



Automated vehicles for public transport services

21 April 2021

## TÜV SÜD: EVA Shuttles in Karlsruhe are the first vehicles in Germany to reach SAE Level 4 function for public transport operations

**Karlsruhe/Munich.** In a milestone for automated driving technology, the autonomous vehicles in a Karlsruhe research project – known as the “EVA Shuttles” – are the first to be used in a public transport pilot project that places automated minibuses on city streets. The EVA in the shuttles’ name stands for the initials of the German terms for “electric”, “connected” and “automated”. In addition, the electrically powered minibuses can be ordered on demand in the ioki app.

Automated navigation involves particularly strict requirements for the safety concept which has been drawn up by the project partners, led by TÜV SÜD, to secure approval for Ella, Vera and Anna – as the three shuttles are known – to operate in the district of Weiherfeld-Dammerstock in the city of Karlsruhe. In addition to extensive testing of vehicle safety, functional safety and cybersecurity, a training scheme for the human drivers accompanying the vehicles is an essential stipulation. The project has received EUR 2.5 million in funding from the German Ministry of Transport and Digital Infrastructure (BMVI).

“Commencement of passenger operations by the EVA Shuttles is a true milestone for automated driving in general, but particularly for Germany as a centre of this technology. This is the first public transport project where a fully autonomous vehicle has taken to the streets”, said Patrick Fruth, CEO Division Mobility at TÜV SÜD, at the press conference for the launch of the EVA Shuttles’ operations in Karlsruhe. Free navigation poses particularly difficult challenges for the technology, but also for the safety driver who must accompany the vehicle under current regulations. It was only logical for the project partners – local public transport authority Verkehrsbetriebe Karlsruhe GmbH, Robert Bosch GmbH, Deutsche Bahn subsidiary ioki GmbH and, at the head of the consortium, research centre FZI Forschungszentrum Informatik – to invite TÜV SÜD Auto Service GmbH to join their research team. After all, the experts at TÜV SÜD had already laid pioneering groundwork four years previously in the Lower Bavarian town of Bad Birnbach, where they had worked with ioki and Deutsche Bahn to launch the first automated shuttle bus. Since the earlier project, TÜV SÜD had amassed a wealth of practical

experience from working on automated driving projects all over the world.

### **Safety driver on board**

The first time of reaching SAE Level 4 in passenger transport primarily means new demands for the safety concept to fulfil. The EVA Shuttles will be the first vehicles to use automated navigation continuously. To reach SAE Level 4 for road traffic and enable the research project to take the next step into passenger fleet operation, the technology and systems used for the SAE Level 2 driver assist system were enhanced with the addition of a safety driver/operator. The safety driver has the option of safely bringing the vehicle to a standstill from automated driving mode at all times; this function forms the essential basis for gaining approval for the vehicles. In addition, the safety driver can take over manual steering of the EVA Shuttle in traffic situations which the automated navigation systems are not yet able to master fully. In other words, the driver closes the last possible safety gap. This safety assurance enables the vehicles to ply their lanes using completely free navigation within a limited area (the residential district of Weiherfeld-Dammerstock), now able to depart from predefined virtual “guide rails” for the first time.

Ella, Vera and Anna choose the best route from A to B completely independently, dealing with road traffic, new passengers and further interim stops as they do so. Their navigation systems are based on high-precision digital maps provided by the Test Area Autonomous Driving Baden-Wuerttemberg and on automation systems developed by the project partners Bosch, ioki and FZI. Obstacles that crop up along the route or junctions that have to be negotiated naturally present particularly tricky challenges for the automated systems –and require the safety driver to pay special attention. In those situations, the driver has to keep a watchful eye on the traffic and the interaction between the shuttle and other road-users, monitoring the shuttle’s progress at all times during evasive action and judging distances accurately and reliably; in case of danger, the driver must always be ready to intervene at the right time – but not too early.

### **The “safety honeycomb”**

To provide precise definitions of the vehicle operator’s scope of action and performance requirements, the project partners under TÜV SÜD’s direction conducted a battery of tests designed to eliminate faults and errors, held field tests to evaluate the operators’ performance and defined a safety perimeter around the shuttle. The result was the “safety honeycomb”, a precisely defined area around the vehicle in which the safety driver must pay particular attention to obstacles and monitor the automatic vehicle’s progress. Dirk Fratzke, Project Lead at TÜV SÜD, has been part of the Karlsruhe-based project since its inception. In his view, “the requirements clearly state that safety drivers must receive in-depth training and must themselves be tested. Given this, training is an essential building block of our safety concept

for the EVA Shuttles. The launch of passenger operation and approval of pilot operation up to speeds of 20 km/h will now take us up to the final project phase, in which we will analyse the interactions between the automated systems and other road-users. Our findings will be incorporated into the advanced development of methods for boosting safety in automated and connected vehicle operation, right up to the approval and testing stage.”

### **Taking international expertise along for the ride**

Approval of the automated vehicles is based on AV-Permit, a service package offered by TÜV SÜD in which the experts support automotive manufacturers and other technology developers worldwide in developing automated vehicles and provide independent, impartial expert opinions as the basis for gaining individual approval of vehicles for road use. This expertise will now also be used in the EVA project, thus assuring safety for this new form of mobility. “Everyone here in Weiherfeld-Dammerstock now has the chance to experience for themselves how automated driving works and how safe it is”, says Fratzke, adding, “The certainty and trust we are building with this research project will ensure the test operations are a success. We are delighted that Karlsruhe has chosen to rely on TÜV SÜD for the safety aspects of this innovative transport project.”

For more information, visit <http://www.tuvsud.com>.

### **Media Relations:**

Vincenzo Lucà TÜV SÜD AG Corporate Communications Westendstr. 199, 80686 Munich	Tel. +49 (0) 89 / 57 91 – 16 67 Fax +49 (0) 89 / 57 91 – 22 69 E-mail <a href="mailto:vincenzo.luca@tuvsud.com">vincenzo.luca@tuvsud.com</a> Internet <a href="http://www.tuvsud.com">http://www.tuvsud.com</a>
--	--

Founded in 1866 as a steam boiler inspection association, the TÜV SÜD Group has evolved into a global enterprise. More than 25,000 employees work at over 1.000 locations in about 50 countries to continually improve technology, systems and expertise. They contribute significantly to making technical innovations such as Industry 4.0, autonomous driving and renewable energy safe and reliable. [www.tuvsud.com](http://www.tuvsud.com)