# AN ALL-PURPOSE TEST FIELD

## DLR's research facility in Lower Saxony facilitates analyses of automated and networked driving

By Eva-Maria Dobriloff


Traffic on the A39 motorway is recorded around the clock. The high-resolution stereo camera systems anonymously monitor passing vehicles travelling in both directions from a height of eight metres.

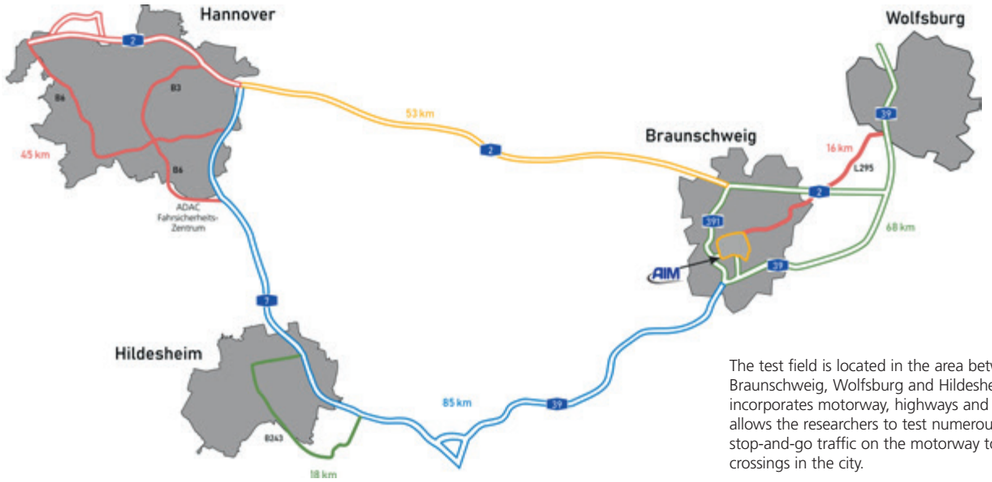
**Less congestion, fewer accidents and lower emissions – the expectations for automated vehicles are high. But what does a car need in order to be able to drive independently? What kind of situations will it have to cope with? DLR's Test Field in Lower Saxony is allowing researchers to address these questions and helping to get the necessary technologies from the computer onto the road. Its most visible features are the 71 masts that line the roadside of the A39 motorway near Braunschweig. These are equipped with state-of-the-art communications technology. With their assistance, the first automated vehicles could soon make it onto the road here. Most of the 280-kilometre-long test field, however, goes somewhat unnoticed.**

The Test Field in Lower Saxony was officially inaugurated on 8 January 2020. Standing on a bridge directly above the A39 motorway, DLR Executive Board Member for Energy and Transport, Karsten Lemmer, presented the complex technical infrastructure of the test field to Lower Saxony ministers Bernd Althusmann and Björn Thümler. It is operated by the DLR Institute of Transportation Systems and can be seen particularly well from here, between Braunschweig and the Wolfsburg-Königslutter intersection. Seventy-one masts, each eight metres tall, line a 7.5-kilometre section of road. Their sensor heads are equipped with tracking and communications technology that allows all relevant traffic data to be recorded around the clock while still adhering to strict data protection regulations. This gives researchers a detailed insight into the behaviour of vehicles and other traffic-related objects. In particular, it enables scientists to generate a continuous movement path for vehicles from when they enter the detection area until they leave it. This provides information on the requirements of future assistance and automated systems, and the normative and non-normative behaviours they will have to address.

Networked vehicles can navigate traffic more safely and bring both drivers and passengers to their destination in a more relaxed fashion. Communications technology makes it possible for vehicles to be warned of roadworks or black ice in advance, and to coordinate efficient traffic merging manoeuvres. Developers can test these technologies at the Test Field in Lower Saxony. Vehicle-to-everything (V2X) communication units installed on the masts along the A39 motorway allow cars to exchange standardised messages informing each other of overtaking manoeuvres or warning of dangerous situations. Despite very few vehicles currently being equipped with the necessary technology, the test field's combined tracking and communications technology also enables scientists to simulate a scenario in which all road users travelling along the A39 motorway communicate with each other. This makes it possible to predict and further investigate future networked mobility scenarios.

### More than just a motorway

The conspicuous camera and communications technology on the A39 motorway are restricted to a particular section of the test field. The entire course extends over 280 kilometres and encompasses stretches of motorway, highways and roads. It also integrates the routes of the Application Platform for Intelligent Mobility (AIM), operated by DLR since 2014, in the Braunschweig urban area. Mobile platforms equipped with the same tracking and communications technology as the fixed masts can also be deployed in locations with no permanent sensors, allowing even test sites, car parks and industrial estates to be used for research. Such areas, and the transitions between different types of roads, are interesting for the development of automated driving functions and cooperative function networks.




The test field is located in the area between Hanover, Braunschweig, Wolfsburg and Hildesheim. It incorporates motorway, highways and roads. This allows the researchers to test numerous situations, from stop-and-go traffic on the motorway to events at zebra crossings in the city.

Look out: traffic jam! The communications technology warns drivers about traffic jams and accidents in real time.

The tracking and communications technology at the edge of the test field records the speed, position and direction of travel of passing cars and lorries and transmits this information to other vehicles. This simulates the communication between vehicles.

Additional key components of the test field include high-precision digital maps and simulations. Automated and networked driving systems must undergo intensive testing before they can be brought to market. But carrying out all of these tests on real roads would prove far too complex and costly. Virtual test facilities make it possible to test the driving functions much more efficiently. This combination of real and virtual facility makes the Test Field in Lower Saxony unique. The digital maps are crucial for an array of different applications, including operating automated vehicles in public spaces, deriving test scenarios and for comparability purposes. In addition, the accuracy of models and developments in simulation-based environments and test sites can be checked. For this purpose, routes are entered into databases alongside vehicle data and contain topographical and topological information about the respective roads, traffic infrastructure, buildings and even vegetation.

**More than just DLR**

A successful research and development platform can be used for a wide range of different purposes and be continuously further developed. The test field should encourage scientific discussion and, together with its users, help to shape the future of automated and networked mobility. With its diverse infrastructure and technology, the platform will prove extremely useful for companies and scientific institutions working in the field of mobility research.

DLR also relied on the expertise of its partners and drew up a close network already during the planning phase. The German Automobile Club of Lower Saxony/Saxony-Anhalt, the company Continental, the engineering firm IAV and the companies NordSys, Oecon, Siemens, Volkswagen and Wolfsburg AG were all important partners and consultants in the development of the test field. This large-scale project received funding from the Ministry for Economic Affairs, Labour, Transport and Digitalisation of Lower Saxony and the Ministry for Science and Culture of Lower Saxony. The Federal State of Lower Saxony also financed the project via the European Regional Development Fund (ERDF). The network of partners will be expanded and, following extensive test measurements, initial projects in cooperation with these companies will begin.

# WHY? WHO IS IT FOR? WHAT NOW?

Three questions for Katharina Seifert, Director of the Institute of Transportation Systems, and Frank Köster, Head of Business Development at the Institute of Transportation Systems and responsible for test field activities.

**Why are test fields needed for the development of automated vehicles?**
**Seifert:** An automated vehicle must be able to cope with a large number of road users and different situations. These situations must be extensively tested in order to develop such vehicles safely. In addition, the sensor technology developed for these vehicles must be tested in a clearly defined area to ensure that it correctly perceives reality.

**Köster:** This requires the combination of simulation-based test environments with mixed-reality approaches and real test sites, as well as testing in public spaces. The Test Field in Lower Saxony offers all this.

**For whom are the services offered by the test field particularly interesting?**
**Köster:** Some examples are companies and scientific institutions that conduct research in the field of automated and networked mobility, that develop sensors, driving systems and innovative technological components for vehicles and the transport infrastructure. But they are also of interest to policymakers and organisations that are looking to learn more about automated and networked driving. We want to create a strong network with these stakeholders.

**How do you see future transport?**
**Seifert:** In my work, I am driven by the idea of shaping a future in which safe driving is a given and driving comfort goes well beyond restful seats. Traffic will flow better and generate less emissions.

**Köster:** We now have the opportunity to design a safer, more efficient and more comfortable mobility. To achieve this, we want to fully exploit the potential of networked and automated vehicle fleets.

**Eva-Maria Dobriloff** is responsible for public relations at the Institute of Transportation Systems.

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Katharina Seifert and Frank Köster

## TEST FIELD IN LOWER SAXONY – TECHNICAL INFRASTRUCTURE

The Test Field is accessible to companies and scientific institutions, either individually or in associations.

**Monitoring technology:** High-resolution stereo camera systems installed over 7.5 kilometres of the A39 motorway offer high-precision tracking of vehicles and other objects within the traffic area.

**Communications technology:** Road-side units (RSUs) on the A39 enable V2X communication between vehicles and infrastructure, allowing messages to be received on the stretch of motorway.

**High-precision maps:** Topographical and topological information about the road, traffic signs and infrastructure provide the foundations for creating realistic virtual traffic environments and can also be used as highly accurate geo-reference landmarks.

**Scenarios & models:** These enable simulation-based analyses of vehicles or vehicle components within a virtual environment. The virtual test field section is approximately 84 kilometres long.

**Interfaces:** Current and historic data from a variety of sources (including the traffic management centre Lower Saxony in Hanover) are imported via standardised data interfaces. Among other things, this makes up-to-date signalling and information from traffic infrastructure accessible to cars.

**Mobile platforms:** These can be used on campaign-specific sections of the test field that are not equipped with stationary infrastructure and in special areas, such as the testing site, car parks and industrial estates.

**Land registry information:** The registry contains information that is relevant for the test field, such as road and guardrail condition, as well as weather data that can be used to explain unusual vehicle behaviour.

**Background systems:** An information and communications technology platform for data management and central information processing and supply serves as an important system component for linking different test field services together.