



Safe System Approach – A (Brief) Introduction

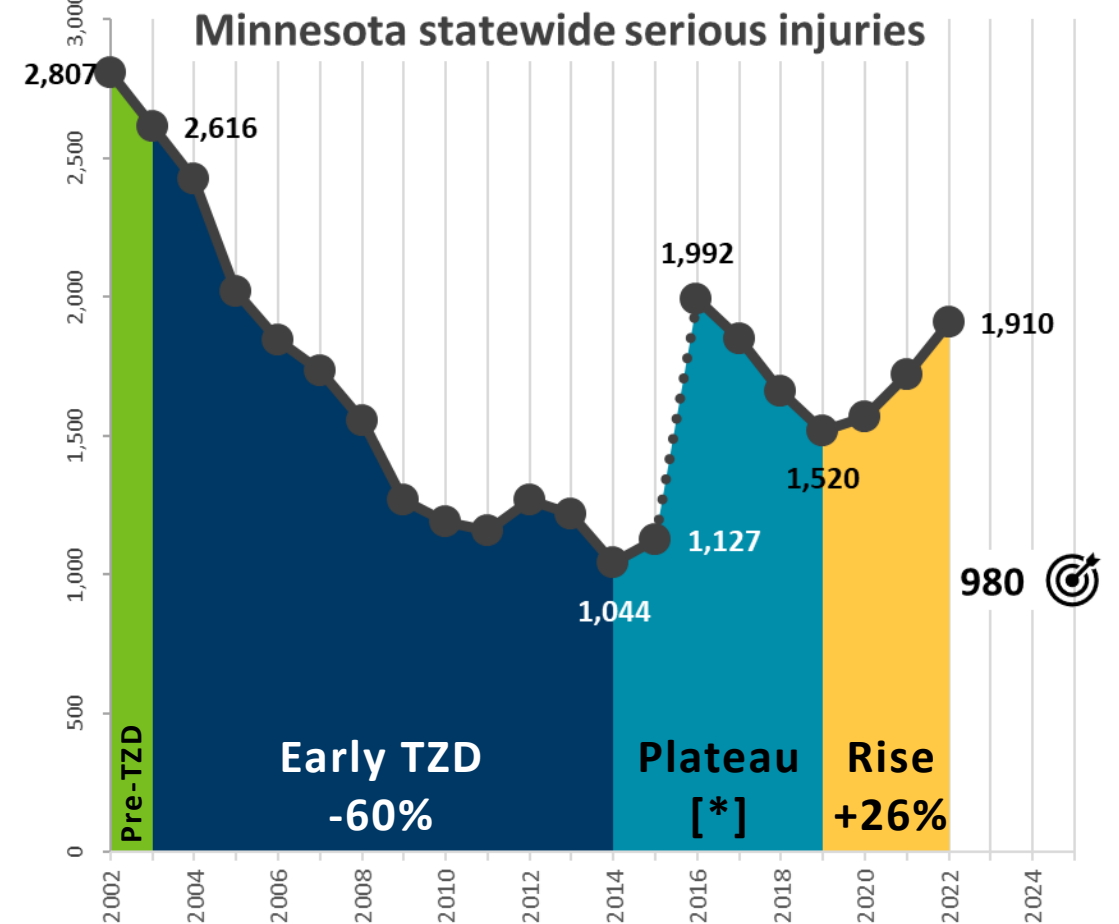
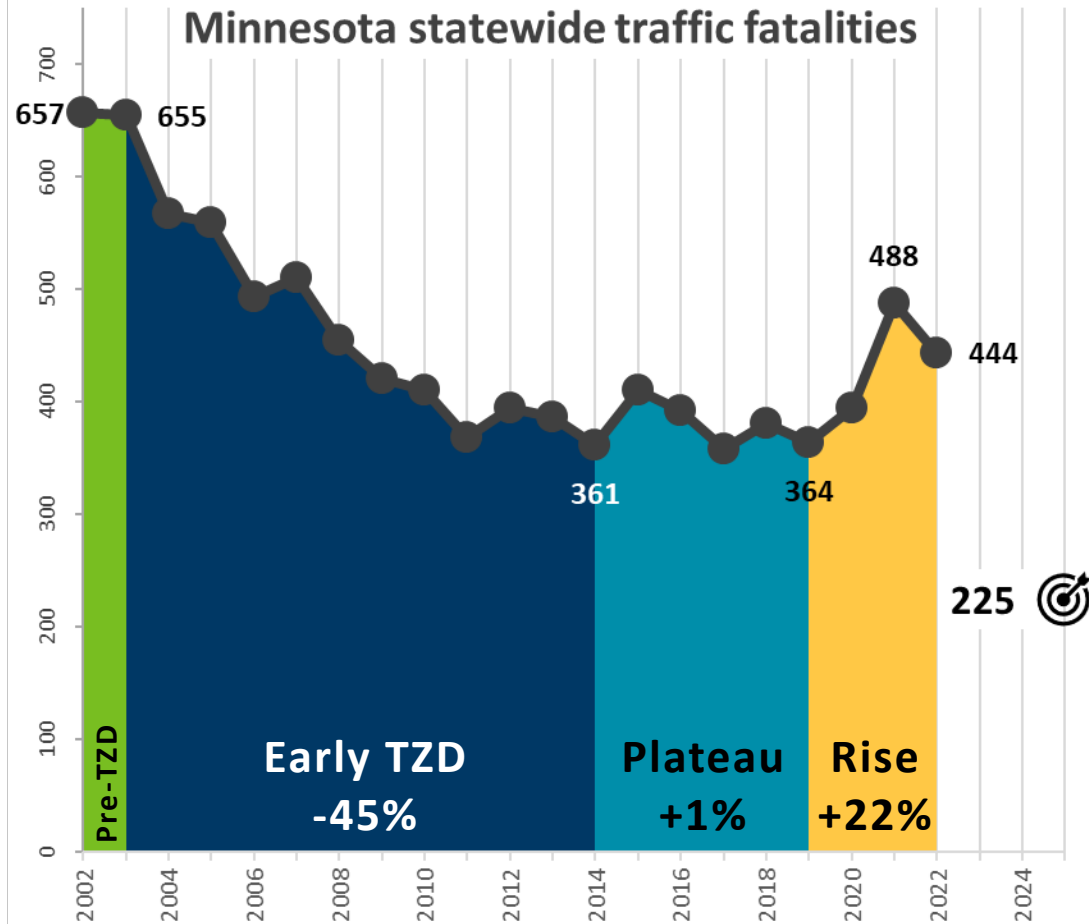
MN TZD Conference 2023

Ken E. Johnson

Office of Traffic Engineering

- TZD's commitment to safety
 - Clearly identified in the Minnesota Strategic Highway Safety Plan; as well as MnDOT's Vision, Mission, 5-year strategic operating plan, and other plans
- Fatal and serious injuries have plateaued and increased
- Safety performance measures – Minnesota has not been meeting these goals
- We have to do things differently – doing the same will not help Minnesota reduce fatal and serious injuries

Why a new approach?



* Minnesota implemented a new crash reporting system in 2016 that increased the number of reported serious injuries



Not just numbers...

As of November 14, 343 (preliminarily) people have died on Minnesota roadways

Here are just a few from the past couple of weeks:

- An 84 year-old female passenger was killed when the vehicle she was in was struck broadside at the intersection of two county roads by a vehicle that ran a red light. The driver of the vehicle that ran the red light was asleep or fatigued at the time of the crash.
- A 44 year-old unbelted male driver was killed when, traveling on a county road, he crossed the centerline and struck an oncoming vehicle head-on.
- A 5 year-old female passenger was killed when the vehicle she was in ran off of a county road, struck a tree, and rolled.
- A 41 year-old male driver was killed when, traveling on a state highway, he collided with a semi traveling in the opposite direction and then struck a vehicle traveling in the same direction as him.

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

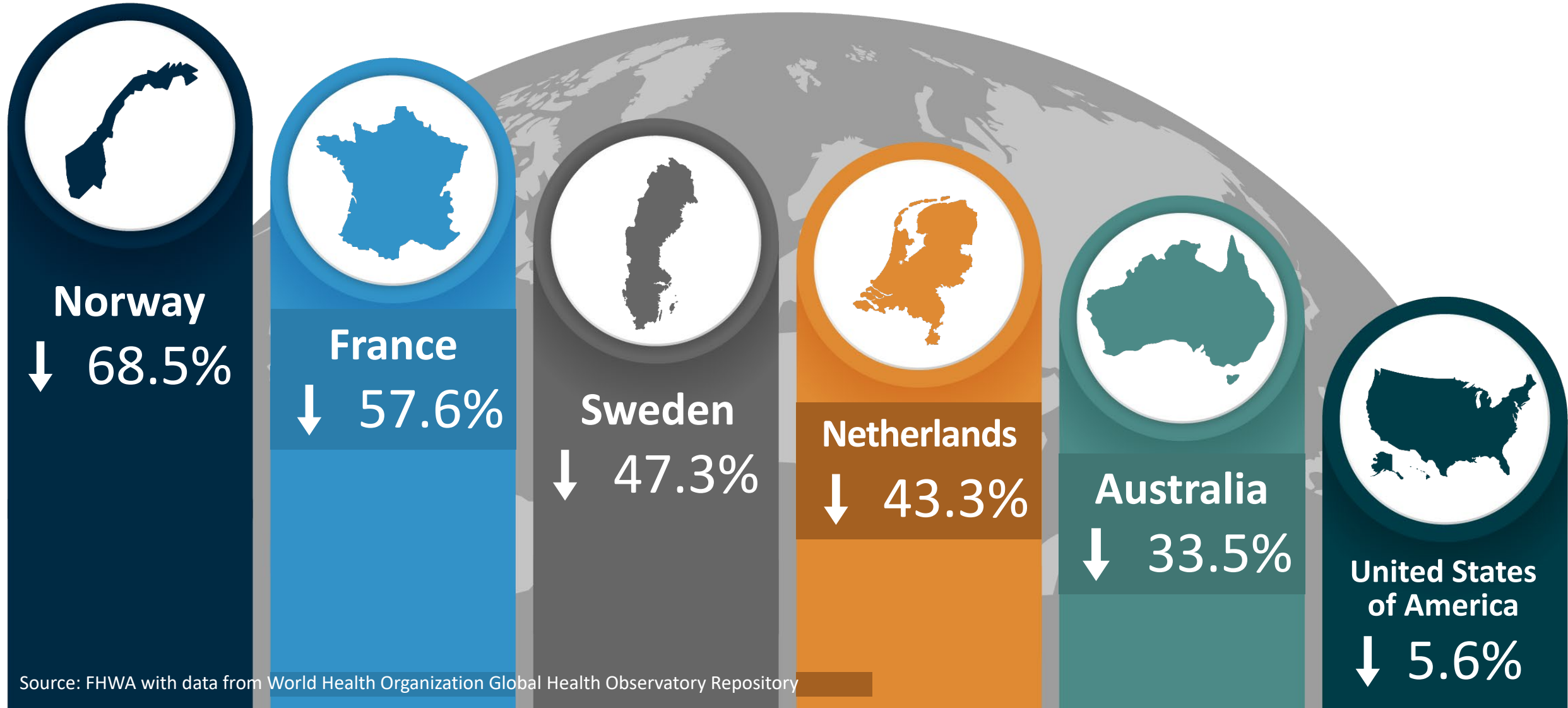
PARADIGM SHIFT





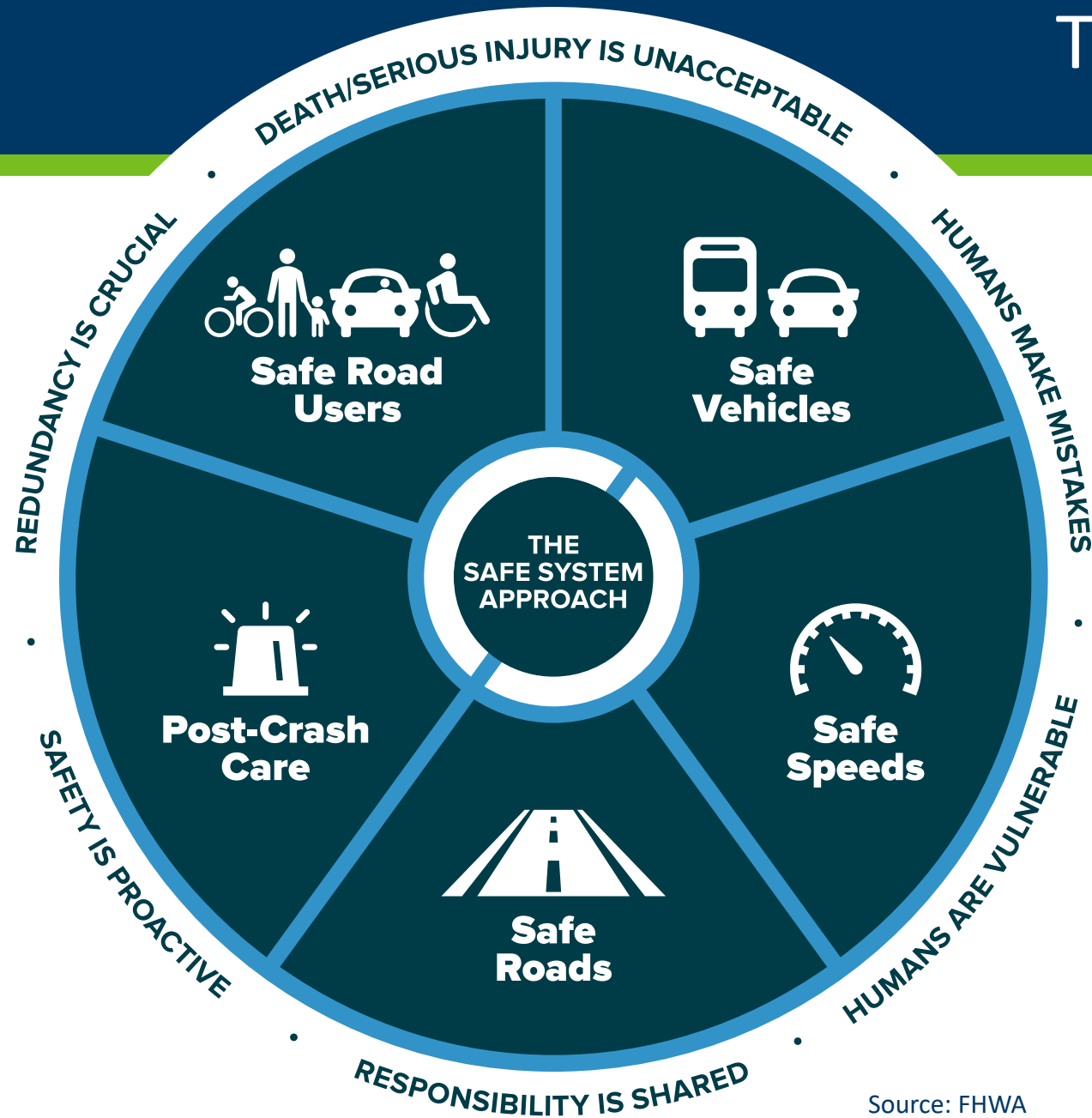
SUCCESSFUL SAFE SYSTEM ADOPTERS

Changes from 2000 to 2019.



Source: FHWA with data from World Health Organization Global Health Observatory Repository

The Safe System Approach



6 Principles

5 Elements

Safe Road Users



Walk



Bike



Drive

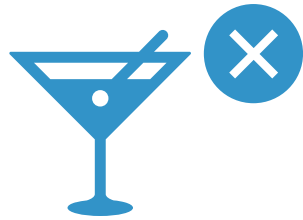


Transit

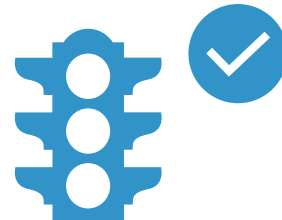


Other

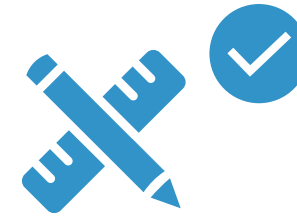
Safe Road Users (continued)



**Not distracted
or impaired**



Follow rules



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



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

Measures that protect other road users

- Bicyclist and pedestrian detection
- Vehicle size and design

New technology

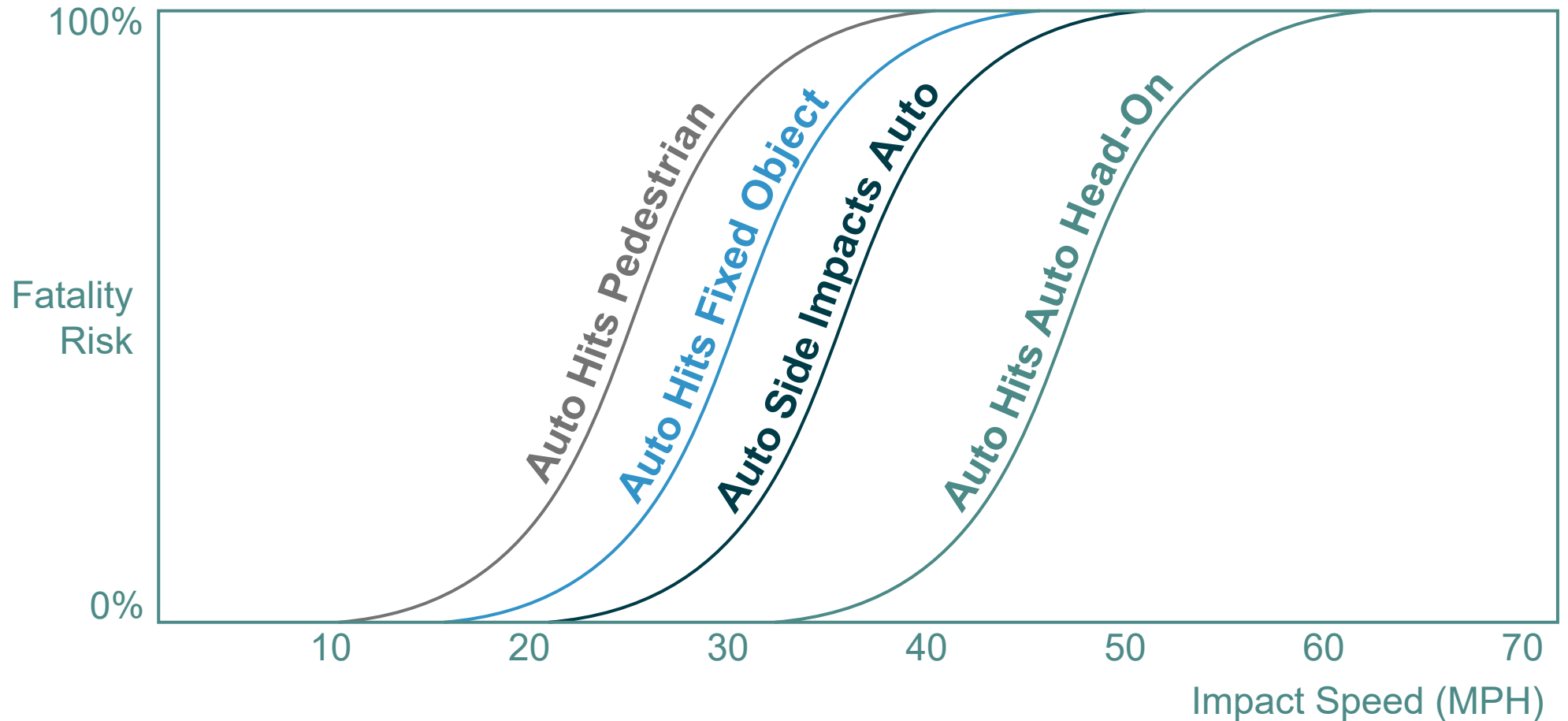
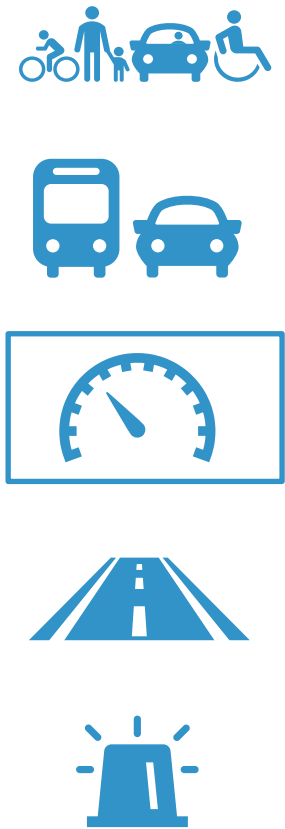
Leveraging connected and automated vehicle (CAV) technology to improve safety



“ 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.”

Organization for Economic Co-operation and Development

Safe Speeds: Fatality Risks



Source: FHWA. Adapted from graphic created by Australian Roads and Traffic Authority of New South Wales.

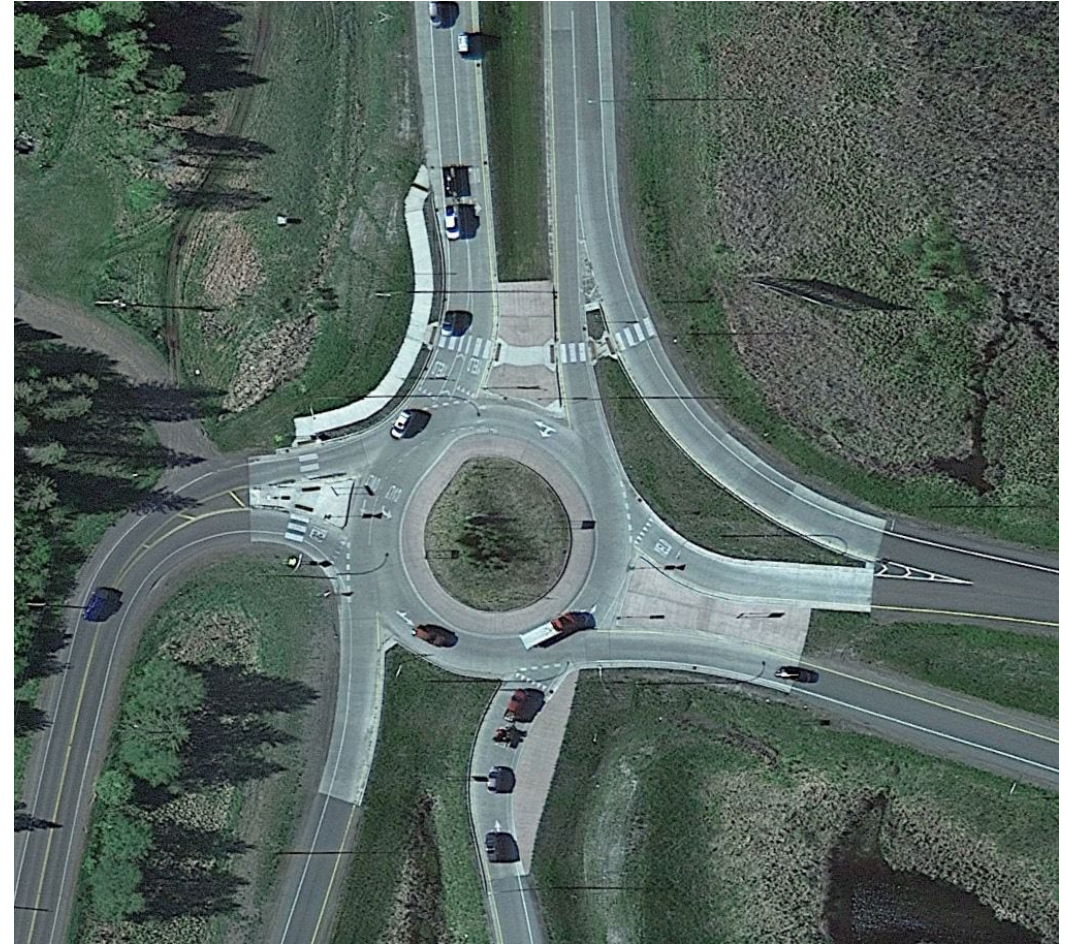


Safe Speeds: treatments that minimize injuries

Speed through typical intersection



Speed through Safe System intersection



I-35 and Highway 33 in Cloquet



Safe roads are designed and operated to:

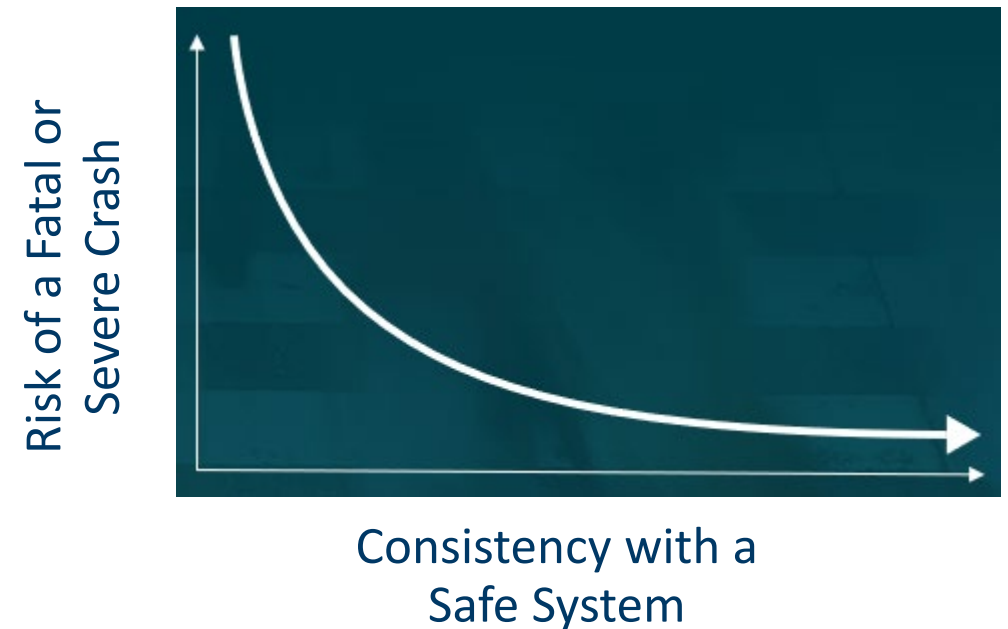
- 1. Prevent crashes among all users**
- 2. Keep impacts on the human body at tolerable levels**



Thoughts on the Safe Roads Element

Think of “Safe Roads” as a continuum – not an absolute

- The aim is to design and operate roads to continuously approach toward creating a Safe System by implementing features appropriate for the intended and actual road use and speed environment
 - Reduce the likelihood of error
 - Reduce the consequences of error



Source: FHWA

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



Managing crash angles



Managing crash energy distribution

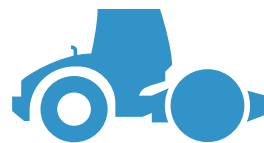
Safe Roads: All Aspects of the Roadway System



Safe roads include all aspects of the roadway system:



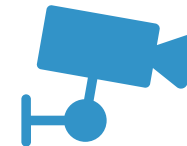
Design



Construction



Maintenance



Operation



Safe Roads through complete streets



Highway 61, Grand Marais, MN

- Increase attentiveness and awareness of all modes
- Separating users in time



Safe Roads through complete streets



Highway 28, Glenwood, MN
Separate users in space



Safe Speeds and Safe Roads



Highway 19, New Prague, MN

Safe Speeds and Safe Roads



298 E Cascade Ave
River Falls, Wisconsin

Google

Street View - Sep 2018



East Cascade Avenue, River Falls, WI

Safe Road design elements



B

Post-Crash Care: Traffic Incident Management



First responders



Crash
investigation



Medical care



Post-Crash Care: Other Aspects



Post-crash care extends to actions after TIM returns a crash scene to normal conditions:



Media



Engineering

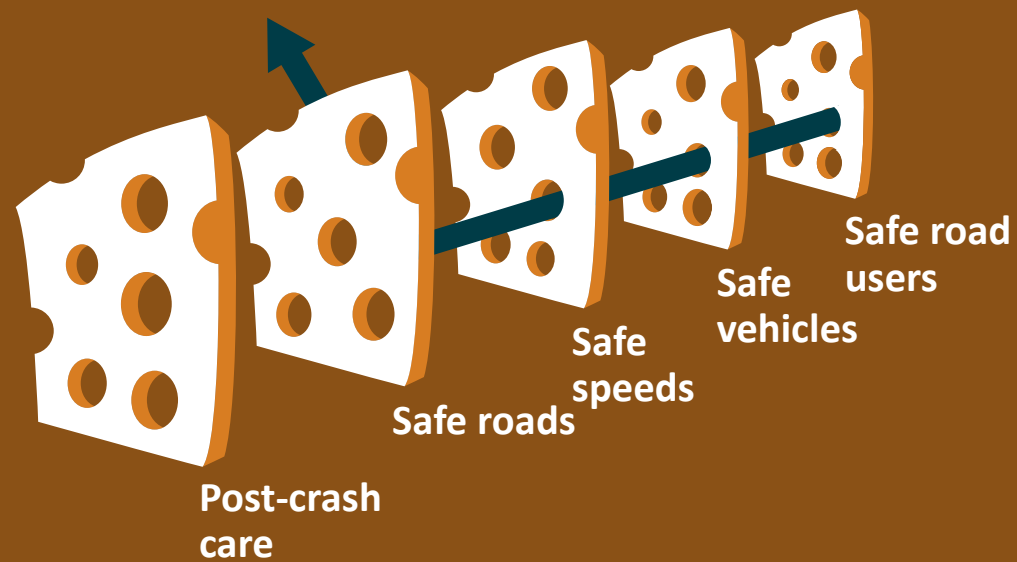


Justice

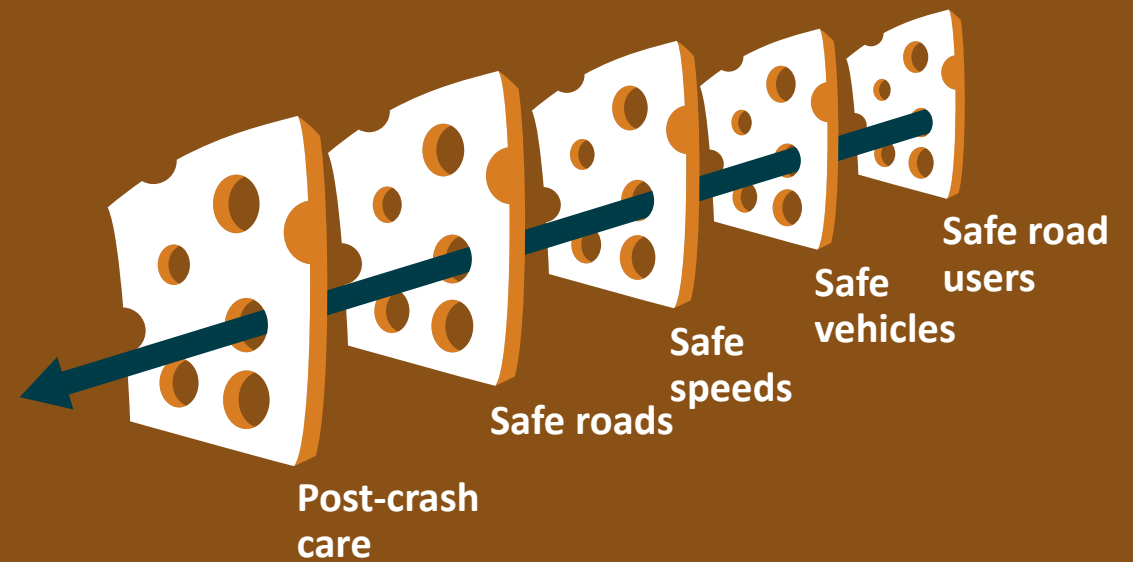


The 5 Safe System Elements Create Redundancy

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



Death and serious injuries only happen when all layers fail





Things we have been doing...

- TZD Partnerships
- HSIP – much of it going to locals (where the majority of life-changing crashes occur)
- District Safety Plans and County Road Safety Plans
- Rumbles
- Roundabouts
- J-turns
- Enhanced edgelines
- Road Safety Audits

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.
The Safe System Approach is how we get
there.**

Questions?