Back-seat **braker**

Electronic braking assistance systems' capabilities are rapidly overtaking that of even the best driver. The resulting performance improvement in new trucks makes roads safer for everyone, although at the price of greater technological complexity. Toby Clark reports

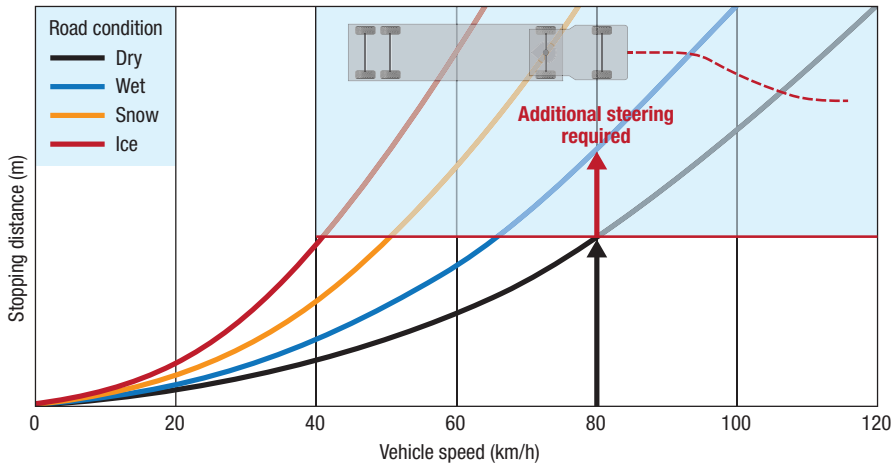
Autonomous emergency braking systems (AEBS) were made compulsory on most new road-going trucks in 2015, with an improved Level 2 standard in force from last year. "AEBS systems have improved continuously," says Christian Brenneke, chief technology officer at WABCO, "and they are still improving today through continuous investment in technology. They reduce more speed, they avoid more accidents. Both lead to fewer accidents and even more importantly, the severity of accidents is reduced significantly. Our latest developments show that even on standing objects an accident cannot be just mitigated, but also fully avoided."

AEBS relies on sensors such as radar, LIDAR and vision systems to tell the vehicle to intervene, but what happens then – particularly if you have a trailer? Richard Owens, marketing manager at Don-Bur, explains: "The tractive unit's AEB system sends circa six bar of pressure down the yellow line to bring the combination to a stop as quickly as possible." And with a relatively modern trailer fitted with an electronic braking system (known as Trailer EBS), "this is backed by a complementary set of CAN-Bus data down the ISO 7638 line to effect the braking in much the same way you would expect if the driver had slammed his foot on the brake. The trailer will respond to the braking signal in the standard way, together with ABS functions."

Continues Brenneke: "Electronic braking systems react fast – an emergency braking event based on sudden brake pedal actuation leads to friction brake activation within less than 50ms." Compared with traditional trailer braking via pneumatic lines, "there is a significant response time advantage".

A further development will be electrically actuated braking, where conventional air or hydraulic operation is replaced by electrically driven brake pads. The advantage is reaction speed and controllability. They are not in production yet, but prototypes have been demonstrated by Haldex, for one.

Even the long-established electronic stability control (ESC/ESP) systems fitted to trucks can do much to prevent rollovers: "ESC, together with roll stability control [RSC], is a tractor-based system that stabilises truck and trailer at the same time by operating the engine



FITTING TRAILER BRAKE TECHNOLOGY

"It's plug and play, it's nuts and bolts, it's pipes and wires." Cartwright Group's technical director Lionel Curtis says that fitting braking controls such as EBS and RSS is straightforward for a trailer builder: "As long as you follow the manufacturer's instructions, and have the right training, you can't go wrong," he says. "Mechanically and electrically it's a piece of cake, [but] setting up the characteristics of the individual trailer is the important thing."

Builders send key trailer parameters to the braking system OEM, who generates a calculation to ensure that the braking controls work properly straight away.

and brakes," explains Brenneke. "In the tractor, each wheel can be braked individually, and in addition the trailer brakes can be applied. In most cases for roll stability control, the whole vehicle combination is braked in order to reduce speed." This is because the lateral force required to keep the truck upright is proportional to the square of the speed, so reducing the speed makes a significant difference.

However, Brenneke points out that for directional control (ESC), individual wheel braking is preferred. Even without individual wheel braking on the trailer, ESC can intervene usefully: if the tractor is understeering (not turning in enough on a curve) then braking its inside rear wheel creates a yaw moment to tighten it onto its intended path. If the tractor is oversteering, its rear wheels are being pushed out and a jack-knife could occur. In this case, braking the outside front wheel will give it a compensating yaw moment – and braking the trailer to 'pull' the tractor back will help further.

A similar principle is used by Volvo in its 'Stretch Braking' feature on EBS-equipped trucks: if a drawbar combination becomes unstable and starts to sway, for instance on a downhill section, the system applies enough trailer braking to straighten the truck and trailer out.

Brenneke adds that benefit can also be obtained from using a trailer with TEBS that has RSS (roll stability support); these systems help to maintain stability in conditions including low-friction surfaces to high dynamic lane changes. WABCO notes, however, that at relatively high speeds and on slippery road surfaces, braking alone might not be enough to stop an accident (see chart, above).

Brenneke predicts that future improvements will be based on additional sensor capabilities. But, he admits, sensors can only take you so far: "Beside sensing vehicle movement, one of the biggest challenges is to detect vehicle conditions continuously through software algorithms, as vehicle load changes have a severe impact on the dynamic behaviour of the vehicle." Technology improvements mean "driver assistance functions that react faster than humans – for example by improved AEBS or turning assist systems".

These turning assist or active steering systems are becoming a reality, with Volvo's Dynamic Steering and ZF's ReAX electrically powered steering (EPS) systems. ZF and WABCO have demonstrated Evasive Manoeuvre Assist (EMA), which combines EPS with AEBS, RSC and technology developed from lane departure warning (LDW) systems.

With EMA, the system responds appropriately if there is insufficient space ahead to stop in a straight line, in this sequence: detect – warn – evade – stop. The driver's instinctive tug on the steering (which is likely in itself to be too weak or too strong) initiates a turn right or left, and the truck attempts to steer a path away from a collision; for example, see figure below.

"EMA in itself requires the use of active steering, which is still not available in most vehicles, so don't expect EMA tomorrow," warns Brenneke.

He goes on to observe that the development of EMA is only a stepping stone to further control systems, and possibly autonomous driving. TE