Similarly detailed test procedures for the assessment of pedestrian AEB systems are almost complete and are planned for implementation during 2016. This type of test procedure is now also being adopted further afield in the US, Japan and China.

ADAS: the future

ESC and AEB are just the beginning of the revolution in crash avoidance. Advanced Driver Assistance Systems (ADAS), such as AEB, designed to prevent or mitigate different crash types, are entering the market every year. The future will bring autonomous steering to prevent head-on collisions and 'run off road' crashes which are often very serious, or even fatal. As technology develops, we'll also see opportunities to reduce other vulnerable road user deaths such as the junction scenario where a car pulls out in front of a motorcycle.

It is important for drivers to remember that most of the ADAS systems currently available are designed to support them only in emergencies and that the driver remains responsible for the vehicle at all times. In the longer term, we can expect to see systems that will automate normal driving functions in limited traffic circumstances, such as control of speed and steering on motorways, in order to relieve the driver of the driving burden. Eventually, driverless cars will transfer this burden from the driver to the vehicle – but that is a long way off for the mainstream market, with the first fully driverless cars not expected until the end of the next decade.

The new world of crash avoidance technologies is on our roads today in the form of AEB, and is already reducing crashes, preventing injuries and fatalities and saving associated societal costs.

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Motorcycle safety through smart technology

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Spend a Sunday meandering your way along the Great Ocean road or through many of the other winding roads, all over Australia and you are sure to encounter dozens of motorcyclists gliding around the smooth curves. The freedom of controlling a machine through the bends accelerating and braking, shifting their weight, picking the best line and leaning into the corners makes a scenic ride even more enjoyable. However with the highs of motorcycle riding come significant risks, many of which can be reduced through intelligent selection of the bike's safety features.

Per kilometre travelled, motorcycle riders are over 37 times more likely than car drivers to be seriously injured when on the road [1]. Motorcycles account for 4.5% of all Australian passenger vehicle registrations and 1.1% of vehicle kilometres travelled. However, motorcycle riders and pillions account for approximately 15% of all road crash deaths and an even higher proportion of serious injuries.

Of the 287 people killed on Victoria's roads in 2011, 49 were riders of motorcycles. This represents 17% of the road toll [2]. The Motorcycle Council of NSW states that almost half (48%) of crashes in their 2006-2010 study involved excessive speed [3]. Importantly this does not mean they were all exceeding the speed limit, just that their speed was inappropriate for the conditions. In fact many accidents occur due to poor road surface, other road users' errors or even animals and debris on the road.

A small change in balance or direction when rounding a corner, loose stones or the need to brake suddenly can all

lead to loss of control accidents. A motorcycle ABS (Anti-lock Braking System) enables a rider the necessary time to focus on steering and balance while braking as hard as they can to wash off some of the speed. In an emergency a rider has many factors to consider: looking forward and to each side to select an 'exit' path; steering to avoid the immediate hazard; balance of the bike and rider; and braking pressure both on the front and rear wheels. Here the motorcycle ABS systems are most helpful. Sensors on each wheel use tiny magnetic impulses to detect the exact wheel speed and its rate of change. These signals are transmitted to the ABS control unit in a less than 1/100th of a second. The ABS computer is programmed with the bike's specific characteristics, tyre size and even calliper elasticity. Almost instantaneously the ABS unit compares the front and rear wheel speeds, throttle position and other elements of the bike's status and relieves the pressure by tiny increments to allow the wheel to maintain its deceleration but stay on the safe side of the slip threshold.

The advanced versions of ABS systems also perform brake proportioning. A rider squeezes the front lever to control the front brake and uses the foot lever to control the rear. A highly skilled rider can control this front and rear pressure and expertly balance both in normal riding conditions. However, in an emergency the advanced versions of ABS can modulate the braking proportionally to allow the rider to rapidly reduce speed without worrying about locking a wheel and losing control. Some of these advanced systems also have the ability to detect if the rear wheel is lifting and modulate the brake force to make sure the wheels stay in touch with the road.

In September 2013 the world's first motorcycle stability control system was launched on the KTM 1190 Adventure. Bosch's Motorcycle Stability Control (MSC) uses an inertia sensor module which computes the vehicle's lean and pitch angles more than 100 times per second. By analysing the lean sensor data, the difference in speed between front and rear wheels, as well as other motorcycle-specific parameters such as tyre size, tyre shape and sensor location, the ABS control unit calculates the physical limits of brake force on the basis of lean angle.

If the MSC recognises that a wheel is starting to lock, the ABS control unit activates the pressure modulator in the hydraulic brake circuit. This lowers and then restores the brake pressure within a fraction of a second, with the result that the perfect amount of brake pressure is applied as is necessary to keep each wheel from locking. (To see this in action follow the video link at http://www.youtube.com/watch?v=mO6-Y40V59U).

Technology has advanced so rapidly in the last decade that purchasers of new bikes are reliant on the motorcycle associations, journalists and technology experts to keep the industry up to date. It is critical that riders choosing their next motorcycle seek out the latest information on these safety technologies. The modern ABS systems are so small and well-tuned that the rider doesn't even notice them. There are many systems available that have multiple settings allowing the rider to select from several calibrations best suited to their riding environment. 'Wet' setting softens the interventions to ensure optimal braking on slippery roads, 'Race' setting allows track day riding without compromising braking safety. Many enduro or dirt bikes allow the ABS system to be switched off thereby maintaining the ability to lock up rear wheels on dirt track adventures but reactivate the safety feature for the ride home.

The developing world has millions of two wheelers on their roads. With 90% of road fatalities vulnerable road users – including cyclists, pedestrians and motorcyclists - many of these are the family income-earner. These families often cannot afford to own a car so the small sub-125cc motorcycle is a popular transport choice. With the smallest Bosch ABS unit weighing less than 700g there is no need for manufacturers to limit these safety systems to larger bikes on the grounds of weight or cost. Last year Bosch sold its one millionth Motorcycle ABS unit and its current generation ABS9 unit is 1/2 the size and weight of its predecessor.

The German accident statistics database GIDAS shows that one-quarter of all motorcycle accidents could be prevented if ABS were standard. The severity of a further one-third of these accidents could be mitigated by the antilock braking system. A recent study in USA [4] states, "Over-braking and under-braking have been shown to be common factors in motorcycle crashes. The rate of fatal motorcycle crashes per 10,000 registered vehicle years was 37% lower for ABS models than for their non-ABS versions." The study concludes "ABS appears to be highly effective in preventing fatal motorcycle crashes."

Australian states and territories all have motorcycle safety high on their priority list. The Victorian police have recommended ABS be considered as part of an ANCAP safety star rating system. The TAC in Victoria is running a campaign called 'The Perfect Ride' which addresses key safety issues including; speed, road position and awareness of other road users. In Western Australia the Office of Road Safety follows a similar line encouraging motorcyclists to wear the appropriate safety gear, and importantly, choose the right bike. Queensland's Department of Transport urged riders to understand their own heightened vulnerability and act accordingly to minimise the risk of collision.

The European Parliament has mandated ABS from 2017 for all motorcycles with more than 125 cc displacement. This directive applies from 2016 to any new models that are launched. Smaller motorcycles with a displacement of 50 cc or more must be fitted either with ABS or a combined

braking system. In the USA the influence of European bikes means that ABS will soon be available on most models. The American Motorcycle Association "doesn't oppose ABS, but has always maintained that ABS should be a rider's choice, must be affordable and riders must be able to switch ABS on and off on dual-sport machines." It is a clear, world-wide movement to ensure reliable, proven safety systems are introduced as quickly as possible to all levels of motorcycles to help slow the disturbing rise in fatal and serious accidents.

While Australia has some of the world's best conditions for riding we also have a disproportionate level of death and serious injury. With an increasing number of motorcycles sharing the ever more crowded roads it is critical that riders give themselves the best chance of avoiding an accident regardless of who is the cause. A bike that can avoid wheel lock up and be controlled while braking hard is a valuable asset in ensuring that any ride finishes on a high; not on a hospital trolley.

Notes

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Standards and consumer information – the winning formula for vehicle safety in the UN Decade of Action

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Each year 1.3 million people are killed and up to 50 million injured in road crashes worldwide. By 2030 the World Health Organisation (WHO) forecasts that road crashes will become the fifth leading cause of death rising to 2.4 million per year [1]. To try to avoid an inexorable rise in road injury the United Nations has proclaimed a Decade of Action for Road Safety 2011-2020 [2] with the goal to reduce the forecast level of fatalities in 2020 by 50% avoiding five million deaths and 50 million injuries. To support this aim the UN Road Safety Collaboration (UNRSC) [3] has prepared a Global Plan for the Decade based on the "safe system" approach; an integrated and holistic strategy that simultaneously promotes safer vehicles, safer roads and safer road users [4].

The world's vehicle fleet reached 1 billion in 2010 and is forecast to double in a decade. This unprecedented increase is occurring in developing countries which account for 90% of global road deaths. About 48% of all road fatalities are vehicle occupants. So unless action is taken now to improve vehicle safety, the newly motorising countries will suffer a growing road injury burden. Today passenger cars in Australia, Europe, Japan and the USA are much safer than ever before. This is the result of regulatory "push" and market "pull". Mandated standards, combined with consumer demand, have stimulated the production of safer vehicles by the automobile industry. The challenge now is to promote similar progress in the rapidly motorising countries.

Through the UN World Forum for Harmonisation of Vehicle Regulation (WP29) [5] motor vehicles can now be internationally approved without further tests provided they meet the relevant UN standards. The World Forum uses two Agreements, adopted in 1958 and 1998, to provide a legal framework that allows any UN Member State to apply voluntarily a wide range of motor vehicle standards. The UN Forum's most important safety regulations are: seat belt anchorages - Reg. 14; safety belts and restraint systems - Reg. 16; occupant protection in frontal collision - Reg. 94; occupant protection in lateral collision - Reg. 95; electronic stability control - GTR 8; and pedestrian protection - GTR 9.