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MOTORRAD

BMW'S HOLISTIC VIEW ON MOTORCYCLE SAFETY

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MOTORCYCLE RIDERS ARE VULNERABLE ROAD USERS.

The BMW Group's safety strategy stands for an collaborative approach between motorcycle and passenger cars.

BMW Motorrad Safety Strategy

Reduction of riding errors and risks via:

- Technology
- Rider safety training
- Personal protective equipment (rider gear)



BMW Automotive Safety Strategy


Protection of Motorcycle riders:

- Accidentology including motorcycle scenarios
- Research on effectiveness of active safety systems
- Implementation of active safety systems in cars considering motorcycle specific characteristics



The BMW Group's safety strategy is an overarching safety approach which takes the interaction of passenger cars and motorcycles into account (joint working groups, combined validation and test events, development and adoption of systems).

BMW MOTORCYCLES ARE PREMIUM PRODUCTS EQUIPPED WITH STATE-OF-THE-ART SAFETY SYSTEMS.

<h2>Safe Driving</h2>	<ul style="list-style-type: none"> Rider safety training: Rider Camps (driving licence training), Safety Training, "Ride Again" Training 	
<h2>Crash Avoidance</h2>	<ul style="list-style-type: none"> DRL: Daytime Running Light ABS (Pro): Anti-lock Braking System (Professional) DTC: Dynamic Traction Control ASC: Automated Stability Control ESA: Electronic Suspension Adjustment (with damping and preload adjustment) TPM: Tire Pressure Monitor Riding modes: Road, Rain, ... (e.g. adjusted throttle response to difficult road conditions) Navigation System: Safe navigation and less driver distraction Active Cruise Control: Keeps safe distance to vehicles ahead Side View Assist: Blind Spot Detection Dynamic brake light: Detects hard deceleration and warns following vehicles 	  
<h2>Crash Protection</h2>	<ul style="list-style-type: none"> Personal Protective Equipment: Rider Crash-Protection (Helmet, suits, boots, gloves ...) 	  
<h2>Post-Crash</h2>	<ul style="list-style-type: none"> eCall: Automated emergency call, exclusive for BMW Motorrad 	

- BMW Motorrad TOP development goals: Rideability, controllability and best ergonomics.
- Constant development of new premium safety systems.

MOTORCYCLE SAFETY: ACCIDENT RESEARCH FINDINGS.

Research on Motorcycle accidents

Riding accidents:
Main cause is loss of control over the motorcycle.
Collision type accidents:
In approx. 80% the opponent is a passenger car.



Influence of the car - accident scenarios from MUSE project, GIDAS, CMC

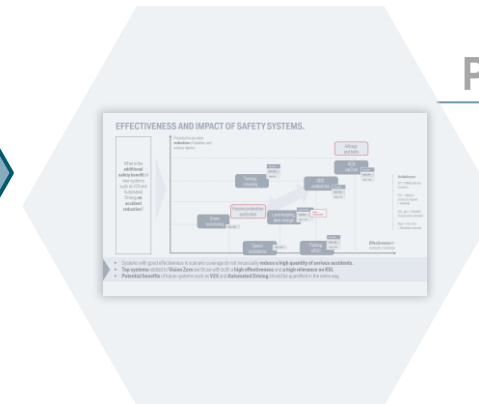


Influence of the rider

'Riders are not the same as drivers'.
1) 'High risk riders': They go to the limits of riding dynamics and vehicle technology on public roads.
→ Not reachable by legal and consumer test ratings
2) Safety oriented riders:
- Riding skills are crucial
- Technical systems need to be controlled in order to benefit
→ Certified rider safety trainings

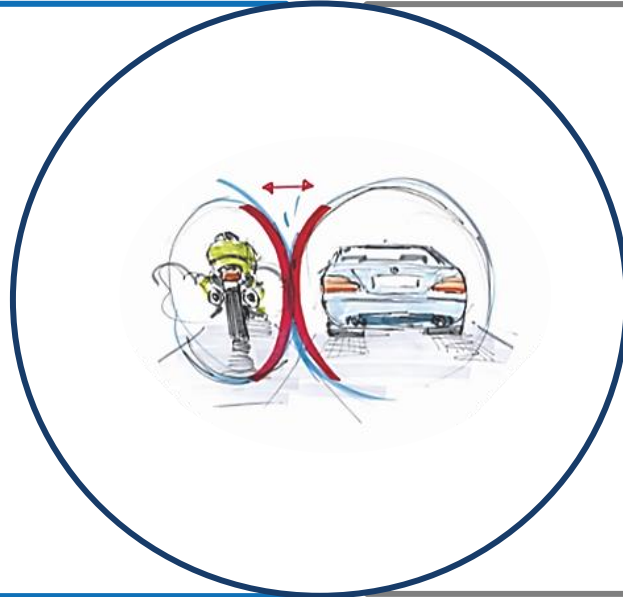


Potential und Effectiveness



- Improving riding skills through continuous rider trainings is the foundation to avoid all types of motorcycle accidents.
- Active safety systems in passenger cars do have a high potential to reduce collision accidents.

MOTORCYCLE SAFETY AND MOTORCYCLE RIDER PROTECTION.



Motorcycle Safety

Goal: To maximize real world safety
- in addition to legal and consumer test ratings
- related to Automated Driving

Motorcycle Rider Protection

- BMW Motorrad holds responsibility for Motorcycle Safety.
- BMW Vehicle Safety holds responsibility for Vehicular Safety, NCAP and Motorcycle Rider Protection.
- At BMW Group both departments are working hand in hand in order to enhance road safety.

MOTORCYCLE RIDER PROTECTION: ACCIDENT RESEARCH SHOWS THE NEED FOR ACTIVE SAFETY SYSTEMS IN PASSENGER CARS.

Accident research on motorcycle accidents



Influence of the car - accident scenarios from the projects MUSE, GIDAS, CMC

Ranking of severe collision type accidents: In most cases the accident is caused by the car driver.
 1) Crossing traffic
 2) Left turn/ farside turn

Influence of the rider



Potential und Effectiveness

Active safety functions show a high potential at crossing and turning scenarios.

MUSE: Motorbike Users Safety Enhancement
 GIDAS: German in-Depth Accident Study
 CMC: Connected Motorcycle Consortium

- More than half of the collision accidents with vehicles occur at junctions, in vast majority the car driver is the main causer.
- BMW sees the highest potential for mitigation of severe accidents in active safety systems in cars for crossing and turning.

ACCIDENT RESEARCH BASED ON EUROPEAN DATABASES SHOWS THE MAIN TYPES OF ACCIDENTS.

Results from MUSE Project

CMFtap
Use Case

1) Left Turn Across Path – Opposite Direction 16,03%, U-Types 211, 281.....

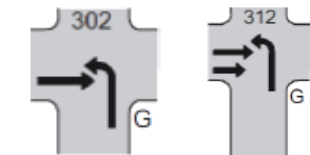


CMC
Use Case

2) Straight Crossing Path – Right Direction 12,84%, U-Type 321.....



3) Left Turn Across Path – Left Direction 11,29%, U-Types 302, 312.....

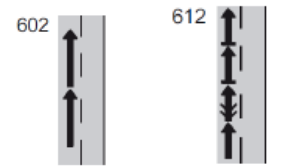


CMR
Use Case

4) Straight Crossing Path – Left Direction 5,83%, U-Type 301.....

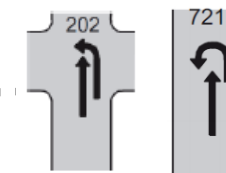


5) Follow-Up Driving 5,77%: U-Types 602, 612, 603



TAP
Use Case

6) Left Turn Across Path – Same Direction 5,01%: U-Types 202, 721,



CMFtap: Car to Motorcyclist Front - turn across path
CMC: Car to Motorcyclist Crossing
CMR: Car to Motorcyclist Rear
TAP: Turn Across Path

- Source: <https://www.utacceram.com/testing-expertise/safety/active/muse-project>
- The sum is 71% (due to weighting), the respective proportion of collision accidents is therefore 1.4 times higher
- KSI: Killed or seriously injured type accidents quantified

- The most frequent collision accident types are left turn and turning/crossing.

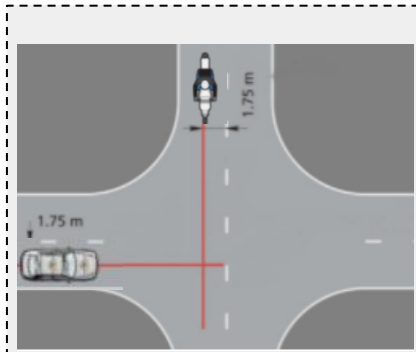
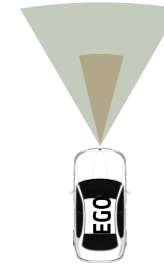
DETECTION PERFORMANCE OF BMW'S ONBOARD-SENSOR SYSTEMS ON MOTORCYCLES.

Motivation

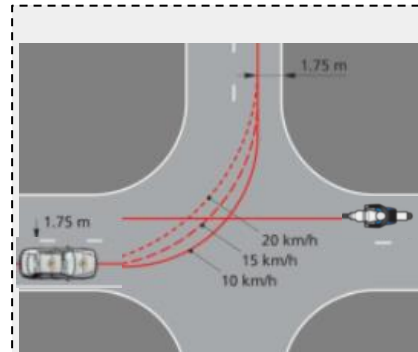
- Validation of passenger car onboard-sensor systems regarding the detection performance on real motorcycles in addition to surrogates.

Test setup

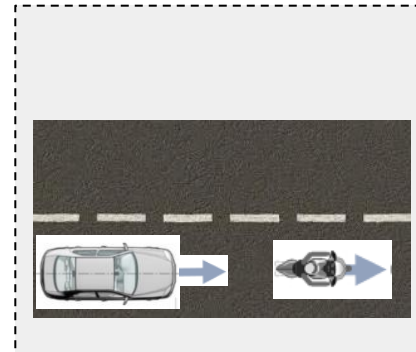
- Several Tests were carried out in relevant scenarios for active safety functions with various vehicle configurations and different types of motorcycles.



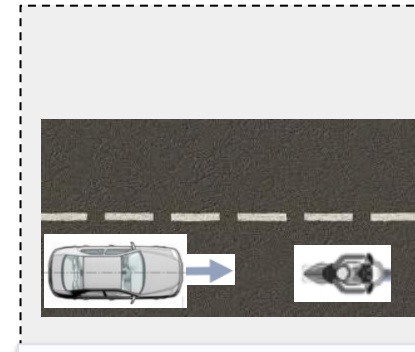
Car to Motorcyclist Crossing



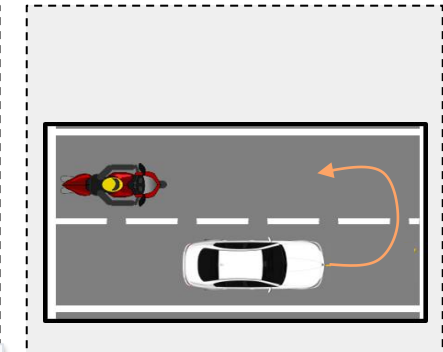
Car to Motorcyclist Front – turn across path



Car to Motorcyclist rear – moving powered two-wheeler



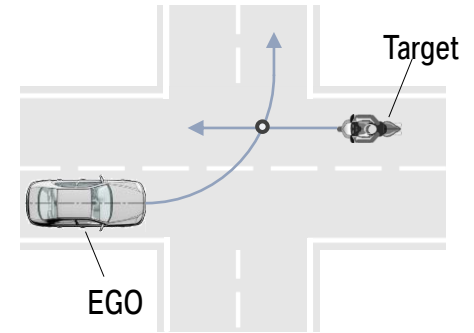
Car to Motorcyclist rear – stationary powered two-wheeler



Turn Across Path – same direction

BMW's active safety systems are developed to detect real motorcycles and scooters.

LEFT TURN ACCIDENTS INVOLVING MOTORCYCLES AND CARS: ACCIDENT DATA ANALYSIS AND BMW ACTIVE SAFETY FUNCTION.



Front collision warning and braking function for turning with oncoming traffic

- Active safety function for turning situations in case of oncoming traffic
- The function reacts on oncoming motorcycles and cars up to 100 kph
- Basic configuration in the latest generation of BMW ADAS systems launched 2021

Data basis GIDAS Germany:

- Data freeze 7/2020
- Passenger cars (M1/N1) and motorcycles (> 125ccm) involved
- Accidents causing severe and fatal injuries (KSI)

EGO-vehicle speed [km/h]	Motorcycle target speed [km/h]															
	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	120
0	0,00%	0,00%	1,05%	1,05%	0,00%	2,11%	0,00%	0,00%	2,11%	0,00%	1,05%	0,00%	0,00%	0,00%	0,00%	0,00%
5	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	1,05%	1,05%	1,05%	1,05%	0,00%	1,05%	0,00%	0,00%	1,05%	1,05%
10	0,00%	0,00%	1,05%	0,00%	1,05%	1,05%	0,00%	0,00%	0,00%	1,05%	1,05%	0,00%	1,05%	1,05%	0,00%	0,00%
15	0,00%	1,05%	2,11%	2,11%	6,32%	3,16%	2,11%	0,00%	1,05%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
20	0,00%	0,00%	3,16%	0,00%	3,16%	2,11%	1,05%	0,00%	0,00%	1,05%	1,05%	0,00%	0,00%	1,05%	0,00%	0,00%
25	1,05%	1,05%	1,05%	2,11%	2,11%	1,05%	1,05%	1,05%	1,05%	1,05%	0,00%	1,05%	0,00%	0,00%	1,05%	0,00%
30	1,05%	1,05%	0,00%	0,00%	4,21%	3,16%	0,00%	0,00%	2,11%	0,00%	2,11%	0,00%	1,05%	0,00%	1,05%	1,05%
35	0,00%	0,00%	2,11%	1,05%	3,16%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
40	1,05%	0,00%	0,00%	0,00%	0,00%	1,05%	0,00%	1,05%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	1,05%	0,00%
45	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	2,11%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
50	0,00%	0,00%	0,00%	0,00%	1,05%	0,00%	1,05%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
55	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	1,05%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%

Euro NCAP 2023*

Extended System

*) Euro NCAP AEB CMFtap:
Automated Emergency Brake
Car to Motorcyclist Front turn across path

- There is a significant amount of severe accidents involving motorcycles oncoming with velocities up to 100 kph.
- The BMW active system is capable to cover >40% more of severe accidents compared to the related Euro NCAP test scenario.

BMW LEFT TURN WARNING INCLUDING AUTOMATED BRAKE ACTIVATION CAR TO MOTORCYCLIST FRONT - TURN ACROSS PATH USE CASE.



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03/10/22
GERBER, ZOELCH