IN SAFE HANDS

Passive and active truck and trailer safety systems are increasingly available, with more about to be mandated. Toby Clark reviews the state of the technologies and likely progress

Truck safety has never been more under the spotlight and, perhaps as a result, trucks have never been safer. There has long been an emphasis on passive safety: manufacturers have achieved ever higher standards for cab strength, underrun protection, seatbelts and airbags. However, passive safety is also about making drivers more aware of their surroundings. Mercedes-Benz says of its Econic: "The low position of the cab, the large panoramic windscreen and the glazed co-driver's door are all safety features." And DAF comments: "Ergonomic design… enables the driver to give maximum attention to the road."

Now active safety has come to the fore, with the imminent arrival of compulsory lane departure warning systems (LDWS) and autonomous emergency braking systems (AEBS) as part of the General Safety Regulation (GSR), under EC regulation 661/2009. LDWS – which does what it says on the tin – becomes compulsory for most trucks over 8 tonnes in November. AEBS – which prevents or minimises collisions by detecting stationary or slower vehicles in front, giving a two-stage warning and, if necessary, applying the brakes – is slightly more complex in terms of its legal implementation.

Regulation EC347/2012 concedes that "an analysis of cost/benefits and of technical and safety aspects has demonstrated that more lead time will be necessary before … AEBS can be applied to all types of vehicle". So it is being implemented in two stages: stage 1 (from November) covers all new N2 (greater than 8 tonnes) and N3 vehicles with air brakes and rear air suspension. Stage 2 comes in on 1 November 2016 for new types, and from 1 November 2018 for all new vehicles (see page 12).

Meanwhile, functions are also being added to existing brake systems – one

example being Volvo's 'Stretch Brake', designed to improve the stability of combinations down hills. If the trailer is catching up with the tractor, it is pulse-braked to 'stretch' the combination. At the moment, this system is limited to operation at speeds below 50kph.

NEW TECHNOLOGY

That said, all existing brake technology has limitations. That's why the slip-control system, being developed by Cambridge Vehicle Dynamics Consortium (CVDC), matters. It promises to improve both the performance and controllability of air brakes, by modulating the brake pressure much more rapidly and finely in response to grip from each tyre (*Transport Engineer*, February 2013, page 10). This system has now entered practical trials – first with a tri-axle trailer equipped with the system's high-speed pneumatic valves (pictured), and subsequently with a fully-equipped tractor-trailer combination.

Testing took place at MIRA, with the assistance of Volvo and Haldex. With the tractor-trailer combination, CVDC's braking distances were shortened significantly. "The straight-line stopping distance was 15–20% better," insists professor David Cebon, CVDC director. "20% represents the best you can possibly do. The limit becomes not the braking system but the tyres," he adds.

Latest developments improve the control of a truck during braking: "Tractor units can use all the friction of the front tyres in braking, and you've got nothing left for turning," explains Cebon. "But we can control the longitudinal and lateral slip of every wheel, which means we can control steering and braking simultaneously. So you've got almost the same braking performance benefits but also amazing improvements in steering." And, he says, those improvements work for vehicles in any load condition: "The

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most recent tests were about two-thirds laden, but in all cases the wheel control is the same."

So what are its prospects? "The university research phase is nearing completion and we're going into commercial research," answers Cebon. "Both companies [Volvo and Haldex] are considering how to take that forward, and they are very enthusiastic about it." CVDC's novel bi-stable air valve, which regulates each brake, should not be a stumbling block. "We've explored some of the issues of design for manufacture... It looks highly doable at low cost."

Uptake, he believes, will come down to a couple of issues: "One is regulatory – for example, if the authorities demand a higher-performance braked truck. If that doesn't happen, the issue is whether manufacturers will sell additional safety as an attribute of the vehicle. Some manufacturers definitely want to do that."

But safety is not only about brakes. Volvo's Dynamic Steering has variable electro-hydraulic assistance. At high speeds it responds only to deliberate steering inputs, while at manoeuvring speeds, assistance is increased for single-finger steering. It also self-centres when reversing. Volvo claims "you can reverse a truck and trailer more than 100m without drifting off course".

Beyond this, there has been relatively little emphasis on low-speed manoeuvring, despite the potential for accidents in the yard. In 2012, Borre and Larsson – at Chalmers University of Technology, in Gothenburg – published a Master's thesis on aids for manoeuvring road trains, which has lessons for any truck operator.

Sufficient lighting is vital, as is communicating with pedestrians (they suggest a secondary, quieter horn) and ways for drivers to judge distances. In that context, all-round vision systems, such as Brigade Electronics' Backeye 360, are now available – combining feeds from several cameras to give a real-time surround view of a vehicle in a single image. Also, Haldex has updated its EB+ soft docking system, which gives audible warnings as a vehicle reverses towards a loading bay: 1m from the dock, the truck stops automatically and, after a couple of seconds, you can complete the manoeuvre manually.

However, onboard sensors can only take you so far: the US DoT distinguishes between systems that are autonomous (using only vehicle sensors) or connected (communicating with other vehicles and roadside infrastructure). Safety agency NHTSA is investigating a dedicated short-range communications (DSRC) radio system for communication between vehicles and the road infrastructure (V2I) or other vehicles (V2V). Based on Wi-Fi (with added security), DSRC has a 300m range – greater than cameras, radar and ultrasonics – and needs no line of sight. Each vehicle transmits a basic safety message (BSM), with position and speed information, up to 10 times per second. Other vehicles process this data to determine collision threats, warn drivers and, if necessary, take control.

V2I applications being developed include 'curve speed warning' and 'spot weather information'. Most of the work has dealt with cars, but a 2014 truck study in Michigan concluded that the BSM would have to be modified to accommodate trailers. TE