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“It’s time to put road accidents in a museum. And that’s no longer a utopian vision. Technologies such as our driver assistance systems and premium tires are ready to play their part. Assistance systems keep the vehicle in lane and on the road, monitor the blind spot, brake autonomously or call for help in an emergency. Tires from the premium Continental brand present excellent braking characteristics that help make the roads a safer place. But it takes a combination of smart assistance systems and our premium tires to deliver maximum safety”, says Dr. Elmar Degenhart, Chairman of the Executive Board of Continental AG.

Dr. Elmar Degenhart

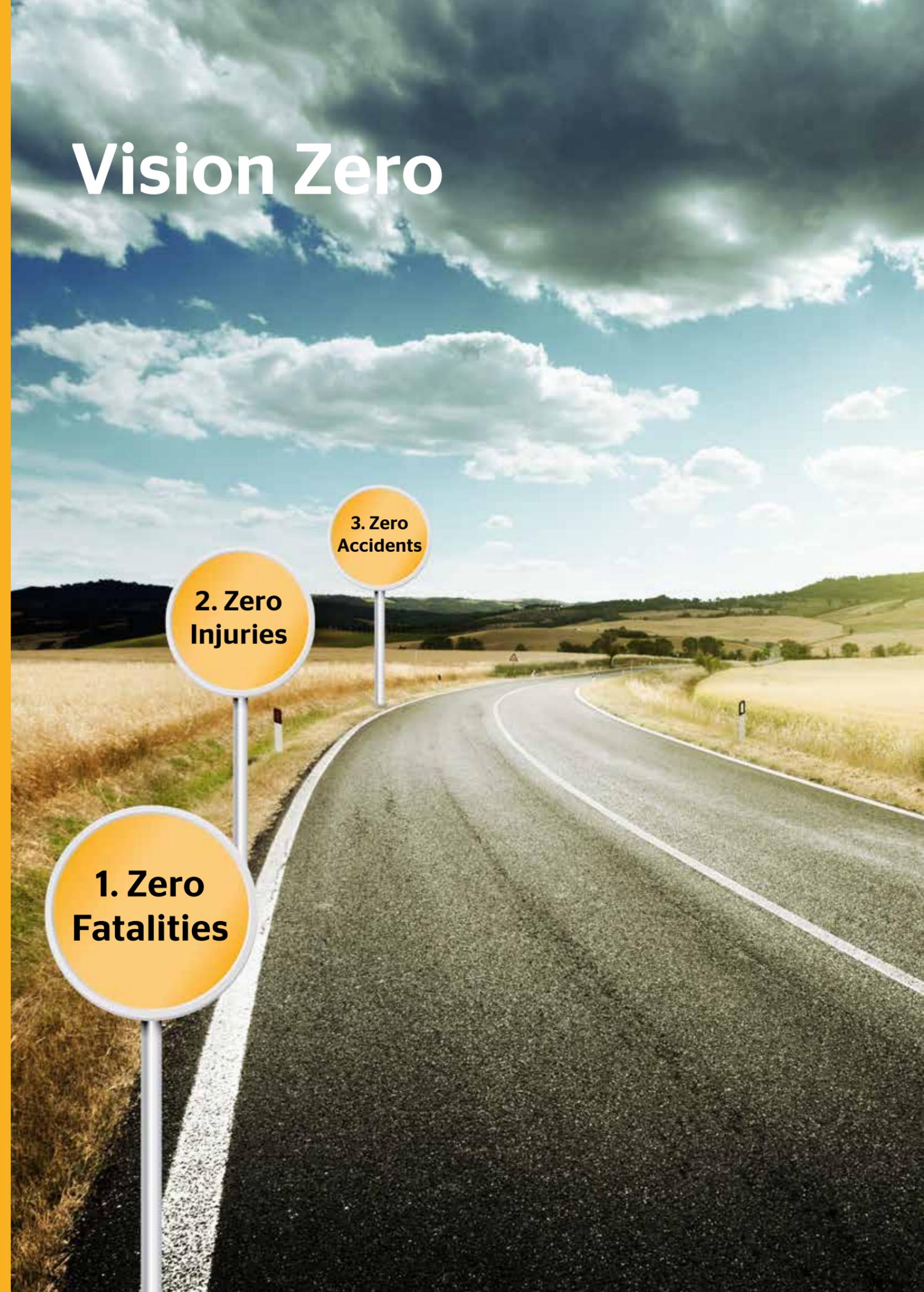


Vision Zero

**1. Zero
Fatalities**

**2. Zero
Injuries**

**3. Zero
Accidents**



The best of all worlds: Multi-sensor solutions combine the advantages of different technologies

Innovative technologies can help to prevent accidents by detecting hazardous situations at an early stage. The two most common types of sensor technology found in today's collision avoidance systems are radar and camera sensing. Both are single-sensor solutions, each of which has its own specific advantages, but at the same time also its inherent limitations. Due to these limitations, the single-sensor radar- or camera-based solutions of today will soon no longer be capable of delivering the much-coveted five-star rating in the EURO NCAP test. Only vehicles equipped with multi-sensor technology will be able to meet the more varied and challenging requirements of the new EURO NCAP test scenarios that will come into force from 2018. By using different types of sensor in combination, such multi-sensor solutions aim to support drivers and improve safety across a wide variety of driving situations.

State-of-the-art driver assistance systems are now firmly established on the car market. Designed to support the driving task, they first emerged in the form of brake boosters and power steering systems. Mercedes was one of the first manufacturers to equip selected models like the 300 SL, the 300 b and the Borgward P 100 with brake boosters in the 1960s. Later milestones were the Anti-lock Braking System (ABS) and the vehicle dynamics system Electronic Stability Control (ESC). The latter marked a step change on safety, moving from mitigating the consequences of a collision to proactive accident prevention. ESC corrects the kind of driver error that would cause the vehicle to skid when cornering.

All of these systems are based on sensors that monitor specific aspects of the vehicle's dynamics such as wheel speed, yaw, lateral acceleration and steering wheel angle and relay the acquired data to an on-board computer. Here the data are analyzed and converted into corrective impulses that help the driver maintain control. For a long time the operation of such sensor-based systems was dependent on driver actions. The system used these actions (for example application of the brake pedal) to determine the driver's intentions. It then supported this "plan" as far as its capabilities allowed. If the driver failed to respond when an accident risk was detected, because they underestimated the risk, or if they were distracted and responded too late, the assistance system was powerless to intervene. Development of the first "seeing" sensors brought a radical change. Camera-based predictive sensors were first deployed in reversing aids. Since 2007 such rear vision technology has

been mandatory on vehicles with a permissible gross vehicle weight over 3.5 tonnes and on buses. When used in forward-facing cameras, this technology has a wide range of possible applications, for example in lane-keeping systems.

As an alternative to cameras, in recent years safety functions such as Emergency Brake Assist have been making increasing use of long-range radar sensors. Both radar and camera systems have the advantage of being able to detect and respond to accident risks without any driver input. Depending on the individual system's design and specification, the assistance system may generate visual and/or audible warning signals if a hazard is detected. Additionally, if the driver fails to react to these signals, the system may even actively intervene, for example by bringing the vehicle to a standstill. The installation of such systems in more and more vehicles in recent years has led to significant improvements in safety.

Consumer organizations force the pace on vehicle safety systems

The increasing number of today's vehicles featuring these safety technologies as standard specification is partly down to the work of the NCAP consumer testing organization, which was founded in 1978 in the USA. NCAP (New Car Assessment Program) aims to provide consumers and vehicle manufacturers with a realistic and objective assessment of vehicle safety performance - among other things based on standardized crash tests. In 1997 a European NCAP program was founded too. Euro NCAP is an association of European transportation departments, automobile clubs and insurance federations based in Brussels. Euro NCAP rates a car's safety on a scale from one to five stars, based on criteria which are continuously evolving and becoming ever more stringent. As well as assessing the vehicle's crash test performance, Euro NCAP also increasingly takes into account the level of "safety assist" technology installed in the vehicle when deciding whether to award the top star rating.

Combining different types of sensor system opens new avenues

In light of the growing number of accidents involving pedestrians and cyclists, particularly in the dark or in low-visibility conditions, Euro NCAP decided back in 2014 to introduce progressively stricter vehicle safety requirements over the period up to 2020 to ensure better protection for the most vulnerable road users. To address the most typical accident scenarios involving pedestrians or cyclists, one of the most important requirements

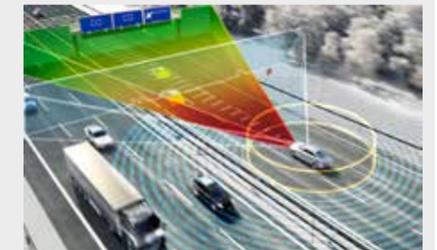
In the near future, integrated multi-sensor systems will assume an important role as an efficient and effective way of reducing driving stress in every conceivable type of dynamic situation.



Emergency Brake Assist with pedestrian recognition



A demo car equipped with a radar sensor and a camera detects when a cyclist crosses the lane and warns when the object is in the path of the vehicle.



360 degree surround view: Different sensors complement each other for a detailed and seamless 360-degree view of the entire vehicle environment.

is to ensure that collision avoidance systems are able to detect crossing objects in good time, and are able to determine the direction and speed of travel of such cross-traffic in fractions of a second. With this aim in mind, from 2018 the Euro NCAP test scenarios will be based on a much wider range of criteria. The new criteria will be so challenging that it will no longer be possible to rely on current single-sensor long-range radar or mono-camera systems to achieve the five-star rating to which manufacturers aspire. In future, the solution will be to use multi-sensor systems.

Based on experience acquired with emergency braking systems, which have been in worldwide use since 1999, as well as on its knowledge of the inherent strengths and weaknesses of individual sensor technologies, Continental has made radar the primary component of its predictive safety systems, while at the same time backing this up with camera-based technology. Cameras make the perfect complement to radar, making it possible to cover as many accident scenarios as possible, including drifting out of lane. Mono-cameras can detect not only lane markings but also road edge markers such as curbstones and crash barriers. They are used in lane-keeping systems and also provide a simple means of implementing functions such as road sign recognition and intelligent headlamp control.

By combining radar sensors and cameras in a multi-sensor system, it is possible to exploit all the strong points of these different systems while at the same time ensuring that the inherent weaknesses of each system are less of an issue than in the case of a single-sensor solution.

Camera-based systems, for example, have a weakness when it comes to changes in visibility, which can impair the system's functioning in real-world driving. A basic rule of thumb is that in any situation where the driver's eye has problems, the camera will have problems too. The most familiar examples of such

situations include fog, driving in the dark or into the sun or situations where sunlight is reflected off a wet road after rain. In the same way that for the driver, sunglasses or a sun visor are often little help in such situations, the basic problem for the camera is always that if there is insufficient contrast in pixel intensity - due to either excessive or insufficient light exposure - reliable object detection is not possible.

Radar systems, by contrast, have a key advantage in this area. Their sensors emit electromagnetic waves which are then reflected back by objects in their path and evaluated. Radar sensors can simultaneously determine the distance, relative speed and angle of detected objects. Radar images can also be used to differentiate between static and dynamic objects. Poor visibility is never a problem for electromagnetic waves. But, of course, radar too has its limitations. For example an unusually large number of objects (and hence a large number of reflected radar signals) in the sensor's "field of vision" makes it more difficult to distinguish potentially critical obstacles from the mass of unimportant information. Radar also lacks the ability to distinguish between colors, which is important for detecting road signs and lane markings.

Future multi-sensor systems will make all types of driving situation less stressful for the driver.

Multi-sensor solutions, with sensors that complement one another, can correct and compensate for weaknesses while at the same time combining their strengths. That said, the tried-and-tested single-sensor systems of today have already brought major improvements in safety. For example, Rear Cross Traffic Alert (RCTA), a parking aid developed by Continental, checks for cars and two-wheelers to the rear of the vehicle when reversing out of a parking space and warns the driver of any hazards. The system can also be configured to initiate autonomous braking in an emergency.

Braking and handling in the wet



Dry braking



Dry handling



Continental and ADAC launch joint “Safe Driving Expert 2017” competition

- › 40 participants for the seven preliminary-round events were drawn at random from over 4,000 applicants
- › The six best drivers from each preliminary event qualify for final in Linthe near Berlin in September
- › The winner gets one year’s use of an i8 plug-in hybrid from vehicle partner BMW

As part of their partnership for greater road safety, Continental and the German automobile association ADAC have launched the “Safe Driving Expert 2017” competition. In what was the first of seven preliminary-round events, 40 women and men got a chance to show how safe, smart and experienced they are at the wheel. At the ADAC driving safety center in the Laatzen district of Hanover, the contestants competed against one another in a total of five theoretical and practical tests. The six best-placed drivers from each preliminary event qualify for the final, which will be held at the ADAC driving safety center in Linthe near Berlin at the beginning of September. The participants were drawn at random from more than 4,000 applicants. The vehicle partner to the entire competition is premium automaker BMW and the winner of the final will get to drive a 362-horsepower BMW i8 plug-in hybrid free of charge for one year.

“The aim of our Safe Driving Expert competition is to actively promote road safety in Germany and thereby make a lasting

contribution to reducing the number of road fatalities,” explained Continental’s Frank Jung, who is responsible for Passenger Car Replacement Tires in Germany. “The idea is for the contestants to learn to recognize the far-reaching consequences of even the smallest of driver errors, understand why driving at appropriate speeds makes sense, and experience for themselves the impact of a vehicle’s tires on its handling.” Under the watchful eyes of by ADAC instructors, after an initial theoretical test the contestants have to show they’ve got what it takes to be a Safe Driving Expert in four practical exercises. In one of these exercises they have to brake the car from a speed of their own choosing safely to a halt before it reaches a specific point on the road. The other tests in which they score marks take them round a slippery bend, through a slalom and onto the skid pan.

Continental has been partnering with ADAC’s eleven driving safety centers in Germany since the beginning of 2017. Both parties see their collaboration as the ideal complement to their own road safety enhancement activities.



Innovations for automated driving - CUBe, Cruising Chauffeur, Trained Parking

More and more people live in towns and cities – according to a UN study conducted in 2014, by 2050 two thirds of the global population will live in urban areas. And in these towns and cities they also drive cars. Accidents, emissions, loss of time, notorious parking problems and stress are the ever-present consequences of this concentration of traffic in urban areas – and this growth in the world’s megacities is helping to drive the radical evolution of our future mobility

“The future of individual mobility in urban areas will be self-driving, electric and part of the shared economy,” says Frank Jourdan, member of the Executive Board of Continental AG and President of the Chassis & Safety division. “That’s why we are working at cross-divisional level to develop solutions for self-driving robo-cabs and will be running our first practical tests before the end of this year. In this respect, Continental can draw on an almost full-line portfolio of our own sensors, actuators, control units and communications technology and connectivity.” According to a study conducted by management consultants Roland Berger, by 2030 roughly one quarter of all transportation tasks will be handled by driverless vehicles. This potential revolution in the automotive business world was all the motivation Continental needed to launch a cross-company development project by the name of Self-Driving Car.

include many elements of typical traffic infrastructure, such as road signs, intersections, pedestrian crossings and sidewalks, making this the ideal setting for realistic trials. In many areas the technology in the CUBe is based on tried and tested components from driver assistance systems that are already installed in production models. But there are also new technologies such as the laser sensor. Building on this expertise, Continental is working to take these systems forward and drive the vehicle in fully autonomous mode. The CUBe puts Continental among the pioneers of the key technologies required for robo-cabs. “This topic has attracted a great deal of interest in recent months,” says Jourdan. “So this is the ideal time to have the courage of our convictions and start practical trials in order to set the stage for the future.” As it does so, Continental will be using a large number of technologies with which the Corporation has extensive experience – from sensors and control units to software algorithms, braking systems and powertrains.

Cruising Chauffeur to be available from 2020

The main risk factor on the roads remains human error. It ranks among the causes of around 90 percent of all accidents. Consequently, automated driving represents an important step along the road to Vision Zero – the goal of a world without road fatalities, injuries and accidents.

Highly automated driving on motorways/freeways is no longer a distant dream. As early as 2012, Continental began trialing such systems on public roads in the U.S. State of Nevada. In the meantime the Corporation has a fleet of development models in operation around the world – in Germany, the USA, Japan and China. The Cruising Chauffeur functionality enables vehicles to assume full control of the vehicle on motorways/freeways to the extent permissible under the relevant national legislation. In line with the driver’s selection, this either takes place in semi-automated form in which the driver still has to monitor the system, or – in the near future – in highly automated mode in which the driver can engage in other activities. With Cruising Chauffeur activated, a central Assisted & Automated Driving Control Unit (ADCU) evaluates the data provided by the environmental sen-



CUBe - Continental Urban mobility Experience - test vehicle

With a view to bringing self-driving mobility above all to urban areas, Continental has built a test vehicle. It’s called the CUBe (Continental Urban mobility Experience) and will be operating in test mode at the Frankfurt plant. The grounds of the plant



sors – camera, radar and LIDAR. Based on this data, the Cruising Chauffeur algorithms compile a 360 degree model of the vehicle environment. In conjunction with a high-resolution map, this will include all moving and stationary objects, the course of the road and the different lanes. The system continuously computes the vehicle’s own position with great precision. As a result, the algorithms can plot the road space that the vehicle can safely enter while respecting the traffic regulations, and drive the car into this space. This means that Cruising Chauffeur can also change lanes and overtake automatically.

Trained Parking

Normally it’s drivers who have to learn how to park their cars – and this is not normally one of their favorite tasks. Continental

has therefore come up with a solution that can at least relieve drivers of routine parking maneuvers: On request, the new Trained Parking functionality stores the exact course of a parking process. If the car is to be parked in the same place again, all the driver has to do is drive it to the vicinity of where the stored process began, then at the touch of a button the vehicle automatically repeats the parking process it has learned. “Maneuvers like moving the car from outside the house and into the garage show just how capable vehicle automation has already become,” says Alfred Eckert, Head of Advanced Engineering at Chassis & Safety. “Automation is already superbly dependable when repeating procedures and the technology is constantly improving when it comes to the identification and handling of modified situations.”



To acquire the vehicle environment for the Trained Parking function, Continental uses the sensors already installed in the vehicle, such as camera and radar systems. “That makes Trained Parking a good example of the efficient, multiple use of the sensor technology in the vehicle,” says Eckert. During the learning process, that is to say the first, manually controlled parking maneuver, the system draws on sensor data to compute a precise map of the environment and stores it. When the vehicle enters the area covered by this map, it can locate its precise position and drive the course it has stored automatically. The driver can get out of the car before activating the parking maneuver. The car parks itself with no further intervention. This way, Trained Parking not only relieves the driver of routine tasks but also means that tight parking spaces can be used without the driver then having to squeeze out of the door.

Stop the Crash was launched in Thailand in spring 2017

Stop the Crash Thailand launched in Bangkok today bringing the global partnership that promotes the latest in life saving crash avoidance technologies, to a country that has one of the worst records in road safety. The Bangkok event follows on from the successful ASEAN launch that took place in Kuala Lumpur November 2016, where the Minister of Transport announced Electronic Stability Control (ESC) would be mandatory in Malaysia from June 2018.

The launch in Bangkok focused on motorcycle safety technologies as nearly three quarters of fatalities on Thailand's roads are two and three wheelers. Anti-lock braking system (ABS) for motorcycles and Blind Spot Detection (BSD), the two technologies demonstrated by Stop the Crash, could make a significant impact in reducing deaths in the country and save



thousands of lives. Other technologies on display included ESC and autonomous emergency braking (AEB). The Thai edition of Stop the Crash is the fourth Stop the Crash event held as part of the partnership's activities.

David Ward Stop the Crash Chairman said: "Stop the Crash is pleased to be in Thailand. This country faces a huge challenge in road safety and technologies such as ABS on motorcycles, ESC and BSD can make a difference. We are pleased that the Thai government has engaged with Stop the Crash, but we urge them to legislate as this is best way to reduce the number of deaths fast."



Kobchai Boonya-orana, Deputy Director General for Department of Disaster Prevention and Mitigation in the Ministry of Interior said: "We are very pleased to be hosting Stop the Crash in Thailand today during UN Road Safety Week. The Thai vehicle fleet is heavily composed of two wheelers, technologies such as ABS for motorcycles and Blind Spot Detection are proven and can prevent crashes. Stop the Crash can make a real difference in accelerating the adoption of life saving technologies into the Thai market and help save lives. We look forward to continued close collaboration with Global NCAP and the Stop the Crash Partnership to achieve these goals." Hon Nikorn Chamnong MP, President of the Ad-Hoc Committee on Road Safety System Reform Thailand

and Member of the Leadership Council of the Global Network for Road Safety Legislators said: "It is great that Stop the



Crash is taking place in Thailand during UN Global Road Safety Week. Safety technology is urgently needed in Thailand in order to address the large number of fatalities found on our roads. This week the #4RoadSafety Manifesto was launched providing a template for legislators to bring road safety regulations to their countries. I hope that following Stop the Crash the Thai government will bring legislation on ESC and ABS in motorcycles, two technologies much needed in our country and that can help save lives."

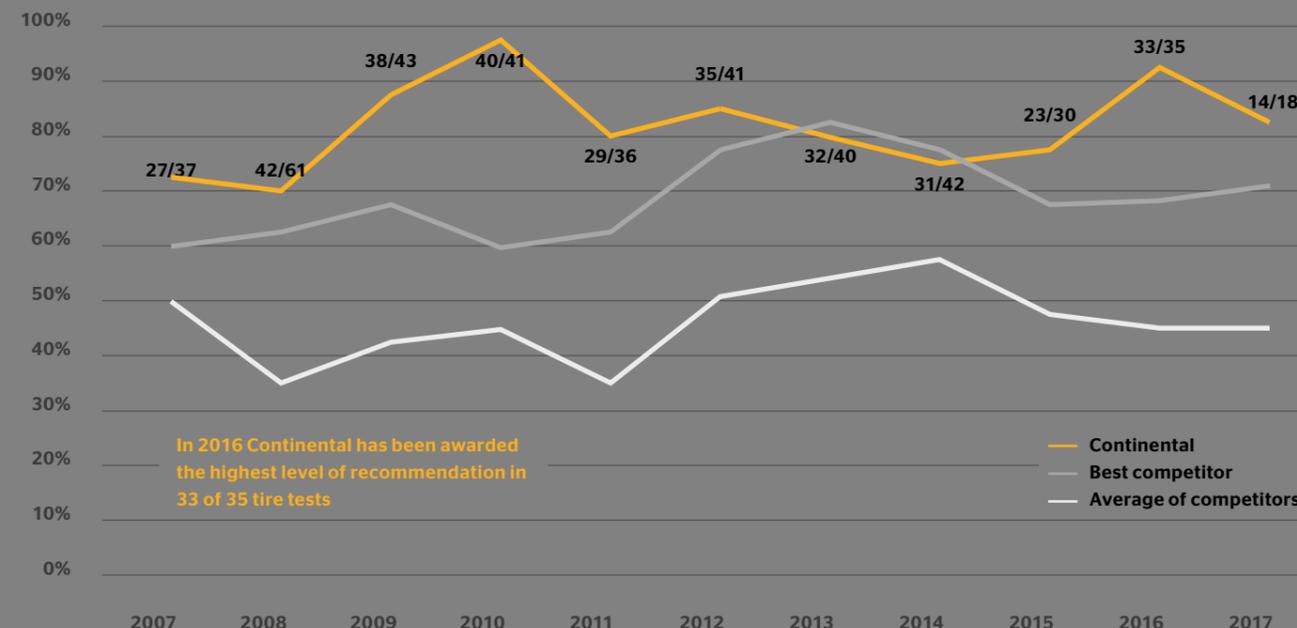


www.stopthecrash.org

Excellent summer tire test results support Vision Zero – safety characteristics given highest weighting by far

Evaluation of all summer tire tests from 2007 until 2017

The premium passenger car tire brand most frequently awarded the highest level of recommendation by independent experts worldwide.



Status: May 2017

Continental is the premium passenger car tire brand most frequently awarded the highest level of recommendation by independent experts worldwide. This finding is confirmed by an evaluation of all the car magazines containing tire test reports available to Continental, from 2007 to the present.

Almost all independent tire test media teams around the world consider the safety characteristics of the tires that they test the most important criterion. This is reflected in the high weighting assigned to test disciplines such as braking on wet and dry roads, aquaplaning and handling. The highest level of recommendation is only awarded to those tires that reveal no weaknesses in any test discipline. Consequently, the number of highest recommendation levels awarded compared to the total number of tire tests conducted is a good indicator of which products/brands offer the highest safety reserves. The graph above shows in percent how many of these highest recommendation levels were awarded to premium Continental products. In 2016 this was the case in 33 out of 35 summer tire tests. The second curve shows the performance of the second-best summer tire brand in each year.

The third curve shows the average for all premium competitors. According to the underlying figures, summer tires of the premium

brand Continental have been tested a total of 424 times since 2007, achieving the highest recommendation level 344 times. At over 80 percent, this equates to a quota which impressively underlines the technology-leading level of the Continental tires developed in Hanover.

Current examples include the best-in-test SportContact 6 featured in Autobild magazine and the test-winning Premium Contact 6 which was shown to have not only the best braking characteristics but the best environmental characteristics as well. As this clearly shows, it is indeed possible to achieve a combination of safety and environmental characteristics at the very highest technological level in a single product. This way, Continental makes a remarkable contribution to Vision Zero as well as to sustainable resource use.



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