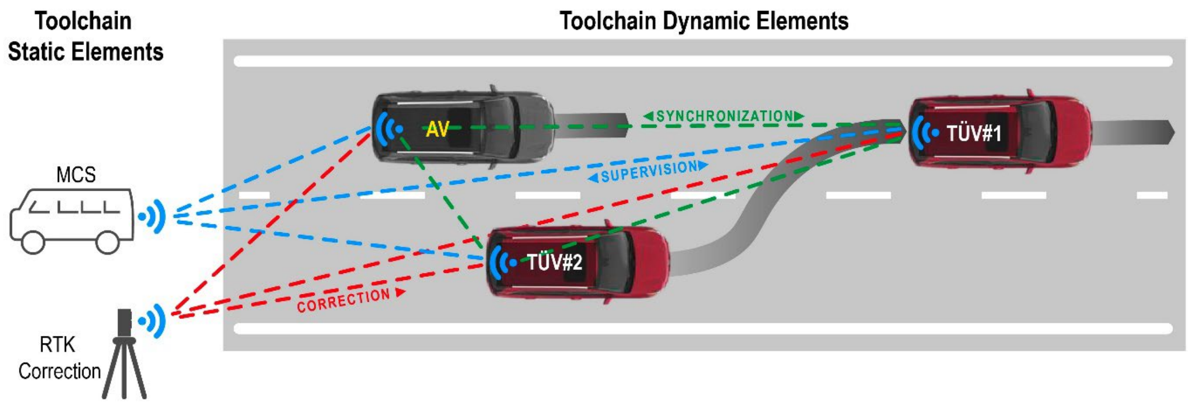
Press Release

Autonomous driving workshop for journalists 1 June 2022

Testing of autonomous driving functions – an example

Zalaegerszeg/Munich. Autonomous driving at the start line! Alongside the rapid development of technology, regulatory framework conditions governing the approval and homologation of vehicles with autonomous driving functions are also picking up speed. The number one requirement for approval is safety. But how do experts and manufacturers ensure that autonomous driving functions will master the infinite variations in traffic scenarios with flying colours? Which physical tests are required for type approval? What role does simulation have to play? TÜV SÜD's experts provide insights into their testing activities and demonstrate that autonomous vehicles already respond safely today.



"Autonomous driving technology has progressed enormously, especially in the last three years", says Christian Gnandt, Global Head Highly Automated Driving at TÜV SÜD. "As an independent testing, inspection and certification (TIC) organisation, we play a central role in this development – not only in physical testing on proving grounds and roads, but also in virtual testing in the form of simulations." This role is not limited to the function of "third party" but in particular extends to cover design and development, validation and the establishment of new test methods which also form the basis of international standards for the approval of autonomous vehicles. The development, harmonisation and standardisation of these test methods is also the mission of the International Alliance for Mobility Testing and Standardization (IAMTS). TÜV SÜD was a founder member of the alliance and has successfully headed it since 2018 alongside leading international companies in the fields of standardisation, technological development and testing.

Demand for reliable, predictable and reproducible tests for autonomous vehicles is on the rise worldwide across all geographical and regulatory borders. With a wealth of international expertise in this area, TÜV SÜD is a highly sought-after and renowned partner. Gnandt explains, “Not only have we supported vehicle manufacturers to ensure their developments conform with official regulations from early design stages and to provide validation of their safety; our experts are also in close dialogue with almost all bodies and committees involved in vehicle approval around the globe. In-depth technological expertise paired with international regulatory experience make us the perfect facilitator between OEMs and regulators, and thus a catalyst of this technology which is so important for the future and the safety of mobility.”

Testing – step one: physical testing

An essential function of fully automated vehicles is the capability to follow another vehicle at a specific distance. This function has been around for some time in forms such as adaptive cruise control (ACC), and is ready for approval. At ZalaZONE’s proving ground, the TÜV SÜD experts demonstrate a physical cut-in test. In this test, the autonomous vehicle (AV) must respond autonomously and correctly when a car cuts in from the adjacent lane just in front of the AV. Test setup: The AV (1) is driving behind a vehicle (3) in the left lane. Another vehicle (2) merges from the right if, say, the right lane ends because of roadworks, and pulls in between the AV and the vehicle in front. The autonomous driving function, which had previously focused on the vehicle in front, now needs to recognise the vehicle cutting in from the right and respond by reducing the vehicle speed or braking to re-establish a safe distance from the new vehicle that has merged into the lane. The AV must perform this task fully autonomously. The backup driver on board will only intervene in case of an emergency. And to make sure nothing bad happens even in case of an accident, a “guided soft target” (GST) will be used for car (2). The precise test parameters, such as the vehicle’s speed, distances and actions, have been defined in accordance with regulatory requirements and are monitored from a control centre. Longitudinal and transverse control are managed using GPS. Emmeram Klotz, Head of Testing and Validation at TÜV SÜD explains, “The measured data provide important input for the validation of simulation models used in other tests of the driving function.”

Step two – simulation

Simulation is increasingly used, accepted by regulators and demanded by auto manufacturers, mainly because of the enormous array of potential situations involved. Given the unfeasibility of testing this infinite number of traffic scenarios on proving grounds or public roads, it bridges the remaining gap. "The use of simulation as a validated test method ultimately enables the vehicle to be made safe in a much greater range of traffic situations", explains Klotz. But how is this done? How is it possible to identify, for example, which are the dangerous situations and what is the critical moment at which a vehicle needs to respond? And what form should that response take? It is obviously impossible to cover all theoretically possible road scenarios, even by using simulation. To make matters worse, every single scenario is influenced by a large number of factors. Given this, one of the experts' key tasks is to filter out the genuinely critical situations in real road-traffic from the infinite array of scenarios.

How does this work? The virtual world offers experts the opportunity to change the individual influencing factors in small increments, simulating the situation on the basis of these parameters. As another advantage, they can do so much faster than in a physical test using a vehicle, and without any accident risk. In the case of adaptive cruise control (ACC), this concerns parameters such as speed, distance or light signals, including signalling. In this way, simulation determines the effectiveness of various influencing factors, working out piece by piece the point at which a situation starts to get critical. This then enables experts to cut down on complex and costly vehicle tests in non-critical areas and focus on critical areas instead. Simulation results, in turn, help to further improve physical tests. Klotz points out, "TÜV SÜD is contributing significantly to our understanding of relevant factors. This enables the experts to reduce the number of necessary tests, and thus the costs, without having to compromise on safety. The results of virtual tests, which are ultimately based on the data obtained in physical tests, are then validated by additional tests on proving grounds and roads. This approach ensures the reliability of virtual test methods and inspires trust in them".

Step three – regulation

Even though automated driving functions have made quantum leaps for years in terms of the technology involved, such as the current leap from SAE Level 4 to Level 5, global collaboration over the homologation of highly and fully-automated vehicles is still in its infancy. Initial success in closing regulatory gaps was achieved two years ago when UNECE Regulation 157 on automatic lane keeping systems (ALKS) was passed. The first standard governing an automated driving function (SAE Level 3), it has been adopted by a total of 42 countries. In 2021, Germany passed the Act on Automated Driving (Gesetz zum autonomen Fahren), which since then has set the regulatory framework for automotive manufacturers, suppliers and owners. In February, the German Parliament adopted the Autonomous Vehicle Approval and Operation Ordinance (Autonome Fahrzeuge Genehmigungs- und Betriebsverordnung, AFGBV), which further details the requirements of the Act on Automated Driving and explicitly promotes virtual test methods. Waiting in the wings is the European Regulation EU L4, which will regulate the move to Level SAE 4. As for UNECE Regulation No. 157, the TÜV SÜD experts collate the complex information derived from global testing and verification practices, using them as a basis for speeding up the development of testing and verification testbeds and technologies for intelligent connected vehicles.

Further information at www.tuvsud.com and at http://zalazone.hu/.

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