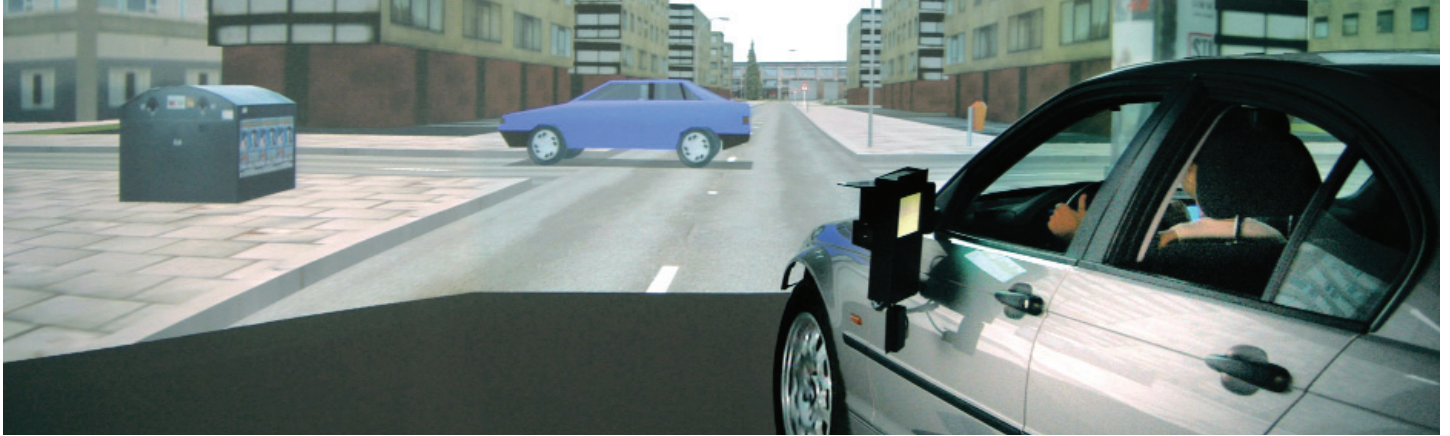


The TNO Driving Simulator



A successful introduction of new driver support systems, traffic management systems or infrastructure elements strongly depends on how drivers are able and willing to interact with these systems. Recent developments in simulation techniques enable designers to study several road design alternatives flexibly and at an early stage, and to assess in advance the effects of modern traffic control systems on traffic performance. A try-out on the simulator can be very cost effective.

Technological progress has increased the possibilities to simulate the behaviour of complex man-machine systems as occurring in air and space travel, sailing and road traffic. An advanced image generation system allows the 'outside world' of the TNO driving simulator to be realized covering a total forward angle of view of 120° and rearview mirrors. A mathematical vehicle model calculates the simulated vehicle's response to driver actions in the same way a real vehicle would respond in terms of course and speed changes. Based on the resulting position and angle of the vehicle, the CGI (Computer Generated Image) computes the outside image in real-time. The picture is projected onto a large cylindrical screen in front of a vehicle mock-up using high-resolution projectors. The subject directly experiences the results of his driving actions on the direction and speed. The subject in the mock-up receives feedback via the sound and steering forces as these would actually occur. The mock-up is also provided with an active accelerator pedal that produces an adjustable counter force to inform the driver directly of the need to reduce speed. The current system can incorporate into the picture the simulation of up to 40 other independently moving

vehicles. The picture system also includes a variety of visual conditions such as day, dusk and night and atmospheric effects such as cloud, haze, glare and fog. A moving base with six degrees of freedom gives a real sensation of acceleration.

Applications

The applications for research into traffic behaviour of road users are legion, and various projects are being undertaken for the Ministry of Transport, Public Works and Water Management including research into the effects on driving behaviour of new infrastructure elements such as tunnels work zones, dedicated lanes, etc. The driving simulator is also being used for several projects of the European Union's Framework programmes which are dealing with future applications of modern electronics to aid motorists in carrying out their driving task, such as collision avoidance systems, navigation systems or driver drowsiness monitoring. For the Dutch Transport Research Centre, studies were conducted concerning the human factors of a motorway signalling system, Adaptive Cruise Control, and Automated Vehicle Guidance (AVG) systems.

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