Strandroth Inc.

Road Safety Advice, Research and Strategy

Applying crash data chain-of-events analysis

Dr Johan Strandroth

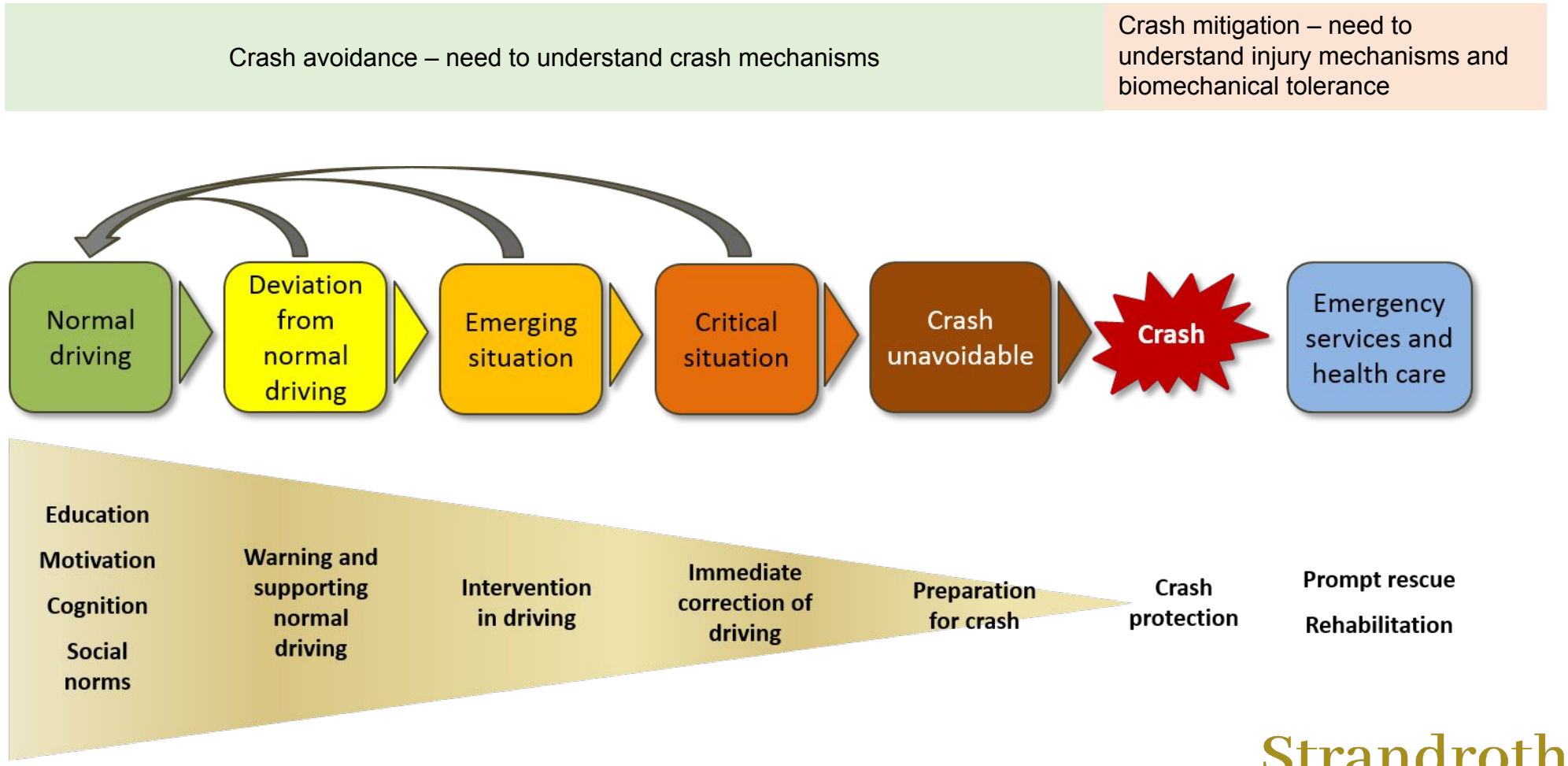
johan@strandroth.com

www.strandroth.com

Content

- Applying chain-of-events analysis
- Counterfactual analysis to guide interventions
- Strategic response scenarios to achieve ambitious targets

The integrated safety chain-of-events



Rizzi M. (2016) Towards a Safe System Approach to Prevent Health Loss among Motorcyclists - The Importance of Motorcycle Stability as a Condition for Integrated Safety

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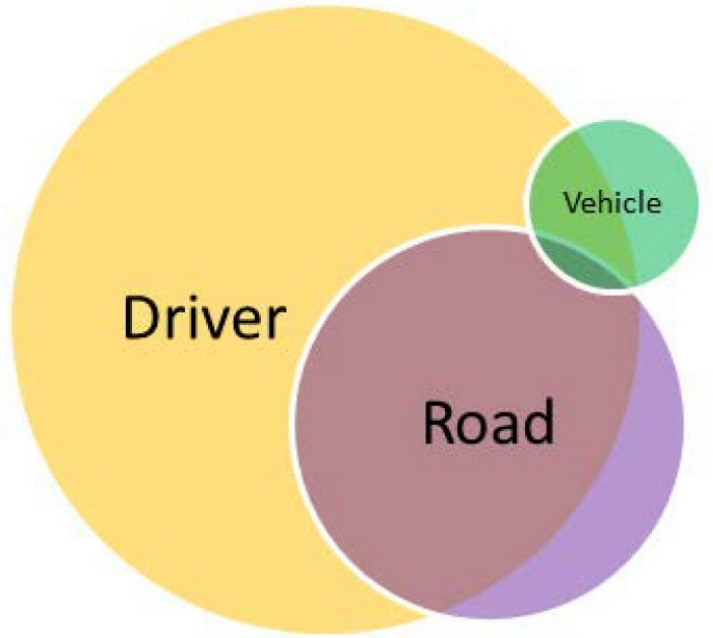
Why are people killed in road transport?

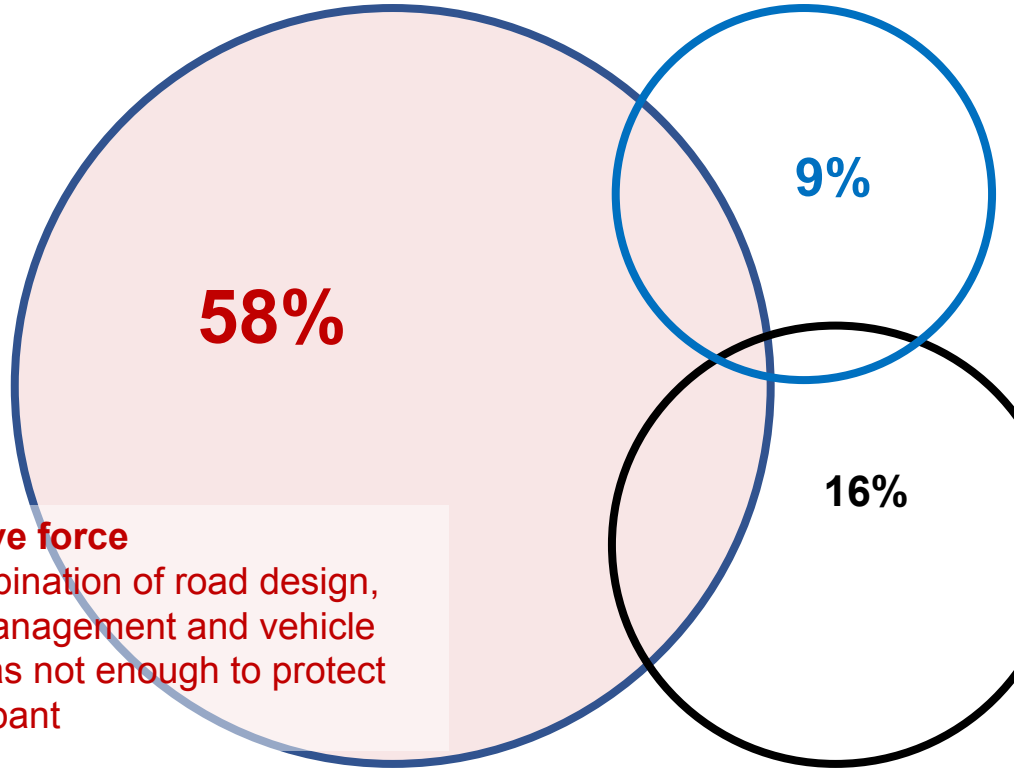
Classification of all fatal crashes in Sweden 2016-2018 (n = 840)

Traditional



Adapted from Kimber (2003)

Safe System



Excessive force
The combination of road design, speed management and vehicle safety was not enough to protect the occupant

Outside System Boundaries
Extreme violations with crucial impact on crash severity

Excessive risk
Lack of protective equipment in cases where it would have changed the injury outcome

Source: Swedish Transport Administration

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Safe System boundary conditions

Severe and fatal injuries

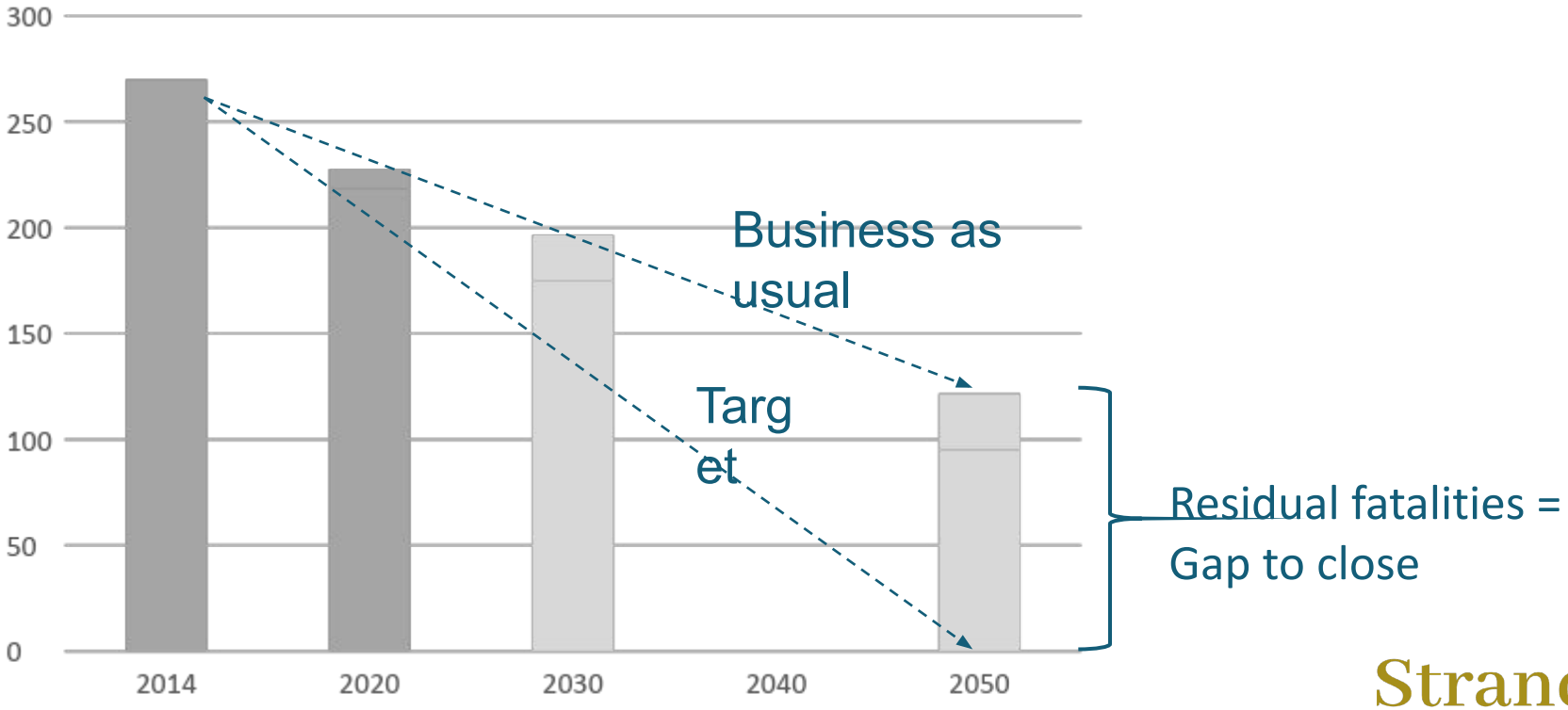
Crash Type		Impact speed
	head on	50 km/h
	side-impact	50 km/h
	side impact with tree	30 km/h
	pedestrian	20 km/h

What analytical tools can guide us on how to get there from where we are now?

Source: Transport Accident Commission (TAC), Victoria, Australia

Baseline analysis

Where do we want to be?
Where are we going in a business as usual scenario?
And where do we start?



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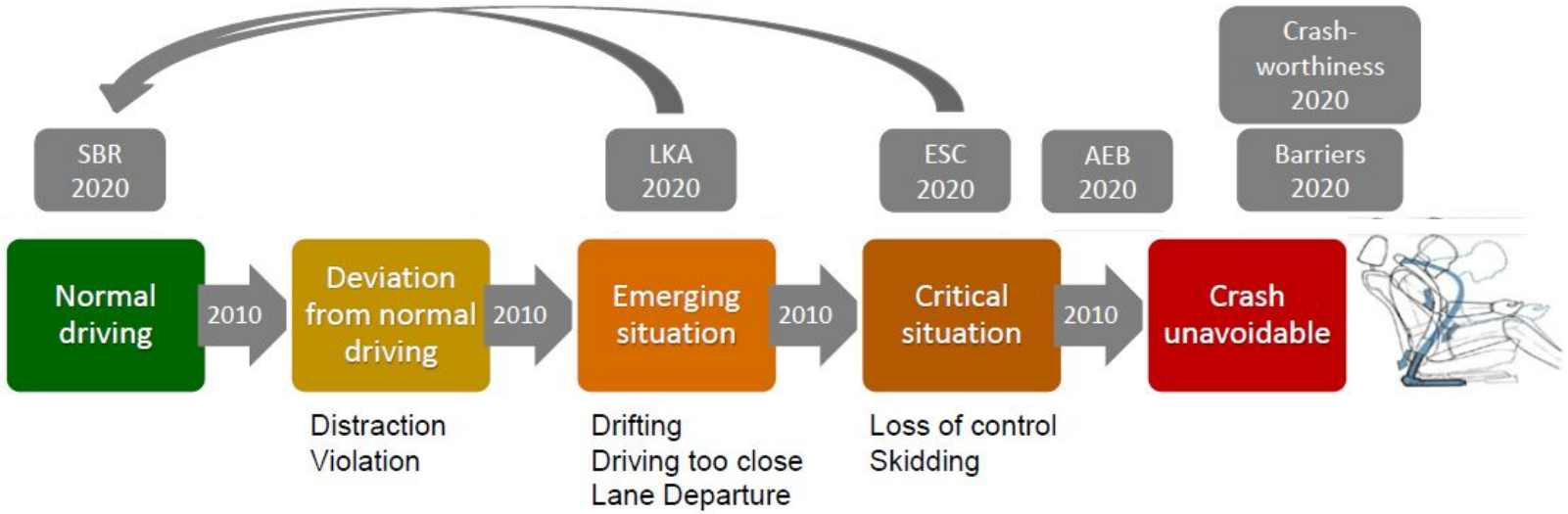
Chain of event analysis



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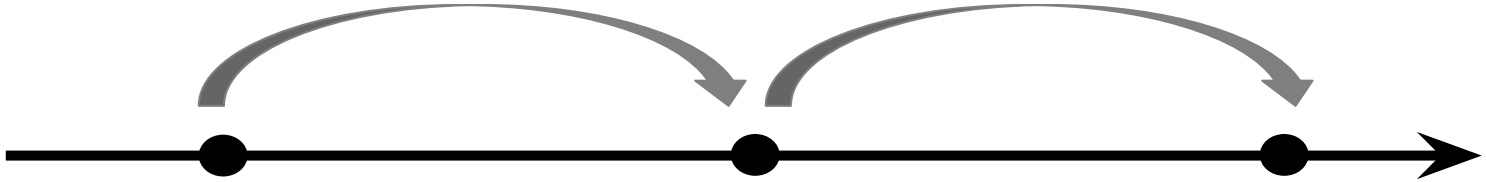
Chain-of-event analysis



Year 2020
Car involved in crash
MY 2005

Year 2030
Car involved in crash
MY 2015

ESC
SBR

Year 2040
Car involved in crash
MY 2025

ESC
SBR
AEB
LKA
Driver monitoring

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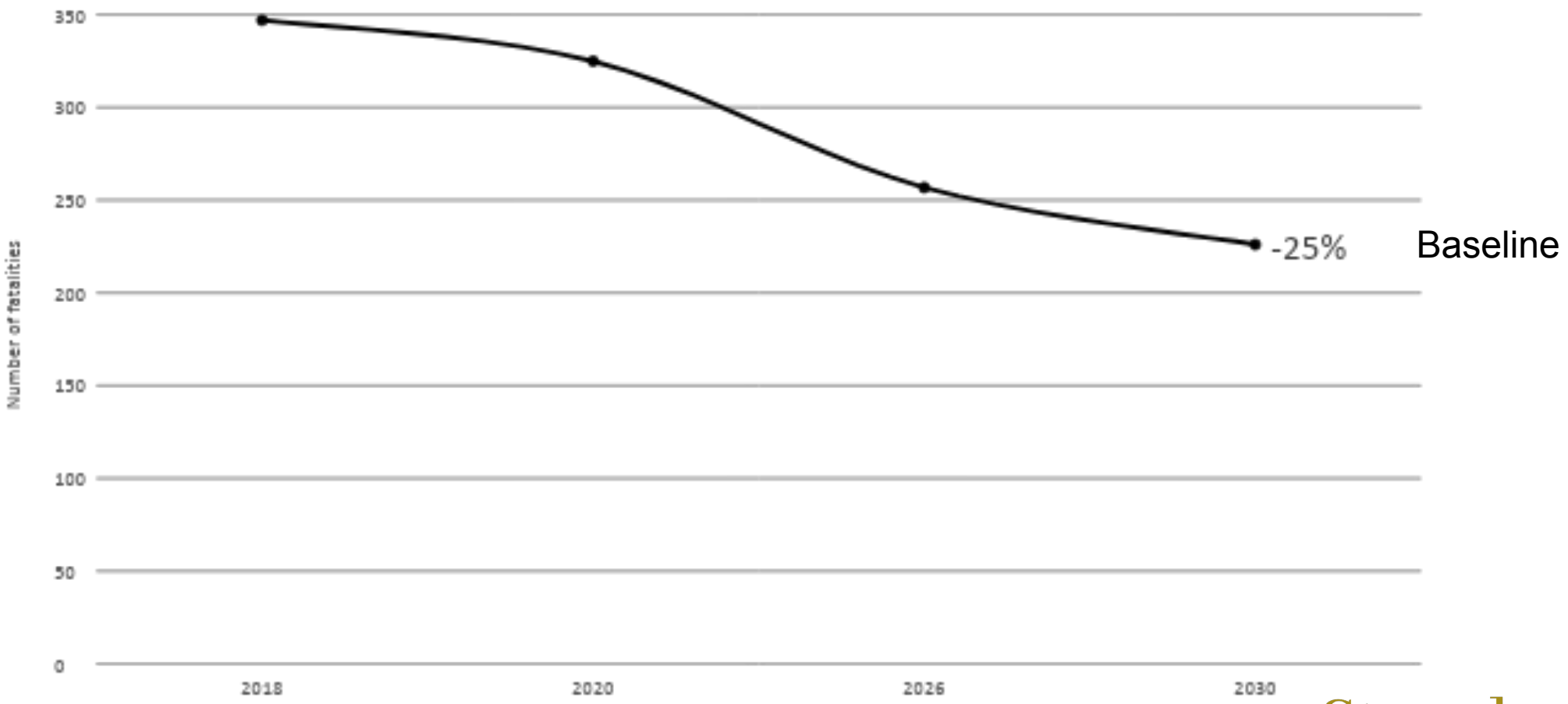
Baseline scenario



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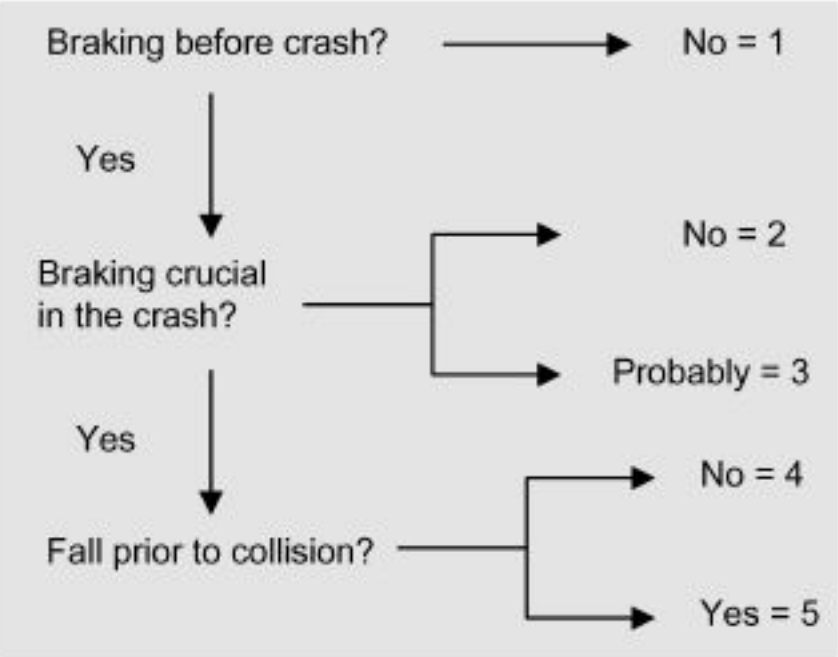
Counterfactual analysis using chain-of-event analysis



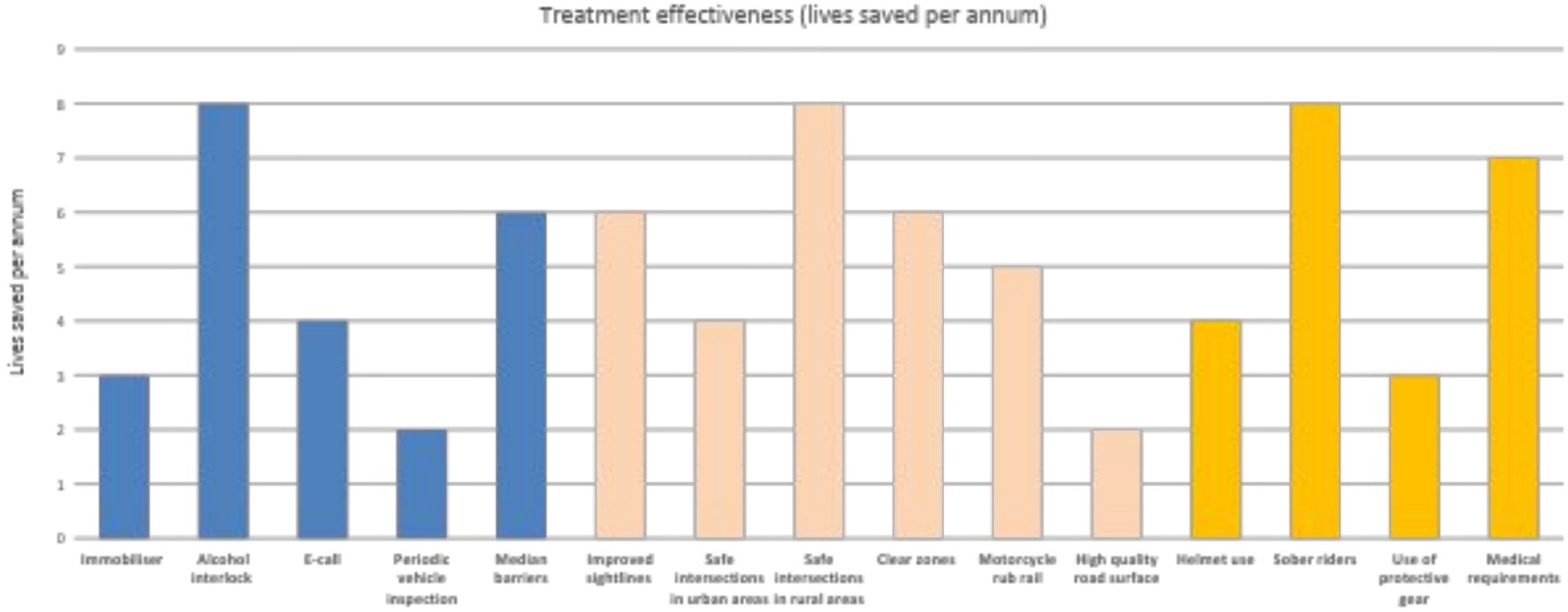
In-depth analysis:
2/3 fatal crashes with motorcycles involve braking where ABS could have made a difference

Statistical study: The overall effectiveness of ABS in Sweden was 48 percent on severe and fatal crashes.

Rizzi, Matteo, Strandroth, Johan and Tingvall, Claes(2009)'The Effectiveness of Antilock Brake Systems on Motorcycles in Reducing Real-Life Crashes and Injuries', Traffic Injury Prevention,10:5,479 — 487

Counterfactual analysis using in-depth crash investigations

Potential benefits of motorcycle safety measures in Sweden



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Combined system benefits

~ 95 % injury reduction

Speed management

Autonomous Emergency Braking
and pedestrian protection

Protective clothing

Ohlin M, Strandroth J, Tingvall C. Combined effects of speed reduction, vehicle frontal design, autonomous emergency braking and helmet use in reducing real life bicycle injuries. Proceedings of the International Cycling Safety Conference 2014, Göteborg, Sweden

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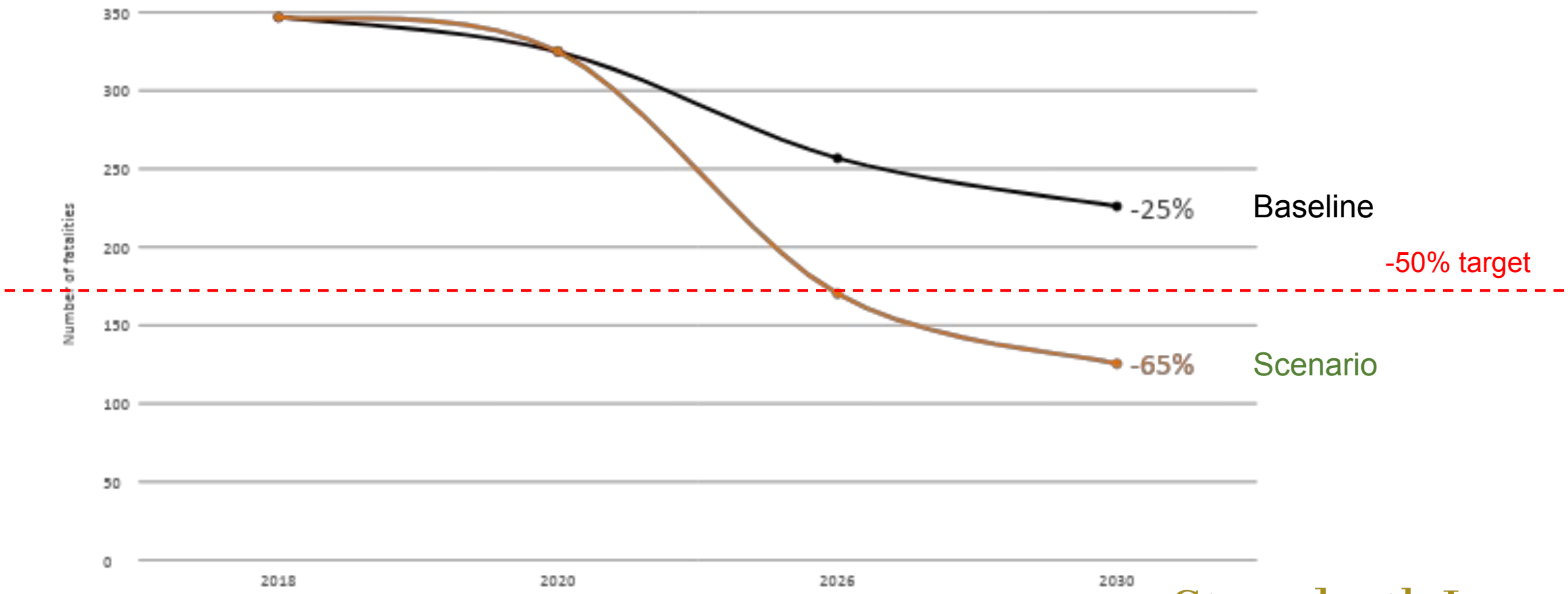
Combined benefits for 2030 scenario



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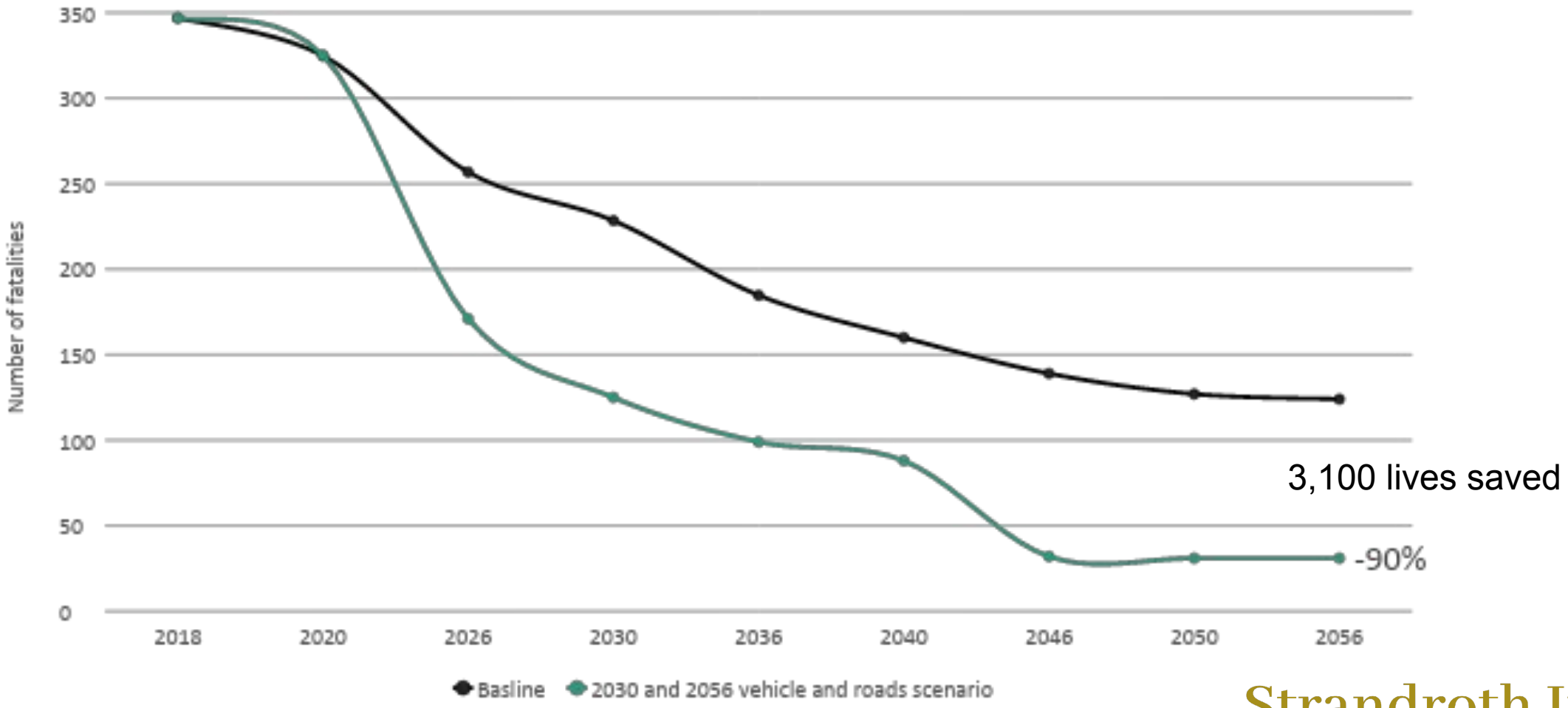
Counterfactual analysis using in-depth crash investigations

Performance Indicators to achieve interim targets

Performance Indicators	Lives saved at 100%	Current	Target	Effect
Share of new motorcycles sold with ABS	21	30%	98%	15
Motorcyclists speed compliance on arterial roads	11	?	80%	6
Motorcyclists speed compliance on municipality roads	4	?	80%	2,5
Share of safe intersections on the arterial road network	4	?	50%	2
Share of motorcycle friendly barriers on the arterial road network	5	0%	50%	2,5
Share of guard rails in curves fitted with motorcycle run rail	2	0%	50%	1
Total (number of lives saved)	**47**			**29**
Corrected for double counting	**28**			**17**
Target 50% reduction				**26**

A Vision Zero scenario



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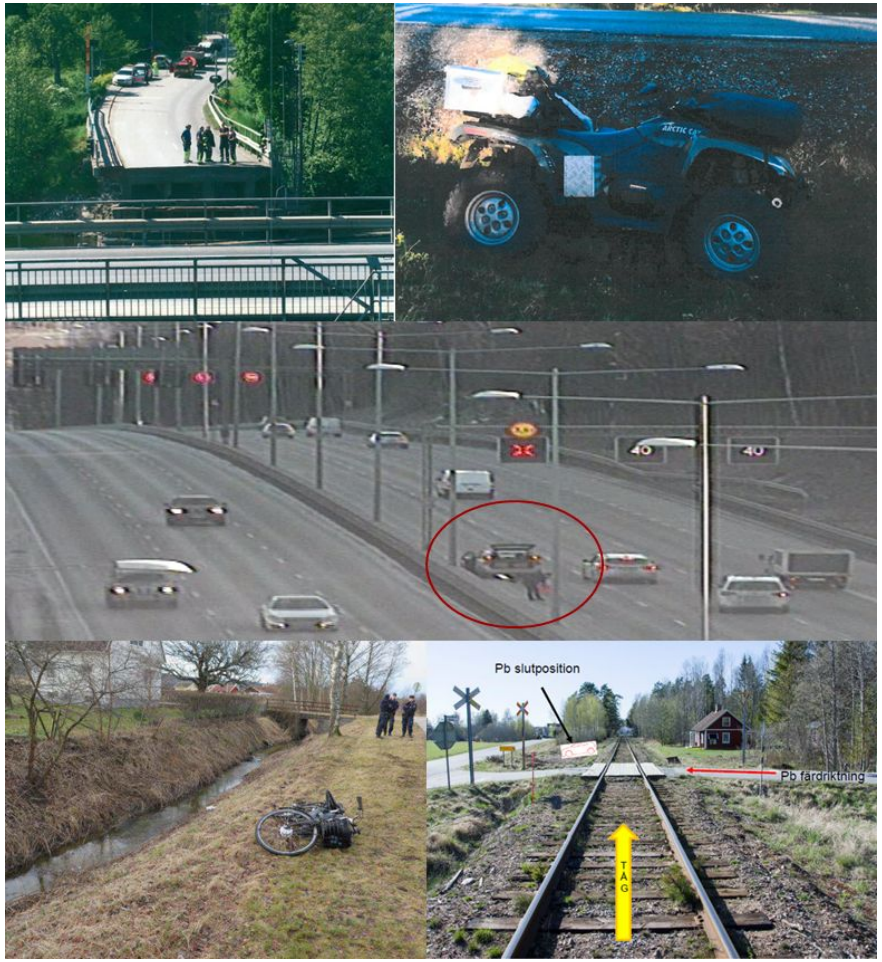
Residual fatalities



31 residual fatalities 2050

- 7 bicycle single, helmet no effect, average age 75 years
- 4 head-on, 80 km/h, HGV, overtaking
- 3 pedestrians, back-over
- 2 ATV single
- 4 pedestrians at highways
- 2 single MC against guardrails
- 2 pedestrians run over by their own car
- 2 elderly car occupants, side collisions
- 2 fatalities with agriculture vehicles
- 3 others

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Recommendation

- Apply in-depth chain-of-event analysis to:
  - Classify fatal and severe injury outcomes to guide decision makers on how to improve the road transport system
  - Investigate the individual and combined effect of road safety interventions
  - Guide the development of evidence based road safety strategy and action plans to achieve ambitious targets