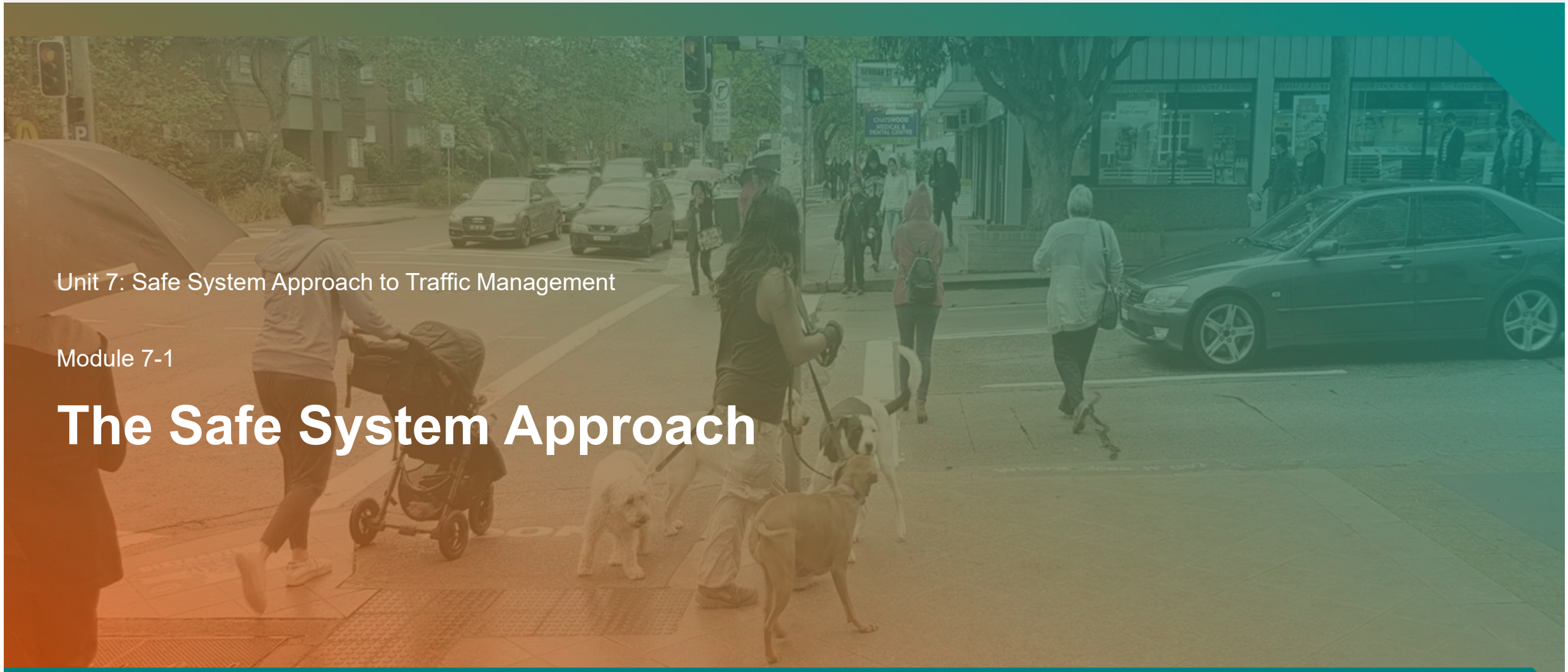

Unit 7: Safe System Approach to Traffic Management

Module 7-1

The Safe System Approach

Traffic Management Training Module

Austroads

Today's presenter

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Roads have been getting safer

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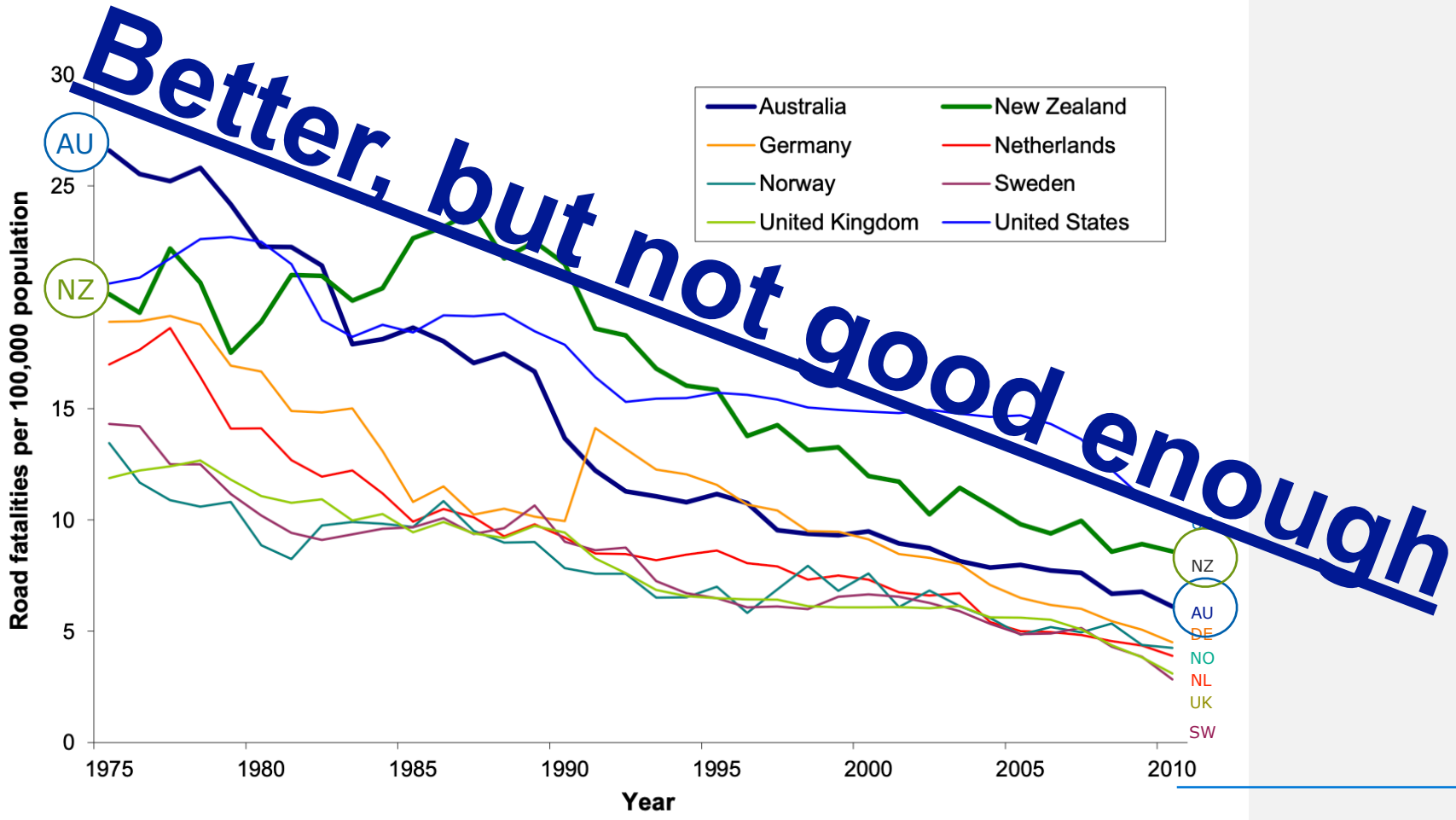
Figure 3.2: Road fatalities per 100 000 population in Australia, New Zealand and selected OECD countries 1975–2010



Roads have been getting safer over time in most countries

Reasons include

Better emergency medicine

Faster response times (mobile phones)

Safer vehicle design *for occupants*

More rigorous enforcement

Better driver regulation

Safer road design

~~More attentive drivers?~~

2020

Adapted from: Austroads Guide to Road Safety Part 1: Road Safety Overview Figure 3.2: Road fatalities per 100 000 population in Australia, New Zealand and selected OECD countries 1975–2010

What is The Safe System Approach

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"At the heart of the Towards Zero [Deaths and Injuries] vision is the belief that **no one should be killed or seriously injured from using the road network**. The aim of Towards Zero is for a world free from road fatalities and serious injuries and the vision is underpinned by the Safe System approach to road safety."

Source: http://www.towardszerofoundation.org/thesafesystem/

Principles of The Safe System Approach

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	People are fallible		Humans are fragile
	Road safety is a shared responsibility		Build a safe and forgiving road system

Source: http://www.towardszerofoundation.org/thesafesystem/

Human Fallibility

People by nature will **make mistakes** *(even when they are not being irresponsible)*.

When these mistakes occur on the road, they can lead to crashes.

Road trauma cannot be eradicated just by improving road user behaviour.

Safe road system must accommodate and account for people making mistakes.

Photo by David Levinson

http://www.towardszerofoundation.org/thesafesystem/

Human Vulnerability

The **human body has a limited physical ability to tolerate crash forces**

The human body is vulnerable not built to withstand impact forces greater than 30km/h – any impact greater than 30km/h greatly increases the risk of dying.

Pedestrians, bicyclists, motorcyclists, scooter riders, and others not in a metal cage are referred to as "vulnerable road users", and are most at risk of sustaining injury in the event of a crash.

A vehicle can absorb some of the crash forces protect the occupant, the speed before the risk of death is lower than people think.

Crash Type		Impact speed
	head on	70 km/h
	side-impact	50 km/h
	side impact with tree	30 km/h
	pedestrian	30 km/h

Source: http://www.towardszerofoundation.org/thesafesystem/

Figure 2: http://www.towardszerofoundation.org/thesafesystem/

Road Safety is a Shared Responsibility

Traditionally, the responsibility for staying safe on the road fell on individual road users.

In the Safe System approach, road safety is a shared responsibility. Everyone has a part to play in keeping ourselves and each other safe on the roads.

In no particular order:

the whole community of road users,
road agencies,
specific groups of road users and the associations that represent them,
the police and justice sector,
vehicle manufacturers,
employers of road users,
parents and schools,
planners and designers,
health care professionals,
governments that allocate funding to road safety programs and health services,
the insurance industry.

Source: http://www.towardszerofoundation.org/thesafesystem/

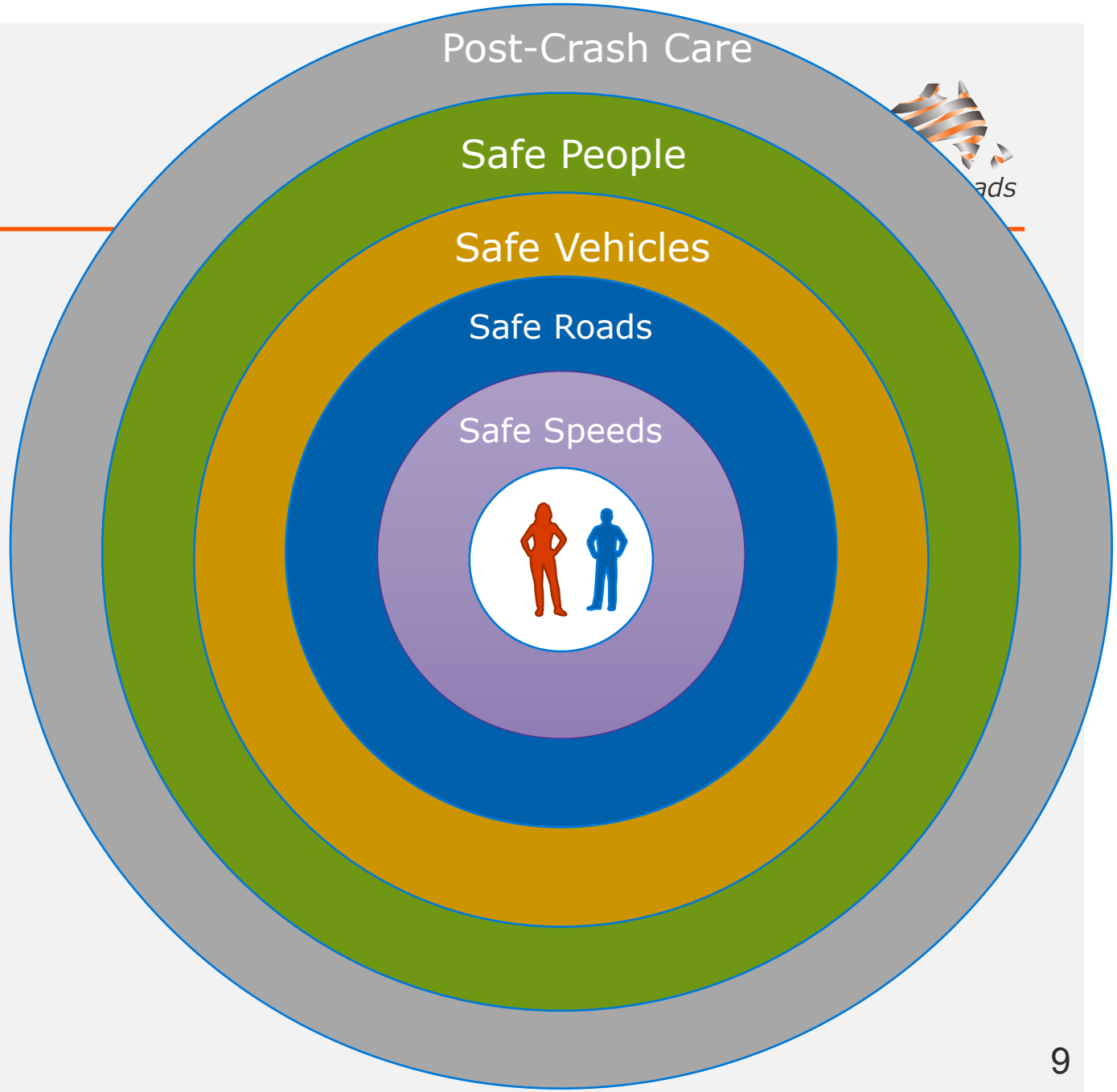
Building a safe and forgiving road system

A safe road system that is forgiving of mistakes must have:

- **Safe Speeds,**
- **Safe Roads,**
- **Safe Vehicles,**
- **Safe People, and**
- **Post-Crash Care**

Layered protection around people keeps them safe from death and serious injuries on the road.

If one part of the system fails, the other parts will still protect people.



http://www.towardszerofoundation.org/thesafesystem/

Based on Figure 1: http://www.towardszerofoundation.org/thesafesystem/

Conventional vs. Safe System Approaches

	Conventional	Safe System
What is the problem?	Accidents	Fatalities and Serious Injuries
What causes the problem?	Speeding, drink driving, inattention, deliberate risk taking	System Failures
Who is ultimately responsible?	Individual road users	System designers and operators
What is the major planning approach?	Incremental approach to reduce residual crashes	A systemic approach to build a safe road system and minimise the harm
What is the appropriate goal?	"Optimum number of fatalities and serious injuries" based on competing objectives	Virtual elimination of death and serious injuries
What is the trade-off?	A balance between mobility and safety	Maximising ***safe mobility***
How is the effort coordinated?	Incremental gain within individual pillars (roads / speeds / vehicles / people)	Optimise solutions across pillars (roads / speeds / vehicles / people) – pillars compensate for each other
What are the cultural manifestations?	Legal liability avoidance and risk aversion	Experimental: Risk assessment, innovation, trials and demonstrations

Source: Austroads AP-560-18 Table 2.6: Differences between the conventional and Vision Zero approach to road safety. Adapted from Swedish Transport Administration. (2015). Dr. Matts Ake-Belin [Powerpoint slides] and Austroads

For more information, See the *Safe System Assessment Framework* on the Austroads website

The effect of a small travel speed change on injury

A small change in travel speed

↓

A relatively large change in perception/reaction time and braking and stopping distance

↓

A much larger change in impact speed

↓

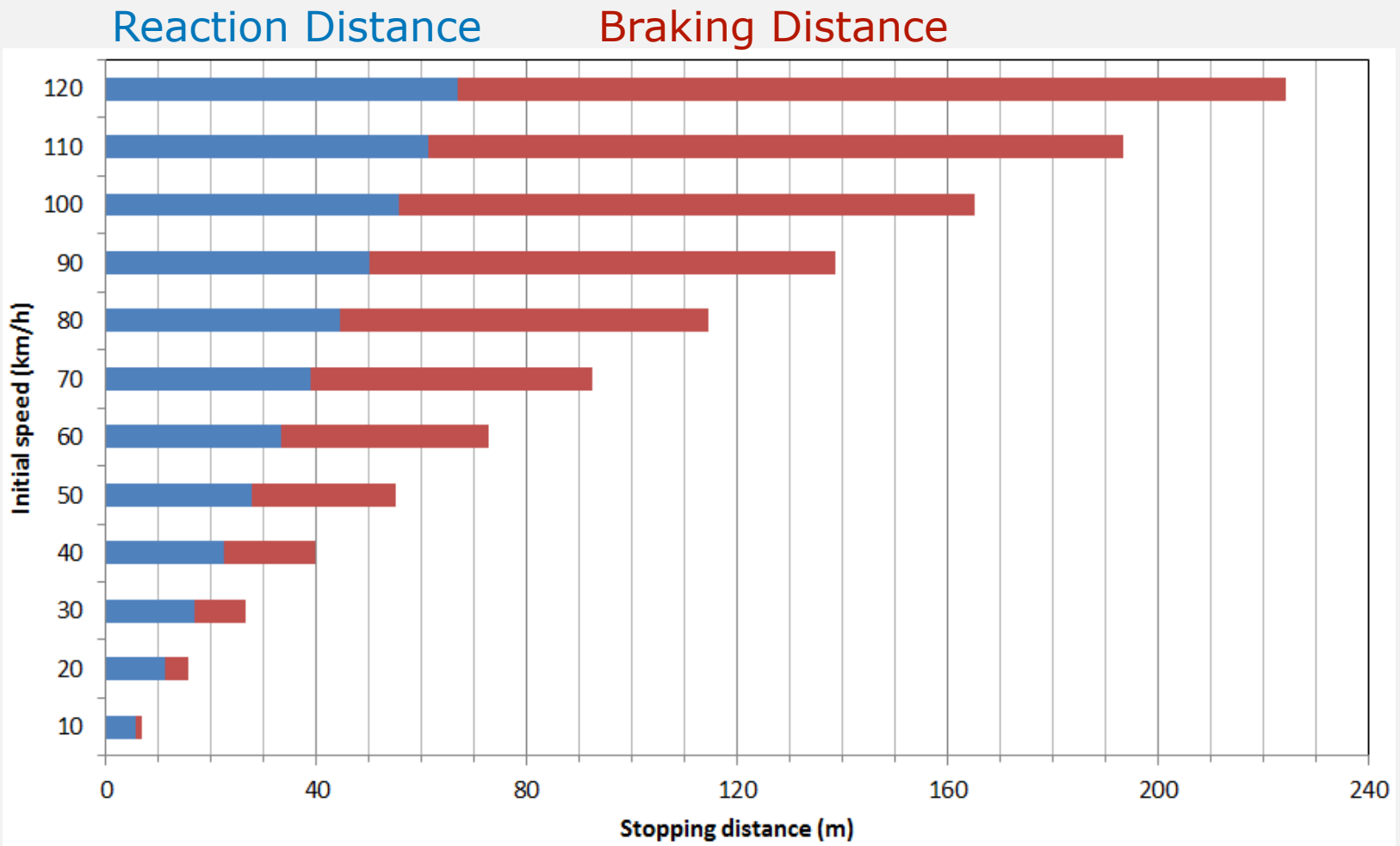
A still larger change in impact energy

↓

A very large change in probability of death and serious injury

Adapted from: Austroads AP-560-18 p.29

Stopping distance as a function of reaction time and braking on a wet sealed pavement surface



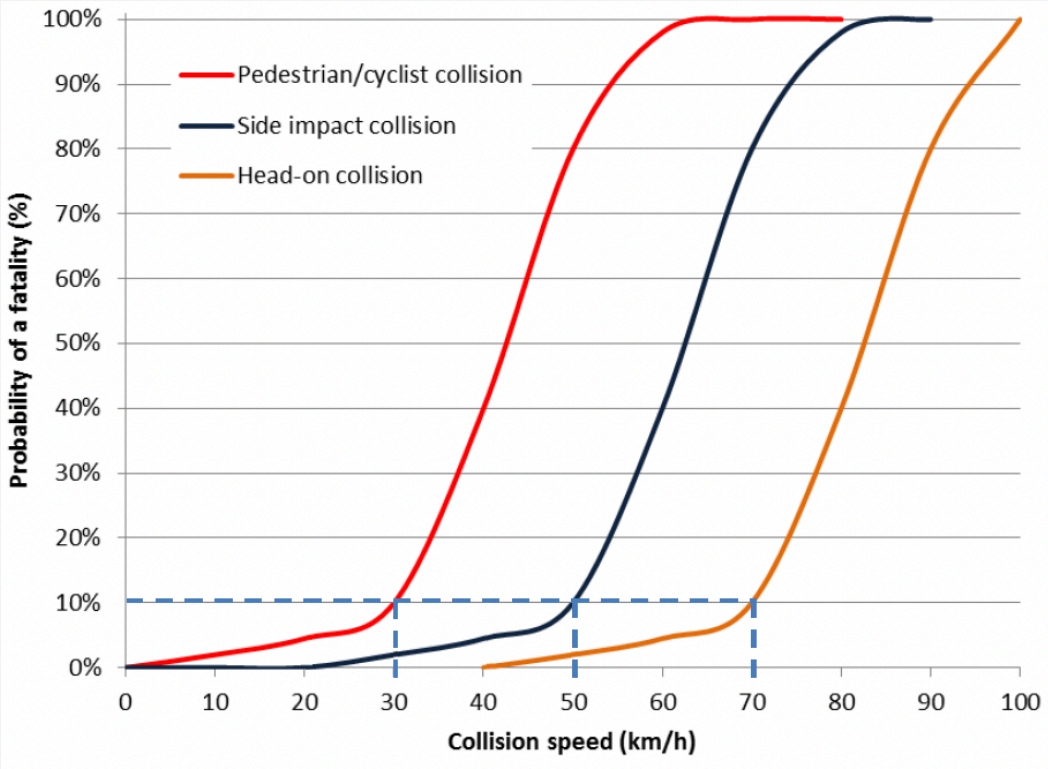
Source: Austroads AP-560-18 Figure 4.2: Stopping distance as a function of reaction time and braking on a wet sealed pavement surface

Wramborg Curves: Generally accepted threshold speeds

Relationships between collision speed and probability of a fatality for different crash configurations.

"According to these probability curves, there is a 10% chance of fatality outcome when vehicles impact at the following speeds:

- 30 km/h in pedestrian/cyclist crashes
- 50 km/h in side impact collisions
- 70 km/h in head-on collisions." (Jurewicz et al. 2015)



Source: Jurewicz, Sobhani et al. (2015) and based on Wramborg (2005)

While 30 km/h is higher than typical pedestrian or bicycle speed, most cyclists operate in speed environments well above 30 km/h, and pedestrians cross streets where that is the typical motor vehicle speed.

Safe System Speeds

Often referred to as the Safe System Speeds, the following aspirational operating speeds are as follows (ECMT, 2006):

30 km/h - Where there is the possibility of a collision between a vulnerable road user and a passenger vehicle

50 km/h - Where there is the possibility of a right angle collision between passenger vehicles

70 km/h - Where there is the possibility of a head on collision between passenger vehicles

≥100 km/h – where this is not possible side or frontal impact between vehicles or impacts with vulnerable road user impacts.

(Rural roads typically operated at 100 km/h. Limited access roadways (like freeways or motorways) typically operate at speeds higher than 100 km/h.)

Source: Antony zone10.jpg. (2020, June 16). *Wikimedia Commons, the free media repository*.

Source: Antony zone30.jpg. (2020, June 16). *Wikimedia Commons, the free media repository*.

Difference in deformation striking a solid object at 60 km/h and 100 km/h

Source: Austroads AP-560-18 Figure 4.5: Difference in deformation striking a solid object at 60 km/h and 100 km/h

Six different road environments all with a 100 km/h speed limit

Note: 100km/h is the default rural speed limit in most jurisdictions, and more often than not it won't be 'signed' as 100km/h.

Roads with a speed greater than 100km/h typically refer to freeways (motorways).

Source: Austroads AP-560-18 Figure 4.6: Six different road environments all with a 100 km/h speed limit

Eliciting desired speeds

Road Elements	Accelerators (intuitively elicit a high speed)	Decelerators (intuitively elicit a lower speed)	Ease of modification
Tangents *(Gentle (long) vs. torturous (short) curves.)*	Long	Short	very low
Physical speed limiters *(e.g. speed humps, chokers, other traffic calming devices)*	Not present	Present	**high**
Openness of the situation *(e.g. trees, buildings abutting roads vs. fields)*	Wide and open road surrounding	Narrow and closed road surrounding	medium
Road width	Wide	Narrow	medium
Road surface	Smooth	Rough	low

Based on Austroads AP-560-18 Table 3.1 Road Infrastructure elements and their influence on speed

Perceived vs. Actual Risk in terms of Energy Transfer

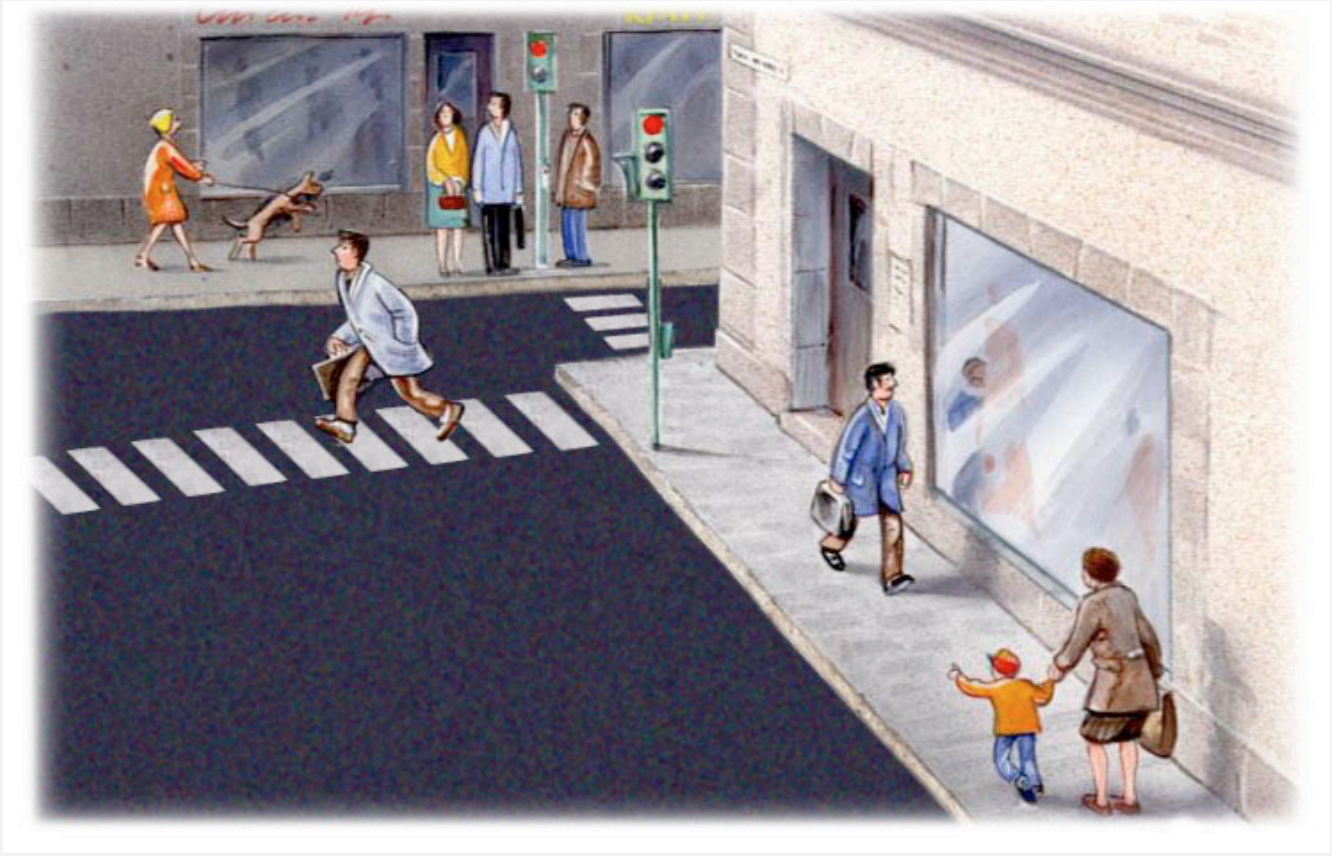
By: Karl Jilg. Source: Claes Tingvall, Swedish Roads Administration

By: Karl Jilg. Source: Claes Tingvall, Swedish Roads Administration

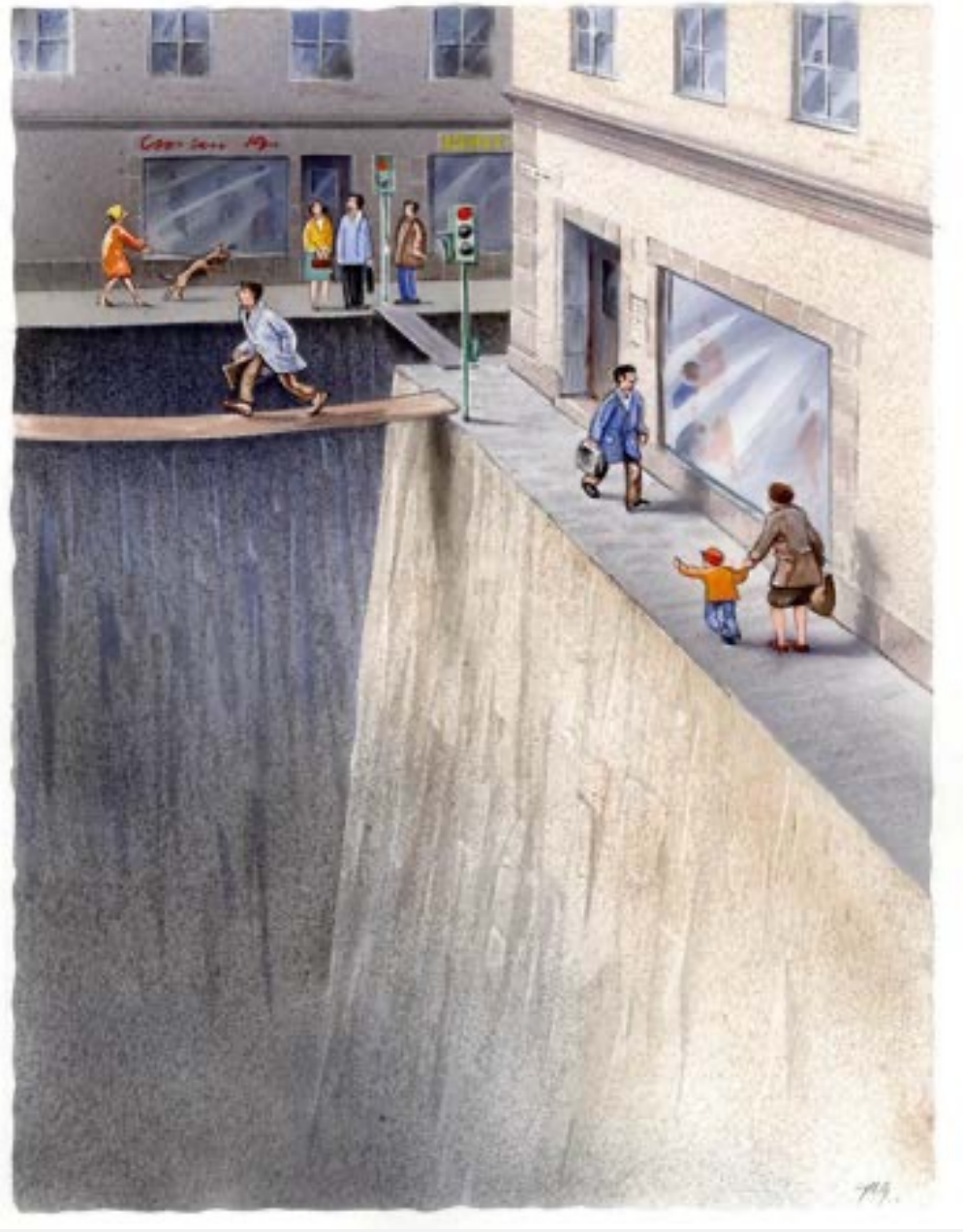
People understand the risk a high drop presents to them — falling off a cliff transfers a lot of energy from the earth to the person falling.

People often underestimate the risk a head on crash imposes.

Rethinking Design



By: Karl Jilg. Source: Claes Tingvall, Swedish Roads Administration



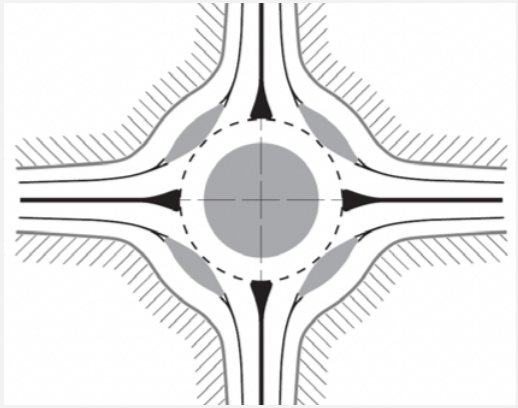
By: Karl Jilg. Source: Claes Tingvall, Swedish Roads Administration

Examples of innovative roundabout design

Roundabouts reduce approach speeds, reduce number of conflict points, and angle of approach.

Signalised Roundabout (UK)

Hamburger Roundabout (USA) Source: http://www.fhwa.dot.gov/publications/research/safety/09060/006. cfm



Flower Roundabout Concept (Slovenia). Source: Tollazzi, Renceli et al. 2011

Mini roundabout (UK). Source: https://www.reddit.com/r/CitiesSkylines/comments /30f5na/traffic_circle_vs_roundabout_and_why_cs_needs/

Turbo Roundabout (The Netherlands)

C Roundabout (NZ). Source: Asmus, Campbell et al. 2012

Roundabout Designs for Pedestrians and Bicyclists

Many roundabouts don't consider pedestrians or bicyclists as well as they could. Here are some alternatives.

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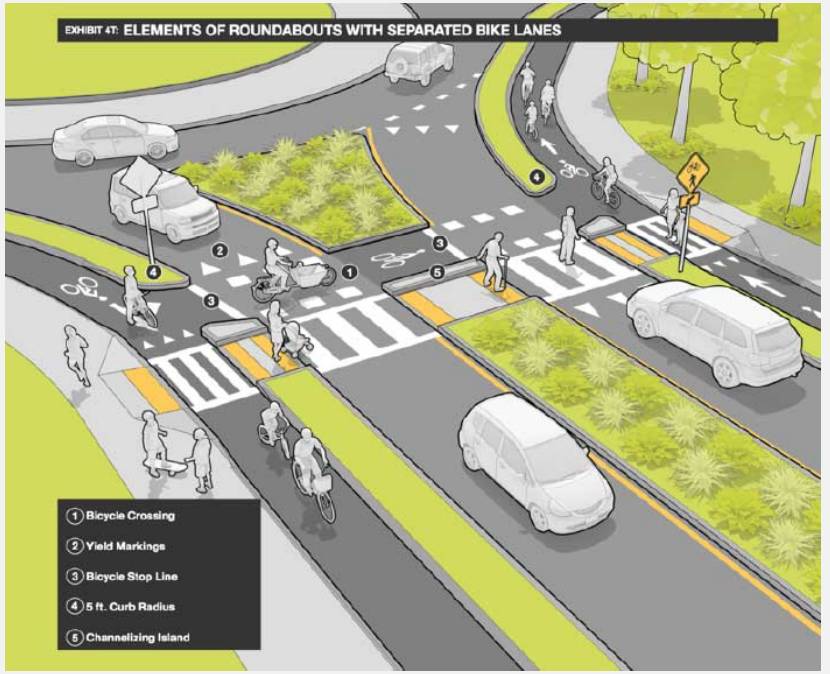
The Hovenring is an elevated bicycle path roundabout between Eindhoven and Veldhoven, Netherlands. Photo source: Huffington Post



Best-practice protected bikeway roundabout design. Source: Massachusetts Separated Bikeway Design Guide.

The Safe System Approach

Austroads

"The Safe System (otherwise known as Vision Zero, Towards Zero, or Sustainable Safety) views **human life and health as paramount to all else** and should be the **first and foremost consideration when designing a road network**."

http://www.towardszerofoundation.org/thesafesystem/

Conclusions: **Safe Speeds**, **Safe Roads**, **Safe Vehicles**, **Safe People**, and **Post-Crash Care**

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Humans are fallible

Humans are vulnerable

Road safety is a shared responsibility

This requires collaborative leadership *among the many actors involved.*

The road system must be safe and forgiving

Lower speeds reduce

- the likelihood of impact, mistakes are correctable (speed influences perception-reaction time)
- the consequences of impact

There are numerous strategies, policies, and physical designs to reduce speeds and do other things to achieve a safe transport system.

Questions

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Question 1

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Who is responsible for road safety?

- Drivers
- Bicyclists
- Engineers
- Law Enforcement

Answer 1

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Who is responsible for road safety?

- Drivers
- Bicyclists
- Engineers
- Law Enforcement

All of the Above and Others

Question 2

How many deaths per year are tolerable to save 1 minute of travel time for 50000 vehicles per day?

- 0
- 1
- 2
- 3

Answer 2

How many deaths per year are tolerable to save 1 minute of travel time for 50000 vehicles per day?

- 0
- ~~1~~
- ~~2~~
- ~~3~~

Question 3

Why is it important to keep speeds low?

Answer 3

Austroads

Why is it important to keep speeds low

Both because:

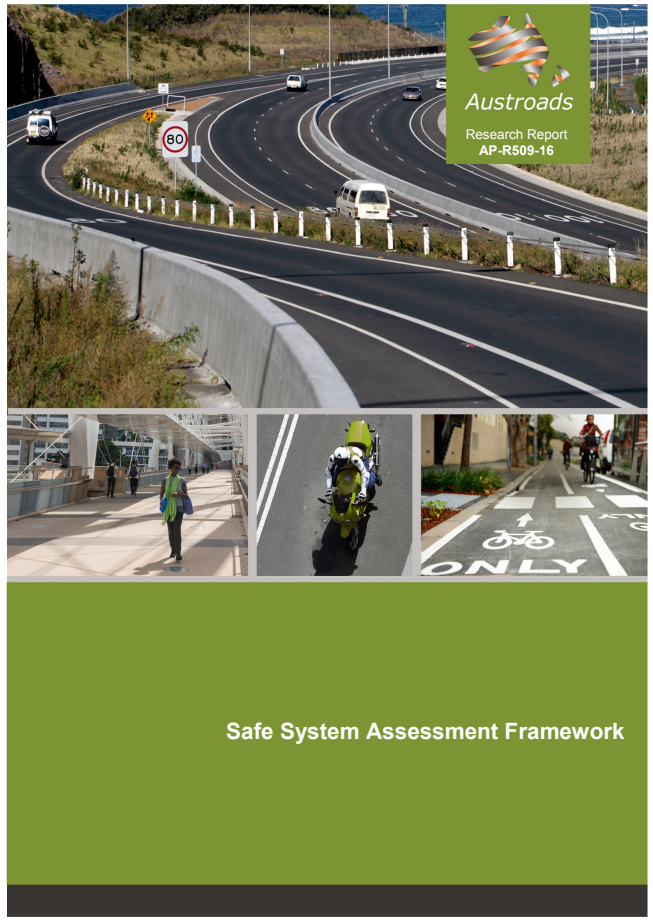
- It reduces the likelihood of a collision
- It reduces the consequences of a collision

Austroads report

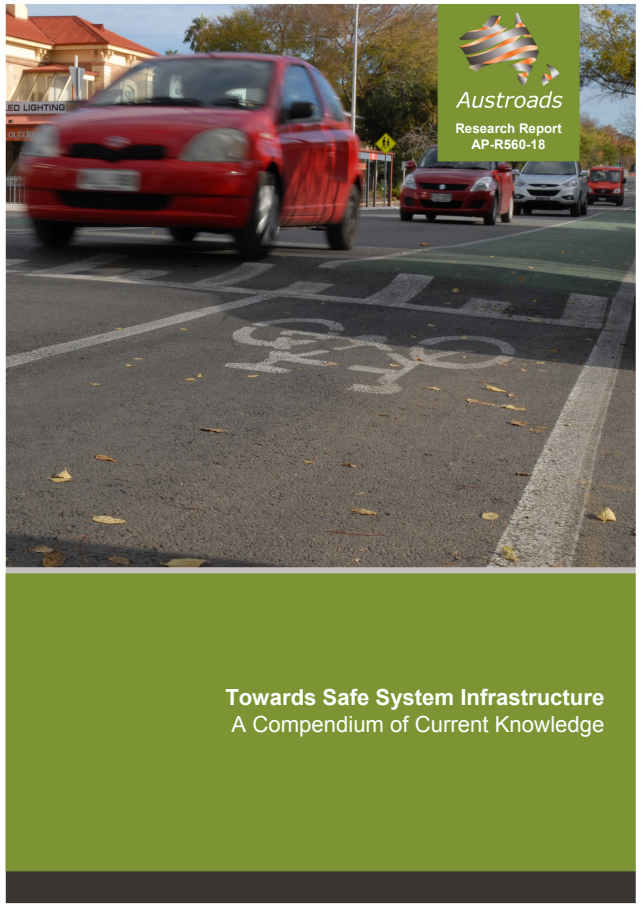
Some of the information from this presentation is conveyed in the Austroads Reports: Safe System Assessment Framework and Towards Safe System Infrastructure

These reports can be downloaded from Austroads Website:

https://austroads.com.au/



Austroads Research Report AP-R509-16
Safe System Assessment Framework



Austroads Research Report AP-R560-18
Towards Safe System Infrastructure: A Compendium of Current Knowledge

References

Jurewicz, C., Sobhani, A., Woolley, J., Dutschke, J., & Corben, B. (2016). Exploration of vehicle impact speed–injury severity relationships for application in safer road design. Transportation research procedia, 14, 4247-4256.