Collaborative Sciences Center for ROAD SAFETY

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Safe Systems: Vision Zero in Action

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Regional Issues and Solutions for Vision Zero in Greater Philadelphia

How can Greater Philadelphia communities implement a Safe Systems Approach with safety culture playing a supporting role into their transportation policies?

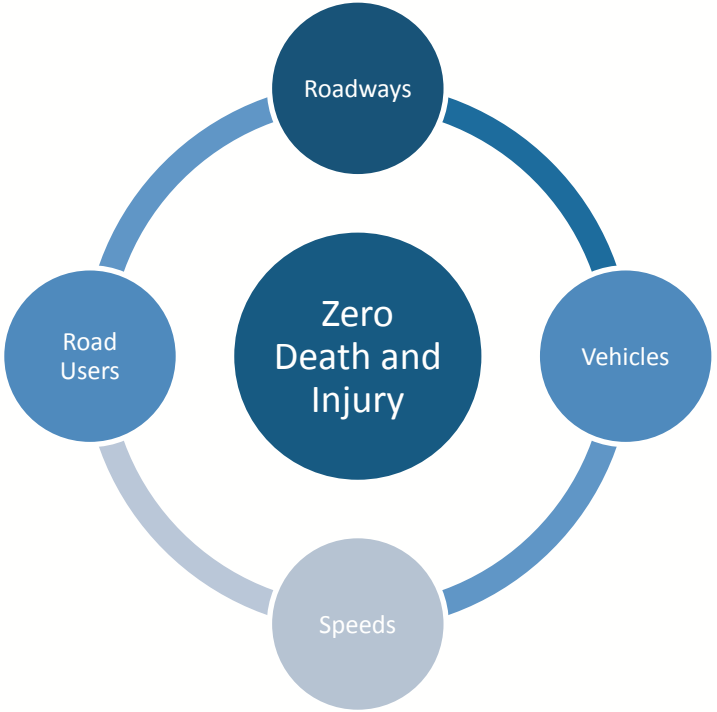
March 24, 2021

Introductory Questions

- Safe Systems may be key to achieving Vision Zero.
- However, Safe Systems may not be implemented without a supportive traffic safety culture.
- Road safety partners always have questions.
  - What is a Safe System?
  - Why do we need Safe Systems?
  - How do we implement Safe Systems?

Defining Safe Systems

- Some versions of Safe Systems:
  - The Netherland's "Sustainable Safety"
  - Sweden's "Vision Zero"
  - Australia's "Safe Systems Approach"
- 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.



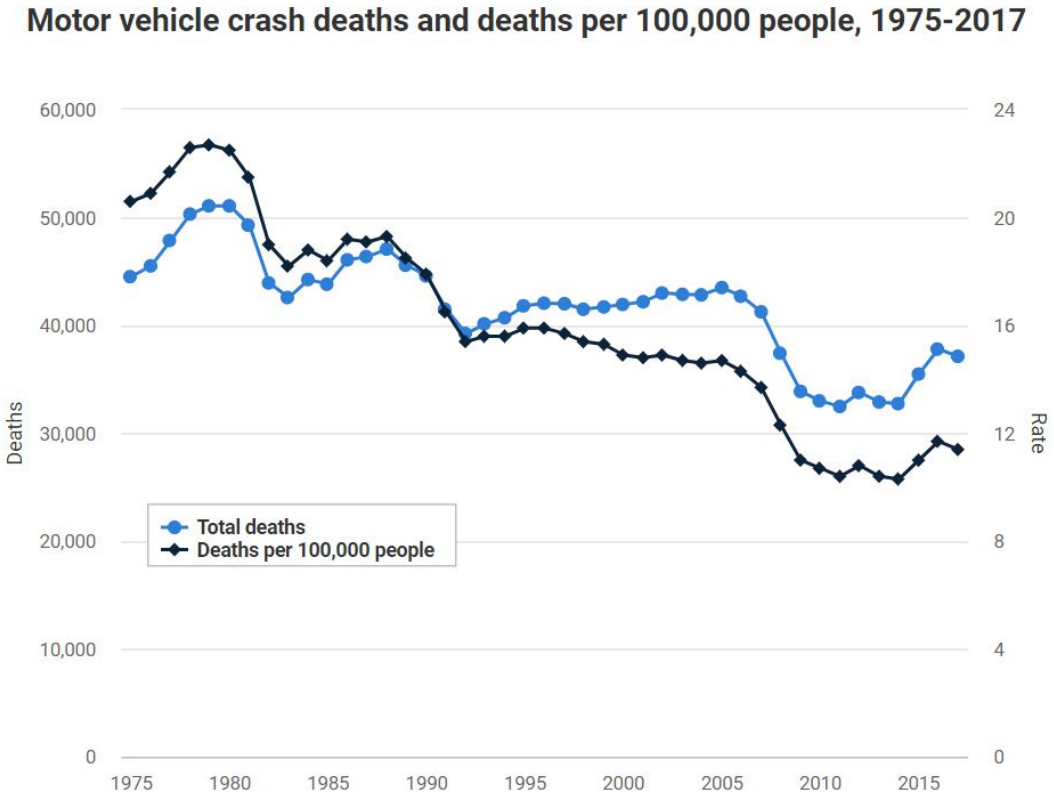
Source: Signor et al., 2018

Defining Safe Systems

- Road to Zero has distilled Safe Systems into 2 key principles:
  - 1. Anticipating Human Error – Safe Systems are designed to anticipate and accommodate errors by drivers and other road users.
    - *Example: Even a momentary distraction can prevent a driver from seeing vulnerable road users or vice-versa. Separating vulnerable road users, such as pedestrians and bicyclists, from traffic wherever possible reduces the likelihood that such predictable errors will lead to a deadly collision.*
  - 2. Accommodating Human Injury Tolerance – Safe Systems are designed to reduce or eliminate opportunities for crashes resulting in forces beyond human endurance.
    - *Example: Where pedestrians and vehicles need to occupy the same space – such as urban crosswalks – reducing vehicle speeds through the use of lower speed limits combined with road design changes can reduce the likelihood of fatal collisions with pedestrians or bicyclists.*

Source: ITE, 2019

Our Motivation

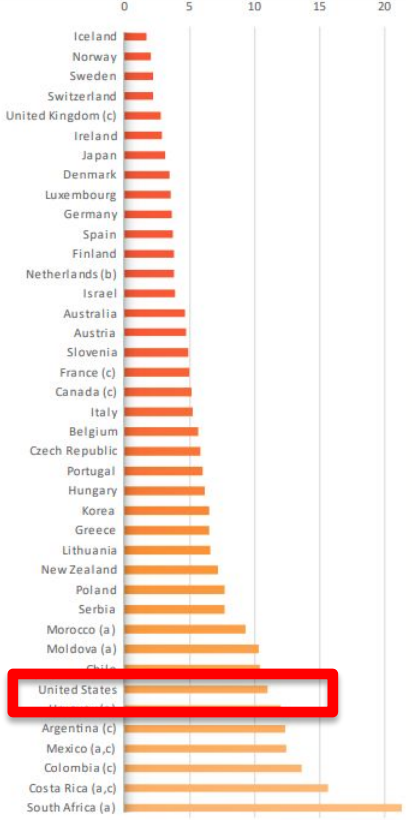


Source: IIHS, 2020

Our Motivation

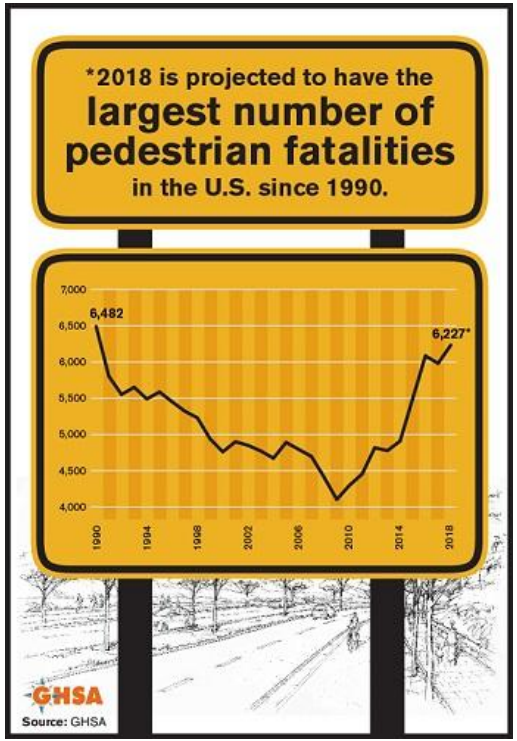
Percentage change in the number of road deaths, 2010-18

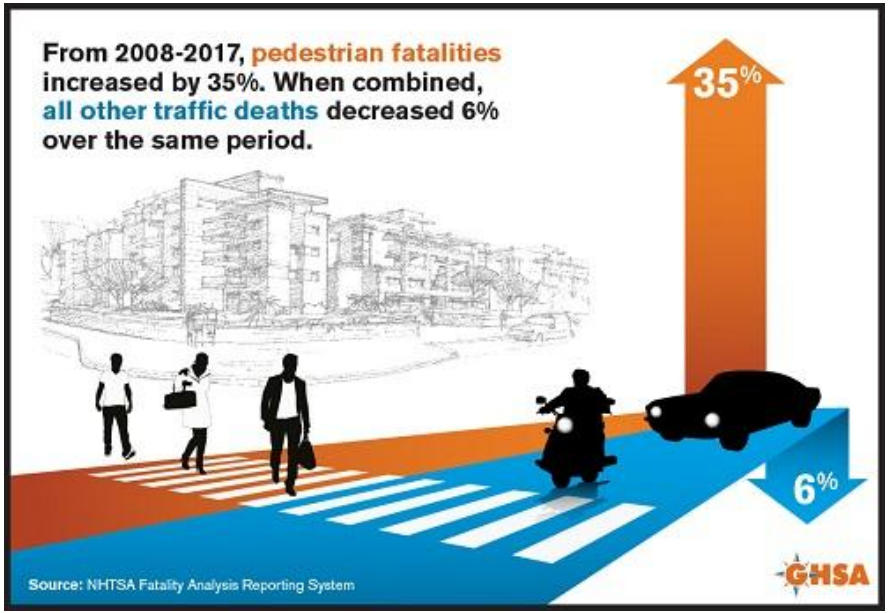
Road fatalities per 100 000 inhabitants, 2019



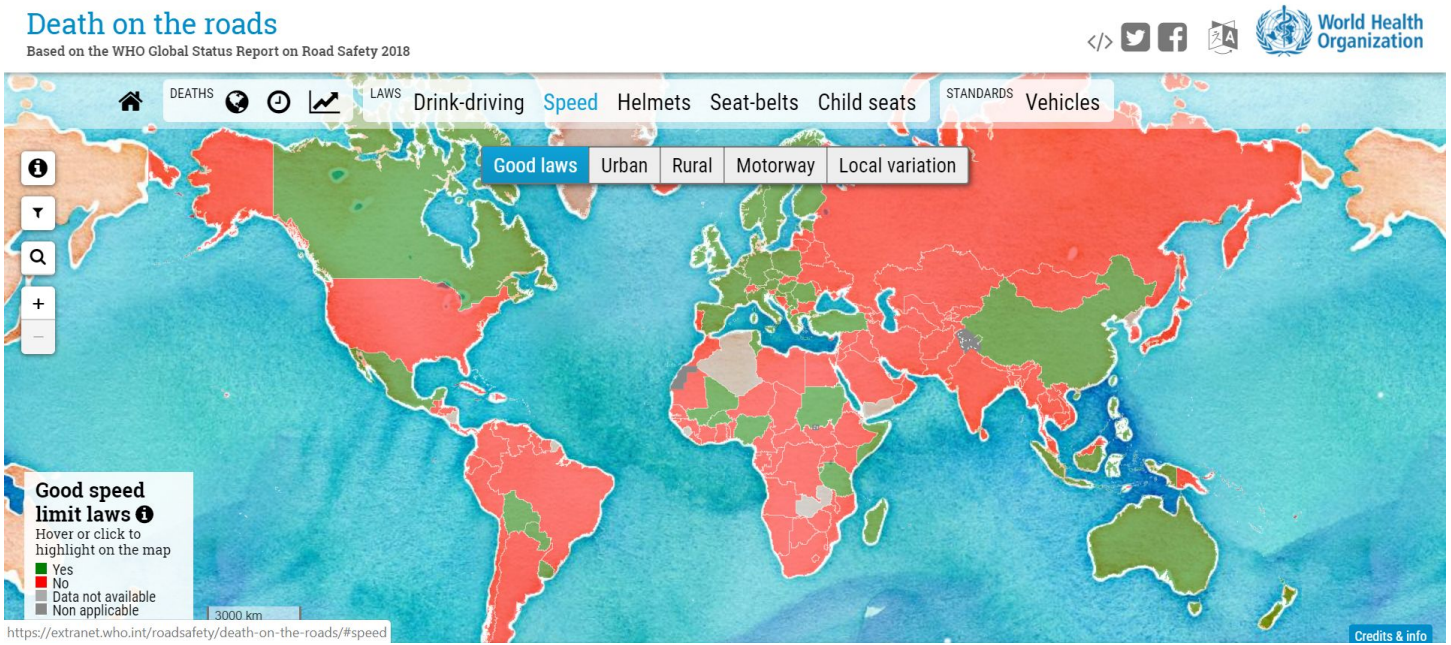
Source: ITF, 2020

Our Motivation





Our Motivation



Source: WHO, 2020

Our Motivation

- Many jurisdictions still prioritize (motorized) mobility over safety.

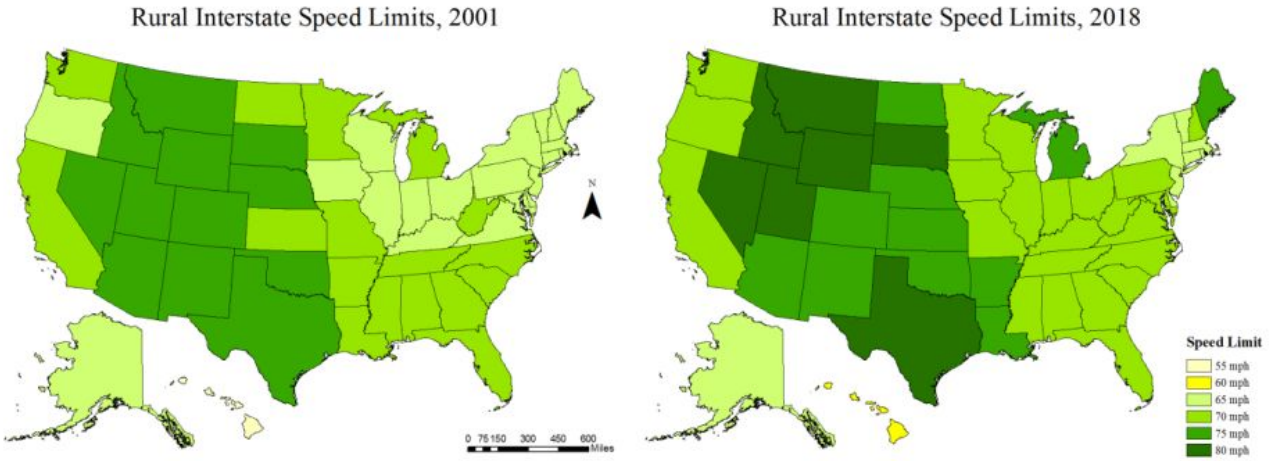
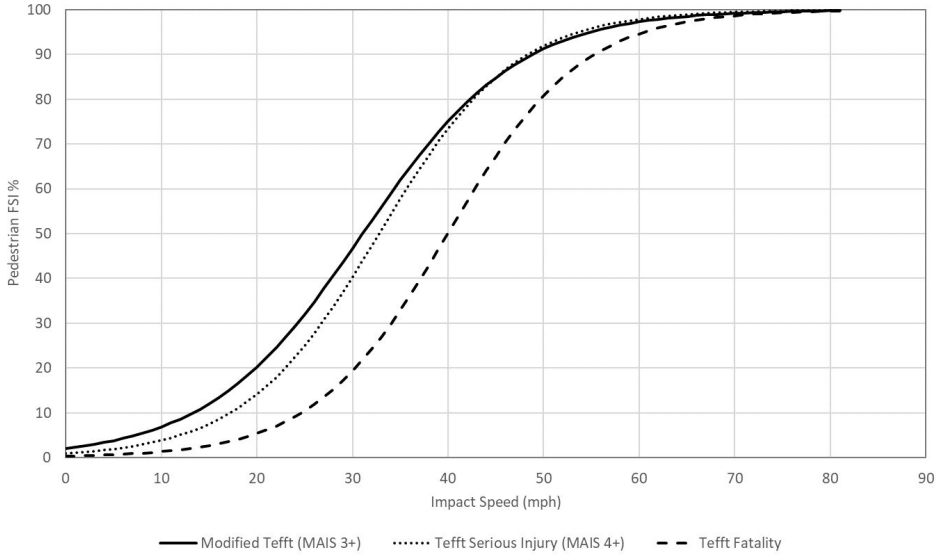


Figure 1. Maximum rural interstate speed limits in 2001 (left) and 2018 (right)

Source: Savolainen et al., 2019

Our Motivation

- Kinetic energy kills.



Source: Porter et al., 2021

Impact Speed (mi/h)	Risk of Fatality (percent)
24-33	10
33-41	25
41-48	50
48-55	75
54-63	90

Source: Sanders et al., 2019

	5	1	1	3
	45	5	7	62
	85	16	22	92

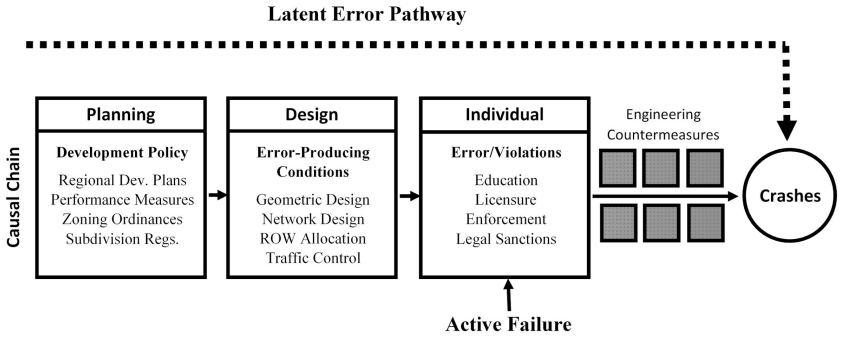
Source: Donnell et al., 2009

Implementing Safe Systems

- Find ways to reimagine our roadways based on the four principles.
  - Adapt the structure and function of the transportation system to the complexities of human behavior.
    - Identify places of latent risk and address those first.
  - Manage the kinetic energy transferred among road users.
    - Separate users in space and time.
  - Treat road user safety as the foundation of all system interventions.
    - Prioritize safety over convenience.
  - Foster the creation of a shared vision and coordinated action.
    - System designers and operators have as much (if not more) responsibility for road safety.

Implementing Safe Systems

- We must have a traffic safety culture that centers humans (and their complex behaviors) in our approaches to design.
- The roadway environment is full of dormant risks that produce and exacerbate driver errors to cause crashes.

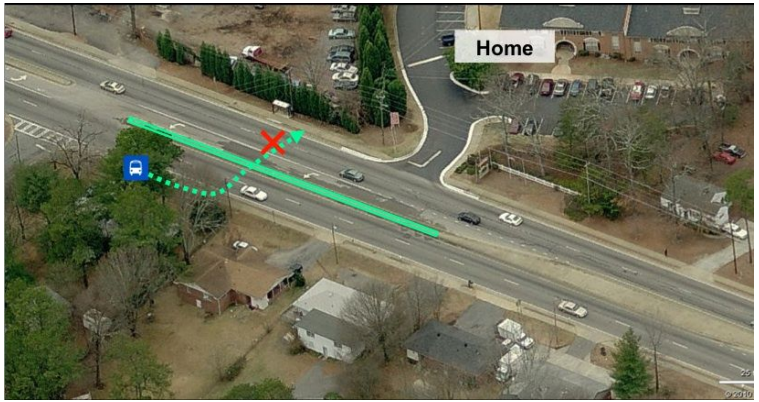


Source: Dumbaugh et al., 2019

Implementing Safe Systems

- Consider just making safe practice the policy.
  - Prioritize pedestrian and bicyclist safety at the beginning of project development.
  - Add crosswalks at all transit stops.
  - Create new warrants when necessary ones are missing.

Source: Dumbaugh et al., 2019



Source: Snyder, 2011

Implementing Safe Systems

- Systemic treatments can fit into a Safe System.

Road diets for speed management

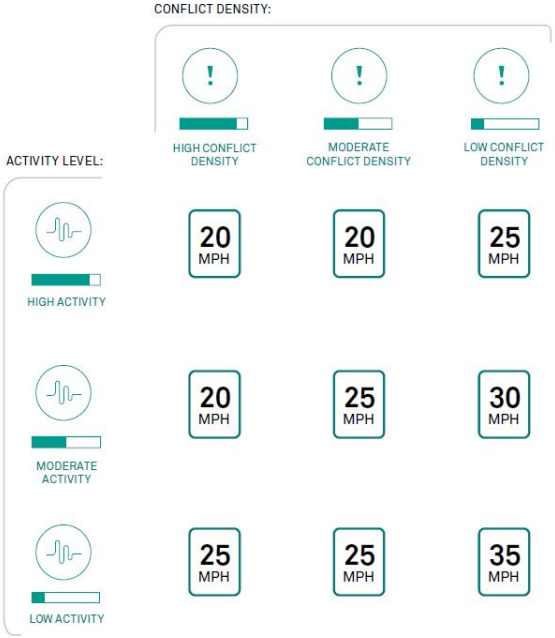
Photo credit: Dan Burden
(pedbikeimages.org)

Pedestrian hybrid beacons for separation in time

Photo credit: Mike Cynecki
(pedbikeimages.org)

Implementing Safe Systems

- We can change speed limits to reduce kinetic energy and manage complexity.



Source: NACTO, 2020

After Boston lowered the default speed limit to 25 mph, the estimated odds of a vehicle

exceeding 35 mph

fell 29.3%

exceeding 30 mph

fell 8.5%

exceeding 25 mph

fell 2.9%

Example: Boston recently lowered citywide speed limits (Hu and Cicchino, 2019)

Implementing Safe Systems

- Prioritizing safety over convenience requires reconsidering land use and roadway functional classification.
  - Many jurisdictions still prioritize (motorized) mobility over safety.
  - We need to reconsider the data we collect for TIAs.

Implementing Safe Systems

- Prioritizing safety over convenience requires affording all travelers the freedom to move by whichever mode they need without harm.

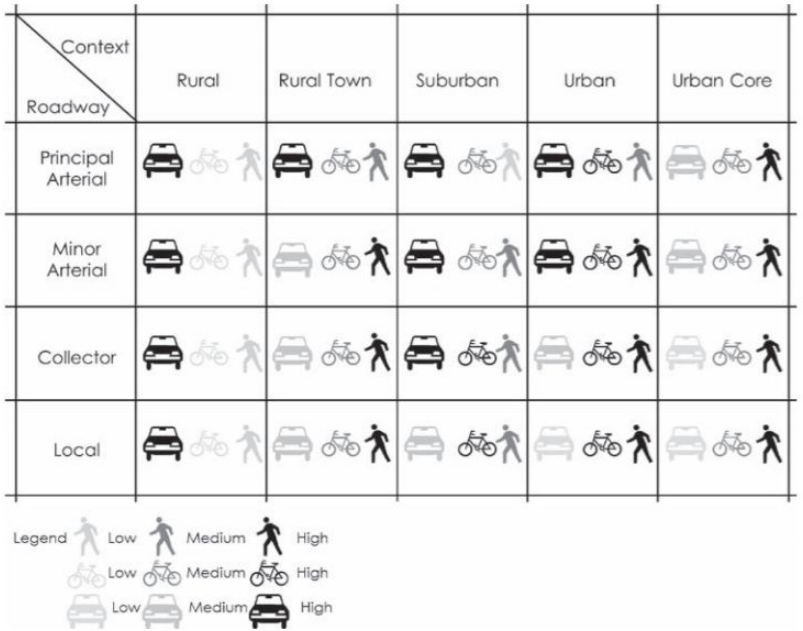
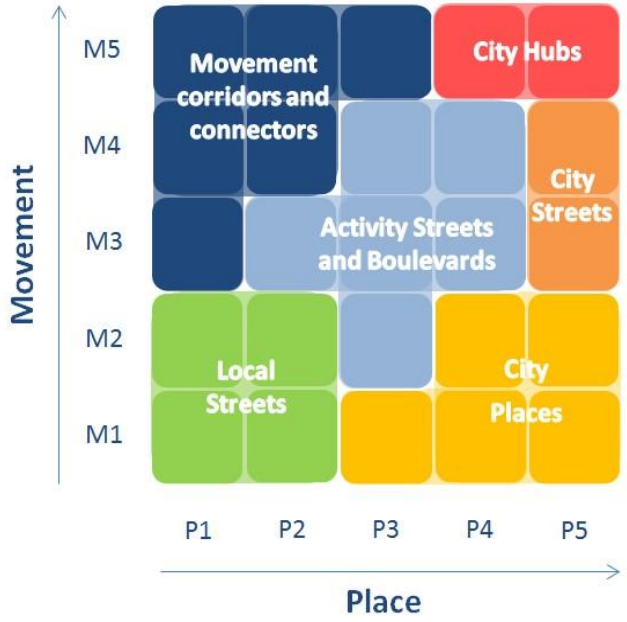


Figure 5. Typical user priorities in the Expanded FCS.

Source: Stamatiadis et al., 2018



Source: Corben, 2020

Implementing Safe Systems

- Using engineering design to create freedom from risk for all road users.

Source: Corben, 2020

At intersections									
Safe System treatment	**Exposure**	**Likelihood**	**Severity**	**City Hubs**	**City Streets**	**City Places**	**Activity Streets & Boulevards**	**Movement Corridors & Connectors**	**Local Streets**
Signalised intersections with 'Scramble' phasing (30 km/h speed limit)		✔	✔	✔	✔		✔		
Limit access by mode	✔	✔	✔	✔		✔			
Raised signalised intersections with 30 km/h ramps		✔	✔	✔	✔		✔		
Safety platforms (30 km/h or lower) on all approaches		✔	✔	✔	✔	✔			✔
Geo-fencing technology for trams, trucks and other large vehicles		✔	✔	✔	✔	✔	✔		
Signalised roundabout with exclusive turn phases for public transport, cyclists and pedestrians		✔	✔	✔			✔	✔	
Grade-separation of pedestrians and cyclists from vehicular traffic		✔		✔					
Roundabouts with 20/30 km/h wombat crossings		✔	✔		✔	✔	✔	✔	✔
Threshold platforms at intersections with side-streets		✔	✔	✔	✔	✔		✔	
Raised intersections with 30 km/h (or lower) platforms		✔	✔	✔	✔	✔	✔	✔	✔
Signalised 'tennis ball' intersections (30 km/h design)		✔	✔					✔	
All-way stop signs		✔	✔			✔		✔	✔
Restricted access intersection	✔	✔	✔			✔		✔	✔

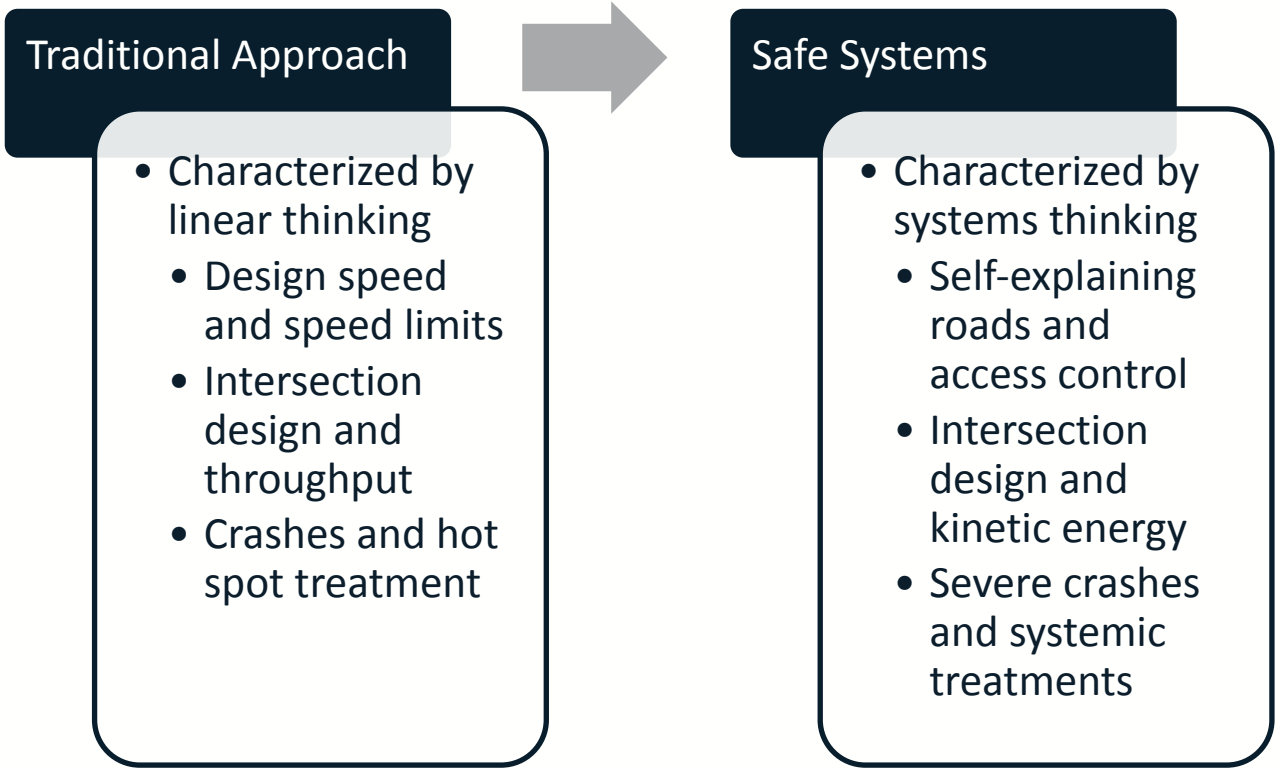
Implementing Safe Systems

- Create energy for all the aforementioned efforts through organizational action.

Source: ITE, 2019

A New Approach

- Safe Systems requires a move to systems thinking.



Thank you!

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