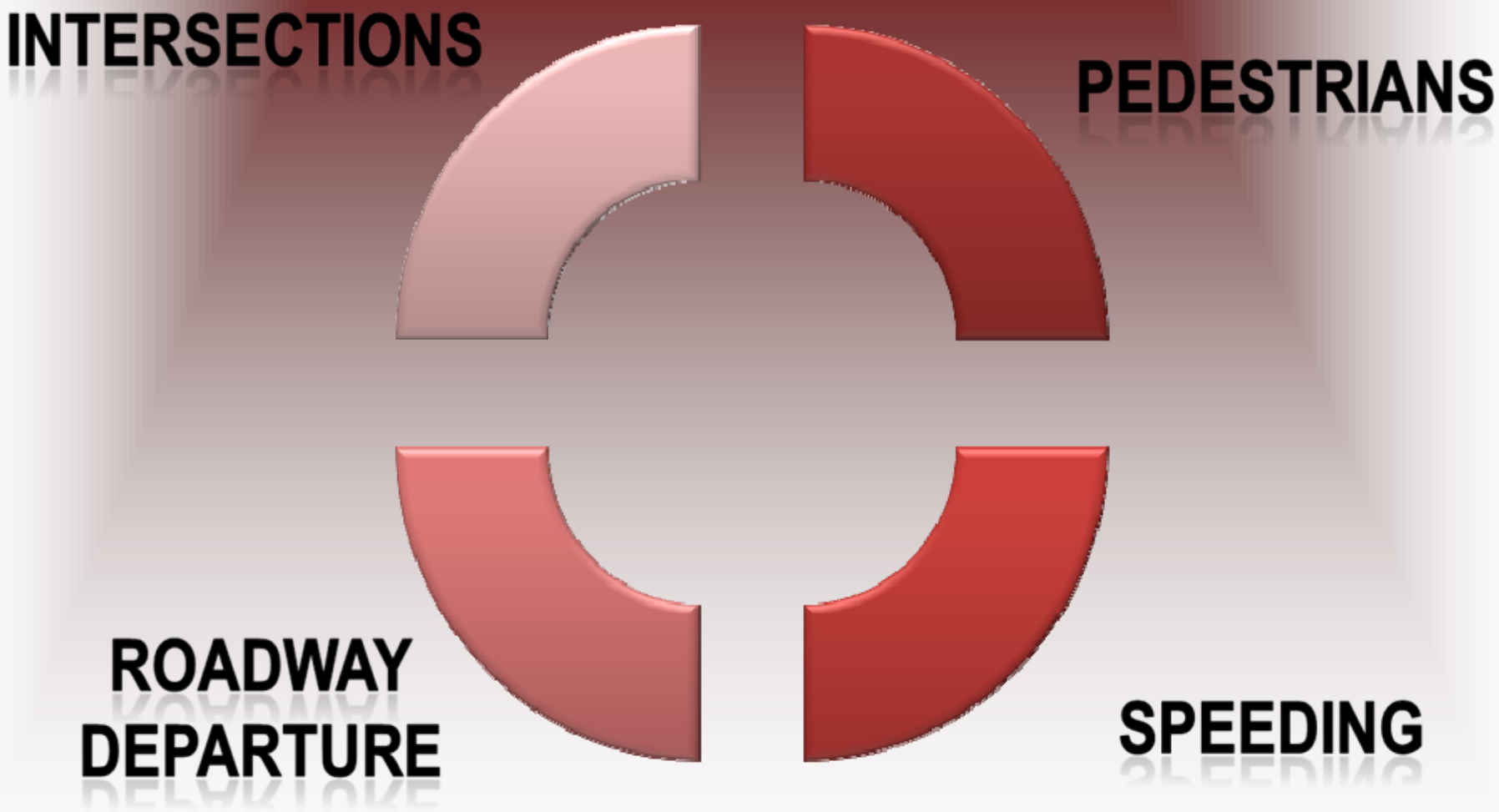
U.S.Department of Transportation
Federal Highway Administration

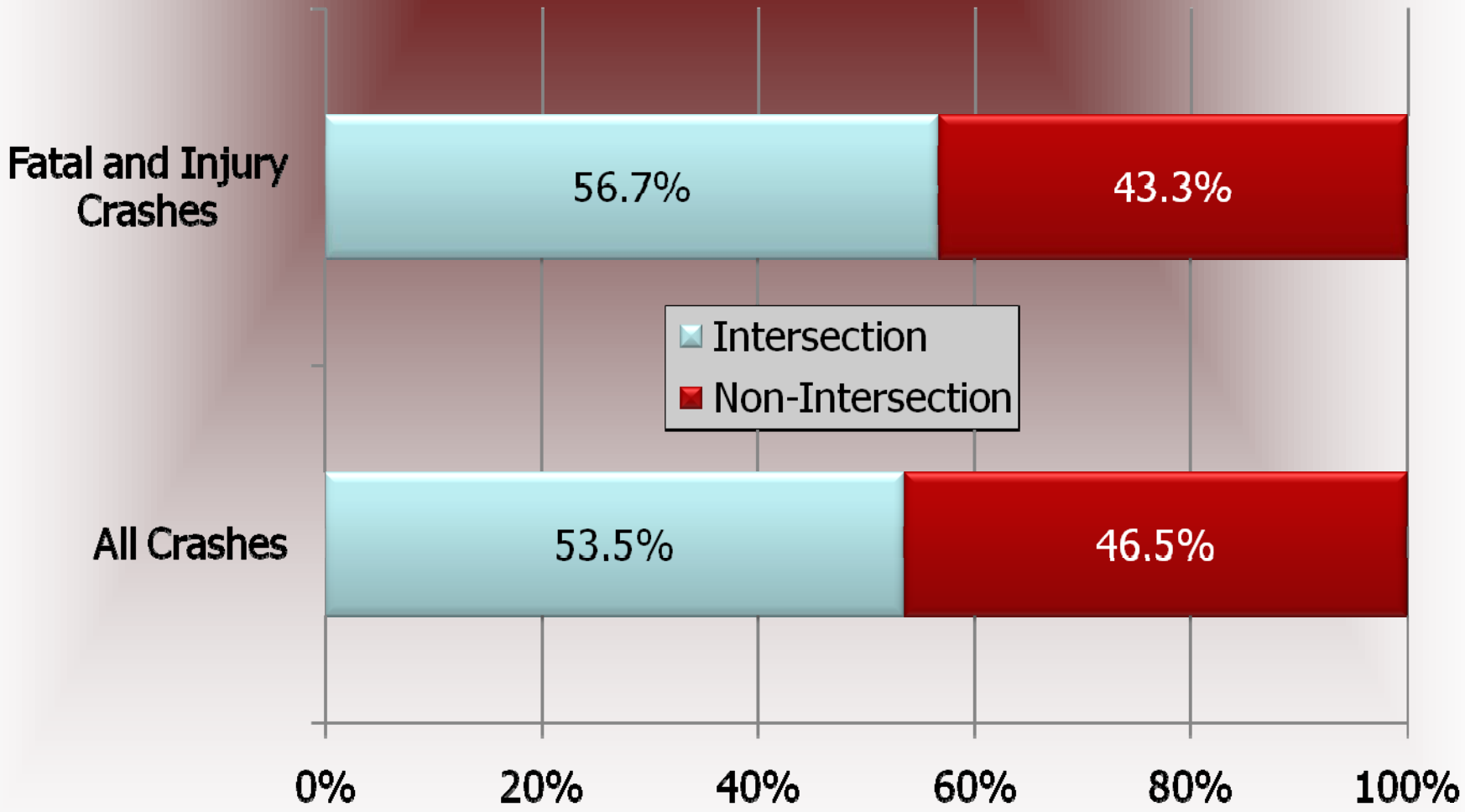
Safe Roads for a Safer Future
Investment in roadway safety saves lives

Safety at Unsignalized Intersections

FHWA Safety Focus Areas

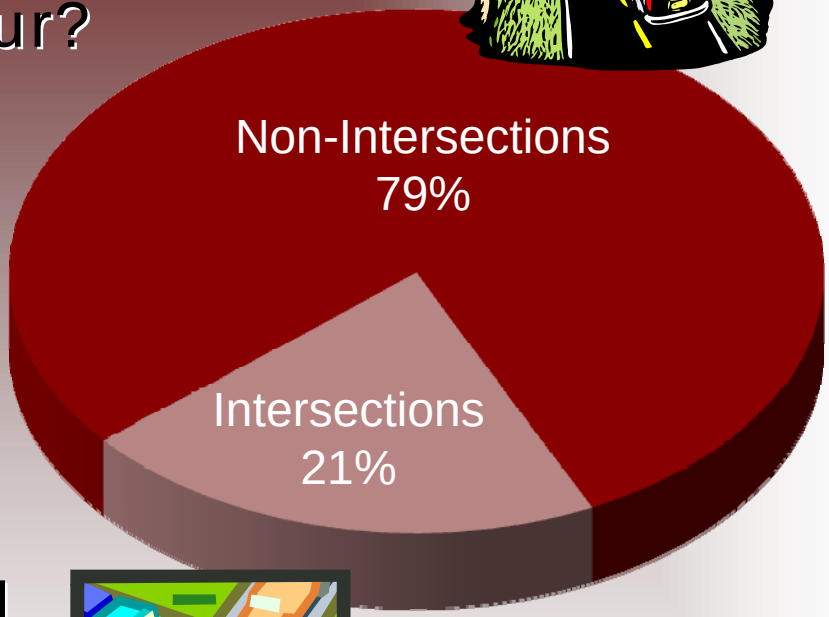


National Statistics



National Statistics

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

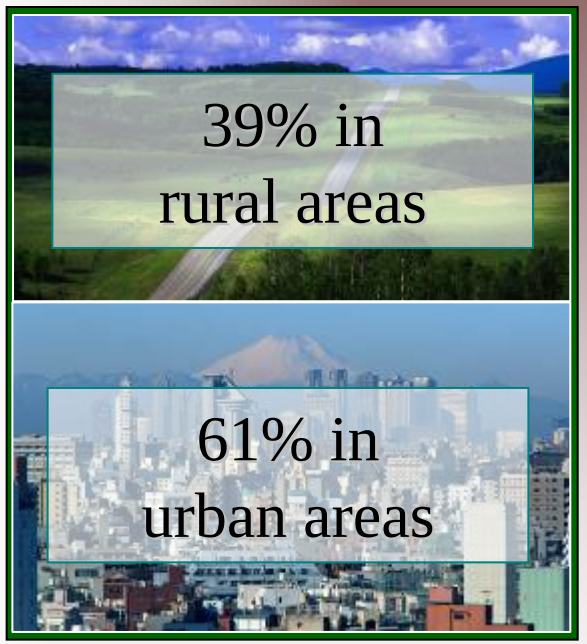


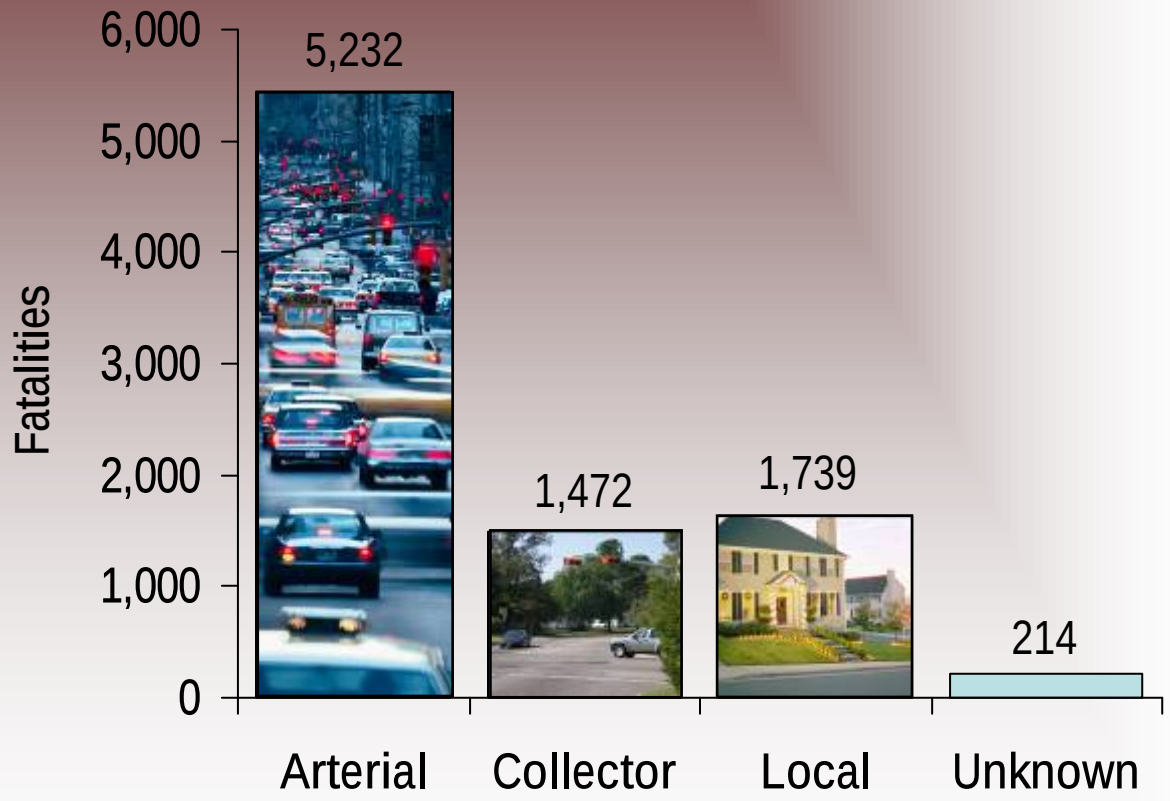
About half of <u>all</u> crashes and half of all injury crashes occur at intersections.

Intersection Fatalities

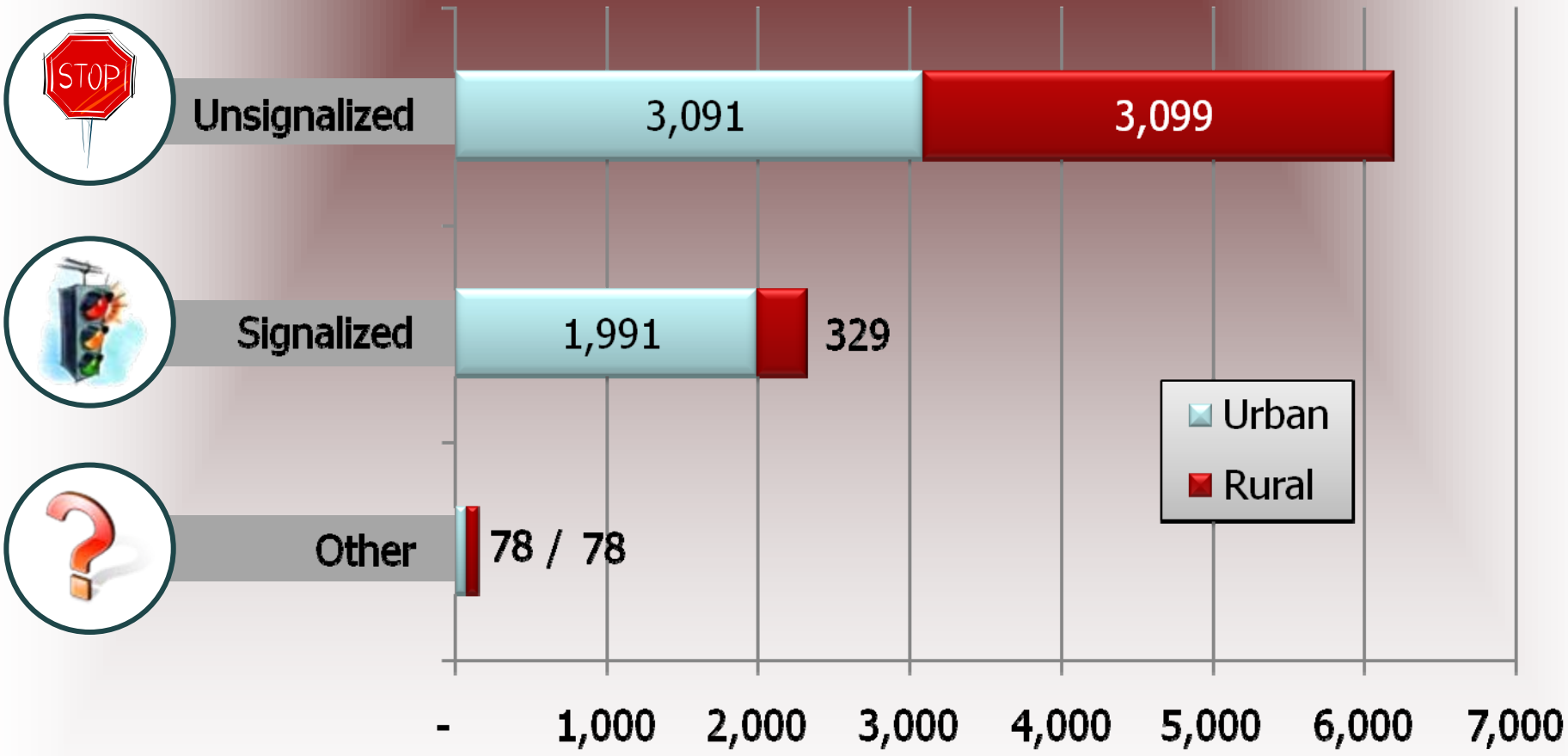
There were 8,657 intersection fatalities in 2007.

Where did they occur?



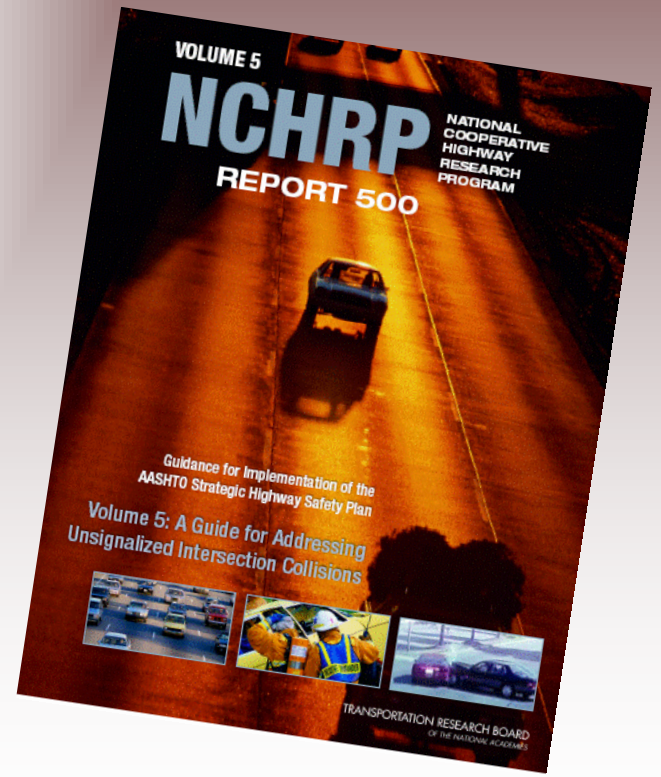


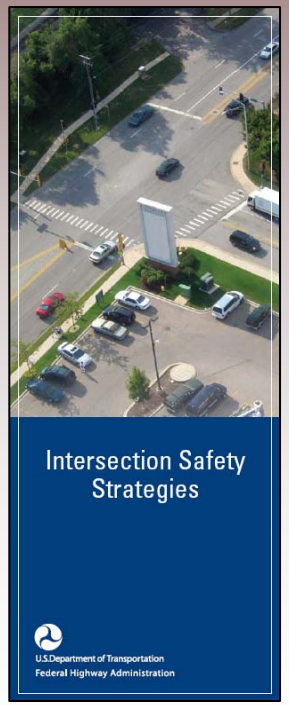
Intersection Fatalities



Intersection Safety Guidance

- NCHRP Report 500 Volume 5
- Guide sheets
- Safety Strategies brochure



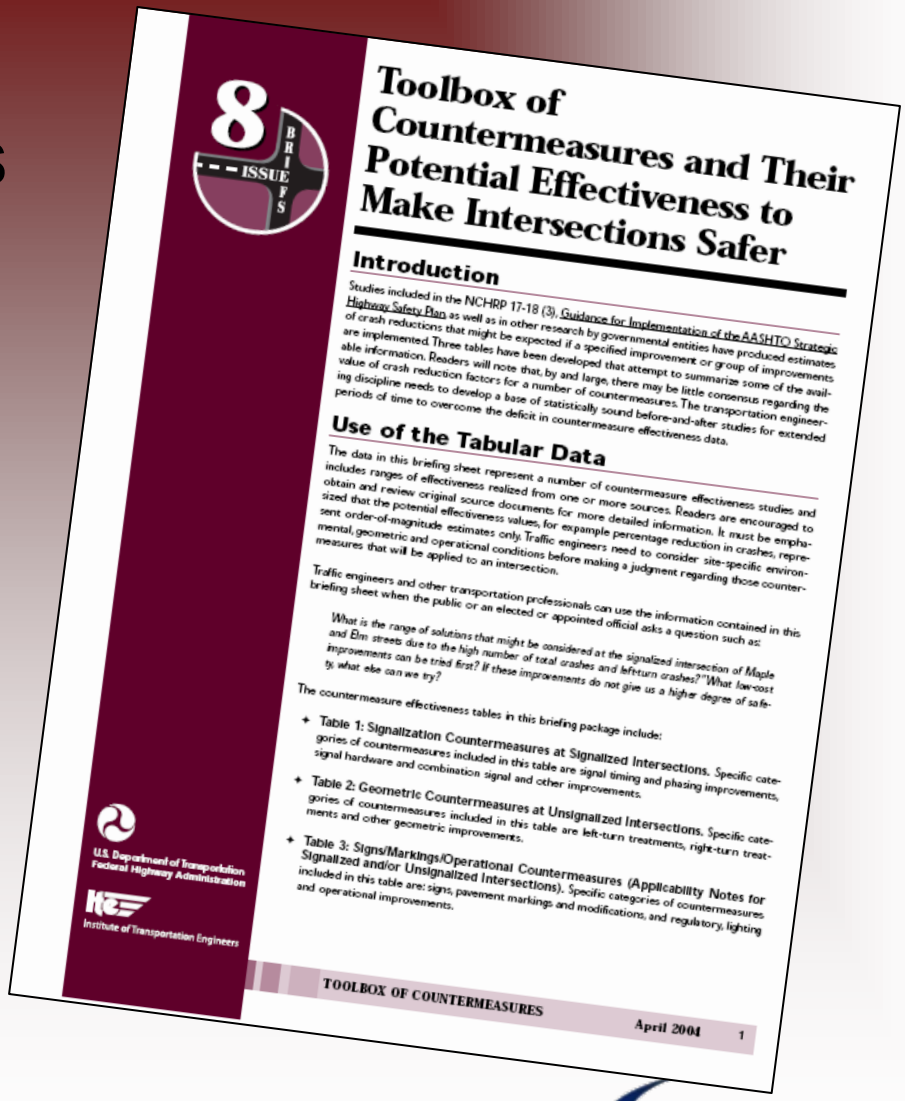


Typical Intersection Crash Types

- Right angle
- Rear end
- Left turn
- Sideswipe
- Pedestrian/bicycle

Crash Reduction Factors

- Quantitative results from research or other studies
- Expected reduction in crashes from implementation of a specific countermeasure



8 ISSUE BRIEFS

U.S. Department of Transportation
Federal Highway Administration

Institute of Transportation Engineers

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 expample 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:

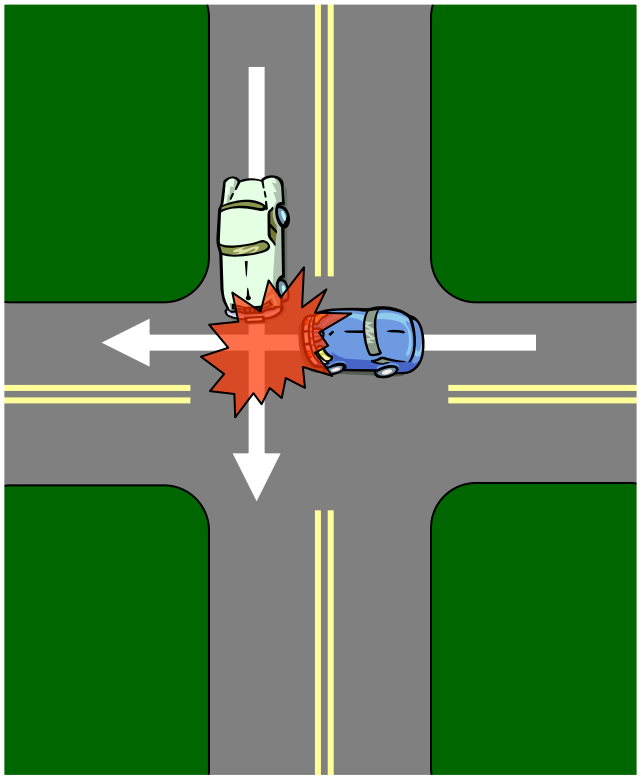
What is the range of solutions that might be considered at the signalized intersection of Maple and Elm streets due to the high number of total crashes and leftturn crashes? What low-cost improvements can be tried first? If these improvements do not give us a higher degree of safety, what else can we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

TOOLBOX OF COUNTERMEASURES April 2004 1

Angle Crashes

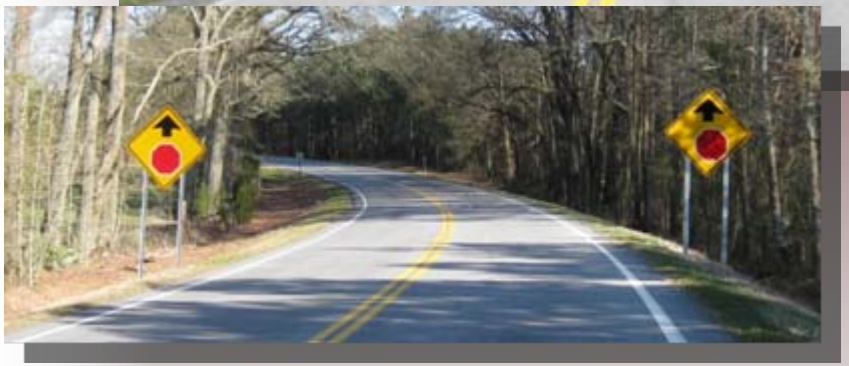


- Account for 53% of fatal crashes at unsignalized intersections
- Potential countermeasures:
  - Clear sight triangles
  - Improve awareness of intersection
  - Apply access management
  - Improve turn lane design
  - Construct roundabouts
  - Construct acceleration lanes
  - Close/relocate intersections
  - Reduce/eliminate skew
  - Post appropriate speed limits
  - Targeted enforcement

Clear Sight Triangles

Improve Awareness of Intersection

Double Warning Signs



Oversize Signs

Improve Awareness of Intersection

Splitter Island

Supplemental Beacons

Improve Awareness of Intersection

Provide Lighting

Install Rumble Strips

Apply Access Management

Right-in/Right-Out

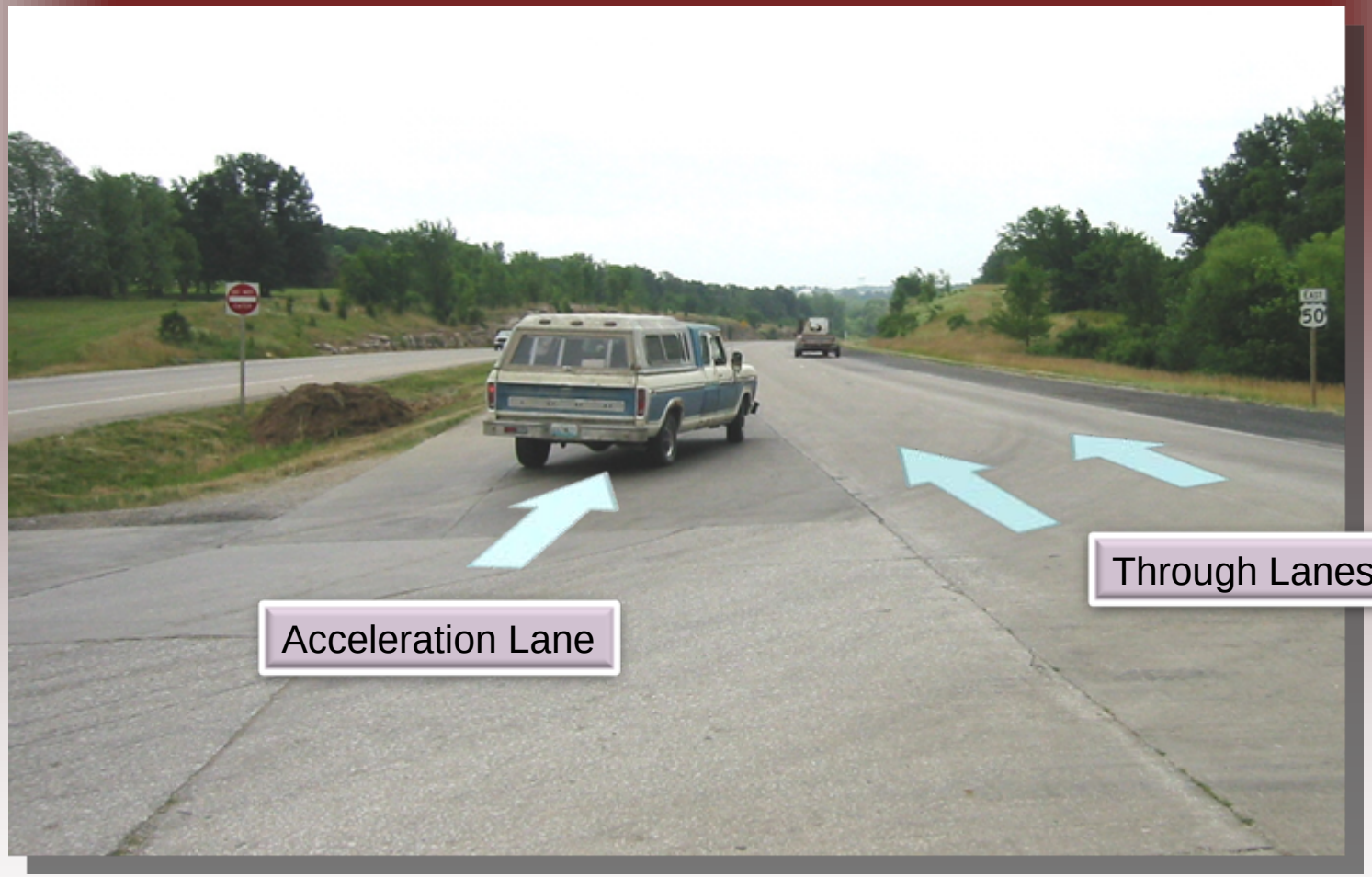
Channelization

Improve Turn Lane Design

Offset Right Turn Lane

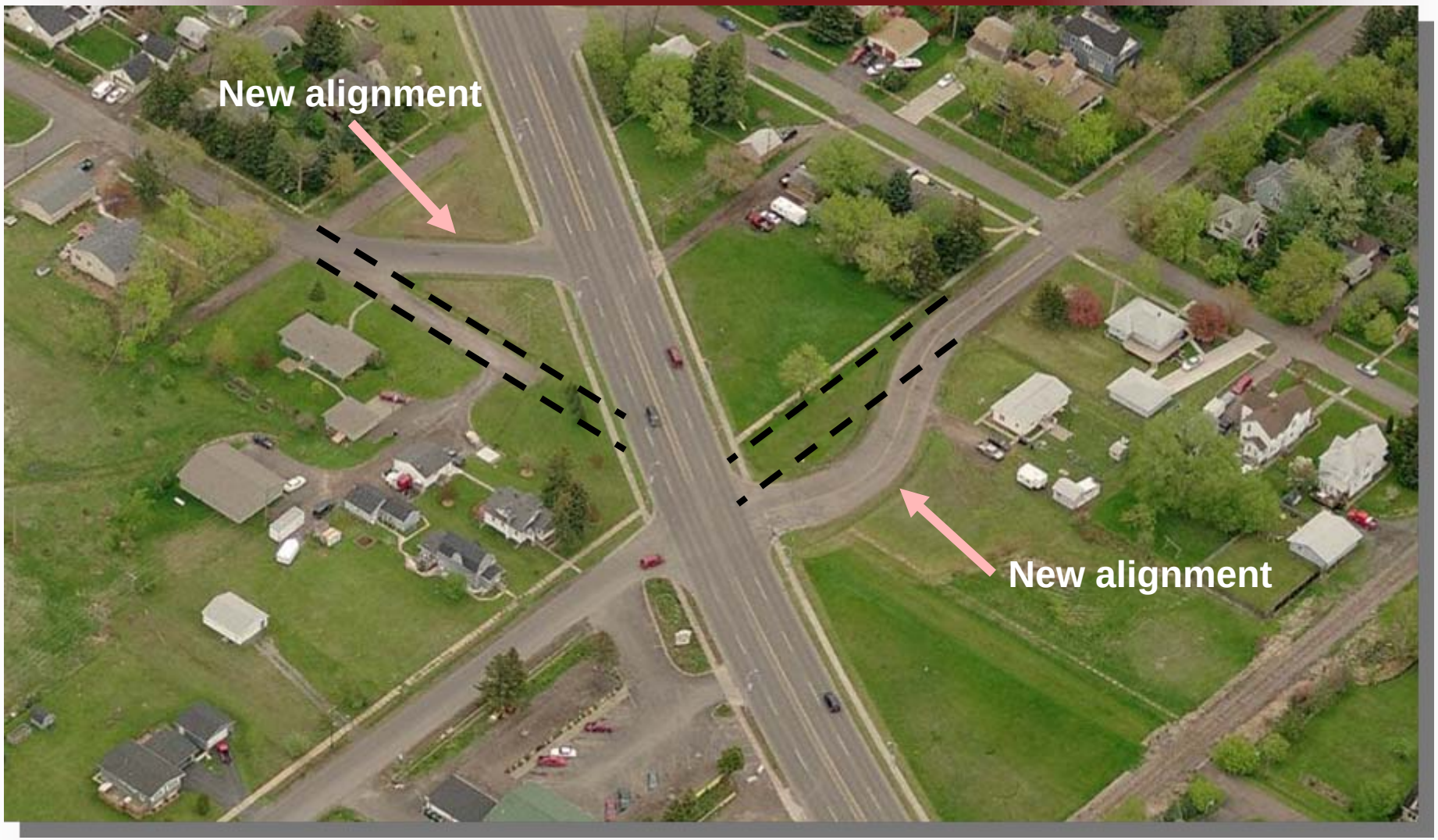
Construct Roundabouts

Construct Left-Turn Acceleration Lanes



Close / Relocate Intersection

Reduce/Eliminate Skew



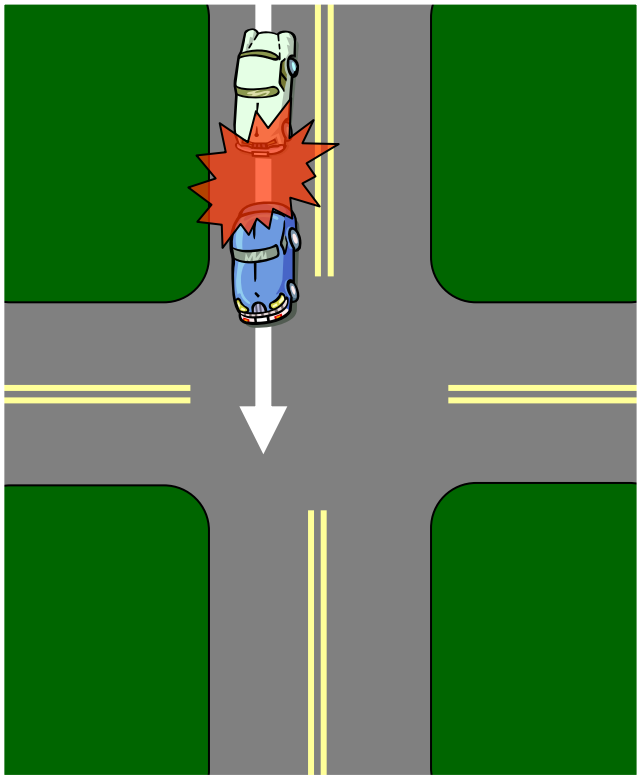
Post Appropriate Speed Limits on Approaches

Targeted Enforcement

Speed violations

Stop violations

Rear End Crashes

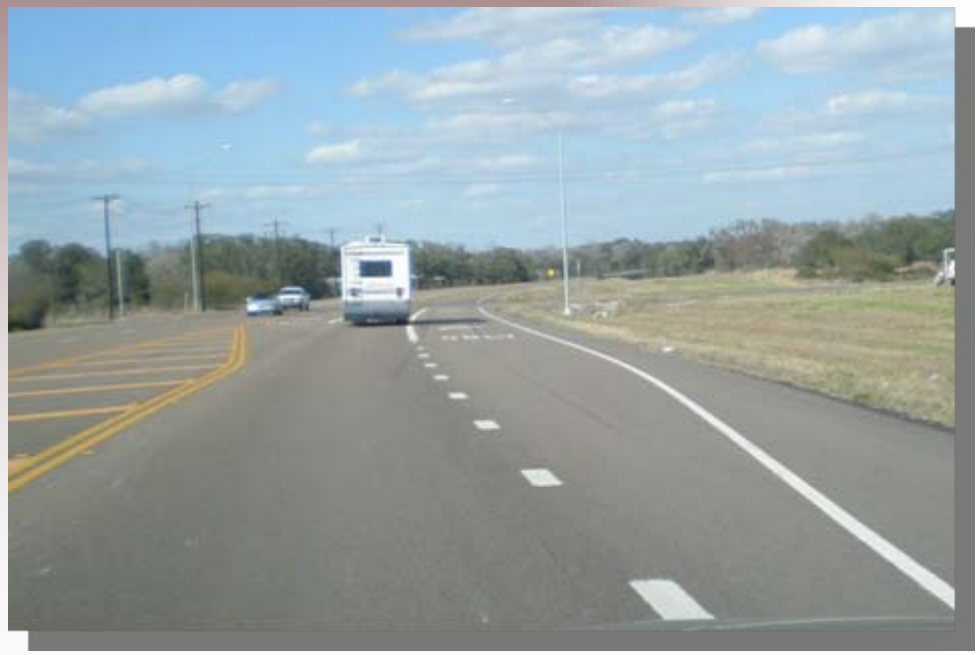


- Account for 6% of fatal crashes at unsignalized intersections
- Potential countermeasures:
  - Install turn lanes
  - Supplemental overhead signing
  - Provide shoulder bypass lanes
  - Provide pavement markings
  - Provide right-turn acceleration lanes
  - Construct roundabouts*
  - Provide left-turn acceleration lanes*
  - Provide lighting*
  - Post appropriate speed limits*
  - Improve intersection awareness*

* Discussed previously

Install Turn Lanes

Left turn lanes



Right turn lanes

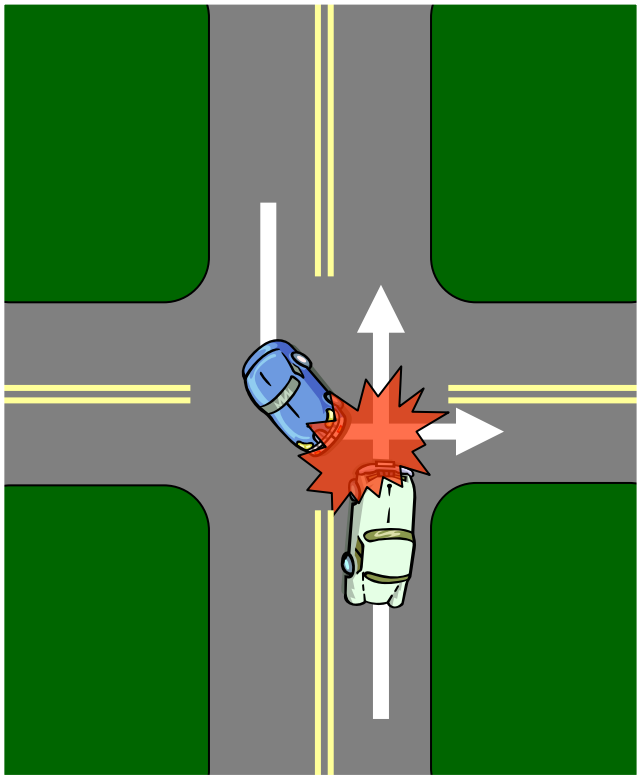
Supplemental Overhead Signing

Provide Shoulder Bypass Lanes

Provide Pavement Markings

Provide Right-Turn Acceleration Lanes

Left Turn Crashes



- Account for 8% of fatal crashes at unsignalized intersections
- Potential countermeasures:
  - Improve turn lane design
  - Implement turn restrictions
  - Use indirect left turn treatments
  - Provide lighting*
  - Clear sight triangles*
  - Provide left turn acceleration lanes*
  - Construct roundabouts*
  - Close/relocate high-risk intersections*

* Discussed previously

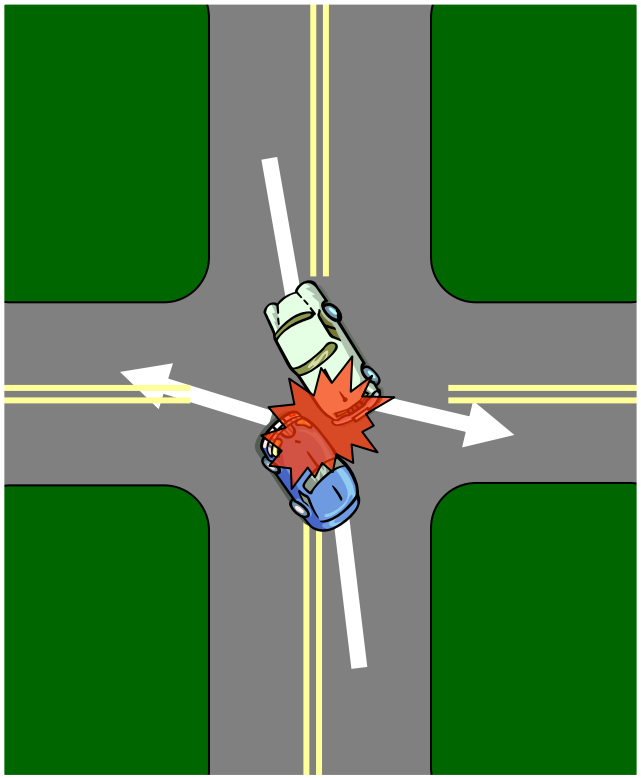
Improve Turn Lane Design

Improve Turn Lane Design

Implement Turn Restrictions

Use Indirect Left Turn Treatments

Sideswipe Crashes



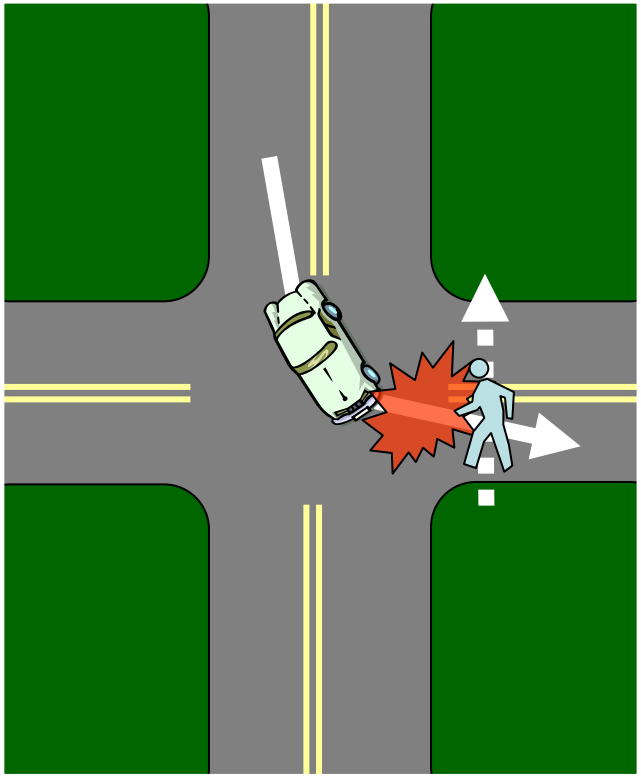
- Account for 2% of fatal crashes at unsignalized intersections
- Potential countermeasures:
  - Install pavement markings
  - Provide lane assignment signing or marking
  - Provide right-turn acceleration lanes*

* Discussed previously

Provide Striping in Median Area

Lane Assignment Signing/Marking

Pedestrian/Bicycle Crashes



- Account for 14% of fatal crashes at unsignalized intersection crashes
- Potential countermeasures:
  - Improve pedestrian/bicycle facilities
  - Provide traffic calming
  - Information and education

Improve Pedestrian/Bicycle Facilities

Advance crossing warning

Continuous/Setback Sidewalks

Provide Traffic Calming

Neighborhood circles

Pedestrian bulb-outs

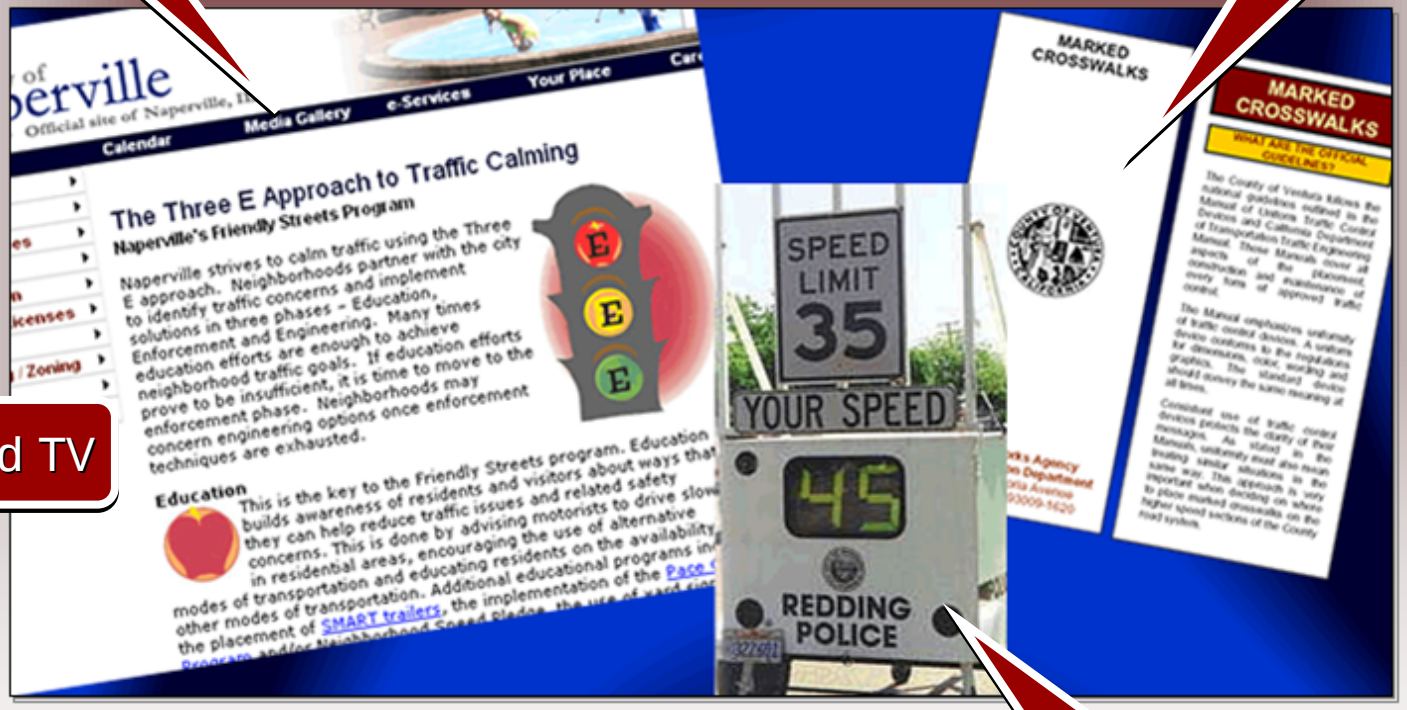
Information and Education

Web sites

In school programs

Printed material

Radio and TV



Community outreach

Speed trailers

For More Information

- AASHTO Report 500 Series Volume 5
  - 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/
- FHWA Office of Safety
  - http://safety.fhwa.dot.gov/