



The intelligent safety system by Bosch

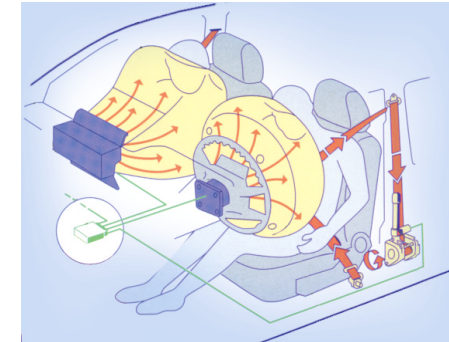




Safety systems in vehicles

- Passive safety systems protect the passengers in case of an accident
 - Airbag
 - Seatbelt tighteners

- Active safety systems help prevent accidents
 - Antilock braking system ABS
 - Traction control system TCS

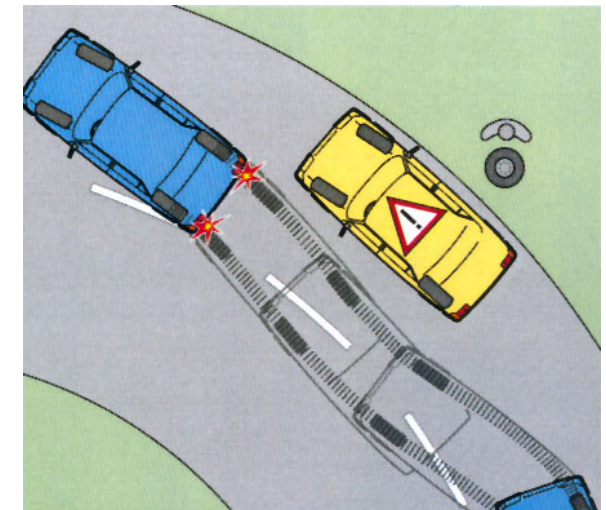




Antilock Braking System

- Prevents the wheels from locking and thus allows avoiding obstacles
- The vehicle remains under control even while braking on one-sided slippery road
- The stopping distance is usually shortened compared to locked wheels

(ABS)





Traction Control System

- Fast interventions in engine management and brakes prevent the driven wheels from spinning
- Safe drive off is possible even on one-sided slippery road
- TCS prevents the vehicle from skidding when accelerating too much in a turn

(ASR)





Electronic Stability-Program



→ **Safety and stability in any driving situation**



What does ESP® do?

- ESP® actively enhances vehicle stability (staying in lane and in direction)
 - Through interventions in the braking system or the engine management
 - To prevent critical situations (i.e. skidding), that might lead to an accident
 - To minimize the risk of side crashes

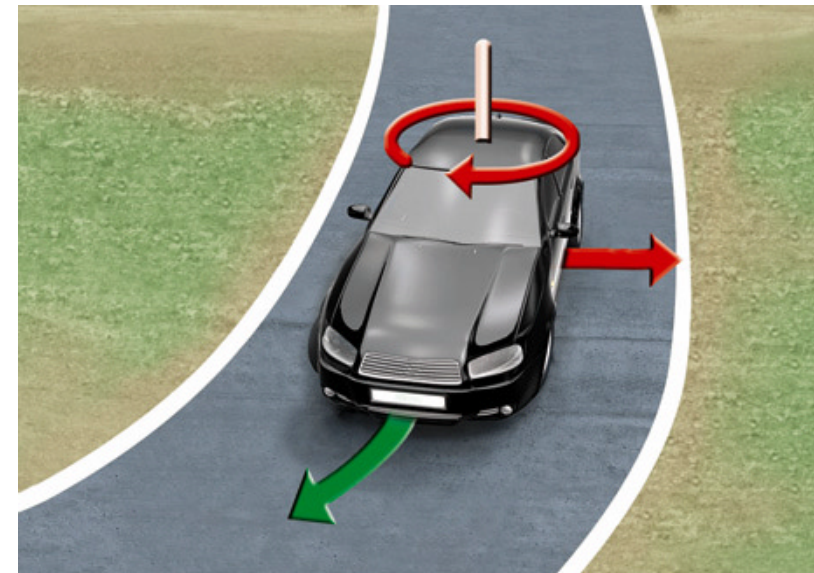




What is so special about ESP®? (1)

→ ESP® watches out:

- Surveys the vehicle's behavior (longitudinal and lateral dynamics)
- Watches the driver's commands (Steering angle, brake pressure, engine torque)
- Is continuously active in the background

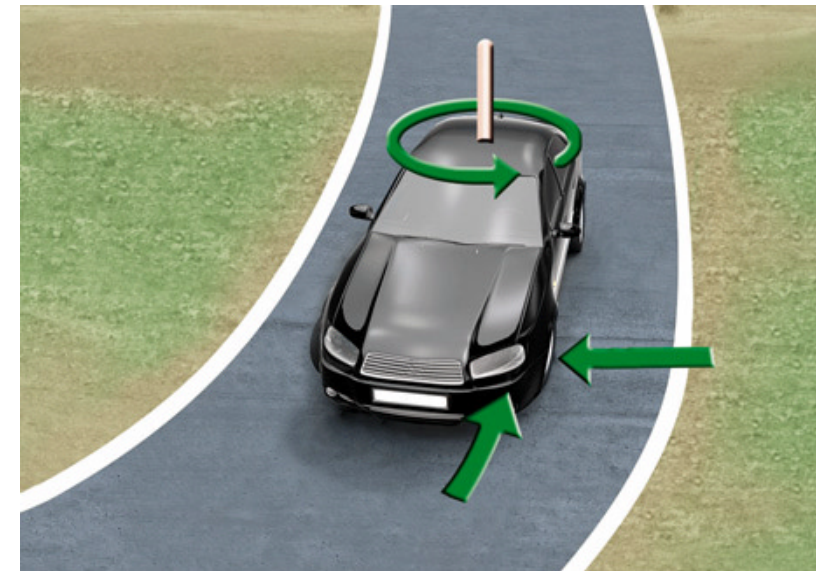




What is so special about ESP®? (2)

→ ESP® knows:

- Recognizes critical situations – in many cases before the driver does
- Considers the possible ways of intervening:
 - Wheel-individual brake pressure application
 - Intervention in the engine management





Why is ESP® so important? (1)

→ Frequent cause for accidents:

The driver loses control of his vehicle. I.e. through

- Speeding
- Misinterpretation of the course or the road condition
- Sudden swerving





Why is ESP® so important? (2)

- 25% of all accidents involving severe personal injury are caused by skidding

(Source: GDV – General Association of German Insurance Companies)





Why is ESP® so important? (3)

- 60% of all accidents with fatal injuries are caused by side crashes
- These side crashes are mainly caused by skidding because of excessive speed, driving errors or excessive steering movements
(Source: GDV – General Association of German Insurance Companies)





Why is ESP® so important? (4)

- Recommendation of the General Association of German Insurance Companies

”Practice shows that vehicle dynamic control systems like ESP® are capable of making skidding avoidable or at least increase control. With their widespread introduction a substantial decrease in the number of serious accidents could be expected.“

(RESIKO-Survey of GDV – General Association of German Insurance Companies)

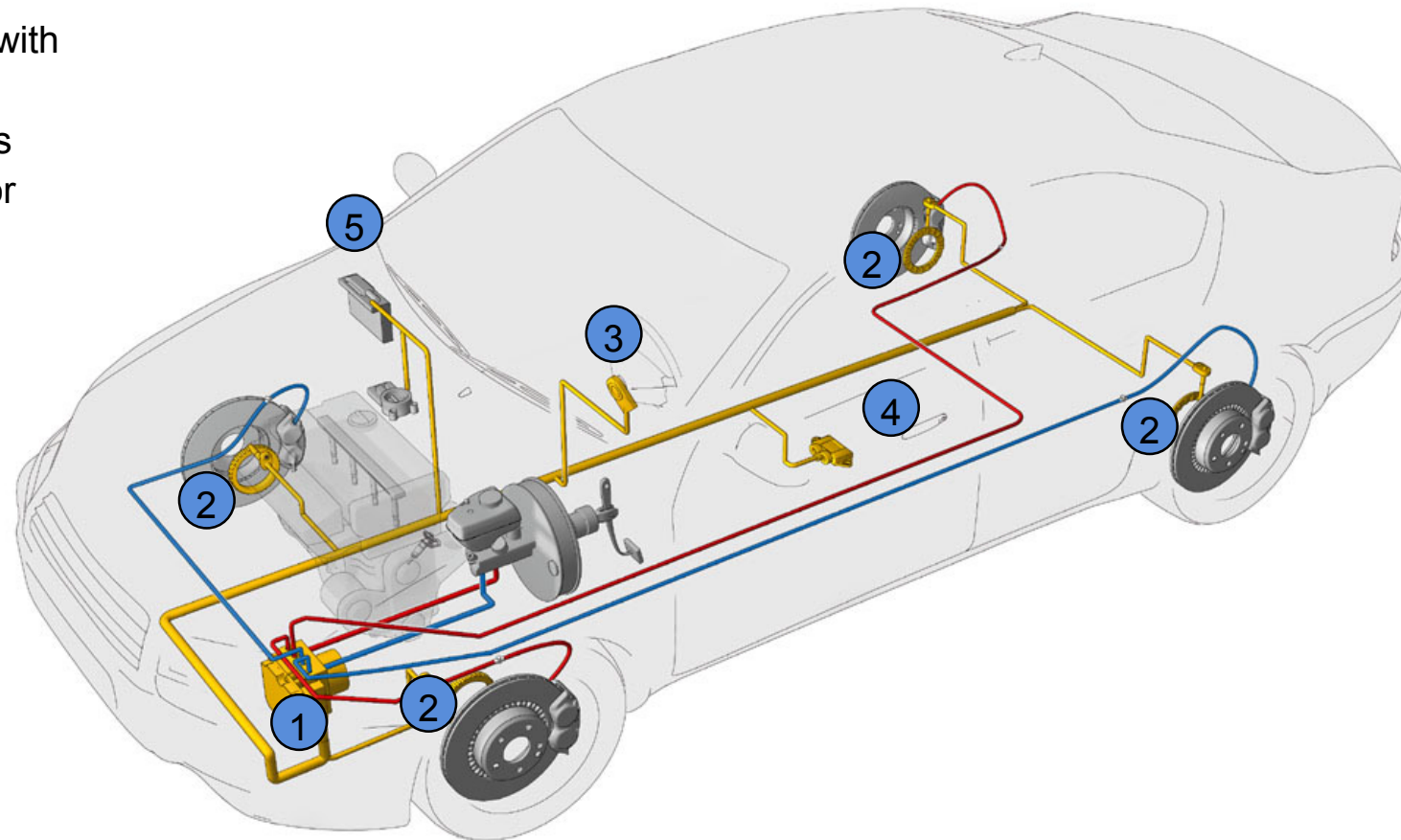




What are the components of ESP®?

The Bosch ESP® components:

- 1 Hydraulic modulator with attached ECU
- 2 Wheel-speed sensors
- 3 Steering-angle sensor
- 4 Yaw-rate and lateral acceleration sensor
- 5 Communication with engine management

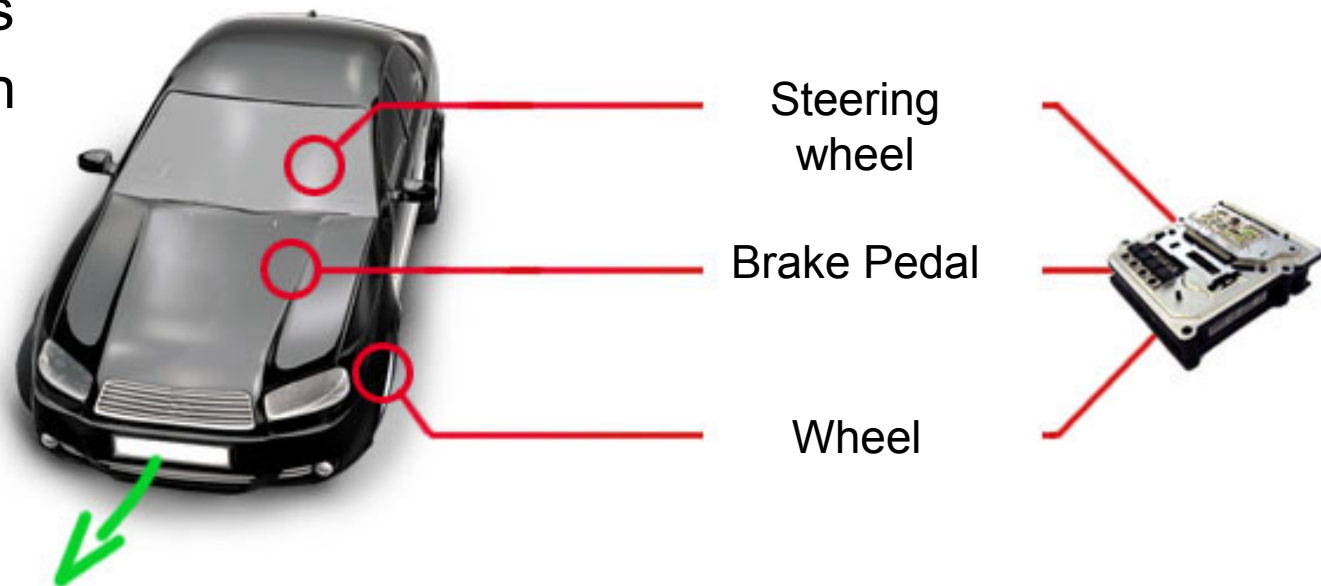




How does ESP® work? (1)

- ESP® analyzes: What is the driver's intention?
 - Position of the steering wheel
 - + wheel speed
 - + position of the accelerator
 - + brake pressure

= ECU recognizes driver's intention





How does ESP® work? (2)

- ESP® examines: How does the vehicle behave?
Yaw speed
+ Lateral forces

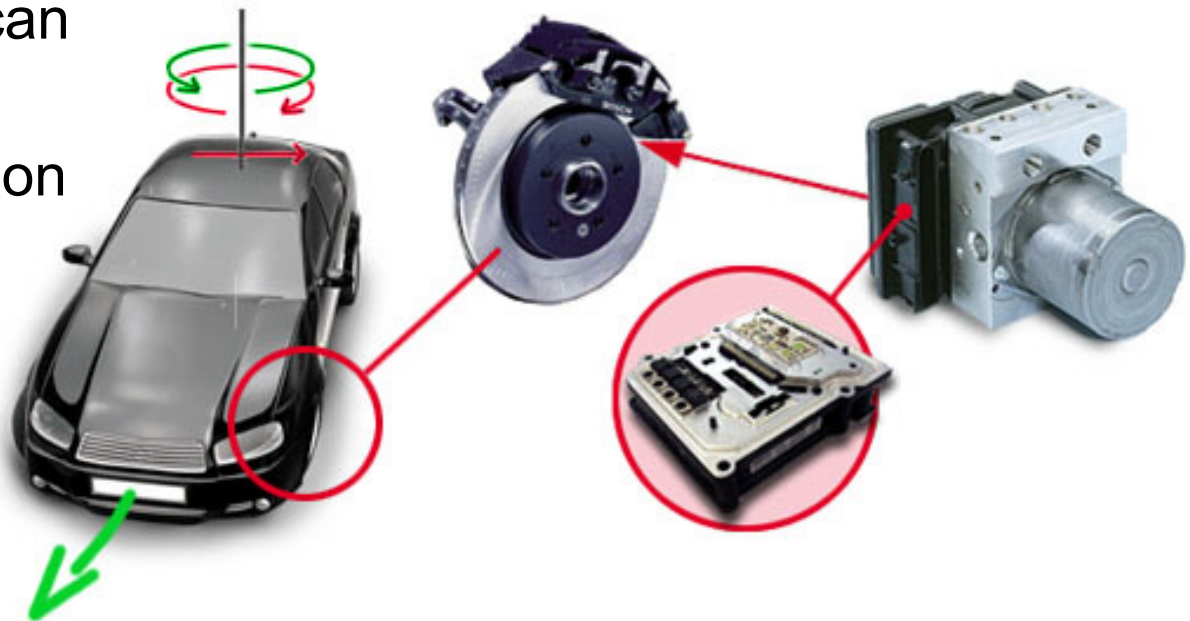
= ECU calculates the vehicle's behaviour





How does ESP® work? (3)

- ESP® acts: It "steers" through brake-application
 - The ECU calculates the required measures
 - The hydraulic unit quickly and individually supplies the brake pressure for each wheel
 - In addition, ESP® can reduce the engine torque via connection to the engine management





In what situations is ESP® needed? (1)

→ Examples:

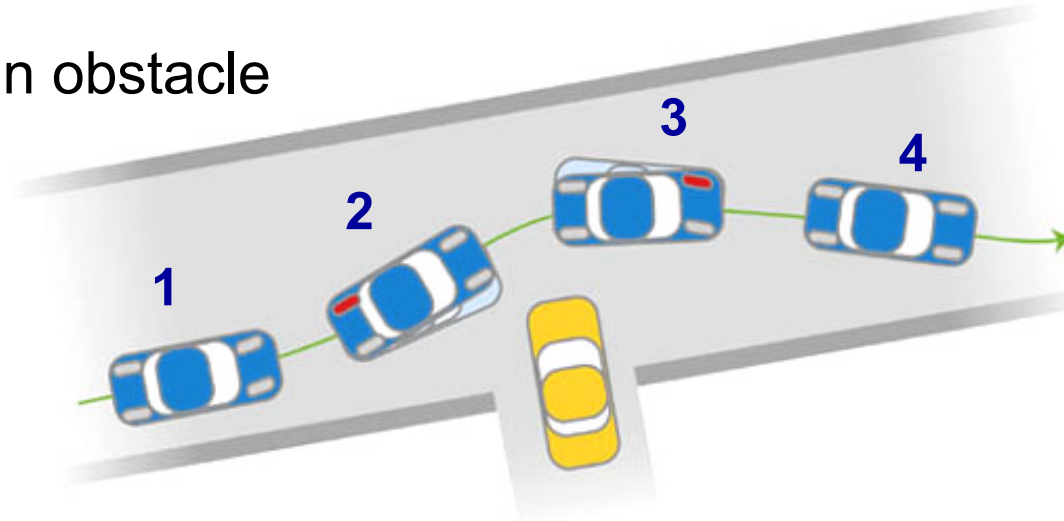
- Avoiding an obstacle
- Sudden wrenching of the steering wheel
- Driving on varying road surfaces
(Longitudinal and/or lateral changes)





In what situations is ESP® needed? (2)

→ Avoiding an obstacle

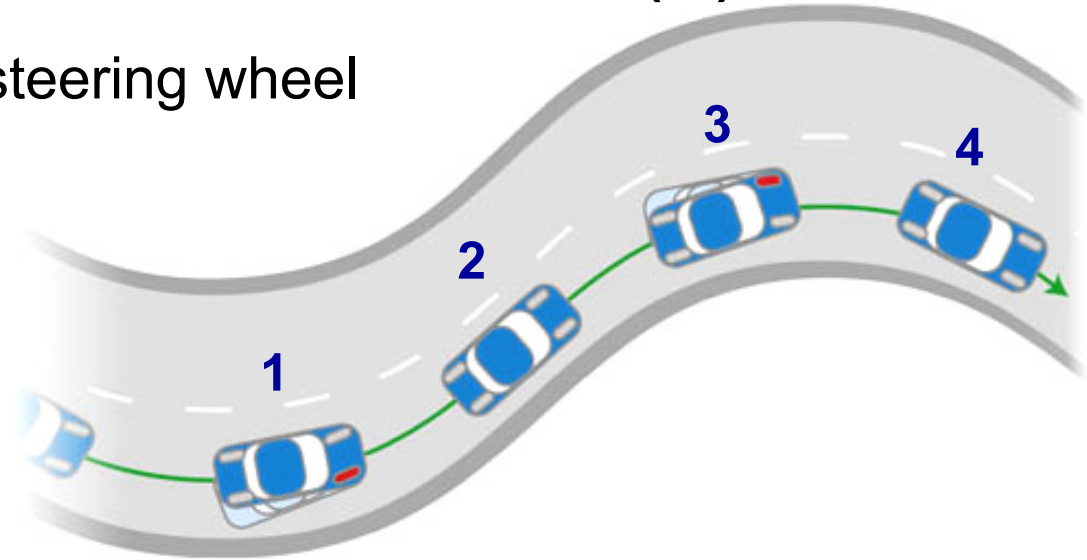


- 1) Hit the brakes, wrench the steering wheel: Vehicle tends to understeer
- 2) ESP® brakes the left rear wheel, vehicle obeys steering-wheel input
- 3) Reverse steering input: Vehicle tends to oversteer, ESP® brakes the front right wheel
- 4) Vehicle becomes stable again



In what situations is ESP® needed? (3)

→ Sudden wrenching of the steering wheel

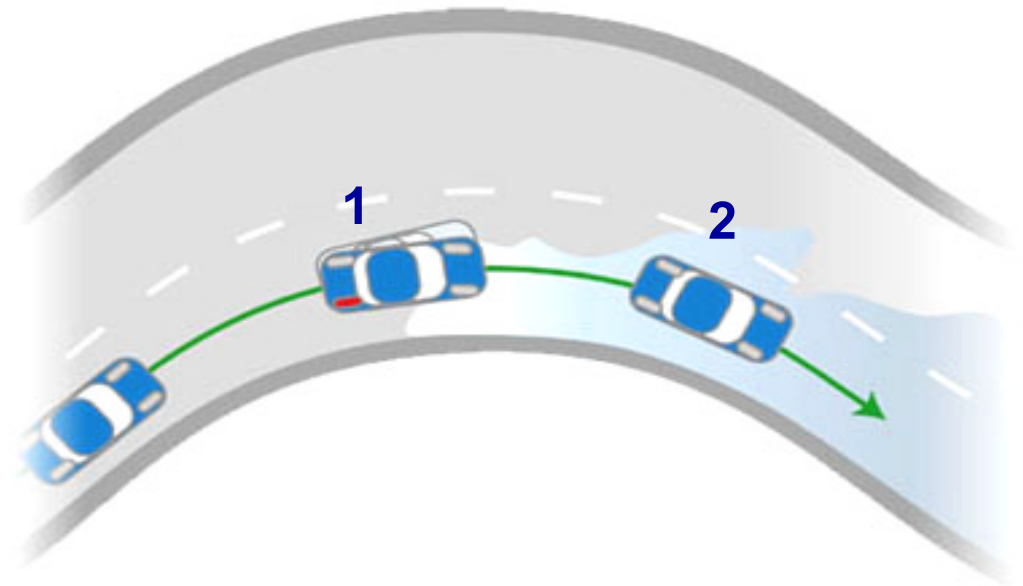


- 1) Vehicle tends to break away. Automatic braking-pressure rise at the front right wheel
- 2) Vehicle is stable
- 3) Vehicle tends to break away. Automatic braking-pressure rise at the front left wheel
- 4) Vehicle is stable



In what situations is ESP® needed? (4)


→ Driving on varying road surfaces



- 1) Vehicle tends to break away (understeer):
ESP intervenes and brakes the right rear wheel while at the same time reducing engine torque
- 2) Vehicle is stable



Do you drive more safely with ESP®?





Is there a way of reducing the consequences of unpleasant surprises when cornering?*

Yes

The electronic stability program ESP® keeps cars safely on track.

* A study conducted by the General Association of the German Insurance Scheme has shown that in 27% of all accidents with serious personal injuries, the car skidded off the road. According to the study, this percentage could be greatly reduced if all cars were fitted with ESP.



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