# Strandroth Inc.

Road Safety Advice, Research and Strategy

## Human Impact: What In-Depth Analysis of Crashes Tells Us

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Dr Johan Strandroth

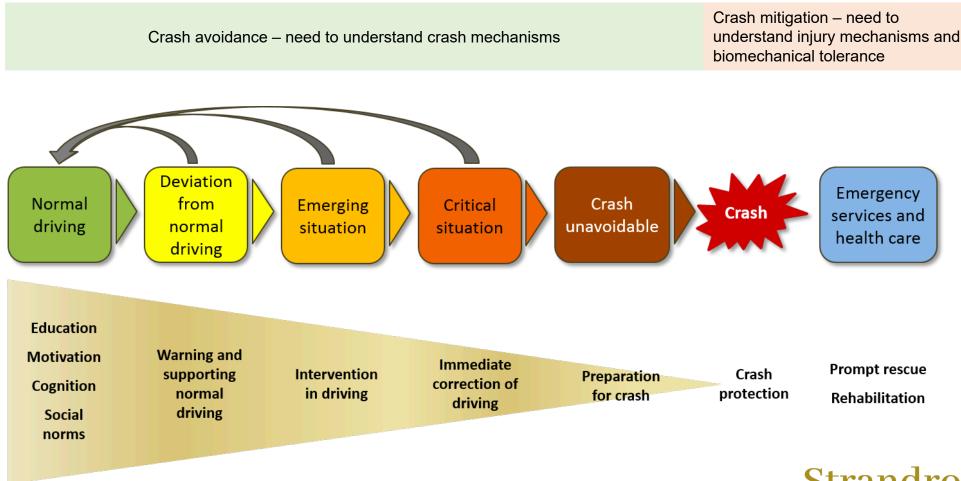
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# Content

- First principle crash avoidance and injury mitigation
- Counterfactual analysis
- Local validation of Safe System boundaries and end states



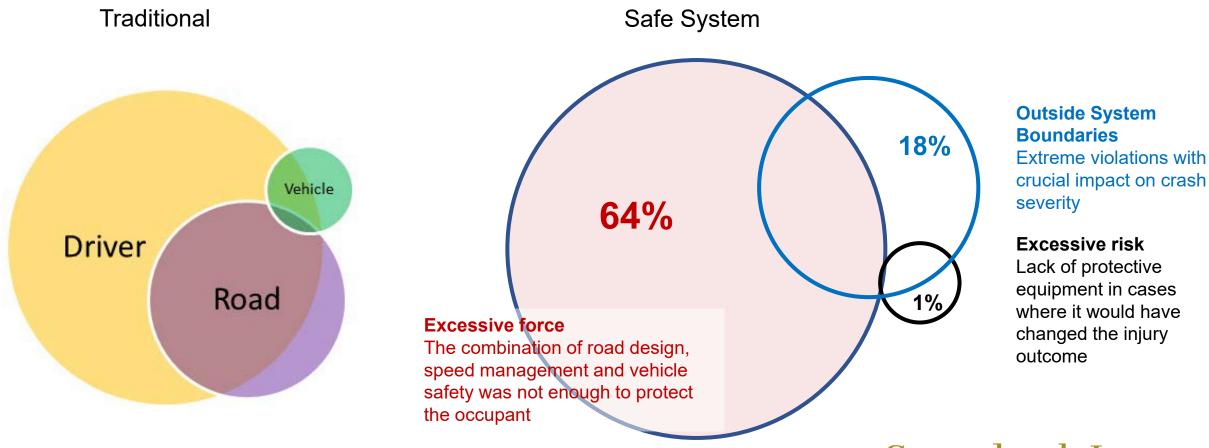
## First principle crash avoidance and injury mitigation



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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First principle crash avoidance and injury mitigation Classification of all fatal motorcycle crashes in Sweden 2016-2018 (n = 163)

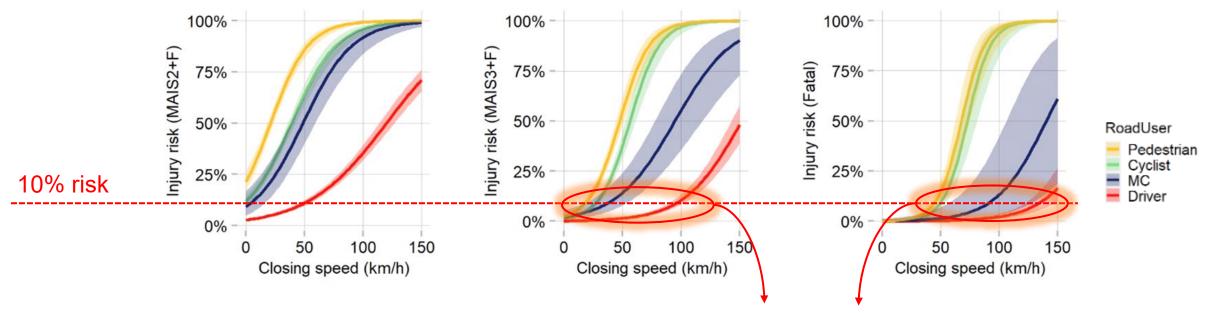


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Adapted from Kimber (2003)

Source: Swedish Transport Administration

### First principle crash avoidance and injury mitigation Human biomechanical tolerance

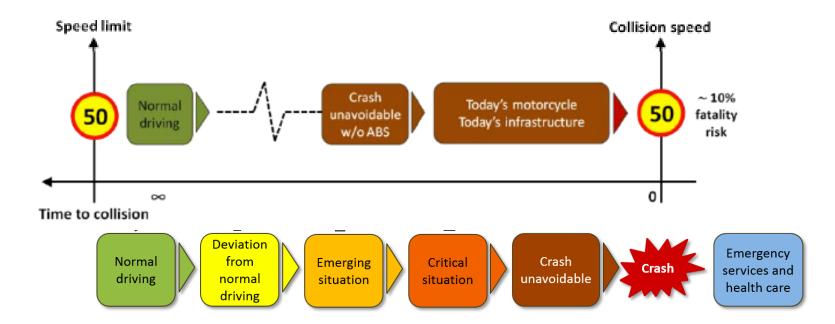


'Acceptable' impact speed for motorcyclists: Max 30 km/h (MAIS3+) to 50 km/h (fatalities)

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Adapted from: Lubbe, N., Wu, Y., & Jeppsson, H. (2022). Safe speeds: fatality and injury risks of pedestrians, cyclists, motorcyclists, and car drivers impacting the front of another passenger car as a function of closing speed and age. *Traffic Safety Research*, *2*, 000006-000006.

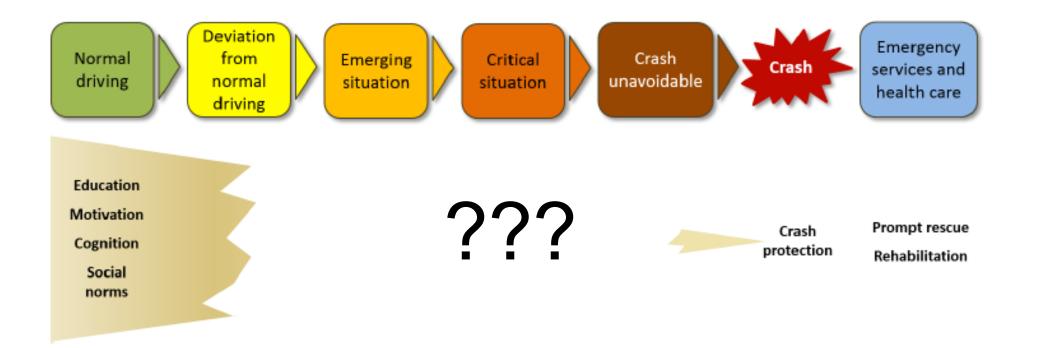
## First principle crash avoidance and injury mitigation



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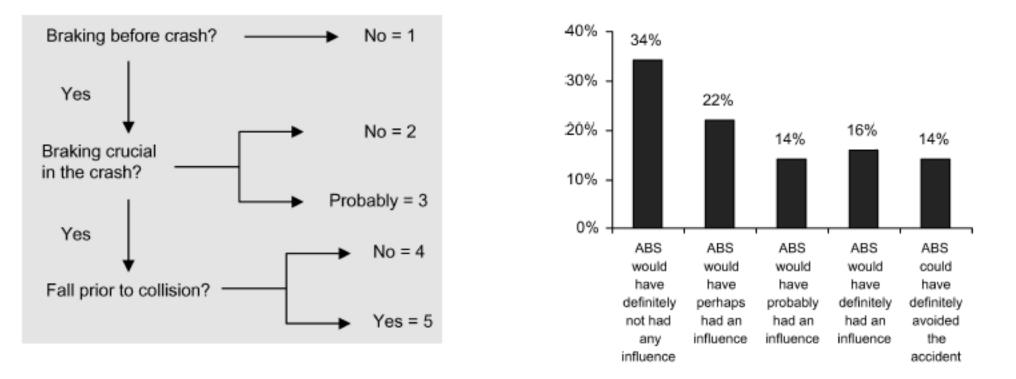
## First principle crash avoidance and injury mitigation



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## Counterfactual analysis using in-depth crash investigations

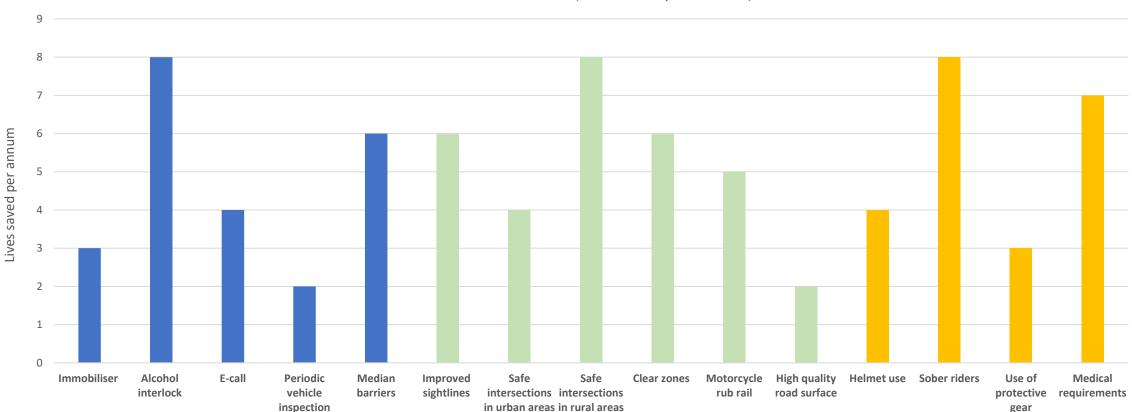


**In-depth analysis:** 2/3 fatal crashes with motorcycles involve braking where ABS could have made a difference **Statistical study:** The overall effectiveness of ABS in Sweden was 48 percent on severe and fatal crashes.

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

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### Counterfactual analysis using in-depth crash investigations Potential benefits of motorcycle safety measures in Sweden



Treatment effectiveness (lives saved per annum)

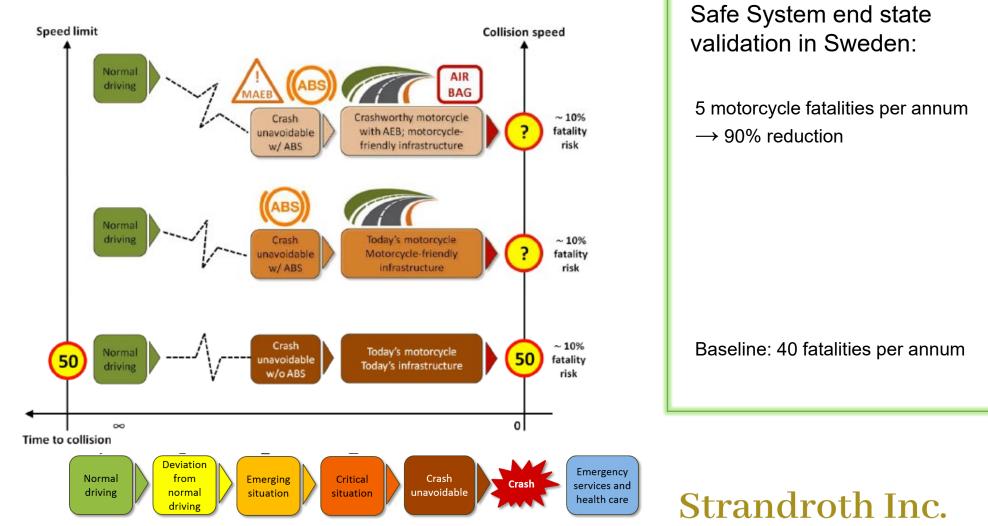
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### Counterfactual analysis using in-depth crash investigations Performance Indicators to achieve interim targets

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

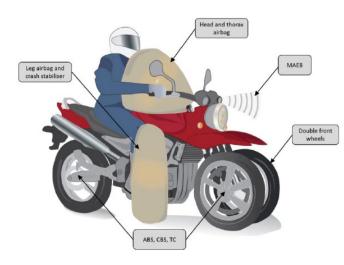
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## A conseptual Safe System for motorcycles



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### A conceptual Safe System for motorcycles





Safe System end state validation in Sweden:

5 motorcycle fatalities per annum  $\rightarrow$  90% reduction

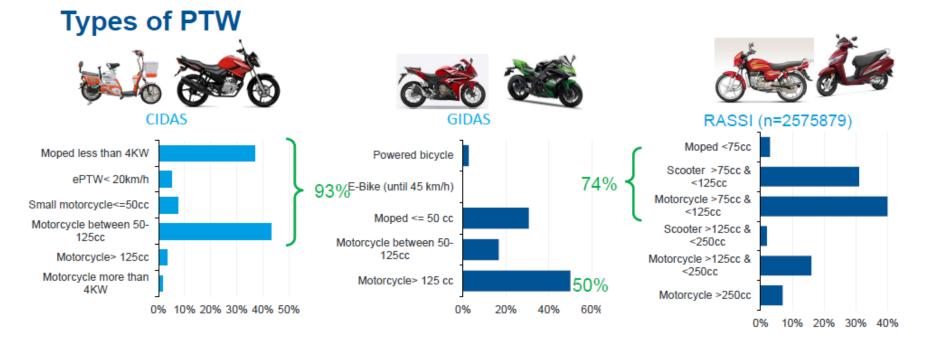
Baseline: 40 fatalities per annum

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### Context sensitive implementation

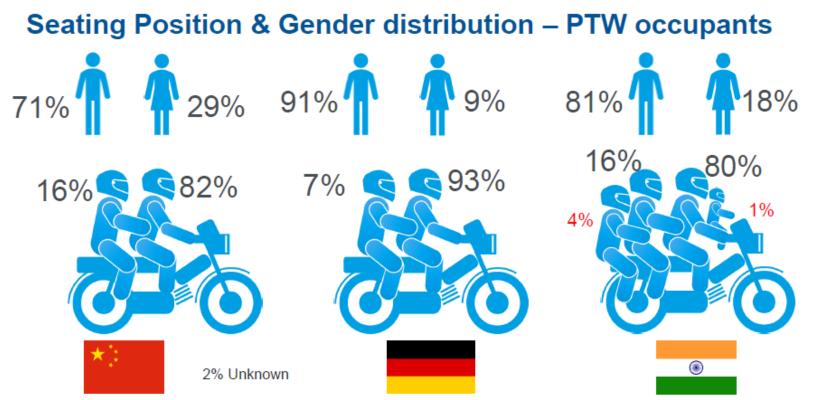


- India & China → Less powered PTW → Daily commute for transport/daily needs
- Germany → More of high powered PTW → Recreational use

Puthan Pisharam, P., Lübbe, N., Shaikh, J. et al (2021). Defining crash configurations for Powered Two-Wheelers: Comparing ISO 13232 to recent indepth crash data from Germany, India and China. Accident Analysis and Prevention, 151. http://dx.doi.org/10.1016/j.aap.2020.105957

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### Context sensitive implementation



Mostly males as riders, In India, often try to accommodate full family (not necessarily helmeted!!)

Puthan Pisharam, P., Lübbe, N., Shaikh, J. et al (2021). Defining crash configurations for Powered Two-Wheelers: Comparing ISO 13232 to recent indepth crash data from Germany, India and China. Accident Analysis and Prevention, 151. http://dx.doi.org/10.1016/j.aap.2020.105957

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### Recommendations

- Develop an evidence based Safe System end state for motorcycles that takes regional mobility needs into account
- Validate the Safe System end state for local conditions using in-depth analysis of fatal and serious motorcycle crashes

