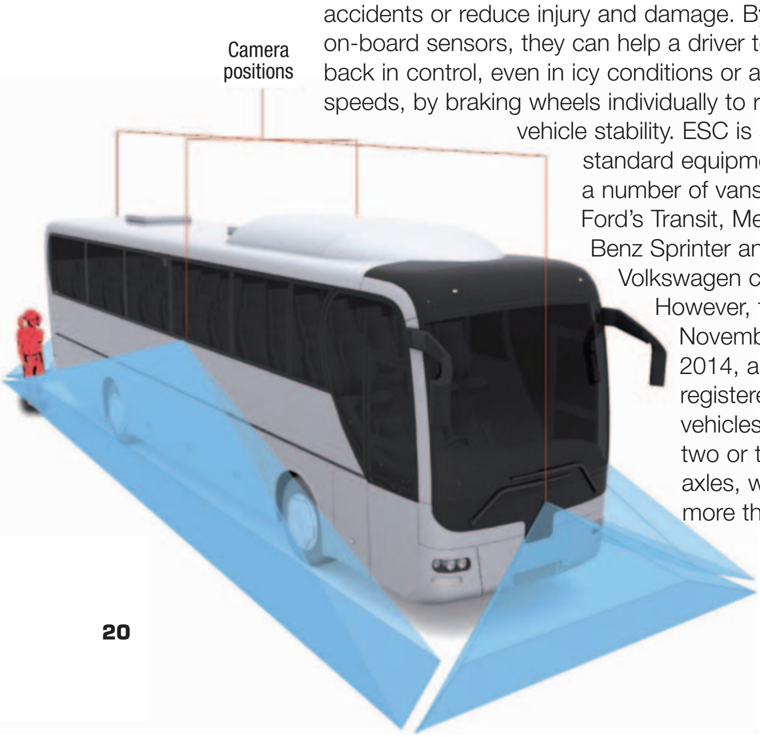
Intelligent van and truck braking systems look set to be just part of a fast-changing set of technologies geared to making a serious dent in the industry's road accident statistics. John Kendall explains

Autonomous

Risk assessment and health and safety are part of the language of business these days, even if the words manage to raise blood pressures as much as they reduce accidents. However, if you think that things have already gone too far in the transport sector, then the next few years will not be guaranteed to put a smile on your face.

Brussels gave us Regulation 661/2009/EC last year, also known as the General Safety Regulation, and it's bound to have far-reaching effects on the vehicles we drive, from motorbikes to cars to trucks. The regulation is intended to simplify the safety requirements that relate to passenger and freight vehicles, replacing around 50 separate directives with a single regulation. For commercial vehicles, this change means new legal requirements in three separate areas: stability control, advanced emergency braking (AEB) and lane departure warning (LDW) systems. It's emergency braking systems that we're concentrating on here, but we shall also outline some of what the other changes will mean.

Electronic stability control systems (ESC/ESP) have done much to help drivers either avoid accidents or reduce injury and damage. By using on-board sensors, they can help a driver to get back in control, even in icy conditions or at high speeds, by braking wheels individually to regain vehicle stability. ESC is already standard equipment on a number of vans, notably Ford's Transit, Mercedes-Benz Sprinter and Volkswagen crafter. However, from November 2014, all newly registered vehicles, with two or three axles, weighing more than 3.5 tonnes gvw, will have to be fitted with ESC. For new type approvals, the deadline is November 2011.



It's a similar story with LDW systems, which are available now on a number of heavy trucks and cars, delivering an audible and/or visual warning, if the vehicle drifts out of lane. Legislation will make such systems compulsory for newly registered vehicles from November 2015 and from November 2013 for all new type approvals.

The driving force behind the legislation is to reduce the number of accidents on European roads. Two million people either lost their lives or were seriously disabled in the last decade on European roads. The European Union set a target to halve road fatalities by 2010, an aspiration that was retained after the number of member States increased to 27 – even though everyone accepts it won't be achievable.

However, some progress has been made. Between 2001 and 2008, road fatalities were reduced by 35% in the original EU 15 member states. Across the EU 27, the reduction was 27%. Accidents involving rear-end collisions with trucks are among the most devastating, because of the

braking

sheer masses involved, so tackling these kinds of accidents has become a stated priority for the EU.

The response has been to introduce AEB (autonomous emergency braking) systems. These will be mandatory on all newly registered trucks in the EU from 1 November 2015 and for all new type approvals from 1 November 2013.

AEB technology

The technology is not new and will be familiar to a number of Transport Engineer readers. Mercedes-Benz introduced it for the Actros heavy truck range in 2006 and WABCO announced its OnGuardMax AEB system in 2008, which should be available for European vehicles manufacturers from this year.

The system combines AEB, LDW and active cruise control (ACC) in one package – and it's worth noting that an AEB system on its own brings together several other established technologies. For example, while electronic brake systems made their first appearance on trucks in the late 1990s, speeding up response times for trailer brakes by operating brake air valves electronically, rather than by mechanical air pressure.

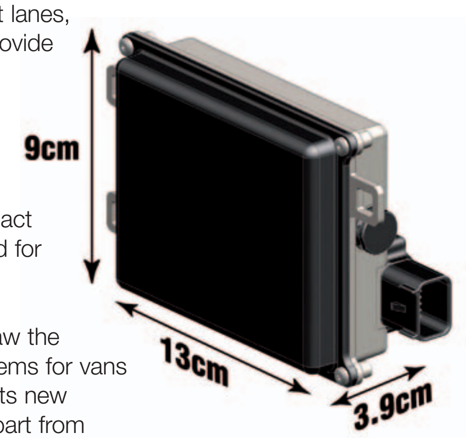
Active cruise control (ACC) was first used on passenger cars in the 1990s. For trucks, vehicles are fitted with a radar sensing system that can detect a vehicle ahead, regardless of weather conditions or visibility. Truck systems are designed to maintain a set distance from the vehicle in front. If the target vehicle slows down, the system will first reduce engine power to try to maintain that set distance, then apply up to around 20% braking effort to reduce speed further, if necessary, and alert the driver to the closing distance.

Where AEB takes a step forward is in enabling the ACC system to bring the vehicle to a complete standstill by automatically activating emergency braking. The system builds up through several stages, because the aim is for the driver to remain in complete control of the vehicle whenever possible. If the driver fails to respond to the reducing distance to the vehicle in front, it will first show a warning on the instrument panel, accompanied by an audible warning. If the driver still fails to react, the system will open the brake valves to apply full braking and bring the vehicle to a halt as quickly as possible. Even if there is insufficient space to avoid a collision, the aim is to reduce injury and damage as much as possible.

Last year, Delphi developed a radar sensor, designed specifically for applications in ACC and AEB systems. Earlier systems were usually dependent on three overlapping radar sensors, generally providing a narrow radar-scanning angle of around three degrees. This does not satisfy all the potential for forward-looking radar systems. Ideally, they should include wide-angle short range and narrow-angle long range scanning to pick up vehicles moving in front from adjacent lanes, as well as pedestrians, and also to provide accurate speed range and data, with effective discrimination of objects. Delphi's electronic scanning radar helps to provide the combination of long-range narrow angle with short-range wide angle scanning in a compact container, with the robustness needed for commercial vehicle operation.

The company has been active in passenger car systems and says it saw the opportunity to adapt its car AEB systems for vans and trucks, when the EU introduced its new legislation for commercial vehicles. Apart from switching from 12 to 24V, adapting a car system for truck use meant that the vertical alignment of the radar sensors became more critical, as Henrik Clasen, strategy manager, Safety Product Business Unit, Europe, at Delphi Electronics & Safety, explains. 'Because of the differences of load, the pitch angle can change more than in a passenger vehicle, especially when you have a truck with steel springs, not air suspension."

Delphi's ESR module contains two distinct antenna arrays, which provide a long range 20 degree field of view and a short range 90 degree field of view



Lane and distance control could save many lives in the transport industry

Clasen also points out that vehicle manufacturers have different approaches to the technology: "One group [of OEMs] is very keen to use the vehicle controls themselves," he says. These manufacturers want to develop the vehicle's behaviour themselves. Others are looking for a bought-in, ready developed package. Delphi does not have this ability in-house and, in such cases, is seeking a partnership with brake system suppliers. "But, from an interface perspective, it is fairly simple," says Clasen. "It's not like electronic stability control. That is much more integrated into the truck itself."

What about cost?

Cost, however, will concern many operators: systems may become mandatory, but they will still represent an on-cost for the vehicle purchaser. In fact, the Delphi electronic scanning radar system is cheaper to produce than earlier electronic scanners, as used for military applications, because the system has been designed for production using existing manufacturing systems for high-volume electronic engine control units. Its long and short range capabilities are produced by building an array of micro-strip radiating elements on a flat substrate, containing two distinct antenna arrays, which provide a long range 20 degree field of view and a short range 90 degree field of view. Delphi's module measures just 13 x 9 x 3.9cm deep.

"The cost of these technologies is coming down quite greatly," asserts Mike Thoeny, engineering director, electronic controls, Delphi Electronics & Safety. "We've been producing radar since 1999 in regular production and I can tell you that the price curve has come down aggressively – and obviously more companies are producing these technologies. What we're now focusing on is not just the technology and growing the capabilities of systems, but, in parallel, using the new developments to make the systems less expensive."

That said, system reliability remains fundamental. As Dr Jurgen Steinberger, from brake system manufacturer Knorr Bremse, says: "There are no issues from a technical standpoint, [but] we have to ensure that the truck does not brake without intention. You have to rely on the sensor signal; you have to analyse it; and you have to be sure that the sensor signal is giving you the right information and, of course, interpret it in the right way. This is the main focus for all manufacturers at the moment."

For Knorr Bremse, the next stage in development is to look at a more graduated system that can determine whether full braking is desirable, or not, in any given emergency. As Steinberger puts it: "We can look at the data and ask, 'Shall we make it full braking, or would the predicted path of the vehicle make the vehicle dynamics so unstable that we would rather only use 80% or 70% of full braking?'."

Meanwhile, now that braking systems accept input signals from equipment other than the brake pedal or parking brake, further developments are also possible. For example, work is underway to integrate data from satellite navigation systems, which include altitude data. "Green ACC is coming," says Delphi's Clasen. "The truck [of the future] will know if it is going downhill for, say, the next three kilometres, so the system could change gears, or adjust the engine management to reduce consumption [and braking effort]."

US-based Alpine Electronics has also developed Top View, which combines cameras at the front, rear and sides of a vehicle with a map database. The system could warn the driver of approaching hazards, such as junctions or tight bends, and calculate if the approach speed is too fast. Similarly, it could be interfaced directly with the brake system to apply braking, if required.

Knorr Bremse's Steinberger refers to 'sensor data fusion' and Top View provides an example of its use – where data from two inputs is combined. Delphi is also working on systems to combine information from the radar sensor with camera data, to detect pedestrians, as well as vehicles, and, again, apply the brakes, if needed. And Mercedes-Benz has also been conducting research into combining data from cameras, digital maps and radar sensors – as well as integrating data transmitted either from vehicle-to-vehicle, or from roadside beacons to vehicles, to warn, for example, of accidents ahead.

Autonomous braking is set to be one step among many on the road to reducing casualties. TE

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