

# Iowa 2012 Strategic Highway Safety Plan Webinar

...An introduction to the Iowa SHSP  
development process and your participation





# Welcome

## Webinar Expectations:

- Meet the SHSP Advisory Team
- Hear an overview of the development process,
- Gain an understanding of Iowa's severe crashes
- Learn about the upcoming SHSP Safety Strategy Workshop

## Who has joined us today?

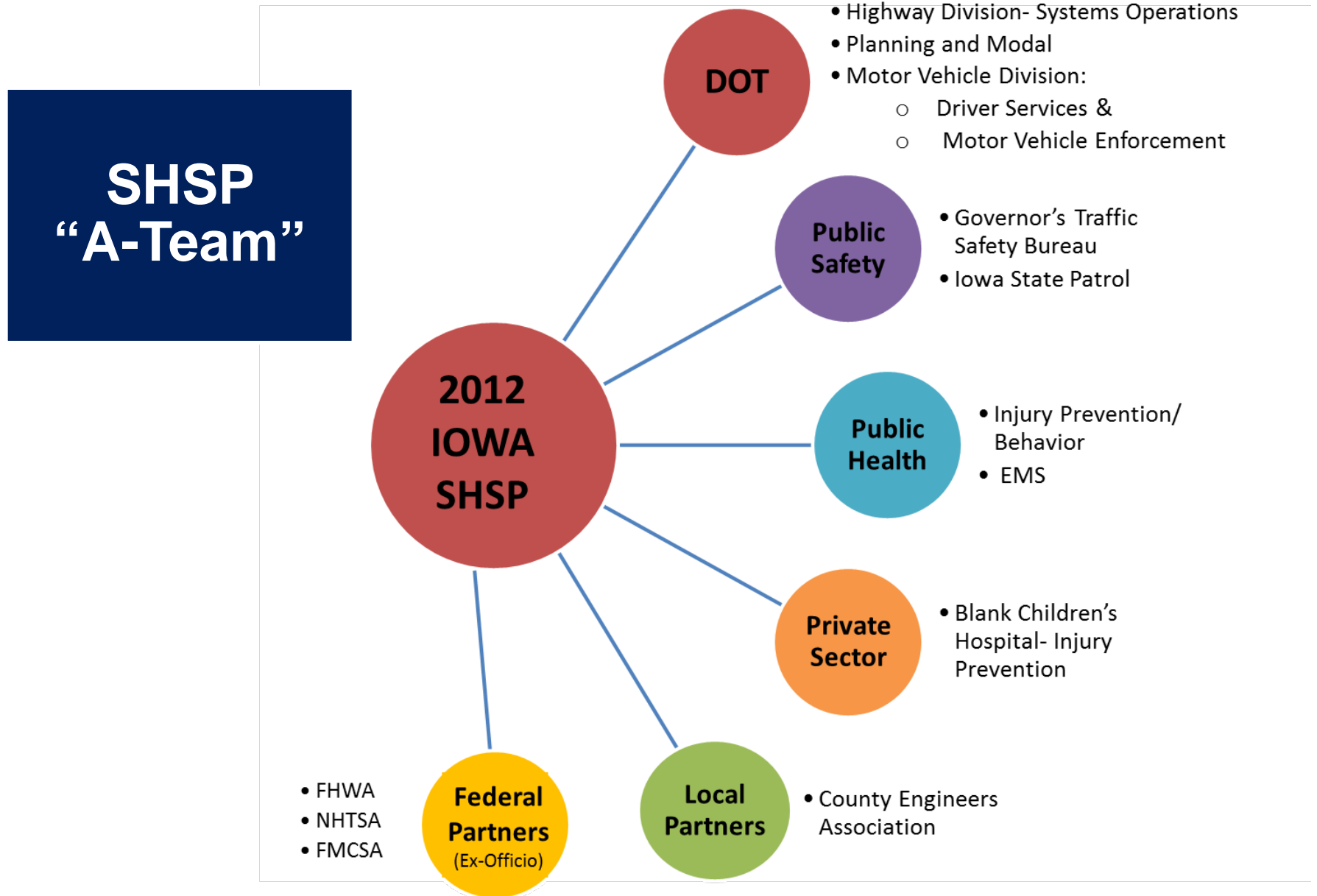
- Introductions
- Webinar is being recorded
- Check In
- Participant Polling

Poll questions:

Attendees



# IOWA SHSP Project Advisory Team



# Meet the A-Team Members

<b>Jeremey Vortherms</b>	<b>(Chair)</b>	<b>State Transportation Safety Engineer</b>	
		Office of Traffic and Safety	Iowa DOT - Highway Division
Steve Gent	Director, Office of Traffic and Safety		Iowa DOT - Highway Division
Kim Snook	Director, Office of Driver Services		Iowa DOT – Motor Vehicle Division
Craig Markley	Director, Office of Systems Planning		Iowa DOT – Planning/Modal Division
David Lorenzen	Chief, Motor Vehicle Enforcement		Iowa DOT – Motor Vehicle Division
David Garrison	Colonel, Iowa State Patrol		Iowa Department of Public Safety (DPS)
Tim Leinen	(Colonel's designee), Iowa State Patrol		Iowa Department of Public Safety (DPS)
Patrick Hoyer	Chief, Governor's Traffic Safety Bureau		Iowa Department of Public Safety (GTSB)
Mark Vander Linden	Behavioral Health		Iowa Department Public Health
Joe Ferrell	EMS Regulations Manager		Iowa Department Public Health
Roger Schletzbaum	Vice President		Iowa County Engineers Association
Kathy Leggett	Child Advocacy, Education and Outreach		Blank Children's Hospital

## Federal Ex-Officio

Roche	Jerry	Safety and Operations Engineer	FHWA Iowa Division Office
Scott	Dean	Program Manager	NHTSA Region 7
McGuire	Shirley	Division Administrator	FMCSA Iowa Division Office





# SHSP Staff / Designees / Alternates

## SHSP Staff

### Mary Stahlhut

Jan Laaser-Webb

Michael Pawlovich

### SHSP Project Manager, Iowa DOT - Highway Division-TAS

SHSP Contract Manager, HSIP Program, Safety Staff, Highway Division-TAS

SHSP Data Point of Contact - Safety Staff, TAS, Iowa DOT,- Highway Division  
Data Quality, Statewide Traffic Records Coordinating Committee (STRCC)

Kathy McLear

Records Manager, Driver Services, Iowa DOT – MVD Iowa DOT

Co-Chair, Statewide Traffic Records Coordinating Committee (STRCC)

Joanne Tinker

Prog.Eval., Department of Public Safety, Governor's Traffic Safety Bureau (GTSB)

Co-Chair, Statewide Traffic Records Coordinating Committee (STRCC)

Jim Meyerdirk

Iowa Department of Public Safety Governor's Traffic Safety Bureau (GTSB)

## CH2MHILL Consultant Team

Howard Preston

Project Manager, Engineer

Cheri Marti

Behavior

Dan Smith

Engineering

Richard Storm

Data

Kim Kolody

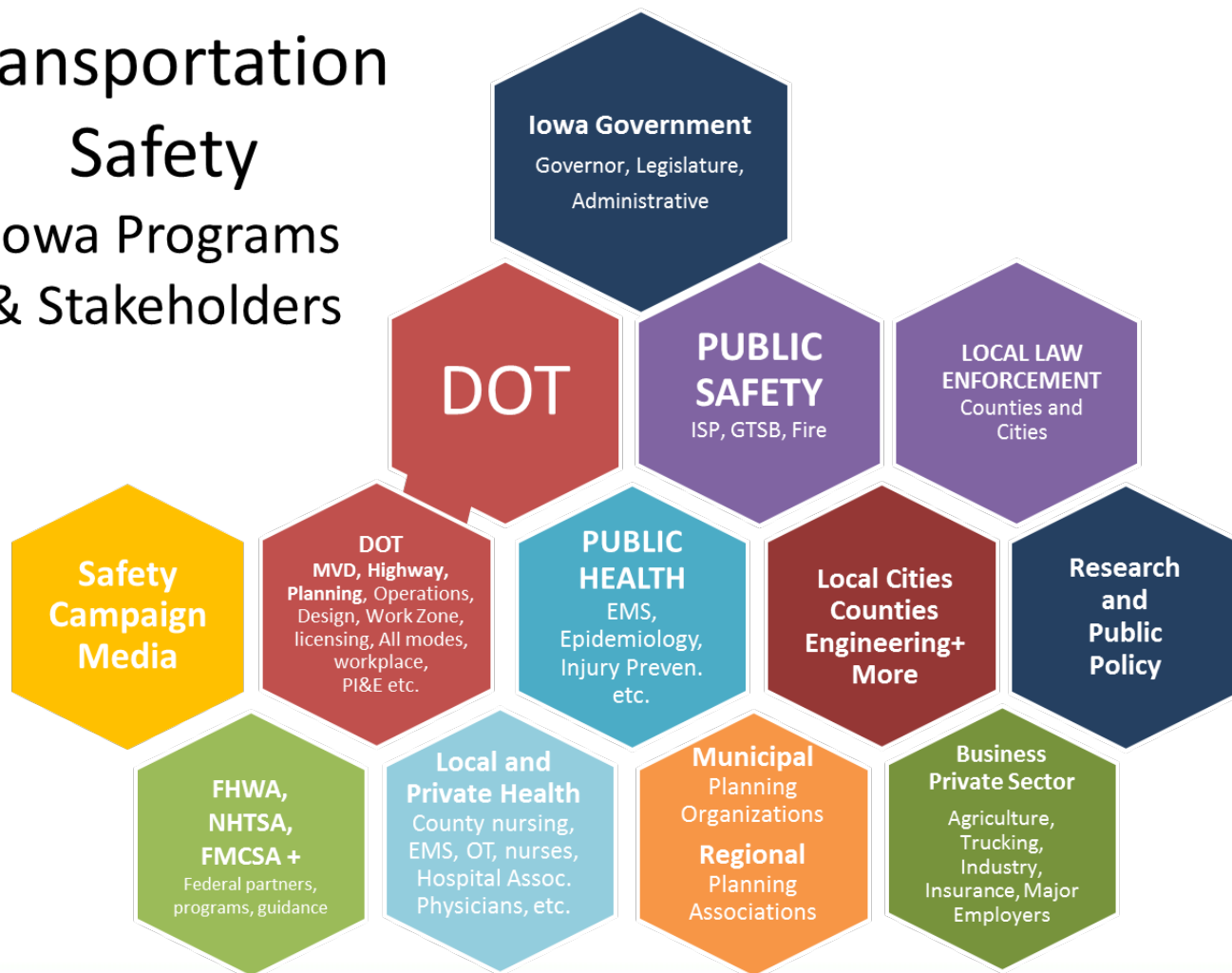
Communications



# A State SHSP Recognizes “Everyone Else” Can Help

## Transportation Safety

Iowa Programs  
& Stakeholders



# Today's Agenda

## Welcome and Introductions

Check In, Participant Polling, The Iowa "A-Team", and Expectations

## SHSP Background – Think how far we've come

What is an "SHSP" ?

Highway Safety 101- Decades of Progress

## Iowa's SHSP – Where do we go next

MAP - 21

Toward Zero Deaths – A National Strategy on Highway Safety

## Data-Driven Process and Participant Polling

Iowa Crash Data Overview

Organizing Data, Crash analysis, and Trend Lines

Safety Performance Measures

Initial Safety Emphasis Areas

Prioritization Process

## Safety Goals and Participant Polling

Samples and Illustrations

## Safety Strategies Workshop – January 23, 2013

Overview of Sample Safety Strategies

## Next Steps

Schedule & Opportunities for Additional Participation

## Wrap Up/Summary and Questions





# What is a State Strategic Highway Safety Plan?

“A statewide coordinated safety plan that provides a comprehensive framework for reducing highway fatalities and serious injuries on all public roads.”

USDOT Strategic Highway Safety Plans Quick Reference



Poll question:

SHSP  
Experience



# What is Iowa's SHSP?

- **Mission, Goal & Objectives**
- **Data Driven**
- **Key Strategies**
- **Guide for Safety Investments**
- **Emphasis on Implementation**





# SHSP Background

Think of how far  
we've come

Highway Safety 101

Decades of Change:  
Roads, Vehicles, Drivers

# Highway Safety 101



Developing the National Highway System



Designing and Building Vehicles



Changing Driver Behavior and Decisions





# Developing National Highway System

- Building

- From Lincoln Highway to Interstates US1 East to I-1 West.
- Super 2's, expressways, freeways

- Improving

- Creating clear zones, replacing intersections with interchanges, removing curves, flattening ditches, managing access.
- Low Cost improvements

- Using

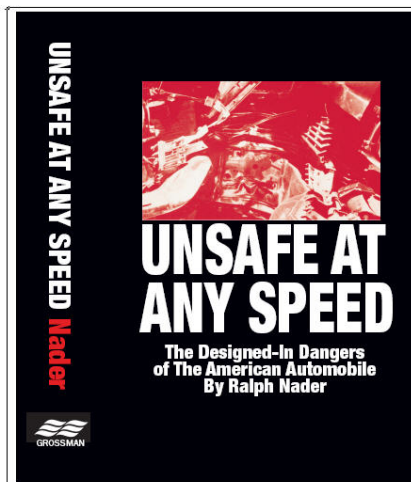
- Rising VMT and average commercial and individual miles driven



# Designing and Building Vehicles



- Bigger, faster, farther, power and automation
  - Americans love their cars
  - Americans love their mobility
- Crashing and Gas Crisis 60's-80's
  - Ralph Nader – SAFER and NHTSA
  - OPEC - Smaller, lighter, more efficient
- Consumer features 90's-2010's
  - Comfort, ease, function,
  - Mobility lifestyle
  - Technology and Entertainment



**Iowa's Strategic Highway Safety Plan**

*Join the plan to save more lives...*

# Changing Driver Behavior Decisions and Outcomes



- The Epidemic

- NHTSA and Dr. Phillip Haddon
- EMS: *Accidental Death and Disability: The Neglected Disease of Modern Society*<sup>29</sup>
- 1966 highway safety and consumer programs established by the National Traffic and Motor Vehicle Safety Act of 1966



- Changing behavior with \$\$\$ incentives and disincentives

- Belts: \$\$ feds, laws, enforcement,
- Alcohol: Education, laws, enforcement
- Crash test dummies and Big Bird



# Haddon Matrix

A scientific approach

***“ENVIRONMENT”***

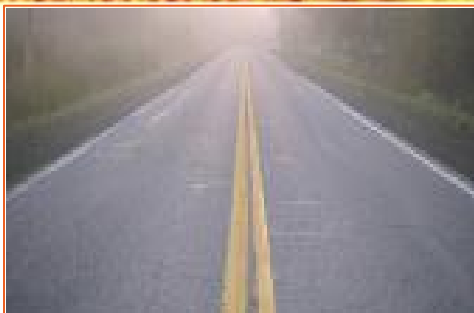
<b>CRASH</b>	<b>Driver</b>	<b>Vehicle</b>	<b>Road</b>	<b>Social/ Culture</b>
<b>Before</b>				
<b>During</b>				
<b>After</b>				

“He called his matrices “aids in sorting questions and knowledge “





# Highway Safety 101- 2012



More Forgiving  
Road Systems



Safer and Smarter  
Easy to Operate  
Vehicles

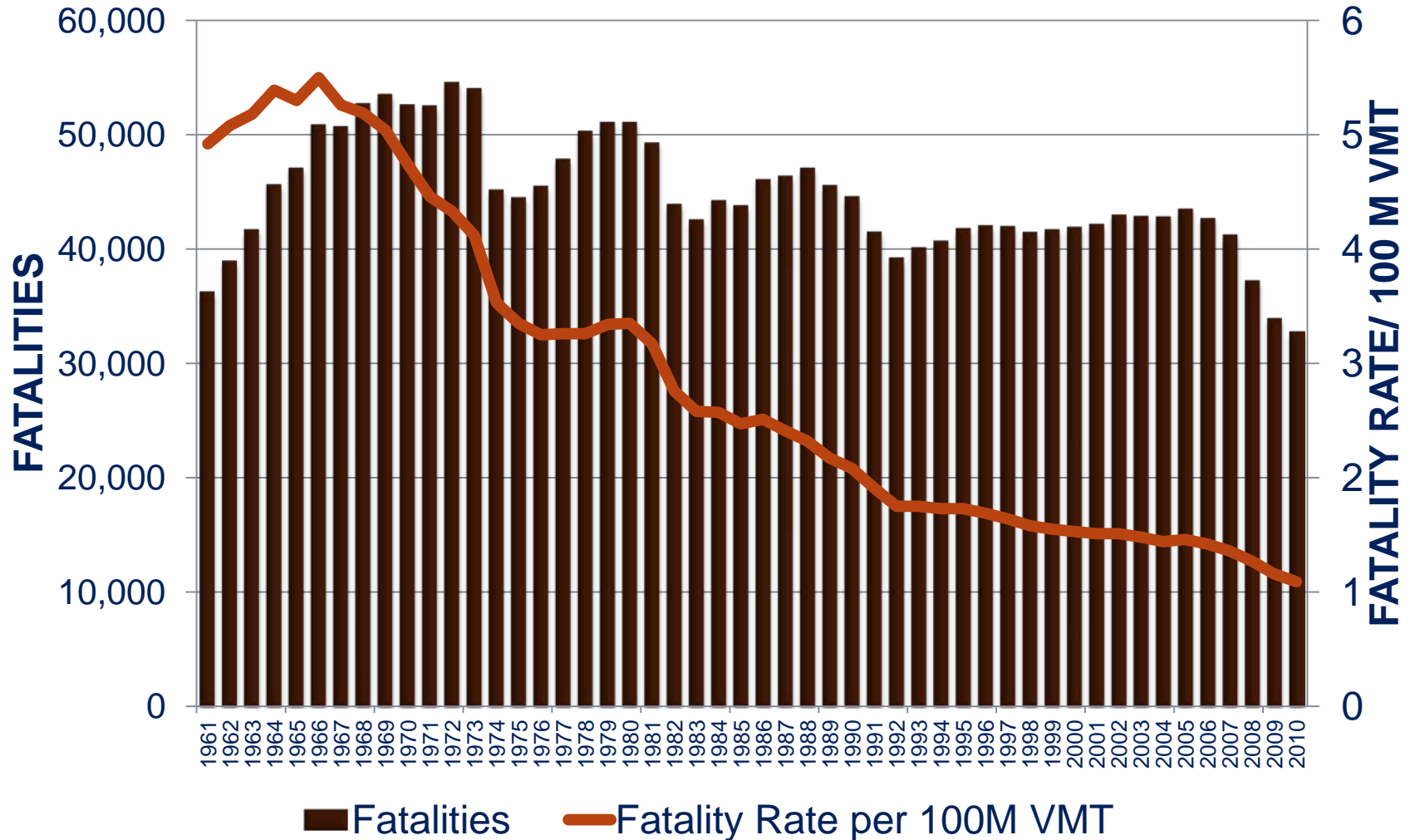


??? Changing ???  
Driver Behavior and Decisions





# National Highway Fatalities



**Iowa's Strategic Highway Safety Plan**

*Join the plan to save more lives...*

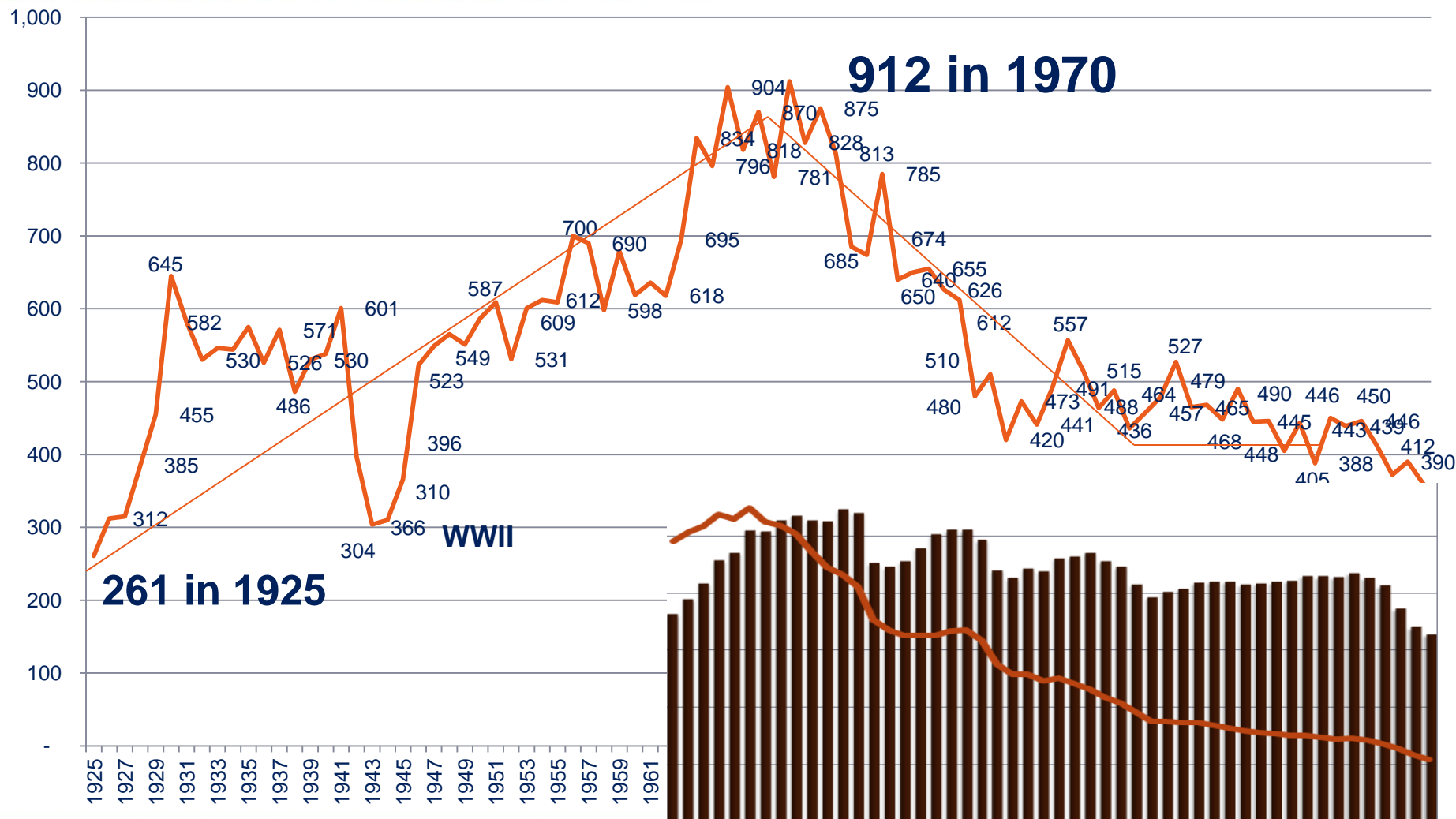
# Iowa Roads, Streets and Bridges

- There are more public road miles in Iowa than interstate miles in the entire 50 states.
- 
- Iowa ranks 14th in the nation in number of miles of roadway. (2009)
- There are approximately 38 miles of road for every 1,000 people in Iowa.
- There are 2,664 bridge structures in Iowa that are made primarily of wood.

2011 Public Road Length Miles by Ownership	
Ownership	Miles
Iowa DOT	8,893*
Counties	89,841
Municipalities	14,904
Parks and institutions	619
Federal agencies	127
Total miles	114,384*



# Iowa's Crash Fatality History



# How are we doing now?

## 2012 Iowa Traffic Fatality Count for 11/09/12

©Iowa Department of Transportation, Motor Vehicle Division, Office of Driver Services

*A fatality is considered "crash-related" when death occurs within 30 days of a crash. Because complex crash investigations can delay the official report of fatalities, the numbers for the two most current months are preliminary and can change considerably.*

Number of Fatalities Reported on this Day for Each Year

2012-2011 Comparison	2012	2011	2010	2009	2008	2007	2006
5	306	301	328	316	333	363	358

Fatalities

Month	2012	2011	2010	2009	2008	2007	2006
January	39	19	18	27	36	33	23
February	23	14	30	21	30	24	34
March	29	40	19	27	29	25	27
April	15	25	23	37	25	35	39
May	48	26	31	46	23	40	34
June	27	25	36	33	43	37	40
July	23	36	35	31	30	51	38
August	39	29	56	29	44	42	37
September	36	43	30	32	37	44	45
October	23	37	43	29	33	34	42
November	4	28	48	35	45	45	34
December		38	21	24	37	36	46
Total	306	360	390	371	412	446	439

# Poll question:

- Prediction for Iowa's annual fatality count in 5 years





# Crashes are Complex



## ► Driver conditions and behavior

- A contributing factor in **95** percent of crashes
- Primary factor in 67 percent of crashes



## ► Roadway design and environment

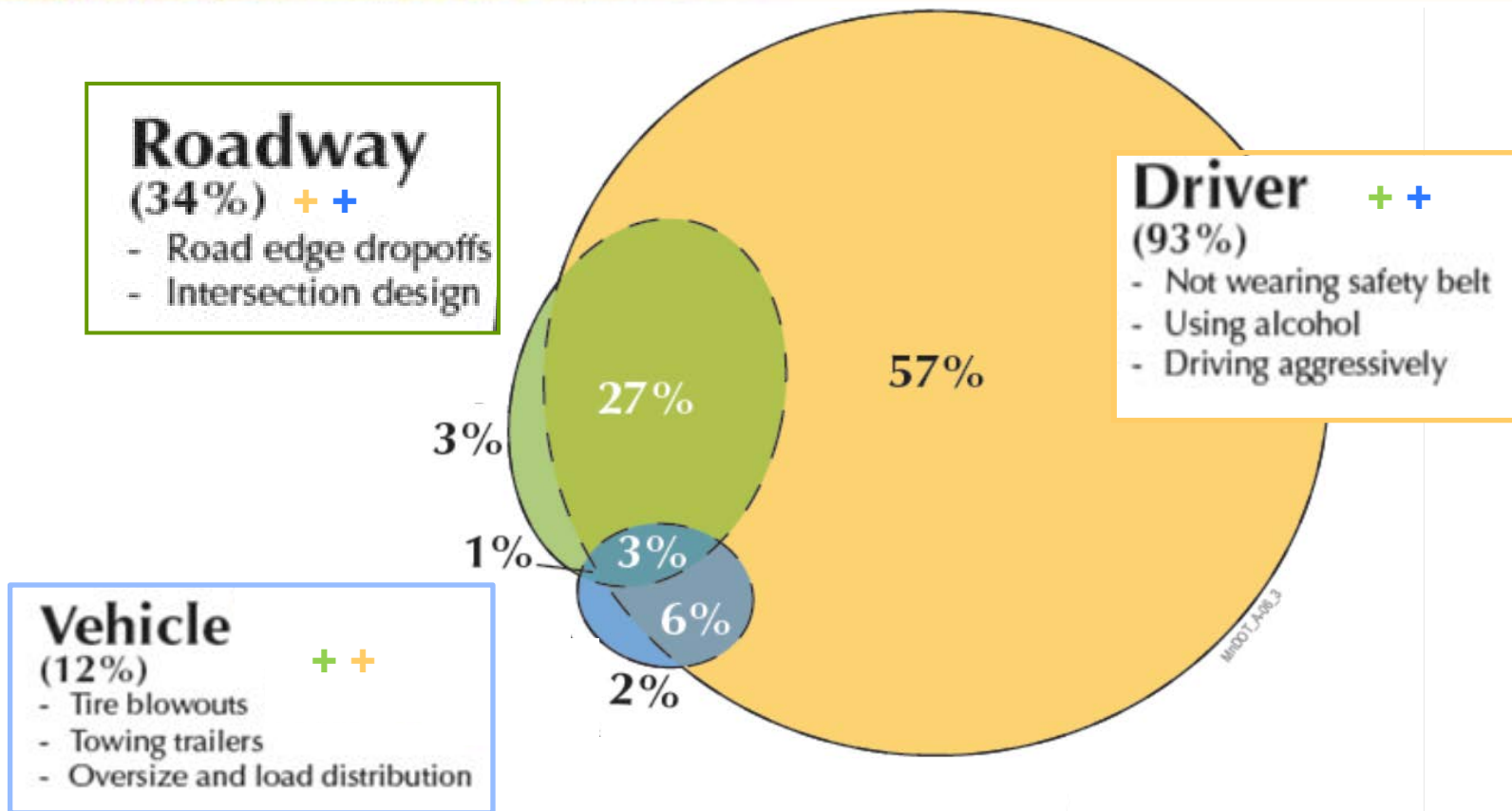
- A contributing factor in **28** percent of crashes
- Primary factor in 4 percent of crashes



## ► Vehicle

- A contributing factor in **8** percent of crashes
- Primary factor in 4 percent of crashes

# Fatal and Serious Injury Factors in Crashes



Example—Roadways are the sole contributing factor in 3% of crashes and the roadway and driver interaction is the factor in 27% of crashes.

Source: *Human Factors & Highway Safety*, Elizabeth Alicandri

# Crashes are Complex...And So Are the Solutions

**E**ngineering



**E**ducation



**E**nforcement



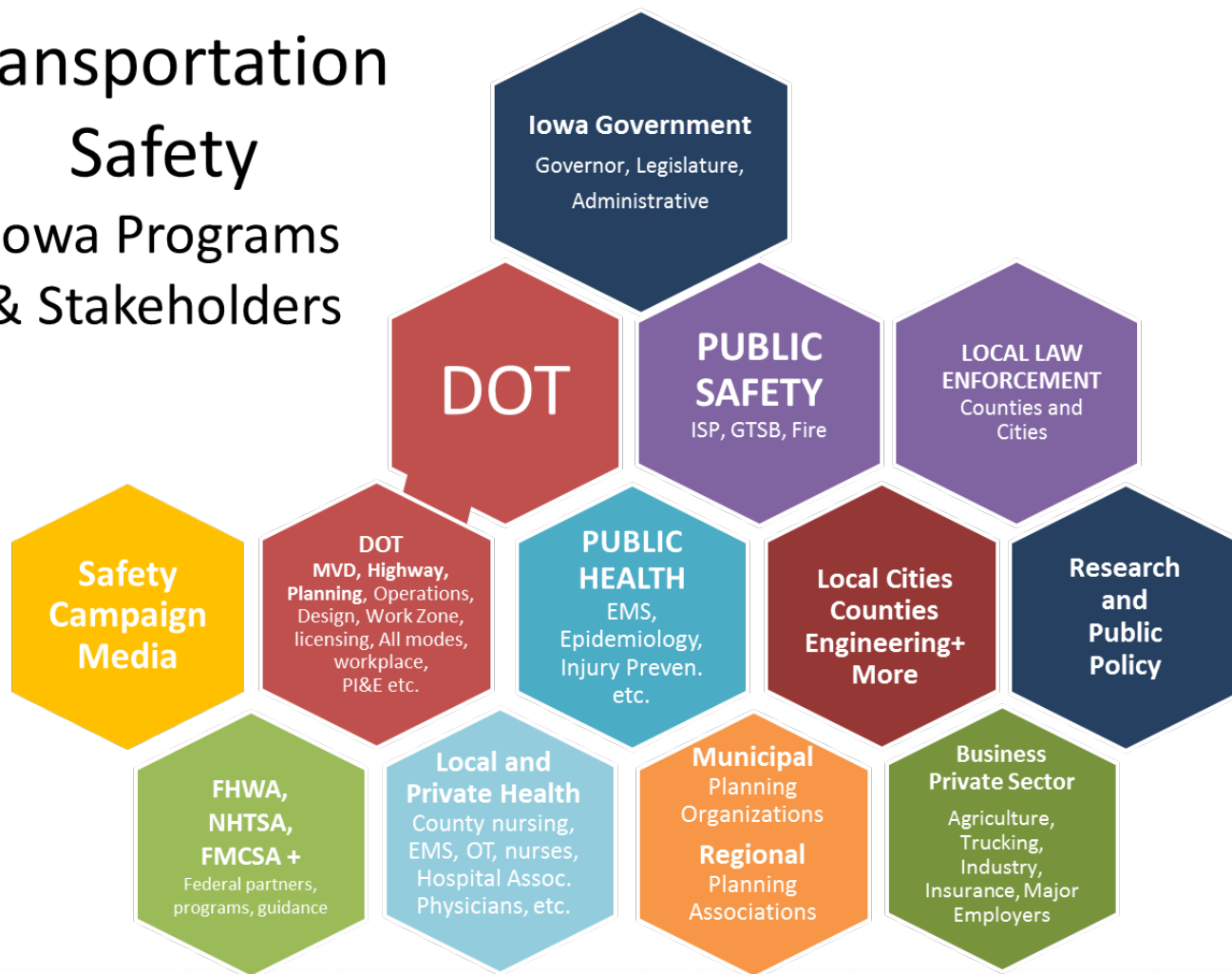
**E**mergency  
Services

**EVERYONE  
ELSE**

# A State SHSP Recognizes “Everyone Else” Can Help

## Transportation Safety

Iowa Programs  
& Stakeholders





# Why Collaboration Matters

- We believe the **SHSP** process can help identify elements of highway safety that each of our organizations can carry forward
- MAP-21
  - Requires states to have safety performance targets
  - Strengthens the expectations that the SHSP, HSP, and MCSP have shared goals



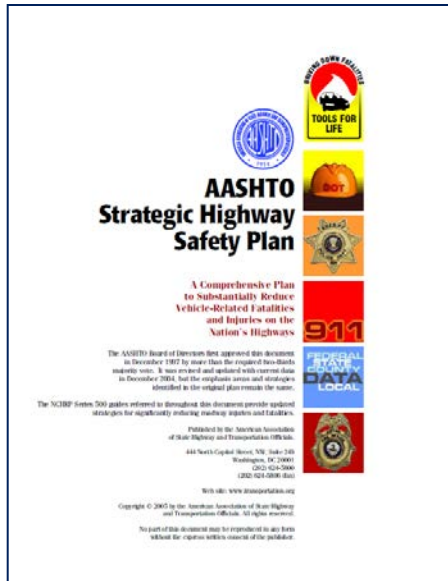


# Why Collaboration Matters

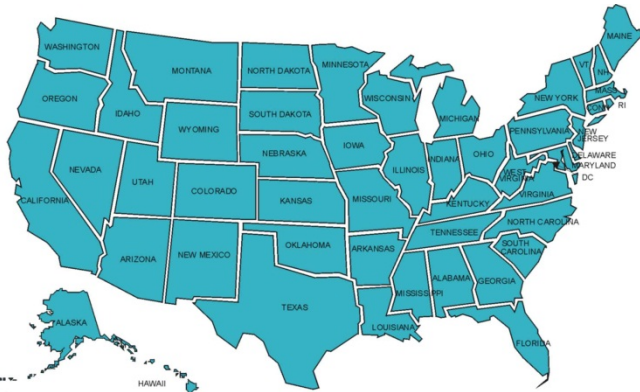
## Map 21 Highway Safety Improvement Program (HSIP)

- Safety throughout all transportation programs remains DOT's number one priority.
- Data-driven, strategic approach to improving highway safety on all public roads that focuses on performance.
- Every State is required to develop a Strategic Highway Safety Plan (SHSP) that lays out strategies to achieving safety targets by requiring regular plan updates and defining a clear linkage between behavioral (NHTSA funded)
- States will set targets for the number of serious injuries and fatalities and the number per vehicle mile of travel.

# AASHTO Strategic Highway Safety Plan Model (1990's - 2000's)



- AASHTO's overall goal is to move away from *independent* activities of engineers, law enforcement, educators, judges, and other highway safety specialists and to **move toward coordinated efforts**.
- The AASHTO Strategic Highway Safety Plan identified 22 goals to pursue in order to significantly reduce highway crash fatalities.
- Identifying and integrating the “E’s” of highway Safety - Engineering, and Behavior Strategies
- To be implemented across all jurisdictions (state, county, municipal, and tribal lands)



# Toward Zero Deaths: Partners Push Forward

- A National Strategy on Highway Safety framed 2009-2010
- National strategy intended as an interdisciplinary guide or framework for safety stakeholder organizations to enhance their safety planning and implementation efforts.
- The national framework will outline proven and innovative new strategies directed at institutional and cultural changes through the 4 E's:
  - Education
  - Enforcement
  - Engineering
  - Emergency Medical Services

<http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2975>



# Why Is TZD Being Launched?

- There is a renewed worldwide focus on fatalities; this is the USA's contribution to the global “Decade of Action”
- To build on the recent successes in fatality reduction
- To build on the lessons of states in their **strategic highway safety plans**
- To build on experiences gained from safety planning and multidisciplinary approaches and involvement from wide variety of highway safety stakeholders & “owned” by all stakeholders



# National Emerging Trends

- Doubling of elderly population by 2030
- Increase in freight traffic from 15 billion tons today to 30 billion by 2050
- Increased distracted and drugged driving
- 2010 deaths—down overall, but:
  - Up for large trucks
  - Up for motorcyclists
  - Up for pedestrians





# TZD Communications

- Cultural change: change Americans' attitudes toward highway safety (NEW emphasis)
- Encourage an aggressive approach based on the ideal that no death is acceptable and that we can eliminate highway fatalities.
- Make “TZD” the common goal for Americans



# 2011 AAA Traffic Safety Culture Index

## ***Speeding***

- 74% of drivers consider it unacceptable for a driver to drive more than 15 mph over the speed limit on a freeway,
  - 52% admit to having done so in the past month.

## ***Cell phone use while driving***

94% consider it a serious threat

- 68% talked on their phone while driving in the last 30 days.
- 31% do so often or regularly.

## ***Texting while driving***

- 35% admit reading a text or email while driving &
- 26% admit sending a text in the last 30 days.

**“We are moving in the right direction when it comes to safety on our roads but we need to do much more. Changing driver behaviors is not rocket science ... it’s harder. Take the first step and make a personal goal to be a safe driver in 2012,” – Peter Kissinger, AAA**



# Culture Change and Tobacco Habits

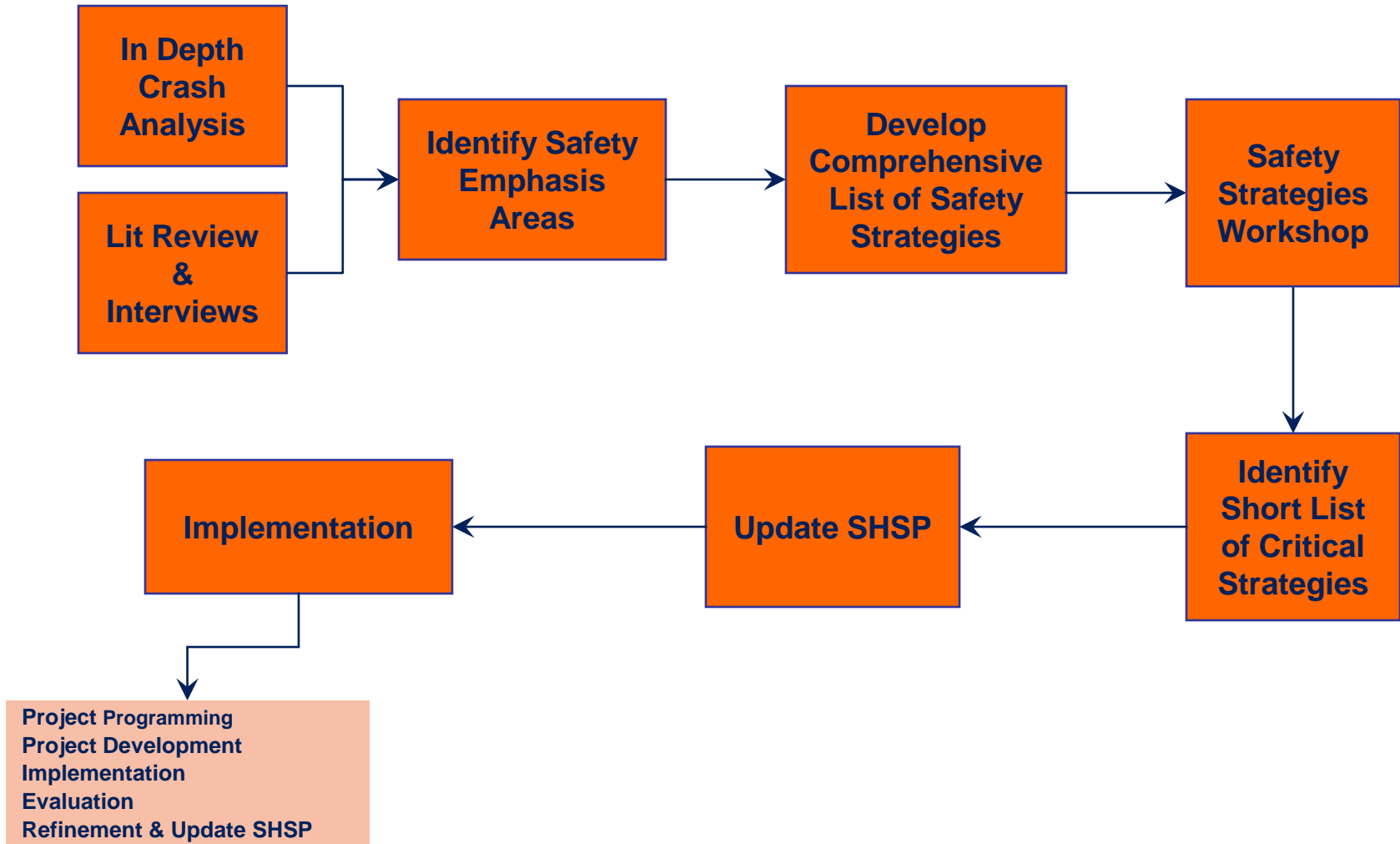
From  
“Stylish and Glamorous”



To  
“Out of Style”



# Iowa's SHSP Update Process





# Designing a Process to ID Safety Opportunities

- Who?
- What?
- When?
- Where?
- Why?
- How to identify topic areas?
- How to identify opportunity areas?
- What data to use?
  - Start with 10 years of crash data
  - Fatal and severe injury
- What data can we add?
- What are the trends?
- Where are counter-trends?
- When to look at rates along with frequencies?
- What causes crashes?
- What systems are crashes on?



.....How?





# Crash Categories + Topics

Driver, Highways, Special Users, Vehicles, Health, Management

**Drivers**  
**Highways**  
**Special Users**  
**Vehicle**  
**Health**  
**Management**

Health		
	Enhancing EMS	Enhancing Emergency Medical Capabilities
		Public Health
Management		
		Implementing Road Safety Audits
		Improving Info & Decision Support Systems
		Creating More Effective Safety Processes/Systems
		Using ITS to Improve Highway Safety
		Develop Multidisciplinary Safety Teams
		Education
	Legislative Initiatives	Legislative Initiatives
		TSIP Funding
		Enforcement Funding
		Safety Corridors
	Safety Culture	Safety Culture
		Leadership & Organizations
		Performance Measures
		Communication
		Information & Knowledge Mgmt

1998 AASHTO SHSP

2001 Iowa Tool Box

2000's NCHRP 500

2006 Iowa CHSP

2010 TZD Framework

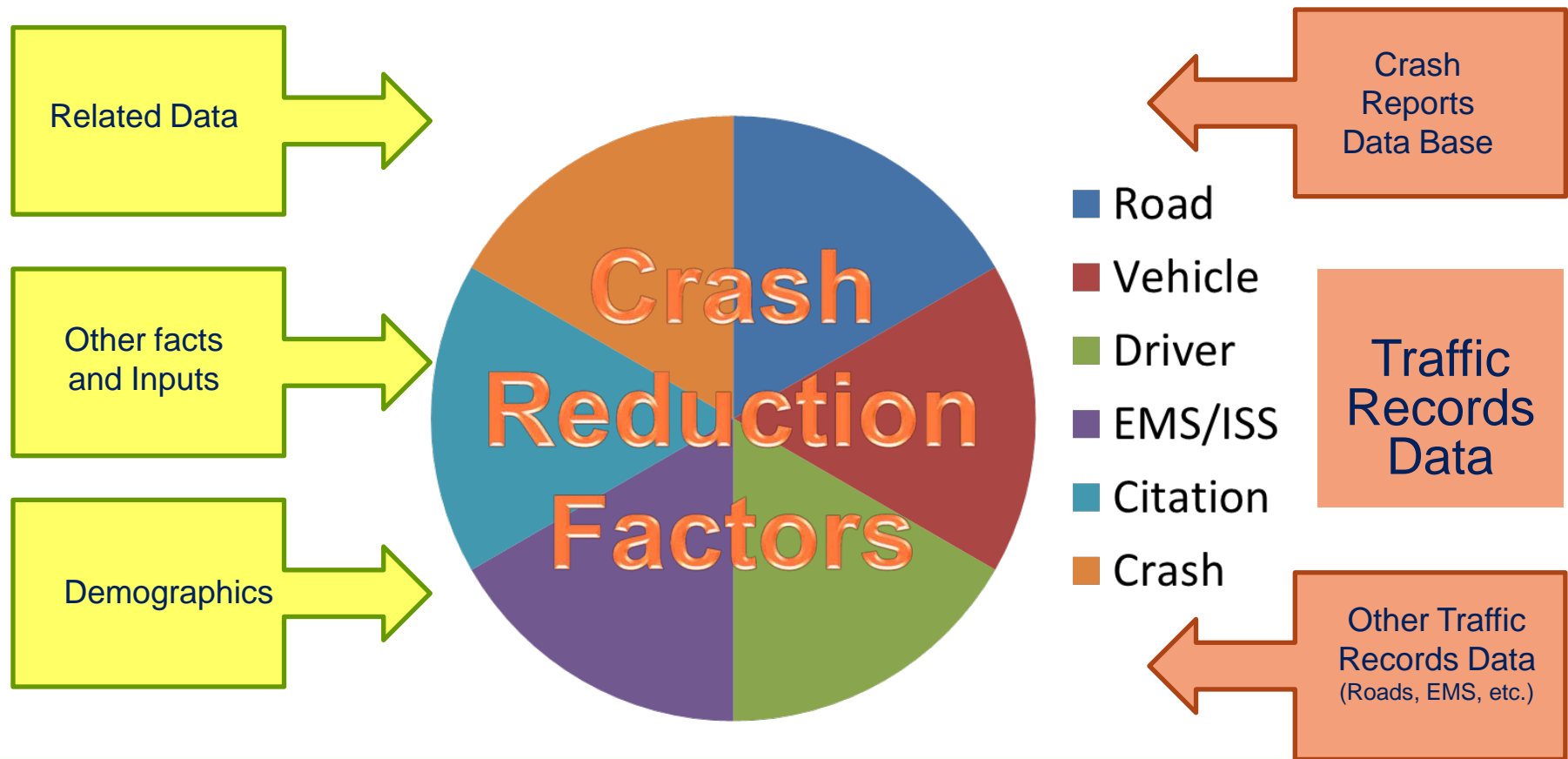
2005-11 NHTSA

*Countermeasures That Work*

2012 IOWA SHSP



# Data-Driven Safety Analysis



# Frequency and Severity Comparisons

Total Crashes: 2007 - 2011

Statewide, Iowa

All Crashes

Frequency



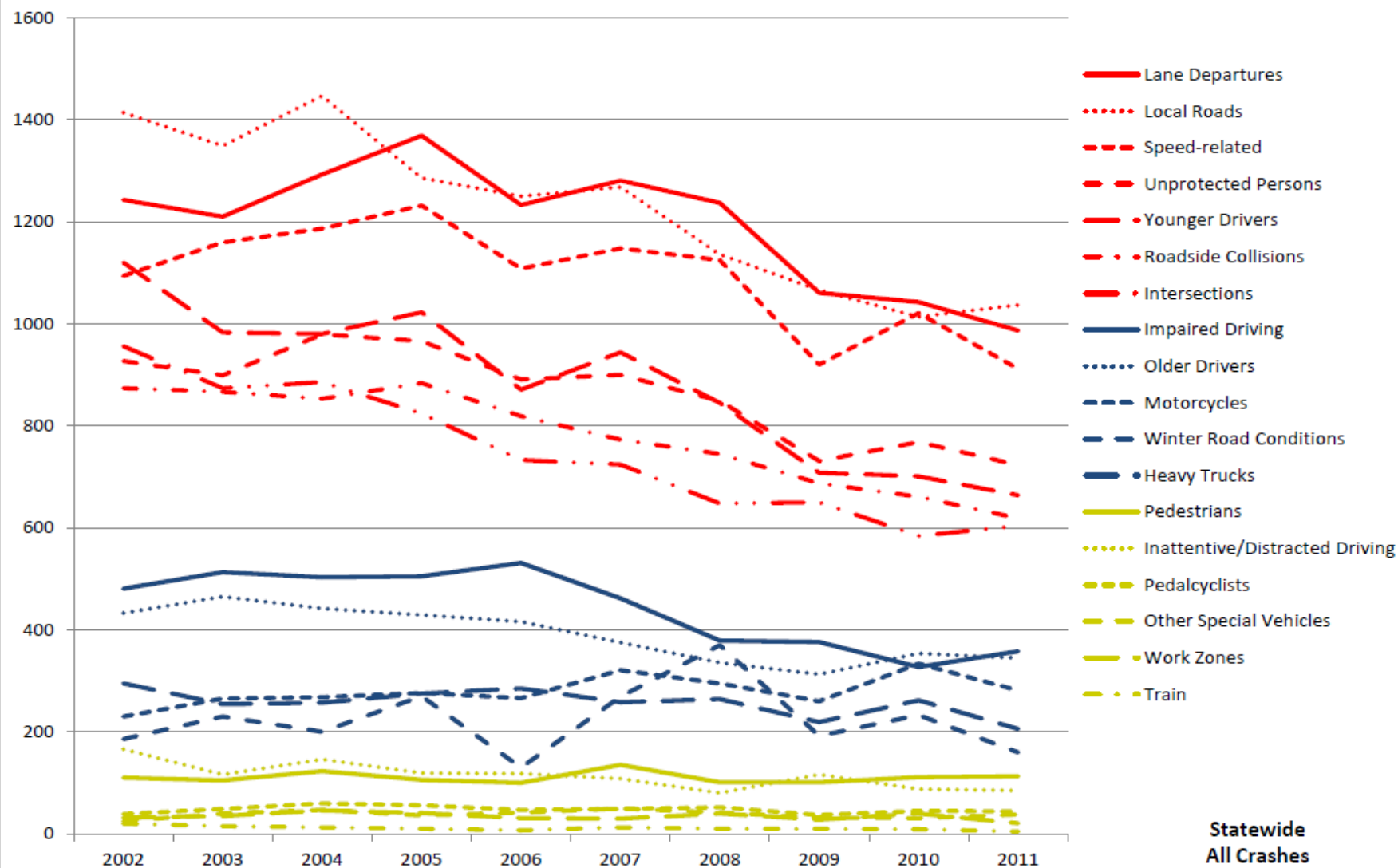
2007 - 2011

Category	Topic Totals	Crash			Injury			Severe Injury Rank	2006 CHSP
		Fatal	Major	Severe*	Fatalities	Major	Severe*		
		1774	6969	8743	1977	8598	10575		
Drivers									
	Younger Drivers	522	2531	3053	607	3255	3862	5	x
	Older Drivers	388	1033	1421	431	1292	1723	9	x
	Speed-related	890	3337	4227	991	4135	5126	3	
	Impaired Driving	435	1086	1521	492	1410	1902	8	
	Inattentive/Distracted Driving	54	315	369	66	411	477	14	x
Highway	Unprotected Persons	930	2192	3122	1044	2927	3971	4	x
	Train	12	31	43	13	34	47	18	
	Lane Departures	1184	3307	4491	1332	4277	5609	1	x
	Roadside Collisions	685	2274	2959	752	2733	3485	6	
	Intersections	390	2261	2651	425	2785	3210	7	x
	Work Zones	29	101	130	35	124	159	17	
	Local Roads	864	3887	4751	931	4590	5521	2	x
Special Users	Winter Road Conditions	191	794	985	213	1011	1224	11	
	Pedestrians	105	420	525	112	449	561	13	
Vehicles	Pedalcyclists	27	195	222	27	200	227	15	
	Motorcycles	244	1095	1339	257	1234	1491	10	x
	Heavy Trucks	321	669	990	371	838	1209	12	
	Other Special Vehicles	45	117	162	47	146	193	16	

\* Severe = Fatal + Major for both crashes and injuries, respectively.

# Prioritizing Topic Areas

**Annual Fatalities and Major Injuries by SHSP Topic Area - Emphasis-based  
2002 - 2011**



# Screening Iowa's Topic Areas



The selected topic areas represent the greatest potential to reduce the number of traffic fatalities & major injuries in Iowa.



# Poll questions:

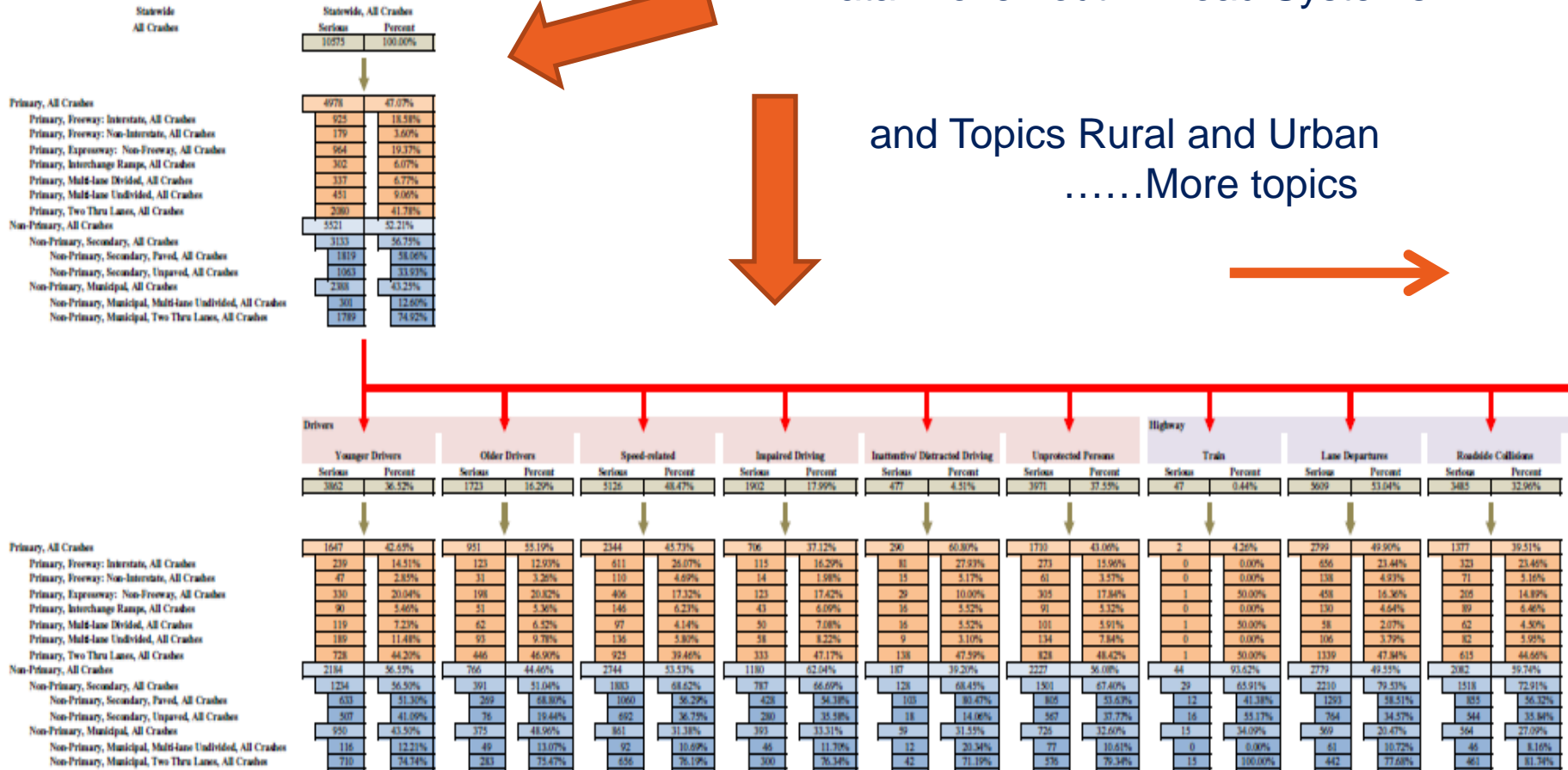
- Topics for further analysis



# Data Analysis Example

Data Broken out in Road Systems

and Topics Rural and Urban  
.....More topics

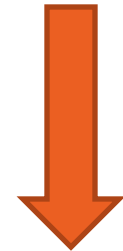


Iowa's Strategic Highway Safety Plan  
Join the plan to save more lives...

# ... The rest of this story is....

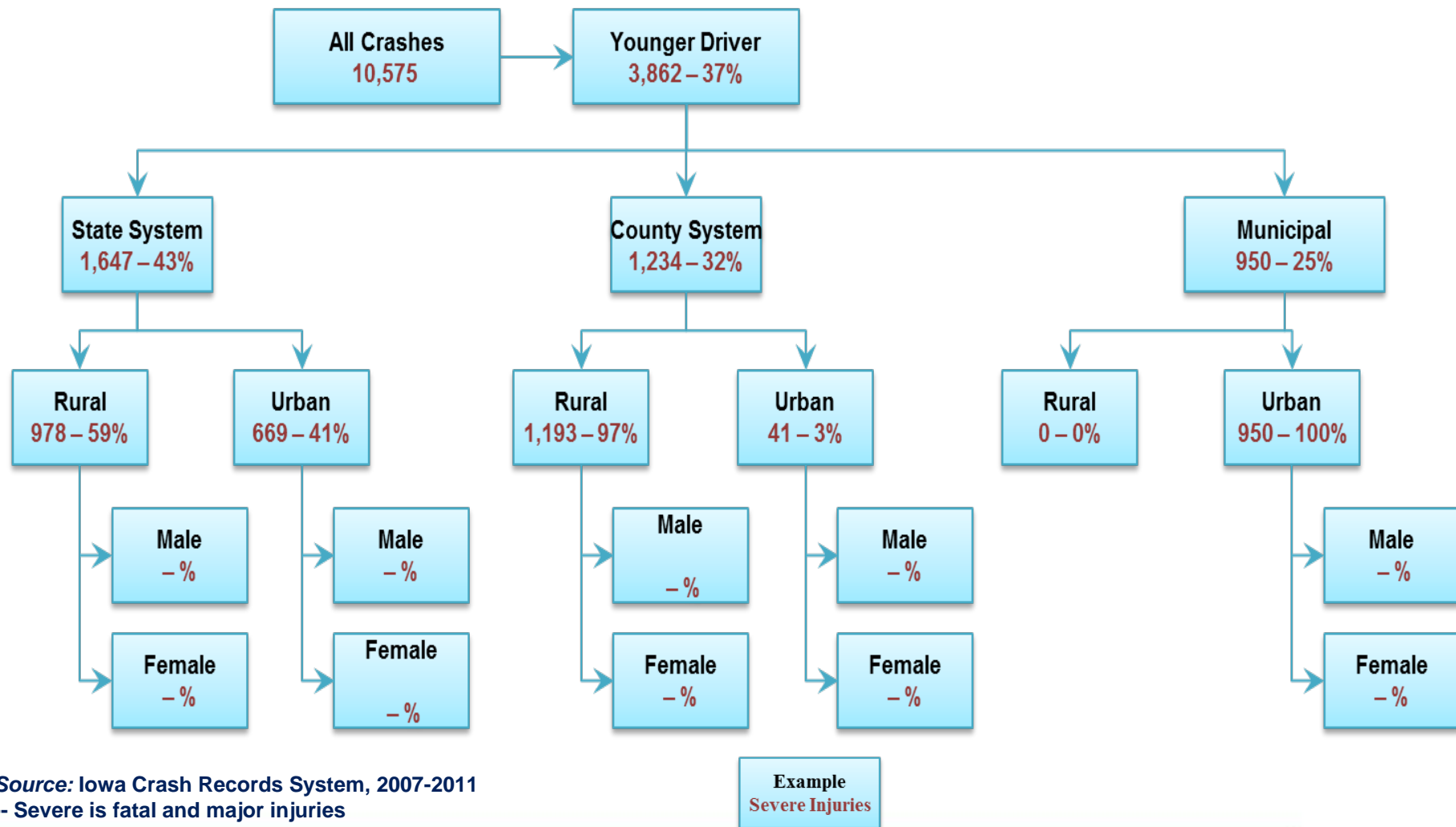
## Data Broken out in Road Systems

and Topics Rural and Urban

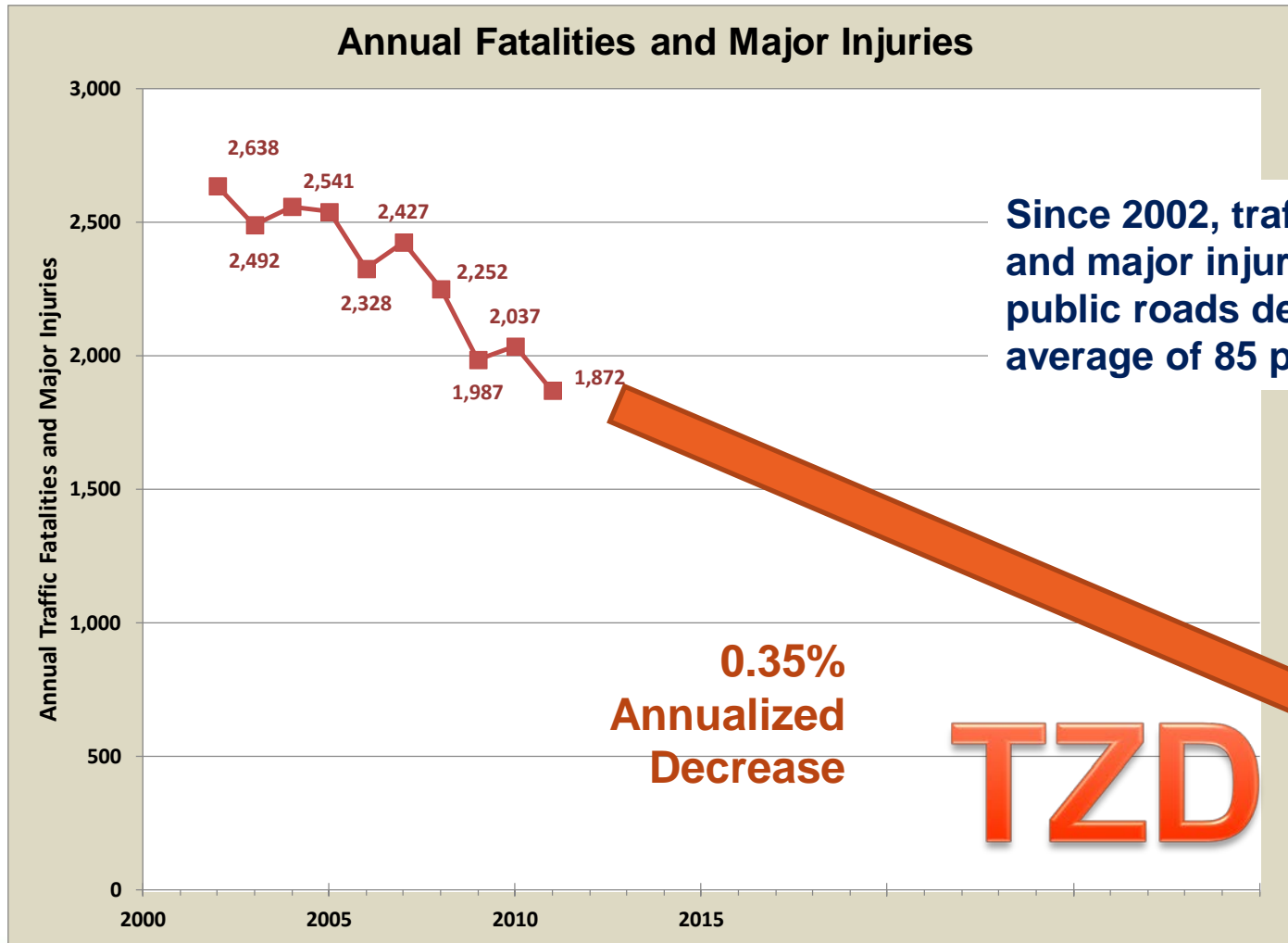


Intersections		Work Zones		Local Roads		Winter Road Conditions		Special Users		Pedalcyclists		Vehicles		Heavy Trucks		Other Special Vehicles	
Serious	Percent	Serious	Percent	Serious	Percent	Serious	Percent	Serious	Percent	Serious	Percent	Serious	Percent	Serious	Percent	Serious	Percent
3210	30.33%	139	1.38%	3521	52.21%	1224	11.53%	361	5.30%	227	2.15%	1491	14.10%	1209	11.43%	193	1.83%
1443	44.92%	133	83.65%	0	0.00%	696	56.37%	178	31.73%	52	22.91%	628	42.12%	888	73.45%	82	42.49%
13	0.90%	63	47.37%	0	NA	209	30.29%	50	28.09%	0	0.00%	76	12.10%	278	31.31%	1	1.22%
9	0.62%	3	2.26%	0	NA	37	5.30%	3	1.69%	0	0.00%	17	2.71%	27	3.04%	2	2.44%
400	27.72%	9	6.77%	0	NA	76	11.01%	12	6.74%	11	21.15%	116	18.47%	157	17.68%	19	23.17%
92	6.38%	12	9.02%	0	NA	22	3.19%	9	5.06%	1	1.92%	62	9.87%	46	5.18%	2	2.44%
215	14.90%	9	6.77%	0	NA	14	2.03%	33	18.54%	7	13.66%	57	9.08%	24	2.76%	7	8.54%
237	16.42%	11	8.27%	0	NA	32	4.64%	35	19.66%	12	23.08%	78	12.42%	50	5.63%	4	4.88%
615	42.62%	34	25.56%	0	NA	313	45.36%	40	22.47%	24	46.15%	257	40.92%	374	42.12%	47	57.32%
1747	54.42%	25	15.72%	3521	100.00%	327	43.06%	370	63.99%	134	76.63%	850	57.07%	317	26.22%	111	57.51%
657	37.61%	9	36.00%	3133	56.75%	323	61.29%	47	12.70%	36	20.69%	431	50.71%	231	72.87%	80	72.07%
295	44.90%	5	35.56%	1819	58.06%	227	30.28%	35	94.47%	32	88.89%	339	78.65%	147	63.64%	37	46.25%
204	31.05%	2	22.22%	1063	33.93%	78	24.15%	11	23.46%	2	5.56%	42	9.74%	62	26.84%	36	45.06%
1090	62.39%	16	64.00%	2388	43.25%	204	30.71%	323	87.30%	138	79.31%	419	49.29%	86	27.13%	31	27.93%
137	12.57%	0	0.00%	303	12.60%	18	8.82%	49	15.17%	20	14.49%	42	10.02%	13	15.12%	12	38.71%
805	71.85%	13	81.25%	1789	74.92%	160	78.43%	250	77.48%	105	76.09%	325	77.57%	62	72.09%	35	51.61%

# Young Driver Analysis

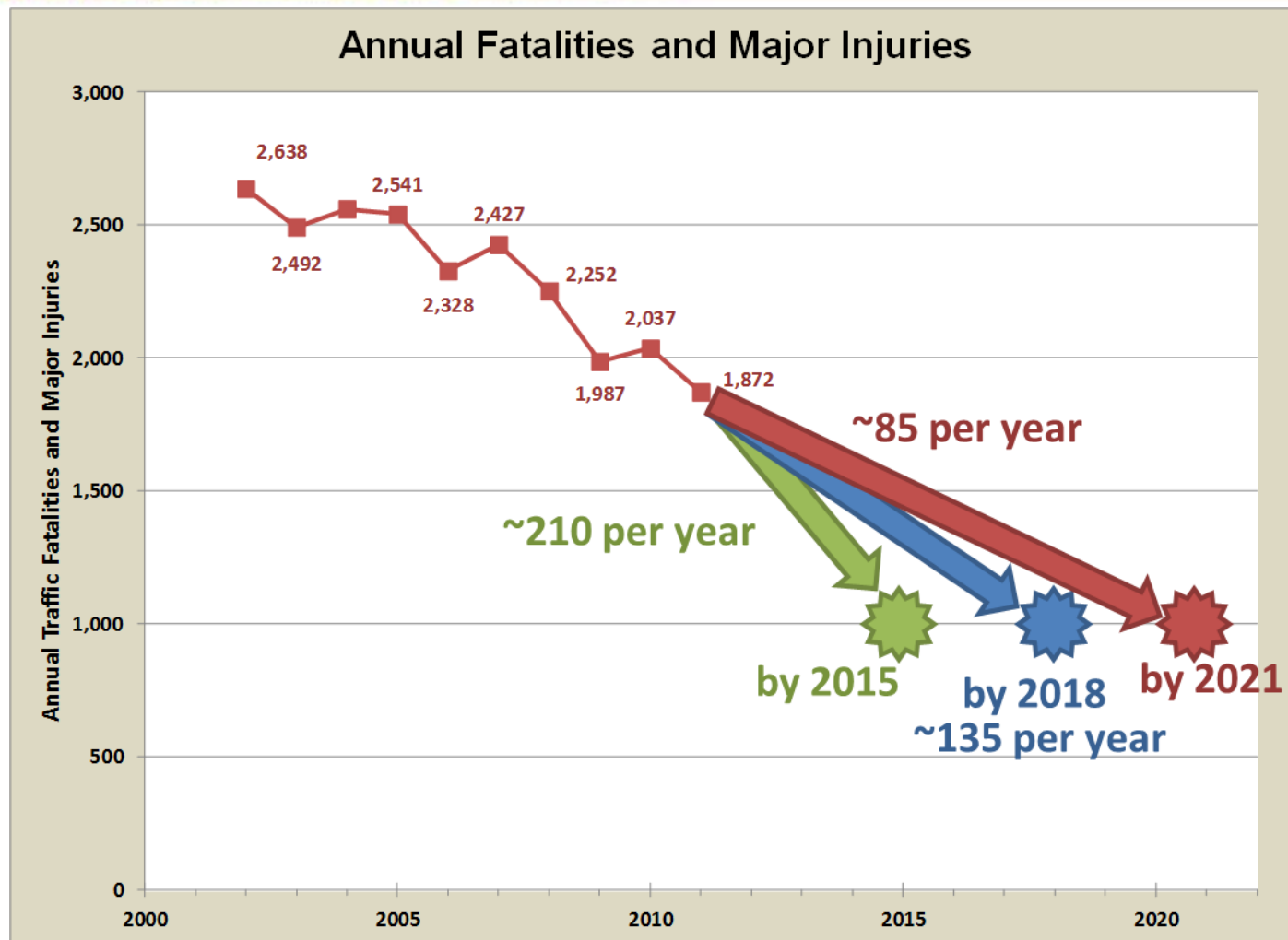


# Iowa's SHSP Long-Term Safety Goal





# Short-Term Injury Reduction Goal





Poll  
questions:

What Goal?



# Iowa SHSP Safety Strategies Workshop

**Date:** January 23, 2013

**Location:** Ankeny Marriott Courtyard

## **Objectives:**

- Create a common understanding among stakeholders
- Multi-disciplinary discussion of a short list of safety strategies



# Safety Workshop - Agenda

- Introductions & Welcome
- SHSP Overview
- Safety Panel
  - 4Es of Discussion
- Iowa Crash Data
  - Analysis and programs
- Breakout Groups
  - By topic areas
  - Prioritization
- Draft strategies and plan

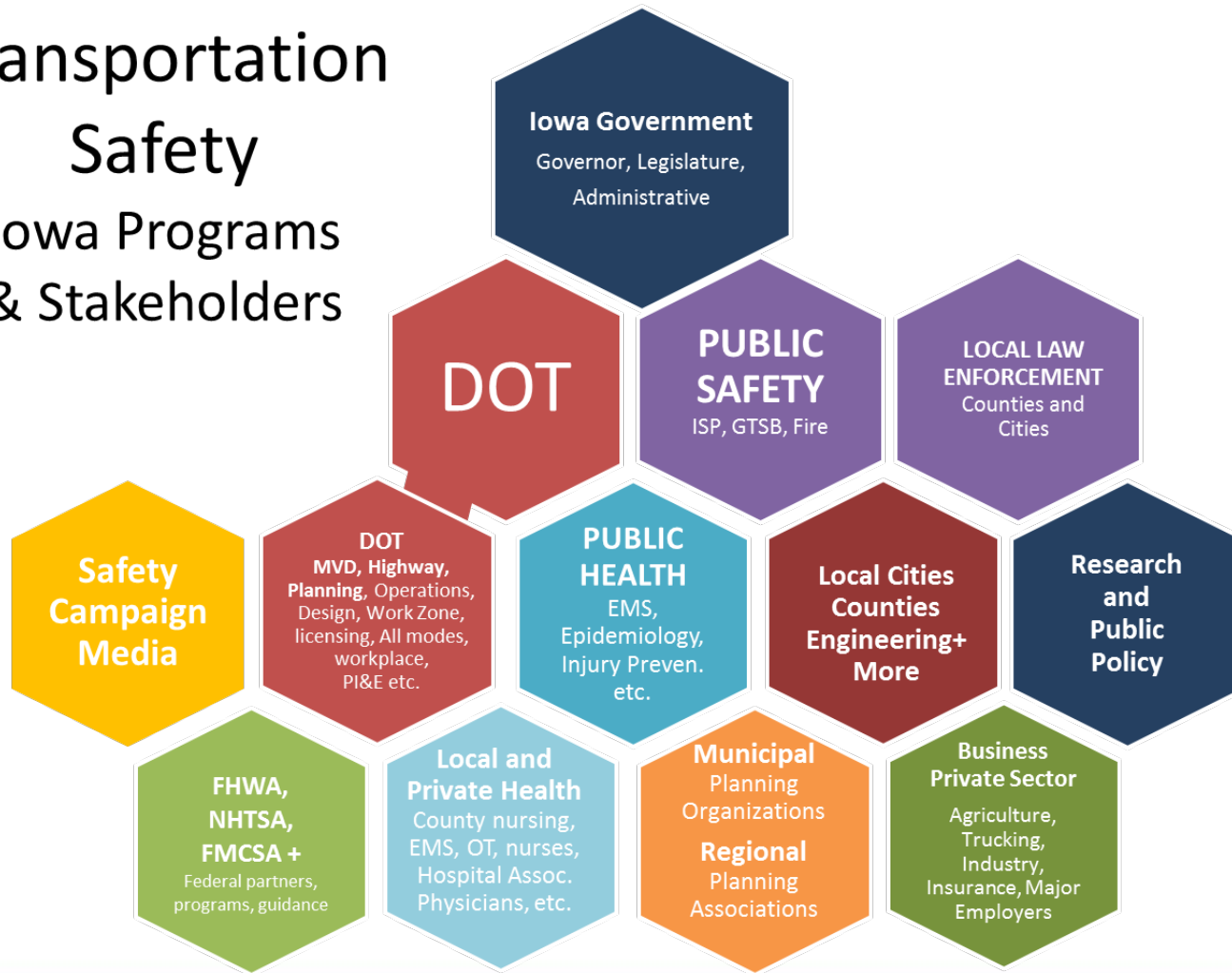




# Attendees for the Strategies Workshop

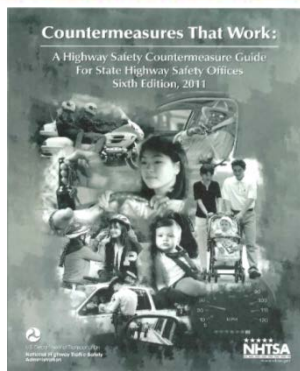
## Transportation Safety

Iowa Programs  
& Stakeholders





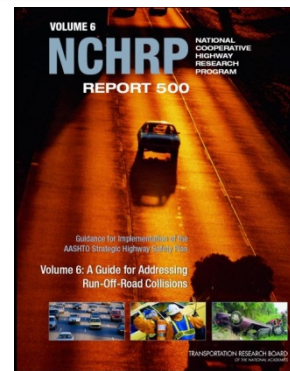
# Safety Strategy Guides - NHTSA and AASHTO / NCHRP



## Countermeasures That Work GHSA *Governor's Highway Safety Association*

- Assists State Highway Safety Offices (SHSOs) in selecting effective, science-based traffic safety countermeasures for major highway safety problem areas.
- Describes major strategies and countermeasures relevant to SHSOs;
- Summarizes their use, effectiveness, costs, and implementation time; and
- Provides references to the most important research summaries and individual studies.
- Revised every two years

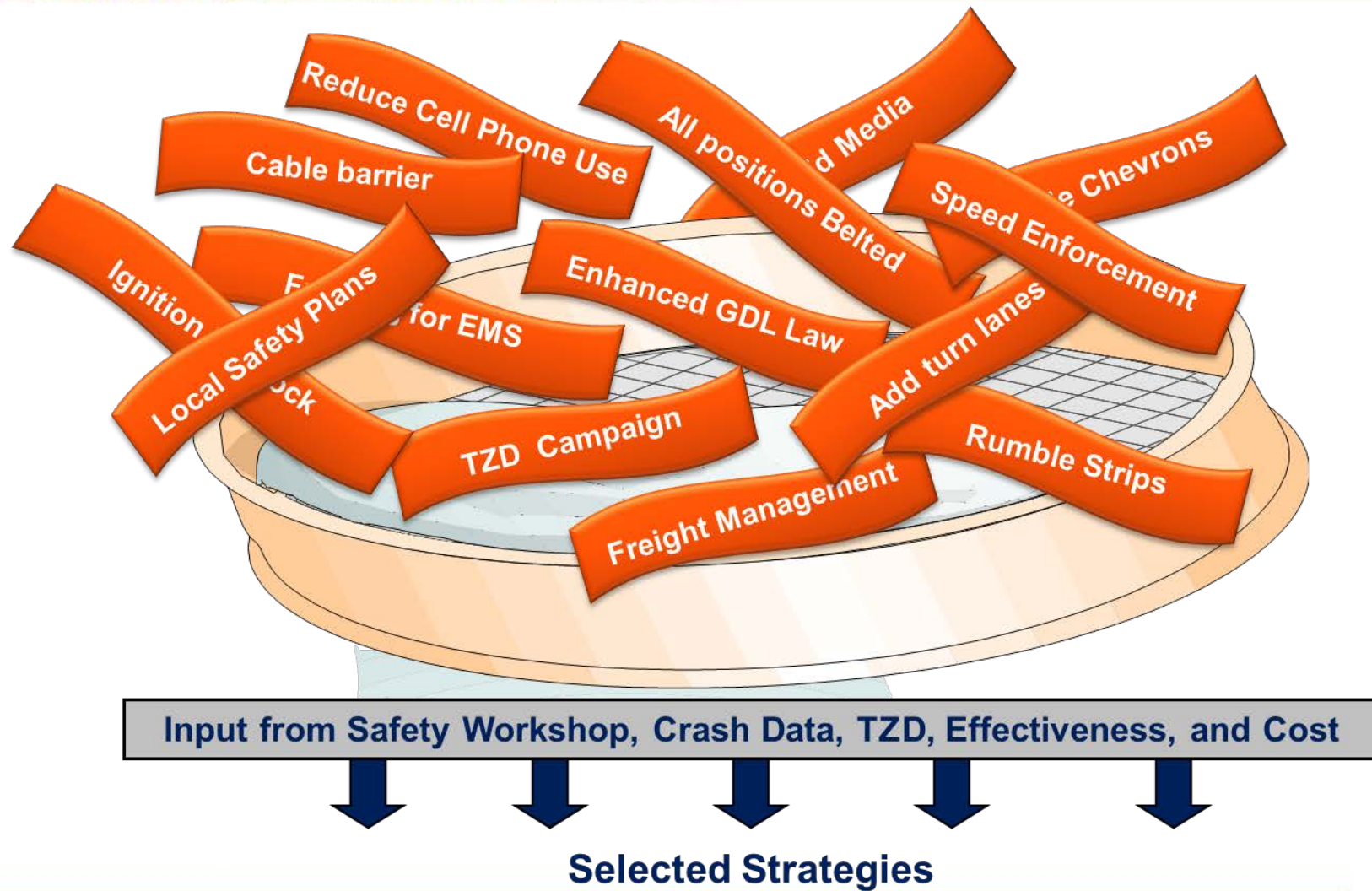
<http://www.ghsa.org/html/publications/countermeasures.html#years>



## Series 500 Guidebooks AASHTO + NCHRP *American Association of Transportation Officials National Cooperative Highway Research Program*

- The implementation process outlined in the series of guides promotes forming working groups and alliances that represent all of the elements of the safety system.
- Provide comprehensive guidance in 22 topic areas..
- In this formation, highway safety specialists can draw upon their combined expertise to reach the bottom-line goal of targeted reduction of crashes and fatalities associated with a particular emphasis area.
- Intended to facilitate agency implementation of SHSP objectives.
- Focus is on low-cost, readily implementable strategies
  - **Proven**
  - **Effective**
  - **Tried**
  - **Experimental**

# Screening - Initial Strategies to match topics



# Example – Typical Run-Off Road Strategies

## Lane Departure Crashes

### Key Objectives:

Keep Vehicles in Their Lane

### Key Strategies:

- Improved curve delineation
- Improved lane markings

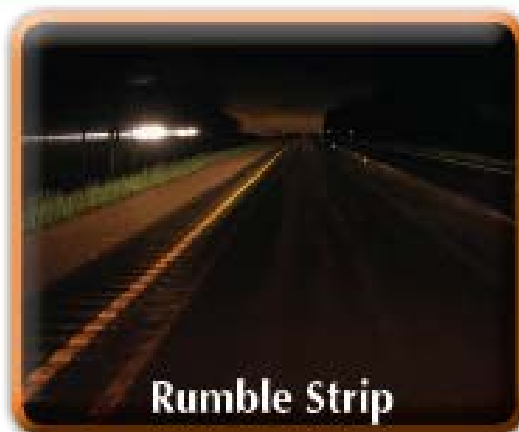


### Key Objectives:

Improve Shoulders

### Key Strategies:

- Safety edge
- Paved shoulders
- Shoulder rumble strips



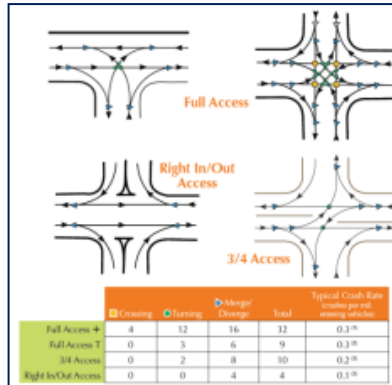


# Example – Typical Intersection Strategies

## Included Strategies:



Change  
Intersection  
Type

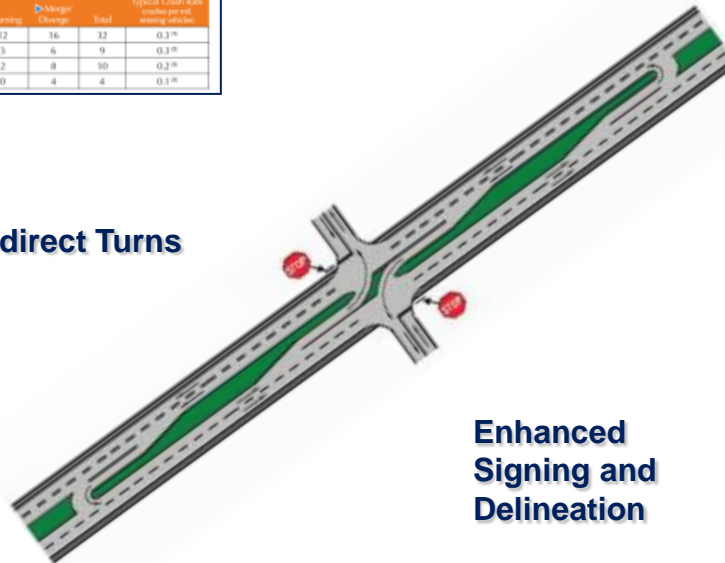


Street  
Lighting

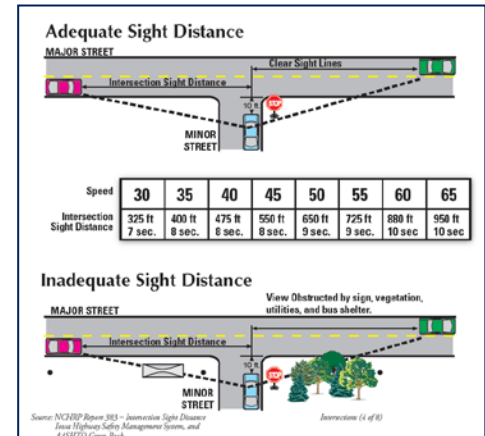


Dynamic  
Warning  
Signs

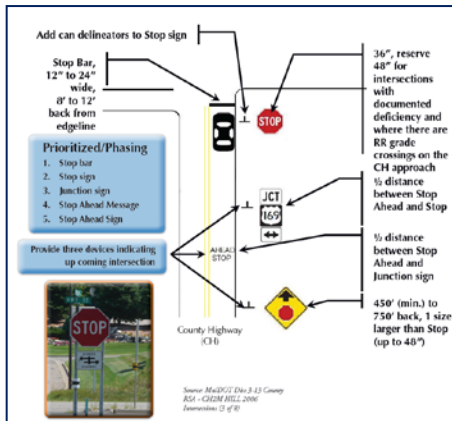
Indirect Turns



Enhanced  
Signing and  
Delineation



Improve Sight Distance



# Young driver example strategy -GDL

- Young drivers are involved in fatal crashes at over twice the rate of drivers aged 21 and older.
- Three-stage GDL laws address these factors by reducing high-risk exposure for novice drivers. Evaluations clearly show the benefits of adopting GDL laws, generally indicating 20- to 50-percent reductions in crashes of young novice drivers.

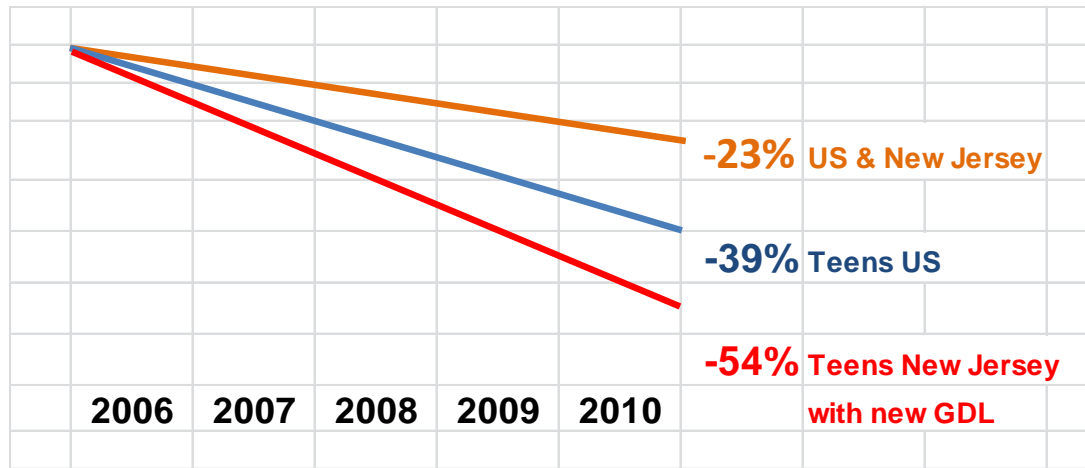
## **Enhanced Graduated Driver Licensing (GDL):**

- Minimum Age 16 for Learner's Permit
- 6-Month Holding Period
- 30-50 Hours Supervised Driving
- Nighttime Driving Restriction
- Passenger Restriction
- Cell Phone Restriction
- Age 18 for Unrestricted License





# Example Safety Strategy: New Jersey GDL



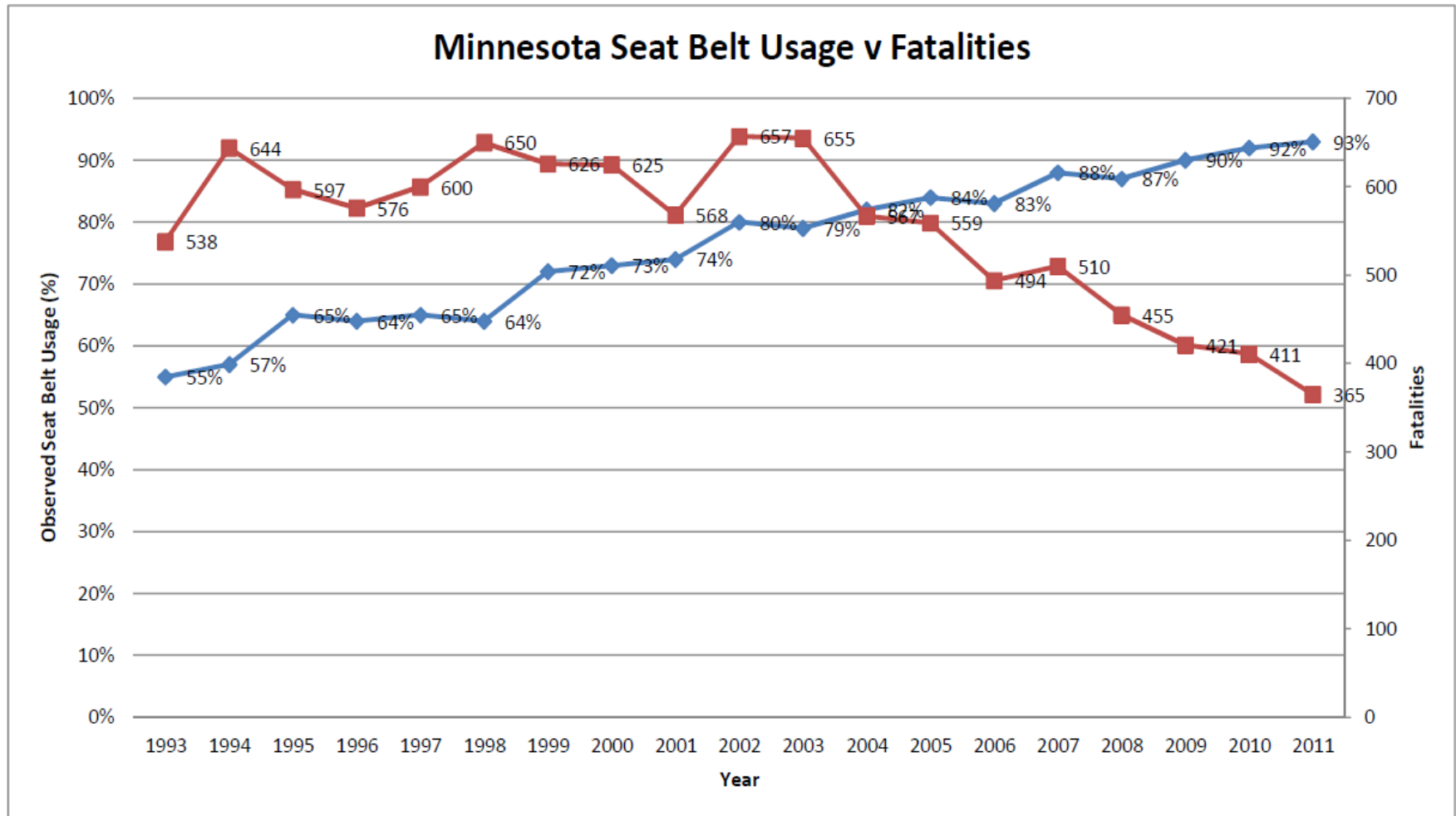
2006-2010

Fatalities from crashes involving young drivers (16-20) declined at a faster rate than overall fatalities.

US overall	-23%
US Teens	-39%
New Jersey overall	-23%
New Jersey teens with comprehensive Graduated Drivers License	-54%



# Example Safety Strategy – Enact a Primary Law



# 2012 Iowa SHSP Current Process Summary

- Engage Stakeholders – November 2012
- Literature Reviews
- Interviews
- Data driven
  - The new National Safety Performance measure = severe crashes
- Foster safety culture among stakeholders
- Strategies Workshop- January 2013
- **Identify ‘targets of opportunity’ based on Iowa’s experience and safety records**
  - Establish safety emphasis areas
  - Determine high priority safety strategies
  - Discuss safety investment options



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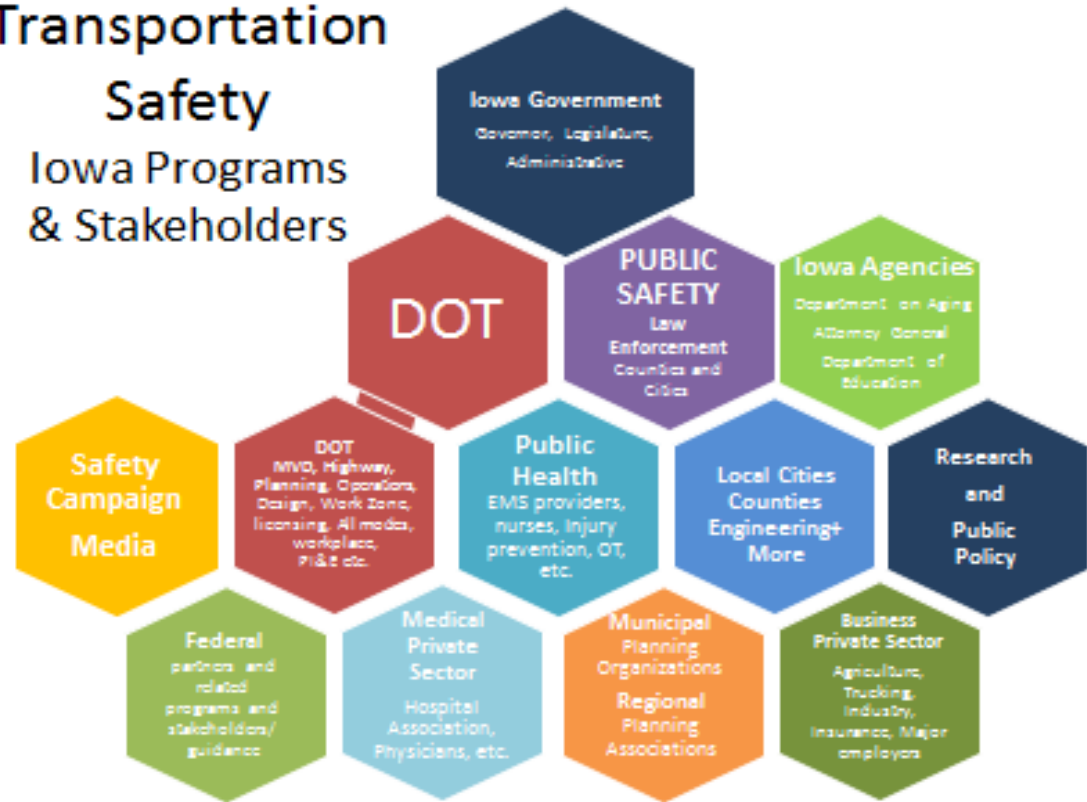


# Next Steps


**Safety  
Strategies  
Workshop**  
January 23, 2013

**Draft SHSP**  
March 2013

## Transportation Safety Iowa Programs & Stakeholders



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# Save the Date

## January 23, 2013

### Iowa SHSP Safety Strategies Workshop

Join the plan  
to save more lives...

To make a significant headway  
Towards Zero Deaths,  
we will need to adopt a culture of  
safety where individual citizens  
and officials will not accept  
fatalities from vehicle crashes  
as a price for mobility.

*-Hugh W. McGee, Ph.D., P.E.*