



SAFE SYSTEM APPROACH

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Washington Traffic Safety Commission

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The Safe System Approach – the basic elements

Safety Culture

Safe System Principles

Safety Cultural

Safe System Elements



SAFE SYSTEM APPROACH

SAFE SYSTEM EVOLUTION

Sustainable Safety
Netherlands, early 1990s

Vision Zero
Sweden, 1997



Safe System
Australia

SAFE SYSTEM ADOPTERS



Sweden

Vision Zero

60-70%

Reduction in fatalities
1994-2015

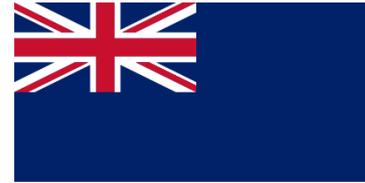


Netherlands

Sustainable Safety

50-60%

Reduction in fatalities
1994-2015



Australia

Safe System

50-60%

Reduction in fatalities
1994-2015



New Zealand

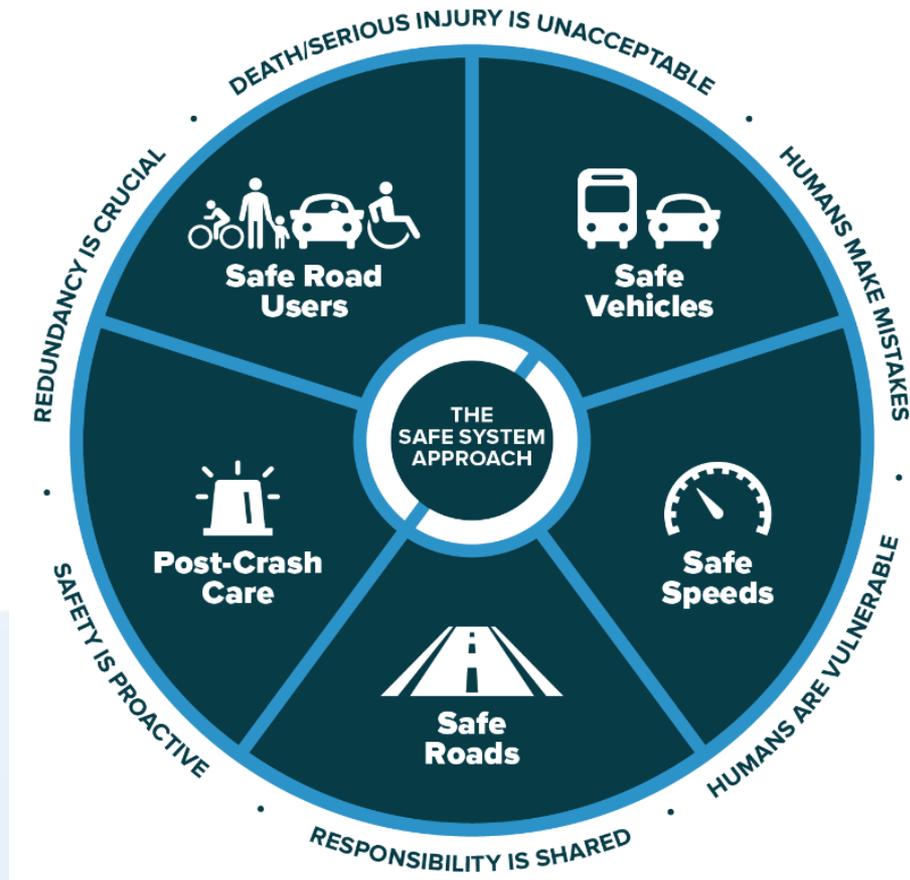
Safer Journeys

50-60%

Reduction in fatalities
1994-2015

Source: World Resources Institute

SAFE SYSTEM APPROACH



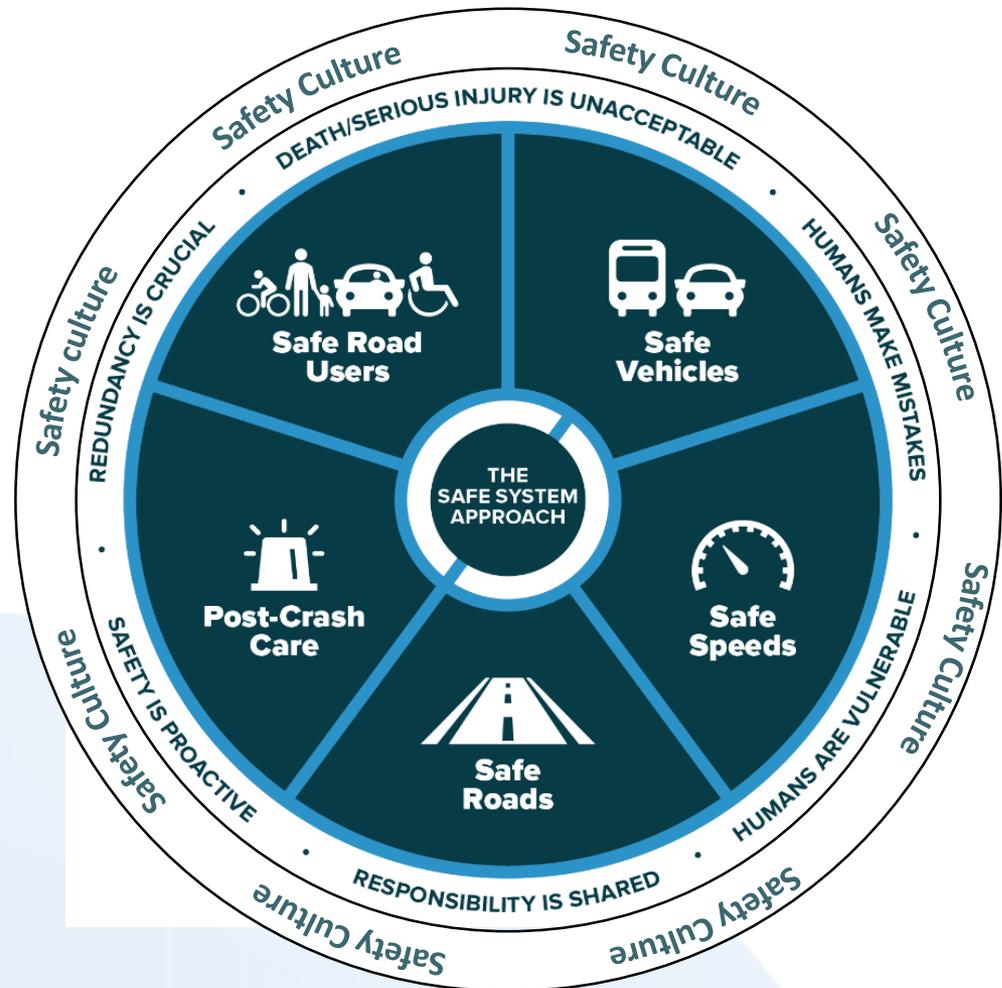
Source: FHWA-SA-20-015

SAFETY CULTURE

ITE - *The Road to Zero: Taking a Safe System Approach*

Safety Culture must surround all we do and be advanced in parallel with the adoption of a Safe System approach to achieve maximum benefit.

<https://www.ite.org/pub/?id=8B6264A1-D5A7-1560-D583-D90F54D8DDB9>



CULTURE SHIFT

Traditional

Safe System

- | | | |
|------------------------|---|------------------------------------|
| Prevent all crashes | ➔ | Prevent fatal and serious crashes |
| React to crashes | ➔ | Proactive approach to crashes |
| Blame road users | ➔ | Shared responsibility |
| Improve human behavior | ➔ | Design and operate for human error |
| Control speeding | ➔ | Reduce system kinetic energy |

SAFE SYSTEM PRINCIPLES

SAFE SYSTEM PRINCIPLES



**Death/Serious Injury
is Unacceptable**



**Humans
Make Mistakes**



**Humans Are
Vulnerable**



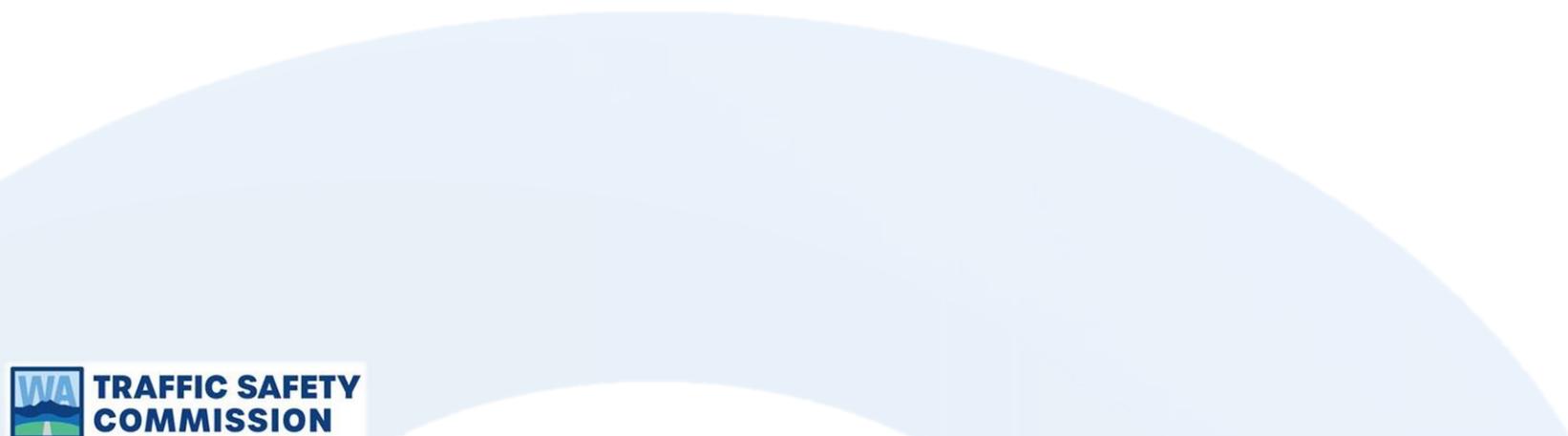
**Responsibility
is Shared**



**Safety is
Proactive**



**Redundancy
is Crucial**



DEATH AND SERIOUS INJURY ARE UNACCEPTABLE



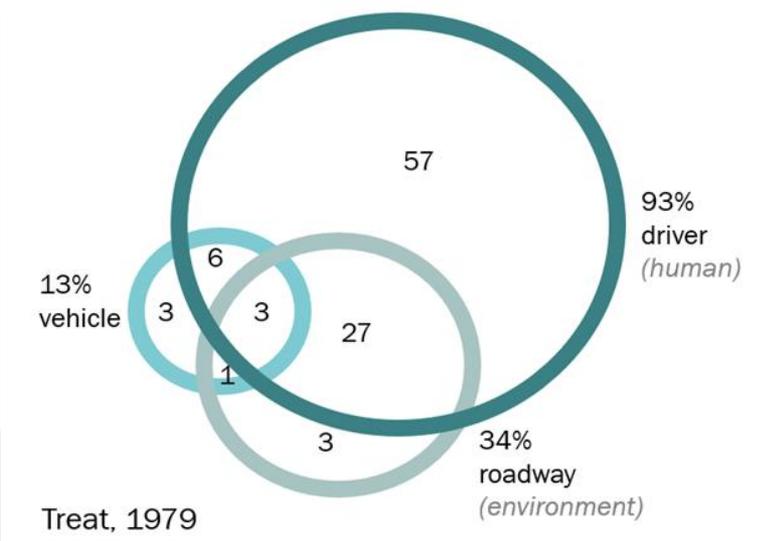
What is the goal for safety for your family this year?

What number do you think is acceptable?



HUMANS MAKE MISTAKES

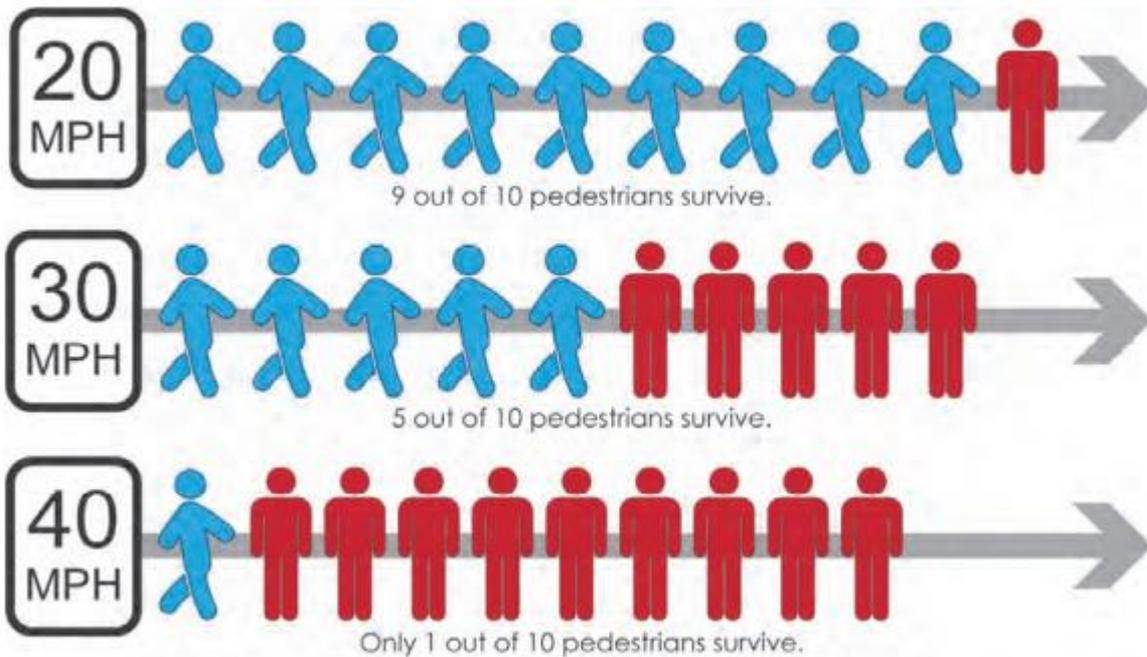
Blame



Shared responsibility

- Evolve from the perception that road user error or behavior was the cause of most crashes
- There are countermeasures that we can implement
 - ✓ Even with error or poor behavior we provide forgiving infrastructure systems that reduce crashes
- All road users share the responsibility of safety

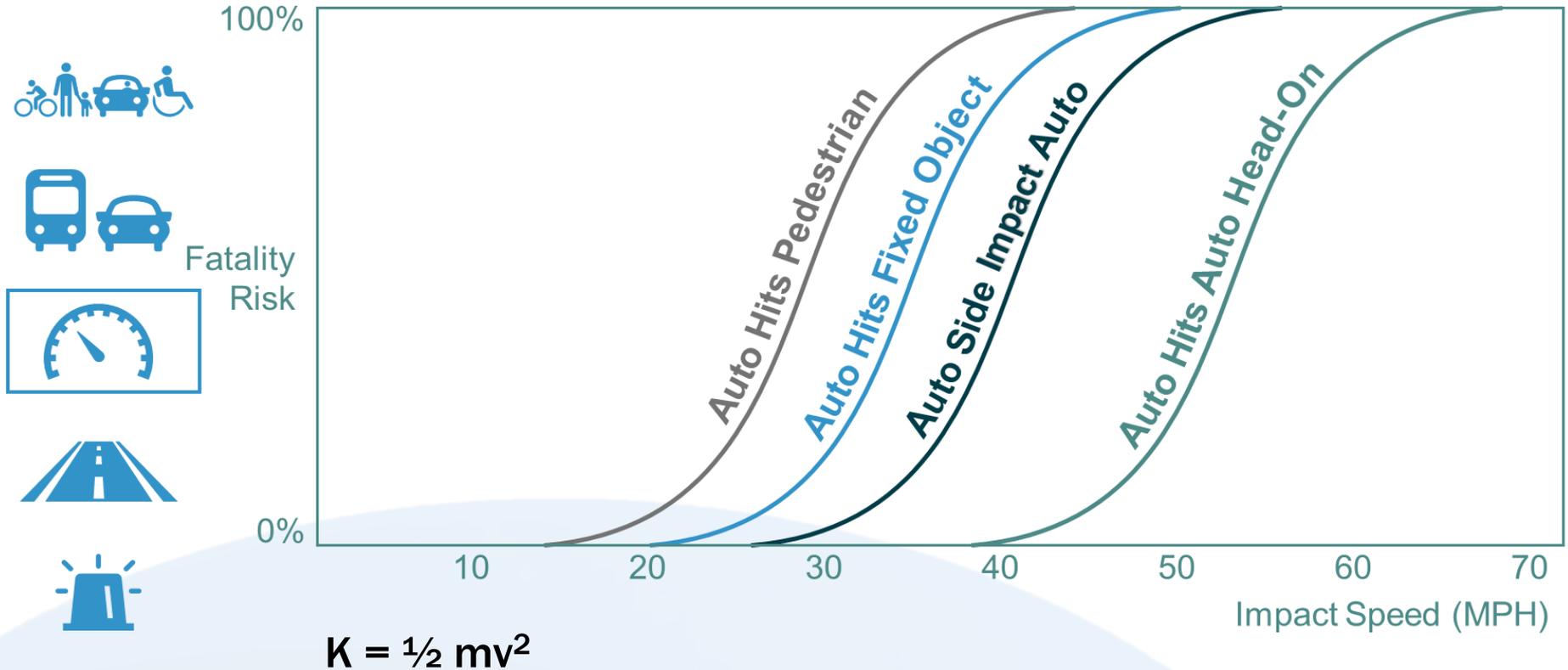
LIMITED HUMAN TOLERANCE TO CRASH FORCES



Source: Target Zero 2019

SAFE SPEEDS: FATALITY RISKS

HUMANS ARE VULNERABLE



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

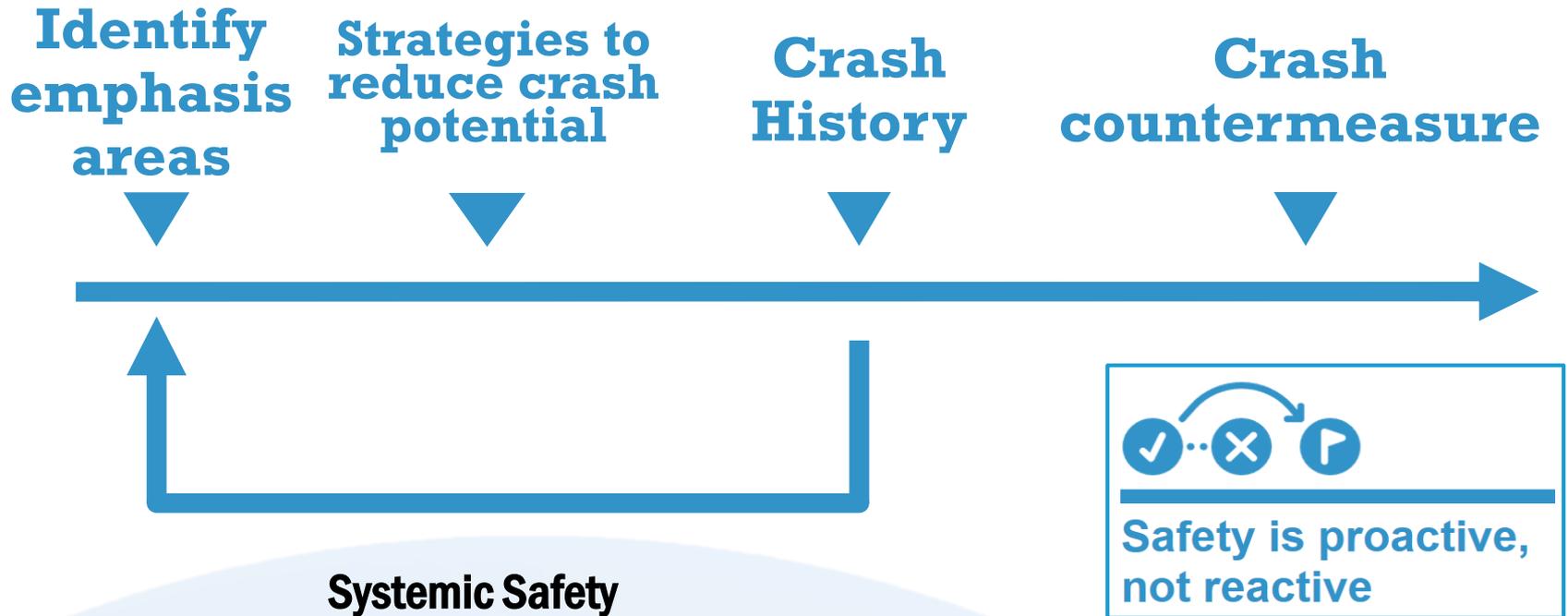
Source: FHWA



Fatality Risk



PROACTIVE VERSUS REACTIVE



Systemic Safety

- WSDOT is targeting 70% of its program towards “systemic safety”
- Reduce crash potential before the crashes occur
- Focus on crash types and potential contributing factors

REDUNDANCY IS CRITICAL

SHARED RESPONSIBILITY

STRENGTHEN ALL PARTS

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

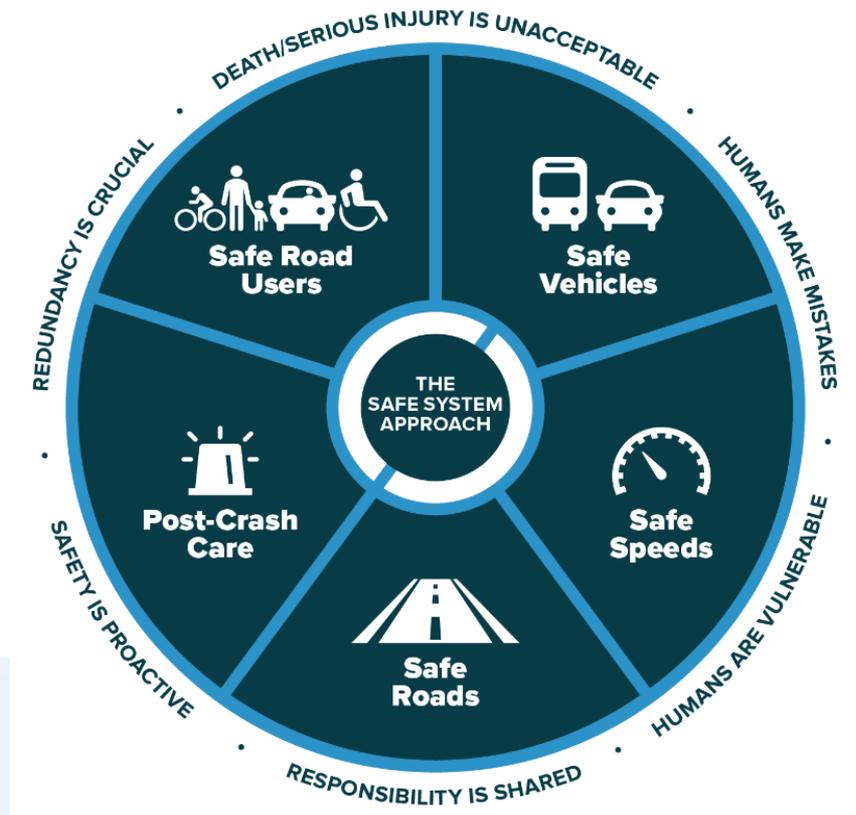


Death and serious injuries only happen when all layers fail



SAFE SYSTEM USES 5Es OF SAFETY

	Death/serious injury is unacceptable
	Humans make mistakes
	Humans are vulnerable
	Responsibility is shared
	Safety is proactive, not reactive
	Redundancy is crucial



- ## 5 Es of Safety
- Engineering
 - Enforcement
 - Education
 - Emergency Medical Services
 - Evaluation, Analysis, Diagnosis

Source: FHWA-SA-20-015

SAFE SYSTEM ELEMENTS

SAFE SYSTEM ELEMENTS



**Safe Road
Users**



**Safe
Vehicles**



**Safe
Speeds**



**Safe
Roads**



**Post-Crash
Care**

Source: FHWA-SA-20-015

SAFE SYSTEM APPROACH


Death/serious injury
is unacceptable


Humans make
mistakes


Humans are
vulnerable


Responsibility
is shared



Safe Road Users



Follow rules



Are not
distracted or
impaired



Act within the
limits of the
road design

SAFE ROAD USERS



Walk



Bike



Drive



Transit



Other

Source: Fehr & Peers

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



Other road user safety

Measures that protect other road users

- Bicycle and pedestrians detection
- Vehicle Size and Design

New technology

Leveraging connected and automated transportation (CAT) technology to reduce crashes

SAFE SYSTEM APPROACH



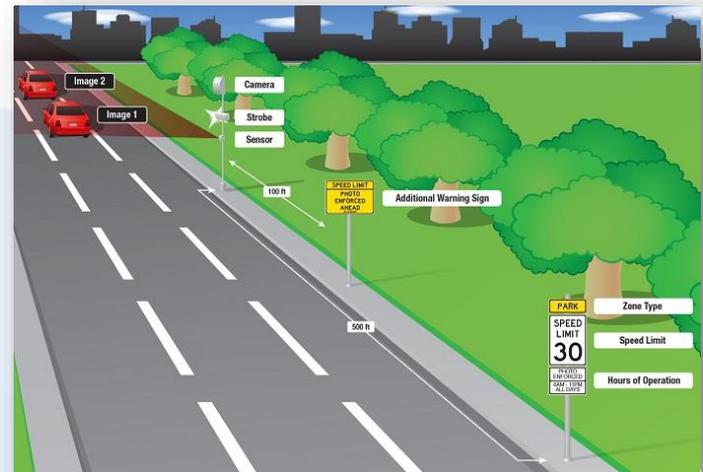
Safe Speeds

Roads designs and operations to accommodate appropriate speeds for the context and modes

Automated speed enforcement



Source: WSDOT



Source: Chicago.gov

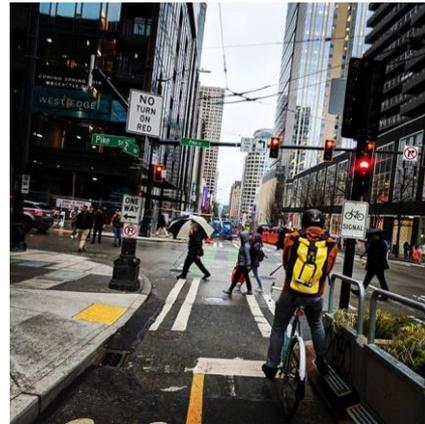
SAFER ROADS



Avoiding crashes involves:



Separating users in space



Separating users in time



Increasing attentiveness and awareness

SAFER ROADS



Managing crash kinetic energy:



Managing speed



Manage Mass difference



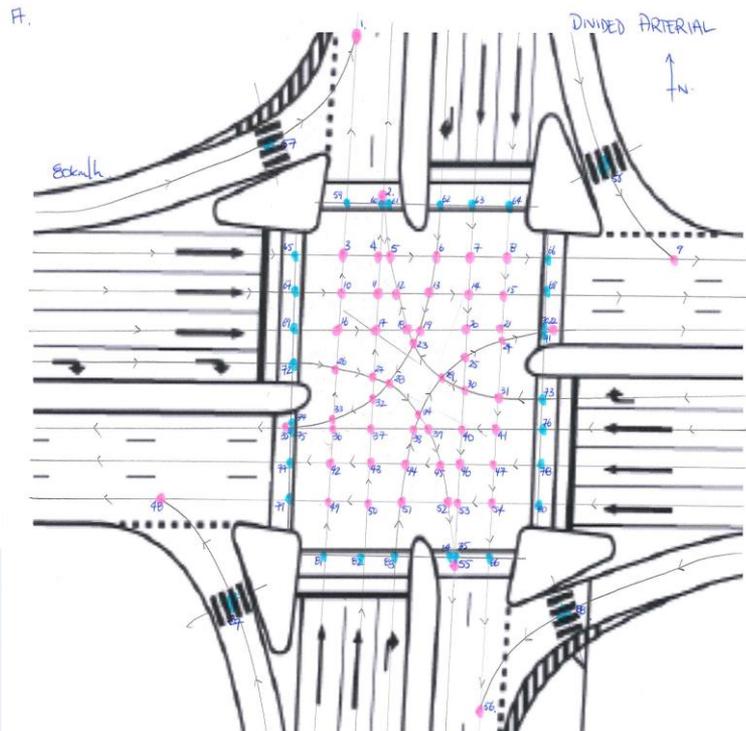
Manage crash angles



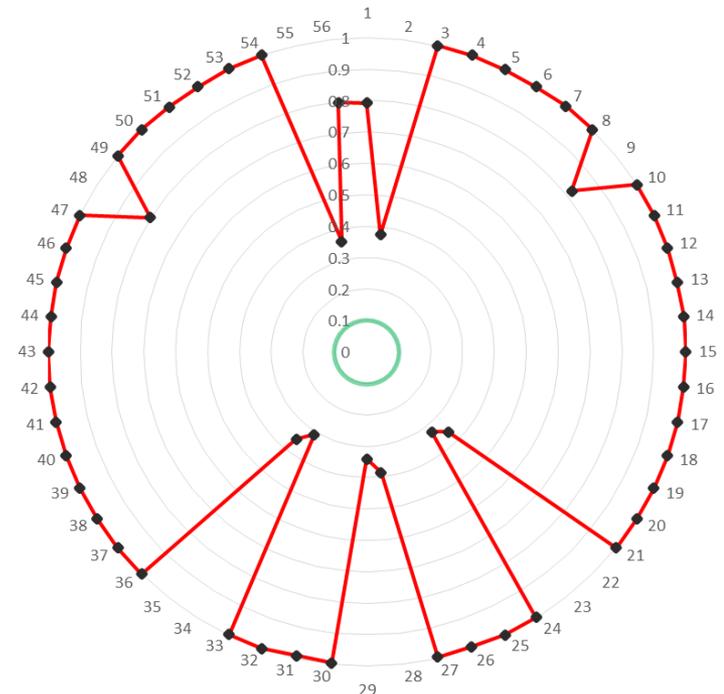
REDUCE INTERSECTION ENERGY

Divided arterial signals - 80 km/h x 60 km/h

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



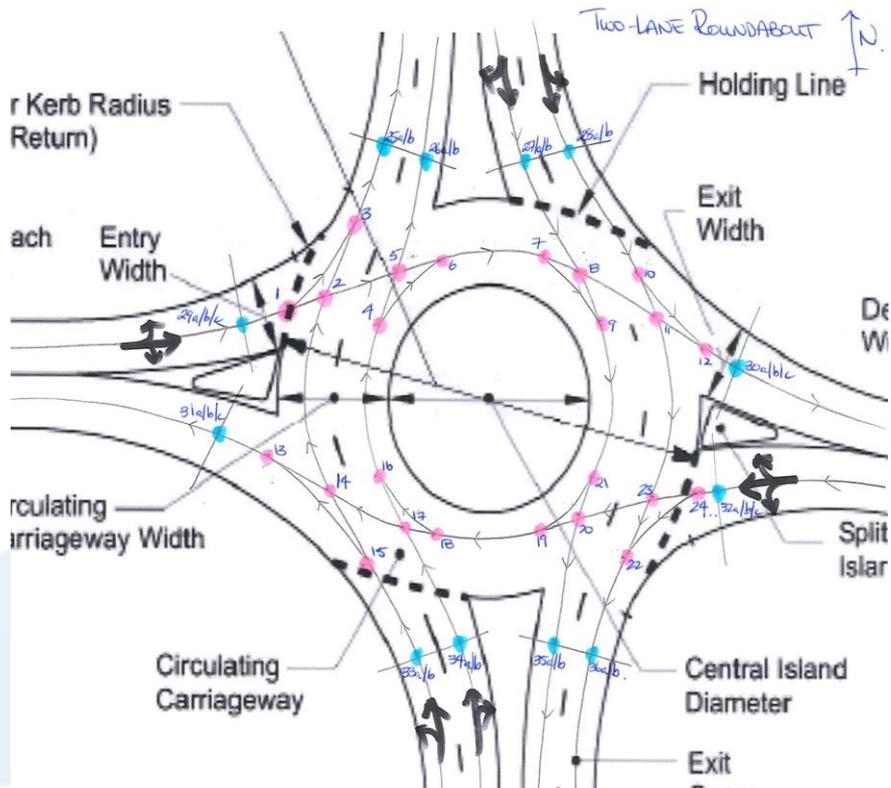
Divided Arterial Int - Conflict points and corresponding Pr(FSI)



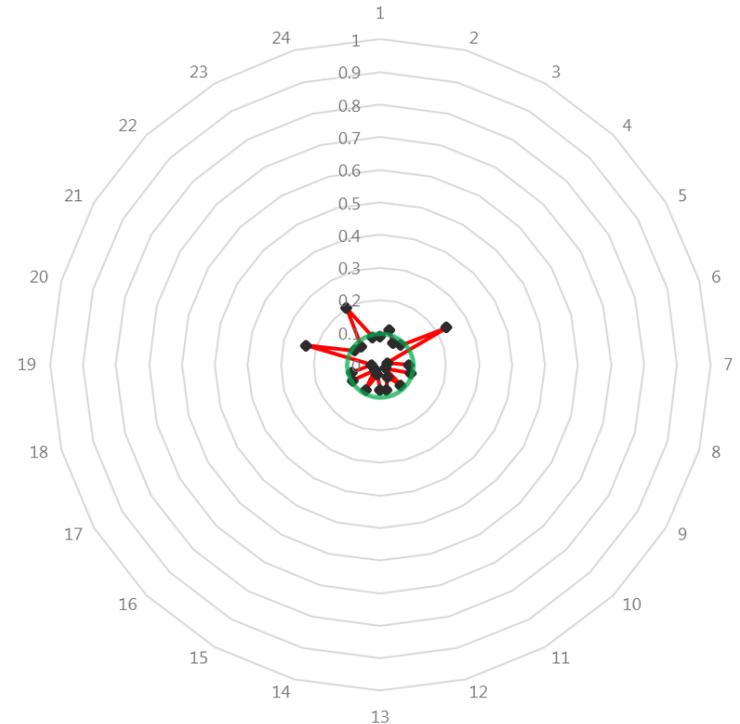
Source: Blair Turner

REDUCE INTERSECTION ENERGY

Divided arterial roundabout - 80 km/h x 60 km/h



Two-Lane Roundabout - Conflict points and corresponding Pr(FSI)



SAFE SYSTEM APPROACH



Post-Crash Care



First responders



Medical care



Traffic incident management

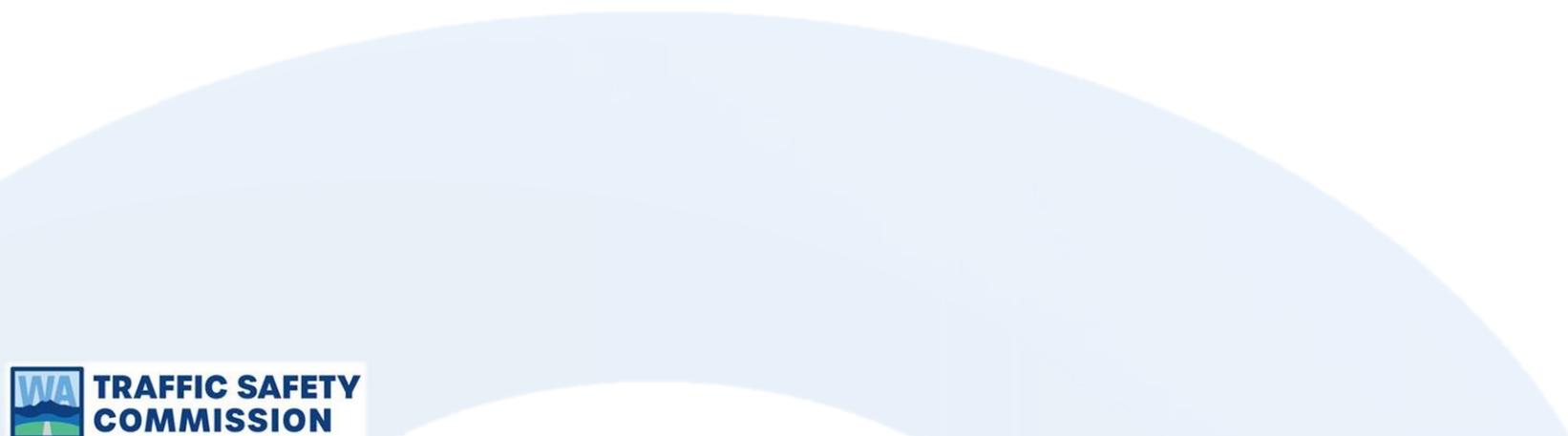


Crash investigation



Justice

Questions



Thank You

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