

Global Challenges for Road Safety till 2030

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Gothenburg, Sweden

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Science and Technology
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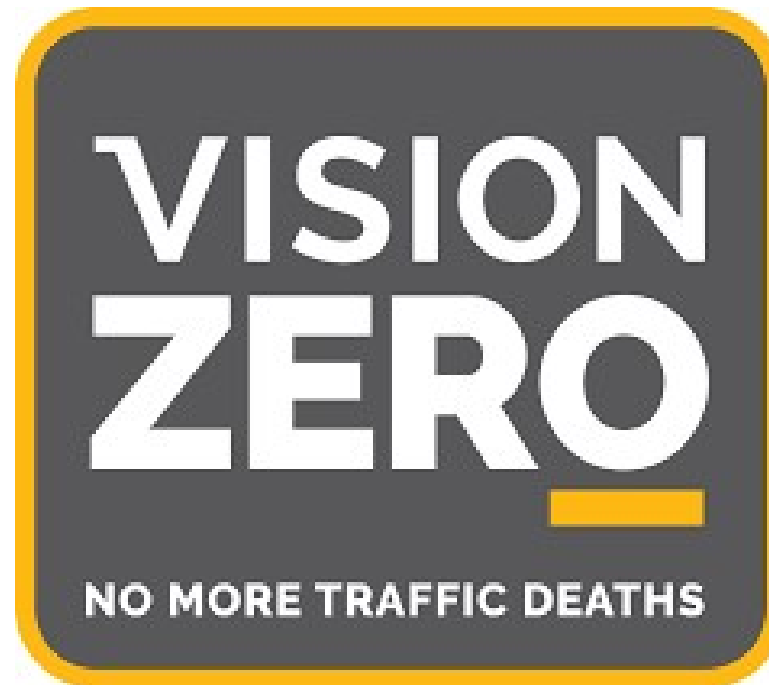
My Background

- 1978 – 2008: TNO The Netherlands, Vehicle Safety R&D Manager. Responsibilities a.o. MADYMO crash simulation software, new crash dummies and European R&D projects.
- 1990 – 2007: visiting professor “Vehicle Safety”, Technical University Eindhoven.
- 2008: SAFETEQ founded, a consulting company in the field of Automotive Safety. See: www.safeteq.com
- Since 2007: visiting professor at Chalmers University (SAFER), Gothenburg, Sweden

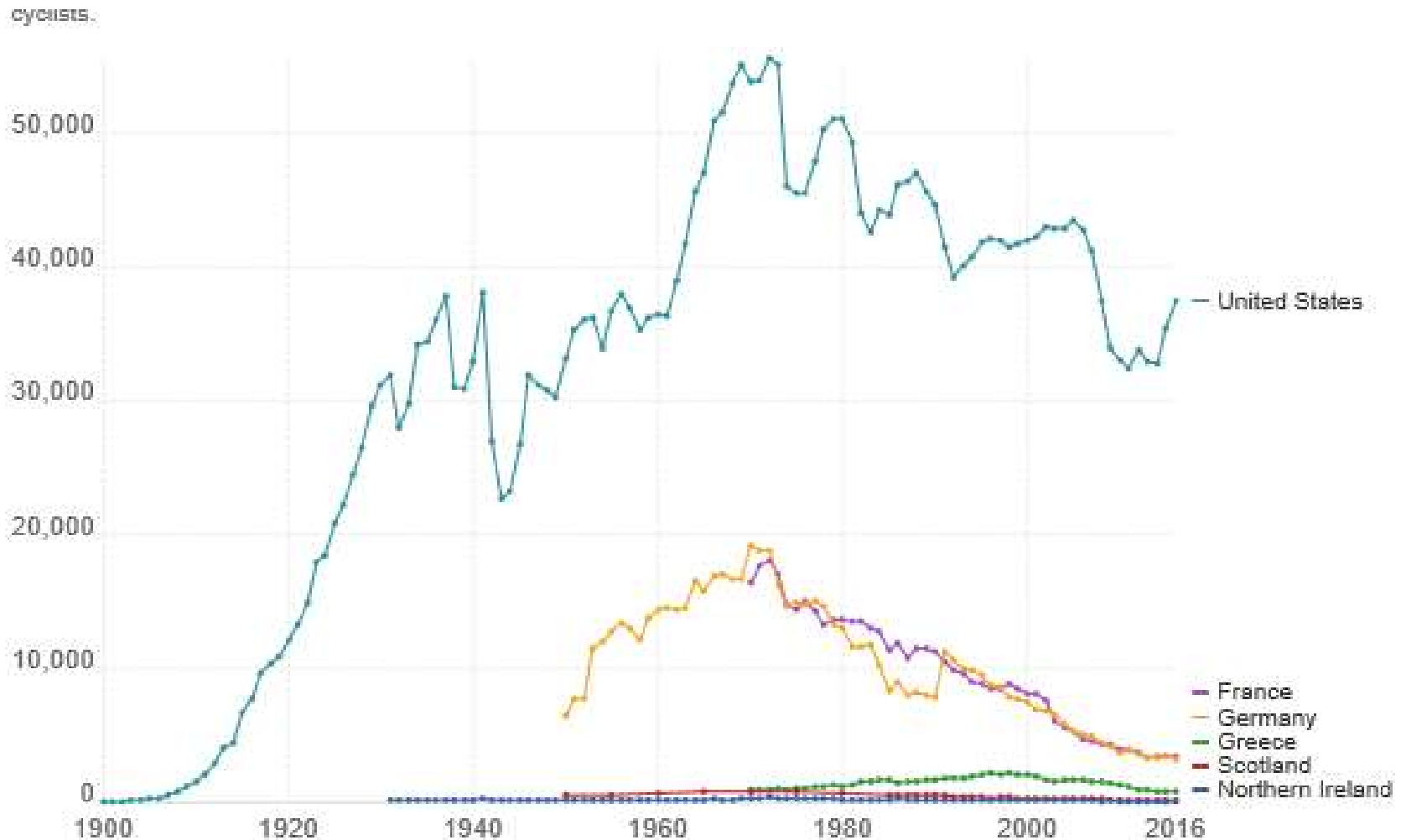


OBJECTIVE

To discuss history and future of road and in particular vehicle safety



Road accidents in US and some European countries



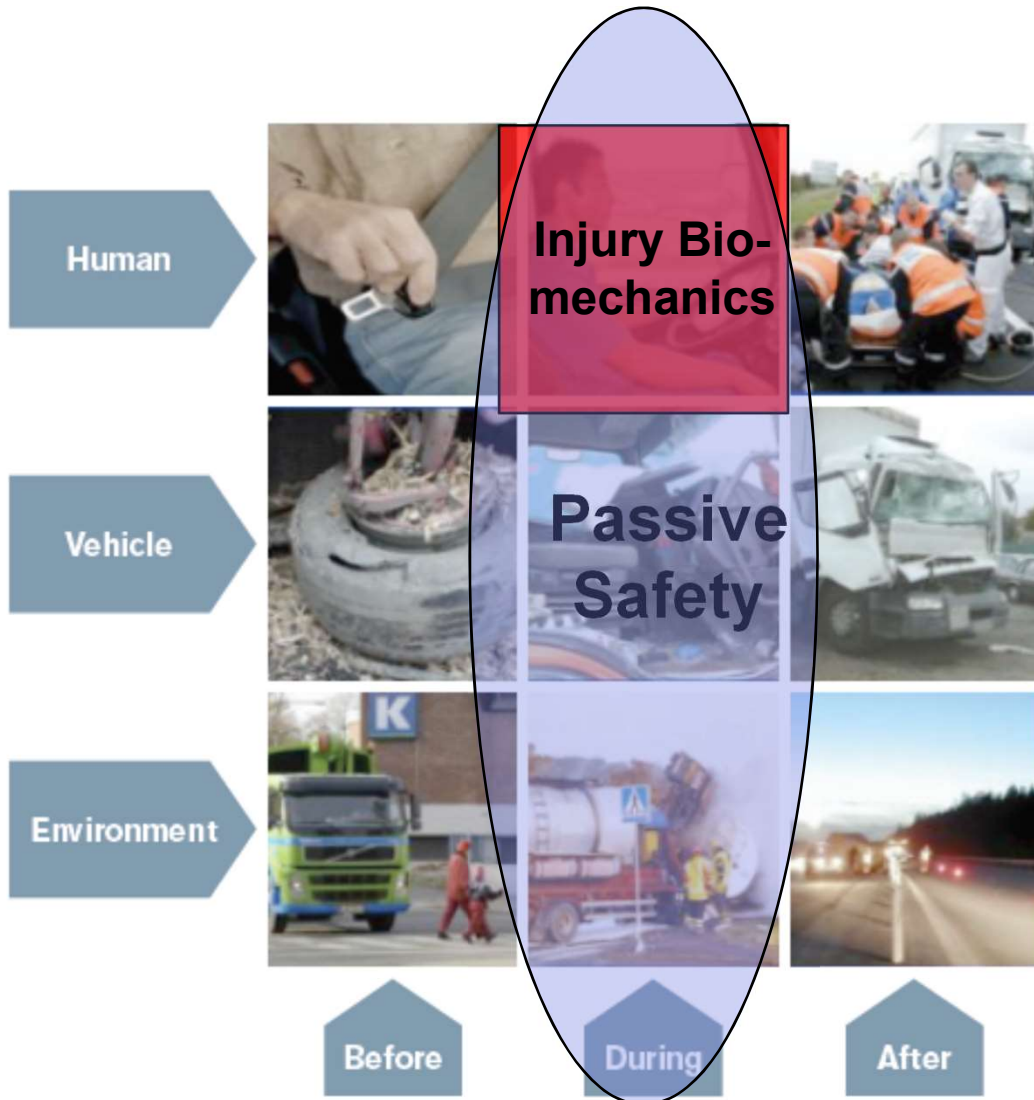
Source: OECD & National Statistic Divisions

OurWorldInData.org - CC BY-SA

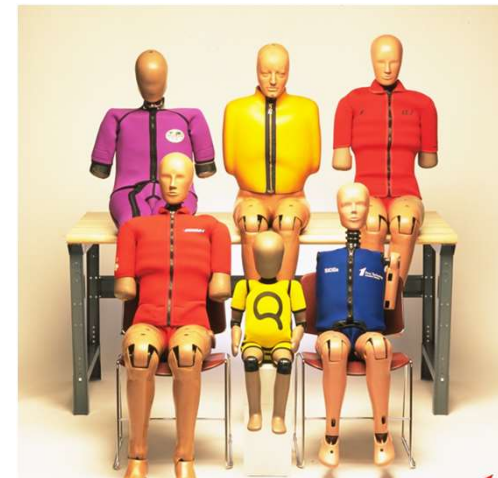
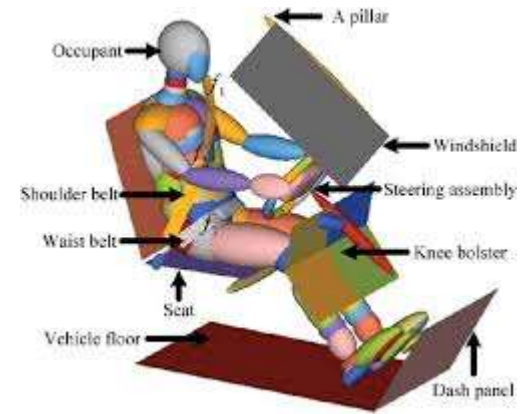
Haddon Matrix approach in injury prevention



My research focus in the eighties



MADYMO



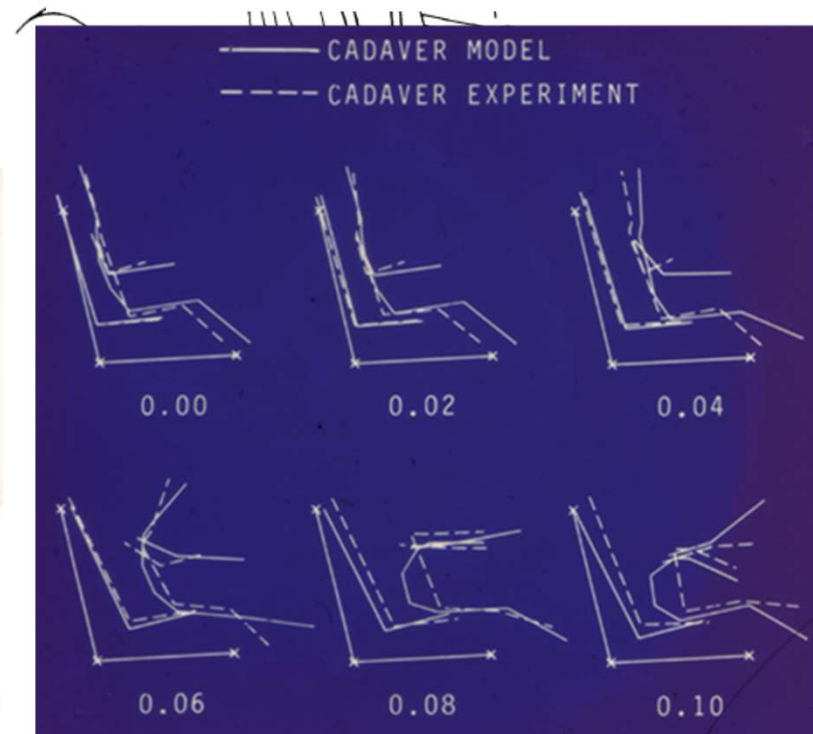
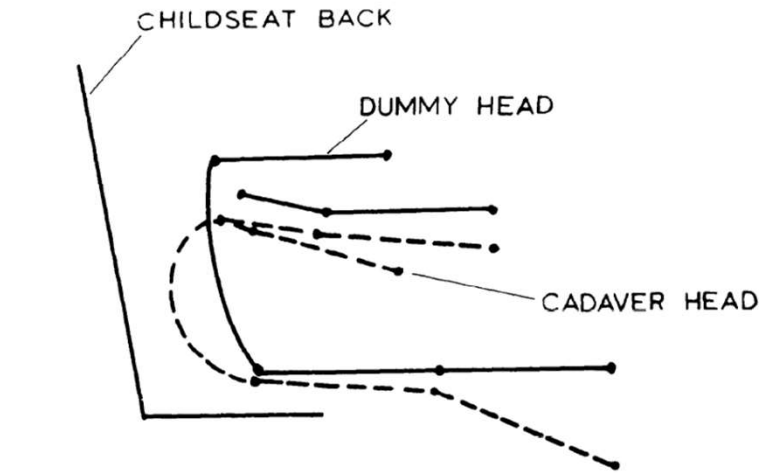
My first crash safety project in 1978

791017

Child Restraint Evaluation by Experimental and Mathematical Simulation

J. Wismans and
J. Maltha

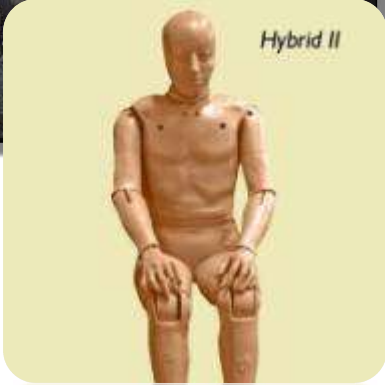
Research Institute for Road Vehicles
TNO-Delft (Holland)



Crash dummy developments

More than half a century of advances.

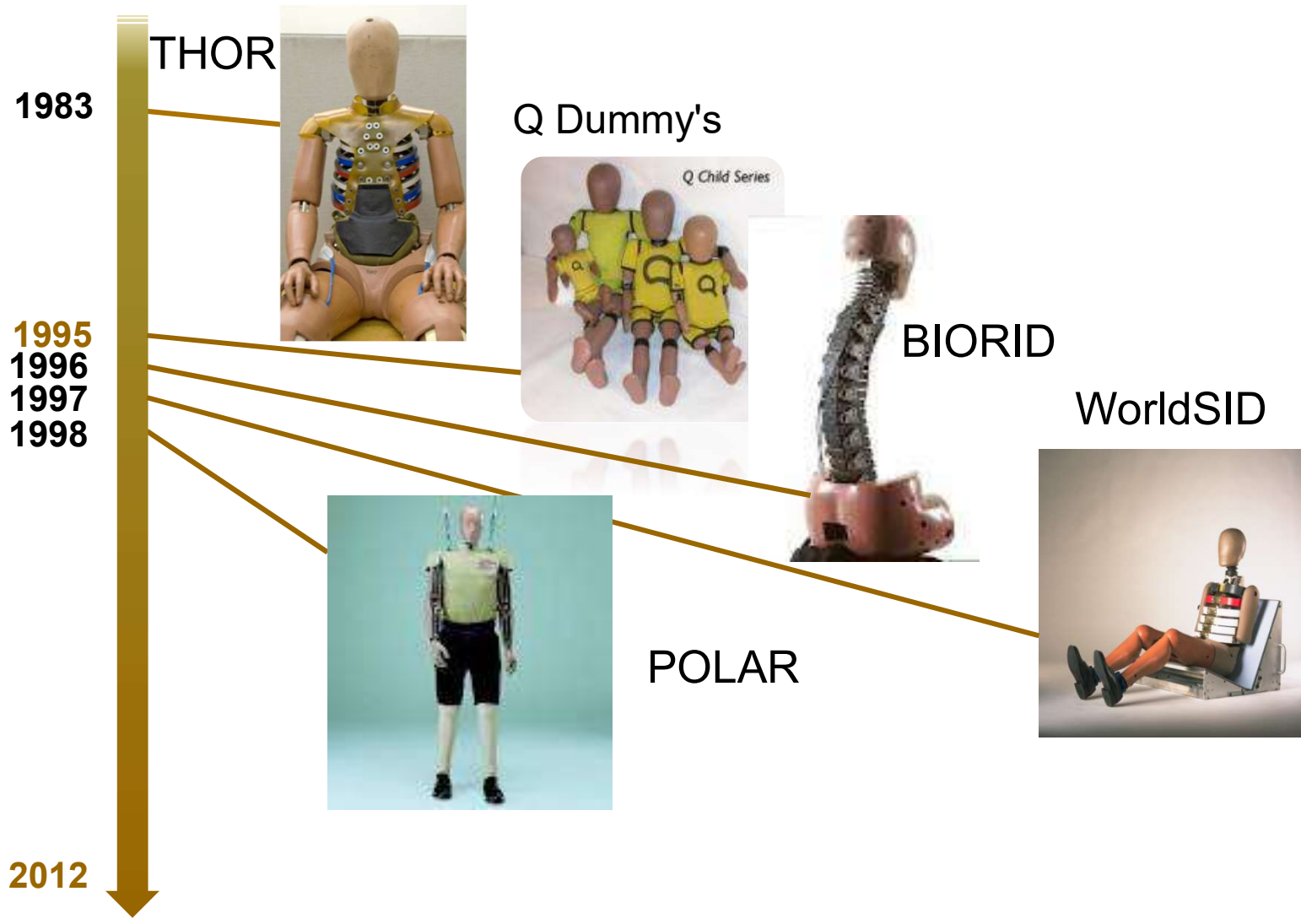
1950's –
1970's



1980's

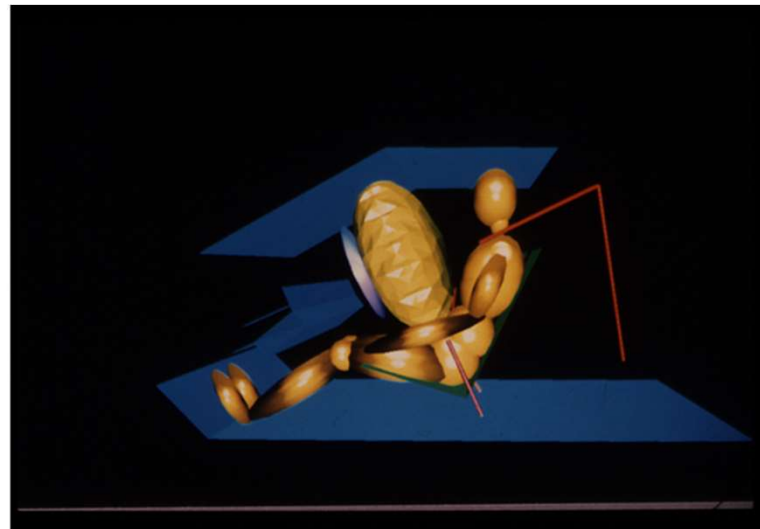


Crash dummy developments

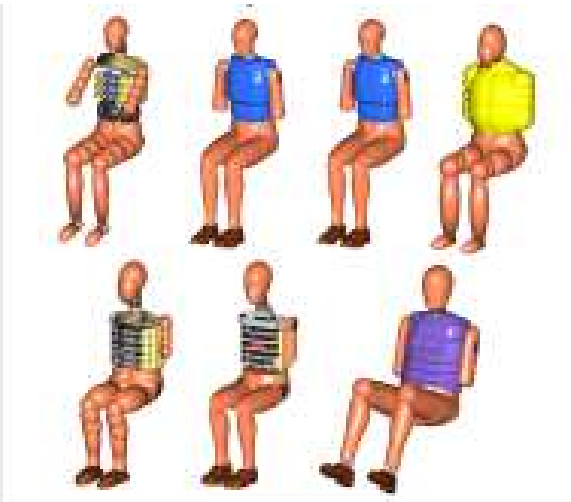
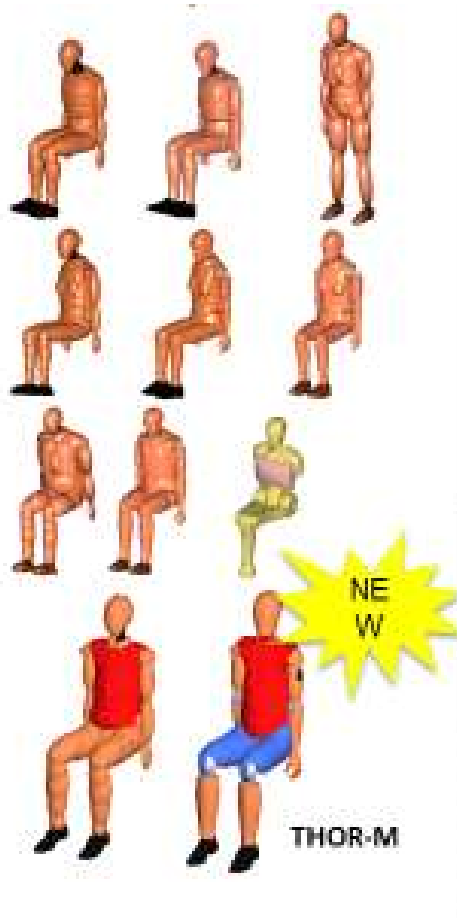


MADYMO brief history

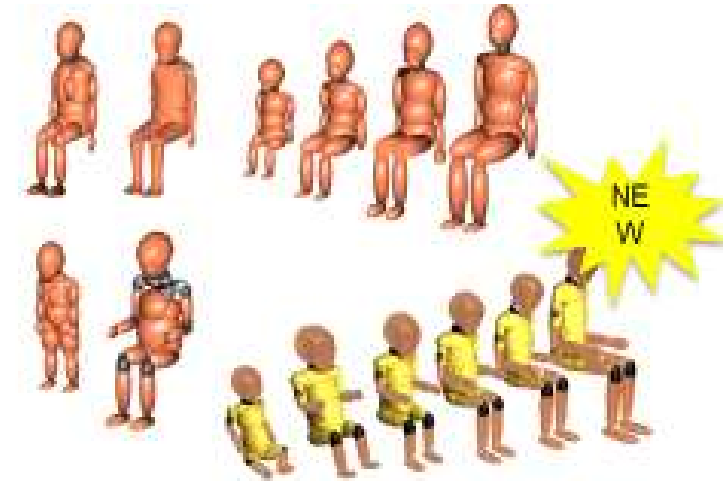
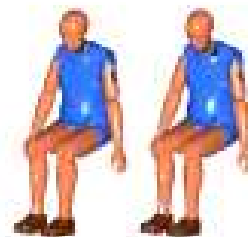
- MADYMO development started in 1976 (multibody technology)
- First mentioning in literature of this type of analyses tools was in 1963 (Mc Henry)
- Most well-known software packages at the start of MADYMO were MVMA-2D and CAL3D in the USA
- First coupling with Finite Element simulations for airbag in 1990



Standard MADYMO dummymodels



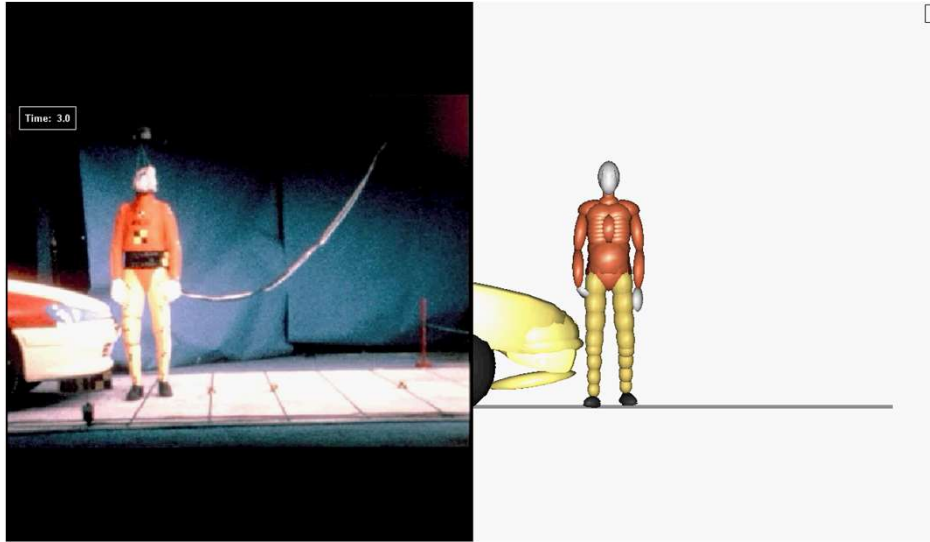
Rear impact dummies



Quality reports



Examples of research activities before 2000



2000 - 2009

Time = -0.000000



Time = -0.000000



2000 - 2009

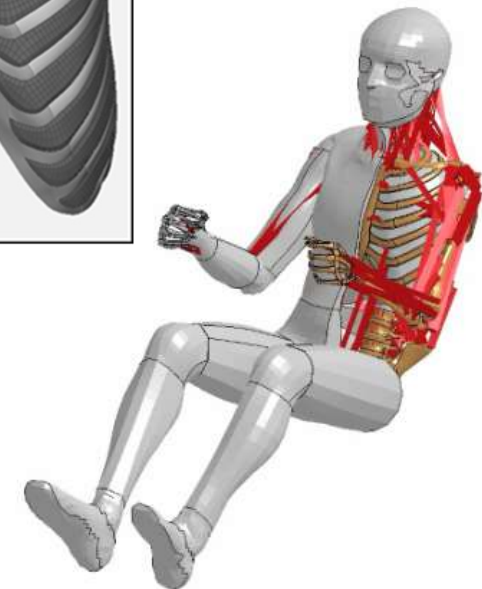
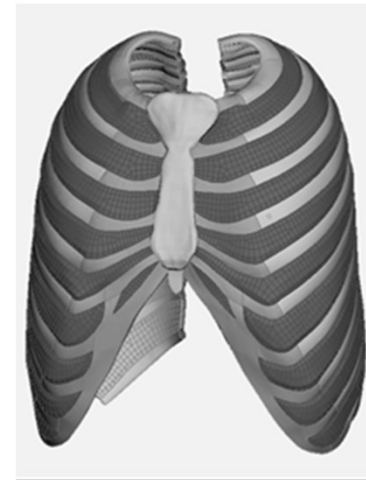
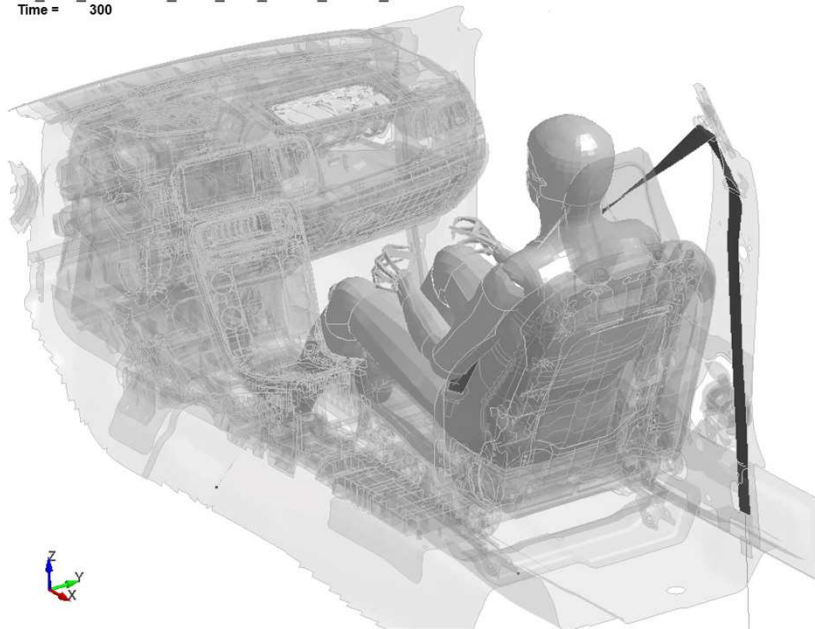


2010-2019

SAFER Human Body Model v 9.0 - Released in January 2018

Makes it possible to seamlessly simulate the occupant movement during a turn or brake maneuver AND injury prediction in a subsequent crash

12_0.5s_avoidance_300N_PPT_frontal_56kmh_crash
Time = 300



2010-2019

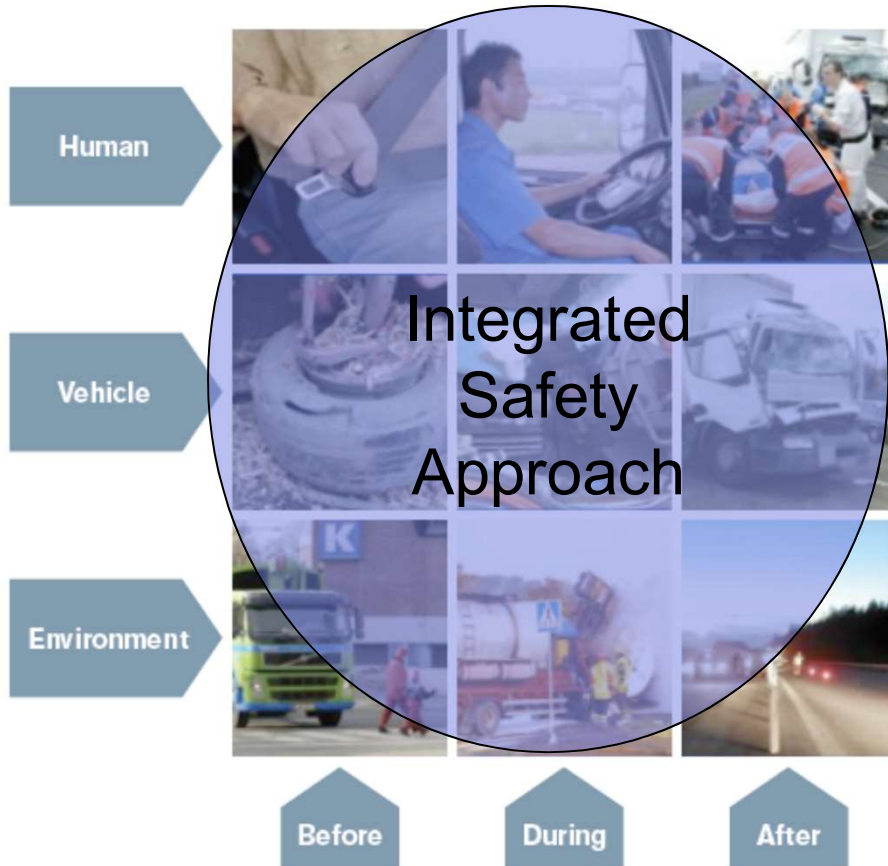
SAFER Human Body Model v 9.0

SAFER Lane Change with Braking Standard belt Validation (PhD's Jonas Östh and Jona Olafsdottir)

1: LS-DYNA keyword deck by LS-PrePost
Loadcase 1 : Time = 749.999512 : Frame 28



2000 - 2009



APROSYS
Integrated Approach

	Car Accidents	Heavy Vehicles Accidents	Pedestrians / Cyclists Accidents	Motorcycle Accidents
Biomechanics	Blue	Blue	Green	Blue
Intelligent Safety Systems	Blue	Green	Blue	Green
Virtual Testing	Green	Blue	Green	Blue
Accident Analysis	Blue	Green	Blue	Green

04/2004

2005

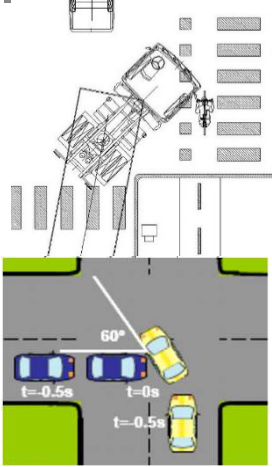
2006

2007

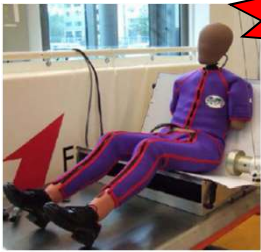
2008

04/2009

Accidentology



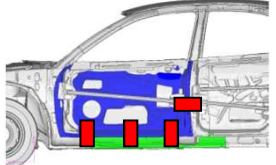
Concepts



WorldSID 5 female



Heavy Vehicle Aggressivity Index

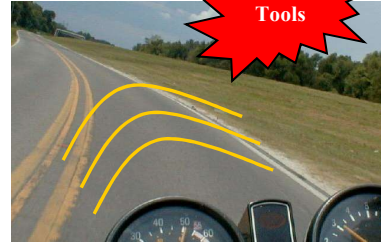


Advanced Side Impact System



ngsha
Car Models

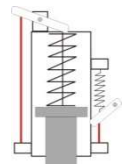
Tools



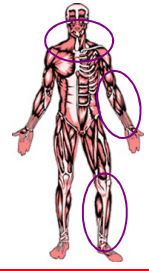
Advanced safety on motorcycles



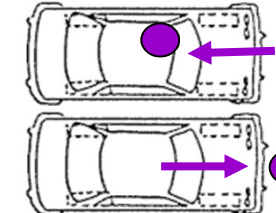
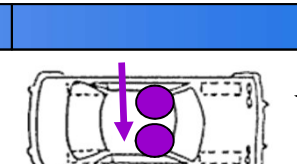
Head injury mechanisms



Smart Material Actuator



Active muscle behavior

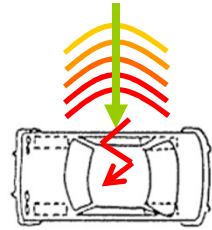
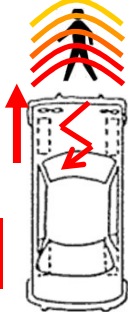


Human models & Virtual Testing Demonstrators



Show cases for improved safety

Demonstrators



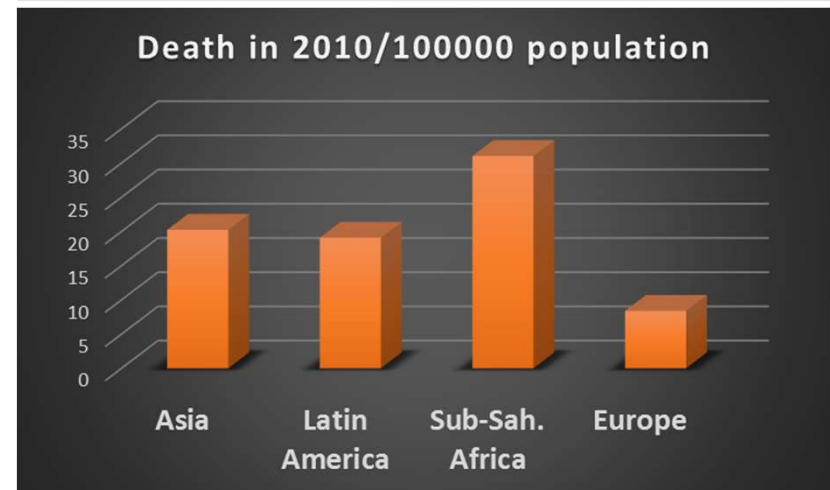
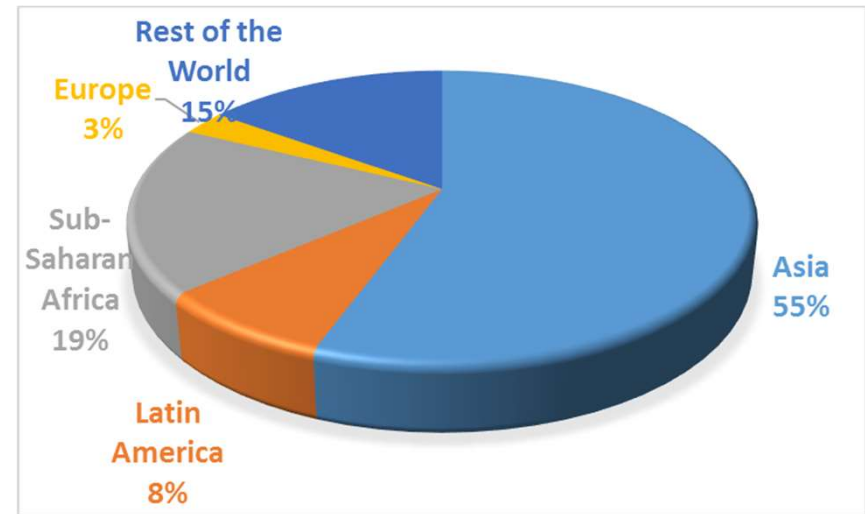
Advanced Safety System Assessment Methods

The global road safety problem

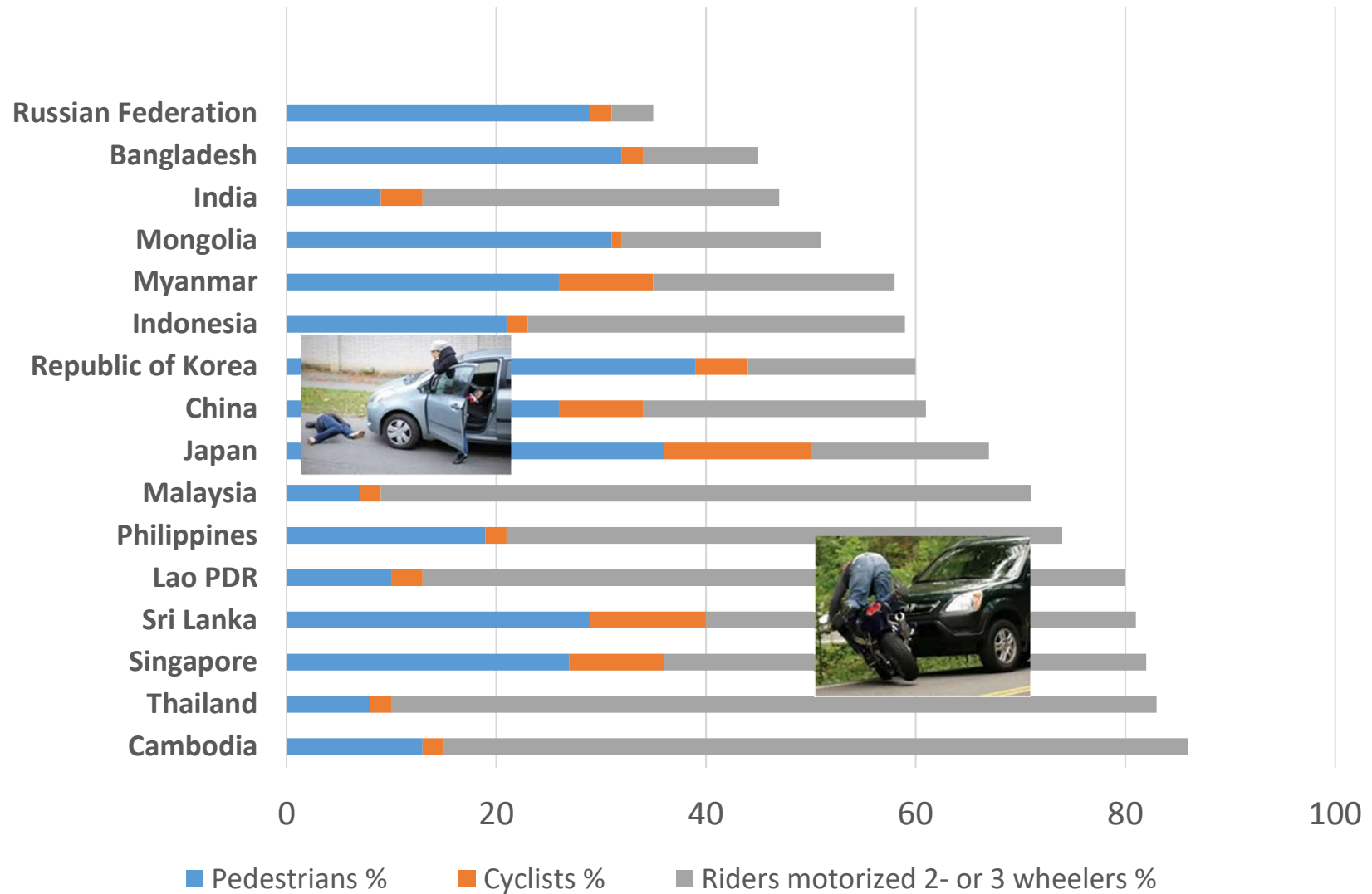
Global Road Traffic Fatalities

source: WHO 2015 and Worldbank/IHME 2014

- 1.3 million fatalities worldwide (2013) of which 55% in Asia, 19% in Sub-Saharan Africa and 8% in Latin-America
- Death per 100.000 capita: in Africa 4 times as high as Europe



Vulnerable Road Users 2013 in Asia

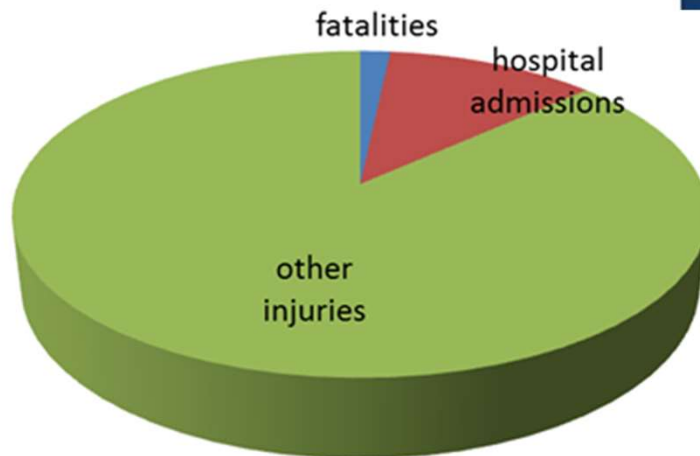


Top causes of death for children and young people

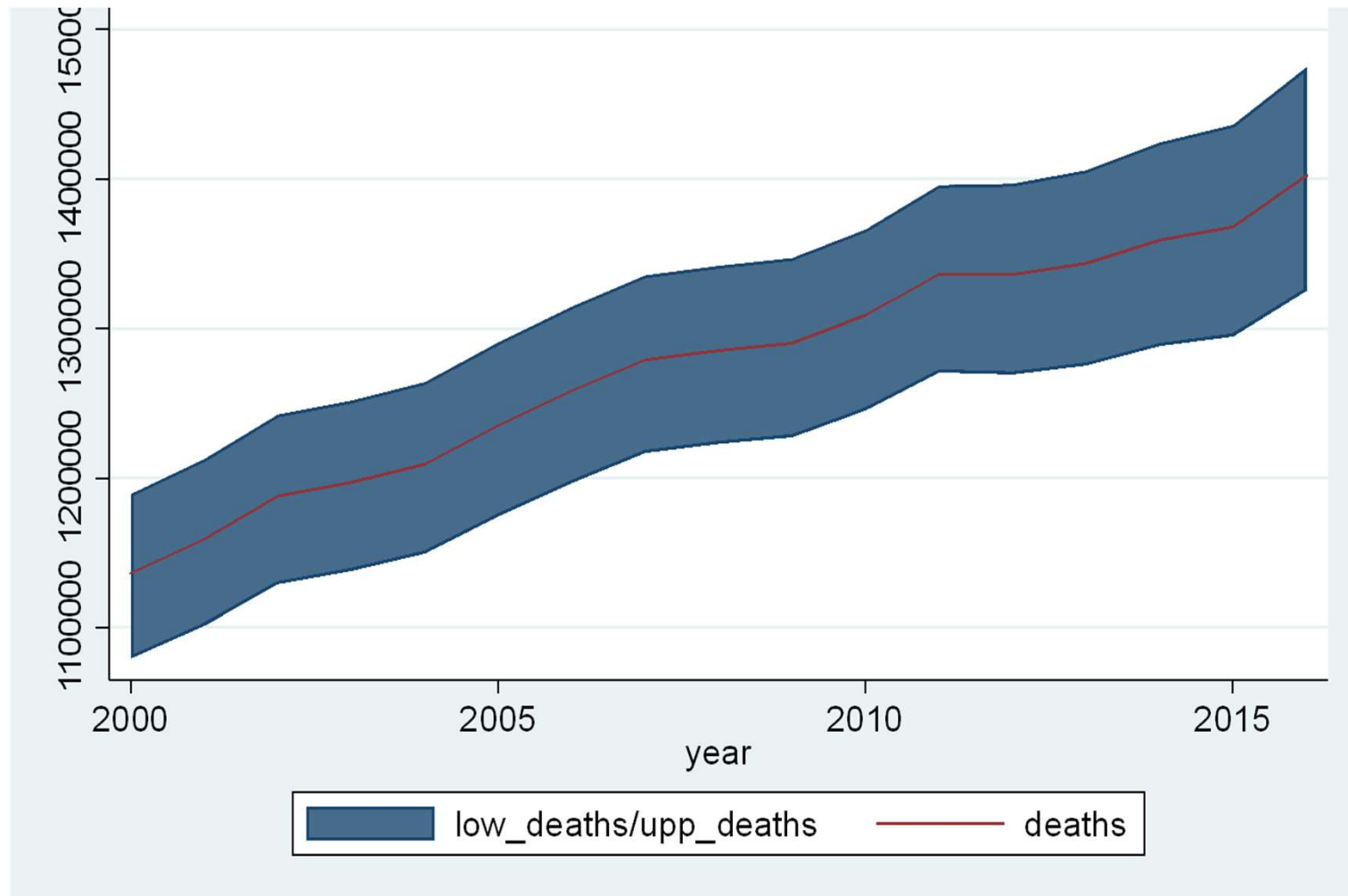
Males				
Rank	Under 1 Cause	1-4 years Cause	5-14 years Cause	15-29 years Cause
1	Preterm birth complications	Malaria	ROAD INJURY	ROAD INJURY
2	Lower respiratory infections	Lower respiratory infections	HIV/AIDS	Interpersonal violence
3	Neonatal encephalopathy	Diarrheal diseases	Diarrheal diseases	Self-harm
4	Neonatal sepsis	Protein-energy malnutrition	Lower respiratory infections	HIV/AIDS
5	Diarrheal diseases	HIV/AIDS	Malaria	Tuberculosis
6	Congenital anomalies	Drowning	Drowning	Drowning
7	Malaria	Meningitis	Typhoid fevers	Malaria
8	Meningitis	ROAD INJURY	Meningitis	Lower respiratory infections
9	Protein-energy malnutrition	Measles	Congenital anomalies	Mechanical forces
10	Syphilis	Fire	Forces of nature	Diarrheal diseases

Fatalities are just the top of the Iceberg (WHO 2013/2015 and Worldbank/IHME 2014)

In addition to 1.3 million fatalities there are 80 million injured persons of which 9 million requiring hospital admission



Trends in number of road traffic deaths Worldwide (2000 – 2016)

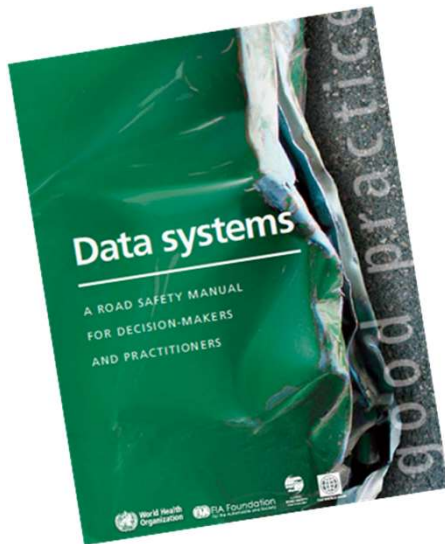


Source: WHO 2018

Problem of Underreporting

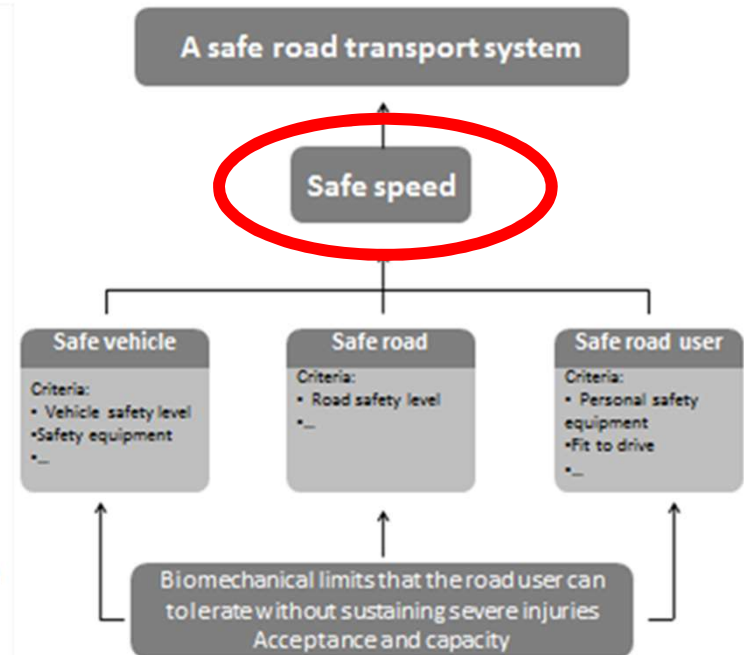
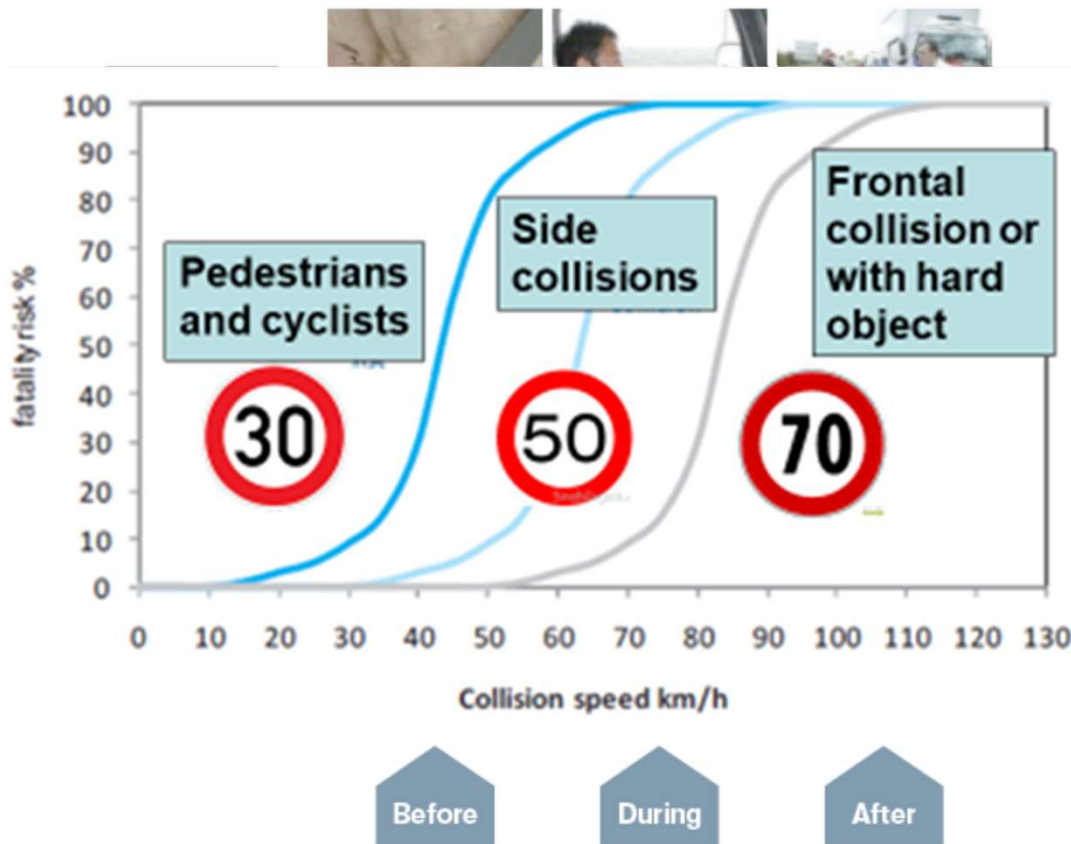
*Example: Road Accident deaths in China in 2010
source: IMHE/World Bank study (2014)*

- Official traffic police records in China: 65,225
- Estimations using other national data sources: 283,000
- Underreporting in China: > 300%

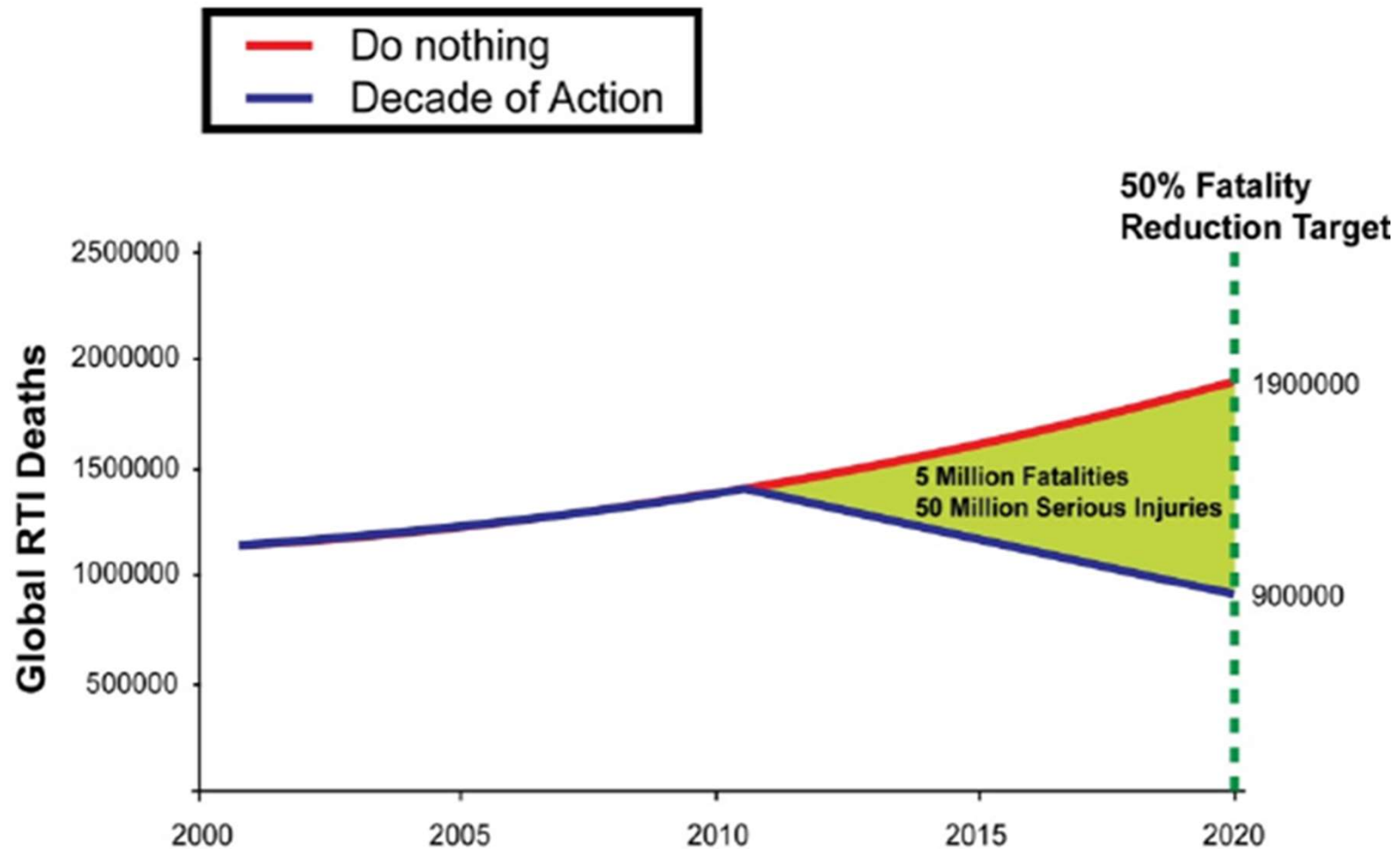


What can be done?

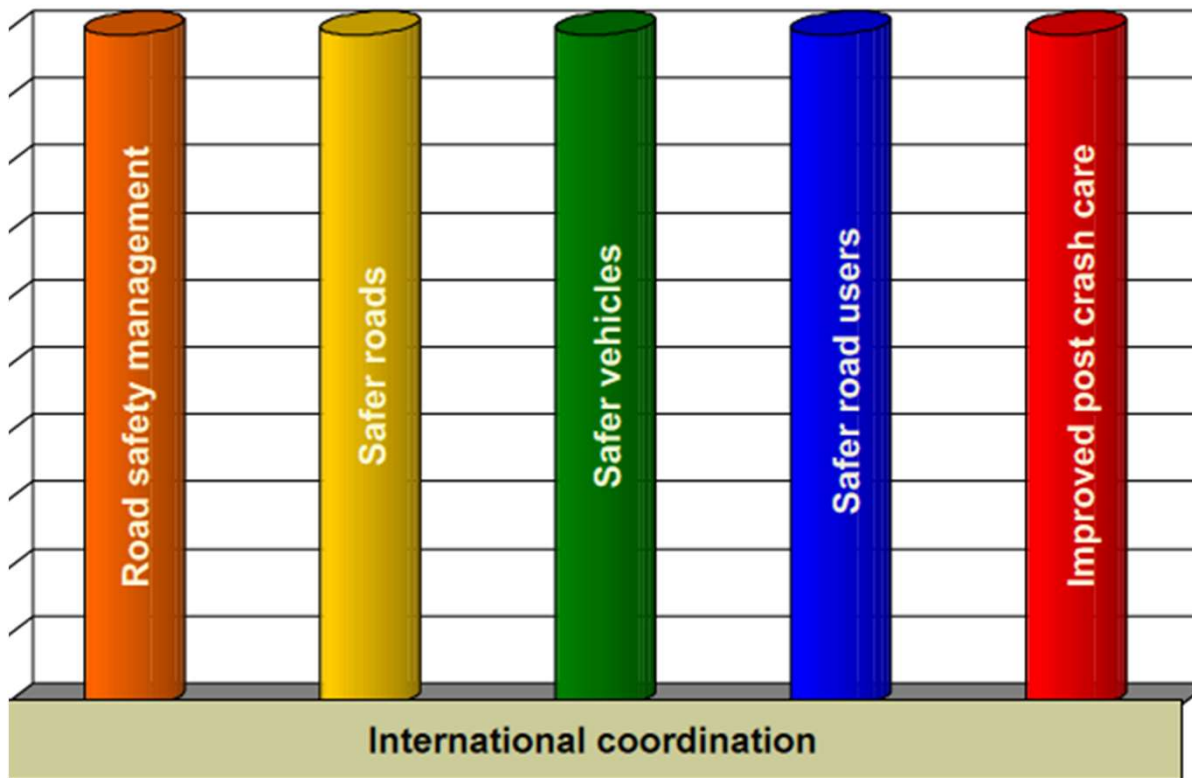
From Haddon Matrix to the Safe System Approach (vision zero)



2011-2020 Decade of Action for road safety



Plan for the Decade: 5 Pillars (left) and 5 risk factors (right)



- Speed
- Drunk-driving
- Not wearing motorcycle helmets
- Not wearing seat-belts
- Not using child restraints

The 2030 Agenda for Sustainable Development, adopted by all UN Member States in 2015



SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY 	2 ZERO HUNGER 	3 GOOD HEALTH AND WELL-BEING 	4 QUALITY EDUCATION 	5 GENDER EQUALITY 	6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY 	8 DECENT WORK AND ECONOMIC GROWTH 	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	10 REDUCED INEQUALITIES 	11 SUSTAINABLE CITIES AND COMMUNITIES 	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION 	14 LIFE BELOW WATER 	15 LIFE ON LAND 	16 PEACE, JUSTICE AND STRONG INSTITUTIONS 	17 PARTNERSHIPS FOR THE GOALS 	

United Nations 2030 Agenda for Sustainable Development (2015)



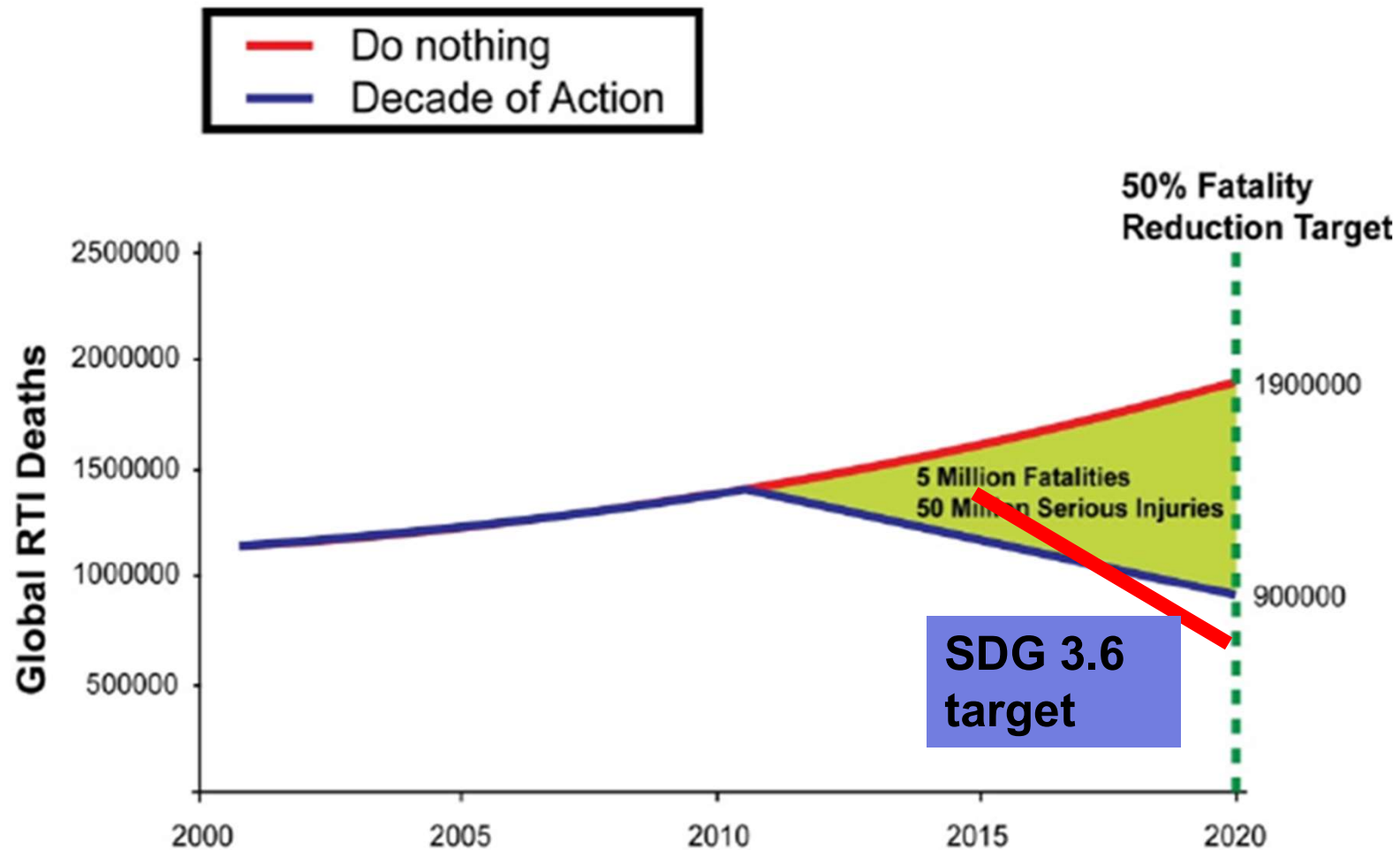
Targets

3.6: by 2020, halve the number of global deaths and injuries from road traffic accidents.

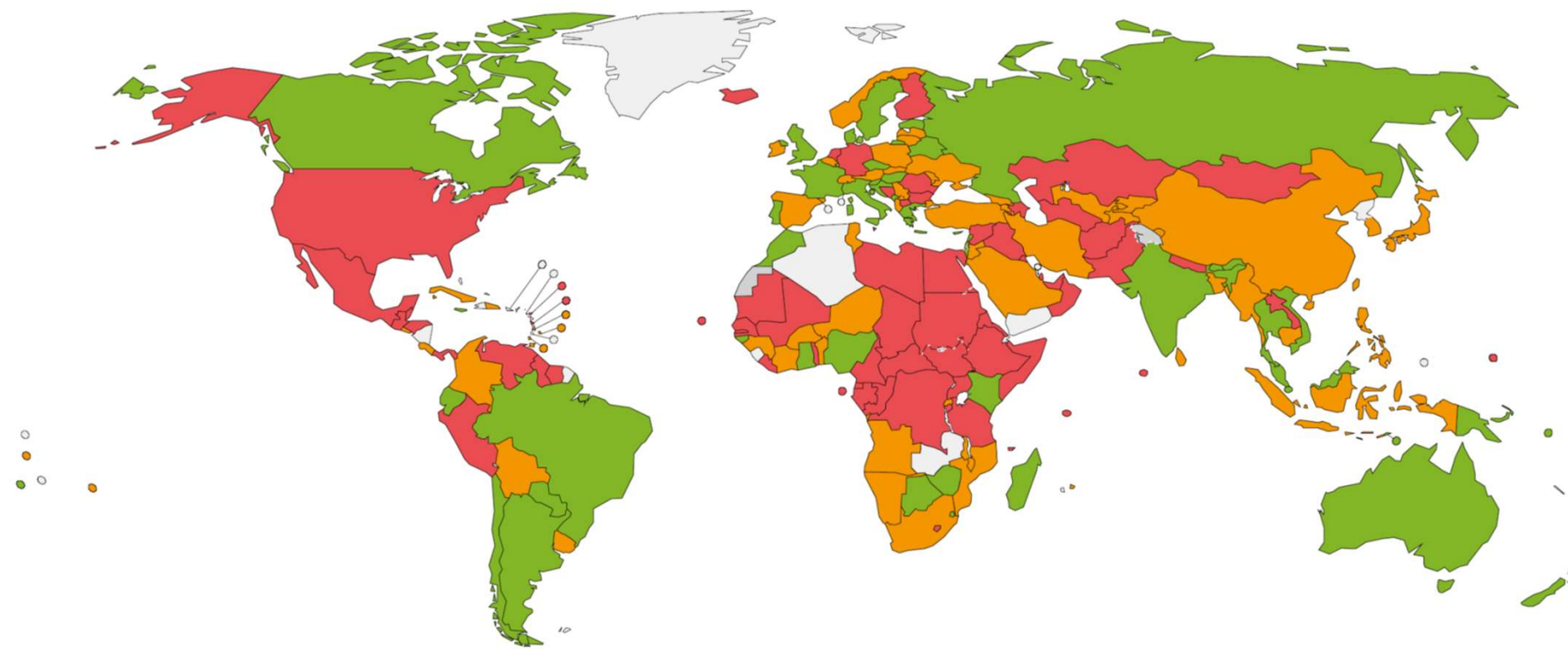


11.2: by 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women and children, persons with disabilities and older persons.

2011-2020 Decade of Action for road safety

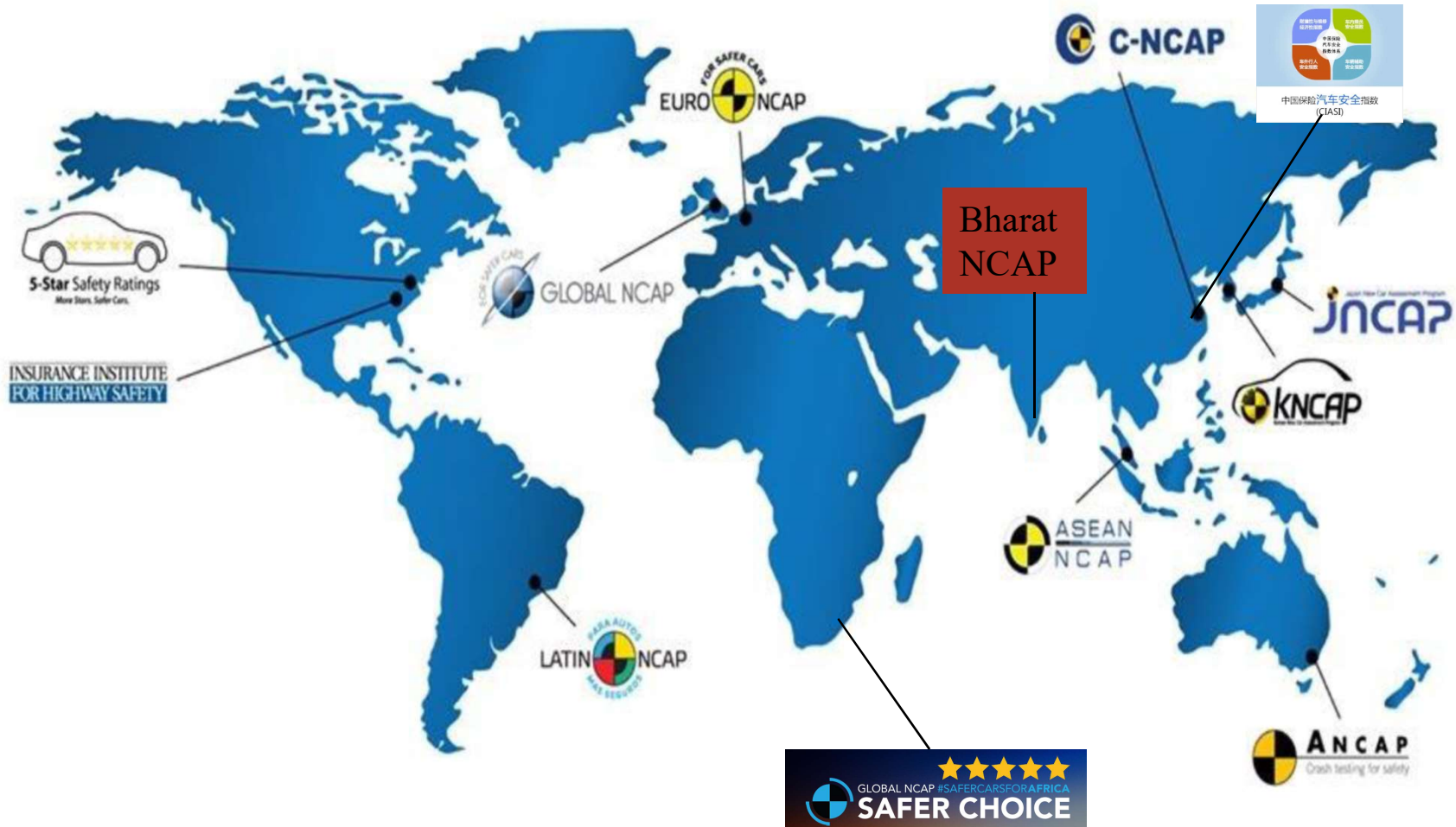


Countries with helmet laws meeting best practice (2017)



- All riders, roads, engines, fastening and standard
- All riders, roads, engines and either fastening or standard
- Not covering all riders or roads or engines / no law
- Data not available
- Not applicable

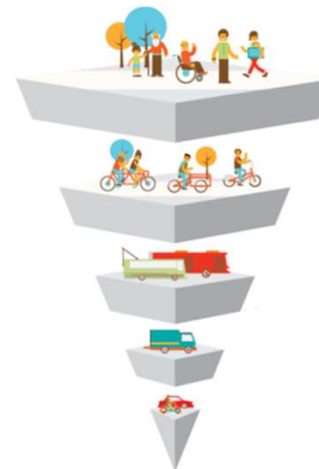
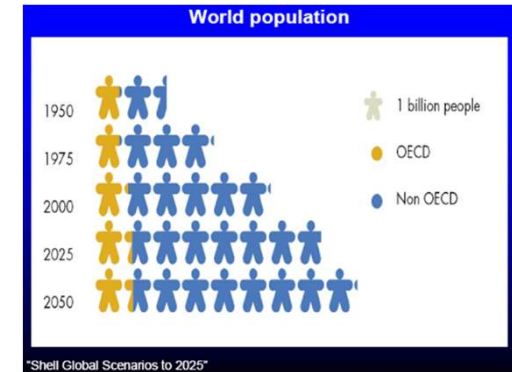
NCAP's Worldwide



Future Outlook

Global societal trends 2030+

- Strong increase in population, in particular in Asia and Africa
- Aging population
- Increasing urbanization and congested megacities
- Increase of motorization in low and middle income countries
- Climate change: urgent need to reduce CO2 and emissions due to transportation
- Many new technology developments including automation
- Policy focus on liveable cities
-



Many changes in transport through technology innovations



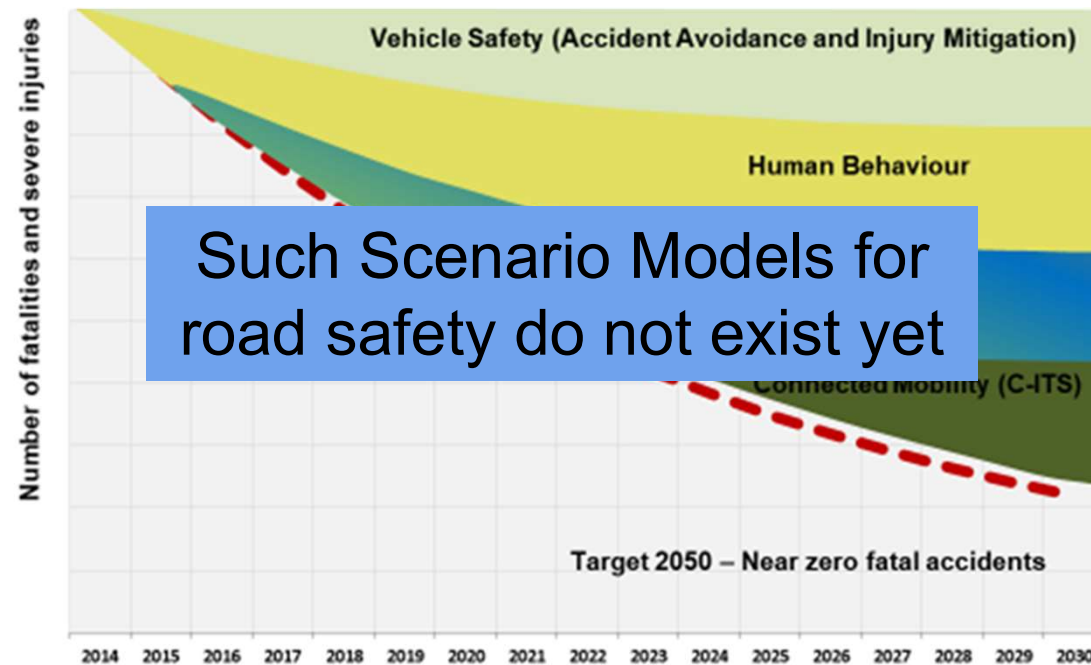
Many disruptions through new technologies like Drones, Internet of Things, Robots, Artificial Intelligence etc.,

How will road safety develop in the future?

- Vision, goals and targets: **how we want the future to be**



- Scenario's: **how to reach these targets?**



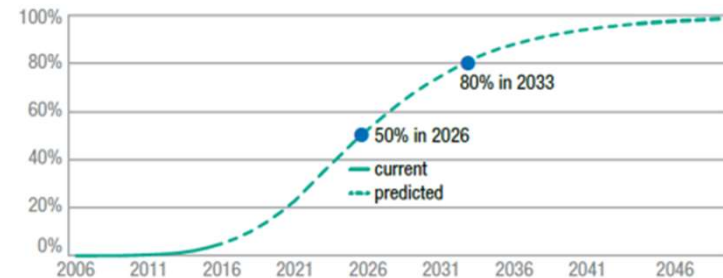
Future of energy?



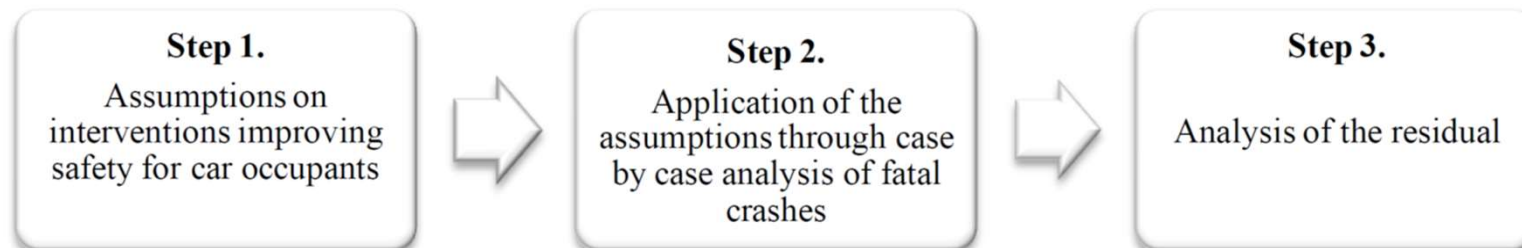
STA/Chalmers Method to Evaluate the Future Impact of Vehicle Safety Technology in Sweden

- Based on real accident data (In-depth, Strada)
- Takes future fleet development and penetration of safety features into account
- Compensates for double counting
- Focus on vehicle safety technology
- Applied a.o. for effect EuroNCAP pedestrian regulation, AEB effect, prediction of future crashes in Sweden in 2020 and 2030

Drivers can expect a mixed fleet of autonomous and conventional cars for decades. Autobrake, for example, won't be in 80 percent of registered vehicles until 2033, even with automakers' pledge to make it standard by 2022.



Bron: IHS. Nov. 2016



SafetyCube European Road Safety Decision Support System (DSS)

- The SafetyCube DSS aims to support evidence-based policy making. It provides detailed interactive information on a large list of road accident risk factors and related road safety countermeasures.
- Link: <https://www.roadsafety-dss.eu/#/>

The screenshot displays the homepage of the SafetyCube DSS. At the top, a large orange banner contains the title "SafetyCube - the European Road Safety Decision Support System" in white text. Below this, the logo "SafetyCube DSS" is shown next to a stylized orange cube icon, followed by the text "European Road Safety Decision Support System". A navigation bar with five tabs is visible: "Search", "Knowledge", "Calculator", "Methodology", and "Support". Below the navigation bar, a paragraph of text describes the system's purpose and provides a link to a "Quick Guide". At the bottom, there are five image-based tiles with labels: "Keyword Search" (a person on a road), "Risk Factors" (a speedometer), "Measures" (a road sign), "Road User Groups" (a cyclist and pedestrian), and "Accident Categories" (a road surface with red splatters).

European Commission 3rd mobility package (May 2018)

VEHICLE SAFETY

The Commission proposes to make the following safety and driver assistance features mandatory:



- INTELLIGENT SPEED ASSISTANCE
- REVERSING DETECTION AND REVERSING CAMERA
- DRIVER DISTRACTION AND DROWSINESS RECOGNITION



- LANE KEEPING ASSISTANCE
- ADVANCED EMERGENCY BRAKING



- DIRECT VISION REQUIREMENTS
- PEDESTRIAN/CYCLISTS DETECTION

INFRASTRUCTURE SAFETY

The Commission proposes to **update the European rules on infrastructure safety management**:



- SCOPE EXTENDED BEYOND MOTORWAYS
Only 8% of fatalities occur on motorways, while 39% happen on primary/main roads.
- NETWORK-WIDE RISK MAPPING
- REINFORCED PROVISIONS FOR VULNERABLE ROAD USERS

EXPECTED IMPACT (2020-2030):

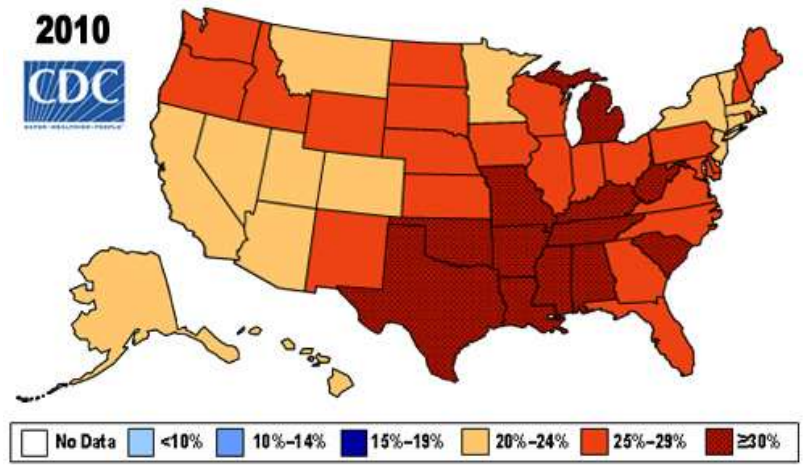
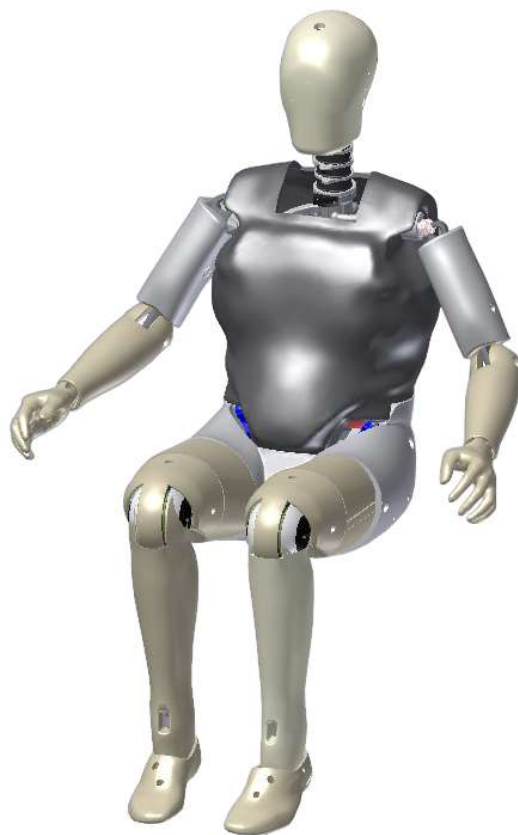
7,300
lives saved

38,900
serious injuries avoided

3,200
lives saved

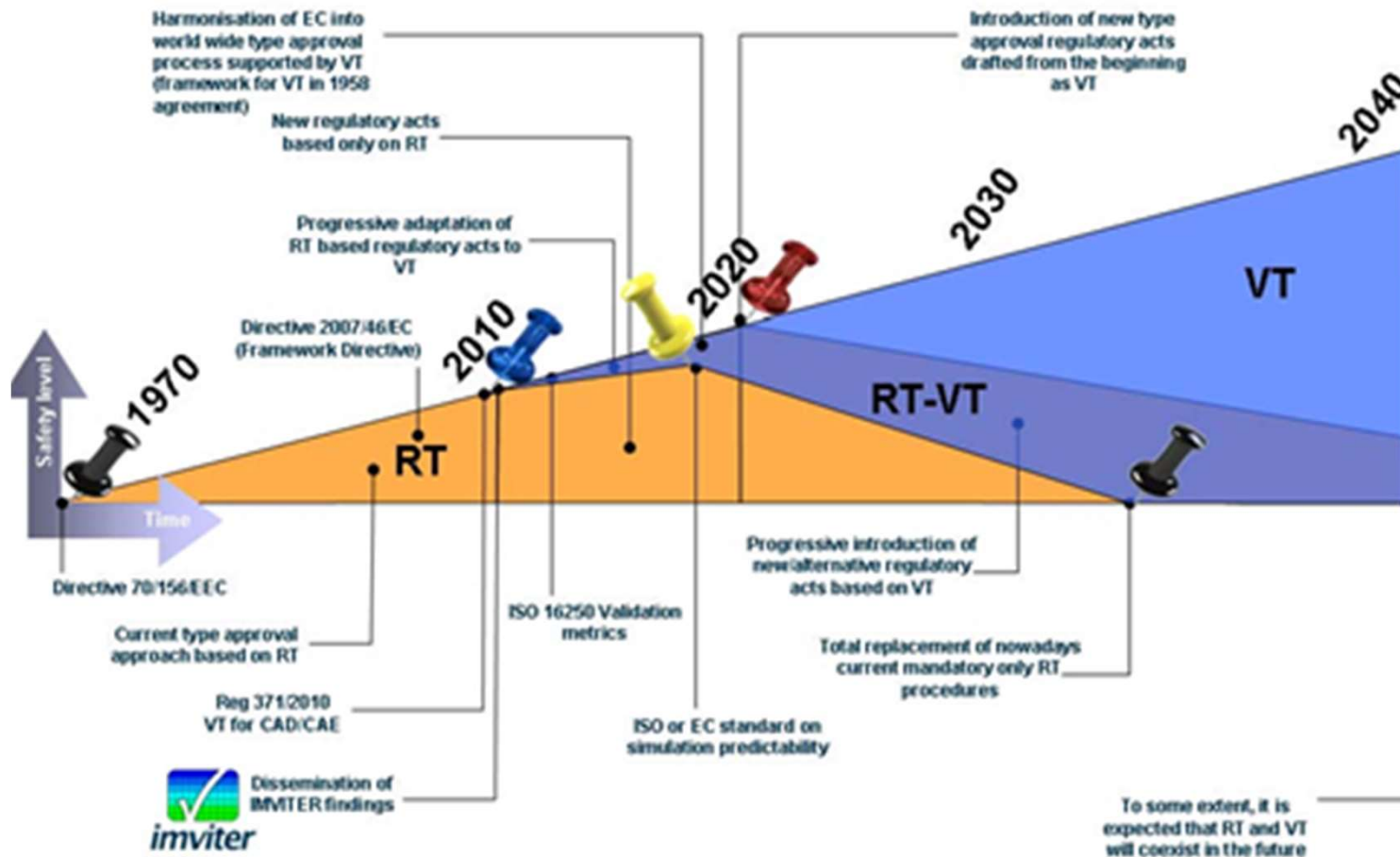
20,700
serious injuries avoided

The future of crash dummies



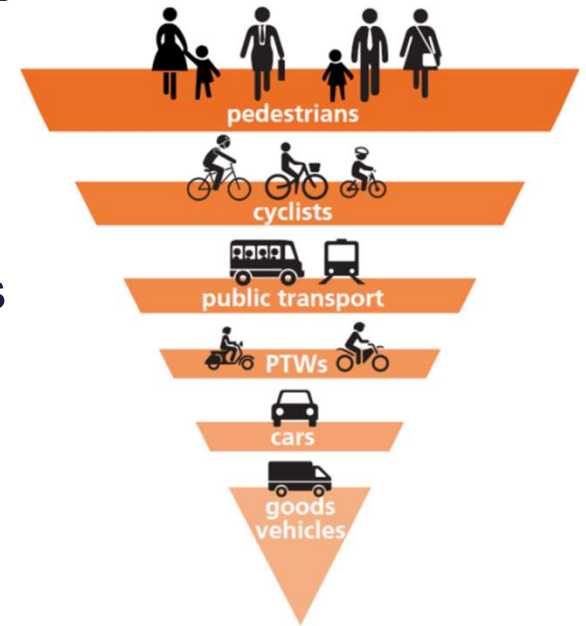
For computer modelling the big challenge is implementation in a regulatory environment

Roadmap for VT implementation



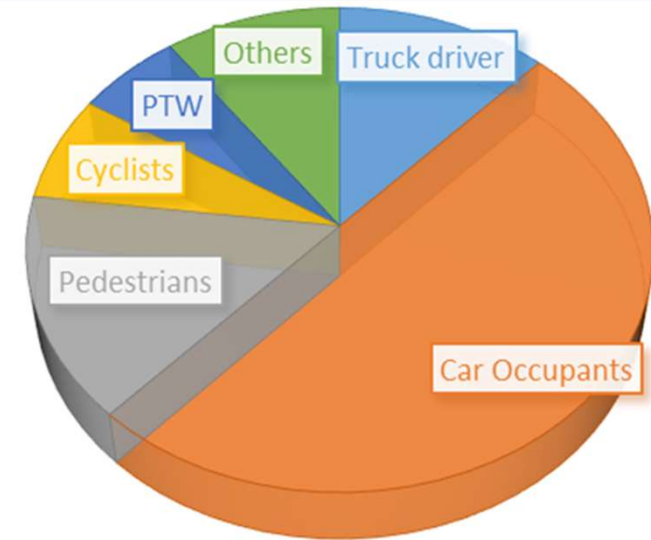
Concluding remarks

- Next to further improvements in vehicle safety (incl. automate driving), prioritization should be given to vulnerable road users like separate lanes for Non-Motorized Traffic (NMT), helmets usage for pedal bikes and in particular also helmets for e-bikes
- Very important also is better and safer public transport in particular also in view of elderly road users. Note that public transport is > 10 times safer than cars per km travelled.
- Measures to improve motorcycle safety like ABS, helmets, protective clothing, visibility and most important: Intelligent Speed Adaption (ISA)

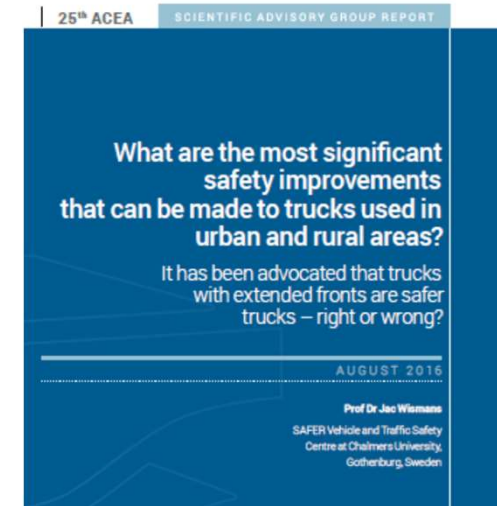


Concluding remarks (Cont.)

- Truck safety in crashes with other road users in Europe in 2011, 4974 of all fatalities (20%) are in collisions with heavy (> 3.5 tons) trucks (17%) and busses and coaches (3%).
- Measures for trucks include blind spots, compatibility with other road users, EA fronts, ISA etc.



Scania Crash Zone Concept



Thanks for your attention



3RD GLOBAL
MINISTERIAL CONFERENCE
ON **ROAD SAFETY**

**ACHIEVING
GLOBAL GOALS
STOCKHOLM
19-20 FEB 2020**