

# Effective Safety Countermeasures and Project Development

**Matthew Enders, P.E.**, Technical Services Manager

**Ed Spilker**, City Safety and Traffic Programs Manager

**Paul Snow**, Safety Analyst

WSDOT Local Programs Division

December 10, 2025

# Agenda

- Local Road Safety Plans
- Target Zero–Safe System Approach
- Safe System Roadway Design Hierarchy
- Proven Safety Countermeasure
- Countermeasure Effectiveness

# Agenda

- Countermeasures:
  - Intersections
  - Active Transportation Users
  - Speed Management
  - Lane Departure
- Spot Location Project Development Considerations
- Systemic Project Development Considerations
- Open Q&A Session

# 2026 City Safety Program

- **Key Dates:**

- Call for projects opened October 2025
- Applications are due **March 6, 2026**
- Funding to be awarded fall 2026
- 100% funding for all phases authorized prior to 4/30/29

- **Estimated Funds:** \$30 million in federal Highway Safety Improvement Program (HSIP) funds.

- **Call for Projects:**

<https://wsdot.wa.gov/business-wsdot/support-local-programs/funding-programs/highway-safety-improvement-program/highway-safety-improvement-program-call-projects>

# City Safety Program

## Training Series:

**Module 1: Local Road Safety Plans**  
November 12, 2025

**Module 2: Effective Safety Countermeasures and Project Development**  
December 10, 2025 (9:00am to 11:00am)

**Module 3: Application Completeness and Project Delivery Considerations**  
January 14, 2026 (9:00am to 11:00am)

\* Webinar recordings and copies of presentations will be posted on the City Safety Program Call for Projects webpage.

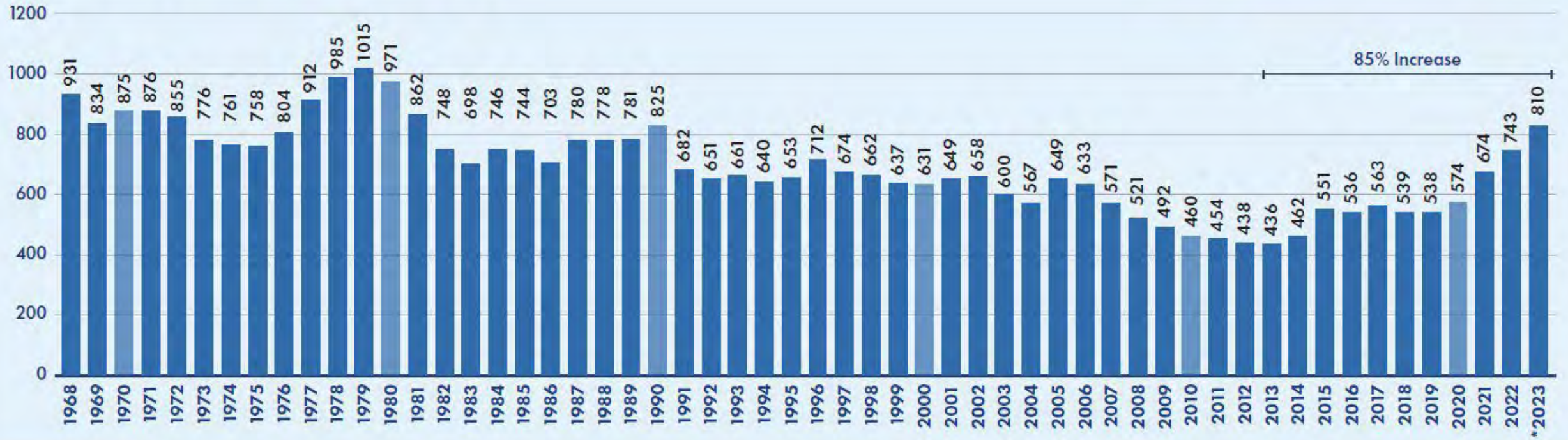
# Mentimeter

- Go to **menti.com** on your device (phone, tablet, computer)
- Enter code 9285 8396
- Then you may answer the first question

# Traffic fatalities and serious injuries are unacceptable.

WASHINGTON STATE FATALITIES, 1968-2023

SOURCE: WTSC HISTORICAL COUNTS, CFC FILES



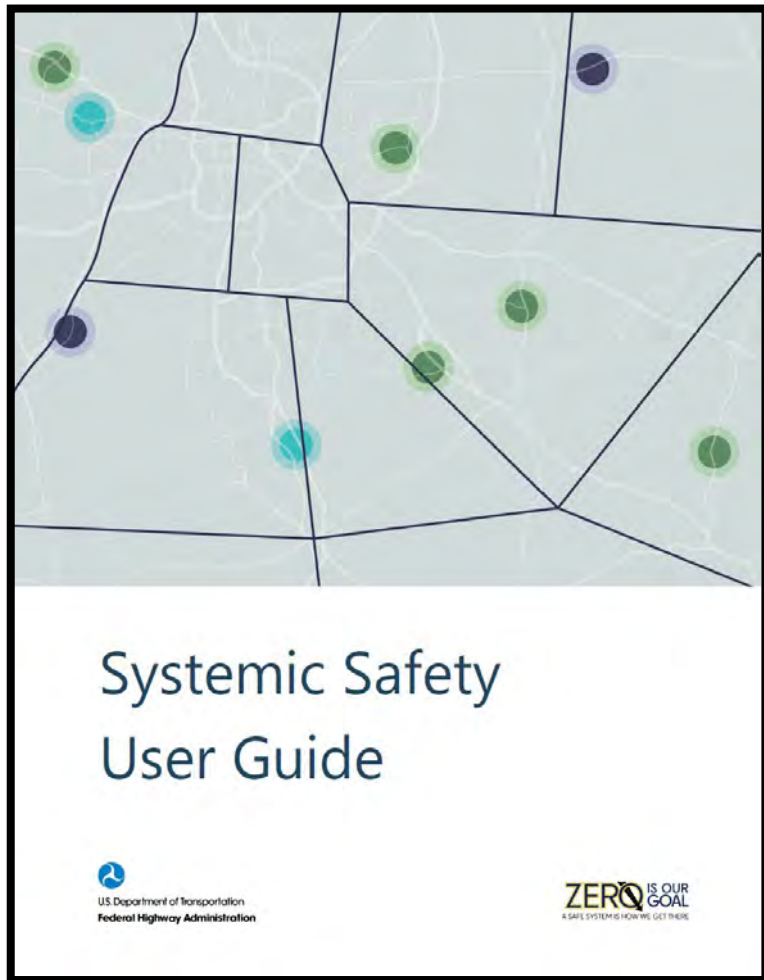
85% Increase

Target Zero

# Local Road Safety Plans

Local Road Safety Plan Step		Plan Element
1	Analyze data to identify focus/priorities	List of crash priorities based on data
2	Analyze individual fatal/serious crashes to identify risk factors	Description of risk factors & selection process
3	Select most common risk factors	
4	Analyze roadway network for presence of risk factors	
5	Create a prioritized list of roadway locations	Prioritized list of roadway locations
6	<b>Identify countermeasures to address prioritized locations</b>	<b>Description of countermeasures &amp; selection process</b>
7	<b>Develop a prioritized list of projects</b>	<b>Prioritized list of projects</b>

# Risk Factors



<https://highways.dot.gov/safety/data-analysis-tools/systemic>



## Typical Risk Factors

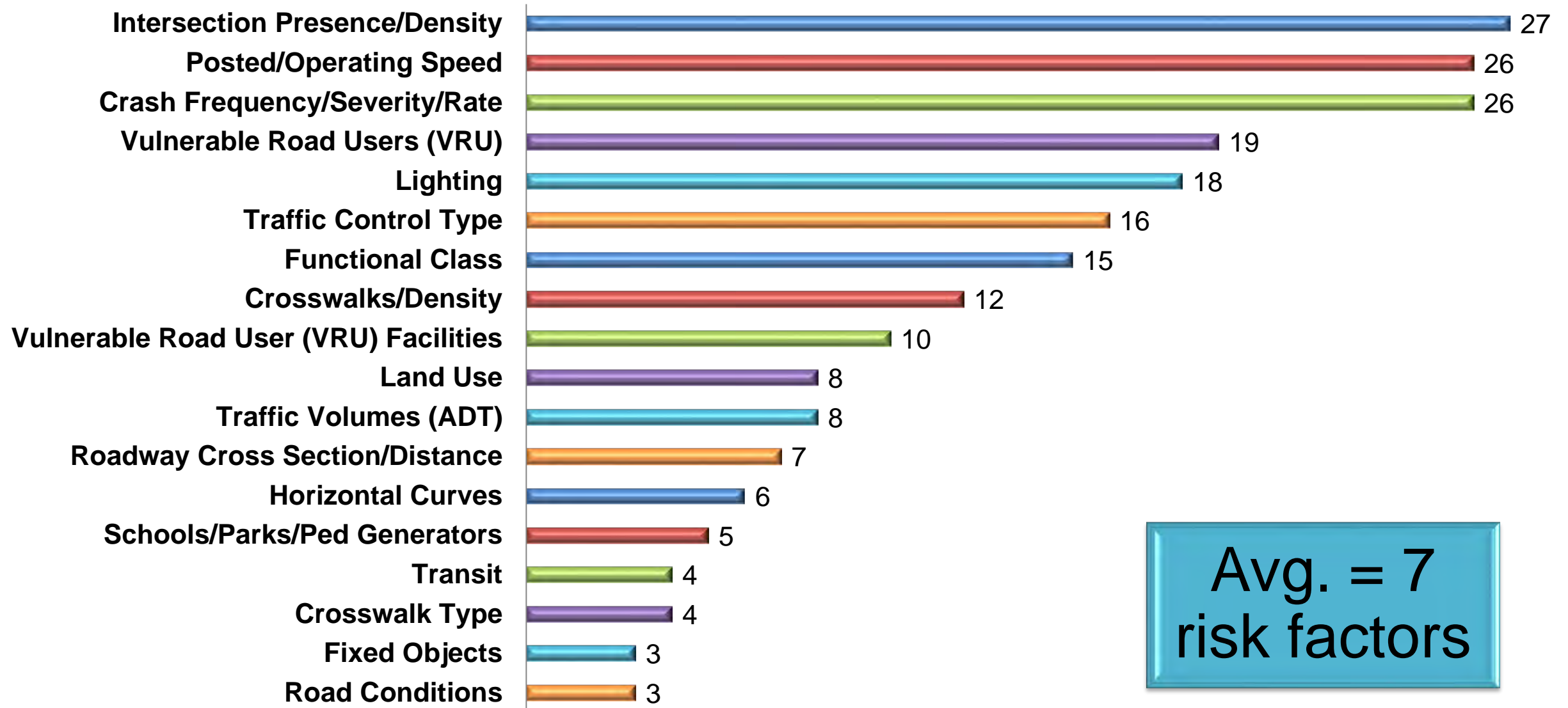
Page 61

Agencies have used an extensive range of risk factors for systemic safety projects, including:

- Aberrant behavior (e.g., seat-belt surveys, distracted driving surveys).
- Access control.
- Area type (urban or rural).
- Bicycle facility type and presence.
- Bicyclist volume.
- Citations.
- Crosswalks.
- Demographic factors.
- Distance to trauma center.
- Edge drop-offs.
- Equity measures.
- Facility type.
- Friction availability or demand.
- Functional class.
- Geographic area.
- Horizontal curve geometry.
- Intersection skew angle.
- Lack of common countermeasures (e.g., lack of pavement markings, curve warning signage, stop bars at intersections).
- Land use.
- Lane or surface width.
- Lighting presence or type.
- Likelihood of associated crash types (e.g., impaired crashes for lane departure crashes, unbelted driving crashes for young driver crashes).
- Median type.
- Median width.
- Number of access points.
- Number of lanes.
- Pedestrian volume.
- Pedestrian facility type and presence.
- Posted speed limit.
- Presence of a visual trap.
- Proximity to interchange.
- Roadway ownership.
- Shoulder type.
- Shoulder width.
- Sidewalk presence.
- Slopes (roadside and median).
- Socioeconomic factors.
- Target crash frequency, severity, density, etc.
- Terrain.
- Traffic volume.
- Transit stops.
- Trip generators.
- Truck traffic.
- Vertical geometry.
- Weather data.



# Risk Factors Used (# Cities in 2024)





201

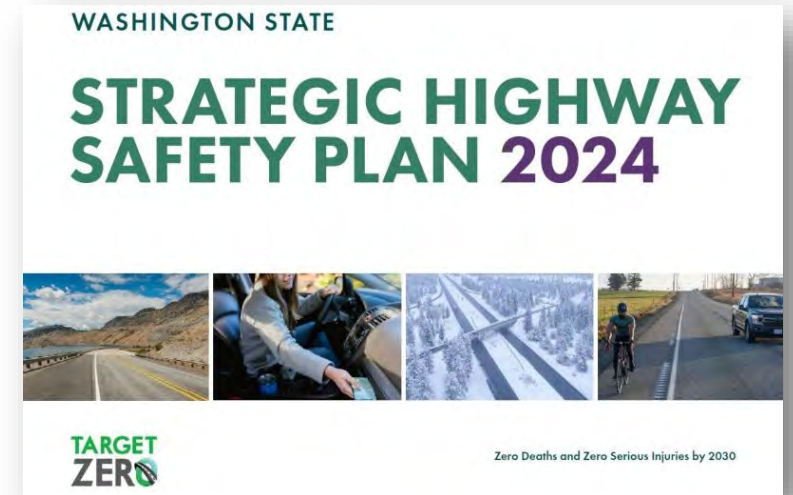
STOP

NEW HOMES  
\$600's

# Target Zero: Safe System Approach

## Core Principles:

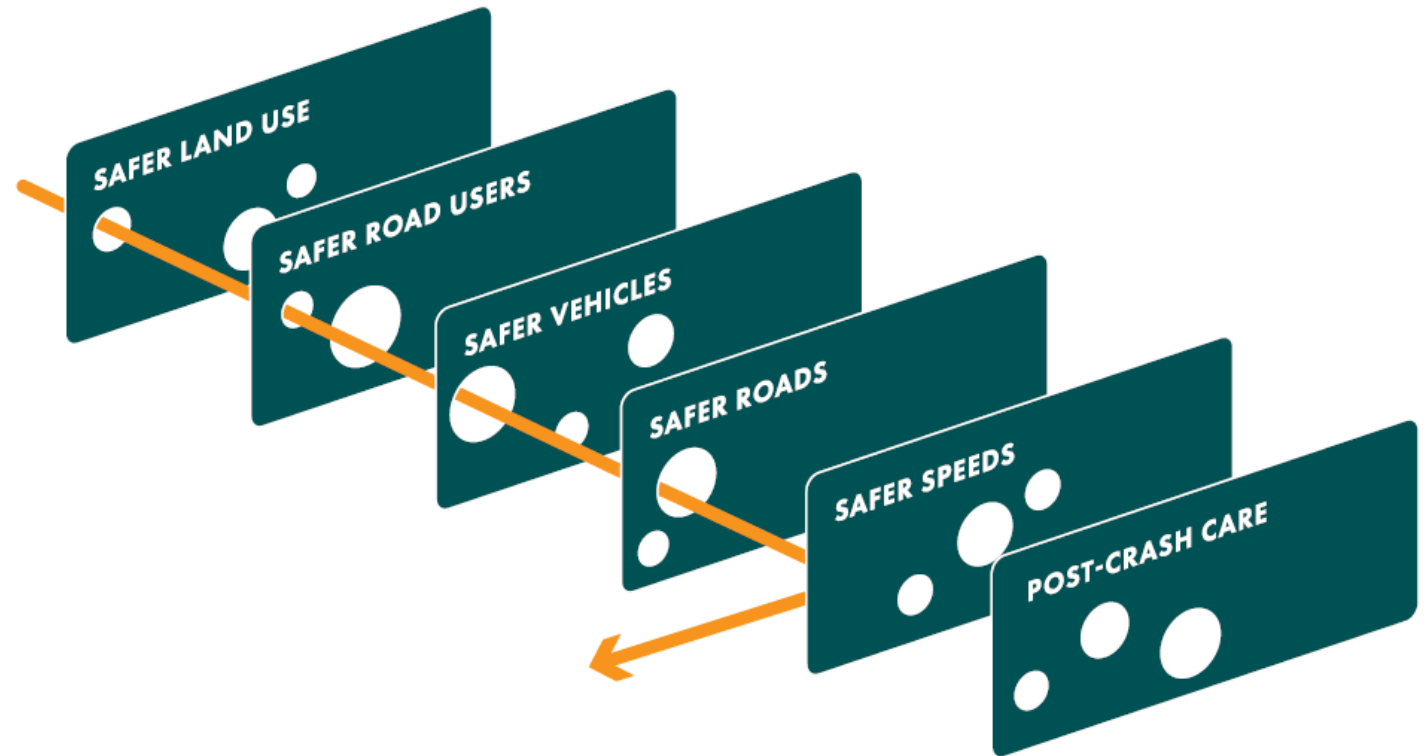
- Death and serious injuries are unacceptable
- Support safe road use
- Reduce large crash forces because humans are vulnerable
- Shared responsibility
- Safety is proactive
- Strengthen all parts of the system to create redundancy



# Target Zero: Safe System Approach

## Core Elements:

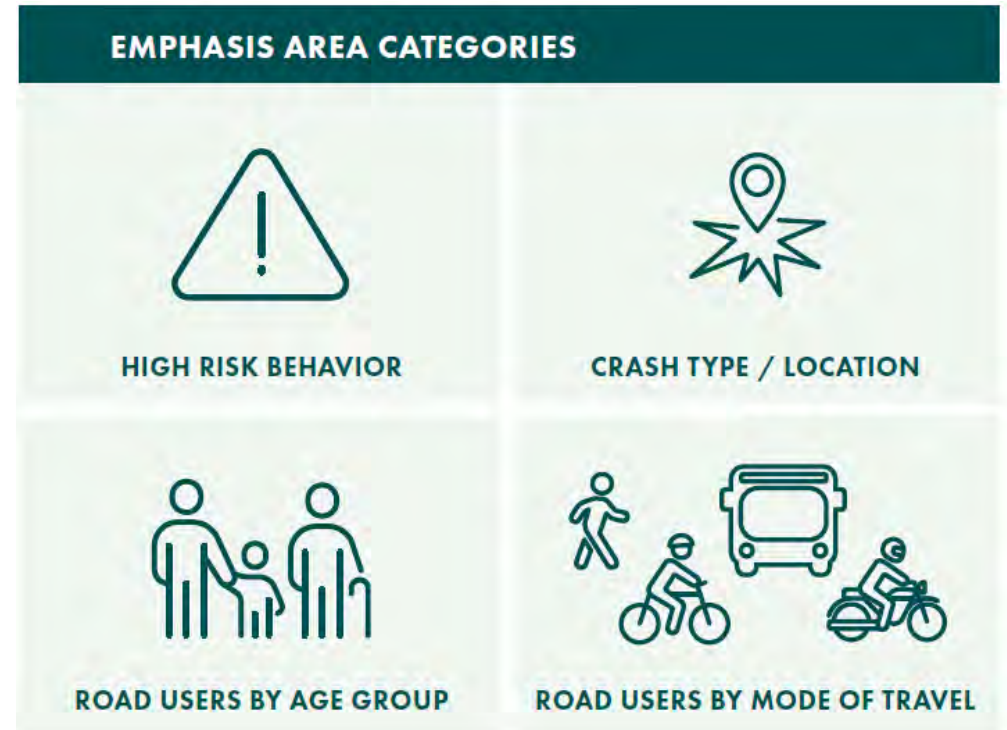
- Safer Land Use
- Safer Road Users
- Safer Vehicles
- Safer Roads
- Safer Speeds
- Post-Crash Care



# Target Zero: Strategies and Countermeasures

## Emphasis Areas:

- Intersections
- Active Transportation Users
- Speed Management
- Lane Departure



*Target Zero*

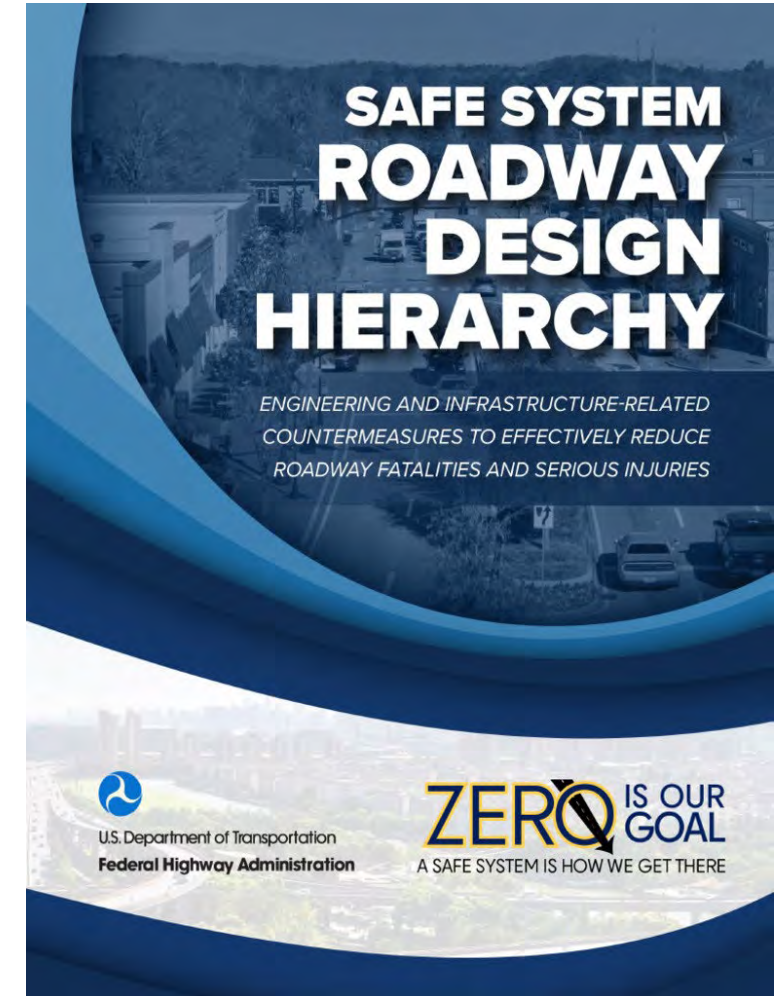
# Safe System Roadway Design Hierarchy

Tier 1 – Remove Severe Conflicts

Tier 2 – Reduce Vehicle Speeds

Tier 3 – Manage Conflicts in Time

Tier 4 – Increase Attentiveness and  
Awareness



# Safe System Roadway Design Hierarchy

## Tier 1 – Remove Severe Conflicts

Removing severe conflicts involves the elimination of specific high-risk conditions. These countermeasures separate road users moving at different speeds or different directions in space to minimize their conflicts with other road users.

### Examples:

- Roundabouts
- Separated Bike Lanes
- Protected Intersections
- Sidewalk
- Median Barrier
- Road Diets



# Safe System Roadway Design Hierarchy

## Tier 2 – Reduce Vehicle Speeds

Implementing design features and speed management strategies to reduce vehicle speeds effectively reduces the kinetic energy involved in a crash should it occur.

### Examples:

- Safe Speed Limits
- Self-Enforcing Roads
- Raised Crosswalks
- Roundabouts
- Speed Safety Cameras
- Variable Speed Limits
- Curb Extensions
- Road Diets



# Safe System Roadway Design Hierarchy

## Tier 3 – Manage Conflicts in Time

When users occupy the same physical space on the roadway a safer environment is created by separating the users in time using traffic control devices, such as traffic signals or hybrid beacons, to minimize conflicts.

### Examples:

- Pedestrian Hybrid Beacons
- Protected Left Turn Phasing
- Pedestrian Scramble
- Emergency Vehicle Preemption
- Leading Pedestrian Intervals
- Coordinated Signal Timing



# Safe System Roadway Design Hierarchy

## Tier 4 – Increase Attentiveness and Awareness

Increasing attentiveness and awareness involves alerting roadway users to certain types of conflicts.

### Examples:

- Enhanced Pavement Markings and Signing
- Rectangular Rapid Flashing Beacons
- Lighting
- High-Viz Crosswalks
- Rumble Strips
- Intersection Bicycle Boxes
- Green Colored Pavement Markings
- Speed Feedback Signs
- Conflict Warning Systems





HARRISON AVE

C.R. England

C.R. England

# FHWA Proven Safety Countermeasures

## Intersections



Backplates with  
Retroreflective  
Borders



Corridor Access  
Management



Dedicated Left- and  
Right-Turn Lanes at  
Intersections



Reduced Left-Turn  
Conflict Intersections



Roundabouts



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



Yellow Change  
Intervals

# FHWA Proven Safety Countermeasures

## Pedestrian/Bicyclist



Bicycle Lanes



Crosswalk Visibility Enhancements



Leading Pedestrian Interval



Medians and Pedestrian Refuge Islands in Urban and Suburban Areas



Pedestrian Hybrid Beacons



Rectangular Rapid Flashing Beacons (RRFB)



Road Diets (Roadway Reconfiguration)



Walkways

# FHWA Proven Safety Countermeasures

## Roadway Departure



Enhanced Delineation  
for Horizontal Curves



Longitudinal Rumble  
Strips and Stripes on  
Two-Lane Roads



Median Barriers



Roadside Design  
Improvements at  
Curves



SafetyEdge<sup>SM</sup>



Wider Edge Lines

# FHWA Proven Safety Countermeasures

## Speed Management



[Appropriate Speed Limits for All Road Users](#)



[Speed Safety Cameras](#)



[Variable Speed Limits](#)

## Crosscutting



[Lighting](#)



[Local Road Safety Plans](#)



[Pavement Friction Management](#)

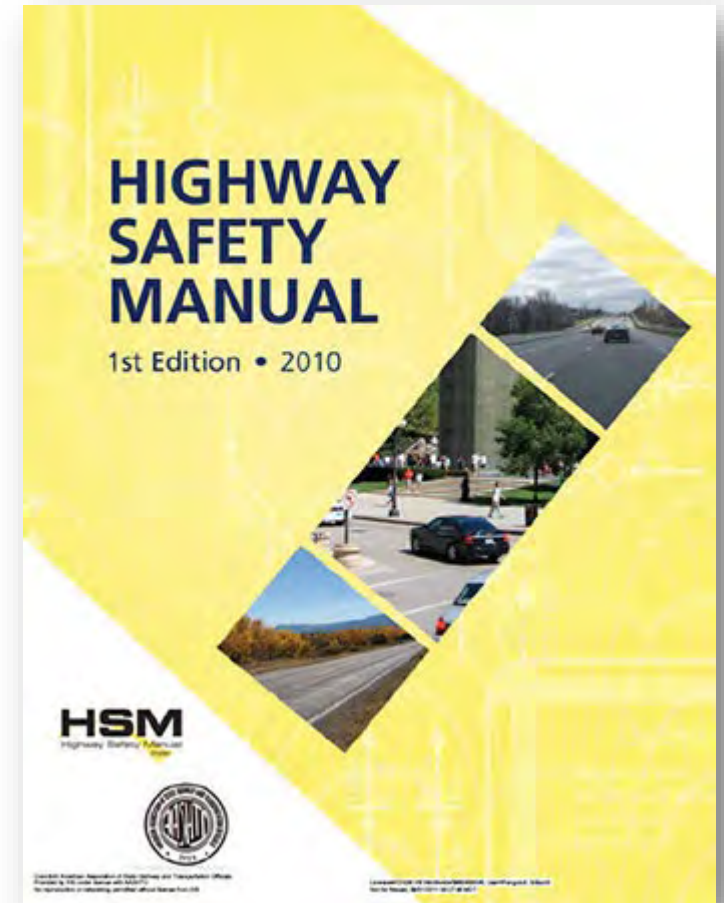


[Road Safety Audit](#)

# Countermeasure Effectiveness

## Crash Modification Factors (CMFs) and Crash Reduction Factors (CRFs)

- Highway Safety Manual
- CMF Clearinghouse
- Emerging Research
- Proxy Effectiveness Measures



# Intersections

## Primary Considerations for Intersection Safety

1. Number and Type of Conflict Points
2. Speeds at the Intersection
3. Visibility
4. Combination of Road User Modes
5. Assignment of Right of Way for Crossing and Turning



# Intersections

Countermeasure	Target Zero, Appx. B6-B7	PSC	SSA Tier	CRF
Roundabouts	INT.3	✓	1	72%
Road Diet/ Reconfiguration	INT.4	✓	1	47%
Traffic Signal			3	14%- 23%
Systemic Traffic Signal Visibility	INT.23, INT.27	✓	4	9%- 15%
Reduce Left-Turn Conflicts	INT.6, INT.14	✓	3	5%- 42%
Access Management	INT.16, INT.17	✓	1	21%- 35%
Systemic Stop-Controlled Visibility	INT.18, INT.27	✓	4	11%- 19%

# Intersections

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# Roundabouts

## Safety Benefits

- Reduce Conflict Points
- Eliminate Left-Turn Conflicts
- Less Severe Crash Angles
- Speed Reduction/ Traffic Calming
- Active Transportation and ADA

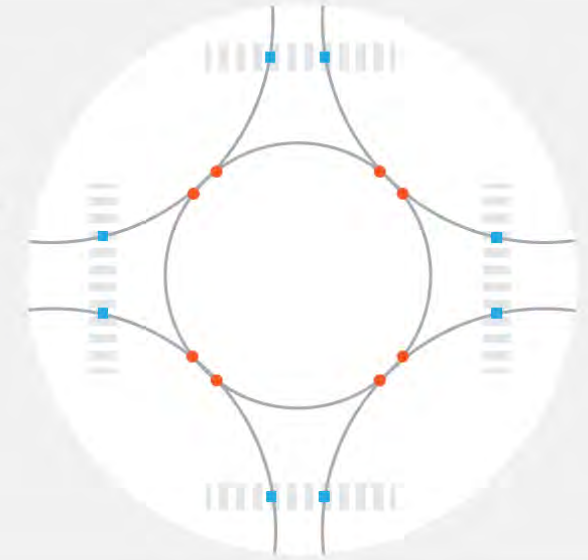
## Scalability and Cost Considerations

- Compact/ Mini Roundabouts
- Modular Designs

## Roundabout-First Intersection Control Analysis/Evaluation

### SINGLE-LANE ROUNDABOUT

- 8 Vehicle-to-Vehicle Conflict Points
- 8 Vehicle-to-Pedestrian Conflict Points



### TRADITIONAL FOUR-WAY INTERSECTION

- 32 Vehicle-to-Vehicle Conflict Points
- 16 Vehicle-to-Pedestrian Conflict Points

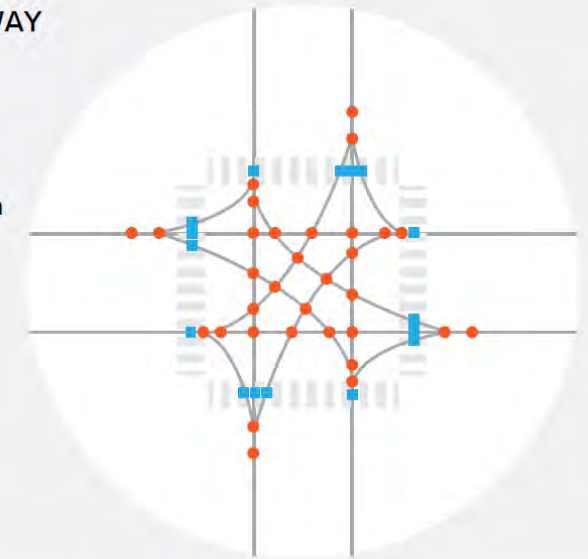


FIGURE 17. INTERSECTION CONFLICT POINTS

Target Zero

# Road Diets (Roadway Reconfigurations)

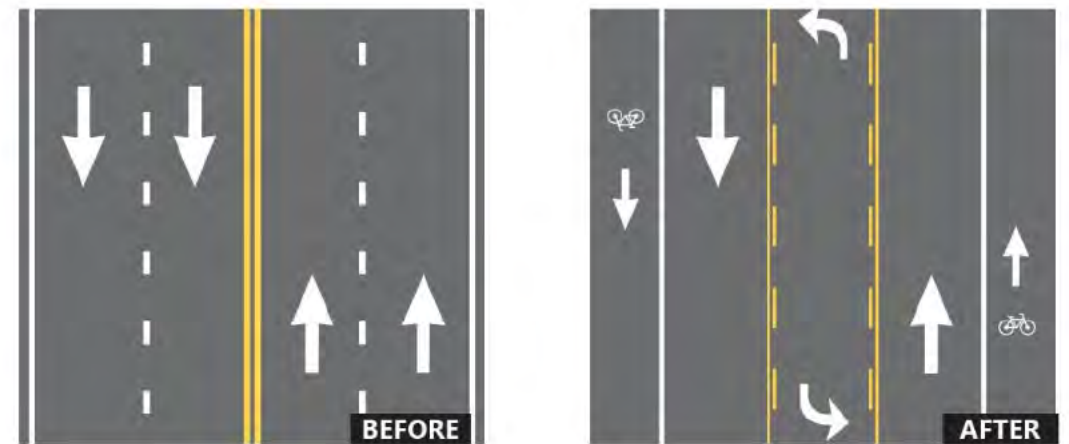
## Safety Benefits

- Dedicated left-turn lane (TWLTL) and fewer through travel lanes reduces right-angle, left-turn and rear-end crashes
- Additional ROW to install pedestrian refuge islands, bicycle lanes, on-street parking, or transit stops
- Fewer lanes for pedestrians to cross; Mitigate multiple-threat crashes
- Speed Management/ Traffic Calming
- Complete Streets

**Traffic Volumes:** 25,000 ADT or less

## Cost Efficiencies

- Pavement Preservation Projects



Before and after example of a Road Diet. Source: FHWA

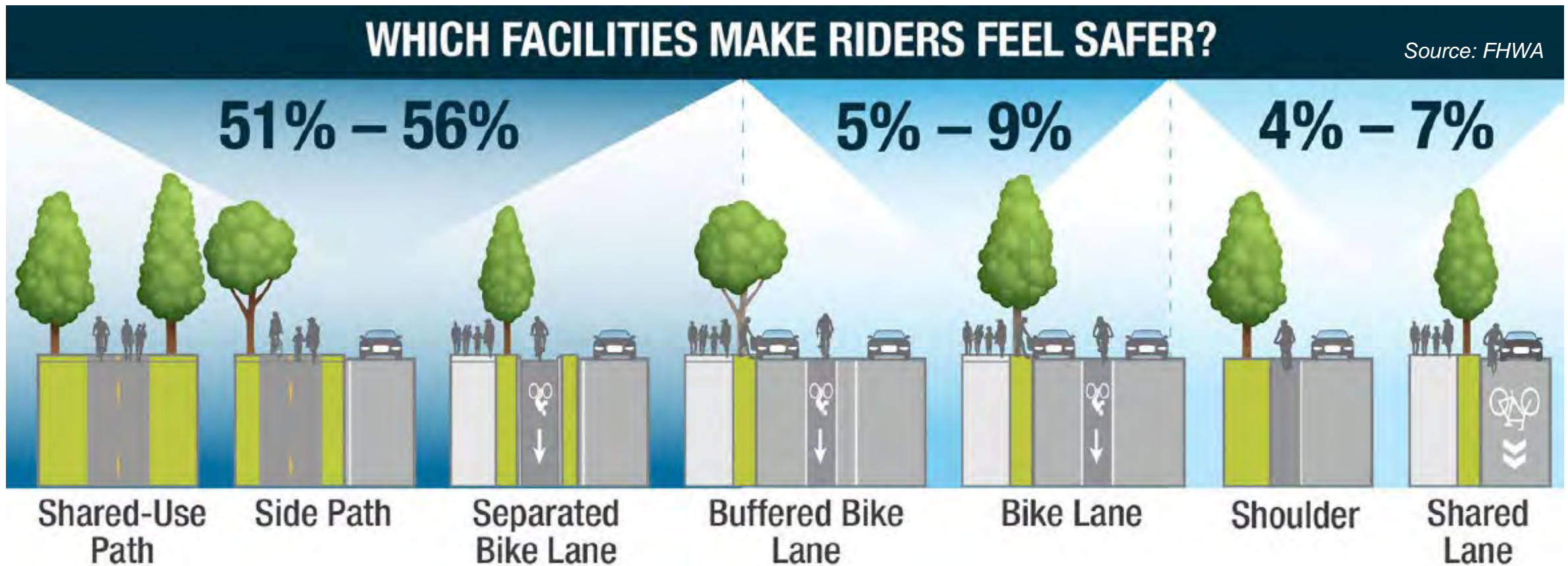
# Intersections: Systemic Low-Cost Safety Improvements

- Systemic Traffic Signal Enhancements
- Systemic Stop-Controlled Enhancements
- Signal Timing and Phasing
- FYA with Pedestrian Recall
- NRTOR (Optional Blank-Out)
- Conflict Warning Systems
- Intersection Lighting
- Red Light Cameras



# Active Transportation User Safety

- Design Users: All Ages and Abilities
- Levels of Traffic Stress (LTS)
- Network Connectivity
- Safe Crossings for Roadway Context



# Active Transportation User Safety

Countermeasure	Target Zero, Appx. B7-B10	PSC	SSA Tier	CRF
Pedestrian Hybrid Beacons	ATU.5	✓	1	55%
Protected Intersection	ATU.9		1	*
Rectangular Rapid Flashing Beacons	ATU.5	✓	4	47%
Leading Pedestrian Interval	ATU.6	✓	3	19%
High-Visibility Crosswalk	ATU.6	✓	4	37%
Median Refuge Island	ATU.4	✓	1	31%
Bike Lanes	ATU.9	✓	1	27%-54%
Sidewalk	ATU.2	✓	1	40%

# Pedestrian Crossing Countermeasures

Countermeasure	CMF
High-Visibility Crosswalk Markings	0.63
Median Refuge Island	0.69
Raised Crosswalk	0.55
Stop Lines/Bars	0.75
RRFBs	0.53
PHBs	0.45
Road Diets	0.53
Intersection Lighting	0.58
Leading Pedestrian Interval (LPI)	0.81
Curb Extensions/Bulb-outs	*

FHWA Safe Transportation for Every Pedestrian

[https://safety.fhwa.dot.gov/ped\\_bike/step/](https://safety.fhwa.dot.gov/ped_bike/step/)

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	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
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)\*\*

# Protected Intersections

## Safety Benefits:

- Reduced Conflicts
- Separates Modes
- Increased Visibility
- Slower Vehicle Speeds

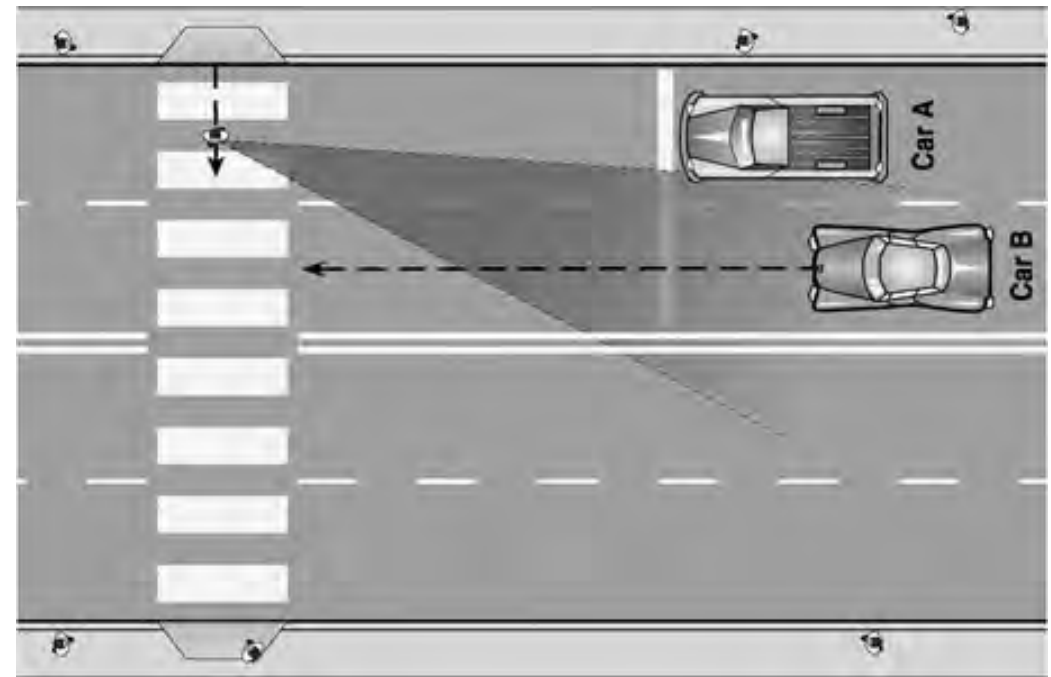
## Features:

- Corner Refuge Islands
- Tighter Curb Radii
- Bike Box and Stop Bars
- Setback Crossings
- Two-Stage Left Turns
- Bicycle and Pedestrian Signal Phasing
- Bicycle Signal Heads



# Active Transportation User Safety: Systemic Mid to Low-Cost Improvements

- High-Visibility Crosswalk Markings
- Raised Crosswalks
- RRFBs and PHBs
- Stop-bars and Signing
- Median Refuge Islands
- Curb Extensions
- Leading Pedestrian Intervals
- NRTOR
- Pedestrian Scale Lighting
- Bike Boxes
- Green Pavement Markings



*SRTS Guide*

# Speed Management

- Speed and Crash Severity
- Self-Enforcing Roads
- Safer Speeds for All

## Death or Serious Injury



20% likelihood of death or serious injury

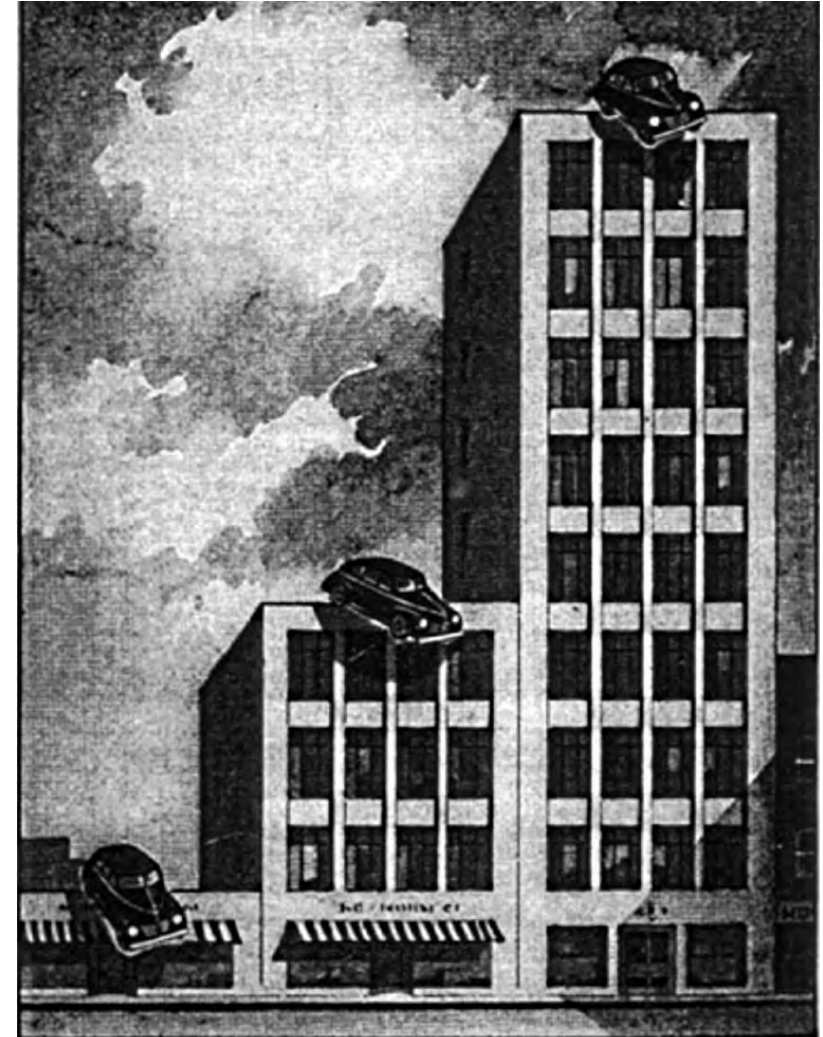


50% likelihood of death or serious injury



80% likelihood of death or serious injury

IIHS



20 mph  
Height: 13.5 ft

40 mph  
Height: 54 ft

60 mph  
Height: 121.5 ft

Target Zero

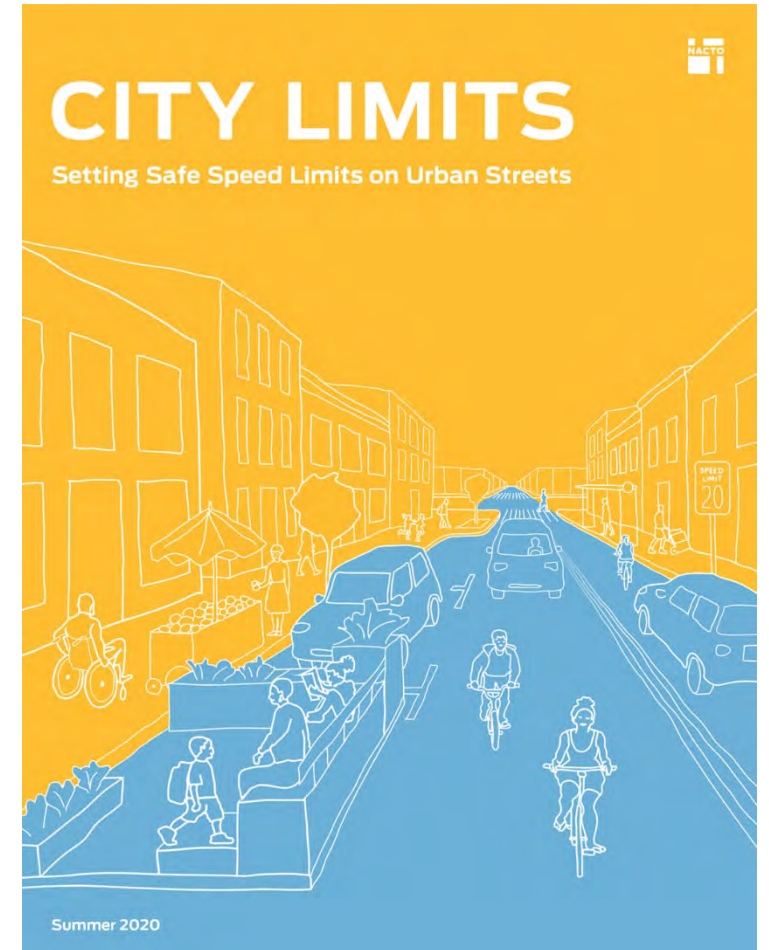
# Speed Management

## Safe Speed Limits:

- Injury-Minimization Speed Limit Policies
- Speed Data Collection

**Safe Target Speed:** A selected speed used to identify the highest operating speed at which vehicles should operate in a particular context to provide safer environments for all roadway users.

- Project Development and Scoping
- Identify Speed Management Countermeasures
- Used to Select Design Speed



NACTO

# Speed Management

Countermeasure	Target Zero, Appx B4	PSC	SSA Tier	CRF*
Safe Speed Limits	SPE.1	✓	2	49%
Speed Safety Cameras	SPE.15	✓	2	12%-28%
Traffic Calming	SPE.2	✓	2	18%-74%
Roundabouts	INT.3 (Appx B6)	✓	1	72%
Coordinated Signal Timing	SPE.6		3	18%-40%
Speed Feedback Signs	SPE.5		4	5%-7%
Transverse Rumble Strips	SPE.2		4	36%
Variable Speed Limits	SPE.4	✓	2	32%

# Speed Management/ Traffic Calming Systemic Safety Improvements

## **Horizontal Deflection**

- Roundabouts
- Chicanes
- Lateral Shifts
- Curb Extensions
- Median Islands

## **Street and Lane Width Reductions**

- Road Diets/Reconfigurations
  - Lane Width
- Curb Extensions and Median Islands
- Tighter Curb Radii

## **Vertical Deflection**

- Speed Humps
- Speed Cushions
- Raised Crosswalks
- Raised Intersections

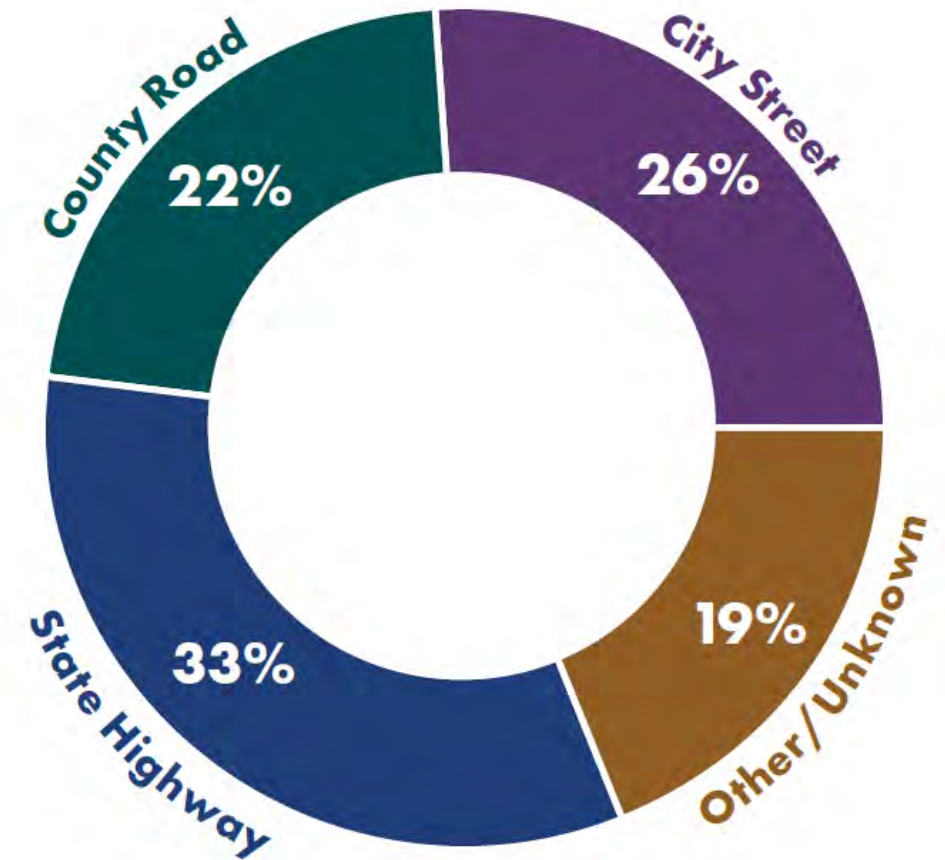
## **Visibility and Awareness**

- Speed Safety Cameras
- Speed Feedback Signs
- Slow Zones and Gateways
- Transverse Rumble Strips
- Variable Speed Limits

# Lane Departure

## Lane Departure Safety Framework

1. Keep drivers in their lane
  - Visibility and Awareness
  - Wide Edge Lines
  - High Friction Surface Treatments
2. Help drivers re-enter their lane
  - Rumble Strips
  - Shoulders
  - Safety Edge
  - Slope Flattening
3. Minimize the consequences of leaving the roadway
  - Guardrail, Curb, and Median Barrier
  - Clear Zone Management



Road Ownership of Lane Departure Fatalities and Serious Injuries

*Target Zero*

# Lane Departure: Systemic Improvements

Countermeasure	Target Zero, Appx. B5	PSC	SSA Tier	CRF*
Raised Medians/ Median barriers	LDX.5	✓	1	55%- 70%
Enhanced Delineation	LDX.6	✓	4	10%- 30%
Center and Edge-line Rumble Strips	LDX.9	✓	4	10%- 49%
High Friction Surface Treatment	LDX.8	✓	1	43%- 72%
Roadside Barrier (Guardrail, etc.)	LDX.16	✓	1	18%- 47%
Systemic Horizontal Curve Warning	LDX.7, LDX.13	✓	4	25%- 43%
Wide Edge Lines	LDX.11	✓	4	36%





## CRASH MODIFICATION FACTORS CLEARINGHOUSE

The **Crash Modification Factors Clearinghouse** provides a searchable database of CMFs along with guidance and resources on using CMFs in road safety practice.

- **Crash Modification Factor (CMF)**
- **Purpose of CMFs**
- **CMF Clearinghouse**



# Why Use the Clearinghouse

- **Evidence-Based Decisions**
- **Consistency**
- **Transparency**
- **Collaboration**



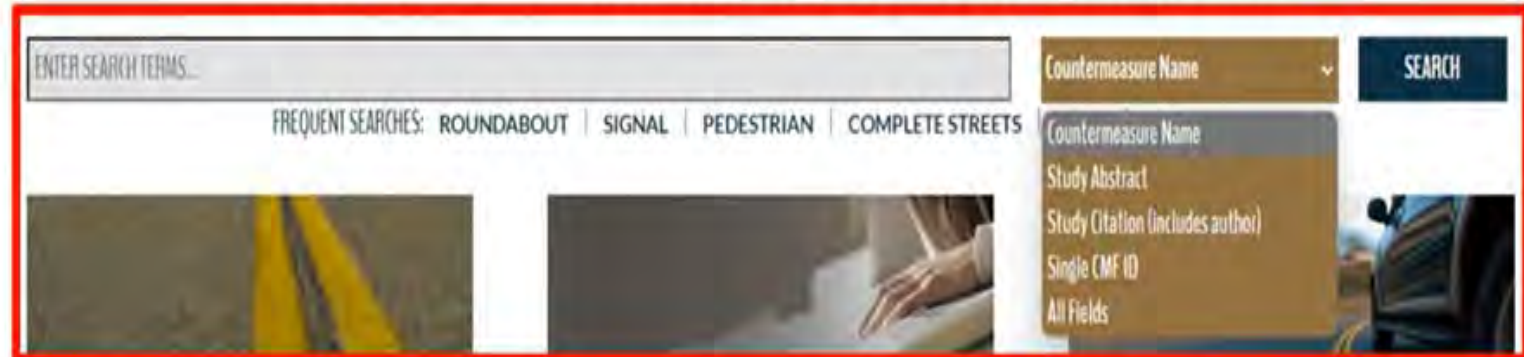
# How to Use the Clearinghouse

- Search for CMFs
- Evaluate Quality
- Apply CMFs

## Searching for CMFs



The Crash Modification Factors Clearinghouse provides a searchable database of CMFs along with guidance and resources on using CMFs in road safety practice.



# SEARCH RESULTS

## SEARCH RESULTS

There were 234 CMFs returned for your search on "roundabouts". [\[MODIFY YOUR SEARCH\]](#).

Having trouble deciding between similar CMFs? Use our [COMPARISON TOOL](#) or [CHECK OUT OUR FAQs](#).

Overwhelmed by too many results? See our [SEARCH TIPS](#).

STAR QUALITY RATING  
 1 (11)  
 2 (69)  
 3 (105)  
 4 (45)  
 5 (4)  
 COUNTRY  
 U.S. & Canada (221)  
 International (10)  
 CRASH TYPE  
 CRASH WEATHER  
 CRASH TIME OF DAY  
 CRASH SEVERITY  
 ROADWAY TYPE  
 AREA TYPE  
 INTERSECTION TYPE  
 INTERSECTION GEOMETRY  
 TRAFFIC CONTROL  
 IN HSM  
 PUBLICATION YEARS

Click on the buttons below to expand or collapse all categories.

Results Control: [EXPAND ALL](#) | [COLLAPSE ALL](#)

▶ Category: Bicyclists (6)

▶ Category: Interchange design (18)

▶ Category: Intersection geometry (203)

▶ Category: Speed management (7)

\*NOTE: You can compare CMFs across countermeasures, subcategories, and categories.

- ▼ Category: Bicyclists (6)
  - ▼ Subcategory: None (6)
    - ▼ Countermeasure: Replacement of traditional intersection with roundabout with a grade separated cycle path

<input type="button" value="Compare"/>	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
<input type="checkbox"/>	0.56	44		Vehicle/bicycle	All	Urban	DANIELS ET AL., 2009	The number of crashes in the a... <a href="#">[READ MORE]</a>

# CMF COMPARISON

Compare	CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference	Comments
<input checked="" type="checkbox"/>	0.831	16.9	★★★★★	All	All	Rural	SUN AND RAHMAN, 2019	[READ MORE]

## Evaluate Quality

- Review the **star rating** to assess reliability.
- Check supporting documentation for study design and context.

## Apply CMFs

- Formula: Expected Crashes With Treatment =  $CMF \times$  Expected Crashes Without Treatment
- Example: A CMF of 0.86 for centerline rumble strips means a **14% crash reduction**.

Countermeasure Name	Install centerline rumble strips	Install centerline rumble strips	Install centerline rumble strips
CMF ID	<a href="#">124</a>	<a href="#">3342</a>	<a href="#">10372</a>
CMF	0.86	0.89	0.831
Study Reference	<a href="#">PERSAUD ET AL., 2003</a>	<a href="#">TORBIC ET AL., 2009</a>	<a href="#">SUN AND RAHMAN, 2019</a>
Unadjusted Standard Error AMF	0.03	0.058	0.016
CMFunction			
Star Rating	★★★★★	★★★★★	★★★★★
Rating Score Total	130	135	140
Crash Type	All	All	All
Crash Severity	All	All	
Crash Time of Day		All	All
Area Type	Rural	Rural	Rural

# Countermeasure Effectiveness

Countermeasure	Crash Modification Factor	Crash Type	Crash Severity	Roadway Type	CMF Value	CMF ID							
RRFB	Install rectangular rapid flashing beacon (RRFB)	Vehicle/Ped	Fatal, Serious, Minor, Possible	NA	0.3	11168							
High-visibility crosswalk	INSTALL HIGH-VISIBILITY CROSSWALK	Vehicle/Ped	All	NA	0.6	4123							
Buffered bike lanes	INSTALL BICYCLE LANES	Vehicle/Bike	Fatal, Serious, Minor, Possible	NA	0.4	7841							
RRFB	High-visibility crosswalk	Install bike lanes											
	0.3	0.6	1							Total CMF	OBJECTID *	Shape *	JURISDICTION
	1	1	1							0.18	5411	Point	City Street
	1	1	1							1	4951	Point	City Street
	0.3	0.6	1							0.18	4929	Point	City Street
	0.3	0.6	1							0.18	4874	Point	City Street
	1	1	1							1	2990	Point	City Street
	1	1	1							1	2461	Point	City Street
	1	1	0.4							0.4	2267	Point	City Street
	1	1	1							1	2113	Point	City Street
	1	1	1							1	1176	Point	City Street
	1	1	1							1	173	Point	City Street
	1	1	1							1	135	Point	City Street

# How the Worksheet Works

- Project Information
- Crash Data Input

A	B	C	D	E	F
<b>WSDOT City Safety Program Benefit/Cost Worksheet For Crash Reduction</b>					
<b>Project name:</b>	NE 8th Street Complete Streets Improvements				
<b>Application year:</b>	2024				
<b>Agency:</b>	*****				
<b>Countermeasures:</b>	Rectangular Rapid Flashing Beacons (RRFB), High-visibility crosswalk, Buffered bike				
<b>Location(s):</b>	NE 8th St and 160th Ave NE				
<b>Agency Identified FIS Crash:</b>	EB25***, EA88***				
<b>Evaluator:</b>					<b>Date:</b>
<b>1a. Initial Total Project Cost, \$:</b>	<b>\$628,000</b>		<b>1b. Year 11 Cost, \$:</b>	<b>\$0</b>	
<b>2. Annual Op. Costs, \$:</b>					
<b>3. Annual Safety Benefits in Number of Collisions:</b>					
Crash Type	Existing Row #	Existing Calcula	After Row #	After Calcula	Difference
a) Fatal injury	1	0.20	0.18	0.04	0.16
b) Suspected serious injury	1	0.20	0.4	0.08	0.12
c) Suspected minor injury	11	2.20	7.94	1.59	0.61
d) Possible Injury	15	3.00	15	3.00	0.00
e) Property damage only	53	10.60	53.00	10.60	0.00
<b>Totals</b>	81.00		76.52		0.90

# Benefit Calculation

<b>3. Annual Safety Benefits in Number of Collisions:</b>					
Crash Type	Existing Raw #	Existing Calcula	After Raw #	After Calcula	Difference
a) Fatal injury	1	0.20	0.18	0.04	0.16
b) Suspected serious injury	1	0.20	0.4	0.08	0.12
c) Suspected minor injury	11	2.20	7.94	1.59	0.61
d) Possible Injury	15	3.00	15	3.00	0.00
e) Property damage only	53	10.60	53.00	10.60	0.00
Totals	81.00		76.52		0.90

## Benefit-Cost Ratio (BCR)

16				
17	<b>8. Present Worth of Costs (PWOC) = I + .68J + 13.59H - T:</b>			\$628,000
18	<b>9. Present Worth of Benefits (PWOB) = 13.59 x Yearly Benefits:</b>			\$15,187,292
19	<b>10. Net Benefit = PWOB-PWOC:</b>			\$14,559,292
20	<b>11. Benefit Cost Ratio, B/C = PWOB/PWOC:</b>			<b>24.18</b>
21				
22				

# Key Takeaways

- **CMFs quantify safety impacts**
- **The Clearinghouse is the go-to resource**
- **Use CMFs in planning and design**

# Systemic Safety Project Development Considerations

## **Systemic Safety Project Principles**

- Proactive: Improve high-risk locations before fatal and serious injury crashes occur.
- Wide-spread coverage (citywide) utilizing mid to low-cost safety countermeasures.

## **Systemic Safety Project Evaluation**

- Priority Risk Factors Addressed (Agency LRSP, Citywide Crash Data)
- Priority High-Risk Locations Receiving Treatment(s) (Agency LRSP)
- Countermeasure(s) Effectiveness (CMF)
- Cost (Total Project Cost)

# Systemic Safety Projects

## **Example 1:** Add or Upgrade to High-Visibility Crosswalk Markings and Stop Bars/Signing at Existing Crosswalks

- Proactive: Addresses 2 Priority Risk Factors identified in the Agency LRSP (Pedestrian Crossings Visibility, Land Use— Schools, Parks, Hospitals).
- Wide-Spread Coverage: 40 Priority High-Risk locations
- Effectiveness (CMF):
  - Add High-Visibility Crosswalk Markings (0.60)
  - Upgrade from Transverse Line to High-Visibility Crosswalk Markings (0.80)
  - Add Stop Bars and Signing (0.85)
- Cost: \$1,500,000 with ADA upgrades as needed
- Application: 2 projects at ~\$750,000 for 20 intersections each prioritized by locations as identified in the agency LRSP.
- Cannot include maintenance costs.

# Systemic Safety Projects

**Example 2:** Install Midblock Crosswalks with RRFB's, Median Refuge Islands, Curb Extensions, Raised Crosswalk, Pedestrian Scale Lighting, Stop Bars and Signing.

- Proactive: Addresses 4 Priority Risk Factors identified in the Agency LRSP (Crosswalk Spacing, High Operating Speeds, Land Use, No Street Lights)
- Wide-Spread Coverage: 6 Priority High-Risk locations
- Effectiveness: 

RRFB's (0.53)	Raised Crosswalk (0.55)
(CMF)	Stop Bars (0.85)
Median Refuges (0.69)	Pedestrian Scale Lighting (0.58)
Curb Extensions (0.70*)	
- Cost: \$2,000,000
- Application: 2 projects at ~\$1,000,000 for 3 intersections each prioritized by locations as identified in the agency LRSP.



# Resources

- Systemic Safety User Guide  
<https://highways.dot.gov/safety/data-analysis-tools/systemic>
- Target Zero  
<http://www.targetzero.com/>
  - Safe System Approach (pp. 36-46)
  - Speed Management (pp. 65-69; Appendix B4)
  - Lane Departure (pp. 81-85; Appendix B5)
  - Intersections (pp. 86-92; Appendix B6-B7)
  - Active Transportation Users (pp. 104-113; Appendix B7-B10)
- Safe System Roadway Design Hierarchy  
[https://highways.dot.gov/sites/fhwa.dot.gov/files/2024-01/Safe\\_System\\_Roadway\\_Design\\_Hierarchy.pdf](https://highways.dot.gov/sites/fhwa.dot.gov/files/2024-01/Safe_System_Roadway_Design_Hierarchy.pdf)

# Resources

- FHWA Proven Safety Countermeasures  
<https://highways.dot.gov/safety/proven-safety-countermeasures>
- CMF Clearinghouse  
<https://cmfclearinghouse.fhwa.dot.gov/>
- WSDOT Design Manual, Chapter 1320 Roundabouts  
<https://wsdot.wa.gov/publications/manuals/fulltext/M22-01/1320.pdf>
- NACTO
  - City Limits: <https://nacto.org/publication/city-limits/>
  - Urban Street Design Guide: <https://nacto.org/publication/urban-street-design-guide/>
  - Urban Bikeway Design Guide:  
<https://nacto.org/publication/urban-bikeway-design-guide/>

# Effective Safety Countermeasures and Project Development

## Questions?

### **Ed Spilker**

City Safety & Traffic Programs  
Manager

[ed.spilker@wsdot.wa.gov](mailto:ed.spilker@wsdot.wa.gov)

360-705-7387

### **Matthew Enders, P.E.**

Technical Services Manager

[matthew.enders@wsdot.wa.gov](mailto:matthew.enders@wsdot.wa.gov)

360-705-6907

### **Paul Snow**

Safety Analyst

[paul.snow@wsdot.wa.gov](mailto:paul.snow@wsdot.wa.gov)

360-705-7380