

...some high school physics



$$E_k = \frac{1}{2} m v^2$$

High impact speed leads to greater kinetic energy transfer to human body and high severity of injury

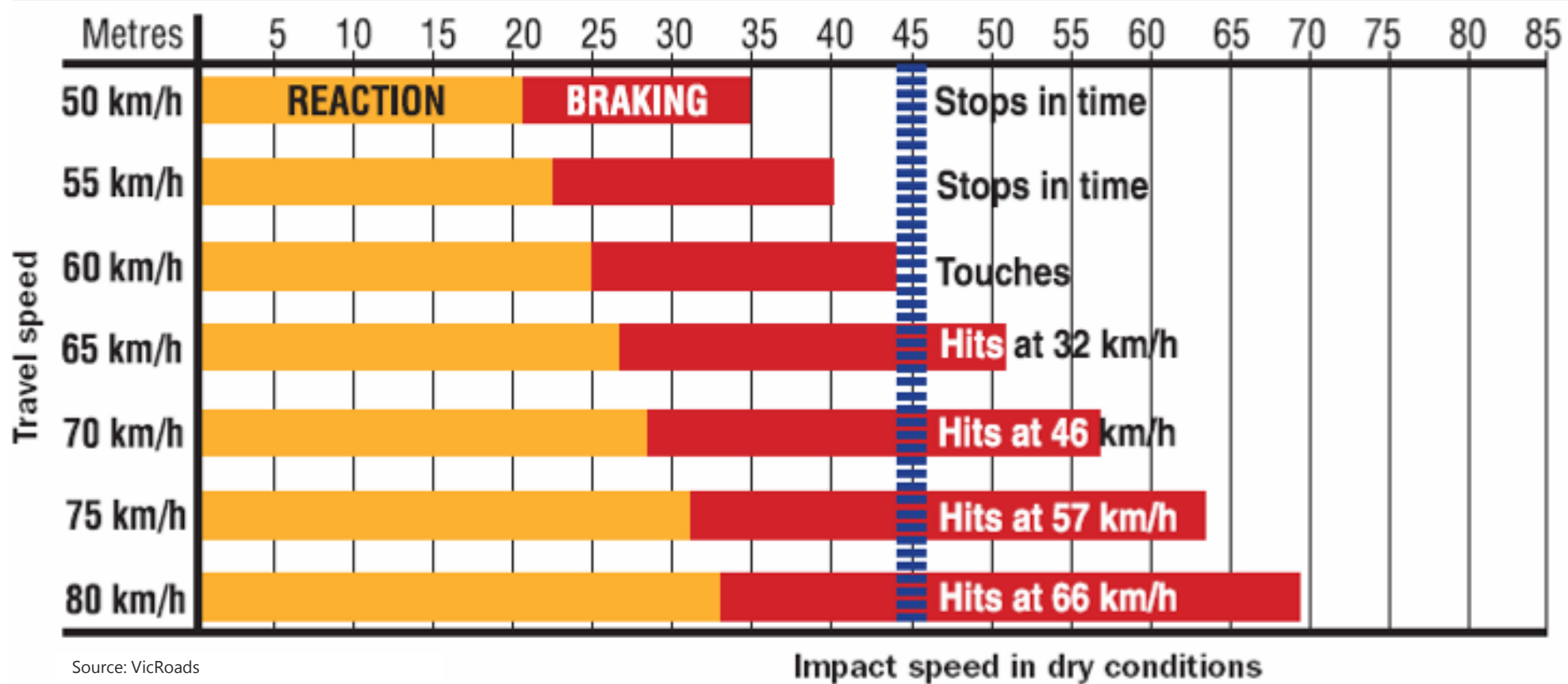
(...the faster they go, the harder they crash)

The difference



Source: RTA (2008)

Travel speed, stopping distance and crash impact speed



Other stopping distance factors



Driver

- Attention
- Fatigue
- Vision
- Impairment
- Driver age & experience
- Hazard perception ability



Vehicle

- Vehicle age
- Type & condition of brakes
- Type & condition of tyres
- Safety features of vehicle
- Vehicle weight



Environmental

- Road surface
- Road gradient
- Road alignment
- Weather conditions (wet/dry)

Effect of speed on vision

Tunnel vision:



16-24km/h



32-48km/h



48-64km/h

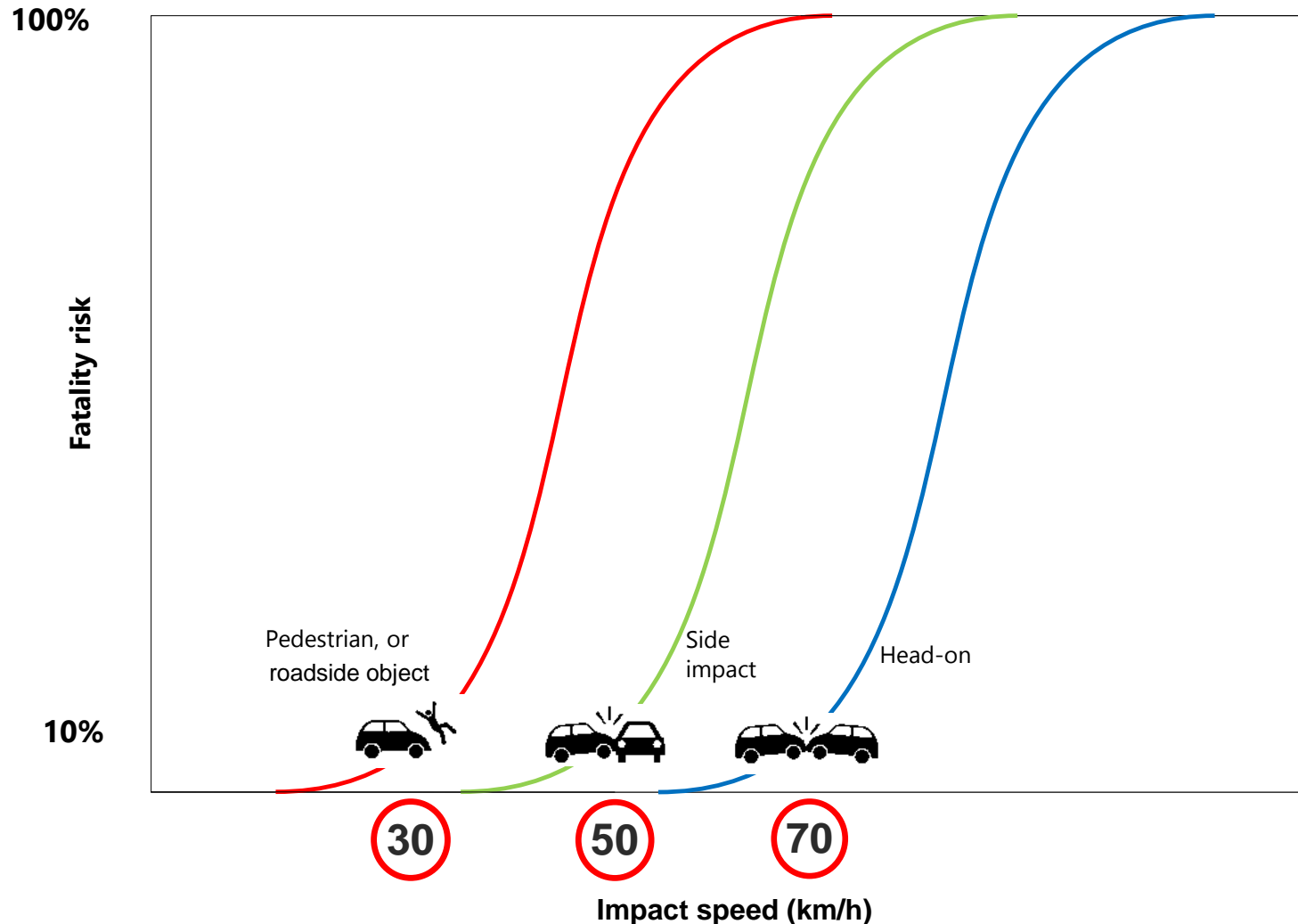


72km/h

Source: NRSPP, ARRB Group

- As speed increases, peripheral vision decreases
- Less likely to notice and react to risks (e.g. side road traffic)

Fatality – critical impact speeds



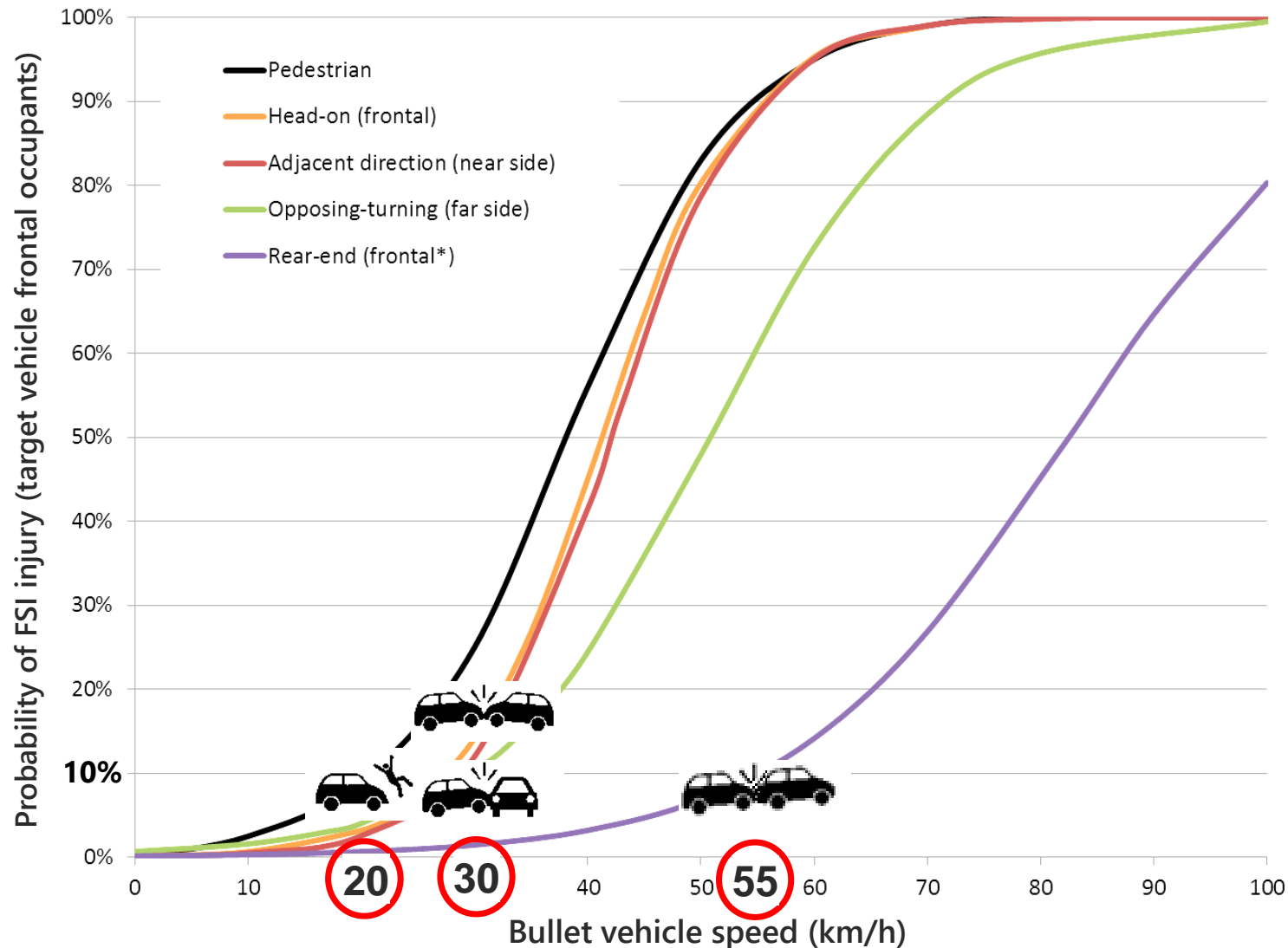
The Swedish 'Safe System speeds' (Wramborg 2005):

Estimated 10% fatality risk at:

- ≤ 30 km/h in pedestrian/cyclist crashes
- ≤ 50 km/h in side impact collisions
- ≤ 70 km/h in head-on collisions.

**Best evidence available in the early 2000s
Many uncertainties about sources.**

Fatal & serious injury – critical impact speeds



New research evidence:

Crash type	FSI-critical impact speeds (Bullet vehicle)
Pedestrian-vehicle	20 km/h
Head-on	30 km/h
Adjacent direction	30 km/h
Opposing-turning	30 km/h*
Rear-end	55 km/h

Assumes equal vehicle masses. Will be lower if the bullet vehicle is heavier.

* May vary depending on the impact angle and the turning vehicle speed.

Source: Jurewicz et al. (2016) based on Bahouth et al. (2014), Davis (2001)

Effect of vehicle mass

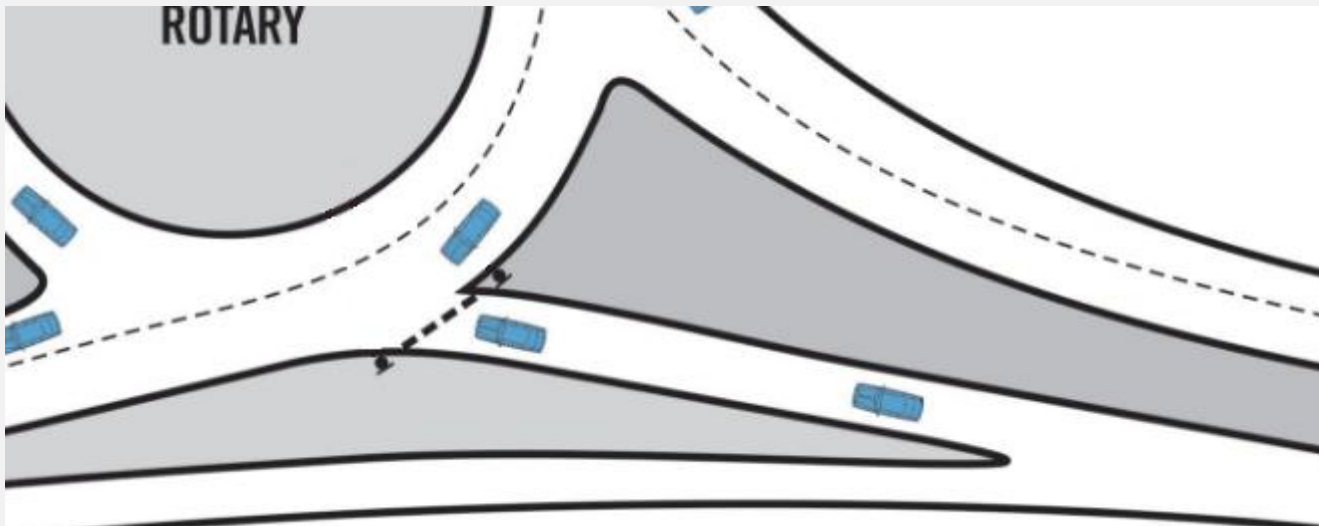
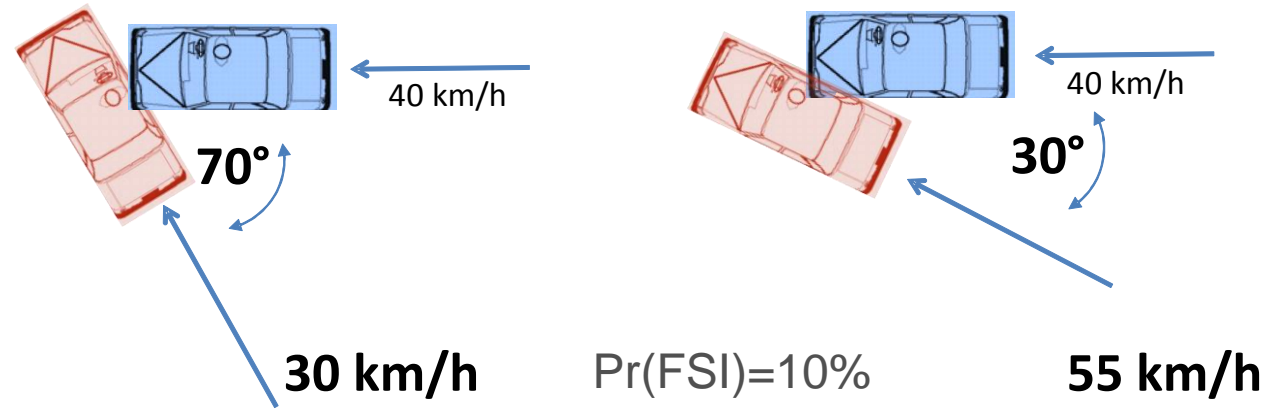
- Heavier vehicle 'wins' in a collision, less deceleration



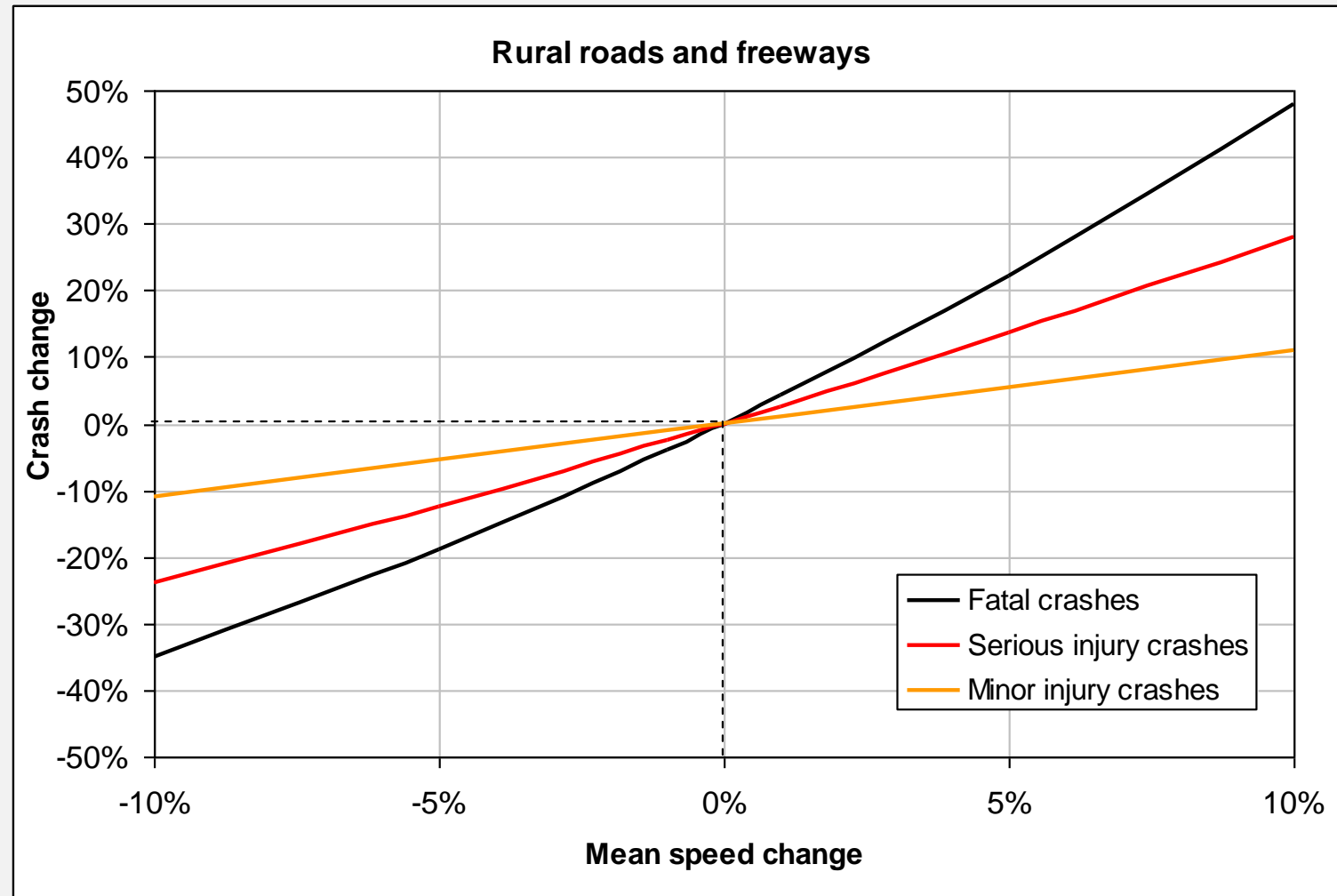
- Lighter vehicle, higher deceleration, higher probability of FSI
 - Truck vs. passenger vehicle
 - Passenger vehicle vs. Cyclist
- There may not be a 'safe speed' for collisions with HVs
- Possible reason why HV crashes are over-represented in FSI statistics

Effect of crash angle

- Intersection and vehicle-vehicle crashes
- Lower deceleration at lower angle
- Lower severity
- One of the reasons why roundabouts are so much safer

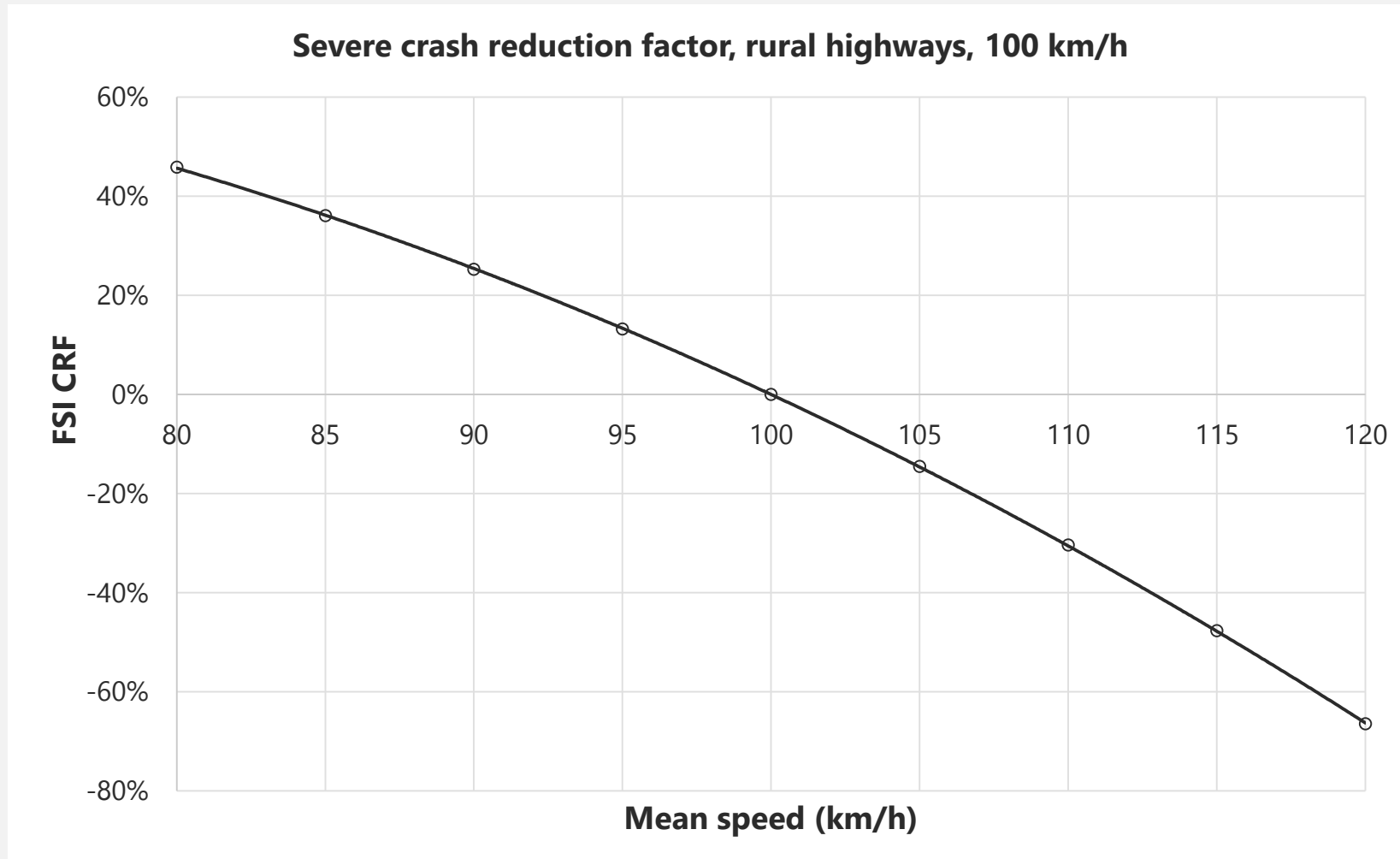


Effect of speed on number of crashes



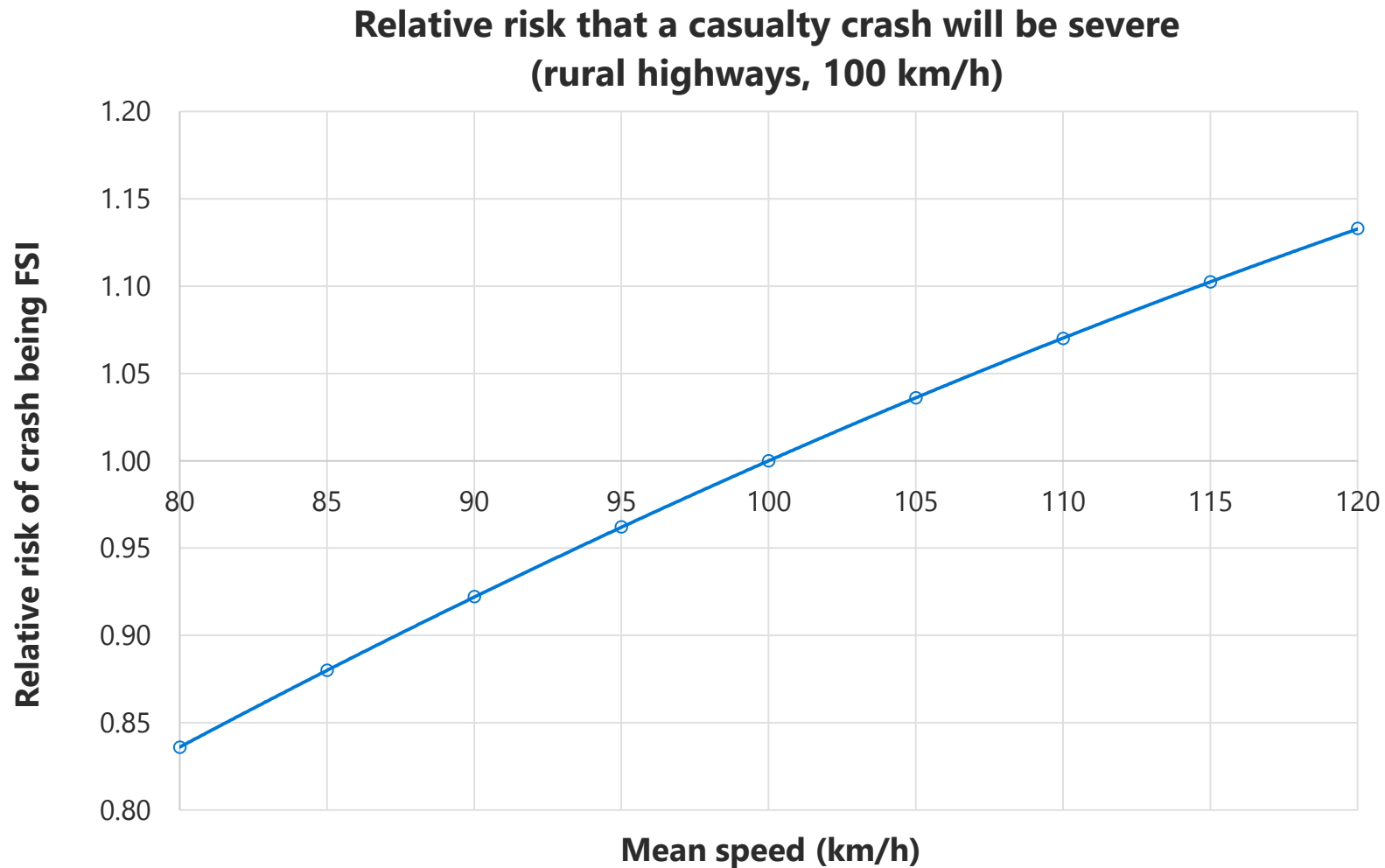
Source: Based on Elvik (2009)

Effect of speed on number of crashes



Source: Based on Elvik (2009), based on the average of ratio of F:SI:MI for the Victorian rural highways.

Effect of speed on severity of crashes



Source: Based on Elvik (2009), based on the average of ratio of F:SI:MI for the Victorian rural highways with 100 km/h speed limit.

What does it mean?

- Principle: reduce energy transfer to road users involved in a crash.
- Reduce traffic speeds where impacts are likely, or even possible.
- Minimise impact speeds using established and innovative methods:
 - Intersections e.g. using roundabouts, raised pavements, rumble strips
 - Pedestrian crossings, e.g. raised pavements
 - Next to cyclists
 - Next to roadside hazards, or on curves, e.g. lower speed limits.
- Minimise angle of impact in vehicle-vehicle crashes.

Thank you