Safe System Approach – An Overview and the SSA Implementation Plan Project

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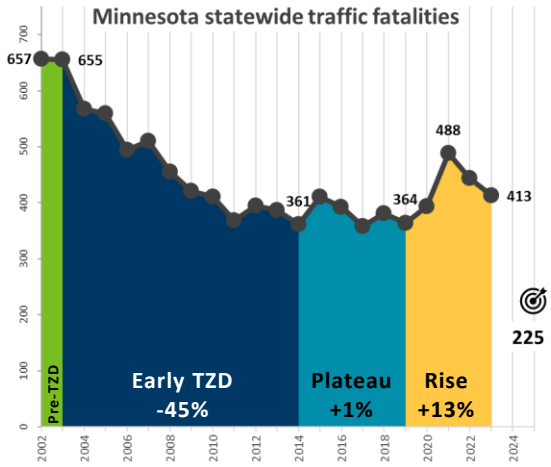
Background

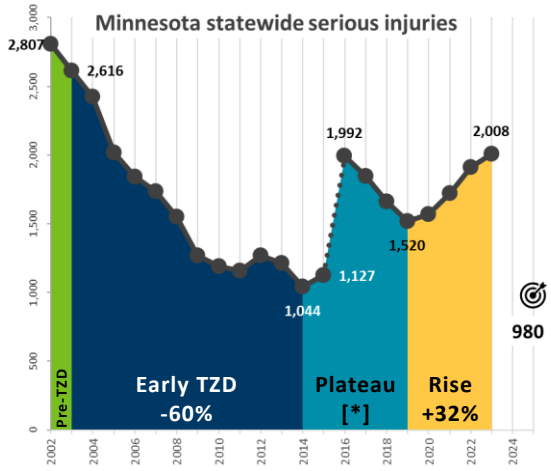
- TZD's commitment to safety
  - Clearly identified in the Minnesota Strategic Highway Safety Plan; as well as MnDOT's Vision, Mission, and Strategic Plan

  Develop a roadway system that reduces the risk of life changing crashes by implementing a Safe System approach
- 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?

preliminary as of 02/12/24





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

Not just numbers…

As of April 19th, 89 (preliminarily) people have died on Minnesota roadways, compared with 59 at the same time last year.

Here are just a few from this year:

- An 83-year-old female driver was killed when her car collided with a truck at a highway and county road intersection.
- A 16-year-old male driver slid off a county road, crossed the centerline into a ditch and hit a tree. He died five days later from injuries sustained in the crash.
- An 11-year-old male pedestrian was struck and killed by a bus while standing or walking in the travel lane of a county highway.
- A 22-year-old male and a 19-year-old female were killed in a crash where their vehicle left the roadway and crashed into multiple trees.

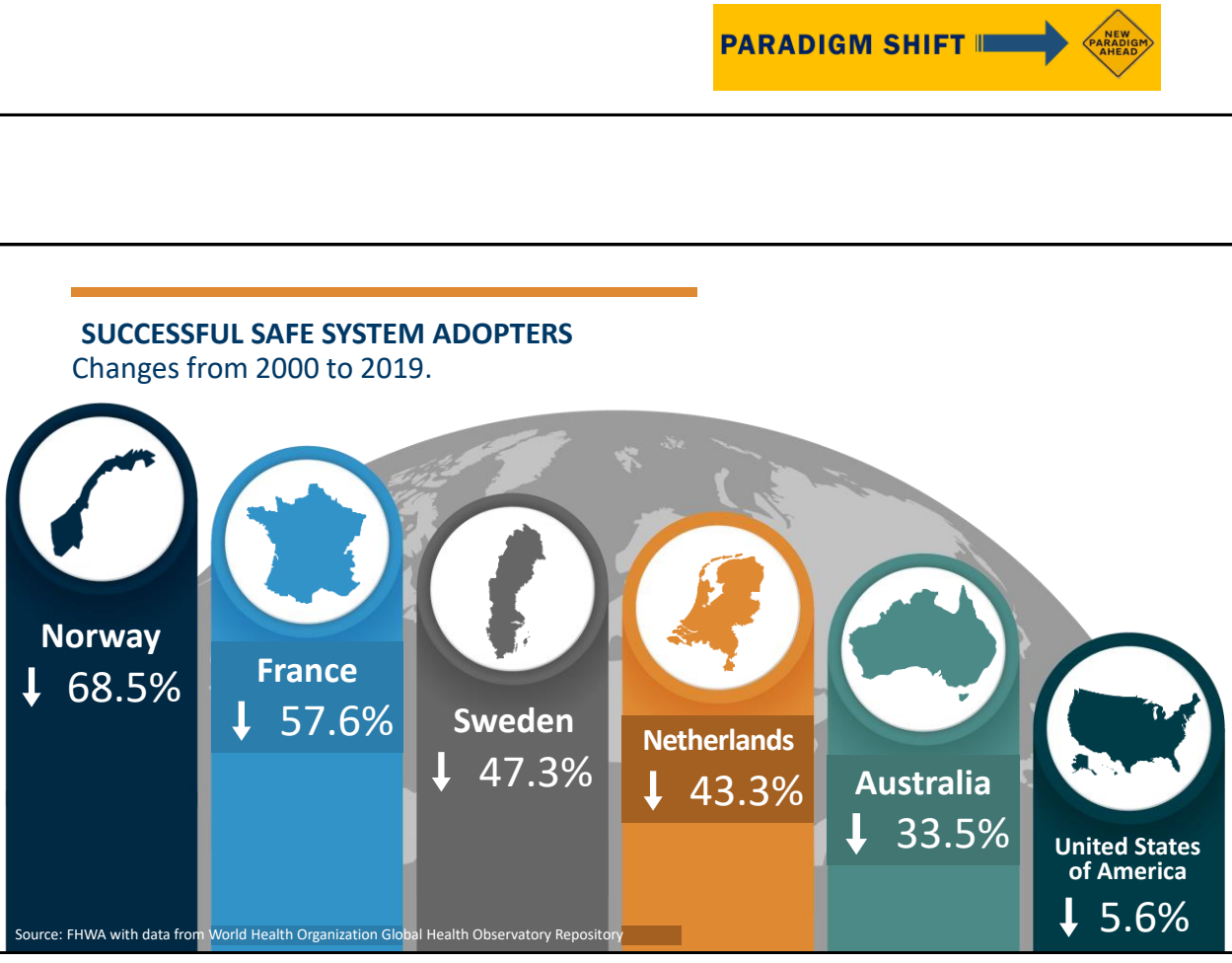
A New Direction

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

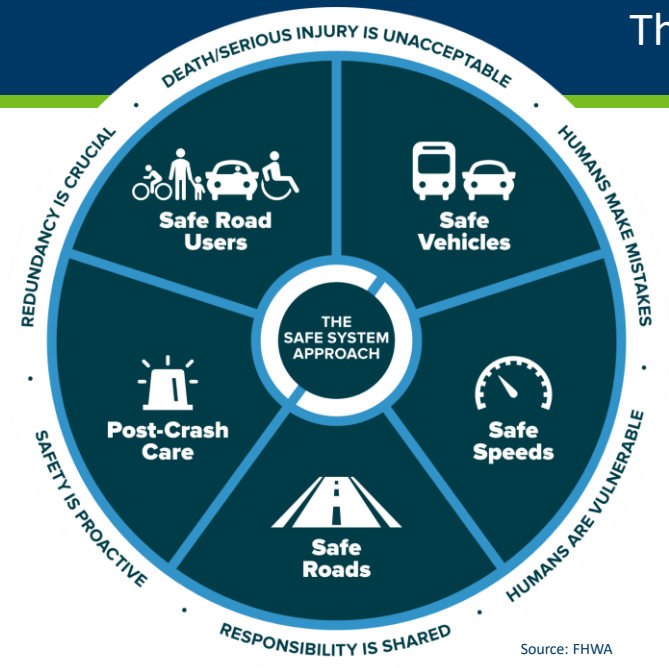
Accommodating human mistakes

Keeping impacts on the human body at tolerable levels

PARADIGM SHIFT



The Safe System Approach



Source: FHWA

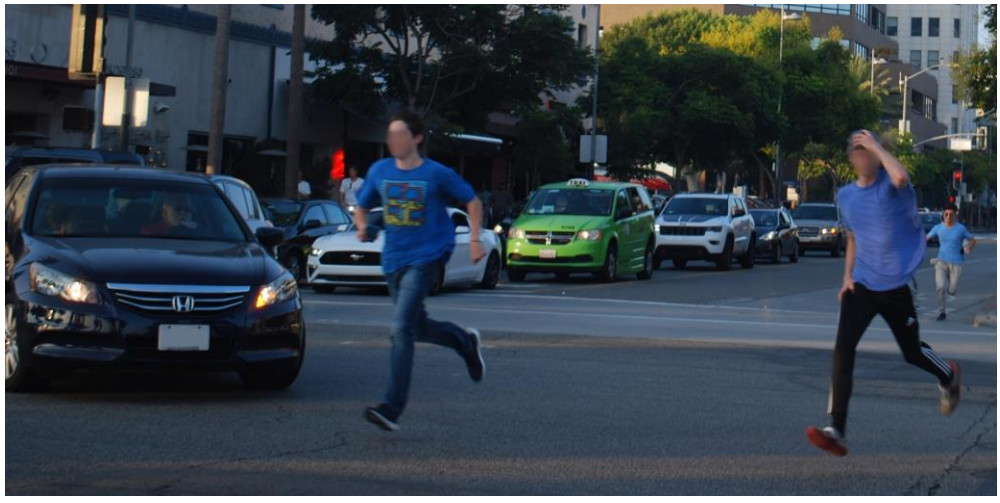
The 6 Safe System Principles

- Death/serious injury is unacceptable
- Humans make mistakes
- Humans are vulnerable
- Responsibility is shared
- Safety is proactive
- Redundancy is crucial

Death/Serious Injury is Unacceptable

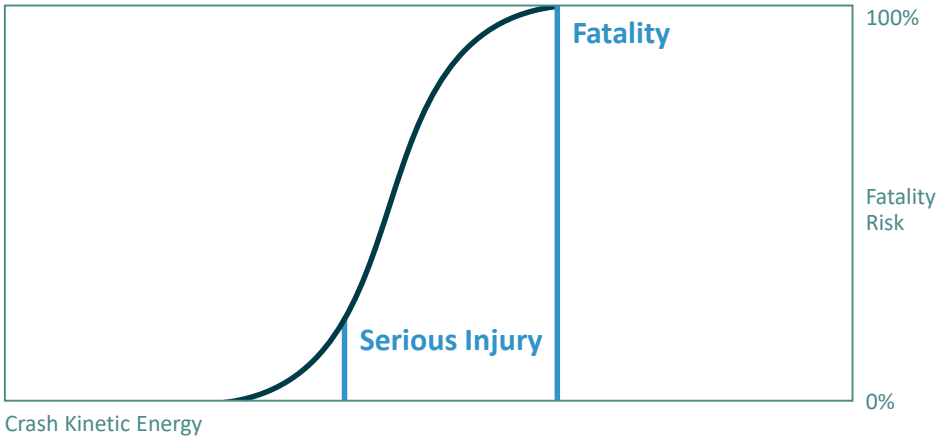
Source: Vision Zero Network

People Make Mistakes



Source: Fehr & Peers

Humans are Vulnerable



Source: FHWA

Responsibility is Shared

Road agencies - Engineering

Planners, designers, builders, operators, maintenance workers

Enforcement

Education

Emergency services

Vehicle manufacturers

Road users

Safety is Proactive

Identify risks

Mitigate risks

Redundancy is Crucial

Safe road users

Safe vehicles

Safe speeds

Safe roads

Post-crash care

Safe Road Users

Walk

Bike

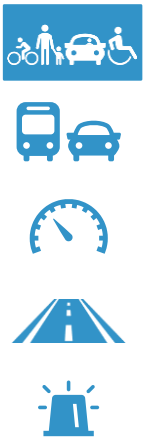
Drive

Transit

Other

Source for all images: Fehr & Peers

Safe Road Users (continued)

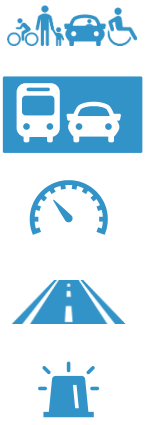


Not distracted or impaired

Follow rules

Act within the limits of the road design

Safe Vehicles



Active safety

Measures to reduce the chance of a crash occurring

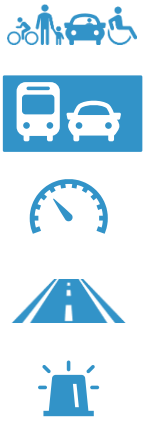
- Lane departure warning
- Autonomous emergency braking

Passive safety

Protective systems for when crashes do occur

- Seatbelts and airbags
- Crash-absorbing vehicle crumple zones

Safe Vehicles (continued)



Other road user safety

Measures that protect other road users

- Bicyclist and pedestrian detection
- Vehicle size and design

New technology

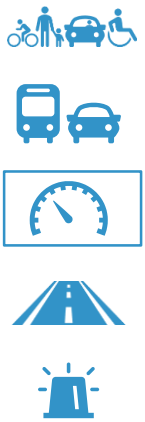
Leveraging connected and automated vehicle (CAV) technology to improve safety

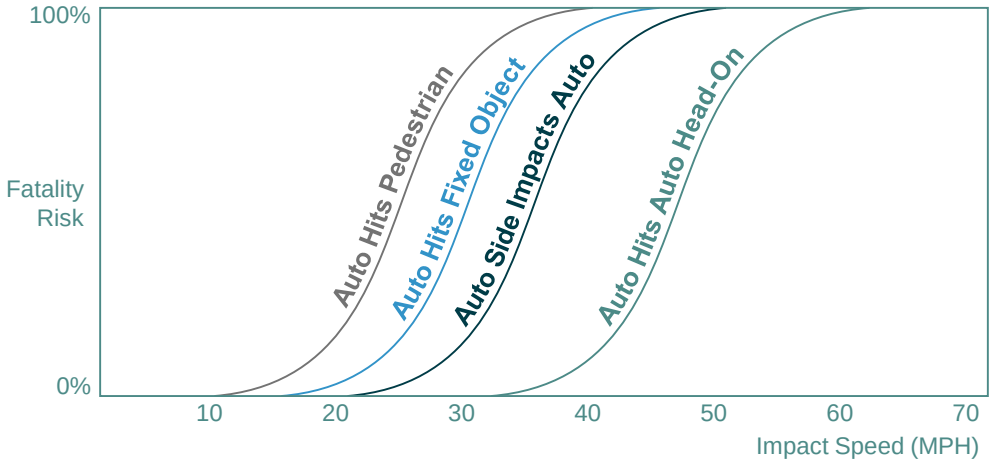
Safe Speeds

> 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."

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

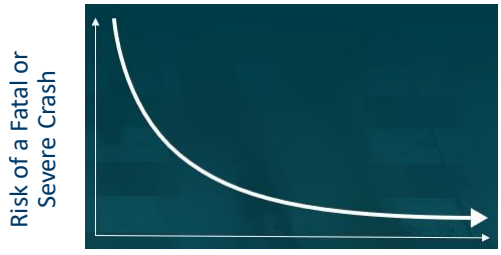
Safe roads are designed and operated to:

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

Source for all images: Fehr & Peers

Safe Roads: Crash Kinetic Energy

Managing crash kinetic energy involves:

Managing speed

Managing crash angles

Managing crash energy distribution

Source: Fehr & Peers

Source: FHWA

Safe Roads: All Aspects of the Roadway System

Safe roads include all aspects of the roadway system:

Design

Construction

Maintenance

Operation

Source: FHWA

Safe Roads through complete streets

Highway 61, Grand Marais, MN

- Increase attentiveness and awareness of all modes

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

East Cascade Avenue, River Falls, WI

Safe Road design elements

B

Post-Crash Care: Traffic Incident Management

First responders

Medical care

Crash investigation

Source: Ron Moore

Post-Crash Care: Other Aspects

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

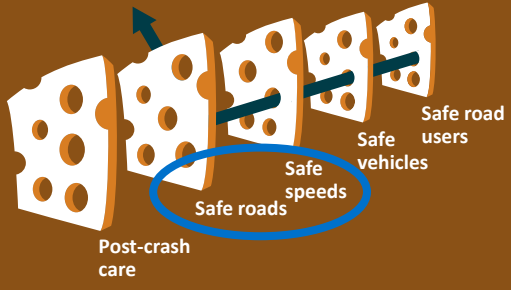
Media

Engineering

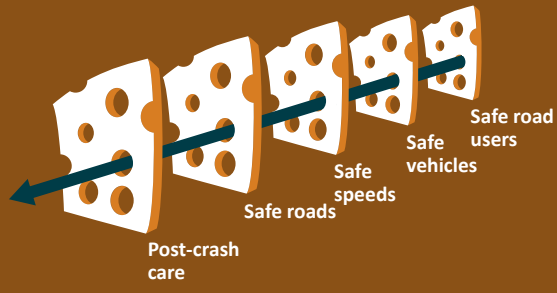
Justice

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



Source: FHWA

Things we have been doing…

- TZD Partnerships
- Federal Safety Funding – 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

Shared Responsibility

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

Possible implementations

- Very early, but some possible implementations:
  - Require life changing crash reduction with all design options/decisions
- Project prioritization
  - Prioritize pavement projects to favor roads with needed safety improvements instead of primarily pavement condition?

Possible implementations

- Increase portion of program towards safety projects
  - What are ramifications to pavements and structures?
- Conduct proactive safety risk assessments prior to and during scoping
  - Highway Safety Manual and data-based assessments to implement projects that maximize the reduction of life changing crashes
  - All projects are required to meet specific safety criteria
  - Safety checklists for preservation, preservation plus, reconstruction?

Possible implementations

- Use Target Speed and Speed Management as design method (as opposed to Design Speed)
- Greater focus on context to determine design parameters – construct self-enforcing roads
  - Design for context instead of defaulting to increasing vehicular capacity
- Make methods that have been shown to reduce fatals and serious injuries default
  - Intersections: All-Way Stop, Roundabouts, J-turns
  - Rural areas: Longitudinal rumbles, forgiving roadsides, intersection lighting, cable median barriers, remove crossovers
  - Urban areas: 3-lane sections, mini-roundabouts, pedestrian bumpouts/medians, design to encourage safe speeds

Possible implementations

- Outreach will be critical, both internal and external
  - Fact sheets and trainings on safety standards to educate internal staff
  - Roadshows
  - Outreach materials
    - Speed Limits/Design Speed/Target Speed, J-turns/Crossover Closures, Roundabouts/Mini-Roundabouts, 3-lane sections, etc
  - Work with/educate local partners (>70% of fatal and serious injury crashes are on local systems)

Possible implementations

- Weave these recommendations into the SHSP
- Weave District and County Safety Plans into the SHSP

- CREATING A MINDSHIFT

  Safety needs drive project selection first and foremost

  (Societal Traffic Safety Culture)

More information

highways.dot.gov/safety/zero-deaths

THE SAFE SYSTEM APPROACH

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

Zero is our goal.
The Safe System Approach is how we get there.

Discussion