Driving Simulator

With a driving simulator, driving tests can be made in a virtual environment. The Federal Highway Research Institute performs various studies with the driving simulator, for example, on the impact of age, illness, fatigue, distraction or psychoactive substances on the driver. Furthermore, the impact of changes in road structure on driver perception and behaviour can be studied prior to any construction being carried out. In addition, driving simulators can be used for the training of driving skills.

Why driving simulation?

Compared to road traffic studies, the driving simulation has two main advantages: Traffic scenarios can be created in the simulator and reproduced over and again, in the exact same way. Thus, subjects can be confronted with scenarios which occur only rarely in reality. Also, interactions with other road users can be created specifically, which is not possible on the road.

A danger to the driver and other road users is excluded in the simulator.

For this reason, the impact of psychoactive substances or distracting activities is often investigated with the driving simulator. The same applies to studying driver behaviour in the case of accidents and near-accidents. Due to the risk, this would not be acceptable in real traffic.

Are the results transferable?

The question of the transferability of results from the simulator to the road is the subject of much debate. A distinction must be made between the congruence of the physical conditions in the simulator and the real vehicle and the congruence of the driver’s behaviour in the simulator and vehicle. The complete simulation of the conditions in a real vehicle is not absolutely necessary for the driver to behave similarly in the simulator to the way he reacts on the road. The transferability of the results must therefore always be considered in relation to the research question. In the past, it could be demonstrated for a number of issues.
The BASt driving simulator

BASt’s fixed-base driving simulator has a high quality projection system which displays a large field of view to the front and to the side (180 degrees). The high resolution of the three projectors (1,400 x 1,050 pixels) allows for detailed representation of traffic and the environment. The rear and side mirrors are LCD displays.

The driver’s cabin ensures a realistic overall impression, based on a mid-size vehicle. It is fully equipped. An engine built in to the steering column provides a realistic steering torque. Any type of displays or tasks can be shown on an additional touch display. This could include for example navigation instructions or different menu structures of an information system.

The driving simulator is operated with eleven networked computers. Sounds from one’s own vehicle and those of other road users are played over a 5.1 sound system.

The SILAB software for the operation of the driving simulator was developed especially for the requirements of experimental studies. It allows for a free design of the route geometry and surrounding landscape, as well as the targeted control of other road users’ behaviour. Thus, even complex interactions, for example with other vehicles or pedestrians can be displayed. Moreover, the sequence of traffic scenarios during driving in correlation to the drivers’ behaviour can be changed.

All data are recorded for subsequent analysis. These include, among other, the driver’s control input, vehicle motion parameters, the route geometry and the positions of other road users. By means of a graphic user interface, parameters can be changed and the data recording monitored during simulation.

Time-synchronous capturing of eye movements is also possible with the BASt driving simulator, by means of two infrared cameras. An EEG system measures the drivers’ brainwaves.

Technical data

- 180° front view via three projectors (LCD technology, 1,400 x 1,050 resolution, 3,800 ANSI Lumen), projected on to three screens of 2.80 x 2.10 m each.
- 5.1 speaker system, 3D sound model, Doppler effect at relative movements.
- Fully equipped driver’s cabin, actuator in the steering column generates a realistic steering torque.
- Dynamics model simulates the behaviour of a BMW 520i with automatic transmission.
- Operation with 11 PCs (Intel Pentium i7 3.4GHz, 3.5 GB RAM, Nvidia GeForce GTX 470) networked in a 1,000-MByte network.
- Software designed for the requirements of experimental research allows free design of routes and complex traffic scenarios.
- Recording of all measurement parameters of vehicle motion, position and behaviour as well as that of other road users.
- Software: SILAB by WIVW GmbH (www.wivw.de)
- Hardware: Ergoneers GmbH (www.ergoneers.com)