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European State of the Art for AEBS systems

Stuttgart, May 2008
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TP/EMD

Active Brake Assist – demonstration

control (-2 m/s^2)

ACC - function

Optic warning

+ ACC - acoustic double alert

+ intermittent acoustic warning

+ haptic warning (-3 m/s^2)

+ permanent acoustic warning

+ emergency braking

+ horn and hazard flasher

AEBS (Active Brake Assist) in a nutshell


Presentation :   IAA 2006

Product Launch: 12/2006

Approx. driven
kilometer at customer: > 1.600.000.000

Feedback from customer: positive

Feedback from public: positive

Claims: sporadic after launch, not qualified

Efficiency: sporadic reports from drivers,
                             first tendencies from statistics very

promising

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AEBS (Active Brake Assist)– public feedback

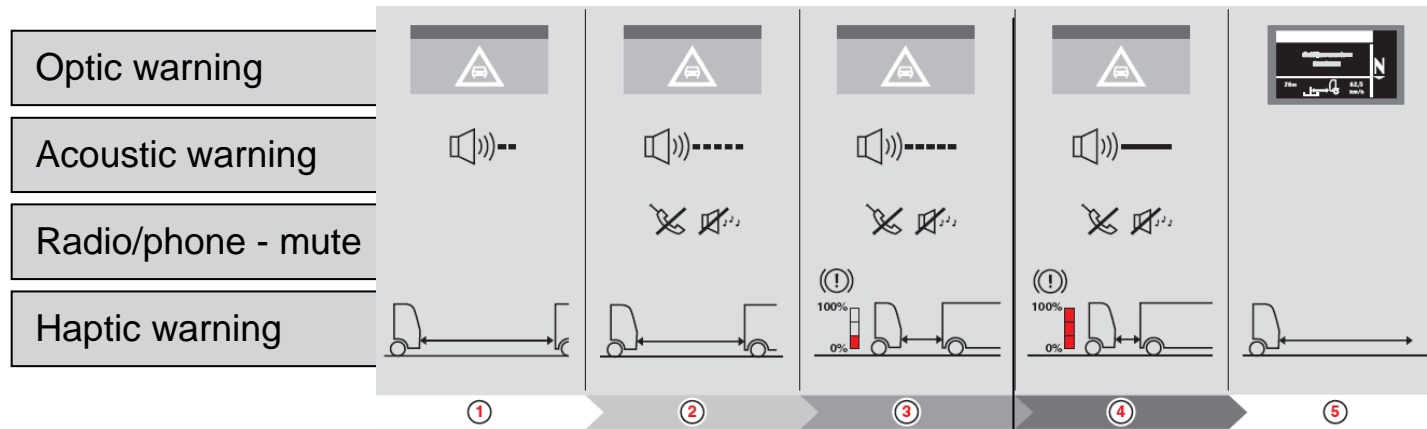- Nomination for German Future Award 2002 (Innovation Award)
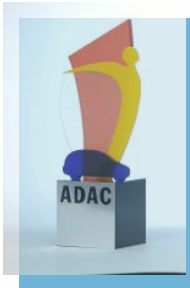
- Gelber Engel 2007 (Innovation Award from ADAC)

- Safety Award of Autosalon Brussels

- European Safety Award for Heavy Duty Vehicles 2007

AEBS (Active Brake Assist) – functional overview

Optic warning					
Acoustic warning					
Radio/phone - mute					
Haptic warning					

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Driver's activities I

Using turn signals, braking or accelerating before or while warning phase 1 – 3 reduces system reaction to optic warning.

Driver's activities I

Kick Down interrupts even emergency braking.

Driver's activities I

System can be switched off at any time

Reaction on driver's activities

Active Brake Assist - customer reaction

- Customer reaction has been evaluated explicitly after start of production

- Customer reaction mainly positive about complete system layout of ACC and Active Brake Assist. Difficult to distinguish between ACC and ABA.

- Warning level is acceptable.

General:
Driver is satisfied with system performance

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Driver is satisfied with system performance.
(Literally) Since truck is mainly used in Italy, warnings are issued more often, but this is caused by the driving behavior /mentality of drivers, who are used to overtake trucks and cut in close to the truck.
Spurious (false) warnings are seldom.
Drivers additional comment:
Driver is more willing to abstain from his TV than from ABA/ART
Positiv:
System is always switched on.
Negativ:
Early warnings while tailgating.

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Active Brake Assist – technical attributes

Feature

the system has the capability to be switched off at any time.

Rationale:

- According to the „Vienna convention" the driver shall be capable in any situation to control the vehicle.

- If the system design leads to a significant level of "early" warnings in some traffic situations, better acceptance can be achieved, if the is driver able to switch off the system temporarily.

- The proven layout gives in practice a switched off rate of 1% or less, so the
  "off – switch" does not reduce the efficiency of the system significantly.
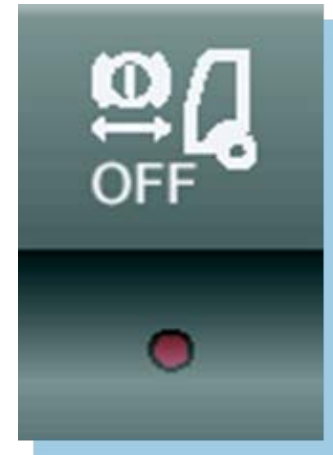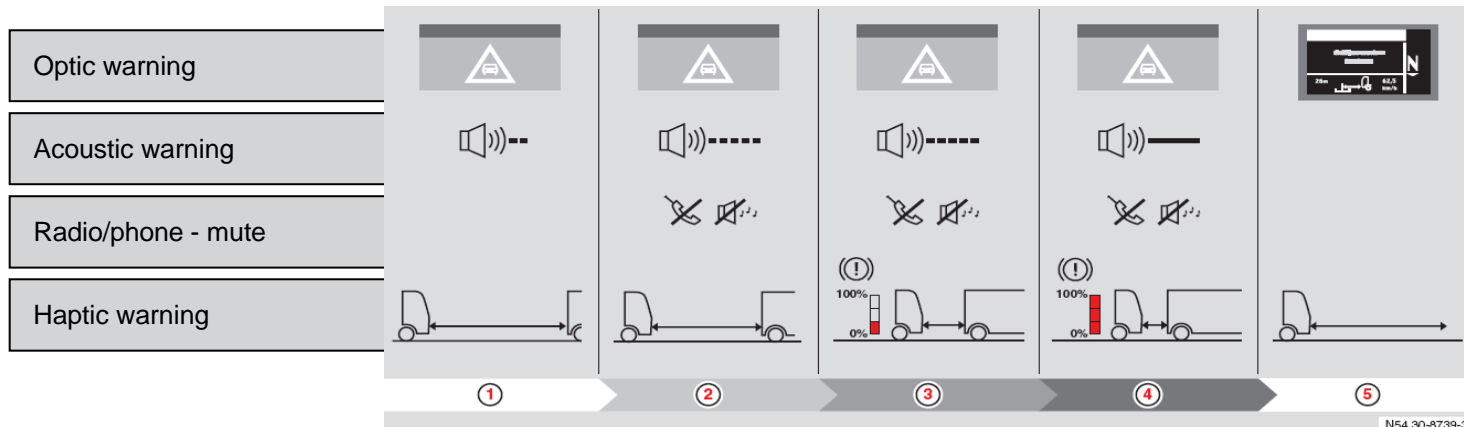
Active Brake Assist – technical attributes

Feature

the system is using a warning cascade in advance to the emergency braking,
drivers reaction during the warning cascade interrupts the warning cascade and
reduces system reaction to optic warning and therefore avoids the emergency braking.

Rationale:

- One intention of the system should be to initiate drivers reaction to avoid
  the critical situation that requires emergency braking.

- The warning must be early enough to enable drivers reaction.

- There are a lot of signals and warnings from integrated or nomadic devices,
  system HMI must raise the urgency of the situation suppressing all other signals.
  (This is not a matter of loudness!)

	①	②	③	④	⑤
Optic warning					
Acoustic warning					
Radio/phone - mute					
Haptic warning					

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Active Brake Assist – technical attributes

Feature

the system is recognizing moving targets (cars, trucks, motor cycles,
as long as they are moving
and even if they come to a complete stop.
The system is up to now not recognizing targets that were never detected moving faster than
10km/h.

Rationale:

- The main use case for AEBS systems is highway traffic, where platoon driving is
  a usual way of traveling for trucks, therefore observing moving targets allows a high
  efficiency.

- To exclude additional risk of accidents braking by fault must be avoided under all circumstances.
  Even the correct recognition of moving targets in the majority of all traffic scenarios needs a lot of
  experience (7 years of development, several millions of test kilometers).

- Since critical situations with stationary targets involved are more seldom and much harder to detect
  correctly, the system design excludes targets that were never detected traveling faster than 10km/h.

Active Brake Assist – technical attributes

Feature

the system is designed to reduce the number of accidents
therefore able to handle differential speeds higher
than 70km/h (**A**ccident **R**eduction **S**ystem)

Rationale:

- The main use case for AEBS systems is highway traffic, where truck speed is restricted
  to 80km/h.
- Due to the high mass involved in truck accidents even collisions with low differential
  speed can lead to significant harms, pure collision mitigation systems are falling short in
  avoiding fatalities.
- Due to physical restrictions (friction, road curvature, traffic behavior, …) collision avoidance
  can not be achieved in all cases,
  therefore the target is to reduce the numbers of accidents as much as possible.

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Active Brake Assist – technical attributes

Feature

system has been introduced to vehicles using
at least one (the rear) axle air-suspended.

Rationale:

- To avoid performance reduction or misbehavior the forward looking sensor must be kept with high accuracy in a direction parallel to the road surface.

- For steel-suspended vehicles it can not be guaranteed that for all load conditions the chassis remains in a direc parallel to the road surface.

- With the sensor chassis-mounted it is necessary to control the chassis position, what can be achieved by a chassis level control system based on at least one axle air-suspended.