



# Connecticut Bicycle and Pedestrian Advisory Board

*Volunteer board members advising agencies of the state on policies, programs, and facilities for bicycles and pedestrians.*

2800 Berlin Turnpike • Newington, CT 06111-4113  
[ctbikepedboard@gmail.com](mailto:ctbikepedboard@gmail.com)



## REGULAR MEETING NOTES Friday November 17, 2023 9 AM Microsoft Teams meeting Join on your computer or mobile app

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**Or call in (audio only)**

[+1 860-840-2075,,852154497#](tel:+18608402075852154497) United States, Hartford

Phone Conference ID: 852 154 497#

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### 1 Call to Order/Roll Call

Sandy Fry (Chair), Brian Kent (Vice Chair), Joe Balskus (Secretary), Rod Parlee, Al Sylvestre, Neil Pade, Sue Smith, Thomas Branchaud

Pat Padlo, OSTA	Christopher Roberts, CTDOT
Charles Harlow, F&O	Bruce Wittchen, OPM
Bob Dickinson, Bloomfield	Jason Hughes, T2 Center
Dimitri Kotoumbas, OSTA	Aaron Budris, NVCOG
Amy Watkins, WalkForMeCT	Grace Yi, City of Hartford
Norm Berg	Craig Babowicz, CTDOT
Lon Hultgren, Mansfield	Graham Curtis, CTDOT
Kate Rattan, SCCOG	
Natasha Fatu, CTDOT	
??, Bike Stonington	
Doug Hausladen, NHPA	
Caitlin Palmer, CRCOG	
Stuart Popper, Cromwell	
Kevin Tedesco, CTDOT	
Anna Bergeron, CTDOT	
Alicia Leite, CTDOT	
Jacob Knowlton, CRCOG	
Bill Champagne, CTDOT	
Erica Lindeberg, Jacobs	
Martha Conneely, Riverfront Recapture	
Delia Fey, NECCOG	

### 1.1 Minutes, **October 27** meeting Accepted by Board.

### 2.0 Reports/Presentations **Natasha Fatu**, CT DOT, Traffic Safety Engineering, Highway Safety Improvement Plan (HSIP) FFY24 Implementation Plan

#### NOTE TO PERSONS WITH SPECIAL NEEDS:

Anyone who requires an auxiliary aid or service for effective communication or other accommodation at a meeting must notify the Connecticut Department of Transportation in advance of the meeting as soon as they are able.



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Presentation was given on the Federal Fiscal Year 2024 Implementation Plan for the Highway Safety Improvement Program. (see attached presentation.) DOT has completed clearance interval retiming on state signals. Municipal signals will be addressed in the future. Pedestrian heads have been added at signalized intersections, and design and installation work is proceeding for RRFBs at midblock crossings. A roundabout study, an illumination study (for crosswalks), a raised crosswalk study, and a right turn on red study are either underway or will be soon. A pedestrian crash hot spot study will be undertaken, and will look at all vulnerable user crashes. The studies will take 1 to 1.5 years and then projects will be initiated afterwards. It was asked if any bumpouts were provided as part of the clearance interval work – no, since that work focused strictly on signal timing. It was asked if there has been any study of the contrast on ped signals – these can be difficult to see for those with low vision. Answer – will look for studies, and accessible pedestrian signals (with audible component) address this.

### **Presentation/Discussion of Complete Streets Controlling Design Criteria and Justification Process: Policy Statement and Directive MOVED TO DECEMBER MEETING**

#### **Other DOT reports**

CCGP awarded 17 grants totaling \$11 million. There were 49 applications. Maximum grant amount is \$800,000.

### 3.0 Old Business

3.1 Annual Report – subcommittee report

3.2 Follow up – Bolton Trail  
CRCOG to follow up

3.2 Getting word out on CTBPAB – anything scheduled, cooking?  
COG quarterly meetings to be scheduled

Route 146 project – public information meeting held, information to be provided on project public survey and meeting link

### 4.0 New Business

4.1 Calendar for next year (attached)  
Accepted for 2024.

Possible locations for in person meetings

- Putnam Bridge trail opening, with in person at VHB office

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- Riverfront Boathouse, Hartford
- Other ideas welcome

4.2 relook at our legislative purpose: “The duties of the board shall include, but not be limited to, examining the need for bicycle and pedestrian transportation, promoting programs and facilities for bicycles and pedestrians in this state, and advising appropriate agencies of the state on policies, programs, and facilities for bicycles and pedestrians.”

Assessing the need is beyond the scope of the 10 member board

### 5.0 Input

5.1 Input from COG's and Vision Zero Updates.  
No updates

5.2 Input from Visitors (5 minutes)  
No updates.

5.3 CT Greenways Council/ECGA  
No report.

5.4 BikeWalk CT  
No report.

5.5 Watch for Me CT  
World Day of Remembrance, 11/18/23, Bushnell Park

5.6 Transport Hartford  
No report.

5.7 CT Trails Program  
No report.

5.8 CT Public Transportation Council

5.9 CT DEEP Trails and Greenways

Next Meeting – **December 15, 2023, 9 AM**  
VIA TEAMS

#### **NOTE TO PERSONS WITH SPECIAL NEEDS:**

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## 2024 MEETING SCHEDULE

Meetings are generally the 4<sup>th</sup> Friday, unless otherwise noted  
MEETINGS WILL BEGIN AT 9 AM

January 26, 2024

February 23, 2024

March 22, 2024

April 26, 2024

May 24, 2024

June 28, 2024

July 26, 2024

August 23, 2024

September 27, 2024

October 25, 2024

November 22, 2024

December 20, 2024 (not the 4<sup>th</sup> Friday)

# Turning Crashes Into Projects - How CTDOT deploys Safety Countermeasures

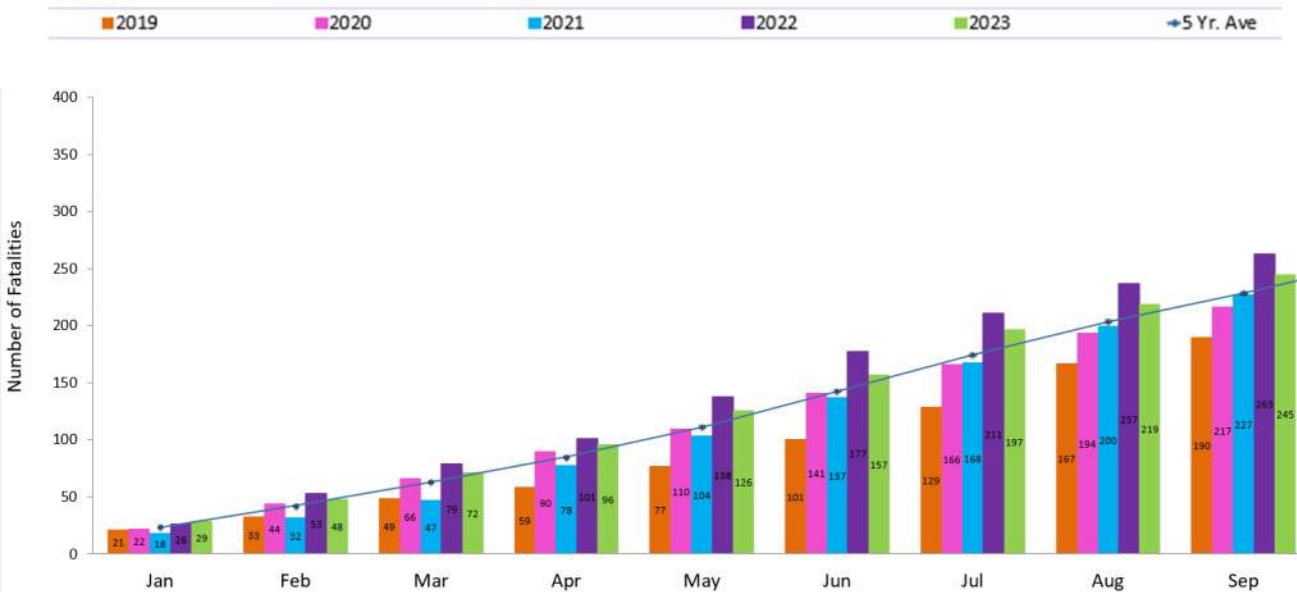
Traffic Safety Engineering



# Connecticut Crash Trends

## Number of Fatalities (Cumulative Totals By Month)

Number of Fatalities (Cumulative Totals By Month)



\* 2020 and later data are preliminary and from CTDOT sources; data from prior years are from NHTSA FARS final files

## Connecticut Traffic Deaths

Year to Date as of November 14<sup>th</sup>

<b>2023</b> 283	<b>2022</b> 315	<b>2021</b> 268	<b>2020</b> 253
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Preliminary Year-End

<b>2022</b> 366	<b>2021</b> 302	<b>2020</b> 299
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# Commitment to Safety

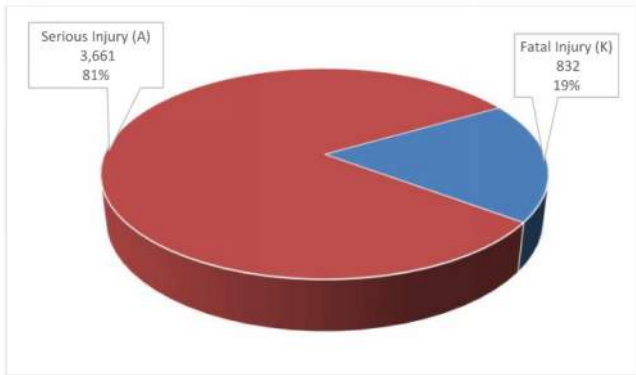
- Strategic Highway Safety Plan
  - Highway Safety Improvement Program – Implementation Plan
  - Vulnerable Road User Assessment
- Review of 2020 to 2022 Fatal and Serious injury crash data on **ALL** public roadways in CT.
  - Decisions must be data-driven.
  - Strategies must be consistent with the SHSP.
  - Internal and external stakeholders.
  - CTDOT has obligated all HSIP funding to HSIP eligible projects for several years.



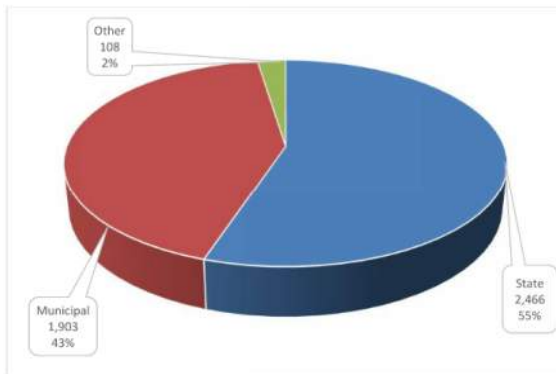
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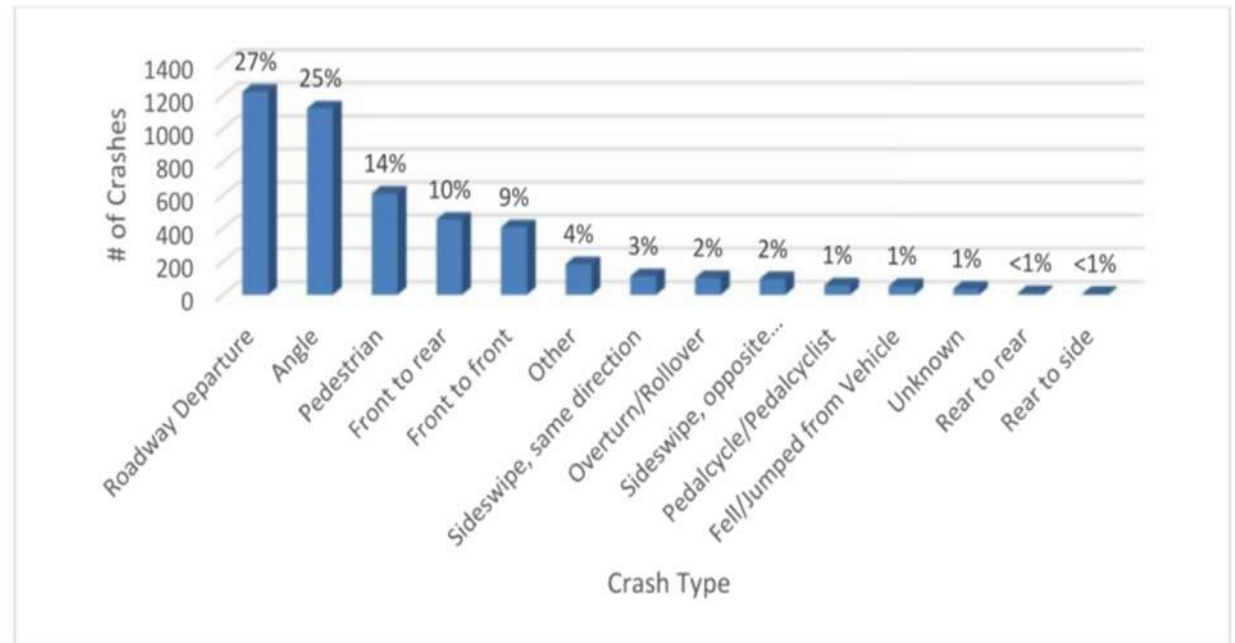
# Crash Graphs



2020-2022 Crash Distribution of K&A



2020-2022 Crash Distribution by Road Ownership



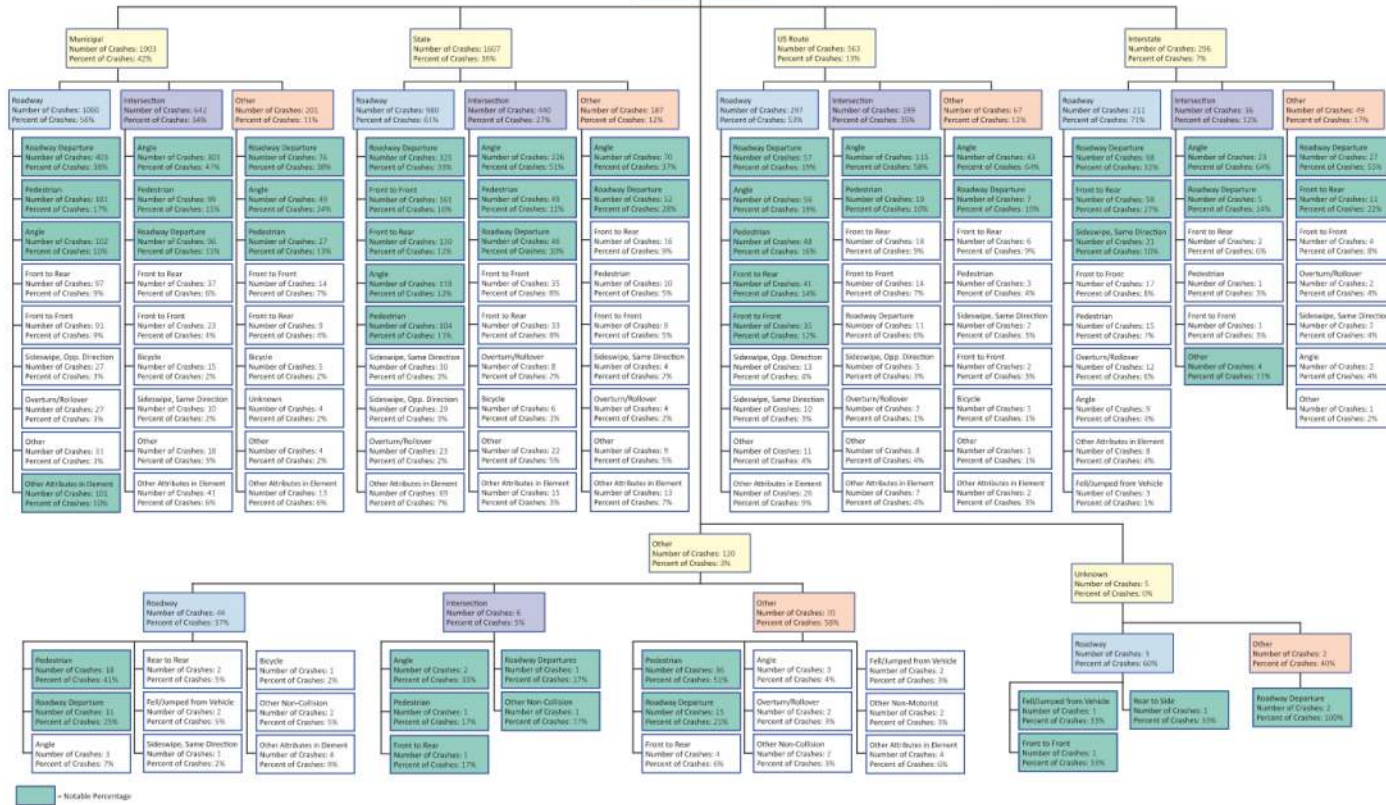
2020-2022 Distribution of fatal and serious injury crashes based on crash type



# Crash Tree

## Connecticut Fatal and Serious Injury Crash Tree State and Municipal Roads

Location: Connecticut  
Date Range: 2020 to 2022  
Number of Crashes: 4494



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# Roadway Departure Projects

## Centerline Rumble Strips (CLRS)

- Target – Distracted Drivers
- Deploying on eligible roadways, both State and Municipal
- Produces noise and vibrations when departing from lane into oncoming traffic
- Up to 44%/64% reduction in fatal/injury crashes on 2-lane roads



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### Longitudinal Rumble Strips and Stripes

**Longitudinal rumble strips** are milled or raised elements on the pavement intended to alert drivers through vibration and sound that their vehicle has left the travel lane. They can be installed on the shoulder, edge line, or at or near the center line of an undivided roadway.

**Rumble strips** are edge line or center line rumble strips where the pavement marking is placed over the rumble strip. This can increase the visibility and durability of the pavement marking during wet, nighttime conditions, and can improve the durability of the marking on roads with snowplowing operations.

**Safety Benefits:**

**Center Line Rumble Strips**  
**44-64%**  
reduction in head-on fatal and injury crashes on two-lane rural roads.<sup>1</sup>

**Shoulder Rumble Strips**  
**13-51%**  
reduction in single vehicle, run-off-road fatal and injury crashes on two-lane rural roads.<sup>4</sup>

With roadway departure crashes accounting for more than half of the fatal roadway crashes annually in the United States, rumble strips and stripes are designed to address these crashes by alerting distracted, drowsy, or otherwise inattentive drivers who drift from their lane. They are most effective when deployed systemically. Transportation agencies should consider milled center line rumble strips (including in passing zone areas) and milled edge line or shoulder rumble strips with bicycle gaps for systemic safety projects, location-specific corridor safety improvements, as well as reconstruction or resurfacing projects.

**Considerations**

- Rumble strips are relatively low-cost, and economic analyses have indicated benefit/cost ratios that exceed 100.<sup>1</sup>
- Where rumble strips cannot be placed due to noise concerns, agencies may consider a design using an oscillating sine wave pattern (also known as "rumble strips") that reduces noise outside of the vehicle. However, the safety benefits of this design need more study.<sup>2</sup>

**Maintenance concerns:**

- Where rumble strips are placed along a pavement joint, there are typically no issues with joint stability if the pavement structure and joint was already in good condition.
- Studies have shown no evidence of issues related to snow, ice, or rain build-up in the rumble strip.<sup>3</sup>

Shoulder rumble strips and center line rumble stripes are installed on this roadway. Source: FHWA

Example of an edge line rumble strip. Source: Missouri DOT

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and <https://highways.dot.gov/safety/two/keep-vehicles-on-road/rumble-strips>.

FHWA-SA-21-035

1. Hines, J., and McGee, H. Decision Support Guide for the Installation of Shoulder and Center Line Rumble Strips on Two-Lane Roads. Federal Highway Administration Report No. FHWA-SA-16-115. (August 2016).  
2. Beckler et al. Did You Hear That? Public Roads Magazine, Volume 80, No. 4. FHWA Publication No. FHWA-HQ-17-022. (2017).  
3. NCHRP Synthesis 339. Centerline Rumble Strips - A Synthesis of Highway Practices, 2005.  
4. ICMF. FHWA 3328. 2005. 2005. NCHRP Report 641. Guidance for the Design and Application of Shoulder and Centerline Rumble Strips. (2005).

**ZERO ROAD DEATHS**



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# Roadway Departure Projects

## High Friction Surface Treatment (HFST)

- Target – Speeding Drivers
- Application of aggregate to enhance pavement friction
- Up to 48% reduction of injury crashes along horizontal curves





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**Pavement Friction Management**

Friction is a critical characteristic of a pavement that affects how vehicles interact with the roadway, including the frequency of crashes. Measuring, monitoring, and maintaining pavement friction—especially at locations where vehicles are frequently turning, slowing, and stopping—can prevent many roadway departure, intersection, and pedestrian-related crashes. Pavement friction treatments, such as High Friction Surface Treatment (HFST), can be better targeted and result in more efficient and effective installations when using continuous pavement friction data along with crash and roadway data.

**Safety Benefits:**  
HFST can reduce crashes up to:

**63%**  
for injury crashes at ramps.<sup>2</sup>

**48%**  
for injury crashes at horizontal curves.<sup>2</sup>

**20%**  
for total crashes at intersections.<sup>3</sup>

**Continuous Pavement Friction Measurement**

Friction data for safety performance is best measured with Continuous Pavement Friction Measurement (CPFM) equipment. Spot friction measurement devices, like locked-wheel skid trailers, cannot safely and accurately collect friction data in curves or intersections, where the pavement polishes more quickly and adequate friction is so much more critical. Without CPFM equipment, agencies will assume the same friction over a mile or more. CPFM technology measures friction continuously at highway speeds and provides both network and segment level data. Practitioners can analyze the friction, crash, and roadway data to better understand and predict where friction-related crashes will occur to better target locations and more effectively install treatments.<sup>1</sup>

**Applications**

HFST should be applied in locations with increased friction demand, including:

- Horizontal curves.
- Interchange ramps.
- Intersection approaches.
  - o Higher-speed signalized and stop-controlled intersections.
  - o Steep downward grades.
- Locations with a history of rear-end, failure to yield, wet-weather, or red-light-running crashes.
- Crosswalk approaches.

**Considerations**

- HFST is applied on existing pavement, so no new pavement is added.
- If the underlying pavement structure is unstable, then the HFST life cycle may be shortened, resulting in pre-mature failure.
- The automated installation method is preferred as it minimizes issues often associated with manual installation: human error due to fatigue, inadequate binder mixing, improper and uneven binder thickness, delayed aggregate placement, and inadequate aggregate coverage.
- The cost can be reduced when bundling installations of multiple locations.

**High Friction Surface Treatment**

HFST consists of a layer of durable, anti-abrasion, and polish-resistant aggregate over a thermosetting polymer resin binder that locks the aggregate in place to restore or enhance friction and skid resistance. Calcined bauxite is the aggregate shown to yield the best results and should be used with HFST applicators.

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://safety.fhwa.dot.gov/provencountermeasures/> and [https://safety.fhwa.dot.gov/roadway\\_dept/pavement\\_friction/high\\_friction/](https://safety.fhwa.dot.gov/roadway_dept/pavement_friction/high_friction/).

FHWA-SA-21-052

1 Dept. of Transportation, Office of Safety, Proven Safety Countermeasures, (2014).  
2 Research Report 177, Accident Modification Factors for Traffic Engineering and Environment, (2008).  
3 NCHRP Report 177, Accident Modification Factors for Traffic Engineering and Environment, (2008).





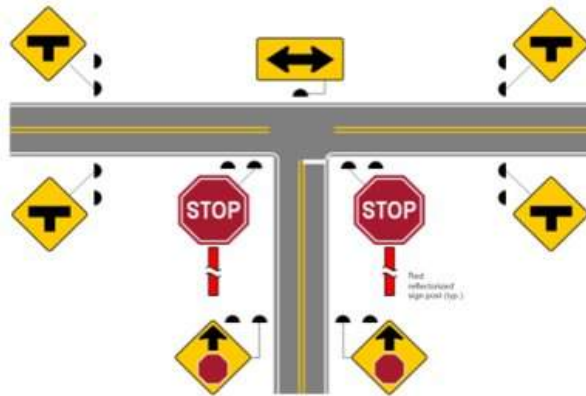
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# Intersection Projects

## Stop Signs at Unsignalized intersections

- Target – Inattentive Drivers
- Enhanced conspicuity, both day and night
- Up to 10% reduction in fatal and injury crashes
- Up to 15% reduction in nighttime crashes
- Up to 27% reduction of fatal and injury crashes at rural intersections.
- Up to 19% reduction of fatal and injury crashes at 2-lane by 2-lane intersections.



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**Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections**

This systemic approach to intersection safety involves deploying a package of multiple low-cost countermeasures, including enhanced signing and pavement markings, at a large number of stop-controlled intersections within a jurisdiction. These countermeasures increase driver awareness and recognition of the intersections and potential conflicts.

**Safety Benefits:**

- 10%** reduction of fatal and injury crashes at all locations/types/areas.
- 15%** reduction of nighttime crashes at all locations/types/areas.
- 27%** reduction of fatal and injury crashes at rural intersections.
- 19%** reduction of fatal and injury crashes at 2-lane by 2-lane intersections.

**Average Benefit-Cost Ratio**  
**12:1**

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and <https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa18047.pdf>.

FHWA-SA-21-031

There are several benefits to systematically applying multiple low-cost countermeasures at stop-controlled intersections, including:

- Resources are maximized because the treatments are low cost.
- A high number of intersections can receive treatment.
- Improvements are highly cost-effective, with an average benefit-cost ratio of 12:1, even assuming a conservative 3-year service life.

The low-cost countermeasures for stop-controlled intersections generally consist of the following treatments:

**On the Through Approach**

- Doubled-up (left and right), oversized advance intersection warning signs, with supplemental street name plaques (can also include flashing beacon).
- Retroreflective sheeting on sign posts.
- Enhanced pavement markings that delineate through lane edge lines.

**On the Stop Approach**

- Doubled-up (left and right), oversized advance "Stop Ahead" intersection warning signs (can also include flashing beacon).
- Doubled-up (left and right), oversized Stop signs.
- Retroreflective sheeting on sign posts.
- Properly placed stop bar.
- Removal of vegetation, parking, or obstructions that limit sight distance.
- Double arrow warning sign at stem of T-intersections.

Example of countermeasures on the through approach.  
Source: South Carolina DOT

Example of countermeasures on the stop approach.  
Source: South Carolina DOT

Source: (CMFED) [2002](#), [2003](#), [2004](#), [2005](#), [2006](#), T. Lu et al. "Safety Effects of Low-Cost Systemic Safety Improvements of Signalized and Stop-Controlled Intersections," 96th Annual Meeting of the Transportation Research Board, Paper Number 17-05076, January 2017.

**ZERO** **DEATHS**  
on the nation's roads



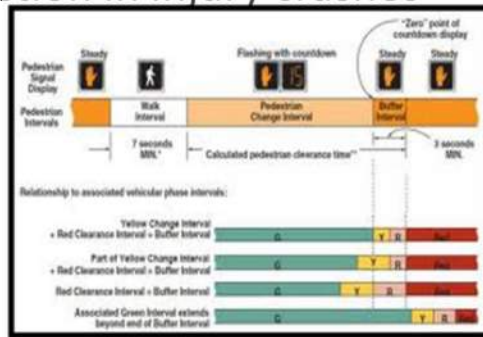
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# Intersection Projects

## Clearance Interval Retiming

- Target – Speeding Drivers
- Project implemented on State Roads
- Currently designing Municipal Road project
- Helps to reduce injury crashes at signals
- Up to 36%-50% reduction in red light running
- Up to 12% reduction in injury crashes



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### Yellow Change Intervals

At a signalized intersection, the yellow change interval is the length of time that the yellow signal indication is displayed following a green signal indication. The yellow signal confirms to motorists that the green has ended and that a red will soon follow.

Since red-light running is a leading cause of severe crashes at signalized intersections, it is imperative that the yellow change interval be appropriately timed. Too brief an interval may result in drivers being unable to stop safely and cause unintentional red-light running. Too long of an interval may result in drivers treating the yellow as an extension of the green phase and invite intentional red-light running. Factors such as the speed of approaching and turning vehicles, driver perception-reaction time, vehicle deceleration, and intersection geometry should all be considered in the timing calculation. Transportation agencies can improve signalized intersection safety and reduce red-light running by reviewing and updating their traffic signal timing policies and procedures concerning the yellow change interval. Agencies should institute regular evaluation and adjustment protocols for existing traffic signal timing. Refer to the *Manual on Uniform Traffic Control Devices* for basic requirements and further recommendations about yellow change interval timing. As part of strategic signal system modernization and updates, incorporating automated traffic signal performance measures (ATSPMs) is a proven approach to improve on traditional retiming processes. ATSPMs provide continuous performance monitoring capability and the ability to modify timing based on actual performance, without requiring expensive modeling or data collection.<sup>1</sup>

**Safety Benefits:**  
**36-50%** reduction in red light running.<sup>2</sup>  
**8-14%** reduction in total crashes.<sup>2</sup>  
**12%** reduction in injury crashes.<sup>2</sup>

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and <https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwas13027.pdf>.

1 Federal Highway Administration, "Automated Traffic Signal Performance," (2020).  
2 CMV © 200, 2007 (ICADP Report 71), Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections, (2011).

FHWA-SA-21-043

ZERO  
CRASHES



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# Pedestrian Projects

## Pedestrian Facilities at Signalized intersections

- Target – Vulnerable Road Users
- Upgrading Pedestrian Indications
- Up to a 13% Reduction in Pedestrian-Vehicle Intersection Crashes



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### Leading Pedestrian Interval

A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter the crosswalk of an intersection 3-7 seconds before vehicles are given a green indication. Pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn right or left.

**Safety Benefits:**  
**13%**  
reduction in pedestrian-vehicle crashes at intersections.<sup>1</sup>

**LPIs provide the following benefits:**

- Increased visibility of crossing pedestrians.
- Reduced conflicts between pedestrians and vehicles.
- Increased likelihood of motorists yielding to pedestrians.
- Enhanced safety for pedestrians who may be slower to start into the intersection.

FHWA's Handbook for Designing Roadways for the Aging Population recommends the use of the LPI at intersections with high turning vehicle volumes. Transportation agencies should refer to the *Manual on Uniform Traffic Control Devices* for guidance on LPI timing and ensure that pedestrian signals are accessible for all users. Costs for implementing LPIs are very low when only signal timing alteration is required.

An LPI allows a pedestrian to establish a presence in the crosswalk before vehicles are given a green indication. Source: FHWA

LPIs reduce potential conflicts between pedestrians and turning vehicles. Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and <https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa19049.pdf>.

FHWA-SA-21-032

1. (CMF # 222) Doughious, E., D. Corbett, C. Lyon, B. Penzard, K. Lon, P. Chun, J. Hamilton, and K. Sigua. "Safety Evaluation of Protected Left Turn Phasing and Leading Pedestrian Intervals on Pedestrian Safety." Report No. FHWA/UT-18-044. Federal Highway Administration, (October 2018).

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SAFER CARAVANS



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# Pedestrian Projects

## Rectangular Rapid Flashing Beacons (RRFB)

- Target – Vulnerable Road Users
- Project Implemented on State & Municipal Roads
- Phase 2 to design/implement at additional locations
- Enhancing visibility of pedestrians at or in crosswalk
- Increases Vehicle Yield Rates by up to 98%
- Up to 47% reduction in Pedestrian Crashes



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**Safety Benefits:**  
RRFBs can reduce crashes up to:  
**47%**  
for pedestrian crashes.<sup>1</sup>

**RRFBs can increase motorist yielding rates up to:**  
**98%**  
(varies by speed limit, number of lanes, crossing distance, and time of day).<sup>2</sup>

**Applications**  
The RRFB is applicable to many types of pedestrian crossings but is particularly effective at multilane crossings with speed limits less than 40 miles per hour.<sup>2</sup> Research suggests RRFBs can result in motorist yielding rates as high as 98 percent of marked crosswalks, but varies depending on the location, posted speed limit, pedestrian crossing distance, one- versus two-way road, and the number of travel lanes.<sup>1</sup> RRFBs can also accompany school or trail crossing warning signs.

RRFBs are placed on both sides of a crosswalk below the pedestrian crossing sign and above the diagonal downward arrow plaque pointing at the crossing.<sup>1</sup> The flashing pattern can be activated with pushbuttons or passive (e.g., video or infrared) pedestrian detection, and should be unlit when not activated.

**Considerations**  
**Agencies should:<sup>3</sup>**

- Install RRFBs in the median rather than the far-side of the roadway if there is a pedestrian refuge or other type of median.
- Use solar-power panels to eliminate the need for a power source.
- Reserve the use of RRFBs for locations with significant pedestrian safety issues, as over-use of RRFB treatments may diminish their effectiveness.

**Agencies shall not:<sup>4</sup>**

- Use RRFBs without the presence of a pedestrian, school or trail crossing warning sign.
- Use RRFBs for crosswalks across approaches controlled by YIELD signs, STOP signs, traffic control signals, or pedestrian hybrid beacons, except for the approach or egress from a roundabout.

**For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and [https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/techSheet\\_RRFB\\_2018.pdf](https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/techSheet_RRFB_2018.pdf).**

FHWA-SA-21-053

<sup>1</sup> MUTCD Manual Appendix 2E - 2015 Edition of Crosswalks  
<sup>2</sup> Rectangular Rapid Flashing Beacons in Pedestrian Safety Guide and Countermeasure Selection System, FHWA, (2013).  
<sup>3</sup> Robinson et al., "Will You Stop for Me? Roadway Design and Traffic Control Device Influence on Driver Yielding to Pedestrians in a Crosswalk with a Rectangular Rapid Flashing Beacon," Report No. TR-CB-0510, Texas A&M Transportation Institute, (2014).  
<sup>4</sup> ICAP ID: 0000, NCHRP Research Report 841, Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, (2017).

ZERO ROAD DEATHS



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# Pedestrian Projects

## Crosswalk Visibility Enhancements

- Target – Vulnerable Road Users
  - Review of lighting at Midblock Crosswalks
    - Up to 42% Reduction in Pedestrian Crashes
  - High-Visibility Crosswalks
    - Countermeasure institutionalized
    - Up to 40% Reduction in Pedestrian Injury Crashes
  - Advance Yield markings and signs
    - Countermeasure Institutionalized
    - Up to 25% Reduction in Pedestrian Crashes
  - Pedestrian Signage Upgrade
    - Increases conspicuity of crosswalks
    - Ensures crosswalk signage is in a state of good repair
    - Deploying for both State and Municipal Roadways

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### Crosswalk Visibility Enhancements

Poor lighting conditions, obstructions such as parked cars, and horizontal or vertical roadway curvature can reduce visibility at crosswalks, contributing to safety issues. For multilane roadway crossings where vehicle volumes are in excess of 10,000 Average Annual Daily Traffic (AADT), a marked crosswalk alone is typically not sufficient. Under such conditions, more substantial crossing improvements could prevent an increase in pedestrian crash potential.

Three main crosswalk visibility enhancements help make crosswalks and the pedestrians, bicyclists, wheelchair and other mobility device users, and transit users using them more visible to drivers. These include high-visibility crosswalks, lighting, and signing and pavement markings. These enhancements can also assist users in deciding where to cross. Agencies can implement these features as standalone or combination enhancements to indicate the preferred location for users to cross.

**Safety Benefits:**  
High-visibility crosswalks can reduce pedestrian injury crashes up to: **40%**<sup>1</sup>

Intersection lighting can reduce pedestrian crashes up to: **42%**<sup>2</sup>

Advance yield or stop markings and signs can reduce pedestrian crashes up to: **25%**<sup>3</sup>

**High-visibility crosswalks**  
High-visibility crosswalks use patterns (i.e. bar paint, continental ladder) that are visible to both the driver and pedestrian from farther away compared to traditional transverse line crosswalks. They should be considered at all midblock pedestrian crossings and uncontrolled intersections. Agencies should use materials such as inlay or thermoplastic tape, instead of paint or brick, for highly reflective crosswalk markings.

**Improved Lighting**  
The goal of crosswalk lighting should be to illuminate with positive contrast to make it easier for a driver to visually identify the pedestrian. This involves carefully placing the luminaires in forward locations to avoid a silhouette effect of the pedestrian.

**Enhanced Signage and Pavement Markings**  
On multilane roadways, agencies can use "YIELD Here to Pedestrians" or "STOP Here for Pedestrians" signs 20 to 50 feet in advance of a marked crosswalk to indicate where a driver should stop or yield to pedestrians, depending on State law to supplement the signing, agencies can also install a STOP or YIELD bar (commonly referred to as "shark's teeth") pavement markings.

In-street signing, such as "STOP Here for Pedestrians" or "YIELD Here to Pedestrians" may be appropriate on roads with two- or three-lane roads where speed limits are 30 miles per hour or less.

Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and [https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-04/techsheet\\_VisEnhancem2018.pdf](https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-04/techsheet_VisEnhancem2018.pdf).

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2. (NCHRP) 2016 Bink, R. and Alex T. Henderson of Road Safety Measures, Oxford, United Kingdom. (2016).  
3. (NCHRP) 2022 Saeger et al. Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. FHWA. (2017).

FHWA-SA-21-049



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# Upcoming Initiatives

- Roundabout Study
- Illumination Study
- Right Turn on Red Study
- Raised Intersection/Crosswalk Study
- Pedestrian Crash Hot-Spot Study

U.S. Department of Transportation  
Federal Highway Administration

OFFICE OF SAFETY  
Proven Safety Countermeasures

## Roundabouts

The modern roundabout is an intersection with a circular configuration that safely and efficiently moves traffic. Roundabouts feature channelized, curved approaches that reduce vehicle speed, entry yield control that gives right-of-way to circulating traffic, and counterclockwise flow around a central island that minimizes conflict points. The net result of lower speeds and reduced conflicts at roundabouts is an environment where crashes that cause injury or fatality are substantially reduced.

Roundabouts are not only a safer type of intersection; they are also efficient in terms of keeping people moving. Even while calming traffic, they can reduce delay and queuing when compared to other intersection alternatives. Furthermore, the lower vehicular speeds and reduced conflict environment can create a more suitable environment for walking and bicycling.

Roundabouts can be implemented in both urban and rural areas under a wide range of traffic conditions. They can replace signals, two-way stop controls, and all-way stop controls. Roundabouts are an effective option for managing speed and transitioning traffic from high-speed to low-speed environments, such as freeway interchange ramp terminals, and rural intersections along high-speed roads.



Illustration of a multilane roundabout. Source: FHWA



Example of a single-lane roundabout. Source: FHWA

**Safety Benefits:**  
Two-Way Stop-Controlled Intersection to a Roundabout



**82%**  
reduction in fatal and injury crashes.<sup>1</sup>

Signalized Intersection to a Roundabout



**78%**  
reduction in fatal and injury crashes.<sup>1</sup>

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and <https://highways.dot.gov/safety/intersectionsafety/intersection-types/roundabouts>.

FHWA-SA-21-042

<sup>1</sup> CMF ID 211-222 AASHTO, The Highway Safety Manual, American Association of State Highway Transportation Professionals, Washington, D.C., (2016).

ZERO ROAD DEATHS



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# Questions?



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