

# LOW COST SAFETY IMPROVEMENTS

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*Practitioner  
Workshop*

**Introduction  
– Session #1**



# Course Instructor

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- **Dean Larsen, Safety and Design Technical Service Team, FHWA Resource Center @ Baltimore**  
**Dean.Larsen@fhwa.dot.gov**

# Self Introductions

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- **Who you are**
- **Who you work for and what you do**
- **What experience you have with safety improvements**
- **What you want to get out of the course**

# Introduction

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## Learning Objectives:

- Review National Traffic Crash Experience
- Relate the application of low cost safety improvements to substantive safety

# Introduction

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## Traffic Safety Facts 2005:

- ❑ 43,443 Deaths

MO : 1,257 Deaths

- ❑ 2,699,000 Injuries

- ❑ 6.159 million police reported crashes
  - A crash every 5 seconds
  - An injury every 10 seconds
  - A fatality every 13 minutes

## Traffic Safety Facts, Missouri , 2005

Fatality Rates: Missouri , U.S. and Best State, 2005

2005	Fatalities	Fatality Rate per 100M VMT	Fatality Rate per 100K Population
Missouri	1,257	1.83	21.67
US	43,443	1.45	14.66
Best State*		0.80	6.91

\*Best Rates: Lowest Rates Attained Across All States

2005 Vehicle Miles Traveled (VMT) Data is Currently Not Available

Trend of Fatalities, 2001 - 2005

		2001	2002	2003	2004	2005
Fatality Counts	Total Fatalities	1,098	1,208	1,232	1,130	1,257
	Alcohol-Related	520	518	493	460	515
	Single Vehicle	624	667	668	639	712
	Non-Junction	884	917	948	896	1,019
	Intersection	131	174	156	140	134
	Intersection-Related	22	33	42	33	33
	Speeding Involved	444	509	517	494	529
	Pedestrians	83	87	78	81	88
	Pedalcyclists	6	16	9	3	8
	Large Truck Involved	139	154	167	158	166
	Roadway Departure	725	761	788	776	888
	Passenger Car Occupants	572	584	606	552	582
	Light Truck/Van Occupants	349	411	388	396	437
	Other/Unknown Occupants (not including Motorcycles)	35	48	57	41	42
	Total Occupants (not including Motorcycles)	956	1,043	1,051	989	1,061
	Motorcycle Riders	53	60	90	56	91

## Top 10 Counties for Fatalities/Fatality Rates

Rank by Number of Fatalities

Rank	County	Fatalities	Rate per 100,000 Population
1	Jackson	85	12.82
2	St. Louis	73	7.27
3	St. Louis city	54	15.68
4	Greene	49	19.54
5	Jefferson	42	19.66
6	Franklin	40	40.37
7	Clay County	31	15.34
8	St. Charles	27	8.18
9	Boone County	26	18.14
10	Buchanan	26	30.62

Rank by Rate of Fatalities

Median Rate for all U.S. Counties : 23.23

Rank	County	Fatalities	Rate per 100,000 Population
1	Daviess County	8	98.51
2	Dallas County	15	91.26
3	Reynolds	5	75.93
4	Pemiscot	14	72.12
5	Shannon County	6	71.71
6	Pike County	13	69.29
7	Clark County	5	68.28
8	Mississippi	9	66.18
9	Montgomery	8	65.76
10	Lawrence	22	59.26

## Other Statistics of Interest

	Fatalities in Missouri	Percent of Total Fatalities in Missouri	Fatalities in US	Percent of Total Fatalities in US
Intersection Fatalities	134	11%	7,796	18%
Pedestrian Fatalities	88	7%	4,881	11%
Pedalcyclists	8	1%	784	2%
Fatalities in Crashes Involving Large Trucks	166	13%	5,212	12%
Roadway Departure Fatalities*	888	71%	25,397	58%
Passenger Cars	582	46%	18,440	42%
Light Trucks and Vans	437	35%	12,975	30%
Other/Unknown**	42	3%	1,626	4%
Total Vehicle Occupants	1,061	84%	33,041	76%
Motorcycle Riders	91	7%	4,553	10%
Total Nonoccupants***	105	8%	5,849	13%
Total Fatalities	1,257		43,443	

\*Fatalities based on FHWA Definition

\*\*Includes Occupants of Large Trucks, Buses and Unknown Vehicle Types

\*\*\*Includes Pedestrians, Pedalcyclists and Other Non-Motorists

# Introduction

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## Cost of All Crashes in U.S. (Year 2000)

❑ \$231 Billion

❑ \$820 for every person in the U.S.

❑ 2.3% of the GDP

# Introduction

Roadway Segment Crash Distribution  
By Rural vs. Urban

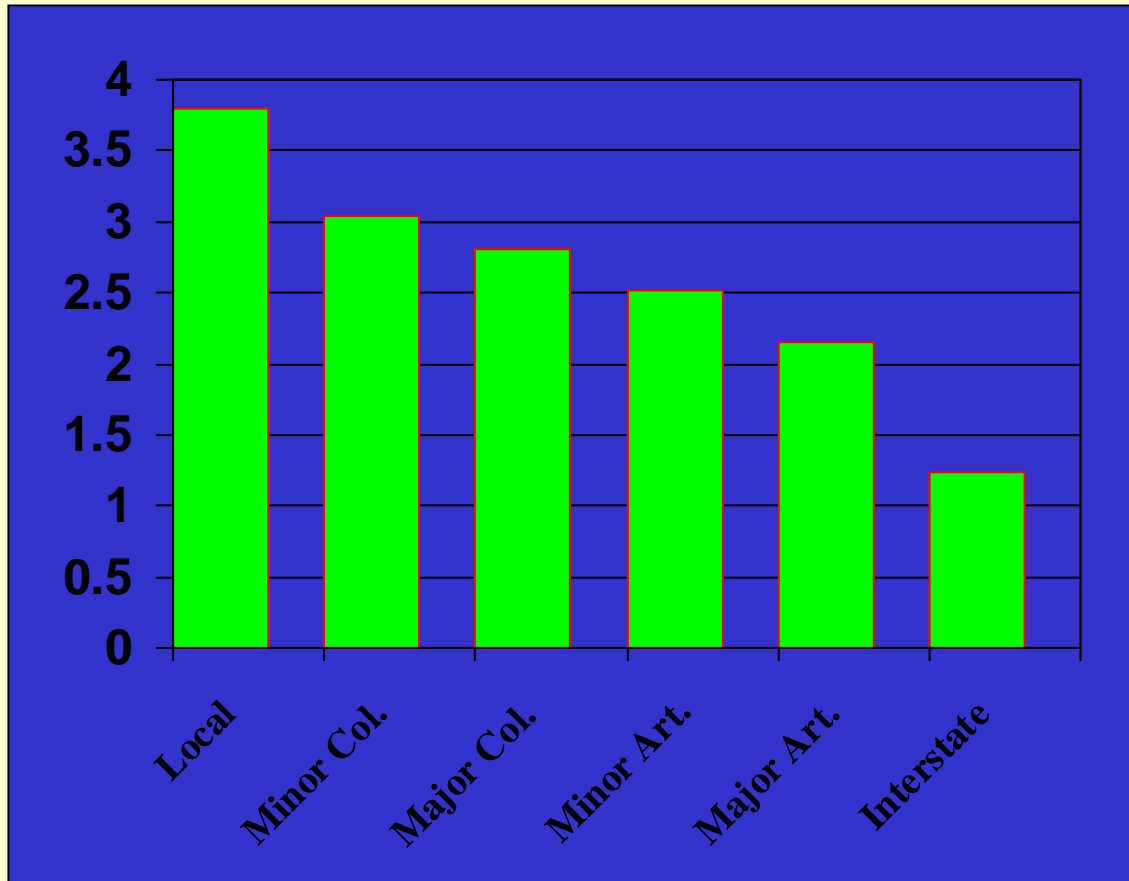


99 DATA

Note: Percentages rounded

# Introduction

## Rural Road Safety by The Numbers



□ Fatality Rate is 2.5 times that for Urban Roads.

□ 40 % of Travel and 60% of Fatalities

# Introduction

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## □ What is “low cost” ?

- Agency definition
- Funding source (capital program, 3R, or Operation and Maintenance budget)
- Developer funded

## □ No “official” definition in this course

- One agency’s “low cost” is another agency’s “too expensive” !
- Generally < \$10,000

# Introduction

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- What is a Low Cost Safety Measure?**
- Let's list some**

# Introduction

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## Discussion



## Low Cost Safety Improvements:

- Signs
- Delineators
- Markings
- Signal timing and equipment
- Shoulder Rumble strips
- Safety Edge
- Lighting
- Others

# Introduction

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~~Safety~~ — an absolute

“Safer” - a relative term

# Key Safety Principles and Design

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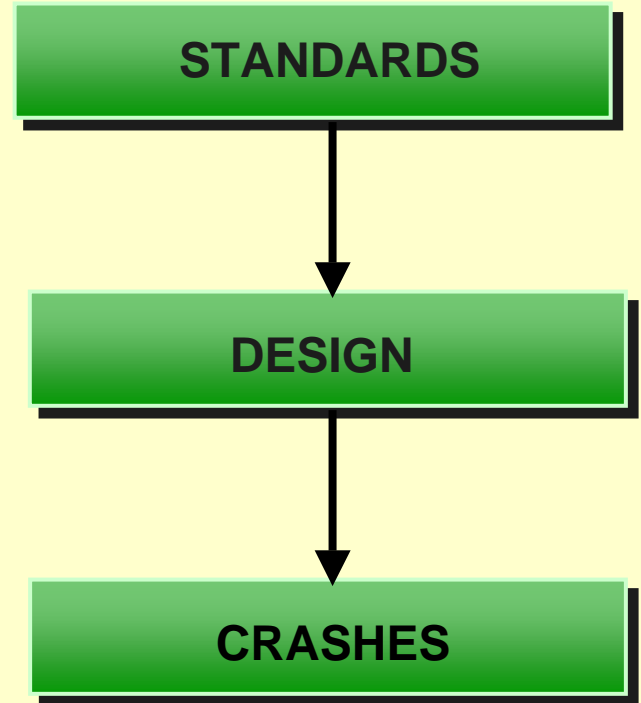


- ❑ No highway is safe, only safer or less so
- ❑ We know how to make highways safer
- ❑ Law of diminishing marginal returns applies
- ❑ Money should be spent effectively

# Link Between Standards and Safety

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- ❑ How can we make highways sufficiently safe?
- ❑ Does applying standards achieve it?
- ❑ How about cost-benefit?
- ❑ What can road professionals do?



# Is this road 'safe' or 'unsafe'?

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# Introduction

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- What are some Low Cost Safety Measures (ie, Traffic Control Devices, shoulder rumble, lighting....) that could make this road safe?
- Let's list them

# Is this road 'safe' or 'unsafe'?

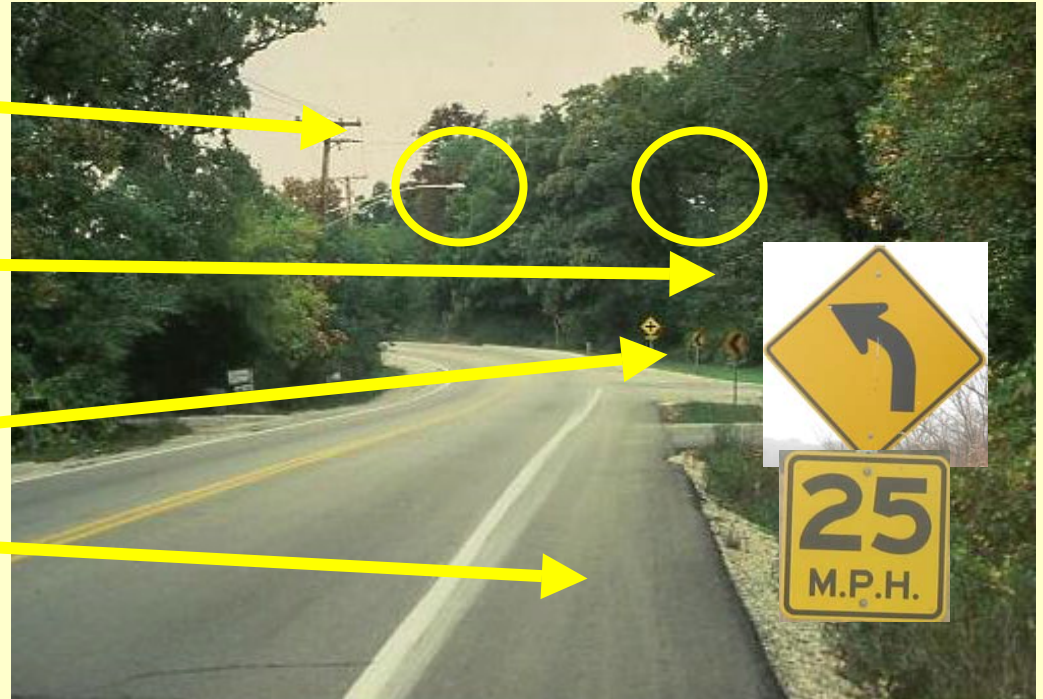
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- Advance Warning Signs
- Delineators
- Chevrons
- Shoulder Rumble Strip
- Lighting

# Is this road 'safe' or 'unsafe'?

- Lighting
- Advance Warning Signs
- Delineators
- Chevrons
- Shoulder Rumble Strip



Which of these low cost measures are required?

# Substantive and Nominal Safety

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- ***Nominal Safety*** is examined in reference to compliance with standards, warrants, guidelines and sanctioned design procedures
- ***Substantive Safety*** is the actual crash frequency and severity for a highway or roadway

# Nominal Safety

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**Nominal Safety** – Advance  
Warning Sign + Advisory  
Speed Plaque

# Substantive and Nominal Safety

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**Nominal Safety**



**1<sup>st</sup> Step**

**Complies ?**

**Yes**

**No**

- **Defines users legal behavior**
- **Provides for special user needs**
- **Protects professionals from claims of legal liability**

# Nominal Safety

## 1<sup>st</sup> Step



**Nominal Safety** – Advance Warning Sign + Advisory Speed Plaque

- Speed limit = 45 mph
- Traffic Volume = 2,000
- Expect 2 crashes per year at this traffic volume
  
- What if this curve experienced 7 crashes in the past two years?

# Nominal and Substantive Safety

## 1<sup>st</sup> Step



**Nominal Safety** – Advance Warning Sign + Advisory Speed Plaque

## 2<sup>nd</sup> Step

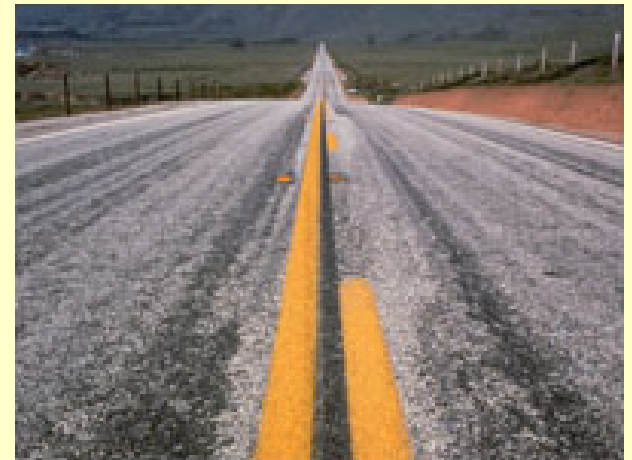


Advance Warning Sign + Advisory Speed + Chevrons = “**Safer**” = **Substantive Safety**

# Key Safety Principles and Design

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- ❑ Knowledge is imprecise, judgment is essential
- ❑ Meeting standard (Green Book and MUTCD) does not necessarily make highway safe
- ❑ Important features of highways not always determined by standards



# Introduction

## Example:



**Nominal Safety** –  
Advance Warning  
Sign – Conventional  
Road Size



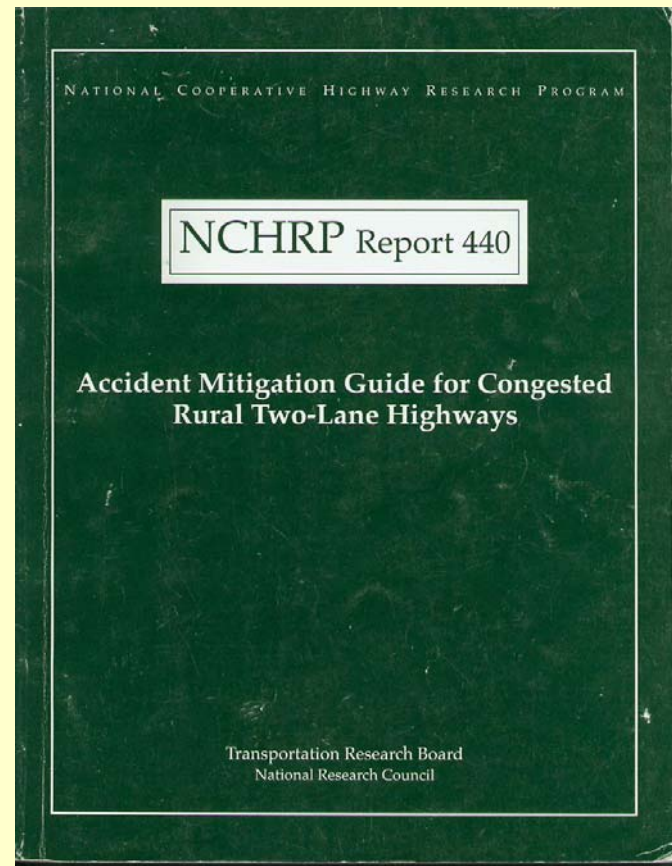
+Oversize +Double-Up  
+Yellow Flashers = 25% to  
35% reduction in Crashes =  
**Substantive Safety**

# Introduction

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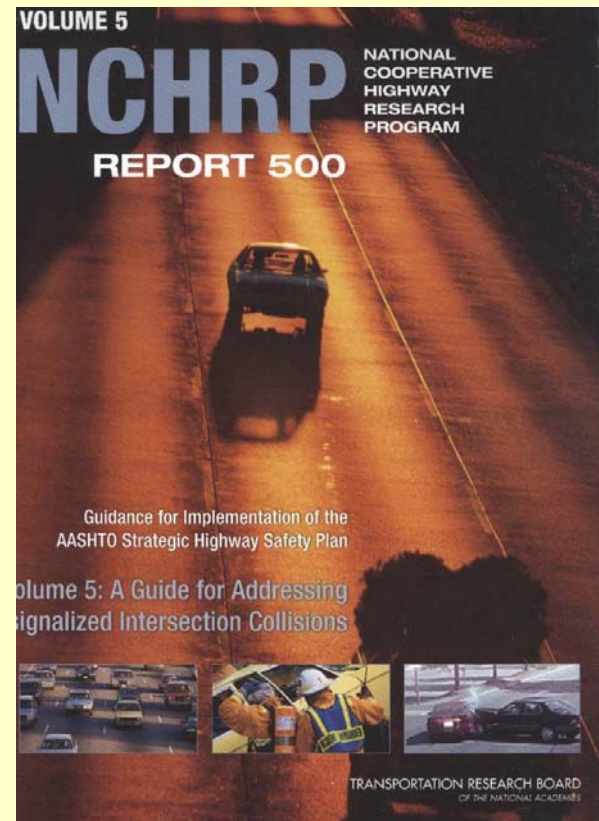
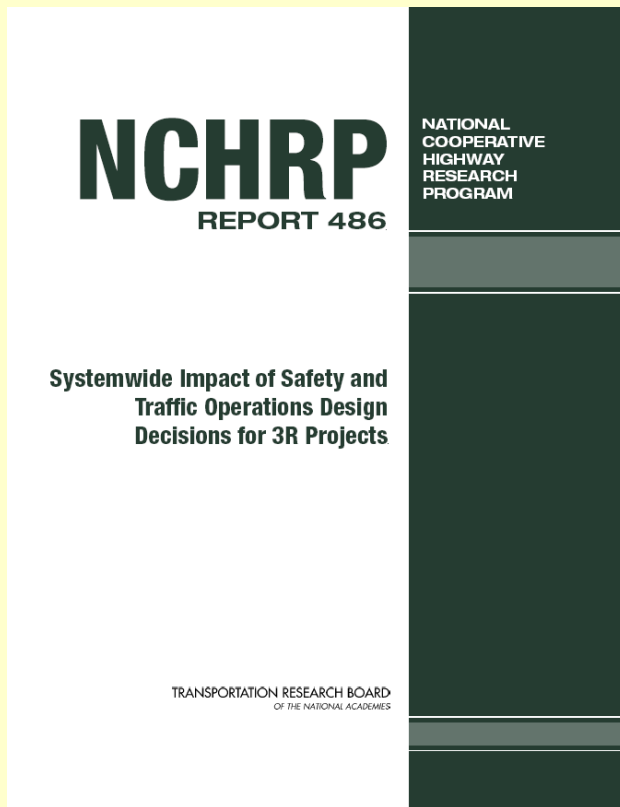
## New & Proven Technologies

**The “Science”  
Associated  
with Safety  
Improvements**



# Introduction

## New & Proven Technologies



# Introduction

## New & Proven Technologies

**Specific Crash Modification Factors/ Crash Reduction Factors are Available**

COUNTERMEASURE	I			III									IV	V	VI
	All	Fatal or Injury	PDO	Head On	Rear End	Right Angle	Side-Swipe	Left Turn	Right Turn	Fixed Object	Pedestrian	Run-Off Road	Wet Pavement	Night	Train-Related
<b>CONSTRUCTION/ RECONSTRUCTION (cont.)</b>															
<b>GUARDRAIL</b>															
install guardrail (1, 2)	5	F:65 I:40										30			
upgrade guardrail (1, 2)	5	F:50 I:35										26			
install at bridge (5)		F:90 I:45	-110*												
install along ditch (5)		26	-19*												
install along embankment (5)		42	-47*												
install to shield trees (5)		F:65 I:51	-90*												
install to shield fixed objects as rocks and steel posts (5)		31	-45*												
<b>TRAFFIC SIGNS</b>															
<b>WARNING SIGNS</b>															
install warning signs (1)	25														
install warning signs in advance of intersections (1, 11)															
- urban	30														
- rural	40														
install warning signs in advance of curves (1, 2, 11)	30	F:55 I:20		29								30			
add signs at railroad crossings (1)															30
install school zone signs (1)	15														
install pavement condition signs (1)												20			

\* A crash reduction factor preceded by a (-) sign indicates an increase should be expected for that type of crash.

TABLE G-1 (CONT'D): ESTIMATED CRASH REDUCTION FACTORS (%)

# Introduction

## Example:



**Nominal Safety** – Advance  
Warning Sign –  
Conventional Road Size



+ Chevrons = Up to 49%  
reduction in Crashes =  
**Substantive Safety**

# Introduction

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**Discussion**



**Countermeasures  
EFFECTS**

**Proven**

**Tried**

**Experimental**

# Introduction

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## Review Questions:

### **Nominal Safety**

**compliance with standards, warrants, guidelines and sanctioned design procedures**

### **Substantive Safety**

**the expected crash frequency and severity for a highway or roadway**

# Introduction

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## Review Questions:

- ❑ **What is the relationship of compliance with the Green Book and the MUTCD to Nominal Safety? Ordinarily can be expected to result in nominal safety performance**
- ❑ **How can you reduce crashes where there is a Substantive Safety problem?**

**Apply low cost safety improvements beyond the nominal (minimal) requirements**

# Introduction

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*Questions?*