

NEW DRIVER SAFETY CONCEPT FOR AUTOMATED AND MANUAL DRIVING MODE

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ABSTRACT

After ten years Mercedes-Benz is presenting once again an ESF (**E**xperimentales **S**icherheitsfahrzeug / Experimental Safety Vehicle) – the ESF 2019. This research vehicle, based on a series production vehicle, represents a platform of safety innovations

In highly automated vehicles, the driver seat occupant is no longer required to maintain a standard driving posture while the vehicle is operating in automated driving mode. This enables new interior concepts with more flexibility and seating comfort, depending on the specific driving situation and responsibility. During automated driving mode, the driver has the option to choose more flexible seating positions to relax, work or enjoy the entertainment system. The visitors of the ESV exhibition will get a chance to experience this safety concept.

The option to choose a more relaxed seating position compels further consideration of occupant safety. The new flexible seating positions are expected to provide the same level of crash worthiness that is known from current standard seating positions for manual driving. For future car concepts, the safety systems need added flexibility to enable new situations beyond the standard driving position.

AUTOMATED DRIVING OFFERS CHANCES FOR NEW SAFETY CONCEPTS

Automated Driving is the current megatrend for future automobiles throughout the automotive industry. Automated Driving will create opportunity for new use-cases which will lead to new vehicle and interior concepts. While these new concepts will provide comfort and convenience benefits to the occupants, it is also necessary to develop a safety concept that provides the user with robust protection from injury in a crash, regardless of whether the vehicle is being operated manually by a human driver, or is being operated automatically by an ADS. It can be expected that the design process for automated vehicles incorporates a safety-oriented, defensive driving style, developed to avoid at-fault crashes with other road users, while avoiding or mitigating crashes caused by others. But due to various factors such as physical limits of vehicle response or the behavior of other road users, it is vital to understand that ADS-operated vehicles might still be involved in vehicle crashes. Thus crash worthiness will still have to be considered, even for vehicles capable of driverless operation.

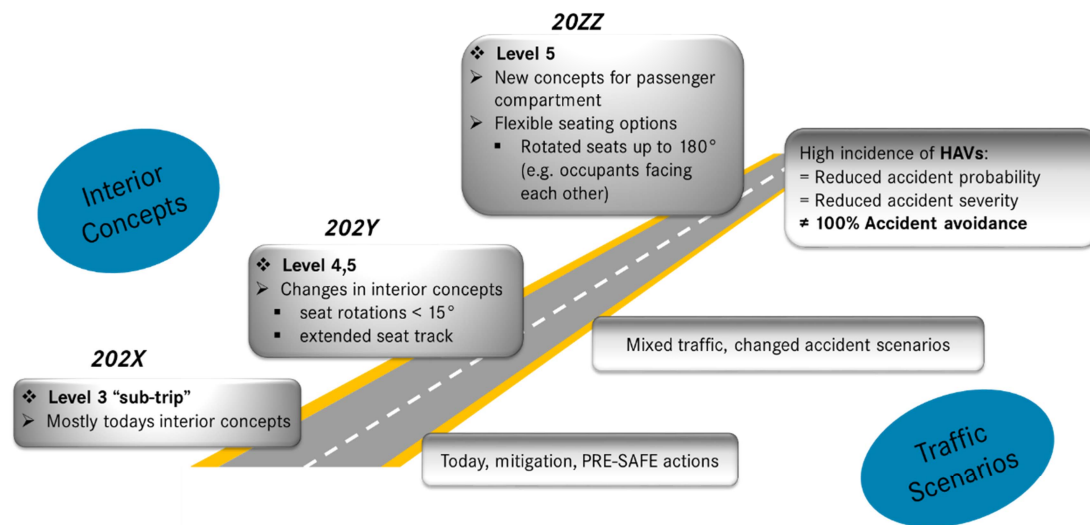


Figure 1. Automated driving from today's perspective

Impact of automated driving levels for safety concepts

Today's driving and safety concepts are based on a manually controlled vehicle, where the driver might also be assisted by advanced driver assistance systems that can enhance comfort and safety. An example is the radar-based collision avoidance system with functions such as distance warning, forward collision warning, dynamic brake support and even automated emergency braking. Although these systems are able to mitigate or avoid certain types of crashes, the driver always has the full responsibility for safe operation of the vehicle while driving in manual mode. Similarly, in future Level 3 conditionally automated driving modes where a driver must operate the vehicle for at least part of every trip, the driver is expected to remain able, alert, and responsive to requests to resume driving, issued by the vehicle. In both cases, the driver needs to maintain a seating position which enables manual or assisted driving.

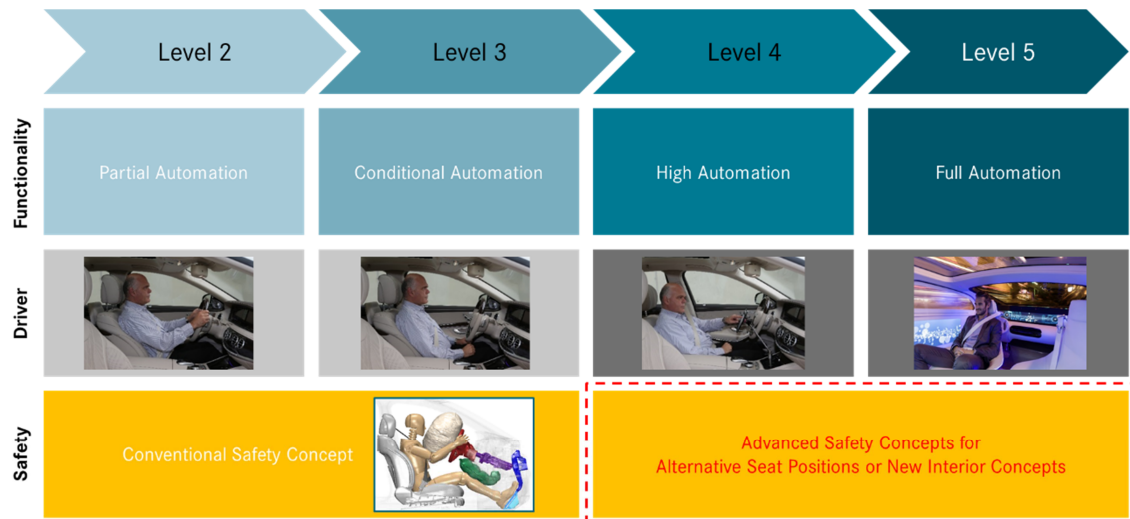


Figure 2. Driver safety concepts are depending on automated driving level

Safety during automated driving:

At Mercedes-Benz we develop highly and fully automated driving (SAE level 4/5) in urban environments at the one hand and on the other we develop the next generation of technologies for driver assistance systems and highly automated driving on highways (SAE Level 3 and Level 4).

This progress has an impact on seating configurations in future vehicles. For one thing occupants are expected to be seated as they would in a conventional taxi cab. Thus the safety systems would be comparable to those in current vehicles. Then in the continuing evolution of automated driving, ADS-operated vehicles will feature new interior concepts including seats that can be rotated 180° from conventional positions and thus allow living room-style seating, as demonstrated by Mercedes-Benz within the research car F015 [1], depicted below. These interior concepts are creating new options for interior stylists, but are also creating new challenges for safety engineers as they develop safety concepts for the future.



Figure 3. Mercedes-Benz F015 - New interior concepts for automated driving [2]

New interior concept for automated driving level 4: The 2019 Mercedes-Benz Experimental Safety Car presents innovative safety concepts for level 4 ADS-equipped dual-mode vehicles that enable either manual driving, or automated driving within specific operational domains. With this type of vehicle, the driver can decide whether to operate it in a traditional, manual mode using steering wheel and control pedals, or take advantage of available automated driving modes. To achieve the full benefit of a highly automated driving mode, Mercedes-Benz seeks to provide more space and comfort for the customer by offering more flexible seating positions to relax, work or further enjoy the entertainment system with improved visibility of the available displays.

CONCLUSIONS

Highly automated driving will offer more options and flexibility for a driver, who can become a passenger when the vehicle is operated in automated driving modes. Not being required to remain in a driving-ready seating position enables more comfortable and relaxing seating and interior options. The new 2019 Mercedes-Benz Experimental Safety Vehicle, displayed at the ESV Safety Conference 2019 in Eindhoven, NL will show new solutions with regard to occupant safety.

REFERENCES

[1] Mercedes-Benz F 015 Concept Car, CES Las Vegas 2015.

[2] Mercedes-Benz ESF 2009 @ ESV Conference 2009 Stuttgart, Prof. Dr.-Ing. Schöneburg, Baumann, Fehring