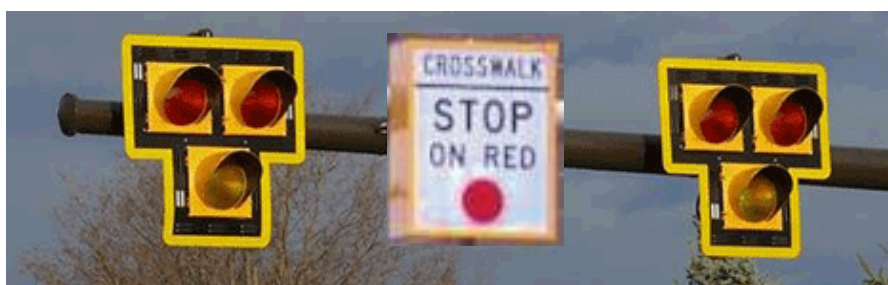




U.S. Department  
of Transportation  
**Federal Highway  
Administration**

## Center for Accelerating Innovation



# Safe Transportation for Every Pedestrian (STEP)



**Becky Crowe**  
FHWA Office of Safety

# STEP

Safe Transportation for Every Pedestrian



**Peter Eun**  
Resource Center

## Today's Guests



**Lauren Blackburn**



**Patrick Adams**  
Maine DOT



**Wayne Emington**  
FHWA Maine



**Mark Cole**  
Virginia DOT



Source: FHWA



Source: FHWA



# Where you walk, what do you see?



OR



Source: FHWA





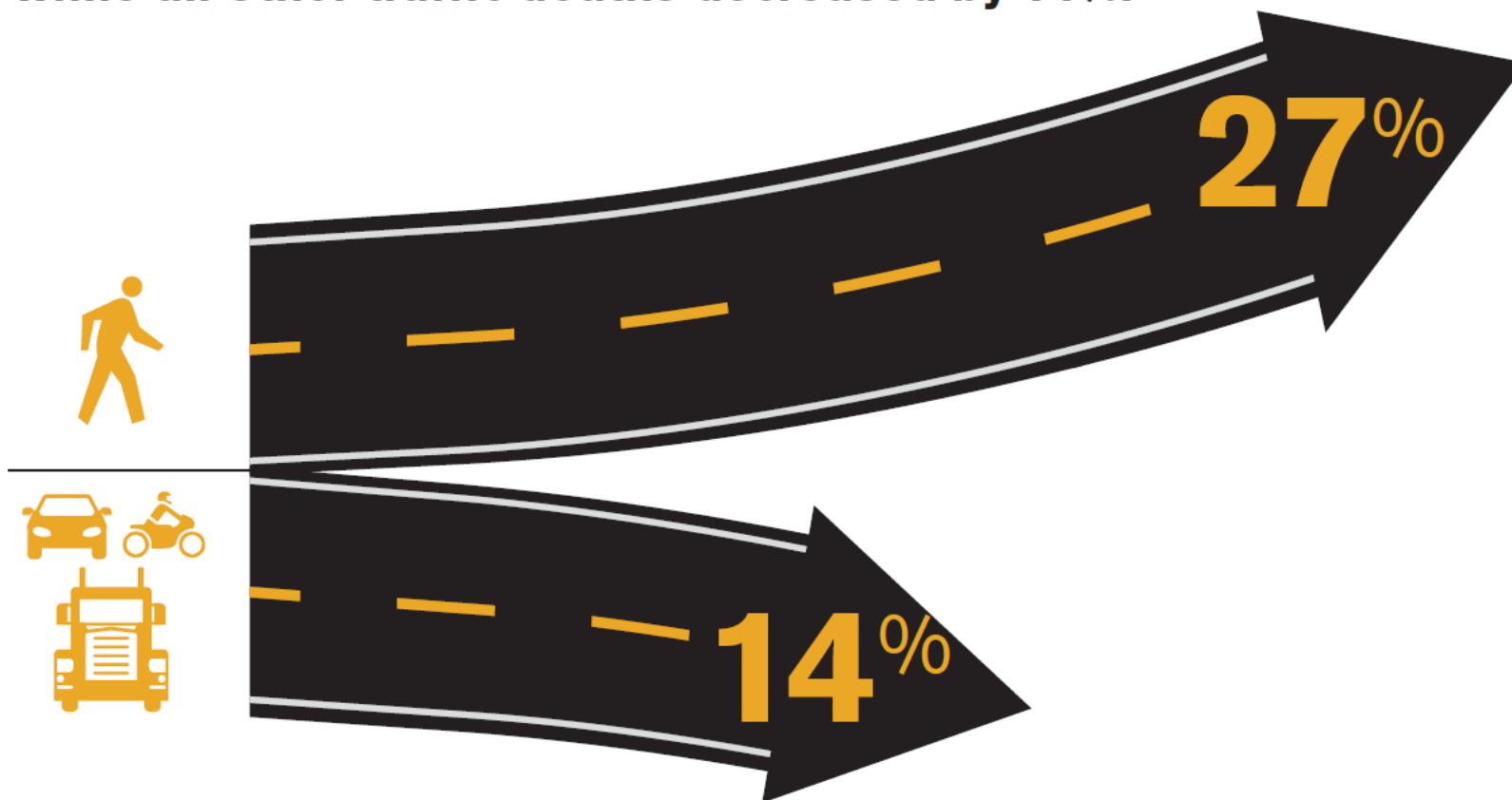
5,987

“On average, a pedestrian was killed nearly every 1.5 hours in traffic crashes in 2016.”

NHTSA

- 2016 FARS Data
- Photo Source: North Carolina Vision Zero, [ncvisionzero.org](http://ncvisionzero.org)

**Pedestrian fatalities increased 27% from 2007-2016,  
while all other traffic deaths decreased by 14%.**



**Source:** NHTSA Fatality Analysis Reporting System

# “Every Day Counts” (EDC)

**State-based model to identify and rapidly deploy proven, but underutilized innovations**

- ✓ shorten the project delivery process
- ✓ **enhance roadway safety**
- ✓ reduce congestion
- ✓ improve environmental sustainability

**Initiating 5<sup>th</sup> Round (2019-2020) - 10 innovations**

# STEP

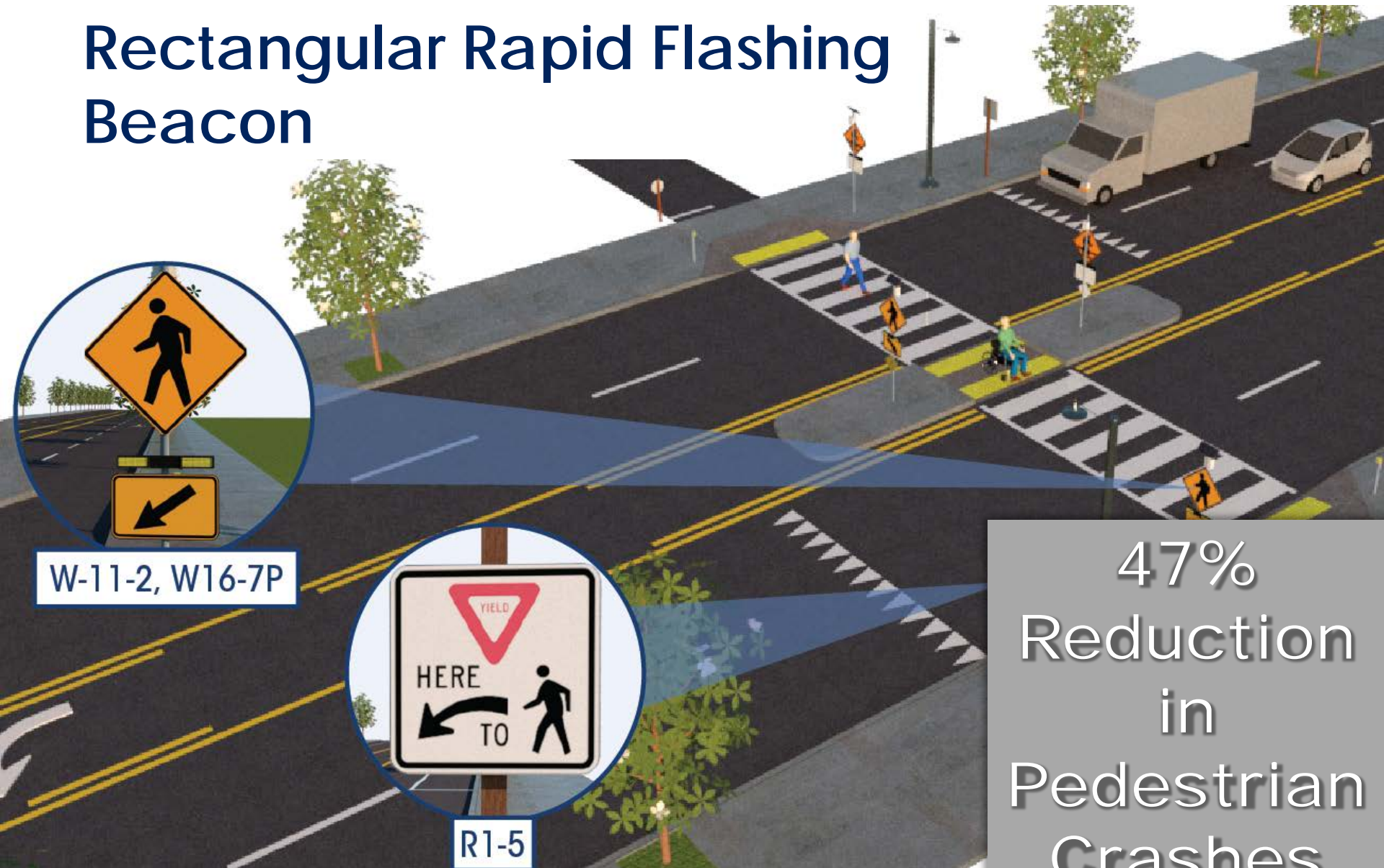
Safe Transportation for Every Pedestrian



# The Spectacular Seven



# Rectangular Rapid Flashing Beacon



47%  
Reduction  
in  
Pedestrian  
Crashes

# PLACEHOLDER for Tech Sheet: Leading Pedestrian Interval

Gives pedestrians a 3+ second head start to enter the crosswalk at an intersection

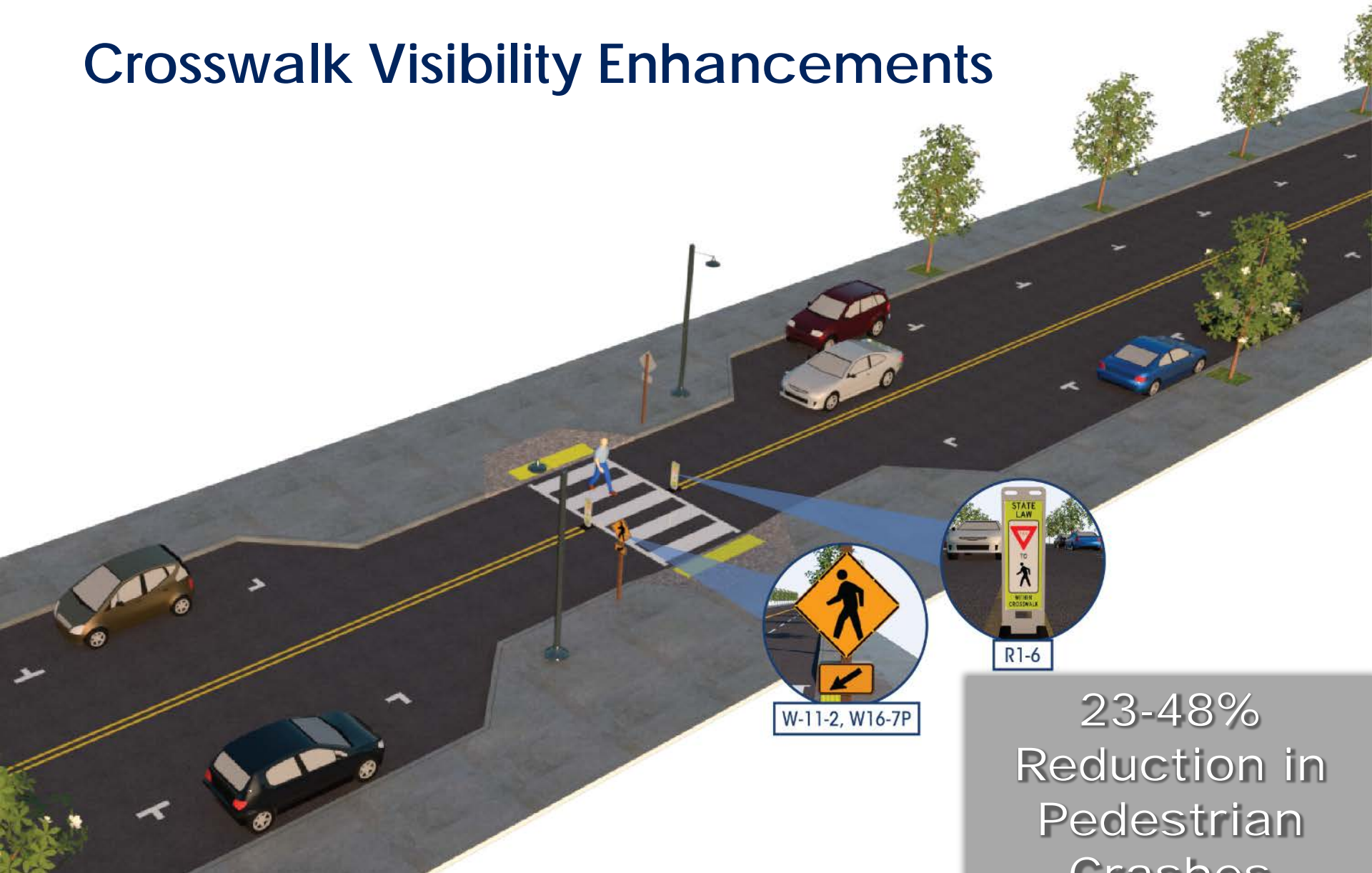
Helpful for older and disabled pedestrians who are slower to start crossing

60%  
Reduction  
in  
Pedestrian  
Crashes



Source: FHWA

# Crosswalk Visibility Enhancements



23-48%  
Reduction in  
Pedestrian  
Crashes



# Raised Crosswalks



45%  
Reduction  
in  
Pedestrian  
Crashes

# Pedestrian Refuge Islands



56%  
Reduction  
in  
Pedestrian  
Crashes

# Pedestrian Hybrid Beacons (PHB)





# Road Diet: Before



# Road Diet: After



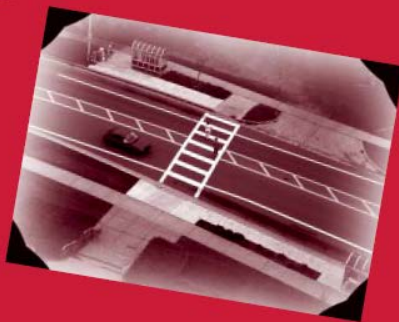
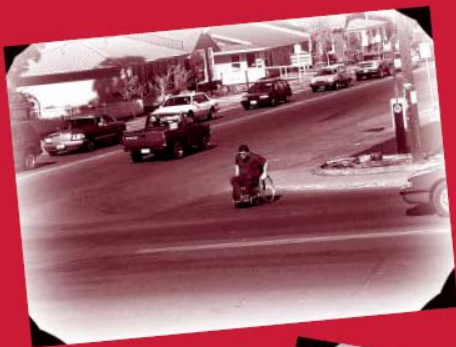


## Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations

Final Report and  
Recommended Guidelines

FHWA PUBLICATION NUMBER: HRT-04-100

SEPTEMBER 2005



U.S. Department of Transportation  
Federal Highway Administration

Research, Development, and Technology  
Turner-Fairbank Highway Research Center  
6300 Georgetown Pike  
McLean, VA 22101-2296



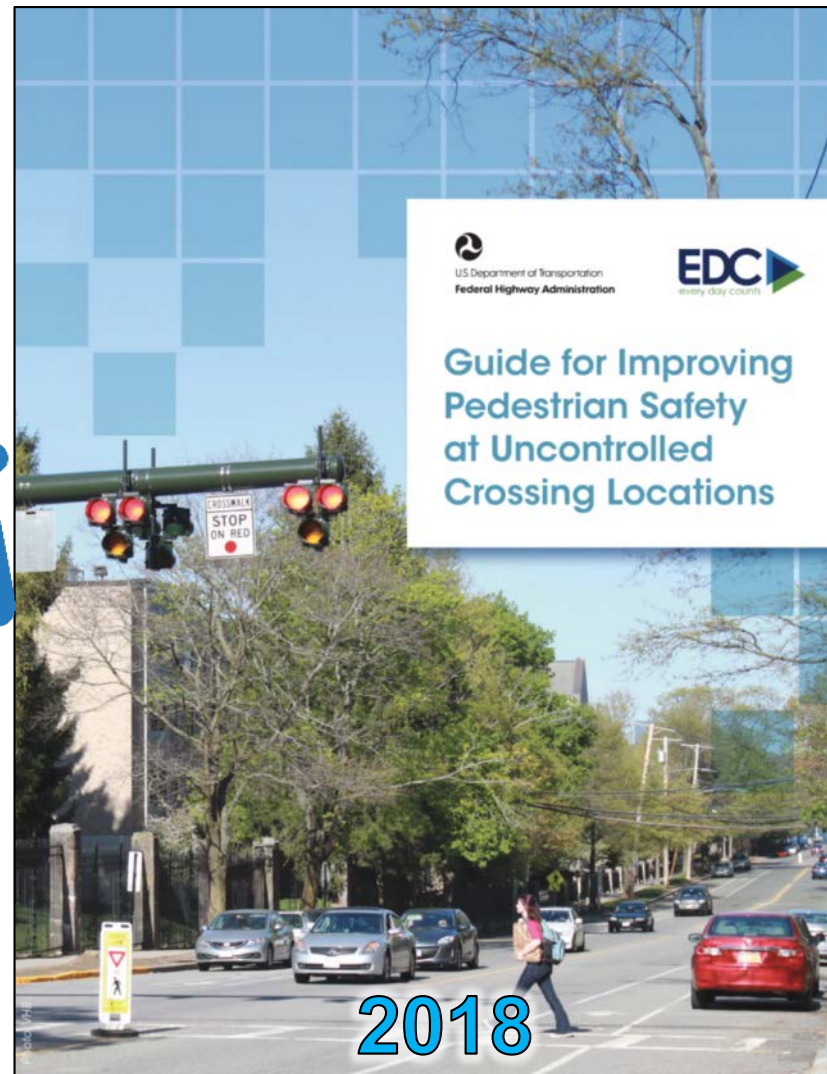
2005



U.S. Department of Transportation  
Federal Highway Administration



## Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations



2018



# 4 Select countermeasures

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
<b>2 lanes</b> (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
<b>3 lanes with raised median</b> (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
<b>3 lanes w/o raised median</b> (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
<b>4+ lanes with raised median</b> (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
<b>4+ lanes w/o raised median</b> (2 or more lanes in each direction)	① ③ ① ③ 5 6 5 ⑥ 7 8 9 7 8 9	① ③ ① ③ 5 ⑥ 5 ⑥ 7 8 9 7 8 9	① ③ ① ③ 5 ⑥ 5 ⑥ 8 ⑨ 7 8 9	① ③ ① ③ 5 ⑥ 5 ⑥ ⑦ 8 ⑨ 7 8 9	① ③ ① ③ 5 ⑥ 5 ⑥ 8 ⑨ ⑦ 8 ⑨	① ③ ① ③ 5 ⑥ 5 ⑥ 8 ⑨ ⑦ 8 ⑨	① ③ ① ③ 5 ⑥ 5 ⑥ ⑦ 8 ⑨ 8 ⑨	① ③ ① ③ 5 ⑥ 5 ⑥ 8 ⑨ 8 ⑨	① ③ ① ③ 5 ⑥ 5 ⑥ 8 ⑨ 8 ⑨
<p>Given the set of conditions in a cell,</p> <ul style="list-style-type: none"> <li># Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.</li> <li>● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.</li> <li>○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*</li> </ul> <p>The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.</p>									
<ol style="list-style-type: none"> <li>1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning sign</li> <li>2 Raised crosswalk</li> <li>3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line</li> <li>4 In-Street Pedestrian Crossing sign</li> <li>5 Curb extension</li> <li>6 Pedestrian refuge island</li> <li>7 Rectangular Rapid-Flashing Beacon (RRFB)**</li> <li>8 Road Diet</li> <li>9 Pedestrian Hybrid Beacon (PHB)**</li> </ol>									

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

\*\*The PHB and RRFB are not both installed at the same crossing location.

# Example



Source: Virginia DOT

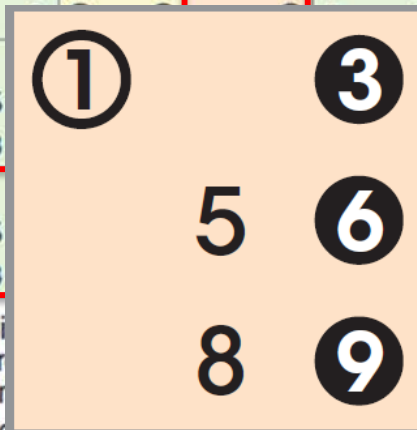
AADT = 14,000

Posted Speed = 40 mph; Actual speeds = average 45 mph

2 Lanes each direction, with two-way center turn lane

**Poll: What countermeasures may be good options for this example?**

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
<b>2 lanes</b> (1 lane in each direction)	① 2 4 5 6	① 5 6 7 9	① 5 6 ⑦ ⑨	① 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 ⑨
<b>3 lanes with raised median</b> (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
<b>3 lanes w/o raised median</b> (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	① 3 4 5 6 7	① ③ 5 6 ⑦ ⑨	① ③ 5 6 ⑦ ⑨	① ③ 4 5 6 ⑨	① ③ 5 6 ⑨	① ③ 5 6 ⑨
<b>4+ lanes with raised median</b> (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 5 7 8	① 5 7 8	① 5 7 8	① ③ 5 8 ⑨	① ③ 5 8 ⑨	① ③ 5 8 ⑨
<b>4+ lanes w/o raised median</b> (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 5 7 8	① 5 7 8	① 5 7 8	① ③ 5 ⑥ 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 Highway Crosswalk
- 2 Raised Curb
- 3 Advance Signs and Markings
- 4 Refuge Island
- 5 Pedestrian Hybrid Beacon (PHB)\*\*
- 6 Road Diet
- 7 Pedestrian Hybrid Beacon (PHB)\*\*
- 8 Road Diet
- 9 Pedestrian Hybrid Beacon (PHB)\*\*

\*Taking restrictions on the lighting levels,

- Advance Signs and Markings
- Refuge Island
- Pedestrian Hybrid Beacon



## Today's Guests



U.S. Department of Transportation  
Federal Highway Administration

Wayne Emington, FHWA Maine Division



Patrick Adams, Maine DOT



Mark Cole, Virginia DOT



## Pedestrian Safety – Where STEP meets Heads Up!

*Patrick Adams*

*MaineDOT Manager of Bicycle  
and Pedestrian Programs*

*Wayne Emington, PE*

*FHWA Safety &  
Operations Engineer*

# Where STEP meets Heads Up!



**Safe Transportation for  
Every Pedestrian (STEP)**





# Safety Target Setting

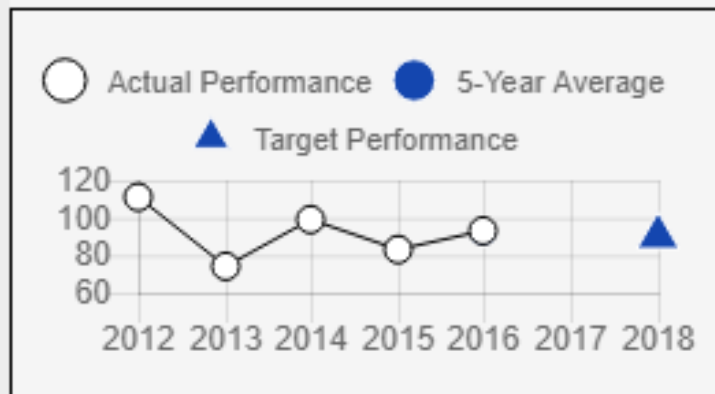
## Number of Non-Motorized Fatalities and Serious Injuries

**Baseline**  
5-Year Average  
2012-2016

**92.0**

**Non-Motorized Fatalities  
and Serious Injuries**  
All Public Roads

**Trend**  
2012-2016  
Desired trend: ↓



Maine Non-Motorized Fatalities and Serious Injuries  
2012-2016

**Target**  
5-Year Average  
2014-2018

**90.0**

**Non-Motorized Fatalities  
and Serious Injuries**  
All Public Roads

# Collaboration Early and Often

MaineDOT -

- Bureau of Planning
- Creative Services
- Safety Office
- Bicycle and Pedestrian Program

Maine Department of Public Safety

- Maine Bureau of Highway Safety
- Maine State Police

Maine DOL's Division of the Blind and Visually Impaired

Federal Highway Administration



Maine's Municipal Planning Organizations

Bicycle Coalition of Maine

Safe Routes to School Program

Maine Developmental Disabilities Council

City of Portland

NL Partners

American Automobile Association

# Vision: Institutionalized

<p><b>Institutionalized:</b> The state/locals have adopted the STEP countermeasures as a standard practice and use them regularly at uncontrolled crossing locations to improve pedestrian safety. There is a formal guidance, policy and/or a process in place to advance the STEP countermeasures.</p>	<ul style="list-style-type: none"><li>• Is there an inventory of locations with STEP countermeasures?</li><li>• State/Locals implement/install STEP countermeasures using a systemic process.</li><li>• The State has a process in place to deploy STEP Countermeasures (Crosswalk Visibility Enhancements, Pedestrian Refuge Islands, Raised Crosswalks, Rectangular Rapid Flashing Beacon (RRFB), Pedestrian Hybrid Beacon (PHB) or Road Diets) to improve pedestrian safety at uncontrolled crossing locations.</li><li>• Included STEP countermeasures in Complete Streets Manual, Project Development Manual, and/or design guidance and is standard practice to improve uncontrolled crossing locations.</li><li>• No special permission is needed to deploy STEP countermeasures.</li></ul>
--	--



# Pedestrian Fatalities in the News

## Baby Boy Killed by Truck in Alton, Maine

The Portland Press Herald reported that the incident happened near Alton Elementary School  
By Alexandra Prim  
Published at 9:51 PM EDT on May 19, 2017 | Updated at 10:47 PM EDT on May 19, 2017



An 18-month-old boy was killed Friday after being run over by a pickup truck in Alton, Maine, said police.



2

LOCAL & STATE | Posted November 20, 2017 | Updated November 21, 2017

INCREASE FONT SIZE

## Augusta man, 81, killed after leaving church supper Saturday night

Emile Morin of Augusta was an active member of St. Augustine Catholic Church on Sand Hill.

BY CHARLES EICHACKER KENNEBEC JOURNAL  
AND KEITH EDWARDS KENNEBEC JOURNAL

Share    



Morning Sentinel

# Local & State

ns.com

## Fatal accidents spur safety campaign

State DOT, Bicycle Coalition of Maine talk pedestrian rules in Winslow

BY BRADLINE ST. AMBROS  
Staff Writer

WINSLOW — After a state-wide spike in pedestrian fatalities and a crash that killed an eight-year-old boy in Lewiston, the Maine Department of Transportation spearheaded a project it's bringing to communities to make the roads safer for pedestrians who like to walk.

In November 2016, Joseph Chaberg, 23, was hit by a pickup truck while in a crosswalk on his way to school. He died at the scene.

"It really galvanized the city of Lewiston," said Patrick Adams, bicycle and pedestrian program manager at the state, "and it also became a rallying cry for a lot of people that we really need to do something."

At the same time, the number of pedestrian fatalities jumped from nine in 2014 to 23 in 2016, and 14 in 2017.

Now the department is trying to collect and share information about "communities" safety measures, which it hopes to turn into actionable pedestrian safety recommendations.

On Wednesday night, Adams and representatives from the Bicycle Coalition of Maine, which has partnered with the state on the project, held a forum at Winslow Elementary School to talk with residents about their concerns and provide safety tips.

"We don't know the community the towns people do," he said, adding that he doesn't see the project as the state's task or the coalition's task, but as an opportunity for the community.

This is the department's eighth presentation, Adams said, adding that it plans to visit a total of 23 communities. It targets the projects in May to June.

The state looked at data on a map of the state and saw 10 "clusters," which led to communities, where fatal pedestrian crashes seemed to occur more often, Adams said.

While Winslow might not have a high rate of accidents, he said, it is a neighbor of Waterville, which is a different story.

"We know you officials will go across the bridge, so you might be involved in one of these situations," he said.

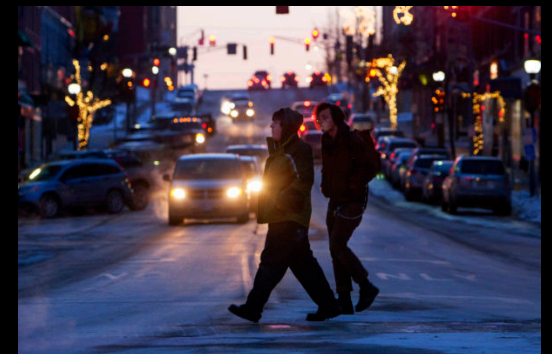
SAFETY PAGE 2

## Maine sets 24-year record for pedestrian fatalities in 2017

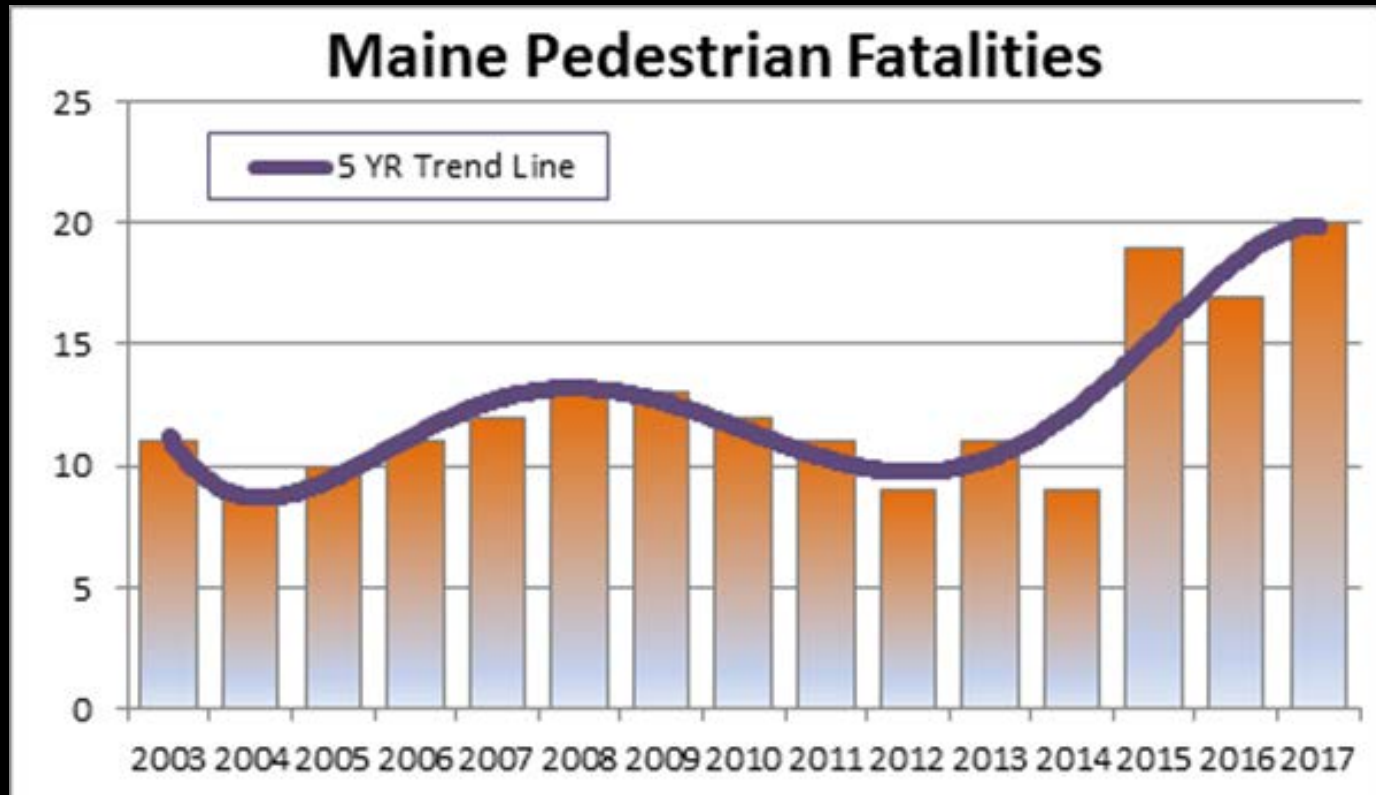


Bangor public safety personnel clean a section of roadway after a car-pedestrian accident at the intersection of Broadway and Garland Street in November 2017.

Tom McCrea | EDN



## Maine's Pedestrian Crash Experience





Year	Pedestrian	Bicycle	Motorcycle	Impaired	% Impaired	Total Fatalities
2011	11	0	15	23	17	136
2012	9	1	24	50	30	164
2013	11	4	14	35	24	145
2014	9	2	10	33	25	131
2015	16	0	32	47	30	156
<b>5 Year Avg.</b>	<b>11.8</b>	<b>1.4</b>	<b>19</b>	<b>37.6</b>	<b>25.2</b>	<b>146.4</b>

This table shows the relationship between the various classifications of fatalities and the total number of fatalities.

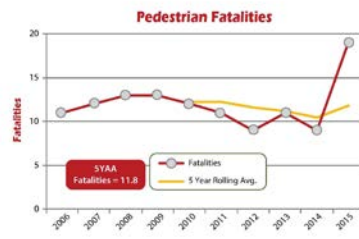


# Maine's Data Driven Strategy

## Maine's 2017 Strategic Highway Safety Plan



Engineering • Education • Enforcement • Emergency Services



## Pedestrians and Bicyclists Our Challenge

### Crashes involving vulnerable road users are a growing concern.

Teenagers, the elderly, people with disabilities, and those with financial limitations often have no means of travel other than walking. Providing a safe place to walk and bike is essential for these and other users of the transportation system. In Maine, on average, a pedestrian is hit by a motor vehicle nearly every day. More than 95% of these reported pedestrian crashes involve injury or death to the pedestrian.

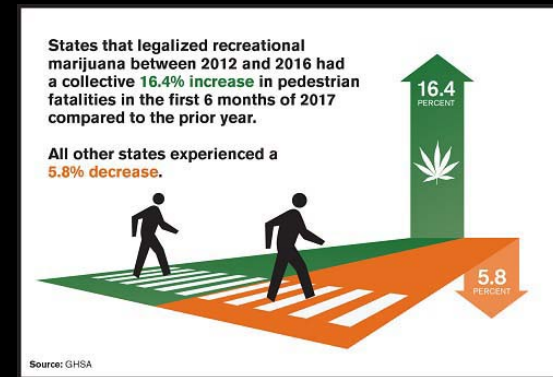
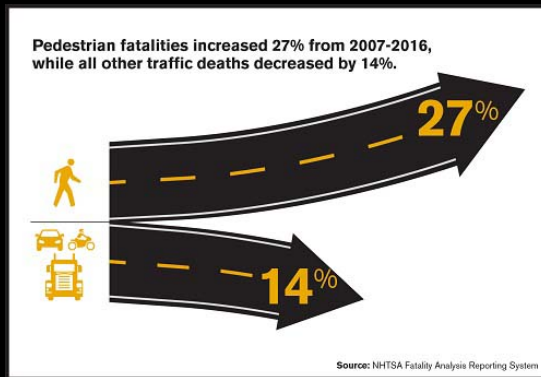
### Maine's Pedestrian Safety Findings:

- Maine's pedestrian crashes are concentrated in population centers, as expected. Ten community clusters have been identified that include 21 towns where crash experience and/or exposure was significant. About 65% of the state's pedestrian crashes occur in these selected communities, including 35% of pedestrian fatalities.
- Nearly 80% of the fatalities occurred to



# Part of a National Trend

(From GHSA 2017 Report)



# Current Maine Efforts

Very complex issue

Both driver and pedestrian actions contribute

## The three E's

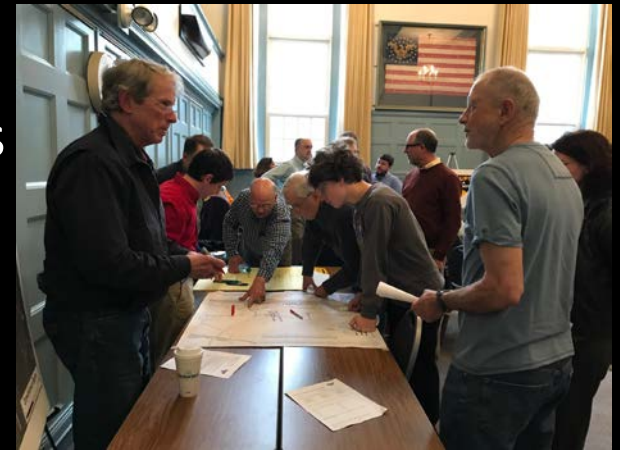
- Education and behavior change – (media, brochures, forums, outreach to specific groups)
- Engineering – (lights, crosswalks, signs)
- Enforcement – (positive & punitive)



# Current Maine Efforts



- Multi-Agency team meets regularly to develop action plans
- Outreach out to select communities
- Local Roads Program's Crosswalks, Sidewalks, & ADA Compliance Workshops
- Focus on hard to reach groups
- Crosswalk reviews and upgrades





# Current Maine Efforts



- RRFB initiative
- Portable Speed Feedback signs
- Higher Visibility Crosswalks - Demonstration Projects
- Building a web resource that everyone can use



**HEADS UP!**  
**SAFETY IS A  
TWO-WAY STREET.**



**NEXT “STEPS”**



# **VDOT's Efforts to Ensure Safe Transportation for Every Pedestrian**

A solid orange vertical bar is positioned to the left of the speaker's name.

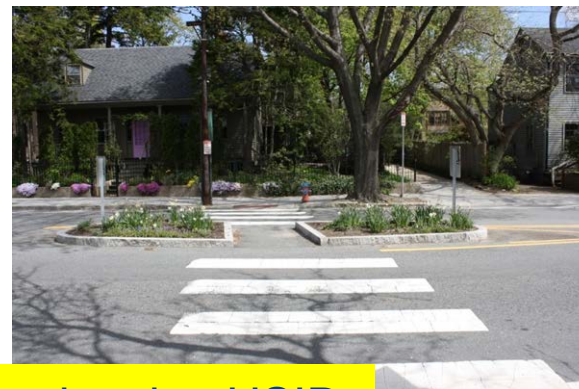
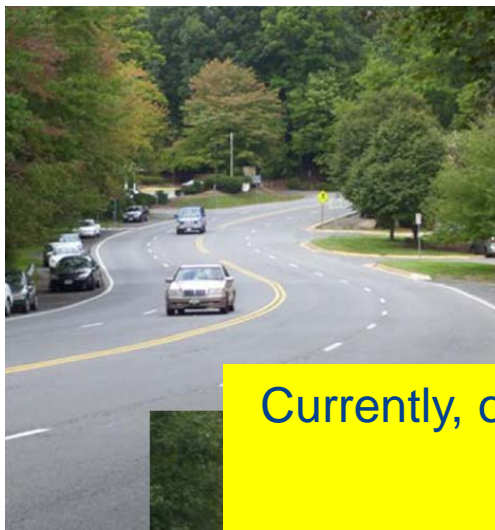
**Mark A. Cole, P.E.**

Assistant Division Administrator – Highway Safety  
Traffic Engineering Division

September 2018



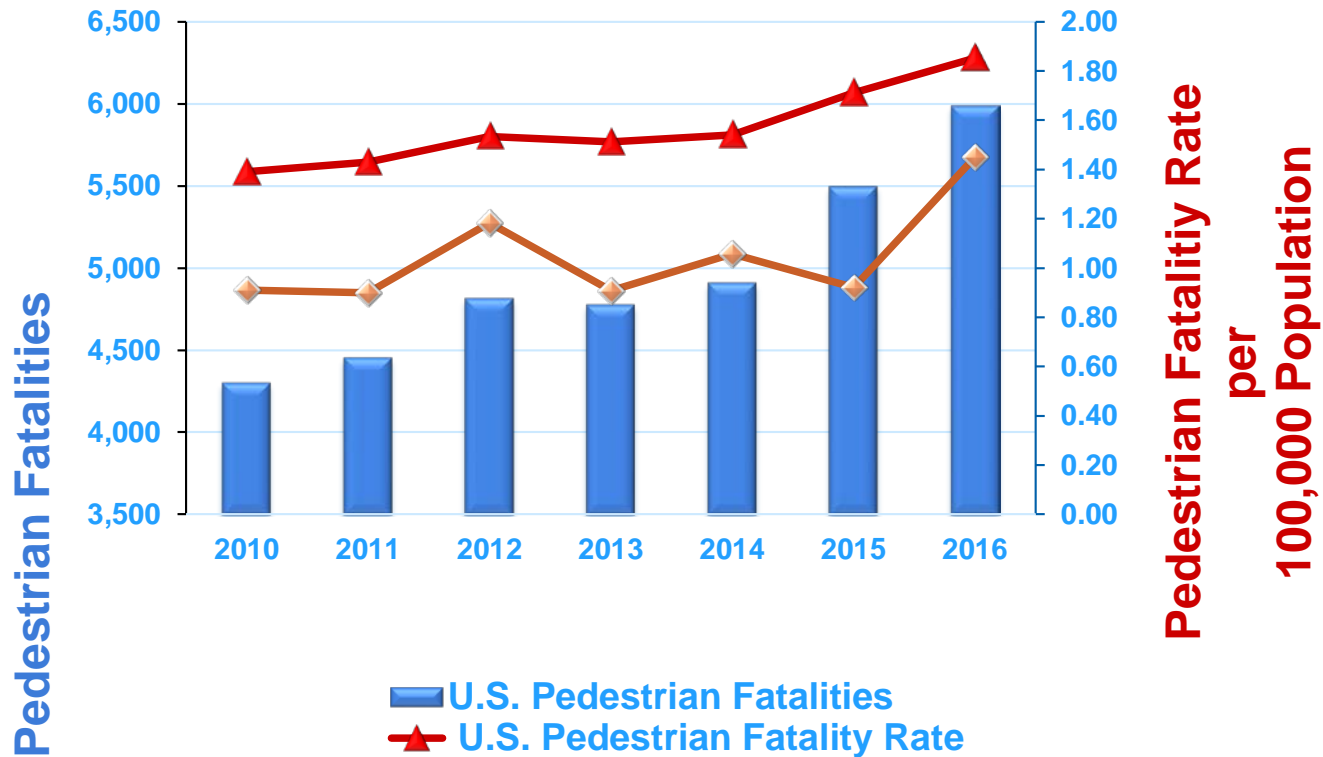
# Virginia Pedestrian and Bicycle Safety Projects



Currently, over 90 bicycle and pedestrian HSIP Projects are underway.  
Valued at \$75 Million



## Pedestrians made up about 16% of Virginia highway fatalities in 2016

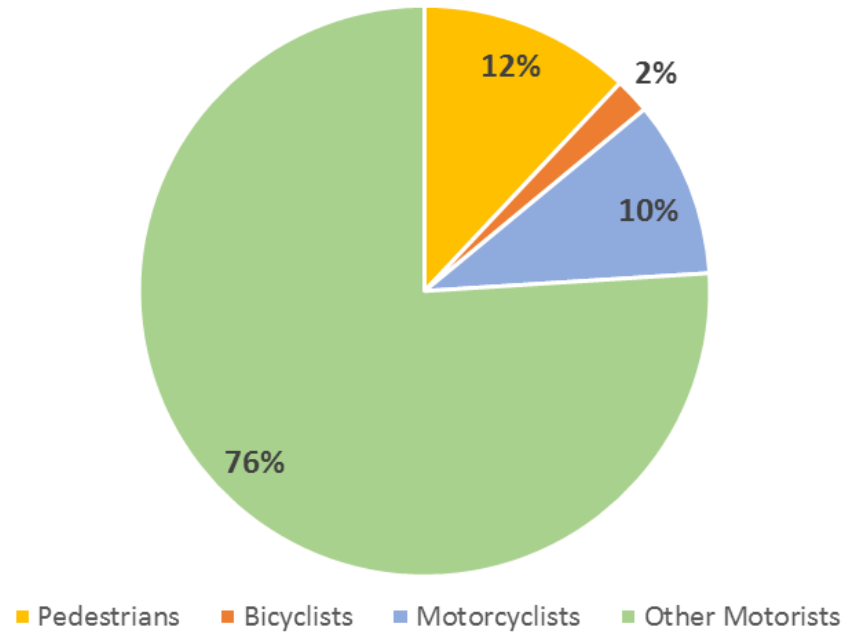


# Vulnerable Road User Deaths are Increasing

In 2017,  
234 vulnerable  
road users died,  
**27% of**  
**all traffic**  
**deaths**

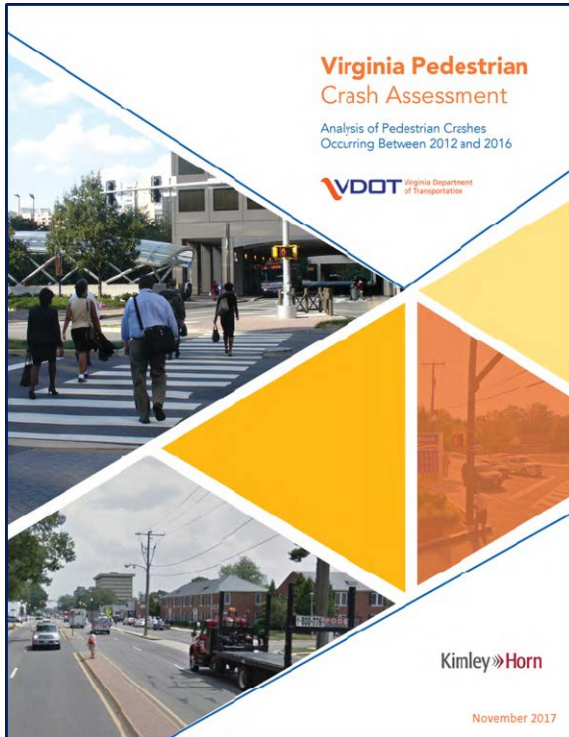


Virginia Traffic Deaths By Roadway User Type  
(2011-2016)

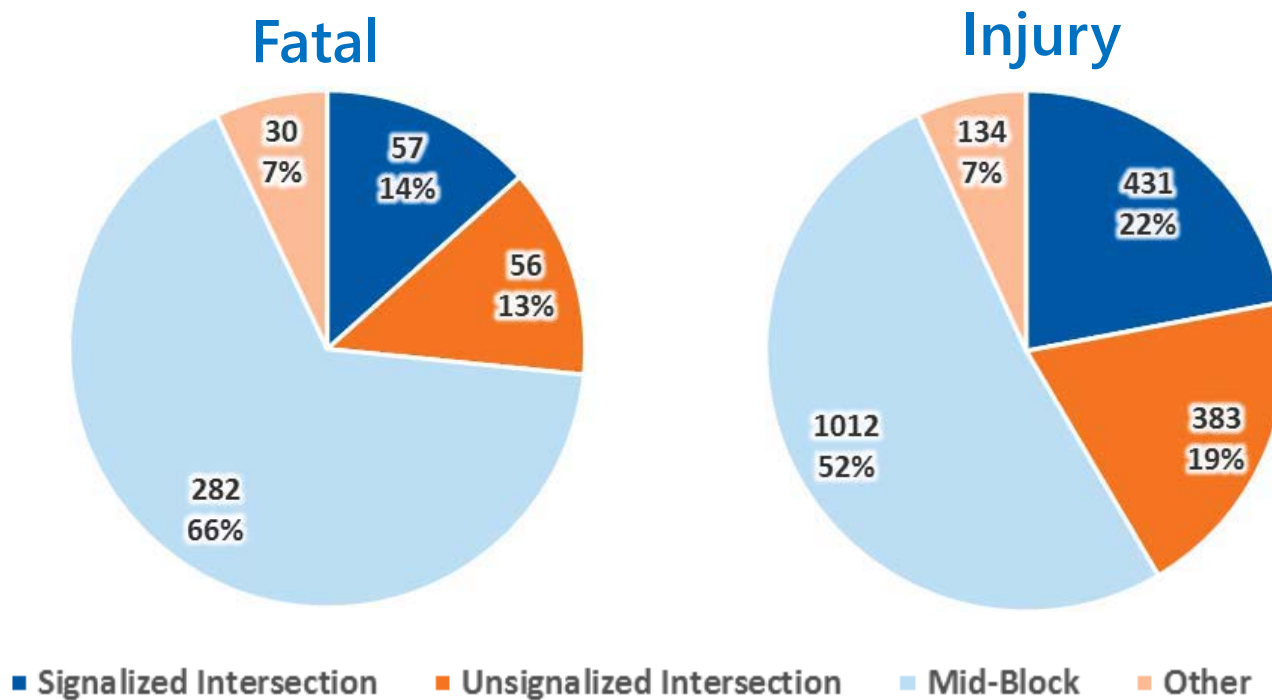




# Virginia Pedestrian Crash Assessment

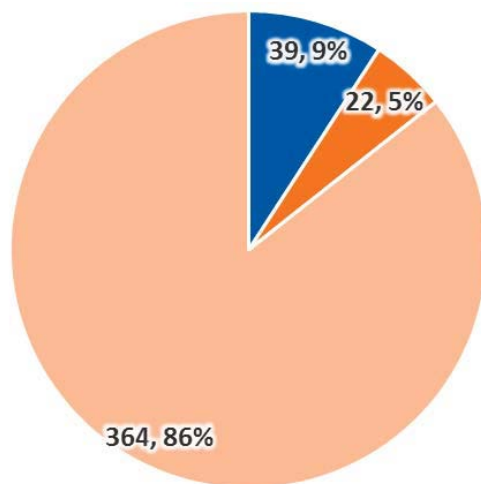


## Where Pedestrian Crashes Occur

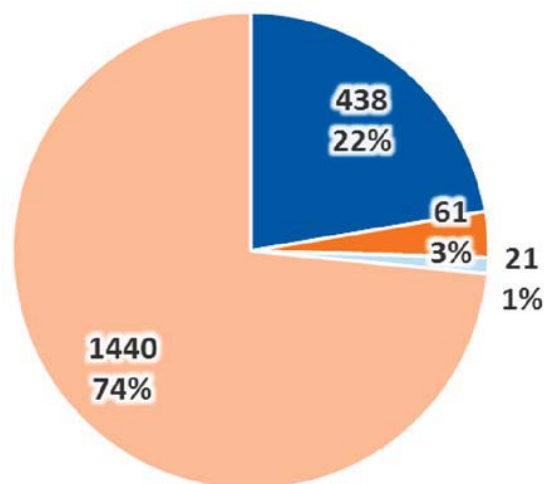


# Ped Crashes By Crosswalk Presence

## Fatal



## Injury



- Marked Crosswalk Present, Pedestrian Struck In Crosswalk
- Marked Crosswalk Present, Pedestrian Not Struck In Crosswalk
- Marked Crosswalk Present, Unclear If Pedestrian Was Struck In Crosswalk
- No Marked Crosswalk Present

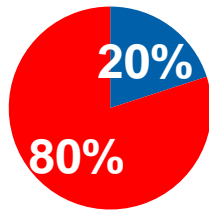


# Pedestrian Crashes By Land Use

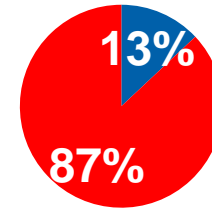
■ Residential/Commercial/Recreational Land

■ Rural/Industrial Land Uses

## Pedestrian Fatal Crashes

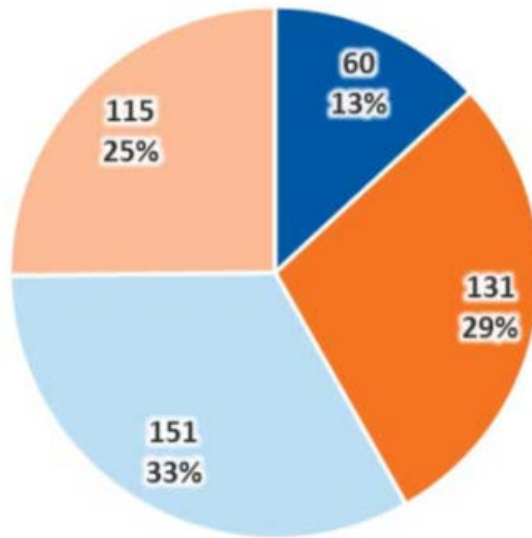


## Pedestrian Injury Crashes

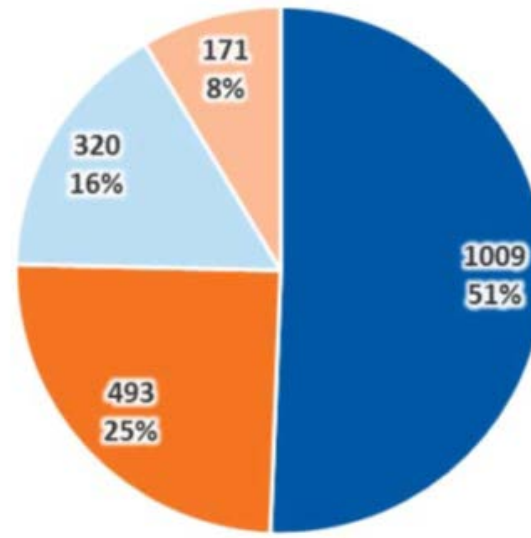


## Ped Crashes By Posted Speed Limit (mph)

Fatal

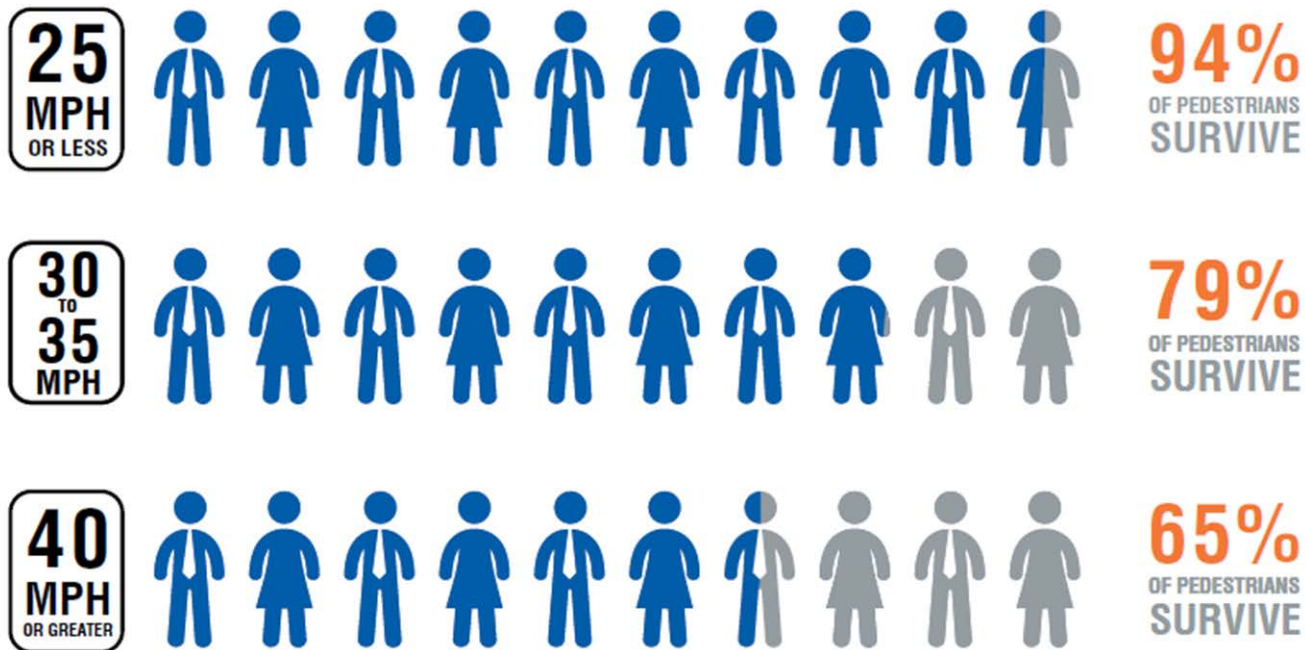


Injury



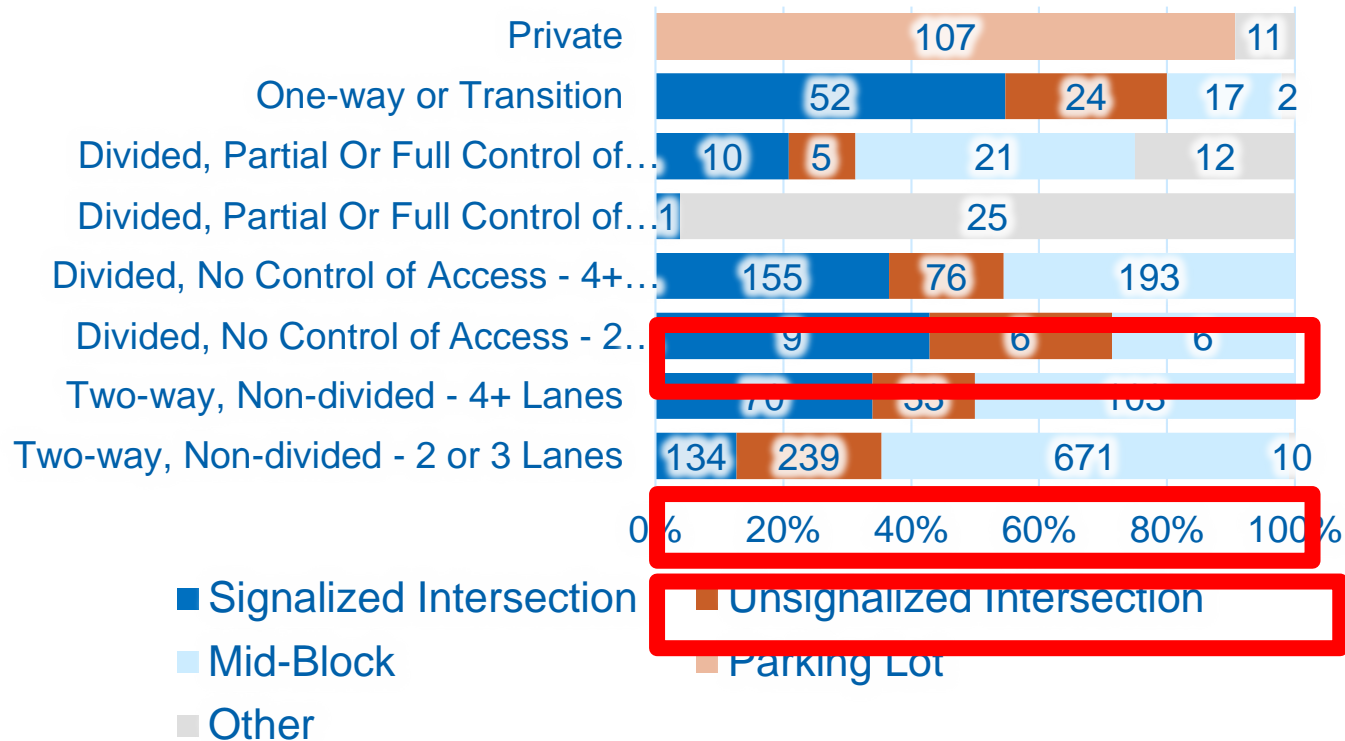
■ ≤ 25 ■ 30 - 35 ■ 40 - 45 ■ ≥ 50

## Ped Crashes And Posted Speed Limit





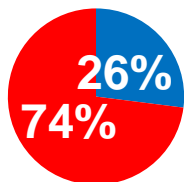
# Pedestrian Injury Crashes By Type of Road



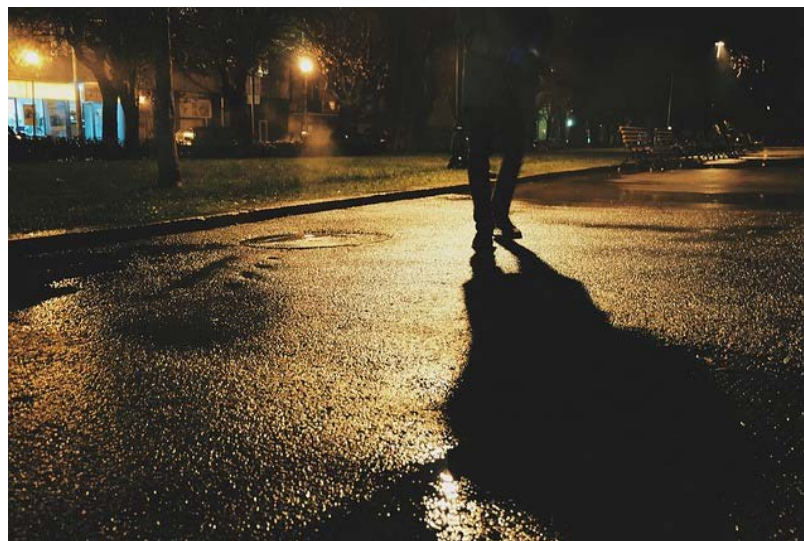
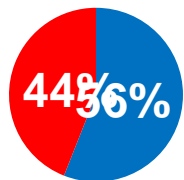
# Pedestrian Crashes in Limited Light Conditions

■ Daylight ■ Limited Light

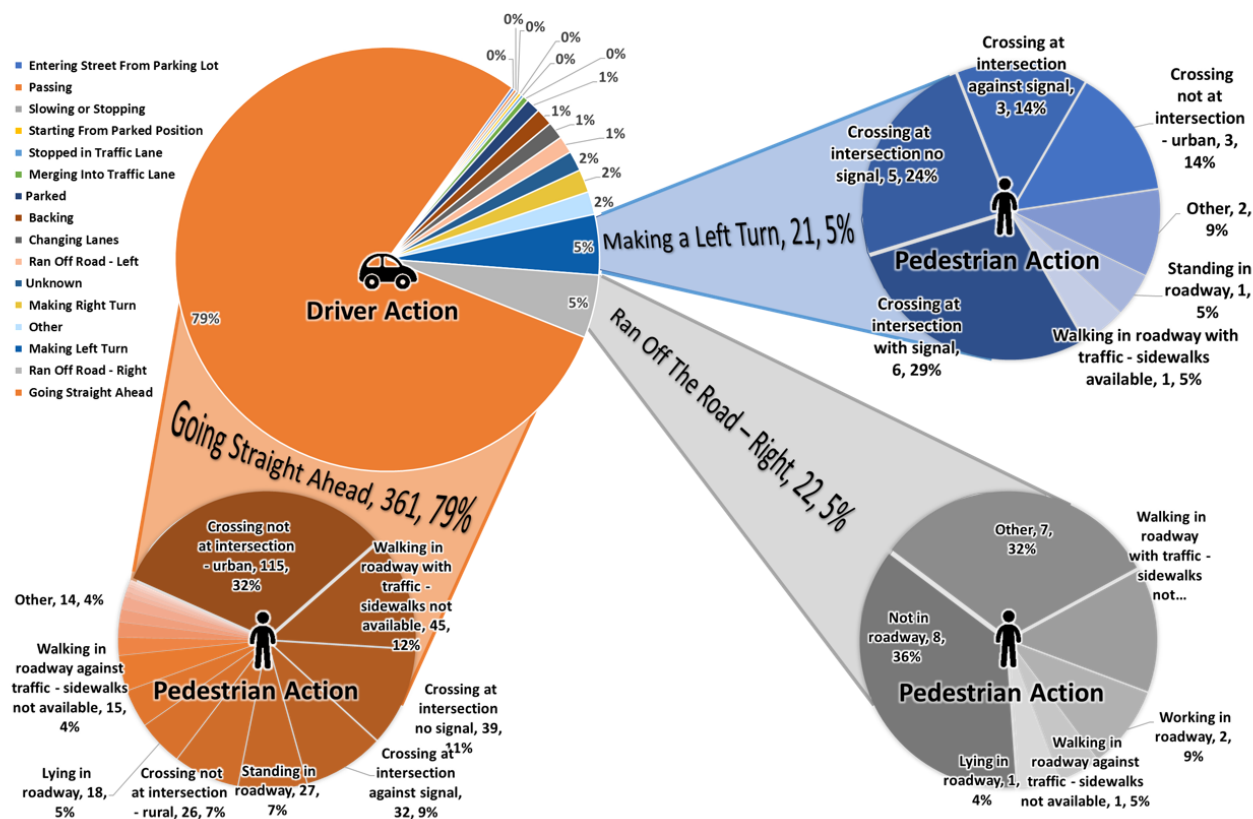
## Pedestrian Fatal Crashes



## Pedestrian Injury Crashes



# Driver and Pedestrian Actions in Fatal Crashes



# Pedestrian Crash Heat Map Example

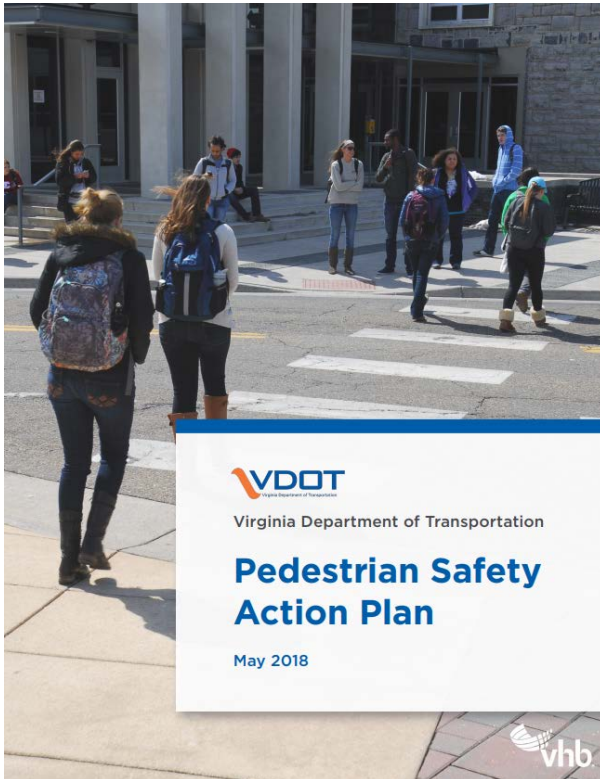
CATEGORICAL HEAT MAP  Salem Pedestrian Injury Crashes (2012-2016)			Total Crashes	Category	Functional Classification						Funding				Roadway Type										Total
				Factor	Interstate	Arterial	Collector	Local	Private	VDOT Interstate	VDOT Primary Route	VDOT Secondary Route	Non-VDOT Route	Two-way, Non-divided - 2 or 3 Lanes	Two-way, Non-divided - 4+ Lanes	Divided, No Control Of Access - 2 or 3 Lanes	Divided, No Control Of Access - 4+ Lanes	Divided, Partial Or Full Control Of Access - 2 or 3 Lanes	Divided, Partial Or Full Control Of Access - 4+ Lanes	One-way or Transition	Private				
				#	2	107	43	52	16	2	31	26	161	142	27	4	32	2	1	2	10				
Total Crashes			220																						
Category	Factor		#																						
Season	Spring (March - May)		55	0	26	8	15	6	0	6	4	45	38	6	1	6	0	0	0	4					
	Summer (June - August)		48	1	22	10	12	3	1	7	10	30	33	5	0	7	1	1	0	1					
	Autumn (September - November)		67	1	32	15	14	5	1	12	7	47	41	6	3	11	1	0	1	4					
	Winter (December - February)		50	0	27	10	11	2	0	6	5	39	30	10	0	8	0	0	1	1					
Location	Signalized Intersection		38	0	33	4	1	0	0	1	0	37	18	6	0	14	0	0	0	0					
	Unsignalized Intersection		50	0	23	12	13	2	0	6	4	40	36	6	3	4	0	0	1	0					
	Mid-Block		116	0	50	27	38	1	0	22	20	74	85	15	1	14	0	0	1	0					
	Parking Lot		9	0	0	0	0	9	0	1	1	7	0	0	0	0	0	0	0	9					
	Other		7	2	1	0	0	4	2	1	1	3	3	0	0	0	2	1	0	1					
Crosswalk	Crosswalk Present, Pedestrian Struck In Crosswalk		45	0	30	9	6	0	0	5	1	39	27	6	3	9	0	0	0	0					
	Crosswalk Present, Pedestrian Not Struck In Crosswalk		2	0	2	0	0	0	0	0	0	2	0	1	0	1	0	0	0	0					
	Crosswalk Present, Unclear If Pedestrian Was Struck In Crosswalk		1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0					
	No Crosswalk Present		172	2	74	34	46	16	2	26	25	119	115	20	1	22	2	1	1	10					



# Virginia Pedestrian Safety Action Plan (PSAP)

## Goals

- Understand Virginia's pedestrian safety concerns and identify solutions to address them
- Make policy, procedure, and practice changes to help ensure safe pedestrian travel
- Consider the relationship between land development and pedestrian safety
- Consider maintenance issues for pedestrian access and safety
- Identify HSIP pedestrian safety projects



# PSAP Steps

**Step 1: Policy Review**

**Step 2: Crash and Data Analysis**

**Step 3: Countermeasure Selection**



## **Step 1: Policy Review**

**Summarize and assess current VDOT policies:**

- **Roadway Design**
- **Traffic Engineering**
- **Permitting and land use**
- **Speed setting procedures**
- **Pedestrian planning and policy**
- **Research (countermeasure guidance)**
- **Project prioritization**

# Policy Gap Analysis

Policy Type	Tier	Strengths	Weaknesses
Complete Streets	◆	VDOT accepts responsibility for maintenance of eligible sidewalks; Includes list of accepted exceptions for providing sidewalks and pedestrian accommodations.	VDOT does not track implementation; exceptions listed in policy are subject to widely varied interpretation.
Crosswalk Marking	★	VDOT updated guidance as part of TE-384. Considers speed, AADT, and land use context.	Complexity of guidance may lead to less-than-optimal implementation.
Signalized Intersection Countermeasures	◆	Northern Virginia Region guidance considers signal phasing, crossing distance, and turning conflicts for installing pedestrian signals.	No existing guidance statewide.
Uncontrolled Crossing Countermeasures	★	TE-384 includes multiple countermeasures, such as PHBs and RRFBs.	Does not specifically address refuge islands and does not offer VDOT-specific criteria for PHBs.
Speed Setting	●	Engineering judgment provides opportunity to consider pedestrian safety.	No guidance or process available for pedestrian activity besides school zone speed setting.
Design Standards	◆	Includes references to refuge islands (medians), crosswalk markings, and signals.	Unclear guidance for assembly of beacons and signs for PHBs and RRFBs
Road Diets	●	Northern Virginia Region reviews resurfacing for road diet opportunities.	No existing statewide guidance.
Key: ● No Specific Policy Applicable      ◆ Incomplete Guidance or Irregular Application      ★ Clear Policy and Consistent Application			



## Example Policy Recommendations

- **Consider VDOT-specific installation guidance for pedestrian safety countermeasures not currently in roadway design manual**
- **Update Traffic Impact Analysis - Pedestrian Levels of Service - per length or duration of pedestrian crossing**
- **Develop road diet design criteria**
- **Create guidance for Pedestrian Priority Zones**
- **Develop a checklist for land development review to consider pedestrian mobility and safety**

## Step 2: Crash and Data Analysis

### Crash Clusters

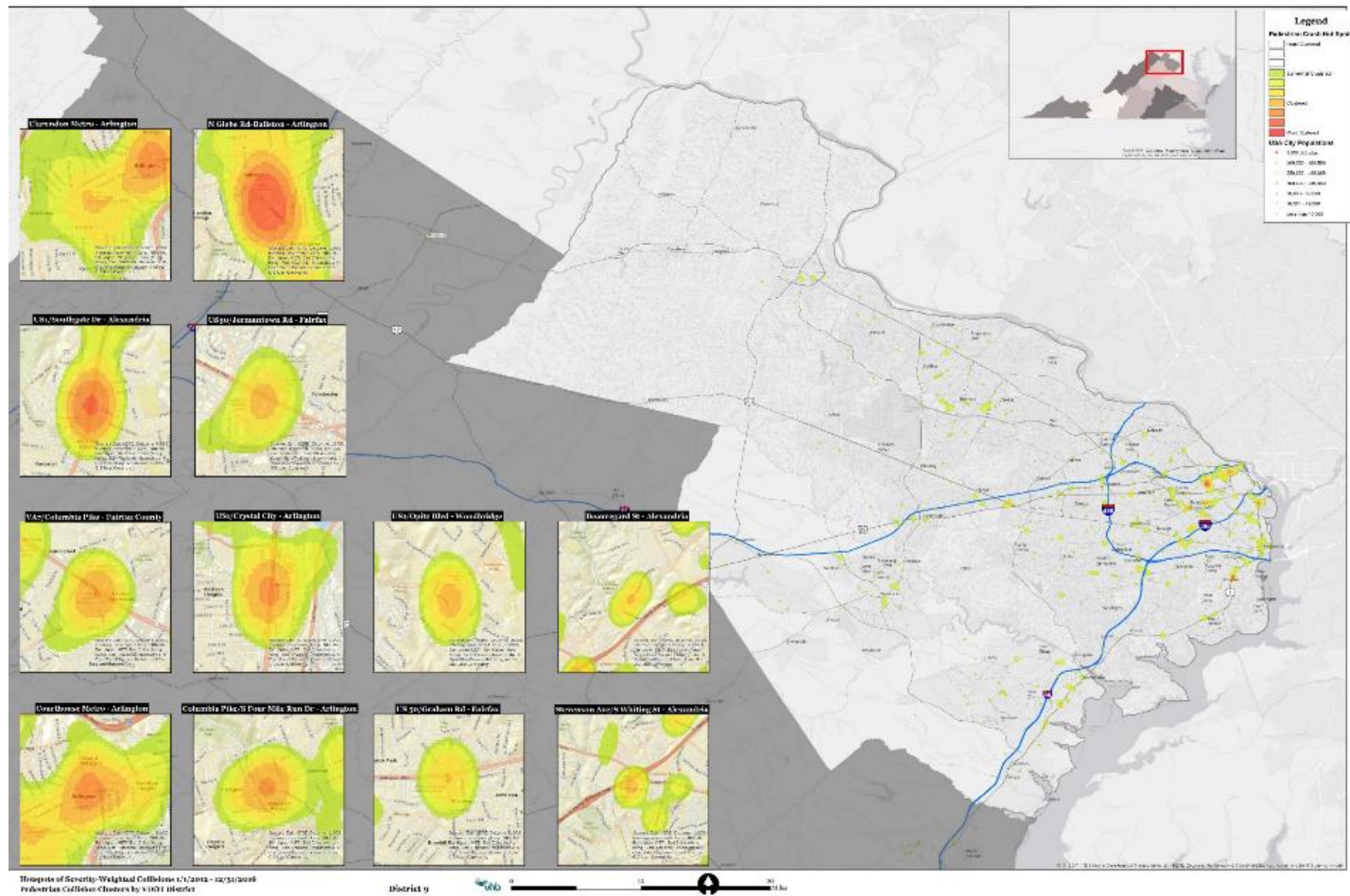
- smaller scale
- focus on crash types



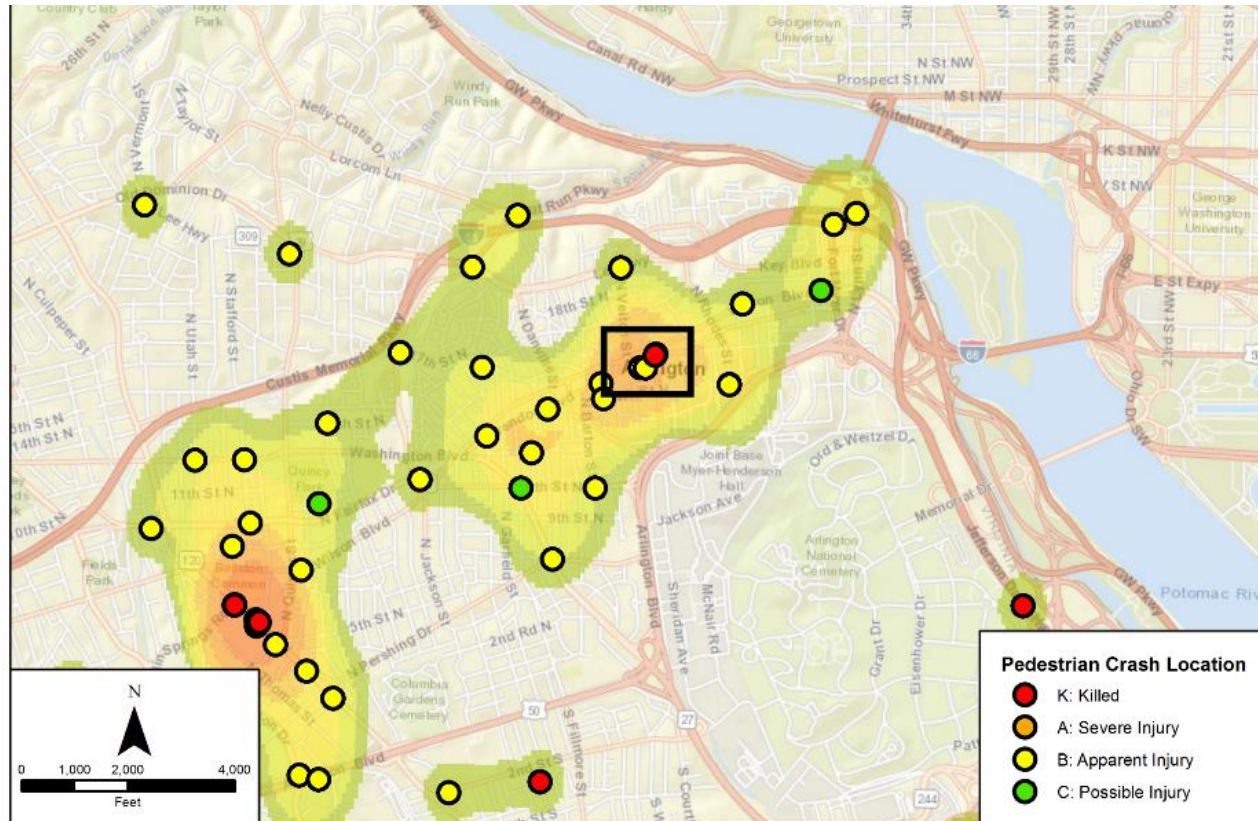
### Priority Pedestrian Corridors

- larger scale
- selected per criteria evaluating risk for crashes

# Example Crash Cluster Map

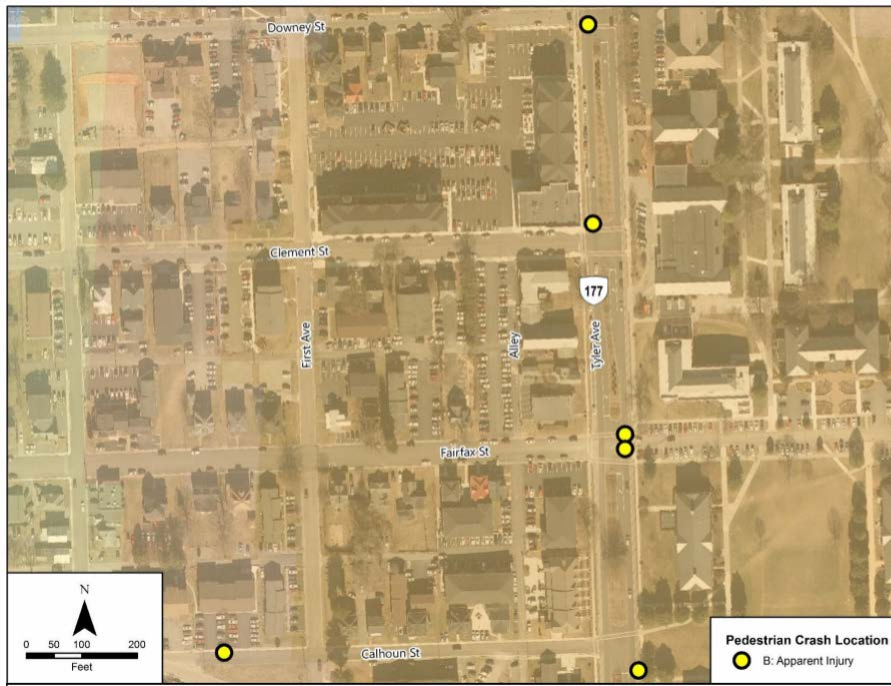


# Example Crash Cluster Site: Arlington





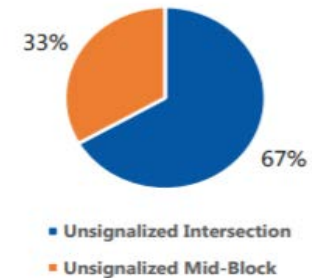
## Radford: Tyler Avenue (SR 177)



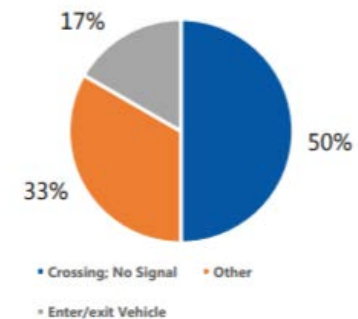
- 5 out of 6 crashes occurred on a two-way, 2-lane median divided roadway.
- All crashes occurred in a 25 mph zone
- 4 out of 6 crashes involved improper or illegal action by the driver.

**Community:** Radford  
**VDOT District:** 2 (Salem)

Crash Location



Pedestrian Action



# Priority Pedestrian Corridors: Criteria Considered

## LAND USE FACTORS

- ✓ Pedestrian destinations (parks, trails, and schools)
- ✓ MPO urban area/land use data layer
- ❑ Bus stops and transit/passenger rail stations

## SPEED FACTORS

- ✓ Posted speed limits
- ❑ Operational speeds

## VISIBILITY FACTORS

- ❑ N/A: Lighting
- ❑ N/A: Pavement markings and crossing

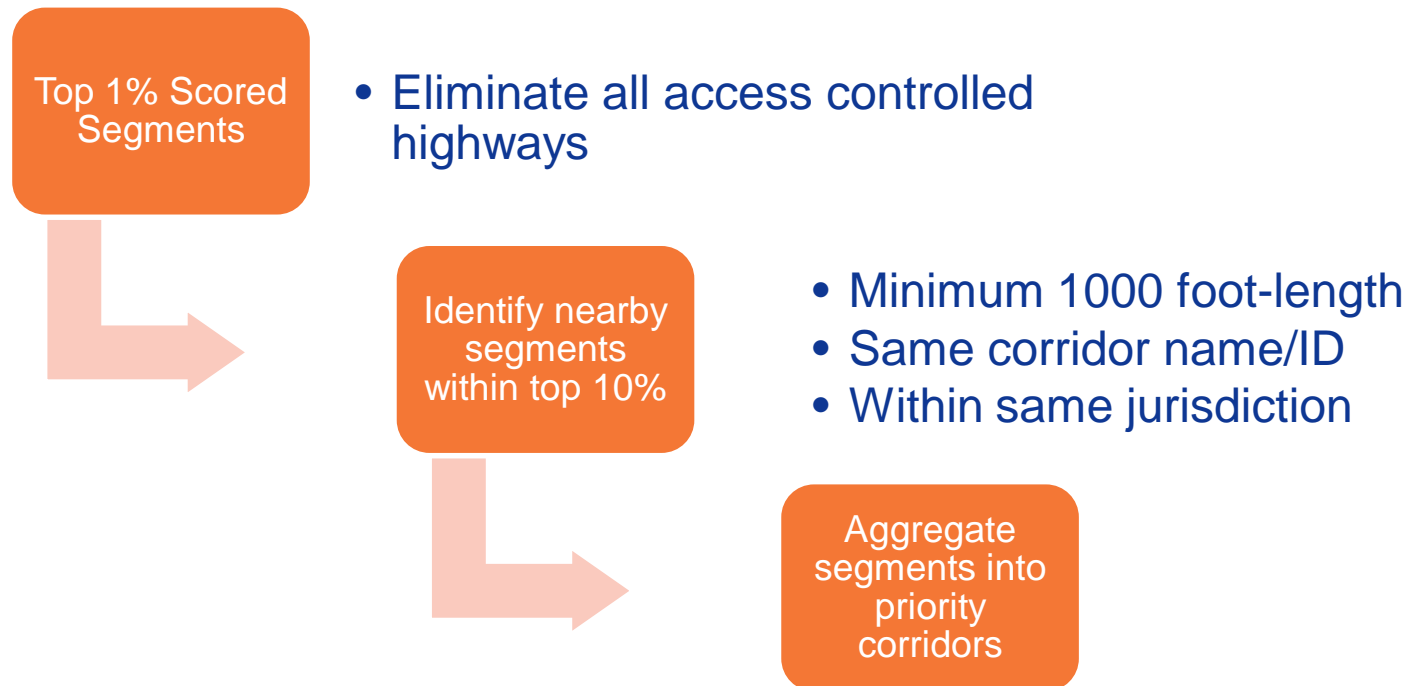
## DESIGN/INFRASTRUCTURE FACTORS

- ❑ Signal density
- ❑ Intersection locations
- ❑ N/A: Sidewalk and path accommodations maintained by VDOT
- ❑ N/A: Crossing distance

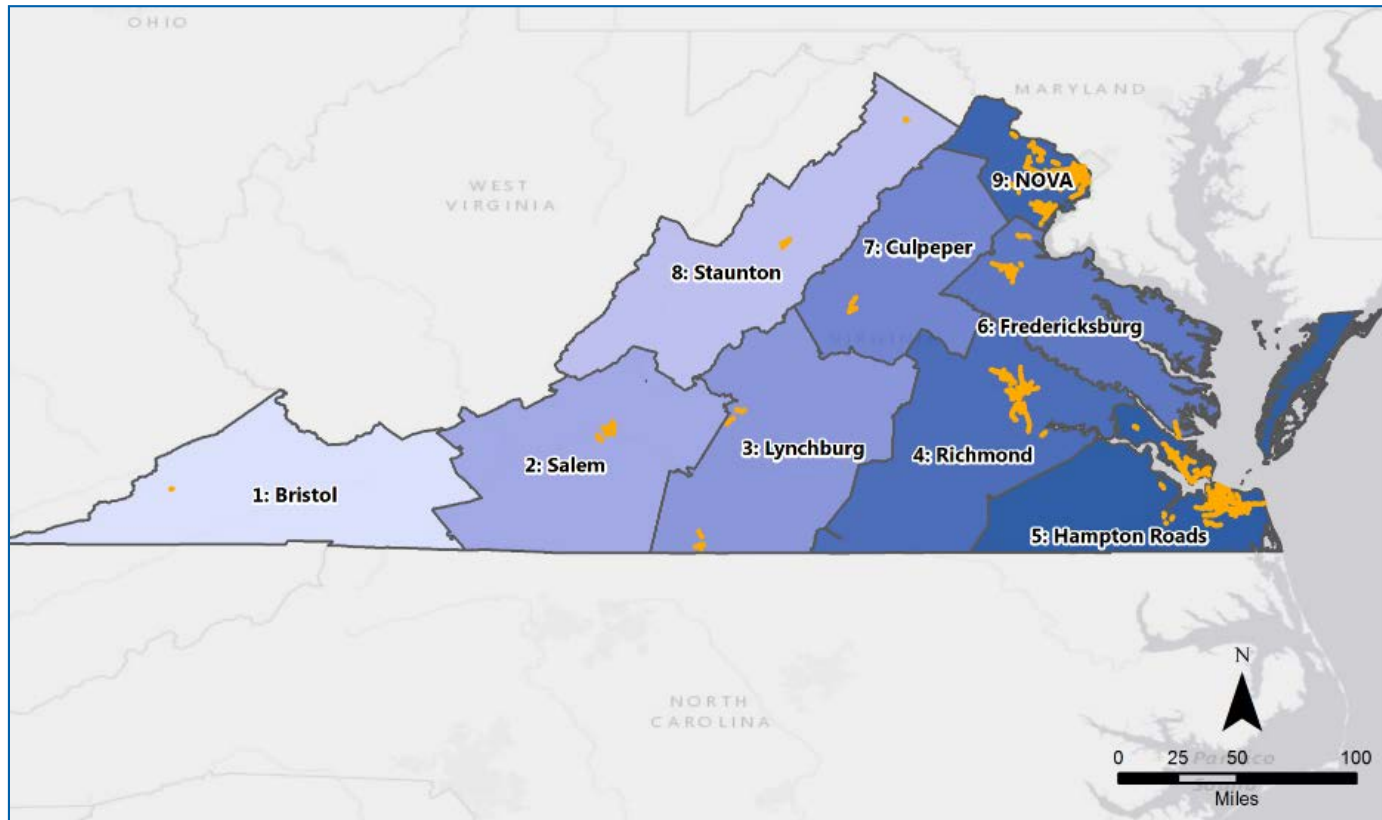
## VOLUME/OTHER FACTORS

- ✓ Pedestrian crash data
- ✓ Vehicle traffic volumes
- ✓ Population and employment density (US Census)
- ✓ Vehicle ownership (US Census)
- ✓ Poverty levels (US Census)
- ✓ Prevalence of impaired (alcohol) citations

# Corridor Selection and Aggregation

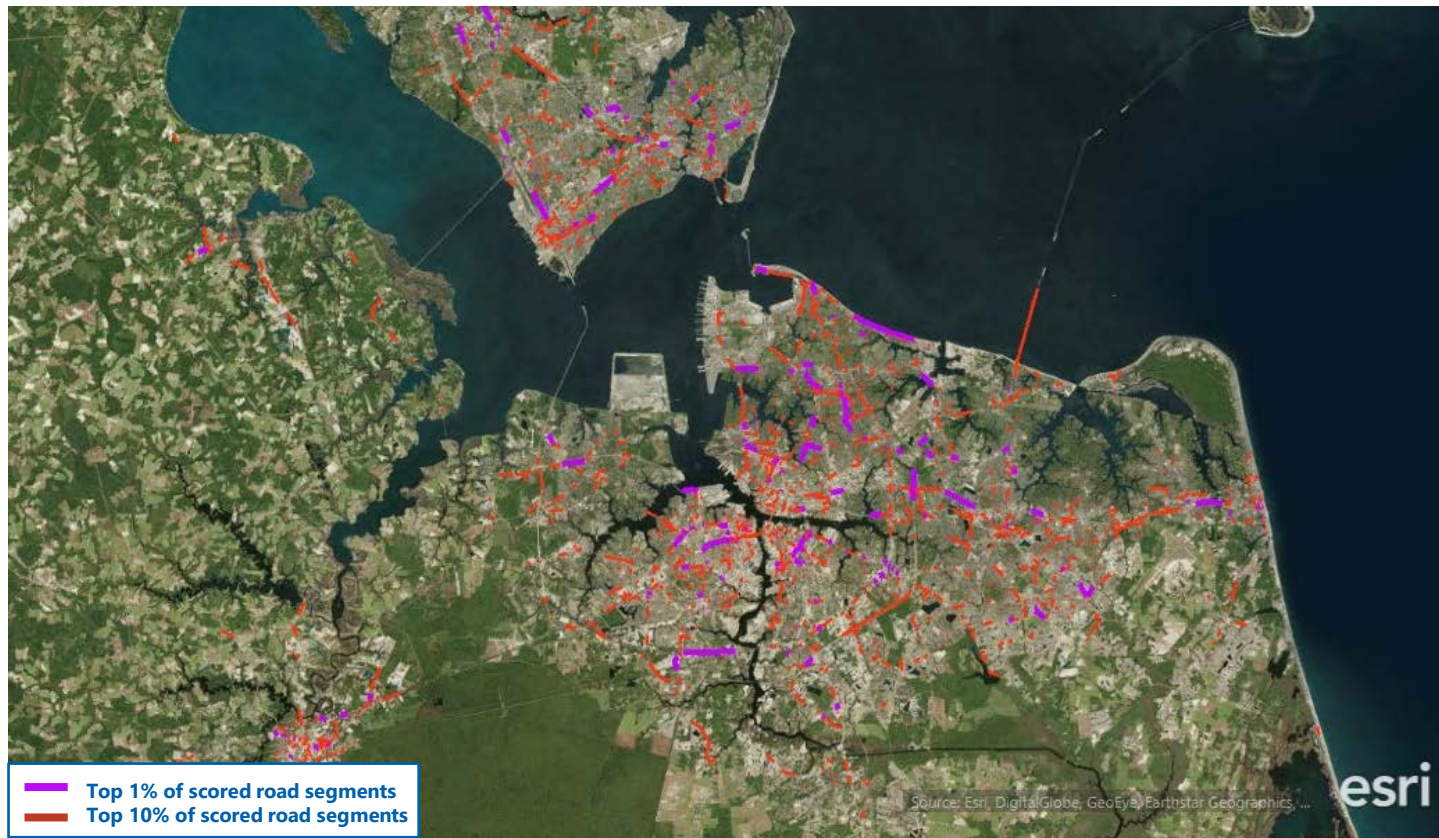


# Priority Corridors Statewide





# Corridor Scoring Example



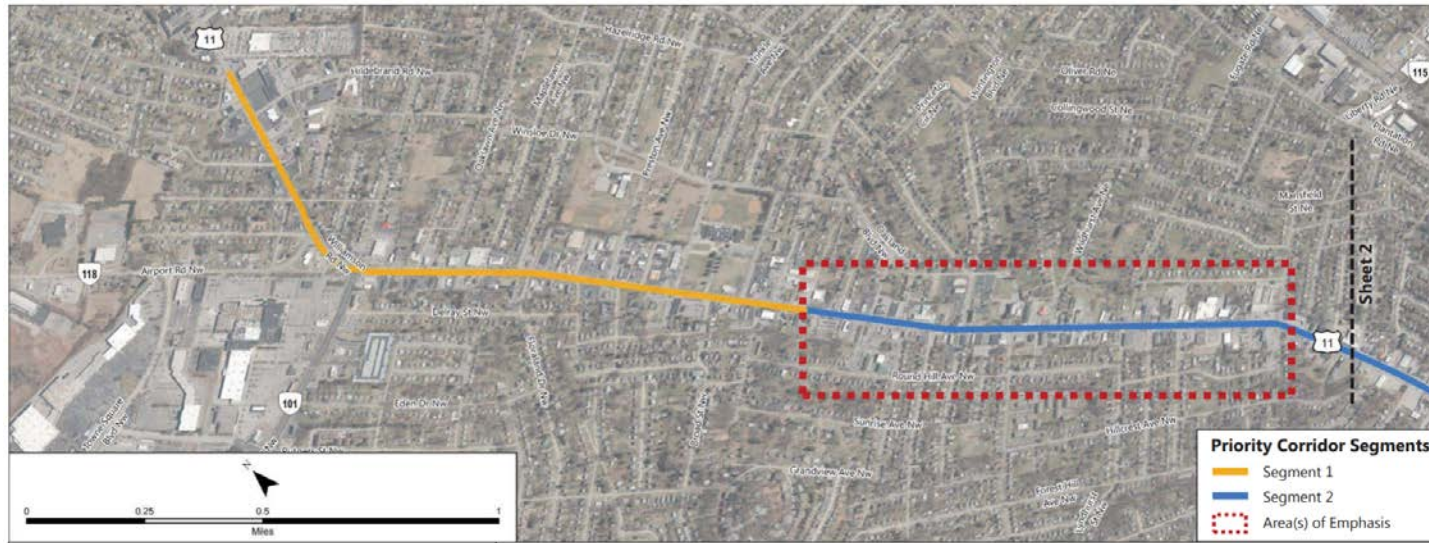
## Priority Corridor Example: Chesapeake Blvd, Norfolk (VA 194)





## Williamson Road (US 11)

**Community:** Roanoke  
**VDOT District:** 2 (Salem)



- 4-lane undivided roadway with moderate density of commercial and institutional land uses. AADT: ~15,000; Speed Limit: 35
- Minimal crosswalk markings between adjacent residential and commercial land uses.

## Step 3: Countermeasure Selection



Princeton, NJ

- **Focus on FHWA Proven Safety Countermeasures**
- **Review other research and guidance: PEDSAFE and NCHRP reports**
- **Existing VDOT policies**



# Countermeasure Selection

- Number of travel lanes
- Speed limit
- ADT (i.e. 10,000-15,000 vpd threshold)
- Presence of median or signalized crossing
- Estimated pedestrian activity (per land use context)
- Presence of existing crosswalk markings
- Crash types & prevalence
  - Time of day: Day versus Night
  - At intersection
  - Driver compliance

# 2018 FHWA Guidance

July 2018 update  
including RRFB

Describes 6-step  
process for  
collecting and  
analyzing data to  
identify  
countermeasure  
options

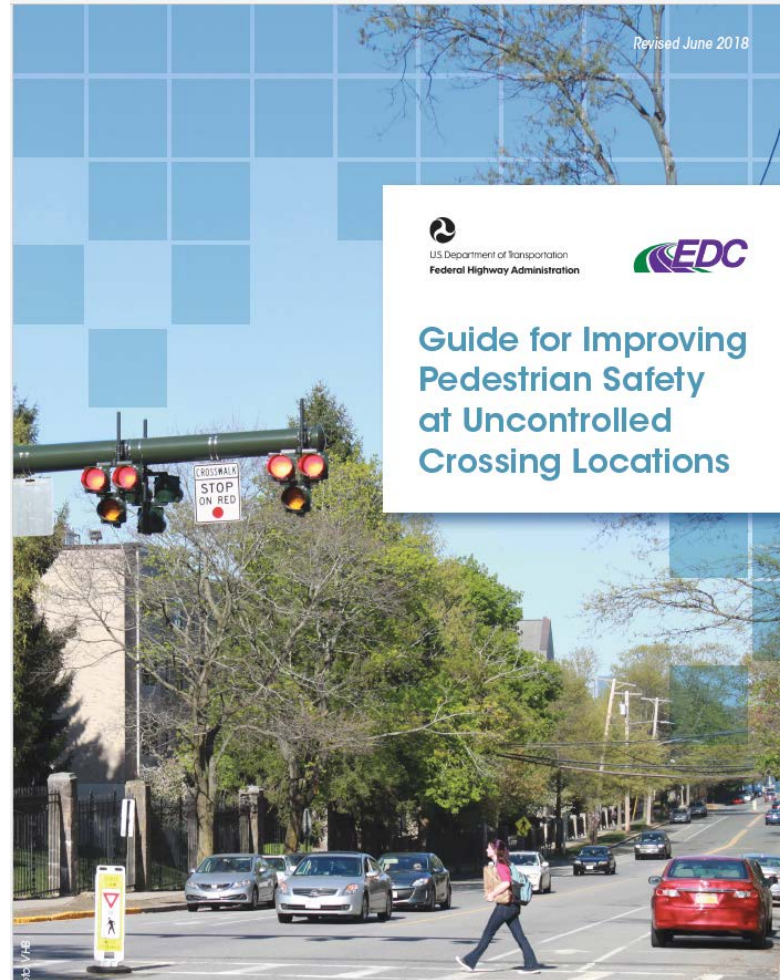















































Table 1. Application of pedestrian crash countermeasures by roadway feature.

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
<b>2 lanes</b> (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
<b>3 lanes with raised median</b> (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
<b>3 lanes w/o raised median</b> (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	① 3 4 5 6 7 9	① ③ 5 6 7 9	① ③ 5 6 9	① ③ 4 5 6 7 9	① ③ 5 6 9	① ③ 5 6 9
<b>4+ lanes with raised median</b> (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
<b>4+ lanes w/o raised median</b> (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
<p>Given the set of conditions in a cell,</p> <ul style="list-style-type: none"> <li># Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.</li> <li>● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.</li> <li>○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*</li> </ul> <p>The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.</p> <ul style="list-style-type: none"> <li>1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs</li> <li>2 Raised crosswalk</li> <li>3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line</li> <li>4 In-Street Pedestrian Crossing sign</li> <li>5 Curb extension</li> <li>6 Pedestrian refuge island</li> <li>7 Rectangular Rapid-Flashing Beacon (RRFB)**</li> <li>8 Road Diet</li> <li>9 Pedestrian Hybrid Beacon (PHB)**</li> </ul>									

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					



## Countermeasures: Signage & Pavement Markings

### Rectangular Rapid Flashing Beacon (RRFB)



A high-frequency blinking pedestrian warning sign used in tandem with a pedestrian cross sign. The beacon can be activated with pushbuttons or automated pedestrian detection.

CRF: 47%

Addresses:  
Visibility  
Crossing  
Awareness

### Pedestrian Hybrid Beacon (PHB)



A beacon to warn and control traffic at unsignalized marked crosswalks. Key design components include: overhead beacons, overhead "CROSSWALK STOP ON RED" signs, a crosswalk, and countdown pedestrian signal heads.

CRF: 18-37%

Addresses:  
Visibility  
Crossing  
Awareness

## Pedestrian Signals

### Pedestrian Countdown Signal



A pedestrian signal head that begins a visible and possibly audible countdown at the beginning of the walk phase or clearance (i.e., DON'T WALK) interval to ensure safe crossing.

CRF: 55-70%

Addresses:  
Crossing  
Time

### Leading Pedestrian Intervals



A signal timing improvement where pedestrians are given an advance walk signal before motorists get a green signal. Makes pedestrians more visible to motorists and improve yielding

CRF:  
Unknown

Addresses:  
Visibility  
Yielding

# Next Steps for VDOT and Local Agencies

## View PSAP Report and Online Map

- [ArcGIS Online map showing crash clusters and priority corridors](#)
- Corridor and crash cluster “cut sheet” maps linked

## Coordinate review with VDOT staff / local agency

- Review local plans, crash reports, and site conditions
- Discuss refined countermeasures

## Develop and submit HSIP and/or SMART SCALE projects

- Project nominations due November 1, 2018
- \$8 Million in HSIP funding for PSAP Phase 1 Projects

**VDOT is also moving policy recommendations forward**

# Thanks!

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# FHWA Technical Assistance

STEP Workshops

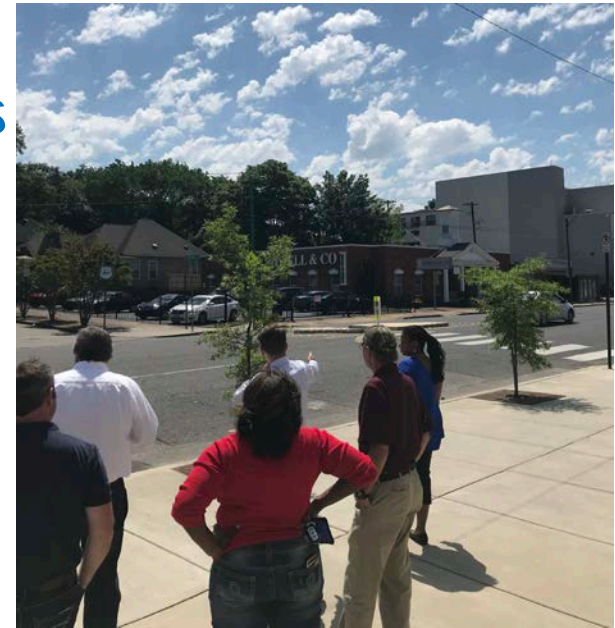
Road Safety Audits/Assessments

Scan Tours

Peer Exchange

Conference Presentations

STEP Action Plans



*Arkansas – Tennessee Scan Tour*  
Source: FHWA

[CAI Home](#)[Every Day Counts](#)[STIC Network](#)[AID Demonstration](#)[Resources](#)

State-Based Innovation Deployment -  
The STIC Network is about establishing a group of representatives from various levels of the highway community in each State to comprehensively and strategically consider all sources of innovation.

[Read more >>](#)



## STIC Incentive Program

Offers technical assistance and funds—up to \$100,000 per STIC per year—to support the costs of standardizing innovative practices in a state transportation agency or other public sector STIC stakeholder.

[Click here for a list of Projects Awarded »](#)

## The Power of the STIC (videos)

## STIC Network

[Get involved](#) with your STIC or [contact a member](#) within your state.

### State Innovation Accomplishments



# EDC-5 Funding Opportunities:

## ❑ ***State Transportation Innovation Council (STIC) Incentive***

- ✓ Up to \$100,000 per STIC per year to standardize an innovation
- ✓ <https://www.fhwa.dot.gov/innovation/stic/>

## ❑ ***Accelerated Innovation Deployment (AID) Demonstration***

- ✓ Up to \$1 million available per year to deploy an innovation not routinely used
- ✓ <https://www.fhwa.dot.gov/innovation/grants/>

# Innovation Deployment News



Weekly newsletter



Bi-monthly magazine

To Subscribe:

Email: <https://www.fhwa.dot.gov/innovation/>

Text: Send "FHWA Innovation" to 468311





# Questions

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A large number of various shoes, including sneakers, dress shoes, flip-flops, and high heels, are scattered across a paved surface. The shoes are of many different colors and styles, creating a dense field of footwear. The text is overlaid on the top half of the image.

During these 90 minutes... we've  
lost another pedestrian and life