



Passive safety success story

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Mercedes-Benz characterises automotive development with continuous safety innovations. Since the middle of the 20th century, the brand has been a systematic innovator and pioneer for this important technological discipline. The success story begins with passive safety – the protection of people against the effects of an accident thanks to vehicle construction and technical systems. Important inventions in this area are celebrating anniversaries in 2019: the safety-enhanced body (1959), the start of systematic crash tests (1959) and the analysis of real accidents (1969) as well as the automatic rollover bar (1989). This tradition is leading Mercedes-Benz into the future with the networking of safety and driver assistance systems.

Stuttgart. The origins of Mercedes-Benz safety development are as old as the car itself. Safe operation of their revolutionary inventions was important even to automotive pioneers Carl Benz and Gottlieb Daimler. For the first third of the 20th century, however, systematic research on this topic was missing – even at the then Daimler-Benz AG.

This changed 80 years ago as the company from Stuttgart employed engineer Béla Barényi. He presented his seven visions of a safe car of the future in a convincing job interview. On 1 August 1939 he took over the newly formed department for safety development.

In 1966 Barényi, together with the newly appointed Mercedes-Benz development executive Hans Scherenberg, designed the allocation of active and passive vehicle safety, which still applies today: passive safety stands for design-specific solutions that protect people from the effects of an accident. Active safety is different. This uses systems that intervene in driving style in a

supportive manner in order to limit the severity of an accident or to avoid it altogether.

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Over the course of his career at Mercedes-Benz, Béla Barényi registered around 2,500 patents between 1939 and 1972, most of which relate to innovations for vehicle safety. In recognition of his groundbreaking work, he was inducted into the Automotive Hall of Fame (AHOF) in Dearborn, Michigan (USA) in 1994. And so, 25 years ago, a chapter in the history of Mercedes-Benz passive safety was closed.

Since the beginning of the 2000s, both types of safety development have been blended into the Mercedes-Benz concept of integral safety. The brand is continuously driving vehicle safety for the future. In particular, this includes the intuitive and intelligent technologies of the Intelligent Drive concept.

Research for safety

The many innovations for Mercedes-Benz passive safety would not be possible without the research of the brand on this topic. For example, 60 years ago, on 10 September 1959, systematic accident tests with complete vehicles (“crash tests”) began at the Sindelfingen plant, which were refined further and further.

As far back as 1956, Mercedes-Benz tested individual vehicle components for their behaviour in an accident with acceleration carriages. And, for 50 years, findings from real traffic accidents have also been incorporated into the comprehensive safety development of Mercedes-Benz products: since 1969, the accident research department has been analysing and reconstructing such collisions.

The experimental safety vehicles

The Stuttgart company also takes part in global research projects for vehicle safety. For example, this includes the Experimental Safety Vehicles (ESV) programme from the 1970s. Various research vehicles are created at Mercedes-Benz under the name Experimental-Sicherheitsfahrzeug (ESF).

For example, in the ESF 24 from 1974 based on the S-Class of the 116 model series, amongst other things, trailblazing innovations in passive safety were tested – such as belt force limiters and airbags (premiering in 1981 in the S-

Class of the 126 model series) as well as seats with integral seat belt anchorage (premiering in 1989 in the SL of the 129 model series).

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Steps towards the future of safety

The first Barényi project at Mercedes-Benz was a test vehicle with a new kind of floor assembly. This platform frame not only offered extra comfort thanks to a significant reduction in so-called shaking vibrations, but also significantly better protection against side impact than the earlier X oval tubular frame.

As the head of the body test department, single vehicle construction and numerous assembly departments, Karl Wilfert was responsible for the solutions for vehicle safety developed in Sindelfingen. On 23 April 1949 he registered a patent for the conical-pin safety door lock.

This was an important step towards the wedge-pin door lock with two safety catches, which keeps doors closed even in an accident and therefore ensures the full stability of the passenger compartment. It was registered for a patent in 1958. In the same year, Mercedes-Benz offered seat belts for all vehicles with individual front seats – but a legal requirement for seat belts was only introduced in Germany in 1976.

The safety-enhanced body of the 111 model series is a milestone

A milestone in passive safety stems from an idea of Béla Barényi's at the start of the 1950s: a passenger car body that absorbs the kinetic energy generated in a collision by deforming at the front or rear ends in a targeted, predefined manner and therefore, in combination with a rigid centre cell, protects the passengers as much as possible.

The concept was registered for a patent in 1951 and was realised for the first time as a safety-enhanced body from September 1959 in the series production of the Mercedes-Benz "fintail" luxury saloon of the W 111 model series. The colloquial term "crumple zone" is established for the defined deformable areas on the front and rear.

The W 111 is characterised by further innovations of passive safety: Mercedes-Benz for the first time realises the "disarmed" vehicle interior, which consciously reduces the number of hard and sharp-edged controls. This

includes the steering wheel with a large baffle plate as well as the series premiere of the wedge-pin door lock with two safety catches.

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This means that with an entire series of innovations, the W 111 model series immediately becomes a sector-characterising vehicle generation for passive safety. This affects the construction of the body (exterior safety) just as much as the design of the vehicle interior (interior safety).

Passive safety is a part of the safety culture of Mercedes-Benz

Over the decades, innovations by Mercedes-Benz have continuously improved the status of passive safety in various areas. These include, for example, safety steering columns as well as various body details. In particular, they have allowed for advances in electronics and sensor systems to start all-new chapters in this area: without digital technology, pioneering innovations such as airbags are not possible.

Airbag development at Mercedes-Benz began in 1966, with the corresponding patent being registered by the company in 1971. As the first production-ready solution, the driver's airbag was introduced in the S-Class of model series 126 in 1981. Due to its fundamental importance, this innovation was quickly adopted by the entire auto industry.

The basic principle of the first airbags still applies today: if the control unit registers a serious accident via various sensors, the airbag is triggered as required. A gas generator fills the airbag. The airbag supplements the restraint effect of the seat belt, which is equipped with pyrotechnical belt tensioners and force limiters. It is therefore also known as an SRS (supplementary restraint system).

Today's passenger cars are frequently fitted with many more airbags as a vital part of the integral safety concept they employ. They range from the knee airbag and the belt airbag in the rear to the thorax/pelvis side airbag. Mercedes-Benz has advanced this development with continuous innovations: the front-passenger airbag, with its world premiere in 1987 in the saloons and coupés of the S-Class, has since become a feature of passive safety. The window airbag has been a part of the family of these potentially life-saving components in Mercedes-Benz vehicles since 1998.

Holistic designs such as the safety-enhanced body are just as important to the success story behind Mercedes-Benz passive safety as innovative details. Such as, for example, the automatically triggered rollover bar of the Mercedes-Benz SL of the R 129 model series. Its operative function is also enabled by advanced developments in electronics and sensor technology.

When not in use, the rollover bar, made from high-strength steel tubing, elegantly retracts in front of the soft top compartment. This means the joy of open-top motoring is not influenced by a fixed bar. In the event of a rollover, the vehicle sensors register the danger and trigger the bar, which extends and engages in 0.3 seconds. In so doing, it ensures the occupant survival space.

30 years ago, in March 1989, the R 129 made its world début at the Geneva Motor Show. Alongside the automatic rollover bar, the integral seats are also a vital part of its safety concept. Seat belts and belt tensioners are built into them.

The many detailed passive safety innovations pioneered by the brand from Stuttgart over the course of eight decades are now integrated as part of a holistic integral safety concept. On this basis, Mercedes-Benz is working on the future dimensions of vehicle safety with many development and research projects.

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In 1939, engineer Béla Barényi, pioneer of passive safety, joins Daimler-Benz AG. Portrait photo of Barényi from the 1950s.

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Karl Wilfert, portrait of the engineer, who was born in Vienna in 1907. From 1933, Wilfert heads the test department, individual vehicle construction, the assembly department of the large series vehicles as well as the body and repair department of the Mercedes-Benz plant in Sindelfingen. After the Second World War, he heads body development, which is supplemented by a stylistics department in 1955.

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In 1959, the safety-enhanced body of the “fintail” saloon of the W 111 model series celebrates its world premiere. Exterior photo of a Mercedes-Benz 220 SE.

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In 1959, the safety-enhanced body of the “fintail” saloon of the W 111 model series celebrates its world premiere. Illustration of the body with defined deformable zones at the front and rear (“crumple zones”) and rigid passenger cell in the centre.

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In 1959, the “fintail” saloon of the W 111 model series celebrates its premiere. It is, amongst other things, characterised by the “disarmed” vehicle interior. Interior photo of a Mercedes-Benz 220 S.

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On 10 September 1959, Mercedes-Benz begins systematic crash tests. Photo of the first crash test, which simulates a front impact of a vehicle of the W 110 model series.

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In 1969, Mercedes-Benz begins targeted accident research. Here real accidents are analysed and reconstructed in order to gain further findings for safety development. Photo from the 1990s with an estate of the 124 model series as an emergency vehicle.

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The Mercedes-Benz SL of the R 129 model series celebrates its world premiere in 1989. Its automatically extending rollover bar represents a milestone in passive safety for open-air vehicles. The photo shows a crash test with a simulation of an overturn above and details of the mechanics below.