<table>
<thead>
<tr>
<th>Project/measure</th>
<th>Location/test bed</th>
<th>Project description</th>
<th>Infrastructure used / supporting road furniture</th>
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</thead>
<tbody>
<tr>
<td><strong>Mobile Edge Computing</strong>&lt;br&gt;Deutsche Telekom AG, Nokia, Continental Fraunhofer ESK</td>
<td>Digital Motorway Test Bed A9</td>
<td>Evolution of the mobile communications network by the application “Mobile Edge Computing” and demonstration on the basis of two examples (performed on 11 September 2015)</td>
<td>The application of the mobile edge computing technology was trialled with the help of the real time brake assist and the overtaking assistance system. Changes to the infrastructure were not necessary. The LTE base radio station at the motorway within the section was equipped with a Mobile Edge Computing IT server for the project.</td>
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<td><strong>Platooning project</strong>&lt;br&gt;MAN Truck &amp; Bus AG</td>
<td>Digital Motorway Test Bed A9</td>
<td>Trialling of a platoon prototype in real world driving on the digital motorway test bed from February to April 2016 in preparation for the “European Truck Platooning Challenge 2016” of the Dutch Government for the journey to Rotterdam at the beginning of April 2016; on this basis, a project of MAN and Schenker DB is being prepared</td>
<td>In the platoon, communication was performed only between the vehicles. Changes to the infrastructure were not necessary.</td>
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<td><strong>Field trial of the vehicle-to-vehicle communication by means of LTE-V technology (LTE for Vehicle Standard)</strong>&lt;br&gt;Deutsche Telekom AG, BMW AG, Toyota Motor Europe S.A., VW/Audi AG and Huawei Technologies GmbH</td>
<td>Digital Motorway Test Bed A9</td>
<td>Field trial of a pre-commercial V2X mobile communications technology; by upgrading the existing LTE (4G) base stations along the A9 near Ingolstadt, between km 439.8 (Denkendorf) and km 472.7 (Langenbruck) to LTE-V (4.5G), network-based direct vehicle-to-vehicle communications were made possible (performed in May/June 2016)</td>
<td>Four base stations of the network operator Deutsche Telekom were upgraded from 4G to 4.5G.</td>
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<td><strong>5G-Connected Mobility</strong>&lt;br&gt;Ericsson GmbH, BMW AG, Deutsche Bahn AG, Telefónica Deutschland Holding AG, Vodafone GmbH, Deutsche Telekom AG, 5G Lab Germany at the Dresden University of Technology, Federal Highway Research Institute, Federal Network Agency</td>
<td>Digital Motorway Test Bed A9</td>
<td>Installation of a 5G test network between the Nürnberg-Feucht and Greding access points with a length of approx. 30 km to trial concrete applications of automated and connected driving; for example, new methods for the transmission of traffic information and the control of traffic independent of the system of a specific manufacturer</td>
<td>• The network consists of a series of bases on the digital motorway test bed  &lt;br&gt;• Sites for mobile communications infrastructure (inter alia radio masts) are made available (Motorway Directorate for Northern Bavaria, Deutsche Bahn AG, Telefónica Deutschland, Deutsche Telekom (DFMGI))  &lt;br&gt;• Connection via fibre infrastructures (Motorway Directorate for Northern Bavaria, Deutsche Bahn AG)  &lt;br&gt;• If required, supplemented by directional radio  &lt;br&gt;• Network is continuously upgraded to a 5G test network</td>
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<td><strong>Innovative radar sensors on the test bed A9</strong>&lt;br&gt;Siemens AG and Infineon Technologies AG</td>
<td>Digital Motorway Test Bed A9</td>
<td>Trialling of innovative radio sensors on the infrastructure to detect the traffic flow</td>
<td>Traffic detection and occupant sensing by means of innovative 77GHz and 120 GHz radar sensors  &lt;br&gt;Area-wide installation  &lt;br&gt;Use of Infineon radar chips</td>
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<td>Providedia - Proactive video-based application of telecommunications technologies in innovative motorway scenarios</td>
<td>Digital Motorway Test Bed A9</td>
<td>Ensuring a comprehensive view at the road ahead for the driver - in the case of highly automated vehicles for the vehicle itself - adapted to the relevant situation, by day and night, even in the case of adverse environmental conditions; this project is funded within the context of Research Programme on Automation and Connectivity in Road Transport by the Federal Ministry of Transport and Digital Infrastructure (BMVI)</td>
<td>“Real-time digital twin” (modelled digital image of the environment) as the basis for the view ahead • Generated from data provided by sensors at the carriageway (cameras, radar) and in vehicles, in combination with data of the connecting mobile communications network • Information is elaborated by data fusion procedures in computing systems of the infrastructure • The view ahead is intended to go significantly beyond the visual range of a vehicle or a driver in traffic conditions • Existing infrastructure such as sign gantries used to install sensors, already existing sensors are also to be used • New masts with sensors and communication facilities intended to supplement the system</td>
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<td>ConVoX - Connected Vehicle (V2X) of Tomorrow Qualcomm CDMA Technologies GmbH, Ericsson GmbH, Audi AG, SWARCO Traffic Systems GmbH, Kaiserslautern University of Technology</td>
<td>Digital Motorway Test Bed A9</td>
<td>Integration of solutions and procedures based on mobile communications for direct inter-equipment communication and network-based 5G connections on the digital motorway test bed A9 between Nürnberg-Feucht and Greding as well as in the city of Rosenheim; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI</td>
<td>5G mobile communications test network from Ericsson is used • Roadside ITS stations are developed • Number and locations of the roadside ITS stations have not yet been determined • Selection of the specifications of the applications which are to be implemented, demonstrated and analyzed • Number of the necessary locations for roadside ITS stations is determined according to the requirements of the selected applications • Completion June 2017, according to schedule</td>
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<td>Digital node 4.0 DLR e.V., Braunschweig University of Technology, VW AG, AVL Software and Functions GmbH, NORDSYS GmbH, Decon Products &amp; Services GmbH, OFFIS e.V., TRANSVER GmbH</td>
<td>Braunschweig</td>
<td>Development of digital solutions for traffic junctions (intersections) with mixed traffic; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI</td>
<td>Reference section of the Application Platform for Intelligent Mobility (AIM) using: • Roadside ITS stations for vehicle-to-infrastructure communications (transmission of traffic light data) • Sensors to detect non-motorized road users via Bluetooth • Variable message signs might be used to control non-equipped vehicles AIM research intersection using: • Sensors to detect vehicles and non-motorized road users on the intersection</td>
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<td>Project Name</td>
<td>Institution</td>
<td>Location</td>
<td>Description</td>
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<td>Veronika</td>
<td>University of Kassel, City of Kassel</td>
<td>Kassel</td>
<td>Research into the interconnection of vehicles and traffic signals for a better traffic flow; for this purpose, trams, buses and emergency vehicles are equipped with on-board units for the exchange of operational and strategic data; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI.</td>
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<td>DIGINET-PS</td>
<td>Berlin University of Technology, T-Systems International GmbH, Berlin Partner for Business and Technology GmbH and Fraunhofer FOKUS</td>
<td>Berlin</td>
<td>Development of a networked infrastructure test bed in a real life urban scenario and realisation along the “Straße des 17. Juni” road, between Ernst-Reuter Platz and the Brandenburg Gate; the test bed is an offer to regional and supraregional undertakings and R&amp;D establishments; there, automated and connected driving and its impacts/effects and the interconnection with public transport can be trialled; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI.</td>
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<td>Harmonize DD</td>
<td>BMW AG, Fraunhofer IVI, Chemnitz University of Technology, Dresden University of Technology, IAV GmbH, MÜGLER AG, Notitel GmbH, Preh Car Connect GmbH, Vodafone GmbH and IVM gGmbH</td>
<td>Dresden</td>
<td>Development of a cloud-based overall system to support highly automated and conventional vehicles in urban areas; research into the minimum equipment of the infrastructure for connected driving in an urban environment; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI.</td>
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### KoMoD
**Cooperative mobility in the digital test bed Düsseldorf**  
Federal state capital Düsseldorf, North-Rhine Westphalian Highway Authority, SWARCO Traffic Systems GmbH, GEVAS software system development and traffic information systems GmbH, ave traffic and information technology GmbH, DLR e.V., Siemens AG, Vodafone GmbH, Mobileye Germany GmbH, RWTH Aachen University, TRW Automotive GmbH, Potsdam University of Applied Sciences

**Düsseldorf**  
The Düsseldorf test bed serves the practice-oriented trialling of new technologies for interconnecting vehicles and infrastructure as well as for connected and (semi-) automated driving in a typical agglomeration; it analyzes driving in an urban area on complex main routes which connect the city centre with the adjacent motorway network; the aim is to trial the provision of data and communications and to consider and assess the mix of technologies with autonomous on-board sensors for the interpretation of the road environment; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI

### Transmission technology
- Equipment of traffic signals and tunnel portals with RSU
- Safety-relevant extension of detection within the tunnel
- Virtual adaptive traffic control systems on the basis of RSU
- LTE high-speed mobile communications (already existing)
- 5G networks Road furniture (already existing)
- Active traffic management systems
- Variable lane use
- Tunnel closure systems
- Adaptive traffic control systems in the tunnel
- Traffic signals with RSU (RSU will be installed within the context of the project)
- Traffic signals with centre-based services
- Parking guidance and information systems
- Detection of parking space occupancy

### Safari
**Safe automated and connected driving with self-updating maps in the Berlin Reinickendorf test bed**  
Berlin Senate Department for the Environment, Transport and Climate Protection, Hella Aglaia Mobile Vision GmbH, IAV GmbH Ingenieurgesellschaft Auto und Verkehr (engineering society “Automobile and Transport”), Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V (corporation to promote applied research), Free University of Berlin

**Berlin**  
Development and practical trialling of the interaction between automated and connected driving and cooperative infrastructure. While the driving situations on federal motorways are in most cases clearly structured, motorists have to master many challenges in inner-city driving situations which may be facilitated by the provision of high-precision maps (HD maps). The central approach of Safari is the assumption that most mistakes are systematic and can be experienced, learned and forecast by automated and connected vehicles. The existing maps as well as those generated within the context of the project, the upgrading of the infrastructure to enhance interconnection as well as other results and findings are components of the “Berlin urban traffic digital test bed” and are made available to other stakeholders; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI

### Transmission technology / storage facilities
- Seamless coverage by LTE high-speed mobile communications (alsospectrum licenses)
- LTE V2X and upgrading to 5G by the “Smart Cells” system
- WLAN (ETSI G5)
- Cloud platform for storage and computing tasks

### Infrastructure provision
- Modernization of traffic signals in the field trial area (Equipment with RSU for the transmission of information about the sequences of traffic signals)
- Provision of maps and information
- High-precision road maps with landmarks
- Roadworks and incident management with high and continuously updated topicality
- Dynamic maps for automated driving

### EDDI
**Electronic tow-bar - Digital innovation**  
DB Schenker AG, Hochschule Fresenius gemeinnützige GmbH (higher education institution), MAN Truck & Bus AG

**Digital Motorway Test Bed A9**  
Trialling of a platoon prototype in real life logistics operation between Nuremberg and Munich; the journeys reflect real transport operations from the logistics system of DB Schenker in order to illustrate the greatest possible practical application and to generate reference values for their practical viability; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI

For the function “road works warning” a roadworks trailer equipped with WLANp must be provided. This technology is currently tested in the ITS corridor in Hesse and is subsequently to be applied, inter alia, on the test bed on the A9.
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<th>Braunschweig, Berlin</th>
<th>The objective of the project is the development and demonstration of flexible and highly automated mobility and vehicle strategies in local public transport in real surroundings, their evaluation with a view to safety, integration into the traffic environment, user acceptance and potential uses as well as the necessary adaptations of outline conditions; the project is funded within the context of the Research Programme on Automation and Connectivity in Road Transport by the BMVI.</th>
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| | - Within the framework of the project, possible use cases for the application of highly automated mobility strategies in local public transport are identified.  
- On this basis, the equipment of the vehicle as well as the selection of the fields of application, of the operational concept as well as the integration into the infrastructures of the two cities of Braunschweig and Berlin are defined.  
- Therefore, it is currently not possible to draw conclusions on the infrastructure and/or the supporting road furniture to be used for the relevant project.  
- The functionalities of AIM in Braunschweig are intended and considered as well as the digital test beds envisaged by the Berlin Senate Department for the Environment, Transport and Climate Protection. |