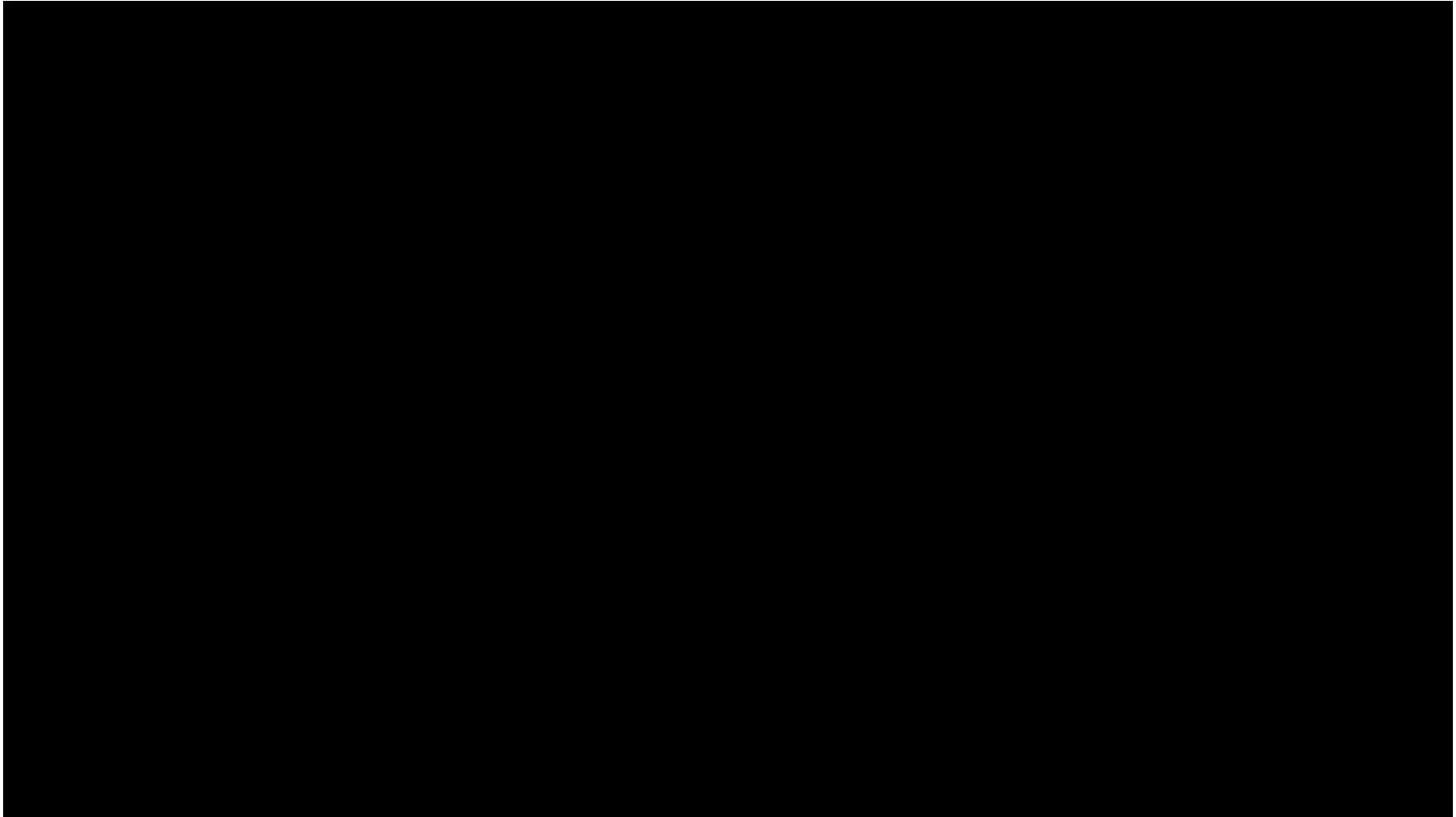# How to reduce road injuries through best-practice speed management : Learnings from Australia's experience

Associate Professor Jennie Oxley
Monash University Accident Research Centre
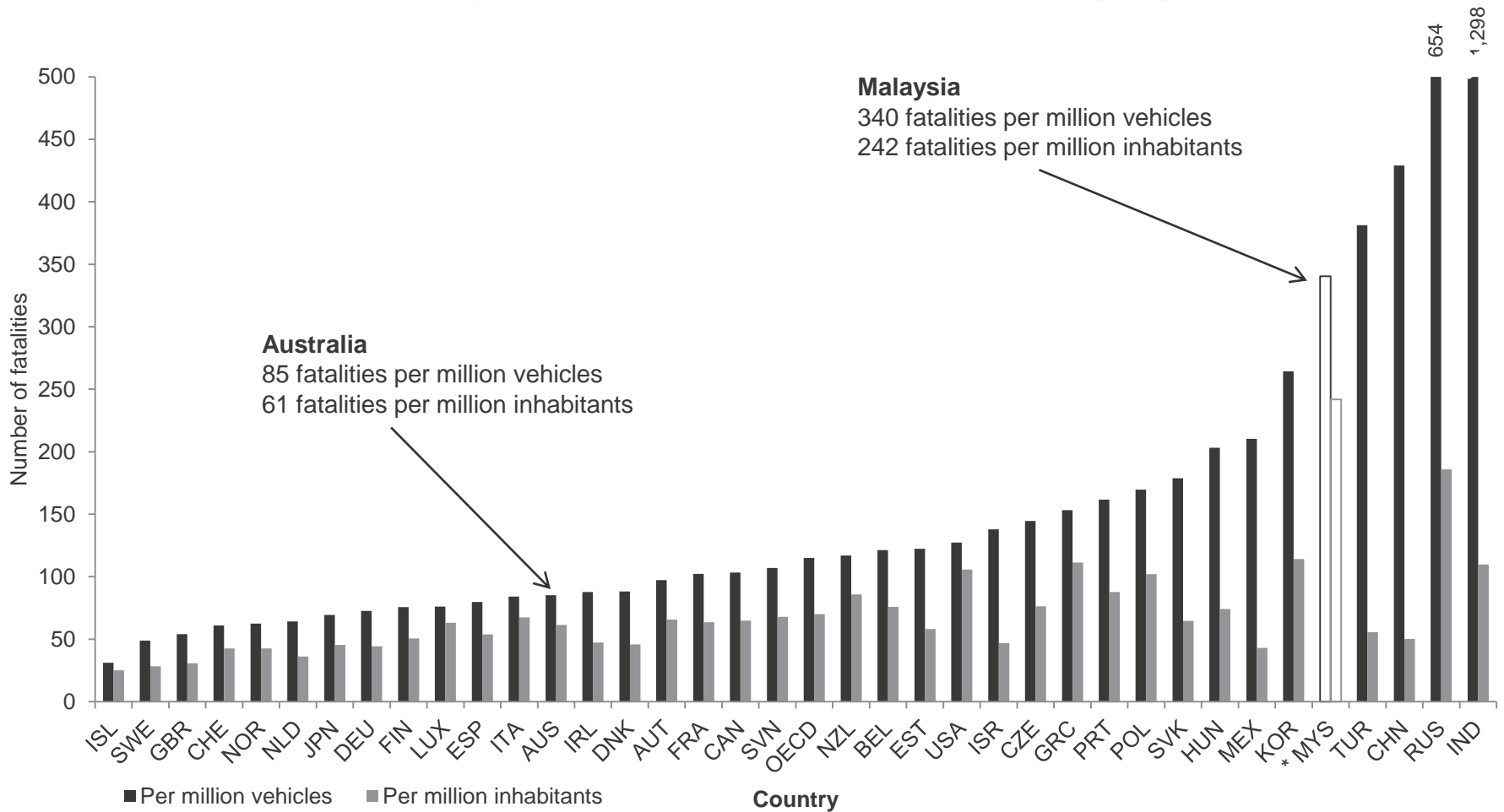
WRI Sao Paulo, 15th December, 2015

The Facts: worldwide

- Globally, over 1.27 million people die on the world's roads each year

- Up to 50 million people suffer serious injuries

- Over 90% of the world's fatalities on the road occur in low- and middle-income countries (with only 48% of the world's registered vehicles)

- Enormous economic, social, community and individual costs

  - Estimated USD518 billion per year

- In the last 12 months, 1,178 people lost their lives on Australia's roads

- Over 10,000 suffered a serious injury

- Road injuries affect us all, but mostly children and young adults, and older adults
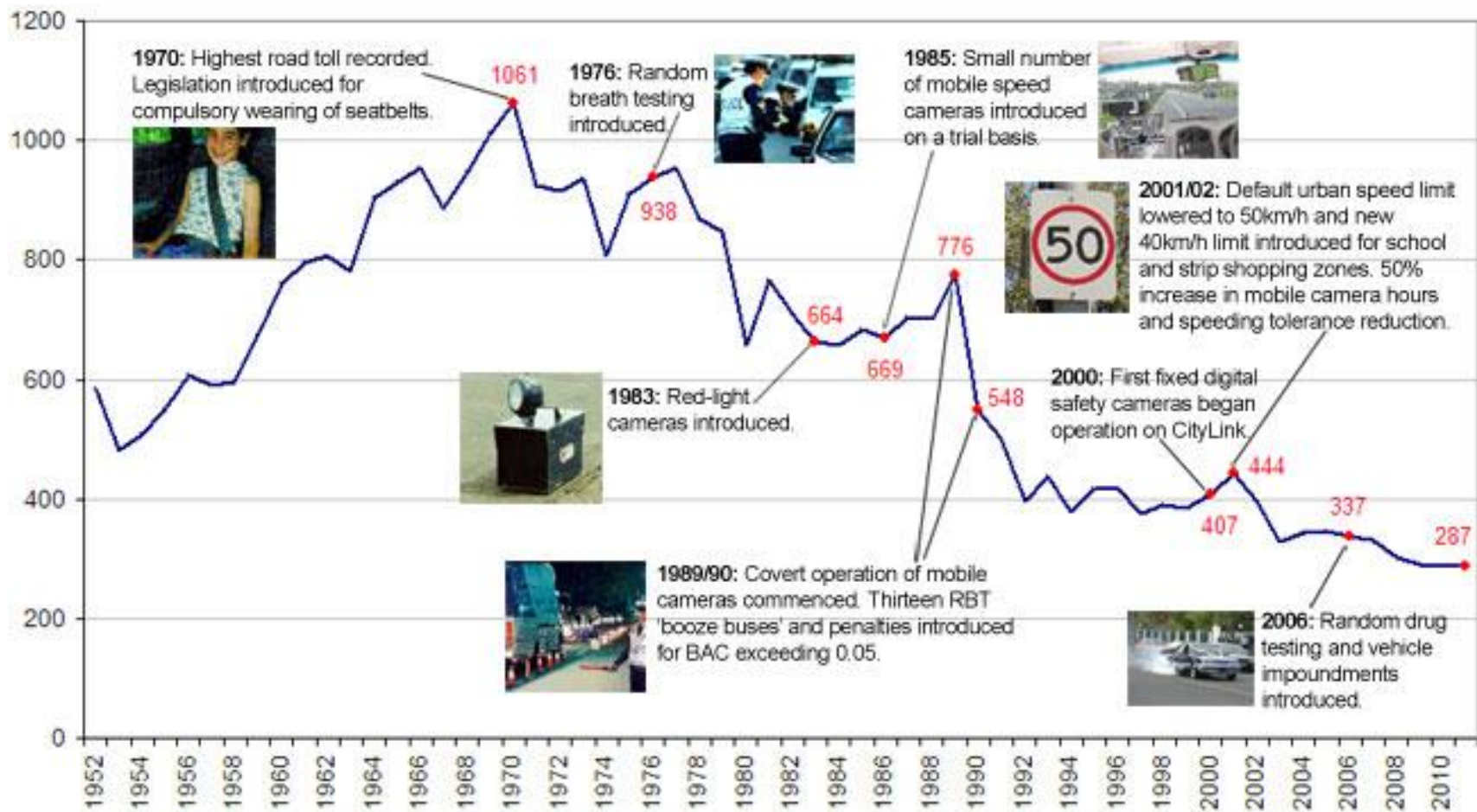
Road fatalities per million vehicles and population

Malaysia
340 fatalities per million vehicles
242 fatalities per million inhabitants

Australia
85 fatalities per million vehicles
61 fatalities per million inhabitants

Number of fatalities

■ Per million vehicles   ■ Per million inhabitants

Country

Sources: OECD Fact Book, 2013

* WHO Country Profile – Malaysia

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The Victorian Experience:

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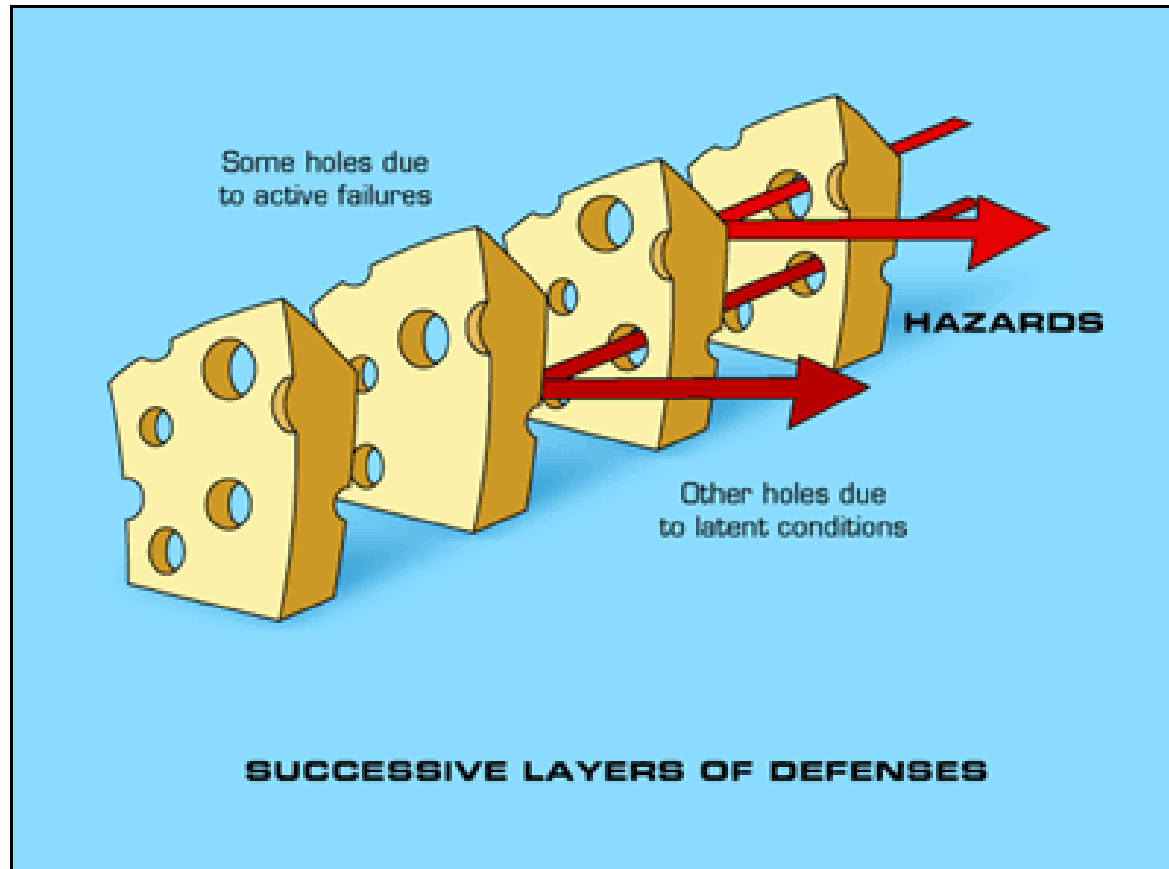
The 'Swiss Cheese' model of injuries
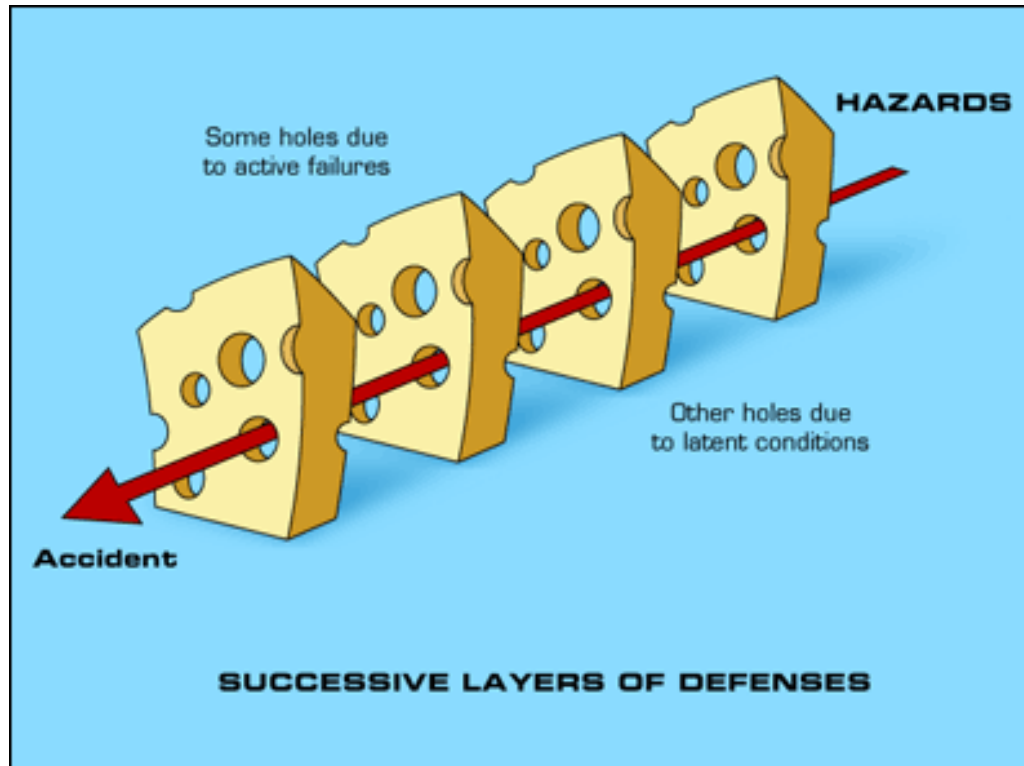
For a catastrophic error to occur, the holes need to align for each step in the process allowing all defenses to be defeated and resulting in an error. If the layers are set up with all the holes lined up, this is an inherently flawed system that will allow a problem at the beginning to progress all the way through to adversely affect the outcome.

Some holes due to active failures

Other holes due to latent conditions

HAZARDS

SUCCESSIVE LAYERS OF DEFENSES

Each slice of cheese is an opportunity to stop an error. The more defenses you put up, the better. Also the fewer the holes and the smaller the holes, the more likely you are to catch/stop errors that may occur.

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Safe System Approach

- Derived from Sweden's 'Vision Zero' and the Dutch 'Sustainable Safety' approaches

- Crashes will continue to occur in spite of best efforts to prevent them (human error)

- Aims to eliminate fatal crashes and reduce serious injury crashes

- Safety interventions based on the best available scientific evidence of what is effective

- A shared responsibility:

  – Road users responsible for complying with system rules

  – System designers and operators responsible for the road-transport system

Safe System Principles

- When crashes do occur, crash energies will reduce to levels that minimize the probability of death and serious injury

    - Provision of a safe, crashworthy system that is forgiving of human error and accommodates vulnerability to serious injury

    - Recognition that all aspects of the transport system work together

    - Manage the road infrastructure, speeds, vehicles and road users and the interactions between these components to achieve safe mobility

- Components of the "Safe System"

    - human (biomechanical tolerance)

    - vehicle (crashworthiness)

    - road infrastructure (crashworthiness)

    - safe speeds (kinetic energy)

Reducing Injuries: Safe System Approach

Source: Safer Journeys

Your risk of crashing

- The relationship between speed, and crash and injury risk is clear and powerful

- In a 60km/h zone, travelling at:

    - 65 km/h, you are *twice* as likely to have a serious crash than if you drive at 60 km/h
    - 70 km/h, *four* times
    - 75 km/h, *ten* times
    - 80 km/h, *32* times

Risk of crashing in a 60 km/h zone

Relative Risk vs Speed (km/h)
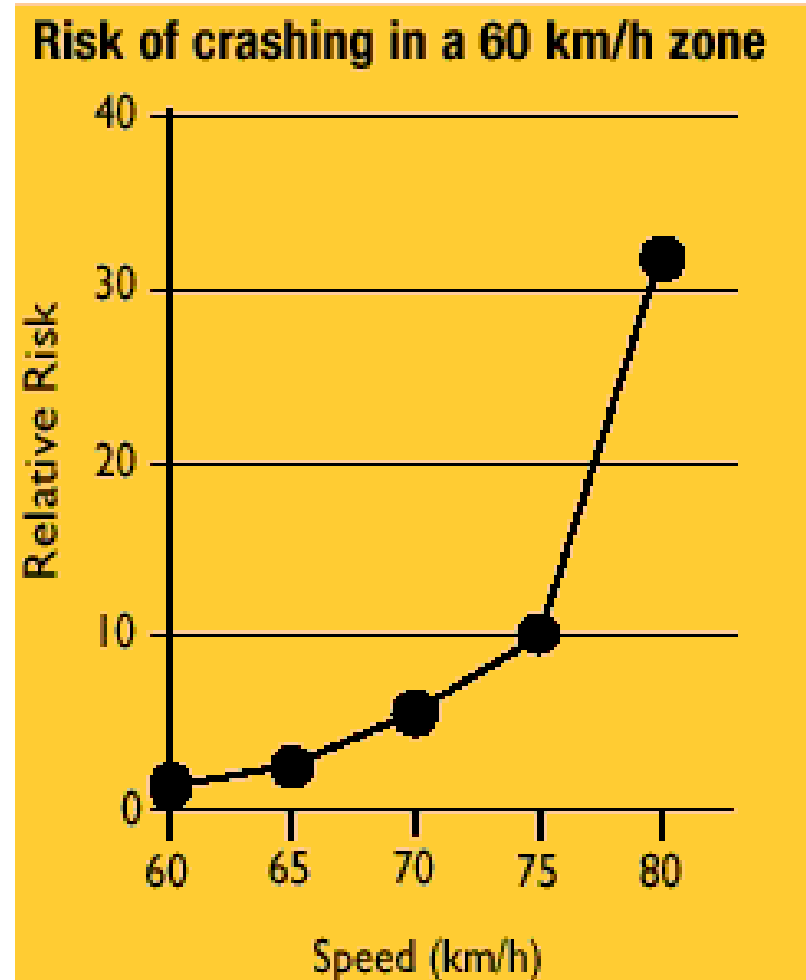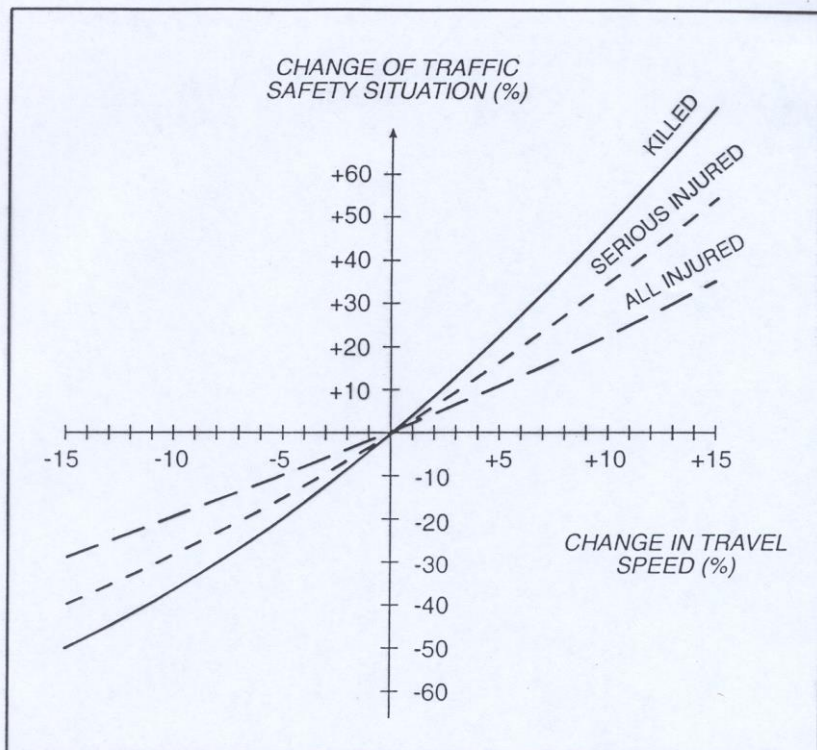
Your risk of injury

Figure 2.3 Effect of changes in the speed limit on the severity of outcome of crashes (from Nilsson).

- **The laws of physics**
  - The relationship between speed and injury risk is also clear
  - The higher the travel speed, the higher the impact,

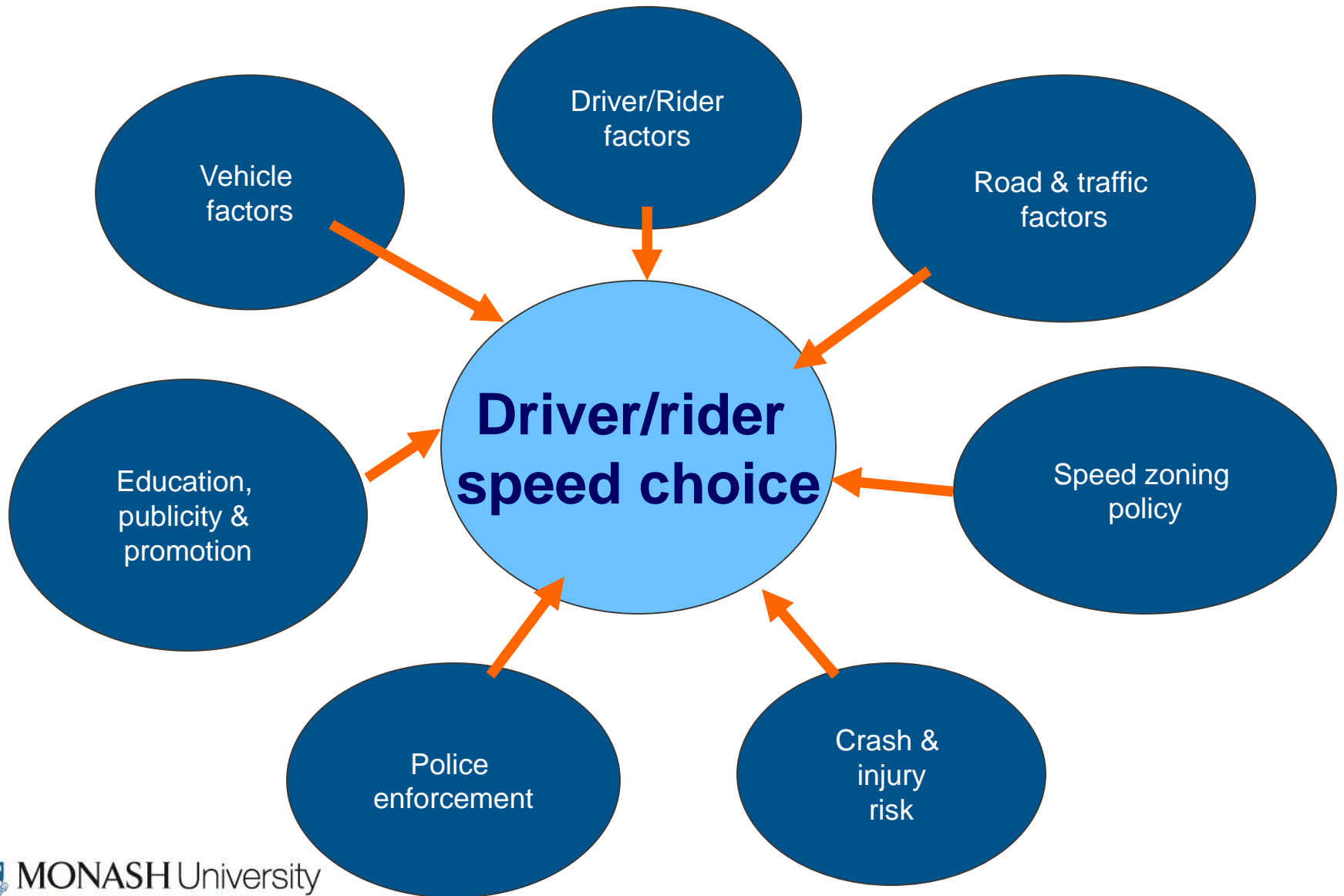# Risk of injury to vulnerable road users

- Vehicle speed is *the* crucial safety issue for pedestrians:

  - Speed is a powerful determinant of crash risk

  - Speed is an even more powerful determinant of injury severity in the event of a collision

- Pedestrians are only safe when vehicle speeds are low, in the order of 30 to 40 km/h
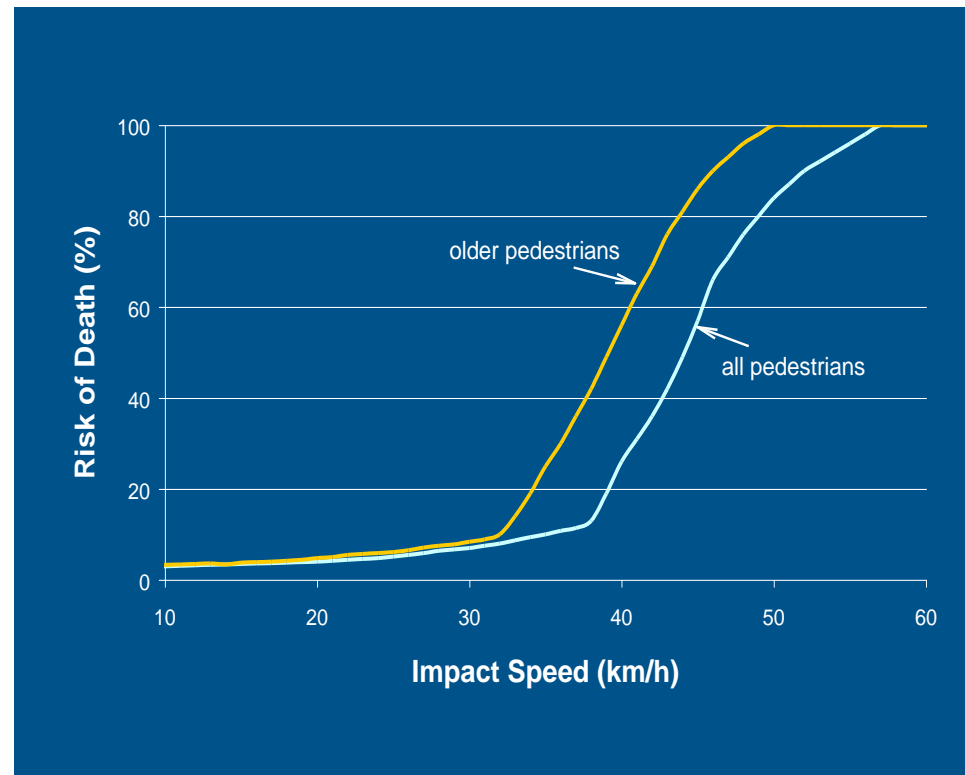
Speed Management

- Historically, the emphasis has been on mobility

    - that is, we strive for the highest mobility until safety is compromised "too much"

    - current speed limits and road design tend to favour high mobility often at the expense of safety

    - is this the balance we want?

- In general, Australian urban speed limits are 10 km/h higher than in other Western countries

    - However, speeds should be at levels that do not exceed human tolerance to violent forces

Driver/Rider factors

Vehicle factors

Road & traffic factors

Education, publicity & promotion

Driver/rider speed choice

Speed zoning policy

Police enforcement

Crash & injury risk

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Driver/Rider Factors

- Drivers and riders:

  - are human and, therefore, make errors

  - consistently over-estimate what is a "safe" speed (poor risk perception)

  - are influenced by perceptions about risks of being "caught"

  - are concerned more about crash than injury risk

  - drive faster due to others around them - thus, a contagious effect

  - young drivers with young passengers travel faster than when alone

  - *knowledge and attitudes* about speed only partly determine *behaviour* – other motives are often at play

Vehicle Factors

- Even the best vehicles cannot protect their occupants in many common crash types.

- "Safe" impact speeds generally fall below 30 to 50 km/h for:

    – side-impacts at intersections

    – collisions with trees and poles

    – pedestrians and other vulnerable road users

    – crashes between incompatible vehicle types

- Low short-term potential for raising the level of "safe" impact speeds through improvements in crashworthiness

- It is probable that drivers over-estimate the protective capabilities of their vehicles

Threshold impact speeds
(human tolerance to violence)

Vehicles cannot protect us in high-speed crashes

- Car/pedestrian   20-30 km/h

- Car/motorcyclist   20-30 km/h

- Car/tree or pole   30-40 km/h

- Car/car (side-impact)   50 km/h

- Car/car (head-on)   70 km/h

Road Factors

- Road features play a vital role in a driver/rider's speed choice:

  - Roadsides and the presence of trees, poles, etc.

  - Intersections, and their design and operational features

  - Alignment of roads and their design speeds

  - Road surface condition

- Traffic conditions (e.g., presence of other road users, general congestion or lack of congestion)

- "Road appearance":

  - Road width

  - Number of lanes

  - Roadside activity

    Divided/undivided

    Alignment (vertical and horizontal)

Speed limits

- Speed limits, arguably, have the single largest influence on driver/rider choice of speed.

- Studies consistently show that crash incidence or crash severity decline whenever speed limits have been reduced

    - After 50 km/h introduced in local streets in Victoria, pedestrian casualty crashes fell by 20% and pedestrian serious casualty crashes by 45%

    - Freeway speed limit reduced from 110km/h to 100km/h (Victoria, 1989) and resulted in a 19% drop in casualty crash rate on freeways

    - Negligible time savings by driving faster

# Opportunities to Achieve More Effective Speed Management

- Understanding driver/rider motivations and information used to choose a travel speed

- Address the key problems:

  - Inherent problems in traditional speed limit setting guidelines;

  - The mismatch between environmental cues and speed limits;

  - Community attitudes towards speeding and speed management (especially enforcement and 'revenue-raising').

- Review and strengthen speed management policies and practices, with a view to creating environments that promote safe behaviour rather than relying on drivers/riders to "decide" what is a safe speed

A more sharply focused speed setting strategy?

- Very low (30-40km/h) speed zones (for vulnerable road users)
  - Lower speed limits (variable) around school zones, strip shopping centres and residential areas
  - Higher priority given to VRU
- Low (50-60km/h) and medium (70-80km/h) speed zones (urban)
  - Reduce average speeds to match the inherent safety of the infrastructure
  - Brings impact speeds within vehicle occupant protection range
  - Minimal impact on travel time
- High (100-110km/h) speed zones (rural)
  - Unrealistic for vehicles to protect occupants in high speed impacts
  - Make the infrastructure inherently safe for high-speed travel
  - Negligible impact on travel time

How do we manage safer road users??

- Human factors contributes to almost all crashes

- Behavioural interventions can support other Safe System components in a range of ways

- Current priorities:

    - Licensing system (entry and exit, loss of licence)

    - Behaviour change:
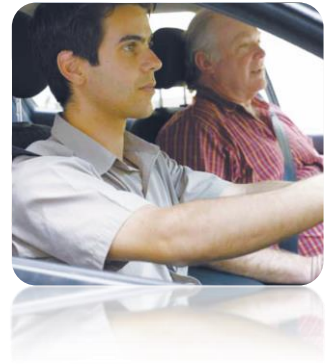
        - Mass media campaigns and educational approaches (awareness)

        - Education and Training programs (skills training, relevant to road user group)

        - Laws and sanctions

        - Enforcement strategies (particularly addressing illegal behaviours and repeat offenders)

Education: Mass media campaigns

– Public awareness of speed as an issue (encompassing a range of health, social and community issues, not only transport)

– Promotion of the benefits of driving at a 'safe' speed

– Understanding of the limits of vehicles in protecting occupants

– Raise perception of 'being caught' and high fines

– Reduce arguments of speed camera 'revenue raising'
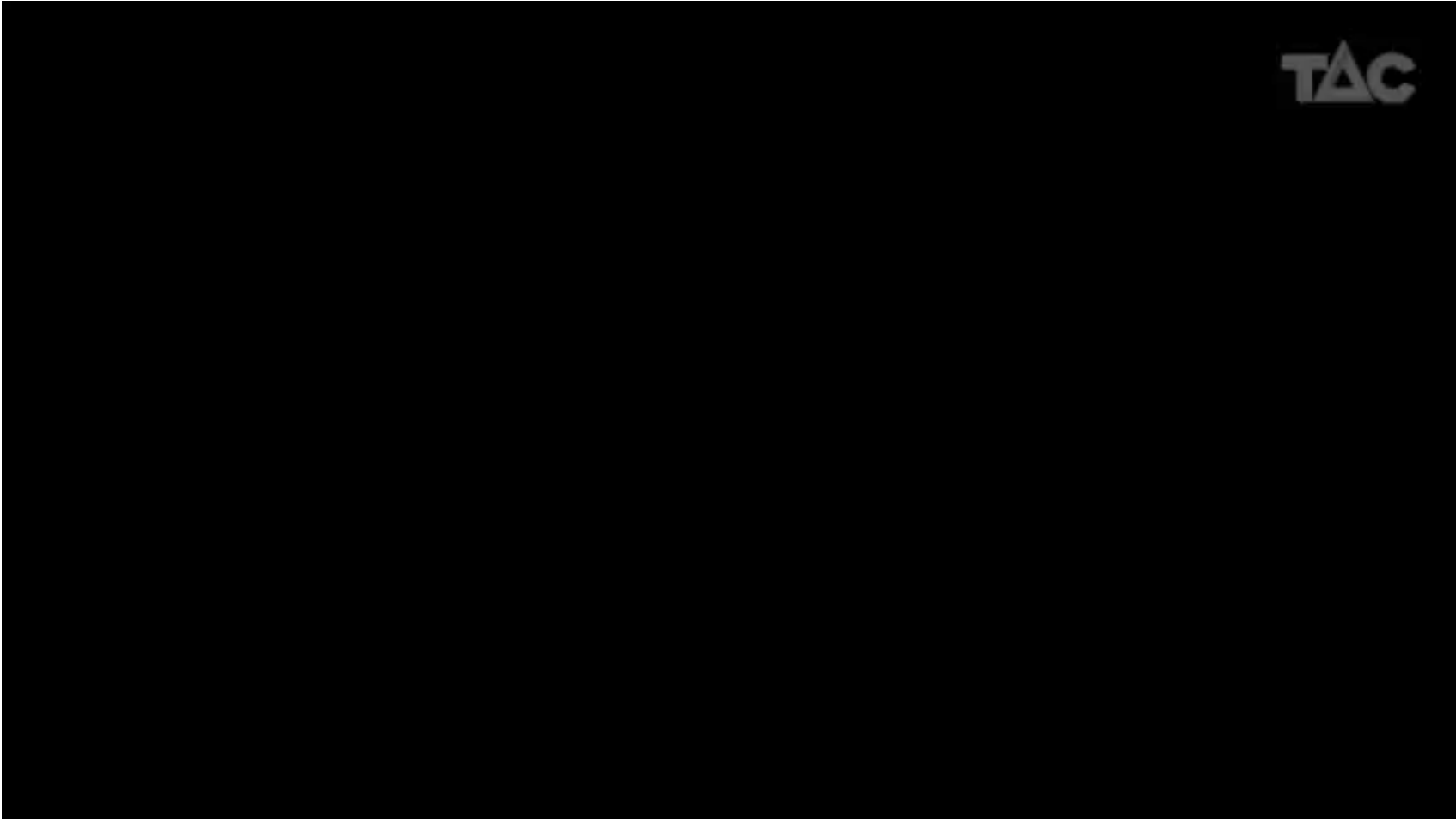
Speed Enforcement

- The effectiveness of speed limits is enhanced with increased speed enforcement

- A tougher enforcement strategy introduced:

    – Multiple methods and diverse equipment (cameras, lazers, radar, moving mode, point to point)

    – High intensity random deployment (effective for area-wide speed reduction)

    – Highly visible, sustained and widespread operations

    – Lower tolerance levels

Road Factors

- Can the appearance of the road be used to enhance safer driver/rider speed choice?

- YES!!!!

- We can create an environment that encourages drivers to travel slower

  - Appropriate speed limits (most powerful source of information), including variable speed limits at high risk locations

  - Create a physical road environment that gives message that fast speed over the limit is inappropriate

  - At locations where risk is increased (e.g., interchanges and saddles), traffic calming and perceptual countermeasures can be implemented

    - For example: chicanes, rumble strips, alternative road surfacing, real time travel speed information

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Vehicle speed reduction

- Physical measures can be introduced to support lower speed limits

  – Low cost
  – Convey the message to drivers that high speed is not appropriate

– Roundabouts

– Pavement narrowing

– Carriageway re-alignment

– Medians and refuge islands

– Alterations to the road surface

– Speed humps

– Raised intersections and crosswalks

– Gateway treatments

– Vehicle-restricted zones

What works and doesn't work?

- What doesn't work:

    - Traditional view of speed limit setting

    - Reliance on humans to choose safe speeds

    - Reliance of vehicles to protect occupants

- What DOES work:

    - When road design is low, advocating for reduced speed limits, appropriate for the environment

    - Support lower speed limits with infrastructure

    - Reduce the mismatch between speed limits and the road environment

    - Educate and empower people about speed and speeding

    - Supporting enforcement activities

Key take home messages

- Human factors should be considered when setting speed limits
  - We should not rely on humans to make safe speed choices
  - Implications for the use of 85th percentile measures in speed limit setting guidelines
- Address the mismatch between speed limit and the road environment
  - Speed limits need to be credible and matched to the environment
- Speed management strategies should have the aim of creating environments that promote safe behaviour: Enhanced by:
  - Matching limits and road environment
  - Effective enforcement
  - Mass media campaigns (awareness of risks, understanding the limits of occupant protection, understanding the benefits of reduced speed, especially where vehicles and VRU mix).

The Challenge Ahead

- We need commitment to be innovative and proactive, not reactive

- We need an integrated approach and make fundamental changes, not incremental changes

- Initiatives must be evidence and research based and address all elements and relationships within a Safe System approach

- PARTNERSHIPS!! We all have responsibilities and need to work together, including broader government, industry, advocacy and education sectors

- We cannot afford to be complacent! Deaths on the road are unacceptable and ZERO deaths should be the goal

Thank You

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