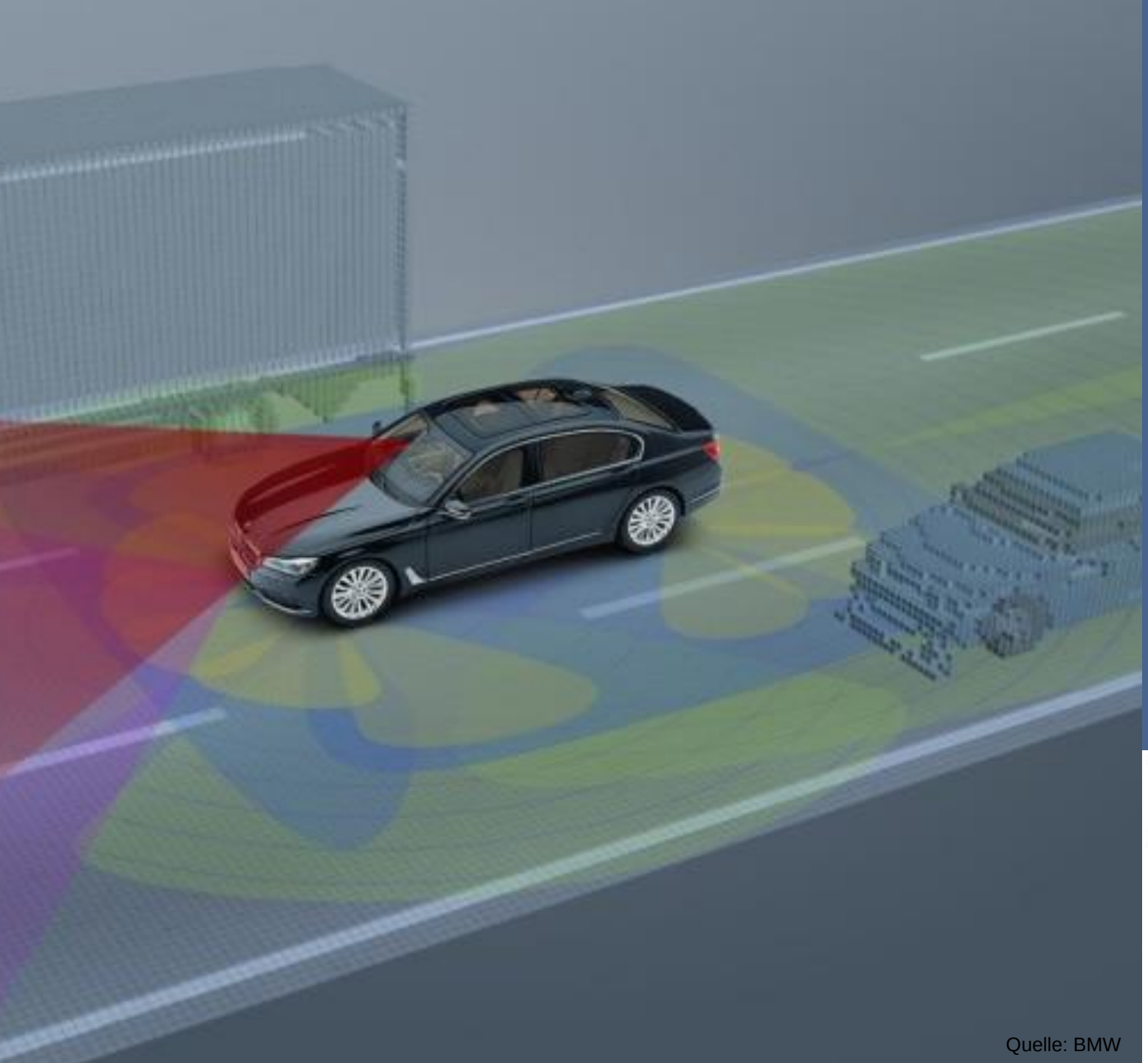


Quelle: BMW

ADAS AND AUTOMATED DRIVING FUNCTIONS

IMPACT POTENTIALS, CHALLENGES AND SOLUTIONS FROM THE POINT OF VIEW OF THE AZT

Dr. Johann Gwehenberger
Dr. Christoph Lauterwasser
Marcel Borrack

AZT Automotive GmbH

VISION ZERO.
Keiner kommt um. Alle kommen an.

Allianz

CONTENT

01 AZT IN-DEPTH ANALYSIS
- METHODS
- RESULTS

02 GDV-STUDY
- EXPERT GROUP
- METHOD
- RESULTS

03 NEW CHALLENGES AND RISKS WITH AUTOMATED DRIVING

04 VISION ZERO – LESSONS LEARNED?

MOTIVATION

Keiner kommt um. Alle kommen an. (Deutscher Verkehrssicherheitsrat)

„Automated Driving will improve Road Safety significantly.“ (Lemmer, 2016)

→ What is the Safety Benefit of ADAS and Automated Driving Functions?

ALLIANZ CENTER FOR TECHNOLOGY – ACCIDENT RESEARCH

Cooperation with OEMs and Suppliers

...

Research projects/ field tests/ queries / ADAS tests

- Research projects
- Mobileye field test
- AZT fleet

Market observation relating the development of safety systems

- Driver Assistance Systems
- Automated Driving
- C2x Communication

Scientific cooperation with Universities

- Diploma-, Bachelor-, Master-, Doctor Thesis's

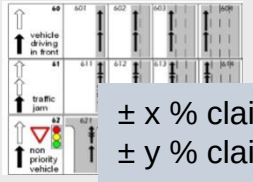
Development of in-depth claim data bases

- TPL claims
- MoD claims

Bodies and labor work

Potential and efficiency analyses of ADAS

- Support for the underwriting
- Risk evaluation

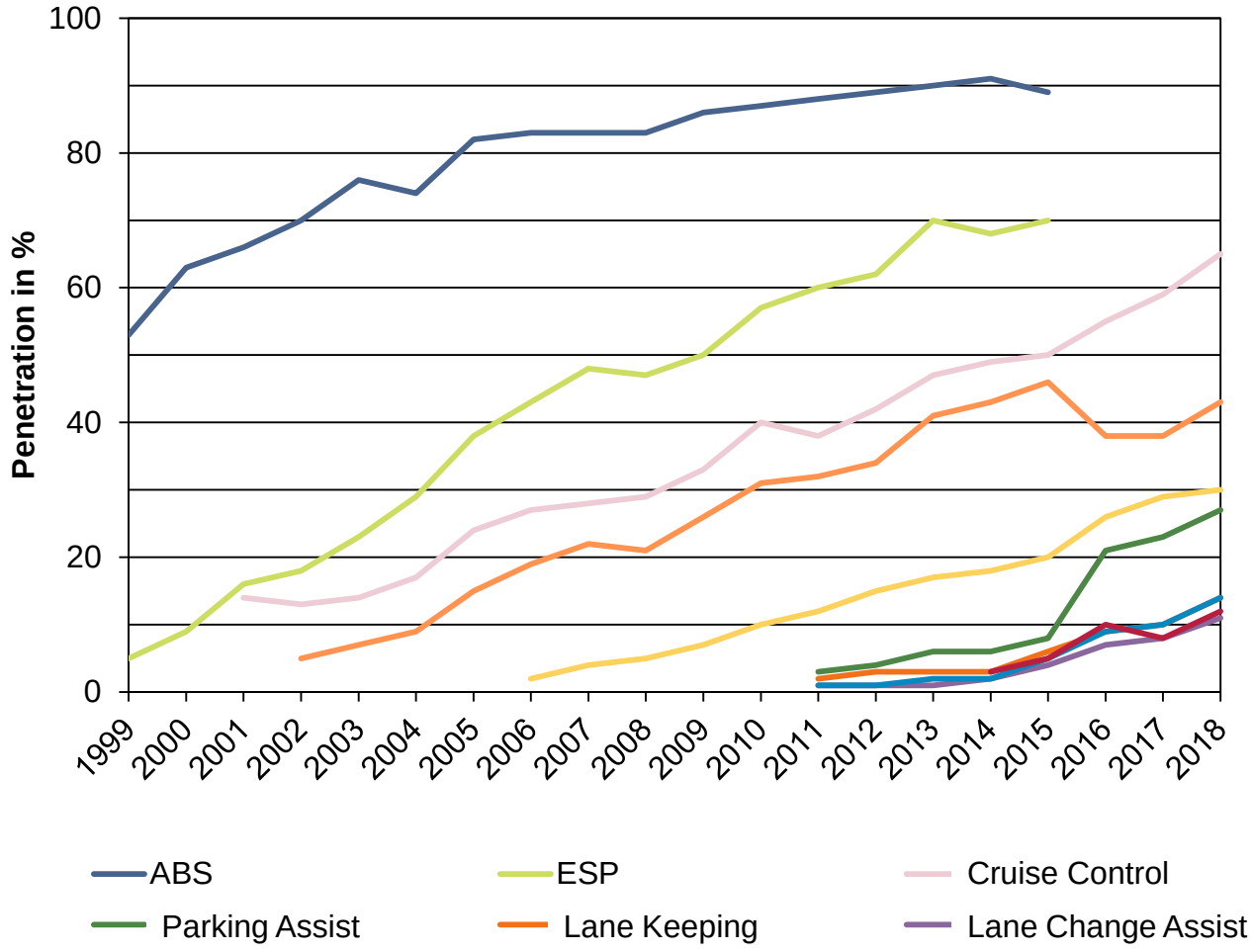


± x % claims
± y % claim costs

Education / presentation / knowledge transfer

- Internal courses for AZ experts
- Consulting of underwriting, claim department, actuaries
- Cooperation with Risk-Management for fleets

MARKET PENETRATION OF ADAS RELATED TO VEHICLE STOCK IN GERMANY

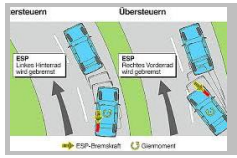
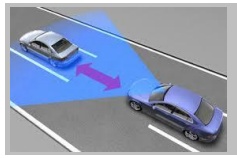
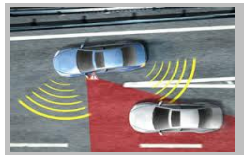
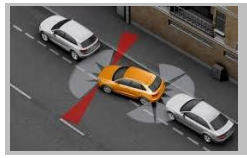


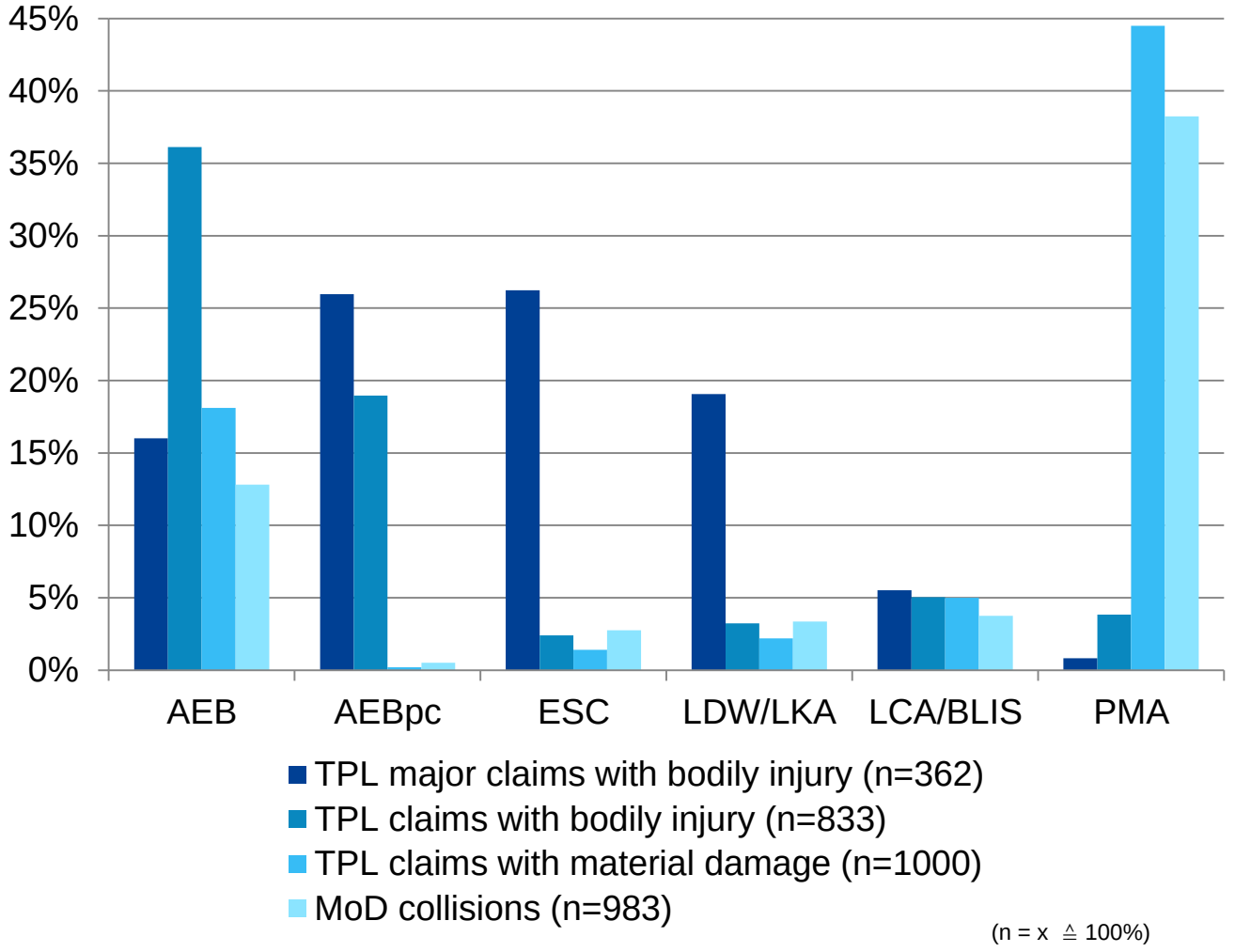
[DAT-Report, 2000-2019]

RELEVANCE OF ADAS

= **theoretical maximum** accident avoidance potential only for a perfect system!

Passenger car insurance claims

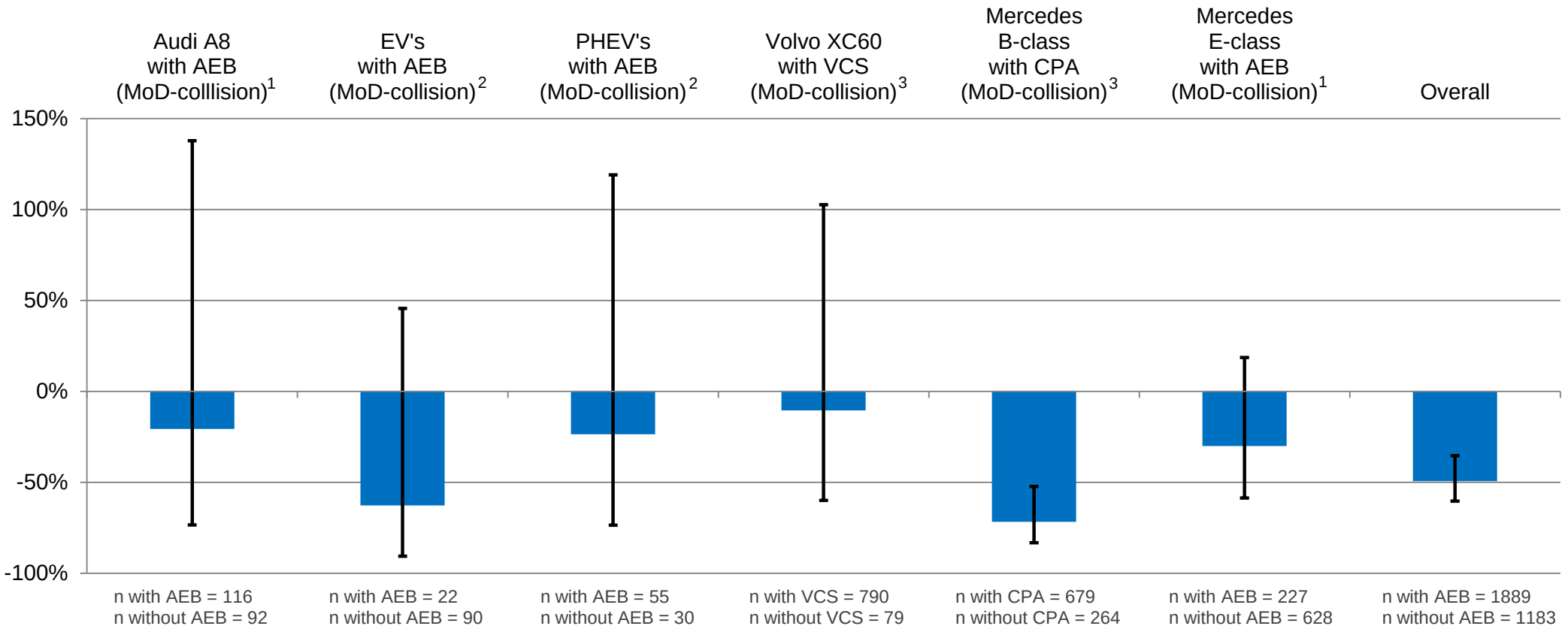
ESC		Electronic Stability Control
AEB		Autonomous Emergency Braking for Longitudinal Traffic ahead only
AEBpc		Autonomous Emergency Braking for Pedestrians and Cyclists ahead only
LDW/LKA		Lane Departure Warning Lane Keeping Assist
LCA/BLIS		Lane Change Assist Blind Spot Detection
PMA		Parking and Maneuvering Assist



(n = x ≙ 100%)

TPL: Third Party Liability
MoD: Motor own Damage

OVERVIEW OF EFFICIENCY STUDIES RELATING THE REDUCTION IN NUMBER OF REAR-END COLLISIONS DUE TO DIFFERENT CRASH AVOIDANCE SYSTEMS



Sources:
AZT-Studies 2016, 2017

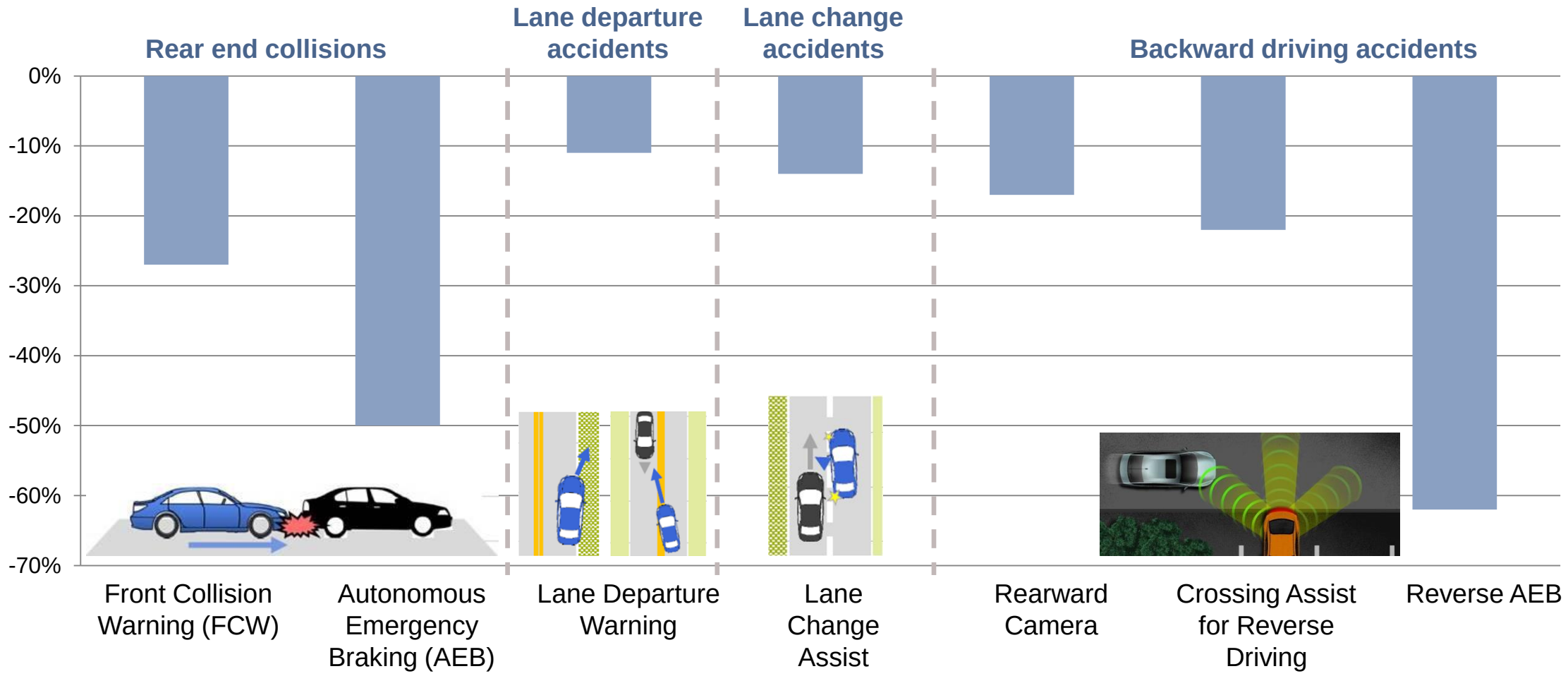
Abbreviations:
MoD: Motor own Damage
AEB: Autonomous Emergency Braking
EV: Electric-Vehicle
PHEV: Plug-In-Hybrid-Electric-Vehicle
CPA: Mercedes Collision Prevention Assist
VCS: Volvo City Safety

Note: A direct comparison or ranking between efficiency studies of different crash avoidance systems is not possible due to e.g. small sample sizes, different driver clientele, different baseline groups and different analysis methods.

[1] Comparison with the same vehicle model without system
[2] Comparison with EV's/PHEV's without system
[3] Comparison with vehicle models of same vehicle class without system

ADAS – Efficiency Study in US

US: Frequency of relevant accidents decreases (comparison vehicle with/without ADAS)



Database: police registered accidents and insurance claims in US

IIHS Insurance Institute for Highway Safety

[IIHS, 2018]

GDV-STUDY

02

KPMG

GIBT ES EINE ZUKUNFT FÜR DIE KFZ-VERSICHERUNG?

Von durchschnittlich 1.250 US-Dollar jährlichem Versicherungsaufwand pro Fahrzeug bleiben beim flächendeckenden Einsatz von Technologie zum Autonomen Fahren in diesem Szenario 250 US-Dollar übrig, gerade einmal 20 Prozent. Dies ist ein radikaler Blick auf das

INSURANCE JOURNAL

Auto Insurance Market to Shrink 60% by 2040: KPMG

Driverless vehicles | + Add to myFT

Technology poised to drive down car insurance premiums

Insurers should brace themselves for a drop of up to 80 per cent in car insurance premiums as technology disrupts one of the mainstays of the industry, according to research from Boston Consulting Group and Morgan Stanley.

Autonome Autos: Versicherungen drohen Milliardenverluste

Self-Driving Cars to Cut U.S. Insurance Premiums 40%, Aon Says

McKinsey&Company

Automotive revolution – perspective towards 2030

Up to 90% lower average crash repair per autonomous vehicle

SPIEGEL ONLINE

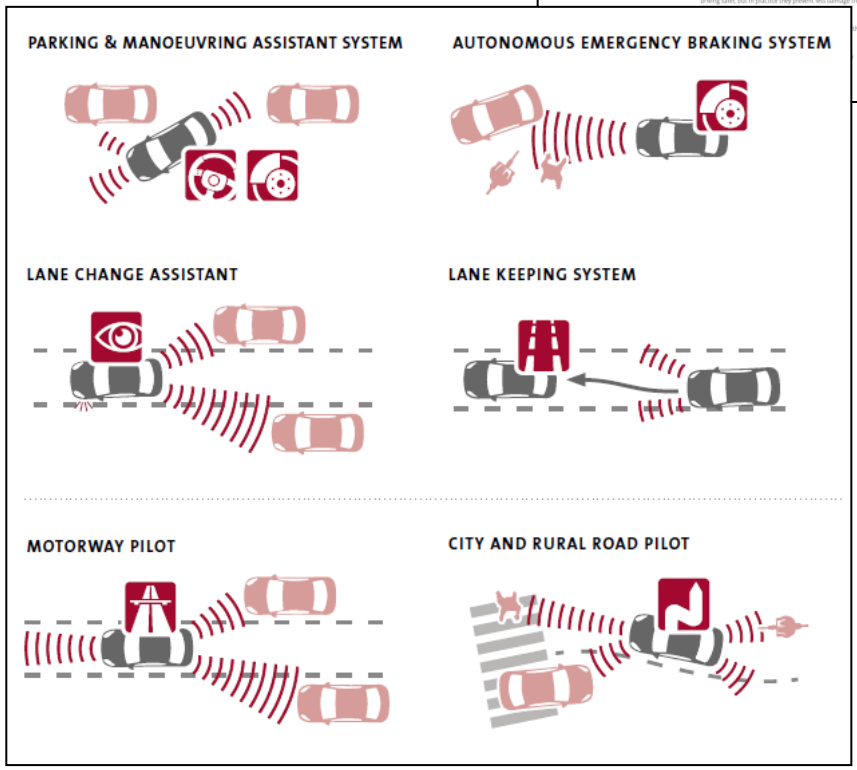
Autonome Autos

Jetzt fährt's los

GDV-STUDY “AUTOMATED DRIVING”

STATUS QUO, OBJECTIVES AND TASKS OF THE GDV WORK GROUP

- Prognosis of the effectiveness of advanced driver assistance systems (ADAS) and highly automated driving functions (HAF) and impact on claims payments up to 2035
- Basis: Current research results of the Allianz Center for Technology (AZT) and the German Insurers Accident Research (UDV)
- Consideration of Motor Third Party Liability (TPL) and Motor own Damage (MoD) for passenger cars, trucks and buses
- Not all damages can be influenced by ADAS/HAF (e.g. limits of sensor technology, partial motor own damage losses: theft, hailstorm…)
- With HAF like motorway pilot only a small effect is to be expected, because only 4 % of TPL claims payments due to accidents on motorways



GDV-STUDY “AUTOMATED DRIVING”

THE METHODOLOGY AT A GLANCE

Step 1: Prognosis of the loss-preventing impact of the systems

Basis: Research of the German Insurers Accident Research (UDV) and the Allianz Center for Technology (AZT)
Determination of four parameters for each individual ADAS/HAF

- **Relevance:** Proportion of the total claims burden that could be **maximally avoided in theory**
- **Efficiency:** Proportion of the maximum avoidable (=relevant) damage under real conditions in road traffic
- **Utilization:** Indicates how often drivers use an existing system
- **Market penetration:** Proportion of vehicles with ADAS/HAF in vehicle stock

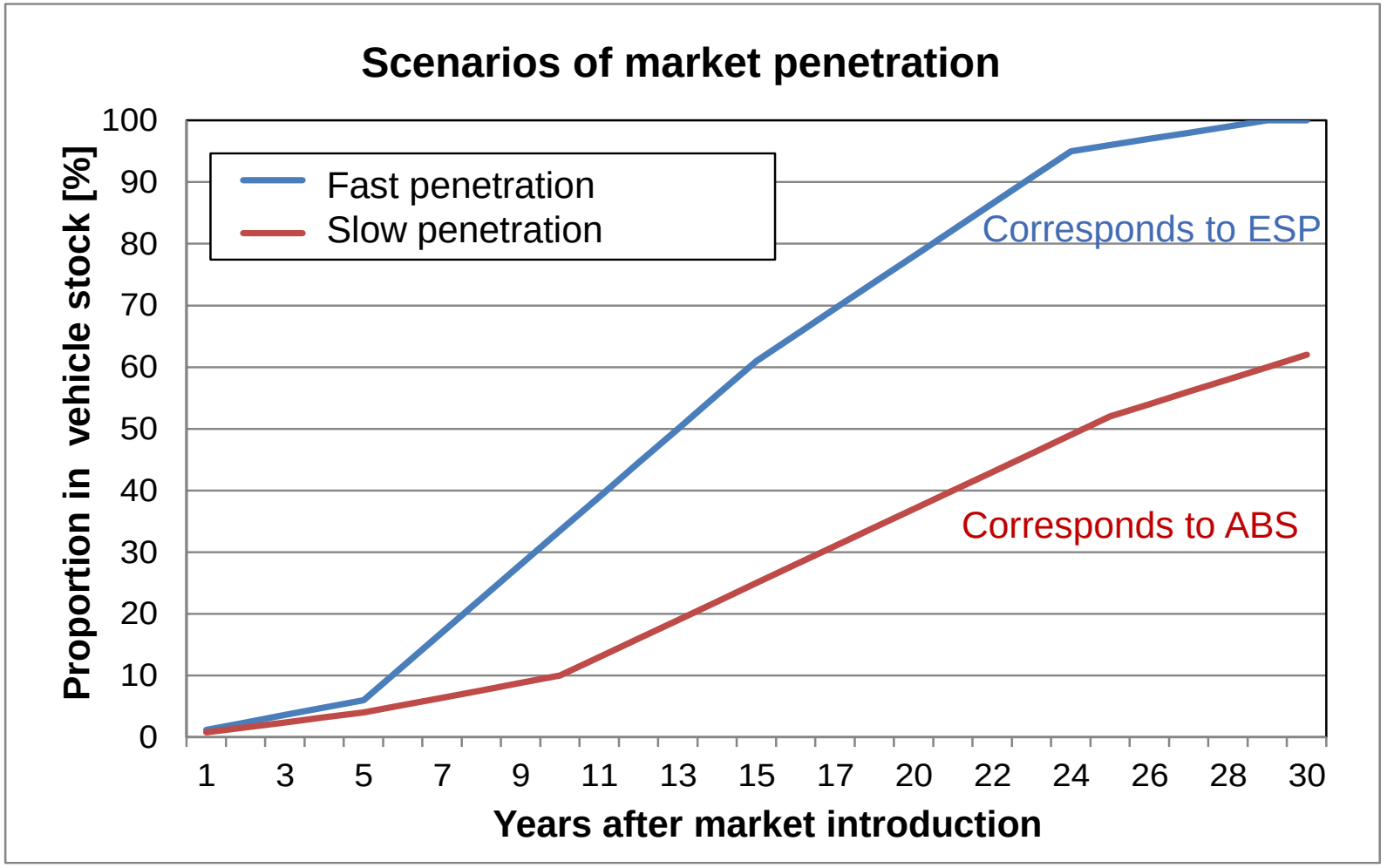
By multiplying these four parameters, we can calculate the actual expectable claims reduction in the year 20XX

Relevance	x	Efficiency	x	Utilization	x	Market Penetration	=	**Reduction**
16%	x	70%	x	90%	x	37/78%	=	**3.7/7.9%**

Example in MoD: Parking and Manoeuvring Assistant

GDV-STUDY “AUTOMATED DRIVING”

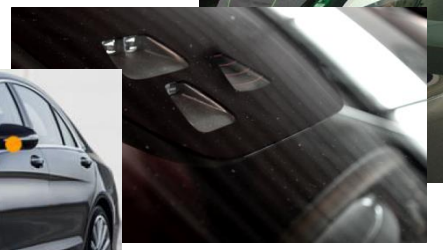
MARKET PENETRATION - PASSENGER CARS



GDV-STUDY “AUTOMATED DRIVING”
THE METHODOLOGY AT A GLANCE

Step 2: Estimation of the development of repair costs

•ADAS/HAF require installation of additional technology on vehicles, which cause higher repair costs in the event of damage

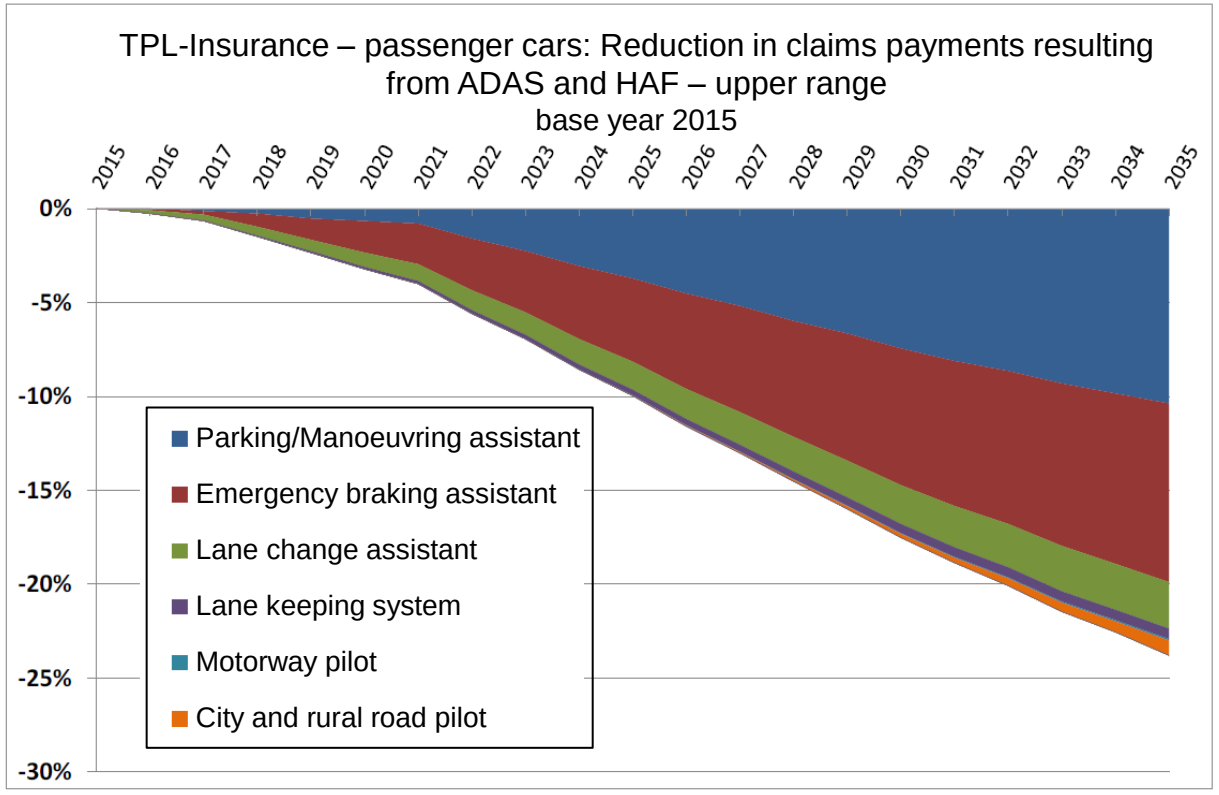


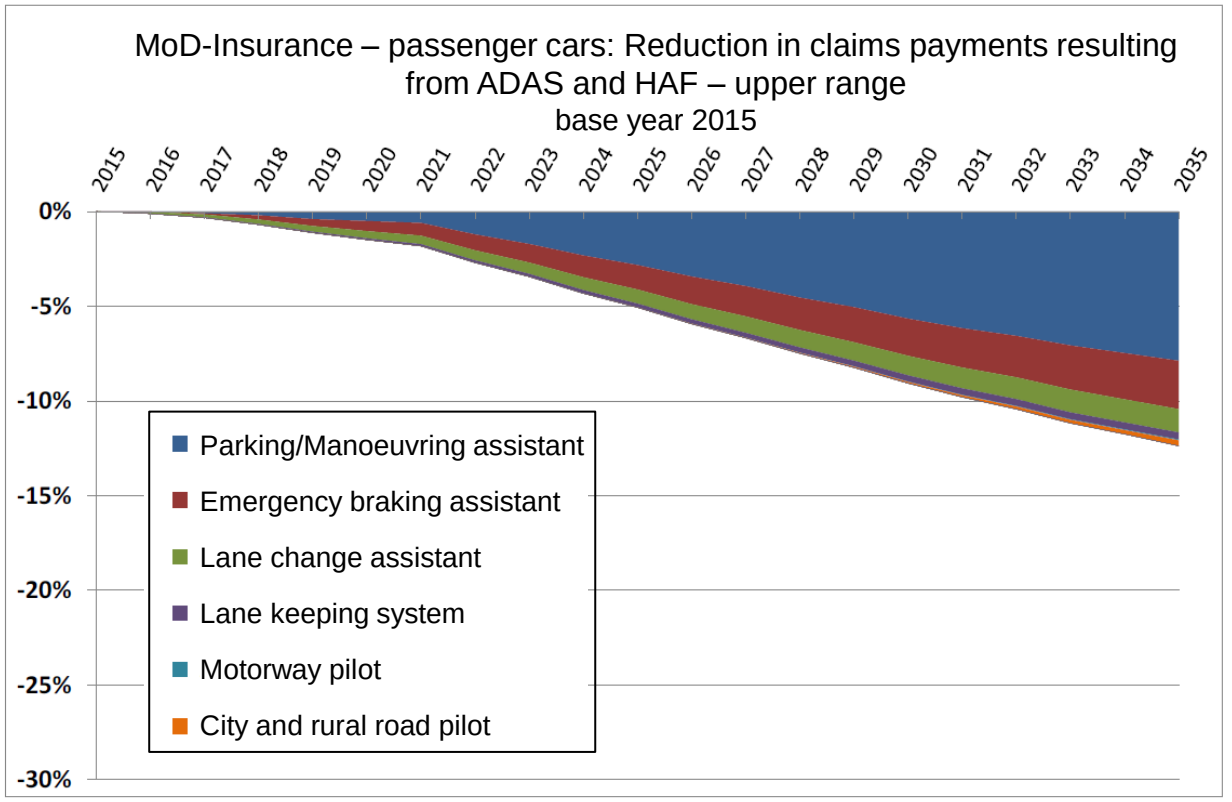
Step 3: Passenger car vehicle stock development in germany up to 2035

•Prediction is based on the study „Shell passenger car scenarios up to 2040“

GDV-STUDY „AUTOMATED DRIVING“

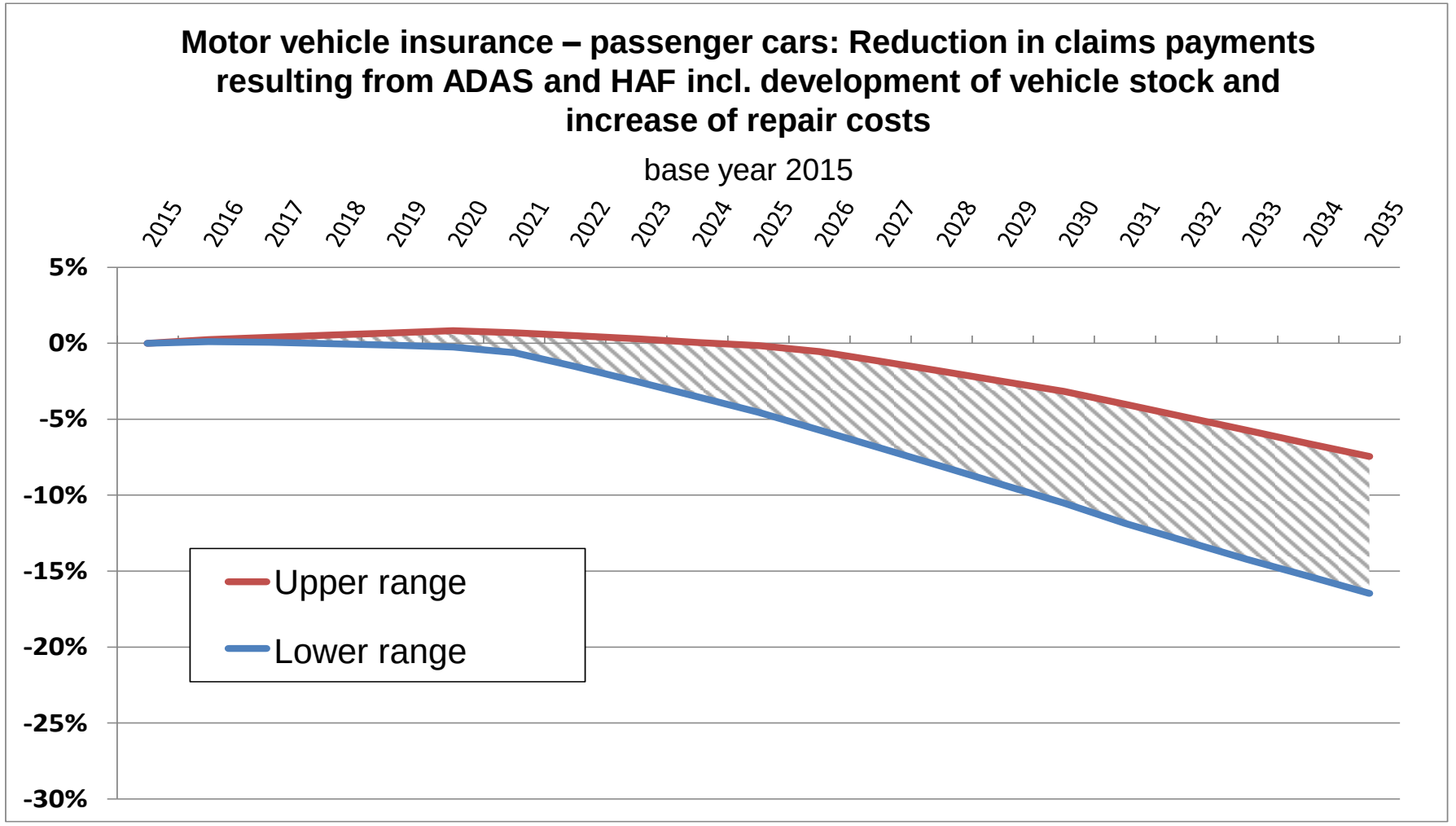
RESULTS AT A GLANCE





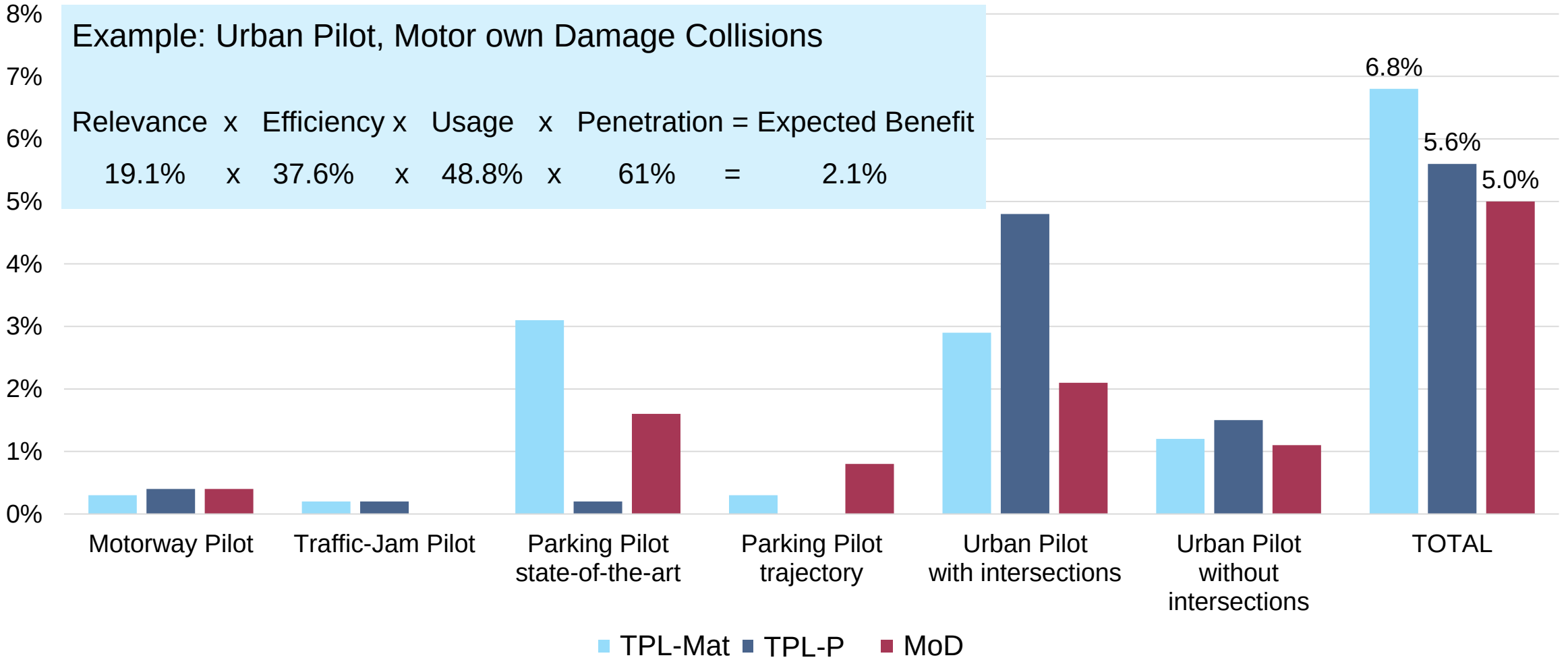
GDV-STUDY „AUTOMATED DRIVING“

RESULTS AT A GLANCE



EXPECTED BENEFIT OF L3+ FUNCTIONS

20 YEARS AFTER MARKET INTRODUCTION

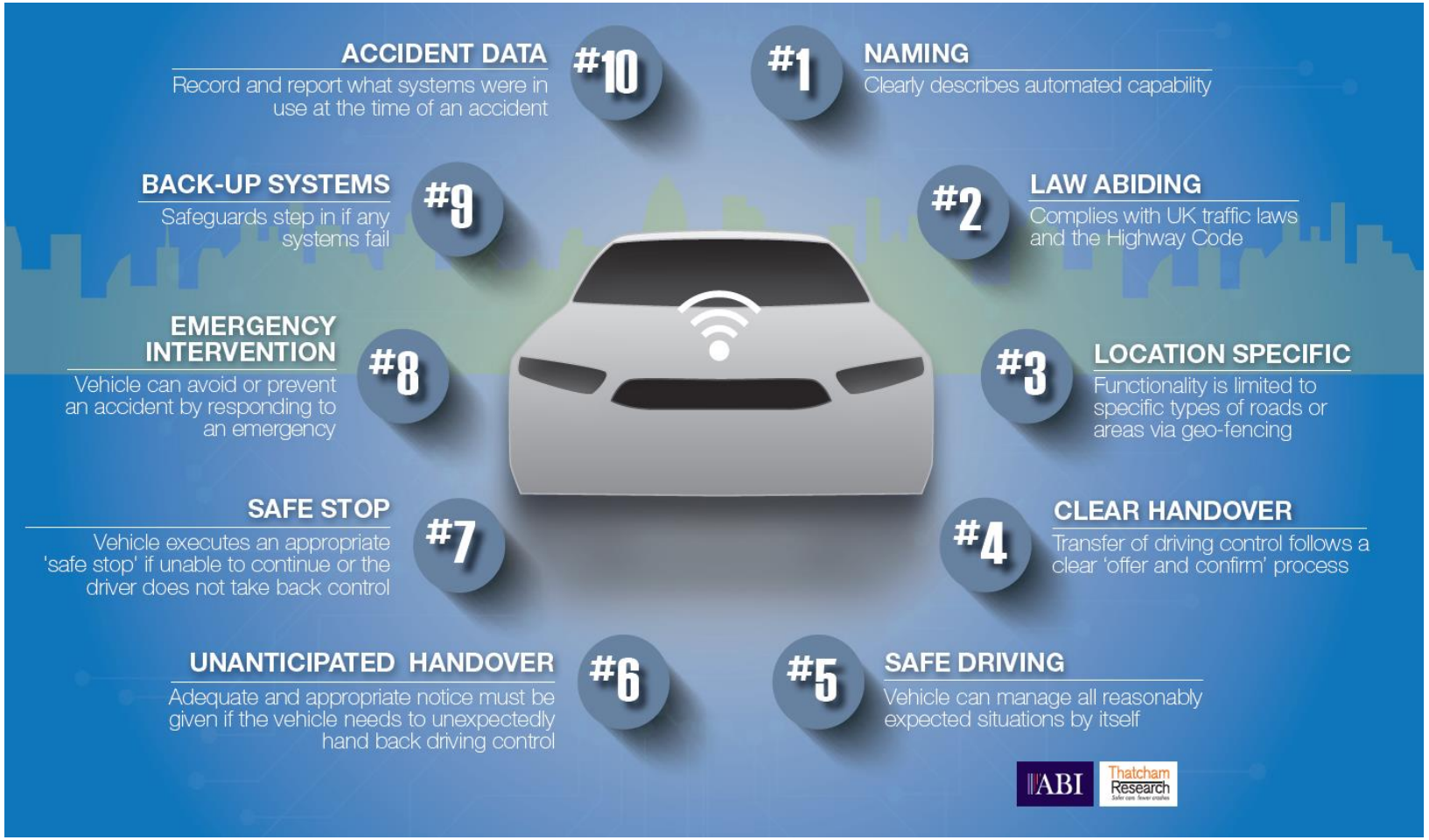


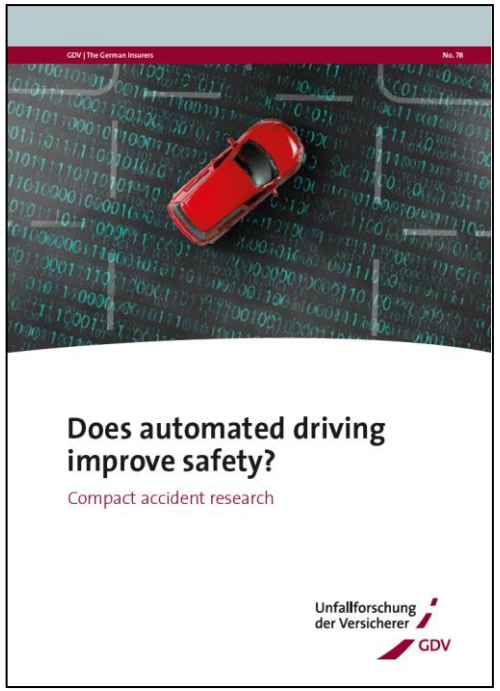
Source: Ostermaier, AZT/TUM

NEW CHALLENGES AND RISKS

03

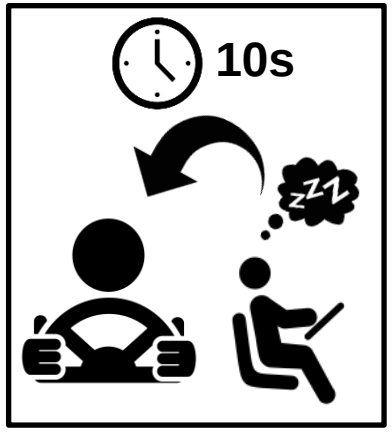
MACHINE VS. DRIVER: MINIMUM CRITERIA FOR AUTOMATED SYSTEMS (LEVELS 3/4)



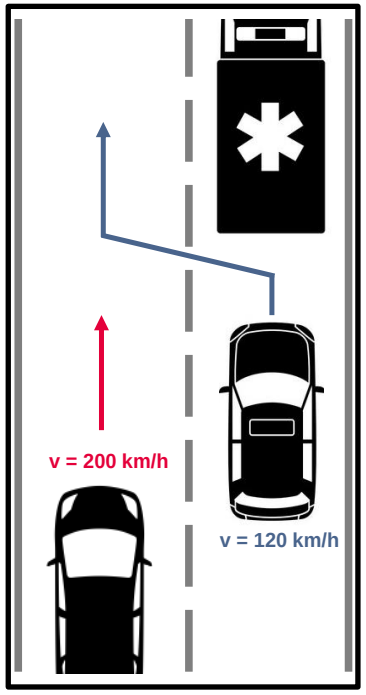


CRITICAL SCENARIOS

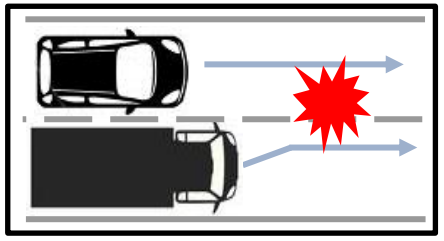
Transition of task



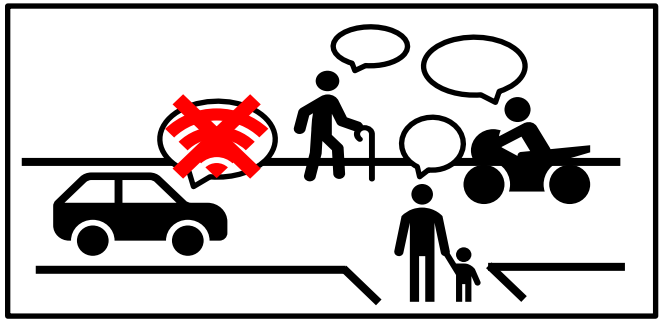
Lane change



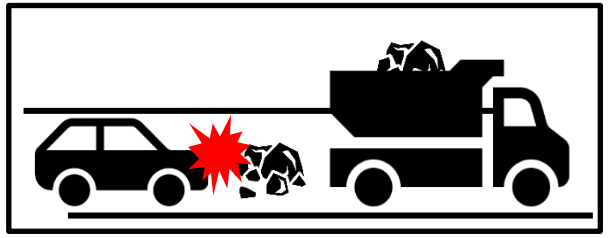
Transversely offset



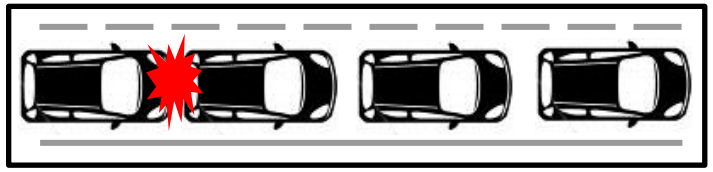
Interaction with traffic participants



Obstacle

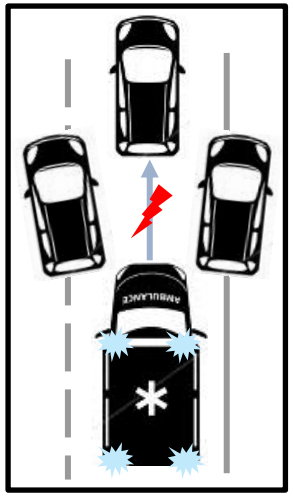


Convoy drive



Environmental conditions

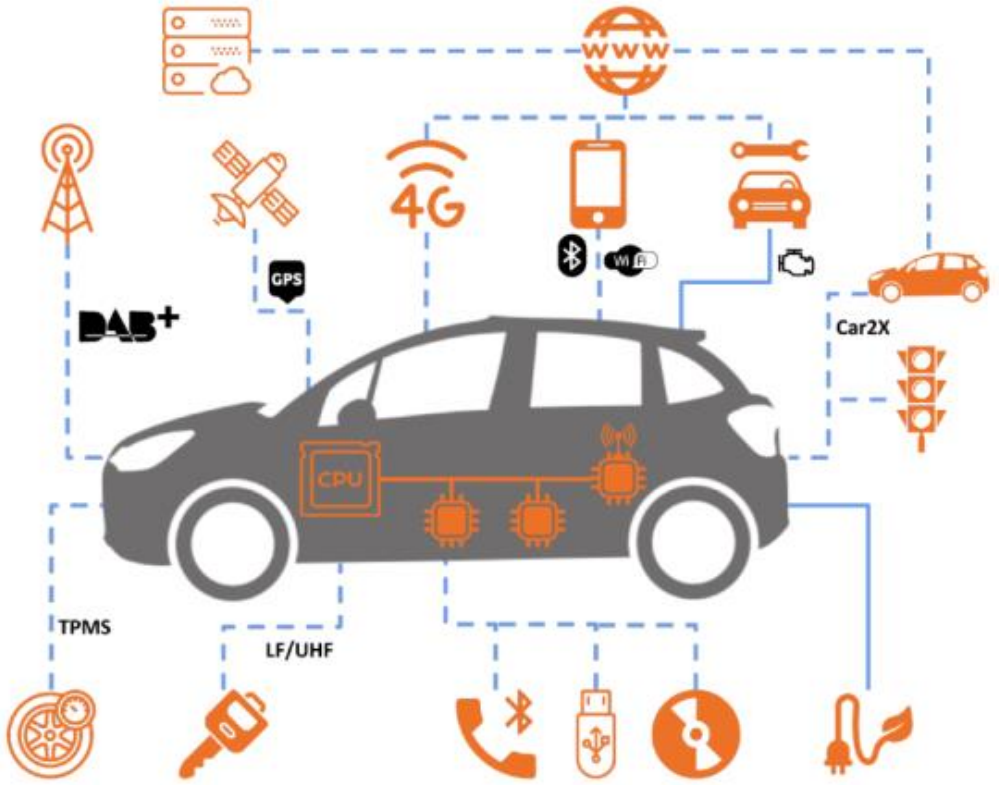
Rescue alley



(Workshop of August 22nd 2018)

IT SECURITY OF VEHICLES

- AZT project with partners (OTH Regensburg / Fraunhofer SIT)
- Risks of telematics devices based on OBD2: significant weaknesses:
  - Data and vehicle security compromised
  - Scalable attack on fleets
- Connected cars under investigation
- IT security throughout lifetime of a vehicle model

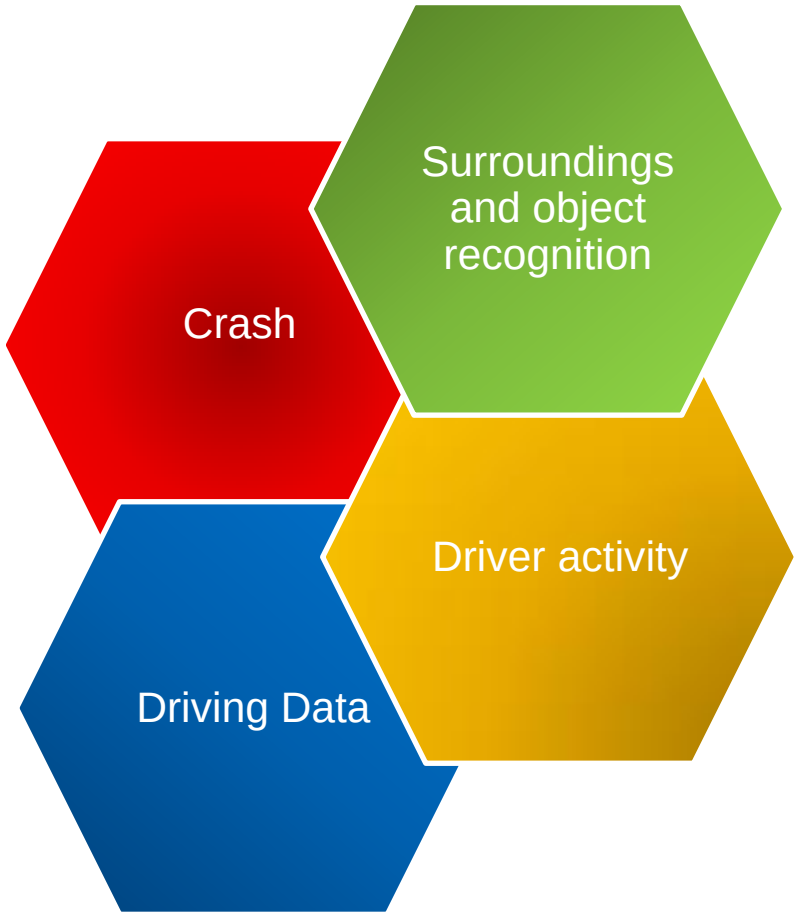


DATA MODELL ACCORDING TO AHEAD

AGGREGATED HOMOLOGATION-PROPOSAL FOR EVENT-RECORDER-DATA FOR AUTOMATED DRIVING

Targets of the working group:

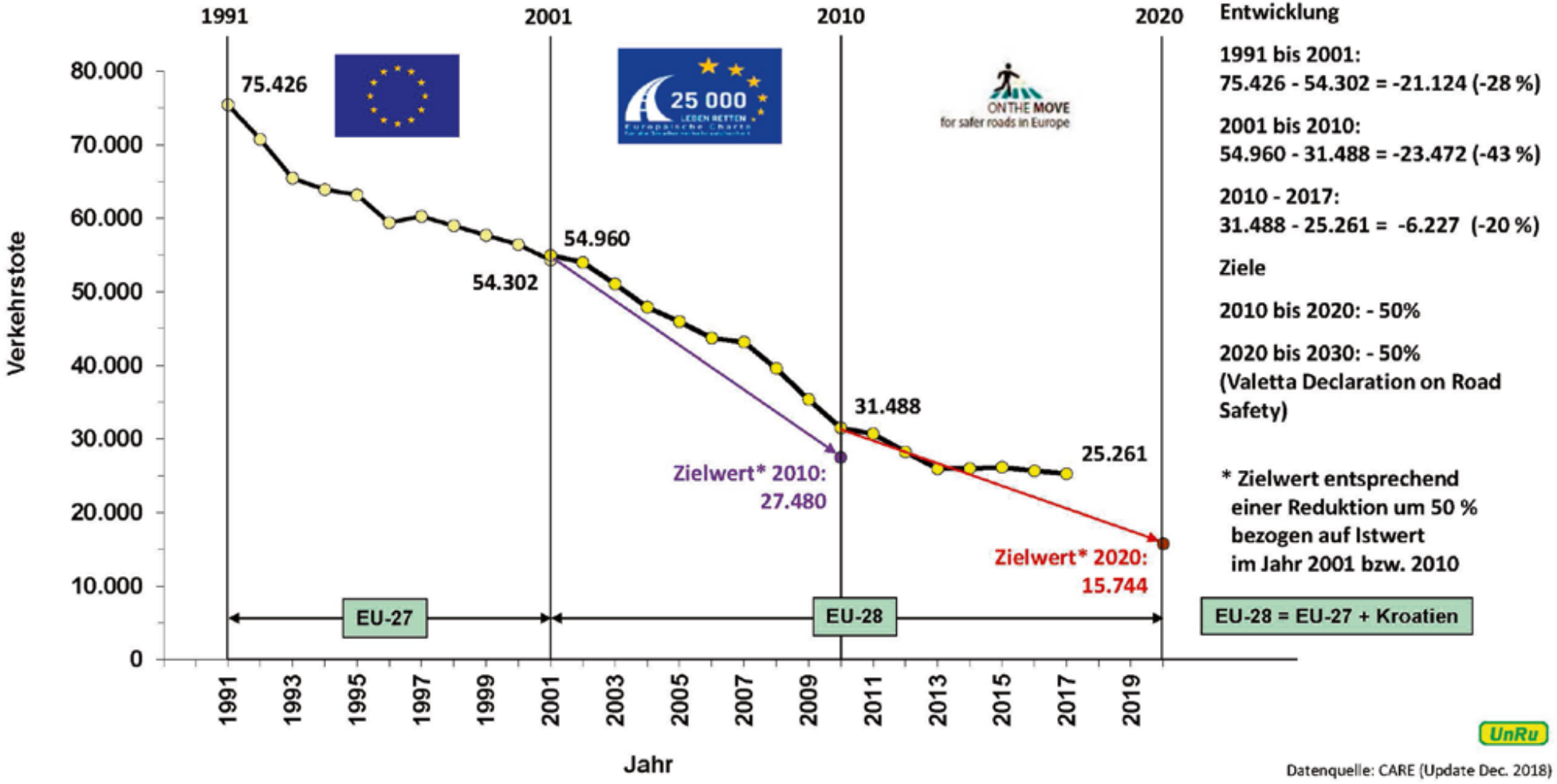
- Advance VERONICA-II results, include new technologies and create extended data elements for an EDR for highly automated driving
- Subdivision of the data elements in 4 standardized categories:
  - **Driving Data**
  - **Driver activity**
  - **Surroundings- and object recognition**
  - **Crash**
- Development of an EDR prototype for highly automated vehicles



VISION ZERO - LESSONS LEARNED?

04

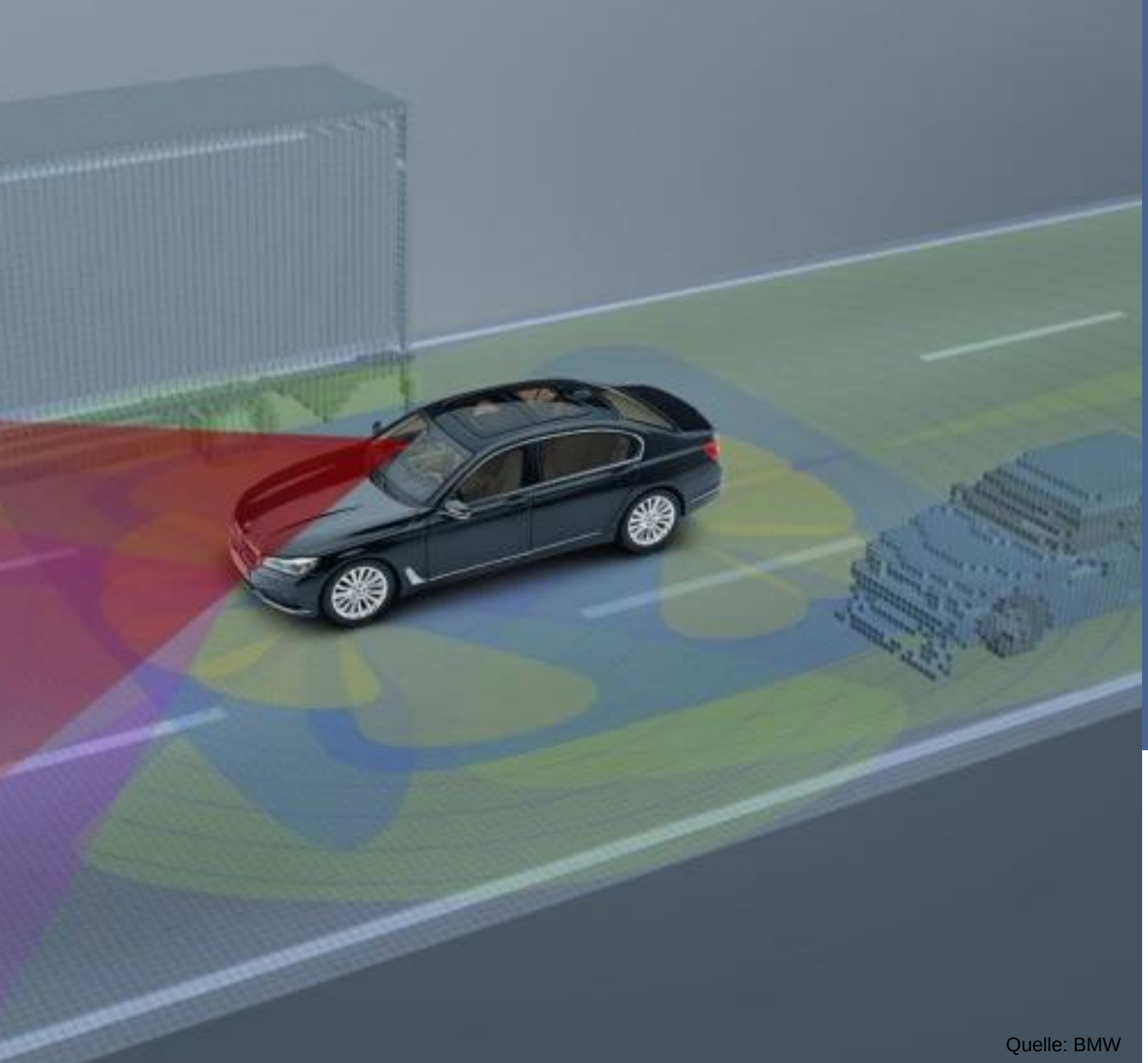
DEVELOPMENT OF THE NUMBER OF ROAD FATALITIES IN THE EUROPEAN UNION SINCE 1991



Source: Berg, VKU Heft 2/2019

LESSONS LEARNED

- It is certain that the EU goal “cutting the number of fatalities by 50 %” will be not reached
- New modes of traffic mobility coming up quickly like e.g. electro scooter or car sharing. This will most likely influence traffic safety negatively!
- ADAS have an positive impact and help to reduce severe accidents. But, there are limitations (e.g. technology, penetration rate, acceptance).
- New L3+ Functions like e.g. motorway pilot will have only a small effect as only 4 % of accidents happen on motorways. Nevertheless, the enhanced technology will help to improve safety also in further domains.
- “Vision Zero” is important and valid but should be clearly communicated as a “Vision”!
- Traffic Safety Methods have to be strengthened by all stakeholders with clear goal-orientated focus!



Quelle: BMW

THANK YOU FOR YOUR ATTENTION!

Allianz

GDV-STUDY „AUTOMATED DRIVING“

RESULTS AT A GLANCE - TPL INSURANCE: PASSENGER CARS

	Parking and manoeuvring assistant	Emergency braking assistant (EBA)	EBA incl. pedestrian and cyclist detection	Lane keeping system	Lane change assistant	Motorway pilot	City and rural road pilot
Market introduction	2017	2013	2015	2010	2011	2017	2025
Relevance in %	21	21	7	3	4	-,-	-,-
Efficiency in %	70	40	10-30	20-40	75	90[3]	90[3]
Utilization in %	90	100	100	50	90	10-50	10-50
Market penetration[1] up to 2035 in %	37 / 78	49 / 95	43 / 87	57 / 98	55 / 97	37	13
Reduction 2035 in % Compared to 2015 [2]	4.9 / 10.4	4.0 / 7.7	0.9 / 1.8	0.3 / 0.6	1.4 / 2.5	0.1 / 0.1	0.8 / 0.8

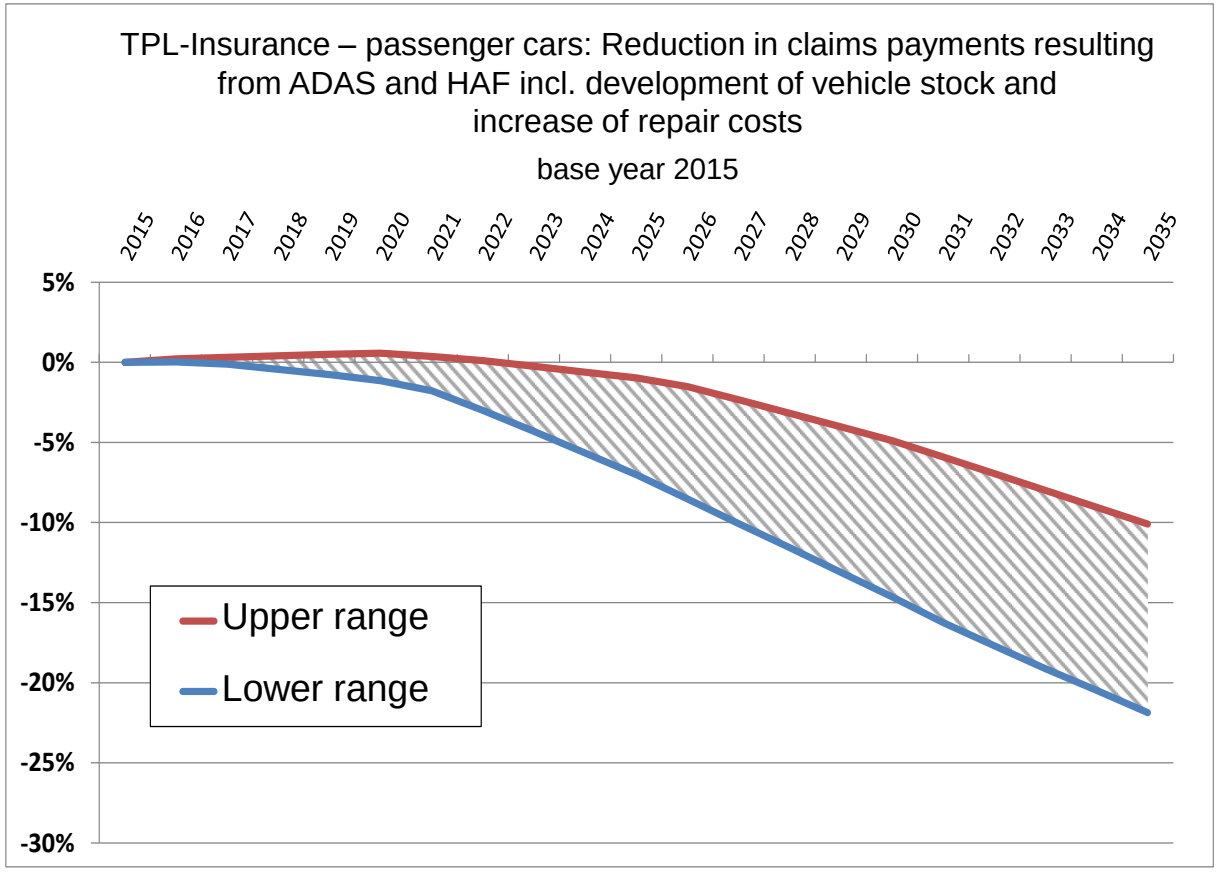
[1] Slow penetration / Fast penetration

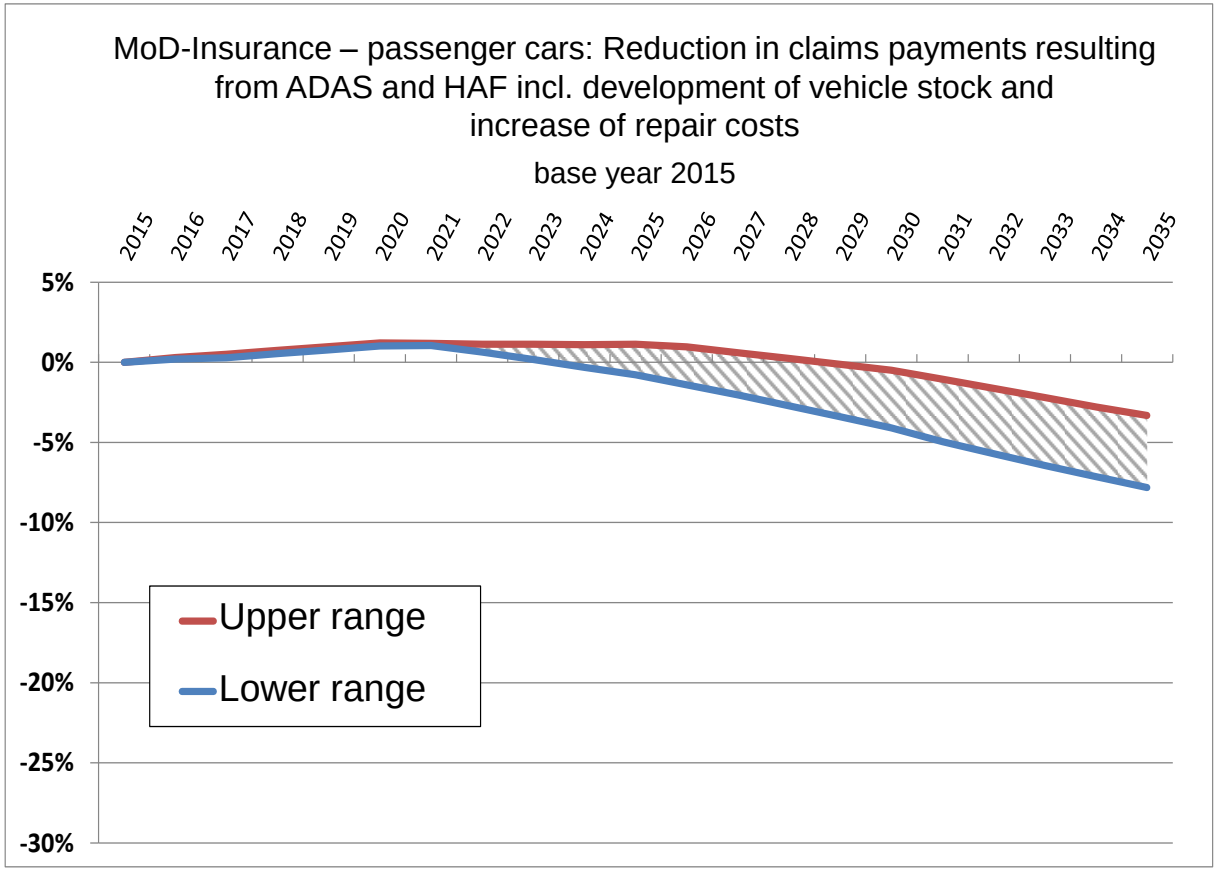
[2] Reduction potential compared to claims payments 2015 considering already available ADAS

[3] Combination of ADAS lead to efficiency increase up to 90%

GDV-STUDY „AUTOMATED DRIVING“

RESULTS AT A GLANCE





GDV-STUDY „AUTOMATED DRIVING“

RESULTS AT A GLANCE - MOD INSURANCE: PASSENGER CARS

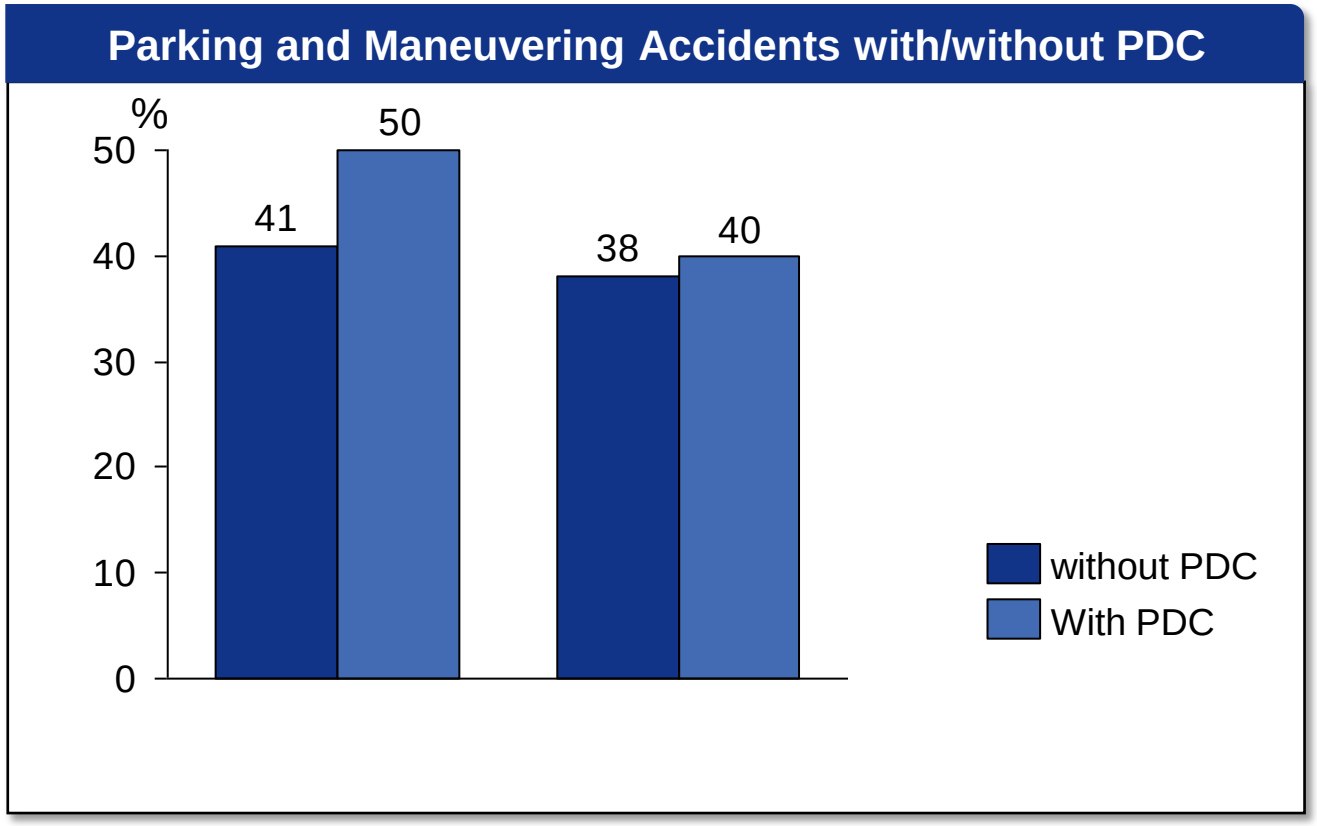
	Parking and manoeuvring assistant	Emergency braking assistant (EBA)	EBA incl. pedestrian and cyclist detection	Lane keeping system	Lane change assistant	Motorway pilot	City and rural road pilot
Market introduction	2017	2013	2015	2010	2011	2017	2025
Relevance in %	17	7	-,-	2	2	-,-	-,-
Efficiency in %	70	40	10-30	20-40	75	90[3]	90[3]
Utilization in %	90	100	100	50	90	10-50	10-50
Market penetration[1] up to 2035 in %	37 / 78	49 / 95	43 / 87	57 / 98	55 / 97	37	13
Reduction 2035 in % Compared to 2015 [2]	3.7 / 7.9	1.3 / 2.6	-,-	0.2 / 0.4	0.7 / 1.2	0.0 / 0.0	0.3 / 0.3

[1] Slow penetration / Fast penetration

[2] Reduction potential compared to claims payments 2015 considering already available ADAS.

[3] Combination of ADAS lead to efficiency increase up to 90%.

HOW EFFECTIVE ARE PARKING AND MANEUVERING ASSISTANCE SYSTEMS?

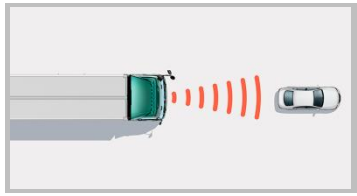
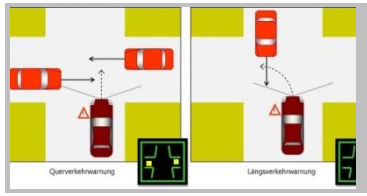
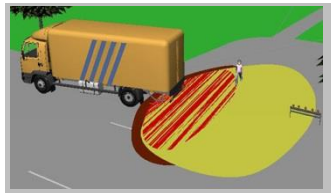


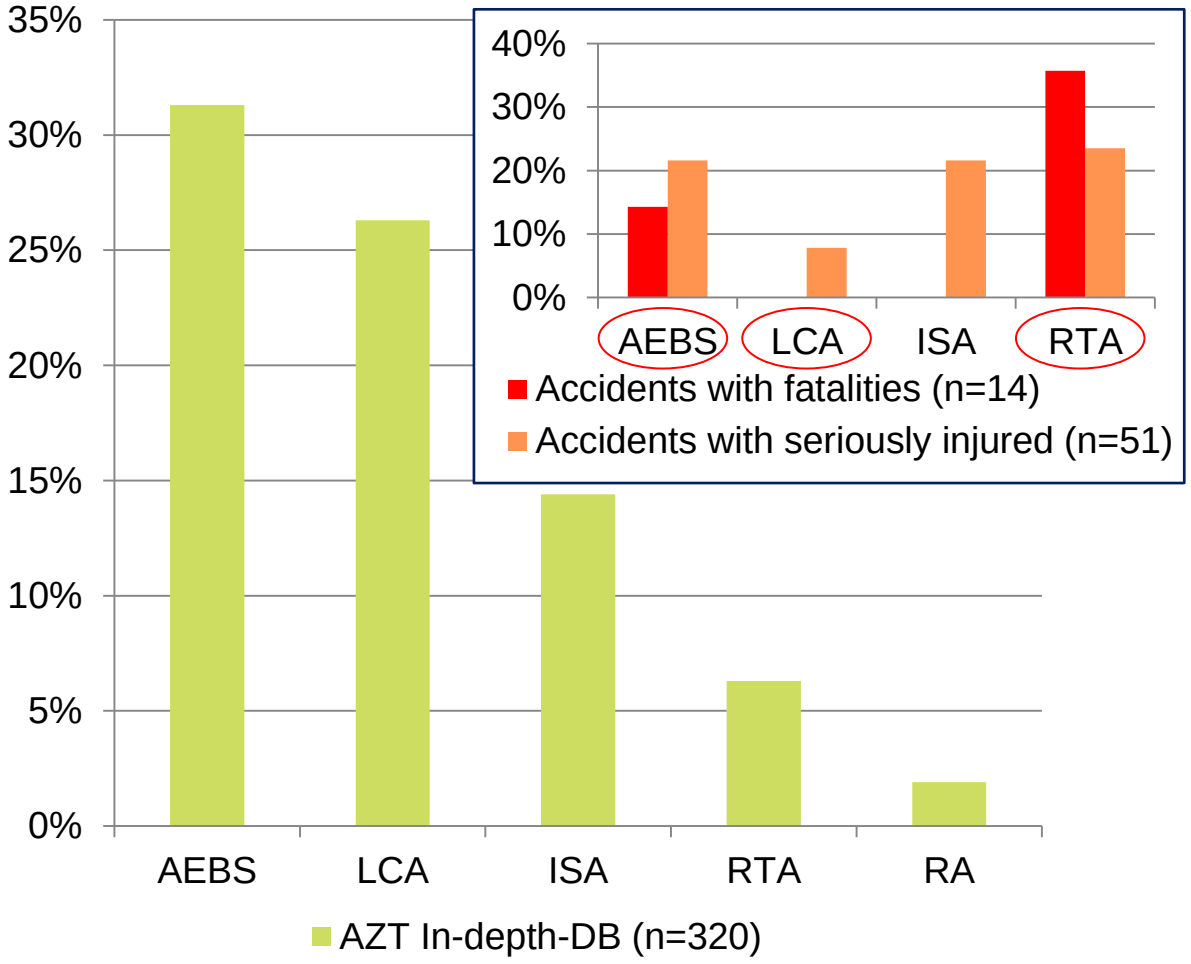
Vehicles with and without PDC have closely the same frequency of parking and maneuvering accidents

RELEVANCE OF ADAS

= **theoretical maximum** accident avoidance potential only for a perfect system!

Heavy duty truck insurance claims with bodily injury

AEBS		Advanced Emergeny Braking System
LCA		Lane Change Assist
ISA		Intersection Assist
RTA		Turning Assist (Right)
RA		Reversing Assist



(n = x ≙ 100%)