

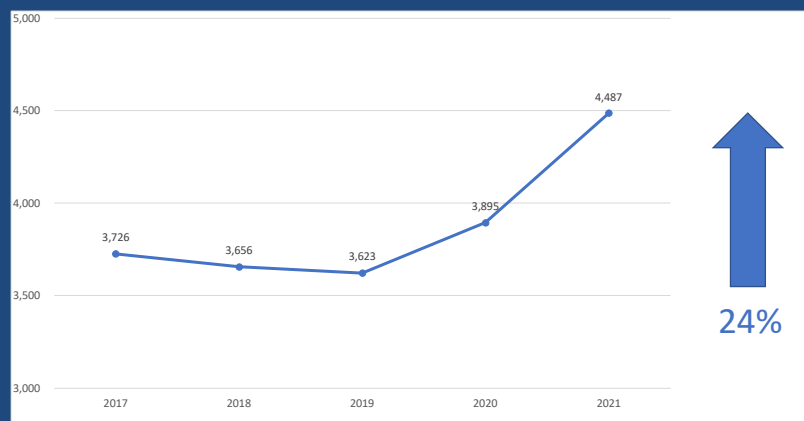
# Texas Traffic Fatalities

Where are we?  
What can be done?

Robert Wunderlich  
Center for Transportation Safety  
Texas A&M Transportation Institute

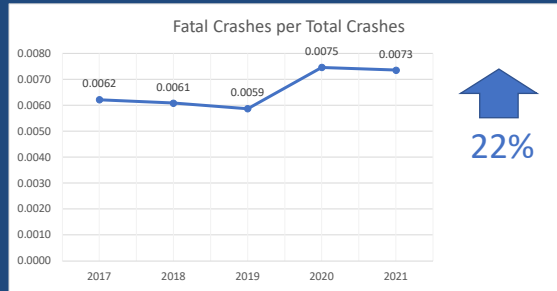
1

## Texas Traffic Fatalities



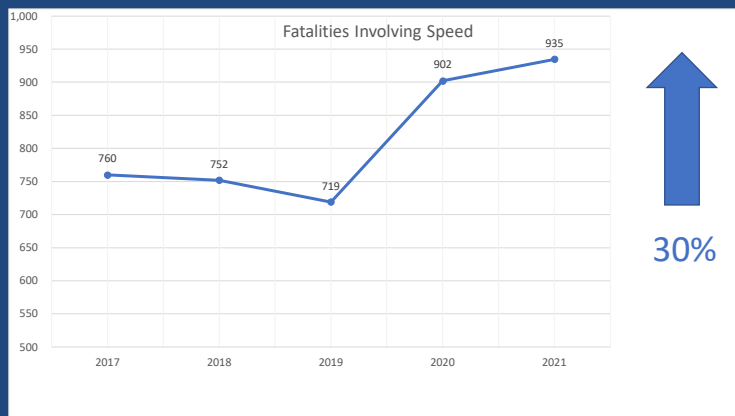
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## Fatality Risk



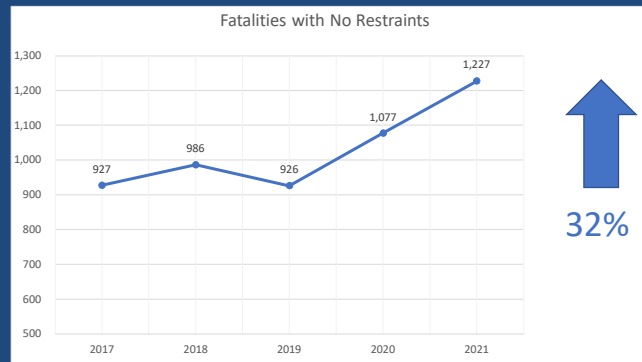
3

## Fatalities Involving Speed



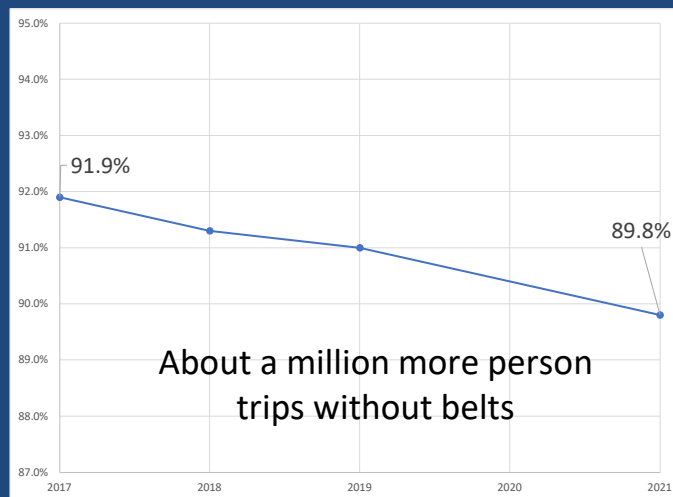
4

## Fatalities Not Using Restraints



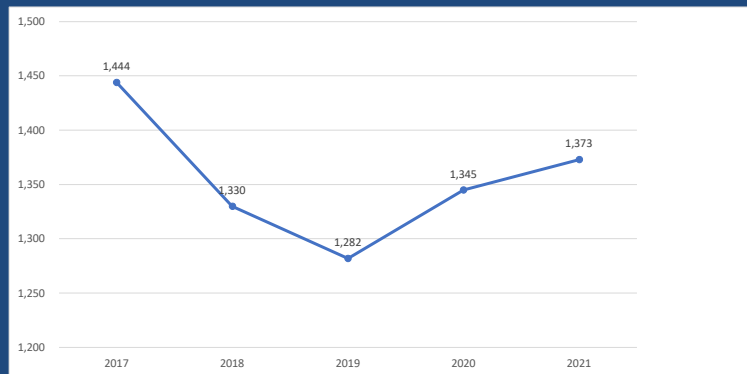
5

## Statewide Seatbelt Usage



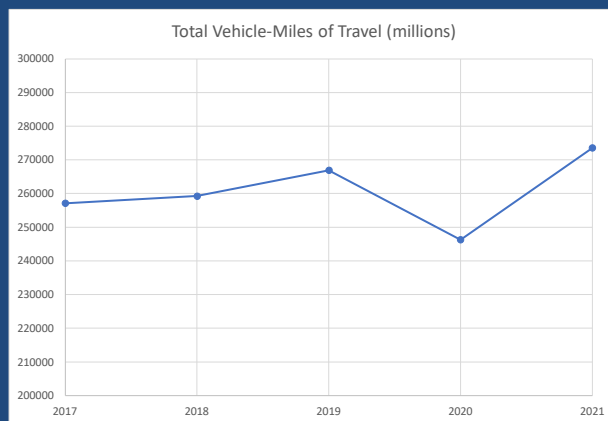
6

## Fatalities Associated with Impairment



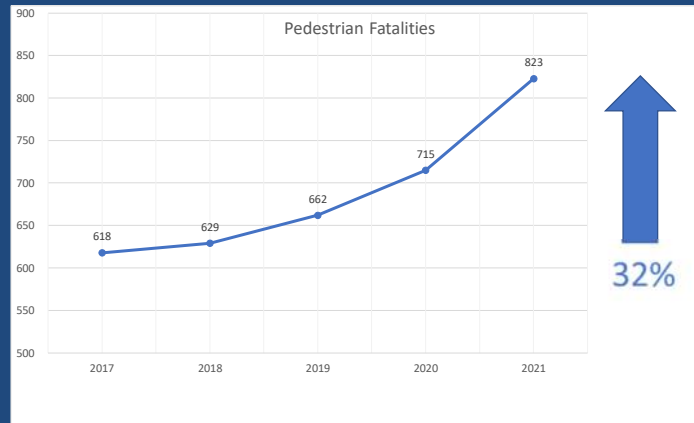
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## Vehicle-Miles of Travel



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## Pedestrian Fatalities



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## So, what can we do?

Build Safety into Every Project

The Safe System  
Approach

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### Design Philosophy Shift

**Maximize System Safety**

Pennies to the Pavement

FROM

TO

Maximizing Safety Benefits to the Public

Build Safety into Every Project!

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### A different Way to View Safety

**Nominal vs Substantive**

*Nominal Safety*

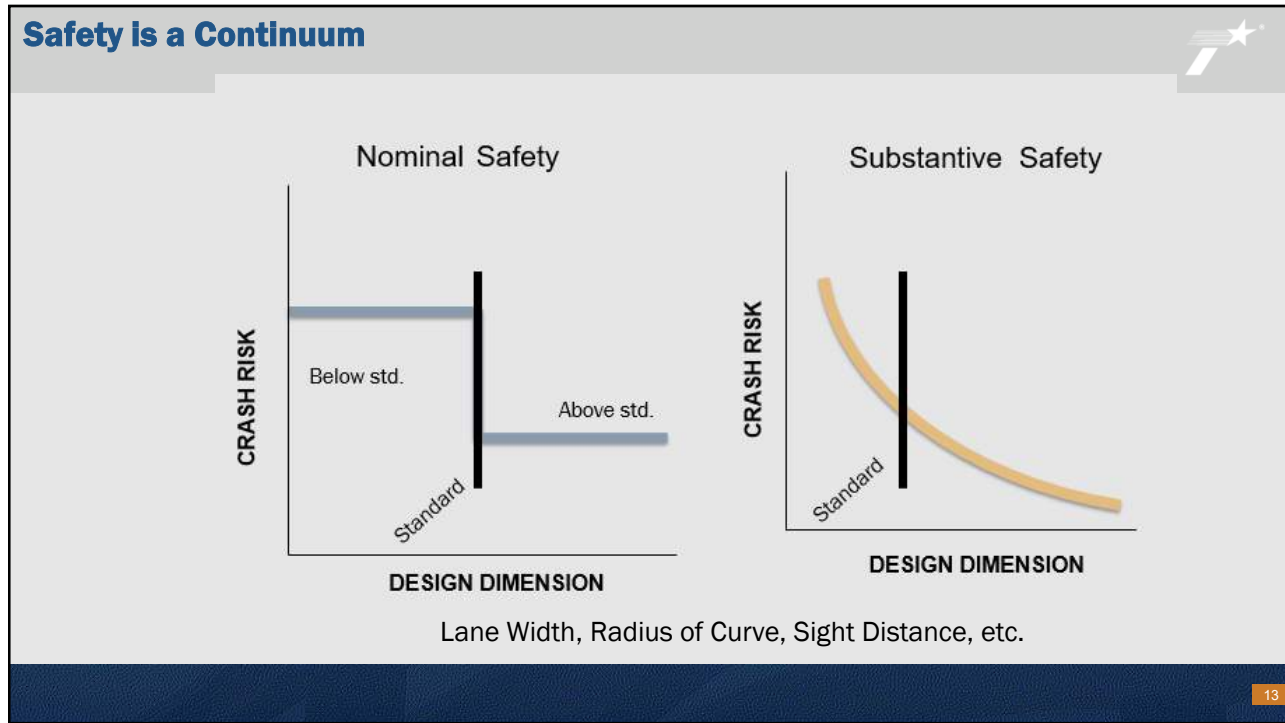
*Substantive Safety* **HSM**  
HIGHWAY SAFETY MANUAL

STANDARDS, WARRANTS, AND GUIDELINES

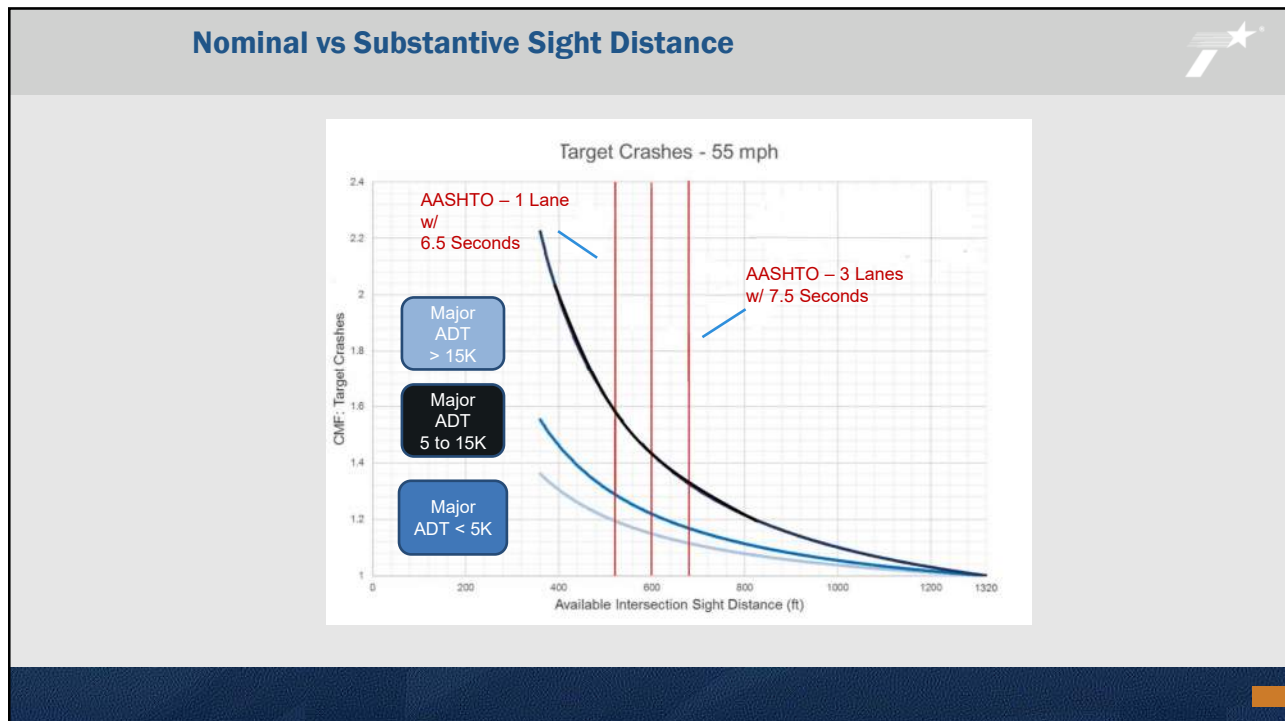
CRASH FREQUENCY AND SEVERITY

Building to Standard **≠** Safety Performance

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## Safety Effect of Roadway Elements



1. Researched and quantified
1. Documented as:
  - a) Safety Performance Functions
  - b) Crash Modification Factors (CMFs)
- a) Form the basis of comparing design alternatives

Examples  
[www.cmfclearinghouse.com](http://www.cmfclearinghouse.com)

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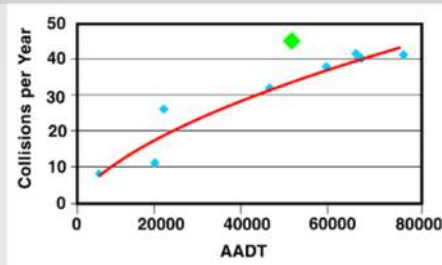
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## SPFs and CMFs



SPFs  
 Safety  
 Performance  
 Functions

Predict the number of  
 crashes based on  
 volume and  
 configuration



Provide the effect of  
 changes in design  
 elements on crashes

0.75

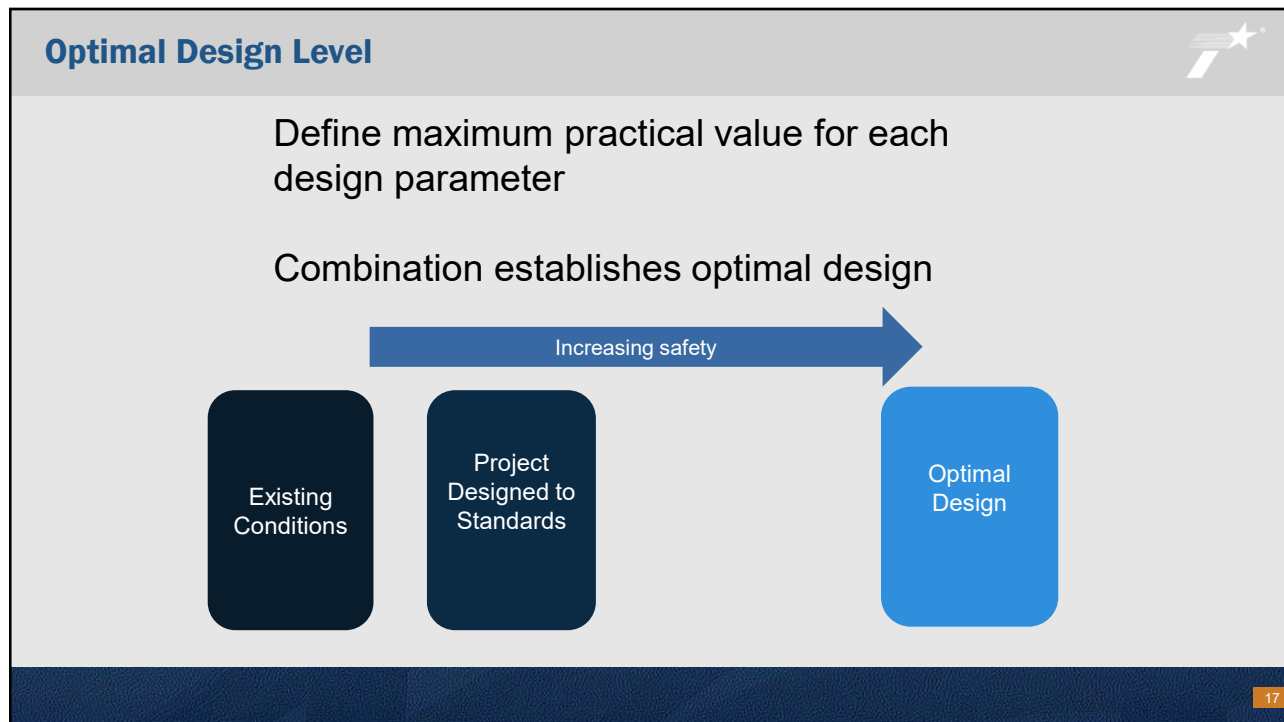
1.15

CMFs  
 Crash  
 Modification  
 Factors

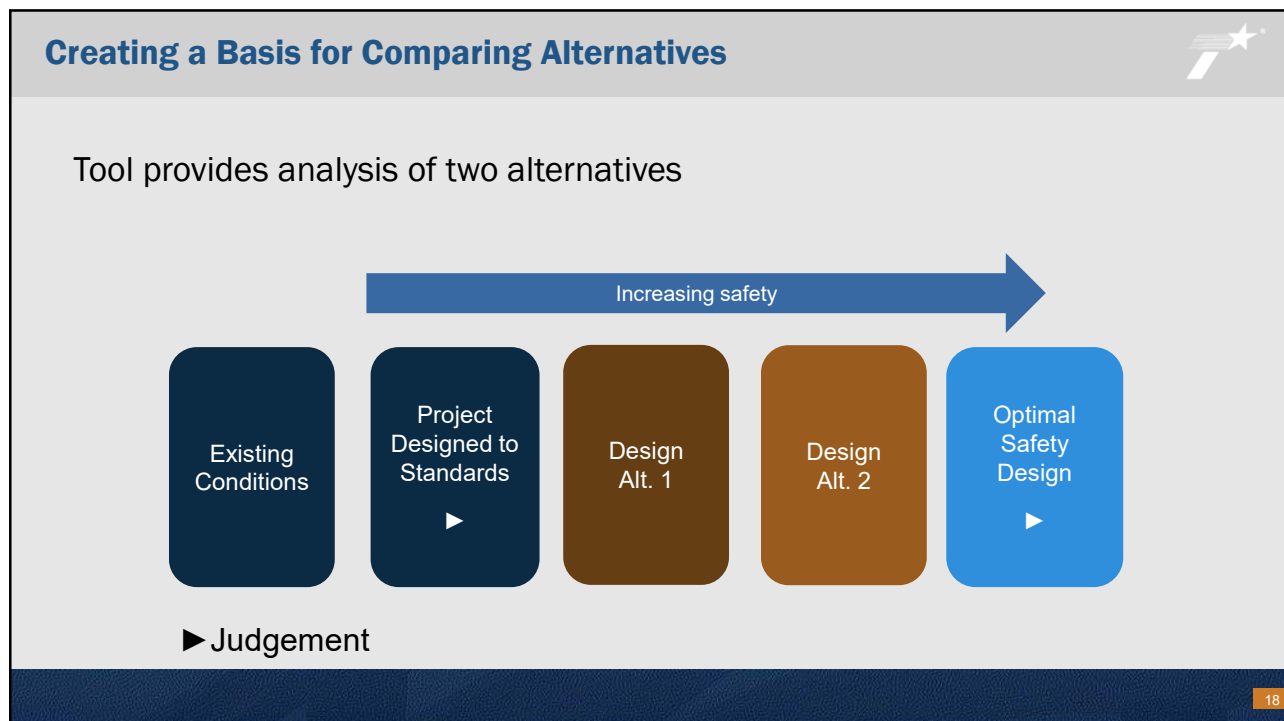
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# Elements

	Existing	Standard	Design 1	Design 2	Optimal (Conventional)
	Minor STOP	Minor STOP	Signalized	Signalized	Minor STOP
	---	---	---	---	---
<b>Geometric Design Elements</b>					
No	Existing	Standard	Design 1	Design 2	Optimal (Conventional)
1	Num of Approaches with Exclusive Left-Turn Lanes	2			2
2	Offset Left-Turn Lanes				
3	Num of Approaches with Exclusive Right-Turn Lanes	0			0
4	Num of Major Streets with Right-Turn Channelization	0			0
5	Sight Distance (ft)	4,500			4,500
6	RCUT Median Width (ft)				
7	Median on Min Approach				
8	Replace Direct Left-Turn with Right Turn/U-Turn				
9	RCUT Offset Distance (ft)				
10	RCUT Number of Driveways				
11	RCUT Acceleration Lane Length (ft)				
12	RCUT Deceleration Lane Length (ft)				
13	RCUT Number of U-Turns				
14	Roundabout (RA) Inboard Circle Diameter (ft)				
15	RA Presence of Outboard Side Leg				
16	RA Presence of Right-Turn Bypass Lane				
17	RA Total Number of Driveway/Access Points of the Roundabout (within 250 ft of sidewalk)				
18	RA Entry Width (ft)				
19	RA Number of Conflicting Lane Conflicting with the Leg				
20	RA Number of Entering Lane on the Leg				
<b>Traffic Control Elements</b>					
20	Lighting	AK			AK
21	Left-Turn Signal Phasing				
22	Increase total change interval (greater than ITE recommended practice)				
23	Number of Approaches for which RTOR is Prohibited				
24	Retain Oppose Signal to Backplane				
25	Advanced Stop Sign Timing				
26	Prohibit Left-Turn	No	AK		AK
27	Number of Approaches with U-Turn Prohibition	0	0	0	0
28	Right-In-Right-Out				
<b>Pedestrian Elements</b>					
<b>Major Road</b>					
30	Median type	Major Road	Major Road	Major Road	Major Road
31	School zone warning	Major Road	Major Road	Major Road	Major Road
32	Location of pedestrian crossing	Major Road	Major Road	Major Road	Major Road
33	Location of pedestrian crossing	Major Road	Major Road	Major Road	Major Road
34	Pedestrian crossing facility type	Major Road	Major Road	Major Road	Major Road
35	Vehicle parking	Major Road	Major Road	Major Road	Major Road
<b>Minor Road</b>					
35	Number of auxiliary lanes	Minor Road	Minor Road	Minor Road	Minor Road
36	Median type	Minor Road	Minor Road	Minor Road	Minor Road
37	School zone warning	Minor Road	Minor Road	Minor Road	Minor Road

# TxDOT Scoring Tools

## Rural Tools

- 2 lane
- Multi-Lane Non-Freeway

## Urban Tools

- Intersection
- Segment under development

<https://www.txdot.gov/inside-txdot/division/design.html>

# The Safe System Approach

If Zero is the Goal,  
This is the Path to it

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The screenshot shows the top navigation bar of the U.S. Department of Transportation website. It includes the DOT logo, the text "U.S. Department of Transportation", and menu items for "ABOUT DOT", "PRIORITIES", and "CONNECT". Social media icons for Facebook, Twitter, Instagram, and LinkedIn are also present. Below the navigation bar is a main heading: "LEARN ABOUT THE NATIONAL ROADWAY SAFETY STRATEGY". Underneath this heading are three featured content cards, each with a representative image and a title:

- THE ROADWAY SAFETY PROBLEM**: Image of a woman hugging a child.
- WHAT IS THE SAFE SYSTEM APPROACH?**: Image of a person pointing at a road scene with a stop sign.
- HOW DOES SAFETY IMPACT U.S. DOT'S WORK IN OTHER PRIORITY AREAS?**: Image of a group of people walking on a city street.

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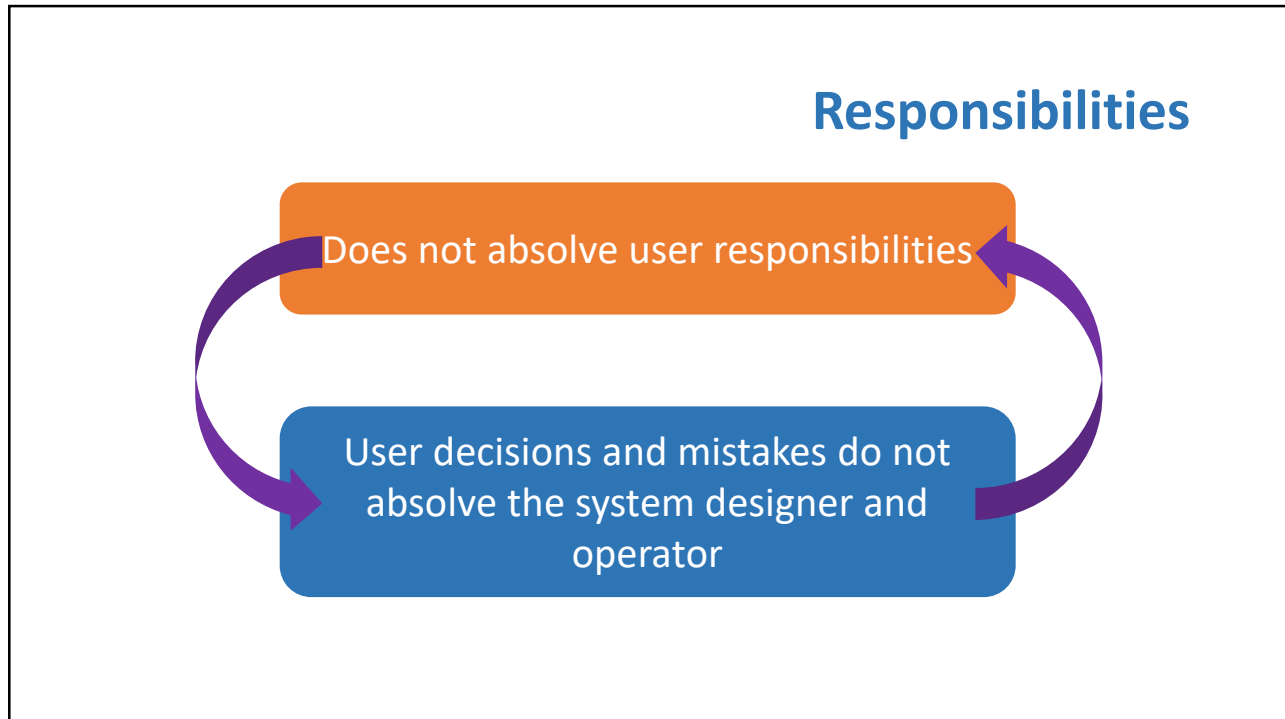
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## System Stewards have a responsibility to:

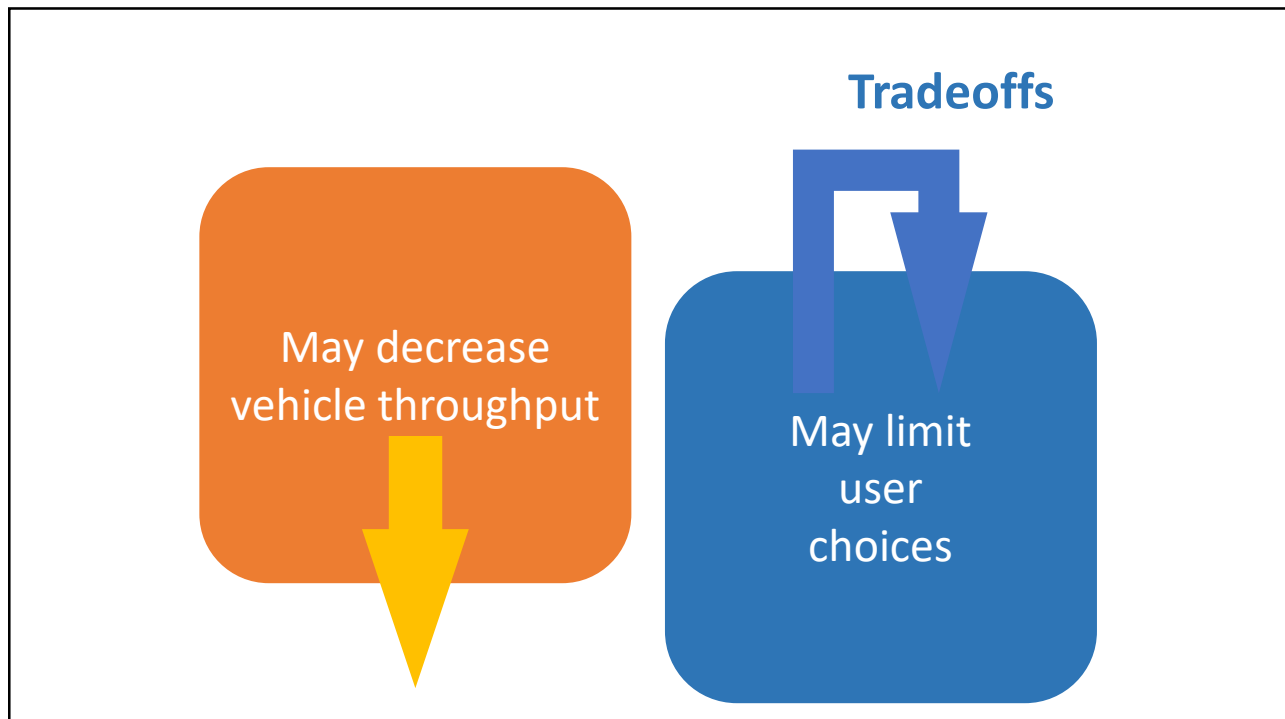
Recognize  
that users make  
mistakes  
and bad decisions

Reduce  
opportunities for  
mistakes &  
mitigate  
consequences

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## Safe System Goals

Design and  
Operate  
Transportation  
System

Anticipates  
Human Error  
&  
Accommodates  
Human Injury  
Tolerance

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## Anticipating and Reducing Human Error

Separating Users in Space

Separating Users in Time

Increasing Attentiveness, Awareness  
and Performance

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## Separating Users in



Space

Time



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## Attentiveness, Awareness and Performance

Increase Visibility

Increase Attentiveness

Simplify

Provide Recovery Space

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## Increasing visibility

75% of US pedestrian fatalities occur at night



Source: Robert Wunderlich



Source: NYC DOT

Clear Sight Lines,  
Stop Lines, Set Backs

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## Increasing Attentiveness

RRFBs



Source: PBIC

Rumble Strips



Shoulder rumble strips and center line rumble strips are installed on this roadway.

Source: FHWA

PHBs

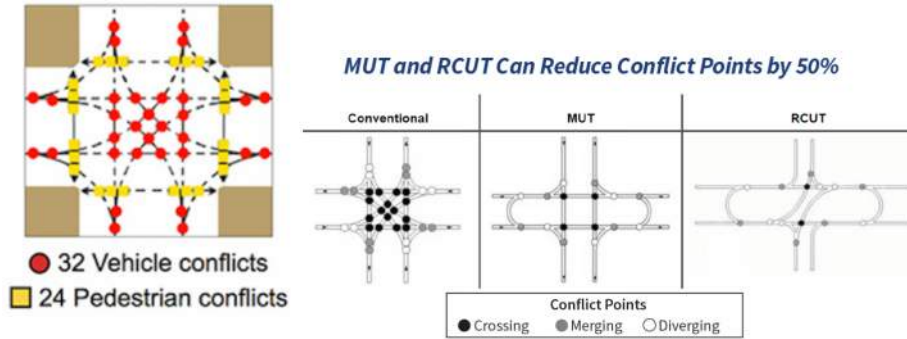


Source: PBIC

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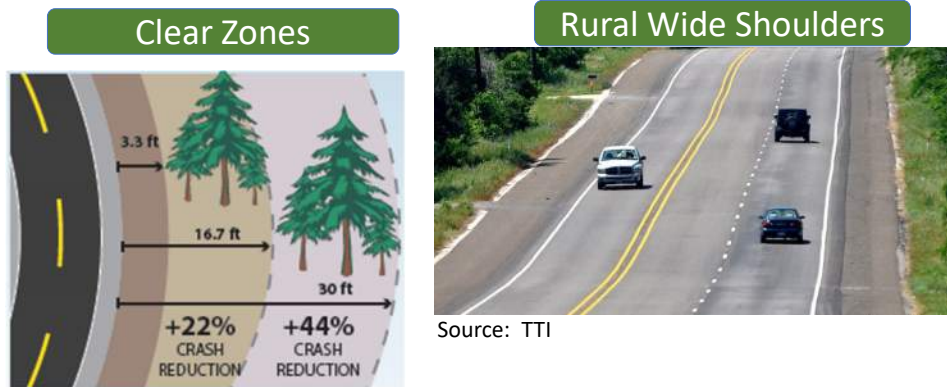
## Limiting Opportunities for Errors by Simplifying



Source: FHWA

33

## Providing Space for Recovery



Source: FHWA

Source: FHWA

34

## Accommodating Human Injury Tolerance

Reduce Kinetic Energy Transfer

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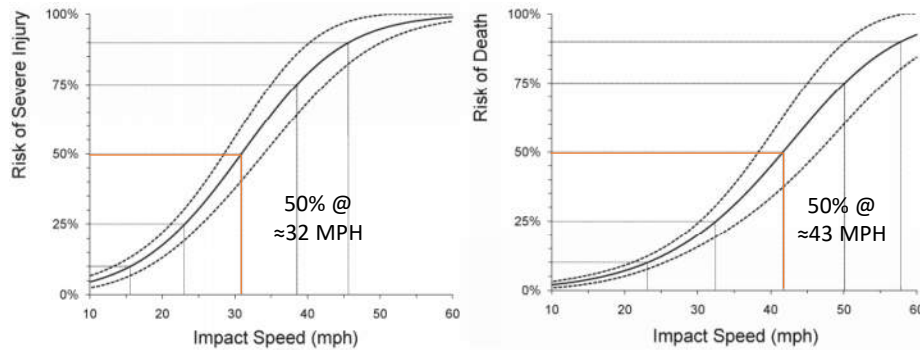
## Accommodating Human Injury Tolerance

Reduce Speeds

Reduce Impact Forces

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## AAA FTS Impact Speed Risk



Reprinted from "Impact Speed and a Pedestrian's Risk of Severe Injury or Death," p. 9, September 2011 by Brian C. Tefft, Copyright (2011), with permission from AAA Foundation for Traffic Safety

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## Power Model of Speed from Elvik

$$\frac{\text{Fatal Crashes after}}{\text{Fatal Crashes before}} = \left( \frac{\text{Average speed after}}{\text{Average speed before}} \right)^{\text{Exponent}}$$

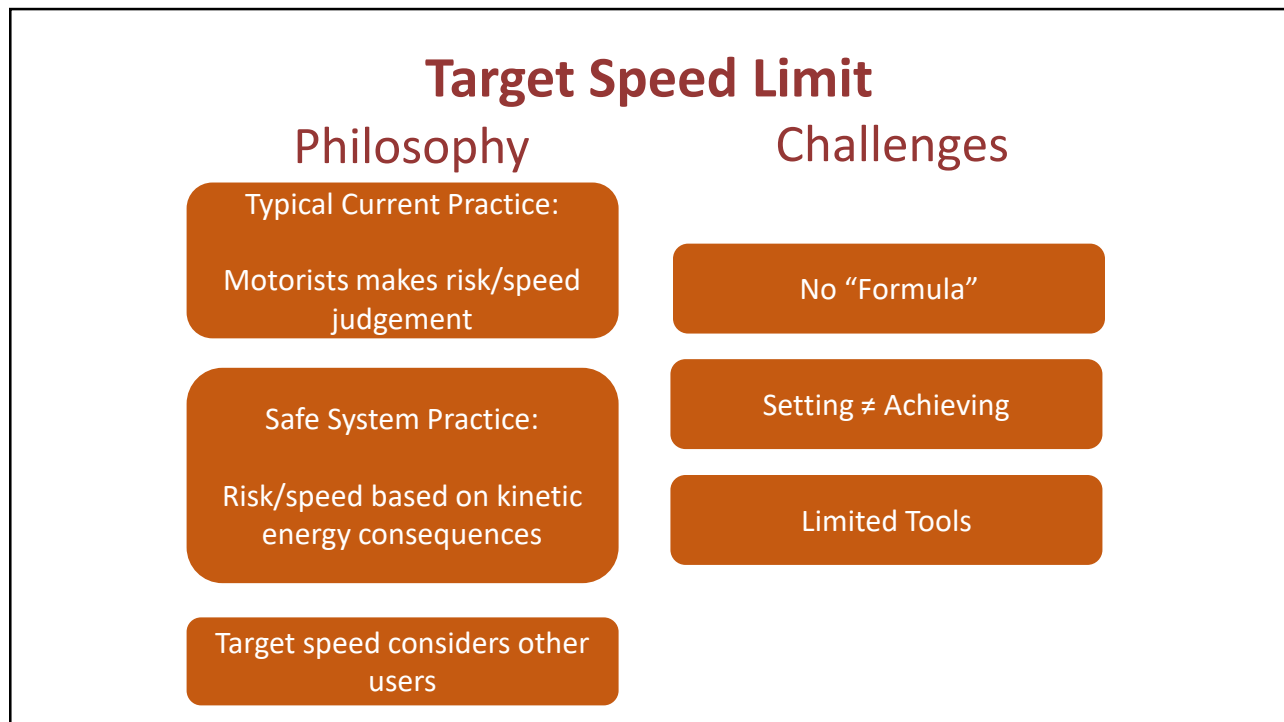
Exponent = 4.5 for fatalities  
3.0 for serious injuries

10% reduction in Speed = 38% reduction in fatalities

27% reduction in serious injuries

Elvik R, et al. *Handbook of Road Safety Measures, Second Edition*. Amsterdam: Elsevier, 2009

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## Speed Management through physical configuration



In addition to making East Boulevard in Charlotte, N.C., more attractive, a road diet reduced travel speeds, bicycle and pedestrian injury rates and the number of rear-end and left-turn collisions. Photo courtesy city of Charlotte

Source: FHWA Resource Center

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## Other Speed Management Techniques

### Vertical alignment



Source: FHWA – Google Street View

### Sanctions



Source: TTI

### Signal Timing



Source: TTI

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## Reducing Impact Forces



Source: PBIC



Source: Rock Miller



Source: PBIC

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## Reducing Impact Forces



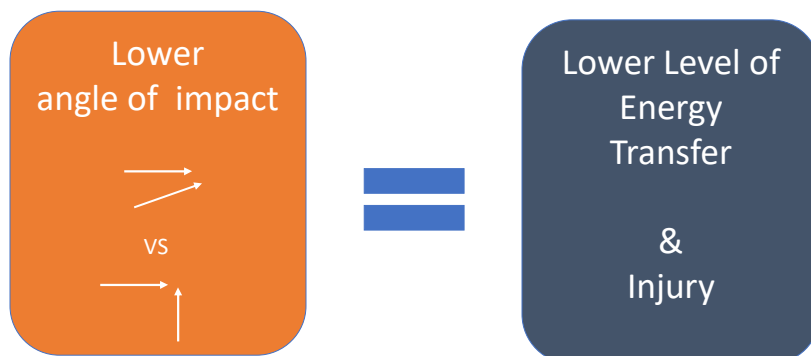
Cable Barrier



Breakaway Sign

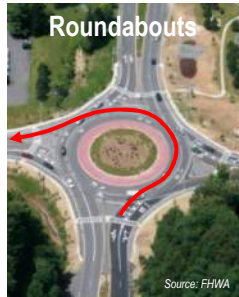
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## Impact Angle and Kinetic Energy



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## Roundabouts: The Trifecta



# 8

conflict points

75% reduction in  
Motor Vehicle conflicts

- Low speed impacts
- Low angle impacts



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## What can you do?

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