

# Automated and connected driving

Defining the testing of future mobility technology



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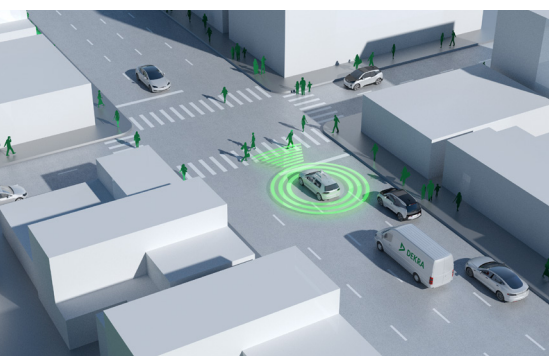




## Meeting the need for integrated testing

The rapid advance of automated and connected driving technologies has made access to specialized testing facilities and extensive simulation capabilities more important than ever before.

As well as the need for functional component testing, there is an urgent requirement for fully integrated technology testing. This includes the ways in which vehicles with automated and connected driving technologies interact with each other and with the infrastructure.



### Defining new standards

Our expertise in vehicle testing and our extensive test and research facilities for connectivity technologies are decisive advantages. They enable us to take the lead in defining protocols and promoting standardization as a proactive partner of OEMs and suppliers within the industry.

We can trace our roots back to 1925, when what is now DEKRA was founded as the German Motor Vehicle Monitoring Association. Today, we have around 46,000 employees in more than 50 countries and are a recognized world leader in independent vehicle testing.

### A strategic approach

DEKRA has developed a unique strategic response to the complex needs of OEMs and suppliers alike. Centered on the expertise of our test site in Germany and our specialist laboratory in Spain, our goal is to provide a fully integrated testing landscape that will meet the needs triggered by innovations that are reshaping the way we live and travel.

## Combining facilities, expertise and know-how

Our two existing facilities in Germany and Spain together represent one of Europe's largest integrated and independent vehicle testing resources.



By contrast, our site in Málaga, Spain, focuses on cutting-edge, lab-based testing and complex scenario modeling for small-scale production. The knowledge gained here under laboratory conditions is then transferred to the local test track and to Klettwitz for integration into large-scale testing projects.



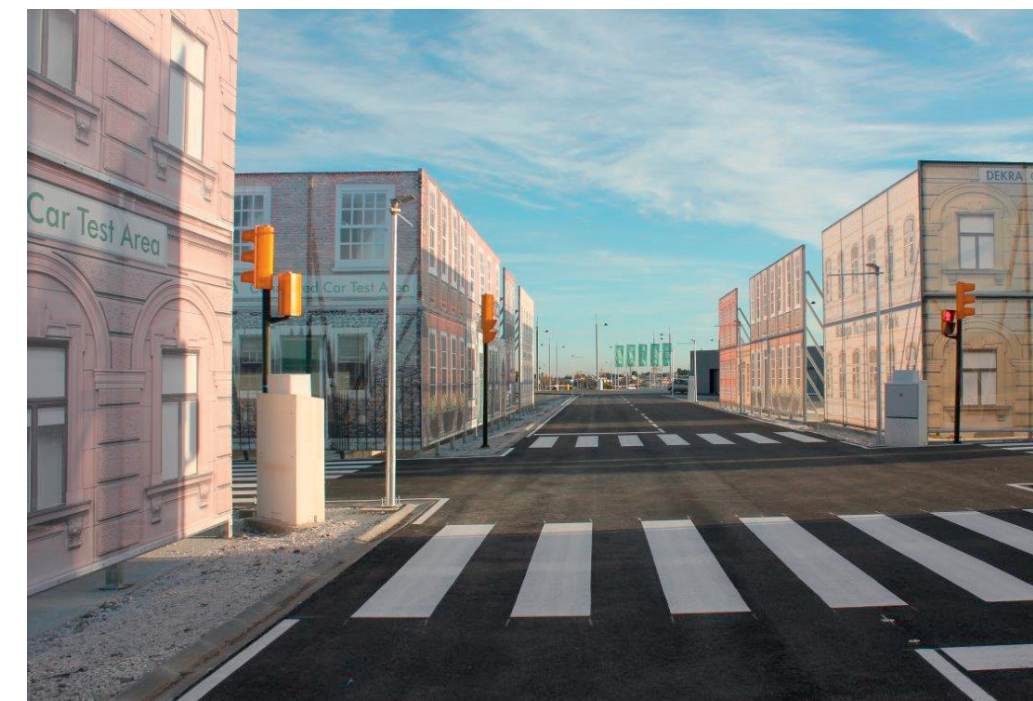
In this way, by sharing their full spectrum of services and expertise, the two sites combine to offer a complete end-to-end testing resource for all aspects of automated and connected driving.

### All your testing needs from a single source

Strategically located to ensure easy access from across Europe as well as from overseas, these two sites offer their facilities and expertise to automotive OEMs and suppliers as well as to academic researchers and R&D teams.

### Collaboration is the key

The core of our integrated approach is how these two centers interact and share knowledge with each other. Our Klettwitz site in Germany is a vast complex dedicated to functional testing, classic driving tests, driver education and events, training and motorsport.





# Testing tomorrow's technologies, today

Our specialist R&D and early production testing hub in Málaga, Spain, is a center of excellence for “vehicle-to-everything” or V2X technologies, as well as for testing and certification of wireless technologies. The aim is to ensure that technologies function properly before they are installed in series production vehicles. For example, testing reception quality and the effects of different weather conditions. We also ensure that vehicles have all necessary certifications for the markets in which they are sold.

As well as deploying actual V2X devices, we can simulate scenarios using dedicated beacons and purpose-built software. These can be used for various bearer technologies (DSRC/WAVE, ITS-G5, 4G/5G) to verify the generation and reception of appropriate signaling messages and corresponding warnings to drivers.



Our connected driving specialists in Málaga can model any scenario or specific problem directly from specification sheets (e.g. Omniair, 5GAA). They then work with total focus on that specific challenge until it has been solved.

### Proven expertise and success

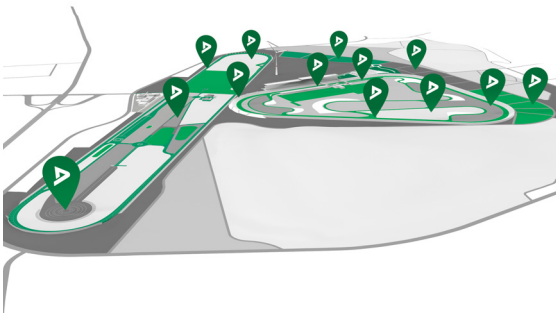
Other connected driving test activities carried out include interoperability, perfor-

mance and usability testing, as well as cybersecurity evaluations for the connected car and field testing.

V2X scenarios we have already successfully tested include Intersection Movement Assist, Green Light Optimal Speed Advisory, Forward Collision Warning and Work Zone Warnings. We have also achieved accreditation for eCall car safety technology for testing in the lab and at customer premises.

# Extensive road testing and modeling facilities

Our large-scale production test track in Klettwitz, Germany, provides Europe's largest and most comprehensive range of driving and testing facilities on a single site. The focus here is on automotive systems, functional, sensor, whole vehicle and infrastructure testing. The goal is to test how the vehicle behaves. For example, will sensors create the right response signals according to the environment ahead – such as crossing pedestrians – and will the vehicle itself react in the right way?



Services extend from providing professional proving grounds, specifically for automated and connected driving, through to full test packages. These can be freely defined by our customers, who then receive the data once testing has been completed. We also offer standard test packages, such as NCAP tests, type approval and conformity of production (CoP) tests.

### Across the full spectrum

DEKRA provides testing facilities for all levels of automated driving from 0 to 5. Key technology areas at present include, for example, lane change warning, lane keeping, parking assist and much more.

Bearing in mind that the current status of viable technology has barely reached Level 3, it is easy to see how much potential DEKRA offers for the future. Whatever test facilities OEMs and suppliers need, we will

provide – right up to Level 5 fully automated driving.

Alongside functional testing, we can model any conceivable scenarios to enable products and systems to be tested against specific criteria. This can include anything from setting up complex urban or non-urban journey scenarios to solving a single specific functional problem.



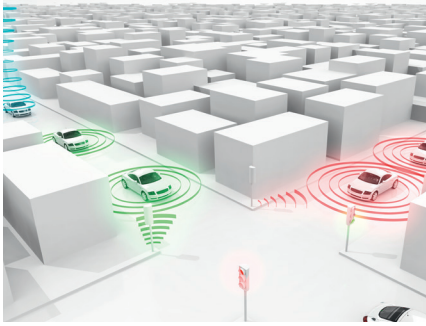
## Automated Driving



### Laboratory/Test Track/Open Road

Level 0 Driver only	Level 1 Assisted	Level 2 Partly automated	Level 3 Highly automated	Level 4 Fully automated	Level 5 Driverless
<ul style="list-style-type: none"><li>&gt; Lane Change Warning</li><li>&gt; Blind Spot</li></ul>	<ul style="list-style-type: none"><li>&gt; Lane Keeping Assistant</li><li>&gt; Park Assistant</li><li>&gt; Cruise Control</li></ul>	<ul style="list-style-type: none"><li>&gt; Key Parking</li><li>&gt; Traffic Jam Assistant</li><li>&gt; Parking Assistant</li></ul>	<ul style="list-style-type: none"><li>&gt; Driving on the Motorway</li><li>&gt; Driving in a Traffic Jam</li></ul>	<ul style="list-style-type: none"><li>&gt; Driving in Town</li><li>&gt; Valet Parking</li></ul>	<ul style="list-style-type: none"><li>&gt; Fully Driverless Driving</li></ul>

## Connected Driving



### Laboratory/Test Track/Open Road

Infotainment Applications	Electrical Vehicle Charging Service Control	Safety & Tracking Control	V2X Communications	Automatic Tolling Services	In Vehicle Wireless Control	Cyber Security
<ul style="list-style-type: none"><li>&gt; Smartphone Integration</li><li>&gt; Communication &amp; Hands-free Calling</li><li>&gt; In Vehicle MiFi</li><li>&gt; In Vehicle TV</li></ul>	<ul style="list-style-type: none"><li>&gt; Charge Points Networking</li><li>&gt; Paying &amp; Billing</li></ul>	<ul style="list-style-type: none"><li>&gt; Safety Tracking &amp; eCall</li><li>&gt; Drive Assistant &amp; Navigation</li><li>&gt; Maintenance &amp; Support</li></ul>	<ul style="list-style-type: none"><li>&gt; Road Hazard Signaling (RHS)</li><li>&gt; Signage Applications</li></ul>	<ul style="list-style-type: none"><li>&gt; Highway Tolling</li><li>&gt; Parking Control</li></ul>	<ul style="list-style-type: none"><li>&gt; Sensors / Actuators (TPMS, RKE)</li><li>&gt; Radars</li></ul>	<ul style="list-style-type: none"><li>&gt; Functional Safety</li><li>&gt; Attack Protection</li><li>&gt; Information Privacy</li></ul>



# From vehicle testing to product launches and training

DEKRA has everything you could possibly need to support your testing activities – and much more besides.

Spread over more than 500 hectares, the site offers four different high-speed circuits including the option of 3-4 highway lanes and markings. There are also three different urban courses, three tunnels and an intersection course.



### Versatility and scale

In addition to multiple test tracks and a large skid pad, there are two multifunctional areas that can be used for freely defined scenarios. The site also features four NCAP straights and a pedestrian safety test facility.

The proving ground at Klettwitz includes over 100 offices, meeting rooms, garages and event rooms. The event center and multifunctional area are ideally equipped to host major corporate events or track days.

### R&D and lab specialists

Alongside our test labs are a 50,000 m² test bed and urban scenario modeling facilities. Here, we can recreate any setting you need to test. Naturally, you can expect to find all the support services and equipment you need to make your time with us comfortable and convenient.

Infrastructure	Test Capabilities
<ul style="list-style-type: none"><li>&gt; dGPS 2cm</li><li>&gt; WLAN 802.11 p</li><li>&gt; 4G, (5G) coverage (DSRC/ITS-5G)</li><li>&gt; 10 GB upload link for customers</li><li>&gt; 800m mobile guard rails</li><li>&gt; Mobile traffic lights</li><li>&gt; Mobile obstacles</li><li>&gt; Traffic signs</li></ul>	<ul style="list-style-type: none"><li>&gt; R&amp;D labs</li><li>&gt; Conformance labs</li><li>&gt; Type approval labs</li><li>&gt; Field test labs</li><li>&gt; Endurance open road environments</li><li>&gt; E2E safety application labs</li><li>&gt; Vehicle test track labs</li><li>&gt; Configuration center</li></ul>



# Creating tomorrow's vehicle testing landscape

Our two existing test centers already offer OEMs and their suppliers more testing facilities than there is technology to test. But it won't stay that way for long. The pace of change in automated and connected driving is so fast that we need to be ahead of the game now. This is the only way we can be certain of meeting the needs of radical new technologies that are fast approaching reality.

### A global network

With this in mind, we are already planning the development of major centers in China and the USA. This will ensure that we can offer our expertise worldwide while minimizing logistics complexity.

Our decades of technical expertise, long-term strategic vision and track record as a world leader in vehicle testing are the foundations on which we will build the future. Together with OEMs and suppliers worldwide, we will shape the mobility technologies and solutions of tomorrow.





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