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Safe Roads for a Safer Future
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http://safety.fhwa.dot.gov

EDC

FoRRRwD
Focus on Reducing Rural Roadway Departures

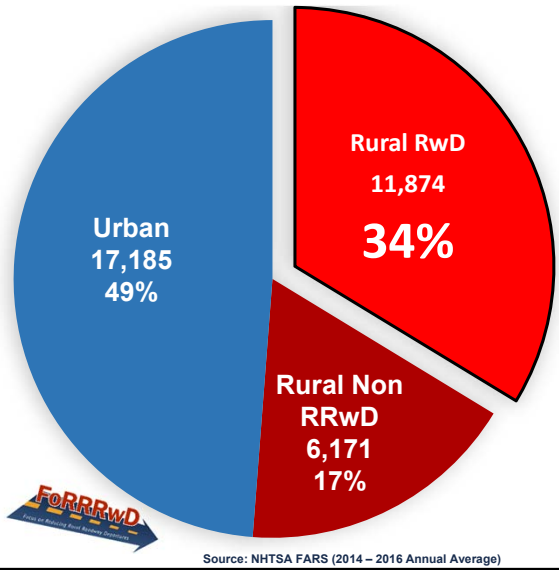
# A Systemic Approach to Reducing Roadway Departures

3/17/2021

## Course Objectives

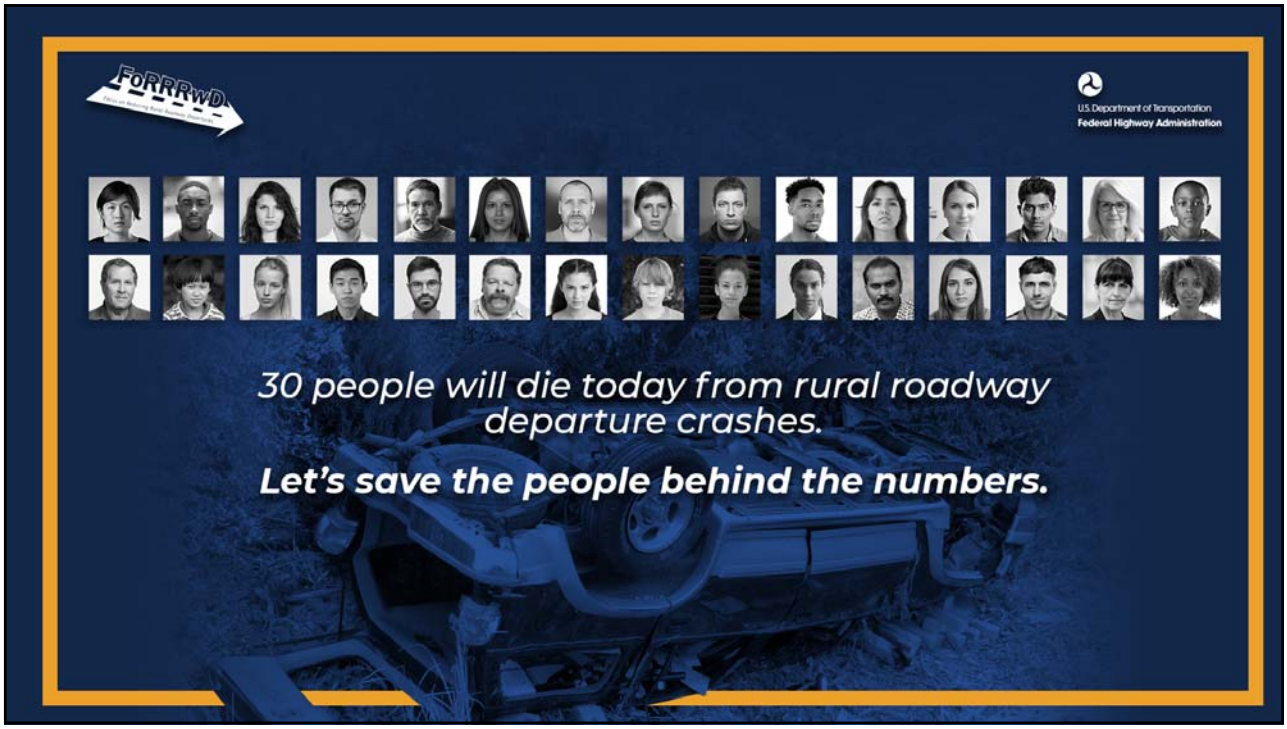
- Understand why the systemic approach is critical to reduce roadway departures.
- Describe the 4-steps in the systemic safety planning process.
- Identify risk factors that are commonly used in the Systemic Approach to reduce rural roadway departures.

## The Rural RwD Component of Fatalities

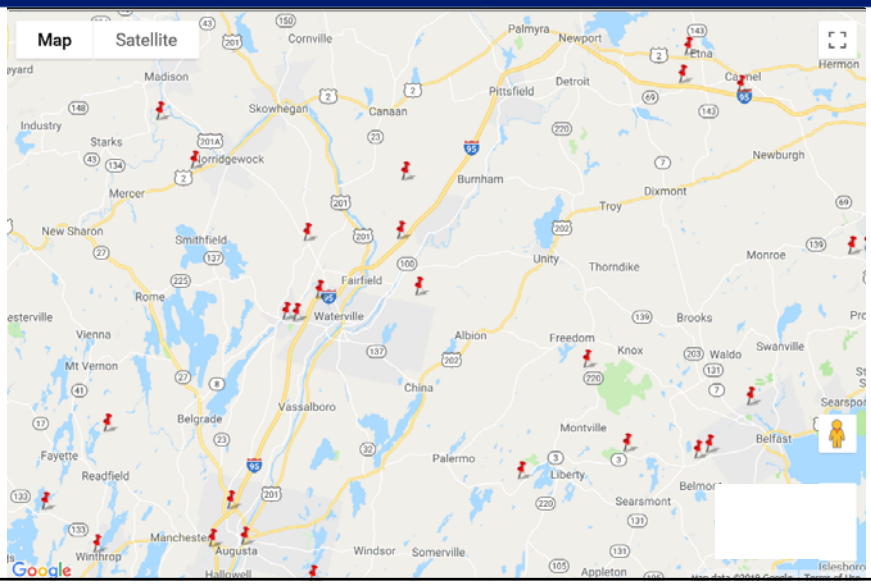



Source: NHTSA FARS (2014 – 2016 Annual Average)

FHWA Roadway Departure (RwD) Definition:
*A crash in which a vehicle crosses an edge line, a center line, or otherwise leaves the traveled way.*

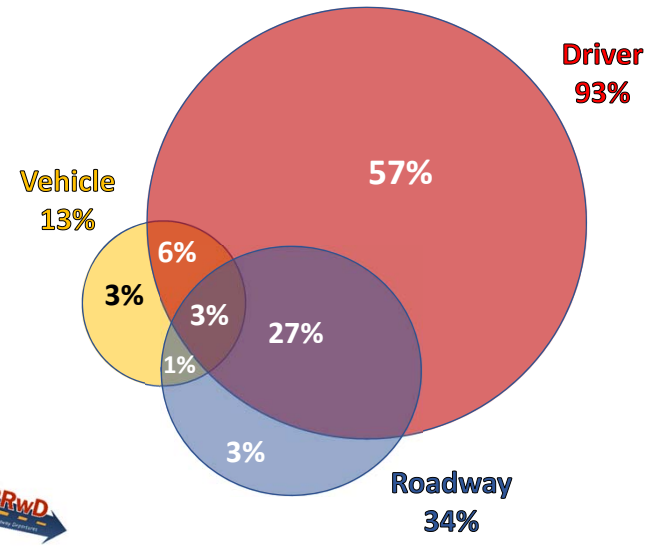



# Where would you invest in safety improvements?




Source: NHTSA FARS
(2013 – 2017 Annual Average)


## Contributing Causes of Crashes




**The Driver is weakest link in this system, so we must design around human needs.**

*FROM: Lum & Reagan, Public Roads Magazine, Winter 1995, "Interactive Highway Safety Design Module*

# Systemic Safety: Definition

The term "systemic safety improvement" means an improvement that is **widely implemented** based on **high-risk roadway features** that are correlated with **particular crash types, rather than crash frequency.**

*-- 23 USC 148 (a)(12) Systemic safety improvement*

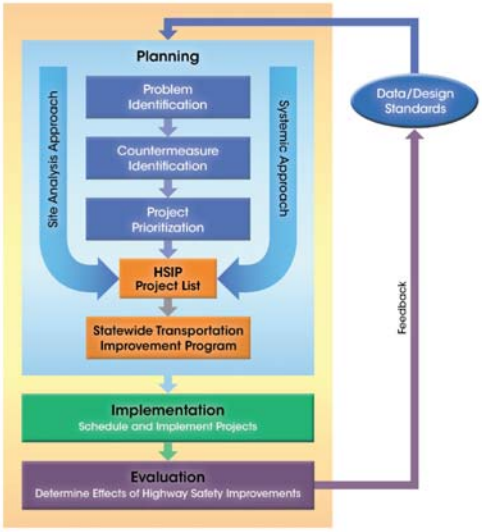



https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/ddsa_resources/ddsa_systemic_analysis.pdf

## Systemic Approach

- Complementary approach to site-specific
  - Proactively identify safety improvements
  - Does not replace reactionary approach
- Primary approach for rural and local roads

**You don't have to wait until a crash occurs to make improvements!**




https://safety.fhwa.dot.gov/systemic/fhwasa13019/sspst.pdf

## Definitions

- Systemic – Deploying countermeasures at locations with the ***greatest potential*** for safety improvement
- Systematic – Deploying countermeasures at ***ALL*** locations

Systemic Example:
Provide enhanced delineation on curves with radii between 500-700 feet which were over-represented in severe crashes

## Element 1 - Systemic Safety Planning Process


Step 1 **Identify Focus Crash Types & Risk Factors**

Step 2 **Screen & Prioritize Candidate Locations**

Step 3 **Select Countermeasures**

Step 4 **Prioritize Projects**

## Step 1: Identify Focus Crash Types & Risk Factors

Gather crash and other data, then analyze the data through the following tasks:

- Task 1: Select Focus Crash Types
- Task 2: Select Focus Facilities
- Task 3: Identify and Evaluate Risk Factors

## Gather Data

Typical data to Identify Focus Crash/Facility Types and Risk Factors can include:

- Crash type
- Crash severity
- Crash location
- Crashes by system
  - State
  - Local
- Crashes by facility type
  - Rural, 2-lane roads (all, segments, curves)
  - Urban, 2-way stop-controlled intersection


***"Do what you can, with what you have, where you are."***

***– Theodore Roosevelt***

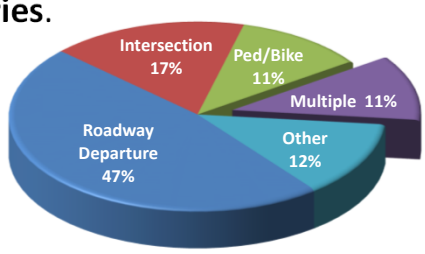
STEP 1 | STEP 2 | STEP 3 | STEP 4

## Task 1 – Select Focus Crash Types

What does "focus crash type" mean?

The crash type that represents the **greatest number of severe crashes** across the roadway system being analyzed and provides the **greatest potential to reduce fatalities and severe injuries**.

- Roadway Departure
- Intersection
- Pedestrian
- Speeding




**US Fatalities by FHWA Focus Area**
**(FARS 2014-2016)**

STEP 1 | STEP 2 | STEP 3 | STEP 4

# Task 1 – Select Focus Crash Types

Select Focus Crash Types

- Systemwide analysis
- Strategic Safety Plans
  - Strategic Highway Safety Plans
    - Emphasis areas
  - Safety Implementation Plans
    - Examples: IL, KY, LA, MN, MO, NE, OH, NY, Thurston County, WA.
- Regional and jurisdictional analyses
  - May differ from statewide needs


STEP 1 | STEP 2 | STEP 3 | STEP 4

# Task 1 - Select Focus Crash Types

**Fatal and Severe Injury Crashes (2007-2011)**
**Percent by Jurisdiction**

| Emphasis Area | Statewide 114,592 mi | |
|---|---|---|
| Total Fatal/Serious Injury | 100% | 63,443 |
| Pedestrian | 19% | 11,786 |
| Bicycle | 5% | 3,390 |
| Heavy Vehicle | 5% | 3,123 |
| Run-Off-Road | 26% | 16,668 |
| Intersection | 41% | 25,791 |
| Head-on | 5% | 3,071 |

STEP 2 | STEP 3

## Task 2 - Select Focus Facilities

What does "focus facility" mean?

The facility type on which the **focus crash type most frequently occurs**.

- Rural, Two-Lane Highways
- Urban, Signalized Intersections
- Horizontal Curves
- Rural, Thru-STOP Intersections



## Task 3- Identify and Evaluate Risk Factors

- Identify potential risk factors
  - Roadway and intersection features
  - Traffic volume
  - Transit stops, land use, etc.
- Evaluate risk factors
- Select final risk factors


http://www.creative-commons-images.com/highway-signs/r/risk.html

# Task 3- Identify and Evaluate Risk Factors

What does "risk factor" mean?

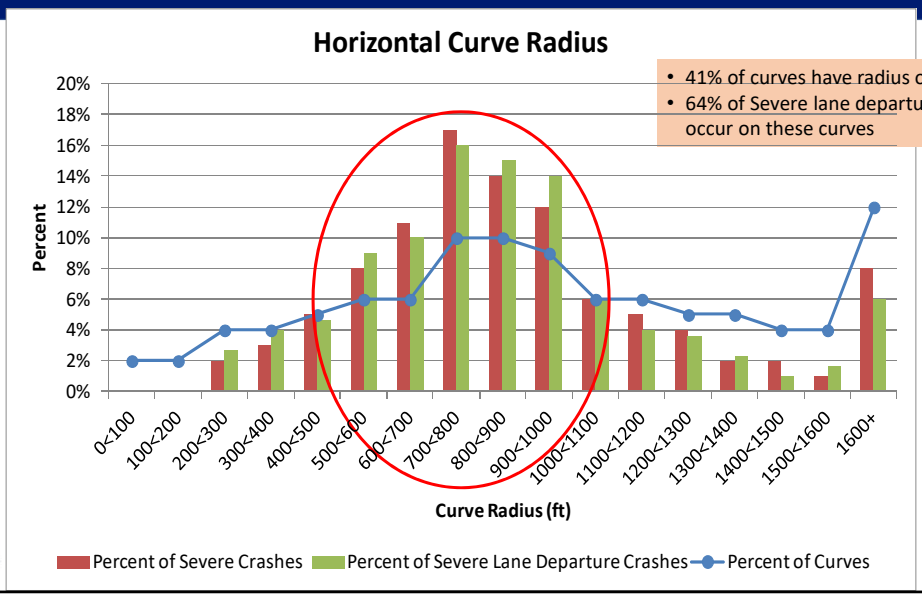
A representation of risk in terms of the observed **characteristics associated with** the locations where the **targeted crash types** occurred.

Potential Risk Factors might include:

- Number of lanes
- Traffic Volume
- Speed Limit
- Lane & Shoulder width
- Median width / type
- Horizontal curvature
  - Superelevation
  - Delineation
  - Advance warning
  - Speed differential
  - Visual trap
- Pavement condition / friction
- Roadside features
  - Sideslope design
  - Clear zone
- Driveway density
- Other features
  - Rumble strips
  - Lighting

STEP 1 | STEP 2 | STEP 3 | STEP 4

# Evaluate Risk Factors: Example 1



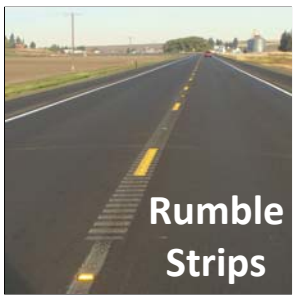
## Step 3 – Select Countermeasures

After screening and prioritizing locations, now it's time to select countermeasures by going through the following tasks:

- Task 1: Assemble Comprehensive List of Countermeasures
- Task 2: Evaluate/Screen Countermeasures
- Task 3: Select Countermeasures for Deployment

STEP 1 | STEP 2 | STEP 3 | STEP 4

## Roadway Departure Countermeasures





STEP 1 | STEP 2 | STEP 3 | STEP 4

## Task 2: Evaluate and Screen Countermeasures

- Documented **effectiveness**
- Implementation and maintenance **costs**
- Consistency with agency polices, practices, and experiences

Source: Kentucky Transportation Cabinet

STEP 1 | STEP 2 | STEP 3 | STEP 4

## Task 3: Select Countermeasures

- Represent highest priorities
  - Most **cost-effective** countermeasures addressing **targeted** crash types
- Provide a range of options for **flexibility**
- Consistent with agency practices and policies


Source: FHWA

STEP 1 | STEP 2 | STEP 3 | STEP 4

## Helpful Hints on Countermeasure Selection

- Seek input from stakeholders during screening process
- Remove initial countermeasures that are not feasible
- There is no optimum number of countermeasures
  - Provide at least one alternative
- Determine appropriate number of locations for initial list
  - Goals and funding amounts
  - Identify locations for on-the-shelf projects
  - Implement with typical construction and maintenance projects
- Consider bundling low cost improvements.



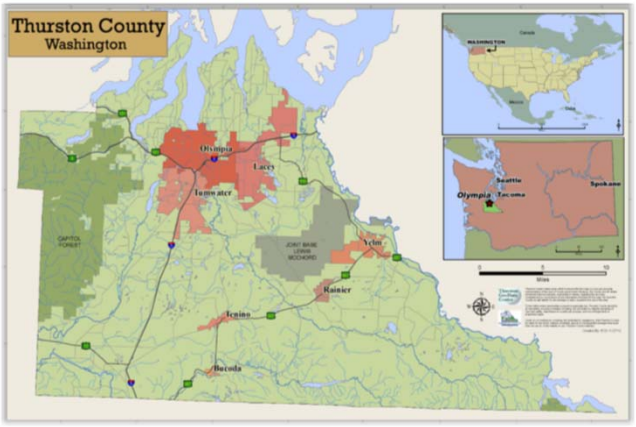
Finally, you develop a list of high priority safety improvement projects for implementation by going through the following tasks:

Task 1: Create Decision Process for Countermeasure Selection

Task 2: Develop Safety Projects

Task 3: Prioritize Safety Project Implementation

## Thurston County, Washington





Local and Rural Road Safety Briefing Sheets

Applying the Systemic Safety Approach on Local Roads

**Introduction**

Local and rural road owners rely upon crash data to identify and treat safety problems.

The traditional "spot location" approach is focused on treating a specific location based on crash history. The "systemic approach" acknowledges that crash frequency or rates at specific locations alone are not always sufficient to determine which countermeasures to implement and where to implement them. This is often true on low-volume local and rural roadways where crash frequencies are lower and crash data are sometimes sparse or incomplete. Systemic implementation of safety countermeasures helps to address the most serious crash types on the entire road system, not just at specific high-crash spot locations.

The systemic safety approach is a two-pronged effort to reduce crashes and serious injuries on the roadways. This approach offers a means to: (1) identify crash types (e.g. intersection, roadway departure, pedestrians) and the location-related factors that contribute to the highest number of fatal and serious injury crashes of each type, and (2) widely implement low-cost countermeasures over several locations with similar crash characteristics and/or similar roadway features. Typically, systemic safety improvements are low-cost, require little maintenance, have documented crash reductions, and address specific crash types or crash risk factors (e.g., narrow shoulders).

**Benefits of Systemic Safety Approach**

The application of the systemic safety approach offers the following benefits:

- Systemic safety improvements can reduce overall fatal and severe crashes of certain types within a jurisdiction more effectively than applying safety improvements at a small number of spot locations.
- The approach allows an agency to adapt for all levels of data availability and can help prioritize data collection needs.
- Countermeasures implemented systemically are typically low-cost improvements.
- Systemic safety improvements help agencies broaden their safety efforts and consider other risk factors in addition to crash history when identifying locations for potential safety improvement.
- Systemic safety improvements can be incorporated into planning, design, and maintenance policies, defended in tort liability cases, and used to develop a multi-year program of projects.
- The approach can bolster public confidence because it allows the agency to implement a proactive safety program.

Systemic safety improvements can be promoted for future use in written policy, implemented through explicit roadway safety improvement projects, and included in capital projects and ongoing maintenance activities.

**Case Study: Thurston County (Washington) Public Works Applies the Systemic Safety Model**

Thurston County Public Works selected roadway departures in horizontal curves as their focus crash type based on a review of severe crash data, with 81 percent of the severe curve crashes occurring on arterial and collector roadways. Thurston County identified run-off-road type crashes on horizontal curves for systemic improvement and selected signing improvements on currently signed curves as the most effective countermeasure.

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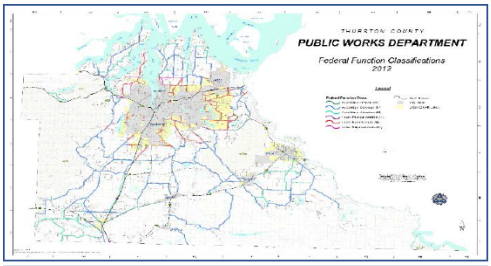
http://safety.fhwa.dot.gov

https://safety.fhwa.dot.gov/local_rural/training/fhwasa14081/systemic_app.pdf

## Thurston County, Washington

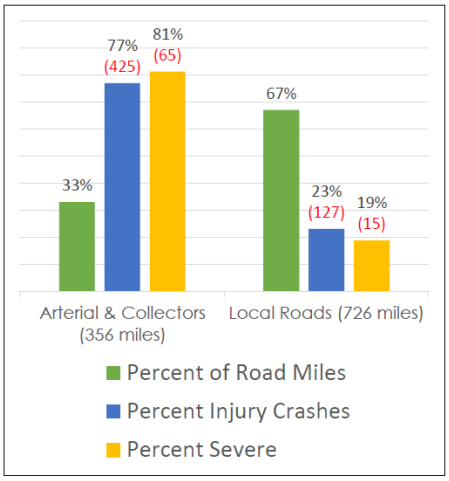
| 2006-2010 Collision Data | Fatal/Serious Injury Crashes Only | | |
|---|---|---|---|
| | All Roads | All Counties | Thurston County |
| Angle (left-Turn) | 16% (2175) | 13% (468) | 9% (16) |
| Intersection-Related | 33% (4557) | 22% (812) | 19% (34) |
| Horizontal Curve | 26% (3674) | 39% (1419) | 45% (80) |

## Thurston County, Washington



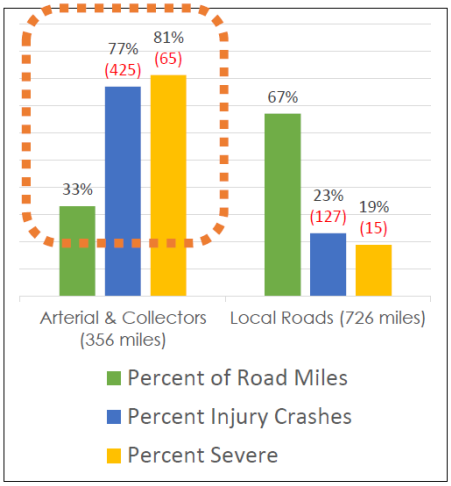

Next we were left with:

- Over 1000 centerline miles
- Over 1500 crashes




## Thurston County, Washington

**Focus area reduced to about 350 centerline miles**



## Thurston County, Washington

**Focus Crash Type**

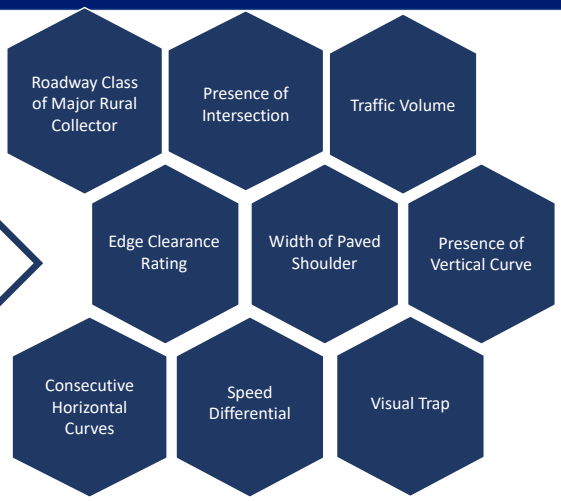
- Roadway Departures in Horizontal Curves

**Focus Facility Type**

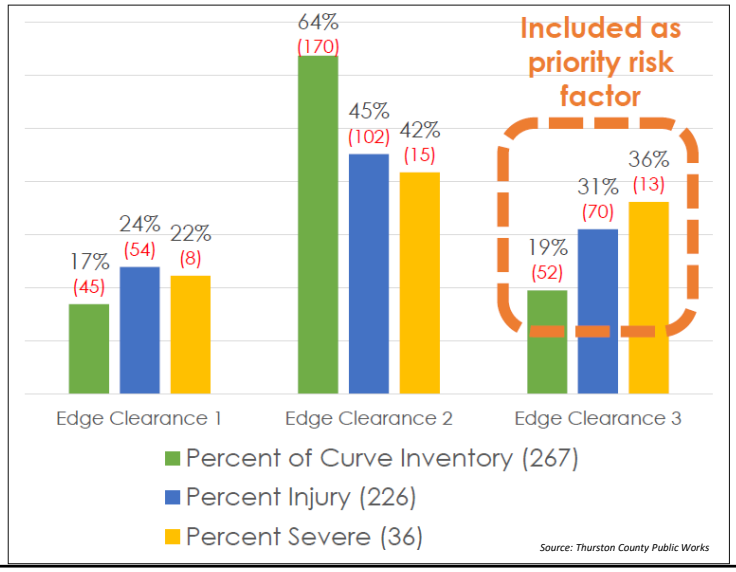
- Arterial and Collector Roadways

## Thurston County, Washington

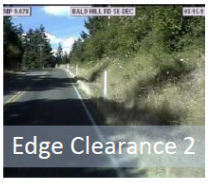
9 Risk Factors

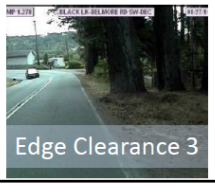


## Thurston County, Washington







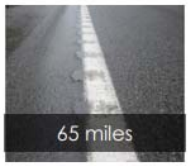

## Thurston County, Washington

- Chevron and large arrow signs
- Larger signs
- Rumble strips
- Barrier delineation
- Extension lines


*Note: In addition to the 5 proven countermeasures provided, Thurston County used other low-cost and corridor consistency countermeasures.*

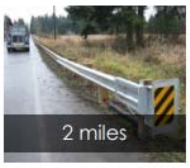
# Thurston County, Washington

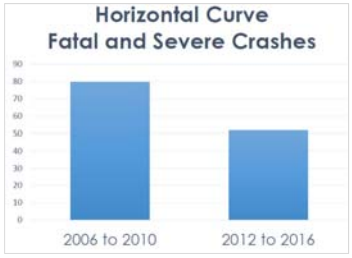











**35% Reduction in Target Crashes**

Source: http://www.countyengineers.org/assets/docs/LRSP%20Pilot_Webinar%203.pdf

# Systemic Safety Resources

- State
  - Strategic Highway Safety Plans
  - Safety Implementation Plans
- FHWA
  - Systemic Safety Project Selection Tool
  - Crash Tree Maker and User Guide
  - CMF Clearinghouse
  - Reliability of Safety Management Series
  - Highway Safety Benefit-Cost Analysis Guide and Tool
- AASHTO
  - Highway Safety Manual (HSM)
  - NCHRP Report 500 Series
  - AASHTOWare Safety Analyst
- Roadway Safety Foundation
  - US Road Assessment Program (usRAP)

**Roadway Safety Data Program (RSDP) Toolbox**


https://safety.fhwa.dot.gov/rsdp/

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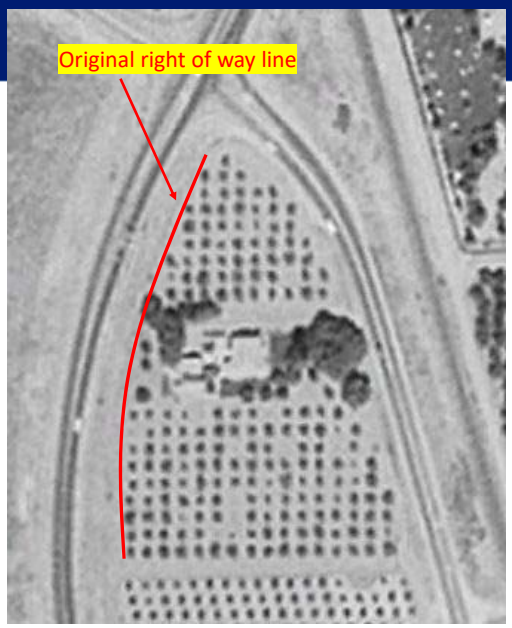
# State Route 99 in Sutter County at Lomo Crossing Safety Project

# Collision Pattern and Previous Safety Improvements

Left – 1998 showing building in NW quadrant

Right – current showing no building

Left – 1998 showing orchard in southeast quadrant




Right – 2004 shows 2 rows of trees removed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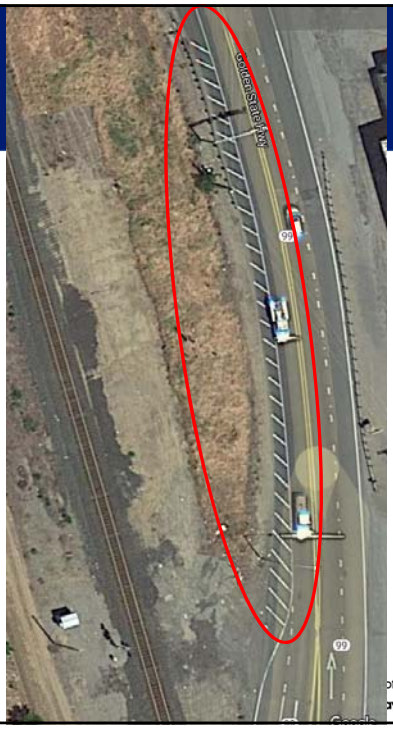

# Questions and Discussion