



U.S. Department of Transportation  
Federal Highway Administration



**Safe Roads for a Safer Future**  
*Investment in roadway safety saves lives*

# Intersection Safety



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Intersection Safety



**Safe Roads for a Safer Future**  
*Investment in roadway safety saves lives*

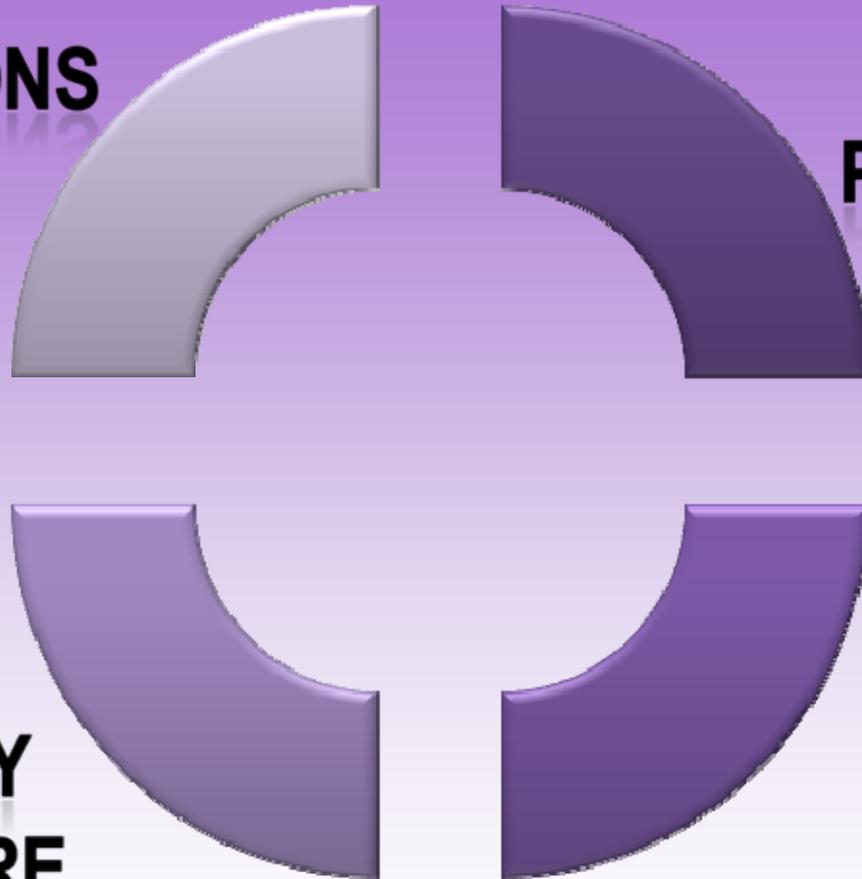
# FHWA Safety Focus Areas

**INTERSECTIONS**

**PEDESTRIANS**

**ROADWAY  
DEPARTURE**

**SPEEDING**



# Intersections



**There are at least 3 million intersections in the United States.**

**At least 300,000 are signalized.**

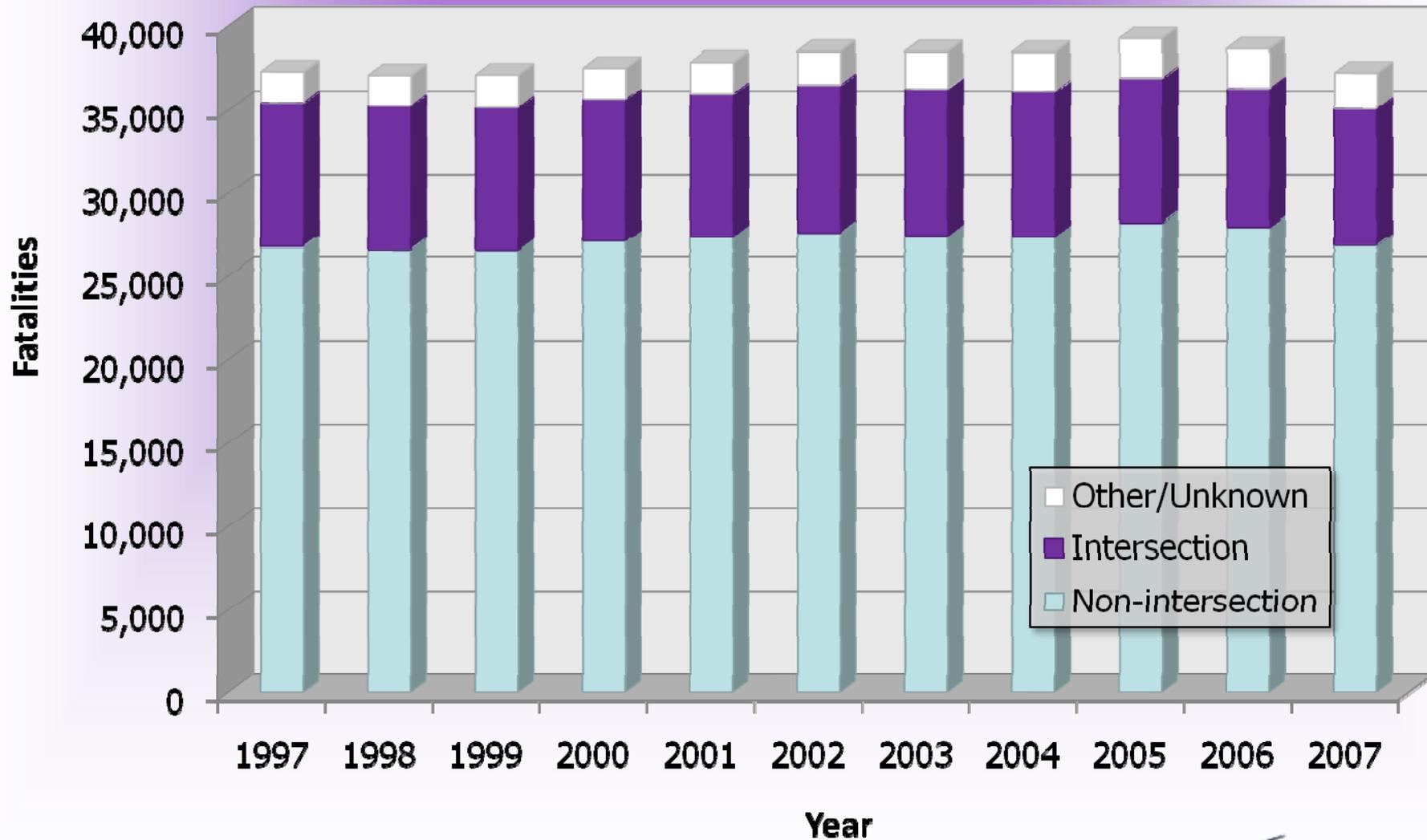


# Intersections

- Among the most hazardous components of the highway system for all users (planned points of conflict)
- Complex speed-distance judgments under time constraints
- Interstates (full access control) have fatality rates less than half of other highway types

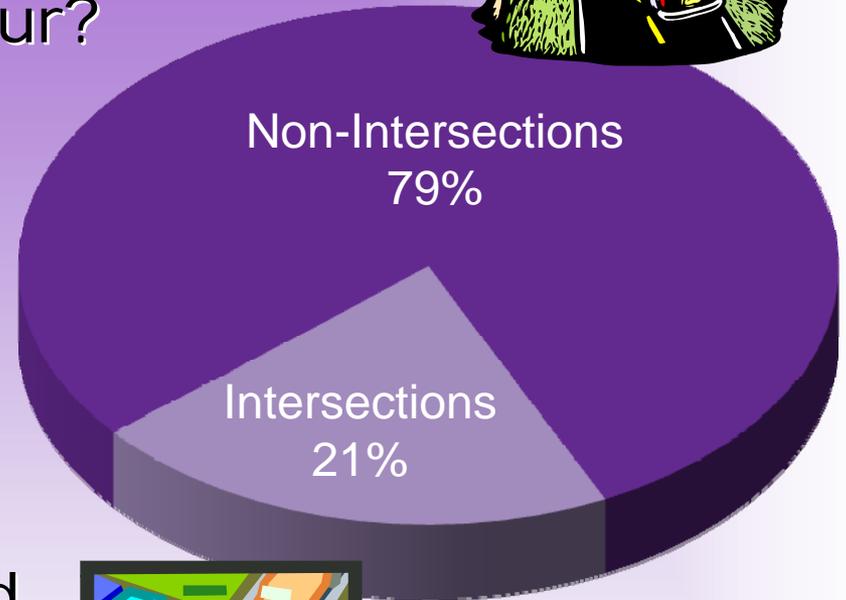


# National Statistics



# National Statistics

There were 41,059 highway fatalities in 2007. Where did they occur?

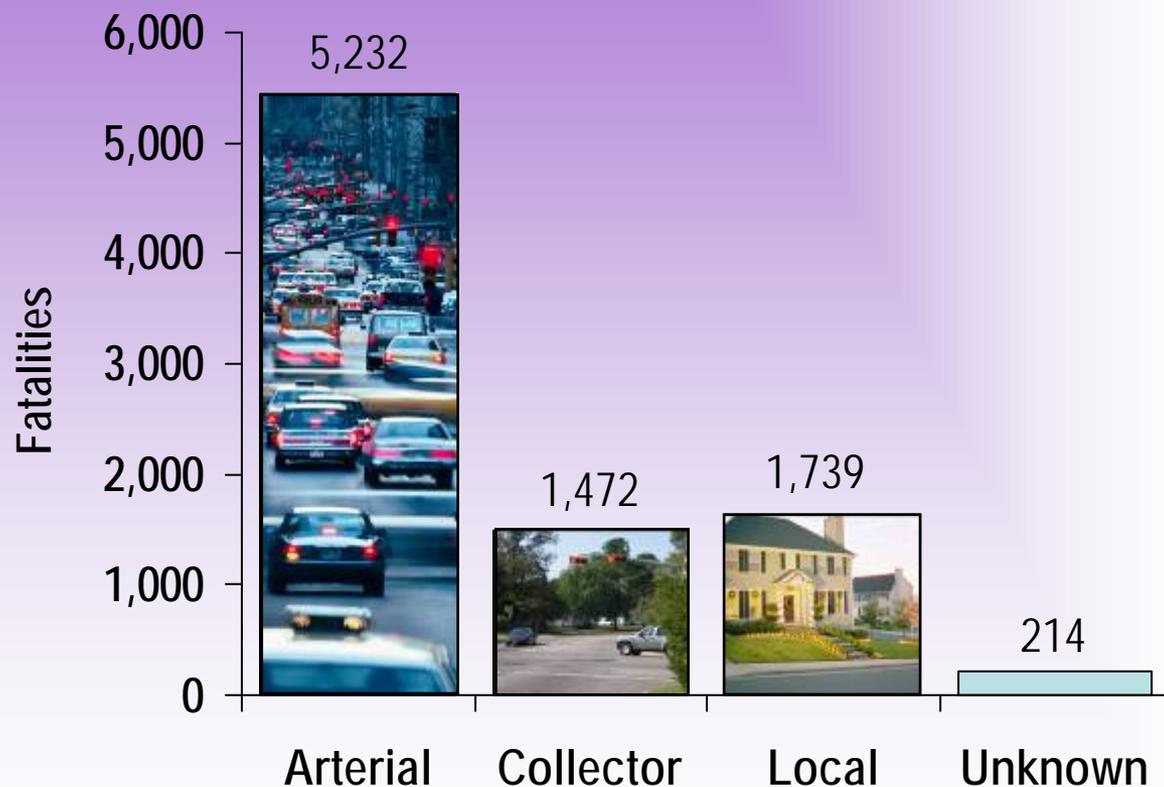


About half of all crashes and half of all injury crashes occur at intersections.



# Intersection Fatalities

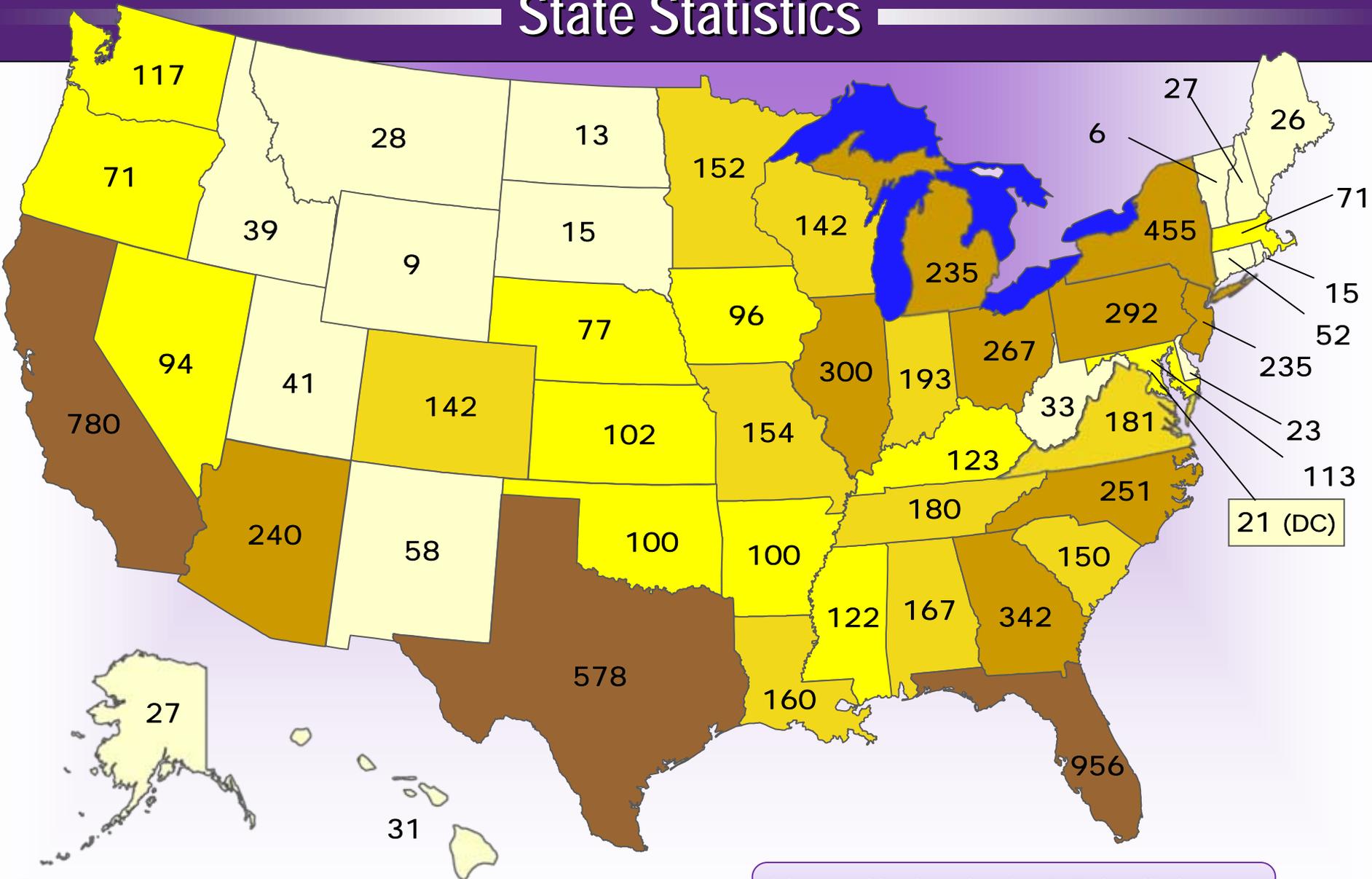
There were 8,657 intersection fatalities in 2007.  
Where did they occur?



# Intersection Fatalities

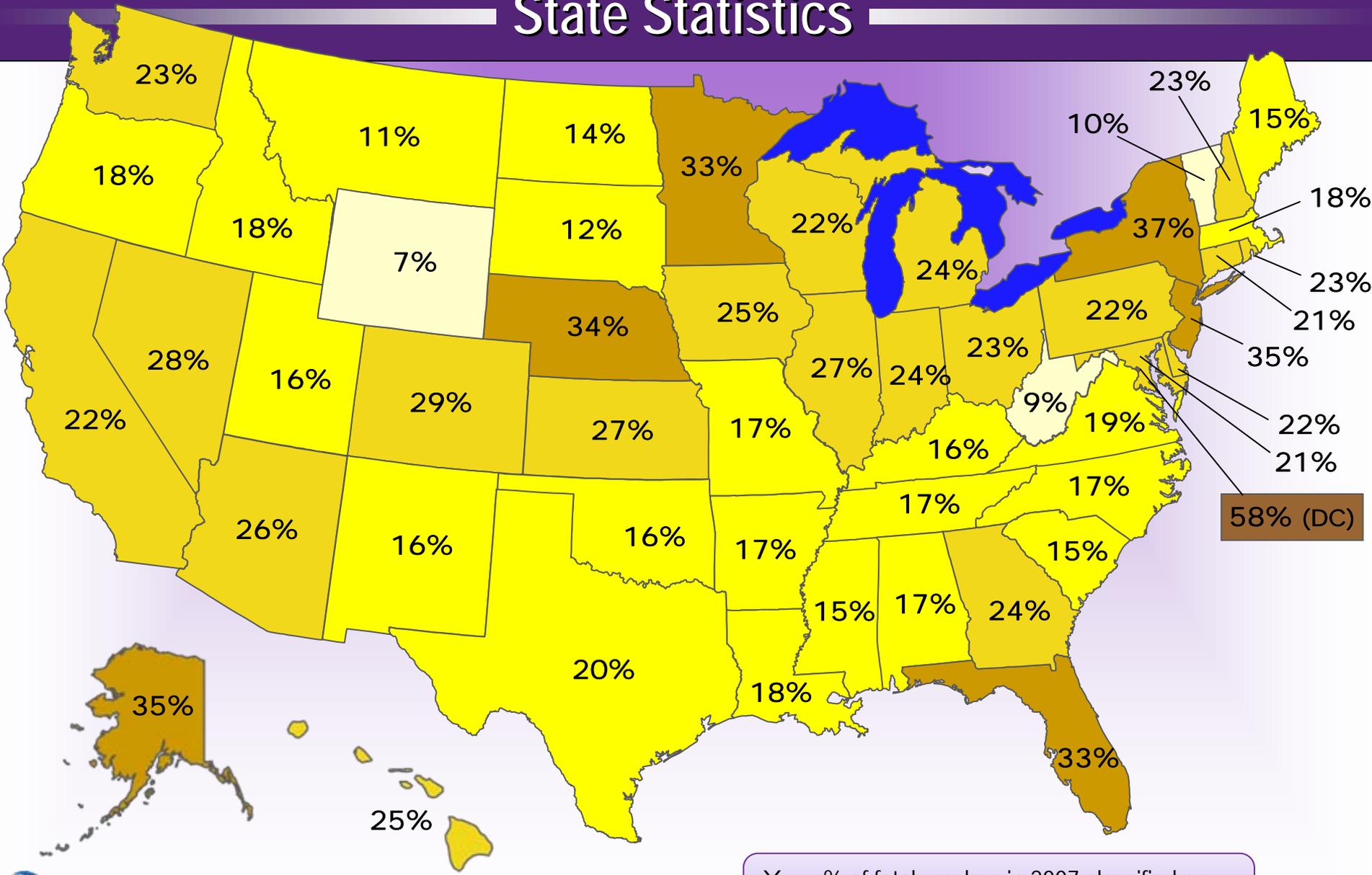


# State Statistics



X = # of fatal crashes in 2007 classified as intersection or intersection-related

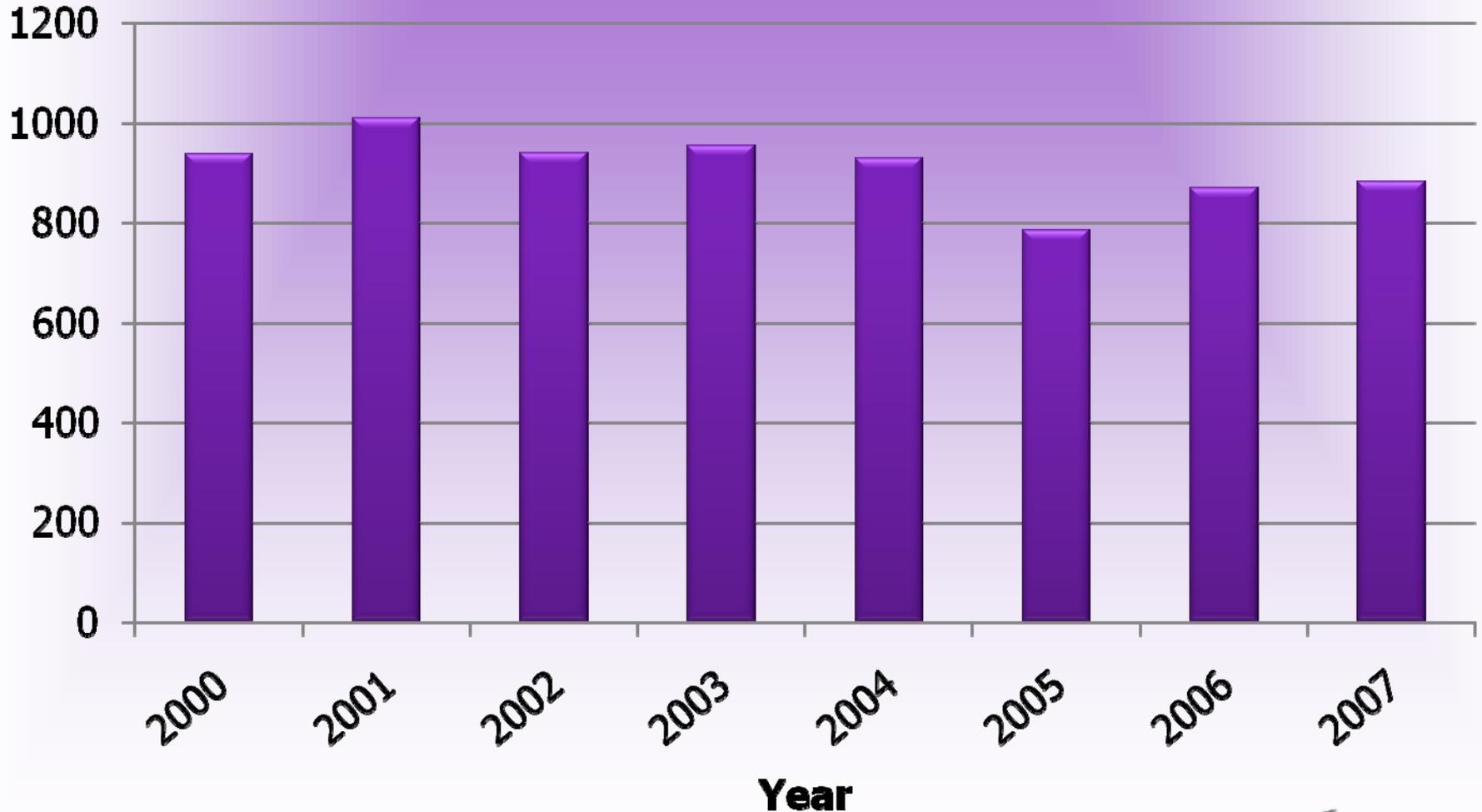
# State Statistics



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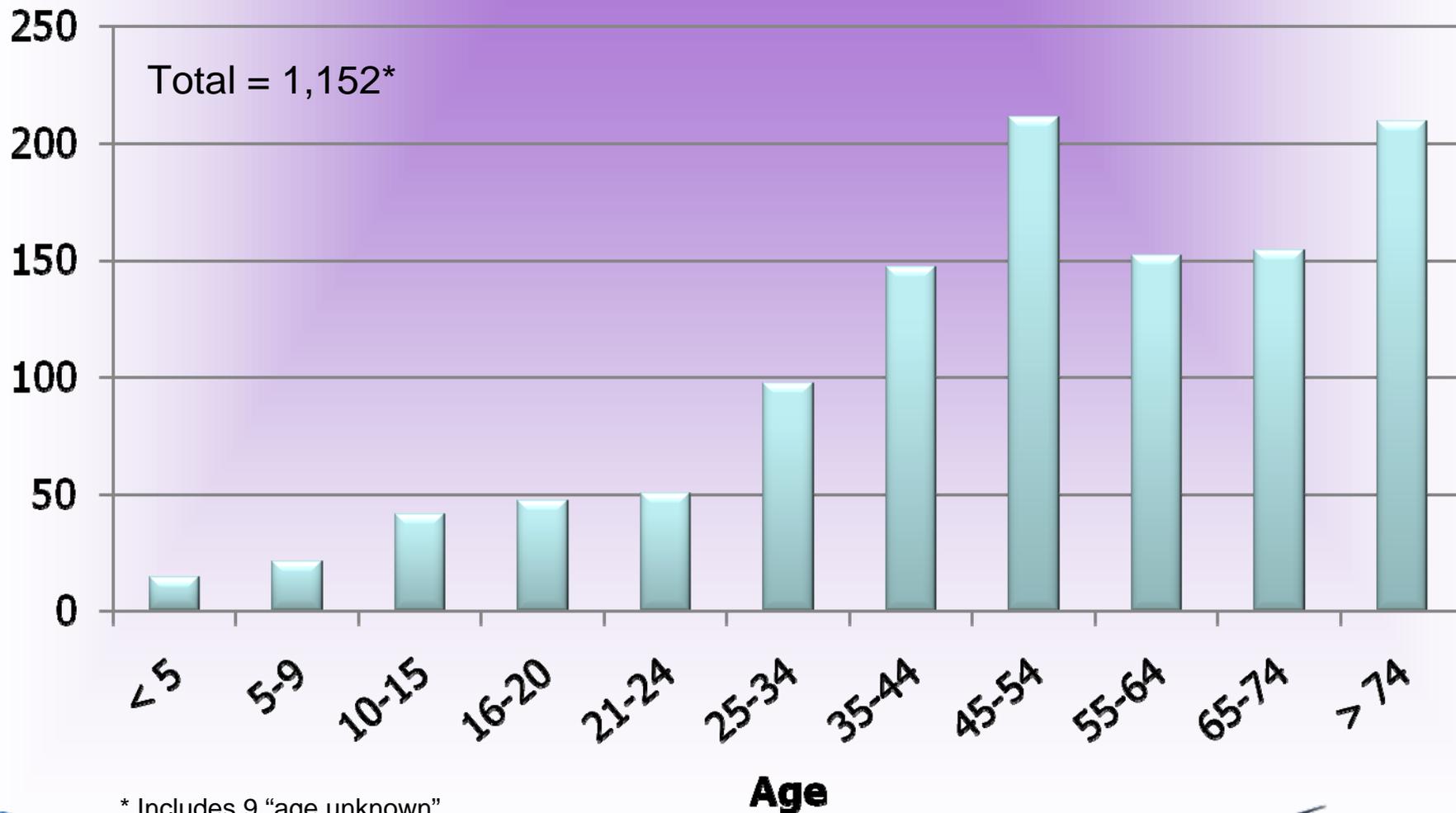
# Red Light Running

## Fatalities Attributed to Red Light Running



# Pedestrians

## 2007 Pedestrian Fatalities at Intersections

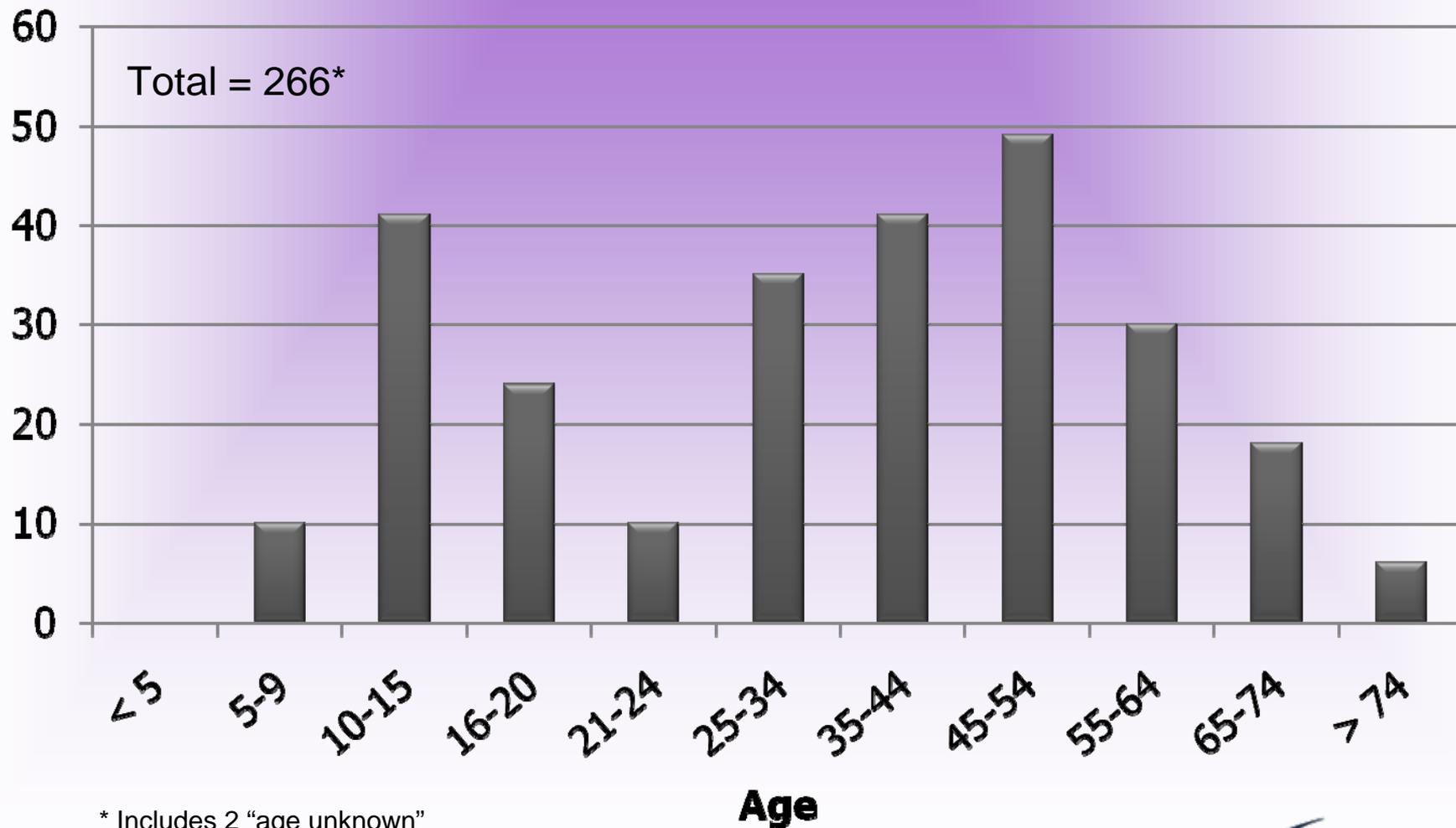


\* Includes 9 "age unknown"



# Bicyclists

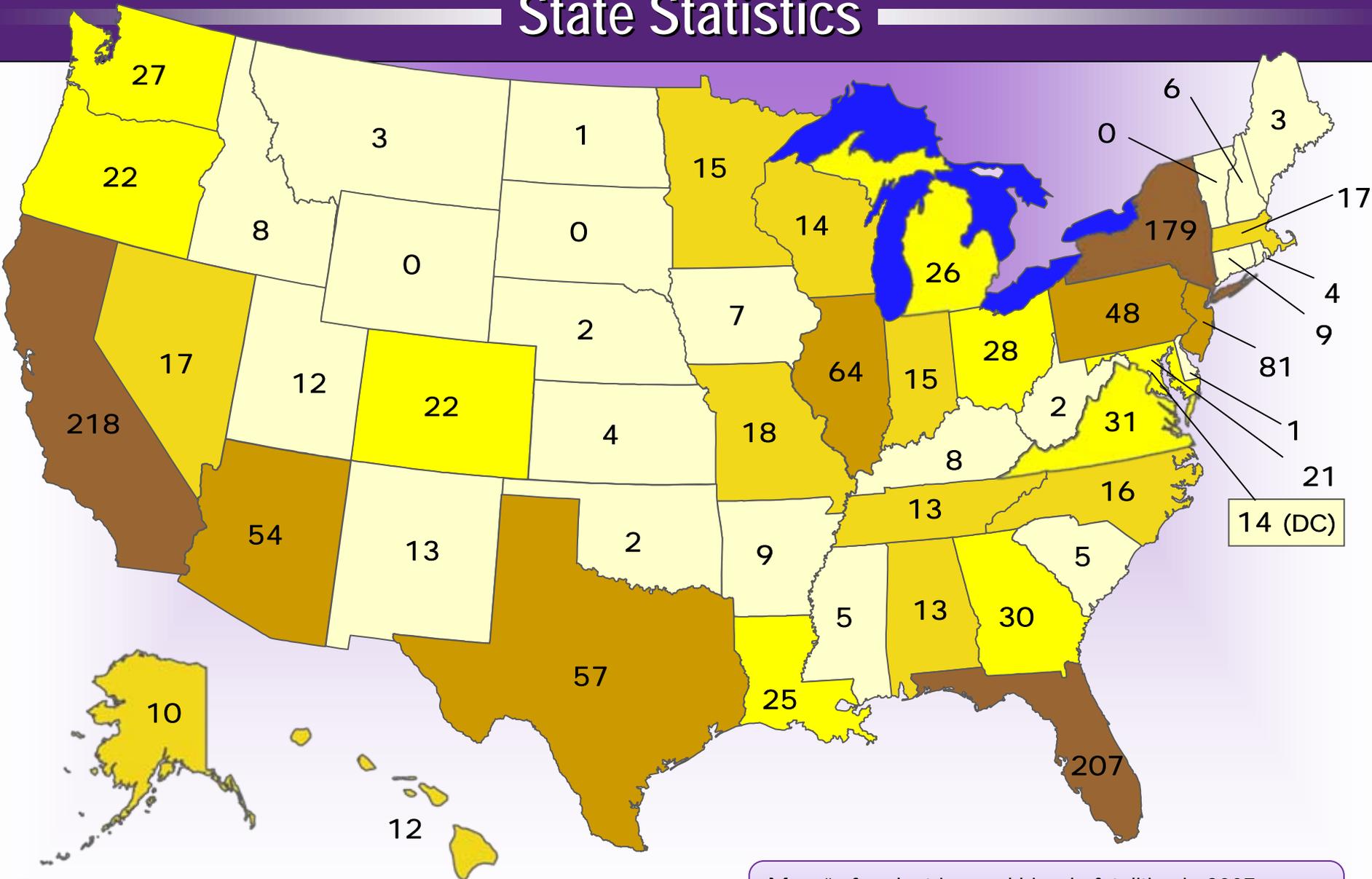
## 2007 Bicyclist Fatalities at Intersections



\* Includes 2 "age unknown"



# State Statistics



X = # of pedestrian and bicycle fatalities in 2007 classified as intersection or intersection-related

# Typical Intersection Crash Types

Right angle

Rear end

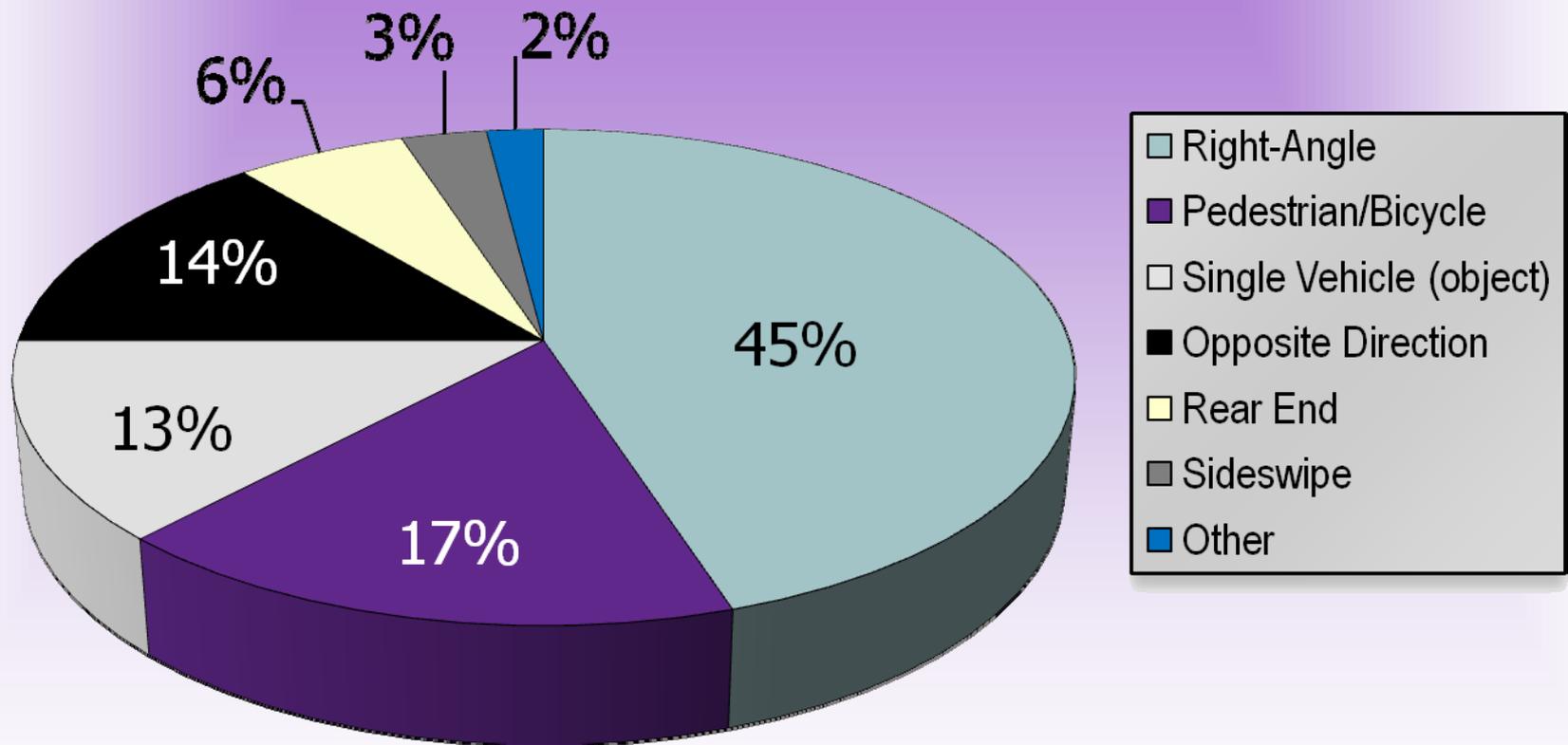
Left turn

Sideswipe

Pedestrian/bicycle



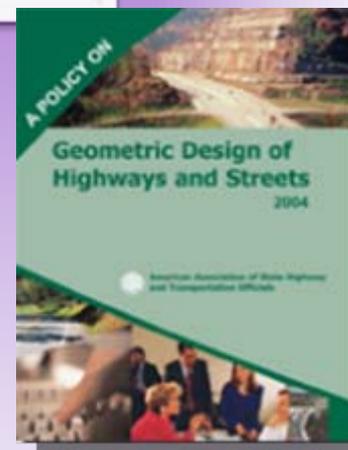
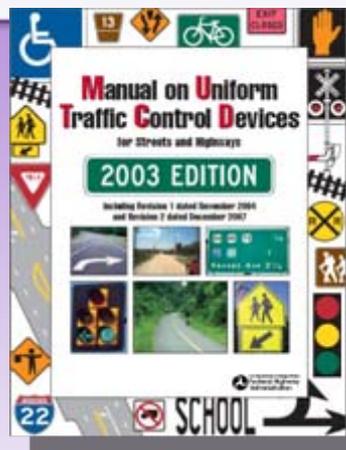
# Crash Type Distribution



# Nominal and Substantive Safety

## Nominal safety:

Meets minimum design and standards criteria



## Substantive safety:

Actual or expected safety performance of a roadway



# Nominal and Substantive Safety

- Two-lane highway with inadequate SSD
- Nominal safety design → advance warning sign
  - But may still have high number of right-angle crashes



# Nominal and Substantive Safety

- Substantive safety → additional advance sign



# Crash Reduction Factors

- <http://safety.fhwa.dot.gov/tools/crf/>

## Desktop Reference for Crash Reduction Factors



Report No. FHWA-SA-08-011  
U.S. Department of Transportation  
Federal Highway Administration

September 2008

FHWA Report Center:  
[report.center@dot.gov](mailto:report.center@dot.gov)

## 8 BRIS ISSUES Toolbox of Countermeasures and Their Potential Effectiveness to Make Intersections Safer

### Introduction

Studies included in the NCHRP 17-18 (3) *Guidance for Implementation of the AASHTO Strategic Highway Safety Plan* as well as in other research by governmental entities have produced estimates of crash reductions that might be expected if a specified improvement or group of improvements are implemented. Three tables have been developed that attempt to summarize some of the available information. Readers will note that, by and large, there may be little consensus regarding the value of crash reduction factors for a number of countermeasures. The transportation engineering discipline needs to develop a base of statistically sound before-and-after studies for extended periods of time to overcome the deficit in countermeasure effectiveness data.

### Use of the Tabular Data

The data in this briefing sheet represent a number of countermeasure effectiveness studies and includes ranges of effectiveness realized from one or more sources. Readers are encouraged to obtain and review original source documents for more detailed information. It must be emphasized that the potential effectiveness values, for example percentage reduction in crashes, represent order-of-magnitude estimates only. Traffic engineers need to consider site-specific environmental, geometric and operational conditions before making a judgment regarding those countermeasures that will be applied to an intersection.

Traffic engineers and other transportation professionals can use the information contained in this briefing sheet when the public or an elected or appointed official asks a question such as:

What is the range of solutions that might be considered at the signalized intersection of Maple and Elm streets due to the high number of total crashes and left-turn crashes? What low-cost improvements can be tried first? If these improvements do not give us a higher degree of safety, what else can we try?

The countermeasure effectiveness tables in this briefing package include:

- Table 1: Signalization Countermeasures at Signalized Intersections. Specific categories of countermeasures included in this table are signal timing and phasing improvements, signal hardware and combination signal and other improvements.
- Table 2: Geometric Countermeasures at Unsignalized Intersections. Specific categories of countermeasures included in this table are left-turn treatments, right-turn treatments and other geometric improvements.
- Table 3: Signs/Markings/Operational Countermeasures (Applicability Notes for Signalized and/or Unsignalized Intersections). Specific categories of countermeasures included in this table are signs, pavement markings and modifications, and regulatory lighting and operational improvements.



U.S. Department of Transportation  
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Institute of Transportation Engineers

TOOLBOX OF COUNTERMEASURES

April 2004 1

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# Techniques for Improving Safety

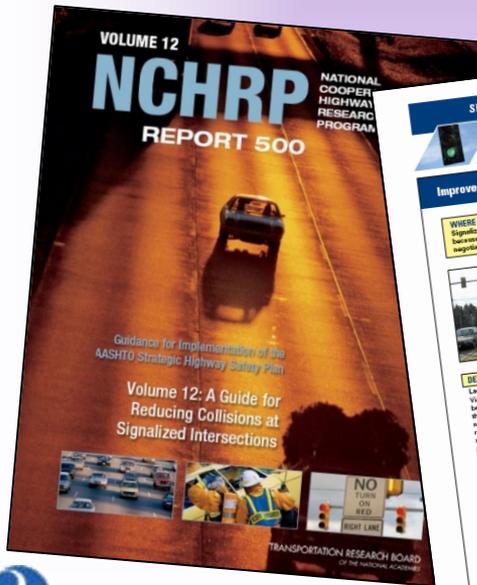
- Increase **visibility** of intersections and traffic control devices
- Increase **awareness** of intersections
- Improve the **design** of intersections to reduce conflicts
- Improve driver **comprehension** to reduce confusion
- Improve the **operations** of intersections
- Improve **sight distance** at intersections
- Improve driver **compliance** with traffic control devices

# Increasing Visibility

One signal head per lane



12" Lenses

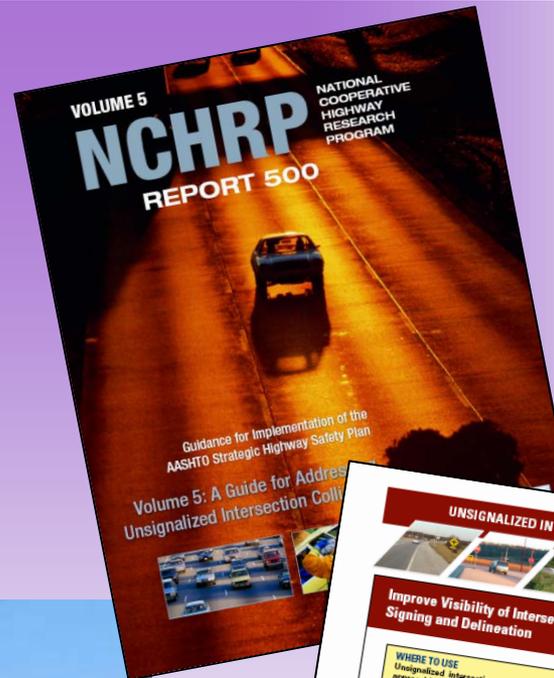


Backplates

# Increasing Visibility



Oversized Signs

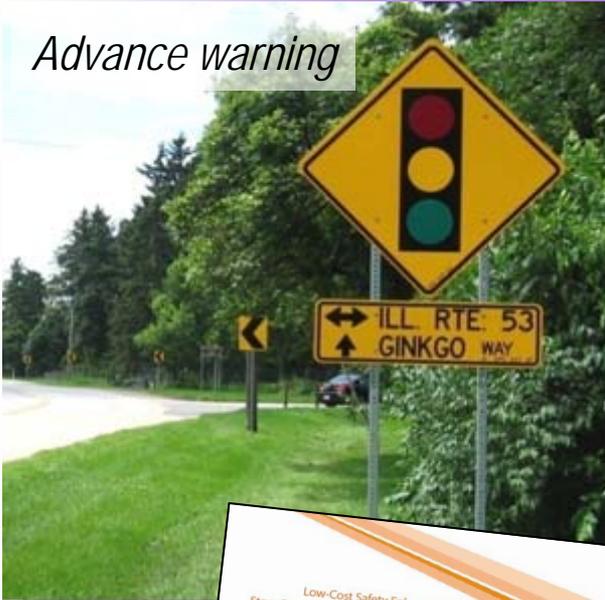


Street lights



# Increasing Awareness

*Advance warning*



*Splitter islands*

Low-Cost Safety Enhancements for Stop-Controlled and Signalized Intersections

**New!**



*Pavement markings*



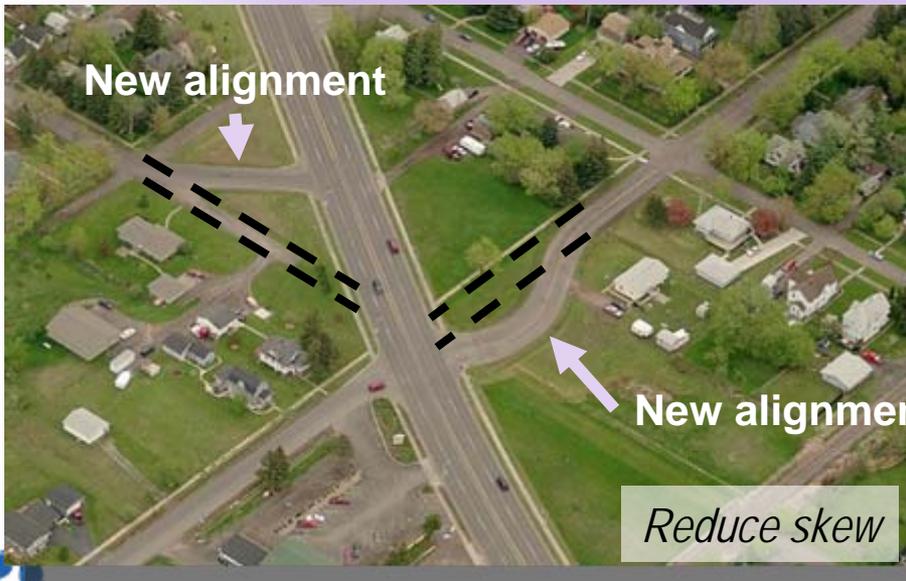
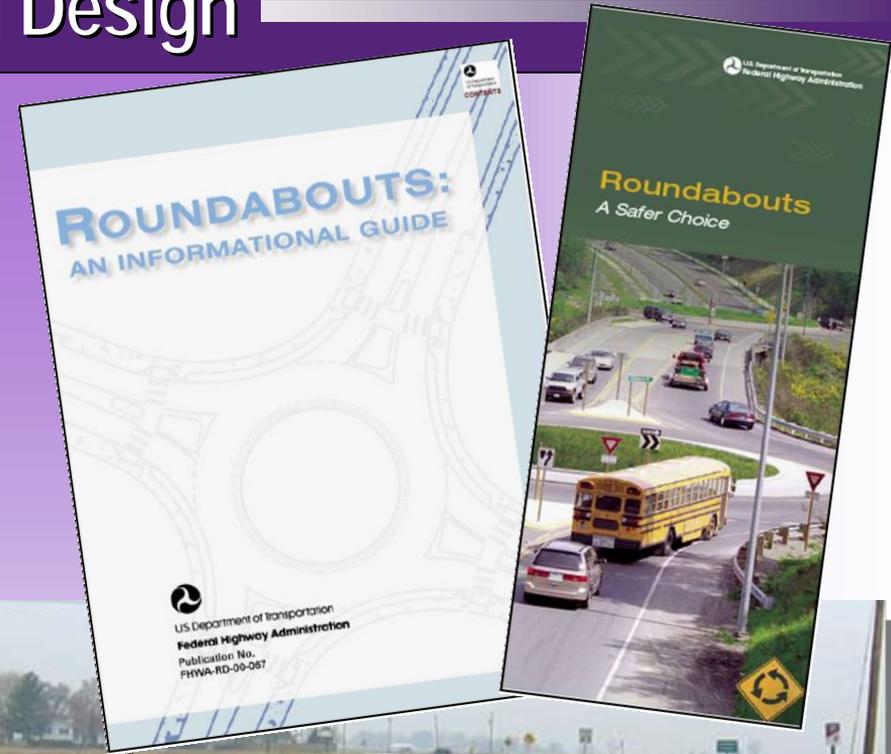
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# Improving Design



*Roundabouts*



*Reduce skew*



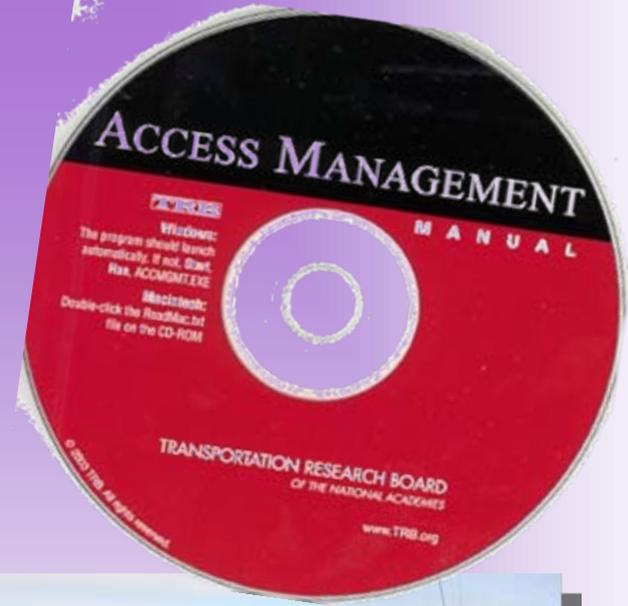
*Turn lanes*

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# Improving Design



*Access management*



*Close driveways*

# Improving Comprehension



*Overhead signing*

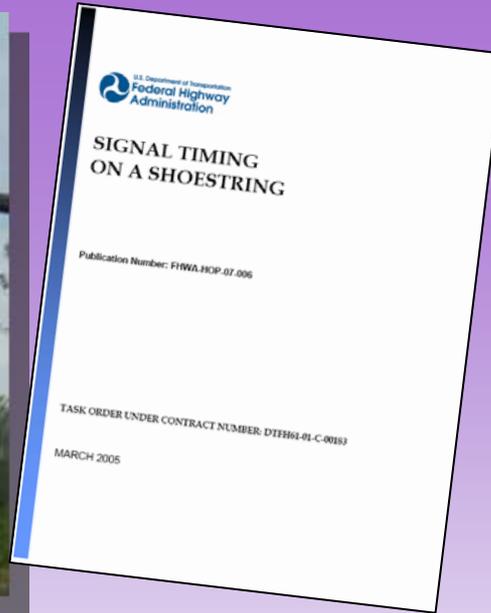


*Turn markings*

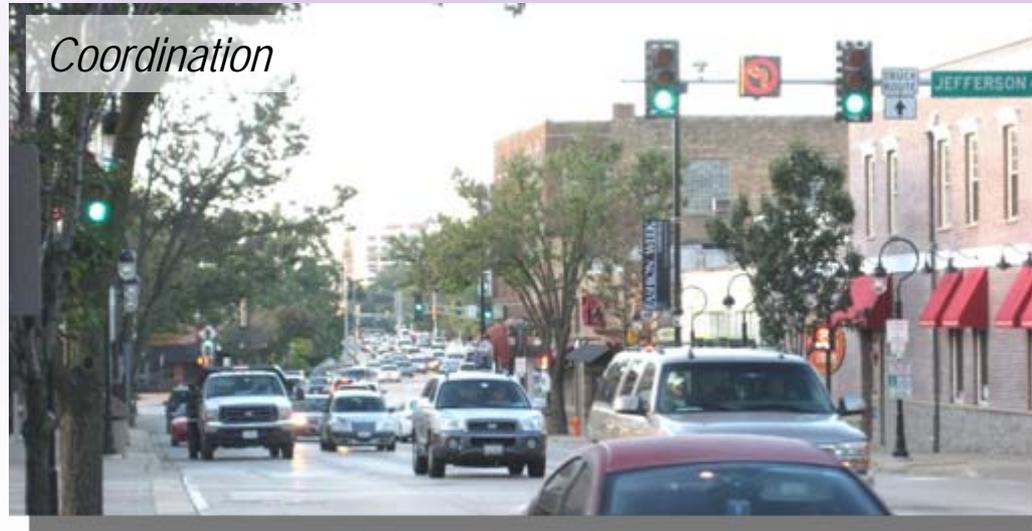
# Improving Operations



Phasing



Change intervals



Coordination



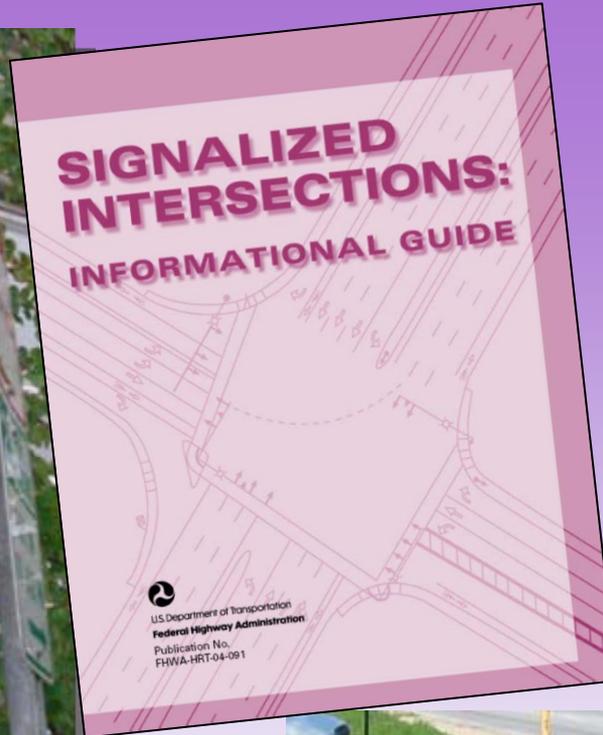
New!

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# Improving Operations



*Countdown signals*



*Turn restrictions*



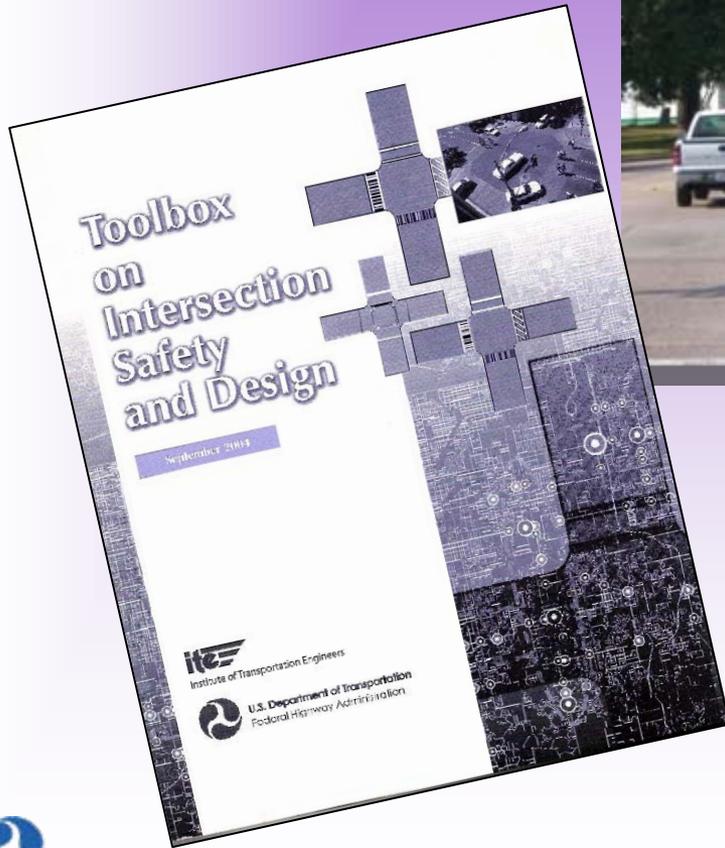
*Signal removal*

# Improving Sight Distance

*Clear sight triangles*



*Offset turn lanes*



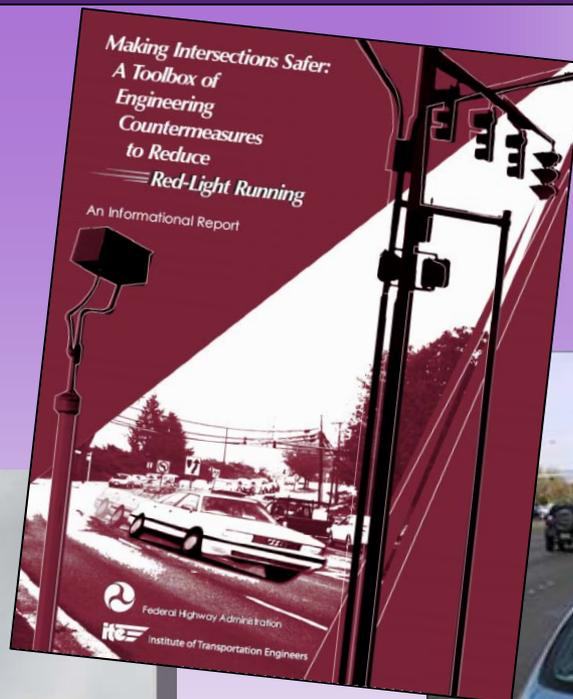
2010 Roadway for a Safer Future  
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# Improving Compliance



*Enforcement lights*



*Automated*



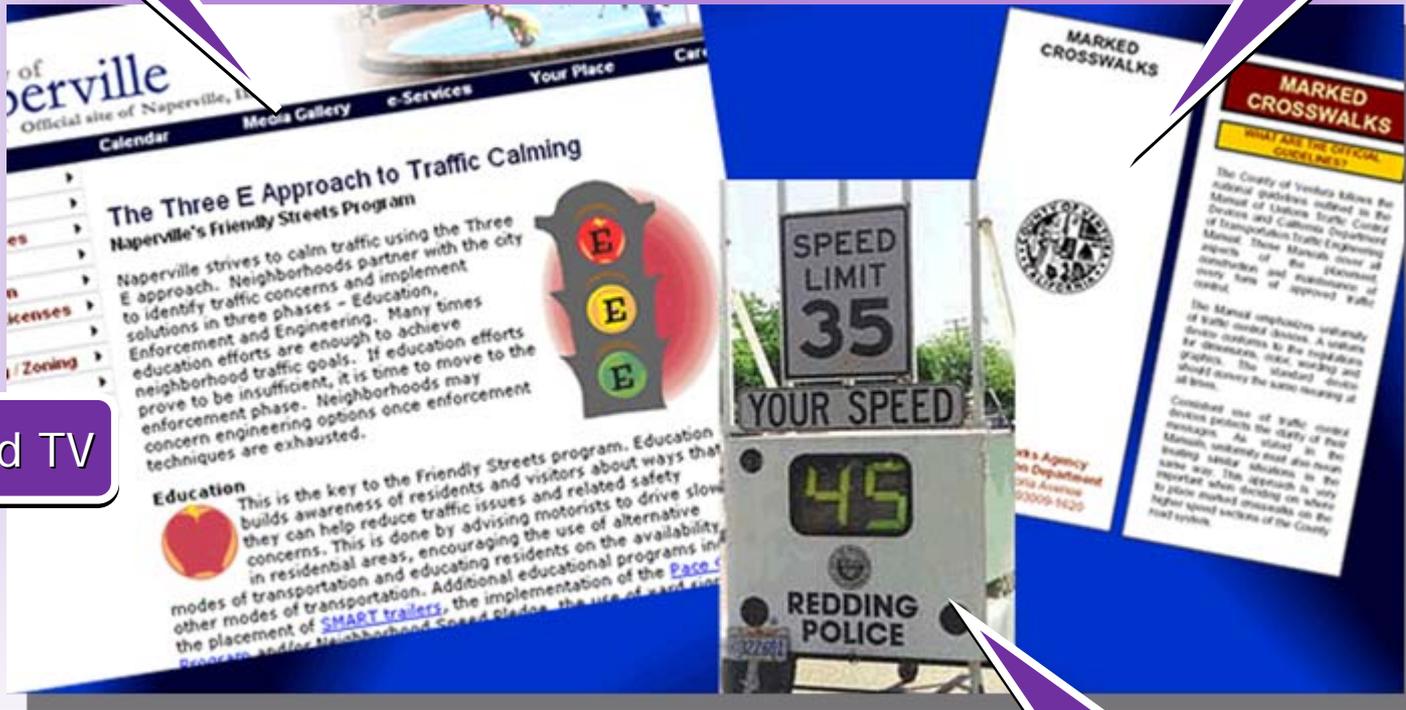
*Traditional*

# Information and Education

Web sites

In school programs

Printed material

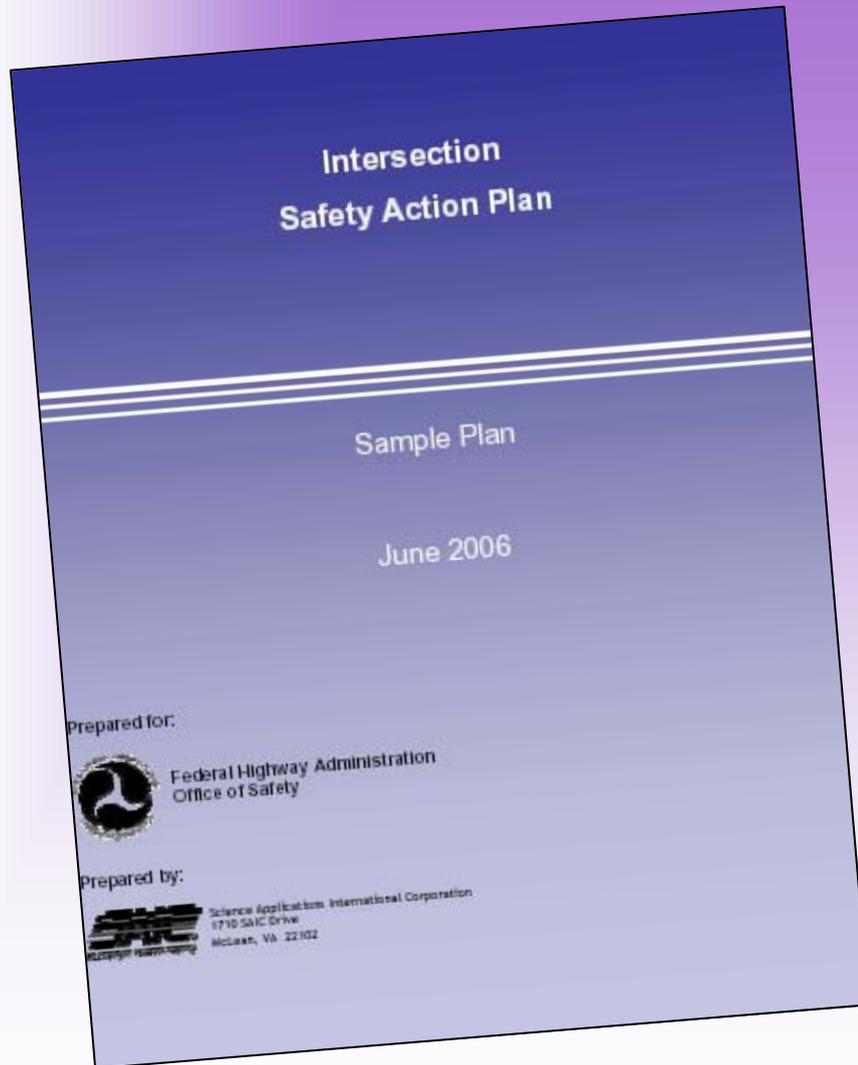


Radio and TV

Community outreach

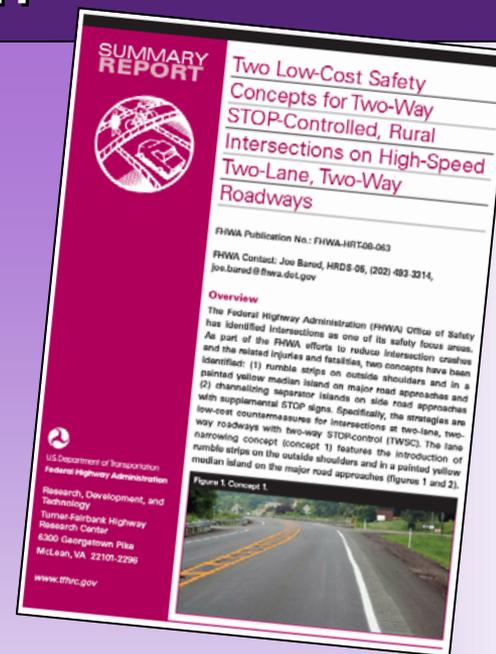
Speed trailers

# Intersection Safety Action Plan



Provides guidance on how to identify and systematically deploy cost-effective, publicly acceptable safety strategies that will result in a substantial statewide reduction of intersection fatalities and serious injuries.

# On-Going Research



- Speed reduction at two-way stop-controlled intersections with lane narrowing using rumble strips
- An informational report on four alternative/innovative intersections and two alternative interchanges
- Surrogate safety assessment model using traffic simulation
- Better signing of 3-lane roundabouts
- Field and laboratory studies of the restricted crossing U-turn intersection
- Field assessment of the detection control system
- Field evaluation of mini-roundabouts

# Training Opportunities



<http://nhi.fhwa.dot.gov/>

- Signalized Intersection Guidebook Workshop
- Intersection Safety Workshop
- Designing and Operating Intersections for Safety
- Interactive Highway Safety Design Model
- Roundabout Workshop
- Low-Cost Safety Improvements Workshop
- Low-Cost Safety Improvements (Blended Approach)
- Planning and Designing for Pedestrian Safety
- Application of Crash Reduction Factors (CRF)
- Science of Crash Reduction Factors



## For More Information

- FHWA Office of Safety
  - <http://safety.fhwa.dot.gov/>
- NCHRP Report 500 Series
  - <http://safety.transportation.org/>
- Manual on Uniform Traffic Control Devices
  - <http://mutcd.fhwa.dot.gov/>
- Toolbox on Intersection Safety and Design
  - <http://www.ite.org/>