In addition to the components of the drive-train (engine, transmission), which provide the vehicle with its means of forward motion, the vehicle systems that limit movement and retard the vehicle also have an important role to play. Without them, safe use of the vehicle in road traffic would not be possible. Furthermore, systems that protect vehicle occupants in the event of an accident are also becoming increasingly important.

Safety systems

There are many factors that affect vehicle safety in road traffic situations:

- the condition of the vehicle (e.g. level of equipment, condition of tires, component wear),
- the weather, road surface and traffic conditions (e.g. side winds, type of road surface and density of traffic), and
- the capabilities of the driver, i.e. his/her driving skills and physical and mental condition.

In the past, it was essentially only the braking system (apart, of course, from the vehicle lights) consisting of brake pedal, brake lines and wheel brakes that contributed to vehicle safety. Over the course of time, more and more systems that actively intervene in braking-system operation have been added. Because of their active intervention, these safety systems are also referred to as active safety systems.

The motor-vehicle safety systems that are found on the most up-to-date vehicles substantially improve their safety.

The brakes are an essential component of a motor vehicle. They are indispensable for safe use of the vehicle in road traffic. At the slow speeds and with the small amount of traffic that were encountered in the early years of motoring, the demands placed on the braking system were far less exacting than they are today. Over the course of time, braking systems have become more and more highly developed. In the final analysis, the high speeds that cars can be driven at today are only possible because there are reliable braking systems which are capable of slowing down the vehicle and bringing it safely to a halt even in hazardous situations. Consequently, the braking system is a key part of a vehicle’s safety systems.

As in all other areas of automotive engineering, electronics have also become established in the safety systems. The demands now placed on safety systems can only be met with the aid of electronic equipment.
Active safety systems
These systems help to prevent accidents and thus make a preventative contribution to road safety. Examples of active vehicle safety systems include
- ABS (Anti-lock Braking System),
- TCS (Traction Control System), and
- ESP (Electronic Stability Program).

These safety systems stabilize the vehicle’s handling response in critical situations and thus maintain its steerability.

Apart from their contribution to vehicle safety, systems such as Adaptive Cruise Control (ACC) essentially offer added convenience by maintaining the distance from the vehicle in front by automatically throttling back the engine or applying the brakes.

Passive safety systems
These systems are designed to protect vehicle occupants from serious injury in the event of an accident. They reduce the risk of injury and thus the severity of the consequences of an accident.

Examples of passive safety systems are the seat-belts required by law, and airbags – which can now be fitted in various positions inside the vehicle such as in front of or at the side of the occupants.

Fig. 1 illustrates the safety systems and components that are found on modern-day vehicles equipped with the most advanced technology.