



# The Safe System Approach and TZD

# What we'll discuss today

- What is the Safe System Approach (SSA)
  - Underlying concept
  - Principles
  - Elements
- How SSA elements relate to the Es of TZD
  - Education
  - Enforcement
  - Engineering
  - Emergency Medical and Trauma Services
  - 'Everyone'
- What your "E" can do related to the Safe System Approach

**Imagine our country as a place where *nobody* has to die from vehicle crashes.**



Source: Fehr & Peers

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## OUR CURRENT REALITY

Traffic fatalities are a public health crisis affecting all road users.

**1.25M**

Lives lost globally each year from traffic crashes

Source: World Resources Institute

**36,096**

Lives lost on US roads in 2019

Source: NHTSA

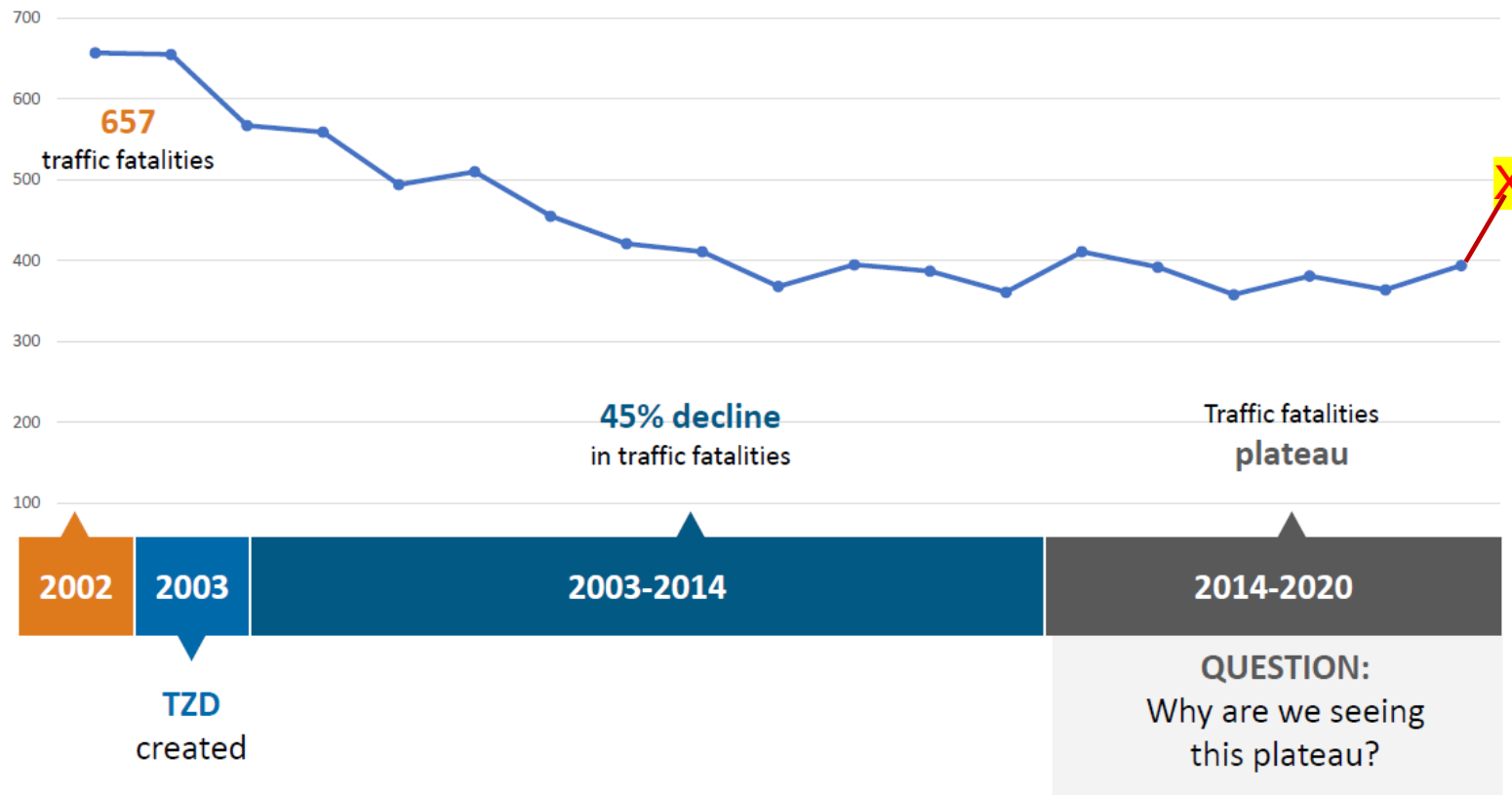
**6,205**

Pedestrians killed in US traffic crashes in 2019

Source: NHTSA

# Why a new approach?

## MN Traffic Safety History



Preliminary fatalities in 2021: **488**



Minnesota Strategic Highway Safety Plan

# New approach needed

- We must do things differently
- TZD 2.0 is refocused to:
  - Safe System Approach
  - Traffic Safety Culture

## Australian Road Safety Commissioner Iain Cameron explains the 'Safe System' approach



30 kph = 18.6 mph

50 kph = 31 mph

<https://www.youtube.com/watch?v=MigxAs0KjBw>

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## A NEW DIRECTION

The Safe System approach aims to eliminate fatal and serious injuries for all road users by:



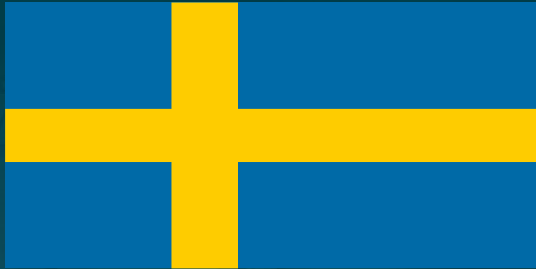
**Accommodating  
human mistakes**



**Keeping impacts on the human  
body at tolerable levels**



# SUCCESSFUL SAFE SYSTEM ADOPTERS



## Sweden

Vision Zero

**60-70%**

Reduction in fatalities  
1994-2015

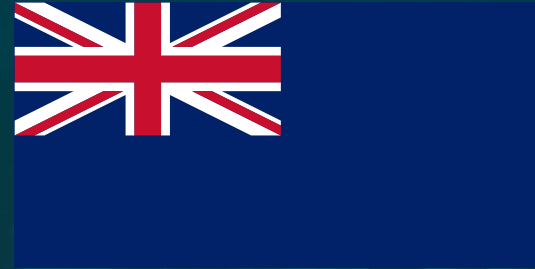


## Netherlands

Sustainable Safety

**50-60%**

Reduction in fatalities  
1994-2015



## Australia

Safe System

**50-60%**

Reduction in fatalities  
1994-2015



## New Zealand

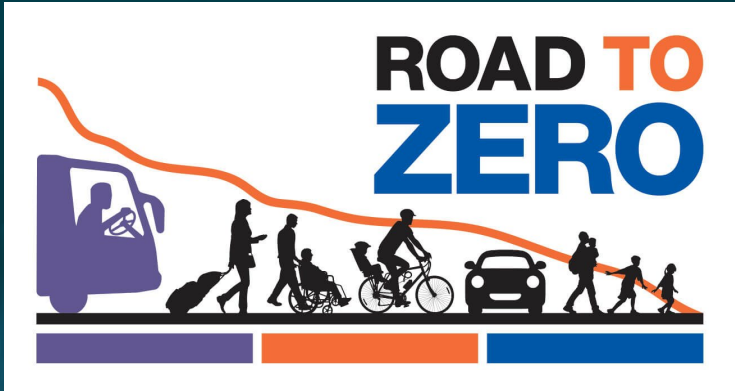
Safer Journeys

**50-60%**

Reduction in fatalities  
1994-2015

Source: World Resources Institute

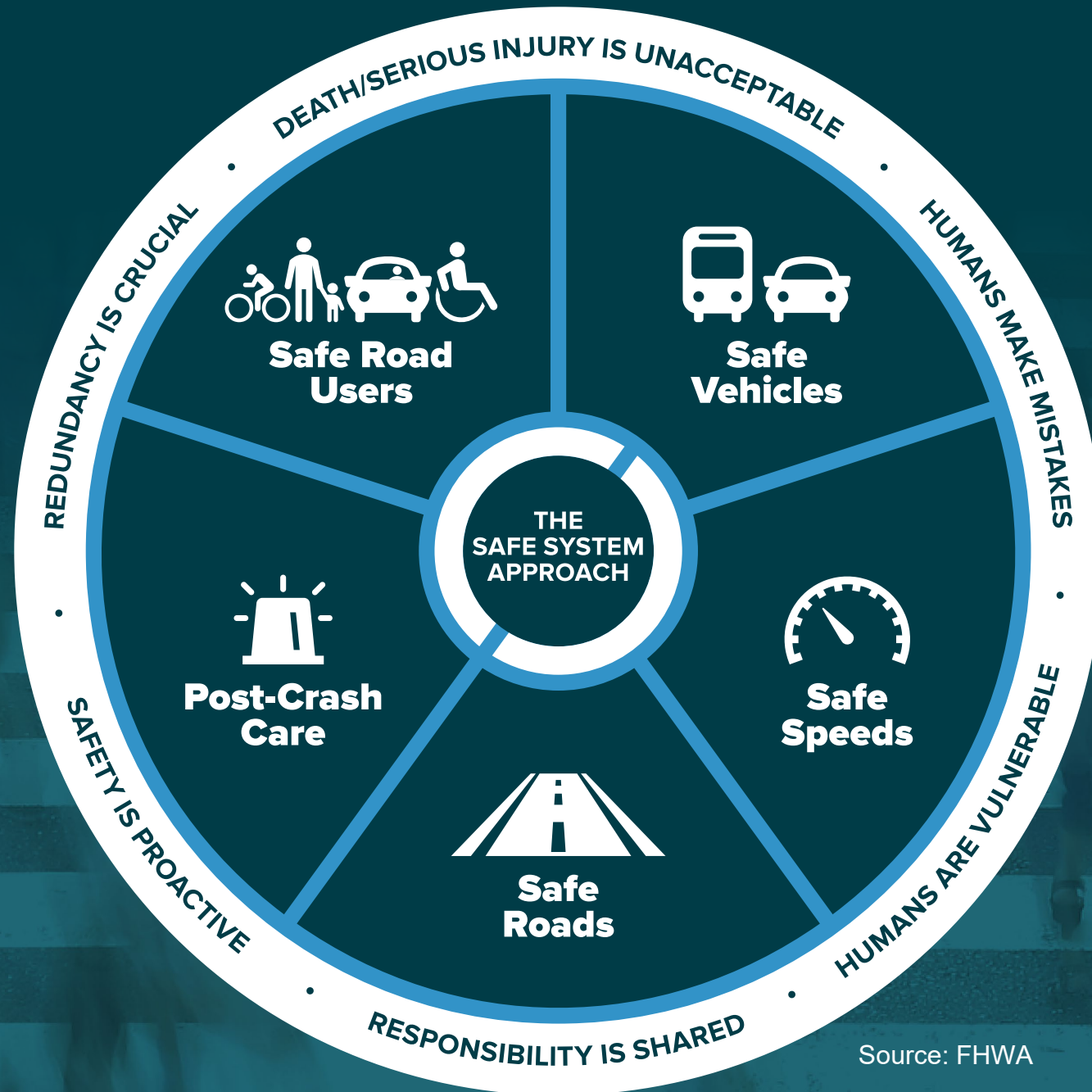
# SAFE SYSTEM IN THE UNITED STATES



**Toward Zero Deaths<sup>®</sup>**  
National Strategy on Highway Safety



# THE SAFE SYSTEM APPROACH



Source: FHWA

# THE 6 SAFE SYSTEM PRINCIPLES



Source: FHWA

# THE 5 SAFE SYSTEM ELEMENTS



Source: FHWA

# THE 6 SAFE SYSTEM PRINCIPLES



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**Death/serious injury  
is unacceptable**



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**Humans make  
mistakes**



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**Humans are  
vulnerable**



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**Responsibility is  
shared**



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**Safety is proactive**



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**Redundancy  
is crucial**

# DEATH/SERIOUS INJURY IS UNACCEPTABLE

- Prohibition sign
- Warning sign
- Person in wheelchair
- Two hands held up
- Checkmark, X, and arrow in a circle
- Refresh/circular arrow

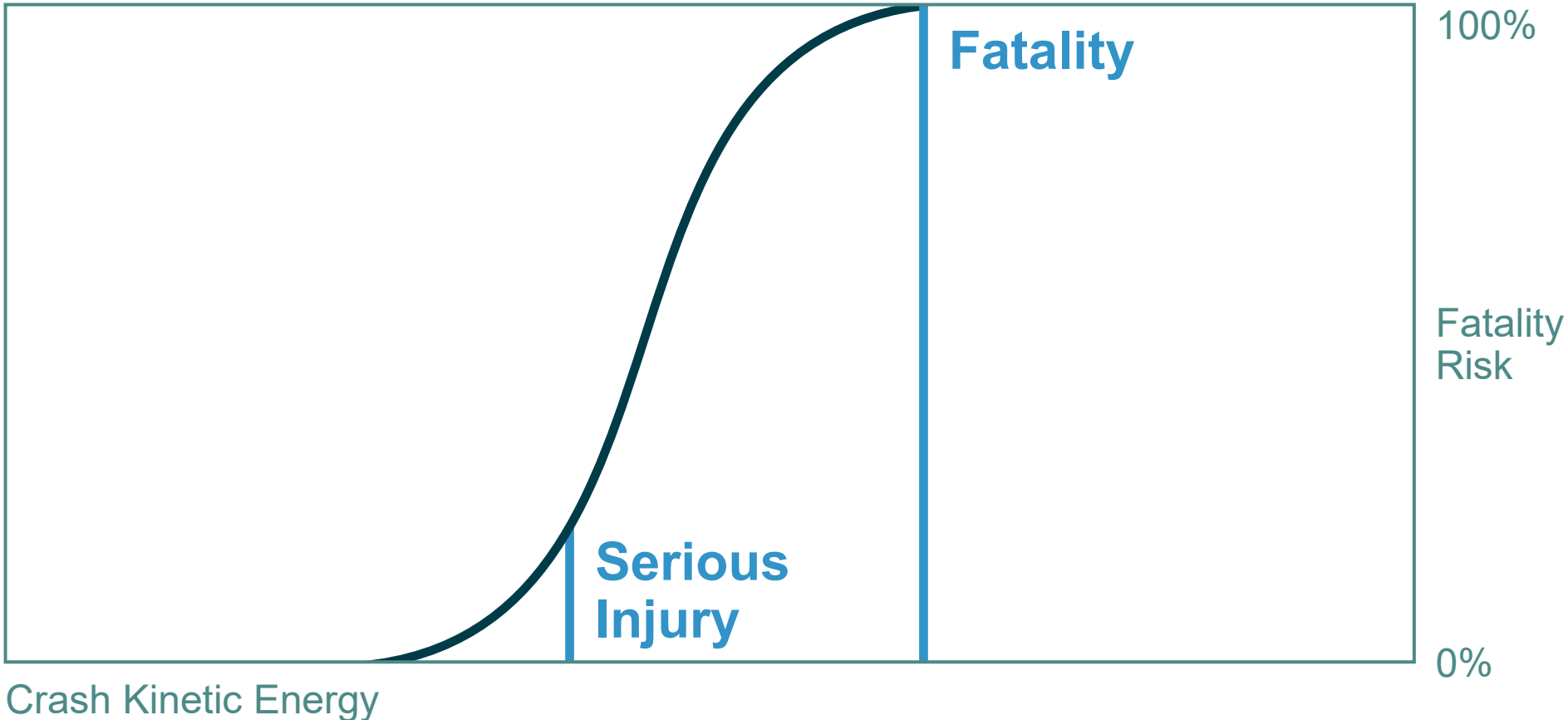
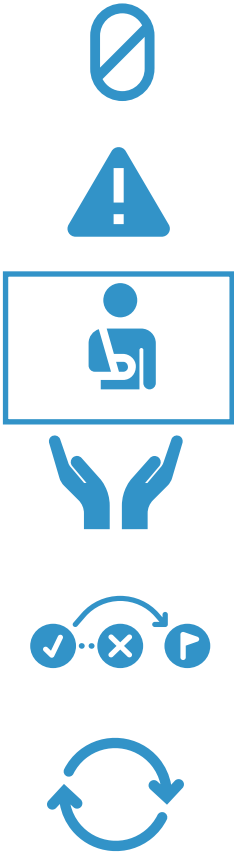


# PEOPLE MAKE MISTAKES





# HUMANS ARE VULNERABLE



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# RESPONSIBILITY IS SHARED



## System managers

Planners, designers, builders, operators, maintenance workers



## Vehicle manufacturers



## Law enforcement personnel

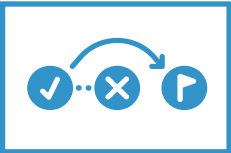
## Post-crash personnel



## System users



# SAFETY IS PROACTIVE



**Identify risks**



**Mitigate risks**

# REDUNDANCY IS CRUCIAL



**Safe road users**



**Safe vehicles**



**Safe speeds**



**Safe roads**



**Post-crash care**

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# THE 5 SAFE SYSTEM ELEMENTS



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**Safe road users**



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**Safe vehicles**



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**Safe speeds**



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**Safe roads**



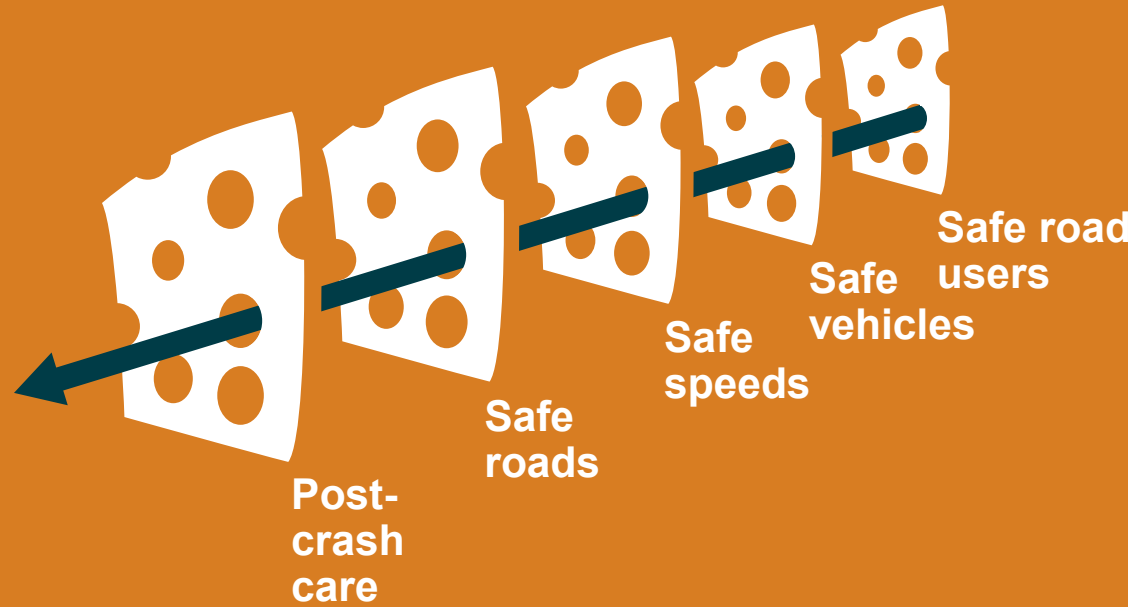
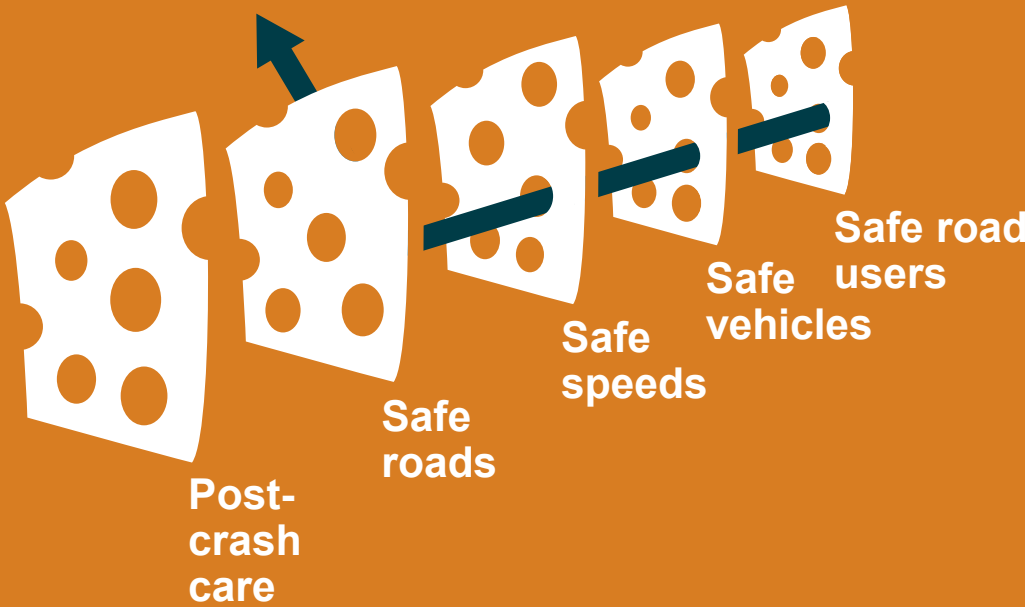
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**Post-crash care**

# THE 5 SAFE SYSTEM ELEMENTS CREATE REDUNDANCY

The "Swiss Cheese Model" of redundancy creates layers of protection

Death and serious injuries only happen when all layers fail



# SAFE ROAD USERS



**Walk**



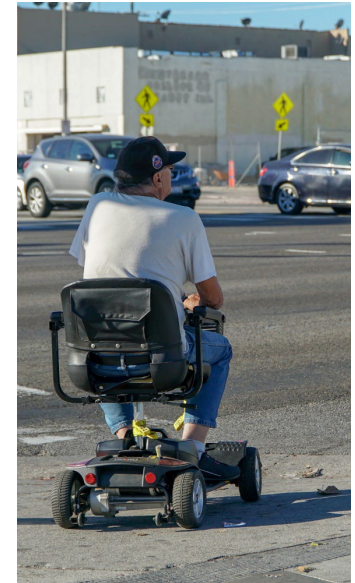
**Bike**



**Drive**

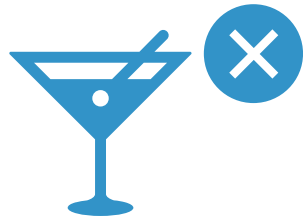


**Transit**

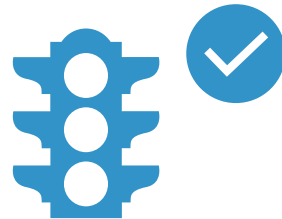


**Other**

# SAFE ROAD USERS – CONTINUED



**Not distracted  
or impaired**



**Follow rules**



**Act within the  
limits of the  
road design**



# Relation to 'E's

- People make mistakes and poor choices (some examples)
  - Seat belt use
  - Speeding
  - Impaired driving
    - Drowsy
    - Alcohol
    - Legal drugs – prescription and over the counter
    - Illegal drugs
    - Combined drugs
  - Distracted Driving
- Education and Enforcement can influence behavior
- Traffic Safety Culture

# SAFE VEHICLES



## Active safety

Measures to reduce the chance of a crash occurring

- Lane departure warning
- Autonomous emergency braking

## Passive safety

Protective systems for when crashes do occur

- Seatbelts and airbags
- Crash-absorbing vehicle crumple zones

# SAFE VEHICLES - CONTINUED



## Other road user safety

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Measures that protect other road users

- Bicyclist and pedestrian detection
- Vehicle size and design

## New technology

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Leveraging connected and automated vehicle (CAV) technology to improve safety

# Relation to 'E's – thoughts?

- Engineering to create and implement the technology
- Education and Enforcement
  - Making sure that the vehicle is roadworthy
  - Car seats are properly installed

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## SAFE SPEEDS



“ Speed is at the heart of a forgiving road transport system. It transcends all aspects of safety: without speed there can be no movement, but with speed comes kinetic energy and with kinetic energy and human error come crashes, injuries, and even deaths.”

Organisation for Economic Co-operation and Development

# SAFE SPEEDS: REDUCING PEDESTRIAN FATALITIES

Hit by a vehicle traveling at

23

MPH

10% risk of death



Hit by a vehicle traveling at

42

MPH

50% risk of death



Hit by a vehicle traveling at

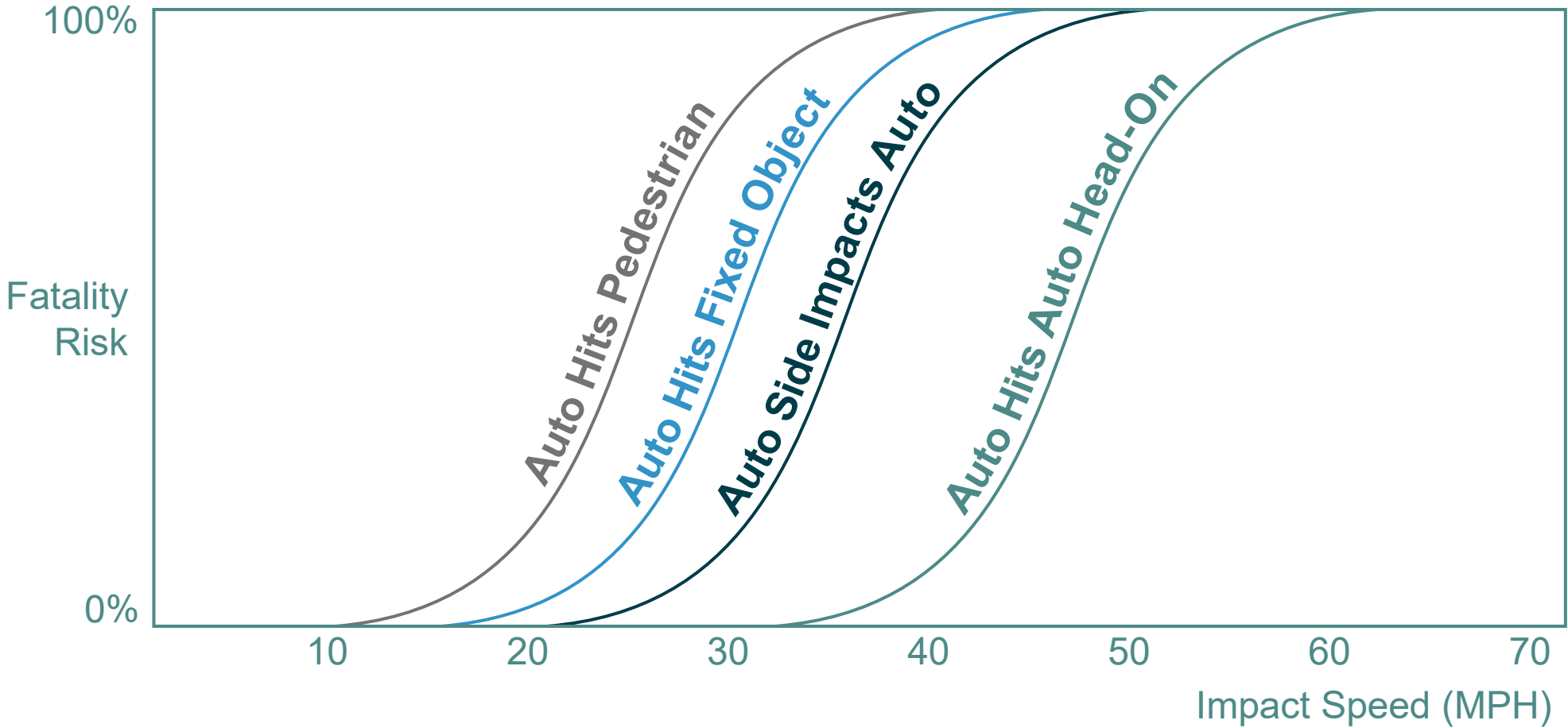
58

MPH

90% risk of death



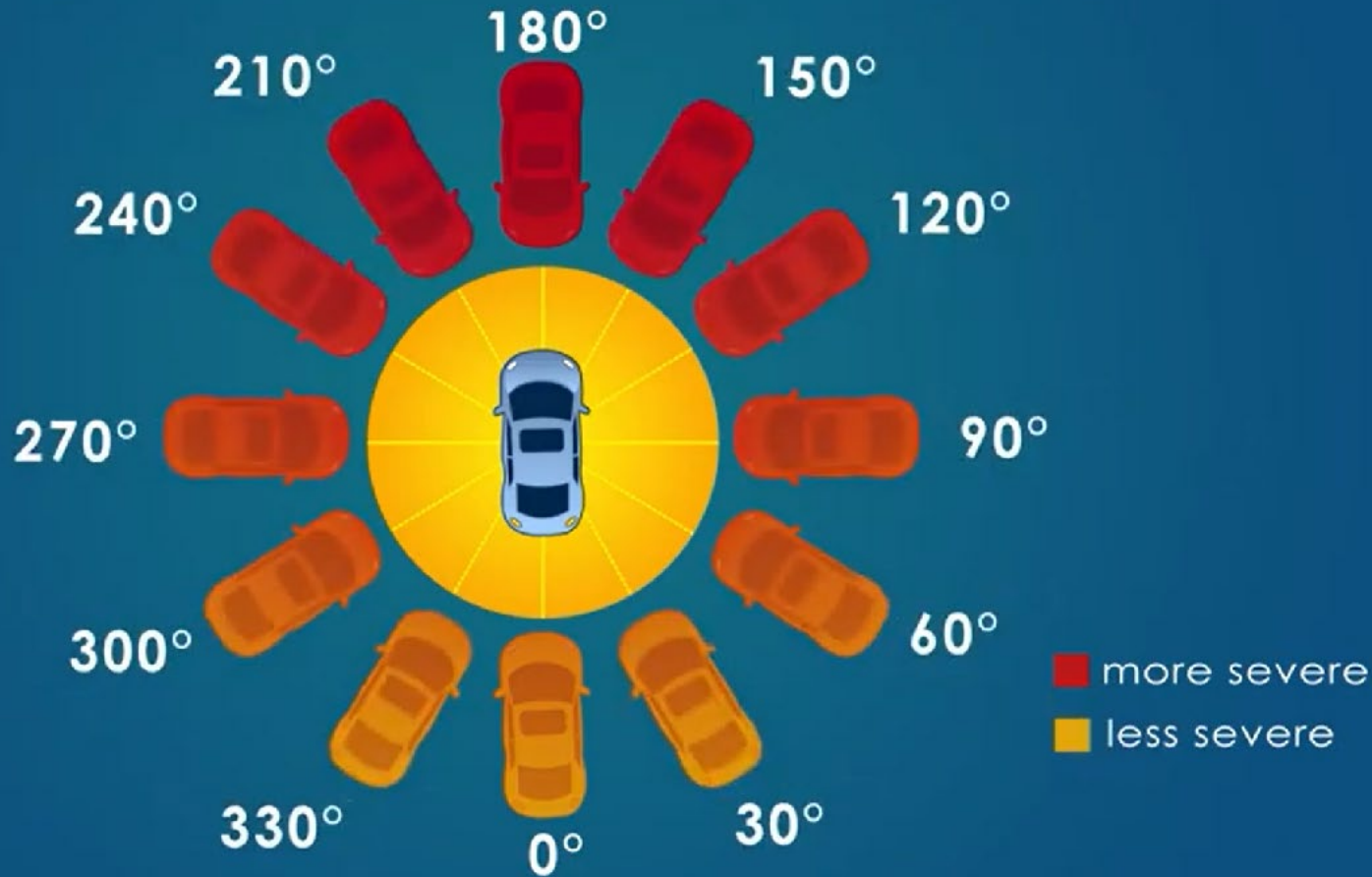
# SAFE SPEEDS: FATALITY RISKS



# HUMANS ARE VULNERABLE



Humans are vulnerable



Designing safer roads is an exercise of managing kinetic energy

$$K = \frac{1}{2}mv^2$$

Velocity is a Vector

- Speed
- Direction (angle of impact)

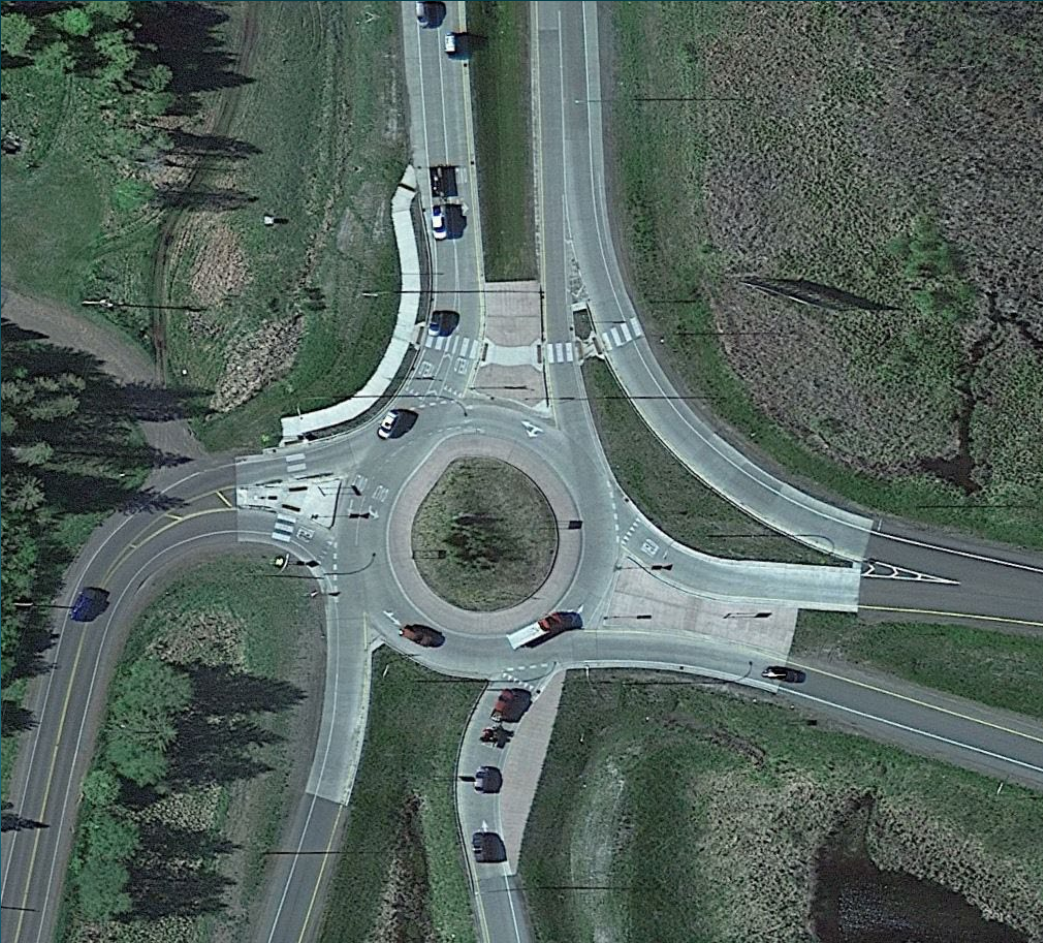


# SAFE SPEED: TREATMENTS THAT MINIMIZE INJURIES

Speed through typical intersection



Speed through Safe System intersection



# Safe speed: treatments that minimize injuries



TH 316 in Hastings MN

# Safe speed



West Superior Street, Lincoln Park Neighborhood, Duluth, MN

# Relation to 'E's – thoughts?

- Education and Enforcement
  - Influence behavior
- Engineering
  - Design to influence travel speed for the appropriate context

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# SAFE ROADS



Safe roads are designed and operated to:

- 1. Prevent crashes**
- 2. Keep impacts on the human body at tolerable levels**

# SAFE ROADS: AVOIDING CRASHES



## Avoiding crashes involves:



**Separating users in space**



**Separating users in time**



**Increasing attentiveness and awareness**

# SAFE ROADS: CRASH KINETIC ENERGY



Managing crash kinetic energy involves:



**Managing speed**



**Manipulating mass**

# SAFE ROADS: CRASH KINETIC ENERGY



Managing crash kinetic energy involves:



Manipulating crash angles



# SAFE ROADS: ALL ASPECTS OF THE ROADWAY SYSTEM



Safe roads include all aspects of the roadway system:



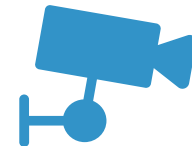
Design



Construction



Maintenance



Operation

# Safer roads



Highway 28, Glenwood MN, Complete Streets  
Separate users in space

# Safer roads



Panel A: Highway 28 prior the improvement (2015)



Panel B: Highway 28 following the improvement (2019)

Highway 28, Glenwood MN  
Increase attentiveness and awareness

# Safer roads



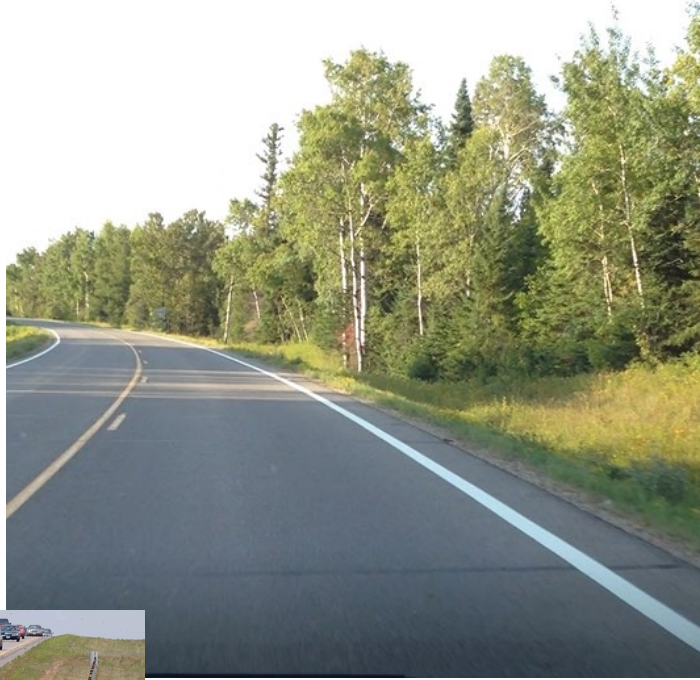
Highway 19, New Prague

# Safer roads



East Cascade Avenue, River Falls, WI

# Safer road design elements



# Relation to 'E's – thoughts?

- We talked a lot about Engineering
- Education is key
  - Often get pushback from the public as they don't understand the safety benefits of the Safer Roads designs
  - Perceived inconvenience

# POST-CRASH CARE



Vital post-crash actions include:



**First responders**



**Medical care**



**Crash investigation**



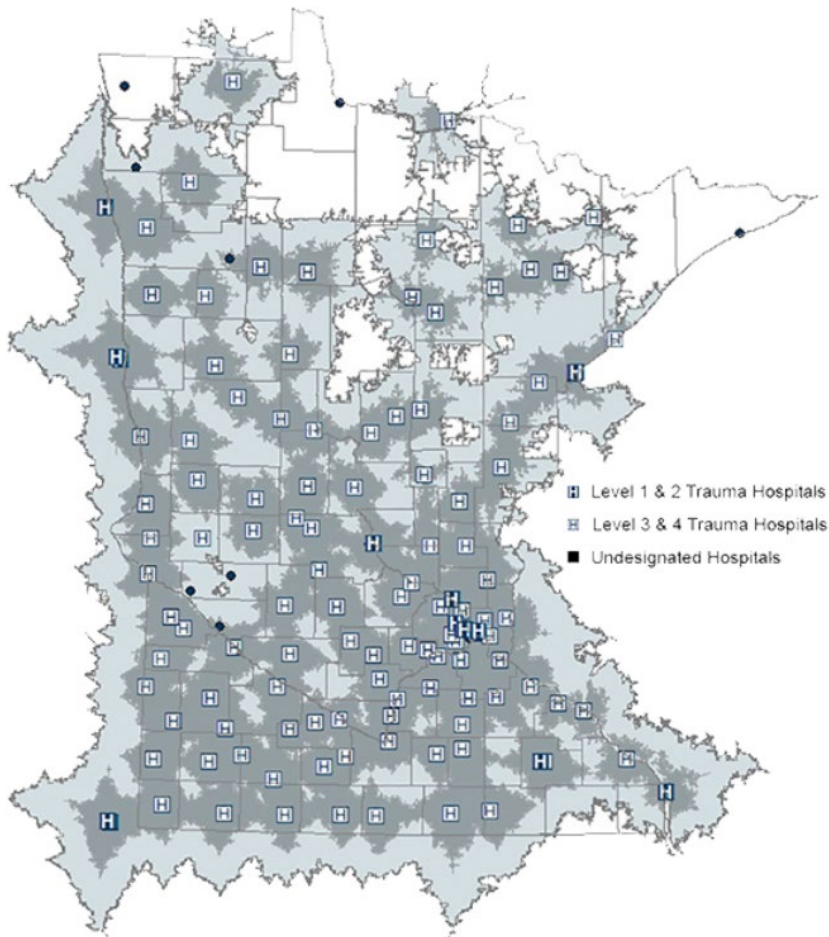
**Traffic incident management**



**Justice**



# Emergency response



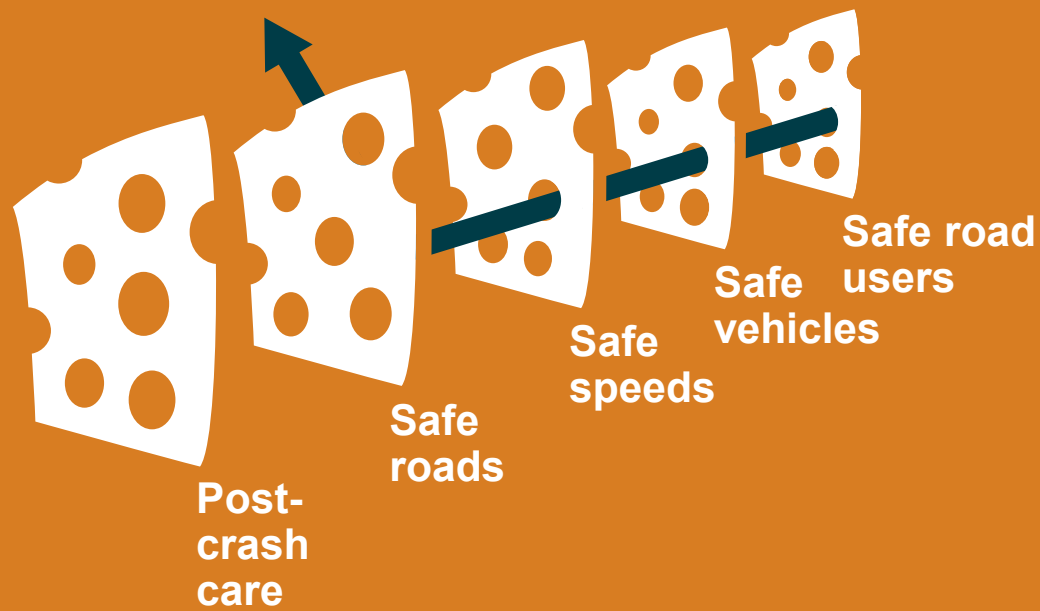
- In MN, a concerted effort was made to:
  - Improve incident response time
  - Dispatching everyone that may be needed
- Statewide trauma system was established by the legislature in 2005

# Relation to 'E's – thoughts?

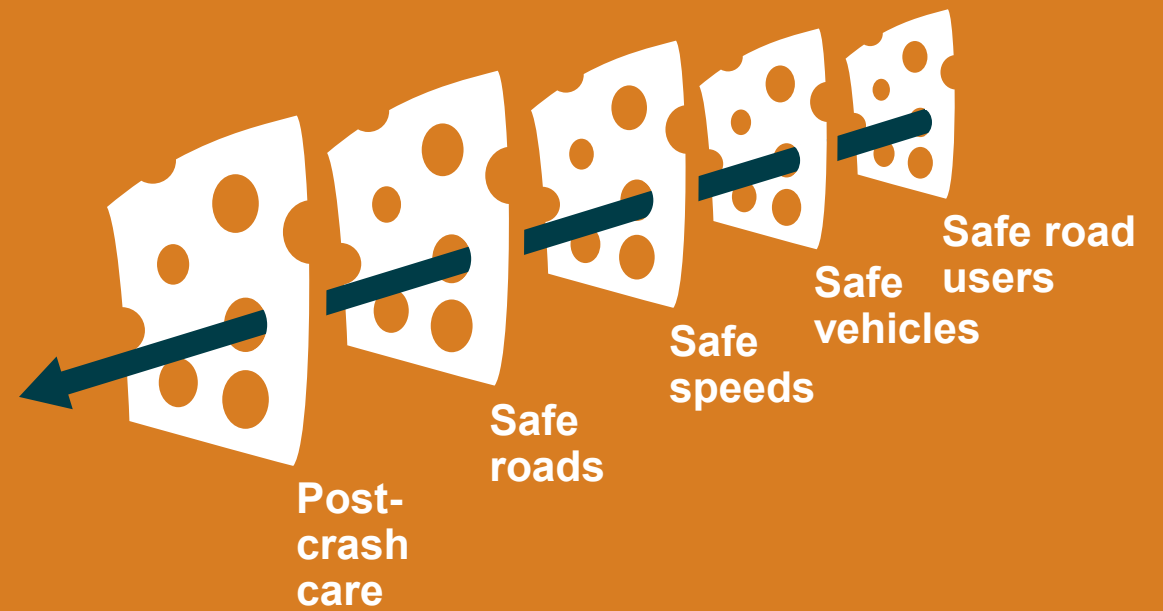
- Emergency Medical and Trauma Services
- Enforcement
- Engineering
- Education

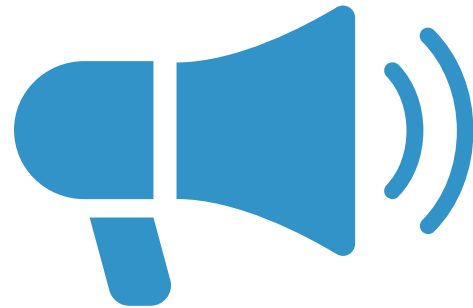
# THE 5 SAFE SYSTEM ELEMENTS CREATE REDUNDANCY

The “Swiss Cheese Model” of redundancy creates layers of protection



Death and serious injuries only happen when all layers fail





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## Safe System Materials

Find more resources at: [safety.fhwa.dot.gov/zerodeaths](https://safety.fhwa.dot.gov/zerodeaths)

# Implementing the Safe System approach is our shared responsibility, *and we all have a role.*



Source: Fehr & Peers



Source: Arlington County, VA



Source: Fehr & Peers



Source: Fehr & Peers

**Zero is our goal.  
A Safe System is how we get there.**

**Questions?**