Collaborative Sciences Center for ROAD SAFETY

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Rethinking Traffic Safety Management in the United States

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Safe Systems: A Human-Centered Approach to Traffic Safety Minnesota

2020 Minnesota TZD Webinar Series

October 29, 2020

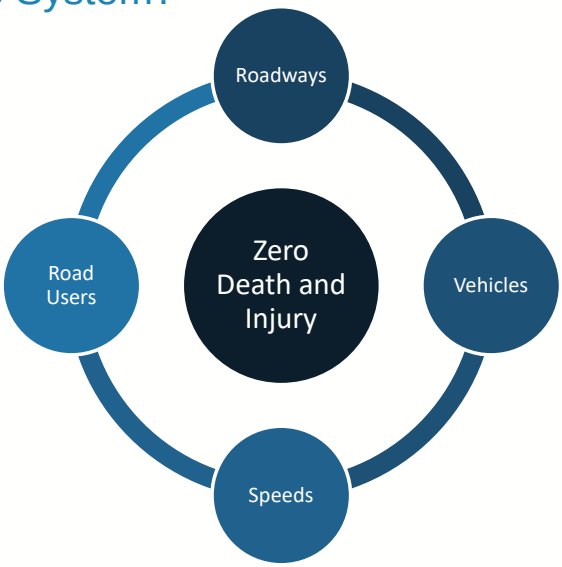
Guiding Questions for Safe Systems

- What is a Safe System?
- Why do we need it?
- How is it different?
- What does Safe Systems look like in the United States?

What is a Safe System?

- Safe Systems have been adopted – under different names – by several different nations.
- Some versions of Safe Systems:
  - The Netherland's "Sustainable Safety"
  - Sweden's "Vision Zero"
  - Australia's "Safe Systems Approach"

What is a Safe System?

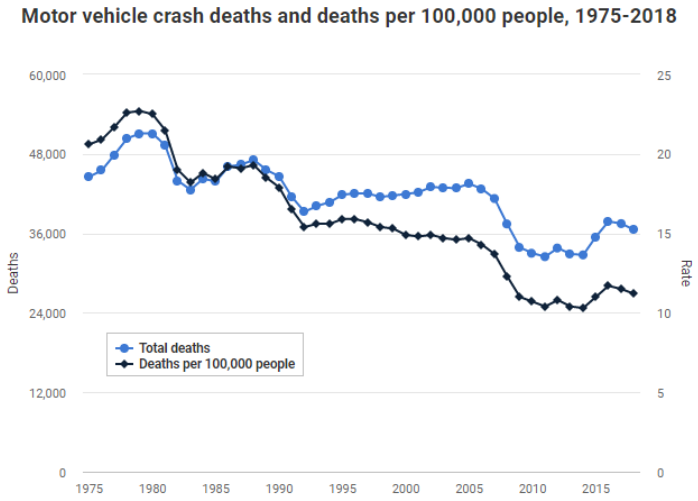


Signor et al., 2018

What is a Safe System?

- CSCRS distinguishes 4 key principles of Safe Systems:
  - Adapt the structure and function of the transportation system to the complexities of human behavior.
  - Manage the kinetic energy transferred among road users.
  - Treat road user safety as the foundation of all system interventions.
  - Foster the creation of a shared vision and coordinated action.

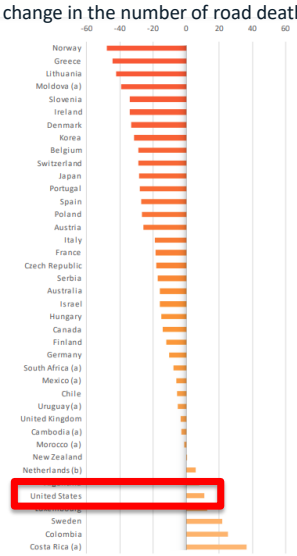
Why do we need it?



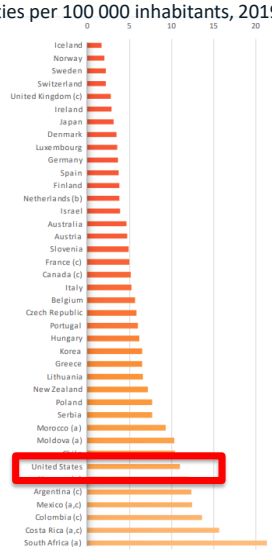
IIHS, 2020

Why do we need it?

Percentage change in the number of road deaths, 2010-18



Road fatalities per 100 000 inhabitants, 2019



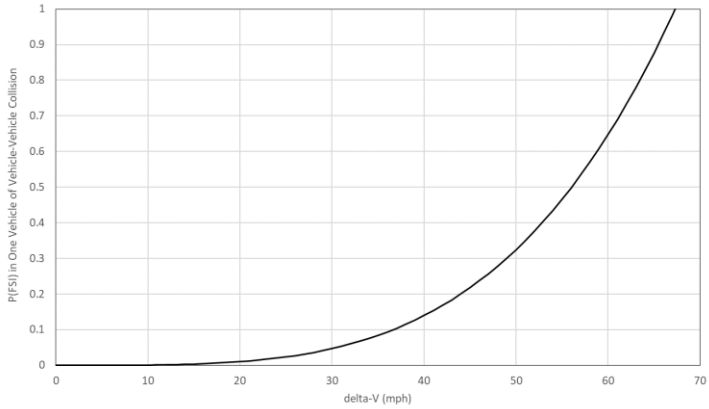
ITF, 2020

Why do we need it?

WHO, 2019

Why do we need it?

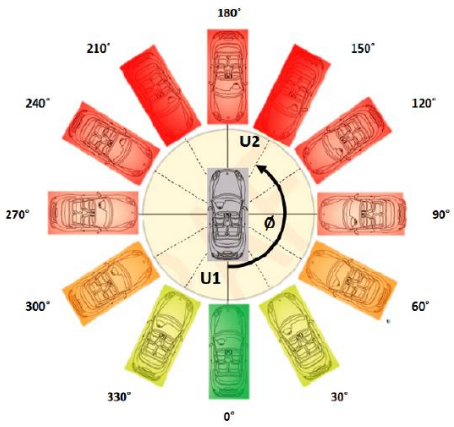
- Humans have a physiological threshold for kinetic energy.
- Kinetic energy depends on the speed and mass involved in a collision.



Porter et al., forthcoming

Why do we need it?

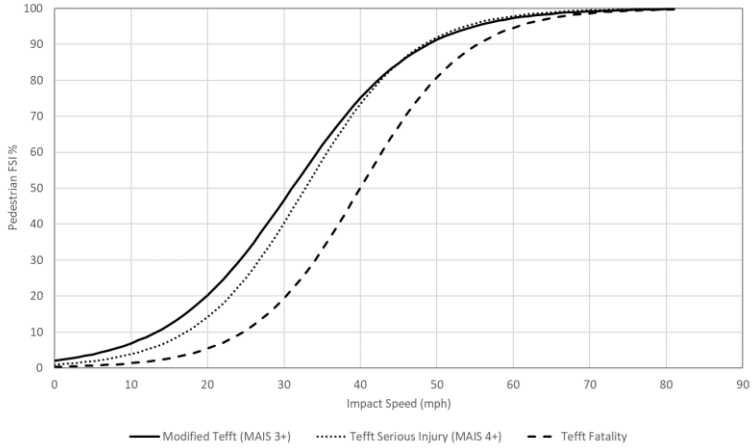
- Humans have a physiological threshold for kinetic energy.
- Kinetic energy can also depend on the angle of collision.



Jurewicz et al., 2017

Why do we need it?

- Unlike vehicle occupants, pedestrians and bicyclists have no protection from the kinetic energy involved in crashes.



Porter et al., forthcoming

Why do we need it?

- Quantifying the risk to pedestrians and bicyclists.

Pedestrians		Bicyclists	
Impact Speed (mi/h)	Risk of Fatality (percent)	Vehicle Travel Speed (mi/h)	Multiple for Fatality Risk
24-33	10	30	2
33-41	25	40	11
41-48	50	50	16
48-55	75		
54-63	90		

Sanders et al., 2019

Cushing et al., 2016

Vehicle Speed (mph)	Probability of pedestrian fatality (%)	Probability of pedestrian fatality age ≤ 14 (%)	Probability of pedestrian fatality age 15 to 59 (%)	Probability of pedestrian fatality age ≥ 60 (%)
20	5	1	1	3
30	45	5	7	62
40	85	16	22	92

Donnell et al., 2009

How is it different?

- Transportation safety management in the United States has followed a series of paradigms (Norton, 2015)
  - Safety First (1900s-20s): Drivers bear responsibility for the safety of others
  - Control (1920s-60s): Expert control through the "3 Es"—Engineering, Education, and Enforcement
  - Crashworthiness (1960s-80s): Cars redesigned for greater occupant protection
  - Responsibility (1980s-today): Drivers responsible for their own safety and the safety of others

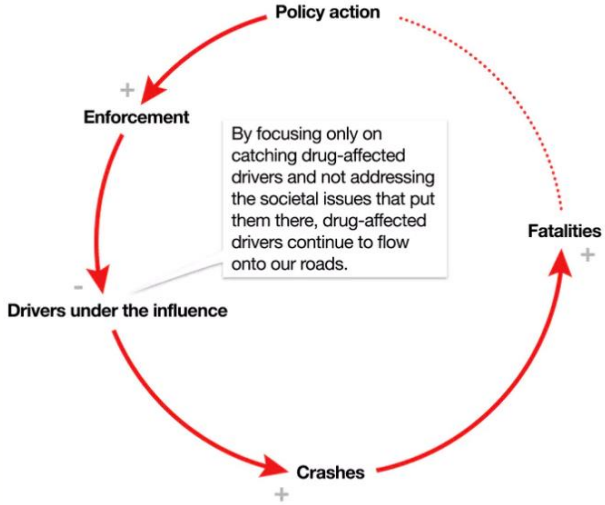
How is it different?

- The traditional approach to transportation safety management is often characterized by linear thinking.
  - E.g. relationship between design speed and posted speed limit
- Safe System differs by:
  - Anticipating human error
  - Accommodating human injury tolerance

ITE, 2019

How is it different?

- Consider our typical approach to traffic safety problems.



McClure, 2017

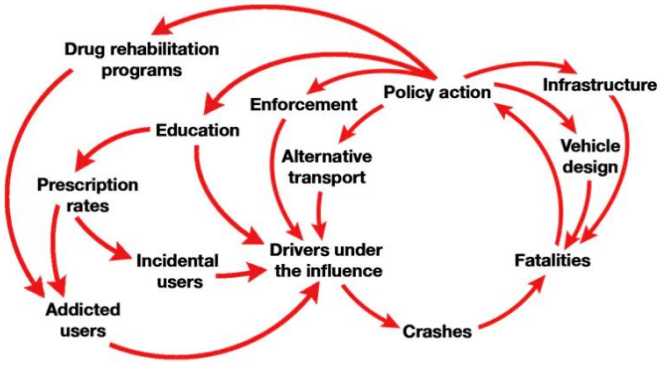
How is it different?

- In a Safe System, we may:
  - Anticipate human error by
    - Separating users in space.
    - Separating users in time.
  - Accommodate human injury tolerance by
    - Reducing speeds through
      - Physical roadway designs.
      - Traffic calming treatments.
      - Minimizing high-speed flow with traffic control.
      - Enforcing speed limits.
    - Reducing impact forces through
      - Designing safer intersections.
      - Improving roadside crashworthiness (or mitigating roadside risk).

ITE, 2019

How is it different?

- *"A new, systems-thinking-based approach is required that considers the **broader societal systems** whose effects manifest inside the road system." – McClure, 2017*



How is it different?

Traditional approach

- Roadway design: Minimize delay and maximize capacity.
- Countermeasures: Reactive adjustments to treat crashes.
- Speeding: Issue citations and enforce speed limits.

Safe Systems

- Roadway design: Manage kinetic energy and prioritize modal affordance.
- Countermeasures: Proactive planning to mitigate risks.
- Speeding: Match land-use to roadway context for self-enforcing roads.

Many in the US are already doing this!

What does Safe Systems look like in the United States?

- All shareholders prioritize modal choice and manage kinetic energy.

Small Town and Rural Design Guide, 2020

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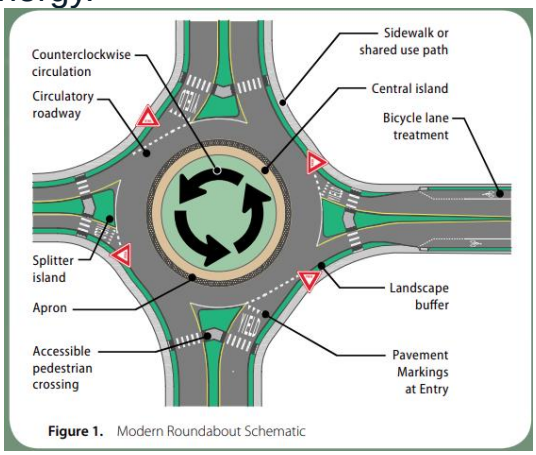

FHWA – Roundabouts and Rural Highways

Krammes and Sheldahl, 2009

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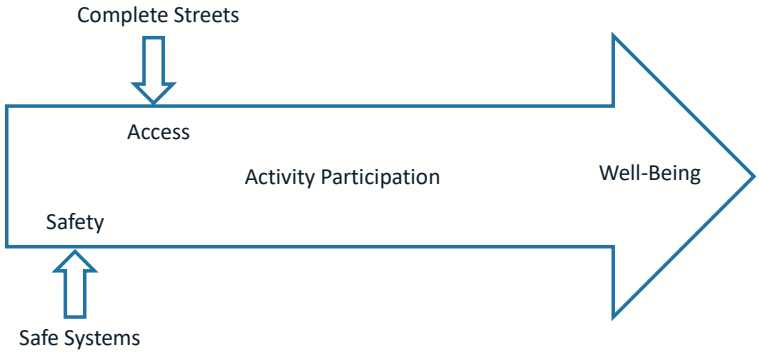

Martens, 2016

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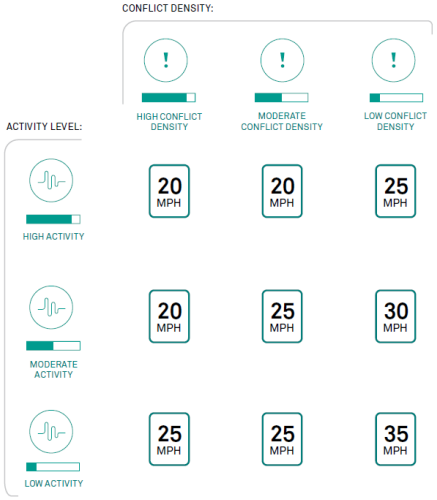
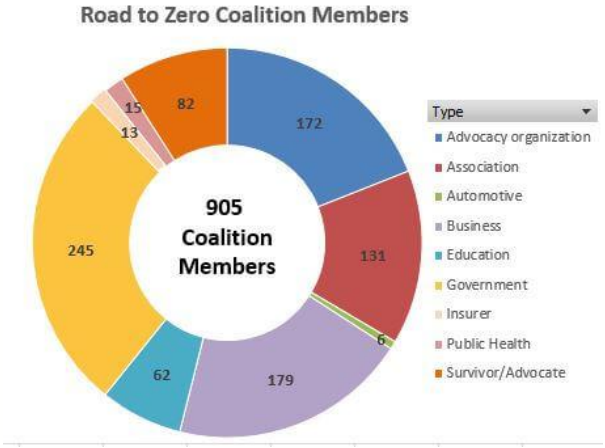


NACTO, 2020

What does Safe Systems look like in the United States?

- Breaking down silos.



National Safety Council, 2019

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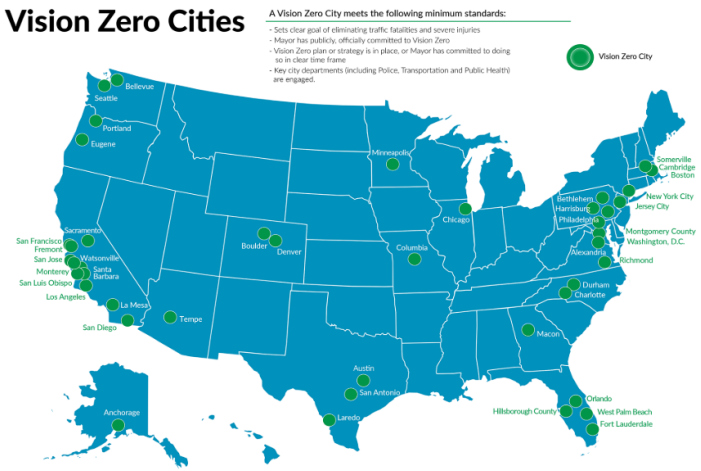

Vision Zero Network, 2019

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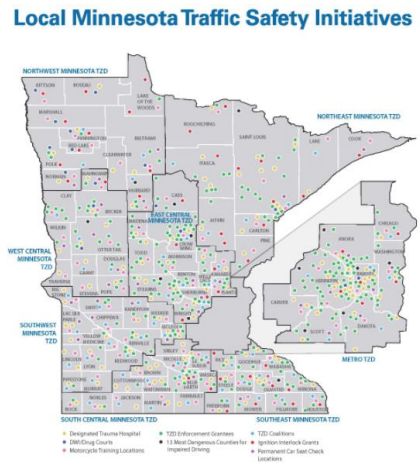

Minnesota TZD, 2019

Key Points

- Safe Systems is a human-centered traffic safety management paradigm that anticipates human error and accommodates human injury tolerance.
- Many current practices fit into a Safe System paradigm, but many more will require rethinking.
- Speed management involves all road users and is an example of the Safe System principle of “shared responsibility.”
- You cannot have a Safe System if you do not provide safe mobility for pedestrians, bicyclists, and motorcyclists.

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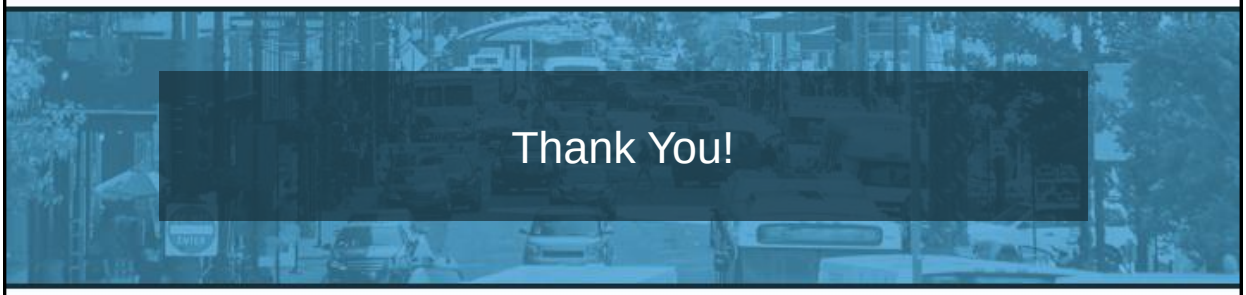

Thank You!

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