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Autonomous Emergency Braking System (AEBS)

A central aspect of reducing heavy-vehicle road trauma will be the widespread uptake of technologies that act automatically to assist human beings to stay safe. Australia recently mandated Vehicle Stability Control (VSC) for some classes of new heavy truck, bus and trailer (see my October 2018 article at www.artsa.com.au/articles). The requirements were mandatory for heavy trailers (excluding dolly trailers) from 1 November 2018 and will be mandatory for heavy motor vehicles (excluding 4- or more- axle trucks and some rigid truck types) from 1 November 2022.
New heavy trailers must have a roll-over protection feature. New heavy motor vehicles must have both a roll-over protection feature and a directional control feature. Both these features involve automatic interventions of the brakes and/or engine control based upon information coming from sensors.
In August 2019 the Federal Government released a Regulation Impact Statement (RIS) entitled: Reducing Heavy Vehicle Rear Impact Crashes: Autonomous Emergency Braking. The RIS reports that Autonomous Emergency Braking System (AEBS) can reduce the severity of almost 15 per cent of crashes involving a heavy vehicle. That is, 15 per cent of crashes involve a heavy vehicle impacting the rear of another vehicle. It is estimated that for these crashes, the road trauma severity could be reduced by 57 per cent. The assumed cost of AEBS on a new heavy vehicle is $1,500 - $2,000.
We can be confident that VSC will reduce crashes based upon overseas experience and local positive experience of fuel tanker operators, timber carters and lately livestock hauliers. There has been great success with VSC reducing roll-overs on timber jinker trailers in Victoria following a mandate by Vic Forests. It is also notable that NSW requires all dangerous goods tankers that carry flammable liquids or gases to have a roll-over stability system. This leadership is to be applauded. Generally safe systems technologies cannot be retrofitted to the in-service motor vehicles, so mandating on new vehicles is necessary.
The next significant safe system technology that should be mandated in Australia is Autonomous Emergency Braking System (AEBS). ARTSA recently received a presentation from Rachel Michaud, Lead Applications Engineer with Knorr Bremse on intelligent braking technology. The technical aspects of this article are based upon her presentation. AEBS uses radar and camera imaging to identify a frontal hazard. It first warns the driver of a pending frontal collision and then automatically brakes the vehicle to reduce the severity of the crash or avoid it. It may control the engine power and it must apply the trailer brakes (if applicable). The illustrations show the three aspects of the response of the Knorr/Bendix Wingman system, that is being marketed in Australia.
The AEBS RIS relies upon estimates of road trauma reduction that were made by Monash University Accident Research Centre (MUARC). It noted that in a crash involving a heavy vehicle impacting the rear of another vehicle, AEB would reduce all forms of trauma by 57 per cent. These types of crashes accounted for almost 15 per cent of all heavy-vehicle involved injury crashes. The scale of serious road trauma involving heavy vehicles in 2016-2017 was 1832 hospitalisations and 204 deaths. The causes of rear-end crashes are thought to be inattention, cars cutting in and inadequate following distance. Not surprisingly, the majority of rear-end crashes – 84 per cent - occur in urban areas and 16 per cent in rural areas. The RIS contains a very interesting prediction of the rear-end casualty crash likelihood by vehicle age. The highest likelihood is for a four-year old heavy vehicle. That likelihood is 0.035 or 35 vehicles per 1000 per year.
The international technical regulation for AEBS is UN Regulation 131, Advanced Emergency Braking Systems. This regulation is applicable to vehicle categories NB with GVM > 8t, NC and ME vehicles. The required technical performance is summarised in the Table. The AEB must warn and then react when the test vehicle is driven at 80 km/h towards both a stationary and moving vehicle target. There are to be three warning and response levels, which are described in simple terms in the Table. Autonomous Emergency Braking was mandated progressively in Europe for new trucks with one or two axles and coaches, since November 2018. The Australian RIS estimated that about 6 per cent of new heavy motor vehicles are currently sold with AEBS. The percentage is higher in the prime mover segment at 23 per cent. This probably reflects the widespread adoption of AEBS in Europe and the growing market penetration of European-manufactured trucks and buses.
The RIS concluded that there is a net community benefit in mandating Autonomous Emergency Braking on new heavy motor vehicles and that it makes sense to require its introduction to be coincident with Vehicle Stability Control (VSC). The reasoning is that AEB uses some common hardware with VSC. However, there is a problem. The range of heavy vehicles envisaged in the RIS is greater than required for VSC. It seems Australia will require AEBS on heavy vehicle types for which VSC is not required; for example, on four axle trucks and some categories of rigid trucks. The problem is that VSC is the 'parent technology' and will be required for AEBS. This creates a hurdle for some vehicle types. I anticipate that the Australian rule might delay these vehicle types.
There is also the problem of different regulations in different countries. The USA regulator NHTSA has foreshadowed mandating AEB on new heavy vehicles (>8500lb) by 1 September 2025, but the draft rule has not yet been released. In the meantime, the USA regulator is building a coalition of vehicle manufacturers who are voluntarily offering AEBS, so the USA has the technology. There are two performance responses in common use, so called Levels 1 & 2. ECE Regulation 131 has mandated Level 2. It is unclear whether the USA will follow suit. Exciting times ahead!

Dr. Peter Hart,
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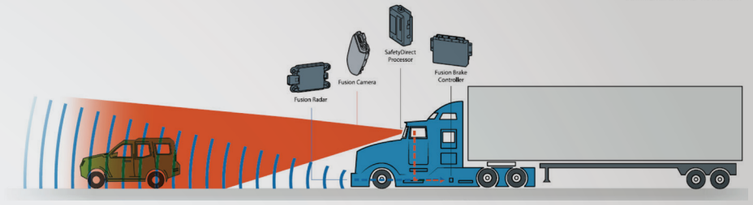
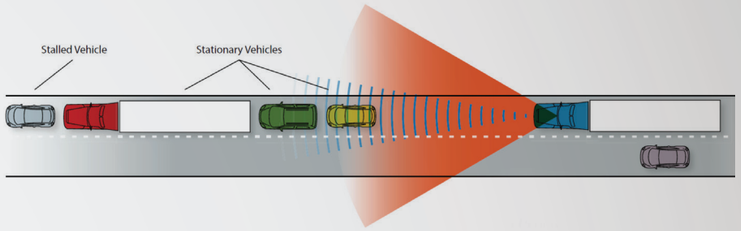
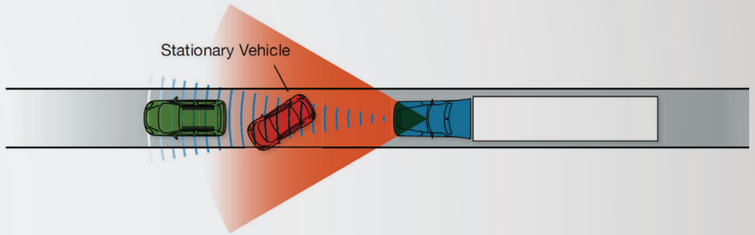
1 STATIONARY VEHICLE TARGET	2 STATIONARY VEHICLE TARGET	3 STATIONARY VEHICLE TARGET	1 MOVING VEHICLE TARGET	2 MOVING VEHICLE TARGET	3 MOVING VEHICLE TARGET
One warning (haptic acoustic, optical), Engine control allowed.	Two warnings (haptic, acoustic, optical). Engine control allowed.	Speed reduction.	One warning. Engine control allowed.	Two warnings. Engine control allowed.	Speed reduction.
No later than 1.4s before the start of emergency braking.	Not later than 0.8s before the start of emergency braking.	At least 10 km/h speed reduction.	No later than 1.4s before the start of emergency braking.	Not later than 0.8s before the start of emergency braking.	No impact with a target moving forward at 32 km/h.

Table: Required performance for a category ME (bus), NB2 (truck with GVM > 8t), NC (heavy truck)







Courtesy: **Bendix Wingman**. When the system identifies a vehicle hazard, it first warns and then applies the brakes. If the system identifies a potential hazard but cannot identify a vehicle hazard, the system will warn but not brake. It can instruct the engine to depower before applying the brakes. Wingman also includes a lane departure warning feature.