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08/07/2018

ID: 62

## **In automated vehicles, the seat-of-the-pants feel comes from the Bosch cloud**

Alliance with Foreca's road-weather experts for predictive road-condition services

- Dirk Hoheisel: "We alert to hazards before critical situations arise."
- Weather data and information from roadside ice-detection systems are the basis for predictive road-condition services.
- As more vehicles become connected, vehicle data will enhance the service.
- Service enhances safety and availability of automated driving functions.
- Bosch road-condition services to be rolled out widely from 2020.

Stuttgart, Germany – Haptic sensation when driving is something that shouldn't be underestimated. What condition is the road in, how well are the tires gripping? Having or developing a feeling for this can help drivers handle their cars appropriately and safely. Race drivers already have a word for it: seat-of-the-pants feel. They mean the contact between the seat of their pants and their driving seat, which allows them to feel the state of the road surface. Automated vehicles also urgently need information about road conditions. Unfortunately, however, they don't have any feeling for such conditions – or haven't up to now. Bosch has developed a system that gives automated vehicles seat-of-the-pants feel. "Wet roads, snow, ice – with our predictive road-condition services, we alert to hazards before critical situations can develop. We are helped here by the weather data provided by our partner Foreca. This means an automated vehicle will know exactly where it can drive autonomously, and how," says the Bosch management board member Dr. Dirk Hoheisel.

Foreca is one of the world's leading providers of weather information, with two decades of experience in predicting road weather conditions. "Combining the expertise of Foreca and Bosch will lead to a new era of road-condition forecasting. Unlike weather forecasts in the media, the Bosch road-condition services take

Robert Bosch Kft.  
1103 Budapest,  
Gyömrői út 104.  
[www.bosch.hu/en](http://www.bosch.hu/en)

Press information:  
Dr. Ferenc Ficzer  
Head of communication  
Bosch Group in Hungary

E-mail: [ferenc.ficzere@hu.bosch.com](mailto:ferenc.ficzere@hu.bosch.com)  
Phone.: + 36 1 879 8852  
[www.boschmediaservice.hu/en](http://www.boschmediaservice.hu/en)

multiple possible forecast scenarios into consideration,” says Petri Marjava, Foreca’s sales director. The road-condition services boost driving safety and smoothness. In addition, the availability of automated driving functions is increased. The Bosch services package is to be rolled out worldwide in 2020, initially on the basis of weather data. As more and more connected cars appear on the roads, the service will be augmented by vehicle data.

### **Automated vehicles adjust their speed in good time**

Up to the highly automated SAE level 4, the decision as to whether a car can assume the task of driving depends on factors such as road type, speed range, and environmental conditions. In future automated vehicles, this decision will also be based on the predictive road-condition services provided by Bosch. Thanks to their help, the automated vehicle will know in good time what environmental conditions to expect. This means it will have plenty of time to adapt its driving style, instead of having to hand over the driving task to the driver at the first sign of impaired road conditions, however minor. If the vehicle’s route takes it through rain, it will adapt its speed well in advance to a level that excludes any risk of aquaplaning and allows it to stop safely at any time. Whatever the SAE automation level, the result is a safe drive that is also smooth and comfortable.

### **Driving automatically, whenever and wherever possible**

For its predictive road-condition services, Bosch is relying on a multiphase concept. By the time of its planned launch in 2020, it cannot be expected that there will be a sufficiently large proportion of connected vehicles on the roads. Bosch estimates it would take some 20 million connected cars to cover the roughly 80,000 kilometers of freeway in Europe alone. For this reason, road-weather forecasts will initially be the only reliable source of information for drawing sound conclusions about road conditions, especially in rural areas where there is less traffic. Bosch will get the constantly updated global road-weather data it needs for this from Foreca. Bosch’s thorough examination of several leading providers showed that the Finnish weather experts were the most accurate road-weather data provider globally. The more precisely hazardous conditions can be predicted and localized, the easier it will be to keep the availability of automated driving functions to a maximum. Thanks to a worldwide reference measuring fleet and machine learning methods, Bosch and Foreca have jointly been able to optimize the safety and availability of the road-weather models. In this way, the two companies have achieved a safety standard of the kind that will be necessary for life-critical systems such as automated driving.

### **ESP interventions allow friction coefficient to be determined**

As a sufficient number of connected vehicles take to the roads, Bosch will supplement its predictive road-condition services with vehicle data. These data will include information stored on the CAN bus, the vehicle’s central data network, such as the temperatures measured inside and outside the vehicle, and whether the windshield wipers are in use. Thanks to connectivity, this data will not remain unused in the vehicle, but will find its way into the Bosch cloud via the

respective automaker's back-end server. In addition, Bosch will evaluate the regular interventions by the ESP anti-skid system. Using mathematical methods, engineers can measure the friction coefficient of the road surface at each individual wheel, as well as the status of each wheel. When all these data are combined and intelligently evaluated, the result is a package of smart Bosch services – and the comforting feeling of being in safe hands.

## **More information:**

Robert Bosch GmbH  
Jörn Ebberg  
phone: +49 711 811-26223

Foreca Ltd.  
Petri Marjava  
phone: +49 176 46149012

dr. Ferenc Ficzer  
phone: +36 1 879-8852

## **Basic information:**

Mobility Solutions is the largest Bosch Group business sector. In 2017, its sales came to 47.4 billion euros, or 61 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is accident-free, emissions-free, and stress-free, and combines the group's expertise in the domains of automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. The business sector's main areas of activity are injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and technology and services for the automotive aftermarket. Bosch is synonymous with important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,000 associates worldwide (as of December 31, 2017). The company generated sales of 78.1 billion euros in 2017. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life." The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. At 125 locations across the globe, Bosch employs some 64,500 associates in research and development.

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