Bosch Safety Survey on Electronic Stability Control ESC

Do Japanese motorists know their guardian angel?
Introduction

Road transport plays a crucial role in every modern society and ensures the mobility of their citizens. Important efforts have been made in the past to make mobility as safe as possible. However, statistics show that much can still be done to reduce the risk of road deaths and injuries. Vehicle safety technologies make important contributions to this effort, and crash avoidance technologies like the Electronic Stability Control (ESC) have opened up new dimensions in achieving better driving safety. Research by NASVA (National Agency for Automotive Safety and Victims’ Aid) shows that in Japan, ESC can reduce the likelihood of being involved in severe single-vehicle accidents and head-on collisions by 62%.

As the director general of the FIA Foundation I would like to urge all car buyers to take this simple step: when choosing your next new or used car, make sure it is equipped with ESC safety!

The Japanese government strives for the 'safest roads in the world' and has implemented a variety of fundamental programs and initiatives for traffic safety since 1971. The target of the current plan is to reduce traffic fatalities in Japan to below 5,000 by 2012.

As a leading automotive technology supplier, Bosch has the vision of accident-free driving and is the pioneer in safety systems that actively prevent traffic accidents before they occur. In 1978, Bosch brought ABS to the market, laying the foundation for all subsequent active safety systems in motor vehicles. In 1995 we followed with the market launch of the ESC, a safety technology that assists drivers in dangerous skidding situations. We see ESC as an essential safety system for every vehicle.

Bosch has conducted a survey which investigates Japanese drivers’ awareness of and attitude towards active safety systems, especially ESC. The survey results show that the life-saving potential of ESC is still not known to most motorists in Japan, and that the benefits need to be further communicated. I hope you will find this brochure both interesting and informative, and that after reading it you will also agree with me that ESC should become a standard component in every car and thereby making Japan’s roads a safer place.

David Ward
Director General
FIA Foundation

For a more detailed insight on ESC, like its functionality, its technical features, video clips and animations, please visit http://www.bosch-escential.jp.

Active Safety Systems

The Electronic Stability Control ESC

The Electronic Stability Control ESC is an active safety system that combines the functions of the Antilock Brake System ABS and the Traction Control System TCS and additionally helps drivers to avoid crashes by significantly reducing the danger of skidding.

ESC is an evolution of the pioneering ABS technology first launched by Bosch in 1978. In critical driving situations, the wheels of a vehicle may lock during braking, thus reducing the adhesion between tires and the road surface. Locked wheels prevent the steering ability of the vehicle and increase stopping distances. ABS detects imminent wheel locking and modulates braking pressure at individual wheels. With ABS the driver can brake safely and steer around obstacles.

Loss of control of the vehicle can occur not only while braking, but also when starting off and accelerating, particularly on slippery roads and on hills. Based on ABS technology, the TCS prevents wheels from spinning by applying the brake at the spinning wheel and by reducing the drive torque. With TCS the driver maintains control of the vehicle when accelerating and has optimal traction.

Sudden maneuvers such as rapid steering and counter steering, sudden lane changes and obstacle avoidance may create vehicle instability and lead to skidding. ESC becomes active when skidding is imminent. It detects the risk of a skid at an early stage even before the driver and uses the vehicle’s brakes to steer the vehicle safely back on track. 25 times a second it compares whether the driver’s steering intention corresponds to the actual direction of the vehicle. If the vehicle moves in a different direction and starts to slide out of control, ESC intervenes instantly by braking the relevant wheel. This selective braking intervention generates the desired counteracting force, so that the vehicle reacts as the driver intends. ESC substantially reduces the complexity of the steering process in critical situations and lessens the demands placed on the driver.
Mobility is an important achievement of modern society that contributes significantly to the economic growth of a nation. But looking at the worldwide road statistics, the need for sustainable mobility – the protection of road users – is apparent and nations are increasingly paying attention to road safety. Loss of control, or skidding, has been demonstrated to be the dominant risk factor in the pre-crash phase. An international comparison of the occurrence of skidding in the pre-crash phase shows that at least 20% of all accidents resulting in injury are related to skidding of the vehicle in the pre-crash phase, and in the case of fatal accidents this figure rises to 40%.

The wider proliferation of ESC across the vehicle fleet has allowed the evaluation of its effects in actual crash situations in many countries. Studies to assess the effectiveness of ESC now have been conducted in Germany, Sweden, France, the United Kingdom, the United States, Australia and Japan. All these studies confirm the benefits of ESC on different road surfaces, using different analytic methods, different makes and models of vehicles, including both cars and SUVs. There is common agreement that ESC is highly effective in reducing single-vehicle accidents in cars and SUVs: fatal single-vehicle crashes by between 30 to 50% among cars and 50 to 70% among SUVs. In 2005 the Japanese study by the National Agency for Automotive Safety and Victims’ Aid (NASVA) confirmed that single vehicle crashes can be reduced by 44% and severe accidents by 62%. An earlier study by Toyota in 2003 indicated similar results: a reduction for single vehicle accidents by 35% and for severe single vehicle accidents by 50%.

In Japan, 27% of the vehicles produced in 2007 were equipped with ESC. Around half of those vehicles were designated for the domestic market. The domestic ESC installation rate for newly registered vehicles in 2007 stood at approximately 14%. An analysis by vehicle segment indicates that ESC is almost a standard feature in the upper, luxury car and SUV segments. The Mini and Minivan segments, however, which together account for approximately 50% of all new car registrations in Japan, reflect either no ESC or an ESC installation rate below 10%. Even in the Small and Compact segments, which together comprise the next largest market share (25%), the installation rate has increased only marginally.

Road Accident Studies
ESC increases road traffic safety

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**New Vehicles Installation Rate ESC in Japan and worldwide**

In 2007, approximately one third of the 73 million passenger and light commercial vehicles below 6 tons produced worldwide were fitted with ESC. This figure is projected to reach 44% by 2010, and by 2012, every second vehicle is expected to have ESC on board. This worldwide increase can be attributed largely to the legislative developments regarding ESC in the US and Australia, where ESC will be mandated in 2011. In Europe, the European Commission has submitted a legislative proposal to make ESC a mandatory equipment for all new vehicles starting in 2012.

**ESC-Installation Rates – based on production**

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Survey Methodology

The Bosch ESC Safety Survey Japan has been commissioned to investigate the importance of vehicle safety to Japanese car buyers. Furthermore the knowledge and the attitude regarding vehicle safety systems have been examined.

The survey has been conducted from May 2008 to June 2008 and covered the Japanese regions of Hokkaido, Tohoku, Kanto, Chubu, Kansai, Chugoku, Shikoku, Kyushu and Okinawa.

The representative market survey was based on an online questionnaire. 503 Japanese drivers with the following demographic characteristics were interviewed:

- **Ratio Female : Male** 31% : 69%
- **Average age of participant** 43 years
- **Average age of car** 4 years
- **Average km per year** 10,150 Kilometers
- **Ratio New Car : Used Car** 71% : 29%
- **Car makes** According to market share

The survey has been conducted earlier in 2006 in seven European countries: Great Britain, the Netherlands, Belgium, Germany, France, Italy and Spain. In this report, the major findings of the Japanese survey are compared with the average results of these European countries.

Critical driving situations are no exception in Japan

**Question** “Have you ever made an emergency stop?”
“Have you ever skidded with your car?”

Almost two thirds of Japanese drivers have already encountered an emergency braking situation, and 43% of the drivers have already skidded with their car.

In Europe, car drivers had similar driving experiences: over 70 percent of interviewees had experienced emergency braking situations, while 30 percent had skidded with their cars. These results reveal that dangerous driving situations can occur to everyone almost anytime.

Avoidance maneuvers are the main reasons for skidding

**Question** “Why did your vehicle go into a skid?”
“Where did you have to make an avoidance maneuver?”

Avoidance maneuvers, triggered for example by situations when a car or a person suddenly appears on the street, are the most common reasons for skidding (39%), followed by run-offs from the road. Drivers responded that avoidance maneuvers happen mainly on country roads and in town. This shows that skidding is not restricted to driving with high speed on motorways, but can occur everywhere. ESC significantly reduces skidding and has been heralded as the biggest life-saver since the introduction of the seat belt.
Japanese drivers
Safety is a main purchasing criterion

Question “How important are the following criteria to you when purchasing a car?”

For Japanese drivers the price is the main criterion when purchasing a car. Safety follows closely in the second place. The criteria mileage, comfort & convenience and design enjoy also high importance among Japanese drivers.

European car buyers consider safety as their no.1 purchasing criterion. In Europe the price ranks second and mileage comes in third place.

Active Safety Systems have a low awareness in Japan

Question “Spontaneously, which car safety systems do you know?”

Overall, the spontaneous recognition of safety systems is rather low in Japan. Among all safety technologies airbags are the most known: 51% of respondents spontaneously named airbags followed by ABS with a 31% rate. Seatbelts come in 3rd place with a rate of 17%. Only 5% of the interviewees were able to recall ESC as a car safety system. Comparing Europe with the Japanese findings, airbags were also number one with 88% recall, followed by seatbelts with 58%. ABS was in third place with approximately 37% recall rate. ESC was recalled by 15% of the respondents.

The survey shows that airbags, belonging to passive safety systems, have the highest recall rate among Japanese drivers. However, passive safety systems only reduce the severity of accidents and injuries after the accident has already occurred, while active safety systems, such as ESC, prevent and actively avoid accidents. The recall rate of active safety systems such as ABS or ESC is at a very low level in Japan.
Awareness of ABS and ESC increase when prompted

**Question** “Have you ever heard of ABS?”
“Have you ever heard of ESC?”

Interviewees who had not mentioned ABS and/or ESC spontaneously in the previous question were prompted for ABS and ESC.

This question resulted in an additional 65% prompted awareness for ABS and 59% for ESC. Combined with the percentages resulting from the spontaneous awareness, this leads to a total awareness of 96% for ABS and 64% for ESC. These results show that there is nearly no difference in the total awareness between Japanese car buyers and their European counterparts: 97% of Europeans know ABS and 61% have heard of ESC.

To understand the benefits of ESC further communication is necessary

**Question** “What are the benefits of ESC?”

Knowing the name ESC is not equal to knowing what ESC is and what its safety benefits are. Out of the 64% of respondents who have heard of ESC only 31% are able to describe its benefits correctly, which is to prevent the car from skidding and to keep the vehicle safely on track. This is on par to Europe where 31% responded correctly, too. However, while in Europe many motorists described ESC correctly in parts, there is a large portion of Japanese drivers who described the benefits of ESC wrongly or did not know anything about the functions of ESC.

Knowledge of ESC
The need for information is high

**Question** “How well informed do you feel about ESC?”

The previous questions showed that the term ESC is common among Japanese drivers but its benefits and functionality are mostly unknown. This question directly addressed the interviewees and asked them about their personal opinion on how well they feel informed about ESC after they have received an explanation of the system’s benefits.

The results show that men feel far better informed than women. Nevertheless there is still a large percentage of both genders that do not feel well informed.
Dealer network and manufacturers
Most important sources of information

Question “Where do you seek information on safety systems when purchasing a car new or second hand?”

- Car dealers/manufacturers: 76%
- Internet: 53%
- Car magazines: 32%
- Friends, Relatives: 24%
- TV programs: 16%
- Newspapers in general: 11%
- I inform myself rarely: 5%

This question investigates how and where Japanese drivers seek information when purchasing a new car. 76% of respondents think car manufacturers and their sales network are the major source of information when purchasing a car. The internet follows second with 53% and 32% of the respondents are seeking information in car magazines. When compared to Europe, 62% got their information directly from manufacturers and dealers, 24% from magazines, 11% from friends, 5% from the TV and only 19% from the internet.

Insufficient availability
Why Japanese cars lack ESC

Question “Why is your car not equipped with ESC?”
(Only asked if ESC not in own car. Multiple answers possible.)

- Do not know/no answer: 58%
- Not available: 21%
- High price/cheaper without: 10%
- Not necessary: 9%
- Other: 8%

Although the majority of respondents can not remember explicitly why their car is not equipped with ESC, every fifth respondent noted that ESC was not available when purchasing the vehicle. This shows that in Japan, the range of models with ESC available as a standard or optional feature is still limited.

Every tenth respondent named the high price of ESC as a reason. At the moment, ESC is mostly only available at the higher grades of a car model, which results in a considerable price adder for ESC. For Japanese buyers, it is still difficult to select ESC when purchasing a car.
Propensity to buy ESC
Growing importance of ESC

My car is equipped with ESC. 17% 59% 24%
ESC is important when buying my next car. 54% 8% 4% 34%
ESC should be made part of the standard equipment. 66% 9% 2% 23%

17% of the survey respondents say their current car is equipped with ESC. After the benefits of ESC were explained, 54% of the respondents think that it is an important feature in the next vehicle purchase. It can therefore be expected that demand for ESC in Japan will rise considerably. This is comparable to Europe where 62% said ESC would be an important feature while purchasing their next car.

Japanese drivers set a high value on road safety but they have a rather low knowledge on ESC and its benefits. The benefits of ESC, after being explained, are very convincing to Japanese drivers: 66% consented that ESC should be made part of the standard equipment. The safety potential of ESC to save lives has led the US to already make ESC mandatory equipment on cars up to 4.5t from 2011 while in Australia and the European Union legislation is currently underway.

History of Active Safety Systems

In 1978, Bosch was the world’s first company to launch the antilock braking system (ABS) with electronic control. ABS was the first active safety system in cars. In 1986, it was followed by the Traction Control System (TCS), which was based on the ABS platform, and in 1995 Bosch developed the Electronic Stability Control.

ABS – the long process of putting an old idea into practice
Preventing wheels from locking had been a research goal since the beginning of the 20th century. As early as 1936, Bosch had registered a patent for a mechanism to prevent locking of wheels of a motor vehicle. After long years of development, everything finally came into place in 1978: the system, known by Bosch as ABS 2, began to be fitted as optional equipment, at first in Mercedes-Benz’s ‘S’-class cars and shortly afterwards in BMW’s 7 series limousines. In 1984, Bosch launched the first ABS in Japanese cars. In the same year, Bosch started developing anti-locking systems for motorcycles. During the succeeding years, developers concentrated on simplifying the ABS. The following ABS generations included additional functions such as electronically distributed brake pressure while steadily reducing size and weight of the unit.

ESC – Electronic Stability Control
The Electronic Stability Control (ESC) integrates the function of ABS, but has the added feature of a “yaw torque control” – a functionality that prevents skidding. It is designed to help drivers maintain control of their vehicles in sudden maneuvers such as rapid steering and counter steering, sudden lane changes, and obstacle-avoidance maneuvers. ESC is always active. 25 times a second it compares whether the driver’s steering input corresponds to the actual direction in which the vehicle is moving. If the vehicle moves in a different direction – either under steering or oversteering – ESC detects the critical situation and reacts immediately. To do this, it uses the vehicle’s braking system as a tool for “steering” the vehicle back on track. Specific braking intervention is directed at individual wheels, such as the inner rear wheel to counter understeering, or the outer front wheel during oversteer. These selective braking interventions generate the desired counteracting force, so that the car reacts as the driver intends.

Together with Mercedes-Benz, Bosch developed the Electronic Stability Control up to readiness for series production, and was the first company worldwide to market it, when it was installed in the S-Class in 1995. In the years that followed, developers refined the system and supplemented it with additional functions. These functions help with hill starts, counter swaying of trailers, or reduce the risk of vans overturning. By extending ESC to include software functions from Vehicle Dynamics Management (VDM), Bosch has created a system that can be networked with steering and chassis systems. This allows new functions that further enhance the safety and agility of the vehicle. Also, Bosch is working to link active and passive safety systems, which up to now have worked independently of each other, with driver assistance systems. In this way, existing sensor information can be used at several points in the vehicle, thus in combination with ESC creating new functions that further reduce the risk of an accident.