Marked crosswalks help to improve pedestrian safety and the connectivity of the pedestrian network. A marked crosswalk policy creates a consistent approach for the evaluation and installation of marked crosswalks. Uniform and consistent application of marked crosswalks can help increase predictability for both pedestrians and drivers. A marked crosswalk policy should:

1. Identify what factors are taken into consideration during evaluation of proposed marked crosswalks at uncontrolled locations (e.g., traffic volume, traffic speeds, crashes, destinations, roadway design, etc.)
2. Establish the primary types of crossing treatments to be considered for any marked crosswalk location (including high visibility crosswalks)
3. Determine a prioritization process for how crosswalk marking is implemented. Inputs to this prioritization may include locational data such as

transit stops, school walking routes, senior walking routes, high collision locations, and midblock locations with high numbers of pedestrians crossing the street.

FHWA's Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations (2018) provides options for crossing improvements, once an agency has determined where to install a marked crosswalk.

ArDOT does not have a detailed marked crosswalk policy or procedure, but uses the MUTCD for its engineering review of crosswalks.

RECOMMENDATION: ArDOT should tie together the crosswalk elements from across the department's resources and place them together for one comprehensive crosswalk policy statement and procedure. The MUTCD language would be integrated into the policy and procedure. Future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

A systematic inventory of conditions at existing marked crosswalks, and potential locations, is necessary for prioritizing locations and selecting countermeasures. This also will eventually require a complete list of existing marked crosswalks locations (lack of a complete list should not delay making improvements

at known problem locations). The review of existing marked crosswalks should be based on the guidelines in the marked crosswalk policy. The results can be used to create a strategy for making improvements at marked crosswalks at uncontrolled locations. ARDOT does not have a complete list of locations where there are marked crosswalks at uncontrolled locations on State highways and they have not completed a detailed inventory of conditions at existing marked crosswalks.

RECOMMENDATION: ARDOT should develop a crosswalk inventory and evaluation using the *Guide for Improving Pedestrian Safety at Uncontrolled Locations* for guidance. The Bicycle and Pedestrian Coordinator in Program Management Division will be responsible for leading this effort.

Selecting Countermeasures and Prioritizing Locations for Improvements

The goal of this improvement strategy is to improve pedestrian crossing facilities at uncontrolled marked crosswalks so that they will operate as they are designed to work, with drivers yielding to pedestrians and pedestrians getting across the road safely. Rather than just deciding whether marked crosswalks should or should not be provided, the improvement strategy asks what are the most effective measures that can be used to help pedestrians safely cross the street. Improvements are typically divided into three types of interventions: simple measures, moderately complex measures, and complex measures. The more complex the measure the more time, money, and coordination among different divisions may be required.

Simple measures include sign replacement and enhancement, high visibility crosswalk remarking, advance stop bars, curb ramps, and lighting adjustments. Moderately complex measures include rectangular rapid flash beacons (RRFBs), pedestrian refuge islands (where no rechannelization of lanes is required), curb extensions, lighting additions, and

changes in pedestrian circulation. Complex measures include Pedestrian Hybrid Beacons (PHBs), Road Diets, crossing islands (where re-channelization is required), raised crosswalks, and intersection redesign. After prioritizing locations using the prioritization methodology as described later in the next chapter, they should be further organized according to complexity.

ARDOT has not selected countermeasures and prioritized locations for improving pedestrian crossing facilities at uncontrolled locations. In general, ARDOT has taken a reactive role with communities interested in adding more expensive countermeasures to marked crosswalks. ARDOT provides permits to local agencies but not funding for putting in higher cost countermeasures like PHBs.

RECOMMENDATION: ARDOT will develop an improvement strategy upon completion of the conditions inventory. This will provide general direction for implementation of the countermeasures and will be tied to the scale of the effort required since once the number of crosswalks and their conditions are known ARDOT will have a better idea of the level of effort required. The Bicycle Pedestrian Coordinator in Program Management Division will be responsible for leading this effort.

5

Toolbox: Pedestrian Crossing Countermeasures at Uncontrolled Locations

Introduction - Selecting Countermeasures

The results of the crash analysis, road safety audit, and/or stakeholder input provide a better understanding of the potential factors influencing crashes at uncontrolled crossing locations. The countermeasures listed in this guide can improve the visibility of crossing locations and reduce crashes, and they each address at least one additional safety concern associated with a higher incidence of collision and/or severe injury. In all cases, the countermeasures, when implemented, should follow MUTCD and other relevant AASHTO, FHWA and State guidance.

Table 1 includes a comprehensive matrix and list of STEP pedestrian crash countermeasures suggested for application at uncontrolled crossing locations per roadway and traffic features. The countermeasures are assigned to specific matrix cells based on safety research, best practices, and established national guidelines. When a pedestrian crossing is established, the countermeasure options in the cells should be reviewed before selecting the optimal group of crossing treatments. Previously obtained characteristics such as pedestrian volume, operational speeds, land use context, and other site features should also be considered when selecting countermeasures. ArDOT will reference the MUTCD and other national, State, and local guidelines when making the final selection of countermeasures.

1. Enhancements at Marked Crosswalks

Locations with marked crosswalks can increase safety with high visibility pavement markings, advanced stop bars and warning signs, in-street pedestrian crossing signs, illumination, curb extensions and tighter curb radii.

High Visibility Crosswalk Markings

High visibility crosswalk markings ensure that drivers see the crosswalk, not just the pedestrian. Two parallel lines indicating a marked crosswalk can be almost invisible to the motorist at uncontrolled locations. When a decision has been made to use crosswalk markings, high visibility markings such as ladder style (“piano keys”) or continental markings (“zebra”) should be used at locations without positive traffic control, and are advised at locations with positive traffic control (signals, stop signs).

ArDOT has high visibility crosswalks as the standard crosswalks on the state system and is included in the standard drawings. Local agencies will often use parallel lines.

RECOMMENDATION: No change to current practice; ArDOT should continue to install high visibility crosswalks at uncontrolled locations.

Advance Yield Bar and Yield Here for Pedestrians sign

A multiple threat crash results when a driver in one lane stops to let the pedestrian cross, blocking the sight lines of the driver in the other lane of a multi-lane approach, who then advances through the crosswalk and hits the crossing pedestrian. If advance yield

nearest crosswalk line; parking should be prohibited in the area between the yield line or stop line and the crosswalk. The MUTCD requires R1-5 signs when yield or stop lines are used in advance of a crosswalk with an uncontrolled multi-lane approach.

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	① 2 4 5 6	① 5 6 7 9	① 5 6 ⑦ ⑨	① 4 5 6 7 9	① 5 6 7 9	① 5 6 ⑦ ⑨	① 4 5 6 7 9	① 5 6 7 9	① 5 6 ⑨
3 lanes with raised median (1 lane in each direction)	① 2 3 4 5	① ③ 5 7 9	① ③ 5 ⑦ ⑨	① ③ 4 5 7 9	① ③ 5 ⑦ ⑨	① ③ 5 ⑦ ⑨	① ③ 4 5 7 9	① ③ 5 ⑦ ⑨	① ③ 5 ⑨
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	① 2 3 4 5 6 7 9	① ③ 5 6 7 9	① ③ 5 6 ⑨ 7 9	① ③ 4 5 6 7 9	① ③ 5 6 ⑦ ⑨	① ③ 5 6 ⑨ 7 9	① ③ 4 5 6 7 9	① ③ 5 6 ⑨ 7 9	① ③ 5 6 ⑨ 7 9
4+ lanes with raised median (2 or more lanes in each direction)	① ③ 5 7 8 9	① ③ 5 7 8 9	① ③ 5 8 ⑨	① ③ 5 7 8 9	① ③ 5 ⑦ 8 ⑨	① ③ 5 8 ⑨	① ③ 5 ⑦ 8 ⑨	① ③ 5 8 ⑨	① ③ 5 8 ⑨
4+ lanes w/o raised median (2 or more lanes in each direction)	① ③ 5 6 7 8 9	① ③ 5 ⑥ 7 8 9	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ 7 8 9	① ③ 5 ⑥ ⑦ 8 ⑨	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ ⑦ 8 ⑨	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ 8 ⑨

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

- 1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
- 2 Raised crosswalk
- 3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
- 4 In-Street Pedestrian Crossing sign
- 5 Curb extension
- 6 Pedestrian refuge island
- 7 Rectangular Rapid-Flashing Beacon (RRFB)**
- 8 Road Diet
- 9 Pedestrian Hybrid Beacon (PHB)**

*Refer to Chapter 4, 'Using Table 1 and Table 2 to Select Countermeasures,' for more information about using multiple countermeasures.

**It should be noted that the PHB and RRFB are not both installed at the same crossing location.

This table was developed using information from: Zegeer, C.V., J.R. Stewart, H.H. Huang, P.A. Lagerwey, J. Feaganes, and B.J. Campbell. (2005). Safety effects of marked versus unmarked crosswalks at uncontrolled locations: Final report and recommended guidelines. FHWA, No. FHWA-HRT-04-100, Washington, D.C.; FHWA. Manual on Uniform Traffic Control Devices, 2009 Edition. (revised 2012). Chapter 4F, Pedestrian Hybrid Beacons. FHWA, Washington, D.C.; FHWA. Crash Modification Factors (CMF) Clearinghouse. <http://www.cmfclearinghouse.org/>; FHWA. Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE). <http://www.pedbikesafe.org/PEDSAFE/>; Zegeer, C., R. Srinivasan, B. Lan, D. Carter, S. Smith, C. Sundstrom, N.J. Thirsk, J. Zegeer, C. Lyon, E. Ferguson, and R. Van Houten. (2017). NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. Transportation Research Board, Washington, D.C.; Thomas, Thirsk, and Zegeer. (2016). NCHRP Synthesis 498: Application of Pedestrian Crossing Treatments for Streets and Highways. Transportation Research Board, Washington, D.C.; and personal interviews with selected pedestrian safety practitioners.

of-way to pedestrians legally crossing the roadway. Pedestrians must yield the right-of-way to vehicles when crossing outside of a marked crosswalk or an unmarked crosswalk at an intersection.














































ARDOT does not have a policy for when and where to install advance yield bars and or yield here to pedestrian signs at uncontrolled locations. However, ARDOT will follow the MUTCD if a decision is made to include an advanced yield line.

RECOMMENDATION: ARDOT will add the use of advance yield bars and pedestrian signs at mid-block crossings to a proposed crosswalk policy and procedure. Maintenance Division and Transportation Planning and Policy will be responsible for leading this effort.

In-street Pedestrian Crossing sign

In-street signs are placed in the middle of the road at a crossing and are often used in conjunction with refuge islands. These signs may be appropriate on 2-lane or 3-lane roads with speed limits of 30 mph

Table 2. Safety issues addressed per countermeasure.

Pedestrian Crash Countermeasure for Uncontrolled Crossings	Safety Issue Addressed				
	Conflicts at crossing locations	Excessive vehicle speed	Inadequate conspicuity/visibility	Drivers not yielding to pedestrians in crosswalks	Insufficient separation from traffic
Crosswalk visibility enhancement					
High-visibility crosswalk markings*					
Parking restriction on crosswalk approach*					
Improved nighttime lighting*					
Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*					
In-Street Pedestrian Crossing sign*					
Curb extension*					
Raised crosswalk					
Pedestrian refuge island					
Pedestrian Hybrid Beacon					
Road Diet					
Rectangular Rapid-Flashing Beacon					

*These countermeasures make up the STEP countermeasure “crosswalk visibility enhancements.” Multiple countermeasures may be implemented at a location as part of crosswalk visibility enhancements.

or less. On higher-speed, higher-volume, and/ or multilane roads, this treatment may not be as visually prominent; therefore, it may be less effective (drivers may not notice the signs in time to stop in advance of the crosswalk). For such roadways, more robust treatments will be needed. MUTCD Section 2B.12— In-Street and Overhead Pedestrian Crossing Signs contains additional information about these signs.

AR DOT does not have a policy for when and where to install in-street pedestrian crossing signs at uncontrolled locations. However, if AR DOT decides to add in-street pedestrian crossing signage, they will refer to the MUTCD and the AASHTO Pedestrian Guide.

RECOMMENDATION: AR DOT will formulate a broader usage policy for when and where to install in-street pedestrian crossing signs at uncontrolled locations and include this as part of its crosswalk policy and procedure. Maintenance Division and Transportation Planning and Policy will be responsible for leading this effort.

Illumination

Up to half of pedestrian crashes occur at night. Lighting greatly increases the driver's ability to see pedestrians crossing the road. As a general practice, AR DOT uses the AASHTO guides as a source for its standards and guidance. The AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (AASHTO Pedestrian Guide) does include a brief discussion of the value of illumination at intersections.

AR DOT will include appropriate level of lighting at pedestrian crossings at uncontrolled locations with certain street projects, but does not pay for utilities or maintenance leaving many local agencies unwilling to sign agreements.

RECOMMENDATION: AR DOT will continue its current practices for illuminating primary crossing points, but should consider the role of crossing beacons as

a substitute treatment in the absence of illuminated crossings (if an agreement with local officials is not forthcoming for lighting assemblies). Maintenance Division and Transportation Planning and Policy will be responsible for leading this effort.

Curb Extensions

Curb extensions extend the sidewalk or curb face into the parking lane or shoulder at an intersection, thus improving sight distance between the driver and pedestrian. They are typically designed to extend no further than the edge of a parking lane or shoulder. They are also known as neckdowns, bumpouts or bulbouts. They are most commonly applied at intersections where they are intended to reduce the pedestrian crossing distance, slow right-turning vehicles, improve visibility between motorists and pedestrians, and provide more space for landscaping or storm water management, among other features. When trees are planted on curb extensions, they can be an effective treatment to visually narrow a street and thus create traffic calming effects.

AR DOT does not have a specific policy for the installation of curb extensions at established pedestrian crossings at uncontrolled locations. AR DOT refers to the AASHTO Pedestrian Guide and will consider using curb extensions under certain situations.

RECOMMENDATION: AR DOT will consider using curb extensions on new and reconstruction projects where appropriate opportunities exist to include curb extensions (AR DOT highways rarely include parallel parking which is a prime condition for the placement of curb extensions).

Tighter Curb Radii

Tighter curb radii can improve sight lines between driver and pedestrian, shorten the crossing distance, bring crosswalks closer to the intersection, and slow right-turning vehicles. Intersection design will determine whether best practices for meeting ADA requirements can be applied. For example, tight curb

radii will usually allow for two ramps at each corner as opposed to just one. The appropriate radius should be calculated for each corner on a case by case basis, taking into account the design vehicle.

ARDOT has a default curb radius standard of 20-30 feet in urban areas.

RECOMMENDATION: The impacts of larger radii on making pedestrian crossings more challenging should be reflected in any standards or guidance developed by ARDOT. This discussion should also be included in the proposed ARDOT crosswalk policy and procedure. The Future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

2. Raised Crosswalks

Raised crosswalks function as an extension of the sidewalk and allow a pedestrian to cross the street without stepping down to street level. A raised crosswalk is typically a candidate treatment on 2-lane or 3-lane roads with speed limits of 30 mph or less and AADTs below 9,000. Raised crossings are generally avoided on truck routes, emergency routes, and arterial streets. For retrofit projects, drainage needs to be evaluated and revised as necessary. See MUTCD Section 3B.25—Speed Hump Markings for additional information about markings that can be used alongside raised crosswalks.

ARDOT does not have a policy regarding raised crosswalks at established pedestrian crossings at uncontrolled locations. ARDOT has one raised crosswalk on state highway that functions as a lower volume main street.

RECOMMENDATION: ARDOT should consider developing guidance regarding the conditions where raised crosswalks are appropriate considering street functional classifications and urban/suburban street contexts. A future Pedestrian Accommodation Policy Update Committee will be

responsible for leading this effort.

3. Pedestrian Refuge Islands

A pedestrian refuge island is typically constructed in the middle of a 2-way street and provides a place for pedestrians to stand and wait for motorists to stop or yield. This countermeasure is highly desirable for midblock pedestrian crossings on roads with four or more lanes, and should be considered especially for undivided crossings of four or more lanes with speed limits of 35 mph or greater and/or annual average daily traffic (AADT) of 9,000 or greater. Median islands may also be a candidate treatment for uncontrolled pedestrian crossings on 3-lane or 2-lane roads, especially where the street is wide and/or where vehicle speed or volumes are moderate to high.

Consideration should be given to creating a two-stage crossing with the island to encourage pedestrians to cross one direction of traffic at a time and look towards oncoming traffic before completing the second part of the crossing. The minimum pedestrian refuge island width is approximately 6 feet. MUTCD Sections 3B.10—Approach Markings for Obstructions, 3B.18—Crosswalk Markings, and 3ScB.23—Curb Markings provide additional information.

ARDOT does not have a policy regarding pedestrian refuge islands at established pedestrian crossings at uncontrolled locations. ARDOT refers to the AASHTO Pedestrian Guide for general guidance.

Medians are sometimes used on urban state routes. Median islands have not been a preferred design especially at signalized intersections. This is because ARDOT prefers to move pedestrians across both directions of an intersection and does not expect pedestrians to wait in the median refuge area if they are unable to cross the entire intersection during the pedestrian signal phase. However, it is not clear if this is why the Department has steered away from their use at unsignalized intersections. At unsignalized intersections and mid-block where a minimum of six

feet of space can be obtained, pedestrian refuge islands should be considered where appropriate.

RECOMMENDATION: ArDOT will research why current practice is not supportive of putting in median refuge islands at uncontrolled intersections and midblock crossings. The Department should have a discussion and reevaluate their policy for uncontrolled intersections, but leave in place the current practice of phasing pedestrian signals to allow for one-stage crossings of intersections for pedestrians. A future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

4. Pedestrian Hybrid Beacons (PHBs) and Rectangular Rapid Flash Beacons (RRFBs)

PHBs are a candidate treatment especially for roads with three or more lanes that generally have AADT above 9,000. PHBs should be strongly considered for all midblock and intersection crossings where the roadway speed limits are equal to or greater than 40 mph. Refer to Table 1 for other conditions where PHBs should be strongly considered and MUTCD Chapter 4F-Pedestrian Hybrid Beacons for their application.

At some uncontrolled crossings, particularly those with four or more lanes, it can be difficult to achieve compliance with laws that require motorists to yield to pedestrians. Vehicle speeds create conditions in which very few drivers feel compelled to yield. One type of device proven to be successful in improving yielding compliance at these locations is the Rectangular Rapid Flash Beacon (RRFB). RRFBs are a pedestrian crossing sign combined with an intensely flashing beacon that is only activated when a pedestrian is present.

RRFBs are considerably less expensive to install than mast-arm mounted signals. They can also be installed with solar-power panels to eliminate the need for a power source. RRFBs should be used in conjunction

with advance yield pavement lines and signs. They are usually implemented at high-volume pedestrian crossings, but may also be considered for priority bicycle route crossings or locations where bike facilities cross roads at mid-block locations.

In December 2017, FHWA terminated the Rectangular Rapid Flashing Beacon Interim Approval IA-11, due to a patent dispute. On March 20th, FHWA announced that the patent dispute had been settled, allowing its production by all manufacturers. This led the Federal Highway Administration to issue Interim Approval (IA-21).

RRFBs must be in accordance with FHWA's Interim Approval (IA-21), issued on 3-20-18. All agencies must resubmit requests to FHWA to use the RRFB following the standard interim approval process.

ArDOT does not have a policy regarding beacons at established pedestrian crossings at uncontrolled locations although ArDOT has used PHBs sparingly (less than 10 locations) and uses them in accordance with MUTCD. Most of the PHBs ArDOT has installed are located at trail crossings. PHBs are fairly well accepted by ArDOT.

RECOMMENDATION: ArDOT should develop a new policy on the use of RRFBs and PHBs with established criteria for their use. These criteria should be featured in the proposed crosswalk policy and procedure. A future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

5. Road Diet

A Road Diet, also called a lane reduction or road rechannelization, is a technique in transportation planning whereby the number of travel lanes and/or effective width of the road is reduced in order to achieve systemic improvements. A frequently-implemented Road Diet involves converting a 4-lane, undivided roadway into a 3-lane roadway with a

center turn lane. This is a candidate treatment for any undivided road with wide travel lanes or multiple lanes that can be narrowed or repurposed to improve pedestrian crossing safety.

After conducting a traffic analysis to consider its feasibility, a Road Diet may be a good candidate for use on roads with four or more lanes and traffic volumes of approximately 20,000 or less. In some cases, Road Diets have been implemented on roads with AADTs of up to 25,000. By reducing the width of the roadway, pedestrians benefit from shorter crossing distances and often bike lanes or streetscape features can be added. Road Diets are often effectively accomplished during pavement resurfacing and enable the implementation of many of the other countermeasures discussed above.

ARDOT does not have a policy regarding Road Diets. ARDOT has implemented several Road Diets, with one project receiving push back from a local agency. While ARDOT viewed the project as a success, the local agency did not. This project has led to ARDOT being somewhat apprehensive to implementing a road diet, although as an agency it is not opposed.

RECOMMENDATION: ARDOT should continue to use Road Diets and should create or make more readily available general criteria for their use. Guidance and design materials should also incorporate the pedestrian concerns and benefits of Road Diets. Transportation Planning and Policy and Roadway Design will be responsible for leading this effort.

6

Policy Recommendations

"Institutionalization" is the integration of pedestrian considerations into agency policies, plans, projects and programs. The intent is to make walking and pedestrian safety a "mainstream" activity.

The following implementation strategies provide a roadmap for implementation of this Plan through institutionalization, with the intent of making pedestrian safety a routine part of all ARDOT activities.

Policy and Planning Documents

In addition to FHWA, AASHTO and MUTCD guidance, ARDOT has developed agency policy and plans on transportation related topics. These documents define approaches to solving safety problems, setting priorities and providing decision making guidance. Policy and planning documents provide a means to increase awareness of pedestrian safety issues while also providing specific objectives for reducing injuries and fatalities.

At any given time, one or more policy, planning and other agency documents are undergoing revisions and updates. This is the ideal time to make changes that begin to institutionalize pedestrian considerations.

The following documents are either being revised, are scheduled to be revised, or are completely new documents:

- » Highway Safety Plan (HSP)
- » Strategic Highway Safety Plan (SHSP)
- » Statewide Bicycle and Pedestrian Plan
- » Long Range Transportation Plan
- » Department Bicycle and Sidewalk accommodation policy¹

RECOMMENDATION: The statewide bicycle and pedestrian plan was just completed and the long-range transportation plan is nearing approval. The most significant opportunity exists for ARDOT to review and include STEP recommendations in the two safety plans as they are updated in the near future. For these two documents, opportunities will exist to include policy and planning guidance – as recommended in this plan - for improving pedestrian safety, with the intent of reducing pedestrian injuries and fatalities. In addition, the 2005 AHTD Sidewalk Accommodation Policy should be updated to include the provision of safe crossings and not just the inclusion of sidewalks.

¹ ARDOT Bicycle and Sidewalk Accommodation Policy - https://www.arkansashighways.com/Trans_Plan_Policy/statewide_planning/bicycle_pedestrian_planning/AR%20bike%20ped%20policy.pdf

That policy should be cross-referenced with the proposed crosswalk policy and procedure as recommended earlier in this plan. A future Pedestrian Accommodation Policy Update Committee will be responsible for leading this effort.

ArDOT Design and Traffic Manuals

In addition to FHWA, AASHTO and MUTCD guidance, ArDOT has developed some design guidance, but more so than most DOTs, the agency relies significantly on AASHTO guides and standards which they have adopted as their own. These manuals are the most used resources for engineers within the Department and following them and further incorporating countermeasure considerations into these manuals is one of the key steps to making their use routine. To varying degrees these guides/manuals address the design of roadway crossings at uncontrolled locations to maximize pedestrian safety and access.

The most significant manuals for ArDOT include:

- » AASHTO 2004 Pedestrian Guide
- » AASHTO Policy on Geometric Design of Highways and Streets (Green Book, 2011 edition)
- » Manual on Uniform Traffic Control Devices

The ArDOT Design Plan Development Guidelines in its current form provides direction on project plan assembly and does not, or is not intended to, address design guidance and standards for roadway crossings at uncontrolled locations.

RECOMMENDATION: ArDOT will continue to use the MUTCD and the 2004 AASHTO pedestrian guide and stands ready to review the new and expanded guidance on pedestrian crossings in the new AASHTO guide once it is adopted by them. In addition, the Department can include some basic design information or at least links to

design guidance, in the proposed crosswalk policy and procedure. ArDOT Roadway Design will be responsible for leading this effort.

Annual Resurfacing and Reconstruction Program

Integrating pedestrian crossing facilities into routine reconstruction and resurfacing projects as part of the ArDOT highway improvement program is a longer-term safety solution, but is perhaps the most effective way of effectuating change. More specifically, using Road Diets and other repurposing of roadway space as part of resurfacing projects, is a cost-effective way to institutionalize pedestrian facilities into resurfacing projects.

Currently ArDOT does not review all resurfacing projects for opportunities to include pedestrian improvements at marked crosswalks at uncontrolled locations. However, there appears to be some basic support for making safety improvements a part of all Resurfacing, Restoration, and Rehabilitation (RRR) projects as presented in the ArDOT Geometric Design Criteria for Non-freeway RRR Projects. That manual supports the inclusion of basic safety improvements, including “signing and pavement markings” which should include crosswalk enhancements.

RECOMMENDATION: ArDOT will improve its consideration of STEP measures as part of its project development process for highway projects. Of the five countermeasures, enhancing crosswalks are the most universally viable option for projects because of the low cost and ease of implementation. However, if certain state highway projects are considered for road diets or involve reconstruction, additional small to moderate-scale STEP measures (pedestrian refuge islands and corner bump-outs) may become feasible. ArDOT Roadway Design, Maintenance Division, Construction Division will be responsible for leading this effort.

Annual American Disabilities Act (ADA) Transition Plan

The ARDOT ADA Transition Plan ensures that all pedestrian facilities will become accessible over time. Implementation of the ADA Transition Plan also provides an opportunity to make safety improvements that benefit all pedestrians. According to ADA, whenever streets are resurfaced, ramps and other accessibility improvements must be made; this activity opens opportunities for crosswalk countermeasures. ARDOT is in the process of preparing its ADA Transition Plan to meet Federal ADA regulations. Currently, the following collections and inventory are being done: a signal inventory is being conducted for the state highway system, a collection of pedestrian ramps are being inventoried, and a sidewalk inventory is being analyzed.

RECOMMENDATION: ARDOT will consider recommending STEP countermeasures as part of its ADA review of projects. This is especially true for low-cost countermeasures such as crosswalk enhancements (high visibility crosswalk markings, crosswalk signage, etc.). Crosswalks are the extension of curb ramps so there is a strong and logical tie between those two facilities.

Public Involvement as an Implementation Strategy

Public involvement is another excellent way to gather comments on crossings, and in many cases, garner support for improving street crossings. Public involvement techniques will gradually build public support for programs and policies to reduce pedestrian crashes. To be effective, stakeholders must feel listened to and heard.

ARDOT routinely solicits public comment on upcoming projects and uses standard forms of public involvement for project development.

RECOMMENDATION: No changes recommended other than to involve pedestrian stakeholders in all planning and safety programming efforts.

Request for Proposals (or Qualifications) – RFPs (or RFQs)

Including experts in pedestrian transportation planning on consulting teams for major public works ensures that opportunities for making pedestrian improvements are maximized. This can be accomplished by making sure the requests for proposals or qualifications (RFPs or RFQs) that are issued by the ARDOT include a requirement for pedestrian expertise. Currently, ARDOT does not require the inclusion of pedestrian experts in responses to RFPs or RFQs.

RECOMMENDATION: ARDOT will examine its standardized RFP solicitation process to ensure that RFPs and RFQs include appropriate requests for pedestrian design expertise. ARDOT Consultant Contracts will be responsible for leading this effort.

Ongoing Training

The field of pedestrian transportation planning and design is changing rapidly as new research is completed and innovative approaches are implemented. To take advantage of these changes and state-of-the-art practices, ARDOT needs to support training. Occasionally, ARDOT has conducted bike training workshops (on the AASHTO Bicycle Guide).

RECOMMENDATION: ARDOT will review the availability of current training opportunities to consider adding offerings that cover STEP countermeasures. Secondly as FHWA and AASHTO continues to develop and update training and workshop materials on how to improve pedestrian safety (presentations at conferences, virtual and in-person workshops, and written materials), ARDOT will consider those offerings. More specifically ARDOT should increase the frequency of trainings, conduct more shorter length webinar trainings, and

Action Plan for Implementing Pedestrian Crossing Countermeasures at Uncontrolled Locations

host the ActiveTrans Priority Tool (APT)² webinar and the Designing for Pedestrian Safety 101. The Bicycle and Pedestrian Coordinator will be responsible for leading this effort.

.....
2 http://www.pedbikeinfo.org/training/webinars_PBIC_LC_120414.cfm

Glossary

AVERAGE ANNUAL DAILY TRAFFIC (AADT)

The total volume of traffic passing a point or segment of a highway facility in both directions for one year divided by the number of days in the year.

AVERAGE DAILY TRAFFIC (ADT)

The average 24-hour volume of traffic passing a point or segment of a highway in both directions.

COMPLETE STREETS

Complete Streets are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities. (Smart Growth America, National Complete Streets Coalition).

CONTROLLED PEDESTRIAN CROSSING

A pedestrian crossing where motorists are required to stop by either a STOP sign, traffic signal, or other traffic control device.

CRASH MODIFICATION FACTOR (CMF)

A multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure. If available, calibrated or locally developed State estimates may provide a better estimate of effects for the State. (Crash Modification Factors Clearinghouse).

CRASH REDUCTION FACTOR (CRF)

The percentage crash reduction that might be expected after implementing a given countermeasure at a specific site.

CURB EXTENSIONS

A roadway edge treatment where a curb line is bulbed out toward the middle of the roadway to narrow the width of the street. Curb extensions are sometimes called “neckdowns.”

HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP)

A Federal-aid program with the purpose to achieve a significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned roads and roads on tribal land. The HSIP requires a data-driven, strategic approach to improving highway safety on all public roads with a focus on performance. (FHWA).

HIGH VISIBILITY CROSSWALK

A pedestrian crossing location marked by patterns such as zebra, ladder, or continental markings as described by the MUTCD.

MARKED CROSSWALK

A pedestrian crossing that is delineated by white crosswalk pavement markings.

PARKING RESTRICTION

Parking restriction can include the removal of parking space markings, installation of new “parking prohibition” pavement markings or curb paint, and signs.

PEDESTRIAN HYBRID BEACON (PHB)

A traffic control device with a face that consists of two red lenses above a single yellow lens. Unlike a traffic signal, the PHB rests in dark until a pedestrian activates it via pushbutton or other form of detection.

RAISED CROSSWALK

Raised crosswalks are ramped speed tables spanning the entire width of the roadway, often placed at midblock crossing locations.

REFUGE ISLAND

A median with a refuge area that is intended to help protect pedestrians who are crossing the road. This countermeasure is sometimes referred to as a crossing island or pedestrian island.

ROAD DIET

A roadway reconfiguration resulting in a reduction in the number of travel lanes. The space gained by eliminating lanes is typically used for other uses and travel modes (FHWA).

ROAD SAFETY AUDIT (RSA)

A formal examination of an existing or future road or intersection by a multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users (FHWA).

TOWARD ZERO DEATHS (TZD)

TZD is a traffic safety framework that seeks to eliminate highway fatalities by engaging diverse safety partners and technology to address traffic safety culture (also see Vision Zero).

UNCONTROLLED PEDESTRIAN CROSSING

An established pedestrian crossing that does not include a traffic signal, beacon, or STOP sign to require that motor vehicles stop before entering the crosswalk.

VEHICLE QUEUE

A line of stopped vehicles in a single travel lane, commonly caused by traffic control at an intersection.

VISION ZERO (VZ)

Similar to TZD, Vision Zero is a vision to eliminate traffic fatalities and serious injuries within the transportation system. VZ employs comprehensive strategies to address roadway design, traffic behavior, and law enforcement.

Appendix: CRF and CMF Summary Table

Table 3. CRFs and CMFs by countermeasure.

Countermeasure	CRF	CMF	Basis	Reference
Crosswalk visibility enhancement ¹	—	—	—	—
Advance STOP/YIELD signs and markings	25%	0.75	Pedestrian crashes ²	Zegeer, et. al. 2017
Add overhead lighting	23%	0.77	Total injury crashes	Harkey, et. al. 2008
High-visibility marking ³	48%	0.52	Pedestrian crashes	Chen, et. al., 2012
High-visibility markings (school zone) ³	37%	0.63	Pedestrian crashes	Feldman, et. al. 2010
Parking restriction on crosswalk approach	30%	0.70	Pedestrian crashes	Gan, et. al., 2005
In-street Pedestrian Crossing sign	UNK	UNK	N/A	N/A
Curb extension	UNK	UNK	N/A	N/A
Raised crosswalk (speed tables)	45%	0.55	Pedestrian crashes	Elvik, et. al., 2004
	30%	0.70	Vehicle crashes	
Pedestrian refuge island	32%	0.68	Pedestrian crashes	Zegeer, et. al., 2017
PHB	55%	0.45	Pedestrian crashes	Zegeer, et. al., 2017
Road Diet – Urban area	19%	0.81	Total crashes	Pawlovich, et. al., 2006
Road Diet – Suburban area	47%	0.53	Total crashes	Persaud, et. al., 2010
RRFB	47%	0.53	Pedestrian crashes	Zegeer, et. al., 2017

¹This category of countermeasure includes treatments which may improve the visibility between the motorist and the crossing pedestrian.

²Refers to pedestrian street crossing crashes, and does not include pedestrians walking along the road crashes or “unusual” crash types.

³The effects of high-visibility pavement markings (e.g., ladder, continental crosswalk markings) in the “after” period is compared to pedestrian crashes with parallel line markings in the “before” period.

References

1. Thomas, L., Lan, B., Sanders, L., Frackleton, A., Gardner, S., and Hintze, M. (2017). In Pursuit of Safety: Systemic Bicycle Crash Analysis in Seattle, WA. TRB 96th Annual Meeting Compendium of Papers. 17-06840. Transportation Research Board. Washington, DC.
2. Zegeer, C., J. Richard Stewart, Herman H. Huang, Peter A. Lagerwey, John Feaganes, and B.J. Campbell. FHWA-HRT-04-100: Safety Effects of Marked versus Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines. Office of Safety Research and Development, Federal Highway

Administration, 2005.

3. R. Srinivasan, B. Lan, D. Carter, S. Smith, C. Sundstrom, N.J. Thirsk, J. Zegeer, C. Lyon, E. Ferguson, and R. Van Houten. NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. NCHRP, Transportation Research Board, Washington, DC, 2017.

Resources

[EDC Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations \(2018\)](#)

This guide assists State or local transportation or traffic safety departments that are considering developing a policy or guide to support the installation of countermeasures at uncontrolled pedestrian crossing locations. This document provides guidance to agencies, including best practices for each step involved in selecting countermeasures. By focusing on uncontrolled crossing locations, agencies can address a significant national safety problem and improve quality of life for pedestrians of all ages and abilities. Agencies may use this guide to develop a customized policy or to supplement existing local decision-making guidelines

[FHWA How to Develop a Pedestrian and Bicycle Safety Action Plan \(2017\)](#)

The purpose of this guide is to assist agencies in developing and implementing a safety action plan to improve conditions for bicycling and walking. The plan lays out a vision for improving safety, examining existing conditions, and using a data-driven approach to match safety programs and improvements with demonstrated safety concerns. This guide will help agencies enhance their existing safety programs and activities, including identifying safety concerns and selecting optimal solutions. It will also serve as a reference for improving pedestrian and bicycle safety through a multidisciplinary and collaborative approach to safety, including street designs and countermeasures, policies, and behavioral programs.

[NCHRP Report 803: Pedestrian and Bicycle Transportation Along Existing Roads—ActiveTrans Priority Tool Guidebook \(2015\)](#)

This resource includes an interactive tool and guidance to help agencies prioritize pedestrian and bicycle improvements, including safety projects, either as standalone or incidental to a roadway project.

[FHWA Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts \(2016\)](#)

This resource focuses on flexibility and options for the design of pedestrian and bicycle networks designed to minimize crash conflicts, including case studies to illustrate various design treatments.

[FHWA State SHSP Resources](#)

The FHWA Office of Safety posts a link to each State's current SHSP. This website also lists noteworthy practices. Many SHSP plans provide an emphasis on pedestrians and contain goals for reducing traffic fatalities and injuries.

[FHWA HSIP Resources](#)

The HSIP includes the projects selected for implementation, an evaluation of past projects, and an annual status report. Projects can include pedestrian safety improvement programs and projects. For example, the 2016 Oregon HSIP Annual Report details how the its All Roads Transportation Safety Program sets aside funding to address systemic pedestrian crash locations.

[State HSP Documents](#)

NHTSA posts the States' current HSP outlining non-infrastructure strategies for improving roadway safety. A State HSP is likely to contain a pedestrian fatality and injury reduction goal, an associated performance measure, and describe non-infrastructure initiatives like enforcement and education programs. For example, Colorado DOT's 2017 HSP (called the 2017 Integrated Safety Plan) supports the Denver Police Department's "Decoy Pedestrian Program" to enforce driver yielding compliance at high-crash pedestrian crossings.

[Manual on Uniform Traffic Control Devices \(MUTCD\)](#)

This manual provides transportation engineers and planners with detailed guidance for the design and application of traffic control devices, including signage, roadway markings, and intersection controls. Refer to the specific sections of the MUTCD listed in the countermeasure descriptions and consult State-level supplements for additional information.

[PEDSAFE: Pedestrian Crash Typing](#)

PEDSAFE provides definitions for 12 key pedestrian crash types identified by the software package, the Pedestrian and Bicycle Crash Analysis Tool (PBCAT). PBCAT is still used by many agencies but may not be compatible with some current operating systems.

[NHTSA Pedestrian Safety Information](#)

NHTSA publishes annual reports summarizing the latest pedestrian fatality statistics. These statistics are based on FARS and the reports describe pedestrian fatality trends per different socioeconomic groups and for each State.

[Walkability Checklist](#)

This tool can be used by community leaders during a walkability audit to evaluate pedestrian infrastructure and traffic behavior.

[FHWA Model Road Safety Audit Policy \(2014\)](#)

This resource outlines the steps typically taken to conduct an RSA and the roles of the stakeholders. Identifying safety issues is an element of the RSA that is accompanied by suggestions on how to enhance the specific road's safety.

[Vision Zero Network](#)

This collaborative website posts case studies and tracks cities who are implementing Vision Zero plans or goals. The Vision Zero Network website also notes best practices by agencies who are working to eliminate traffic fatalities and serious injuries. Vision Zero goals are accompanied by policies, strategies, and target

dates. For example, Columbia, Missouri's Vision Zero Action Plan contains an outreach campaign to educate pedestrians and drivers on new and potentially confusing infrastructure improvements like pedestrian hybrid beacons and enhanced pedestrian crosswalks.

[Countermeasure Selection System](#)

This online tool includes links to research studies, crash reduction statistics, and case studies for nearly 70 pedestrian safety countermeasures. Its Countermeasure Selection Tool provides countermeasure recommendations for uncontrolled crossing locations based upon variables such as AADT, vehicle speed, and number of lanes.

[Highway Safety Manual](#)

This manual provides detailed guidance for the collection, analysis, and evaluation of roadway crash data, as well as related CMFs and treatment selection guidance.

[FHWA Road Diet Desk Reference \(2015\)](#)

This resource includes sample policy, case studies, and design guidance for agencies and decision-makers considering Road Diets. The benefits of Road Diets include reducing vehicle speeds, reducing number of lanes to cross, and allocating space for pedestrian refuge island.

[FHWA Design Resource Index](#)

This resource directs practitioners to the specific location of information about pedestrian and bicycle treatments or countermeasures, across various design guidelines published by organizations such as AASHTO, the Institute of Transportation Engineers, and National Association of City Transportation Officials.

[TCRP REPORT 112/NCHRP REPORT 562: Improving Pedestrian Safety at Unsignalized Crossings \(2006\)](#)

This document recommends treatments to improve safety for pedestrians crossing high-volume, high-speed roadways at unsignalized intersections, with

particular focus on roadways served by public transportation.

[AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, 1st Edition \(2004\)](#)

This guide provides recommendations for the planning, design, and operation of accommodations for pedestrians on public rights-of-way. This guide also discusses the impact of land use and site design on pedestrian safety and connectivity

[FHWA Federal-aid Program Administration](#)

This website includes links to guidance for local and State governments administering federally-funded projects, such as those funded by HSIP or STBG.

[Pedestrian RSA Guidelines and Prompt Lists \(2007\)](#)

This resource complements practices for RSAs with additional guidance and a field manual for a pedestrian-focused RSA. An RSA team will use the knowledge of a diverse team, analysis of crash data, and a site visit to identify pedestrian safety issues.

[Pedestrian RSA Case Studies \(2009\)](#)

This website provides links to several examples of RSAs focused on identifying pedestrian safety risks and improvement strategies. For example, the City of Tucson, Arizona conducted an RSA of roadways with PHBs to improve the countermeasures' visibility and usability.

[FHWA Pedestrian and Bicycle Funding Opportunities Summary \(2016\)](#)

This resource includes a matrix comparing eligibility of various federal transportation funding programs for different types of bicycle and pedestrian projects.

[FHWA Guidebook for Developing Pedestrian and Bicycle Performance Measures \(2016\)](#)

This resource identifies a wide variety of potential metrics for setting goals, prioritizing projects and evaluating outcomes of bicycle and pedestrian plans, including plans for pedestrian safety improvements. Performance measures may include pedestrian levels of service or pedestrian fatality rates.

[NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments \(2017\)](#)

This report describes the safety benefits and CMFs for four types of pedestrian crossing treatments—rectangular rapid flashing beacons, PHBs, pedestrian refuge islands, and advance crosswalk signs and pavement markings.

[NCHRP Synthesis 498: Application of Pedestrian Crossing Treatments for Streets and Highways \(2016\)](#)

This is a compilation of existing practices regarding the selection and implementation of pedestrian crossing improvements, as well as a literature review of research on more than 25 pedestrian crossing treatments.

[NHTSA "A Primer for Highway Safety Professionals" \(2016\)](#)

This resource outlines a comprehensive approach to improving safety for bicyclists and pedestrians and offers a summary of the most frequently used engineering, enforcement, and education safety measures. The resource identifies how certain treatments may be placed in relation to other treatments, such as the coordinated installation of a pedestrian refuge island and lighting.

Other State Resources

[Arkansas Bike and Pedestrian Plan:](https://www.arkansashighways.com/Trans_Plan_Policy/biking/Arkansas%20Bike-Ped%20Plan%20-%20FINAL%20-03312017.pdf)

https://www.arkansashighways.com/Trans_Plan_Policy/biking/Arkansas%20Bike-Ped%20Plan%20-%20FINAL%20-03312017.pdf

[ARDOT Strategic Highway Safety Plan:](https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/arkansas_fy2018_hsp.pdf)

https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/arkansas_fy2018_hsp.pdf

[Arkansas Highway Safety Office FY2017 Performance Plan and Highway Safety Plan:](https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ar_fy17hsp.pdf)

https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ar_fy17hsp.pdf

[ARDOT Strategic Highway Safety Plan, Towards Zero Deaths \(2013\):](https://www.arkansashighways.com/Trans_Plan_Policy/traffic_safety/strategichighwaysafetyplan.pdf)

https://www.arkansashighways.com/Trans_Plan_Policy/traffic_safety/strategichighwaysafetyplan.pdf

[ARDOT Design Manual:](https://www.arkansashighways.com/roadway_design_division/Roadway%20Design%20Plan%20Development%20Guidelines.pdf)

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